



Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic

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This module contains information about Cisco Express Forwarding and describes the required and optional tasks for configuring a load-balancing scheme for Cisco Express Forwarding traffic. Load-balancing allows you to optimize resources by distributing traffic over multiple paths.

Cisco Express Forwarding is an advanced Layer 3 IP switching technology. It optimizes network performance and scalability for all kinds of networks: those that carry small amounts of traffic and those that carry large amounts of traffic in complex patterns, such as the Internet and networks characterized by intensive web-based applications or interactive sessions.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the “[Feature Information for Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic](#)” section on page 16.

Use Cisco Feature Navigator to find information about platform support and Cisco IOS and Catalyst OS software image support. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.

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Prerequisites for Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic

- Cisco Express Forwarding or distributed Cisco Express Forwarding must be enabled on your switch or router.
- If you enable per-packet load balancing for traffic going to a particular destination, all interfaces that can forward traffic to that destination must be enabled for per-packet load balancing.

Restrictions for Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic

You must globally configure load balancing on Cisco 12000 Series Router E2 line cards in the same way: either in per-destination or per-packet mode. It is not possible (as in other Cisco IOS software-based platforms) to configure some packet prefixes in per-destination mode and others in per-packet mode.

Information About Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic

Before configuring a load-balancing scheme for Cisco Express Forwarding traffic, you should understand the following concepts:

- [Cisco Platform Support for Central Cisco Express Forwarding and Distributed Cisco Express Forwarding, page 3](#)
- [Cisco Express Forwarding Load-Balancing Overview, page 3](#)
- [Per-Destination Load Balancing for Cisco Express Forwarding Traffic, page 3](#)
- [Per-Packet Load Balancing for Cisco Express Forwarding Traffic, page 4](#)
- [Load-Balancing Algorithms for Cisco Express Forwarding Traffic, page 4](#)

For links to information about other Cisco Express Forwarding and distributed Cisco Express Forwarding features that you can configure, see the “[Additional References](#)” section on page 13.

Cisco Platform Support for Central Cisco Express Forwarding and Distributed Cisco Express Forwarding

Cisco Express Forwarding is enabled by default on most Cisco platforms running Cisco IOS software Release 12.0 or later. When Cisco Express Forwarding is enabled on a router, the Route Processor (RP) performs the express forwarding.

To find out if Cisco Express Forwarding is enabled on your platform, enter the **show ip cef** command. If Cisco Express Forwarding is enabled, you receive output that looks like this:

```
Router# show ip cef

Prefix          Next Hop          Interface
[...]
10.2.61.8/24    192.168.100.1     FastEthernet1/0/0
                192.168.101.1     FastEthernet6/1
[...]
```

If Cisco Express Forwarding is not enabled on your platform, the output for the **show ip cef** command looks like this:

```
Router# show ip cef

%CEF not running
```

Distributed Cisco Express Forwarding is enabled by default on the Catalyst 6500 series switch, the Cisco 7500 series router, and the Cisco 12000 series router. When distributed Cisco Express Forwarding is enabled on your platform, the line cards perform the express forwarding.

If Cisco Express Forwarding is not enabled on your platform, use the **ip cef** command to enable (central) Cisco Express Forwarding or the **ip cef distributed** command to enable distributed Cisco Express Forwarding.

Cisco Express Forwarding Load-Balancing Overview

Cisco Express Forwarding load balancing is based on a combination of source and destination packet information; it allows you to optimize resources by distributing traffic over multiple paths.

You can configure load balancing on a per-destination or per-packet basis. Because load-balancing decisions are made on the outbound interface, load balancing must be configured on the outbound interface.

Per-Destination Load Balancing for Cisco Express Forwarding Traffic

Per-destination load balancing allows the router to use multiple paths to achieve load sharing across multiple source-destination host pairs. Packets for a given source-destination host pair are guaranteed to take the same path, even if multiple paths are available. Traffic streams destined for different pairs tend to take different paths.

Per-destination load balancing is enabled by default when you enable Cisco Express Forwarding. To use per-destination load balancing, you do not perform any additional tasks once Cisco Express Forwarding is enabled. Per-destination is the load-balancing method of choice for most situations.

