



# Cross-Platform Release Notes for Cisco IOS Release 12.2SB

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Cisco IOS Release 12.2(33)SB15

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These release notes support Cisco IOS Release 12.2SB up to and including Cisco IOS Release 12.2(33)SB15. These release notes are updated as needed to describe new features, memory requirements, hardware support, software platform deferrals, and related documents.

Cisco IOS Release 12.2SB is tailored for service provider networks and large-scale enterprise networks. The main purposes of Release 12.2SB are the following:

- For the Cisco 10000 series, to introduce greater scalability for Multiprotocol Label Switching (MPLS) provider edge (PE) applications with the introduction of advanced High Availability (HA) capabilities.
- For the Cisco 7200 series, Cisco 7301, and Cisco 10000 series, to introduce the Intelligent Service Gateway (ISG).
- For the Cisco 7304, to introduce significant improvements for MPLS VPNs by supporting advanced quality of service (QoS) features such as a multiple action policer and support for 3-level hierarchical policies.

For more information, see the [“Introduction” section on page 2](#).

For a list of the software caveats that apply to Cisco IOS Release 12.2SB, see the [“Troubleshooting” section on page 170](#), the [Caveats for Cisco IOS Release 12.2](#) document, and the “Caveats” section in the [Cross-Platform Release Notes for Cisco IOS Release 12.2S](#). These documents are updated for every maintenance release and are located on Cisco.com.

Use these release notes with the [Cross-Platform Release Notes for Cisco IOS Release 12.2](#) document and the [Cross-Platform Release Notes for Cisco IOS Release 12.2S](#), both of which are located on Cisco.com.

We recommend that you view the field notices for this release to see if your software or hardware platforms are affected. If you have an account on Cisco.com, you can find field notices at [http://www.cisco.com/warp/customer/tech\\_tips/index/fn.html](http://www.cisco.com/warp/customer/tech_tips/index/fn.html). If you do not have a Cisco.com login account, you can find field notices at [http://www.cisco.com/warp/public/tech\\_tips/index/fn.html](http://www.cisco.com/warp/public/tech_tips/index/fn.html).



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## Introduction

Cisco IOS Release 12.2SB is based on Cisco IOS Release 12.2(25)S and includes many features from Cisco IOS Release 12.2T.

For the Cisco 10000 series, Release 12.2SB supports select features from Release 12.2(25)S that include Multiprotocol Label Switching (MPLS) provider edge (PE) feature parity with Cisco IOS Release 12.0(27)S, along with greater scalability and feature enhancements.

For the Cisco 7200 series and Cisco 7301, all features that are in Release 12.2(25)S are also in Release 12.2SB. (Cisco IOS Release 12.2(33)SB does not support Cisco 7200 series and Cisco 7301 series routers. To upgrade, move to Cisco IOS Release 12.2(33)SRC.)

For the Cisco 7304, all features that are supported in Cisco IOS Release 12.2S, up to and including Release 12.2(25)S3, are also in Release 12.2SB.

Many of the features and the hardware that are supported in this software have been previously released to customers on other software releases.

For information on new features and Cisco IOS commands that are supported by Release 12.2SB, see the [“New and Changed Information” section on page 30](#) and the [“Troubleshooting” section on page 170](#).

## Early Deployment Releases

These release notes describe the Cisco 7200 series routers, Cisco 7301 router, Cisco 7304 router, and Cisco 10000 series routers for Cisco IOS Release 12.2SB, which is an early deployment (ED) release based on Cisco IOS Release 12.2 and Release 12.2S. Early deployment releases contain fixes for software caveats and support for new Cisco hardware and software features. [Table 1](#) shows the Cisco IOS Release 12.2SB early deployment releases for the above-mentioned platforms.

**Table 1** *Early Deployment Releases for the Cisco 7200 Series, Cisco 7301, Cisco 7304, and Cisco 10000 Series*

<b>Cisco IOS ED Release</b>	<b>Type of ED Release</b>	<b>Additional Software Features</b>	<b>Additional Hardware Features</b>	<b>Availability</b>
12.2(33)SB11	Rebuild	No new software features.	No new hardware features.	09/28/2011
12.2(33)SB10	Rebuild	No new software features.	No new hardware features.	04/11/2011
12.2(33)SB9	Rebuild	No new software features.	No new hardware features.	10/27/2010
12.2(33)SB8a	Rebuild	No new software features.	No new hardware features.	02/10/2010
12.2(33)SB8	Rebuild	See the <a href="#">“New Software Features in Cisco IOS Release 12.2(33)SB8”</a> section on page 31.	No new hardware features.	01/20/2010
12.2(33)SB7	Rebuild	See the <a href="#">“New Software Features in Cisco IOS Release 12.2(33)SB7”</a> section on page 32.	No new hardware features.	08/20/2009
12.2(33)SB6	Rebuild	No new software features.	No new hardware features.	07/15/2009
12.2(33)SB5	Rebuild	No new software features.	No new hardware features.	04/08/2009
12.2(33)SB4	Rebuild	No new software features.	No new hardware features.	03/30/2009
12.2(33)SB3	Rebuild	No new software features.	No new hardware features.	01/05/2009
12.2(33)SB2	Rebuild	See the <a href="#">“New Software Features in Cisco IOS Release 12.2(33)SB2”</a> section on page 33.	See the <a href="#">“New Hardware Features in Cisco IOS Release 12.2(33)SB2”</a> section on page 33.	09/29/2008
12.2(33)SB1	Rebuild	No new software features.	No new hardware features.	07/15/2008
12.2(33)SB <sup>1</sup>	Maintenance	See the <a href="#">“New Software Features in Cisco IOS Release 12.2(33)SB”</a> section on page 36.	See the <a href="#">“New Hardware Features in Cisco IOS Release 12.2(33)SB”</a> section on page 35.	04/20/2008
12.2(31)SB21	Rebuild	No new software features.	No new hardware features.	06/10/2011
12.2(31)SB20	Rebuild	No new software features.	No new hardware features.	2/25/2011
12.2(31)SB19	Rebuild	No new software features.	No new hardware features.	09/20/2010
12.2(31)SB18	Rebuild	No new software features.	No new hardware features.	03/31/2010
12.2(31)SB17	Rebuild	No new software features.	No new hardware features.	11/05/2009
12.2(31)SB16	Rebuild	No new software features.	No new hardware features.	07/23/2009
12.2(31)SB15	Rebuild	No new software features.	No new hardware features.	04/03/2009
12.2(31)SB14	Rebuild	No new software features.	No new hardware features.	01/23/2009
12.2(31)SB13	Rebuild	No new software features.	No new hardware features.	08/27/2008
12.2(31)SB12	Rebuild	See the <a href="#">“New Software Features in Cisco IOS Release 12.2(31)SB12”</a> section on page 62.	No new hardware features.	06/06/2008
12.2(31)SB11	Rebuild	No new software features.	No new hardware features.	02/11/2008
12.2(31)SB10	Rebuild	See the <a href="#">“New Software Features in Cisco IOS Release 12.2(31)SB10”</a> section on page 63.	No new hardware features.	11/20/2007
12.2(31)SB9	Rebuild	No new software features.	No new hardware features.	10/22/2007

**Table 1** Early Deployment Releases for the Cisco 7200 Series, Cisco 7301, Cisco 7304, and Cisco 10000 Series (con-

Cisco IOS ED Release	Type of ED Release	Additional Software Features	Additional Hardware Features	Availability
12.2(31)SB8	Rebuild	No new software features.	No new hardware features.	09/20/2007
12.2(31)SB7	Rebuild	No new software features.	No new hardware features.	08/23/2007
12.2(31)SB6	Rebuild	See the “New Software Features in Cisco IOS Release 12.2(31)SB6” section on page 63.	See the “New Hardware Features in Cisco IOS Release 12.2(31)SB6” section on page 63.	07/12/2007
12.2(31)SB5 <sup>2</sup>	Rebuild	See the “New Software Features in Cisco IOS Release 12.2(31)SB5” section on page 65.	See the “New Hardware Features in Cisco IOS Release 12.2(31)SB5” section on page 64.	04/23/2007
12.2(31)SB3x	Rebuild	No new software features.	No new hardware features.	04/13/2007
12.2(31)SB3	Deferred Rebuild	See the “New Software Features in Cisco IOS Release 12.2(31)SB3” section on page 66.	No new hardware features.	02/23/2007
12.2(31)SB2 <sup>3</sup>	Maintenance	See the “New Software Features in Cisco IOS Release 12.2(31)SB2” section on page 70.	See the “New Hardware Features in Cisco IOS Release 12.2(31)SB2” section on page 67.	12/04/2006
12.2(28)SB13	Rebuild	No new software features	No new hardware features	01/30/2009
12.2(28)SB12	Rebuild	No new software features	No new hardware features	03/28/2008
12.2(28)SB11	Rebuild	No new software features	No new hardware features	02/06/2008
12.2(28)SB10	Rebuild	No new software features.	No new hardware features.	11/05/2007
12.2(28)SB9	Rebuild	No new software features.	No new hardware features.	08/08/2007
12.2(28)SB8	Rebuild	No new software features.	No new hardware features.	05/25/2007
12.2(28)SB7	Rebuild	No new software features.	No new hardware features.	05/02/2007
12.2(28)SB6	Rebuild	See the “New Software Features in Cisco IOS Release 12.2(28)SB6” section on page 105.	See the “New Hardware Features in Cisco IOS Release 12.2(28)SB6” section on page 105.	01/12/2007
12.2(28)SB5	Rebuild	No new software features.	No new hardware features.	10/03/2006
12.2(28)SB4	Rebuild	No new software features.	No new hardware features.	08/31/2006
12.2(28)SB3	Rebuild	No new software features.	No new hardware features.	07/24/2006
12.2(28)SB2	Rebuild	See the “New Software Features in Cisco IOS Release 12.2(28)SB2” section on page 106.	See the New Hardware Features in Cisco IOS Release 12.2(28)SB2, page 106.	06/19/2006
12.2(28)SB1	Rebuild	No new software features.	No new hardware features.	05/11/2006
12.2(28)SB	Maintenance	See the “New Software Features in Cisco IOS Release 12.2(28)SB” section on page 112.	See the “New Hardware Features in Cisco IOS Release 12.2(28)SB” section on page 110.	03/20/2006

1. Cisco IOS Release 12.2(33)SB does not support Cisco 7200 series and Cisco 7301 series routers. To upgrade, move to Cisco IOS Release 12.2(33)SRC.
2. Cisco IOS Release 12.2(31)SB4 is not publicly available.
3. Cisco IOS Release 12.2(31)SB and Release 12.2(31)SB1 are not publicly available.

# System Requirements

This section describes the system requirements for Cisco IOS Release 12.2SB and includes the following sections:

- [Supported Hardware, page 5](#)
  - [Determining the Software Version, page 11](#)
  - [Upgrading to a New Software Release, page 11](#)
  - [Microcode Software, page 12](#)
  - [Feature Support, page 28](#)
  - [Memory Recommendations, page 30](#)
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## Supported Hardware

This section describes the platforms, port adapters, and line cards that are supported in Cisco IOS Release 12.2SB and consists of the following subsections:

- [Supported Platforms, page 5](#)
- [Supported Port Adapters for the Cisco 7200 Series, Cisco 7301, and Cisco 7304, page 7](#)
- [Supported Line Cards for the Cisco 10000 Series Routers, page 10](#)

## Supported Platforms

Cisco IOS Release 12.2SB supports the following platforms:

- Cisco 7200 series routers (Cisco IOS Release 12.2(33)SB does not support Cisco 7200 series routers. To upgrade, move to Cisco IOS Release 12.2(33)SRC.)
- Cisco 7301 router (Cisco IOS Release 12.2(33)SB does not support Cisco 7301 series routers. To upgrade, move to Cisco IOS Release 12.2(33)SRC.)
- Cisco 7304 router
- Cisco 10000 series routers (the Cisco 10008 with a PRE-2, PRE-3, or PRE-4) is supported in Cisco IOS Release 12.2(33)SB. For detailed descriptions of the new hardware features, see the [“New and Changed Information” section on page 30](#).

For detailed descriptions of the new hardware features, see the [“New and Changed Information” section on page 30](#).

Table 2 describes the supported platforms for Cisco IOS Release 12.2SB and uses the following conventions:

- Yes—The platform is supported in the release.
- No—The platform is not supported in the release.

**Table 2** Supported Platforms for Cisco IOS Release 12.2SB

Cisco IOS Release	7200 Series <sup>1</sup>	7301 Router	7304 Router	10000 Series
12.2(33)SB11	No	No	Yes	Yes
12.2(33)SB10	No	No	Yes	Yes
12.2(33)SB9	No	No	Yes	Yes
12.2(33)SB8a	No	No	Yes	Yes
12.2(33)SB8	No	No	Yes	Yes
12.2(33)SB7	No	No	Yes	Yes
12.2(33)SB6	No	No	Yes	Yes
12.2(33)SB5	No	No	Yes	Yes
12.2(33)SB4	No	No	Yes	Yes
12.2(33)SB3	No	No	Yes	Yes
12.2(33)SB2	No	No	Yes	Yes
12.2(33)SB1	No	No	Yes	Yes
12.2(33)SB <sup>2</sup>	No	No	Yes	Yes
12.2(31)SB21	Yes	Yes	Yes	Yes
12.2(31)SB20	Yes	Yes	Yes	Yes
12.2(31)SB19	Yes	Yes	Yes	Yes
12.2(31)SB18	Yes	Yes	Yes	Yes
12.2(31)SB17	Yes	Yes	Yes	Yes
12.2(31)SB16	Yes	Yes	Yes	Yes
12.2(31)SB15	Yes	Yes	Yes	Yes
12.2(31)SB14	Yes	Yes	Yes	Yes
12.2(31)SB13	Yes	Yes	Yes	Yes
12.2(31)SB12	Yes	Yes	Yes	Yes
12.2(31)SB11	Yes	Yes	Yes	Yes
12.2(31)SB10	Yes	Yes	Yes	Yes
12.2(31)SB9	Yes	Yes	Yes	Yes
12.2(31)SB8	Yes	Yes	Yes	Yes
12.2(31)SB7	Yes	Yes	Yes	Yes
12.2(31)SB6	Yes	Yes	Yes	Yes
12.2(31)SB5 <sup>3</sup>	Yes	Yes	Yes	Yes
12.2(31)SB3x	Yes	Yes	Yes	Yes
12.2(31)SB3	Yes	Yes	Yes	Yes

**Table 2** Supported Platforms for Cisco IOS Release 12.2SB (continued)

Cisco IOS Release	7200 Series <sup>1</sup>	7301 Router	7304 Router	10000 Series
12.2(31)SB2 <sup>4</sup>	Yes	Yes	Yes	Yes
12.2(28)SB13	Yes	Yes	Yes	Yes
12.2(28)SB12	Yes	Yes	Yes	Yes
12.2(28)SB11	Yes	Yes	Yes	Yes
12.2(28)SB10	Yes	Yes	Yes	Yes
12.2(28)SB9	Yes	Yes	Yes	Yes
12.2(28)SB8	Yes	Yes	Yes	Yes
12.2(28)SB7	Yes	Yes	Yes	Yes
12.2(28)SB6	Yes	Yes	Yes	Yes
12.2(28)SB5	Yes	Yes	Yes	Yes
12.2(28)SB4	Yes	Yes	Yes	Yes
12.2(28)SB3	Yes	Yes	Yes	Yes
12.2(28)SB2	Yes	Yes	Yes	Yes
12.2(28)SB1	No	No	Yes	No
12.2(28)SB	Yes	Yes	Yes	Yes

1. The Cisco 7201 is introduced in Cisco IOS Release 12.2(31)SB5.
2. Cisco IOS Release 12.2(33)SB does not support Cisco 7200 series and Cisco 7301 series routers. To upgrade, move to Cisco IOS Release 12.2(33)SRC.
3. Cisco IOS Release 12.2(31)SB4 is not publicly available.
4. Cisco IOS Release 12.2(31)SB and Release 12.2(31)SB1 are not publicly available.

## Supported Port Adapters for the Cisco 7200 Series, Cisco 7301, and Cisco 7304

Table 3 lists the port adapters that are supported for the Cisco 7200 series routers, and Cisco 7301 router in Cisco IOS Release 12.2SB and uses the following conventions:

- Yes—The port adapter is supported in the software image.
- No—The port adapter is not supported in the software image.
- In—The release in the “In” column indicates the Cisco IOS 12.2SB release in which the port adapter was introduced. If a cell in this column contains an em dash (—), support for the port adapter was inherited from Cisco IOS Release 12.2 or from another release and was included in the initial base release of Cisco IOS Release 12.2SB.

**Table 3** Supported Port Adapters for the Cisco 7200 Series, Cisco 7301, and Cisco 7304

Cisco Product Number <sup>1</sup>	Adapter Description	In	7200 Series		7301 Router	7304 Router
			7201	VXR		
<b>ATM Port Adapters</b>						
PA-A3-OC3MM	1-port ATM Enhanced OC3c/STM1 multimode	—	Yes	Yes	Yes	Yes
PA-A3-OC3SMI	1-port ATM Enhanced OC3c/STM1 single mode (IR)	—	Yes	Yes	Yes	Yes

**Table 3 Supported Port Adapters for the Cisco 7200 Series, Cisco 7301, and Cisco 7304 (continued)**

Cisco Product Number <sup>1</sup>	Adapter Description	In	7200 Series		7301 Router	7304 Router
			7201	VXR		
PA-A3-OC3SML	1-port ATM Enhanced OC3c/STM1 single mode (LR)	—	No	Yes	Yes	Yes
PA-A3-OC12MM	1-port ATM Enhanced OC12/STM4 multimode	—	No	No	No	No
PA-A3-OC12SMI	1-port ATM Enhanced OC12/STM4 single mode (IR)	—	No	No	No	No
PA-A3-E3	1-port ATM Enhanced E3	—	No	Yes	Yes	Yes
PA-A3-T3	1-port ATM Enhanced DS3	—	Yes	Yes	Yes	Yes
PA-A3-8E1IMA	8-port ATM Inverse Mux E1, 120 ohms	—	Yes	Yes	Yes	Yes
PA-A3-8T1IMA	8-port ATM Inverse Mux T1	—	Yes	Yes	Yes	Yes
PA-A6-OC3MM	1-port ATM OC-3c/STM-1 multimode, enhanced	12.2(28)SB	Yes	Yes	Yes	Yes <sup>2</sup>
PA-A6-OC3SMI	1-port ATM OC-3c/STM-1 single-mode (IR), enhanced	12.2(28)SB	Yes	Yes	Yes	Yes <sup>2</sup>
PA-A6-OC3SML	1-port ATM OC-3c/STM-1 single-mode (LR), enhanced	12.2(28)SB	Yes	Yes	Yes	Yes <sup>2</sup>
PA-A6-T3	1-port ATM DS3, enhanced	12.2(28)SB	Yes	Yes	Yes	Yes <sup>2</sup>
PA-A6-E3	1-port ATM E3, enhanced	12.2(28)SB	Yes	Yes	Yes	Yes <sup>2</sup>
<b>Ethernet/Fast Ethernet/Gigabit Ethernet Port Adapters</b>						
PA-4E	4-port Ethernet 10BASE-T	—	No	Yes	Yes	Yes
PA-4E1G/75	4-port E1 G.703 Serial, 75 ohms/unbalanced	—	Yes	Yes	Yes	Yes
PA-4E1G/120	4-port E1 G.703 Serial, 120 ohms/balanced	—	Yes	Yes	Yes	Yes
PA-8E	8-port Ethernet 10BASE-T	—	Yes	Yes	Yes	Yes
PA-2FE-FX	2-port Fast Ethernet 100BASE-FX	—	Yes	Yes	Yes	Yes
PA-2FE-TX	2-port Fast Ethernet 100BASE-TX	—	Yes	Yes	Yes	Yes
PA-GE	1-port Gigabit Ethernet	—	Yes	Yes	No	Yes
<b>High-Speed Serial Port Adapters</b>						
PA-H	1-port High-Speed Serial Interface (HSSI)	—	Yes	Yes	Yes	Yes
PA-2H	2-port High-Speed Serial Interface (HSSI)	—	No	Yes	Yes	Yes
<b>Multichannel Serial Port Adapters</b>						
PA-MC-T3	1-port multichannel T3	—	Yes	Yes	Yes	Yes
PA-MC-E3	1-port multichannel E3	—	Yes	Yes	Yes	Yes
PA-MC-2T3+	2-port multichannel T3	—	No	Yes	Yes	Yes
PA-MC-2T1	2-port multichannel T1, integrated CSU/DSUs	—	Yes	Yes	Yes	Yes
PA-MC-2E1/120	2-port multichannel E1, G.703 120-ohm interface	—	Yes	Yes	Yes	Yes
PA-MC-4T1	4-port multichannel T1, integrated CSU/DSUs	—	Yes	Yes	Yes	Yes
PA-MC-8TE1+	8-port multichannel T1/E1 8PRI	—	Yes	Yes	Yes	Yes
PA-MC-STM-1MM	1-port multichannel STM-1 multimode	—	Yes	Yes	Yes	Yes



**Table 3** Supported Port Adapters for the Cisco 7200 Series, Cisco 7301, and Cisco 7304 (continued)

Cisco Product Number <sup>1</sup>	Adapter Description	In	7200 Series		7301 Router	7304 Router
			7201	VXR		
PA-MC-STM-1SMI	1-port multichannel STM-1 single mode	—	Yes	Yes	Yes	Yes
PA-4B-U	4-port BRI, U Interface	—	No	Yes	Yes	No
PA-8B-S/T	8-port BRI, S/T Interface	—	No	Yes	Yes	No
<b>Shared Port Adapters (SPAs)</b>						
SPA-4FE-7304	4-port 10/100 Fast Ethernet SPA	—	No	No	No	Yes
SPA-2GE-7304	2-port 10/100/1000 Gigabit Ethernet SPA	—	No	No	No	Yes
SPA-2XOC3-POS	2-port OC-3c/STM-1 POS SPA	—	No	No	No	Yes
SPA-4XOC3-POS	4-port OC-3c/STM-1 POS SPA	—	No	No	No	Yes
SPA-1OC12-POS	1-port OC-12c/STM-4 POS SPA	—	No	No	No	Yes
SPA-2XT3/E3	2-port T3/E3 Serial SPA	—	No	No	No	Yes
SPA-4XT3/E3	4-port T3/E3 Serial SPA	—	No	No	No	Yes
<b>SONET Port Adapters</b>						
PA-POS-OC3MM	1-port Packet over SONET OC3c/STM1 multimode	—	No	Yes	Yes	Yes
PA-POS-OC3SMI	1-port Packet over SONET OC3c/STM1 single mode (IR)	—	No	Yes	Yes	Yes
PA-POS-OC3SML	1-port Packet over SONET OC3c/STM1 single mode (LR)	—	No	Yes	Yes	Yes
PA-POS-1OC3	1-port OC-3/STM-1 POS (with APS)	12.2(28)SB6	Yes	Yes	Yes	Yes <sup>3</sup>
PA-POS-2OC3	2-port OC-3/STM-1 POS (with APS)	—	Yes	Yes	Yes	Yes
<b>T1/E1 Port Adapters</b>						
PA-4T+	4-port Serial, Enhanced	—	Yes	Yes	Yes	Yes
PA-8T-V35	8-port Serial, V.35	—	No	Yes	Yes	Yes
PA-8T-X21	8-port Serial, X.21	—	No	Yes	Yes	Yes
PA-8T-232	8-port Serial, 232	—	No	Yes	Yes	Yes
<b>T3/E3 Port Adapters</b>						
PA-T3+	1-port T3 Serial, Enhanced	—	Yes	Yes	Yes	Yes
PA-2T3+	2-port T3 Serial, Enhanced	—	Yes	Yes	Yes	Yes
PA-E3	1-port E3 Serial, E3 DSUs	—	Yes	Yes	Yes	Yes
PA-2E3	2-port E3 Serial, E3 DSUs	—	Yes	Yes	Yes	Yes

1. For a spare product number, append an equal sign (=) to the product number. For a spare product number, append an equal sign (=) to the product number. If a product number is listed as a spare product in the table, that is, with an equal sign (=), it means that the product is only available as a spare product. For End-of-Sale (EOS) and End-of-Life (EOL) information about port adapters, refer to the Cisco product bulletins at the following locations:

Cisco 7200 series: [http://www.cisco.com/en/US/products/hw/routers/ps341/prod\\_eol\\_notices\\_list.html](http://www.cisco.com/en/US/products/hw/routers/ps341/prod_eol_notices_list.html)

Cisco 7300 series: [http://www.cisco.com/en/US/products/hw/routers/ps352/prod\\_eol\\_notices\\_list.html](http://www.cisco.com/en/US/products/hw/routers/ps352/prod_eol_notices_list.html)

Cisco 7400 series: [http://www.cisco.com/en/US/products/hw/routers/ps354/prod\\_eol\\_notices\\_list.html](http://www.cisco.com/en/US/products/hw/routers/ps354/prod_eol_notices_list.html)

2. Support on the Cisco 7304 was added in both Cisco IOS Release 12.2(28)SB6 and Release 12.2(31)SB2.

3. Support on the Cisco 7200 series and Cisco 7301 was added in Cisco IOS Release 12.2(28)SB6; support on the Cisco 7304 was added in Release 12.2(31)SB2.

For information about troubleshooting port adapters and about alerts, see the Cisco documents at the following location:

[http://www.cisco.com/en/US/products/hw/modules/ps2033/tsd\\_products\\_support\\_troubleshoot\\_and\\_alerts.html](http://www.cisco.com/en/US/products/hw/modules/ps2033/tsd_products_support_troubleshoot_and_alerts.html)

## Supported Line Cards for the Cisco 10000 Series Routers

Table 4 lists the line cards that are supported for the Cisco 10000 series routers in Cisco IOS Release 12.2(28)SB and later releases. The number in the “In” column indicates the Cisco IOS 12.2SB release in which the line card was introduced. For example, (28) means that a line card was introduced in Cisco IOS Release 12.2(28)SB. If a cell in this column contains an em dash (—), support for the line card was inherited from other releases and was included in Cisco IOS Release 12.2(28)SB.

**Table 4** Supported Line Cards for the Cisco 10000 Series Router

Common Abbreviation	Cisco Product Number <sup>1</sup>	Line Card Description	In
<b>ATM Line Cards</b>			
1-Port OC-12 ATM	ESR-1OC-12-ATM <sup>2</sup>	1-port OC-12 ATM	—
4-Port OC-3 ATM	ESR-4OC3-ATM-SM	4-port OC-3/STM-1 ATM, single mode	—
4-Port OC-3 ATM LR	ESR-4OC3-ATM-SM-LR	4-port OC-3/STM-1 ATM, long reach	(28)
8-Port E3/DS3 ATM	ESR-8E3/DS3-ATM	8-port E3/DS3 ATM	—
<b>Channelized Line Cards</b>			
1-Port Channelized OC-12/STM-4	ESR-1COC-12/STM-4-SMI <sup>3</sup>	1-port channelized OC-12/STM-4 (STS-12), single mode, intermediate reach	—
	ESR-1COC-12/STM-4-SML	1-port channelized OC-12/STM-4 (STS-12), single mode, long reach	—
4-Port Channelized STM-1/OC-3	ESR-4OC3-ChSTM-1/OC-3	4-port channelized OC-3/STM-1 SDH, single mode	—
4-Port Channelized T3 Half-Height	ESR-HH-4CT3	4-port channelized T3 half-height	(28)
6-Port Channelized T3	ESR-6CT3	6-port channelized T3	—
24-Port T1/E1	ESR-24CT1/E1	24-port channelized E1/T1	—
<b>Electrical Interface Line Card</b>			
8-Port Unchannelized E3/T3	ESR-8E3/DS3	8-port clear channel E3/DS3 line card	—
<b>Ethernet Line Cards</b>			
1-Port GE	ESR-1GE	1-port Gigabit Ethernet	—
1-Port GE Half-Height	ESR-HH-1GE	1-port Gigabit Ethernet half-height	—
8-Port FE Half-Height	ESR-HH-8FE-TX	8-port Fast Ethernet half-height	—
Half-Height Carrier	ESR-HH-CARRIER	Full-length base carrier for half-height line card	—

**Table 4** Supported Line Cards for the Cisco 10000 Series Router (continued)

Common Abbreviation	Cisco Product Number <sup>1</sup>	Line Card Description	In
<b>Packet over SONET (POS)/Synchronous Digital Hierarchy (SDH) Line Cards</b>			
1-Port OC-12/STM-4 POS	ESR-1OC-12/P-SMI	1-port OC-12/STS-12c/STM-4 POS/SDH, single mode, intermediate reach	—
	ESR-1OC-12/P-SML	1-port OC-12/STS-12c/STM-4 POS, single mode, long reach	—
1-port OC-48/STM-16 POS	ESR1OC48/P/SRPSMS	1-port OC-48/STM-16 POS/SRP, single mode, short reach	—
	ESR1OC48/P/SRPSML	1-port OC-48/STM-16 POS/SRP, single mode, long reach	—
6-Port OC-3c/STM-1 POS	ESR-6OC3/P-SMI	6-port OC-3c/STS-3c/STM-1 POS/SDH, single mode, intermediate reach	—
	ESR-6OC3/P-SML	6-port OC-3c/STS-3c/STM-1 POS/SDH, single mode, long reach	—

1. For a spare product number, append an equal sign (=) to the product number. If a product number is listed as a spare product in the table, that is, with an equal sign (=), it means that the product is only available as a spare product. For End-of-Sale (EOS) and End-of-Life (EOL) information about line cards, refer to the Cisco product bulletins at the following location:

[http://www.cisco.com/en/US/products/hw/routers/ps133/prod\\_eol\\_notices\\_list.html](http://www.cisco.com/en/US/products/hw/routers/ps133/prod_eol_notices_list.html)

2. The old part number for this line card is ESR-1OC12ATM-SM.
3. The old part number for this line card is ESR-1COC12-SML.

For information about troubleshooting line cards and about alerts, see the Cisco documents at the following location:

[http://www.cisco.com/en/US/products/hw/routers/ps133/tsd\\_products\\_support\\_troubleshoot\\_and\\_alerts.html](http://www.cisco.com/en/US/products/hw/routers/ps133/tsd_products_support_troubleshoot_and_alerts.html)

## Determining the Software Version

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

```
Router#> show version
```

```
Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (rsp-jsv-mz), Version 12.2(31)SB6, EARLY DEPLOYMENT RELEASE
SOFTWARE
```

## Upgrading to a New Software Release

For information about selecting a new Cisco IOS software release, see *How to Choose a Cisco IOS Software Release* at the following location:

[http://www.cisco.com/warp/public/130/choosing\\_ios.shtml](http://www.cisco.com/warp/public/130/choosing_ios.shtml)

For information about upgrading the Cisco 7200 series routers, Cisco 7301 router, Cisco 7304 router and Cisco 10000 series routers, see the document at the following location:

[http://www.cisco.com/en/US/products/hw/routers/ps133/products\\_tech\\_note09186a0080094c07.shtml](http://www.cisco.com/en/US/products/hw/routers/ps133/products_tech_note09186a0080094c07.shtml)

In addition, for the Cisco 10000 series, see the *Upgrading to Cisco IOS Release 12.2(28)SB on a Cisco 10000 Series Router* document at the following location:

<http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/upgrade/upgdsb.htm>

For Cisco IOS upgrade ordering instructions, see the document at the following location:

[http://www.cisco.com/warp/public/cc/pd/iosw/prodlit/957\\_pp.htm](http://www.cisco.com/warp/public/cc/pd/iosw/prodlit/957_pp.htm)

To choose a new Cisco IOS software release by comparing feature support or memory requirements, use Cisco Feature Navigator. Cisco Feature Navigator is a web-based tool that enables you to determine which Cisco IOS and Catalyst OS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or by feature set (software image). Under the release section, you can compare Cisco IOS software releases side by side to display both the features unique to each software release and the features that the releases have in common.

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

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

To choose a new Cisco IOS software release based on information about defects that affect that software, use Bug Toolkit at the following URL:

[http://www.cisco.com/cgi-bin/Support/Bugtool/launch\\_bugtool.pl](http://www.cisco.com/cgi-bin/Support/Bugtool/launch_bugtool.pl)

## Microcode Software

This section describes microcode software that is supported for the Cisco 7304 in Cisco IOS Release 12.2S and consists of the following subsections:

- [Bundled FPGAs for the Cisco 7304, page 12](#)
- [Shared Port Adapter FPD Image Packages for the Cisco 7304, page 19](#)

### Bundled FPGAs for the Cisco 7304

This section provides information about the field-programmable gate array (FPGA) images for the Cisco 7304. These images apply only to the Cisco 7304.

If the versions of the FPGA images that are running on your Cisco 7304 do not match the versions that are bundled in the Cisco IOS software, we recommend that you update your FPGA images. For more details, see the *Cisco 7304 FPGA Bundling and Update* document:

[http://www.cisco.com/en/US/docs/ios/12\\_1/12\\_1ex/feature/guide/73fpga.html](http://www.cisco.com/en/US/docs/ios/12_1/12_1ex/feature/guide/73fpga.html)

### Bundled FPGAs for Cisco IOS Release 12.2(33)SB10

The MSC-100 FPGA bundle has changed from 0.27 to 0.29 for Cisco IOS Release 12.2(33)SB10. All Cisco IOS Release 12.2(33)SB10 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

### Bundled FPGAs for Cisco IOS Release 12.2(33)SB9

There are no new FPGA images for Cisco IOS Release 12.2(33)SB9. All Cisco IOS Release 12.2(33)SB9 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB8**

There are no new FPGA images for Cisco IOS Release 12.2(33)SB8. All Cisco IOS Release 12.2(33)SB8 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB7**

There are no new FPGA images for Cisco IOS Release 12.2(33)SB7. All Cisco IOS Release 12.2(33)SB7 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB6**

There are no new FPGA images for Cisco IOS Release 12.2(33)SB6. All Cisco IOS Release 12.2(33)SB6 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB5**

There are no new FPGA images for Cisco IOS Release 12.2(33)SB5. All Cisco IOS Release 12.2(33)SB5 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB4**

There are no new FPGA images for Cisco IOS Release 12.2(33)SB4. All Cisco IOS Release 12.2(33)SB4 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB3**

There are no new FPGA images for Cisco IOS Release 12.2(33)SB3. All Cisco IOS Release 12.2(33)SB3 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB2**

There are no new FPGA images for Cisco IOS Release 12.2(33)SB2. All Cisco IOS Release 12.2(33)SB2 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB1**

There are no new FPGA images for Cisco IOS Release 12.2(33)SB1. All Cisco IOS Release 12.2(33)SB1 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(33)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(33)SB**

All Cisco IOS Release 12.2(33)SB software images for the Cisco 7304 support the bundled FPGAs that are listed in [Table 6](#).

