



Using the Print Utilities to Troubleshoot and Fix Samba Driver Installation Problems

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The Cisco WAAS and Cisco WAFS software products use a combination of technologies to allow Windows clients to print, including Samba suite, CUPS, and proprietary Cisco code. Samba offers a Windows-compatible print server solution that runs on a Linux platform. Although most drivers are compatible with Samba, as well as with all of the Microsoft Windows Hardware Quality Labs (WHQL)-signed drivers, there are some discrepancies, and some drivers are not fully compatible with Samba.

This document explains how to troubleshoot and fix many common Samba print driver installation problems using the print utilities tool developed by Cisco. This document contains the following sections:

- [Requirements](#)
- [Overview](#)
- [Troubleshooting](#)
- [Obtaining Documentation](#)
- [Obtaining Technical Assistance](#)



Note

If the print utilities do not solve your problem, or if you need additional support related to these utilities, see the [“Obtaining Technical Assistance” section on page 10](#).



Requirements

You can use the Cisco print utilities after you have discovered a printing problem, such as a print form is missing, duplex printing is not available, or the job will not spool.

**Note**

These troubleshooting utilities do not handle drivers that fail during the installation process itself.

To run the Cisco print utilities, note the following:

- We recommend that the Samba print server be accessible over the LAN.
- You must first successfully install a print driver on the Samba print server using the Add Printer Wizard.
- You must have the same printer installed on both the Samba print server and on a local Windows print server. (The Cisco print utilities must be run from a Windows client machine that has the same driver installed locally.)
- The troubleshooting utilities run on Windows XP and Windows 2003 clients.
- The troubleshooting utilities can fix problems for Windows 2000 and later versions of print drivers only. These troubleshooting utilities are not intended to work for Windows NT or Windows 98 print drivers.

Overview

The Cisco print utilities include the following two utilities that run on a Windows XP or Windows 2003 client:

- [Print_Diff Utility](#)
- [Print_Fix Utility](#)

**Note**

When you use these utilities, no changes are made to the Windows client machine that runs the `print_diff` or `print_fix` utilities. Modifications are made to the Samba print server only.

The Cisco print utilities tool has three objectives:

- Identify problems in a driver installation by comparing the driver setup on Samba to the Windows driver installation that is mapped to a local Windows client printing port.
- Provide reports on driver installation problems to shorten the debugging process.
- Resolve many common problems that occur when Windows print drivers are installed on the Samba print server.

This tool facilitates print driver troubleshooting and resolves some common installation problems; however, some drivers are incompatible with Samba. For example, Fiery Drivers incorporated into some printer manufacturer solutions are not compatible with Samba. Other multifunction printers (MFPs) may also have limited functionality when working with Samba and are not supported by WAAS. Certain print drivers with complex features, such as sophisticated paper handling, may not be compatible with the WAAS software.

For information about how to determine if a print driver is compatible with your software, see the “WAAS Print Driver Support and Interoperability” section at the following URL:

http://www.cisco.com/en/US/products/ps6870/prod_release_notes_list.html

Print_Diff Utility

This section contains the following information about the print_diff utility:

- [Functional Description](#)
- [Command Line Syntax](#)
- [Examples](#)
- [Sample Output](#)

Functional Description

The print_diff utility extracts the print driver properties from the Windows client machine and the Samba print server and compares the two for any differences. The print_diff utility retrieves the following information:

- Print forms (EnumForms)
- Printer device DEV MODE (DocumentProperties)
- Print processors (EnumPrintProcessors)—Samba does not support EMF printing, so the utility only notifies about the print processors that are supported.
- Set of driver-specific registry keys and their corresponding values (EnumPrinterKey, EnumPrinterDataEx)

The print_diff utility verifies the driver installation on the Samba print server. If the driver failed to install on the Samba print server, if the Samba and Windows print servers do not include the same driver, or if the Windows printer is not using the WinPrint processor, the utility exits with an error message. (See [Example 1](#).)

All data that is retrieved from the two print queues is saved in .csv formatted files that can be compared using Excel or a text editor. You will have one output file for the Windows client machine and one for the Samba print server. The output files are saved in the same directory as the print utility. (See the [“Sample Output”](#) section on page 5.)

Command Line Syntax

Use the following command line syntax to run the print_diff utility:

```
print_diff --winprint <windows_local_printer_name>
```

```
print_diff --sambaprint <\\print_server_name\samba_queue_name>
```

The print_diff command can be entered as a single line as follows:

```
print_diff --winprint <windows_local_printer_name> --sambaprint <\\print_server_name\samba_queue_name>
```

[Table 1](#) describes the argument variables for print_diff.

