



Release Notes for Cisco 1600 Series Routers for Cisco IOS Release 12.1T

November 27, 2000



Note

Note: The Cisco 1600 series has reached End-of-Sales (EoS as of February 28, 2003). The replacement products are the Cisco 1700 series routers.

These release notes for the Cisco 1600 series routers describe the enhancements provided in Cisco IOS Release 12.1 T. These release notes are updated as needed.

For a list of the software caveats that apply to Cisco IOS Release 12.1 T, see *Caveats for Cisco IOS Release 12.1 T* that accompanies these release notes. The caveats document is updated for every maintenance release and is located on Cisco.com and the Documentation CD-ROM.

Use these release notes with *Cross-Platform Release Notes for Cisco IOS Release 12.1* on Cisco.com and the Documentation CD-ROM.

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78-10841-04 Rev.B0

Early Deployment Releases

These release notes describe the Cisco 1600 series routers for Cisco IOS Release 12.1 T, which is an early deployment (ED) release based on Cisco IOS Release 12.1. Early deployment releases contain fixes for software caveats and support for new Cisco hardware and software features. The following list shows the recent early deployment releases of the Cisco 1600 series routers:

- Release 11.2 P, up to 11.2(21)P
- Release 11.3 T, up to 11.3(11)T
- Release 12.0 T, up to 12.0(7)T
- Release 12.1 T, up to 12.1(5)T

For more information, see the “Platform-Specific Documents” section on page 18 about accessing related release note documents.

System Requirements

This section describes the system requirements for Cisco IOS Release 12.1 T:

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Memory Requirements

Table 1 Memory Requirements for Cisco 1600 Series Routers

Platforms	Feature Sets	Image Name	Software Image	Recommended Flash Memory	Recommended DRAM Memory	Runs from
Cisco 1600– Cisco 1604	IP Feature Sets	IP	c1600-y-1	8 MB	4 MB	Flash
		IP Plus	c1600-sy-1	12 MB	4 MB	Flash
		IP Plus IPSEC 56	c1600-sy56i-1	12 MB	6 MB	Flash
		IP/IPX	c1600-ny-1	8 MB	4 MB	Flash
		IP/IPX/AT/IBM	c1600-bnr2y-1	12 MB	4 MB	Flash
		IP/IPX/AT/IBM Plus	c1600-bnr2sy-1	16 MB	6 MB	Flash
		IP/FW	c1600-oy-1	12 MB	6 MB	Flash
		IP/IPX/FW Plus	c1600-nosy-1	12 MB	6 MB	Flash
		IP/FW Plus IPSEC 56	c1600-osy56i-1	16 MB	6 MB	Flash
		IP/IPX/AT/IBM/FW Plus IPSEC 56	c1600-bnor2sy56i-1	16 MB	6 MB	Flash

Table 1 Memory Requirements for Cisco 1600 Series Routers (continued)

Platforms	Feature Sets	Image Name	Software Image	Recommended Flash Memory	Recommended DRAM Memory	Runs from
Cisco 1601-R – 1605-R	IP Feature Sets	IP	c1600-y-mz	4 MB	10 MB	RAM
		IP Plus	c1600-sy-mz	6 MB	12 MB	RAM
		IP Plus IPSEC 56	c1600-sy56i-mz	6 MB	16 MB	RAM
		IP/IPX	c1600-ny-mz	4 MB	10 MB	RAM
		IP/IPX/AT/IBM	c1600-bnr2y-mz	6 MB	12 MB	RAM
		IP/IPX/AT/IBM Plus	c1600-bnr2sy-mz	8 MB	16 MB	RAM
		IP/FW	c1600-oy-mz	6 MB	12 MB	RAM
		IP/IPX/FW Plus	c1600-nosy-mz	6 MB	16 MB	RAM
		IP/FW Plus IPSEC 56	c1600-osy56i-mz	6 MB	16 MB	RAM
		IP/IPX/AT/IBM/FW Plus IPSEC 56	c1600-bnor2sy56i-mz	8 MB	24 MB	RAM

Hardware Supported

Cisco IOS Release 12.1 T supports the Cisco 1600 series routers:

- Cisco 1601, Cisco 1601-R
- Cisco 1602, Cisco 1602-R
- Cisco 1603, Cisco 1603-R
- Cisco 1604, Cisco 1604-R
- Cisco 1605-R

Cisco 1600 series routers have two memory architectures: one run-from-Flash (RFF) and one run-from-RAM (RFR). Router model names with an R are RFR routers; all other models are RFF. In this document, model names without an R refer to both RFF and RFR models, except where otherwise noted.

For detailed descriptions of the new hardware features, see “New and Changed Information” section on page 8.

Table 2 Supported Interfaces for the Cisco 1600 Series

Interface, Network Module, or Data Rate	Platforms Supported
1 Ethernet port	Cisco 1601–1604
1 built-in WAN port	Cisco 1601–1604
1 WAN interface-card expansion slot	Cisco 1601–1604
1 built-in serial WAN port	Cisco 1601
1 onboard 56-kbps 4-wire DSU/CSU	Cisco 1602

Table 2 Supported Interfaces for the Cisco 1600 Series (continued)

Interface, Network Module, or Data Rate	Platforms Supported
1 ISDN BRI S/T port	Cisco 1603
ISDN BRI U interface with a built-in NT 1 device	Cisco 1604
2 Ethernet LAN interfaces	Cisco 1601-R–1605-R
1-port ISDN BRI with S/T interface	Cisco 1601, Cisco 1602, Cisco 1601-R–1605-R
1-port synchronous/asynchronous serial	Cisco 1600 series
1-port ISDN BRI with integrated NT1 and with a U interface	Cisco 1601, 1602, Cisco 1601-R–1605-R
1-port ISDN Leased Line BRI S/T WAN interface	Cisco 1603, Cisco 1604
1-port 56/64kbps DSU/CSU WAN interface	Cisco 1600 series
1-port T1/Fractional T1 DSU/CSU WAN interface	Cisco 1600 series

Determining the Software Release

To determine the version of Cisco IOS software running on your Cisco 1600 series router, log in to the router and enter the **show version EXEC** command:

```
router> show version
Cisco IOS Software
IOS (tm) 12.1 T Software (C1600-NY-L), Version 12.1(5)T, RELEASE SOFTWARE
```

Upgrading to a New Software Release

For general information about upgrading to a new software release, see *Cisco IOS Upgrade Ordering Instructions* located at:

http://www.cisco.com/warp/public/cc/cisco/mkt/ios/prodlit/957_pp.htm

Feature Set Tables

The Cisco IOS software is packaged in feature sets consisting of software images—depending on the platform. Each feature set contains a specific set of Cisco IOS features.

