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1.3 batik 1.7

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1.23 JBoss Drools 4.0.7

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1.24 JCraft JSch 0.1.50

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```
/* -*-mode:java; c-basic-offset:2; indent-tabs-mode:nil -*- */  
/*
```

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```
*/
```

```
package com.jcraft.jsch;
```

```
public class Buffer{  
    final byte[] tmp=new byte[4];  
    byte[] buffer;  
    int index;  
    int s;  
    public Buffer(int size){  
        buffer=new byte[size];  
        index=0;  
        s=0;  
    }  
    public Buffer(byte[] buffer){  
        this.buffer=buffer;
```

```

    index=0;
    s=0;
}
public Buffer(){ this(1024*10*2); }
public void putByte(byte foo){
    buffer[index++]=foo;
}
public void putByte(byte[] foo) {
    putByte(foo, 0, foo.length);
}
public void putByte(byte[] foo, int begin, int length) {
    System.arraycopy(foo, begin, buffer, index, length);
    index+=length;
}
public void putString(byte[] foo){
    putString(foo, 0, foo.length);
}
public void putString(byte[] foo, int begin, int length) {
    putInt(length);
    putByte(foo, begin, length);
}
public void putInt(int val) {
    tmp[0]=(byte)(val >>> 24);
    tmp[1]=(byte)(val >>> 16);
    tmp[2]=(byte)(val >>> 8);
    tmp[3]=(byte)(val);
    System.arraycopy(tmp, 0, buffer, index, 4);
    index+=4;
}
public void putLong(long val) {
    tmp[0]=(byte)(val >>> 56);
    tmp[1]=(byte)(val >>> 48);
    tmp[2]=(byte)(val >>> 40);
    tmp[3]=(byte)(val >>> 32);
    System.arraycopy(tmp, 0, buffer, index, 4);
    tmp[0]=(byte)(val >>> 24);
    tmp[1]=(byte)(val >>> 16);
    tmp[2]=(byte)(val >>> 8);
    tmp[3]=(byte)(val);
    System.arraycopy(tmp, 0, buffer, index+4, 4);
    index+=8;
}
void skip(int n) {
    index+=n;
}
void putPad(int n) {
    while(n>0){
        buffer[index++]=(byte)0;
    }
}

```

```

        n--;
    }
}

public void putMPIInt(byte[] foo){
    int i=foo.length;
    if((foo[0]&0x80)!=0){
        i++;
        putInt(i);
        putByte((byte)0);
    }
    else{
        putInt(i);
    }
    putByte(foo);
}

public int getLength(){
    return index-s;
}

public int getOffSet(){
    return s;
}

public void setOffSet(int s){
    this.s=s;
}

public long getLong(){
    long foo = getInt()&0xffffffffL;
    foo = ((foo<<32) | (getInt()&0xffffffffL));
    return foo;
}

public int getInt(){
    int foo = getShort();
    foo = ((foo<<16)&0xffff0000) | (getShort()&0xffff);
    return foo;
}

public long getUInt(){
    long foo = 0L;
    long bar = 0L;
    foo = getByte();
    foo = ((foo<<8)&0xff00)|(getByte()&0xff);
    bar = getByte();
    bar = ((bar<<8)&0xff00)|(getByte()&0xff);
    foo = ((foo<<16)&0xffff0000) | (bar&0xffff);
    return foo;
}

int getShort() {
    int foo = getByte();
    foo = ((foo<<8)&0xff00)|(getByte()&0xff);
    return foo;
}

```

```

}
public int getByte() {
    return (buffer[s++]&0xff);
}
public void getByte(byte[] foo) {
    getByte(foo, 0, foo.length);
}
void getByte(byte[] foo, int start, int len) {
    System.arraycopy(buffer, s, foo, start, len);
    s+=len;
}
public int getByte(int len) {
    int foo=s;
    s+=len;
    return foo;
}
public byte[] getMPIInt() {
    int i=getInt(); // uint32
    if(i<0 || // bigger than 0x7fffffff
        i>8*1024){
        // TODO: an exception should be thrown.
        i = 8*1024; // the session will be broken, but working around OOME.
    }
    byte[] foo=new byte[i];
    getByte(foo, 0, i);
    return foo;
}
public byte[] getMPIIntBits() {
    int bits=getInt();
    int bytes=(bits+7)/8;
    byte[] foo=new byte[bytes];
    getByte(foo, 0, bytes);
    if((foo[0]&0x80)!=0){
        byte[] bar=new byte[foo.length+1];
        bar[0]=0; // ??
        System.arraycopy(foo, 0, bar, 1, foo.length);
        foo=bar;
    }
    return foo;
}
public byte[] getString() {
    int i = getInt(); // uint32
    if(i<0 || // bigger than 0x7fffffff
        i>256*1024){
        // TODO: an exception should be thrown.
        i = 256*1024; // the session will be broken, but working around OOME.
    }
    byte[] foo=new byte[i];

```

```

        getByte(foo, 0, i);
        return foo;
    }
    byte[] getString(int[]start, int[]len) {
        int i=getInt();
        start[0]=getByte(i);
        len[0]=i;
        return buffer;
    }
    public void reset(){
        index=0;
        s=0;
    }
    public void shift(){
        if(s==0)return;
        System.arraycopy(buffer, s, buffer, 0, index-s);
        index=index-s;
        s=0;
    }
    void rewind(){
        s=0;
    }

    byte getCommand(){
        return buffer[5];
    }

    void checkFreeSize(int n){
        if(buffer.length<index+n){
            byte[] tmp = new byte[buffer.length*2];
            System.arraycopy(buffer, 0, tmp, 0, index);
            buffer = tmp;
        }
    }

    byte[][] getBytes(int n, String msg) throws JSchException {
        byte[][] tmp = new byte[n][];
        for(int i = 0; i < n; i++){
            int j = getInt();
            if(getLength() < j){
                throw new JSchException(msg);
            }
            tmp[i] = new byte[j];
            getByte(tmp[i]);
        }
        return tmp;
    }
}

```

```

/*
static Buffer fromBytes(byte[]... args){
    int length = args.length*4;
    for(int i = 0; i < args.length; i++){
        length += args[i].length;
    }
    Buffer buf = new Buffer(length);
    for(int i = 0; i < args.length; i++){
        buf.putString(args[i]);
    }
    return buf;
}
*/

static Buffer fromBytes(byte[][] args){
    int length = args.length*4;
    for(int i = 0; i < args.length; i++){
        length += args[i].length;
    }
    Buffer buf = new Buffer(length);
    for(int i = 0; i < args.length; i++){
        buf.putString(args[i]);
    }
    return buf;
}

/*
static String[] chars={
    "0","1","2","3","4","5","6","7","8","9", "a","b","c","d","e","f"
};
static void dump_buffer(){
    int foo;
    for(int i=0; i<tmp_buffer_index; i++){
        foo=tmp_buffer[i]&0xff;
        System.err.print(chars[(foo>>>4)&0xf]);
        System.err.print(chars[foo&0xf]);
        if(i%16==15){
            System.err.println("");
            continue;
        }
        if(i>0 && i%2==1){
            System.err.print(" ");
        }
    }
    System.err.println("");
}

static void dump(byte[] b){

```

```

    dump(b, 0, b.length);
}
static void dump(byte[] b, int s, int l){
    for(int i=s; i<s+l; i++){
        System.err.print(Integer.toHexString(b[i]&0xff)+":");
    }
    System.err.println("");
}
}
*/
}

```

1.25 JFreeChart 1.0.1

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Version 2.1, February 1999

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1.29 jzlib 1.0.7

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```
/* -*-mode:java; c-basic-offset:2; -*- */  
/*
```

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*/

/*

* This program is based on zlib-1.1.3, so all credit should go authors

* Jean-loup Gailly(jloup@gzip.org) and Mark Adler(madler@alumni.caltech.edu)

* and contributors of zlib.

*/

package com.jcraft.jzlib;

final class Adler32{

// largest prime smaller than 65536

static final private int BASE=65521;

// NMAX is the largest n such that 255n(n+1)/2 + (n+1)(BASE-1) <= 2^32-1

static final private int NMAX=5552;

long Adler32(long Adler, byte[] buf, int index, int len){

if(buf == null){ return 1L; }

long s1=Adler&0xffff;

long s2=(Adler>>16)&0xffff;

int k;

while(len > 0) {

k=len<NMAX?len:NMAX;

len-=k;

while(k>=16){

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

s1+=buf[index++]&0xff; s2+=s1;

```

        s1+=buf[index++]&0xff; s2+=s1;
        s1+=buf[index++]&0xff; s2+=s1;
        k-=16;
    }
    if(k!=0){
        do{
            s1+=buf[index++]&0xff; s2+=s1;
        }
        while(--k!=0);
    }
    s1%=BASE;
    s2%=BASE;
}
return (s2<<16)|s1;
}

/*
private java.util.zip.Adler32 Adler32=new java.util.zip.Adler32();
long Adler32(long value, byte[] buf, int index, int len){
    if(value==1) { Adler32.reset();}
    if(buf==null) { Adler32.reset();}
    else { Adler32.update(buf, index, len);}
    return Adler32.getValue();
}
*/
}

```

1.30 leveldbjni 1.2

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```

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1.33 libvirt 0.8.4

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1.34 libxml2 2.9.0 :Fri Jul 10 16:11:34 2009

Daniel Veillard

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 */

#define IN_LIBXML
```

```

#include "libxml.h"

#include <string.h>
#ifdef HAVE_STDLIB_H
#include <stdlib.h>
#endif
#ifdef HAVE_TIME_H
#include <time.h>
#endif

/*
 * Following http://www.ocert.org/advisories/ocert-2011-003.html
 * it seems that having hash randomization might be a good idea
 * when using XML with untrusted data
 */
#ifdef HAVE_CONFIG_H
#include <config.h>
#endif
#ifdef HAVE_LIBXML2
#include <libxml2/libxml.h>
#endif
#ifdef HAVE_LIBXML2_PARSER
#include <libxml2/parser.h>
#endif
#ifdef HAVE_LIBXML2_HASH
#include <libxml2/hash.h>
#endif
#ifdef HAVE_LIBXML2_XMLMEMORY
#include <libxml2/xmlmemory.h>
#endif
#ifdef HAVE_LIBXML2_XMLERROR
#include <libxml2/xmlerror.h>
#endif
#ifdef HAVE_LIBXML2_GLOBALS
#include <libxml2/globals.h>
#endif

#define MAX_HASH_LEN 8

/* #define DEBUG_GROW */

/*
 * A single entry in the hash table
 */
typedef struct _xmlHashEntry xmlHashEntry;
typedef xmlHashEntry *xmlHashEntryPtr;
struct _xmlHashEntry {
    struct _xmlHashEntry *next;
    xmlChar *name;
    xmlChar *name2;
    xmlChar *name3;
    void *payload;
    int valid;
};

/*
 * The entire hash table
 */
struct _xmlHashTable {
    struct _xmlHashEntry *table;

```

```

    int size;
    int nbElems;
    xmlDictPtr dict;
#ifdef HASH_RANDOMIZATION
    int random_seed;
#endif
};

/*
 * xmlHashComputeKey:
 * Calculate the hash key
 */
static unsigned long
xmlHashComputeKey(xmlHashTablePtr table, const xmlChar *name,
                  const xmlChar *name2, const xmlChar *name3) {
    unsigned long value = 0L;
    char ch;

#ifdef HASH_RANDOMIZATION
    value = table->random_seed;
#endif
    if (name != NULL) {
        value += 30 * (*name);
        while ((ch = *name++) != 0) {
            value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
        }
    }
    if (name2 != NULL) {
        while ((ch = *name2++) != 0) {
            value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
        }
    }
    if (name3 != NULL) {
        while ((ch = *name3++) != 0) {
            value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
        }
    }
    return (value % table->size);
}

static unsigned long
xmlHashComputeQKey(xmlHashTablePtr table,
                  const xmlChar *prefix, const xmlChar *name,
                  const xmlChar *prefix2, const xmlChar *name2,
                  const xmlChar *prefix3, const xmlChar *name3) {
    unsigned long value = 0L;
    char ch;

```

```

#ifdef HASH_RANDOMIZATION
    value = table->random_seed;
#endif
    if (prefix != NULL)
value += 30 * (*prefix);
    else
value += 30 * (*name);

    if (prefix != NULL) {
while ((ch = *prefix++) != 0) {
    value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
}
value = value ^ ((value << 5) + (value >> 3) + (unsigned long)');
}
    if (name != NULL) {
while ((ch = *name++) != 0) {
    value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
}
}
    if (prefix2 != NULL) {
while ((ch = *prefix2++) != 0) {
    value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
}
}
    if (name2 != NULL) {
while ((ch = *name2++) != 0) {
    value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
}
}
    if (prefix3 != NULL) {
while ((ch = *prefix3++) != 0) {
    value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
}
value = value ^ ((value << 5) + (value >> 3) + (unsigned long)');
}
    if (name3 != NULL) {
while ((ch = *name3++) != 0) {
    value = value ^ ((value << 5) + (value >> 3) + (unsigned long)ch);
}
}
    return (value % table->size);
}

/**
 * xmlHashCreate:
 * @size: the size of the hash table
 */

```

```

* Create a new xmlHashTablePtr.
*
* Returns the newly created object, or NULL if an error occurred.
*/
xmlHashTablePtr
xmlHashCreate(int size) {
    xmlHashTablePtr table;

    if (size <= 0)
        size = 256;

    table = xmlMalloc(sizeof(xmlHashTable));
    if (table) {
        table->dict = NULL;
        table->size = size;
    table->nbElems = 0;
        table->table = xmlMalloc(size * sizeof(xmlHashEntry));
        if (table->table) {
            memset(table->table, 0, size * sizeof(xmlHashEntry));
#ifdef HASH_RANDOMIZATION
            table->random_seed = __xmlRandom();
#endif
            return(table);
        }
        xmlFree(table);
    }
    return(NULL);
}

/**
* xmlHashCreateDict:
* @size: the size of the hash table
* @dict: a dictionary to use for the hash
*
* Create a new xmlHashTablePtr which will use @dict as the internal dictionary
*
* Returns the newly created object, or NULL if an error occurred.
*/
xmlHashTablePtr
xmlHashCreateDict(int size, xmlDictPtr dict) {
    xmlHashTablePtr table;

    table = xmlHashCreate(size);
    if (table != NULL) {
        table->dict = dict;
    xmlDictReference(dict);
    }
    return(table);
}

```

```

}

/**
 * xmlHashGrow:
 * @table: the hash table
 * @size: the new size of the hash table
 *
 * resize the hash table
 *
 * Returns 0 in case of success, -1 in case of failure
 */
static int
xmlHashGrow(xmlHashTablePtr table, int size) {
    unsigned long key;
    int oldsize, i;
    xmlHashEntryPtr iter, next;
    struct _xmlHashEntry *oldtable;
#ifdef DEBUG_GROW
    unsigned long nbElem = 0;
#endif

    if (table == NULL)
        return(-1);
    if (size < 8)
        return(-1);
    if (size > 8 * 2048)
        return(-1);

    oldsize = table->size;
    oldtable = table->table;
    if (oldtable == NULL)
        return(-1);

    table->table = xmlMalloc(size * sizeof(xmlHashEntry));
    if (table->table == NULL) {
        table->table = oldtable;
        return(-1);
    }
    memset(table->table, 0, size * sizeof(xmlHashEntry));
    table->size = size;

    /* If the two loops are merged, there would be situations where
    a new entry needs to be allocated and data copied into it from
    the main table. So instead, we run through the array twice, first
    copying all the elements in the main array (where we can't get
    conflicts) and then the rest, so we only free (and don't allocate)
    */
    for (i = 0; i < oldsize; i++) {

```

```

if (oldtable[i].valid == 0)
    continue;
key = xmlHashComputeKey(table, oldtable[i].name, oldtable[i].name2,
    oldtable[i].name3);
memcpy(&(table->table[key]), &(oldtable[i]), sizeof(xmlHashEntry));
table->table[key].next = NULL;
}

for (i = 0; i < oldsize; i++) {
iter = oldtable[i].next;
while (iter) {
    next = iter->next;

    /*
     * put back the entry in the new table
     */

    key = xmlHashComputeKey(table, iter->name, iter->name2,
        iter->name3);
    if (table->table[key].valid == 0) {
memcpy(&(table->table[key]), iter, sizeof(xmlHashEntry));
table->table[key].next = NULL;
xmlFree(iter);
    } else {
iter->next = table->table[key].next;
table->table[key].next = iter;
    }

#ifdef DEBUG_GROW
    nbElem++;
#endif

    iter = next;
}
}

xmlFree(oldtable);

#ifdef DEBUG_GROW
xmlGenericError(xmlGenericErrorContext,
    "xmlHashGrow : from %d to %d, %d elems\n", oldsize, size, nbElem);
#endif

return(0);
}

/**
 * xmlHashFree:

```

```

* @table: the hash table
* @f: the deallocator function for items in the hash
*
* Free the hash @table and its contents. The userdata is
* deallocated with @f if provided.
*/
void
xmlHashFree(xmlHashTablePtr table, xmlHashDeallocator f) {
    int i;
    xmlHashEntryPtr iter;
    xmlHashEntryPtr next;
    int inside_table = 0;
    int nbElems;

    if (table == NULL)
return;
    if (table->table) {
nbElems = table->nbElems;
for(i = 0; (i < table->size) && (nbElems > 0); i++) {
    iter = &(table->table[i]);
    if (iter->valid == 0)
continue;
    inside_table = 1;
    while (iter) {
next = iter->next;
if ((f != NULL) && (iter->payload != NULL))
    f(iter->payload, iter->name);
if (table->dict == NULL) {
    if (iter->name)
xmlFree(iter->name);
    if (iter->name2)
xmlFree(iter->name2);
    if (iter->name3)
xmlFree(iter->name3);
}
iter->payload = NULL;
if (!inside_table)
    xmlFree(iter);
nbElems--;
inside_table = 0;
iter = next;
    }
}
xmlFree(table->table);
}
if (table->dict)
    xmlDictFree(table->dict);
xmlFree(table);

```

```

}

/**
 * xmlHashAddEntry:
 * @table: the hash table
 * @name: the name of the userdata
 * @userdata: a pointer to the userdata
 *
 * Add the @userdata to the hash @table. This can later be retrieved
 * by using the @name. Duplicate names generate errors.
 *
 * Returns 0 the addition succeeded and -1 in case of error.
 */
int
xmlHashAddEntry(xmlHashTablePtr table, const xmlChar *name, void *userdata) {
    return(xmlHashAddEntry3(table, name, NULL, NULL, userdata));
}

/**
 * xmlHashAddEntry2:
 * @table: the hash table
 * @name: the name of the userdata
 * @name2: a second name of the userdata
 * @userdata: a pointer to the userdata
 *
 * Add the @userdata to the hash @table. This can later be retrieved
 * by using the (@name, @name2) tuple. Duplicate tuples generate errors.
 *
 * Returns 0 the addition succeeded and -1 in case of error.
 */
int
xmlHashAddEntry2(xmlHashTablePtr table, const xmlChar *name,
    const xmlChar *name2, void *userdata) {
    return(xmlHashAddEntry3(table, name, name2, NULL, userdata));
}

/**
 * xmlHashUpdateEntry:
 * @table: the hash table
 * @name: the name of the userdata
 * @userdata: a pointer to the userdata
 * @f: the deallocator function for replaced item (if any)
 *
 * Add the @userdata to the hash @table. This can later be retrieved
 * by using the @name. Existing entry for this @name will be removed
 * and freed with @f if found.
 *
 * Returns 0 the addition succeeded and -1 in case of error.

```

```

*/
int
xmlHashUpdateEntry(xmlHashTablePtr table, const xmlChar *name,
    void *userdata, xmlHashDeallocator f) {
    return(xmlHashUpdateEntry3(table, name, NULL, NULL, userdata, f));
}

/**
 * xmlHashUpdateEntry2:
 * @table: the hash table
 * @name: the name of the userdata
 * @name2: a second name of the userdata
 * @userdata: a pointer to the userdata
 * @f: the deallocator function for replaced item (if any)
 *
 * Add the @userdata to the hash @table. This can later be retrieved
 * by using the (@name, @name2) tuple. Existing entry for this tuple will
 * be removed and freed with @f if found.
 *
 * Returns 0 the addition succeeded and -1 in case of error.
 */
int
xmlHashUpdateEntry2(xmlHashTablePtr table, const xmlChar *name,
    const xmlChar *name2, void *userdata,
    xmlHashDeallocator f) {
    return(xmlHashUpdateEntry3(table, name, name2, NULL, userdata, f));
}

/**
 * xmlHashLookup:
 * @table: the hash table
 * @name: the name of the userdata
 *
 * Find the userdata specified by the @name.
 *
 * Returns the pointer to the userdata
 */
void *
xmlHashLookup(xmlHashTablePtr table, const xmlChar *name) {
    return(xmlHashLookup3(table, name, NULL, NULL));
}

/**
 * xmlHashLookup2:
 * @table: the hash table
 * @name: the name of the userdata
 * @name2: a second name of the userdata
 *

```

```

* Find the userdata specified by the (@name, @name2) tuple.
*
* Returns the pointer to the userdata
*/
void *
xmlHashLookup2(xmlHashTablePtr table, const xmlChar *name,
               const xmlChar *name2) {
    return(xmlHashLookup3(table, name, name2, NULL));
}

/**
 * xmlHashQLookup:
 * @table: the hash table
 * @prefix: the prefix of the userdata
 * @name: the name of the userdata
 *
 * Find the userdata specified by the QName @prefix:@name/@name.
 *
 * Returns the pointer to the userdata
 */
void *
xmlHashQLookup(xmlHashTablePtr table, const xmlChar *prefix,
               const xmlChar *name) {
    return(xmlHashQLookup3(table, prefix, name, NULL, NULL, NULL, NULL));
}

/**
 * xmlHashQLookup2:
 * @table: the hash table
 * @prefix: the prefix of the userdata
 * @name: the name of the userdata
 * @prefix2: the second prefix of the userdata
 * @name2: a second name of the userdata
 *
 * Find the userdata specified by the QNames tuple
 *
 * Returns the pointer to the userdata
 */
void *
xmlHashQLookup2(xmlHashTablePtr table, const xmlChar *prefix,
                const xmlChar *name, const xmlChar *prefix2,
                const xmlChar *name2) {
    return(xmlHashQLookup3(table, prefix, name, prefix2, name2, NULL, NULL));
}

/**
 * xmlHashAddEntry3:
 * @table: the hash table

```

```

* @name: the name of the userdata
* @name2: a second name of the userdata
* @name3: a third name of the userdata
* @userdata: a pointer to the userdata
*
* Add the @userdata to the hash @table. This can later be retrieved
* by using the tuple (@name, @name2, @name3). Duplicate entries generate
* errors.
*
* Returns 0 the addition succeeded and -1 in case of error.
*/
int
xmlHashAddEntry3(xmlHashTablePtr table, const xmlChar *name,
                 const xmlChar *name2, const xmlChar *name3,
                 void *userdata) {
    unsigned long key, len = 0;
    xmlHashEntryPtr entry;
    xmlHashEntryPtr insert;

    if ((table == NULL) || (name == NULL))
        return(-1);

    /*
     * If using a dict internalize if needed
     */
    if (table->dict) {
        if (!xmlDictOwns(table->dict, name)) {
            name = xmlDictLookup(table->dict, name, -1);
            if (name == NULL)
                return(-1);
        }
        if ((name2 != NULL) && (!xmlDictOwns(table->dict, name2))) {
            name2 = xmlDictLookup(table->dict, name2, -1);
            if (name2 == NULL)
                return(-1);
        }
        if ((name3 != NULL) && (!xmlDictOwns(table->dict, name3))) {
            name3 = xmlDictLookup(table->dict, name3, -1);
            if (name3 == NULL)
                return(-1);
        }
    }

    /*
     * Check for duplicate and insertion location.
     */
    key = xmlHashComputeKey(table, name, name2, name3);
    if (table->table[key].valid == 0) {

```

```

insert = NULL;
    } else {
        if (table->dict) {
            for (insert = &(table->table[key]); insert->next != NULL;
insert = insert->next) {
if ((insert->name == name) &&
    (insert->name2 == name2) &&
    (insert->name3 == name3))
    return(-1);
len++;
    }
    if ((insert->name == name) &&
(insert->name2 == name2) &&
(insert->name3 == name3))
return(-1);
} else {
    for (insert = &(table->table[key]); insert->next != NULL;
insert = insert->next) {
if ((xmlStrEqual(insert->name, name)) &&
    (xmlStrEqual(insert->name2, name2)) &&
    (xmlStrEqual(insert->name3, name3)))
    return(-1);
len++;
    }
    if ((xmlStrEqual(insert->name, name)) &&
(xmlStrEqual(insert->name2, name2)) &&
(xmlStrEqual(insert->name3, name3)))
return(-1);
}
}

if (insert == NULL) {
entry = &(table->table[key]);
    } else {
entry = xmlMalloc(sizeof(xmlHashEntry));
if (entry == NULL)
    return(-1);
    }

if (table->dict != NULL) {
    entry->name = (xmlChar *) name;
    entry->name2 = (xmlChar *) name2;
    entry->name3 = (xmlChar *) name3;
    } else {
entry->name = xmlStrdup(name);
entry->name2 = xmlStrdup(name2);
entry->name3 = xmlStrdup(name3);
    }

```

```

    entry->payload = userdata;
    entry->next = NULL;
    entry->valid = 1;

    if (insert != NULL)
insert->next = entry;

    table->nbElems++;

    if (len > MAX_HASH_LEN)
xmlHashGrow(table, MAX_HASH_LEN * table->size);

    return(0);
}

/**
 * xmlHashUpdateEntry3:
 * @table: the hash table
 * @name: the name of the userdata
 * @name2: a second name of the userdata
 * @name3: a third name of the userdata
 * @userdata: a pointer to the userdata
 * @f: the deallocator function for replaced item (if any)
 *
 * Add the @userdata to the hash @table. This can later be retrieved
 * by using the tuple (@name, @name2, @name3). Existing entry for this tuple
 * will be removed and freed with @f if found.
 *
 * Returns 0 the addition succeeded and -1 in case of error.
 */
int
xmlHashUpdateEntry3(xmlHashTablePtr table, const xmlChar *name,
                    const xmlChar *name2, const xmlChar *name3,
                    void *userdata, xmlHashDeallocator f) {
    unsigned long key;
    xmlHashEntryPtr entry;
    xmlHashEntryPtr insert;

    if ((table == NULL) || name == NULL)
return(-1);

    /*
     * If using a dict internalize if needed
     */
    if (table->dict) {
        if (!xmlDictOwns(table->dict, name)) {
            name = xmlDictLookup(table->dict, name, -1);

```

```

    if (name == NULL)
        return(-1);
}
    if ((name2 != NULL) && (!xmlDictOwns(table->dict, name2))) {
name2 = xmlDictLookup(table->dict, name2, -1);
    if (name2 == NULL)
        return(-1);
}
    if ((name3 != NULL) && (!xmlDictOwns(table->dict, name3))) {
name3 = xmlDictLookup(table->dict, name3, -1);
    if (name3 == NULL)
        return(-1);
}
}

/*
 * Check for duplicate and insertion location.
 */
key = xmlHashComputeKey(table, name, name2, name3);
if (table->table[key].valid == 0) {
insert = NULL;
} else {
    if (table->dict) {
        for (insert = &(table->table[key]); insert->next != NULL;
insert = insert->next) {
if ((insert->name == name) &&
    (insert->name2 == name2) &&
    (insert->name3 == name3)) {
    if (f)
f(insert->payload, insert->name);
    insert->payload = userdata;
    return(0);
}
}
    if ((insert->name == name) &&
(insert->name2 == name2) &&
(insert->name3 == name3)) {
if (f)
    f(insert->payload, insert->name);
insert->payload = userdata;
return(0);
}
} else {
    for (insert = &(table->table[key]); insert->next != NULL;
insert = insert->next) {
if ((xmlStrEqual(insert->name, name)) &&
    (xmlStrEqual(insert->name2, name2)) &&
    (xmlStrEqual(insert->name3, name3))) {

```

```

        if (f)
f(insert->payload, insert->name);
        insert->payload = userdata;
        return(0);
    }
}
    if ((xmlStrEqual(insert->name, name)) &&
(xmlStrEqual(insert->name2, name2)) &&
(xmlStrEqual(insert->name3, name3))) {
    if (f)
        f(insert->payload, insert->name);
    insert->payload = userdata;
    return(0);
    }
}
}

```

```

    if (insert == NULL) {
entry = &(table->table[key]);
    } else {
entry = xmlMalloc(sizeof(xmlHashEntry));
if (entry == NULL)
    return(-1);
    }

```

```

    if (table->dict != NULL) {
        entry->name = (xmlChar *) name;
        entry->name2 = (xmlChar *) name2;
        entry->name3 = (xmlChar *) name3;
    } else {
entry->name = xmlStrdup(name);
entry->name2 = xmlStrdup(name2);
entry->name3 = xmlStrdup(name3);
    }
    entry->payload = userdata;
    entry->next = NULL;
    entry->valid = 1;
    table->nbElems++;

