



About This Guide

This guide provides configuration information for features that are platform-specific to the Cisco 10000 series router. Documentation is also provided for cross-platform features that function differently on the Cisco 10000 series router than on other supported platforms.

Cross-platform features that function on the Cisco 10000 series router as they do on other supported platforms, and platform-independent features that are supported on the Cisco 10000 series router are described in the general Cisco IOS documentation.

This introduction provides information about the following topics:

- [Guide Revision History, page xxv](#)
- [Audience, page xxx](#)
- [Document Organization, page xxx](#)
- [Document Conventions, page xxxii](#)
- [Related Documentation, page xxxiii](#)
- [Obtaining Documentation, Obtaining Support, and Security Guidelines, page xxxiv](#)

Guide Revision History

Cisco IOS Release	Part Number	Publication Date
Release 12.2(33)XNE3	OL-2226-23	June, 2010

Added the features listed in the [“New Features in Cisco IOS Release 12.2\(33\)XNE3”](#) section on [page 1-16](#)

Cisco IOS Release	Part Number	Publication Date
Release 12.2(33)XNE	OL-2226-22	November, 2009

Added the features listed in the [“New Features in Cisco IOS Release 12.2\(33\)XNE”](#) section on [page 1-16](#)

Cisco IOS Release	Part Number	Publication Date
Release 12.2(33)SB3	OL-2226-21	December, 2008

Added the features listed in the [“New Features in Cisco IOS Release 12.2\(33\)SB3”](#) section on page 1-18

Cisco IOS Release	Part Number	Publication Date
Release 12.2(33)SB2	OL-2226-20	September, 2008

Added the features listed in the [“New Features in Cisco IOS Release 12.2\(33\)SB2”](#) section on page 1-18

Cisco IOS Release	Part Number	Publication Date
Release 12.2(33)SB	OL-2226-19	September, 2008

Added the scaling limit of L4R sessions for PRE2, PRE3, and PRE4 in the [Chapter 2, “Scalability and Performance”](#)

Cisco IOS Release	Part Number	Publication Date
Release 12.2(33)SB	OL-2226-18	March, 2008

Removed Using PXF Commands and Configuring Layer 2 Local Switching chapters.

Added the features listed in the [“New Features in Cisco IOS Release 12.2\(33\)SB”](#) section on page 1-18.

Cisco IOS Release	Part Number	Publication Date
Release 12.2(31)SB5	OL-2226-17	April, 2007

Added the GRE Tunnel IP Source and Destination VRF Membership feature in [Chapter 27, “IP Tunneling.”](#)

Added the [“New Features in Cisco IOS Release 12.2\(31\)SB5”](#) section on page 1-19.

Cisco IOS Release	Part Number	Publication Date
Release 12.2(31)SB3	OL-2226-16	February, 2007

Description

Added the features listed in the [“New Features in Cisco IOS Release 12.2\(31\)SB3”](#) section on page 1-19.

Cisco IOS Release	Part Number	Publication Date
Release 12.2(31)SB2	OL-2226-15	November, 2006

Description

Added the features listed in the [“New Features in Cisco IOS Release 12.2\(31\)SB2”](#) section on page 1-20.

Cisco IOS Release	Part Number	Publication Date
Release 12.2(28)SB	OL-2226-14	July, 2006

Description

Added the features listed in the [New Features in Cisco IOS Release 12.2\(28\)SB](#), page 1-21.

Cisco IOS Release	Part Number	Publication Date
Release 12.3(7)XI7	OL-2226-13	September, 2005

Description

Changed the Related Documentation link to the new [Cisco 10000 Series Router Documentation Roadmap](#)

Added the features listed in the [“New Features in Cisco IOS Release 12.3\(7\)XI7”](#) section on page 1-25.

Removed the “pointer to a pointer” for the PPPoE Circuit-Tag Processing feature by removing a summary and a pointer from Chapter 16, Configuring RADIUS Features, and retaining only the pointer to the feature module in the [New Features in Cisco IOS Release 12.3\(7\)XI3](#), page 1-26.

Removed the restriction for non-support of SSG in [Restrictions for IP Unnumbered on VLANs](#), page 7-3.

Added support for the 1-Port Channelized OC-12/STM-4 line card in [Restrictions for MR-APS](#), page 14-21.

