



Release Notes for Cisco ONS 15454 SDH Release 4.5

July, 2003

Release notes address closed (maintenance) issues, caveats, and new features for the Cisco ONS 15454 SDH multiplexer. For detailed information regarding features, capabilities, hardware, and software introduced with this release, refer to the “Release 4.1 and 4.5” version of the of the *Cisco ONS 15454 SDH Installation and Operations Guide*, and *Cisco ONS 15454 SDH Troubleshooting and Reference Guide*. For the most current version of the Release Notes for Cisco ONS 15454 SDH Release 4.5, visit the following URL:

<http://www.cisco.com/univercd/cc/td/doc/product/ong/15454sdh/sdhrelnt/index.htm>

Cisco also provides Bug Toolkit, a web resource for tracking defects. To access Bug Toolkit, visit the following URL:

http://www.cisco.com/cgi-bin/Support/Bugtool/launch_bugtool.pl

Contents

- [Changes to the Release Notes, page 2](#)
- [Caveats, page 2](#)
- [Resolved Caveats for Release 4.5, page 10](#)
- [New Features and Functionality, page 10](#)
- [Related Documentation, page 22](#)
- [Obtaining Documentation, page 22](#)
- [Obtaining Technical Assistance, page 24](#)



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

Copyright © 2003. Cisco Systems, Inc. All rights reserved.

Changes to the Release Notes

This section documents supplemental changes that have been added to the *Release Notes for Cisco ONS 15454 SDH Release 4.5* since the production of the Cisco ONS 15454 SDH System Software CD for Release 4.5.

The following changes have been added to the release notes for Release 4.5

A [Note](#) on page 6 has been added to the release notes for Release 4.5.

Changes to Caveats

The following caveat has been added.

[JRE Updates, page 7](#)

[DDTS # CSCsh41324, page 2](#)

Caveats

Review the notes listed below before deploying the ONS 15454 SDH. Caveats with DDTS tracking numbers are known system limitations that are scheduled to be addressed in a subsequent release. Caveats without DDTS tracking numbers are provided to point out procedural or situational considerations when deploying the product.

TL1

DDTS # CSCsh41324

When running release 4.1.4, if a circuit is created within CTC and if that circuit is retrieved via TL1, all looks as expected. However, after the software is upgraded to release 6 and latter, the circuit retrieve does not show the same value as was before. For example FAC-4-1 changes to FAC-4-0. Workaround is to delete and recreate the circuit within CTC.

Hardware

DDTS # CSCea78210

The TXP_MR_2.5G and TXPP_MR_2.5G cards do not support TX Optical power performance monitoring on the trunk port. To see this, go to the Optics Performance Monitoring tab of the TXP_MR_2.5G or TXPP_MR_2.5G card, and select the trunk port. TX Optical Pwr is not shown.

2.5G Multi-Rate Transponder Cards

DDTS # CSCeb25490

Occasionally CTC displays a LO-TXPOWER alarm when SMT4 and STM1 SFP is installed at the client port of a TXP or TXPP card. The LO-TXPOWER alarm is displayed when the alarm threshold is set to the default value in the TX POWER LOW field of the Optical Threshold in the CTC provisioning window. To work around this issue, lower the alarm threshold value (TX POWER LOW (dBm)) of Optical Threshold in the CTC provisioning window. Refer to Table XX for threshold values. This issue will be resolved in Release 4.6.

Table 1 contains the High and Low Alarm Thresholds of Tx-power and Rx-power of SFPs in TXP and TXPP cards. The values of these thresholds are read from the EEPROM inside the SFPs. This table can be used as a reference in PM alarm provisioning and Threshold Alarm verification.

Table 1 Alarm Thresholds

Part#	Rate	TxHi ¹	TxLow	RxHi	RxLow
10-1421-02	OC48-SR	2.0	-14.6	0	-21.0
10-1422-01	OC48-IR	4.0	-9.6	3.0	-23.2
10-1829-01	OC12-IR	-6.9	-13.1	-6.0	-31.0
10-1828-01	OC3-IR	-6.9	-13.9	-6.0	-31.0
10-1832-01	2FC/2GB-LX	0.9	-13.2	1.0	-24.0
10-1590-01	2FC	1.0	-14.6	N/A ²	N/A
10-1750-01	ESCON	N/A	N/A	N/A	N/A

1. The power unit for TxHi/TxLow/RxHi/RxLow used is dBm.

2. N/A means Not Available. The vendor did not provide the information in this field.

DDTS # CSCuk42668

TXP-MR-2.5G F1-UDC may not be passed through in a line-terminated configuration with OTN off. This can occur with clean, OC-3/STM-1, line-terminated traffic, with OTN disabled, when you create a D1-D3 tunnel, a D4-D12 tunnel, and an F1-UDC from client to client. This issue will not be resolved.

DDTS # CSCeb49210

A soft reset of the working or protect 2.5g multirate card in a Y-cable protection group clears an existing "Lockout of protection" request. It is not known when or if this issue will be resolved.

DDTS # CSCuk42752

If you go to the Overhead Circuits Tab in network view and select any User Data, F1 or User Data D4-D12 circuit type, no nXP cards are available for selection in the Endpoints. However, user Data type circuits can still be made end-to-end (where "end-to-end" refers to external cards, such as AIC to AIC) if the nXP cards are put in Transparent mode. It is not known when or if this issue will be resolved.

DDTS # CSCeb49422

With TXPP cards, a traffic loss up to six seconds can occur during a DWDM protection switch. This behavior may be exhibited during protection switches by certain third-party fiber channel switches due to loss of buffer credits resulting in a reconvergence of the fiber channel link. This issue is under investigation.

DDTS # CSCeb53044

The 2G Fiber Channel (FC) payload data type in the TXP_MR_2.5G and TXPP_MR_2.5G cards does not support any 8B/10B Payload PM monitoring.

DDTS # CSCeb39991

SCHED-PMREPT-CLNT does not generate the automatic report for TXPP cards. If you schedule PM reports on a Client or Trunk port of a TXPP, REPT^PM^EVT is never generated. However, the RTRV-PMSCHED-ALL count shows that the count is decreasing. This issue will be resolved in Release 4.6.

DDTS # CSCeb32065

Once engaged, the ALR will not restart on the trunk lines of a TXP or TXPP card. This occurs whenever ALR engages on the trunk lines of a TXP or TXPP card and the recover pulse width is provisioned to less than 40 seconds. This is a function of the trunk laser turn-on time, and the limiting recovery pulse width will vary by card. To avoid this issue, provision the pulse width to 40 seconds or more.