**Table 5** *Bundled FPGA Versions for Cisco IOS Release 12.2(33)SB Sorted by Hardware Type*

<b>FPGA Image</b>	<b>Hardware Type</b>	<b>FPGA Version Bundled</b>	<b>Minimum Required Hardware Version</b>	<b>Approx. Upgrade Time in Minutes</b>
Cisco 7300 PXF VTMS	0x001C	1.00	0.00	
NSE-100 Motherboard FPGA	0x0001	1.10	2.00	15
NSE-100-CR Motherboard FPGA	0x0001	1.13	4.00	15
NSE-100-CR Motherboard FPGA	0x0001	1.14	5.00	15
NSE-100 Daughterboard FPGA	0x0002	1.07	0.00	6
NSE-100 Daughterboard FPGA	0x0002	1.08	5.00	6
OC-3 POS line card FPGA	0x0004	0.22	2.00	8
OC-48 POS line card FPGA	0x0003	0.16	2.00	5
6E3 line card FPGA	0x0005	0.21	2.00	12
6T3 line card FPGA	0x0005	0.21	2.00	12
OC-12 POS line card FPGA	0x0006	0.20	1.00	12
OC-3 ATM line card FPGA	0x0007	0.19	2.00	8
OC-12 ATM line card FPGA	0x0007	0.19	2.00	8
CC-PA line card FPGA	0x0008	1.40	1.01	8
MSC-100 FPGA	0x000D	0.27 <sup>1</sup>	0.10	22
NPE-G100 FPGA (PS)	0x000A	2.05	0.30	12
NPE-G100 FPGA (ES)	0x000A	2.05	0.20	12
NSE-150 FPGA	0x000E	0.08	0.00	12
CC-PA IOS image	0x0021	0.0	1.00	—
CC-PA IOS image	0x0023	0.0	0.0	—

1. The MSC-100 FPGA bundle has changed from 0.27 to 0.29 for Cisco IOS Release 12.2(33)SB10.

### **Bundled FGAs for Cisco IOS Release 12.2(31)SB21**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB21. All Cisco IOS Release 12.2(31)SB1 software images for the Cisco 7304 support the bundled FGAs that were released in Release 12.2(31)SB2.

### **Bundled FGAs for Cisco IOS Release 12.2(31)SB20**

The MSC-100 FPGA bundle has changed from 0.27 to 0.29 for Cisco IOS Release 12.2(31)SB20. All Cisco IOS Release 12.2(31)SB1 software images for the Cisco 7304 support the bundled FGAs that were released in Release 12.2(31)SB2.

### **Bundled FGAs for Cisco IOS Release 12.2(31)SB19**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB19. All Cisco IOS Release 12.2(31)SB1 software images for the Cisco 7304 support the bundled FGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB18**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB18. All Cisco IOS Release 12.2(31)SB18 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB17**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB17. All Cisco IOS Release 12.2(31)SB17 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB16**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB16. All Cisco IOS Release 12.2(31)SB16 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB15**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB15. All Cisco IOS Release 12.2(31)SB15 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB14**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB14. All Cisco IOS Release 12.2(31)SB14 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB13**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB13. All Cisco IOS Release 12.2(31)SB13 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB12**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB12. All Cisco IOS Release 12.2(31)SB12 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB11**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB11. All Cisco IOS Release 12.2(31)SB11 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

**Bundled FPGAs for Cisco IOS Release 12.2(31)SB10**

There are no new FPGA images for Cisco IOS Release 12.2(31)SB10. All Cisco IOS Release 12.2(31)SB10 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

### Bundled FPGAs for Cisco IOS Release 12.2(31)SB9

There are no new FPGA images for Cisco IOS Release 12.2(31)SB9. All Cisco IOS Release 12.2(31)SB9 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

### Bundled FPGAs for Cisco IOS Release 12.2(31)SB8

There are no new FPGA images for Cisco IOS Release 12.2(31)SB8. All Cisco IOS Release 12.2(31)SB8 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

### Bundled FPGAs for Cisco IOS Release 12.2(31)SB7

There are no new FPGA images for Cisco IOS Release 12.2(31)SB7. All Cisco IOS Release 12.2(31)SB7 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

### Bundled FPGAs for Cisco IOS Release 12.2(31)SB6

There are no new FPGA images for Cisco IOS Release 12.2(31)SB6. All Cisco IOS Release 12.2(31)SB6 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

### Bundled FPGAs for Cisco IOS Release 12.2(31)SB5

There are no new FPGA images for Cisco IOS Release 12.2(31)SB5. All Cisco IOS Release 12.2(31)SB5 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

### Bundled FPGAs for Cisco IOS Release 12.2(31)SB3

There are no new FPGA images for Cisco IOS Release 12.2(31)SB3. All Cisco IOS Release 12.2(31)SB3 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(31)SB2.

### Bundled FPGAs for Cisco IOS Release 12.2(31)SB2

All Cisco IOS Release 12.2(31)SB2 software images for the Cisco 7304 support the bundled FPGAs that are listed in [Table 6](#).

**Table 6** Bundled FPGA Versions for Cisco IOS Release 12.2(31)SB2 Sorted by Hardware Type

FPGA Image	Hardware Type	FPGA Version Bundled	Minimum Required Hardware Version	Approx. Upgrade Time in Minutes
NSE-100 Motherboard FPGA	0x0001	1.10	2.00	15
NSE-100-CR Motherboard FPGA	0x0001	1.13	4.00	15
NSE-100-CR Motherboard FPGA	0x0001	1.14	5.00	15
NSE-100 Daughterboard FPGA	0x0002	1.07	0.00	6
NSE-100 Daughterboard FPGA	0x0002	1.08	5.00	6
OC-48 POS line card FPGA	0x0003	0.16	2.00	5



**Table 6** *Bundled FPGA Versions for Cisco IOS Release 12.2(31)SB2 Sorted by Hardware Type*

<b>FPGA Image</b>	<b>Hardware Type</b>	<b>FPGA Version Bundled</b>	<b>Minimum Required Hardware Version</b>	<b>Approx. Upgrade Time in Minutes</b>
OC-3 POS line card FPGA	0x0004	0.22	2.00	8
6E3 line card FPGA	0x0005	0.21	2.00	12
6T3 line card FPGA	0x0005	0.21	2.00	12
OC-12 POS line card FPGA	0x0006	0.20	1.00	12
OC-3 ATM line card FPGA	0x0007	0.19	2.00	8
OC-12 ATM line card FPGA	0x0007	0.19	2.00	8
CC-PA line card FPGA	0x0008	1.40	1.01	8
NPE-G100 FPGA (PS)	0x000A	2.05	0.30	12
NPE-G100 FPGA (ES)	0x000A	2.05	0.20	12
MSC-100 FPGA	0x000D	0.27 <sup>1</sup>	0.10	22
NSE-150 FPGA	0x000E	0.08	0.00	12

1. The MSC-100 FPGA bundle has changed from 0.27 to 0.29 for Cisco IOS Release 12.2(31)SB20.

#### **Bundled FGAs for Cisco IOS Release 12.2(28)SB13**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB13. All Cisco IOS Release 12.2(28)SB13 software images for the Cisco 7304 support the bundled FGAs that were released in Release 12.2(28)SB.

#### **Bundled FGAs for Cisco IOS Release 12.2(28)SB12**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB12. All Cisco IOS Release 12.2(28)SB12 software images for the Cisco 7304 support the bundled FGAs that were released in Release 12.2(28)SB.

#### **Bundled FGAs for Cisco IOS Release 12.2(28)SB11**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB11. All Cisco IOS Release 12.2(28)SB11 software images for the Cisco 7304 support the bundled FGAs that were released in Release 12.2(28)SB.

#### **Bundled FGAs for Cisco IOS Release 12.2(28)SB10**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB10. All Cisco IOS Release 12.2(28)SB10 software images for the Cisco 7304 support the bundled FGAs that were released in Release 12.2(28)SB.

#### **Bundled FGAs for Cisco IOS Release 12.2(28)SB9**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB9. All Cisco IOS Release 12.2(28)SB9 software images for the Cisco 7304 support the bundled FGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB8**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB8. All Cisco IOS Release 12.2(28)SB8 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB7**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB7. All Cisco IOS Release 12.2(28)SB7 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB6**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB6. All Cisco IOS Release 12.2(28)SB6 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB5**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB5. All Cisco IOS Release 12.2(28)SB5 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB4**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB4. All Cisco IOS Release 12.2(28)SB4 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB3**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB3. All Cisco IOS Release 12.2(28)SB3 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB2**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB2. All Cisco IOS Release 12.2(28)SB2 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB1**

There are no new FPGA images for Cisco IOS Release 12.2(28)SB1. All Cisco IOS Release 12.2(28)SB1 software images for the Cisco 7304 support the bundled FPGAs that were released in Release 12.2(28)SB.

**Bundled FPGAs for Cisco IOS Release 12.2(28)SB**

All Cisco IOS Release 12.2(28)SB software images for the Cisco 7304 support the bundled FPGAs that are listed in [Table 7](#).

**Table 7** Bundled FPGA Versions for Cisco IOS Release 12.2(28)SB Sorted by Hardware Type

FPGA Image	Hardware Type	FPGA Version Bundled	Minimum Required Hardware Version	Approx. Upgrade Time in Minutes
NSE-100 Motherboard FPGA	0x0001	1.10	2.00	15
NSE-100-CR Motherboard FPGA	0x0001	1.13	4.00	15
NSE-100-CR Motherboard FPGA	0x0001	1.14	5.00	15
NSE-100 Daughterboard FPGA	0x0002	1.07	0.00	6
NSE-100 Daughterboard FPGA	0x0002	1.08	5.00	6
OC-48 POS line card FPGA	0x0003	0.16	2.00	5
OC-3 POS line card FPGA	0x0004	0.22	2.00	8
6E3 line card FPGA	0x0005	0.21	2.00	12
6T3 line card FPGA	0x0005	0.21	2.00	12
OC-12 POS line card FPGA	0x0006	0.20	1.00	12
OC-3 ATM line card FPGA	0x0007	0.19	2.00	8
OC-12 ATM line card FPGA	0x0007	0.19	2.00	8
CC-PA line card FPGA	0x0008	1.40	1.01	8
NPE-G100 FPGA (PS)	0x000A	2.05	0.30	12
NPE-G100 FPGA (ES)	0x000A	2.05	0.20	12
MSC-100 FPGA	0x000D	0.27	0.10	22

## Shared Port Adapter FPD Image Packages for the Cisco 7304

Field-programmable device (FPD) image packages are used to update shared port adapter (SPA) FPD images. If a discrepancy exists between an SPA FPD image and the Cisco IOS image that is running on the router, the SPA will be deactivated until this discrepancy is resolved. For additional information on FPDs, including the upgrade process, see the “Upgrading Field-Programmable Devices” section of the *Cisco 7304 Modular Services Card and Shared Port Adapter Software Configuration Guide*:

<http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/73mcspsa/mcspsasw/index.htm>



### Note

The maximum time to upgrade the FPD image(s) on one SPA is 2 minutes. The total FPD upgrade time depends on the number of SPAs.

## Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB10

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB10 is the c7304-fpd-pkg.122-33.SB10 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB9**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB9 is the c7304-fpd-pkg.122-33.SB9 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB8**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB8 is the c7304-fpd-pkg.122-33.SB8 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB7**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB7 is the c7304-fpd-pkg.122-33.SB7 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB6**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB6 is the c7304-fpd-pkg.122-33.SB6 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB5**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB5 is the c7304-fpd-pkg.122-33.SB5 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB4**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB4 is the c7304-fpd-pkg.122-33.SB4 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB3

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB3 is the c7304-fpd-pkg.122-33.SB3 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB2

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB2 is the c7304-fpd-pkg.122-33.SB2 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB1

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB1 is the c7304-fpd-pkg.122-33.SB1 pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(33)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(33)SB

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(33)SB is the c7304-fpd-pkg.122-32.9.37.SB pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com.

**Table 8** Release 12.2(33)SB FPD Image Package Contents

Supported SPAs	FPD ID	FPD Component Name	FPD Component Version	Minimum Required Hardware Version
7304-4FE-SPA	1	Data & I/O FPGA	4.18	0.0
7304-2GE-SPA	1	Data & I/O FPGA	4.18	0.0
SPA-2XOC3-POS	1	I/O FPGA	3.4	0.0
SPA-4XOC3-POS	1	I/O FPGA	3.4	0.0
SPA-1OC12-POS	1	I/O FPGA	3.4	0.0
SPA-2XT3/E3	1	ROMMON	2.12	0.0
	2	I/O FPGA	1.0	0.0
	3	E3 FPGA	1.4	0.0
	4	T3 FPGA	1.4	0.0
SPA-4XT3/E3	1	ROMMON	2.12	0.0
	2	I/O FPGA	1.0	0.0
	3	E3 FPGA	1.4	0.0
	4	T3 FPGA	1.4	0.0

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB21**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB21 is the c7304-fpd-pkg.122-31.SB21.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB20**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB20 is the c7304-fpd-pkg.122-31.SB20.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB19**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB19 is the c7304-fpd-pkg.122-31.SB19.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB18**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB18 is the c7304-fpd-pkg.122-31.SB18.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB17**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB17 is the c7304-fpd-pkg.122-31.SB17.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB16**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB16 is the c7304-fpd-pkg.122-31.SB16.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB15**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB15 is the c7304-fpd-pkg.122-31.SB15.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB14**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB14 is the c7304-fpd-pkg.122-31.SB14.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB13**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB13 is the c7304-fpd-pkg.122-31.SB13.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB12**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB12 is the c7304-fpd-pkg.122-31.SB12.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB11**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB11 is the c7304-fpd-pkg.122-31.SB11.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB10**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB10 is the c7304-fpd-pkg.122-31.SB10.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB9**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB9 is the c7304-fpd-pkg.122-31.SB9.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB8**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB8 is the c7304-fpd-pkg.122-31.SB8.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB7**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB7 is the c7304-fpd-pkg.122-31.SB7.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB6**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB6 is the c7304-fpd-pkg.122-31.SB6.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB5**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB5 is the c7304-fpd-pkg.122-31.SB5.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB3**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB3 is the c7304-fpd-pkg.122-31.SB3.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(31)SB2.



### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(31)SB2

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(31)SB2 is the c7304-fpd-pkg.122-31.SB2.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com.

**Table 9** Release 12.2(31)SB2 FPD Image Package Contents

Supported SPAs	FPD ID	FPD Component Name	FPD Component Version	Minimum Required Hardware Version
7304-4FE-SPA	1	Data & I/O FPGA	4.18	0.0
7304-2GE-SPA	1	Data & I/O FPGA	4.18	0.0
SPA-2XOC3-POS	1	I/O FPGA	3.4	0.0
SPA-4XOC3-POS	1	I/O FPGA	3.4	0.0
SPA-1OC12-POS	1	I/O FPGA	3.4	0.0
SPA-2XT3/E3	1	ROMMON	2.12	0.0
	2	I/O FPGA	0.24	0.0
	3	E3 FPGA	1.4	0.0
	4	T3 FPGA	1.4	0.0
SPA-4XT3/E3	1	ROMMON	2.12	0.0
	2	I/O FPGA	0.24	0.0
	3	E3 FPGA	1.4	0.0
	4	T3 FPGA	1.4	0.0

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB13

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB13 is the c7304-fpd-pkg.122-28.SB13.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB12

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB12 is the c7304-fpd-pkg.122-28.SB12.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB11

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB11 is the c7304-fpd-pkg.122-28.SB11.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB10**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB10 is the c7304-fpd-pkg.122-28.SB10.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB9**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB9 is the c7304-fpd-pkg.122-28.SB9.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB8**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB8 is the c7304-fpd-pkg.122-28.SB8.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB7**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB7 is the c7304-fpd-pkg.122-28.SB7.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB6**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB6 is the c7304-fpd-pkg.122-28.SB6.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### **Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB5**

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB5 is the c7304-fpd-pkg.122-28.SB5.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB4

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB4 is the c7304-fpd-pkg.122-28.SB4.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB3

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB3 is the c7304-fpd-pkg.122-28.SB3.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB2

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB2 is the c7304-fpd-pkg.122-28.SB2.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB1

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB1 is the c7304-fpd-pkg.122-28.SB1.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com. The content of this SPA FPD image package is the same as the content of the SPA FPD image package for Release 12.2(28)SB.

### Shared Port Adapter FPD Image Package for Cisco IOS Release 12.2(28)SB

The FPD image package that is used to upgrade SPAs on a router that runs Cisco IOS Release 12.2(28)SB is the c7304-fpd-pkg.122-28.SB.pkg file. This SPA FPD image package file is accessible from the page where you downloaded your specific Cisco IOS image from the Software Center on Cisco.com.

**Table 10** Release 12.2(28)SB FPD Image Package Contents

Supported SPAs	FPD ID	FPD Component Name	FPD Component Version	Minimum Required Hardware Version
7304-4FE-SPA	1	Data & I/O FPGA	4.18	0.0
7304-2GE-SPA	1	Data & I/O FPGA	4.18	0.0
SPA-2XOC3-POS	1	I/O FPGA	3.4	0.0
SPA-4XOC3-POS	1	I/O FPGA	3.4	0.0
SPA-1OC12-POS	1	I/O FPGA	3.4	0.0

**Table 10** Release 12.2(28)SB FPD Image Package Contents (continued)

Supported SPAs	FPD ID	FPD Component Name	FPD Component Version	Minimum Required Hardware Version
SPA-2XT3/E3	1	ROMMON	2.12	0.0
	2	I/O FPGA	0.24	0.0
	3	E3 FPGA	0.6	0.0
	4	T3 FPGA	0.14	0.0
SPA-4XT3/E3	1	ROMMON	2.12	0.0
	2	I/O FPGA	0.24	0.0
	3	E3 FPGA	0.6	0.0
	4	T3 FPGA	0.14	0.0

## Feature Support

Cisco IOS software is packaged in feature sets that consist of software images that support specific platforms. The feature sets available for a specific platform depend on which Cisco IOS software images are included in a release. Each feature set contains specific Cisco IOS features.



### Caution

Cisco IOS images with strong encryption (including, but not limited to 168-bit [3DES] data encryption feature sets) are subject to U.S. 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 because of U.S. 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](mailto:export@cisco.com).

Feature-to-image mapping is available through Cisco Feature Navigator. Cisco Feature Navigator is a web-based tool that enables you to determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or by feature set (software image). You can compare Cisco IOS software releases side-by-side to display both the features unique to each software release and the features that the releases have in common.

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

[www.cisco.com/go/cfn](http://www.cisco.com/go/cfn)

For help with Cisco Feature Navigator, see the help information at the following URL:

[http://www.cisco.com/web/applicat/CFNTOOLS/Help\\_Docs/help/cfn\\_support.html](http://www.cisco.com/web/applicat/CFNTOOLS/Help_Docs/help/cfn_support.html)

## Determining the Software Images (Feature Sets) That Support a Specific Feature

To determine which software images (feature sets) in a Cisco IOS release support a specific feature, go to the [Cisco Feature Navigator home page](#) and perform the following steps.

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**Step 1** From the Cisco Feature Navigator home page, click **Research Features**.

- Step 2** Select your software type or leave the field as “All”.
- Step 3** To find a feature, you can search by either Feature or Technology (select the appropriate button). If you select Search by Feature, you can further filter your search by using the Filter By text box.
- Step 4** Choose a feature from the Available Features text box, and click the **Add** button to add the feature to the Selected Features text box.




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**Note** To learn more about a feature in the list, click the **View Desc** button in the Available Features text box.

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Repeat this step to add features. A maximum of 20 features can be chosen for a single search.

- Step 5** Click **Continue** when you are finished choosing features.
- Step 6** In the Release/Platform Tree area, select either your release (from the Train-Release list) or your platform (from the Platform list).
- Step 7** The “Search Result” table will list all the software images (feature sets) that support the features that you chose.




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**Note** You can download your results into an Excel spreadsheet by clicking on the Download Excel button.

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## Determining the Features Supported in a Specific Software Image (Feature Set)

To determine which features are supported in a specific software image (feature set), go to the [Cisco Feature Navigator home page](#) and perform the following steps.

- Step 1** From the Cisco Feature Navigator home page, click **Research Software**.
- Step 2** Select your software type from the drop-down list and chose the **Release** button in the “Search By” area.
- Step 3** From the Major Release drop-down list, chose the appropriate major release.
- Step 4** From the Release drop-down list, choose the appropriate maintenance release.
- Step 5** From the Platform drop-down list, choose the appropriate hardware platform.
- Step 6** From the Feature Set drop-down list, choose the appropriate feature set. The Image Details area will provide details on the specific image. The Available Features area will list all the features that are supported by the feature set (software image) that you chose.




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**Note** To learn more about a feature in the list, click the **View Desc** button in the Available Features text box.

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## Memory Recommendations

To determine memory recommendations for software images (feature sets) in your Cisco IOS release, go to the [Cisco Feature Navigator home page](#) and perform the following steps.

- 
- Step 1** From the Cisco Feature Navigator home page, click **Research Software**.
  - Step 2** Select your software type from the drop-down list and choose the **Release** button in the “Search By” area.
  - Step 3** From the Major Release drop-down list, choose the appropriate major release.
  - Step 4** From the Release drop-down list, choose the appropriate maintenance release.
  - Step 5** From the Platform drop-down list, choose the appropriate hardware platform.
  - Step 6** From the Feature Set drop-down list, choose the appropriate feature set.
  - Step 7** The Image Details area will provide details on the specific image including the DRAM and flash memory recommendations for each image. The Available Features area will list all the features that are supported by the feature set (software image) that you chose.
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## New and Changed Information

This section lists the new hardware and software features supported by Cisco IOS Release 12.2SB and contains the following subsections:

- [New Hardware Features in Cisco IOS Release 12.2\(33\)SB8, page 31](#)
- [New Software Features in Cisco IOS Release 12.2\(33\)SB8, page 31](#)
- [New Hardware Features in Cisco IOS Release 12.2\(33\)SB7, page 32](#)
- [New Software Features in Cisco IOS Release 12.2\(33\)SB7, page 32](#)
- [New Hardware Features in Cisco IOS Release 12.2\(33\)SB3, page 32](#)
- [New Software Features in Cisco IOS Release 12.2\(33\)SB3, page 32](#)
- [New Hardware Features in Cisco IOS Release 12.2\(33\)SB2, page 33](#)
- [New Software Features in Cisco IOS Release 12.2\(33\)SB2, page 33](#)
- [New Hardware Features in Cisco IOS Release 12.2\(33\)SB, page 35](#)
- [New Software Features in Cisco IOS Release 12.2\(33\)SB, page 36](#)
- [New Hardware Features in Cisco IOS Release 12.2\(31\)SB12, page 62](#)
- [New Software Features in Cisco IOS Release 12.2\(31\)SB12, page 62](#)
- [New Hardware Features in Cisco IOS Release 12.2\(31\)SB10, page 62](#)
- [New Software Features in Cisco IOS Release 12.2\(31\)SB10, page 63](#)
- [New Hardware Features in Cisco IOS Release 12.2\(31\)SB6, page 63](#)
- [New Software Features in Cisco IOS Release 12.2\(31\)SB6, page 63](#)
- [New Hardware Features in Cisco IOS Release 12.2\(31\)SB5, page 64](#)
- [New Software Features in Cisco IOS Release 12.2\(31\)SB5, page 65](#)

- [New Hardware Features in Cisco IOS Release 12.2\(31\)SB3](#), page 65
- [New Software Features in Cisco IOS Release 12.2\(31\)SB3](#), page 66
- [New Hardware Features in Cisco IOS Release 12.2\(31\)SB2](#), page 67
- [New Software Features in Cisco IOS Release 12.2\(31\)SB2](#), page 70
- [New Hardware Features in Cisco IOS Release 12.2\(28\)SB6](#), page 105
- [New Software Features in Cisco IOS Release 12.2\(28\)SB6](#), page 105
- [New Hardware Features in Cisco IOS Release 12.2\(28\)SB2](#), page 106
- [New Software Features in Cisco IOS Release 12.2\(28\)SB2](#), page 106
- [New Hardware Features in Cisco IOS Release 12.2\(28\)SB](#), page 110
- [New Software Features in Cisco IOS Release 12.2\(28\)SB](#), page 112

**Note**

These release notes are not cumulative and list only features that are new to Cisco IOS Release 12.2SB. The parent releases for Release 12.2SB are Release 12.2 and Release 12.2S. For information about inherited features, refer to Cisco.com or Cisco Feature Navigator. For Cisco.com, either go to [Cisco.com](http://www.cisco.com) and select the appropriate software release under Products and Service and IOS Software or go to <http://www.cisco.com/univercd/home/index.htm> and select the appropriate software release under Cisco IOS Software and Release Notes. You can use the Cisco Feature Navigator tool at <http://www.cisco.com/go/fn>.

**Note**

For information about supported platforms, line cards, and port adapters, see the [“Supported Hardware” section on page 5](#).

## New Hardware Features in Cisco IOS Release 12.2(33)SB8

There are no new hardware features in Cisco IOS Release 12.2(33)SB8.

## New Software Features in Cisco IOS Release 12.2(33)SB8

This section describes new and changed features in Cisco IOS Release 12.2(33)SB8. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(33)SB8. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### BGP VRF-Lite iBGP Peering

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The BGP VRF-Lite iBGP Peering feature provides the ability to have VRF-lite aware iBGP Peers.

## MLPoE LAC Switching

Platform: Cisco 10000 series (PRE-3 and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/mlp.html#wp1639566>

However, due to PXF resource limitations, the MLPoE LAC Switching feature is supported on the PRE3 and PRE4 platform only.

- MLPoEoQinQ encapsulation between the CPE and LAC is supported.
- MLPoEoA encapsulation between the CPE and LAC is supported.

## New Hardware Features in Cisco IOS Release 12.2(33)SB7

There are no new hardware features in Cisco IOS Release 12.2(33)SB7.

## New Software Features in Cisco IOS Release 12.2(33)SB7

This section describes new and changed features in Cisco IOS Release 12.2(33)SB7. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(33)SB7. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

## Lawful Intercept Enhancements

Platform: Cisco 10000 series (PRE-2 and PRE-3)

In Cisco IOS Release 12.2(33)SB7, LI support for L2TP LNS applications is introduced for the Lawful Intercept feature.

## New Hardware Features in Cisco IOS Release 12.2(33)SB3

There are no new hardware features in Cisco IOS Release 12.2(33)SB3.

## New Software Features in Cisco IOS Release 12.2(33)SB3

This section describes new and changed features in Cisco IOS Release 12.2(33)SB3. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(33)SB3. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below.



If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

## Convergence Acceleration

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The Convergence Acceleration feature allows faster failover of IGP routes in both equal and unequal cost paths

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/dffsrv.html#wpxref66966>

## New Hardware Features in Cisco IOS Release 12.2(33)SB2

This section describes new and changed features in Cisco IOS Release 12.2(33)SB2. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(33)SB2. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### 8-Port Gigabit Ethernet SPA V2

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The 8-port Gigabit Ethernet SPA, version 2, is a half-height SPA that has eight individual fiber optic receivers that support SFPs. Each port can send and receive traffic using the optical fiber connections. For more information, see the *Cisco 10000 Series SIP and SPA Hardware Installation Guide* at [http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/install\\_upgrade/10000series/10kspahwg.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/install_upgrade/10000series/10kspahwg.html) and the *Cisco 10000 Series Router SIP and SPA Software Configuration Guide* at [http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/configuration/10000series/10kspaswg.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/configuration/10000series/10kspaswg.html).

## New Software Features in Cisco IOS Release 12.2(33)SB2

This section describes new and changed features in Cisco IOS Release 12.2(33)SB2. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(33)SB2. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

## IPv6 VPN over MPLS (6VPE) Inter-AS Options on the Cisco 10000 Series Router

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The IPv6 VPN over MPLS (6VPE) functionality supports enabling of interautonomous-system access using the Inter-AS options on PRE 3 and PRE 4 cards.

## L2TP Forwarding of PPPoE Tagging Information Scalability on the Cisco 10000 Series Router

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The L2TP Forwarding of PPPoE Tagging Information Scalability feature on the Cisco 10000 Series Router feature allows you to transfer DSL line information from the L2TP Access Concentrator (LAC) to the L2TP Network Server (LNS). Using this feature, you can also override the nas-port-id and/or calling-station-id VSAs on the LNS with the Circuit-ID and Remote-ID VSA respectively. This feature is supported on the Cisco 10000 series router.

For more information, refer to the *L2TP Forwarding of PPPoE Tagging Information Scalability on the Cisco 10000 Series Router* document at:

[http://www.cisco.com/en/US/docs/ios/vpdn/configuration/guide/config\\_aaa\\_for\\_vpdn\\_ps6441\\_TSD\\_Products\\_Configuration\\_Guide\\_Chapter.html#wp1239108](http://www.cisco.com/en/US/docs/ios/vpdn/configuration/guide/config_aaa_for_vpdn_ps6441_TSD_Products_Configuration_Guide_Chapter.html#wp1239108)

## MLP at LNS with ATM Tunnel

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The MLP at LNS with ATM Tunnel feature allows service providers to support MLP and LFI on single-link MLP bundles as DSL aggregation networks migrate to Ethernet-based connectivity to BRAS usage, with the mix of Ethernet and ATM access networks. This feature supports MLP bundles on an L2TP LNS with ATM tunnel.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/mlp.html>

## MLP at LNS with HQoS and ATM Overhead Accounting

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The MLP at LNS with HQoS and ATM Overhead Accounting feature supports MLP bundles on L2TP LNS with H-QoS on a single-member bundle.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qacct.html>

## MLPoE LAC Switching

Platform: Cisco 10000 series (PRE-3)

The MLPoE LAC Switching feature supports MLPoE between CPE and LAC, and switching the MLPoE to the LNS. However, due to PXF resource limitations, this feature is supported on the PRE3 platform only.

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/mlp.html>

## New Hardware Features in Cisco IOS Release 12.2(33)SB

This section describes new and changed features in Cisco IOS Release 12.2(33)SB. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(33)SB. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### 1-Port 10 Gigabit Ethernet Shared Port Adapter, LANPHY XFP Optics

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The Cisco 1-Port 10-GE SPA is a single height SPA. The interface connector on this SPA is a fiber optic receiver that supports one XFP. The SPA provide standards-based 10-GE implementation for compatibility and interoperability. For more information, see the *Cisco 10000 Series SIP and SPA Hardware Installation Guide* and the *Cisco 10000 Series SIP and SPA Software Configuration Guide*:

[http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/install\\_upgrade/10000series/10ovspa.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/install_upgrade/10000series/10ovspa.html)

### 2-Port Gigabit Ethernet Shared Port Adapter

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The Cisco 2-Port GE SPA is a single height SPA. The interface connector on this SPA is a fiber optic receiver that supports SFPs. The SPA provide standards-based GE implementation for compatibility and interoperability. For more information see, the *Cisco 10000 Series SIP and SPA Hardware Installation Guide* and the *Cisco 10000 Series SIP and SPA Software Configuration Guide*.

[http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/install\\_upgrade/10000series/10ovspa.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/install_upgrade/10000series/10ovspa.html)

### 5-Port Gigabit Ethernet Shared Port Adapter

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The Cisco 2-Port GE SPA is a single height SPA. The interface connector on this SPA is a fiber optic receiver that supports SFPs. The SPA provide standards-based GE implementation for compatibility and interoperability. For more information see, the *Cisco 10000 Series SIP and SPA Hardware Installation Guide* and the *Cisco 10000 Series SIP and SPA Software Configuration Guide*.

[http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/install\\_upgrade/10000series/10ovspa.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/install_upgrade/10000series/10ovspa.html)

### Cisco 10000 Series Performance Routing Engine 4

Platform: Cisco 10000 series (PRE-3, PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/routers/10000/10008/install\\_and\\_upgrade/pre\\_installation/pre4\\_guide/pre4ins.html](http://www.cisco.com/en/US/docs/routers/10000/10008/install_and_upgrade/pre_installation/pre4_guide/pre4ins.html)

## Cisco 10000 Series SPA Interface Processor-600

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The Cisco 10000 Series SPA Interface Processor-600 is designed to enable four half-height or two full-height SPAs using two adjacent line-card slots of the Cisco 10000 Series router. Using application specific integrated circuits (ASIC) with flexibility to bond together point-to-point links, the SIP provides up to 11.2 Gbps of bandwidth and support for 10GE interface at line-rate. For more information see, the Cisco 10000 Series SIP and SPA Hardware Installation Guide.

[http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/install\\_upgrade/10000series/10ovrsip.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/install_upgrade/10000series/10ovrsip.html)

## New Software Features in Cisco IOS Release 12.2(33)SB

This section describes new and changed features in Cisco IOS Release 12.2(33)SB. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(33)SB. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### 1-Port 10 Gigabit Ethernet Shared Port Adapter, LANPHY XFP Optics

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The Cisco 1-Port 10-GE SPA is a single height SPA. The interface connector on this SPA is a fiber optic receiver that supports one XFP. The SPA provide standards-based 10-GE implementation for compatibility and interoperability. For more information, see the *Cisco 10000 Series SIP and SPA Hardware Installation Guide* and the *Cisco 10000 Series SIP and SPA Software Configuration Guide*:

[http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/install\\_upgrade/10000series/10ovspa.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/install_upgrade/10000series/10ovspa.html)

### Alarm Filtering Support in the Cisco Entity Alarm MIB

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_alarm\\_mib.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_alarm_mib.html)

### Any Transport over MPLS (AToM): Remote Ethernet Port Shutdown

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/atom.html>

## Any Transport over MPLS (AToM): Tunnel Selection

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The Any Transport over MPLS (AToM): Tunnel Selection feature allows you to select core-facing paths and map these paths to groups of AToM VCs. You can configure a preferred path by specifying either an MPLS traffic engineering (TE) tunnel or destination IP address/DNS name.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/atom.html>

## AToM Class-Based Match Frame Relay DE

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The AToM Class-Based Match Frame Relay DE feature enables you to classify traffic based on the setting of the Frame Relay DE bit.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Classifying Traffic” chapter, “Defining Match Criteria Using the match Commands” section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## AToM Set FR DE as Police Action

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The AToM Set Frame Relay DE as Police Action feature enables you to set the Frame Relay discard eligibility (DE) bit using the set-frde-transmit policing action.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Policing Traffic” chapter, “Policing Actions” section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## ATM VP Average Traffic Rate

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The ATM VP Average Traffic Rate feature is a subscriber and virtual path (VP) traffic reporting feature that enables you to display the 5-minute traffic rates on VP counters.