Removed Chapter 16, “IEEE 802.1Q-in-Q VLAN Tag Termination,” and added a pointer to the *PPPoE—QinQ Support* feature guide, located at the following URL. This document includes support for IPoQ-in-Q.

http://www.cisco.com/en/US/products/sw/iosswrel/ps5207/products_feature_guide09186a00801f0f4a.html

Relocated the remaining QoS features to the *Cisco 10000 Series Router Quality of Service Configuration Guide*, located at the following URL:

http://www.cisco.com/en/US/products/hw/routers/ps133/products_configuration_guide_book09186a00805b9497.html

The chapter references for the following relocated features see the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

- Class-based Weighted Fair Queuing—See “Sharing Bandwidth Fairly During Congestion”
- Define Interface Policy-Map AV Pairs AAA—See “Configuring Dynamic Subscriber Services”
- Dynamic Bandwidth Selection—See “Configuring Dynamic Subscriber Services”
- Hierarchical Shaping—See “Shaping Traffic”
- IP Quality of Service for Subscribers—See “Regulating Subscriber Traffic”

- MPLS QoS—See “Configuring Quality of Service for MPLS Traffic”
- MPLS Traffic Engineering—Diffserv Aware—See “Configuring Quality of Service for MPLS Traffic”
- Per VRF AAA (see Chapter 18, “Configuring Quality of Service for MPLS Traffic”)

Added feature histories and mini tables of contents for each feature in this guide.

Added the Static MAC Address for PPPoE feature in [Chapter 6, “Configuring PPPoE over Ethernet and IEEE 802.1Q VLAN”](#)

Cisco IOS Release	Part Number	Publication Date
Release 12.3(7)XI6	OL-2226-10	June, 2005

Description

Corrected MR-APS configuration in [Example 14-1](#).

Added output policing behavior on an LNS VAI (CSCee07016) in [Restrictions for the LNS, page 5-28](#).

Corrected examples to show VLANs instead of ATM PVCs in [Chapter 6, “Configuring PPPoE over Ethernet and IEEE 802.1Q VLAN”](#).

Added a chapter to describe frequently-used show PXF commands in Chapter 23, “Using PXF Commands”.

Revised a note about mapping sessions to VRFs by using the RADIUS server in [PPP over Ethernet to MPLS VPN, page 3-5](#).

Added a description of PRE support on Cisco 10000 series routers in [Hardware Requirements, page 1-1](#).

Cisco IOS Release	Part Number	Publication Date
Release 12.3(7)XI3	OL-2226-09	March, 2005

Description

Added the features listed in the “[New Features in Cisco IOS Release 12.3\(7\)XI3](#)” section on page 1-26.

Corrected scaling limits for active VCs on ATM line cards (CSCeg37235) in:

- [VC Scaling, page 2-8](#)
- [Configuring atm pxf queuing, page 2-16](#)
- Restrictions for Hierarchical Shaping (moved to the *Cisco 10000 Series Router Quality of Service Configuration Guide*)
- [ATM VC Scaling and VC Assignment, page 8-4](#)
- [Restrictions for VBR-nrt Oversubscription, page 8-15](#)

Changed the configurable ATM oversubscription factor range from 1-50 to 1-500 in [Configuring VBR-nrt Oversubscription, page 8-17](#)

Corrected the restrictions for MPLS QoS to indicate that the **set mpls experimental imposition topmost** command is not supported.

Added a restriction for enabling IP multicast fast switching in [Restrictions for IP Multicast, page 15-34](#)

Changed the title of this guide to include MPLS configuration

Relocated QoS features to the *Cisco 10000 Series Router Quality of Service Configuration Guide*, located at the following URL:

http://www.cisco.com/en/US/products/hw/routers/ps133/products_configuration_guide_book09186a00805b9497.html

The chapter references in the following relocated features see the *Cisco 10000 Series Router Quality of Service Configuration*:

- Modular QoS CLI Overview—See “Quality of Service Overview.”
- MQC Policy Map Support on Configured VC Range ATM—See “Attaching Service Policies.”
- Strict Priority Queuing—See “Prioritizing Services.”
- 3-Color Policer—See “Policing Traffic.”
- Percent-Based Policing—See “Policing Traffic.”
- Queue Scaling—See “Managing Packet Queue Congestion.”
- IEEE 802.1p Class of Service—See “Marking Traffic.”
- Per DSCP Weighted Random Early Detection—See “Managing Packet Queue Congestion.”
- Per Precedence Weighted Random Early Detection Statistics—See “Managing Packet Queue Congestion.”
- Weighted Random Early Detection with Queue Limit—See “Managing Packet Queue Congestion.”
- VC Weighting—See “Oversubscribing Physical and Virtual Links.”
- Dynamic ATM VP and VC Configuration Modification—See “Oversubscribing Physical and Virtual Links.”
- Interface Oversubscription—See “Oversubscribing Physical and Virtual Links.”
- 3-Level Hierarchical QoS Policies—See “Defining QoS for Multiple Policy Levels.”

