Cisco 1721 and Cisco 1760 Modular Access Routers with MOD1700-VPN FIPS 140-2 Non-Proprietary Security Policy

Level 2 Validation
Version 1.3
May 7, 2004

Introduction

This is the non-proprietary Cryptographic Module Security Policy for the 1721 and 1760 Modular Access Routers with MOD1700-VPN. This security policy describes how the 1721 and 1760 routers (Hardware Version: 1721, 1760; MOD1700-VPN: Hardware Version 2.1, Board Version A0; Firmware Version: IOS 12.3(3d)) meet the security requirements of FIPS 140-2, and how to operate the 1721 and 1760 routers in a secure FIPS 140-2 mode. This policy was prepared as part of the Level 2 FIPS 140-2 validation of the 1721 and 1760 routers.

FIPS 140-2 (*Federal Information Processing Standards Publication 140-2—Security Requirements for Cryptographic Modules*) details the U.S. Government requirements for cryptographic modules. More information about the FIPS 140-2 standard and validation program is available on the NIST website at http://csrc.nist.gov/cryptval/.

This document contains the following sections:

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Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

References

This document deals only with operations and capabilities of the 1721 and 1760 routers in the technical terms of a FIPS 140-2 cryptographic module security policy. More information is available on the 1721 and 1760 routers and the entire 1700 Series from the following sources:

- The Cisco Systems website contains information on the full line of products at www.cisco.com. The 1700 Series product descriptions can be found at:

  http://www.cisco.com/en/US/products/hw/routers/ps221/index.html

- For answers to technical or sales related questions please refer to the contacts listed on the Cisco Systems website at www.cisco.com.
- The NIST Validated Modules website (http://csrc.nist.gov/cryptval) contains contact information for answers to technical or sales-related questions for the module

Terminology

In this document, the Cisco 1721 and 1760 routers are referred to as the routers, the modules, or the systems.

Document Organization

The Security Policy document is part of the FIPS 140-2 Submission Package. In addition to this document, the Submission Package contains:

- Vendor Evidence document
- Finite State Machine
- Module Software Listing
- Other supporting documentation as additional references

This document provides an overview of the 1721 and 1760 routers and explains the secure configuration and operation of the modules. This introduction section is followed by the section "The Cisco 1721/1760 Cryptographic Module", which details the general features and functionality of the 1721 and 1760 routers. The section "Secure Operation of the Cisco 1721/1760 Router" specifically addresses the required configuration for the FIPS-mode of operation.

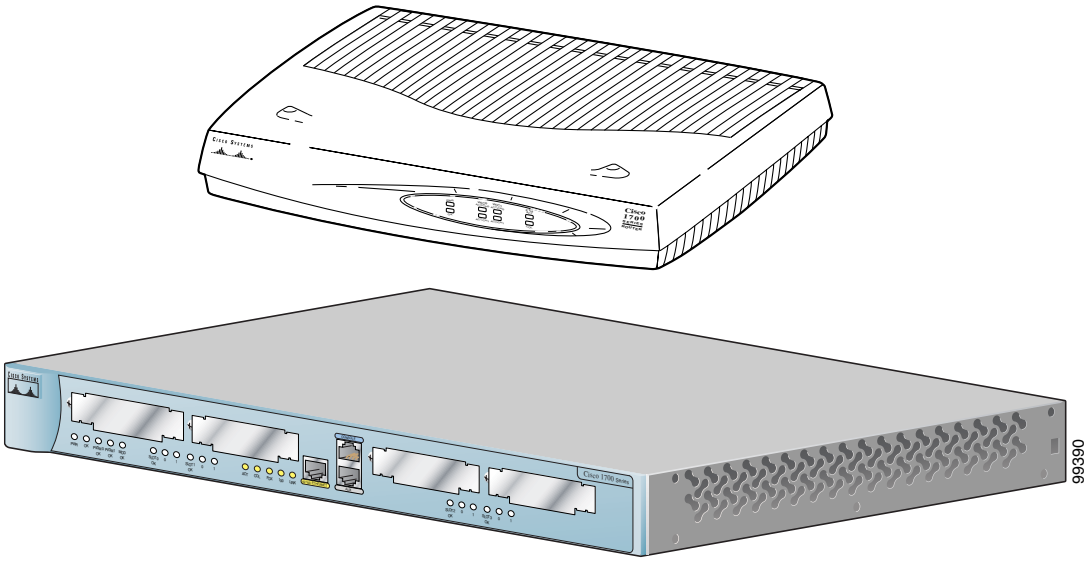
With the exception of this Non-Proprietary Security Policy, the FIPS 140-2 Validation Submission Documentation is Cisco-proprietary and is releasable only under appropriate non-disclosure agreements. For access to these documents, please contact Cisco Systems.

The Cisco 1721/1760 Cryptographic Module

Branch office networking requirements are dramatically evolving, driven by web and e-commerce applications to enhance productivity and merging the voice and data infrastructure to reduce costs. The Cisco 1721 and 1760 routers offer versatility, integration, and security to branch offices. With numerous WAN Interface Cards (WICs) and Voice Interface Cards (VICs) available, the modular architecture of the Cisco router easily allows interfaces to be upgraded to accommodate network expansion. The Cisco

1721 and 1760 provide a scalable, secure, manageable remote access server that meets FIPS 140-2 Level 2 requirements. This section describes the general features and functionality provided by the Cisco 1721 and 1760 routers.