```

```

    if (insert != NULL) {
insert->next = entry;
    }
    return(0);
}

```

```

/**

```

```

* xmlHashLookup3:

```

```

* @table: the hash table
* @name: the name of the userdata
* @name2: a second name of the userdata
* @name3: a third name of the userdata
*
* Find the userdata specified by the (@name, @name2, @name3) tuple.
*
* Returns the a pointer to the userdata
*/
void *
xmlHashLookup3(xmlHashTablePtr table, const xmlChar *name,
               const xmlChar *name2, const xmlChar *name3) {
    unsigned long key;
    xmlHashEntryPtr entry;

    if (table == NULL)
        return(NULL);
    if (name == NULL)
        return(NULL);
    key = xmlHashComputeKey(table, name, name2, name3);
    if (table->table[key].valid == 0)
        return(NULL);
    if (table->dict) {
        for (entry = &(table->table[key]); entry != NULL; entry = entry->next) {
            if ((entry->name == name) &&
                (entry->name2 == name2) &&
                (entry->name3 == name3))
                return(entry->payload);
        }
        for (entry = &(table->table[key]); entry != NULL; entry = entry->next) {
            if ((xmlStrEqual(entry->name, name)) &&
                (xmlStrEqual(entry->name2, name2)) &&
                (xmlStrEqual(entry->name3, name3)))
                return(entry->payload);
        }
        return(NULL);
    }

/**
* xmlHashQLookup3:
* @table: the hash table
* @prefix: the prefix of the userdata
* @name: the name of the userdata
* @prefix2: the second prefix of the userdata
* @name2: a second name of the userdata
* @prefix3: the third prefix of the userdata
* @name3: a third name of the userdata

```

```

*
* Find the userdata specified by the (@name, @name2, @name3) tuple.
*
* Returns the a pointer to the userdata
*/
void *
xmlHashQLookup3(xmlHashTablePtr table,
                 const xmlChar *prefix, const xmlChar *name,
                 const xmlChar *prefix2, const xmlChar *name2,
                 const xmlChar *prefix3, const xmlChar *name3) {
    unsigned long key;
    xmlHashEntryPtr entry;

    if (table == NULL)
        return(NULL);
    if (name == NULL)
        return(NULL);
    key = xmlHashComputeQKey(table, prefix, name, prefix2,
                             name2, prefix3, name3);
    if (table->table[key].valid == 0)
        return(NULL);
    for (entry = &(table->table[key]); entry != NULL; entry = entry->next) {
        if ((xmlStrQEqual(prefix, name, entry->name)) &&
            (xmlStrQEqual(prefix2, name2, entry->name2)) &&
            (xmlStrQEqual(prefix3, name3, entry->name3)))
            return(entry->payload);
    }
    return(NULL);
}

typedef struct {
    xmlHashScanner hashscanner;
    void *data;
} stubData;

static void
stubHashScannerFull (void *payload, void *data, const xmlChar *name,
                     const xmlChar *name2 ATTRIBUTE_UNUSED,
                     const xmlChar *name3 ATTRIBUTE_UNUSED) {
    stubData *stubdata = (stubData *) data;
    stubdata->hashscanner (payload, stubdata->data, (xmlChar *) name);
}

/**
 * xmlHashScan:
 * @table: the hash table
 * @f: the scanner function for items in the hash
 * @data: extra data passed to f

```

```

*
* Scan the hash @table and applied @f to each value.
*/
void
xmlHashScan(xmlHashTablePtr table, xmlHashScanner f, void *data) {
    stubData stubdata;
    stubdata.data = data;
    stubdata.hashscanner = f;
    xmlHashScanFull (table, stubHashScannerFull, &stubdata);
}

/**
 * xmlHashScanFull:
 * @table: the hash table
 * @f: the scanner function for items in the hash
 * @data: extra data passed to f
 *
 * Scan the hash @table and applied @f to each value.
 */
void
xmlHashScanFull(xmlHashTablePtr table, xmlHashScannerFull f, void *data) {
    int i, nb;
    xmlHashEntryPtr iter;
    xmlHashEntryPtr next;

    if (table == NULL)
return;
    if (f == NULL)
return;

    if (table->table) {
for(i = 0; i < table->size; i++) {
    if (table->table[i].valid == 0)
continue;
    iter = &(table->table[i]);
    while (iter) {
next = iter->next;
        nb = table->nbElems;
if ((f != NULL) && (iter->payload != NULL))
    f(iter->payload, data, iter->name,
        iter->name2, iter->name3);
        if (nb != table->nbElems) {
            /* table was modified by the callback, be careful */
            if (iter == &(table->table[i])) {
                if (table->table[i].valid == 0)
                    iter = NULL;
                if (table->table[i].next != next)
                    iter = &(table->table[i]);
            }
        }
    }
}
}

```

```

        } else
        iter = next;
    } else
    iter = next;
}
}
}

/**
 * xmlHashScan3:
 * @table: the hash table
 * @name: the name of the userdata or NULL
 * @name2: a second name of the userdata or NULL
 * @name3: a third name of the userdata or NULL
 * @f: the scanner function for items in the hash
 * @data: extra data passed to f
 *
 * Scan the hash @table and applied @f to each value matching
 * (@name, @name2, @name3) tuple. If one of the names is null,
 * the comparison is considered to match.
 */
void
xmlHashScan3(xmlHashTablePtr table, const xmlChar *name,
             const xmlChar *name2, const xmlChar *name3,
             xmlHashScanner f, void *data) {
    xmlHashScanFull3 (table, name, name2, name3,
                     (xmlHashScannerFull) f, data);
}

/**
 * xmlHashScanFull3:
 * @table: the hash table
 * @name: the name of the userdata or NULL
 * @name2: a second name of the userdata or NULL
 * @name3: a third name of the userdata or NULL
 * @f: the scanner function for items in the hash
 * @data: extra data passed to f
 *
 * Scan the hash @table and applied @f to each value matching
 * (@name, @name2, @name3) tuple. If one of the names is null,
 * the comparison is considered to match.
 */
void
xmlHashScanFull3(xmlHashTablePtr table, const xmlChar *name,
                const xmlChar *name2, const xmlChar *name3,
                xmlHashScannerFull f, void *data) {
    int i;

```

```

xmlHashEntryPtr iter;
xmlHashEntryPtr next;

if (table == NULL)
return;
if (f == NULL)
return;

if (table->table) {
for(i = 0; i < table->size; i++) {
    if (table->table[i].valid == 0)
continue;
    iter = &(table->table[i]);
    while (iter) {
next = iter->next;
if (((name == NULL) || (xmlStrEqual(name, iter->name))) &&
    ((name2 == NULL) || (xmlStrEqual(name2, iter->name2))) &&
    ((name3 == NULL) || (xmlStrEqual(name3, iter->name3))) &&
    (iter->payload != NULL)) {
f(iter->payload, data, iter->name,
    iter->name2, iter->name3);
}
iter = next;
}
}
}
}

/**
 * xmlHashCopy:
 * @table: the hash table
 * @f: the copier function for items in the hash
 *
 * Scan the hash @table and applied @f to each value.
 *
 * Returns the new table or NULL in case of error.
 */
xmlHashTablePtr
xmlHashCopy(xmlHashTablePtr table, xmlHashCopier f) {
    int i;
    xmlHashEntryPtr iter;
    xmlHashEntryPtr next;
    xmlHashTablePtr ret;

    if (table == NULL)
return(NULL);
    if (f == NULL)
return(NULL);

```

```

    ret = xmlHashCreate(table->size);
    if (table->table) {
for(i = 0; i < table->size; i++) {
    if (table->table[i].valid == 0)
continue;
    iter = &(table->table[i]);
    while (iter) {
next = iter->next;
xmlHashAddEntry3(ret, iter->name, iter->name2,
    iter->name3, f(iter->payload, iter->name));
iter = next;
    }
    }
    ret->nbElems = table->nbElems;
    return(ret);
}

/**
 * xmlHashSize:
 * @table: the hash table
 *
 * Query the number of elements installed in the hash @table.
 *
 * Returns the number of elements in the hash table or
 * -1 in case of error
 */
int
xmlHashSize(xmlHashTablePtr table) {
    if (table == NULL)
return(-1);
    return(table->nbElems);
}

/**
 * xmlHashRemoveEntry:
 * @table: the hash table
 * @name: the name of the userdata
 * @f: the deallocator function for removed item (if any)
 *
 * Find the userdata specified by the @name and remove
 * it from the hash @table. Existing userdata for this tuple will be removed
 * and freed with @f.
 *
 * Returns 0 if the removal succeeded and -1 in case of error or not found.
 */
int xmlHashRemoveEntry(xmlHashTablePtr table, const xmlChar *name,

```

```

        xmlHashDeallocator f) {
    return(xmlHashRemoveEntry3(table, name, NULL, NULL, f));
}

/**
 * xmlHashRemoveEntry2:
 * @table: the hash table
 * @name: the name of the userdata
 * @name2: a second name of the userdata
 * @f: the deallocator function for removed item (if any)
 *
 * Find the userdata specified by the (@name, @name2) tuple and remove
 * it from the hash @table. Existing userdata for this tuple will be removed
 * and freed with @f.
 *
 * Returns 0 if the removal succeeded and -1 in case of error or not found.
 */
int
xmlHashRemoveEntry2(xmlHashTablePtr table, const xmlChar *name,
    const xmlChar *name2, xmlHashDeallocator f) {
    return(xmlHashRemoveEntry3(table, name, name2, NULL, f));
}

/**
 * xmlHashRemoveEntry3:
 * @table: the hash table
 * @name: the name of the userdata
 * @name2: a second name of the userdata
 * @name3: a third name of the userdata
 * @f: the deallocator function for removed item (if any)
 *
 * Find the userdata specified by the (@name, @name2, @name3) tuple and remove
 * it from the hash @table. Existing userdata for this tuple will be removed
 * and freed with @f.
 *
 * Returns 0 if the removal succeeded and -1 in case of error or not found.
 */
int
xmlHashRemoveEntry3(xmlHashTablePtr table, const xmlChar *name,
    const xmlChar *name2, const xmlChar *name3, xmlHashDeallocator f) {
    unsigned long key;
    xmlHashEntryPtr entry;
    xmlHashEntryPtr prev = NULL;

    if (table == NULL || name == NULL)
        return(-1);

    key = xmlHashComputeKey(table, name, name2, name3);

```

```

if (table->table[key].valid == 0) {
    return(-1);
} else {
    for (entry = &(table->table[key]); entry != NULL; entry = entry->next) {
        if (xmlStrEqual(entry->name, name) &&
            xmlStrEqual(entry->name2, name2) &&
            xmlStrEqual(entry->name3, name3)) {
            if ((f != NULL) && (entry->payload != NULL))
                f(entry->payload, entry->name);
            entry->payload = NULL;
        }
        if (table->dict == NULL) {
            if(entry->name)
                xmlFree(entry->name);
            if(entry->name2)
                xmlFree(entry->name2);
            if(entry->name3)
                xmlFree(entry->name3);
        }
        if(prev) {
            prev->next = entry->next;
            xmlFree(entry);
        } else {
            if (entry->next == NULL) {
                entry->valid = 0;
            } else {
                entry = entry->next;
            }
            memcpy(&(table->table[key]), entry, sizeof(xmlHashEntry));
            xmlFree(entry);
        }
    }
    table->nbElems--;
    return(0);
}
prev = entry;
}
return(-1);
}
}

```

```
#define bottom_hash
```

```
#include "elfgcchack.h"
```

```
/*
```

```
* list.c: lists handling implementation
```

```
*
```

```
* Copyright (C) 2000 Gary Pennington and Daniel Veillard.
```

```
*
```

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*
* Author: Gary.Pennington@uk.sun.com
*/

```

```

#define IN_LIBXML
#include "libxml.h"

```

```

#include <stdlib.h>
#include <string.h>
#include <libxml/xmlmemory.h>
#include <libxml/list.h>
#include <libxml/globals.h>

```

```

/*
* Type definition are kept internal
*/

```

```

struct _xmlLink
{
    struct _xmlLink *next;
    struct _xmlLink *prev;
    void *data;
};

```

```

struct _xmlList
{
    xmlLinkPtr sentinel;
    void (*linkDeallocator)(xmlLinkPtr );
    int (*linkCompare)(const void *, const void*);
};

```

```

/*****
*
*
* Interfaces
*
*
*****/

```

```

/**
* xmlLinkDeallocator:
* @l: a list
* @lk: a link
*

```

```

* Unlink and deallocate @lk from list @l
*/
static void
xmlLinkDeallocator(xmlListPtr l, xmlLinkPtr lk)
{
    (lk->prev)->next = lk->next;
    (lk->next)->prev = lk->prev;
    if(l->linkDeallocator)
        l->linkDeallocator(lk);
    xmlFree(lk);
}

/**
 * xmlLinkCompare:
 * @data0: first data
 * @data1: second data
 *
 * Compares two arbitrary data
 *
 * Returns -1, 0 or 1 depending on whether data1 is greater equal or smaller
 *      than data0
 */
static int
xmlLinkCompare(const void *data0, const void *data1)
{
    if (data0 < data1)
        return (-1);
    else if (data0 == data1)
        return (0);
    return (1);
}

/**
 * xmlListLowerSearch:
 * @l: a list
 * @data: a data
 *
 * Search data in the ordered list walking from the beginning
 *
 * Returns the link containing the data or NULL
 */
static xmlLinkPtr
xmlListLowerSearch(xmlListPtr l, void *data)
{
    xmlLinkPtr lk;

    if (l == NULL)
        return(NULL);

```

```

    for(lk = l->sentinel->next;lk != l->sentinel && l->linkCompare(lk->data, data) <0 ;lk = lk->next);
    return lk;
}

/**
 * xmlListHigherSearch:
 * @l: a list
 * @data: a data
 *
 * Search data in the ordered list walking backward from the end
 *
 * Returns the link containing the data or NULL
 */
static xmlLinkPtr
xmlListHigherSearch(xmlListPtr l, void *data)
{
    xmlLinkPtr lk;

    if (l == NULL)
        return(NULL);
    for(lk = l->sentinel->prev;lk != l->sentinel && l->linkCompare(lk->data, data) >0 ;lk = lk->prev);
    return lk;
}

/**
 * xmlListSearch:
 * @l: a list
 * @data: a data
 *
 * Search data in the list
 *
 * Returns the link containing the data or NULL
 */
static xmlLinkPtr
xmlListLinkSearch(xmlListPtr l, void *data)
{
    xmlLinkPtr lk;
    if (l == NULL)
        return(NULL);
    lk = xmlListLowerSearch(l, data);
    if (lk == l->sentinel)
        return NULL;
    else {
        if (l->linkCompare(lk->data, data) ==0)
            return lk;
        return NULL;
    }
}

```

```

/**
 * xmlListLinkReverseSearch:
 * @l: a list
 * @data: a data
 *
 * Search data in the list processing backward
 *
 * Returns the link containing the data or NULL
 */
static xmlLinkPtr
xmlListLinkReverseSearch(xmlListPtr l, void *data)
{
    xmlLinkPtr lk;
    if (l == NULL)
        return(NULL);
    lk = xmlListHigherSearch(l, data);
    if (lk == l->sentinel)
        return NULL;
    else {
        if (l->linkCompare(lk->data, data) == 0)
            return lk;
        return NULL;
    }
}

/**
 * xmlListCreate:
 * @dealloc: an optional deallocator function
 * @compare: an optional comparison function
 *
 * Create a new list
 *
 * Returns the new list or NULL in case of error
 */
xmlListPtr
xmlListCreate(xmlListDeallocator deallocator, xmlListDataCompare compare)
{
    xmlListPtr l;
    if (NULL == (l = (xmlListPtr)xmlMalloc( sizeof(xmlList)))) {
        xmlGenericError(xmlGenericErrorContext,
            "Cannot initialize memory for list");
        return (NULL);
    }
    /* Initialize the list to NULL */
    memset(l, 0, sizeof(xmlList));

    /* Add the sentinel */

```

```

if (NULL == (l->sentinel = (xmlLinkPtr)xmlMalloc(sizeof(xmlLink)))) {
    xmlGenericError(xmlGenericErrorContext,
        "Cannot initialize memory for sentinel");
xmlFree(l);
    return (NULL);
}
l->sentinel->next = l->sentinel;
l->sentinel->prev = l->sentinel;
l->sentinel->data = NULL;

/* If there is a link deallocator, use it */
if (deallocator != NULL)
    l->linkDeallocator = deallocator;
/* If there is a link comparator, use it */
if (compare != NULL)
    l->linkCompare = compare;
else /* Use our own */
    l->linkCompare = xmlLinkCompare;
return l;
}

/**
 * xmlListSearch:
 * @l: a list
 * @data: a search value
 *
 * Search the list for an existing value of @data
 *
 * Returns the value associated to @data or NULL in case of error
 */
void *
xmlListSearch(xmlListPtr l, void *data)
{
    xmlLinkPtr lk;
    if (l == NULL)
        return(NULL);
    lk = xmlListLinkSearch(l, data);
    if (lk)
        return (lk->data);
    return NULL;
}

/**
 * xmlListReverseSearch:
 * @l: a list
 * @data: a search value
 *
 * Search the list in reverse order for an existing value of @data

```

```

*
* Returns the value associated to @data or NULL in case of error
*/
void *
xmlListReverseSearch(xmlListPtr l, void *data)
{
    xmlLinkPtr lk;
    if (l == NULL)
        return(NULL);
    lk = xmlListLinkReverseSearch(l, data);
    if (lk)
        return (lk->data);
    return NULL;
}

/**
 * xmlListInsert:
 * @l: a list
 * @data: the data
 *
 * Insert data in the ordered list at the beginning for this value
 *
 * Returns 0 in case of success, 1 in case of failure
 */
int
xmlListInsert(xmlListPtr l, void *data)
{
    xmlLinkPtr lkPlace, lkNew;

    if (l == NULL)
        return(1);
    lkPlace = xmlListLowerSearch(l, data);
    /* Add the new link */
    lkNew = (xmlLinkPtr) xmlMalloc(sizeof(xmlLink));
    if (lkNew == NULL) {
        xmlGenericError(xmlGenericErrorContext,
            "Cannot initialize memory for new link");
        return (1);
    }
    lkNew->data = data;
    lkPlace = lkPlace->prev;
    lkNew->next = lkPlace->next;
    (lkPlace->next)->prev = lkNew;
    lkPlace->next = lkNew;
    lkNew->prev = lkPlace;
    return 0;
}

```

```

/**
 * xmlListAppend:
 * @l: a list
 * @data: the data
 *
 * Insert data in the ordered list at the end for this value
 *
 * Returns 0 in case of success, 1 in case of failure
 */
int xmlListAppend(xmlListPtr l, void *data)
{
    xmlLinkPtr lkPlace, lkNew;

    if (l == NULL)
        return(1);
    lkPlace = xmlListHigherSearch(l, data);
    /* Add the new link */
    lkNew = (xmlLinkPtr) xmlMalloc(sizeof(xmlLink));
    if (lkNew == NULL) {
        xmlGenericError(xmlGenericErrorContext,
            "Cannot initialize memory for new link");
        return (1);
    }
    lkNew->data = data;
    lkNew->next = lkPlace->next;
    (lkPlace->next)->prev = lkNew;
    lkPlace->next = lkNew;
    lkNew->prev = lkPlace;
    return 0;
}

/**
 * xmlListDelete:
 * @l: a list
 *
 * Deletes the list and its associated data
 */
void xmlListDelete(xmlListPtr l)
{
    if (l == NULL)
        return;

    xmlListClear(l);
    xmlFree(l->sentinel);
    xmlFree(l);
}

/**

```

```

* xmlListRemoveFirst:
* @l: a list
* @data: list data
*
* Remove the first instance associated to data in the list
*
* Returns 1 if a deallocation occurred, or 0 if not found
*/
int
xmlListRemoveFirst(xmlListPtr l, void *data)
{
    xmlLinkPtr lk;

    if (l == NULL)
        return(0);
    /*Find the first instance of this data */
    lk = xmlListLinkSearch(l, data);
    if (lk != NULL) {
        xmlLinkDeallocator(l, lk);
        return 1;
    }
    return 0;
}

/**
* xmlListRemoveLast:
* @l: a list
* @data: list data
*
* Remove the last instance associated to data in the list
*
* Returns 1 if a deallocation occurred, or 0 if not found
*/
int
xmlListRemoveLast(xmlListPtr l, void *data)
{
    xmlLinkPtr lk;

    if (l == NULL)
        return(0);
    /*Find the last instance of this data */
    lk = xmlListLinkReverseSearch(l, data);
    if (lk != NULL) {
        xmlLinkDeallocator(l, lk);
        return 1;
    }
    return 0;
}

```

```

/**
 * xmlListRemoveAll:
 * @l: a list
 * @data: list data
 *
 * Remove the all instance associated to data in the list
 *
 * Returns the number of deallocation, or 0 if not found
 */
int
xmlListRemoveAll(xmlListPtr l, void *data)
{
    int count=0;

    if (l == NULL)
        return(0);

    while(xmlListRemoveFirst(l, data))
        count++;
    return count;
}

/**
 * xmlListClear:
 * @l: a list
 *
 * Remove the all data in the list
 */
void
xmlListClear(xmlListPtr l)
{
    xmlLinkPtr lk;

    if (l == NULL)
        return;
    lk = l->sentinel->next;
    while(lk != l->sentinel) {
        xmlLinkPtr next = lk->next;

        xmlLinkDeallocator(l, lk);
        lk = next;
    }
}

/**
 * xmlListEmpty:
 * @l: a list

```

```

*
* Is the list empty ?
*
* Returns 1 if the list is empty, 0 if not empty and -1 in case of error
*/
int
xmlListEmpty(xmlListPtr l)
{
    if (l == NULL)
        return(-1);
    return (l->sentinel->next == l->sentinel);
}

/**
 * xmlListFront:
 * @l: a list
 *
 * Get the first element in the list
 *
 * Returns the first element in the list, or NULL
 */
xmlLinkPtr
xmlListFront(xmlListPtr l)
{
    if (l == NULL)
        return(NULL);
    return (l->sentinel->next);
}

/**
 * xmlListEnd:
 * @l: a list
 *
 * Get the last element in the list
 *
 * Returns the last element in the list, or NULL
 */
xmlLinkPtr
xmlListEnd(xmlListPtr l)
{
    if (l == NULL)
        return(NULL);
    return (l->sentinel->prev);
}

/**
 * xmlListSize:
 * @l: a list

```

```

*
* Get the number of elements in the list
*
* Returns the number of elements in the list or -1 in case of error
*/
int
xmlListSize(xmlListPtr l)
{
    xmlLinkPtr lk;
    int count=0;

    if (l == NULL)
        return(-1);
    /* TODO: keep a counter in xmlList instead */
    for(lk = l->sentinel->next; lk != l->sentinel; lk = lk->next, count++);
    return count;
}

/**
 * xmlListPopFront:
 * @l: a list
 *
 * Removes the first element in the list
 */
void
xmlListPopFront(xmlListPtr l)
{
    if(!xmlListEmpty(l))
        xmlLinkDeallocator(l, l->sentinel->next);
}

/**
 * xmlListPopBack:
 * @l: a list
 *
 * Removes the last element in the list
 */
void
xmlListPopBack(xmlListPtr l)
{
    if(!xmlListEmpty(l))
        xmlLinkDeallocator(l, l->sentinel->prev);
}

/**
 * xmlListPushFront:
 * @l: a list
 * @data: new data

```

```

*
* add the new data at the beginning of the list
*
* Returns 1 if successful, 0 otherwise
*/
int
xmlListPushFront(xmlListPtr l, void *data)
{
    xmlLinkPtr lkPlace, lkNew;

    if (l == NULL)
        return(0);
    lkPlace = l->sentinel;
    /* Add the new link */
    lkNew = (xmlLinkPtr) xmlMalloc(sizeof(xmlLink));
    if (lkNew == NULL) {
        xmlGenericError(xmlGenericErrorContext,
            "Cannot initialize memory for new link");
        return (0);
    }
    lkNew->data = data;
    lkNew->next = lkPlace->next;
    (lkPlace->next)->prev = lkNew;
    lkPlace->next = lkNew;
    lkNew->prev = lkPlace;
    return 1;
}

/**
 * xmlListPushBack:
 * @l: a list
 * @data: new data
 *
 * add the new data at the end of the list
 *
 * Returns 1 if successful, 0 otherwise
 */
int
xmlListPushBack(xmlListPtr l, void *data)
{
    xmlLinkPtr lkPlace, lkNew;

    if (l == NULL)
        return(0);
    lkPlace = l->sentinel->prev;
    /* Add the new link */
    if (NULL == (lkNew = (xmlLinkPtr) xmlMalloc(sizeof(xmlLink)))) {
        xmlGenericError(xmlGenericErrorContext,

```

```

        "Cannot initialize memory for new link");
    return (0);
}
lkNew->data = data;
lkNew->next = lkPlace->next;
(lkPlace->next)->prev = lkNew;
lkPlace->next = lkNew;
lkNew->prev = lkPlace;
return 1;
}

/**
 * xmlLinkGetData:
 * @lk: a link
 *
 * See Returns.
 *
 * Returns a pointer to the data referenced from this link
 */
void *
xmlLinkGetData(xmlLinkPtr lk)
{
    if (lk == NULL)
        return(NULL);
    return lk->data;
}

/**
 * xmlListReverse:
 * @l: a list
 *
 * Reverse the order of the elements in the list
 */
void
xmlListReverse(xmlListPtr l)
{
    xmlLinkPtr lk;
    xmlLinkPtr lkPrev;

    if (l == NULL)
        return;
    lkPrev = l->sentinel;
    for (lk = l->sentinel->next; lk != l->sentinel; lk = lk->next) {
        lkPrev->next = lkPrev->prev;
        lkPrev->prev = lk;
        lkPrev = lk;
    }
    /* Fix up the last node */

```

```

    lkPrev->next = lkPrev->prev;
    lkPrev->prev = lk;
}

/**
 * xmlListSort:
 * @l: a list
 *
 * Sort all the elements in the list
 */
void
xmlListSort(xmlListPtr l)
{
    xmlListPtr lTemp;

    if (l == NULL)
        return;
    if(xmlListEmpty(l))
        return;

    /* I think that the real answer is to implement quicksort, the
     * alternative is to implement some list copying procedure which
     * would be based on a list copy followed by a clear followed by
     * an insert. This is slow...
     */

    if (NULL ==(lTemp = xmlListDup(l)))
        return;
    xmlListClear(l);
    xmlListMerge(l, lTemp);
    xmlListDelete(lTemp);
    return;
}

/**
 * xmlListWalk:
 * @l: a list
 * @walker: a processing function
 * @user: a user parameter passed to the walker function
 *
 * Walk all the element of the first from first to last and
 * apply the walker function to it
 */
void
xmlListWalk(xmlListPtr l, xmlListWalker walker, const void *user) {
    xmlLinkPtr lk;

    if ((l == NULL) || (walker == NULL))

```

```

        return;
    for(lk = l->sentinel->next; lk != l->sentinel; lk = lk->next) {
        if((walker(lk->data, user)) == 0)
            break;
    }
}

/**
 * xmlListReverseWalk:
 * @l: a list
 * @walker: a processing function
 * @user: a user parameter passed to the walker function
 *
 * Walk all the element of the list in reverse order and
 * apply the walker function to it
 */
void
xmlListReverseWalk(xmlListPtr l, xmlListWalker walker, const void *user) {
    xmlLinkPtr lk;

    if ((l == NULL) || (walker == NULL))
        return;
    for(lk = l->sentinel->prev; lk != l->sentinel; lk = lk->prev) {
        if((walker(lk->data, user)) == 0)
            break;
    }
}

/**
 * xmlListMerge:
 * @l1: the original list
 * @l2: the new list
 *
 * include all the elements of the second list in the first one and
 * clear the second list
 */
void
xmlListMerge(xmlListPtr l1, xmlListPtr l2)
{
    xmlListCopy(l1, l2);
    xmlListClear(l2);
}

/**
 * xmlListDup:
 * @old: the list
 *
 * Duplicate the list

```

```

*
* Returns a new copy of the list or NULL in case of error
*/
xmlListPtr
xmlListDup(const xmlListPtr old)
{
    xmlListPtr cur;

    if (old == NULL)
        return(NULL);
    /* Hmmm, how to best deal with allocation issues when copying
     * lists. If there is a de-allocator, should responsibility lie with
     * the new list or the old list. Surely not both. I'll arbitrarily
     * set it to be the old list for the time being whilst I work out
     * the answer
     */
    if (NULL == (cur = xmlListCreate(NULL, old->linkCompare)))
        return (NULL);
    if (0 != xmlListCopy(cur, old))
        return NULL;
    return cur;
}