DDTS # CSCeb49144

The Lamp Test feature does not display all the LED colors available on the 2.5G Transponder. This issue will be resolved in Release 4.6.

DDTS # CSCeb37346

Near end and far end PMs might increment simultaneously on TXPP-2.5G cards. This can occur when two nodes have TXPP-2.5G cards and two nodes have STM16 cards in a four node network, where both TXPP-2.5G cards have STM16 SFPs on them, and are in MS (Line Termination) mode. By default, the TXPP-2.5G cards are in Splitter protection: the first DWDM port is working and the second is protect. If you remove the receive fiber of the first DWDM port on one TXPP-2.5G card, both near and far end counts begin to increment. The far end counts should not increment in this case. This issue is seen only when the Txpd cards have G709 and FEC on. If the cards have G709 and FEC off, only the near end counts will increment, as expected.

DDTS # CSCeb26662 and CSCea88023

With TXP-MR-2.5G cards, when the current 1 day Optics PM rolls over, the information is inaccurate. This issue is under investigation for resolution in a future release.

DDTS # CSCuk42588

With ALS mode configured as “Auto Restart” or “Manual Restart,” it is possible the ALS Pulse Duration Recovery time can be set to values out of ITU-T recommendation G.664. You can use values out of the range defined in ITU-T recommendation G.664 only in order to interoperate with equipment that lasers cannot turn on or off within the required pulse time. To stay within the specification, you can set this value to 2 seconds and up to 2.25 seconds.

DDTS # CSCea81219

On the TXPP, the default value for Tx Power High for TCAs & Alarms is too high for the trunk ports. Since Tx Power TCA and Alarm are not supported for trunk ports, this caveat is for informational purposes only.

DDTS # CSCeb24815

With TXP-MR-2.5G cards, ratios are calculated incorrectly after clearing statistics. This is because after you clear statistics the entire time period becomes invalid. Once the time period rolls over again, values will be reliable for the new period.

DDTS # CSCeb27187

During a Y-Cable protection switch, the client interface sends 200,000 to 300,000 8B/10B errors towards the attached Catalyst 3550 switch. The switch reacts to this large amount of 8B/10B errors by reinitializing the interface and spanning tree. The end result is that a protection switch can lead to a 30-45 second traffic hit if the switch is running spanning tree (default mode). This is expected behavior.

DDTS # CSCea87290

In a Y-Cable protection group, if GCCs are defined on both cards, both cards' active LEDs will be green.

DDTS # CSCeb12609

For the TXPP, attenuating Port 2 Rx signal, SD, and SF alarms are not declared before LOC is raised. This is due to the intrinsic design of the optical interface, which allows required BER performances with dispersion and OSNR penalties.

This can occur when Port 2 is in back to back or has low dispersions and high OSNR.

DDTS # CSCea68773

The ACTV/STBY LED shows AMBER when a 2.5G transponder is first connected. The DWDM cards introduced a new design: When all the ports are OOS on a card, the card is considered to be in standby mode.

Line Cards

Ethernet Polarity Detection

The TCC2 does not support Ethernet polarity detection. The TCC+ and TCCI both support this feature. If your Ethernet connection has the incorrect polarity (this can only occur with cables that have the receive wire pairs flipped), the TCC+/I will work, but the TCC2 will not. In this event, a standing condition, “LAN Connection Polarity Reverse Detected” (COND-LAN-POL-REV), will be raised (a notification will appear on the LCD, and there will be an alarm raised). This issue will most likely be seen during an upgrade or initial node deployment. To correct the situation, ensure that your Ethernet cable has the correct mapping of the wire wrap pins. For Ethernet pin mappings, consult the “DLP-A 21 Install LAN Wires on the Backplane” procedure in the user documentation.

Active TCC2 Card Removal

Active TCC2 cards should not be removed. If the active TCC2 card must be removed, to minimize network interruption you can first perform a lockout on all circuits that originate from the node whose active TCC2 will be removed (performing a lockout on all spans will also accomplish the same goal). No lockout is necessary for switches initiated through CTC.



Caution

If you mistakenly remove an active TCC2 card and you subsequently lose traffic on some interface cards, you may need to physically reset these cards if they fail to regain traffic.

DDTS # CSCdy65482

On the AIC-i card, a volume adjustment on the receive value of a four-wire orderwire circuit will be displayed as the negative of its actual value. To work around this issue, enter the negative of the value you actually want for the receive value. For example, adjust the receive value on CTC to -2 dbm for a gain of 2 dbm. This issue will be resolved in a future release.

Maintenance and Administration



Caution

VxWorks is intended for qualified Cisco personnel only. Customer use of VxWorks is not recommended, nor is it supported by Cisco's Technical Assistance Center. Inappropriate use of VxWorks commands can have a negative and service affecting impact on your network. Please consult the troubleshooting guide for your release and platform for appropriate troubleshooting procedures. To exit without logging in, enter a Control-D (hold down the Control and D keys at the same time) at the Username prompt. To exit after logging in, type “logout” at the VxWorks shell prompt.



Note

Release 4.5 supports DWDM applications only. You may not upgrade from an earlier release to Release 4.5.

JRE Updates

Cisco ONS platforms ship with a Java Runtime Environment (JRE) from Sun Microsystems. Occasionally Sun releases maintenance releases to the JRE. The Sun Microsystems website lists JRE maintenance releases and the issues resolved for each. Cisco recommends that you review these listings to determine if the issues resolved in any given JRE maintenance release warrant a JRE upgrade for your particular network. Cisco tests only with the specific JRE actually shipped with the ONS software CD.

DDTS # CSCuk44594

In the Network View, a Terminal site for which only the boards but not the connections between them are provisioned is displayed as “unknown site.” In the provisioning panel the type shown is Terminal, but it is not possible to insert Power values. To correct this, create the connections between the boards. This issue will be resolved in a future release.

DDTS # CSCeb40891

At the end of a software reset sequence, both the OPT-PRE and OPT-BST cards override the OSRI command. The resulting effect is that if an amplifier is switched off by OSRI command and then is affected by a software reset command, it switches on the power output at the power set value. Avoid inspecting the amplifier optical connectors via a microscope tool when the unit is powered on or there is an optical signal connected to its input port (COM RX port). This issue will be resolved in a future release.