Figure 1 The Cisco 1721 and Cisco 1760 Routers

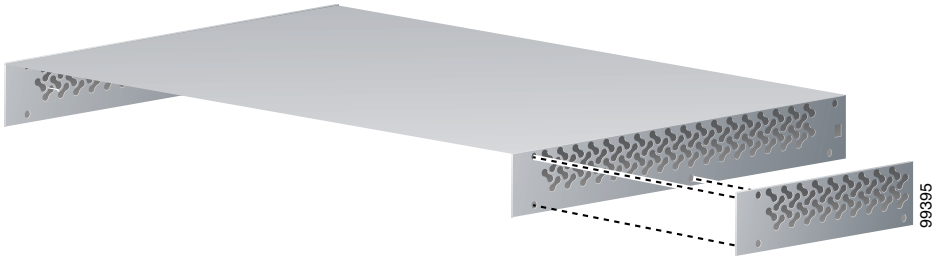


The 1721 and 1760 routers are multi-chip standalone cryptographic modules. The cryptographic boundary of the module consists of the physical perimeter of the module minus the three-dimensional space allocated for WICs and VICs. The cryptographic boundary includes the connection apparatus between the WIC (or VIC) and the motherboard/daughterboard that hosts the WIC (or VIC), but the boundary does not include the WIC (or VIC) itself. In other words, the cryptographic boundary encompasses all hardware components within the case of the device except any installed modular WICs (or VICs). All of the functionality discussed in this document is provided by components within this cryptographic boundary.

The Cisco 1721 and 1760 routers incorporate the MOD1700-VPN cryptographic accelerator card. The MOD1700-VPN is located inside the module chassis, and is installed directly on the motherboard.

The 1760 requires that a special opacity shield be installed over the right-hand side air vents in order to operate in FIPS-approved mode. The shield decreases the effective size of the vent holes, reducing visibility within the cryptographic boundary to FIPS-approved specifications. The shield is self-adhering to the side of the chassis. To install the shield, remove it from its paper backing and apply the shield to the chassis, aligning the holes on the shield with the vent-holes on the side of the chassis. Figure 3 demonstrates the proper application of the shield.

Figure 2 Cisco 1760 Opacity Shield Application

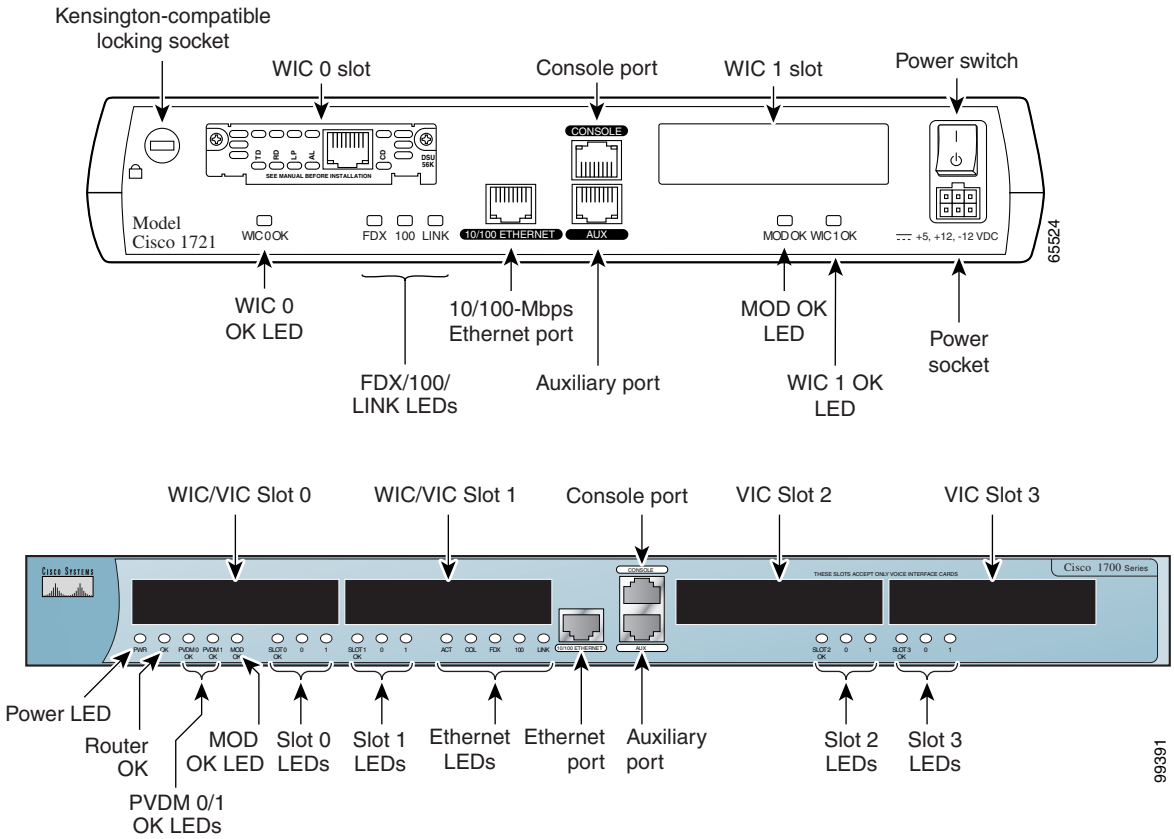


Cisco IOS features such as tunneling, data encryption, and termination of Remote Access WANs via IPSec, Layer 2 Forwarding (L2F) and Layer 2 Tunneling Protocols (L2TP) make the Cisco 1700 an ideal platform for building virtual private networks or outsourced dial solutions. Cisco 1700`s RISC-based processor provides the power needed for the dynamic requirements of the remote branch office.

Module Interfaces

The interfaces for the router are located on the rear panel of the 1721 and the front panel of the 1760 as shown in Figure 3.

Figure 3 Cisco 1721 and Cisco 1760 Physical Interfaces



The Cisco 1721 and 1760 routers feature console and auxiliary ports, single fixed LAN interfaces, two Cisco WAN interface card (WIC) slots on the 1721, and two WIC slots and two Voice interface card (VIC) slots on the 1760. WAN interface cards support a variety of serial, ISDN BRI, and integrated CSU/DSU options for primary and backup WAN connectivity. All Cisco 1700 series routers include an auxiliary port supporting 115Kbps Dial-On-Demand Routing, ideal for back-up WAN connectivity.

A WIC is inserted into one of the WIC slots, which are located on the back panel of the 1721 and the front panel of the 1760. WICs interface directly with the processor, and cannot perform cryptographic functions; they only serve as a data input and data output physical interface.