Because per-destination load balancing depends on the statistical distribution of traffic, load sharing becomes more effective as the number of source-destination host pairs increases.

You can use per-destination load balancing to ensure that packets for a given host pair arrive in order. All packets intended for a certain host pair are routed over the same link (or links).

Typically, you disable per-destination load balancing when you want to enable per-packet load balancing.

**Note**

The Cisco 10000 series router and the Cisco 12000 series router are configured by default to perform per-destination load balancing.

Per-Packet Load Balancing for Cisco Express Forwarding Traffic

Cisco Express Forwarding Per-packet load balancing allows the router to send successive data packets over different paths without regard to individual hosts or user sessions. It uses the round-robin method to determine which path each packet takes to the destination. Per-packet load balancing ensures that the traffic is balanced over multiple links.

Per-packet load balancing is good for single-path destinations, but packets for a given source-destination host pair might take different paths. Per-packet load balancing can therefore introduce reordering of packets. This type of load balancing is inappropriate for certain types of data traffic (such as voice traffic over IP) that depend on packets arriving at the destination in sequence.

Use per-packet load balancing to help ensure that a path for a single source-destination host pair does not get overloaded. If the bulk of the data passing through parallel links is for a single pair, per-destination load balancing overloads a single link while other links have very little traffic. Enabling per-packet load balancing allows you to use alternate paths to the same busy destination.

Load-Balancing Algorithms for Cisco Express Forwarding Traffic

The following load-balancing algorithms are provided for use with Cisco Express Forwarding traffic. You select a load-balancing algorithm with the **ip cef load-sharing algorithm** command.

- **Original algorithm**—The original Cisco Express Forwarding load-balancing algorithm produces distortions in load sharing across multiple routers because the same algorithm was used on every router. Depending on your network environment, you should select either the universal algorithm (default) or the tunnel algorithm instead.
- **Universal algorithm**—The universal load-balancing algorithm allows each router on the network to make a different load sharing decision for each source-destination address pair, which resolves load-sharing imbalances. The router is set to perform universal load sharing by default.
- **Tunnel algorithm**—The tunnel algorithm is designed to balance the per-packet load when only a few source and destination pairs are involved.
- **Include-ports algorithm**—The include-ports algorithm allows you to use the Layer 4 source and destination ports as part of the load-balancing decision. This method benefits traffic streams running over equal cost paths that are not load shared because the majority of the traffic is between peer addresses that use different port numbers, such as Real-Time Protocol (RTP) streams. The include-ports algorithm is available in Cisco IOS Release 12.4(11)T and later releases.

How to Configure a Load-Balancing Scheme for Cisco Express Forwarding Traffic

Perform the following tasks to configure and fine-tune load balancing for Cisco Express Forwarding:

- [Enabling or Disabling Cisco Express Forwarding Per-Destination Load Balancing, page 5](#) (optional)
- [Configuring Cisco Express Forwarding Per-Packet Load Balancing, page 6](#) (optional)
- [Selecting a Cisco Express Forwarding Load-Balancing Algorithm, page 7](#) (optional)

Enabling or Disabling Cisco Express Forwarding Per-Destination Load Balancing

Perform this task to enable or disable Cisco Express Forwarding per-destination load balancing.

Typically, you disable per-destination load balancing when you want to enable per-packet load balancing.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot/port* or **interface** *type slot/port-adapter/port*
4. **[no] ip cef load-sharing [per-packet] [per-destination]**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<pre>interface type slot/port</pre> or <pre>interface type slot/port-adapter/port</pre> <p>Example: Router(config)# interface ethernet 1/1</p> or <p>Example: Router(config)# interface fastethernet 1/0/0</p>	Configures an interface type and enters interface configuration mode. <ul style="list-style-type: none"> The <i>type</i> argument specifies the type of interface to be configured. The <i>slot</i> argument specifies the slot number. Refer to the appropriate hardware manual for slot and port information. The <i>port</i> argument specifies the port number. Refer to the appropriate hardware manual for slot and port information. The <i>port-adapter</i> argument specifies the port adapter number. Refer to the appropriate hardware manual for information about port adapter compatibility. <p>Note The slashes after the <i>slot</i> argument and <i>port-adapter</i> argument are required.</p>
Step 4	<pre>[no] ip cef load-sharing [per-packet]</pre> <pre>[per-destination]</pre> <p>Example: Router(config-if)# no ip cef load-sharing per-destination</p>	Enables load balancing for Cisco Express Forwarding. <ul style="list-style-type: none"> The no ip cef load-sharing command disables Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic load balancing. The per-packet keyword enables per-packet load balancing on the interface. The per-destination keyword enables per-destination load balancing on the interface.
Step 5	<pre>end</pre> <p>Example: Router(config-if)# end</p>	Exits to privileged EXEC mode.