Cisco IOS Release 12.1 T supports the same feature sets as Cisco IOS Release 12.1, but Release 12.1 T can include new features supported by the Cisco 1600 series routers.

**Caution**

Cisco IOS images with strong encryption (including, but not limited to 168-bit (3DES) data encryption feature sets) are subject to United States government export controls and have limited distribution. Strong encryption images to be installed outside the United States are likely to require an export license. Customer orders may be denied or subject to delay due to United States government regulations. When applicable, the purchaser/user must obtain local import and use authorizations for all encryption strengths. Please contact your sales representative or distributor for more information, or send an e-mail to export@cisco.com.

Table 3 and Table 4 list the features and feature sets supported by the Cisco 1600 series routers in Cisco IOS Release 12.1 T. Both use the following conventions:

- Yes—The feature is supported in the software image.
- No—The feature is not supported in the software image.
- In—The number in the “In” column indicates the Cisco IOS release in which the feature was introduced. For example, (2) means a feature was introduced in 12.1(2)T. If a cell in this column is empty, the feature was included in the initial base release.

**Note**

These feature set tables contain only the features specific to the T-train. For a more complete list of features, see the feature set tables in the mainline release notes on Cisco.com:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121relnt/xprn121/121feats.htm>.

Table 3 Feature List by Feature Set for the Cisco 1600 Routers, Part 1

Features	In	Feature Set				
		IP	IP Plus	IP Plus IPSEC 56	IP/IPX	IP/IPX/AT/ IBM
Configuration Fundamentals						
Circuit Interface Identification MIB	(3)	Yes	Yes	Yes	Yes	Yes
Individual SNMP Trap Support	(3)	Yes	Yes	Yes	Yes	Yes
IP Multicast						
Bidirectional PIM	(2)	No	Yes	Yes	No	No
IP Routing Protocols						
OSPF Flooding Reduction	(2)	Yes	Yes	Yes	Yes	Yes
Management						
Service Assurance Agent Enhancements		Yes	Yes	Yes	Yes	Yes
Miscellaneous						
AutoInstall Using DHCP for LAN Interfaces	(5)	Yes	Yes	Yes	Yes	Yes

Table 3 Feature List by Feature Set for the Cisco 1600 Routers, Part 1 (continued)

Features	In	Feature Set				
		IP	IP Plus	IP Plus IPSEC 56	IP/IPX	IP/IPX/AT/ IBM
Class-Based Quality of Service Management Information Base	(5)	Yes	Yes	Yes	Yes	Yes
Closed User Group Selection Facility Suppress Option	(5)	Yes	Yes	Yes	Yes	Yes
Implementing DiffServ for End-to-End Quality of Service	(5)	Yes	Yes	Yes	Yes	Yes
L2TP Tunnel Management Enhancements	(5)	No	Yes	Yes	No	No
L2TP Tunnel Switching	(5)	No	Yes	Yes	No	No
NAT - Support for NetMeeting Directory (Internet Locator Service - ILS)	(5)	Yes	Yes	Yes	Yes	Yes
NAT - Support of IP Phone to Cisco Call Manager	(5)	Yes	Yes	Yes	Yes	Yes
NTP MIB	(5)	No	Yes	Yes	No	No
Parser Cache	(5)	Yes	Yes	Yes	Yes	Yes
PIM Dense Mode State Refresh	(5)	No	Yes	Yes	No	No
SDLC SNRM Timer and Window Size Enhancements	(5)	No	No	No	No	Yes
UDLR Tunnel ARP and IGMP Proxy	(5)	No	Yes	Yes	No	No
WAN						
Frame Relay Switching Enhancements: Shaping and Policing	(2)	No	Yes	Yes	No	No

Table 4 Feature List by Feature Set for the Cisco 1600 Routers, Part 2

Features	In	Feature Set				
		IP/IPX/AT/ IBM Plus	IP/FW	IP/IPX/FW Plus	IP/FW Plus IPSEC 56	IP/IPX/AT/ IBM/FW Plus IPSEC 56
Configuration Fundamentals						
Circuit Interface Identification MIB	(3)	Yes	Yes	Yes	Yes	Yes
Individual SNMP Trap Support	(3)	Yes	Yes	Yes	Yes	Yes
IP Multicast						
Bidirectional PIM	(2)	Yes	No	Yes	Yes	Yes
IP Routing Protocols						
OSPF Flooding Reduction	(2)	Yes	Yes	Yes	Yes	Yes
Management						
Service Assurance Agent Enhancements		Yes	Yes	Yes	Yes	Yes
Miscellaneous						
AutoInstall Using DHCP for LAN Interfaces	(5)	Yes	Yes	Yes	Yes	Yes
Class-Based Quality of Service Management Information Base	(5)	Yes	Yes	Yes	Yes	Yes
Closed User Group Selection Facility Suppress Option	(5)	Yes	Yes	Yes	Yes	Yes
Implementing DiffServ for End-to-End Quality of Service	(5)	Yes	Yes	Yes	Yes	Yes
L2TP Tunnel Management Enhancements	(5)	Yes	No	Yes	Yes	Yes
L2TP Tunnel Switching	(5)	Yes	No	Yes	Yes	Yes
NAT - Support for NetMeeting Directory (Internet Locator Service - ILS)	(5)	Yes	Yes	Yes	Yes	Yes
NAT - Support of IP Phone to Cisco Call Manager	(5)	Yes	Yes	Yes	Yes	Yes
NTP MIB	(5)	Yes	No	Yes	Yes	Yes
Parser Cache	(5)	Yes	Yes	Yes	Yes	Yes
PIM Dense Mode State Refresh	(5)	Yes	No	Yes	Yes	Yes

Table 4 Feature List by Feature Set for the Cisco 1600 Routers, Part 2 (continued)

Features	In	Feature Set				
		IP/IPX/AT/ IBM Plus	IP/FW	IP/IPX/FW Plus	IP/FW Plus IPSEC 56	IP/IPX/AT/ IBM/FW Plus IPSEC 56
SDLC SNRM Timer and Window Size Enhancements	(5)	Yes	No	No	No	Yes
UDLR Tunnel ARP and IGMP Proxy	(5)	Yes	No	Yes	Yes	Yes
WAN						
Frame Relay Switching Enhancements: Shaping and Policing	(2)	Yes	No	Yes	Yes	Yes

New and Changed Information

The following sections list the new hardware and software features supported by the Cisco 1600 series routers for Release 12.1 T.