The physical interfaces include a power plug for the power supply and a power switch. The router has one Fast Ethernet (10/100 RJ-45) connector for data transfers in and out. The module also has two other RJ-45 connectors on the back panel for a console terminal for local system access and an auxiliary port for remote system access or dial backup using a modem. The 10/100Base-T LAN port has Link/Activity, 10/100Mbps, and half/full duplex LEDs. Figure 4 shows the LEDs located on the rear panel of the 1721 with descriptions detailed in Table 1:

Figure 4 Cisco 1721 Rear Panel LEDs

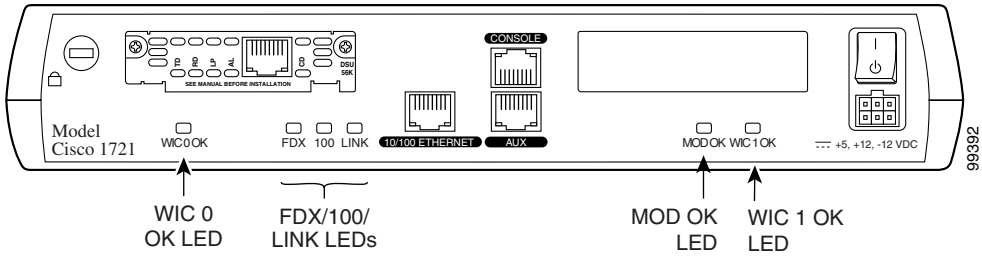


Table 1 Cisco 1721 Rear Panel LEDs and Descriptions

LED	Indication	Description
WIC 0 OK	Green	A WIC is correctly inserted in the card slot
	Off	No WIC present / WIC incorrectly inserted in the card slot
WIC 1 OK	Green	A WIC is correctly inserted in the card slot
	Off	No WIC present / WIC incorrectly inserted in the card slot
FDX	Green	The interface is transmitting data in full-duplex mode
	Off	When off, the interface is transmitting data in half-duplex mode
100 Mbps	Green	The speed of the interface is 100 Mbps
	Off	The speed of the interface is 10 Mbps or no link is established
LINK	Green	An Ethernet link has been established
	Off	No Ethernet link established
MOD OK	Green	VPN hardware encryption module is installed and recognized by Cisco IOS
	Off	VPN hardware encryption module not installed / not recognized by Cisco IOS

Figure 5 shows the front panel LEDs of the 1721 and 1760, which provide overall status of the router's operation. The front panel of the 1721 displays whether or not the router is booted, overall activity/link status, and collision information. The front panel of the 1760 displays whether or not the router is booted, overall activity/link status, collision information, and specific information for each installed interface.

Figure 5 Cisco 1721 and 1760 Front Panel LEDs

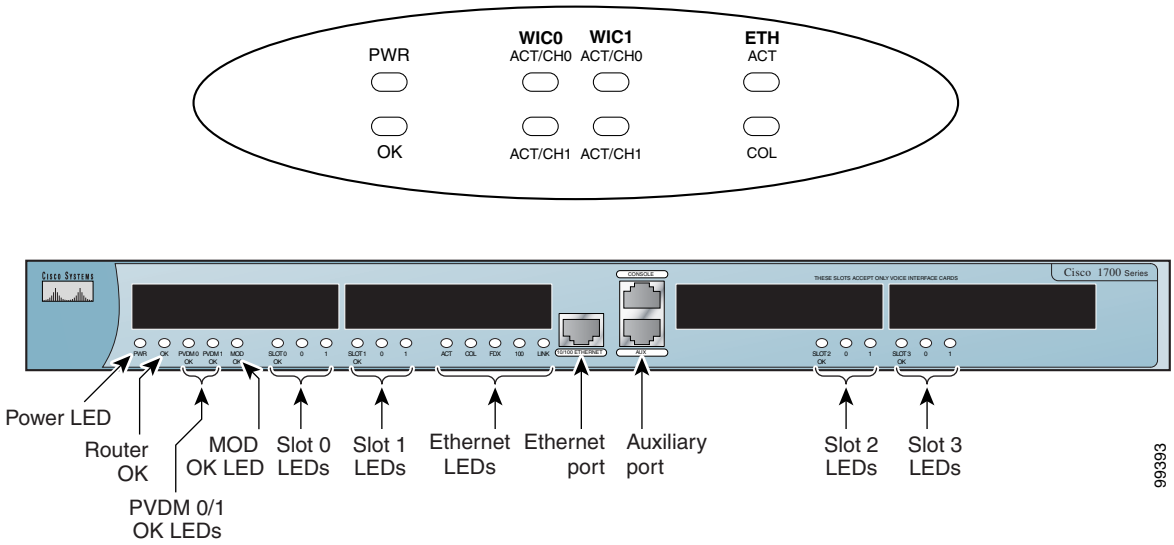


Table 2 and Table 3 provide more detailed information conveyed by the LEDs on the front panel of the Cisco 1721 and 1760 routers:

Table 2 Cisco 1721 Front Panel LEDs and Descriptions

LED	Indication	Description
PWR	Green	Power is supplied to the router
	Off	The router is not powered on
OK	Green	The router has successfully booted up and the software is functional. This LED blinks during the power-on self-test (POST)
	Off	The router has not successfully booted up
WIC 0 ACT/CH0	Green	Serial and DSU/CSU cards—Blinks when data is being sent to or received from the port on the card in the WIC0 slot
		ISDN cards—On solid when the first ISDN B channel is up for the card in the WIC0 slot
		2-port serial cards—Blinks when data is being sent to or received from the first port on the 2-port card in the WIC0 slot
WIC 0 ACT/CH1	Green	Serial and CSU/DSU cards—Remains off
		ISDN cards—On solid when the second ISDN B channel is up for the card in the WIC0 slot
		2-port serial cards—Blinks when data is being sent to or received from the second port on the 2-port card in the WIC0 slot

Table 2 Cisco 1721 Front Panel LEDs and Descriptions (Continued)