/**
 * xmlListCopy:
 * @cur: the new list
 * @old: the old list
 *
 * Move all the element from the old list in the new list
 *
 * Returns 0 in case of success 1 in case of error
 */
int
xmlListCopy(xmlListPtr cur, const xmlListPtr old)
{
    /* Walk the old tree and insert the data into the new one */
    xmlLinkPtr lk;

    if ((old == NULL) || (cur == NULL))
        return(1);
    for(lk = old->sentinel->next; lk != old->sentinel; lk = lk->next) {
        if (0 != xmlListInsert(cur, lk->data)) {
            xmlListDelete(cur);
            return (1);
        }
    }
    return (0);
}

```

```
/* xmlListUnique() */  
/* xmlListSwap */  
#define bottom_list  
#include "elfgcchack.h"
```

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```
/*
 *
 * $Id$
 *
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 *
 *****/

 *
 * A note to trio contributors:
 *
 * Avoid heap allocation at all costs to ensure that the trio functions
 * are async-safe. The exceptions are the printf/fprintf functions, which
 * uses fputc, and the asprintf functions and the <alloc> modifier, which
 * by design are required to allocate from the heap.
 *
 *****/

/*
 * TODO:
 * - Scan is probably too permissive about its modifiers.
 * - C escapes in %#[] ?
 * - Multibyte characters (done for format parsing, except scan groups)
 * - Complex numbers? (C99 _Complex)
 * - Boolean values? (C99 _Bool)
 * - C99 NaN(n-char-sequence) missing. The n-char-sequence can be used
 *   to print the mantissa, e.g. NaN(0xc000000000000000)
 * - Should we support the GNU %a alloc modifier? GNU has an ugly hack
 *   for %a, because C99 used %a for other purposes. If specified as
 *   %as or %a[ it is interpreted as the alloc modifier, otherwise as
 *   the C99 hex-float. This means that you cannot scan %as as a hex-float
 *   immediately followed by an 's'.
 * - Scanning of collating symbols.
 */
```

```

/*****
* Trio include files
*/
#include "triodef.h"
#include "trio.h"
#include "triop.h"
#include "trionan.h"
#if !defined(TRIO_MINIMAL)
# include "triostr.h"
#endif

/*****
*
* Definitions
*
*****/

#include <math.h>
#include <limits.h>
#include <float.h>

#if (defined(__STDC_ISO_10646__) || defined(MB_LEN_MAX) \
    || defined(USE_MULTIBYTE) || TRIO_WIDECHAR) \
    && !defined(_WIN32_WCE)
# define TRIO_COMPILER_SUPPORTS_MULTIBYTE
# if !defined(MB_LEN_MAX)
# define MB_LEN_MAX 6
# endif
#endif

#if (defined(TRIO_COMPILER_MSVC) && (_MSC_VER >= 1100)) || defined(TRIO_COMPILER_BCB)
# define TRIO_COMPILER_SUPPORTS_MSVC_INT
#endif

#if defined(_WIN32_WCE)
#include <winccompat.h>
#endif

/*****
* Generic definitions
*/

#if !(defined(DEBUG) || defined(NDEBUG))
# define NDEBUG
#endif

#include <assert.h>

```

```

#include <ctype.h>
#if !defined(TRIO_COMPILER_SUPPORTS_C99)
# define isblank(x) (((x)==32) || ((x)==9))
#endif
#if defined(TRIO_COMPILER_ANCIENT)
# include <varargs.h>
#else
# include <stdarg.h>
#endif
#include <stddef.h>

#ifdef HAVE_ERRNO_H
#include <errno.h>
#endif

#ifndef NULL
# define NULL 0
#endif
#define NIL ((char)0)
#ifndef FALSE
# define FALSE (1 == 0)
# define TRUE (! FALSE)
#endif
#define BOOLEAN_T int

/* mincore() can be used for debugging purposes */
#define VALID(x) (NULL != (x))

#if TRIO_ERRORS
/*
 * Encode the error code and the position. This is decoded
 * with TRIO_ERROR_CODE and TRIO_ERROR_POSITION.
 */
# define TRIO_ERROR_RETURN(x,y) (- ((x) + ((y) << 8)))
#else
# define TRIO_ERROR_RETURN(x,y) (-1)
#endif

typedef unsigned long trio_flags_t;

/*****
 * Platform specific definitions
 */
#if defined(TRIO_PLATFORM_UNIX)
# include <unistd.h>
# include <signal.h>
# include <locale.h>

```

```

# define USE_LOCALE
#endif /* TRIO_PLATFORM_UNIX */
#if defined(TRIO_PLATFORM_VMS)
# include <unistd.h>
#endif
#if defined(TRIO_PLATFORM_WIN32)
# if defined(_WIN32_WCE)
# include <winccompat.h>
# else
# include <io.h>
# define read _read
# define write _write
# endif
#endif /* TRIO_PLATFORM_WIN32 */

#if TRIO_WIDECHAR
# if defined(TRIO_COMPILER_SUPPORTS_ISO94)
# include <wchar.h>
# include <wctype.h>
typedef wchar_t trio_wchar_t;
typedef wint_t trio_wint_t;
# else
typedef char trio_wchar_t;
typedef int trio_wint_t;
# define WCONST(x) L ## x
# define WEOF EOF
# define iswalnum(x) isalnum(x)
# define iswalppha(x) isalpha(x)
# define iswblank(x) isblank(x)
# define iswcntrl(x) iscntrl(x)
# define iswdigit(x) isdigit(x)
# define iswgraph(x) isgraph(x)
# define iswlower(x) islower(x)
# define iswprint(x) isprint(x)
# define iswpunct(x) ispunct(x)
# define iswspace(x) isspace(x)
# define iswupper(x) isupper(x)
# define iswxdigit(x) isxdigit(x)
# endif
#endif

/*****
* Compiler dependent definitions
*/

/* Support for long long */
#ifndef __cplusplus

```

```

# if !defined(USE_LONGLONG)
# if defined(TRIO_COMPILER_GCC) && !defined(__STRICT_ANSI__)
# define USE_LONGLONG
# elif defined(TRIO_COMPILER_SUNPRO)
# define USE_LONGLONG
# elif defined(_LONG_LONG) || defined(_LONGLONG)
# define USE_LONGLONG
# endif
# endif
#endif

/* The extra long numbers */
#if defined(USE_LONGLONG)
typedef signed long long int trio_longlong_t;
typedef unsigned long long int trio_ulonglong_t;
#elif defined(TRIO_COMPILER_SUPPORTS_MSVC_INT)
typedef signed __int64 trio_longlong_t;
typedef unsigned __int64 trio_ulonglong_t;
#else
typedef TRIO_SIGNED long int trio_longlong_t;
typedef unsigned long int trio_ulonglong_t;
#endif

/* Maximal and fixed integer types */
#if defined(TRIO_COMPILER_SUPPORTS_C99)
# include <stdint.h>
typedef intmax_t trio_intmax_t;
typedef uintmax_t trio_uintmax_t;
typedef int8_t trio_int8_t;
typedef int16_t trio_int16_t;
typedef int32_t trio_int32_t;
typedef int64_t trio_int64_t;
#elif defined(TRIO_COMPILER_SUPPORTS_UNIX98)
# include <inttypes.h>
typedef intmax_t trio_intmax_t;
typedef uintmax_t trio_uintmax_t;
typedef int8_t trio_int8_t;
typedef int16_t trio_int16_t;
typedef int32_t trio_int32_t;
typedef int64_t trio_int64_t;
#elif defined(TRIO_COMPILER_SUPPORTS_MSVC_INT)
typedef trio_longlong_t trio_intmax_t;
typedef trio_ulonglong_t trio_uintmax_t;
typedef __int8 trio_int8_t;
typedef __int16 trio_int16_t;
typedef __int32 trio_int32_t;
typedef __int64 trio_int64_t;
#else

```

```

typedef trio_longlong_t trio_intmax_t;
typedef trio_ulonglong_t trio_uintmax_t;
# if defined(TRIO_INT8_T)
typedef TRIO_INT8_T trio_int8_t;
# else
typedef TRIO_SIGNED char trio_int8_t;
# endif
# if defined(TRIO_INT16_T)
typedef TRIO_INT16_T trio_int16_t;
# else
typedef TRIO_SIGNED short trio_int16_t;
# endif
# if defined(TRIO_INT32_T)
typedef TRIO_INT32_T trio_int32_t;
# else
typedef TRIO_SIGNED int trio_int32_t;
# endif
# if defined(TRIO_INT64_T)
typedef TRIO_INT64_T trio_int64_t;
# else
typedef trio_longlong_t trio_int64_t;
# endif
#endif

#if (!(defined(TRIO_COMPILER_SUPPORTS_C99) \
|| defined(TRIO_COMPILER_SUPPORTS_UNIX01))) \
&& !defined(_WIN32_WCE)
# define floorl(x) floor((double)(x))
# define fmodl(x,y) fmod((double)(x),(double)(y))
# define powl(x,y) pow((double)(x),(double)(y))
#endif

#define TRIO_FABS(x) (((x) < 0.0) ? -(x) : (x))

/*****

* Internal Definitions
*/

#ifndef DECIMAL_DIG
# define DECIMAL_DIG DBL_DIG
#endif

/* Long double sizes */
#ifdef LDBL_DIG
# define MAX_MANTISSA_DIGITS LDBL_DIG
# define MAX_EXPONENT_DIGITS 4
# define MAX_DOUBLE_DIGITS LDBL_MAX_10_EXP
#else

```

```

#define MAX_MANTISSA_DIGITS DECIMAL_DIG
#define MAX_EXPONENT_DIGITS 3
#define MAX_DOUBLE_DIGITS DBL_MAX_10_EXP
#endif

#ifdef TRIO_COMPILER_ANCIENT || !defined(LDBL_DIG)
#undef LDBL_DIG
#undef LDBL_MANT_DIG
#undef LDBL_EPSILON
#define LDBL_DIG DBL_DIG
#define LDBL_MANT_DIG DBL_MANT_DIG
#define LDBL_EPSILON DBL_EPSILON
#endif

/* The maximal number of digits is for base 2 */
#define MAX_CHARS_IN(x) (sizeof(x) * CHAR_BIT)
/* The width of a pointer. The number of bits in a hex digit is 4 */
#define POINTER_WIDTH ((sizeof("0x") - 1) + sizeof(trio_pointer_t) * CHAR_BIT / 4)

/* Infinite and Not-A-Number for floating-point */
#define INFINITE_LOWER "inf"
#define INFINITE_UPPER "INF"
#define LONG_INFINITE_LOWER "infinite"
#define LONG_INFINITE_UPPER "INFINITE"
#define NAN_LOWER "nan"
#define NAN_UPPER "NAN"

#ifdef HAVE_ISASCII && !defined(isascii)
#define isascii(x) ((unsigned int)(x) < 128)
#endif

/* Various constants */
enum {
    TYPE_PRINT = 1,
    TYPE_SCAN = 2,

    /* Flags. FLAGS_LAST must be less than ULONG_MAX */
    FLAGS_NEW = 0,
    FLAGS_STICKY = 1,
    FLAGS_SPACE = 2 * FLAGS_STICKY,
    FLAGS_SHOWSIGN = 2 * FLAGS_SPACE,
    FLAGS_LEFTADJUST = 2 * FLAGS_SHOWSIGN,
    FLAGS_ALTERNATIVE = 2 * FLAGS_LEFTADJUST,
    FLAGS_SHORT = 2 * FLAGS_ALTERNATIVE,
    FLAGS_SHORTSHORT = 2 * FLAGS_SHORT,
    FLAGS_LONG = 2 * FLAGS_SHORTSHORT,
    FLAGS_QUAD = 2 * FLAGS_LONG,
    FLAGS_LONGDOUBLE = 2 * FLAGS_QUAD,

```

```

FLAGS_SIZE_T      = 2 * FLAGS_LONGDOUBLE,
FLAGS_PTRDIFF_T   = 2 * FLAGS_SIZE_T,
FLAGS_INTMAX_T    = 2 * FLAGS_PTRDIFF_T,
FLAGS_NILPADDING  = 2 * FLAGS_INTMAX_T,
FLAGS_UNSIGNED    = 2 * FLAGS_NILPADDING,
FLAGS_UPPER       = 2 * FLAGS_UNSIGNED,
FLAGS_WIDTH       = 2 * FLAGS_UPPER,
FLAGS_WIDTH_PARAMETER = 2 * FLAGS_WIDTH,
FLAGS_PRECISION   = 2 * FLAGS_WIDTH_PARAMETER,
FLAGS_PRECISION_PARAMETER = 2 * FLAGS_PRECISION,
FLAGS_BASE        = 2 * FLAGS_PRECISION_PARAMETER,
FLAGS_BASE_PARAMETER = 2 * FLAGS_BASE,
FLAGS_FLOAT_E     = 2 * FLAGS_BASE_PARAMETER,
FLAGS_FLOAT_G     = 2 * FLAGS_FLOAT_E,
FLAGS_QUOTE       = 2 * FLAGS_FLOAT_G,
FLAGS_WIDECHAR    = 2 * FLAGS_QUOTE,
FLAGS_ALLOC       = 2 * FLAGS_WIDECHAR,
FLAGS_IGNORE      = 2 * FLAGS_ALLOC,
FLAGS_IGNORE_PARAMETER = 2 * FLAGS_IGNORE,
FLAGS_VARSIZE_PARAMETER = 2 * FLAGS_IGNORE_PARAMETER,
FLAGS_FIXED_SIZE  = 2 * FLAGS_VARSIZE_PARAMETER,
FLAGS_LAST        = FLAGS_FIXED_SIZE,
/* Reused flags */
FLAGS_EXCLUDE     = FLAGS_SHORT,
FLAGS_USER_DEFINED = FLAGS_IGNORE,
FLAGS_ROUNDING    = FLAGS_INTMAX_T,
/* Compounded flags */
FLAGS_ALL_VARSIZES = FLAGS_LONG | FLAGS_QUAD | FLAGS_INTMAX_T | FLAGS_PTRDIFF_T
| FLAGS_SIZE_T,
FLAGS_ALL_SIZES   = FLAGS_ALL_VARSIZES | FLAGS_SHORTEST | FLAGS_SHORT,

NO_POSITION = -1,
NO_WIDTH    = 0,
NO_PRECISION = -1,
NO_SIZE     = -1,

/* Do not change these */
NO_BASE     = -1,
MIN_BASE    = 2,
MAX_BASE    = 36,
BASE_BINARY = 2,
BASE_OCTAL  = 8,
BASE_DECIMAL = 10,
BASE_HEX    = 16,

/* Maximal number of allowed parameters */
MAX_PARAMETERS = 64,
/* Maximal number of characters in class */

```

```

MAX_CHARACTER_CLASS = UCHAR_MAX + 1,

/* Maximal string lengths for user-defined specifiers */
MAX_USER_NAME = 64,
MAX_USER_DATA = 256,

/* Maximal length of locale separator strings */
MAX_LOCALE_SEPARATOR_LENGTH = MB_LEN_MAX,
/* Maximal number of integers in grouping */
MAX_LOCALE_GROUPS = 64,

/* Initial size of asprintf buffer */
DYNAMIC_START_SIZE = 32
};

#define NO_GROUPING ((int)CHAR_MAX)

/* Fundamental formatting parameter types */
#define FORMAT_UNKNOWN 0
#define FORMAT_INT 1
#define FORMAT_DOUBLE 2
#define FORMAT_CHAR 3
#define FORMAT_STRING 4
#define FORMAT_POINTER 5
#define FORMAT_COUNT 6
#define FORMAT_PARAMETER 7
#define FORMAT_GROUP 8
#if TRIO_GNU
# define FORMAT_ERRNO 9
#endif
#if TRIO_EXTENSION
# define FORMAT_USER_DEFINED 10
#endif

/* Character constants */
#define CHAR_IDENTIFIER '%'
#define CHAR_BACKSLASH '\\'
#define CHAR_QUOTE '"'
#define CHAR_ADJUST ' '

/* Character class expressions */
#define CLASS_ALNUM "[:alnum:]"
#define CLASS_ALPHA "[:alpha:]"
#define CLASS_BLANK "[:blank:]"
#define CLASS_CNTRL "[:cntrl:]"
#define CLASS_DIGIT "[:digit:]"
#define CLASS_GRAPH "[:graph:]"
#define CLASS_LOWER "[:lower:]"

```

```

#define CLASS_PRINT "[:print:]"
#define CLASS_PUNCT "[:punct:]"
#define CLASS_SPACE "[:space:]"
#define CLASS_UPPER "[:upper:]"
#define CLASS_XDIGIT "[:xdigit:]"

/*
 * SPECIFIERS:
 *
 *
 * a Hex-float
 * A Hex-float
 * c Character
 * C Widechar character (wint_t)
 * d Decimal
 * e Float
 * E Float
 * F Float
 * F Float
 * g Float
 * G Float
 * i Integer
 * m Error message
 * n Count
 * o Octal
 * p Pointer
 * s String
 * S Widechar string (wchar_t *)
 * u Unsigned
 * x Hex
 * X Hex
 * [] Group
 * <> User-defined
 *
 * Reserved:
 *
 * D Binary Coded Decimal %D(length,precision) (OS/390)
 */
#define SPECIFIER_CHAR 'c'
#define SPECIFIER_STRING 's'
#define SPECIFIER_DECIMAL 'd'
#define SPECIFIER_INTEGER 'i'
#define SPECIFIER_UNSIGNED 'u'
#define SPECIFIER_OCTAL 'o'
#define SPECIFIER_HEX 'x'
#define SPECIFIER_HEX_UPPER 'X'
#define SPECIFIER_FLOAT_E 'e'
#define SPECIFIER_FLOAT_E_UPPER 'E'

```

```

#define SPECIFIER_FLOAT_F 'f'
#define SPECIFIER_FLOAT_F_UPPER 'F'
#define SPECIFIER_FLOAT_G 'g'
#define SPECIFIER_FLOAT_G_UPPER 'G'
#define SPECIFIER_POINTER 'p'
#define SPECIFIER_GROUP '['
#define SPECIFIER_UNGROUP ']'
#define SPECIFIER_COUNT 'n'
#if TRIO_UNIX98
# define SPECIFIER_CHAR_UPPER 'C'
# define SPECIFIER_STRING_UPPER 'S'
#endif
#if TRIO_C99
# define SPECIFIER_HEXFLOAT 'a'
# define SPECIFIER_HEXFLOAT_UPPER 'A'
#endif
#if TRIO_GNU
# define SPECIFIER_ERRNO 'm'
#endif
#if TRIO_EXTENSION
# define SPECIFIER_BINARY 'b'
# define SPECIFIER_BINARY_UPPER 'B'
# define SPECIFIER_USER_DEFINED_BEGIN '<'
# define SPECIFIER_USER_DEFINED_END '>'
# define SPECIFIER_USER_DEFINED_SEPARATOR ':'
#endif

/*
* QUALIFIERS:
*
*
* Numbers = d,i,o,u,x,X
* Float = a,A,e,E,f,F,g,G
* String = s
* Char = c
*
*
* 9$ Position
*   Use the 9th parameter. 9 can be any number between 1 and
*   the maximal argument
*
* 9 Width
*   Set width to 9. 9 can be any number, but must not be postfix
*   by '$'
*
* h Short
*   Numbers:
*   (unsigned) short int

```

- *
 - * hh Short short
 - * Numbers:
 - * (unsigned) char
- *
 - * l Long
 - * Numbers:
 - * (unsigned) long int
 - * String:
 - * as the S specifier
 - * Char:
 - * as the C specifier
- *
 - * ll Long Long
 - * Numbers:
 - * (unsigned) long long int
- *
 - * L Long Double
 - * Float
 - * long double
- *
 - * # Alternative
 - * Float:
 - * Decimal-point is always present
 - * String:
 - * non-printable characters are handled as \number
- *
 - * Spacing
- *
 - * + Sign
- *
 - * - Alignment
- *
 - * . Precision
- *
 - * * Parameter
 - * print: use parameter
 - * scan: no parameter (ignore)
- *
 - * q Quad
- *
 - * Z size_t
- *
 - * w Widechar
- *
 - * ' Thousands/quote
 - * Numbers:
 - * Integer part grouped in thousands

```

* Binary numbers:
*   Number grouped in nibbles (4 bits)
* String:
*   Quoted string
*
* j intmax_t
* t ptrdiff_t
* z size_t
*
* ! Sticky
* @ Parameter (for both print and scan)
*
* I n-bit Integer
* Numbers:
*   The following options exists
*   I8 = 8-bit integer
*   I16 = 16-bit integer
*   I32 = 32-bit integer
*   I64 = 64-bit integer
*/
#define QUALIFIER_POSITION '$'
#define QUALIFIER_SHORT 'h'
#define QUALIFIER_LONG 'l'
#define QUALIFIER_LONG_UPPER 'L'
#define QUALIFIER_ALTERNATIVE '#'
#define QUALIFIER_SPACE ' '
#define QUALIFIER_PLUS '+'
#define QUALIFIER_MINUS '-'
#define QUALIFIER_DOT '.'
#define QUALIFIER_STAR '*'
#define QUALIFIER_CIRCUMFLEX '^' /* For scanlists */
#if TRIO_C99
# define QUALIFIER_SIZE_T 'z'
# define QUALIFIER_PTRDIFF_T 't'
# define QUALIFIER_INTMAX_T 'j'
#endif
#if TRIO_BSD || TRIO_GNU
# define QUALIFIER_QUAD 'q'
#endif
#if TRIO_GNU
# define QUALIFIER_SIZE_T_UPPER 'Z'
#endif
#if TRIO_MISC
# define QUALIFIER_WIDECHAR 'w'
#endif
#if TRIO_MICROSOFT
# define QUALIFIER_FIXED_SIZE 'T'
#endif

```

```

#if TRIO_EXTENSION
# define QUALIFIER_QUOTE "\""
# define QUALIFIER_STICKY '!'
# define QUALIFIER_VARSIZE '&' /* This should remain undocumented */
# define QUALIFIER_PARAM '@' /* Experimental */
# define QUALIFIER_COLON ':' /* For scanlists */
# define QUALIFIER_EQUAL '=' /* For scanlists */
# define QUALIFIER_ROUNDING_UPPER 'R'
#endif

/*****
*
* Internal Structures
*
*****/

/* Parameters */
typedef struct {
/* An indication of which entry in the data union is used */
int type;
/* The flags */
trio_flags_t flags;
/* The width qualifier */
int width;
/* The precision qualifier */
int precision;
/* The base qualifier */
int base;
/* The size for the variable size qualifier */
int varsize;
/* The marker of the end of the specifier */
int indexAfterSpecifier;
/* The data from the argument list */
union {
char *string;
#if TRIO_WIDECHAR
trio_wchar_t *wstring;
#endif
trio_pointer_t pointer;
union {
trio_intmax_t as_signed;
trio_uintmax_t as_unsigned;
} number;
double doubleNumber;
double *doublePointer;
trio_long_double_t longdoubleNumber;
trio_long_double_t *longdoublePointer;

```

```

    int errorNumber;
} data;
/* For the user-defined specifier */
char user_name[MAX_USER_NAME];
char user_data[MAX_USER_DATA];
} trio_parameter_t;

/* Container for customized functions */
typedef struct {
    union {
        trio_outstream_t out;
        trio_instream_t in;
    } stream;
    trio_pointer_t closure;
} trio_custom_t;

/* General trio "class" */
typedef struct _trio_class_t {
/*
    * The function to write characters to a stream.
    */
    void (*OutStream) TRIO_PROTO((struct _trio_class_t *, int));
/*
    * The function to read characters from a stream.
    */
    void (*InStream) TRIO_PROTO((struct _trio_class_t *, int *));
/*
    * The current location in the stream.
    */
    trio_pointer_t location;
/*
    * The character currently being processed.
    */
    int current;
/*
    * The number of characters that would have been written/read
    * if there had been sufficient space.
    */
    int processed;
/*
    * The number of characters that are actually written/read.
    * Processed and committed will only differ for the *nprintf
    * and *nscanf functions.
    */
    int committed;
/*
    * The upper limit of characters that may be written/read.
    */

```

```

int max;
/*
 * The last output error that was detected.
 */
int error;
} trio_class_t;

/* References (for user-defined callbacks) */
typedef struct _trio_reference_t {
    trio_class_t *data;
    trio_parameter_t *parameter;
} trio_reference_t;

/* Registered entries (for user-defined callbacks) */
typedef struct _trio_userdef_t {
    struct _trio_userdef_t *next;
    trio_callback_t callback;
    char *name;
} trio_userdef_t;

/*****
 *
 * Internal Variables
 *
 *****/

static TRIO_CONST char rcsid[] = "@(#) $Id$";

/*
 * Need this to workaround a parser bug in HP C/iX compiler that fails
 * to resolves macro definitions that includes type 'long double',
 * e.g: va_arg(arg_ptr, long double)
 */
#ifdef TRIO_PLATFORM_MPEIX
static TRIO_CONST trio_long_double_t ___dummy_long_double = 0;
#endif

static TRIO_CONST char internalNullString[] = "(nil)";

#ifdef USE_LOCALE
static struct lconv *internalLocaleValues = NULL;
#endif

/*
 * UNIX98 says "in a locale where the radix character is not defined,
 * the radix character defaults to a period (.)"
 */
static int internalDecimalPointLength = 1;

```

```

static int internalThousandSeparatorLength = 1;
static char internalDecimalPoint = '.';
static char internalDecimalPointString[MAX_LOCALE_SEPARATOR_LENGTH + 1] = ".";
static char internalThousandSeparator[MAX_LOCALE_SEPARATOR_LENGTH + 1] = ",";
static char internalGrouping[MAX_LOCALE_GROUPS] = { (char)NO_GROUPING };

static TRIO_CONST char internalDigitsLower[] = "0123456789abcdefghijklmnopqrstuvwxyz";
static TRIO_CONST char internalDigitsUpper[] = "0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ";
static BOOLEAN_T internalDigitsUnconverted = TRUE;
static int internalDigitArray[128];
#if TRIO_EXTENSION
static BOOLEAN_T internalCollationUnconverted = TRUE;
static char internalCollationArray[MAX_CHARACTER_CLASS][MAX_CHARACTER_CLASS];
#endif

#if TRIO_EXTENSION
static TRIO_VOLATILE trio_callback_t internalEnterCriticalRegion = NULL;
static TRIO_VOLATILE trio_callback_t internalLeaveCriticalRegion = NULL;
static trio_userdef_t *internalUserDef = NULL;
#endif

/*****
 *
 * Internal Functions
 *
 *****/

#if defined(TRIO_MINIMAL)
# define TRIO_STRING_PUBLIC static
# include "triostr.c"
#endif /* defined(TRIO_MINIMAL) */

/*****
 * TrioIsQualifier
 *
 * Description:
 * Remember to add all new qualifiers to this function.
 * QUALIFIER_POSITION must not be added.
 */
TRIO_PRIVATE BOOLEAN_T
TrioIsQualifier
TRIO_ARGS1((character),
    TRIO_CONST char character)
{
    /* QUALIFIER_POSITION is not included */
    switch (character)
    {

```

```

case '0': case '1': case '2': case '3': case '4':
case '5': case '6': case '7': case '8': case '9':
case QUALIFIER_PLUS:
case QUALIFIER_MINUS:
case QUALIFIER_SPACE:
case QUALIFIER_DOT:
case QUALIFIER_STAR:
case QUALIFIER_ALTERNATIVE:
case QUALIFIER_SHORT:
case QUALIFIER_LONG:
case QUALIFIER_LONG_UPPER:
case QUALIFIER_CIRCUMFLEX:
#if defined(QUALIFIER_SIZE_T)
case QUALIFIER_SIZE_T:
#endif
#if defined(QUALIFIER_PTRDIFF_T)
case QUALIFIER_PTRDIFF_T:
#endif
#if defined(QUALIFIER_INTMAX_T)
case QUALIFIER_INTMAX_T:
#endif
#if defined(QUALIFIER_QUAD)
case QUALIFIER_QUAD:
#endif
#if defined(QUALIFIER_SIZE_T_UPPER)
case QUALIFIER_SIZE_T_UPPER:
#endif
#if defined(QUALIFIER_WIDECHAR)
case QUALIFIER_WIDECHAR:
#endif
#if defined(QUALIFIER_QUOTE)
case QUALIFIER_QUOTE:
#endif
#if defined(QUALIFIER_STICKY)
case QUALIFIER_STICKY:
#endif
#if defined(QUALIFIER_VARSIZE)
case QUALIFIER_VARSIZE:
#endif
#if defined(QUALIFIER_PARAM)
case QUALIFIER_PARAM:
#endif
#if defined(QUALIFIER_FIXED_SIZE)
case QUALIFIER_FIXED_SIZE:
#endif
#if defined(QUALIFIER_ROUNDING_UPPER)
case QUALIFIER_ROUNDING_UPPER:
#endif

