



Release Notes for Cisco iSCSI Driver Version 2.1.2 for Linux

June 28, 2002



Note

You can find the most current documentation on Cisco.com. This set of electronic documents may contain updates and modifications made after the hard-copy documents were printed.

These release notes support Cisco iSCSI Driver version 2.1.2 for Linux.

For a list of software caveats that apply to version 2.1.2, see the “[Caveats](#)” section. The caveats are updated for every maintenance version and are located on Cisco.com and the Documentation CD-ROM.

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Introduction

The iSCSI Driver for Linux provides an IP host with the ability to access storage through an IP network. The iSCSI driver uses iSCSI protocol to transport SCSI requests and responses over an IP network between the host and a Cisco SN 5400 Series system.

Architecturally, the iSCSI driver combines with the host TCP/IP stack, network drivers, and NICs to provide the same functions as a SCSI adapter driver with a host bus adapter (HBA).

The iSCSI driver provides a transport for SCSI requests and responses for storage devices; however, instead of providing a transport for directly attached devices, the driver transports the SCSI requests and responses between the IP host and a Cisco SN 5400 Series system via an IP network. The SN 5400 Series system, in turn, transports SCSI requests and responses between it and the storage devices attached to it.

Once the iSCSI driver is installed, the IP host will proceed with a discovery process for iSCSI storage devices as follows:

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- Step 1 The iSCSI driver requests available iSCSI targets from the SN 5400 Series system.
 - Step 2 The SN 5400 Series system sends available iSCSI target names to the IP host.
 - Step 3 The IP host logs into the iSCSI targets.
 - Step 4 The SN 5400 Series system accepts the IP host login.
 - Step 5 The IP host queries targets for device information.
 - Step 6 Targets respond with device information.
 - Step 7 The IP host creates a table of internal devices.
-

The iSCSI Driver for Linux provides IP access to a maximum of 16 remote SCSI targets. Each target will be probed for up to 256 LUNs, until the Linux kernel's limit of SCSI devices has been reached. Remote SCSI targets can be accessed through one or more SN 5400 Series systems up to a maximum of 16 SN 5400 Series systems.

**Note**

The iSCSI protocol is an IETF-defined protocol for IP storage (ips). For more information about the iSCSI protocol, refer to the IETF standards for IP storage at <http://www.ietf.org>.

System Requirements

This section describes the system requirements for version 2.1.2 and includes the following information:

- [Operating System Requirements, page 3](#)
- [SN 5400 Series System Software Requirements, page 5](#)
- [Obtaining the iSCSI Driver and Updated SN 5400 Series System Software, page 5](#)
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Operating System Requirements

- This driver requires either a Linux kernel version 2.2.16 or later, or a Linux kernel version 2.4.16 or later, running on an Intel IA32 (80386, 80486, Pentium) or equivalent, processor. Compilation requires that the kernel header files match the kernel version you want to use the driver with. Once compiled, the objects and executables can be moved to another host running the same level of the operating system.
- The iSCSI Driver for Linux supports multiple processors, and may be run on up to four multiprocessors.
- To ensure the best performance for iSCSI drivers, the extended windowing feature of TCP should be enabled on all IP hosts connecting to the SN 5400 Series system. In general, a larger window size enhances SN 5400 Series system performance.
- The receive and transmit flow control feature of the Gigabit Ethernet driver should be enabled on all IP hosts connecting to the SN 5400 Series system.
- If you are using a 3Com Gigabit Ethernet Server network interface card, the minimum supported revision level is “B” (3C985B-SX). Using a card with a lower revision level will decrease performance.
- Kernels released after June 7, 2002 may or may not work with this driver, depending on what changes have been made to the kernel’s SCSI midlayer code. See the “[Important Notes](#)” section on [page 8](#) for additional information about known problems with Linux kernel code.



Note

Additional information about Linux kernel issues can be found in the Linux Kernel HOWTO document at <http://www.linux.org/docs/>.