LED	Indication	Description
WIC 1 ACT/CH0	Green	Serial and DSU/CSU cards—Blinks when data is being sent to or received from the port on the card in the WIC1 slot
		ISDN cards—On solid when the first ISDN B channel is up for the card in the WIC1 slot
		2-port serial cards—Blinks when data is being sent to or received from the first port on the 2-port card in the WIC1 slot
WIC 1 ACT/CH1	Green	Serial and CSU/DSU cards—Remains off
		ISDN cards—On solid when the second ISDN B channel is up for the card in the WIC1 slot
		2-port serial cards—Blinks when data is being sent to or received from the second port on the 2-port card in the WIC1 slot
ETH ACT	Green	Blinks when there is network activity on the Ethernet port
ETH COL	Yellow	Blinks when there are packet collisions on the local Ethernet network

Table 3 Cisco 1760 Front Panel LEDs and Descriptions

LED	Indication	Description
PWR	Green	Power is supplied to the router
	Off	The router is not powered on
OK	Green	The router has successfully booted up and the software is functional. This LED blinks during the power-on self-test (POST)
	Off	The router has not successfully booted up
PVDM 0 OK	Green	On when a packet voice data module (PVDM) is correctly inserted in PVDM card slot 0
PVDM 1 OK	Green	n when a packet voice data module (PVDM) is correctly inserted in PVDM card slot 1
MOD OK	Green	On when a VPN module is present
FDX	Green	The interface is transmitting data in full-duplex mode
	Off	When off, the interface is transmitting data in half-duplex mode
100 Mbps	Green	The speed of the interface is 100 Mbps
	Off	The speed of the interface is 10 Mbps or no link is established
LINK	Green	An Ethernet link has been established
	Off	No Ethernet link established
SLOT 0 OK	Green	On when either a WIC or a VIC is correctly inserted in the card slot
0	Green	ISDN—On when the first ISDN B channel is connected
		Serial, CSU/DSU, and VIC—Blinks when data is being sent to or received from port 0 in slot 0. For the VIC-2BRI-ST-NT/TE, blinks when data is being sent to or received from any of the B channels

Table 3 Cisco 1760 Front Panel LEDs and Descriptions (Continued)

LED	Indication	Description
1	Green	ISDN—On when the second ISDN B channel is connected
		Serial and VIC—Blinks when data is being sent to or received from port 1 in slot 0
SLOT 1 OK	Green	On when either a WIC or a VIC is correctly inserted in the card slot
0	Green	ISDN—On when the first ISDN B channel is connected
		Serial, CSU/DSU, and VIC—Blinks when data is being sent to or received from port 0 in slot 1
1	Green	ISDN—On when the second ISDN B channel is connected
		Serial and VIC—Blinks when data is being sent to or received from port 1 in slot 1
SLOT 2 OK	Green	On when a VIC is correctly inserted in the card slot
0	Green	VIC—Blinks when data is being sent to or received from port 0 in slot 2
1	Green	VIC—Blinks when data is being sent to or received from port 1 in slot 2
SLOT 3 OK	Green	On when a VIC is correctly inserted in the card slot
0	Green	VIC—Blinks when data is being sent to or received from port 0 in slot 3
1	Green	VIC—Blinks when data is being sent to or received from port 1 in slot 3

All of these physical interfaces are separated into the logical interfaces from FIPS 140-2 as described in the Table 4:

Table 4 FIPS 140-2 Logical Interfaces

Router Physical Interface	FIPS 140-2 Logical Interface
10/100BASE-TX LAN Port WIC/VIC Interface Console Port Auxiliary Port	Data Input Interface
10/100BASE-TX LAN Port WIC/VIC Interface Console Port Auxiliary Port	Data Output Interface
10/100BASE-TX LAN Port WIC/VIC Interface Power Switch Console Port Auxiliary Port	Control Input Interface

Table 4 FIPS 140-2 Logical Interfaces (Continued)

Router Physical Interface	FIPS 140-2 Logical Interface
10/100BASE-TX LAN Port WIC/VIC Interface LAN Port LEDs 10/100BASE-TX LAN Port LEDs Power LED Activity LED Console Port Auxiliary Port	Status Output Interface
Power Plug	Power Interface

Roles and Services

Authentication is role-based. There are two main roles in the router that operators may assume: the Crypto Officer role and the User role. The administrator of the router assumes the Crypto Officer role in order to configure and maintain the router using Crypto Officer services, while the Users exercise only the basic User services. Both roles are authenticated by providing a valid username and password. The configuration of the encryption and decryption functionality is performed only by the Crypto Officer after authentication to the Crypto Officer role by providing a valid Crypto Officer username and password. Once the Crypto Officer configured the encryption and decryption functionality, the User can use this functionality after authentication to the User role by providing a valid User username and password. The Crypto Officer can also use the encryption and decryption functionality after authentication to the Crypto Officer role. The module supports RADIUS and TACACS+ for authentication and they are used in the FIPS mode. A complete description of all the management and configuration capabilities of the Cisco 1721 and 1760 Routers can be found in the *Performing Basic System Management* manual and in the online help for the router.

The User and Crypto Officer passwords and the RADIUS/TACACS+ shared secrets must each be at least 8 alphanumeric characters in length. See the "Secure Operation of the Cisco 1721/1760 Router" section on page 20 for more information. If only integers 0-9 are used without repetition for an 8 digit PIN, the probability of randomly guessing the correct sequence is 1 in 1,814,400. Including the rest of the alphanumeric characters drastically decreases the odds of guessing the correct sequence.

Crypto Officer Services

During initial configuration of the router, the Crypto Officer password (the "enable" password) is defined. A Crypto Officer may assign permission to access the Crypto Officer role to additional accounts, thereby creating additional Crypto Officers.

The Crypto Officer role is responsible for the configuration and maintenance of the router. The Crypto Officer services consist of the following:

- **Configure the router**—define network interfaces and settings, create command aliases, set the protocols the router will support, enable interfaces and network services, set system date and time, and load authentication information.
- **Define Rules and Filters**—create packet Filters that are applied to User data streams on each interface. Each Filter consists of a set of Rules, which define a set of packets to permit or deny based characteristics such as protocol ID, addresses, ports, TCP connection establishment, or packet direction.

