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1.343 der_derive 0.7.3

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1.344 wayland-protocols If-6.12.20-2.0.0
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1.348 x25519-dalek 2.0.1
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1.349 proc-macro2-0.4.30 0.4.30
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1.353 quote-0.6.13 0.6.13
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1.354 x509-cert 0.2.5
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1.355 zeroize_derive 1.4.2
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1.356 syn-2.0.104 2.0.104
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1.357 syn-0.15.44 0.15.44
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1.358 iperf 3.19.1
1.358.1 Notifications
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1.360 glib 2.86.1
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1.361 lxcfs 6.0.5
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1.362 nghttp2 1.68.0

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1.367.1 Available under license
1.368 aho-corasick 1.1.4
1.368.1 Available under license
1.369 unicode-ident 1.0.22
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1.370 pillow 10.4.0
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1.371 @cesw/macros-assets 5.5.0
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1.405 anyhow 1.0.100
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1.415 thiserror 2.0.17
1.415.1 Available under license
1.416 tokio 1.48.0
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1.417 thread_local 1.1.9
1.417.1 Available under license
1.418 thiserror-impl 2.0.17
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1.419 pin-project-internal 1.1.10
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1.435 derive_more-impl 2.1.0
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1.436 openssl-sys 0.9.111
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1.444 clap_builder 4.5.53

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1.445 pythonurllib 2.6.1

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1.446 wireless-backports v5.15.58-2025_0820

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1.453 cryptsetup 2.8.3

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1.454 nginx 1.28.1

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1.455 libarchive 3.8.5

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1.456 v4l-utils 54ad63a39810c4134d84255596d231dc82ab84ed

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1.457 libunwind 1.9.0-pre

1.457.1 Available under license

1.458 com.android.talkback TfPu_release_14_1-pre

1.458.1 Available under license

1.459 imx-optee-os 3.16.0

1.459.1 Available under license

1.460 imx-optee-client 3.16.0

1.460.1 Available under license

1.1 libjpeg 6b

1.1.1 Notifications :

This software is based in part on the work of the Independent JPEG Group.

1.1.2 Available under license :

The Independent JPEG Group's JPEG software

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README for release 6b of 27-Mar-1998

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This distribution contains the sixth public release of the Independent JPEG Group's free JPEG software. You are welcome to redistribute this software and to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

Serious users of this software (particularly those incorporating it into larger programs) should contact IJG at jpeg-info@uunet.uu.net to be added to our electronic mailing list. Mailing list members are notified of updates and have a chance to participate in technical discussions, etc.

This software is the work of Tom Lane, Philip Gladstone, Jim Boucher, Lee Crocker, Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Guido Vollbeding, Ge' Weijers, and other members of the Independent JPEG Group.

IJG is not affiliated with the official ISO JPEG standards committee.

DOCUMENTATION

ROADMAP

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This file contains the following sections:

OVERVIEW	General description of JPEG and the IJG software.
LEGAL ISSUES	Copyright, lack of warranty, terms of distribution.
REFERENCES	Where to learn more about JPEG.
ARCHIVE LOCATIONS	Where to find newer versions of this software.
RELATED SOFTWARE	Other stuff you should get.
FILE FORMAT WARS	Software *not* to get.
TO DO	Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.doc How to configure and install the IJG software.
usage.doc Usage instructions for cjpeg, djpeg, jpegtran,
 rdjpgcom, and wrjpgcom.
*.1 Unix-style man pages for programs (same info as usage.doc).
wizard.doc Advanced usage instructions for JPEG wizards only.
change.log Version-to-version change highlights.

Programmer and internal
documentation:

libjpeg.doc How to use the JPEG library in your own programs.
example.c Sample code for calling the JPEG library.
structure.doc Overview of the JPEG library's internal structure.
filelist.doc Road map of IJG files.
coderules.doc Coding style rules --- please read if you contribute code.

Please read at least the files install.doc and usage.doc. Useful information can also be found in the JPEG FAQ (Frequently Asked Questions) article. See ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or more of the REFERENCES, then looking at the documentation files (in roughly the order listed) before diving into the code.

OVERVIEW

=====

This package contains C software to implement JPEG image compression and decompression. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and gray-scale images.

JPEG is intended for compressing "real-world" scenes; line drawings, cartoons and other non-realistic images are not its strong suit. JPEG is lossy, meaning that the output image is not exactly identical to the input image. Hence you must not use JPEG if you have to have identical output bits. However, on typical photographic images, very good compression levels can be obtained with no visible change, and remarkably high compression levels are possible if you can tolerate a low-quality image. For more details, see the references, or just experiment with various compression settings.

This software implements JPEG baseline, extended-sequential, and progressive compression processes. Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. For legal reasons, we are not distributing code for the arithmetic-coding variants of JPEG; see LEGAL ISSUES. We have made no provision for supporting

the
hierarchical or lossless processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files, plus two sample applications "cjpeg" and "djpeg", which use the library to perform conversion between JPEG and some other popular image file formats. The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG decoding, but they are essential for output to colormapped file formats or colormapped displays. These extra functions can be compiled out of the library if not required for a particular application. We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and flexibility, while also making it fast enough to be useful. In particular, the software is not intended to be read as a tutorial on JPEG. (See the REFERENCES section for introductory material.) Rather, it is intended to be reliable, portable, industrial-strength code. We do not claim to have achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products. No royalty is required, but we do ask for an acknowledgement in product documentation, as described under LEGAL ISSUES.

LEGAL ISSUES

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In plain English:

1. We don't promise that this software works. (But if you find any bugs, please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a program, you must acknowledge somewhere in your documentation that you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied, with respect to this software, its quality, accuracy, merchantability, or

fitness for a particular purpose. This software is provided "AS IS", and you, its user, assume the entire risk as to its quality and accuracy.

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All Rights Reserved except as specified below.

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- (2) If only executable code is distributed, then the accompanying documentation must state that "this software is based in part on the work of the Independent JPEG Group".
- (3) Permission for use of this software is granted only if the user accepts full responsibility for any undesirable consequences; the authors accept NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code, not just to the unmodified library. If you use our work, you ought to acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name in advertising or publicity relating to this software or products derived from it. This software may be referred to only as "the Independent JPEG Group's software".

We specifically permit and encourage the use of this software as the basis of commercial products, provided that all warranty or liability claims are assumed by the product vendor.

ansi2knr.c is included in this distribution by permission of L. Peter Deutsch, sole proprietor of its copyright holder, Aladdin Enterprises of Menlo Park, CA. ansi2knr.c is NOT covered by the above copyright and conditions, but instead by the usual distribution terms of the Free Software Foundation; principally, that you must include source code if you redistribute it. (See the file ansi2knr.c for full details.) However, since ansi2knr.c is not needed as part of any program generated from the IJG code, this does not limit you more than the foregoing paragraphs do.

The Unix configuration script "configure" was produced with GNU Autoconf. It is copyright by the Free Software Foundation but is freely distributable. The same holds for its supporting scripts (config.guess, config.sub,

ltconfig, ltmain.sh). Another support script, install-sh, is copyright by M.I.T. but is also freely distributable.

It appears that the arithmetic coding option of the JPEG spec is covered by patents owned by IBM, AT&T, and Mitsubishi. Hence arithmetic coding cannot legally be used without obtaining one or more licenses. For this reason, support for arithmetic coding has been removed from the free JPEG software. (Since arithmetic coding provides only a marginal gain over the unpatented Huffman mode, it is unlikely that very many implementations will support it.) So far as we are aware, there are no patent restrictions on the remaining code.

The IJG distribution formerly included code to read and write GIF files. To avoid entanglement with the Unisys LZW patent, GIF reading support has been removed altogether, and the GIF writer has been simplified to produce "uncompressed GIFs". This technique does not use the LZW algorithm; the resulting GIF files are larger than usual, but are readable by all standard GIF decoders.

We are required to state that

"The Graphics Interchange Format(c) is the Copyright property of CompuServe Incorporated. GIF(sm) is a Service Mark property of CompuServe Incorporated."

REFERENCES

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We

highly recommend reading one or more of these references before trying to understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is Wallace, Gregory K. "The JPEG Still Picture Compression Standard", Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44. (Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PostScript file containing a revised version of Wallace's article is available at <ftp://ftp.uu.net/graphics/jpeg/wallace.ps.gz>. The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics) omits the sample images that appeared in CACM, but it includes corrections and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in "The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by

M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides good explanations and example C code for a multitude of compression methods including JPEG. It is an excellent source if you are comfortable reading C code but don't know much about data compression in general. The book's JPEG sample code is far from industrial-strength, but when you are ready to look at a full implementation, you've got one here...

The best full description of JPEG is the textbook "JPEG Still Image Data Compression Standard" by William B. Pennebaker and Joan L. Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1. Price US\$59.95, 638 pp. The book includes the complete text of the ISO JPEG standards (DIS 10918-1 and draft DIS 10918-2). This is by far the most complete exposition of JPEG in existence, and we highly recommend it.

The

JPEG standard itself is not available electronically; you must order a paper copy through ISO or ITU. (Unless you feel a need to own a certified official copy, we recommend buying the Pennebaker and Mitchell book instead; it's much cheaper and includes a great deal of useful explanatory material.) In the USA, copies of the standard may be ordered from ANSI Sales at (212) 642-4900, or from Global Engineering Documents at (800) 854-7179. (ANSI doesn't take credit card orders, but Global does.) It's not cheap: as of 1992, ANSI was charging \$95 for Part 1 and \$47 for Part 2, plus 7% shipping/handling. The standard is divided into two parts, Part 1 being the actual specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS 10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 2: Compliance testing" and has document numbers ISO/IEC IS 10918-2, ITU-T T.83.

Some extensions to the original JPEG standard are defined in JPEG Part 3, a newer ISO standard numbered ISO/IEC IS 10918-3 and ITU-T T.84. IJG currently does not support any Part 3 extensions.

The JPEG standard does not specify all details of an interchangeable file format. For the omitted details we follow the "JFIF" conventions, revision 1.02. A copy of the JFIF spec is available from:

Literature Department

C-Cube Microsystems, Inc.

1778 McCarthy Blvd.

Milpitas, CA 95035

phone (408) 944-6300, fax (408) 944-6314

A PostScript version of this document is available by FTP at

<ftp://ftp.uu.net/graphics/jpeg/jfif.ps.gz>. There is also a plain text

version at <ftp://ftp.uu.net/graphics/jpeg/jfif.txt.gz>, but it is missing the figures.

The TIFF 6.0 file format specification can be obtained by FTP from <ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz>. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems. IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6). Instead, we recommend the JPEG design proposed by TIFF Technical Note #2 (Compression tag 7). Copies of this Note can be obtained from <ftp.sgi.com> or from <ftp://ftp.uu.net/graphics/jpeg/>. It is expected that the next revision of the TIFF spec will replace the 6.0 JPEG design with the Note's design. Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note. libtiff is available from <ftp://ftp.sgi.com/graphics/tiff/>.

ARCHIVE LOCATIONS

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The "official" archive site for this software is <ftp.uu.net> (Internet address 192.48.96.9). The most recent released version can always be found there in directory [graphics/jpeg](ftp://ftp.uu.net/graphics/jpeg/jpegsrc.v6b.tar.gz). This particular version will be archived as <ftp://ftp.uu.net/graphics/jpeg/jpegsrc.v6b.tar.gz>. If you don't have direct Internet access, UUNET's archives are also available via UUCP; contact help@uunet.uu.net for information on retrieving files that way.

Numerous Internet sites maintain copies of the UUNET files. However, only <ftp.uu.net> is guaranteed to have the latest official version.

You can also obtain this software in DOS-compatible "zip" archive format from the SimTel archives (<ftp://ftp.simtel.net/pub/simtelnet/msdos/graphics/>), or on CompuServe in the Graphics Support forum (GO CIS:GRAPHSUP), library 12 "JPEG Tools". Again, these versions may sometimes lag behind the <ftp.uu.net> release.

The JPEG FAQ (Frequently Asked Questions) article is a useful source of general information about JPEG. It is updated constantly and therefore is not included in this distribution. The FAQ is posted every two weeks to Usenet newsgroups [comp.graphics.misc](news:comp.graphics.misc), [news.answers](news:news.answers), and other groups. It is available on the World Wide Web at <http://www.faqs.org/faqs/jpeg-faq/> and other [news.answers](news:news.answers) archive sites, including the official [news.answers](news:news.answers) archive at [rtfm.mit.edu: ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/](http://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/). If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu with body
send [usenet/news.answers/jpeg-faq/part1](news:usenet/news.answers/jpeg-faq/part1)
send [usenet/news.answers/jpeg-faq/part2](news:usenet/news.answers/jpeg-faq/part2)

RELATED SOFTWARE

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Numerous viewing and image manipulation programs now support JPEG. (Quite a few of them use this library to do so.) The JPEG FAQ described above lists some of the more popular free and shareware viewers, and tells where to obtain them on Internet.

If you are on a Unix machine, we highly recommend Jef Poskanzer's free PBPLUS software, which provides many useful operations on PPM-format image files. In particular, it can convert PPM images to and from a wide range of other formats, thus making cjpeg/djpeg considerably more useful. The latest version is distributed by the NetPBM group, and is available from numerous sites,

notably <ftp://wuarchive.wustl.edu/graphics/graphics/packages/NetPBM/>.

Unfortunately PBPLUS/NETPBM is not nearly as portable as the IJG software is; you are likely to have difficulty making it work on any non-Unix machine.

A different free JPEG implementation, written by the PVRG group at Stanford, is available from <ftp://havefun.stanford.edu/pub/jpeg/>. This program is designed for research and experimentation rather than production use; it is slower, harder to use, and less portable than the IJG code, but it is easier to read and modify. Also, the PVRG code supports lossless JPEG, which we do not. (On the other hand, it doesn't do progressive JPEG.)

FILE FORMAT WARS

=====

Some JPEG programs produce files that are not compatible with our library. The root of the problem is that the ISO JPEG committee failed to specify a concrete file format. Some vendors "filled in the blanks" on their own, creating proprietary formats that no one else could read.

(For example, none of the early commercial JPEG implementations for the Macintosh were able to exchange compressed files.)

The file format we have adopted is called JFIF (see REFERENCES). This format has been agreed to by a number of major commercial JPEG vendors, and it has become the de facto standard. JFIF is a minimal or "low end" representation. We recommend the use of TIFF/JPEG (TIFF revision 6.0 as modified by TIFF Technical Note #2) for "high end" applications that need to record a lot of additional data about an image. TIFF/JPEG is fairly new and not yet widely supported, unfortunately.

The upcoming JPEG Part 3 standard defines a file format called SPIFF. SPIFF is interoperable with JFIF, in the sense that most JFIF decoders should

be able to read the most common variant of SPIFF. SPIFF has some technical advantages over JFIF, but its major claim to fame is simply that it is an official standard rather than an informal one. At this point it is unclear whether

SPIFF will supersede JFIF or whether JFIF will remain the de-facto standard. IJG intends to support SPIFF once the standard is frozen, but we have not decided whether it should become our default output format or not. (In any case, our decoder will remain capable of reading JFIF indefinitely.)

Various proprietary file formats incorporating JPEG compression also exist. We have little or no sympathy for the existence of these formats. Indeed, one of the original reasons for developing this free software was to help force convergence on common, open format standards for JPEG files. Don't use a proprietary file format!

TO DO

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The major thrust for v7 will probably be improvement of visual quality. The current method for scaling the quantization tables is known not to be very good at low Q values. We also intend to investigate block boundary smoothing, "poor man's variable quantization", and other means of improving quality-vs-file-size performance without sacrificing compatibility.

In future versions, we are considering supporting some of the upcoming JPEG Part 3 extensions --- principally, variable quantization and the SPIFF file format.

As always, speeding things up is of great interest.

Please send bug reports, offers of help, etc. to jpeg-info@uunet.uu.net.

1.2 protobuf 2.6.1

1.2.1 Available under license :

This file contains a list of people who have made large contributions to the public version of Protocol Buffers.

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- * Small patch to handle trailing slashes in --proto_path flag.

Johan Euphrosine <proppy@aminche.com>

- * Small patch to fix Python CallMethod().

Ulrich Kunitz <kune@deine-taler.de>

- * Small optimizations to Python serialization.

Leandro Lucarella <llucax@gmail.com>

- * VI syntax highlighting tweaks.

- * Fix compiler to not make output executable.

Dilip Joseph <dilip.antony.joseph@gmail.com>

- * Heuristic detection of sub-messages when printing unknown fields in text format.

Brian Atkinson <nairb774@gmail.com>

- * Added @Override annotation to generated Java code where appropriate.

Vincent Choiniere <Choiniere.Vincent@hydro.qc.ca>

- * Tru64 support.

Monty Taylor <monty.taylor@gmail.com>

- * Solaris 10 + Sun Studio fixes.

Alek Storm <alek.storm@gmail.com>

- * Slicing support for repeated scalar fields for the Python API.

Oleg Smolsky <oleg.smolsky@gmail.com>

- * MS Visual Studio error format option.

- * Detect unordered_map in stl_hash.m4.

Brian Olson <brianolson@google.com>

- * gzip/zlib I/O support.

Michael Poole <mdpoole@troilus.org>

- * Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).

- * Added generation of field number constants.

Wink Saville <wink@google.com>

- * Fixed initialization ordering problem in logging code.

Will Pierce <willp@nuclei.com>

- * Small patch improving performance of in Python serialization.

Alexandre Vassalotti <alexandre@peadrop.com>

- * Emacs mode for Protocol Buffers (editors/protobuf-mode.el).

Scott Stafford <scott.stafford@gmail.com>

- * Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.

Alexander Melnikov <alm@sibmail.ru>

- * HPUX support.

Oliver Jowett <oliver.jowett@gmail.com>

- * Detect whether zlib is new enough in configure script.

- * Fixes for Solaris 10 32/64-bit confusion.

Evan Jones <evanj@mit.edu>

- * Optimize Java serialization code when writing a small message to a stream.

- * Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.

- * Clean up some Java warnings.

- * Fix bug with permanent callbacks that delete themselves when run.

Michael Kucharski <m.kucharski@gmail.com>

- * Added CodedInputStream.getTotalBytesRead().

Kacper Kowalik <xarthisius.kk@gmail.com>

- * Fixed m4/acx_pthread.m4 problem for some Linux distributions.

William Orr <will@worrbase.com>

- * Fixed detection of sched_yield on Solaris.

- * Added atomicops for Solaris

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This file contains a list of people who've made non-trivial
contribution to the Google C++ Testing Framework project. People
who commit code to the project are encouraged to add their names
here. Please keep the list sorted by first names.

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1.3 readline 5.2

1.3.1 Available under license :

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1.4 bash 3.2.57

1.4.1 Available under license :

From friedman@cli.com Thu May 25 12:19:06 1995
Flags: 10
Return-Path: friedman@cli.com
Received: from po.cwru.edu (root@po.CWRU.Edu [129.22.4.2]) by odin.INS.CWRU.Edu with ESMTP (8.6.10+cwru/CWRU-2.1-ins)
id MAA08685; Thu, 25 May 1995 12:19:05 -0400 (from friedman@cli.com for <chet@odin.INS.CWRU.Edu>)
Received: from cli.com (cli.com [192.31.85.1]) by po.cwru.edu with SMTP (8.6.10+cwru/CWRU-2.3)
id MAA11299; Thu, 25 May 1995 12:19:00 -0400 (from friedman@cli.com for <chet@po.cwru.edu>)
Received: from tepui.cli.com by cli.com (4.1/SMI-4.1)
id AA27213; Thu, 25 May 95 11:18:25 CDT
Received: by tepui.cli.com (4.1) id AA16031; Thu, 25 May 95 11:18:23 CDT
Message-Id: <9505251618.AA16031@tepui.cli.com>
From: friedman@gnu.ai.mit.edu (Noah Friedman)
To: chet@po.cwru.edu
Subject: Bash scripts
Reply-To: friedman@gnu.ai.mit.edu
In-Reply-To: <chet@odin.ins.cwru.edu> Thu, 25 May 1995 11:19:59 -0400
References: <9505251519.AA06424.SM@odin.INS.CWRU.Edu>
Date: Thu, 25 May 95 11:18:21 CST

>Hi. I snagged

some of your bash functions from your home directory on
>the FSF machines (naughty, I know), and I was wondering if you'd let
>me distribute them with bash-2.0. Thanks.

Sure. I think there's a later copy in
~ftp/friedman/shell-inits/init-4.89.tar.gz. There are also some elisp and
es frobs in that file.

It should serve as a pretty good example of how to get carried away. :-)

From spcedt@armory.com Wed May 10 10:21:11 1995

Flags: 10

Return-Path: spcedt@armory.com

Received: from po.cwru.edu (root@po.CWRU.Edu [129.22.4.2]) by odin.INS.CWRU.Edu with ESMTP
(8.6.10+cwru/CWRU-2.1-ins)

id KAA22876; Wed, 10 May 1995 10:21:10 -0400 (from spcedt@armory.com for <chet@odin.INS.CWRU.Edu>)

Received: from deepthought.armory.com (mmdf@deepthought.armory.com [192.122.209.42]) by po.cwru.edu with
SMTP (8.6.10+cwru/CWRU-2.3)

id BAA16354; Wed, 10 May 1995 01:33:22 -0400 (from spcedt@armory.com for <chet@po.cwru.edu>)

From: John DuBois <spcedt@armory.com>

Date: Tue, 9 May 1995 22:33:12 -0700

In-Reply-To: Chet Ramey <chet@odin.ins.cwru.edu>

"ksh scripts" (May 9, 1:36pm)

X-Www: <http://www.armory.com/~spcedt/>

X-Mailer: Mail User's Shell (7.2.5 10/14/92)

To: chet@po.cwru.edu

Subject: Re: ksh scripts

Message-ID: <9505092233.aa13001@deepthought.armory.com>

Sure. The canonical versions are available on ftp.armory.com; you might
want to pick up the latest versions
before modifying them.

John

On May 9, 1:36pm, Chet Ramey wrote:

} Subject: ksh scripts

} From odin.ins.cwru.edu!chet Tue May 9 10:39:51 1995

} Received: from odin.INS.CWRU.Edu by deepthought.armory.com id aa22336;

} 9 May 95 10:39 PDT

} Received: (chet@localhost) by odin.INS.CWRU.Edu (8.6.10+cwru/CWRU-2.1-ins)

} id NAA20487; Tue, 9 May 1995 13:39:24 -0400 (from chet)

} Date: Tue, 9 May 1995 13:36:54 -0400

} From: Chet Ramey <chet@odin.ins.cwru.edu>

} To: john@armory.com

} Subject: ksh scripts

} Cc: chet@odin.ins.cwru.edu

} Reply-To: chet@po.cwru.edu

} Message-ID: <9505091736.AA20411.SM@odin.INS.CWRU.Edu>

```

} Read-Receipt-To: chet@po.CWRU.Edu
} MIME-Version: 1.0
} Content-Type: text/plain; charset=us-ascii
} Status: OR
}
} Hi. I'm the maintainer of bash (the GNU `Bourne Again shell') for
} the FSF.
}
} I picked up a tar file of ksh scripts you wrote from an anon FTP site
} a while back. I'd like your permission to include modified versions
} of some of them in
} the next major bash distribution (with proper credit
} given, of course). Is it OK if I do that?
}
} Chet Ramey
}
} --
} ``The lyf so short, the craft so long to lerne." - Chaucer
}
} Chet Ramey, Case Western Reserve University Internet: chet@po.CWRU.Edu
}-- End of excerpt from Chet Ramey
    GNU GENERAL PUBLIC LICENSE
    Version 2, June 1991

```

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id MAA01565; Tue, 1 Aug 1995 12:13:18 -0400 (from mikel@ora.com for <chet@odin.INS.CWRU.Edu>)

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From: mikel@ora.com (Michael Loukides)

Message-Id: <9508011257.AA00672@los.ora.com>

Subject: Re: Ksh debugger from Rosenblatt's book [for bash]

To: Chet Ramey <chet@odin.INS.CWRU.Edu>

Cc: cmarie@ora.com, cam@iinet.com.au, brosenblatt@tm.com

In-Reply-To: Chet Ramey <chet@odin.INS.CWRU.Edu>, Mon, 31 Jul 1995 16:22:48 -0400

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1.5 linux-kernel 4.5.4

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```

/* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)
* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)
*
* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.
* http://www.hypermall.com/
* 10/1/97 - commented out CFG_PHYIE bit - we don't care when the PHY
* interrupts us (except possibly for removal/insertion of the cable?)
* 10/4/97 - began heavy inline documentation of the code. Corrected typos
* and spelling mistakes.
* 10/5/97 - added code to handle PHY interrupts, disable PHY on
* loss of link, and correctly re-enable PHY when link is
* re-established. (put back CFG_PHYIE)
*
* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.
*
* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997
*
* Linux driver for the IDT77201 NICStAR PCI ATM controller.
* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;
* see init_nicstar() for PHY initialization to change this. This driver
* expects the Linux ATM stack to support scatter-gather
  lists
* (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.
*
* Implementing minimal-copy of received data:
* IDT always receives data into a small buffer, then large buffers
* as needed. This means that data must always be copied to create
* the linear buffer needed by most non-ATM protocol stacks (e.g. IP)
* Fix is simple: make large buffers large enough to hold entire
* SDU, and leave <small_buffer_data> bytes empty at the start. Then
* copy small buffer contents to head of large buffer.
* Trick is to avoid fragmenting Linux, due to need for a lot of large
* buffers. This is done by 2 things:
* 1) skb->destructor / skb->atm.recycle_buffer
*    combined, allow nicstar_free_rx_skb to be called to
*    recycle large data buffers
* 2) skb_clone of received buffers
* See nicstar_free_rx_skb and linearize_buffer for implementation
* details.
*
*
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- *
- * M. Welsh, 6 July 1996
- *
- *
- */

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static inline int license_is_gpl_compatible(const char *license)
{
    return (strcmp(license, "GPL") == 0
        || strcmp(license, "GPL v2") == 0
        || strcmp(license, "GPL and additional rights") == 0
        || strcmp(license, "Dual BSD/GPL") == 0
        || strcmp(license, "Dual MIT/GPL") == 0
        || strcmp(license, "Dual MPL/GPL") == 0);
}
```

#endif

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(in case you are wondering where CyberLogin is, EON changed its login
procedure and CyberLogin is no longer used.)

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for the nxt2004 frontend driver

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A ``library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The ``Library'', below, refers to any such software library or work which has been distributed under these terms. A ``work based on the Library'' means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it,
either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term ``modification".)

``Source code'' for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

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You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

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The modified work must itself be a software library.

@item

You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

@item

You must

cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

@item

If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

@end enumerate

These requirements apply to the modified work as a whole. If identifiable sections

of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this

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You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

@item

You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

@item

A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a ``work that uses the Library''. Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a ``work that uses the Library'' with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a ``work that uses the library''. The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a ``work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise,
if the work is a derivative of the Library, you may
distribute the object code for the work under the terms of Section 6.
Any executables containing that work also fall under Section 6,
whether or not they are linked directly with the Library itself.

@item

As an exception to the Sections above, you may also combine or link a ``work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of
this License. Also, you must do one
of these things:

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Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable ``work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the

Library will not necessarily be able to recompile the application to use the modified definitions.)

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Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

@item

Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

@item

If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

@item

Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

@end enumerate

For an executable, the required form of the ``work that uses the Library'' must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

@item

You may place library facilities that are a work based on the Library side-by-side in a single library together with other library

facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

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Accompany the combined library with a copy of the same work based on the Library,
uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

@item

Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

@end enumerate

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@subheading END OF TERMS AND CONDITIONS

@page

@subheading How to Apply These Terms to Your New Libraries

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To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the ``copyright" line and a pointer to where the full notice is found.

@smallexample

@var{one line to give the library's name and an idea of what it does.}

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smallexample

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a ``copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

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`Frob' (a library for tweaking knobs) written by James Random Hacker.

@var{signature of Ty Coon}, 1 April 1990

Ty Coon, President of Vice

@end smallexample

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Version 2.1, February 1999

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To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

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Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser

General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order

to run.

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Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary

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License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License.

Section 6 states terms for distribution of such executables.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the

object code for the work under the terms of Section 6.

Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany

the work with the complete corresponding

machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application

to use the modified definitions.)

- b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.
- c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

- a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any

other library

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1.28 evmctl 1.2

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/* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)

* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)

*

* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.

* <http://www.hypermall.com/>

* 10/1/97 - commented out CFG_PHYIE bit - we don't care when the PHY

* interrupts us (except possibly for removal/insertion of the cable?)

* 10/4/97 - began heavy inline documentation of the code. Corrected typos

* and spelling mistakes.

* 10/5/97 - added code to handle PHY interrupts, disable PHY on

* loss of link, and correctly re-enable PHY when link is

* re-established. (put back CFG_PHYIE)

*

* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.

*

* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997

*

* Linux driver for the IDT77201 NICStAR PCI ATM controller.

* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;

* see init_nicstar() for PHY initialization to change this. This driver

* expects the Linux ATM stack to support scatter-gather

lists

* (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.

*

* Implementing minimal-copy of received data:

* IDT always receives data into a small buffer, then large buffers

* as needed. This means that data must always be copied to create

* the linear buffer needed by most non-ATM protocol stacks (e.g. IP)

* Fix is simple: make large buffers large enough to hold entire

* SDU, and leave <small_buffer_data> bytes empty at the start. Then

* copy small buffer contents to head of large buffer.

* Trick is to avoid fragmenting Linux, due to need for a lot of large

* buffers. This is done by 2 things:

* 1) skb->destructor / skb->atm.recycle_buffer

* combined, allow nicstar_free_rx_skb to be called to

* recycle large data buffers

* 2) skb_clone of received buffers

* See nicstar_free_rx_skb and linearize_buffer for implementation

* details.

*

*

*

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*

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*

* M. Welsh, 6 July 1996

*

*

*/

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Diego Picciani <d.picciani@novacomp.it>
for CyberLogin for Linux which allows logging onto EON
(in case you are wondering where CyberLogin is, EON changed its login
procedure and CyberLogin is no longer used.)

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for the nxt2004 frontend driver

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for merging the nxt2002 and nxt2004 modules into a
single nxt200x frontend driver.

(If you think you should be in this list, but you are not, drop a
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```
Gnomovision version 69, Copyright (C) year name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

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```
Yoyodyne, Inc., hereby disclaims all copyright interest in the program
`Gnomovision' (which makes passes at compilers) written by James Hacker.
```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

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Version 1.0

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1.30 libjpeg 8b

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```
/*
 * cdjpeg.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains common support routines used by the IJG application
 * programs (cjpeg, djpeg, jpegtran).
 */
```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/cdjpeg.c
```

No license file was found, but licenses were detected in source scan.

```
/*
 * jdpostct.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains the decompression postprocessing controller.
 * This controller manages the upsampling, color conversion, and color
 * quantization/reduction steps; specifically, it controls the buffering
 * between upsample/color conversion and color quantization/reduction.
 *
 * If no color quantization/reduction is required, then this module has no
 * work to do, and it just hands off to the upsample/color conversion code.
 * An integrated upsample/convert/quantize process would replace this module
 * entirely.
 */
```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jdpostct.c
```

No license file was found, but licenses were detected in source scan.

```
/*
 * transupp.c
 *
 * Copyright (C) 1997-2017, Thomas G. Lane, Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
```

- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains image transformation routines and other utility code
- * used by the jpegtran sample application. These are NOT part of the core
- * JPEG library. But we keep these routines separate from jpegtran.c to
- * ease the task of maintaining jpegtran-like programs that have other user
- * interfaces.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/transupp.c

No license file was found, but licenses were detected in source scan.

- /*
- * jmemsys.h
- *
- * Copyright (C) 1992-1997, Thomas G. Lane.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This include file defines the interface between the system-independent
- * and system-dependent portions of the JPEG memory manager. No other
- * modules need include it. (The system-independent portion is jmemmgr.c;
- * there are several different versions of the system-dependent portion.)
- *
- * This file works as-is for the system-dependent memory managers supplied
- * in the IJG distribution. You may need to modify it if you write a
- * custom memory manager. If system-dependent changes are needed in
- * this file, the best method is to #ifdef them based on a configuration
- * symbol supplied in jconfig.h, as we have done with USE_MSDOS_MEMMGR
- * and USE_MAC_MEMMGR.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jmemsys.h

No license file was found, but licenses were detected in source scan.

- /*
- * jctrans.c
- *
- * Copyright (C) 1995-1998, Thomas G. Lane.
- * Modified 2000-2017 by Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains library routines for transcoding compression,
- * that is, writing raw DCT coefficient arrays to an output JPEG file.
- * The routines in jcapimin.c will also be needed by a transcoder.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jctrans.c

No license file was found, but licenses were detected in source scan.

/*

* jcmaint.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2003-2012 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the main buffer controller for compression.

* The main buffer lies between the pre-processor and the JPEG

* compressor proper; it holds downsampled data in the JPEG colorspace.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jcmaint.c

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/*

* rdrle.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to read input images in Utah RLE format.

* The Utah Raster Toolkit library is required (version 3.1 or later).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume input from

* an ordinary stdio stream. They further assume that reading begins

* at the start of the file; start_input may need work if the

* user interface has already read some data (e.g., to determine that

* the file is indeed RLE format).

*

* Based on code contributed by Mike Lijewski,

* with updates from Robert Hutchinson.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/rdrle.c

No license file was found, but licenses were detected in source scan.

```

/*
 * rdtarga.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to read input images in Targa format.
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume input from
 * an ordinary stdio stream. They further assume that reading begins
 * at the start of the file; start_input may need work if the
 * user interface has already read some data (e.g., to determine that
 * the file is indeed Targa format).
 *
 * Based on code contributed by Lee Daniel Crocker.
 */

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/rdtarga.c
```

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```

/*
 * jutils.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2009-2011 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains tables and miscellaneous utility routines needed
 * for both compression and decompression.
 * Note we prefix all global names with "j" to minimize conflicts with
 * a surrounding application.
 */

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jutils.c
```

No license file was found, but licenses were detected in source scan.

```

/*
 * jddctmgr.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2002-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.

```

- * For conditions of distribution and use, see the accompanying README file.
- /*
- * This file contains the inverse-DCT management logic.
- * This code selects a particular IDCT implementation to be used,
- * and it performs related housekeeping chores. No code in this file
- * is executed per IDCT step, only during output pass setup.
- /*
- * Note that the IDCT routines are responsible for performing coefficient
- * dequantization as well as the IDCT proper. This module sets up the
- * dequantization multiplier table needed by the IDCT routine.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jddctmgr.c

No license file was found, but licenses were detected in source scan.

- /*
- * jcmaster.c
- /*
- * Copyright (C) 1991-1997, Thomas G. Lane.
- * Modified 2003-2017 by Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- /*
- * This file contains master control logic for the JPEG compressor.
- * These routines are concerned with parameter validation, initial setup,
- * and inter-pass control (determining the number of passes and the work
- * to be done in each pass).
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jcmaster.c

No license file was found, but licenses were detected in source scan.

- /*
- * jfdctint.c
- /*
- * Copyright (C) 1991-1996, Thomas G. Lane.
- * Modification developed 2003-2015 by Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- /*
- * This file contains a slow-but-accurate integer implementation of the
- * forward DCT (Discrete Cosine Transform).
- /*
- * A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
- * on each column. Direct algorithms are also available, but they are
- * much more complex and seem not to be any faster when reduced to code.

```

*
* This implementation is based on an algorithm described in
* C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
* Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,
* Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
* The primary algorithm described there uses 11 multiplies
  and 29 adds.
* We use their alternate method with 12 multiplies and 32 adds.
* The advantage of this method is that no data path contains more than one
* multiplication; this allows a very simple and accurate implementation in
* scaled fixed-point arithmetic, with a minimal number of shifts.
*
* We also provide FDCT routines with various input sample block sizes for
* direct resolution reduction or enlargement and for direct resolving the
* common 2x1 and 1x2 subsampling cases without additional resampling: NxN
* (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 output DCT block.
*
* For N<8 we fill the remaining block coefficients with zero.
* For N>8 we apply a partial N-point FDCT on the input samples, computing
* just the lower 8 frequency coefficients and discarding the rest.
*
* We must scale the output coefficients of the N-point FDCT appropriately
* to the standard 8-point FDCT level by 8/N per 1-D pass. This scaling
* is folded into the constant multipliers
  (pass 2) and/or final/initial
* shifting.
*
* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
* since there would be too many additional constants to pre-calculate.
*/

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jfdctint.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jdatasrc.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains decompression data source routines for the case of
* reading JPEG data from memory or from a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different source manager.
* IMPORTANT: we assume that fread() will correctly transcribe an array of

```


* JOCTETs from 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdatasrc.c

No license file was found, but licenses were detected in source scan.

/*

* jdsample.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2002-2015 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains upsampling routines.

*

* Upsampling input data is counted in "row groups". A row group

* is defined to be (v_samp_factor * DCT_v_scaled_size / min_DCT_v_scaled_size)

* sample rows of each component. Upsampling will normally produce

* max_v_samp_factor pixel rows from each row group (but this could vary

* if the upsampler is applying a scale factor of its own).

*

* An excellent reference for image resampling is

* Digital Image Warping, George Wolberg, 1990.

* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdsample.c

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/*

* jcomapi.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains application interface routines that are used for both

* compression and decompression.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jcomapi.c

No license file was found, but licenses were detected in source scan.

```

/*
 * jdapimin.c
 *
 * Copyright (C) 1994-1998, Thomas G. Lane.
 * Modified 2009-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains application interface code for the decompression half
 * of the JPEG library. These are the "minimum" API routines that may be
 * needed in either the normal full-decompression case or the
 * transcoding-only case.
 *
 * Most of the routines intended to be called directly by an application
 * are in this file or in jdapistd.c. But also see jcomapi.c for routines
 * shared by compression and decompression, and jdtrans.c for the transcoding
 * case.
 */

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jdapimin.c
```

No license file was found, but licenses were detected in source scan.

```

/*
 * jdinput.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2002-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains input control logic for the JPEG decompressor.
 * These routines are concerned with controlling the decompressor's input
 * processing (marker reading and coefficient decoding). The actual input
 * reading is done in jdmarker.c, jdhuff.c, and jdarith.c.
 */

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jdinput.c
```

No license file was found, but licenses were detected in source scan.

```

/*
 * jdhuff.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2006-2016 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.

```

*
 * This file contains Huffman entropy decoding routines.
 * Both sequential and progressive modes are supported in this single module.
 *
 * Much of the complexity here has to do with supporting input suspension.
 * If the data source module demands suspension, we want to be able to back
 * up to the start of the current MCU. To do this, we copy state variables
 * into local working storage, and update them back to the permanent
 * storage only upon successful completion of an MCU.
 */

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdhuff.c

No license file was found, but licenses were detected in source scan.

/*
 * jidctint.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modification developed 2002-2016 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a slow-but-accurate integer implementation of the
 * inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
 * must also perform dequantization of the input coefficients.
 *
 * A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
 * on each row (or vice versa, but it's more convenient to emit a row at
 * a time). Direct algorithms are also available, but they are much more
 * complex and seem not to be any faster when reduced to code.
 *
 * This implementation is based on an algorithm described in
 * C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
 * Algorithms with 11 Multiplications",
 * Proc. Int'l. Conf. on Acoustics,
 * Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
 * The primary algorithm described there uses 11 multiplies and 29 adds.
 * We use their alternate method with 12 multiplies and 32 adds.
 * The advantage of this method is that no data path contains more than one
 * multiplication; this allows a very simple and accurate implementation in
 * scaled fixed-point arithmetic, with a minimal number of shifts.
 *
 * We also provide IDCT routines with various output sample block sizes for
 * direct resolution reduction or enlargement and for direct resolving the
 * common 2x1 and 1x2 subsampling cases without additional resampling: NxN
 * (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 input DCT block.
 *

- * For $N < 8$ we simply take the corresponding low-frequency coefficients of
- * the 8×8 input DCT block and apply an $N \times N$ point IDCT on the sub-block
- * to yield the downscaled outputs.
- * This can be seen as direct low-pass downsampling
- from the DCT domain
- * point of view rather than the usual spatial domain point of view,
- * yielding significant computational savings and results at least
- * as good as common bilinear (averaging) spatial downsampling.
- *
- * For $N > 8$ we apply a partial $N \times N$ IDCT on the 8 input coefficients as
- * lower frequencies and higher frequencies assumed to be zero.
- * It turns out that the computational effort is similar to the 8×8 IDCT
- * regarding the output size.
- * Furthermore, the scaling and descaling is the same for all IDCT sizes.
- *
- * CAUTION: We rely on the FIX() macro except for the $N=1,2,4,8$ cases
- * since there would be too many additional constants to pre-calculate.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jidctint.c

No license file was found, but licenses were detected in source scan.

/*

- * jerror.h

*

- * Copyright (C) 1994-1997, Thomas G. Lane.

- * Modified 1997-2012 by Guido Vollbeding.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * This file defines the error and message codes for the JPEG library.

- * Edit this file to add new codes, or to translate the message strings to

- * some other language.

- * A set of error-reporting macros are defined too. Some applications using

- * the JPEG library may wish to include this file to get the error codes

- * and/or the macros.

*/

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jerror.h

No license file was found, but licenses were detected in source scan.

/*

- * jmemname.c

*

- * Copyright (C) 1992-1997, Thomas G. Lane.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file provides a generic implementation of the system-dependent
- * portion of the JPEG memory manager. This implementation assumes that
- * you must explicitly construct a name for each temp file.
- * Also, the problem of determining the amount of memory available
- * is shoved onto the user.
- */

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jmemname.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jmemmgr.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2011-2012 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains the JPEG system-independent memory management
 * routines. This code is usable across a wide variety of machines; most
 * of the system dependencies have been isolated in a separate file.
 * The major functions provided here are:
 *   * pool-based allocation and freeing of memory;
 *   * policy decisions about how to divide available memory among the
 *     virtual arrays;
 *   * control logic for swapping virtual arrays between main memory and
 *     backing storage.
 * The separate system-dependent file provides the actual backing-storage
 * access code, and it contains the policy decision about how much total
 * main memory to use.
 * This file is
 * system-dependent in the sense that some of its functions
 * are unnecessary in some systems. For example, if there is enough virtual
 * memory so that backing storage will never be used, much of the virtual
 * array control logic could be removed. (Of course, if you have that much
 * memory then you shouldn't care about a little bit of unused code...)
 */
```

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jmemmgr.c

No license file was found, but licenses were detected in source scan.

```
/*
 * wrtarga.c
 *
 */
```

- * Copyright (C) 1991-1996, Thomas G. Lane.
- * Modified 2015-2017 by Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains routines to write output images in Targa format.
- *
- * These routines may need modification for non-Unix environments or
- * specialized applications. As they stand, they assume output to
- * an ordinary stdio stream.
- *
- * Based on code contributed by Lee Daniel Crocker.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/wrtarga.c

No license file was found, but licenses were detected in source scan.

```
/*
 * wrppm.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2009-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to write output images in PPM/PGM format.
 * The extended 2-byte-per-sample raw PPM/PGM formats are supported.
 * The PBMPLUS library is NOT required to compile this software
 * (but it is highly useful as a set of PPM image manipulation programs).
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume output to
 * an ordinary stdio stream.
 */
```

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/wrppm.c

No license file was found, but licenses were detected in source scan.

```
/*
 * wrgif.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2015-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 */
```

```

* This file contains routines to write output images in GIF format.
*
*****
* NOTE: to avoid entanglements with Unisys' patent on LZW compression,  *
* this code has been modified to output "uncompressed GIF" files.      *
* There is no trace of the LZW algorithm in this file.                  *
*****
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume output to
* an ordinary stdio stream.
*/
/*
* This code is loosely based on ppmto gif from the PBMPLUS
distribution
* of Feb. 1991. That file contains the following copyright notice:
*   Based on GIFENCODE by David Rowley <mgardi@watdscu.waterloo.edu>.
*   Lempel-Ziv compression based on "compress" by Spencer W. Thomas et al.
*   Copyright (C) 1989 by Jef Poskanzer.
*   Permission to use, copy, modify, and distribute this software and its
*   documentation for any purpose and without fee is hereby granted, provided
*   that the above copyright notice appear in all copies and that both that
*   copyright notice and this permission notice appear in supporting
*   documentation. This software is provided "as is" without express or
*   implied warranty.
*
* We are also required to state that
*   "The Graphics Interchange Format(c) is the Copyright property of
*   CompuServe Incorporated. GIF(sm) is a Service Mark property of
*   CompuServe Incorporated."
*/

Found in path(s):
* /jpeg-9c-tar-gz/jpeg-9c/wrgif.c
No license file was found, but licenses were detected in source scan.

/*
* jquant2.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2011 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains 2-pass color quantization (color mapping) routines.
* These routines provide selection of a custom color map for an image,
* followed by mapping of the image to that color map, with optional
* Floyd-Steinberg dithering.

```

- * It is also possible to use just the second pass to map to an arbitrary
- * externally-given color map.
- *
- * Note: ordered dithering is not supported, since there isn't any fast
- * way to compute intercolor distances; it's unclear that ordered dither's
- * fundamental assumptions even hold with an irregularly spaced color map.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jquant2.c

No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: FILE LIST

Copyright (C) 1994-2017, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

Here is a road map to the files in the IJG JPEG distribution. The distribution includes the JPEG library proper, plus two application programs ("cjpeg" and "djpeg") which use the library to convert JPEG files to and from some other popular image formats. A third application "jpegtran" uses the library to do lossless conversion between different variants of JPEG. There are also two stand-alone applications, "rdjpgcom" and "wrjpgcom".

THE JPEG LIBRARY

=====

Include files:

jpeglib.h JPEG library's exported data and function declarations.

jconfig.h Configuration declarations. Note: this file is not present in the distribution; it is generated during installation.

jmorecfg.h Additional configuration declarations; need not be changed for a standard installation.

jerror.h Declares JPEG library's error and trace message codes.

jinclude.h Central include file used by all IJG .c files to reference system include files.

jpegint.h JPEG library's internal data structures.

jdct.h Private declarations for forward & reverse DCT subsystems.

jmemsys.h Private declarations for memory management subsystem.

jversion.h Version information.

Applications using the library should include jpeglib.h (which in turn

includes jconfig.h and jmorecfg.h). Optionally, jerror.h may be included if the application needs to reference individual JPEG error codes. The other include files are intended for internal use and would not normally be included by an application program. (cjpeg/djpeg/etc do use jinclude.h, since its function is to improve portability of the whole IJG distribution. Most other applications will directly include the system include files they want, and hence won't need jinclude.h.)

C source code files:

These files contain most of the functions intended to be called directly by an application program:

jpegim.c Application program interface: core routines for compression.
jpegstd.c Application program interface: standard compression.
jdapim.c Application program interface: core routines for decompression.
jdapistd.c Application program interface: standard decompression.
jcomapi.c Application program interface routines common to compression and decompression.
jcparm.c Compression parameter setting helper routines.
jctrans.c API and library routines for transcoding compression.
jdtrans.c API and library routines for transcoding decompression.

Compression side of the library:

jcinit.c Initialization: determines which other modules to use.
jcmaster.c Master control: setup and inter-pass sequencing logic.
jcmainct.c Main buffer controller (preprocessor => JPEG compressor).
jcprepct.c Preprocessor buffer controller.
jccoefct.c Buffer controller for DCT coefficient buffer.
jccolor.c Color space conversion.
jcsample.c Downsampling.
jcdctmgr.c DCT manager (DCT implementation selection & control).
jfdctint.c Forward DCT using slow-but-accurate integer method.
jfdctfst.c Forward DCT using faster, less accurate integer method.
jfdctflt.c Forward DCT using floating-point arithmetic.
jchuff.c Huffman entropy coding.
jcarith.c Arithmetic entropy coding.
jcmarker.c JPEG marker writing.
jdatadst.c Data destination managers for memory and stdio output.

Decompression side of the library:

jdmaster.c Master control: determines which other modules to use.
jdinput.c Input controller: controls input processing modules.

jdmainct.c Main buffer controller (JPEG decompressor => postprocessor).
jdcoeftc.c Buffer controller for DCT coefficient buffer.
jdpostct.c Postprocessor buffer controller.
jdmarker.c JPEG marker reading.
jdhuff.c Huffman entropy decoding.
jdarith.c Arithmetic entropy decoding.
jddctmgr.c IDCT manager (IDCT implementation selection & control).
jidctint.c Inverse DCT using slow-but-accurate integer method.
jidctfst.c Inverse DCT using faster, less accurate integer method.
jidctflt.c Inverse DCT using floating-point arithmetic.
jdsample.c Upsampling.
jdcOLOR.c Color space conversion.
jdmerge.c Merged upsampling/color conversion (faster, lower quality).
jquant1.c One-pass color quantization using a fixed-spacing colormap.
jquant2.c Two-pass color quantization using a custom-generated colormap.
Also handles one-pass quantization to an externally given map.
jdatasrc.c Data source managers for memory and stdio input.

Support files for both compression and decompression:

jaricom.c Tables for common use in arithmetic entropy encoding and decoding routines.
jerror.c Standard error handling routines (application replaceable).
jmemmgr.c System-independent (more or less) memory management code.
jutils.c Miscellaneous utility routines.

jmemmgr.c relies on a system-dependent memory management module. The IJG distribution includes the following implementations of the system-dependent module:

jmemnobs.c "No backing store": assumes adequate virtual memory exists.
jmemansi.c Makes temporary files with ANSI-standard routine tmpfile().
jmemname.c Makes temporary files with program-generated file names.
jmemdos.c Custom implementation for MS-DOS (16-bit environment only):
can use extended and expanded memory as well as temp files.
jmemmac.c Custom implementation for Apple Macintosh.

Exactly one of the system-dependent modules should be configured into an installed JPEG library (see install.txt for hints about which one to use).
On unusual systems you may find it worthwhile to make a special system-dependent memory manager.

Non-C source code files:

jmemdosa.asm 80x86 assembly code support for jmemdos.c; used only in

MS-DOS-specific configurations of the JPEG library.

CJPEG/DJPEG/JPEGTRAN

=====

Include files:

cdjpeg.h Declarations shared by cjpeg/djpeg/jpegtran modules.

cderror.h Additional

error and trace message codes for cjpeg et al.

transupp.h Declarations for jpegtran support routines in transupp.c.

C source code files:

cjpeg.c Main program for cjpeg.

djpeg.c Main program for djpeg.

jpegtran.c Main program for jpegtran.

cdjpeg.c Utility routines used by all three programs.

rdcolmap.c Code to read a colormap file for djpeg's "-map" switch.

rdswitch.c Code to process some of cjpeg's more complex switches.

Also used by jpegtran.

transupp.c Support code for jpegtran: lossless image manipulations.

Image file reader modules for cjpeg:

rdbmp.c BMP file input.

rdgif.c GIF file input (now just a stub).

rdppm.c PPM/PGM file input.

rdrlc.c Utah RLE file input.

rdtarga.c Targa file input.

Image file writer modules for djpeg:

wrbmp.c BMP file output.

wrgif.c GIF file output (a mere shadow of its former self).

wrppm.c PPM/PGM file output.

wrrlc.c Utah RLE file output.

wrtarga.c Targa file output.

RDJPGCOM/WRJPGCOM

=====

C source

code files:

rdjpgcom.c Stand-alone rdjpgcom application.

wrjpgcom.c Stand-alone wrjpgcom application.

These programs do not depend on the IJG library. They do use jconfig.h and jinclude.h, only to improve portability.

ADDITIONAL FILES

=====

Documentation (see README for a guide to the documentation files):

README Master documentation file.

*.txt Other documentation files.

*.1 Documentation in Unix man page format.

change.log Version-to-version change highlights.

example.c Sample code for calling JPEG library.

Configuration/installation files and programs (see install.txt for more info):

configure Unix shell script to perform automatic configuration.

configure.ac Source file for use with Autoconf to generate configure.

ltmain.sh Support scripts for configure (from GNU libtool).

config.guess

config.sub

depcomp

missing

ar-lib

compile

install-sh Install shell script for those Unix systems lacking one.

Makefile.in Makefile input for configure.

Makefile.am Source file

for use with Automake to generate Makefile.in.

ckconfig.c Program to generate jconfig.h on non-Unix systems.

jconfig.txt Template for making jconfig.h by hand.

mak*.* Sample makefiles for particular systems.

jconfig.* Sample jconfig.h for particular systems.

libjpeg.map Script to generate shared library with versioned symbols.

libjpeg.pc.in libjpeg.pc pkg-config file input for configure.

aclocal.m4 M4 macro definitions for use with Autoconf.

Test files (see install.txt for test procedure):

test*.* Source and comparison files for confidence test.

These are binary image files, NOT text files.

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/filelist.txt

No license file was found, but licenses were detected in source scan.

```
/*
 * jerror.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modified 2012-2015 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains simple error-reporting and trace-message routines.
 * These are suitable for Unix-like systems and others where writing to
 * stderr is the right thing to do. Many applications will want to replace
 * some or all of these routines.
 *
 * If you define USE_WINDOWS_MESSAGEBOX in jconfig.h or in the makefile,
 * you get a Windows-specific hack to display error messages in a dialog box.
 * It ain't much, but it beats dropping error messages into the bit bucket,
 * which is what happens to output to stderr under most Windows C compilers.
 *
 * These routines are used by both the compression and decompression code.
 */
```

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jerror.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdatadst.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2009-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains compression data destination routines for the case of
 * emitting JPEG data to memory or to a file (or any stdio stream).
 * While these routines are sufficient for most applications,
 * some will want to use a different destination manager.
 * IMPORTANT: we assume that fwrite() will correctly transcribe an array of
 * JOCTETs into 8-bit-wide elements on external storage. If char is wider
 * than 8 bits on your machine, you may need to do some tweaking.
 */
```

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdatadst.c

No license file was found, but licenses were detected in source scan.

```
/*
 * ckconfig.c
 *
 * Copyright (C) 1991-1994, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 */
```

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/ckconfig.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jmemnobs.c
 *
 * Copyright (C) 1992-1996, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file provides a really simple implementation of the system-
 * dependent portion of the JPEG memory manager. This implementation
 * assumes that no backing-store files are needed: all required space
 * can be obtained from malloc().
 * This is very portable in the sense that it'll compile on almost anything,
 * but you'd better have lots of main memory (or virtual memory) if you want
 * to process big images.
 * Note that the max_memory_to_use option is ignored by this implementation.
 */
```

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jmemnobs.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jidctfst.c
 *
 * Copyright (C) 1994-1998, Thomas G. Lane.
 * Modified 2015-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a fast, not so accurate integer implementation of the
 * inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
 * must also perform dequantization of the input coefficients.
 *
 * A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
 * on each row (or vice versa, but it's more convenient to emit a row at
 * a time). Direct algorithms are also available, but they are much more
```

```

* complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm
is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with fixed-point math,
* accuracy is lost due to imprecise representation of the scaled
* quantization values. The smaller the quantization table entry, the less
* precise the scaled value, so this implementation does worse with high-
* quality-setting files than with low-quality ones.
*/

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jidctfst.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* wrjpgcom.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2015-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a very simple stand-alone application that inserts
* user-supplied text as a COM (comment) marker in a JFIF file.
* This may be useful as an example of the minimum logic needed to parse
* JPEG markers.
*/

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/wrjpgcom.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* cdjpeg.h
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.

```

* For conditions of distribution and use, see the accompanying README file.
*
* This file contains common declarations for the sample applications
* cjpeg and djpeg. It is NOT used by the core JPEG library.
*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/cdjpeg.h

No license file was found, but licenses were detected in source scan.

/*

* jcarith.c

*

* Developed 1997-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains portable arithmetic entropy encoding routines for JPEG

* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).

*

* Both sequential and progressive modes are supported in this single module.

*

* Suspension is not currently supported in this module.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jcarith.c

No license file was found, but licenses were detected in source scan.

/*

* jfdctfst.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2003-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a fast, not so accurate integer implementation of the

* forward DCT (Discrete Cosine Transform).

*

* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT

* on each column. Direct algorithms are also available, but they are

* much more complex and seem not to be any faster when reduced to code.

*

* This implementation is based on Arai, Agui, and Nakajima's algorithm for

* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

* Japanese, but the algorithm is described in the Pennebaker & Mitchell

* JPEG textbook (see REFERENCES section in file README). The following code

- * is based directly on figure 4-8 in P&M.
- * While an 8-point DCT cannot be done in less than 11 multiplies, it is
- * possible to arrange the computation so that many of the multiplies are
- * simple scalings of the final outputs. These multiplies can then be
- * folded into the multiplications or divisions by the JPEG quantization
- * table entries. The AA&N method leaves only 5 multiplies and 29 adds
- * to be done in the DCT itself.
- * The primary disadvantage of this method is that with fixed-point math,
- * accuracy is lost due to imprecise representation of the scaled
- * quantization values. The smaller the quantization table entry, the less
- * precise the scaled value, so this implementation does worse with high-
- * quality-setting files than with low-quality ones.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jfdctfst.c

No license file was found, but licenses were detected in source scan.

; For conditions of distribution and use, see the accompanying README file.

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jmemdosa.asm

No license file was found, but licenses were detected in source scan.

/*

- * transupp.h

*

- * Copyright (C) 1997-2013, Thomas G. Lane, Guido Vollbeding.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * This file contains declarations for image transformation routines and
- * other utility code used by the jpegtran sample application. These are
- * NOT part of the core JPEG library. But we keep these routines separate
- * from jpegtran.c to ease the task of maintaining jpegtran-like programs
- * that have other user interfaces.

*

- * NOTE: all the routines declared here have very specific requirements
- * about when they are to be executed during the reading and writing of the
- * source and destination files. See the comments in transupp.c, or see
- * jpegtran.c for an example of correct usage.

*/

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/transupp.h

No license file was found, but licenses were detected in source scan.

/*

```

* jcmarker.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2003-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write JPEG datastream markers.
*/

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jcmarker.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jcapimin.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2003-2010 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
* of the JPEG library. These are the "minimum" API routines that may be
* needed in either the normal full-compression case or the transcoding-only
* case.
*
* Most of the routines intended to be called directly by an application
* are in this file or in jcapistd.c. But also see jcparam.c for
* parameter-setup helper routines, jcomapi.c for routines shared by
* compression and decompression, and jctrans.c for the transcoding case.
*/

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jcapimin.c
```

No license file was found, but licenses were detected in source scan.

INSTALLATION INSTRUCTIONS for the Independent JPEG Group's JPEG software

Copyright (C) 1991-2017, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file explains how to configure and install the IJG software. We have tried to make this software extremely portable and flexible, so that it can be adapted to almost any environment. The downside of this decision is that the installation process is complicated. We have provided shortcuts to simplify

the task on common systems. But in any case, you will need at least a little familiarity with C programming and program build procedures for your system.

If you are only using this software as part of a larger program, the larger program's installation procedure may take care of configuring the IJG code.

For example, Ghostscript's installation script

will configure the IJG code.

You don't need to read this file if you just want to compile Ghostscript.

If you are on a Unix machine, you may not need to read this file at all.

Try doing

`./configure`

`make`

`make test`

If that doesn't complain, do

`make install`

(better do "`make -n install`" first to see if the makefile will put the files where you want them). Read further if you run into snags or want to customize the code for your system.

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BEFORE YOU START

=====

Before installing the software you must unpack the distributed source code.

Since you are reading this file, you have probably already succeeded in this task. However, there is a potential for error if you needed

to convert the

files to the local standard text file format (for example, if you are on

MS-DOS you may have converted LF end-of-line to CR/LF). You must apply

such conversion to all the files EXCEPT those whose names begin with "test".

The test files contain binary data; if you change them in any way then the

self-test will give bad results.

Please check the last section of this file to see if there are hints for the specific machine or compiler you are using.

CONFIGURING THE SOFTWARE

=====

To configure the IJG code for your system, you need to create two files:

- * jconfig.h: contains values for system-dependent #define symbols.
- * Makefile: controls the compilation process.

(On a non-Unix machine, you may create "project files" or some other substitute for a Makefile. jconfig.h is needed in any environment.)

We provide three different ways to generate these files:

- * On a Unix system, you can just run the "configure" script.
- * We provide sample jconfig files and makefiles for popular machines; if your machine matches one of the samples, just copy the right sample files to jconfig.h and Makefile.
- * If all else fails, read the instructions below and make your own files.

Configuring the software using the automatic "configure" script

If you are on a Unix machine, you can just type

```
./configure
```

and let the configure script construct appropriate configuration files.

If you're using "csh" on an old version of System V, you might need to type

```
sh configure
```

instead to prevent csh from trying to execute configure itself.

Expect configure to run for a few minutes, particularly on slower machines; it works by compiling a series of test programs.

Configure was created with GNU Autoconf and it follows the usual conventions for GNU configure scripts. It makes a few assumptions that you may want to override. You can do this by providing optional switches to configure:

*

Configure will build both static and shared libraries, if possible.

If you want to build libjpeg only as a static library, say

```
./configure --disable-shared
```

If you want to build libjpeg only as a shared library, say

```
./configure --disable-static
```

Configure uses GNU libtool to take care of system-dependent shared library building methods.

* Configure will use gcc (GNU C compiler) if it's available, otherwise cc.
To force a particular compiler to be selected, use the CC option, for example
./configure CC='cc'
The same method can be used to include any unusual compiler switches.
For example, on HP-UX you probably want to say
./configure CC='cc -Aa'
to get HP's compiler to run in ANSI mode.

* The default CFLAGS setting is "-g" for non-gcc compilers, "-g -O2" for gcc.
You can override this by saying, for example,
./configure CFLAGS='-O2'
if you want to compile without debugging support.

* Configure will set up the makefile so that "make install" will install files
into /usr/local/bin,
/usr/local/man, etc. You can specify an installation
prefix other than "/usr/local" by giving configure the option "--prefix=PATH".

* If you don't have a lot of swap space, you may need to enable the IJG
software's internal virtual memory mechanism. To do this, give the option
"--enable-maxmem=N" where N is the default maxmemory limit in megabytes.
This is discussed in more detail under "Selecting a memory manager", below.
You probably don't need to worry about this on reasonably-sized Unix machines,
unless you plan to process very large images.

Configure has some other features that are useful if you are cross-compiling
or working in a network of multiple machine types; but if you need those
features, you probably already know how to use them.

Configuring the software using one of the supplied jconfig and makefile files

If you have one of these systems, you can just use the provided configuration
files:

Makefile jconfig
file System and/or compiler

makefile.manx jconfig.manx Amiga, Manx Aztec C
makefile.sas jconfig.sas Amiga, SAS C
makeproj.mac jconfig.mac Apple Macintosh, Metrowerks CodeWarrior
mak*jpeg.st jconfig.st Atari ST/STE/TT, Pure C or Turbo C
makefile.bcc jconfig.bcc MS-DOS or OS/2, Borland C
makefile.dj jconfig.dj MS-DOS, DJGPP (Delorie's port of GNU C)
makefile.mc6 jconfig.mc6 MS-DOS, Microsoft C (16-bit only)
makefile.wat jconfig.wat MS-DOS, OS/2, or Windows NT, Watcom C

makefile.vc jconfig.vc Windows, MS Visual C++
makefile.vs jconfig.vc Windows, MS Visual C++ 6 Developer Studio
make*.vc6
makefile.vs jconfig.vc Windows, Visual Studio 2017 (v15)
make*.v15
makefile.b32 jconfig.vc Windows, Borland C++ 32-bit (bcc32)
makefile.mms jconfig.vms Digital VMS, with MMS software
makefile.vms jconfig.vms Digital VMS, without MMS software

Copy the proper jconfig file to jconfig.h and the makefile to Makefile (or whatever your system uses as the standard makefile name). For more info see the appropriate system-specific hints section near the end of this file.

Configuring the software by hand

First, generate a jconfig.h file. If you are moderately familiar with C, the comments in jconfig.txt should be enough information to do this; just copy jconfig.txt to jconfig.h and edit it appropriately. Otherwise, you may prefer to use the ckconfig.c program. You will need to compile and execute ckconfig.c by hand --- we hope you know at least enough to do that. ckconfig.c may not compile the first try (in fact, the whole idea is for it to fail if anything is going to). If you get compile errors, fix them by editing ckconfig.c according to the directions given in ckconfig.c. Once you get it to run, it will write a suitable jconfig.h file, and will also print out some advice about which makefile to use.

You may also want to look at the canned jconfig files, if there is one for a system similar to yours.

Second, select a makefile

and copy it to Makefile (or whatever your system uses as the standard makefile name). The most generic makefiles we provide are

makefile.ansi: if your C compiler supports function prototypes

makefile.unix: if not.

(You have function prototypes if ckconfig.c put "#define HAVE_PROTOTYPES" in jconfig.h.) You may want to start from one of the other makefiles if there is one for a system similar to yours.

Look over the selected Makefile and adjust options as needed. In particular you may want to change the CC and CFLAGS definitions. For instance, if you are using GCC, set CC=gcc. If you had to use any compiler switches to get ckconfig.c to work, make sure the same switches are in CFLAGS.

If you are on a system that doesn't use makefiles, you'll need to set up

project files (or whatever you do use) to compile all the source files and link them into executable files cjpeg, djpeg, jpegtran, rdjpgcom, and wrjpgcom. See the file lists in any of the makefiles to find out which files go into each program. Note that the provided makefiles all make a "library" file libjpeg first, but you don't have to do that if you don't want to; the file lists identify which source files are actually needed for compression, decompression, or both. As a last resort, you can make a batch script that just compiles everything and links it all together; makefile.vms is an example of this (it's for VMS systems that have no make-like utility).

Here are comments about some specific configuration decisions you'll need to make:

Command line style

These programs can use a Unix-like command line style which supports redirection and piping, like this:

```
cjpeg inputfile >outputfile
cjpeg <inputfile >outputfile
source program | cjpeg >outputfile
```

The simpler "two file" command line style is just

```
cjpeg inputfile outputfile
```

You may prefer the two-file style, particularly if you don't have pipes.

You MUST use two-file style on any system that doesn't cope well with binary data

fed through stdin/stdout; this is true for some MS-DOS compilers, for example. If you're not on a Unix system, it's safest to assume you need two-file style. (But if your compiler provides either the Posix-standard fdopen() library routine or a Microsoft-compatible setmode() routine, you can safely use the Unix command line style, by defining USE_FDOPEN or USE_SETMODE respectively.)

To use the two-file style, make jconfig.h say "#define TWO_FILE_COMMANDLINE".

Selecting a memory manager

The IJG code is capable of working on images that are too big to fit in main memory; data is swapped out to temporary files as necessary. However, the code to do this is rather system-dependent. We provide five different memory managers:

* jmemansi.c This version uses the ANSI-standard library routine tmpfile(), which not all non-ANSI systems have. On some systems tmpfile() may put the temporary file in a non-optimal

location; if you don't like what it does,
use `jmemname.c`.

* `jmemname.c` This version creates named temporary files. For anything except a Unix machine, you'll need to configure the `select_file_name()` routine appropriately; see the comments near the head of `jmemname.c`. If you use this version, define `NEED_SIGNAL_CATCHER` in `jconfig.h` to make sure the temp files are removed if the program is aborted.

* `jmemnobs.c` (That stands for No Backing Store :-).) This will compile on almost any system, but it assumes you have enough main memory or virtual memory to hold the biggest images you work with.

* `jmemdos.c` This should be used with most 16-bit MS-DOS compilers. See the system-specific notes about MS-DOS for more info. IMPORTANT: if you use this, define `USE_MSDOS_MEMMGR` in `jconfig.h`, and include the assembly file `jmemdosa.asm` in the programs. The supplied makefiles and `jconfig` files for 16-bit MS-DOS compilers already do both.

* `jmemmac.c` Custom version for Apple Macintosh; see the system-specific notes for Macintosh for more info.

To use a particular memory manager, change the `SYSDEPMEM` variable in your makefile to equal the corresponding object file name (for example, `jmemansi.o` or `jmemansi.obj` for `jmemansi.c`).

If you have plenty of (real or virtual) main memory, just use `jmemnobs.c`. "Plenty" means about ten bytes for every pixel in the largest images you plan to process, so a lot of systems don't meet this criterion. If yours doesn't, try `jmemansi.c` first. If that doesn't compile, you'll have to use `jmemname.c`; be sure to adjust `select_file_name()` for local conditions. You may also need to change `unlink()` to `remove()` in `close_backing_store()`.

Except with `jmemnobs.c` or `jmemmac.c`, you need to adjust the `DEFAULT_MAX_MEM` setting to a reasonable value for your system (either by adding a `#define` for `DEFAULT_MAX_MEM` to `jconfig.h`, or by adding a `-D` switch to the Makefile). This value limits the amount of data space the program will attempt to allocate. Code and static data space isn't counted, so the actual memory needs for `cjpeg` or `djpeg` are typically 100 to 150Kb more than the max-memory setting. Larger max-memory settings reduce the amount of I/O needed to process a large image, but too large a value can result in "insufficient memory" failures. On most Unix machines (and other systems with virtual memory), just set `DEFAULT_MAX_MEM` to several million and forget it. At the other end of the spectrum, for MS-DOS machines you probably can't go much

above 300K to 400K. (On MS-DOS the value refers to conventional memory only. Extended/expanded memory is handled separately by jmemdos.c.)

BUILDING THE SOFTWARE

=====

Now you should be able to compile the software. Just say "make" (or whatever's necessary to start the compilation). Have a cup of coffee.

Here are some things that could go wrong:

If your compiler complains about undefined structures, you should be able to shut it up by putting "#define INCOMPLETE_TYPES_BROKEN" in jconfig.h.

If

you have trouble with missing system include files or inclusion of the wrong ones, read jinclude.h. This shouldn't happen if you used configure or ckconfig.c to set up jconfig.h.

There are a fair number of routines that do not use all of their parameters; some compilers will issue warnings about this, which you can ignore. There are also a few configuration checks that may give "unreachable code" warnings. Any other warning deserves investigation.

If you don't have a getenv() library routine, define NO_GETENV.

Also see the system-specific hints, below.

TESTING THE SOFTWARE

=====

As a quick test of functionality we've included a small sample image in several forms:

testorig.jpg Starting point for the djpeg tests.

testimg.ppm The output of djpeg testorig.jpg

testimg.bmp The output of djpeg -bmp -colors 256 testorig.jpg

testimg.jpg The output of cjpeg testimg.ppm

testprog.jpg Progressive-mode equivalent of testorig.jpg.

testimgp.jpg The output of cjpeg -progressive
-optimize testimg.ppm

(The first- and second-generation .jpg files aren't identical since the default compression parameters are lossy.) If you can generate duplicates of the testimg* files then you probably have working programs.

With most of the makefiles, "make test" will perform the necessary comparisons.

If you're using a makefile that doesn't provide the test option, run `djpeg` and `cjpeg` by hand and compare the output files to `testing*` with whatever binary file comparison tool you have. The files should be bit-for-bit identical.

If the programs complain "`MAX_ALLOC_CHUNK` is wrong, please fix", then you need to reduce `MAX_ALLOC_CHUNK` to a value that fits in type `size_t`. Try adding "`#define MAX_ALLOC_CHUNK 65520L`" to `jconfig.h`. A less likely configuration error is "`ALIGN_TYPE` is wrong, please fix": defining `ALIGN_TYPE` as long should take care of that one.

If the `cjpeg` test run fails with "Missing Huffman code table entry", it's a good bet that you needed to define `RIGHT_SHIFT_IS_UNSIGNED`.

Go back to the configuration step and run `ckconfig.c`. (This is a good plan for any other test failure, too.)

If you are using Unix (one-file) command line style on a non-Unix system, it's a good idea to check that binary I/O through `stdin/stdout` actually works. You should get the same results from "`djpeg <testorig.jpg >out.ppm`" as from "`djpeg -outfile out.ppm testorig.jpg`". Note that the makefiles all use the latter style and therefore do not exercise `stdin/stdout`! If this check fails, try recompiling with `USE_SETMODE` or `USE_FDOPEN` defined. If it still doesn't work, better use two-file style.

If you chose a memory manager other than `jmemnobs.c`, you should test that temporary-file usage works. Try "`djpeg -bmp -colors 256 -max 0 testorig.jpg`" and make sure its output matches `testing.bmp`. If you have any really large images handy, try compressing them with `-optimize` and/or decompressing with `-colors 256` to make sure your `DEFAULT_MAX_MEM` setting is not too large.

NOTE:

this is far from an exhaustive test of the JPEG software; some modules, such as 1-pass color quantization, are not exercised at all. It's just a quick test to give you some confidence that you haven't missed something major.

INSTALLING THE SOFTWARE

=====

Once you're done with the above steps, you can install the software by copying the executable files (`cjpeg`, `djpeg`, `jpegtran`, `rdjpgcom`, and `wrjpgcom`) to wherever you normally install programs. On Unix systems, you'll also want to put the man pages (`cjpeg.1`, `djpeg.1`, `jpegtran.1`, `rdjpgcom.1`, `wrjpgcom.1`) in the man-page directory. The pre-fab makefiles don't support this step since there's such a wide variety of installation procedures on different

systems.

If you generated a Makefile with the "configure" script, you can just say
make install

to install the programs and their man pages into the standard places.

(You'll probably need to be root to do this.) We recommend first saying

make -n install

to see

where configure thought the files should go. You may need to edit the Makefile, particularly if your system's conventions for man page filenames don't match what configure expects.

If you want to install the IJG library itself, for use in compiling other programs besides ours, then you need to put the four include files

jpeglib.h jerror.h jconfig.h jmorecfg.h

into your include-file directory, and put the library file libjpeg.a

(extension may vary depending on system) wherever library files go.

If you generated a Makefile with "configure", it will do what it thinks is the right thing if you say

make install-lib

OPTIONAL STUFF

=====

Progress monitor:

If you like, you can #define PROGRESS_REPORT (in jconfig.h) to enable display of percent-done progress reports. The routine provided in cdjpeg.c merely prints percentages to stderr, but you can customize it to do something fancier.

Utah RLE file format support:

We distribute the software with support for RLE image files

(Utah Raster

Toolkit format) disabled, because the RLE support won't compile without the

Utah library. If you have URT version 3.1 or later, you can enable RLE

support as follows:

1. #define RLE_SUPPORTED in jconfig.h.
2. Add a -I option to CFLAGS in the Makefile for the directory containing the URT .h files (typically the "include" subdirectory of the URT distribution).
3. Add -L... -lrle to LDLIBS in the Makefile, where ... specifies the directory containing the URT "librle.a" file (typically the "lib" subdirectory of the URT distribution).

Support for 9-bit to 12-bit deep pixel data:

The IJG code currently allows 8, 9, 10, 11, or 12 bits sample data precision. (For color, this means 8 to 12 bits per channel, of course.) If you need to work with deeper than 8-bit data, you can compile the IJG code for 9-bit to 12-bit operation.

To do so:

1. In `jmorecfg.h`, define `BITS_IN_JSAMPLE` as 9, 10, 11, or 12 rather than 8.
2. In `jconfig.h`, undefine `BMP_SUPPORTED`, `RLE_SUPPORTED`, and `TARGA_SUPPORTED`, because the code for those formats doesn't handle deeper than 8-bit data and won't even compile. (The PPM code does work, as explained below. The GIF code works too; it scales 8-bit GIF data to and from 12-bit depth automatically.)
3. Compile. Don't expect "make test" to pass, since the supplied test files are for 8-bit data.

Currently, 9-bit to 12-bit support does not work on 16-bit-int machines.

Run-time selection and conversion of data precision are currently not supported and may be added later.

Exception: The transcoding part (`jpegtran`) supports all settings in a single instance, since it operates on the level of DCT coefficients and not sample values.

The PPM reader (`rdppm.c`) can read deeper than 8-bit data from either text-format or binary-format PPM and PGM files. Binary-format PPM/PGM files which have a `maxval` greater than 255 are assumed to use 2 bytes per sample, MSB first (big-endian order). As of early 1995, 2-byte binary format is not officially supported by the PBMPLUS library, but it is expected that a future release of PBMPLUS will support it. Note that the PPM reader will read files of any `maxval` regardless of the `BITS_IN_JSAMPLE` setting; incoming data is automatically rescaled to `maxval=MAXJSAMPLE` as appropriate for the `cjpeg` bit depth.

The PPM writer (`wrppm.c`) will normally write 2-byte binary PPM or PGM format, `maxval=MAXJSAMPLE`, when compiled with `BITS_IN_JSAMPLE>8`. Since this format is not yet widely supported, you can disable it by compiling `wrppm.c` with `PPM_NORAWWORD` defined; then the data is scaled down to 8 bits to make a standard 1-byte/sample PPM or PGM file. (Yes, this means still another copy of `djpeg` to keep around. But hopefully you won't need it for very long. Poskanzer's supposed to get that new PBMPLUS release out Real Soon Now.)

Of course, if you are working with 9-bit to 12-bit data, you probably have it stored in some other, nonstandard format. In that case you'll probably want to write your own I/O modules to read and write your format.

Note:

The standard Huffman tables are only valid for 8-bit data precision. If you selected more than 8-bit data precision, cjpeg uses arithmetic coding by default. The Huffman encoder normally uses entropy optimization to compute usable tables for higher precision. Otherwise, you'll have to supply different default Huffman tables.

Removing code:

If you need to make a smaller version of the JPEG software, some optional functions can be removed at compile time. See the `xxx_SUPPORTED` #defines in `jconfig.h` and `jmorecfg.h`. If at all possible, we recommend that you leave in decoder support for all valid JPEG files, to ensure that you can read anyone's output. Taking out support for image file formats that you don't use is the most painless way to make the programs smaller. Another possibility is to remove some of the DCT methods: in particular, the "IFAST" method may not be enough faster than the others to be worth keeping on your machine. (If you do remove ISLOW or IFAST, be sure to redefine `JDCT_DEFAULT` or `JDCT_FASTEST` to a supported method, by adding a #define in `jconfig.h`.)

OPTIMIZATION

=====

Unless you own a Cray, you'll probably be interested in making the JPEG software go as fast as possible. This section covers some machine-dependent optimizations you may want to try. We suggest that before trying any of this, you first get the basic installation to pass the self-test step. Repeat the self-test after any optimization to make sure that you haven't broken anything.

The integer DCT routines perform a lot of multiplications. These multiplications must yield 32-bit results, but none of their input values are more than 16 bits wide. On many machines, notably the 680x0 and 80x86 CPUs, a 16x16=>32 bit multiply instruction is faster than a full 32x32=>32 bit multiply. Unfortunately there is no portable way to specify such a multiplication in C, but some compilers can generate one when you use the right combination of casts. See the `MULTIPLYxxx` macro definitions in `jdct.h`. If your compiler makes "int" be 32 bits and "short" be 16 bits, defining `SHORTxSHORT_32` is fairly likely to work. When experimenting with alternate definitions, be sure to test not only whether the code still works (use the self-test), but also whether it is actually faster --- on some compilers, alternate definitions may compute the right answer, yet be slower than the default. Timing cjpeg on a large PGM (grayscale) input file is the best way to check this, as the DCT will be the largest fraction of the runtime in that mode. (Note: some of the distributed compiler-specific `jconfig` files

already contain #define switches to select appropriate MULTIPLYxxx definitions.)

If your machine has sufficiently fast floating point hardware, you may find that the float DCT method is faster than the integer DCT methods, even after tweaking the integer multiply macros. In that case you may want to make the float DCT be the default method. (The only objection to this is that float DCT results may vary slightly across machines.) To do that, add "#define JDCT_DEFAULT JDCT_FLOAT" to jconfig.h. Even if you don't change the default, you should redefine JDCT_FASTEST, which is the method selected by jpeg's -fast switch. Don't forget to update the documentation files (usage.txt and/or cjpeg.1, djpeg.1) to agree with what you've done.

If access to "short" arrays is slow on your machine, it may be a win to define type JCOEF as int rather than short. This will cost a good deal of memory though, particularly in some multi-pass modes, so don't do it unless you have memory to burn and short is REALLY slow.

If your compiler can compile function calls in-line, make sure the INLINE macro in jmorecfg.h is defined as the keyword that marks a function inline-able. Some compilers have a switch that tells the compiler to inline any function it thinks is profitable (e.g., -finline-functions for gcc). Enabling such a switch is likely to make the compiled code bigger but faster.

In general, it's worth trying the maximum optimization level of your compiler, and experimenting with any optional optimizations such as loop unrolling. (Unfortunately, far too many compilers have optimizer bugs ... be prepared to back off if the code fails self-test.) If you do any experimentation along these lines, please report the optimal settings to jpeg-info@jpegclub.org so we can mention them in future releases. Be sure to specify your machine and compiler version.

HINTS FOR SPECIFIC SYSTEMS

=====

We welcome reports on changes needed for systems not mentioned here. Submit 'em to jpeg-info@jpegclub.org. Also, if configure or ckconfig.c is wrong about how to configure the JPEG software for your system, please let us know.

Acorn RISC OS:

(Thanks to Simon Middleton for these hints on compiling with Desktop C.)
After renaming the files according

to Acorn conventions, take a copy of
makefile.ansi, change all occurrences of 'libjpeg.a' to 'libjpeg.o' and
change these definitions as indicated:

```
CFLAGS= -throwback -IC: -Wn
LDLIBS=C:o.Stubs
SYSDEPMEM=jmemansi.o
LN=Link
AR=LibFile -c -o
```

Also add a new line '.c.o:; \$(cc) \$< \$(cflags) -c -o \$@'. Remove the
lines '\$(RM) libjpeg.o' and '\$(AR2) libjpeg.o' and the 'jconfig.h'
dependency section.

Copy jconfig.txt to jconfig.h. Edit jconfig.h to define TWO_FILE_COMMANDLINE
and CHAR_IS_UNSIGNED.

Run the makefile using !AMU not !Make. If you want to use the 'clean' and
'test' makefile entries then you will have to fiddle with the syntax a bit
and rename the test files.

Amiga:

SAS C 6.50 reportedly is too buggy to compile the IJG code properly.
A patch to update to 6.51 is available from SAS or AmiNet FTP sites.

The supplied config files are set up to use jmemname.c as the memory
manager, with temporary files being created on the device named by
"JPEGTMP:".

Atari ST/STE/TT:

Copy

the project files makcjpeg.st, makdjpeg.st, maktjpeg.st, and makljpeg.st
to cjpeg.prj, djpeg.prj, jpegtran.prj, and libjpeg.prj respectively. The
project files should work as-is with Pure C. For Turbo C, change library
filenames "pc..." to "tc..." in each project file. Note that libjpeg.prj
selects jmemansi.c as the recommended memory manager. You'll probably want to
adjust the DEFAULT_MAX_MEM setting --- you want it to be a couple hundred K
less than your normal free memory. Put "#define DEFAULT_MAX_MEM nnnn" into
jconfig.h to do this.

To use the 68881/68882 coprocessor for the floating point DCT, add the
compiler option "-8" to the project files and replace pcftlib.lib with
pc881lib.lib in cjpeg.prj and djpeg.prj. Or if you don't have a
coprocessor, you may prefer to remove the float DCT code by undefining

DCT_FLOAT_SUPPORTED in jmorecfg.h (since without a coprocessor, the float code will be too slow to be useful). In that case, you can delete pcftlib.lib from the project files.

Note that you must make libjpeg.lib before making cjpeg.ttp, djpeg.ttp, or jpegtran.ttp. You'll have to perform the self-test by hand.

We haven't bothered to include project files for rdjpgcom and wrjpgcom. Those source files should just be compiled by themselves; they don't depend on the JPEG library. You can use the default.prj project file of the Pure C distribution to make the programs.

There is a bug in some older versions of the Turbo C library which causes the space used by temporary files created with "tmpfile()" not to be freed after an abnormal program exit. If you check your disk afterwards, you will find cluster chains that are allocated but not used by a file. This should not happen in cjpeg/djpeg/jpegtran, since we enable a signal catcher to explicitly close temp files before exiting. But if you use the JPEG library with your own code, be sure to supply a signal catcher, or else use a different system-dependent memory manager.

Cray:

Should you be so fortunate as to be running JPEG on a Cray YMP, there is a compiler bug in old versions of Cray's Standard C (prior to 3.1). If you still have an old compiler, you'll need to insert a line reading "#pragma novector" just before the loop

```
for (i = 1; i <= (int) htbl->bits[l]; i++)
    huffsize[p++] = (char) l;
```

in fix_huff_tbl (in V5beta1, line 204 of jchuff.c and line 176 of jdchuff.c). [This bug may or may not still occur with the current IJG code, but it's probably a dead issue anyway...]

HP-UX:

If you have HP-UX 7.05 or later with the "software development" C compiler, you should run the compiler in ANSI mode. If using the configure script, say

```
./configure CC='cc -Aa'
```

(or -Ae if you prefer). If configuring by hand, use makefile.ansi and add "-Aa" to the CFLAGS line in the makefile.

If you have a pre-7.05 system, or if you are using the non-ANSI C compiler delivered with a minimum HP-UX system, then you must use makefile.unix

(and do NOT add -Aa); or just run configure without the CC option.

On HP 9000 series 800 machines, the HP C compiler is buggy in revisions prior to A.08.07. If you get complaints about "not a typedef name", you'll have to use makefile.unix, or run configure without the CC option.

Macintosh, generic comments:

The supplied user-interface files (cjpeg.c, djpeg.c, etc) are set up to provide a Unix-style command line interface. You can use this interface on the Mac by means of the ccommand() library routine provided by Metrowerks CodeWarrior or Think C. This is only appropriate for testing the library, however; to make a user-friendly equivalent of cjpeg/djpeg you'd really want to develop a Mac-style user interface. There isn't a complete example available at the moment, but there are some helpful starting points:

1. Sam Bushell's free "To JPEG" applet provides drag-and-drop conversion to JPEG under System 7 and later. This only illustrates how to use the compression half of the library, but it does a very nice job of that part.

The

CodeWarrior source code is available from <http://www.pobox.com/~jsam>.

2. Jim Brunner prepared a Mac-style user interface for both compression and decompression. Unfortunately, it hasn't been updated since IJG v4, and the library's API has changed considerably since then. Still it may be of some help, particularly as a guide to compiling the IJG code under Think C. Jim's code is available from the Info-Mac archives, at sumex-aim.stanford.edu or mirrors thereof; see file /info-mac/dev/src/jpeg-convert-c.hqx.

jmemmac.c is the recommended memory manager back end for Macintosh. It uses NewPtr/DisposePtr instead of malloc/free, and has a Mac-specific implementation of jpeg_mem_available(). It also creates temporary files that follow Mac conventions. (That part of the code relies on System-7-or-later OS functions. See the comments in jmemmac.c if you need to run it on System 6.) NOTE that USE_MAC_MEMMGR must be defined in jconfig.h to use jmemmac.c.

You can also use jmemnobs.c, if you don't care about handling images larger than available memory. If you use any memory manager back end other than jmemmac.c, we recommend replacing "malloc" and "free" by "NewPtr" and "DisposePtr", because Mac C libraries often have peculiar implementations of malloc/free. (For instance, free() may not return the freed space to the Mac Memory Manager. This is undesirable for the IJG code because jmemmgr.c already clumps space requests.)

Macintosh, Metrowerks CodeWarrior:

The Unix-command-line-style interface can be used by defining `USE_CCOMMAND`. You'll also need to define `TWO_FILE_COMMANDLINE` to avoid `stdin/stdout`. This means that when using the `cjpeg/djpeg` programs, you'll have to type the input and output file names in the "Arguments" text-edit box, rather than using the file radio buttons. (Perhaps `USE_FDOPEN` or `USE_SETMODE` would eliminate the problem, but I haven't heard from anyone who's tried it.)

On 680x0 Macs, Metrowerks defines type "double" as a 10-byte IEEE extended float.

`jmemmgr.c` won't like this: it wants `sizeof(ALIGN_TYPE)` to be a power of 2. Add `#define ALIGN_TYPE long` to `jconfig.h` to eliminate the complaint.

The supplied configuration file `jconfig.mac` can be used for your `jconfig.h`; it includes all the recommended symbol definitions. If you have AppleScript installed, you can run the supplied script `makeproj.mac` to create CodeWarrior project files for the library and the testbed applications, then build the library and applications. (Thanks to Dan Sears and Don Agro for this nifty hack, which saves us from trying to maintain CodeWarrior project files as part of the IJG distribution...)

Macintosh, Think C:

The documentation in Jim Brunner's "JPEG Convert" source code (see above) includes detailed build instructions for Think C; it's probably somewhat out of date for the current release, but may be helpful.

If you want to build the minimal command line version, proceed as follows. You'll have to prepare project files for the programs; we don't include any in the distribution since they are not text files. Use the file lists in any of the supplied makefiles as a guide. Also add the ANSI and Unix C libraries in a separate segment. You may need to divide the JPEG files into more than one segment; we recommend dividing compression and decompression modules. Define `USE_CCOMMAND` in `jconfig.h` so that the `ccommand()` routine is called. You must also define `TWO_FILE_COMMANDLINE` because `stdin/stdout` don't handle binary data correctly.

On 680x0 Macs, Think C defines type "double" as a 12-byte IEEE extended float. `jmemmgr.c` won't like this: it wants `sizeof(ALIGN_TYPE)` to be a power of 2. Add `#define ALIGN_TYPE long` to `jconfig.h` to eliminate the complaint.

`jconfig.mac` should work as a `jconfig.h` configuration file for Think C, but the `makeproj.mac` AppleScript script is specific to CodeWarrior. Sorry.

MIPS R3000:

MIPS's cc version 1.31 has a rather nasty optimization bug. Don't use -O if you have that compiler version.

(Use "cc -V" to check the version.)

Note that the R3000 chip is found in workstations from DEC and others.

MS-DOS, generic comments for 16-bit compilers:

The IJG code is designed to work well in 80x86 "small" or "medium" memory models (i.e., data pointers are 16 bits unless explicitly declared "far"; code pointers can be either size). You may be able to use small model to compile cjpeg or djpeg by itself, but you will probably have to use medium model for any larger application. This won't make much difference in performance. You *will* take a noticeable performance hit if you use a large-data memory model, and you should avoid "huge" model if at all possible. Be sure that NEED_FAR_POINTERS is defined in jconfig.h if you use a small-data memory model; be sure it is NOT defined if you use a large-data model. (The supplied makefiles and jconfig files for Borland and Microsoft C compile in medium model and define NEED_FAR_POINTERS.)

The DOS-specific memory manager, jmemdos.c, should be used if possible.

It needs some assembly-code routines which are in jmemdosa.asm; make sure your makefile assembles that file and includes it in the library. If you don't have a suitable assembler, you can get pre-assembled object files for jmemdosa by FTP from <ftp.uu.net:/graphics/jpeg/jdosaobj.zip>. (DOS-oriented distributions of the IJG source code often include these object files.)

When using jmemdos.c, jconfig.h must define USE_MSDOS_MEMMGR and must set MAX_ALLOC_CHUNK to less than 64K (65520L is a typical value). If your C library's far-heap malloc() can't allocate blocks that large, reduce MAX_ALLOC_CHUNK to whatever it can handle.

If you can't use jmemdos.c for some reason --- for example, because you don't have an assembler to assemble jmemdosa.asm --- you'll have to fall back to jmemansi.c or jmemname.c. You'll probably still need to set MAX_ALLOC_CHUNK in jconfig.h, because most DOS C libraries won't malloc() more than 64K at a time. IMPORTANT: if you use jmemansi.c or jmemname.c, you will have to compile in a large-data memory model in order to get the right stdio library. Too bad.

wrjpgcom needs to be compiled in large model, because it malloc()s a 64KB work area to hold the comment text. If your C library's malloc can't handle that, reduce MAX_COM_LENGTH as necessary in wrjpgcom.c.

Most MS-DOS compilers treat stdin/stdout as text files, so you must use two-file command line style. But if your compiler has either fdopen() or

setmode(), you can use one-file style if you like. To do this, define `USE_SETMODE` or `USE_FDOPEN` so that `stdin/stdout` will be set to binary mode. (`USE_SETMODE` seems to work with more DOS compilers than `USE_FDOPEN`.) You should test that I/O through `stdin/stdout` produces the same results as I/O to explicitly named files... the "make test" procedures in the supplied makefiles do NOT use `stdin/stdout`.

MS-DOS, generic comments for 32-bit compilers:

None of the above comments about memory models apply if you are using a 32-bit flat-memory-space environment, such as DJGPP or Watcom C. (And you should use one if you have it, as performance will be much better than 8086-compatible code!) For flat-memory-space compilers, do NOT define `NEED_FAR_POINTERS`, and do NOT use `jmemdos.c`. Use `jmemnobs.c` if the environment supplies adequate virtual memory, otherwise use `jmemansi.c` or `jmemname.c`.

You'll still need to be careful about binary I/O through `stdin/stdout`. See the last paragraph of the previous section.

MS-DOS, Borland C:

Be sure to convert all the source files to DOS text format (CR/LF newlines). Although Borland C will often work OK with unmodified Unix (LF newlines) source files, sometimes it will give bogus compile errors. "Illegal character '#'" is the most common such error. (This is true with Borland C 3.1, but perhaps is fixed in newer releases.)

If you want one-file command line style, just undefine `TWO_FILE_COMMANDLINE`. `jconfig.bcc` already includes `#define USE_SETMODE` to make this work. (fdopen does not work correctly.)

MS-DOS, Microsoft C:

`makefile.mc6` works with Microsoft C, DOS Visual C++, etc. It should only be used if you want to build a 16-bit (small or medium memory model) program.

If you want one-file command line style, just undefine `TWO_FILE_COMMANDLINE`. `jconfig.mc6` already includes `#define USE_SETMODE` to make this work. (fdopen does not work correctly.)

Note that this makefile assumes that the working copy of itself is called "makefile". If you want to call it something else, say "makefile.mak",

be sure to adjust the dependency line that reads "\$ (RFILE) : makefile". Otherwise the make will fail because it doesn't know how to create "makefile". Worse, some releases of Microsoft's make utilities give an incorrect error message in this situation.

Old versions of MS C fail with an "out of macro expansion space" error because they can't cope with the macro TRACEMS8 (defined in jerror.h). If this happens to you, the easiest solution is to change TRACEMS8 to expand to nothing. You'll lose the ability to dump out JPEG coefficient tables with djpeg -debug -debug, but at least you can compile.

Original MS C 6.0 is very buggy; it compiles incorrect code unless you turn off optimization entirely (remove -O from CFLAGS). 6.00A is better, but it still generates bad code if you enable loop optimizations (-Ol or -Ox).

MS C 8.0 crashes when compiling jquant1.c with optimization switch /Oo ... which is on by default. To work around this bug, compile that one file with /Oo-.

Microsoft Windows (all versions), generic comments:

Some Windows system include files define typedef boolean as "unsigned char". The IJG code also defines typedef boolean, but we make it an "enum" by default. This doesn't affect the IJG programs because we don't import those Windows include files. But if you use the JPEG library in your own program, and some of your program's files import one definition of boolean while some import the other, you can get all

sorts of mysterious problems. A good preventive step is to make the IJG library use "unsigned char" for boolean. To do that, add something like this to your jconfig.h file:

```
/* Define "boolean" as unsigned char, not enum, per Windows custom */
#ifdef __RPCNDR_H__ /* don't conflict if rpcnldr.h already read */
typedef unsigned char boolean;
#endif
#ifdef FALSE /* in case these macros already exist */
#define FALSE 0 /* values of boolean */
#endif
#ifdef TRUE
#define TRUE 1
#endif
#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
```

(This is already in jconfig.vc, by the way.)

windef.h contains the declarations

```
#define far
#define FAR far
```

Since `jmorecfg.h` tries to define `FAR` as empty, you may get a compiler warning if you include both `jpeglib.h` and `windef.h` (which `windows.h` includes). To suppress the warning, you can put `"#ifndef FAR"/"#endif"` around the line `"#define FAR"` in `jmorecfg.h`. (Something like this is already in `jmorecfg.h`, by the way.)

When using

the library in a Windows application, you will almost certainly want to modify or replace the error handler module `jerror.c`, since our default error handler does a couple of inappropriate things:

1. it tries to write error and warning messages on `stderr`;
2. in event of a fatal error, it exits by calling `exit()`.

A simple stopgap solution for problem 1 is to replace the line

```
fprintf(stderr, "%s\n", buffer);
```

(in `output_message` in `jerror.c`) with

```
MessageBox(GetActiveWindow(),buffer,"JPEG Error",MB_OK|MB_ICONERROR);
```

It's highly recommended that you at least do that much, since otherwise error messages will disappear into nowhere. (Beginning with IJG v6b, this code is already present in `jerror.c`; just define `USE_WINDOWS_MESSAGEBOX` in `jconfig.h` to enable it.)

The proper solution for problem 2 is to return control to your calling application after a library error. This can be done with the `setjmp/longjmp` technique discussed in `libjpeg.txt` and illustrated in `example.c`. (NOTE: some

older Windows C compilers provide versions of `setjmp/longjmp` that don't actually work under Windows. You may need to use the Windows system functions `Catch` and `Throw` instead.)

The recommended memory manager under Windows is `jmemnobs.c`; in other words, let Windows do any virtual memory management needed. You should NOT use `jmemdos.c` nor `jmemdosa.asm` under Windows.

For Windows 3.1, we recommend compiling in medium or large memory model; for newer Windows versions, use a 32-bit flat memory model. (See the MS-DOS sections above for more info about memory models.) In the 16-bit memory models only, you'll need to put

```
#define MAX_ALLOC_CHUNK 65520L /* Maximum request to malloc() */
```

into `jconfig.h` to limit allocation chunks to 64Kb. (Without that, you'd have to use huge memory model, which slows things down unnecessarily.) `jmemnobs.c` works without modification in large or flat memory models, but to use medium model, you need to modify its `jpeg_get_large` and `jpeg_free_large` routines to

allocate far memory. In any case, you might like to replace its calls to `malloc` and `free` with direct calls on Windows memory allocation functions.

You may also want to modify `jdatasrc.c` and `jdatadst.c` to use Windows file operations rather than `fread/fwrite`. This is only necessary if your C compiler doesn't provide a competent implementation of C stdio functions.

You might want to tweak the `RGB_xxx` macros in `jmorecfg.h` so that the library will accept or deliver color pixels in BGR sample order, not RGB; BGR order is usually more convenient under Windows. Note that this change will break the sample applications `cjpeg/djpeg`, but the library itself works fine.

Many people want to convert the IJG library into a DLL. This is reasonably straightforward, but watch out for the following:

1. Don't try to compile as a DLL in small or medium memory model; use large model, or even better, 32-bit flat model. Many places in the IJG code assume the address of a local variable is an ordinary (not FAR) pointer; that isn't true in a medium-model DLL.

2. Microsoft C cannot pass file pointers between applications and DLLs. (See Microsoft Knowledge Base, PSS ID Number Q50336.) So `jdatasrc.c` and `jdatadst.c` don't work if you open a file in your application and then pass the pointer to the DLL. One workaround is to make `jdatasrc.c/jdatadst.c` part of your main application rather than part of the DLL.

3. You'll probably need to modify the macros `GLOBAL()` and `EXTERN()` to attach suitable linkage keywords to the exported routine names. Similarly, you'll want to modify `METHODDEF()` and `JMETHOD()` to ensure function pointers are declared in a way that lets application routines be called back through the function pointers. These macros are in `jmorecfg.h`. Typical definitions for a 16-bit DLL are:

```
#define GLOBAL(type) type _far _pascal _loadds _export
#define EXTERN(type) extern type _far _pascal _loadds
#define METHODDEF(type) static type _far _pascal
#define JMETHOD(type,methodname,arglist)
\
```

```
type (_far _pascal *methodname) arglist
```

For a 32-bit DLL you may want something like

```
#define GLOBAL(type) __declspec(dllexport) type
#define EXTERN(type) extern __declspec(dllexport) type
```

Although not all the `GLOBAL` routines are actually intended to be called by the application, the performance cost of making them all DLL entry points is negligible.

The unmodified IJG library presents a very C-specific application interface, so the resulting DLL is only usable from C or C++ applications. There has been some talk of writing wrapper code that would present a simpler interface usable from other languages, such as Visual Basic. This is on our to-do list

but hasn't been very high priority --- any volunteers out there?

Microsoft Windows, Borland C:

The provided jconfig.bcc should work OK in a 32-bit Windows environment, but you'll need to tweak it in a 16-bit environment (you'd need to define NEED_FAR_POINTERS and MAX_ALLOC_CHUNK). Beware that makefile.bcc will need alteration if you want to use it for Windows --- in particular, you should use jmemnobs.c not jmemdos.c under Windows.

Borland C++ 4.5 fails with an internal compiler error when trying to compile jdmerge.c in 32-bit mode. If enough people complain, perhaps Borland will fix it. In the meantime, the simplest known workaround is to add a redundant definition of the variable range_limit in h2v1_merged_upsample(), at the head of the block that handles odd image width (about line 268 in v6 jdmerge.c):

```
/* If image width is odd, do the last output column separately */
if (cinfo->output_width & 1) {
    register JSAMPLE * range_limit = cinfo->sample_range_limit; /* ADD THIS */
    cb = GETJSAMPLE(*inptr1);
```

Pretty bizarre, especially since the very similar routine h2v2_merged_upsample doesn't trigger the bug.

Recent reports suggest that this bug does not occur with "bcc32a" (the Pentium-optimized version of the compiler).

Another report from a user of Borland C 4.5 was that incorrect code (leading to a color shift in processed images) was produced if any of the following optimization switch combinations were used:

```
-Ot -Og
-Ot -Op
-Ot -Om
```

So try backing off on optimization if you see such a problem. (Are there several different releases all numbered "4.5"??)

Microsoft Windows, Microsoft Visual C++:

jconfig.vc should work OK with any Microsoft compiler for a 32-bit memory model. makefile.vc is intended for command-line use. (If you are using the Developer Studio environment, you may prefer the DevStudio project files; see below.)

IJG JPEG 7 adds extern "C" to jpeglib.h. This avoids the need to put extern "C" { ... } around #include "jpeglib.h" in your C++ application. You can also force VC++ to treat the library as C++ code by renaming all the *.c files to *.cpp (and adjusting the makefile to match).

In this case you also need to define the symbol `DONT_USE_EXTERN_C` in the configuration to prevent `jpeglib.h` from using `extern "C"`.

Microsoft Windows,

Microsoft Visual C++ 6 Developer Studio:

We include makefiles that should work as project files in Developer Studio 6.0 or later. There is a library makefile that builds the IJG library as a static Win32 library, and application makefiles that build the sample applications as Win32 console applications. (Even if you only want the library, we recommend building the applications so that you can run the self-test.)

To use:

1. Open the command prompt, change to the main directory and execute the command line
`NMAKE /f makefile.vc setup-vc6`
This will move `jconfig.vc` to `jconfig.h` and makefiles to project files.
(Note that the renaming is critical!)
2. Open the workspace file `jpeg.dsw`, build the library project.
(If you are using Developer Studio more recent than 6.0, you'll probably get a message saying that the project files are being updated.)
3. Open the workspace file `apps.dsw`, build the application projects.
4. To perform the self-test, execute the command line
`NMAKE /f makefile.vc test-build`
5. Move the application `.exe` files from ``app`\Release` to an appropriate location on your path.

Microsoft Windows, Visual Studio 2017 (v15):

We include makefiles that should work as project files in Visual Studio 2017 (v15) or later. There is a library makefile that builds the IJG library as a static Win32 library, and application makefiles that build the sample applications as Win32 console applications. (Even if you only want the library, we recommend building the applications so that you can run the self-test.)

To use:

1. Open the Developer Command Prompt, change to the main directory and execute the command line
`NMAKE /f makefile.vc setup-v15`
This will move `jconfig.vc` to `jconfig.h` and makefiles to project files.
(Note that the renaming is critical!)
2. Open the solution file `jpeg.sln`, build the library project.
 - a) If you are using Visual Studio more recent than

2017 (v15), you'll probably get a message saying that the project files are being updated.

- b) If necessary, open the project properties and adapt the Windows Target Platform Version in the Configuration Properties, General section; we support the latest version at the time of release.
- 3. Open the solution file apps.sln, build the application projects.
- 4. To perform the self-test, execute the command line
NMAKE /f makefile.vs test-build
- 5. Move the application .exe files from `app`\Release to an appropriate location on your path.

OS/2, Borland C++:

Watch out for optimization bugs in older Borland compilers; you may need to back off the optimization switch settings. See the comments in makefile.bcc.

SGI:

On some SGI systems, you may need to set "AR2= ar -ts" in the Makefile. If you are using configure, you can do this by saying
./configure RANLIB='ar -ts'
This change is not needed on all SGIs. Use it only if the make fails at the stage of linking the completed programs.

On the MIPS R4000 architecture (Indy, etc.), the compiler option "-mips2" reportedly speeds up the float DCT method substantially, enough to make it faster than the default int method (but still slower than the fast int method). If you use -mips2, you may want to alter the default DCT method to be float. To do this, put "#define JDCT_DEFAULT JDCT_FLOAT" in jconfig.h.

VMS:

On an Alpha/VMS system with MMS, be sure to use the "/Marco=Alpha=1" qualifier with MMS when building the JPEG package.

VAX/VMS v5.5-1 may have problems with the test step of the build procedure reporting differences when it compares the original and test images. If the error points to the last block of the files, it is most likely bogus and may be safely ignored. It seems to be because the files are Stream_LF and Backup/Compare has difficulty with the (presumably) null padded files. This problem was not observed on VAX/VMS v6.1 or AXP/VMS v6.1.

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/install.txt

No license file was found, but licenses were detected in source scan.

/*

* jquant1.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2011 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains 1-pass color quantization (color mapping) routines.

* These routines provide mapping to a fixed color map using equally spaced

* color values. Optional Floyd-Steinberg or ordered dithering is available.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jquant1.c

No license file was found, but licenses were detected in source scan.

/*

* jcprepct.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the compression preprocessing controller.

* This controller manages the color conversion, downsampling,

* and edge expansion steps.

*

* Most of the complexity here is associated with buffering input rows

* as required by the downsampler. See the comments at the head of

* jcsample.c for the downsampler's needs.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jcprepct.c

No license file was found, but licenses were detected in source scan.

/*

* jcdctmgr.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2003-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains the forward-DCT management logic.
- * This code selects a particular DCT implementation to be used,
- * and it performs related housekeeping chores including coefficient
- * quantization.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jcdctmgr.c

No license file was found, but licenses were detected in source scan.

/*

- * jcpam.c

*

- * Copyright (C) 1991-1998, Thomas G. Lane.

- * Modified 2003-2013 by Guido Vollbeding.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * This file contains optional default-setting code for the JPEG compressor.

- * Applications do not have to use this file, but those that don't use it

- * must know a lot more about the innards of the JPEG code.

*/

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jcpam.c

No license file was found, but licenses were detected in source scan.

The Independent JPEG Group's JPEG software

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README for release 9c of 14-Jan-2018

=====

This distribution contains the ninth public release of the Independent JPEG Group's free JPEG software. You are welcome to redistribute this software and to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone, Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson, Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers, and other members of the Independent JPEG Group.

IJG is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP

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This file contains the following sections:

OVERVIEW General description of
JPEG and the IJG software.
LEGAL ISSUES Copyright, lack of warranty, terms of distribution.
REFERENCES Where to learn more about JPEG.
ARCHIVE LOCATIONS Where to find newer versions of this software.
ACKNOWLEDGMENTS Special thanks.
FILE FORMAT WARS Software *not* to get.
TO DO Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.txt How to configure and install the IJG software.
usage.txt Usage instructions for cjpeg, djpeg, jpegtran,
 rdjpgcom, and wrjpgcom.
*.1 Unix-style man pages for programs (same info as usage.txt).
wizard.txt Advanced usage instructions for JPEG wizards only.
change.log Version-to-version change highlights.

Programmer and internal documentation:

libjpeg.txt How to use the JPEG library in your own programs.
example.c Sample code for calling the JPEG library.
structure.txt Overview of the JPEG library's internal structure.
filelist.txt Road map of IJG files.
coderules.txt Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information can also be found in the JPEG FAQ (Frequently Asked Questions) article. See ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or more of the REFERENCES, then looking at the documentation files (in roughly the order listed) before diving into the code.

OVERVIEW

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This package contains C software to implement JPEG image encoding, decoding, and transcoding. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and grayscale images.

This software implements JPEG baseline, extended-sequential, and progressive

compression processes. Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. We have made no provision for supporting the hierarchical or lossless processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files, plus two sample applications "cjpeg" and "djpeg", which use the library to perform conversion between JPEG and some other popular image file formats. The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG decoding, but they are essential for output to colormapped file formats or colormapped displays. These extra functions can be compiled out of the library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and flexibility, while also making it fast enough to be useful. In particular, the software is not intended to be read as a tutorial on JPEG. (See the REFERENCES section for introductory material.) Rather, it is intended to be reliable, portable, industrial-strength code. We do not claim to have achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products. No royalty is required, but we do ask for an acknowledgement in product documentation, as described under LEGAL ISSUES.

LEGAL ISSUES

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In plain English:

1. We don't promise that this software works. (But if you find any bugs, please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a program, you must acknowledge somewhere in your documentation that you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied, with respect to this software, its quality, accuracy, merchantability, or fitness for a particular purpose. This software is provided "AS IS", and you, its user, assume the entire risk as to its quality and accuracy.

This software is copyright (C) 1991-2018, Thomas G. Lane, Guido Vollbeding. All Rights Reserved except as specified below.

Permission is hereby granted to use, copy, modify, and distribute this software (or portions thereof) for any purpose, without fee, subject to these conditions:

(1) If any part of the source code for this software is distributed, then this README file must be included, with this copyright and no-warranty notice unaltered; and any additions, deletions, or changes to the original files must be clearly indicated in accompanying documentation.

(2)

If only executable code is distributed, then the accompanying documentation must state that "this software is based in part on the work of the Independent JPEG Group".

(3) Permission for use of this software is granted only if the user accepts full responsibility for any undesirable consequences; the authors accept NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code, not just to the unmodified library. If you use our work, you ought to acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name in advertising or publicity relating to this software or products derived from it. This software may be referred to only as "the Independent JPEG Group's software".

We specifically permit and encourage the use of this software as the basis of commercial products, provided that all warranty or liability claims are assumed by the product vendor.

The Unix configuration script "configure" was produced with GNU Autoconf.

It is copyright by the Free Software Foundation but is freely distributable.

The same holds for its supporting scripts (config.guess, config.sub, ltmain.sh). Another support script, install-sh, is copyright by X Consortium but is also freely distributable.

The IJG distribution formerly included code to read and write GIF files. To avoid entanglement with the Unisys LZW patent (now expired), GIF reading

support has been removed altogether, and the GIF writer has been simplified to produce "uncompressed GIFs". This technique does not use the LZW algorithm; the resulting GIF files are larger than usual, but are readable by all standard GIF decoders.

REFERENCES

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We recommend reading one or more of these references before trying to understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is Wallace, Gregory K. "The JPEG Still Picture Compression Standard", Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44.

(Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PDF file containing a revised version of Wallace's article is available at <http://www.ijg.org/files/Wallace.JPEG.pdf>. The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics) omits the sample images that appeared in CACM, but it includes corrections and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in "The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides good explanations and example C code for a multitude of compression methods including JPEG. It is an excellent source if you are comfortable reading C code but don't know much about data compression in general. The book's JPEG sample code is far from industrial-strength, but when you are ready to look at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still Image Data Compression Standard" by William B. Pennebaker and Joan L. Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1. Price US\$59.95, 638 pp. The book includes the complete text of the ISO JPEG standards (DIS 10918-1 and draft DIS 10918-2).

Although this is by far the most detailed and comprehensive exposition of JPEG publicly available, we point out that it is still missing an explanation of the most essential properties and algorithms of the underlying DCT technology.

If you think that you know about DCT-based JPEG after reading this book, then you are in delusion. The real fundamentals and corresponding potential of DCT-based JPEG are not publicly known so far, and that

is the reason for
all the mistaken developments taking place in the image coding domain.

The original JPEG standard is divided into two parts, Part 1 being the actual specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS 10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 2: Compliance testing" and has document numbers ISO/IEC IS 10918-2, ITU-T T.83.

IJG JPEG 8 introduced an implementation of the JPEG SmartScale extension which is specified in two documents: A contributed document at ITU and ISO with title "ITU-T JPEG-Plus Proposal for Extending ITU-T T.81 for Advanced Image Coding", April 2006, Geneva, Switzerland. The latest version of this document is Revision 3. And a contributed document ISO/IEC JTC1/SC29/WG1 N 5799 with title "Evolution of JPEG", June/July 2011, Berlin, Germany.

IJG JPEG 9 introduces a reversible color transform for improved lossless compression which is described in a contributed document ISO/IEC JTC1/SC29/WG1 N 6080 with title "JPEG 9 Lossless Coding", June/July 2012, Paris, France.

The JPEG standard does not specify all details of an interchangeable file format. For the omitted details we follow the "JFIF" conventions, version 2. JFIF version 1 has been adopted as Recommendation ITU-T T.871 (05/2011) : Information technology - Digital compression and coding of continuous-tone still images: JPEG File Interchange Format (JFIF). It is available as a free download in PDF file format from <http://www.itu.int/rec/T-REC-T.871>. A PDF file of the older JFIF document is available at <http://www.w3.org/Graphics/JPEG/jfif3.pdf>.

The TIFF 6.0 file format specification can be obtained by FTP from <ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz>. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems.

IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6). Instead, we recommend the JPEG design proposed by TIFF Technical Note #2 (Compression tag 7). Copies of this Note can be obtained from <http://www.ijg.org/files/>. It is expected that the next revision of the TIFF spec will replace the 6.0 JPEG design with the Note's design. Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note.

ARCHIVE LOCATIONS

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The "official" archive site for this software is www.ijg.org.

The most recent released version can always be found there in directory "files". This particular version will be archived as <http://www.ijg.org/files/jpegsrc.v9c.tar.gz>, and in Windows-compatible "zip" archive format as <http://www.ijg.org/files/jpegsr9c.zip>.

The JPEG FAQ (Frequently Asked Questions) article is a source of some general information about JPEG.

It is available on the World Wide Web

at <http://www.faqs.org/faqs/jpeg-faq/>

and other news.answers archive sites, including the official news.answers archive at rtfm.mit.edu: <ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/>.

If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu with body

send usenet/news.answers/jpeg-faq/part1

send usenet/news.answers/jpeg-faq/part2

ACKNOWLEDGMENTS

=====

Thank to Juergen Bruder for providing me with a copy of the common DCT algorithm article, only to find out that I had come to the same result in a more direct and comprehensible way with a more generative approach.

Thank to Istvan Sebestyen and Joan L. Mitchell for inviting me to the ITU JPEG (Study Group 16) meeting in Geneva, Switzerland.

Thank to Thomas Wiegand and Gary Sullivan for inviting me to the Joint Video Team (MPEG & ITU) meeting in Geneva, Switzerland.

Thank to Thomas Richter and Daniel Lee for inviting me to the ISO/IEC JTC1/SC29/WG1 (previously known as JPEG, together with ITU-T SG16) meeting in Berlin, Germany.

Thank to John Korejwa and Massimo Ballerini for inviting me to fruitful consultations in Boston, MA and Milan, Italy.

Thank to Hendrik Elstner, Roland Fassauer, Simone Zuck, Guenther Maier-Gerber, Walter Stoeber, Fred Schmitz, and Norbert Braunagel for corresponding business development.

Thank to Nico Zschach and Dirk Stelling of the technical support team at the Digital Images company in Halle for providing me with extra equipment for configuration tests.

Thank to Richard F. Lyon (then of Foveon Inc.) for fruitful communication about JPEG configuration in Sigma Photo Pro software.

Thank to Andrew Finkenstadt for hosting the ijg.org site.

Thank to Thomas G. Lane for the original design and development of this singular software package.

Thank to Lars Goehler, Andreas Heinecke, Sebastian Fuss, Yvonne Roebert, Andrej Werner, and Ulf-Dietrich Braumann for support and public relations.

FILE FORMAT WARS

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The ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16) currently promotes different formats containing the name "JPEG" which is misleading because these formats are incompatible with original DCT-based JPEG and are based on faulty technologies. IJG therefore does not and will not support such momentary mistakes (see REFERENCES).

There exist also distributions under the name "OpenJPEG" promoting such kind of formats which is misleading because they don't support original JPEG images.

We have no sympathy for the promotion of inferior formats. Indeed, one of the original reasons for developing this free software was to help force convergence on common, interoperable format standards for JPEG files. Don't use an incompatible file format!

(In any case, our decoder will remain capable of reading existing JPEG image files indefinitely.)

The ISO committee pretends to be "responsible for the popular JPEG" in their public reports which is not true because they don't respond to actual requirements

for the maintenance of the original JPEG specification.

Furthermore, the ISO committee pretends to "ensure interoperability" with their standards which is not true because their "standards" support only application-specific and proprietary use cases and contain mathematically incorrect code.

There are currently different distributions in circulation containing the name "libjpeg" which is misleading because they don't have the features and are incompatible with formats supported by actual IJG libjpeg distributions. One of those fakes is released by members of the ISO committee and just uses the name of libjpeg for misdirection of people, similar to the abuse of the name JPEG as described above, while having nothing in common with actual IJG libjpeg distributions and containing mathematically incorrect code.

The other one claims to be a "derivative" or "fork" of the original libjpeg, but violates the license conditions as described under LEGAL ISSUES above

and violates

basic C programming properties.

We have no sympathy for the release of misleading, incorrect and illegal distributions derived from obsolete code bases.

Don't use an obsolete code base!

According to the UCC (Uniform Commercial Code) law, IJG has the lawful and legal right to foreclose on certain standardization bodies and other institutions or corporations that knowingly perform substantial and systematic deceptive acts and practices, fraud, theft, and damaging of the value of the people of this planet without their knowing, willing and intentional consent.

The titles, ownership, and rights of these institutions and all their assets are now duly secured and held in trust for the free people of this planet. People of the planet, on every country, may have a financial interest in the assets of these former principals, agents, and beneficiaries of the foreclosed institutions and corporations.

IJG asserts what is: that each man, woman, and child has unalienable value and rights granted

and deposited in them by the Creator and not any one of the people is subordinate to any artificial principality, corporate fiction or the special interest of another without their appropriate knowing, willing and intentional consent made by contract or accommodation agreement.

IJG expresses that which already was.

The people have already determined and demanded that public administration entities, national governments, and their supporting judicial systems must be fully transparent, accountable, and liable.

IJG has secured the value for all concerned free people of the planet.

A partial list of foreclosed institutions and corporations ("Hall of Shame") is currently prepared and will be published later.

TO DO

=====

Version 9 is the second release of a new generation JPEG standard to overcome the limitations of the original JPEG specification, and is the first true source reference JPEG codec.

More features are being prepared for coming releases...

Please send bug reports, offers of help, etc. to jpeg-info@jpegclub.org.

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/README

No license file was found, but licenses were detected in source scan.

```

/*
 * jcsample.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains downsampling routines.
 *
 * Downsampling input data is counted in "row groups". A row group
 * is defined to be max_v_samp_factor pixel rows of each component,
 * from which the downsampler produces v_samp_factor sample rows.
 * A single row group is processed in each call to the downsampler module.
 *
 * The downsampler is responsible for edge-expansion of its output data
 * to fill an integral number of DCT blocks horizontally. The source buffer
 * may be modified if it is helpful for this purpose (the source buffer is
 * allocated wide enough to correspond to the desired output width).
 * The caller (the prep controller) is responsible for vertical padding.
 *
 * The downsampler may request
 * "context rows" by setting need_context_rows
 * during startup. In this case, the input arrays will contain at least
 * one row group's worth of pixels above and below the passed-in data;
 * the caller will create dummy rows at image top and bottom by replicating
 * the first or last real pixel row.
 *
 * An excellent reference for image resampling is
 * Digital Image Warping, George Wolberg, 1990.
 * Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
 *
 * The downsampling algorithm used here is a simple average of the source
 * pixels covered by the output pixel. The hi-falutin sampling literature
 * refers to this as a "box filter". In general the characteristics of a box
 * filter are not very good, but for the specific cases we normally use (1:1
 * and 2:1 ratios) the box is equivalent to a "triangle filter" which is not
 * nearly so bad. If you intend to use other sampling ratios, you'd be well
 * advised to improve this code.
 *
 * A simple input-smoothing
 * capability is provided. This is mainly intended
 * for cleaning up color-dithered GIF input files (if you find it inadequate,
 * we suggest using an external filtering program such as pnmconvol). When
 * enabled, each input pixel P is replaced by a weighted sum of itself and its
 * eight neighbors. P's weight is 1-8*SF and each neighbor's weight is SF,
 * where SF = (smoothing_factor / 1024).
 * Currently, smoothing is only supported for 2h2v sampling factors.
 */

```

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jcsample.c

No license file was found, but licenses were detected in source scan.

/*

* jdmarker.c

*

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modified 2009-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to decode JPEG datastream markers.

* Most of the complexity arises from our desire to support input

* suspension: if not all of the data for a marker is available,

* we must exit back to the application. On resumption, we reprocess

* the marker.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdmarker.c

No license file was found, but licenses were detected in source scan.

/*

* jchuff.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2006-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains Huffman entropy encoding routines.

* Both sequential and progressive modes are supported in this single module.

*

* Much of the complexity here has to do with supporting output suspension.

* If the data destination module demands suspension, we want to be able to

* back up to the start of the current MCU. To do this, we copy state

* variables into local working storage, and update them back to the

* permanent JPEG objects only upon successful completion of an MCU.

*

* We do not support output suspension for the progressive JPEG mode, since

* the library currently does not allow multiple-scan files to be written

* with output suspension.

*/

Found

in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jchuff.c

No license file was found, but licenses were detected in source scan.

/*

* jcinit.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2003-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains initialization logic for the JPEG compressor.

* This routine is in charge of selecting the modules to be executed and

* making an initialization call to each one.

*

* Logically, this code belongs in jcmaster.c. It's split out because

* linking this routine implies linking the entire compression library.

* For a transcoding-only application, we want to be able to use jcmaster.c

* without linking in the whole library.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jcinit.c

No license file was found, but licenses were detected in source scan.

/*

* rdbmp.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2009-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to read input images in Microsoft "BMP"

* format (MS Windows 3.x, OS/2 1.x, and OS/2 2.x flavors).

* Currently, only 8-, 24-, and 32-bit images are supported, not 1-bit or

* 4-bit (feeding such low-depth images into JPEG would be silly anyway).

* Also, we don't support RLE-compressed files.

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume input from

* an ordinary stdio stream. They further assume that reading begins

* at the start of the file; start_input may need work if the

* user interface has already read some data (e.g., to determine that

* the file is

indeed BMP format).

*

* This code contributed by James Arthur Boucher.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/rdbmp.c

No license file was found, but licenses were detected in source scan.

/*

* djpeg.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2009-2015 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a command-line user interface for the JPEG decompressor.

* It should work on any system with Unix- or MS-DOS-style command lines.

*

* Two different command line styles are permitted, depending on the

* compile-time switch TWO_FILE_COMMANDLINE:

* djpeg [options] inputfile outputfile

* djpeg [options] [inputfile]

* In the second style, output is always to standard output, which you'd

* normally redirect to a file or pipe to some other program. Input is

* either from a named file or from standard input (typically redirected).

* The second style is convenient on Unix but is unhelpful on systems that

* don't support pipes. Also, you MUST use the

first style if your system

* doesn't do binary I/O to stdin/stdout.

* To simplify script writing, the "-outfile" switch is provided. The syntax

* djpeg [options] -outfile outputfile inputfile

* works regardless of which command line style is used.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/djpeg.c

No license file was found, but licenses were detected in source scan.

/*

* jpeglib.h

*

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modified 2002-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file defines the application interface for the JPEG library.

* Most applications using the library need only include this file,

* and perhaps jerror.h if they want to know the exact error codes.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jpeglib.h

No license file was found, but licenses were detected in source scan.

/*

* jpegtran.c

*

* Copyright (C) 1995-2013, Thomas G. Lane, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a command-line user interface for JPEG transcoding.

* It is very similar to cjpeg.c, and partly to djpeg.c, but provides

* lossless transcoding between different JPEG file formats. It also

* provides some lossless and sort-of-lossless transformations of JPEG data.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jpegtran.c

No license file was found, but licenses were detected in source scan.

/*

* jversion.h

*

* Copyright (C) 1991-2018, Thomas G. Lane, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains software version identification.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jversion.h

No license file was found, but licenses were detected in source scan.

/*

* jdct.h

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2002-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This include file contains common declarations for the forward and

* inverse DCT modules. These declarations are private to the DCT managers

- * (jcdctmgr.c, jddctmgr.c) and the individual DCT algorithms.
- * The individual DCT algorithms are kept in separate files to ease
- * machine-dependent tuning (e.g., assembly coding).

*/

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jdct.h

No license file was found, but licenses were detected in source scan.

/*

- * jdarith.c

*

- * Developed 1997-2015 by Guido Vollbeding.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * This file contains portable arithmetic entropy decoding routines for JPEG

- * (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).

*

- * Both sequential and progressive modes are supported in this single module.

*

- * Suspension is not currently supported in this module.

*/

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jdarith.c

No license file was found, but licenses were detected in source scan.

/*

- * jmemdos.c

*

- * Copyright (C) 1992-1997, Thomas G. Lane.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * This file provides an MS-DOS-compatible implementation of the system-

- * dependent portion of the JPEG memory manager. Temporary data can be

- * stored in extended or expanded memory as well as in regular DOS files.

*

- * If you use this file, you must be sure that NEED_FAR_POINTERS is defined

- * if you compile in a small-data memory model; it should NOT be defined if

- * you use a large-data memory model. This file is not recommended if you

- * are using a flat-memory-space 386 environment such as DJGCC or Watcom C.

- * Also, this code will NOT work if struct fields are aligned on greater than

- * 2-byte boundaries.

*

- * Based on code contributed by Ge' Weijers.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jmemdos.c

No license file was found, but licenses were detected in source scan.

/*

* jinclude.h

*

* Copyright (C) 1991-1994, Thomas G. Lane.

* Modified 2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file exists to provide a single place to fix any problems with

* including the wrong system include files. (Common problems are taken

* care of by the standard jconfig symbols, but on really weird systems

* you may have to edit this file.)

*

* NOTE: this file is NOT intended to be included by applications using the

* JPEG library. Most applications need only include jpeglib.h.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jinclude.h

No license file was found, but licenses were detected in source scan.

/*

* jccolor.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2011-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains input colorspace conversion routines.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jccolor.c

No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: SYSTEM ARCHITECTURE

Copyright (C) 1991-2013, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file provides an overview of the architecture of the IJG JPEG software; that is, the functions of the various modules in the system and the interfaces between modules. For more precise details about any data structure or calling convention, see the include files and comments in the source code.

We assume that the reader is already somewhat familiar with the JPEG standard. The README file includes references for learning about JPEG. The file libjpeg.txt describes the library from the viewpoint of an application programmer using the library; it's best to read that file before this one. Also, the file coderules.txt describes the coding style conventions we use.

In this document, JPEG-specific terminology follows the JPEG standard:

A "component" means a color channel, e.g., Red or Luminance.

A "sample" is a single component value (i.e., one number in the image data).

A "coefficient" is a frequency coefficient (a DCT transform output number).

A "block" is an array of samples or coefficients.

An "MCU" (minimum coded unit) is an interleaved set of blocks of size determined by the sampling factors, or a single block in a noninterleaved scan.

We do not use the terms "pixel" and "sample" interchangeably. When we say pixel, we mean an element of the full-size image, while a sample is an element of the downsampled image. Thus the number of samples may vary across components while the number of pixels does not. (This terminology is not used rigorously throughout the code, but it is used in places where confusion would otherwise result.)

*** System features ***

The IJG distribution contains two parts:

- * A subroutine library for JPEG compression and decompression.

- * cjpeg/djpeg, two sample applications that use the library to transform JFIF JPEG files to and from several other image formats.

cjpeg/djpeg are of no great intellectual complexity: they merely add a simple command-line user interface and I/O routines for several uncompressed image formats. This document concentrates on the library itself.

We desire the library to be capable of supporting all JPEG baseline, extended sequential, and progressive DCT processes. The library does not support the hierarchical or lossless processes defined in the standard.

Within these limits, any set of compression parameters allowed by the JPEG spec should be readable for decompression. (We can be more restrictive about what formats we can generate.) Although the system design allows for all parameter values, some uncommon settings are not yet implemented and may never be; nonintegral sampling ratios are the prime example. Furthermore, we treat 8-bit vs. 12-bit data precision as a

compile-time switch, not a run-time option, because most machines can store 8-bit pixels much more compactly than 12-bit.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, libtiff uses this library to implement JPEG compression within the TIFF file format.)

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. This code can be omitted if not needed.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

*** Portability issues ***

Portability is an essential requirement for the library. The key portability issues that show up at the level of system architecture are:

1. Memory usage. We want the code to be able to run on PC-class machines with limited memory. Images should therefore be processed sequentially (in strips), to avoid holding the whole image in memory at once. Where a full-image buffer is necessary, we should be able to use either virtual memory or temporary files.
2. Near/far pointer distinction. To run efficiently on 80x86 machines, the code should distinguish "small" objects (kept in near data space) from "large" ones (kept in far data space). This is an annoying restriction, but fortunately it does not impact code quality for less brain-damaged machines, and the source code clutter turns out to be minimal with sufficient use of pointer typedefs.
3. Data precision. We assume that "char" is at least 8 bits, "short" and "int" at least 16, "long" at least 32. The code will work fine with larger

data sizes, although memory may be used inefficiently in some cases. However, the JPEG compressed datastream must ultimately appear on external storage as a sequence of 8-bit bytes if it is to conform to the standard. This may pose a problem on machines where char is wider than 8 bits. The library represents compressed data as an array of values of typedef JOCTET. If no data type exactly 8 bits wide is available, custom data source and data destination modules must be written to unpack and pack the chosen JOCTET datatype into 8-bit external representation.

*** System overview ***

The compressor and decompressor are each divided into two main sections: the JPEG compressor or decompressor proper, and the preprocessing or postprocessing functions. The interface between these two sections is the image data that the official JPEG spec regards as its input or output: this data is in the colorspace to be used for compression, and it is downsampled to the sampling factors to be used. The preprocessing and postprocessing steps are responsible for converting a normal image representation to or from this form. (Those few applications that want to deal with YCbCr downsampled data can skip the preprocessing or postprocessing step.)

Looking more closely, the compressor library contains the following main elements:

Preprocessing:

- * Color space conversion (e.g., RGB to YCbCr).
- * Edge expansion and downsampling. Optionally, this step can do simple smoothing --- this is often helpful for low-quality source data.

JPEG proper:

- * MCU assembly, DCT, quantization.
- * Entropy coding (sequential or progressive, Huffman or arithmetic).

In addition to these modules we need overall control, marker generation, and support code (memory management & error handling). There is also a module responsible for physically writing the output data --- typically this is just an interface to fwrite(), but some applications may need to do something else with the data.