DDTS # CSCeb49189

In SDH circuit creation, occasionally the circuit type combo box contains the SONET circuit types, in addition to all SDH circuit types. This can occur when the environment contains different NE nodes, and the login node is one of the old NE in the network. If this occurs, ignore the SONET circuit types and select from the available SDH circuit types. This issue can occur in Release 4.5 only if CTC is used from a Release 4.5 node, containing DWDM only cards, connected to Release 4.0 nodes containing the other cards, and will be resolved in Release 4.6.

DDTS # CSCdz84149

If a user is logged into CTC as a superuser (or other higher level security type), and then another superuser changes the first user's security level to “retrieve” (or another lower level security type) without first logging the user out, the lower level user is then still able to perform some actions authorized only for the original login security level. For example, a “provisioning” level user demoted to “retrieve” level in this manner can still provision and edit MS-SPRings (BLSRs) while logged into the current session, though the same user may no longer provision DCCs. To ensure that a user's level is changed completely, the superuser must log the user out prior to changing the security level. This issue is under investigation.

DDTS # CSCdz90753

In the Maintenance > Cross Connect Resource Pane, the VT matrix port detail is inconsistent with the general VT matrix data. This can occur when a 1+1 protection scheme is in place. To avoid confusion, note that the VT matrix data counts the VTs for both the working and protect card, while the detail data counts the VTs only for the working card. This issue is under investigation.

DDTS # CSCdy10030

CVs are not positively adjusted after exiting a UAS state. When a transition has been made from counting UAS, at least 10 seconds of non-SES must be counted to exit UAS. There are no plans to resolve this issue at this time.

DDTS # CSCdx35561

CTC is unable to communicate with an ONS 15454 SDH that is connected via an Ethernet craft port. CTC does, however, communicate over an RS-DCC link with an ONS 15454 SDH that is Ethernet connected, yielding a slow connection. This situation occurs when multiple nodes are on a single Ethernet segment and the nodes have different values for any of the following features:

- Enable OSPF on the LAN
- Enable Firewall
- Craft Access Only

When any of these features are enabled, the proxy ARP service on the node is also disabled. The ONS 15454 SDH proxy ARP service assumes that all nodes are participating in the service.

This situation can also occur immediately after the aforementioned features are enabled. Other hosts on the Ethernet segment (for example, the subnet router) may retain incorrect ARP settings for the ONS 15454 SDHs.

To avoid this issue, all nodes on the same Ethernet segment must have the same values for Enable OSPF on the LAN, Enable Firewall, and Craft Access Only. If any of these values have changed recently, it may be necessary to allow connected hosts (such as the subnet router) to expire their ARP entries.

You can avoid waiting for the ARP entries to expire on their own by removing the RS-DCC links from the affected ONS 15454 SDH nodes. This will disconnect them for the purposes of the proxy ARP service and the nodes should become directly accessible over the Ethernet. Network settings on the nodes can then be provisioned as desired, after which the RS-DCC can be restored.

This issue will not be resolved.

DDTS # CSCdy11012

When the topology host is connected to multiple OSPF areas, but CTC is launched on a node that is connected to fewer areas, the topology host appears in CTC, and all nodes appear in the network view, but some nodes remain disconnected. This can occur when the CTC host does not have routing information to connect to the disconnected nodes. (This can happen, for example, if automatic host detection was used to connect the CTC workstation to the initial node.)

CTC will be able to contact the topology host to learn about all the nodes in all the OSPF areas, but will be unable to contact any nodes that are not in the OSPF areas used by the launch node. Therefore, some nodes will remain disconnected in the CTC network view.

To work around this issue, if no firewall enabled, then the network configuration of the CTC host can be changed to allow CTC to see all nodes in the network. The launch node must be on its own subnet to prevent network partitioning, and craft access must not be enabled. The CTC host must be provisioned with an address on the same subnet as the initial node (but this address must not conflict with any other node in the network), and with the default gateway of the initial node. CTC will now be able to contact all nodes in the network.

If a firewall is enabled on any node in the network, then CTC will be unable to contact nodes outside of the initial OSPF areas. This issue will not be resolved.

DDTS # CSCdw38283

If a node has one good BITS reference and is running in a normal state, and you configure a second BITS reference, then reconfigure the second reference within 30 seconds of applying the first configuration, the node will enter FAST START SYNC mode. To avoid this problem, wait a minute before configuring the second reference a second time. This issue is a hardware limitation, and there are no current plans to resolve it.

DDTS # CSCdw23208

The following table summarizes B1, B2, and B3 error count reporting for SDH optical cards. Note that not all reporting is done according to ITU specifications. In particular, ITU specifies error counts for B1 and B3 as the number of blocks with errors (refer to ITU-T G.826 for paths and ITU-T G.829 for RS and MS).

Table 0-2 Error Count Reporting

	B1	B2	B3
ITU Specification	block	bit	block
STM1	block	bit	block
STM4	bit	bit	bit
STM16 trunk	bit	bit	bit
STM16 AS	block	bit	bit
STM64	block	bit	bit
STM1-8	bit	bit	bit
STM4-4	bit	bit	bit

DDTS # CSCdw82689

After creating 509 VLANs and provisioning many Ethernet circuits, Ethernet circuit provisioning can become very slow, or possibly fail. Ethernet traffic may also incur an outage of a few minutes. To avoid this problem, delete any VLANs that are created but not used, and do not recreate them. There is no resolution planned for this issue.

DDTS # CSCdv10824: Netscape Plugins Directory

If you use CTC, JRE, and the Netscape browser with a Microsoft Windows platform, you must ensure that any new installation of Netscape uses the same Netscape directory as the previous installation did, if such an installation existed. If you install Netscape using a different path for the plugins directory, you will need to reinstall JRE so that it can detect the new directory.

“Are you sure” Prompts

Whenever a proposed change occurs, the “Are you sure” dialog box appears to warn the user that the action can change existing provisioning states or can cause traffic disruptions.

Resolved Caveats for Release 4.5

This section highlights new features and functionality for Release 4.5. For detailed documentation of each of these features, consult the user documentation.

New Features and Functionality

This section highlights new features and functionality for Release 4.5. For detailed documentation of each of these features, consult the user documentation.