Table 1 *Print_Diff Argument Variable Descriptions*

Argument	Description
--winprint <windows_local_printer_name>	Windows printer name on the local Windows client machine. To obtain this data do the following: From the Windows client machine, choose Start > Settings > Printers and Faxes . Right click on the desired printer name, and then choose Properties .
--sambaprint <\\print_server_name\samba_queue_name>	NetBIOS name of the Samba print server and the printer queue_name.

Examples

[Example 1](#) and [Example 2](#) show the command line and examples of a failed attempt and a successful completion of the print_diff utility.

Example 1 Print Diff Error Message

In this example, the print_diff utility discovers that the printer name for the Samba printer is not valid and displays this error message:

```
print_diff.exe --winprint "HP LaserJet 2420 PS" --sambaprint \\10.56.70.119\hp_2420ps
Unable to open samba printer: \\10.56.70.119\hp_2420ps
ERROR: [0x709], The printer name is invalid.
Failed to execute print_diff!
```

Example 2 Print Diff Success

In this example, the print_diff utility successfully compares the driver setup on the Samba server to the Windows driver installation and provides the following report:

```
print_diff.exe --winprint "HP LaserJet 2420 PS" --sambaprint \\10.56.70.119\hp_2420ps
.
.
.
[161] [WatermarkPool:4] value under [HPPresetRoot\WatermarkPoolData] Key
[162] [WatermarkPool:3] value under [HPPresetRoot\WatermarkPoolData] Key
[163] [WatermarkPool:2] value under [HPPresetRoot\WatermarkPoolData] Key
[164] [WatermarkPool:1] value under [HPPresetRoot\WatermarkPoolData] Key
[165] [WatermarkPool:0] value under [HPPresetRoot\WatermarkPoolData] Key
[166] [PresetPool:1] value under [HPPresetRoot\PresetPoolData] Key
[167] [PresetPool:0] value under [HPPresetRoot\PresetPoolData] Key
[168] [PresetPoolMaxIndexCount] value under [HPPresetRoot] Key
[169] [HPRestrictedUserGuid] value under [HPPresetRoot] Key
[170] [flags] value under [DsSpooler] Key
[171] [url] value under [DsSpooler] Key
[172] [printShareName] value under [DsSpooler] Key
-----
In total Samba print server doesn't support [172] registry Values supported by Windows
print server
-----
Samba print server supports all [HP LaserJet 2420 PS] Windows print queue forms
print_diff finished successfully!
```

Sample Output

When you enter two printers as command-line arguments, all differences in supported Windows print forms (if any) are displayed in the Windows cmd console. In addition, a standard CSV formatted file that contains all of the retrieved data (such as, all possible forms, registry keys, and printer device properties) is created for each printer (Samba and Windows) and is saved in the same directory as the print utility. The CSV output files use the naming convention, `print_server_name_queue_name.csv`. For example, the CSV filenames for the two printers in the previous examples would be as follows:

```
HP_LaserJet_2420_PS_.csv
```

```
10_56_70_119_hp_2420_ps_.csv
```

The CSV output file contains output similar to the following;

```
DEVMODE values
Device Name
SPEC Version 1025
Driver Version 296
DEVMODE structure size 156
Private driver data 3868
Initialized DEVMODE members 58785551
Paper orientation 1
Paper size to print 1
Custom paper length 2794
Custom paper width 2159
Paper scale factor 100
Number of copies to be printed 1
Paper source 1025
Printer x-resolution 600
Color or monochrome 2
Duplex or one sided 1
Printer y-resolution 600
TrueType fonts 2
Use collate 1
Form name to use
Pixels per logical inch 0
Color resolution in bits per pixel of the display device 0
Width in pixels of the visible device surface 0
Height in pixels of the visible device surface 0
Frequency 0
Type of media being printed 256
Dithering 0
```

You can compare the output for the Windows printer with the output for the Samba printer by opening the CSV files in Excel and viewing the files side by side (**Window > Compare Side by Side**).