Device Names

Linux assigns SCSI device nodes dynamically whenever a SCSI logical unit is detected. Variations in process scheduling and network delay may result in iSCSI targets being mapped to different SCSI device nodes (e.g. /dev/sda, /dev/sdb) every time the driver is started. Because of this variability, configuring applications or operating system utilities to use the standard SCSI device nodes to access iSCSI devices may result in SCSI commands being sent to the wrong target or logical unit.

To provide a more reliable namespace, the iSCSI driver scans the system to determine the mapping from SCSI device nodes to iSCSI targets, and then creates a tree of directories and symbolic links under /dev/iscsi to make it easier to use a particular iSCSI target's logical units.

Under /dev/iscsi, there is a directory tree containing subdirectories for each iSCSI bus number, each target id number on the bus, and each logical unit number for each target. For example, the whole disk device for bus 0, target id 0, LUN 0 would be /dev/iscsi/bus0/target0/lun0/disk.

In each logical unit directory there is a symbolic link for each SCSI device node that may be connected to that particular logical unit. The symbolic links are modeled after the Linux device naming convention.

- The symbolic link *disk* maps to the whole-disk SCSI device node (e.g. /dev/sda, /dev/sdb, etc.).
- The symbolic links *part1* through *part15* map to each partition of that SCSI disk (e.g. /dev/sda1, dev/sda15, etc.).



Note

These links will exist regardless of the number of disk partitions. Opening the partition devices will result in an error if the partition does not actually exist on the disk.

- The symbolic link *mt* maps to the auto-rewind SCSI tape device node for this LUN (e.g. `/dev/st0`), if any.
- Additional links for *mtl*, *mtm* and *mta* map to the other auto-rewind devices (e.g. `/dev/st0l`, `/dev/st0m`, `/dev/st0a`), regardless of whether these device nodes actually exist or can be opened.
- The symbolic link *mtn* maps to the no-rewind SCSI tape device node for this LUN (e.g. `/dev/nst0`), if any.
- Additional links for *mtln*, *mtmn* and *mtan* map to the other no-rewind devices (e.g. `/dev/nst0l`, `/dev/nst0m`, `/dev/nst0a`), regardless of whether those device nodes actually exist or can be opened.
- The symbolic link *cd* maps to the SCSI CD-ROM device node for this LUN (e.g. `/dev/scd0`), if any.
- The symbolic link *generic* maps to the SCSI generic device node for this LUN (e.g. `/dev/sg0`), if any.

**Note**

Because the symlink creation process must open all of the SCSI device nodes in `/dev` in order to determine which nodes map to iSCSI devices, many `modprobe` messages may be logged to `syslog`. The messages indicate that `modprobe` could not find a driver for a specific combination of major and minor numbers. These are normal messages that occur when Linux is unable to find a driver to associate with a SCSI device node that the iSCSI daemon is opening as part of the symlink creation process, and can be ignored.

Mounting Filesystems

Do not add mount entries for iSCSI devices to `/etc/fstab` because the Linux boot process normally mounts filesystems listed in `/etc/fstab` before the network is configured. The script “`iscsi-mountall`” will manage the checking and mounting of devices listed in the file `/etc/fstab.iscsi`, which has the same format as `/etc/fstab`. This script is automatically invoked by the iSCSI startup script.

To avoid the configuration problems associated with device name changes resulting from configuration changes and the variability of mapping between SCSI device nodes and iSCSI targets, mount the `/dev/iscsi` tree symlinks, use filesystem UUIDs or labels (see man pages for `mke2fs`, `mount`, and `fstab`) or logical volume management (see Linux LVM).

Unmounting Filesystems

It is very important to unmount all filesystems on iSCSI devices before the iSCSI driver stops. If the iSCSI driver stops while iSCSI devices are mounted, buffered writes may not be committed to disk and filesystem corruption can occur.

Since Linux will not unmount filesystems that are being used by a running process, before iSCSI devices can be unmounted, any processes using those devices must be stopped.

To avoid filesystem corruption, the iSCSI shutdown script will automatically kill all processes using devices in `/etc/fstab.iscsi`, first by sending them `SIGTERM`, and then by sending any remaining processes `SIGKILL`. It will then unmount all iSCSI filesystems and kill the iSCSI daemon, terminating all connections to iSCSI devices.