New Software Features in Cisco IOS Release 12.1(5)T

The following new software features are supported by the Cisco 1600 series routers for Release 12.1(5)T.

AutoInstall Using DHCP for LAN Interfaces

The AutoInstall Using DHCP for LAN Interfaces feature replaces the use of the Bootstrap Protocol (BOOTP) with the use of the Dynamic Host Configuration Protocol (DHCP) for Cisco IOS AutoInstall over LAN interfaces. AutoInstall is a Cisco IOS software feature which provides for the configuration of a new routing device automatically when the device is initialized. DHCP (defined in RFC 2131) is based on the Bootstrap Protocol, which provides the framework for passing configuration information to hosts on a TCP/IP network. DHCP adds the capability of automatic allocation of reusable network addresses and additional configuration options. In Cisco IOS release 12.1(5)T, the IP address procurement phase of the AutoInstall process is now accomplished using DHCP for Ethernet, Token Ring, and FDDI interfaces. Prior to this release, IP addresses for LAN interfaces were obtained using BOOTP during the AutoInstall process. The AutoInstall Using DHCP for LAN Interfaces feature also allows the routing device to recognize IP address allocation messages coming from regular BOOTP servers, providing a seamless transition for those devices already using BOOTP servers for AutoInstall. Additionally, this feature allows for the uploading of configuration files using unicast TFTP. For further details, please see the following document:

http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121newft/121t/121t5/dt_dhcpa.htm

Class-Based Quality of Service Management Information Base

The Class-Based Quality of Service Management Information Base (Class-Based QoS MIB) provides read access to class-based QoS configurations. This MIB also provides QoS statistics information based on the Modular QoS CLI, including information regarding class map and policy map parameters.

This Class-Based QoS MIB is actually two MIBs: CISCO-CLASS-BASED-QOS-MIB and CISCO-CLASS-BASED-QOS-CAPABILITY-MIB.

Closed User Group Selection Facility Suppress Option

A closed user group (CUG) selection facility is a specific encoding element that allows a destination data terminal equipment (DTE) to identify the CUG to which the source and destination DTEs belong. The Closed User Group Selection Facility Suppress Option feature enables a user to configure an X.25 data communications equipment (DCE) interface or X.25 profile with a DCE station type to remove the CUG selection facility from incoming call packets destined for the preferential CUG only or for all CUGs. You can also remove the selection facility from a CUG with outgoing access (CUG/OA).

Implementing DiffServ for End-to-End Quality of Service

Differentiated services (DiffServ) describes a set of end-to-end quality of service (QoS) capabilities. End-to-end QoS means that the network can deliver service required by specific network traffic from one end of the network to another. Cisco IOS QoS software supports three types of service models: best-effort, integrated (IntServ), and differentiated services (DiffServ).

For more information about the best-effort and integrated-service models, see the *Cisco IOS Quality of Service Solution Configuration Guide*.

Differentiated services is a multiple service model that satisfies different QoS requirements. The network tries to deliver service based on the QoS specified by each packet. This specification can occur in different ways, for example, using the 6-bit Differentiated Services Code Point (DSCP) setting in IP packets or source and destination addresses. The network uses the QoS specification to classify, mark, shape, police traffic, and perform intelligent queuing.

Differentiated services is used for several mission-critical applications and for providing end-to-end QoS. Typically, differentiated services is appropriate for aggregate flows because it performs a relatively coarse level of traffic classification.

Cisco IOS QoS includes the following features that support differentiated services:

- Committed access rate (CAR), which performs packet classification through IP precedence and QoS group settings. CAR performs metering and policing of traffic, providing bandwidth management.
- Intelligent queuing schemes such as Weighted Random Early Detection (WRED) and Weighted Fair Queuing (WFQ) and their equivalent features on the Versatile Interface Processor (VIP), which are VIP-distributed WRED services.
- Modular QoS Command-Line Interface (MQC) so that you can specify a traffic class independently of QoS policies.
- Low Latency Queuing (LLQ) brings strict priority queuing to Class-Based Weighted Fair Queuing (CBWFQ). Strict priority queuing allows delay-sensitive data, such as voice, to be unqueued and sent first (before packets in other queues are unqueued), giving delay-sensitive data preferential treatment over other traffic.

- Generic Traffic Shaping (GTS) shapes traffic by reducing outbound traffic flow to avoid congestion. It constrains traffic to a particular bit rate by using the token bucket mechanism. GTS applies on a per-interface basis and can use access lists to select the traffic to shape.

For more information about Cisco IOS QoS features, see the *Cisco IOS Quality of Service Solutions Guide* and the *Cisco IOS Quality of Service Command Reference*.

NAT - Support for NetMeeting Directory (Internet Locator Service - ILS)

Microsoft NetMeeting is a Windows-based application that enables multi-user interaction and collaboration from a users PC over the Internet or an intranet. Support for the NetMeeting Directory (ILS) allows connections by name from the directory built into the NetMeeting application. Destination IP addresses do not need to be known in order for a connection to be made.

NAT - Support of IP Phone to Cisco Call Manager

Cisco IP Phones use the Selsius Skinny Station Protocol to connect with and register to the Cisco Call Manager (CCM). Messages flow back and forth that include IP address and Port information which is used to identify other IP Phone users with which a call can be placed.