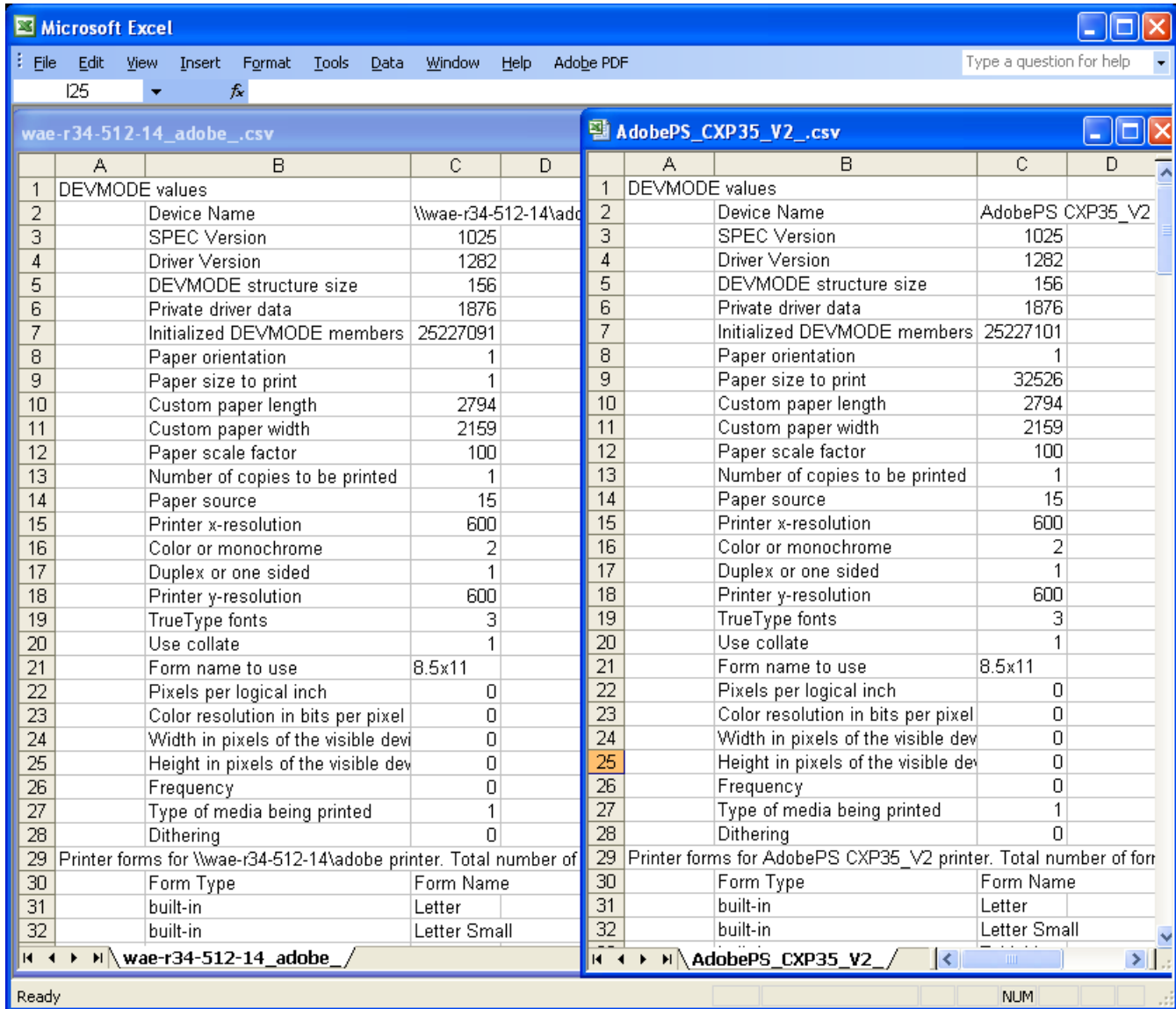
For example, [Figure 1](#) shows a sample of the `print_diff` output for an Adobe printer on the Windows print server (`AdobePS_CXP35_V2_.csv`) and the `print_diff` output for the same printer on the Samba print server (`wae-r34-512-14_adobe_.csv`) and compares them side by side using Excel.



Note

The `print_diff` command uses the printer name as the argument. However, as shown in this example, if you create a printer in the Windows print server without specifying a printer name, Windows by default uses the driver name as the printer name. If you did not specify a printer name in the Windows print server, the printer name that you must use as the argument for the `print_diff` command will be the driver name. This name also becomes part of the output filename.

Figure 1 Comparing the Print Diff Output



Print_Fix Utility

This section contains the following information about the print_fix utility:

- [Functional Description](#)
- [Command Line Syntax](#)
- [Examples](#)

Functional Description

Installing a print driver on a Samba print server can sometimes result in inaccuracies in the installed forms and registry keys. The `print_fix` utility resolves many inaccuracies that occur when the Samba print server fails to read the Windows driver information correctly.