- **Status Functions**—view the router configuration, routing tables, active sessions, use Gets to view SNMP MIB II statistics, health, temperature, memory status, voltage, packet statistics, review accounting logs, and view physical interface status.
- **Manage the router**—log off users, shutdown or reload the outer, manually back up router configurations, view complete configurations, manager user rights, and restore router configurations.
- **Set Encryption/Bypass**—set up the configuration tables for IP tunneling. Set keys and algorithms to be used for each IP range or allow plaintext packets to be set from specified IP address.
- **Change WAN Interface Cards**—insert and remove WICs in the WAN interface slot as described in the "Initial Setup" section on page 20 of this document.

User Services

A User enters the system by accessing the console port with a terminal program. The IOS prompts the User for their password. If the password is correct, the User is allowed entry to the IOS executive program. The services available to the User role consist of the following:

- **Status Functions**—view state of interfaces, state of layer 2 protocols, version of IOS currently running
- **Network Functions**—connect to other network devices through outgoing telnet, PPP, etc. and initiate diagnostic network services (i.e., ping, mtrace)
- **Terminal Functions**—adjust the terminal session (e.g., lock the terminal, adjust flow control)
- **Directory Services**—display directory of files kept in flash memory

Physical Security

The router is entirely encased by a thick steel chassis. Two WIC slots are provided on the rear of the 1721, and four WIC/VIC slots are provided on the front of the 1760. On-board LAN connectors and Console/Auxiliary connectors are provided on the rear of the 1721 and the front of the 1760, and the power cable connection and a power switch are provided on the rear of both models. The top portion of the chassis may be removed to allow access to the motherboard, memory, and expansion slots.

Any WIC or VIC slot, which is not populated with a WIC or a VIC, must be populated with an appropriate slot cover in order to operate in a FIPS compliant mode. The slot covers are included with each router, and additional covers may be ordered from Cisco. The same procedure mentioned below to apply tamper evidence labels for WICs and VICs must also be followed to apply tamper evidence labels for the slot covers.

Once the router has been configured in to meet FIPS 140-2 Level 2 requirements, the router cannot be accessed without signs of tampering. To seal the system, apply serialized tamper-evidence labels as follows:

Applying Serialized Tamper-Evidence Labels to the Cisco 1721

To apply serialized tamper-evidence labels to the Cisco 1721:

Step 1 Clean the cover of any grease, dirt, or oil before applying the tamper evidence labels. Alcohol-based cleaning pads are recommended for this purpose. The temperature of the router should be above 10 C.

Step 2 Place the first label on the router as shown in Figure 6. The tamper evidence label should be placed so that the one half of the tamper evidence label covers the top-half of the right side of the enclosure and the other half covers the bottom-half of the right side of the router. Any attempt to remove the enclosure will leave tamper evidence.

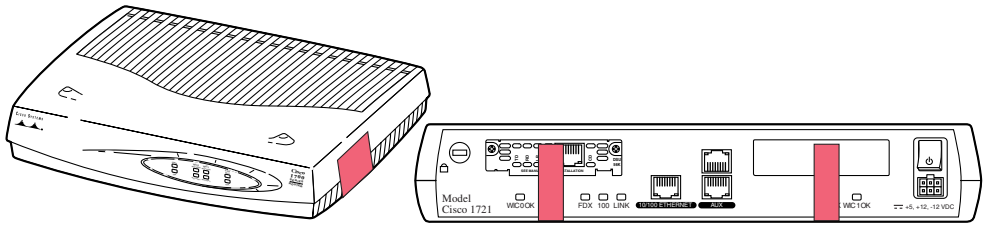
Step 3 Place the second label on the router as shown in Figure 6. The tamper evidence label should be placed so that the one half of the tamper evidence label covers the top-half of the left side of the enclosure and the other half covers the bottom-half of the left side of the router. Any attempt to remove the enclosure will leave tamper evidence.

Step 4 Place the third label on the router as shown in Figure 6. The tamper evidence label should be placed so that the half of the label covers the enclosure and the other half covers the left WAN interface card slot. Any attempt to remove a WAN interface card will leave tamper evidence.

Step 5 Place the fourth label on the router as shown in Figure 6. The tamper evidence label should be placed so that one half of the label covers the enclosure and the other half covers the right WAN interface card slot. Any attempt to remove a WAN interface card will leave tamper evidence.

Step 6 The labels completely cure within five minutes.

Figure 6 Cisco 1721 Tamper Evidence Label Placement



Applying Serialized Tamper-Evidence Labels to the Cisco 1760

To apply serialized tamper-evidence labels to the Cisco 1760:

Step 1 Clean the cover of any grease, dirt, or oil before applying the tamper evidence labels. Alcohol-based cleaning pads are recommended for this purpose. The temperature of the router should be above 10 C.

Step 2 Place the first label on the router as shown in Figure 7. The tamper evidence label should be placed so that the one half of the tamper evidence label covers the right side of the enclosure and the other half covers the right side of the front of the router. Any attempt to remove the enclosure will leave tamper evidence.

Step 3 Place the second label on the router as shown in Figure 7. The tamper evidence label should be placed so that the one half of the tamper evidence label covers the left side of the enclosure and the other half covers the left side of the front of the router. Any attempt to remove the enclosure will leave tamper evidence.

Step 4 Place the third label on the router as shown in Figure 7. The tamper evidence label should be placed so that the half of the label covers the bottom of the enclosure and the other half covers the first WAN interface card slot. Any attempt to remove a WAN interface card will leave tamper evidence.

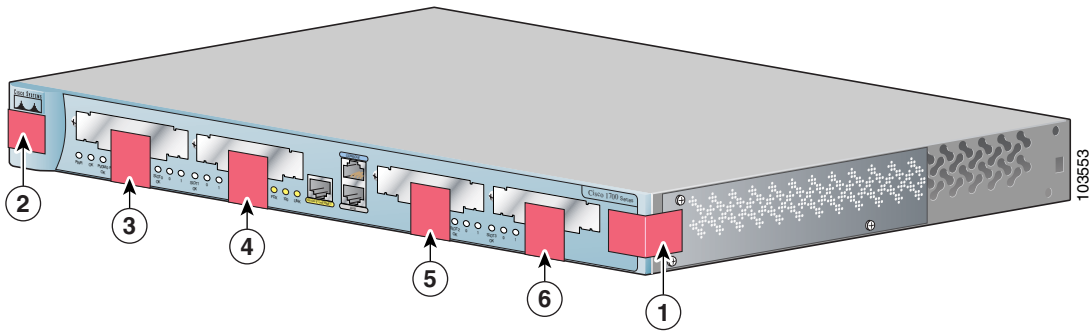
Step 5 Place the fourth label on the router as shown in Figure 7. The tamper evidence label should be placed so that the half of the label covers the bottom of the enclosure and the other half covers the second WAN interface card slot. Any attempt to remove a WAN interface card will leave tamper evidence.