The decompressor library contains the following main elements:

JPEG proper:

- * Entropy decoding (sequential or progressive, Huffman or arithmetic).
- * Dequantization, inverse DCT, MCU disassembly.

Postprocessing:

- * Upsampling. Optionally, this step may be able to do more general

rescaling of the image.

- * Color space conversion (e.g., YCbCr to RGB). This step may also provide gamma adjustment [currently it does not].

- * Optional color quantization (e.g., reduction to 256 colors).

- * Optional

color precision reduction (e.g., 24-bit to 15-bit color).

[This feature is not currently implemented.]

We also need overall control, marker parsing, and a data source module.

The support code (memory management & error handling) can be shared with the compression half of the library.

There may be several implementations of each of these elements, particularly in the decompressor, where a wide range of speed/quality tradeoffs is very useful. It must be understood that some of the best speedups involve merging adjacent steps in the pipeline. For example, upsampling, color space conversion, and color quantization might all be done at once when using a low-quality ordered-dither technique. The system architecture is designed to allow such merging where appropriate.

Note: it is convenient to regard edge expansion (padding to block boundaries) as a preprocessing/postprocessing function, even though the JPEG spec includes it in compression/decompression. We do this because

downsampling/upsampling

can be simplified a little if they work on padded data: it's not necessary to have special cases at the right and bottom edges. Therefore the interface buffer is always an integral number of blocks wide and high, and we expect compression preprocessing to pad the source data properly. Padding will occur only to the next block (block_size-sample) boundary. In an interleaved-scan situation, additional dummy blocks may be used to fill out MCUs, but the MCU assembly and disassembly logic will create or discard these blocks internally. (This is advantageous for speed reasons, since we avoid DCTing the dummy blocks. It also permits a small reduction in file size, because the compressor can choose dummy block contents so as to minimize their size in compressed form. Finally, it makes the interface buffer specification independent of whether the file is actually interleaved or not.)

Applications that wish to deal directly with the downsampled data must provide similar

buffering and padding for odd-sized images.

*** Poor man's object-oriented programming ***

It should be clear by now that we have a lot of quasi-independent processing steps, many of which have several possible behaviors. To avoid cluttering the code with lots of switch statements, we use a simple form of object-style programming to separate out the different possibilities.

For example, two different color quantization algorithms could be implemented as two separate modules that present the same external interface; at runtime, the calling code will access the proper module indirectly through an "object".

We can get the limited features we need while staying within portable C. The basic tool is a function pointer. An "object" is just a struct containing one or more function pointer fields, each of which corresponds to a method name in real object-oriented languages. During initialization we fill in the function pointers with references to whichever module we have determined

we need to use in this run. Then invocation of the module is done by indirecting through a function pointer; on most machines this is no more expensive than a switch statement, which would be the only other way of making the required run-time choice. The really significant benefit, of course, is keeping the source code clean and well structured.

We can also arrange to have private storage that varies between different implementations of the same kind of object. We do this by making all the module-specific object structs be separately allocated entities, which will be accessed via pointers in the master compression or decompression struct. The "public" fields or methods for a given kind of object are specified by a commonly known struct. But a module's initialization code can allocate a larger struct that contains the common struct as its first member, plus additional private fields. With appropriate pointer casting, the module's internal functions can access these private fields.

(For a simple example, see `jdatadst.c`, which implements the external interface specified by struct `jpeg_destination_mgr`, but adds extra fields.)

(Of course this would all be a lot easier if we were using C++, but we are not yet prepared to assume that everyone has a C++ compiler.)

An important benefit of this scheme is that it is easy to provide multiple versions of any method, each tuned to a particular case. While a lot of precalculation might be done to select an optimal implementation of a method, the cost per invocation is constant. For example, the upsampling step might have a "generic" method, plus one or more "hardwired" methods for the most popular sampling factors; the hardwired methods would be faster because they'd use straight-line code instead of for-loops. The cost to determine which method to use is paid only once, at startup, and the selection criteria are hidden from the callers of the method.

This plan differs a little bit from usual object-oriented structures, in that only one instance of each object class will exist during execution. The reason for having the class structure is that on different runs we may create different instances (choose to execute different modules). You can think of

the term "method" as denoting the common interface presented by a particular set of interchangeable functions, and "object" as denoting a group of related methods, or the total shared interface behavior of a group of modules.

*** Overall control structure ***

We previously mentioned the need for overall control logic in the compression and decompression libraries. In IJG implementations prior to v5, overall control was mostly provided by "pipeline control" modules, which proved to be large, unwieldy, and hard to understand. To improve the situation, the control logic has been subdivided into multiple modules. The control modules consist of:

1. Master control for module selection and initialization. This has two responsibilities:

1A. Startup

initialization at the beginning of image processing.

The individual processing modules to be used in this run are selected and given initialization calls.

1B. Per-pass control. This determines how many passes will be performed and calls each active processing module to configure itself appropriately at the beginning of each pass. End-of-pass processing, where necessary, is also invoked from the master control module.

Method selection is partially distributed, in that a particular processing module may contain several possible implementations of a particular method, which it will select among when given its initialization call. The master control code need only be concerned with decisions that affect more than one module.

2. Data buffering control. A separate control module exists for each inter-processing-step data buffer. This module is responsible for invoking the processing steps that write or read that data buffer.

Each

buffer controller sees the world as follows:

```
input data => processing step A => buffer => processing step B => output data
      |           |           |
      ----- controller -----
```

The controller knows the dataflow requirements of steps A and B: how much data they want to accept in one chunk and how much they output in one chunk. Its function is to manage its buffer and call A and B at the proper times.

A data buffer control module may itself be viewed as a processing step by a higher-level control module; thus the control modules form a binary tree with elementary processing steps at the leaves of the tree.

The control modules are objects. A considerable amount of flexibility can be had by replacing implementations of a control module. For example:

- * Merging of adjacent steps in the pipeline is done by replacing a control module and its pair of processing-step modules with a single processing-step module.

(Hence the possible merges are determined by the tree of control modules.)

- * In some processing modes, a given interstep buffer need only be a "strip" buffer large enough to accommodate the desired data chunk sizes. In other modes, a full-image buffer is needed and several passes are required. The control module determines which kind of buffer is used and manipulates virtual array buffers as needed. One or both processing steps may be unaware of the multi-pass behavior.

In theory, we might be able to make all of the data buffer controllers interchangeable and provide just one set of implementations for all. In practice, each one contains considerable special-case processing for its particular job. The buffer controller concept should be regarded as an overall system structuring principle, not as a complete description of the task performed by any one controller.

*** Compression object structure ***

Here is a sketch of the logical structure of the JPEG compression library:

```

                                |-- Colospace conversion
        |-- Preprocessing controller --|
        |                                |-- Downsampling
Main controller --|
        |                                |-- Forward DCT, quantize
        |-- Coefficient controller --|
                                |-- Entropy encoding
```

This sketch also describes the flow of control (subroutine calls) during typical image data processing. Each of the components shown in the diagram is an "object" which may have several different implementations available. One or more source code files contain the actual implementation(s) of each object.

The objects shown above are:

- * Main controller: buffer controller for the subsampled-data buffer, which holds the preprocessed input data. This controller invokes preprocessing to

fill the subsampled-data buffer, and JPEG compression to empty it. There is usually no need for a full-image buffer here; a strip buffer is adequate.

- * Preprocessing controller: buffer controller for the downsampling input data buffer, which lies between colorspace conversion and downsampling. Note that a unified conversion/downsampling module would probably replace this controller entirely.
- * Colorspace conversion: converts application image data into the desired JPEG color space; also changes the data from pixel-interleaved layout to separate component planes. Processes one pixel row at a time.
- * Downsampling: performs reduction of chroma components as required. Optionally may perform pixel-level smoothing as well. Processes a "row group" at a time, where a row group is defined as V_{max} pixel rows of each component before downsampling, and V_k sample rows afterwards (remember V_k differs across components). Some downsampling or smoothing algorithms may require context rows above and below the current row group; the preprocessing controller is responsible for supplying these rows via proper buffering. The downsampler is responsible for edge expansion at the right edge (i.e., extending each sample row to a multiple of `block_size` samples); but the preprocessing controller is responsible for vertical edge expansion (i.e., duplicating the bottom sample row as needed to make a multiple of `block_size` rows).
- * Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU assembly, including insertion of dummy DCT blocks when needed at the right or bottom edge. When performing Huffman-code optimization or emitting a multiscan JPEG file, this controller is responsible for buffering the full image. The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the JPEG file is noninterleaved.
- * Forward DCT and quantization: Perform DCT, quantize, and emit coefficients. Works on one or more DCT blocks at a time. (Note: the coefficients are now emitted in normal array order, which the entropy encoder is expected to convert to zigzag order as necessary. Prior versions of the IJG code did the conversion to zigzag order within the quantization step.)
- * Entropy encoding: Perform Huffman or arithmetic entropy coding and emit the coded data to the data destination module. Works on one MCU per call. For progressive JPEG, the same DCT blocks are fed to the entropy coder during each pass, and the coder must emit the appropriate subset of coefficients.

In addition to the above objects, the compression library includes these objects:

- * Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules.
- * Marker writing: generates JPEG markers (except for RSTn, which is emitted by the entropy encoder when needed).
- * Data destination manager: writes the output JPEG datastream to its final destination (e.g., a file). The destination manager supplied with the library knows how to write to a stdio stream or to a memory buffer; for other behaviors, the surrounding application may provide its own destination manager.
- * Memory manager: allocates and releases memory, controls virtual arrays (with backing store management, where required).
- * Error handler: performs formatting and output of error and trace messages; determines handling of nonfatal errors. The surrounding application may override some or all of this object's methods to change error handling.
- * Progress monitor: supports output of "percent-done" progress reports. This object represents an optional callback to the surrounding application: if wanted, it must be supplied by the application.

The error handler, destination manager, and progress monitor objects are defined as separate objects in order to simplify application-specific customization of the JPEG library. A surrounding application may override individual methods or supply its own all-new implementation of one of these objects. The object interfaces for these objects are therefore treated as part of the application interface of the library, whereas the other objects are internal to the library.

The error handler and memory manager are shared by JPEG compression and decompression; the progress monitor, if used, may be shared as well.

*** Decompression object structure ***

Here is a sketch of the logical structure of the JPEG decompression library:

```

                                |-- Entropy decoding
        |-- Coefficient controller --|
        |                               |-- Dequantize, Inverse DCT
Main controller --|
```

```

|                                |-- Upsampling
|-- Postprocessing controller --| |-- Colorspace conversion
                                |-- Color quantization
                                |-- Color precision reduction

```

As before, this diagram also represents typical control flow. The objects shown are:

- * Main controller: buffer controller for the subsampled-data buffer, which holds the output of JPEG decompression proper. This controller's primary task is to feed the postprocessing procedure. Some upsampling algorithms may require context rows above and below the current row group; when this is true, the main controller is responsible for managing its buffer so as to make context rows available. In the current design, the main buffer is always a strip buffer; a full-image buffer is never required.
- * Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU disassembly, including deletion of any dummy DCT blocks at the right or bottom edge. When reading a multiscan JPEG file, this controller is responsible for buffering the full image. (Buffering DCT coefficients, rather than samples, is necessary to support progressive JPEG.) The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the source JPEG file is noninterleaved.
- * Entropy decoding: Read coded data from the data source module and perform Huffman or arithmetic entropy decoding. Works on one MCU per call. For progressive JPEG decoding, the coefficient controller supplies the prior coefficients of each MCU (initially all zeroes), which the entropy decoder modifies in each scan.
- * Dequantization and inverse DCT: like it says. Note that the coefficients buffered by the coefficient controller have NOT been dequantized; we merge dequantization and inverse DCT into a single step for speed reasons. When scaled-down output is asked for, simplified DCT algorithms may be used that need fewer coefficients and emit fewer samples per DCT block, not the full 8x8. Works on one DCT block at a time.
- * Postprocessing controller: buffer controller for the color quantization input buffer, when quantization is in use. (Without quantization, this controller just calls the upsampler.) For two-pass quantization, this controller is responsible for buffering the full-image data.
- * Upsampling: restores chroma components to full size. (May support more general output rescaling, too. Note that if undersized DCT outputs have

been emitted by the DCT module, this module must adjust so that properly sized outputs are created.) Works on one row group at a time. This module also calls the color conversion module, so its top level is effectively a buffer controller for the upsampling->color conversion buffer. However, in all but the highest-quality operating modes, upsampling and color conversion are likely to be merged into a single step.

- * Colorspace conversion: convert from JPEG color space to output color space, and change data layout from separate component planes to pixel-interleaved. Works on one pixel row at a time.

- * Color quantization: reduce the data to colormapped form, using either an externally specified colormap or an internally generated one. This module is not used for full-color output. Works on one pixel row at a time; may require two passes to generate a color map. Note that the output will always be a single component representing colormap indexes. In the current design, the output values are JSAMPLEs, so an 8-bit compilation cannot quantize to more than 256 colors. This is unlikely to be a problem in practice.

- * Color reduction: this module handles color precision reduction, e.g., generating 15-bit color (5 bits/primary) from JPEG's 24-bit output. Not quite clear yet how this should be handled... should we merge it with colorspace conversion???

Note that some high-speed operating modes might condense the entire postprocessing sequence to a single module (upsample, color convert, and quantize in one step).

In addition to the above objects, the decompression library includes these objects:

- * Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules. This is subdivided into input and output control: `jdinput.c` controls only input-side processing, while `jdmaster.c` handles overall initialization and output-side control.

- * Marker reading: decodes JPEG markers (except for RSTn).

- * Data source manager: supplies the input JPEG datastream. The source manager supplied with the library knows how to read from a stdio stream or from a memory buffer; for other behaviors, the surrounding application may provide its own source manager.

- * Memory manager: same as for compression library.

* Error handler: same as for compression library.

* Progress monitor: same as for compression library.

As with compression, the data source manager, error handler, and progress monitor are candidates for replacement by a surrounding application.

*** Decompression input and output separation ***

To support efficient incremental display of progressive JPEG files, the decompressor is divided into two sections that can run independently:

1. Data input includes marker parsing, entropy decoding, and input into the coefficient controller's DCT coefficient buffer. Note that this processing is relatively cheap and fast.
2. Data output reads from the DCT coefficient buffer and performs the IDCT and all postprocessing steps.

For a progressive JPEG file, the data input processing is allowed to get arbitrarily far ahead of the data output processing. (This occurs only if the application calls `jpeg_consume_input()`; otherwise input and output run in lockstep, since the input section is called only when the output section needs more data.) In this way the application can avoid making extra display passes when data is arriving faster than the display pass can run. Furthermore, it is possible to abort an output pass without losing anything, since the coefficient buffer is read-only as far as the output section is concerned. See `libjpeg.txt` for more detail.

A full-image coefficient array is only created if the JPEG file has multiple scans (or if the application specifies buffered-image mode anyway). When reading a single-scan file, the coefficient controller normally creates only a one-MCU buffer, so input and output processing must run in lockstep in this case. `jpeg_consume_input()` is effectively a no-op in this situation.

The main impact of dividing the decompressor in this fashion is that we must be very careful with shared variables in the `cinfo` data structure. Each variable that can change during the course of decompression must be classified as belonging to data input or data output, and each section must look only at its own variables. For example, the data output section may not depend on any of the variables that describe the current scan in the JPEG file, because these may change as the data input section advances into a new scan.

The progress monitor is (somewhat arbitrarily) defined to treat

input of the file as one pass when buffered-image mode is not used, and to ignore data input work completely when buffered-image mode is used. Note that the library has no reliable way to predict the number of passes when dealing with a progressive JPEG file, nor can it predict the number of output passes in buffered-image mode. So the work estimate is inherently bogus anyway.

No comparable division is currently made in the compression library, because there isn't any real need for it.

*** Data formats ***

Arrays of pixel sample values use the following data structure:

```
typedef something JSAMPLE; a pixel component value, 0..MAXJSAMPLE
typedef JSAMPLE *JSAMPROW; ptr to a row of samples
typedef JSAMPROW *JSAMPARRAY; ptr to a list of rows
typedef JSAMPARRAY *JSAMPIMAGE; ptr to a list of color-component arrays
```

The basic element type JSAMPLE will typically be one of unsigned char, (signed) char, or short. Short will be used if samples wider than 8 bits are to be supported (this is a compile-time option). Otherwise, unsigned char is used if possible. If the compiler only supports signed chars, then it is necessary to mask off the value when reading. Thus, all reads of JSAMPLE values must be coded as "GETJSAMPLE(value)", where the macro will be defined as "((value) & 0xFF)" on signed-char machines and "((int) (value))" elsewhere.

With these conventions, JSAMPLE values can be assumed to be ≥ 0 . This helps simplify correct rounding during downsampling, etc. The JPEG standard's specification that sample values run from -128..127 is accommodated by subtracting 128 from the sample value in the DCT step. Similarly, during decompression the output of the IDCT step will be immediately shifted back to 0..255. (NB: different values are required when 12-bit samples are in use. The code is written in terms of MAXJSAMPLE and CENTERJSAMPLE, which will be defined as 255 and 128 respectively in an 8-bit implementation, and as 4095 and 2048 in a 12-bit implementation.)

We use a pointer per row, rather than a two-dimensional JSAMPLE array. This choice costs only a small amount of memory and has several benefits:

- * Code using the data structure doesn't need to know the allocated width of the rows. This simplifies edge expansion/compression, since we can work in an array that's wider than the logical picture width.
- * Indexing doesn't require multiplication; this is a performance win on many machines.
- * Arrays with more than 64K total elements can be supported even on machines

where malloc() cannot allocate chunks larger than 64K.

* The rows forming a component array may be allocated at different times without extra copying. This trick allows some speedups in smoothing steps that need access to the previous and next rows.

Note that each color component is stored in a separate array; we don't use the traditional layout in which the components of a pixel are stored together.

This simplifies coding of modules that work on

each component independently,

because they don't need to know how many components there are. Furthermore, we can read or write each component to a temporary file independently, which is helpful when dealing with noninterleaved JPEG files.

In general, a specific sample value is accessed by code such as

```
GETJSAMPLE(image[colorcomponent][row][col])
```

where col is measured from the image left edge, but row is measured from the first sample row currently in memory. Either of the first two indexings can be precomputed by copying the relevant pointer.

Since most image-processing applications prefer to work on images in which the components of a pixel are stored together, the data passed to or from the surrounding application uses the traditional convention: a single pixel is represented by N consecutive JSAMPLE values, and an image row is an array of (# of color components)*(image width) JSAMPLEs. One or more rows of data can be represented by a pointer of type JSAMPARRAY in this scheme.

This scheme is

converted to component-wise storage inside the JPEG library. (Applications that want to skip JPEG preprocessing or postprocessing will have to contend with component-wise storage.)

Arrays of DCT-coefficient values use the following data structure:

```
typedef short JCOEF; a 16-bit signed integer
```

```
typedef JCOEF JBLOCK[DCTSIZE2]; an 8x8 block of coefficients
```

```
typedef JBLOCK *JBLOCKROW; ptr to one horizontal row of 8x8 blocks
```

```
typedef JBLOCKROW *JBLOCKARRAY; ptr to a list of such rows
```

```
typedef JBLOCKARRAY *JBLOCKIMAGE; ptr to a list of color component arrays
```

The underlying type is at least a 16-bit signed integer; while "short" is big enough on all machines of interest, on some machines it is preferable to use "int" for speed reasons, despite the storage cost. Coefficients are grouped into 8x8 blocks (but we always use #defines DCTSIZE and DCTSIZE2 rather than "8" and "64").

The contents of a coefficient block may be in either "natural" or zigzagged order,

and may be true values or divided by the quantization coefficients, depending on where the block is in the processing pipeline. In the current library, coefficient blocks are kept in natural order everywhere; the entropy codecs zigzag or dezigzag the data as it is written or read. The blocks contain quantized coefficients everywhere outside the DCT/IDCT subsystems. (This latter decision may need to be revisited to support variable quantization a la JPEG Part 3.)

Notice that the allocation unit is now a row of 8x8 coefficient blocks, corresponding to block_size rows of samples. Otherwise the structure is much the same as for samples, and for the same reasons.

On machines where malloc() can't handle a request bigger than 64Kb, this data structure limits us to rows of less than 512 JBLOCKS, or a picture width of 4000+ pixels. This seems an acceptable restriction.

On 80x86 machines, the bottom-level pointer types (JSAMPROW and JBLOCKROW) must be declared as "far" pointers, but the upper levels can be "near" (implying that the pointer lists are allocated in the DS segment). We use a #define symbol FAR, which expands to the "far" keyword when compiling on 80x86 machines and to nothing elsewhere.

*** Suspensible processing ***

In some applications it is desirable to use the JPEG library as an incremental, memory-to-memory filter. In this situation the data source or destination may be a limited-size buffer, and we can't rely on being able to empty or refill the buffer at arbitrary times. Instead the application would like to have control return from the library at buffer overflow/underrun, and then resume compression or decompression at a later time.

This scenario is supported for simple cases. (For anything more complex, we recommend that the application "bite the bullet" and develop real multitasking capability.) The libjpeg.txt file goes into more detail about the usage and limitations of this capability; here we address the implications for library structure.

The

essence of the problem is that the entropy codec (coder or decoder) must be prepared to stop at arbitrary times. In turn, the controllers that call the entropy codec must be able to stop before having produced or consumed all the data that they normally would handle in one call. That part is reasonably straightforward: we make the controller call interfaces include "progress counters" which indicate the number of data chunks successfully processed, and we require callers to test the counter rather than just assume all of the data

was processed.

Rather than trying to restart at an arbitrary point, the current Huffman codecs are designed to restart at the beginning of the current MCU after a suspension due to buffer overflow/underrun. At the start of each call, the codec's internal state is loaded from permanent storage (in the JPEG object structures) into local variables. On successful completion of the MCU, the permanent state is updated. (This copying is not very expensive, and may even lead to **improved** performance if the local variables can be registerized.) If a suspension occurs, the codec simply returns without updating the state, thus effectively reverting to the start of the MCU. Note that this implies leaving some data unprocessed in the source/destination buffer (ie, the compressed partial MCU). The data source/destination module interfaces are specified so as to make this possible. This also implies that the data buffer must be large enough to hold a worst-case compressed MCU; a couple thousand bytes should be enough.

In a successive-approximation AC refinement scan, the progressive Huffman decoder has to be able to undo assignments of newly nonzero coefficients if it suspends before the MCU is complete, since decoding requires distinguishing previously-zero and previously-nonzero coefficients. This is a bit tedious but probably won't have much effect on performance. Other variants of Huffman decoding need not worry about this, since they will just store the same values again if forced to repeat the MCU.

This approach would probably not work for an arithmetic codec, since its modifiable state is quite large and couldn't be copied cheaply. Instead it would have to suspend and resume exactly at the point of the buffer end.

The JPEG marker reader is designed to cope with suspension at an arbitrary point. It does so by backing up to the start of the marker parameter segment, so the data buffer must be big enough to hold the largest marker of interest. Again, a couple KB should be adequate. (A special "skip" convention is used to bypass COM and APPn markers, so these can be larger than the buffer size without causing problems; otherwise a 64K buffer would be needed in the worst case.)

The JPEG marker writer currently does **not** cope with suspension. We feel that this is not necessary; it is much easier simply to require the application to ensure there is enough buffer space before starting. (An empty 2K buffer is more than sufficient for the header markers; and ensuring there are a dozen or two bytes available before calling `jpeg_finish_compress()` will suffice for the trailer.) This would not work for writing multi-scan JPEG files, but we simply do not intend to support that capability with suspension.

*** Memory manager services ***

The JPEG library's memory manager controls allocation and deallocation of memory, and it manages large "virtual" data arrays on machines where the operating system does not provide virtual memory. Note that the same memory manager serves both compression and decompression operations.

In all cases, allocated objects are tied to a particular compression or decompression master record, and they will be released when that master record is destroyed.

The memory manager does not provide explicit deallocation of objects. Instead, objects are created in "pools" of free storage, and a whole pool can be freed at once. This approach helps prevent storage-leak bugs, and it speeds up operations whenever malloc/free are slow (as they often are). The pools can be regarded as lifetime identifiers for objects. Two pools/lifetimes are defined:

- * JPOOL_PERMANENT lasts until master record is destroyed

- * JPOOL_IMAGE lasts until done with image (JPEG datastream)

Permanent lifetime is used for parameters and tables that should be carried across from one datastream to another; this includes all application-visible parameters. Image lifetime is used for everything else. (A third lifetime, JPOOL_PASS = one processing pass, was originally planned. However it was dropped as not being worthwhile. The actual usage patterns are such that the peak memory usage would be about the same anyway; and having per-pass storage substantially complicates the virtual memory allocation rules --- see below.)

The memory manager deals with three kinds of object:

1. "Small" objects. Typically these require no more than 10K-20K total.

2. "Large" objects. These may require tens to hundreds of K depending on image size. Semantically they behave the same as small objects, but we distinguish them for two reasons:

- * On MS-DOS machines, large objects are referenced by FAR pointers, small objects by NEAR pointers.

- * Pool allocation heuristics may differ for large and small objects.

Note that individual "large" objects cannot exceed the size allowed by type size_t, which may be 64K or less on some machines.

3. "Virtual" objects. These are large 2-D arrays of JSAMPLEs or JBLOCKs (typically large enough for the entire image being processed). The memory manager provides stripwise access to these arrays. On machines without virtual memory, the rest of the array may be swapped out to a temporary file.

(Note: JSAMPARRAY and JBLOCKARRAY data structures are a combination of large

objects for the data proper and small objects for the row pointers. For convenience and speed, the memory manager provides single routines to create these structures. Similarly, virtual arrays include a small control block and a JSAMPARRAY or JBLOCKARRAY working buffer, all created with one call.)

In the present implementation, virtual arrays are only permitted to have image lifespan. (Permanent lifespan would not be reasonable, and pass lifespan is not very useful since a virtual array's raison d'etre is to store data for multiple passes through the image.) We also expect that only "small" objects will be given permanent lifespan, though this restriction is not required by the memory manager.

In a non-virtual-memory machine, some performance benefit can be gained by making the in-memory buffers for virtual arrays be as large as possible. (For small images, the buffers might fit entirely in memory, so blind swapping would be very wasteful.) The memory manager will adjust the height of the buffers to fit within a prespecified maximum memory usage. In order to do this in a reasonably optimal fashion, the manager needs to allocate all of the virtual arrays at once. Therefore, there isn't a one-step allocation routine for virtual arrays; instead, there is a "request" routine that simply allocates the control block, and a "realize" routine (called just once) that determines space allocation and creates all of the actual buffers. The realize routine must allow for space occupied by non-virtual large objects. (We don't bother to factor in the space needed for small objects, on the grounds that it isn't worth the trouble.)

To support all this, we establish the following protocol for doing business with the memory manager:

1. Modules must request virtual arrays (which may have only image lifespan) during the initial setup phase, i.e., in their `jinit_xxx` routines.
2. All "large" objects (including JSAMPARRAYs and JBLOCKARRAYs) must also be allocated during initial setup.
3. `realize_virt_arrays` will be called at the completion of initial setup.

The above conventions ensure that sufficient information is available for it to choose a good size for virtual array buffers.

Small objects of any lifespan may be allocated at any time. We expect that the total space used for small objects will be small enough to be negligible in the `realize_virt_arrays` computation.

In a virtual-memory machine, we simply pretend that the available space is infinite, thus causing `realize_virt_arrays` to decide that it can allocate all the virtual arrays as full-size in-memory buffers. The overhead of the virtual-array access protocol is very small when no swapping occurs.

A virtual array can be specified to be "pre-zeroed"; when this flag is set,

never-yet-written sections of the array are set to zero before being made available to the caller. If this flag is not set, never-written sections of the array contain garbage. (This feature exists primarily because the equivalent logic would otherwise be needed in jdcoefct.c for progressive JPEG mode; we may as well make it available for possible other uses.)

The first write pass on a virtual array is required to occur in top-to-bottom order; read passes, as well as any write passes after the first one, may access the array in any order. This restriction exists partly to simplify the virtual array control logic, and partly because some file systems may not support seeking beyond the current end-of-file in a temporary file. The main implication of this restriction is that rearrangement of rows (such as converting top-to-bottom data order to bottom-to-top) must be handled while reading data out of the virtual array, not while putting it in.

*** Memory manager internal structure ***

To isolate system dependencies as much as possible, we have broken the memory manager into two parts. There is a reasonably system-independent "front end" (jmemmgr.c) and a "back end" that contains only the code likely to change across systems. All of the memory management methods outlined above are implemented by the front end.

The back end provides the following routines for use by the front end (none of these routines are known to the rest of the JPEG code):

jpeg_mem_init, jpeg_mem_term system-dependent initialization/shutdown

jpeg_get_small, jpeg_free_small interface to malloc and free library routines (or their equivalents)

jpeg_get_large, jpeg_free_large interface to FAR malloc/free in MSDOS machines; else usually the same as jpeg_get_small/jpeg_free_small

jpeg_mem_available estimate available memory

jpeg_open_backing_store create a backing-store object

read_backing_store, manipulate a backing-store object
write_backing_store,
close_backing_store

On some systems there will be more than one type of backing-store object (specifically, in MS-DOS a backing store file might be an area of extended memory as well as a disk file). jpeg_open_backing_store is responsible for

choosing how to implement a given object. The read/write/close routines are method pointers in the structure that describes a given object; this lets them be different for different object types.

It may be necessary to ensure that backing store objects are explicitly released upon abnormal program termination. For example, MS-DOS won't free extended memory by itself. To support this, we will expect the main program or surrounding application to arrange to call `self_destruct` (typically via `jpeg_destroy`) upon abnormal termination. This may require a SIGINT signal handler or equivalent. We don't want to have the back end module install its own signal handler, because that would pre-empt the surrounding application's ability to control signal handling.

The IJG distribution includes several memory manager back end implementations. Usually the same back end should be suitable for all applications on a given system, but it is possible for an application to supply its own back end at need.

*** Implications of DNL marker ***

Some JPEG files may use a DNL marker to postpone definition of the image height

(this would be useful for a fax-like scanner's output, for instance).

In these files the SOF marker claims the image height is 0, and you only find out the true image height at the end of the first scan.

We could read these files as follows:

1. Upon seeing zero image height, replace it by 65535 (the maximum allowed).
2. When the DNL is found, update the image height in the global image descriptor.

This implies that control modules must avoid making copies of the image height, and must re-test for termination after each MCU row. This would be easy enough to do.

In cases where image-size data structures are allocated, this approach will result in very inefficient use of virtual memory or much-larger-than-necessary temporary files. This seems acceptable for something that probably won't be a mainstream usage. People might have to forgo use of memory-hogging options (such as two-pass color quantization or noninterleaved JPEG files) if they want efficient conversion of such files.

(One could improve efficiency by demanding a user-supplied upper bound for the height, less than 65536; in most cases it could be much less.)

The standard also permits the SOF marker to overestimate the image height, with a DNL to give the true, smaller height at the end of the first scan.

This would solve the space problems if the overestimate wasn't too great. However, it implies that you don't even know whether DNL will be used.

This leads to a couple of very serious objections:

1. Testing for a DNL marker must occur in the inner loop of the decompressor's Huffman decoder; this implies a speed penalty whether the feature is used or not.
2. There is no way to hide the last-minute change in image height from an application using the decoder. Thus *every* application using the IJG library would suffer a complexity penalty whether it cared about DNL or not.

We currently do not support DNL because of these problems.

A different approach is to insist that DNL-using files be preprocessed by a separate program that reads ahead to the DNL, then goes back and fixes the SOF marker. This is a much simpler solution and is probably far more efficient. Even if one wants piped input, buffering the first scan of the JPEG file needs a lot smaller temp file than is implied by the maximum-height method. For this approach we'd simply treat DNL as a no-op in the decompressor (at most, check that it matches the SOF image height).

We will not worry about making the compressor capable of outputting DNL. Something similar to the first scheme above could be applied if anyone ever wants to make that work.

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/structure.txt

No license file was found, but licenses were detected in source scan.

```
/*
 * rdswitch.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2003-2015 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to process some of cjpeg's more complicated
 * command-line switches. Switches processed here are:
 * -qtables file Read quantization tables from text file
 * -scans file Read scan script from text file
 * -quality N[,N,...] Set quality ratings
 * -qslots N[,N,...] Set component quantization table selectors
 * -sample HxV[,HxV,...] Set component sampling factors
 */
```

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/rdswitch.c

No license file was found, but licenses were detected in source scan.

/*

* jfdctflt.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2003-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a floating-point implementation of the

* forward DCT (Discrete Cosine Transform).

*

* This implementation should be more accurate than either of the integer

* DCT implementations. However, it may not give the same results on all

* machines because of differences in roundoff behavior. Speed will depend

* on the hardware's floating point capacity.

*

* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT

* on each column. Direct algorithms are also available, but they are

* much more complex and seem not to be any faster when reduced to code.

*

* This implementation is based on Arai, Agui, and Nakajima's algorithm for

* scaled

DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

* Japanese, but the algorithm is described in the Pennebaker & Mitchell

* JPEG textbook (see REFERENCES section in file README). The following code

* is based directly on figure 4-8 in P&M.

* While an 8-point DCT cannot be done in less than 11 multiplies, it is

* possible to arrange the computation so that many of the multiplies are

* simple scalings of the final outputs. These multiplies can then be

* folded into the multiplications or divisions by the JPEG quantization

* table entries. The AA&N method leaves only 5 multiplies and 29 adds

* to be done in the DCT itself.

* The primary disadvantage of this method is that with a fixed-point

* implementation, accuracy is lost due to imprecise representation of the

* scaled quantization values. However, that problem does not arise if

* we use floating point arithmetic.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jfdctflt.c

No license file was found, but licenses were detected in source scan.

/*

* wrtle.c

*

- * Copyright (C) 1991-1996, Thomas G. Lane.
- * Modified 2017 by Guido Vollbeding.
- * This file is part of the Independent JPEG Group's software.
- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains routines to write output images in RLE format.
- * The Utah Raster Toolkit library is required (version 3.1 or later).
- *
- * These routines may need modification for non-Unix environments or
- * specialized applications. As they stand, they assume output to
- * an ordinary stdio stream.
- *
- * Based on code contributed by Mike Lijewski,
- * with updates from Robert Hutchinson.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/wrrle.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jconfig.txt
 *
 * Copyright (C) 1991-1994, Thomas G. Lane.
 * Modified 2009-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file documents the configuration options that are required to
 * customize the JPEG software for a particular system.
 *
 * The actual configuration options for a particular installation are stored
 * in jconfig.h. On many machines, jconfig.h can be generated automatically
 * or copied from one of the "canned" jconfig files that we supply. But if
 * you need to generate a jconfig.h file by hand, this file tells you how.
 *
 * DO NOT EDIT THIS FILE --- IT WON'T ACCOMPLISH ANYTHING.
 * EDIT A COPY NAMED JCONFIG.H.
 */
```

```
/*
 * These symbols indicate the properties of your machine or compiler.
 * #define the symbol if yes, #undef it if no.
 */
```

```
/* Does your compiler
```

```

support function prototypes?
* (If not, you also need to use ansi2knr, see install.txt)
*/
#define HAVE_PROTOTYPES

/* Does your compiler support the declaration "unsigned char" ?
* How about "unsigned short" ?
*/
#define HAVE_UNSIGNED_CHAR
#define HAVE_UNSIGNED_SHORT

/* Define "void" as "char" if your compiler doesn't know about type void.
* NOTE: be sure to define void such that "void *" represents the most general
* pointer type, e.g., that returned by malloc().
*/
/* #define void char */

/* Define "const" as empty if your compiler doesn't know the "const" keyword.
*/
/* #define const */

/* Define this if an ordinary "char" type is unsigned.
* If you're not sure, leaving it undefined will work at some cost in speed.
* If you defined HAVE_UNSIGNED_CHAR then the speed difference is minimal.
*/
#undef CHAR_IS_UNSIGNED

/* Define this if your system has an ANSI-conforming <stddef.h> file.
*/
#define HAVE_STDDEF_H

/* Define this if your system has an ANSI-conforming <stdlib.h>
file.
*/
#define HAVE_STDLIB_H

/* Define this if your system does not have an ANSI/SysV <string.h>,
* but does have a BSD-style <strings.h>.
*/
#undef NEED_BSD_STRINGS

/* Define this if your system does not provide typedef size_t in any of the
* ANSI-standard places (stddef.h, stdlib.h, or stdio.h), but places it in
* <sys/types.h> instead.
*/
#undef NEED_SYS_TYPES_H

/* For 80x86 machines, you need to define NEED_FAR_POINTERS,

```

```

* unless you are using a large-data memory model or 80386 flat-memory mode.
* On less brain-damaged CPUs this symbol must not be defined.
* (Defining this symbol causes large data structures to be referenced through
* "far" pointers and to be allocated with a special version of malloc.)
*/
#undef NEED_FAR_POINTERS

/* Define this if your linker needs global names to be unique in less
* than the first 15 characters.
*/
#undef NEED_SHORT_EXTERNAL_NAMES

/* Although a real ANSI C compiler can deal perfectly well with pointers to
* unspecified
structures (see "incomplete types" in the spec), a few pre-ANSI
* and pseudo-ANSI compilers get confused. To keep one of these bozos happy,
* define INCOMPLETE_TYPES_BROKEN. This is not recommended unless you
* actually get "missing structure definition" warnings or errors while
* compiling the JPEG code.
*/
#undef INCOMPLETE_TYPES_BROKEN

/* Define "boolean" as unsigned char, not enum, on Windows systems.
*/
#ifdef _WIN32
#ifndef __RPCNDR_H__ /* don't conflict if rpcnldr.h already read */
typedef unsigned char boolean;
#endif
#ifndef FALSE /* in case these macros already exist */
#define FALSE 0 /* values of boolean */
#endif
#ifndef TRUE
#define TRUE 1
#endif
#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
#endif

/*
* The following options affect code selection within the JPEG library,
* but they don't need to be visible to applications using the library.
* To minimize application namespace pollution, the symbols won't be
* defined unless JPEG_INTERNALS
has been defined.
*/

#ifdef JPEG_INTERNALS

```

```

/* Define this if your compiler implements ">>" on signed values as a logical
 * (unsigned) shift; leave it undefined if ">>" is a signed (arithmetic) shift,
 * which is the normal and rational definition.
 */
#undef RIGHT_SHIFT_IS_UNSIGNED

#endif /* JPEG_INTERNALS */

/*
 * The remaining options do not affect the JPEG library proper,
 * but only the sample applications cjpeg/djpeg (see cjpeg.c, djpeg.c).
 * Other applications can ignore these.
 */

#ifdef JPEG_CJPEG_DJPEG

/* These defines indicate which image (non-JPEG) file formats are allowed. */

#define BMP_SUPPORTED /* BMP image file format */
#define GIF_SUPPORTED /* GIF image file format */
#define PPM_SUPPORTED /* PBMPLUS PPM/PGM image file format */
#define RLE_SUPPORTED /* Utah RLE image file format */
#define TARGA_SUPPORTED /* Targa image file format */

/* Define this if you want to name both input and output files on the command
 * line, rather than using stdout
 * and optionally stdin. You MUST do this if
 * your system can't cope with binary I/O to stdin/stdout. See comments at
 * head of cjpeg.c or djpeg.c.
 */
#undef TWO_FILE_COMMANDLINE

/* Define this if your system needs explicit cleanup of temporary files.
 * This is crucial under MS-DOS, where the temporary "files" may be areas
 * of extended memory; on most other systems it's not as important.
 */
#undef NEED_SIGNAL_CATCHER

/* By default, we open image files with fopen(...,"rb") or fopen(...,"wb").
 * This is necessary on systems that distinguish text files from binary files,
 * and is harmless on most systems that don't. If you have one of the rare
 * systems that complains about the "b" spec, define this symbol.
 */
#undef DONT_USE_B_MODE

/* Define this if you want percent-done progress reports from cjpeg/djpeg.

```

```
*/  
#undef PROGRESS_REPORT
```

```
#endif /* JPEG_CJPEG_DJPEG */
```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jconfig.txt
```

No license file was found, but licenses were detected in source scan.

```
/*
```

```
* jmemansi.c
```

```
*
```

```
* Copyright (C) 1992-1996, Thomas G. Lane.
```

```
* This file is part of the Independent JPEG Group's software.
```

```
* For conditions of distribution and use, see the accompanying README file.
```

```
*
```

```
* This file provides a simple generic implementation of the system-
```

```
* dependent portion of the JPEG memory manager. This implementation
```

```
* assumes that you have the ANSI-standard library routine tmpfile().
```

```
* Also, the problem of determining the amount of memory available
```

```
* is shoved onto the user.
```

```
*/
```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jmemansi.c
```

No license file was found, but licenses were detected in source scan.

```
/*
```

```
* jdmerge.c
```

```
*
```

```
* Copyright (C) 1994-1996, Thomas G. Lane.
```

```
* Modified 2013-2017 by Guido Vollbeding.
```

```
* This file is part of the Independent JPEG Group's software.
```

```
* For conditions of distribution and use, see the accompanying README file.
```

```
*
```

```
* This file contains code for merged upsampling/color conversion.
```

```
*
```

```
* This file combines functions from jdsample.c and jdcolor.c;
```

```
* read those files first to understand what's going on.
```

```
*
```

```
* When the chroma components are to be upsampled by simple replication
```

```
* (ie, box filtering), we can save some work in color conversion by
```

```
* calculating all the output pixels corresponding to a pair of chroma
```

```
* samples at one time. In the conversion equations
```

```
*  $R = Y + K1 * Cr$ 
```

```
*  $G = Y + K2 * Cb + K3 * Cr$ 
```

```
*  $B = Y + K4 * Cb$ 
```

- * only the Y term varies among the group of pixels corresponding to a pair
- * of chroma samples, so the rest of the terms can be calculated just once.
- * At typical sampling ratios, this eliminates half or three-quarters of the
- * multiplications needed for color conversion.
- *
- * This file currently provides implementations for the following cases:
- * YCC => RGB color conversion only (YCbCr or BG_YCC).
- * Sampling ratios of 2h1v or 2h2v.
- * No scaling needed at upsample time.
- * Corner-aligned (non-CCIR601) sampling alignment.
- * Other special cases could be added, but in most applications these are
- * the only common cases. (For uncommon cases we fall back on the more
- * general code in jdsample.c and jdcolor.c.)
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jdmerge.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jaricom.c
 *
 * Developed 1997-2011 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains probability estimation tables for common use in
 * arithmetic entropy encoding and decoding routines.
 *
 * This data represents Table D.3 in the JPEG spec (D.2 in the draft),
 * ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81, and Table 24
 * in the JBIG spec, ISO/IEC IS 11544 and CCITT Recommendation ITU-T T.82.
 */
```

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jaricom.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jidctflt.c
 *
 * Copyright (C) 1994-1998, Thomas G. Lane.
 * Modified 2010-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a floating-point implementation of the
```

- * inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
- * must also perform dequantization of the input coefficients.
- *
- * This implementation should be more accurate than either of the integer
- * IDCT implementations. However, it may not give the same results on all
- * machines because of differences in roundoff behavior. Speed will depend
- * on the hardware's floating point capacity.
- *
- * A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
- * on each row (or vice versa, but it's more convenient to emit a row at
- * a time). Direct algorithms are also available, but they
- are much more
- * complex and seem not to be any faster when reduced to code.
- *
- * This implementation is based on Arai, Agui, and Nakajima's algorithm for
- * scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
- * Japanese, but the algorithm is described in the Pennebaker & Mitchell
- * JPEG textbook (see REFERENCES section in file README). The following code
- * is based directly on figure 4-8 in P&M.
- * While an 8-point DCT cannot be done in less than 11 multiplies, it is
- * possible to arrange the computation so that many of the multiplies are
- * simple scalings of the final outputs. These multiplies can then be
- * folded into the multiplications or divisions by the JPEG quantization
- * table entries. The AA&N method leaves only 5 multiplies and 29 adds
- * to be done in the DCT itself.
- * The primary disadvantage of this method is that with a fixed-point
- * implementation, accuracy is lost due to imprecise representation of the
- * scaled quantization values. However,
- that problem does not arise if
- * we use floating point arithmetic.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jidctflt.c

No license file was found, but licenses were detected in source scan.

/*

- * jdapistd.c

*

- * Copyright (C) 1994-1996, Thomas G. Lane.

- * Modified 2002-2013 by Guido Vollbeding.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * This file contains application interface code for the decompression half

- * of the JPEG library. These are the "standard" API routines that are

- * used in the normal full-decompression case. They are not used by a

- * transcoding-only application. Note that if an application links in

- * jpeg_start_decompress, it will end up linking in the entire decompressor.
- * We thus must separate this file from jdapimin.c to avoid linking the
- * whole decompression library into a transcoder.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jdapistd.c

No license file was found, but licenses were detected in source scan.

/*

- * jmemmac.c

*

- * Copyright (C) 1992-1997, Thomas G. Lane.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * jmemmac.c provides an Apple Macintosh implementation of the system-

- * dependent portion of the JPEG memory manager.

*

- * If you use jmemmac.c, then you must define USE_MAC_MEMMGR in the

- * JPEG_INTERNALS part of jconfig.h.

*

- * jmemmac.c uses the Macintosh toolbox routines NewPtr and DisposePtr

- * instead of malloc and free. It accurately determines the amount of

- * memory available by using CompactMem. Notice that if left to its

- * own devices, this code can chew up all available space in the

- * application's zone, with the exception of the rather small "slop"

- * factor computed in jpeg_mem_available(). The application can ensure

- * that more space is left over by reducing max_memory_to_use.

*

- * Large images

are swapped to disk using temporary files and System 7.0+'s

- * temporary folder functionality.

*

- * Note that jmemmac.c depends on two features of MacOS that were first

- * introduced in System 7: FindFolder and the FSSpec-based calls.

- * If your application uses jmemmac.c and is run under System 6 or earlier,

- * and the jpeg library decides it needs a temporary file, it will abort,

- * printing error messages about requiring System 7. (If no temporary files

- * are created, it will run fine.)

*

- * If you want to use jmemmac.c in an application that might be used with

- * System 6 or earlier, then you should remove dependencies on FindFolder

- * and the FSSpec calls. You will need to replace FindFolder with some

- * other mechanism for finding a place to put temporary files, and you

- * should replace the FSSpec calls with their HFS equivalents:

*

- * FSpDelete -> HDelete

```

* FSpGetFInfo -> HGetFInfo
* FSpCreate -> HCreate
* FSpOpenDF -> HOpen
*** Note: not HOpenDF ***
* FSMakeFSSpec -> (fill in spec by hand.)
*
* (Use HOpen instead of HOpenDF. HOpen is just a glue-interface to PBHOpen,
* which is on all HFS macs. HOpenDF is a System 7 addition which avoids the
* ages-old problem of names starting with a period.)
*
* Contributed by Sam Bushell (jsam@iagu.on.net) and
* Dan Gildor (gyld@in-touch.com).
*/

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jmemmac.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jdmainct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2002-2016 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the main buffer controller for decompression.
* The main buffer lies between the JPEG decompressor proper and the
* post-processor; it holds downsampled data in the JPEG colorspace.
*
* Note that this code is bypassed in raw-data mode, since the application
* supplies the equivalent of the main buffer in that case.
*/

```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/jdmainct.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jpegint.h
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 1997-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file provides common declarations for the various JPEG modules.
* These declarations are considered internal to the JPEG library; most

```

* applications using the library shouldn't need to include this file.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jpegint.h

No license file was found, but licenses were detected in source scan.

/*

* jdcolor.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2011-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains output colorspace conversion routines.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdcolor.c

No license file was found, but licenses were detected in source scan.

/*

* cderror.h

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2009-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file defines the error and message codes for the cjpeg/djpeg

* applications. These strings are not needed as part of the JPEG library

* proper.

* Edit this file to add new codes, or to translate the message strings to

* some other language.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/cderror.h

No license file was found, but licenses were detected in source scan.

/*

* rdcolmap.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

```

* This file implements djpeg's "-map file" switch. It reads a source image
* and constructs a colormap to be supplied to the JPEG decompressor.
*
* Currently, these file formats are supported for the map file:
*   GIF: the contents of the GIF's global colormap are used.
*   PPM (either text or raw flavor): the entire file is read and
*       each unique pixel value is entered in the map.
* Note that reading a large PPM file will be horrendously slow.
* Typically, a PPM-format map file should contain just one pixel
* of each desired color. Such a file can be extracted from an
* ordinary image PPM file with ppmtomap(1).
*
* Rescaling a PPM that has a maxval unequal to MAXJSAMPLE is not
* currently implemented.
*/

/* Portions of this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation. This software is provided "as is" without express or
** implied warranty.
*/

Found in path(s):
* /jpeg-9c-tar-gz/jpeg-9c/rdcolmap.c
No license file was found, but licenses were detected in source scan.

/*
* jcapistd.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
* of the JPEG library. These are the "standard" API routines that are
* used in the normal full-compression case. They are not used by a
* transcoding-only application. Note that if an application links in
* jpeg_start_compress, it will end up linking in the entire compressor.
* We thus must separate this file from jcapimin.c to avoid linking the
* whole compression library into a transcoder.
*/

```

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jcapistd.c

No license file was found, but licenses were detected in source scan.

/*

* jdmaster.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2002-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains master control logic for the JPEG decompressor.

* These routines are concerned with selecting the modules to be executed

* and with determining the number of passes and the work to be done in each

* pass.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdmaster.c

No license file was found, but licenses were detected in source scan.

/*

* jccoefct.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2003-2011 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the coefficient buffer controller for compression.

* This controller is the top level of the JPEG compressor proper.

* The coefficient buffer lies between forward-DCT and entropy encoding steps.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jccoefct.c

No license file was found, but licenses were detected in source scan.

/*

* rdjpgcom.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2009 by Bill Allombert, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains a very simple stand-alone application that displays

* the text in COM (comment) markers in a JFIF file.
* This may be useful as an example of the minimum logic needed to parse
* JPEG markers.
*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/rdjpgcom.c

No license file was found, but licenses were detected in source scan.

/*
* wrbmp.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in Microsoft "BMP"
* format (MS Windows 3.x and OS/2 1.x flavors).
* Either 8-bit colormapped or 24-bit full-color format can be written.
* No compression is supported.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume output to
* an ordinary stdio stream.
*
* This code contributed by James Arthur Boucher.
*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/wrbmp.c

No license file was found, but licenses were detected in source scan.

/*
* rdgif.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in GIF format.
*

* NOTE: to avoid entanglements with Unisys' patent on LZW compression, *
* the ability to read GIF files has been removed from the IJG distribution. *
* Sorry about that. *

*
*/

```
* We are required to state that
* "The Graphics Interchange Format(c) is the Copyright property of
* CompuServe Incorporated. GIF(sm) is a Service Mark property of
* CompuServe Incorporated."
*/
```

Found in path(s):

```
* /jpeg-9c-tar-gz/jpeg-9c/rdgif.c
```

No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: CODING RULES

Copyright (C) 1991-1996, Thomas G. Lane.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

Since numerous people will be contributing code and bug fixes, it's important to establish a common coding style. The goal of using similar coding styles is much more important than the details of just what that style is.

In general we follow the recommendations of "Recommended C Style and Coding Standards" revision 6.1 (Cannon et al. as modified by Spencer, Keppel and Brader). This document is available in the IJG FTP archive (see `jpeg/doc/cstyle.ms.tbl.Z`, or `cstyle.txt.Z` for those without `nroff/tbl`).

Block comments should be laid out thusly:

```
/*
* Block comments in this style.
*/
```

We indent statements in K&R style, e.g.,

```
if (test) {
    then-part;
} else {
    else-part;
}
```

with two spaces per indentation

level. (This indentation convention is handled automatically by GNU Emacs and many other text editors.)

Multi-word names should be written in lower case with underscores, e.g., `multi_word_name` (not `multiWordName`). Preprocessor symbols and enum constants are similar but upper case (`MULTI_WORD_NAME`). Names should be unique within the first fifteen characters. (On some older systems, global names must be unique within six characters. We accommodate this without cluttering the source code by using macros to substitute shorter names.)

We use function prototypes everywhere; we rely on automatic source code transformation to feed prototype-less C compilers. Transformation is done by the simple and portable tool 'ansi2knr.c' (courtesy of Ghostscript). ansi2knr is not very bright, so it imposes a format requirement on function declarations: the function name MUST BEGIN IN COLUMN 1. Thus all functions should be written in the following style:

```
LOCAL(int *)
function_name (int a, char
*b)
{
    code...
}
```

Note that each function definition must begin with GLOBAL(type), LOCAL(type), or METHODDEF(type). These macros expand to "static type" or just "type" as appropriate. They provide a readable indication of the routine's usage and can readily be changed for special needs. (For instance, special linkage keywords can be inserted for use in Windows DLLs.)

ansi2knr does not transform method declarations (function pointers in structs). We handle these with a macro JMETHOD, defined as

```
#ifdef HAVE_PROTOTYPES
#define JMETHOD(type,methodname,arglist) type (*methodname) arglist
#else
#define JMETHOD(type,methodname,arglist) type (*methodname) ()
#endif
```

which is used like this:

```
struct function_pointers {
    JMETHOD(void, init_entropy_encoder, (int somearg, jparms *jp));
    JMETHOD(void, term_entropy_encoder, (void));
};
```

Note the set of parentheses surrounding the parameter list.

A similar solution is used for forward and external function declarations (see the EXTERN and JPP macros).

If the code is to work on non-ANSI compilers, we cannot rely on a prototype declaration to coerce actual parameters into the right types. Therefore, use explicit casts on actual parameters whenever the actual parameter type is not identical to the formal parameter. Beware of implicit conversions to "int".

It seems there are some non-ANSI compilers in which the sizeof() operator is defined to return int, yet size_t is defined as long. Needless to say, this is brain-damaged. Always use the SIZEOF() macro in place of sizeof(), so that the result is guaranteed to be of type size_t.

The JPEG library is intended to be used within larger programs. Furthermore, we want it to be reentrant so that it can be used by applications that process multiple images concurrently. The following rules support these requirements:

1. Avoid direct use of file I/O, "malloc", error report printouts, etc; pass these through the common routines provided.
2. Minimize global namespace pollution. Functions should be declared static wherever possible. (Note that our method-based calling conventions help this a lot: in many modules only the initialization function will ever need to be called directly, so only that function need be externally visible.) All global function names should begin with "jpeg_", and should have an abbreviated name (unique in the first six characters) substituted by macro when NEED_SHORT_EXTERNAL_NAMES is set.
3. Don't use global variables; anything that must be used in another module should be in the common data structures.
4. Don't use static variables except for read-only constant tables. Variables that should be private to a module can be placed into private structures (see the system architecture document, structure.txt).
5. Source file names should begin with "j" for files that are part of the library proper; source files that are not part of the library, such as cjpeg.c and djpeg.c, do not begin with "j". Keep source file names to eight characters (plus ".c" or ".h", etc) to make life easy for MS-DOSers. Keep compression and decompression code in separate source files --- some applications may want only one half of the library.

Note: these rules (particularly #4) are not followed religiously in the modules that are used in cjpeg/djpeg but are not part of the JPEG library proper. Those modules are not really intended to be used in other applications.

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/coderules.txt

No license file was found, but licenses were detected in source scan.

/*

* cjpeg.c

*

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modified 2003-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.
- *
- * This file contains a command-line user interface for the JPEG compressor.
- * It should work on any system with Unix- or MS-DOS-style command lines.
- *
- * Two different command line styles are permitted, depending on the
- * compile-time switch TWO_FILE_COMMANDLINE:
- * cjpeg [options] inputfile outputfile
- * cjpeg [options] [inputfile]
- * In the second style, output is always to standard output, which you'd
- * normally redirect to a file or pipe to some other program. Input is
- * either from a named file or from standard input (typically redirected).
- * The second style is convenient on Unix but is unhelpful on systems that
- * don't support pipes. Also, you MUST use the
- first style if your system
- * doesn't do binary I/O to stdin/stdout.
- * To simplify script writing, the "-outfile" switch is provided. The syntax
- * cjpeg [options] -outfile outputfile inputfile
- * works regardless of which command line style is used.
- */

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/cjpeg.c

No license file was found, but licenses were detected in source scan.

/*

- * jmorecfg.h

*

- * Copyright (C) 1991-1997, Thomas G. Lane.

- * Modified 1997-2013 by Guido Vollbeding.

- * This file is part of the Independent JPEG Group's software.

- * For conditions of distribution and use, see the accompanying README file.

*

- * This file contains additional configuration options that customize the

- * JPEG software for special applications or support machine-dependent

- * optimizations. Most users will not need to touch this file.

*/

Found in path(s):

- * /jpeg-9c-tar-gz/jpeg-9c/jmorecfg.h

No license file was found, but licenses were detected in source scan.

/*

- * rdppm.c

*

- * Copyright (C) 1991-1997, Thomas G. Lane.

- * Modified 2009-2017 by Bill Allombert, Guido Vollbeding.

- * This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to read input images in PPM/PGM format.

* The extended 2-byte-per-sample raw PPM/PGM formats are supported.

* The PBMPLUS library is NOT required to compile this software

* (but it is highly useful as a set of PPM image manipulation programs).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume input from

* an ordinary stdio stream. They further assume that reading begins

* at the start of the file; start_input may need work if the

* user interface has already read some data (e.g., to determine that

* the file is indeed PPM format).

*/

/* Portions

of this code are based on the PBMPLUS library, which is:

**

** Copyright (C) 1988 by Jef Poskanzer.

**

** Permission to use, copy, modify, and distribute this software and its

** documentation for any purpose and without fee is hereby granted, provided

** that the above copyright notice appear in all copies and that both that

** copyright notice and this permission notice appear in supporting

** documentation. This software is provided "as is" without express or

** implied warranty.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/rdppm.c

No license file was found, but licenses were detected in source scan.

/*

* jdcoefct.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2002-2011 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the coefficient buffer controller for decompression.

* This controller is the top level of the JPEG decompressor proper.

* The coefficient buffer lies between entropy decoding and inverse-DCT steps.

*

* In buffered-image mode, this controller is the interface between

* input-oriented processing and output-oriented processing.

* Also, the input side (only) is used when reading a file for transcoding.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdcoefct.c

No license file was found, but licenses were detected in source scan.

/*

* jdtrans.c

*

* Copyright (C) 1995-1997, Thomas G. Lane.

* Modified 2000-2009 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains library routines for transcoding decompression,

* that is, reading raw DCT coefficient arrays from an input JPEG file.

* The routines in jdapimin.c will also be needed by a transcoder.

*/

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/jdtrans.c

No license file was found, but licenses were detected in source scan.

USING THE IJG JPEG LIBRARY

Copyright (C) 1994-2013, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file describes how to use the IJG JPEG library within an application program. Read it if you want to write a program that uses the library.

The file example.c provides heavily commented skeleton code for calling the JPEG library. Also see jpeglib.h (the include file to be used by application programs) for full details about data structures and function parameter lists. The library source code, of course, is the ultimate reference.

Note that there have been *major* changes from the application interface presented by IJG version 4 and earlier versions. The old design had several inherent limitations, and it had accumulated a lot of cruft as we added features while trying to minimize application-interface changes. We have sacrificed backward compatibility in the version 5 rewrite, but we think the improvements justify this.

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You should read at least the overview and basic usage sections before trying to program with the library.

The sections on advanced features can be read if and when you need them.

OVERVIEW

=====

Functions provided by the library

The IJG JPEG library provides C code to read and write JPEG-compressed image files. The surrounding application program receives or supplies image data a scanline at a time, using a straightforward uncompressed image format. All details of color conversion and other preprocessing/postprocessing can be handled by the library.

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These

functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. The application indirectly selects use of this code by specifying the format in which it wishes to supply or receive image data. For example, if colormapped output is requested, then the decompression library automatically invokes color quantization.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

A word about functions **not** provided by the library. We handle a subset of the ISO JPEG standard; most baseline, extended-sequential, and progressive JPEG processes are supported. (Our subset includes all features now in common use.) Unsupported ISO options include:

- * Hierarchical storage
- * Lossless JPEG
- * DNL marker
- * Nonintegral subsampling ratios

We

support 8-bit to 12-bit data precision, but this is a compile-time choice rather than a run-time choice; hence it is difficult to use different precisions in a single application.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, this library is used by the free LIBTIFF library to support JPEG compression in TIFF.)

Outline of typical usage

The rough outline of a JPEG compression operation is:

```
Allocate and initialize a JPEG compression object
Specify the destination for the compressed data (eg, a file)
Set parameters for compression, including image size & colorspace
jpeg_start_compress(...);
while (scan lines remain to be written)
    jpeg_write_scanlines(...);
```

```
jpeg_finish_compress(...);  
Release the JPEG compression  
object
```

A JPEG compression object holds parameters and working state for the JPEG library. We make creation/destruction of the object separate from starting or finishing compression of an image; the same object can be re-used for a series of image compression operations. This makes it easy to re-use the same parameter settings for a sequence of images. Re-use of a JPEG object also has important implications for processing abbreviated JPEG datastreams, as discussed later.

The image data to be compressed is supplied to `jpeg_write_scanlines()` from in-memory buffers. If the application is doing file-to-file compression, reading image data from the source file is the application's responsibility. The library emits compressed data by calling a "data destination manager", which typically will write the data into a file; but the application can provide its own destination manager to do something else.

Similarly, the rough outline of a JPEG decompression operation is:

```
Allocate and initialize  
a JPEG decompression object  
Specify the source of the compressed data (eg, a file)  
Call jpeg_read_header() to obtain image info  
Set parameters for decompression  
jpeg_start_decompress(...);  
while (scan lines remain to be read)  
    jpeg_read_scanlines(...);  
jpeg_finish_decompress(...);  
Release the JPEG decompression object
```

This is comparable to the compression outline except that reading the datastream header is a separate step. This is helpful because information about the image's size, colorspace, etc is available when the application selects decompression parameters. For example, the application can choose an output scaling ratio that will fit the image into the available screen size.

The decompression library obtains compressed data by calling a data source manager, which typically will read the data from a file; but other behaviors can be obtained with a custom source manager. Decompressed data is delivered into in-memory buffers passed to `jpeg_read_scanlines()`.

It is possible to abort an incomplete compression or decompression operation by calling `jpeg_abort()`; or, if you do not need to retain the JPEG object, simply release it by calling `jpeg_destroy()`.

JPEG compression and decompression objects are two separate struct types. However, they share some common fields, and certain routines such as `jpeg_destroy()` can work on either type of object.

The JPEG library has no static variables: all state is in the compression or decompression object. Therefore it is possible to process multiple compression and decompression operations concurrently, using multiple JPEG objects.

Both compression and decompression can be done in an incremental memory-to-memory fashion, if suitable source/destination managers are used. See the section on "I/O suspension" for more details.

BASIC LIBRARY USAGE

=====

Data formats

Before diving into procedural details, it is helpful to understand the image data format that the JPEG library expects or returns.

The standard input image format is a rectangular array of pixels, with each pixel having the same number of "component" or "sample" values (color channels). You must specify how many components there are and the colorspace interpretation of the components. Most applications will use RGB data (three components per pixel) or grayscale data (one component per pixel). PLEASE NOTE THAT RGB DATA IS THREE SAMPLES PER PIXEL, GRAYSCALE ONLY ONE. A remarkable number of people manage to miss this, only to find that their programs don't work with grayscale JPEG files.

There is no provision for colormapped input. JPEG files are always full-color or full grayscale (or sometimes another colorspace such as CMYK). You can feed in a colormapped image by expanding it to full-color format. However JPEG often doesn't work very well with source data that has been colormapped, because of dithering noise. This is discussed in more detail in the JPEG FAQ and the other references mentioned in the README file.

Pixels are stored by scanlines, with each scanline running from left to right. The component values for each pixel are adjacent in the row; for example, R,G,B,R,G,B,R,G,B,... for 24-bit RGB color. Each scanline is an array of data type `JSAMPLE` --- which is typically "unsigned char", unless you've changed `jpegconf.h`. (You can also change the RGB pixel layout, say to B,G,R order, by modifying `jpegconf.h`. But see the restrictions listed in that file before doing so.)

A 2-D array of pixels is formed by making a list of pointers to the starts of scanlines; so the scanlines need not be physically adjacent in memory. Even if you process just one scanline at a time, you must make a one-element pointer array to conform to this structure. Pointers to JSAMPLE rows are of type JSAMPROW, and the pointer to the pointer array is of type JSAMPARRAY.

The library accepts or supplies one or more complete scanlines per call. It is not possible to process part of a row at a time. Scanlines are always processed top-to-bottom. You can process an entire image in one call if you have it all in memory, but usually it's simplest to process one scanline at a time.

For best results, source data values should have the precision specified by BITS_IN_JSAMPLE (normally 8 bits). For instance, if you choose to compress data that's only 6 bits/channel, you should left-justify each value in a byte before passing it to the compressor. If you need to compress data that has more than 8 bits/channel, compile with BITS_IN_JSAMPLE = 9 to 12. (See "Library compile-time options", later.)

The data format returned by the decompressor is the same in all details, except that colormapped output is supported. (Again, a JPEG file is never colormapped. But you can ask the decompressor to perform on-the-fly color quantization to deliver colormapped output.) If you request colormapped output then the returned data array contains a single JSAMPLE per pixel; its value is an index into a color map. The color map is represented as a 2-D JSAMPARRAY in which each row holds the values of one color component, that is, colormap[i][j] is the value of the i'th color component for pixel value (map index) j. Note that since the colormap indexes are stored in JSAMPLEs, the maximum number of colors is limited by the size of JSAMPLE (ie, at most 256 colors for an 8-bit JPEG library).

Compression details

Here we revisit the JPEG compression outline given in the overview.

1. Allocate and initialize a JPEG compression object.

A JPEG compression object is a "struct jpeg_compress_struct". (It also has a bunch of subsidiary structures which are allocated via malloc(), but the application doesn't control those directly.) This struct can be just a local variable in the calling routine, if a single routine is going to execute the whole JPEG compression sequence. Otherwise it can be static or allocated

from malloc().

You will also need a structure representing a JPEG error handler. The part of this that the library cares about is a "struct jpeg_error_mgr". If you are providing your own error handler, you'll typically want to embed the jpeg_error_mgr struct in a larger structure; this is discussed later under "Error handling". For now we'll assume you are just using the default error handler. The default error handler will print JPEG error/warning messages on stderr, and it will call exit() if a fatal error occurs.

You must initialize the error handler structure, store a pointer to it into the JPEG object's "err" field, and then call jpeg_create_compress() to initialize the rest of the JPEG object.

Typical code for this step, if you are using the default error handler, is

```
struct jpeg_compress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_compress(&cinfo);
```

jpeg_create_compress allocates a small amount of memory, so it could fail if you are out of memory. In that case it will exit via the error handler; that's why the error handler must be initialized first.

2. Specify the destination for the compressed data (eg, a file).

As previously mentioned, the JPEG library delivers compressed data to a "data destination" module. The library includes one data destination module which knows how to write to a stdio stream. You can use your own destination module if you want to do something else, as discussed later.

If you use the standard destination module, you must open the target stdio stream beforehand. Typical code for this step looks like:

```
FILE * outfile;
...
if ((outfile = fopen(filename, "wb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
jpeg_stdio_dest(&cinfo, outfile);
```

where the last line invokes the standard destination module.

WARNING: it is critical that the binary compressed data be delivered to the output file unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You can select the data destination after setting other parameters (step 3), if that's more convenient. You may not change the destination between calling jpeg_start_compress() and jpeg_finish_compress().

3. Set parameters for compression, including image size & colorspace.

You must supply information about the source image by setting the following fields in the JPEG object (cinfo structure):

image_width Width of image, in pixels
image_height Height of image, in pixels
input_components Number of color channels (samples per pixel)
in_color_space Color space of source image

The image dimensions are, hopefully, obvious. JPEG supports image dimensions of 1 to 64K pixels in either direction. The input color space is typically RGB or grayscale, and input_components is 3 or 1 accordingly. (See "Special color spaces", later, for more info.) The in_color_space field must be assigned one of the J_COLOR_SPACE enum constants, typically JCS_RGB or JCS_GRAYSCALE.

JPEG has a large number of compression parameters that determine how the image is encoded. Most applications don't need or want to know about all these parameters. You can set all the parameters to reasonable defaults by calling jpeg_set_defaults(); then, if there are particular values you want to change, you can do so after that. The "Compression parameter selection" section tells about all the parameters.

You must set in_color_space correctly before calling jpeg_set_defaults(), because the defaults depend on the source image colorspace. However the other three source image parameters need not be valid until you call jpeg_start_compress(). There's no harm in calling jpeg_set_defaults() more than once, if that happens to be convenient.

Typical
code for a 24-bit RGB source image is

```

cinfo.image_width = Width; /* image width and height, in pixels */
cinfo.image_height = Height;
cinfo.input_components = 3; /* # of color components per pixel */
cinfo.in_color_space = JCS_RGB; /* colorspace of input image */

jpeg_set_defaults(&cinfo);
/* Make optional parameter settings here */

```

4. jpeg_start_compress(...);

After you have established the data destination and set all the necessary source image info and other parameters, call `jpeg_start_compress()` to begin a compression cycle. This will initialize internal state, allocate working storage, and emit the first few bytes of the JPEG datastream header.

Typical code:

```
jpeg_start_compress(&cinfo, TRUE);
```

The "TRUE" parameter ensures that a complete JPEG interchange datastream will be written. This is appropriate in most cases. If you think you might want to use an abbreviated datastream, read the section on abbreviated datastreams, below.

Once you have called `jpeg_start_compress()`, you may not alter any JPEG parameters or other fields of the JPEG object until you have completed the compression cycle.

5. while (scan lines remain to be written) jpeg_write_scanlines(...);

Now write all the required image data by calling `jpeg_write_scanlines()` one or more times. You can pass one or more scanlines in each call, up to the total image height. In most applications it is convenient to pass just one or a few scanlines at a time. The expected format for the passed data is discussed under "Data formats", above.

Image data should be written in top-to-bottom scanline order. The JPEG spec contains some weasel wording about how top and bottom are application-defined terms (a curious interpretation of the English language...) but if you want your files to be compatible with everyone else's, you **WILL** use top-to-bottom order. If the source data must be read in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently.

Examples

of this can be found in the sample application cjpeg.

The library maintains a count of the number of scanlines written so far in the `next_scanline` field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like `"while (cinfo.next_scanline < cinfo.image_height)"`.

Code for this step depends heavily on the way that you store the source data. `example.c` shows the following code for the case of a full-size 2-D source array containing 3-byte RGB pixels:

```
JSAMPROW row_pointer[1]; /* pointer to a single row */
int row_stride; /* physical row width in buffer */

row_stride = image_width * 3; /* JSAMPLEs per row in image_buffer */

while (cinfo.next_scanline < cinfo.image_height) {
    row_pointer[0] = & image_buffer[cinfo.next_scanline * row_stride];
    jpeg_write_scanlines(&cinfo, row_pointer, 1);
}
```

`jpeg_write_scanlines()` returns the number of scanlines actually written.

This will normally be equal to the number

passed in, so you can usually

ignore the return value. It is different in just two cases:

- * If you try to write more scanlines than the declared image height, the additional scanlines are ignored.
- * If you use a suspending data destination manager, output buffer overrun will cause the compressor to return before accepting all the passed lines. This feature is discussed under "I/O suspension", below. The normal stdio destination manager will NOT cause this to happen.

In any case, the return value is the same as the change in the value of `next_scanline`.

6. `jpeg_finish_compress(...)`;

After all the image data has been written, call `jpeg_finish_compress()` to complete the compression cycle. This step is ESSENTIAL to ensure that the last bufferload of data is written to the data destination.

`jpeg_finish_compress()` also releases working memory associated with the JPEG object.

Typical code:

```
jpeg_finish_compress(&cinfo);
```

If using the stdio destination manager,

don't forget to close the output
stdio stream (if necessary) afterwards.

If you have requested a multi-pass operating mode, such as Huffman code optimization, `jpeg_finish_compress()` will perform the additional passes using data buffered by the first pass. In this case `jpeg_finish_compress()` may take quite a while to complete. With the default compression parameters, this will not happen.

It is an error to call `jpeg_finish_compress()` before writing the necessary total number of scanlines. If you wish to abort compression, call `jpeg_abort()` as discussed below.

After completing a compression cycle, you may dispose of the JPEG object as discussed next, or you may use it to compress another image. In that case return to step 2, 3, or 4 as appropriate. If you do not change the destination manager, the new datastream will be written to the same target. If you do not change any JPEG parameters, the new datastream will be written with the same parameters as before. Note that you can change the input image dimensions freely between cycles, but if you change the input colorspace, you should call `jpeg_set_defaults()` to adjust for the new colorspace; and then you'll need to repeat all of step 3.

7. Release the JPEG compression object.

When you are done with a JPEG compression object, destroy it by calling `jpeg_destroy_compress()`. This will free all subsidiary memory (regardless of the previous state of the object). Or you can call `jpeg_destroy()`, which works for either compression or decompression objects --- this may be more convenient if you are sharing code between compression and decompression cases. (Actually, these routines are equivalent except for the declared type of the passed pointer. To avoid gripes from ANSI C compilers, `jpeg_destroy()` should be passed a `j_common_ptr`.)

If you allocated the `jpeg_compress_struct` structure from `malloc()`, freeing it is your responsibility --- `jpeg_destroy()` won't. Ditto for the error handler structure.

Typical code:

```
jpeg_destroy_compress(&cinfo);
```

8.

Aborting.

If you decide to abort a compression cycle before finishing, you can clean up in either of two ways:

- * If you don't need the JPEG object any more, just call `jpeg_destroy_compress()` or `jpeg_destroy()` to release memory. This is legitimate at any point after calling `jpeg_create_compress()` --- in fact, it's safe even if `jpeg_create_compress()` fails.
- * If you want to re-use the JPEG object, call `jpeg_abort_compress()`, or call `jpeg_abort()` which works on both compression and decompression objects. This will return the object to an idle state, releasing any working memory. `jpeg_abort()` is allowed at any time after successful object creation.

Note that cleaning up the data destination, if required, is your responsibility; neither of these routines will call `term_destination()`. (See "Compressed data handling", below, for more about that.)

`jpeg_destroy()` and `jpeg_abort()` are the only safe calls to make on a JPEG object that has reported an error by calling `error_exit` (see "Error handling" for more info). The internal state of such an object is likely to be out of whack. Either of these two routines will return the object to a known state.

Decompression details

Here we revisit the JPEG decompression outline given in the overview.

1. Allocate and initialize a JPEG decompression object.

This is just like initialization for compression, as discussed above, except that the object is a "struct `jpeg_decompress_struct`" and you call `jpeg_create_decompress()`. Error handling is exactly the same.

Typical code:

```
struct jpeg_decompress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_decompress(&cinfo);
```

(Both here and in the IJG code, we usually use variable name "cinfo" for both compression and decompression objects.)

2. Specify the source of the compressed data (eg, a file).

As previously mentioned, the JPEG library reads compressed data from a "data source" module. The library includes one data source module which knows how to read from a stdio stream. You can use your own source module if you want to do something else, as discussed later.

If you use the standard source module, you must open the source stdio stream beforehand. Typical code for this step looks like:

```
FILE * infile;
...
if ((infile = fopen(filename, "rb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
jpeg_stdio_src(&cinfo, infile);
```

where the last line invokes the standard source module.

WARNING: it is critical that the binary compressed data be read unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You may not change the data source between calling jpeg_read_header() and jpeg_finish_decompress(). If you wish to read a series of JPEG images from a single source file, you should repeat the jpeg_read_header() to jpeg_finish_decompress() sequence without reinitializing either the JPEG object or the data source module; this prevents buffered input data from being discarded.

3. Call jpeg_read_header() to obtain image info.

Typical code for this step is just

```
jpeg_read_header(&cinfo, TRUE);
```

This will read the source datastream header markers, up to the beginning of the compressed data proper. On return, the image dimensions and other info have been stored in the JPEG object. The application may wish to consult this information before selecting decompression parameters.

More complex code is necessary if

- * A suspending data source is used --- in that case `jpeg_read_header()` may return before it has read all the header data. See "I/O suspension", below. The normal stdio source manager will NOT cause this to happen.
- * Abbreviated JPEG files are to be processed --- see the section on abbreviated datastreams. Standard applications that deal only in interchange JPEG files need not be concerned with this case either.

It is permissible to stop at this point if you just wanted to find out the image dimensions and other header info for a JPEG file. In that case, call `jpeg_destroy()` when you are done with the JPEG object, or call `jpeg_abort()` to return it to an idle state before selecting a new data source and reading another header.

4. Set parameters for decompression.

`jpeg_read_header()` sets appropriate default decompression parameters based on the properties of the image (in particular, its colorspace). However, you may well want to alter these defaults before beginning the decompression. For example, the default is to produce full color output from a color file. If you want colormapped output you must ask for it. Other options allow the returned image to be scaled and allow various speed/quality tradeoffs to be selected. "Decompression parameter selection", below, gives details.

If the defaults are appropriate, nothing need be done at this step.

Note that all default values are set by each call to `jpeg_read_header()`. If you reuse a decompression object, you cannot expect your parameter settings to be preserved across cycles, as you can for compression. You must set desired parameter values each time.

5. `jpeg_start_decompress(...)`;

Once the parameter values are satisfactory, call `jpeg_start_decompress()` to begin decompression. This will initialize internal state, allocate working memory, and prepare for returning data.

Typical code is just

```
jpeg_start_decompress(&cinfo);
```

If you have requested a multi-pass operating mode, such as 2-pass color quantization, `jpeg_start_decompress()` will do everything needed before data output can begin. In this case `jpeg_start_decompress()` may take quite a while to complete. With a single-scan

(non progressive) JPEG file and default decompression parameters, this will not happen; `jpeg_start_decompress()` will return quickly.

After this call, the final output image dimensions, including any requested scaling, are available in the JPEG object; so is the selected colormap, if colormapped output has been requested. Useful fields include

`output_width` image width and height, as scaled
`output_height`
`out_color_components` # of color components in `out_color_space`
`output_components` # of color components returned per pixel
`colormap` the selected colormap, if any
`actual_number_of_colors` number of entries in colormap

`output_components` is 1 (a colormap index) when quantizing colors; otherwise it equals `out_color_components`. It is the number of JSAMPLE values that will be emitted per pixel in the output arrays.

Typically you will need to allocate data buffers to hold the incoming image. You will need `output_width * output_components` JSAMPLEs per scanline in your output buffer, and a total of `output_height` scanlines will be returned.

Note: if you are using the JPEG library's internal memory manager to allocate data buffers (as `djpeg` does), then the manager's protocol requires that you request large buffers *before* calling `jpeg_start_decompress()`. This is a little tricky since the `output_XXX` fields are not normally valid then. You can make them valid by calling `jpeg_calc_output_dimensions()` after setting the relevant parameters (scaling, output color space, and quantization flag).

6. while (scan lines remain to be read)
 `jpeg_read_scanlines(...)`;

Now you can read the decompressed image data by calling `jpeg_read_scanlines()` one or more times. At each call, you pass in the maximum number of scanlines to be read (ie, the height of your working buffer); `jpeg_read_scanlines()` will return up to that many lines. The return value is the number of lines actually read. The format of the returned data is discussed under "Data formats", above. Don't forget that grayscale and color JPEGs will return different data formats!

Image data is returned in top-to-bottom scanline order. If you must write out the image in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently. Examples of this can be found in the sample application `djpeg`.

The library maintains a count of the number of scanlines returned so far in the `output_scanline` field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like `"while (cinfo.output_scanline < cinfo.output_height)"`. (Note that the test should NOT be against `image_height`, unless you never use scaling. The `image_height` field is the height of the original unscaled image.) The return value always equals the change in the value of `output_scanline`.

If you don't use a suspending data source, it is safe to assume that `jpeg_read_scanlines()` reads at least one scanline per call, until the bottom of the image has been reached.

If you use a buffer larger than one scanline, it is NOT safe to assume that `jpeg_read_scanlines()` fills it. (The current implementation returns only a few scanlines per call, no matter how large a buffer you pass.) So you must always provide a loop that calls `jpeg_read_scanlines()` repeatedly until the whole image has been read.

7. `jpeg_finish_decompress(...)`;

After all the image data has been read, call `jpeg_finish_decompress()` to complete the decompression cycle. This causes working memory associated with the JPEG object to be released.

Typical code:

```
jpeg_finish_decompress(&cinfo);
```

If using the stdio source manager, don't forget to close the source stdio stream if necessary.

It is an error to call `jpeg_finish_decompress()` before reading the correct total number of scanlines. If you wish to abort decompression, call `jpeg_abort()` as discussed below.

After completing a decompression cycle, you may dispose of the JPEG object as discussed next, or you may use it to decompress another image. In that case return to step 2 or 3 as appropriate. If you do not change the source manager, the next image will be read from the same source.

8. Release the JPEG decompression object.

When you are done with a JPEG decompression object, destroy it by calling

jpeg_destroy_decompress() or jpeg_destroy(). The previous discussion of destroying compression objects applies here too.

Typical code:

```
jpeg_destroy_decompress(&cinfo);
```

9. Aborting.

You can abort a decompression cycle by calling jpeg_destroy_decompress() or jpeg_destroy() if you don't need the JPEG object any more, or jpeg_abort_decompress() or jpeg_abort() if you want to reuse the object. The previous discussion of aborting compression cycles applies here too.

Mechanics of usage: include files, linking, etc

Applications using the JPEG library should include the header file jpeglib.h to obtain declarations of data types and routines. Before including jpeglib.h, include system headers that define at least the typedefs FILE and size_t. On ANSI-conforming systems, including <stdio.h> is sufficient; on older Unix systems, you may need <sys/types.h> to define size_t.

If the application needs to refer to individual JPEG library error codes, also include jerror.h to define those symbols.

jpeglib.h indirectly includes the files jconfig.h and jmorecfg.h. If you are installing the JPEG header files in a system directory, you will want to install all four files: jpeglib.h, jerror.h, jconfig.h, jmorecfg.h.

The most convenient way to include the JPEG code into your executable program is to prepare a library file ("libjpeg.a", or a corresponding name on non-Unix machines) and reference it at your link step. If you use only half of the library (only compression or only decompression), only that much code will be included from the library, unless your linker is hopelessly brain-damaged. The supplied makefiles build libjpeg.a automatically (see install.txt).

While you can build the JPEG library as a shared library if the whim strikes you, we don't really recommend it. The trouble with shared libraries is that at some point you'll probably try to substitute a new version of the library without recompiling the calling applications. That generally doesn't work because the parameter struct declarations usually change with each new version. In other words, the library's API is **not** guaranteed binary compatible across versions; we only try to ensure source-code compatibility.

(In hindsight, it might have been smarter to hide the parameter structs from applications and introduce a ton of access functions instead. Too late now, however.)

On some systems your application may need to set up a signal handler to ensure that temporary files are deleted if the program is interrupted. This is most critical if you are on MS-DOS and use the `jmemdos.c` memory manager back end; it will try to grab extended memory for temp files, and that space will NOT be freed automatically. See `cjpeg.c` or `djpeg.c` for an example signal handler.

It may be worth pointing out that the core JPEG library does not actually require the `stdio` library: only the default source/destination managers and error handler need it. You can use the library in a `stdio`-less environment if you replace those modules and use `jmemnobs.c` (or another memory manager of your own devising). More info about the minimum system library requirements may be found in `jinclue.h`.

ADVANCED FEATURES

=====

Compression parameter selection

This section describes all the optional parameters you can set for JPEG compression, as well as the "helper" routines provided to assist in this task. Proper setting of some parameters requires detailed understanding of the JPEG standard; if you don't know what a parameter is for, it's best not to mess with it! See REFERENCES in the README file for pointers to more info about JPEG.

It's a good idea to call `jpeg_set_defaults()` first, even if you plan to set all the parameters; that way your code is more likely to work with future JPEG libraries that have additional parameters. For the same reason, we recommend you use a helper routine where one is provided, in preference to twiddling `cinfo` fields directly.

The helper routines are:

`jpeg_set_defaults (j_compress_ptr cinfo)`

This routine sets all JPEG parameters to reasonable defaults, using only the input image's color space (field `in_color_space`, which must already be set in `cinfo`). Many applications will only need to use this routine and perhaps `jpeg_set_quality()`.

`jpeg_set_colorspace (j_compress_ptr cinfo, J_COLOR_SPACE colorspace)`

Sets the JPEG file's colorspace (field `jpeg_color_space`) as specified, and sets other color-space-dependent parameters appropriately. See "Special color spaces", below, before using this. A large number of parameters, including all per-component parameters, are set by this routine; if you want to twiddle individual parameters you should call `jpeg_set_colorspace()` before rather than after.

`jpeg_default_colorspace (j_compress_ptr cinfo)`
Selects an appropriate JPEG colorspace based on `cinfo->in_color_space`, and calls `jpeg_set_colorspace()`. This is actually a subroutine of `jpeg_set_defaults()`. It's broken out in case you want to change just the colorspace-dependent JPEG parameters.

`jpeg_set_quality (j_compress_ptr cinfo, int quality, boolean force_baseline)`
Constructs JPEG quantization tables appropriate for the indicated quality setting. The quality value is expressed on the 0..100 scale recommended by IJG (cjpeg's "-quality" switch uses this routine). Note that the exact mapping from quality values to tables may change in future IJG releases as more is learned about DCT quantization. If the `force_baseline` parameter is TRUE, then the quantization table entries are constrained to the range 1..255 for full JPEG baseline compatibility.

In the current implementation, this only makes a difference for quality settings below 25, and it effectively prevents very small/low quality files from being generated. The IJG decoder is capable of reading the non-baseline files generated at low quality settings when `force_baseline` is FALSE, but other decoders may not be.

`jpeg_set_linear_quality (j_compress_ptr cinfo, int scale_factor, boolean force_baseline)`
Same as `jpeg_set_quality()` except that the generated tables are the sample tables given in the JPEG spec section K.1, multiplied by the specified scale factor (which is expressed as a percentage; thus `scale_factor = 100` reproduces the spec's tables). Note that larger scale factors give lower quality. This entry point is useful for conforming to the Adobe PostScript DCT conventions, but we do not recommend linear scaling as a user-visible quality scale otherwise. `force_baseline` again constrains the computed table entries to 1..255.

`int jpeg_quality_scaling (int quality)`
Converts a value on the IJG-recommended quality scale to a linear scaling percentage. Note that this routine may change or go away in future releases --- IJG may choose to adopt a scaling method that can't be expressed as a simple scalar multiplier, in which case the premise of this routine collapses. Caveat user.

jpeg_default_qtables (j_compress_ptr cinfo, boolean force_baseline)

Set default quantization tables with linear q_scale_factor[] values
(see below).

jpeg_add_quant_table (j_compress_ptr cinfo, int which_tbl,

const unsigned int *basic_table,

int scale_factor, boolean force_baseline)

Allows an arbitrary quantization table to be created. which_tbl indicates which table slot to fill. basic_table points to an array of 64 unsigned ints given in normal array order. These values are multiplied by scale_factor/100 and then clamped to the range 1..65535 (or to 1..255 if force_baseline is TRUE).

CAUTION: prior to library version

6a, jpeg_add_quant_table expected

the basic table to be given in JPEG zigzag order. If you need to write code that works with either older or newer versions of this routine, you must check the library version number. Something like "#if JPEG_LIB_VERSION >= 61" is the right test.

jpeg_simple_progression (j_compress_ptr cinfo)

Generates a default scan script for writing a progressive-JPEG file.

This is the recommended method of creating a progressive file, unless you want to make a custom scan sequence. You must ensure that the JPEG color space is set correctly before calling this routine.

Compression parameters (cinfo fields) include:

boolean arith_code

If TRUE, use arithmetic coding.

If FALSE, use Huffman coding.

int block_size

Set DCT block size. All N from 1 to 16 are possible.

Default is 8 (baseline format).

Larger values produce higher compression,

smaller values produce higher quality.

An exact DCT stage is possible with 1 or 2.

With the default quality

of 75 and default Luminance qtable

the DCT+Quantization stage is lossless for value 1.

Note that values other than 8 require a SmartScale capable decoder, introduced with IJG JPEG 8. Setting the block_size parameter for compression works with version 8c and later.

J_DCT_METHOD dct_method

Selects the algorithm used for the DCT step. Choices are:

JDCT_ISLOW: slow but accurate integer algorithm

JDCT_IFAST: faster, less accurate integer method

JDCT_FLOAT: floating-point method

JDCT_DEFAULT: default method (normally JDCT_ISLOW)

JDCT_FASTEST: fastest method (normally JDCT_IFAST)

The FLOAT method is very slightly more accurate than the ISLOW method, but may give different results on different machines due to varying roundoff behavior. The integer methods should give the same results on all machines. On machines with sufficiently fast FP hardware, the floating-point method may also be the fastest. The IFAST method is considerably less accurate than the other two; its use is not recommended if high quality is a concern. JDCT_DEFAULT and JDCT_FASTEST are macros configurable by each installation.

unsigned int scale_num, scale_denom

Scale the image by the fraction scale_num/scale_denom. Default is 1/1, or no scaling. Currently, the supported scaling ratios are M/N with all N from 1 to 16, where M is the destination DCT size, which is 8 by default (see block_size parameter above). (The library design allows for arbitrary scaling ratios but this is not likely to be implemented any time soon.)

J_COLOR_SPACE jpeg_color_space

int num_components

The JPEG color space and corresponding number of components; see "Special color spaces", below, for more info. We recommend using jpeg_set_colorspace() if you want to change these.

J_COLOR_TRANSFORM color_transform

Internal color transform identifier, writes LSE marker if nonzero (requires decoder with inverse color transform support, introduced with IJG JPEG 9).

Two values are currently possible:

JCT_NONE and JCT_SUBTRACT_GREEN.

Set this value for lossless RGB application *before* calling jpeg_set_colorspace(), because entropy table assignment in jpeg_set_colorspace() depends on color_transform.

boolean optimize_coding

TRUE causes the compressor to compute optimal Huffman coding tables for the image. This requires an extra pass over the data and therefore costs a good deal of space and time. The default is FALSE, which tells the compressor to use the supplied or default Huffman tables. In most cases optimal tables save only a few percent of file size compared to the default tables. Note that when this is TRUE, you need not supply Huffman tables at all, and any you do supply will be overwritten.

unsigned int restart_interval

int restart_in_rows

To emit restart markers in the JPEG file, set one of these nonzero.

Set restart_interval to specify the exact interval in MCU blocks.

Set restart_in_rows to specify the interval in MCU rows. (If

restart_in_rows

is not 0, then restart_interval is set after the

image width in MCUs is computed.) Defaults are zero (no restarts).

One restart marker per MCU row is often a good choice.

NOTE: the overhead of restart markers is higher in grayscale JPEG

files than in color files, and MUCH higher in progressive JPEGs.

If you use restarts, you may want to use larger intervals in those cases.

const jpeg_scan_info * scan_info

int num_scans

By default, scan_info is NULL; this causes the compressor to write a

single-scan sequential JPEG file. If not NULL, scan_info points to

an array of scan definition records of length num_scans. The

compressor will then write a JPEG file having one scan for each scan

definition record. This is used to generate noninterleaved or

progressive JPEG files. The library checks that the scan array

defines a valid JPEG scan sequence. (jpeg_simple_progression creates

a suitable scan definition array for progressive JPEG.) This is

discussed further under "Progressive

JPEG support".

boolean do_fancy_downsampling

If TRUE, use direct DCT scaling with DCT size > 8 for downsampling of chroma components.

If FALSE, use only DCT size <= 8 and simple separate downsampling.

Default is TRUE.

For better image stability in multiple generation compression cycles

it is preferable that this value matches the corresponding

do_fancy_upsampling value in decompression.

int smoothing_factor

If non-zero, the input image is smoothed; the value should be 1 for

minimal smoothing to 100 for maximum smoothing. Consult jcsample.c

for details of the smoothing algorithm. The default is zero.

boolean write_JFIF_header

If TRUE, a JFIF APP0 marker is emitted. jpeg_set_defaults() and

jpeg_set_colorspace() set this TRUE if a JFIF-legal JPEG color space

(ie, YCbCr or grayscale) is selected, otherwise FALSE.

UINT8 JFIF_major_version

UINT8 JFIF_minor_version

The version number to be written into the JFIF marker.
jpeg_set_defaults() initializes the version to
1.01 (major=minor=1).
You should set it to 1.02 (major=1, minor=2) if you plan to write
any JFIF 1.02 extension markers.

UINT8 density_unit

UINT16 X_density

UINT16 Y_density

The resolution information to be written into the JFIF marker;
not used otherwise. density_unit may be 0 for unknown,
1 for dots/inch, or 2 for dots/cm. The default values are 0,1,1
indicating square pixels of unknown size.

boolean write_Adobe_marker

If TRUE, an Adobe APP14 marker is emitted. jpeg_set_defaults() and
jpeg_set_colorspace() set this TRUE if JPEG color space RGB, CMYK,
or YCCCK is selected, otherwise FALSE. It is generally a bad idea
to set both write_JFIF_header and write_Adobe_marker. In fact,
you probably shouldn't change the default settings at all --- the
default behavior ensures that the JPEG file's color space can be
recognized by the decoder.

JQUANT_TBL * quant_tbl_ptrs[NUM_QUANT_TBLS]

Pointers to coefficient quantization tables, one per table slot,
or NULL if no table is
defined for a slot. Usually these should
be set via one of the above helper routines; jpeg_add_quant_table()
is general enough to define any quantization table. The other
routines will set up table slot 0 for luminance quality and table
slot 1 for chrominance.

int q_scale_factor[NUM_QUANT_TBLS]

Linear quantization scaling factors (percentage, initialized 100)
for use with jpeg_default_qtables().
See rdswitch.c and cjpeg.c for an example of usage.
Note that the q_scale_factor[] fields are the "linear" scales, so you
have to convert from user-defined ratings via jpeg_quality_scaling().
Here is an example code which corresponds to cjpeg -quality 90,70:

```
jpeg_set_defaults(cinfo);

/* Set luminance quality 90. */
cinfo->q_scale_factor[0] = jpeg_quality_scaling(90);
/* Set chrominance quality 70. */
cinfo->q_scale_factor[1] = jpeg_quality_scaling(70);

jpeg_default_qtables(cinfo, force_baseline);
```

CAUTION: You must also set 1x1 subsampling for efficient separate color quality selection, since the default value used by library is 2x2:

```
cinfo->comp_info[0].v_samp_factor = 1;
cinfo->comp_info[0].h_samp_factor = 1;
```

JHUFF_TBL * dc_huff_tbl_ptrs[NUM_HUFF_TBLS]

JHUFF_TBL * ac_huff_tbl_ptrs[NUM_HUFF_TBLS]

Pointers to Huffman coding tables, one per table slot, or NULL if no table is defined for a slot. Slots 0 and 1 are filled with the JPEG sample tables by `jpeg_set_defaults()`. If you need to allocate more table structures, `jpeg_alloc_huff_table()` may be used. Note that optimal Huffman tables can be computed for an image by setting `optimize_coding`, as discussed above; there's seldom any need to mess with providing your own Huffman tables.

The actual dimensions of the JPEG image that will be written to the file are given by the following fields. These are computed from the input image dimensions and the compression parameters by `jpeg_start_compress()`. You can also call `jpeg_calc_jpeg_dimensions()` to obtain the values that will result from the current parameter settings. This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size.

JDIMENSION jpeg_width Actual dimensions of output image.

JDIMENSION jpeg_height

Per-component parameters are stored in the struct `cinfo.comp_info[i]` for component number `i`. Note that components here refer to components of the JPEG color space, *not* the source image color space. A suitably large `comp_info[]` array is allocated by `jpeg_set_defaults()`; if you choose not to use that routine, it's up to you to allocate the array.

int component_id

The one-byte identifier code to be recorded in the JPEG file for this component. For the standard color spaces, we recommend you leave the default values alone.

int h_samp_factor

int v_samp_factor

Horizontal and vertical sampling factors for the component; must be 1..4 according to the JPEG standard. Note that larger sampling factors indicate a higher-resolution component; many people find

this

behavior quite unintuitive. The default values are 2,2 for luminance components and 1,1 for chrominance components, except for grayscale where 1,1 is used.

int quant_tbl_no

Quantization table number for component. The default value is 0 for luminance components and 1 for chrominance components.

int dc_tbl_no

int ac_tbl_no

DC and AC entropy coding table numbers. The default values are 0 for luminance components and 1 for chrominance components.

int component_index

Must equal the component's index in comp_info[]. (Beginning in release v6, the compressor library will fill this in automatically; you don't have to.)

Decompression parameter selection

Decompression parameter selection is somewhat simpler than compression parameter selection, since all of the JPEG internal parameters are recorded in the source file and need not be supplied by the application. (Unless you are working with abbreviated files, in which case see "Abbreviated

datastreams", below.) Decompression parameters control the postprocessing done on the image to deliver it in a format suitable for the application's use. Many of the parameters control speed/quality tradeoffs, in which faster decompression may be obtained at the price of a poorer-quality image. The defaults select the highest quality (slowest) processing.

The following fields in the JPEG object are set by jpeg_read_header() and may be useful to the application in choosing decompression parameters:

JDIMENSION image_width Width and height of image

JDIMENSION image_height

int num_components Number of color components

J_COLOR_SPACE jpeg_color_space Colorspace of image

boolean saw_JFIF_marker TRUE if a JFIF APP0 marker was seen

UINT8 JFIF_major_version Version information from JFIF marker

UINT8 JFIF_minor_version

UINT8 density_unit Resolution data from JFIF marker

UINT16 X_density

UINT16 Y_density

boolean saw_Adobe_marker TRUE if an Adobe APP14 marker was seen

UINT8 Adobe_transform Color transform code from Adobe marker

The JPEG color space, unfortunately, is something of a guess since the JPEG standard proper does not provide a way to record it. In practice most files adhere to the JFIF or Adobe conventions, and the decoder will recognize these correctly. See "Special color spaces", below, for more info.

The decompression parameters that determine the basic properties of the returned image are:

J_COLOR_SPACE out_color_space

Output color space. jpeg_read_header() sets an appropriate default based on jpeg_color_space; typically it will be RGB or grayscale. The application can change this field to request output in a different colorspace. For example, set it to JCS_GRAYSCALE to get grayscale output from a color file. (This is useful for previewing: grayscale output is faster than full color since the color components need not be processed.) Note that not all possible color space transforms are currently implemented; you may need to extend jdcolor.c if you want an unusual conversion.

unsigned int scale_num, scale_denom

Scale the image by the fraction scale_num/scale_denom. Currently, the supported scaling ratios are M/N with all M from 1 to 16, where N is the source DCT size, which is 8 for baseline JPEG. (The library design allows for arbitrary scaling ratios but this is not likely to be implemented any time soon.) The values are initialized by jpeg_read_header() with the source DCT size. For baseline JPEG this is 8/8. If you change only the scale_num value while leaving the other unchanged, then this specifies the DCT scaled size to be applied on the given input. For baseline JPEG this is equivalent to M/8 scaling, since the source DCT size for baseline JPEG is 8. Smaller scaling ratios permit significantly faster decoding since fewer pixels need be processed and a simpler IDCT method can be used.

boolean quantize_colors

If set TRUE, colormapped output will be delivered. Default is FALSE, meaning that full-color output will be delivered.

The next three parameters are relevant only if quantize_colors is TRUE.

int desired_number_of_colors

Maximum number of colors to use in generating a library-supplied color

map (the actual number of colors is returned in a different field).
Default 256. Ignored when the application supplies its own color map.

boolean two_pass_quantize

If TRUE, an extra pass over the image is made to select a custom color map for the image. This usually looks a lot better than the one-size-fits-all colormap that is used otherwise. Default is TRUE. Ignored when the application supplies its own color map.

J_DITHER_MODE dither_mode

Selects color dithering method. Supported values are:

JDITHER_NONE no dithering: fast, very low quality

JDITHER_ORDERED ordered dither: moderate speed and quality

JDITHER_FS Floyd-Steinberg dither: slow, high quality

Default is JDITHER_FS. (At present, ordered dither is implemented only in the single-pass, standard-colormap case. If you ask for ordered dither when two_pass_quantize is TRUE or when you supply an external color map, you'll get F-S dithering.)

When quantize_colors is TRUE, the target color map is described by the next two fields. colormap is set to NULL by jpeg_read_header(). The application can supply a color map by setting colormap non-NULL and setting actual_number_of_colors to the map size. Otherwise, jpeg_start_decompress() selects a suitable color map and sets these two fields itself.

[Implementation restriction: at present, an externally supplied colormap is only accepted for 3-component output color spaces.]

JSAMPARRAY colormap

The color map, represented as a 2-D pixel array of out_color_components rows and actual_number_of_colors columns. Ignored if not quantizing.

CAUTION: if the JPEG library creates its own colormap, the storage pointed to by this field is released by jpeg_finish_decompress().

Copy the colormap somewhere else first, if you want to save it.

int actual_number_of_colors

The number of colors in the color map.

Additional decompression parameters that the application may set include:

J_DCT_METHOD dct_method

Selects the algorithm used for the DCT step. Choices are the same as described above for compression.

boolean do_fancy_upsampling

If TRUE, use direct DCT scaling with DCT size > 8 for upsampling of chroma components.

If FALSE, use only DCT size ≤ 8 and simple separate upsampling.
Default is TRUE.
For better image stability in multiple generation compression cycles
it is preferable that this value matches the corresponding
do_fancy_downsampling value in compression.

boolean do_block_smoothing

If TRUE, interblock smoothing is applied in early stages of decoding
progressive JPEG files; if FALSE, not. Default is TRUE. Early
progression stages look "fuzzy" with smoothing, "blocky" without.
In any case, block smoothing ceases to be applied after the first few
AC coefficients are known
to full accuracy, so it is relevant only
when using buffered-image mode for progressive images.

boolean enable_1pass_quant

boolean enable_external_quant

boolean enable_2pass_quant

These are significant only in buffered-image mode, which is
described in its own section below.

The output image dimensions are given by the following fields. These are
computed from the source image dimensions and the decompression parameters
by jpeg_start_decompress(). You can also call jpeg_calc_output_dimensions()
to obtain the values that will result from the current parameter settings.
This can be useful if you are trying to pick a scaling ratio that will get
close to a desired target size. It's also important if you are using the
JPEG library's memory manager to allocate output buffer space, because you
are supposed to request such buffers *before* jpeg_start_decompress().

JDIMENSION output_width Actual dimensions of output image.

JDIMENSION output_height

int out_color_components Number of color
components in out_color_space.

int output_components Number of color components returned.

int rec_outbuf_height Recommended height of scanline buffer.

When quantizing colors, output_components is 1, indicating a single color map
index per pixel. Otherwise it equals out_color_components. The output arrays
are required to be output_width * output_components JSAMPLEs wide.

rec_outbuf_height is the recommended minimum height (in scanlines) of the
buffer passed to jpeg_read_scanlines(). If the buffer is smaller, the
library will still work, but time will be wasted due to unnecessary data
copying. In high-quality modes, rec_outbuf_height is always 1, but some
faster, lower-quality modes set it to larger values (typically 2 to 4).

If you are going to ask for a high-speed processing mode, you may as well

go to the trouble of honoring `rec_outbuf_height` so as to avoid data copying.
(An output buffer larger than `rec_outbuf_height` lines is OK, but won't
provide any material speed improvement
over that height.)

Special color spaces

The JPEG standard itself is "color blind" and doesn't specify any particular color space. It is customary to convert color data to a luminance/chrominance color space before compressing, since this permits greater compression. The existing JPEG file interchange format standards specify YCbCr or GRAYSCALE data (JFIF version 1), GRAYSCALE, RGB, YCbCr, CMYK, or YCCK (Adobe), or BG_RGB or BG_YCC (big gamut color spaces, JFIF version 2). For special applications such as multispectral images, other color spaces can be used, but it must be understood that such files will be unportable.

The JPEG library can handle the most common colorspace conversions (namely `RGB <=> YCbCr` and `CMYK <=> YCCK`). It can also deal with data of an unknown color space, passing it through without conversion. If you deal extensively with an unusual color space, you can easily extend the library to understand additional color spaces and perform appropriate conversions.

For compression, the source data's color space is specified by field `in_color_space`. This is transformed to the JPEG file's color space given by `jpeg_color_space`. `jpeg_set_defaults()` chooses a reasonable JPEG color space depending on `in_color_space`, but you can override this by calling `jpeg_set_colorspace()`. Of course you must select a supported transformation. `jccolor.c` currently supports the following transformations:

`RGB => YCbCr`

`RGB => GRAYSCALE`

`RGB => BG_YCC`

`YCbCr => GRAYSCALE`

`YCbCr => BG_YCC`

`CMYK => YCCK`

plus the null transforms: `GRAYSCALE => GRAYSCALE`, `RGB => RGB`,
`BG_RGB => BG_RGB`, `YCbCr => YCbCr`, `BG_YCC => BG_YCC`, `CMYK => CMYK`,
`YCCK => YCCK`, and `UNKNOWN => UNKNOWN`.

The file interchange format standards (JFIF and Adobe) specify APPn markers that indicate the color space of the JPEG file. It is important to ensure that these are written correctly, or omitted if the JPEG file's color space is not one of the ones supported by the interchange standards.

`jpeg_set_colorspace()` will set the compression parameters to include or omit the APPn markers properly, so long as it is told the truth about the JPEG

color space. For example, if you are writing some random 3-component color space without conversion, don't try to fake out the library by setting `in_color_space` and `jpeg_color_space` to `JCS_YCbCr`; use `JCS_UNKNOWN`. You may want to write an APPn marker of your own devising to identify the colorspace --- see "Special markers", below.

When told that the color space is `UNKNOWN`, the library will default to using luminance-quality compression parameters for all color components. You may well want to change these parameters. See the source code for `jpeg_set_colorspace()`, in `jcparam.c`, for details.

For decompression, the JPEG file's color space is given in `jpeg_color_space`, and this is transformed to the output color space `out_color_space`. `jpeg_read_header`'s setting of `jpeg_color_space` can be relied on if the file conforms to JFIF

or Adobe conventions, but otherwise it is no better than a guess. If you know the JPEG file's color space for certain, you can override `jpeg_read_header`'s guess by setting `jpeg_color_space`. `jpeg_read_header` also selects a default output color space based on (its guess of) `jpeg_color_space`; set `out_color_space` to override this. Again, you must select a supported transformation. `jdcolor.c` currently supports

`YCbCr => RGB`

`YCbCr => GRAYSCALE`

`BG_YCC => RGB`

`BG_YCC => GRAYSCALE`

`RGB => GRAYSCALE`

`GRAYSCALE => RGB`

`YCCK => CMYK`

as well as the null transforms. (Since `GRAYSCALE=>RGB` is provided, an application can force grayscale JPEGs to look like color JPEGs if it only wants to handle one case.)

The two-pass color quantizer, `jquant2.c`, is specialized to handle RGB data (it weights distances appropriately for RGB colors). You'll need to modify the code if you want to use it for non-RGB output color spaces. Note that `jquant2.c` is used to map to an application-supplied colormap as well as for the normal two-pass colormap selection process.

CAUTION: it appears that Adobe Photoshop writes inverted data in CMYK JPEG files: 0 represents 100% ink coverage, rather than 0% ink as you'd expect. This is arguably a bug in Photoshop, but if you need to work with Photoshop CMYK files, you will have to deal with it in your application. We cannot "fix" this in the library by inverting the data during the `CMYK<=>YCCK` transform, because that would break other applications, notably Ghostscript. Photoshop versions prior to 3.0 write EPS files containing JPEG-encoded CMYK data in the same inverted-YCCK representation used in bare JPEG files, but the surrounding PostScript code performs an inversion using the PS image

operator. I am told that Photoshop 3.0 will write uninverted YCCK in EPS/JPEG files, and will omit the PS-level inversion. (But the data polarity used in bare JPEG files will not change in 3.0.) In either case, the JPEG library must not invert the data itself, or else Ghostscript would read these EPS files incorrectly.

Error handling

When the default error handler is used, any error detected inside the JPEG routines will cause a message to be printed on stderr, followed by exit(). You can supply your own error handling routines to override this behavior and to control the treatment of nonfatal warnings and trace/debug messages. The file example.c illustrates the most common case, which is to have the application regain control after an error rather than exiting.

The JPEG library never writes any message directly; it always goes through the error handling routines. Three classes of messages are recognized:

- * Fatal errors: the library cannot continue.
- * Warnings: the library can continue, but the data is corrupt, and a damaged output image is likely to result.
- * Trace/informational messages. These come with a trace level indicating the importance of the message; you can control the verbosity of the program by adjusting the maximum trace level that will be displayed.

You may, if you wish, simply replace the entire JPEG error handling module (jerror.c) with your own code. However, you can avoid code duplication by only replacing some of the routines depending on the behavior you need. This is accomplished by calling jpeg_std_error() as usual, but then overriding some of the method pointers in the jpeg_error_mgr struct, as illustrated by example.c.

All of the error handling routines will receive a pointer to the JPEG object (a j_common_ptr which points to either a jpeg_compress_struct or a jpeg_decompress_struct; if you need to tell which, test the is_decompressor field). This struct includes a pointer to the error manager struct in its "err" field. Frequently, custom error handler routines will need to access additional data which is not known to the JPEG library or the standard error handler. The most convenient way to do this is to embed either the JPEG object or the jpeg_error_mgr struct in a larger structure that contains additional fields; then casting the passed pointer provides access to the additional fields. Again, see example.c for one way to do it. (Beginning with IJG version 6b, there is also a void pointer "client_data" in each JPEG object, which the application can also use to find related data.

The library does not touch `client_data` at all.)

The individual methods that you might wish to override are:

`error_exit (j_common_ptr cinfo)`

Receives control for a fatal error. Information sufficient to generate the error message has been stored in `cinfo->err`; call `output_message` to display it. Control must NOT return to the caller; generally this routine will `exit()` or `longjmp()` somewhere. Typically you would override this routine to get rid of the `exit()` default behavior. Note that if you continue processing, you should clean up the JPEG object with `jpeg_abort()` or `jpeg_destroy()`.

`output_message (j_common_ptr cinfo)`

Actual output of any JPEG message.

Override this to send messages somewhere other than `stderr`. Note that this method does not know how to generate a message, only where to send it.

`format_message (j_common_ptr cinfo, char * buffer)`

Constructs a readable error message string based on the error info stored in `cinfo->err`. This method is called by `output_message`. Few applications should need to override this method. One possible reason for doing so is to implement dynamic switching of error message language.

`emit_message (j_common_ptr cinfo, int msg_level)`

Decide whether or not to emit a warning or trace message; if so, calls `output_message`. The main reason for overriding this method would be to abort on warnings. `msg_level` is -1 for warnings, 0 and up for trace messages.

Only `error_exit()` and `emit_message()` are called from the rest of the JPEG library; the other two are internal to the error handler.

The actual message texts are stored in an array of strings which is pointed to by the field `err->jpeg_message_table`.

The messages are numbered from 0 to `err->last_jpeg_message`, and it is these code numbers that are used in the JPEG library code. You could replace the message texts (for instance, with messages in French or German) by changing the message table pointer. See `error.h` for the default texts. CAUTION: this table will almost certainly change or grow from one library version to the next.

It may be useful for an application to add its own message texts that are handled by the same mechanism. The error handler supports a second "add-on" message table for this purpose. To define an addon table, set the pointer `err->addon_message_table` and the message numbers `err->first_addon_message` and

err->last_addon_message. If you number the addon messages beginning at 1000 or so, you won't have to worry about conflicts with the library's built-in messages. See the sample applications cjpeg/djpeg for an example of using addon messages (the addon messages are defined in cderror.h).

Actual

invocation of the error handler is done via macros defined in jerror.h:

ERREXITn(...) for fatal errors

WARNMSn(...) for corrupt-data warnings

TRACEMSn(...) for trace and informational messages.

These macros store the message code and any additional parameters into the error handler struct, then invoke the error_exit() or emit_message() method.

The variants of each macro are for varying numbers of additional parameters.

The additional parameters are inserted into the generated message using standard printf() format codes.

See jerror.h and jerror.c for further details.

Compressed data handling (source and destination managers)

The JPEG compression library sends its compressed data to a "destination manager" module. The default destination manager just writes the data to a memory buffer or to a stdio stream, but you can provide your own manager to do something else. Similarly, the decompression library calls a

"source manager" to obtain the compressed data; you can provide your own source manager if you want the data to come from somewhere other than a memory buffer or a stdio stream.

In both cases, compressed data is processed a bufferload at a time: the destination or source manager provides a work buffer, and the library invokes the manager only when the buffer is filled or emptied. (You could define a one-character buffer to force the manager to be invoked for each byte, but that would be rather inefficient.) The buffer's size and location are controlled by the manager, not by the library. For example, the memory source manager just makes the buffer pointer and length point to the original data in memory. In this case the buffer-reload procedure will be invoked only if the decompressor ran off the end of the datastream, which would indicate an erroneous datastream.

The work buffer is defined as an array of datatype JOCTET, which is generally "char" or "unsigned char". On a machine

where char is not exactly 8 bits

wide, you must define JOCTET as a wider data type and then modify the data source and destination modules to transcribe the work arrays into 8-bit units on external storage.

A data destination manager struct contains a pointer and count defining the next byte to write in the work buffer and the remaining free space:

```
JOCTET * next_output_byte; /* => next byte to write in buffer */
size_t free_in_buffer;    /* # of byte spaces remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is filled. The manager's `empty_output_buffer` method must reset the pointer and count. The manager is expected to remember the buffer's starting address and total size in private fields not visible to the library.

A data destination manager provides three methods:

`init_destination (j_compress_ptr cinfo)`

Initialize destination. This is called by `jpeg_start_compress()` before any data is actually written. It must initialize `next_output_byte` and `free_in_buffer`. `free_in_buffer` must be initialized to a positive value.

`empty_output_buffer (j_compress_ptr cinfo)`

This is called whenever the buffer has filled (`free_in_buffer` reaches zero). In typical applications, it should write out the *entire* buffer (use the saved start address and buffer length; ignore the current state of `next_output_byte` and `free_in_buffer`). Then reset the pointer & count to the start of the buffer, and return `TRUE` indicating that the buffer has been dumped. `free_in_buffer` must be set to a positive value when `TRUE` is returned. A `FALSE` return should only be used when I/O suspension is desired (this operating mode is discussed in the next section).

`term_destination (j_compress_ptr cinfo)`

Terminate destination --- called by `jpeg_finish_compress()` after all data has been written. In most applications, this must flush any data remaining in the buffer. Use either `next_output_byte` or `free_in_buffer` to determine how much data is in the buffer.

`term_destination()` is NOT called by `jpeg_abort()` or `jpeg_destroy()`. If you want the destination manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a `jpeg_destination_mgr` struct, fill in its method pointers, and insert a pointer to the struct into the "dest" field of the JPEG compression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the `jpeg_stdio_dest()` or `jpeg_mem_dest()` routines of the supplied destination

managers.

Decompression source managers follow a parallel design, but with some additional frammishes. The source manager struct contains a pointer and count defining the next byte to read from the work buffer and the number of bytes remaining:

```
const JOCTET * next_input_byte; /* => next byte to read from buffer */
size_t bytes_in_buffer;      /* # of bytes remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is emptied. The manager's `fill_input_buffer` method must reset the pointer and count. In most applications, the manager must remember the buffer's starting address and total size in private fields not visible to the library.

A data source manager provides five methods:

`init_source (j_decompress_ptr cinfo)`

Initialize source. This is called by `jpeg_read_header()` before any data is actually read. Unlike `init_destination()`, it may leave `bytes_in_buffer` set to 0 (in which case a `fill_input_buffer()` call will occur immediately).

`fill_input_buffer (j_decompress_ptr cinfo)`

This is called whenever `bytes_in_buffer` has reached zero and more data is wanted. In typical applications, it should read fresh data into the buffer (ignoring the current state of `next_input_byte` and `bytes_in_buffer`), reset the pointer & count to the start of the buffer, and return `TRUE` indicating that the buffer has been reloaded. It is not necessary to fill the buffer entirely, only to obtain at least one more byte. `bytes_in_buffer` **MUST** be set to a positive value if `TRUE` is returned. A `FALSE` return should only be used when I/O suspension is desired (this mode is discussed in the next section).

`skip_input_data (j_decompress_ptr cinfo, long num_bytes)`

Skip `num_bytes` worth of data. The buffer pointer and count should be advanced over `num_bytes` input bytes, refilling the buffer as needed. This is used to skip over a potentially large amount of uninteresting data (such as an APPn marker). In some applications it may be possible to optimize away the reading of the skipped data, but it's not clear that being smart is worth much trouble; large skips are uncommon. `bytes_in_buffer` may be zero on return. A zero or negative skip count should be treated as a no-op.

`resync_to_restart (j_decompress_ptr cinfo, int desired)`

This routine is called only when the decompressor has failed to find

a restart (RSTn) marker where one is expected. Its mission is to find a suitable point for resuming decompression. For most applications, we recommend that you just use the default resync procedure, `jpeg_resync_to_restart()`. However, if you are able to back up in the input data stream, or if you have a-priori knowledge about the likely location of restart markers, you may be able to do better. Read the `read_restart_marker()` and `jpeg_resync_to_restart()` routines in `jdmarker.c` if you think you'd like to implement your own resync procedure.

`term_source (j_decompress_ptr cinfo)`

Terminate source --- called by `jpeg_finish_decompress()` after all data has been read. Often a no-op.

For both `fill_input_buffer()` and `skip_input_data()`, there is no such thing as an EOF return. If the end of the file has been reached, the routine has a choice of exiting via `ERREXIT()` or inserting fake data into the buffer. In most cases, generating a warning message and inserting a fake EOI marker is the best course of action --- this will allow the decompressor to output however much of the image is there. In pathological cases, the decompressor may swallow the EOI and again demand data ... just keep feeding it fake EOIs. `jdatsrc.c` illustrates the recommended error recovery behavior.

`term_source()` is NOT called by `jpeg_abort()` or `jpeg_destroy()`. If you want the source manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a `jpeg_source_mgr` struct, fill in its method pointers, and insert a pointer to the struct into the "src" field of the JPEG decompression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the `jpeg_stdio_src()` or `jpeg_mem_src()` routines of the supplied source managers.

For more information, consult the memory and stdio source and destination managers in `jdatsrc.c` and `jdadst.c`.

I/O suspension

Some applications need to use the JPEG library as an incremental memory-to-memory

filter: when the compressed data buffer is filled or emptied, they want control to return to the outer loop, rather than expecting that the buffer can be emptied or reloaded within the data source/destination manager subroutine. The library supports this need by providing an "I/O suspension" mode, which we describe in this section.

The I/O suspension mode is not a panacea: nothing is guaranteed about the maximum amount of time spent in any one call to the library, so it will not eliminate response-time problems in single-threaded applications. If you need guaranteed response time, we suggest you "bite the bullet" and implement a real multi-tasking capability.

To use I/O suspension, cooperation is needed between the calling application and the data source or destination manager; you will always need a custom source/destination manager. (Please read the previous section if you haven't already.) The basic idea is that the `empty_output_buffer()` or `fill_input_buffer()` routine is a no-op, merely returning `FALSE` to indicate that it has done nothing. Upon seeing this, the JPEG library suspends operation and returns to its caller. The surrounding application is responsible for emptying or refilling the work buffer before calling the JPEG library again.

Compression suspension:

For compression suspension, use an `empty_output_buffer()` routine that returns `FALSE`; typically it will not do anything else. This will cause the compressor to return to the caller of `jpeg_write_scanlines()`, with the return value indicating that not all the supplied scanlines have been accepted. The application must make more room in the output buffer, adjust the output buffer pointer/count appropriately, and then call `jpeg_write_scanlines()` again, pointing to the first unconsumed scanline.

When forced to suspend, the compressor will backtrack to a convenient stopping point (usually the start of the current MCU); it will regenerate some output data when restarted. Therefore, although `empty_output_buffer()` is only called when the buffer is filled, you should NOT write out the entire buffer after a suspension. Write only the data up to the current position of `next_output_byte/free_in_buffer`. The data beyond that point will be regenerated after resumption.

Because of the backtracking behavior, a good-size output buffer is essential for efficiency; you don't want the compressor to suspend often. (In fact, an overly small buffer could lead to infinite looping, if a single MCU required more data than would fit in the buffer.) We recommend a buffer of at least several Kbytes. You may want to insert explicit code to ensure that you don't call `jpeg_write_scanlines()` unless there is a reasonable amount of space in the output buffer; in other words, flush the buffer before trying to compress more data.

The compressor does not allow suspension while it is trying to write JPEG markers at the beginning and end of the file. This means that:

- * At the beginning of a compression operation, there must be enough free space in the output buffer to hold the header markers (typically 600 or so bytes). The recommended buffer size is bigger than this anyway, so this is not a problem as long as you start with an empty buffer. However, this restriction might catch you if you insert large special markers, such as a JFIF thumbnail image, without flushing the buffer afterwards.
- * When you call `jpeg_finish_compress()`, there must be enough space in the output buffer to emit any buffered data and the final EOI marker. In the current implementation, half a dozen bytes should suffice for this, but for safety's sake we recommend ensuring that at least 100 bytes are free before calling `jpeg_finish_compress()`.

A more significant restriction is that `jpeg_finish_compress()` cannot suspend. This means you cannot use suspension with multi-pass operating modes, namely Huffman code optimization and multiple-scan output. Those modes write the whole file during `jpeg_finish_compress()`, which will certainly result in buffer overrun. (Note that this restriction applies only to compression, not decompression. The decompressor supports input suspension in all of its operating modes.)

Decompression suspension:

For decompression suspension, use a `fill_input_buffer()` routine that simply returns `FALSE` (except perhaps during error recovery, as discussed below). This will cause the decompressor to return to its caller with an indication that suspension has occurred. This can happen at four places:

- * `jpeg_read_header()`: will return `JPEG_SUSPENDED`.
- * `jpeg_start_decompress()`: will return `FALSE`, rather than its usual `TRUE`.
- * `jpeg_read_scanlines()`: will return the number of scanlines already completed (possibly 0).
- * `jpeg_finish_decompress()`: will return `FALSE`, rather than its usual `TRUE`.

The surrounding application must recognize these cases, load more data into the input buffer, and repeat the call. In the case of `jpeg_read_scanlines()`, increment the passed pointers past any scanlines successfully read.

Just as with compression, the decompressor will typically backtrack to a convenient restart point before suspending. When `fill_input_buffer()` is called, `next_input_byte/bytes_in_buffer` point to the current restart point, which is where the decompressor will backtrack to if `FALSE` is returned. The data beyond that position must NOT be discarded if you suspend; it needs to be re-read upon resumption. In most implementations, you'll need to shift this data down to the start of your work buffer and then load more data after it. Again, this behavior means that a several-Kbyte work buffer is essential for decent performance; furthermore, you should load a reasonable amount of new data before resuming decompression. (If you loaded, say, only one new

byte each time around, you could waste a LOT of cycles.)

The `skip_input_data()` source manager routine requires special care in a suspension scenario.

This routine is NOT granted the ability to suspend the decompressor; it can decrement `bytes_in_buffer` to zero, but no more. If the requested skip distance exceeds the amount of data currently in the input buffer, then `skip_input_data()` must set `bytes_in_buffer` to zero and record the additional skip distance somewhere else. The decompressor will immediately call `fill_input_buffer()`, which should return `FALSE`, which will cause a suspension return. The surrounding application must then arrange to discard the recorded number of bytes before it resumes loading the input buffer. (Yes, this design is rather baroque, but it avoids complexity in the far more common case where a non-suspending source manager is used.)

If the input data has been exhausted, we recommend that you emit a warning and insert dummy EOI markers just as a non-suspending data source manager would do. This can be handled either in the surrounding application logic or within `fill_input_buffer()`; the latter is probably more efficient. If `fill_input_buffer()` knows that no more data is available, it can set the pointer/count to point to a dummy EOI marker and then return `TRUE` just as though it had read more data in a non-suspending situation.

The decompressor does not attempt to suspend within standard JPEG markers; instead it will backtrack to the start of the marker and reprocess the whole marker next time. Hence the input buffer must be large enough to hold the longest standard marker in the file. Standard JPEG markers should normally not exceed a few hundred bytes each (DHT tables are typically the longest). We recommend at least a 2K buffer for performance reasons, which is much larger than any correct marker is likely to be. For robustness against damaged marker length counts, you may wish to insert a test in your application for the case that the input buffer is completely full and yet the decoder has suspended without consuming any data --- otherwise, if this situation did occur, it would lead to an endless loop. (The library can't provide this test since it has no idea whether "the buffer is full", or even whether there is a fixed-size input buffer.)

The input buffer would need to be 64K to allow for arbitrary COM or APPn markers, but these are handled specially: they are either saved into allocated memory, or skipped over by calling `skip_input_data()`. In the former case, suspension is handled correctly, and in the latter case, the problem of buffer overrun is placed on `skip_input_data`'s shoulders, as explained above. Note that if you provide your own marker handling routine for large markers, you should consider how to deal with buffer overflow.

Multiple-buffer management:

In some applications it is desirable to store the compressed data in a linked list of buffer areas, so as to avoid data copying. This can be handled by having `empty_output_buffer()` or `fill_input_buffer()` set the pointer and count to reference the next available buffer; `FALSE` is returned only if no more buffers are available. Although seemingly straightforward, there is a pitfall in this approach: the backtrack that occurs when `FALSE` is returned could back up into an earlier buffer. For example, when `fill_input_buffer()` is called, the current pointer & count indicate the backtrack restart point. Since `fill_input_buffer()` will set the pointer and count to refer to a new buffer, the restart position must be saved somewhere else. Suppose a second call to `fill_input_buffer()` occurs in the same library call, and no additional input data is available, so `fill_input_buffer` must return `FALSE`. If the JPEG library has not moved the pointer/count forward in the current buffer, then *the correct restart point is the saved position in the prior buffer*. Prior buffers may be discarded only after the library establishes a restart point within a later buffer. Similar remarks apply for output into a chain of buffers.

The library will never attempt to backtrack over a `skip_input_data()` call, so any skipped data can be permanently discarded. You still have to deal with the case of skipping not-yet-received data, however.

It's much simpler to use only a single buffer; when `fill_input_buffer()` is called, move any unconsumed data (beyond the current pointer/count) down to the beginning of this buffer and then load new data into the remaining buffer space. This approach requires a little more data copying but is far easier to get right.

Progressive JPEG support

Progressive JPEG rearranges the stored data into a series of scans of increasing quality. In situations where a JPEG file is transmitted across a slow communications link, a decoder can generate a low-quality image very quickly from the first scan, then gradually improve the displayed quality as more scans are received. The final image after all scans are complete is identical to that of a regular (sequential) JPEG file of the same quality setting. Progressive JPEG files are often slightly smaller than equivalent sequential JPEG files, but the possibility of incremental display is the main reason for using progressive JPEG.

The IJG encoder library generates progressive JPEG files when given a suitable "scan script" defining how to divide the data into scans.

Creation of progressive JPEG files is otherwise transparent to the encoder. Progressive JPEG files can also be read transparently by the decoder library. If the decoding application simply uses the library as defined above, it will receive a final decoded image without any indication that the file was progressive. Of course, this approach does not allow incremental display. To perform incremental display, an application needs to use the decoder library's "buffered-image" mode, in which it receives a decoded image multiple times.

Each displayed scan requires about as much work to decode as a full JPEG image of the same size, so the decoder must be fairly fast in relation to the data transmission rate in order to make incremental display useful. However, it is possible to skip displaying the image and simply add the incoming bits to the decoder's coefficient buffer. This is fast because only Huffman decoding need be done, not IDCT, upsampling, colorspace conversion, etc. The IJG decoder library allows the application to switch dynamically between displaying the image and simply absorbing the incoming bits. A properly coded application can automatically adapt the number of display passes to suit the time available as the image is received. Also, a final higher-quality display cycle can be performed from the buffered data after the end of the file is reached.

Progressive compression:

To create a progressive JPEG file (or a multiple-scan sequential JPEG file), set the scan_info cinfo field to point to an array of scan descriptors, and perform compression as usual. Instead of constructing your own scan list, you can call the jpeg_simple_progression() helper routine to create a recommended progression sequence; this method should be used by all applications that don't want to get involved in the nitty-gritty of progressive scan sequence design. (If you want to provide user control of scan sequences, you may wish to borrow the scan script reading code found in rdswitch.c, so that you can read scan script files just like cjpeg's.) When scan_info is not NULL, the compression library will store DCT'd data into a buffer array as jpeg_write_scanlines() is called, and will emit all the requested scans during jpeg_finish_compress(). This implies that multiple-scan output cannot be created with a suspending data destination manager, since jpeg_finish_compress() does not support suspension. We should also note that the compressor currently forces Huffman optimization mode when creating a progressive JPEG file, because the default Huffman tables are unsuitable for progressive files.

Progressive decompression:

When buffered-image mode is not used, the decoder library will

read all of
a multi-scan file during `jpeg_start_decompress()`, so that it can provide a final decoded image. (Here "multi-scan" means either progressive or multi-scan sequential.) This makes multi-scan files transparent to the decoding application. However, existing applications that used suspending input with version 5 of the IJG library will need to be modified to check for a suspension return from `jpeg_start_decompress()`.

To perform incremental display, an application must use the library's buffered-image mode. This is described in the next section.

Buffered-image mode

In buffered-image mode, the library stores the partially decoded image in a coefficient buffer, from which it can be read out as many times as desired. This mode is typically used for incremental display of progressive JPEG files, but it can be used with any JPEG file. Each scan of a progressive JPEG file adds more data (more detail) to the buffered image. The application can display in

lockstep with the source file (one display pass per input scan), or it can allow input processing to outrun display processing. By making input and display processing run independently, it is possible for the application to adapt progressive display to a wide range of data transmission rates.

The basic control flow for buffered-image decoding is

```
jpeg_create_decompress()
set data source
jpeg_read_header()
set overall decompression parameters
cinfo.buffered_image = TRUE; /* select buffered-image mode */
jpeg_start_decompress()
for (each output pass) {
    adjust output decompression parameters if required
    jpeg_start_output() /* start a new output pass */
    for (all scanlines in image) {
        jpeg_read_scanlines()
        display scanlines
    }
    jpeg_finish_output() /* terminate output pass */
}
jpeg_finish_decompress()
jpeg_destroy_decompress()
```

This differs from ordinary unbuffered decoding in that there is an additional

level of looping. The application can choose how many output passes to make and how to display each pass.