The `print_fix` utility resolves any differences between the two sets of print driver properties. The `print_fix` utility also updates the registry keys in Samba and restores the missing print functionality.

The following data is completed by the `print_fix` utility:

- Driver forms (AddForm)—Any form found on the Windows print server and not found on the Samba print server is added to the Samba TDB (Temporary DataBase) files using AddForm.
- Missing or incomplete print driver configuration registry keys (print driver-specific configuration data) (SetPrinterData or/and SetPrinterDataEx).
- All keys under the Printer DSDriver Key (HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Print\Printers\print_driver_name).

Command Line Syntax

Use the following command line syntax to run the `print_fix` utility:

```
print_fix --winprint <windows_local_printer_name>
--sambaprint <\\print_server_name\samba_queue_name>
[--command <FORMS | KEYS>]
```

The `print_fix` command can be entered as a single line, as follows:

```
print_fix --winprint <windows_local_printer_name> --sambaprint <\\print_server_name\samba_queue_name>
```

[Table 2](#) describes the argument variables for `print_fix`.

Table 2 *Print Fix Argument Variable Descriptions*

Argument	Description
<code>--winprint <windows_local_printer_name></code>	Windows print queue installed on the local (Windows) print server with the correct print driver already installed and initialized.
<code>--sambaprint <\\print_server_name\samba_queue_name></code>	Remote print queue installed on the Samba print server with the print driver already installed and initialized.
<code>--command <FORMS KEYS></code>	(Optional) If you supply the command argument with a corresponding value for FORMS or KEYS, then only the module specified (FORMS or KEYS) will be corrected by the <code>print_fix</code> utility. By default, when this argument is not specified, the <code>print_fix</code> utility fixes both forms and keys.

Examples

[Example 3](#) shows the command line and an error message for the `print_fix` utility, and [Example 4](#) shows a successful completion of the `print_fix` utility.

Example 3 Print Fix Error Message

In this example, the `print_fix` utility discovers that the printer name for the Samba printer is not valid and displays this error message:

```
print_fix.exe --winprint "HP LaserJet 2420 PS" --sambaprint " "
Unable to open samba printer:
ERROR: [0x709], The printer name is invalid.
Failed to execute print_fix!
```

Example 4 Print Fix Success

In this example, the utility successfully adds the missing printer or user-specific forms:

```
print_fix.exe -winprint "HP LaserJet 2420 PS" --sambaprint "\\10.56.70.119\hp_2420ps
.
.
[Custom 17]
[Custom 18]
[Custom 19]
[Custom 20]
[Letter (8.5 x 11 in)]
[Folio (8.5 x 13 in)]
[Legal (8.5 x 14 in)]
[Executive (7.25 x 10.5 in)]
[Hagaki Card 100 x 148 mm]
[8.5x13]
[8.5+13]
[8.5x11 LEF]
[8.5x11 SEF]
-----
Successfully added [76] printer or user specific forms
Successfully added [0] builtin forms
-----
print_fix finished successfully!
```

Troubleshooting

Troubleshooting includes the following topics:

- [Preliminary Tasks](#)
- [Using the Print Utilities](#)

Preliminary Tasks

Before you run the print utilities, try to fix the printing problem by changing one of the print properties, such as the paper orientation (or some other print property). Apply the change, and then change the property back and apply the change. Test the printer. If the printer still fails to print, run the print utilities.

To change printing or driver properties, follow these steps:

-
- Step 1** In the Settings menu, choose **Printers and Faxes** and the name of the printer that is having the problem.
- Step 2** In the printer queue window, choose **Printer > Properties > Advanced**:
- The driver properties are found under the **Advanced** tab.
 - The page orientation is found by clicking **Printing Defaults**.
- Step 3** Change the paper orientation or one of the driver properties, and click **Apply**.
-

Using the Print Utilities

To troubleshoot print driver problems using the Cisco print utilities, follow these steps:

-
- Step 1** Install the same print driver that you installed on the Samba print server on a local Windows XP or 2003 print server. (You must have administrative privileges for installing print drivers locally.)
- The Cisco print utilities must be run from a Windows client machine that has the same driver installed locally.
- Step 2** Check to make sure that the driver on the Samba print server is initialized.
- Step 3** Connect to the Samba print server as follows:
- From the Windows client command line shell (cmd), connect to the Samba print server with administrative privileges by using the **net use** command, as shown in the following example:


```
net use \\<Samba_print_server_name>\print$ * /USER:<admin_user>
```
 - When prompted, enter the admin user's password, where `admin_user` and `admin_user's password` are accounts that were created in the AAA section of WAAS Central Manager.