**Caution**

Filesystems not listed in `/etc/fstab.iscsi` may not be automatically unmounted.

SN 5400 Series System Software Requirements

The iSCSI Driver version 2.1.2 for Linux can connect to a Cisco SN 5400 Series system running software release 2.1.1 or later; this driver cannot connect to a Cisco SN 5420 Storage Router running software release 1.1.x.

Obtaining the iSCSI Driver and Updated SN 5400 Series System Software

From time to time, Cisco releases updated versions of SN 5400 Series system software and iSCSI drivers. Updated versions of SN 5400 Series system software and the Cisco iSCSI drivers, accompanying readme files, release notes and example configuration files are available for download.

You must be a registered Cisco.com user to download Cisco SN 5400 Series system software and iSCSI drivers.

You can access software by following these instructions:

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- Step 1** At <http://www.cisco.com>, log in to Cisco.com. Under **Service & Support**, click **Software Center**.
 - Step 2** At the Software Center web page, under **Software Products & Downloads**, click **Storage Networking Software**.
 - Step 3** At the Storage Networking Software web page, click the appropriate link for your software.
 - Step 4** At the Software Download web page, click the link for the software that you want to download. Clicking the link will cause another web page to be displayed. Follow the instructions on that and any subsequent web pages to download the software.
 - Step 5** To install and configure storage router software, see the appropriate storage router software configuration guide and release notes. To install and configure an iSCSI driver, see the readme file that accompanies the iSCSI driver (in the downloaded driver archive file) and the appropriate release notes.
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Upgrading to a New Version

To upgrade to a new version of iSCSI driver software, follow these instructions:

-
- Step 1** Unmount all iSCSI file systems and stop the old iSCSI driver. For example, to manually stop the iSCSI version 2.1.1 driver that was installed in the default directory, enter:


```
/etc/rc.d/init.d/iscsi stop
```
 - Step 2** Remove the current iSCSI driver. Change to the directory containing the current iSCSI driver and issue the make remove command. You must have super-user (root) authority to remove the driver. For example:


```
cd /usr/src/linux-iscsi-2.1.1
make remove
```

This deletes the appropriate files from /lib/modules and /usr/local/sbin directories. The configuration files in /etc are not deleted.

- Step 3** Select a directory in which to unpack the new linux-iscsi-<version>.tgz file, such as /usr/src. Make the directory if it does not exist. The <version> is the three digit version of the driver. For example:

```
mkdir -p /usr/src/  
cp /tmp/linux-iscsi-2.1.2.tgz /usr/src
```

- Step 4** Change to the directory created in Step 3, and uncompress the file using the tar command. For example:

```
cd /usr/src/  
tar xzvf linux-iscsi-2.1.2.tgz
```

This creates a driver source subdirectory named linux-iscsi-2.1.2.

- Step 5** Change to the linux_iscsi_2.1.2 subdirectory, created in Step 4, and compile the iSCSI driver. If your kernel sources are not in the usual place, add “TOPDIR=/path/to/kernel” or edit the definition of TOPDIR in the Makefile. For example:

```
cd /usr/src/linux-iscsi-2.1.2  
make
```

- Step 6** Install the iSCSI driver. You must have super-user (root) authority to install the driver. For example:

```
make install
```

- Step 7** The install process does not overwrite any existing /etc/iscsi.conf files. Compare the new version of the iscsi.conf file to the existing /etc/iscsi.conf file. Update the existing file with any additional information from the new file and save it as /etc/iscsi.conf. The iscsi.conf man page has a more detailed description of the configuration file format. To read the man page:

```
man iscsi.conf
```

- Step 8** (Optional) If you are using a non-Red Hat Linux distribution you may need to edit your boot scripts to properly run the iSCSI setup script. You may also need to change the order of the boot script to ensure that iSCSI services are started after the network has been initialized.

- Step 9** Verify that your iSCSI partitions are listed in /etc/fstab.iscsi. It has the same format as /etc/fstab. The init scripts will automatically mount and unmount these partitions automatically.

- Step 10** Reboot the system to start and reload the iSCSI driver.