Step 6 Place the fifth label on the router as shown in Figure 7. The tamper evidence label should be placed so that the half of the label covers the bottom of the enclosure and the other half covers the third WAN interface card slot. Any attempt to remove a WAN interface card will leave tamper evidence.

Step 7 Place the sixth label on the router as shown in Figure 7. The tamper evidence label should be placed so that the half of the label covers the bottom of the enclosure and the other half covers the fourth WAN interface card slot. Any attempt to remove a WAN interface card will leave tamper evidence.

Step 8 The labels completely cure within five minutes.

Figure 7 Cisco 1760 Tamper Evidence Label Placement



The tamper evidence seals are produced from a special thin gauge vinyl with self-adhesive backing. Any attempt to open the router, remove WIC cards, or remove the front faceplate will damage the tamper evidence seals or the painted surface and metal of the module cover. Since the tamper evidence seals have non-repeated serial numbers, they may be inspected for damage and compared against the applied serial numbers to verify that the module has not been tampered. Tamper evidence seals can also be inspected for signs of tampering, which include the following: curled corners, bubbling, crinkling, rips, tears, and slices. The word "OPEN" may appear if the label was peeled back.

Cryptographic Key Management

The router securely administers both cryptographic keys and other critical security parameters such as passwords. The tamper evidence seals provide physical protection for all keys. All keys are also protected by the password-protection on the Crypto Officer role login, and can be zeroized by the Crypto Officer. Keys are exchanged manually and entered electronically via manual key exchange or Internet Key Exchange (IKE).

The modules contain a cryptographic accelerator card (the MOD1700-VPN), which provides DES (56-bit) (only for legacy systems), and 3DES (168-bit) IPSec encryption, MD5 and SHA-1 hashing, and has hardware support for DH and RSA key generation.

The module supports the following critical security parameters (CSPs):

Table 5 Critical Security Parameters

#	CSP Name	Description	Storage
1	CSP 1	This is the seed key for X9.31 PRNG. This key is stored in DRAM and updated periodically after the generation of 400 bites; hence, it is zeroized periodically. Also, the operator can turn off the router to zeroize this key.	DRAM (plaintext)
2	CSP 2	The private exponent used in Diffie-Hellman (DH) exchange. Zeroized after DH shared secret has been generated.	DRAM (plaintext)
3	CSP 3	The shared secret within IKE exchange. Zeroized when IKE session is terminated.	DRAM (plaintext)
4	CSP 4	Same as above	DRAM (plaintext)
5	CSP 5	Same as above	DRAM (plaintext)
6	CSP 6	Same as above	DRAM (plaintext)
7	CSP 7	The IKE session encrypt key. The zeroization is the same as above.	DRAM (plaintext)
8	CSP 8	The IKE session authentication key. The zeroization is the same as above.	DRAM (plaintext)
9	CSP 9	The RSA private key. “crypto key zeroize” command zeroizes this key.	NVRAM (plaintext)
10	CSP 10	The key used to generate IKE skeyid during preshared-key authentication. “no crypto isakmp key” command zeroizes it. This key can have two forms based on whether the key is related to the hostname or the IP address.	NVRAM (plaintext)
11	CSP 11	This key generates keys 3, 4, 5 and 6. This key is zeroized after generating those keys.	DRAM (plaintext)
12	CSP 12	The RSA public key used to validate signatures within IKE. These keys are expired either when CRL (certificate revocation list) expires or 5 secs after if no CRL exists. After above expiration happens and before a new public key structure is created this key is deleted. This key does not need to be zeroized because it is a public key; however, it is zeroized as mentioned here.	DRAM (plaintext)
13	CSP 13	The fixed key used in Cisco vendor ID generation. This key is embedded in the module binary image and can be deleted by erasing the Flash.	NVRAM (plaintext)
14	CSP 14	The IPSec encryption key. Zeroized when IPSec session is terminated.	DRAM (plaintext)

Table 5 Critical Security Parameters (Continued)

15	CSP 15	The IPSec authentication key. The zeroization is the same as above.	DRAM (plaintext)
16	CSP 16	The RSA public key of the CA. “no crypto ca trust <label>” command invalidates the key and it frees the public key label which in essence prevent use of the key. This key does not need to be zeroized because it is a public key.	NVRAM (plaintext)
17	CSP 17	This key is a public key of the DNS server. Zeroized using the same mechanism as above. “no crypto ca trust <label>” command invalidate the DNS server’s public key and it frees the public key label which in essence prevent use of that key. This label is different from the label in the above key. This key does not need to be zeroized because it is a public key.	NVRAM (plaintext)
18	CSP 18	The SSL session key. Zeroized when the SSL connection is terminated.	DRAM (plaintext)
19	CSP 19	The ARAP key that is hardcoded in the module binary image. This key can be deleted by erasing the Flash.	Flash (plaintext)
20	CSP 20	This is an ARAP user password used as an authentication key. A function uses this key in a DES algorithm for authentication.	DRAM (plaintext)
21	CSP 21	The key used to encrypt values of the configuration file. This key is zeroized when the “no key config-key” is issued.	NVRAM (plaintext)
22	CSP 22	This key is used by the router to authenticate itself to the peer. The router itself gets the password (that is used as this key) from the AAA server and sends it onto the peer. The password retrieved from the AAA server is zeroized upon completion of the authentication attempt.	DRAM (plaintext)
23	CSP 23	The RSA public key used in SSH. Zeroized after the termination of the SSH session. This key does not need to be zeroized because it is a public key; However, it is zeroized as mentioned here.	DRAM (plaintext)
24	CSP 24	The authentication key used in PPP. This key is in the DRAM and not zeroized at runtime. One can turn off the router to zeroize this key because it is stored in DRAM.	DRAM (plaintext)
25	CSP 25	This key is used by the router to authenticate itself to the peer. The key is identical to #22 except that it is retrieved from the local database (on the router itself). Issuing the “no username password” zeroizes the password (that is used as this key) from the local database.	NVRAM (plaintext)
26	CSP 26	This is the SSH session key. It is zeroized when the SSH session is terminated.	DRAM (plaintext)
27	CSP 27	The password of the User role. This password is zeroized by overwriting it with a new password.	NVRAM (plaintext)
28	CSP 28	The plaintext password of the CO role. This password is zeroized by overwriting it with a new password.	NVRAM (plaintext)