Note If you are using a WAFS system, then the admin user is one of the Print Admin group users defined in the Active Directory (AD).

- Step 4** Install the `print_diff` and `print_fix` utilities on the Windows client machine:
- a. Using FTP, transfer the `Print Utilities.zip` file from the Cisco.com software download site to the Windows client machine.
 - b. Create a subdirectory in the Windows client C:\ drive, and name it `PrintUtils`, for example.
 - c. Unzip the `Print Utilities.zip` file by extracting the two utility files, `print_diff.exe` and `print_fix.exe`, to the C:\PrintUtils directory.
 - d. Run the utilities from the `PrintUtils` directory.
- Step 5** To run the `print_diff` utility, use the **print_diff** command as shown in the following example:
- ```
print_diff --winprint "Brother HL-5170DN series" --sambaprint "\\prn_srv_305\Brother"
```
- Step 6** To run the `print_fix` utility, use the **print\_fix** command as shown in the following example:
- ```
print_fix --winprint "Brother HL-5170DN series" --sambaprint "\\prn_srv_305\Brother"
--command "KEYS"
```

**Caution**

Before you attempt to run the `print_fix` utility, you must force the Samba print server to recognize that the driver exists. Otherwise, the `print_fix` utility does not fix the driver problem. To do this step, change one of the driver properties and apply the change. (See the “[Preliminary Tasks](#)” section on page 8.)

Change the property back to its original setting, and apply the change. Test the printer. If the printer still fails to print, run the `print_fix` utility.

- Step 7** After you run the `print_fix` utility, close all open Windows Explorer connections to the Samba print server by using the following command:

```
net use \\<Samba_print_server_name>\print$ * /delete
```

(This step applies to WAAS systems only.)

- Step 8** Reconnect to the Samba print server using Windows Explorer, and proceed to **Printers and Faxes**.

Make sure that the printer you installed is showing in the list of printers and that you can successfully connect to it for printing.

- Step 9** To verify that all missing properties have been added to the Samba print server, you can run the `print_diff` utility again. You must then test the print driver to verify that missing driver functionality has been restored.

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. This section explains the product documentation resources that Cisco offers.

Cisco.com

You can access the most current Cisco documentation at this URL:

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

You can access the Cisco website at this URL:

<http://www.cisco.com>

You can access international Cisco websites at this URL:

http://www.cisco.com/public/countries_languages.shtml

Product Documentation DVD

The Product Documentation DVD is a library of technical product documentation on a portable medium. The DVD enables you to access installation, configuration, and command guides for Cisco hardware and software products. With the DVD, you have access to the HTML documentation and some of the PDF files found on the Cisco website at this URL:

<http://www.cisco.com/univercd/home/home.htm>

The Product Documentation DVD is created and released regularly. DVDs are available singly or by subscription. Registered Cisco.com users can order a Product Documentation DVD (product number DOC-DOCDVD= or DOC-DOCDVD=SUB) from Cisco Marketplace at the Product Documentation Store at this URL:

<http://www.cisco.com/go/marketplace/docstore>

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You must be a registered Cisco.com user to access Cisco Marketplace. Registered users may order Cisco documentation at the Product Documentation Store at this URL:

<http://www.cisco.com/go/marketplace/docstore>

If you do not have a user ID or password, you can register at this URL:

<http://tools.cisco.com/RPF/register/register.do>

Documentation Feedback

You can provide feedback about Cisco technical documentation on the Cisco Support site area by entering your comments in the feedback form available in every online document.

Cisco Product Security Overview

Cisco provides a free online Security Vulnerability Policy portal at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

From this site, you will find information about how to do the following:

- Report security vulnerabilities in Cisco products
- Obtain assistance with security incidents that involve Cisco products
- Register to receive security information from Cisco

A current list of security advisories, security notices, and security responses for Cisco products is available at this URL:

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

To see security advisories, security notices, and security responses as they are updated in real time, you can subscribe to the Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed. Information about how to subscribe to the PSIRT RSS feed is found at this URL:

http://www.cisco.com/en/US/products/products_psirt_rss_feed.html

Reporting Security Problems in Cisco Products

Cisco is committed to delivering secure products. We test our products internally before we release them, and we strive to correct all vulnerabilities quickly. If you think that you have identified a vulnerability in a Cisco product, contact PSIRT:

- For emergencies only — security-alert@cisco.com

An emergency is either a condition in which a system is under active attack or a condition for which a severe and urgent security vulnerability should be reported. All other conditions are considered nonemergencies.