Configuring Cisco Express Forwarding Per-Packet Load Balancing

Perform the following task to configure Cisco Express Forwarding per-packet load balancing.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type slot/port* or **interface** *type slot/port-adapter/port*
4. **[no] ip load-sharing** [per-packet] [per-destination]
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	<pre>enable</pre> <p>Example: Router> enable </p>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> Enter your password if prompted.
Step 2	<pre>configure terminal</pre> <p>Example: Router# configure terminal </p>	<p>Enters global configuration mode.</p>
Step 3	<pre>interface type slot/port</pre> <p>or</p> <pre>interface type slot/port-adapter/port</pre> <p>Example: Router(config)# interface ethernet 1/1 or Router(config)# interface fastethernet 1/0/0 </p>	<p>Configures an interface type and enters interface configuration mode.</p> <ul style="list-style-type: none"> The <i>type</i> argument specifies the type of interface to be configured. The <i>slot</i> argument specifies the slot number. Refer to the appropriate hardware manual for slot and port information. The <i>port</i> argument specifies the port number. Refer to the appropriate hardware manual for slot and port information. The <i>port-adapter</i> argument specifies the port adapter number. Refer to the appropriate hardware manual for information about port adapters. <p>Note The slashes after the <i>slot</i> argument and <i>port-adapter</i> argument are required.</p>
Step 4	<pre>[no] ip load-sharing [per-packet] [per-destination]</pre> <p>Example: Router(config-if)# ip load-sharing per-packet </p>	<p>Enables load balancing for Cisco Express Forwarding.</p> <ul style="list-style-type: none"> The per-packet keyword enables per-packet load balancing on the interface. The per-destination keyword enables per-destination load balancing on the interface.
Step 5	<pre>end</pre> <p>Example: Router(config-if)# end </p>	<p>Exits to privileged EXEC mode.</p>

Selecting a Cisco Express Forwarding Load-Balancing Algorithm

Perform one of the following tasks to elect a Cisco Express Forwarding load-balancing algorithm.

- [Selecting a Tunnel Load-Balancing Algorithm for Cisco Express Forwarding Traffic, page 8](#)
- [Selecting an Include-Ports Layer 4 Load-Balancing Algorithm for Cisco Express Forwarding Traffic, page 9](#)

The router is set to perform universal load sharing by default.

Selecting a Tunnel Load-Balancing Algorithm for Cisco Express Forwarding Traffic

Perform the following task to select a tunnel load-balancing algorithm for Cisco Express Forwarding traffic. Select the tunnel algorithm when your network environment contains only a few source and destination pairs.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip cef load-sharing algorithm { original | tunnel [id] | universal [id] | include-ports { source [id] | [destination] [id] | source [id] destination [id] } }**
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<pre>ip cef load-sharing algorithm {original tunnel [id] universal [id] include-ports [source [id] [destination] [id] source [id] destination [id]}}</pre> <p>Example: Router(config)# ip cef load-sharing algorithm tunnel</p>	<p>Selects a Cisco Express Forwarding load-balancing algorithm.</p> <ul style="list-style-type: none"> • The original keyword sets the load-balancing algorithm to the original algorithm, based on a source and destination hash. • The tunnel keyword sets the load-balancing algorithm to one that can be used in tunnel environments or in environments where there are only a few IP source and destination address pairs. • The <i>id</i> argument is a fixed identifier. • The universal keyword sets the load-balancing algorithm to one that uses a source and destination and an ID hash. • The include-ports source keywords set the load-balancing algorithm to one that uses the source port. • The include-ports destination keywords set the load-balancing algorithm to one that uses the destination port. • The include-ports source destination keywords set the load-balancing algorithm to one that uses both source and destination ports.
Step 4	<pre>end</pre> <p>Example: Router(config)# end</p>	<p>Exits to privileged EXEC mode.</p>

Selecting an Include-Ports Layer 4 Load-Balancing Algorithm for Cisco Express Forwarding Traffic

Perform the following task to select an include-ports load-balancing algorithm for Cisco Express Forwarding traffic. Select the include-port algorithm when your network environment contains traffic running over equal-cost paths that is not load shared because the majority of the traffic is between peer addresses with different port numbers, such as RTP streams.