If you do not wish to reboot your machine, you can start the iSCSI devices immediately with the **start** command. For example:

```
/etc/rc.d/init.d/iscsi start
```

See the readme file for additional information about installing iSCSI driver software.

Uninstalling iSCSI Driver Software

To uninstall the iSCSI driver software, follow these instructions:

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- Step 1** Change to the linux-iscsi-<version> directory. The <version> is the three digit version. For example:
- ```
cd /usr/src/linux-iscsi-2.1.2
```
- Step 2** Remove the iSCSI driver. You must have super-user (root) authority to remove the driver. For example:
- ```
make remove
```
- This deletes the appropriate files from /lib/modules and /usr/local/sbin directories. The configuration files in /etc are not deleted, since they will be needed if another driver is installed at a later time.
- Step 3** Back up one directory and delete the source code. For example:
- ```
cd ..
rm -fr linux-iscsi-2.1.2
```
- 

## Upgrading the Linux Kernel

Because the Cisco iSCSI driver for Linux contains a Linux kernel module, the iSCSI driver must be rebuilt and reinstalled if you make any changes to your Linux kernel.

To remove, rebuild and reinstall the iSCSI driver for Linux, follow these instructions:

- 
- Step 1** Log in with super-user (root) authority, and change to the linux-iscsi-<version> directory. The <version> is the three digit version. For example:
- ```
cd /usr/src/linux-iscsi-2.1.2
```
- Step 2** Remove the iSCSI driver. For example:
- ```
make remove
```
- Step 3** Rebuild the iSCSI driver. For example:
- ```
make clean  
make
```
- Step 4** Reinstall the iSCSI driver. For example:
- ```
make install
```
-

# Important Notes

As of 6 June, 2002 there are several issues with the Linux kernel code that can cause problems when using SCSI devices (including iSCSI devices). Linux kernels released after this date may or may not have fixed these problems.

- Linux kernels 2.2.16 through 2.2.20 and 2.4.0 through 2.4.18 are known to have a problem in the SCSI error recovery process. In some cases, a successful device reset may be ignored and the SCSI layer will continue on to the later stages of the error recovery process.

The problem occurs when multiple SCSI commands for a particular device are queued in the low-level SCSI driver when a device reset occurs. Even if the low-level driver correctly reports that all the commands for the device have been completed by the reset, Linux will assume only one command has been completed and continue the error recovery process. (If only one command has timed out or failed, Linux will correctly terminate the error recovery process following the device reset.)

This action is undesirable because the later states of error recovery may send other types of resets, which can affect other SCSI initiators using the target or other targets on the same bus. It is also undesirable because there are more serious bugs in the later stages of the Linux SCSI error recovery process.

The Linux iSCSI driver now attempts to avoid this problem by replacing the usual error recovery handler for SCSI commands that timeout or fail.

- Linux kernels 2.2.16 through 2.2.20 and 2.4.0 through 2.4.2 may take SCSI devices offline after Linux issues a reset as part of the error recovery process. Taking a device offline causes all I/O to the device to fail until the HBA driver is reloaded.

After the error recovery process does a reset, it sends a SCSI Test Unit Ready command to check if the SCSI target is operational again. If this command returns SCSI sense data, instead of correctly retrying the command, Linux will treat it as a fatal error and immediately take the SCSI device offline.

The Test Unit Ready will almost always be returned with sense data because most targets return a deferred error in the sense data of the first command received after a reset. This is a way of telling the initiator that a reset has occurred. Therefore, the affected Linux kernel versions almost always take the SCSI device offline after a reset occurs.

This bug is fixed in Linux kernels 2.4.3 and later.

The Linux iSCSI driver now attempts to avoid this problem by replacing the usual error recovery handler for SCSI commands that timeout or fail.

- Linux kernels 2.2.16 through 2.2.21 and 2.4.0 through 2.4.18 appear to have problems when SCSI commands are completed with a check condition containing sense data. This can result in applications receiving I/O errors, short reads or short writes.