To be able to deploy Cisco IOS Network Address Translation (NAT) between the IP Phone and CCM in a scalable environment, NAT needs to be able to detect the Selsius Skinny Station Protocol and understand the information passed within the messages.

When an IP Phone attempts to connect to the CCM and it matches the configured NAT translation rules, NAT will translate the original source IP address and replace it with one from the configured pool. This new address is what will be reflected in the CCM and be visible to other IP Phone users.

NTP MIB

The Network Time Protocol (NTP) is used to synchronize timekeeping among a set of distributed time servers and clients. The Cisco NTP MIB enables users to remotely monitor an NTP server using the Simple Network Management Protocol (SNMP), provided the MIB itself is implemented on that server. Use of the NTP MIB to monitor the NTP status of routing devices is accomplished using software on a Network Management System (NMS). There are no new or modified Cisco IOS software commands associated with this feature.

The Cisco implementation of the NTP MIB is based on NTP version 3 (RFC-1305). The MIB objects are all read-only. SNMP requests are processed by reading the corresponding variables from the NTP subsystem and returning them in the response. The NTP MIB defines a set of NTP server system objects, including an NTP server peers table and an NTP server filter register table. For complete details on the Cisco implementation of the NTP MIB, see the MIB file itself ("CISCO-NTP-MIB.my", available through Cisco.com at <http://www.cisco.com/public/mibs/v2/>).

Parser Cache

The Parser Cache feature optimizes the parsing (translation) of Cisco IOS software configuration command lines by remembering how to parse recently encountered command lines. This feature was developed to improve the the scalability of the Cisco IOS software command-line interface (CLI) parser when processing large configuration files. This improvement is especially useful for those cases in which thousands of virtual circuits must be configured for interfaces, or hundreds of access lists (ACLs) are required. The parser chain cache can rapidly recognize and translate configuration lines which differ

slightly from previously used configuration lines (for example, `pvc 0/100`, `pvc 0/101`, and so on). Testing indicates an improvement to load time of between 30% and 36% for large configuration files when using the parser cache.

The parser cache is enabled by default on all platforms using Cisco IOS 12.1(5)T or later. A new command, `[no] parser cache`, allows the disabling or re-enabling of this feature.

PIM Dense Mode State Refresh

The PIM Dense Mode State Refresh feature keeps the pruned state in PIM dense mode from timing out by periodically forwarding a control message down the source-based distribution tree. The control message refreshes the prune state on the outgoing interfaces of each router in the distribution tree.

SDLC SNRM Timer and Window Size Enhancements

The SDLC SNRM Timer and Window Size Enhancements feature introduces a new window size setting for SDLC configurations, and a new timeout setting for the SNRM frame. These enhancements change the operation of SDLC processing on a multidrop line.

Window Size Setting

Prior to this feature, all SDLC addresses on the multidrop had the same window count. Now the window count can be configured on a Physical Unit (PU) or SDLC address level. This enhancement gives a controller a different window size than other devices on the interface, and allows devices attached to the multidrop to be sized individually.

Timeout Setting for SNRM frame

Cisco IOS software SDLC implementation currently utilizes a common response timer (T1) for all outstanding commands. Calculating the maximum frame size and line speed produces a minimum time of 3.5 seconds for receiving acknowledgments; thus, polling stations used for link activation utilize this 3.5-second timer. This is a problem on a multidrop, because stations that do not respond to the SNRM will have 3.5 seconds of downtime-waiting before the next station that is active is polled. This enhancement reduces the time to stations that are waiting idle, as opposed to those that are active.

UDLR Tunnel ARP and IGMP Proxy

Most protocols in the Internet assume that links are bidirectional. In particular, routing protocols used by directly connected routers no longer behave properly in the presence of a unidirectional link, such as a satellite link. The Unidirectional Link Routing feature, introduced in Cisco IOS Release 12.0(3)T, enables a router to emulate the behavior of a bidirectional link for operation of IP over unidirectional links.

The unidirectional link routing (UDLR) enhancements introduced in Cisco IOS Release 12.1(5)T include enhancements to the existing UDLR tunnel mechanism and the addition of the Internet Group Management Protocol (IGMP) proxy mechanism.

New Software Features in Cisco IOS Release 12.1(3)T

The following new software features are supported by the Cisco 1600 series routers for Release 12.1(3)T.

Circuit Interface Identification MIB

The Circuit Interface Description MIB feature adds support for a new Cisco enterprise MIB, used for monitoring individual circuits using SNMP. The Circuit Interface MIB (CISCO-CIRCUIT-INTERFACE-MIB) provides a MIB object which can be used to provide a description of individual circuit-based interfaces (for example, interfaces using ATM or Frame-Relay). This description will then be returned when linkup and linkdown SNMP traps are generated for the described interface.

The Circuit Interface MIB consists of a single table, with each row being a sequence of two objects: Circuit Interface Description (cciDescr) and Circuit Interface Status (cciStatus).

The cciDescr object is used to identify circuits using a textual description of up to 255 characters specified by the user (note that MIB objects are modified using network management system (NMS) applications, and can not be configured using the Cisco IOS command-line interface). When the row is created by a user, a value is set for the cciDescr object. The table is indexed by ifIndex from the IF-MIB. The cciStatus is the RowStatus object for the rows in the table.

The cciStatus object can be set to only two values by the user: createAndGo(4), which creates a new row, and destroy(6), which removes an existing row. If the row is created successfully, the cciStatus will be active(1). When creating a new row, the user should set the cciDescr object along with the cciStatus in a single **snmp set pdu** command. If the row is already active, only the cciDescr object can be modified. The other option is to delete the row first by setting the cciStatus to destroy(6) and then recreate the row with a new value for cciDescr. When creating a new row, the ifIndex is validated first. If the ifIndex value is not valid, the row is not created and an error code is returned. Similarly, if, when an interface is deleted, there was a corresponding row in this table, that row will be deleted automatically.

After a description is created for an interface, the description (the cciDescr object) will be sent along with the other varbinds as part of linkup and linkdown trap notifications.