```

```

    return TRUE;
default:
    return FALSE;
}
}

/*****
* TrioSetLocale
*/
#if defined(USE_LOCALE)
TRIO_PRIVATE void
TrioSetLocale(TRIO_NOARGS)
{
    internalLocaleValues = (struct lconv *)localeconv();
    if (internalLocaleValues)
    {
        if ((internalLocaleValues->decimal_point) &&
            (internalLocaleValues->decimal_point[0] != NIL))
        {
            internalDecimalPointLength = trio_length(internalLocaleValues->decimal_point);
            if (internalDecimalPointLength == 1)
            {
                internalDecimalPoint = internalLocaleValues->decimal_point[0];
            }
            else
            {
                internalDecimalPoint = NIL;
                trio_copy_max(internalDecimalPointString,
                    sizeof(internalDecimalPointString),
                    internalLocaleValues->decimal_point);
            }
        }
        if ((internalLocaleValues->thousands_sep) &&
            (internalLocaleValues->thousands_sep[0] != NIL))
        {
            trio_copy_max(internalThousandSeparator,
                sizeof(internalThousandSeparator),
                internalLocaleValues->thousands_sep);
            internalThousandSeparatorLength = trio_length(internalThousandSeparator);
        }
        if ((internalLocaleValues->grouping) &&
            (internalLocaleValues->grouping[0] != NIL))
        {
            trio_copy_max(internalGrouping,
                sizeof(internalGrouping),
                internalLocaleValues->grouping);
        }
    }
}

```

```

}
#endif /* defined(USE_LOCALE) */

TRIO_PRIVATE int
TrioCalcThousandSeparatorLength
TRIO_ARGS1((digits),
    int digits)
{
#ifdef TRIO_EXTENSION
    int count = 0;
    int step = NO_GROUPING;
    char *groupingPointer = internalGrouping;

    while (digits > 0)
    {
        if (*groupingPointer == CHAR_MAX)
        {
            /* Disable grouping */
            break; /* while */
        }
        else if (*groupingPointer == 0)
        {
            /* Repeat last group */
            if (step == NO_GROUPING)
            {
                /* Error in locale */
                break; /* while */
            }
        }
        else
        {
            step = *groupingPointer++;
        }
        if (digits > step)
            count += internalThousandSeparatorLength;
        digits -= step;
    }
    return count;
#else
    return 0;
#endif
}

TRIO_PRIVATE BOOLEAN_T
TrioFollowedBySeparator
TRIO_ARGS1((position),
    int position)
{

```

```

#if TRIO_EXTENSION
int step = 0;
char *groupingPointer = internalGrouping;

position--;
if (position == 0)
    return FALSE;
while (position > 0)
{
    if (*groupingPointer == CHAR_MAX)
    {
        /* Disable grouping */
        break; /* while */
    }
    else if (*groupingPointer != 0)
    {
        step = *groupingPointer++;
    }
    if (step == 0)
        break;
    position -= step;
}
return (position == 0);
#else
return FALSE;
#endif
}

/*****
* TrioGetPosition
*
* Get the %n$ position.
*/
TRIO_PRIVATE int
TrioGetPosition
TRIO_ARGS2((format, indexPointer),
    TRIO_CONST char *format,
    int *indexPointer)
{
#if TRIO_UNIX98
char *tmpformat;
int number = 0;
int index = *indexPointer;

number = (int)trio_to_long(&format[index], &tmpformat, BASE_DECIMAL);
index = (int)(tmpformat - format);
if ((number != 0) && (QUALIFIER_POSITION == format[index++]))
{

```

```

    *indexPointer = index;
    /*
    * number is decreased by 1, because n$ starts from 1, whereas
    * the array it is indexing starts from 0.
    */
    return number - 1;
}
#endif
return NO_POSITION;
}

#if TRIO_EXTENSION
/*****
* TrioFindNamespace
*
* Find registered user-defined specifier.
* The prev argument is used for optimization only.
*/
TRIO_PRIVATE trio_userdef_t *
TrioFindNamespace
TRIO_ARGS2((name, prev),
    TRIO_CONST char *name,
    trio_userdef_t **prev)
{
    trio_userdef_t *def;

    if (internalEnterCriticalRegion)
        (void)internalEnterCriticalRegion(NULL);

    for (def = internalUserDef; def; def = def->next)
    {
        /* Case-sensitive string comparison */
        if (trio_equal_case(def->name, name))
            break;

        if (prev)
            *prev = def;
    }

    if (internalLeaveCriticalRegion)
        (void)internalLeaveCriticalRegion(NULL);

    return def;
}
#endif

/*****
* TrioPower

```

```

*
* Description:
* Calculate pow(base, exponent), where number and exponent are integers.
*/
TRIO_PRIVATE trio_long_double_t
TrioPower
TRIO_ARGS2((number, exponent),
    int number,
    int exponent)
{
    trio_long_double_t result;

    if (number == 10)
    {
        switch (exponent)
        {
            /* Speed up calculation of common cases */
            case 0:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E-1);
                break;
            case 1:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+0);
                break;
            case 2:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+1);
                break;
            case 3:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+2);
                break;
            case 4:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+3);
                break;
            case 5:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+4);
                break;
            case 6:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+5);
                break;
            case 7:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+6);
                break;
            case 8:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+7);
                break;
            case 9:
                result = (trio_long_double_t)number * TRIO_SUFFIX_LONG(1E+8);
                break;
            default:

```

```

    result = powl((trio_long_double_t)number,
(trio_long_double_t)exponent);
    break;
}
}
else
{
    return powl((trio_long_double_t)number, (trio_long_double_t)exponent);
}
return result;
}

/*****
* TrioLogarithm
*/
TRIO_PRIVATE double
TrioLogarithm
TRIO_ARGS2((number, base),
    double number,
    int base)
{
    double result;

    if (number <= 0.0)
    {
        /* x1C crashes on log(0) */
        result = (number == 0.0) ? trio_ninf() : trio_nan();
    }
    else
    {
        {
            if (base == 10)
            {
                result = log10(number);
            }
            else
            {
                result = log10(number) / log10((double)base);
            }
        }
    }
    return result;
}

/*****
* TrioLogarithmBase
*/
TRIO_PRIVATE double
TrioLogarithmBase
TRIO_ARGS1((base),

```

```

    int base)
{
    switch (base)
    {
        case BASE_BINARY : return 1.0;
        case BASE_OCTAL  : return 3.0;
        case BASE_DECIMAL: return 3.321928094887362345;
        case BASE_HEX    : return 4.0;
        default          : return TrioLogarithm((double)base, 2);
    }
}

/*****
* TrioParse
*
* Description:
* Parse the format string
*/
TRIO_PRIVATE int
TrioParse
TRIO_ARGS5((type, format, parameters, arglist, argarray),
    int type,
    TRIO_CONST char *format,
    trio_parameter_t *parameters,
    va_list *arglist,
    trio_pointer_t *argarray)
{
    /* Count the number of times a parameter is referenced */
    unsigned short usedEntries[MAX_PARAMETERS];
    /* Parameter counters */
    int parameterPosition;
    int currentParam;
    int maxParam = -1;
    /* Utility variables */
    trio_flags_t flags;
    int width;
    int precision;
    int varsize;
    int base;
    int index; /* Index into formatting string */
    int dots; /* Count number of dots in modifier part */
    BOOLEAN_T positional; /* Does the specifier have a positional? */
    BOOLEAN_T gotSticky = FALSE; /* Are there any sticky modifiers at all? */
    /*
    * indices specifies the order in which the parameters must be
    * read from the va_args (this is necessary to handle positionals)
    */
    int indices[MAX_PARAMETERS];

```

```

int pos = 0;
/* Various variables */
char ch;
#if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)
int charlen;
#endif
int save_errno;
int i = -1;
int num;
char *tmpformat;

/* One and only one of arglist and argarray must be used */
assert((arglist != NULL) ^ (argarray != NULL));

/*
 * The 'parameters' array is not initialized, but we need to
 * know which entries we have used.
 */
memset(usedEntries, 0, sizeof(usedEntries));

save_errno = errno;
index = 0;
parameterPosition = 0;
#if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)
(void)mblen(NULL, 0);
#endif

while (format[index])
{
#if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)
if (! isascii(format[index]))
{
/*
 * Multibyte characters cannot be legal specifiers or
 * modifiers, so we skip over them.
 */
charlen = mblen(&format[index], MB_LEN_MAX);
index += (charlen > 0) ? charlen : 1;
continue; /* while */
}
#endif /* TRIO_COMPILER_SUPPORTS_MULTIBYTE */
if (CHAR_IDENTIFIER == format[index++])
{
if (CHAR_IDENTIFIER == format[index])
{
index++;
continue; /* while */
}
}
}

```

```

flags = FLAGS_NEW;
dots = 0;
currentParam = TrioGetPosition(format, &index);
positional = (NO_POSITION != currentParam);
if (!positional)
{
    /* We have no positional, get the next counter */
    currentParam = parameterPosition;
}
if(currentParam >= MAX_PARAMETERS)
{
    /* Bail out completely to make the error more obvious */
    return TRIO_ERROR_RETURN(TRIO_ETOOMANY, index);
}

if (currentParam > maxParam)
    maxParam = currentParam;

/* Default values */
width = NO_WIDTH;
precision = NO_PRECISION;
base = NO_BASE;
varsize = NO_SIZE;

while (TrioIsQualifier(format[index]))
{
    ch = format[index++];

    switch (ch)
    {
case QUALIFIER_SPACE:
    flags |= FLAGS_SPACE;
    break;

case QUALIFIER_PLUS:
    flags |= FLAGS_SHOWSIGN;
    break;

case QUALIFIER_MINUS:
    flags |= FLAGS_LEFTADJUST;
    flags &= ~FLAGS_NILPADDING;
    break;

case QUALIFIER_ALTERNATIVE:
    flags |= FLAGS_ALTERNATIVE;
    break;

```

```

case QUALIFIER_DOT:
    if (dots == 0) /* Precision */
    {
        dots++;

        /* Skip if no precision */
        if (QUALIFIER_DOT == format[index])
            break;

        /* After the first dot we have the precision */
        flags |= FLAGS_PRECISION;
        if ((QUALIFIER_STAR == format[index])
#ifdef QUALIFIER_PARAM
            || (QUALIFIER_PARAM == format[index])
#endif
        )
        {
            index++;
            flags |= FLAGS_PRECISION_PARAMETER;

            precision = TrioGetPosition(format, &index);
            if (precision == NO_POSITION)
            {
                parameterPosition++;
                if (positional)
                    precision = parameterPosition;
                else
                {
                    precision = currentParam;
                    currentParam = precision + 1;
                }
            }
            else
            {
                if (! positional)
                    currentParam = precision + 1;
                if (width > maxParam)
                    maxParam = precision;
            }
            if (currentParam > maxParam)
                maxParam = currentParam;
        }
        else
        {
            precision = trio_to_long(&format[index],
                                    &tmpformat,
                                    BASE_DECIMAL);
            index = (int)(tmpformat - format);

```

```

    }
    }
else if (dots == 1) /* Base */
{
    dots++;

    /* After the second dot we have the base */
    flags |= FLAGS_BASE;
    if ((QUALIFIER_STAR == format[index])
#ifdef QUALIFIER_PARAM
        || (QUALIFIER_PARAM == format[index])
#endif
    )
    {
        index++;
        flags |= FLAGS_BASE_PARAMETER;
        base = TrioGetPosition(format, &index);
        if (base == NO_POSITION)
        {
            parameterPosition++;
            if (positional)
                base = parameterPosition;
            else
            {
                base = currentParam;
                currentParam = base + 1;
            }
        }
        else
        {
            if (! positional)
                currentParam = base + 1;
            if (base > maxParam)
                maxParam = base;
        }
        if (currentParam > maxParam)
            maxParam = currentParam;
    }
    else
    {
        base = trio_to_long(&format[index],
                           &tmpformat,
                           BASE_DECIMAL);
        if (base > MAX_BASE)
            return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
        index = (int)(tmpformat - format);
    }
}

```

```

else
{
    return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
}
break; /* QUALIFIER_DOT */

#if defined(QUALIFIER_PARAM)
case QUALIFIER_PARAM:
    type = TYPE_PRINT;
    /* FALLTHROUGH */
#endif
case QUALIFIER_STAR:
    /* This has different meanings for print and scan */
    if (TYPE_PRINT == type)
    {
        /* Read with from parameter */
        flags |= (FLAGS_WIDTH | FLAGS_WIDTH_PARAMETER);
        width = TrioGetPosition(format, &index);
        if (width == NO_POSITION)
        {
            parameterPosition++;
            if (positional)
                width = parameterPosition;
            else
            {
                width = currentParam;
                currentParam = width + 1;
            }
        }
        else
        {
            if (!positional)
                currentParam = width + 1;
            if (width > maxParam)
                maxParam = width;
        }
        if (currentParam > maxParam)
            maxParam = currentParam;
    }
    else
    {
        /* Scan, but do not store result */
        flags |= FLAGS_IGNORE;
    }

    break; /* QUALIFIER_STAR */

case '0':

```

```

    if (! (flags & FLAGS_LEFTADJUST))
        flags |= FLAGS_NILPADDING;
    /* FALLTHROUGH */
case '1': case '2': case '3': case '4':
case '5': case '6': case '7': case '8': case '9':
    flags |= FLAGS_WIDTH;
    /* &format[index - 1] is used to "rewind" the read
    * character from format
    */
    width = trio_to_long(&format[index - 1],
        &tmpformat,
        BASE_DECIMAL);
    index = (int)(tmpformat - format);
    break;

case QUALIFIER_SHORT:
    if (flags & FLAGS_SHORTEST)
        return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
    else if (flags & FLAGS_SHORT)
        flags |= FLAGS_SHORTEST;
    else
        flags |= FLAGS_SHORT;
    break;

case QUALIFIER_LONG:
    if (flags & FLAGS_QUAD)
        return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
    else if (flags & FLAGS_LONG)
        flags |= FLAGS_QUAD;
    else
        flags |= FLAGS_LONG;
    break;

case QUALIFIER_LONG_UPPER:
    flags |= FLAGS_LONGDOUBLE;
    break;

#ifdef QUALIFIER_SIZE_T
case QUALIFIER_SIZE_T:
    flags |= FLAGS_SIZE_T;
    /* Modify flags for later truncation of number */
    if (sizeof(size_t) == sizeof(trio_ulonglong_t))
        flags |= FLAGS_QUAD;
    else if (sizeof(size_t) == sizeof(long))
        flags |= FLAGS_LONG;
    break;
#endif

```

```

#if defined(QUALIFIER_PTRDIFF_T)
case QUALIFIER_PTRDIFF_T:
    flags |= FLAGS_PTRDIFF_T;
    if (sizeof(ptrdiff_t) == sizeof(trio_ulonglong_t))
        flags |= FLAGS_QUAD;
    else if (sizeof(ptrdiff_t) == sizeof(long))
        flags |= FLAGS_LONG;
    break;
#endif

#if defined(QUALIFIER_INTMAX_T)
case QUALIFIER_INTMAX_T:
    flags |= FLAGS_INTMAX_T;
    if (sizeof(trio_intmax_t) == sizeof(trio_ulonglong_t))
        flags |= FLAGS_QUAD;
    else if (sizeof(trio_intmax_t) == sizeof(long))
        flags |= FLAGS_LONG;
    break;
#endif

#if defined(QUALIFIER_QUAD)
case QUALIFIER_QUAD:
    flags |= FLAGS_QUAD;
    break;
#endif

#if defined(QUALIFIER_FIXED_SIZE)
case QUALIFIER_FIXED_SIZE:
    if (flags & FLAGS_FIXED_SIZE)
        return TRIO_ERROR_RETURN(TRIO_EINVAL, index);

    if (flags & (FLAGS_ALL_SIZES | FLAGS_LONGDOUBLE |
        FLAGS_WIDECHAR | FLAGS_VARSIZE_PARAMETER))
        return TRIO_ERROR_RETURN(TRIO_EINVAL, index);

    if ((format[index] == '6') &&
        (format[index + 1] == '4'))
    {
        varsize = sizeof(trio_int64_t);
        index += 2;
    }
    else if ((format[index] == '3') &&
        (format[index + 1] == '2'))
    {
        varsize = sizeof(trio_int32_t);
        index += 2;
    }
    else if ((format[index] == '1') &&

```

```

        (format[index + 1] == '6'))
    {
        varsize = sizeof(trio_int16_t);
        index += 2;
    }
else if (format[index] == '8')
    {
        varsize = sizeof(trio_int8_t);
        index++;
    }
else
    return TRIO_ERROR_RETURN(TRIO_EINVAL, index);

    flags |= FLAGS_FIXED_SIZE;
    break;
#endif

#if defined(QUALIFIER_WIDECHAR)
    case QUALIFIER_WIDECHAR:
        flags |= FLAGS_WIDECHAR;
        break;
#endif

#if defined(QUALIFIER_SIZE_T_UPPER)
    case QUALIFIER_SIZE_T_UPPER:
        break;
#endif

#if defined(QUALIFIER_QUOTE)
    case QUALIFIER_QUOTE:
        flags |= FLAGS_QUOTE;
        break;
#endif

#if defined(QUALIFIER_STICKY)
    case QUALIFIER_STICKY:
        flags |= FLAGS_STICKY;
        gotSticky = TRUE;
        break;
#endif

#if defined(QUALIFIER_VARSIZE)
    case QUALIFIER_VARSIZE:
        flags |= FLAGS_VARSIZE_PARAMETER;
        parameterPosition++;
        if (positional)
            varsize = parameterPosition;
        else

```

```

    {
        varsize = currentParam;
        currentParam = varsize + 1;
    }
    if (currentParam > maxParam)
        maxParam = currentParam;
    break;
#endif

#ifdef QUALIFIER_ROUNDING_UPPER
    case QUALIFIER_ROUNDING_UPPER:
        flags |= FLAGS_ROUNDING;
        break;
#endif

default:
    /* Bail out completely to make the error more obvious */
    return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
}
} /* while qualifier */

/*
 * Parameters only need the type and value. The value is
 * read later.
 */
if (flags & FLAGS_WIDTH_PARAMETER)
{
    usedEntries[width] += 1;
    parameters[pos].type = FORMAT_PARAMETER;
    parameters[pos].flags = 0;
    indices[width] = pos;
    width = pos++;
}
if (flags & FLAGS_PRECISION_PARAMETER)
{
    usedEntries[precision] += 1;
    parameters[pos].type = FORMAT_PARAMETER;
    parameters[pos].flags = 0;
    indices[precision] = pos;
    precision = pos++;
}
if (flags & FLAGS_BASE_PARAMETER)
{
    usedEntries[base] += 1;
    parameters[pos].type = FORMAT_PARAMETER;
    parameters[pos].flags = 0;
    indices[base] = pos;
    base = pos++;
}

```

```

    }
    if (flags & FLAGS_VARSIZE_PARAMETER)
    {
        usedEntries[varsize] += 1;
        parameters[pos].type = FORMAT_PARAMETER;
        parameters[pos].flags = 0;
        indices[varsize] = pos;
        varsize = pos++;
    }

    indices[currentParam] = pos;

    switch (format[index++])
    {
    #if defined(SPECIFIER_CHAR_UPPER)
        case SPECIFIER_CHAR_UPPER:
            flags |= FLAGS_WIDECHAR;
            /* FALLTHROUGH */
    #endif
        case SPECIFIER_CHAR:
            if (flags & FLAGS_LONG)
                flags |= FLAGS_WIDECHAR;
            else if (flags & FLAGS_SHORT)
                flags &= ~FLAGS_WIDECHAR;
            parameters[pos].type = FORMAT_CHAR;
            break;

    #if defined(SPECIFIER_STRING_UPPER)
        case SPECIFIER_STRING_UPPER:
            flags |= FLAGS_WIDECHAR;
            /* FALLTHROUGH */
    #endif
        case SPECIFIER_STRING:
            if (flags & FLAGS_LONG)
                flags |= FLAGS_WIDECHAR;
            else if (flags & FLAGS_SHORT)
                flags &= ~FLAGS_WIDECHAR;
            parameters[pos].type = FORMAT_STRING;
            break;

        case SPECIFIER_GROUP:
            if (TYPE_SCAN == type)
            {
                int depth = 1;
                parameters[pos].type = FORMAT_GROUP;
                if (format[index] == QUALIFIER_CIRCUMFLEX)
                    index++;
                if (format[index] == SPECIFIER_UNGROUP)

```

```

    index++;
    if (format[index] == QUALIFIER_MINUS)
        index++;
    /* Skip nested brackets */
    while (format[index] != NIL)
    {
        if (format[index] == SPECIFIER_GROUP)
        {
            depth++;
        }
        else if (format[index] == SPECIFIER_UNGROUP)
        {
            if (--depth <= 0)
            {
                index++;
                break;
            }
        }
        index++;
    }
    break;

case SPECIFIER_INTEGER:
    parameters[pos].type = FORMAT_INT;
    break;

case SPECIFIER_UNSIGNED:
    flags |= FLAGS_UNSIGNED;
    parameters[pos].type = FORMAT_INT;
    break;

case SPECIFIER_DECIMAL:
    /* Disable base modifier */
    flags &= ~FLAGS_BASE_PARAMETER;
    base = BASE_DECIMAL;
    parameters[pos].type = FORMAT_INT;
    break;

case SPECIFIER_OCTAL:
    flags |= FLAGS_UNSIGNED;
    flags &= ~FLAGS_BASE_PARAMETER;
    base = BASE_OCTAL;
    parameters[pos].type = FORMAT_INT;
    break;

#if defined(SPECIFIER_BINARY)
case SPECIFIER_BINARY_UPPER:

```

```

    flags |= FLAGS_UPPER;
    /* FALLTHROUGH */
case SPECIFIER_BINARY:
    flags |= FLAGS_NILPADDING;
    flags &= ~FLAGS_BASE_PARAMETER;
    base = BASE_BINARY;
    parameters[pos].type = FORMAT_INT;
    break;
#endif

case SPECIFIER_HEX_UPPER:
    flags |= FLAGS_UPPER;
    /* FALLTHROUGH */
case SPECIFIER_HEX:
    flags |= FLAGS_UNSIGNED;
    flags &= ~FLAGS_BASE_PARAMETER;
    base = BASE_HEX;
    parameters[pos].type = FORMAT_INT;
    break;

case SPECIFIER_FLOAT_E_UPPER:
    flags |= FLAGS_UPPER;
    /* FALLTHROUGH */
case SPECIFIER_FLOAT_E:
    flags |= FLAGS_FLOAT_E;
    parameters[pos].type = FORMAT_DOUBLE;
    break;

case SPECIFIER_FLOAT_G_UPPER:
    flags |= FLAGS_UPPER;
    /* FALLTHROUGH */
case SPECIFIER_FLOAT_G:
    flags |= FLAGS_FLOAT_G;
    parameters[pos].type = FORMAT_DOUBLE;
    break;

case SPECIFIER_FLOAT_F_UPPER:
    flags |= FLAGS_UPPER;
    /* FALLTHROUGH */
case SPECIFIER_FLOAT_F:
    parameters[pos].type = FORMAT_DOUBLE;
    break;

case SPECIFIER_POINTER:
    if (sizeof(trio_pointer_t) == sizeof(trio_ulonglong_t))
        flags |= FLAGS_QUAD;
    else if (sizeof(trio_pointer_t) == sizeof(long))
        flags |= FLAGS_LONG;

```

```

    parameters[pos].type = FORMAT_POINTER;
    break;

case SPECIFIER_COUNT:
    parameters[pos].type = FORMAT_COUNT;
    break;

#if defined(SPECIFIER_HEXFLOAT)
# if defined(SPECIFIER_HEXFLOAT_UPPER)
    case SPECIFIER_HEXFLOAT_UPPER:
        flags |= FLAGS_UPPER;
        /* FALLTHROUGH */
# endif
    case SPECIFIER_HEXFLOAT:
        base = BASE_HEX;
        parameters[pos].type = FORMAT_DOUBLE;
        break;
#endif

#if defined(FORMAT_ERRNO)
    case SPECIFIER_ERRNO:
        parameters[pos].type = FORMAT_ERRNO;
        break;
#endif

#if defined(SPECIFIER_USER_DEFINED_BEGIN)
    case SPECIFIER_USER_DEFINED_BEGIN:
        {
            unsigned int max;
            int without_namespace = TRUE;

            parameters[pos].type = FORMAT_USER_DEFINED;
            parameters[pos].user_name[0] = NIL;
            tmpformat = (char *)&format[index];

            while ((ch = format[index]))
            {
                index++;
                if (ch == SPECIFIER_USER_DEFINED_END)
                {
                    if (without_namespace)
                    {
                        /* We must get the handle first */
                        parameters[pos].type = FORMAT_PARAMETER;
                        parameters[pos].indexAfterSpecifier = index;
                        parameters[pos].flags = FLAGS_USER_DEFINED;
                        /* Adjust parameters for insertion of new one */
                        pos++;
                    }
                }
            }
        }
    }
#endif

```

```

        usedEntries[currentParam] += 1;
        parameters[pos].type = FORMAT_USER_DEFINED;
        currentParam++;
        indices[currentParam] = pos;
        if (currentParam > maxParam)
            maxParam = currentParam;
    }
    /* Copy the user data */
    max = (unsigned int)(&format[index] - tmpformat);
    if (max > MAX_USER_DATA)
        max = MAX_USER_DATA;
    trio_copy_max(parameters[pos].user_data,
        max,
        tmpformat);
    break; /* while */
}
if (ch == SPECIFIER_USER_DEFINED_SEPARATOR)
{
    without_namespace = FALSE;
    /* Copy the namespace for later looking-up */
    max = (int)(&format[index] - tmpformat);
    if (max > MAX_USER_NAME)
        max = MAX_USER_NAME;
    trio_copy_max(parameters[pos].user_name,
        max,
        tmpformat);
    tmpformat = (char *)&format[index];
}
}
if (ch != SPECIFIER_USER_DEFINED_END)
    return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
}
break;
#endif /* defined(SPECIFIER_USER_DEFINED_BEGIN) */

default:
    /* Bail out completely to make the error more obvious */
    return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
}

/* Count the number of times this entry has been used */
usedEntries[currentParam] += 1;

/* Find last sticky parameters */
if (gotSticky && !(flags & FLAGS_STICKY))
{
    for (i = pos - 1; i >= 0; i--)
    {

```

```

if (parameters[i].type == FORMAT_PARAMETER)
    continue;
if ((parameters[i].flags & FLAGS_STICKY) &&
    (parameters[i].type == parameters[pos].type))
{
    /* Do not overwrite current qualifiers */
    flags |= (parameters[i].flags & (unsigned long)~FLAGS_STICKY);
    if (width == NO_WIDTH)
width = parameters[i].width;
    if (precision == NO_PRECISION)
precision = parameters[i].precision;
    if (base == NO_BASE)
base = parameters[i].base;
    break;
}
}
}

parameters[pos].indexAfterSpecifier = index;
parameters[pos].flags = flags;
parameters[pos].width = width;
parameters[pos].precision = precision;
parameters[pos].base = (base == NO_BASE) ? BASE_DECIMAL : base;
parameters[pos].varsize = varsize;
pos++;

if (! positional)
    parameterPosition++;

} /* if identifier */

} /* while format characters left */

for (num = 0; num <= maxParam; num++)
{
    if (usedEntries[num] != 1)
{
    if (usedEntries[num] == 0) /* gap detected */
        return TRIO_ERROR_RETURN(TRIO_EGAP, num);
    else /* double references detected */
        return TRIO_ERROR_RETURN(TRIO_EDBLREF, num);
    }

    i = indices[num];

    /*
    * FORMAT_PARAMETERS are only present if they must be read,
    * so it makes no sense to check the ignore flag (besides,

```

```

    * the flags variable is not set for that particular type)
    */
    if ((parameters[i].type != FORMAT_PARAMETER) &&
        (parameters[i].flags & FLAGS_IGNORE))
        continue; /* for all arguments */

    /*
     * The stack arguments are read according to ANSI C89
     * default argument promotions:
     *
     * char      = int
     * short     = int
     * unsigned char = unsigned int
     * unsigned short = unsigned int
     * float     = double
     *
     * In addition to the ANSI C89 these types are read (the
     * default argument promotions of C99 has not been
     * considered yet)
     *
     * long long
     * long double
     * size_t
     * ptrdiff_t
     * intmax_t
     */
    switch (parameters[i].type)
    {
    case FORMAT_GROUP:
    case FORMAT_STRING:
    #if TRIO_WIDECHAR
        if (flags & FLAGS_WIDECHAR)
        {
            parameters[i].data.wstring = (argarray == NULL)
? va_arg(*arglist, trio_wchar_t *)
: (trio_wchar_t*)(argarray[num]);
        }
        else
    #endif
        {
            parameters[i].data.string = (argarray == NULL)
? va_arg(*arglist, char *)
: (char*)(argarray[num]);
        }
        break;

    #if defined(FORMAT_USER_DEFINED)
    case FORMAT_USER_DEFINED:

```

```

#endif
case FORMAT_POINTER:
case FORMAT_COUNT:
case FORMAT_UNKNOWN:
    parameters[i].data.pointer = (argarray == NULL)
        ? va_arg(*arglist, trio_pointer_t )
        : argarray[num];
    break;

case FORMAT_CHAR:
case FORMAT_INT:
    if (TYPE_SCAN == type)
    {
        if (argarray == NULL)
            parameters[i].data.pointer =
                (trio_pointer_t)va_arg(*arglist, trio_pointer_t);
        else
        {
            if (parameters[i].type == FORMAT_CHAR)
                parameters[i].data.pointer =
                    (trio_pointer_t)((char *)argarray[num]);
            else if (parameters[i].flags & FLAGS_SHORT)
                parameters[i].data.pointer =
                    (trio_pointer_t)((short *)argarray[num]);
            else
                parameters[i].data.pointer =
                    (trio_pointer_t)((int *)argarray[num]);
        }
    }
    else
    {
        #if defined(QUALIFIER_VARSIZE) || defined(QUALIFIER_FIXED_SIZE)
            if (parameters[i].flags
                & (FLAGS_VARSIZE_PARAMETER | FLAGS_FIXED_SIZE))
            {
                if (parameters[i].flags & FLAGS_VARSIZE_PARAMETER)
                {
                    /*
                     * Variable sizes are mapped onto the fixed sizes, in
                     * accordance with integer promotion.
                     *
                     * Please note that this may not be portable, as we
                     * only guess the size, not the layout of the numbers.
                     * For example, if int is little-endian, and long is
                     * big-endian, then this will fail.
                     */
                    varsize = (int)parameters[parameters[i].varsize].data.number.as_unsigned;
                }
            }
        #endif
    }
}

```

```

else
{
    /* Used for the I<bits> modifiers */
    varsize = parameters[i].varsize;
}
parameters[i].flags &= ~FLAGS_ALL_VARSIZES;

if (varsize <= (int)sizeof(int))
;
else if (varsize <= (int)sizeof(long))
    parameters[i].flags |= FLAGS_LONG;
#ifdef QUALIFIER_INTMAX_T
else if (varsize <= (int)sizeof(trio_longlong_t))
    parameters[i].flags |= FLAGS_QUAD;
else
    parameters[i].flags |= FLAGS_INTMAX_T;
#else
else
    parameters[i].flags |= FLAGS_QUAD;
#endif
}
#endif /* defined(QUALIFIER_VARSIZE) */
#ifdef QUALIFIER_SIZE_T || defined(QUALIFIER_SIZE_T_UPPER)
    if (parameters[i].flags & FLAGS_SIZE_T)
        parameters[i].data.number.as_unsigned = (argarray == NULL)
            ? (trio_uintmax_t)va_arg(*arglist, size_t)
            : (trio_uintmax_t)((size_t *)argarray[num]);
    else
#endif
#ifdef QUALIFIER_PTRDIFF_T
    if (parameters[i].flags & FLAGS_PTRDIFF_T)
        parameters[i].data.number.as_unsigned = (argarray == NULL)
            ? (trio_uintmax_t)va_arg(*arglist, ptrdiff_t)
            : (trio_uintmax_t)((ptrdiff_t *)argarray[num]);
    else
#endif
#ifdef QUALIFIER_INTMAX_T
    if (parameters[i].flags & FLAGS_INTMAX_T)
        parameters[i].data.number.as_unsigned = (argarray == NULL)
            ? (trio_uintmax_t)va_arg(*arglist, trio_intmax_t)
            : (trio_uintmax_t)((trio_intmax_t *)argarray[num]);
    else
#endif
#ifdef QUALIFIER_ULONGLONG_T
    if (parameters[i].flags & FLAGS_QUAD)
        parameters[i].data.number.as_unsigned = (argarray == NULL)
            ? (trio_uintmax_t)va_arg(*arglist, trio_ulonglong_t)
            : (trio_uintmax_t)((trio_ulonglong_t *)argarray[num]);
    else if (parameters[i].flags & FLAGS_LONG)

```

```

parameters[i].data.number.as_unsigned = (argarray == NULL)
? (trio_uintmax_t)va_arg(*arglist, long)
: (trio_uintmax_t)((long *)argarray[num]);
else
{
if (argarray == NULL)
parameters[i].data.number.as_unsigned = (trio_uintmax_t)va_arg(*arglist, int);
else
{
if (parameters[i].type == FORMAT_CHAR)
parameters[i].data.number.as_unsigned = (trio_uintmax_t)((char *)argarray[num]);
else if (parameters[i].flags & FLAGS_SHORT)
parameters[i].data.number.as_unsigned = (trio_uintmax_t)((short *)argarray[num]);
else
parameters[i].data.number.as_unsigned = (trio_uintmax_t)((int *)argarray[num]);
}
}
}
break;

```

case FORMAT_PARAMETER:

```

/*
 * The parameter for the user-defined specifier is a pointer,
 * whereas the rest (width, precision, base) uses an integer.
 */
if (parameters[i].flags & FLAGS_USER_DEFINED)
parameters[i].data.pointer = (argarray == NULL)
? va_arg(*arglist, trio_pointer_t)
: argarray[num];
else
parameters[i].data.number.as_unsigned = (argarray == NULL)
? (trio_uintmax_t)va_arg(*arglist, int)
: (trio_uintmax_t)((int *)argarray[num]);
break;

```

case FORMAT_DOUBLE:

```

if (TYPE_SCAN == type)
{
if (parameters[i].flags & FLAGS_LONGDOUBLE)
parameters[i].data.longdoublePointer = (argarray == NULL)
? va_arg(*arglist, trio_long_double_t *)
: (trio_long_double_t *)argarray[num];
else
{
if (parameters[i].flags & FLAGS_LONG)
parameters[i].data.doublePointer = (argarray == NULL)
? va_arg(*arglist, double *)
: (double *)argarray[num];

```

```

else
    parameters[i].data.doublePointer = (argarray == NULL)
        ? (double *)va_arg(*arglist, float *)
        : (double *)((float *)argarray[num]);
    }
}
else
{
    if (parameters[i].flags & FLAGS_LONGDOUBLE)
parameters[i].data.longdoubleNumber = (argarray == NULL)
    ? va_arg(*arglist, trio_long_double_t)
    : (trio_long_double_t)((trio_long_double_t *)argarray[num]);
    else
    {
        if (argarray == NULL)
            parameters[i].data.longdoubleNumber =
                (trio_long_double_t)va_arg(*arglist, double);
        else
        {
            if (parameters[i].flags & FLAGS_SHORT)
parameters[i].data.longdoubleNumber =
                (trio_long_double_t)((float *)argarray[num]);
            else
parameters[i].data.longdoubleNumber =
                (trio_long_double_t)((double *)argarray[num]);
        }
    }
}
break;

#ifdef(FORMAT_ERRNO)
case FORMAT_ERRNO:
    parameters[i].data.errorNumber = save_errno;
    break;
#endif

default:
    break;
}
} /* for all specifiers */
return num;
}

/*****
*
* FORMATTING
*
*****/

```

```

*****/

/*****
* TrioWriteNumber
*
* Description:
*   Output a number.
*   The complexity of this function is a result of the complexity
*   of the dependencies of the flags.
*/

TRIO_PRIVATE void
TrioWriteNumber
TRIO_ARGS6((self, number, flags, width, precision, base),
    trio_class_t *self,
    trio_uintmax_t number,
    trio_flags_t flags,
    int width,
    int precision,
    int base)
{
    BOOLEAN_T isNegative;
    BOOLEAN_T isNumberZero;
    BOOLEAN_T isPrecisionZero;
    BOOLEAN_T ignoreNumber;
    char buffer[MAX_CHARS_IN(trio_uintmax_t) * (1 + MAX_LOCALE_SEPARATOR_LENGTH) + 1];
    char *bufferend;
    char *pointer;
    TRIO_CONST char *digits;
    int i;
    int length;
    char *p;
    int count;

    assert(VALID(self));
    assert(VALID(self->OutputStream));
    assert(((base >= MIN_BASE) && (base <= MAX_BASE)) || (base == NO_BASE));

    digits = (flags & FLAGS_UPPER) ? internalDigitsUpper : internalDigitsLower;
    if (base == NO_BASE)
        base = BASE_DECIMAL;

    isNumberZero = (number == 0);
    isPrecisionZero = (precision == 0);
    ignoreNumber = (isNumberZero
        && isPrecisionZero
        && !((flags & FLAGS_ALTERNATIVE) && (base == BASE_OCTAL)));

```

```

if (flags & FLAGS_UNSIGNED)
{
    isNegative = FALSE;
    flags &= ~FLAGS_SHOWSIGN;
}
else
{
    isNegative = ((trio_intmax_t)number < 0);
    if (isNegative)
number = -((trio_intmax_t)number);
}

if (flags & FLAGS_QUAD)
    number &= (trio_ulonglong_t)-1;
else if (flags & FLAGS_LONG)
    number &= (unsigned long)-1;
else
    number &= (unsigned int)-1;

/* Build number */
pointer = bufferend = &buffer[sizeof(buffer) - 1];
*pointer-- = NIL;
for (i = 1; i < (int)sizeof(buffer); i++)
{
    *pointer-- = digits[number % base];
    number /= base;
    if (number == 0)
break;

    if ((flags & FLAGS_QUOTE) && TrioFollowedBySeparator(i + 1))
{
    /*
    * We are building the number from the least significant
    * to the most significant digit, so we have to copy the
    * thousand separator backwards
    */
    length = internalThousandSeparatorLength;
    if (((int)(pointer - buffer) - length) > 0)
    {
        p = &internalThousandSeparator[length - 1];
        while (length-- > 0)
*pointer-- = *p--;
    }
}

if (! ignoreNumber)
{

```

```

/* Adjust width */
width -= (bufferend - pointer) - 1;
}

/* Adjust precision */
if (NO_PRECISION != precision)
{
    precision -= (bufferend - pointer) - 1;
    if (precision < 0)
precision = 0;
    flags |= FLAGS_NILPADDING;
}

/* Calculate padding */
count = (! ((flags & FLAGS_LEFTADJUST) || (precision == NO_PRECISION)))
    ? precision
    : 0;

/* Adjust width further */
if (isNegative || (flags & FLAGS_SHOWSIGN) || (flags & FLAGS_SPACE))
    width--;
if ((flags & FLAGS_ALTERNATIVE) && !isNumberZero)
{
    switch (base)
    {
case BASE_BINARY:
case BASE_HEX:
    width -= 2;
    break;
case BASE_OCTAL:
    if (!(flags & FLAGS_NILPADDING) || (count == 0))
        width--;
    break;
default:
    break;
}
}

/* Output prefixes spaces if needed */
if (! ((flags & FLAGS_LEFTADJUST) ||
((flags & FLAGS_NILPADDING) && (precision == NO_PRECISION))))
{
    while (width-- > count)
self->OutStream(self, CHAR_ADJUST);
}

/* width has been adjusted for signs and alternatives */
if (isNegative)

```

```

        self->OutStream(self, '-');
    else if (flags & FLAGS_SHOWSIGN)
        self->OutStream(self, '+');
    else if (flags & FLAGS_SPACE)
        self->OutStream(self, ' ');

    /* Prefix is not written when the value is zero */
    if ((flags & FLAGS_ALTERNATIVE) && !isNumberZero)
    {
        switch (base)
        {
        case BASE_BINARY:
            self->OutStream(self, '0');
            self->OutStream(self, (flags & FLAGS_UPPER) ? 'B' : 'b');
            break;

        case BASE_OCTAL:
            if (!(flags & FLAGS_NILPADDING) || (count == 0))
                self->OutStream(self, '0');
            break;

        case BASE_HEX:
            self->OutStream(self, '0');
            self->OutStream(self, (flags & FLAGS_UPPER) ? 'X' : 'x');
            break;

        default:
            break;
        } /* switch base */
    }

    /* Output prefixed zero padding if needed */
    if (flags & FLAGS_NILPADDING)
    {
        if (precision == NO_PRECISION)
            precision = width;
        while (precision-- > 0)
        {
            self->OutStream(self, '0');
            width--;
        }
    }

    if (!ignoreNumber)
    {
        /* Output the number itself */
        while (*(++pointer))
    }

```

```

    self->OutStream(self, *pointer);
}
}

/* Output trailing spaces if needed */
if (flags & FLAGS_LEFTADJUST)
{
    while (width-- > 0)
self->OutStream(self, CHAR_ADJUST);
}
}

/*****
* TrioWriteStringCharacter
*
* Description:
* Output a single character of a string
*/
TRIO_PRIVATE void
TrioWriteStringCharacter
TRIO_ARGS3((self, ch, flags),
    trio_class_t *self,
    int ch,
    trio_flags_t flags)
{
    if (flags & FLAGS_ALTERNATIVE)
    {
        if (! isprint(ch))
        {
            /*
             * Non-printable characters are converted to C escapes or
             * \number, if no C escape exists.
             */
            self->OutStream(self, CHAR_BACKSLASH);
            switch (ch)
            {
                case '\007': self->OutStream(self, 'a'); break;
                case '\b': self->OutStream(self, 'b'); break;
                case '\f': self->OutStream(self, 'f'); break;
                case '\n': self->OutStream(self, 'n'); break;
                case '\r': self->OutStream(self, 'r'); break;
                case '\t': self->OutStream(self, 't'); break;
                case '\v': self->OutStream(self, 'v'); break;
                case '\\': self->OutStream(self, '\\'); break;
                default:
                    self->OutStream(self, 'x');
                    TrioWriteNumber(self, (trio_uintmax_t)ch,
                        FLAGS_UNSIGNED | FLAGS_NILPADDING,

```

```

        2, 2, BASE_HEX);
    break;
}
}
else if (ch == CHAR_BACKSLASH)
{
    self->OutStream(self, CHAR_BACKSLASH);
    self->OutStream(self, CHAR_BACKSLASH);
}
else
{
    self->OutStream(self, ch);
}
}
else
{
    self->OutStream(self, ch);
}
}

/*****
* TrioWriteString
*
* Description:
* Output a string
*/
TRIO_PRIVATE void
TrioWriteString
TRIO_ARGS5((self, string, flags, width, precision),
    trio_class_t *self,
    TRIO_CONST char *string,
    trio_flags_t flags,
    int width,
    int precision)
{
    int length;
    int ch;

    assert(VALID(self));
    assert(VALID(self->OutStream));

    if (string == NULL)
    {
        string = internalNullString;
        length = sizeof(internalNullString) - 1;
        /* Disable quoting for the null pointer */
        flags &= (~FLAGS_QUOTE);
        width = 0;
    }

```

```

    }
else
    {
        length = trio_length(string);
    }
if ((NO_PRECISION != precision) &&
    (precision < length))
    {
        length = precision;
    }
width -= length;

if (flags & FLAGS_QUOTE)
    self->OutStream(self, CHAR_QUOTE);

if (! (flags & FLAGS_LEFTADJUST))
    {
        while (width-- > 0)
            self->OutStream(self, CHAR_ADJUST);
    }

while (length-- > 0)
    {
        /* The ctype parameters must be an unsigned char (or EOF) */
        ch = (int)((unsigned char)(*string++));
        TrioWriteStringCharacter(self, ch, flags);
    }

if (flags & FLAGS_LEFTADJUST)
    {
        while (width-- > 0)
            self->OutStream(self, CHAR_ADJUST);
    }
if (flags & FLAGS_QUOTE)
    self->OutStream(self, CHAR_QUOTE);
}

/*****
* TrioWriteWideStringCharacter
*
* Description:
* Output a wide string as a multi-byte sequence
*/
#if TRIO_WIDECHAR
TRIO_PRIVATE int
TrioWriteWideStringCharacter
TRIO_ARGS4((self, wch, flags, width),
    trio_class_t *self,

```

```

    trio_wchar_t wch,
    trio_flags_t flags,
    int width)
{
    int size;
    int i;
    int ch;
    char *string;
    char buffer[MB_LEN_MAX + 1];

    if (width == NO_WIDTH)
        width = sizeof(buffer);

    size = wctomb(buffer, wch);
    if ((size <= 0) || (size > width) || (buffer[0] == NIL))
        return 0;

    string = buffer;
    i = size;
    while ((width >= i) && (width-- > 0) && (i-- > 0))
    {
        /* The ctype parameters must be an unsigned char (or EOF) */
        ch = (int)((unsigned char)(*string++));
        TrioWriteStringCharacter(self, ch, flags);
    }
    return size;
}
#endif /* TRIO_WIDECHAR */

/*****
* TrioWriteWideString
*
* Description:
* Output a wide character string as a multi-byte string
*/
#if TRIO_WIDECHAR
TRIO_PRIVATE void
TrioWriteWideString
TRIO_ARGS5((self, wstring, flags, width, precision),
    trio_class_t *self,
    TRIO_CONST trio_wchar_t *wstring,
    trio_flags_t flags,
    int width,
    int precision)
{
    int length;
    int size;

```

```

assert(VALID(self));
assert(VALID(self->OutStream));

#if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)
(void)mblen(NULL, 0);
#endif

if (wstring == NULL)
{
    TrioWriteString(self, NULL, flags, width, precision);
    return;
}

if (NO_PRECISION == precision)
{
    length = INT_MAX;
}
else
{
    length = precision;
    width -= length;
}

if (flags & FLAGS_QUOTE)
    self->OutStream(self, CHAR_QUOTE);

if (! (flags & FLAGS_LEFTADJUST))
{
    while (width-- > 0)
self->OutStream(self, CHAR_ADJUST);
}

while (length > 0)
{
    size = TrioWriteWideStringCharacter(self, *wstring++, flags, length);
    if (size == 0)
break; /* while */
    length -= size;
}

if (flags & FLAGS_LEFTADJUST)
{
    while (width-- > 0)
self->OutStream(self, CHAR_ADJUST);
}
if (flags & FLAGS_QUOTE)
    self->OutStream(self, CHAR_QUOTE);
}

```

```

#endif /* TRIO_WIDECHAR */

/*****
* TrioWriteDouble
*
* http://wwwold.dkuug.dk/JTC1/SC22/WG14/www/docs/dr_211.htm
*
* "5.2.4.2.2 paragraph #4
*
* The accuracy [...] is implementation defined, as is the accuracy
* of the conversion between floating-point internal representations
* and string representations performed by the library routine in
* <stdio.h>"
*/
/* FIXME: handle all instances of constant long-double number (L)
* and *l() math functions.
*/
TRIO_PRIVATE void
TrioWriteDouble
TRIO_ARGS6((self, number, flags, width, precision, base),
    trio_class_t *self,
    trio_long_double_t number,
    trio_flags_t flags,
    int width,
    int precision,
    int base)
{
    trio_long_double_t integerNumber;
    trio_long_double_t fractionNumber;
    trio_long_double_t workNumber;
    int integerDigits;
    int fractionDigits;
    int exponentDigits;
    int baseDigits;
    int integerThreshold;
    int fractionThreshold;
    int expectedWidth;
    int exponent = 0;
    unsigned int uExponent = 0;
    int exponentBase;
    trio_long_double_t dblBase;
    trio_long_double_t dblIntegerBase;
    trio_long_double_t dblFractionBase;
    trio_long_double_t integerAdjust;
    trio_long_double_t fractionAdjust;
    BOOLEAN_T isNegative;
    BOOLEAN_T isExponentNegative = FALSE;
    BOOLEAN_T requireTwoDigitExponent;

```

```

BOOLEAN_T isHex;
TRIO_CONST char *digits;
char *groupingPointer;
int i;
int index;
BOOLEAN_T hasOnlyZeroes;
int zeroes = 0;
register int trailingZeroes;
BOOLEAN_T keepTrailingZeroes;
BOOLEAN_T keepDecimalPoint;
trio_long_double_t epsilon;

assert(VALID(self));
assert(VALID(self->OutStream));
assert(((base >= MIN_BASE) && (base <= MAX_BASE)) || (base == NO_BASE));

/* Determine sign and look for special quantities */
switch (trio_fpclassify_and_signbit(number, &isNegative))
{
case TRIO_FP_NAN:
    TrioWriteString(self,
        (flags & FLAGS_UPPER)
        ? NAN_UPPER
        : NAN_LOWER,
        flags, width, precision);
    return;

case TRIO_FP_INFINITE:
    if (isNegative)
    {
        /* Negative infinity */
        TrioWriteString(self,
            (flags & FLAGS_UPPER)
            ? "-" INFINITE_UPPER
            : "-" INFINITE_LOWER,
            flags, width, precision);
        return;
    }
    else
    {
        /* Positive infinity */
        TrioWriteString(self,
            (flags & FLAGS_UPPER)
            ? INFINITE_UPPER
            : INFINITE_LOWER,
            flags, width, precision);
        return;
    }
}

```

```

default:
    /* Finitude */
    break;
}

/* Normal numbers */
if (flags & FLAGS_LONGDOUBLE)
{
    baseDigits = (base == 10)
? LDBL_DIG
: (int)floor(LDBL_MANT_DIG / TrioLogarithmBase(base));
    epsilon = LDBL_EPSILON;
}
else if (flags & FLAGS_SHORT)
{
    baseDigits = (base == BASE_DECIMAL)
? FLT_DIG
: (int)floor(FLT_MANT_DIG / TrioLogarithmBase(base));
    epsilon = FLT_EPSILON;
}
else
{
    baseDigits = (base == BASE_DECIMAL)
? DBL_DIG
: (int)floor(DBL_MANT_DIG / TrioLogarithmBase(base));
    epsilon = DBL_EPSILON;
}

digits = (flags & FLAGS_UPPER) ? internalDigitsUpper : internalDigitsLower;
isHex = (base == BASE_HEX);
if (base == NO_BASE)
    base = BASE_DECIMAL;
dblBase = (trio_long_double_t)base;
keepTrailingZeroes = !( (flags & FLAGS_ROUNDING) ||
    ( (flags & FLAGS_FLOAT_G) &&
        !(flags & FLAGS_ALTERNATIVE) ) );

if (flags & FLAGS_ROUNDING)
    precision = baseDigits;

if (precision == NO_PRECISION)
{
    if (isHex)
    {
        keepTrailingZeroes = FALSE;
        precision = FLT_MANT_DIG;
    }
}

```

```

    else
    {
        precision = FLT_DIG;
    }
}

if (isNegative)
    number = -number;

if (isHex)
    flags |= FLAGS_FLOAT_E;

if (flags & FLAGS_FLOAT_G)
{
    if (precision == 0)
precision = 1;

    if ((number < 1.0E-4) || (number > powl(base,
        (trio_long_double_t)precision)))
    {
        /* Use scientific notation */
        flags |= FLAGS_FLOAT_E;
    }
    else if (number < 1.0)
    {
        /*
         * Use normal notation. If the integer part of the number is
         * zero, then adjust the precision to include leading fractional
         * zeros.
         */
        workNumber = TrioLogarithm(number, base);
        workNumber = TRIO_FABS(workNumber);
        if (workNumber - floorl(workNumber) < 0.001)
            workNumber--;
        zeroes = (int)floorl(workNumber);
    }
}

if (flags & FLAGS_FLOAT_E)
{
    /* Scale the number */
    workNumber = TrioLogarithm(number, base);
    if (trio_isinf(workNumber) == -1)
    {
        exponent = 0;
        /* Undo setting */
        if (flags & FLAGS_FLOAT_G)
            flags &= ~FLAGS_FLOAT_E;
    }
}

```

```

    }
    else
    {
        exponent = (int)floorl(workNumber);
        number /= powl(dblBase, (trio_long_double_t)exponent);
        isExponentNegative = (exponent < 0);
        uExponent = (isExponentNegative) ? -exponent : exponent;
        if (isHex)
            uExponent *= 4; /* log16(2) */
        /* No thousand separators */
        flags &= ~FLAGS_QUOTE;
    }
}

integerNumber = floorl(number);
fractionNumber = number - integerNumber;

/*
 * Truncated number.
 *
 * Precision is number of significant digits for FLOAT_G
 * and number of fractional digits for others.
 */
integerDigits = (integerNumber > epsilon)
    ? 1 + (int)TrioLogarithm(integerNumber, base)
    : 1;
fractionDigits = ((flags & FLAGS_FLOAT_G) && (zeroes == 0))
    ? precision - integerDigits
    : zeroes + precision;

dblFractionBase = TrioPower(base, fractionDigits);

workNumber = number + 0.5 / dblFractionBase;
if (floorl(number) != floorl(workNumber))
{
    if (flags & FLAGS_FLOAT_E)
    {
        /* Adjust if number was rounded up one digit (ie. 0.99 to 1.00) */
        exponent++;
        isExponentNegative = (exponent < 0);
        uExponent = (isExponentNegative) ? -exponent : exponent;
        if (isHex)
            uExponent *= 4; /* log16(2) */
        workNumber = (number + 0.5 / dblFractionBase) / dblBase;
        integerNumber = floorl(workNumber);
        fractionNumber = workNumber - integerNumber;
    }
    else

```

```

{
    /* Adjust if number was rounded up one digit (ie. 99 to 100) */
    integerNumber = floorl(number + 0.5);
    fractionNumber = 0.0;
    integerDigits = (integerNumber > epsilon)
        ? 1 + (int)TrioLogarithm(integerNumber, base)
        : 1;
}
}

/* Estimate accuracy */
integerAdjust = fractionAdjust = 0.5;
if (flags & FLAGS_ROUNDING)
{
    if (integerDigits > baseDigits)
    {
        integerThreshold = baseDigits;
        fractionDigits = 0;
        dblFractionBase = 1.0;
        fractionThreshold = 0;
        precision = 0; /* Disable decimal-point */
        integerAdjust = TrioPower(base, integerDigits - integerThreshold - 1);
        fractionAdjust = 0.0;
    }
    else
    {
        integerThreshold = integerDigits;
        fractionThreshold = fractionDigits - integerThreshold;
        fractionAdjust = 1.0;
    }
}
else
{
    integerThreshold = INT_MAX;
    fractionThreshold = INT_MAX;
}

/*
 * Calculate expected width.
 * sign + integer part + thousands separators + decimal point
 * + fraction + exponent
 */
fractionAdjust /= dblFractionBase;
hasOnlyZeroes = (floorl((fractionNumber + fractionAdjust) * dblFractionBase) < epsilon);
keepDecimalPoint = ( (flags & FLAGS_ALTERNATIVE) ||
    !((precision == 0) ||
    (!keepTrailingZeroes && hasOnlyZeroes)) );
if (flags & FLAGS_FLOAT_E)

```

```

    {
        exponentDigits = (uExponent == 0)
? 1
: (int)ceil(TrioLogarithm((double)(uExponent + 1),
    (isHex) ? 10.0 : base));
    }
else
    exponentDigits = 0;
requireTwoDigitExponent = ((base == BASE_DECIMAL) && (exponentDigits == 1));

expectedWidth = integerDigits + fractionDigits
+ (keepDecimalPoint
    ? internalDecimalPointLength
    : 0)
+ ((flags & FLAGS_QUOTE)
    ? TrioCalcThousandSeparatorLength(integerDigits)
    : 0);
if (isNegative || (flags & FLAGS_SHOWSIGN) || (flags & FLAGS_SPACE))
    expectedWidth += sizeof("-") - 1;
if (exponentDigits > 0)
    expectedWidth += exponentDigits +
        ((requireTwoDigitExponent ? sizeof("E+0") : sizeof("E+")) - 1);
if (isHex)
    expectedWidth += sizeof("0X") - 1;

/* Output prefixing */
if (flags & FLAGS_NILPADDING)
{
    /* Leading zeros must be after sign */
    if (isNegative)
self->OutStream(self, '-');
    else if (flags & FLAGS_SHOWSIGN)
self->OutStream(self, '+');
    else if (flags & FLAGS_SPACE)
self->OutStream(self, ' ');
    if (isHex)
{
self->OutStream(self, '0');
self->OutStream(self, (flags & FLAGS_UPPER) ? 'X' : 'x');
}
    if (!(flags & FLAGS_LEFTADJUST))
{
for (i = expectedWidth; i < width; i++)
{
    self->OutStream(self, '0');
}
}
}

```

```

else
{
    /* Leading spaces must be before sign */
    if (!(flags & FLAGS_LEFTADJUST))
    {
        for (i = expectedWidth; i < width; i++)
        {
            self->OutStream(self, CHAR_ADJUST);
        }
    }
    if (isNegative)
self->OutStream(self, '-');
    else if (flags & FLAGS_SHOWSIGN)
self->OutStream(self, '+');
    else if (flags & FLAGS_SPACE)
self->OutStream(self, ' ');
    if (isHex)
    {
        self->OutStream(self, '0');
        self->OutStream(self, (flags & FLAGS_UPPER) ? 'X' : 'x');
    }
}

/* Output the integer part and thousand separators */
dblIntegerBase = 1.0 / TrioPower(base, integerDigits - 1);
for (i = 0; i < integerDigits; i++)
{
    workNumber = floorl(((integerNumber + integerAdjust) * dblIntegerBase));
    if (i > integerThreshold)
    {
        /* Beyond accuracy */
        self->OutStream(self, digits[0]);
    }
    else
    {
        self->OutStream(self, digits[(int)fmodl(workNumber, dblBase)]);
    }
    dblIntegerBase *= dblBase;

    if (((flags & (FLAGS_FLOAT_E | FLAGS_QUOTE)) == FLAGS_QUOTE)
    && TrioFollowedBySeparator(integerDigits - i))
    {
        for (groupingPointer = internalThousandSeparator;
            *groupingPointer != NIL;
            groupingPointer++)
        {
            self->OutStream(self, *groupingPointer);
        }
    }
}