Table 5 Critical Security Parameters (Continued)

29	CSP 29	The ciphertext password of the CO role. However, the algorithm used to encrypt this password is not FIPS approved. Therefore, this password is considered plaintext for FIPS purposes. This password is zeroized by overwriting it with a new password.	NVRAM (plaintext)
30	CSP 30	The RADIUS shared secret. This shared secret is zeroized by executing the "no" form of the RADIUS shared secret set command.	NVRAM (plaintext), DRAM (plaintext)
31	CSP 31	The TACACS+ shared secret. This shared secret is zeroized by executing the "no" form of the TACACS+ shared secret set command.	NVRAM (plaintext), DRAM (plaintext)

The services accessing the CSPs, the type of access and which role accesses the CSPs are listed in Table 6.

Table 6 Role and Service Access to CSPs

SRDI/Role/Service Access Policy	Role/Service	User Role	Status Functions	Network Functions	Terminal Functions	Directory Services	Crypto-Officer Role	Configure the Router	Define Rules and Filters	Status Functions	Manage the Router	Set Encryptions/Bypass	Change WAN Interface Cards
Security Relevant Data Item													
CSP 1				r							d	r w d	
CSP 2				r								r w d	
CSP 3				r								r w d	
CSP 4				r								r w d	
CSP 5				r								r w d	
CSP 6				r								r w d	

Table 6 Role and Service Access to CSPs (Continued)

SRDI/Role/Service Access Policy	Role/Service	User Role	Status Functions	Network Functions	Terminal Functions	Directory Services	Crypto-Officer Role	Configure the Router	Define Rules and Filters	Status Functions	Manage the Router	Set Encryptions/Bypass	Change WAN Interface Cards
CSP 7				r								r w d	
CSP 8				r								r w d	
CSP 9				r								r w d	
CSP 10				r								r w d	
CSP 11				r								r w d	
CSP 12				r								r w d	
CSP 13				r				r w d					
CSP 14				r								r w d	
CSP 15				r								r w d	
CSP 16				r								r w	
CSP 17				r								r w d	
CSP 18				r								r w d	

Table 6 Role and Service Access to CSPs (Continued)

SRDI/Role/Service Access Policy	Role/Service	User Role	Status Functions	Network Functions	Terminal Functions	Directory Services	Crypto-Officer Role	Configure the Router	Define Rules and Filters	Status Functions	Manage the Router	Set Encryptions/Bypass	Change WAN Interface Cards
CSP 19				r				r w d					
CSP 20				r							r w d		
CSP 21								r w d			r w d		
CSP 22				r							r w d		
CSP 23				r								r w d	
CSP 24				r							d	r w	
CSP 25				r				r w d					
CSP 26				r								r w d	
CSP 27				r							r w d		
CSP 28											r w d		
CSP 29											r w d		

Table 6 Role and Service Access to CSPs (Continued)

SRDI/Role/Service Access Policy	Role/Service	User Role	Status Functions	Network Functions	Terminal Functions	Directory Services	Crypto-Officer Role	Configure the Router	Define Rules and Filters	Status Functions	Manage the Router	Set Encryptions/Bypass	Change WAN Interface Cards
CSP 30											r w d		
CSP 31											r w d		

The module supports DES (only for legacy systems), 3DES, DES-MAC, TDES-MAC, AES, SHA-1, HMAC-SHA-1, MD5, MD4, HMAC MD5, Diffie-Hellman, RSA (for digital signatures and encryption/decryption (for IKE authentication)), cryptographic algorithms. The MD5, HMAC MD5, and MD4 algorithms are disabled when operating in FIPS mode.

The module supports three types of key management schemes:

- Manual key exchange method that is symmetric. DES/3DES/AES key and HMAC-SHA-1 key are exchanged manually and entered electronically.
- Internet Key Exchange method with support for exchanging pre-shared keys manually and entering electronically.
  - The pre-shared keys are used with Diffie-Hellman key agreement technique to derive DES, 3DES or AES keys.
  - The pre-shared key is also used to derive HMAC-SHA-1 key.
- Internet Key Exchange with RSA-signature authentication.

All pre-shared keys are associated with the CO role that created the keys, and the CO role is protected by a password. Therefore, the CO password is associated with all the pre-shared keys. The Crypto Officer needs to be authenticated to store keys. All Diffie-Hellman (DH) keys agreed upon for individual tunnels are directly associated with that specific tunnel only via the IKE protocol.

Key Zeroization

All of the keys and CSPs of the module can be zeroized. Please refer to the Description column of Table 5 for information on methods to zeroize each key and CSP.

Self-Tests

In order to prevent any secure data from being released, it is important to test the cryptographic components of a security module to insure all components are functioning correctly. The router includes an array of self-tests that are run during startup and periodically during operations. If any of the self-tests fail, the router transitions into an error state. Within the error state, all secure data transmission is halted and the router outputs status information indicating the failure.