The simplest approach to displaying progressive images is to do one display pass for each scan appearing in the input file. In this case the outer loop condition is typically

```
while (! jpeg_input_complete(&cinfo))
```

and the start-output call should read

```
jpeg_start_output(&cinfo, cinfo.input_scan_number);
```

The second parameter to `jpeg_start_output()` indicates which scan of the input file is to be displayed; the scans are numbered starting at 1 for this purpose. (You can use a loop counter starting at 1 if you like, but using the library's input scan counter is easier.) The library automatically reads data as necessary to complete each requested scan, and `jpeg_finish_output()` advances to the next scan or end-of-image marker (hence `input_scan_number` will be incremented by the time control arrives back at `jpeg_start_output()`). With this technique, data is read from the input file only as needed, and input and output

processing run in lockstep.

After reading the final scan and reaching the end of the input file, the buffered image remains available; it can be read additional times by repeating the `jpeg_start_output()/jpeg_read_scanlines()/jpeg_finish_output()` sequence. For example, a useful technique is to use fast one-pass color quantization for display passes made while the image is arriving, followed by a final display pass using two-pass quantization for highest quality. This is done by changing the library parameters before the final output pass. Changing parameters between passes is discussed in detail below.

In general the last scan of a progressive file cannot be recognized as such until after it is read, so a post-input display pass is the best approach if you want special processing in the final pass.

When done with the image, be sure to call `jpeg_finish_decompress()` to release the buffered image (or just use `jpeg_destroy_decompress()`).

If input data arrives faster than it can be displayed, the application can cause the library to decode input data in advance of what's needed to produce output. This is done by calling the routine `jpeg_consume_input()`.

The return value is one of the following:

`JPEG_REACHED_SOS`: reached an SOS marker (the start of a new scan)

`JPEG_REACHED_EOI`: reached the EOI marker (end of image)

`JPEG_ROW_COMPLETED`: completed reading one MCU row of compressed data

`JPEG_SCAN_COMPLETED`: completed reading last MCU row of current scan

`JPEG_SUSPENDED`: suspended before completing any of the above

(`JPEG_SUSPENDED` can occur only if a suspending data source is used.) This

routine can be called at any time after initializing the JPEG object. It reads some additional data and returns when one of the indicated significant events occurs. (If called after the EOI marker is reached, it will immediately return JPEG_REACHED_EOI without attempting to read more data.)

The library's output processing will automatically call jpeg_consume_input() whenever

the output processing overtakes the input; thus, simple lockstep display requires no direct calls to jpeg_consume_input(). But by adding calls to jpeg_consume_input(), you can absorb data in advance of what is being displayed. This has two benefits:

- * You can limit buildup of unprocessed data in your input buffer.
- * You can eliminate extra display passes by paying attention to the state of the library's input processing.

The first of these benefits only requires interspersing calls to jpeg_consume_input() with your display operations and any other processing you may be doing. To avoid wasting cycles due to backtracking, it's best to call jpeg_consume_input() only after a hundred or so new bytes have arrived. This is discussed further under "I/O suspension", above. (Note: the JPEG library currently is not thread-safe. You must not call jpeg_consume_input() from one thread of control if a different library routine is working on the same JPEG object in another thread.)

When input arrives fast enough that more than one new scan is available before you start a new output pass, you may as well skip the output pass corresponding to the completed scan. This occurs for free if you pass cinfo.input_scan_number as the target scan number to jpeg_start_output(). The input_scan_number field is simply the index of the scan currently being consumed by the input processor. You can ensure that this is up-to-date by emptying the input buffer just before calling jpeg_start_output(): call jpeg_consume_input() repeatedly until it returns JPEG_SUSPENDED or JPEG_REACHED_EOI.

The target scan number passed to jpeg_start_output() is saved in the cinfo.output_scan_number field. The library's output processing calls jpeg_consume_input() whenever the current input scan number and row within that scan is less than or equal to the current output scan number and row. Thus, input processing can "get ahead" of the output processing but is not allowed to "fall behind".

You can achieve several different effects by manipulating this interlock rule. For example, if you pass a target scan number greater than the current input scan number, the output processor will wait until that scan starts to arrive before producing any output. (To avoid an infinite loop, the target scan number is automatically reset to the last scan number when the end of image is reached. Thus, if you specify a large target scan number, the library will just absorb the entire input file and

then perform an output pass. This is effectively the same as what `jpeg_start_decompress()` does when you don't select buffered-image mode.) When you pass a target scan number equal to the current input scan number, the image is displayed no faster than the current input scan arrives. The final possibility is to pass a target scan number less than the current input scan number; this disables the input/output interlock and causes the output processor to simply display whatever it finds in the image buffer, without waiting for input. (However, the library will not accept a target scan number less than one, so you can't avoid waiting for the first scan.)

When data is arriving faster than the output display processing can advance through the image, `jpeg_consume_input()` will store data into the buffered image beyond the point at which the output processing is reading data out again. If the input arrives fast enough, it may "wrap around" the buffer to the point where the input is more than one whole scan ahead of the output. If the output processing simply proceeds through its display pass without paying attention to the input, the effect seen on-screen is that the lower part of the image is one or more scans better in quality than the upper part. Then, when the next output scan is started, you have a choice of what target scan number to use. The recommended choice is to use the current input scan number at that time, which implies that you've skipped the output scans corresponding to the input scans that were completed while you processed the previous output scan. In this way, the decoder automatically adapts its speed to the arriving data, by skipping output scans as necessary to keep up with the arriving data.

When using this strategy, you'll want to be sure that you perform a final output pass after receiving all the data; otherwise your last display may not be full quality across the whole screen. So the right outer loop logic is something like this:

```
do {
    absorb any waiting input by calling jpeg_consume_input()
    final_pass = jpeg_input_complete(&cinfo);
    adjust output decompression parameters if required
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
    ...
    jpeg_finish_output()
} while (! final_pass);
```

rather than quitting as soon as `jpeg_input_complete()` returns TRUE. This arrangement makes it simple to use higher-quality decoding parameters for the final pass. But if you don't want to use special parameters for the

final pass, the right loop logic is like this:

```
for (;;) {
    absorb any waiting input by calling jpeg_consume_input()
    jpeg_start_output(&cinfo, cinfo.input_scan_number);
```



```

...
jpeg_finish_output()
if (jpeg_input_complete(&cinfo) &&
    cinfo.input_scan_number == cinfo.output_scan_number)
    break;
}

```

In this case you don't need to know in advance whether an output pass is to be the last one, so it's not necessary to have reached EOF before starting the final output pass; rather, what you want to test is whether the output pass was performed in sync with the final input scan. This form of the loop will avoid an extra output pass whenever the decoder is able (or nearly able) to keep up with the incoming data.

When the data transmission speed is high, you might begin a display pass, then find that much or all of the file has arrived before you can complete the pass. (You can detect this by noting the JPEG_REACHED_EOI return code from jpeg_consume_input(), or equivalently by testing jpeg_input_complete().)

In this situation you may wish to abort the current display pass and start a new one using the newly arrived information. To do so, just call jpeg_finish_output() and then start a new pass with jpeg_start_output().

A variant strategy is to abort and restart display if more than one complete scan arrives during an output pass; this can be detected by noting JPEG_REACHED_SOS returns and/or examining cinfo.input_scan_number. This idea should be employed with caution, however, since the display process might never get to the bottom of the image before being aborted, resulting in the lower part of the screen being several passes worse than the upper. In most cases it's probably best to abort an output pass only if the whole file has arrived and you want to begin the final output pass immediately.

When receiving data across a communication link, we recommend always using the current input scan number for the output target scan number;

if a higher-quality final pass is to be done, it should be started (aborting any incomplete output pass) as soon as the end of file is received. However, many other strategies are possible. For example, the application can examine the parameters of the current input scan and decide whether to display it or not. If the scan contains only chroma data, one might choose not to use it as the target scan, expecting that the scan will be small and will arrive quickly. To skip to the next scan, call jpeg_consume_input() until it returns JPEG_REACHED_SOS or JPEG_REACHED_EOI. Or just use the next higher number as the target scan for jpeg_start_output(); but that method doesn't let you inspect the next scan's parameters before deciding to display it.

In buffered-image mode, jpeg_start_decompress() never performs input and thus never suspends. An application that uses input suspension with

buffered-image mode must be prepared for suspension returns from these routines:

- * `jpeg_start_output()`

performs input only if you request 2-pass quantization and the target scan isn't fully read yet. (This is discussed below.)

- * `jpeg_read_scanlines()`, as always, returns the number of scanlines that it was able to produce before suspending.

- * `jpeg_finish_output()` will read any markers following the target scan, up to the end of the file or the SOS marker that begins another scan. (But it reads no input if `jpeg_consume_input()` has already reached the end of the file or a SOS marker beyond the target output scan.)

- * `jpeg_finish_decompress()` will read until the end of file, and thus can suspend if the end hasn't already been reached (as can be tested by calling `jpeg_input_complete()`).

`jpeg_start_output()`, `jpeg_finish_output()`, and `jpeg_finish_decompress()` all return TRUE if they completed their tasks, FALSE if they had to suspend.

In the event of a FALSE return, the application must load more input data and repeat the call. Applications that use non-suspending data sources need

not check the return values of these three routines.

It is possible to change decoding parameters between output passes in the buffered-image mode. The decoder library currently supports only very limited changes of parameters. ONLY THE FOLLOWING parameter changes are allowed after `jpeg_start_decompress()` is called:

- * `dct_method` can be changed before each call to `jpeg_start_output()`.

For example, one could use a fast DCT method for early scans, changing to a higher quality method for the final scan.

- * `dither_mode` can be changed before each call to `jpeg_start_output()`;

of course this has no impact if not using color quantization. Typically one would use ordered dither for initial passes, then switch to Floyd-Steinberg dither for the final pass. Caution: changing dither mode can cause more memory to be allocated by the library. Although the amount of memory involved is not large (a scanline or so), it may cause the initial `max_memory_to_use` specification to be exceeded, which in the worst case would result in an out-of-memory failure.

- * `do_block_smoothing` can be changed before each call to `jpeg_start_output()`.

This setting is relevant only when decoding a progressive JPEG image. During the first DC-only scan, block smoothing provides a very "fuzzy" look instead of the very "blocky" look seen without it; which is better seems a matter of personal taste. But block smoothing is nearly always a win during later stages, especially when decoding a successive-approximation image: smoothing helps to hide the slight blockiness that otherwise shows up on smooth gradients until the lowest coefficient bits are sent.

- * Color quantization mode can be changed under the rules described below.

You *cannot* change between full-color and quantized output (because that

would alter the required I/O buffer sizes), but you can change which quantization method is used.

When generating color-quantized output, changing quantization method is a

very useful way of switching between high-speed and high-quality display.

The library allows you to change among its three quantization methods:

1. Single-pass quantization to a fixed color cube.

Selected by `cinfo.two_pass_quantize = FALSE` and `cinfo.colormap = NULL`.

2. Single-pass quantization to an application-supplied colormap.

Selected by setting `cinfo.colormap` to point to the colormap (the value of `two_pass_quantize` is ignored); also set `cinfo.actual_number_of_colors`.

3. Two-pass quantization to a colormap chosen specifically for the image.

Selected by `cinfo.two_pass_quantize = TRUE` and `cinfo.colormap = NULL`. (This is the default setting selected by `jpeg_read_header`, but it is probably NOT what you want for the first pass of progressive display!)

These methods offer successively better quality and lesser speed. However, only the first method is available for quantizing in non-RGB color spaces.

IMPORTANT: because the different quantizer methods have very different working-storage

requirements, the library requires you to indicate which

one(s) you intend to use before you call `jpeg_start_decompress()`. (If we did not require this, the `max_memory_to_use` setting would be a complete fiction.)

You do this by setting one or more of these three `cinfo` fields to `TRUE`:

`enable_1pass_quant` Fixed color cube colormap

`enable_external_quant` Externally-supplied colormap

`enable_2pass_quant` Two-pass custom colormap

All three are initialized `FALSE` by `jpeg_read_header()`. But

`jpeg_start_decompress()` automatically sets `TRUE` the one selected by the current `two_pass_quantize` and `colormap` settings, so you only need to set the enable flags for any other quantization methods you plan to change to later.

After setting the enable flags correctly at `jpeg_start_decompress()` time, you can change to any enabled quantization method by setting `two_pass_quantize` and `colormap` properly just before calling `jpeg_start_output()`. The following special rules apply:

1. You must

explicitly set `cinfo.colormap` to `NULL` when switching to 1-pass or 2-pass mode from a different mode, or when you want the 2-pass quantizer to be re-run to generate a new colormap.

2. To switch to an external colormap, or to change to a different external colormap than was used on the prior pass, you must call `jpeg_new_colormap()` after setting `cinfo.colormap`.

NOTE: if you want to use the same colormap as was used in the prior pass, you should not do either of these things. This will save some nontrivial switchover costs.

(These requirements exist because `cinfo.colormap` will always be non-`NULL`

after completing a prior output pass, since both the 1-pass and 2-pass quantizers set it to point to their output colormaps. Thus you have to do one of these two things to notify the library that something has changed. Yup, it's a bit klugy, but it's necessary to do it this way for backwards compatibility.)

Note that in buffered-image mode, the library generates any requested colormap during `jpeg_start_output()`, not during `jpeg_start_decompress()`.

When using two-pass quantization, `jpeg_start_output()` makes a pass over the buffered image to determine the optimum color map; it therefore may take a significant amount of time, whereas ordinarily it does little work. The progress monitor hook is called during this pass, if defined. It is also important to realize that if the specified target scan number is greater than or equal to the current input scan number, `jpeg_start_output()` will attempt to consume input as it makes this pass. If you use a suspending data source, you need to check for a FALSE return from `jpeg_start_output()` under these conditions. The combination of 2-pass quantization and a not-yet-fully-read target scan is the only case in which `jpeg_start_output()` will consume input.

Application authors who support buffered-image mode may be tempted to use it for all JPEG images, even single-scan ones. This will work, but it is inefficient: there is

no need to create an image-sized coefficient buffer for single-scan images. Requesting buffered-image mode for such an image wastes memory. Worse, it can cost time on large images, since the buffered data has to be swapped out or written to a temporary file. If you are concerned about maximum performance on baseline JPEG files, you should use buffered-image mode only when the incoming file actually has multiple scans. This can be tested by calling `jpeg_has_multiple_scans()`, which will return a correct result at any time after `jpeg_read_header()` completes.

It is also worth noting that when you use `jpeg_consume_input()` to let input processing get ahead of output processing, the resulting pattern of access to the coefficient buffer is quite nonsequential. It's best to use the memory manager `jmemnobs.c` if you can (ie, if you have enough real or virtual main memory). If not, at least make sure that `max_memory_to_use` is set as high as possible. If the JPEG memory manager has to use a temporary file, you will probably see a lot of disk traffic and poor performance. (This could be improved with additional work on the memory manager, but we haven't gotten around to it yet.)

In some applications it may be convenient to use `jpeg_consume_input()` for all input processing, including reading the initial markers; that is, you may wish to call `jpeg_consume_input()` instead of `jpeg_read_header()` during

startup. This works, but note that you must check for JPEG_REACHED_SOS and JPEG_REACHED_EOI return codes as the equivalent of jpeg_read_header's codes. Once the first SOS marker has been reached, you must call jpeg_start_decompress() before jpeg_consume_input() will consume more input; it'll just keep returning JPEG_REACHED_SOS until you do. If you read a tables-only file this way, jpeg_consume_input() will return JPEG_REACHED_EOI without ever returning JPEG_REACHED_SOS; be sure to check for this case. If this happens, the decompressor will not read any more input until you call jpeg_abort() to reset it. It is OK to call jpeg_consume_input() even when not using buffered-image mode, but in that case it's basically a no-op after the initial markers have been read: it will just return JPEG_SUSPENDED.

Abbreviated datastreams and multiple images

A JPEG compression or decompression object can be reused to process multiple images. This saves a small amount of time per image by eliminating the "create" and "destroy" operations, but that isn't the real purpose of the feature. Rather, reuse of an object provides support for abbreviated JPEG datastreams. Object reuse can also simplify processing a series of images in a single input or output file. This section explains these features.

A JPEG file normally contains several hundred bytes worth of quantization and Huffman tables. In a situation where many images will be stored or transmitted with identical tables, this may represent an annoying overhead. The JPEG

standard therefore permits tables to be omitted. The standard defines three classes of JPEG datastreams:

- * "Interchange" datastreams contain an image and all tables needed to decode the image. These are the usual kind of JPEG file.
- * "Abbreviated image" datastreams contain an image, but are missing some or all of the tables needed to decode that image.
- * "Abbreviated table specification" (henceforth "tables-only") datastreams contain only table specifications.

To decode an abbreviated image, it is necessary to load the missing table(s) into the decoder beforehand. This can be accomplished by reading a separate tables-only file. A variant scheme uses a series of images in which the first image is an interchange (complete) datastream, while subsequent ones are abbreviated and rely on the tables loaded by the first image. It is assumed that once the decoder has read a table, it will remember that table until a new definition for the same table number is encountered.

It

is the application designer's responsibility to figure out how to associate the correct tables with an abbreviated image. While abbreviated datastreams can be useful in a closed environment, their use is strongly discouraged in

any situation where data exchange with other applications might be needed.
Caveat designer.

The JPEG library provides support for reading and writing any combination of tables-only datastreams and abbreviated images. In both compression and decompression objects, a quantization or Huffman table will be retained for the lifetime of the object, unless it is overwritten by a new table definition.

To create abbreviated image datastreams, it is only necessary to tell the compressor not to emit some or all of the tables it is using. Each quantization and Huffman table struct contains a boolean field "sent_table", which normally is initialized to FALSE. For each table used by the image, the header-writing process emits the table and sets sent_table = TRUE unless it is already TRUE. (In normal usage, this prevents outputting the same table definition multiple times, as would otherwise occur because the chroma components typically share tables.) Thus, setting this field to TRUE before calling jpeg_start_compress() will prevent the table from being written at all.

If you want to create a "pure" abbreviated image file containing no tables, just call "jpeg_suppress_tables(&cinfo, TRUE)" after constructing all the tables. If you want to emit some but not all tables, you'll need to set the individual sent_table fields directly.

To create an abbreviated image, you must also call jpeg_start_compress() with a second parameter of FALSE, not TRUE. Otherwise jpeg_start_compress() will force all the sent_table fields to FALSE. (This is a safety feature to prevent abbreviated images from being created accidentally.)

To create a tables-only file, perform the same parameter setup that you normally would, but instead of calling jpeg_start_compress() and so on, call jpeg_write_tables(&cinfo). This will write an abbreviated datastream containing only SOI, DQT and/or DHT markers, and EOI. All the quantization and Huffman tables that are currently defined in the compression object will be emitted unless their sent_tables flag is already TRUE, and then all the sent_tables flags will be set TRUE.

A sure-fire way to create matching tables-only and abbreviated image files is to proceed as follows:

```
create JPEG compression object
set JPEG parameters
set destination to tables-only file
jpeg_write_tables(&cinfo);
set destination to image file
```

```

jpeg_start_compress(&cinfo, FALSE);
write data...
jpeg_finish_compress(&cinfo);

```

Since the JPEG parameters are not altered between writing the table file and the abbreviated image file, the same tables are sure to be used. Of course, you can repeat the `jpeg_start_compress()` ... `jpeg_finish_compress()` sequence many times to produce many abbreviated image files matching the table file.

You

cannot suppress output of the computed Huffman tables when Huffman optimization is selected. (If you could, there'd be no way to decode the image...) Generally, you don't want to set `optimize_coding = TRUE` when you are trying to produce abbreviated files.

In some cases you might want to compress an image using tables which are not stored in the application, but are defined in an interchange or tables-only file readable by the application. This can be done by setting up a JPEG decompression object to read the specification file, then copying the tables into your compression object. See `jpeg_copy_critical_parameters()` for an example of copying quantization tables.

To read abbreviated image files, you simply need to load the proper tables into the decompression object before trying to read the abbreviated image. If the proper tables are stored in the application program, you can just allocate the table structs and fill in their contents directly. For example, to load a fixed quantization table into table slot "n":

```

if (cinfo.quant_tbl_ptrs[n] == NULL)
    cinfo.quant_tbl_ptrs[n] = jpeg_alloc_quant_table((j_common_ptr) &cinfo);
quant_ptr = cinfo.quant_tbl_ptrs[n]; /* quant_ptr is JQUANT_TBL* */
for (i = 0; i < 64; i++) {
    /* Qtable[] is desired quantization table, in natural array order */
    quant_ptr->quantval[i] = Qtable[i];
}

```

Code to load a fixed Huffman table is typically (for AC table "n"):

```

if (cinfo.ac_huff_tbl_ptrs[n] == NULL)
    cinfo.ac_huff_tbl_ptrs[n] = jpeg_alloc_huff_table((j_common_ptr) &cinfo);
huff_ptr = cinfo.ac_huff_tbl_ptrs[n]; /* huff_ptr is JHUFF_TBL* */
for (i = 1; i <= 16; i++) {
    /* counts[i] is number of Huffman codes of length i bits, i=1..16 */
    huff_ptr->bits[i] = counts[i];
}
for (i = 0; i < 256; i++) {

```

```

/* symbols[] is the list of Huffman symbols, in code-length order */
huff_ptr->huffval[i] = symbols[i];
}

```

(Note that trying to set `cinfo.quant_tbl_ptrs[n]` to point directly at a constant `JQUANT_TBL` object is not safe. If the incoming file happened to contain a quantization table definition, your master table would get overwritten! Instead allocate a working table copy and copy the master table into it, as illustrated above. Ditto for Huffman tables, of course.)

You might want to read the tables from a tables-only file, rather than hard-wiring them into your application. The `jpeg_read_header()` call is sufficient to read a tables-only file. You must pass a second parameter of `FALSE` to indicate that you do not require an image to be present. Thus, the typical scenario is

```

create JPEG decompression object
set source to tables-only file
jpeg_read_header(&cinfo, FALSE);
set source to abbreviated image file
jpeg_read_header(&cinfo, TRUE);
set decompression parameters
jpeg_start_decompress(&cinfo);
read data...
jpeg_finish_decompress(&cinfo);

```

In some cases, you may want to read a file without knowing whether it contains an image or just tables. In that case, pass `FALSE` and check the return value from `jpeg_read_header()`: it will be `JPEG_HEADER_OK` if an image was found, `JPEG_HEADER_TABLES_ONLY` if only tables were found. (A third return value, `JPEG_SUSPENDED`, is possible when using a suspending data source manager.) Note that `jpeg_read_header()` will not complain if you read an abbreviated image for which you haven't loaded the missing tables; the missing-table check occurs later, in `jpeg_start_decompress()`.

It is possible to read a series of images from a single source file by repeating the `jpeg_read_header() ... jpeg_finish_decompress()` sequence, without releasing/recreating the JPEG object or the data source module. (If you did reinitialize, any partial bufferload left in the data source buffer at the end of one image would be discarded, causing you to lose the start of the next image.) When you use this method, stored tables are automatically carried forward, so some of the images can be abbreviated images that depend on tables from earlier images.

If you intend to write a series of images into a single destination file, you might want to make a specialized data destination module that doesn't flush the output buffer at `term_destination()` time. This would speed things up by some trifling amount. Of course, you'd need to remember to flush the buffer after the last image. You can make the later images be abbreviated ones by passing `FALSE` to `jpeg_start_compress()`.

Special markers

Some applications may need to insert or extract special data in the JPEG datastream. The JPEG standard provides marker types "COM" (comment) and "APP0" through "APP15" (application) to hold application-specific data. Unfortunately, the use of these markers is not specified by the standard. COM markers are fairly widely used to hold user-supplied text. The JFIF file format spec uses APP0 markers with specified initial strings to hold certain data. Adobe applications use APP14 markers beginning with the string "Adobe" for miscellaneous data. Other APPn markers are rarely seen, but might contain almost anything.

If you wish to store user-supplied text, we recommend you use COM markers and place readable 7-bit ASCII text in them. Newline conventions are not standardized --- expect to find LF (Unix style), CR/LF (DOS style), or CR (Mac style). A robust COM reader should be able to cope with random binary garbage, including nulls, since some applications generate COM markers containing non-ASCII junk. (But yours should not be one of them.)

For program-supplied data, use an APPn marker, and be sure to begin it with an identifying string so that you can tell whether the marker is actually yours. It's probably best to avoid using APP0 or APP14 for any private markers. (NOTE: the upcoming SPIFF standard will use APP8 markers; we recommend you not use APP8 markers for any private purposes, either.)

Keep in mind that at most 65533 bytes can be put into one marker, but you can have as many markers as you like.

By default, the IJG compression library will write a JFIF APP0 marker if the selected JPEG colorspace is grayscale or YCbCr, or an Adobe APP14 marker if the selected colorspace is RGB, CMYK, or YCCK. You can disable this, but we don't recommend it. The decompression library will recognize JFIF and Adobe markers and will set the JPEG colorspace properly when one is found.

You can write special markers immediately following the datastream header by calling `jpeg_write_marker()` after `jpeg_start_compress()` and before the first

call to `jpeg_write_scanlines()`. When you do this, the markers appear after the SOI and the JFIF APP0 and Adobe APP14 markers (if written), but before all else. Specify the marker type parameter as "JPEG_COM" for COM or "JPEG_APP0 + n" for APPn. (Actually, `jpeg_write_marker` will let you write any marker type, but we don't recommend writing any other kinds of marker.) For example, to write a user comment string pointed to by `comment_text`:

```
jpeg_write_marker(cinfo, JPEG_COM, comment_text, strlen(comment_text));
```

If it's not convenient to store all the marker data in memory at once, you can instead call `jpeg_write_m_header()` followed by multiple calls to `jpeg_write_m_byte()`. If you do it this way, it's your responsibility to call `jpeg_write_m_byte()` exactly the number of times given in the length parameter to `jpeg_write_m_header()`. (This method lets you empty the output buffer partway through a marker, which might be important when using a suspending data destination module. In any case, if you are using a suspending destination, you should flush its buffer after inserting any special markers. See "I/O suspension".)

Or, if you prefer to synthesize the marker byte sequence yourself, you can just cram it straight into the data destination module.

If you are writing JFIF 1.02 extension markers (thumbnail images), don't forget to set `cinfo.JFIF_minor_version = 2` so that the encoder will write the correct

JFIF version number in the JFIF header marker. The library's default is to write version 1.01, but that's wrong if you insert any 1.02 extension markers. (We could probably get away with just defaulting to 1.02, but there used to be broken decoders that would complain about unknown minor version numbers. To reduce compatibility risks it's safest not to write 1.02 unless you are actually using 1.02 extensions.)

When reading, two methods of handling special markers are available:

1. You can ask the library to save the contents of COM and/or APPn markers into memory, and then examine them at your leisure afterwards.
2. You can supply your own routine to process COM and/or APPn markers on-the-fly as they are read.

The first method is simpler to use, especially if you are using a suspending data source; writing a marker processor that copes with input suspension is not easy (consider what happens if the marker is longer than your available input buffer). However, the second method conserves memory since the marker data need not be kept around after it's been processed.

For either method, you'd normally set up marker handling after creating a decompression object and before calling `jpeg_read_header()`, because the markers of interest will typically be near the head of the file and so will

be scanned by `jpeg_read_header`. Once you've established a marker handling method, it will be used for the life of that decompression object (potentially many datastreams), unless you change it. Marker handling is determined separately for COM markers and for each APPn marker code.

To save the contents of special markers in memory, call `jpeg_save_markers(cinfo, marker_code, length_limit)` where `marker_code` is the marker type to save, `JPEG_COM` or `JPEG_APP0+n`. (To arrange to save all the special marker types, you need to call this routine 17 times, for COM and APP0-APP15.) If the incoming marker is longer than `length_limit` data bytes, only `length_limit` bytes will be saved; this parameter allows you to avoid chewing up memory when you only need to see the first few bytes of a potentially large marker. If you want to save all the data, set `length_limit` to `0xFFFF`; that is enough since marker lengths are only 16 bits. As a special case, setting `length_limit` to 0 prevents that marker type from being saved at all. (That is the default behavior, in fact.)

After `jpeg_read_header()` completes, you can examine the special markers by following the `cinfo->marker_list` pointer chain. All the special markers in the file appear in this list, in order of their occurrence in the file (but omitting any markers of types you didn't ask for). Both the original data length and the saved data length are recorded for each list entry; the latter will not exceed `length_limit` for the particular marker type. Note that these lengths exclude the marker length word, whereas the stored representation within the JPEG file includes it. (Hence the maximum data length is really only 65533.)

It is possible that additional special markers appear in the file beyond the SOS marker at which `jpeg_read_header` stops; if so, the marker list will be extended during reading of the rest of the file. This is not expected to be common, however. If you are short on memory you may want to reset the length limit to zero for all marker types after finishing `jpeg_read_header`, to ensure that the `max_memory_to_use` setting cannot be exceeded due to addition of later markers.

The marker list remains stored until you call `jpeg_finish_decompress` or `jpeg_abort`, at which point the memory is freed and the list is set to empty. (`jpeg_destroy` also releases the storage, of course.)

Note that the library is internally interested in APP0 and APP14 markers; if you try to set a small nonzero length limit on these types, the library will silently force the length up to the minimum it wants. (But you can set a zero length limit to prevent them from being saved at all.) Also, in a 16-bit environment,

the maximum length limit may be constrained to less than 65533 by malloc() limitations. It is therefore best not to assume that the effective length limit is exactly what you set it to be.

If you want to supply your own marker-reading routine, you do it by calling `jpeg_set_marker_processor()`. A marker processor routine must have the signature

```
boolean jpeg_marker_parser_method (j_decompress_ptr cinfo)
```

Although the marker code is not explicitly passed, the routine can find it in `cinfo->unread_marker`. At the time of call, the marker proper has been read from the data source module. The processor routine is responsible for reading the marker length word and the remaining parameter bytes, if any. Return TRUE to indicate success. (FALSE should be returned only if you are using a suspending data source and it tells you to suspend. See the standard marker processors in `jdmarker.c` for appropriate coding methods if you need to use a suspending data source.)

If you override the default

APP0 or APP14 processors, it is up to you to recognize JFIF and Adobe markers if you want colorspace recognition to occur properly. We recommend copying and extending the default processors if you want to do that. (A better idea is to save these marker types for later examination by calling `jpeg_save_markers()`; that method doesn't interfere with the library's own processing of these markers.)

`jpeg_set_marker_processor()` and `jpeg_save_markers()` are mutually exclusive --- if you call one it overrides any previous call to the other, for the particular marker type specified.

A simple example of an external COM processor can be found in `djpeg.c`. Also, see `jpegtran.c` for an example of using `jpeg_save_markers`.

Raw (downsampled) image data

Some applications need to supply already-downsampled image data to the JPEG compressor, or to receive raw downsampled data from the decompressor. The library supports this requirement by allowing the application to write
or

read raw data, bypassing the normal preprocessing or postprocessing steps. The interface is different from the standard one and is somewhat harder to use. If your interest is merely in bypassing color conversion, we recommend that you use the standard interface and simply set `jpeg_color_space = in_color_space` (or `jpeg_color_space = out_color_space` for decompression). The mechanism described in this section is necessary only to supply or receive downsampled image data, in which not all components have the same

dimensions.

To compress raw data, you must supply the data in the colorspace to be used in the JPEG file (please read the earlier section on Special color spaces) and downsampled to the sampling factors specified in the JPEG parameters. You must supply the data in the format used internally by the JPEG library, namely a JSAMPIMAGE array. This is an array of pointers to two-dimensional arrays, each of type JSAMPARRAY. Each 2-D array holds the values for one color component.

This structure is necessary since the components are of different sizes. If the image dimensions are not a multiple of the MCU size, you must also pad the data correctly (usually, this is done by replicating the last column and/or row). The data must be padded to a multiple of a DCT block in each component: that is, each downsampled row must contain a multiple of `block_size` valid samples, and there must be a multiple of `block_size` sample rows for each component. (For applications such as conversion of digital TV images, the standard image size is usually a multiple of the DCT block size, so that no padding need actually be done.)

The procedure for compression of raw data is basically the same as normal compression, except that you call `jpeg_write_raw_data()` in place of `jpeg_write_scanlines()`. Before calling `jpeg_start_compress()`, you must do the following:

- * Set `cinfo->raw_data_in` to TRUE. (It is set FALSE by `jpeg_set_defaults()`.)

This notifies the library that you will be supplying raw data.

Furthermore, set `cinfo->do_fancy_downsampling` to FALSE if you want to use real downsampled data. (It is set TRUE by `jpeg_set_defaults()`.)

- * Ensure `jpeg_color_space` is correct --- an explicit `jpeg_set_colorspace()` call is a good idea. Note that since color conversion is bypassed, `in_color_space` is ignored, except that `jpeg_set_defaults()` uses it to choose the default `jpeg_color_space` setting.

- * Ensure the sampling factors, `cinfo->comp_info[i].h_samp_factor` and `cinfo->comp_info[i].v_samp_factor`, are correct. Since these indicate the dimensions of the data you are supplying, it's wise to set them explicitly, rather than assuming the library's defaults are what you want.

To pass raw data to the library, call `jpeg_write_raw_data()` in place of `jpeg_write_scanlines()`. The two routines work similarly except that `jpeg_write_raw_data` takes a JSAMPIMAGE data array rather than JSAMPARRAY. The scanlines count passed to and returned from `jpeg_write_raw_data` is measured in terms of the component with the largest `v_samp_factor`.

`jpeg_write_raw_data()` processes one MCU row per call, which is to say `v_samp_factor*block_size` sample rows of each component. The passed `num_lines` value must be at least `max_v_samp_factor*block_size`, and the return value

will be exactly that amount (or possibly some multiple of that amount, in future library versions). This is true even on the last call at the bottom of the image; don't forget to pad your data as necessary.

The required dimensions of the supplied data can be computed for each component as

`cinfo->comp_info[i].width_in_blocks*block_size` samples per row

`cinfo->comp_info[i].height_in_blocks*block_size` rows in image

after `jpeg_start_compress()` has initialized those fields. If the valid data is smaller than this, it must be padded appropriately. For some sampling factors and image sizes, additional dummy DCT blocks are inserted to make the image a multiple of the MCU dimensions.

The library creates such dummy

blocks itself; it does not read them from your supplied data. Therefore you need never pad by more than `block_size` samples. An example may help here.

Assume 2h2v downsampling of YCbCr data, that is

`cinfo->comp_info[0].h_samp_factor = 2` for Y

`cinfo->comp_info[0].v_samp_factor = 2`

`cinfo->comp_info[1].h_samp_factor = 1` for Cb

`cinfo->comp_info[1].v_samp_factor = 1`

`cinfo->comp_info[2].h_samp_factor = 1` for Cr

`cinfo->comp_info[2].v_samp_factor = 1`

and suppose that the nominal image dimensions (`cinfo->image_width` and `cinfo->image_height`) are 101x101 pixels. Then `jpeg_start_compress()` will compute `downsampled_width = 101` and `width_in_blocks = 13` for Y, `downsampled_width = 51` and `width_in_blocks = 7` for Cb and Cr (and the same for the height fields). You must pad the Y data to at least $13*8 = 104$ columns and rows, the Cb/Cr data to at least $7*8 = 56$ columns and rows. The MCU height is `max_v_samp_factor = 2` DCT rows so you must pass at least 16 scanlines

on each call to `jpeg_write_raw_data()`, which is to say 16 actual sample rows of Y and 8 each of Cb and Cr. A total of 7 MCU rows are needed, so you must pass a total of $7*16 = 112$ "scanlines". The last DCT block row of Y data is dummy, so it doesn't matter what you pass for it in the data arrays, but the scanlines count must total up to 112 so that all of the Cb and Cr data gets passed.

Output suspension is supported with raw-data compression: if the data destination module suspends, `jpeg_write_raw_data()` will return 0.

In this case the same data rows must be passed again on the next call.

Decompression with raw data output implies bypassing all postprocessing.

You must deal with the color space and sampling factors present in the incoming file. If your application only handles, say, 2h1v YCbCr data, you must check for and fail on other color spaces or other sampling factors. The library will not convert to a different color space for you.

To obtain raw data output,
set `cinfo->raw_data_out = TRUE` before
`jpeg_start_decompress()` (it is set `FALSE` by `jpeg_read_header()`). Be sure to
verify that the color space and sampling factors are ones you can handle.
Furthermore, set `cinfo->do_fancy_upsampling = FALSE` if you want to get real
downsampled data (it is set `TRUE` by `jpeg_read_header()`).
Then call `jpeg_read_raw_data()` in place of `jpeg_read_scanlines()`. The
decompression process is otherwise the same as usual.

`jpeg_read_raw_data()` returns one MCU row per call, and thus you must pass a
buffer of at least `max_v_samp_factor*block_size` scanlines (scanline counting
is the same as for raw-data compression). The buffer you pass must be large
enough to hold the actual data plus padding to DCT-block boundaries. As with
compression, any entirely dummy DCT blocks are not processed so you need not
allocate space for them, but the total scanline count includes them. The
above example of computing buffer dimensions for raw-data compression is
equally valid for decompression.

Input

suspension is supported with raw-data decompression: if the data source
module suspends, `jpeg_read_raw_data()` will return 0. You can also use
buffered-image mode to read raw data in multiple passes.

Really raw data: DCT coefficients

It is possible to read or write the contents of a JPEG file as raw DCT
coefficients. This facility is mainly intended for use in lossless
transcoding between different JPEG file formats. Other possible applications
include lossless cropping of a JPEG image, lossless reassembly of a
multi-strip or multi-tile TIFF/JPEG file into a single JPEG datastream, etc.

To read the contents of a JPEG file as DCT coefficients, open the file and do
`jpeg_read_header()` as usual. But instead of calling `jpeg_start_decompress()`
and `jpeg_read_scanlines()`, call `jpeg_read_coefficients()`. This will read the
entire image into a set of virtual coefficient-block arrays, one array per
component. The return value is a pointer
to an array of virtual-array
descriptors. Each virtual array can be accessed directly using the JPEG
memory manager's `access_virt_barray` method (see Memory management, below,
and also `read.structure.txt`'s discussion of virtual array handling). Or,
for simple transcoding to a different JPEG file format, the array list can
just be handed directly to `jpeg_write_coefficients()`.

Each block in the block arrays contains quantized coefficient values in
normal array order (not JPEG zigzag order). The block arrays contain only
DCT blocks containing real data; any entirely-dummy blocks added to fill out

interleaved MCUs at the right or bottom edges of the image are discarded during reading and are not stored in the block arrays. (The size of each block array can be determined from the `width_in_blocks` and `height_in_blocks` fields of the component's `comp_info` entry.) This is also the data format expected by `jpeg_write_coefficients()`.

When you are done using the virtual arrays, call `jpeg_finish_decompress()` to release the array storage and return the decompression object to an idle state; or just call `jpeg_destroy()` if you don't need to reuse the object.

If you use a suspending data source, `jpeg_read_coefficients()` will return `NULL` if it is forced to suspend; a non-`NULL` return value indicates successful completion. You need not test for a `NULL` return value when using a non-suspending data source.

It is also possible to call `jpeg_read_coefficients()` to obtain access to the decoder's coefficient arrays during a normal decode cycle in buffered-image mode. This frammish might be useful for progressively displaying an incoming image and then re-encoding it without loss. To do this, decode in buffered-image mode as discussed previously, then call `jpeg_read_coefficients()` after the last `jpeg_finish_output()` call. The arrays will be available for your use until you call `jpeg_finish_decompress()`.

To write the contents of a JPEG file as DCT coefficients, you must provide the

DCT coefficients stored in virtual block arrays. You can either pass block arrays read from an input JPEG file by `jpeg_read_coefficients()`, or allocate virtual arrays from the JPEG compression object and fill them yourself. In either case, `jpeg_write_coefficients()` is substituted for `jpeg_start_compress()` and `jpeg_write_scanlines()`. Thus the sequence is

- * Create compression object
- * Set all compression parameters as necessary
- * Request virtual arrays if needed
- * `jpeg_write_coefficients()`
- * `jpeg_finish_compress()`
- * Destroy or re-use compression object

`jpeg_write_coefficients()` is passed a pointer to an array of virtual block array descriptors; the number of arrays is equal to `cinfo.num_components`.

The virtual arrays need only have been requested, not realized, before `jpeg_write_coefficients()` is called. A side-effect of `jpeg_write_coefficients()` is to realize any virtual arrays that have been requested from the compression object's memory manager. Thus, when obtaining the

virtual arrays from the compression object, you should fill the arrays after calling `jpeg_write_coefficients()`. The data is actually written out

when you call `jpeg_finish_compress()`; `jpeg_write_coefficients()` only writes the file header.

When writing raw DCT coefficients, it is crucial that the JPEG quantization tables and sampling factors match the way the data was encoded, or the resulting file will be invalid. For transcoding from an existing JPEG file, we recommend using `jpeg_copy_critical_parameters()`. This routine initializes all the compression parameters to default values (like `jpeg_set_defaults()`), then copies the critical information from a source decompression object. The decompression object should have just been used to read the entire JPEG input file --- that is, it should be awaiting `jpeg_finish_decompress()`.

`jpeg_write_coefficients()` marks all tables stored in the compression object as needing to be written to the output file (thus, it acts like `jpeg_start_compress(cinfo, TRUE)`). This is for safety's sake, to avoid emitting abbreviated JPEG files by accident. If you really want to emit an abbreviated JPEG file, call `jpeg_suppress_tables()`, or set the tables' individual `sent_table` flags, between calling `jpeg_write_coefficients()` and `jpeg_finish_compress()`.

Progress monitoring

Some applications may need to regain control from the JPEG library every so often. The typical use of this feature is to produce a percent-done bar or other progress display. (For a simple example, see `cjpeg.c` or `djpeg.c`.) Although you do get control back frequently during the data-transferring pass (the `jpeg_read_scanlines` or `jpeg_write_scanlines` loop), any additional passes will occur inside `jpeg_finish_compress` or `jpeg_start_decompress`; those routines may take a long time to execute, and you don't get control back until they are done.

You can define a progress-monitor routine which will be called periodically by the library. No guarantees are made about how often this call will occur, so we don't recommend you use it for mouse tracking or anything like that. At present, a call will occur once per MCU row, scanline, or sample row group, whichever unit is convenient for the current processing mode; so the wider the image, the longer the time between calls. During the data transferring pass, only one call occurs per call of `jpeg_read_scanlines` or `jpeg_write_scanlines`, so don't pass a large number of scanlines at once if you want fine resolution in the progress count. (If you really need to use the callback mechanism for time-critical tasks like mouse tracking, you could insert additional calls inside some of the library's inner loops.)

To establish a progress-monitor callback, create a struct `jpeg_progress_mgr`,

fill in its progress_monitor field with a pointer to your callback routine, and set cinfo->progress to point to the struct. The callback will be called whenever cinfo->progress is non-NULL. (This pointer is set to NULL by jpeg_create_compress or jpeg_create_decompress; the library will not change it thereafter. So if you allocate dynamic storage for the progress struct, make sure it will live as long as the JPEG object does. Allocating from the JPEG memory manager with lifetime JPOOL_PERMANENT will work nicely.) You can use the same callback routine for both compression and decompression.

The jpeg_progress_mgr struct contains four fields which are set by the library:

```
long pass_counter; /* work units completed in this pass */
long pass_limit; /* total number of work units in this pass */
int completed_passes; /* passes completed so far */
int total_passes; /* total number of passes expected */
```

During any one pass, pass_counter increases from 0 up to (not including) pass_limit; the step size is usually but not necessarily 1. The pass_limit value may change from one pass to another. The expected total number of passes is in total_passes, and the number of passes already completed is in completed_passes. Thus the fraction of work completed may be estimated as

$$\frac{\text{completed\_passes} + (\text{pass\_counter}/\text{pass\_limit})}{\text{total\_passes}}$$

ignoring the fact that the passes may not be equal amounts of work.

When decompressing, pass_limit can even change within a pass, because it depends on the number of scans in the JPEG file, which isn't always known in advance. The computed fraction-of-work-done may jump suddenly (if the library discovers it has overestimated the number of scans) or even decrease (in the opposite case). It is not wise to put great faith in the work estimate.

When using the decompressor's buffered-image mode, the progress monitor work estimate is likely to be completely unhelpful, because the library has no way to know how many output passes will be demanded of it. Currently, the library sets total_passes based on the assumption that there will be one more output pass if the input file end hasn't yet been read (jpeg_input_complete() isn't TRUE), but no more output passes if the file end has been reached when the output pass is started. This means that total_passes will rise as additional output passes are requested. If you have a way of determining the input file size, estimating progress based on the fraction of the file that's been read will probably be more useful than using the library's value.

Memory management

This section covers some key facts about the JPEG library's built-in memory manager. For more info, please read `structure.txt`'s section about the memory manager, and consult the source code if necessary.

All memory and temporary file allocation within the library is done via the memory manager. If necessary, you can replace the "back end" of the memory manager to control allocation yourself (for example, if you don't want the library to use `malloc()` and `free()` for some reason).

Some data is allocated "permanently" and will not be freed until the JPEG object

is destroyed. Most data is allocated "per image" and is freed by `jpeg_finish_compress`, `jpeg_finish_decompress`, or `jpeg_abort`. You can call the memory manager yourself to allocate structures that will automatically be freed at these times. Typical code for this is

```
ptr = (*cinfo->mem->alloc_small) ((j_common_ptr) cinfo, JPOOL_IMAGE, size);
```

Use `JPOOL_PERMANENT` to get storage that lasts as long as the JPEG object. Use `alloc_large` instead of `alloc_small` for anything bigger than a few Kbytes. There are also `alloc_sarray` and `alloc_barray` routines that automatically build 2-D sample or block arrays.

The library's minimum space requirements to process an image depend on the image's width, but not on its height, because the library ordinarily works with "strip" buffers that are as wide as the image but just a few rows high. Some operating modes (eg, two-pass color quantization) require full-image buffers. Such buffers are treated as "virtual arrays": only the current strip need be in memory, and the rest can be swapped out to a temporary file.

If you use the simplest memory manager back end (`jmemnobs.c`), then no temporary files are used; virtual arrays are simply `malloc()`'d. Images bigger than memory can be processed only if your system supports virtual memory. The other memory manager back ends support temporary files of various flavors and thus work in machines without virtual memory. They may also be useful on Unix machines if you need to process images that exceed available swap space.

When using temporary files, the library will make the in-memory buffers for its virtual arrays just big enough to stay within a "maximum memory" setting. Your application can set this limit by setting `cinfo->mem->max_memory_to_use` after creating the JPEG object. (Of course, there is still a minimum size for the buffers, so the max-memory setting is effective only if it is bigger than the minimum space needed.) If you allocate any large structures yourself, you must allocate

them before `jpeg_start_compress()` or `jpeg_start_decompress()` in order to have them counted against the max memory limit. Also keep in mind that space allocated with `alloc_small()` is ignored, on the assumption that it's too small to be worth worrying about; so a reasonable safety margin should be left when setting `max_memory_to_use`.

If you use the `jmemname.c` or `jmemdos.c` memory manager back end, it is important to clean up the JPEG object properly to ensure that the temporary files get deleted. (This is especially crucial with `jmemdos.c`, where the "temporary files" may be extended-memory segments; if they are not freed, DOS will require a reboot to recover the memory.) Thus, with these memory managers, it's a good idea to provide a signal handler that will trap any early exit from your program. The handler should call either `jpeg_abort()` or `jpeg_destroy()` for any active JPEG objects. A handler is not needed with `jmemnobs.c`, and shouldn't be necessary with `jmemansi.c` or `jmemmac.c` either, since the C library is supposed to take care of deleting files made with `tmpfile()`.

Memory usage

Working memory requirements while performing compression or decompression depend on image dimensions, image characteristics (such as colorspace and JPEG process), and operating mode (application-selected options).

As of v6b, the decompressor requires:

1. About 24K in more-or-less-fixed-size data. This varies a bit depending on operating mode and image characteristics (particularly color vs. grayscale), but it doesn't depend on image dimensions.
2. Strip buffers (of size proportional to the image width) for IDCT and upsampling results. The worst case for commonly used sampling factors is about 34 bytes * width in pixels for a color image. A grayscale image only needs about 8 bytes per pixel column.
3. A full-image DCT coefficient buffer is needed to decode a multi-scan JPEG file (including progressive JPEGs), or whenever you select buffered-image mode. This takes 2 bytes/coefficient. At typical 2x2 sampling, that's 3 bytes per pixel for a color image. Worst case (1x1 sampling) requires 6 bytes/pixel. For grayscale, figure 2 bytes/pixel.
4. To perform 2-pass color quantization, the decompressor also needs a 128K color lookup table and a full-image pixel buffer (3 bytes/pixel). This does not count any memory allocated by the application, such as a buffer to hold the final output image.

The above figures are valid for 8-bit JPEG data precision and a machine with 32-bit ints. For 9-bit to 12-bit JPEG data, double the size of the strip buffers and quantization pixel buffer. The "fixed-size" data will be somewhat smaller with 16-bit ints, larger with 64-bit ints. Also, CMYK or other unusual color spaces will require different amounts of space.

The full-image coefficient and pixel buffers, if needed at all, do not have to be fully RAM resident; you can have the library use temporary

files instead

when the total memory usage would exceed a limit you set.

(But if your OS supports virtual memory, it's probably better to just use `jmemnobs` and let the OS do the swapping.)

The compressor's memory requirements are similar, except that it has no need for color quantization. Also, it needs a full-image DCT coefficient buffer if Huffman-table optimization is asked for, even if progressive mode is not requested.

If you need more detailed information about memory usage in a particular situation, you can enable the `MEM_STATS` code in `jmemmgr.c`.

Library compile-time options

A number of compile-time options are available by modifying `jmorecfg.h`.

The IJG code currently supports 8-bit to 12-bit sample data precision by defining `BITS_IN_JSAMPLE` as 8, 9, 10, 11, or 12.

Note that a value larger than 8 causes `JSAMPLE` to be larger than a `char`, so it affects the surrounding application's image data.

The sample applications `cjpeg` and `djpeg` can support deeper than 8-bit data

only for PPM and GIF file formats; you must disable the other file formats to compile a 9-bit to 12-bit `cjpeg` or `djpeg`. (`install.txt` has more information about that.)

Run-time selection and conversion of data precision are currently not supported and may be added later.

Exception: The transcoding part (`jpegtran`) supports all settings in a single instance, since it operates on the level of DCT coefficients and not sample values.

(If you need to include an 8-bit library and a 9-bit to 12-bit library for compression or decompression in a single application, you could probably do it by defining `NEED_SHORT_EXTERNAL_NAMES` for just one of the copies. You'd have to access the 8-bit and the 9-bit to 12-bit copies from separate application source files. This is untested ... if you try it, we'd like to hear whether it works!)

Note that the standard Huffman tables are only valid for 8-bit data precision.

If you selected more than 8-bit data precision, `cjpeg` uses arithmetic coding by default.

The Huffman encoder normally uses entropy optimization to compute usable tables for higher precision. Otherwise, you'll have to supply different default Huffman tables. You may also want to supply your own DCT quantization tables; the existing quality-scaling code has been developed for 8-bit use, and probably doesn't generate especially good tables

for 9-bit to 12-bit.

The maximum number of components (color channels) in the image is determined by `MAX_COMPONENTS`. The JPEG standard allows up to 255 components, but we expect that few applications will need more than four or so.

On machines with unusual data type sizes, you may be able to improve performance or reduce memory space by tweaking the various typedefs in `jmorecfg.h`. In particular, on some RISC CPUs, access to arrays of "short"s is quite slow; consider trading memory for speed by making `JCOEF`, `INT16`, and `UINT16` be "int" or "unsigned int". `UINT8` is also a candidate to become int. You probably don't want to make `JSAMPLE` be int unless you have lots of memory to burn.

You can reduce the size of the library by compiling out various optional functions. To do this, undefine `xxx_SUPPORTED` symbols as necessary.

You can also save a few K by not having text error messages in the library; the standard error message table occupies about 5Kb. This is particularly reasonable for embedded applications where there's no good way to display a message anyway. To do this, remove the creation of the message table (`jpeg_std_message_table[]`) from `jerror.c`, and alter `format_message` to do something reasonable without it. You could output the numeric value of the message code number, for example. If you do this, you can also save a couple more K by modifying the `TRACEMSn()` macros in `jerror.h` to expand to nothing; you don't need trace capability anyway, right?

Portability considerations

The JPEG library has been written to be extremely portable; the sample applications `cjpeg` and `djpeg` are slightly less so. This section summarizes the design goals in this area. (If you encounter any bugs that cause the library to be less portable than is claimed here, we'd appreciate hearing about them.)

The code works fine on ANSI C, C++, and pre-ANSI C compilers, using any of the popular system include file setups, and some not-so-popular ones too. See `install.txt` for configuration procedures.

The code is not dependent on the exact sizes of the C data types. As distributed, we make the assumptions that

- char is at least 8 bits wide
- short is at least 16 bits wide
- int is at least 16 bits wide

long is at least 32 bits wide

(These are the minimum requirements of the ANSI C standard.) Wider types will work fine, although memory may be used inefficiently if char is much larger than 8 bits or short is much bigger than 16 bits. The code should work equally well with 16- or 32-bit ints.

In a system where these assumptions are not met, you may be able to make the code work by

modifying the typedefs in jmorecfg.h. However, you will probably have difficulty if int is less than 16 bits wide, since references to plain int abound in the code.

char can be either signed or unsigned, although the code runs faster if an unsigned char type is available. If char is wider than 8 bits, you will need to redefine JOCTET and/or provide custom data source/destination managers so that JOCTET represents exactly 8 bits of data on external storage.

The JPEG library proper does not assume ASCII representation of characters. But some of the image file I/O modules in cjpeg/djpeg do have ASCII dependencies in file-header manipulation; so does cjpeg's select_file_type() routine.

The JPEG library does not rely heavily on the C library. In particular, C stdio is used only by the data source/destination modules and the error handler, all of which are application-replaceable. (cjpeg/djpeg are more heavily dependent on stdio.) malloc and free are called only from the memory manager

"back end" module, so you can use a different memory allocator by replacing that one file.

The code generally assumes that C names must be unique in the first 15 characters. However, global function names can be made unique in the first 6 characters by defining NEED_SHORT_EXTERNAL_NAMES.

More info about porting the code may be gleaned by reading jconfig.txt, jmorecfg.h, and jinclude.h.

Notes for MS-DOS implementors

The IJG code is designed to work efficiently in 80x86 "small" or "medium" memory models (i.e., data pointers are 16 bits unless explicitly declared "far"; code pointers can be either size). You may be able to use small model to compile cjpeg or djpeg by itself, but you will probably have to use medium model for any larger application. This won't make much difference in performance. You *will* take a noticeable performance hit if you use a large-data memory model (perhaps 10%-25%), and you should avoid "huge" model

if at all possible.

The

JPEG library typically needs 2Kb-3Kb of stack space. It will also malloc about 20K-30K of near heap space while executing (and lots of far heap, but that doesn't count in this calculation). This figure will vary depending on selected operating mode, and to a lesser extent on image size. There is also about 5Kb-6Kb of constant data which will be allocated in the near data segment (about 4Kb of this is the error message table). Thus you have perhaps 20K available for other modules' static data and near heap space before you need to go to a larger memory model. The C library's static data will account for several K of this, but that still leaves a good deal for your needs. (If you are tight on space, you could reduce the sizes of the I/O buffers allocated by jdatasrc.c and jdatadst.c, say from 4K to 1K. Another possibility is to move the error message table to far memory; this should be doable with only localized hacking on jerror.c.)

About 2K of the near heap space is "permanent" memory that will not be released until you destroy the JPEG object. This is only an issue if you save a JPEG object between compression or decompression operations.

Far data space may also be a tight resource when you are dealing with large images. The most memory-intensive case is decompression with two-pass color quantization, or single-pass quantization to an externally supplied color map. This requires a 128Kb color lookup table plus strip buffers amounting to about 40 bytes per column for typical sampling ratios (eg, about 25600 bytes for a 640-pixel-wide image). You may not be able to process wide images if you have large data structures of your own.

Of course, all of these concerns vanish if you use a 32-bit flat-memory-model compiler, such as DJGPP or Watcom C. We highly recommend flat model if you can use it; the JPEG library is significantly faster in flat model.

Found in path(s):

* /jpeg-9c-tar-gz/jpeg-9c/libjpeg.txt

1.31 python-favicon 0.7.0

1.31.1 Available under license :

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1.32 python-soupsieve 2.0.1

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Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

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- b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.
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For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

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1.35 fuse 3.9.3

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1.40 dri2proto 2.8

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1.41 glproto 1.4.17

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1.44 mpdecimal 2.5.1

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1.45 libglvnd v1.3.4

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1.46 keyutils 1.6.1

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If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not

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5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.
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1.57 rand 0.8.5

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To do so, attach the following notices to the program. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the program's name and a brief idea of what it does.>
Copyright (C) 19yy <name of author>
```

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```
Gnomovision version 69, Copyright (C) 19yy name of author
Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c'
for details.
```

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w' and `show c'; they could even be mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the program
`Gnomovision' (which makes passes at compilers) written by James Hacker.
```


<signature of Ty Coon>, 1 April 1989

Ty Coon, President of Vice

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*/

// Original can be found at:

// <https://bitbucket.org/lindenlab/lld>

// Modifications by Joshua Bell inexorabletash@gmail.com

// <https://github.com/inexorabletash/polyfill>

// ES3/ES5 implementation of the Khronos Typed Array Specification

// Ref: <http://www.khronos.org/registry/typedarray/specs/latest/>

// Date: 2011-02-01

//

// Variations:

// * Allows typed_array.get/set() as alias for subscripts (typed_array[])

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'sources': ['<@(openssl_sources)', '<@(openssl_sources_BSD-x86)'],
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wcwidth.js: JavaScript Porting of Markus Kuhn's wcwidth() Implementation

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""

spdx-license-ids

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Installation

[Download JSON directly](https://raw.githubusercontent.com/shinnn/spdx-license-ids/master/index.json), or
[use](https://docs.npmjs.com/cli/install) [npm](https://docs.npmjs.com/about-npm/):

...

npm install spdx-license-ids

...

[Node.js](https://nodejs.org/) API

require('spdx-license-ids')

Type: `string[]`

All license IDs except for the currently deprecated ones.

```javascript

```
const ids = require('spdx-license-ids');
//=> ['0BSD', 'AAL', 'ADSL', 'AFL-1.1', 'AFL-1.2', 'AFL-2.0', 'AFL-2.1', 'AFL-3.0', 'AGPL-1.0-only', ...]

ids.includes('BSD-3-Clause'); //=> true
ids.includes('CC-BY-1.0'); //=>
true

ids.includes('GPL-3.0'); //=> false
```



```
require('spdx-license-ids/deprecated')
```


```

Type: `string[]`

Deprecated license IDs.

```
```javascript
const deprecatedIds = require('spdx-license-ids/deprecated');
//=> ['AGPL-1.0', 'AGPL-3.0', 'GFDL-1.1', 'GFDL-1.2', 'GFDL-1.3', 'GPL-1.0', 'GPL-2.0', ...]

deprecatedIds.includes('BSD-3-Clause'); //=> false
deprecatedIds.includes('CC-BY-1.0'); //=> false

deprecatedIds.includes('GPL-3.0'); //=> true
```
```

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}

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In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <http://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now		
PSF	yes			

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'openssl/crypto/md4/md4_one.c',
'openssl/crypto/md5/md5_dgst.c',
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'openssl/crypto/threads_win.c',
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'openssl/crypto/x509v3/v3_genn.c',
'openssl/crypto/x509v3/v3_ia5.c',
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'openssl/crypto/x509v3/v3_int.c',
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'openssl/crypto/x509v3/v3_pcia.c',
'openssl/crypto/x509v3/v3_pcons.c',
'openssl/crypto/x509v3/v3_pku.c',
'openssl/crypto/x509v3/v3_pmaps.c',
'openssl/crypto/x509v3/v3_prn.c',
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'./config/archs/BSD-x86_64/asm/crypto/aes/aesni-sha1-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/aes/aesni-sha256-x86_64.s',
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'./config/archs/BSD-x86_64/asm/crypto/aes/vpaes-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/bn/rsaz-avx2.s',
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'./config/archs/BSD-x86_64/asm/crypto/bn/x86_64-gf2m.s',
'./config/archs/BSD-x86_64/asm/crypto/bn/x86_64-mont.s',
'./config/archs/BSD-x86_64/asm/crypto/bn/x86_64-mont5.s',
'./config/archs/BSD-x86_64/asm/crypto/camellia/cml1-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/chacha/chacha-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/ec/ecp_nistz256-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/ec/x25519-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/md5/md5-x86_64.s',

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'./config/archs/BSD-x86_64/asm/crypto/modes/aesni-gcm-x86_64.s',
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'./config/archs/BSD-x86_64/asm/crypto/rc4/rc4-md5-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/rc4/rc4-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/sha/keccak1600-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/sha/sha1-mb-x86_64.s',
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'./config/archs/BSD-x86_64/asm/crypto/sha/sha256-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/sha/sha512-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/whrlpool/wp-x86_64.s',
'./config/archs/BSD-x86_64/asm/crypto/x86_64cpuid.s',
'./config/archs/BSD-x86_64/asm/engines/e_padlock-x86_64.s',
],
'openssl_defines_BSD-x86_64': [
'NDEBUG',
'L_ENDIAN',
'OPENSSL_PIC',
'OPENSSL_CPUID_OBJ',
'OPENSSL_IA32_SSE2',
'OPENSSL_BN_ASM_MONT',
'OPENSSL_BN_ASM_MONT5',
'OPENSSL_BN_ASM_GF2m',
'SHA1_ASM',
'SHA256_ASM',
'SHA512_ASM',
'KECCAK1600_ASM',
'RC4_ASM',
'MD5_ASM',
'AESNI_ASM',
'VPAES_ASM',
'GHASH_ASM',
'ECP_NISTZ256_ASM',
'X25519_ASM',
'POLY1305_ASM',
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'openssl_cflags_BSD-x86_64': [
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'-Wall -O3',
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'openssl_ex_libs_BSD-x86_64': [
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'./crypto',
'./crypto/include/internal',
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'libraries': ['<@(openssl_ex_libs_BSD-x86_64)'],
'sources': ['<@(openssl_sources)', '<@(openssl_sources_BSD-x86_64)'],
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'NDEBUG',
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'openssl_cflags_BSD-x86_64': [
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'openssl_ex_libs_BSD-x86_64': [
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'openssl_cli_srcs_BSD-x86_64': [

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'openssl/apps/asn1pars.c',
'openssl/apps/ca.c',
'openssl/apps/ciphers.c',
'openssl/apps/cms.c',
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'openssl/apps/dgst.c',
'openssl/apps/dhparam.c',
'openssl/apps/dsa.c',
'openssl/apps/dsaparam.c',
'openssl/apps/ec.c',
'openssl/apps/ecparam.c',
'openssl/apps/enc.c',
'openssl/apps/engine.c',
'openssl/apps/errstr.c',
'openssl/apps/gendsa.c',
'openssl/apps/genpkey.c',
'openssl/apps/genrsa.c',
'openssl/apps/nseq.c',
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'openssl/apps/spkac.c',
'openssl/apps/srp.c',
'openssl/apps/storeutl.c',
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'openssl/apps/verify.c',
'openssl/apps/version.c',
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'openssl/apps/app_rand.c',

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'openssl/apps/apps.c',
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'openssl/ssl/d1_lib.c',
'openssl/ssl/d1_msg.c',
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'openssl/ssl/packet.c',
'openssl/ssl/pqueue.c',
'openssl/ssl/record/dtls1_bitmap.c',

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'RC4_ASM',
'MD5_ASM',
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'variables': {
'openssl_defines_BSD-x86': [
'NDEBUG',
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'OPENSSL_CPUID_OBJ',
'OPENSSL_BN_ASM_PART_WORDS',
'OPENSSL_IA32_SSE2',
'OPENSSL_BN_ASM_MONT',
'OPENSSL_BN_ASM_GF2m',
'SHA1_ASM',
'SHA256_ASM',
'SHA512_ASM',
'RC4_ASM',
'MD5_ASM',
'RMD160_ASM',
'AESNI_ASM',
'VPAES_ASM',
```

```

'WHIRLPOOL_ASM',
'GHASH_ASM',
'ECP_NISTZ256_ASM',
'POLY1305_ASM',
],
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'-Wa,--noexecstack',
'-Wall -O3 -fomit-frame-pointer',
'-pthread',
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'-pthread',
],
'openssl_cli_srcs_BSD-x86': [
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'openssl/apps/ca.c',
'openssl/apps/ciphers.c',
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```

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'openssl/apps/opt.c',
'openssl/apps/s_cb.c',
'openssl/apps/s_socket.c',
],
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'include_dirs': [
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],
'cflags' : ['<@(openssl_cflags_BSD-x86)'],
'libraries': ['<@(openssl_ex_libs_BSD-x86)'],
'sources': ['<@(openssl_cli_srcs_BSD-x86)'],
}

```

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validate-npm-package-license

=====

Give me a string and I'll tell you if it's a valid npm package license string.

```
```javascript
var valid = require('validate-npm-package-license');
```
```

SPDX license identifiers are valid license strings:

```
```javascript

var assert = require('assert');
var validSPDXExpression = {
 validForNewPackages: true,
 validForOldPackages: true,
 spdx: true
};

assert.deepEqual(valid('MIT'), validSPDXExpression);
assert.deepEqual(valid('BSD-2-Clause'), validSPDXExpression);
assert.deepEqual(valid('Apache-2.0'), validSPDXExpression);
assert.deepEqual(valid('ISC'), validSPDXExpression);
```
```

The function will return a warning and suggestion for nearly-correct license identifiers:

```
```javascript
assert.deepEqual(
 valid('Apache 2.0'),
 {
 validForOldPackages: false,
 validForNewPackages: false,
 warnings: [
 'license should be ' +
 'a valid SPDX license expression (without "LicenseRef"), ' +
 '"UNLICENSED", or ' +
 '"SEE LICENSE IN <filename>"',
 'license is similar to the valid expression "Apache-2.0"'
]
 }
);
```
```

SPDX expressions are valid, too ...

```
```javascript
// Simple SPDX license expression for dual licensing
assert.deepEqual(
 valid('(GPL-3.0-only OR BSD-2-Clause)'),
 validSPDXExpression
);
```
```

... except if they contain `LicenseRef`:

```
```javascript
var warningAboutLicenseRef = {
 validForOldPackages: false,
 validForNewPackages: false,
 spdx: true,
 warnings: [
 'license should be ' +
 'a valid SPDX license expression (without "LicenseRef"), ' +
 '"UNLICENSED", or ' +
 '"SEE LICENSE IN <filename>"',
]
};

assert.deepEqual(
 valid('LicenseRef-Made-Up'),
 warningAboutLicenseRef
);

assert.deepEqual(
 valid('(MIT OR LicenseRef-Made-Up)'),
 warningAboutLicenseRef
);
```
```

If you can't describe your licensing terms with standardized SPDX identifiers, put the terms in a file in the package and point users there:

```
```javascript
assert.deepEqual(
 valid('SEE
 LICENSE IN LICENSE.txt'),
 {
 validForNewPackages: true,
 validForOldPackages: true,
 inFile: 'LICENSE.txt'
 }
);
```
```

```

    }
  );

  assert.deepEqual(
    valid('SEE LICENSE IN license.md'),
    {
      validForNewPackages: true,
      validForOldPackages: true,
      inFile: 'license.md'
    }
  );
  ...

```

If there aren't any licensing terms, use `UNLICENSED`:

```

```javascript
var unlicensed = {
 validForNewPackages: true,
 validForOldPackages: true,
 unlicensed: true
};
assert.deepEqual(valid('UNLICENSED'), unlicensed);
assert.deepEqual(valid('UNLICENSED'), unlicensed);
...

```

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'variables': {
'openssl_sources': [
'openssl/ssl/bio_ssl.c',
'openssl/ssl/d1_lib.c',
'openssl/ssl/d1_msg.c',
'openssl/ssl/d1_srtp.c',
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zlib.h -- interface  
of the 'zlib' general purpose compression library  
version 1.2.8, April 28th, 2013

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## 1.60 mtr 0.94

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## 1.61 libqrencode 3.4.1

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 8efd98903fca507e58144865d26c47c91565bb55/quickjs/libregexp.c  
 \* /quickjspp-8efd98903fca507e58144865d26c47c91565bb55-tar-gz/quickjspp-

8efd98903fca507e58144865d26c47c91565bb55/quickjs/libregex.h  
\* /quickjspp-8efd98903fca507e58144865d26c47c91565bb55-tar-gz/quickjspp-  
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## 1.65 wayland-ivi-extension r32-l4t-cisco.12

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## 1.76 libconfig 1.7.3

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

### 3. You may opt to apply the terms of the ordinary GNU General Public

License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library".

The executable is therefore covered by this License.  
Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6.

Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

- d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed

(in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

- a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.
- b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

8. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

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Ty Coon, President of Vice

That's all there is to it!

Format: <http://www.debian.org/doc/packaging-manuals/copyright-format/1.0/>

Upstream-Name: ls-config

Source: <https://github.com/lucas-net-pl/ls-config>

Files: \*

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Files: debian/\*

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Public License version 2 can be found in "/usr/share/common-licenses/GPL-2".

# Please also look if there are files or directories which have a

# different copyright/license attached and list them here.

# Please avoid to pick license terms that are more restrictive than the

# packaged work, as it may make Debian's contributions unacceptable upstream.

@c \input texinfo.tex @c -\*-texinfo-\*-

@c

@c %\*\*start of header

@c All text is ignored before the setfilename.

@setfilename LGPL.info

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@center Version 2.1, February 1999

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@center Preamble

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it too, but we suggest you first think carefully about whether this  
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For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library. Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the ``Lesser'' General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an

advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a ``work based on the library" and a ``work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

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@center TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

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This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called ``this License"). Each licensee is addressed as ``you".

A ``library" means a collection of software functions and/or data

prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The ``Library'', below, refers to any such software library or work which has been distributed under these terms. A ``work based on the Library'' means either the Library or any derivative work under copyright law: that is to say, a work containing  
the Library or a portion of it, either  
verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term ``modification".)

``Source code'' for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

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You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

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You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

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The modified work must itself be a software library.

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You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

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You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

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If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

@end enumerate

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

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Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

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A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a ``work that uses the Library''. Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.



However, linking a ``work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a ``work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a ``work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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As an exception to the Sections above, you may also combine or link a ``work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

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Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable ``work that uses the Library'', as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

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Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

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Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

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If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

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Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

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For an executable, the required form of the ``work that uses the Library'' must include any data and utility programs needed for reproducing the executable from

it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler,

kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

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Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

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* Define compile time symbols for CPU type and operating system type.
* This file should only contain preprocessor commands so that
* there are no dependencies on other files.
*
* cpuopsys.h
*
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*/
```

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```

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 */
```

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`*/libnvdc-r32-l4t-cisco-3-tar-gz/nvdc/nvdc_headers/include/p4-mirror/sdk/nvidia/inc/xapi-sdk.h`

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 */
/**
 * NvColorDataType defines the data type of color components.
 *
 * The default datatype of color components is 'Integer' which should be used
 * when the color value is to be interpreted as an integer value ranging from 0
 * to the maximum value representable by the width of the components (as
 * specified by the packing of the component). Use 'Integer' also when the
 * interpretation of color value bits is not known, does not matter or is
 * context dependent.
```

```

*
* A data type
of 'Signed' indicates that the color value is to be interpreted
* as a signed two's complement integer value. The width of the component
* includes the sign bit (e.g. S8 ranges from -128 to 127).
*
* A data type of 'Float' indicates that float values are stored in the
* components of the color. The combination of data type 'Float' and the
* bit width of the component packing defines the final data format of the
* individual component.
*
* The list below defines the accepted combinations, when adding new
* float formats please add an entry into this list.
*
* - DataType = Float, Component bit width = 32:
* A IEEE 754 single precision float (binary32) with 1 sign bit,
* 8 exponent bits and 23 mantissa bits.
*
* - DataType = Float, Component bit width = 16:
* A IEEE 754 half precision float (binary16) with 1 sign bit,
* 5 exponent bits and 10 mantissa bits.
*
* - DataType = Float, Component bit width = 10:
* An unsigned nvfloat with 5 exponent
bits and 5 mantissa bits.
*
* - DataType = Float, Component bit width = 11:
* An unsigned nvfloat with 5 exponent bits and 6 mantissa bits.
*
* - DataType = FloatISP, Component bit width = 16:
* A Nvidia proprietary Floating point representation for optimal
* usage in ISP, with 4 exponent bits and 12 mantissa bits.
*/

```

Found in path(s):

```

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```

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bzip2/libbzip2 version 1.0.4 of 20 December 2006

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# 1.86 libdrm 2.4.109-cisco

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 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/amdgpu\_test.c  
 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/bo\_tests.c  
 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/amdgpu\_test.h

\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/cs\_tests.c

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/freedreno\_bo.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/freedreno\_drmif.h  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/freedreno\_pipe.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/freedreno\_ringbuffer.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/freedreno\_ringbuffer.h  
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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/libkms/intel.c  
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\* Keith Whitwell <keith@tungstengraphics.com>

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/vce\_ib.h

\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/vce\_tests.c

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\*

\* Authors:

\* Ben Widawsky <ben@bwidawsk.net>

\*

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tegra/tegra.c  
 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tegra/private.h  
 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tegra/tegra.h

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/\* xf86drmHash.c -- Small hash table support for integer -> integer mapping

\* Created: Sun Apr 18 09:35:45 1999 by faith@precisioninsight.com

\*

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\*

\* Authors: Rickard E. (Rik) Faith <faith@valinux.com>

\*

\* DESCRIPTION

```

*
* This file contains a straightforward implementation of a fixed-sized
* hash table using self-organizing linked lists [Knuth73, pp. 398-399] for
* collision resolution. There are two potentially interesting things
* about this implementation:
*
* 1) The table is power-of-two sized. Prime sized tables are more
* traditional, but do not have a significant advantage over power-of-two
* sized table, especially when double hashing is not used for collision
* resolution.
*
* 2) The hash computation
 uses a table of random integers [Hanson97,
* pp. 39-41].
*
* FUTURE ENHANCEMENTS
*
* With a table size of 512, the current implementation is sufficient for a
* few hundred keys. Since this is well above the expected size of the
* tables for which this implementation was designed, the implementation of
* dynamic hash tables was postponed until the need arises. A common (and
* naive) approach to dynamic hash table implementation simply creates a
* new hash table when necessary, rehashes all the data into the new table,
* and destroys the old table. The approach in [Larson88] is superior in
* two ways: 1) only a portion of the table is expanded when needed,
* distributing the expansion cost over several insertions, and 2) portions
* of the table can be locked, enabling a scalable thread-safe
* implementation.
*
* REFERENCES
*
* [Hanson97] David R. Hanson. C Interfaces and Implementations:
* Techniques for Creating Reusable Software. Reading, Massachusetts:
* Addison-Wesley, 1997.
*
* [Knuth73] Donald E. Knuth. The Art of Computer Programming. Volume 3:
* Sorting and Searching. Reading, Massachusetts: Addison-Wesley, 1973.
*
* [Larson88] Per-Ake Larson. "Dynamic Hash Tables". CACM 31(4), April
* 1988, pp. 446-457.
*
*/

```

Found in path(s):

```

* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/hash.c
* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/xf86drmHash.c

```

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/modetest/meson.build

\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/radeon/meson.build

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/intel/meson.build

\*

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/radeon/meson.build

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/tegra/meson.build

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/data/meson.build

\*

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/meson.build

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/man/meson.build

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/modeprint/meson.build  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/meson.build  
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 \*  
 \* AFBC is a proprietary lossless image compression protocol and format.  
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 \* transferred between IP blocks.  
 \*  
 \* AFBC has several features which may be supported and/or used, which are

- \* represented using bits in the modifier. Not all combinations are valid,
- \* and different devices or use-cases may support different combinations.
- \*
- \* Further information on the use of AFBC modifiers can be found in
- \* Documentation/gpu/afbc.rst
- \*/
- /\*
- \* Arm Fixed-Rate Compression (AFRC) modifiers
- \*
- \* AFRC is a proprietary fixed rate image compression protocol and format,
- \* designed to provide guaranteed bandwidth and memory footprint
- \* reductions
- in graphics and media use-cases.
- \*
- \* AFRC buffers consist of one or more planes, with the same components
- \* and meaning as an uncompressed buffer using the same pixel format.
- \*
- \* Within each plane, the pixel/luma/chroma values are grouped into
- \* "coding unit" blocks which are individually compressed to a
- \* fixed size (in bytes). All coding units within a given plane of a buffer
- \* store the same number of values, and have the same compressed size.
- \*
- \* The coding unit size is configurable, allowing different rates of compression.
- \*
- \* The start of each AFRC buffer plane must be aligned to an alignment granule which
- \* depends on the coding unit size.
- \*
- \* Coding Unit Size    Plane Alignment
- \* -----    -----
- \* 16 bytes            1024 bytes
- \* 24 bytes            512 bytes
- \* 32 bytes            2048 bytes
- \*
- \* Coding units are grouped into paging tiles. AFRC buffer dimensions must be aligned
- \* to a multiple of the paging tile dimensions.
- \* The dimensions
- of each paging tile depend on whether the buffer is optimised for
- \* scanline (SCAN layout) or rotated (ROT layout) access.
- \*
- \* Layout    Paging Tile Width    Paging Tile Height
- \* -----    -----    -----
- \* SCAN    16 coding units    4 coding units
- \* ROT    8 coding units    8 coding units
- \*
- \* The dimensions of each coding unit depend on the number of components
- \* in the compressed plane and whether the buffer is optimised for
- \* scanline (SCAN layout) or rotated (ROT layout) access.
- \*



```

* Number of Components in Plane Layout Coding Unit Width Coding Unit Height
* -----
* 1 SCAN 16 samples 4 samples
* Example: 16x4 luma samples in a 'Y' plane
* 16x4 chroma 'V' values, in the 'V' plane of a fully-planar YUV buffer
* -----
* 1
* ROT 8 samples 8 samples
* Example: 8x8 luma samples in a 'Y' plane
* 8x8 chroma 'V' values, in the 'V' plane of a fully-planar YUV buffer
* -----
* 2 DONT CARE 8 samples 4 samples
* Example: 8x4 chroma pairs in the 'UV' plane of a semi-planar YUV buffer
* -----
* 3 DONT CARE 4 samples 4 samples
* Example: 4x4 pixels in an RGB buffer without alpha
* -----
* 4 DONT CARE 4 samples 4 samples
* Example: 4x4 pixels in an RGB buffer with alpha
*/
/*
* Amlogic Video Framebuffer Compression modifiers
*
* Amlogic uses a proprietary lossless image compression protocol and format
* for their hardware video codec accelerators, either video decoders or
* video input encoders.
*
* It considerably reduces memory bandwidth while writing and reading
* frames in memory.
*
* The underlying storage is considered to be 3 components, 8bit or 10-bit
* per component YCbCr 420, single plane :
* - DRM_FORMAT_YUV420_8BIT
* - DRM_FORMAT_YUV420_10BIT
*
* The first 8 bits of the mode defines the layout, then the following 8 bits
* defines the options changing the layout.
*
* Not all combinations are valid, and different SoCs may support different
* combinations of layout and options.
*/
/*
* 64K_S is the same for GFX9/GFX10/GFX10_RBPLUS and hence has GFX9 as canonical
* version.
*/

```

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```
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 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/radeon/bof.c

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The release criteria for libdrm is essentially "if you need a release, make one". There is no designated release engineer or maintainer. Anybody is free to make a release if there's a certain feature or bug fix they need in a released version of libdrm.

When new ioctl definitions are merged into drm-next, we will add support to libdrm, at which point we typically create a new release. However, this is up to whoever is driving the feature in question.

Follow these steps to release a new version of libdrm:

1) Bump the version number in meson.build. We seem to have settled for 2.4.x as the versioning scheme for libdrm, so just bump the micro version.

2) Run `ninja -C builddir/ dist` to generate the tarballs.  
 Make sure that the version number of the tarball name in builddir/meson-dist/ matches the number you bumped to. Move that tarball to the libdrm repo root for the release script to pick up.

3) Push the updated master branch with the bumped version number:

git push origin master

assuming the remote for the upstream libdrm repo is called origin.

4) Use the release.sh script from the xorg/util/modular repo to upload the tarballs to the freedesktop.org download area and

create an announce email template. The script takes one argument:  
the path to the libdrm checkout. So, if a checkout of modular is  
at the same level than the libdrm repo:

```
./modular/release.sh libdrm
```

This copies the two tarballs to freedesktop.org and creates  
libdrm-2.4.16.announce which has a detailed summary of the  
changes, links to the tarballs, MD5 and SHA1 sums and pre-filled  
out email headers. Fill out the blank between the email headers  
and the list of changes with a brief message of what changed or  
what prompted this release. Send out the email and you're done!

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* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/RELEASING
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* Authors:
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* Christian Gmeiner <christian.gmeiner@gmail.com>
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Found in path(s):

```
* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/etnaviv/etnaviv_pipe.c
```

```
* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/etnaviv/etnaviv_priv.h
```

```
* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/etnaviv/etnaviv_2d_test.c
```

\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/etnaviv/etnaviv\_cmd\_stream.c

\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/etnaviv/etnaviv\_drmif.h

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/\* exynos.c

\*

\* Copyright 2009 Samsung Electronics Co., Ltd.

\* Authors:

\* SooChan Lim <sc1.lim@samsung.com>

\* Sangjin LEE <lsj119@samsung.com>

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/\* drmsl.c -- Skip list test

\* Created: Mon May 10 09:28:13 1999 by faith@precisioninsight.com

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 \* Authors: Rickard E. (Rik) Faith <faith@valinux.com>  
 \*  
 \* DESCRIPTION  
 \*  
 \* This file contains a straightforward skip list implementation.n  
 \*  
 \* FUTURE ENHANCEMENTS  
 \*  
 \* REFERENCES  
 \*  
 \* [Pugh90] William Pugh. Skip Lists: A Probabilistic Alternative to  
 \* Balanced Trees. CACM 33(6), June 1990, pp. 668-676.  
 \*  
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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/drmsl.c

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/decode\_messages.h  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/amdgpu/amdgpu\_vm.c

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/ttmtest/src/xf86dri.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/ttmtest/src/xf86dristr.h

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\* DRM based mode setting test program

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\* Jesse Barnes <jesse.barnes@intel.com>

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/modetest/modetest.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/modetest/buffers.h

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 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/amdgpu/amdgpu\_device.c  
 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/amdgpu/amdgpu.h  
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- common.xml ( 20583 bytes, from 2016-09-06 14:14:12)

- state\_hi.xml ( 25653 bytes, from 2016-09-06 14:45:17)

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Contributing to libdrm

=====

Submitting Patches

-----

Patches should be sent to [dri-devel@lists.freedesktop.org](mailto:dri-devel@lists.freedesktop.org), using git send-email. For patches only touching driver specific code one of the driver mailing lists (like [amd-gfx@lists.freedesktop.org](mailto:amd-gfx@lists.freedesktop.org)) is also appropriate. See git documentation for help:

<http://git-scm.com/documentation>

Since dri-devel is a very busy mailing list please use `--subject-prefix="PATCH libdrm"` to make it easier to find libdrm patches. This is best done by running

```
git config --local format.subjectprefix "PATCH libdrm"
```

The first line of a commit message should contain a prefix indicating what part is affected by the patch followed by one sentence that describes the change. For examples:

```
amdgpu: Use uint32_t i in amdgpu_find_bo_by_cpu_mapping
```

The body of the commit message should describe what the patch changes and why, and also note any particular side effects. For a recommended reading on writing commit messages, see:

<http://who-t.blogspot.de/2009/12/on-commit-messages.html>

Your patches should also include a Signed-off-by line with your name and email address. If you're not the patch's original author, you should also gather S-o-b's by them (and/or whomever gave the patch to you.) The significance of this is that it certifies that you created the patch, that it was created under an appropriate open source license, or provided to you under those terms. This lets us indicate a chain of responsibility for the copyright status of the code. For more details:

<https://developercertificate.org/>

We won't reject patches that lack S-o-b, but it is strongly recommended.

## Review and Merging

-----

Patches should have at least one positive review (Reviewed-by: tag) or indication of approval (Acked-by: tag) before merging. For any code shared between drivers this is mandatory.

Please note that kernel/userspace API header files have special rules, see [include/drm/README](#).

Coding style in the project loosely follows the CodingStyle of the linux kernel:

<https://www.kernel.org/doc/html/latest/process/coding-style.html?highlight=coding%20style>

## Commit Rights

-----

Commit rights will be granted to anyone who requests them and fulfills the below criteria:

- Submitted a few (5-10 as a rule of thumb) non-trivial (not just simple spelling fixes and whitespace adjustment) patches that have been merged already. Since libdrm is just a glue library between the kernel and userspace drivers, merged patches to those components also count towards the commit criteria.
- Are actively participating on discussions about their work (on the mailing list or IRC). This should not be interpreted as a requirement to review other peoples patches but just make sure that patch submission isn't one-way communication. Cross-review is still highly encouraged.
- Will be regularly contributing further patches. This includes regular contributors to other parts of the open source graphics stack who only do the oddball rare patch within libdrm itself.
- Agrees to use their commit rights in accordance with the documented merge criteria, tools, and processes.

To apply for commit rights ("Developer" role in gitlab) send a mail to [dri-devel@lists.freedesktop.org](mailto:dri-devel@lists.freedesktop.org) and please ping the maintainers if your request is stuck.

Committers are encouraged to request their commit rights get removed when they no longer contribute to the project. Commit rights will be reinstated when they come back to the project.

Maintainers and committers should encourage contributors to request commit rights, as especially junior contributors tend to underestimate their skills.

## Code of Conduct

-----

Please be aware the fd.o Code of Conduct also applies to libdrm:

<https://www.freedesktop.org/wiki/CodeOfConduct/>

See the gitlab project owners for contact details of the libdrm maintainers.

Abuse of commit

rights, like engaging in commit fights or willfully pushing patches that violate the documented merge criteria, will also be handled through the Code of Conduct enforcement process.

Happy hacking!

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/syncobj\_tests.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/ras\_tests.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/amdgpu/deadlock\_tests.c  
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 * /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/exynos/exynos_fimg2d.h
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* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/xf86drmMode.h
* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/xf86drmMode.c

```

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 */
```

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/tests/exynos/exynos\_fimg2d\_perf.c

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\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/kgsl/kgsl\_pipe.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/msm/msm\_device.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/kgsl/kgsl\_bo.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/kgsl/kgsl\_ringbuffer.c  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/msm/msm\_priv.h  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/msm/msm\_ringbuffer.c

\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/msm/msm\_pipe.c  
\*  
/mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/kgsl/kgsl\_priv.h  
\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/freedreno/kgsl/kgsl\_device.c  
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```

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*
* Authors: Rickard E. (Rik) Faith <faith@valinux.com>
*
* DESCRIPTION
*
* This file contains a straightforward skip list implementation.n
*
* FUTURE ENHANCEMENTS
*
* REFERENCES
*
* [Pugh90] William Pugh. Skip Lists: A Probabilistic Alternative to
* Balanced Trees. CACM 33(6), June 1990, pp. 668-676.
*
*/

```

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```

* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/xf86drmSL.c

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 \*  
 \* Authors: Ben Skeggs  
 \*/

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 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/nouveau/pushbuf.c  
 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/nouveau/bufctx.c  
 \* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/nouveau/abi16.c

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```
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\*  
 \* Authors: Rickard E. (Rik) Faith <faith@valinux.com>  
 \*  
 \* DESCRIPTION  
 \*  
 \* This file contains a simple, straightforward implementation of the Park  
 \* & Miller "Minimal Standard" PRNG [PM88, PMS93], which is a Lehmer  
 \* multiplicative linear congruential generator (MLCG) with a period of  
 \*  $2^{31}-1$ .  
 \*  
 \* This implementation is intended to provide a reliable, portable PRNG  
 \* that is suitable for testing a hash table implementation and for  
 \* implementing skip lists.  
 \*  
 \* FUTURE ENHANCEMENTS  
 \*  
 \* If initial seeds are not selected randomly, two instances of the PRNG  
 \* can be correlated.  
 \* [Knuth81, pp. 32-33] describes a shuffling technique  
 \* that can eliminate this problem.  
 \*  
 \* If PRNGs are used for simulation, the period of the current  
 \* implementation may be too short. [LE88] discusses methods of combining  
 \* MLCGs to produce much longer periods, and suggests some alternative  
 \* values for A and M. [LE90 and Sch92] also provide information on  
 \* long-period PRNGs.  
 \*  
 \* REFERENCES  
 \*  
 \* [Knuth81] Donald E. Knuth. The Art of Computer Programming. Volume 2:  
 \* Seminumerical Algorithms. Reading, Massachusetts: Addison-Wesley, 1981.  
 \*  
 \* [LE88] Pierre L'Ecuyer. "Efficient and Portable Combined Random Number  
 \* Generators". CACM 31(6), June 1988, pp. 742-774.  
 \*  
 \* [LE90] Pierre L'Ecuyer. "Random Numbers for Simulation". CACM 33(10,  
 \* October 1990, pp. 85-97.  
 \*  
 \* [PM88] Stephen K. Park and Keith W. Miller. "Random Number Generators:  
 \* Good Ones are Hard to Find". CACM 31(10), October 1988, pp. 1192-1201.  
 \*  
 \* [Sch92] Bruce Schneier. "Pseudo-Ransom Sequence  
 \* Generator for 32-Bit  
 \* CPUs". Dr. Dobbs's Journal 17(2), February 1992, pp. 34, 37-38, 40.  
 \*  
 \* [PMS93] Stephen K. Park, Keith W. Miller, and Paul K. Stockmeyer. In  
 \* "Technical Correspondence: Remarks on Choosing and Implementing Random  
 \* Number Generators". CACM 36(7), July 1993, pp. 105-110.



\*  
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Found in path(s):

\* /mesa-drm-libdrm-2-4-109-tar-gz/mesa-drm-libdrm-2.4.109/xf86drmRandom.c

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Mathieu Desnoyers

September 26, 2010

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## 1.97 e2fsprogs 1.42.13

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Index: tdbsa/tdb.c

=====

--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

\*/

/\*

- Unix SMB/CIFS implementation.
- + trivial database library - standalone version
- trivial database library - private includes
- 
- Copyright (C) Andrew Tridgell           2005
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Gadi Oxman, August 1995

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#

# This is a Makefile stub which handles the creation of BSD shared

```

libraries.
#
In order to use this stub, the following makefile variables must be defined.
#
BSDLIB_VERSION = 1.0
BSDLIB_IMAGE = libce
BSDLIB_MYDIR = et
BSDLIB_INSTALL_DIR = $(SHLIBDIR)
#

all:: image

real-subdirs:: Makefile
@echo " MKDIR pic"
@mkdir -p pic

BSD_LIB = $(BSDLIB_IMAGE).so.$(BSDLIB_VERSION)
BSDLIB_PIC_FLAG = -fpic

image: $(BSD_LIB)

$(BSD_LIB): $(OBJS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LDFLAGS) $(OBJS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;`/$(BSD_LIB) $(BSD_LIB))

install-shlibs install:: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LDCONFIG)

install-strip: install

install-shlibs-strip: install-shlibs

uninstall-shlibs uninstall::
$(RM) -f $(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)

clean::
$(RM)
-rf pic
$(RM) -f $(BSD_LIB)
$(RM) -f ../$(BSD_LIB)

```

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Theodore Ts'o  
23-June-2007

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```
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Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

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Ty Coon, President of Vice

@end smallexample

That's all there is to it!

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Mesa 3-D graphics library

Version: 7.0

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# 1.106 digest 0.10.7

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## 1.109 generic-array 0.14.7

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## 1.112 block-buffer 0.10.4

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Jean-loup Gailly      Mark Adler  
jloup@gzip.org      madler@alumni.caltech.edu  
/\* zlib.h -- interface of the 'zlib' general purpose compression library  
version 1.3.1, January 22nd, 2024

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The data format used by the zlib library is described by RFCs (Request for Comments) 1950 to 1952 in the files <http://tools.ietf.org/html/rfc1950> (zlib format), rfc1951 (deflate format) and rfc1952 (gzip format).

\*/

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```
/* gzlib.c -- zlib functions common to reading and writing gzip files
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*/
```

## 1.118 busybox 1.36.1

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bzip2/libbzip2 version 1.0.4 of 20 December 2006

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If the program is interactive, make it output a short notice

like this

when it starts in an interactive mode:

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<signature of Ty Coon>, 1 April 1989

Ty Coon, President of  
Vice

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# 1.119 glibc2 2.38

## 1.119.1 Available under license :

@c The GNU Lesser General Public License.

@center Version 2.1, February 1999

@c This file is intended to be included within another document,

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same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

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``Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means



all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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@item

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Otherwise,  
if the work is a derivative of the Library, you may  
distribute the object code for the work under the terms of Section 6.  
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@item

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copyright notice for the Library among them, as well as a reference  
directing the user to the copy of  
this License. Also, you must do one  
of these things:

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library already present on the user's computer system, rather than  
copying library functions into the executable,  
and (2) will operate  
properly with a modified version of the library, if the user installs  
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@subheading END OF TERMS AND CONDITIONS

@page

@subheading How to Apply These Terms to Your New Libraries

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```
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```
@end
smallexample
```

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```
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`Frob' (a library for tweaking knobs) written by James Random Hacker.
```

```
@var{signature of Ty Coon}, 1 April 1990
Ty Coon, President of Vice
@end smallexample
```

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```
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```

```
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# 1.135 protobuf 26.1

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- \* Small patch to handle trailing slashes in --proto\_path flag.

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- \* Small patch to fix Python CallMethod().

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- \* Small optimizations to Python serialization.

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- \* VI syntax highlighting tweaks.
- \* Fix compiler to not make output executable.

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- \* Heuristic detection of sub-messages when printing unknown fields in text format.

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- \* Added @Override annotation to generated Java code where appropriate.

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- \* Tru64 support.

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- \* Solaris 10 + Sun Studio fixes.

Alek Storm <alek.storm@gmail.com>

- \* Slicing support for repeated scalar fields for the Python API.

Oleg Smolsky <oleg.smolsky@gmail.com>

- \* MS Visual Studio error format option.
- \* Detect unordered\_map in stl\_hash.m4.

Brian Olson <brianolson@google.com>

- \* gzip/zlib I/O support.

Michael Poole <mdpooles@troilus.org>

- \* Fixed warnings about generated constructors not explicitly initializing all fields (only present with certain compiler settings).
- \* Added generation of field number constants.

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- \* Fixed initialization ordering problem in logging code.

Will Pierce <willp@nuclei.com>

- \* Small patch improving performance of in Python serialization.

Alexandre Vassalotti <alexandre@peadrop.com>

- \* Emacs mode for Protocol Buffers (editors/protobuf-mode.el).

Scott Stafford <scott.stafford@gmail.com>

- \* Added Swap(), SwapElements(), and RemoveLast() to Reflection interface.

Alexander Melnikov <alm@sibmail.ru>

- \* HPUX support.

Oliver Jowett <oliver.jowett@gmail.com>

- \* Detect whether zlib is new enough in configure script.
- \* Fixes for Solaris 10 32/64-bit confusion.

Evan Jones <evanj@mit.edu>

- \* Optimize Java serialization code when writing a small message to a stream.
- \* Optimize Java serialization of strings so that UTF-8 encoding happens only once per string per serialization call.
- \* Clean up some Java warnings.
- \* Fix bug with permanent callbacks that delete themselves when run.

Michael Kucharski <m.kucharski@gmail.com>

- \* Added CodedInputStream.getTotalBytesRead().

Kacper Kowalik <xarthisius.kk@gmail.com>

- \* Fixed m4/acx\_pthread.m4 problem for some Linux distributions.

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- \* Fixed detection of sched\_yield on Solaris.
- \* Added atomicops for Solaris

Andrew Paprocki <andrew@ishiboo.com>

- \* Fixed minor IBM xLC compiler build issues
- \* Added atomicops for AIX (POWER)

Nipunn Koorapati <nipunn1313@gmail.com>

- \* Provide a type alias field ValueType on EnumTypeWrapper
- \* Match service argument names to abstract interface

# 1.136 libgpiod 2.1.1

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## 1.140 libjpeg 9f

### 1.140.1 Available under license :

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```
/*
 * jerror.h
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * Modified 1997-2018 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file defines the error and message codes for the JPEG library.
 * Edit this file to add new codes, or to translate the message strings to
 * some other language.
 * A set of error-reporting macros are defined too. Some applications using
 * the JPEG library may wish to include this file to get the error codes
 * and/or the macros.
 */
```

Found in path(s):

```
* /jpeg9f-zip/jpeg-9f/jerror.h
```

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```
/*
 * jmemmac.c
 *
 * Copyright (C) 1992-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * jmemmac.c provides an Apple Macintosh implementation of the system-
 * dependent portion of the JPEG memory manager.
 *
 * If you use jmemmac.c, then you must define USE_MAC_MEMMGR in the
 * JPEG_INTERNALS part of jconfig.h.
```

```

*
* jmemmac.c uses the Macintosh toolbox routines NewPtr and DisposePtr
* instead of malloc and free. It accurately determines the amount of
* memory available by using CompactMem. Notice that if left to its
* own devices, this code can chew up all available space in the
* application's zone, with the exception of the rather small "slop"
* factor computed in jpeg_mem_available(). The application can ensure
* that more space is left over by reducing max_memory_to_use.
*
* Large images
 are swapped to disk using temporary files and System 7.0+'s
* temporary folder functionality.
*
* Note that jmemmac.c depends on two features of MacOS that were first
* introduced in System 7: FindFolder and the FSSpec-based calls.
* If your application uses jmemmac.c and is run under System 6 or earlier,
* and the jpeg library decides it needs a temporary file, it will abort,
* printing error messages about requiring System 7. (If no temporary files
* are created, it will run fine.)
*
* If you want to use jmemmac.c in an application that might be used with
* System 6 or earlier, then you should remove dependencies on FindFolder
* and the FSSpec calls. You will need to replace FindFolder with some
* other mechanism for finding a place to put temporary files, and you
* should replace the FSSpec calls with their HFS equivalents:
*
* FSpDelete -> HDelete
* FSpGetFInfo -> HGetFInfo
* FSpCreate -> HCreate
* FSpOpenDF -> HOpen
* *** Note: not HOpenDF ***
* FSMakeFSSpec -> (fill in spec by hand.)
*
* (Use HOpen instead of HOpenDF. HOpen is just a glue-interface to PBHOpen,
* which is on all HFS macs. HOpenDF is a System 7 addition which avoids the
* ages-old problem of names starting with a period.)
*
* Contributed by Sam Bushell (jsam@iagu.on.net) and
* Dan Gildor (gyld@in-touch.com).
*/

```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jmemmac.c
```

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```
/*
```

```
* rdswitch.c
```

```
*
```

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- \* Modified 2003-2020 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains routines to process some of cjpeg's more complicated
- \* command-line switches. Switches processed here are:
- \* -qtables file Read quantization tables from text file
- \* -scans file Read scan script from text file
- \* -quality N[,N,...] Set quality ratings
- \* -qslots N[,N,...] Set component quantization table selectors
- \* -sample HxV[,HxV,...] Set component sampling factors
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/rdswitch.c

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```
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 *
 * This file contains routines to write output images in Microsoft "BMP"
 * format (MS Windows 3.x and OS/2 1.x flavors).
 * Either 8-bit colormapped or 24-bit full-color format can be written.
 * No compression is supported.
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume output to
 * an ordinary stdio stream.
 *
 * This code contributed by James Arthur Boucher.
 */
```

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/wrbmp.c

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```
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 * ckconfig.c
 *
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```

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/ckconfig.c

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/\*

\* jmemdos.c

\*

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\*

\* This file provides an MS-DOS-compatible implementation of the system-

\* dependent portion of the JPEG memory manager. Temporary data can be

\* stored in extended or expanded memory as well as in regular DOS files.

\*

\* If you use this file, you must be sure that NEED\_FAR\_POINTERS is defined

\* if you compile in a small-data memory model; it should NOT be defined if

\* you use a large-data memory model. This file is not recommended if you

\* are using a flat-memory-space 386 environment such as DJGCC or Watcom C.

\* Also, this code will NOT work if struct fields are aligned on greater than

\* 2-byte boundaries.

\*

\* Based on code contributed by Ge' Weijers.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jmemdos.c

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/\*

\* djpeg.c

\*

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\*

\* This file contains a command-line user interface for the JPEG decompressor.

\* It should work on any system with Unix- or MS-DOS-style command lines.

\*

\* Two different command line styles are permitted, depending on the

\* compile-time switch TWO\_FILE\_COMMANDLINE:

\* djpeg [options] inputfile outputfile

\* djpeg [options] [inputfile]

\* In the second style, output is always to standard output, which you'd

\* normally redirect to a file or pipe to some other program. Input is



- \* either from a named file or from standard input (typically redirected).
- \* The second style is convenient on Unix but is unhelpful on systems that
- \* don't support pipes. Also, you MUST use the
- first style if your system
- \* doesn't do binary I/O to stdin/stdout.
- \* To simplify script writing, the "-outfile" switch is provided. The syntax
- \* djpeg [options] -outfile outputfile inputfile
- \* works regardless of which command line style is used.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/djpeg.c

No license file was found, but licenses were detected in source scan.

```
/*
 * alternate cjpeg.c
 *
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 * This file is part of the Independent JPEG Group's software.
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 *
 * This file contains an alternate user interface for the JPEG compressor.
 * One or more input files are named on the command line, and output file
 * names are created by substituting ".jpg" for the input file's extension.
 */
```

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/cjpegalt.c

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```
/*
 * jfdctflt.c
 *
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 *
 * This file contains a floating-point implementation of the
 * forward DCT (Discrete Cosine Transform).
 *
 * This implementation should be more accurate than either of the integer
 * DCT implementations. However, it may not give the same results on all
 * machines because of differences in roundoff behavior. Speed will depend
 * on the hardware's floating point capacity.
 *
 * A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
```

- \* on each column. Direct algorithms are also available, but they are
- \* much more complex and seem not to be any faster when reduced to code.
- \*
- \* This implementation is based on Arai, Agui, and Nakajima's algorithm for
- \* scaled
- DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
- \* Japanese, but the algorithm is described in the Pennebaker & Mitchell
- \* JPEG textbook (see REFERENCES section in file README). The following code
- \* is based directly on figure 4-8 in P&M.
- \* While an 8-point DCT cannot be done in less than 11 multiplies, it is
- \* possible to arrange the computation so that many of the multiplies are
- \* simple scalings of the final outputs. These multiplies can then be
- \* folded into the multiplications or divisions by the JPEG quantization
- \* table entries. The AA&N method leaves only 5 multiplies and 29 adds
- \* to be done in the DCT itself.
- \* The primary disadvantage of this method is that with a fixed-point
- \* implementation, accuracy is lost due to imprecise representation of the
- \* scaled quantization values. However, that problem does not arise if
- \* we use floating point arithmetic.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jfdctflt.c

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/\*

- \* jpegtran.c

\*

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\*

- \* This file contains a command-line user interface for JPEG transcoding.

- \* It is very similar to cjpeg.c, and partly to djpeg.c, but provides

- \* lossless transcoding between different JPEG file formats. It also

- \* provides some lossless and sort-of-lossless transformations of JPEG data.

\*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jpegtran.c

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/\*

- \* jconfig.txt

\*

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- \* This file is part of the Independent JPEG Group's software.

```

* For conditions of distribution and use, see the accompanying README file.
*
* This file documents the configuration options that are required to
* customize the JPEG software for a particular system.
*
* The actual configuration options for a particular installation are stored
* in jconfig.h. On many machines, jconfig.h can be generated automatically
* or copied from one of the "canned" jconfig files that we supply. But if
* you need to generate a jconfig.h file by hand, this file tells you how.
*
* DO NOT EDIT THIS FILE --- IT WON'T ACCOMPLISH ANYTHING.
* EDIT A COPY NAMED JCONFIG.H.
*/

```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jconfig.txt
```

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```

/*
* jcmaster.c
*
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* This file is part of the Independent JPEG Group's software.
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*
* This file contains master control logic for the JPEG compressor.
* These routines are concerned with parameter validation, initial setup,
* and inter-pass control (determining the number of passes and the work
* to be done in each pass).
*/

```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jcmaster.c
```

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```

/*
* cdjpeg.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
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*
* This file contains common support routines used by the IJG application
* programs (cjpeg, djpeg, jpegtran).
*/

```

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/cdjpeg.c

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/\*

\* jpeglib.h

\*

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\*

\* This file defines the application interface for the JPEG library.

\* Most applications using the library need only include this file,

\* and perhaps jerror.h if they want to know the exact error codes.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jpeglib.h

No license file was found, but licenses were detected in source scan.

/\*

\* jquant1.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2011-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains 1-pass color quantization (color mapping) routines.

\* These routines provide mapping to a fixed color map using equally spaced

\* color values. Optional Floyd-Steinberg or ordered dithering is available.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jquant1.c

No license file was found, but licenses were detected in source scan.

/\*

\* cjpeg.c

\*

\* Copyright (C) 1991-1998, Thomas G. Lane.

\* Modified 2003-2013 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains a command-line user interface for the JPEG compressor.

\* It should work on any system with Unix- or MS-DOS-style command lines.

\*

- \* Two different command line styles are permitted, depending on the
- \* compile-time switch TWO\_FILE\_COMMANDLINE:
- \* cjpeg [options] inputfile outputfile
- \* cjpeg [options] [inputfile]
- \* In the second style, output is always to standard output, which you'd
- \* normally redirect to a file or pipe to some other program. Input is
- \* either from a named file or from standard input (typically redirected).
- \* The second style is convenient on Unix but is unhelpful on systems that
- \* don't support pipes. Also, you MUST use the
- first style if your system
- \* doesn't do binary I/O to stdin/stdout.
- \* To simplify script writing, the "-outfile" switch is provided. The syntax
- \* cjpeg [options] -outfile outputfile inputfile
- \* works regardless of which command line style is used.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/cjpeg.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdinput.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2002-2020 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains input control logic for the JPEG decompressor.
 * These routines are concerned with controlling the decompressor's input
 * processing (marker reading and coefficient decoding). The actual input
 * reading is done in jdmarker.c, jdhuft.c, and jdarith.c.
 */
```

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jdinput.c

No license file was found, but licenses were detected in source scan.

```
/*
 * rdcolmap.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file implements djpeg's "-map file" switch. It reads a source image
 * and constructs a colormap to be supplied to the JPEG decompressor.
 */
```

```

* Currently, these file formats are supported for the map file:
* GIF: the contents of the GIF's global colormap are used.
* PPM (either text or raw flavor): the entire file is read and
* each unique pixel value is entered in the map.
* Note that reading a large PPM file will be horrendously slow.
* Typically, a PPM-format map file should contain just one pixel
* of each desired color. Such a file can be extracted from an
* ordinary image PPM file with ppmtomap(1).
*
* Rescaling a PPM that has a maxval unequal to MAXJSAMPLE is not
* currently implemented.
*/
/* Portions of this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation. This software is provided "as is" without express or
** implied warranty.
*/

```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/rdcolmap.c
```

No license file was found, but licenses were detected in source scan.

The Independent JPEG Group's JPEG software

=====

README for release 9f of 14-Jan-2024

=====

This distribution contains the ninth public release of the Independent JPEG Group's free JPEG software. You are welcome to redistribute this software and to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone, Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson, John Korejwa, Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers, and other members of the Independent JPEG Group.

IJG is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP

=====

This file contains the following sections:

OVERVIEW        General  
description of JPEG and the IJG software.  
LEGAL ISSUES     Copyright, lack of warranty, terms of distribution.  
REFERENCES       Where to learn more about JPEG.  
ARCHIVE LOCATIONS Where to find newer versions of this software.  
ACKNOWLEDGMENTS Special thanks.  
FILE FORMAT WARS Software \*not\* to get.  
TO DO            Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.txt     How to configure and install the IJG software.  
usage.txt       Usage instructions for cjpeg, djpeg, jpegtran,  
                 rdjpgcom, and wrjpgcom.  
\*.1            Unix-style man pages for programs (same info as usage.txt).  
wizard.txt      Advanced usage instructions for JPEG wizards only.  
cdaltui.txt     Description of alternate user interface for cjpeg/djpeg.  
change.log      Version-to-version change highlights.

Programmer and internal documentation:

libjpeg.txt     How to use the JPEG library in your own programs.  
example.c       Sample code for calling the JPEG library.  
structure.txt   Overview of the JPEG library's internal structure.  
filelist.txt    Road map of IJG files.  
coderules.txt   Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information can also be found in the JPEG FAQ (Frequently Asked Questions) article. See ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or more of the REFERENCES, then looking at the documentation files (in roughly the order listed) before diving into the code.

## OVERVIEW

=====

This package contains C software to implement JPEG image encoding, decoding, and transcoding. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and grayscale images.

This software implements JPEG baseline, extended-sequential, and progressive compression processes.

Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. We have made no provision for supporting the hierarchical or lossless processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files, plus two sample applications "cjpeg" and "djpeg", which use the library to perform conversion between JPEG and some other popular image file formats. The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG decoding, but they are essential for output to colormapped file formats or colormapped displays. These extra functions can be compiled out of the library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and flexibility, while also making it fast enough to be useful. In particular, the software is not intended to be read as a tutorial on JPEG. (See the REFERENCES section for introductory material.) Rather, it is intended to be reliable, portable, industrial-strength code. We do not claim to have achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products. No royalty is required, but we do ask for an acknowledgement in product documentation, as described under LEGAL ISSUES.

## LEGAL ISSUES

=====

In plain English:

1. We don't promise that this software works. (But if you find any bugs, please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a program, you must acknowledge somewhere in your documentation that you've used the IJG code.

In legalese:



The authors make NO WARRANTY or representation, either express or implied, with respect to this software, its quality, accuracy, merchantability, or fitness for a particular purpose. This software is provided "AS IS", and you, its user, assume the entire risk as to its quality and accuracy.

This software is copyright (C) 1991-2024, Thomas G. Lane, Guido Vollbeding. All Rights Reserved except as specified below.

Permission is hereby granted to use, copy, modify, and distribute this software (or portions thereof) for any purpose, without fee, subject to these conditions:

- (1) If any part of the source code for this software is distributed, then this README file must be included, with this copyright and no-warranty notice unaltered; and any additions, deletions, or changes to the original files must be clearly indicated in accompanying documentation.
- (2) If only executable code is distributed, then the accompanying documentation must state that "this software is based in part on the work of the Independent JPEG Group".
- (3) Permission for use of this software is granted only if the user accepts full responsibility for any undesirable consequences; the authors accept NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code, not just to the unmodified library. If you use our work, you ought to acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name in advertising or publicity relating to this software or products derived from it. This software may be referred to only as "the Independent JPEG Group's software".

We specifically permit and encourage the use of this software as the basis of commercial products, provided that all warranty or liability claims are assumed by the product vendor.

The Unix configuration script "configure" was produced with GNU Autoconf. It is copyright by the Free Software Foundation but is freely distributable. The same holds for its supporting scripts (config.guess, config.sub, ltmain.sh). Another support script, install-sh, is copyright by X Consortium but is also freely distributable.

## REFERENCES

=====

We recommend reading one or more of these references before trying to understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is Wallace, Gregory K. "The JPEG Still Picture Compression Standard", Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44. (Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PDF file containing a revised version of Wallace's article is available at <https://www.ijg.org/files/Wallace.JPEG.pdf>.

The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics) omits the sample images that appeared in CACM, but it includes corrections and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in "The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides good explanations and example C code for a multitude of compression methods including JPEG. It is an excellent source if you are comfortable reading C code but don't know much about data compression in general. The book's JPEG sample code is far from industrial-strength, but when you are ready to look at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still Image Data Compression Standard" by William B. Pennebaker and Joan L. Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1. Price US\$59.95, 638 pp. The book includes the complete text of the ISO JPEG standards (DIS 10918-1 and draft DIS 10918-2). Although this is by far the most detailed and comprehensive exposition of JPEG publicly available, we point out that it is still missing an explanation of the most essential properties and algorithms of the underlying DCT technology.

If you think that you know about DCT-based JPEG after reading this book, then you are in delusion. The real fundamentals and corresponding potential of DCT-based JPEG are not publicly known so far, and that is the reason for all the mistaken developments taking place in the image coding domain.

The original JPEG standard is divided into two parts, Part 1 being the actual specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part

1: Requirements and guidelines" and has document numbers ISO/IEC IS 10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 2: Compliance testing" and has document

numbers ISO/IEC IS 10918-2, ITU-T T.83.

IJG JPEG 8 introduced an implementation of the JPEG SmartScale extension which is specified in two documents: A contributed document at ITU and ISO with title "ITU-T JPEG-Plus Proposal for Extending ITU-T T.81 for Advanced Image Coding", April 2006, Geneva, Switzerland. The latest version of this document is Revision 3. And a contributed document ISO/IEC JTC1/SC29/WG1 N 5799 with title "Evolution of JPEG", June/July 2011, Berlin, Germany.

IJG JPEG 9 introduces a reversible color transform for improved lossless compression which is described in a contributed document ISO/IEC JTC1/SC29/WG1 N 6080 with title "JPEG 9 Lossless Coding", June/July 2012, Paris, France.

The JPEG standard does not specify all details of an interchangeable file

format. For the omitted details we follow the "JFIF" conventions, version 2. JFIF version 1 has been adopted as Recommendation ITU-T T.871 (05/2011) : Information technology - Digital compression and coding of continuous-tone still images: JPEG File Interchange Format (JFIF). It is available as a free download in PDF file format from <https://www.itu.int/rec/T-REC-T.871>. A PDF file of the older JFIF document is available at <https://www.w3.org/Graphics/JPEG/jfif3.pdf>.

The TIFF 6.0 file format specification can be obtained by FTP from <ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz>. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems. IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6). Instead, we recommend the JPEG design proposed by TIFF Technical Note #2 (Compression tag 7). Copies of this Note can be obtained from <https://www.ijg.org/files/>. It is expected that the next revision of the TIFF spec will replace the 6.0 JPEG design with the Note's design. Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note.

## ARCHIVE LOCATIONS

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The "official" archive site for this software is [www.ijg.org](http://www.ijg.org). The most recent released version can always be found there in directory "files". This particular version will be archived in Windows-compatible "zip" archive format as <https://www.ijg.org/files/jpegsr9f.zip>, and in Unix-compatible "tar.gz" archive format as <https://www.ijg.org/files/jpegsr.v9f.tar.gz>.

The JPEG FAQ (Frequently Asked Questions) article is a source of some general information about JPEG. It is available on the World Wide Web at <http://www.faqs.org/faqs/jpeg-faq/>

and other news.answers archive sites, including the official news.answers archive at [rtfm.mit.edu: ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/](http://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/). If you don't have Web or FTP access, send e-mail to [mail-server@rtfm.mit.edu](mailto:mail-server@rtfm.mit.edu) with  
body  
send usenet/news.answers/jpeg-faq/part1  
send usenet/news.answers/jpeg-faq/part2

## ACKNOWLEDGMENTS

=====

Thank to Juergen Bruder for providing me with a copy of the common DCT algorithm article, only to find out that I had come to the same result in a more direct and comprehensible way with a more generative approach.

Thank to Istvan Sebestyen and Joan L. Mitchell for inviting me to the ITU JPEG (Study Group 16) meeting in Geneva, Switzerland.

Thank to Thomas Wiegand and Gary Sullivan for inviting me to the Joint Video Team (MPEG & ITU) meeting in Geneva, Switzerland.

Thank to Thomas Richter and Daniel Lee for inviting me to the ISO/IEC JTC1/SC29/WG1 (previously known as JPEG, together with ITU-T SG16) meeting in Berlin, Germany.

Thank to John Korejwa and Massimo Ballerini for inviting me to fruitful consultations in Boston, MA and Milan, Italy.

Thank to Hendrik Elstner, Roland Fassauer, Simone Zuck, Guenther Maier-Gerber, Walter Stoeber, Fred Schmitz,  
and Norbert Braunagel  
for corresponding business development.

Thank to Nico Zschach and Dirk Stelling of the technical support team at the Digital Images company in Halle for providing me with extra equipment for configuration tests.

Thank to Richard F. Lyon (then of Foveon Inc.) for fruitful communication about JPEG configuration in Sigma Photo Pro software.

Thank to Andrew Finkenstadt for hosting the [ijg.org](http://ijg.org) site.

Thank to Thomas G. Lane for the original design and development of this singular software package.

Thank to Lars Goehler, Andreas Heinecke, Sebastian Fuss,  
Yvonne Roebert, Andrej Werner, Ulf-Dietrich Braumann,

and Nina Ssymank for support and public relations.

## FILE FORMAT WARS

=====

The ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16) currently promotes different formats containing the name "JPEG" which is misleading because these formats are incompatible with original DCT-based JPEG and are based on faulty technologies.

IJG therefore does not and will not support such momentary mistakes (see REFERENCES).

There exist also distributions under the name "OpenJPEG" promoting such kind of formats which is misleading because they don't support original JPEG images.

We have no sympathy for the promotion of inferior formats. Indeed, one of the original reasons for developing this free software was to help force convergence on common, interoperable format standards for JPEG files.

Don't use an incompatible file format!

(In any case, our decoder will remain capable of reading existing JPEG image files indefinitely.)

The ISO committee pretends to be "responsible for the popular JPEG" in their public reports which is not true because they don't respond to actual requirements for the maintenance of the original JPEG specification. Furthermore, the ISO committee pretends to "ensure interoperability" with their standards which is not true because their "standards" support only application-specific and proprietary use cases and contain mathematically incorrect code.

There are currently different distributions in circulation containing the name "libjpeg" which is misleading because they don't have the features and are incompatible with formats supported by actual IJG libjpeg distributions. One of those fakes is released by members of the ISO committee and just uses the name of libjpeg for misdirection of people, similar to the abuse of the name JPEG as described above, while having nothing in common with actual IJG libjpeg distributions and containing mathematically incorrect code.

The other one claims to be a "derivative" or "fork" of the original libjpeg, but violates the license conditions as described under LEGAL ISSUES above and violates basic C programming properties.

We have no sympathy for the release of misleading, incorrect and illegal distributions derived from obsolete code bases.

Don't use an obsolete code base!

According to the UCC (Uniform Commercial Code) law, IJG has

the lawful and  
legal right to foreclose on certain standardization bodies and other  
institutions or corporations that knowingly perform substantial and  
systematic deceptive acts and practices, fraud, theft, and damaging of the  
value of the people of this planet without their knowing, willing and  
intentional consent.

The titles, ownership, and rights of these institutions and all their assets  
are now duly secured and held in trust for the free people of this planet.  
People of the planet, on every country, may have a financial interest in  
the assets of these former principals, agents, and beneficiaries of the  
foreclosed institutions and corporations.

IJG asserts what is: that each man, woman, and child has unalienable value  
and rights granted and deposited in them by the Creator and not any one of  
the people is subordinate to any artificial principality, corporate fiction  
or the special interest of another without their appropriate knowing,  
willing and intentional consent made by contract  
or accommodation agreement.

IJG expresses that which already was.

The people have already determined and demanded that public administration  
entities, national governments, and their supporting judicial systems must  
be fully transparent, accountable, and liable.

IJG has secured the value for all concerned free people of the planet.

A partial list of foreclosed institutions and corporations ("Hall of Shame")  
is currently prepared and will be published later.

TO DO

=====

Version 9 is the second release of a new generation JPEG standard  
to overcome the limitations of the original JPEG specification,  
and is the first true source reference JPEG codec.  
More features are being prepared for coming releases...

Please send bug reports, offers of help, etc. to [jpeg-info@ijg.org](mailto:jpeg-info@ijg.org).

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/README

No license file was found, but licenses were detected in source scan.

/\*

\* jdpostct.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

- \* This file contains the decompression postprocessing controller.
- \* This controller manages the upsampling, color conversion, and color
- \* quantization/reduction steps; specifically, it controls the buffering
- \* between upsample/color conversion and color quantization/reduction.
- \*
- \* If no color quantization/reduction is required, then this module has no
- \* work to do, and it just hands off to the upsample/color conversion code.
- \* An integrated upsample/convert/quantize process would replace this module
- \* entirely.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jdpostct.c

No license file was found, but licenses were detected in source scan.

## IJG JPEG LIBRARY: ALTERNATE USER INTERFACE FOR CJPEG/DJPEG

Copyright (C) 2020-2023, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

There is an alternate command-line user interface for the IJG JPEG software. It is designed for use under MS-DOS, and may also be useful on other non-Unix operating systems. (For that matter, this code works fine on Unix, but the standard command-line syntax is better on Unix because it is pipe-friendly.)

With this user interface, cjpeg and djpeg accept multiple input file names on the command line; output file names are generated by substituting appropriate extensions. The user is prompted before any already-existing file will be overwritten.

Expansion of wild-card file specifications is useful but is not directly provided by this code. Most DOS C compilers have the ability to do wild-card expansion "behind the scenes", and we rely on that feature. On other systems, the shell may do it for you, as is done on Unix.

Also, a DOS-specific routine is provided to determine available memory; this makes the -maxmemory switch unnecessary except in unusual cases. If you know how to determine available memory on a different system, you can easily add the necessary code. (And please send it along to jpeg-info@ijg.org so we can include it in future releases!)

## INSTALLATION

=====

Rename the standard cjpeg.c file to cjpegstd.c, then rename cjpegalt.c to cjpeg.c.

Rename the standard djpeg.c file to djpegstd.c, then rename djpegalt.c to djpeg.c.

Then build the software as described in install.txt, with these exceptions:

- \* Define PROGRESS\_REPORT in jconfig.h if you want the percent-done display.
- \* Define NO\_OVERWRITE\_CHECK if you \*don't\* want overwrite confirmation.
- \* You may ignore the USE\_SETMODE and TWO\_FILE\_COMMANDLINE symbols discussed in install.txt; these files do not use them.
- \* As given, djpegalt.c defaults to BMP output (not PPM output as in the standard djpeg.c). If you want something different, modify DEFAULT\_FMT.

You may also need to do something special to enable filename wild-card expansion, assuming your compiler has that capability at all.

Modify the standard usage.txt file as described below. (If you want to use the Unix-style manual pages cjpeg.1 and djpeg.1, better fix them too.)

To restore the standard user interface:

Rename cjpeg.c to cjpegalt.c, then rename cjpegstd.c to cjpeg.c.

Rename djpeg.c to djpegalt.c, then rename djpegstd.c to djpeg.c.

Then recompile/rebuild.

Here are some specific notes for popular MS-DOS compilers:

Borland C:

Add "-DMSDOS" to CFLAGS to enable use of the DOS memory determination code.

Link with the standard library file WILDARGS.OBJ to get wild-card expansion.

Microsoft C:

Add "-DMSDOS" to CFLAGS to enable use of the DOS memory determination code.

Link with the standard library

file SETARGV.OBJ to get wild-card expansion.

In the versions I've used, you must also add /NOE to the linker switches to avoid a duplicate-symbol error from including SETARGV.

DJGPP (we recommend version 2.0 or later):

Add "-DFREE\_MEM\_ESTIMATE=0" to CFLAGS. Wild-card expansion is automatic.

USAGE

=====

Most of the standard usage.txt file also applies to the alternate version, but replace its "GENERAL USAGE" section with the text below. Edit the text



as necessary if you don't support wildcards or overwrite checking. Be sure to fix the djpeg switch descriptions if you are not defaulting to PPM output. Also, if you've provided an accurate memory-estimation procedure, you can probably eliminate the HINTS related to the -maxmemory switch.

## GENERAL USAGE

We provide two programs, cjpeg to compress an image file into JPEG format, and djpeg to decompress a JPEG file back into a conventional image format.

The basic command line is:

```
cjpeg [switches] list of image files
```

or

```
djpeg
```

```
[switches] list of jpeg files
```

Each file named is compressed or decompressed. The input file(s) are not modified; the output data is written to files which have the same names except for extension. cjpeg always uses ".jpg" for the output file name's extension; djpeg uses one of ".bmp", ".gif", ".ppm", ".rle", or ".tga", depending on what output format is selected by the switches.

For example, to convert xxx.bmp to xxx.jpg and yyy.ppm to yyy.jpg, say:

```
cjpeg xxx.bmp yyy.ppm
```

On most systems you can use standard wildcards to specify the list of input files; for example, on DOS "djpeg \*.jpg" decompresses all the JPEG files in the current directory.

If an intended output file already exists, you'll be asked whether or not to overwrite it. If you say no, the program skips that input file and goes on to the next one.

You can intermix switches and file names; for example

```
djpeg -gif file1.jpg -targa file2.jpg
```

decompresses file1.jpg into GIF format (file1.gif) and file2.jpg into Targa format

(file2.tga). Only switches to the left of a given file name affect processing of that file; when there are conflicting switches, the rightmost one takes precedence.

You can override the program's choice of output file name by using the -outfile switch, as in

```
cjpeg -outfile output.jpg input.ppm
```

-outfile only affects the first input file name to its right.

The currently supported image file formats are: PPM (PBMPLUS color format),

PGM (PBMPLUS grayscale format), BMP, GIF, Targa, and RLE (Utah Raster Toolkit format). (RLE is supported only if the URT library is available, which it isn't on most non-Unix systems.) cjpeg recognizes the input image format automatically, with the exception of some Targa-format files. You have to tell djpeg which format to generate.

JPEG files are in the standard JFIF file format. There are other, less widely used JPEG-based file formats, but we don't support them.

All switch names may be abbreviated; for example, -grayscale may be written -gray or -gr. Most of the "basic" switches can be abbreviated to as little as one letter. Upper and lower case are equivalent (-BMP is the same as -bmp). British spellings are also accepted (e.g., -greyscale), though for brevity these are not mentioned below.

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/cdaltui.txt

No license file was found, but licenses were detected in source scan.

/\*

\* jcinit.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2003-2017 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains initialization logic for the JPEG compressor.

\* This routine is in charge of selecting the modules to be executed and

\* making an initialization call to each one.

\*

\* Logically, this code belongs in jcmaster.c. It's split out because

\* linking this routine implies linking the entire compression library.

\* For a transcoding-only application, we want to be able to use jcmaster.c

\* without linking in the whole library.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jcinit.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdmainct.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2002-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains the main buffer controller for decompression.
- \* The main buffer lies between the JPEG decompressor proper and the
- \* post-processor; it holds downsampled data in the JPEG colorspace.
- \*
- \* Note that this code is bypassed in raw-data mode, since the application
- \* supplies the equivalent of the main buffer in that case.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jdmainct.c

No license file was found, but licenses were detected in source scan.

/\*

- \* transupp.c

\*

- \* Copyright (C) 1997-2023, Thomas G. Lane, Guido Vollbeding.

- \* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.

\*

- \* This file contains image transformation routines and other utility code

- \* used by the jpegtran sample application. These are NOT part of the core

- \* JPEG library. But we keep these routines separate from jpegtran.c to

- \* ease the task of maintaining jpegtran-like programs that have other user

- \* interfaces.

\*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/transupp.c

No license file was found, but licenses were detected in source scan.

/\*

- \* rdbmp.c

\*

- \* Copyright (C) 1994-1996, Thomas G. Lane.

- \* Modified 2009-2019 by Guido Vollbeding.

- \* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.

\*

- \* This file contains routines to read input images in Microsoft "BMP"

- \* format (MS Windows 3.x, OS/2 1.x, and OS/2 2.x flavors).

- \* Currently, only 8-, 24-, and 32-bit images are supported, not 1-bit or

- \* 4-bit (feeding such low-depth images into JPEG would be silly anyway).

- \* Also, we don't support RLE-compressed files.

\*

- \* These routines may need modification for non-Unix environments or

- \* specialized applications. As they stand, they assume input from

\* an ordinary stdio stream. They further assume that reading begins  
\* at the start of the file; start\_input may need work if the  
\* user interface has already read some data (e.g., to determine that  
\* the file is  
indeed BMP format).  
\*  
\* This code contributed by James Arthur Boucher.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/rdbmp.c

No license file was found, but licenses were detected in source scan.

/\*  
\* jcapistd.c  
\*  
\* Copyright (C) 1994-1996, Thomas G. Lane.  
\* Modified 2013 by Guido Vollbeding.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains application interface code for the compression half  
\* of the JPEG library. These are the "standard" API routines that are  
\* used in the normal full-compression case. They are not used by a  
\* transcoding-only application. Note that if an application links in  
\* jpeg\_start\_compress, it will end up linking in the entire compressor.  
\* We thus must separate this file from jcapimin.c to avoid linking the  
\* whole compression library into a transcoder.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jcapistd.c

No license file was found, but licenses were detected in source scan.

/\*  
\* jutils.c  
\*  
\* Copyright (C) 1991-1996, Thomas G. Lane.  
\* Modified 2009-2020 by Guido Vollbeding.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains tables and miscellaneous utility routines needed  
\* for both compression and decompression.  
\* Note we prefix all global names with "j" to minimize conflicts with  
\* a surrounding application.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jutils.c

No license file was found, but licenses were detected in source scan.

/\*

\* jidctfst.c

\*

\* Copyright (C) 1994-1998, Thomas G. Lane.

\* Modified 2015-2017 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains a fast, not so accurate integer implementation of the

\* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine

\* must also perform dequantization of the input coefficients.

\*

\* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT

\* on each row (or vice versa, but it's more convenient to emit a row at

\* a time). Direct algorithms are also available, but they are much more

\* complex and seem not to be any faster when reduced to code.

\*

\* This implementation is based on Arai, Agui, and Nakajima's algorithm for

\* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

\* Japanese, but the algorithm

is described in the Pennebaker & Mitchell

\* JPEG textbook (see REFERENCES section in file README). The following code

\* is based directly on figure 4-8 in P&M.

\* While an 8-point DCT cannot be done in less than 11 multiplies, it is

\* possible to arrange the computation so that many of the multiplies are

\* simple scalings of the final outputs. These multiplies can then be

\* folded into the multiplications or divisions by the JPEG quantization

\* table entries. The AA&N method leaves only 5 multiplies and 29 adds

\* to be done in the DCT itself.

\* The primary disadvantage of this method is that with fixed-point math,

\* accuracy is lost due to imprecise representation of the scaled

\* quantization values. The smaller the quantization table entry, the less

\* precise the scaled value, so this implementation does worse with high-

\* quality-setting files than with low-quality ones.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jidctfst.c

No license file was found, but licenses were detected in source scan.

/\*

\* jidctint.c

\*

\* Copyright (C) 1991-1998, Thomas G. Lane.