New Hardware

Optical Service Channel Modules

An optical service channel (OSC) is a bidirectional channel connecting all the nodes in a ring. The channel transports OSC overhead that is used to manage ONS 15454 SDH DWDM networks. The OSC uses the 1510 nm wavelength and does not affect client traffic, because the OSC signal is outside the client traffic band (OOB). The primary purpose of this channel is to carry supervision and management traffic for the DWDM network. It also provides transparent links between each node in the network. The OSC is an STM-1 formatted signal.

There are two versions of the OSC modules, OSCM and OSC-CSM with a combiner and separator module.

OSCM

The OSCM is used in amplified nodes that include the booster amplifier called the OPT-BST. The OPT-BST includes the required OSC wavelength combiner and separator component. The OSCM cannot be used in nodes where you want to use OC-N cards, electrical cards, or cross-connect cards. The OSCM uses Slots 8 and 10 which are also cross-connect card slots. The cross-connect cards enable functionality on the OC-N cards and electrical cards.

Release 4.5 does not support DWDM cards and features along with cross-connect, OC-N, and electrical cards.

The OSCM supports the following features:

- STM-1 formatted OSC
- Supervisory data channel (SDC) forwarded to the TCC2 cards for processing
- Distribution of the synchronous clock to all nodes in the ring
- 100BaseT FE user data channel
- Monitoring functions such as orderwire support and optical safety

The STM-1 RS-DCC overhead bytes are used for network communications. An optical transceiver terminates the STM-1 then it is regenerated and converted into an electrical signal. The RS-DCC bytes are forwarded to the active and standby TCC2 cards for processing via the SCL bus on the backplane. The OSCM is able to terminate/insert the F1 User channel in the Overhead of OC-3 / STM-1 frame. The F1 is forwarded to the AIC-I and made available via a G.703 interface at 64Kb/s. Order-wire bytes (E1, E2) are also forwarded via the SCL bus to the TCC2 for forwarding to the AIC-I card.

The payload portion of the STM-1 is used to carry the fast Ethernet user data channel. The frame is sent to a POS processing block that extracts the Ethernet packets and makes it available at the RJ-45 connector.

OSC-CSM

The OSC-CSM is used in all the nodes where OPT-BST is not needed/used. The OSC-CSM can be installed in Slots 1-6 and 12-17. OSC-CSM will be used in the future with OPT-BST to support configurations where both OPT-BST and XC units are required (hybrid).



Note

Release 4.5 does not support DWDM cards and features along with cross-connect, OC-N, and electrical cards.

The OSC-CSM supports the following features:

- Optical combiner and separator module for multiplexing and demultiplexing the optical service channel to or from the wave division multiplexing (WDM) signal
- STM-1 formatted OSC
- Supervisory data channel (SDC) forwarded to the TCC2 cards for processing
- Distribution of the synchronous clock to all nodes in the ring
- 100baseT FE user data channel
- Monitoring functions such as order wire support and optical safety

The WDM signal coming from the line is passed through the OSC combiner and separator where the OSC signal is extracted from the WDM signal. The WDM signal is sent along with the remaining channels to the COM port (label on the front panel) for routing to the OADM or amplifier units, while the OSC signal is sent to an optical transceiver.

The OSC is an STM-1 formatted signal. The STM-1 RS-DCC overhead bytes are used for network communications. An optical transceiver terminates the STM-1 then it is regenerated and converted into an electrical signal. The RS-DCC bytes are forwarded to the active and standby TCC2 cards for processing via the SCL bus on the backplane. The OSCM is able to terminate/insert the F1 User channel in the Overhead of OC-3 / STM-1 frame. The F1 is forwarded to the AIC-I and made available via a G.703 interface at 64Kb/s. Order-wire bytes (E1, E2) are also forwarded via the SCL bus to the TCC2 for forwarding to the AIC-I card.

The payload portion of the STM-1 is used to carry the fast Ethernet user data channel. The frame is sent to a POS processing block that extracts the Ethernet packets and makes it available at the RJ-45 front panel connector.

The OSC-CSM distributes the reference clock information by removing it from the incoming STM-1 signal and then sending it to the active and standby TCC2s.

Optical Amplifiers

Optical amplifiers are used in amplified nodes such as hub nodes, amplified OADM nodes, terminal nodes, and line amplifier nodes. There are two forms of amplifiers, the optical preamplifier (OPT-PRE) and the optical booster amplifier (OPT-BST). For more information consult the user documentation. The optical amplifier card architecture includes an optical plug-in module with a controller that manages optical power, laser current, and temperature control loops.

The OPT-PRE can operate in two modes:

- Constant Gain for ring with span length less than 28 dB
- Constant Power in linear network topologies with span exceeding 28 dB

In constant gain rings, the APC (Automatic Power Control) feature will compensate any span degradation.

In constant power mode, automatic power control (APC) requirements change since span loss degradation does not effect the system and amplifiers are not able to automatically modify the output power for variations in the number of channels when provisioning changes and a failure occurs.

The OPT-BST is always operated in Constant Gain Mode. Its optical gain is limited to 20 dB.

OPT-PRE

The OPT-PRE is designed to support 64 channels at 50 GHz channel spacing, but currently Release 4.5 supports 32 channels at 100 GHz. The OPT-PRE is a C-band DWDM, two-stage EDFA with mid-stage access loss (MAL) for allocation to a dispersion compensation unit (DCU). To control the gain tilt, the OPT-PRE is equipped with a built-in variable optical attenuator (VOA). The VOA can also be used to pad the DCU to a reference value. You can install the OPT-PRE in Slots 1-6 and 12-17.

The OPT-PRE features:

- True variable gain
- Fast transient suppression
- Settable maximum output power
- Fixed output power mode (mode used during provisioning)
- Mid-stage access for fiber based DCU
- ASE compensation in fixed gain mode
- Full monitoring and alarm handling with settable thresholds
- Optical safety: signal loss detection and alarming, fast power down control and reduced max output power in safe power mode

The OPT-PRE has four signal photodiodes to monitor the input and output optical power of the two amplifier stages through CTC. The OPT-PRE also has an optical output port for external monitoring.

OPT-BST

The OPT-BST is designed to support 64 channels at 50 GHz channel spacing, but currently Software R4.5 supports 32 channels at 100 GHz. The OPT-BST is a C-band DWDM EDFA with optical service channel add and drop capability. When an ONS 15454 SDH has an OPT-BST installed, it is only necessary to have the optical service channel module (OSCM) to process the OSC. You can install the OPT-BST in Slots 1-6 and 12-17. To control the gain tilt, the OPT-BST is equipped with a built-in variable optical attenuator (VOA).