Cisco IOS Release	Part Number	Publication Date
Release 12.3(7)XI2	OL-2226-08	November, 2004

Description

Added the features listed in the “[New Features in Cisco IOS Release 12.3\(7\)XI2](#)” section on page 1-26.

Added a scaling limitation for create on demand PVCs and PPP sessions in [Limitations and Restrictions](#), page 2-3

Changed the SAR page limit (CSCee59870) in [ATM VC Scaling and VC Assignment](#), page 8-4

Added information about the behavior of high water mark and low water mark values used with VC weighting in High Water Mark and Low Water Mark Values (moved to the *Cisco 10000 Series Router Quality of Service Configuration Guide*)

Added a table indicating scaling limits for active VCs on ATM line cards in:

- [Configuring atm pxf queuing](#), page 2-16
- Restrictions for Hierarchical Shaping (moved to the *Cisco 10000 Series Router Quality of Service Configuration Guide*)
- [ATM VC Scaling and VC Assignment](#), page 8-4
- [Restrictions for VBR-nrt Oversubscription](#), page 8-15

Cisco IOS Release	Part Number	Publication Date
Release 12.3(7)XI1	OL-2226-07	August, 2004

Description

Added the new features listed in the [“New Features in Cisco IOS Release 12.3\(7\)XI1”](#) section on page 1-26.

Audience

This guide is designed for system and network managers responsible for configuring broadband aggregation, leased-line, and MPLS services and on the Cisco 10000 series router. The manager should be experienced using Cisco IOS software and be familiar with the operation of the Cisco 10000 series router.

Document Organization

This guide contains the following chapters:

Chapter	Title	Description
Chapter 1	Broadband Aggregation Overview	Lists new features and enhancements in each release; describes hardware requirements. Provides examples of broadband and leased-line architecture models.
Chapter 2	Scalability and Performance	Describes limitations and restrictions, and how to configure the Cisco 10000 series router for high scalability.
Chapter 3	Configuring Remote Access to MPLS VPN	Describes the Remote Access (RA) to MPLS VPN feature that allows the service provider to offer a scalable end-to-end VPN service to remote users.
Chapter 4	Configuring Multiprotocol Label Switching	Describes MPLS-related features, such as BGP Multipath load sharing, Session Limit per VRF, and Half-duplex VRF.
Chapter 5	Configuring Layer 2 Tunnel Protocol Access Concentrator and Network Server	Describes how to configure the Cisco 10000 series router as a Layer 2 Tunnel Protocol Access Concentrator (LAC) or as an L2TP Network Server (LNS). The managed LNS feature of the Cisco 10000 series router enables the router to assign a subscriber session to a VRF instance and route the session within the VRF to the destination network.
Chapter 6	Configuring PPPoE over Ethernet and IEEE 802.1Q VLANs	Describes the PPPoE over Ethernet feature that enables direct connection to an Ethernet interface. Also describes the IEEE 802.1Q VLANs feature that enables the Cisco 10000 series router to support PPPoE over IEEE 802.1Q encapsulated VLANs using Gigabit Ethernet.
Chapter 7	Configuring IP Unnumbered over VLAN	Describes the IP Unnumbered over VLAN feature that helps service providers to conserve IP address space for service provider configurations that include Ethernet VLAN subinterfaces.