After receiving a SCSI command with sense data, the Linux SCSI midlayer checks if some sectors of an I/O request have been transferred and informs the application layer if an I/O request has partially completed. The SCSI midlayer then retries the request for any sectors that have not yet been transferred. Because of the partial I/O request completion, applications may receive short reads or writes.

All UNIX applications should handle these conditions, but there may be some applications that do not.

There are also some cases where the application receives an I/O error rather than a short read or write. The exact cause of the I/O errors is still being investigated, but it appears to be a bug in the Linux kernel's SCSI layer or block device layer.

- Linux kernel 2.2.16 through 2.2.21 and 2.4.0 through 2.4.18 may crash on a NULL pointer if a SCSI device is taken offline while one of the Linux kernel's I/O daemons (e.g. kpiod, kflushd, etc.) is trying to do I/O to the SCSI device. The exact cause of this problem is still being investigated.




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**Note** Some of the other bugs in the Linux kernel's error recovery handling may result in a SCSI device being taken offline, thus triggering this bug and resulting in a Linux kernel crash.

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- Linux kernels 2.2.16 through 2.2.21 running on uniprocessors may hang if a SCSI disk device node is opened while the Linux SCSI device structure for that node is still being initialized.

This occurs because the sd driver which controls SCSI disks will loop forever waiting for a device busy flag to be cleared at a certain point in the open routine for the disk device. Because this particular loop will never yield control of the processor, the process initializing the SCSI disk device is not allowed to run, and the initialization process can never clear the device busy flag which the sd driver is constantly checking.

A similar problem exists in the SCSI generic driver in some 2.4 kernel versions. The sg driver may crash on a bad pointer if a /dev/sg\* device is opened while it is being initialized.

## Caveats

Caveats describe unexpected behavior or defects in iSCSI software versions. Severity 1 caveats are the most serious caveats; severity 2 caveats are less serious.

This document describes open and resolved severity 1 and 2 caveats and selected caveats of other severities:

- The “[Open Caveats](#)” section lists open caveats that apply to the current version and may apply to previous versions.
- The “[Resolved Caveats](#)” section list caveats resolved in this version, but open in previous versions.

Within the sections, the caveats are sorted alphanumerically by caveat number.



**Note**

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If you have an account with Cisco.com, you can use Bug Navigator II to find caveats of any severity for any version. You can reach Bug Navigator II on Cisco.com at Service & Support: [http://www.cisco.com/cgi-bin/Support/Bugtool/launch\\_bugtool.pl](http://www.cisco.com/cgi-bin/Support/Bugtool/launch_bugtool.pl).

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## Open Caveats

There are no severity 1 or 2 caveats open against the iSCSI driver version 2.1.2. For a more complete list of caveats against this release, access Cisco.com as described in the section “[Cisco.com](#)” at the end of this document.

## Resolved Caveats

- CSCdx22530

The Linux host may panic if a storage device is physically removed without stopping data traffic running to the device. This only occurs on Linux hosts running the 2.2 kernel (specifically 2.2.16-3). The cause of the problem is still under investigation, but appears to be in the Linux 2.2 kernel; Linux hosts running the 2.4 kernel (specifically tested on 2.4.8 kernel) do not experience this error.

Workaround: Run with the Linux 2.4.8 kernel, if possible. If the problem occurs when running the Linux 2.2 kernel, reboot the host.

- CSCdx42910

When connecting to an SN 5428 Storage Router using version 2.1.1 of the iSCSI driver for Linux, you may receive these messages in the system log when starting the driver:

```
Apr 26 12:41:28 dell kernel: scsi singledevice 0 0 7 13
Apr 26 12:41:28 dell kernel: scsi: unknown type 31
Apr 26 12:41:28 dell kernel: Vendor: CISCO Model: SN5420 Rev: 1
Apr 26 12:41:28 dell kernel: Type: Unknown ANSI S CSI revision: 02
Apr 26 12:41:28 dell kernel: resize_dma_pool: unknown device type 31
```

The most recent SN 5428 firmware more accurately reflects the status of a LUN when using LUN mapping, but the iSCSI driver for Linux version 2.1.1 does not interpret the new status codes correctly.