Prerequisites

Your system must be using an image that supports Cisco Express Forwarding in Cisco IOS Release 12.4(11)T or a later release.

Restrictions

The Layer 4 load-balancing algorithm applies to software switched packets.

For platforms that switch traffic using a hardware forwarding engine, the hardware load-balancing decision might be different from the software load-balancing decision for the same traffic stream. You might want to override the configured algorithm.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip cef load-sharing algorithm { original | tunnel [id] | universal [id] | | include-ports { source [id] | [destination] [id] | source [id] destination [id] } }**
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p>Step 3</p> <pre>ip cef load-sharing algorithm {original tunnel [id] universal [id] include-ports {source [id] [destination] [id] source [id] destination [id]}}</pre> <p>Example: Router(config)# ip cef load-sharing algorithm include-ports source destination</p>	<p>Selects a Cisco Express Forwarding load-balancing algorithm.</p> <ul style="list-style-type: none"> • The original keyword sets the load-balancing algorithm to the original algorithm, based on a source and destination hash. • The tunnel keyword sets the load-balancing algorithm to one that can be used in tunnel environments or in environments where there are only a few IP source and destination address pairs. • The <i>id</i> argument is a fixed identifier. • The universal keyword sets the load-balancing algorithm to one that uses a source and destination and an ID hash. • The include-ports source keyword sets the load-balancing algorithm to one that uses the source port. • The include-ports destination keyword sets the load-balancing algorithm to one that uses the destination port. • The include-ports source destination keyword sets the load-balancing algorithm to one that uses the source and destination ports.
<p>Step 4</p> <pre>end</pre> <p>Example: Router(config)# end</p>	<p>Exits to privileged mode.</p>

Configuration Examples for Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic

This section provides the following examples for configuring a load-balancing scheme for Cisco Express Forwarding traffic:

- [Enabling or Disabling Cisco Express Forwarding Per-Destination Load Balancing: Example, page 12](#)
- [Configuring Cisco Express Forwarding Per-Packet Load Balancing: Example, page 12](#)
- [Selecting a Cisco Express Forwarding Load-Balancing Algorithm: Example, page 12](#)

Enabling or Disabling Cisco Express Forwarding Per-Destination Load Balancing: Example

Per-destination load balancing is enabled by default when you enable Cisco Express Forwarding. Typically, you disable per-destination load balancing when you want to enable per-packet load balancing. The following example shows how to disable per-destination load balancing:

```
configure terminal
!
interface ethernet 1/1
no ip load-sharing per-destination
end
```

Configuring Cisco Express Forwarding Per-Packet Load Balancing: Example

The following example shows how to configure per-packet load balancing for Cisco Express Forwarding:

```
configure terminal
!
interface ethernet 1/1
ip load-sharing per-packet
end
```

If you want to enable per-packet load balancing for traffic intended for a particular destination, all interfaces that can forward traffic to that destination must be enabled for per-packet load-balancing.

Selecting a Cisco Express Forwarding Load-Balancing Algorithm: Example

The router is set to perform universal load balancing by default.