The OPT-BST features:

- Fixed gain mode (with programmable tilt)
- True variable gain
- Fast transient suppression
- Settable maximum output power
- Fixed output power mode (mode used during provisioning)
- ASE compensation in fixed gain mode

- Full monitoring and alarm handling with settable thresholds
- Optical safety: signal loss detection and alarming, fast power down control and reduced max output power in safe power mode

The OPT-BST amplifier supports optical safety remote interlock (OSRI) and automatic laser shutdown (ALS). The OSRI is a feature capable of shutting down the optical output power or reducing the power to a safe level (automatic power reduction). The ALS feature is a safety mechanism used in the event of a fiber cut.

Multiplexer and Demultiplexer Cards

32MUX-O

The 32 channel multiplex card multiplexes 32 100 GHz spaced channels identified in the channel plan. The 32MUX-O takes up two slots in an ONS 15454 SDH and can be installed in Slots 1-6 and 12-17. The 32MUX-O features include

Each single channel port is equipped with VOAs for automatic optical power regulation prior to multiplexing. In the case of electrical power failure, the VOA is set to its maximum attenuation (or to a fixed and configurable value) for safety purposes. A manual VOA setting is also available.

Each single channel port is monitored using a photodiode to enable automatic power regulation.

An additional optical monitoring port with 1/99 splitting ratio is available.

32DMX-O

The 32 channel demux card demultiplexes 32 100 GHz spaced channels identified in the channel plan. The 32DMX-O takes up two slots in an ONS 15454 SDH and can be installed in Slots 1-6 and 12-17. The 32DMX-O features include

Each single channel port is equipped with VOAs for automatic optical power regulation after demultiplexing. In the case of electrical power failure, the VOA is set to its maximum attenuation (or to a fixed and configurable value) for safety purposes. A manual VOA setting is also available.

Each single channel port is monitored using a photodiode to enable automatic power regulation.

4MD-xx.x

The 4MD-xx.x card multiplexes and demultiplexes four 100 GHz spaced channels identified in the channel plan. The 4MD-xx.x card is designed to be used with band OADMs. There are eight versions of this card that correspond with the eight, four-channel band OADMs. The 4MD-xx.x can be installed in Slots 1-6 and 12-17.

The 4MD has the following features:

- Passive optical plug-in module with cascaded interferential filters that perform the channel multiplex/demultiplex function
- Software controlled VOAs at every port of the multiplex section to regulate the optical power of each multiplexed channel
- Software monitored photodiodes at the input and output ports for power control and safety purposes

Optical Add Drop Multiplex Cards

AD-1C-xx.x

The One-Channel Add/Drop card passively adds and drops one of the 32 channels utilized within the 100-GHz grid spacing of the DWDM card system. Thirty-two versions of this card—each designed only for use with one wavelength—are used in the ONS 15454 SDH DWDM system. Each wavelength version of the card has a different part number.

The AD-1C-xx.x has the following features:

- Passive optical plug-in module has two cascaded interferential filters that perform the channel add and drop functions
- Software-controlled VOA regulates the optical power of the inserted channel
- Software-controlled VOA regulates the insertion loss of the express optical path
- Internal control of the VOA settings and functions, photodiode detection, and alarm thresholds

AD-2C-xx.x

The Two-Channel Add/Drop card passively adds and drops two adjacent 100-GHz channels within the same band. Sixteen versions of this card—each designed for use with one pair of wavelengths—are used in the ONS 15454 SDH DWDM system. The card bidirectionally adds and drops in two different sections on the same card to manage signal flow in both directions.

The AD-2C-xx.x has the following features:

- Passive optical plug-in module has cascaded interferential filters that perform the channel add and drop functions
- Two software-controlled VOAs in the add section, one for each add port, regulate the optical power of inserted channels
- Software-controlled VOA regulate insertion loss on express channels
- Internal control of the VOA settings and functions, photodiode detection, and alarm thresholds

AD-4C-xx.x

The Four-Channel Add/Drop card passively adds and drops all four 100GHz-spaced channels within the same band. Eight versions of this card—each designed for use with one band of wavelengths—are used in the ONS 15454 SDH DWDM system. The card bidirectionally adds and drops in two different sections on the same card to manage signal flow in both directions. There are eight versions of this card.

The AD-4C-xx.x has the following features:

- Passive optical plug-in module has cascaded interferential filters that perform the channel add and drop functions
- Four software-controlled VOAs in the add section, one for each add port, regulate the optical power of inserted channels
- Two software-controlled VOAs regulate insertion loss on express and drop channel power.
- Internal control of the VOA settings and functions, photodiode detection, and alarm thresholds

AD-1B-xx.x

The One-Band Add/Drop card passively adds and drops a single band of four adjacent 100GHz-spaced channels. Eight versions of this card with eight different part numbers—each version designed for use with one band of wavelengths—are used in the ONS 15454 SDH DWDM system. The card bidirectionally adds and drops in two different sections on the same card to manage signal flow in both directions. This card can be used when there is asymmetric adding and dropping on each side (east or west) of the node; a band can be added or dropped on one side but not on the other.

The AD-1B-xx.x has the following features:

Passive optical plug-in module with two cascaded interferential filters that perform the channel add and drop functions.

- Two software-controlled VOAs regulate the optical power flowing in the OADM paths
 - VOA Drop is used to regulate the output power of the channels in the dropped band
 - VOA Express is used to regulate the insertion loss of the express path
- Changing the attenuation of the VOA drop sets output power of the dropped band
- The VOA express is used to regulate the insertion loss of the express path
- Internal controlled VOA settings and functions, photodiode detection, and alarm thresholds

AD-4B-xx.x

The Four-Band Add/Drop card passively adds or drops four bands of four adjacent 100GHz-spaced channels. Two versions of this card with different part numbers—each version designed for use with one set of bands—are used in the ONS 15454 SDH DWDM system. The card bidirectionally adds and drops in two different sections on the same card to manage signal flow in both directions. This card can be used when there is asymmetric adding and dropping on each side (east or west) of the node; a band can be added or dropped on one side but not on the other.

The AD-4B-xx.x has the following features:

- Several software-controlled VOAs regulate the optical power flowing in the OADM paths
- Changing the attenuation of the VOA drop sets output power of the dropped band
- The VOA express is used to regulate the insertion loss of the express path
- Internal controlled VOA settings and functions, photodiode detection, and alarm thresholds

Automatic Power Control

Each ONS 15454 DWDM node has an automatic power control (APC) feature that maintains constant channel power when channels are added and dropped, or maintains the channel power constant when span loss degradation occurs. This feature functions at both the node and network levels.