This feature extends the **show atm vp** command to provide rate information. Minute counters on the ATM VPs support the **show atm vp** command.

For detailed information about this feature, see the *ATM VP Average Traffic Rate, Release 12.2(33)SB* feature guide:

[http://www.cisco.com/en/US/docs/routers/10000/10008/feature/guides/122\\_33SB/avgrate.html](http://www.cisco.com/en/US/docs/routers/10000/10008/feature/guides/122_33SB/avgrate.html)

## BFD Echo Mode

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

## BFD Version 1 Support

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

## BFD—VRF Support

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

## BFD—WAN Interface Support (ATM, FR, POS, and Serial)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

## BGP Features

Cisco IOS Release 12.2(33)SB introduces support for the following BGP features.

### BGP Neighbor Policy

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bgp\\_basic\\_net.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bgp_basic_net.html)

### BGP Per Neighbor SOO Configuration

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bgp\\_neighbor\\_soo.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bgp_neighbor_soo.html)

## BGP Route-Map Continue Support for Outbound Policy

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bgp\\_external\\_sp.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bgp_external_sp.html)

## BGP Support for BFD

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bgp\\_adv\\_features.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bgp_adv_features.html)

## Bidirectional Forwarding Detection (BFD) Standard Implementation

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

## Cisco Express Forwarding—SNMP CEF-MIB Support

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipswitch/configuration/guide/cef\\_snmp\\_mib.html](http://www.cisco.com/en/US/docs/ios/ipswitch/configuration/guide/cef_snmp_mib.html)

## Cisco IOS Scripting with Tcl

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_script\\_tcl.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_script_tcl.html)

## CISCO-DATA-COLLECTION-MIB

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_mib\\_collect\\_trans.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_mib_collect_trans.html)

## CNS

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_services.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_services.html)

## CNS—Configuration Agent

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_services.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_services.html)

## CNS—Event Agent

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_services.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_services.html)

## CNS—Image Agent

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_services.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_services.html)

## CNS Config Retrieve Enhancement with Retry and Interval

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_services.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_services.html)

## Command Scheduler (Kron)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_services.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_services.html)



## Command Scheduler (Kron) Policy for System Startup

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_services.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_services.html)

## Config Change Tracking Identifier

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The Config Change Tracking Identifier feature assigns a version number to each saved version of the Cisco IOS running-config file, and displays output about the versions. When the version number is updated, a notification of the change in version number is generated. The Config Logger can also use this feature to determine if there have been any changes to the Cisco IOS running-config file. To enable the Config Change Tracking Identifier feature, enter the **show config id** command.

## Config Logger Persistency

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/config-logger-6149.html>

## Configuration Change Notification and Logging

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf\\_config-logger.html](http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf_config-logger.html)

## Configuration Generation Performance Enhancement

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/config\\_cache.html](http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/config_cache.html)

## Configuration Partitioning

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf\\_partition.html](http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf_partition.html)

## Configuration Replace and Configuration Rollback

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf\\_config-rollback.html](http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf_config-rollback.html)

## Configuration Rollback Confirmed Change

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf\\_config-rollback.html](http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf_config-rollback.html)

## Contextual Configuration Diff Utility

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf\\_config-diff.html](http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf_config-diff.html)

## Control Plane Policing—Platform Improvement

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The Control Plane Policing—Platform Enhancement feature enhances CoPP by providing the following functionality:

- User-level punt monitoring—Enhances your ability to monitor users and traffic to prevent a denial of service (DoS) attack.  
Using this feature, you can monitor individual users and display statistical information about traffic that the parallel express forwarding (PXF) engine sends (punts) to the Route Processor (RP). This information allows you to see when a DoS attack occurs. You can then take action by dropping or rate-limiting the punted traffic.
- Configurable rate and burst size for the divert cause policer—Introduces the **platform c10k divert-policer** command that enables you to set the rate and burst size of the divert cause policer.
- Drop alarms for packet drops by the To-RP queue and divert cause policer—Monitors possible DoS attacks by sending warning messages (alarms) to the console and the syslog log file to alert you when a change in drop activities occurs, such as packet drops due to congestion in the To-RP queues or due to aggregated traffic that violates the divert cause policer.

For detailed information about this feature, see the *Cisco 10000 Series Router Control Plane Policing—Platform Enhancement, Release 12.2(33)SB* feature guide:

[http://www.cisco.com/en/US/docs/routers/10000/10008/feature/guides/122\\_33SB/cppenhan.html](http://www.cisco.com/en/US/docs/routers/10000/10008/feature/guides/122_33SB/cppenhan.html)

## DHCPv6—Relay—Reload Persistent Interface ID Option

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-dhcp.html>

## Embedded Event Manager (EEM) 2.3

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_eem\\_overview.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_eem_overview.html)

## Embedded Resource Manager (ERM)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_erm\\_resource.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_erm_resource.html)

## Embedded Resource Manager (ERM)—MIB

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_erm\\_mib.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_erm_mib.html)

## Embedded Syslog Manager (ESM)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_esm\\_syslog.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_esm_syslog.html)

## EtherChannel Mini-Links

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ce/ether/configuration/guide/ce\\_Inkbnl.html](http://www.cisco.com/en/US/docs/ios/ce/ether/configuration/guide/ce_Inkbnl.html)

## Ethernet Overhead Accounting

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The Ethernet Overhead Accounting feature enables the router to account for downstream Ethernet frame headers when applying shaping to packets.

A user-defined offset specifies the number of overhead bytes the router is to use when calculating the overhead per packet. The router calculates the overhead before applying shaping.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Overhead Accounting” chapter, “Ethernet Overhead Accounting” section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## Exclusive Configuration Change Access and Access Session Locking

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf\\_config-lock.html](http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/cf_config-lock.html)

## GEC—8 Member Links

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbcelacp.html#wp1053782](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbcelacp.html#wp1053782)

## HTTP TACAC+ Accounting Support

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_http\\_web.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_http_web.html)

## HTTPS—HTTP Server and Client with SSL 3.0

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_https\\_sc\\_ssl3.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_https_sc_ssl3.html)

## IEEE 802.1Q and QinQ Support on GEC

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## IEEE 802.1Q Tunneling (QinQ) for AToM

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/atom.html>

## Gigabit EtherChannel Features

Cisco IOS Release 12.2(33)SB introduces support for the following Gigabit EtherChannel (GEC) features.

### IEEE 802.3ad—Faster Link Switchover Time

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce\\_Inkbndl.html](http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce_Inkbndl.html)

### IEEE 802.3ad—Maximum Number of Links Increased

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce\\_Inkbndl.html](http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce_Inkbndl.html)

### IEEE 802.3ad MIB

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce\\_lacpmib.html](http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce_lacpmib.html)

### ISSU—GEC

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

### MVPN—Support on GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

### NSF—Support for GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

### NSR—Support for GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

**PBR—Support for GEC Bundle**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

**PPPoEoE—Support for GEC Bundle**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

**PPPoEoQinQ—Support for GEC Bundle**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

**PPPoVLAN—Support for GEC Bundle**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

**QoS—Service Policies on Aggregate GEC**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

**SSO—GEC**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

**IGP Convergence Acceleration**

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The IGP Convergence Acceleration feature allows faster failover of IGP routes in a load balanced situation.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/dffsrv.html>

## Interfaces MIB: SNMP Context Based Access

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The interface MIB (IF-MIB) has been modified to support context-aware packet information in virtual route forwarding (VRF) environments. VRF environments require that contexts apply to VPNs so that clients can be given selective access to the information stored in the IF-MIB. Clients that belong to a particular VRF can access information about the interface from the IF-MIB that belongs to that VRF only. When a client tries to get information from an interface that is associated with a particular context, the client can see only the information that belongs to that context and cannot see information to which it is not entitled. No commands have been modified or added to support this feature. This feature is automatically enabled when VRF is configured.

The IF-MIB supports all tables defined in RFC 2863 and the CISCO- IFEXTENSION-MIB.

## IP SLAs—LSP Health Monitor

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla\\_lsp\\_mon\\_autodisc.html](http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla_lsp_mon_autodisc.html)

## IP SLAs—LSP Health Monitor with LSP Discovery

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla\\_lsp\\_mon\\_autodisc.html](http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla_lsp_mon_autodisc.html)

## IP SLAs for Metro-Ethernet

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla\\_metro\\_ethernet.html](http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla_metro_ethernet.html)

## IP SLAs for MPLS Pseudo Wire (PWE3) via VCCV

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla\\_lsp\\_mon\\_autodisc.html](http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla_lsp_mon_autodisc.html)

## IP SLAs Random Scheduler

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla\\_multi\\_scheduler.html](http://www.cisco.com/en/US/docs/ios/ipsla/configuration/guide/sla_multi_scheduler.html)

## IPv6—CNS Agents

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng\\_apps.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng_apps.html)

## IPv6—Config Logger

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng\\_apps.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng_apps.html)

## IPv6—HTTP(S)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng\\_apps.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng_apps.html)

## IPv6—IP SLAs (UDP Jitter, UDP Echo, ICMP Echo, TCP Connect)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng\\_apps.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng_apps.html)

## IPv6—Netconf

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng\\_apps.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng_apps.html)

## IPv6—SOAP

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng\\_apps.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng_apps.html)



## IPv6 Default Router Preferences

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-addrg\\_bsc\\_con.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-addrg_bsc_con.html)

## IPv6 VPN over MPLS (6VPE)

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The IPv6 VPN over MPLS (6VPE) feature enables IPv6 sites in a VPN that communicates with each other over an MPLS IPv4 core network using MPLS LSPs. This feature relies on multiprotocol BGP extensions in the IPv4 network configuration on the provider edge (PE) router to exchange IPv6 VPN reachability information in addition to an MPLS label for each IPv6 address prefix to be advertised. PE routers are configured to be dual stack to support both IPv4 and IPv6. In a dual stack configuration, IPv4 and IPv6 VPNs can coexist with similar coverage and policies. The implementation also provides IPv6 VRF-Lite support.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/dffsrv.html>

## Intelligent Service Gateway (ISG) Features

Cisco IOS Release 12.2(33)SB introduces support for the following Intelligent Service Gateway (ISG) features.

### ISG: Flow Control: Flow Redirect (PXF scaling)

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/scaling.html>

### ISG: Flow Control: QoS Control: MQC Support for IP Sessions

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The Modular QoS CLI (MQC) Support for IP Sessions feature extends the router's QoS functionality to support per-user QoS on IP sessions. Using this feature, you can configure queuing and non-queuing features on IP sessions, either locally on the router or remotely using an authentication, authorization, and accounting (AAA) server such as RADIUS. This feature also supports dynamic interface association (interface redundancy) for IP sessions, L2TP network server (LNS) sessions, and L2TP access concentrator (LAC) sessions.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* "Regulating and Shaping Subscriber Traffic" chapter, "MQC Support for IP Sessions" section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

**ISG: Policy Control: ISG-SCE Control Bus**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/isg/configuration/guide/isg\\_sce\\_control\\_bus.html](http://www.cisco.com/en/US/docs/ios/isg/configuration/guide/isg_sce_control_bus.html)

**ISG:Session:Protection and Resiliency:Keepalive—ARP, ICMP**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/isg/configuration/guide/isg\\_pol\\_sessn\\_maint.html](http://www.cisco.com/en/US/docs/ios/isg/configuration/guide/isg_pol_sessn_maint.html)

**IS-IS Support for BFD over IPv4**

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

**ISSU—GEC**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

**ISSU—SNMP**

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ha/configuration/guide/ha-inserv\\_updg.html](http://www.cisco.com/en/US/docs/ios/ha/configuration/guide/ha-inserv_updg.html)

**ISSU Support for 2 Port GE SPA V2 with 2 RJ45 Ports**

Platform: Cisco 10000 series (PRE-3 and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/install\\_upgrade/10000series/10ovspa.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/install_upgrade/10000series/10ovspa.html)

**ISSU Support for 5 Port GE SPA V2**

Platform: Cisco 10000 series (PRE-3 and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/interfaces\\_modules/shared\\_port\\_adapters/install\\_upgrade/10000series/10ovspa.html](http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/install_upgrade/10000series/10ovspa.html)

## L2TP Forwarding of PPPoE Tag Information

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/vpdn/configuration/guide/config\\_aaa\\_for\\_vpdn.html](http://www.cisco.com/en/US/docs/ios/vpdn/configuration/guide/config_aaa_for_vpdn.html)

## L2VPN Interworking: Ethernet VLAN to ATM AAL5

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/l2vpn.html>

## L2VPN Interworking: Ethernet/VLAN to Frame Relay

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/l2vpn.html>

## L2VPN Local Switching—HDLC/PPP

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The L2VPN Local Switching—HDLC/PPP feature enables local switching capability for HDLC and PPP AC in L2VPN.

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/wan/configuration/guide/wan\\_l2\\_lcl\\_swng.html](http://www.cisco.com/en/US/docs/ios/wan/configuration/guide/wan_l2_lcl_swng.html)

## Logging to Local Nonvolatile Storage (ATA Disk)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_log\\_local\\_nonvol.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_log_local_nonvol.html)

## MLP on LNS

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The MLP at LNS feature allows service providers to support MLP and LFI on single-link MLP bundles. This enables high-priority, low-latency packets to be interleaved between fragments of lower-priority higher-latency packets.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/mlp.html>

## MPLS Features

Cisco IOS Release 12.2(33)SB introduces support for the following MPLS features.

### MPLS EM—MPLS LDP MIB (RFC3815)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_em\\_ldp\\_mib\\_3815.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_em_ldp_mib_3815.html)

### MPLS EM—MPLS LSR MIB (RFC3813)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_em\\_ldp\\_mib\\_3813.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_em_ldp_mib_3813.html)

### MPLS EM—MPLS VPN MIB RFC4382 Upgrade

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_em\\_vpn\\_mib\\_4382.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_em_vpn_mib_4382.html)

### MPLS Enhancements to Interfaces MIB

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_enhance\\_mib.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_enhance_mib.html)

### MPLS LDP—IGP Synchronization

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_ldp\\_igp\\_synch.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_ldp_igp_synch.html)

**Note**

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OSPF only is supported in this release. IS-IS is not supported.

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### MPLS LDP—Local Label Allocation Filtering

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_ldp\\_alloc\\_filter.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_ldp_alloc_filter.html)

### **MPLS LDP—Lossless MD5 Session Authentication**

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_ldp\\_lossless\\_md5.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_ldp_lossless_md5.html)

### **MPLS LDP—VRF Aware Static Labels**

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_vrf\\_aware\\_static.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_vrf_aware_static.html)

### **MPLS Static Labels**

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_vrf\\_aware\\_static.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_vrf_aware_static.html)

## **MPLS VPN Features**

Cisco IOS Release 12.2(33)SB introduces support for the following MPLS VPN features.

### **MPLS VPN—BGP Local Convergence**

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_vpn\\_pece\\_lnk\\_prot.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_vpn_pece_lnk_prot.html)

### **MPLS VPN—VRF CLI for IPv4 and IPv6 VPNs**

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_vpn\\_ipv4\\_ipv6.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_vpn_ipv4_ipv6.html)

## **MQC—Traffic Shaping Overhead Accounting for ATM**

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/overhead\\_acctng.html](http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/overhead_acctng.html)

## MVPN—Support on GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## NAT—Route Maps in PXF

The NAT—Route Maps in PXF feature introduces the ability for NAT to use route maps for translation purposes in the PXF processing path on Cisco 7304 routers using an NSE-100 or an NSE-150.

For additional information on this feature, see the *PXF Information for Cisco 7304 Routers* document.

## Netconf Access for Configuration over BEEP

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_netconf.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_netconf.html)

## NETCONF over SSHv2

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cns\\_netconf.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cns_netconf.html)

## Netflow Multicast Support

Platform: Cisco 10000 series (PRE-3 and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netflow/configuration/guide/cfg\\_nf\\_multi\\_acctg.html](http://www.cisco.com/en/US/docs/ios/netflow/configuration/guide/cfg_nf_multi_acctg.html)

## NSF—Support for GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## NSF/SSO—Any Transport over MPLS (AToM)

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The NSF/SSO—Any Transport over MPLS (AToM) feature improves the availability of a network that uses AToM to provide Layer 2 VPN services. AToM NSF/SSO provides the ability to detect failures and handle them with minimal disruption to the service being provided. AToM NSF is achieved by SSO and NSF mechanisms. A standby Route Processor (RP) provides control-plane redundancy. The control

plane state and data plane provisioning information for the attachment circuits (ACs) and AToM pseudowires (PWs) are checkpointed to the standby RP to provide NSF for AToM L2VPNs upon switchover from the primary RP.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/atom.html>

## NSR—Support for GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## OSPF Graceful Shutdown

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_ospf\\_ttl.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_ospf_ttl.html)

## OSPF Support for BFD over IPv4

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

## OSPFv2 Local RIB

Platform: Cisco 10000 series (PRE-1, PRE-2, and PRE3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_ospf\\_local\\_rib.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_ospf_local_rib.html)

## OSPFv3 Fast Convergence—LSA and SPF Throttling

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-ospf.html>

## PBR—Support for GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## Periodic MIB Data Collection and Transfer Mechanism

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_mib\\_collect\\_trans.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_mib_collect_trans.html)

## Policy Map Scaling Phase 2

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The Policy Map Scaling Phase 2 feature enables the router to support a maximum of 8192 unique policy maps for the PRE3 and PRE4, doubling the number supported in previous releases. The router continues to support up to 4096 policy maps for the PRE2.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Configuring QoS Policy Actions and Rules” chapter, “8K Policy Maps” section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## PPPoE—QinQ Support

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/bbds1/configuration/guide/bba\\_pppoe\\_qinq.html](http://www.cisco.com/en/US/docs/ios/bbds1/configuration/guide/bba_pppoe_qinq.html)

## PPPoE over VLANs Scaling and PPPoE over VLANs Forwarding over PVC

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/bbds1/configuration/guide/bba\\_pppoe\\_vlan\\_enh.html](http://www.cisco.com/en/US/docs/ios/bbds1/configuration/guide/bba_pppoe_vlan_enh.html)

## PPPoE—Session Limit Local Override

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/bbds1/configuration/guide/bba\\_pppoe\\_sllov.html](http://www.cisco.com/en/US/docs/ios/bbds1/configuration/guide/bba_pppoe_sllov.html)

## PPPoE—Smart Server Selection

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/bbds1/configuration/guide/bba\\_pppoe\\_sss.html](http://www.cisco.com/en/US/docs/ios/bbds1/configuration/guide/bba_pppoe_sss.html)



## PPPoEoE—Support for GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## PPPoEoQinQ—Support for GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## PPPoVLAN—Support for GEC Bundle

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## PPPoX Hitless Failover

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce\\_inkbndl.html](http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce_inkbndl.html)

## QoS: ATM-CLP-Based WRED

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The QoS: ATM-CLP-Based WRED feature configures a drop policy for WRED based on a cell loss priority (CLP) value. Valid values are 0 or 1. When this feature is configured, the router uses the value of the CLP bit to randomly drop packets leaving the pseudowire and going out an ATM interface. The router also supports ATM CLP-based WRED on non-Layer2 VPN outbound ATM interfaces.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Managing Packet Queue Congestion” chapter, “Controlling Congestion Using Weighted Random Early Detection” section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## QoS: Per-Session Shaping for ATM Interfaces

Platform: Cisco 10000 series (PRE-3 and PRE-4)

The QoS: Per-Session Shaping for ATM Interfaces feature enables the router to shape session traffic on L2TP network server (LNS) outbound ATM interfaces.

Using this feature, you can apply a hierarchical QoS policy to an ATM interface and manage the traffic belonging to a session. The shaping feature configured in the parent policy map shapes the classes of traffic that comprise the session traffic and the queuing features configured in the child policies enables the router to queue the session packets, rather than drop them.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Regulating and Shaping Subscriber Traffic” chapter, “Per Session Shaping for ATM Interfaces” section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## QoS—Service Policies on Aggregate GEC

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## QoS—Set ATM CLP Bit Using Policer

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The Set ATM CLP bit using a policer feature enables you to set the ATM cell loss priority (CLP) bit using the set-clp-transmit policing action.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Policing Traffic” chapter, “Policing Actions” section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## QoS: Set L2 CoS as a Policer Action

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The QoS: Set L2 CoS as a Policer Action feature enables you to set the Layer 2 class of service (CoS) bits using the set-cos-transmit policing action.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Policing Traffic” chapter, “Policing Actions” section:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## QoS: Simultaneous Policy Map on Interface and PPP Session

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The QoS: Simultaneous Policy Map on Interface and PPP Session feature allows the broadband aggregation system (BRAS) to provide multiple levels of QoS hierarchy that shape traffic at different points of congestion in the Layer 2 network. This enables the BRAS to avoid congestion in downstream links within the network. The BRAS prioritizes the traffic based on the subscriber’s contracted bandwidth and subscribed services.

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide* “Simultaneous Policy Maps” chapter:

<http://cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## QoS: Tunnel Marking for GRE Tunnels

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/tnl\\_mrkg\\_gre\\_tnls.html](http://www.cisco.com/en/US/docs/ios/qos/configuration/guide/tnl_mrkg_gre_tnls.html)

## Reliable Delivery and Filtering for Syslog

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_reliable\\_del\\_filter.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_reliable_del_filter.html)

## RFC 3020 Multilink Frame Relay MIB Support

Platform: Cisco 10000 series (PRE-3 and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/wan/configuration/guide/wan\\_ml\\_fr\\_mib\\_3020.html](http://www.cisco.com/en/US/docs/ios/wan/configuration/guide/wan_ml_fr_mib_3020.html)

## RFC 4293 IP-MIB (IPv6 Only)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng\\_apps.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng_apps.html)

## Role-Based Access Control CLI Commands

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/security/configuration/guide/sec\\_role\\_base\\_cli.html](http://www.cisco.com/en/US/docs/ios/security/configuration/guide/sec_role_base_cli.html)

## Secure SNMP Views

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The USM, VACM and Community MIBs have information that can potentially be used to gain access to the router using SNMP. Therefore, the USM, VACM, and Community MIBs are excluded from the default SNMP access view so as not to allow remote access unless specifically configured. However, when an SNMP view is created with any parent object identifier (OID) of these MIBs included (for example “internet included”), these MIBs also get included in the view. To increase security, the Secure SNMP Views enhancement excludes these MIBs from SNMP access views even when parent OIDs are included in the view. Prior to this release, when configuring SNMP views with parent OIDs that include

the USM, VACM, or Community OIDs, the user was required to explicitly exclude them. For example, the following configuration can be used for excluding security-sensitive MIBs from the SNMP view named “test”:

```
! - include all MIBs under the parent tree “internet” snmp-server view test internet included
! -- exclude snmpUsmMIB snmp-server view test 1.3.6.1.6.3.15 excluded
! -- exclude snmpVacmMIB snmp-server view test 1.3.6.1.6.3.16 excluded
! -- exclude snmpCommunityMIB snmp-server view test 1.3.6.1.6.3.18 excluded
```

Beginning in Cisco IOS Releases 12.0(26)S and 12.2(2)T, the USM, VACM, and Community MIBs are excluded from any parent OIDs in a configured view by default. If you wish to include these MIBs in a view, you must now explicitly include them.

## SNMP Support for MTR

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/mtr/configuration/guide/multi-top\\_rtng.html](http://www.cisco.com/en/US/docs/ios/mtr/configuration/guide/multi-top_rtng.html)

## SNMP Support for VPNs

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_cfg\\_snmp\\_sup.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cfg_snmp_sup.html)

## SNMPv3—3DES and AES Encryption Support

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm\\_encrypt\\_snmp\\_sup.html](http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_encrypt_snmp_sup.html)

## SSO—BFD (Admin Down)

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

## SSO—GEC

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/gec.html>

## SSO—LACP

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce\\_Inkbndl.html](http://www.cisco.com/en/US/docs/ios/cether/configuration/guide/ce_Inkbndl.html)

## Static Routes for BFD

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp\\_bfd.html](http://www.cisco.com/en/US/docs/ios/iproute/configuration/guide/irp_bfd.html)

## Syslog over IPV6

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng\\_apps.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-mng_apps.html)

## System Logging—EAL4 Certification Enhancements

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)



### Note

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Official EAL4 certification is not claimed by Cisco. This feature is part of current and planned enhancements that may qualify Cisco IOS software for future certification.

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This feature includes the following enhancements:

- The system logging process will now generate “audit start” and “audit stop” messages.
- The system logging process will now generate messages that include the date and time of an event, the type of event, the subject identity, and the outcome (success or failure) of an event.
- Changes to logging parameters will be logged.
- Loss of audit record is minimized.

## Throttling of AAA (RADIUS) Records

Platforms: Cisco 7304-NPE-G100, Cisco 7304-NSE-100, Cisco 7304-NSE-150, Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/security/configuration/guide/sec\\_throtl\\_aaa.html](http://www.cisco.com/en/US/docs/ios/security/configuration/guide/sec_throtl_aaa.html)

## Unicast Reverse Path Forwarding (uRPF)

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

The Unicast Reverse Path Forwarding (uRPF) feature is used to verify that the path of an incoming packet is consistent with the local packet forwarding information. This is achieved by performing a reverse path lookup using the source IP address of an incoming packet to determine the current path to that IP address. The validity of this path determines whether uRPF passes or drops the packet.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/urpf.html>

## VRF-Aware VPDN Tunnels

Platform: Cisco 10000 series (PRE-2, PRE-3, and PRE-4)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/tunnIng.html>

## New Hardware Features in Cisco IOS Release 12.2(31)SB12

There are no new hardware features in Cisco IOS Release 12.2(31)SB12.

## New Software Features in Cisco IOS Release 12.2(31)SB12

This section describes new and changed features in Cisco IOS Release 12.2(31)SB12. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB12. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

## Lawful Intercept for MLP

Platform: Cisco 10000 series routers

This feature supports SNMP-based Layer 3 lawful intercept on MLP bundles. For more information, see the “Lawful Intercept Overview” chapter in the *Cisco 10000 Series Router Lawful Intercept Configuration Guide*.

[http://cisco.com/en/US/docs/routers/10000/10008/feature/guides/lawful\\_intercept/10LIovr.html](http://cisco.com/en/US/docs/routers/10000/10008/feature/guides/lawful_intercept/10LIovr.html)

## New Hardware Features in Cisco IOS Release 12.2(31)SB10

There are no new hardware features in Cisco IOS Release 12.2(31)SB10.

## New Software Features in Cisco IOS Release 12.2(31)SB10

This section describes new and changed features in Cisco IOS Release 12.2(31)SB10. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB10. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### ATM OAM Loopback Mode Detection

The ATM OAM Loopback Mode Detection feature lets the router automatically detect when a peer ATM interface is in loopback mode. When loopback is detected on an interface where end-to-end F5 Operation, Administration, and Maintenance (OAM) is enabled, the impacted permanent virtual circuit (PVC) is moved to a DOWN state, and traffic is suspended. When the loopback condition in the peer ATM interface is removed, the PVC is moved back to an UP state.

For detailed information about this feature, see the following:

[http://www.cisco.com/en/US/docs/ios/atm/configuration/guide/atm\\_lmd\\_oam.html](http://www.cisco.com/en/US/docs/ios/atm/configuration/guide/atm_lmd_oam.html)

## New Hardware Features in Cisco IOS Release 12.2(31)SB6

This section describes new and changed features in Cisco IOS Release 12.2(31)SB6. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB6. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### 1000BASE-T SFP Pluggable Transceiver

The 1-port Gigabit Ethernet half-height line card supports the 1000BASE-T SFP pluggable transceiver for Category 5 copper wire. The SFP-GE-T provides full-duplex Gigabit Ethernet connectivity to high-end workstations and between wiring closets over an existing copper network infrastructure. The SFP-GE-T maximum cabling distance is 328 feet (100 m). For more information, see to the *Cisco 10000 Series Router Line Card Configuration Guide*:

[http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/line\\_card\\_\\_software/lncl-sw.html](http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/line_card__software/lncl-sw.html)

## New Software Features in Cisco IOS Release 12.2(31)SB6

This section describes new and changed features in Cisco IOS Release 12.2(31)SB6. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB6. To determine if a feature is new or changed, see the feature history

table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

## PPP Session Queuing on ATM Virtual Circuits

PPP Session Queuing on ATM Virtual Circuits (VCs) enables you to shape and queue PPP over ATM (PPPoA) and PPP over Ethernet over ATM (PPPoEoA) sessions to a user specified rate. Multiple sessions can exist on any ATM VC and have QoS policies applied, or some of the sessions might have QoS policies while others do not. The router shapes the sum of all PPPoA or PPPoEoA traffic on a VC so that the subscriber's connection to the DSLAM does not become congested. Queuing-related functionality provides different levels of service to the various applications that execute over the PPPoA or PPPoEoA session.

For more information, see the “Configuring Dynamic Subscriber Services” chapter in the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## QoS: Per-Session Shaping and Queuing on LNS

Platform: Cisco 10000 series (PRE-3)



### Note

This feature was introduced in Cisco IOS Release 12.2(28)SB for the Cisco 7200 series and Cisco 7301.

The QoS: Per-Session Shaping and Queuing on LNS feature provides the ability to shape (for example, transmit or drop) or queue (for transmission later) the traffic going from an Internet service provider (ISP) to an ISP subscriber over a Layer 2 Tunneling Protocol (L2TP) Network Server (LNS). With this feature, the outgoing traffic is shaped or queued on a per-session basis.

For detailed information about this feature for the Cisco 10000 series, see the “Configuring Dynamic Subscriber Services” chapter in the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## New Hardware Features in Cisco IOS Release 12.2(31)SB5

This section describes new and changed features in Cisco IOS Release 12.2(31)SB5. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB5. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.



## Cisco 7201 Router

The Cisco 7201 router provides application-specific features for broadband subscriber aggregation and network application services with high processing performance. The Cisco 7201 is a compact 1-rack-unit router that integrates the following components:

- four built-in Gigabit Ethernet ports
- pluggable Gigabit Ethernet optics (that is, small form-factor pluggable [SFP] optics)
- one dedicated 10/100-Mbps copper Ethernet Management port
- one USB port for general storage and security token storage
- one port adapter slot, one CompactFlash Disk slot
- 1 GB SDRAM DIMM (which can be upgraded to 2 GB)
- console and auxiliary ports

For detailed information about this product, see the *Cisco 7201 Installation and Configuration Guide*: [http://www.cisco.com/en/US/docs/routers/7200/install\\_and\\_upgrade/7201\\_install\\_config/7201\\_icg.html](http://www.cisco.com/en/US/docs/routers/7200/install_and_upgrade/7201_install_config/7201_icg.html)

## New Software Features in Cisco IOS Release 12.2(31)SB5

This section describes new and changed features in Cisco IOS Release 12.2(31)SB5. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB5. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### Generic Routing Encapsulation Tunnel IP Source and Destination VRF Membership

Platform: Cisco 1000 series (PRE-2 and PRE-3)

The Generic Routing Encapsulation (GRE) Tunnel IP Source and Destination VRF Membership feature enables multicast traffic from subscribers to traverse a tunnel interface on the router and terminate in a VRF. Instead of the termination point being in the global routing table, the tunnel's source and destination endpoints terminate within a non-global VRF.

For detailed information about this feature, see the following document:

For additional information, see the "IP Tunneling" chapter in the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

[http://www.cisco.com/en/US/docs/routers/10000/10008/feature/guides/122\\_31sb5/fs\\_gripvrf.html](http://www.cisco.com/en/US/docs/routers/10000/10008/feature/guides/122_31sb5/fs_gripvrf.html)

## New Hardware Features in Cisco IOS Release 12.2(31)SB3

There are no new hardware features in Cisco IOS Release 12.2(31)SB3.

## New Software Features in Cisco IOS Release 12.2(31)SB3

This section describes new and changed features in Cisco IOS Release 12.2(31)SB3. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB3. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### Embedded Event Manager (EEM) 2.2

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sb\\_eem22.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sb_eem22.html)

### IS-IS-MIB

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2/12\\_2sg/feature/guide/ismibspt.html](http://www.cisco.com/en/US/docs/ios/12_2/12_2sg/feature/guide/ismibspt.html)

### QoS: MQC Classification, Policing, and Marking on LAC

Platform: Cisco 10000 series (PRE-2)



#### Note

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Support for this feature on the PRE-3 was introduced in Cisco IOS Release 12.2(31)SB2.

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For detailed information about this feature, see the “Shaping Traffic” chapter in the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qshape.html>

### TCP MSS Adjustment

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the “Configuring PPPoE over Ethernet and IEEE 802.1Q VLAN” chapter in the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

[http://www.cisco.com/en/US/docs/ios/12\\_2t/12\\_2t4/feature/guide/ft\\_admss.html](http://www.cisco.com/en/US/docs/ios/12_2t/12_2t4/feature/guide/ft_admss.html)

## New Hardware Features in Cisco IOS Release 12.2(31)SB2

This section describes new and changed features in Cisco IOS Release 12.2(31)SB2. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB2. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### 1-Port Enhanced ATM Port Adapter with Support for 8000 VCs

Platform: Cisco 7304 (NSE-100, NSE-150, NPE-G100)



#### Note

Cisco IOS Release 12.2(28)SB introduced support for this port adapter on the Cisco 7200 series and Cisco 7301. Release 12.2(31)SB2 adds support for the Cisco 7304.

Cisco IOS Release 12.2(31)SB2 adds support for the PA-A6 port adapters and support for 8000 virtual circuits (VCs) on PA-A6 port adapters that are installed in the Cisco 7304 router. The PA-A6 is a series of single-width, single-port, ATM port adapters. With advanced ATM features, the PA-A6 port adapters support broadband aggregation, WAN aggregation, and campus/MAN aggregation.