Self-tests performed by the IOS image:

- Power-up tests:
  - Firmware integrity test
  - RSA signature KAT (both signature and verification)
  - DES KAT
  - TDES KAT
  - AES KAT
  - SHA-1 KAT
  - PRNG KAT
  - Power-up bypass test
  - Diffie-Hellman self-test
  - HMAC-SHA-1 KAT
- Conditional tests:
  - Conditional bypass test
  - Pairwise consistency test on RSA signature
  - Continuous random number generator tests

Self-tests performed by the MOD1700-VPN (cryptographic accelerator):

- Power-up tests:
  - Firmware integrity test
  - DES KAT
  - TDES KAT
  - HMAC-SHA-1 KAT
- Conditional tests:
  - Continuous random number generator test

Secure Operation of the Cisco 1721/1760 Router

The Cisco 1721 and 1760 Modular Access Routers with MOD1700-VPN meet all the Level 2 requirements for FIPS 140-2. Follow the setting instructions provided below to place the module in FIPS mode. Operating this router without maintaining the following settings will remove the module from the FIPS approved mode of operation.

Initial Setup

- The Crypto Officer must ensure that the MOD1700-VPN cryptographic accelerator card is installed in the module by opening the chassis and visually confirming the presence of the MOD1700-VPN. Please refer to the Cisco publication Installing the Virtual Private Network Module in a Cisco 1700 Series Router for detailed instructions on chassis disassembly and reassembly, and MOD1700-VPN identification. This document may be accessed on the web at:

  http://www.cisco.com/univercd/cc/td/doc/product/access/acs_mod/1700/1700cnts/interclr.pdf

- The Crypto Officer must apply tamper evidence labels as described in the "Physical Security" section of this document.
- Only a Crypto Officer may add and remove WAN Interface Cards. When removing the tamper evidence label, the Crypto Officer should remove the entire label from the router and clean the cover of any grease, dirt, or oil with an alcohol-based cleaning pad. The Crypto Officer must re-apply tamper evidence labels on the router as described in the "Physical Security" section of this document.
- The Crypto Officer must apply the opacity shield as described in the "The Cisco 1721/1760 Cryptographic Module" section of this document.
- The Crypto Officer must disable IOS Password Recovery by executing the following commands:

```
configure terminal
no service password-recovery
end
show version
```

Note Once Password Recovery is disabled, administrative access to the module without the password will not be possible.

System Initialization and Configuration

- The Crypto Officer must perform the initial configuration. IOS version 12.3(3d) is the only allowable image; no other image may be loaded.
- The value of the boot field must be 0x0101 (the factory default). This setting disables break from the console to the ROM monitor and automatically boots the IOS image. From the "configure terminal" command line, the Crypto Officer enters the following syntax:

```
config-register 0x0101
```

- The Crypto Officer must create the "enable" password for the Crypto Officer role. The password must be at least 8 characters and is entered when the Crypto Officer first engages the "enable" command. The Crypto Officer enters the following syntax at the "#" prompt:

  ```
  enable secret [PASSWORD]
  ```

- The Crypto Officer must always assign passwords (of at least 8 characters) to users. Identification and authentication on the console port is required for Users. From the "configure terminal" command line, the Crypto Officer enters the following syntax:

  ```
  line con 0
  password [PASSWORD]
  login local
  ```

- The Crypto Officer shall only assign users to a privilege level 1 (the default).
- The Crypto Officer shall not assign a command to any privilege level other than its default.
- The Crypto Officer may configure the module to use RADIUS or TACACS+ for authentication. Configuring the module to use RADIUS or TACACS+ for authentication is optional. If the module is configured to use RADIUS or TACACS+, the Crypto-Officer must define RADIUS or TACACS+ shared secret keys that are at least 8 characters long.
- If the Crypto Officer loads any IOS image onto the router, this will put the router into a non-FIPS mode of operation.

IPSec Requirements and Cryptographic Algorithms

- There are two types of key management method that are allowed in FIPS mode: Internet Key Exchange (IKE) and IPSec manually entered keys.
- Although the IOS implementation of IKE allows a number of algorithms, only the following algorithms are allowed in a FIPS 140-2 configuration:
  - ah-sha-hmac
  - esp-des
  - esp-sha-hmac
  - esp-3des
  - esp-aes
- The following algorithms are not FIPS approved and should be disabled:
  - MD-4 and MD-5 for signing
  - MD-5 HMAC

Protocols

All SNMP operations must be performed within a secure IPSec tunnel.

Remote Access

- Telnet access to the module is only allowed via a secure IPSec tunnel between the remote system and the module. The Crypto officer must configure the module so that any remote connections via telnet are secured through IPSec.
- SSH access to the module is only allowed if SSH is configured to use a FIPS-approved algorithm. The Crypto officer must configure the module so that SSH uses only FIPS-approved algorithms.

Related Documentation

For more information about the Cisco 1721 and Cisco 1760 modular access routers, refer to the following documents:

- *Cisco 1721 Access Router Hardware Installation Guide*
- *Cisco 1760 Modular Access Router Hardware Installation Guide*
- *Cisco 1700 Series Router Software Configuration Guide*

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

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

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

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

Ordering Documentation

You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpck/pdi.htm

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Ordering tool:

  http://www.cisco.com/en/US/partner/ordering/index.shtml

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

Documentation Feedback

You can send comments about technical documentation to bug-doc@cisco.com.

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170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

For all customers, partners, resellers, and distributors who hold valid Cisco service contracts, Cisco Technical Support provides 24-hour-a-day, award-winning technical assistance. The Cisco Technical Support Website on Cisco.com features extensive online support resources. In addition, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not hold a valid Cisco service contract, contact your reseller.

Cisco Technical Support Website

The Cisco Technical 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, 365 days a year at this URL:

http://www.cisco.com/techsupport

Access to all tools on the Cisco Technical 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

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 automatically

provides recommended solutions. If your issue is not resolved using the recommended resources, your service request will be assigned to a Cisco TAC 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 TAC 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)—Your 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 operation 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 your network is impaired, but 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.

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

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

- The Cisco *Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the Cisco Product Catalog at this URL:

  http://cisco.com/univercd/cc/td/doc/pcat/

- *Cisco Press* publishes a wide range of general networking, training and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

  http://www.ciscopress.com

- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

  http://www.cisco.com/packet

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

  http://www.cisco.com/go/iqmagazine

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems 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

- 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

This document is to be used in conjunction with the documents listed in the "Related Documentation" section.