For further details on automatic power control, consult the user documentation.

Automatic Node Setup

Automatic node setup (ANS) is a TCC2 function that adjusts values of the VOAs on the DWDM channel paths to equalize the per-channel power at the amplifier input. This power equalization means that at launch, all the channels have the same amplifier power level, independent of the input signal on the client interface and independent of the path crossed by the signal inside the node. This equalization is needed for two reasons:

1. Every path introduces a different penalty on the signal that crosses it.
2. Client interfaces add their signal to the ONS 15454 SDH DWDM ring with different power levels.

For further details on automatic node setup, consult the user documentation.

2.5G_MR_TXP and 2.5G_MR_TXP-P Cards

The 2.5G_MR_TXP card (2.5G multirate transponder) processes one 8-Mbps to 2.488-Gbps signal (client side) into one 8-Mbps to 2.5-Gbps, 100-GHz DWDM signal (trunk side). It provides one long reach STM-16/OC-48 port per card (trunk side), compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE.

The 2.5G_MR_TXP card features an ITU compliant 1550 nm laser for the trunk/line port and a 1310 nm laser for the client port (the client side is equipped with SFP and may be either 1310nm or 850nm) and contains two transmit and receive connector pairs (labeled) on the card faceplate. The card uses dual LC connectors for optical cable termination.

The 2.5G_MR_TXP-P card (2.5G multirate transponder-protected) processes one 8-Mbps to 2.488-Gbps signal (client side) into two 8-Mbps to 2.5-Gbps, 100-GHz DWDM signals (trunk side). It provides two long reach STM-16/OC-48 ports per card, compliant with ITU-T G.707, ITU-T G.957, and Telcordia GR-253-CORE.

The 2.5G_MR_TXP-P card features an ITU compliant 1550 nm laser for the trunk/line port and a 1310 nm or 850 nm laser (depending on the SFP) for the client port and contains three transmit and receive connector pairs (labeled) on the card faceplate. The card uses dual LC connectors for optical cable termination.

The 2.5G_MR_TXP and 2.5G_MR_TXP-P cards are tunable over four adjacent wavelengths in the 1550 nm, ITU 100-GHz range. They are available in eight different versions, covering 32 different wavelengths in the 1550 nm range.

The trunk/line port operates at up to 2.488 Gbps (or up to 2.66 Gbps with ITU-T G.709 Digital Wrapper/FEC) over unamplified distances up to 223.7 miles (360 km) with different types of fiber.

You can install 2.5G_MR_TXP and 2.5G_MR_TXP-P cards in Slots 1 to 6 and 12 to 17. You can provision either card in a linear configuration. TXP_MR_10G and 2.5G_MR_TXP-P cards cannot be provisioned as MSSP or SNCP. They can be used in the middle of BLSR or 1+1 spans; however, they can only be used in the middle of BLSR and 1+1 spans when configured for transparent termination mode.

The 2.5G_MR_TXP and 2.5G_MR_TXP-P cards detect SF, LOS, or LOF conditions on the optical facility. Refer to the Cisco ONS 15454 Troubleshooting Guide for a description of these conditions. These cards also count section and line BIP errors from B1 and B2 byte registers in the section and line overhead.

For further specifications, protection, and operation modes of these cards, consult the user documentation.

New Software Features and Functionality

DWDM

Release 4.5 offers a DWDM optical solution designed to provide transparent, reliable and manageable transport capacity to Cisco Metro optical products such as the ONS 15454 SDH, ONS 15600, ONS 15530 and ONS 15540. Release 4.5 DWDM features a transport capacity of 32 wavelengths, 100 GHz spaced, in the C-band. Future releases will upgrade the transport capacity to 64 wavelengths 50 GHz spaced.

Release 4.5 supports DWDM transmission over four different network topologies: hubbed ring, multi-hubbed ring, meshed ring and single span. The ring extension covered by Release 4.5 DWDM ranges to upwards of 400 km.

Release 4.5 supports a common DWDM transport layer to different Cisco ONG products. Release 4.5 DWDM works as a common transport server layer for multiple Cisco clients such as the ONS 15454 SDH, ONS 15600, ONS 15530, and ONS 15540 over a Metro ring. The concurrent transmission of these clients over the ring offered by Release 4.5 DWDM is

- Transparent
- Managed and supervised
- Easily provisionable

DWDM Features

The Release 4.5 DWDM transport capacity is 32 channels at 100 GHz spacing. Future releases will upgrade this capacity to 64 channels at 50 GHz spacing.

Release 4.5 DWDM is designed to be compatible with the ONS 15454 SDH platform. All DWDM cards are ONS 15454-like cards that fit in ONS 15454 SDH shelves, the local craft interface used to manage the DWDM cards is an extension of the ONS 15454 SDH CTC, and CTM may be used as the network manager.

Release 4.5 DWDM supports transmission over Metro Core/Regional rings of most line cards of the Cisco metro products, both of the ONS 15454 SDH and ONS 15530 family. For a complete list of the supported interfaces, see the user documentation.

Each DWDM Network Element can be equipped with cards that realize the termination of all DWDM channels (Hub node), or with cards that perform the add/drop of a channel subset with a granularity of 1, 2, 4 channels or 1, 4 bands (OADM nodes). All NE losses can be compensated with optical amplifier cards. Dispersion Compensating Units (DCUs) provide chromatic dispersion compensation when needed. For a detailed description of DWDM NEs, see the user documentation.

An OSC channel is provisioned to carry user data channels and network management channels, supporting DCN and engineering orderwire.

The SW features of Release 4.5 DWDM allow the easy provisioning of new channels in the ring and the automatic power control of the channel power when there is a change both in terms of channel count and span loss.

Network configurations

Release 4.5 DWDM supports the following network configurations.

Open (Hubbed) Ring

In this network topology a hub node terminates all the DWDM channels. In an open ring, a channel can be configured to support protected traffic between the hub node and any node in the ring--working and protected traffic are allocated on the same wavelength on both sides of the ring. Protected traffic completely saturates a wavelength channel in an open ring; that is, no wavelength reuse is possible. Conversely a wavelength channel can be configured to support unprotected multi-hop traffic, reusing the same wavelength channel in different sections of the ring. From a transmission point of view, this network application corresponds to two bidirectional point-to-point links with OADM nodes.