The following PA-A6 port adapters are supported:

- PA-A6-OC3MM: 1-port ATM OC-3c/STM-1 multimode port adapter, enhanced
- PA-A6-OC3SMI: 1-port ATM OC-3c/STM-1 single-mode (IR) port adapter, enhanced
- PA-A6-OC3SML: 1-port ATM OC-3c/STM-1 single-mode (LR) port adapter, enhanced
- PA-A6-T3: 1-port ATM DS3 port adapter, enhanced
- PA-A6-E3: 1-port ATM E3 port adapter, enhanced

For detailed information about these products, see the *PA-A6 Port Adapter Installation and Configuration* document:

[http://www.cisco.com/en/US/docs/interfaces\\_modules/port\\_adapters/install\\_upgrade/atm/pa-a6\\_ATM\\_install\\_config/pa-a6.html](http://www.cisco.com/en/US/docs/interfaces_modules/port_adapters/install_upgrade/atm/pa-a6_ATM_install_config/pa-a6.html)

### 1-Port Packet over SONET OC3c/STM1 Port Adapter

Platform: Cisco 7304 (NSE-100, NSE-150, NPE-G100)

For detailed information about the 1-port Packet over SONET OC3c/STM1 port adapter (PA-POS-1OC3), see the following documents:

- *Cisco 1-Port OC-3/STM-1 Packet-Over-SONET Port Adapter* data sheet:  
[http://www.cisco.com/en/US/prod/collateral/routers/ps341/product\\_data\\_sheet0900aecd80221d3d.html](http://www.cisco.com/en/US/prod/collateral/routers/ps341/product_data_sheet0900aecd80221d3d.html)
- *PA-POS-1OC3 Single-Port Port Adapter Installation and Configuration Guide*:
- [http://www.cisco.com/en/US/docs/interfaces\\_modules/port\\_adapters/install\\_upgrade/multichannel\\_serial/pa-pos-1oc3\\_install\\_config/6514\\_1oc.html](http://www.cisco.com/en/US/docs/interfaces_modules/port_adapters/install_upgrade/multichannel_serial/pa-pos-1oc3_install_config/6514_1oc.html)

## Network Services Engine 150 (NSE-150)

Platform: Cisco 7304

The NSE-150 is a processor for the Cisco 7304 router. It contains two internal processors for forwarding network traffic: a Parallel eXpress Forwarding (PXF) processor, which accelerates the processing of IP packets for features supported in the PXF processing path; and a Route Processor (RP), which handles all non-IP packets and all packets that are not forwarded using the PXF processing path.

The NSE-150 introduces the following enhancements to the Cisco 7304 router:

- Additional port density through on-board Gigabit Ethernet ports. The NSE-150 has four on-board Gigabit Ethernet ports.
- Improved overall memory for better overall performance (for example, additional DRAM, column memory for PXF, packet memory for the Route Processor, and NVRAM).
- Increased RP and PXF memory to enable more scalability (for the routing table, FIB table, and Turbo ACL).
- Improved processing power for the control plane functions (for example, routing protocols and statistics collection).
- USB ports. Support for USB ports on the NSE-150 will be introduced as an enhancement in a future release of Cisco IOS Release 12.2SB.

For additional information on the NSE-150, see the *Cisco 7304 Network Services Engine Installation and Configuration Guide*:

[http://www.cisco.com/en/US/docs/routers/7300/install\\_and\\_upgrade/7304/7304\\_fru/7304\\_nse\\_icg/nse.html](http://www.cisco.com/en/US/docs/routers/7300/install_and_upgrade/7304/7304_fru/7304_nse_icg/nse.html)

## NPE-G2 Network Processing Engine

Platform: Cisco 7200VXR series

The Network Processing Engine NPE-G2 is the latest and highest-performing routing engine with the largest scalability within the family of network processing engines for the Cisco 7200VXR series. A new chip design on the NPE-G2 provides up to double the performance of the NPE-G1. This great performance improvement makes the NPE-G2 an ideal solution for the new aggregation services for enterprises and service providers.

The NPE-G2 offers following benefits:

- Provides double the performance compared to the Cisco 7200 VXR series NPE-G1—up to 2 million packets per second (pps) in Cisco Express Forwarding (CEF)
- Offers three 10/100/1000-Mbps copper Ethernet ports and optical ports (10/100/1000 Mbps over copper or 1000 Mbps over industry-standard SFP) for LAN/WAN connectivity
- Provides two USB ports for general storage and security token storage
- Provides one dedicated 10/100-Mbps copper Ethernet port for management
- Offers 1 GB of DRAM memory by default and 2 GB DRAM is available as an option
- Eliminates the requirement for an I/O controller
- Extends the use of the available I/O slot for a single port adapter in combination with the Port Adapter Jacket Card (C7200-JC-PA)
- Offers greatly improved price/performance ratio

**Note**

An I/O controller module can be used with the NPE-G2, but it is not necessary for system functionality. Installing an I/O controller in a Cisco 7200VXR series chassis with the NPE-G2 activates the console and auxiliary ports on the I/O controller and automatically disables the console and auxiliary ports on the NPE-G2. However, you can still use the CompactFlash Disk slots and Ethernet ports on both the NPE-G2 and I/O controller when both cards are installed.

For detailed information about this product, see the following documents:

- *Cisco 7200VXR NPE-G2 Network Processing Engine* data sheet  
[http://www.cisco.com/en/US/products/hw/routers/ps341/products\\_data\\_sheet0900aecd8047177b.html](http://www.cisco.com/en/US/products/hw/routers/ps341/products_data_sheet0900aecd8047177b.html)
- The “NPE-G2 Overview” chapter of the *Network Processing Engine and Network Services Engine Installation and Configuration* document:  
[http://www.cisco.com/en/US/docs/routers/7200/install\\_and\\_upgrade/network\\_process\\_engine\\_inst\\_all\\_config/4448o6.html](http://www.cisco.com/en/US/docs/routers/7200/install_and_upgrade/network_process_engine_inst_all_config/4448o6.html)
- The “NPE-G1 and NPE-G2 Installation and Configuration Information” chapter of the *Network Processing Engine and Network Services Engine Installation and Configuration* document:  
[http://www.cisco.com/en/US/docs/routers/7200/install\\_and\\_upgrade/network\\_process\\_engine\\_inst\\_all\\_config/npense.html](http://www.cisco.com/en/US/docs/routers/7200/install_and_upgrade/network_process_engine_inst_all_config/npense.html)

## Performance Routing Engine 3 (PRE-3)

Platform: Cisco 10000 series

For detailed information about this product, see the following documents:

- *Cisco 10000 Series Performance Routing Engine 3* data sheet:  
[http://www.cisco.com/en/US/products/hw/routers/ps133/products\\_data\\_sheet0900aecd8049f279.html](http://www.cisco.com/en/US/products/hw/routers/ps133/products_data_sheet0900aecd8049f279.html)
- *Cisco 10008 Router Performance Routing Engine 3 Installation* document:  
[http://www.cisco.com/en/US/docs/routers/10000/10008/install\\_and\\_upgrade/pre\\_installation/pre3\\_guide/tcamcmds.html](http://www.cisco.com/en/US/docs/routers/10000/10008/install_and_upgrade/pre_installation/pre3_guide/tcamcmds.html)

**Note**

For the Cisco 10000 series, the PRE-3 supports all features that are supported on the PRE-2 in Cisco IOS Release 12.2(28)SB and Release 12.2(28)SB1. Even though these features are new for the PRE-3 in Cisco IOS Release 12.2(31)SB2, they are not called out in the “[New Software Features in Cisco IOS Release 12.2\(31\)SB2](#)” section to improve the usability of the release notes documentation.

For information about these features, see the “[New Software Features in Cisco IOS Release 12.2\(28\)SB](#)” and “[New Software Features in Cisco IOS Release 12.2\(28\)SB2](#)” sections.

## Port Adapter Jacket Card for Cisco 7200VXR Series (C7200-JC-PA)

Platform: Cisco 7200 series

The port adapter jacket card for the Cisco 7200VXR series addresses the demand for additional slot density and flexibility by enabling the I/O slot to hold a single port adapter for additional capacity on routers with the Cisco 7200VXR series NPE-G1 or NPE-G2. Benefits of the jacket card include the following:

- Provides one additional slot for a single selected port adapter.
- Allows a high-bandwidth port adapter such as the 2-port OC-3/STM-1 POS port adapter to be moved onto a dedicated Peripheral Component Interconnect (PCI) bus that the NPE-G1 or NPE-G2 provides.
- Reduces PCI contention among other port adapters.
- Provides a cost-effective way to increase the slot density in parallel to the increased switching capacity of the newest engine of the router, the Cisco NPE-G2.

For detailed information about this product, see the following documents:

- *Cisco 7200VXR Series Port Adapter Jacket Card* data sheet:  
[http://www.cisco.com/en/US/products/hw/routers/ps341/products\\_data\\_sheet0900aecd804419c6.html](http://www.cisco.com/en/US/products/hw/routers/ps341/products_data_sheet0900aecd804419c6.html)
- *Port Adapter Jacket Card Installation Guide*:  
[http://www.cisco.com/en/US/docs/routers/7200/install\\_and\\_upgrade/port\\_adapter\\_jacket\\_card\\_install/8427J.html](http://www.cisco.com/en/US/docs/routers/7200/install_and_upgrade/port_adapter_jacket_card_install/8427J.html)

## New Software Features in Cisco IOS Release 12.2(31)SB2

This section describes new and changed features in Cisco IOS Release 12.2(31)SB2. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(31)SB2. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.



### Note

For the Cisco 10000 series, the PRE-3 supports all features that are supported on the PRE-2 in Cisco IOS Release 12.2(28)SB and Release 12.2(28)SB1. Even though these features are new for the PRE-3 in Cisco IOS Release 12.2(31)SB2, they are not called out in the “[New Software Features in Cisco IOS Release 12.2\(31\)SB2](#)” section to improve the usability of the release notes documentation. For information about these features, see the “[New Software Features in Cisco IOS Release 12.2\(28\)SB](#)” and “[New Software Features in Cisco IOS Release 12.2\(28\)SB2](#)” sections.

[Table 11](#) lists the features that are supported for the Cisco 10000 series in Cisco IOS Release 12.2(31)SB2 and uses the following conventions:

- Yes—The feature is supported on the PRE-2 and/or PRE-3.
- No—The feature is not supported on the PRE-2 or PRE-3, or the feature is not New.
- New—The feature has never before been released in any public Cisco IOS software image for the Cisco 10000 series; the feature is released for the first time for the Cisco 10000 series in Cisco IOS Release 12.2(31)SB2. (Other features may be new for the Cisco 10000 series in Cisco IOS Release 12.2(31)SB2 but have been released before in other public Cisco IOS software images for the Cisco 10000 series.)

**Table 11** *Features Introduced for the Cisco 10000 Series in Cisco IOS Release 12.2(31)SB2*

Feature Name	PRE-2	PRE-3	New
802.1p COS Bit Set for PPP & PPPoE Control Frames	Yes	Yes	New
AAA High Availability Support for Local PPPoX Sessions	Yes	Yes	New
<b>BGP Features</b>			
• BGP MIB Support Enhancements	Yes	Yes	New
• BGP Selective Address Tracking	Yes	Yes	New
• BGP Support for Fast Peering Session Deactivation	Yes	Yes	New
• BGP Support for Next-Hop Address Tracking	Yes	Yes	New
• BGP Support for TCP Path MTU Discovery per Session	Yes	Yes	New
Calling Station ID Attribute 31	Yes	Yes	New
Cisco Express Forwarding - SNMP CEF-MIB Support	Yes	Yes	New
<b>Cisco MIBs</b>			
• CISCO-IP-URPF-MIB Support	Yes	Yes	New
• CISCO-NETFLOW-MIB	Yes	Yes	New
• CISCO-QINQ-VLAN-MIB	Yes	Yes	New
Class Based Ethernet CoS Matching & Marking (802.1p & ISL CoS)	Yes	Yes	New
CNS - Image Agent	Yes	Yes	New
Configuration Replace and Configuration Rollback	Yes	Yes	New
Control Plane Policing (CPP)	Yes	Yes	New
Control Plane Policing - Time Based	Yes	Yes	New
DHCP Relay Option 82 - Per Interface Support	Yes	Yes	New
Dynamic Bandwidth Selection—ATM VC Weights Attribute Specification	Yes	Yes	No
Fast EtherChannel [Link Aggregation Control Protocol (LACP) (802.3ad) for Gigabit Interfaces]	Yes	Yes	New
FHRP - Object Tracking List	Yes	Yes	New
Frame Relay - Multilink (MLFR-FRF.16)	No	Yes	New
IEEE 802.3ad, Link Aggregation Control Protocol	Yes	Yes	New
<b>In-Service Software Upgrade Features</b>			
• ISSU - DHCP ODAP Client/Server	Yes	Yes	New
• ISSU - DHCP Proxy Client	Yes	Yes	New
• ISSU - DHCP Relay on Unnumbered Interface	Yes	Yes	New
• ISSU - DHCP Server	Yes	Yes	New
• ISSU - GLBP	Yes	Yes	New
• ISSU - IS-IS	Yes	Yes	New
• ISSU - PPPoA	Yes	Yes	New

**Table 11**      **Features Introduced for the Cisco 10000 Series in Cisco IOS Release 12.2(31)SB2 (continued)**

<b>Feature Name</b>	<b>PRE-2</b>	<b>PRE-3</b>	<b>New</b>
• ISSU - PPPoE	Yes	Yes	New
• ISSU - Remote Access to MPLS VPN	Yes	Yes	New
<b>Intelligent Service Gateway Features</b>			
• ISG: Accounting: Postpaid	Yes	Yes	New
• ISG: Accounting: Prepaid	Yes	Yes	New
• ISG: Accounting: Tariff Switching	Yes	Yes	New
• ISG: Instrumentation: Session and Flow Monitoring (Local and External)	Yes	Yes	New
• ISG: Policy Control: DHCP Proxy	Yes	Yes	New
• ISG: Policy Control: Policy Server: CoA ASCII Command Code Support	Yes	Yes	New
• ISG: Policy Control: Policy: Triggers (Time, Volume, Duration)	Yes	Yes	New
• ISG: Session: Authentication (MAC, IP, EAP)	Yes	Yes	New
• ISG: Session: Creation: Interface IP Session: L2	Yes	Yes	New
• ISG: Session: Creation: Interface IP Session: L3	Yes	Yes	New
• ISG: Session: Creation: IP Session: Protocol Event (DHCP, RADIUS)	Yes	Yes	New
• ISG: Session: Creation: IP Session: Subnet & Source IP: L2	Yes	Yes	New
• ISG: Session: Creation: IP Session: Subnet & Source IP: L3	Yes	Yes	New
• ISG: Session: VRF Transfer	Yes	Yes	New
IP Options Selective Drop	Yes	Yes	New
<b>IP SLAs Features</b>			
• IP SLAs - DHCP Operation	Yes	Yes	No
• IP SLAs - Distribution of Statistics	Yes	Yes	No
• IP SLAs - DNS Operation	Yes	Yes	No
• IP SLAs - FTP Operation	Yes	Yes	No
• IP SLAs - HTTP Operation	Yes	Yes	No
• IP SLAs - ICMP Echo Operation	Yes	Yes	No
• IP SLAs - ICMP Path Echo Operation	Yes	Yes	No
• IP SLAs - LSP Health Monitor with LSP Discovery	Yes	Yes	New
• IP SLAs - MPLS VPN Aware	Yes	Yes	No
• IP SLAs - Multi-Operation Scheduler	Yes	Yes	No
• IP SLAs - One-way Measurements	Yes	Yes	No
• IP SLAs - Path Jitter	Yes	Yes	No
• IP SLAs - Reaction Threshold	Yes	Yes	No
• IP SLAs - Scheduling	Yes	Yes	No



**Table 11** *Features Introduced for the Cisco 10000 Series in Cisco IOS Release 12.2(31)SB2 (continued)*

Feature Name	PRE-2	PRE-3	New
• IP SLAs - TCP Connect Operation	Yes	Yes	No
• IP SLAs - UDP Echo Operation	Yes	Yes	No
• IP SLAs - UDP Jitter Operation	Yes	Yes	No
• IP SLAs - UDP VoIP Operation	Yes	Yes	No
• IP SLAs - VoIP Threshold Traps	Yes	Yes	No
IPv6 Hardware: PxF Accelerated for IPv6 over MPLS (6PE)	Yes	Yes	New
IPv6 MIBs	Yes	Yes	New
L2TP Calling Station ID Suppression	Yes	Yes	New
L2TP Domain Screening	Yes	Yes	No
L2VPN Interworking: Ethernet to VLAN Interworking	Yes	Yes	New
Lawful Intercept Enhancements	Yes	Yes	New
<b>MPLS Features</b>			
• MPLS Embedded Management - LSP Ping/Traceroute for LDP	Yes	Yes	No
• MPLS Embedded Management - MPLS Multipath LSP Traceroute	Yes	Yes	New
• MPLS PE-to-PE Traffic Statistics for NetFlow	Yes	Yes	New
• MPLS Traffic Engineering MIB	Yes	Yes	No
• MPLS VPN MIB v05 - Trap Enhancements	Yes	Yes	New
• MPLS VPN - VRF Selection Based on Source IP Address	Yes	Yes	New
<b>MQC Features</b>			
• MQC - Distribution of Remaining Bandwidth via Ratio	No	Yes	New
• MQC - Hierarchical Queuing with 3 Level Scheduler	No	Yes	New
• MQC - Multi-Level Priority Queues	No	Yes	New
• MQC - Traffic Shaping Overhead Accounting for ATM	No	Yes	New
Multicast VPN Extranet Support	Yes	Yes	New
Multicast VPN Extranet VRF Select	Yes	Yes	New
Multiclass Multilink PPP Enhancement	Yes	No	New
NAS-Port ID Format C Enhancement	Yes	Yes	New
<b>NetFlow Features</b>			
• NetFlow Export of BGP Nexthop Information	Yes	Yes	New
• NetFlow MPLS Aggregation	Yes	Yes	New
• Random Sampled NetFlow	Yes	Yes	New
<b>OSPF Features</b>			
• NSF - OSPF RFC 3623 Graceful Restart	Yes	Yes	New
• OSPF MIB Support of RFC 1850 and Latest Extensions	Yes	Yes	New
• OSPF Sham-Link MIB Support	Yes	Yes	New

**Table 11**      **Features Introduced for the Cisco 10000 Series in Cisco IOS Release 12.2(31)SB2 (continued)**

<b>Feature Name</b>	<b>PRE-2</b>	<b>PRE-3</b>	<b>New</b>
Persistent Storage	No	Yes	New
Per-VRF Assignment of BGP Router ID	Yes	Yes	New
PPP-Max-Payload and IWF PPPoE Tag Support	Yes	Yes	New
<b>PPPoE Features</b>			
• PPPoE Agent Remote ID & DSL Line Characteristics Enhancement	Yes	Yes	New
• PPPoE QinQ Support	Yes	Yes	New
• PPPoE Session Limiting on Inner QinQ VLAN	Yes	Yes	New
PXF-Based Frame Relay DE Bit Marking	Yes	Yes	New
<b>QoS Features</b>			
• QoS: CBQoS Management - Policy-to-Interface Mapping Support	Yes	Yes	New
• QoS: CBQoS MIB Index Enhancements	Yes	Yes	New
• QoS Child Service Policy for Priority Class	No	Yes	New
• QoS: Classification, Policing, and Marking on LAC	No	Yes	New
• QoS - Hierarchical Queuing for Ethernet DSLAMs	No	Yes	New
• QoS: Match VLAN	Yes	Yes	New
• QoS - Percentage-Based Shaping	Yes	Yes	New
• QoS - Policing Support for GRE Tunnels	Yes	Yes	New
• QoS Priority Propagation in Multi-level Scheduler	No	Yes	New
• QoS - VLAN Tag Based	Yes	Yes	New
SNMP - Session to Interface Mapping Improvements	Yes	Yes	New
SNMP Support for VPNs	Yes	Yes	New
<b>Stateful Switchover Features</b>			
• SSO - DHCP ODAP Client/Server	Yes	Yes	New
• SSO - DHCP Proxy Client	Yes	Yes	New
• SSO - DHCP Relay on Unnumbered Interface	Yes	Yes	New
• SSO - DHCP Server	Yes	Yes	New
• SSO - GLBP	Yes	Yes	New
• SSO - Multilink Frame Relay	No	Yes	New
• SSO - PPPoA	Yes	Yes	New
• SSO - PPPoE	Yes	Yes	New
• SSO - Remote Access to MPLS VPN	Yes	Yes	New
Static MAC Address for PPPoE	Yes	Yes	No
VRF-Aware System Message Logging (Syslog)	Yes	Yes	New
VRF-Aware VPDN Tunnels	Yes	Yes	New
Weighted Random Early Detection Improvements	Yes	Yes	New

Table 12 shows how select features for the Cisco 7304 are supported and uses the following conventions:

- Yes—The feature is supported on the engine and/or in the PFX path.
- No—The feature is not supported on the engine and/or in the PFX path.

**Table 12** Features Supported on the Cisco 7304 Engines and in the PFX Path

Feature	NSE-100	NSE-150	NPE-G100	Support in the PFX Path
<b>BGP Features</b>				
• BGP MIB Support Enhancements	Yes	Yes	Yes	No
• BGP Multicast Inter-AS (IAS) VPN	Yes	Yes	Yes	No
• BGP Selective Address Tracking	Yes	Yes	Yes	No
• BGP Support for Fast Peering Session Deactivation	Yes	Yes	Yes	No
• BGP Support for Next-Hop Address Tracking	Yes	Yes	Yes	No
• BGP Support for TCP Path MTU Discovery per Session	Yes	Yes	Yes	No
Cisco Express Forwarding - SNMP CEF-MIB Support	Yes	Yes	Yes	No
CISCO-IP-URPF-MIB Support	Yes	Yes	Yes	No
CISCO-NETFLOW-MIB	No	No	Yes	No
Clear IP Traffic CLI	Yes	Yes	Yes	No
CNS-Image Agent	Yes	Yes	Yes	No
Configuration Replace and Configuration Rollback	Yes	Yes	Yes	No
DHCP Relay Option 82 - Per Interface Support	Yes	Yes	Yes	No
Fast EtherChannel	Yes	Yes	Yes	Yes
FHRP - Object Tracking List	Yes	Yes	Yes	No
Gigabit EtherChannel	Yes	Yes	Yes	Yes
ICMP Unreachable Rate Limiting User Feedback	Yes	Yes	Yes	No
IEEE 802.1p Support	Yes	Yes	No	Yes
IP SLAs Features	Yes	Yes	Yes	No
IPv6 MIBs	Yes	Yes	Yes	No
Modular QoS CLI-Based Classification for Layer 2 Frames in PFX	Yes	Yes	No	Yes
<b>MPLS Features</b>				
• MPLS Embedded Management - LSP Ping/Traceroute for LDP	Yes	Yes	Yes	No
• MPLS Embedded Management - MPLS Multipath LSP Traceroute	Yes	Yes	Yes	No
• MPLS Traffic Engineering (TE) MIB	Yes	Yes	Yes	No
• MPLS VPN MIB v05 - Trap Enhancements	Yes	Yes	Yes	No
Multicast VPN Extranet Support	No	No	Yes	No

**Table 12**      **Features Supported on the Cisco 7304 Engines and in the PFX Path (continued)**

<b>Feature</b>	<b>NSE-100</b>	<b>NSE-150</b>	<b>NPE-G100</b>	<b>Support in the PFX Path</b>
Multicast VPN Inter-AS Support	Yes	Yes	Yes	No
NAT - Integration with MPLS VPNs	Yes	Yes	Yes	Yes
<b>NetFlow Features</b>				
• Flexible NetFlow	No	No	Yes	No
• NetFlow Egress Accounting	Yes	Yes	No	No
• NetFlow MPLS Aggregation	Yes	Yes	Yes	No
<b>OSPF Features</b>				
• NSF - OSPF RFC 3623 Graceful Restart	Yes	Yes	Yes	No
• OSPF Enhanced Traffic Statistics for OSPFv2 and OSPFv3	Yes	Yes	Yes	No
• OSPF MIB Support of RFC 1850 and Latest Extensions	Yes	Yes	Yes	No
• OSPF Sham-Link MIB Support	Yes	Yes	Yes	No
• OSPF SNMP ifIndex Value for Interface ID in OSPFv2 and OSPFv3 Data Fields	Yes	Yes	Yes	No
Per-VRF Assignment of BGP Router ID	Yes	Yes	Yes	No
QoS: CBQoS Management - Policy-to-Interface Mapping Support	Yes	Yes	Yes	No
QoS: CBQoS MIB Index Enhancements	Yes	Yes	Yes	No
Rate-Based Satellite Control Protocol (RBSCP)	Yes	Yes	Yes	No
SFP Security Verification	Yes	Yes	Yes	No
SNMP - Session to Interface Mapping Improvements	Yes	Yes	Yes	No
SSO-GLBP	No	No	Yes	No
Transmission Control Protocol Features	Yes	Yes	Yes	No
Turbo ACL Scalability Enhancements (Phase II)	Yes	Yes	No	Not applicable <sup>1</sup>
VRF-Aware System Message Logging (Syslog)	Yes	Yes	Yes	No

1. The Turbo ACL Scalability Enhancements (Phase II) feature consists of an internal enhancement that accelerates the removal of memory within the PFX path and a functionality that sets memory limits on the Route Processor (RP) path.

## 802.1p COS Bit Set for PPP and PPPoE Control Frames

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sb8021p2.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sb8021p2.html)

## AAA High Availability Support for Local PPPoX Sessions

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sb\\_aaaha.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sb_aaaha.html)

## BGP Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following Border Gateway Protocol (BGP) features.

### BGP MIB Support Enhancements

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2s/feature/guide/fs\\_bmibe.html](http://www.cisco.com/en/US/docs/ios/12_2s/feature/guide/fs_bmibe.html)

### BGP Multicast Inter-AS (IAS) VPN

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_0s/feature/guide/cs\\_bmiav.html](http://www.cisco.com/en/US/docs/ios/12_0s/feature/guide/cs_bmiav.html)

### BGP Selective Address Tracking

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbbgpsn.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbbgpsn.html)

### BGP Support for Fast Peering Session Deactivation

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbbsfda.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbbsfda.html)

### BGP Support for Next-Hop Address Tracking

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbbnhop.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbbnhop.html)

### BGP Support for TCP Path MTU Discovery per Session

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbbgpmtu.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbbgpmtu.html)

## Calling Station ID Attribute 31

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-2 and PRE-3)

The **radius-server attribute 31** command is a new command in Cisco IOS Release 12.2(31)SB2. This new command replaces the **radius-server attribute 31 remote-id** command, which was first introduced in Release 12.2(28)SB. The new command adds two new keywords, **mac** and **send**, and includes the **remote-id** keyword from the original **radius-server attribute 31 remote-id** command.

## Cisco Express Forwarding - SNMP CEF-MIB Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbcefmib.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbcefmib.html)

## Cisco MIBs

Cisco IOS Release 12.2(31)SB2 and later releases support the following Cisco MIBs.

### CISCO-IP-URPF-MIB Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sburpmib.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sburpmib.html)

### CISCO-NETFLOW-MIB

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco documents:

- *Cisco 7200 Series Router MIB Specifications Guide*  
[http://www.cisco.com/en/US/docs/routers/7200/technical\\_references/7200\\_mib\\_guides/7200\\_mib\\_specs\\_guide\\_v3/7200mib3.html](http://www.cisco.com/en/US/docs/routers/7200/technical_references/7200_mib_guides/7200_mib_specs_guide_v3/7200mib3.html)
- *Cisco 7301 Router MIB Specifications Guide*  
[http://www.cisco.com/en/US/docs/routers/7300/technical\\_references/7301\\_mib\\_guides/7301\\_mib\\_specs\\_guide\\_v3/7301mib1.html](http://www.cisco.com/en/US/docs/routers/7300/technical_references/7301_mib_guides/7301_mib_specs_guide_v3/7301mib1.html)
- *Cisco 7304 Router MIB Specifications Guide*  
[http://www.cisco.com/en/US/docs/routers/7300/technical\\_references/7304\\_mib\\_guides/7304\\_mib\\_specs\\_guide\\_v2/7304mib.html](http://www.cisco.com/en/US/docs/routers/7300/technical_references/7304_mib_guides/7304_mib_specs_guide_v2/7304mib.html)
- *Cisco 10000 Series Router Broadband MIB Specifications Guide*  
[http://www.cisco.com/en/US/docs/routers/10000/10008/technical\\_references/mibs/guides/broadband/mib\\_guide\\_ver4a/bbgv4a.html](http://www.cisco.com/en/US/docs/routers/10000/10008/technical_references/mibs/guides/broadband/mib_guide_ver4a/bbgv4a.html)

## CISCO-QINQ-VLAN-MIB

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Cisco 10000 Series Router Broadband MIB Specifications Guide*:

[http://www.cisco.com/en/US/docs/routers/10000/10008/technical\\_references/mibs/guides/broadband/mib\\_guide\\_ver4a/bbgv4a.html](http://www.cisco.com/en/US/docs/routers/10000/10008/technical_references/mibs/guides/broadband/mib_guide_ver4a/bbgv4a.html)

## Class Based Ethernet CoS Matching & Marking (802.1p & ISL CoS)

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following chapters in the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

- Chapter 2, “Classifying Traffic”

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qclass.html>

- Chapter 7, “Marking Traffic”

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qmark.html>

## Clear IP Traffic CLI

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbipclip.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbipclip.html)

## CNS Image Agent

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sb\\_ensia.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sb_ensia.html)

## Configuration Replace and Configuration Rollback

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_7/gtrollbk.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_7/gtrollbk.htm)

## Control Plane Policing (CPP)

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/copp.htm>

## Control Plane Policing—Time Based

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/copp.htm>

## DHCP Relay Option 82 per Interface Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *DHCP Option 82 per Interface Support* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t6/htdhoft8.htm>

## Dynamic Bandwidth Selection—ATM VC Weights Attribute Specification

Platform: Cisco 10000 series (PRE-2 and PRE-3)

The Dynamic Bandwidth Selection—ATM VC Weights Attribute Specification feature enables broadband customers to configure session bandwidth dynamically. The Cisco 10000 series router offers a dynamic quality of service (QoS) model that enables you to download QoS parameters from a RADIUS server to an ATM virtual circuit (VC).

This feature enables wholesale service providers to sell different levels of service to retail service providers, based on the bandwidth of the ATM VC connection. The retail service provider can then offer subscribers the ability to choose services with varying levels of bandwidth allocation. If a subscriber changes services, the service provider can dynamically change the ATM shaping on the VC based on the RADIUS profile of the subscriber. RADIUS accounting mechanisms control billing for the different services. An extension to Dynamic Bandwidth Selection (DBS) provides the ability to modify an existing VC weight and watermark values using a RADIUS pull model in which the subscriber triggers the parameter changes. The DBS Extensions—VC Weight and Watermark feature enables the modification of existing VC weight and watermark values without tearing down and recreating the VC.

On a RADIUS server, this feature allows VC weight and watermark parameters to be applied (through RADIUS pull) and installed or modified by specific events (through RADIUS push) while the session remains active. Any changes to these VC parameters configured using the Modular QoS CLI (MQC) affect only the NVGEN values and not the RADIUS-pulled values.

For detailed information about this feature, see the following chapters in the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

- “Configuring Dynamic Subscriber Services”  
<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qrad.html>
- “Distributing Bandwidth Between Queues”  
<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qbwdth.html>
- “Shaping Traffic”  
<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qshape.html>

## Fast EtherChannel and Gigabit EtherChannel Features

The following Fast EtherChannel (FEC) and Gigabit EtherChannel (GEC) features are supported in Cisco IOS Release 12.2(31)SB2.



## Fast EtherChannel

Platform: Cisco 7304

This Fast EtherChannel (FEC) feature introduces Fast EtherChannel support for the Cisco 7304 router. This support is introduced for a Cisco 7304 router that uses an NSE-100, NSE-150, or NPE-G100. Fast EtherChannel bundles are PXF-accelerated for the NSE-100 and the NSE-150.

Additionally, PXF-acceleration for QoS rate limiting of Fast EtherChannel bundles is also introduced as part of this feature. Because this portion of the feature is PXF-related, it applies only to the NSE-100 and the NSE-150.

For additional information about Fast EtherChannels on the Cisco 7304 router, see *Cisco 7304 Router Fast EtherChannel and Gigabit EtherChannel Notes*:

<http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/7304swf/7304eth.htm>

For additional information about PXF, see the *PXF Information for the Cisco 7304 Router* document:

[http://www.cisco.com/en/US/docs/routers/7300/maintain\\_and\\_operate\\_guides/7304\\_maintain\\_and\\_operate\\_guides/7304pxf.html](http://www.cisco.com/en/US/docs/routers/7300/maintain_and_operate_guides/7304_maintain_and_operate_guides/7304pxf.html)

## Gigabit EtherChannel

Platform: Cisco 7304

This Gigabit EtherChannel (GEC) feature introduces Gigabit EtherChannel support for the Cisco 7304 router. This support is introduced for a Cisco 7304 router that uses an NSE-100, NSE-150, or NPE-G100. Gigabit EtherChannel bundles are PXF-accelerated for the NSE-100 and the NSE-150.

Additionally, PXF-acceleration for QoS rate limiting of Gigabit EtherChannel bundles is also introduced as part of this feature. Because this portion of the feature is PXF-related, it applies only to the NSE-100 and the NSE-150.

For additional information about Gigabit EtherChannels on the Cisco 7304 router, see *Cisco 7304 Router Fast EtherChannel and Gigabit EtherChannel Notes*:

<http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/7304swf/7304eth.htm>

For additional information about PXF, see the *PXF Information for the Cisco 7304 Router* document:

[http://www.cisco.com/en/US/docs/routers/7300/maintain\\_and\\_operate\\_guides/7304\\_maintain\\_and\\_operate\\_guides/7304pxf.html](http://www.cisco.com/en/US/docs/routers/7300/maintain_and_operate_guides/7304_maintain_and_operate_guides/7304pxf.html)

## Link Aggregation Control Protocol (LACP) (802.3ad) for Gigabit Interfaces

Platform: Cisco 10000 series (PRE-2 and PRE3)

For detailed information about this feature, which for the Cisco 10000 series is also known as the Fast EtherChannel (FEC) feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/10gigeth.htm>

## FHRP—Object Tracking List

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sb\\_otl.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sb_otl.html)

## Field-Programmable Device Upgrades

Platform: Cisco 7200 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124limit/124x/124xd4/fpd.htm>

## Frame Relay - Multilink (MLFR-FRF.16)

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the *Multilink Frame Relay (FRF.16)* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fs\\_mfr.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fs_mfr.htm)

## HTTP 1.1 Web Server and Client

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sb\\_http1.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sb_http1.htm)

## ICMP Unreachable Rate Limiting User Feedback

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the *Configuring IP Services* document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbipicmp.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbipicmp.html)

## IEEE 802.1p Support

Platform: Cisco 7304

The IEEE 802.1p Support feature introduces IEEE 801.p support, which is also referred to as Class of Service (CoS) Value Marking in some Cisco documentation, in the PXF processing path for a Cisco 7304 router that uses an NSE-100 or an NSE-150.