```

```

}
}

/* Insert decimal point and build the fraction part */
trailingZeroes = 0;

if (keepDecimalPoint)
{
    if (internalDecimalPoint)
    {
        self->OutStream(self, internalDecimalPoint);
    }
    else
    {
        for (i = 0; i < internalDecimalPointLength; i++)
        {
            self->OutStream(self, internalDecimalPointString[i]);
        }
    }
}

for (i = 0; i < fractionDigits; i++)
{
    if ((integerDigits > integerThreshold) || (i > fractionThreshold))
    {
        /* Beyond accuracy */
        trailingZeroes++;
    }
    else
    {
        fractionNumber *= dblBase;
        fractionAdjust *= dblBase;
        workNumber = floorl(fractionNumber + fractionAdjust);
        fractionNumber -= workNumber;
        index = (int)fmodl(workNumber, dblBase);
        if (index == 0)
        {
            trailingZeroes++;
        }
        else
        {
            while (trailingZeroes > 0)
            {
                /* Not trailing zeroes after all */
                self->OutStream(self, digits[0]);
                trailingZeroes--;
            }
            self->OutStream(self, digits[index]);
        }
    }
}

```

```

    }
}
}

if (keepTrailingZeroes)
{
    while (trailingZeroes > 0)
    {
        self->OutStream(self, digits[0]);
        trailingZeroes--;
    }
}

/* Output exponent */
if (exponentDigits > 0)
{
    self->OutStream(self,
        isHex
        ? ((flags & FLAGS_UPPER) ? 'P' : 'p')
        : ((flags & FLAGS_UPPER) ? 'E' : 'e'));
    self->OutStream(self, (isExponentNegative) ? '-' : '+');

    /* The exponent must contain at least two digits */
    if (requireTwoDigitExponent)
        self->OutStream(self, '0');

    if (isHex)
base = 10.0;
    exponentBase = (int)TrioPower(base, exponentDigits - 1);
    for (i = 0; i < exponentDigits; i++)
    {
        self->OutStream(self, digits[(uExponent / exponentBase) % base]);
        exponentBase /= base;
    }
}

/* Output trailing spaces */
if (flags & FLAGS_LEFTADJUST)
{
    for (i = expectedWidth; i < width; i++)
    {
        self->OutStream(self, CHAR_ADJUST);
    }
}

}

/*****
* TrioFormatProcess
*

```

```

* Description:
* This is the main engine for formatting output
*/

TRIO_PRIVATE int
TrioFormatProcess
TRIO_ARGS3((data, format, parameters),
    trio_class_t *data,
    TRIO_CONST char *format,
    trio_parameter_t *parameters)
{
#if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)
    int charlen;
#endif
    int i;
    TRIO_CONST char *string;
    trio_pointer_t pointer;
    trio_flags_t flags;
    int width;
    int precision;
    int base;
    int index;

    index = 0;
    i = 0;
#if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)
    (void)mblen(NULL, 0);
#endif

    while (format[index])
    {
        #if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)
            if (! isascii(format[index]))
            {
                charlen = mblen(&format[index], MB_LEN_MAX);
                /*
                 * Only valid multibyte characters are handled here. Invalid
                 * multibyte characters (charlen == -1) are handled as normal
                 * characters.
                 */
                if (charlen != -1)
                {
                    while (charlen-- > 0)
                    {
                        data->OutStream(data, format[index++]);
                    }
                    continue; /* while characters left in formatting string */
                }
            }
        }
    }
}

```

```

#endif /* TRIO_COMPILER_SUPPORTS_MULTIBYTE */
    if (CHAR_IDENTIFIER == format[index])
    {
        if (CHAR_IDENTIFIER == format[index + 1])
        {
            data->OutStream(data, CHAR_IDENTIFIER);
            index += 2;
        }
        else
        {
            /* Skip the parameter entries */
            while (parameters[i].type == FORMAT_PARAMETER)
                i++;

            flags = parameters[i].flags;

            /* Find width */
            width = parameters[i].width;
            if (flags & FLAGS_WIDTH_PARAMETER)
            {
                /* Get width from parameter list */
                width = (int)parameters[width].data.number.as_signed;
                if (width < 0)
                {
                    /*
                     * A negative width is the same as the - flag and
                     * a positive width.
                     */
                    flags |= FLAGS_LEFTADJUST;
                    flags &= ~FLAGS_NILPADDING;
                    width = -width;
                }
            }

            /* Find precision */
            if (flags & FLAGS_PRECISION)
            {
                precision = parameters[i].precision;
                if (flags & FLAGS_PRECISION_PARAMETER)
                {
                    /* Get precision from parameter list */
                    precision = (int)parameters[precision].data.number.as_signed;
                    if (precision < 0)
                    {
                        /*
                         * A negative precision is the same as no
                         * precision
                         */

```

```

    precision = NO_PRECISION;
}
}
else
{
    precision = NO_PRECISION;
}

/* Find base */
base = parameters[i].base;
if (flags & FLAGS_BASE_PARAMETER)
{
    /* Get base from parameter list */
    base = (int)parameters[base].data.number.as_signed;
}

switch (parameters[i].type)
{
case FORMAT_CHAR:
    if (flags & FLAGS_QUOTE)
        data->OutStream(data, CHAR_QUOTE);
    if (! (flags & FLAGS_LEFTADJUST))
    {
        while (--width > 0)
            data->OutStream(data, CHAR_ADJUST);
    }
#if TRIO_WIDECHAR
    if (flags & FLAGS_WIDECHAR)
    {
        TrioWriteWideStringCharacter(data,
            (trio_wchar_t)parameters[i].data.number.as_signed,
            flags,
            NO_WIDTH);
    }
    else
#endif
    {
        TrioWriteStringCharacter(data,
            (int)parameters[i].data.number.as_signed,
            flags);
    }

    if (flags & FLAGS_LEFTADJUST)
    {
        while(--width > 0)
            data->OutStream(data, CHAR_ADJUST);
    }
}

```

```

    if (flags & FLAGS_QUOTE)
        data->OutStream(data, CHAR_QUOTE);

    break; /* FORMAT_CHAR */

case FORMAT_INT:
    TrioWriteNumber(data,
        parameters[i].data.number.as_unsigned,
        flags,
        width,
        precision,
        base);

    break; /* FORMAT_INT */

case FORMAT_DOUBLE:
    TrioWriteDouble(data,
        parameters[i].data.longdoubleNumber,
        flags,
        width,
        precision,
        base);
    break; /* FORMAT_DOUBLE */

case FORMAT_STRING:
#ifdef TRIO_WIDECHAR
    if (flags & FLAGS_WIDECHAR)
    {
        TrioWriteWideString(data,
            parameters[i].data.wstring,
            flags,
            width,
            precision);
    }
    else
#endif
    {
        TrioWriteString(data,
            parameters[i].data.string,
            flags,
            width,
            precision);
    }
    break; /* FORMAT_STRING */

case FORMAT_POINTER:
    {
        trio_reference_t reference;

```

```

    reference.data = data;
    reference.parameter = &parameters[i];
    trio_print_pointer(&reference, parameters[i].data.pointer);
}
break; /* FORMAT_POINTER */

case FORMAT_COUNT:
    pointer = parameters[i].data.pointer;
    if (NULL != pointer)
    {
        /*
         * C99 paragraph 7.19.6.1.8 says "the number of
         * characters written to the output stream so far by
         * this call", which is data->committed
         */
#ifdef QUALIFIER_SIZE_T || defined(QUALIFIER_SIZE_T_UPPER)
        if (flags & FLAGS_SIZE_T)
            *(size_t *)pointer = (size_t)data->committed;
        else
#endif
#ifdef QUALIFIER_PTRDIFF_T
        if (flags & FLAGS_PTRDIFF_T)
            *(ptrdiff_t *)pointer = (ptrdiff_t)data->committed;
        else
#endif
#ifdef QUALIFIER_INTMAX_T
        if (flags & FLAGS_INTMAX_T)
            *(trio_intmax_t *)pointer = (trio_intmax_t)data->committed;
        else
#endif
#ifdef QUALIFIER_QUAD
        if (flags & FLAGS_QUAD)
        {
            *(trio_ulonglong_t *)pointer = (trio_ulonglong_t)data->committed;
        }
        else if (flags & FLAGS_LONG)
        {
            *(long int *)pointer = (long int)data->committed;
        }
        else if (flags & FLAGS_SHORT)
        {
            *(short int *)pointer = (short int)data->committed;
        }
        else
        {
            *(int *)pointer = (int)data->committed;
        }
    }
}

```

```

        break; /* FORMAT_COUNT */

case FORMAT_PARAMETER:
    break; /* FORMAT_PARAMETER */

#if defined(FORMAT_ERRNO)
case FORMAT_ERRNO:
    string = trio_error(parameters[i].data.errorNumber);
    if (string)
    {
        TrioWriteString(data,
            string,
            flags,
            width,
            precision);
    }
    else
    {
        data->OutStream(data, '#');
        TrioWriteNumber(data,
            (trio_uintmax_t)parameters[i].data.errorNumber,
            flags,
            width,
            precision,
            BASE_DECIMAL);
    }
    break; /* FORMAT_ERRNO */
#endif /* defined(FORMAT_ERRNO) */

#if defined(FORMAT_USER_DEFINED)
case FORMAT_USER_DEFINED:
    {
        trio_reference_t reference;
        trio_userdef_t *def = NULL;

        if (parameters[i].user_name[0] == NIL)
        {
            /* Use handle */
            if ((i > 0) ||
                (parameters[i - 1].type == FORMAT_PARAMETER))
                def = (trio_userdef_t *)parameters[i - 1].data.pointer;
        }
        else
        {
            /* Look up namespace */
            def = TrioFindNamespace(parameters[i].user_name, NULL);
        }
        if (def) {

```

```

        reference.data = data;
        reference.parameter = &parameters[i];
        def->callback(&reference);
    }
}
break;
#endif /* defined(FORMAT_USER_DEFINED) */

default:
    break;
} /* switch parameter type */

/* Prepare for next */
index = parameters[i].indexAfterSpecifier;
i++;
}
}
else /* not identifier */
{
    data->OutStream(data, format[index++]);
}
}
return data->processed;
}

/*****
* TrioFormatRef
*/
TRIO_PRIVATE int
TrioFormatRef
TRIO_ARGS4((reference, format, arglist, argarray),
    trio_reference_t *reference,
    TRIO_CONST char *format,
    va_list *arglist,
    trio_pointer_t *argarray)
{
    int status;
    trio_parameter_t parameters[MAX_PARAMETERS];

    status = TrioParse(TYPE_PRINT, format, parameters, arglist, argarray);
    if (status < 0)
        return status;

    status = TrioFormatProcess(reference->data, format, parameters);
    if (reference->data->error != 0)
    {
        status = reference->data->error;
    }
}

```

```

return status;
}

/*****
* TrioFormat
*/
TRIO_PRIVATE int
TrioFormat
TRIO_ARGS6((destination, destinationSize, OutStream, format, arglist, argarray),
    trio_pointer_t destination,
    size_t destinationSize,
    void (*OutStream) TRIO_PROTO((trio_class_t *, int)),
    TRIO_CONST char *format,
    va_list *arglist,
    trio_pointer_t *argarray)
{
    int status;
    trio_class_t data;
    trio_parameter_t parameters[MAX_PARAMETERS];

    assert(VALID(OutStream));
    assert(VALID(format));

    memset(&data, 0, sizeof(data));
    data.OutStream = OutStream;
    data.location = destination;
    data.max = destinationSize;
    data.error = 0;

    #if defined(USE_LOCALE)
    if (NULL == internalLocaleValues)
    {
        TrioSetLocale();
    }
    #endif

    status = TrioParse(TYPE_PRINT, format, parameters, arglist, argarray);
    if (status < 0)
        return status;

    status = TrioFormatProcess(&data, format, parameters);
    if (data.error != 0)
    {
        status = data.error;
    }
    return status;
}

```

```

/*****
* TrioOutputStreamFile
*/
TRIO_PRIVATE void
TrioOutputStreamFile
TRIO_ARGS2((self, output),
    trio_class_t *self,
    int output)
{
    FILE *file;

    assert(VALID(self));
    assert(VALID(self->location));

    file = (FILE *)self->location;
    self->processed++;
    if (fputc(output, file) == EOF)
    {
        self->error = TRIO_ERROR_RETURN(TRIO_EOF, 0);
    }
    else
    {
        self->committed++;
    }
}

/*****
* TrioOutputStreamFileDescriptor
*/
TRIO_PRIVATE void
TrioOutputStreamFileDescriptor
TRIO_ARGS2((self, output),
    trio_class_t *self,
    int output)
{
    int fd;
    char ch;

    assert(VALID(self));

    fd = *((int *)self->location);
    ch = (char)output;
    self->processed++;
    if (write(fd, &ch, sizeof(char)) == -1)
    {
        self->error = TRIO_ERROR_RETURN(TRIO_ERRNO, 0);
    }
    else

```

```

    {
        self->committed++;
    }
}

/*****
* TrioOutputStreamCustom
*/
TRIO_PRIVATE void
TrioOutputStreamCustom
TRIO_ARGS2((self, output),
    trio_class_t *self,
    int output)
{
    int status;
    trio_custom_t *data;

    assert(VALID(self));
    assert(VALID(self->location));

    data = (trio_custom_t *)self->location;
    if (data->stream.out)
    {
        status = (data->stream.out)(data->closure, output);
        if (status >= 0)
        {
            self->committed++;
        }
        else
        {
            if (self->error == 0)
            {
                self->error = TRIO_ERROR_RETURN(TRIO_ECUSTOM, -status);
            }
        }
    }
    self->processed++;
}

/*****
* TrioOutputStreamString
*/
TRIO_PRIVATE void
TrioOutputStreamString
TRIO_ARGS2((self, output),
    trio_class_t *self,
    int output)
{

```

```

char **buffer;

assert(VALID(self));
assert(VALID(self->location));

buffer = (char **)self->location;
**buffer = (char)output;
(*buffer)++;
self->processed++;
self->committed++;
}

/*****
* TrioOutputStreamStringMax
*/
TRIO_PRIVATE void
TrioOutputStreamStringMax
TRIO_ARGS2((self, output),
    trio_class_t *self,
    int output)
{
    char **buffer;

    assert(VALID(self));
    assert(VALID(self->location));

    buffer = (char **)self->location;

    if (self->processed < self->max)
    {
        **buffer = (char)output;
        (*buffer)++;
        self->committed++;
    }
    self->processed++;
}

/*****
* TrioOutputStreamStringDynamic
*/
TRIO_PRIVATE void
TrioOutputStreamStringDynamic
TRIO_ARGS2((self, output),
    trio_class_t *self,
    int output)
{
    assert(VALID(self));
    assert(VALID(self->location));

```

```

if (self->error == 0)
{
    trio_xstring_append_char((trio_string_t *)self->location,
        (char)output);
    self->committed++;
}
/* The processed variable must always be increased */
self->processed++;
}

/*****
 *
 * Formatted printing functions
 *
 *****/

#ifdef TRIO_DOCUMENTATION
# include "doc/doc_printf.h"
#endif
/** @addtogroup Printf
    @{
*/

/*****
 * printf
 */

/**
    Print to standard output stream.

    @param format Formatting string.
    @param ... Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_printf
TRIO_VARGS2((format, va_alist),
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;

    assert(VALID(format));

    TRIO_VA_START(args, format);
    status = TrioFormat(stdout, 0, TrioOutputStreamFile, format, &args, NULL);

```

```

TRIO_VA_END(args);
return status;
}

/**
    Print to standard output stream.

    @param format Formatting string.
    @param args Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_vprintf
TRIO_ARGS2((format, args),
    TRIO_CONST char *format,
    va_list args)
{
    assert(VALID(format));

    return TrioFormat(stdout, 0, TrioOutputStreamFile, format, &args, NULL);
}

/**
    Print to standard output stream.

    @param format Formatting string.
    @param args Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_printfv
TRIO_ARGS2((format, args),
    TRIO_CONST char *format,
    trio_pointer_t * args)
{
    assert(VALID(format));

    return TrioFormat(stdout, 0, TrioOutputStreamFile, format, NULL, args);
}

/*****
* fprintf
*/

/**
    Print to file.

    @param file File pointer.

```

```

    @param format Formatting string.
    @param ... Arguments.
    @return Number of printed characters.
*/

TRIO_PUBLIC int
trio_fprintf
TRIO_VARGS3((file, format, va_alist),
    FILE *file,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;

    assert(VALID(file));
    assert(VALID(format));

    TRIO_VA_START(args, format);
    status = TrioFormat(file, 0, TrioOutputStreamFile, format, &args, NULL);
    TRIO_VA_END(args);
    return status;
}

/**
    Print to file.

    @param file File pointer.
    @param format Formatting string.
    @param args Arguments.
    @return Number of printed characters.
*/

TRIO_PUBLIC int
trio_vfprintf
TRIO_ARGS3((file, format, args),
    FILE *file,
    TRIO_CONST char *format,
    va_list args)
{
    assert(VALID(file));
    assert(VALID(format));

    return TrioFormat(file, 0, TrioOutputStreamFile, format, &args, NULL);
}

/**
    Print to file.

    @param file File pointer.

```

```

    @param format Formatting string.
    @param args Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_fprintfv
TRIO_ARGS3((file, format, args),
    FILE *file,
    TRIO_CONST char *format,
    trio_pointer_t * args)
{
    assert(VALID(file));
    assert(VALID(format));

    return TrioFormat(file, 0, TrioOutputStreamFile, format, NULL, args);
}

/*****
 * dprintf
 */

/**
    Print to file descriptor.

    @param fd File descriptor.
    @param format Formatting string.
    @param ... Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_dprintf
TRIO_VARGS3((fd, format, va_alist),
    int fd,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;

    assert(VALID(format));

    TRIO_VA_START(args, format);
    status = TrioFormat(&fd, 0, TrioOutputStreamFileDescriptor, format, &args, NULL);
    TRIO_VA_END(args);
    return status;
}

/**

```

Print to file descriptor.

@param fd File descriptor.

@param format Formatting string.

@param args Arguments.

@return Number of printed characters.

*/

TRIO_PUBLIC int

trio_vdprintf

TRIO_ARGS3((fd, format, args),

int fd,

TRIO_CONST char *format,

va_list args)

{

assert(VALID(format));

return TrioFormat(&fd, 0, TrioOutputStreamFileDescriptor, format, &args, NULL);

}

/**

Print to file descriptor.

@param fd File descriptor.

@param format Formatting string.

@param args Arguments.

@return Number of printed characters.

*/

TRIO_PUBLIC int

trio_dprintfv

TRIO_ARGS3((fd, format, args),

int fd,

TRIO_CONST char *format,

trio_pointer_t *args)

{

assert(VALID(format));

return TrioFormat(&fd, 0, TrioOutputStreamFileDescriptor, format, NULL, args);

}

* cprintf

*/

TRIO_PUBLIC int

trio_cprintf

TRIO_VARGS4((stream, closure, format, va_alist),

trio_outstream_t stream,

trio_pointer_t closure,

TRIO_CONST char *format,

```

    TRIO_VA_DECL)
{
    int status;
    va_list args;
    trio_custom_t data;

    assert(VALID(stream));
    assert(VALID(format));

    TRIO_VA_START(args, format);
    data.stream.out = stream;
    data.closure = closure;
    status = TrioFormat(&data, 0, TrioOutputStreamCustom, format, &args, NULL);
    TRIO_VA_END(args);
    return status;
}

TRIO_PUBLIC int
trio_vprintf
TRIO_ARGS4((stream, closure, format, args),
    trio_outstream_t stream,
    trio_pointer_t closure,
    TRIO_CONST char *format,
    va_list args)
{
    trio_custom_t data;

    assert(VALID(stream));
    assert(VALID(format));

    data.stream.out = stream;
    data.closure = closure;
    return TrioFormat(&data, 0, TrioOutputStreamCustom, format, &args, NULL);
}

TRIO_PUBLIC int
trio_cprintfv
TRIO_ARGS4((stream, closure, format, args),
    trio_outstream_t stream,
    trio_pointer_t closure,
    TRIO_CONST char *format,
    void **args)
{
    trio_custom_t data;

    assert(VALID(stream));
    assert(VALID(format));

```

```

data.stream.out = stream;
data.closure = closure;
return TrioFormat(&data, 0, TrioOutputStreamCustom, format, NULL, args);
}

/*****

* sprintf
*/

/**
Print to string.

@param buffer Output string.
@param format Formatting string.
@param ... Arguments.
@return Number of printed characters.
*/
TRIO_PUBLIC int
trio_sprintf
TRIO_VARGS3((buffer, format, va_alist),
    char *buffer,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
int status;
va_list args;

assert(VALID(buffer));
assert(VALID(format));

TRIO_VA_START(args, format);
status = TrioFormat(&buffer, 0, TrioOutputStreamString, format, &args, NULL);
*buffer = NIL; /* Terminate with NIL character */
TRIO_VA_END(args);
return status;
}

/**
Print to string.

@param buffer Output string.
@param format Formatting string.
@param args Arguments.
@return Number of printed characters.
*/
TRIO_PUBLIC int
trio_vsprintf
TRIO_ARGS3((buffer, format, args),

```

```

    char *buffer,
    TRIO_CONST char *format,
    va_list args)
{
    int status;

    assert(VALID(buffer));
    assert(VALID(format));

    status = TrioFormat(&buffer, 0, TrioOutputStreamString, format, &args, NULL);
    *buffer = NIL;
    return status;
}

/**
    Print to string.

    @param buffer Output string.
    @param format Formatting string.
    @param args Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_sprintfv
TRIO_ARGS3((buffer, format, args),
    char *buffer,
    TRIO_CONST char *format,
    trio_pointer_t *args)
{
    int status;

    assert(VALID(buffer));
    assert(VALID(format));

    status = TrioFormat(&buffer, 0, TrioOutputStreamString, format, NULL, args);
    *buffer = NIL;
    return status;
}

/*****
* snprintf
*/

/**
    Print at most @p max characters to string.

    @param buffer Output string.
    @param max Maximum number of characters to print.

```

```

    @param format Formatting string.
    @param ... Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_snprintf
TRIO_VARGS4((buffer, max, format, va_alist),
    char *buffer,
    size_t max,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;

    assert(VALID(buffer));
    assert(VALID(format));

    TRIO_VA_START(args, format);
    status = TrioFormat(&buffer, max > 0 ? max - 1 : 0,
        TrioOutputStreamStringMax, format, &args, NULL);
    if (max > 0)
        *buffer = NIL;
    TRIO_VA_END(args);
    return status;
}

/**
    Print at most @p max characters to string.

    @param buffer Output string.
    @param max Maximum number of characters to print.
    @param format Formatting string.
    @param args Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_vsnprintf
TRIO_ARGS4((buffer, max, format, args),
    char *buffer,
    size_t max,
    TRIO_CONST char *format,
    va_list args)
{
    int status;

    assert(VALID(buffer));
    assert(VALID(format));

```

```

status = TrioFormat(&buffer, max > 0 ? max - 1 : 0,
    TrioOutputStreamStringMax, format, &args, NULL);
if (max > 0)
    *buffer = NIL;
return status;
}

/**
    Print at most @p max characters to string.

    @param buffer Output string.
    @param max Maximum number of characters to print.
    @param format Formatting string.
    @param args Arguments.
    @return Number of printed characters.
*/
TRIO_PUBLIC int
trio_snprintfv
TRIO_ARGS4((buffer, max, format, args),
    char *buffer,
    size_t max,
    TRIO_CONST char *format,
    trio_pointer_t *args)
{
    int status;

    assert(VALID(buffer));
    assert(VALID(format));

    status = TrioFormat(&buffer, max > 0 ? max - 1 : 0,
        TrioOutputStreamStringMax, format, NULL, args);
    if (max > 0)
        *buffer = NIL;
    return status;
}

/*****
* snprintfcat
* Appends the new string to the buffer string overwriting the '\0'
* character at the end of buffer.
*/
TRIO_PUBLIC int
trio_snprintfcat
TRIO_VARGS4((buffer, max, format, va_alist),
    char *buffer,
    size_t max,
    TRIO_CONST char *format,

```

```

    TRIO_VA_DECL)
{
    int status;
    va_list args;
    size_t buf_len;

    TRIO_VA_START(args, format);

    assert(VALID(buffer));
    assert(VALID(format));

    buf_len = trio_length(buffer);
    buffer = &buffer[buf_len];

    status = TrioFormat(&buffer, max - 1 - buf_len,
        TrioOutputStreamStringMax, format, &args, NULL);
    TRIO_VA_END(args);
    *buffer = NIL;
    return status;
}

TRIO_PUBLIC int
trio_vsnprintfcat
TRIO_ARGS4((buffer, max, format, args),
    char *buffer,
    size_t max,
    TRIO_CONST char *format,
    va_list args)
{
    int status;
    size_t buf_len;

    assert(VALID(buffer));
    assert(VALID(format));

    buf_len = trio_length(buffer);
    buffer = &buffer[buf_len];
    status = TrioFormat(&buffer, max - 1 - buf_len,
        TrioOutputStreamStringMax, format, &args, NULL);
    *buffer = NIL;
    return status;
}

/*****
* trio_aprintf
*/

/* Deprecated */

```

```

TRIO_PUBLIC char *
trio_aprintf
TRIO_VARGS2((format, va_alist),
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    va_list args;
    trio_string_t *info;
    char *result = NULL;

    assert(VALID(format));

    info = trio_xstring_duplicate("");
    if (info)
    {
        TRIO_VA_START(args, format);
        (void)TrioFormat(info, 0, TrioOutputStreamStringDynamic,
            format, &args, NULL);
        TRIO_VA_END(args);

        trio_string_terminate(info);
        result = trio_string_extract(info);
        trio_string_destroy(info);
    }
    return result;
}

/* Deprecated */
TRIO_PUBLIC char *
trio_vaprintf
TRIO_ARGS2((format, args),
    TRIO_CONST char *format,
    va_list args)
{
    trio_string_t *info;
    char *result = NULL;

    assert(VALID(format));

    info = trio_xstring_duplicate("");
    if (info)
    {
        (void)TrioFormat(info, 0, TrioOutputStreamStringDynamic,
            format, &args, NULL);
        trio_string_terminate(info);
        result = trio_string_extract(info);
        trio_string_destroy(info);
    }
}

```

```

return result;
}

TRIO_PUBLIC int
trio_asprintf
TRIO_VARGS3((result, format, va_alist),
    char **result,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    va_list args;
    int status;
    trio_string_t *info;

    assert(VALID(format));

    *result = NULL;

    info = trio_xstring_duplicate("");
    if (info == NULL)
    {
        status = TRIO_ERROR_RETURN(TRIO_ENOMEM, 0);
    }
    else
    {
        TRIO_VA_START(args, format);
        status = TrioFormat(info, 0, TrioOutputStreamStringDynamic,
            format, &args, NULL);
        TRIO_VA_END(args);
        if (status >= 0)
        {
            trio_string_terminate(info);
            *result = trio_string_extract(info);
        }
        trio_string_destroy(info);
    }
    return status;
}

TRIO_PUBLIC int
trio_vasprintf
TRIO_ARGS3((result, format, args),
    char **result,
    TRIO_CONST char *format,
    va_list args)
{
    int status;
    trio_string_t *info;

```

```

assert(VALID(format));

*result = NULL;

info = trio_xstring_duplicate("");
if (info == NULL)
{
    status = TRIO_ERROR_RETURN(TRIO_ENOMEM, 0);
}
else
{
    status = TrioFormat(info, 0, TrioOutputStreamStringDynamic,
        format, &args, NULL);
    if (status >= 0)
    {
        trio_string_terminate(info);
        *result = trio_string_extract(info);
    }
    trio_string_destroy(info);
}
return status;
}

/** @ } End of Printf documentation module */

/*****
 *
 * CALLBACK
 *
 *****/

#if defined(TRIO_DOCUMENTATION)
#include "doc/doc_register.h"
#endif
/**
 * @addtogroup UserDefined
 * @ {
 */

#if TRIO_EXTENSION

/*****
 * trio_register
 */

/**
 * Register new user-defined specifier.