Multi-hubbed Ring

A multi-hubbed ring is a special case of an open ring, where two or more hub nodes are inserted. Protected traffic can be established only between the two hub nodes. Multi-hop traffic can be provisioned on this ring. From a transmission point of view, this corresponds to two (or more) point-to-point links with OADM nodes.

Closed (Meshed) Ring

Closed (or meshed) ring topology is characterized by the absence of the hub node: only amplified and passive OADM nodes are present. Protected traffic can be provisioned between any two nodes, but in this case the selected wavelength channel cannot be reused in the ring. Unprotected multi-hop traffic can also be provisioned on this network topology. A meshed ring must be designed in order to prevent ASE lasing in the ring. Configuring a particular node as an Anti-ASE node does this.

Linear Configurations

Linear configurations are characterized by the presence of two terminal sites (west and east). The terminal sites must be equipped with a 32MUX-O and a 32DMX-O card. Between the two terminal sites OADM, or line amplifier nodes can be inserted. On a linear configuration only unprotected traffic can be provisioned.

Single Span Link

A single span link is a particular linear configuration characterized by a very long single span, exceeding 28 dB and up to 37 dB, with pre and post amplification.

Network Elements

The following node types are supported with Release 4.5. For system functional specifications and power requirements, consult the user documentation.

Hub Node

The hub node is a node equipped with two 32-channel mux (32MUX-O) and two 32-channel demux (32DMX-O) cards. A node equipped with two couples of 32MUX-O and 32DMX-O with some channels configured as pass through is a particular instance of an OADM node. The main architecture of a hub node is very similar to the architecture of a back-to-back terminal node in a conventional DWDM system.

All the units equipping a hub node can be plugged into a single ONS 15454 SDH shelf, plus a DCU shelf, if dispersion compensation function is necessary.

Terminal node

A Release 4.5 DWDM terminal node is used in point-to-point configurations and is simply a hub node where either the west (terminal node east) or the east (terminal node west) is removed. For signal flow and description refer to the user documentation. The presence of a Terminal node is mandatory in all linear configurations.

OADM Node

In an OADM node a channel can be:

- **ADDED/DROPPED:** (independently to or from each direction)
- **EXPRESS:** passing through the reflected bands of all the OADM units present in the OADM node
- **OPTICALLY BYPASSED:** dropped on one side by an OADM card and inserted on the other side by an OADM card, without being electrically regenerated



Note

The difference between an OPTICALLY BYPASSED and EXPRESS path is that when a channel is configured as OPTICALLY BYPASSED, it can be dropped in a future ring reconfiguration without affecting any other channel.

In a Release 4.5 DWDM system, the OADM sites can be equipped with OPT-PRE and/or OPT-BST amplifiers, depending on the loss of the node and on the loss of the preceding and following spans. Whenever the OPT-BST is absent, the OSC-CSM must be used instead of the OSCM card.

An OADM site can be realized in two ways:

1. Using band and/or channel OADM filter units. This configuration provides the best flexibility as the OADM filter units can be combined in many different ways to satisfy the node traffic. The list of OADM filter units that can be deployed in an OADM node is:
 - AD-1C-xx.x
 - AD-2C-xx.x
 - AD-4C-xx.x
 - AD-1B-xx.x
 - AD-4B-xx.x
 - 4MD-xx.x
2. Using two couples of 32MUX-O and 32DMX-O cards and configuring all the channels that are express in that node as pass through. Solution 2 is preferable when a significant amount of traffic is terminated in the node. In this configuration the OADM node also provides Anti-ASE functionality.

The OADM cards (either band or channel) can be configured East or West side. For example, a single band OADM card (AD-1B-xx.x) west facing will drop the band with ID xx.x on the west-to-east fiber, while it will add the same band, xx.x, on the east-to-west fiber. Symmetrically the band AD-1B-xx.x unit east facing will add the band xx.x on the west-to-east fiber, while it will drop the band xx.x on the east-to-west fiber. Band and/or channel OADM cards can be used in the same OADM node.

For amplified OADM and passive OADM node unit combinations and examples, consult the user documentation.

Anti-ASE node

In a closed loop configuration the Release 4.5 ONS 15454 SDH requires a site that prevents ASE accumulation and lasing.

The anti-ASE node can be realized in two ways:

1. With an OADM node equipped with 32MUX-O and 32DMX-O cards. This solution is adopted when the total number of wavelengths deployed in the ring is higher than 10.
2. When the total number of wavelengths deployed in the ring is lower than 10, the anti-ASE node is realized with an OADM node where all the channels that are not terminated in the node are configured as optically bypass. In other words, no channels in the anti-ASE node can travel through the express path of the OADM node. This is because the express path-cord is physically removed in an anti-ASE node.

In a closed ring there are additional constraints on the number of times a wavelength must be terminated in the ring in order to avoid lasing.

Reference configurations for an Anti-ASE node can be obtained using any OADM node configurations where no channels can travel through the express path, but they can only be dropped and demultiplexed at channel level on one side, and added and multiplexed on the other.

Line Amplifier Node

The Line Amplifier Node is composed of only amplifier units (OPT-PRE and OPT-BST in all possible combinations), placed at each side of the node and all of the required common cards.

In order to maintain the amplifier gain tilt within the specification, an additional fixed attenuator may be required between each preamplifier output and the booster corresponding input for matching the correct optical input power value.

The two OSCMs are connected with the relevant ports of the east or west booster units in order to multiplex the Optical Service Channel signal with the pass through channels. If an OPT-BST is not deployed within the node, an OSC-CSM unit must be used instead of the OSCM.

Optical Service Channel & Supervisory Bus

The Release 4.5 DWDM system uses an STM-1 framed out of band (1510 nm) Optical Service Channel (OSC) to transport signaling, supervision, user channels and order-wire signals from one node to another. The OSC signal is multiplexed on the same transmission fiber pairs used by the DWDM signal.

In the Service channel the following services are transported:

- DCC bytes used by TCC2s to exchange DCN packets between remote nodes
- 100 Mbps Ethernet user data channel
- F1 user channel in the overhead of OC-3 / STM-1 frame
- Two EOW channels signaling using the E1/E2 bytes

In a generic node two OSCMs are used to transport the service channel, one OSCM facing west (OSCM-W) and the other OSCM facing east (OSCM-E). The two units have the same hardware and software images but are automatically configured to be east or west depending on slot position.