Marking a packet with a local CoS value enables users to associate a Layer 2 CoS value with a packet. The value can then be used to classify packets based on user-defined requirements. Layer 2 to Layer 3 mapping can also be configured by matching on the CoS value, because switches already have the capability to match and set CoS values. If a packet that needs to be marked to differentiate user-defined quality of service (QoS) services is leaving a router and entering a switch, the router should set the CoS value of the packet, because the switch can process the Layer 2 CoS header marking.

There are two ways to configure marking of packets using the CoS value. The first method is configuring the **set cos** command in the Modular QoS CLI and marking CoS values based on user-defined criteria. The second method is using the **set-cos-transmit** option in the **police** command.

For additional information about IEEE 802.1p, see the *Class-Based Marking* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121newft/121t/121t5/cbpmark2.htm>

For additional information about PXF, see the *PXF Information for the Cisco 7304 Router* document:  
[http://www.cisco.com/en/US/docs/routers/7300/maintain\\_and\\_operate\\_guides/7304\\_maintain\\_and\\_operate\\_guides/7304pxf.html](http://www.cisco.com/en/US/docs/routers/7300/maintain_and_operate_guides/7304_maintain_and_operate_guides/7304pxf.html)

## IEEE 802.3ad, Link Aggregation Control Protocol

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *IEEE 802.3ad Link Bundling* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbcelacp.htm>

## In-Service Software Upgrade Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following In-Service Software Upgrade (ISSU) features.

### ISSU - DHCP Features

Platform: Cisco 10000 series (PRE-2 and PRE-3)

Cisco IOS Release 12.2(31)SB2 and later releases support the following ISSU - Dynamic Host Configuration Protocol (DHCP) features.

- ISSU - DHCP ODAP Client/Server
- ISSU - DHCP Proxy Client
- ISSU - DHCP Relay on Unnumbered Interface
- ISSU - DHCP Server

For detailed information about this feature, see the *ISSU and SSO—DHCP High Availability Features* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbdhcpha.htm>

### ISSU - GLBP

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/qlbpissu.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/qlbpissu.html)

### ISSU - IS-IS

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbisissu.htm>

**ISSU - PPPoA**

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Cisco IOS Broadband High Availability In-Service Software Upgrade* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbissubb.htm>

**ISSU - PPPoE**

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Cisco IOS Broadband High Availability In-Service Software Upgrade* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbissubb.htm>

**ISSU - Remote Access to MPLS VPN**

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Cisco IOS Broadband High Availability In-Service Software Upgrade* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbissubb.htm>

**Intelligent Service Gateway Features**

Cisco IOS Release 12.2(31)SB2 and later releases support the following Intelligent Service Gateway (ISG) features:

- ISG: Accounting: Postpaid  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Accounting: Prepaid  
Platform: Cisco 10000 series (PRE-2 and PRE-3)




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**Note** Cisco IOS Release 12.2(28)SB introduced support for the ISG: Accounting: Time-Based Prepaid feature; Release 12.2(31)SB2 adds support for the ISG: Accounting: Volume-Based Prepaid feature.

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- ISG: Accounting: Tariff Switching  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Instrumentation: Session and Flow Monitoring (Local and External)  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Policy Control: DHCP Proxy  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Policy Control: Policy Server: CoA ASCII Command Code Support  
Platforms: Cisco 7200 series, Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Policy Control: Policy: Triggers (Time, Volume, Duration)  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Policy Control: RADIUS Proxy Enhancement  
Platforms: Cisco 7200 series, Cisco 7301

- ISG: Session: Authentication (MAC, IP, EAP)  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Session: Creation: Interface IP Session: L2  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Session: Creation: Interface IP Session: L3  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Session: Creation: IP Session: Protocol Event (DHCP, RADIUS)  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Session: Creation: IP Session: Subnet & Source IP: L2  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Session: Creation: IP Session: Subnet & Source IP: L3  
Platform: Cisco 10000 series (PRE-2 and PRE-3)
- ISG: Session: VRF Transfer  
Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about these features, see the following Cisco documents:

- *Cisco IOS Intelligent Service Gateway Configuration Guide, Release 12.2SB*  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/cg/isg\\_lib/isg\\_c/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/cg/isg_lib/isg_c/index.htm)
- *Cisco IOS ISG Command Reference, Release 12.2SB*  
[http://www.cisco.com/en/US/products/ps6566/prod\\_command\\_reference\\_list.html](http://www.cisco.com/en/US/products/ps6566/prod_command_reference_list.html)

## IP Options Selective Drop

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the “Protecting the Router from DoS Attacks” chapter in the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/overview.html>

## IP SLAs Features

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

Cisco IOS IP SLAs features provide the capability to verify service guarantees, increase network reliability by validating network performance, proactively identify and alert users about network issues or deviations, and increase Return on Investment (ROI) by easing the deployment of new IP services. Cisco IOS IP SLAs use active probing techniques for end-to-end quantitative measurement of network performance, health, and connectivity for Voice over IP (VoIP), Multiprotocol Label Switching (MPLS), and TCP/IP networks. The IP SLAs features are also directly integrated with other Cisco IOS products such as Optimized Edge Routing (OER), Enhanced Object Tracker (EoT), and Embedded Event Manager (EEM).

Cisco IOS Release 12.2(31)SB2 and later releases support the following IP SLAs features:

- IP SLAs - DHCP Operation
- IP SLAs - Distribution of Statistics
- IP SLAs - DNS Operation
- IP SLAs - FTP Operation
- IP SLAs - HTTP Operation

- IP SLAs - ICMP Echo Operation
- IP SLAs - ICMP Path Echo Operation
- IP SLAs - LSP Health Monitor with LSP Discovery
- IP SLAs - MPLS VPN Aware
- IP SLAs - Multi-Operation Scheduler
- IP SLAs - One-way Measurements
- IP SLAs - Path Jitter
- IP SLAs - Reaction Threshold
- IP SLAs - Scheduling
- IP SLAs - TCP Connect Operation
- IP SLAs - UDP Echo Operation
- IP SLAs - UDP Jitter Operation
- IP SLAs - UDP VoIP Operation
- IP SLAs - VoIP Threshold Traps

For detailed information about the IP SLAs - LSP Health Monitor with LSP Discovery feature, see the following document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sb2pdisc.htm>

All other Cisco IOS IP SLAs configuration information is included in the *Cisco IOS IP SLAs Configuration Guide, Release 12.4*:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla\\_c/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124cg/hsla_c/index.htm)

Cisco IOS IP SLAs command reference information is included in the *Cisco IOS IP SLAs Command Reference, Release 12.2SB*:

[http://www.cisco.com/en/US/products/ps6566/prod\\_command\\_reference\\_list.html](http://www.cisco.com/en/US/products/ps6566/prod_command_reference_list.html)

## IPv6 Hardware: PxF Accelerated for IPv6 over MPLS (6PE)

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Cisco 10008 Router Performance Routing Engine 3 Installation* document:

[http://www.cisco.com/en/US/docs/routers/10000/10008/install\\_and\\_upgrade/pre\\_installation/pre3\\_guide/pre3ins.html](http://www.cisco.com/en/US/docs/routers/10000/10008/install_and_upgrade/pre_installation/pre3_guide/pre3ins.html)

## IPv6 MIBs

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the “MIBs” section in the “Implementing IPv6 Addressing and Basic Connectivity” chapter of the *Cisco IOS IPv6 Configuration Library*:

[http://www.cisco.com/en/US/docs/ios/12\\_2t/ipv6/ipv6\\_vgf.html](http://www.cisco.com/en/US/docs/ios/12_2t/ipv6/ipv6_vgf.html)

## IS-IS MIB

Platform: Cisco 7200 series

For detailed information about this feature, see the *IS-IS MIB Support* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122sg25/ismibspt.htm>

## L2VPN Interworking: Ethernet to VLAN Interworking

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the “Configuring Any Transport over MPLS” chapter of the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/overview.html>

## Lawful Intercept Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following Lawful Intercept features.

### Lawful Intercept Enhancements

Platform: Cisco 10000 series (PRE-2 and PRE-3)

In addition to support for the Lawful Intercept feature on the PRE-3, the following enhancements are introduced for the Lawful Intercept feature in Cisco IOS Release 12.2(31)SB2:

- The new CISCO-USER-CONNECTION-TAP-MIB that supports RADIUS-based user connection intercepts
- Support for lawful intercepts when Routed Bridged Encapsulation (RBE) is configured on the router (RFC 1483)
- VRF-aware IP taps via the citapStream VRF OID in the CISCO-IP-TAP-MIB
- PRE-2 and PRE-3 Layer 3 intercepts that are processed by the Parallel eXpress Forwarding (PXF) engine

For detailed information about the Lawful Intercept feature, see the *Cisco 10000 Series Router Lawful Intercept Configuration Guide*:

[http://www.cisco.com/en/US/docs/routers/10000/10008/feature/guides/lawful\\_intercept/10LIprf.html](http://www.cisco.com/en/US/docs/routers/10000/10008/feature/guides/lawful_intercept/10LIprf.html)

### Service Independent Intercept Architecture: SNMP-Based Lawful Intercept

Platforms: Cisco 7200 series, Cisco 7301



**Note**

For the Cisco 7200 series, SNMP-Based Lawful Intercept is supported only on Cisco 7200 VXR routers that are configured with an NPE-225, NPE-400, NPE-G1, or NPE-G2.



**Note**

RADIUS-Based Lawful Intercept was introduced in Cisco IOS Release 12.2(28)SB for the Cisco 7200 series and Cisco 7301.

SNMP-Based Lawful Intercept, which is a Layer 3 feature (that is, a feature at the IP level), is based on SNMPv3. The following MIBs are supported for SNMP-Based Lawful Intercept:

- CISCO-IP-TAP-MIB
- CISCO-IP-TAP2-MIB
- CISCO-USER-CONNECTION-TAP-MIB

For detailed information about the Service Independent Intercept (SII) architecture, see the *Service Independent Intercept* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/ht\\_ssi.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/ht_ssi.htm)

## Layer 2 Tunnel Protocol Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following Layer 2 Tunnel Protocol (L2TP) features.

### L2TP Calling Station ID Suppression

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/callstub.htm>

### L2TP Domain Screening

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/domstub.htm>

### L2TP Tunnel Selection Load Balancing with Random Algorithm

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/selstub.htm>

## MPLS Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following Multiprotocol Label Switching (MPLS) features.

### MPLS Embedded Management - LSP Ping/Traceroute for LDP

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t6/ht\\_lspng.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t6/ht_lspng.htm)



## MPLS Embedded Management - MPLS Multipath LSP Traceroute

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sb\\_mmtr.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sb_mmtr.htm)

## MPLS Traffic Engineering (TE) MIB

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304



### Note

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This feature was introduced in Cisco IOS Release 12.2(28)SB2 for the Cisco 10000 series.

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For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/temib2.htm>

## MPLS VPN MIB v05 - Trap Enhancements

Platforms: Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)



### Note

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This feature was introduced in Cisco IOS Release 12.2(28)SB for the Cisco 7200 series and Cisco 7301.

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For detailed information about this feature, see the *MPLS VPN—MIB Support* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s25/fsvnmb25.htm>

## MPLS VPN - VRF Selection Based on Source IP Address

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122sz/12214sz/122szvrf.htm>

## MQC Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following Modular QoS CLI (MQC) features.

### Modular QoS CLI-Based Classification for Layer 2 Frames in PXF

Platform: Cisco 7304

The Modular QoS CLI-Based Classification for Layer 2 Frames in PXF feature enables Parallel eXpress Forwarding (PXF) acceleration of various **match** commands in the Modular QoS CLI (MQC) to classify Layer 2 packets for Cisco 7304 routers that use an NSE-100 or an NSE-150.

Specifically, classification of the matching of the following packets is PXF-accelerated as a result of this feature:

- VLAN ID (**match-vlan**)
- Class of Service bit (**match cos**)
- Input interface (**match input-interface**)
- Frame Relay DLCI (**match fr-dlci**)
- Frame Relay Discard Eligibility (**match fr-de**)

For more information, see the following documents:

- For general information about how **match** commands are used in the MQC, see the “Modular Quality of Service Command-Line Interface” chapter of the *Cisco IOS Quality of Service Solutions Configuration Guide, Release 12.2*:  
[http://www.cisco.com/en/US/docs/ios/12\\_2/qos/configuration/guide/qcfmcli2.html](http://www.cisco.com/en/US/docs/ios/12_2/qos/configuration/guide/qcfmcli2.html)
- For additional information about the **match cos**, **match fr-dlci**, and **match input-interface** commands, see “Quality of Service Commands: M through N” chapter in the *Cisco IOS Quality of Service Solutions Command Reference, Release 12.4T*.  
[http://www.cisco.com/en/US/docs/ios/qos/command/reference/qos\\_book.html](http://www.cisco.com/en/US/docs/ios/qos/command/reference/qos_book.html)
- For additional information about the **match-vlan** command, see the “match vlan” section in the *Quality of Service on Aggregate VLAN Traffic Contents* document:  
[http://www.cisco.com/en/US/docs/ios/12\\_0s/feature/guide/aggvlan.html](http://www.cisco.com/en/US/docs/ios/12_0s/feature/guide/aggvlan.html)
- For additional information about the **match fr-de** command, see “match fr-de” section of the *QoS: Tunnel Marking for L2TPv3 Tunnels* document:  
<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12stnlmk.htm#wp1100535>
- For additional information about PXF, see the *PXF Information for the Cisco 7304 Router* document:  
[http://www.cisco.com/en/US/docs/routers/7300/maintain\\_and\\_operate\\_guides/7304\\_maintain\\_and\\_operate\\_guides/7304pxf.html](http://www.cisco.com/en/US/docs/routers/7300/maintain_and_operate_guides/7304_maintain_and_operate_guides/7304pxf.html)

### MQC - Distribution of Remaining Bandwidth via Ratio

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the *Distribution of Remaining Bandwidth Using Ratio* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/bwratio.htm>

### MQC - Hierarchical Queuing with 3 Level Scheduler

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/3lvl sched.htm>

## MQC - Multi-Level Priority Queues

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/mpq.htm>

## MQC - Traffic Shaping Overhead Accounting for ATM

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/ovrhactg.htm>

## Multicast VPN

Cisco IOS Release 12.2(31)SB2 and later releases support the following multicast Virtual Private Network (VPN) features.

### Multicast VPN Extranet Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Configuring Multicast VPN Extranet Support* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/extvpnsb.htm>

### Multicast VPN Extranet VRF Select

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbmexsel.htm>

### Multicast VPN Inter-AS Support

Platforms: Cisco 7200 series, Cisco 7304

For detailed information about this feature, see the *Configuring Multicast VPN Inter-AS Support* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s30/iasmcpv.htm>

## Multiclass Multilink PPP Enhancement

Platform: Cisco 10000 series (PRE-2)

Prior to Cisco IOS Release 12.2(31)SB2, the Multiclass Multilink PPP (MC-MLP) feature provided support for 16 reassembly classes by the receive logic, but only 2 classes were supported for transmit logic. Beginning with Cisco IOS Release 12.2(31)SB2, MC-MLP provides expanded support to include 4 classes for transmit logic on the Cisco 10000 series.

For detailed information about Multiclass Multilink PPP feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/mcmlp.htm>

## NAS-Port ID Format C Enhancement

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/nas\\_id\\_c.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/nas_id_c.htm)

## NAT - Integration with MPLS VPNs

Platform: Cisco 7304

The NAT - Integration with MPLS VPNs feature functions for a Cisco 7304 router that uses an NSE-100, NSE-150, or NPE-G100. The NAT - Integration with MPLS VPNs feature is PXF-accelerated on a Cisco 7304 router that uses an NSE-100 or NSE-150.

Network Address Translation (NAT) allows a single device, such as a router, to act as an agent between the Internet (or public network) and a local (or private) network. Although NAT systems can provide broad levels of security advantages, their main objective is to economize on address space.

NAT allows organizations to resolve the problem of IP address depletion when they have existing networks and need to access the Internet. Sites that do not yet possess network interface card (NIC)-registered IP addresses must acquire them. Cisco IOS NAT eliminates concern and bureaucratic delay by dynamically mapping thousands of hidden internal addresses to a range of easy-to-get addresses.

In general, a NAT system makes it more difficult for an attacker to determine the following:

- Number of systems running on a network
- Type of machines and operating systems that they are running
- Network topology and arrangement

NAT integration with Multiprotocol Label Switching (MPLS) Virtual Private Networks (VPNs) allows multiple MPLS VPNs to be configured on a single device to work together. NAT can differentiate which MPLS VPN it receives IP traffic from even if the MPLS VPNs are all using the same IP addressing scheme. This enables multiple MPLS VPN customers to share services while ensuring that each MPLS VPN is completely separate from the other.

For additional information on this feature, see the *NAT Integration with MPLS VPNs* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftnatvpn.htm>

For additional information about PXF, see the *PXF Information for the Cisco 7304 Router* document:

[http://www.cisco.com/en/US/docs/routers/7300/maintain\\_and\\_operate\\_guides/7304\\_maintain\\_and\\_operate\\_guides/7304pxf.html](http://www.cisco.com/en/US/docs/routers/7300/maintain_and_operate_guides/7304_maintain_and_operate_guides/7304pxf.html)

## NetFlow Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following NetFlow features.

### Flexible NetFlow

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbfnf.htm>

## NetFlow Egress Accounting

Platform: Cisco 7304

The NetFlow Egress Accounting feature introduces egress NetFlow accounting in the Parallel eXpress Forwarding (PXF) processing path for a Cisco 7304 router that uses an NSE-100 or NSE-150.

The NetFlow Egress Accounting feature enables you to capture IP flow information for packets that undergo Multiprotocol Label Switching (MPLS) label disposition; that is, packets that arrive on a router as MPLS packets and are transmitted as IP packets. It also allows the router to capture IP information for packets that arrive on a router as IP packets and leave that router as an IP packet.

This feature enables service providers to compute MPLS core traffic matrices and better manage network traffic patterns.

For more information, see the following documents:

- For additional information on egress NetFlow accounting, see the *MPLS Egress NetFlow Accounting* document:  
<http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121newft/121t/121t5/egress.htm>
- For additional information about PXF, see the *PXF Information for the Cisco 7304 Router* document:  
[http://www.cisco.com/en/US/docs/routers/7300/maintain\\_and\\_operate\\_guides/7304\\_maintain\\_and\\_operate\\_guides/7304pxf.html](http://www.cisco.com/en/US/docs/routers/7300/maintain_and_operate_guides/7304_maintain_and_operate_guides/7304pxf.html)

## NetFlow Export of BGP Nexthop Information

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbnfbgpp.htm>

## NetFlow MPLS Aggregation

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, which is also known for the Cisco 10000 series as the MPLS PE-to-PE Traffic Statistics for NetFlow feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbmplspp.htm>

## Random Sampled NetFlow

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbrsnf.htm>

## OSPF Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following Open Shortest Path First (OSPF) features.

### NSF-OSPF RFC 3623 Graceful Restart

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s32/gr\\_ospf.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s32/gr_ospf.htm)

### OSPF Enhanced Traffic Statistics for OSPFv2 and OSPFv3

Platforms: Cisco 7200 series, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t6/htostats.htm>

### OSPF MIB Support of RFC 1850 and Latest Extensions

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/products/ps6566/products\\_feature\\_guide09186a00804eb09a.html](http://www.cisco.com/en/US/products/ps6566/products_feature_guide09186a00804eb09a.html)

### OSPF Sham-Link MIB Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s30/ospfslms.htm>

### OSPF SNMP ifIndex Value for Interface ID in OSPFv2 and OSPFv3 Data Fields

Platforms: Cisco 7200 series, Cisco 7304

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t6/ht\\_ifndx.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t6/ht_ifndx.htm)

### Persistent Storage

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the *Stateful Switchover* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fssso20s.htm>

### Per-VRF Assignment of BGP Router ID

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sr/newft/122sra33/srbgprid.htm>

## PPP-Max-Payload and IWF PPPoE Tag Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/ppmpiwf.htm>

## PPPoE Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following PPP over Ethernet (PPPoE) features.

### PPPoE Agent Remote ID & DSL Line Characteristics Enhancement

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/rmt\\_dsl.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/rmt_dsl.htm)

### PPPoE QinQ Support

Platforms: Cisco 7200 series, Cisco 10000 series (PRE-2 and PRE-3)



#### Note

This feature was introduced in Cisco IOS Release 12.2(28)SB2. Release 12.2(31)SB2 adds support for IP over Q-in-Q (IPoQ-in-Q).

For detailed information about this feature, which is also known as the IEEE 802.1Q-in-Q VLAN Tag Termination feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_7/gt\\_qinq.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_7/gt_qinq.htm)

### PPPoE Session Limiting on Inner QinQ VLAN

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbseslt2.htm>

## PXF-Based Frame Relay DE Bit Marking

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/ios\\_xe/qos/configuration/guide/mrkg\\_netwk\\_traffic\\_xe.html](http://www.cisco.com/en/US/docs/ios/ios_xe/qos/configuration/guide/mrkg_netwk_traffic_xe.html)

## QoS Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following quality of service (QoS) features.

## QoS: CBQoS Management - Policy-to-Interface Mapping Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/cbqosmap.htm>

## QoS: CBQoS MIB Index Enhancements

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, which may be known also as the CBQOSMIB Index Persistency feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t4/ht\\_cbqos.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t4/ht_cbqos.htm)

## QoS Child Service Policy for Priority Class

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/chldprio.htm>

## QoS: Classification, Policing, and Marking on LAC

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the following chapters in the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

- Chapter 2, “Classifying Traffic”

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qclass.html>

- Chapter 6, “Policing Traffic”

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qpolce.html>

- Chapter 7, “Marking Traffic”

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qmark.html>

## QoS - Hierarchical Queuing for Ethernet DSLAMs

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/10edslam.htm>

## QoS: Match VLAN

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/ht\\_mvlan.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/ht_mvlan.htm)



## QoS - Percentage-Based Shaping

Platform: Cisco 10000 series (PRE-2 and PRE-3)



### Note

This feature was introduced in Cisco IOS Release 12.2(28)SB for the Cisco 7200 series and Cisco 7301.

For detailed information about this feature, see the “Shaping Traffic” chapter of the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qshape.html>

## QoS - Policing Support for GRE Tunnels

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/grepol.htm>

## QoS Priority Propagation in Multi-level Scheduler

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the *MQC Hierarchical Queuing with 3 Level Scheduler* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/3lvl sched.htm>

## QoS - VLAN Tag Based

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/vlntqos.htm>

## RADIUS Logical Line ID

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, which is also known as the LLID Blocking feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftlineid.htm>

## Rate-Based Satellite Control Protocol (RBSCP)

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the *RBSCP (Rate Based Satellite Control Protocol)* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbrbscp.htm>

## Routed Bridge Encapsulation with ATM Virtual Circuit Bundles

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124t/124t4/htrbeatm.htm>

## SFP Security Verification

Platforms: Cisco 7200 series, Cisco 7304

Cisco IOS Release 12.2(31)SB2 supports the SFP Security Verification feature in Cisco transceivers (Gigabit Interface Converters [GBICs] or small form-factor pluggable [SFP] converters). (This feature is also known as the Cisco Quality ID feature.)

The SFP Security Verification feature primarily consists of the following components:

- A unique encrypted code in the GBIC module or SFP module that enables the Cisco IOS software to identify Cisco-pluggable parts.
- The ability of the Cisco IOS software to enable only those ports that are populated with Cisco parts. The SFP Security Verification feature allows customers to have confidence that the GBIC modules or SFP modules being deployed are certified to be compatible with the Cisco network device in which they are being deployed.

## SNMP - Session to Interface Mapping Improvements

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the “CISCO-AAA-SESSION-MIB” section in the following Cisco documents:

- *Cisco 7200 Series Router MIB Specifications Guide*  
[http://www.cisco.com/en/US/docs/routers/7200/technical\\_references/7200\\_mib\\_guides/7200\\_mib\\_specs\\_guide\\_v3/7200mib3\\_1.html](http://www.cisco.com/en/US/docs/routers/7200/technical_references/7200_mib_guides/7200_mib_specs_guide_v3/7200mib3_1.html)
- *Cisco 7301 Router MIB Specifications Guide*  
[http://www.cisco.com/en/US/docs/routers/7300/technical\\_references/7301\\_mib\\_guides/7301\\_mib\\_specs\\_guide\\_v3/7301mib3\\_1.html](http://www.cisco.com/en/US/docs/routers/7300/technical_references/7301_mib_guides/7301_mib_specs_guide_v3/7301mib3_1.html)
- *Cisco 7304 Router MIB Specifications Guide*  
[http://www.cisco.com/en/US/docs/routers/7300/technical\\_references/7304\\_mib\\_guides/7304\\_mib\\_specs\\_guide\\_v2/7304mib.html](http://www.cisco.com/en/US/docs/routers/7300/technical_references/7304_mib_guides/7304_mib_specs_guide_v2/7304mib.html)
- *Cisco 10000 Series Router Broadband MIB Specifications Guide*  
[http://www.cisco.com/en/US/docs/routers/10000/10008/technical\\_references/mibs/guides/broadband/mib\\_guide\\_ver4a/bbgv4a.html](http://www.cisco.com/en/US/docs/routers/10000/10008/technical_references/mibs/guides/broadband/mib_guide_ver4a/bbgv4a.html)

## SNMP Support for VPNs

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *SNMP Support over VPNs—Context-Based Access Control* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_2/gtsnmpvp.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_2/gtsnmpvp.htm)

## Stateful Switchover Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following Stateful Switchover (SSO) features.

### SSO - DHCP ODAP Client/Server

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *ISSU and SSO—DHCP High Availability Features* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbdhcpha.htm>

### SSO - DHCP Proxy Client

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *ISSU and SSO—DHCP High Availability Features* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbdhcpha.htm>

### SSO - DHCP Relay on Unnumbered Interface

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *ISSU and SSO—DHCP High Availability Features* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbdhcpha.htm>

### SSO - DHCP Server

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *ISSU and SSO—DHCP High Availability Features* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbdhcpha.htm>

### SSO - GLBP

Platforms: Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sglbpsso.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sglbpsso.html)

## SSO - Multilink Frame Relay

Platform: Cisco 10000 series (PRE-3)

For detailed information about this feature, see the *Stateful Switchover* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fssso20s.htm>

## SSO - PPPoA

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Cisco IOS Broadband High Availability Stateful Switchover* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbssobb.htm>

## SSO - PPPoE

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Cisco IOS Broadband High Availability Stateful Switchover* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbssobb.htm>

## SSO - Remote Access to MPLS VPN

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the *Cisco IOS Broadband High Availability Stateful Switchover* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbssobb.htm>

## Static MAC Address for PPPoE

Platform: Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the “Static MAC Address for PPPoE” section in the “Configuring PPPoE over Ethernet and IEEE 802.1Q VLAN” chapter of the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/vlan.html>

## Transmission Control Protocol Features

Cisco IOS Release 12.2(31)SB2 and later releases support the following Transmission Control Protocol (TCP) features.

### TCP Application Flags Enhancement

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbtcpaf1.htm>

## TCP - Explicit Congestion Notification

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbtcpecn.htm>

## TCP Show Extension

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbtcpse.htm>

## TCP Window Scaling

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbtcpwin.htm>

## Turbo ACL Scalability Enhancements (Phase II)

Platform: Cisco 7304

The Turbo ACL Scalability Enhancements (Phase II) feature improves processing of access control lists (ACLs) for a Cisco 7304 router that uses an NSE-100 or NSE-150.

These enhancements improve processing of all Parallel eXpress Forwarding (PXF) traffic on a Cisco 7304 router that uses a network services engine (NSE) by more efficiently processing traffic that requires Turbo ACL classification in the PXF processing path. This feature also introduces user-configuration options that allow users to define the amount of memory used for Turbo ACL purposes in the Route Processor (RP) processing path.

For additional information on this feature, see *Turbo Access Control List Scalability Enhancements* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/sbtaclse.htm>

## VPDN Debug Output

Platforms: Cisco 7200 series, Cisco 7301

The VPDN Debug Outputs feature enhances the **debug vpdn 12x-packets** command to decode both inbound and outbound Layer 2 Tunneling Protocol (L2TP) hexadecimal control packets for each L2TP Access Controller (LAC) or L2TP Network Server (LNS). In releases earlier than Cisco IOS Release 12.2(31)SB2, the **debug vpdn 12x-packets** command decoded only incoming L2TP hexadecimal control packets. With Cisco IOS Release 12.2(31)SB2 or later releases, in addition to decoding outbound control packets, the **debug vpdn 12x-packets** command decodes information regarding tunnel and session setup and teardown, Zero-Length Body (ZLB) packets, and attribute-value (AV) pairs. This feature also improves the readability of debug output.

You can debug outbound L2TP hexadecimal control packets by using the **debug vpdn 12x-packets** command in privileged EXEC mode.

The following example shows the **debug vpdn 12x-packets** command output with outbound debug output highlighted in **bold**:

```

3d22h: %LINK-3-UPDOWN: Interface Serial3/0, changed state to up
3d22h: Tnl 29029 L2TP: O SCCRQ
3d22h: Tnl 29029 L2TP: Parse AVP 0, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Parse SCCRQ
3d22h: Tnl 29029 L2TP: Parse AVP 2, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Protocol Ver 256
3d22h: Tnl 29029 L2TP: Parse AVP 6, len 8, flag 0x0
3d22h: Tnl 29029 L2TP: Firmware Ver 0x1130
3d22h: Tnl 29029 L2TP: Parse AVP 7, len 16, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Hostname LAC-tunnel
3d22h: Tnl 29029 L2TP: Parse AVP 8, len 25, flag 0x0
3d22h: Tnl 29029 L2TP: Vendor Name Cisco Systems, Inc.
3d22h: Tnl 29029 L2TP: Parse AVP 10, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Rx Window Size 20050
3d22h: Tnl 29029 L2TP: Parse AVP 11, len 22, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Chlng
B1 E9 3B 84 72 66 19 B1 C5 46 8F E7 31 A8 3B BC
3d22h: Tnl 29029 L2TP: Parse AVP 9, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Assigned Tunnel ID 29029
3d22h: Tnl 29029 L2TP: Parse AVP 3, len 10, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Framing Cap 0x0
3d22h: Tnl 29029 L2TP: Parse AVP 4, len 10, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Bearer Cap 0x0
3d22h: Tnl 29029 L2TP: Parse Cisco AVP 110, len 6, flag 0x0
3d22h: Tnl 29029 L2TP: PPPoE Relay Forward Capable
3d22h: Tnl 29029 L2TP: O SCCRQ, flg TLS, ver 2, len 141, tnl 0, ns 0, nr 0
C8 02 00 8D 00 00 00 00 00 00 00 00 80 08 00 00
C8 02 00 8D 00 00 00 00 00 00 00 00 80 08 00 00
00 00 00 01 80 08 00 00 00 02 01 00 00 08 00 00
00 06 11 30 80 10 00 00 00 07 4C 41 43 2D 74 75
6E 6E 65 6C 00 19 00 00 00 08 43 69 73 63 6F 20
53 79 73 74 65 6D 73 ...
3d22h: Tnl 29029 L2TP: Parse AVP 0, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Parse SCCRP
3d22h: Tnl 29029 L2TP: Parse AVP 2, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Protocol Ver 256
3d22h: Tnl 29029 L2TP: Parse AVP 6, len 8, flag 0x0
3d22h: Tnl 29029 L2TP: Firmware Ver 0x1120
3d22h: Tnl 29029 L2TP: Parse AVP 7, len 16, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Hostname LNS-tunnel
3d22h: Tnl 29029 L2TP: Parse AVP 8, len 25, flag 0x0
3d22h: Tnl 29029 L2TP: Vendor Name Cisco Systems, Inc.
3d22h: Tnl 29029 L2TP: Parse AVP 10, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Rx Window Size 20050
3d22h: Tnl 29029 L2TP: Parse AVP 11, len 22, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Chlng
7F 8B 30 8C 1D CD 44 49 CA 71 C3 6F 45 C2 89 B1
3d22h: Tnl 29029 L2TP: Parse AVP 13, len 22, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Chlng Resp
C3 A8 1B 39 6B 42 82 A5 AC A1 11 36 94 97 A2 1D
3d22h: Tnl 29029 L2TP: Parse AVP 9, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Assigned Tunnel ID 18566
3d22h: Tnl 29029 L2TP: Parse AVP 3, len 10, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Framing Cap 0x0
3d22h: Tnl 29029 L2TP: Parse AVP 4, len 10, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Bearer Cap 0x0
3d22h: Tnl 29029 L2TP: Parse Cisco AVP 110, len 6, flag 0x0
3d22h: Tnl 29029 L2TP: PPPoE Relay Forward Capable
3d22h: Tnl 29029 L2TP: No missing AVPs in SCCRP
3d22h: Tnl 29029 L2TP: I SCCRP, flg TLS, ver 2, len 163, tnl 29029, ns 0, nr 1
contiguous pak, size 163

```

```

C8 02 00 A3 71 65 00 00 00 00 01 80 08 00 00
00 00 00 02 80 08 00 00 00 02 01 00 00 08 00 00
00 06 11 20 80 10 00 00 00 07 4C 4E 53 2D 74 75
6E 6E 65 6C 00 19 00 00 00 08 43 69 73 63 6F 20
53 79 73 74 65 6D 73 2C ...
3d22h: Tnl 29029 L2TP: I SCCRP from LNS-tunnel
3d22h: Tnl 29029 L2TP: O SCCCN to LNS-tunnel tnlid 18566
3d22h: Tnl 29029 L2TP: Parse AVP 0, len 8, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Parse SCCCN
3d22h: Tnl 29029 L2TP: Parse AVP 13, len 22, flag 0x8000 (M)
3d22h: Tnl 29029 L2TP: Chlng Resp
3B 74 77 E8 DD 30 64 48 C2 63 42 D5 37 C3 B9 F2
3d22h: Tnl 29029 L2TP: O SCCCN, flg TLS, ver 2, len 42, tnl 18566, ns 1, nr 1
C8 02 00 2A 48 86 00 00 00 01 80 08 00 00
00 00 00 03 80 16 00 00 00 0D 3B 74 77 E8 DD 30
64 48 C2 63 42 D5 37 C3 B9 F2
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: O ICRQ to LNS-tunnel 18566/0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 0, len 8, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse ICRQ
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 15, len 10, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Serial Number 1563200007
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 14, len 8, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Assigned Call ID 61
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 18, len 10, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Bearer Type 2
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse Cisco AVP 100, len 15, flag 0x0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Client NAS Port
53 65 72 69 61 6C 33 2F 30
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: O ICRQ, flg TLS, ver 2, len 63, tnl 18566,
lsid 61, rsid 0, ns 2, nr 1
C8 02 00 3F 48 86 00 00 00 02 00 01 80 08 00 00
00 00 00 0A 80 0A 00 00 00 0F 5D 2C 8A 07 80 08
00 00 00 0E 00 3D 80 0A 00 00 00 12 00 00 00 02
00 0F 00 09 00 64 53 65 72 69 61 6C 33 2F 30
3d22h: Tnl 29029 L2TP: I ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 29029, ns
1, nr 2
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 0, len 8, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse ICRP
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 14, len 8, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Assigned Call ID 9
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: No missing AVPs in ICRP
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: I ICRP, flg TLS, ver 2, len 28, tnl 29029,
lsid 61, rsid 0, ns 1, nr 3
contiguous pak, size 28
C8 02 00 1C 71 65 00 3D 00 01 00 03 80 08 00 00
00 00 00 0B 80 08 00 00 00 0E 00 09
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: O ICCN to LNS-tunnel 18566/9
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 0, len 8, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse ICCN
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 24, len 10, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Connect Speed 1544000
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 19, len 10, flag 0x8000 (M)
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Framing Type 1
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 27, len 17, flag 0x0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Last Sent LCPREQ
03 05 C2 23 05 05 06 1D 9C 69 09
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 28, len 12, flag 0x0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Last Rx LCPREQ
05 06 1F 19 E3 07
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 31, len 22, flag 0x0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Proxy Auth Chal
FF 0D CB C7 E4 07 74 9F 43 0C 82 B5 17 69 4D 9E
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 32, len 8, flag 0x0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Proxy Auth ID 60

```

```

3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 30, len 22, flag 0x0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Proxy Auth Name client@cisco.com
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 33, len 22, flag 0x0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Proxy Auth Resp
  80 45 E2 C5 A7 D0 8C C1 0F 0A 14 F8 9E F7 21 F3
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Parse AVP 29, len 8, flag 0x0
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: Proxy Auth Type 2
3d22h: Se3/0 Tnl/Sn 29029/61 L2TP: O ICCN, flg TLS, ver 2, len 151, tnl 18566,
lsid 61, rsid 9, ns 3, nr 2
C8 02 00 97 48 86 00 09 00 03 00 02 80 08 00 00
00 00 00 0C 80 0A 00 00 00 18 00 17 8F 40 80 0A
00 00 00 13 00 00 00 01 00 11 00 00 00 1B 03 05
C2 23 05 05 06 1D 9C 69 09 00 0C 00 00 00 1C 05
06 1F 19 E3 07 00 16 ...
3d22h: Tnl 29029 L2TP: I ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 29029, ns 2, nr 4
3d22h: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up

```

For more information about the **debug vpdn 12x-packets** command, see the *Cisco IOS Debug Command Reference*:

[http://www.cisco.com/en/US/docs/ios/debug/command/reference/db\\_book.html](http://www.cisco.com/en/US/docs/ios/debug/command/reference/db_book.html)

## VRF-Aware System Message Logging (Syslog)

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series (PRE-2 and PRE-3)

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sr/newft/122sra33/srvrflsg.htm>

## VRF-Aware VPDN Tunnels

Platform: Cisco 10000 series (PRE-2 and PRE-3)



### Note

This feature was introduced in Cisco IOS Release 12.2(28)SB for the Cisco 7200 series and Cisco 7301.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbvpdnmh.htm>

## Weighted Random Early Detection Improvements

Platform: Cisco 10000 series (PRE-2 and PRE-3)

Cisco IOS Release 12.2(31)SB2 contains the following Weighted Random Early Detection (WRED) improvements for the Performance Routing Engine 3 (PRE-3):

- Instantaneous per-packet calculation of the average queue depth
- Better approximation of drop curves
- Maximum of 21 WRED profiles and 13 default profiles per policy map with typical configurations

Improvements have also been made in the collection of statistical information for WRED and other quality of service (QoS) features. Instead of polling for statistics, the PRE-3 transfers statistical data to the Route Processor (RP) on-demand every 10 seconds. As a result, statistics can be collected more quickly and with a significant improvement in memory requirements.