- For nonemergencies — psirt@cisco.com

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532



Tip

We encourage you to use Pretty Good Privacy (PGP) or a compatible product (for example, GnuPG) to encrypt any sensitive information that you send to Cisco. PSIRT can work with information that has been encrypted with PGP versions 2.x through 9.x.

Never use a revoked encryption key or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one linked in the Contact Summary section of the Security Vulnerability Policy page at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

The link on this page has the current PGP key ID in use.

If you do not have or use PGP, contact PSIRT to find other means of encrypting the data before sending any sensitive material.

Product Alerts and Field Notices

Modifications to or updates about Cisco products are announced in Cisco Product Alerts and Cisco Field Notices. You can receive these announcements by using the Product Alert Tool on Cisco.com. This tool enables you to create a profile and choose those products for which you want to receive information.

To access the Product Alert Tool, you must be a registered Cisco.com user. Registered users can access the tool at this URL:

<http://tools.cisco.com/Support/PAT/do/ViewMyProfiles.do?local=en>

To register as a Cisco.com user, go to this URL:

<http://tools.cisco.com/RPF/register/register.do>

Obtaining Technical Assistance

Cisco Technical Support provides 24-hour-a-day award-winning technical assistance. The Cisco Support website on Cisco.com features extensive online support resources. In addition, if you have a valid Cisco service contract, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not have a valid Cisco service contract, contact your reseller.

Cisco Support Website

The Cisco Support website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day at this URL:

<http://www.cisco.com/en/US/support/index.html>

Access to all tools on the Cisco Support website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

<http://tools.cisco.com/RPF/register/register.do>



Note

Before you submit a request for service online or by phone, use the **Cisco Product Identification Tool** to locate your product serial number. You can access this tool from the Cisco Support website by clicking the **Get Tools & Resources** link, clicking the **All Tools (A-Z)** tab, and then choosing **Cisco Product Identification Tool** from the alphabetical list. This tool offers three search options: by product ID or model name; by tree view; or, for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.



Tip

Displaying and Searching on Cisco.com

If you suspect that the browser is not refreshing a web page, force the browser to update the web page by holding down the Ctrl key while pressing **F5**.

To find technical information, narrow your search to look in technical documentation, not the entire Cisco.com website. After using the Search box on the Cisco.com home page, click the **Advanced Search** link next to the Search box on the resulting page and then click the **Technical Support & Documentation** radio button.

To provide feedback about the Cisco.com website or a particular technical document, click **Contacts & Feedback** at the top of any Cisco.com web page.

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

<http://www.cisco.com/techsupport/servicerequest>

For S1 or S2 service requests, or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411

Australia: 1 800 805 227

EMEA: +32 2 704 55 55

USA: 1 800 553 2447

For a complete list of Cisco TAC contacts, go to this URL:

<http://www.cisco.com/techsupport/contacts>

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—An existing network is “down” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Severity 3 (S3)—Operational performance of the network is impaired while most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The Cisco Online Subscription Center is the website where you can sign up for a variety of Cisco e-mail newsletters and other communications. Create a profile and then select the subscriptions that you would like to receive. To visit the Cisco Online Subscription Center, go to this URL:

<http://www.cisco.com/offer/subscribe>

- The *Cisco Product Quick Reference Guide* is a handy, compact reference tool that includes brief product overviews, key features, sample part numbers, and abbreviated technical specifications for many Cisco products that are sold through channel partners. It is updated twice a year and includes the latest Cisco channel product offerings. To order and find out more about the *Cisco Product Quick Reference Guide*, go to this URL:

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

- Cisco Marketplace provides a variety of Cisco books, reference guides, documentation, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:

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

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- *Internet Protocol Journal* is a quarterly journal published by Cisco for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the *Internet Protocol Journal* at this URL:

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

- Networking products offered by Cisco, as well as customer support services, can be obtained at this URL:

<http://www.cisco.com/en/US/products/index.html>

- Networking Professionals Connection is an interactive website where networking professionals share questions, suggestions, and information about networking products and technologies with Cisco experts and other networking professionals. Join a discussion at this URL:

<http://www.cisco.com/discuss/networking>

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<http://www.cisco.com/univercd/cc/td/doc/abtnicd/136957.htm>

- World-class networking training is available from Cisco. You can view current offerings at this URL:

<http://www.cisco.com/en/US/learning/index.html>

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