Individual SNMP Trap Support

The Individual SNMP Trap Support Feature adds the ability to enable or disable SNMP system management notifications (traps) individually. SNMP traps that can be specified are *authentication-failure*, *linkup*, *linkdown*, and *coldstart*. This feature expands the functionality of the **snmp-server enable traps snmp** command. Prior to the introduction of this feature, all four trap types were enabled or disabled simultaneously by the **snmp-server enable traps snmp** command.

Individual SNMP Trap Support is supported for all versions of SNMP supported by Cisco IOS software (SNMPv1, SNMPv2c, and SNMPv3).



Note

As both SNMP traps and informs are enabled or disabled through the use of the **snmp-server enable traps** command, all references to traps in this document also apply to informs. The term "notifications" is used to refer to both traps and informs.

New Software Features in Cisco IOS Release 12.1(2)T

The following new software features are supported by the Cisco 1600 series routers for Release 12.1(2)T:

Bidirectional PIM

Bidir-PIM is a variant of the Protocol Independent Multicast (PIM) suite of routing protocols for IP multicast. In PIM, packet traffic for a multicast group is routed according to the rules of the mode configured for that multicast group. The Cisco IOS implementation of PIM supports three modes for a multicast group:

- Bidirectional mode
- Dense mode
- Sparse mode

A router can simultaneously support all three modes or any combination of them for different multicast groups. In bidirectional mode, traffic is only routed along a bidirectional shared tree that is rooted at the rendezvous point (RP) for the group. In bidir-PIM, the IP address of the RP acts as the key to having all routers establish a loop-free spanning tree topology rooted in that IP address. This IP address does not need to be a router, but can be any unassigned IP address on a network that is reachable throughout the PIM domain. Using this technique is the preferred configuration for establishing a redundant RP configuration for bidir-PIM.

Membership to a bidirectional group is signalled via explicit Join messages. Traffic from sources is unconditionally sent up the shared tree toward the RP and passed down the tree toward the receivers on each branch of the tree.

Bidir-PIM is designed to be used for many-to-many applications within individual PIM domains. Multicast groups in bidirectional mode can scale to an arbitrary number of sources without incurring overhead due to the number of sources.

Bidir-PIM is derived from the mechanisms of PIM sparse mode (PIM SM) and shares many SPT operations. Bidir-PIM also has unconditional forwarding of source traffic toward the RP upstream on the shared tree, but no registering process for sources as in PIM SM. These modifications are necessary and sufficient to allow forwarding of traffic in all routers solely based on the (*, G) multicast routing entries. This feature eliminates any source-specific state and allows scaling capability to an arbitrary number of sources.

Frame Relay Switching Enhancements: Shaping and Policing

The Frame Relay Switching Enhancements feature enables a router in a Frame Relay network to be used as a Frame Relay switch.

This feature includes the following Frame Relay switching enhancements:

- Traffic Shaping on Switched PVCs
- Frame Relay Switching over ISDN B Channels
- Traffic Policing on UNI DCE
- Congestion Management on Switched PVCs

Before the Frame Relay Switching Enhancements feature was introduced, routers had limited Frame Relay switching functionality. With this feature, a router acting as a virtual Frame Relay switch can be configured to do the following:

- Apply Frame Relay traffic shaping functionality to switched PVCs, enabling the router to act as a Frame Relay port concentrator.
- Support ISDN interfaces in addition to serial interfaces.
- Discard switched packets with the DE bit set when there is network congestion.
- Police incoming traffic to ensure adherence to service contracts.
- Set the Forward/Backward Explicit Congestion Notification (FECN/BECN) bits in switched packets when there is network congestion.

OSPF Flooding Reduction

The explosive growth of the Internet has placed the focus on the scalability of Interior Gateway Protocols such as OSPF. The networks using OSPF are becoming larger every day and will continue to expand to accommodate the demand to connect to the Internet.

Internet Service Providers and customers with large networks have regularly complained that OSPF has a traffic overhead, even when the network topology is stable.

By design, OSPF requires link-state advertisements (LSAs) to be refreshed as they expire after 3600 seconds. Some implementations have tried to improve the flooding by reducing the frequency to refresh from 30 minutes to around 50 minutes or so.

This solution reduces the amount of refresh traffic but requires at least one refresh before the LSA expires. The OSPF Flooding Reduction feature works by reducing unnecessary refreshing and flooding of already known and unchanged information. To achieve this reduction, the LSAs are now flooded with the higher bit set, thus making them DoNotAge (DNA) LSAs.

New Software Features in Cisco IOS Release 12.1(1)T

The following new software feature is supported by the Cisco 1600 series routers for Release 12.1(1)T:

Service Assurance Agent Enhancements

The Service Assurance (SA) Agent is both an enhancement to and a new name for the Response Time Reporter (RTR) feature that was introduced in Cisco IOS Release 11.2. The feature allows you to monitor network performance between a Cisco router and a remote device (which can be another Cisco router, an IP host, or a mainframe host) by measuring key Service Level Agreement (SLA) metrics such as response time, network resources, availability, jitter, connect time, packet loss and application performance. This feature enables you to perform troubleshooting, problem analysis, and notifications based on the statistics collected by the SA Agent.

The SA Agent Enhancements feature introduces new performance measurement operations and enhancements to assist in the measurement of SLAs. With Cisco IOS Release 12.1(1)T, the SA Agent provides new capabilities that enable you to do the following:

- Measure FTP file download response time using the new FTP operation.
- Monitor one-way latency reporting through enhancements to the Jitter operation.
- Configure a new option for the DHCP operation.

- Manually enable a responder port.
- Verify data for the UDPEcho operation.
- Configure new options for the **rtr schedule** command.
- Restart an operation.

Limitations and Restrictions

MIBs

Old Cisco Management Information Bases (MIBs) will be replaced in a future release. Currently, OLD-CISCO-* MIBs are being converted into more scalable MIBs—without affecting existing Cisco IOS products or NMS applications. You can update from deprecated MIBs to the replacement MIBs as shown in Table 5.