Chapter	Title	Description
Chapter 8	Configuring ATM Permanent Virtual Circuit Autoprovisioning	Describes how to configure the ATM PVC autoprovisioning feature that enables DSL wholesale service providers to dynamically provision ATM service for subscribers using a local configuration. Also describes the VBR-nrt Oversubscription feature.
Chapter 9	Configuring the Multihop Feature	Describes how to configure the multihop feature that enables the Cisco 10000 series router to terminate sessions arriving in L2TP tunnels from LACs and to forward the sessions through new L2TP tunnels to the router's peer L2TP Network Server (LNS). Also describes how to configure the preservation of the IP type of service (ToS) field for tunneled IP packets.
Chapter 10	Configuring Address Pools	Describes address assignment mechanisms, including the on-demand address pool manager feature and the overlapping addresses feature. Describes how to configure each of these features.
Chapter 11	Configuring Local AAA Server, User Database—Domain to VRF	Describes the Local AAA Server, User Database—Domain to VRF feature, which extends the Cisco IOS AAA Authorization to local AAA profiles on the router without using an AAA Server.
Chapter 12	Configuring Traffic Filtering	Describes the IP Receive ACLs and Time-Based ACLs features that provide filtering capability for traffic that is destined for the router and protects the router from remote intrusions.
Chapter 13	Unicast Reverse Path Forwarding	Describes the Unicast Reverse Path Forwarding feature that verifies if the path of an incoming packet is consistent with the local packet forwarding information. The validity of this path determines whether uRPF passes or drops the packet.
Chapter 14	Configuring Automatic Protection Switching	Describes the Multirouter Automatic Protection Switching (MR-APS) feature that enables SONET connections to switch from one SONET circuit to another SONET circuit if a circuit failure occurs.
Chapter 15	Configuring IP Multicast	Describes the IP Multicast feature.
Chapter 16	Configuring RADIUS Features	Describes the RADIUS attribute screening, RADIUS transmit retries, RADIUS Attribute 31: PPPoX Calling-Station-ID, and RADIUS packet of disconnect features.
Chapter 17	Configuring L2 Virtual Private Networks	Describes L2VPN features of both LS and AToM types available on Cisco 10000 series router.
Chapter 18	Configuring L2VPN Interworking	Describes L2 interworking features available on Cisco 10000 series router.
Chapter 19	Configuring Multilink Point-to-Point Connections	Describes MLP and how to configure it on serial and ATM connections on the Cisco 10000 series router.
Chapter 20	Configuring Gigabit EtherChannel Features	Describes Gigabit EtherChannel features available on Cisco 10000 series router.
Chapter 21	Configuring IP Version 6	Lists the IPv6 features that are supported on the Cisco 10000 series router and notes limitations of that support.
Chapter 22	Configuring Template ACLs	Describes Template ACLs, in which one ACL represents many similar ACLs.

Chapter	Title	Description
Chapter 23	Protecting the Router from DoS Attacks	Describes how to protect against denial of service (DoS) attacks.
Chapter 24	IP Tunneling	Describes the Generic Routing Encapsulation Tunnel IP Source and Destination VRF Membership feature.
Appendix A	RADIUS Attributes	Lists RADIUS attributes that the Cisco 10000 series router supports.

This guide also includes a Glossary and an Index.

Document Conventions

This guide uses the following conventions:

- **Bold** is used for commands, keywords, and buttons.
- *Italics* are used for command input for which you supply values.
- Screen font is used for examples of information that are displayed on the screen.
- **Bold screen** font is used for examples of information that you enter.
- Vertical bars (|) indicate separate alternative, mutually exclusive elements.
- Square brackets ([]) indicate optional elements.
- Braces ({ }) indicate a required choice.
- Braces within square brackets ([{}]) indicate a required choice within an optional element.



Note

Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the guide.



Timesaver

Means the *described action saves time*. You can save time by performing the action described in the paragraph.



Caution

Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.



Warning

Means ***danger***. You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and familiar with standard practices for preventing accidents. To see translated versions of warnings, refer to the ***Regulatory Compliance and Safety Information*** document that accompanied the device.

Related Documentation

For more information about the Cisco 10000 series router, its features, and hardware, go to the Cisco 10000 series router documentation roadmap, located at the following URL:

http://www.cisco.com/en/US/products/hw/routers/ps133/products_documentation_roadmap09186a00804ba4f3.html

For information about Cisco IOS Release 12.2, including command reference and system error messages, go to the Cisco IOS Release 12.2 documentation web page, located at the following URL:

http://www.cisco.com/en/US/products/sw/iosswrel/ps1835/tsd_products_support_series_home.html

RFCs

RFC	Title
RFC 791	Internet Protocol
RFC 1163	A Border Gateway Protocol (BGP)
RFC 1483	Multiprotocol Encapsulation over ATM
RFC 1490	Multiprotocol Interconnect over Frame Relay
RFC 1661	The Point-to-Point Protocol (PPP)
RFC 1990	The PPP Multilink Protocol (MP)
RFC 2373	IP Version 6 Addressing Architecture
RFC 2516	A Method for Transmitting PPP Over Ethernet (PPPoE)
RFC 2529	Transmission of IPv6 over IPv4 Domains without Explicit Tunnels
RFC 2661	Layer Two Tunneling Protocol "L2TP"
RFC 2685	Virtual Private Networks Identifier
RFC 2867	RADIUS Accounting Modifications for Tunnel Protocol Support
RFC 3036	LDP Specification
RFC 3107	Carrying Label Information in BGP-4
RFC 3587	IPv6 Global Unicast Address Format
RFC 4193	Unique Local IPv6 Unicast Addresses
RFC 4659	BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN
RFC 2684	Multiprotocol Encapsulation over ATM Adaptation Layer 5
RFC 2427	Multiprotocol Interconnect over Frame Relay

Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and also recommended aliases and general Cisco documents, see the monthly *What's New in Cisco Product Documentation*, which also lists all new and revised Cisco technical documentation, at:

<http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html>