For more information about WRED improvements, see the “Managing Packet Queue Congestion” chapter in the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qqueue.html>

## New Hardware Features in Cisco IOS Release 12.2(28)SB6

This section describes new and changed features in Cisco IOS Release 12.2(28)SB6. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(28)SB6. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### 1-Port Packet over SONET OC3c/STM1 Port Adapter

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about the 1-port Packet over SONET OC3c/STM1 port adapter (PA-POS-1OC3), see the following documents:

- *Cisco 1-Port OC-3/STM-1 Packet-Over-SONET Port Adapter* data sheet:  
[http://www.cisco.com/en/US/prod/collateral/routers/ps341/product\\_data\\_sheet0900aecd80221d3d.html](http://www.cisco.com/en/US/prod/collateral/routers/ps341/product_data_sheet0900aecd80221d3d.html)
- *PA-POS-1OC3 Single-Port Port Adapter Installation and Configuration Guide*:  
[http://www.cisco.com/univercd/cc/td/doc/product/core/7301/73pa/73-son/6514\\_1oc/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/core/7301/73pa/73-son/6514_1oc/index.htm)

## New Software Features in Cisco IOS Release 12.2(28)SB6

This section describes new and changed features in Cisco IOS Release 12.2(28)SB6. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(28)SB6. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### Service Independent Intercept Architecture: SNMP-Based Lawful Intercept

Platforms: Cisco 7200 series, Cisco 7301



#### Note

For the Cisco 7200 series, SNMP-Based Lawful Intercept is supported only on Cisco 7200 VXR routers that are configured with an NPE-225, NPE-400, or NPE-G1. Support for the NPE-G2 is available as of Cisco IOS Release 12.2(31)SB2.

**Note**

RADIUS-Based Lawful Intercept was introduced in Cisco IOS Release 12.2(28)SB for the Cisco 7200 series and Cisco 7301.

SNMP-Based Lawful Intercept, which is a Layer 3 feature (that is, a feature at the IP level), is based on SNMPv3. The following MIBs are supported for SNMP-Based Lawful Intercept:

- CISCO-IP-TAP-MIB
- CISCO-IP-TAP2-MIB

For detailed information about the Service Independent Intercept (SII) architecture, see the *Service Independent Intercept* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/ht\\_ssi.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/ht_ssi.htm)

## Static MAC Address for PPPoE

Platform: Cisco 10000 series

For detailed information about this feature, see the “Static MAC Address for PPPoE” section in the “Configuring PPPoE over Ethernet and IEEE 802.1Q VLAN” chapter of the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/vlan.html>

## New Hardware Features in Cisco IOS Release 12.2(28)SB2

This section describes new and changed features in Cisco IOS Release 12.2(28)SB2. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(28)SB2. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### CWDM SFP for the 1-Port Gigabit Ethernet Half-Height Line Card

The 1-port Gigabit Ethernet half-height line card includes support for Coarse Wave Division Multiplexer (CWDM) Small Form-Factor Pluggable (SFP) laser optical transceiver modules. For more information, see the following *Cisco CWDM GBIC and CWDM SFP Installation Note*:

[http://www.cisco.com/univercd/cc/td/doc/product/gbic\\_sfp/gbic\\_doc/78\\_15222.htm](http://www.cisco.com/univercd/cc/td/doc/product/gbic_sfp/gbic_doc/78_15222.htm)

## New Software Features in Cisco IOS Release 12.2(28)SB2

This section describes new and changed features in Cisco IOS Release 12.2(28)SB2. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(28)SB2. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below.

If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

**Table 13** shows features that have never before been released in any public Cisco IOS software image for the Cisco 10000 series and that released for the first time for the Cisco 10000 series in Cisco IOS Release 12.2(28)SB2. Other features may be new for the Cisco 10000 series in Cisco IOS Release 12.2(28)SB2, but have been released before in other public Cisco IOS software images for the Cisco 10000 series, and are therefore not included in **Table 13**.

**Table 13**      **New Features for the Cisco 10000 Series in Cisco IOS Release 12.2(28)SB2**

Feature Name
MPLS VPN Half-Duplex VRF with Dynamic and Static PE-CE Routing

## BGP Support for NonStop Routing (NSR) with Stateful Switchover (SSO)

Platform: Cisco 10000 series

For detailed information about this feature, see the following document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbb\\_bnsr.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbb_bnsr.htm)

## Lawful Intercept

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/10LawInt.pdf](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/10LawInt.pdf)

## MPLS Traffic Engineering Features

Cisco IOS Release 12.2(28)SB2 introduces support for the following Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) features on the Cisco 10000 series.



### Note

With the exception of the MPLS Traffic Engineering—Overload Avoidance Support for IS-IS feature, support for these features was introduced in Cisco IOS Release 12.2(28)SB on the Cisco 7200 series, Cisco 7301, and Cisco 7304.

## MPLS Diff-Serv-Aware Traffic Engineering (DS-TE)

Platform: Cisco 10000 series

For detailed information about this feature, see the *MPLS Traffic Engineering—DiffServ Aware* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/12s\\_dste.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/12s_dste.htm)

**MPLS Traffic Engineering (TE)**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s23/fs23te.htm>

**MPLS Traffic Engineering (TE)—Automatic Bandwidth Adjustment for TE Tunnels**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fsbandaj.htm>

**MPLS Traffic Engineering (TE)—Configurable Path Calculation Metric for Tunnels**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fsmetric.htm>

**MPLS Traffic Engineering (TE)—Forwarding Adjacency**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s18/fstefa\\_3.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s18/fstefa_3.htm)

**MPLS Traffic Engineering (TE)—Interarea Tunnels**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s18/fsiarea3.htm>

**MPLS Traffic Engineering (TE)—IP Explicit Address Exclusion**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftaddexc.htm>

**MPLS Traffic Engineering (TE) MIB**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/temib2.htm>

## MPLS Traffic Engineering—Overload Avoidance Support for IS-IS

Platform: Cisco 10000 series

For detailed information about this feature, see the following document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/fsscen.htm>

## MPLS Traffic Engineering (TE)—Scalability Enhancements

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/fsscen.htm>

## MPLS Traffic Engineering (TE)—SNMP Notification Support

Platform: Cisco 10000 series

For detailed information about this feature, see the *MPLS Traffic Engineering MIB* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/temib2.htm>

## MPLS VPN Half-Duplex VRF with Dynamic and Static PE-CE Routing

Platform: Cisco 10000 series

For detailed information about this feature, see the *MPLS VPN Half-Duplex VRF* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/hdvrfdyn.htm>

## NetFlow PXF Timers

Platform: Cisco 10000 series

For detailed information about this feature, see the *Configuring NetFlow PXF Timers* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb\\_npxft.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb_npxft.htm)

## PPPoE QinQ Support

Platform: Cisco 10000 series

For detailed information about this feature, which is also known as the IEEE 802.1Q-in-Q VLAN Tag Termination feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_7/gt\\_qinq.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_7/gt_qinq.htm)

## RSVP Refresh Reduction and Reliable Messaging

Platform: Cisco 10000 series



### Note

This feature was introduced in Cisco IOS Release 12.2(28)SB for the Cisco 7200 series, Cisco 7301, and Cisco 7304.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s29/fsrelmsg.htm>

## New Hardware Features in Cisco IOS Release 12.2(28)SB

This section describes new and changed features in Cisco IOS Release 12.2(28)SB. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(28)SB. To determine if a feature is new or changed, see the feature history table at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

### 1-Port Enhanced ATM Port Adapter with Support for 8000 VCs

Platforms: Cisco 7200 series, Cisco 7301

Cisco IOS Release 12.2(28)SB adds support for the PA-A6 port adapters and support for 8000 virtual circuits (VCs) on the PA-A6 port adapters. The PA-A6 is a series of single-width, single-port, ATM port adapters. With advanced ATM features, the PA-A6 port adapters support broadband aggregation, WAN aggregation, and campus/MAN aggregation.

The following PA-A6 port adapters are supported:

- PA-A6-OC3MM: 1-port ATM OC-3c/STM-1 multimode port adapter, enhanced
- PA-A6-OC3SMI: 1-port ATM OC-3c/STM-1 single-mode (IR) port adapter, enhanced
- PA-A6-OC3SML: 1-port ATM OC-3c/STM-1 single-mode (LR) port adapter, enhanced
- PA-A6-T3: 1-port ATM DS3 port adapter, enhanced
- PA-A6-E3: 1-port ATM E3 port adapter, enhanced

For detailed information about these products, see the *PA-A6 Port Adapter Installation and Configuration* document:

[http://www.cisco.com/univercd/cc/td/doc/product/core/7206/port\\_adp/atm\\_-pas/pa-a6/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/core/7206/port_adp/atm_-pas/pa-a6/index.htm)

## 4-Port Half-Height Channelized T3 Line Card

Platform: Cisco 10000 series

For detailed information about this product, see the following Cisco document:

[http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/line\\_card\\_\\_software/10slct3h.html](http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/line_card__software/10slct3h.html)

## 4-Port OC-3/ATM Long-Reach Line Card

Platform: Cisco 10000 series

For detailed information about this product, see the following Cisco document:

[http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/line\\_card\\_\\_software/lncd-sw.html](http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/line_card__software/lncd-sw.html)

## 1000BASE-T GBIC Support for the Network Services Engine 100

Platform: Cisco 7304

The 1000BASE-T GBIC (WS-G5483=) is supported on Gigabit Ethernet interfaces of the Network Services Engine 100 (NSE-100).

For detailed information about this product, see the following Cisco document:

[http://www.cisco.com/en/US/products/hw/modules/ps872/products\\_data\\_sheet09186a008014cb5e.html](http://www.cisco.com/en/US/products/hw/modules/ps872/products_data_sheet09186a008014cb5e.html)

## CWDM GBIC Support for the Network Services Engine 100

Platform: Cisco 7304

Support for the following Coarse Wave Division Multiplexer (CWDM) Gigabit Interface Converters (GBICs) is introduced on Gigabit Ethernet ports of the Network Service Engine 100 (NSE-100):

- CWDM-GBIC-1470=
- CWDM-GBIC-1490=
- CWDM-GBIC-1510=
- CWDM-GBIC-1530=
- CWDM-GBIC-1550=
- CWDM-GBIC-1570=
- CWDM-GBIC-1590=
- CWDM-GBIC-1610=

For detailed information about these products, see the following Cisco document:

[http://www.cisco.com/en/US/products/hw/modules/ps4999/products\\_data\\_sheet09186a00801a557c.html](http://www.cisco.com/en/US/products/hw/modules/ps4999/products_data_sheet09186a00801a557c.html)

## CWDM SFP Support for the Network Processing Engine 100

Platform: Cisco 7304

The following Coarse Wave Division Multiplexer (CWDM) Small Form-Factor Pluggable (SFP) laser optical transceiver modules are supported on Gigabit Ethernet ports of the Network Processing Engine 100 (NPE-G100):

- CWDM-SFP-1470=
- CWDM-SFP-1490=
- CWDM-SFP-1510=
- CWDM-SFP-1530=
- CWDM-SFP-1550=
- CWDM-SFP-1570=
- CWDM-SFP-1590=
- CWDM-SFP-1610=

For detailed information about these products, see the following Cisco document:

[http://www.cisco.com/en/US/products/hw/modules/ps4999/products\\_data\\_sheet09186a00801a557c.html](http://www.cisco.com/en/US/products/hw/modules/ps4999/products_data_sheet09186a00801a557c.html)

## CWDM SFP Support for the 2-Port Gigabit Ethernet SPA on the Cisco 7304 Router

Platform: Cisco 7304

The following Coarse Wave Division Multiplexer (CWDM) Small Form-Factor Pluggable (SFP) laser optical transceiver modules are supported on Gigabit Ethernet ports of the 2-port Gigabit Ethernet SPA (SPA-2GE-7304):

- CWDM-SFP-1470=
- CWDM-SFP-1490=
- CWDM-SFP-1510=
- CWDM-SFP-1530=
- CWDM-SFP-1550=
- CWDM-SFP-1570=
- CWDM-SFP-1590=
- CWDM-SFP-1610=

For detailed information about these products, see the following Cisco document:

[http://www.cisco.com/en/US/products/hw/modules/ps4999/products\\_data\\_sheet09186a00801a557c.html](http://www.cisco.com/en/US/products/hw/modules/ps4999/products_data_sheet09186a00801a557c.html)

## New Software Features in Cisco IOS Release 12.2(28)SB

This section describes new and changed features in Cisco IOS Release 12.2(28)SB. Some features may be new to Cisco IOS Release 12.2SB but were released in earlier Cisco IOS software releases. Some features may have been released in earlier Cisco IOS software releases and have been changed in Cisco IOS Release 12.2(28)SB. To determine if a feature is new or changed, see the feature history table



at the beginning of the feature module for that feature. Links to feature modules are included below. If a feature listed below does not have a link to a feature module, that feature is documented only in the release notes, and information about whether the feature is new or changed will be available in the feature description provided below.

[Table 14](#) shows features that have never before been released in any public Cisco IOS software image for the Cisco 10000 series and that released for the first time for the Cisco 10000 series in Cisco IOS Release 12.2(28)SB. Other features may be new for the Cisco 10000 series in Cisco IOS Release 12.2(28)SB, but have been released before in other public Cisco IOS software images for the Cisco 10000 series, and are therefore not included in [Table 14](#).

**Table 14**      ***New Features for the Cisco 10000 Series in Cisco IOS Release 12.2(28)SB***

<b>Feature Name</b>
AAA CLI Stop Record Enhancement
Any Transport over MPLS (AToM): Frame Relay over MPLS (FRoMPLS)
ATM Conditional Debug Support
Dual Rate Three Color Policer
Hierarchical Input Policing
IGMPv3
Intelligent Service Gateway (ISG) Features
IP Multicast Load Splitting Across Equal-Cost Paths
IP SLAs - LSP Health Monitor
IPv6 Features
L2TP Congestion Avoidance
Layer 2 Local Switching
Link Fragmentation Interleave over Frame Relay (FRF.12)
Logging to Local Non-Volatile Storage (ATA Disk)
MLPPP with Link Fragmentation Interleave (LFI)
MPLS Carrier Supporting Carrier Features: <ul style="list-style-type: none"> <li>• MPLS VPN—Carrier Supporting Carrier</li> <li>• MPLS VPN—Carrier Supporting Carrier—IPv4 BGP Label Distribution</li> </ul>
MPLS Embedded Management—LSP Ping/Traceroute and AToM VCCV
MPLS HA Features: <ul style="list-style-type: none"> <li>• NSF/SSO: MPLS LDP and LDP Graceful Restart</li> <li>• NSF/SSO: MPLS VPN</li> <li>• MPLS High Availability</li> </ul>
and <ul style="list-style-type: none"> <li>• Cisco Express Forwarding: Command Changes</li> <li>• MPLS High Availability: Command Changes</li> </ul>
MPLS LDP MD5 Global Configuration
MPLS VPN—Explicit Null Label Support with BGP IPv4 Label Session

**Table 14** *New Features for the Cisco 10000 Series in Cisco IOS Release 12.2(28)SB (continued)*

Feature Name
Multicast-VPN: Multicast Support for MPLS VPN
Pseudowire Emulation Edge-to-Edge MIBs for Ethernet Services
RADIUS Server Load Balancing
Stateful Switchover (SSO) for Multilink PPP (MLP)
Template ACL/12-Bit ACE

Table 15 shows how select features for the Cisco 7304 are supported and uses the following conventions:

- Yes—The feature is supported on the engine and/or in the PFX path.
- No—The feature is not supported on the engine and/or in the PFX path.

**Table 15** *Features Supported on the Cisco 7304 Engines and in the PFX Path*

Feature	Support on the NSE-100	Support on the NPE-G100	Support in the PFX Path
Frame Relay—show and debug Command Enhancements	Yes	Yes	No
IP SLAs LSP Health Monitor	Yes	Yes	No
MPLS VPN—eIBGP Multipath Loadbalancing Enhancements	Yes	Yes	Yes
MPLS VPN—VRF-Select for PFX	Yes	Not applicable <sup>1</sup>	Yes
Multiple Action Policer for PFX	Yes	Not applicable <sup>1</sup>	Yes
Three-level Hierarchical Policy Support in PFX	Yes	Not applicable <sup>1</sup>	Yes
Turbo Access Control List Scalability Enhancements [Phase 1]	Yes	Not applicable <sup>1</sup>	No <sup>2</sup>
Warm Reload	Yes	Yes	Not applicable <sup>3</sup>

1. This feature is supported on the NPE-G100 but not in the PFX path of the NPE-G100. Therefore, the PFX enhancement is not applicable to the NPE-G100.
2. Although this feature is not supported in the PFX path, this enhancement improve system memory utilization in the PFX path.
3. This feature does not apply to the PFX path.

## AAA Features

Cisco IOS Release 12.2(28)SB introduces support for the following AAA features.

### AAA CLI Stop Record Enhancement

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the *Per VRF AAA* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftvrfaaa.htm>

## AAA Double Authentication Secured by Absolute Timeout

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_7/gt\\_dasat.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_7/gt_dasat.htm)

## AAA Per-User Scalability

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *Per VRF AAA* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftvrfaaa.htm>

## AAA-PPP-VPDN Non-Blocking

Platforms: Cisco 7200 series, Cisco 7301

Previously, Cisco IOS software created a statically configurable number of processes to authenticate calls. Each process would handle a single call, but in some situations the limited number of processes could not keep up with the incoming call rate. This resulted in some calls timing out. The AAA-PPP-VPDN Non-Blocking feature changes the software architecture such that the number of processes do not limit the rate of call handling.

## ACL Default Direction

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftacldir.htm>

## Any Transport over MPLS (AToM): Frame Relay over MPLS (FRoMPLS)

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature for the Cisco 10000 series, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/overview.html>

## ATM Features

Cisco IOS Release 12.2(28)SB introduces support for the following ATM features.

### ATM Bulk VC Configuration

Platform: Cisco 10000 series

For detailed information about this feature, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/overview.html>

## ATM Conditional Debug Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature (which is also known as the ATM Conditional debug/show Commands feature), see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sbc27/12satmdb.htm>

## ATM Multilink PPP Support on Multiple VCs

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 7500 series, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftatmmlt.htm>

## ATM OAM Ping

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s21/12atmpng.htm>

## ATM OAM Traffic Reduction

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s23/atmoam.htm>

## ATM PVCs

Platform: Cisco 10000 series

The ATM line cards support the full range of virtual path identifier (VPI)/virtual channel identifier (VCI) pairs (unidirection only)—8-bit VPI range and 16 bit VCI range. [Table 16](#) lists the maximum number of active virtual channels (VCs) supported on ATM line cards for Cisco IOS Release 12.2(28)SB.

**Table 16 Active VCs on ATM Line Cards**

Line Card	Maximum VCs per Port	Maximum VCs per Module	Number of VBR, CBR, Shaped UBR VCs
E3/DS3	4,096	32,768 <sup>1</sup>	28,672 <sup>2</sup>
OC-3	8,191	32,764 <sup>3</sup>	28,672 <sup>4</sup>
OC-12	16,384	16,384	16,384

1. For 32,768 VCs per module, 4096 VCs must be unshaped UBR VCs.
2. For 28,672 VBR, CBR, and shaped UBR VCs, no VCs can be in shaped VP tunnels. If VCs are in shaped VPs, the number of VBR, CBR, and shaped UBR VCs is 22,204.
3. For 32,764 VCs per module, 4096 VCs must be unshaped UBR VCs.
4. For 28,672 VBR, CBR, and shaped UBR VCs, no VCs can be in shaped VP tunnels. If VCs are in shaped VPs, the number of VBR, CBR, and shaped UBR VCs is 22,204.

You can configure the maximum number of VCs across the ports in any fashion, provided that you do not exceed the per-port maximum.

Although the maximum number of VBR, CBR, and shaped UBR VCs per E3/DS3 and OC-3 ATM line card is 28,672, the router supports a maximum of 22,204 VBR, CBR, and shaped UBR VCs per line card that you can place within virtual path (VP) tunnels. If you attempt to bring up more than 22,204 VCs in a configuration that includes VP tunnels and VCs (hierarchical traffic shaping configuration), the VCs might not assign traffic correctly or the VCs might not come up at all. Be sure to limit the number of configured VBR, CBR, and shaped UBR VCs on an ATM card to less than 22,204 VCs if you place the VCs in VP tunnels.

### ATM PVC Range and Routed Bridge Encapsulation Subinterface Grouping

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

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

### ATM VC into VP Shaping

Platform: Cisco 10000 series

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/10qttitle.html>

### Attribute Screening for Access Requests

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123limit/123b/123b3/gt\\_asfar.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123limit/123b/123b3/gt_asfar.htm)

## Autosense of MUX/SNAP Encapsulation and PPPoA/PPPoE on ATM PVCs

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122b/122b\\_15/ftpauto2.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122b/122b_15/ftpauto2.htm)

## BGP Features

Cisco IOS Release 12.2(28)SB introduces support for the following Border Gateway Protocol (BGP) features.

### BGP 4 MIB Support for per-Peer Received Routes

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, which is also known as the BGP Received Routes MIB feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s21/sbgprmb.htm>

### BGP Convergence Optimization

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

BGP Convergence Optimization introduces a new algorithm for update generation that reduces the time that is required for Border Gateway Protocol (BGP) convergence. Neighbor update messages are optimized before they are forwarded to neighbors. Updates are optimized and forwarded based on peer groups and per-individual neighbors. This enhancement improves BGP convergence, router boot time, and transient memory usage. This enhancement is not user configurable.

**Note**

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This feature is also known as BGP: Reduction in Transient Memory Usage.

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### BGP Cost Community Support for EIGRP MPLS VPN PE-CE with Backdoor Links

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s25/fsbgpccce.htm#wp1027129>

### BGP Increased Support of Numbered AS-Path Access Lists to 500

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sbc27/ftiaaspa.htm>

## BGP Support for IP Prefix Import from a Global Table into a VRF Table

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2s/feature/guide/fs\\_bgivt.html](http://www.cisco.com/en/US/docs/ios/12_2s/feature/guide/fs_bgivt.html)

## Bit Error Rate Testing (BERT)

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s21/bert.htm>

## Bridged 1483 Encapsulated Traffic over ATM SVCs

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ftbridge.htm>

## Byte-Based Weighted Random Early Detection

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s26/fsbyte.htm>

## CEF/dCEF - Cisco Express Forwarding

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature for the Cisco 10000 series, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/overview.html>

## Clear IPC Statistics

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ft\\_ipc.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ft_ipc.htm)





### DHCP Client Dynamic Subnet Allocation API

Platform: Cisco 7200 series

The DHCP Client Dynamic Subnet Allocation API feature is an application programming interface (API) that is called by the DHCP Server—On-Demand Address Pool Manager feature for obtaining a subnet or releasing a subnet to the source server via DHCP. This feature allows automated configuration of Layer 3 devices for simplified deployment.

### DHCP—Configurable DHCP Client

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP Lease Limit per ATM RBE Unnumbered Interface

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP ODAP Server Support

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP On-Demand Address Pool Manager for Non-MPLS VPN Pools

Platform: Cisco 10000 series

For detailed information about this feature, see the following *DHCP Server—On-Demand Address Pool Manager* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP Option 82 Support for Routed Bridge Encapsulation

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP Relay MPLS VPN Support

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP Relay Subscriber Identifier Suboption

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP Release and Renew CLI in EXEC Mode

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP Server—On-Demand Address Pool Manager

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP Server—Option to Ignore All BOOTP Requests

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP—Static Mapping

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCP—Statically Configured Routes Using a DHCP Gateway

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdhcpsb.htm>

### DHCPv6 Prefix Delegation via AAA

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the “Prefix Delegation” section in the “Implementing ADSL and Deploying Dial Access for IPv6” chapter that is part of the *Cisco IOS IPv6 Configuration Library*:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-adsl\\_dial.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-adsl_dial.html)

## DHCPv6 Relay Agent

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

A client locates a DHCP server by using a reserved, link-scoped multicast address. Therefore, it is a requirement for direct communication between the client and the server that the client and the server be attached to the same link. However, in some situations in which ease of management, economy, or scalability is a concern, it is desirable to allow a DHCP client to send a message to a DHCP server that is not connected to the same link. A DHCP relay agent, which may reside on the client's link, is used to relay messages between the client and the server. DHCP relay agent operation is transparent to the client.

For more information, see the *Implementing Basic Connectivity for IPv6* chapter that is part of the *Cisco IOS IPv6 Configuration Library*:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-addrg\\_bsc\\_con.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-addrg_bsc_con.html)

## Distributed Time-Based Access Lists

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t2/ftdistac.htm>

## Dialer CEF

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftdlrcef.htm>

## DNS Spoofing

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_2/gtdnsspf.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_2/gtdnsspf.htm)

## Dynamic ATM VP and VC Configuration Modification

Platform: Cisco 10000 series

The Dynamic ATM VP and VC Configuration Modification feature enables you to change the virtual circuit (VC) weight or virtual path (VP) shaping parameters without affecting the state of the VC or VP. In other words, the VC and VP remain up and operational (the VC or VP is not torn down at the segmentation and reassembly [SAR], and the session does not go down). The dynamic parameters include ATM VP parameters (peak cell rate [PCR] or cell delay variation tolerance [CDVT]) and VC parameters (weight, PCR, sustainable cell rate [SCR], maximum burst size [MBS], and CDVT). When you change the VC parameters or the VP rate, there can be a momentary change in the shaped rate of the VP, in which the rate at which cells are sent may be over or under the configured rate. The session stays up, and no data is lost.

The range of integer values that are supported by the *weighting-value* argument of the **weight** command is 5 to 255.

## Dynamic Subscriber Bandwidth Selection

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftdbs.htm>

## EIGRP MPLS VPN PE-CE Site of Origin (SoO)

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_8/gtmvesoo.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_8/gtmvesoo.htm)

## Embedded Event Manager 2.1

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_14/gteem21.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_14/gteem21.htm)

## Enabling OSPFv2 on an Interface Using the ip ospf area Command

Platform: Cisco 10000 series

For detailed information about this feature, which is also known as the Area Command in Interface Mode for OSPFv2 feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s29/ospfarea.htm>

## Enhanced Tracking Support

Platform: Cisco 10000 series

For detailed information about this feature, including Enhanced Object Tracking, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbaiptrk.htm>

## Entity/Environment Monitoring

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco documents:

- For the Cisco 7200 series, see the *Cisco 7200 Series Router MIB Specifications Guide*:

[http://www.cisco.com/en/US/docs/routers/7200/technical\\_references/7200\\_mib\\_guides/7200\\_mib\\_specs\\_guide\\_v3/7200mib3\\_1.html](http://www.cisco.com/en/US/docs/routers/7200/technical_references/7200_mib_guides/7200_mib_specs_guide_v3/7200mib3_1.html)

- For the Cisco 7301, see the *Cisco 7301 Router MIB Specifications Guide*:  
[http://www.cisco.com/en/US/docs/routers/7300/technical\\_references/7301\\_mib\\_guides/7301\\_mib\\_specs\\_guide\\_v3/7301mib3\\_1.html](http://www.cisco.com/en/US/docs/routers/7300/technical_references/7301_mib_guides/7301_mib_specs_guide_v3/7301mib3_1.html)

## Extended NAS-Port-Type and NAS-Port Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/rd\\_naspt.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/rd_naspt.htm)

## Frame Relay Features

Cisco IOS Release 12.2(28)SB introduced support for the following Frame Relay features.

### Frame Relay Fast Restart

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120st/120st19/19stfr72.htm>

### Frame Relay MIB Enhancements

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftfrmibe.htm>

### Frame Relay—show and debug Command Enhancements

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series.

For detailed information about this feature, which is also known as the Frame Relay **show** Command and **debug** Command Enhancements feature, see the following Cisco document:

[http://www.cisco.com/en/US/products/ps6566/products\\_feature\\_guide09186a0080519921.html](http://www.cisco.com/en/US/products/ps6566/products_feature_guide09186a0080519921.html)

### Frame Relay VC Bundling

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *Frame Relay PVC Bundles with IP and MPLS QoS Support* document:

[http://www.cisco.com/en/US/docs/ios/12\\_2t/12\\_2t13/feature/guide/ft\\_frbnd.html](http://www.cisco.com/en/US/docs/ios/12_2t/12_2t13/feature/guide/ft_frbnd.html)

## Generic Routing Encapsulation (GRE) Tunnel Keepalive

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb\\_gretk.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb_gretk.htm)

## Globalized Channelizations for SONET/SDH

Platform: Cisco 10000 series

The Globalized Channelizations for SONET/SDH feature enables the Cisco 10000 series 1-port channelized OC-12 line card and 4-port channelized STM-1 line card to support the following globalized channelization modes:

- SONET channelization:
  - STS-1 over DS3/T3
  - STS-1 over DS3/T3 over DS1
  - STS-1 over DS3/T3 over DS3 subrate
  - STS-1 over VT1.5 over DS1
  - STS-1 over VT2 over E1
- Synchronous Digital Hierarchy (SDH) channelization:
  - STM-1 over AU-3 over DS3/T3
  - STM-1 over AU-3 over DS3/T3 over DS3 subrate
  - STM-1 over AU-3 over TUG-2 over C-11 over DS1/T1
  - STM-1 over AU-3 over TUG-2 over C-12 over E1
  - STM-1 over AU-4 over TUG-3 over TUG-2 over C-11 over DS1/T1
  - STM-1 over AU-4 over TUG-3 over TUG-2 over C-12 over E1

## IEEE 802.1p Support

Platform: Cisco 10000 series

The IEEE's 802.1p standard now allows a range of traffic prioritization of Layer 2 frames from critical to non-critical through a frame priority tag, providing a higher quality of service (QoS) on high-speed LANs. Network managers can implement traffic prioritization through infrastructure device upgrades. IEEE 802.1p is a key enabler to QoS by enabling "Prioritized Ethernet" with up to eight priorities in Ethernet and Token Ring networks.