A single OSCM can be used in terminal nodes of a point-to-point link.

Each OSCM or OSC-CSM establishes a point-to-point link with the adjacent node (OSCM-W communicates with OSCM-E and vice versa).

DWDM Network Topology Discovery

Each ONS 15454 SDH DWDM node has a network topology discover function that can identify:

- Other ONS 15454 SDH DWDM nodes in an ONS 15454 SDH DWDM network
- The different types of DWDM networks
- When the DWDM network is complete and when it is incomplete

For further details on DWDM network topology discovery, consult the user documentation.

Wavelength Path Provisioning

In a Release 4.5 DWDM network you can create new circuits and retrieve circuits already created via Network Circuit Provisioning (NCP). The following NCP enhancements make this possible.

Circuit Provisioning

DWDM circuit provisioning and removal is performed by a CTC component called NCP.

NCP is responsible for:

- Understanding if the circuit is feasible
- Creating the new circuit
- Triggering the signalling protocol to activate the circuit

DWDM Circuit Provisioning Requests can set up:

- Unidirectional paths from Node A to Node B allocating for these paths the specified wavelength in the selected line direction
- Bidirectional paths from Node A to Node B allocating for these paths the specified
- Wavelengths in both East to West and West to East line directions

Circuit Removal

A Circuit Removal Request allows you to remove a circuit previously created. Circuit multiple selection is supported. CTC notifies the user of the Circuit Deletion Result (by means of an Information or Error Dialog).

Since creation of a bidirectional circuit is split by NCP into creation of two independent unidirectional circuits, DWDM circuits retrieved by NCP will be all unidirectional.

This means that it's not possible to remove bidirectional circuits; rather, you will remove a pair of unidirectional circuits.

Circuit Discovery

CTC is able to discover the circuit map of a Release 4.5 DWDM network using the same approach implemented for SONET and SDH circuits.

For each circuit CTC shows:

- SOURCE node
- DESTINATION node
- PASS THROUGH node

NCP is able to discover the Release 4.5 DWDM circuits using information created during circuit provisioning.

CTC is able to show the list of discovered circuits at the Network, Node, and Card levels.

CTC also provides a separate graphical representation of the OCHNC Circuit, called “Detailed Map.” The Detailed Map representation of an OCHNC Circuit displays in a separate window and shows all Release 4.5 DWDM nodes through which the circuit traverses, from the source node to the destination node.

Wavelength Path

Release 4.5 DWDM OADMs are not configurable and Mux/Demuxes are not transparent: optical paths are pre-cabled, and non-software configurable by the user.

You can activate existing circuits but not create an unanticipated new circuit. DWDM circuit provisioning supports the following:

- Channel allocation data table--documenting the channels that are allocated on the node
- Node topology configuration data table--documenting the Add and Drop capability of the node
- Provisioned circuit discovery
- Creating new circuits

Before creating a new circuit NCP checks if the circuit is feasible. A circuit is feasible if:

- A path has been effectively pre-cabled between source and destination
- The channel is not already used in any span between source and destination

Related Documentation

Release-Specific Documents

- *Release Notes for Cisco ONS 15454 SDH Release 4.1*
- *Release Notes for Cisco ONS 15454 Release 4.5*

Platform-Specific Documents

- *Cisco ONS 15454 SDH Installation and Operations Guide, Release 4.1 and 4.5*
- *Cisco ONS 15454 SDH Troubleshooting and Maintenance Guide, Release 4.1 and 4.5*
- *Cisco ONS 15454 SDH Product Overview, Release 4.1 and 4.5*

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at the following sites:

- <http://www.cisco.com>
- <http://www-china.cisco.com>
- <http://www-europe.cisco.com>

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships 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 as an annual subscription.

Ordering Documentation

Cisco documentation is available in the following ways:

- Registered Cisco Direct Customers can order Cisco Product documentation from the Networking Products MarketPlace:
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 corporate headquarters (California, USA) at 408 526-7208 or, in North America, by calling 800 553-NETS(6387).

Documentation Feedback

If you are reading Cisco product documentation on the World Wide Web, you can submit technical comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco.

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

To submit your comments by mail, use the response card behind the front cover of your document, or write to the following address:

Attn Document Resource Connection
Cisco Systems, Inc.
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 documentation, troubleshooting tips, and sample configurations from online tools. For Cisco.com registered users, additional troubleshooting tools are available from the TAC website.

Cisco.com

Cisco.com is the foundation of a suite of interactive, networked services that provides immediate, open access to Cisco information and resources at anytime, from anywhere in the world. This highly integrated Internet application is a powerful, easy-to-use tool for doing business with Cisco.

Cisco.com provides a broad range of features and services to help customers and partners streamline business processes and improve productivity. Through Cisco.com, you can find information about Cisco and our networking solutions, services, and programs. In addition, you can resolve technical issues with online technical support, download and test software packages, and order Cisco learning materials and merchandise. Valuable online skill assessment, training, and certification programs are also available.

Customers and partners can self-register on Cisco.com to obtain additional personalized information and services. Registered users can order products, check on the status of an order, access technical support, and view benefits specific to their relationships with Cisco.

To access Cisco.com, go to the following website:

<http://www.cisco.com>

Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

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

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

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

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

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

Contacting TAC by Telephone

If you have a priority level 1 (P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

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

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

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

CCIP, CCSP, the Cisco Arrow logo, the Cisco *Powered* Network mark, Cisco Unity, Follow Me Browsing, FormShare, and StackWise are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn, and iQuick Study are service marks of Cisco Systems, Inc.; and Aironet, ASIST, BPX, Catalyst, CCDA, CCDP, CCIE, CCNA, CCNP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, the Cisco IOS logo, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Empowering the Internet Generation, Enterprise/Solver, EtherChannel, EtherSwitch, Fast Step, GigaStack, Internet Quotient, IOS, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, LightStream, MGX, MICA, the Networkers logo, Networking Academy, Network Registrar, *Packet*, PIX, Post-Routing, Pre-Routing, RateMUX, Registrar, ScriptShare, SlideCast, SMARTnet, StrataView Plus, Stratm, SwitchProbe, TeleRouter, The Fastest Way to Increase Your Internet Quotient, TransPath, and VCO are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the U.S. and certain other countries.

All other trademarks mentioned in this document or Web site are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0304R)

Copyright © 2003, Cisco Systems, Inc.
All rights reserved.