Table 5 *Deprecated and Replacement MIBs*

Deprecated MIB	Replacement
OLD-CISCO-APPLETALK-MIB	RFC1243-MIB
OLD-CISCO-CHASSIS-MIB	ENTITY-MIB
OLD-CISCO-CPUK-MIB	To be decided
OLD-CISCO-DECNET-MIB	To be decided
OLD-CISCO-ENV-MIB	CISCO-ENVMON-MIB
OLD-CISCO-FLASH-MIB	CISCO-FLASH-MIB
OLD-CISCO-INTERFACES-MIB	IF-MIB CISCO-QUEUE-MIB
OLD-CISCO-IP-MIB	To be decided
OLD-CISCO-MEMORY-MIB	CISCO-MEMORY-POOL-MIB
OLD-CISCO-NOVELL-MIB	NOVELL-IPX-MIB
OLD-CISCO-SYS-MIB	(Compilation of other OLD* MIBs)
OLD-CISCO-SYSTEM-MIB	CISCO-CONFIG-COPY-MIB
OLD-CISCO-TCP-MIB	CISCO-TCP-MIB
OLD-CISCO-TS-MIB	To be decided
OLD-CISCO-VINES-MIB	CISCO-VINES-MIB
OLD-CISCO-XNS-MIB	To be decided



Note

Cisco Management Information Base (MIB) User Quick Reference is no longer published. If you have an account with Cisco.com, you can find the current list of MIBs supported by Cisco. To reach the *Cisco Network Management Toolkit*, go to Cisco.com, press **Login**, and click to **Software Center: Network Mgmt Products: Cisco Network Management Toolkit: Cisco MIB**.

Important Notes

The following sections contain important notes about Cisco IOS Release 12.1 T that can apply to the Cisco 1600 series routers.

Last Maintenance Release of Cisco IOS Release 12.1 T

The last maintenance release of the 12.1 T release train is 12.1(5)T. The migration path for customers who need bug fixes for the 12.1 T features is the 12.2 mainline release. The 12.2 mainline release has the complete feature content of 12.1 T and will eventually reach general deployment (GD).

The last maintenance release was renamed from 12.1(4)T to 12.1(5)T to synchronize with its parent software base, the 12.1(5) mainline release, and to reflect that 12.1(5)T has all the bug fixes of the 12.1(5) mainline release. The 12.1 T release train is a superset of the 12.1 mainline release; hence any defect fixed in the 12.1 mainline is also fixed in 12.1 T. The set of features for 12.1(4)T is the same as that for 12.1(5)T. There was no change in the feature content of the release. The release was renamed so that the releases would be consistent with the Cisco release process.

Caveat CSCdr91706 and IOS HTTP Vulnerability

A defect in multiple releases of Cisco IOS software will cause a Cisco router or switch to halt and reload if the IOS HTTP service is enabled, browsing to `http://router-ip/anytext?/` is attempted, and the enable password is supplied when requested. This defect can be exploited to produce a denial of service (DoS) attack.

The vulnerability, identified as Cisco bug ID CSCdr91706, affects virtually all mainstream Cisco routers and switches running Cisco IOS software releases 12.0 through 12.1, inclusive. This is not the same defect as CSCdr36952.

The vulnerability has been corrected and Cisco is making fixed releases available for free to replace all affected IOS releases. Customers are urged to upgrade to releases that are not vulnerable to this defect as shown in detail below.

This vulnerability can only be exploited if the enable password is known or not set.

You are strongly encouraged to read the complete advisory, which is available at <http://www.cisco.com/warp/public/707/ioshttpserverquery-pub.shtml>.

Caveats

Caveats describe unexpected behavior in Cisco IOS software releases. Severity 1 caveats are the most serious caveats; severity 2 caveats are less serious. Severity 3 caveats are moderate caveats, and only select severity 3 caveats are included in the caveats document.

For information on caveats in Cisco IOS Release 12.1 T, see *Caveats for Cisco IOS Release 12.1 T*.

All caveats in Cisco IOS Release 12.1 are also in Cisco IOS Release 12.1 T.

For information on caveats in Cisco IOS Release 12.0, see *Caveats for Cisco IOS Release 12.1*, which lists severity 1 and 2 caveats and is located on Cisco.com and the Documentation CD-ROM.

**Note**

If you have an account with Cisco.com, you can use Bug Navigator II to find caveats of any severity for any release. To reach Bug Navigator II, go to Cisco.com and press **Login**. Then go to **Software Center: Cisco IOS Software: Cisco Bugtool Navigator II**. Another option is to go to <http://www.cisco.com/support/bugtools>.

Related Documentation

The following sections describe the documentation available for the Cisco 1600 series routers. These documents consist of hardware and software installation guides, Cisco IOS configuration and command references, system error messages, feature modules, and other documents.

Documentation is available as printed manuals or electronic documents, except for feature modules, which are available online on Cisco.com and the Documentation CD-ROM.

Use these release notes with these documents:

- Release-Specific Documents, page 17
- Platform-Specific Documents, page 18
- Feature Modules, page 18
- Cisco IOS Software Documentation Set, page 19

Release-Specific Documents

The following documents are specific to Cisco IOS Release 12.1 and are located on Cisco.com and the Documentation CD-ROM:

- *Cross-Platform Release Notes for Cisco IOS Release 12.1*

On Cisco.com at:

Technical Documents: Documentation Home Page: Cisco IOS Software Configuration: Cisco IOS Release 12.1

On the Documentation CD-ROM at:

Cisco Product Documentation: Cisco IOS Software Configuration: Cisco IOS Release 12.1: Release Notes: Cross-Platform Release Notes

- Product bulletins, field notices, and other release-specific documents on Cisco.com at:

Technical Documents

- *Caveats for Cisco IOS Release 12.1*

See *Caveats for Cisco IOS Release 12.1* and *Caveats for Cisco IOS Release 12.1 T*, which contain caveats applicable to all platforms for all maintenance releases of Cisco IOS Release 12.1 and Release 12.1 T.

On Cisco.com at:

Technical Documents: Documentation Home Page: Cisco IOS Software Configuration: Cisco IOS Release 12.1: Caveats

On the Documentation CD-ROM at:

Cisco Product Documentation: Cisco IOS Software Configuration: Cisco IOS Release 12.1: Caveats



Note If you have an account with Cisco.com, you can use Bug Navigator II to find caveats of any severity for any release. To reach Bug Navigator II, go to Cisco.com and press **Login**. Then go to **Software Center: Cisco IOS Software: Cisco Bugtool Navigator II**. Another option is to go to <http://www.cisco.com/support/bugtools>.