```

```

@param callback
@param name
@return Handle.
*/
TRIO_PUBLIC trio_pointer_t
trio_register
TRIO_ARGS2((callback, name),
    trio_callback_t callback,
    TRIO_CONST char *name)
{
    trio_userdef_t *def;
    trio_userdef_t *prev = NULL;

    if (callback == NULL)
        return NULL;

    if (name)
    {
        {
            /* Handle built-in namespaces */
            if (name[0] == ':')
            {
                {
                    if (trio_equal(name, ":enter"))
                    {
                        internalEnterCriticalRegion = callback;
                    }
                    else if (trio_equal(name, ":leave"))
                    {
                        internalLeaveCriticalRegion = callback;
                    }
                }
                return NULL;
            }

            /* Bail out if namespace is too long */
            if (trio_length(name) >= MAX_USER_NAME)
                return NULL;

            /* Bail out if namespace already is registered */
            def = TrioFindNamespace(name, &prev);
            if (def)
                return NULL;
        }

        def = (trio_userdef_t *)TRIO_MALLOC(sizeof(trio_userdef_t));
        if (def)
        {
            if (internalEnterCriticalRegion)
                (void)internalEnterCriticalRegion(NULL);
        }
    }
}

```

```

    if (name)
    {
        /* Link into internal list */
        if (prev == NULL)
            internalUserDef = def;
        else
            prev->next = def;
    }

    /* Initialize */
    def->callback = callback;
    def->name = (name == NULL)
? NULL
: trio_duplicate(name);
    def->next = NULL;

    if (internalLeaveCriticalRegion)
(void)internalLeaveCriticalRegion(NULL);
    }
    return (trio_pointer_t)def;
}

/**
    Unregister an existing user-defined specifier.

    @param handle
    */
void
trio_unregister
TRIO_ARGS1((handle),
    trio_pointer_t handle)
{
    trio_userdef_t *self = (trio_userdef_t *)handle;
    trio_userdef_t *def;
    trio_userdef_t *prev = NULL;

    assert(VALID(self));

    if (self->name)
    {
        def = TrioFindNamespace(self->name, &prev);
        if (def)
        {
            if (internalEnterCriticalRegion)
                (void)internalEnterCriticalRegion(NULL);

            if (prev == NULL)
                internalUserDef = NULL;

```

```

else
    prev->next = def->next;

if (internalLeaveCriticalRegion)
    (void)internalLeaveCriticalRegion(NULL);
}
trio_destroy(self->name);
}
TRIO_FREE(self);
}

/*****
* trio_get_format [public]
*/
TRIO_CONST char *
trio_get_format
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
#if defined(FORMAT_USER_DEFINED)
    assert(((trio_reference_t *)ref)->parameter->type == FORMAT_USER_DEFINED);
#endif

    return (((trio_reference_t *)ref)->parameter->user_data);
}

/*****
* trio_get_argument [public]
*/
trio_pointer_t
trio_get_argument
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
#if defined(FORMAT_USER_DEFINED)
    assert(((trio_reference_t *)ref)->parameter->type == FORMAT_USER_DEFINED);
#endif

    return ((trio_reference_t *)ref)->parameter->data.pointer;
}

/*****
* trio_get_width / trio_set_width [public]
*/
int
trio_get_width
TRIO_ARGS1((ref),
    trio_pointer_t ref)

```

```

{
    return (((trio_reference_t *)ref)->parameter->width);
}

void
trio_set_width
TRIO_ARGS2((ref, width),
    trio_pointer_t ref,
    int width)
{
    (((trio_reference_t *)ref)->parameter->width = width;
}

/*****
* trio_get_precision / trio_set_precision [public]
*/
int
trio_get_precision
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->precision);
}

void
trio_set_precision
TRIO_ARGS2((ref, precision),
    trio_pointer_t ref,
    int precision)
{
    (((trio_reference_t *)ref)->parameter->precision = precision;
}

/*****
* trio_get_base / trio_set_base [public]
*/
int
trio_get_base
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->base);
}

void
trio_set_base
TRIO_ARGS2((ref, base),
    trio_pointer_t ref,

```

```

    int base)
{
    ((trio_reference_t *)ref)->parameter->base = base;
}

/*****
* trio_get_long / trio_set_long [public]
*/
int
trio_get_long
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_LONG)
        ? TRUE
        : FALSE;
}

void
trio_set_long
TRIO_ARGS2((ref, is_long),
    trio_pointer_t ref,
    int is_long)
{
    if (is_long)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_LONG;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_LONG;
}

/*****
* trio_get_longlong / trio_set_longlong [public]
*/
int
trio_get_longlong
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_QUAD)
        ? TRUE
        : FALSE;
}

void
trio_set_longlong
TRIO_ARGS2((ref, is_longlong),
    trio_pointer_t ref,
    int is_longlong)

```

```

{
    if (is_longlong)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_QUAD;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_QUAD;
}

/*****
* trio_get_longdouble / trio_set_longdouble [public]
*/
int
trio_get_longdouble
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_LONGDOUBLE)
        ? TRUE
        : FALSE;
}

void
trio_set_longdouble
TRIO_ARGS2((ref, is_longdouble),
    trio_pointer_t ref,
    int is_longdouble)
{
    if (is_longdouble)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_LONGDOUBLE;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_LONGDOUBLE;
}

/*****
* trio_get_short / trio_set_short [public]
*/
int
trio_get_short
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_SHORT)
        ? TRUE
        : FALSE;
}

void
trio_set_short
TRIO_ARGS2((ref, is_short),

```

```

    trio_pointer_t ref,
    int is_short)
{
    if (is_short)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_SHORT;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_SHORT;
}

/*****
 * trio_get_shortshort / trio_set_shortshort [public]
 */
int
trio_get_shortshort
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_SHORTSHORT)
        ? TRUE
        : FALSE;
}

void
trio_set_shortshort
TRIO_ARGS2((ref, is_shortshort),
    trio_pointer_t ref,
    int is_shortshort)
{
    if (is_shortshort)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_SHORTSHORT;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_SHORTSHORT;
}

/*****
 * trio_get_alternative / trio_set_alternative [public]
 */
int
trio_get_alternative
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_ALTERNATIVE)
        ? TRUE
        : FALSE;
}

void

```

```

trio_set_alternative
TRIO_ARGS2((ref, is_alternative),
    trio_pointer_t ref,
    int is_alternative)
{
    if (is_alternative)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_ALTERNATIVE;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_ALTERNATIVE;
}

/*****
* trio_get_alignment / trio_set_alignment [public]
*/
int
trio_get_alignment
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_LEFTADJUST)
        ? TRUE
        : FALSE;
}

void
trio_set_alignment
TRIO_ARGS2((ref, is_leftaligned),
    trio_pointer_t ref,
    int is_leftaligned)
{
    if (is_leftaligned)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_LEFTADJUST;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_LEFTADJUST;
}

/*****
* trio_get_spacing /trio_set_spacing [public]
*/
int
trio_get_spacing
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_SPACE)
        ? TRUE
        : FALSE;
}

```

```

void
trio_set_spacing
TRIO_ARGS2((ref, is_space),
    trio_pointer_t ref,
    int is_space)
{
    if (is_space)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_SPACE;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_SPACE;
}

/*****
* trio_get_sign / trio_set_sign [public]
*/
int
trio_get_sign
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_SHOWSIGN)
        ? TRUE
        : FALSE;
}

void
trio_set_sign
TRIO_ARGS2((ref, is_sign),
    trio_pointer_t ref,
    int is_sign)
{
    if (is_sign)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_SHOWSIGN;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_SHOWSIGN;
}

/*****
* trio_get_padding / trio_set_padding [public]
*/
int
trio_get_padding
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_NILPADDING)
        ? TRUE

```

```

        : FALSE;
    }

void
trio_set_padding
TRIO_ARGS2((ref, is_padding),
    trio_pointer_t ref,
    int is_padding)
{
    if (is_padding)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_NILPADDING;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_NILPADDING;
}

/*****
 * trio_get_quote / trio_set_quote [public]
 */
int
trio_get_quote
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_QUOTE)
        ? TRUE
        : FALSE;
}

void
trio_set_quote
TRIO_ARGS2((ref, is_quote),
    trio_pointer_t ref,
    int is_quote)
{
    if (is_quote)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_QUOTE;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_QUOTE;
}

/*****
 * trio_get_upper / trio_set_upper [public]
 */
int
trio_get_upper
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{

```

```

return (((trio_reference_t *)ref)->parameter->flags & FLAGS_UPPER)
? TRUE
: FALSE;
}

void
trio_set_upper
TRIO_ARGS2((ref, is_upper),
    trio_pointer_t ref,
    int is_upper)
{
    if (is_upper)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_UPPER;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_UPPER;
}

/*****
* trio_get_largest / trio_set_largest [public]
*/
#ifdef TRIO_C99
int
trio_get_largest
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_INTMAX_T)
? TRUE
: FALSE;
}

void
trio_set_largest
TRIO_ARGS2((ref, is_largest),
    trio_pointer_t ref,
    int is_largest)
{
    if (is_largest)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_INTMAX_T;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_INTMAX_T;
}
#endif

/*****
* trio_get_ptrdiff / trio_set_ptrdiff [public]
*/
int

```

```

trio_get_ptrdiff
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_PTRDIFF_T)
        ? TRUE
        : FALSE;
}

void
trio_set_ptrdiff
TRIO_ARGS2((ref, is_ptrdiff),
    trio_pointer_t ref,
    int is_ptrdiff)
{
    if (is_ptrdiff)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_PTRDIFF_T;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_PTRDIFF_T;
}

/*****
* trio_get_size / trio_set_size [public]
*/
#ifdef TRIO_C99
int
trio_get_size
TRIO_ARGS1((ref),
    trio_pointer_t ref)
{
    return (((trio_reference_t *)ref)->parameter->flags & FLAGS_SIZE_T)
        ? TRUE
        : FALSE;
}

void
trio_set_size
TRIO_ARGS2((ref, is_size),
    trio_pointer_t ref,
    int is_size)
{
    if (is_size)
        ((trio_reference_t *)ref)->parameter->flags |= FLAGS_SIZE_T;
    else
        ((trio_reference_t *)ref)->parameter->flags &= ~FLAGS_SIZE_T;
}
#endif

```

```

/*****
* trio_print_int [public]
*/
void
trio_print_int
TRIO_ARGS2((ref, number),
    trio_pointer_t ref,
    int number)
{
    trio_reference_t *self = (trio_reference_t *)ref;

    TrioWriteNumber(self->data,
        (trio_uintmax_t)number,
        self->parameter->flags,
        self->parameter->width,
        self->parameter->precision,
        self->parameter->base);
}

/*****
* trio_print_uint [public]
*/
void
trio_print_uint
TRIO_ARGS2((ref, number),
    trio_pointer_t ref,
    unsigned int number)
{
    trio_reference_t *self = (trio_reference_t *)ref;

    TrioWriteNumber(self->data,
        (trio_uintmax_t)number,
        self->parameter->flags | FLAGS_UNSIGNED,
        self->parameter->width,
        self->parameter->precision,
        self->parameter->base);
}

/*****
* trio_print_double [public]
*/
void
trio_print_double
TRIO_ARGS2((ref, number),
    trio_pointer_t ref,
    double number)
{
    trio_reference_t *self = (trio_reference_t *)ref;

```

```

TrioWriteDouble(self->data,
    number,
    self->parameter->flags,
    self->parameter->width,
    self->parameter->precision,
    self->parameter->base);
}

/*****
* trio_print_string [public]
*/
void
trio_print_string
TRIO_ARGS2((ref, string),
    trio_pointer_t ref,
    char *string)
{
    trio_reference_t *self = (trio_reference_t *)ref;

    TrioWriteString(self->data,
        string,
        self->parameter->flags,
        self->parameter->width,
        self->parameter->precision);
}

/*****
* trio_print_ref [public]
*/
int
trio_print_ref
TRIO_VARGS3((ref, format, va_alist),
    trio_pointer_t ref,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list arglist;

    assert(VALID(format));

    TRIO_VA_START(arglist, format);
    status = TrioFormatRef((trio_reference_t *)ref, format, &arglist, NULL);
    TRIO_VA_END(arglist);
    return status;
}

```

```

/*****
* trio_vprint_ref [public]
*/
int
trio_vprint_ref
TRIO_ARGS3((ref, format, arglist),
    trio_pointer_t ref,
    TRIO_CONST char *format,
    va_list arglist)
{
    assert(VALID(format));

    return TrioFormatRef((trio_reference_t *)ref, format, &arglist, NULL);
}

/*****
* trio_printv_ref [public]
*/
int
trio_printv_ref
TRIO_ARGS3((ref, format, argarray),
    trio_pointer_t ref,
    TRIO_CONST char *format,
    trio_pointer_t *argarray)
{
    assert(VALID(format));

    return TrioFormatRef((trio_reference_t *)ref, format, NULL, argarray);
}

#endif /* TRIO_EXTENSION */

/*****
* trio_print_pointer [public]
*/
void
trio_print_pointer
TRIO_ARGS2((ref, pointer),
    trio_pointer_t ref,
    trio_pointer_t pointer)
{
    trio_reference_t *self = (trio_reference_t *)ref;
    trio_flags_t flags;
    trio_uintmax_t number;

    if (NULL == pointer)
    {
        TRIO_CONST char *string = internalNullString;

```

```

    while (*string)
self->data->OutStream(self->data, *string++);
}
else
{
    /*
    * The subtraction of the null pointer is a workaround
    * to avoid a compiler warning. The performance overhead
    * is negligible (and likely to be removed by an
    * optimizing compiler). The (char *) casting is done
    * to please ANSI C++.
    */
    number = (trio_uintmax_t)((char *)pointer - (char *)0);
    /* Shrink to size of pointer */
    number &= (trio_uintmax_t)-1;
    flags = self->parameter->flags;
    flags |= (FLAGS_UNSIGNED | FLAGS_ALTERNATIVE |
        FLAGS_NILPADDING);
    TrioWriteNumber(self->data,
        number,
        flags,
        POINTER_WIDTH,
        NO_PRECISION,
        BASE_HEX);
}
}

/** @ } End of UserDefined documentation module */

/*****
*
* LOCALES
*
*****/

/*****
* trio_locale_set_decimal_point
*
* Decimal point can only be one character. The input argument is a
* string to enable multibyte characters. At most MB_LEN_MAX characters
* will be used.
*/
TRIO_PUBLIC void
trio_locale_set_decimal_point
TRIO_ARGS1((decimalPoint),
    char *decimalPoint)
{
#ifdef USE_LOCALE

```

```

if (NULL == internalLocaleValues)
{
    TrioSetLocale();
}
#endif
internalDecimalPointLength = trio_length(decimalPoint);
if (internalDecimalPointLength == 1)
{
    internalDecimalPoint = *decimalPoint;
}
else
{
    internalDecimalPoint = NIL;
    trio_copy_max(internalDecimalPointString,
        sizeof(internalDecimalPointString),
        decimalPoint);
}
}

/*****
* trio_locale_set_thousand_separator
*
* See trio_locale_set_decimal_point
*/
TRIO_PUBLIC void
trio_locale_set_thousand_separator
TRIO_ARGS1((thousandSeparator),
    char *thousandSeparator)
{
#ifdef USE_LOCALE
    if (NULL == internalLocaleValues)
    {
        TrioSetLocale();
    }
#endif
    trio_copy_max(internalThousandSeparator,
        sizeof(internalThousandSeparator),
        thousandSeparator);
    internalThousandSeparatorLength = trio_length(internalThousandSeparator);
}

/*****
* trio_locale_set_grouping
*
* Array of bytes. Reversed order.
*
* CHAR_MAX : No further grouping
* 0       : Repeat last group for the remaining digits (not necessary

```

```

*      as C strings are zero-terminated)
* n      : Set current group to n
*
* Same order as the grouping attribute in LC_NUMERIC.
*/
TRIO_PUBLIC void
trio_locale_set_grouping
TRIO_ARGS1((grouping),
    char *grouping)
{
#ifdef USE_LOCALE
    if (NULL == internalLocaleValues)
    {
        TrioSetLocale();
    }
#endif
    trio_copy_max(internalGrouping,
        sizeof(internalGrouping),
        grouping);
}

/*****
*
* SCANNING
*
*****/

/*****
* TrioSkipWhitespaces
*/
TRIO_PRIVATE int
TrioSkipWhitespaces
TRIO_ARGS1((self),
    trio_class_t *self)
{
    int ch;

    ch = self->current;
    while (isspace(ch))
    {
        self->InStream(self, &ch);
    }
    return ch;
}

/*****
* TrioGetCollation

```

```

*/
#if TRIO_EXTENSION
TRIO_PRIVATE void
TrioGetCollation(TRIO_NOARGS)
{
    int i;
    int j;
    int k;
    char first[2];
    char second[2];

    /* This is computationally expensive */
    first[1] = NIL;
    second[1] = NIL;
    for (i = 0; i < MAX_CHARACTER_CLASS; i++)
    {
        k = 0;
        first[0] = (char)i;
        for (j = 0; j < MAX_CHARACTER_CLASS; j++)
        {
            second[0] = (char)j;
            if (trio_equal_locale(first, second))
                internalCollationArray[i][k++] = (char)j;
        }
        internalCollationArray[i][k] = NIL;
    }
}
#endif

/*****
* TrioGetCharacterClass
*
* FIXME:
* multibyte
*/
TRIO_PRIVATE int
TrioGetCharacterClass
TRIO_ARGS4((format, indexPointer, flagsPointer, characterclass),
    TRIO_CONST char *format,
    int *indexPointer,
    trio_flags_t *flagsPointer,
    int *characterclass)
{
    int index = *indexPointer;
    int i;
    char ch;
    char range_begin;
    char range_end;

```

```

*flagsPointer &= ~FLAGS_EXCLUDE;

if (format[index] == QUALIFIER_CIRCUMFLEX)
{
    *flagsPointer |= FLAGS_EXCLUDE;
    index++;
}
/*
 * If the ungroup character is at the beginning of the scanlist,
 * it will be part of the class, and a second ungroup character
 * must follow to end the group.
 */
if (format[index] == SPECIFIER_UNGROUP)
{
    characterclass[(int)SPECIFIER_UNGROUP]++;
    index++;
}
/*
 * Minus is used to specify ranges. To include minus in the class,
 * it must be at the beginning of the list
 */
if (format[index] == QUALIFIER_MINUS)
{
    characterclass[(int)QUALIFIER_MINUS]++;
    index++;
}
/* Collect characters */
for (ch = format[index];
     (ch != SPECIFIER_UNGROUP) && (ch != NIL);
     ch = format[++index])
{
    switch (ch)
    {
case QUALIFIER_MINUS: /* Scanlist ranges */

/*
 * Both C99 and UNIX98 describes ranges as implementation-
 * defined.
 *
 * We support the following behaviour (although this may
 * change as we become wiser)
 * - only increasing ranges, ie. [a-b] but not [b-a]
 * - transitive ranges, ie. [a-b-c] == [a-c]
 * - trailing minus, ie. [a-] is interpreted as an 'a'
 *   and a '-'
 * - duplicates (although we can easily convert these
 *   into errors)

```

```

*/
range_begin = format[index - 1];
range_end = format[++index];
if (range_end == SPECIFIER_UNGROUP)
{
    /* Trailing minus is included */
    characterclass[(int)ch]++;
    ch = range_end;
    break; /* for */
}
if (range_end == NIL)
    return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
if (range_begin > range_end)
    return TRIO_ERROR_RETURN(TRIO_ERANGE, index);

for (i = (int)range_begin; i <= (int)range_end; i++)
    characterclass[i]++;

ch = range_end;
break;

#if TRIO_EXTENSION

case SPECIFIER_GROUP:

    switch (format[index + 1])
    {
        case QUALIFIER_DOT: /* Collating symbol */
            /*
             * FIXME: This will be easier to implement when multibyte
             * characters have been implemented. Until now, we ignore
             * this feature.
             */
            for (i = index + 2; ; i++)
            {
                if (format[i] == NIL)
                    /* Error in syntax */
                    return -1;
                else if (format[i] == QUALIFIER_DOT)
                    break; /* for */
            }
            if (format[++i] != SPECIFIER_UNGROUP)
                return -1;

            index = i;
            break;

        case QUALIFIER_EQUAL: /* Equivalence class expressions */

```

```

    {
unsigned int j;
unsigned int k;

if (internalCollationUnconverted)
{
    /* Lazy evaluation of collation array */
    TrioGetCollation();
    internalCollationUnconverted = FALSE;
}
for (i = index + 2; ; i++)
{
    if (format[i] == NIL)
        /* Error in syntax */
        return -1;
    else if (format[i] == QUALIFIER_EQUAL)
        break; /* for */
    else
    {
        /* Mark any equivalent character */
        k = (unsigned int)format[i];
        for (j = 0; internalCollationArray[k][j] != NIL; j++)
            characterclass[(int)internalCollationArray[k][j]]++;
    }
}
if (format[++i] != SPECIFIER_UNGROUP)
    return -1;

index = i;
}
break;

case QUALIFIER_COLON: /* Character class expressions */

    if (trio_equal_max(CLASS_ALNUM, sizeof(CLASS_ALNUM) - 1,
        &format[index]))
    {
        for (i = 0; i < MAX_CHARACTER_CLASS; i++)
            if (isalnum(i))
                characterclass[i]++;
        index += sizeof(CLASS_ALNUM) - 1;
    }
    else if (trio_equal_max(CLASS_ALPHA, sizeof(CLASS_ALPHA) - 1,
        &format[index]))
    {
        for (i = 0; i < MAX_CHARACTER_CLASS; i++)
            if (isalpha(i))
                characterclass[i]++;
    }

```

```

index += sizeof(CLASS_ALPHA) - 1;
}
else if (trio_equal_max(CLASS_CNTRL, sizeof(CLASS_CNTRL) - 1,
    &format[index]))
{
for (i = 0; i < MAX_CHARACTER_CLASS; i++)
    if (iscntrl(i))
        characterclass[i]++;
index += sizeof(CLASS_CNTRL) - 1;
}
else if (trio_equal_max(CLASS_DIGIT, sizeof(CLASS_DIGIT) - 1,
    &format[index]))
{
for (i = 0; i < MAX_CHARACTER_CLASS; i++)
    if (isdigit(i))
        characterclass[i]++;
index += sizeof(CLASS_DIGIT) - 1;
}
else if (trio_equal_max(CLASS_GRAPH, sizeof(CLASS_GRAPH) - 1,
    &format[index]))
{
for (i = 0; i < MAX_CHARACTER_CLASS; i++)
    if (isgraph(i))
        characterclass[i]++;
index += sizeof(CLASS_GRAPH) - 1;
}
else if (trio_equal_max(CLASS_LOWER, sizeof(CLASS_LOWER) - 1,
    &format[index]))
{
for (i = 0; i < MAX_CHARACTER_CLASS; i++)
    if (islower(i))
        characterclass[i]++;
index += sizeof(CLASS_LOWER) - 1;
}
else if (trio_equal_max(CLASS_PRINT, sizeof(CLASS_PRINT) - 1,
    &format[index]))
{
for (i = 0; i < MAX_CHARACTER_CLASS; i++)
    if (isprint(i))
        characterclass[i]++;
index += sizeof(CLASS_PRINT) - 1;
}
else if (trio_equal_max(CLASS_PUNCT, sizeof(CLASS_PUNCT) - 1,
    &format[index]))
{
for (i = 0; i < MAX_CHARACTER_CLASS; i++)
    if (ispunct(i))
        characterclass[i]++;

```

```

    index += sizeof(CLASS_PUNCT) - 1;
}
    else if (trio_equal_max(CLASS_SPACE, sizeof(CLASS_SPACE) - 1,
        &format[index]))
{
    for (i = 0; i < MAX_CHARACTER_CLASS; i++)
        if (isspace(i))
            characterclass[i]++;
    index += sizeof(CLASS_SPACE) - 1;
}
    else if (trio_equal_max(CLASS_UPPER, sizeof(CLASS_UPPER) - 1,
        &format[index]))
{
    for (i = 0; i < MAX_CHARACTER_CLASS; i++)
        if (isupper(i))
            characterclass[i]++;
    index += sizeof(CLASS_UPPER) - 1;
}
    else if (trio_equal_max(CLASS_XDIGIT, sizeof(CLASS_XDIGIT) - 1,
        &format[index]))
{
    for (i = 0; i < MAX_CHARACTER_CLASS; i++)
        if (isxdigit(i))
            characterclass[i]++;
    index += sizeof(CLASS_XDIGIT) - 1;
}
    else
    {
        characterclass[(int)ch]++;
    }
    break;

default:
    characterclass[(int)ch]++;
    break;
}
break;

#endif /* TRIO_EXTENSION */

default:
    characterclass[(int)ch]++;
    break;
}
}
return 0;
}

```

```

/*****
* TrioReadNumber
*
* We implement our own number conversion in preference of strtol and
* strtoul, because we must handle 'long long' and thousand separators.
*/

TRIO_PRIVATE BOOLEAN_T
TrioReadNumber
TRIO_ARGS5((self, target, flags, width, base),
    trio_class_t *self,
    trio_uintmax_t *target,
    trio_flags_t flags,
    int width,
    int base)
{
    trio_uintmax_t number = 0;
    int digit;
    int count;
    BOOLEAN_T isNegative = FALSE;
    BOOLEAN_T gotNumber = FALSE;
    int j;

    assert(VALID(self));
    assert(VALID(self->InStream));
    assert((base >= MIN_BASE && base <= MAX_BASE) || (base == NO_BASE));

    if (internalDigitsUnconverted)
    {
        /* Lazy evaluation of digits array */
        memset(internalDigitArray, -1, sizeof(internalDigitArray));
        for (j = 0; j < (int)sizeof(internalDigitsLower) - 1; j++)
        {
            internalDigitArray[(int)internalDigitsLower[j]] = j;
            internalDigitArray[(int)internalDigitsUpper[j]] = j;
        }
        internalDigitsUnconverted = FALSE;
    }

    TrioSkipWhitespaces(self);

    if (!(flags & FLAGS_UNSIGNED))
    {
        /* Leading sign */
        if (self->current == '+')
        {
            self->InStream(self, NULL);
        }
        else if (self->current == '-')

```

```

{
    self->InStream(self, NULL);
    isNegative = TRUE;
}
}

count = self->processed;

if (flags & FLAGS_ALTERNATIVE)
{
    switch (base)
    {
    case NO_BASE:
    case BASE_OCTAL:
    case BASE_HEX:
    case BASE_BINARY:
        if (self->current == '0')
        {
            self->InStream(self, NULL);
            if (self->current)
            {
                if ((base == BASE_HEX) &&
                    (trio_to_upper(self->current) == 'X'))
                {
                    self->InStream(self, NULL);
                }
                else if ((base == BASE_BINARY) &&
                    (trio_to_upper(self->current) == 'B'))
                {
                    self->InStream(self, NULL);
                }
            }
        }
        else
            return FALSE;
        break;
    default:
        break;
    }
}

while (((width == NO_WIDTH) || (self->processed - count < width)) &&
    (!(self->current == EOF) || isspace(self->current)))
{
    if (isascii(self->current))
    {
        digit = internalDigitArray[self->current];
        /* Abort if digit is not allowed in the specified base */
    }
}

```

```

        if ((digit == -1) || (digit >= base))
            break;
    }
    else if (flags & FLAGS_QUOTE)
    {
        /* Compare with thousands separator */
        for (j = 0; internalThousandSeparator[j] && self->current; j++)
        {
            if (internalThousandSeparator[j] != self->current)
                break;
        }

        self->InStream(self, NULL);
    }
    if (internalThousandSeparator[j])
        break; /* Mismatch */
    else
        continue; /* Match */
}
else
    break;

    number *= base;
    number += digit;
    gotNumber = TRUE; /* we need at least one digit */

    self->InStream(self, NULL);
}

/* Was anything read at all? */
if (!gotNumber)
    return FALSE;

if (target)
    *target = (isNegative) ? -((trio_intmax_t)number) : number;
return TRUE;
}

/*****
* TrioReadChar
*/
TRIO_PRIVATE int
TrioReadChar
TRIO_ARGS4((self, target, flags, width),
    trio_class_t *self,
    char *target,
    trio_flags_t flags,
    int width)
{

```

```

int i;
char ch;
trio_uintmax_t number;

assert(VALID(self));
assert(VALID(self->InStream));

for (i = 0;
     (self->current != EOF) && (i < width);
     i++)
{
    ch = (char)self->current;
    self->InStream(self, NULL);
    if ((flags & FLAGS_ALTERNATIVE) && (ch == CHAR_BACKSLASH))
    {
        switch (self->current)
        {
            case '\\': ch = '\\'; break;
            case 'a': ch = '\007'; break;
            case 'b': ch = '\b'; break;
            case 'f': ch = '\f'; break;
            case 'n': ch = '\n'; break;
            case 'r': ch = '\r'; break;
            case 't': ch = '\t'; break;
            case 'v': ch = '\v'; break;
            default:
                if (isdigit(self->current))
                {
                    /* Read octal number */
                    if (!TrioReadNumber(self, &number, 0, 3, BASE_OCTAL))
                        return 0;
                    ch = (char)number;
                }
                else if (trio_to_upper(self->current) == 'X')
                {
                    /* Read hexadecimal number */
                    self->InStream(self, NULL);
                    if (!TrioReadNumber(self, &number, 0, 2, BASE_HEX))
                        return 0;
                    ch = (char)number;
                }
                else
                {
                    ch = (char)self->current;
                }
                break;
            }
        }
    }
}