- \* Modification developed 2002-2018 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains a slow-but-accurate integer implementation of the
- \* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
- \* must also perform dequantization of the input coefficients.
- \*
- \* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
- \* on each row (or vice versa, but it's more convenient to emit a row at
- \* a time). Direct algorithms are also available, but they are much more
- \* complex and seem not to be any faster when reduced to code.
- \*
- \* This implementation is based on an algorithm described in
- \* C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
- \* Algorithms with 11 Multiplications",
- Proc. Int'l. Conf. on Acoustics,
- \* Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
- \* The primary algorithm described there uses 11 multiplies and 29 adds.
- \* We use their alternate method with 12 multiplies and 32 adds.
- \* The advantage of this method is that no data path contains more than one
- \* multiplication; this allows a very simple and accurate implementation in
- \* scaled fixed-point arithmetic, with a minimal number of shifts.
- \*
- \* We also provide IDCT routines with various output sample block sizes for
- \* direct resolution reduction or enlargement and for direct resolving the
- \* common 2x1 and 1x2 subsampling cases without additional resampling: NxN
- \* (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 input DCT block.
- \*
- \* For N<8 we simply take the corresponding low-frequency coefficients of
- \* the 8x8 input DCT block and apply an NxN point IDCT on the sub-block
- \* to yield the downsampled outputs.
- \* This can be seen as direct low-pass downsampling
- from the DCT domain
- \* point of view rather than the usual spatial domain point of view,
- \* yielding significant computational savings and results at least
- \* as good as common bilinear (averaging) spatial downsampling.
- \*
- \* For N>8 we apply a partial NxN IDCT on the 8 input coefficients as
- \* lower frequencies and higher frequencies assumed to be zero.
- \* It turns out that the computational effort is similar to the 8x8 IDCT
- \* regarding the output size.
- \* Furthermore, the scaling and descaling is the same for all IDCT sizes.
- \*
- \* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
- \* since there would be too many additional constants to pre-calculate.
- \*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jidctint.c

No license file was found, but licenses were detected in source scan.

/\*

\* jddctmgr.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2002-2013 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the inverse-DCT management logic.

\* This code selects a particular IDCT implementation to be used,

\* and it performs related housekeeping chores. No code in this file

\* is executed per IDCT step, only during output pass setup.

\*

\* Note that the IDCT routines are responsible for performing coefficient

\* dequantization as well as the IDCT proper. This module sets up the

\* dequantization multiplier table needed by the IDCT routine.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jddctmgr.c

No license file was found, but licenses were detected in source scan.

/\*

\* cdjpeg.h

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains common declarations for the sample applications

\* cjpeg and djpeg. It is NOT used by the core JPEG library.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/cdjpeg.h

No license file was found, but licenses were detected in source scan.

/\*

\* jcomapi.c

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains application interface routines that are used for both  
\* compression and decompression.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jcomapi.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcarith.c

\*

\* Developed 1997-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains portable arithmetic entropy encoding routines for JPEG

\* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).

\*

\* Both sequential and progressive modes are supported in this single module.

\*

\* Suspension is not currently supported in this module.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jcarith.c

No license file was found, but licenses were detected in source scan.

/\*

\* jpegint.h

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 1997-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file provides common declarations for the various JPEG modules.

\* These declarations are considered internal to the JPEG library; most

\* applications using the library shouldn't need to include this file.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jpegint.h

No license file was found, but licenses were detected in source scan.

/\*

\* jdapimin.c



\*  
 \* Copyright (C) 1994-1998, Thomas G. Lane.  
 \* Modified 2009-2020 by Guido Vollbeding.  
 \* This file is part of the Independent JPEG Group's software.  
 \* For conditions of distribution and use, see the accompanying README file.  
 \*  
 \* This file contains application interface code for the decompression half  
 \* of the JPEG library. These are the "minimum" API routines that may be  
 \* needed in either the normal full-decompression case or the  
 \* transcoding-only case.  
 \*  
 \* Most of the routines intended to be called directly by an application  
 \* are in this file or in jdapistd.c. But also see jcomapi.c for routines  
 \* shared by compression and decompression, and jdtrans.c for the transcoding  
 \* case.  
 \*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdapimin.c

No license file was found, but licenses were detected in source scan.

/\*  
 \* jcsample.c  
 \*  
 \* Copyright (C) 1991-1996, Thomas G. Lane.  
 \* Modified 2003-2020 by Guido Vollbeding.  
 \* This file is part of the Independent JPEG Group's software.  
 \* For conditions of distribution and use, see the accompanying README file.  
 \*  
 \* This file contains downsampling routines.  
 \*  
 \* Downsampling input data is counted in "row groups". A row group  
 \* is defined to be max\_v\_samp\_factor pixel rows of each component,  
 \* from which the downsampler produces v\_samp\_factor sample rows.  
 \* A single row group is processed in each call to the downsampler module.  
 \*  
 \* The downsampler is responsible for edge-expansion of its output data  
 \* to fill an integral number of DCT blocks horizontally. The source buffer  
 \* may be modified if it is helpful for this purpose (the source buffer is  
 \* allocated wide enough to correspond to the desired output width).  
 \* The caller (the prep controller) is responsible for vertical  
 \* padding.  
 \*  
 \* The downsampler may request "context rows" by setting need\_context\_rows  
 \* during startup. In this case, the input arrays will contain at least  
 \* one row group's worth of pixels above and below the passed-in data;  
 \* the caller will create dummy rows at image top and bottom by replicating  
 \* the first or last real pixel row.

```

*
* An excellent reference for image resampling is
* Digital Image Warping, George Wolberg, 1990.
* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
*
* The downsampling algorithm used here is a simple average of the source
* pixels covered by the output pixel. The hi-falutin sampling literature
* refers to this as a "box filter". In general the characteristics of a box
* filter are not very good, but for the specific cases we normally use (1:1
* and 2:1 ratios) the box is equivalent to a "triangle filter" which is not
* nearly so bad. If you intend to use other sampling ratios, you'd be well
* advised
to improve this code.
*
* A simple input-smoothing capability is provided. This is mainly intended
* for cleaning up color-dithered GIF input files (if you find it inadequate,
* we suggest using an external filtering program such as pnmconvol). When
* enabled, each input pixel P is replaced by a weighted sum of itself and its
* eight neighbors. P's weight is 1-8*SF and each neighbor's weight is SF,
* where SF = (smoothing_factor / 1024).
* Currently, smoothing is only supported for 2h2v sampling factors.
*/

```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jcsample.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jidctflt.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2010-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a floating-point implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* This implementation should be more accurate than either of the integer
* IDCT implementations. However, it may not give the same results on all
* machines because of differences in roundoff behavior. Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they

```

are much more

- \* complex and seem not to be any faster when reduced to code.
- \*
- \* This implementation is based on Arai, Agui, and Nakajima's algorithm for
- \* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
- \* Japanese, but the algorithm is described in the Pennebaker & Mitchell
- \* JPEG textbook (see REFERENCES section in file README). The following code
- \* is based directly on figure 4-8 in P&M.
- \* While an 8-point DCT cannot be done in less than 11 multiplies, it is
- \* possible to arrange the computation so that many of the multiplies are
- \* simple scalings of the final outputs. These multiplies can then be
- \* folded into the multiplications or divisions by the JPEG quantization
- \* table entries. The AA&N method leaves only 5 multiplies and 29 adds
- \* to be done in the DCT itself.
- \* The primary disadvantage of this method is that with a fixed-point
- \* implementation, accuracy is lost due to imprecise representation of the
- \* scaled quantization values. However,
- that problem does not arise if
- \* we use floating point arithmetic.
- \*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jidctflt.c

No license file was found, but licenses were detected in source scan.

/\*

\* jctrans.c

\*

\* Copyright (C) 1995-1998, Thomas G. Lane.

\* Modified 2000-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains library routines for transcoding compression,

\* that is, writing raw DCT coefficient arrays to an output JPEG file.

\* The routines in jcapimin.c will also be needed by a transcoder.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jctrans.c

No license file was found, but licenses were detected in source scan.

/\*

\* cderror.h

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2009-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file defines the error and message codes for the cjpeg/djpeg
- \* applications. These strings are not needed as part of the JPEG library
- \* proper.
- \* Edit this file to add new codes, or to translate the message strings to
- \* some other language.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/cderror.h

No license file was found, but licenses were detected in source scan.

- /\*
- \* wrjpgcom.c
- \*
- \* Copyright (C) 1994-1997, Thomas G. Lane.
- \* Modified 2015-2017 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains a very simple stand-alone application that inserts
- \* user-supplied text as a COM (comment) marker in a JFIF file.
- \* This may be useful as an example of the minimum logic needed to parse
- \* JPEG markers.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/wrjpgcom.c

No license file was found, but licenses were detected in source scan.

- /\*
- \* jfdctfst.c
- \*
- \* Copyright (C) 1994-1996, Thomas G. Lane.
- \* Modified 2003-2017 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains a fast, not so accurate integer implementation of the
- \* forward DCT (Discrete Cosine Transform).
- \*
- \* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
- \* on each column. Direct algorithms are also available, but they are
- \* much more complex and seem not to be any faster when reduced to code.
- \*
- \* This implementation is based on Arai, Agui, and Nakajima's algorithm for
- \* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in

- \* Japanese, but the algorithm is described in the Pennebaker & Mitchell
- \* JPEG textbook (see REFERENCES section in file README). The following code
- \* is based directly on figure 4-8 in P&M.
- \* While an 8-point DCT cannot be done in less than 11 multiplies, it is
- \* possible to arrange the computation so that many of the multiplies are
- \* simple scalings of the final outputs. These multiplies can then be
- \* folded into the multiplications or divisions by the JPEG quantization
- \* table entries. The AA&N method leaves only 5 multiplies and 29 adds
- \* to be done in the DCT itself.
- \* The primary disadvantage of this method is that with fixed-point math,
- \* accuracy is lost due to imprecise representation of the scaled
- \* quantization values. The smaller the quantization table entry, the less
- \* precise the scaled value, so this implementation does worse with high-
- \* quality-setting files than with low-quality ones.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jfdctfst.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jmemname.c
 *
 * Copyright (C) 1992-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file provides a generic implementation of the system-dependent
 * portion of the JPEG memory manager. This implementation assumes that
 * you must explicitly construct a name for each temp file.
 * Also, the problem of determining the amount of memory available
 * is shoved onto the user.
 */
```

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jmemname.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdatasrc.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2009-2022 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains decompression data source routines for the case of
 * reading JPEG data from memory or from a file (or any stdio stream).
```

\* While these routines are sufficient for most applications,  
\* some will want to use a different source manager.  
\* IMPORTANT: we assume that fread() will correctly transcribe an array of  
\* JOCTETs from 8-bit-wide elements on external storage. If char is wider  
\* than 8 bits on your machine, you may need to do some tweaking.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdatasrc.c

No license file was found, but licenses were detected in source scan.

/\*

\* jccolor.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2011-2023 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains input colorspace conversion routines.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jccolor.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdcoefct.c

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2002-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the coefficient buffer controller for decompression.

\* This controller is the top level of the JPEG decompressor proper.

\* The coefficient buffer lies between entropy decoding and inverse-DCT steps.

\*

\* In buffered-image mode, this controller is the interface between

\* input-oriented processing and output-oriented processing.

\* Also, the input side (only) is used when reading a file for transcoding.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdcoefct.c

No license file was found, but licenses were detected in source scan.

/\*

```

* jmemnobs.c
*
* Copyright (C) 1992-1996, Thomas G. Lane.
* Modified 2019 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file provides a really simple implementation of the system-
* dependent portion of the JPEG memory manager. This implementation
* assumes that no backing-store files are needed: all required space
* can be obtained from malloc().
* This is very portable in the sense that it'll compile on almost anything,
* but you'd better have lots of main memory (or virtual memory) if you want
* to process big images.
* Note that the max_memory_to_use option is respected by this implementation.
*/

```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jmemnobs.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jdapistd.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2002-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the decompression half
* of the JPEG library. These are the "standard" API routines that are
* used in the normal full-decompression case. They are not used by a
* transcoding-only application. Note that if an application links in
* jpeg_start_decompress, it will end up linking in the entire decompressor.
* We thus must separate this file from jdapimin.c to avoid linking the
* whole decompression library into a transcoder.
*/

```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jdapistd.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jccoefct.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2003-2022 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.

```

\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains the coefficient buffer controller for compression.  
\* This controller is the top level of the JPEG compressor proper.  
\* The coefficient buffer lies between forward-DCT and entropy encoding steps.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jccoefct.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdtrans.c

\*

\* Copyright (C) 1995-1997, Thomas G. Lane.

\* Modified 2000-2009 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains library routines for transcoding decompression,

\* that is, reading raw DCT coefficient arrays from an input JPEG file.

\* The routines in jdapimin.c will also be needed by a transcoder.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdtrans.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdmaster.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2002-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains master control logic for the JPEG decompressor.

\* These routines are concerned with selecting the modules to be executed

\* and with determining the number of passes and the work to be done in each

\* pass.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdmaster.c

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/\*

\* jaricom.c



\*  
 \* Developed 1997-2011 by Guido Vollbeding.  
 \* This file is part of the Independent JPEG Group's software.  
 \* For conditions of distribution and use, see the accompanying README file.  
 \*  
 \* This file contains probability estimation tables for common use in  
 \* arithmetic entropy encoding and decoding routines.  
 \*  
 \* This data represents Table D.3 in the JPEG spec (D.2 in the draft),  
 \* ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81, and Table 24  
 \* in the JBIG spec, ISO/IEC IS 11544 and CCITT Recommendation ITU-T T.82.  
 \*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jaricom.c

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/\*  
 \* wrgif.c  
 \*  
 \* Copyright (C) 1991-1996, Thomas G. Lane.  
 \* Modified 2015-2019 by Guido Vollbeding.  
 \* This file is part of the Independent JPEG Group's software.  
 \* For conditions of distribution and use, see the accompanying README file.  
 \*  
 \* This file contains routines to write output images in GIF format.  
 \*  
 \* These routines may need modification for non-Unix environments or  
 \* specialized applications. As they stand, they assume output to  
 \* an ordinary stdio stream.  
 \*/  
 /\*  
 \* This code is loosely based on ppmtogif from the PBMPLUS distribution  
 \* of Feb. 1991. That file contains the following copyright notice:  
 \* Based on GIFENCOD by David Rowley <mgardi@watdscu.waterloo.edu>.  
 \* Lempel-Ziv compression based on "compress" by Spencer W. Thomas et al.  
 \* Copyright (C) 1989 by Jef Poskanzer.  
 \* Permission to use, copy, modify, and distribute this software and its  
 \* documentation for any purpose  
 and without fee is hereby granted, provided  
 \* that the above copyright notice appear in all copies and that both that  
 \* copyright notice and this permission notice appear in supporting  
 \* documentation. This software is provided "as is" without express or  
 \* implied warranty.  
 \*/

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```
/*
 * jcmarker.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
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 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to write JPEG datastream markers.
 */
```

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jcmarker.c

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```
/*
 * jmorecfg.h
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 1997-2022 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains additional configuration options that customize the
 * JPEG software for special applications or support machine-dependent
 * optimizations. Most users will not need to touch this file.
 */
```

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jmorecfg.h

No license file was found, but licenses were detected in source scan.

```
/*
 * jcmainct.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2003-2012 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains the main buffer controller for compression.
 * The main buffer lies between the pre-processor and the JPEG
 * compressor proper; it holds downsampled data in the JPEG colorspace.
 */
```

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jcmainct.c

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/\*

\* jdmerge.c

\*

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\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains code for merged upsampling/color conversion.

\*

\* This file combines functions from jdsample.c and jdcOLOR.c;

\* read those files first to understand what's going on.

\*

\* When the chroma components are to be upsampled by simple replication

\* (ie, box filtering), we can save some work in color conversion by

\* calculating all the output pixels corresponding to a pair of chroma

\* samples at one time. In the conversion equations

\*  $R = Y + K1 * Cr$

\*  $G = Y + K2 * Cb + K3 * Cr$

\*  $B = Y + K4 * Cb$

\* only the Y term varies among the group of pixels corresponding to a pair

\* of chroma samples, so the rest of the terms can be calculated just  
once.

\* At typical sampling ratios, this eliminates half or three-quarters

\* of the multiplications needed for color conversion.

\*

\* This file currently provides implementations for the following cases:

\* YCC => RGB color conversion only (YCbCr or BG\_YCC).

\* Sampling ratios of 2h1v or 2h2v.

\* No scaling needed at upsample time.

\* Corner-aligned (non-CCIR601) sampling alignment.

\* Other special cases could be added, but in most applications these

\* are the only common cases. (For uncommon cases we fall back on

\* the more general code in jdsample.c and jdcOLOR.c.)

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdmerge.c

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/\*

\* jcapimin.c

\*

\* Copyright (C) 1994-1998, Thomas G. Lane.

\* Modified 2003-2010 by Guido Vollbeding.

- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains application interface code for the compression half
- \* of the JPEG library. These are the "minimum" API routines that may be
- \* needed in either the normal full-compression case or the transcoding-only
- \* case.
- \*
- \* Most of the routines intended to be called directly by an application
- \* are in this file or in jcapistd.c. But also see jcparam.c for
- \* parameter-setup helper routines, jcomapi.c for routines shared by
- \* compression and decompression, and jctrans.c for the transcoding case.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jcapimin.c

No license file was found, but licenses were detected in source scan.

- /\*
- \* rdtarga.c
- \*
- \* Copyright (C) 1991-1996, Thomas G. Lane.
- \* Modified 2017-2019 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains routines to read input images in Targa format.
- \*
- \* These routines may need modification for non-Unix environments or
- \* specialized applications. As they stand, they assume input from
- \* an ordinary stdio stream. They further assume that reading begins
- \* at the start of the file; start\_input may need work if the
- \* user interface has already read some data (e.g., to determine that
- \* the file is indeed Targa format).
- \*
- \* Based on code contributed by Lee Daniel Crocker.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/rdtarga.c

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- \* /jpegsr9f-zip/jpeg-9f/libjpeg.txt
- \* /jpegsr9f-zip/jpeg-9f/coderules.txt
- \* /jpegsr9f-zip/jpeg-9f/install.txt

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## IJG JPEG LIBRARY: SYSTEM ARCHITECTURE

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This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file provides an overview of the architecture of the IJG JPEG software; that is, the functions of the various modules in the system and the interfaces between modules. For more precise details about any data structure or calling convention, see the include files and comments in the source code.

We assume that the reader is already somewhat familiar with the JPEG standard. The README file includes references for learning about JPEG. The file libjpeg.txt describes the library from the viewpoint of an application programmer using the library; it's best to read that file before this one. Also, the file coderules.txt describes the coding style conventions we use.

In this document, JPEG-specific terminology follows the JPEG standard:

A "component" means a color channel, e.g., Red or Luminance.

A "sample" is a single component value (i.e., one number in the image data).

A "coefficient" is a frequency coefficient (a DCT transform output number).

A "block" is an array of samples or coefficients.

An "MCU" (minimum coded unit) is an interleaved set of blocks of size determined by the sampling factors, or a single block in a noninterleaved scan.

We do not use the terms "pixel" and "sample" interchangeably. When we say pixel, we mean an element of the full-size image, while a sample is an element of the downsampled image. Thus the number of samples may vary across components while the number of pixels does not. (This terminology is not used rigorously throughout the code, but it is used in places where confusion would otherwise result.)

### \*\*\* System features \*\*\*

The IJG distribution contains two parts:

- \* A subroutine library for JPEG compression and decompression.

- \* cjpeg/djpeg, two sample applications that use the library to transform JFIF JPEG files to and from several other image formats.

cjpeg/djpeg are of no great intellectual complexity: they merely add a simple command-line user interface and I/O routines for several uncompressed image formats. This document concentrates on the library itself.

We desire the library to be capable of supporting all JPEG baseline, extended

sequential, and progressive DCT processes. The library does not support the hierarchical or lossless processes defined in the standard.

Within these limits, any set of compression parameters allowed by the JPEG spec should be readable for decompression. (We can be more restrictive about what formats we can generate.) Although the system design allows for all parameter values, some uncommon settings are not yet implemented and may never be; nonintegral sampling ratios are the prime example. Furthermore, we treat 8-bit vs. 12-bit data precision as a compile-time switch, not a run-time option, because most machines can store 8-bit pixels much more compactly than 12-bit.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, libtiff uses this library to implement JPEG compression within the TIFF file format.)

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. This code can be omitted if not needed.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

### \*\*\* Portability issues \*\*\*

Portability is an essential requirement for the library. The key portability issues that show up at the level of system architecture are:

1. Memory usage. We want the code to be able to run on PC-class machines with limited memory. Images should therefore be processed sequentially (in strips), to avoid holding the whole image in memory at once. Where a full-image buffer is necessary, we should be able to use either virtual memory or temporary files.
2. Near/far pointer distinction. To run efficiently on 80x86 machines, the

code

should distinguish "small" objects (kept in near data space) from "large" ones (kept in far data space). This is an annoying restriction, but fortunately it does not impact code quality for less brain-damaged machines, and the source code clutter turns out to be minimal with sufficient use of pointer typedefs.

3. Data precision. We assume that "char" is at least 8 bits, "short" and "int" at least 16, "long" at least 32. The code will work fine with larger data sizes, although memory may be used inefficiently in some cases. However, the JPEG compressed datastream must ultimately appear on external storage as a sequence of 8-bit bytes if it is to conform to the standard. This may pose a problem on machines where char is wider than 8 bits. The library represents compressed data as an array of values of typedef JOCTET. If no data type exactly 8 bits wide is available, custom data source and data destination modules must be written to unpack and pack the chosen JOCTET datatype into 8-bit external representation.

#### \*\*\* System overview \*\*\*

The compressor and decompressor are each divided into two main sections: the JPEG compressor or decompressor proper, and the preprocessing or postprocessing functions. The interface between these two sections is the image data that the official JPEG spec regards as its input or output: this data is in the colorspace to be used for compression, and it is downsampled to the sampling factors to be used. The preprocessing and postprocessing steps are responsible for converting a normal image representation to or from this form. (Those few applications that want to deal with YCbCr downsampled data can skip the preprocessing or postprocessing step.)

Looking more closely, the compressor library contains the following main elements:

Preprocessing:

- \* Color space conversion (e.g., RGB to YCbCr).
- \* Edge expansion and downsampling. Optionally, this step can do simple smoothing --- this is often helpful for low-quality source data.

JPEG proper:

- \* MCU assembly, DCT, quantization.
- \* Entropy coding (sequential or progressive, Huffman or arithmetic).

In addition to these modules we need overall control, marker generation, and support code (memory management & error handling). There is also a module responsible for physically writing the output data --- typically this is just an interface to fwrite(), but some applications may need to

do something else with the data.

The decompressor library contains the following main elements:

JPEG proper:

- \* Entropy decoding (sequential or progressive, Huffman or arithmetic).
- \* Dequantization, inverse DCT, MCU disassembly.

Postprocessing:

- \* Upsampling. Optionally, this step may be able to do more general rescaling of the image.
- \* Color space conversion (e.g., YCbCr to RGB). This step may also provide gamma adjustment [ currently it does not ].
- \* Optional color quantization (e.g., reduction to 256 colors).
- \* Optional

color precision reduction (e.g., 24-bit to 15-bit color).

[This feature is not currently implemented.]

We also need overall control, marker parsing, and a data source module.

The support code (memory management & error handling) can be shared with the compression half of the library.

There may be several implementations of each of these elements, particularly in the decompressor, where a wide range of speed/quality tradeoffs is very useful. It must be understood that some of the best speedups involve merging adjacent steps in the pipeline. For example, upsampling, color space conversion, and color quantization might all be done at once when using a low-quality ordered-dither technique. The system architecture is designed to allow such merging where appropriate.

Note: it is convenient to regard edge expansion (padding to block boundaries) as a preprocessing/postprocessing function, even though the JPEG spec includes it in compression/decompression. We do this because

downsampling/upsampling

can be simplified a little if they work on padded data: it's not necessary to have special cases at the right and bottom edges. Therefore the interface buffer is always an integral number of blocks wide and high, and we expect compression preprocessing to pad the source data properly. Padding will occur only to the next block (block\_size-sample) boundary. In an interleaved-scan situation, additional dummy blocks may be used to fill out MCUs, but the MCU assembly and disassembly logic will create or discard these blocks internally. (This is advantageous for speed reasons, since we avoid DCTing the dummy blocks. It also permits a small reduction in file size, because the compressor can choose dummy block contents so as to minimize their size in compressed form. Finally, it makes the interface buffer specification independent of whether the file is actually interleaved or not.)

Applications that wish to deal directly with the downsampled data must provide similar



buffering and padding for odd-sized images.

\*\*\* Poor man's object-oriented programming \*\*\*

It should be clear by now that we have a lot of quasi-independent processing steps, many of which have several possible behaviors. To avoid cluttering the code with lots of switch statements, we use a simple form of object-style programming to separate out the different possibilities.

For example, two different color quantization algorithms could be implemented as two separate modules that present the same external interface; at runtime, the calling code will access the proper module indirectly through an "object".

We can get the limited features we need while staying within portable C. The basic tool is a function pointer. An "object" is just a struct containing one or more function pointer fields, each of which corresponds to a method name in real object-oriented languages. During initialization we fill in the function pointers with references to whichever module we have determined

we need to use in this run. Then invocation of the module is done by indirecting through a function pointer; on most machines this is no more expensive than a switch statement, which would be the only other way of making the required run-time choice. The really significant benefit, of course, is keeping the source code clean and well structured.

We can also arrange to have private storage that varies between different implementations of the same kind of object. We do this by making all the module-specific object structs be separately allocated entities, which will be accessed via pointers in the master compression or decompression struct. The "public" fields or methods for a given kind of object are specified by a commonly known struct. But a module's initialization code can allocate a larger struct that contains the common struct as its first member, plus additional private fields. With appropriate pointer casting, the module's internal functions can access these private fields.

(For a simple example, see `jdatadst.c`, which implements the external interface specified by struct `jpeg_destination_mgr`, but adds extra fields.)

(Of course this would all be a lot easier if we were using C++, but we are not yet prepared to assume that everyone has a C++ compiler.)

An important benefit of this scheme is that it is easy to provide multiple versions of any method, each tuned to a particular case. While a lot of precalculation might be done to select an optimal implementation of a method, the cost per invocation is constant. For example, the upsampling step might have a "generic" method, plus one or more "hardwired" methods for the most popular sampling factors; the hardwired methods would be faster because they'd

use straight-line code instead of for-loops. The cost to determine which method to use is paid only once, at startup, and the selection criteria are hidden from the callers of the method.

This plan differs a little bit from usual object-oriented structures, in that only one instance of each object class will exist during execution. The reason for having the class structure is that on different runs we may create different instances (choose to execute different modules). You can think of the term "method" as denoting the common interface presented by a particular set of interchangeable functions, and "object" as denoting a group of related methods, or the total shared interface behavior of a group of modules.

### \*\*\* Overall control structure \*\*\*

We previously mentioned the need for overall control logic in the compression and decompression libraries. In IJG implementations prior to v5, overall control was mostly provided by "pipeline control" modules, which proved to be large, unwieldy, and hard to understand. To improve the situation, the control logic has been subdivided into multiple modules. The control modules consist of:

1. Master control for module selection and initialization. This has two responsibilities:

- 1A. Startup

initialization at the beginning of image processing.

The individual processing modules to be used in this run are selected and given initialization calls.

- 1B. Per-pass control. This determines how many passes will be performed and calls each active processing module to configure itself appropriately at the beginning of each pass. End-of-pass processing, where necessary, is also invoked from the master control module.

Method selection is partially distributed, in that a particular processing module may contain several possible implementations of a particular method, which it will select among when given its initialization call. The master control code need only be concerned with decisions that affect more than one module.

2. Data buffering control. A separate control module exists for each inter-processing-step data buffer. This module is responsible for invoking the processing steps that write or read that data buffer.

Each

buffer controller sees the world as follows:

```
input data => processing step A => buffer => processing step B => output data
 | | |
 ----- controller -----
```

The controller knows the dataflow requirements of steps A and B: how much data they want to accept in one chunk and how much they output in one chunk. Its function is to manage its buffer and call A and B at the proper times.

A data buffer control module may itself be viewed as a processing step by a higher-level control module; thus the control modules form a binary tree with elementary processing steps at the leaves of the tree.

The control modules are objects. A considerable amount of flexibility can be had by replacing implementations of a control module. For example:

- \* Merging of adjacent steps in the pipeline is done by replacing a control module and its pair of processing-step modules with a single processing-step module.

(Hence the possible merges are determined by the tree of control modules.)

- \* In some processing modes, a given interstep buffer need only be a "strip" buffer large enough to accommodate the desired data chunk sizes. In other modes, a full-image buffer is needed and several passes are required.

The control module determines which kind of buffer is used and manipulates virtual array buffers as needed. One or both processing steps may be unaware of the multi-pass behavior.

In theory, we might be able to make all of the data buffer controllers interchangeable and provide just one set of implementations for all. In practice, each one contains considerable special-case processing for its particular job. The buffer controller concept should be regarded as an overall system structuring principle, not as a complete description of the task performed by any one controller.

\*\*\* Compression object structure \*\*\*

Here is a sketch of the logical structure of the JPEG compression library:

```

 |-- Colospace conversion
 |-- Preprocessing controller --|
 | |-- Downsampling
Main controller --|
 | |-- Forward DCT, quantize
 |-- Coefficient controller --|
 |-- Entropy encoding
```

This sketch also describes the flow of control (subroutine calls) during typical image data processing. Each of the components shown in the diagram is an "object" which may have several different implementations available. One or more source code files contain the actual implementation(s) of each object.

The objects shown above are:

- \* Main controller: buffer controller for the subsampled-data buffer, which holds the preprocessed input data. This controller invokes preprocessing to fill the subsampled-data buffer, and JPEG compression to empty it. There is usually no need for a full-image buffer here; a strip buffer is adequate.
- \* Preprocessing controller: buffer controller for the downsampling input data buffer, which lies between colorspace conversion and downsampling. Note that a unified conversion/downsampling module would probably replace this controller entirely.
- \* Colorspace conversion: converts application image data into the desired JPEG color space; also changes the data from pixel-interleaved layout to separate component planes. Processes one pixel row at a time.
- \* Downsampling: performs reduction of chroma components as required. Optionally may perform pixel-level smoothing as well. Processes a "row group" at a time, where a row group is defined as  $V_{max}$  pixel rows of each component before downsampling, and  $V_k$  sample rows afterwards (remember  $V_k$  differs across components). Some downsampling or smoothing algorithms may require context rows above and below the current row group; the preprocessing controller is responsible for supplying these rows via proper buffering. The downsampler is responsible for edge expansion at the right edge (i.e., extending each sample row to a multiple of `block_size` samples); but the preprocessing controller is responsible for vertical edge expansion (i.e., duplicating the bottom sample row as needed to make a multiple of `block_size` rows).
- \* Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU assembly, including insertion of dummy DCT blocks when needed at the right or bottom edge. When performing Huffman-code optimization or emitting a multiscan JPEG file, this controller is responsible for buffering the full image. The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the JPEG file is noninterleaved.
- \* Forward DCT and quantization: Perform DCT, quantize, and emit coefficients. Works on one or more DCT blocks at a time. (Note: the coefficients

are now

emitted in normal array order, which the entropy encoder is expected to convert to zigzag order as necessary. Prior versions of the IJG code did the conversion to zigzag order within the quantization step.)

\* Entropy encoding: Perform Huffman or arithmetic entropy coding and emit the coded data to the data destination module. Works on one MCU per call. For progressive JPEG, the same DCT blocks are fed to the entropy coder during each pass, and the coder must emit the appropriate subset of coefficients.

In addition to the above objects, the compression library includes these objects:

\* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules.

\* Marker writing: generates JPEG markers (except for RSTn, which is emitted by the entropy encoder when needed).

\* Data destination manager: writes the output JPEG datastream to its final destination (e.g., a file). The destination manager supplied with the library knows how to write to a stdio stream or to a memory buffer; for other behaviors, the surrounding application may provide its own destination manager.

\* Memory manager: allocates and releases memory, controls virtual arrays (with backing store management, where required).

\* Error handler: performs formatting and output of error and trace messages; determines handling of nonfatal errors. The surrounding application may override some or all of this object's methods to change error handling.

\* Progress monitor: supports output of "percent-done" progress reports. This object represents an optional callback to the surrounding application: if wanted, it must be supplied by the application.

The error handler, destination manager, and progress monitor objects are defined as separate objects in order to simplify application-specific customization of the JPEG library. A surrounding application may override individual methods or supply its own all-new implementation of one of these objects. The object interfaces for these objects are therefore treated as part of the application interface of the library, whereas the other objects are internal to the library.

The error handler and memory manager are shared by JPEG compression and

decompression; the progress monitor, if used, may be shared as well.

### \*\*\* Decompression object structure \*\*\*

Here is a sketch of the logical structure of the JPEG decompression library:

```

 |-- Entropy decoding
 |-- Coefficient controller --|
 | |-- Dequantize, Inverse DCT
Main controller --|
 | |-- Upsampling
 |-- Postprocessing controller --| |-- Colorspace conversion
 |-- Color quantization
 |-- Color precision reduction
```

As before, this diagram  
also represents typical control flow. The objects  
shown are:

\* Main controller: buffer controller for the subsampled-data buffer, which holds the output of JPEG decompression proper. This controller's primary task is to feed the postprocessing procedure. Some upsampling algorithms may require context rows above and below the current row group; when this is true, the main controller is responsible for managing its buffer so as to make context rows available. In the current design, the main buffer is always a strip buffer; a full-image buffer is never required.

\* Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU disassembly, including deletion of any dummy DCT blocks at the right or bottom edge. When reading a multiscan JPEG file, this controller is responsible for buffering the full image. (Buffering DCT coefficients, rather than samples, is necessary to support progressive JPEG.) The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the source JPEG file is noninterleaved.

\* Entropy decoding: Read coded data from the data source module and perform Huffman or arithmetic entropy decoding. Works on one MCU per call. For progressive JPEG decoding, the coefficient controller supplies the prior coefficients of each MCU (initially all zeroes), which the entropy decoder modifies in each scan.

\* Dequantization and inverse DCT: like it says. Note that the coefficients buffered by the coefficient controller have NOT been dequantized; we merge dequantization and inverse DCT into a single step for speed reasons. When scaled-down output is asked for, simplified DCT algorithms may be used

that need fewer coefficients and emit fewer samples per DCT block, not the full 8x8. Works on one DCT block at a time.

- \* Postprocessing controller: buffer controller for the color quantization input buffer, when quantization is in use. (Without quantization, this controller just calls the upsampler.) For two-pass quantization, this controller is responsible for buffering the full-image data.
- \* Upsampling: restores chroma components to full size. (May support more general output rescaling, too. Note that if undersized DCT outputs have been emitted by the DCT module, this module must adjust so that properly sized outputs are created.) Works on one row group at a time. This module also calls the color conversion module, so its top level is effectively a buffer controller for the upsampling->color conversion buffer. However, in all but the highest-quality operating modes, upsampling and color conversion are likely to be merged into a single step.
- \* Colorspace conversion: convert from JPEG color space to output color space, and change data layout from separate component planes to pixel-interleaved. Works on one pixel row at a time.
- \* Color quantization: reduce the data to colormapped form, using either an externally specified colormap or an internally generated one. This module is not used for full-color output. Works on one pixel row at a time; may require two passes to generate a color map. Note that the output will always be a single component representing colormap indexes. In the current design, the output values are JSAMPLEs, so an 8-bit compilation cannot quantize to more than 256 colors. This is unlikely to be a problem in practice.
- \* Color reduction: this module handles color precision reduction, e.g., generating 15-bit color (5 bits/primary) from JPEG's 24-bit output. Not quite clear yet how this should be handled... should we merge it with colorspace conversion???

Note that some high-speed operating modes might condense the entire postprocessing sequence to a single module (upsample, color convert, and quantize in one step).

In addition to the above objects, the decompression library includes these objects:

- \* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules. This is subdivided into input and output control: jdinput.c controls only input-side processing,

while `jdmaster.c` handles overall initialization and output-side control.

- \* Marker reading: decodes JPEG markers (except for `RSTn`).
- \* Data source manager: supplies the input JPEG datastream. The source manager supplied with the library knows how to read from a `stdio` stream or from a memory buffer; for other behaviors, the surrounding application may provide its own source manager.
- \* Memory manager: same as for compression library.
- \* Error handler: same as for compression library.
- \* Progress monitor: same as for compression library.

As with compression, the data source manager, error handler, and progress monitor are candidates for replacement by a surrounding application.

#### \*\*\* Decompression input and output separation \*\*\*

To support efficient incremental display of progressive JPEG files, the decompressor is divided into two sections that can run independently:

1. Data input includes marker parsing, entropy decoding, and input into the coefficient controller's DCT coefficient buffer. Note that this processing is relatively cheap and fast.
2. Data output reads from the DCT coefficient buffer and performs the IDCT and all postprocessing steps.

For a progressive JPEG file, the data input processing is allowed to get arbitrarily far ahead of the data output processing. (This occurs only if the application calls `jpeg_consume_input()`; otherwise input and output run in lockstep, since the input section is called only when the output section needs more data.) In this way the application can avoid making extra display passes when data is arriving faster than the display pass can run. Furthermore, it is possible to abort an output pass without losing anything, since the coefficient buffer is read-only as far as the output section is concerned. See `libjpeg.txt` for more detail.

A full-image coefficient array is only created if the JPEG file has multiple scans (or if the application specifies buffered-image mode anyway). When reading a single-scan file, the coefficient controller normally creates only a one-MCU buffer, so input and output processing must run in lockstep in this case. `jpeg_consume_input()` is effectively a no-op in this situation.



The main impact of dividing the decompressor in this fashion is that we must be very careful with shared variables in the cinfo data structure. Each variable that can change during the course of decompression must be classified as belonging to data input or data output, and each section must look only at its own variables. For example, the data output section may not depend on any of the variables that describe the current scan in the JPEG file, because these may change as the data input section advances into a new scan.

The progress monitor is (somewhat arbitrarily) defined to treat input of the file as one pass when buffered-image mode is not used, and to ignore data input work completely when buffered-image mode is used. Note that the library has no reliable way to predict the number of passes when dealing with a progressive JPEG file, nor can it predict the number of output passes in buffered-image mode. So the work estimate is inherently bogus anyway.

No comparable division is currently made in the compression library, because there isn't any real need for it.

#### \*\*\* Data formats \*\*\*

Arrays of pixel sample values use the following data structure:

```
typedef something JSAMPLE; a pixel component value, 0..MAXJSAMPLE
typedef JSAMPLE *JSAMPROW; ptr to a row of samples
typedef JSAMPROW *JSAMPARRAY; ptr to a list of rows
typedef JSAMPARRAY *JSAMPIMAGE; ptr to a list of color-component arrays
```

The basic element type JSAMPLE will typically be one of unsigned char, (signed) char, or short. Short will be used if samples wider than 8 bits are to be supported (this is a compile-time option). Otherwise, unsigned char is used if possible. If the compiler only supports signed chars, then it is necessary to mask off the value when reading. Thus, all reads of JSAMPLE values must be coded as "GETJSAMPLE(value)", where the macro will be defined as "((value) & 0xFF)" on signed-char machines and "((int) (value))" elsewhere.

With these conventions, JSAMPLE values can be assumed to be  $\geq 0$ . This helps simplify correct rounding during downsampling, etc. The JPEG standard's specification that sample values run from -128..127 is accommodated by subtracting 128 from the sample value in the DCT step. Similarly, during decompression the output of the IDCT step will be immediately shifted back to 0..255. (NB: different values are required when 12-bit samples are in use. The code is written in terms of MAXJSAMPLE and CENTERJSAMPLE, which will be defined as 255 and 128 respectively in an 8-bit implementation, and as 4095

and 2048 in a 12-bit implementation.)

We use a pointer per row, rather than a two-dimensional JSAMPLE array. This choice costs only a small amount of memory and has several benefits:

- \* Code using the data structure doesn't need to know the allocated width of the rows. This simplifies edge expansion/compression, since we can work in an array that's wider than the logical picture width.
- \* Indexing doesn't require multiplication; this is a performance win on many machines.
- \* Arrays with more than 64K total elements can be supported even on machines where malloc() cannot allocate chunks larger than 64K.
- \* The rows forming a component array may be allocated at different times without extra copying. This trick allows some speedups in smoothing steps that need access to the previous and next rows.

Note that each color component is stored in a separate array; we don't use the traditional layout in which the components of a pixel are stored together.

This simplifies coding of modules that work on each component independently,

because they don't need to know how many components there are. Furthermore, we can read or write each component to a temporary file independently, which is helpful when dealing with noninterleaved JPEG files.

In general, a specific sample value is accessed by code such as

```
GETJSAMPLE(image[colorcomponent][row][col])
```

where col is measured from the image left edge, but row is measured from the first sample row currently in memory. Either of the first two indexings can be precomputed by copying the relevant pointer.

Since most image-processing applications prefer to work on images in which the components of a pixel are stored together, the data passed to or from the surrounding application uses the traditional convention: a single pixel is represented by N consecutive JSAMPLE values, and an image row is an array of (# of color components)\*(image width) JSAMPLEs. One or more rows of data can be represented by a pointer of type JSAMPARRAY in this scheme.

This scheme is

converted to component-wise storage inside the JPEG library. (Applications that want to skip JPEG preprocessing or postprocessing will have to contend with component-wise storage.)

Arrays of DCT-coefficient values use the following data structure:

```
typedef short JCOEF; a 16-bit signed integer
```

```
typedef JCOEF JBLOCK[DCTSIZE2]; an 8x8 block of coefficients
```

```
typedef JBLOCK *JBLOCKROW; ptr to one horizontal row of 8x8 blocks
```

```
typedef JBLOCKROW *JBLOCKARRAY; ptr to a list of such rows
typedef JBLOCKARRAY *JBLOCKIMAGE; ptr to a list of color component arrays
```

The underlying type is at least a 16-bit signed integer; while "short" is big enough on all machines of interest, on some machines it is preferable to use "int" for speed reasons, despite the storage cost. Coefficients are grouped into 8x8 blocks (but we always use #defines DCTSIZE and DCTSIZE2 rather than "8" and "64").

The contents of a coefficient block may be in either "natural" or zigzagged order, and may be true values or divided by the quantization coefficients, depending on where the block is in the processing pipeline. In the current library, coefficient blocks are kept in natural order everywhere; the entropy codecs zigzag or dezigzag the data as it is written or read. The blocks contain quantized coefficients everywhere outside the DCT/IDCT subsystems. (This latter decision may need to be revisited to support variable quantization a la JPEG Part 3.)

Notice that the allocation unit is now a row of 8x8 coefficient blocks, corresponding to block\_size rows of samples. Otherwise the structure is much the same as for samples, and for the same reasons.

On machines where malloc() can't handle a request bigger than 64Kb, this data structure limits us to rows of less than 512 JBLOCKS, or a picture width of 4000+ pixels. This seems an acceptable restriction.

On 80x86 machines, the bottom-level pointer types (JSAMPROW and JBLOCKROW) must be declared as "far" pointers, but the upper levels can be "near" (implying that the pointer lists are allocated in the DS segment). We use a #define symbol FAR, which expands to the "far" keyword when compiling on 80x86 machines and to nothing elsewhere.

\*\*\* Suspendable processing \*\*\*

In some applications it is desirable to use the JPEG library as an incremental, memory-to-memory filter. In this situation the data source or destination may be a limited-size buffer, and we can't rely on being able to empty or refill the buffer at arbitrary times. Instead the application would like to have control return from the library at buffer overflow/underrun, and then resume compression or decompression at a later time.

This scenario is supported for simple cases. (For anything more complex, we recommend that the application "bite the bullet" and develop real multitasking capability.) The libjpeg.txt file goes into more detail about the usage and

limitations of this capability; here we address the implications for library structure.

The

essence of the problem is that the entropy codec (coder or decoder) must be prepared to stop at arbitrary times. In turn, the controllers that call the entropy codec must be able to stop before having produced or consumed all the data that they normally would handle in one call. That part is reasonably straightforward: we make the controller call interfaces include "progress counters" which indicate the number of data chunks successfully processed, and we require callers to test the counter rather than just assume all of the data was processed.

Rather than trying to restart at an arbitrary point, the current Huffman codecs are designed to restart at the beginning of the current MCU after a suspension due to buffer overflow/underrun. At the start of each call, the codec's internal state is loaded from permanent storage (in the JPEG object structures) into local variables. On successful completion of the MCU, the permanent state is updated. (This copying is not very expensive, and may even lead to \*improved\* performance if the local variables can be registerized.) If a suspension occurs, the codec simply returns without updating the state, thus effectively reverting to the start of the MCU. Note that this implies leaving some data unprocessed in the source/destination buffer (ie, the compressed partial MCU). The data source/destination module interfaces are specified so as to make this possible. This also implies that the data buffer must be large enough to hold a worst-case compressed MCU; a couple thousand bytes should be enough.

In a successive-approximation AC refinement scan, the progressive Huffman decoder has to be able to undo assignments of newly nonzero coefficients if it suspends before the MCU is complete, since decoding requires distinguishing previously-zero and previously-nonzero coefficients. This is a bit tedious but probably won't have much effect on performance. Other variants of Huffman decoding need not worry about this, since they will just store the same values again if forced to repeat the MCU.

This approach would probably not work for an arithmetic codec, since its modifiable state is quite large and couldn't be copied cheaply. Instead it would have to suspend and resume exactly at the point of the buffer end.

The JPEG marker reader is designed to cope with suspension at an arbitrary point. It does so by backing up to the start of the marker parameter segment, so the data buffer must be big enough to hold the largest marker of interest. Again, a couple KB should be adequate. (A special "skip" convention is used to bypass COM and APPn markers, so these can be larger than the buffer size without causing problems; otherwise a 64K buffer would be needed in the worst

case.)

The JPEG marker writer currently does *\*not\** cope with suspension.

We feel that this is not necessary; it is much easier simply to require the application to ensure there is enough buffer space before starting. (An empty 2K

buffer is more than sufficient for the header markers; and ensuring there are a dozen or two bytes available before calling `jpeg_finish_compress()` will suffice for the trailer.) This would not work for writing multi-scan JPEG files, but we simply do not intend to support that capability with suspension.

### \*\*\* Memory manager services \*\*\*

The JPEG library's memory manager controls allocation and deallocation of memory, and it manages large "virtual" data arrays on machines where the operating system does not provide virtual memory. Note that the same memory manager serves both compression and decompression operations.

In all cases, allocated objects are tied to a particular compression or decompression master record, and they will be released when that master record is destroyed.

The memory manager does not provide explicit deallocation of objects. Instead, objects are created in "pools" of free storage, and a whole pool can be freed at once. This approach helps prevent storage-leak bugs, and

it speeds up operations whenever `malloc/free` are slow (as they often are).

The pools can be regarded as lifetime identifiers for objects. Two pools/lifetimes are defined:

- \* `JPOOL_PERMANENT` lasts until master record is destroyed

- \* `JPOOL_IMAGE` lasts until done with image (JPEG datastream)

Permanent lifetime is used for parameters and tables that should be carried across from one datastream to another; this includes all application-visible parameters. Image lifetime is used for everything else. (A third lifetime, `JPOOL_PASS` = one processing pass, was originally planned. However it was dropped as not being worthwhile. The actual usage patterns are such that the peak memory usage would be about the same anyway; and having per-pass storage substantially complicates the virtual memory allocation rules --- see below.)

The memory manager deals with three kinds of object:

1. "Small" objects. Typically these require no more than 10K-20K total.
2. "Large" objects. These may require tens to hundreds of K depending on image size. Semantically they behave the same as small objects, but we distinguish them for two reasons:

- \* On MS-DOS machines, large objects are referenced by FAR pointers,

small objects by NEAR pointers.

\* Pool allocation heuristics may differ for large and small objects.

Note that individual "large" objects cannot exceed the size allowed by type size\_t, which may be 64K or less on some machines.

3. "Virtual" objects. These are large 2-D arrays of JSAMPLEs or JBLOCKs (typically large enough for the entire image being processed). The memory manager provides stripwise access to these arrays. On machines without virtual memory, the rest of the array may be swapped out to a temporary file.

(Note: JSAMPARRAY and JBLOCKARRAY data structures are a combination of large objects for the data proper and small objects for the row pointers. For convenience and speed, the memory manager provides single routines to create these structures. Similarly, virtual arrays include a small control block and a JSAMPARRAY or JBLOCKARRAY working buffer, all created with one call.)

In the present implementation, virtual arrays are only permitted to have image lifespan. (Permanent lifespan would not be reasonable, and pass lifespan is not very useful since a virtual array's raison d'etre is to store data for multiple passes through the image.) We also expect that only "small" objects will be given permanent lifespan, though this restriction is not required by the memory manager.

In a non-virtual-memory machine, some performance benefit can be gained by making the in-memory buffers for virtual arrays be as large as possible. (For small images, the buffers might fit entirely in memory, so blind swapping would be very wasteful.) The memory manager will adjust the height of the buffers to fit within a prespecified maximum memory usage. In order to do this in a reasonably optimal fashion, the manager needs to allocate all of the virtual arrays at once. Therefore, there isn't a one-step allocation routine for virtual arrays; instead, there is a "request" routine that simply allocates the control block, and a "realize" routine (called just once) that determines space allocation and creates all of the actual buffers. The realize routine must allow for space occupied by non-virtual large objects. (We don't bother to factor in the space needed for small objects, on the grounds that it isn't worth the trouble.)

To support all this, we establish the following protocol for doing business with the memory manager:

1. Modules must request virtual arrays (which may have only image lifespan) during the initial setup phase, i.e., in their jinit\_xxx routines.
2. All "large" objects (including JSAMPARRAYs and JBLOCKARRAYs) must also be allocated during initial setup.
3. realize\_virt\_arrays will be called at the completion of initial setup.

The above conventions ensure that

sufficient information is available

for it to choose a good size for virtual array buffers.

Small objects of any lifespan may be allocated at any time. We expect that the total space used for small objects will be small enough to be negligible in the `realize_virt_arrays` computation.

In a virtual-memory machine, we simply pretend that the available space is infinite, thus causing `realize_virt_arrays` to decide that it can allocate all the virtual arrays as full-size in-memory buffers. The overhead of the virtual-array access protocol is very small when no swapping occurs.

A virtual array can be specified to be "pre-zeroed"; when this flag is set, never-yet-written sections of the array are set to zero before being made available to the caller. If this flag is not set, never-written sections of the array contain garbage. (This feature exists primarily because the equivalent logic would otherwise be needed in `jdcoefct.c` for progressive JPEG mode; we may as well make it available for possible other uses.)

The first write pass on a virtual array is required to occur in top-to-bottom order; read passes, as well as any write passes after the first one, may access the array in any order. This restriction exists partly to simplify the virtual array control logic, and partly because some file systems may not support seeking beyond the current end-of-file in a temporary file. The main implication of this restriction is that rearrangement of rows (such as converting top-to-bottom data order to bottom-to-top) must be handled while reading data out of the virtual array, not while putting it in.

### \*\*\* Memory manager internal structure \*\*\*

To isolate system dependencies as much as possible, we have broken the memory manager into two parts. There is a reasonably system-independent "front end" (`jmemmgr.c`) and a "back end" that contains only the code likely to change across systems. All of the memory management methods outlined above are implemented by the front end.

The back end provides the following routines for use by the front end (none of these routines are known to the rest of the JPEG code):

`jpeg_mem_init`, `jpeg_mem_term` system-dependent initialization/shutdown

`jpeg_get_small`, `jpeg_free_small` interface to malloc and free library routines (or their equivalents)

`jpeg_get_large`, `jpeg_free_large` interface to FAR malloc/free in MSDOS machines; else usually the same as  
`jpeg_get_small`/`jpeg_free_small`

jpeg\_mem\_available estimate available memory

jpeg\_open\_backing\_store create a backing-store object

read\_backing\_store, manipulate a backing-store object

write\_backing\_store,

close\_backing\_store

On some systems there will be more than one type of backing-store object (specifically, in MS-DOS a backing store file might be an area of extended memory as well as a disk file). jpeg\_open\_backing\_store is responsible for choosing how to implement a given object. The read/write/close routines are method pointers in the structure that describes a given object; this lets them be different for different object types.

It may be necessary to ensure that backing store objects are explicitly released upon abnormal program termination. For example, MS-DOS won't free extended memory by itself. To support this, we will expect the main program or surrounding application to arrange to call self\_destruct (typically via jpeg\_destroy) upon abnormal termination. This may require a SIGINT signal handler or equivalent. We don't want to have the back end module install its own signal handler, because that would pre-empt the surrounding application's ability to control signal handling.

The IJG distribution includes several memory manager back end implementations. Usually the same back end should be suitable for all applications on a given system, but it is possible for an application to supply its own back end at need.

#### \*\*\* Implications of DNL marker \*\*\*

Some JPEG files may use a DNL marker to postpone definition of the image height

(this would be useful for a fax-like scanner's output, for instance).

In these files the SOF marker claims the image height is 0, and you only find out the true image height at the end of the first scan.

We could read these files as follows:

1. Upon seeing zero image height, replace it by 65535 (the maximum allowed).
2. When the DNL is found, update the image height in the global image descriptor.

This implies that control modules must avoid making copies of the image height, and must re-test for termination after each MCU row. This would be easy enough to do.



In cases where image-size data structures are allocated, this approach will result in very inefficient use of virtual memory or much-larger-than-necessary temporary files. This seems acceptable for something that probably won't be a mainstream usage. People might have to forgo use of memory-hogging options (such as two-pass color quantization or noninterleaved JPEG files) if they want efficient conversion of such files.

(One could improve efficiency by demanding a user-supplied upper bound for the height, less than 65536; in most cases it could be much less.)

The standard also permits the SOF marker to overestimate the image height, with a DNL to give the true, smaller height at the end of the first scan. This would solve the space problems if the overestimate wasn't too great. However, it implies that you don't even know whether DNL will be used.

This leads to a couple of very serious objections:

1. Testing for a DNL marker must occur in the inner loop of the decompressor's Huffman decoder; this implies a speed penalty whether the feature is used or not.
2. There is no way to hide the last-minute change in image height from an application using the decoder. Thus *every* application using the IJG library would suffer a complexity penalty whether it cared about DNL or not.

We currently do not support DNL because of these problems.

A different approach is to insist that DNL-using files be preprocessed by a separate program that reads ahead to the DNL, then goes back and fixes the SOF marker. This is a much simpler solution and is probably far more efficient. Even if one wants piped input, buffering the first scan of the JPEG file needs a lot smaller temp file than is implied by the maximum-height method. For this approach we'd simply treat DNL as a no-op in the decompressor (at most, check that it matches the SOF image height).

We will not worry about making the compressor capable of outputting DNL. Something similar to the first scheme above could be applied if anyone ever wants to make that work.

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/structure.txt

No license file was found, but licenses were detected in source scan.

/\*

\* alternate djpeg.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2009-2023 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains an alternate user interface for the JPEG decompressor.
- \* One or more input files are named on the command line, and output file
- \* names are created by substituting an appropriate extension.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/djpegalt.c

No license file was found, but licenses were detected in source scan.

```

/*
 * jfdctint.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modification developed 2003-2018 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a slow-but-accurate integer implementation of the
 * forward DCT (Discrete Cosine Transform).
 *
 * A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
 * on each column. Direct algorithms are also available, but they are
 * much more complex and seem not to be any faster when reduced to code.
 *
 * This implementation is based on an algorithm described in
 * C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
 * Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,
 * Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
 * The primary algorithm described there uses 11 multiplies
 * and 29 adds.
 * We use their alternate method with 12 multiplies and 32 adds.
 * The advantage of this method is that no data path contains more than one
 * multiplication; this allows a very simple and accurate implementation in
 * scaled fixed-point arithmetic, with a minimal number of shifts.
 *
 * We also provide FDCT routines with various input sample block sizes for
 * direct resolution reduction or enlargement and for direct resolving the
 * common 2x1 and 1x2 subsampling cases without additional resampling: NxN
 * (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 output DCT block.
 *
 * For N<8 we fill the remaining block coefficients with zero.
 * For N>8 we apply a partial N-point FDCT on the input samples, computing
 * just the lower 8 frequency coefficients and discarding the rest.
 *
 * We must scale the output coefficients of the N-point FDCT appropriately
 * to the standard 8-point FDCT level by 8/N per 1-D pass. This scaling

```

\* is folded into the constant multipliers  
(pass 2) and/or final/initial  
\* shifting.  
\*  
\* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases  
\* since there would be too many additional constants to pre-calculate.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jfdctint.c

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; For conditions of distribution and use, see the accompanying README file.

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jmemdosa.asm

No license file was found, but licenses were detected in source scan.

/\*

\* transupp.h

\*

\* Copyright (C) 1997-2019, Thomas G. Lane, Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains declarations for image transformation routines and

\* other utility code used by the jpegtran sample application. These are

\* NOT part of the core JPEG library. But we keep these routines separate

\* from jpegtran.c to ease the task of maintaining jpegtran-like programs

\* that have other user interfaces.

\*

\* NOTE: all the routines declared here have very specific requirements

\* about when they are to be executed during the reading and writing of the

\* source and destination files. See the comments in transupp.c, or see

\* jpegtran.c for an example of correct usage.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/transupp.h

No license file was found, but licenses were detected in source scan.

/\*

\* rdgif.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2019-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

```

*
* This file contains routines to read input images in GIF format.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed GIF format).
*/
/*
* This code is loosely based on giftppm from the PBMPLUS distribution
* of Feb. 1991. That file contains the following copyright notice:
* +-----+
* | Copyright 1990,
* | David Koblas.
* |
* | Permission to use, copy, modify, and distribute this software |
* | and its documentation for any purpose and without fee is hereby |
* | granted, provided that the above copyright notice appear in all |
* | copies and that both that copyright notice and this permission |
* | notice appear in supporting documentation. This software is |
* | provided "as is" without express or implied warranty.
* |
* +-----+
*/

```

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/rdgif.c

No license file was found, but licenses were detected in source scan.

```

/*
* rdrle.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2019 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Utah RLE format.
* The Utah Raster Toolkit library is required (version 3.1 or later).
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed RLE format).
*
* Based on code contributed by Mike Lijewski,

```

\* with updates from Robert Hutchinson.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/rdrle.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcparam.c

\*

\* Copyright (C) 1991-1998, Thomas G. Lane.

\* Modified 2003-2022 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains optional default-setting code for the JPEG compressor.

\* Applications do not have to use this file, but those that don't use it

\* must know a lot more about the innards of the JPEG code.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jcparam.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdsample.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2002-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains upsampling routines.

\*

\* Upsampling input data is counted in "row groups". A row group

\* is defined to be (v\_samp\_factor \* DCT\_v\_scaled\_size / min\_DCT\_v\_scaled\_size)

\* sample rows of each component. Upsampling will normally produce

\* max\_v\_samp\_factor pixel rows from each row group (but this could vary

\* if the upsampler is applying a scale factor of its own).

\*

\* An excellent reference for image resampling is

\* Digital Image Warping, George Wolberg, 1990.

\* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdsample.c

No license file was found, but licenses were detected in source scan.

```
/*
 * rdppm.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2009-2020 by Bill Allombert, Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to read input images in PPM/PGM format.
 * The extended 2-byte-per-sample raw PPM/PGM formats are supported.
 * The PBMPLUS library is NOT required to compile this software
 * (but it is highly useful as a set of PPM image manipulation programs).
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume input from
 * an ordinary stdio stream. They further assume that reading begins
 * at the start of the file; start_input may need work if the
 * user interface has already read some data (e.g., to determine that
 * the file is indeed PPM format).
 */
/* Portions
of this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation. This software is provided "as is" without express or
** implied warranty.
*/
```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/rdppm.c
```

No license file was found, but licenses were detected in source scan.

```
/*
 * jdct.h
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2002-2023 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This include file contains common declarations for the forward and
```

\* inverse DCT modules. These declarations are private to the DCT managers  
\* (jcdctmgr.c, jddctmgr.c) and the individual DCT algorithms.  
\* The individual DCT algorithms are kept in separate files to ease  
\* machine-dependent tuning (e.g., assembly coding).  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdct.h

No license file was found, but licenses were detected in source scan.

/\*

\* jversion.h

\*

\* Copyright (C) 1991-2024, Thomas G. Lane, Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains software version identification.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jversion.h

No license file was found, but licenses were detected in source scan.

/\*

\* wrtle.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2017-2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to write output images in RLE format.

\* The Utah Raster Toolkit library is required (version 3.1 or later).

\*

\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume output to

\* an ordinary stdio stream.

\*

\* Based on code contributed by Mike Lijewski,

\* with updates from Robert Hutchinson.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/wrtle.c

No license file was found, but licenses were detected in source scan.

/\*

```

* jchuff.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2006-2023 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy encoding routines.
* Both sequential and progressive modes are supported in this single module.
*
* Much of the complexity here has to do with supporting output suspension.
* If the data destination module demands suspension, we want to be able to
* back up to the start of the current MCU. To do this, we copy state
* variables into local working storage, and update them back to the
* permanent JPEG objects only upon successful completion of an MCU.
*
* We do not support output suspension for the progressive JPEG mode, since
* the library currently does not allow multiple-scan files to be written
* with output suspension.
*/

```

Found

in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jchuff.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jquant2.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2011-2020 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains 2-pass color quantization (color mapping) routines.
* These routines provide selection of a custom color map for an image,
* followed by mapping of the image to that color map, with optional
* Floyd-Steinberg dithering.
* It is also possible to use just the second pass to map to an arbitrary
* externally-given color map.
*
* Note: ordered dithering is not supported, since there isn't any fast
* way to compute intercolor distances; it's unclear that ordered dither's
* fundamental assumptions even hold with an irregularly spaced color map.
*/

```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jquant2.c
```



No license file was found, but licenses were detected in source scan.

```
/*
 * jdmarker.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modified 2009-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to decode JPEG datastream markers.
 * Most of the complexity arises from our desire to support input
 * suspension: if not all of the data for a marker is available,
 * we must exit back to the application. On resumption, we reprocess
 * the marker.
 */
```

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdmarker.c

No license file was found, but licenses were detected in source scan.

#### IJG JPEG LIBRARY: FILE LIST

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This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

Here is a road map to the files in the IJG JPEG distribution. The distribution includes the JPEG library proper, plus two application programs ("cjpeg" and "djpeg") which use the library to convert JPEG files to and from some other popular image formats. A third application "jpegtran" uses the library to do lossless conversion between different variants of JPEG. There are also two stand-alone applications, "rdjpgcom" and "wrjpgcom".

#### THE JPEG LIBRARY

=====

Include files:

jpeglib.h JPEG library's exported data and function declarations.

jconfig.h Configuration declarations. Note: this file is not present in the distribution; it is generated during installation.

jmorecfg.h Additional

configuration declarations; need not be changed for a standard installation.

jerror.h Declares JPEG library's error and trace message codes.  
jinclude.h Central include file used by all IJG .c files to reference system include files.  
jpegint.h JPEG library's internal data structures.  
jdct.h Private declarations for forward & reverse DCT subsystems.  
jmemsys.h Private declarations for memory management subsystem.  
jversion.h Version information.

Applications using the library should include jpeglib.h (which in turn includes jconfig.h and jmorecfg.h). Optionally, jerror.h may be included if the application needs to reference individual JPEG error codes. The other include files are intended for internal use and would not normally be included by an application program. (cjpeg/djpeg/etc do use jinclude.h, since its function is to improve portability of the whole IJG distribution. Most other applications will directly include the system include files they want, and hence won't need jinclude.h.)

C source code files:

These files contain most of the functions intended to be called directly by an application program:

jcapiimin.c Application program interface: core routines for compression.  
jcapistd.c Application program interface: standard compression.  
jdapiimin.c Application program interface: core routines for decompression.  
jdapistd.c Application program interface: standard decompression.  
jcomapi.c Application program interface routines common to compression and decompression.  
jcparam.c Compression parameter setting helper routines.  
jctrans.c API and library routines for transcoding compression.  
jdtrans.c API and library routines for transcoding decompression.

Compression side of the library:

jcinit.c Initialization: determines which other modules to use.  
jcmaster.c Master control: setup and inter-pass sequencing logic.  
jcmainct.c Main buffer controller (preprocessor => JPEG compressor).  
jcprepct.c Preprocessor buffer controller.  
jccoefct.c Buffer controller for DCT coefficient buffer.  
jccolor.c Color space conversion.  
jcsample.c Downsampling.  
jcdctmgr.c DCT manager (DCT implementation selection & control).  
jfdctint.c Forward DCT using slow-but-accurate integer method.  
jfdctfst.c Forward DCT using faster, less accurate integer method.  
jfdctflt.c Forward DCT using floating-point arithmetic.

jchuff.c Huffman entropy coding.  
jcarith.c Arithmetic entropy coding.  
jcmarker.c JPEG marker writing.  
jdatadst.c Data destination managers for memory and stdio output.

Decompression side of the library:

jdmaster.c Master control: determines which other modules to use.  
jdinput.c Input controller: controls input processing modules.  
jdmainct.c Main buffer controller (JPEG decompressor => postprocessor).  
jdcoeft.c Buffer controller for DCT coefficient buffer.  
jdpostct.c Postprocessor buffer controller.  
jdmarker.c JPEG marker reading.  
jd Huff.c Huffman entropy decoding.  
jdarith.c Arithmetic entropy decoding.  
jddctmgr.c IDCT manager (IDCT implementation selection & control).  
jdtint.c Inverse DCT using slow-but-accurate integer method.  
jdtfst.c Inverse DCT using faster, less accurate integer method.  
jdtflt.c Inverse DCT using floating-point arithmetic.  
jdsample.c Upsampling.  
jdcolor.c Color space conversion.  
jdmerge.c Merged upsampling/color conversion (faster, lower quality).  
jquant1.c One-pass color quantization using a fixed-spacing colormap.  
jquant2.c Two-pass color quantization using a custom-generated colormap.  
Also handles one-pass quantization to an externally given map.  
jdatasrc.c Data source managers for memory and stdio input.

Support files for both compression and decompression:

jaricom.c Tables for common use in arithmetic entropy encoding and decoding routines.  
jerror.c Standard error handling routines (application replaceable).  
jmemmgr.c System-independent (more or less) memory management code.  
jutils.c Miscellaneous utility routines.

jmemmgr.c relies on a system-dependent memory management module. The IJG distribution includes the following implementations of the system-dependent module:

jmemnobs.c "No backing store": assumes adequate virtual memory exists.  
jmemansi.c Makes temporary files with ANSI-standard routine tmpfile().  
jmemname.c Makes temporary files with program-generated file names.  
jmemdos.c Custom implementation for MS-DOS (16-bit environment only): can use extended and expanded memory as well as temp files.  
jmemmac.c Custom implementation for Apple Macintosh.

Exactly one of the system-dependent modules should be configured into an installed JPEG library (see install.txt for hints about which one to use).  
On unusual systems you may find it worthwhile to make a special system-dependent memory manager.

Non-C source code files:

jmemdos.asm 80x86 assembly code support for jmemdos.c; used only in MS-DOS-specific configurations of the JPEG library.

## CJPEG/DJPEG/JPEGTRAN

=====

Include files:

cdjpeg.h Declarations shared by cjpeg/djpeg/jpegtran modules.  
cderror.h Additional  
error and trace message codes for cjpeg et al.  
transupp.h Declarations for jpegtran support routines in transupp.c.

C source code files:

cjpeg.c Main program for cjpeg.  
cjpegalt.c Main program for cjpeg with alternate user interface.  
djpeg.c Main program for djpeg.  
djpegalt.c Main program for djpeg with alternate user interface.  
jpegtran.c Main program for jpegtran.  
cdjpeg.c Utility routines used by all three programs.  
rdcolmap.c Code to read a colormap file for djpeg's "-map" switch.  
rdswitch.c Code to process some of cjpeg's more complex switches.  
Also used by jpegtran.  
transupp.c Support code for jpegtran: lossless image manipulations.

Image file reader modules for cjpeg:

rdbmp.c BMP file input.  
rdgif.c GIF file input.  
rdppm.c PPM/PGM file input.  
rdrlc.c Utah RLE file input.  
rdtarga.c Targa file input.

Image file writer modules for djpeg:

wrbmp.c BMP file output.  
wrgif.c GIF file output.  
wrppm.c PPM/PGM file output.

wrrle.c Utah RLE file output.

wrtarga.c Targa

file output.

## RDJPGCOM/WRJPGCOM

=====

C source code files:

rdjpgcom.c Stand-alone rdjpgcom application.

wrjpgcom.c Stand-alone wrjpgcom application.

These programs do not depend on the IJG library. They do use jconfig.h and jinclude.h, only to improve portability.

## ADDITIONAL FILES

=====

Documentation (see README for a guide to the documentation files):

README Master documentation file.

\*.txt Other documentation files.

\*.1 Documentation in Unix man page format.

change.log Version-to-version change highlights.

example.c Sample code for calling JPEG library.

Configuration/installation files and programs (see install.txt for more info):

configure Unix shell script to perform automatic configuration.

configure.ac Source file for use with Autoconf to generate configure.

ltmain.sh Support scripts for configure (from GNU libtool).

config.guess

config.sub

depcomp

missing

ar-lib

compile

install-sh Install shell script for those Unix systems  
lacking one.

Makefile.in Makefile input for configure.

Makefile.am Source file for use with Automake to generate Makefile.in.

ckconfig.c Program to generate jconfig.h on non-Unix systems.

jconfig.txt Template for making jconfig.h by hand.

mak\*.\* Sample makefiles for particular systems.

jconfig.\* Sample jconfig.h for particular systems.

libjpeg.map Script to generate shared library with versioned symbols.

libjpeg.pc.in libjpeg.pc pkg-config file input for configure.  
aclocal.m4 M4 macro definitions for use with Autoconf.

Test files (see install.txt for test procedure):

test\*.\* Source and comparison files for confidence test.  
These are binary image files, NOT text files.

Found in path(s):

\* /jpeg9f-zip/jpeg-9f/filelist.txt

No license file was found, but licenses were detected in source scan.

/\*

\* jcdctmgr.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2003-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the forward-DCT management logic.

\* This code selects a particular DCT implementation to be used,

\* and it performs related housekeeping chores including coefficient

\* quantization.

\*/

Found in path(s):

\* /jpeg9f-zip/jpeg-9f/jcdctmgr.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdhuff.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2006-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains Huffman entropy decoding routines.

\* Both sequential and progressive modes are supported in this single module.

\*

\* Much of the complexity here has to do with supporting input suspension.

\* If the data source module demands suspension, we want to be able to back

\* up to the start of the current MCU. To do this, we copy state variables

\* into local working storage, and update them back to the permanent

\* storage only upon successful completion of an MCU.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdhuff.c

No license file was found, but licenses were detected in source scan.

/\*

\* jmemansi.c

\*

\* Copyright (C) 1992-1996, Thomas G. Lane.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file provides a simple generic implementation of the system-

\* dependent portion of the JPEG memory manager. This implementation

\* assumes that you have the ANSI-standard library routine tmpfile().

\* Also, the problem of determining the amount of memory available

\* is shoved onto the user.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jmemansi.c

No license file was found, but licenses were detected in source scan.

/\*

\* jmemmgr.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2011-2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the JPEG system-independent memory management

\* routines. This code is usable across a wide variety of machines; most

\* of the system dependencies have been isolated in a separate file.

\* The major functions provided here are:

\* \* pool-based allocation and freeing of memory;

\* \* policy decisions about how to divide available memory among the

\* virtual arrays;

\* \* control logic for swapping virtual arrays between main memory and

\* backing storage.

\* The separate system-dependent file provides the actual backing-storage

\* access code, and it contains the policy decision about how much total

\* main memory to use.

\* This file is

system-dependent in the sense that some of its functions

\* are unnecessary in some systems. For example, if there is enough virtual

\* memory so that backing storage will never be used, much of the virtual

\* array control logic could be removed. (Of course, if you have that much

\* memory then you shouldn't care about a little bit of unused code...)

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jmemmgr.c

No license file was found, but licenses were detected in source scan.

/\*

\* rdjpgcom.c

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2009 by Bill Allombert, Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains a very simple stand-alone application that displays

\* the text in COM (comment) markers in a JFIF file.

\* This may be useful as an example of the minimum logic needed to parse

\* JPEG markers.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/rdjpgcom.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdcolor.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2011-2023 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains output colorspace conversion routines.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdcolor.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdarith.c

\*

\* Developed 1997-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains portable arithmetic entropy decoding routines for JPEG

\* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).



\*  
\* Both sequential and progressive modes are supported in this single module.  
\*  
\* Suspension is not currently supported in this module.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jdarith.c

No license file was found, but licenses were detected in source scan.

/\*  
\* jmemsys.h  
\*  
\* Copyright (C) 1992-1997, Thomas G. Lane.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This include file defines the interface between the system-independent  
\* and system-dependent portions of the JPEG memory manager. No other  
\* modules need include it. (The system-independent portion is jmemmgr.c;  
\* there are several different versions of the system-dependent portion.)  
\*  
\* This file works as-is for the system-dependent memory managers supplied  
\* in the IJG distribution. You may need to modify it if you write a  
\* custom memory manager. If system-dependent changes are needed in  
\* this file, the best method is to #ifdef them based on a configuration  
\* symbol supplied in jconfig.h, as we have done with USE\_MSDOS\_MEMMGR  
\* and USE\_MAC\_MEMMGR.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jmemsys.h

No license file was found, but licenses were detected in source scan.

/\*  
\* wrppm.c  
\*  
\* Copyright (C) 1991-1996, Thomas G. Lane.  
\* Modified 2009-2020 by Guido Vollbeding.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains routines to write output images in PPM/PGM format.  
\* The extended 2-byte-per-sample raw PPM/PGM formats are supported.  
\* The PBMPLUS library is NOT required to compile this software  
\* (but it is highly useful as a set of PPM image manipulation programs).  
\*  
\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume output to  
\* an ordinary stdio stream.  
\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/wrppm.c

No license file was found, but licenses were detected in source scan.

/\*

\* wrtarga.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2015-2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to write output images in Targa format.

\*

\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume output to

\* an ordinary stdio stream.

\*

\* Based on code contributed by Lee Daniel Crocker.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/wrtarga.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcprepct.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2003-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the compression preprocessing controller.

\* This controller manages the color conversion, downsampling,

\* and edge expansion steps.

\*

\* Most of the complexity here is associated with buffering input rows

\* as required by the downsampler. See the comments at the head of

\* jcsample.c for the downsampler's needs.

\*/

Found in path(s):

\* /jpegsr9f-zip/jpeg-9f/jcprepct.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jinclude.h
 *
 * Copyright (C) 1991-1994, Thomas G. Lane.
 * Modified 2017-2022 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file exists to provide a single place to fix any problems with
 * including the wrong system include files. (Common problems are taken
 * care of by the standard jconfig symbols, but on really weird systems
 * you may have to edit this file.)
 *
 * NOTE: this file is NOT intended to be included by applications using
 * the JPEG library. Most applications need only include jpeglib.h.
 */
```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jinclude.h
```

No license file was found, but licenses were detected in source scan.

```
/*
 * jdatadst.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2009-2022 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains compression data destination routines for the case of
 * emitting JPEG data to memory or to a file (or any stdio stream).
 * While these routines are sufficient for most applications,
 * some will want to use a different destination manager.
 * IMPORTANT: we assume that fwrite() will correctly transcribe an array of
 * JOCTETs into 8-bit-wide elements on external storage. If char is wider
 * than 8 bits on your machine, you may need to do some tweaking.
 */
```

Found in path(s):

```
* /jpegsr9f-zip/jpeg-9f/jdatadst.c
```

No license file was found, but licenses were detected in source scan.

```
/*
 * jerror.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
```

- \* Modified 2012-2015 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains simple error-reporting and trace-message routines.
- \* These are suitable for Unix-like systems and others where writing to
- \* stderr is the right thing to do. Many applications will want to replace
- \* some or all of these routines.
- \*
- \* If you define USE\_WINDOWS\_MESSAGEBOX in jconfig.h or in the makefile,
- \* you get a Windows-specific hack to display error messages in a dialog box.
- \* It ain't much, but it beats dropping error messages into the bit bucket,
- \* which is what happens to output to stderr under most Windows C compilers.
- \*
- \* These routines are used by both the compression and decompression code.
- \*/

Found in path(s):

- \* /jpegsr9f-zip/jpeg-9f/jerror.c

## 1.141 libsndfile 1.2.2

### 1.141.1 Available under license :

Apache License

Version 2.0, January 2004

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# 1.146 pem-rfc7468 0.7.0

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# 1.147 pkcs8 0.10.2

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## 1.148 zeroize 1.8.1

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# 1.149 num-bigint-dig 0.8.4

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## 1.150 subtle 2.6.1

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# 1.151 num-integer 0.1.46

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## 1.152 const-oid 0.9.6

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# 1.154 num-iter 0.1.45

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# 1.155 signature 2.2.0

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## 1.158 spki 0.7.3

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## 1.160 lazy\_static 1.5.0

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## 1.162 libsepol 3.7

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# 1.163 python-pillow 10.4.0

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Name: badpaletteentry

Columns: 4

#

0 0 0 Index 3

65 38

103 62 49 Index 6

79 73 72 Index 7

114 101 97 Index 8

208 127 100 Index 9

151 144 142 Index 10

221 207 199 Index 11

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## 1.170 cairo 1.18.2

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```
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* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Extend.java
*
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/UserScaledFontInitFunc.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/SurfaceObserverMode.java
* /cairo-1-18-2-sources-jar/io/github/jwharm/cairobindings/Proxy.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Format.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/ToyFontFace.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/MimeType.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RecordingSurface.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PDFVersion.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/ScriptMode.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/SurfaceObserver.java
```

- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PathElement.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Matrix.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PathData.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Path.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Status.java
- \*
- /cairo-1-18-2-sources-jar/org/freedesktop/cairo/TextExtents.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/UserScaledFontRenderGlyphFunc.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PatternType.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Filter.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PathDataType.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Mesh.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RasterSourceFinishFunc.java
- \* /cairo-1-18-2-sources-jar/io/github/jwharm/cairobindings/ArenaCloseAction.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FontOptions.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/SVGSurface.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/freetype/FreeType2.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RGBA.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FTSynthesize.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FontSlant.java
- \*
- /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Glyph.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Circle.java
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- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/DeviceType.java
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- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/LinearGradient.java
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- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/LineCap.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Script.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/HintMetrics.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PDFOutlineFlags.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/UserScaledFontUnicodeToGlyphFunc.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/SVGVersion.java
- \*
- /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RegionOverlap.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/ReadFunc.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/ColorMode.java
- \* /cairo-1-18-2-sources-jar/io/github/jwharm/cairobindings/Interop.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/ScriptSurface.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RasterSourceAcquireFunc.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FillRule.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RasterSourceReleaseFunc.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FontExtents.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/LineJoin.java
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```

* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/TextCluster.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RectangleInt.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FTFontFace.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FTScaledFont.java
*
/cairo-1-18-2-sources-jar/org/freedesktop/cairo/DestroyFunc.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Cairo.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Region.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PDFMetadata.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/UserScaledFontTextToGlyphsFunc.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RasterSource.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/WriteFunc.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RectangleList.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/SurfacePattern.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/UserFontFace.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/SolidPattern.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FontWeight.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/TeeSurface.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/UserDataKey.java
*
/cairo-1-18-2-sources-jar/org/freedesktop/cairo/RasterSourceSnapshotFunc.java
* /cairo-1-18-2-sources-jar/io/github/jwharm/cairobindings/LibLoad.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Rectangle.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Point.java
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* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PDFSurface.java
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* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/RasterSourceCopyFunc.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Gradient.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/HintStyle.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Operator.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Rect.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/PSLevel.java
* /cairo-1-18-2-sources-jar/io/github/jwharm/cairobindings/Platform.java
*
/cairo-1-18-2-sources-jar/org/freedesktop/cairo/Dither.java
* /cairo-1-18-2-sources-jar/io/github/jwharm/cairobindings/MemoryCleaner.java
* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/SurfaceType.java
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Found in path(s):

- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Pattern.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Content.java
- \*
- /cairo-1-18-2-sources-jar/org/freedesktop/cairo/ImageSurface.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/freetype/package-info.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Context.java
- \* /cairo-1-18-2-sources-jar/module-info.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/FontFace.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Glyphs.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Surface.java
- \* /cairo-1-18-2-sources-jar/io/github/jwharm/cairobindings/package-info.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/ScaledFont.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/package-info.java
- \* /cairo-1-18-2-sources-jar/org/freedesktop/cairo/Device.java

# 1.171 tcpdump 4.99.5

## 1.171.1 Available under license :

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IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED  
WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.  
# -\*- perl -\*-

```
$testlist = [
 # This specific test fails on OpenBSD because the .pcap file uses DLT_RAW,
 # which OpenBSD treats as DLT_LOOP.
 {
 config_unset => 'IS_OPENBSD',
 name => 'heap-overflow-1',
 input => 'heap-overflow-1.pcap',
 output => 'heap-overflow-1.out',
 args => '-v'
 },
];

1;
```

## 1.172 ffmpeg n6.1.2

### 1.172.1 Available under license :

# License

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Some optional parts of FFmpeg are licensed under the GNU General Public License version 2 or later (GPL v2+). See the file `COPYING.GPLv2` for details. None of these parts are used by default, you have to explicitly pass `--enable-gpl` to configure to activate them. In this case, FFmpeg's license changes to GPL v2+.

Specifically, the GPL parts of FFmpeg are:

- libpostproc
- optional x86 optimization in the files
  - `libavcodec/x86/flac\_dsp\_gpl.asm`
  - `libavcodec/x86/idct\_mmx.c`
  - `libavfilter/x86/vf\_removegrain.asm`
- the following building and testing tools
  - `compat/solaris/make\_sunver.pl`
  - `doc/t2h.pm`
  - `doc/texi2pod.pl`
  - `libswresample/tests/swresample.c`
  - `tests/checkasm/\*`

- `tests/tiny\_ssim.c`
- 
- the following filters in libavfilter:
  - `signature\_lookup.c`
  - `vf\_blackframe.c`
  - `vf\_boxblur.c`
  - `vf\_colormatrix.c`
  - `vf\_cover\_rect.c`
  - `vf\_cropdetect.c`
  - `vf\_delogo.c`
  - `vf\_eq.c`
  - `vf\_find\_rect.c`
  - `vf\_fspp.c`
  - `vf\_histeq.c`
  - `vf\_hqdn3d.c`
  - `vf\_kerndeint.c`
  - `vf\_lensfun.c` (GPL version 3 or later)
  - `vf\_mcdeint.c`
  - `vf\_mpdecimate.c`
  - `vf\_nnedi.c`
  - `vf\_owdenoise.c`
  - `vf\_perspective.c`
  - `vf\_phase.c`
  - `vf\_pp.c`
  - `vf\_pp7.c`
  - `vf\_pullup.c`
  - `vf\_repeatfields.c`
  - `vf\_sab.c`
  - `vf\_signature.c`
  - `vf\_smartblur.c`
  - `vf\_spp.c`
  - `vf\_stereo3d.c`
  - `vf\_super2xsai.c`
  - `vf\_tinterlace.c`
  - `vf\_uspp.c`
  - `vf\_vaguedenoiser.c`
  - `vsrc\_mptestsrc.c`

Should you, for whatever reason, prefer to use version 3 of the (L)GPL, then the configure parameter `--enable-version3` will activate this licensing option for you. Read the file `COPYING.LGPLv3` or, if you have enabled GPL parts, `COPYING.GPLv3` to learn the exact legal terms that apply in this case.

There are a handful of files under other licensing terms, namely:

\* The files `libavcodec/jfdctfst.c`, `libavcodec/jfdctint\_template.c` and `libavcodec/jrevdct.c` are taken from libjpeg, see the top of the files for

licensing details. Specifically note that you must credit the IJG in the documentation accompanying your program if you only distribute executables. You must also indicate any changes including additions and deletions to those three files in the documentation.

\* `tests/reference.pnm` is under the expat license.

## ## External libraries

FFmpeg can be combined with a number of external libraries, which sometimes affect the licensing of binaries resulting from the combination.

## ### Compatible libraries

The following libraries are under GPL version 2:

- avisynth
- frei0r
- libcdio
- libdavs2
- librubberband
- libvidstab
- libx264
- libx265
- libxavs
- 
- libxavs2
- libxvid

When combining them with FFmpeg, FFmpeg needs to be licensed as GPL as well by passing `--enable-gpl` to configure.

The following libraries are under LGPL version 3:

- gmp
- libaribb24
- liblensfun

When combining them with FFmpeg, use the configure option `--enable-version3` to upgrade FFmpeg to the LGPL v3.

The VMAF, mbedTLS, RK MPI, OpenCORE and VisualOn libraries are under the Apache License 2.0. That license is incompatible with the LGPL v2.1 and the GPL v2, but not with version 3 of those licenses. So to combine these libraries with FFmpeg, the license version needs to be upgraded by passing `--enable-version3` to configure.

The smbclient library is under the GPL v3, to combine it with FFmpeg, the options `--enable-gpl` and `--enable-version3` have to be passed to configure to upgrade FFmpeg to the GPL v3.

### ### Incompatible libraries

There are certain libraries you can combine with FFmpeg whose licenses are not compatible with the GPL and/or the LGPL. If you wish to enable these libraries, even in circumstances that their license may be incompatible, pass `--enable-nonfree` to configure. This will cause the resulting binary to be unredistributable.

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```
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```

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```
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```

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# 1.173 nanotts 2

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Version 2.0, January 2004

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# 1.174 jpeg 9f

## 1.174.1 Available under license :

No license file was found, but licenses were detected in source scan.

```
/*
 * jquant1.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2011-2020 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains 1-pass color quantization (color mapping) routines.
```

\* These routines provide mapping to a fixed color map using equally spaced  
\* color values. Optional Floyd-Steinberg or ordered dithering is available.  
\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jquant1.c

No license file was found, but licenses were detected in source scan.

/\*

\* rdppm.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2009-2020 by Bill Allombert, Guido Vollbeding.

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\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to read input images in PPM/PGM format.

\* The extended 2-byte-per-sample raw PPM/PGM formats are supported.

\* The PBMPLUS library is NOT required to compile this software

\* (but it is highly useful as a set of PPM image manipulation programs).

\*

\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume input from

\* an ordinary stdio stream. They further assume that reading begins

\* at the start of the file; start\_input may need work if the

\* user interface has already read some data (e.g., to determine that

\* the file is indeed PPM format).

\*/

/\* Portions

of this code are based on the PBMPLUS library, which is:

\*\*\*

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\*\*\*

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\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/rdppm.c

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/\*

\* wrbmp.c

\*

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- \*
- \* This file contains routines to write output images in Microsoft "BMP"
- \* format (MS Windows 3.x and OS/2 1.x flavors).
- \* Either 8-bit colormapped or 24-bit full-color format can be written.
- \* No compression is supported.
- \*
- \* These routines may need modification for non-Unix environments or
- \* specialized applications. As they stand, they assume output to
- \* an ordinary stdio stream.
- \*
- \* This code contributed by James Arthur Boucher.
- \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/wrbmp.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jinclude.h
 *
 * Copyright (C) 1991-1994, Thomas G. Lane.
 * Modified 2017-2022 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
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 *
 * This file exists to provide a single place to fix any problems with
 * including the wrong system include files. (Common problems are taken
 * care of by the standard jconfig symbols, but on really weird systems
 * you may have to edit this file.)
 *
 * NOTE: this file is NOT intended to be included by applications using
 * the JPEG library. Most applications need only include jpeglib.h.
 */
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jinclude.h

No license file was found, but licenses were detected in source scan.

```
/*
 * jconfig.txt
 *
 * Copyright (C) 1991-1994, Thomas G. Lane.
 * Modified 2009-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
```

```

* For conditions of distribution and use, see the accompanying README file.
*
* This file documents the configuration options that are required to
* customize the JPEG software for a particular system.
*
* The actual configuration options for a particular installation are stored
* in jconfig.h. On many machines, jconfig.h can be generated automatically
* or copied from one of the "canned" jconfig files that we supply. But if
* you need to generate a jconfig.h file by hand, this file tells you how.
*
* DO NOT EDIT THIS FILE --- IT WON'T ACCOMPLISH ANYTHING.
* EDIT A COPY NAMED JCONFIG.H.
*/

/*
* These symbols indicate the properties of your machine or compiler.
* #define the symbol if yes, #undef it if no.
*/

/* Does your compiler
support function prototypes?
* (If not, you also need to use ansi2knr, see install.txt)
*/
#define HAVE_PROTOTYPES

/* Does your compiler support the declaration "unsigned char" ?
* How about "unsigned short" ?
*/
#define HAVE_UNSIGNED_CHAR
#define HAVE_UNSIGNED_SHORT

/* Define "void" as "char" if your compiler doesn't know about type void.
* NOTE: be sure to define void such that "void *" represents the most general
* pointer type, e.g., that returned by malloc().
*/
/* #define void char */

/* Define "const" as empty if your compiler doesn't know the "const" keyword.
*/
/* #define const */

/* Define this if an ordinary "char" type is unsigned.
* If you're not sure, leaving it undefined will work at some cost in speed.
* If you defined HAVE_UNSIGNED_CHAR then the speed difference is minimal.
*/
#undef CHAR_IS_UNSIGNED

```

```

/* Define this if your system has an ANSI-conforming <stddef.h> file.
*/
#define HAVE_STDDEF_H

/* Define this if your system has an ANSI-conforming <stdlib.h>
file.
*/
#define HAVE_STDLIB_H

/* Define this if your system does not have an ANSI/SysV <string.h>,
* but does have a BSD-style <strings.h>.
*/
#undef NEED_BSD_STRINGS

/* Define this if your system does not provide typedef size_t in any of the
* ANSI-standard places (stddef.h, stdlib.h, or stdio.h), but places it in
* <sys/types.h> instead.
*/
#undef NEED_SYS_TYPES_H

/* For 80x86 machines, you need to define NEED_FAR_POINTERS,
* unless you are using a large-data memory model or 80386 flat-memory mode.
* On less brain-damaged CPUs this symbol must not be defined.
* (Defining this symbol causes large data structures to be referenced through
* "far" pointers and to be allocated with a special version of malloc.)
*/
#undef NEED_FAR_POINTERS

/* Define this if your linker needs global names to be unique in less
* than the first 15 characters.
*/
#undef NEED_SHORT_EXTERNAL_NAMES

/* Although a real ANSI C compiler can deal perfectly well with pointers to
* unspecified
structures (see "incomplete types" in the spec), a few pre-ANSI
* and pseudo-ANSI compilers get confused. To keep one of these bozos happy,
* define INCOMPLETE_TYPES_BROKEN. This is not recommended unless you
* actually get "missing structure definition" warnings or errors while
* compiling the JPEG code.
*/
#undef INCOMPLETE_TYPES_BROKEN

/* Define "boolean" as unsigned char, not enum, on Windows systems.
*/
#ifdef _WIN32
#ifndef __RPCNDR_H__ /* don't conflict if rpcnldr.h already read */
typedef unsigned char boolean;

```

```

#endif
#ifndef FALSE /* in case these macros already exist */
#define FALSE 0 /* values of boolean */
#endif
#ifndef TRUE
#define TRUE 1
#endif
#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
#endif

/*
 * The following options affect code selection within the JPEG library,
 * but they don't need to be visible to applications using the library.
 * To minimize application namespace pollution, the symbols won't be
 * defined unless JPEG_INTERNALS
 * has been defined.
 */

#ifdef JPEG_INTERNALS

/* Define this if your compiler implements ">>" on signed values as a logical
 * (unsigned) shift; leave it undefined if ">>" is a signed (arithmetic) shift,
 * which is the normal and rational definition.
 */
#undef RIGHT_SHIFT_IS_UNSIGNED

#endif /* JPEG_INTERNALS */

/*
 * The remaining options do not affect the JPEG library proper,
 * but only the sample applications cjpeg/djpeg (see cjpeg.c, djpeg.c).
 * Other applications can ignore these.
 */

#ifdef JPEG_CJPEG_DJPEG

/* These defines indicate which image (non-JPEG) file formats are allowed. */

#define BMP_SUPPORTED /* BMP image file format */
#define GIF_SUPPORTED /* GIF image file format */
#define PPM_SUPPORTED /* PBMPLUS PPM/PGM image file format */
#undef RLE_SUPPORTED /* Utah RLE image file format */
#define TARGA_SUPPORTED /* Targa image file format */

/* Define this if you want to name both input and output files on the command

```

```
* line, rather than using stdout
and optionally stdin. You MUST do this if
* your system can't cope with binary I/O to stdin/stdout. See comments at
* head of cjpeg.c or djpeg.c.
*/
```

```
#undef TWO_FILE_COMMANDLINE
```

```
/* Define this if your system needs explicit cleanup of temporary files.
* This is crucial under MS-DOS, where the temporary "files" may be areas
* of extended memory; on most other systems it's not as important.
*/
```

```
#undef NEED_SIGNAL_CATCHER
```

```
/* By default, we open image files with fopen(...,"rb") or fopen(...,"wb").
* This is necessary on systems that distinguish text files from binary files,
* and is harmless on most systems that don't. If you have one of the rare
* systems that complains about the "b" spec, define this symbol.
*/
```

```
#undef DONT_USE_B_MODE
```

```
/* Define this if you want percent-done progress reports from cjpeg/djpeg.
*/
```

```
#undef PROGRESS_REPORT
```

```
#endif /* JPEG_CJPEG_DJPEG */
```

Found in path(s):

```
* /jpegsrc-v9f-tar-gz/jpeg-9f/jconfig.txt
```

No license file was found, but licenses were detected in source scan.

```
/*
```

```
* jdarith.c
```

```
*
```

```
* Developed 1997-2020 by Guido Vollbeding.
```

```
* This file is part of the Independent JPEG Group's software.
```

```
* For conditions of distribution and use, see the accompanying README file.
```

```
*
```

```
* This file contains portable arithmetic entropy decoding routines for JPEG
```

```
* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
```

```
*
```

```
* Both sequential and progressive modes are supported in this single module.
```

```
*
```

```
* Suspension is not currently supported in this module.
```

```
*/
```

Found in path(s):

```
* /jpegsrc-v9f-tar-gz/jpeg-9f/jdarith.c
```



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```
/*
 * jcomapi.c
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * Modified 2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
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 *
 * This file contains application interface routines that are used for both
 * compression and decompression.
 */
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcomapi.c

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```
/*
 * ckconfig.c
 *
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 */
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/ckconfig.c

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```
/*
 * jerror.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modified 2012-2015 by Guido Vollbeding.
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 *
 * This file contains simple error-reporting and trace-message routines.
 * These are suitable for Unix-like systems and others where writing to
 * stderr is the right thing to do. Many applications will want to replace
 * some or all of these routines.
 *
 * If you define USE_WINDOWS_MESSAGEBOX in jconfig.h or in the makefile,
 * you get a Windows-specific hack to display error messages in a dialog box.
 * It ain't much, but it beats dropping error messages into the bit bucket,
 * which is what happens to output to stderr under most Windows C compilers.
 */
```

\* These routines are used by both the compression and decompression code.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jerror.c

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/\*

\* jdmarker.c

\*

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\*

\* This file contains routines to decode JPEG datastream markers.

\* Most of the complexity arises from our desire to support input

\* suspension: if not all of the data for a marker is available,

\* we must exit back to the application. On resumption, we reprocess

\* the marker.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdmarker.c

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/\*

\* jddctmgr.c

\*

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\* Modified 2002-2013 by Guido Vollbeding.

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\*

\* This file contains the inverse-DCT management logic.

\* This code selects a particular IDCT implementation to be used,

\* and it performs related housekeeping chores. No code in this file

\* is executed per IDCT step, only during output pass setup.

\*

\* Note that the IDCT routines are responsible for performing coefficient

\* dequantization as well as the IDCT proper. This module sets up the

\* dequantization multiplier table needed by the IDCT routine.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jddctmgr.c

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```

/*
 * rdbmp.c
 *
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 * Modified 2009-2019 by Guido Vollbeding.
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 *
 * This file contains routines to read input images in Microsoft "BMP"
 * format (MS Windows 3.x, OS/2 1.x, and OS/2 2.x flavors).
 * Currently, only 8-, 24-, and 32-bit images are supported, not 1-bit or
 * 4-bit (feeding such low-depth images into JPEG would be silly anyway).
 * Also, we don't support RLE-compressed files.
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume input from
 * an ordinary stdio stream. They further assume that reading begins
 * at the start of the file; start_input may need work if the
 * user interface has already read some data (e.g., to determine that
 * the file is
indeed BMP format).
 *
 * This code contributed by James Arthur Boucher.
 */

```

Found in path(s):

```
* /jpegsrc-v9f-tar-gz/jpeg-9f/rdbmp.c
```

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```

/*
 * rdswitch.c
 *
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 *
 * This file contains routines to process some of cjpeg's more complicated
 * command-line switches. Switches processed here are:
 * -qtables file Read quantization tables from text file
 * -scans file Read scan script from text file
 * -quality N[,N,...] Set quality ratings
 * -qslots N[,N,...] Set component quantization table selectors
 * -sample HxV[,HxV,...] Set component sampling factors
 */

```

Found in path(s):

```
* /jpegsrc-v9f-tar-gz/jpeg-9f/rdswitch.c
```

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Since numerous people will be contributing code and bug fixes, it's important to establish a common coding style. The goal of using similar coding styles is much more important than the details of just what that style is.

In general we follow the recommendations of "Recommended C Style and Coding Standards" revision 6.1 (Cannon et al. as modified by Spencer, Keppel and Brader). This document is available in the IJG FTP archive (see `jpeg/doc/cstyle.ms.tbl.Z`, or `cstyle.txt.Z` for those without `nroff/tbl`).

Block comments should be laid out thusly:

```
/*
 * Block comments in this style.
*/
```

We indent statements in K&R style, e.g.,

```
if (test) {
 then-part;
} else {
 else-part;
}
```

with two spaces per indentation

level. (This indentation convention is handled automatically by GNU Emacs and many other text editors.)

Multi-word names should be written in lower case with underscores, e.g., `multi_word_name` (not `multiWordName`). Preprocessor symbols and enum constants are similar but upper case (`MULTI_WORD_NAME`). Names should be unique within the first fifteen characters. (On some older systems, global names must be unique within six characters. We accommodate this without cluttering the source code by using macros to substitute shorter names.)

We use function prototypes everywhere; we rely on automatic source code transformation to feed prototype-less C compilers. Transformation is done by the simple and portable tool '`ansi2knr.c`' (courtesy of Ghostscript). `ansi2knr` is not very bright, so it imposes a format requirement on function declarations: the function name MUST BEGIN IN COLUMN 1. Thus all functions should be written in the following style:

```

LOCAL(int *)
function_name (int a, char
*b)
{
 code...
}

```

Note that each function definition must begin with `GLOBAL(type)`, `LOCAL(type)`, or `METHODDEF(type)`. These macros expand to "static type" or just "type" as appropriate. They provide a readable indication of the routine's usage and can readily be changed for special needs. (For instance, special linkage keywords can be inserted for use in Windows DLLs.)

`ansi2knr` does not transform method declarations (function pointers in structs). We handle these with a macro `JMETHOD`, defined as

```

#ifdef HAVE_PROTOTYPES
#define JMETHOD(type,methodname,arglist) type (*methodname) arglist
#else
#define JMETHOD(type,methodname,arglist) type (*methodname) ()
#endif

```

which is used like this:

```

struct function_pointers {
 JMETHOD(void, init_entropy_encoder, (int somearg, jparms *jp));
 JMETHOD(void, term_entropy_encoder, (void));
};

```

Note the set of parentheses surrounding the parameter list.

A similar solution is used for forward and external function declarations (see the `EXTERN` and `JPP` macros).

If the code is to work on non-ANSI compilers, we cannot rely on a prototype declaration to coerce actual parameters into the right types. Therefore, use explicit casts on actual parameters whenever the actual parameter type is not identical to the formal parameter. Beware of implicit conversions to "int".

It seems there are some non-ANSI compilers in which the `sizeof()` operator is defined to return `int`, yet `size_t` is defined as `long`. Needless to say, this is brain-damaged. Always use the `SIZEOF()` macro in place of `sizeof()`, so that the result is guaranteed to be of type `size_t`.

The JPEG library is intended to be used within larger programs. Furthermore, we want it to be reentrant so that it can be used by applications that process multiple images concurrently. The following rules support these requirements:

1. Avoid direct use of file I/O, "malloc", error report printouts, etc; pass these through the common routines provided.

## 2. Minimize global namespace

pollution. Functions should be declared static wherever possible. (Note that our method-based calling conventions help this a lot: in many modules only the initialization function will ever need to be called directly, so only that function need be externally visible.) All global function names should begin with "jpeg\_", and should have an abbreviated name (unique in the first six characters) substituted by macro when NEED\_SHORT\_EXTERNAL\_NAMES is set.

3. Don't use global variables; anything that must be used in another module should be in the common data structures.

4. Don't use static variables except for read-only constant tables. Variables that should be private to a module can be placed into private structures (see the system architecture document, structure.txt).

5. Source file names should begin with "j" for files that are part of the library proper; source files that are not part of the library, such as cjpeg.c and djpeg.c, do not begin with "j". Keep source file names to eight characters (plus ".c" or ".h", etc) to make life easy for MS-DOSers. Keep compression and decompression code in separate source files --- some applications may want only one half of the library.

Note: these rules (particularly #4) are not followed religiously in the modules that are used in cjpeg/djpeg but are not part of the JPEG library proper. Those modules are not really intended to be used in other applications.

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/coderules.txt

No license file was found, but licenses were detected in source scan.

/\*

\* jpeglib.h

\*

\* Copyright (C) 1991-1998, Thomas G. Lane.

\* Modified 2002-2022 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file defines the application interface for the JPEG library.

\* Most applications using the library need only include this file,

\* and perhaps jerror.h if they want to know the exact error codes.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jpeglib.h

No license file was found, but licenses were detected in source scan.

/\*

\* jfdctint.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modification developed 2003-2018 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains a slow-but-accurate integer implementation of the

\* forward DCT (Discrete Cosine Transform).

\*

\* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT

\* on each column. Direct algorithms are also available, but they are

\* much more complex and seem not to be any faster when reduced to code.

\*

\* This implementation is based on an algorithm described in

\* C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT

\* Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,

\* Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.

\* The primary algorithm described there uses 11 multiplies

and 29 adds.

\* We use their alternate method with 12 multiplies and 32 adds.

\* The advantage of this method is that no data path contains more than one

\* multiplication; this allows a very simple and accurate implementation in

\* scaled fixed-point arithmetic, with a minimal number of shifts.

\*

\* We also provide FDCT routines with various input sample block sizes for

\* direct resolution reduction or enlargement and for direct resolving the

\* common 2x1 and 1x2 subsampling cases without additional resampling: NxN

\* (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 output DCT block.

\*

\* For N<8 we fill the remaining block coefficients with zero.

\* For N>8 we apply a partial N-point FDCT on the input samples, computing

\* just the lower 8 frequency coefficients and discarding the rest.

\*

\* We must scale the output coefficients of the N-point FDCT appropriately

\* to the standard 8-point FDCT level by 8/N per 1-D pass. This scaling

\* is folded into the constant multipliers

(pass 2) and/or final/initial

\* shifting.

\*

\* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases

\* since there would be too many additional constants to pre-calculate.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jfdctint.c

No license file was found, but licenses were detected in source scan.

/\*

\* wrtarga.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2015-2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to write output images in Targa format.

\*

\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume output to

\* an ordinary stdio stream.

\*

\* Based on code contributed by Lee Daniel Crocker.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/wrtarga.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcmainct.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2003-2012 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the main buffer controller for compression.

\* The main buffer lies between the pre-processor and the JPEG

\* compressor proper; it holds downsampled data in the JPEG colorspace.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcmainct.c

No license file was found, but licenses were detected in source scan.

/\*

\* jquant2.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2011-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.



- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains 2-pass color quantization (color mapping) routines.
- \* These routines provide selection of a custom color map for an image,
- \* followed by mapping of the image to that color map, with optional
- \* Floyd-Steinberg dithering.
- \* It is also possible to use just the second pass to map to an arbitrary
- \* externally-given color map.
- \*
- \* Note: ordered dithering is not supported, since there isn't any fast
- \* way to compute intercolor distances; it's unclear that ordered dither's
- \* fundamental assumptions even hold with an irregularly spaced color map.
- \*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jquant2.c

No license file was found, but licenses were detected in source scan.

## IJG JPEG LIBRARY: FILE LIST

Copyright (C) 1994-2020, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

Here is a road map to the files in the IJG JPEG distribution. The distribution includes the JPEG library proper, plus two application programs ("cjpeg" and "djpeg") which use the library to convert JPEG files to and from some other popular image formats. A third application "jpegtran" uses the library to do lossless conversion between different variants of JPEG. There are also two stand-alone applications, "rdjpgcom" and "wrjpgcom".

## THE JPEG LIBRARY

=====

Include files:

jpeglib.h JPEG library's exported data and function declarations.

jconfig.h Configuration declarations. Note: this file is not present in the distribution; it is generated during installation.

jmorecfg.h Additional configuration declarations; need not be changed for a standard installation.

jerror.h Declares JPEG library's error and trace message codes.

jinclue.h Central include file used by all IJG .c files to reference system include files.

jpegint.h JPEG library's internal data structures.  
jdct.h Private declarations for forward & reverse DCT subsystems.  
jmemsys.h Private declarations for memory management subsystem.  
jversion.h Version information.

Applications using the library should include jpeglib.h (which in turn includes jconfig.h and jmorecfg.h). Optionally, jerror.h may be included if the application needs to reference individual JPEG error codes. The other include files are intended for internal use and would not normally be included by an application program. (cjpeg/djpeg/etc do use jinclude.h, since its function is to improve portability of the whole IJG distribution. Most other applications will directly include the system include files they want, and hence won't need jinclude.h.)

C source code files:

These files contain most of the functions intended to be called directly by an application program:

jpegim.c Application program interface: core routines for compression.  
jpegstd.c Application program interface: standard compression.  
jdapim.c Application program interface: core routines for decompression.  
jdapistd.c Application program interface: standard decompression.  
jcomapi.c Application program interface routines common to compression and decompression.  
jcparm.c Compression parameter setting helper routines.  
jctrans.c API and library routines for transcoding compression.  
jdtrans.c API and library routines for transcoding decompression.

Compression side of the library:

jcinit.c Initialization: determines which other modules to use.  
jcmaster.c Master control: setup and inter-pass sequencing logic.  
jcmainct.c Main buffer controller (preprocessor => JPEG compressor).  
jcprepct.c Preprocessor buffer controller.  
jccoefct.c Buffer controller for DCT coefficient buffer.  
jccolor.c Color space conversion.  
jcsample.c Downsampling.  
jcdctmgr.c DCT manager (DCT implementation selection & control).  
jfdctint.c Forward DCT using slow-but-accurate integer method.  
jfdctfst.c Forward DCT using faster, less accurate integer method.  
jfdctflt.c Forward DCT using floating-point arithmetic.  
jchuff.c Huffman entropy coding.  
jcarith.c Arithmetic entropy coding.  
jcmarker.c JPEG marker writing.

jdadast.c Data destination managers for memory and stdio output.

Decompression side of the library:

jdmaster.c Master control: determines which other modules to use.

jdinput.c Input controller: controls input processing modules.

jdmainct.c Main buffer controller (JPEG decompressor => postprocessor).

jdcoeft.c Buffer controller for DCT coefficient buffer.

jdpostct.c Postprocessor buffer controller.

jdmarker.c JPEG marker reading.

jdhuft.c Huffman entropy decoding.

jdarith.c Arithmetic entropy decoding.

jddctmgr.c IDCT manager (IDCT implementation selection & control).

jidctint.c Inverse DCT using slow-but-accurate integer method.

jidctfst.c Inverse DCT using faster, less accurate integer method.

jidctflt.c Inverse DCT using floating-point arithmetic.

jdsample.c Upsampling.

jdcolor.c Color space conversion.

jdmerge.c Merged upsampling/color conversion (faster, lower quality).

jquant1.c One-pass color quantization using a fixed-spacing colormap.

jquant2.c Two-pass color quantization using a custom-generated colormap.

Also handles one-pass quantization to an externally given map.

jdatsrc.c Data source managers for memory and stdio input.

Support files for both compression and decompression:

jaricom.c Tables for common use in arithmetic entropy encoding and decoding routines.

jerror.c Standard error handling routines (application replaceable).

jmemmgr.c System-independent (more or less) memory management code.

jutils.c Miscellaneous utility routines.

jmemmgr.c relies on a system-dependent memory management module. The IJG distribution

includes the following implementations of the system-dependent module:

jmemnobs.c "No backing store": assumes adequate virtual memory exists.

jmemansi.c Makes temporary files with ANSI-standard routine tmpfile().

jmemname.c Makes temporary files with program-generated file names.

jmemdos.c Custom implementation for MS-DOS (16-bit environment only): can use extended and expanded memory as well as temp files.

jmemmac.c Custom implementation for Apple Macintosh.

Exactly one of the system-dependent modules should be configured into an installed JPEG library (see install.txt for hints about which one to use).

On unusual systems you may find it worthwhile to make a special

system-dependent memory manager.

Non-C source code files:

jmemdos.asm 80x86 assembly code support for jmemdos.c; used only in MS-DOS-specific configurations of the JPEG library.

CJPEG/DJPEG/JPEGTRAN

=====

Include files:

cdjpeg.h Declarations shared by cjpeg/djpeg/jpegtran modules.

cderror.h Additional

error and trace message codes for cjpeg et al.

transupp.h Declarations for jpegtran support routines in transupp.c.

C source code files:

cjpeg.c Main program for cjpeg.

cjpegalt.c Main program for cjpeg with alternate user interface.

djpeg.c Main program for djpeg.

djpegalt.c Main program for djpeg with alternate user interface.

jpegtran.c Main program for jpegtran.

cdjpeg.c Utility routines used by all three programs.

rdcolmap.c Code to read a colormap file for djpeg's "-map" switch.

rdswitch.c Code to process some of cjpeg's more complex switches.

Also used by jpegtran.

transupp.c Support code for jpegtran: lossless image manipulations.

Image file reader modules for cjpeg:

rdbmp.c BMP file input.

rdgif.c GIF file input.

rdppm.c PPM/PGM file input.

rdrlc.c Utah RLE file input.

rdtarga.c Targa file input.

Image file writer modules for djpeg:

wrbmp.c BMP file output.

wrgif.c GIF file output.

wrppm.c PPM/PGM file output.

wrrlc.c Utah RLE file output.

wrtarga.c Targa

file output.

## RDJPGCOM/WRJPGCOM

=====

C source code files:

rdjpgcom.c Stand-alone rdjpgcom application.

wrjpgcom.c Stand-alone wrjpgcom application.

These programs do not depend on the IJG library. They do use jconfig.h and jinclude.h, only to improve portability.

## ADDITIONAL FILES

=====

Documentation (see README for a guide to the documentation files):

README Master documentation file.

\*.txt Other documentation files.

\*.1 Documentation in Unix man page format.

change.log Version-to-version change highlights.

example.c Sample code for calling JPEG library.

Configuration/installation files and programs (see install.txt for more info):

configure Unix shell script to perform automatic configuration.

configure.ac Source file for use with Autoconf to generate configure.

ltmain.sh Support scripts for configure (from GNU libtool).

config.guess

config.sub

depcomp

missing

ar-lib

compile

install-sh Install shell script for those Unix systems

lacking one.

Makefile.in Makefile input for configure.

Makefile.am Source file for use with Automake to generate Makefile.in.

ckconfig.c Program to generate jconfig.h on non-Unix systems.

jconfig.txt Template for making jconfig.h by hand.

mak\*.\* Sample makefiles for particular systems.

jconfig.\* Sample jconfig.h for particular systems.

libjpeg.map Script to generate shared library with versioned symbols.

libjpeg.pc.in libjpeg.pc pkg-config file input for configure.

aclocal.m4 M4 macro definitions for use with Autoconf.

Test files (see install.txt for test procedure):

test\*.\* Source and comparison files for confidence test.

These are binary image files, NOT text files.

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/filelist.txt

No license file was found, but licenses were detected in source scan.

/\*

\* cdjpeg.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains common support routines used by the IJG application

\* programs (cjpeg, djpeg, jpegtran).

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/cdjpeg.c

No license file was found, but licenses were detected in source scan.

/\*

\* jpegtran.c

\*

\* Copyright (C) 1995-2019, Thomas G. Lane, Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains a command-line user interface for JPEG transcoding.

\* It is very similar to cjpeg.c, and partly to djpeg.c, but provides

\* lossless transcoding between different JPEG file formats. It also

\* provides some lossless and sort-of-lossless transformations of JPEG data.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jpegtran.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdmerge.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2013-2022 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains code for merged upsampling/color conversion.
- \*
- \* This file combines functions from jdsample.c and jdcOLOR.c;
- \* read those files first to understand what's going on.
- \*
- \* When the chroma components are to be upsampled by simple replication
- \* (ie, box filtering), we can save some work in color conversion by
- \* calculating all the output pixels corresponding to a pair of chroma
- \* samples at one time. In the conversion equations
- \*  $R = Y + K1 * Cr$
- \*  $G = Y + K2 * Cb + K3 * Cr$
- \*  $B = Y + K4 * Cb$
- \* only the Y term varies among the group of pixels corresponding to a pair
- \* of chroma samples, so the rest of the terms can be calculated just
- once.
- \* At typical sampling ratios, this eliminates half or three-quarters
- \* of the multiplications needed for color conversion.
- \*
- \* This file currently provides implementations for the following cases:
- \* YCC => RGB color conversion only (YCbCr or BG\_YCC).
- \* Sampling ratios of 2h1v or 2h2v.
- \* No scaling needed at upsample time.
- \* Corner-aligned (non-CCIR601) sampling alignment.
- \* Other special cases could be added, but in most applications these
- \* are the only common cases. (For uncommon cases we fall back on
- \* the more general code in jdsample.c and jdcOLOR.c.)
- \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdmerge.c

No license file was found, but licenses were detected in source scan.

/\*

\* jccoefct.c

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2003-2022 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the coefficient buffer controller for compression.

\* This controller is the top level of the JPEG compressor proper.

\* The coefficient buffer lies between forward-DCT and entropy encoding steps.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jccoefct.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdatasrc.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2009-2022 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains decompression data source routines for the case of

\* reading JPEG data from memory or from a file (or any stdio stream).

\* While these routines are sufficient for most applications,

\* some will want to use a different source manager.

\* IMPORTANT: we assume that fread() will correctly transcribe an array of

\* JOCTETs from 8-bit-wide elements on external storage. If char is wider

\* than 8 bits on your machine, you may need to do some tweaking.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdatasrc.c

No license file was found, but licenses were detected in source scan.

/\*

\* jmemdos.c

\*

\* Copyright (C) 1992-1997, Thomas G. Lane.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file provides an MS-DOS-compatible implementation of the system-

\* dependent portion of the JPEG memory manager. Temporary data can be

\* stored in extended or expanded memory as well as in regular DOS files.

\*

\* If you use this file, you must be sure that NEED\_FAR\_POINTERS is defined

\* if you compile in a small-data memory model; it should NOT be defined if

\* you use a large-data memory model. This file is not recommended if you

\* are using a flat-memory-space 386 environment such as DJGCC or Watcom C.

\* Also, this code will NOT work if struct fields are aligned on greater than

\* 2-byte boundaries.

\*

\* Based on code contributed by Ge' Weijers.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jmemdos.c



No license file was found, but licenses were detected in source scan.

```
/*
 * jmemsys.h
 *
 * Copyright (C) 1992-1997, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This include file defines the interface between the system-independent
 * and system-dependent portions of the JPEG memory manager. No other
 * modules need include it. (The system-independent portion is jmemmgr.c;
 * there are several different versions of the system-dependent portion.)
 *
 * This file works as-is for the system-dependent memory managers supplied
 * in the IJG distribution. You may need to modify it if you write a
 * custom memory manager. If system-dependent changes are needed in
 * this file, the best method is to #ifdef them based on a configuration
 * symbol supplied in jconfig.h, as we have done with USE_MSDOS_MEMMGR
 * and USE_MAC_MEMMGR.
 */
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jmemsys.h

No license file was found, but licenses were detected in source scan.

```
/*
 * jidctint.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modification developed 2002-2018 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a slow-but-accurate integer implementation of the
 * inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
 * must also perform dequantization of the input coefficients.
 *
 * A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
 * on each row (or vice versa, but it's more convenient to emit a row at
 * a time). Direct algorithms are also available, but they are much more
 * complex and seem not to be any faster when reduced to code.
 *
 * This implementation is based on an algorithm described in
 * C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
 * Algorithms with 11 Multiplications",
 * Proc. Int'l. Conf. on Acoustics,
 * Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
```

- \* The primary algorithm described there uses 11 multiplies and 29 adds.
- \* We use their alternate method with 12 multiplies and 32 adds.
- \* The advantage of this method is that no data path contains more than one
- \* multiplication; this allows a very simple and accurate implementation in
- \* scaled fixed-point arithmetic, with a minimal number of shifts.
- \*
- \* We also provide IDCT routines with various output sample block sizes for
- \* direct resolution reduction or enlargement and for direct resolving the
- \* common 2x1 and 1x2 subsampling cases without additional resampling: NxN
- \* (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 input DCT block.
- \*
- \* For N<8 we simply take the corresponding low-frequency coefficients of
- \* the 8x8 input DCT block and apply an NxN point IDCT on the sub-block
- \* to yield the downscaled outputs.
- \* This can be seen as direct low-pass downsampling
- from the DCT domain
- \* point of view rather than the usual spatial domain point of view,
- \* yielding significant computational savings and results at least
- \* as good as common bilinear (averaging) spatial downsampling.
- \*
- \* For N>8 we apply a partial NxN IDCT on the 8 input coefficients as
- \* lower frequencies and higher frequencies assumed to be zero.
- \* It turns out that the computational effort is similar to the 8x8 IDCT
- \* regarding the output size.
- \* Furthermore, the scaling and descaling is the same for all IDCT sizes.
- \*
- \* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
- \* since there would be too many additional constants to pre-calculate.
- \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jidctint.c

No license file was found, but licenses were detected in source scan.

/\*

\* jversion.h

\*

\* Copyright (C) 1991-2024, Thomas G. Lane, Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains software version identification.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jversion.h

No license file was found, but licenses were detected in source scan.

```
/*
 * jchuff.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2006-2023 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains Huffman entropy encoding routines.
 * Both sequential and progressive modes are supported in this single module.
 *
 * Much of the complexity here has to do with supporting output suspension.
 * If the data destination module demands suspension, we want to be able to
 * back up to the start of the current MCU. To do this, we copy state
 * variables into local working storage, and update them back to the
 * permanent JPEG objects only upon successful completion of an MCU.
 *
 * We do not support output suspension for the progressive JPEG mode, since
 * the library currently does not allow multiple-scan files to be written
 * with output suspension.
 */
```

Found

in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jchuff.c

No license file was found, but licenses were detected in source scan.