## IGMP State Limit

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

The IGMP State Limit feature provides protection against denial of service attacks caused by IGMP packets. The new CLI introduced by this feature allows you to configure a limit on the number of IGMP states that results from IGMP, IGMP Version 3 lite, and URL Rendezvous Directory (URD) membership reports on a per-interface or global basis. Membership reports in excess of the configured limits will not be entered in the IGMP cache, and traffic for those excess membership reports will not be forwarded.

For more information, see the *Customizing IGMP* document:

[http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/imc\\_customize\\_igmp.html](http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/imc_customize_igmp.html)

## IGMPv3

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the *Customizing IGMP* document:

[http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/imc\\_customize\\_igmp.html](http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/imc_customize_igmp.html)

## Improved show commands for MLP-ATM LFI

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the *Troubleshooting Enhancements for Multilink PPP over ATM Link Fragmentation and Interleaving* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_7/gtrrbmlp.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_7/gtrrbmlp.htm)

## Intelligent Service Gateway (ISG) Features

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series.

Cisco IOS Release 12.2(28)SB introduces support for the following Intelligent Service Gateway (ISG) features on the Cisco 7200 series, Cisco 7301, and Cisco 10000 series as explained in [Table 17](#).

**Table 17** ISG Features Supported per Platform

ISG Feature	Cisco 7301 Router	Cisco 7200 Series	Cisco 10000 Series
ISG: Authentication: DHCP Option 82 Line ID - AAA Authorization Support	Yes	Yes	No
ISG: Accounting: Postpaid	Yes	Yes	No
ISG: Accounting: Time-Based Prepaid	Yes	Yes	Yes
ISG: Accounting: Volume-Based Prepaid	Yes	Yes	No
ISG: Accounting: Per Session, Service & Flow	Yes	Yes	Yes
ISG: Accounting: Tariff Switching	Yes	Yes	No
ISG: Flow Control: Flow Redirect (L4, Captive Portal)	Yes	Yes	Yes
ISG: Flow Control: QoS Control: Dynamic Rate Limiting	Yes	Yes	Yes
ISG: Instrumentation: Advanced Conditional Debugging	Yes	Yes	Yes
ISG: Instrumentation: Session & Flow Monitoring (local and external)	Yes	Yes	No
ISG: Network Interface: IP Routed, VRF Aware MPLS	Yes	Yes	No
ISG: Network Interface: Tunneled (L2TP)	Yes	Yes	Yes
ISG: Policy Control: DHCP Proxy	Yes	Yes	No
ISG: Policy Control: Multidimensional Identity per Session	Yes	Yes	Yes
ISG: Policy Control: Policy: Domain Based (Auto-domain)	Yes	Yes	Yes
ISG: Policy Control: Policy Server: CoA (QoS, L4 Redirect, User ACL, TimeOut)	Yes	Yes	Yes
ISG: Policy Control: Policy Server: SSG-SESM Protocol	Yes	Yes	Yes

**Table 17** ISG Features Supported per Platform

ISG Feature	Cisco 7301 Router	Cisco 7200 Series	Cisco 10000 Series
ISG: Policy Control: Policy: Triggers: Duration	Yes	Yes	No
ISG: Policy Control: Service Profiles	Yes	Yes	Yes
ISG: Policy Control: User Profiles	Yes	Yes	Yes
ISG: Session: Auth: PBHK	Yes	Yes	Yes
ISG: Session: Auth: Single Sign On	Yes	Yes	Yes
ISG: Session: Authentication (MAC, IP, EAP)	Yes	Yes	No
ISG: Session: Creation: Interface IP Session: L2	Yes	Yes	No
ISG: Session: Creation: Interface IP Session: L3	Yes	Yes	No
ISG: Session: Creation: IP Session: Protocol Event (DHCP)	Yes	Yes	No
ISG: Session: Creation: IP Session: Subnet & Source IP: L2	Yes	Yes	No
ISG: Session: Creation: IP Session: Subnet & Source IP: L3	Yes	Yes	No
ISG: Session: LifeCycle: Idle Timeout	Yes	Yes	Yes
ISG: Session: LifeCycle: POD	Yes	Yes	Yes
ISG: Session: Multi-Service Creation and Flow Control	Yes	Yes	Yes
ISG: Session: VRF Transfer	Yes	Yes	No

For detailed information about these features, see the *Cisco IOS Intelligent Service Gateway Configuration Guide* that is part of the *Cisco IOS ISG Configuration Library*:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/isg/configuration/guide/isg\\_lib.html](http://www.cisco.com/en/US/docs/ios/12_2sb/isg/configuration/guide/isg_lib.html)

## Interface Alias Long Name Support

Platform: Cisco 10000 series

For detailed information about this feature, see the following *Interface Index Display and Interface Alias Long Name Support for SNMP* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t2/ftshowif.htm>

## IP Features

Cisco IOS Release 12.2(28)SB introduced support the following IP features.

### IPMROUTE-STD-MIB

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

The IPMROUTE-STD-MIB, as defined in RFC 2932, is a module for IP multicast routing in a manner independent of the specific multicast routing protocol in use. Support for this MIB replaces the draft form of the IPMROUTE-MIB.



The IPMROUTE-STD-MIB supports all the MIB objects of the IPMROUTE-MIB and also supports the following four new MIB objects:

- ipMRouteEntryCount
- ipMRouteHCOctets
- ipMRouteInterfaceHCInMcastOctets
- ipMRouteInterfaceHCOutMcastOctets

The ipMRouteScopeNameTable MIB object is not supported because it is not relevant to multicast routers.

### IP Multicast Load Splitting Across Equal-Cost Paths

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the *Load Splitting IP Multicast* document:

[http://www.cisco.com/en/US/docs/ios/12\\_4t/ip\\_mcast/configuration/guide/mctlsplt.html](http://www.cisco.com/en/US/docs/ios/12_4t/ip_mcast/configuration/guide/mctlsplt.html)

For detailed information about this feature for the Cisco 10000 series, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/broadband/overview.html>

### IP SLAs LSP Health Monitor

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/products/ps6566/products\\_feature\\_guide09186a0080528450.html](http://www.cisco.com/en/US/products/ps6566/products_feature_guide09186a0080528450.html)

### IPv6 Access Services: DHCPv6 Prefix Delegation

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

DHCP for IPv6 can be used in environments to deliver stateless address assignment information. Stateless address assignment uses configuration parameters that do not require a server to maintain a dynamic state for individual clients, such as DNS server addresses and domain search list options.

For more information, see the *Implementing Basic Connectivity for IPv6* document:

[http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-addrg\\_bsc\\_con.html](http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-addrg_bsc_con.html)

### IPv6 Features for the Cisco 10000 Series

Platform: Cisco 10000 series

Cisco IOS Release 12.2(28)SB supports the IPv6 Hardware: PXF Accelerated for IPv6 Forwarding feature for the Cisco 10000 series, which includes support for the following IPv6 features:

- IPv6 features:
  - IPv6: address types: Anycast
  - IPv6: address types: Unicast
  - IPv6: ICMPv6  
(Note: A ping in the fast-path mode is not supported; the support rate is limited to 10 pings per second per interface.)

- IPv6: ICMPv6 redirect
- IPv6: IPv6 MTU path discovery
- IPv6: IPv6 neighbor discovery
- IPv6: IPv6 stateless autoconfiguration
- IPv6: IPv6 static cache entry for neighbor discovery
- IPv6: neighbor discovery duplicate address detection
- IPv6: strict Reverse Path Forwarding (RPF)
- IPv6 Switching Services features:
  - IPv6 switching: CEF/dCEF support
  - IPv6 switching: CEFv6 switched configured IPv6 over IPv4 tunnels
- IPv6 Routing features:
  - IPv6 routing: RIP for IPv6 (RIPng)
  - IPv6 routing: static routing
  - IPv6 routing: route redistribution
  - IPv6 routing: multiprotocol BGP extensions for IPv6
  - IPv6 routing: multiprotocol BGP link-local address peering
  - IPv6 routing: IS-IS support for IPv6
  - IPv6 routing: IS-IS multitopology support for IPv6
  - IPv6 routing: OSPF for IPv6 (OSPFv3)
- IPv6 Services and Management features:
  - IPv6 services: AAAA DNS lookups over an IPv4 transport
  - IPv6 services: standard access control lists
  - IPv6 services: DNS lookups over an IPv6 transport
  - IPv6 services: Secure Shell support over IPv6
  - IPv6 services: Cisco Discovery Protocol—IPv6 address family support for neighbor information
  - IPv6 services: CISCO-IP-MIB support
  - IPv6 services: CISCO-IP-FORWARDING-MIB support
  - IPv6 services: extended access control lists3
- IPv6 Tunnel Services features:
  - IPv6 tunneling: manually configured IPv6 over IPv4 tunnels
  - IPv6 tunneling: IPv6 over IPv4 GRE tunnels
- IPv6 Data Link Layer features:
  - IPv6 data link: ATM PVC and ATM LANE
  - IPv6 data link: Ethernet, Fast Ethernet, Gigabit Ethernet, and 10-Gigabit Ethernet
  - IPv6 data link: Frame Relay PVC
  - IPv6 data link: Cisco High-Level Data Link Control

- IPv6 data link: PPP service over packet over SONET, ISDN, and serial (synchronous and asynchronous) interfaces  
(Note: PPPoA, PPPoE, and PPP over a VLAN are not supported; PPP over a serial link is supported.)
- IPv6 data link: VLANs using IEEE 802.1Q encapsulation

**Note**


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Cisco 10000 series routers do not support IPv6 multicast routing.

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For more information about these IPv6 features, see the “Start Here: Cisco IOS Software Release Specifics for IPv6 Features” chapter of the *Cisco IOS IPv6 Configuration Library*:

[http://www.cisco.com/en/US/docs/ios/12\\_2t/ipv6/ipv6\\_vgf.html](http://www.cisco.com/en/US/docs/ios/12_2t/ipv6/ipv6_vgf.html)

## ISDN Backup in MPLS Core

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_2/gtisdnbk.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_2/gtisdnbk.htm)

## In Service Software Upgrade (ISSU)

Platform: Cisco 10000 series

The In Service Software Upgrade (ISSU) feature includes support for the following features:

- ISSU - ARP
- ISSU - ATM
- ISSU - Frame Relay
- ISSU - HDLC
- ISSU - HSRP
- ISSU - PPP/MLP
- ISSU - QoS
- ISSU - SNMP

For detailed information about these features, see the *Cisco IOS In Service Software Upgrade Process* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb\\_issu.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb_issu.htm)

The ISSU feature includes support for the following MPLS features:

- ISSU - MPLS LDP
- ISSU - MPLS QoS
- ISSU - MPLS L3VPN

For detailed information about these features, see the *ISSU MPLS Clients* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/iscli28.htm>

The ISSU feature is supported on the following line cards:

- 1-port channelized OC-12/STM-4
- 1-port Gigabit Ethernet
- 1-port half-height Gigabit Ethernet
- 1-port OC-12 ATM
- 1-port OC-12 Packet over SONET (PoS)
- 1-port OC-48 PoS
- 4-port channelized OC-3/STM-1
- 4-port channelized half-height T3
- 4-port OC-3 ATM
- 6-port channelized T3
- 6-port OC-3 PoS
- 8-port ATM E3/DS3
- 8-port E3/DS3
- 8-port half-height Fast Ethernet
- 24-port channelized E1/T1

## L2TP and L2TPv3 Features

Cisco IOS Release 12.2(28)SB introduces support for the following L2TP and L2TPv3 features.

### L2TP Congestion Avoidance

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbl2scca.htm>

### L2TP Disconnect Cause Information

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_4/gtl2disc.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_4/gtl2disc.htm)

### L2TP Extended Failover

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbl2tpef.htm>

## L2TP Redirect

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbl2tpmr.htm>

## L2TP Security

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbl2tsec.htm>

## L2TP Tunnel Connection Speed Labeling

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbclabel.htm>

## L2TPv3 Control Message Hashing

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *Layer 2 Tunnel Protocol Version 3* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s31/l2tpv31s.htm>

## L2TPv3 Control Message Rate Limiting

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *Layer 2 Tunnel Protocol Version 3* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s31/l2tpv31s.htm>

## Protocol Demultiplexing for L2TPv3

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *Layer 2 Tunnel Protocol Version 3* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s31/l2tpv31s.htm>

## Layer 2 Local Switching

Platform: Cisco 10000 series

For detailed information about this feature, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/index.htm>

## Layer 2 Local Switching: Frame Relay to Frame Relay

Platform: Cisco 10000 series

For detailed information about this feature, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/index.htm>

## Layer 2 VPN Features

Cisco IOS Release 12.2(28)SB introduces support for the following Layer 2 VPN features.

### L2VPN Pseudowire Redundancy

Platform: Cisco 7403

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s31/fspseudo.htm>

### L2VPN Pseudowire Switching

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s31/fsstitch.htm>

### Layer 2 VPN: Syslog, SNMP Trap and Show Command Enhancements for AToM and L2TPv3

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *Layer 2 Tunnel Protocol Version 3* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s31/l2tpv31s.htm>

### NSF/SSO: L2VPN Pseudowire Redundancy Support

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sudosso.htm>

## Local AAA Server

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_14/gt\\_laas.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_14/gt_laas.htm)

## Local Template-Based ATM PVC Provisioning

Platform: Cisco 10000 series

The Local Template-Based ATM PVC Provisioning feature supports permanent virtual circuit (PVC) autoprovisioning for an infinite range of virtual path identifier (VPI)/virtual channel identifier (VCI) combinations on an ATM interface. This feature enables ATM PVCs to be provisioned automatically as needed from a local configuration, which makes the provisioning of large numbers of digital subscriber line (DSL) subscribers easier, faster, and less prone to error. ATM PVC autoprovisioning can be configured on a PVC, an ATM PVC range, or a virtual circuit (VC) class. If a VC class that is configured with ATM PVC autoprovisioning is assigned to the main interface, all the PVCs on that main interface will be autoprovisioned; this configuration is sometimes called an infinite range.

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122b/122b\\_15/ftpvc.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122b/122b_15/ftpvc.htm)

## Logging to Local Non-Volatile Storage (ATA Disk)

Platform: Cisco 10000 series

For detailed information about this feature, see the *Syslog Writing to Flash* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/cs\\_sysls.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/cs_sysls.htm)

## MLP LFI over ATM Configuration Scaling

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, which is also known as the Link Fragmentation and Interleaving for Frame Relay and ATM Virtual Circuits feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbamlatm.htm>

## MPLS Features

Cisco IOS Release 12.2(28)SB introduces support for the following Multiprotocol Label Switching (MPLS) and MPLS-related features.

### MPLS (Multiprotocol Label Switching)

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature for the Cisco 10000 series, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/index.htm>

### MPLS-Aware NetFlow

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sx\\_mnf.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sx_mnf.htm)

## MPLS Egress NetFlow Accounting

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/egrsbk.htm>

## MPLS Embedded Management—High Capacity Counter

Platforms: Cisco 7200 series, Cisco 7301

As of Cisco IOS Release 12.2(28)SB, the MPLS IF MIB has a 64-bit structure to ensure that high-capacity loads can be handled.

## MPLS Embedded Management—LSP Ping/Traceroute and AToM VCCV

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_0s/feature/guide/gslspt.html](http://www.cisco.com/en/US/docs/ios/12_0s/feature/guide/gslspt.html)

## MPLS Label Distribution MIB: MPLS LDP Trap Enhancement

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, which is also known as the MPLS VPN MIB v05 - Trap Enhancements feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s25/fsvnmb25.htm#wp1027129>

## MPLS Label Distribution Protocol (LDP)

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftldp13.htm>

## MPLS—LDP AutoConfiguration

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s30/fsldpaut.htm>

## MPLS—LDP MD5 Global Configuration

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb\\_md5.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb_md5.htm)



## MPLS—LDP Session Protection

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s30/fssespro.htm>

## MPLS—Multilink PPP Support

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_7/gtmpmlp.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_7/gtmpmlp.htm)

## MPLS QoS—DiffServ Tunnel Mode Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftdmode.htm>

## MPLS HA Features

Cisco IOS Release 12.2(28)SB introduces support for the following Multiprotocol Label Switching (MPLS) High Availability (HA) features for the Cisco 10000 series.



### Note

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In Cisco IOS Release 12.2(28)SB, the Cisco 10000 series supports Route Processor Redundancy Plus (RPR+) and Stateful Switchover (SSO). However for broadband aggregation features, the Cisco 10000 series supports RPR+ only.

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## NSF/SSO: MPLS LDP and LDP Graceful Restart

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s25/fslpdgr.htm>

## NSF/SSO: MPLS VPN

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s25/fsvpngr.htm>

## MPLS High Availability

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s25/fshaov.htm>

## Command Changes in Relation to MPLS HA

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For command changes in relation to Multiprotocol Label Switching (MPLS) high availability (HA), see the following documents:

- Cisco Express Forwarding: Command Changes  
<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s25/fscefcmd.htm>
- MPLS High Availability: Command Changes  
<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s25/fscmdha.htm>

## MPLS Traffic Engineering Features

Cisco IOS Release 12.2(28)SB introduces support for the following Multiprotocol Label Switching (MPLS) Traffic Engineering (TE) features:

### MPLS Diff-Serv-Aware Traffic Engineering (DS-TE)

Platforms: 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the *MPLS Traffic Engineering—DiffServ Aware* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/12s\\_dste.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/12s_dste.htm)

### MPLS Traffic Engineering (TE)

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s23/fs23te.htm>

### MPLS Traffic Engineering (TE)—Automatic Bandwidth Adjustment for TE Tunnels

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fsbandaj.htm>

### **MPLS Traffic Engineering (TE)—Configurable Path Calculation Metric for Tunnels**

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fsmetric.htm>

### **MPLS Traffic Engineering (TE)—Forwarding Adjacency**

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s18/fstefa\\_3.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s18/fstefa_3.htm)

### **MPLS Traffic Engineering (TE)—Interarea Tunnels**

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s18/fsiarea3.htm>

### **MPLS Traffic Engineering (TE)—IP Explicit Address Exclusion**

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftaddexc.htm>

### **MPLS Traffic Engineering (TE)—Scalability Enhancements**

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/fsscen.htm>

### **MPLS Traffic Engineering (TE)—SNMP Notification Support**

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the *MPLS Traffic Engineering MIB* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/temib2.htm>

## MPLS VPN Features

Cisco IOS Release 12.2(28)SB introduces support for the following Multiprotocol Label Switching (MPLS) Virtual Private Network (VPN) features.

### MPLS VPN—Carrier Supporting Carrier

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbb2scsc.htm>

### MPLS VPN—Carrier Supporting Carrier—IPv4 BGP Label Distribution

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbbcs13.htm>

### MPLS VPN—eiBGP Multipath Loadbalancing Enhancements

Platform: Cisco 7304, Cisco 10000 series

In this Cisco IOS release, the MPLS-VPN eiBGP Multipath Loadbalancing feature has been enhanced to support up to 96,000 VPN routes in a scenario in which there are four BGP paths and one IGP path to each BGP peer. In previous Cisco IOS releases, up to 48,000 VPN routes were supported.

It is important to note that the maximum number of load-balanced paths used per route decreases from 16 to 8 as a result of this feature. The number of load-balanced paths per route is determined using a round-robin algorithm, but the round-robin algorithm now can only use up to 8 paths instead of 16, like it could previously.

This is a functional enhancement that introduces no new configuration.

### MPLS VPN—Explicit Null Label Support with BGP IPv4 Label Session

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s27/gsxnlbsp.htm>

### MPLS VPN—Half Duplex VRF (HDVRF) Support with Static Routing

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/hdvrfdyn.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/hdvrfdyn.html)

### MPLS VPN—Inter-AS—IPv4 BGP Label Distribution

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[https://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sbb\\_smlp.html](https://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sbb_smlp.html)

### MPLS VPN—Inter-Autonomous System Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

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

### MPLS VPN—MIB Support: MPLS VPN Trap Enhancement

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *MPLS VPN—MIB Support* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s25/fsvnmb25.htm#wp1027129>

### MPLS VPN—Show Running VRF

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb\\_srvf.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb_srvf.htm)

### MPLS VPN—VPN-Aware LDP MIB

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *MPLS Label Distribution Protocol MIB* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ldpmib13.htm#wp1015327>

### MPLS VPN—VRF-Select for PXF

Platform: Cisco 7304

VRF-Select is supported in the PXF processing path for a Cisco 7304.

For information about MPLS VPN VRF-Select, see the *MPLS VPN: VRF Selection Based on Source IP Address* document:

[http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp\\_vpn\\_vrf\\_select\\_ip.html](http://www.cisco.com/en/US/docs/ios/mpls/configuration/guide/mp_vpn_vrf_select_ip.html)

For additional information about this feature and all other features in the PXF-processing path, including restrictions, see the *Cisco 7304 Troubleshooting and Configuration Notes* document:

<http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/trouble/1270note.htm#wp65935>

### Multicast-VPN: Multicast Support for MPLS VPN

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature (which is also known as the Multicast VPN—IP Multicast Support for MPLS VPNs feature), see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbb\\_mvsn.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbb_mvsn.htm)

## MQC Policy Map Support on Configured VC Range

Platforms: Cisco 7200 series, Cisco 7301

The MQC Policy Map Support on Configured VC Range feature extends policy map functionality to simplify the configuration of ranges of ATM VCs. Using the **service-policy** command, this feature allows you to apply a QoS service policy to a range of VCs.

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/28sbvrng.htm>

## Multilink Frame Relay (FRF.16.1) Variable Bandwidth Class Support

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *Multilink Frame Relay (FRF.16.1)* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fs\\_mfr.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s14/fs_mfr.htm)

## Multiple Action Policer for PXF

Platform: Cisco 7304

The Multiple Action Policer feature further extends the functionality of the Cisco IOS Traffic Policing feature (a single-rate policer feature). The Traffic Policing feature is a traffic policing mechanism that allows you to control the maximum rate of traffic sent or received on an interface. Both of these traffic policing mechanisms mark packets as conforming to, exceeding, or violating a specified rate. After a packet is marked, you can specify an action to be taken on the packet based on that marking.

With the Traffic Policing feature, you can specify only one conform action, one exceed action, and one violate action. Now with the Multiple Action Policer feature, you can specify multiple conform, exceed, and violate actions for the marked packets.

The Multiple Action Policer feature is introduced in the PXF processing path for the first time. For additional information about this feature and all other features in the PXF-processing path, including restrictions, see the *Cisco 7304 Troubleshooting and Configuration Notes* document:

<http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/trouble/1270note.htm#wp65935>

## Multirouter Automatic Protection Switching (APS)

Platform: Cisco 10000 series

For detailed information about this feature, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/index.htm>

## NetFlow MPLS Label Export

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sx\\_pal.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sx_pal.htm)

## Nonstop Forwarding and Stateful Switchover Features

### Nonstop Forwarding

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

Cisco IOS Release 12.2(28)SB supports the following Nonstop Forwarding (NSF) features:

- Integrated IS-IS Nonstop Forwarding Awareness
- Nonstop Forwarding (NSF) Awareness
- Nonstop Forwarding (NSF) for BGP
- Nonstop Forwarding (NSF) for IS-IS
- Nonstop Forwarding with Stateful Switchover (NSF/SSO)

For detailed information about these features, see the *Cisco Nonstop Forwarding* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fsnsf20s.htm>

### Stateful Switchover

Platforms: Cisco 7304, Cisco 10000 series

Cisco IOS Release 12.2(28)SB supports the following Stateful Switchover (SSO) features:

- APS Stateful Switchover (APS SSO)




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**Note** APS SSO is supported only on the Cisco 10000 series.

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- Stateful Switchover (SSO) for ATM
- Stateful Switchover (SSO) for Frame Relay
- Stateful Switchover (SSO) for HDLC
- Stateful Switchover (SSO) for Multilink PPP (MLP)
- Stateful Switchover (SSO) for PPP

For detailed information about these features with the exception of the SSO - Multilink PPP (MLP) feature, see the *Stateful Switchover* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fssso20s.htm>

For detailed information about the SSO - Multilink PPP (MLP) feature, see the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/index.htm>

## Offload Server Accounting Enhancement

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftoffact.htm>

## OSPF ABR Type 3 LSA Filtering

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftabrt3f.htm>

## Packet Classification Using the Frame Relay DLCI Number

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s26/ftdlc26i.htm>

## peer pool backup Command

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the *Peer Pool Backup* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_4/gtpeerpl.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_4/gtpeerpl.htm)

## Per-Packet Load Balancing (PPLB)

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s21/pplb.htm>

## Per-User QoS via AAA Policy Name

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ft\\_puq.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ft_puq.htm)

## Per VRF AAA

Platform: Cisco 10000 series

For detailed information about this feature, see the *Per VRF AAA* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftvrfaaa.htm>

## PIM Multicast Scalability

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

The PIM Multicast Scalability feature enhances the Protocol Independent Multicast (PIM) protocol in Cisco IOS software by adding a new level of scalability. With this feature, edge devices can have a large number of multicast groups and users without increasing the CPU utilization of the router.



## Policer Enhancement: Multiple Actions

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s26/fsmu26s.htm>

## Post-Switchover Core Dump

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/coredump.htm>

## PPP MLP MRRU Negotiation Configuration

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_7/gtmpmrru.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_7/gtmpmrru.htm)

## PPPoE Features

Cisco IOS Release 12.2(28)SB introduces support for the following PPPoE features.

### PPPoA/PPPoE Autosense for ATM PVCs

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftp\\_auto.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftp_auto.htm)

### PPPoE Circuit-ID Tag Processing

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbecidtg.htm>

### PPPoE over Gigabit Ethernet Interface

Platform: Cisco 7200 series, Cisco 7301, Cisco 10000 series

The PPPoE over Gigabit Ethernet feature enhances PPP over Ethernet (PPPoE) functionality by adding support for PPPoE and PPPoE over IEEE 802.1Q VLANs on Gigabit Ethernet interfaces.

## PPPoE Relay

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_4/gtpppoer.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_4/gtpppoer.htm)

## PPPoE Service Selection

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_4/gtppoess.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_4/gtppoess.htm)

## PPPoE Session Limit

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ftppoesl.htm>

## PPPoE Session Limit per NAS Port

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122b/122b\\_15/12b\\_nas.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122limit/122b/122b_15/12b_nas.htm)

## PPPoE Session Recovery After Reload

Platforms: Cisco 7200 series, Cisco 7301 Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_2/gtppprec.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_2/gtppprec.htm)

## Pseudowire Emulation Edge-to-Edge MIBs for Ethernet Services

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbpweatm.htm>

## Pseudowire Emulation Edge-to-Edge MIBs for Ethernet and Frame Relay Services

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbpweatm.htm>

## QoS Features for the Cisco 7200 Series and Cisco 7301

Cisco IOS Release 12.2(28)SB supports the following QoS features for the Cisco 7200 series and Cisco 7301.

### QoS: ATM Cell-Based Policer

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/fscbp.htm>

### QoS: ATM-CLP and Layer 2 CoS-Based WRED

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12swred.htm>

### QoS: CBQoS MIB Parity Across Cisco IOS Release 12.0S, 12.2SB, and 12.3T

Platforms: Cisco 7200 series, Cisco 7301

Several MIB objects have been added to existing tables, and a new table has been added to the Class-Based Quality of Service (QoS) MIB (CBQoS MIB). These additions to the CBQoS MIB provide parity of the MIB across three specific Cisco IOS Releases—Cisco IOS Release 12.0S, 12.2SB, and 12.3T. As a result of these additions and revisions, the CBQoS MIB now supports the same features across all three of these platforms.

The CBQoS MIB now supports the following Cisco IOS features:

- QoS: ATM Cell-Based Policer

The QoS: ATM Cell-Based Policer feature allows you to configure traffic policing for ATM cells. This feature allows you to specify traffic policing in cells, bytes, or percentage of bandwidth.

For more information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/fscbp.htm>

- QoS: ATM-CLP and Layer 2 CoS-Based WRED

The QoS: ATM-CLP and Layer 2 CoS-Based WRED feature extends the functionality of the Cisco Weighted Random Early Detection (WRED) software. With the QoS: ATM-CLP and Layer 2 CoS-Based WRED feature, WRED can take into account the Layer 2 class of service (CoS) value of a packet and the ATM cell loss priority (CLP) of a packet when calculating the drop probability of network traffic.

For more information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12swred.htm>

- QoS: Color-Aware Policer

The QoS: Color-Aware Policer feature enables a “color-aware” method of traffic policing. This feature allows you to police traffic according to the color classification of a packet that is based on packet-matching criteria defined for two user-specified traffic classes: the conform-color class and the exceed-color class. These two traffic classes are created using the **conform-color** command, and the metering rates are defined using the **police** command.

For more information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s26/12s\\_cap.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s26/12s_cap.htm)

- Low Latency Queuing with Priority Percentage Support

This feature allows you to configure bandwidth as a percentage within low latency queuing (LLQ).

For more information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12sllqpc.htm>

- QoS: Percentage-Based Policing

The QoS: Percentage-Based Policing feature allows you to configure traffic policing on the basis of a percentage of bandwidth available on the interface. This feature also allows you to specify the committed burst (bc) size and the excess burst (be) size (used for configuring traffic policing) in milliseconds (ms). Configuring traffic policing in this manner enables you to use the same policy map for multiple interfaces with differing amounts of bandwidth.

For more information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12spctpg.htm>

- QoS: Percentage-Based Shaping

The QoS: Percentage-Based Shaping feature allows you to configure traffic policing and traffic shaping on the basis of a percentage of bandwidth available on the interface. This feature also allows you to specify the committed (conform) burst (bc) size and the excess (peak) burst (be) size (used for configuring traffic shaping) in milliseconds (ms). Configuring traffic shaping in this manner enables you to use the same policy map for multiple interfaces with differing amounts of bandwidth.

For more information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12spctsg.htm>

- QoS: Time-Based Thresholds for WRED and Queue Limit

The QoS: Time-Based Thresholds for WRED and Queue Limit feature allows you to specify the Weighted Random Early Detection (WRED) minimum and maximum thresholds or the queue limit threshold in milliseconds (ms). Previously, these thresholds could only be specified in packets or bytes. Now, all three units of measure are available. Once the threshold limits are configured in a policy map, the policy map can be used on multiple interfaces, including those with different amounts of bandwidth.

For more information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12swrdql.htm>

The following additional changes were made to the MIB tables:

- One new table was added (cbQosSetStats), and objects were added to an existing table (chQosSetCFG). These tables are associated with the various **set** commands available in the Cisco IOS software.

For more information about the Cisco IOS **set** commands, see the Cisco command reference publications for the Cisco IOS release that you are using.

For a list of the specific MIB objects added, see the CISCO-CLASS-BASED-QOS-MIB-CAPABILITY.html file at the following URL:

<http://tools.cisco.com/Support/SNMP/do/BrowseMIB.do?local=en&mibName=CISCO-CLASS-BASED-QOS-MIB-CAPABILITY>

For more information about the preceding CBQoS MIB and the MIB objects and tables, and to locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

<http://tools.cisco.com/ITDIT/MIBS/servlet/index>

### **QoS: Color-Aware Policer**

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s26/12s\\_cap.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s26/12s_cap.htm)

### **QoS: Frame Relay QoS Hierarchical Queueing Framework Support**

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb\\_frhqf.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb_frhqf.htm)

### **QoS: Match on ATM CLP**

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12smcatm.htm>

### **QoS: Percentage-Based Policing**

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12spctpg.htm>

**QoS: Percentage-Based Shaping**

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12spctsg.htm>

**QoS: Percentage-Based and Time-Based Policing Parameters**

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/12spbtbp.htm>

**QoS: Per-Session Shaping and Queuing on LNS**

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbsbpssq.htm>

**QoS Features for the Cisco 10000 Series**

Cisco IOS Release 12.2(28)SB supports the following quality of service (QoS) features for the Cisco 10000 series:

- Dual Rate Three Color Policer
- Enhanced Random Early Detection (RED) Statistics
- Hierarchical Input Policing
- MLPPP with Link Fragmentation Interleave (LFI)
- Link Fragmentation Interleave over Frame Relay (FRF.12)
- Policy Map Scaling
- Random Early Detection (RED) with Queue-Limit
- Three Color Policer
- Three-Level Policy Maps
- VC Oversubscription

In addition to the Cisco 10000 series, the following features are also supported on the Cisco 7200 series, Cisco 7301, and Cisco 7304:

- Class-Based Ethernet CoS Matching & Marking (802.1p & ISL CoS)
- Class-Based Marking
- Class-Based Policing
- Class-Based Shaping
- Class-Based Weighted Fair Queuing (CBWFQ)
- Diffserv Compliant WRED
- Low Latency Queueing (LLQ)

- Low Latency Queueing (LLQ) for Frame Relay
- Modular QoS CLI (MQC)
- Priority Queueing (PQ)
- QoS for Virtual Private Networks
- QoS Packet Marking
- QoS Policy Propagation via Border Gateway Protocol (QPPB)
- Random Early Detection (RED)
- Weighted RED (WRED)

For information about all features that are mentioned in this section, see the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

In addition, Cisco IOS Release 12.2(28)SB supports the following QoS features for the Cisco 10000 series.

### **Modular QoS CLI (MQC)-Based Frame Relay Traffic Shaping**

Platform: Cisco 10000 series

The Modular QoS CLI (MQC)-based Frame Relay Traffic Shaping feature provides users with the ability to configure Frame Relay Traffic Shaping (FRTS) by using MQC commands.

### **QoS: Broadband Aggregation Enhancements, Phase 1**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbbbrs1a.htm>

### **QoS: Enhanced Show Commands for Active Policies**

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb\\_acpm.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb_acpm.htm)

## **RADIUS Features**

Cisco IOS Release 12.2(28)SB introduces support for the following RADIUS features.

### **Framed-Route in RADIUS Accounting**

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_4/gt\\_fra22.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_4/gt_fra22.htm)

## RADIUS-Based Lawful Intercept

Platforms: Cisco 7200 series, Cisco 7301

**Note**

For the Cisco 7200 series, RADIUS-Based Lawful Intercept is supported only on Cisco 7200 VXR routers that are configured with an NPE-225, NPE-400, or NPE-G1. Support for the NPE-G2 will be available as of Cisco IOS Release 12.2(31)SB2.