Platform-Specific Documents

These individual and groups of documents are available for the Cisco 1600 series routers on Cisco.com and the Documentation CD-ROM:

- *Quick Start Guides*
- *Cisco 1600 Series Hardware Installation Guide*
- *Cisco 1600 Series Software Configuration Guide*
- Cisco 1600 series router configuration notes
- Release notes for Cisco 1600 series routers
- Regulatory compliance and safety information for the Cisco 1600 series
- *WAN Interface Cards Hardware Installation Guide*
- *Cisco 1600 Fast Step Quick Start Guide*

On Cisco.com at:

Technical Documents: Documentation Home Page: Cisco Product Documentation: Access Servers and Access Routers: Modular Access Routers: Cisco 1600 Series Routers

On the Documentation CD-ROM at:

Cisco Product Documentation: Access Servers and Access Routers: Modular Access Routers: Cisco 1600 Series Routers

Feature Modules

Feature modules describe new features supported by Cisco IOS Release 12.1 T and are updates to the Cisco IOS documentation set. A feature module consists of a brief overview of the feature, benefits, configuration tasks, and a command reference. As updates, the feature modules are available online only. Feature module information is incorporated in the next printing of the Cisco IOS documentation set.

On Cisco.com at:

Technical Documents: Documentation Home Page: Cisco IOS Software Configuration: Cisco IOS Release 12.1: New Feature Documentation

On the Documentation CD-ROM at:

Cisco Product Documentation: Cisco IOS Software Configuration: Cisco IOS Release 12.1: New Feature Documentation

Cisco IOS Software Documentation Set

The Cisco IOS software documentation set consists of the Cisco IOS configuration guides, Cisco IOS command references, and several other supporting documents that are shipped with your order in electronic form on the Documentation CD-ROM—unless you specifically ordered the printed versions.

Documentation Modules

Each module in the Cisco IOS documentation set consists of two books: a configuration guide and a corresponding command reference. Chapters in a configuration guide describe protocols, configuration tasks, Cisco IOS software functionality, and contain comprehensive configuration examples. Chapters in a command reference provide complete command syntax information. Use each configuration guide with its corresponding command reference.

On Cisco.com and the Documentation CD-ROM, two master hot-linked documents provide information for the Cisco IOS software documentation set.

On Cisco.com at:

Technical Documents: Documentation Home Page: Cisco IOS Software Configuration: Cisco IOS Release 12.1: Configuration Guides and Command References

On the Documentation CD-ROM at:

Cisco Product Documentation: Cisco IOS Software Configuration: Cisco IOS Release 12.1: Configuration Guides and Command References

Cisco IOS Release 12.1 Documentation Set

Table 6 describes the contents of the Cisco IOS Release 12.1 software documentation set, which is available in electronic form and in printed form ordered.



Note

You can find the most current Cisco IOS documentation on Cisco.com and the Documentation CD-ROM. These electronic documents may contain updates and modifications made after the hard-copy documents were printed.

On Cisco.com at:

Technical Documents: Documentation Home Page: Cisco IOS Software Configuration: Cisco IOS Release 12.1

On the Documentation CD-ROM at:

Cisco Product Documentation: Cisco IOS Software Configuration: Cisco IOS Release 12.1

Table 6 Cisco IOS Software Release 12.1 Documentation Set

Books	Major Topics
<ul style="list-style-type: none"> • <i>Cisco IOS Configuration Fundamentals Configuration Guide</i> • <i>Cisco IOS Configuration Fundamentals Command Reference</i> 	<ul style="list-style-type: none"> Cisco IOS User Interfaces Cisco IOS File Management Cisco IOS System Management
<ul style="list-style-type: none"> • <i>Cisco IOS Bridging and IBM Networking Configuration Guide</i> • <i>Cisco IOS Bridging and IBM Networking Command Reference, Volume I</i> • <i>Cisco IOS Bridging and IBM Networking Command Reference, Volume II</i> 	<ul style="list-style-type: none"> Using Cisco IOS Software Overview of SNA Internetworking Bridging IBM Networking
<ul style="list-style-type: none"> • <i>Cisco IOS Dial Services Configuration Guide: Terminal Services</i> • <i>Cisco IOS Dial Services Configuration Guide: Network Services</i> • <i>Cisco IOS Dial Services Command Reference</i> 	<ul style="list-style-type: none"> Preparing for Dial Access Modem Configuration and Management ISDN and Signalling Configuration PPP Configuration Dial-on-Demand Routing Configuration Dial-Backup Configuration Terminal Service Configuration Large-Scale Dial Solutions Cost-Control Solutions Virtual Private Networks X.25 on ISDN Solutions Telco Solutions Dial-Related Addressing Services Interworking Dial Access Scenarios
<ul style="list-style-type: none"> • <i>Cisco IOS Interface Configuration Guide</i> • <i>Cisco IOS Interface Command Reference</i> 	<ul style="list-style-type: none"> Interface Configuration Overview Configuring LAN Interfaces Configuring Serial Interfaces Configuring Logical Interfaces
<ul style="list-style-type: none"> • <i>Cisco IOS IP and IP Routing Configuration Guide</i> • <i>Cisco IOS IP and IP Routing Command Reference</i> 	<ul style="list-style-type: none"> IP Addressing and Services IP Routing Protocols IP Multicast
<ul style="list-style-type: none"> • <i>Cisco IOS AppleTalk and Novell IPX Configuration Guide</i> • <i>Cisco IOS AppleTalk and Novell IPX Command Reference</i> 	<ul style="list-style-type: none"> AppleTalk and Novell IPX Overview Configuring AppleTalk Configuring Novell IPX
<ul style="list-style-type: none"> • <i>Cisco IOS Apollo Domain, Banyan VINES, DECnet, ISO CLNS, and XNS Configuration Guide</i> • <i>Cisco IOS Apollo Domain, Banyan VINES, DECnet, ISO CLNS, and XNS Command Reference</i> 	<ul style="list-style-type: none"> Apollo Domain, Banyan VINES, DECnet, ISO CLNS, and XNS Overview Configuring Apollo Domain Configuring Banyan VINES Configuring DECnet Configuring ISO CLNS Configuring XNS
<ul style="list-style-type: none"> • <i>Cisco IOS Multiservice Applications Configuration Guide</i> • <i>Cisco IOS Multiservice Applications Command Reference</i> 	<ul style="list-style-type: none"> Multiservice Applications Overview Voice Video Broadband