```
/*
 * alternate djpeg.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2009-2023 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains an alternate user interface for the JPEG decompressor.
 * One or more input files are named on the command line, and output file
 * names are created by substituting an appropriate extension.
 */
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/djpegalt.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdcoefct.c
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
```

- \* Modified 2002-2020 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains the coefficient buffer controller for decompression.
- \* This controller is the top level of the JPEG decompressor proper.
- \* The coefficient buffer lies between entropy decoding and inverse-DCT steps.
- \*
- \* In buffered-image mode, this controller is the interface between
- \* input-oriented processing and output-oriented processing.
- \* Also, the input side (only) is used when reading a file for transcoding.
- \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdcoefct.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jcinit.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2003-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains initialization logic for the JPEG compressor.
 * This routine is in charge of selecting the modules to be executed and
 * making an initialization call to each one.
 *
 * Logically, this code belongs in jcmaster.c. It's split out because
 * linking this routine implies linking the entire compression library.
 * For a transcoding-only application, we want to be able to use jcmaster.c
 * without linking in the whole library.
 */
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcinit.c

No license file was found, but licenses were detected in source scan.

## INSTALLATION INSTRUCTIONS for the Independent JPEG Group's JPEG software

Copyright (C) 1991-2023, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file explains how to configure and install the IJG software. We have tried to make this software extremely portable and flexible, so that it can be

adapted to almost any environment. The downside of this decision is that the installation process is complicated. We have provided shortcuts to simplify the task on common systems. But in any case, you will need at least a little familiarity with C programming and program build procedures for your system.

If you are only using this software as part of a larger program, the larger program's installation procedure may take care of configuring the IJG code. For example, Ghostscript's installation script will configure the IJG code. You don't need to read this file if you just want to compile Ghostscript.

If you are on a Unix machine, you may not need to read this file at all.

Try doing

```
./configure
```

```
make
```

```
make test
```

If that doesn't complain, do

```
make install
```

(better do "make -n install" first to see if the makefile will put the files where you want them). Read further if you run into snags or want to customize the code for your system.

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## BEFORE YOU START

=====

Before installing the software you must unpack the distributed source code.

Since you are reading this file, you have probably already succeeded in this task. However, there is a potential for error if you needed

to convert the

files to the local standard text file format (for example, if you are on

MS-DOS you may have converted LF end-of-line to CR/LF). You must apply

such conversion to all the files EXCEPT those whose names begin with "test".  
The test files contain binary data; if you change them in any way then the self-test will give bad results.

Please check the last section of this file to see if there are hints for the specific machine or compiler you are using.

## CONFIGURING THE SOFTWARE

=====

To configure the IJG code for your system, you need to create two files:

- \* jconfig.h: contains values for system-dependent #define symbols.
- \* Makefile: controls the compilation process.

(On a non-Unix machine, you may create "project files" or some other substitute for a Makefile. jconfig.h is needed in any environment.)

We provide three different ways to generate these files:

- \* On a Unix system, you can just run the "configure" script.
- \* We provide sample jconfig files and makefiles for popular machines; if your machine matches one of the samples, just copy the right sample files to jconfig.h and Makefile.
- \* If all else fails, read the instructions below and make your own files.

### Configuring the software using the automatic "configure" script

-----

If you are on a Unix machine, you can just type

```
./configure
```

and let the configure script construct appropriate configuration files.

If you're using "csh" on an old version of System V, you might need to type

```
sh configure
```

instead to prevent csh from trying to execute configure itself.

Expect configure to run for a few minutes, particularly on slower machines; it works by compiling a series of test programs.

Configure was created with GNU Autoconf and it follows the usual conventions for GNU configure scripts. It makes a few assumptions that you may want to override. You can do this by providing optional switches to configure:

\*

Configure will build both static and shared libraries, if possible.

If you want to build libjpeg only as a static library, say

```
./configure --disable-shared
```

If you want to build libjpeg only as a shared library, say

```
./configure --disable-static
```

Configure uses GNU libtool to take care of system-dependent shared library building methods.

\* Configure will use gcc (GNU C compiler) if it's available, otherwise cc. To force a particular compiler to be selected, use the CC option, for example  
./configure CC='cc'  
The same method can be used to include any unusual compiler switches. For example, on HP-UX you probably want to say  
./configure CC='cc -Aa'  
to get HP's compiler to run in ANSI mode.

\* The default CFLAGS setting is "-g" for non-gcc compilers, "-g -O2" for gcc. You can override this by saying, for example,  
./configure CFLAGS='-O2'  
if you want to compile without debugging support.

\* Configure will set up the makefile so that "make install" will install files into /usr/local/bin, /usr/local/man, etc. You can specify an installation prefix other than "/usr/local" by giving configure the option "--prefix=PATH".

\* If you don't have a lot of swap space, you may need to enable the IJG software's internal virtual memory mechanism. To do this, give the option "--enable-maxmem=N" where N is the default maxmemory limit in megabytes. This is discussed in more detail under "Selecting a memory manager", below. You probably don't need to worry about this on reasonably-sized Unix machines, unless you plan to process very large images.

Configure has some other features that are useful if you are cross-compiling or working in a network of multiple machine types; but if you need those features, you probably already know how to use them.

Configuring the software using one of the supplied jconfig and makefile files

-----  
If you have one of these systems, you can just use the provided configuration files:

Makefile jconfig  
file System and/or compiler

makefile.manx jconfig.manx Amiga, Manx Aztec C  
makefile.sas jconfig.sas Amiga, SAS C  
makeproj.mac jconfig.mac Apple Macintosh, Metrowerks CodeWarrior  
makefile.xc jconfig.xc Apple Mac, Xcode 15  
mak\*jpeg.st jconfig.st Atari ST/Mega/STE/TT/Falcon, Pure C or Turbo C  
makefile.bcc jconfig.bcc MS-DOS or OS/2, Borland C

makefile.dj jconfig.dj MS-DOS, DJGPP (Delorie's port of GNU C)  
 makefile.mc6 jconfig.mc6 MS-DOS, Microsoft C (16-bit only)  
 makefile.wat jconfig.wat MS-DOS, OS/2, or Windows NT, Watcom C  
 makefile.vc jconfig.vc Windows, MS Visual C++  
 makefile.vs jconfig.vc Windows, MS Visual C++ 6 Developer Studio  
 make\*.vc6  
 makefile.vs jconfig.vc Windows, Visual Studio 2019-2022 version 16-17  
 make\*.v16  
 makefile.b32 jconfig.vc Windows, C++Builder/RAD Studio 10.4-11  
 mak\*jpeg.bcb  
 makefile.b32 jconfig.vc Windows, Embarcadero C++ for Win32 (bcc32)  
 makefile.c32 jconfig.vc Windows, Embarcadero C++ for Win32 (bcc32c)  
 makefile.d32  
 makefile.x32 jconfig.vc Windows,  
 Embarcadero C++ for Win32 (bcc32x)  
 makefile.b64 jconfig.vc Windows, Embarcadero C++ for Win64 (bcc64)  
 makefile.mms jconfig.vms Digital VMS, with MMS software  
 makefile.vms jconfig.vms Digital VMS, without MMS software

Copy the proper jconfig file to jconfig.h and the makefile to Makefile (or whatever your system uses as the standard makefile name). For more info see the appropriate system-specific hints section near the end of this file.

#### Configuring the software by hand

-----

First, generate a jconfig.h file. If you are moderately familiar with C, the comments in jconfig.txt should be enough information to do this; just copy jconfig.txt to jconfig.h and edit it appropriately. Otherwise, you may prefer to use the ckconfig.c program. You will need to compile and execute ckconfig.c by hand --- we hope you know at least enough to do that. ckconfig.c may not compile the first try (in fact, the whole idea is for it to fail if anything is going to).

If you get compile errors, fix them by editing ckconfig.c according to the directions given in ckconfig.c. Once you get it to run, it will write a suitable jconfig.h file, and will also print out some advice about which makefile to use.

You may also want to look at the canned jconfig files, if there is one for a system similar to yours.

Second, select a makefile and copy it to Makefile (or whatever your system uses as the standard makefile name). The most generic makefiles we provide are

makefile.ansi: if your C compiler supports function prototypes  
 makefile.unix: if not.

(You have function prototypes if ckconfig.c put "#define HAVE\_PROTOTYPES"



in jconfig.h.) You may want to start from one of the other makefiles if there is one for a system similar to yours.

Look over the selected Makefile and adjust options as needed. In particular you may want to change the CC and CFLAGS definitions. For instance, if you are using GCC, set CC=gcc. If you had to use any compiler switches to get ckconfig.c to work, make sure the same switches are in CFLAGS.

If you are on a system that doesn't use makefiles, you'll need to set up project files (or whatever you do use) to compile all the source files and link them into executable files cjpeg, djpeg, jpegtran, rdjpgcom, and wrjpgcom. See the file lists in any of the makefiles to find out which files go into each program. Note that the provided makefiles all make a "library" file libjpeg first, but you don't have to do that if you don't want to; the file lists identify which source files are actually needed for compression, decompression, or both. As a last resort, you can make a batch script that just compiles everything and links it all together; makefile.vms is an example of this (it's for VMS systems that have no make-like utility).

Here are comments about some specific configuration decisions you'll need to make:

#### Command line style

-----

These programs can use a Unix-like command line style which supports redirection

and piping, like this:

cjpeg inputfile >outputfile

cjpeg <inputfile >outputfile

source program | cjpeg >outputfile

The simpler "two file" command line style is just

cjpeg inputfile outputfile

You may prefer the two-file style, particularly if you don't have pipes.

You MUST use two-file style on any system that doesn't cope well with binary data fed through stdin/stdout; this is true for some MS-DOS compilers, for example. If you're not on a Unix system, it's safest to assume you need two-file style. (But if your compiler provides either the Posix-standard fdopen() library routine or a Microsoft-compatible setmode() routine, you can safely use the Unix command line style, by defining USE\_FDOPEN or USE\_SETMODE respectively.)

To use the two-file style, make jconfig.h say "#define TWO\_FILE\_COMMANDLINE".

#### Selecting a memory manager

-----

The IJG code is capable of working on images that are too big to fit in main memory; data is swapped out to temporary files as necessary. However, the code to do this is rather system-dependent. We provide five different memory managers:

- \* `jmemansi.c` This version uses the ANSI-standard library routine `tmpfile()`, which not all non-ANSI systems have. On some systems `tmpfile()` may put the temporary file in a non-optimal location; if you don't like what it does, use `jmemname.c`.
- \* `jmemname.c` This version creates named temporary files. For anything except a Unix machine, you'll need to configure the `select_file_name()` routine appropriately; see the comments near the head of `jmemname.c`. If you use this version, define `NEED_SIGNAL_CATCHER` in `jconfig.h` to make sure the temp files are removed if the program is aborted.
- \* `jmemnobs.c` (That stands for No Backing Store :-).) This will compile on almost any system, but it assumes you have enough main memory or virtual memory to hold the biggest images you work with.
- \* `jmemdos.c` This should be used with most 16-bit MS-DOS compilers. See the system-specific notes about MS-DOS for more info. IMPORTANT: if you use this, define `USE_MSDOS_MEMMGR` in `jconfig.h`, and include the assembly file `jmemdosa.asm` in the programs. The supplied makefiles and `jconfig` files for 16-bit MS-DOS compilers already do both.
- \* `jmemmac.c` Custom version for Apple Macintosh; see the system-specific notes for Macintosh for more info.

To use a particular memory manager, change the `SYSDEPMEM` variable in your makefile to equal the corresponding object file name (for example, `jmemansi.o` or `jmemansi.obj` for `jmemansi.c`).

If you have plenty of (real or virtual) main memory, just use `jmemnobs.c`. "Plenty" means about ten bytes for every pixel in the largest images you plan to process, so a lot of systems don't meet this criterion. If yours doesn't, try `jmemansi.c` first. If that doesn't compile, you'll have to use `jmemname.c`; be sure to adjust `select_file_name()` for local conditions. You may also need to change `unlink()` to `remove()` in `close_backing_store()`.

Except with `jmemnobs.c` or `jmemmac.c`, you need to adjust the `DEFAULT_MAX_MEM` setting to a reasonable value for your system (either by adding a `#define` for

DEFAULT\_MAX\_MEM to jconfig.h, or by adding a -D switch to the Makefile). This value limits the amount of data space the program will attempt to allocate. Code and static data space isn't counted, so the actual memory needs for cjpeg or djpeg are typically 100 to 150Kb more than the max-memory setting. Larger max-memory settings reduce the amount of I/O needed to process a large image, but too large a value can result in "insufficient memory" failures. On most Unix machines (and other systems with virtual memory), just set DEFAULT\_MAX\_MEM to several million and forget it. At the other end of the spectrum, for MS-DOS machines you probably can't go much above 300K to 400K. (On MS-DOS the value refers to conventional memory only. Extended/expanded memory is handled separately by jmemdos.c.)

## BUILDING THE SOFTWARE

=====

Now you should be able to compile the software. Just say "make" (or whatever's necessary to start the compilation). Have a cup of coffee.

Here are some things that could go wrong:

If your compiler complains about undefined structures, you should be able to shut it up by putting "#define INCOMPLETE\_TYPES\_BROKEN" in jconfig.h.

If you have trouble with missing system include files or inclusion of the wrong ones, read jinclude.h. This shouldn't happen if you used configure or ckconfig.c to set up jconfig.h.

There are a fair number of routines that do not use all of their parameters; some compilers will issue warnings about this, which you can ignore. There are also a few configuration checks that may give "unreachable code" warnings. Any other warning deserves investigation.

If you don't have a getenv() library routine, define NO\_GETENV.

Also see the system-specific hints, below.

## TESTING THE SOFTWARE

=====

As a quick test of functionality we've included a small sample image in several forms:

- testorig.jpg Starting point for the djpeg tests.
- testimg.ppm The output of djpeg testorig.jpg
- testimg.gif The output of djpeg -gif testorig.jpg

testimg.bmp The output of `djpeg -bmp -colors 256 testorig.jpg`  
testimg.jpg The output of `cjpeg testimg.ppm`  
testprog.jpg Progressive-mode equivalent of testorig.jpg.  
testimgp.jpg The output of `cjpeg -progressive -optimize testimg.ppm`  
(The first- and second-generation .jpg files aren't identical since the  
default compression parameters are lossy.) If you can generate duplicates  
of the testimg\* files then you probably have working programs.

With most of the makefiles, "make test" will perform the necessary  
comparisons.

If you're using a makefile that doesn't provide the test option, run `djpeg`  
and `cjpeg` by hand and compare the output files to testimg\* with whatever  
binary file comparison tool you have. The files should be bit-for-bit  
identical.

If the programs complain "MAX\_ALLOC\_CHUNK  
is wrong, please fix", then you  
need to reduce MAX\_ALLOC\_CHUNK to a value that fits in type `size_t`.  
Try adding "#define MAX\_ALLOC\_CHUNK 65520L" to `jconfig.h`. A less likely  
configuration error is "ALIGN\_TYPE is wrong, please fix": defining ALIGN\_TYPE  
as long should take care of that one.

If the `cjpeg` test run fails with "Missing Huffman code table entry", it's a  
good bet that you needed to define RIGHT\_SHIFT\_IS\_UNSIGNED. Go back to the  
configuration step and run `ckconfig.c`. (This is a good plan for any other  
test failure, too.)

If you are using Unix (one-file) command line style on a non-Unix system,  
it's a good idea to check that binary I/O through `stdin/stdout` actually  
works. You should get the same results from "`djpeg <testorig.jpg >out.ppm`"  
as from "`djpeg -outfile out.ppm testorig.jpg`". Note that the makefiles all  
use the latter style and therefore do not exercise `stdin/stdout`! If this  
check fails, try recompiling with `USE_SETMODE` or `USE_FDOPEN` defined.  
If it still  
doesn't work, better use two-file style.

If you chose a memory manager other than `jmemnobs.c`, you should test that  
temporary-file usage works. Try "`djpeg -bmp -colors 256 -max 0 testorig.jpg`"  
and make sure its output matches testimg.bmp. If you have any really large  
images handy, try compressing them with `-optimize` and/or decompressing with  
`-colors 256` to make sure your `DEFAULT_MAX_MEM` setting is not too large.

NOTE: this is far from an exhaustive test of the JPEG software; some modules,  
such as 1-pass color quantization, are not exercised at all. It's just a  
quick test to give you some confidence that you haven't missed something  
major.

## INSTALLING THE SOFTWARE

=====

Once you're done with the above steps, you can install the software by copying the executable files (cjpeg, djpeg, jpegtran, rdjpgcom, and wrjpgcom) to wherever you normally install programs. On Unix systems, you'll also want to put the man pages (cjpeg.1, djpeg.1, jpegtran.1, rdjpgcom.1, wrjpgcom.1) in the man-page directory. The pre-fab makefiles don't support this step since there's such a wide variety of installation procedures on different systems.

If you generated a Makefile with the "configure" script, you can just say  
make install  
to install the programs and their man pages into the standard places. (You'll probably need to be root to do this.) We recommend first saying  
make -n install  
to see where configure thought the files should go. You may need to edit the Makefile, particularly if your system's conventions for man page filenames don't match what configure expects.

If you want to install the IJG library itself, for use in compiling other programs besides ours, then you need to put the four include files  
jpeglib.h jerror.h jconfig.h jmorecfg.h  
into your include-file directory, and put the library file libjpeg.a (extension may vary depending on system) wherever library files go. If you generated a Makefile with "configure", it will do what it thinks is the  
right thing if you say  
make install-lib

## OPTIONAL STUFF

=====

Progress monitor:

If you like, you can #define PROGRESS\_REPORT (in jconfig.h) to enable display of percent-done progress reports. The routine provided in cdjpeg.c merely prints percentages to stderr, but you can customize it to do something fancier.

Utah RLE file format support:

We distribute the software with support for RLE image files (Utah Raster Toolkit format) disabled, because the RLE support won't compile without the Utah library. If you have URT version 3.1 or later, you can enable RLE

support as follows:

1. #define RLE\_SUPPORTED in jconfig.h.
2. Add a -I option to CFLAGS in the Makefile for the directory containing the URT .h files (typically the "include" subdirectory of the URT distribution).
3. Add -L... -lrle to LDLIBS in the Makefile, where ... specifies the directory containing the URT "librle.a" file (typically the "lib" subdirectory of the URT distribution).

#### Support

for 9-bit to 12-bit deep pixel data:

The IJG code currently allows 8, 9, 10, 11, or 12 bits sample data precision. (For color, this means 8 to 12 bits per channel, of course.) If you need to work with deeper than 8-bit data, you can compile the IJG code for 9-bit to 12-bit operation.

To do so:

1. In jmorecfg.h, define BITS\_IN\_JSAMPLE as 9, 10, 11, or 12 rather than 8.
2. In jconfig.h, undefine BMP\_SUPPORTED, RLE\_SUPPORTED, and TARGA\_SUPPORTED, because the code for those formats doesn't handle deeper than 8-bit data and won't even compile. (The PPM code does work, as explained below. The GIF code works too; it scales 8-bit GIF data to and from 12-bit depth automatically.)
3. Compile. Don't expect "make test" to pass, since the supplied test files are for 8-bit data.

Currently, 9-bit to 12-bit support does not work on 16-bit-int machines.

Run-time selection and conversion of data precision are currently not supported and may be added later.

#### Exception:

The transcoding part (jpegtran) supports all settings in a single instance, since it operates on the level of DCT coefficients and not sample values.

The PPM reader (rdppm.c) can read deeper than 8-bit data from either text-format or binary-format PPM and PGM files. Binary-format PPM/PGM files which have a maxval greater than 255 are assumed to use 2 bytes per sample, MSB first (big-endian order). As of early 1995, 2-byte binary format is not officially supported by the PBMPLUS library, but it is expected that a future release of PBMPLUS will support it. Note that the PPM reader will read files of any maxval regardless of the BITS\_IN\_JSAMPLE setting; incoming data is automatically rescaled to maxval=MAXJSAMPLE as appropriate for the cjpeg bit depth.

The PPM writer (wrppm.c) will normally write 2-byte binary PPM or PGM format, maxval=MAXJSAMPLE, when compiled with BITS\_IN\_JSAMPLE>8. Since this format is not yet widely supported, you can disable it by compiling wrppm.c

with

PPM\_NORAWWORD defined; then the data is scaled down to 8 bits to make a standard 1-byte/sample PPM or PGM file. (Yes, this means still another copy of djpeg to keep around. But hopefully you won't need it for very long. Poskanzer's supposed to get that new PBMPLUS release out Real Soon Now.)

Of course, if you are working with 9-bit to 12-bit data, you probably have it stored in some other, nonstandard format. In that case you'll probably want to write your own I/O modules to read and write your format.

Note:

The standard Huffman tables are only valid for 8-bit data precision. If you selected more than 8-bit data precision, cjpeg uses arithmetic coding by default. The Huffman encoder normally uses entropy optimization to compute usable tables for higher precision. Otherwise, you'll have to supply different default Huffman tables.

Removing code:

If you need to make a smaller version of the JPEG software, some optional functions can be removed at compile time. See the `xxx_SUPPORTED` #defines in `jconfig.h` and `jmorecfg.h`. If at all possible, we recommend that you leave in decoder support for all valid JPEG files, to ensure that you can read anyone's output. Taking out support for image file formats that you don't use is the most painless way to make the programs smaller. Another possibility is to remove some of the DCT methods: in particular, the "IFAST" method may not be enough faster than the others to be worth keeping on your machine. (If you do remove ISLOW or IFAST, be sure to redefine `JDCT_DEFAULT` or `JDCT_FASTEST` to a supported method, by adding a #define in `jconfig.h`.)

## OPTIMIZATION

=====

Unless you own a Cray, you'll probably be interested in making the JPEG software go as fast as possible. This section covers some machine-dependent optimizations you may want to try. We suggest that before trying any of this, you first get the basic installation to pass the self-test step.

Repeat the self-test after any optimization to make sure that you haven't broken anything.

The integer DCT routines perform a lot of multiplications. These multiplications must yield 32-bit results, but none of their input values are more than 16 bits wide. On many machines, notably the 680x0 and 80x86 CPUs, a 16x16=>32 bit multiply instruction is faster than a full 32x32=>32 bit multiply. Unfortunately there is no portable way to specify such a

multiplication in C, but some compilers can generate one when you use the right combination of casts. See the MULTIPLYxxx macro definitions in jdct.h. If your compiler makes "int" be 32 bits and "short" be 16 bits, defining SHORTxSHORT\_32 is fairly likely to work. When experimenting with alternate definitions, be sure to test not only whether the code still works (use the self-test), but also whether it is actually faster --- on some compilers, alternate definitions may compute the right answer, yet be slower than the default. Timing cjpeg on a large PGM (grayscale) input file is the best way to check this, as the DCT will be the largest fraction of the runtime in that mode. (Note: some of the distributed compiler-specific jconfig files already contain #define switches to select appropriate MULTIPLYxxx definitions.)

If your machine has sufficiently fast floating point hardware, you may find that the float DCT method is faster than the integer DCT methods, even after tweaking the integer multiply macros. In that case you may want to make the float DCT be the default method. (The only objection to this is that float DCT results may vary slightly across machines.) To do that, add "#define JDCT\_DEFAULT JDCT\_FLOAT" to jconfig.h. Even if you don't change the default, you should redefine JDCT\_FASTEST, which is the method selected by djpeg's -fast switch. Don't forget to update the documentation files (usage.txt and/or cjpeg.1, djpeg.1) to agree with what you've done.

If access to "short" arrays is slow on your machine, it may be a win to define type JCOEF as int rather than short.

This will cost a good deal of memory though, particularly in some multi-pass modes, so don't do it unless you have memory to burn and short is REALLY slow.

If your compiler can compile function calls in-line, make sure the INLINE macro in jmorecfg.h is defined as the keyword that marks a function inline-able. Some compilers have a switch that tells the compiler to inline any function it thinks is profitable (e.g., -finline-functions for gcc). Enabling such a switch is likely to make the compiled code bigger but faster.

In general, it's worth trying the maximum optimization level of your compiler, and experimenting with any optional optimizations such as loop unrolling. (Unfortunately, far too many compilers have optimizer bugs ... be prepared to back off if the code fails self-test.) If you do any experimentation along these lines, please report the optimal settings to jpeg-info@ijg.org so we can mention them in future releases. Be sure to specify your machine and compiler version.

## HINTS

### FOR SPECIFIC SYSTEMS

=====



We welcome reports on changes needed for systems not mentioned here. Submit 'em to [jpeg-info@ijg.org](mailto:jpeg-info@ijg.org). Also, if configure or ckconfig.c is wrong about how to configure the JPEG software for your system, please let us know.

Acorn RISC OS:

(Thanks to Simon Middleton for these hints on compiling with Desktop C.)

After renaming the files according to Acorn conventions, take a copy of makefile.ansi, change all occurrences of 'libjpeg.a' to 'libjpeg.o' and change these definitions as indicated:

```
CFLAGS= -throwback -IC: -Wn
LDLIBS=C:o.Stubs
SYSDEPMEM=jmemansi.o
LN=Link
AR=LibFile -c -o
```

Also add a new line '.c.o; \$(cc) \$< \$(cflags) -c -o \$@'. Remove the lines '\$(RM) libjpeg.o' and '\$(AR2) libjpeg.o' and the 'jconfig.h' dependency section.

Copy jconfig.txt to jconfig.h. Edit jconfig.h to define TWO\_FILE\_COMMANDLINE and CHAR\_IS\_UNSIGNED.

Run the makefile using !AMU not !Make. If you want to use the 'clean' and 'test' makefile entries then you will have to fiddle with the syntax a bit and rename the test files.

Amiga:

SAS C 6.50 reportedly is too buggy to compile the IJG code properly. A patch to update to 6.51 is available from SAS or AmiNet FTP sites.

The supplied config files are set up to use jmemname.c as the memory manager, with temporary files being created on the device named by "JPEGTMP:".

Atari ST/Mega/STE/TT/Falcon:

Copy the project files makcjpeg.st, makdjpeg.st, maktjpeg.st, and makljjpeg.st to cjpeg.prj, djpeg.prj, jpegtran.prj, and libjpeg.prj respectively. The project files should work as-is with Pure C. For Turbo C, change library filenames "pc..." to "tc..." in each project file. Note that libjpeg.prj

selects jmemansi.c as the recommended memory manager. You'll probably want to adjust the DEFAULT\_MAX\_MEM setting --- you want it to be a couple hundred K less than your normal free memory. Put "#define DEFAULT\_MAX\_MEM nnnn" into jconfig.h to do this.

To use the 68881/68882 coprocessor for the floating point DCT, add the compiler option "-8" to the project files and replace pcftlib.lib with pc881lib.lib in cjpeg.prj and djpeg.prj. Or if you don't have a coprocessor, you may prefer to remove the float DCT code by undefining DCT\_FLOAT\_SUPPORTED in jmorecfg.h (since without a coprocessor, the float code will be too slow to be useful). In that case, you can delete pcftlib.lib from the project files.

Note that you must make libjpeg.lib before making cjpeg.ttp, djpeg.ttp, or jpegtran.ttp. You'll have to perform the self-test by hand.

We haven't bothered to include project files for rdjpgcom and wrjpgcom. Those source files should just be compiled by themselves; they don't depend on the JPEG library. You can use the default.prj project file of the Pure C distribution to make the programs.

There is a bug in some older versions of the Turbo C library which causes the space used by temporary files created with "tmpfile()" not to be freed after an abnormal program exit. If you check your disk afterwards, you will find cluster chains that are allocated but not used by a file. This should not happen in cjpeg/djpeg/jpegtran, since we enable a signal catcher to explicitly close temp files before exiting. But if you use the JPEG library with your own code, be sure to supply a signal catcher, or else use a different system-dependent memory manager.

Cray:

Should you be so fortunate as to be running JPEG on a Cray YMP, there is a compiler bug in old versions of Cray's Standard C (prior to 3.1). If you still have an old compiler, you'll need to insert a line reading "#pragma novector" just before the loop

```
for (i = 1; i <= (int) htbl->bits[l]; i++)
 huffsize[p++] = (char) l;
```

in fix\_huff\_tbl (in V5beta1, line 204 of jchuff.c and line 176 of jdchuff.c). [This bug may or may not still occur with the current IJG code, but it's probably a dead issue anyway...]

HP-UX:

If you have HP-UX 7.05 or later with the "software development" C compiler, you should run the compiler in ANSI mode. If using the configure script, say

```
./configure CC='cc -Aa'
```

(or `-Ae` if you prefer). If configuring by hand, use `makefile.ansi` and add `"-Aa"` to the `CFLAGS` line in the `makefile`.

If you have a pre-7.05 system, or if you are using the non-ANSI C compiler delivered with a minimum HP-UX system, then you must use `makefile.unix` (and do NOT add `-Aa`); or just run `configure` without the `CC` option.

On HP 9000 series 800 machines, the HP C compiler is buggy in revisions prior to A.08.07. If you get complaints about "not a typedef name", you'll have to use `makefile.unix`, or run `configure` without the `CC` option.

Macintosh, generic comments:

The supplied user-interface files (`cjpeg.c`, `djpeg.c`, etc) are set up to provide a Unix-style command line interface. You can use this interface on the Mac by means of the `ccommand()` library routine provided by Metrowerks CodeWarrior or Think C. This is only appropriate for testing the library, however; to make a

user-friendly equivalent of `cjpeg/djpeg` you'd really want to develop a Mac-style user interface. There isn't a complete example available at the moment, but there are some helpful starting points:

1. Sam Bushell's free "To JPEG" applet provides drag-and-drop conversion to JPEG under System 7 and later. This only illustrates how to use the compression half of the library, but it does a very nice job of that part.

The CodeWarrior source code is available from <http://www.pobox.com/~jsam>.

2. Jim Brunner prepared a Mac-style user interface for both compression and decompression. Unfortunately, it hasn't been updated since IJG v4, and the library's API has changed considerably since then. Still it may be of some help, particularly as a guide to compiling the IJG code under Think C. Jim's code is available from the Info-Mac archives, at [sumex-aim.stanford.edu](http://sumex-aim.stanford.edu) or mirrors thereof; see file `/info-mac/dev/src/jpeg-convert-c.hqx`.

`jmemmac.c` is the recommended memory manager back end for Macintosh.

It uses

`NewPtr/DisposePtr` instead of `malloc/free`, and has a Mac-specific implementation of `jpeg_mem_available()`. It also creates temporary files that follow Mac conventions. (That part of the code relies on System-7-or-later OS functions. See the comments in `jmemmac.c` if you need to run it on System 6.) NOTE that `USE_MAC_MEMMGR` must be defined in `jconfig.h` to use `jmemmac.c`.

You can also use `jmemnobs.c`, if you don't care about handling images larger than available memory. If you use any memory manager back end other than

jmemmac.c, we recommend replacing "malloc" and "free" by "NewPtr" and "DisposePtr", because Mac C libraries often have peculiar implementations of malloc/free. (For instance, free() may not return the freed space to the Mac Memory Manager. This is undesirable for the IJG code because jmemmgr.c already clumps space requests.)

Macintosh, Metrowerks CodeWarrior:

The Unix-command-line-style interface can be used by defining USE\_CCOMMAND.

You'll also need to

define TWO\_FILE\_COMMANDLINE to avoid stdin/stdout.

This means that when using the cjpeg/djpeg programs, you'll have to type the input and output file names in the "Arguments" text-edit box, rather than using the file radio buttons. (Perhaps USE\_FDOPEN or USE\_SETMODE would eliminate the problem, but I haven't heard from anyone who's tried it.)

On 680x0 Macs, Metrowerks defines type "double" as a 10-byte IEEE extended float. jmemmgr.c won't like this: it wants sizeof(ALIGN\_TYPE) to be a power of 2. Add "#define ALIGN\_TYPE long" to jconfig.h to eliminate the complaint.

The supplied configuration file jconfig.mac can be used for your jconfig.h; it includes all the recommended symbol definitions. If you have AppleScript installed, you can run the supplied script makeproj.mac to create CodeWarrior project files for the library and the testbed applications, then build the library and applications. (Thanks to Dan Sears and Don Agro for this nifty hack, which saves us from trying to maintain CodeWarrior project files as part of the IJG distribution...)

Macintosh, Think C:

The documentation in Jim Brunner's "JPEG Convert" source code (see above) includes detailed build instructions for Think C; it's probably somewhat out of date for the current release, but may be helpful.

If you want to build the minimal command line version, proceed as follows. You'll have to prepare project files for the programs; we don't include any in the distribution since they are not text files. Use the file lists in any of the supplied makefiles as a guide. Also add the ANSI and Unix C libraries in a separate segment. You may need to divide the JPEG files into more than one segment; we recommend dividing compression and decompression modules. Define USE\_CCOMMAND in jconfig.h so that the ccommand() routine is called. You must also define TWO\_FILE\_COMMANDLINE because stdin/stdout don't handle binary data correctly.

On 680x0 Macs, Think C defines type "double" as a 12-byte IEEE extended

float.

jmemmgr.c won't like this: it wants sizeof(ALIGN\_TYPE) to be a power of 2.

Add "#define ALIGN\_TYPE long" to jconfig.h to eliminate the complaint.

jconfig.mac should work as a jconfig.h configuration file for Think C,  
but the makeproj.mac AppleScript script is specific to CodeWarrior. Sorry.

MIPS R3000:

MIPS's cc version 1.31 has a rather nasty optimization bug. Don't use -O

if you have that compiler version. (Use "cc -V" to check the version.)

Note that the R3000 chip is found in workstations from DEC and others.

MS-DOS, generic comments for 16-bit compilers:

The IJG code is designed to work well in 80x86 "small" or "medium" memory

models (i.e., data pointers are 16 bits unless explicitly declared "far";

code pointers can be either size). You may be able to use small model to

compile cjpeg or djpeg by itself, but you will probably have to use medium

model for any larger application. This won't make much difference in

performance. You *will* take a noticeable performance

hit if you use a

large-data memory model, and you should avoid "huge" model if at all

possible. Be sure that NEED\_FAR\_POINTERS is defined in jconfig.h if you use

a small-data memory model; be sure it is NOT defined if you use a large-data

model. (The supplied makefiles and jconfig files for Borland and Microsoft C

compile in medium model and define NEED\_FAR\_POINTERS.)

The DOS-specific memory manager, jmemdos.c, should be used if possible.

It needs some assembly-code routines which are in jmemdosa.asm; make sure

your makefile assembles that file and includes it in the library. If you

don't have a suitable assembler, you can get pre-assembled object files for

jmemdosa by FTP from <ftp.uu.net:/graphics/jpeg/jdosaobj.zip>. (DOS-oriented

distributions of the IJG source code often include these object files.)

When using jmemdos.c, jconfig.h must define USE\_MSDOS\_MEMMGR and must set

MAX\_ALLOC\_CHUNK to less than 64K (65520L is a typical value). If your

C library's far-heap malloc()

can't allocate blocks that large, reduce

MAX\_ALLOC\_CHUNK to whatever it can handle.

If you can't use jmemdos.c for some reason --- for example, because you

don't have an assembler to assemble jmemdosa.asm --- you'll have to fall

back to jmemansi.c or jmemname.c. You'll probably still need to set

MAX\_ALLOC\_CHUNK in jconfig.h, because most DOS C libraries won't malloc()

more than 64K at a time. IMPORTANT: if you use jmemansi.c or jmemname.c,

you will have to compile in a large-data memory model in order to get the right stdio library. Too bad.

wrjpgcom needs to be compiled in large model, because it malloc()s a 64KB work area to hold the comment text. If your C library's malloc can't handle that, reduce MAX\_COM\_LENGTH as necessary in wrjpgcom.c.

Most MS-DOS compilers treat stdin/stdout as text files, so you must use two-file command line style. But if your compiler has either fdopen() or setmode(), you can use one-file style if you like. To do this, define USE\_SETMODE or USE\_FDOPEN so that stdin/stdout will be set to binary mode. (USE\_SETMODE seems to work with more DOS compilers than USE\_FDOPEN.) You should test that I/O through stdin/stdout produces the same results as I/O to explicitly named files... the "make test" procedures in the supplied makefiles do NOT use stdin/stdout.

MS-DOS, generic comments for 32-bit compilers:

None of the above comments about memory models apply if you are using a 32-bit flat-memory-space environment, such as DJGPP or Watcom C. (And you should use one if you have it, as performance will be much better than 8086-compatible code!) For flat-memory-space compilers, do NOT define NEED\_FAR\_POINTERS, and do NOT use jmemdos.c. Use jmemnobs.c if the environment supplies adequate virtual memory, otherwise use jmemansi.c or jmemname.c.

You'll still need to be careful about binary I/O through stdin/stdout. See the last paragraph of the previous section.

MS-DOS, Borland C:

Be sure to convert all the source files to DOS text format (CR/LF newlines). Although Borland C will often work OK with unmodified Unix (LF newlines) source files, sometimes it will give bogus compile errors. "Illegal character '#'" is the most common such error. (This is true with Borland C 3.1, but perhaps is fixed in newer releases.)

If you want one-file command line style, just undefine TWO\_FILE\_COMMANDLINE. jconfig.bcc already includes #define USE\_SETMODE to make this work. (fdopen does not work correctly.)

MS-DOS, Microsoft C:

makefile.mc6 works with Microsoft C, DOS Visual C++, etc. It should only be used if you want to build a 16-bit (small or medium memory model) program.

If you want one-file command line style, just undefine TWO\_FILE\_COMMANDLINE. jconfig.mc6 already includes #define USE\_SETMODE to make this work. (fdopen does not work correctly.)

Note that this makefile assumes that the working copy of itself is called "makefile". If you want to call it something else, say "makefile.mak", be sure to adjust the dependency line that reads "\$(RFILE) : makefile". Otherwise the make will fail because it doesn't know how to create "makefile". Worse, some releases of Microsoft's make utilities give an incorrect error message in this situation.

Old versions of MS C fail with an "out of macro expansion space" error because they can't cope with the macro TRACEMS8 (defined in jerror.h). If this happens to you, the easiest solution is to change TRACEMS8 to expand to nothing. You'll lose the ability to dump out JPEG coefficient tables with djpeg -debug -debug, but at least you can compile.

Original MS C 6.0 is very buggy; it compiles incorrect code unless you turn off optimization entirely (remove -O from CFLAGS). 6.00A is better, but it still generates bad code if you enable loop optimizations (-Ol or -Ox).

MS C 8.0 crashes when compiling jquant1.c with optimization switch /Oo ... which is on by default. To work around this bug, compile that one file with /Oo-.

Microsoft Windows (all versions), generic comments:

Some

Windows system include files define typedef boolean as "unsigned char". The IJG code also defines typedef boolean, but we make it an "enum" by default. This doesn't affect the IJG programs because we don't import those Windows include files. But if you use the JPEG library in your own program, and some of your program's files import one definition of boolean while some import the other, you can get all sorts of mysterious problems. A good preventive step is to make the IJG library use "unsigned char" for boolean. To do that, add something like this to your jconfig.h file:

```
/* Define "boolean" as unsigned char, not enum, per Windows custom */
#ifdef __RPCNDR_H__ /* don't conflict if rpcnldr.h already read */
typedef unsigned char boolean;
#else
#ifdef FALSE /* in case these macros already exist */
#define FALSE 0 /* values of boolean */
#endif
#endif
```

```
#ifndef TRUE
#define TRUE 1
#endif
#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
```

(This is already  
in jconfig.vc, by the way.)

windef.h contains the declarations

```
#define far
#define FAR far
```

Since jmorecfg.h tries to define FAR as empty, you may get a compiler warning if you include both jpeglib.h and windef.h (which windows.h includes). To suppress the warning, you can put "#ifndef FAR"/"#endif" around the line "#define FAR" in jmorecfg.h.

(Something like this is already in jmorecfg.h, by the way.)

When using the library in a Windows application, you will almost certainly want to modify or replace the error handler module jerror.c, since our default error handler does a couple of inappropriate things:

1. it tries to write error and warning messages on stderr;
2. in event of a fatal error, it exits by calling exit().

A simple stopgap solution for problem 1 is to replace the line

```
fprintf(stderr, "%s\n", buffer);
```

(in output\_message in jerror.c) with

```
MessageBox(GetActiveWindow(),buffer,"JPEG Error",MB_OK|MB_ICONERROR);
```

It's highly recommended that you at least do that much,

since otherwise

error messages will disappear into nowhere. (Beginning with IJG v6b, this code is already present in jerror.c; just define USE\_WINDOWS\_MESSAGEBOX in jconfig.h to enable it.)

The proper solution for problem 2 is to return control to your calling application after a library error. This can be done with the setjmp/longjmp technique discussed in libjpeg.txt and illustrated in example.c. (NOTE: some older Windows C compilers provide versions of setjmp/longjmp that don't actually work under Windows. You may need to use the Windows system functions Catch and Throw instead.)

The recommended memory manager under Windows is jmemnobs.c; in other words, let Windows do any virtual memory management needed. You should NOT use jmemdos.c nor jmemdosa.asm under Windows.

For Windows 3.1, we recommend compiling in medium or large memory model; for newer Windows versions, use a 32-bit flat memory model. (See the MS-DOS sections above for more info about memory models.) In the

16-bit memory

models only, you'll need to put



`#define MAX_ALLOC_CHUNK 65520L /* Maximum request to malloc() */`  
into `jconfig.h` to limit allocation chunks to 64Kb. (Without that, you'd have to use huge memory model, which slows things down unnecessarily.)  
`jmemnobs.c` works without modification in large or flat memory models, but to use medium model, you need to modify its `jpeg_get_large` and `jpeg_free_large` routines to allocate far memory. In any case, you might like to replace its calls to `malloc` and `free` with direct calls on Windows memory allocation functions.

You may also want to modify `jdatasrc.c` and `jdatadst.c` to use Windows file operations rather than `fread/fwrite`. This is only necessary if your C compiler doesn't provide a competent implementation of C `stdio` functions.

You might want to tweak the `RGB_xxx` macros in `jmorecfg.h` so that the library will accept or deliver color pixels in BGR sample order, not RGB; BGR order is usually more convenient under Windows. Note that this change will break the sample applications `cjpeg/djpeg`, but the library itself works fine.

Many people want to convert the IJG library into a DLL. This is reasonably straightforward, but watch out for the following:

1. Don't try to compile as a DLL in small or medium memory model; use large model, or even better, 32-bit flat model. Many places in the IJG code assume the address of a local variable is an ordinary (not FAR) pointer; that isn't true in a medium-model DLL.
2. Microsoft C cannot pass file pointers between applications and DLLs. (See Microsoft Knowledge Base, PSS ID Number Q50336.) So `jdatasrc.c` and `jdatadst.c` don't work if you open a file in your application and then pass the pointer to the DLL. One workaround is to make `jdatasrc.c/jdatadst.c` part of your main application rather than part of the DLL.
3. You'll probably need to modify the macros `GLOBAL()` and `EXTERN()` to attach suitable linkage keywords to the exported routine names. Similarly, you'll want to modify `METHODDEF()` and `JMETHOD()` to ensure function pointers are declared in a way that lets application routines be called back through the function pointers. These macros are in `jmorecfg.h`. Typical definitions for a 16-bit DLL are:  
`#define GLOBAL(type) type _far _pascal _loadds _export`  
`#define EXTERN(type) extern type _far _pascal _loadds`  
`#define METHODDEF(type) static type _far _pascal`  
`#define JMETHOD(type,methodname,arglist) \`  
`type (_far _pascal *methodname) arglist`  
For a 32-bit DLL you may want something like  
`#define GLOBAL(type) __declspec(dllexport) type`

```
#define EXTERN(type) extern __declspec(dllexport) type
```

Although not all the GLOBAL routines are actually intended to be called by the application, the performance cost of making them all DLL entry points is negligible.

The unmodified IJG library presents a very C-specific application interface, so the resulting DLL is only usable from C or C++ applications. There has been some talk of writing wrapper code that would present a simpler interface usable from other languages, such as Visual Basic. This is on our to-do list but hasn't been very high priority --- any volunteers out there?

Microsoft Windows, Borland C:

The provided jconfig.bcc should work OK in a 32-bit Windows environment, but you'll need to tweak it in a 16-bit environment (you'd need to define NEED\_FAR\_POINTERS and MAX\_ALLOC\_CHUNK). Beware that makefile.bcc will need alteration if you want to use it for Windows --- in particular, you should use jmemnobs.c not jmemdos.c under Windows.

Borland C++ 4.5 fails with an internal compiler error when trying to compile jdmerge.c in 32-bit mode. If enough people complain, perhaps Borland will fix it. In the meantime, the simplest known workaround is to add a redundant definition of the variable range\_limit in h2v1\_merged\_upsample(), at the head of the block that handles odd image width (about line 268 in v6 jdmerge.c):

```
/* If image width is odd, do the last output column separately
*/
if (cinfo->output_width & 1) {
 register JSAMPLE * range_limit = cinfo->sample_range_limit; /* ADD THIS */
 cb = GETJSAMPLE(*inptr1);
```

Pretty bizarre, especially since the very similar routine h2v2\_merged\_upsample doesn't trigger the bug.

Recent reports suggest that this bug does not occur with "bcc32a" (the Pentium-optimized version of the compiler).

Another report from a user of Borland C 4.5 was that incorrect code (leading to a color shift in processed images) was produced if any of the following optimization switch combinations were used:

```
-Ot -Og
-Ot -Op
-Ot -Om
```

So try backing off on optimization if you see such a problem. (Are there several different releases all numbered "4.5"??)

Microsoft Windows, Microsoft Visual C++:

jconfig.vc should work OK with any Microsoft compiler for a 32-bit memory model. makefile.vc is intended for command-line use. (If you are using the Developer Studio environment, you may prefer the DevStudio project files; see below.)

## IJG

JPEG 7 adds extern "C" to jpeglib.h. This avoids the need to put extern "C" { ... } around #include "jpeglib.h" in your C++ application. You can also force VC++ to treat the library as C++ code by renaming all the \*.c files to \*.cpp (and adjusting the makefile to match). In this case you also need to define the symbol DONT\_USE\_EXTERN\_C in the configuration to prevent jpeglib.h from using extern "C".

Microsoft Windows, Microsoft Visual C++ 6 Developer Studio:

We include makefiles that should work as project files in Developer Studio 6.0 or later. There is a library makefile that builds the IJG library as a static Win32 library, and application makefiles that build the sample applications as Win32 console applications. (Even if you only want the library, we recommend building the applications so that you can run the self-test.)

To use:

1. Open the Windows Command Prompt, change to the source directory and execute the command line  
nmake /f makefile.vc setup-vc6  
If you get an error message saying that the "nmake" command could not be found, execute the command  
"%ProgramFiles%\Microsoft Visual Studio\VC98\Bin\VCVARS32"  
to set the environment for using Microsoft Visual C++ tools, and repeat the nmake call.  
This will move jconfig.vc to jconfig.h and makefiles to project files. (Note that the renaming is critical!)  
Alternatively you can use  
nmake /f makefile.vc setupcopy-vc6  
This will create renamed copies of the files, which allows to repeat the setup later.
2. Open the workspace file jpeg.dsw, build the library project. (If you are using Developer Studio more recent than 6.0, you'll probably get a message saying that the project files are being updated.)
3. Open the workspace file apps.dsw, build the application projects.
4. To perform the self-test, execute the command line  
nmake /f makefile.vc test-build
5. Move the application .exe files from the Release folder to an appropriate location on your path.

Microsoft Windows,  
Microsoft Visual Studio 2019-2022 version 16-17:

We include makefiles that should work as project files in Visual Studio 2019-2022 version 16-17 or later. There is a library makefile that builds the IJG library as a static Win32/x64/ARM/ARM64/ARM64EC library, and application makefiles that build the sample applications as Win32/x64/ARM/ARM64/ARM64EC console applications. (Even if you only want the library, we recommend building the applications so that you can run the self-test.)

To use:

1. Ensure you've checked the item "Desktop development with C++" in the Workloads tab of Visual Studio Installer.  
Open the Developer Command Prompt for VS 2019-2022, change to the source directory and execute the command line  
`nmake /f makefile.vs setup-v16`  
This will move `jconfig.vc` to `jconfig.h` and makefiles to project files.  
(Note that the renaming is critical!)  
Alternatively you can use  
`nmake /f makefile.vs setupcopy-v16`  
This will create renamed copies of the files,  
which  
allows to repeat the setup later.
2. Open the solution file `jpeg.sln`, build the library project.
  - a) If you are using Visual Studio more recent than 2022 version 17, you'll possibly get a message saying that the project files are being updated.
  - b) If necessary, open the project properties and adapt the Windows Target Platform Version (or Windows SDK Version) in the Configuration Properties, General section.
  - c) If you get a warning saying that a platform cannot be found, you can either
    - \* forgo the platform and ignore the warning, or
    - \* remove the platform in the Configuration Manager, or
    - \* install the corresponding platform build tools in Visual Studio Installer (Workloads tab Optional components or Individual components tab).
  - d) If you want to build x64 code, change the platform setting from Win32 to x64. You can build Win32 and x64 versions side by side.
  - e) If you want to build ARM/ARM64/ARM64EC code, change the platform setting to ARM/ARM64/ARM64EC. Ensure you've installed the ARM/ARM64/ARM64EC build tools in Visual Studio Installer (Workloads tab Optional components or Individual components tab). You can build Win32/x64/ARM/ARM64/ARM64EC versions side by side.
3. Open the solution file `apps.sln`, build the application projects.

4. To perform the self-test, execute the command line

```
nmake /f makefile.vs test-32
```

for the Win32 build, or on a 64-bit system

```
nmake /f makefile.vs test-64
```

for the x64 build.

Note: test options for ARM code will be added

as soon as Windows on ARM reference devices are available.

To date there are no Windows on ARM reference devices available.

5. Move the application .exe files from the Release folder to an appropriate location on your path.

Microsoft Windows, Embarcadero C++Builder/RAD Studio 10.4-11:

We include makefiles that should work as project files in C++Builder/RAD Studio 10.4-11 or later. There is a library makefile that builds the IJG library as a static

Win32/Win64 library, and application makefiles

that build the sample applications as Win32/Win64 console applications.

(Even if you only want the library, we recommend building the applications so that you can run the self-test.)

To use:

1. Open the RAD Studio Command Prompt (or the standard Windows Command Prompt, since the environment is set system-wide during RAD Studio installation), change to the source directory and execute the command line

```
make -fmakefile.b32 setup-cb
```

This will move jconfig.vc to jconfig.h and makefiles to project files.

(Note that the renaming is critical!)

Alternatively you can use

```
make -fmakefile.b32 setupcopy-cb
```

This will create renamed copies of the files, which allows to repeat the setup later.

(You can use one of the other makefiles .c32, .d32, .x32, or .b64 instead of .b32.)

2. Open the project file jpeg.cbproj, build the library project.

a) By default, the classic Borland compiler (bcc32) is used for the Win32

build. To enable the Clang-based compiler for a specific project, select Project > Options > C++ Compiler and deselect the Use classic Borland compiler option.

b) If you want to build Win64 code, change the platform setting from Windows 32 Bit to Windows 64 Bit.

You can build Win32 and Win64 versions side by side.

3. Open the project group file apps.groupproj, build the application projects.

4. To perform the self-test, execute the command line

```
make -fmakefile.b32 test-32
for the Win32 build, or on a 64-bit system
make -fmakefile.b32 test-64
for the Win64 build.
```

5. Move the application .exe files from the Release folder to an appropriate location on your path.

OS/2, Borland C++:

Watch out for optimization bugs in older Borland compilers; you may need to back off the optimization switch settings. See the comments in makefile.bcc.

SGI:

On some SGI systems, you may need to set "AR2= ar -ts" in the Makefile. If you are using configure, you can do this by saying

```
./configure
RANLIB='ar -ts'
```

This change is not needed on all SGIs. Use it only if the make fails at the stage of linking the completed programs.

On the MIPS R4000 architecture (Indy, etc.), the compiler option "-mips2" reportedly speeds up the float DCT method substantially, enough to make it faster than the default int method (but still slower than the fast int method). If you use -mips2, you may want to alter the default DCT method to be float. To do this, put "#define JDCT\_DEFAULT JDCT\_FLOAT" in jconfig.h.

VMS:

On an Alpha/VMS system with MMS, be sure to use the "/Marco=Alpha=1" qualifier with MMS when building the JPEG package.

VAX/VMS v5.5-1 may have problems with the test step of the build procedure reporting differences when it compares the original and test images. If the error points to the last block of the files, it is most likely bogus and may be safely ignored. It seems to be because the files are Stream\_LF and Backup/Compare has difficulty with the (presumably) null padded files.

This problem was not observed on VAX/VMS v6.1 or AXP/VMS v6.1.

Found in path(s):

```
* /jpegsrc-v9f-tar-gz/jpeg-9f/install.txt
```

No license file was found, but licenses were detected in source scan.

## IJG JPEG LIBRARY: SYSTEM ARCHITECTURE

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This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file provides an overview of the architecture of the IJG JPEG software; that is, the functions of the various modules in the system and the interfaces between modules. For more precise details about any data structure or calling convention, see the include files and comments in the source code.

We assume that the reader is already somewhat familiar with the JPEG standard. The README file includes references for learning about JPEG. The file libjpeg.txt describes the library from the viewpoint of an application programmer using the library; it's best to read that file before this one. Also, the file coderules.txt describes the coding style conventions we use.

In this document, JPEG-specific terminology follows the JPEG standard:

A "component" means a color channel, e.g., Red or Luminance.

A "sample" is a single component value (i.e., one number in the image data).

A "coefficient" is a frequency coefficient (a DCT transform output number).

A "block" is an array of samples or coefficients.

An "MCU" (minimum coded unit) is an interleaved set of blocks of size determined by the sampling factors, or a single block in a noninterleaved scan.

We do not use the terms "pixel" and "sample" interchangeably. When we say pixel, we mean an element of the full-size image, while a sample is an element of the downsampled image. Thus the number of samples may vary across components while the number of pixels does not. (This terminology is not used rigorously throughout the code, but it is used in places where confusion would otherwise result.)

### \*\*\* System features \*\*\*

The IJG distribution contains two parts:

- \* A subroutine library for JPEG compression and decompression.

- \* cjpeg/djpeg, two sample applications that use the library to transform JFIF JPEG files to and from several other image formats.

cjpeg/djpeg are of no great intellectual complexity: they merely add a simple command-line user interface and I/O routines for several uncompressed image formats. This document concentrates on the library itself.

We desire the library to be capable of supporting all JPEG baseline, extended sequential, and progressive DCT processes. The library does not support the hierarchical or lossless processes defined in the standard.

Within these limits, any set of compression parameters allowed by the JPEG spec should be readable for decompression. (We can be more restrictive about what formats we can generate.) Although the system design allows for all parameter values, some uncommon settings are not yet implemented and may never be; nonintegral sampling ratios are the prime example. Furthermore, we treat 8-bit vs. 12-bit data precision as a compile-time switch, not a run-time option, because most machines can store 8-bit pixels much more compactly than 12-bit.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, libtiff uses this library to implement JPEG compression within the TIFF file format.)

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. This code can be omitted if not needed.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

#### \*\*\* Portability issues \*\*\*

Portability is an essential requirement for the library. The key portability issues that show up at the level of system architecture are:

1. Memory usage. We want the code to be able to run on PC-class machines with limited memory. Images should therefore be processed sequentially (in strips), to avoid holding the whole image in memory at once. Where a full-image buffer is necessary, we should be able to use either virtual memory or temporary files.
2. Near/far pointer distinction. To run efficiently on 80x86 machines, the code



should distinguish "small" objects (kept in near data space) from "large" ones (kept in far data space). This is an annoying restriction, but fortunately it does not impact code quality for less brain-damaged machines, and the source code clutter turns out to be minimal with sufficient use of pointer typedefs.

3. Data precision. We assume that "char" is at least 8 bits, "short" and "int" at least 16, "long" at least 32. The code will work fine with larger data sizes, although memory may be used inefficiently in some cases. However, the JPEG compressed datastream must ultimately appear on external storage as a sequence of 8-bit bytes if it is to conform to the standard. This may pose a problem on machines where char is wider than 8 bits. The library represents compressed data as an array of values of typedef JOCTET. If no data type exactly 8 bits wide is available, custom data source and data destination modules must be written to unpack and pack the chosen JOCTET datatype into 8-bit external representation.

#### \*\*\* System overview \*\*\*

The compressor and decompressor are each divided into two main sections: the JPEG compressor or decompressor proper, and the preprocessing or postprocessing functions. The interface between these two sections is the image data that the official JPEG spec regards as its input or output: this data is in the colorspace to be used for compression, and it is downsampled to the sampling factors to be used. The preprocessing and postprocessing steps are responsible for converting a normal image representation to or from this form. (Those few applications that want to deal with YCbCr downsampled data can skip the preprocessing or postprocessing step.)

Looking more closely, the compressor library contains the following main elements:

##### Preprocessing:

- \* Color space conversion (e.g., RGB to YCbCr).
- \* Edge expansion and downsampling. Optionally, this step can do simple smoothing --- this is often helpful for low-quality source data.

##### JPEG proper:

- \* MCU assembly, DCT, quantization.
- \* Entropy coding (sequential or progressive, Huffman or arithmetic).

In addition to these modules we need overall control, marker generation, and support code (memory management & error handling). There is also a module responsible for physically writing the output data --- typically this is just an interface to fwrite(), but some applications may need to do something else with the data.

The decompressor library contains the following main elements:

JPEG proper:

- \* Entropy decoding (sequential or progressive, Huffman or arithmetic).
- \* Dequantization, inverse DCT, MCU disassembly.

Postprocessing:

- \* Upsampling. Optionally, this step may be able to do more general rescaling of the image.
- \* Color space conversion (e.g., YCbCr to RGB). This step may also provide gamma adjustment [ currently it does not ].
- \* Optional color quantization (e.g., reduction to 256 colors).
- \* Optional

color precision reduction (e.g., 24-bit to 15-bit color).

[This feature is not currently implemented.]

We also need overall control, marker parsing, and a data source module.

The support code (memory management & error handling) can be shared with the compression half of the library.

There may be several implementations of each of these elements, particularly in the decompressor, where a wide range of speed/quality tradeoffs is very useful. It must be understood that some of the best speedups involve merging adjacent steps in the pipeline. For example, upsampling, color space conversion, and color quantization might all be done at once when using a low-quality ordered-dither technique. The system architecture is designed to allow such merging where appropriate.

Note: it is convenient to regard edge expansion (padding to block boundaries) as a preprocessing/postprocessing function, even though the JPEG spec includes it in compression/decompression. We do this because

downsampling/upsampling

can be simplified a little if they work on padded data: it's not necessary to have special cases at the right and bottom edges. Therefore the interface buffer is always an integral number of blocks wide and high, and we expect compression preprocessing to pad the source data properly. Padding will occur only to the next block (block\_size-sample) boundary. In an interleaved-scan situation, additional dummy blocks may be used to fill out MCUs, but the MCU assembly and disassembly logic will create or discard these blocks internally. (This is advantageous for speed reasons, since we avoid DCTing the dummy blocks. It also permits a small reduction in file size, because the compressor can choose dummy block contents so as to minimize their size in compressed form. Finally, it makes the interface buffer specification independent of whether the file is actually interleaved or not.)

Applications that wish to deal directly with the downsampled data must provide similar

buffering and padding for odd-sized images.

\*\*\* Poor man's object-oriented programming \*\*\*

It should be clear by now that we have a lot of quasi-independent processing steps, many of which have several possible behaviors. To avoid cluttering the code with lots of switch statements, we use a simple form of object-style programming to separate out the different possibilities.

For example, two different color quantization algorithms could be implemented as two separate modules that present the same external interface; at runtime, the calling code will access the proper module indirectly through an "object".

We can get the limited features we need while staying within portable C. The basic tool is a function pointer. An "object" is just a struct containing one or more function pointer fields, each of which corresponds to a method name in real object-oriented languages. During initialization we fill in the function pointers with references to whichever module we have determined

we need to use in this run. Then invocation of the module is done by indirecting through a function pointer; on most machines this is no more expensive than a switch statement, which would be the only other way of making the required run-time choice. The really significant benefit, of course, is keeping the source code clean and well structured.

We can also arrange to have private storage that varies between different implementations of the same kind of object. We do this by making all the module-specific object structs be separately allocated entities, which will be accessed via pointers in the master compression or decompression struct. The "public" fields or methods for a given kind of object are specified by a commonly known struct. But a module's initialization code can allocate a larger struct that contains the common struct as its first member, plus additional private fields. With appropriate pointer casting, the module's internal functions can access these private fields.

(For a simple example, see `jdatadst.c`, which implements the external interface specified by struct `jpeg_destination_mgr`, but adds extra fields.)

(Of course this would all be a lot easier if we were using C++, but we are not yet prepared to assume that everyone has a C++ compiler.)

An important benefit of this scheme is that it is easy to provide multiple versions of any method, each tuned to a particular case. While a lot of precalculation might be done to select an optimal implementation of a method, the cost per invocation is constant. For example, the upsampling step might have a "generic" method, plus one or more "hardwired" methods for the most popular sampling factors; the hardwired methods would be faster because they'd

use straight-line code instead of for-loops. The cost to determine which method to use is paid only once, at startup, and the selection criteria are hidden from the callers of the method.

This plan differs a little bit from usual object-oriented structures, in that only one instance of each object class will exist during execution. The reason for having the class structure is that on different runs we may create different instances (choose to execute different modules). You can think of the term "method" as denoting the common interface presented by a particular set of interchangeable functions, and "object" as denoting a group of related methods, or the total shared interface behavior of a group of modules.

### \*\*\* Overall control structure \*\*\*

We previously mentioned the need for overall control logic in the compression and decompression libraries. In IJG implementations prior to v5, overall control was mostly provided by "pipeline control" modules, which proved to be large, unwieldy, and hard to understand. To improve the situation, the control logic has been subdivided into multiple modules. The control modules consist of:

1. Master control for module selection and initialization. This has two responsibilities:

1A. Startup

initialization at the beginning of image processing.

The individual processing modules to be used in this run are selected and given initialization calls.

1B. Per-pass control. This determines how many passes will be performed and calls each active processing module to configure itself appropriately at the beginning of each pass. End-of-pass processing, where necessary, is also invoked from the master control module.

Method selection is partially distributed, in that a particular processing module may contain several possible implementations of a particular method, which it will select among when given its initialization call. The master control code need only be concerned with decisions that affect more than one module.

2. Data buffering control. A separate control module exists for each inter-processing-step data buffer. This module is responsible for invoking the processing steps that write or read that data buffer.

Each

buffer controller sees the world as follows:

```
input data => processing step A => buffer => processing step B => output data
 | | |
 ----- controller -----
```

The controller knows the dataflow requirements of steps A and B: how much data they want to accept in one chunk and how much they output in one chunk. Its function is to manage its buffer and call A and B at the proper times.

A data buffer control module may itself be viewed as a processing step by a higher-level control module; thus the control modules form a binary tree with elementary processing steps at the leaves of the tree.

The control modules are objects. A considerable amount of flexibility can be had by replacing implementations of a control module. For example:

- \* Merging of adjacent steps in the pipeline is done by replacing a control module and its pair of processing-step modules with a single processing-step module.

(Hence the possible merges are determined by the tree of control modules.)

- \* In some processing modes, a given interstep buffer need only be a "strip" buffer large enough to accommodate the desired data chunk sizes. In other modes, a full-image buffer is needed and several passes are required.

The control module determines which kind of buffer is used and manipulates virtual array buffers as needed. One or both processing steps may be unaware of the multi-pass behavior.

In theory, we might be able to make all of the data buffer controllers interchangeable and provide just one set of implementations for all. In practice, each one contains considerable special-case processing for its particular job. The buffer controller concept should be regarded as an overall system structuring principle, not as a complete description of the task performed by any one controller.

\*\*\* Compression object structure \*\*\*

Here is a sketch of the logical structure of the JPEG compression library:

```
 |-- Colospace conversion
 |-- Preprocessing controller --|
 | |-- Downsampling
Main controller --|
 | |-- Forward DCT, quantize
 |-- Coefficient controller --|
 |-- Entropy encoding
```

This sketch also describes the flow of control (subroutine calls) during typical image data processing. Each of the components shown in the diagram is an "object" which may have several different implementations available. One or more source code files contain the actual implementation(s) of each object.

The objects shown above are:

- \* Main controller: buffer controller for the subsampled-data buffer, which holds the preprocessed input data. This controller invokes preprocessing to fill the subsampled-data buffer, and JPEG compression to empty it. There is usually no need for a full-image buffer here; a strip buffer is adequate.
- \* Preprocessing controller: buffer controller for the downsampling input data buffer, which lies between colorspace conversion and downsampling. Note that a unified conversion/downsampling module would probably replace this controller entirely.
- \* Colorspace conversion: converts application image data into the desired JPEG color space; also changes the data from pixel-interleaved layout to separate component planes. Processes one pixel row at a time.
- \* Downsampling: performs reduction of chroma components as required. Optionally may perform pixel-level smoothing as well. Processes a "row group" at a time, where a row group is defined as  $V_{max}$  pixel rows of each component before downsampling, and  $V_k$  sample rows afterwards (remember  $V_k$  differs across components). Some downsampling or smoothing algorithms may require context rows above and below the current row group; the preprocessing controller is responsible for supplying these rows via proper buffering. The downsampler is responsible for edge expansion at the right edge (i.e., extending each sample row to a multiple of `block_size` samples); but the preprocessing controller is responsible for vertical edge expansion (i.e., duplicating the bottom sample row as needed to make a multiple of `block_size` rows).
- \* Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU assembly, including insertion of dummy DCT blocks when needed at the right or bottom edge. When performing Huffman-code optimization or emitting a multiscan JPEG file, this controller is responsible for buffering the full image. The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the JPEG file is noninterleaved.
- \* Forward DCT and quantization: Perform DCT, quantize, and emit coefficients. Works on one or more DCT blocks at a time. (Note: the coefficients

are now

emitted in normal array order, which the entropy encoder is expected to convert to zigzag order as necessary. Prior versions of the IJG code did the conversion to zigzag order within the quantization step.)

\* Entropy encoding: Perform Huffman or arithmetic entropy coding and emit the coded data to the data destination module. Works on one MCU per call. For progressive JPEG, the same DCT blocks are fed to the entropy coder during each pass, and the coder must emit the appropriate subset of coefficients.

In addition to the above objects, the compression library includes these objects:

\* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules.

\* Marker writing: generates JPEG markers (except for RSTn, which is emitted by the entropy encoder when needed).

\* Data destination manager: writes the output JPEG datastream to its final destination (e.g., a file). The destination manager supplied with the library knows how to write to a stdio stream or to a memory buffer; for other behaviors, the surrounding application may provide its own destination manager.

\* Memory manager: allocates and releases memory, controls virtual arrays (with backing store management, where required).

\* Error handler: performs formatting and output of error and trace messages; determines handling of nonfatal errors. The surrounding application may override some or all of this object's methods to change error handling.

\* Progress monitor: supports output of "percent-done" progress reports. This object represents an optional callback to the surrounding application: if wanted, it must be supplied by the application.

The error handler, destination manager, and progress monitor objects are defined as separate objects in order to simplify application-specific customization of the JPEG library. A surrounding application may override individual methods or supply its own all-new implementation of one of these objects. The object interfaces for these objects are therefore treated as part of the application interface of the library, whereas the other objects are internal to the library.

The error handler and memory manager are shared by JPEG compression and

decompression; the progress monitor, if used, may be shared as well.

### \*\*\* Decompression object structure \*\*\*

Here is a sketch of the logical structure of the JPEG decompression library:

```

 |-- Entropy decoding
 |-- Coefficient controller --|
 | |-- Dequantize, Inverse DCT
Main controller --|
 | |-- Upsampling
 |-- Postprocessing controller --| |-- Colorspace conversion
 |-- Color quantization
 |-- Color precision reduction
```

As before, this diagram  
also represents typical control flow. The objects  
shown are:

\* Main controller: buffer controller for the subsampled-data buffer, which holds the output of JPEG decompression proper. This controller's primary task is to feed the postprocessing procedure. Some upsampling algorithms may require context rows above and below the current row group; when this is true, the main controller is responsible for managing its buffer so as to make context rows available. In the current design, the main buffer is always a strip buffer; a full-image buffer is never required.

\* Coefficient controller: buffer controller for the DCT-coefficient data. This controller handles MCU disassembly, including deletion of any dummy DCT blocks at the right or bottom edge. When reading a multiscan JPEG file, this controller is responsible for buffering the full image. (Buffering DCT coefficients, rather than samples, is necessary to support progressive JPEG.) The equivalent of one fully interleaved MCU row of subsampled data is processed per call, even when the source JPEG file is noninterleaved.

\* Entropy decoding: Read coded data from the data source module and perform Huffman or arithmetic entropy decoding. Works on one MCU per call. For progressive JPEG decoding, the coefficient controller supplies the prior coefficients of each MCU (initially all zeroes), which the entropy decoder modifies in each scan.

\* Dequantization and inverse DCT: like it says. Note that the coefficients buffered by the coefficient controller have NOT been dequantized; we merge dequantization and inverse DCT into a single step for speed reasons. When scaled-down output is asked for, simplified DCT algorithms may be used



that need fewer coefficients and emit fewer samples per DCT block, not the full 8x8. Works on one DCT block at a time.

- \* Postprocessing controller: buffer controller for the color quantization input buffer, when quantization is in use. (Without quantization, this controller just calls the upsampler.) For two-pass quantization, this controller is responsible for buffering the full-image data.
- \* Upsampling: restores chroma components to full size. (May support more general output rescaling, too. Note that if undersized DCT outputs have been emitted by the DCT module, this module must adjust so that properly sized outputs are created.) Works on one row group at a time. This module also calls the color conversion module, so its top level is effectively a buffer controller for the upsampling->color conversion buffer. However, in all but the highest-quality operating modes, upsampling and color conversion are likely to be merged into a single step.
- \* Colorspace conversion: convert from JPEG color space to output color space, and change data layout from separate component planes to pixel-interleaved. Works on one pixel row at a time.
- \* Color quantization: reduce the data to colormapped form, using either an externally specified colormap or an internally generated one. This module is not used for full-color output. Works on one pixel row at a time; may require two passes to generate a color map. Note that the output will always be a single component representing colormap indexes. In the current design, the output values are JSAMPLEs, so an 8-bit compilation cannot quantize to more than 256 colors. This is unlikely to be a problem in practice.
- \* Color reduction: this module handles color precision reduction, e.g., generating 15-bit color (5 bits/primary) from JPEG's 24-bit output. Not quite clear yet how this should be handled... should we merge it with colorspace conversion???

Note that some high-speed operating modes might condense the entire postprocessing sequence to a single module (upsample, color convert, and quantize in one step).

In addition to the above objects, the decompression library includes these objects:

- \* Master control: determines the number of passes required, controls overall and per-pass initialization of the other modules. This is subdivided into input and output control: jdinput.c controls only input-side processing,

while `jdmaster.c` handles overall initialization and output-side control.

- \* Marker reading: decodes JPEG markers (except for `RSTn`).
- \* Data source manager: supplies the input JPEG datastream. The source manager supplied with the library knows how to read from a `stdio` stream or from a memory buffer; for other behaviors, the surrounding application may provide its own source manager.
- \* Memory manager: same as for compression library.
- \* Error handler: same as for compression library.
- \* Progress monitor: same as for compression library.

As with compression, the data source manager, error handler, and progress monitor are candidates for replacement by a surrounding application.

#### \*\*\* Decompression input and output separation \*\*\*

To support efficient incremental display of progressive JPEG files, the decompressor is divided into two sections that can run independently:

1. Data input includes marker parsing, entropy decoding, and input into the coefficient controller's DCT coefficient buffer. Note that this processing is relatively cheap and fast.
2. Data output reads from the DCT coefficient buffer and performs the IDCT and all postprocessing steps.

For a progressive JPEG file, the data input processing is allowed to get arbitrarily far ahead of the data output processing. (This occurs only if the application calls `jpeg_consume_input()`; otherwise input and output run in lockstep, since the input section is called only when the output section needs more data.) In this way the application can avoid making extra display passes when data is arriving faster than the display pass can run. Furthermore, it is possible to abort an output pass without losing anything, since the coefficient buffer is read-only as far as the output section is concerned. See `libjpeg.txt` for more detail.

A full-image coefficient array is only created if the JPEG file has multiple scans (or if the application specifies buffered-image mode anyway). When reading a single-scan file, the coefficient controller normally creates only a one-MCU buffer, so input and output processing must run in lockstep in this case. `jpeg_consume_input()` is effectively a no-op in this situation.

The main impact of dividing the decompressor in this fashion is that we must be very careful with shared variables in the cinfo data structure. Each variable that can change during the course of decompression must be classified as belonging to data input or data output, and each section must look only at its own variables. For example, the data output section may not depend on any of the variables that describe the current scan in the JPEG file, because these may change as the data input section advances into a new scan.

The progress monitor is (somewhat arbitrarily) defined to treat input of the file as one pass when buffered-image mode is not used, and to ignore data input work completely when buffered-image mode is used. Note that the library has no reliable way to predict the number of passes when dealing with a progressive JPEG file, nor can it predict the number of output passes in buffered-image mode. So the work estimate is inherently bogus anyway.

No comparable division is currently made in the compression library, because there isn't any real need for it.

#### \*\*\* Data formats \*\*\*

Arrays of pixel sample values use the following data structure:

```
typedef something JSAMPLE; a pixel component value, 0..MAXJSAMPLE
typedef JSAMPLE *JSAMPROW; ptr to a row of samples
typedef JSAMPROW *JSAMPARRAY; ptr to a list of rows
typedef JSAMPARRAY *JSAMPIMAGE; ptr to a list of color-component arrays
```

The basic element type JSAMPLE will typically be one of unsigned char, (signed) char, or short. Short will be used if samples wider than 8 bits are to be supported (this is a compile-time option). Otherwise, unsigned char is used if possible. If the compiler only supports signed chars, then it is necessary to mask off the value when reading. Thus, all reads of JSAMPLE values must be coded as "GETJSAMPLE(value)", where the macro will be defined as "((value) & 0xFF)" on signed-char machines and "((int) (value))" elsewhere.

With these conventions, JSAMPLE values can be assumed to be  $\geq 0$ . This helps simplify correct rounding during downsampling, etc. The JPEG standard's specification that sample values run from -128..127 is accommodated by subtracting 128 from the sample value in the DCT step. Similarly, during decompression the output of the IDCT step will be immediately shifted back to 0..255. (NB: different values are required when 12-bit samples are in use. The code is written in terms of MAXJSAMPLE and CENTERJSAMPLE, which will be defined as 255 and 128 respectively in an 8-bit implementation, and as 4095

and 2048 in a 12-bit implementation.)

We use a pointer per row, rather than a two-dimensional JSAMPLE array. This choice costs only a small amount of memory and has several benefits:

- \* Code using the data structure doesn't need to know the allocated width of the rows. This simplifies edge expansion/compression, since we can work in an array that's wider than the logical picture width.
- \* Indexing doesn't require multiplication; this is a performance win on many machines.
- \* Arrays with more than 64K total elements can be supported even on machines where malloc() cannot allocate chunks larger than 64K.
- \* The rows forming a component array may be allocated at different times without extra copying. This trick allows some speedups in smoothing steps that need access to the previous and next rows.

Note that each color component is stored in a separate array; we don't use the traditional layout in which the components of a pixel are stored together.

This simplifies coding of modules that work on each component independently,

because they don't need to know how many components there are. Furthermore, we can read or write each component to a temporary file independently, which is helpful when dealing with noninterleaved JPEG files.

In general, a specific sample value is accessed by code such as

```
GETJSAMPLE(image[colorcomponent][row][col])
```

where col is measured from the image left edge, but row is measured from the first sample row currently in memory. Either of the first two indexings can be precomputed by copying the relevant pointer.

Since most image-processing applications prefer to work on images in which the components of a pixel are stored together, the data passed to or from the surrounding application uses the traditional convention: a single pixel is represented by N consecutive JSAMPLE values, and an image row is an array of (# of color components)\*(image width) JSAMPLEs. One or more rows of data can be represented by a pointer of type JSAMPARRAY in this scheme.

This scheme is

converted to component-wise storage inside the JPEG library. (Applications that want to skip JPEG preprocessing or postprocessing will have to contend with component-wise storage.)

Arrays of DCT-coefficient values use the following data structure:

```
typedef short JCOEF; a 16-bit signed integer
```

```
typedef JCOEF JBLOCK[DCTSIZE2]; an 8x8 block of coefficients
```

```
typedef JBLOCK *JBLOCKROW; ptr to one horizontal row of 8x8 blocks
```

```
typedef JBLOCKROW *JBLOCKARRAY; ptr to a list of such rows
typedef JBLOCKARRAY *JBLOCKIMAGE; ptr to a list of color component arrays
```

The underlying type is at least a 16-bit signed integer; while "short" is big enough on all machines of interest, on some machines it is preferable to use "int" for speed reasons, despite the storage cost. Coefficients are grouped into 8x8 blocks (but we always use #defines DCTSIZE and DCTSIZE2 rather than "8" and "64").

The contents of a coefficient block may be in either "natural" or zigzagged order, and may be true values or divided by the quantization coefficients, depending on where the block is in the processing pipeline. In the current library, coefficient blocks are kept in natural order everywhere; the entropy codecs zigzag or dezigzag the data as it is written or read. The blocks contain quantized coefficients everywhere outside the DCT/IDCT subsystems. (This latter decision may need to be revisited to support variable quantization a la JPEG Part 3.)

Notice that the allocation unit is now a row of 8x8 coefficient blocks, corresponding to block\_size rows of samples. Otherwise the structure is much the same as for samples, and for the same reasons.

On machines where malloc() can't handle a request bigger than 64Kb, this data structure limits us to rows of less than 512 JBLOCKS, or a picture width of 4000+ pixels. This seems an acceptable restriction.

On 80x86 machines, the bottom-level pointer types (JSAMPROW and JBLOCKROW) must be declared as "far" pointers, but the upper levels can be "near" (implying that the pointer lists are allocated in the DS segment). We use a #define symbol FAR, which expands to the "far" keyword when compiling on 80x86 machines and to nothing elsewhere.

\*\*\* Suspendable processing \*\*\*

In some applications it is desirable to use the JPEG library as an incremental, memory-to-memory filter. In this situation the data source or destination may be a limited-size buffer, and we can't rely on being able to empty or refill the buffer at arbitrary times. Instead the application would like to have control return from the library at buffer overflow/underrun, and then resume compression or decompression at a later time.

This scenario is supported for simple cases. (For anything more complex, we recommend that the application "bite the bullet" and develop real multitasking capability.) The libjpeg.txt file goes into more detail about the usage and

limitations of this capability; here we address the implications for library structure.

The

essence of the problem is that the entropy codec (coder or decoder) must be prepared to stop at arbitrary times. In turn, the controllers that call the entropy codec must be able to stop before having produced or consumed all the data that they normally would handle in one call. That part is reasonably straightforward: we make the controller call interfaces include "progress counters" which indicate the number of data chunks successfully processed, and we require callers to test the counter rather than just assume all of the data was processed.

Rather than trying to restart at an arbitrary point, the current Huffman codecs are designed to restart at the beginning of the current MCU after a suspension due to buffer overflow/underrun. At the start of each call, the codec's internal state is loaded from permanent storage (in the JPEG object structures) into local variables. On successful completion of the MCU, the permanent state is updated. (This copying is not very expensive, and may even lead to \*improved\* performance if the local variables can be registerized.) If a suspension occurs, the codec simply returns without updating the state, thus effectively reverting to the start of the MCU. Note that this implies leaving some data unprocessed in the source/destination buffer (ie, the compressed partial MCU). The data source/destination module interfaces are specified so as to make this possible. This also implies that the data buffer must be large enough to hold a worst-case compressed MCU; a couple thousand bytes should be enough.

In a successive-approximation AC refinement scan, the progressive Huffman decoder has to be able to undo assignments of newly nonzero coefficients if it suspends before the MCU is complete, since decoding requires distinguishing previously-zero and previously-nonzero coefficients. This is a bit tedious but probably won't have much effect on performance. Other variants of Huffman decoding need not worry about this, since they will just store the same values again if forced to repeat the MCU.

This approach would probably not work for an arithmetic codec, since its modifiable state is quite large and couldn't be copied cheaply. Instead it would have to suspend and resume exactly at the point of the buffer end.

The JPEG marker reader is designed to cope with suspension at an arbitrary point. It does so by backing up to the start of the marker parameter segment, so the data buffer must be big enough to hold the largest marker of interest. Again, a couple KB should be adequate. (A special "skip" convention is used to bypass COM and APPn markers, so these can be larger than the buffer size without causing problems; otherwise a 64K buffer would be needed in the worst

case.)

The JPEG marker writer currently does *\*not\** cope with suspension.

We feel that this is not necessary; it is much easier simply to require the application to ensure there is enough buffer space before starting. (An empty 2K

buffer is more than sufficient for the header markers; and ensuring there are a dozen or two bytes available before calling jpeg\_finish\_compress() will suffice for the trailer.) This would not work for writing multi-scan JPEG files, but we simply do not intend to support that capability with suspension.

### \*\*\* Memory manager services \*\*\*

The JPEG library's memory manager controls allocation and deallocation of memory, and it manages large "virtual" data arrays on machines where the operating system does not provide virtual memory. Note that the same memory manager serves both compression and decompression operations.

In all cases, allocated objects are tied to a particular compression or decompression master record, and they will be released when that master record is destroyed.

The memory manager does not provide explicit deallocation of objects. Instead, objects are created in "pools" of free storage, and a whole pool can be freed at once. This approach helps prevent storage-leak bugs, and

it speeds up operations whenever malloc/free are slow (as they often are).

The pools can be regarded as lifetime identifiers for objects. Two pools/lifetimes are defined:

- \* JPOOL\_PERMANENT lasts until master record is destroyed

- \* JPOOL\_IMAGE lasts until done with image (JPEG datastream)

Permanent lifetime is used for parameters and tables that should be carried across from one datastream to another; this includes all application-visible parameters. Image lifetime is used for everything else. (A third lifetime, JPOOL\_PASS = one processing pass, was originally planned. However it was dropped as not being worthwhile. The actual usage patterns are such that the peak memory usage would be about the same anyway; and having per-pass storage substantially complicates the virtual memory allocation rules --- see below.)

The memory manager deals with three kinds of object:

1. "Small" objects. Typically these require no more than 10K-20K total.

2. "Large" objects. These may

require tens to hundreds of K depending on

image size. Semantically they behave the same as small objects, but we distinguish them for two reasons:

- \* On MS-DOS machines, large objects are referenced by FAR pointers,

small objects by NEAR pointers.

\* Pool allocation heuristics may differ for large and small objects.

Note that individual "large" objects cannot exceed the size allowed by type `size_t`, which may be 64K or less on some machines.

3. "Virtual" objects. These are large 2-D arrays of JSAMPLEs or JBLOCKs (typically large enough for the entire image being processed). The memory manager provides stripwise access to these arrays. On machines without virtual memory, the rest of the array may be swapped out to a temporary file.

(Note: JSAMPARRAY and JBLOCKARRAY data structures are a combination of large objects for the data proper and small objects for the row pointers. For convenience and speed, the memory manager provides single routines to create these structures. Similarly, virtual arrays include a small control block and a JSAMPARRAY or JBLOCKARRAY working buffer, all created with one call.)

In the present implementation, virtual arrays are only permitted to have image lifespan. (Permanent lifespan would not be reasonable, and pass lifespan is not very useful since a virtual array's *raison d'être* is to store data for multiple passes through the image.) We also expect that only "small" objects will be given permanent lifespan, though this restriction is not required by the memory manager.

In a non-virtual-memory machine, some performance benefit can be gained by making the in-memory buffers for virtual arrays be as large as possible. (For small images, the buffers might fit entirely in memory, so blind swapping would be very wasteful.) The memory manager will adjust the height of the buffers to fit within a prespecified maximum memory usage. In order to do this in a reasonably optimal fashion, the manager needs to allocate all of the virtual arrays at once. Therefore, there isn't a one-step allocation routine for virtual arrays; instead, there is a "request" routine that simply allocates the control block, and a "realize" routine (called just once) that determines space allocation and creates all of the actual buffers. The realize routine must allow for space occupied by non-virtual large objects. (We don't bother to factor in the space needed for small objects, on the grounds that it isn't worth the trouble.)

To support all this, we establish the following protocol for doing business with the memory manager:

1. Modules must request virtual arrays (which may have only image lifespan) during the initial setup phase, i.e., in their `jinit_xxx` routines.
2. All "large" objects (including JSAMPARRAYs and JBLOCKARRAYs) must also be allocated during initial setup.
3. `realize_virt_arrays` will be called at the completion of initial setup.

The above conventions ensure that



sufficient information is available

for it to choose a good size for virtual array buffers.

Small objects of any lifespan may be allocated at any time. We expect that the total space used for small objects will be small enough to be negligible in the `realize_virt_arrays` computation.

In a virtual-memory machine, we simply pretend that the available space is infinite, thus causing `realize_virt_arrays` to decide that it can allocate all the virtual arrays as full-size in-memory buffers. The overhead of the virtual-array access protocol is very small when no swapping occurs.

A virtual array can be specified to be "pre-zeroed"; when this flag is set, never-yet-written sections of the array are set to zero before being made available to the caller. If this flag is not set, never-written sections of the array contain garbage. (This feature exists primarily because the equivalent logic would otherwise be needed in `jdcoefct.c` for progressive JPEG mode; we may as well make it available for possible other uses.)

The first write pass on a virtual array is required to occur in top-to-bottom order; read passes, as well as any write passes after the first one, may access the array in any order. This restriction exists partly to simplify the virtual array control logic, and partly because some file systems may not support seeking beyond the current end-of-file in a temporary file. The main implication of this restriction is that rearrangement of rows (such as converting top-to-bottom data order to bottom-to-top) must be handled while reading data out of the virtual array, not while putting it in.

### \*\*\* Memory manager internal structure \*\*\*

To isolate system dependencies as much as possible, we have broken the memory manager into two parts. There is a reasonably system-independent "front end" (`jmemmgr.c`) and a "back end" that contains only the code likely to change across systems. All of the memory management methods outlined above are implemented by the front end.

The back end provides the following routines for use by the front end (none of these routines are known to the rest of the JPEG code):

`jpeg_mem_init`, `jpeg_mem_term` system-dependent initialization/shutdown

`jpeg_get_small`, `jpeg_free_small` interface to malloc and free library routines (or their equivalents)

`jpeg_get_large`, `jpeg_free_large` interface to FAR malloc/free in MSDOS machines; else usually the same as `jpeg_get_small`/`jpeg_free_small`

jpeg\_mem\_available estimate available memory

jpeg\_open\_backing\_store create a backing-store object

read\_backing\_store, manipulate a backing-store object

write\_backing\_store,

close\_backing\_store

On some systems there will be more than one type of backing-store object (specifically, in MS-DOS a backing store file might be an area of extended memory as well as a disk file). jpeg\_open\_backing\_store is responsible for choosing how to implement a given object. The read/write/close routines are method pointers in the structure that describes a given object; this lets them be different for different object types.

It may be necessary to ensure that backing store objects are explicitly released upon abnormal program termination. For example, MS-DOS won't free extended memory by itself. To support this, we will expect the main program or surrounding application to arrange to call self\_destruct (typically via jpeg\_destroy) upon abnormal termination. This may require a SIGINT signal handler or equivalent. We don't want to have the back end module install its own signal handler, because that would pre-empt the surrounding application's ability to control signal handling.

The IJG distribution includes several memory manager back end implementations. Usually the same back end should be suitable for all applications on a given system, but it is possible for an application to supply its own back end at need.

#### \*\*\* Implications of DNL marker \*\*\*

Some JPEG files may use a DNL marker to postpone definition of the image height

(this would be useful for a fax-like scanner's output, for instance).

In these files the SOF marker claims the image height is 0, and you only find out the true image height at the end of the first scan.

We could read these files as follows:

1. Upon seeing zero image height, replace it by 65535 (the maximum allowed).
2. When the DNL is found, update the image height in the global image descriptor.

This implies that control modules must avoid making copies of the image height, and must re-test for termination after each MCU row. This would be easy enough to do.

In cases where image-size data structures are allocated, this approach will result in very inefficient use of virtual memory or much-larger-than-necessary temporary files. This seems acceptable for something that probably won't be a mainstream usage. People might have to forgo use of memory-hogging options (such as two-pass color quantization or noninterleaved JPEG files) if they want efficient conversion of such files.

(One could improve efficiency by demanding a user-supplied upper bound for the height, less than 65536; in most cases it could be much less.)

The standard also permits the SOF marker to overestimate the image height, with a DNL to give the true, smaller height at the end of the first scan. This would solve the space problems if the overestimate wasn't too great. However, it implies that you don't even know whether DNL will be used.

This leads to a couple of very serious objections:

1. Testing for a DNL marker must occur in the inner loop of the decompressor's Huffman decoder; this implies a speed penalty whether the feature is used or not.
2. There is no way to hide the last-minute change in image height from an application using the decoder. Thus *every* application using the IJG library would suffer a complexity penalty whether it cared about DNL or not.

We currently do not support DNL because of these problems.

A different approach is to insist that DNL-using files be preprocessed by a separate program that reads ahead to the DNL, then goes back and fixes the SOF marker. This is a much simpler solution and is probably far more efficient. Even if one wants piped input, buffering the first scan of the JPEG file needs a lot smaller temp file than is implied by the maximum-height method. For this approach we'd simply treat DNL as a no-op in the decompressor (at most, check that it matches the SOF image height).

We will not worry about making the compressor capable of outputting DNL. Something similar to the first scheme above could be applied if anyone ever wants to make that work.

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/structure.txt

No license file was found, but licenses were detected in source scan.

/\*

\* wrjpgcom.c

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2015-2017 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains a very simple stand-alone application that inserts  
\* user-supplied text as a COM (comment) marker in a JFIF file.  
\* This may be useful as an example of the minimum logic needed to parse  
\* JPEG markers.  
\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/wrjpgcom.c

No license file was found, but licenses were detected in source scan.

/\*  
\* jccolor.c  
\*  
\* Copyright (C) 1991-1996, Thomas G. Lane.  
\* Modified 2011-2023 by Guido Vollbeding.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains input colorspace conversion routines.  
\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jccolor.c

No license file was found, but licenses were detected in source scan.

/\*  
\* transupp.c  
\*  
\* Copyright (C) 1997-2023, Thomas G. Lane, Guido Vollbeding.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains image transformation routines and other utility code  
\* used by the jpegtran sample application. These are NOT part of the core  
\* JPEG library. But we keep these routines separate from jpegtran.c to  
\* ease the task of maintaining jpegtran-like programs that have other user  
\* interfaces.  
\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/transupp.c

No license file was found, but licenses were detected in source scan.

/\*  
\* jmemansi.c  
\*

\* Copyright (C) 1992-1996, Thomas G. Lane.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file provides a simple generic implementation of the system-  
\* dependent portion of the JPEG memory manager. This implementation  
\* assumes that you have the ANSI-standard library routine tmpfile().  
\* Also, the problem of determining the amount of memory available  
\* is shoved onto the user.  
\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jmemansi.c

No license file was found, but licenses were detected in source scan.

The Independent JPEG Group's JPEG software

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README for release 9f of 14-Jan-2024

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This distribution contains the ninth public release of the Independent JPEG Group's free JPEG software. You are welcome to redistribute this software and to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone, Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson, John Korejwa, Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers, and other members of the Independent JPEG Group.

IJG is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP

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This file contains the following sections:

OVERVIEW            General  
description of JPEG and the IJG software.  
LEGAL ISSUES        Copyright, lack of warranty, terms of distribution.  
REFERENCES          Where to learn more about JPEG.  
ARCHIVE LOCATIONS   Where to find newer versions of this software.  
ACKNOWLEDGMENTS    Special thanks.  
FILE FORMAT WARS    Software \*not\* to get.  
TO DO                Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:

install.txt    How to configure and install the IJG software.  
usage.txt     Usage instructions for cjpeg, djpeg, jpegtran,  
              rdjpgcom, and wrjpgcom.  
\*.1           Unix-style man pages for programs (same info as usage.txt).  
wizard.txt    Advanced usage instructions for JPEG wizards only.  
cdaltui.txt   Description of alternate user interface for cjpeg/djpeg.  
change.log    Version-to-version change highlights.

Programmer and internal documentation:

libjpeg.txt   How to use the JPEG library in your own programs.  
example.c     Sample code for calling the JPEG library.  
structure.txt  Overview of the JPEG library's internal structure.  
filelist.txt   Road map of IJG files.  
coderrules.txt Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information can also be found in the JPEG FAQ (Frequently Asked Questions) article. See ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or more of the REFERENCES, then looking at the documentation files (in roughly the order listed) before diving into the code.

## OVERVIEW

=====

This package contains C software to implement JPEG image encoding, decoding, and transcoding. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and grayscale images.

This software implements JPEG baseline, extended-sequential, and progressive compression processes.

Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. We have made no provision for supporting the hierarchical or lossless processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files, plus two sample applications "cjpeg" and "djpeg", which use the library to perform conversion between JPEG and some other popular image file formats. The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG

decoding, but they are essential for output to colormapped file formats or colormapped displays. These extra functions can be compiled out of the library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and flexibility, while also making it fast enough to be useful. In particular, the software is not intended to be read as a tutorial on JPEG. (See the REFERENCES section for introductory material.) Rather, it is intended to be reliable, portable, industrial-strength code. We do not claim to have achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products. No royalty is required, but we do ask for an acknowledgement in product documentation, as described under LEGAL ISSUES.

## LEGAL ISSUES

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In plain English:

1. We don't promise that this software works. (But if you find any bugs, please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a program, you must acknowledge somewhere in your documentation that you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied, with respect to this software, its quality, accuracy, merchantability, or fitness for a particular purpose. This software is provided "AS IS", and you, its user, assume the entire risk as to its quality and accuracy.

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Permission is hereby granted to use, copy, modify, and distribute this software (or portions thereof) for any purpose, without fee, subject to these conditions:

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README file must be included, with this copyright and no-warranty notice unaltered; and any additions, deletions, or changes to the original files must be clearly indicated in accompanying documentation.

(2) If only executable code is distributed, then the accompanying documentation must state that "this software is based in part on the work of the Independent JPEG Group".

(3) Permission for use of this software is granted only if the user accepts full responsibility for any undesirable consequences; the authors accept NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code, not just to the unmodified library. If you use our work, you ought to acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name in advertising or publicity relating to this software or products derived from it. This software may be referred to only as "the Independent JPEG Group's software".

We specifically permit and encourage the use of this software as the basis of commercial products, provided that all warranty or liability claims are assumed by the product vendor.

The Unix configuration script "configure" was produced with GNU Autoconf. It is copyright by the Free Software Foundation but is freely distributable. The same holds for its supporting scripts (config.guess, config.sub, ltmain.sh). Another support script, install-sh, is copyright by X Consortium but is also freely distributable.

## REFERENCES

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We recommend reading one or more of these references before trying to understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is Wallace, Gregory K. "The JPEG Still Picture Compression Standard", Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44. (Adjacent articles in that issue discuss MPEG motion picture compression, applications of JPEG, and related topics.) If you don't have the CACM issue handy, a PDF file containing a revised version of Wallace's article is available at <https://www.iijg.org/files/Wallace.JPEG.pdf>.

The file (actually a preprint for an article that appeared in IEEE Trans. Consumer Electronics)



omits the sample images that appeared in CACM, but it includes corrections and some added material. Note: the Wallace article is copyright ACM and IEEE, and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in "The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides good explanations and example C code for a multitude of compression methods including JPEG. It is an excellent source if you are comfortable reading C code but don't know much about data compression in general. The book's JPEG sample code is far from industrial-strength, but when you are ready to look at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still Image Data Compression

Standard" by William B. Pennebaker and Joan L.

Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1.

Price US\$59.95, 638 pp. The book includes the complete text of the ISO JPEG standards (DIS 10918-1 and draft DIS 10918-2).

Although this is by far the most detailed and comprehensive exposition of JPEG publicly available, we point out that it is still missing an explanation of the most essential properties and algorithms of the underlying DCT technology.

If you think that you know about DCT-based JPEG after reading this book, then you are in delusion. The real fundamentals and corresponding potential of DCT-based JPEG are not publicly known so far, and that is the reason for all the mistaken developments taking place in the image coding domain.

The original JPEG standard is divided into two parts, Part 1 being the actual specification, while Part 2 covers compliance testing methods. Part 1 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part

1: Requirements and guidelines" and has document numbers ISO/IEC IS 10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of Continuous-tone Still Images, Part 2: Compliance testing" and has document numbers ISO/IEC IS 10918-2, ITU-T T.83.

IJG JPEG 8 introduced an implementation of the JPEG SmartScale extension which is specified in two documents: A contributed document at ITU and ISO with title "ITU-T JPEG-Plus Proposal for Extending ITU-T T.81 for Advanced Image Coding", April 2006, Geneva, Switzerland. The latest version of this document is Revision 3. And a contributed document ISO/IEC JTC1/SC29/WG1 N 5799 with title "Evolution of JPEG", June/July 2011, Berlin, Germany.

IJG JPEG 9 introduces a reversible color transform for improved lossless compression which is described in a contributed document ISO/IEC JTC1/SC29/WG1 N 6080 with title "JPEG 9 Lossless Coding", June/July 2012, Paris, France.

The JPEG standard does not specify all details of an interchangeable

file

format. For the omitted details we follow the "JFIF" conventions, version 2. JFIF version 1 has been adopted as Recommendation ITU-T T.871 (05/2011) : Information technology - Digital compression and coding of continuous-tone still images: JPEG File Interchange Format (JFIF). It is available as a free download in PDF file format from <https://www.itu.int/rec/T-REC-T.871>. A PDF file of the older JFIF document is available at <https://www.w3.org/Graphics/JPEG/jfif3.pdf>.

The TIFF 6.0 file format specification can be obtained by FTP from <ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz>. The JPEG incorporation scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious problems. IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6). Instead, we recommend the JPEG design proposed by TIFF Technical Note #2 (Compression tag 7). Copies of this Note can be obtained from <https://www.ijg.org/files/>. It is expected that the next revision of the TIFF spec will replace the 6.0 JPEG design with the Note's design. Although IJG's own code does not support TIFF/JPEG, the free libtiff library uses our library to implement TIFF/JPEG per the Note.

## ARCHIVE LOCATIONS

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The "official" archive site for this software is [www.ijg.org](http://www.ijg.org). The most recent released version can always be found there in directory "files". This particular version will be archived in Windows-compatible "zip" archive format as <https://www.ijg.org/files/jpegsr9f.zip>, and in Unix-compatible "tar.gz" archive format as <https://www.ijg.org/files/jpegsr.v9f.tar.gz>.

The JPEG FAQ (Frequently Asked Questions) article is a source of some general information about JPEG. It is available on the World Wide Web at <http://www.faqs.org/faqs/jpeg-faq/> and other news.answers archive sites, including the official news.answers archive at [rtfm.mit.edu](http://rtfm.mit.edu): <ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/>. If you don't have Web or FTP access, send e-mail to [mail-server@rtfm.mit.edu](mailto:mail-server@rtfm.mit.edu) with  
body  
send usenet/news.answers/jpeg-faq/part1  
send usenet/news.answers/jpeg-faq/part2

## ACKNOWLEDGMENTS

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Thank to Juergen Bruder for providing me with a copy of the common DCT algorithm article, only to find out that I had come to the same result in a more direct and comprehensible way with a more generative approach.

Thank to Istvan Sebestyen and Joan L. Mitchell for inviting me to the ITU JPEG (Study Group 16) meeting in Geneva, Switzerland.

Thank to Thomas Wiegand and Gary Sullivan for inviting me to the Joint Video Team (MPEG & ITU) meeting in Geneva, Switzerland.

Thank to Thomas Richter and Daniel Lee for inviting me to the ISO/IEC JTC1/SC29/WG1 (previously known as JPEG, together with ITU-T SG16) meeting in Berlin, Germany.

Thank to John Korejwa and Massimo Ballerini for inviting me to fruitful consultations in Boston, MA and Milan, Italy.

Thank to Hendrik Elstner, Roland Fassauer, Simone Zuck, Guenther Maier-Gerber, Walter Stoeber, Fred Schmitz, and Norbert Braunagel for corresponding business development.

Thank to Nico Zschach and Dirk Stelling of the technical support team at the Digital Images company in Halle for providing me with extra equipment for configuration tests.

Thank to Richard F. Lyon (then of Foveon Inc.) for fruitful communication about JPEG configuration in Sigma Photo Pro software.

Thank to Andrew Finkenstadt for hosting the [ijg.org](http://ijg.org) site.

Thank to Thomas G. Lane for the original design and development of this singular software package.

Thank to Lars Goehler, Andreas Heinecke, Sebastian Fuss, Yvonne Roebert, Andrej Werner, Ulf-Dietrich Braumann, and Nina Ssymank for support and public relations.

## FILE FORMAT WARS

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The ISO/IEC JTC1/SC29/WG1 standards committee (previously known as JPEG, together with ITU-T SG16) currently promotes different formats containing the name "JPEG" which is misleading because these formats are incompatible with original DCT-based JPEG and are based on faulty technologies.

IJG therefore does not and will not support such momentary mistakes

(see REFERENCES).

There exist also distributions under the name "OpenJPEG" promoting such kind of formats which is misleading because they don't support original JPEG images.

We have no sympathy for the promotion of inferior formats. Indeed, one of the original reasons for developing this free software was to help force convergence on common, interoperable format standards for JPEG files.

Don't use an incompatible file format!

(In any case, our decoder will remain capable of reading existing JPEG image files indefinitely.)

The ISO committee pretends to be "responsible for the popular JPEG" in their public reports which is not true because they don't respond to actual requirements for the maintenance of the original JPEG specification. Furthermore, the ISO committee pretends to "ensure interoperability" with their standards which is not true because their "standards" support only application-specific and proprietary use cases and contain mathematically incorrect code.

There are currently different distributions in circulation containing the name "libjpeg" which is misleading because they don't have the features and are incompatible with formats supported by actual IJG libjpeg distributions. One of those fakes is released by members of the ISO committee and just uses the name of libjpeg for misdirection of people, similar to the abuse of the name JPEG as described above, while having nothing in common with actual IJG libjpeg distributions and containing mathematically incorrect code.

The other one claims to be a "derivative" or "fork" of the original libjpeg, but violates the license conditions as described under LEGAL ISSUES above and violates basic C programming properties.

We have no sympathy for the release of misleading, incorrect and illegal distributions derived from obsolete code bases.

Don't use an obsolete code base!

According to the UCC (Uniform Commercial Code) law, IJG has the lawful and legal right to foreclose on certain standardization bodies and other institutions or corporations that knowingly perform substantial and systematic deceptive acts and practices, fraud, theft, and damaging of the value of the people of this planet without their knowing, willing and intentional consent.

The titles, ownership, and rights of these institutions and all their assets are now duly secured and held in trust for the free people of this planet. People of the planet, on every country, may have a financial interest in the assets of these former principals, agents, and beneficiaries of the foreclosed institutions and corporations.

IJG asserts what is: that each man, woman, and child has unalienable value and rights granted and deposited in them by the Creator and not any one of

the people is subordinate to any artificial principality, corporate fiction or the special interest of another without their appropriate knowing, willing and intentional consent made by contract or accommodation agreement.

IJG expresses that which already was.

The people have already determined and demanded that public administration entities, national governments, and their supporting judicial systems must be fully transparent, accountable, and liable.

IJG has secured the value for all concerned free people of the planet.

A partial list of foreclosed institutions and corporations ("Hall of Shame") is currently prepared and will be published later.

TO DO

=====

Version 9 is the second release of a new generation JPEG standard to overcome the limitations of the original JPEG specification, and is the first true source reference JPEG codec. More features are being prepared for coming releases...

Please send bug reports, offers of help, etc. to [jpeg-info@ijg.org](mailto:jpeg-info@ijg.org).

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/README

No license file was found, but licenses were detected in source scan.

```
/*
 * transupp.h
 *
 * Copyright (C) 1997-2019, Thomas G. Lane, Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains declarations for image transformation routines and
 * other utility code used by the jpegtran sample application. These are
 * NOT part of the core JPEG library. But we keep these routines separate
 * from jpegtran.c to ease the task of maintaining jpegtran-like programs
 * that have other user interfaces.
 *
 * NOTE: all the routines declared here have very specific requirements
 * about when they are to be executed during the reading and writing of the
 * source and destination files. See the comments in transupp.c, or see
 * jpegtran.c for an example of correct usage.
 */
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/transupp.h

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/\*

\* jdapistd.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2002-2013 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains application interface code for the decompression half

\* of the JPEG library. These are the "standard" API routines that are

\* used in the normal full-decompression case. They are not used by a

\* transcoding-only application. Note that if an application links in

\* jpeg\_start\_decompress, it will end up linking in the entire decompressor.

\* We thus must separate this file from jdapimin.c to avoid linking the

\* whole decompression library into a transcoder.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdapistd.c

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; For conditions of distribution and use, see the accompanying README file.

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\* /jpegsrc-v9f-tar-gz/jpeg-9f/jmemdosa.asm

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/\*

\* wrppm.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2009-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to write output images in PPM/PGM format.

\* The extended 2-byte-per-sample raw PPM/PGM formats are supported.

\* The PBMPLUS library is NOT required to compile this software

\* (but it is highly useful as a set of PPM image manipulation programs).

\*

\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume output to

\* an ordinary stdio stream.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/wrppm.c

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/\*

\* jmemname.c

\*

\* Copyright (C) 1992-1997, Thomas G. Lane.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file provides a generic implementation of the system-dependent

\* portion of the JPEG memory manager. This implementation assumes that

\* you must explicitly construct a name for each temp file.

\* Also, the problem of determining the amount of memory available

\* is shoved onto the user.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jmemname.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcapistd.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

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\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains application interface code for the compression half

\* of the JPEG library. These are the "standard" API routines that are

\* used in the normal full-compression case. They are not used by a

\* transcoding-only application. Note that if an application links in

\* jpeg\_start\_compress, it will end up linking in the entire compressor.

\* We thus must separate this file from jcapimin.c to avoid linking the

\* whole compression library into a transcoder.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcapistd.c

No license file was found, but licenses were detected in source scan.

/\*

\* jpegint.h

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 1997-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file provides common declarations for the various JPEG modules.  
\* These declarations are considered internal to the JPEG library; most  
\* applications using the library shouldn't need to include this file.  
\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jpegint.h

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/\*

\* jutils.c

\*

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\* Modified 2009-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains tables and miscellaneous utility routines needed

\* for both compression and decompression.

\* Note we prefix all global names with "j" to minimize conflicts with

\* a surrounding application.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jutils.c

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/\*

\* rdgif.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2019-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to read input images in GIF format.

\*

\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume input from

\* an ordinary stdio stream. They further assume that reading begins

\* at the start of the file; start\_input may need work if the

\* user interface has already read some data (e.g., to determine that

\* the file is indeed GIF format).

\*/

/\*



```

* This code is loosely based on giftppm from the PBMPLUS distribution
* of Feb. 1991. That file contains the following copyright notice:
* +-----+
* | Copyright 1990,
* | David Koblas. |
* | Permission to use, copy, modify, and distribute this software |
* | and its documentation for any purpose and without fee is hereby |
* | granted, provided that the above copyright notice appear in all |
* | copies and that both that copyright notice and this permission |
* | notice appear in supporting documentation. This software is |
* | provided "as is" without express or implied warranty. |
* +-----+
*/

```

Found in path(s):

```
* /jpegsrc-v9f-tar-gz/jpeg-9f/rdgif.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jidctflt.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2010-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a floating-point implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* This implementation should be more accurate than either of the integer
* IDCT implementations. However, it may not give the same results on all
* machines because of differences in roundoff behavior. Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they
* are much more
* complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are

```

- \* simple scalings of the final outputs. These multiplies can then be
- \* folded into the multiplications or divisions by the JPEG quantization
- \* table entries. The AA&N method leaves only 5 multiplies and 29 adds
- \* to be done in the DCT itself.
- \* The primary disadvantage of this method is that with a fixed-point
- \* implementation, accuracy is lost due to imprecise representation of the
- \* scaled quantization values. However,
- that problem does not arise if
- \* we use floating point arithmetic.
- \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jidctflt.c

No license file was found, but licenses were detected in source scan.

## USING THE IJG JPEG LIBRARY

Copyright (C) 1994-2023, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

This file describes how to use the IJG JPEG library within an application program. Read it if you want to write a program that uses the library.

The file `example.c` provides heavily commented skeleton code for calling the JPEG library. Also see `jpeglib.h` (the include file to be used by application programs) for full details about data structures and function parameter lists. The library source code, of course, is the ultimate reference.

Note that there have been *major* changes from the application interface presented by IJG version 4 and earlier versions. The old design had several inherent limitations, and it had accumulated a lot of cruft as we added features while trying to minimize application-interface changes. We have sacrificed backward compatibility in the version 5 rewrite, but we think the improvements justify this.

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You should read at least the overview and basic usage sections before trying to program with the library.

The sections on advanced features can be read if and when you need them.

## OVERVIEW

=====

### Functions provided by the library

-----

The IJG JPEG library provides C code to read and write JPEG-compressed image files. The surrounding application program receives or supplies image data a scanline at a time, using a straightforward uncompressed image format. All details of color conversion and other preprocessing/postprocessing can be handled by the library.

The library includes a substantial amount of code that is not covered by the JPEG standard but is necessary for typical applications of JPEG. These functions preprocess the image before JPEG compression or postprocess it after decompression. They include colorspace conversion, downsampling/upsampling, and color quantization. The application indirectly selects use of this code by specifying the format in which it wishes to supply or receive image data. For example, if colormapped output is requested,

then the decompression library automatically invokes color quantization.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing, and even more so in decompression postprocessing. The decompression library provides multiple implementations that cover most of the useful tradeoffs, ranging from very-high-quality down to fast-preview operation. On the compression side we have generally not provided low-quality choices, since compression is normally less time-critical. It should be understood that the low-quality modes may not meet the JPEG standard's accuracy requirements; nonetheless, they are useful for viewers.

A word about functions \*not\* provided by the library. We handle a subset of the ISO JPEG standard; most baseline, extended-sequential, and progressive JPEG processes are supported. (Our subset includes all features now in common use.) Unsupported ISO options include:

- \* Hierarchical storage
- \* Lossless JPEG
- \* DNL marker
- \* Nonintegral subsampling ratios

We

support 8-bit to 12-bit data precision, but this is a compile-time choice rather than a run-time choice; hence it is difficult to use different precisions in a single application.

By itself, the library handles only interchange JPEG datastreams --- in particular the widely used JFIF file format. The library can be used by surrounding code to process interchange or abbreviated JPEG datastreams that are embedded in more complex file formats. (For example, this library is used by the free LIBTIFF library to support JPEG compression in TIFF.)

Outline of typical usage

-----

The rough outline of a JPEG compression operation is:

```
Allocate and initialize a JPEG compression object
Specify the destination for the compressed data (eg, a file)
Set parameters for compression, including image size & colorspace
jpeg_start_compress(...);
while (scan lines remain to be written)
 jpeg_write_scanlines(...);
jpeg_finish_compress(...);
Release the JPEG compression
object
```

A JPEG compression object holds parameters and working state for the JPEG

library. We make creation/destruction of the object separate from starting or finishing compression of an image; the same object can be re-used for a series of image compression operations. This makes it easy to re-use the same parameter settings for a sequence of images. Re-use of a JPEG object also has important implications for processing abbreviated JPEG datastreams, as discussed later.

The image data to be compressed is supplied to `jpeg_write_scanlines()` from in-memory buffers. If the application is doing file-to-file compression, reading image data from the source file is the application's responsibility. The library emits compressed data by calling a "data destination manager", which typically will write the data into a file; but the application can provide its own destination manager to do something else.

Similarly, the rough outline of a JPEG decompression operation is:

```
Allocate and initialize
a JPEG decompression object
Specify the source of the compressed data (eg, a file)
Call jpeg_read_header() to obtain image info
Set parameters for decompression
jpeg_start_decompress(...);
while (scan lines remain to be read)
 jpeg_read_scanlines(...);
jpeg_finish_decompress(...);
Release the JPEG decompression object
```

This is comparable to the compression outline except that reading the datastream header is a separate step. This is helpful because information about the image's size, colorspace, etc is available when the application selects decompression parameters. For example, the application can choose an output scaling ratio that will fit the image into the available screen size.

The decompression library obtains compressed data by calling a data source manager, which typically will read the data from a file; but other behaviors can be obtained with a custom source manager. Decompressed data is delivered into in-memory buffers passed to `jpeg_read_scanlines()`.

It is possible to abort an incomplete compression or decompression operation by calling `jpeg_abort()`; or, if you do not need to retain the JPEG object, simply release it by calling `jpeg_destroy()`.

JPEG compression and decompression objects are two separate struct types. However, they share some common fields, and certain routines such as `jpeg_destroy()` can work on either type of object.

The JPEG library has no static variables: all state is in the compression

or decompression object. Therefore it is possible to process multiple compression and decompression operations concurrently, using multiple JPEG objects.

Both compression and decompression can be done in an incremental memory-to-memory fashion, if suitable source/destination managers are used. See the section on "I/O suspension" for more details.

## BASIC LIBRARY USAGE

=====

### Data formats

-----

Before diving into procedural details, it is helpful to understand the image data format that the JPEG library expects or returns.

The standard input image format is a rectangular array of pixels, with each pixel having the same number of "component" or "sample" values (color channels). You must specify how many components there are and the colorspace interpretation of the components. Most applications will use RGB data (three components per pixel) or grayscale data (one component per pixel). PLEASE NOTE THAT RGB DATA IS THREE SAMPLES PER PIXEL, GRAYSCALE ONLY ONE. A remarkable number of people manage to miss this, only to find that their programs don't work with grayscale JPEG files.

There is no provision for colormapped input. JPEG files are always full-color or full grayscale (or sometimes another colorspace such as CMYK). You can feed in a colormapped image by expanding it to full-color format. However JPEG often doesn't work very well with source data that has been colormapped, because of dithering noise. This is discussed in more detail in the JPEG FAQ and the other references mentioned in the README file.

Pixels are stored by scanlines, with each scanline running from left to right. The component values for each pixel are adjacent in the row; for example, R,G,B,R,G,B,R,G,B,... for 24-bit RGB color. Each scanline is an array of data type JSAMPLE --- which is typically "unsigned char", unless you've changed jmorecfg.h. (You can also change the RGB pixel layout, say to B,G,R order, by modifying jmorecfg.h. But see the restrictions listed in that file before doing so.)

A 2-D array of pixels is formed by making a list of pointers to the starts of scanlines; so the scanlines need not be physically adjacent in memory. Even if you process just one scanline at a time, you must make a one-element pointer array to conform to this structure. Pointers to JSAMPLE rows are of

type JSAMPROW, and the pointer to the pointer array is of type JSAMPARRAY.

The library accepts or supplies one or more complete scanlines per call.

It is not possible to process part of a row at a time. Scanlines are always

processed top-to-bottom. You can process an entire image in one call if you have it all in memory, but usually it's simplest to process one scanline at a time.

For best results, source data values should have the precision specified by BITS\_IN\_JSAMPLE (normally 8 bits). For instance, if you choose to compress data that's only 6 bits/channel, you should left-justify each value in a byte before passing it to the compressor. If you need to compress data that has more than 8 bits/channel, compile with BITS\_IN\_JSAMPLE = 9 to 12. (See "Library compile-time options", later.)

The data format returned by the decompressor is the same in all details, except that colormapped output is supported. (Again, a JPEG file is never colormapped. But you can ask the decompressor to perform on-the-fly color quantization to deliver colormapped output.) If you request colormapped output then the returned data array contains a single JSAMPLE per pixel; its value is an index into a color map. The color map is represented as a 2-D JSAMPARRAY in which each row holds the values of one color component, that is, colormap[i][j] is the value of the i'th color component for pixel value (map index) j. Note that since the colormap indexes are stored in JSAMPLEs, the maximum number of colors is limited by the size of JSAMPLE (ie, at most 256 colors for an 8-bit JPEG library).

#### Compression details

-----

Here we revisit the JPEG compression outline given in the overview.

1. Allocate and initialize a JPEG compression object.

A JPEG compression object is a "struct jpeg\_compress\_struct". (It also has a bunch of subsidiary structures which are allocated via malloc(), but the application doesn't control those directly.) This struct can be just a local variable in the calling routine, if a single routine is going to execute the whole JPEG compression sequence. Otherwise it can be static or allocated from malloc().

You will also need a structure representing a JPEG error handler. The part of this that the library cares about is a "struct jpeg\_error\_mgr". If you

are providing your own error handler, you'll typically want to embed the `jpeg_error_mgr` struct in a larger structure; this is discussed later under "Error handling". For now we'll assume you are just using the default error handler. The default error handler will print JPEG error/warning messages on `stderr`, and it will call `exit()` if a fatal error occurs.

You must initialize the error handler structure, store a pointer to it into the JPEG object's "err" field, and then call `jpeg_create_compress()` to initialize the rest of the JPEG object.

Typical code for this step, if you are using the default error handler, is

```
struct jpeg_compress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_compress(&cinfo);
```

`jpeg_create_compress` allocates a small amount of memory, so it could fail if you are out of memory. In that case it will exit via the error handler; that's why the error handler must be initialized first.

## 2. Specify the destination for the compressed data (eg, a file).

As previously mentioned, the JPEG library delivers compressed data to a "data destination" module. The library includes one data destination module which knows how to write to memory or to a file (or any stdio stream). You can use your own destination module if you want to do something else, as discussed later.

If you use the standard destination module, you must open the target stdio stream beforehand. Typical code for this step looks like:

```
FILE * outfile;
...
if ((outfile = fopen(filename, "wb")) == NULL) {
 fprintf(stderr, "can't open %s\n", filename);
 exit(1);
}
jpeg_stdio_dest(&cinfo, outfile);
```

where the last line invokes the standard destination module.

**WARNING:** it is critical that the binary compressed data be delivered to the output file unchanged. On non-Unix systems the stdio library may perform newline translation



or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You can select the data destination after setting other parameters (step 3), if that's more convenient. You may not change the destination between calling jpeg\_start\_compress() and jpeg\_finish\_compress().

### 3. Set parameters for compression, including image size & colorspace.

You must supply information about the source image by setting the following fields in the JPEG object (cinfo structure):

image\_width Width of image, in pixels  
image\_height Height of image, in pixels  
input\_components Number of color channels (samples per pixel)  
in\_color\_space Color space of source image

The image dimensions are, hopefully, obvious. JPEG supports image dimensions of 1 to 64K pixels in either direction. The

input color space is typically

RGB or grayscale, and input\_components is 3 or 1 accordingly. (See "Special color spaces", later, for more info.) The in\_color\_space field must be assigned one of the J\_COLOR\_SPACE enum constants, typically JCS\_RGB or JCS\_GRAYSCALE.

JPEG has a large number of compression parameters that determine how the image is encoded. Most applications don't need or want to know about all these parameters. You can set all the parameters to reasonable defaults by calling jpeg\_set\_defaults(); then, if there are particular values you want to change, you can do so after that. The "Compression parameter selection" section tells about all the parameters.

You must set in\_color\_space correctly before calling jpeg\_set\_defaults(), because the defaults depend on the source image colorspace. However the other three source image parameters need not be valid until you call jpeg\_start\_compress(). There's no harm in calling jpeg\_set\_defaults() more than once, if that happens to be convenient.

Typical code for a 24-bit RGB source image is

```
cinfo.image_width = Width; /* image width and height, in pixels */
cinfo.image_height = Height;
cinfo.input_components = 3; /* # of color components per pixel */
cinfo.in_color_space = JCS_RGB; /* colorspace of input image */
```

```
jpeg_set_defaults(&cinfo);
/* Make optional parameter settings here */
```

#### 4. jpeg\_start\_compress(...);

After you have established the data destination and set all the necessary source image info and other parameters, call `jpeg_start_compress()` to begin a compression cycle. This will initialize internal state, allocate working storage, and emit the first few bytes of the JPEG datastream header.

Typical code:

```
jpeg_start_compress(&cinfo, TRUE);
```

The "TRUE" parameter ensures that a complete JPEG interchange datastream will be written. This is appropriate in most cases. If you think you might want to use an abbreviated datastream, read the section on abbreviated datastreams, below.

Once

you have called `jpeg_start_compress()`, you may not alter any JPEG parameters or other fields of the JPEG object until you have completed the compression cycle.

#### 5. while (scan lines remain to be written)

```
jpeg_write_scanlines(...);
```

Now write all the required image data by calling `jpeg_write_scanlines()` one or more times. You can pass one or more scanlines in each call, up to the total image height. In most applications it is convenient to pass just one or a few scanlines at a time. The expected format for the passed data is discussed under "Data formats", above.

Image data should be written in top-to-bottom scanline order. The JPEG spec contains some weasel wording about how top and bottom are application-defined terms (a curious interpretation of the English language...) but if you want your files to be compatible with everyone else's, you WILL use top-to-bottom order. If the source data must be read in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently.

Examples of this can be found in the sample application `cjpeg`.

The library maintains a count of the number of scanlines written so far in the `next_scanline` field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like

```
"while (cinfo.next_scanline < cinfo.image_height)".
```

Code for this step depends heavily on the way that you store the source data. example.c shows the following code for the case of a full-size 2-D source array containing 3-byte RGB pixels:

```
JSAMPROW row_pointer[1]; /* pointer to a single row */
int row_stride; /* physical row width in buffer */

row_stride = image_width * 3; /* JSAMPLEs per row in image_buffer */

while (cinfo.next_scanline < cinfo.image_height) {
 row_pointer[0] = & image_buffer[cinfo.next_scanline * row_stride];
 jpeg_write_scanlines(&cinfo, row_pointer, 1);
}
```

jpeg\_write\_scanlines() returns the number of scanlines actually written.

This will normally

be equal to the number passed in, so you can usually

ignore the return value. It is different in just two cases:

- \* If you try to write more scanlines than the declared image height, the additional scanlines are ignored.

- \* If you use a suspending data destination manager, output buffer overrun will cause the compressor to return before accepting all the passed lines.

This feature is discussed under "I/O suspension", below. The normal stdio destination manager will NOT cause this to happen.

In any case, the return value is the same as the change in the value of next\_scanline.

## 6. jpeg\_finish\_compress(...);

After all the image data has been written, call jpeg\_finish\_compress() to complete the compression cycle. This step is ESSENTIAL to ensure that the last bufferload of data is written to the data destination.

jpeg\_finish\_compress() also releases working memory associated with the JPEG object.

Typical code:

```
jpeg_finish_compress(&cinfo);
```

If using the stdio

destination manager, don't forget to close the output

stdio stream (if necessary) afterwards.

If you have requested a multi-pass operating mode, such as Huffman code optimization, jpeg\_finish\_compress() will perform the additional passes using

data buffered by the first pass. In this case `jpeg_finish_compress()` may take quite a while to complete. With the default compression parameters, this will not happen.

It is an error to call `jpeg_finish_compress()` before writing the necessary total number of scanlines. If you wish to abort compression, call `jpeg_abort()` as discussed below.

After completing a compression cycle, you may dispose of the JPEG object as discussed next, or you may use it to compress another image. In that case return to step 2, 3, or 4 as appropriate. If you do not change the destination manager, the new datastream will be written to the same target. If you do not change any JPEG parameters, the new datastream will be written with the same parameters as before.

Note that you can change the input image dimensions freely between cycles, but if you change the input colorspace, you should call `jpeg_set_defaults()` to adjust for the new colorspace; and then you'll need to repeat all of step 3.

## 7. Release the JPEG compression object.

When you are done with a JPEG compression object, destroy it by calling `jpeg_destroy_compress()`. This will free all subsidiary memory (regardless of the previous state of the object). Or you can call `jpeg_destroy()`, which works for either compression or decompression objects --- this may be more convenient if you are sharing code between compression and decompression cases. (Actually, these routines are equivalent except for the declared type of the passed pointer. To avoid gripes from ANSI C compilers, `jpeg_destroy()` should be passed a `j_common_ptr`.)

If you allocated the `jpeg_compress_struct` structure from `malloc()`, freeing it is your responsibility --- `jpeg_destroy()` won't. Ditto for the error handler structure.

Typical  
code:

```
jpeg_destroy_compress(&cinfo);
```

## 8. Aborting.

If you decide to abort a compression cycle before finishing, you can clean up in either of two ways:

\* If you don't need the JPEG object any more, just call `jpeg_destroy_compress()` or `jpeg_destroy()` to release memory. This is

legitimate at any point after calling `jpeg_create_compress()` --- in fact, it's safe even if `jpeg_create_compress()` fails.

\* If you want to re-use the JPEG object, call `jpeg_abort_compress()`, or call `jpeg_abort()` which works on both compression and decompression objects. This will return the object to an idle state, releasing any working memory. `jpeg_abort()` is allowed at any time after successful object creation.

Note that cleaning up the data destination, if required, is your responsibility; neither of these routines will call `term_destination()`. (See "Compressed data handling", below, for more about that.)

`jpeg_destroy()` and `jpeg_abort()` are the only safe calls to make on a JPEG object that has reported an error by calling `error_exit` (see "Error handling" for more info). The internal state of such an object is likely to be out of whack. Either of these two routines will return the object to a known state.

## Decompression details

-----

Here we revisit the JPEG decompression outline given in the overview.

1. Allocate and initialize a JPEG decompression object.

This is just like initialization for compression, as discussed above, except that the object is a "struct `jpeg_decompress_struct`" and you call `jpeg_create_decompress()`. Error handling is exactly the same.

Typical code:

```
struct jpeg_decompress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_decompress(&cinfo);
```

(Both here and in the IJG code, we usually use variable name "cinfo" for both compression and decompression objects.)

2. Specify the source of the compressed data (eg, a file).

As previously mentioned, the JPEG library reads compressed data from a "data source" module. The library includes one data source module which knows how to read from memory or from a file (or any stdio stream). You can use your

own source module if you want to do something else, as discussed later.

If you use the standard source module, you must open the source stdio stream beforehand. Typical code for this step looks like:

```
FILE * infile;
...
if ((infile = fopen(filename, "rb")) == NULL) {
 fprintf(stderr, "can't open %s\n", filename);
 exit(1);
}
jpeg_stdio_src(&cinfo, infile);
```

where the last line invokes the standard source module.

WARNING: it is critical that the binary compressed data be read unchanged. On non-Unix systems the stdio library may perform newline translation or otherwise corrupt binary data. To suppress this behavior, you may need to use a "b" option to fopen (as shown above), or use setmode() or another routine to put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that has been found to work on many systems.

You may not change the data source between calling jpeg\_read\_header() and jpeg\_finish\_decompress(). If you wish to read a series of JPEG images from a single source file, you should repeat the jpeg\_read\_header() to jpeg\_finish\_decompress() sequence without reinitializing either the JPEG object or the data source module; this prevents buffered input data from being discarded.

3. Call jpeg\_read\_header() to obtain image info.

Typical code for this step is just

```
jpeg_read_header(&cinfo, TRUE);
```

This will read the source datastream header markers, up to the beginning of the compressed data proper. On return, the image dimensions and other info have been stored in the JPEG object. The application may wish to consult this information before selecting decompression parameters.

More complex code is necessary if

- \* A suspending data source is used --- in that case jpeg\_read\_header() may return before it has read all the header data. See "I/O suspension", below. The normal stdio source manager will NOT cause this to happen.
- \* Abbreviated JPEG files are to be processed --- see the section on

abbreviated datastreams. Standard applications that deal only in interchange JPEG files need not be concerned with this case either.

It is permissible to stop at this point if you just wanted to find out the image dimensions and other header info for a JPEG file. In that case, call `jpeg_destroy()` when you are done with the JPEG object, or call `jpeg_abort()` to return it to an idle state before selecting a new data source and reading another header.

#### 4. Set parameters for decompression.

`jpeg_read_header()` sets appropriate default decompression parameters based on the properties of the image (in particular, its colorspace). However, you may well want to alter these defaults before beginning the decompression. For example, the default is to produce full color output from a color file. If you want colormapped output you must ask for it. Other options allow the returned image to be scaled and allow various speed/quality tradeoffs to be selected. "Decompression parameter selection", below, gives details.

If the defaults are appropriate, nothing need be done at this step.

Note that all default values are set by each call to `jpeg_read_header()`. If you reuse a decompression object, you cannot expect your parameter settings to be preserved across cycles, as you can for compression. You must set desired parameter values each time.

#### 5. `jpeg_start_decompress(...);`

Once the parameter values are satisfactory, call `jpeg_start_decompress()` to begin decompression. This will initialize internal state, allocate working memory, and prepare for returning data.

Typical code is just

```
jpeg_start_decompress(&cinfo);
```

If you have requested a multi-pass operating mode, such as 2-pass color quantization, `jpeg_start_decompress()` will do everything needed before data output can begin. In this case `jpeg_start_decompress()` may take quite a while to complete. With a single-scan (non progressive) JPEG file and default decompression parameters, this will not happen; `jpeg_start_decompress()` will return quickly.

After this call, the final output image dimensions, including any requested

scaling, are available in the JPEG object; so is the selected colormap, if colormapped output has been requested. Useful fields include

output\_width image width and height, as scaled  
output\_height  
out\_color\_components # of color components in out\_color\_space  
output\_components # of color components returned per pixel  
colormap the selected colormap, if any  
actual\_number\_of\_colors number of entries in colormap

output\_components is 1 (a colormap index) when quantizing colors; otherwise it equals out\_color\_components. It is the number of JSAMPLE values that will be emitted per pixel in the output arrays.

Typically you will need to allocate data buffers to hold the incoming image. You will need output\_width \* output\_components JSAMPLEs per scanline in your output buffer, and a total of output\_height scanlines will be returned.

Note: if you are using the JPEG library's internal memory manager to allocate data buffers (as djpeg does), then the manager's protocol requires that you request large buffers \*before\* calling jpeg\_start\_decompress(). This is a little tricky since the output\_XXX fields are not normally valid then. You can make them valid by calling jpeg\_calc\_output\_dimensions() after setting the relevant parameters (scaling, output color space, and quantization flag).

6. while (scan lines remain to be read)  
    jpeg\_read\_scanlines(...);

Now you can read the decompressed image data by calling jpeg\_read\_scanlines() one or more times. At each call, you pass in the maximum number of scanlines to be read (ie, the height of your working buffer); jpeg\_read\_scanlines() will return up to that many lines. The return value is the number of lines actually read. The format of the returned data is discussed under "Data formats", above. Don't forget that grayscale and color JPEGs will return different data formats!

Image data is returned in top-to-bottom scanline order. If you must write out the image in bottom-to-top order, you can use the JPEG library's virtual array mechanism to invert the data efficiently. Examples of this can be found in the sample application djpeg.

The library maintains a count of the number of scanlines returned so far in the output\_scanline field of the JPEG object. Usually you can just use this variable as the loop counter, so that the loop test looks like "while (cinfo.output\_scanline < cinfo.output\_height)". (Note that the test



should NOT be against `image_height`, unless you never use scaling. The `image_height` field is the height of the original unscaled image.) The return value always equals the change in the value of `output_scanline`.

If you don't use a suspending data source, it is safe to assume that `jpeg_read_scanlines()` reads at least one scanline per call, until the bottom of the image has been reached.

If you use a buffer larger than one scanline, it is NOT safe to assume that `jpeg_read_scanlines()` fills it. (The current implementation returns only a few scanlines per call, no matter how large a buffer you pass.) So you must always provide a loop that calls `jpeg_read_scanlines()` repeatedly until the whole image has been read.

#### 7. `jpeg_finish_decompress(...)`;

After all the image data has been read, call `jpeg_finish_decompress()` to complete the decompression cycle. This causes working memory associated with the JPEG object to be released.

Typical code:

```
jpeg_finish_decompress(&cinfo);
```

If using the stdio source manager, don't forget to close the source stdio stream if necessary.

It is an error to call `jpeg_finish_decompress()` before reading the correct total number of scanlines. If you wish to abort decompression, call `jpeg_abort()` as discussed below.

After completing a decompression cycle, you may dispose of the JPEG object as discussed next, or you may use it to decompress another image. In that case return to step 2 or 3 as appropriate. If you do not change the source manager, the next image will be read from the same source.

#### 8. Release the JPEG decompression object.

When you are done with a JPEG decompression object, destroy it by calling `jpeg_destroy_decompress()` or `jpeg_destroy()`. The previous discussion of destroying compression objects applies here too.

Typical code:

```
jpeg_destroy_decompress(&cinfo);
```

## 9. Aborting.

You can abort a decompression cycle by calling `jpeg_destroy_decompress()` or `jpeg_destroy()` if you don't need the JPEG object any more, or `jpeg_abort_decompress()` or `jpeg_abort()` if you want to reuse the object. The previous discussion of aborting compression cycles applies here too.

Mechanics of usage: include files, linking, etc

-----

Applications using the JPEG library should include the header file `jpeglib.h` to

obtain declarations of data types and routines. Before including `jpeglib.h`, include system headers that define at least the typedefs `FILE` and `size_t`. On ANSI-conforming systems, including `<stdio.h>` is sufficient; on older Unix systems, you may need `<sys/types.h>` to define `size_t`.

If the application needs to refer to individual JPEG library error codes, also include `jerror.h` to define those symbols.

`jpeglib.h` indirectly includes the files `jconfig.h` and `jmorecfg.h`. If you are installing the JPEG header files in a system directory, you will want to install all four files: `jpeglib.h`, `jerror.h`, `jconfig.h`, `jmorecfg.h`.

The most convenient way to include the JPEG code into your executable program is to prepare a library file ("`libjpeg.a`", or a corresponding name on non-Unix machines) and reference it at your link step. If you use only half of the library (only compression or only decompression), only that much code will be included from the library, unless your linker is hopelessly brain-damaged.

The supplied makefiles build `libjpeg.a` automatically (see `install.txt`).

While you can build the JPEG library as a shared library if the whim strikes you, we don't really recommend it. The trouble with shared libraries is that at some point you'll probably try to substitute a new version of the library without recompiling the calling applications. That generally doesn't work because the parameter struct declarations usually change with each new version. In other words, the library's API is *\*not\** guaranteed binary compatible across versions; we only try to ensure source-code compatibility. (In hindsight, it might have been smarter to hide the parameter structs from applications and introduce a ton of access functions instead. Too late now, however.)

On some systems your application may need to set up a signal handler to ensure

that temporary files are deleted if the program is interrupted. This is most critical if you are on MS-DOS and use the jmemdos.c memory manager back end;

it will try to grab extended memory for temp files, and that space will NOT be freed automatically. See cjpeg.c or djpeg.c for an example signal handler.

It may be worth pointing out that the core JPEG library does not actually require the stdio library: only the default source/destination managers and error handler need it. You can use the library in a stdio-less environment if you replace those modules and use jmemnobs.c (or another memory manager of your own devising). More info about the minimum system library requirements may be found in jinclude.h.

## ADVANCED FEATURES

=====

### Compression parameter selection

-----

This section describes all the optional parameters you can set for JPEG compression, as well as the "helper" routines provided to assist in this task. Proper setting of some parameters requires detailed understanding of the JPEG standard; if you don't know what a parameter is for, it's best not to mess with it! See

REFERENCES in the README file for pointers to more info about JPEG.

It's a good idea to call jpeg\_set\_defaults() first, even if you plan to set all the parameters; that way your code is more likely to work with future JPEG libraries that have additional parameters. For the same reason, we recommend you use a helper routine where one is provided, in preference to twiddling cinfo fields directly.

The helper routines are:

jpeg\_set\_defaults (j\_compress\_ptr cinfo)

This routine sets all JPEG parameters to reasonable defaults, using only the input image's color space (field in\_color\_space, which must already be set in cinfo). Many applications will only need to use this routine and perhaps jpeg\_set\_quality().

jpeg\_set\_colorspace (j\_compress\_ptr cinfo, J\_COLOR\_SPACE colorspace)

Sets the JPEG file's colorspace (field jpeg\_color\_space) as specified, and sets other color-space-dependent parameters appropriately. See "Special color spaces", below, before using this. A large number of

parameters, including all per-component parameters, are set by this

routine; if you want to twiddle individual parameters you should call `jpeg_set_colorspace()` before rather than after.

`jpeg_default_colorspace (j_compress_ptr cinfo)`

Selects an appropriate JPEG colorspace based on `cinfo->in_color_space`, and calls `jpeg_set_colorspace()`. This is actually a subroutine of `jpeg_set_defaults()`. It's broken out in case you want to change just the colorspace-dependent JPEG parameters.

`jpeg_set_quality (j_compress_ptr cinfo, int quality, boolean force_baseline)`

Constructs JPEG quantization tables appropriate for the indicated quality setting. The quality value is expressed on the 0..100 scale recommended by IJG (cjpeg's "-quality" switch uses this routine). Note that the exact mapping from quality values to tables may change in future IJG releases as more is learned about DCT quantization. If the `force_baseline` parameter is TRUE, then the quantization table entries are constrained to the range 1..255 for full JPEG baseline compatibility. In the current implementation, this only makes a difference for quality settings below 25, and it effectively prevents very small/low quality files from being generated. The IJG decoder is capable of reading the non-baseline files generated at low quality settings when `force_baseline` is FALSE, but other decoders may not be.

`jpeg_set_linear_quality (j_compress_ptr cinfo, int scale_factor, boolean force_baseline)`

Same as `jpeg_set_quality()` except that the generated tables are the sample tables given in the JPEG spec section K.1, multiplied by the specified scale factor (which is expressed as a percentage; thus `scale_factor = 100` reproduces the spec's tables). Note that larger scale factors give lower quality. This entry point is useful for conforming to the Adobe PostScript DCT conventions, but we do not recommend linear scaling as a user-visible quality scale otherwise. `force_baseline` again constrains the computed table entries to 1..255.

`int jpeg_quality_scaling (int quality)`

Converts a value on the IJG-recommended quality scale to a linear scaling percentage. Note that this routine may change or go away in future releases --- IJG may choose to adopt a scaling method that can't be expressed as a simple scalar multiplier, in which case the premise of this routine collapses. Caveat user.

`jpeg_default_qtables (j_compress_ptr cinfo, boolean force_baseline)`

Set default quantization tables with linear `q_scale_factor[]` values (see below).

`jpeg_add_quant_table (j_compress_ptr cinfo, int which_tbl,`

```
const unsigned int *basic_table,
int scale_factor, boolean force_baseline)
```

Allows an arbitrary quantization table to be created. `which_tbl` indicates which table slot to fill. `basic_table` points to an array of 64 unsigned ints given in normal array order. These values are multiplied by `scale_factor/100` and then clamped to the range 1..65535 (or to 1..255 if `force_baseline` is TRUE).

CAUTION: prior to library version 6a, `jpeg_add_quant_table` expected the basic table to be given in JPEG zigzag order. If you need to write code that works with either older or newer versions of this routine, you must check the library version number. Something like `"#if JPEG_LIB_VERSION >= 61"` is the right test.

```
jpeg_simple_progression (j_compress_ptr cinfo)
```

Generates a default scan script for writing a progressive-JPEG file. This is the recommended method of creating a progressive file, unless you want to make a custom scan sequence. You must ensure that the JPEG color space is set correctly before calling this routine.

Compression parameters (`cinfo` fields) include:

```
boolean arith_code
```

If TRUE, use arithmetic coding.

If FALSE, use Huffman coding.

```
int block_size
```

Set DCT block size. All N from 1 to 16 are possible.

Default is 8 (baseline format).

Larger values produce higher compression,  
smaller values produce higher quality.

An exact DCT stage  
is possible with 1 or 2.

With the default quality of 75 and default quantization tables  
the DCT+Quantization stage is lossless for value 1.

Note that values other than 8 require a SmartScale capable decoder,  
introduced with IJG JPEG 8. Setting the `block_size` parameter for  
compression works with version 8c and later.

```
J_DCT_METHOD dct_method
```

Selects the algorithm used for the DCT step. Choices are:

JDCT\_ISLOW: slow but accurate integer algorithm

JDCT\_IFAST: faster, less accurate integer method

JDCT\_FLOAT: floating-point method

JDCT\_DEFAULT: default method (normally JDCT\_ISLOW)

JDCT\_FASTEST: fastest method (normally JDCT\_IFAST)

The FLOAT method is very slightly more accurate than the ISLOW method,

but may give different results on different machines due to varying roundoff behavior. The integer methods should give the same results on all machines. On machines with sufficiently fast FP hardware, the floating-point method may also be the fastest. The IFAST method is

considerably less accurate than the other two; its use is not recommended if high quality is a concern. JDCT\_DEFAULT and JDCT\_FASTEST are macros configurable by each installation.

unsigned int scale\_num, scale\_denom

Scale the image by the fraction scale\_num/scale\_denom. Default is 1/1, or no scaling. Currently, the supported scaling ratios are M/N with all N from 1 to 16, where M is the destination DCT size, which is 8 by default (see block\_size parameter above). (The library design allows for arbitrary scaling ratios but this is not likely to be implemented any time soon.)

J\_COLOR\_SPACE jpeg\_color\_space

int num\_components

The JPEG color space and corresponding number of components; see "Special color spaces", below, for more info. We recommend using jpeg\_set\_colorspace() if you want to change these.

J\_COLOR\_TRANSFORM color\_transform

Internal color transform identifier, writes LSE marker if nonzero (requires decoder with inverse color transform support, introduced with IJG JPEG 9).

Two values are currently possible: JCT\_NONE and JCT\_SUBTRACT\_GREEN. Set this value for lossless RGB application \*before\* calling jpeg\_set\_colorspace(), because entropy table assignment in jpeg\_set\_colorspace() depends on color\_transform.

boolean optimize\_coding

TRUE causes the compressor to compute optimal Huffman coding tables for the image. This requires an extra pass over the data and therefore costs a good deal of space and time. The default is FALSE, which tells the compressor to use the supplied or default Huffman tables. In most cases optimal tables save only a few percent of file size compared to the default tables. Note that when this is TRUE, you need not supply Huffman tables at all, and any you do supply will be overwritten.

unsigned int restart\_interval

int restart\_in\_rows

To emit restart markers in the JPEG file, set one of these nonzero. Set restart\_interval to specify the exact interval in MCU blocks. Set restart\_in\_rows to

specify the interval in MCU rows. (If restart\_in\_rows is not 0, then restart\_interval is set after the image width in MCUs is computed.) Defaults are zero (no restarts). One restart marker per MCU row is often a good choice. NOTE: the overhead of restart markers is higher in grayscale JPEG files than in color files, and MUCH higher in progressive JPEGs. If you use restarts, you may want to use larger intervals in those cases.

```
const jpeg_scan_info * scan_info
int num_scans
```

By default, scan\_info is NULL; this causes the compressor to write a single-scan sequential JPEG file. If not NULL, scan\_info points to an array of scan definition records of length num\_scans. The compressor will then write a JPEG file having one scan for each scan definition record. This is used to generate noninterleaved or progressive JPEG files. The library checks that the scan array defines a valid JPEG scan sequence. (jpeg\_simple\_progression creates a suitable scan definition array for progressive JPEG.) This is discussed further under "Progressive JPEG support".

```
boolean do_fancy_downsampling
```

If TRUE, use direct DCT scaling with DCT size > 8 for downsampling of chroma components. If FALSE, use only DCT size <= 8 and simple separate downsampling. Default is TRUE. For better image stability in multiple generation compression cycles it is preferable that this value matches the corresponding do\_fancy\_upsampling value in decompression.

```
int smoothing_factor
```

If non-zero, the input image is smoothed; the value should be 1 for minimal smoothing to 100 for maximum smoothing. Consult jcsample.c for details of the smoothing algorithm. The default is zero.

```
boolean write_JFIF_header
```

If TRUE, a JFIF APP0 marker is emitted. jpeg\_set\_defaults() and jpeg\_set\_colorspace() set this TRUE if a JFIF-legal JPEG color space (ie, YCbCr or grayscale) is selected, otherwise FALSE.

```
UINT8 JFIF_major_version
```

```
UINT8 JFIF_minor_version
```

The version number to be written into the JFIF marker.

jpeg\_set\_defaults() initializes the version to 1.01 (major=minor=1).