Workaround: These messages can be ignored, and should not affect the functioning of the iSCSI driver; however an upgrade to version 2.1.2 is recommended. Version 2.1.2 of the iSCSI driver for Linux handles the new status codes correctly, resolving this problem.

## Related Documentation

The following sections describe the related documentation available for the iSCSI Driver version 2.1.2 for Linux and the Cisco SN 5400 Series system. These documents consist of the iSCSI driver release notes, readme and example configuration files, and the SN 5400 Series system hardware installation and software configuration guides.

The SN 5400 Series system hardware installation and software configuration documentation sets are available as printed manuals or electronic documents. The iSCSI driver readme file and example configuration file are available in electronic format, as part of the software download package. See the [“Obtaining the iSCSI Driver and Updated SN 5400 Series System Software”](#) section on page 5 for details.

## Release-Specific Documents

This Release Notes document is the only document specific to iSCSI Driver version 2.1.2 for Linux. It is located on Cisco.com and the Documentation CD-ROM.

Each release of SN 5400 Series system software includes an associated Release Notes document, which is also available as an electronic document on Cisco.com and the Documentation CD-ROM.

## Hardware Documents

Refer to the appropriate SN 5400 Series system hardware installation guide for hardware installation procedures. The *Cisco SN 5420 Storage Router Hardware Installation Guide* provides hardware installation procedures for SN 5420 Storage Routers. The *Cisco SN 5428 Storage Router Hardware Installation Guide* provides hardware installation procedures for SN 5428 Storage Routers. These documents are available as printed manuals. They are also available as electronic documents on Cisco.com and the Documentation CD-ROM

## Software Documents

Refer to the appropriate SN 5400 Series system software configuration guide for software configuration information. The *Cisco SN 5420 Storage Router Software Configuration Guide Release 2.1* provides configuration information for SN 5420 Storage Routers. The *Cisco SN 5428 Storage Router Software Configuration Guide* provides configuration information for SN 5428 Storage Routers. These documents are available as printed manuals. They are also available as electronic documents on Cisco.com and the Documentation CD-ROM.

For documentation on the SN 5400 Series system web-based GUI, refer to the SN 5400 Series system web-based GUI online Help system.

## Service and Support

For service and support for a product purchased from a reseller, contact the reseller, who offers a wide variety of Cisco service and support programs described in “Service and Support” of Cisco Information Packet shipped with your product.



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**Note**

If you purchased your product from a reseller, you can access Cisco.com as a guest. Cisco.com is Cisco Systems’ primary real-time support channel. Your reseller offers programs that include direct access to Cisco.com services.

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For service and support for a product purchased directly from Cisco, use Cisco.com.

## Software Configuration Tips on the Cisco TAC Home Page

A variety of Cisco SN 5400 Series system software and iSCSI driver installation, configuration and usage tips are available on the Cisco Technical Assistance Center (TAC) Web Site.

For example, you can access Cisco SN 5420 “tech tips” by following these instructions:

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- Step 1 At <http://www.cisco.com> (or <http://www.cisco.com/login/cisco/>, if you are a registered Cisco.com user and logged in), under **Products & Technologies**, select **Routers** from the drop-down list.
  - Step 2 At the Cisco Routers web page, under **Cisco SN 5400 Series Storage Routers**, click the **SN 5420 Product Support** link.
  - Step 3 At the Cisco SN 5420 Storage Router Product Support web page, click the appropriate links for additional information about installing and configuring SN 5400 Series system software and iSCSI drivers.
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## Obtaining Documentation

These sections explain how to obtain documentation from Cisco Systems.

### World Wide Web

You can access the most current Cisco documentation on the World Wide Web at this URL:

<http://www.cisco.com>

Translated documentation is available at this URL:

[http://www.cisco.com/public/countries\\_languages.shtml](http://www.cisco.com/public/countries_languages.shtml)

### Documentation CD-ROM

Cisco documentation and additional literature are available in a Cisco Documentation CD-ROM package, which is shipped with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual subscription.