Table 6 Cisco IOS Software Release 12.1 Documentation Set

Books	Major Topics
<ul style="list-style-type: none"> • <i>Cisco IOS Quality of Service Solutions Configuration Guide</i> • <i>Cisco IOS Quality of Service Solutions Command Reference</i> 	Quality of Service Overview Classification Congestion Management Congestion Avoidance Policing and Shaping Signalling Link Efficiency Mechanisms Quality of Service Solutions
<ul style="list-style-type: none"> • <i>Cisco IOS Security Configuration Guide</i> • <i>Cisco IOS Security Command Reference</i> 	Security Overview Authentication, Authorization, and Accounting (AAA) Security Server Protocols Traffic Filtering and Firewalls IP Security and Encryption Other Security Features
<ul style="list-style-type: none"> • <i>Cisco IOS Switching Services Configuration Guide</i> • <i>Cisco IOS Switching Services Command Reference</i> 	Cisco IOS Switching Services Overview Cisco IOS Switching Paths Cisco Express Forwarding NetFlow Switching MPLS Switching Multilayer Switching Multicast Distributed Switching Virtual LANs LAN Emulation
<ul style="list-style-type: none"> • <i>Cisco IOS Wide-Area Networking Configuration Guide</i> • <i>Cisco IOS Wide-Area Networking Command Reference</i> 	Wide-Area Networking Overview Configuring ATM Configuring Frame Relay Configuring Frame Relay-ATM Interworking Configuring SMDS Configuring X.25 and LAPB
<ul style="list-style-type: none"> • <i>New Features in 12.1-Based Limited Lifetime Releases</i> • <i>New Features in Release 12.1 T</i> • Release Notes (Release note and caveat documentation for 12.1-based releases and various platforms) • <i>Cisco IOS Debug Command Reference</i> • <i>Cisco IOS Dial Services Quick Configuration Guide</i> 	

**Note**

Cisco Management Information Base (MIB) User Quick Reference is no longer published. If you have an account with Cisco.com, you can find the current list of MIBs supported by Cisco. To reach the *Cisco Network Management Toolkit*, go to CC, press **Login**, and click to **Software Center: Network Mgmt Products: Cisco Network Management Toolkit: Cisco MIB**.

Obtaining Documentation

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at <http://www.cisco.com>, <http://www-china.cisco.com>, or <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. Therefore, it is probably more current than printed documentation. The CD-ROM package is available as a single unit or as an annual subscription.

Ordering Documentation

Registered Cisco.com users can order the Documentation CD-ROM and other Cisco Product documentation through our online Subscription Services at <http://www.cisco.com/cgi-bin/subcat/kaojump.cgi>.

Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco's corporate headquarters (California, USA) at 408 526-4000 or, in North America, call 800 553-NETS (6387).

Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Warranty or maintenance contract customers can use the Technical Assistance Center. All customers can submit technical feedback on Cisco documentation using the web, e-mail, a self-addressed stamped response card included in many printed documents, or by sending mail to Cisco.

Cisco.com

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

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- WWW: www.cisco.com
- Telnet: cco.cisco.com
- Modem using standard connection rates and the following terminal settings: VT100 emulation; 8 data bits; no parity; and 1 stop bit.
 - From North America, call 408 526-8070
 - From Europe, call 33 1 64 46 40 82

You can e-mail questions about using Cisco.com to cco-team@cisco.com.

Technical Assistance Center

The Cisco Technical Assistance Center (TAC) is available to warranty or maintenance contract customers who need technical assistance with a Cisco product that is under warranty or covered by a maintenance contract.

To display the TAC web site that includes links to technical support information and software upgrades and for requesting TAC support, use www.cisco.com/techsupport.

To contact by e-mail, use one of the following:

Language	E-mail Address
English	tac@cisco.com
Hanzi (Chinese)	chinese-tac@cisco.com
Kanji (Japanese)	japan-tac@cisco.com
Hangul (Korean)	korea-tac@cisco.com
Spanish	tac@cisco.com
Thai	thai-tac@cisco.com

In North America, TAC can be reached at 800 553-2447 or 408 526-7209. For other telephone numbers and TAC e-mail addresses worldwide, consult the following web site: <http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml>.

Software Configuration Tips on the Cisco Technical Assistance Center Home Page

If you have a Cisco.com log-in account, you can access the following URL, which contains links and tips on configuring your Cisco products:

http://www.cisco.com/public/technotes/tech_sw.html

This URL is subject to change without notice. If it changes, point your Web browser to Cisco.com, press **Login**, and click on this path: **Technical Assistance Center: Technical Tips**.

The following sections are provided from the Technical Tips page:

- **Access Dial Cookbook**—Contains common configurations or recipes for configuring various access routes and dial technologies.
- **Field Notices**—Notifies you of any critical issues regarding Cisco products and includes problem descriptions, safety or security issues, and hardware defects.
- **Frequently Asked Questions**—Describes the most frequently asked technical questions about Cisco hardware and software.
- **Hardware**—Provides technical tips related to specific hardware platforms.
- **Hot Tips**—Describes popular tips and hints gathered from the Cisco Technical Assistance Center (TAC). Most of these documents are available from the TAC Fax-on-demand service. To reach Fax-on-demand and receive documents at your fax machine from the United States, call 888-50-CISCO (888-502-4726). From other areas, call 650-596-4408.
- **Internetworking Features**—Lists tips on using Cisco IOS software features and services.
- **Sample Configurations**—Provides actual configuration examples that are complete with topology and annotations.

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, for your convenience many documents contain a response card behind the front cover. Otherwise, you can mail your comments to the following address:

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

We appreciate and value your comments.

This document is to be used in conjunction with the documents listed in the “Related Documentation” section on page 17.

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