```

```

        if (target)
        target[i] = ch;
    }
    return i + 1;
}

/*****
 * TrioReadString
 */
TRIO_PRIVATE BOOLEAN_T
TrioReadString
TRIO_ARGS4((self, target, flags, width),
    trio_class_t *self,
    char *target,
    trio_flags_t flags,
    int width)
{
    int i;

    assert(VALID(self));
    assert(VALID(self->InStream));

    TrioSkipWhitespaces(self);

    /*
     * Continue until end of string is reached, a whitespace is encountered,
     * or width is exceeded
     */
    for (i = 0;
        ((width == NO_WIDTH) || (i < width)) &&
        (! ((self->current == EOF) || isspace(self->current)));
        i++)
    {
        if (TrioReadChar(self, (target ? &target[i] : 0), flags, 1) == 0)
            break; /* for */
    }
    if (target)
        target[i] = NIL;
    return TRUE;
}

/*****
 * TrioReadWideChar
 */
#if TRIO_WIDECHAR
TRIO_PRIVATE int
TrioReadWideChar

```

```

TRIO_ARGS4((self, target, flags, width),
    trio_class_t *self,
    trio_wchar_t *target,
    trio_flags_t flags,
    int width)
{
    int i;
    int j;
    int size;
    int amount = 0;
    trio_wchar_t wch;
    char buffer[MB_LEN_MAX + 1];

    assert(VALID(self));
    assert(VALID(self->InStream));

    for (i = 0;
        (self->current != EOF) && (i < width);
        i++)
    {
        if (isascii(self->current))
        {
            if (TrioReadChar(self, buffer, flags, 1) == 0)
                return 0;
            buffer[1] = NIL;
        }
        else
        {
            /*
             * Collect a multibyte character, by enlarging buffer until
             * it contains a fully legal multibyte character, or the
             * buffer is full.
             */
            j = 0;
            do
            {
                buffer[j++] = (char)self->current;
                buffer[j] = NIL;
                self->InStream(self, NULL);
            }
            while ((j < (int)sizeof(buffer)) && (mblen(buffer, (size_t)j) != j));
        }
        if (target)
        {
            size = mbtowc(&wch, buffer, sizeof(buffer));
            if (size > 0)
                target[i] = wch;
        }
    }
}

```

```

        amount += size;
        self->InStream(self, NULL);
    }
    return amount;
}
#endif /* TRIO_WIDECHAR */

/*****
 * TrioReadWideString
 */
#if TRIO_WIDECHAR
TRIO_PRIVATE BOOLEAN_T
TrioReadWideString
TRIO_ARGS4((self, target, flags, width),
    trio_class_t *self,
    trio_wchar_t *target,
    trio_flags_t flags,
    int width)
{
    int i;
    int size;

    assert(VALID(self));
    assert(VALID(self->InStream));

    TrioSkipWhitespaces(self);

#if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)
    (void)mblen(NULL, 0);
#endif

    /*
     * Continue until end of string is reached, a whitespace is encountered,
     * or width is exceeded
     */
    for (i = 0;
        ((width == NO_WIDTH) || (i < width)) &&
        (! (self->current == EOF) || isspace(self->current)));
    {
        size = TrioReadWideChar(self, &target[i], flags, 1);
        if (size == 0)
            break; /* for */

        i += size;
    }
    if (target)
        target[i] = WCONST('\0');

```

```

    return TRUE;
}
#endif /* TRIO_WIDECHAR */

/*****
 * TrioReadGroup
 *
 * FIXME: characterclass does not work with multibyte characters
 */
TRIO_PRIVATE BOOLEAN_T
TrioReadGroup
TRIO_ARGS5((self, target, characterclass, flags, width),
    trio_class_t *self,
    char *target,
    int *characterclass,
    trio_flags_t flags,
    int width)
{
    int ch;
    int i;

    assert(VALID(self));
    assert(VALID(self->InStream));

    ch = self->current;
    for (i = 0;
        ((width == NO_WIDTH) || (i < width)) &&
        (! ((ch == EOF) ||
            (((flags & FLAGS_EXCLUDE) != 0) ^ (characterclass[ch] == 0)))));
        i++)
    {
        if (target)
            target[i] = (char)ch;
        self->InStream(self, &ch);
    }

    if (target)
        target[i] = NIL;
    return TRUE;
}

/*****
 * TrioReadDouble
 *
 * FIXME:
 *   add long double
 *   handle base
 */

```

```

TRIO_PRIVATE BOOLEAN_T
TrioReadDouble
TRIO_ARGS4((self, target, flags, width),
    trio_class_t *self,
    trio_pointer_t target,
    trio_flags_t flags,
    int width)
{
    int ch;
    char doubleString[512];
    int index = 0;
    int start;
    int j;
    BOOLEAN_T isHex = FALSE;

    doubleString[0] = 0;

    if ((width == NO_WIDTH) || (width > (int)sizeof(doubleString) - 1))
        width = sizeof(doubleString) - 1;

    TrioSkipWhitespaces(self);

    /*
     * Read entire double number from stream. trio_to_double requires
     * a string as input, but InStream can be anything, so we have to
     * collect all characters.
     */
    ch = self->current;
    if ((ch == '+') || (ch == '-'))
    {
        doubleString[index++] = (char)ch;
        self->InStream(self, &ch);
        width--;
    }

    start = index;
    switch (ch)
    {
        case 'n':
        case 'N':
            /* Not-a-number */
            if (index != 0)
                break;
            /* FALLTHROUGH */
        case 'i':
        case 'I':
            /* Infinity */
            while (isalpha(ch) && (index - start < width))

```

```

{
    doubleString[index++] = (char)ch;
    self->InStream(self, &ch);
}

    doubleString[index] = NIL;

    /* Case insensitive string comparison */
    if (trio_equal(&doubleString[start], INFINITE_UPPER) ||
        trio_equal(&doubleString[start], LONG_INFINITE_UPPER))
    {
        if (flags & FLAGS_LONGDOUBLE)
        {
            if ((start == 1) && (doubleString[0] == '-'))
            {
                *((trio_long_double_t *)target) = trio_ninf();
            }
            else
            {
                *((trio_long_double_t *)target) = trio_pinf();
            }
        }
        else
        {
            if ((start == 1) && (doubleString[0] == '-'))
            {
                *((double *)target) = trio_ninf();
            }
            else
            {
                *((double *)target) = trio_pinf();
            }
        }
        return TRUE;
    }

    if (trio_equal(doubleString, NAN_UPPER))
    {
        /* NaN must not have a preceeding + nor - */
        if (flags & FLAGS_LONGDOUBLE)
        {
            *((trio_long_double_t *)target) = trio_nan();
        }
        else
        {
            *((double *)target) = trio_nan();
        }
        return TRUE;
    }

    return FALSE;
}

```

```

case '0':
    doubleString[index++] = (char)ch;
    self->InStream(self, &ch);
    if (trio_to_upper(ch) == 'X')
    {
        isHex = TRUE;
        doubleString[index++] = (char)ch;
        self->InStream(self, &ch);
    }
    break;

default:
    break;
}

while ((ch != EOF) && (index - start < width))
{
    /* Integer part */
    if (isHex ? isxdigit(ch) : isdigit(ch))
    {
        doubleString[index++] = (char)ch;
        self->InStream(self, &ch);
    }
    else if (flags & FLAGS_QUOTE)
    {
        /* Compare with thousands separator */
        for (j = 0; internalThousandSeparator[j] && self->current; j++)
        {
            if (internalThousandSeparator[j] != self->current)
                break;
            self->InStream(self, &ch);
        }
        if (internalThousandSeparator[j])
            break; /* Mismatch */
        else
            continue; /* Match */
    }
    else
        break; /* while */
}
if (ch == '.')
{
    /* Decimal part */
    doubleString[index++] = (char)ch;
    self->InStream(self, &ch);
    while ((isHex ? isxdigit(ch) : isdigit(ch)) &&

```

```

        (index - start < width))
    {
        doubleString[index++] = (char)ch;
        self->InStream(self, &ch);
    }
    if (isHex ? (trio_to_upper(ch) == 'P') : (trio_to_upper(ch) == 'E'))
    {
        /* Exponent */
        doubleString[index++] = (char)ch;
        self->InStream(self, &ch);
        if ((ch == '+') || (ch == '-'))
        {
            doubleString[index++] = (char)ch;
            self->InStream(self, &ch);
        }
        while (isdigit(ch) && (index - start < width))
        {
            doubleString[index++] = (char)ch;
            self->InStream(self, &ch);
        }
    }
}

if ((index == start) || (*doubleString == NIL))
    return FALSE;

doubleString[index] = 0;

if (flags & FLAGS_LONGDOUBLE)
{
    *((trio_long_double_t *)target) = trio_to_long_double(doubleString, NULL);
}
else
{
    *((double *)target) = trio_to_double(doubleString, NULL);
}
return TRUE;
}

/*****
* TrioReadPointer
*/
TRIO_PRIVATE BOOLEAN_T
TrioReadPointer
TRIO_ARGS3((self, target, flags),
    trio_class_t *self,
    trio_pointer_t *target,
    trio_flags_t flags)

```

```

{
    trio_uintmax_t number;
    char buffer[sizeof(internalNullString)];

    flags |= (FLAGS_UNSIGNED | FLAGS_ALTERNATIVE | FLAGS_NILPADDING);

    if (TrioReadNumber(self,
        &number,
        flags,
        POINTER_WIDTH,
        BASE_HEX))
    {
        /*
         * The strange assignment of number is a workaround for a compiler
         * warning
         */
        if (target)
            *target = (char *)0 + number;
        return TRUE;
    }
    else if (TrioReadString(self,
        (flags & FLAGS_IGNORE)
        ? NULL
        : buffer,
        0,
        sizeof(internalNullString) - 1))
    {
        if (trio_equal_case(buffer, internalNullString))
        {
            if (target)
                *target = NULL;
            return TRUE;
        }
    }
    return FALSE;
}

/*****
 * TrioScanProcess
 */
TRIO_PRIVATE int
TrioScanProcess
TRIO_ARGS3((data, format, parameters),
    trio_class_t *data,
    TRIO_CONST char *format,
    trio_parameter_t *parameters)
{
    #if defined(TRIO_COMPILER_SUPPORTS_MULTIBYTE)

```

```

int charlen;
int cnt;
#endif
int assignment;
int ch;
int index; /* Index of format string */
int i; /* Index of current parameter */
trio_flags_t flags;
int width;
int base;
trio_pointer_t pointer;

assignment = 0;
i = 0;
index = 0;
data->InStream(data, &ch);

#ifdef TRIO_COMPILER_SUPPORTS_MULTIBYTE
(void)mblen(NULL, 0);
#endif

while (format[index])
{
#ifdef TRIO_COMPILER_SUPPORTS_MULTIBYTE
if (! isascii(format[index]))
{
charlen = mblen(&format[index], MB_LEN_MAX);
if (charlen != -1)
{
/* Compare multibyte characters in format string */
for (cnt = 0; cnt < charlen - 1; cnt++)
{
if (ch != format[index + cnt])
{
return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
}
}
data->InStream(data, &ch);
}
continue; /* while characters left in formatting string */
}
}
#endif /* TRIO_COMPILER_SUPPORTS_MULTIBYTE */

if ((EOF == ch) && (parameters[i].type != FORMAT_COUNT))
{
return (assignment > 0) ? assignment : EOF;
}

```

```

    if (CHAR_IDENTIFIER == format[index])
    {
        if (CHAR_IDENTIFIER == format[index + 1])
        {
            /* Two % in format matches one % in input stream */
            if (CHAR_IDENTIFIER == ch)
            {
                data->InStream(data, &ch);
                index += 2;
                continue; /* while format chars left */
            }
            else
            return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
        }

        /* Skip the parameter entries */
        while (parameters[i].type == FORMAT_PARAMETER)
            i++;

        flags = parameters[i].flags;
        /* Find width */
        width = parameters[i].width;
        if (flags & FLAGS_WIDTH_PARAMETER)
        {
            /* Get width from parameter list */
            width = (int)parameters[width].data.number.as_signed;
        }
        /* Find base */
        base = parameters[i].base;
        if (flags & FLAGS_BASE_PARAMETER)
        {
            /* Get base from parameter list */
            base = (int)parameters[base].data.number.as_signed;
        }

        switch (parameters[i].type)
        {
            case FORMAT_INT:
            {
                trio_uintmax_t number;

                if (0 == base)
                    base = BASE_DECIMAL;

                if (!TrioReadNumber(data,
                    &number,
                    flags,
                    width,

```

```

        base))
    return assignment;

    if (!(flags & FLAGS_IGNORE))
    {
        assignment++;

        pointer = parameters[i].data.pointer;
#if defined(QUALIFIER_SIZE_T) || defined(QUALIFIER_SIZE_T_UPPER)
        if (flags & FLAGS_SIZE_T)
            *(size_t *)pointer = (size_t)number;
        else
#endif
#if defined(QUALIFIER_PTRDIFF_T)
        if (flags & FLAGS_PTRDIFF_T)
            *(ptrdiff_t *)pointer = (ptrdiff_t)number;
        else
#endif
#if defined(QUALIFIER_INTMAX_T)
        if (flags & FLAGS_INTMAX_T)
            *(trio_intmax_t *)pointer = (trio_intmax_t)number;
        else
#endif
        if (flags & FLAGS_QUAD)
            *(trio_ulonglong_t *)pointer = (trio_ulonglong_t)number;
        else if (flags & FLAGS_LONG)
            *(long int *)pointer = (long int)number;
        else if (flags & FLAGS_SHORT)
            *(short int *)pointer = (short int)number;
        else
            *(int *)pointer = (int)number;
    }
}

break; /* FORMAT_INT */

case FORMAT_STRING:
#if TRIO_WIDECHAR
    if (flags & FLAGS_WIDECHAR)
    {
        if (!TrioReadWideString(data,
            (flags & FLAGS_IGNORE)
            ? NULL
            : parameters[i].data.wstring,
            flags,
            width))
            return assignment;
    }
}
else

```

```

#endif
{
    if (!TrioReadString(data,
        (flags & FLAGS_IGNORE)
        ? NULL
        : parameters[i].data.string,
        flags,
        width))
        return assignment;
}
if (!(flags & FLAGS_IGNORE))
assignment++;
break; /* FORMAT_STRING */

case FORMAT_DOUBLE:
{
trio_pointer_t pointer;

if (flags & FLAGS_IGNORE)
{
    pointer = NULL;
}
else
{
    pointer = (flags & FLAGS_LONGDOUBLE)
        ? (trio_pointer_t)parameters[i].data.longdoublePointer
        : (trio_pointer_t)parameters[i].data.doublePointer;
}
if (!TrioReadDouble(data, pointer, flags, width))
{
    return assignment;
}
if (!(flags & FLAGS_IGNORE))
{
    assignment++;
}
break; /* FORMAT_DOUBLE */
}
case FORMAT_GROUP:
{
int characterclass[MAX_CHARACTER_CLASS + 1];
int rc;

/* Skip over modifiers */
while (format[index] != SPECIFIER_GROUP)
{
    index++;
}

```

```

/* Skip over group specifier */
index++;

memset(characterclass, 0, sizeof(characterclass));
rc = TrioGetCharacterClass(format,
    &index,
    &flags,
    characterclass);
if (rc < 0)
    return rc;

if (!TrioReadGroup(data,
    (flags & FLAGS_IGNORE)
    ? NULL
    : parameters[i].data.string,
    characterclass,
    flags,
    parameters[i].width))
    return assignment;
if (!(flags & FLAGS_IGNORE))
    assignment++;
}
break; /* FORMAT_GROUP */

case FORMAT_COUNT:
    pointer = parameters[i].data.pointer;
    if (NULL != pointer)
    {
        int count = data->committed;
        if (ch != EOF)
            count--; /* a character is read, but is not consumed yet */
#ifdef QUALIFIER_SIZE_T || defined(QUALIFIER_SIZE_T_UPPER)
        if (flags & FLAGS_SIZE_T)
            *(size_t *)pointer = (size_t)count;
        else
#endif
#ifdef QUALIFIER_PTRDIFF_T
        if (flags & FLAGS_PTRDIFF_T)
            *(ptrdiff_t *)pointer = (ptrdiff_t)count;
        else
#endif
#ifdef QUALIFIER_INTMAX_T
        if (flags & FLAGS_INTMAX_T)
            *(trio_intmax_t *)pointer = (trio_intmax_t)count;
        else
#endif
        if (flags & FLAGS_QUAD)
        {

```

```

        *(trio_ulonglong_t *)pointer = (trio_ulonglong_t)count;
    }
else if (flags & FLAGS_LONG)
{
    *(long int *)pointer = (long int)count;
}
else if (flags & FLAGS_SHORT)
{
    *(short int *)pointer = (short int)count;
}
else
{
    *(int *)pointer = (int)count;
}
}
break; /* FORMAT_COUNT */

case FORMAT_CHAR:
#ifdef TRIO_WIDECHAR
    if (flags & FLAGS_WIDECHAR)
    {
        if (TrioReadWideChar(data,
            (flags & FLAGS_IGNORE)
            ? NULL
            : parameters[i].data.wstring,
            flags,
            (width == NO_WIDTH) ? 1 : width) == 0)
            return assignment;
    }
    else
#endif
{
    if (TrioReadChar(data,
        (flags & FLAGS_IGNORE)
        ? NULL
        : parameters[i].data.string,
        flags,
        (width == NO_WIDTH) ? 1 : width) == 0)
        return assignment;
}
    if (!(flags & FLAGS_IGNORE))
assignment++;
    break; /* FORMAT_CHAR */

case FORMAT_POINTER:
    if (!TrioReadPointer(data,
        (flags & FLAGS_IGNORE)
        ? NULL

```

```

        : (trio_pointer_t *)parameters[i].data.pointer,
        flags))
return assignment;
    if (!(flags & FLAGS_IGNORE))
assignment++;
    break; /* FORMAT_POINTER */

case FORMAT_PARAMETER:
    break; /* FORMAT_PARAMETER */

default:
    return TRIO_ERROR_RETURN(TRIO_EINVAL, index);
}
ch = data->current;
index = parameters[i].indexAfterSpecifier;
i++;
}
    else /* Not an % identifier */
{
    if (isspace((int)format[index]))
    {
        /* Whitespaces may match any amount of whitespaces */
        ch = TrioSkipWhitespaces(data);
    }
    else if (ch == format[index])
    {
        data->InStream(data, &ch);
    }
    else
        return assignment;

    index++;
}
}
return assignment;
}

/*****
* TrioScan
*/
TRIO_PRIVATE int
TrioScan
TRIO_ARGS6((source, sourceSize, InStream, format, arglist, argarray),
    trio_pointer_t source,
    size_t sourceSize,
    void (*InStream) TRIO_PROTO((trio_class_t *, int *)),
    TRIO_CONST char *format,
    va_list *arglist,

```

```

    trio_pointer_t *argarray)
{
    int status;
    trio_parameter_t parameters[MAX_PARAMETERS];
    trio_class_t data;

    assert(VALID(InStream));
    assert(VALID(format));

    memset(&data, 0, sizeof(data));
    data.InStream = InStream;
    data.location = (trio_pointer_t)source;
    data.max = sourceSize;
    data.error = 0;

#ifdef USE_LOCALE
    if (NULL == internalLocaleValues)
    {
        TrioSetLocale();
    }
#endif

    status = TrioParse(TYPE_SCAN, format, parameters, arglist, argarray);
    if (status < 0)
        return status;

    status = TrioScanProcess(&data, format, parameters);
    if (data.error != 0)
    {
        status = data.error;
    }
    return status;
}

/*****
* TrioInStreamFile
*/
TRIO_PRIVATE void
TrioInStreamFile
TRIO_ARGS2((self, intPointer),
    trio_class_t *self,
    int *intPointer)
{
    FILE *file = (FILE *)self->location;

    assert(VALID(self));
    assert(VALID(file));

```

```

self->current = fgetc(file);
if (self->current == EOF)
{
    self->error = (ferror(file))
? TRIO_ERROR_RETURN(TRIO_ERRNO, 0)
: TRIO_ERROR_RETURN(TRIO_EOF, 0);
}
else
{
    self->processed++;
    self->committed++;
}

if (VALID(intPointer))
{
    *intPointer = self->current;
}
}

/*****
* TrioInStreamFileDescriptor
*/
TRIO_PRIVATE void
TrioInStreamFileDescriptor
TRIO_ARGS2((self, intPointer),
    trio_class_t *self,
    int *intPointer)
{
    int fd = *((int *)self->location);
    int size;
    unsigned char input;

    assert(VALID(self));

    size = read(fd, &input, sizeof(char));
    if (size == -1)
    {
        self->error = TRIO_ERROR_RETURN(TRIO_ERRNO, 0);
        self->current = EOF;
    }
    else
    {
        self->current = (size == 0) ? EOF : input;
    }
    if (self->current != EOF)
    {
        self->committed++;
        self->processed++;
    }
}

```

```

    }

    if (VALID(intPointer))
    {
        *intPointer = self->current;
    }
}

/*****
* TrioInStreamCustom
*/
TRIO_PRIVATE void
TrioInStreamCustom
TRIO_ARGS2((self, intPointer),
    trio_class_t *self,
    int *intPointer)
{
    trio_custom_t *data;

    assert(VALID(self));
    assert(VALID(self->location));

    data = (trio_custom_t *)self->location;

    self->current = (data->stream.in == NULL)
        ? NIL
        : (data->stream.in)(data->closure);

    if (self->current == NIL)
    {
        self->current = EOF;
    }
    else
    {
        self->processed++;
        self->committed++;
    }

    if (VALID(intPointer))
    {
        *intPointer = self->current;
    }
}

/*****
* TrioInStreamString
*/
TRIO_PRIVATE void

```

```

TrioInStreamString
TRIO_ARGS2((self, intPointer),
    trio_class_t *self,
    int *intPointer)
{
    unsigned char **buffer;

    assert(VALID(self));
    assert(VALID(self->location));

    buffer = (unsigned char **)self->location;
    self->current = (*buffer)[0];
    if (self->current == NIL)
    {
        self->current = EOF;
    }
    else
    {
        (*buffer)++;
        self->processed++;
        self->committed++;
    }

    if (VALID(intPointer))
    {
        *intPointer = self->current;
    }
}

/*****
 *
 * Formatted scanning functions
 *
 *****/

#if defined(TRIO_DOCUMENTATION)
# include "doc/doc_scanf.h"
#endif
/** @addtogroup Scanf
    @ {
 */

/*****
 * scanf
 */

/**
    Scan characters from standard input stream.

```

```

    @param format Formatting string.
    @param ... Arguments.
    @return Number of scanned characters.
*/

TRIO_PUBLIC int
trio_scanf
TRIO_VARGS2((format, va_alist),
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;

    assert(VALID(format));

    TRIO_VA_START(args, format);
    status = TrioScan((trio_pointer_t)stdin, 0,
        TrioInStreamFile,
        format, &args, NULL);
    TRIO_VA_END(args);
    return status;
}

TRIO_PUBLIC int
trio_vscanf
TRIO_ARGS2((format, args),
    TRIO_CONST char *format,
    va_list args)
{
    assert(VALID(format));

    return TrioScan((trio_pointer_t)stdin, 0,
        TrioInStreamFile,
        format, &args, NULL);
}

TRIO_PUBLIC int
trio_scanfv
TRIO_ARGS2((format, args),
    TRIO_CONST char *format,
    trio_pointer_t *args)
{
    assert(VALID(format));

    return TrioScan((trio_pointer_t)stdin, 0,
        TrioInStreamFile,
        format, NULL, args);
}

```

```

}

/*****
* fscanf
*/
TRIO_PUBLIC int
trio_fscanf
TRIO_VARGS3((file, format, va_alist),
    FILE *file,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;

    assert(VALID(file));
    assert(VALID(format));

    TRIO_VA_START(args, format);
    status = TrioScan((trio_pointer_t)file, 0,
        TrioInStreamFile,
        format, &args, NULL);
    TRIO_VA_END(args);
    return status;
}

TRIO_PUBLIC int
trio_vfscanf
TRIO_ARGS3((file, format, args),
    FILE *file,
    TRIO_CONST char *format,
    va_list args)
{
    assert(VALID(file));
    assert(VALID(format));

    return TrioScan((trio_pointer_t)file, 0,
        TrioInStreamFile,
        format, &args, NULL);
}

TRIO_PUBLIC int
trio_fscanfv
TRIO_ARGS3((file, format, args),
    FILE *file,
    TRIO_CONST char *format,
    trio_pointer_t *args)
{

```

```

assert(VALID(file));
assert(VALID(format));

return TrioScan((trio_pointer_t)file, 0,
    TrioInStreamFile,
    format, NULL, args);
}

/*****
 * dscanf
 */
TRIO_PUBLIC int
trio_dscanf
TRIO_VARGS3((fd, format, va_alist),
    int fd,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;

    assert(VALID(format));

    TRIO_VA_START(args, format);
    status = TrioScan((trio_pointer_t)&fd, 0,
        TrioInStreamFileDescriptor,
        format, &args, NULL);
    TRIO_VA_END(args);
    return status;
}

TRIO_PUBLIC int
trio_vdscanf
TRIO_ARGS3((fd, format, args),
    int fd,
    TRIO_CONST char *format,
    va_list args)
{
    assert(VALID(format));

    return TrioScan((trio_pointer_t)&fd, 0,
        TrioInStreamFileDescriptor,
        format, &args, NULL);
}

TRIO_PUBLIC int
trio_dscanfv
TRIO_ARGS3((fd, format, args),

```

```

    int fd,
    TRIO_CONST char *format,
    trio_pointer_t *args)
{
    assert(VALID(format));

    return TrioScan((trio_pointer_t)&fd, 0,
        TrioInStreamFileDescriptor,
        format, NULL, args);
}

/*****
 * cscanf
 */
TRIO_PUBLIC int
trio_cscanf
TRIO_VARGS4((stream, closure, format, va_alist),
    trio_instream_t stream,
    trio_pointer_t closure,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;
    trio_custom_t data;

    assert(VALID(stream));
    assert(VALID(format));

    TRIO_VA_START(args, format);
    data.stream.in = stream;
    data.closure = closure;
    status = TrioScan(&data, 0, TrioInStreamCustom, format, &args, NULL);
    TRIO_VA_END(args);
    return status;
}

TRIO_PUBLIC int
trio_vscanf
TRIO_ARGS4((stream, closure, format, args),
    trio_instream_t stream,
    trio_pointer_t closure,
    TRIO_CONST char *format,
    va_list args)
{
    trio_custom_t data;

    assert(VALID(stream));

```

```

assert(VALID(format));

data.stream.in = stream;
data.closure = closure;
return TrioScan(&data, 0, TrioInStreamCustom, format, &args, NULL);
}

TRIO_PUBLIC int
trio_cscanfv
TRIO_ARGS4((stream, closure, format, args),
    trio_instream_t stream,
    trio_pointer_t closure,
    TRIO_CONST char *format,
    trio_pointer_t *args)
{
    trio_custom_t data;

    assert(VALID(stream));
    assert(VALID(format));

    data.stream.in = stream;
    data.closure = closure;
    return TrioScan(&data, 0, TrioInStreamCustom, format, NULL, args);
}

/*****
 * sscanf
 */
TRIO_PUBLIC int
trio_sscanf
TRIO_VARGS3((buffer, format, va_alist),
    TRIO_CONST char *buffer,
    TRIO_CONST char *format,
    TRIO_VA_DECL)
{
    int status;
    va_list args;

    assert(VALID(buffer));
    assert(VALID(format));

    TRIO_VA_START(args, format);
    status = TrioScan((trio_pointer_t)&buffer, 0,
        TrioInStreamString,
        format, &args, NULL);
    TRIO_VA_END(args);
    return status;
}

```

```

TRIO_PUBLIC int
trio_vscanf
TRIO_ARGS3((buffer, format, args),
    TRIO_CONST char *buffer,
    TRIO_CONST char *format,
    va_list args)
{
    assert(VALID(buffer));
    assert(VALID(format));

    return TrioScan((trio_pointer_t)&buffer, 0,
        TrioInStreamString,
        format, &args, NULL);
}

TRIO_PUBLIC int
trio_sscanfv
TRIO_ARGS3((buffer, format, args),
    TRIO_CONST char *buffer,
    TRIO_CONST char *format,
    trio_pointer_t *args)
{
    assert(VALID(buffer));
    assert(VALID(format));

    return TrioScan((trio_pointer_t)&buffer, 0,
        TrioInStreamString,
        format, NULL, args);
}

/** @ } End of Scanf documentation module */

/*****
* trio_strerror
*/
TRIO_PUBLIC TRIO_CONST char *
trio_strerror
TRIO_ARGS1((errorcode),
    int errorcode)
{
    /* Textual versions of the error codes */
    switch (TRIO_ERROR_CODE(errorcode))
    {
        case TRIO_EOF:
            return "End of file";
        case TRIO_EINVAL:
            return "Invalid argument";
    }
}

```

```

case TRIO_ETOOMANY:
    return "Too many arguments";
case TRIO_EDBLREF:
    return "Double reference";
case TRIO_EGAP:
    return "Reference gap";
case TRIO_ENOMEM:
    return "Out of memory";
case TRIO_ERANGE:
    return "Invalid range";
case TRIO_ECUSTOM:
    return "Custom error";
default:
    return "Unknown";
}
}

```

1.35 Net SNMP - net-snmp 5.6.1

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1.36 OpenForecast 0.4

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1.43 phantomjs v1

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1.46 unzip 6.0

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1.47 velocity 1.6.2

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1.48 zip 3.0

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