RADIUS-Based Lawful Intercept is a Layer-2 feature, that is, a feature at the user-session level. With RADIUS-Based Lawful Intercept, traffic interception is provisioned through RADIUS and the resulting interception data is sent to the mediation device by using a RADIUS interface. The SNMP interface is completely bypassed.

For detailed information about RADIUS-Based Lawful Intercept, see the following Cisco document:

[http://www.cisco.com/en/US/docs/ios/12\\_2sb/feature/guide/sb\\_radlw.html](http://www.cisco.com/en/US/docs/ios/12_2sb/feature/guide/sb_radlw.html)

## RADIUS NAS-IP-Address Configurability

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123limit/123b/123b3/gt\\_siara.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123limit/123b/123b3/gt_siara.htm)

## RADIUS Push for MOD CLI Policies

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the *Define Interface Policy-Map AV Pairs AAA* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123limit/123x/123xi7/123xiqos.htm>

## RADIUS Server Load Balancing

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7403, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbrlddbl.htm>

## RADIUS Server Reorder on Failure

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123\\_1/gt\\_rsrof.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123_1/gt_rsrof.htm)



## radius-server source-port Command

Platform: Cisco 10000 series

The **radius-server source-ports extended** command enabled you to configure the NAS to use 200 ports in the range from 21645 to 21844 as the source ports for sending out RADIUS requests. With 200 source ports, up to 256\*200 authentication and accounting requests can be outstanding at one time. During peak call volume, typically when a router first boots or when an interface flaps, the extra source ports allow sessions to recover more quickly on large-scale aggregation platforms.

To return to the default setting, in which ports 1645 and 1646 are used as the source ports for RADIUS requests, use the **no** form of this command.

For more information, see the *Cisco IOS Security Command Reference, Release 12.3* document:

[http://www.cisco.com/en/US/docs/ios/12\\_3/security/command/reference/sec\\_p1g.html](http://www.cisco.com/en/US/docs/ios/12_3/security/command/reference/sec_p1g.html)

## RADIUS Timeout Set During Pre-Authentication

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ftattr27.htm>

## RADIUS Tunnel Preference for Load Balancing and Fail-Over

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbradlbf.htm>

## RADIUS Attributes

Cisco IOS Release 12.2(28)SB introduces support for the following RADIUS attributes.

### Connect-Info RADIUS Attribute 77

Platform: Cisco 10000 series

The Connect-Info RADIUS Attribute 77 feature introduces support for RADIUS attribute 77 (Connect-Info), which provides information about connection speeds, modulation, and compression for modem dial-in connections via RADIUS accounting “start” and “stop” records.

When the NAS sends attribute 77 in accounting “start” and “stop” records, you can measure—across the platform—the connect rates. That is, attribute 77 allows you to record “transmit” speed (the speed at which the NAS modem sends information) and “receive” speed (the speed at which the NAS receives information). These modem speeds for user sessions allow you to determine whether user modem connections renegotiate to lower speeds shortly into a session. If the transmit and receive speeds are different from each other, attribute 77 will report both speeds, which allows you to establish the modem connection speeds that customers get from their session.

### RADIUS Attribute 5 (NAS-Port) Format Specified on a Per-Server Group Level

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_14/ra5f.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_14/ra5f.htm)

## RADIUS Attribute 52 and 53 Gigaword Support

Platform: Cisco 10000 series

The RADIUS Attribute 52 and 53 Gigaword Support feature introduces support for attribute 52 (Acct-Input-Gigawords) and attribute 53 (Acct-Output-Gigawords). Attribute 52 keeps track of the number of times that the Acct-Input-Octets counter has rolled over the 32-bit integer throughout the course of the provided service; attribute 53 keeps track of the number of times the Acct-Output-Octets counter has rolled over the 32-bit integer throughout the delivery of service. Both attributes can be present only in Accounting-Request records where the Acct-Status-Type is set to “Stop” or “Interim-Update.” These attributes can be used to accurately account for and bill for usage.

## RADIUS Attribute 77 for DSL

Platform: Cisco 10000 series

The RADIUS Attribute 77 for DSL feature introduces support for attribute 77 (Connect-Info) to carry the textual name of the virtual circuit class associated with the given permanent virtual circuit (PVC). (Although attribute 77 does not carry the unspecified bit rate (UBR), the UBR can be inferred from the class name used if one UBR is set up on each class.) Attribute 77 is sent from the network access server (NAS) to the RADIUS server via Accounting-Request and Accounting-Response packets.

## RADIUS Attribute 82: Tunnel Assignment ID

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbrad\\_82.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbrad_82.htm)

## RADIUS Attribute 91 Encrypted and Tagged VSA Support

Platform: Cisco 10000 series

For detailed information about this feature, see the *Encrypted and Tagged VSA Support for RADIUS Attribute 91* section in the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122relnt/6400/64\\_24b6.htm#115840](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122relnt/6400/64_24b6.htm#115840)

## RADIUS Attribute Screening

Platform: Cisco 10000 series

For detailed information about this feature, which is also known as the RADIUS Attribute Value Screening feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/fttras.htm>

## Reserve Memory for Console Access

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s22/ftresmem.htm>

## Route Processor Redundancy Plus (RPR+)

Platforms: Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the *Stateful Switchover* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/122snwft/release/122s20/fssso20s.htm>

## RSVP Refresh Reduction and Reliable Messaging

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s29/fsrelmsg.htm>

## Secure Shell Version 2 Support

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, including the Secure Shell SSH Version 2 Client Support feature, also known as the SSHv2 feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_4/gt\\_ssh2.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_4/gt_ssh2.htm)

## show Command Redirect

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftshowre.htm>

## Sticky IP

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, which is also known as the RADIUS Attribute 8 (Framed-IP-Address) in Access Requests feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t11/radattr8.htm>

## Subscriber Service Switch

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbsss.htm>

## TCP MSS Adjustment

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ft\\_admss.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t4/ft_admss.htm)

## Template ACL/12-Bit ACE

Platform: Cisco 10000 series

For detailed information about this feature, see “Chapter 19, Configuring Template ACLs” in the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/index.htm>

## Three-level Hierarchical Policy Support in PXF

Platform: Cisco 7304

The Modular QoS CLI (MQC) enables users to configure hierarchical policy maps, in which a grandparent policy uses a parent policy, and a parent policy uses a child policy. Support for all three levels of hierarchy was previously not available on the Cisco 7304 router, which used to support two levels of hierarchy. This feature is available in the PXF-processing path.

This feature is the addition of a third level of hierarchy within the MQC. It does not introduce any new commands. For information on configuring the MQC, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fqos\\_c/fqcprt8/qcfmcli2.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122cgcr/fqos_c/fqcprt8/qcfmcli2.htm)

For additional information about this feature and all other features in the PXF-processing path, including restrictions, see the *Cisco 7304 Troubleshooting and Configuration Notes* document:

<http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/trouble/1270note.htm#wp65935>

## Turbo Access Control List Scalability Enhancements [Phase 1]

Platform: Cisco 7304

In previous Cisco IOS releases, the ability of Turbo Access Control Lists to control PXF traffic could be limited. When the Turbo ACL classification tables grew large because of substantially-sized configurations and certain traffic patterns, all traffic that required ACL classification was punted to the Route Processor because the Turbo ACL table sizes exceeded the amount of available PXF memory.

This feature improves Turbo ACL scalability and enables support for large ACL tables.

This is a functional enhancement that introduces no new configuration.

## UDI - Unique Device Identifier

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_4/gtpepudi.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_4/gtpepudi.htm)

## UDP Forwarding Support of IP Redundancy Virtual Router Group (VRG)

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ftudpvrg.htm>

## Using 31-Bit Prefixes on IPv4 Point-to-Point Links

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t2/ft31addr.htm>

## VBR - NRT Oversubscription

Platform: Cisco 10000 series

For detailed information about this feature, see the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

## Virtual Sub-Interface

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the *Configuration Enhancements for Broadband Scalability* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t13/ftbbenh.htm>

## Virtual Template Interfaces Limit Expansion

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb\\_vtle.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sb_vtle.htm)

## VLAN ID Rewrite

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the *Any Transport over MPLS* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s28/fsatom28.htm>

## VLANs over IP Unnumbered Subinterfaces

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_4/gtunvlan.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_4/gtunvlan.htm)

## VPDN Features

Cisco IOS Release 12.2(28)SB introduces support for the following VPDN features.

### Accounting of VPDN Disconnect Cause

Platforms: Cisco 7200 series, Cisco 7301

In the past, when a Layer 2 Tunneling Protocol (L2TP) or Layer 2 Forwarding (L2F) session failed or disconnected, the network access server (NAS) and Home GateWay (HGW) reported a very generic disconnect-cause code, such as “LOST CARRIER.” These generic codes did not provide enough detailed information for accounting and debugging purposes. The Accounting of VPDN Disconnect Cause feature adds eight new disconnect-cause codes that describe the status of Virtual Private Dialup Network (VPDN) failures and disconnects more specifically than existing generic disconnect-cause codes. These new disconnect-cause codes can be found in the “RADIUS Vendor-Specific Attributes and RADIUS Disconnect-Cause Attribute Values” appendix of the *Cisco IOS Security Configuration Guide, Release 12.2*:

[http://www.cisco.com/en/US/docs/ios/12\\_2/security/configuration/guide/fsecur\\_c.html](http://www.cisco.com/en/US/docs/ios/12_2/security/configuration/guide/fsecur_c.html)

### RFC-2867 Tunnel Accounting

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the *RFC-2867 RADIUS Tunnel Accounting* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbradtac.htm>

### Shell-Based Authentication of VPDN Users

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbexvpnt.htm>

### Timer and Retry Enhancements for L2TP and L2F

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbretreh.htm>

## Tunnel Authentication via Radius on LNS

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the *Tunnel Authentication via RADIUS on Tunnel Terminator* document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbtunaut.htm>

## VPDN Default Group Template

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbdevvpdn.htm>

## VPDN Group Session Limiting

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbvpdngs.htm>

## VPDN Multihop by DNIS

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbvmhopd.htm>

## VPN MIB Enhancements for per-VRF Session Counting

Platforms: Cisco 7200 series, Cisco 7301

An extension has been added to the virtual private dialup network (VPDN) CISCO-VPDN-MGMT-MIB that returns the total number of active sessions for each VPDN template. For customers that associate a VPDN template to each VPN routing and forwarding (VRF) instance, this MIB extension provides a way to monitor session usage per VRF.

Service providers can terminate sessions from multiple customer accounts on the same L2TP network server (LNS). Sharing of the LNS is done by creating one VRF per customer. Session limits on VPDN templates and VPDN groups are configured to control the allocation of sessions among customers and among users within the same customer account. A VPDN template is associated with each VRF, and its session limit restricts the total number of sessions for a customer account. Within that account, users may be assigned to different VPDN groups as their access requirements dictate. Session limits on VPDN groups further control the allocation of customer sessions among VPDN users. In such a setup, the service provider must use Simple Network Management Protocol (SNMP) to retrieve the total number of active sessions per customer to monitor their usage on the LNS.

Prior to the introduction of this MIB enhancement, only the total number of sessions on the LNS across all customer accounts could be retrieved through SNMP. This enhancement extends the CISCO-VPDN-MGMT-MIB to include a read-only table of VPDN template entries, with each entry reporting the number of active sessions across all VPDN groups that are associated with that template. The table entries can be accessed individually by using GET requests or consecutively using repeated GET-NEXT requests.

## VPDN Session Disconnect AAA Attribute

Platforms: Cisco 7200 series, Cisco 7301, Cisco 10000 series

The VPDN Session Disconnect AAA Attribute feature adds support for a new vendor-specific attribute (VSA) to be included in accounting stop records. The VSA provides information about the reason for the session disconnect and the identity of the device that initiated the disconnection. This feature introduces support for the **accounting** keyword of the `vpdn-logging` command in Cisco IOS Release 12.2(28)SB, and is enabled by entering the **vpdn-logging accounting** command and keyword.

## VRF-Aware VPDN Tunnels

Platforms: Cisco 7200 series, Cisco 7301

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb28/sbvdpnmh.htm>

## VPN Routing/Forwarding (VRF) CLI Command

Platform: Cisco 10000 series

The Virtual Private Network (VPN) routing/forwarding (VRF) command enables you to enter comments about your VRF configuration.

**description** *description string*

**no description**

The following output is from a configuration example:

```
Router(config)# ip vrf V4
Router(config-vrf)# ?
IP VPN Routing/Forwarding instance configuration commands:
  default      Set a command to its defaults
  description  VRF specific description
  exit         Exit from VRF configuration mode
  export       VRF export
  import       VRF import
  maximum      Set a limit
  no           Negate a command or set its defaults
  rd           Specify Route Distinguisher
  route-target Specify Target VPN Extended Communities
Router(config-vrf)# desc
Router(config-vrf)# description ?
  LINE Up to 80 characters describing this VRF
Router(config-vrf)# description This Is My 4th VRF
Router(config-vrf)# end
Router# sh ru | beg V4
ip vrf V4
  description This Is My 4th VRF
  rd 1:406
  route-target export 1:400
  route-target import 1:400
```



## Warm Reload

Platforms: Cisco 7200 series, Cisco 7301, Cisco 7304

The Warm Reload feature enables you to reload your routers without reading images from storage. That is, the Cisco IOS image reboots without ROM monitor mode (ROMMON) intervention by restoring the read-write data from a previously saved copy in the RAM and by starting execution without either copying the image from flash to RAM or self-decompressing the image. Thus, the overall availability of your system improves because the time to reboot your router is significantly reduced.

For additional information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t\\_2/gtwrmbt.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios123/123newft/123t/123t_2/gtwrmbt.htm)

## XML Interface to Syslog Messages

Platform: Cisco 10000 series

For detailed information about this feature, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122/122newft/122t/122t15/ftxmlsys.htm>

## MIBs

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

<http://tools.cisco.com/ITDIT/MIBS/servlet/index>

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

To access Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to [cco-locksmith@cisco.com](mailto:cco-locksmith@cisco.com). An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

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

## Limitations and Restrictions

The following sections contain information about limitations and restrictions in Cisco IOS Release 12.2SB that can apply to the Cisco 7200 series routers, Cisco 7301 router, Cisco 7304 router, and Cisco 10000 series routers.

### Limitations and Restrictions in Cisco IOS Release 12.2(33)SB

This section describes limitations and restrictions in Cisco IOS Release 12.2(33)SB and later releases.

#### ATM RBE with IPv6

ATM RBE with IPv6 is not supported on the Cisco 10000 series routers. The **atm route-bridged ipv6** command is not a supported CLI.

#### New Boot Image Requirements for Cisco IOS Release 12.2(33)SB

The Cisco IOS Release 12.2(33)SB images for PRE3 RP can only be loaded by the following versions of boot images:

- Cisco IOS Release 12.2(31)SB10 or newer boot images.
- Cisco IOS Release 12.2(33)SB boot images.

If user uses older eboot image, the following error message will be seen:

```
*****
%SYS-3-IMAGE_TOO_BIG: 'tftp://2.0.0.1/user/c10k3-p11-mz.v122_33_sb_throttle-nightly' is
too large for available memory (30801944 bytes).
%SYS-6-BOOT_MESSAGES: Messages above this line are from the boot loader.
boot of "tftp://2.0.0.1/user/c10k3-p11-mz.v122_33_sb_throttle-nightly" using boot helper
"bootflash:c10k3-eboot-mz.v122_31_sb1_throttle-nightly" failed error returned: File read
failed -- Not enough space
loadprog: error - on file open
No bootldr found or bootldr boot failed. Using ROMMON TFTP boot instead...
*****
```

To correct this situation, upgrade the eboot image to one described above.

### Limitations and Restrictions in Cisco IOS Release 12.2(31)SB11

This section describes limitations and restrictions in Cisco IOS Release 12.2(31)SB11 and later releases.

#### VLAN Mobility Is Not Allowed for ISG Sessions

For IP sessions initiated through DHCP, ISG does not allow the users to roam from one VLAN to the other. ISG expects the VLAN to remain the same throughout the user session.

If the user moves from one VLAN to the other, the user needs to reboot the Customer Premise Equipment (laptop or the modem) to initiate a new session.

## Limitations and Restrictions in Cisco IOS Release 12.2(31)SB2

This section describes limitations and restrictions in Cisco IOS Release 12.2(31)SB2 and later releases.

### NSE-150 USB Ports Not Supported

The NSE-150 USB ports are currently not supported on a Cisco 7304 router and should not be used for any reason. Support for USB ports on the NSE-150 will be introduced as an enhancement in a future release of Cisco IOS Release 12.2SB.

## Limitations and Restrictions in Cisco IOS Release 12.2(28)SB

This section describes limitations and restrictions in Cisco IOS Release 12.2(28)SB and later releases.

### Event-Timestamp AVP for the Cisco 10000 Series

In Cisco IOS Release 12.2SB, Event-Timestamp AVP is not supported in Packet of Disconnect (PoD) on the Cisco 10000 series routers.

### High Availability Support for the Cisco 10000 Series

In Cisco IOS Release 12.2(28)SB, the Cisco 10000 series supports Route Processor Redundancy Plus (RPR+), Stateful Switchover (SSO), and In Service Software Upgrade (ISSU). However for broadband aggregation features, the Cisco 10000 series supports RPR+ only.

### ISSU Restriction for the Cisco 10000 Series

The In Service Software Upgrade (ISSU) feature for the Cisco 10000 series is not supported for MPLS VPN—Inter-Autonomous System (Inter-AS) configurations.

### Per Precedence WRED Statistics

In the output of the **show policy-map interface** command, the Tail Drops counter indicates the number of packets dropped because the average queue length exceeded the maximum threshold for the given precedence. However, under burst conditions, it is possible that packets can be dropped because the queue is full. These packets are not counted as Tail Drops. The number of packets that are dropped under burst conditions when the queue is full are counted as Output Queue Drops.

### RADIUS Attribute 31: PPPoX Calling Station ID

In Cisco IOS Release 12.2(28)SB, the Cisco 10000 series does not support the RADIUS Attribute 31: PPPoX Calling Station ID feature.

## Scaling Limits for L2TP Tunnels on the Cisco 10000 Series

For information about scaling limits for L2TP tunnels on the Cisco 10000 series, see the “Scaling Enhancements” section in the “Scalability and Performance” chapter of the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*:

<http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/swconfig/cfggdes/bba/scaling.htm#wp1030846>

## SNMP Version 1 BGP4-MIB Limitations

You may notice incorrect BGP trap OID output when you use the SNMP version 1 BGP4-MIB that is available for download at <ftp://ftp.cisco.com/pub/mibs/v1/BGP4-MIB-V1SMLI.my>. When a router sends BGP traps (notifications) about state changes on an SNMP version 1 monitored BGP peer, the enterprise OID is incorrectly displayed as .1.3.6.1.2.1.15 (bgp) instead of .1.3.6.1.2.1.15.7 (bgpTraps). The problem is not due to any error with Cisco IOS software. This problem occurs because the BGP4-MIB does not follow RFC 1908 rules regarding version 1 and version 2 trap compliance. This MIB is controlled by IANA under the guidance of the IETF, and work is currently in progress by the IETF to replace this MIB with a new version that represents the current state of the BGP protocol. In the meantime, we recommend that you use the SNMP version 2 BGP4-MIB or the CISCO-BGP4-MIB to avoid an incorrect trap OID.

## System Limits for Policy Maps on the Cisco 10000 Series

The maximum number of classes supported per policy map on a Cisco 10000 series in Cisco IOS Release 12.2(28)SB is 64. The maximum number of policy maps supported per system is 4096.

## tunnel vrf Command Not Supported on the Cisco 10000 Series

The Cisco 10000 series does not support the **tunnel vrf vrf-name** command in Cisco IOS Release 12.2(28)SB. Therefore, you cannot configure a tunnel for which both the source address and the destination address are located in a VPN routing/forwarding (VRF) instance, for example, when a tunnel is established between a customer edge (CE) router and a provider edge (PE) router. All tunnel source and destination addresses must be located in the global routing table.

The Cisco 10000 series does support a configuration in which the IP address of the tunnel itself is located in a VRF instance, for example, when the tunnel extends a VRF instance from one PE router to another PE router.

# Important Notes

The following sections contain important notes about Cisco IOS Release 12.2SB that can apply to the Cisco 7200 series routers, Cisco 7301 router, Cisco 7304 router, and Cisco 10000 series routers.

## Deferrals

Cisco IOS software images are subject to deferral. Cisco recommends that you view the deferral notices at the following location to determine if your software release is affected:

<http://www.cisco.com/kobayashi/sw-center/sw-ios-advisories.shtml>

## Cisco IOS Release 12.2(31)SB3 Deferred

Cisco IOS Release 12.2(31)SB3 is deferred and replaced by Cisco IOS Release 12.2(31)SB3x. Release 12.2(31)SB3 is not properly supportable because of severely limited debug capability.

Release 12.2(31)SB3x includes the required debug capability but is otherwise identical to Release 12.2(31)SB3.

We strongly recommend that you remove Release 12.2(31)SB3 and replaced it by Release 12.2(31)SB3x as soon as possible.

## Field Notices and Bulletins

- **Field Notices**—We recommend that you view the field notices for this release to see if your software or hardware platforms are affected. If you have an account with Cisco.com, you can find field notices at [http://www.cisco.com/warp/customer/tech\\_tips/index/fn.html](http://www.cisco.com/warp/customer/tech_tips/index/fn.html). If you do not have a Cisco.com login account, you can find field notices at [http://www.cisco.com/warp/public/tech\\_tips/index/fn.html](http://www.cisco.com/warp/public/tech_tips/index/fn.html).
- **Product Bulletins**—If you have an account with Cisco.com, you can find product bulletins at <http://www.cisco.com/warp/customer/cc/general/bulletin/index.shtml>. If you do not have a Cisco.com login account, you can find product bulletins at <http://www.cisco.com/warp/public/cc/general/bulletin/iosw/index.shtml>.

## Important Notes for Cisco IOS Release 12.2(33)SB

This section describes important issues that you should be aware of for Cisco IOS Release 12.2(33)SB and later releases.

### ATM Virtual Circuits Changed in Virtual Paths

The behavior of ATM virtual circuits (VCs) in virtual paths (VPs) has changed in Cisco IOS Release 12.2(33)SB. Previously, ATM VCs would come up automatically once the VP and associated VCs were configured. Now in Cisco IOS Release 12.2(33)SB, the ATM VCs in a VP only come up if “no-f4-mgmt” is configured on the VP.

### Mode Change on an 8-Port E3/DS3 ATM Line Card

The behavior of the 8-Port E3/DS3 ATM line card has changed in Cisco IOS Release 12.2(33)SB. Previously, the mode of an already provisioned card could be changed while the line card was in use. Now in Cisco IOS Release 12.2(33) SB, the line card should first be removed and reprovisioned before the mode is changed.

For detailed information about these commands, see the *Cisco 10000 Series Line Card Configuration Guide*.

## Important Notes for Cisco IOS Release 12.2(31)SB2

This section describes important issues that you should be aware of for Cisco IOS Release 12.2(31)SB2 and later releases.

## ARP Commands

As of Cisco IOS Release 12.2(31)SB2, new Address Resolution Protocol (ARP) commands are supported for the Cisco 7200 series, Cisco 7301, and Cisco 7304. For detailed information about these commands, see the *Monitoring and Maintaining ARP Information* document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124tcg/tiad\\_c/arp/htarpmon.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124tcg/tiad_c/arp/htarpmon.htm)

## Detection Mechanism for the MPLS Traffic Engineering (TE)—Fast Reroute (FRR) Node Protection, with RSVP Hellos Support Feature

When the detection mechanism for the MPLS Traffic Engineering (TE)—Fast Reroute (FRR) Node Protection, with RSVP Hellos Support feature is configured with a refresh interval and missed refresh limit that are too short, a neighbor may be declared down while the neighbor is actually up, and a warning message may be generated. To prevent this situation, configure the refresh interval and missed refresh limit in the following ways:

- Ensure that the *interval-value* argument in the **ip rsvp signalling hello refresh interval interval-value** command is 200 milliseconds or longer.
- Ensure that the *msg-countip* argument in the **rsvp signalling hello [fast-reroute] refresh misses msg-count** command has a value of 4 or more.

The detection interval for the detection mechanism should be at least 800 milliseconds (that is, 200 milliseconds of the *interval-value* argument multiplied by the value 4 of the *msg-countip* argument) or longer.

## NPE-G2 Support for the show environment Command

The output of the **show environment** command has been modified to support the NPE-G2 network processing engine on the Cisco 7200 VXR in Cisco IOS Release 12.2(31)SB2 and later releases. For detailed information about this command, see the following Cisco document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios124/124newft/124limit/124x/124xd4/showenv2.htm>

## Outdated ATA ROM Monitor Library (Monlib) [CSCsg64518]

Symptoms: The following symptoms may occur:

- When you enter the **dir** command for a disk from the ROM monitor (ROMMON) prompt, it make take too long to list the files or the command may time-out and fails to list the files.
- When you boot the router from a disk by entering the **boot** command or by initiating a switchover, it make take too long to load the image or the operation may time-out and the router fails to boot.

Conditions: These symptoms are observed on a Cisco router that has an ATA file system when the ATA ROM monitor library (Monlib) on the disk for which the **dir** command is entered or on which the boot image resides is very old. However, the symptoms can also occur because of other software issues or disk related-hardware issues.

Workaround: Upgrade the Monlib of the disk.

Further Problem Description:

To check the Monlib version of the disk, enter the **show disk0: filesystems** command. In the output, look for the details under “ATA MONLIB INFO,” as in the following example:

```

ATA MONLIB INFO
  Image Monlib size      69912
  Disk Monlib Size      69912
  Disk Space Available  73728
  Name                  NA
  End Sector            NA
  Start sector         NA
  Updated By           NA <-- Look for this information.
  Version              NA <-- Look for this information.

```

“NA” is very old image. You should see a Cisco IOS version that created the Monlib. The Cisco IOS version can be a good indicator of how old the Monlib is, as in the following example:

```

ATA MONLIB INFO
  Image Monlib size = 67288
  Disk monlib size = 70656
  Name = c10k-atafslib-m
  Monlib Start sector = 2
  Monlib End sector = 133
  Monlib updated by = C10K2-P11-M12.2(31)SB2 <--Look for the Cisco IOS software image
  Monlib version = 1 <-- Look for the MONLIB version no.

```

You can upgrade the Monlib through two methods:

- 1st Method: Enter the **upgrade filesystem monlib disk0:** command. Monlib software resides on the disk. By entering the above-mentioned command you upgrade the Monlib to the Monlib in the Cisco IOS software image that resides on the router without deleting the other files on the disk.

There is a reserved space for the Monlib on the disk. If this reserved space is not sufficiently large enough to hold the new Monlib, the upgrade command may fail. (Note that this reserved space is not the disk space and should not be confused with the free space on the disk).

- 2nd Method: Upgrade by entering the **format** command for the disk, in which case the other files on the disk are deleted. When you format the disk, a reserved space is created and the Monlib is upgraded to the Monlib in the Cisco IOS software image that resides on the router.

## QoS CLI Migration from PRE-2 to PRE-3

The Quality of Service (QoS) Command-Line Interface (CLI) Migration from PRE-2 to PRE-3 feature provides QoS CLI backward-compatibility between the Cisco 10000 series PRE-2 and PRE-3, thereby enabling the PRE-3 to accept PRE-2-style commands. For detailed information about this feature, see the following Cisco document:

[http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/cli\\_migr.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sb31/cli_migr.htm)

## Valid Ranges for MLP Interfaces on the Cisco 10000 Series

Table 18 lists the valid numerical ranges you can specify on the Cisco 10000 series when creating MLP interfaces using the **interface multilink** command.

**Table 18** MLP Interface Ranges for the PRE-2 and PRE-3

Cisco IOS Release	PRE-2 MLP Interface Ranges	PRE-3 MLP Interface Ranges
Release 12.2(28)SB and its rebuilds	1 to 9999	Not Applicable
Release 12.2(31)SB2 and later	1 to 9999 65,536 to 2,147,483,647	1 to 9999 65,536 to 2,147,483,647

For more information, see the “[Configuring Multilink Point-to-Point Protocol Connections on the Cisco 10000 Series](#)” section on page 168.

## Important Notes for Cisco IOS Release 12.2(28)SB

This section describes important issues that you should be aware of for Cisco IOS Release 12.2(28)SB and later releases.

### Configuring Multilink Point-to-Point Protocol Connections on the Cisco 10000 Series

This section provides information about configuring Multilink Point-to-Point (MLP) connections on the Cisco 10000 series.

#### Configuration Commands for MLP

The following commands can be used to configure MLP and MLP-based link fragmentation and interleaving:

- **interface multilink** command

When creating MLP interfaces using the **interface multilink** command, the valid numerical ranges you can specify for the PRE-2 in Cisco IOS Release 12.2(28)SB and its rebuilds are from 1 to 9999.

- **ppp multilink** command
- **ppp multilink fragment-delay** command
- **ppp multilink interleave** command
- **ppp multilink fragmentation** command
- **ppp multilink fragment disable** command
- **ppp multilink group** command

For more information about MLP-based link fragmentation and interleaving, see the *Cisco 10000 Series Router Quality of Service Configuration Guide*:

<http://www.cisco.com/en/US/docs/routers/10000/10008/configuration/guides/qos/qoscf.html>

#### MLP Overhead

MLP encapsulation adds six extra bytes (4 header, 2 checksum) to each outbound packet. These overhead bytes reduce the effective bandwidth on the connection; therefore, the throughput for an MLP bundle is slightly less than an equivalent bandwidth connection that is not using MLP. If the average packet size is large, the extra MLP overhead is not readily apparent; however, if the average packet size is small, the extra overhead becomes more noticeable.

Using MLP fragmentation adds additional overhead to a packet. Each fragment contains six bytes of MLP header plus a link encapsulation header (for example, a High Level Data Link Control (HDLC) header).



## MPLS MTU Command Change

The behavior of the **mpls mtu** command has changed in Cisco IOS Release 12.2(28)SB and later releases. You cannot set the MPLS MTU value larger than the interface MTU value. This prevents problems such as dropped packets when MPLS MTU value settings are larger than interface MTU values. Cisco IOS software allows the MPLS MTU value to be higher than the interface MTU value only for interfaces that have a default interface MTU value of 1580 or less. For more information, see the following document:

<http://www.cisco.com/univercd/cc/td/doc/product/software/ios122sb/newft/122sbc27/newmtu.htm>

## Tuning I/O Buffers for Nonstop Forwarding (NSF)/Stateful Switchover (SSO) Functionality

For proper Nonstop Forwarding (NSF)/Stateful Switchover (SSO) functionality in scaled configurations, we recommend that you tune the number of I/O buffers on the Cisco 10000 series. (The default I/O buffer settings are good settings for standard configurations.) When NSF/SSO functionality is enabled, tune the I/O buffers by entering the following commands:

- `buffers small permanent 2500`
- `buffers small max-free 4000`
- `buffers small min-free 1000`
- `buffers middle permanent 2500`
- `buffers middle max-free 3500`
- `buffers middle min-free 1000`
- `buffers verybig permanent 1000`
- `buffers verybig max-free 2000`
- `buffers verybig min-free 150`

For more information about buffer tuning, see the *Buffer Tuning for all Cisco Routers* document:

[http://www.cisco.com/en/US/products/hw/routers/ps133/products\\_tech\\_note09186a00800a7b80.shtml](http://www.cisco.com/en/US/products/hw/routers/ps133/products_tech_note09186a00800a7b80.shtml)

If you need assistance with the buffer tuning process, call your support team.

## Upgrading PCI Port Adapter Carrier Card ROMmon for the Cisco 7304 Router

Beginning in Cisco IOS Release 12.2(28)SB, the PCI Port Adapter Carrier Card (7300-CC-PA) requires a one-time ROMmon upgrade to function. If this upgrade is not performed, the PCI Port Adapter Carrier Card with the incompatible ROMmon will be deactivated until the PCI Port Adapter Carrier Card ROMmon upgrade is performed.

The upgraded ROMmon image is bundled with the Cisco IOS software image; no additional images need to be downloaded to perform the upgrade. The upgrade can be performed by answering a prompt that will appear when certain processes, including the Cisco IOS bootup process, recognize that the PA-CC ROMmon requires an upgrade. Other methods of upgrading PA-CC ROMmon exist.

For additional information on this process, see the *Upgrading PCI Port Adapter Carrier Card ROMmon* document:

<http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/7304swf/paccrom.htm>

# Troubleshooting

The following documents provide assistance with troubleshooting your Cisco hardware and software:

- *Hardware Troubleshooting Index Page:*  
<http://www.cisco.com/warp/public/108/index.shtml>
- *Troubleshooting Bus Error Exceptions:*  
[http://www.cisco.com/en/US/products/sw/iosswrel/ps1831/products\\_tech\\_note09186a00800cdd51.shtml](http://www.cisco.com/en/US/products/sw/iosswrel/ps1831/products_tech_note09186a00800cdd51.shtml)
- *Why Does My Router Lose Its Configuration During Reboot?:*  
[http://www.cisco.com/warp/public/63/lose\\_config\\_6201.html](http://www.cisco.com/warp/public/63/lose_config_6201.html)
- *Troubleshooting Router Hangs:*  
[http://www.cisco.com/warp/public/63/why\\_hang.html](http://www.cisco.com/warp/public/63/why_hang.html)
- *Troubleshooting Memory Problems:*  
<http://www.cisco.com/warp/public/63/mallocfail.shtml>
- *Troubleshooting High CPU Utilization on Cisco Routers:*  
<http://www.cisco.com/warp/public/63/highcpu.html>
- *Troubleshooting Router Crashes:*  
[http://www.cisco.com/warp/public/122/crashes\\_router\\_troubleshooting.shtml](http://www.cisco.com/warp/public/122/crashes_router_troubleshooting.shtml)
- *Using CAR During DOS Attacks:*  
[http://www.cisco.com/warp/public/63/car\\_rate\\_limit\\_icmp.html](http://www.cisco.com/warp/public/63/car_rate_limit_icmp.html)

## Caveats

To reduce the size of these release notes, caveats have been moved to the following locations:

- [Caveats for Cisco IOS Release 12.2\(33\)SB3 through 12.2\(33\)SB14, page 171](#)
- [Caveats for Cisco IOS Release 12.2\(31\)SB15 through 12.2\(33\)SB2, page 451](#)
- [Caveats for Cisco IOS Release 12.2\(28\)SB through 12.2\(31\)SB14, page 637](#)