### Ordering Documentation

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Networking Products MarketPlace:

[http://www.cisco.com/cgi-bin/order/order\\_root.pl](http://www.cisco.com/cgi-bin/order/order_root.pl)

- Registered Cisco.com users can order the Documentation CD-ROM through the online Subscription Store:

<http://www.cisco.com/go/subscription>

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, U.S.A.) at 408 526-7208 or, elsewhere in North America, by calling 800 553-NETS (6387).

## Documentation Feedback

You can submit comments electronically on Cisco.com. In the Cisco Documentation home page, click the **Fax** or **Email** option in the “Leave Feedback” section at the bottom of the page.

You can e-mail your comments to bug-doc@cisco.com.

You can submit your comments by mail by using the response card behind the front cover of your document or by writing to the following address:

Cisco Systems  
Attn: Document Resource Connection  
170 West Tasman Drive  
San Jose, CA 95134-9883

We appreciate your comments.

## Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain online documentation, troubleshooting tips, and sample configurations from online tools by using the Cisco Technical Assistance Center (TAC) Web Site. Cisco.com registered users have complete access to the technical support resources on the Cisco TAC Web Site.

## Cisco.com

Cisco.com is the foundation of a suite of interactive, networked services that provides immediate, open access to Cisco information, networking solutions, services, programs, and resources at any time, from anywhere in the world.

Cisco.com is a highly integrated Internet application and a powerful, easy-to-use tool that provides a broad range of features and services to help you with these tasks:

- Streamline business processes and improve productivity
- Resolve technical issues with online support
- Download and test software packages
- Order Cisco learning materials and merchandise
- Register for online skill assessment, training, and certification programs

If you want to obtain customized information and service, you can self-register on Cisco.com. To access Cisco.com, go to this URL:

<http://www.cisco.com>

## Technical Assistance Center

The Cisco Technical Assistance Center (TAC) is available to all customers who need technical assistance with a Cisco product, technology, or solution. Two levels of support are available: the Cisco TAC Web Site and the Cisco TAC Escalation Center.

Cisco TAC inquiries are categorized according to the urgency of the issue:

- Priority level 4 (P4)—You need information or assistance concerning Cisco product capabilities, product installation, or basic product configuration.
- Priority level 3 (P3)—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- Priority level 2 (P2)—Your production network is severely degraded, affecting significant aspects of business operations. No workaround is available.
- Priority level 1 (P1)—Your production network is down, and a critical impact to business operations will occur if service is not restored quickly. No workaround is available.

The Cisco TAC resource that you choose is based on the priority of the problem and the conditions of service contracts, when applicable.

### Cisco TAC Web Site

You can use the Cisco TAC Web Site to resolve P3 and P4 issues yourself, saving both cost and time. The site provides around-the-clock access to online tools, knowledge bases, and software. To access the Cisco TAC Web Site, go to this URL:

<http://www.cisco.com/tac>

All customers, partners, and resellers who have a valid Cisco service contract have complete access to the technical support resources on the Cisco TAC Web Site. The Cisco TAC Web Site requires a Cisco.com login ID and password. If you have a valid service contract but do not have a login ID or password, go to this URL to register:

<http://www.cisco.com/register/>

If you are a Cisco.com registered user, and you cannot resolve your technical issues by using the Cisco TAC Web Site, you can open a case online by using the TAC Case Open tool at this URL:

<http://www.cisco.com/tac/caseopen>

If you have Internet access, we recommend that you open P3 and P4 cases through the Cisco TAC Web Site.

### Cisco TAC Escalation Center

The Cisco TAC Escalation Center addresses priority level 1 or priority level 2 issues. These classifications are assigned when severe network degradation significantly impacts business operations. When you contact the TAC Escalation Center with a P1 or P2 problem, a Cisco TAC engineer automatically opens a case.

To obtain a directory of toll-free Cisco TAC telephone numbers for your country, go to this URL:

<http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml>

Before calling, please check with your network operations center to determine the level of Cisco support services to which your company is entitled: for example, SMARTnet, SMARTnet Onsite, or Network Supported Accounts (NSA). When you call the center, please have available your service agreement number and your product serial number.

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This document is to be used in conjunction with the documents listed in the [“Related Documentation”](#) section.



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