You should set it to 1.02 (major=1, minor=2) if you plan to write any JFIF 1.02 extension markers.

UINT8 density\_unit

UINT16 X\_density

UINT16 Y\_density

The resolution information to be written into the JFIF marker; not used otherwise. density\_unit may be 0 for unknown, 1 for dots/inch, or 2 for dots/cm. The default values are 0,1,1 indicating square pixels of unknown size.

boolean write\_Adobe\_marker

If TRUE, an Adobe APP14 marker is emitted. jpeg\_set\_defaults() and jpeg\_set\_colorspace() set this TRUE if JPEG color space RGB, CMYK, or YCCCK is selected, otherwise FALSE. It is generally a bad idea to set both write\_JFIF\_header and write\_Adobe\_marker. In fact, you probably shouldn't change the default settings at all --- the default behavior ensures that the JPEG file's color space can be recognized by the decoder.

JQUANT\_TBL \* quant\_tbl\_ptrs[NUM\_QUANT\_TBLS]

Pointers to coefficient quantization

tables, one per table slot,

or NULL if no table is defined for a slot. Usually these should be set via one of the above helper routines; jpeg\_add\_quant\_table() is general enough to define any quantization table. The other routines will set up table slot 0 for luminance quality and table slot 1 for chrominance.

int q\_scale\_factor[NUM\_QUANT\_TBLS]

Linear quantization scaling factors (percentage, initialized 100)

for use with jpeg\_default\_qtables().

See rdswitch.c and cjpeg.c for an example of usage.

Note that the q\_scale\_factor[] fields are the "linear" scales, so you have to convert from user-defined ratings via jpeg\_quality\_scaling().

Here is an example code which corresponds to cjpeg -quality 90,70:

```
jpeg_set_defaults(cinfo);
```

```
/* Set luminance quality 90. */
```

```
cinfo->q_scale_factor[0] = jpeg_quality_scaling(90);
```

```
/* Set chrominance quality 70. */
```

```
cinfo->q_scale_factor[1] = jpeg_quality_scaling(70);
```

```
jpeg_default_qtables(cinfo, force_baseline);
```

CAUTION:

You must also set 1x1 subsampling for efficient separate color quality selection, since the default value used by library is 2x2:



```
cinfo->comp_info[0].v_samp_factor = 1;
cinfo->comp_info[0].h_samp_factor = 1;
```

JHUFF\_TBL \* dc\_huff\_tbl\_ptrs[NUM\_HUFF\_TBLS]

JHUFF\_TBL \* ac\_huff\_tbl\_ptrs[NUM\_HUFF\_TBLS]

Pointers to Huffman coding tables, one per table slot, or NULL if no table is defined for a slot. Slots 0 and 1 are filled with the JPEG sample tables by `jpeg_set_defaults()`. If you need to allocate more table structures, `jpeg_alloc_huff_table()` may be used. Note that optimal Huffman tables can be computed for an image by setting `optimize_coding`, as discussed above; there's seldom any need to mess with providing your own Huffman tables.

The actual dimensions of the JPEG image that will be written to the file are given by the following fields. These are computed from the input image dimensions and the compression parameters by `jpeg_start_compress()`. You can also call `jpeg_calc_jpeg_dimensions()` to obtain the values that will result from the current parameter settings. This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size.

JDIMENSION jpeg\_width Actual dimensions of output image.

JDIMENSION jpeg\_height

Per-component parameters are stored in the struct `cinfo.comp_info[i]` for component number `i`. Note that components here refer to components of the JPEG color space, \*not\* the source image color space. A suitably large `comp_info[]` array is allocated by `jpeg_set_defaults()`; if you choose not to use that routine, it's up to you to allocate the array.

int component\_id

The one-byte identifier code to be recorded in the JPEG file for this component. For the standard color spaces, we recommend you leave the default values alone.

int h\_samp\_factor

int v\_samp\_factor

Horizontal and vertical sampling factors for the component; must be 1..4 according to the JPEG standard. Note that larger sampling factors

indicate a higher-resolution component; many people find this behavior quite unintuitive. The default values are 2,2 for luminance components and 1,1 for chrominance components, except for grayscale where 1,1 is used.

int quant\_tbl\_no

Quantization table number for component. The default value is 0 for luminance components and 1 for chrominance components.

int dc\_tbl\_no

int ac\_tbl\_no

DC and AC entropy coding table numbers. The default values are 0 for luminance components and 1 for chrominance components.

int component\_index

Must equal the component's index in comp\_info[]. (Beginning in release v6, the compressor library will fill this in automatically; you don't have to.)

#### Decompression parameter selection

-----

Decompression parameter selection is somewhat simpler than compression parameter selection, since all of the JPEG internal parameters are recorded in the source file and need not be supplied by the application. (Unless you are working with abbreviated files, in which case see "Abbreviated datastreams", below.) Decompression parameters control the postprocessing done on the image to deliver it in a format suitable for the application's use. Many of the parameters control speed/quality tradeoffs, in which faster decompression may be obtained at the price of a poorer-quality image. The defaults select the highest quality (slowest) processing.

The following fields in the JPEG object are set by jpeg\_read\_header() and may be useful to the application in choosing decompression parameters:

JDIMENSION image\_width Width and height of image

JDIMENSION image\_height

int num\_components Number of color components

J\_COLOR\_SPACE jpeg\_color\_space Colorspace of image

boolean saw\_JFIF\_marker TRUE if a JFIF APP0 marker was seen

UINT8 JFIF\_major\_version Version information from JFIF marker

UINT8 JFIF\_minor\_version

UINT8 density\_unit Resolution data from JFIF marker

UINT16 X\_density

UINT16 Y\_density

boolean saw\_Adobe\_marker TRUE

if an Adobe APP14 marker was seen

UINT8 Adobe\_transform Color transform code from Adobe marker

The JPEG color space, unfortunately, is something of a guess since the JPEG

standard proper does not provide a way to record it. In practice most files adhere to the JFIF or Adobe conventions, and the decoder will recognize these correctly. See "Special color spaces", below, for more info.

The decompression parameters that determine the basic properties of the returned image are:

`J_COLOR_SPACE out_color_space`

Output color space. `jpeg_read_header()` sets an appropriate default based on `jpeg_color_space`; typically it will be RGB or grayscale. The application can change this field to request output in a different colorspace. For example, set it to `JCS_GRAYSCALE` to get grayscale output from a color file. (This is useful for previewing: grayscale output is faster than full color since the color components need not be processed.) Note that not all possible color space transforms are currently implemented; you may need to extend `jdcolor.c` if you want an unusual conversion.

`unsigned int scale_num, scale_denom`

Scale the image by the fraction `scale_num/scale_denom`. Currently, the supported scaling ratios are  $M/N$  with all  $M$  from 1 to 16, where  $N$  is the source DCT size, which is 8 for baseline JPEG. (The library design allows for arbitrary scaling ratios but this is not likely to be implemented any time soon.) The values are initialized by `jpeg_read_header()` with the source DCT size. For baseline JPEG this is 8/8. If you change only the `scale_num` value while leaving the other unchanged, then this specifies the DCT scaled size to be applied on the given input. For baseline JPEG this is equivalent to  $M/8$  scaling, since the source DCT size for baseline JPEG is 8. Smaller scaling ratios permit significantly faster decoding since fewer pixels need be processed and a simpler IDCT method can be used.

`boolean quantize_colors`

If set TRUE, colormapped output will be delivered. Default is FALSE, meaning that full-color output will be delivered.

The next three parameters are relevant only if `quantize_colors` is TRUE.

`int desired_number_of_colors`

Maximum number of colors to use in generating a library-supplied color map (the actual number of colors is returned in a different field). Default 256. Ignored when the application supplies its own color map.

`boolean two_pass_quantize`

If TRUE, an extra pass over the image is made to select a custom color

map for the image. This usually looks a lot better than the one-size-fits-all colormap that is used otherwise. Default is TRUE. Ignored when the application supplies its own color map.

J\_DITHER\_MODE dither\_mode

Selects color dithering method. Supported values are:

JDITHER\_NONE no dithering: fast, very low quality

JDITHER\_ORDERED ordered dither: moderate speed and quality

JDITHER\_FS Floyd-Steinberg dither: slow, high quality

Default is JDITHER\_FS.

(At present, ordered dither is implemented

only in the single-pass, standard-colormap case. If you ask for ordered dither when two\_pass\_quantize is TRUE or when you supply an external color map, you'll get F-S dithering.)

When quantize\_colors is TRUE, the target color map is described by the next two fields. colormap is set to NULL by jpeg\_read\_header(). The application can supply a color map by setting colormap non-NULL and setting actual\_number\_of\_colors to the map size. Otherwise, jpeg\_start\_decompress() selects a suitable color map and sets these two fields itself.

[Implementation restriction: at present, an externally supplied colormap is only accepted for 3-component output color spaces.]

JSAMPARRAY colormap

The color map, represented as a 2-D pixel array of out\_color\_components rows and actual\_number\_of\_colors columns. Ignored if not quantizing.

CAUTION: if the JPEG library creates its own colormap, the storage pointed to by this field is released by jpeg\_finish\_decompress().

Copy

the colormap somewhere else first, if you want to save it.

int actual\_number\_of\_colors

The number of colors in the color map.

Additional decompression parameters that the application may set include:

J\_DCT\_METHOD dct\_method

Selects the algorithm used for the DCT step. Choices are the same as described above for compression.

boolean do\_fancy\_upsampling

If TRUE, use direct DCT scaling with DCT size > 8 for upsampling of chroma components.

If FALSE, use only DCT size <= 8 and simple separate upsampling.

Default is TRUE.

For better image stability in multiple generation compression cycles it is preferable that this value matches the corresponding do\_fancy\_downsampling value in compression.

boolean do\_block\_smoothing

If TRUE, interblock smoothing is applied in early stages of decoding progressive JPEG files; if FALSE, not. Default is TRUE. Early progression stages look "fuzzy" with smoothing, "blocky" without.

In any case, block smoothing ceases to

be applied after the first few

AC coefficients are known to full accuracy, so it is relevant only when using buffered-image mode for progressive images.

boolean enable\_1pass\_quant

boolean enable\_external\_quant

boolean enable\_2pass\_quant

These are significant only in buffered-image mode, which is described in its own section below.

The output image dimensions are given by the following fields. These are computed from the source image dimensions and the decompression parameters by jpeg\_start\_decompress(). You can also call jpeg\_calc\_output\_dimensions() to obtain the values that will result from the current parameter settings.

This can be useful if you are trying to pick a scaling ratio that will get close to a desired target size. It's also important if you are using the JPEG library's memory manager to allocate output buffer space, because you are supposed to request such buffers *\*before\** jpeg\_start\_decompress().

JDIMENSION output\_width Actual dimensions of output image.

JDIMENSION

output\_height

int out\_color\_components Number of color components in out\_color\_space.

int output\_components Number of color components returned.

int rec\_outbuf\_height Recommended height of scanline buffer.

When quantizing colors, output\_components is 1, indicating a single color map index per pixel. Otherwise it equals out\_color\_components. The output arrays are required to be output\_width \* output\_components JSAMPLEs wide.

rec\_outbuf\_height is the recommended minimum height (in scanlines) of the buffer passed to jpeg\_read\_scanlines(). If the buffer is smaller, the library will still work, but time will be wasted due to unnecessary data copying. In high-quality modes, rec\_outbuf\_height is always 1, but some faster, lower-quality modes set it to larger values (typically 2 to 4).

If you are going to ask for a high-speed processing mode, you may as well go to the trouble of honoring rec\_outbuf\_height so as to avoid data copying.

(An output buffer larger than rec\_outbuf\_height

lines is OK, but won't

provide any material speed improvement over that height.)

## Special color spaces

-----

The JPEG standard itself is "color blind" and doesn't specify any particular color space. It is customary to convert color data to a luminance/chrominance color space before compressing, since this permits greater compression. The existing JPEG file interchange format standards specify YCbCr or GRAYSCALE data (JFIF version 1), GRAYSCALE, RGB, YCbCr, CMYK, or YCCK (Adobe), or BG\_RGB or BG\_YCC (big gamut color spaces, JFIF version 2). For special applications such as multispectral images, other color spaces can be used, but it must be understood that such files will be unportable.

The JPEG library can handle the most common colorspace conversions (namely RGB  $\Leftrightarrow$  YCbCr and CMYK  $\Leftrightarrow$  YCCK). It can also deal with data of an unknown color space, passing it through without conversion. If you deal extensively with an unusual color space, you can easily extend the library to understand additional color spaces and perform appropriate conversions.

For compression, the source data's color space is specified by field `in_color_space`. This is transformed to the JPEG file's color space given by `jpeg_color_space`. `jpeg_set_defaults()` chooses a reasonable JPEG color space depending on `in_color_space`, but you can override this by calling `jpeg_set_colorspace()`. Of course you must select a supported transformation. `jpegcolor.c` currently supports the following transformations:

RGB  $\Rightarrow$  YCbCr

RGB  $\Rightarrow$  GRAYSCALE

RGB  $\Rightarrow$  BG\_YCC

YCbCr  $\Rightarrow$  GRAYSCALE

YCbCr  $\Rightarrow$  BG\_YCC

CMYK  $\Rightarrow$  YCCK

plus the null transforms: GRAYSCALE  $\Rightarrow$  GRAYSCALE, RGB  $\Rightarrow$  RGB, BG\_RGB  $\Rightarrow$  BG\_RGB, YCbCr  $\Rightarrow$  YCbCr, BG\_YCC  $\Rightarrow$  BG\_YCC, CMYK  $\Rightarrow$  CMYK, YCCK  $\Rightarrow$  YCCK, and UNKNOWN  $\Rightarrow$  UNKNOWN.

The file interchange format standards (JFIF and Adobe) specify APPn markers that indicate the color space of the JPEG file. It is important to ensure that these are written correctly, or omitted if the JPEG file's color space

is not one of the ones supported by the interchange standards.

`jpeg_set_colorspace()` will set the compression parameters to include or omit the APPn markers properly, so long as it is told the truth about the JPEG color space. For example, if you are writing some random 3-component color space without conversion, don't try to fake out the library by setting `in_color_space` and `jpeg_color_space` to `JCS_YCbCr`; use `JCS_UNKNOWN`.

You may want to write an APPn marker of your own devising to identify the colorspace --- see "Special markers", below.

When told that the color space is UNKNOWN, the library will default to using luminance-quality compression parameters for all color components. You may well want to change these parameters. See the source code for `jpeg_set_colorspace()`, in `jcparam.c`, for details.

For decompression, the JPEG file's color space is given in `jpeg_color_space`, and this is transformed to the output color space `out_color_space`.

`jpeg_read_header`'s setting of `jpeg_color_space`

can be relied on if the file

conforms to JFIF or Adobe conventions, but otherwise it is no better than a

guess. If you know the JPEG file's color space for certain, you can override

`jpeg_read_header`'s guess by setting `jpeg_color_space`. `jpeg_read_header` also

selects a default output color space based on (its guess of) `jpeg_color_space`;

set `out_color_space` to override this. Again, you must select a supported

transformation. `jdcolor.c` currently supports

YCbCr => RGB

YCbCr => GRAYSCALE

BG\_YCC => RGB

BG\_YCC => GRAYSCALE

RGB => GRAYSCALE

GRAYSCALE => RGB

YCCK => CMYK

as well as the null transforms. (Since GRAYSCALE=>RGB is provided, an application can force grayscale JPEGs to look like color JPEGs if it only wants to handle one case.)

The two-pass color quantizer, `jquant2.c`, is specialized to handle RGB data (it weights distances appropriately for RGB colors). You'll need to modify the code if you want to use it for non-RGB output color spaces. Note that `jquant2.c`

is used to map to an application-supplied colormap as well as for the normal two-pass colormap selection process.

CAUTION: it appears that Adobe Photoshop writes inverted data in CMYK JPEG files: 0 represents 100% ink coverage, rather than 0% ink as you'd expect.

This is arguably a bug in Photoshop, but if you need to work with Photoshop

CMYK files, you will have to deal with it in your application. We cannot

"fix" this in the library by inverting the data during the CMYK<=>YCCK

transform, because that would break other applications, notably Ghostscript.

Photoshop versions prior to 3.0 write EPS files containing JPEG-encoded CMYK

data in the same inverted-YCCK representation used in bare JPEG files, but

the surrounding PostScript code performs an inversion using the PS image

operator. I am told that Photoshop 3.0 will write uninverted YCCK in

EPS/JPEG files, and will omit the PS-level inversion. (But the data

polarity used in bare JPEG files will not change in 3.0.) In either case,

the

JPEG library must not invert the data itself, or else Ghostscript would read these EPS files incorrectly.

## Error handling

-----

When the default error handler is used, any error detected inside the JPEG routines will cause a message to be printed on stderr, followed by exit(). You can supply your own error handling routines to override this behavior and to control the treatment of nonfatal warnings and trace/debug messages. The file `example.c` illustrates the most common case, which is to have the application regain control after an error rather than exiting.

The JPEG library never writes any message directly; it always goes through the error handling routines. Three classes of messages are recognized:

- \* Fatal errors: the library cannot continue.
- \* Warnings: the library can continue, but the data is corrupt, and a damaged output image is likely to result.
- \* Trace/informational messages. These come with a trace level indicating the importance of the message;  
you can control the verbosity of the  
program by adjusting the maximum trace level that will be displayed.

You may, if you wish, simply replace the entire JPEG error handling module (`jerror.c`) with your own code. However, you can avoid code duplication by only replacing some of the routines depending on the behavior you need. This is accomplished by calling `jpeg_std_error()` as usual, but then overriding some of the method pointers in the `jpeg_error_mgr` struct, as illustrated by `example.c`.

All of the error handling routines will receive a pointer to the JPEG object (a `j_common_ptr` which points to either a `jpeg_compress_struct` or a `jpeg_decompress_struct`; if you need to tell which, test the `is_decompressor` field). This struct includes a pointer to the error manager struct in its "err" field. Frequently, custom error handler routines will need to access additional data which is not known to the JPEG library or the standard error handler. The most convenient way to do this is to embed either the JPEG object or the `jpeg_error_mgr` struct in a larger structure that contains additional fields; then casting the passed pointer provides access to the additional fields. Again, see `example.c` for one way to do it. (Beginning with IJG version 6b, there is also a void pointer "client\_data" in each JPEG object, which the application can also use to find related data. The library does not touch `client_data` at all.)

The individual methods that you might wish to override are:



`error_exit (j_common_ptr cinfo)`

Receives control for a fatal error. Information sufficient to generate the error message has been stored in `cinfo->err`; call `output_message` to display it. Control must NOT return to the caller; generally this routine will `exit()` or `longjmp()` somewhere. Typically you would override this routine to get rid of the `exit()` default behavior. Note that if you continue processing, you should clean up the JPEG object with `jpeg_abort()` or `jpeg_destroy()`.

`output_message`

`(j_common_ptr cinfo)`

Actual output of any JPEG message. Override this to send messages somewhere other than `stderr`. Note that this method does not know how to generate a message, only where to send it.

`format_message (j_common_ptr cinfo, char * buffer)`

Constructs a readable error message string based on the error info stored in `cinfo->err`. This method is called by `output_message`. Few applications should need to override this method. One possible reason for doing so is to implement dynamic switching of error message language.

`emit_message (j_common_ptr cinfo, int msg_level)`

Decide whether or not to emit a warning or trace message; if so, calls `output_message`. The main reason for overriding this method would be to abort on warnings. `msg_level` is -1 for warnings, 0 and up for trace messages.

Only `error_exit()` and `emit_message()` are called from the rest of the JPEG library; the other two are internal to the error handler.

The actual message texts are stored in an array of strings which is pointed to by the field `err->jpeg_message_table`. The messages are numbered from 0 to `err->last_jpeg_message`, and it is these code numbers that are used in the JPEG library code. You could replace the message texts (for instance, with messages in French or German) by changing the message table pointer. See `jerror.h` for the default texts. CAUTION: this table will almost certainly change or grow from one library version to the next.

It may be useful for an application to add its own message texts that are handled by the same mechanism. The error handler supports a second "add-on" message table for this purpose. To define an addon table, set the pointer `err->addon_message_table` and the message numbers `err->first_addon_message` and `err->last_addon_message`. If you number the addon messages beginning at 1000 or so, you won't have to worry about conflicts with the library's built-in messages. See the sample applications `cjpeg/djpeg` for an example of using addon

messages (the addon messages are defined in `cderror.h`).

Actual invocation of the error handler is done via macros defined in `jerror.h`:

`ERREXITn(...)` for fatal errors

`WARNMSn(...)` for corrupt-data warnings

`TRACEMSn(...)` for trace and informational messages.

These macros store the message code and any additional parameters into the error handler struct, then invoke the `error_exit()` or `emit_message()` method.

The variants of each macro are for varying numbers of additional parameters.

The additional parameters are inserted into the generated message using standard `printf()` format codes.

See `jerror.h` and `jerror.c` for further details.

Compressed data handling (source and destination managers)

-----

The JPEG compression library sends its compressed data to a "destination manager" module. The default destination manager just writes the data to a memory buffer or to a stdio stream, but you can provide your own manager to do something

else. Similarly, the decompression library calls a "source manager" to obtain the compressed data; you can provide your own source manager if you want the data to come from somewhere other than a memory buffer or a stdio stream.

In both cases, compressed data is processed a bufferload at a time: the destination or source manager provides a work buffer, and the library invokes the manager only when the buffer is filled or emptied. (You could define a one-character buffer to force the manager to be invoked for each byte, but that would be rather inefficient.) The buffer's size and location are controlled by the manager, not by the library. For example, the memory source manager just makes the buffer pointer and length point to the original data in memory. In this case the buffer-reload procedure will be invoked only if the decompressor ran off the end of the datastream, which would indicate an erroneous datastream.

The work buffer is defined as an array of datatype `JOCTET`, which is generally

"char" or "unsigned char". On a machine where char is not exactly 8 bits wide, you must define `JOCTET` as a wider data type and then modify the data source and destination modules to transcribe the work arrays into 8-bit units on external storage.

A data destination manager struct contains a pointer and count defining the next byte to write in the work buffer and the remaining free space:

```
JOCTET * next_output_byte; /* => next byte to write in buffer */
size_t free_in_buffer; /* # of byte spaces remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is filled. The manager's `empty_output_buffer` method must reset the pointer and count. The manager is expected to remember the buffer's starting address and total size in private fields not visible to the library.

A data destination manager provides three methods:

`init_destination (j_compress_ptr cinfo)`

Initialize destination. This is called by `jpeg_start_compress()` before any data is actually written. It must initialize `next_output_byte` and `free_in_buffer`. `free_in_buffer` must be initialized to a positive value.

`empty_output_buffer (j_compress_ptr cinfo)`

This is called whenever the buffer has filled (`free_in_buffer` reaches zero). In typical applications, it should write out the *entire* buffer (use the saved start address and buffer length; ignore the current state of `next_output_byte` and `free_in_buffer`). Then reset the pointer & count to the start of the buffer, and return `TRUE` indicating that the buffer has been dumped. `free_in_buffer` must be set to a positive value when `TRUE` is returned. A `FALSE` return should only be used when I/O suspension is desired (this operating mode is discussed in the next section).

`term_destination (j_compress_ptr cinfo)`

Terminate destination --- called by `jpeg_finish_compress()` after all data has been written. In most applications, this must flush any data remaining in the buffer. Use either `next_output_byte` or `free_in_buffer` to determine how much data is in the buffer.

`term_destination()` is NOT called by `jpeg_abort()` or `jpeg_destroy()`. If you want the destination manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a `jpeg_destination_mgr` struct, fill in its method pointers, and insert a pointer to the struct into the "dest" field of the JPEG compression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the `jpeg_stdio_dest()` or `jpeg_mem_dest()` routines of the supplied destination managers.

Decompression source managers follow a parallel design, but with some additional frammishes. The source manager struct contains a pointer and count

defining the next byte to read from the work buffer and the number of bytes remaining:

```
const JOCTET * next_input_byte; /* => next byte to read from buffer */
size_t bytes_in_buffer; /* # of bytes
remaining in buffer */
```

The library increments the pointer and decrements the count until the buffer is emptied. The manager's `fill_input_buffer` method must reset the pointer and count. In most applications, the manager must remember the buffer's starting address and total size in private fields not visible to the library.

A data source manager provides five methods:

`init_source (j_decompress_ptr cinfo)`

Initialize source. This is called by `jpeg_read_header()` before any data is actually read. Unlike `init_destination()`, it may leave `bytes_in_buffer` set to 0 (in which case a `fill_input_buffer()` call will occur immediately).

`fill_input_buffer (j_decompress_ptr cinfo)`

This is called whenever `bytes_in_buffer` has reached zero and more data is wanted. In typical applications, it should read fresh data into the buffer (ignoring the current state of `next_input_byte` and `bytes_in_buffer`), reset the pointer & count to the start of the buffer, and return TRUE indicating that the buffer has been reloaded.

It is not necessary to fill the buffer entirely, only to obtain at least one more byte. `bytes_in_buffer` MUST be set to a positive value if TRUE is returned. A FALSE return should only be used when I/O suspension is desired (this mode is discussed in the next section).

`skip_input_data (j_decompress_ptr cinfo, long num_bytes)`

Skip `num_bytes` worth of data. The buffer pointer and count should be advanced over `num_bytes` input bytes, refilling the buffer as needed. This is used to skip over a potentially large amount of uninteresting data (such as an APPn marker). In some applications it may be possible to optimize away the reading of the skipped data, but it's not clear that being smart is worth much trouble; large skips are uncommon. `bytes_in_buffer` may be zero on return. A zero or negative skip count should be treated as a no-op.

`resync_to_restart (j_decompress_ptr cinfo, int desired)`

This routine is called only when the decompressor has failed to find a restart (RSTn) marker where one is expected. Its mission is to find a suitable point for resuming decompression. For most applications, we recommend that you just use the default resync

procedure, `jpeg_resync_to_restart()`. However, if you are able to back up in the input data stream, or if you have a-priori knowledge about the likely location of restart markers, you may be able to do better. Read the `read_restart_marker()` and `jpeg_resync_to_restart()` routines in `jdmarker.c` if you think you'd like to implement your own resync procedure.

`term_source (j_decompress_ptr cinfo)`

Terminate source --- called by `jpeg_finish_decompress()` after all data has been read. Often a no-op.

For both `fill_input_buffer()` and `skip_input_data()`, there is no such thing as an EOF return. If the end of the file has been reached, the routine has a choice of exiting via `ERREXIT()` or inserting fake data into the buffer. In most cases, generating a warning message and inserting a fake EOI marker is the best course of action --- this will allow the decompressor to output however much of the image is there. In pathological cases, the decompressor may swallow the EOI and again demand data ... just keep feeding it fake EOIs. `jdatsrc.c` illustrates the recommended error recovery behavior.

`term_source()` is NOT called by `jpeg_abort()` or `jpeg_destroy()`. If you want the source manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a `jpeg_source_mgr` struct, fill in its method pointers, and insert a pointer to the struct into the "src" field of the JPEG decompression object. This can be done in-line in your setup code if you like, but it's probably cleaner to provide a separate routine similar to the `jpeg_stdio_src()` or `jpeg_mem_src()` routines of the supplied source managers.

For more information, consult the memory and stdio source and destination managers in `jdatsrc.c` and `jdadst.c`.

## I/O suspension

-----

### Some applications

need to use the JPEG library as an incremental memory-to-memory filter: when the compressed data buffer is filled or emptied, they want control to return to the outer loop, rather than expecting that the buffer can be emptied or reloaded within the data source/destination manager subroutine. The library supports this need by providing an "I/O suspension" mode, which we describe in this section.

The I/O suspension mode is not a panacea: nothing is guaranteed about the maximum amount of time spent in any one call to the library, so it will not eliminate response-time problems in single-threaded applications. If you

need guaranteed response time, we suggest you "bite the bullet" and implement a real multi-tasking capability.

To use I/O suspension, cooperation is needed between the calling application and the data source or destination manager; you will always need a custom source/destination manager. (Please read the previous section if you haven't already.) The basic idea

is that the `empty_output_buffer()` or `fill_input_buffer()` routine is a no-op, merely returning `FALSE` to indicate that it has done nothing. Upon seeing this, the JPEG library suspends operation and returns to its caller. The surrounding application is responsible for emptying or refilling the work buffer before calling the JPEG library again.

Compression suspension:

For compression suspension, use an `empty_output_buffer()` routine that returns `FALSE`; typically it will not do anything else. This will cause the compressor to return to the caller of `jpeg_write_scanlines()`, with the return value indicating that not all the supplied scanlines have been accepted. The application must make more room in the output buffer, adjust the output buffer pointer/count appropriately, and then call `jpeg_write_scanlines()` again, pointing to the first unconsumed scanline.

When forced to suspend, the compressor will backtrack to a convenient stopping point (usually the start of the current MCU); it will regenerate some output data when restarted. Therefore, although `empty_output_buffer()` is only called when the buffer is filled, you should NOT write out the entire buffer after a suspension. Write only the data up to the current position of `next_output_byte/free_in_buffer`. The data beyond that point will be regenerated after resumption.

Because of the backtracking behavior, a good-size output buffer is essential for efficiency; you don't want the compressor to suspend often. (In fact, an overly small buffer could lead to infinite looping, if a single MCU required more data than would fit in the buffer.) We recommend a buffer of at least several Kbytes. You may want to insert explicit code to ensure that you don't call `jpeg_write_scanlines()` unless there is a reasonable amount of space in the output buffer; in other words, flush the buffer before trying to compress more data.

The compressor does not allow suspension while it is trying to write JPEG markers at the beginning and end of the file. This means that:

- \* At the beginning of a compression operation, there must be enough free space in the output buffer to hold the header markers (typically 600 or so bytes). The recommended buffer size is bigger than this anyway, so

this is not a problem as long as you start with an empty buffer. However, this restriction might catch you if you insert large special markers, such as a JFIF thumbnail image, without flushing the buffer afterwards.

\* When you call `jpeg_finish_compress()`, there must be enough space in the output buffer to emit any buffered data and the final EOI marker. In the current implementation, half a dozen bytes should suffice for this, but for safety's sake we recommend ensuring that at least 100 bytes are free before calling `jpeg_finish_compress()`.

A more significant restriction is that `jpeg_finish_compress()` cannot suspend. This means you cannot use suspension with multi-pass operating modes, namely Huffman

code optimization and multiple-scan output. Those modes write the whole file during `jpeg_finish_compress()`, which will certainly result in buffer overrun. (Note that this restriction applies only to compression, not decompression. The decompressor supports input suspension in all of its operating modes.)

Decompression suspension:

For decompression suspension, use a `fill_input_buffer()` routine that simply returns `FALSE` (except perhaps during error recovery, as discussed below). This will cause the decompressor to return to its caller with an indication that suspension has occurred. This can happen at four places:

- \* `jpeg_read_header()`: will return `JPEG_SUSPENDED`.
- \* `jpeg_start_decompress()`: will return `FALSE`, rather than its usual `TRUE`.
- \* `jpeg_read_scanlines()`: will return the number of scanlines already completed (possibly 0).
- \* `jpeg_finish_decompress()`: will return `FALSE`, rather than its usual `TRUE`.

The surrounding application must recognize these cases, load more data into

the input buffer, and repeat the call. In the case of `jpeg_read_scanlines()`, increment the passed pointers past any scanlines successfully read.

Just as with compression, the decompressor will typically backtrack to a convenient restart point before suspending. When `fill_input_buffer()` is called, `next_input_byte/bytes_in_buffer` point to the current restart point, which is where the decompressor will backtrack to if `FALSE` is returned. The data beyond that position must NOT be discarded if you suspend; it needs to be re-read upon resumption. In most implementations, you'll need to shift this data down to the start of your work buffer and then load more data after it. Again, this behavior means that a several-Kbyte work buffer is essential for decent performance; furthermore, you should load a reasonable amount of new data before resuming decompression. (If you loaded, say, only one new byte each time around, you could waste a LOT of cycles.)

The `skip_input_data()` source manager

routine requires special care in a suspension scenario. This routine is NOT granted the ability to suspend the decompressor; it can decrement `bytes_in_buffer` to zero, but no more. If the requested skip distance exceeds the amount of data currently in the input buffer, then `skip_input_data()` must set `bytes_in_buffer` to zero and record the additional skip distance somewhere else. The decompressor will immediately call `fill_input_buffer()`, which should return `FALSE`, which will cause a suspension return. The surrounding application must then arrange to discard the recorded number of bytes before it resumes loading the input buffer. (Yes, this design is rather baroque, but it avoids complexity in the far more common case where a non-suspending source manager is used.)

If the input data has been exhausted, we recommend that you emit a warning and insert dummy EOI markers just as a non-suspending data source manager would do. This can be handled either in the surrounding application logic or within `fill_input_buffer()`; the latter is probably more efficient. If `fill_input_buffer()` knows that no more data is available, it can set the pointer/count to point to a dummy EOI marker and then return `TRUE` just as though it had read more data in a non-suspending situation.

The decompressor does not attempt to suspend within standard JPEG markers; instead it will backtrack to the start of the marker and reprocess the whole marker next time. Hence the input buffer must be large enough to hold the longest standard marker in the file. Standard JPEG markers should normally not exceed a few hundred bytes each (DHT tables are typically the longest). We recommend at least a 2K buffer for performance reasons, which is much larger than any correct marker is likely to be. For robustness against damaged marker length counts, you may wish to insert a test in your application for the case that the input buffer is completely full and yet the decoder has suspended without consuming any data --- otherwise, if this situation did occur, it would lead to an endless loop. (The library can't provide this test since it has no idea whether "the buffer is full", or even whether there is a fixed-size input buffer.)

The input buffer would need to be 64K to allow for arbitrary COM or APPn markers, but these are handled specially: they are either saved into allocated memory, or skipped over by calling `skip_input_data()`. In the former case, suspension is handled correctly, and in the latter case, the problem of buffer overrun is placed on `skip_input_data`'s shoulders, as explained above. Note that if you provide your own marker handling routine for large markers, you should consider how to deal with buffer overflow.

Multiple-buffer management:

In some applications it is desirable to store the compressed data in a linked list of buffer areas, so as to avoid data copying. This can be handled by



having `empty_output_buffer()` or `fill_input_buffer()` set the pointer and count to

reference the next available buffer; `FALSE` is returned only if no more buffers are available. Although seemingly straightforward, there is a pitfall in this approach: the backtrack that occurs when `FALSE` is returned could back up into an earlier buffer. For example, when `fill_input_buffer()` is called, the current pointer & count indicate the backtrack restart point. Since `fill_input_buffer()` will set the pointer and count to refer to a new buffer, the restart position must be saved somewhere else. Suppose a second call to `fill_input_buffer()` occurs in the same library call, and no additional input data is available, so `fill_input_buffer` must return `FALSE`. If the JPEG library has not moved the pointer/count forward in the current buffer, then \*the correct restart point is the saved position in the prior buffer\*. Prior buffers may be discarded only after the library establishes a restart point within a later buffer. Similar remarks apply for output into a chain of buffers.

The library

will never attempt to backtrack over a `skip_input_data()` call, so any skipped data can be permanently discarded. You still have to deal with the case of skipping not-yet-received data, however.

It's much simpler to use only a single buffer; when `fill_input_buffer()` is called, move any unconsumed data (beyond the current pointer/count) down to the beginning of this buffer and then load new data into the remaining buffer space. This approach requires a little more data copying but is far easier to get right.

Progressive JPEG support

-----

Progressive JPEG rearranges the stored data into a series of scans of increasing quality. In situations where a JPEG file is transmitted across a slow communications link, a decoder can generate a low-quality image very quickly from the first scan, then gradually improve the displayed quality as more scans are received. The final image after all scans are complete is identical to that of a regular (sequential) JPEG file of the same quality setting. Progressive JPEG files are often slightly smaller than equivalent sequential JPEG files, but the possibility of incremental display is the main reason for using progressive JPEG.

The IJG encoder library generates progressive JPEG files when given a suitable "scan script" defining how to divide the data into scans. Creation of progressive JPEG files is otherwise transparent to the encoder. Progressive JPEG files can also be read transparently by the decoder library. If the decoding application simply uses the library as defined above, it

will receive a final decoded image without any indication that the file was progressive. Of course, this approach does not allow incremental display. To perform incremental display, an application needs to use the decoder library's "buffered-image" mode, in which it receives a decoded image multiple times.

Each displayed scan requires about as much work to decode as a full JPEG image of the same size, so the decoder must be fairly fast in relation to the data transmission rate in order to make incremental display useful. However, it is possible to skip displaying the image and simply add the incoming bits to the decoder's coefficient buffer. This is fast because only Huffman decoding need be done, not IDCT, upsampling, colorspace conversion, etc. The IJG decoder library allows the application to switch dynamically between displaying the image and simply absorbing the incoming bits. A properly coded application can automatically adapt the number of display passes to suit the time available as the image is received. Also, a final higher-quality display cycle can be performed from the buffered data after the end of the file is reached.

Progressive compression:

To create a progressive JPEG file (or a multiple-scan sequential JPEG file), set the scan\_info cinfo field to point to an array of scan descriptors, and perform compression as usual. Instead of constructing your own scan list, you can call the

jpeg\_simple\_progression() helper routine to create a recommended progression sequence; this method should be used by all applications that don't want to get involved in the nitty-gritty of progressive scan sequence design. (If you want to provide user control of scan sequences, you may wish to borrow the scan script reading code found in rdswitch.c, so that you can read scan script files just like cjpeg's.)

When scan\_info is not NULL, the compression library will store DCT'd data into a buffer array as jpeg\_write\_scanlines() is called, and will emit all the requested scans during jpeg\_finish\_compress(). This implies that multiple-scan output cannot be created with a suspending data destination manager, since jpeg\_finish\_compress() does not support suspension. We should also note that the compressor currently forces Huffman optimization mode when creating a progressive JPEG file, because the default Huffman tables are unsuitable for progressive files.

Progressive decompression:

When

buffered-image mode is not used, the decoder library will read all of a multi-scan file during jpeg\_start\_decompress(), so that it can provide a final decoded image. (Here "multi-scan" means either progressive or multi-scan sequential.) This makes multi-scan files transparent to the

decoding application. However, existing applications that used suspending input with version 5 of the IJG library will need to be modified to check for a suspension return from `jpeg_start_decompress()`.

To perform incremental display, an application must use the library's buffered-image mode. This is described in the next section.

#### Buffered-image mode

-----

In buffered-image mode, the library stores the partially decoded image in a coefficient buffer, from which it can be read out as many times as desired. This mode is typically used for incremental display of progressive JPEG files, but it can be used with any JPEG file. Each scan of a progressive JPEG file adds more data (more detail) to the buffered image. The application can display in lockstep with the source file (one display pass per input scan), or it can allow input processing to outrun display processing. By making input and display processing run independently, it is possible for the application to adapt progressive display to a wide range of data transmission rates.

The basic control flow for buffered-image decoding is

```
jpeg_create_decompress()
set data source
jpeg_read_header()
set overall decompression parameters
cinfo.buffered_image = TRUE; /* select buffered-image mode */
jpeg_start_decompress()
for (each output pass) {
 adjust output decompression parameters if required
 jpeg_start_output() /* start a new output pass */
 for (all scanlines in image) {
 jpeg_read_scanlines()
 display scanlines
 }
 jpeg_finish_output() /* terminate output pass */
}
jpeg_finish_decompress()
jpeg_destroy_decompress()
```

This differs from ordinary unbuffered decoding in that there is an additional level of looping. The application can choose how many output passes to make and how to display each pass.

The simplest approach to displaying progressive images is to do one display pass for each scan appearing in the input file. In this case the outer loop condition is typically

```
while (! jpeg_input_complete(&cinfo))
```

and the start-output call should read

```
jpeg_start_output(&cinfo, cinfo.input_scan_number);
```

The second parameter to `jpeg_start_output()` indicates which scan of the input file is to be displayed; the scans are numbered starting at 1 for this purpose. (You can use a loop counter starting at 1 if you like, but using the library's input scan counter is easier.) The library automatically reads data as necessary to complete each requested scan, and `jpeg_finish_output()` advances to the next scan or end-of-image marker (hence `input_scan_number` will be incremented by the time control arrives back at `jpeg_start_output()`).

With this technique, data is

read from the input file only as needed, and

input and output processing run in lockstep.

After reading the final scan and reaching the end of the input file, the buffered image remains available; it can be read additional times by repeating the `jpeg_start_output()/jpeg_read_scanlines()/jpeg_finish_output()` sequence. For example, a useful technique is to use fast one-pass color quantization for display passes made while the image is arriving, followed by a final display pass using two-pass quantization for highest quality. This is done by changing the library parameters before the final output pass. Changing parameters between passes is discussed in detail below.

In general the last scan of a progressive file cannot be recognized as such until after it is read, so a post-input display pass is the best approach if you want special processing in the final pass.

When done with the image, be sure to call `jpeg_finish_decompress()` to release the buffered image (or just use `jpeg_destroy_decompress()`).

If

input data arrives faster than it can be displayed, the application can cause the library to decode input data in advance of what's needed to produce output. This is done by calling the routine `jpeg_consume_input()`.

The return value is one of the following:

`JPEG_REACHED_SOS`: reached an SOS marker (the start of a new scan)

`JPEG_REACHED_EOI`: reached the EOI marker (end of image)

`JPEG_ROW_COMPLETED`: completed reading one MCU row of compressed data

`JPEG_SCAN_COMPLETED`: completed reading last MCU row of current scan

`JPEG_SUSPENDED`: suspended before completing any of the above

(`JPEG_SUSPENDED` can occur only if a suspending data source is used.) This

routine can be called at any time after initializing the JPEG object. It

reads some additional data and returns when one of the indicated significant

events occurs. (If called after the EOI marker is reached, it will

immediately return `JPEG_REACHED_EOI` without attempting to read more data.)

The library's

output processing will automatically call `jpeg_consume_input()` whenever the output processing overtakes the input; thus, simple lockstep display requires no direct calls to `jpeg_consume_input()`. But by adding calls to `jpeg_consume_input()`, you can absorb data in advance of what is being displayed. This has two benefits:

- \* You can limit buildup of unprocessed data in your input buffer.
- \* You can eliminate extra display passes by paying attention to the state of the library's input processing.

The first of these benefits only requires interspersing calls to `jpeg_consume_input()` with your display operations and any other processing you may be doing. To avoid wasting cycles due to backtracking, it's best to call `jpeg_consume_input()` only after a hundred or so new bytes have arrived. This is discussed further under "I/O suspension", above. (Note: the JPEG library currently is not thread-safe. You must not call `jpeg_consume_input()` from one thread of control if a different library routine is working on the same JPEG object in another thread.)

When input arrives fast enough that more than one new scan is available before you start a new output pass, you may as well skip the output pass corresponding to the completed scan. This occurs for free if you pass `cinfo.input_scan_number` as the target scan number to `jpeg_start_output()`. The `input_scan_number` field is simply the index of the scan currently being consumed by the input processor. You can ensure that this is up-to-date by emptying the input buffer just before calling `jpeg_start_output()`: call `jpeg_consume_input()` repeatedly until it returns `JPEG_SUSPENDED` or `JPEG_REACHED_EOI`.

The target scan number passed to `jpeg_start_output()` is saved in the `cinfo.output_scan_number` field. The library's output processing calls `jpeg_consume_input()` whenever the current input scan number and row within that scan is less than or equal to the current output scan number and row. Thus, input processing can "get ahead" of the output processing but is not allowed to "fall behind". You can achieve several different effects by manipulating this interlock rule. For example, if you pass a target scan number greater than the current input scan number, the output processor will wait until that scan starts to arrive before producing any output. (To avoid an infinite loop, the target scan number is automatically reset to the last scan number when the end of image is reached. Thus, if you specify a large target scan number, the library will just absorb the entire input file and then perform an output pass. This is effectively the same as what `jpeg_start_decompress()` does when you don't select buffered-image mode.) When you pass a target scan number equal to the current input scan number, the image is displayed no faster than the current input scan arrives. The

final possibility is to pass a target scan number less than the current input scan number; this disables the input/output interlock and causes the output processor

to simply display whatever it finds in the image buffer, without waiting for input. (However, the library will not accept a target scan number less than one, so you can't avoid waiting for the first scan.)

When data is arriving faster than the output display processing can advance through the image, `jpeg_consume_input()` will store data into the buffered image beyond the point at which the output processing is reading data out again. If the input arrives fast enough, it may "wrap around" the buffer to the point where the input is more than one whole scan ahead of the output. If the output processing simply proceeds through its display pass without paying attention to the input, the effect seen on-screen is that the lower part of the image is one or more scans better in quality than the upper part. Then, when the next output scan is started, you have a choice of what target scan number to use. The recommended choice is to use the current input scan number at that time,

which implies that you've skipped the output scans corresponding to the input scans that were completed while you processed the previous output scan. In this way, the decoder automatically adapts its speed to the arriving data, by skipping output scans as necessary to keep up with the arriving data.

When using this strategy, you'll want to be sure that you perform a final output pass after receiving all the data; otherwise your last display may not be full quality across the whole screen. So the right outer loop logic is something like this:

```
do {
 absorb any waiting input by calling jpeg_consume_input()
 final_pass = jpeg_input_complete(&cinfo);
 adjust output decompression parameters if required
 jpeg_start_output(&cinfo, cinfo.input_scan_number);
 ...
 jpeg_finish_output()
} while (! final_pass);
```

rather than quitting as soon as `jpeg_input_complete()` returns TRUE. This arrangement makes it simple to use higher-quality decoding parameters for the final pass.

But if you don't want to use special parameters for the final pass, the right loop logic is like this:

```
for (;;) {
 absorb any waiting input by calling jpeg_consume_input()
 jpeg_start_output(&cinfo, cinfo.input_scan_number);
 ...
 jpeg_finish_output()
 if (jpeg_input_complete(&cinfo) &&
 cinfo.input_scan_number == cinfo.output_scan_number)
```

```
break;
}
```

In this case you don't need to know in advance whether an output pass is to be the last one, so it's not necessary to have reached EOF before starting the final output pass; rather, what you want to test is whether the output pass was performed in sync with the final input scan. This form of the loop will avoid an extra output pass whenever the decoder is able (or nearly able) to keep up with the incoming data.

When the data transmission speed is high, you might begin a display pass, then find that much or all of the file has arrived before you can complete the pass. (You can detect this by noting the JPEG\_REACHED\_EOI return code from jpeg\_consume\_input(), or equivalently by testing jpeg\_input\_complete().) In this situation you may wish to abort the current display pass and start a new one using the newly arrived information. To do so, just call jpeg\_finish\_output() and then start a new pass with jpeg\_start\_output().

A variant strategy is to abort and restart display if more than one complete scan arrives during an output pass; this can be detected by noting JPEG\_REACHED\_SOS returns and/or examining cinfo.input\_scan\_number. This idea should be employed with caution, however, since the display process might never get to the bottom of the image before being aborted, resulting in the lower part of the screen being several passes worse than the upper. In most cases it's probably best to abort an output pass only if the whole file has arrived and you want to begin the final output pass immediately.

When receiving data across a communication link, we recommend always using the current input scan number for the output target scan number; if a higher-quality final pass is to be done, it should be started (aborting any incomplete output pass) as soon as the end of file is received. However, many other strategies are possible. For example, the application can examine the parameters of the current input scan and decide whether to display it or not. If the scan contains only chroma data, one might choose not to use it as the target scan, expecting that the scan will be small and will arrive quickly. To skip to the next scan, call jpeg\_consume\_input() until it returns JPEG\_REACHED\_SOS or JPEG\_REACHED\_EOI. Or just use the next higher number as the target scan for jpeg\_start\_output(); but that method doesn't let you inspect the next scan's parameters before deciding to display it.

In buffered-image mode, jpeg\_start\_decompress() never performs input and thus never suspends. An application that uses input suspension with buffered-image mode must be prepared for suspension returns from these routines:

- \* jpeg\_start\_output() performs input only if you request 2-pass quantization

and the target scan isn't fully read yet. (This is discussed below.)

- \* `jpeg_read_scanlines()`, as always, returns the number of scanlines that it was able to produce before suspending.

- \* `jpeg_finish_output()` will read any markers following the target scan, up to the end of the file or the SOS marker that begins another scan. (But it reads no input if `jpeg_consume_input()` has already reached the end of the file or a SOS marker beyond the target output scan.)

- \* `jpeg_finish_decompress()` will read until the end of file, and thus can suspend if the end hasn't already been reached (as can be tested by calling `jpeg_input_complete()`).

`jpeg_start_output()`, `jpeg_finish_output()`, and `jpeg_finish_decompress()` all return TRUE if they completed their tasks, FALSE if they had to suspend.

In the event of a FALSE return, the application must load more input data and repeat the

call. Applications that use non-suspending data sources need

not check the return values of these three routines.

It is possible to change decoding parameters between output passes in the buffered-image mode. The decoder library currently supports only very limited changes of parameters. ONLY THE FOLLOWING parameter changes are allowed after `jpeg_start_decompress()` is called:

- \* `dct_method` can be changed before each call to `jpeg_start_output()`.

For example, one could use a fast DCT method for early scans, changing to a higher quality method for the final scan.

- \* `dither_mode` can be changed before each call to `jpeg_start_output()`;

of course this has no impact if not using color quantization. Typically one would use ordered dither for initial passes, then switch to Floyd-Steinberg dither for the final pass. Caution: changing dither mode can cause more memory to be allocated by the library. Although the amount of memory involved is not large (a scanline or so), it may cause the

initial `max_memory_to_use` specification to be exceeded, which in the worst case would result in an out-of-memory failure.

- \* `do_block_smoothing` can be changed before each call to `jpeg_start_output()`.

This setting is relevant only when decoding a progressive JPEG image.

During the first DC-only scan, block smoothing provides a very "fuzzy" look instead of the very "blocky" look seen without it; which is better seems a matter of personal taste. But block smoothing is nearly always a win during later stages, especially when decoding a successive-approximation image: smoothing helps to hide the slight blockiness that otherwise shows up on smooth gradients until the lowest coefficient bits are sent.

- \* Color quantization mode can be changed under the rules described below.

You *cannot* change between full-color and quantized output (because that would alter the required I/O buffer sizes), but you can change which quantization method is used.

When generating



color-quantized output, changing quantization method is a very useful way of switching between high-speed and high-quality display.

The library allows you to change among its three quantization methods:

1. Single-pass quantization to a fixed color cube.

Selected by `cinfo.two_pass_quantize = FALSE` and `cinfo.colormap = NULL`.

2. Single-pass quantization to an application-supplied colormap.

Selected by setting `cinfo.colormap` to point to the colormap (the value of `two_pass_quantize` is ignored); also set `cinfo.actual_number_of_colors`.

3. Two-pass quantization to a colormap chosen specifically for the image.

Selected by `cinfo.two_pass_quantize = TRUE` and `cinfo.colormap = NULL`.

(This is the default setting selected by `jpeg_read_header`, but it is probably NOT what you want for the first pass of progressive display!)

These methods offer successively better quality and lesser speed. However, only the first method is available for quantizing in non-RGB color spaces.

#### IMPORTANT:

because the different quantizer methods have very different working-storage requirements, the library requires you to indicate which one(s) you intend to use before you call `jpeg_start_decompress()`. (If we did not require this, the `max_memory_to_use` setting would be a complete fiction.)

You do this by setting one or more of these three `cinfo` fields to TRUE:

`enable_1pass_quant` Fixed color cube colormap

`enable_external_quant` Externally-supplied colormap

`enable_2pass_quant` Two-pass custom colormap

All three are initialized FALSE by `jpeg_read_header()`. But

`jpeg_start_decompress()` automatically sets TRUE the one selected by the current `two_pass_quantize` and `colormap` settings, so you only need to set the enable flags for any other quantization methods you plan to change to later.

After setting the enable flags correctly at `jpeg_start_decompress()` time, you can change to any enabled quantization method by setting `two_pass_quantize` and `colormap` properly just before calling `jpeg_start_output()`.

The following special rules apply:

1. You must explicitly set `cinfo.colormap` to NULL when switching to 1-pass or 2-pass mode from a different mode, or when you want the 2-pass quantizer to be re-run to generate a new colormap.
2. To switch to an external colormap, or to change to a different external colormap than was used on the prior pass, you must call `jpeg_new_colormap()` after setting `cinfo.colormap`.

NOTE: if you want to use the same colormap as was used in the prior pass, you should not do either of these things. This will save some nontrivial switchover costs.

(These requirements exist because `cinfo.colormap` will always be non-NULL after completing a prior output pass, since both the 1-pass and 2-pass quantizers set it to point to their output colormaps. Thus you have to do one of these two things to notify the library that something has changed.

Yup, it's a bit klugy, but it's necessary to do it this way for backwards

compatibility.)

Note that in buffered-image mode, the library generates any requested colormap during `jpeg_start_output()`, not during `jpeg_start_decompress()`.

When using two-pass quantization, `jpeg_start_output()` makes a pass over the buffered image to determine the optimum color map; it therefore may take a significant amount of time, whereas ordinarily it does little work. The progress monitor hook is called during this pass, if defined. It is also important to realize that if the specified target scan number is greater than or equal to the current input scan number, `jpeg_start_output()` will attempt to consume input as it makes this pass. If you use a suspending data source, you need to check for a FALSE return from `jpeg_start_output()` under these conditions. The combination of 2-pass quantization and a not-yet-fully-read target scan is the only case in which `jpeg_start_output()` will consume input.

Application authors who support buffered-image mode may be tempted to use it for all JPEG images, even single-scan ones. This will work, but it is inefficient: there is no need to create an image-sized coefficient buffer for single-scan images. Requesting buffered-image mode for such an image wastes memory. Worse, it can cost time on large images, since the buffered data has to be swapped out or written to a temporary file. If you are concerned about maximum performance on baseline JPEG files, you should use buffered-image mode only when the incoming file actually has multiple scans. This can be tested by calling `jpeg_has_multiple_scans()`, which will return a correct result at any time after `jpeg_read_header()` completes.

It is also worth noting that when you use `jpeg_consume_input()` to let input processing get ahead of output processing, the resulting pattern of access to the coefficient buffer is quite nonsequential. It's best to use the memory manager `jmemnobs.c` if you can (ie, if you have enough real or virtual main memory). If not, at least make sure that `max_memory_to_use` is set as high as possible. If the JPEG memory manager has to use a temporary file, you will probably see a lot of disk traffic and poor performance. (This could be improved with additional work on the memory manager, but we haven't gotten around to it yet.)

In some applications it may be convenient to use `jpeg_consume_input()` for all input processing, including reading the initial markers; that is, you may wish to call `jpeg_consume_input()` instead of `jpeg_read_header()` during startup. This works, but note that you must check for `JPEG_REACHED_SOS` and `JPEG_REACHED_EOI` return codes as the equivalent of `jpeg_read_header's` codes. Once the first SOS marker has been reached, you must call `jpeg_start_decompress()` before `jpeg_consume_input()` will consume more input;

it'll just keep returning JPEG\_REACHED\_SOS until you do. If you read a tables-only file this way, jpeg\_consume\_input() will return JPEG\_REACHED\_EOI without ever returning JPEG\_REACHED\_SOS; be sure to check for this case. If this happens, the decompressor will not read any more input until you call jpeg\_abort() to reset it. It is OK to call jpeg\_consume\_input() even when not using buffered-image mode, but in that case it's basically a no-op after the initial markers have been read: it will just return JPEG\_SUSPENDED.

## Abbreviated datastreams and multiple images

-----

A JPEG compression or decompression object can be reused to process multiple images. This saves a small amount of time per image by eliminating the "create" and "destroy" operations, but that isn't the real purpose of the feature. Rather, reuse of an object provides support for abbreviated JPEG datastreams. Object reuse can also simplify processing a series of images in a single input or output file. This section explains these features.

A JPEG file normally contains several hundred bytes worth of quantization and Huffman tables. In a situation where many images will be stored or transmitted with identical tables, this may represent an annoying overhead.

The JPEG standard therefore permits tables to be omitted. The standard defines three classes of JPEG datastreams:

- \* "Interchange" datastreams contain an image and all tables needed to decode the image. These are the usual kind of JPEG file.
- \* "Abbreviated image" datastreams contain an image, but are missing some or all of the tables needed to decode that image.
- \* "Abbreviated table specification" (henceforth "tables-only") datastreams contain only table specifications.

To decode an abbreviated image, it is necessary to load the missing table(s) into the decoder beforehand. This can be accomplished by reading a separate tables-only file. A variant scheme uses a series of images in which the first image is an interchange (complete) datastream, while subsequent ones are abbreviated and rely on the tables loaded by the first image. It is assumed that once the decoder has read a table, it will remember that table until a new definition for the same table number is encountered.

It is the application designer's responsibility to figure out how to associate the correct tables with an abbreviated image. While abbreviated datastreams can be useful in a closed environment, their use is strongly discouraged in any situation where data exchange with other applications might be needed. Caveat designer.

The JPEG library provides support for reading and writing any combination of

tables-only datastreams and abbreviated images. In both compression and decompression objects, a quantization or Huffman table will be retained for the lifetime of the object, unless it is overwritten by a new table definition.

To create abbreviated image datastreams, it is only necessary to tell the compressor not to emit some or all of the tables it is using. Each quantization and Huffman table struct contains a boolean field "sent\_table", which normally is initialized to FALSE. For each table used by the image, the header-writing

process emits the table and sets sent\_table = TRUE unless it is already TRUE. (In normal usage, this prevents outputting the same table definition multiple times, as would otherwise occur because the chroma components typically share tables.) Thus, setting this field to TRUE before calling jpeg\_start\_compress() will prevent the table from being written at all.

If you want to create a "pure" abbreviated image file containing no tables, just call "jpeg\_suppress\_tables(&cinfo, TRUE)" after constructing all the tables. If you want to emit some but not all tables, you'll need to set the individual sent\_table fields directly.

To create an abbreviated image, you must also call jpeg\_start\_compress() with a second parameter of FALSE, not TRUE. Otherwise jpeg\_start\_compress() will force all the sent\_table fields to FALSE. (This is a safety feature to prevent abbreviated images from being created accidentally.)

To create a tables-only file, perform the same parameter setup that you normally would, but instead of calling jpeg\_start\_compress() and so on, call jpeg\_write\_tables(&cinfo). This will write an abbreviated datastream containing only SOI, DQT and/or DHT markers, and EOI. All the quantization and Huffman tables that are currently defined in the compression object will be emitted unless their sent\_tables flag is already TRUE, and then all the sent\_tables flags will be set TRUE.

A sure-fire way to create matching tables-only and abbreviated image files is to proceed as follows:

```
create JPEG compression object
set JPEG parameters
set destination to tables-only file
jpeg_write_tables(&cinfo);
set destination to image file
jpeg_start_compress(&cinfo, FALSE);
write data...
jpeg_finish_compress(&cinfo);
```

Since the JPEG parameters are not altered between writing the table file and the abbreviated image file, the same tables are sure to be used. Of course, you can repeat the `jpeg_start_compress()` ... `jpeg_finish_compress()` sequence many times to produce many abbreviated image files matching the table file.

You cannot suppress output of the computed Huffman tables when Huffman optimization is selected. (If you could, there'd be no way to decode the image...) Generally, you don't want to set `optimize_coding = TRUE` when you are trying to produce abbreviated files.

In some cases you might want to compress an image using tables which are not stored in the application, but are defined in an interchange or tables-only file readable by the application. This can be done by setting up a JPEG decompression object to read the specification file, then copying the tables into your compression object. See `jpeg_copy_critical_parameters()` for an example of copying quantization tables.

To read abbreviated image files, you simply need to load the proper tables into the decompression object before trying to read the abbreviated image. If the proper tables are stored in the application program, you can just allocate the table structs and fill in their contents directly. For example, to load a fixed quantization table into table slot "n":

```
if (cinfo.quant_tbl_ptrs[n] == NULL)
 cinfo.quant_tbl_ptrs[n] = jpeg_alloc_quant_table((j_common_ptr) &cinfo);
quant_ptr = cinfo.quant_tbl_ptrs[n]; /* quant_ptr is JQUANT_TBL* */
for (i = 0; i < 64; i++) {
 /* Qtable[] is desired quantization table, in natural array order */
 quant_ptr->quantval[i] = Qtable[i];
}
```

Code to load a fixed Huffman table is typically (for AC table "n"):

```
if (cinfo.ac_huff_tbl_ptrs[n] == NULL)
 cinfo.ac_huff_tbl_ptrs[n] = jpeg_alloc_huff_table((j_common_ptr) &cinfo);
huff_ptr = cinfo.ac_huff_tbl_ptrs[n]; /* huff_ptr is JHUFF_TBL* */
for (i = 1; i <= 16; i++) {
 /* counts[i] is number of Huffman codes of length i bits, i=1..16 */
 huff_ptr->bits[i] = counts[i];
}
for (i = 0; i < 256; i++) {
 /* symbols[] is the list of Huffman symbols, in code-length order */
 huff_ptr->huffval[i] = symbols[i];
}
```

(Note that trying to set `cinfo.quant_tbl_ptrs[n]` to point directly at a constant `JQUANT_TBL` object is not safe. If the incoming file happened to contain a quantization table definition, your master table would get overwritten! Instead allocate a working table copy and copy the master table into it, as illustrated above. Ditto for Huffman tables, of course.)

You might want to read the tables from a tables-only file, rather than hard-wiring them into your application. The `jpeg_read_header()` call is sufficient to read a tables-only file. You must pass a second parameter of `FALSE` to indicate that you do not require an image to be present. Thus, the typical scenario is

```
create JPEG decompression object
set source to tables-only file
jpeg_read_header(&cinfo, FALSE);
set source to abbreviated image file
jpeg_read_header(&cinfo, TRUE);
set decompression parameters
jpeg_start_decompress(&cinfo);
read data...
jpeg_finish_decompress(&cinfo);
```

In some cases, you may want to read a file without knowing whether it contains an image or just tables. In that case, pass `FALSE` and check the return value from `jpeg_read_header()`: it will be `JPEG_HEADER_OK` if an image was found, `JPEG_HEADER_TABLES_ONLY` if only tables were found. (A third return value, `JPEG_SUSPENDED`, is possible when using a suspending data source manager.) Note that `jpeg_read_header()` will not complain if you read an abbreviated image for which you haven't loaded the missing tables; the missing-table check occurs later, in `jpeg_start_decompress()`.

It is possible to read a series of images from a single source file by repeating the `jpeg_read_header()` ... `jpeg_finish_decompress()` sequence, without releasing/recreating the JPEG object or the data source module. (If you did reinitialize, any partial bufferload left in the data source buffer at the end of one image would be discarded, causing you to lose the start of the next image.) When you use this method, stored tables are automatically carried forward, so some of the images can be abbreviated images that depend on tables from earlier images.

If you intend to write a series of images into a single destination file, you might want to make a specialized data destination module that doesn't flush the output buffer at `term_destination()` time. This would speed things up by some trifling amount. Of course, you'd need to remember to flush the buffer after the last image. You can make the later images be abbreviated

ones by passing FALSE to jpeg\_start\_compress().

## Special markers

-----

Some applications may need to insert or extract special data in the JPEG datastream. The JPEG standard provides marker types "COM" (comment) and "APP0" through "APP15" (application) to hold application-specific data. Unfortunately, the use of these markers is not specified by the standard. COM markers are fairly widely used to hold user-supplied text. The JFIF file format spec uses APP0 markers with specified initial strings to hold certain data. Adobe applications use APP14 markers beginning with the string "Adobe" for miscellaneous data. Other APPn markers are rarely seen, but might contain almost anything.

If you wish to store user-supplied text, we recommend you use COM markers and place readable 7-bit ASCII text in them. Newline conventions are not standardized --- expect to find LF (Unix style), CR/LF (DOS style), or CR (Mac style). A robust COM reader should be able to cope with random binary garbage, including nulls, since some applications generate COM markers containing non-ASCII junk. (But yours should not be one of them.)

For program-supplied data, use an APPn marker, and be sure to begin it with an identifying string so that you can tell whether the marker is actually yours. It's probably best to avoid using APP0 or APP14 for any private markers. (NOTE: the upcoming SPIFF standard will use APP8 markers; we recommend you not use APP8 markers for any private purposes, either.)

## Keep in mind

that at most 65533 bytes can be put into one marker, but you can have as many markers as you like.

By default, the IJG compression library will write a JFIF APP0 marker if the selected JPEG colorspace is grayscale or YCbCr, or an Adobe APP14 marker if the selected colorspace is RGB, CMYK, or YCCK. You can disable this, but we don't recommend it. The decompression library will recognize JFIF and Adobe markers and will set the JPEG colorspace properly when one is found.

You can write special markers immediately following the datastream header by calling jpeg\_write\_marker() after jpeg\_start\_compress() and before the first call to jpeg\_write\_scanlines(). When you do this, the markers appear after the SOI and the JFIF APP0 and Adobe APP14 markers (if written), but before all else. Specify the marker type parameter as "JPEG\_COM" for COM or "JPEG\_APP0 + n" for APPn. (Actually, jpeg\_write\_marker will let you write any marker type, but we don't recommend writing any other kinds of marker.)

For

example, to write a user comment string pointed to by `comment_text`:

```
jpeg_write_marker(cinfo, JPEG_COM, comment_text, strlen(comment_text));
```

If it's not convenient to store all the marker data in memory at once, you can instead call `jpeg_write_m_header()` followed by multiple calls to `jpeg_write_m_byte()`. If you do it this way, it's your responsibility to call `jpeg_write_m_byte()` exactly the number of times given in the `length` parameter to `jpeg_write_m_header()`. (This method lets you empty the output buffer partway through a marker, which might be important when using a suspending data destination module. In any case, if you are using a suspending destination, you should flush its buffer after inserting any special markers. See "I/O suspension".)

Or, if you prefer to synthesize the marker byte sequence yourself, you can just cram it straight into the data destination module.

If you are writing JFIF 1.02 extension markers (thumbnail images), don't forget to set `cinfo.JFIF_minor_version` = 2 so that the encoder will write the correct JFIF version number in the JFIF header marker. The library's default is to write version 1.01, but that's wrong if you insert any 1.02 extension markers. (We could probably get away with just defaulting to 1.02, but there used to be broken decoders that would complain about unknown minor version numbers. To reduce compatibility risks it's safest not to write 1.02 unless you are actually using 1.02 extensions.)

When reading, two methods of handling special markers are available:

1. You can ask the library to save the contents of COM and/or APPn markers into memory, and then examine them at your leisure afterwards.
2. You can supply your own routine to process COM and/or APPn markers on-the-fly as they are read.

The first method is simpler to use, especially if you are using a suspending data source; writing a marker processor that copes with input suspension is not easy (consider what happens if the marker is longer than your available input buffer). However, the second method conserves memory since the marker data need not be kept around after it's been processed.

For either method, you'd normally set up marker handling after creating a decompression object and before calling `jpeg_read_header()`, because the markers of interest will typically be near the head of the file and so will be scanned by `jpeg_read_header`. Once you've established a marker handling method, it will be used for the life of that decompression object (potentially many datastreams), unless you change it. Marker handling is determined separately for COM markers and for each APPn marker code.



To save the contents of special markers in memory, call `jpeg_save_markers(cinfo, marker_code, length_limit)` where `marker_code` is the marker type to save, `JPEG_COM` or `JPEG_APP0+n`. (To arrange to save all the special marker types, you need to call this routine 17 times, for `COM` and `APP0-APP15`.) If the incoming marker is longer than `length_limit` data bytes, only `length_limit` bytes will be saved; this parameter allows you to avoid chewing up memory when you only need to see the first few bytes of a potentially large marker. If you want to save all the data, set `length_limit` to `0xFFFF`; that is enough since marker lengths are only 16 bits. As a special case, setting `length_limit` to 0 prevents that marker type from being saved at all. (That is the default behavior, in fact.)

After `jpeg_read_header()` completes, you can examine the special markers by following the `cinfo->marker_list` pointer chain. All the special markers in the file appear in this list, in order of their occurrence in the file (but omitting any markers of types you didn't ask for). Both the original data length and the saved data length are recorded for each list entry; the latter will not exceed `length_limit` for the particular marker type. Note that these lengths exclude the marker length word, whereas the stored representation within the JPEG file includes it. (Hence the maximum data length is really only 65533.)

It is possible that additional special markers appear in the file beyond the SOS marker at which `jpeg_read_header` stops; if so, the marker list will be extended during reading of the rest of the file. This is not expected to be common, however. If you are short on memory you may want to reset the length limit to zero for all marker types after finishing `jpeg_read_header`, to ensure that the `max_memory_to_use` setting cannot be exceeded due to addition of later markers.

The marker list remains stored until you call `jpeg_finish_decompress` or `jpeg_abort`, at which point the memory is freed and the list is set to empty. (`jpeg_destroy` also releases the storage, of course.)

Note that the library is internally interested in `APP0` and `APP14` markers; if you try to set a small nonzero length limit on these types, the library will silently force the length up to the minimum it wants. (But you can set a zero length limit to prevent them from being saved at all.) Also, in a 16-bit environment, the maximum length limit may be constrained to less than 65533 by `malloc()` limitations. It is therefore best not to assume that the effective length limit is exactly what you set it to be.

If you want to supply your own marker-reading routine, you do it by calling

jpeg\_set\_marker\_processor(). A marker processor routine must have the signature

```
boolean jpeg_marker_parser_method (j_decompress_ptr cinfo)
```

Although the marker code is not explicitly passed, the routine can find it in `cinfo->unread_marker`. At the time of call, the marker proper has been read from the data source module. The processor routine is responsible for reading the marker length word and the remaining parameter bytes, if any. Return TRUE to indicate success. (FALSE should be returned only if you are using a suspending data source and it tells you to suspend. See the standard marker processors in `jdmarker.c` for appropriate coding methods if you need to use a suspending data source.)

If you override the default APP0 or APP14 processors, it is up to you to recognize JFIF and Adobe markers if you want colorspace recognition to occur properly. We recommend copying and extending the default processors if you want to do that. (A better idea is to save these marker types for later examination by calling `jpeg_save_markers()`; that method doesn't interfere with the library's own processing of these markers.)

`jpeg_set_marker_processor()` and `jpeg_save_markers()` are mutually exclusive --- if you call one it overrides any previous call to the other, for the particular marker type specified.

A simple example of an external COM processor can be found in `djpeg.c`. Also, see `jpegtran.c` for an example of using `jpeg_save_markers`.

Raw (downsampled) image data

-----

Some applications need to supply already-downsampled image data to the JPEG compressor, or to receive raw downsampled data from the decompressor. The library supports

this requirement by allowing the application to write or read raw data, bypassing the normal preprocessing or postprocessing steps. The interface is different from the standard one and is somewhat harder to use. If your interest is merely in bypassing color conversion, we recommend that you use the standard interface and simply set `jpeg_color_space = in_color_space` (or `jpeg_color_space = out_color_space` for decompression). The mechanism described in this section is necessary only to supply or receive downsampled image data, in which not all components have the same dimensions.

To compress raw data, you must supply the data in the colorspace to be used in the JPEG file (please read the earlier section on Special color spaces) and downsampled to the sampling factors specified in the JPEG parameters.

You must supply the data in the format used internally by the JPEG library, namely a JSAMPIMAGE array. This is an array of pointers to two-dimensional arrays, each of type JSAMPARRAY.

Each 2-D array holds the values for one color component. This structure is necessary since the components are of different sizes. If the image dimensions are not a multiple of the MCU size, you must also pad the data correctly (usually, this is done by replicating the last column and/or row). The data must be padded to a multiple of a DCT block in each component: that is, each downsampled row must contain a multiple of DCT\_h\_scaled\_size valid samples, and there must be a multiple of DCT\_v\_scaled\_size sample rows for each component. (For applications such as conversion of digital TV images, the standard image size is usually a multiple of the DCT block size, so that no padding need actually be done.)

The procedure for compression of raw data is basically the same as normal compression, except that you call jpeg\_write\_raw\_data() in place of jpeg\_write\_scanlines(). Before calling jpeg\_start\_compress(), you must do the following:

- \* Set cinfo->raw\_data\_in to TRUE. (It is set FALSE by jpeg\_set\_defaults().)  
This notifies the library that you will be supplying raw data.
- \* Ensure jpeg\_color\_space is correct --- an explicit jpeg\_set\_colorspace() call is a good idea. Note that since color conversion is bypassed, in\_color\_space is ignored, except that jpeg\_set\_defaults() uses it to choose the default jpeg\_color\_space setting.
- \* Ensure the sampling factors, cinfo->comp\_info[i].h\_samp\_factor and cinfo->comp\_info[i].v\_samp\_factor, are correct. Since these indicate the dimensions of the data you are supplying, it's wise to set them explicitly, rather than assuming the library's defaults are what you want.

To pass raw data to the library, call jpeg\_write\_raw\_data() in place of jpeg\_write\_scanlines(). The two routines work similarly except that jpeg\_write\_raw\_data takes a JSAMPIMAGE data array rather than JSAMPARRAY. The scanlines count passed to and returned from jpeg\_write\_raw\_data is measured in terms of the component with the largest v\_samp\_factor.

jpeg\_write\_raw\_data() processes one MCU row per call, which is to say v\_samp\_factor\*min\_DCT\_v\_scaled\_size sample rows of each component. The passed num\_lines value must be at least max\_v\_samp\_factor\*min\_DCT\_v\_scaled\_size, and the return value will be exactly that amount (or possibly some multiple of that amount, in future library versions). This is true even on the last call at the bottom of the image; don't forget to pad your data as necessary.

The required dimensions of the supplied data can be computed for each component as

```
cinfo->comp_info[i].width_in_blocks *
cinfo->comp_info[i].DCT_h_scaled_size samples per row
```

`cinfo->comp_info[i].height_in_blocks *`  
`cinfo->comp_info[i].DCT_v_scaled_size` rows in image  
 after `jpeg_start_compress()` has initialized those fields. If the valid data is smaller than this, it must be padded appropriately. For some sampling factors and image sizes, additional dummy DCT blocks are inserted to make the image a multiple of the MCU dimensions. The library creates such dummy blocks itself; it does not read them from your supplied data. Therefore you need never pad by more than `DCT_scaled_size` samples.

An example may help here. Assume 2h2v downsampling of YCbCr data, that is  
`cinfo->comp_info[0].h_samp_factor = 2` for Y  
`cinfo->comp_info[0].v_samp_factor = 2`  
`cinfo->comp_info[1].h_samp_factor = 1` for Cb  
`cinfo->comp_info[1].v_samp_factor = 1`  
`cinfo->comp_info[2].h_samp_factor = 1` for Cr  
`cinfo->comp_info[2].v_samp_factor = 1`  
 and suppose that the nominal image dimensions (`cinfo->image_width` and `cinfo->image_height`) are 101x101 pixels. Then `jpeg_start_compress()` will compute `downsampled_width = 101` and `width_in_blocks = 13` for Y, `downsampled_width = 51` and `width_in_blocks = 7` for Cb and Cr (and the same for the height fields). You must pad the Y data to at least  $13 \times 8 = 104$  columns and rows, the Cb/Cr data to at least  $7 \times 8 = 56$  columns and rows. The MCU height is `max_v_samp_factor = 2` DCT rows so you must pass at least 16 scanlines on each call to `jpeg_write_raw_data()`, which is to say 16 actual sample rows of Y and 8 each of Cb and Cr. A total of 7 MCU rows are needed, so you must pass a total of  $7 \times 16 = 112$  "scanlines". The last DCT block row of Y data is dummy, so it doesn't matter what you pass for it in the data arrays, but the scanlines count must total up to 112 so that all of the Cb and Cr data gets passed.

Output suspension is supported with raw-data compression: if the data destination module suspends, `jpeg_write_raw_data()` will return 0. In this case the same data rows must be passed again on the next call.

Decompression with raw data output implies bypassing all postprocessing: you cannot ask for color quantization, for instance. More seriously, you must deal with the color space and sampling factors present in the incoming file. If your application only handles, say, 2h1v YCbCr data, you must check for and fail on other color spaces or other sampling factors. The library will not convert to a different color space for you.

To obtain raw data output, set `cinfo->raw_data_out = TRUE` before `jpeg_start_decompress()` (it is set `FALSE` by `jpeg_read_header()`). Be sure to verify that the color space and sampling factors are ones you can handle. Then call `jpeg_read_raw_data()` in place of `jpeg_read_scanlines()`. The

decompression process is otherwise the same as usual.

`jpeg_read_raw_data()` returns one MCU row per call, and thus you must pass a buffer of at least `max_v_samp_factor*min_DCT_v_scaled_size` scanlines (scanline counting is the same as for raw-data compression). The buffer you pass must be large enough to hold the actual data plus padding to DCT-block boundaries. As with compression, any entirely dummy DCT blocks are not processed so you need not allocate space for them, but the total scanline count includes them. The above example of computing buffer dimensions for raw-data compression is equally valid for decompression.

Input suspension is supported

with raw-data decompression: if the data source module suspends, `jpeg_read_raw_data()` will return 0. You can also use buffered-image mode to read raw data in multiple passes.

Really raw data: DCT coefficients

-----

It is possible to read or write the contents of a JPEG file as raw DCT coefficients. This facility is mainly intended for use in lossless transcoding between different JPEG file formats. Other possible applications include lossless cropping of a JPEG image, lossless reassembly of a multi-strip or multi-tile TIFF/JPEG file into a single JPEG datastream, etc.

To read the contents of a JPEG file as DCT coefficients, open the file and do `jpeg_read_header()` as usual. But instead of calling `jpeg_start_decompress()` and `jpeg_read_scanlines()`, call `jpeg_read_coefficients()`. This will read the entire image into a set of virtual coefficient-block arrays, one array per component. The return value is a pointer to an array of virtual-array descriptors.

Each virtual array can be accessed directly using the JPEG memory manager's `access_virt_barray` method (see Memory management, below, and also `read.structure.txt`'s discussion of virtual array handling). Or, for simple transcoding to a different JPEG file format, the array list can just be handed directly to `jpeg_write_coefficients()`.

Each block in the block arrays contains quantized coefficient values in normal array order (not JPEG zigzag order). The block arrays contain only DCT blocks containing real data; any entirely-dummy blocks added to fill out interleaved MCUs at the right or bottom edges of the image are discarded during reading and are not stored in the block arrays. (The size of each block array can be determined from the `width_in_blocks` and `height_in_blocks` fields of the component's `comp_info` entry.) This is also the data format expected by `jpeg_write_coefficients()`.

When you are done using the virtual arrays, call `jpeg_finish_decompress()`

to release the array storage  
and return the decompression object to an idle  
state; or just call `jpeg_destroy()` if you don't need to reuse the object.

If you use a suspending data source, `jpeg_read_coefficients()` will return NULL if it is forced to suspend; a non-NULL return value indicates successful completion. You need not test for a NULL return value when using a non-suspending data source.

It is also possible to call `jpeg_read_coefficients()` to obtain access to the decoder's coefficient arrays during a normal decode cycle in buffered-image mode. This frammish might be useful for progressively displaying an incoming image and then re-encoding it without loss. To do this, decode in buffered-image mode as discussed previously, then call `jpeg_read_coefficients()` after the last `jpeg_finish_output()` call. The arrays will be available for your use until you call `jpeg_finish_decompress()`.

To write the contents of a JPEG file as DCT coefficients, you must provide the DCT coefficients stored in virtual block

arrays. You can either pass

block arrays read from an input JPEG file by `jpeg_read_coefficients()`, or allocate virtual arrays from the JPEG compression object and fill them yourself. In either case, `jpeg_write_coefficients()` is substituted for `jpeg_start_compress()` and `jpeg_write_scanlines()`. Thus the sequence is

- \* Create compression object
- \* Set all compression parameters as necessary
- \* Request virtual arrays if needed
- \* `jpeg_write_coefficients()`
- \* `jpeg_finish_compress()`
- \* Destroy or re-use compression object

`jpeg_write_coefficients()` is passed a pointer to an array of virtual block array descriptors; the number of arrays is equal to `cinfo.num_components`.

The virtual arrays need only have been requested, not realized, before `jpeg_write_coefficients()` is called. A side-effect of `jpeg_write_coefficients()` is to realize any virtual arrays that have been requested from the compression object's memory manager. Thus, when obtaining the virtual arrays from the compression object, you should fill the arrays after calling `jpeg_write_coefficients()`. The data is actually written out when you call `jpeg_finish_compress()`; `jpeg_write_coefficients()` only writes the file header.

When writing raw DCT coefficients, it is crucial that the JPEG quantization tables and sampling factors match the way the data was encoded, or the resulting file will be invalid. For transcoding from an existing JPEG file, we recommend using `jpeg_copy_critical_parameters()`. This routine initializes

all the compression parameters to default values (like `jpeg_set_defaults()`), then copies the critical information from a source decompression object. The decompression object should have just been used to read the entire JPEG input file --- that is, it should be awaiting `jpeg_finish_decompress()`.

`jpeg_write_coefficients()` marks all tables stored in the compression object as needing to be written to the output file (thus, it acts like `jpeg_start_compress(cinfo, TRUE)`). This is for safety's sake, to avoid emitting abbreviated JPEG files by accident. If you really want to emit an abbreviated JPEG file, call `jpeg_suppress_tables()`, or set the tables' individual `sent_table` flags, between calling `jpeg_write_coefficients()` and `jpeg_finish_compress()`.

#### Progress monitoring

-----

Some applications may need to regain control from the JPEG library every so often. The typical use of this feature is to produce a percent-done bar or other progress display. (For a simple example, see `cjpeg.c` or `djpeg.c`.) Although you do get control back frequently during the data-transferring pass (the `jpeg_read_scanlines` or `jpeg_write_scanlines` loop), any additional passes will occur inside `jpeg_finish_compress` or `jpeg_start_decompress`; those routines may take a long time to execute, and you don't get control back until they are done.

You can define a progress-monitor routine which will be called periodically by the library. No guarantees are made about how often this call will occur, so we don't recommend you use it for mouse tracking or anything like that. At present, a call will occur once per MCU row, scanline, or sample row group, whichever unit is convenient for the current processing mode; so the wider the image, the longer the time between calls. During the data transferring pass, only one call occurs per call of `jpeg_read_scanlines` or `jpeg_write_scanlines`, so don't pass a large number of scanlines at once if you want fine resolution in the progress count. (If you really need to use the callback mechanism for time-critical tasks like mouse tracking, you could insert additional calls inside some of the library's inner loops.)

To establish a progress-monitor callback, create a struct `jpeg_progress_mgr`, fill in its `progress_monitor` field with a pointer to your callback routine, and set `cinfo->progress` to point to the struct. The callback will be called whenever `cinfo->progress` is non-NULL. (This pointer is set to NULL by `jpeg_create_compress` or `jpeg_create_decompress`; the library will not change it thereafter. So if you allocate dynamic storage for the progress struct, make sure it will live as long as the JPEG object does. Allocating from the

JPEG memory manager with lifetime JPOOL\_PERMANENT will work nicely.) You can use the same callback routine for both compression and decompression.

The jpeg\_progress\_mgr struct contains four fields which are set by the library:

```
long pass_counter; /* work units completed in this pass */
long pass_limit; /* total number of work units in this pass */
int completed_passes; /* passes completed so far */
int total_passes; /* total number of passes expected */
```

During any one pass, pass\_counter increases from 0 up to (not including) pass\_limit; the step size is usually but not necessarily 1. The pass\_limit value may change from one pass to another. The expected total number of passes is in total\_passes, and the number of passes already completed is in completed\_passes. Thus the fraction

of work completed may be estimated as

$$\frac{\text{completed\_passes} + (\text{pass\_counter}/\text{pass\_limit})}{\text{total\_passes}}$$

ignoring the fact that the passes may not be equal amounts of work.

When decompressing, pass\_limit can even change within a pass, because it depends on the number of scans in the JPEG file, which isn't always known in advance. The computed fraction-of-work-done may jump suddenly (if the library discovers it has overestimated the number of scans) or even decrease (in the opposite case). It is not wise to put great faith in the work estimate.

When using the decompressor's buffered-image mode, the progress monitor work estimate is likely to be completely unhelpful, because the library has no way to know how many output passes will be demanded of it. Currently, the library sets total\_passes based on the assumption that there will be one more output pass if the input file end hasn't yet been read (jpeg\_input\_complete() isn't TRUE), but

no more output passes if the file end has been reached when the output pass is started. This means that total\_passes will rise as additional output passes are requested. If you have a way of determining the input file size, estimating progress based on the fraction of the file that's been read will probably be more useful than using the library's value.

## Memory management

This section covers some key facts about the JPEG library's built-in memory manager. For more info, please read structure.txt's section about the memory manager, and consult the source code if necessary.

All memory and temporary file allocation within the library is done via the memory manager. If necessary, you can replace the "back end" of the memory manager to control allocation yourself (for example, if you don't want the



library to use malloc() and free() for some reason).

Some data is allocated "permanently" and will not be freed until the JPEG object is destroyed. Most data is allocated

"per image" and is freed by

jpeg\_finish\_compress, jpeg\_finish\_decompress, or jpeg\_abort. You can call the memory manager yourself to allocate structures that will automatically be freed at these times. Typical code for this is

```
ptr = (*cinfo->mem->alloc_small) ((j_common_ptr) cinfo, JPOOL_IMAGE, size);
```

Use JPOOL\_PERMANENT to get storage that lasts as long as the JPEG object.

Use alloc\_large instead of alloc\_small for anything bigger than a few Kbytes.

There are also alloc\_sarray and alloc\_barray routines that automatically build 2-D sample or block arrays.

The library's minimum space requirements to process an image depend on the image's width, but not on its height, because the library ordinarily works with "strip" buffers that are as wide as the image but just a few rows high. Some operating modes (eg, two-pass color quantization) require full-image buffers. Such buffers are treated as "virtual arrays": only the current strip need be in memory, and the rest can be swapped out to a temporary file.

If you use the simplest memory manager back end (jmemnobs.c), then no temporary files are used; virtual arrays are simply malloc()'d. Images bigger than memory can be processed only if your system supports virtual memory. The other memory manager back ends support temporary files of various flavors and thus work in machines without virtual memory. They may also be useful on Unix machines if you need to process images that exceed available swap space.

When using temporary files, the library will make the in-memory buffers for its virtual arrays just big enough to stay within a "maximum memory" setting. Your application can set this limit by setting cinfo->mem->max\_memory\_to\_use after creating the JPEG object. (Of course, there is still a minimum size for the buffers, so the max-memory setting is effective only if it is bigger than the minimum space needed.) If you allocate any large structures yourself, you must allocate them before jpeg\_start\_compress() or jpeg\_start\_decompress() in order to have them counted against the max memory limit. Also keep in mind that space allocated with alloc\_small() is ignored, on the assumption that it's too small to be worth worrying about; so a reasonable safety margin should be left when setting max\_memory\_to\_use.

If you use the jmemname.c or jmemdos.c memory manager back end, it is important to clean up the JPEG object properly to ensure that the temporary files get deleted. (This is especially crucial with jmemdos.c, where the "temporary files" may be extended-memory segments; if they are not freed, DOS will require a reboot to recover the memory.) Thus, with these memory managers, it's a good idea to provide a signal handler that will trap any

early exit from your program. The handler should call either `jpeg_abort()` or `jpeg_destroy()` for any active JPEG objects. A handler is not needed with `jmemnobs.c`, and shouldn't be necessary with `jmemansi.c` or `jmemmac.c` either, since the C library is supposed to take care of deleting files made with `tmpfile()`.

## Memory usage

-----

Working memory requirements while performing compression or decompression depend on image dimensions, image characteristics (such as colorspace and JPEG process), and operating mode (application-selected options).

As of v6b, the decompressor requires:

1. About 24K in more-or-less-fixed-size data. This varies a bit depending on operating mode and image characteristics (particularly color vs. grayscale), but it doesn't depend on image dimensions.
2. Strip buffers (of size proportional to the image width) for IDCT and upsampling results. The worst case for commonly used sampling factors is about 34 bytes \* width in pixels for a color image. A grayscale image only needs about 8 bytes per pixel column.
3. A full-image DCT coefficient buffer is needed to decode a multi-scan JPEG file (including progressive JPEGs), or whenever you select buffered-image mode. This takes 2 bytes/coefficient.

At typical 2x2 sampling, that's

3 bytes per pixel for a color image. Worst case (1x1 sampling) requires 6 bytes/pixel. For grayscale, figure 2 bytes/pixel.

4. To perform 2-pass color quantization, the decompressor also needs a 128K color lookup table and a full-image pixel buffer (3 bytes/pixel). This does not count any memory allocated by the application, such as a buffer to hold the final output image.

The above figures are valid for 8-bit JPEG data precision and a machine with 32-bit ints. For 9-bit to 12-bit JPEG data, double the size of the strip buffers and quantization pixel buffer. The "fixed-size" data will be somewhat smaller with 16-bit ints, larger with 64-bit ints. Also, CMYK or other unusual color spaces will require different amounts of space.

The full-image coefficient and pixel buffers, if needed at all, do not have to be fully RAM resident; you can have the library use temporary files instead when the total memory usage would exceed a limit you set.

(But if your OS supports virtual memory, it's probably better to just use `jmemnobs` and let the OS do the swapping.)

The compressor's memory requirements are similar, except that it has no need

for color quantization. Also, it needs a full-image DCT coefficient buffer if Huffman-table optimization is asked for, even if progressive mode is not requested.

If you need more detailed information about memory usage in a particular situation, you can enable the MEM\_STATS code in jmemmgr.c.

#### Library compile-time options

-----

A number of compile-time options are available by modifying jmorecfg.h.

The IJG code currently supports 8-bit to 12-bit sample data precision by defining BITS\_IN\_JSAMPLE as 8, 9, 10, 11, or 12.

Note that a value larger than 8 causes JSAMPLE to be larger than a char, so it affects the surrounding application's image data.

The sample applications cjpeg and djpeg can support deeper than 8-bit data only for PPM and GIF file formats;

you must disable the other file formats

to compile a 9-bit to 12-bit cjpeg or djpeg. (install.txt has more information about that.)

Run-time selection and conversion of data precision are currently not supported and may be added later.

Exception: The transcoding part (jpegtran) supports all settings in a single instance, since it operates on the level of DCT coefficients and not sample values.

(If you need to include an 8-bit library and a 9-bit to 12-bit library for compression or decompression in a single application, you could probably do it by defining NEED\_SHORT\_EXTERNAL\_NAMES for just one of the copies. You'd have to access the 8-bit and the 9-bit to 12-bit copies from separate application source files. This is untested ... if you try it, we'd like to hear whether it works!)

Note that the standard Huffman tables are only valid for 8-bit data precision.

If you selected more than 8-bit data precision, cjpeg uses arithmetic coding by default. The Huffman encoder normally uses

entropy optimization to

compute usable tables for higher precision. Otherwise, you'll have to

supply different default Huffman tables. You may also want to supply your

own DCT quantization tables; the existing quality-scaling code has been developed for 8-bit use, and probably doesn't generate especially good tables for 9-bit to 12-bit.

The maximum number of components (color channels) in the image is determined by MAX\_COMPONENTS. The JPEG standard allows up to 255 components, but we expect that few applications will need more than four or so.

On machines with unusual data type sizes, you may be able to improve performance or reduce memory space by tweaking the various typedefs in `jmorecfg.h`. In particular, on some RISC CPUs, access to arrays of "short"s is quite slow; consider trading memory for speed by making `JCOEF`, `INT16`, and `UINT16` be "int" or "unsigned int". `UINT8` is also a candidate to become int. You probably don't want to make `JSAMPLE` be int unless you have lots of memory to burn.

You can reduce the size of the library by compiling out various optional functions. To do this, undefine `xxx_SUPPORTED` symbols as necessary.

You can also save a few K by not having text error messages in the library; the standard error message table occupies about 5Kb. This is particularly reasonable for embedded applications where there's no good way to display a message anyway. To do this, remove the creation of the message table (`jpeg_std_message_table[]`) from `jerror.c`, and alter `format_message` to do something reasonable without it. You could output the numeric value of the message code number, for example. If you do this, you can also save a couple more K by modifying the `TRACEMSn()` macros in `jerror.h` to expand to nothing; you don't need trace capability anyway, right?

#### Portability considerations

-----

The JPEG library has been written to be extremely portable; the sample applications `cjpeg` and `djpeg` are slightly less so. This section summarizes the design goals in this area. (If you encounter any bugs that cause the library to be less portable than is claimed here, we'd appreciate hearing about them.)

The code works fine on ANSI C, C++, and pre-ANSI C compilers, using any of the popular system include file setups, and some not-so-popular ones too. See `install.txt` for configuration procedures.

The code is not dependent on the exact sizes of the C data types. As distributed, we make the assumptions that

- char is at least 8 bits wide
- short is at least 16 bits wide
- int is at least 16 bits wide
- long is at least 32 bits wide

(These are the minimum requirements of the ANSI C standard.) Wider types will work fine, although memory may be used inefficiently if char is much larger than 8 bits or short is much bigger than 16 bits. The code should work equally well with 16- or 32-bit ints.

In a system where these assumptions are not met, you may be able to make the code work by modifying the typedefs in `jmorecfg.h`. However, you will probably have difficulty if `int` is less than 16 bits wide, since references to plain `int` abound in the code.

`char` can be either signed or unsigned, although the code runs faster if an unsigned `char` type is available. If `char` is wider than 8 bits, you will need to redefine `JOCTET` and/or provide custom data source/destination managers so that `JOCTET` represents exactly 8 bits of data on external storage.

The JPEG library proper does not assume ASCII representation of characters. But some of the image file I/O modules in `cjpeg/djpeg` do have ASCII dependencies in file-header manipulation; so does `cjpeg's select_file_type()` routine.

The JPEG library does not rely heavily on the C library. In particular, `C stdio` is used only by the data source/destination modules and the error handler, all of which are application-replaceable. (`cjpeg/djpeg` are more heavily dependent on `stdio`.) `malloc` and `free` are called only from the memory manager "back end" module, so you can use a different memory allocator by replacing that one file.

The code generally assumes that C names must be unique in the first 15 characters. However, global function names can be made unique in the first 6 characters by defining `NEED_SHORT_EXTERNAL_NAMES`.

More info about porting the code may be gleaned by reading `jconfig.txt`, `jmorecfg.h`, and `jinclue.h`.

Notes for MS-DOS implementors

-----

The IJG code is designed to work efficiently in 80x86 "small" or "medium" memory models (i.e., data pointers are 16 bits unless explicitly declared "far"; code pointers can be either size). You may be able to use small model to compile `cjpeg` or `djpeg` by itself, but you will probably have to use medium model for any larger application. This won't make much difference in performance. You *will* take a noticeable performance hit if you use a large-data memory model (perhaps 10%-25%), and you should avoid "huge" model if at all possible.

The JPEG library typically needs 2Kb-3Kb of stack space. It will also `malloc` about 20K-30K of near heap space while executing (and lots of far heap, but that doesn't count in this calculation). This figure will vary

depending on selected operating mode, and to a lesser extent on image size. There is also about 5Kb-6Kb of constant data which will be allocated in the near data segment (about 4Kb of this is the error message table). Thus you have perhaps 20K available for other modules' static data and near heap space before you need to go to a larger memory model. The C library's static data will account for several K of this, but that still leaves a good deal for your needs. (If you are tight on space, you could reduce the sizes of the I/O buffers allocated by jdatasrc.c and jdatadst.c, say from 4K to 1K. Another possibility is to move the error message table to far memory; this should be doable with only localized hacking on jerror.c.)

About 2K of the near heap space is "permanent" memory that will not be released until you destroy the JPEG object. This is only an issue if you save a JPEG object between compression or decompression operations.

Far data space may also be a tight resource when you are dealing with large images. The most memory-intensive case is decompression with two-pass color quantization, or single-pass quantization to an externally supplied color map. This requires a 128Kb color lookup table plus strip buffers amounting to about 40 bytes per column for typical sampling ratios (eg, about 25600 bytes for a 640-pixel-wide image). You may not be able to process wide images if you have large data structures of your own.

Of course, all of these concerns vanish if you use a 32-bit flat-memory-model compiler, such as DJGPP or Watcom C. We highly recommend flat model if you can use it; the JPEG library is significantly faster in flat model.

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/libjpeg.txt

No license file was found, but licenses were detected in source scan.

/\*

\* jmemnobs.c

\*

\* Copyright (C) 1992-1996, Thomas G. Lane.

\* Modified 2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file provides a really simple implementation of the system-

\* dependent portion of the JPEG memory manager. This implementation

\* assumes that no backing-store files are needed: all required space

\* can be obtained from malloc().

\* This is very portable in the sense that it'll compile on almost anything,

\* but you'd better have lots of main memory (or virtual memory) if you want

\* to process big images.

\* Note that the max\_memory\_to\_use option is respected by this implementation.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jmemnobs.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcmarker.c

\*

\* Copyright (C) 1991-1998, Thomas G. Lane.

\* Modified 2003-2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to write JPEG datastream markers.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcmarker.c

No license file was found, but licenses were detected in source scan.

/\*

\* rdrle.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to read input images in Utah RLE format.

\* The Utah Raster Toolkit library is required (version 3.1 or later).

\*

\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume input from

\* an ordinary stdio stream. They further assume that reading begins

\* at the start of the file; start\_input may need work if the

\* user interface has already read some data (e.g., to determine that

\* the file is indeed RLE format).

\*

\* Based on code contributed by Mike Lijewski,

\* with updates from Robert Hutchinson.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/rdrle.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcsample.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2003-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains downsampling routines.

\*

\* Downsampling input data is counted in "row groups". A row group

\* is defined to be max\_v\_samp\_factor pixel rows of each component,

\* from which the downsampler produces v\_samp\_factor sample rows.

\* A single row group is processed in each call to the downsampler module.

\*

\* The downsampler is responsible for edge-expansion of its output data

\* to fill an integral number of DCT blocks horizontally. The source buffer

\* may be modified if it is helpful for this purpose (the source buffer is

\* allocated wide enough to correspond to the desired output width).

\* The caller (the prep controller) is responsible for vertical

padding.

\*

\* The downsampler may request "context rows" by setting need\_context\_rows

\* during startup. In this case, the input arrays will contain at least

\* one row group's worth of pixels above and below the passed-in data;

\* the caller will create dummy rows at image top and bottom by replicating

\* the first or last real pixel row.

\*

\* An excellent reference for image resampling is

\* Digital Image Warping, George Wolberg, 1990.

\* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.

\*

\* The downsampling algorithm used here is a simple average of the source

\* pixels covered by the output pixel. The hi-falutin sampling literature

\* refers to this as a "box filter". In general the characteristics of a box

\* filter are not very good, but for the specific cases we normally use (1:1

\* and 2:1 ratios) the box is equivalent to a "triangle filter" which is not

\* nearly so bad. If you intend to use other sampling ratios, you'd be well

\* advised

to improve this code.

\*

\* A simple input-smoothing capability is provided. This is mainly intended

\* for cleaning up color-dithered GIF input files (if you find it inadequate,

\* we suggest using an external filtering program such as pnmconvol). When

\* enabled, each input pixel P is replaced by a weighted sum of itself and its

\* eight neighbors. P's weight is 1-8\*SF and each neighbor's weight is SF,

\* where SF = (smoothing\_factor / 1024).

\* Currently, smoothing is only supported for 2h2v sampling factors.

\*/



Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcsample.c

No license file was found, but licenses were detected in source scan.

## IJG JPEG LIBRARY: ALTERNATE USER INTERFACE FOR CJPEG/DJPEG

Copyright (C) 2020-2023, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

There is an alternate command-line user interface for the IJG JPEG software.

It is designed for use under MS-DOS, and may also be useful on other non-Unix operating systems. (For that matter, this code works fine on Unix, but the standard command-line syntax is better on Unix because it is pipe-friendly.)

With this user interface, cjpeg and djpeg accept multiple input file names on the command line; output file names are generated by substituting appropriate extensions. The user is prompted before any already-existing file will be overwritten.

Expansion of wild-card file specifications is useful but is not directly provided by this code. Most DOS C compilers have the ability to do wild-card

expansion "behind the scenes", and we rely on that feature. On other systems, the shell may do it for you, as is done on Unix.

Also, a DOS-specific routine is provided to determine available memory; this makes the -maxmemory switch unnecessary except in unusual cases. If you know how to determine available memory on a different system, you can easily add the necessary code. (And please send it along to jpeg-info@ijg.org so we can include it in future releases!)

## INSTALLATION

=====

Rename the standard cjpeg.c file to cjpegstd.c, then rename cjpegalt.c to cjpeg.c.

Rename the standard djpeg.c file to djpegstd.c, then rename djpegalt.c to djpeg.c.

Then build the software as described in install.txt, with these exceptions:

- \* Define PROGRESS\_REPORT in jconfig.h if you want the percent-done display.
- \* Define NO\_OVERWRITE\_CHECK if you \*don't\* want overwrite confirmation.
- \* You may ignore the USE\_SETMODE and TWO\_FILE\_COMMANDLINE symbols discussed in install.txt; these

files do not use them.

\* As given, djpegalt.c defaults to BMP output (not PPM output as in the standard djpeg.c). If you want something different, modify DEFAULT\_FMT.

You may also need to do something special to enable filename wild-card expansion, assuming your compiler has that capability at all.

Modify the standard usage.txt file as described below. (If you want to use the Unix-style manual pages cjpeg.1 and djpeg.1, better fix them too.)

To restore the standard user interface:

Rename cjpeg.c to cjpegalt.c, then rename cjpegstd.c to cjpeg.c.

Rename djpeg.c to djpegalt.c, then rename djpegstd.c to djpeg.c.

Then recompile/rebuild.

Here are some specific notes for popular MS-DOS compilers:

Borland C:

Add "-DMSDOS" to CFLAGS to enable use of the DOS memory determination code.

Link with the standard library file WILDARGS.OBJ to get wild-card expansion.

Microsoft C:

Add "-DMSDOS" to CFLAGS to enable use of the DOS memory determination code.

Link with the standard library

file SETARGV.OBJ to get wild-card expansion.

In the versions I've used, you must also add /NOE to the linker switches to avoid a duplicate-symbol error from including SETARGV.

DJGPP (we recommend version 2.0 or later):

Add "-DFREE\_MEM\_ESTIMATE=0" to CFLAGS. Wild-card expansion is automatic.

## USAGE

=====

Most of the standard usage.txt file also applies to the alternate version, but replace its "GENERAL USAGE" section with the text below. Edit the text as necessary if you don't support wildcards or overwrite checking. Be sure to fix the djpeg switch descriptions if you are not defaulting to PPM output. Also, if you've provided an accurate memory-estimation procedure, you can probably eliminate the HINTS related to the -maxmemory switch.

## GENERAL USAGE

We provide two programs, cjpeg to compress an image file into JPEG format, and djpeg to decompress a JPEG file back into a conventional image format.

The basic command line is:

`cjpeg [switches] list of image files`

or

`djpeg`

`[switches] list of jpeg files`

Each file named is compressed or decompressed. The input file(s) are not modified; the output data is written to files which have the same names except for extension. `cjpeg` always uses ".jpg" for the output file name's extension; `djpeg` uses one of ".bmp", ".gif", ".ppm", ".rle", or ".tga", depending on what output format is selected by the switches.

For example, to convert `xxx.bmp` to `xxx.jpg` and `yyy.ppm` to `yyy.jpg`, say:

`cjpeg xxx.bmp yyy.ppm`

On most systems you can use standard wildcards to specify the list of input files; for example, on DOS "`djpeg *.jpg`" decompresses all the JPEG files in the current directory.

If an intended output file already exists, you'll be asked whether or not to overwrite it. If you say no, the program skips that input file and goes on to the next one.

You can intermix switches and file names; for example

`djpeg -gif file1.jpg -targa file2.jpg`

decompresses `file1.jpg` into GIF format (`file1.gif`) and `file2.jpg` into Targa format

(`file2.tga`). Only switches to the left of a given file name affect processing of that file; when there are conflicting switches, the rightmost one takes precedence.

You can override the program's choice of output file name by using the

`-outfile` switch, as in

`cjpeg -outfile output.jpg input.ppm`

`-outfile` only affects the first input file name to its right.

The currently supported image file formats are: PPM (PBMPLUS color format), PGM (PBMPLUS grayscale format), BMP, GIF, Targa, and RLE (Utah Raster Toolkit format). (RLE is supported only if the URT library is available, which it isn't on most non-Unix systems.) `cjpeg` recognizes the input image format automatically, with the exception of some Targa-format files. You have to tell `djpeg` which format to generate.

JPEG files are in the standard JFIF file format. There are other, less widely used JPEG-based file formats, but we don't support them.

All switch names may be abbreviated; for example, `-grayscale` may be written

-gray

or -gr. Most of the "basic" switches can be abbreviated to as little as one letter. Upper and lower case are equivalent (-BMP is the same as -bmp). British spellings are also accepted (e.g., -greyscale), though for brevity these are not mentioned below.

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/cdaltui.txt

No license file was found, but licenses were detected in source scan.

/\*

\* jcmaster.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2003-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains master control logic for the JPEG compressor.

\* These routines are concerned with parameter validation, initial setup,

\* and inter-pass control (determining the number of passes and the work

\* to be done in each pass).

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcmaster.c

No license file was found, but licenses were detected in source scan.

/\*

\* rdjpgcom.c

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2009 by Bill Allombert, Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains a very simple stand-alone application that displays

\* the text in COM (comment) markers in a JFIF file.

\* This may be useful as an example of the minimum logic needed to parse

\* JPEG markers.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/rdjpgcom.c

No license file was found, but licenses were detected in source scan.

/\*

\* jfdctflt.c

```

*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2003-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a floating-point implementation of the
* forward DCT (Discrete Cosine Transform).
*
* This implementation should be more accurate than either of the integer
* DCT implementations. However, it may not give the same results on all
* machines because of differences in roundoff behavior. Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column. Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled
DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with a fixed-point
* implementation, accuracy is lost due to imprecise representation of the
* scaled quantization values. However, that problem does not arise if
* we use floating point arithmetic.
*/

```

Found in path(s):

```

* /jpegsrc-v9f-tar-gz/jpeg-9f/jfdctflt.c

```

No license file was found, but licenses were detected in source scan.

```

/*
* alternate cjpeg.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2009-2023 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*

```

- \* This file contains an alternate user interface for the JPEG compressor.
- \* One or more input files are named on the command line, and output file
- \* names are created by substituting ".jpg" for the input file's extension.
- \*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/cjpegalt.c

No license file was found, but licenses were detected in source scan.

/\*

- \* jctrans.c

\*

- \* Copyright (C) 1995-1998, Thomas G. Lane.

- \* Modified 2000-2020 by Guido Vollbeding.

- \* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.

\*

- \* This file contains library routines for transcoding compression,

- \* that is, writing raw DCT coefficient arrays to an output JPEG file.

- \* The routines in jcapimin.c will also be needed by a transcoder.

\*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jctrans.c

No license file was found, but licenses were detected in source scan.

/\*

- \* jcapimin.c

\*

- \* Copyright (C) 1994-1998, Thomas G. Lane.

- \* Modified 2003-2010 by Guido Vollbeding.

- \* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.

\*

- \* This file contains application interface code for the compression half

- \* of the JPEG library. These are the "minimum" API routines that may be

- \* needed in either the normal full-compression case or the transcoding-only

- \* case.

\*

- \* Most of the routines intended to be called directly by an application

- \* are in this file or in jcapistd.c. But also see jcparam.c for

- \* parameter-setup helper routines, jcomapi.c for routines shared by

- \* compression and decompression, and jctrans.c for the transcoding case.

\*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jcapimin.c

No license file was found, but licenses were detected in source scan.

```
/*
* jcpam.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2003-2022 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains optional default-setting code for the JPEG compressor.
* Applications do not have to use this file, but those that don't use it
* must know a lot more about the innards of the JPEG code.
*/
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcpam.c

No license file was found, but licenses were detected in source scan.

```
/*
* jdmaster.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2002-2020 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains master control logic for the JPEG decompressor.
* These routines are concerned with selecting the modules to be executed
* and with determining the number of passes and the work to be done in each
* pass.
*/
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdmaster.c

No license file was found, but licenses were detected in source scan.

```
/*
* jdpostct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the decompression postprocessing controller.
* This controller manages the upsampling, color conversion, and color
* quantization/reduction steps; specifically, it controls the buffering
* between upsample/color conversion and color quantization/reduction.
```

\*  
\* If no color quantization/reduction is required, then this module has no  
\* work to do, and it just hands off to the upsample/color conversion code.  
\* An integrated upsample/convert/quantize process would replace this module  
\* entirely.  
\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdpostct.c  
No license file was found, but licenses were detected in source scan.

/\*  
\* jdct.h  
\*  
\* Copyright (C) 1994-1996, Thomas G. Lane.  
\* Modified 2002-2023 by Guido Vollbeding.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This include file contains common declarations for the forward and  
\* inverse DCT modules. These declarations are private to the DCT managers  
\* (jcdctmgr.c, jddctmgr.c) and the individual DCT algorithms.  
\* The individual DCT algorithms are kept in separate files to ease  
\* machine-dependent tuning (e.g., assembly coding).  
\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdct.h  
No license file was found, but licenses were detected in source scan.

/\*  
\* jdapimin.c  
\*  
\* Copyright (C) 1994-1998, Thomas G. Lane.  
\* Modified 2009-2020 by Guido Vollbeding.  
\* This file is part of the Independent JPEG Group's software.  
\* For conditions of distribution and use, see the accompanying README file.  
\*  
\* This file contains application interface code for the decompression half  
\* of the JPEG library. These are the "minimum" API routines that may be  
\* needed in either the normal full-decompression case or the  
\* transcoding-only case.  
\*  
\* Most of the routines intended to be called directly by an application  
\* are in this file or in jdapistd.c. But also see jcomapi.c for routines  
\* shared by compression and decompression, and jdtrans.c for the transcoding  
\* case.  
\*/



Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdapimin.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdtrans.c

\*

\* Copyright (C) 1995-1997, Thomas G. Lane.

\* Modified 2000-2009 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains library routines for transcoding decompression,

\* that is, reading raw DCT coefficient arrays from an input JPEG file.

\* The routines in jdapimin.c will also be needed by a transcoder.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdtrans.c

No license file was found, but licenses were detected in source scan.

/\*

\* djpeg.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2009-2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains a command-line user interface for the JPEG decompressor.

\* It should work on any system with Unix- or MS-DOS-style command lines.

\*

\* Two different command line styles are permitted, depending on the

\* compile-time switch TWO\_FILE\_COMMANDLINE:

\* djpeg [options] inputfile outputfile

\* djpeg [options] [inputfile]

\* In the second style, output is always to standard output, which you'd

\* normally redirect to a file or pipe to some other program. Input is

\* either from a named file or from standard input (typically redirected).

\* The second style is convenient on Unix but is unhelpful on systems that

\* don't support pipes. Also, you MUST use the

first style if your system

\* doesn't do binary I/O to stdin/stdout.

\* To simplify script writing, the "-outfile" switch is provided. The syntax

\* djpeg [options] -outfile outputfile inputfile

\* works regardless of which command line style is used.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/djpeg.c

No license file was found, but licenses were detected in source scan.

/\*

\* cjpeg.c

\*

\* Copyright (C) 1991-1998, Thomas G. Lane.

\* Modified 2003-2013 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains a command-line user interface for the JPEG compressor.

\* It should work on any system with Unix- or MS-DOS-style command lines.

\*

\* Two different command line styles are permitted, depending on the

\* compile-time switch TWO\_FILE\_COMMANDLINE:

\* cjpeg [options] inputfile outputfile

\* cjpeg [options] [inputfile]

\* In the second style, output is always to standard output, which you'd

\* normally redirect to a file or pipe to some other program. Input is

\* either from a named file or from standard input (typically redirected).

\* The second style is convenient on Unix but is unhelpful on systems that

\* don't support pipes. Also, you MUST use the

first style if your system

\* doesn't do binary I/O to stdin/stdout.

\* To simplify script writing, the "-outfile" switch is provided. The syntax

\* cjpeg [options] -outfile outputfile inputfile

\* works regardless of which command line style is used.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/cjpeg.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcdctmgr.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2003-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the forward-DCT management logic.

\* This code selects a particular DCT implementation to be used,

\* and it performs related housekeeping chores including coefficient

\* quantization.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcdctmgr.c

No license file was found, but licenses were detected in source scan.

/\*

\* wrgif.c

\*

\* Copyright (C) 1991-1996, Thomas G. Lane.

\* Modified 2015-2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains routines to write output images in GIF format.

\*

\* These routines may need modification for non-Unix environments or

\* specialized applications. As they stand, they assume output to

\* an ordinary stdio stream.

\*/

/\*

\* This code is loosely based on ppmtogif from the PBMPLUS distribution

\* of Feb. 1991. That file contains the following copyright notice:

\* Based on GIFENCOD by David Rowley <mgardi@watdscu.waterloo.edu>.

\* Lempel-Ziv compression based on "compress" by Spencer W. Thomas et al.

\* Copyright (C) 1989 by Jef Poskanzer.

\* Permission to use, copy, modify, and distribute this software and its

\* documentation for any purpose

and without fee is hereby granted, provided

\* that the above copyright notice appear in all copies and that both that

\* copyright notice and this permission notice appear in supporting

\* documentation. This software is provided "as is" without express or

\* implied warranty.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/wrgif.c

No license file was found, but licenses were detected in source scan.

/\*

\* jdhuft.c

\*

\* Copyright (C) 1991-1997, Thomas G. Lane.

\* Modified 2006-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains Huffman entropy decoding routines.

- \* Both sequential and progressive modes are supported in this single module.
- \*
- \* Much of the complexity here has to do with supporting input suspension.
- \* If the data source module demands suspension, we want to be able to back
- \* up to the start of the current MCU. To do this, we copy state variables
- \* into local working storage, and update them back to the permanent
- \* storage only upon successful completion of an MCU.
- \*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jdhuff.c

No license file was found, but licenses were detected in source scan.

```
/*
 * wrtle.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2017-2019 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to write output images in RLE format.
 * The Utah Raster Toolkit library is required (version 3.1 or later).
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications. As they stand, they assume output to
 * an ordinary stdio stream.
 *
 * Based on code contributed by Mike Lijewski,
 * with updates from Robert Hutchinson.
 */
```

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/wrtle.c

No license file was found, but licenses were detected in source scan.

```
/*
 * cderror.h
 *
 * Copyright (C) 1994-1997, Thomas G. Lane.
 * Modified 2009-2020 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file defines the error and message codes for the cjpeg/djpeg
 * applications. These strings are not needed as part of the JPEG library
 * proper.
 * Edit this file to add new codes, or to translate the message strings to
```

\* some other language.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/cderror.h

No license file was found, but licenses were detected in source scan.

/\*

\* rdcolmap.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file implements djpeg's "-map file" switch. It reads a source image

\* and constructs a colormap to be supplied to the JPEG decompressor.

\*

\* Currently, these file formats are supported for the map file:

\* GIF: the contents of the GIF's global colormap are used.

\* PPM (either text or raw flavor): the entire file is read and

\* each unique pixel value is entered in the map.

\* Note that reading a large PPM file will be horrendously slow.

\* Typically, a PPM-format map file should contain just one pixel

\* of each desired color. Such a file can be extracted from an

\* ordinary image PPM file with ppmtomap(1).

\*

\* Rescaling a PPM that has a maxval unequal to MAXJSAMPLE is not

\* currently implemented.

\*/

/\* Portions of this code are based on the PBMPLUS library, which is:

\*\*

\*\* Copyright (C) 1988 by Jef Poskanzer.

\*\*

\*\* Permission to use, copy, modify, and distribute this software and its

\*\* documentation for any purpose and without fee is hereby granted, provided

\*\* that the above copyright notice appear in all copies and that both that

\*\* copyright notice and this permission notice appear in supporting

\*\* documentation. This software is provided "as is" without express or

\*\* implied warranty.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/rdcolmap.c

No license file was found, but licenses were detected in source scan.

/\*

\* jerror.h

\*

- \* Copyright (C) 1994-1997, Thomas G. Lane.
- \* Modified 1997-2018 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file defines the error and message codes for the JPEG library.
- \* Edit this file to add new codes, or to translate the message strings to
- \* some other language.
- \* A set of error-reporting macros are defined too. Some applications using
- \* the JPEG library may wish to include this file to get the error codes
- \* and/or the macros.
- \*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jerror.h

No license file was found, but licenses were detected in source scan.

/\*

- \* jdcolor.c

\*

- \* Copyright (C) 1991-1997, Thomas G. Lane.
- \* Modified 2011-2023 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains output colorspace conversion routines.
- \*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jdcolor.c

No license file was found, but licenses were detected in source scan.

/\*

- \* jdatadst.c

\*

- \* Copyright (C) 1994-1996, Thomas G. Lane.
- \* Modified 2009-2022 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains compression data destination routines for the case of
- \* emitting JPEG data to memory or to a file (or any stdio stream).
- \* While these routines are sufficient for most applications,
- \* some will want to use a different destination manager.
- \* IMPORTANT: we assume that fwrite() will correctly transcribe an array of
- \* JOCTETs into 8-bit-wide elements on external storage. If char is wider
- \* than 8 bits on your machine, you may need to do some tweaking.
- \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdatadst.c

No license file was found, but licenses were detected in source scan.

/\*

\* jcrepct.c

\*

\* Copyright (C) 1994-1996, Thomas G. Lane.

\* Modified 2003-2020 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains the compression preprocessing controller.

\* This controller manages the color conversion, downsampling,

\* and edge expansion steps.

\*

\* Most of the complexity here is associated with buffering input rows

\* as required by the downsampler. See the comments at the head of

\* jcsample.c for the downsampler's needs.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jcrepct.c

No license file was found, but licenses were detected in source scan.

/\*

\* jaricom.c

\*

\* Developed 1997-2011 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains probability estimation tables for common use in

\* arithmetic entropy encoding and decoding routines.

\*

\* This data represents Table D.3 in the JPEG spec (D.2 in the draft),

\* ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81, and Table 24

\* in the JBIG spec, ISO/IEC IS 11544 and CCITT Recommendation ITU-T T.82.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jaricom.c

No license file was found, but licenses were detected in source scan.

/\*

\* jmemmgr.c

\*

- \* Copyright (C) 1991-1997, Thomas G. Lane.
- \* Modified 2011-2019 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains the JPEG system-independent memory management
- \* routines. This code is usable across a wide variety of machines; most
- \* of the system dependencies have been isolated in a separate file.
- \* The major functions provided here are:
- \* \* pool-based allocation and freeing of memory;
- \* \* policy decisions about how to divide available memory among the
- \* virtual arrays;
- \* \* control logic for swapping virtual arrays between main memory and
- \* backing storage.
- \* The separate system-dependent file provides the actual backing-storage
- \* access code, and it contains the policy decision about how much total
- \* main memory to use.
- \* This file is
- system-dependent in the sense that some of its functions
- \* are unnecessary in some systems. For example, if there is enough virtual
- \* memory so that backing storage will never be used, much of the virtual
- \* array control logic could be removed. (Of course, if you have that much
- \* memory then you shouldn't care about a little bit of unused code...)
- \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jmemmgr.c

No license file was found, but licenses were detected in source scan.

/\*

\* cdjpeg.h

\*

\* Copyright (C) 1994-1997, Thomas G. Lane.

\* Modified 2019 by Guido Vollbeding.

\* This file is part of the Independent JPEG Group's software.

\* For conditions of distribution and use, see the accompanying README file.

\*

\* This file contains common declarations for the sample applications

\* cjpeg and djpeg. It is NOT used by the core JPEG library.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/cdjpeg.h

No license file was found, but licenses were detected in source scan.

/\*

\* jmorecfg.h

\*



- \* Copyright (C) 1991-1997, Thomas G. Lane.
- \* Modified 1997-2022 by Guido Vollbeding.
- \* This file is part of the Independent JPEG Group's software.
- \* For conditions of distribution and use, see the accompanying README file.
- \*
- \* This file contains additional configuration options that customize the
- \* JPEG software for special applications or support machine-dependent
- \* optimizations. Most users will not need to touch this file.
- \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jmorecfg.h

No license file was found, but licenses were detected in source scan.

/\*

\* jdsample.c

\*

- \* Copyright (C) 1991-1996, Thomas G. Lane.

- \* Modified 2002-2020 by Guido Vollbeding.

- \* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.

\*

- \* This file contains upsampling routines.

\*

- \* Upsampling input data is counted in "row groups". A row group

- \* is defined to be (v\_samp\_factor \* DCT\_v\_scaled\_size / min\_DCT\_v\_scaled\_size)

- \* sample rows of each component. Upsampling will normally produce

- \* max\_v\_samp\_factor pixel rows from each row group (but this could vary

- \* if the upsampler is applying a scale factor of its own).

\*

- \* An excellent reference for image resampling is

- \* Digital Image Warping, George Wolberg, 1990.

- \* Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.

\*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdsample.c

No license file was found, but licenses were detected in source scan.

/\*

\* rdtarga.c

\*

- \* Copyright (C) 1991-1996, Thomas G. Lane.

- \* Modified 2017-2019 by Guido Vollbeding.

- \* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.

\*

- \* This file contains routines to read input images in Targa format.

```

*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed Targa format).
*
* Based on code contributed by Lee Daniel Crocker.
*/

```

Found in path(s):

```
* /jpegsrc-v9f-tar-gz/jpeg-9f/rdtarga.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jcarith.c
*
* Developed 1997-2020 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains portable arithmetic entropy encoding routines for JPEG
* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
*
* Both sequential and progressive modes are supported in this single module.
*
* Suspension is not currently supported in this module.
*/

```

Found in path(s):

```
* /jpegsrc-v9f-tar-gz/jpeg-9f/jcarith.c
```

No license file was found, but licenses were detected in source scan.

```

/*
* jfdctfst.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2003-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a fast, not so accurate integer implementation of the
* forward DCT (Discrete Cosine Transform).
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column. Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.

```

\*  
 \* This implementation is based on Arai, Agui, and Nakajima's algorithm for  
 \* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in  
 \* Japanese, but the algorithm is described in the Pennebaker & Mitchell  
 \* JPEG textbook (see REFERENCES section in file README). The following code  
 \* is based directly on figure 4-8 in P&M.  
 \* While an 8-point DCT cannot be done in less than 11 multiplies, it is  
 \* possible to arrange the computation so that many of the multiplies are  
 \* simple scalings of the final outputs. These multiplies can then be  
 \* folded into the multiplications or divisions by the JPEG quantization  
 \* table entries. The AA&N method leaves only 5 multiplies and 29 adds  
 \* to be done in the DCT itself.  
 \* The primary disadvantage of this method is that with fixed-point math,  
 \* accuracy is lost due to imprecise representation of the scaled  
 \* quantization values. The smaller the quantization table entry, the less  
 \* precise the scaled value, so this implementation does worse with high-  
 \* quality-setting files than with low-quality ones.  
 \*/

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jfdctfst.c

No license file was found, but licenses were detected in source scan.

/\*  
 \* jmemmac.c  
 \*  
 \* Copyright (C) 1992-1997, Thomas G. Lane.  
 \* This file is part of the Independent JPEG Group's software.  
 \* For conditions of distribution and use, see the accompanying README file.  
 \*  
 \* jmemmac.c provides an Apple Macintosh implementation of the system-  
 \* dependent portion of the JPEG memory manager.  
 \*  
 \* If you use jmemmac.c, then you must define USE\_MAC\_MEMMGR in the  
 \* JPEG\_INTERNALS part of jconfig.h.  
 \*  
 \* jmemmac.c uses the Macintosh toolbox routines NewPtr and DisposePtr  
 \* instead of malloc and free. It accurately determines the amount of  
 \* memory available by using CompactMem. Notice that if left to its  
 \* own devices, this code can chew up all available space in the  
 \* application's zone, with the exception of the rather small "slop"  
 \* factor computed in jpeg\_mem\_available(). The application can ensure  
 \* that more space is left over by reducing max\_memory\_to\_use.  
 \*  
 \* Large images  
 \* are swapped to disk using temporary files and System 7.0+'s  
 \* temporary folder functionality.  
 \*

- \* Note that jmemmac.c depends on two features of MacOS that were first
- \* introduced in System 7: FindFolder and the FSSpec-based calls.
- \* If your application uses jmemmac.c and is run under System 6 or earlier,
- \* and the jpeg library decides it needs a temporary file, it will abort,
- \* printing error messages about requiring System 7. (If no temporary files
- \* are created, it will run fine.)
- \*
- \* If you want to use jmemmac.c in an application that might be used with
- \* System 6 or earlier, then you should remove dependencies on FindFolder
- \* and the FSSpec calls. You will need to replace FindFolder with some
- \* other mechanism for finding a place to put temporary files, and you
- \* should replace the FSSpec calls with their HFS equivalents:
- \*
- \* FSpDelete -> HDelete
- \* FSpGetFInfo -> HGetFInfo
- \* FSpCreate -> HCreate
- \* FSpOpenDF -> HOpen
- \*\*\* Note: not HOpenDF \*\*\*
- \* FSMakeFSSpec -> (fill in spec by hand.)
- \*
- \* (Use HOpen instead of HOpenDF. HOpen is just a glue-interface to PBHOpen,
- \* which is on all HFS macs. HOpenDF is a System 7 addition which avoids the
- \* ages-old problem of names starting with a period.)
- \*
- \* Contributed by Sam Bushell (jsam@iagu.on.net) and
- \* Dan Gildor (gyld@in-touch.com).
- \*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jmemmac.c

No license file was found, but licenses were detected in source scan.

/\*

- \* jdinput.c

\*

- \* Copyright (C) 1991-1997, Thomas G. Lane.

- \* Modified 2002-2020 by Guido Vollbeding.

- \* This file is part of the Independent JPEG Group's software.

- \* For conditions of distribution and use, see the accompanying README file.

\*

- \* This file contains input control logic for the JPEG decompressor.

- \* These routines are concerned with controlling the decompressor's input

- \* processing (marker reading and coefficient decoding). The actual input

- \* reading is done in jdmarker.c, jdhuft.c, and jdarith.c.

\*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jdinput.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdmainct.c
 *
 * Copyright (C) 1994-1996, Thomas G. Lane.
 * Modified 2002-2020 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains the main buffer controller for decompression.
 * The main buffer lies between the JPEG decompressor proper and the
 * post-processor; it holds downsampled data in the JPEG colorspace.
 *
 * Note that this code is bypassed in raw-data mode, since the application
 * supplies the equivalent of the main buffer in that case.
 */
```

Found in path(s):

\* /jpegsrc-v9f-tar-gz/jpeg-9f/jdmainct.c

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```
/*
 * jidctfst.c
 *
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 *
 * This file contains a fast, not so accurate integer implementation of the
 * inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
 * must also perform dequantization of the input coefficients.
 *
 * A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
 * on each row (or vice versa, but it's more convenient to emit a row at
 * a time). Direct algorithms are also available, but they are much more
 * complex and seem not to be any faster when reduced to code.
 *
 * This implementation is based on Arai, Agui, and Nakajima's algorithm for
 * scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
 * Japanese, but the algorithm
 * is described in the Pennebaker & Mitchell
 * JPEG textbook (see REFERENCES section in file README). The following code
 * is based directly on figure 4-8 in P&M.
 *
 * While an 8-point DCT cannot be done in less than 11 multiplies, it is
 * possible to arrange the computation so that many of the multiplies are
 * simple scalings of the final outputs. These multiplies can then be
```

- \* folded into the multiplications or divisions by the JPEG quantization
- \* table entries. The AA&N method leaves only 5 multiplies and 29 adds
- \* to be done in the DCT itself.
- \* The primary disadvantage of this method is that with fixed-point math,
- \* accuracy is lost due to imprecise representation of the scaled
- \* quantization values. The smaller the quantization table entry, the less
- \* precise the scaled value, so this implementation does worse with high-
- \* quality-setting files than with low-quality ones.
- \*/

Found in path(s):

- \* /jpegsrc-v9f-tar-gz/jpeg-9f/jidctfst.c

# 1.175 iovec 0.1.4

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## 1.176 lxc 6.0.2

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"Source code" for a work means the preferred form of the work for

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Version 3, 29 June 2007

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## TERMS AND CONDITIONS

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The

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b) Convey the object code in, or embodied in, a physical product (including a physical distribution medium), accompanied by a written offer, valid for at least three years and valid for as

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## 1.184 futures-io 0.3.31

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## 1.187 zerofrom 0.1.5

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## 1.188 futures-sink 0.3.31

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# 1.189 heck 0.5.0

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## 1.191 rustix 0.38.44

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## 1.193 sharded-slab 0.1.7

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## 1.194 futures-macro 0.3.31

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# 1.195 pin-project-lite 0.2.16

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git ls-files

## 1.196 cpufeatures 0.2.17

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## 1.197 itertools 0.14.0

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`Gnomovision' (which makes passes at compilers) written by James Hacker.
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<signature of Ty Coon>, 1 April 1989
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[This is the first released version of the library GPL. It is numbered 2 because it goes with version 2 of the ordinary GPL.]

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we

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Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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## 1.202 less 668

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The

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\* /libdrm-nvdc-r32-l4t-dc6f112fc56-tar/drm-nvdc/drm\_nvdc\_headers/include/nvrm\_host1x.h

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* /libdrm-nvdc-r32-l4t-dc6f112fc56-tar/drm-nvdc/include/drm-funcs.h
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/\*! \brief

\* Define compile time symbols for CPU type and operating system type.

\* This file should only contain preprocessor commands so that

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\*

\* cpuopsys.h

\*

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- \*/
- /\*\*
- \* NvColorDataType defines the data type of color components.
- \*
- \* The default datatype of color components is 'Integer' which should be used
- \* when the color value is to be interpreted as an integer value ranging from 0
- \* to the maximum value representable by the width of the components (as
- \* specified by the packing of the component). Use 'Integer' also when the
- \* interpretation of color value bits is not known, does not matter or is
- \* context dependent.
- \*
- \* A data type
- of 'Signed' indicates that the color value is to be interpreted
- \* as a signed two's complement integer value. The width of the component
- \* includes the sign bit (e.g. S8 ranges from -128 to 127).
- \*
- \* A data type of 'Float' indicates that float values are stored in the
- \* components of the color. The combination of data type 'Float' and the
- \* bit width of the component packing defines the final data format of the
- \* individual component.
- \*
- \* The list below defines the accepted combinations, when adding new
- \* float formats please add an entry into this list.
- \*
- \* - DataType = Float, Component bit width = 32:
- \*   A IEEE 754 single precision float (binary32) with 1 sign bit,
- \*   8 exponent bits and 23 mantissa bits.
- \*
- \* - DataType = Float, Component bit width = 16:
- \*   A IEEE 754 half precision float (binary16) with 1 sign bit,
- \*   5 exponent bits and 10 mantissa bits.
- \*
- \* - DataType = Float, Component bit width = 10:
- \*   An unsigned nvfloat with 5 exponent
- bits and 5 mantissa bits.
- \*
- \* - DataType = Float, Component bit width = 11:
- \*   An unsigned nvfloat with 5 exponent bits and 6 mantissa bits.
- \*
- \* - DataType = FloatISP, Component bit width = 16:
- \*   A Nvidia proprietary Floating point representation for optimal
- \*   usage in ISP, with 4 exponent bits and 12 mantissa bits.
- \*/

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\* nvctassert.h

```

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* NVidia ct_assert (compile time assertion) function.
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<!--

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# Userspace-RCU LGPL 2.1+ re-licensing

Mathieu Desnoyers

May 13th, 2009

IBM Corporation allowed LGPLv2.1+ licensing of their contribution to the  
userspace RCU library in a patch submitted on May 8, 2009 from Paul E.  
McKenney and reviewed by Steven L. Bennett:

<https://lists.lttng.org/pipermail/lttng-dev/2009-May/012835.html>

I (Mathieu Desnoyers) re-implemented ACCESS\_ONCE(), likely(), unlikely() and  
barrier() from scratch without reference to the original code.

commit id : 2dc5fa0f7cfbfb0a64a7a67b39626650e863f16a

Bert Wesarg <bert.wesarg@googlemail.com> approved LGPL re-licensing of his  
patch in an email dated May 13, 2009 :

<http://lkml.org/lkml/2009/5/13/16>

xchg() primitives has been rewritten from a MIT-licensed cmpxchg for Intel  
and powerpc. They are MIT-licensed and therefore usable in LGPL code.  
This cmpxchg code was obtained from the atomic\_ops  
project:

[http://www.hpl.hp.com/research/linux/atomic\\_ops/](http://www.hpl.hp.com/research/linux/atomic_ops/)

I (Mathieu Desnoyers) wrote the remainder of the code.

The license for the library files in this project was therefore changed to LGPLv2.1 on May 13, 2009, as detailed in LICENSE.  
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```

#define _LGPL_SOURCE
#include <urcu.h>

```

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```

http://www.hpl.hp.com/research/linux/atomic_ops/LICENSING.txt
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```

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snprintf/fvwrite.c  
snprintf/fvwrite.h  
snprintf/local.h  
snprintf/mbrtowc\_sb.c  
snprintf/snprintf.c  
snprintf/variuous.h  
snprintf/vfprintf.c  
snprintf/wcio.h:5  
snprintf/wsetup.c

The

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#

# Example makefile for build outside of the LTTng-UST tree.

hello:

`\${CC}` -O2 -I. -o hello -lc -lltng-ust hello.c tp.c

.PHONY: clean

clean:

rm -f hello

# Example makefile for build outside of the LTTng-UST tree.

hello:

`\${CC}` -O2 -I. -o hello -lc -lltng-ust hello.c tp.c

.PHONY: clean

clean:

rm -f hello

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THANKS

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## 1.219 memoffset 0.9.1

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## 1.221 nix 0.30.1

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```
use crate::errno::Errno;
use crate::sys::signal::Signal;
use crate::unistd::Pid;
use crate::Result;
use cfg_if::cfg_if;
use libc::{self, c_int};
use std::ptr;

pub type RequestType = c_int;

cfg_if! {
 if #[cfg(any(freebsdlike, apple_targets, target_os = "openbsd"))] {
```

```

 #[doc(hidden)]
 pub type AddressType = *mut ::libc::c_char;
} else {
 #[doc(hidden)]
 pub type AddressType = *mut ::libc::c_void;
}
}

libc_enum! {
 #[repr(i32)]
 /// Ptrace Request enum defining the action to be taken.
 #[non_exhaustive]
 pub enum Request {
 PT_TRACE_ME,
 PT_READ_I,
 PT_READ_D,
 #[cfg(apple_targets)]
 PT_READ_U,
 PT_WRITE_I,
 PT_WRITE_D,
 #[cfg(apple_targets)]
 PT_WRITE_U,
 PT_CONTINUE,
 PT_KILL,
 #[cfg(any(any(freebsdlike, apple_targets),
 all(target_os = "openbsd", target_arch = "x86_64"),
 all(target_os = "netbsd", any(target_arch = "x86_64",
 target_arch = "powerpc"))))]
 PT_STEP,
 PT_ATTACH,
 PT_DETACH,
 #[cfg(apple_targets)]
 PT_SIGEXC,
 #[cfg(apple_targets)]
 PT_THUPDATE,
 #[cfg(apple_targets)]
 PT_ATTACHEXC
 }
}

unsafe fn ptrace_other(
 request: Request,
 pid: Pid,
 addr: AddressType,
 data: c_int,
) -> Result<c_int> {
 unsafe {
 Errno::result(libc::ptrace(

```



```

 request as RequestType,
 libc::pid_t::from(pid),
 addr,
 data,
))
 .map(|_| 0)
}
}

/// Sets the process as traceable, as with `ptrace(PT_TRACEME, ...)`
///
/// Indicates that this process is to be traced by its parent.
/// This is the only ptrace request to be issued by the tracee.
pub fn traceme() -> Result<()> {
 unsafe {
 ptrace_other(Request::PT_TRACE_ME, Pid::from_raw(0), ptr::null_mut(), 0)
 .map(drop)
 }
}

/// Attach to a running
/// process, as with `ptrace(PT_ATTACH, ...)`
///
/// Attaches to the process specified by `pid`, making it a tracee of the calling process.
pub fn attach(pid: Pid) -> Result<()> {
 unsafe {
 ptrace_other(Request::PT_ATTACH, pid, ptr::null_mut(), 0).map(drop)
 }
}

/// Detaches the current running process, as with `ptrace(PT_DETACH, ...)`
///
/// Detaches from the process specified by `pid` allowing it to run freely, optionally delivering a
/// signal specified by `sig`.
pub fn detach<T: Into<Option<Signal>>>>(pid: Pid, sig: T) -> Result<()> {
 let data = match sig.into() {
 Some(s) => s as c_int,
 None => 0,
 };
 unsafe {
 ptrace_other(Request::PT_DETACH, pid, ptr::null_mut(), data).map(drop)
 }
}

/// Restart the stopped tracee process, as with `ptrace(PTRACE_CONT, ...)`
///
/// Continues the execution of the process with PID `pid`, optionally
/// delivering a signal specified by `sig`.

```

```

pub fn cont<T: Into<Option<Signal>>>(pid: Pid, sig: T)
-> Result<()> {
 let data = match sig.into() {
 Some(s) => s as c_int,
 None => 0,
 };
 unsafe {
 // Ignore the useless return value
 ptrace_other(Request::PT_CONTINUE, pid, 1 as AddressType, data)
 .map(drop)
 }
}

/// Issues a kill request as with `ptrace(PT_KILL, ...)`
///
/// This request is equivalent to `ptrace(PT_CONTINUE, ..., SIGKILL);`
pub fn kill(pid: Pid) -> Result<()> {
 unsafe {
 ptrace_other(Request::PT_KILL, pid, 0 as AddressType, 0).map(drop)
 }
}

/// Move the stopped tracee process forward by a single step as with
/// `ptrace(PT_STEP, ...)`
///
/// Advances the execution of the process with PID `pid` by a single step optionally delivering a
/// signal specified by `sig`.
///
/// # Example
/// ```rust
/// use nix::sys::ptrace::step;
/// use nix::unistd::Pid;
/// use nix::sys::signal::Signal;
/// use nix::sys::wait::*;
/// // If a process changes state to the stopped state because of a SIGUSR1
/// // signal,
/// this will step the process forward and forward the user
/// // signal to the stopped process
/// match waitpid(Pid::from_raw(-1), None) {
/// Ok(WaitStatus::Stopped(pid, Signal::SIGUSR1)) => {
/// let _ = step(pid, Signal::SIGUSR1);
/// }
/// _ => {},
/// }
/// ```
#[cfg(any(
 any(freebsdlike, apple_targets),
 all(target_os = "openbsd", target_arch = "x86_64"),

```

```

all(
 target_os = "netbsd",
 any(target_arch = "x86_64", target_arch = "powerpc")
)
))]
pub fn step<T: Into<Option<Signal>>>(pid: Pid, sig: T) -> Result<()> {
 let data = match sig.into() {
 Some(s) => s as c_int,
 None => 0,
 };
 unsafe {
 ptrace_other(Request::PT_STEP, pid, ptr::null_mut(), data).map(drop)
 }
}

/// Reads a word from a processes memory at the given address
/// Technically, ptrace doesn't dereference the pointer. It passes it directly
/// to the kernel.
#[allow(clippy::not_unsafe_ptr_arg_deref)]
pub fn read(pid: Pid, addr: AddressType)
-> Result<c_int> {
 unsafe {
 // Traditionally there was a difference between reading data or
 // instruction memory but not in modern systems.
 ptrace_other(Request::PT_READ_D, pid, addr, 0)
 }
}

/// Writes a word into the processes memory at the given address
/// Technically, ptrace doesn't dereference the pointer. It passes it directly
/// to the kernel.
#[allow(clippy::not_unsafe_ptr_arg_deref)]
pub fn write(pid: Pid, addr: AddressType, data: c_int) -> Result<()> {
 unsafe { ptrace_other(Request::PT_WRITE_D, pid, addr, data).map(drop) }
}

```

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## 1.222 sha-2 0.10.9

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## 1.226 seatd 0.6.4

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## 1.228 itoa 1.0.15

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# 1.231 bluez 5.82

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/opt/cola/permits/2483113333\_1758625024.5315385/0/libtraceevent-1-8-3-tar-gz/libtraceevent-  
1.8.3/LICENSES/GPL-2.0Valid-License-Identifier:  
GPL-2.0  
/opt/cola/permits/2483113333\_1758625024.5315385/0/libtraceevent-1-8-3-tar-gz/libtraceevent-  
1.8.3/LICENSES/LGPL-2.1Valid-License-Identifier:  
LGPL-2.1  
/opt/cola/permits/2483113333\_1758625024.5315385/0/libtraceevent-1-8-3-tar-gz/libtraceevent-1.8.3/meson.build#  
SPDX-License-Identifier: LGPL-2.1  
/opt/cola/permits/2483113333\_1758625024.5315385/0/libtraceevent-1-8-3-tar-gz/libtraceevent-  
1.8.3/plugins/plugin\_mac80211.c// SPDX-License-Identifier: LGPL-2.1  
/opt/cola/permits/2483113333\_1758625024.5315385/0/libtraceevent-1-8-3-tar-gz/libtraceevent-1.8.3/src/event-  
parse.c// SPDX-License-Identifier: LGPL-2.1

Found in path(s):

\*

## 1.237 libusb 1.0.29

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If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the



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When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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a)

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- c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
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For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

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# 1.239 libcgroup 3.2.0

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Version 2.1, February 1999

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=====

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-----  
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/opt/cola/permits/2483113343\_1758625024.5970304/0/libtracefs-1-8-1-tar-gz/libtracefs-1.8.1/LICENSES/GPL-  
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/opt/cola/permits/2483113343\_1758625024.5970304/0/libtracefs-1-8-1-tar-gz/libtracefs-1.8.1/meson.build# SPDX-  
License-Identifier: LGPL-2.1  
/opt/cola/permits/2483113343\_1758625024.5970304/0/libtracefs-1-8-1-tar-gz/libtracefs-1.8.1/src/sqlhist.tab.c/\* A  
Bison parser, made by GNU Bison 3.6.4. \*/

/opt/cola/permits/2483113343\_1758625024.5970304/0/libtracefs-1-8-1-tar-gz/libtracefs-1.8.1/src/sqlhist.tab.h/\*

A Bison parser, made by GNU Bison 3.6.4. \*/

Found in path(s):

\*

No license file was found, but licenses were detected in source scan.

libtracefs(3)

Found in path(s):

\* /libtracefs-1-8-1-tar-gz/libtracefs-1.8.1/Documentation/libtracefs-cpu-buf.txt

# 1.241 dlib 20.0

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```
printf("%s",png_get_copyright(NULL));
```

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Glenn Randers-Pehrson

glennrp at users.sourceforge.net

November 14, 2013

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# 1.242 libusb1-sys 0.7.0

## 1.242.1 Available under license :

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Version 2.1, February 1999

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Any executables

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## 1.246 drm 0.14.1

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## 1.248 downcast-rs 1.2.1

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## 1.255 pam 1.7.1

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## 1.256 libzip 1.11.4

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name: BSD

on: [push]

permissions:

contents: read

jobs:

NetBSD:

runs-on: ubuntu-latest

steps:

- name: checkout

uses: actions/checkout@v4

- name: NetBSD test

uses: vmactions/netbsd-vm@v1

with:

uses: true

copyback: false

prepare: |

/usr/sbin/pkg\_add cmake zstd py313-pip

/usr/pkg/bin/pip-3.13 install nihtest

# [https://docs.github.com/en/actions/writing-workflows/choosing-what-your-workflow-does/workflow-](https://docs.github.com/en/actions/writing-workflows/choosing-what-your-workflow-does/workflow-commands-for-github-actions#adding-a-system-path)

[commands-for-github-actions#adding-a-system-path](https://docs.github.com/en/actions/writing-workflows/choosing-what-your-workflow-does/workflow-commands-for-github-actions#adding-a-system-path)

echo "/usr/pkg/bin" >> "\$GITHUB\_PATH"

run: |

cmake -E make\_directory \${runner.workspace}/build

cmake \${matrix.cmake\_extra} \${github.workspace}

cmake --build . --config Release

ctest --output-on-failure -V -C Release

# 1.257 iproute 6.15.0

## 1.257.1 Available under license :

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\* Last update: 06/15/2005

\* Issue date: 06/15/2005

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## MMC tools (mmc-utils)

=====

mmc-utils is a tool for configuring MMC storage devices from userspace.

## Contribution guidelines

-----

The project works using a mailing list patch submission process, similar to the process used for the Linux kernel itself.

One can document themselves by reading how to submit a patch in the official Linux kernel documentation:

<https://www.kernel.org/doc/html/latest/process/submitting-patches.html>

Not all sections apply but it should be a good way to get started.

A patch should be sent as a mail (not as an attachment, see documentation above) to the [linux-mmc@vger.kernel.org](mailto:linux-mmc@vger.kernel.org) mailing list with maintainers as Cc recipients.

## Documentation

-----

<https://mmc-utils.readthedocs.io/en/latest/>

## Maintainers

-----

Avri Altman <[avri.altman@wdc.com](mailto:avri.altman@wdc.com)>

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# 1.261 openssl 1.1.1zc

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# 1.264 open-ldap 2.6.10

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## 1.265 e2fsprogs 1.47.3

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Index: tdbsa/tdb.c

=====

--- tdbsa.orig/tdb.c

+++ tdbsa/tdb.c

@@ -4,11 +4,11 @@ Rev: 23371

Last Changed Date: 2007-06-06 20:14:06 -0400 (Wed, 06 Jun 2007)

\*/

/\*

- Unix SMB/CIFS implementation.
- + trivial database library - standalone version
  
- trivial database library - private includes
- 
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Theodore Ts'o  
23-June-2007

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Ty Coon, President of Vice

```

That's all there is to it!
#
This is a Makefile stub which handles the creation of BSD shared
libraries.
#
In order to use this stub, the following makefile variables must be defined.
#
BSDLIB_VERSION = 1.0
BSDLIB_IMAGE = libce
BSDLIB_MYDIR = et
BSDLIB_INSTALL_DIR = $(SHLIBDIR)
#

all:: image

real-subdirs:: Makefile
@echo " MKDIR pic"
@mkdir -p pic

BSD_LIB = $(BSDLIB_IMAGE).so.$(BSDLIB_VERSION)
BSDLIB_PIC_FLAG = -fpic

image: $(BSD_LIB)

$(BSD_LIB): $(OBJS)
(cd pic; ld -Bshareable -o $(BSD_LIB) $(LDFLAGS_SHLIB) $(OBJS))
$(MV) pic/$(BSD_LIB) .
$(RM) -f ../$(BSD_LIB)
(cd ..; $(LN) $(LINK_BUILD_FLAGS) \
`echo $(my_dir) | sed -e 's;lib/;;'/'$(BSD_LIB) $(BSD_LIB)`)

install-shlibs install:: $(BSD_LIB)
@echo " INSTALL_PROGRAM $(BSDLIB_INSTALL_DIR)/$(BSD_LIB)"
@$(INSTALL_PROGRAM) $(BSD_LIB) \
$(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)
@-$(LDCONFIG)

install-strip: install

install-shlibs-strip:: install-shlibs

uninstall-shlibs uninstall::
$(RM) -f $(DESTDIR)$$(BSDLIB_INSTALL_DIR)/$(BSD_LIB)

clean::
$(RM)
-rf pic
$(RM) -f $(BSD_LIB)

```



\$(RM) -f ../\$(BSD\_LIB)

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Upstream-Name: e2fsprogs

Upstream-Contact: Theodore Ts'o <tytso@mit.edu>

Source: <http://sourceforge.net/projects/e2fsprogs>

Comment:

This is the Debian GNU/Linux prepackaged version of the EXT2 file system utilities (e2fsck, mke2fs, etc.). The EXT2 utilities were written by Theodore Ts'o <tytso@mit.edu> and Remy Card <card@masi.ibp.fr>.

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2001 Alcove <<http://www.alcove.com/>>

1997 Klee Dienes

1995-1996 Michael Nonweiler <mrn20@cam.ac.uk>

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Files: debian/fuse-ext2.1

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Files: lib/et/\*

lib/ss/\*

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Files: lib/et/com\_right.c

Comment: Taken from lib/com\_err/error.c from Kerberos4kth distribution.

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lib/e2p/\*  
lib/support/print\_fs\_flags.c  
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## 1.268 wayland-sys 0.31.7

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## 1.269 wayland-client 0.31.11

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# 1.270 libc 0.2.174

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## 1.271 wayland-backend 0.3.11

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## 1.272 wayland-protocols-rs 0.32.9

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## 1.273 wayland-server 0.31.10

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## 1.274 autocfg 1.5.0

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## 1.276 wayland-scanner 0.31.7

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Shield logo: Badger, Trent  
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# 1.280 syslog-ng 4.9.0

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Upstream-Name: syslog-ng

Upstream-Contact: Syslog-ng users' and developers' mailing list <[syslog-ng@lists.balabit.hu](mailto:syslog-ng@lists.balabit.hu)>

Source: [git://github.com/syslog-ng/syslog-ng.git](https://github.com/syslog-ng/syslog-ng.git)

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#define SYSLOG\_NG\_LICENSE\_H\_INCLUDED

1

#include "commands.h"

extern GOptionEntry license\_options[];

```
gint slng_license(int argc, char *argv[], const gchar *mode, GOptionContext *ctx);
```

```
#endif
```

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```
#####
generated files are ignored
#####
 ignore
\ctags
\mailmap
scl/syslogconf/convert-syslogconf.awk$
.*/*\.*.am$
.*\.(ql|yaml|md|y|l|txt|xml|xsd|log|key|crt|files|in|conf|.example|gradle|mk|supp|sub|guess|list|pc|.cmake)$
\.*rc$
.*[/\^]+-grammar\.[ch]$
(.*)?(README|\.gitignore|pylintrc)$
lib/ivykis
lib/eventlog
modules/java/org_syslog_ng_[^/_-]+\.*h$
modules/(afmongodb|afamqp)/dummy\.*c$
modules/kafka/tests/sample\.*properties
modules/grpc/protos/opentelemetry-proto
modules/grpc/protos/grafana-loki
```

```

modules/grpc/protos/googleapis-proto
modules/grpc/protos/clickhouse-proto
modules/cloud-auth/jwt-cpp
dev-utils/plugin_skeleton_creator/plugin_template.*
(lib|modules)/.*\conf$
dist\conf$
.*\gradle
scl/syslog-ng\conf$
docker/syslog-ng\conf$
tests/copyright/policy$
(syslog-ng-)?config.h$
lib/cfg-lex\.[ch]$
tgz2build
autom4te\cache
m4
Mk
.*\.(a|bin|class|css|dirstamp|html|idx|jar|js|o|la|lai|lo|MF|persist|Plo|Po|pc|pyc|so|so\0\0\0|soT|spec|trs)$
(.*)?Makefile$
doc/man
(_configs\.sed|\.project\.cproject|config\.status)$
stamp-h1$
tests/functional/test\conf$
scripts/update-patterndb$
(contrib|debian)
packaging/debian
packaging/debian/(man|source)
packaging/rhel
packaging/package-indexer/(Dockerfile|example-cfg\.yaml|pyproject\.toml)$
packaging/package-indexer/indexer/apt_conf/.*\conf$
doc/ChangeLog\.[0-9]$
(\.gitmodules|AUTHORS|COPYING|INSTALL|VERSION|aclocal\.m4|compile|configure|depcomp|install-
sh|libtool|ltmain\.sh|missing|test-driver|ylwrap)$
.*[/^\.]*$
GPATH|GTAGS|GRTAGS|GSYMS
dbld/build/*$
dbld/release/*$
dbld/install/*$
dbld/images/*$
dbld/(functions\.sh|(build|packages|pip_packages)\.manifest|tarball-changes\.ignore)$
dbld\dockerignore$
cmake/*$
tests/light/pytest.ini
tests/light/tox.ini
tests/light/.pre-commit-config.yaml
.github/workflows/*$
lib/logmsg/tests/messages/syslog-ng-(pe-)?[0-9]*-msg.h$
modules/python-modules/requirements\lock
scl/darwinosl/darwinosl-metadata-db.csv

```

lib/multi-line/smart-multi-line\fsms\$

.editorconfig

#####

#

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#####

        LGPLv2.1+\_SSL,non-balabit

cmake/Modules/FindLIBBPF\cmake

lib/timeutils/zonecache.[ch]\$

modules/secure-logging

modules/secure-logging/tests

modules/secure-logging/slogencrypt

modules/secure-logging/slogverify

modules/secure-logging/slogkey

lib/compat/cpp-(start|end).\h\$

lib/compat/curl.\h\$

lib/compat/getline.\c\$

lib/compat/json.\h\$

lib/healthcheck

lib/healthcheck/tests

lib/file-monitor\.[ch]

lib/cfg-source\.[ch]

lib/metrics-pipe\.[ch]

lib/metrics/label-template\.(c|h)\$

lib/metrics/dyn-metrics-template\.(c|h)\$

lib/metrics/dyn-metrics-store\.(c|h)\$

lib/metrics/dyn-metrics-cache\.(c|h)\$

lib/metrics/metrics\.(c|h)\$

lib/rewrite/rewrite-set-facility\.

lib/rewrite/rewrite-set-matches\.[ch]

lib/rewrite/rewrite-unset-matches\.[ch]

lib/rewrite/tests/test\_set\_matches\.

lib/rewrite/tests/test\_set\_facility\.

lib/rewrite/tests/test\_set\_tag\.

lib/rewrite/rewrite-set-pri\.

lib/rewrite/rewrite-set-pri\.

lib/stats/stats-cluster-key-builder\.[ch]

lib/stats/stats-prometheus\.

lib/stats/stats-prometheus\.

lib/stats/stats-compatible\.

lib/stats/tests/test\_stats\_prometheus\.

lib/stats/tests/test\_stats\_cluster\_key\_builder\.

lib/timeutils/timeutils\.

lib/stackdump\.[ch]

lib/logscheduler\.[ch]

lib/logscheduler-pipe\.[ch]  
 lib/logmsg/tests/dump\_logmsg\.c  
 lib/multi-line/smart-multi-line\.[ch]  
 lib/multi-line/tests/test\_smart\_multi\_line\.c  
 libtest/mock-logpipe\.[ch]  
 libtest/filterx-lib\.[ch]  
 lib/generic-number\.[ch]  
 lib/tests/test\_generic\_number\.c  
 lib/severity-aliases\.table  
 lib/transport/transport-adapter\.[ch]  
 lib/transport/transport-globals\.[ch]  
 syslog-ng-ctl/commands/log-level.[ch]  
 syslog-ng-ctl/commands/attach.[ch]  
 modules/afsocket/afsocket-signals.h  
 syslog-ng-ctl/commands/healthcheck.[ch]  
 modules/python-modules/syslogng/confgen\.py  
 modules/python-modules/syslogng/dest\.py  
 modules/python-modules/syslogng/logger\.py  
 modules/python-modules/syslogng/message\.py  
 modules/python-modules/syslogng/parser\.py  
 modules/python-modules/syslogng/reloc\.py  
 modules/python-modules/syslogng/template\.py  
 modules/python/python-confgen\.[ch]  
 lib/tests/test\_logscheduler\.c  
 lib/filterx/.\*\.[ch]  
 lib/filterx/filterx-grammar\.ym  
 lib/logproto/logproto-auto-server\.[ch]  
 lib/transport/transport-factory-haproxy\.[ch]  
 lib/transport/tests/test\_transport\.c

#####

#

These tests are GPLd even though they reside under lib/ and are excluded

# from the LGPL declaration of lib/ below.

#####

GPLv2+\_SSL

lib/tests/test\_clone\_logmsg\.c  
 lib/tests/test\_dnscache\.c  
 lib/tests/test\_findcrfl\.c  
 lib/tests/test\_hostid\.c  
 lib/tests/test\_logwriter\.c  
 lib/tests/test\_matcher\.c  
 lib/tests/test\_msgparse\.c  
 lib/tests/test\_ringbuffer\.c  
 lib/tests/test\_serialize\.c  
 lib/tests/test\_thread\_wakeup\.c  
 lib/tests/test\_zone\.c

```
#####
These files are LGPLd, they are intended to be reusable.
#####

 LGPLv2.1+ _SSL

autogen\sh$
sub-configure\sh$
configure\ac$
Makefile\am$
lib/(compat|str-repr|timeutils|control|debugger|filter|logproto|multi-
line|parser|rewrite|stats|template|tests|transport|logmsg|value-pairs|secret-storage|logthrddest|logthrsouce|ack-
tracker|signal-slot-connector|[/]*$)
lib/scanner/(csv-scanner|list-scanner|kv-scanner|xml-scanner|[/]*$)
libtest
syslog-ng(-ctl)?
modules/java-modules/common
modules/java/(native|proxies|src)
modules/native
modules/http/http-signals.h
modules/http/compression\.[ch]
tests/loggen
persist-tool
modules/python-modules/syslogng/_init__\.py
modules/python-modules/syslogng/persist\.py
modules/python-modules/syslogng/source\.py
modules/python/python-startup.(c|h)$
modules/python/python-global.(c|h)$

#####
#
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#####

 GPLv2+ _SSL,non-balabit

modules/diskq/tests/test_diskq_counters\.c
modules/http/http-plugin\.[ch]
modules/http/http-parser.h
modules/timestamp/rewrite-.*$
modules/timestamp/tf-format-date.*$
modules/timestamp/tests/test_format_date.*$
modules/add-contextual-data/add-contextual-data-glob-selector\.[ch]$
modules/add-contextual-data/tests/test_glob_selector\.c$
modules/affile/tests/test_file_writer\.c$
modules/affile/stdout\.[ch]
modules/afsocket/socket-options-unix\.[ch]$
modules/basicfuncs/vp-funcs\.[ch]$
modules/basicfuncs/tf-tag\.c$
modules/diskq/diskq-global-metrics\.[ch]$
modules/diskq/tests/test_logqueue_disk\.c$
modules/metrics-probe/metrics-probe(|-parser|-plugin|-grammar)\.(c|h|ym)$
```



```

modules/metrics-probe/tests/test_metrics_probe\.c$
modules/darwinosl/darwinosl(|-parser|-plugin|-grammar|-source|-source-oslog|-source-persist)\.(c|h|m|ym)$
modules/grpc/otel/otel-(grammar|parser|plugin|source|source-services|servicecall|protobuf-parser|protobuf-
formatter|dest|dest-worker|logmsg-handles)\.(c|h|cpp|hpp|ym)$
modules/grpc/otel/grpc-credentials-builder\.(h|cpp|hpp)$
modules/grpc/otel/syslog-ng-otlp-(dest|dest-worker)\.(h|cpp|hpp)$
modules/grpc/otel/tests/test-otel-(protobuf-parser|protobuf-formatter)\.cpp$
modules/grpc/otel/tests/test-syslog-ng-otlp\.cpp$
modules/grpc/otel/tests/test-otel-filterx\.cpp$
modules/grpc/loki
modules/grpc/bigquery
modules/grpc/pubsub
modules/grpc/clickhouse
modules/grpc/common
modules/grpc/protos/apphook\.(cpp|h)$
modules/cloud-auth/cloud-auth(|-grammar|-parser|-plugin)\.(c|h|cpp|hpp|ym)$
modules/cloud-auth/google-auth\.(h|cpp|hpp)$
modules/cloud-auth/azure-auth\.(h|cpp|hpp)$
modules/examples/inner-destinations/tls-test-validation
modules/examples/sources/random-choice-generator
modules/python/python-options.(c|h)$
modules/python/python-reloc\.(c|h)$
modules/python/python-binding.(c|h)$
modules/python/python-flags.(c|h)$
modules/python/tests/test_python_options.c$
modules/python/tests/test_python_reloc\.c$
modules/json/filterx-format-json\.[ch]$
modules/json/filterx-cache-json-file\.[ch]$
modules/json/tests/test_filterx_format_json\.c$
scl/fortigate/.*\conf$
scl/cee/.*\conf$
scl/elasticsearch/elastic-datastream.conf$
scl/logscale/logscale\conf$
scl/mariadb/.*\conf$
scl/python/python-modules\conf$
scl/darwinosl/plugin\conf$
scl/splunk/splunk\conf$
scl/google/google-pubsub\conf$
scl/azure/azure-monitor\conf$
scl/openobserve/.*\conf$
scl/pgsql/pgsql\conf$
scl/qbittorrent/qbittorrent\conf$
scl/pihole/pihole\conf$
scl/jellyfin/jellyfin\conf$
scl/arr/arr\conf$
modules/python-modules/syslogng/modules/kubernetes/*
modules/ebpf/*
modules/python-modules/syslogng/modules/hypr/*

```

modules/python-modules/syslogng/modules/example/\*  
modules/python-modules/syslogng/modules/s3/\*  
modules/python-modules/syslogng/modules/webhook/scl/\*  
modules/python-modules/syslogng/modules/webhook/\_\_init\_\_.py  
modules/python-modules/setup\py  
scripts/build-python-venv\sh  
modules/syslogformat/sdata-parser\.[ch]  
tests/light/functional\_tests/config\_change/test\_python\_custom\_options\py  
tests/light/functional\_tests/logpath/\_\_init\_\_.py  
tests/light/functional\_tests/logpath/test\_named\_logpaths.py  
tests/light/functional\_tests/logpath/test\_named\_logpaths\_with\_catchall\_flag.py  
tests/light/functional\_tests/logpath/test\_named\_logpaths\_with\_fallback\_flag.py  
tests/light/functional\_tests/logpath/test\_named\_logpaths\_with\_final\_flag.py  
tests/light/functional\_tests/parsers/sdata-parser/test\_sdata\_parser\py  
tests/light/functional\_tests/parsers/group-lines-parser/test\_group\_lines\_parser\py  
tests/light/functional\_tests/parsers/postgresql-csvlog-parser/test\_postgresql\_csvlog\_parser\py  
tests/light/functional\_tests/logpath/test\_conditionals\py  
tests/light/functional\_tests/logpath/test\_midpoint\_destinations\py  
tests/light/functional\_tests/value-pairs/test\_value\_pairs\py  
tests/light/functional\_tests/templates/test\_template\_stmt\py  
tests/light/functional\_tests/filters/test\_multiple\_filters\py  
tests/light/functional\_tests/filterx/test\_filterx\py  
tests/light/functional\_tests/filterx/test\_filterx\_scope\py  
tests/light/functional\_tests/parsers/metrics-probe/test\_metrics\_probe\py  
tests/light/functional\_tests/source\_drivers/syslog\_source/auto/test\_auto\_proto\py  
tests/light/src/syslog\_ng\_ctl/prometheus\_stats\_handler.py  
tests/light/src/syslog\_ng\_config/statements/template/template\py  
tests/light/src/syslog\_ng\_config/statements/\_\_init\_\_\py  
tests/light/src/syslog\_ng/syslog\_ng\_docker\_executor.py  
modules/correlation/id-counter\.[ch]\$  
modules/correlation/group-lines.h  
modules/xml/windows-eventlog-xml-parser\h  
modules/xml/tests/test\_windows\_eventlog\_xml\_parser\c  
modules/examples/filterx/example-filterx-func/example-filterx-func-plugin\.[ch]  
modules/grpc/otel/filterx  
modules/kvformat/filterx-func-parse-kv\.[ch]  
modules/kvformat/filterx-func-format-kv\.[ch]  
modules/kvformat/tests/test\_filterx\_func\_parse\_kv.c  
modules/kvformat/tests/test\_filterx\_func\_format\_kv.c

#####

#

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#####

GPLv2+\_SSL

news/create-newsfile.py

news/next-pr-id.py

```

dev-utils/plugin_skeleton_creator/create_plugin.sh
tests/functional
tests/unit
tests/valgrind
tests/build-log-cflags-propagation.sh
tests/collect-cov.sh
tests/commits/check.sh
tests/copyright/check.sh
tests/light
modules/java/(tools|[/]*$)
modules/java-modules/(dummy|hdfs|[/]*$)
modules/(afamqp|affile|afmongodb|afprog|afsmtp|afsocket|afsql|afstomp|afstreams|afuser|azure-auth-
header|basicfuncs|cef|confgen|cryptofuncs|csvparser|timestamp|diskq|correlation|geoip2|graphite|json|kvformat|linux
-kmsg-format|pacctformat|pseudofile|python|python-modules|redis|riemann|syslogformat|systemd-
journal|getent|system-source|stardate|snmptrapd-parser|xml|openbsd|examples|kafka|afsnmp|mqtt|regexp-parser|rate-
limit-filter|[/]*$)
modules/(add-contextual-data|tagsparser|map-value-pairs|hook-commands|appmodel|[/]*$)
modules/cryptofuncs/cryptofuncs.c$
modules/cryptofuncs/tests/test_cryptofuncs.c$
modules/http/(http-loadbalancer|http-worker)\.[ch]$
modules/http/response-handler\.[ch]$
modules/http/http-curl-header-list\.[ch]$
modules/http/autodetect-ca-location\.[ch]$
packaging/package-indexer/.*.py$
scl
scripts
modules/http/tests
modules/http/http\.[ch]
modules/http/http-parser.c
modules/http/http-grammar.ym
modules/correlation/group-lines.c
modules/python-modules/syslogng/modules/webhook/source.py
docker/Dockerfile
docker/entrypoint.sh
Doxyfile
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Copyright (c) 1996-2015 Balzs Scheidler

```

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lib/  
libtest/  
syslog-ng/  
syslog-ng-ctl/  
persist-tool/  
tests/loggen/  
docker/

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FAQ:

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The questions and answers below try to summarize the intentions behind this licensing scheme.

Q: Is it possible to create derived works of syslog-ng under the GPL/LGPL licenses?

A: Yes, that's exactly the point of open source. Works derived from the plugins will have to use the GPL license, but you can choose to use LGPL for them as well.

Q: Do I need to sign a Contributory License Agreement in order for my contribution to be accepted?

A: No, starting with syslog-ng 3.2, you don't need to sign a CLA in order to have your contributions accepted.

Q: Is it possible to create non-free plugins for syslog-ng?

A: Yes. It is our understanding that plugins are derived works of the syslog-ng core but not derived works of other plugins. Thus, non-free plugins are possible, provided they do not link to any of the GPLv2 plugins explicitly and the only connection between two plugins is via the syslog-ng core.

Q: Who is permitted to create non-free plugins for syslog-ng? Is it just BalaBit (the current copyright holder as of the initial 3.2 release)?

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## 1.284 utf8proc 2.10.0

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# 1.285 icu 78.1

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layout: default
title: Legalities
parent: Release & Milestone Tasks
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(See the find\_textfiles

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for

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## Commands to generate dependency files

GEN\_DEPS.c= \$(CC) -E -MM \$(DEFS) \$(CPPFLAGS)

GEN\_DEPS.cc= \$(CXX) -E -MM \$(DEFS) \$(CPPFLAGS)

## Flags for position independent code

SHAREDLIBCFLAGS = -fPIC

SHAREDLIBCXXFLAGS = -fPIC

SHAREDLIBCPPFLAGS = -DPIC

## Additional flags when building libraries and with threads

THREADSCPPFLAGS = -D\_REENTRANT

LIBCPPFLAGS =

## Compiler switch to embed a runtime search path

LD\_RPATH=

LD\_RPATH\_PRE= -Wl,-rpath,

## Compiler switch to embed a library name

LD\_SONAME = -Wl,-soname -Wl,\$(notdir \$(MIDDLE\_SO\_TARGET))

## Shared library options

LD\_SOOPTIONS= -Wl,-Bsymbolic

## Shared object suffix

SO = so

## Non-shared intermediate object suffix

STATIC\_O = ao

```

Compilation
rules
%. $(STATIC_O): $(srcdir)/%.c
$(COMPILE.c) $(STATICCPPFLAGS) $(STATICCFLAGS) -o $@ $<
%.o: $(srcdir)/%.c
$(COMPILE.c) $(DYNAMICCPPFLAGS) $(DYNAMICCFLAGS) -o $@ $<

%. $(STATIC_O): $(srcdir)/%.cpp
$(COMPILE.cc) $(STATICCPPFLAGS) $(STATICCXXFLAGS) -o $@ $<
%.o: $(srcdir)/%.cpp
$(COMPILE.cc) $(DYNAMICCPPFLAGS) $(DYNAMICCXXFLAGS) -o $@ $<

Dependency rules
%.d: $(srcdir)/%.c
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.c) $< \
| sed "s/\($*\)\.o[:]*/\1.o $@ : /g"' > $@; \
[-s $@] || rm -f $@

%.d: $(srcdir)/%.cpp
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.cc) $< \
| sed "s/\($*\)\.o[:]*/\1.o $@ : /g"' > $@; \
[-s $@] || rm -f $@

Versioned libraries rules

%. $(SO).$(SO_TARGET_VERSION_MAJOR): %. $(SO).$(SO_TARGET_VERSION)
$(RM) $@ && ln -s ${<F} $@
%. $(SO): %. $(SO).$(SO_TARGET_VERSION_MAJOR)
$(RM) $@ && ln -s ${*F}. $(SO).$(SO_TARGET_VERSION) $@

Bind internal references

LDflags that pkgdata will use
BIR_LDFLAGS= -Wl,-Bsymbolic

Dependencies [i.e. map files] for the final library
BIR_DEPS=

Remove shared library 's'
STATIC_PREFIX_WHEN_USED =
STATIC_PREFIX =

End BSD-specific setup

```

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JSON parsing library (nlohmann/json)

File: vendor/json/upstream/single\_include/nlohmann/json.hpp (only for ICU4C)

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File: aclocal.m4 (only for ICU4C)

Section: pkg.m4 - Macros to locate and utilise pkg-config.

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#
docs/FTL.TXT
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#
include/freetype/internal/fthash.h
#
src/base/fthash.c
src/base/md5.c
src/base/md5.h
#
src/bdf/bdf.c
src/bdf/bdf.h
src/bdf/bdfdrivr.c
src/bdf/bdfdrivr.h
src/bdf/bdferror.h
src/bdf/bdflib.c
src/bdf/module.mk
src/bdf/README
src/bdf/rules.mk
#
src/pcf/module.mk
src/pcf/pcf.c
src/pcf/pcf.h
src/pcf/pcfdrivr.c
src/pcf/pcfdrivr.h
src/pcf/pcferror.h
src/pcf/pcfread.c
```

```
src/pcf/pcfread.h
src/pcf/pcfutil.c
src/pcf/pcfutil.h
src/pcf/README
src/pcf/rules.mk
#
src/gzip/adler32.c
src/gzip/ftzconf.c
src/gzip/infblock.c
src/gzip/infblock.h
src/gzip/infcodes.c
src/gzip/infcodes.h
src/gzip/inffixed.h
src/gzip/inflate.c
src/gzip/inftrees.c
src/gzip/inftrees.h
src/gzip/infutil.c
src/gzip/infutil.h
src/gzip/zconf.h
src/gzip/zlib.h
src/gzip/zutil.c
src/gzip/zutil.h
#
src/tools/apinames.c
src/tools/ftrandom/ftrandom.c
#
subprojects/dlg
#
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The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w' and `show c'; they could even be mouse-clicks or menu items--whatever suits your program.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the program, if necessary. Here is a sample; alter the names:

Yoyodyne, Inc., hereby disclaims all copyright interest in the program  
`Gnomovision' (which makes passes at compilers) written by James Hacker.

<signature of Ty Coon>, 1 April 1989  
Ty Coon, President of Vice

This General Public License does not permit incorporating your program into proprietary programs. If your program is a subroutine library, you may consider it more useful to permit linking proprietary applications with the library. If this is what you want to do, use the GNU Library General Public License instead of this License.

# 1.300 vim 9.1.1616

## 1.300.1 Available under license :

\*uganda.txt\* For Vim version 9.1. Last change: 2025 Jul 08

VIM REFERENCE MANUAL by Bram Moolenaar

\*uganda\* \*Uganda\* \*copying\* \*copyright\* \*license\*  
SUMMARY

\*iccf\* \*ICCF\*

Vim is Charityware. You can use and copy it as much as you like, but you are encouraged to make a donation for needy children in Uganda. Please see |kcc| below or visit the ICCF web site, available at these URLs:

<https://iccf-holland.org/>  
<https://www.vim.org/iccf/>  
<https://www.iccf.nl/>

You can also sponsor the development of Vim, see |sponsor|. The money goes to Uganda anyway.

The Open Publication License applies to the Vim documentation, see |manual-copyright|.

The icons used for the toolbar in the Win32 GUI are from the "Farm-Fresh Web Icons" set. These icons are licensed under the Creative Commons Attribution 3.0 License and were created by FatCow Web Hosting. They were previously available at <http://www.fatcow.com/free-icons> and are still available at: <https://www.iconarchive.com/show/farm-fresh-icons-by-fatcow.1.html>

===

begin of license ===

VIM LICENSE

I) There are no restrictions on distributing unmodified copies of Vim except that they must include this license text. You can also distribute

unmodified parts of Vim, likewise unrestricted except that they must include this license text. You are also allowed to include executables that you made from the unmodified Vim sources, plus your own usage examples and Vim scripts.

II) It is allowed to distribute a modified (or extended) version of Vim, including executables and/or source code, when the following four conditions are met:

- 1) This license text must be included unmodified.
- 2) The modified Vim must be distributed in one of the following five ways:

- a) If you make changes to Vim yourself, you must clearly describe in the distribution how to contact you. When the maintainer asks you (in any way) for a copy of the modified Vim you distributed, you must

make your changes, including source code, available to the maintainer without fee. The maintainer reserves the right to include your changes in the official version of Vim. What the maintainer will do with your changes and under what license they will be distributed is negotiable. If there has been no negotiation then this license, or a later version, also applies to your changes. The current maintainers are listed here: <https://github.com/orgs/vim/people>. If this changes it will be announced in appropriate places (most likely [vim.sf.net](http://vim.sf.net), [www.vim.org](http://www.vim.org) and/or [comp.editors](http://comp.editors)). When it is completely impossible to contact the maintainer, the obligation to send him your changes ceases. Once the maintainer has confirmed that he has received your changes they will not have to be sent again.

- b) If you have received a modified Vim that was distributed as mentioned under a) you are allowed to further distribute it unmodified, as mentioned at I).

If you make additional changes the text under a) applies to those changes.

- c) Provide all the changes, including source code, with every copy of the modified Vim you distribute. This may be done in the form of a context diff. You can choose what license to use for new code you add. The changes and their license must not restrict others from making their own changes to the official version of Vim.

- d) When you have a modified Vim which includes changes as mentioned under c), you can distribute it without the source code for the changes if the following three conditions are met:

- The license that applies to the changes permits you to distribute the changes to the Vim maintainer without fee or restriction, and permits the Vim maintainer to include the changes in the official version of Vim without fee or restriction.
- You keep the changes for at least three years after last distributing the corresponding modified Vim. When

the maintainer

or someone who you distributed the modified Vim to asks you (in any way) for the changes within this period, you must make them

available to him.

- You clearly describe in the distribution how to contact you. This contact information must remain valid for at least three years after last distributing the corresponding modified Vim, or as long as possible.

e) When the GNU General Public License (GPL) applies to the changes, you can distribute the modified Vim under the GNU GPL version 2 or any later version.

3) A message must be added, at least in the output of the ":version" command and in the intro screen, such that the user of the modified Vim is able to see that it was modified. When distributing as mentioned under 2)e) adding the message is only required for as far as this does not conflict with the license used for the changes.

4) The contact information as required under 2)a) and 2)d)

must not be

removed or changed, except that the person himself can make corrections.

III) If you distribute a modified version of Vim, you are encouraged to use the Vim license for your changes and make them available to the maintainer, including the source code. The preferred way to do this is by e-mail or by uploading the files to a server and e-mailing the URL. If the number of changes is small (e.g., a modified Makefile) e-mailing a context diff will do. The e-mail address to be used is  
<maintainer@vim.org>

IV) It is not allowed to remove this license from the distribution of the Vim sources, parts of it or from a modified version. You may use this license for previous Vim releases instead of the license that they came with, at your option.

=== end of license ===

Note:

- If you are happy with Vim, please express that by reading the rest of this file and consider helping needy children in Uganda.

- If you want to support further Vim development consider becoming a [sponsor]. The money goes to Uganda anyway.

- According to Richard Stallman the Vim license is GNU GPL compatible. A few minor changes have been made since he checked it, but that should not make a difference.

- If you link Vim with a library that goes under the GNU GPL, this limits further distribution to the GNU GPL. Also when you didn't actually change

anything in Vim.

- Once a change is included that goes under the GNU GPL, this forces all further changes to also be made under the GNU GPL or a compatible license.

- If you distribute a modified version of Vim, you can include your name and contact information with the "--with-modified-by" configure argument or the MODIFIED\_BY define.

- This license applies to the source code of Vim. However, different license conditions may apply to some runtime files included with Vim; these will be specified in the header of each respective file.

=====

Kibaale

Children's Centre \*kcc\* \*Kibaale\* \*charity\*

Kibaale Children's Centre (KCC) is located in Kibaale, a small town in the south of Uganda, near Tanzania, in East Africa. The area is known as Rakai District. The population is mostly farmers. Although people are poor, there usually is enough food. But this district is suffering from AIDS more than any other part of the world. Some say that it started there. Estimations are that in the past 10 to 30% of the Ugandans are infected with HIV. Because parents die, there are many orphans. In this district about 60,000 children have lost one or both parents, out of a population of 350,000. Although AIDS is now mostly under control, the problems are still continuing.

The children need a lot of help. The KCC is working hard to provide the needy with food, medical care and education. Food and medical care to keep them healthy now, and education so that they can take care of themselves in the future. KCC works on a Christian base, but help is given to children of any religion.

The key to solving the problems in this area is education. This has been neglected in the past years with president Idi Amin and the following civil wars. Now that the government is stable again, the children and parents have to learn how to take care of themselves and how to avoid infections. There is also help for people who are ill and hungry, but the primary goal is to prevent people from getting ill and to teach them how to grow healthy food.

Most of the orphans are living in an extended family. An uncle or older sister is taking care of them. Because these families are big and the income (if any) is low, a child is lucky if it gets healthy food. Clothes, medical care and schooling is beyond its reach. To help these needy children, a sponsorship program was put into place. A child can be financially adopted. For a few dollars a month KCC sees to it that the child gets indispensable items, is healthy, goes to school and KCC takes care of anything else that

needs to be done for the child and the family that supports it.

Besides helping the child directly, the environment where the child grows up needs to be improved. KCC helps schools to improve their teaching methods. There is a demonstration school at the centre and teacher trainings are given. Health workers are being trained, hygiene education is carried out and households are stimulated to build a proper latrine. I helped setting up a production site for cement slabs. These are used to build a good latrine. They are sold below cost price.

There is a clinic at the project, which provides children and their family medical help. Since 2020 a maternity ward was added and 24/7 service is available. When needed, transport to a hospital is offered. Immunization programs are carried out and help is provided when an epidemic is breaking out (measles and cholera have been a problem).

\*donate\*

Summer

1994 to summer 1995 I spent a whole year at the centre, working as a volunteer. I have helped to expand the centre and worked in the area of water and sanitation. I learned that the help that the KCC provides really helps. When I came back to Holland, I wanted to continue supporting KCC. To do this I'm raising funds and organizing the sponsorship program. Please consider one of these possibilities:

1. Sponsor a child in primary school: 17 euro a month (or more).
2. Sponsor a child in secondary school: 25 euro a month (or more).
3. Sponsor the clinic: Any amount a month or quarter
4. A one-time donation

Compared with other organizations that do child sponsorship the amounts are very low. This is because the money goes directly to the centre. Less than 5% is used for administration. This is possible because this is a small organization that works with volunteers. If you would like to sponsor a child, you should have the intention to do this for at least one year.

How do you know that the money will be spent right? First of all you have my personal guarantee as the author of Vim. I trust the people that are working at the centre, I know them personally. Furthermore, the centre has been co-sponsored and inspected by World Vision, Save the Children Fund and is now under the supervision of Pacific Academy Outreach Society. The centre is visited about once a year to check the progress (at our own cost). I have visited the centre myself many times, starting in 1993. The visit reports are on the ICCF web site.

If you have any further questions, send e-mail: <Bram@vim.org>.

The address of the centre is:



Kibaale Children's Centre  
p.o. box 1658  
Masaka, Uganda, East Africa

Sending money:    \*iccf-donations\*

Check the ICCF web site for the latest information! See |iccf| for the URL.

USA: The methods mentioned below can be used.

If you must send a check send it to our Canadian partner:

<https://www.kuwasha.net/>

Canada: Contact

Kuwasha in Surrey, Canada. They take care of the Canadian sponsors for the children in Kibaale. Kuwasha forwards 100% of the money to the project in Uganda. You can send them a one time donation directly.

Look on their site for information about sponsorship:

<https://www.kuwasha.net/>

If you make a donation to Kuwasha you will receive a tax receipt which can be submitted with your tax return.

Holland: Transfer to the account of "Stichting ICCF Holland" in Amersfoort. This will allow for tax deduction if you live in Holland. ING bank, IBAN: NL95 INGB 0004 5487 74

Germany: It is possible to make donations that allow for a tax return.

Check the ICCF web site for the latest information:

<https://iccf-holland.org/germany.html>

Europe: Use a bank transfer if possible. See "Others" below for the swift code and IBAN number.

Any other method should work. Ask for information about sponsorship.

Credit Card: You can use PayPal to send money with a Credit card. This is

the most widely used Internet based payment system. It's really simple to use. Use this link to find more info:

[https://www.paypal.com/en\\_US/mrb/pal=XAC62PML3GF8Q](https://www.paypal.com/en_US/mrb/pal=XAC62PML3GF8Q)

The e-mail address for sending the money to is:

[Bram@iccf-holland.org](mailto:Bram@iccf-holland.org)

Others: Transfer to this account if possible:

ING bank: IBAN: NL95 INGB 0004 5487 74

Swift code: INGBNL2A

under the name "stichting ICCF Holland", Amersfoort

Checks are not accepted.

vim:tw=78:ts=8:noet:ft=help:norl:

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LICENZA VIM

Nota: Agli effetti legali ha valore non la seguente traduzione italiana, ma l'originale inglese su cui basata. alla versione inglese che si fa riferimento qui sotto quando si parla di "questa licenza" (NdT).

- I) Non ci sono restrizioni alla distribuzione di copie non modificate di Vim, alla condizione che esse includano il testo di questa licenza. Si possono anche distribuire parti non modificate di Vim, sempre senza restrizioni, alla condizione che esse includano il testo di questa licenza. anche consentito includere programmi eseguibili da voi preparati a partire dai file sorgenti Vim non modificati, pi i vostri esempi di utilizzo e i vostri script Vim.
- II) consentito distribuire una versione modificata (o estesa) di Vim, contenente programmi eseguibile e/o codice sorgente, quando siano rispettare le seguenti quattro condizioni:

- 1) Il testo di questa licenza deve essere incluso senza modifiche.
- 2) La versione modificata di Vim dev'essere distribuita in una delle seguenti cinque maniere:
  - a) Se voi personalmente modificate a Vim, dovete descrivere chiaramente nella distribuzione come possibile mettersi in contatto con voi. Quando il manutentore vi chiede (in qualsiasi forma) una copia della versione modificata di Vim da voi distribuita, dovete rendere disponibili le vostre modifiche, compreso il codice sorgente, al manutentore, senza alcuna spesa. Il manutentore si riserva il diritto di includere le vostre modifiche nella versione ufficiale di Vim. Quel che il manutentore potrà fare con le vostre modifiche e sotto quale licenza esse verranno distribuite può essere oggetto di negoziazione. Se non c'è stata alcuna negoziazione, questa licenza, o una versione successiva della stessa, anche applicabile alle vostre modifiche. I manutentori correnti sono elencati qui:  
<https://github.com/orgs/vim/people>.  
Se dovessero cambiare, ne sarà dato annuncio nei luoghi appropriati (verosimilmente [vim.sf.net](http://vim.sf.net), [www.vim.org](http://www.vim.org) e/o [comp.editors](mailto:comp.editors)). Quando sia completamente impossibile contattare il manutentore, l'obbligo di spedirgli le vostre modifiche viene meno. Una volta che il manutentore abbia confermato di aver ricevuto le vostre modifiche, non sarà necessario spedirle ulteriormente.
  - b) Se avete ricevuto un Vim modificato che era stato distribuito come descritto al punto a) potete ulteriormente distribuirlo senza modificarlo, come menzionato al punto I). Se fate ulteriori modifiche, il testo al punto a) si applica a queste modifiche.
  - c) Includete tutte le modifiche, compreso il codice sorgente, con ogni copia del Vim modificato da voi distribuito. Questo può essere fatto sotto forma dell'output di un comando "diff", che contenga anche il contesto [ossia anche le linee non modificate di sorgente che vengono prima o dopo le modifiche - NdT]. Potete scegliere quale licenza volete utilizzare per il nuovo codice sorgente che voi aggiungere. Le modifiche e la relativa licenza non devono impedire a terzi di apportare le loro proprie modifiche a Vim.
  - d) Quando avete un Vim modificato che comprende modifiche quali quelle menzionate al punto c), potete distribuirlo senza il codice sorgente che descrive le modifiche, se le seguenti tre condizioni sono soddisfatte:
    - La licenza applicabile alle modifiche vi consente di distribuire le modifiche al manutentore Vim senza alcun costo o restrizione, e permette al manutentore Vim di includere le modifiche nella versione ufficiale di Vim senza alcun costo o restrizione.
    - Le modifiche da voi fatte sono conservate per almeno tre anni,

dopo che avrete distribuito per l'ultima volta il Vim modificato corrispondente alle modifiche stesse. Quando il manutentore o qualcuno a cui voi avete distribuito il Vim modificato vi chiede (in qualsiasi forma) le modifiche, entro il periodo qui indicato, dovete fargliele avere.

- Dovete descrivere chiaramente nella distribuzione come possibile mettersi in contatto con voi. Questa informazione di contatto deve rimanere valida per almeno tre anni dopo l'ultima data di distribuzione della corrispondente modifica di Vim, oppure il più a lungo possibile.

e) Quando al GNU General Public License (GPL) si applica alle modifiche, potete distribuire il Vim modificato sotto la versione 2 della licenza GNU GPL versione 2 o una qualsiasi versione successiva della stessa licenza.

3) Un messaggio deve essere aggiunto, almeno all'output del comando `":version"` e nella schermata introduttiva, in modo che l'utilizzatore del Vim modificato sia in grado di comprendere cosa è stato modificato. Quando si distribuisca come menzionato al punto 2)e) l'aggiunta del messaggio richiesta solo se ci non conduca a conflitti con la licenza usata per le modifiche.

4) L'informazione di contatto, richiesta ai punti 2)a) e 2)d) non deve essere rimossa o modificata, tranne che per il fatto che la persona stessa può apportare delle correzioni.

III) Se distribuite una versione modificata di Vim, siete incoraggiati a utilizzare la licenza Vim per le vostre modifiche, e a mettere le modifiche a disposizione del manutentore, compreso il codice sorgente. Il modo preferito in cui fare questo è tramite e-mail o caricando i file su un server ed inviandone l'indirizzo (URL) tramite e-mail. Se il numero di modifiche è piccolo (per esempio, una modifica a un Makefile) inviare tramite

email l'output del comando `diff` con contesto può essere sufficiente. L'indirizzo e-mail da utilizzare `<maintainer@vim.org>`

IV) Non è consentito rimuovere questa licenza dalla distribuzione dei codici sorgente Vim, anche in parte, o da una versione di Vim modificata. Potete usare questa licenza per precedenti versioni di Vim, invece della licenza con cui esse sono state distribuite, a vostra scelta.

#### LICENZA DO VIM

I) Não há restrições para distribuir cópias não modificadas do Vim, exceto que elas devem incluir este texto de licença. Você também pode distribuir partes não modificadas do Vim, igualmente irrestritas, exceto que elas devem incluir este texto de licença. Você também tem permissão para incluir executáveis que você fez a partir das fontes não modificadas do Vim, além de seus próprios exemplos de uso e scripts do Vim.

II) permitido distribuir uma verso modificada (ou estendida) do Vim, incluindo executveis e/ou cdigo-fonte, quando as quatro condies a seguir forem atendidas:

- 1) Este texto de licena deve ser includo sem modificaes.
- 2) O Vim modificado deve ser distribudo de uma das cinco formas a seguir:

a) Se voc fizer alteraes no Vim, dever descrever claramente na distribuio como entrar em contato com voc. Quando o mantenedor solicitar a voc (de qualquer forma) uma cpia do Vim modificado que voc distribuiu, voc dever disponibilizar

suas alteraes,

incluindo o cdigo-fonte, ao mantenedor sem taxa. O mantenedor reserva o direito de incluir suas alteraes na verso oficial do Vim. O que o mantenedor far com suas alteraes e sob qual licena elas sero distribudas negociavel. Se no houve negcio ento esta licena, ou uma verso posterior, tambm se aplica s suas alteraes. Os mantenedores atuais esto listados aqui: <https://github.com/orgs/vim/people>. Se isso mudar, ser anunciado em lugares apropriados (provavelmente [vim.sf.net](http://vim.sf.net), [www.vim.org](http://www.vim.org) e/ou [comp.editors](mailto:comp.editors)). Quando for completamente impossvel contatar o mantenedor, a obrigao de enviar a ele suas alteraes cessa. Uma vez que o mantenedor tenha confirmado que ele recebeu suas alteraes, elas no precisaro ser enviadas novamente.

b) Se voc recebeu um Vim modificado que foi distribudo como mencionado em a), voc tem permissso para distribu-lo

sem

modificaes, como mencionado em I). Se voc fizer alteraes adicionais, o texto em a) se aplica a essas alteraes.

c) Fornea todas as alteraes, incluindo o cdigo-fonte, com cada cpia do Vim modificado que voc distribuir. Isso pode ser feito na forma de um diff de contexto. Voc pode escolher qual licena usar para o novo cdigo que voc adicionar. As alteraes e sua licena no devem restringir outros de fazer suas prprias alteraes na verso oficial do Vim.

d) Quando voc tem um Vim modificado que inclui alteraes conforme mencionado em c), voc pode distribu-lo sem o cdigo-fonte para as alteraes se as trs condies a seguir forem atendidas:

- A licena que se aplica s alteraes permite que voc distribua as alteraes para o mantenedor do Vim sem taxa ou restrio, e permite que o mantenedor do Vim inclua as alteraes na verso oficial do Vim sem taxa ou

restrio.

- Voc mantm as alteraes por pelo menos trs anos aps a ltima distribuio do Vim modificado correspondente. Quando o mantenedor ou algum para quem voc distribuiu o Vim modificado solicitar a voc (de qualquer forma) as alteraes dentro deste perodo, voc deve disponibiliz-las a ele.

- Voc descreve claramente na distribuio como entrar em contato com voc. Estas informaes de contato devem permanecer vlidas por

pelo menos trs anos aps a ltima distribuio do Vim modificado correspondente, ou pelo maior tempo possvel.

e) Quando a Licena Pblica Geral GNU (GPL) se aplica s alteraes, voc pode distribuir o Vim modificado sob a GNU GPL verso 2 ou qualquer verso posterior.

3) Uma mensagem deve ser adicionada, no mnimo na sada do comando `":version"` e na tela de introduo, de modo que o usurio do Vim modificado seja capaz de ver que ele foi modificado.

Ao distribuir

conforme mencionado em 2)e), s necessrio adicionar a mensagem na medida em que isso no entre em conflito com a licena usada para as alteraes.

4) As informaes de contato conforme exigido em 2)a) e 2)d) no devem ser removidas ou alteradas, exceto que a prpria pessoa pode fazer correes.

III) Se voc distribuir uma verso modificada do Vim, encorajamos que use a licena do Vim para suas alteraes e disponibiliz-las ao mantenedor, incluindo o cdigo-fonte. A maneira preferida de fazer isso por e-mail ou enviando os arquivos para um servidor e enviando a URL por e-mail. Se o nmero de alteraes for pequeno (por exemplo, um Makefile modificado), enviar um diff de contexto por e-mail ser suficiente. O endereo de e-mail a ser usado <maintainer@vim.org>

IV) No permitido remover esta licena da distribuio das fontes do Vim, partes dela ou de uma verso modificada. Voc pode usar esta licena para verses anteriores do Vim em vez da licena com a qual elas vieram, a seu critrio.

GNU LESSER GENERAL PUBLIC LICENSE  
Version 2.1, February 1999

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[This is the first released version of the Lesser GPL. It also counts as the successor of the GNU Library Public License, version 2, hence the version number 2.1.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Lesser General Public License, applies to some specially designated software packages--typically libraries--of the Free Software Foundation and other authors who decide to use it. You can use it too, but we suggest you first think carefully about whether this license or the ordinary General Public License is the better strategy to use in any particular case, based on the explanations below.

When we speak of free software, we are referring to freedom of use, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish); that you receive source code or can get it if you want it; that you can change the software and use pieces of it in new free programs; and that you are informed that you can do these things.

To protect your rights, we need to make restrictions that forbid distributors to deny you these rights or to ask you to surrender these rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

To protect each distributor, we want to make it very clear that there is no warranty for the free library. Also, if the library is modified by someone else and passed on, the recipients should know that what they have is not the original version, so that the original author's reputation will not be affected by problems that might be introduced by others.

Finally, software patents pose a constant threat to the existence of any free program. We wish to make sure that a company cannot effectively restrict the users of a free program by obtaining a restrictive license from a patent holder. Therefore, we insist that any patent license obtained for a version of the library must be consistent with the full freedom of use specified in this license.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries into non-free programs.

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Any executables

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source code for the Library including whatever

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Contributors to the EditorConfig Vim Plugin:

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maintainer@vim.org

IV)  
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## 1.301 tokio-tungstenite 0.27.0

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## 1.308 utf-8 0.7.6

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# 1.313 alsa-plugins 1.2.12

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## 1.315 linux-kernel 6.12.34

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/\* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)

\* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)

\*

\* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.

\* <http://www.hypermall.com/>

\* 10/1/97 - commented out CFG\_PHYIE bit - we don't care when the PHY

\* interrupts us (except possibly for removal/insertion of the cable?)

\* 10/4/97 - began heavy inline documentation of the code. Corrected typos

\* and spelling mistakes.

\* 10/5/97 - added code to handle PHY interrupts, disable PHY on

\* loss of link, and correctly re-enable PHY when link is

\* re-established. (put back CFG\_PHYIE)

\*

\* Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.

\*

\* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997

\*

\* Linux driver for the IDT77201 NICStAR PCI ATM controller.

\* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;

\* see init\_nicstar() for PHY initialization to change this. This driver

\* expects the Linux ATM stack to support scatter-gather

lists

\* (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.

\*

- \* Implementing minimal-copy of received data:
- \* IDT always receives data into a small buffer, then large buffers
- \* as needed. This means that data must always be copied to create
- \* the linear buffer needed by most non-ATM protocol stacks (e.g. IP)
- \* Fix is simple: make large buffers large enough to hold entire
- \* SDU, and leave <small\_buffer\_data> bytes empty at the start. Then
- \* copy small buffer contents to head of large buffer.
- \* Trick is to avoid fragmenting Linux, due to need for a lot of large
- \* buffers. This is done by 2 things:
- \* 1) skb->destructor / skb->atm.recycle\_buffer
- \* combined, allow nicstar\_free\_rx\_skb to be called to
- \* recycle large data buffers
- \* 2) skb\_clone of received buffers
- \* See nicstar\_free\_rx\_skb and linearize\_buffer for implementation
- \* details.
- \*
- \*
- \*
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- \* M. Welsh, 6 July 1996
- \*
- \*
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```

```
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```

```
static inline int license_is_gpl_compatible(const char *license)
```

```
{
 return (strcmp(license, "GPL") == 0
 || strcmp(license, "GPL v2") == 0
 || strcmp(license, "GPL and additional rights") == 0
 || strcmp(license, "Dual BSD/GPL") == 0
 || strcmp(license, "Dual MIT/GPL") == 0
 || strcmp(license, "Dual MPL/GPL") == 0);
}
```

```
#endif
```

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```

```
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The End

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//http-parser

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# 1.326 regex-syntax 0.8.8

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## 1.327 regex-automata 0.4.13

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## 1.328 der 0.7.10

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## 1.332 enumn 0.1.14

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# 1.335 coset 0.3.8

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## 1.336 semver 1.0.26

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master.60d616ad3abd925956207b9b6ff981afa  
004e792

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## 1.342 libc\_malloc 1.0.7

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# 1.343 der\_derive 0.7.3

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# 1.345 rustversion 1.0.21

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## 1.346 rsa 0.9.8

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## 1.347 sec1 0.7.3

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# 1.348 x25519-dalek 2.0.1

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## 1.349 proc-macro2-0.4.30 0.4.30

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# 1.350 zerocopy 0.8.26

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## 1.351 base16ct 0.2.0

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# 1.355 zeroize\_derive 1.4.2

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When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

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Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

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## 1.364 cfg-if 1.0.4

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Upstream-Contact: Syslog-ng users' and developers' mailing list <[syslog-ng@lists.balabit.hu](mailto:syslog-ng@lists.balabit.hu)>

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1

#include "commands.h"

```
extern GOptionEntry license_options[];
gint slang_license(int argc, char *argv[], const gchar *mode, GOptionContext *ctx);
```

#endif

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#####

# generated files are ignored #

#####

ignore

\.ctags

\.mailmap

scl/syslogconf/convert-syslogconf.awk\$

.\*/\*.\*.am\$

.\*\.(ql|yaml|md|y|l|txt|xml|xsd|log|key|crt|files|in|conf|.example|gradle|mk|supp|sub|guess|list|pc|.cmake)\$

\..\*rc\$

.\*[/^]+-grammar\[ch]\$

(.\*)?(README|\.gitignore|pylintrc)\$

lib/ivykis

lib/eventlog

modules/java/org\_syslog\_ng\_[^/\_-]+\h\$

modules/(afmongodb|afamqp)/dummy\.c\$

modules/kafka/tests/sample\.properties

modules/grpc/protos/opentelemetry-proto

modules/grpc/protos/grafana-loki

modules/grpc/protos/googleapis-proto

modules/grpc/protos/clickhouse-proto

modules/cloud-auth/jwt-cpp

dev-utils/plugin\_skeleton\_creator/plugin\_template.\*

(lib|modules)/.\*\.conf\$

dist\.conf\$

.\*\/.\*.gradle

scl/syslog-ng\.conf\$

docker/syslog-ng\.conf\$

tests/copyright/policy\$

(syslog-ng-)?config\.h\$

lib/cfg-lex\[ch]\$

tgz2build

autom4te\.cache

m4

Mk

.\*\.(a|bin|class|css|dirstamp|html|idx|jar|js|o|la|lai|lo|MF|persist|Plo|Po|pc|pyc|so|so\.0\.0\.0|soT|spec|trs)\$

(.\*)?Makefile\$

doc/man

(\_configs\.sed|\.project|\.cproject|config\.status)\$

stamp-h1\$

tests/functional/test\.conf\$

scripts/update-patterndb\$

(contrib|debian)

packaging/debian

packaging/debian/(man|source)

packaging/rhel

```

packaging/package-indexer/(Dockerfile|example-cfg\.yaml|pyproject\.toml)$
packaging/package-indexer/indexer/apt_conf/.*\.conf$
doc/ChangeLog\.[0-9]$
(\.gitmodules|AUTHORS|COPYING|INSTALL|VERSION|aclocal\.m4|compile|configure|depcomp|install-
sh|libtool|ltmain\.sh|missing|test-driver|ylwrap)$
.*[/^\.]*$
GPATH|GTAGS|GRTAGS|GSYMS
dbld/build/.*$
dbld/release/.*$
dbld/install/.*$
dbld/images/.*$
dbld/(functions\.sh|(build|packages|pip_packages)\.manifest|tarball-changes\.ignore)$
dbld\.dockerignore$
cmake/.*$
tests/light/pytest.ini
tests/light/tox.ini
tests/light/.pre-commit-config.yaml
.github/workflows/.*$
lib/logmsg/tests/messages/syslog-ng-(pe-)?[.0-9]*-msg.h$
modules/python-modules/requirements\.lock
scl/darwinosl/darwinosl-metadata-db.csv
lib/multi-line/smart-multi-line\.fsm$
.editorconfig

```

```

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#
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related copyright statement.
#####
 LGPLv2.1+_SSL,non-balabit

```

```

cmake/Modules/FindLIBBPF\.cmake
lib/timeutils/zonecache.[ch]$
modules/secure-logging
modules/secure-logging/tests
modules/secure-logging/slogencrypt
modules/secure-logging/slogverify
modules/secure-logging/slogkey
lib/compat/cpp-(start|end)\.h$
lib/compat/curl\.h$
lib/compat/getline\.c$
lib/compat/json\.h$
lib/filter/filter-blank\.[ch]$
lib/filter/tests/test_filter_blank\.c$
lib/healthcheck
lib/healthcheck/tests
lib/file-monitor\.[ch]
lib/cfg-source\.[ch]

```



lib/metrics-pipe\.[ch]  
lib/metrics/label-template\.(c|h)\$  
lib/metrics/dyn-metrics-template\.(c|h)\$  
lib/metrics/dyn-metrics-store\.(c|h)\$  
lib/metrics/dyn-metrics-cache\.(c|h)\$  
lib/metrics/metrics\.(c|h)\$  
lib/rewrite/rewrite-set-facility\.h  
lib/rewrite/rewrite-set-matches\.[ch]  
lib/rewrite/rewrite-unset-matches\.[ch]  
lib/rewrite/tests/test\_set\_matches\.c  
lib/rewrite/tests/test\_set\_facility\.c  
lib/rewrite/tests/test\_set\_tag\.c  
lib/rewrite/rewrite-set-pri\.h  
lib/rewrite/rewrite-set-pri\.c  
lib/stats/stats-cluster-key-builder\.[ch]  
lib/stats/stats-prometheus\.c  
lib/stats/stats-prometheus\.h  
lib/stats/stats-compat\.h  
lib/stats/tests/test\_stats\_prometheus\.c  
lib/stats/tests/test\_stats\_cluster\_key\_builder\.c  
lib/timeutils/timeutils\.h  
lib/stackdump\.[ch]  
lib/logscheduler\.[ch]  
lib/logscheduler-pipe\.[ch]  
lib/logmsg/tests/dump\_logmsg\.c  
lib/multi-line/smart-multi-line\.[ch]  
lib/multi-line/tests/test\_smart\_multi\_line\.c  
libtest/mock-logpipe\.[ch]  
lib/generic-number\.[ch]  
lib/tests/test\_generic\_number\.c  
lib/severity-aliases\.table  
lib/transport/transport-adapter\.[ch]  
lib/transport/transport-globals\.[ch]  
syslog-ng-ctl/commands/log-level.[ch]  
syslog-ng-ctl/commands/attach.[ch]  
modules/afsocket/afsocket-signals.h  
syslog-ng-ctl/commands/healthcheck.[ch]  
modules/python-modules/syslogng/configgen\.py  
modules/python-modules/syslogng/dest\.py  
modules/python-modules/syslogng/logger\.py  
modules/python-modules/syslogng/message\.py  
modules/python-modules/syslogng/parser\.py  
modules/python-modules/syslogng/reloc\.py  
modules/python-modules/syslogng/template\.py  
modules/python/python-configgen\.[ch]  
lib/tests/test\_logscheduler\.c  
lib/logproto/logproto-auto-server\.[ch]  
lib/transport/transport-factory-haproxy\.[ch]

lib/transport/tests/test\_transport\.

#####

#

These tests are GPLd even though they reside under lib/ and are excluded  
# from the LGPL declaration of lib/ below.

#####

GPLv2+ \_SSL

lib/tests/test\_clone\_logmsg\.

lib/tests/test\_dnscache\.

lib/tests/test\_findcrlf\.

lib/tests/test\_hostid\.

lib/tests/test\_logwriter\.

lib/tests/test\_matcher\.

lib/tests/test\_msgparse\.

lib/tests/test\_ringbuffer\.

lib/tests/test\_serialize\.

lib/tests/test\_thread\_wakeup\.

lib/tests/test\_zone\.

#####

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#####

LGPLv2.1+ \_SSL

autogen\.

sub-configure\.

configure\.

Makefile\.

lib/(compat|str-repr|timeutils|control|debugger|filter|logproto|multi-

line|parser|rewrite|stats|template|tests|transport|logmsg|value-pairs|secret-storage|logthrddest|logthrsourcelack-  
tracker|signal-slot-connector|[^]\*)\$

lib/scanner/(csv-scanner|list-scanner|kv-scanner|xml-scanner|[^]\*)\$

libtest

syslog-ng(-ctl)?

modules/java-modules/common

modules/java/(native|proxies|src)

modules/native

modules/http/http-signals.h

modules/http/compression\.[ch]

tests/loggen

persist-tool

modules/python-modules/syslogng/\_\_init\_\_\.

modules/python-modules/syslogng/persist\.

modules/python-modules/syslogng/source\.

modules/python/python-startup.(c|h)\$

modules/python/python-global.(c|h)\$

#####

```
#
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#####
GPLv2+_SSL,non-balabit
modules/diskq/tests/test_diskq_counters\c
modules/http/http-plugin\.[ch]
modules/http/http-parser.h
modules/timestamp/rewrite-.*$
modules/timestamp/tf-format-date.*$
modules/timestamp/tests/test_format_date.*$
modules/add-contextual-data/add-contextual-data-glob-selector\.[ch]$
modules/add-contextual-data/tests/test_glob_selector\c$
modules/affile/tests/test_file_writer\c$
modules/affile/stdout\.[ch]
modules/afsocket/socket-options-unix\.[ch]$
modules/basicfuncs/vp-funcs\.[ch]$
modules/basicfuncs/tf-tag\c$
modules/diskq/diskq-global-metrics\.[ch]$
modules/diskq/tests/test_logqueue_disk\c$
modules/metrics-probe/metrics-probe(|-parser|-plugin|-grammar)\.(c|h|ym)$
modules/metrics-probe/tests/test_metrics_probe\c$
modules/darwinosl/darwinosl(|-parser|-plugin|-grammar|-source|-source-oslog|-source-persist)\.(c|h|m|ym)$
modules/grpc/otel/otel-(grammar|parser|plugin|source|source-services|servicecall|protobuf-parser|protobuf-formatter|dest|dest-worker|logmsg-handles)\.(c|h|cpp|hpp|ym)$
modules/grpc/otel/grpc-credentials-builder\.(h|cpp|hpp)$
modules/grpc/otel/syslog-ng-otlp-(dest|dest-worker)\.(h|cpp|hpp)$
modules/grpc/otel/tests/test-otel-(protobuf-parser|protobuf-formatter)\.cpp$
modules/grpc/otel/tests/test-syslog-ng-otlp\.cpp$
modules/grpc/loki
modules/grpc/bigquery
modules/grpc/pubsub
modules/grpc/clickhouse
modules/grpc/common
modules/grpc/protos/apphook\.(cpp|h)$
modules/cloud-auth/cloud-auth(|-grammar|-parser|-plugin)\.(c|h|cpp|hpp|ym)$
modules/cloud-auth/google-auth\.(h|cpp|hpp)$
modules/cloud-auth/azure-auth\.(h|cpp|hpp)$
modules/examples/inner-destinations/tls-test-validation
modules/examples/sources/random-choice-generator
modules/python/python-options.(c|h)$
modules/python/python-reloc.(c|h)$
modules/python/python-binding.(c|h)$
modules/python/python-flags.(c|h)$
modules/python/tests/test_python_options.c$
modules/python/tests/test_python_reloc.c$
scl/fortigate/.*\.conf$
scl/cee/.*\.conf$
scl/elasticsearch/elastic-datastream.conf$
```

scl/logscale/logscale\conf\$  
scl/mariadb/\*.conf\$  
scl/python/python-modules\conf\$  
scl/darwinosl/plugin\conf\$  
scl/splunk/splunk\conf\$  
scl/google/google-pubsub\conf\$  
scl/azure/azure-monitor\conf\$  
scl/openobserve/\*.conf\$  
scl/pgsql/pgsql\conf\$  
scl/qbittorrent/qbittorrent\conf\$  
scl/pihole/pihole\conf\$  
scl/jellyfin/jellyfin\conf\$  
scl/arr/arr\conf\$  
modules/python-modules/syslogng/modules/kubernetes/\*  
modules/ebpf/\*  
modules/python-modules/syslogng/modules/hypr/\*  
modules/python-modules/syslogng/modules/example/\*  
modules/python-modules/syslogng/modules/s3/\*  
modules/python-modules/syslogng/modules/webhook/scl/\*  
modules/python-modules/syslogng/modules/webhook/\_\_init\_\_.py  
modules/python-modules/setup.py  
scripts/build-python-venv.sh  
modules/syslogformat/sdata-parser.[ch]  
tests/light/functional\_tests/config\_change/test\_python\_custom\_options.py  
tests/light/functional\_tests/logpath/\_\_init\_\_.py  
tests/light/functional\_tests/logpath/test\_named\_logpaths.py  
tests/light/functional\_tests/logpath/test\_named\_logpaths\_with\_catchall\_flag.py  
tests/light/functional\_tests/logpath/test\_named\_logpaths\_with\_fallback\_flag.py  
tests/light/functional\_tests/logpath/test\_named\_logpaths\_with\_final\_flag.py  
tests/light/functional\_tests/parsers/sdata-parser/test\_sdata\_parser.py  
tests/light/functional\_tests/parsers/group-lines-parser/test\_group\_lines\_parser.py  
tests/light/functional\_tests/parsers/postgresql-csvlog-parser/test\_postgresql\_csvlog\_parser.py  
tests/light/functional\_tests/logpath/test\_conditionals.py  
tests/light/functional\_tests/logpath/test\_midpoint\_destinations.py  
tests/light/functional\_tests/value-pairs/test\_value\_pairs.py  
tests/light/functional\_tests/templates/test\_template\_stmt.py  
tests/light/functional\_tests/filters/test\_multiple\_filters.py  
tests/light/functional\_tests/parsers/metrics-probe/test\_metrics\_probe.py  
tests/light/functional\_tests/source\_drivers/syslog\_source/auto/test\_auto\_proto.py  
tests/light/src/syslog\_ng\_ctl/prometheus\_stats\_handler.py  
tests/light/src/syslog\_ng\_config/statements/template/template.py  
tests/light/src/syslog\_ng\_config/statements/\_\_init\_\_.py  
tests/light/src/syslog\_ng/syslog\_ng\_docker\_executor.py  
modules/correlation/id-counter.[ch]\$  
modules/correlation/group-lines.h  
modules/xml/windows-eventlog-xml-parser.h  
modules/xml/tests/test\_windows\_eventlog\_xml\_parser.c  
modules/affile/logrotate.[ch]

tests/light/functional\_tests/destination\_drivers/file\_destination/test\_logrotate\_all\_messages\_received\.  
tests/light/functional\_tests/destination\_drivers/file\_destination/test\_logrotate\_deleting\_log\_file\.  
tests/light/functional\_tests/destination\_drivers/file\_destination/test\_logrotate\_rotation\_failure\.

#####

#

These files are GPLd with Balabit origin.

#####

GPLv2+\_SSL

news/create-newsfile.py

news/next-pr-id.py

dev-utils/plugin\_skeleton\_creator/create\_plugin.sh

tests/functional

tests/unit

tests/valgrind

tests/build-log-cflags-propagation.sh

tests/collect-cov.sh

tests/commits/check.sh

tests/copyright/check.sh

tests/light

modules/java/(tools[^\]\*)\$

modules/java-modules/(dummy|hdfs[^\]\*)\$

modules/(afamqp|affile|afmongodb|afprog|afsmtp|afsocket|afsql|afstomp|afstreams|afuser|azure-auth-  
header|basicfuncs|cef|confgen|cryptofuncs|csvparser|timestamp|diskq|correlation|geoip2|graphite|json|kvformat|linux  
-kmsg-format|pacctformat|pseudofile|python|python-modules|redis|riemann|syslogformat|systemd-  
journal|getent|system-source|stardate|snmptrapd-parser|xml|openbsd|examples|kafka|afsnmp|mqtt|regexp-parser|rate-  
limit-filter[^\]\*)\$

modules/(add-contextual-data|tagsparser|map-value-pairs|hook-commands|appmodel[^\]\*)\$

modules/cryptofuncs/cryptofuncs.c\$

modules/cryptofuncs/tests/test\_cryptofuncs.c\$

modules/http/(http-loadbalancer|http-worker)\.[ch]\$

modules/http/response-handler\.[ch]\$

modules/http/http-curl-header-list\.[ch]\$

modules/http/autodetect-ca-location\.[ch]\$

packaging/package-indexer/\*.py\$

scl

scripts

modules/http/tests

modules/http/http\.[ch]

modules/http/http-parser.c

modules/http/http-grammar.ym

modules/correlation/group-lines.c

modules/python-modules/syslogng/modules/webhook/source.py

docker/Dockerfile

docker/entrypoint.sh

Doxyfile

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## 1.368 aho-corasick 1.1.4

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Name: badpaletteentry

Columns: 4

#

0 0 0 Index 3

65 38

103 62 49 Index 6

79 73 72 Index 7

114 101 97 Index 8

208 127 100 Index 9

151 144 142 Index 10

221 207 199 Index 11

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Name: Test

Columns: 0

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Julian Seward, jseward@acm.org
bzip2/libbzip2 version 1.0.8 of 13 July 2019

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Name: custompalette

Columns: 4

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0 0 0 Index 3

65 38 30 Index 4

103 62 49 Index 6

79 73 72 Index 7

114 101 97 Index 8

208 127 100 Index 9

151 144 142 Index 10

221 207 199 Index 11

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1.373 commons-lang3 3.14.0

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Portions of code from MODP_ASCII - Ascii transformations (upper/lower, etc)
<https://github.com/client9/stringencoders>

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```

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/ViewOscillator.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/MotionEvent.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ReactiveGuide.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/ViewTransition.java
*
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/ViewTimeCycle.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/MotionButton.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/ViewSpline.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/ViewTransitionController.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/FloatLayout.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/MotionLabel.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/SharedValues.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/Carousel.java
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* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintLayout.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Guideline.java
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* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintAttribute.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Constraints.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Placeholder.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Barrier.java

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* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/TransitionAdapter.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/OnSwipe.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/Group.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/MotionPlaceholder.java
*
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/Layer.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionHelper.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/MockView.java

```

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintHelper.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/ViewState.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/CircularFlow.java
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* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/helper/widget/Flow.java
* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionInterpolator.java
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* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintsChangedListener.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionLayout.java

*

/constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyTimeCycle.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyPosition.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyTrigger.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyFrames.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionScene.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/Key.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/TouchResponse.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintProperties.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/Debug.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/ImageFilterView.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyCycle.java

*

/constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/MotionTelltale.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/StateSet.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyPositionBase.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/utils/StopLogic.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionController.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/VirtualLayout.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/DesignTool.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/KeyAttributes.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/utils/widget/ImageFilterButton.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionPaths.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/widget/ConstraintLayoutStates.java

*

/constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/CustomFloatAttributes.java

* /constraintlayout-2-1-4-sources-jar/androidx/constraintlayout/motion/widget/MotionConstrainedPoint.java

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1.382 soupsieve 2.0.1

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1.386 beautiful-soup 4.12.2

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1.389 tabulate 0.9.0

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1.390 savedstate-ctx 1.2.0

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 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/FragmentDescription.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/exceptions/package-info.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/FragmentStatus.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/exceptions/RequiredFragmentPathException.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/package-info.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/Fragment.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/exceptions/DownloadingException.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/FragmentDownloader.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/FragmentPath.java
 *
 /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/FragmentClassLoader.java
 * /fragment-1-3-6-sources-jar/io/github/shiruka/fragment/FragmentInfo.java

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1.392 savedstate 1.2.0

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* /savedstate-1-2-0-sources-jar/com/linecorp/lich/savedstate/SavedStateTesting.kt
* /savedstate-1-2-0-sources-jar/com/linecorp/lich/savedstate/SavedStates.kt
* /savedstate-1-2-0-sources-jar/com/linecorp/lich/savedstate/ViewModelArgs.kt
*
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1.393 memchr 2.7.5

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1.394 miniz_oxide 0.8.9

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1.395 hashbrown 0.15.5

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1.396 gimli 0.32.0

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1.397 rustc-demangle 0.1.26

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1.398 addr2line 0.25.0

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```

```
## Commands to generate dependency files
GEN_DEPS.c= $(CC) -E -MM $(DEFS) $(CPPFLAGS)
GEN_DEPS.cc= $(CXX) -E -MM $(DEFS) $(CPPFLAGS)
```

```
## Flags for position independent code
SHAREDLIBCFLAGS = -fPIC
SHAREDLIBCXXFLAGS = -fPIC
SHAREDLIBCPPFLAGS = -DPIC
```

```
## Additional flags when building libraries and with threads
THREADSCPPFLAGS = -D_REENTRANT
LIBCPPFLAGS =
```

```
## Compiler switch to embed a runtime search path
LD_RPATH=
LD_RPATH_PRE= -Wl,-rpath,
```

```
## Compiler switch to embed a library name
LD_SONAME = -Wl,-soname -Wl,$(notdir $(MIDDLE_SO_TARGET))
```

```
## Shared library options
LD_SOOPTIONS= -Wl,-Bsymbolic
```

```
## Shared object suffix
SO = so
## Non-shared intermediate object suffix
STATIC_O = ao
```

```
## Compilation
rules
%. $(STATIC_O): $(srcdir)/%.c
$(COMPILE.c) $(STATICCPPFLAGS) $(STATICCFLAGS) -o $@ $<
%.o: $(srcdir)/%.c
$(COMPILE.c) $(DYNAMICCPPFLAGS) $(DYNAMICCFLAGS) -o $@ $<
```

```
%. $(STATIC_O): $(srcdir)/%.cpp
$(COMPILE.cc) $(STATICCPPFLAGS) $(STATICCXXFLAGS) -o $@ $<
```

```
%o: $(srcdir)/%.cpp
$(COMPILE.cc) $(DYNAMICCPPFLAGS) $(DYNAMICCXXFLAGS) -o $@ $<
```

Dependency rules

```
%d: $(srcdir)/%.c
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.c) $< \
| sed "s/\($*\)\.o[ :]*/\1.o $@ : /g"' > $@; \
[ -s $@ ] || rm -f $@'
```

```
%d: $(srcdir)/%.cpp
@echo "generating dependency information for $<"
@$(SHELL) -ec '$(GEN_DEPS.cc) $< \
| sed "s/\($*\)\.o[ :]*/\1.o $@ : /g"' > $@; \
[ -s $@ ] || rm -f $@'
```

Versioned libraries rules

```
%. $(SO).$(SO_TARGET_VERSION_MAJOR): %. $(SO).$(SO_TARGET_VERSION)
$(RM) $@ && ln -s ${<F} $@
%. $(SO): %. $(SO).$(SO_TARGET_VERSION_MAJOR)
$(RM) $@ && ln -s ${*F}. $(SO).$(SO_TARGET_VERSION) $@
```

Bind internal references

```
# LDflags that pkgdata will use
BIR_LDFLAGS= -Wl,-Bsymbolic
```

```
# Dependencies [i.e. map files] for the final library
BIR_DEPS=
```

```
## Remove shared library 's'
STATIC_PREFIX_WHEN_USED =
STATIC_PREFIX =
```

```
## End BSD-specific setup
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```

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JSON parsing library (nlohmann/json)

File: vendor/json/upstream/single_include/nlohmann/json.hpp (only for ICU4C)

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Section: pkg.m4 - Macros to locate and utilise pkg-config.

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File: sorttable.js (only for ICU4J)

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Format: Archive (Bsd)

Member: "one.o"

Format: ELF 64-bit

FileHeader {

 Ident {

 Magic: [7F, 45, 4C, 46]

 Class: ELFCLASS64 (0x2)

 Data: ELFDATA2LSB (0x1)

 Version: EV_CURRENT (0x1)

 OsAbi: ELFOSABI_SYSV (0x0)

 AbiVersion: 0x0

 Unused: [0, 0, 0, 0, 0, 0]

 }

 Type: ET_REL (0x1)

 Machine: EM_X86_64 (0x3E)

 Version: EV_CURRENT (0x1)

 Entry: 0x0

 ProgramHeaderOffset: 0x0

 SectionHeaderOffset: 0x228

 Flags: 0x0

HeaderSize: 0x40
ProgramHeaderEntrySize: 0x0
ProgramHeaderCount: 0
SectionHeaderEntrySize: 0x40
SectionHeaderCount: 12
SectionHeaderStringTableIndex: 11
}

SectionHeader {
 Index: 0
 Name: "" (0x0)
 Type: SHT_NULL (0x0)
 Flags: 0x0
 Address: 0x0
 Offset: 0x0
 Size: 0x0
 Link: 0
 Info: 0
 AddressAlign: 0x0
 EntrySize: 0x0
}

SectionHeader {
 Index: 1
 Name: ".text" (0x1B)
 Type: SHT_PROGBITS (0x1)
 Flags: 0x6
 SHF_ALLOC (0x2)
 SHF_EXECINSTR
 (0x4)
 Address: 0x0
 Offset: 0x40
 Size: 0x16
 Link: 0
 Info: 0
 AddressAlign: 0x1
 EntrySize: 0x0
}

SectionHeader {
 Index: 2
 Name: ".data" (0x21)
 Type: SHT_PROGBITS (0x1)
 Flags: 0x3
 SHF_WRITE (0x1)
 SHF_ALLOC (0x2)
 Address: 0x0
 Offset: 0x56
 Size: 0x0
 Link: 0
 Info: 0

```

    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 3
    Name: ".bss" (0x27)
    Type: SHT_NOBITS (0x8)
    Flags: 0x3
        SHF_WRITE (0x1)
        SHF_ALLOC (0x2)
    Address: 0x0
    Offset: 0x56
    Size: 0x0
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 4
    Name: ".comment" (0x2C)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x30
        SHF_MERGE (0x10)
        SHF_STRINGS (0x20)
    Address: 0x0
    Offset: 0x56
    Size: 0x2C
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x1
}
SectionHeader {
    Index: 5
    Name: ".note.GNU-stack" (0x35)
    Type: SHT_PROGBITS
(0x1)
    Flags: 0x0
    Address: 0x0
    Offset: 0x82
    Size: 0x0
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {

```

```

Index: 6
Name: ".note.gnu.property" (0x45)
Type: SHT_NOTE (0x7)
Flags: 0x2
    SHF_ALLOC (0x2)
Address: 0x0
Offset: 0x88
Size: 0x20
Link: 0
Info: 0
AddressAlign: 0x8
EntrySize: 0x0
Note {
    Name: "GNU" (0x4)
    Type: NT_GNU_PROPERTY_TYPE_0 (0x5)
    Property {
        Type: GNU_PROPERTY_X86_FEATURE_1_AND (0xC0000002)
        Value: 0x3
            GNU_PROPERTY_X86_FEATURE_1_IBT (0x1)
            GNU_PROPERTY_X86_FEATURE_1_SHSTK (0x2)
        }
    }
}
}
SectionHeader {
    Index: 7
    Name: ".eh_frame" (0x5D)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x2
        SHF_ALLOC (0x2)
    Address: 0x0
    Offset: 0xA8
    Size: 0x58
    Link: 0
    Info: 0
    AddressAlign: 0x8
    EntrySize: 0x0
}
SectionHeader {
    Index: 8
    Name: ".rela.eh_frame"
(0x58)
    Type: SHT_RELA (0x4)
    Flags: 0x40
        SHF_INFO_LINK (0x40)
    Address: 0x0
    Offset: 0x190
    Size: 0x30
    Link: 9

```

```

Info: 7
AddressAlign: 0x8
EntrySize: 0x18
Relocation {
    Offset: 0x20
    Type: R_X86_64_PC32 (0x2)
    Symbol: "" (0x2)
}
Relocation {
    Offset: 0x40
    Type: R_X86_64_PC32 (0x2)
    Symbol: "" (0x2)
    Addend: 0xB
}
}
SectionHeader {
    Index: 9
    Name: ".symtab" (0x1)
    Type: SHT_SYMTAB (0x2)
    Flags: 0x0
    Address: 0x0
    Offset: 0x100
    Size: 0x78
    Link: 10
    Info: 3
    AddressAlign: 0x8
    EntrySize: 0x18
    Symbol {
        Index: 0
        Name: 0x0
        Value: 0x0
        Size: 0x0
        Type: STT_NOTYPE (0x0)
        Bind: STB_LOCAL (0x0)
        Other: STV_DEFAULT (0x0)
        SectionIndex: SHN_UNDEF (0x0)
    }
    Symbol {
        Index: 1
        Name: "<stdin>" (0x1)
        Value: 0x0
        Size: 0x0
        Type: STT_FILE (0x4)
        Bind: STB_LOCAL
(0x0)
        Other: STV_DEFAULT (0x0)
        SectionIndex: SHN_ABS (0xFFFF1)
    }
}

```

```

Symbol {
  Index: 2
  Name: "" (0x0)
  Value: 0x0
  Size: 0x0
  Type: STT_SECTION (0x3)
  Bind: STB_LOCAL (0x0)
  Other: STV_DEFAULT (0x0)
  SectionIndex: 1
}
Symbol {
  Index: 3
  Name: "one_a" (0x9)
  Value: 0x0
  Size: 0xB
  Type: STT_FUNC (0x2)
  Bind: STB_GLOBAL (0x1)
  Other: STV_DEFAULT (0x0)
  SectionIndex: 1
}
Symbol {
  Index: 4
  Name: "one_b" (0xF)
  Value: 0xB
  Size: 0xB
  Type: STT_FUNC (0x2)
  Bind: STB_GLOBAL (0x1)
  Other: STV_DEFAULT (0x0)
  SectionIndex: 1
}
}
}
SectionHeader {
  Index: 10
  Name: ".strtab" (0x9)
  Type: SHT_STRTAB (0x3)
  Flags: 0x0
  Address: 0x0
  Offset: 0x178
  Size: 0x15
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}
SectionHeader {
  Index: 11
  Name:

```

".shstrtab" (0x11)
Type: SHT_STRTAB (0x3)
Flags: 0x0
Address: 0x0
Offset: 0x1C0
Size: 0x67
Link: 0
Info: 0
AddressAlign: 0x1
EntrySize: 0x0
}

Member: "two.o"

Format: ELF 64-bit

FileHeader {

Ident {

Magic: [7F, 45, 4C, 46]
Class: ELFCLASS64 (0x2)
Data: ELFDATA2LSB (0x1)
Version: EV_CURRENT (0x1)
OsAbi: ELFOSABI_SYSV (0x0)
AbiVersion: 0x0
Unused: [0, 0, 0, 0, 0, 0, 0]

}

Type: ET_REL (0x1)

Machine: EM_X86_64 (0x3E)

Version: EV_CURRENT (0x1)

Entry: 0x0

ProgramHeaderOffset: 0x0

SectionHeaderOffset: 0x228

Flags: 0x0

HeaderSize: 0x40

ProgramHeaderEntrySize: 0x0

ProgramHeaderCount: 0

SectionHeaderEntrySize: 0x40

SectionHeaderCount: 12

SectionHeaderStringTableIndex: 11

}

SectionHeader {

Index: 0

Name: "" (0x0)

Type: SHT_NULL (0x0)

Flags: 0x0

Address: 0x0

Offset: 0x0

Size: 0x0

Link: 0

Info: 0

```

    AddressAlign:
    0x0
    EntrySize: 0x0
}
SectionHeader {
    Index: 1
    Name: ".text" (0x1B)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x6
        SHF_ALLOC (0x2)
        SHF_EXECINSTR (0x4)
    Address: 0x0
    Offset: 0x40
    Size: 0x16
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 2
    Name: ".data" (0x21)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x3
        SHF_WRITE (0x1)
        SHF_ALLOC (0x2)
    Address: 0x0
    Offset: 0x56
    Size: 0x0
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 3
    Name: ".bss" (0x27)
    Type: SHT_NOBITS (0x8)
    Flags: 0x3
        SHF_WRITE (0x1)
        SHF_ALLOC (0x2)
    Address: 0x0
    Offset: 0x56
    Size: 0x0
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0

```



```

}
SectionHeader {
  Index: 4
  Name: ".comment" (0x2C)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x30
    SHF_MERGE (0x10)
    SHF_STRINGS (0x20)
  Address: 0x0
  Offset: 0x56
  Size: 0x2C
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x1
}
SectionHeader {
  Index: 5
  Name: ".note.GNU-stack" (0x35)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x0
  Address: 0x0
  Offset: 0x82
  Size: 0x0
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}
SectionHeader {
  Index: 6
  Name: ".note.gnu.property" (0x45)
  Type: SHT_NOTE (0x7)
  Flags: 0x2
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0x88
  Size: 0x20
  Link: 0
  Info: 0
  AddressAlign: 0x8
  EntrySize: 0x0
  Note {
    Name: "GNU" (0x4)
    Type: NT_GNU_PROPERTY_TYPE_0 (0x5)
    Property {
      Type: GNU_PROPERTY_X86_FEATURE_1_AND (0xC0000002)
      Value: 0x3
    }
  }
}

```

```

        GNU_PROPERTY_X86_FEATURE_1_IBT (0x1)
        GNU_PROPERTY_X86_FEATURE_1_SHSTK (0x2)
    }
}
}
SectionHeader {
    Index: 7
    Name: ".eh_frame" (0x5D)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x2
        SHF_ALLOC (0x2)
    Address: 0x0
    Offset: 0xA8
    Size: 0x58
    Link: 0
    Info: 0
    AddressAlign: 0x8
    EntrySize: 0x0
}
SectionHeader {
    Index: 8
    Name: ".rela.eh_frame" (0x58)
    Type: SHT_RELA (0x4)
    Flags: 0x40
        SHF_INFO_LINK (0x40)
    Address: 0x0
    Offset: 0x190
    Size: 0x30
    Link: 9
    Info: 7
    AddressAlign: 0x8
    EntrySize: 0x18
    Relocation {
        Offset: 0x20
        Type: R_X86_64_PC32 (0x2)
        Symbol: "" (0x2)
    }
    Relocation {
        Offset: 0x40
        Type: R_X86_64_PC32 (0x2)
        Symbol: "" (0x2)
        Addend: 0xB
    }
}
SectionHeader {
    Index: 9
    Name: ".symtab" (0x1)
    Type: SHT_SYMTAB (0x2)

```

Flags: 0x0
Address: 0x0
Offset: 0x100
Size: 0x78
Link: 10
Info: 3
AddressAlign: 0x8
EntrySize: 0x18
Symbol {
 Index: 0
 Name: 0x0
 Value: 0x0
 Size: 0x0
 Type: STT_NOTYPE (0x0)
 Bind: STB_LOCAL (0x0)
 Other: STV_DEFAULT (0x0)
 SectionIndex: SHN_UNDEF
(0x0)
}
Symbol {
 Index: 1
 Name: "<stdin>" (0x1)
 Value: 0x0
 Size: 0x0
 Type: STT_FILE (0x4)
 Bind: STB_LOCAL (0x0)
 Other: STV_DEFAULT (0x0)
 SectionIndex: SHN_ABS (0xFFF1)
}
Symbol {
 Index: 2
 Name: "" (0x0)
 Value: 0x0
 Size: 0x0
 Type: STT_SECTION (0x3)
 Bind: STB_LOCAL (0x0)
 Other: STV_DEFAULT (0x0)
 SectionIndex: 1
}
Symbol {
 Index: 3
 Name: "two_a" (0x9)
 Value: 0x0
 Size: 0xB
 Type: STT_FUNC (0x2)
 Bind: STB_GLOBAL (0x1)
 Other: STV_DEFAULT (0x0)
 SectionIndex: 1

```

}
Symbol {
  Index: 4
  Name: "two_b" (0xF)
  Value: 0xB
  Size: 0xB
  Type: STT_FUNC (0x2)
  Bind: STB_GLOBAL (0x1)
  Other: STV_DEFAULT (0x0)
  SectionIndex: 1
}
}

```

```

SectionHeader {
  Index: 10
  Name: ".strtab" (0x9)
  Type: SHT_STRTAB (0x3)
  Flags: 0x0
  Address: 0x0
  Offset: 0x178
  Size: 0x15
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}

```

```

SectionHeader {
  Index: 11
  Name: ".shstrtab" (0x11)
  Type: SHT_STRTAB (0x3)
  Flags: 0x0
  Address: 0x0
  Offset: 0x1C0
  Size: 0x67
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}

```

Member: "three.o"

Format: ELF 64-bit

```

FileHeader {
  Ident {
    Magic: [7F, 45, 4C, 46]
    Class: ELFCLASS64 (0x2)
    Data: ELFDATA2LSB (0x1)
    Version: EV_CURRENT (0x1)
    OsAbi: ELFOSABI_SYSV (0x0)
  }
}

```

```

    AbiVersion: 0x0
    Unused: [0, 0, 0, 0, 0, 0, 0]
}
Type: ET_REL (0x1)
Machine: EM_X86_64 (0x3E)
Version: EV_CURRENT (0x1)
Entry: 0x0
ProgramHeaderOffset: 0x0
SectionHeaderOffset: 0x230
Flags: 0x0
HeaderSize: 0x40
ProgramHeaderEntrySize: 0x0
ProgramHeaderCount: 0
SectionHeaderEntrySize: 0x40
SectionHeaderCount: 12
SectionHeaderStringTableIndex: 11
}
SectionHeader {
    Index: 0
    Name: "" (0x0)
    Type: SHT_NULL (0x0)
    Flags: 0x0
    Address: 0x0
    Offset: 0x0
    Size: 0x0
    Link: 0
    Info: 0
    AddressAlign: 0x0
    EntrySize: 0x0
}
SectionHeader {
    Index: 1
    Name: ".text" (0x1B)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x6
        SHF_ALLOC (0x2)
        SHF_EXECINSTR (0x4)
    Address: 0x0
    Offset: 0x40
    Size: 0x16
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 2
    Name: ".data" (0x21)

```

Type: SHT_PROGBITS (0x1)
Flags: 0x3
 SHF_WRITE (0x1)
 SHF_ALLOC (0x2)
Address: 0x0
Offset: 0x56
Size: 0x0
Link: 0
Info: 0
AddressAlign: 0x1
EntrySize: 0x0
}

SectionHeader {
 Index: 3
 Name: ".bss" (0x27)
 Type: SHT_NOBITS (0x8)
 Flags: 0x3
 SHF_WRITE (0x1)
 SHF_ALLOC (0x2)
 Address: 0x0
 Offset: 0x56
 Size: 0x0
 Link: 0
 Info: 0
 AddressAlign: 0x1
 EntrySize: 0x0
}

SectionHeader {
 Index: 4
 Name: ".comment" (0x2C)
 Type: SHT_PROGBITS (0x1)
 Flags: 0x30
 SHF_MERGE (0x10)
 SHF_STRINGS (0x20)
 Address: 0x0
 Offset: 0x56
 Size: 0x2C
 Link: 0
 Info: 0
 AddressAlign: 0x1
 EntrySize: 0x1
}

SectionHeader {
 Index: 5
 Name: ".note.GNU-stack" (0x35)
 Type: SHT_PROGBITS (0x1)
 Flags: 0x0
 Address: 0x0

```

Offset: 0x82
Size: 0x0
Link: 0
Info: 0
AddressAlign: 0x1
EntrySize: 0x0
}
SectionHeader {
  Index: 6
  Name: ".note.gnu.property" (0x45)
  Type: SHT_NOTE (0x7)
  Flags: 0x2
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0x88
  Size: 0x20
  Link: 0
  Info: 0
  AddressAlign: 0x8
  EntrySize: 0x0
  Note {
    Name: "GNU" (0x4)
    Type: NT_GNU_PROPERTY_TYPE_0 (0x5)
    Property {
      Type: GNU_PROPERTY_X86_FEATURE_1_AND (0xC0000002)
      Value: 0x3
        GNU_PROPERTY_X86_FEATURE_1_IBT (0x1)
        GNU_PROPERTY_X86_FEATURE_1_SHSTK (0x2)
    }
  }
}
}
SectionHeader {
  Index: 7
  Name: ".eh_frame" (0x5D)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x2
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0xA8
  Size: 0x58
  Link: 0
  Info: 0
  AddressAlign: 0x8
  EntrySize: 0x0
}
SectionHeader {
  Index: 8
  Name: ".rela.eh_frame" (0x58)

```

Type: SHT_RELA (0x4)
Flags: 0x40
SHF_INFO_LINK (0x40)
Address: 0x0
Offset: 0x198
Size: 0x30
Link: 9
Info: 7
AddressAlign: 0x8
EntrySize: 0x18
Relocation {
Offset: 0x20
Type: R_X86_64_PC32 (0x2)
Symbol: "" (0x2)
}
Relocation {
Offset: 0x40
Type: R_X86_64_PC32 (0x2)
Symbol: "" (0x2)
Addend: 0xB
}
}
SectionHeader {
Index: 9
Name: ".symtab" (0x1)
Type: SHT_SYMTAB (0x2)
Flags: 0x0
Address: 0x0
Offset: 0x100
Size: 0x78
Link: 10
Info: 3
AddressAlign: 0x8
EntrySize: 0x18
Symbol {
Index: 0
Name: 0x0
Value: 0x0
Size: 0x0
Type: STT_NOTYPE (0x0)
Bind: STB_LOCAL (0x0)
Other: STV_DEFAULT (0x0)
SectionIndex: SHN_UNDEF (0x0)
}
Symbol {
Index: 1
Name: "<stdin>" (0x1)
Value: 0x0


```

    Size: 0x0
    Type: STT_FILE (0x4)
    Bind: STB_LOCAL (0x0)
    Other: STV_DEFAULT (0x0)
    SectionIndex: SHN_ABS (0xFFFF1)
}
Symbol {
    Index: 2
    Name: "" (0x0)
    Value: 0x0
    Size: 0x0
    Type: STT_SECTION (0x3)
    Bind: STB_LOCAL (0x0)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
Symbol {
    Index: 3
    Name: "three_a" (0x9)
    Value: 0x0
    Size: 0xB
    Type: STT_FUNC (0x2)
    Bind: STB_GLOBAL (0x1)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
Symbol {
    Index: 4
    Name: "three_b" (0x11)
    Value: 0xB
    Size: 0xB
    Type: STT_FUNC (0x2)
    Bind: STB_GLOBAL (0x1)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
}
SectionHeader {
    Index: 10
    Name: ".strtab" (0x9)
    Type: SHT_STRTAB (0x3)
    Flags: 0x0
    Address: 0x0
    Offset: 0x178
    Size: 0x19
    Link: 0
    Info: 0
    AddressAlign: 0x1

```

```

    EntrySize: 0x0
}
SectionHeader {
    Index: 11
    Name: ".shstrtab" (0x11)
    Type: SHT_STRTAB (0x3)
    Flags: 0x0
    Address: 0x0
    Offset: 0x1C8
    Size: 0x67
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}

Member: "a.o"
Format: ELF 64-bit
FileHeader {
    Ident {
        Magic: [7F, 45, 4C, 46]
        Class: ELFCLASS64 (0x2)
        Data: ELFDATA2LSB (0x1)
        Version: EV_CURRENT (0x1)
        OsAbi: ELFOSABI_SYSV (0x0)
        AbiVersion: 0x0
        Unused: [0, 0, 0, 0, 0, 0, 0]
    }
    Type: ET_REL (0x1)
    Machine: EM_X86_64 (0x3E)
    Version: EV_CURRENT (0x1)
    Entry: 0x0
    ProgramHeaderOffset: 0x0
    SectionHeaderOffset: 0x228
    Flags: 0x0
    HeaderSize: 0x40
    ProgramHeaderEntrySize:
0x0
    ProgramHeaderCount: 0
    SectionHeaderEntrySize: 0x40
    SectionHeaderCount: 12
    SectionHeaderStringTableIndex: 11
}
SectionHeader {
    Index: 0
    Name: "" (0x0)
    Type: SHT_NULL (0x0)
    Flags: 0x0

```

```

Address: 0x0
Offset: 0x0
Size: 0x0
Link: 0
Info: 0
AddressAlign: 0x0
EntrySize: 0x0
}
SectionHeader {
  Index: 1
  Name: ".text" (0x1B)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x6
    SHF_ALLOC (0x2)
    SHF_EXECINSTR (0x4)
  Address: 0x0
  Offset: 0x40
  Size: 0x16
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}
SectionHeader {
  Index: 2
  Name: ".data" (0x21)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x3
    SHF_WRITE (0x1)
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0x56
  Size: 0x0
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}
SectionHeader {
  Index: 3
  Name: ".bss" (0x27)
  Type: SHT_NOBITS (0x8)
  Flags: 0x3
    SHF_WRITE (0x1)
    SHF_ALLOC
(0x2)
  Address: 0x0
  Offset: 0x56

```

```

Size: 0x0
Link: 0
Info: 0
AddressAlign: 0x1
EntrySize: 0x0
}
SectionHeader {
  Index: 4
  Name: ".comment" (0x2C)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x30
    SHF_MERGE (0x10)
    SHF_STRINGS (0x20)
  Address: 0x0
  Offset: 0x56
  Size: 0x2C
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x1
}
SectionHeader {
  Index: 5
  Name: ".note.GNU-stack" (0x35)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x0
  Address: 0x0
  Offset: 0x82
  Size: 0x0
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}
SectionHeader {
  Index: 6
  Name: ".note.gnu.property" (0x45)
  Type: SHT_NOTE (0x7)
  Flags: 0x2
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0x88
  Size: 0x20
  Link: 0
  Info: 0
  AddressAlign: 0x8
  EntrySize: 0x0
  Note {

```

```

    Name: "GNU" (0x4)
    Type: NT_GNU_PROPERTY_TYPE_0 (0x5)
    Property {
        Type: GNU_PROPERTY_X86_FEATURE_1_AND
(0xC0000002)
        Value: 0x3
        GNU_PROPERTY_X86_FEATURE_1_IBT (0x1)
        GNU_PROPERTY_X86_FEATURE_1_SHSTK (0x2)
    }
}
}
}
SectionHeader {
    Index: 7
    Name: ".eh_frame" (0x5D)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x2
        SHF_ALLOC (0x2)
    Address: 0x0
    Offset: 0xA8
    Size: 0x58
    Link: 0
    Info: 0
    AddressAlign: 0x8
    EntrySize: 0x0
}
SectionHeader {
    Index: 8
    Name: ".rela.eh_frame" (0x58)
    Type: SHT_RELA (0x4)
    Flags: 0x40
        SHF_INFO_LINK (0x40)
    Address: 0x0
    Offset: 0x190
    Size: 0x30
    Link: 9
    Info: 7
    AddressAlign: 0x8
    EntrySize: 0x18
    Relocation {
        Offset: 0x20
        Type: R_X86_64_PC32 (0x2)
        Symbol: "" (0x2)
    }
    Relocation {
        Offset: 0x40
        Type: R_X86_64_PC32 (0x2)
        Symbol: "" (0x2)
        Addend: 0xB

```

```

    }
}
SectionHeader {
    Index: 9
    Name: ".symtab" (0x1)
    Type: SHT_SYMTAB (0x2)
    Flags: 0x0
    Address:
0x0
    Offset: 0x100
    Size: 0x78
    Link: 10
    Info: 3
    AddressAlign: 0x8
    EntrySize: 0x18
    Symbol {
        Index: 0
        Name: 0x0
        Value: 0x0
        Size: 0x0
        Type: STT_NOTYPE (0x0)
        Bind: STB_LOCAL (0x0)
        Other: STV_DEFAULT (0x0)
        SectionIndex: SHN_UNDEF (0x0)
    }
    Symbol {
        Index: 1
        Name: "<stdin>" (0x1)
        Value: 0x0
        Size: 0x0
        Type: STT_FILE (0x4)
        Bind: STB_LOCAL (0x0)
        Other: STV_DEFAULT (0x0)
        SectionIndex: SHN_ABS (0xFFF1)
    }
    Symbol {
        Index: 2
        Name: "" (0x0)
        Value: 0x0
        Size: 0x0
        Type: STT_SECTION (0x3)
        Bind: STB_LOCAL (0x0)
        Other: STV_DEFAULT (0x0)
        SectionIndex: 1
    }
    Symbol {
        Index: 3
        Name: "a_one" (0x9)

```

```

    Value: 0x0
    Size: 0xB
    Type: STT_FUNC (0x2)
    Bind: STB_GLOBAL (0x1)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
Symbol {
    Index: 4
    Name: "a_two" (0xF)
    Value: 0xB
    Size: 0xB
    Type: STT_FUNC (0x2)
    Bind: STB_GLOBAL (0x1)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
}
SectionHeader {
    Index: 10
    Name: ".strtab" (0x9)
    Type: SHT_STRTAB (0x3)
    Flags: 0x0
    Address: 0x0
    Offset: 0x178
    Size: 0x15
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 11
    Name: ".shstrtab" (0x11)
    Type: SHT_STRTAB (0x3)
    Flags: 0x0
    Address: 0x0
    Offset: 0x1C0
    Size: 0x67
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}

Member: "b.o"
Format: ELF 64-bit
FileHeader {

```

```

Ident {
    Magic: [7F, 45, 4C, 46]
    Class: ELFCLASS64 (0x2)
    Data: ELFDATA2LSB (0x1)
    Version: EV_CURRENT (0x1)
    OsAbi: ELFOSABI_SYSV (0x0)
    AbiVersion: 0x0
    Unused: [0, 0, 0, 0, 0, 0, 0]
}
Type: ET_REL (0x1)
Machine: EM_X86_64 (0x3E)
Version: EV_CURRENT (0x1)
Entry: 0x0
ProgramHeaderOffset: 0x0
SectionHeaderOffset: 0x228
Flags: 0x0
HeaderSize: 0x40
ProgramHeaderEntrySize: 0x0
ProgramHeaderCount: 0
SectionHeaderEntrySize: 0x40
SectionHeaderCount: 12
SectionHeaderStringTableIndex: 11
}
SectionHeader {
    Index: 0
    Name: "" (0x0)
    Type: SHT_NULL (0x0)
    Flags: 0x0
    Address: 0x0
    Offset: 0x0
    Size: 0x0
    Link: 0
    Info: 0
    AddressAlign: 0x0
    EntrySize: 0x0
}
SectionHeader {
    Index: 1
    Name: ".text" (0x1B)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x6
        SHF_ALLOC (0x2)
        SHF_EXECINSTR (0x4)
    Address: 0x0
    Offset: 0x40
    Size: 0x16
    Link: 0
    Info: 0

```



```

    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 2
    Name: ".data" (0x21)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x3
        SHF_WRITE (0x1)
        SHF_ALLOC (0x2)
    Address: 0x0
    Offset: 0x56
    Size: 0x0
    Link: 0
    Info: 0
    AddressAlign:
0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 3
    Name: ".bss" (0x27)
    Type: SHT_NOBITS (0x8)
    Flags: 0x3
        SHF_WRITE (0x1)
        SHF_ALLOC (0x2)
    Address: 0x0
    Offset: 0x56
    Size: 0x0
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 4
    Name: ".comment" (0x2C)
    Type: SHT_PROGBITS (0x1)
    Flags: 0x30
        SHF_MERGE (0x10)
        SHF_STRINGS (0x20)
    Address: 0x0
    Offset: 0x56
    Size: 0x2C
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x1

```

```

}
SectionHeader {
  Index: 5
  Name: ".note.GNU-stack" (0x35)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x0
  Address: 0x0
  Offset: 0x82
  Size: 0x0
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}
SectionHeader {
  Index: 6
  Name: ".note.gnu.property" (0x45)
  Type: SHT_NOTE (0x7)
  Flags: 0x2
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0x88
  Size: 0x20
  Link: 0
  Info: 0
  AddressAlign:
0x8
  EntrySize: 0x0
  Note {
    Name: "GNU" (0x4)
    Type: NT_GNU_PROPERTY_TYPE_0 (0x5)
    Property {
      Type: GNU_PROPERTY_X86_FEATURE_1_AND (0xC0000002)
      Value: 0x3
        GNU_PROPERTY_X86_FEATURE_1_IBT (0x1)
        GNU_PROPERTY_X86_FEATURE_1_SHSTK (0x2)
    }
  }
}
SectionHeader {
  Index: 7
  Name: ".eh_frame" (0x5D)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x2
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0xA8
  Size: 0x58

```

```

Link: 0
Info: 0
AddressAlign: 0x8
EntrySize: 0x0
}
SectionHeader {
  Index: 8
  Name: ".rela.eh_frame" (0x58)
  Type: SHT_REL (0x4)
  Flags: 0x40
    SHF_INFO_LINK (0x40)
  Address: 0x0
  Offset: 0x190
  Size: 0x30
  Link: 9
  Info: 7
  AddressAlign: 0x8
  EntrySize: 0x18
  Relocation {
    Offset: 0x20
    Type: R_X86_64_PC32 (0x2)
    Symbol: "" (0x2)
  }
  Relocation {
    Offset: 0x40
    Type: R_X86_64_PC32 (0x2)
    Symbol: "" (0x2)
    Addend: 0xB
  }
}
SectionHeader {
  Index: 9
  Name: ".symtab" (0x1)
  Type: SHT_SYMTAB (0x2)
  Flags: 0x0
  Address: 0x0
  Offset: 0x100
  Size: 0x78
  Link: 10
  Info: 3
  AddressAlign: 0x8
  EntrySize: 0x18
  Symbol {
    Index: 0
    Name: 0x0
    Value: 0x0
    Size: 0x0
    Type: STT_NOTYPE (0x0)

```

```

    Bind: STB_LOCAL (0x0)
    Other: STV_DEFAULT (0x0)
    SectionIndex: SHN_UNDEF (0x0)
}
Symbol {
    Index: 1
    Name: "<stdin>" (0x1)
    Value: 0x0
    Size: 0x0
    Type: STT_FILE (0x4)
    Bind: STB_LOCAL (0x0)
    Other: STV_DEFAULT (0x0)
    SectionIndex: SHN_ABS (0xFFFF1)
}
Symbol {
    Index: 2
    Name: "" (0x0)
    Value: 0x0
    Size: 0x0
    Type: STT_SECTION (0x3)
    Bind: STB_LOCAL (0x0)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
Symbol {
    Index: 3
    Name: "b_one" (0x9)

    Value: 0x0
    Size: 0xB
    Type: STT_FUNC (0x2)
    Bind: STB_GLOBAL (0x1)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
Symbol {
    Index: 4
    Name: "b_two" (0xF)
    Value: 0xB
    Size: 0xB
    Type: STT_FUNC (0x2)
    Bind: STB_GLOBAL (0x1)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
}
SectionHeader {
    Index: 10

```

```

Name: ".strtab" (0x9)
Type: SHT_STRTAB (0x3)
Flags: 0x0
Address: 0x0
Offset: 0x178
Size: 0x15
Link: 0
Info: 0
AddressAlign: 0x1
EntrySize: 0x0
}
SectionHeader {
  Index: 11
  Name: ".shstrtab" (0x11)
  Type: SHT_STRTAB (0x3)
  Flags: 0x0
  Address: 0x0
  Offset: 0x1C0
  Size: 0x67
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}

Member: "c.o"
Format: ELF 64-bit
FileHeader {
  Ident {
    Magic: [7F, 45, 4C, 46]
    Class: ELFCLASS64 (0x2)
    Data: ELFDATA2LSB (0x1)
    Version: EV_CURRENT (0x1)

    OsAbi: ELFOSABI_SYSV (0x0)
    AbiVersion: 0x0
    Unused: [0, 0, 0, 0, 0, 0, 0]
  }
  Type: ET_REL (0x1)
  Machine: EM_X86_64 (0x3E)
  Version: EV_CURRENT (0x1)
  Entry: 0x0
  ProgramHeaderOffset: 0x0
  SectionHeaderOffset: 0x228
  Flags: 0x0
  HeaderSize: 0x40
  ProgramHeaderEntrySize: 0x0
  ProgramHeaderCount: 0

```

```
SectionHeaderEntrySize: 0x40
SectionHeaderCount: 12
SectionHeaderStringTableIndex: 11
}
SectionHeader {
  Index: 0
  Name: "" (0x0)
  Type: SHT_NULL (0x0)
  Flags: 0x0
  Address: 0x0
  Offset: 0x0
  Size: 0x0
  Link: 0
  Info: 0
  AddressAlign: 0x0
  EntrySize: 0x0
}
SectionHeader {
  Index: 1
  Name: ".text" (0x1B)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x6
    SHF_ALLOC (0x2)
    SHF_EXECINSTR (0x4)
  Address: 0x0
  Offset: 0x40
  Size: 0x16
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}
SectionHeader {
  Index: 2
  Name: ".data" (0x21)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x3
    SHF_WRITE (0x1)
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0x56
  Size: 0x0
  Link: 0
  Info: 0
  AddressAlign: 0x1
  EntrySize: 0x0
}
SectionHeader {
```

Index: 3
Name: ".bss" (0x27)
Type: SHT_NOBITS (0x8)
Flags: 0x3
 SHF_WRITE (0x1)
 SHF_ALLOC (0x2)
Address: 0x0
Offset: 0x56
Size: 0x0
Link: 0
Info: 0
AddressAlign: 0x1
EntrySize: 0x0
}

SectionHeader {
 Index: 4
 Name: ".comment" (0x2C)
 Type: SHT_PROGBITS (0x1)
 Flags: 0x30
 SHF_MERGE (0x10)
 SHF_STRINGS (0x20)
 Address: 0x0
 Offset: 0x56
 Size: 0x2C
 Link: 0
 Info: 0
 AddressAlign: 0x1
 EntrySize: 0x1
}

SectionHeader {
 Index: 5
 Name: ".note.GNU-stack" (0x35)
 Type: SHT_PROGBITS (0x1)
 Flags: 0x0
 Address: 0x0
 Offset: 0x82
 Size: 0x0
 Link: 0
 Info: 0
 AddressAlign: 0x1
 EntrySize: 0x0
}

SectionHeader {
 Index: 6
 Name: ".note.gnu.property" (0x45)
 Type: SHT_NOTE (0x7)
 Flags: 0x2
 SHF_ALLOC (0x2)

```

Address: 0x0
Offset: 0x88
Size: 0x20
Link: 0
Info: 0
AddressAlign: 0x8
EntrySize: 0x0
Note {
  Name: "GNU" (0x4)
  Type: NT_GNU_PROPERTY_TYPE_0 (0x5)
  Property {
    Type: GNU_PROPERTY_X86_FEATURE_1_AND (0xC0000002)
    Value: 0x3
      GNU_PROPERTY_X86_FEATURE_1_IBT (0x1)
      GNU_PROPERTY_X86_FEATURE_1_SHSTK (0x2)
  }
}
}
}
SectionHeader {
  Index: 7
  Name: ".eh_frame" (0x5D)
  Type: SHT_PROGBITS (0x1)
  Flags: 0x2
    SHF_ALLOC (0x2)
  Address: 0x0
  Offset: 0xA8
  Size: 0x58
  Link: 0
  Info: 0
  AddressAlign: 0x8
  EntrySize: 0x0
}
SectionHeader {
  Index: 8
  Name: ".rela.eh_frame" (0x58)
  Type: SHT_RELA (0x4)
  Flags: 0x40
    SHF_INFO_LINK (0x40)
  Address: 0x0
  Offset: 0x190
  Size: 0x30
  Link: 9
  Info: 7
  AddressAlign: 0x8
  EntrySize: 0x18
  Relocation {

```



```

Offset: 0x20
Type: R_X86_64_PC32 (0x2)
Symbol: "" (0x2)
}
Relocation {
  Offset: 0x40
  Type: R_X86_64_PC32 (0x2)
  Symbol: "" (0x2)
  Addend: 0xB
}
}
SectionHeader {
  Index: 9
  Name: ".symtab" (0x1)
  Type: SHT_SYMTAB (0x2)
  Flags: 0x0
  Address: 0x0
  Offset: 0x100
  Size: 0x78
  Link: 10
  Info: 3
  AddressAlign: 0x8
  EntrySize: 0x18
  Symbol {
    Index: 0
    Name: 0x0
    Value: 0x0
    Size: 0x0
    Type: STT_NOTYPE (0x0)
    Bind: STB_LOCAL (0x0)
    Other: STV_DEFAULT (0x0)
    SectionIndex: SHN_UNDEF (0x0)
  }
  Symbol {
    Index: 1
    Name: "<stdin>" (0x1)
    Value: 0x0
    Size: 0x0
    Type: STT_FILE (0x4)
    Bind: STB_LOCAL (0x0)
    Other: STV_DEFAULT (0x0)
    SectionIndex: SHN_ABS (0xFFF1)
  }
  Symbol {
    Index: 2
    Name: "" (0x0)
    Value: 0x0
    Size: 0x0

```

```

    Type: STT_SECTION (0x3)
    Bind: STB_LOCAL (0x0)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
Symbol {
    Index: 3
    Name: "c_one" (0x9)
    Value: 0x0
    Size: 0xB
    Type: STT_FUNC (0x2)
    Bind: STB_GLOBAL (0x1)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
Symbol {
    Index: 4
    Name: "c_two" (0xF)
    Value: 0xB
    Size: 0xB
    Type: STT_FUNC (0x2)
    Bind: STB_GLOBAL (0x1)
    Other: STV_DEFAULT (0x0)
    SectionIndex: 1
}
}
SectionHeader {
    Index: 10
    Name: ".strtab" (0x9)
    Type: SHT_STRTAB (0x3)
    Flags: 0x0
    Address: 0x0
    Offset: 0x178
    Size: 0x15
    Link: 0
    Info: 0
    AddressAlign: 0x1
    EntrySize: 0x0
}
SectionHeader {
    Index: 11
    Name: ".shstrtab" (0x11)
    Type: SHT_STRTAB (0x3)
    Flags: 0x0
    Address: 0x0
    Offset: 0x1C0
    Size: 0x67
    Link: 0

```

```
Info: 0
AddressAlign: 0x1
EntrySize: 0x0
}
```

```
Symbol {
  Name: "one_a"
  Member:
    "one.o"
}
```

```
Symbol {
  Name: "one_b"
  Member: "one.o"
}
```

```
Symbol {
  Name: "two_a"
  Member: "two.o"
}
```

```
Symbol {
  Name: "two_b"
  Member: "two.o"
}
```

```
Symbol {
  Name: "three_a"
  Member: "three.o"
}
```

```
Symbol {
  Name: "three_b"
  Member: "three.o"
}
```

```
Symbol {
  Name: "a_one"
  Member: "a.o"
}
```

```
Symbol {
  Name: "a_two"
  Member: "a.o"
}
```

```
Symbol {
  Name: "b_one"
  Member: "b.o"
}
```

```
Symbol {
  Name: "b_two"
  Member: "b.o"
}
```

```
Symbol {
  Name: "c_one"
```

```

    Member: "c.o"
}
Symbol {
    Name: "c_two"
    Member: "c.o"
}

```

1.403 ciscossh 1.17.72.5

1.403.1 Notifications :

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (<http://www.openssl.org/>)

This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).

This product includes software written by Tim Hudson (tjh@cryptsoft.com).

1.403.2 Available under license :

```

/* $OpenBSD: poll.h,v 1.11 2003/12/10 23:10:08 millert Exp $ */

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 */

/* OPENBSD ORIGINAL: sys/sys/poll.h */

#ifndef _COMPAT_POLL_H_
#define _COMPAT_POLL_H_

```

```

#include <sys/types.h>
#ifdef HAVE_POLL_H
# include <poll.h>
#else
# ifdef HAVE_SYS_POLL_H
# include <sys/poll.h>
# endif
#endif

#ifndef HAVE_STRUCT_POLLFD_FD
typedef struct pollfd {
    int fd;
    short events;
    short revents;
} pollfd_t;

#endif

#ifndef POLLIN
# define POLLIN 0x0001
#endif
#ifndef POLLPRI
# define POLLPRI 0x0002
#endif
#ifndef POLLOUT
# define POLLOUT 0x0004
#endif
#ifndef POLLERR
# define POLLERR 0x0008
#endif
#ifndef POLLHUP
# define POLLHUP 0x0010
#endif
#ifndef POLLNVAL
# define POLLNVAL 0x0020
#endif

#if 0
/*
    the following are currently not implemented */
#define POLLRDNORM 0x0040
#define POLLNORM POLLRDNORM
#define POLLWRNORM POLLOUT
#define POLLRDBAND 0x0080
#define POLLWRBAND 0x0100
#endif

#define INFTIM (-1) /* not standard */
#endif /* !HAVE_STRUCT_POLLFD_FD */

```

```

#ifndef HAVE_NFDS_T
/* on most used systems is ...long... */
typedef unsigned long int nfd_t;
#endif

#ifndef HAVE_POLL
int poll(struct pollfd *, nfd_t, int);
#endif

#ifndef HAVE_PPOLL
int ppoll(struct pollfd *, nfd_t, const struct timespec *, const sigset_t *);
#endif

#endif /* !_COMPAT_POLL_H_ */
/*
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*/

#ifndef _BSD_WAITPID_H
#define _BSD_WAITPID_H

#ifndef HAVE_WAITPID
/* Clean out any potential issues */
#undef WIFEXITED
#undef WIFSTOPPED

```

```
#undef WIFSIGNALED
```

```
/* Define required functions to mimic a POSIX look and feel */  
#define _W_INT(w) (*(int*)&(w)) /* convert union wait to int */  
#define WIFEXITED(w) (!((_W_INT(w)) & 0377))  
#define WIFSTOPPED(w) ((_W_INT(w)) & 0100)  
#define WIFSIGNALED(w) (!WIFEXITED(w) && !WIFSTOPPED(w))  
#define WEXITSTATUS(w) (int)(WIFEXITED(w) ? ((_W_INT(w) >> 8) & 0377) : -1)  
#define WTERMSIG(w) (int)(WIFSIGNALED(w) ? (_W_INT(w) & 0177) : -1)  
#define WCOREFLAG 0x80  
#define WCOREDUMP(w) ((_W_INT(w)) & WCOREFLAG)
```

```
/* Prototype */
```

```
pid_t waitpid(int,  
int *, int);
```

```
#endif /* !HAVE_WAITPID */
```

```
#endif /* _BSD_WAITPID_H */
```

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```
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```

[Tatu continues]

```
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- RSA is no longer included, found in the OpenSSL library
- IDEA is no longer included, its use is deprecated
- DES is now external, in the OpenSSL library
- GMP is no longer used, and instead we call BN code from OpenSSL
- Zlib is now external, in a library
- The make-ssh-known-hosts script is no longer included
- TSS has been removed
- MD5 is now external, in the OpenSSL library
- RC4 support has been replaced with ARC4 support from OpenSSL
- Blowfish is now external, in the OpenSSL library

[The licence continues]

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- *
- * Optimised ANSI C code for the Rijndael cipher (now AES)
- *
- * @author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
- * @author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
- * @author Paulo Barreto <paulo.barreto@terra.com.br>
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*/

#include "includes.h"

#if !defined(HAVE_STATVFS) || !defined(HAVE_FSTATVFS)


```

#include <sys/types.h>

#ifdef HAVE_SYS_MOUNT_H
#include <sys/mount.h>
#endif
#ifdef HAVE_SYS_STATFS_H
#include <sys/statfs.h>
#endif
#ifdef HAVE_SYS_VFS_H
#include <sys/vfs.h>
#endif

#ifndef HAVE_FSBLKCNT_T
typedef unsigned long fsblkcnt_t;
#endif
#ifndef HAVE_FSFILCNT_T
typedef unsigned long fsfilcnt_t;
#endif

#ifndef ST_RDONLY
#define ST_RDONLY 1
#endif
#ifndef ST_NOSUID
#define ST_NOSUID 2
#endif

/* as defined in IEEE Std 1003.1, 2004 Edition */
struct statvfs {
    unsigned long f_bsize; /* File system block size. */
    unsigned long f_frsize; /* Fundamental file system block size. */
    fsblkcnt_t f_blocks; /* Total number of blocks on file system in */
    /* units of f_frsize. */
    fsblkcnt_t f_bfree; /* Total number of free blocks. */
    fsblkcnt_t f_bavail; /* Number of free blocks available to */
    /* non-privileged process. */
    fsfilcnt_t f_files; /* Total number of file serial numbers. */
    fsfilcnt_t f_ffree; /* Total number of free file serial numbers. */
    fsfilcnt_t f_favail; /* Number of file serial numbers available to */
    /* non-privileged process. */
    unsigned long f_fsid; /*
    File system ID. */
    unsigned long f_flag; /* BBit mask of f_flag values. */
    unsigned long f_namemax; /* Maximum filename length. */
};
#endif

```

```

#ifndef HAVE_STATVFS
int statvfs(const char *, struct statvfs *);
#endif

#ifndef HAVE_FSTATVFS
int fstatvfs(int, struct statvfs *);
#endif

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 */

#ifndef _BSD_MISC_H
#define _BSD_MISC_H

#include "includes.h"

char *ssh_get_progname(char *);

#ifndef HAVE_SETSID
#define setsid() setpgid(0,
    getpid())
#endif /* !HAVE_SETSID */

#ifndef HAVE_SETENV
int setenv(const char *, const char *, int);
#endif /* !HAVE_SETENV */

#ifndef HAVE_SETLOGIN
int setlogin(const char *);
#endif /* !HAVE_SETLOGIN */

#ifndef HAVE_INETGR
int inetgr(const char *, const char *, const char *, const char *);
#endif /* HAVE_INETGR */

```

```

#if !defined(HAVE_SETEUID) && defined(HAVE_SETREUID)
int seteuid(uid_t);
#endif /* !defined(HAVE_SETEUID) && defined(HAVE_SETREUID) */

#if !defined(HAVE_SETEGID) && defined(HAVE_SETRESGID)
int setegid(uid_t);
#endif /* !defined(HAVE_SETEGID) && defined(HAVE_SETRESGID) */

#if !defined(HAVE_STRERROR) && defined(HAVE_SYS_ERRLIST) && defined(HAVE_SYS_NERR)
const char *strerror(int);
#endif

#if !defined(HAVE_SETLINEBUF)
#define setlinebuf(a) (setvbuf((a), NULL, _IOLBF, 0))
#endif

#ifndef HAVE_UTIMES
#ifndef HAVE_STRUCT_TIMEVAL
struct timeval {
    long tv_sec;
    long tv_usec;
}
#endif /* HAVE_STRUCT_TIMEVAL */

int utimes(const char *, const struct timeval *);
#endif
/* HAVE_UTIMES */

#ifndef AT_FDCWD
# define AT_FDCWD (-2)
#endif

#ifndef HAVE_FCHMODAT
int fchmodat(int, const char *, mode_t, int);
#endif

#ifndef HAVE_FCHOWNAT
int fchownat(int, const char *, uid_t, gid_t, int);
#endif

#ifndef HAVE_TRUNCATE
int truncate (const char *, off_t);
#endif /* HAVE_TRUNCATE */

#ifndef HAVE_STRUCT_TIMESPEC
struct timespec {
    time_t tv_sec;
    long tv_nsec;

```

```

};
#endif /* !HAVE_STRUCT_TIMESPEC */

#if !defined(HAVE_NANOSLEEP) && !defined(HAVE_NSLEEP)
int nanosleep(const struct timespec *, struct timespec *);
#endif

#ifndef HAVE_UTIMENSAT
/* start with the high bits and work down to minimise risk of overlap */
# ifndef AT_SYMLINK_NOFOLLOW
#  define AT_SYMLINK_NOFOLLOW 0x80000000
# endif
int utimensat(int, const char *, const struct timespec[2], int);
#endif /* !HAVE_UTIMENSAT */

#ifndef HAVE_USLEEP
int usleep(unsigned int useconds);
#endif

#ifndef HAVE_TCGETPGRP
pid_t tcgetpgrp(int);
#endif

#ifndef HAVE_TCSENDBREAK
int tcsendbreak(int, int);
#endif

#ifndef
HAVE_UNSETENV
int unsetenv(const char *);
#endif

#ifndef HAVE_ISBLANK
int isblank(int);
#endif

#ifndef HAVE_GETPGID
pid_t getpgid(pid_t);
#endif

#ifndef HAVE_PSELECT
/* may require struct timespec declared above */
int pselect(int, fd_set *, fd_set *, fd_set *, const struct timespec *,
    const sigset_t *);
#endif

#if !HAVE_DECL_ENDGREN
void endgrent(void);

```

```

#endif

#ifndef HAVE_ENDGRENT
static inline void endgrent(void) {}
#endif

#if !HAVE_DECL_ENDPWENT
void endpwent(void);
#endif

#ifdef KRB5
#ifndef HAVE_KRB5_GET_ERROR_MESSAGE
# define krb5_get_error_message krb5_get_err_text
#endif

#ifndef HAVE_KRB5_FREE_ERROR_MESSAGE
# define krb5_free_error_message(a,b) do { } while(0)
#endif
#endif /*def KRB5*/

#ifndef HAVE_PLEDGE
int pledge(const char *promises, const char *paths[]);
#endif

/* bsd-err.h */
#ifndef HAVE_ERR
void err(int, const char *, ...) __attribute__((format(printf, 2, 3)));
#endif
#ifndef HAVE_ERRX
void errx(int, const char *, ...) __attribute__((format(printf, 2, 3)));
#endif
#ifndef HAVE_WARN
void warn(const char *, ...) __attribute__((format(printf, 1, 2)));
#endif

#ifndef HAVE_RAISE
int raise(int);
#endif

#ifndef HAVE_GETSID
pid_t getsid(pid_t);
#endif

#ifndef HAVE_FLOCK
# define LOCK_SH 0x01
# define LOCK_EX 0x02
# define LOCK_NB 0x04

```

```

# define LOCK_UN 0x08
int flock(int, int);
#endif

#ifdef FFLUSH_NULL_BUG
# define fflush(x) (_ssh_compat_fflush(x))
#endif

#ifndef HAVE_LOCALTIME_R
struct tm *localtime_r(const time_t *, struct tm *);
#endif

#endif /* _BSD_MISC_H */
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#ifndef _BSD_SIGNAL_H
#define _BSD_SIGNAL_H

#include "includes.h"

#if !defined(HAVE_STRSIGNAL)
char *strsignal(int);
#endif

#endif /* _BSD_SIGNAL_H */
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- *
- * Created: Sat Sep 02 12:17:00 2000 cv
- *
- * This file contains functions for forcing opened file descriptors to
- * binary mode on Windows systems.
- */

```
#ifndef _BSD_CYGWIN_UTIL_H
#define _BSD_CYGWIN_UTIL_H
```

```
#ifdef HAVE_CYGWIN
```

```
#undef ERROR
```

```
/* Avoid including windows headers. */
typedef void *HANDLE;
#define INVALID_HANDLE_VALUE ((HANDLE) -1)
#define DNLEN 16
#define UNLEN 256
```

```
/* Cygwin functions for which declarations are only available when including
   windows headers, so we have to define them here explicitly. */
extern HANDLE cygwin_logon_user (const struct passwd *, const char *);
extern void cygwin_set_impersonation_token (const HANDLE);
```

```
#include
<sys/cygwin.h>
#include <io.h>
```

```
#define CYGWIN_SSH_PRIVSEP_USER (cygwin_ssh_privsep_user())
const char *cygwin_ssh_privsep_user();
```

```
int binary_open(const char *, int , ...);
int check_ntsec(const char *);
```

```

char **fetch_windows_environment(void);
void free_windows_environment(char **);
int cygwin_ug_match_pattern_list(const char *, const char *);

#ifndef NO_BINARY_OPEN
#define open binary_open
#endif

#endif /* HAVE_CYGWIN */

#endif /* _BSD_CYGWIN_UTIL_H */
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#ifndef _NEXT_POSIX_H
#define _NEXT_POSIX_H

#ifdef HAVE_NEXT
#include <sys/dir.h>

/* NGROUPS_MAX is behind -lposix. Use the BSD version which is NGROUPS */
#undef NGROUPS_MAX
#define NGROUPS_MAX NGROUPS

/* NeXT's readdir() is BSD (struct direct) not POSIX (struct dirent) */

```



```

#define dirent direct

/* Swap out NeXT's BSD wait() for a more POSIX compliant one */
pid_t posix_wait(int *);
#define wait(a) posix_wait(a)

/* #ifdef wrapped functions that need defining for clean compiling */
pid_t getppid(void);
void vhangup(void);
int inetgr(const char *, const char *, const char *, const char *);

/* TERMCAP */
int tcgetattr(int, struct termios *);
int tcsetattr(int, int,
    const struct termios *);
int tcsetpgrp(int, pid_t);
speed_t cfgetospeed(const struct termios *);
speed_t cfgetispeed(const struct termios *);
int cfsetospeed(struct termios *, int);
int cfsetispeed(struct termios *, int);
#endif /* HAVE_NEXT */
#endif /* _NEXT_POSIX_H */
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#ifndef HAVE_SETRESGID
int setresgid(gid_t, gid_t, gid_t);
#endif
#ifndef HAVE_SETRESUID
int setresuid(uid_t, uid_t, uid_t);
#endif

```

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1.413 matchers 0.2.0

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1.414 socket2 0.6.1

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1.415 thiserror 2.0.17

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1.416 tokio 1.48.0

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1.417 thread_local 1.1.9

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//! FreeBSD and NetBSD xattr support.

```
use libc::{c_int, c_void, size_t, EPERM};
use std::ffi::{CString, OsStr, OsString};
use std::io;
use std::mem;
use std::os::unix::ffi::{OsStrExt, OsStringExt};
use std::os::unix::io::{AsRawFd, BorrowedFd};
use std::path::Path;
use std::ptr;
```

```
use libc::{
    extattr_delete_fd, extattr_delete_file, extattr_delete_link, extattr_get_fd, extattr_get_file,
    extattr_get_link, extattr_list_fd, extattr_list_file, extattr_list_link, extattr_set_fd,
    extattr_set_file, extattr_set_link, EXTATTR_NAMESPACE_SYSTEM, EXTATTR_NAMESPACE_USER,
};
```

```
use crate::util::allocate_loop;
```

```
pub const ENOATTR: i32 = libc::ENOATTR;
pub const ERANGE: i32 = libc::ERANGE;
```

```
const EXTATTR_NAMESPACE_USER_STRING: &str = "user";
const EXTATTR_NAMESPACE_SYSTEM_STRING: &str = "system";
const EXTATTR_NAMESPACE_NAMES: [&str; 3] = [
    "empty",
    EXTATTR_NAMESPACE_USER_STRING,
    EXTATTR_NAMESPACE_SYSTEM_STRING,
];
```

```
fn path_to_c(path: &Path) -> io::Result<CString> {
    match CString::new(path.as_os_str().as_bytes())
    {
        Ok(name) => Ok(name),
        Err(_) => Err(io::Error::new(io::ErrorKind::NotFound, "file not found")),
    }
}
```

```
#[inline]
fn slice_parts(buf: &mut [u8]) -> (*mut c_void, size_t) {
    if buf.is_empty() {
```

```

        (ptr::null_mut(), 0)
    } else {
        (buf.as_mut_ptr().cast(), buf.len() as size_t)
    }
}

/// An iterator over a set of extended attributes names.
#[derive(Default)]
pub struct XAttrs {
    user_attrs: Box<[u8]>,
    system_attrs: Box<[u8]>,
    offset: usize,
}

impl Clone for XAttrs {
    fn clone(&self) -> Self {
        XAttrs {
            user_attrs: Vec::from(&*self.user_attrs).into_boxed_slice(),
            system_attrs: Vec::from(&*self.system_attrs).into_boxed_slice(),
            offset: self.offset,
        }
    }
}

fn clone_from(&mut self, other: &XAttrs) {
    self.offset = other.offset;

    let mut data = mem::replace(&mut self.user_attrs, Box::new([])).into_vec();
    data.extend(other.user_attrs.iter().cloned());
    self.user_attrs = data.into_boxed_slice();

    data = mem::replace(&mut self.system_attrs, Box::new([])).into_vec();
    data.extend(other.system_attrs.iter().cloned());
    self.system_attrs = data.into_boxed_slice();
}

impl Iterator for XAttrs {
    type Item = OsString;
    fn next(&mut self) -> Option<OsString> {
        if self.user_attrs.is_empty() && self.system_attrs.is_empty() {
            return None;
        }

        if self.offset == self.user_attrs.len() + self.system_attrs.len() {
            return None;
        }

        let data = if self.offset < self.system_attrs.len() {

```

```

        &self.system_attrs[self.offset..]
    } else {
        &self.user_attrs[self.offset - self.system_attrs.len()..]
    };

    let siz = data[0] as usize;

    self.offset += siz + 1;
    if self.offset < self.system_attrs.len() {
        Some(prefix_namespace(
            OsStr::from_bytes(&data[1..siz
+ 1])),
            EXTATTR_NAMESPACE_SYSTEM,
        ))
    } else {
        Some(prefix_namespace(
            OsStr::from_bytes(&data[1..siz + 1]),
            EXTATTR_NAMESPACE_USER,
        ))
    }
}

fn size_hint(&self) -> (usize, Option<usize>) {
    if self.user_attrs.len() + self.system_attrs.len() == self.offset {
        (0, Some(0))
    } else {
        (1, None)
    }
}

// This could use libc::extattr_string_to_namespace, but it's awkward because
// that requires nul-terminated strings, which Rust's std is loathe to provide.
fn name_to_ns(name: &OsStr) -> io::Result<(c_int, CString)> {
    let mut groups = name.as_bytes().splitn(2, |&b| b == b'.').take(2);
    let nsname = match groups.next() {
        Some(s) => s,
        None => {
            return Err(io::Error::new(
                io::ErrorKind::InvalidInput,
                "couldn't find namespace",
            ))
        }
    };
};

let propname
= match groups.next() {
    Some(s) => s,

```



```

None => {
    return Err(io::Error::new(
        io::ErrorKind::InvalidInput,
        "couldn't find attribute",
    ))
}
};

let ns_int = match EXTATTR_NAMESPACE_NAMES
    .iter()
    .position(|&s| s.as_bytes() == nsname)
{
    Some(i) => i,
    None => {
        return Err(io::Error::new(
            io::ErrorKind::InvalidInput,
            "no matching namespace",
        ))
    }
};

Ok((ns_int as c_int, CString::new(propname)?))
}

fn prefix_namespace(attr: &OsStr, ns: c_int) -> OsString {
    let nsname = EXTATTR_NAMESPACE_NAMES[ns as usize];
    let mut v = Vec::with_capacity(nsname.as_bytes().len() + attr.as_bytes().len() + 1);
    v.extend(nsname.as_bytes());
    v.extend("." as_bytes());
    v.extend(attr.as_bytes());
    OsString::from_vec(v)
}

fn cvt(res: libc::ssize_t) -> io::Result<usize> {
    if res < 0 {
        Err(io::Error::last_os_error())
    } else {
        Ok(res as usize)
    }
}

pub fn get_fd(fd: BorrowedFd<'_>, name: &OsStr) -> io::Result<Vec<u8>> {
    let (ns, name) = name_to_ns(name)?;
    unsafe {
        allocate_loop(|buf| {
            let (ptr, len) = slice_parts(buf);
            cvt(extattr_get_fd(fd.as_raw_fd(), ns, name.as_ptr(), ptr, len))
        })
    }
}

```

```

    }
}

pub fn set_fd(fd: BorrowedFd<'_>, name: &OsStr, value: &[u8]) -> io::Result<()> {
    let (ns, name) = name_to_ns(name)?;
    let ret = unsafe {
        extattr_set_fd(
            fd.as_raw_fd(),
            ns,
            name.as_ptr(),
            value.as_ptr() as *const c_void,
            value.len() as size_t,
        )
    };
    if ret == -1 {
        Err(io::Error::last_os_error())
    } else {
        Ok(())
    }
}

```

```

pub fn remove_fd(fd: BorrowedFd<'_>, name: &OsStr) -> io::Result<()> {
    let (ns, name) = name_to_ns(name)?;
    let ret = unsafe { extattr_delete_fd(fd.as_raw_fd(), ns, name.as_ptr()) };

    if ret != 0 {
        Err(io::Error::last_os_error())
    } else {
        Ok(())
    }
}

```

```

pub fn list_fd(fd: BorrowedFd<'_>) -> io::Result<XAttrs> {
    let sysvec = unsafe {
        let res = allocate_loop(|buf| {
            let (ptr, len) = slice_parts(buf);
            cvt(extattr_list_fd(
                fd.as_raw_fd(),
                EXTATTR_NAMESPACE_SYSTEM,
                ptr,
                len,
            ))
        });
        // On FreeBSD, system attributes require root privileges to view. However,
        // to mimic the behavior of listxattr in linux and osx, we need to query
        // them anyway and return empty results if we get EPERM
        match res {
            Ok(v) => v,

```

```

Err(err) => {
    if err.raw_os_error() == Some(EPERM) {
        Vec::new()
    } else {
        return Err(err);
    }
}
};

let uservec = unsafe {
    let res = allocate_loop(|buf|
{
    let (ptr, len) = slice_parts(buf);
    cvt(extattr_list_fd(
        fd.as_raw_fd(),
        EXTATTR_NAMESPACE_USER,
        ptr,
        len,
    ))
});
    match res {
        Ok(v) => v,
        Err(err) => return Err(err),
    }
};

Ok(XAttrs {
    system_attrs: sysvec.into_boxed_slice(),
    user_attrs: uservec.into_boxed_slice(),
    offset: 0,
})
}

pub fn get_path(path: &Path, name: &OsStr, deref: bool) -> io::Result<Vec<u8>> {
    let (ns, name) = name_to_ns(name)?;
    let path = path_to_c(path)?;
    let extattr_get_func = if deref {
        extattr_get_file
    } else {
        extattr_get_link
    };
    unsafe {
        allocate_loop(|buf| {
            let (ptr, len) = slice_parts(buf);
            cvt(extattr_get_func(path.as_ptr(), ns, name.as_ptr(), ptr, len))
        })
    }
}

```

```
}
```

```
pub fn set_path(path: &Path, name: &OsStr, value: &[u8], deref: bool) -> io::Result<()>
{
    let (ns, name) = name_to_ns(name)?;
    let path = path_to_c(path)?;
    let extattr_set_func = if deref {
        extattr_set_file
    } else {
        extattr_set_link
    };
    let ret = unsafe {
        extattr_set_func(
            path.as_ptr(),
            ns,
            name.as_ptr(),
            value.as_ptr() as *const c_void,
            value.len() as size_t,
        )
    };
    if ret == -1 {
        Err(io::Error::last_os_error())
    } else {
        Ok(())
    }
}
```

```
pub fn remove_path(path: &Path, name: &OsStr, deref: bool) -> io::Result<()> {
    let (ns, name) = name_to_ns(name)?;
    let path = path_to_c(path)?;
    let extattr_delete_func = if deref {
        extattr_delete_file
    } else {
        extattr_delete_link
    };
    let ret = unsafe { extattr_delete_func(path.as_ptr(), ns, name.as_ptr()) };
    if ret != 0 {
        Err(io::Error::last_os_error())
    } else {
        Ok(())
    }
}
```

```
pub fn list_path(path: &Path, deref: bool) -> io::Result<XAttrs>
{
    let path = path_to_c(path)?;
    let extattr_list_func = if deref {
        extattr_list_file
    }
}
```

```

    } else {
        extattr_list_link
    };
let sysvec = unsafe {
    let res = allocate_loop(|buf| {
        let (ptr, len) = slice_parts(buf);
        cvt(extattr_list_func(
            path.as_ptr(),
            EXTATTR_NAMESPACE_SYSTEM,
            ptr,
            len,
        ))
    });
    // On FreeBSD, system attributes require root privileges to view. However,
    // to mimic the behavior of listxattr in linux and osx, we need to query
    // them anyway and return empty results if we get EPERM
    match res {
        Ok(v) => v,
        Err(err) => {
            if err.raw_os_error() == Some(EPERM) {
                Vec::new()
            } else {
                return Err(err);
            }
        }
    }
};

let uservec = unsafe {
    let res = allocate_loop(|buf|
{
    let (ptr, len) = slice_parts(buf);
    cvt(extattr_list_func(
        path.as_ptr(),
        EXTATTR_NAMESPACE_USER,
        ptr,
        len,
    ))
    });
    match res {
        Ok(v) => v,
        Err(err) => return Err(err),
    }
};

Ok(XAttrs {
    system_attrs: sysvec.into_boxed_slice(),
    user_attrs: uservec.into_boxed_slice(),
})

```

```
    offset: 0,  
  })  
}  
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```

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DER GEGENSTAND DIESER LIZENZ (WIE UNTER "SCHUTZGEGENSTAND" DEFINIERT) WIRD UNTER DEN BEDINGUNGEN DIESER CREATIVE COMMONS PUBLIC LICENSE ("CCPL", "LIZENZ" ODER "LIZENZVERTRAG") ZUR VERFÜGUNG GESTELLT. DER SCHUTZGEGENSTAND IST DURCH DAS

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DURCH DIE AUSBUNG EINES DURCH DIESE LIZENZ GEWHRTEN RECHTS AN DEM SCHUTZGEGENSTAND ERKLÄREN SIE SICH MIT DEN LIZENZBEDINGUNGEN RECHTSVERBINDLICH EINVERSTANDEN. SOWEIT DIESE LIZENZ ALS LIZENZVERTRAG ANZUSEHEN IST, GEWHRT IHNEN DER LIZENZGEBER DIE IN DER LIZENZ GENANNTE RECHTE UNENTGELTLICH UND IM AUSTAUSCH DAFÜR, DASS SIE DAS GEBUNDENSEIN AN DIE LIZENZBEDINGUNGEN AKZEPTIEREN.

1. Definitionen

a. Der Begriff "Abwandlung" im Sinne dieser Lizenz bezeichnet das Ergebnis jeglicher Art von Veränderung des Schutzgegenstandes, solange die eigenpersönlichen Züge des Schutzgegenstandes darin nicht verblissen und daran eigene Schutzrechte entstehen. Das kann insbesondere eine Bearbeitung, Umgestaltung, Änderung, Anpassung, Übersetzung oder Heranziehung des Schutzgegenstandes zur Vertonung von Laufbildern sein. Nicht als Abwandlung des Schutzgegenstandes gelten seine Aufnahme in eine Sammlung oder ein Sammelwerk und die freie Benutzung des Schutzgegenstandes.

b. Der Begriff "Sammelwerk" im Sinne dieser Lizenz meint eine Zusammenstellung von literarischen, künstlerischen oder wissenschaftlichen Inhalten, sofern diese Zusammenstellung aufgrund von Auswahl und Anordnung der darin enthaltenen selbständigen Elemente eine geistige Schöpfung darstellt, unabhängig davon, ob die Elemente systematisch oder methodisch angelegt und dadurch einzeln zugänglich sind oder nicht.

c. "Verbreiten" im Sinne dieser Lizenz bedeutet, den Schutzgegenstand oder Abwandlungen im Original oder in Form von Vervielfältigungsstücken, mithin in körperlich fixierter Form der Öffentlichkeit anzubieten oder in Verkehr zu bringen.

d. Unter "Lizenzelementen" werden im Sinne dieser Lizenz die folgenden bergeordneten Lizenzcharakteristika verstanden, die vom Lizenzgeber ausgewählt wurden und in der Bezeichnung der Lizenz zum Ausdruck kommen: "Namensnennung", "Weitergabe unter gleichen Bedingungen".

e. Der "*Lizenzgeber*" im Sinne dieser Lizenz ist diejenige natürliche oder juristische Person oder Gruppe, die den Schutzgegenstand unter den Bedingungen dieser Lizenz anbietet und insoweit als Rechteinhaberin auftritt.

f. "Rechteinhaber" im Sinne dieser Lizenz ist der Urheber des Schutzgegenstandes oder jede andere natürliche oder juristische Person oder Gruppe von Personen, die am Schutzgegenstand ein Immaterialgüterrecht erlangt hat, welches die in Abschnitt 3 genannten Handlungen erfasst und bei dem eine Einräumung von Nutzungsrechten oder eine Weitervertragung an Dritte möglich ist.

g. Der Begriff "Schutzgegenstand" bezeichnet in dieser Lizenz den literarischen, künstlerischen oder wissenschaftlichen Inhalt, der unter den Bedingungen dieser Lizenz angeboten wird. Das kann insbesondere eine persönliche geistige Schöpfung jeglicher Art, ein Werk der kleinen Münze, ein nachgelassenes Werk oder auch ein Lichtbild oder anderes Objekt eines verwandten Schutzrechts sein, unabhängig von der Art seiner Fixierung und unabhängig davon, auf welche Weise jeweils eine Wahrnehmung erfolgen kann, gleichviel ob in analoger oder

digitaler Form. Soweit Datenbanken oder Zusammenstellungen von Daten einen immaterialgterrechtlichen Schutz eigener Art genieen, unterfallen auch sie dem Begriff "Schutzgegenstand" im Sinne dieser Lizenz.

h. Mit "Sie" bzw. "Ihnen" ist die natrliche oder juristische Person gemeint, die in dieser Lizenz im Abschnitt 3 genannte Nutzungen des Schutzgegenstandes vornimmt und zuvor in Hinblick auf den Schutzgegenstand nicht gegen Bedingungen dieser Lizenz verstoen oder aber die ausdrckliche Erlaubnis des Lizenzgebers erhalten hat, die durch diese Lizenz gewhrten Nutzungsrechte trotz eines vorherigen Verstoes auszubuen.

i. Unter "ffentlich Zeigen" im Sinne dieser Lizenz sind Verffentlichungen und Prsentationen des Schutzgegenstandes zu verstehen, die fr eine Mehrzahl von Mitgliedern der ffentlichkeit bestimmt sind und in unkrplicher Form mittels ffentlicher Wiedergabe in Form von Vortrag, Auffhrung, Vorfrhrung, Darbietung, Sendung, Weitersendung, zeit- und ortsunabhngiger Zugnglichmachung oder in krplicher Form mittels Ausstellung erfolgen, unabhngig von bestimmten

Veranstaltungen und unabhngig von den zum Einsatz kommenden Techniken und Verfahren, einschlielich drahtgebundener oder drahtloser Mittel und Einstellen in das Internet.

j. "Vervielfltigen" im Sinne dieser Lizenz bedeutet, mittels beliebiger Verfahren Vervielfltigungsstcke des Schutzgegenstandes herzustellen, insbesondere durch Ton- oder Bildaufzeichnungen, und umfasst auch den Vorgang, erstmals krpliche Fixierungen des Schutzgegenstandes sowie Vervielfltigungsstcke dieser Fixierungen anzufertigen, sowie die bertragung des Schutzgegenstandes auf einen Bild- oder Tontrger oder auf ein anderes elektronisches Medium, gleichviel ob in digitaler oder analoger Form.

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ii. erlaubt ausdrcklich das Lizenzieren von ihr unterstellten Abwandlungen unter vorliegender Lizenz, unter einer anderen rechtsordnungsspezifisch angepassten Creative-Commons-Lizenz mit denselben Lizenzelementen, wie sie die vorliegende Lizenz aufweist, oder unter der entsprechenden Creative-Commons-Unported-Lizenz.

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3. Einrumung von Nutzungsrechten. Unter den Bedingungen dieser Lizenz rumt Ihnen der Lizenzgeber - unbeschadet unverzichtbarer Rechte und vorbehaltlich des Abschnitts 3.e) - das vergtungsfreie, rumlich und zeitlich (fr die Dauer des Schutzrechts am Schutzgegenstand) unbeschrnkte einfache Recht ein, den Schutzgegenstand auf die folgenden Arten und Weisen zu nutzen ("unentgeltlich eingerumtes einfaches Nutzungsrecht fr jedermann"):

a. Den Schutzgegenstand in beliebiger Form und Menge zu vervielfltigen, ihn in Sammelwerke zu integrieren und

ihn als Teil solcher Sammelwerke zu vervielfältigen;

b. Abwandlungen des Schutzgegenstandes anzufertigen, einschließlich Übersetzungen unter Nutzung jedweder Medien, sofern deutlich erkennbar gemacht wird, dass es sich um Abwandlungen handelt;

c. den Schutzgegenstand, allein oder in Sammelwerke aufgenommen, öffentlich zu zeigen und zu verbreiten;

d. Abwandlungen des Schutzgegenstandes zu veröffentlichen, öffentlich zu zeigen und zu verbreiten.

e. Bezüglich Vergütung für die Nutzung des Schutzgegenstandes gilt Folgendes:

i. Unverzichtbare gesetzliche Vergütungsansprüche: Soweit unverzichtbare Vergütungsansprüche im Gegenzug für gesetzliche Lizenzen vorgesehen oder Pauschalabgabensysteme (zum Beispiel für Leermedien) vorhanden sind, behält sich der Lizenzgeber das ausschließliche Recht vor, die entsprechende Vergütung einzuziehen für jede Ausübung eines Rechts aus dieser Lizenz durch Sie.

ii. Vergütung bei Zwangslizenzen: Sofern Zwangslizenzen außerhalb dieser Lizenz vorgesehen sind und zustande kommen, verzichtet der Lizenzgeber für alle Fälle einer lizenzgerechten Nutzung des Schutzgegenstandes durch Sie auf jegliche Vergütung.

iii. Vergütung in sonstigen Fällen: Bezüglich lizenzgerechter Nutzung des Schutzgegenstandes durch Sie, die nicht unter die beiden vorherigen Abschnitte (i) und (ii) fällt, verzichtet der Lizenzgeber auf jegliche Vergütung, unabhängig davon, ob eine Einziehung der Vergütung durch ihn selbst oder nur durch eine Verwertungsgesellschaft möglich wäre.

Das vorgenannte

Nutzungsrecht wird für alle bekannten sowie für alle noch nicht bekannten Nutzungsarten eingeräumt. Es beinhaltet auch das Recht, solche Änderungen am Schutzgegenstand vorzunehmen, die für bestimmte nach dieser Lizenz zulässige Nutzungen technisch erforderlich sind. Alle sonstigen Rechte, die über diesen Abschnitt hinaus nicht ausdrücklich durch den Lizenzgeber eingeräumt werden, bleiben diesem allein vorbehalten. Soweit Datenbanken oder Zusammenstellungen von Daten Schutzgegenstand dieser Lizenz oder Teil dessen sind und einen immateriell-rechtlichen Schutz eigener Art genießen, verzichtet der Lizenzgeber auf sämtliche aus diesem Schutz resultierenden Rechte.

4. Bedingungen. Die Einräumung des Nutzungsrechts gemäß Abschnitt 3 dieser Lizenz erfolgt ausdrücklich nur unter den folgenden Bedingungen:

a. Sie dürfen den Schutzgegenstand ausschließlich unter den Bedingungen dieser Lizenz verbreiten oder öffentlich zeigen. Sie müssen dabei stets eine Kopie dieser Lizenz oder deren vollständige Internetadresse in Form des Uniform-Resource-Identifier (URI) beifügen. Sie dürfen keine Vertrags- oder Nutzungsbedingungen anbieten oder fordern, die die Bedingungen dieser Lizenz oder die durch diese Lizenz gewährten Rechte beschränken. Sie dürfen den Schutzgegenstand nicht unterlizenzieren. Bei jeder Kopie des Schutzgegenstandes, die Sie verbreiten oder öffentlich zeigen, müssen Sie alle Hinweise unverändert lassen, die auf diese Lizenz und den Haftungsausschluss hinweisen. Wenn Sie den Schutzgegenstand verbreiten oder öffentlich zeigen, dürfen Sie (in Bezug auf den Schutzgegenstand) keine technischen Maßnahmen ergreifen, die den Nutzer des Schutzgegenstandes in der Ausübung der ihm durch diese Lizenz gewährten Rechte behindern können. Dieser Abschnitt 4.a) gilt auch für den Fall, dass der Schutzgegenstand einen Bestandteil eines Sammelwerkes bildet, was jedoch nicht bedeutet, dass das Sammelwerk insgesamt dieser Lizenz unterstellt werden muss. Sofern Sie ein Sammelwerk erstellen, müssen Sie auf die Mitteilung

eines Lizenzgebers hin aus dem Sammelwerk die in Abschnitt 4.c) aufgezählten Hinweise entfernen. Wenn Sie eine Abwandlung vornehmen, müssen Sie auf die Mitteilung eines Lizenzgebers hin von der Abwandlung die in Abschnitt 4.c) aufgezählten Hinweise entfernen.

b. Sie dürfen eine Abwandlung ausschließlich unter den Bedingungen

i. dieser Lizenz,

ii. einer späteren Version dieser Lizenz mit denselben Lizenzelementen,

iii. einer rechtsordnungsspezifischen Creative-Commons-Lizenz mit denselben Lizenzelementen ab Version 3.0 aufwärts (z.B. Namensnennung - Weitergabe unter gleichen Bedingungen 3.0 US),

iv. der Creative-Commons-Attribution-Lizenz mit denselben Lizenzelementen ab Version 3.0 aufwärts, oder

v. einer mit Creative Commons kompatiblen Lizenz

verbreiten oder öffentlich zeigen.

Falls Sie die Abwandlung gemäß Abschnitt (v) unter einer mit Creative Commons kompatiblen Lizenz lizenzieren, müssen Sie deren Lizenzbestimmungen Folge leisten.

Falls Sie die Abwandlungen unter einer der unter (i)-(iv) genannten Lizenzen ("Verwendbare Lizenzen") lizenzieren, müssen Sie deren Lizenzbestimmungen sowie folgenden Bestimmungen Folge leisten: Sie müssen stets eine Kopie der verwendbaren Lizenz oder deren vollständige Internetadresse in Form des Uniform-Resource-Identifier (URI) beifügen, wenn Sie die Abwandlung verbreiten oder öffentlich zeigen. Sie dürfen keine Vertrags- oder Nutzungsbedingungen anbieten oder fordern, die die Bedingungen der verwendbaren Lizenz oder die durch sie gewährten Rechte beschränken. Bei jeder Abwandlung, die Sie verbreiten oder öffentlich zeigen, müssen Sie alle Hinweise auf die verwendbare Lizenz und den Haftungsausschluss unverändert lassen. Wenn Sie die Abwandlung verbreiten oder öffentlich zeigen, dürfen Sie (in Bezug auf die Abwandlung) keine technischen Maßnahmen ergreifen, die den Nutzer der Abwandlung in der Ausübung der ihm durch die verwendbare Lizenz gewährten Rechte behindern können.

Dieser Abschnitt 4.b) gilt auch für den Fall, dass die Abwandlung einen Bestandteil eines Sammelwerkes bildet, was jedoch nicht bedeutet, dass das Sammelwerk insgesamt der verwendbaren Lizenz unterstellt werden muss.

c. Die Verbreitung und das öffentliche Zeigen des Schutzgegenstandes oder auf ihm aufbauender Abwandlungen oder ihn enthaltender Sammelwerke ist Ihnen nur unter der Bedingung gestattet, dass Sie, vorbehaltlich etwaiger Mitteilungen im Sinne von Abschnitt 4.a), alle dazu gehörenden Rechtevermerke unberührt lassen. Sie sind verpflichtet, die Rechteinhaberschaft in einer der Nutzung entsprechenden, angemessenen Form anzuerkennen, indem Sie - soweit bekannt - Folgendes angeben:

i. Den Namen (oder das Pseudonym, falls ein solches verwendet wird) des Rechteinhabers und / oder, falls der Lizenzgeber im Rechtevermerk, in den Nutzungsbedingungen oder auf andere angemessene Weise eine Zuschreibung an Dritte vorgenommen hat (z.B. an eine Stiftung, ein Verlagshaus oder eine Zeitung) ("Zuschreibungsempfänger"), Namen bzw. Bezeichnung dieses oder dieser Dritten;

ii. den Titel des Inhaltes;

iii. in einer praktikablen Form den Uniform-Resource-Identifier (URI, z.B. Internetadresse), den der Lizenzgeber zum Schutzgegenstand angegeben hat, es sei denn, dieser URI verweist nicht auf den Rechtevermerk oder die Lizenzinformationen zum Schutzgegenstand;

iv. und im Falle einer Abwandlung des Schutzgegenstandes in bereinstimmung mit Abschnitt 3.b) einen Hinweis darauf, dass es sich um eine Abwandlung handelt.

Die nach diesem Abschnitt 4.c) erforderlichen Angaben können in jeder angemessenen Form gemacht werden; im Falle einer Abwandlung des Schutzgegenstandes oder eines Sammelwerkes müssen diese Angaben das Minimum darstellen und bei gemeinsamer Nennung mehrerer Rechteinhaber dergestalt erfolgen, dass sie zumindest ebenso hervorgehoben sind wie die Hinweise auf die übrigen Rechteinhaber. Die Angaben nach diesem Abschnitt dürfen Sie ausschließlich zur Angabe der Rechteinhaberschaft in der oben bezeichneten Weise verwenden. Durch die Ausübung Ihrer Rechte aus dieser Lizenz dürfen Sie ohne eine vorherige, separat und schriftlich vorliegende Zustimmung des Lizenzgebers und / oder des Zuschreibungsempfängers weder explizit noch implizit irgendeine Verbindung zum Lizenzgeber oder Zuschreibungsempfänger und ebenso wenig eine Unterstützung oder Billigung durch ihn andeuten.

d. Die oben unter 4.a) bis c) genannten Einschränkungen gelten nicht für solche Teile des Schutzgegenstandes, die allein deshalb unter den Schutzgegenstandsbegriff fallen, weil sie als Datenbanken oder Zusammenstellungen von Daten einen immaterialgüterrechtlichen Schutz eigener Art genießen.

e. Persönlichkeitsrechte bleiben - soweit sie bestehen - von dieser Lizenz unberührt.

5. Gewährleistung

SO FERN KEINE ANDERS LAUTENDE, SCHRIFTLICHE VEREINBARUNG ZWISCHEN DEM LIZENZGEBER UND IHNEN GESCHLOSSEN WURDE UND SOWEIT MANGEL NICHT ARGLISTIG VERSCHWIEGEN

WURDEN, BIETET DER LIZENZGEBER DEN SCHUTZGEGENSTAND UND DIE EINRÜHMUNG VON RECHTEN UNTER AUSSCHLUSS JEGLICHER GEWHRLEISTUNG AN UND BERNIMMT WEDER AUSDRÜCKLICH NOCH KONKLUDENT GARANTIEEN IRGEND EINER ART. DIES UMFASST INSBESONDERE DAS FREISEIN VON SACH- UND RECHTSMANGELN, UNABHÄNGIG VON DEREN ERKENNBARKEIT FÜR DEN LIZENZGEBER, DIE VERKEHRSFÄHIGKEIT DES SCHUTZGEGENSTANDES, SEINE VERWENDBARKEIT FÜR EINEN BESTIMMTEN ZWECK SOWIE DIE KORREKTHEIT VON BESCHREIBUNGEN. DIESE GEWHRLEISTUNGSBESCHRÄNKUNG GILT NICHT, SOWEIT MANGEL ZU SCHÜDEN DER IN ABSCHNITT 6 BEZEICHNETEN ART FÜHREN UND AUF SEITEN DES LIZENZGEBERS DAS JEWEILS GENANNT VERSCHULDEN BZW. VERTRETEN MÜSSEN EBENFALLS VORLIEGT.

6. Haftungsbeschränkung

DER LIZENZGEBER HAFTET IHNEN GEGENÜBER IN BEZUG AUF SCHÜDEN AUS DER VERLETZUNG DES LEBENS, DES KÖRPERS ODER DER GESUNDHEIT NUR, SO FERN IHM WENIGSTENS FAHRLÄSSIGKEIT VORZUWERFEN IST, FÜR SONSTIGE SCHÜDEN NUR BEI GROBER FAHRLÄSSIGKEIT ODER VORSATZ, UND BERNIMMT DARÜBER HINAUS KEINERLEI FREIWILLIGE HAFTUNG.

7.

Erlschen

a. Diese Lizenz und die durch sie eingerumten Nutzungsrechte erlschen mit Wirkung fr die Zukunft im Falle eines Verstoes gegen die Lizenzbedingungen durch Sie, ohne dass es dazu der Kenntnis des Lizenzgebers vom Versto oder einer weiteren Handlung einer der Vertragsparteien bedarf. Mit natrlichen oder juristischen Personen, die Abwandlungen des Schutzgegenstandes oder diesen enthaltende Sammelwerke unter den Bedingungen dieser Lizenz von Ihnen erhalten haben, bestehen nachtrglich entstandene Lizenzbeziehungen jedoch solange weiter, wie die genannten Personen sich ihrerseits an smtliche Lizenzbedingungen halten. Darber hinaus gelten die Ziffern 1, 2, 5, 6, 7, und 8 auch nach einem Erlschen dieser Lizenz fort.

b. Vorbehaltlich der oben genannten Bedingungen gilt diese Lizenz unbefristet bis der rechtliche Schutz fr den Schutzgegenstand ausluft. Davon abgesehen behlt der Lizenzgeber das Recht, den Schutzgegenstand unter anderen Lizenzbedingungen anzubieten oder die eigene Weitergabe des Schutzgegenstandes jederzeit einzustellen, solange die Ausbung dieses Rechts nicht einer Kndigung oder einem Widerruf dieser Lizenz (oder irgendeiner Weiterlizenzierung, die auf Grundlage dieser Lizenz bereits erfolgt ist bzw. zuknftig noch erfolgen muss) dient und diese Lizenz unter Bercksichtigung der oben zum Erlschen genannten Bedingungen vollumfnglich wirksam bleibt.

8. Sonstige Bestimmungen

a. Jedes Mal wenn Sie den Schutzgegenstand fr sich genommen oder als Teil eines Sammelwerkes verbreiten oder ffentlich zeigen, bietet der Lizenzgeber dem Empfänger eine Lizenz zu den gleichen Bedingungen und im gleichen Umfang an, wie Ihnen in Form dieser Lizenz.

b. Jedes Mal wenn Sie eine Abwandlung des Schutzgegenstandes verbreiten oder ffentlich zeigen, bietet der Lizenzgeber dem Empfänger eine Lizenz am ursprnglichen Schutzgegenstand zu den gleichen Bedingungen und im gleichen Umfang an, wie Ihnen in Form dieser Lizenz.

c. Sollte eine Bestimmung dieser Lizenz unwirksam sein, so bleibt davon die Wirksamkeit der Lizenz im brigen unberhrt.

d. Keine Bestimmung dieser Lizenz soll als abbedungen und kein Versto gegen sie als zulssig gelten, solange die von dem Verzicht oder von dem Versto betroffene Seite nicht schriftlich zugestimmt hat.

e. Diese Lizenz (zusammen mit in ihr ausdrcklich vorgesehenen Erlaubnissen, Mitteilungen und Zustimmungen, soweit diese tatschlich vorliegen) stellt die vollstndige Vereinbarung zwischen dem Lizenzgeber und Ihnen in Bezug auf den Schutzgegenstand dar. Es bestehen keine Abreden, Vereinbarungen oder Erklrungen in Bezug auf den Schutzgegenstand, die in dieser Lizenz nicht genannt sind. Rechtsgeschftliche nderungen des Verhltnisses zwischen dem Lizenzgeber und Ihnen sind nur ber Modifikationen dieser Lizenz mglich. Der Lizenzgeber ist an etwaige zustzliche, einseitig durch Sie bermittelte Bestimmungen nicht gebunden. Diese Lizenz kann nur durch schriftliche Vereinbarung zwischen Ihnen und dem Lizenzgeber modifiziert werden. Derlei Modifikationen wirken ausschlielich zwischen dem Lizenzgeber und Ihnen und wirken sich nicht auf die Dritten gem Ziffern 8.a) und b) angeboteten Lizenzen aus.

f. Sofern zwischen Ihnen und dem Lizenzgeber keine anderweitige Vereinbarung getroffen wurde und soweit Wahlfreiheit besteht, findet auf diesen Lizenzvertrag das Recht der Bundesrepublik Deutschland Anwendung.

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//! This file contains the BSD APIs available in Haiku. It corresponds to the
//! header files in `headers/compatibility/bsd`.

//!

//! Note that Haiku's BSD compatibility is a combination of system APIs and
//! utility libraries. There should only be system APIs in `libc`. When you are
//! trying to determine whether something should be included in this file, the
//! best indicator is whether it also exists in the BSD-specific definitions in
//! this libc crate.

use crate::prelude::*;

// stringlist.h (utility library)

// Note: this is kept because it was previously introduced

pub type StringList = _stringlist;

s! {

// stringlist.h (utility library)

// Note: this is kept because it was previously introduced

pub struct _stringlist {

pub sl_str: *mut *mut c_char,

pub sl_max: size_t,

pub sl_cur: size_t,

}

// sys/event.h

pub struct kevent {

pub ident: crate::uintptr_t,

pub filter: c_short,

pub flags: c_ushort,

pub fflags: c_uint,

pub data: i64,

pub udata: *mut c_void,

pub ext: [u64; 4],

}

// sys/link_elf.h

pub struct dl_phdr_info {

pub dlpi_addr: crate::Elf_Addr,

pub dlpi_name: *const c_char,

pub dlpi_phdr: *const crate::Elf_Phdr,

pub dlpi_phnum: crate::Elf_Half,

}

}

```

// sys/event.h
pub const EVFILT_READ: i16 = -1;
pub const EVFILT_WRITE: i16 = -2;
pub const EVFILT_PROC: i16 = -5;
pub const EV_ADD: u16 = 0x0001;
pub const EV_DELETE: u16 = 0x0002;
pub const EV_ONESHOT: u16 = 0x0010;
pub const EV_CLEAR: u16 = 0x0020;
pub const EV_EOF: u16 = 0x8000;
pub const EV_ERROR: u16 = 0x4000;
pub const NOTE_EXIT: u32 = 0x80000000;

// sys/ioccom.h
pub const IOC_VOID: c_ulong = 0x20000000;
pub const IOC_OUT: c_ulong = 0x40000000;
pub const IOC_IN: c_ulong = 0x80000000;
pub const IOC_INOUT: c_ulong = IOC_IN | IOC_OUT;
pub const IOC_DIRMASK: c_ulong = 0xe0000000;

#[link(name = "bsd")]
extern "C" {
    // stdlib.h
    pub fn daemon(nochdir:
c_int, noclose: c_int) -> c_int;
    pub fn getprogname() -> *const c_char;
    pub fn setprogname(progname: *const c_char);
    pub fn arc4random() -> u32;
    pub fn arc4random_uniform(upper_bound: u32) -> u32;
    pub fn arc4random_buf(buf: *mut c_void, n: size_t);
    pub fn mkstemps(template: *mut c_char, suffixlen: c_int) -> c_int;
    pub fn strtonum(
        nptr: *const c_char,
        minval: c_longlong,
        maxval: c_longlong,
        errstr: *mut *const c_char,
    ) -> c_longlong;

    // pty.h
    pub fn openpty(
        amaster: *mut c_int,
        aslave: *mut c_int,
        name: *mut c_char,
        term: *mut crate::termios,
        winp: *mut crate::winsize,
    ) -> c_int;
    pub fn login_tty(_fd: c_int) -> c_int;
    pub fn forkpty(
        amaster: *mut c_int,

```

```

    name: *mut c_char,
    term: *mut crate::termios,
    winp: *mut crate::winsize,
) -> crate::pid_t;

// string.h
pub fn strsep(string: *mut *mut c_char, delimiters:
*const c_char) -> *mut c_char;
pub fn explicit_bzero(buf: *mut c_void, len: size_t);

// stringlist.h (utility library)
// Note: this is kept because it was previously introduced
pub fn sl_init() -> *mut StringList;
pub fn sl_add(sl: *mut StringList, n: *mut c_char) -> c_int;
pub fn sl_free(sl: *mut StringList, i: c_int);
pub fn sl_find(sl: *mut StringList, n: *mut c_char) -> *mut c_char;

// sys/event.h
pub fn kqueue() -> c_int;
pub fn kevent(
    kq: c_int,
    changelist: *const kevent,
    nchanges: c_int,
    eventlist: *mut kevent,
    nevents: c_int,
    timeout: *const crate::timespec,
) -> c_int;

// sys/link_elf.h
pub fn dl_iterate_phdr(
    callback: Option<
        unsafe extern "C" fn(info: *mut dl_phdr_info, size: usize, data: *mut c_void) -> c_int,
    >,
    data: *mut c_void,
) -> c_int;

// sys/time.h
pub fn lutimes(file: *const c_char, times: *const crate::timeval)
-> c_int;

// sys/uov.h
pub fn preadv(
    fd: c_int,
    iov: *const crate::iovec,
    iovcnt: c_int,
    offset: crate::off_t,
) -> ssize_t;
pub fn pwritev(

```

```

        fd: c_int,
        iov: *const crate::iovec,
        iovcnt: c_int,
        offset: crate::off_t,
    ) -> ssize_t;

// sys/wait.h
pub fn wait4(
    pid: crate::pid_t,
    status: *mut c_int,
    options: c_int,
    rusage: *mut crate::rusage,
) -> crate::pid_t;
}
=====

```

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Lizenzvertrag

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1. Definitionen

a. Unter einer Bearbeitung wird eine Übersetzung oder andere Bearbeitung des Werkes verstanden, die Ihre persönliche geistige Schöpfung ist. Eine freie Benutzung des Werkes wird nicht als Bearbeitung angesehen.

b. Unter den Lizenzelementen werden die folgenden Lizenzcharakteristika verstanden, die vom Lizenzgeber ausgewählt und in der Bezeichnung der Lizenz genannt werden: Namensnennung, Nicht-kommerziell, Weitergabe unter gleichen Bedingungen.

c. Unter dem Lizenzgeber wird die natürliche oder juristische Person verstanden, die den Schutzgegenstand unter den Bedingungen dieser Lizenz anbietet.

d. Unter einem Sammelwerk wird eine Sammlung von Werken, Daten oder anderen unabhängigen Elementen verstanden, die aufgrund der Auswahl oder Anordnung der Elemente eine persönliche geistige Schöpfung ist. Darunter fallen auch solche Sammelwerke, deren Elemente systematisch oder methodisch angeordnet und einzeln mit Hilfe elektronischer Mittel oder auf andere Weise zugänglich sind (Datenbankwerke). Ein Sammelwerk wird im Zusammenhang mit dieser Lizenz nicht als Bearbeitung (wie oben beschrieben) angesehen.

e. Mit SIE und Ihnen ist die natürliche oder juristische Person gemeint, die die durch diese Lizenz gewährten Nutzungsrechte ausübt und die zuvor die Bedingungen dieser Lizenz im Hinblick auf das Werk nicht verletzt hat, oder die die ausdrückliche Erlaubnis des Lizenzgebers erhalten hat, die durch diese Lizenz gewährten Nutzungsrechte trotz einer vorherigen Verletzung auszuüben.

f. Unter dem Schutzgegenstand wird das Werk oder Sammelwerk oder das Schutzobjekt eines verwandten Schutzrechts, das Ihnen unter den Bedingungen dieser Lizenz angeboten wird, verstanden.

g. Unter dem Urheber wird die natürliche Person verstanden, die das Werk geschaffen hat.

h. Unter einem verwandten Schutzrecht wird das Recht an einem anderen urheberrechtlichen Schutzgegenstand als einem Werk verstanden, zum Beispiel einer wissenschaftlichen Ausgabe, einem nachgelassenen Werk, einem Lichtbild, einer Datenbank, einem Tonträger, einer Funksendung, einem Laufbild oder einer Darbietung eines ausübenden Künstlers.

i. Unter dem Werk wird eine persönliche geistige Schöpfung verstanden, die Ihnen unter den Bedingungen dieser Lizenz angeboten wird.

2. Schranken des Urheberrechts. Diese Lizenz lässt sämtliche Befugnisse unberührt, die sich aus den Schranken des Urheberrechts, aus dem Erschöpfungsgrundsatz oder anderen Beschränkungen der Ausschließlichkeitsrechte des Rechteinhabers ergeben.

3. Lizenzierung. Unter den Bedingungen dieses Lizenzvertrages räumt Ihnen der Lizenzgeber ein lizenzgebührenfreies, räumlich und zeitlich (für die Dauer des Urheberrechts oder verwandten Schutzrechts) unbeschränktes einfaches Nutzungsrecht ein, den Schutzgegenstand in der folgenden Art und Weise zu nutzen:

- a. den Schutzgegenstand in körperlicher Form zu verwerten, insbesondere zu vervielfältigen, zu verbreiten und auszustellen;
- b. den Schutzgegenstand in unkörperlicher Form öffentlich wiederzugeben, insbesondere vorzutragen, aufzuführen und vorzuführen, öffentlich zugänglich zu machen, zu senden, durch Bild- und Tonträger wiederzugeben sowie Funksendungen und öffentliche Zugänglichmachungen wiederzugeben;
- c. den Schutzgegenstand auf Bild- oder Tonträger aufzunehmen, Lichtbilder davon herzustellen, weiterzusenden und in dem in a. und b. genannten Umfang zu verwerten;
- d. den Schutzgegenstand zu bearbeiten oder in anderer Weise umzugestalten und die Bearbeitungen zu veröffentlichen und in dem in a. bis c. genannten Umfang zu verwerten;

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4. Beschränkungen. Die Einräumung der Nutzungsrechte gemäß Ziffer 3 erfolgt ausdrücklich nur unter den folgenden Bedingungen:

- a. Sie dürfen den Schutzgegenstand ausschließlich unter den Bedingungen dieser Lizenz vervielfältigen, verbreiten oder öffentlich wiedergeben, und Sie müssen stets eine Kopie oder die vollständige Internetadresse in Form des Uniform-Resource-Identifier (URI) dieser Lizenz beifügen, wenn Sie den Schutzgegenstand vervielfältigen, verbreiten oder öffentlich wiedergeben. Sie dürfen keine Vertragsbedingungen anbieten oder fordern, die die Bedingungen dieser Lizenz oder die durch sie gewährten Rechte ändern oder beschränken. Sie dürfen den Schutzgegenstand nicht unterlizenzieren. Sie müssen alle Hinweise unverändert lassen, die auf diese Lizenz und den Haftungsausschluss hinweisen. Sie dürfen den Schutzgegenstand mit keinen technischen Schutzmaßnahmen versehen, die den Zugang oder den Gebrauch des Schutzgegenstandes in einer Weise kontrollieren, die mit den Bedingungen dieser Lizenz im Widerspruch stehen. Die genannten Beschränkungen gelten auch für den Fall, dass der Schutzgegenstand einen Bestandteil eines Sammelwerkes bildet; sie verlangen aber nicht, dass das Sammelwerk insgesamt zum Gegenstand dieser Lizenz gemacht wird. Wenn Sie ein Sammelwerk erstellen, müssen Sie - soweit dies praktikabel ist - auf die Mitteilung eines Lizenzgebers oder Urhebers hin aus dem Sammelwerk jeglichen Hinweis auf diesen Lizenzgeber oder diesen Urheber entfernen. Wenn Sie den Schutzgegenstand bearbeiten, müssen Sie - soweit dies praktikabel ist - auf die Aufforderung eines Rechtsinhabers hin von der Bearbeitung jeglichen Hinweis auf diesen Rechtsinhaber entfernen.

- b. Sie dürfen eine Bearbeitung ausschließlich unter den Bedingungen dieser Lizenz, einer späteren Version dieser Lizenz mit denselben Lizenzelementen wie diese Lizenz oder einer Creative Commons iCommons Lizenz, die dieselben Lizenzelemente wie diese Lizenz

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c. Sie dürfen die in Ziffer 3 gewährten Nutzungsrechte in keiner Weise verwenden, die hauptsächlich auf einen geschäftlichen Vorteil oder eine vertraglich geschuldete geldwerte Vergütung abzielt oder darauf gerichtet ist. Erhalten Sie im Zusammenhang mit der Einräumung der Nutzungsrechte ebenfalls einen Schutzgegenstand, ohne dass eine vertragliche Verpflichtung hierzu besteht, so wird dies nicht als geschäftlicher Vorteil oder vertraglich geschuldete geldwerte Vergütung angesehen, wenn keine Zahlung oder geldwerte Vergütung in Verbindung mit dem Austausch der Schutzgegenstände geleistet wird (z.B. File-Sharing).

d. Wenn Sie den Schutzgegenstand oder eine Bearbeitung oder ein Sammelwerk vervielfältigen, verbreiten oder öffentlich wiedergeben, müssen Sie alle Urhebervermerke für den Schutzgegenstand unverändert lassen und die Urheberschaft oder Rechtsinhaberschaft in einer der von Ihnen vorgenommenen

Nutzung angemessenen Form anerkennen, indem Sie den Namen (oder das Pseudonym, falls ein solches verwendet wird) des Urhebers oder Rechteinhabers nennen, wenn dieser angegeben ist. Dies gilt auch für den Titel des Schutzgegenstandes, wenn dieser angegeben ist, sowie - in einem vernünftigerweise durchführbaren Umfang - für die mit dem Schutzgegenstand zu verbindende Internetadresse in Form des Uniform-Resource-Identifier (URI), wie sie der Lizenzgeber angegeben hat, sofern dies geschehen ist, es sei denn, diese Internetadresse verweist nicht auf den Urhebervermerk oder die Lizenzinformationen zu dem Schutzgegenstand. Bei einer Bearbeitung ist ein Hinweis darauf aufzuführen, in welcher Form der Schutzgegenstand in die Bearbeitung eingegangen ist (z.B. Französische Übersetzung des ... (Werk) durch ... (Urheber) oder Das Drehbuch beruht auf dem Werk des ... (Urheber)). Ein solcher Hinweis kann in jeder angemessenen Weise erfolgen, wobei jedoch bei einer Bearbeitung, einer Datenbank oder einem Sammelwerk der Hinweis zumindest an gleicher Stelle und in ebenso auffälliger Weise zu erfolgen hat wie vergleichbare Hinweise auf andere Rechtsinhaber.

e. Obwohl die gemäss Ziffer 3 gewährten Nutzungsrechte in umfassender Weise ausgeübt werden dürfen, findet diese Erlaubnis ihre gesetzliche Grenze in den Persönlichkeitsrechten der Urheber und ausübenden Künstler, deren berechnete geistige und persönliche Interessen bzw. deren Ansehen oder Ruf nicht dadurch gefährdet werden dürfen, dass ein Schutzgegenstand über das gesetzlich zulässige Mass hinaus beeinträchtigt wird.

5. Gewährleistung. Sofern dies von den Vertragsparteien nicht anderweitig schriftlich vereinbart, bietet der Lizenzgeber keine Gewährleistung für die erteilten Rechte, außer für den Fall, dass Mängel arglistig verschwiegen wurden. Für Mängel anderer Art, insbesondere bei der mangelhaften Lieferung von Verkörperungen des Schutzgegenstandes, richtet sich die Gewährleistung nach der Regelung, die die Person, die Ihnen den Schutzgegenstand

zur Verfügung stellt, mit Ihnen außerhalb dieser Lizenz vereinbart, oder - wenn eine solche Regelung nicht getroffen wurde - nach den gesetzlichen Vorschriften.

6. Haftung. Über die in Ziffer 5 genannte Gewährleistung hinaus haftet Ihnen der Lizenzgeber nur für Vorsatz und grobe Fahrlässigkeit.

7. Vertragsende

a. Dieser Lizenzvertrag und die durch ihn eingerumten Nutzungsrechte enden automatisch bei jeder Verletzung der Vertragsbedingungen durch Sie. Fr natrlche und juristische Personen, die von Ihnen eine Bearbeitung, eine Datenbank oder ein Sammelwerk unter diesen Lizenzbedingungen erhalten haben, gilt die Lizenz jedoch weiter, vorausgesetzt, diese natrlichen oder juristischen Personen erfllen smtliche Vertragsbedingungen. Die Ziffern 1, 2, 5, 6, 7 und 8 gelten bei einer Vertragsbeendigung fort.

b. Unter den oben genannten Bedingungen erfolgt die Lizenz auf unbegrenzte Zeit (fr die Dauer des Schutzrechts). Dennoch behlt sich der Lizenzgeber das Recht vor, den Schutzgegenstand unter anderen Lizenzbedingungen zu nutzen oder die eigene Weitergabe des Schutzgegenstandes jederzeit zu beenden, vorausgesetzt, dass solche Handlungen nicht dem Widerruf dieser Lizenz dienen (oder jeder anderen Lizenzierung, die auf Grundlage dieser Lizenz erfolgt ist oder erfolgen muss) und diese Lizenz wirksam bleibt, bis Sie unter den oben genannten Voraussetzungen endet.

8. Schlussbestimmungen

a. Jedes Mal, wenn Sie den Schutzgegenstand vervielfltigen, verbreiten oder ffentlich wiedergeben, bietet der Lizenzgeber dem Erwerber eine Lizenz fr den Schutzgegenstand unter denselben Vertragsbedingungen an, unter denen er Ihnen die Lizenz eingerumt hat.

b. Jedes Mal, wenn Sie eine Bearbeitung vervielfltigen, verbreiten oder ffentlich wiedergeben, bietet der Lizenzgeber dem Erwerber eine Lizenz fr den ursprnglichen Schutzgegenstand unter denselben Vertragsbedingungen an, unter denen er Ihnen die Lizenz eingerumt hat.

c. Sollte eine Bestimmung dieses Lizenzvertrages unwirksam sein, so wird die Wirksamkeit der brigen Lizenzbestimmungen dadurch nicht berhrt, und an die Stelle der unwirksamen Bestimmung tritt eine Ersatzregelung, die dem mit der unwirksamen Bestimmung angestrebten Zweck am nchsten kommt.

d. Nichts soll dahingehend ausgelegt werden, dass auf eine Bestimmung dieses Lizenzvertrages verzichtet oder einer Vertragsverletzung zugestimmt wird, so lange ein solcher Verzicht oder eine solche Zustimmung nicht schriftlich vorliegen und von der verzichtenden oder zustimmenden Vertragspartei unterschrieben sind

e. Dieser Lizenzvertrag stellt die vollstndige Vereinbarung zwischen den Vertragsparteien hinsichtlich des Schutzgegenstandes dar. Es gibt keine weiteren ergnzenden Vereinbarungen oder mndlichen Abreden im Hinblick auf den Schutzgegenstand. Der Lizenzgeber ist an keine zuztlichen Abreden gebunden, die aus irgendeiner Absprache mit Ihnen entstehen knnten. Der Lizenzvertrag kann nicht ohne eine bereinstimmende schriftliche Vereinbarung zwischen dem Lizenzgeber und Ihnen abgndert werden.

f. Auf diesen Lizenzvertrag findet das Recht der Bundesrepublik Deutschland Anwendung.

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r#" 2.1

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- a.
- b.
- c.
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- e.
- f.

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304918241924202102

3

7b

- a.
- b.
- c.
- d.
- e.
- f.
- g.

4

5

34

- a.
- b.
- c. URIUniform Resource Identifier
- d. URI
- e.
- f.
- g.
- h.
- i.
- j. 1234URIURIURI5
- k.

6

7

- a. 1249
- b. a
- c. ab

8

- a.
- b.
- c.
- d.

9

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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

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//! `ioctl` opcode behavior for BSD platforms.

use super::{Direction, Opcode};

```
pub(super) const fn compose_opcode(
    dir: Direction,
    group: Opcode,
    num: Opcode,
    size: Opcode,
) -> Opcode {
    let dir = match dir {
        Direction::None => NONE,
        Direction::Read => READ,
        Direction::Write => WRITE,
        Direction::ReadWrite => READ | WRITE,
    };

    dir | num | (group << 8) | ((size & IOCPARAM_MASK) << 16)
}
```

```
// `IOC_VOID`
pub const NONE: Opcode = 0x2000_0000;
// `IOC_OUT` (out is from the perspective of the kernel)
pub const READ: Opcode = 0x4000_0000;
// `IOC_IN` (in is from the perspective of the kernel)
pub const WRITE: Opcode = 0x8000_0000;
pub const IOCPARAM_MASK: Opcode = 0x1FFF;
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```

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//! `ioctl` opcode behavior for BSD platforms.

```
use super::{Direction, RawOpcode};
```

```
pub(super) const fn compose_opcode(
```

```
    dir: Direction,
```

```
    group: RawOpcode,
```

```
    num: RawOpcode,
```

```
    size: RawOpcode,
```

```
) -> RawOpcode {
```

```
    let dir = match dir {
```

```
        Direction::None => NONE,
```

```
        Direction::Read => READ,
```

```
        Direction::Write => WRITE,
```

```
        Direction::ReadWrite => READ | WRITE,
```

```
    };
```

```
    dir | num | (group << 8) | ((size & IOCPARAM_MASK) << 16)
```

```
}
```

```
// `IOC_VOID`
```

```
pub const NONE: RawOpcode = 0x2000_0000;
```

```
// `IOC_OUT` (out is from the perspective of the kernel)
```

```
pub const READ: RawOpcode = 0x4000_0000;
```

```
// `IOC_IN` (in is from the perspective of the kernel)
```

```
pub const WRITE: RawOpcode = 0x8000_0000;
```

```
pub const IOCPARAM_MASK: RawOpcode = 0x1FFF;
```

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Version 3, 29 June 2007

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By Shawn Hargreaves, 18 October 1998.

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cre une Oeuvre dite Collective, la demande de tout Offrant, il devra, dans la mesure du possible, retirer de l'Oeuvre dite Collective toute référence au dit Offrant, comme demandé. Si l'Acceptant cre une Oeuvre dite Collective, la demande de tout Auteur, il devra, dans la mesure du possible, retirer de l'Oeuvre dite Collective toute référence au dit Auteur, comme demandé. Si l'Acceptant cre une Oeuvre dite Drive, la demande de tout Offrant, il devra, dans la mesure du possible, retirer de l'Oeuvre dite Drive toute référence au dit Offrant, comme demandé. Si l'Acceptant cre une Oeuvre dite Drive, la demande de tout Auteur, il devra, dans la mesure du possible, retirer de l'Oeuvre dite Drive toute référence au dit Auteur, comme demandé.

b. L'Acceptant peut reproduire, distribuer, représenter ou communiquer au public une Oeuvre dite Drive y compris par voie numérique uniquement sous les termes de ce Contrat, ou d'une version ultérieure de ce Contrat comprenant les mêmes Options du Contrat que le présent Contrat, ou un Contrat Creative Commons iCommons comprenant les mêmes Options du Contrat que le présent Contrat (par exemple Paternité - Pas d'Utilisation Commerciale - Partage Des Conditions Initiales A l'Identique 2.0 Japon). L'Acceptant doit inclure une copie ou l'adresse Internet (Identifiant Uniforme de Ressource) du présent Contrat, ou d'un autre Contrat tel que décrit la phrase précédente, toute reproduction ou enregistrement de l'Oeuvre dite Drive que l'Acceptant distribue, représente ou communique au public y compris par voie numérique. L'Acceptant ne peut pas offrir ou imposer de conditions d'utilisation sur l'Oeuvre dite Drive qui altèrent ou restreignent les termes du présent Contrat ou l'exercice des droits qui y sont accordés au bénéficiaire, et doit conserver intactes toutes les informations qui renvoient ce Contrat et l'avertissement sur les garanties. L'Acceptant ne peut pas reproduire, distribuer, représenter ou communiquer au public y compris par voie numérique l'Oeuvre dite Drive en utilisant une mesure technique de contrôle d'accès ou de contrôle d'utilisation qui serait contradictoire avec les termes de cet Accord contractuel. Les mentions ci-dessus s'appliquent l'Oeuvre dite Drive telle qu'incorpore dans une Oeuvre dite Collective, mais, en dehors de l'Oeuvre dite Drive en elle-même, ne soumettent pas l'Oeuvre Collective, aux termes du présent Contrat.

c. L'Acceptant ne peut exercer aucun des droits conférés par l'article 3 avec l'intention ou l'objectif d'obtenir un profit commercial ou une compensation financière personnelle. L'change de l'Oeuvre avec d'autres Oeuvres protégées par le droit de la propriété littéraire et artistique par le partage électronique de fichiers, ou par tout autre moyen, n'est pas considéré comme un change avec l'intention ou l'objectif d'un profit commercial ou d'une compensation financière personnelle, dans la mesure où aucun paiement ou compensation financière n'intervient en relation avec l'change d'Oeuvres protégées.

d. Si l'Acceptant reproduit, distribue, représente ou communique au public, y compris par voie numérique, l'Oeuvre ou toute Oeuvre dite Drive ou toute Oeuvre dite Collective, il doit conserver intactes toutes les informations sur le régime des droits et en attribuer la paternité à l'Auteur Original, de manière raisonnable au regard du médium ou du moyen utilisé. Il doit communiquer le nom de l'Auteur Original ou son éventuel pseudonyme s'il est indiqué ; le titre de l'Oeuvre Originale s'il est indiqué ; dans la mesure du possible, l'adresse Internet ou Identifiant Uniforme de Ressource (URI), s'il existe, spécifié par l'Offrant comme associé à l'Oeuvre, moins que cette adresse ne renvoie pas aux informations légales (paternité et conditions d'utilisation de l'Oeuvre). Dans le cas d'une Oeuvre dite Drive, il doit indiquer les éléments identifiant l'utilisation de l'Oeuvre dans l'Oeuvre dite Drive par exemple Traduction anglaise de l'Oeuvre par l'Auteur Original ou Scénario basé sur l'Oeuvre par l'Auteur Original.

Ces obligations d'attribution de paternité doivent être exécutées de manière raisonnable. Cependant, dans le cas d'une Oeuvre dite Drive ou d'une Oeuvre dite Collective, ces informations doivent, au minimum, apparaître de la même manière aussi visible que celles auxquelles apparaissent les informations de même nature.

e. Dans le cas où une utilisation de l'Oeuvre serait soumise à un régime légal de gestion collective obligatoire, l'Offrant se réserve le droit exclusif de collecter ces redevances par l'intermédiaire de la société de perception et de répartition des

droits comptente. Sont notamment concerns la radiodiffusion et la communication dans un lieu public de phonogrammes publis des fins de commerce, certains cas de retransmission par cble et satellite, la copie prive d'Oeuvres fixes sur phonogrammes ou vidogrammes, la reproduction par reprographie.

5. Garantie et exonration de responsabilit

a. En mettant l'Oeuvre la disposition du public selon les termes de ce Contrat, l'Offrant dclare de bonne foi qu' sa connaissance et dans les limites d'une enquete raisonnable :

i. L'Offrant a obtenu tous les droits sur l'Oeuvre ncessaires pour pouvoir autoriser l'exercice des droits accords par le prsent Contrat, et permettre la jouissance paisible et l'exercice licite de ces droits, ceci sans que l'Acceptant n'ait aucune obligation de verser de rmunration ou tout autre paiement ou droits, dans la limite des mcanismes de gestion collective obligatoire applicables dcrits l'article 4(e);

ii. L'Oeuvre n'est constitutive ni d'une violation des droits de tiers, notamment du droit de la propriit littraire et artistique, du droit des marques, du droit de l'information, du droit civil ou de tout autre droit, ni de diffamation, de violation de la vie prive ou de tout autre prjudice dlictuel l'gard de toute tierce partie.

b. A l'exception des situations expressment mentionnes dans le prsent Contrat ou dans un autre accord crit, ou exiges par la loi applicable, l'Oeuvre est mise disposition en l'tat sans garantie d'aucune sorte, qu'elle soit expresse ou tacite, y compris l'gard du contenu ou de l'exactitude de l'Oeuvre.

6. Limitation de responsabilit. A l'exception des garanties d'ordre public imposes par la loi applicable et des rparations imposes par le rgime de la responsabilit vis--vis d'un tiers en raison de la violation des garanties prvues par l'article 5 du prsent contrat, l'Offrant ne sera en aucun cas tenu responsable vis--vis de l'Acceptant, sur la base d'aucune thorie lgale ni en raison d'aucun prjudice direct, indirect, matriel ou moral, rsultant de l'excuton du prsent Contrat ou de l'utilisation de l'Oeuvre, y compris dans l'hypothse o l'Offrant avait connaissance de la possible existence d'un tel prjudice.

7. Rsiliation

a. Tout manquement aux termes du contrat par l'Acceptant entrane la rsiliation automatique du Contrat et la fin des droits qui en dcoulent. Cependant, le contrat conserve ses effets envers les personnes physiques ou morales qui ont eu de la part de l'Acceptant, en excution du prsent contrat, la mise disposition d'Oeuvres dites Drives, ou d'Oeuvres dites Collectives, ceci tant qu'elles respectent pleinement leurs obligations. Les sections 1, 2, 5, 6 et 7 du contrat continuent s'appliquer aprs la rsiliation de celui-ci.

b. Dans les limites indiques ci-dessus, le prsent Contrat s'applique pendant toute la dure de protection de l'Oeuvre selon le droit applicable. Nanmoins, l'Offrant se rserve tout moment le droit d'exploiter l'Oeuvre sous des conditions contractuelles diffrentes, ou d'en cesser la diffusion; cependant, le recours cette option ne doit pas conduire retirer les effets du prsent Contrat (ou de tout contrat qui a t ou doit tre accord selon les termes de ce Contrat), et ce Contrat continuera s'appliquer dans tous ses effets jusqu' ce que sa rsiliation intervienne dans les conditions dcrites ci-dessus.

8. Divers

a. A chaque reproduction ou communication au public par voie numérique de l'Oeuvre ou d'une Oeuvre dite Collective par l'Acceptant, l'Offrant propose au bénéficiaire une offre de mise à disposition de l'Oeuvre dans des termes et conditions identiques à ceux accordés à la partie Acceptante dans le présent Contrat.

b. A chaque reproduction ou communication au public par voie numérique d'une Oeuvre dite Drive par l'Acceptant, l'Offrant propose au bénéficiaire une offre de mise à disposition du bénéficiaire de l'Oeuvre originale dans des termes et conditions identiques à ceux accordés à la partie Acceptante dans le présent Contrat.

c. La nullité ou l'inapplicabilité d'une quelconque disposition de ce Contrat au regard de la loi applicable n'affecte pas celle des autres dispositions qui resteront pleinement valides et applicables. Sans action additionnelle par les parties, cet accord, lesdites dispositions devront être interprétés dans la mesure minimum nécessaire à leur validité et leur applicabilité.

d. Aucune limite, renonciation ou modification des termes ou dispositions du présent Contrat ne pourra être acceptée sans le consentement écrit et signé de la partie compétente.

e. Ce Contrat constitue le seul accord entre les parties en ce qui concerne la mise à disposition de l'Oeuvre. Il n'existe aucun document annexe, accord supplémentaire ou mandat portant sur cette Oeuvre en dehors des éléments mentionnés ici. L'Offrant ne sera tenu par aucune disposition supplémentaire qui pourrait apparaître dans une quelconque communication en provenance de l'Acceptant. Ce Contrat ne peut être modifié sans l'accord mutuel écrit de l'Offrant et de l'Acceptant.

f. Le droit applicable est le droit français.

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"#

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Version 2.1, February 1999

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Preamble

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You must make sure that they, too, receive or can get the source code. If you link other code with the library, you must provide complete object files to the recipients, so that they can relink them with the library after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

We protect your rights with a two-step method: (1) we copyright the library, and (2) we offer you this license, which gives you legal permission to copy, distribute and/or modify the library.

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Most GNU software, including some libraries, is covered by the ordinary GNU General Public License. This license, the GNU Lesser General Public License, applies to certain designated libraries, and is quite different from the ordinary General Public License. We use this license for certain libraries in order to permit linking those libraries

into non-free programs.

When a program is linked with a library, whether statically or using a shared library, the combination of the two is legally speaking a combined work, a derivative of the original library. The ordinary General Public License therefore permits such linking only if the entire combination fits its criteria of freedom. The Lesser General Public License permits more lax criteria for linking other code with the library.

We call this license the "Lesser" General Public License because it does Less to protect the user's freedom than the ordinary General Public License. It also provides other free software developers Less of an advantage over competing non-free programs. These disadvantages are the reason we use the ordinary General Public License for many libraries. However, the Lesser license provides advantages in certain special circumstances.

For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

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Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred

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all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

a) The modified work must itself be a software library.

b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.

c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.

d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program

that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute

the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on

the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object

code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from

a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6.

As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

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"#

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This FDK AAC Codec software is intended to be used on a wide variety of Android devices.

AAC's HE-AAC and HE-AAC v2 versions are regarded as today's most efficient general perceptual audio codecs. AAC-ELD is considered the best-performing full-bandwidth communications codec by independent studies and is widely deployed. AAC has been standardized by ISO and IEC as part of the MPEG specifications.

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LICENTIE VERLEENDE RECHTEN MET BETREKKING TOT HET WERK AANVAARDT EN GAAT DE GEBRUIKER AKKOORD MET DE VOORWAARDEN VAN DEZE LICENTIE, MET DIEN VERSTANDE DAT (DE INHOUD VAN) DEZE LICENTIE OP VOORHAND VOLDOENDE DUIDELIJK KENBAAR DIENT TE ZIJN VOOR DE ONTVANGER VAN HET WERK.

DE LICENTIEGEVER VERLEENT DE GEBRUIKER DE IN DEZE LICENTIE OMSCHREVEN RECHTEN MET INACHTNEMING VAN DE DESBETREFFENDE VOORWAARDEN.

1. Definities

a. 'Verzamelwerk' een werk waarin het Werk, in zijn geheel en in ongewijzigde vorm, samen met een of meer andere werken, die elk een afzonderlijk en zelfstandig werk vormen, tot een geheel is samengevoegd. Voorbeelden van een verzamelwerk zijn een tijdschrift, een bloemlezing of een encyclopedie. Een Verzamelwerk zal voor de toepassing van deze Licentie niet als een Afgeleid werk (als hieronder omschreven) worden beschouwd.

b. 'Afgeleid werk' een werk dat is gebaseerd op het Werk of op het Werk en andere reeds bestaande werken. Voorbeelden van een Afgeleid werk zijn een vertaling, een muziekschikking (arrangement), een toneelbewerking, een literaire bewerking, een verfilming, een geluidsopname, een kunstreproductie, een verkorte versie, een samenvatting of enig andere bewerking van het Werk, met dien verstande dat een Verzamelwerk voor de toepassing van deze Licentie niet als een Afgeleid werk zal

worden beschouwd.

Indien het Werk een muziekwerk betreft, zal de synchronisatie van de tijdslijnen van het Werk en een bewegend beeld ('synching') voor de toepassing van deze Licentie als een Afgeleid Werk worden beschouwd.

c. 'Licentiegever' de natuurlijke persoon/personen of rechtspersoon/rechtspersonen die het Werk volgens de voorwaarden van deze Licentie aanbiedt/aanbieden.

d. 'Maker' de natuurlijke persoon/personen of rechtspersoon/personen die het oorspronkelijke werk gemaakt heeft/hebben. Voor de toepassing van deze Licentie wordt onder de Maker mede verstaan de uitvoerende kunstenaar, film- en fonogramproducent en omroeporganisaties in de zin van de Wet op de naburige rechten en de producent van een databank in de zin van de Databankenwet.

e. 'Werk' het auteursrechtelijk beschermde werk dat volgens de voorwaarden van deze Licentie wordt aangeboden. Voor de toepassing van deze Licentie wordt onder het Werk mede verstaan het fonogram, de eerste vastlegging van een film en het (omroep)programma in de zin van de Wet op de naburige rechten en de databank in de zin van de Databankenwet, voor zover dit fonogram, deze eerste vastlegging van een film, dit (omroep)programma en deze databank beschermd wordt krachtens de toepasselijke wet in de jurisdictie van de Gebruiker.

f. 'Gebruiker' de natuurlijke persoon of rechtspersoon die rechten ingevolge deze Licentie uitoefent en die de voorwaarden van deze Licentie met betrekking tot het Werk niet eerder geschonden heeft, of die van de Licentiegever uitdrukkelijke toestemming gekregen heeft om rechten ingevolge deze Licentie uit te oefenen ondanks een eerdere schending.

2.

Beperkingen van de uitsluitende rechten. Niets in deze Licentie strekt ertoe om de rechten te beperken die voortvloeien uit de beperkingen en uitputting van de uitsluitende rechten van de rechthebbende krachtens het auteursrecht, de naburige rechten, het databankenrecht of enige andere toepasselijke rechten.

3. Licentieverlening. Met inachtneming van de voorwaarden van deze Licentie verleent de Licentiegever hierbij aan de Gebruiker een wereldwijde, niet-exclusieve licentie om de navolgende rechten met betrekking tot het Werk vrij van royalty's uit te oefenen voor de duur van de toepasselijke intellectuele eigendomsrechten:

a. het reproduceren van het Werk, het opnemen van het Werk in een of meerdere Verzamelwerken, en het reproduceren van het in de Verzamelwerken opgenomen Werk;

b. het maken en reproduceren van Afgeleide werken met dien verstande dat met betrekking tot het Afgeleide werk, met inbegrip van welke vertaling in welk medium dan ook, duidelijk wordt gemaakt dat er wijzigingen in het oorspronkelijke Werk zijn aangebracht. Bijvoorbeeld, aan een vertaling kan worden toegevoegd dat 'het oorspronkelijke Werk is van het Engels in het Spaans vertaald', of in geval van een verandering kan worden aangegeven dat 'het oorspronkelijke werk is veranderd';

c. het verspreiden van exemplaren van het Werk, het in het openbaar tonen, op- en uitvoeren en het on-line beschikbaar stellen van het Werk, afzonderlijk en als deel van een Verzamelwerk;

d. het verspreiden van exemplaren van Afgeleide werken, het in het openbaar te tonen, op- en uitvoeren en het on-line beschikbaar stellen van Afgeleide werken;

e. het opvragen en hergebruiken van het Werk;

f. Volledigheidshalve dient te worden vermeld dat:

i. Niet voor afstand vatbare heffingsregelingen. in het geval van niet voor afstand vatbare heffingsregelingen (bijvoorbeeld met betrekking tot thuiskopien) de Licentiegever zich het recht voorbehoudt om dergelijke heffingen te innen

(al dan niet door middel van een auteursrechtenorganisatie) bij zowel commercieel als niet-commercieel gebruik van het Werk;

ii. Voor afstand vatbare heffingsregeling. in het geval van voor afstand vatbare heffingsregelingen (bijvoorbeeld met betrekking tot leenrechten) de Licentiegever afstand doet van het recht om dergelijke heffingen te innen bij zowel commercieel als niet-commercieel gebruik van het Werk;

iii. Collectief rechtenbeheer. de Licentiegever afstand doet van het recht om vergoedingen te innen (zelfstandig of, indien de Licentiegever lid is van een auteursrechtenorganisatie, door middel van die organisatie) bij zowel commercieel als niet-commercieel gebruik van het Werk.

De Gebruiker mag deze rechten uitoefenen met behulp van alle thans bekende media, dragers en formats. De Gebruiker is tevens gerechtigd om technische wijzigingen aan te brengen die noodzakelijk zijn om de rechten met behulp van andere media, dragers en formats uit te oefenen. Alle niet uitdrukkelijk verleende rechten zijn hierbij voorbehouden aan de Licentiegever, met inbegrip van maar niet beperkt tot de rechten die in artikel 4(d) worden genoemd. Voor zover de Licentiegever op basis van het nationale recht ter implementatie van de Europese Databankenrichtlijn over uitsluitende rechten beschikt doet de Licentiegever afstand van deze rechten.

4. Beperkingen. De in artikel 3 verleende Licentie is uitdrukkelijk gebonden aan de volgende beperkingen:

a. De Gebruiker mag het Werk uitsluitend verspreiden, in het openbaar tonen, op- of uitvoeren of on-line beschikbaar stellen met inachtneming van de voorwaarden van deze Licentie, en de Gebruiker dient een exemplaar van, of de Uniform Resource Identifier voor, deze Licentie toe te voegen aan elk exemplaar van het Werk dat de Gebruiker verspreidt, in het openbaar toont, op- of uitvoert, of on-line beschikbaar stelt. Het is de Gebruiker niet toegestaan om het Werk onder enige afwijkende voorwaarden aan te bieden waardoor de voorwaarden van deze Licentie dan wel de mogelijkheid van de ontvangers van het Werk om de rechten krachtens deze Licentie uit te oefenen worden beperkt. Het is de Gebruiker niet toegestaan om het Werk in sublicentie te geven. De Gebruiker dient alle vermeldingen die verwijzen naar deze Licentie dan wel naar de uitsluiting van garantie te laten staan. Het is de Gebruiker niet toegestaan om het Werk te verspreiden, in het openbaar te tonen, op- of uit te voeren of on-line beschikbaar te stellen met toepassing van technologische voorzieningen waardoor de voorwaarden van deze Licentie dan wel de mogelijkheid van de ontvangers van het Werk om de rechten krachtens deze Licentie uit te oefenen worden beperkt. Het voorgaande is tevens van toepassing op het Werk dat deel uitmaakt van een Verzamelwerk, maar dat houdt niet in dat het Verzamelwerk, afgezien van het Werk zelf, gebonden is aan de voorwaarden van deze Licentie. Indien de Gebruiker een Verzamelwerk maakt, dient deze, op verzoek van welke Licentiegever ook, de op grond van artikel 4(b) vereiste naamsvermelding uit het Verzamelwerk te verwijderen, voor zover praktisch mogelijk, conform het verzoek. Indien de Gebruiker een Afgeleid werk maakt, dient hij, op verzoek van welke Licentiegever ook, de op grond van artikel 4(b) vereiste naamsvermelding uit het Afgeleide werk te verwijderen, voorzover praktisch mogelijk, conform het verzoek.

b. Indien de Gebruiker het Werk, Afgeleide Werken of Verzamelwerken verspreidt, in het openbaar toont, op- of uitvoert of on-line beschikbaar stelt, dient de Gebruiker, tenzij er sprake is van een verzoek als vermeld in lid 4(a), alle auteursrechtvermeldingen met betrekking tot het Werk te laten staan. Tevens dient de Gebruiker, op een wijze die redelijk is in verhouding tot het gebruikte medium, de naam te vermelden van (i) de Maker (of zijn/haar pseudoniem indien van toepassing) indien deze wordt vermeld; en/of (ii) van (een) andere partij(en) (b.v. sponsor, uitgeverij, tijdschrift)

indien de naamsvermelding van deze partij(en) ("Naamsvermeldingsgerechtigden") in de auteursrechtvermelding of algemene voorwaarden van de Licentiegever of op een andere redelijke wijze verplicht is gesteld door de Maker en/of de Licentiegever; de titel van het Werk indien deze wordt vermeld; voorzover redelijkerwijs toepasbaar de Uniform Resource Identifier, indien aanwezig, waarvan de Licentiegever heeft aangegeven dat deze bij het Werk hoort, tenzij de URI niet verwijst naar de auteursrechtvermeldingen of de licentie-informatie betreffende het Werk; in overeenstemming met artikel 3(b) in geval van een Afgeleid werk, door te verwijzen naar het gebruik van het Werk in het Afgeleide werk (bijvoorbeeld: 'De Franse vertaling van het Werk van de Maker' of 'Scenario gebaseerd op het Werk van de Maker'). De Gebruiker dient op redelijke wijze aan de in dit artikel genoemde vereisten te voldoen; echter, met dien verstande dat, in geval van een Afgeleid werk of een Verzamelwerk, de naamsvermeldingen in ieder geval geplaatst dienen te worden, indien er een naamsvermelding van alle makers van het Afgeleide werk of het Verzamelwerk geplaatst wordt dan als deel van die naamsvermeldingen, en op een wijze die in ieder geval even duidelijk is als de naamsvermeldingen van de overige makers.

Volledigheidshalve dient te worden vermeld dat de Gebruiker uitsluitend gebruik mag maken van de naamsvermelding op de in dit artikel omschreven wijze teneinde te voldoen aan de naamsvermeldingsverplichting en, door gebruikmaking van zijn rechten krachtens deze Licentie, is het de Gebruiker niet toegestaan om op enigerlei wijze de indruk te wekken dat er sprake is van enig verband met, sponsorschap van of goedkeuring van de (toepasselijke) Maker, Licentiegever c.q. Naamsvermeldingsgerechtigden van de Gebruiker of diens gebruik van het Werk, zonder de afzonderlijke, uitdrukkelijke, voorafgaande, schriftelijke toestemming van de Maker, Licentiegever c.q. Naamsvermeldingsgerechtigden.

c. Volledigheidshalve dient te worden vermeld, dat de hierboven vermelde beperkingen (lid 4(a) en lid 4(b)) niet van toepassing zijn op die onderdelen van het Werk die geacht worden te vallen onder de definitie van het 'Werk' zoals vermeld in deze Licentie uitsluitend omdat zij voldoen aan de criteria van het sui generis databankenrecht krachtens het nationale recht ter implementatie van de Europese Databankenrichtlijn.

d. De in artikel 3 verleende rechten moeten worden uitgeoefend met inachtneming van het morele recht van de Maker (en/of de uitvoerende kunstenaar) om zich te verzetten tegen elke misvorming, vermindering of andere aantasting van het werk, welke nadeel zou kunnen toebrengen aan de eer of de naam van de Maker (en/of de uitvoerende kunstenaar) of aan zijn waarde in deze hoedanigheid, indien en voor zover de Maker (en/of de uitvoerende kunstenaar) op grond van een op hem van toepassing zijnde wettelijke bepaling geen afstand kan doen van dat morele recht.

5. Garantie en vrijwaring.

TENZIJ ANDERS SCHRIFTELIJK IS OVEREENGEKOMEN DOOR DE PARTIJEN, STELT DE LICENTIEGEVER HET WERK BESCHIKBAAR OP 'AS-IS' BASIS, ZONDER ENIGE GARANTIE, HETZIJ DIRECT, INDIRECT OF ANDERSZINS, MET BETREKKING TOT HET WERK, MET INBEGRIJ VAN, MAAR NIET BEPERKT TOT GARANTIES MET BETREKKING TOT DE EIGENDOMSTITEL, DE VERKOOPBAARHEID, DE GESCHIKTHEID VOOR BEPAALDE DOELEINDEN, MOGELIJKE INBREUK, DE AFWEZIGHEID VAN LATENTE OF ANDERE TEKORTKOMINGEN, DE JUISTHEID OF DE AAN- OF

AFWEZIGHEID VAN FOUTEN, ONGEACHT DE OPSPOORBAARHEID DAARVAN, INDIEN EN VOORZOVER DE WET NIET ANDERS BEPAALT.

6. Beperking van de aansprakelijkheid.

DE LICENTIEGEEVER AANVAARDT GEEN ENKELE AANSPRAKELIJKHEID JEGENS DE GEBRUIKER VOOR ENIGE BIJZONDERE OF INCIDENTELE SCHADE OF GEVOLGSCHADE VOORTVLOEIEND UIT DEZE LICENTIE OF HET GEBRUIK VAN HET WERK, ZELFS NIET INDIEN DE LICENTIEGEEVER OP DE HOOGTE IS GESTELD VAN HET RISICO VAN DERGELIJKE SCHADE, INDIEN EN VOORZOVER DE WET NIET ANDERS BEPAALT.

7. Beindiging

a. Deze Licentie en de daarin verleende rechten vervallen automatisch op het moment dat de Gebruiker in strijd handelt met de voorwaarden van deze Licentie. De licenties van natuurlijke personen of rechtspersonen die Verzamelwerken hebben ontvangen van de Gebruiker krachtens deze Licentie blijven echter in stand zolang dergelijke natuurlijke personen of rechtspersonen zich houden aan de voorwaarden van die licenties. Na de beindiging van deze Licentie blijven artikelen 1, 2, 5, 6, 7 en 8 onverminderd van kracht.

b. Met inachtneming van de hierboven vermelde voorwaarden wordt de Licentie verleend voor de duur van de toepasselijke intellectuele eigendomsrechten op het Werk. De Licentiegever behoudt zich desalniettemin te allen tijde het recht voor om het Werk volgens gewijzigde licentievoorwaarden te verspreiden of om het Werk niet langer te verspreiden; met dien verstande dat een dergelijk besluit niet de intrekking van deze Licentie (of enig andere licentie die volgens de voorwaarden van deze Licentie (verplicht) is verleend) tot gevolg heeft, en deze Licentie onverminderd van kracht blijft tenzij zij op de in lid a omschreven wijze wordt beïndigd.

8. Diversen

a. Elke keer dat de Gebruiker het Werk of een Verzamelwerk verspreidt of on-line beschikbaar stelt, biedt de Licentiegever de ontvanger een licentie op het Werk aan volgens de algemene voorwaarden van deze Licentie.

b. Elke keer dat de Gebruiker een Afgeleid werk verspreidt of on-line beschikbaar stelt, biedt de Licentiegever de ontvanger een licentie op het oorspronkelijke werk aan volgens de algemene voorwaarden van deze Licentie.

c. Indien enige bepaling van deze Licentie nietig of niet rechtens afdwingbaar is, zullen de overige voorwaarden van deze Licentie volledig van kracht blijven. De nietige of niet-afdwingbare bepaling zal, zonder tussenkomst van de partijen, worden vervangen door een geldige en afdwingbare bepaling waarbij het doel en de strekking van de oorspronkelijke bepaling zoveel mogelijk in acht worden genomen.

d. Een verklaring van afstand van in deze Licentie verleende rechten of een wijziging van de voorwaarden van deze Licentie dient schriftelijk te geschieden en getekend te zijn door de partij die verantwoordelijk is voor de verklaring van afstand respectievelijk de partij wiens toestemming voor de wijziging is vereist.

f. Deze Licentie bevat de volledige overeenkomst tussen de partijen met betrekking tot het in licentie gegeven Werk. Er zijn geen andere afspraken gemaakt met betrekking tot het Werk. De Licentiegever is niet gebonden aan

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/// The datatype used for the ioctl number

#[doc(hidden)]

#[cfg(not(solarish))]

pub type ioctl_num_type = ::libc::c_ulong;

#[doc(hidden)]

#[cfg(solarish)]

pub type ioctl_num_type = ::libc::c_int;

/// The datatype used for the 3rd argument

#[doc(hidden)]

pub type ioctl_param_type = ::libc::c_int;

mod consts {

use crate::sys::ioctl::ioctl_num_type;

#[doc(hidden)]

pub const VOID: ioctl_num_type = 0x2000_0000;

#[doc(hidden)]

pub const OUT: ioctl_num_type = 0x4000_0000;

#[doc(hidden)]

#[allow(overflowing_literals)]

pub const IN: ioctl_num_type = 0x8000_0000;

#[doc(hidden)]

pub const INOUT: ioctl_num_type = IN | OUT;

#[doc(hidden)]

pub const IOCPARM_MASK: ioctl_num_type = 0x1fff;

}

pub use self::consts::*;

#[macro_export]

#[doc(hidden)]

macro_rules! ioc {

(\$inout:expr, \$group:expr, \$num:expr, \$len:expr) => {

\$inout

| ((\$len as \$crate::sys::ioctl::ioctl_num_type
& \$crate::sys::ioctl::IOCPARM_MASK)

<< 16)

| ((\$group as \$crate::sys::ioctl::ioctl_num_type) << 8)

| (\$num as \$crate::sys::ioctl::ioctl_num_type)

};

}

```

/// Generate an ioctl request code for a command that passes no data.
///
/// This is equivalent to the `_IO()` macro exposed by the C ioctl API.
///
/// You should only use this macro directly if the `ioctl` you're working
/// with is "bad" and you cannot use `ioctl_none!()` directly.
///
/// # Example
///
/// ```
/// ##[macro_use] extern crate nix;
/// const KVMIO: u8 = 0xAE;
/// ioctl_write_int_bad!(kvm_create_vm, request_code_none!(KVMIO, 0x03));
/// # fn main() {}
/// ```
#[macro_export(local_inner_macros)]
macro_rules! request_code_none {
    ($g:expr, $n:expr) => {
        ioc!($crate::sys::ioctl::VOID, $g, $n, 0)
    };
}

/// Generate an ioctl request code for a command that passes an integer
///
/// This is equivalent to the `_IOWINT()` macro exposed by the C ioctl API.
///
/// You should only use this macro directly if the
/// `ioctl` you're working
/// with is "bad" and you cannot use `ioctl_write_int!()` directly.
#[macro_export(local_inner_macros)]
macro_rules! request_code_write_int {
    ($g:expr, $n:expr) => {
        ioc(
            $crate::sys::ioctl::VOID,
            $g,
            $n,
            ::std::mem::size_of::<$crate::libc::c_int>()
        )
    };
}

/// Generate an ioctl request code for a command that reads.
///
/// This is equivalent to the `_IOR()` macro exposed by the C ioctl API.
///
/// You should only use this macro directly if the `ioctl` you're working
/// with is "bad" and you cannot use `ioctl_read!()` directly.

```

```

///
/// The read/write direction is relative to userland, so this
/// command would be userland is reading and the kernel is
/// writing.
#[macro_export(local_inner_macros)]
macro_rules! request_code_read {
    ($g:expr, $n:expr, $len:expr) => {
        ioc!($crate::sys::ioctl::OUT, $g, $n, $len)
    };
}

/// Generate an ioctl request code for a command that writes.
///
///
/// This is equivalent to the `_IOW()` macro exposed by the C ioctl API.
///
/// You should only use this macro directly if the `ioctl` you're working
/// with is "bad" and you cannot use `ioctl_write!()` directly.
///
/// The read/write direction is relative to userland, so this
/// command would be userland is writing and the kernel is
/// reading.
#[macro_export(local_inner_macros)]
macro_rules! request_code_write {
    ($g:expr, $n:expr, $len:expr) => {
        ioc!($crate::sys::ioctl::IN, $g, $n, $len)
    };
}

/// Generate an ioctl request code for a command that reads and writes.
///
///
/// This is equivalent to the `_IOWR()` macro exposed by the C ioctl API.
///
/// You should only use this macro directly if the `ioctl` you're working
/// with is "bad" and you cannot use `ioctl_readwrite!()` directly.
#[macro_export(local_inner_macros)]
macro_rules! request_code_readwrite {
    ($g:expr, $n:expr, $len:expr) => {
        ioc!($crate::sys::ioctl::INOUT, $g, $n, $len)
    };
}

```

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```
"#
use crate::errno::Errno;
use crate::sys::signal::Signal;
use crate::unistd::Pid;
use crate::Result;
use cfg_if::cfg_if;
use libc::{self, c_int};
use std::ptr;

pub type RequestType = c_int;

cfg_if! {
    if #[cfg(any(freebsdlike, apple_targets, target_os = "openbsd"))] {
        #[doc(hidden)]
        pub type AddressType = *mut ::libc::c_char;
    } else {
        #[doc(hidden)]
        pub type AddressType = *mut ::libc::c_void;
    }
}
```

```
libc_enum! {
    #[repr(i32)]
    /// Ptrace Request enum defining the action to be taken.
    #[non_exhaustive]
    pub enum Request {
        PT_TRACE_ME,
        PT_READ_I,
        PT_READ_D,
        #[cfg(apple_targets)]
        PT_READ_U,
        PT_WRITE_I,
        PT_WRITE_D,
        #[cfg(apple_targets)]
        PT_WRITE_U,
        PT_CONTINUE,
        PT_KILL,
        #[cfg(any(any(freebsdlike, apple_targets),
            all(target_os = "openbsd", target_arch = "x86_64"),
            all(target_os = "netbsd", any(target_arch = "x86_64",
                target_arch = "powerpc"))))]
        PT_STEP,
        PT_ATTACH,
        PT_DETACH,
        #[cfg(apple_targets)]
        PT_SIGEXC,
```

```

    #[cfg(apple_targets)]
    PT_THUPDATE,
    #[cfg(apple_targets)]
    PT_ATTACHEXC
}
}

```

```

unsafe fn ptrace_other(
    request: Request,
    pid: Pid,
    addr: AddressType,
    data: c_int,
) -> Result<c_int> {
    unsafe {
        Errno::result(libc::ptrace(
            request as RequestType,
            libc::pid_t::from(pid),
            addr,
            data,
        ))
        .map(|_| 0)
    }
}

```

```

/// Sets the process as traceable, as with `ptrace(PT_TRACE_ME, ...)`
///

```

```

/// Indicates that this process is to be traced by its parent.
/// This is the only ptrace request to be issued by the tracee.

```

```

pub fn traceme() -> Result<()> {
    unsafe {
        ptrace_other(Request::PT_TRACE_ME, Pid::from_raw(0), ptr::null_mut(), 0)
        .map(drop)
    }
}

```

```

/// Attach to a running
process, as with `ptrace(PT_ATTACH, ...)`
///
/// Attaches to the process specified by `pid`, making it a tracee of the calling process.

```

```

pub fn attach(pid: Pid) -> Result<()> {
    unsafe {
        ptrace_other(Request::PT_ATTACH, pid, ptr::null_mut(), 0).map(drop)
    }
}

```

```

/// Detaches the current running process, as with `ptrace(PT_DETACH, ...)`
///

```

```

/// Detaches from the process specified by `pid` allowing it to run freely, optionally delivering a

```

```

/// signal specified by `sig`.
pub fn detach<T: Into<Option<Signal>>>>(pid: Pid, sig: T) -> Result<()> {
    let data = match sig.into() {
        Some(s) => s as c_int,
        None => 0,
    };
    unsafe {
        ptrace_other(Request::PT_DETACH, pid, ptr::null_mut(), data).map(drop)
    }
}

/// Restart the stopped tracee process, as with `ptrace(PTRACE_CONT, ...)`
///
/// Continues the execution of the process with PID `pid`, optionally
/// delivering a signal specified by `sig`.
pub fn cont<T: Into<Option<Signal>>>>(pid: Pid, sig: T)
-> Result<()> {
    let data = match sig.into() {
        Some(s) => s as c_int,
        None => 0,
    };
    unsafe {
        // Ignore the useless return value
        ptrace_other(Request::PT_CONTINUE, pid, 1 as AddressType, data)
            .map(drop)
    }
}

/// Issues a kill request as with `ptrace(PT_KILL, ...)`
///
/// This request is equivalent to `ptrace(PT_CONTINUE, ..., SIGKILL);`
pub fn kill(pid: Pid) -> Result<()> {
    unsafe {
        ptrace_other(Request::PT_KILL, pid, 0 as AddressType, 0).map(drop)
    }
}

/// Move the stopped tracee process forward by a single step as with
/// `ptrace(PT_STEP, ...)`
///
/// Advances the execution of the process with PID `pid` by a single step optionally delivering a
/// signal specified by `sig`.
///
/// # Example
/// ```rust
/// use nix::sys::ptrace::step;
/// use nix::unistd::Pid;
/// use nix::sys::signal::Signal;

```

```

/// use nix::sys::wait::*;
/// // If a process changes state to the stopped state because of a SIGUSR1
/// // signal,
/// this will step the process forward and forward the user
/// // signal to the stopped process
/// match waitpid(Pid::from_raw(-1), None) {
///     Ok(WaitStatus::Stopped(pid, Signal::SIGUSR1)) => {
///         let _ = step(pid, Signal::SIGUSR1);
///     }
///     _ => {},
/// }
/// ```
#[cfg(any(
    any(freebsdlike, apple_targets),
    all(target_os = "openbsd", target_arch = "x86_64"),
    all(
        target_os = "netbsd",
        any(target_arch = "x86_64", target_arch = "powerpc")
    )
))]
pub fn step<T: Into<Option<Signal>>>(pid: Pid, sig: T) -> Result<> {
    let data = match sig.into() {
        Some(s) => s as c_int,
        None => 0,
    };
    unsafe {
        ptrace_other(Request::PT_STEP, pid, ptr::null_mut(), data).map(drop)
    }
}

/// Reads a word from a processes memory at the given address
/// Technically, ptrace doesn't dereference the pointer. It passes it directly
/// to the kernel.
#[allow(clippy::not_unsafe_ptr_arg_deref)]
pub fn read(pid: Pid, addr: AddressType)
-> Result<c_int> {
    unsafe {
        // Traditionally there was a difference between reading data or
        // instruction memory but not in modern systems.
        ptrace_other(Request::PT_READ_D, pid, addr, 0)
    }
}

/// Writes a word into the processes memory at the given address
/// Technically, ptrace doesn't dereference the pointer. It passes it directly
/// to the kernel.
#[allow(clippy::not_unsafe_ptr_arg_deref)]
pub fn write(pid: Pid, addr: AddressType, data: c_int) -> Result<> {

```

```
unsafe { ptrace_other(Request::PT_WRITE_D, pid, addr, data).map(drop) }  
}
```

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Version 1.0 - 22 November 2005

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Version 1.1 - 26 February 2007

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"#

1.418 thiserror-impl 2.0.17

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1.419 pin-project-internal 1.1.10

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1.421 serde_json 1.0.145

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1.423 unbound 1.24.2

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1.424 python 3.13.11

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Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see <https://www.cwi.nl>) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see <https://www.cnri.reston.va.us>) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see <https://www.python.org/psf/>) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

All

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1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now		
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1.426 rust-openssl 0.10.75

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1.427 tracing-subscriber 0.3.22

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1.428 libc 0.2.178

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//! This file contains the BSD APIs available in Haiku. It corresponds to the
//! header files in `headers/compatibility/bsd`.

//!

//! Note that Haiku's BSD compatibility is a combination of system APIs and
//! utility libraries. There should only be system APIs in `libc`. When you are
//! trying to determine whether something should be included in this file, the
//! best indicator is whether it also exists in the BSD-specific definitions in
//! this libc crate.

use crate::prelude::*;

// stringlist.h (utility library)

// Note: this is kept because it was previously introduced

pub type StringList = _stringlist;

s! {

 // stringlist.h (utility library)

 // Note: this is kept because it was previously introduced

 pub struct _stringlist {

 pub sl_str: *mut *mut c_char,

 pub sl_max: size_t,

 pub sl_cur: size_t,

 }

 // sys/event.h

 pub struct kevent {

 pub ident: crate::uintptr_t,

```

    pub filter: c_short,
    pub flags: c_ushort,

    pub fflags: c_uint,
    pub data: i64,
    pub udata: *mut c_void,
    pub ext: [u64; 4],
}

// sys/link_elf.h
pub struct dl_phdr_info {
    pub dlpi_addr: crate::Elf_Addr,
    pub dlpi_name: *const c_char,
    pub dlpi_phdr: *const crate::Elf_Phdr,
    pub dlpi_phnum: crate::Elf_Half,
}
}

// sys/event.h
pub const EVFILT_READ: i16 = -1;
pub const EVFILT_WRITE: i16 = -2;
pub const EVFILT_PROC: i16 = -5;
pub const EV_ADD: u16 = 0x0001;
pub const EV_DELETE: u16 = 0x0002;
pub const EV_ONESHOT: u16 = 0x0010;
pub const EV_CLEAR: u16 = 0x0020;
pub const EV_EOF: u16 = 0x8000;
pub const EV_ERROR: u16 = 0x4000;
pub const NOTE_EXIT: u32 = 0x80000000;

// sys/ioccom.h
pub const IOC_VOID: c_ulong = 0x20000000;
pub const IOC_OUT: c_ulong = 0x40000000;
pub const IOC_IN: c_ulong = 0x80000000;
pub const IOC_INOUT: c_ulong = IOC_IN | IOC_OUT;
pub const IOC_DIRMASK: c_ulong = 0xe0000000;

#[link(name = "bsd")]
extern "C" {
    // stdlib.h
    pub fn daemon(nochdir:
c_int, noclose: c_int) -> c_int;
    pub fn getprogname() -> *const c_char;
    pub fn setprogname(progname: *const c_char);
    pub fn arc4random() -> u32;
    pub fn arc4random_uniform(upper_bound: u32) -> u32;
    pub fn arc4random_buf(buf: *mut c_void, n: size_t);
    pub fn mkstemp(template: *mut c_char, suffixlen: c_int) -> c_int;

```

```

pub fn strtonum(
    nptr: *const c_char,
    minval: c_longlong,
    maxval: c_longlong,
    errstr: *mut *const c_char,
) -> c_longlong;

// pty.h
pub fn openpty(
    amaster: *mut c_int,
    aslave: *mut c_int,
    name: *mut c_char,
    term: *mut crate::termios,
    winp: *mut crate::winsize,
) -> c_int;
pub fn login_tty(_fd: c_int) -> c_int;
pub fn forkpty(
    amaster: *mut c_int,
    name: *mut c_char,
    term: *mut crate::termios,
    winp: *mut crate::winsize,
) -> crate::pid_t;

// string.h
pub fn strsep(string: *mut *mut c_char, delimiters:
*const c_char) -> *mut c_char;
pub fn explicit_bzero(buf: *mut c_void, len: size_t);

// stringlist.h (utility library)
// Note: this is kept because it was previously introduced
pub fn sl_init() -> *mut StringList;
pub fn sl_add(sl: *mut StringList, n: *mut c_char) -> c_int;
pub fn sl_free(sl: *mut StringList, i: c_int);
pub fn sl_find(sl: *mut StringList, n: *mut c_char) -> *mut c_char;

// sys/event.h
pub fn kqueue() -> c_int;
pub fn kevent(
    kq: c_int,
    changelist: *const kevent,
    nchanges: c_int,
    eventlist: *mut kevent,
    nevents: c_int,
    timeout: *const crate::timespec,
) -> c_int;

// sys/link_elf.h
pub fn dl_iterate_phdr(

```

```

callback: Option<
  unsafe extern "C" fn(info: *mut dl_phdr_info, size: usize, data: *mut c_void) -> c_int,
>,
data: *mut c_void,
) -> c_int;

// sys/time.h
pub fn lutimes(file: *const c_char, times: *const crate::timeval)
-> c_int;

// sys/uio.h
pub fn preadv(
  fd: c_int,
  iov: *const crate::iovec,
  iovcnt: c_int,
  offset: crate::off_t,
) -> ssize_t;
pub fn pwritev(
  fd: c_int,
  iov: *const crate::iovec,
  iovcnt: c_int,
  offset: crate::off_t,
) -> ssize_t;

// sys/wait.h
pub fn wait4(
  pid: crate::pid_t,
  status: *mut c_int,
  options: c_int,
  rusage: *mut crate::rusage,
) -> crate::pid_t;
}
//! Interfaces common across the BSD family.

```

1.429 derive_more 2.1.0

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1.430 semver 1.0.27

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1.435 derive_more-impl 2.1.0

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1.436 openssl-sys 0.9.111

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1.437 tracing-core 0.1.35

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1.438 python-ujson 5.11.0

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Portions of code from MODP_ASCII - Ascii transformations (upper/lower, etc)
<https://github.com/client9/stringencoders>

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1.439 http 1.4.0

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Upstream-Name: tarantool-http

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Source: <https://github.com/tarantool/http>

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1.440 crypto-common 0.1.7

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1.445 pythonurllib 2.6.1

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(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

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1.454 nginx 1.28.1

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1.455 libarchive 3.8.5

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1.456 v4l-utils

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In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

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"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

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(For example, a function in a library to compute square roots has
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However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License.

Section 6 states

terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

^L

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- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under

Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

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- c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
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^L

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^L

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Ty Coon, President of Vice

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Return-Path: bill@thedirks.org

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Received: from localhost (localhost.localdomain [127.0.0.1]) by zmta01.collab.prod.int.phx2.redhat.com (Postfix) with ESMTP id B6AB39081C; Wed, 19 May 2010 02:43:28 -0400 (EDT)

Received: from zmta01.collab.prod.int.phx2.redhat.com ([127.0.0.1]) by localhost (zmta01.collab.prod.int.phx2.redhat.com [127.0.0.1]) (amavisd-new, port 10024) with ESMTP id ieqQbA5XErc0; Wed, 19 May 2010 02:43:28 -0400 (EDT)

Received: from int-mx04.intmail.prod.int.phx2.redhat.com (int-mx04.intmail.prod.int.phx2.redhat.com [10.5.11.17]) by zmta01.collab.prod.int.phx2.redhat.com (Postfix) with ESMTP id A451890805; Wed, 19 May 2010 02:43:28 -0400 (EDT)

Received: from mx1.redhat.com (ext-mx02.extmail.prod.ext.phx2.redhat.com [10.5.110.6]) by int-mx04.intmail.prod.int.phx2.redhat.com (8.13.8/8.13.8) with ESMTP id o4J6hSHT030087; Wed, 19 May 2010 02:43:28 -0400

Received: from gs8.inmotionhosting.com (gs8b.inmotionhosting.com [74.124.194.50]) by mx1.redhat.com (8.13.8/8.13.8) with ESMTP id o4J6hH34025980; Wed, 19 May 2010 02:43:17 -0400

Received: from 75-54-226-58.lightspeed.frmtca.sbcglobal.net ([75.54.226.58] helo=[192.168.1.67]) by gs8.inmotionhosting.com with esmtpsa (TLSv1:AES256-SHA:256) (Exim 4.69)

(envelope-from <bill@thedirks.org>)

id 1OEd8K-0004wo-An; Tue, 18 May 2010 23:52:00 -0700

Message-ID: <4BF38878.9030208@thedirks.org>

Date: Tue, 18 May 2010 23:43:04 -0700

From: Bill Dirks <bill@thedirks.org>

User-Agent: Mozilla/5.0 (Windows; U; Windows NT 6.1; en-US; rv:1.9.1.9) Gecko/20100317 Thunderbird/3.0.4

MIME-Version: 1.0

To: Hans de Goede <hdegoede@redhat.com>

CC: Huzaifa Sidhpurwala <huzaifas@redhat.com>

Subject: Re: License question about v4l1-compat.c

References: <4BF2445B.2080203@redhat.com>

In-Reply-To: <4BF2445B.2080203@redhat.com>

Content-Type: text/plain;

charset=ISO-8859-1; format=flowed
Content-Transfer-Encoding: 7bit
X-AntiAbuse: This header was added to track abuse, please include it with any abuse report
X-AntiAbuse: Primary Hostname - gs8.inmotionhosting.com
X-AntiAbuse: Original Domain - redhat.com
X-AntiAbuse: Originator/Caller UID/GID - [47 12] / [47 12]
X-AntiAbuse: Sender Address Domain - thedirks.org
X-Source:
X-Source-Args:
X-Source-Dir:
X-RedHat-Spam-Score: 0 ()
X-Scanned-By: MIMEDefang 2.67 on 10.5.11.17
X-Scanned-By: MIMEDefang 2.67 on 10.5.110.6

Hi, Hans. Nice to 'meet' you.

Yes, that's fine. Take what you need from my code and use it in your
LGPL licensed library. I'm all in favor of removing v4l1 from the kernel.

Bill.

On 5/18/2010 12:40 AM, Hans de Goede wrote:

> Hi Bill,
>
> AFAIK you've been out of the v4l loop, so I assume you
> don't know me, this let me start with a shot self introduction:
>
> I'm a Linux enthusiast / developer. Amongst other things I've
> ported over many webcam drivers from v4l1
> to v4l2 and I'm the
> author and maintainer of libv4l.
>
> Let me also quickly introduce libv4l about 3 years ago I had
> too much free time and was looking for a hobby project and I
> decided that improving webcam support under Linux would be
> a nice project. At that time there were many webcam driver but
> most of them were out of tree, including the gspca driver
> which is a usb webcam driver framework supporting a lot
> of different chipsets.
>
> One problem with getting these merged is that a lot of webcam
> chipsets produce proprietary (compressed) video formats, which
> apps don't understand. The out of tree drivers all "fixed" this
> by doing decompression and video format conversion inside the
> kernel.
>
> This was not acceptable thus it was time to write a library

> to sit between v4l2 apps and devices which could do format
> conversion if necessary. This resulted in libv4l2 and
> libv4lconvert being written, with libv4l2 being the glue sitting
> in between and libv4lconvert
> doing the actual conversion.
>
> But this did not help v4l1 apps, so I also wrote libv4l1 for those.
>
> Both libv4l1 and libv4l2 work by emulating the raw device API, all
> one needs to do is write v4lx_open instead of plain open when opening
> the device and then use v4lx_ioctl, etc. on the resulting fd instead
> of their plain versions. This serves 2 purposes:
> 1) It makes porting of apps the the library trivial
> 2) It allows for an LD_PRELOAD shim (used for proprietary apps such
> as skype).
>
> And now (finally) my question to you, lately we (the v4l devs) have
> been working on removing the last bits of v4l1 from the kernel.
> We would like to also remove the v4l1 ioctl compatibility (*), but
> currently libv4l1 depends on the v4l1 ioctl compatibility for some
> ioctls.
>
> Fixing this comes down to looking at what the kernel compat code
> does and then implementing that in libv4l1. This will likely involve
> some direct copying and libv4l1 is licensed under the LGPL rather
>
> then the GPL. Thus my question is would it be ok to use your v4l1 compat
> code under the LGPL inside libv4l1 ?
>
> Thanks & Regards,
>
> Hans
>
>
> (*) As in practice v4l1 apps need libv4l1 anyways both for format
> conversion and because some v4l2 drivers don't implement VIDIOCGMBUF
> including rather important ones like the UVC driver, thus we've
> come to the conclusion that we might just as well drop the
> compatibility from the kernel
>

#####

Return-Path: kraxel@redhat.com

Received: from zmta02.collab.prod.int.phx2.redhat.com (LHLO

zmta02.collab.prod.int.phx2.redhat.com) (10.5.5.32) by

mail06.corp.redhat.com with LMTP; Wed, 19 May 2010 04:25:49 -0400 (EDT)

Received: from localhost (localhost.localdomain [127.0.0.1])
by zmta02.collab.prod.int.phx2.redhat.com (Postfix) with ESMTP id BA56C9C63A
for <hdegoede@redhat.com>; Wed, 19 May 2010 04:25:49 -0400 (EDT)
Received: from zmta02.collab.prod.int.phx2.redhat.com
([127.0.0.1])
by localhost (zmta02.collab.prod.int.phx2.redhat.com [127.0.0.1]) (amavisd-new, port 10024)
with ESMTP id JBJ9UuFZvkuv for <hdegoede@redhat.com>;
Wed, 19 May 2010 04:25:49 -0400 (EDT)
Received: from int-mx08.intmail.prod.int.phx2.redhat.com (int-mx08.intmail.prod.int.phx2.redhat.com [10.5.11.21])
by zmta02.collab.prod.int.phx2.redhat.com (Postfix) with ESMTP id 9E8119C608
for <hdegoede@mail.corp.redhat.com>; Wed, 19 May 2010 04:25:49 -0400 (EDT)
Received: from zweiblum.home.kraxel.org (vpn1-7-147.ams2.redhat.com [10.36.7.147])
by int-mx08.intmail.prod.int.phx2.redhat.com (8.13.8/8.13.8) with ESMTP id o4J8PjFh018889
(version=TLSv1/SSLv3 cipher=DHE-RSA-AES256-SHA bits=256 verify=NO)
for <hdegoede@redhat.com>; Wed, 19 May 2010 04:25:47 -0400
Message-ID: <4BF3A088.4050101@redhat.com>
Date: Wed, 19 May 2010 10:25:44 +0200
From: Gerd Hoffmann <kraxel@redhat.com>
User-Agent: Mozilla/5.0 (X11; U; Linux x86_64; en-US; rv:1.9.1.9) Gecko/20100430 Fedora/3.0.4-2.fc12
Thunderbird/3.0.4
MIME-Version: 1.0
To: Hans de Goede <hdegoede@redhat.com>
Subject: Re: Re-licensing v4l1-compat.c code which you wrote
References: <4BF3A064.7080602@redhat.com>
In-Reply-To: <4BF3A064.7080602@redhat.com>
Content-Type: text/plain; charset=ISO-8859-1; format=flowed
Content-Transfer-Encoding: 7bit
X-Scanned-By: MIMEDefang 2.67 on 10.5.11.21

Hi,

> My question to you is would it be ok to use your v4l1 compat
> contributions under the LGPL inside libv4l1 ?

Fine with me.

cheers,
Gerd

#####

Return-Path: hverkuil@xs4all.nl
Received: from zmta02.collab.prod.int.phx2.redhat.com (LHLO
zmta02.collab.prod.int.phx2.redhat.com) (10.5.5.32) by
mail06.corp.redhat.com with LMTP; Wed, 19 May 2010 04:28:02 -0400 (EDT)
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from zmta02.collab.prod.int.phx2.redhat.com ([127.0.0.1])

by localhost (zmta02.collab.prod.int.phx2.redhat.com [127.0.0.1]) (amavisd-new, port 10024)

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Received: from int-mx03.intmail.prod.int.phx2.redhat.com (int-mx03.intmail.prod.int.phx2.redhat.com [10.5.11.16])

by zmta02.collab.prod.int.phx2.redhat.com (Postfix) with ESMTP id CFAC29C608;

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Received: from mx1.redhat.com (ext-mx10.extmail.prod.ext.phx2.redhat.com [10.5.110.14])

by int-mx03.intmail.prod.int.phx2.redhat.com (8.13.8/8.13.8) with ESMTP id o4J8S2bj019331;

Wed, 19 May 2010 04:28:02 -0400

Received: from smtp-vbr8.xs4all.nl (smtp-vbr8.xs4all.nl [194.109.24.28])

by mx1.redhat.com (8.13.8/8.13.8) with ESMTP id o4J8Rp9r025653;

Wed, 19 May 2010 04:27:51 -0400

Received: from webmail.xs4all.nl (dovemail13.xs4all.nl [194.109.26.15])

by smtp-vbr8.xs4all.nl (8.13.8/8.13.8) with ESMTP id o4J8RiZq008091;

Wed, 19 May 2010 10:27:45

+0200 (CEST)

(envelope-from hverkuil@xs4all.nl)

Received: from 62.70.2.252

(SquirrelMail authenticated user hverkuil)

by webmail.xs4all.nl with HTTP;

Wed, 19 May 2010 10:27:50 +0200

Message-ID: <3968c0dc456676eb0b1652936d795482.squirrel@webmail.xs4all.nl>

In-Reply-To: <4BF3A064.7080602@redhat.com>

References: <4BF3A064.7080602@redhat.com>

Date: Wed, 19 May 2010 10:27:50 +0200

Subject: Re: Re-licensing v4l1-compat.c code which you wrote

From: "Hans Verkuil" <hverkuil@xs4all.nl>

To: "Hans de Goede" <hdegoede@redhat.com>

Cc: "Gerd Hoffmann" <kraxel@redhat.com>,

"Mauro Carvalho Chehab" <mchehab@redhat.com>,

"Trent Piepho" <xyzy@speakeasy.org>,

"Huzaifa Sidhpurwala" <huzaifas@redhat.com>

User-Agent: SquirrelMail/1.4.18

MIME-Version: 1.0

Content-Type: text/plain; charset=iso-8859-1

Content-Transfer-Encoding: 8bit

X-Virus-Scanned: by XS4ALL Virus Scanner

X-RedHat-Spam-Score: -0.02 (RCVD_IN_DNSWL_NONE,T_RP_MATCHES_RCVD)

X-Scanned-By: MIMEDefang

2.67 on 10.5.11.16

X-Scanned-By: MIMEDefang 2.67 on 10.5.110.14

> Hi All,

>

> I'm writing you all because you've contributed patches

> to the kernels v4l1 ioctl compat code living in v4l1-compat.c
>
> Most of you already know me, and know that I'm working on
> making libv4l1 become independent of the kernel v4l1 ioctl
> compat code, so that it can be removed from the kernel.
>
> For those who don't know me or the v4l1 cleanup effort,
> read below for the long story.
>
> Making libv4l1 independent of the v4l1-compat.c code in the
> kernel comes down to looking at what the kernel compat code
> does and then implementing that in libv4l1. This will likely involve
> some direct copying and libv4l1 is licensed under the LGPL rather
> than the GPL. I already have permission from Bill Dirks who wrote
> the initial v4l1-compat code to do this.
>
> My question to you is would it be ok to use your v4l1 compat
> contributions under the LGPL inside libv4l1 ?

Permission granted.

Looking

forward to seeing this in libv4l1 so we can kill this legacy code
in the kernel.

Regards,

Hans Verkuil

>
> Thanks & Regards,
>
> Hans
>
>
> The long story:
>
> I'm a Linux enthusiast / developer. Amongst other things I've
> ported over many webcam drivers from v4l1 to v4l2 and I'm the
> author and maintainer of libv4l.
>
> Let me also quickly introduce libv4l about 3 years ago I had
> too much free time and was looking for a hobby project and I
> decided that improving webcam support under Linux would be
> a nice project. At that time there were many webcam driver but
> most of them were out of tree, including the gspca driver
> which is a usb webcam driver framework supporting a lot
> of different chipsets.

>
> One problem with getting these merged is that a lot of webcam
> chipsets produce proprietary (compressed) video formats, which
> apps don't understand. The out of tree drivers all "fixed" this
> by doing decompression and video format conversion inside the
> kernel.
>
>
This was not acceptable thus it was time to write a library
> to sit between v4l2 apps and devices which could do format
> conversion if necessary. This resulted in libv4l2 and
> libv4lconvert being written, with libv4l2 being the glue sitting
> in between and libv4lconvert doing the actual conversion.
>
> But this did not help v4l1 apps, so I also wrote libv4l1 for those.
>
> Both libv4l1 and libv4l2 work by emulating the raw device API, all
> one needs to do is write v4lx_open instead of plain open when opening
> the device and then use v4lx_ioctl, etc. on the resulting fd instead
> of their plain versions. This serves 2 purposes:
> 1) It makes porting of apps the the library trivial
> 2) It allows for an LD_PRELOAD shim (used for proprietary apps such
> as skype).
>
> Lately we (the v4l devs) have been working on removing the last bits
> of v4l1 from the kernel. We would like to also remove the v4l1 ioctl
> compatibility (*), but currently libv4l1 depends on the v4l1 ioctl
>
compatibility for some ioctls, we are working on fixing this
> which involves re-using code from v4l1-compat.c, hence the
> re-licensing permission question.
>
> (*) As in practice v4l1 apps need libv4l1 anyways both for format
> conversion and because some v4l2 drivers don't implement VIDIOCGMBUF
> including rather important ones like the UVC driver, thus we've
> come to the conclusion that we might just as well drop the
> compatibility from the kernel.
>

--

Hans Verkuil - video4linux developer - sponsored by TANDBERG, part of Cisco

#####

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Date: Wed, 19 May 2010 11:24:57 -0300
From: Mauro Carvalho Chehab <mchehab@kernel.org>
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Subject: Re: Re-licensing v4l1-compat.c code which you wrote
References: <4BF3A064.7080602@redhat.com>
In-Reply-To: <4BF3A064.7080602@redhat.com>
Content-Type: text/plain; charset=ISO-8859-1
Content-Transfer-Encoding: 7bit
X-Scanned-By: MIMEDefang 2.67 on 10.5.11.21

Hans de Goede wrote:

> Hi All,
>
> I'm writing you all because you've contributed patches
> to the kernels v4l1 ioctl compat code living in v4l1-compat.c
>
> Most of you already know me, and know that I'm working on
> making libv4l1 become independent of the kernel v4l1 ioctl
> compat code, so that it can be removed from the kernel.
>
> For those who don't know me or the v4l1 cleanup effort,
> read below for the long story.
>
> Making libv4l1 independent of the v4l1-compat.c code in the
> kernel comes down to looking at what the kernel compat code

> does and then implementing
that in libv4l1. This will likely involve
> some direct copying and libv4l1 is licensed under the LGPL rather
> then the GPL. I already have permission from Bill Dirks who wrote
> the initial v4l1-compat code to do this.
>
> My question to you is would it be ok to use your v4l1 compat
> contributions under the LGPL inside libv4l1 ?

LGPL for v4l1-compat code is fine for me.

Cheers,
Mauro

#####

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1.457 libunwind 1.9.0-pre

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1.458 com.android.talkback

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1.459 imx-optee-os 3.16.0

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1.460 imx-optee-client 3.16.0

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