The following examples show how to select a different Cisco Express Forwarding load-balancing algorithm:

- [Selecting a Tunnel Load-Balancing Algorithm for Cisco Express Forwarding Traffic: Example, page 12](#)
- [Selecting an Include-Ports Layer 4 Load-Balancing Algorithm for Cisco Express Forwarding Traffic: Example, page 13](#)

Selecting a Tunnel Load-Balancing Algorithm for Cisco Express Forwarding Traffic: Example

The following example shows how to select a tunnel load-balancing algorithm for Cisco Express Forwarding:

```
configure terminal
!
ip cef load-sharing algorithm tunnel
end
```

The following example shows how to disable the tunnel load-balancing algorithm:

```
configure terminal
!
no ip cef load-sharing algorithm tunnel
end
```

Selecting an Include-Ports Layer 4 Load-Balancing Algorithm for Cisco Express Forwarding Traffic: Example

The following example shows how to select an include-ports Layer 4 load-balancing algorithm for Cisco Express Forwarding traffic:

```
configure terminal
!
ip cef load-sharing algorithm include-ports source
end
```

This example sets up load sharing that includes the source port in the load-balancing decision.

To disable the include-ports Layer 4 load-balancing algorithm and return to the default universal mode, enter the following commands:

```
configure terminal
!
no ip cef load-sharing algorithm
end
```

Additional References

The following sections provide references related to configuring a load-balancing scheme for Cisco Express Forwarding traffic.

Related Documents

Related Topic	Document Title
IP switching commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples.	Cisco IOS IP Switching Command Reference
List of the features documented in the Cisco Express Forwarding modules	Cisco Express Forwarding Features Roadmap
Overview of the Cisco Express Forwarding feature	Cisco Express Forwarding Overview
Tasks for verifying basic Cisco Express Forwarding and distributed Cisco Express Forwarding operation	Configuring Basic Cisco Express Forwarding for Improved Performance, Scalability, and Resiliency in Dynamic Networks
Tasks for enabling or disabling Cisco Express Forwarding or distributed Cisco Express Forwarding	Enabling or Disabling Cisco Express Forwarding or Distributed Cisco Express Forwarding to Customize Switching and Forwarding for Dynamic Networks
Tasks for configuring Cisco Express Forwarding consistency checkers	Configuring Cisco Express Forwarding Consistency Checkers for Route Processors and Line Cards
Tasks for configuring epochs for Cisco Express Forwarding tables	Configuring Epochs to Clear and Rebuild Cisco Express Forwarding and Adjacency Tables
Tasks for configuring and verifying Cisco Express Forwarding network accounting	Configuring Cisco Express Forwarding Network Accounting
Tasks for customizing the display of recorded Cisco Express Forwarding events	Customizing the Display of Recorded Cisco Express Forwarding Events

Additional References

Related Topic	Document Title
Tasks for customizing the display of recorded Cisco Express Forwarding events	<i>Customizing the Display of Recorded Cisco Express Forwarding Events</i>
Explanation of and troubleshooting information for the Cisco IOS software implementation of Layer 3 load balancing across multiple parallel links when Cisco Express Forwarding is used	<i>Troubleshooting Load Balancing Over Parallel Links Using Cisco Express Forwarding</i>

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/cisco/web/support/index.html</p>

Feature Information for Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic

Table 1 lists the release history for this feature.

For information on a feature in this technology that is not documented here, see the [Cisco Express Forwarding Features Roadmap](#).

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.



Note

Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1 Feature Information for Configuring a Load-Balancing Scheme for Cisco Express Forwarding Traffic

Feature Name	Releases	Feature Configuration Information
Cisco Express Forwarding Support for Layer 4 Port-Based Load Balancing	12.4(11)T	<p>This feature allows Cisco Express Forwarding to include Layer 4 port information in the decision for load sharing on equal cost paths.</p> <p>In 12.4(11)T, this feature was introduced.</p> <p>The following sections provide information about this feature:</p> <ul style="list-style-type: none"> • Load-Balancing Algorithms for Cisco Express Forwarding Traffic, page 4 • Selecting a Cisco Express Forwarding Load-Balancing Algorithm, page 7 <p>The following commands were modified by this feature: ip cef load-sharing algorithm and show ip cef exact-route.</p>

Glossary

adjacency—A relationship formed between selected neighboring routers and end nodes for the purpose of exchanging routing information. Adjacency is based upon the use of a common media segment by the routers and nodes involved.

Cisco Express Forwarding—A Layer 3 switching technology. Cisco Express Forwarding can also refer to central Cisco Express Forwarding mode, one of two modes of Cisco Express Forwarding operation. Cisco Express Forwarding enables a Route Processor to perform express forwarding. Distributed Cisco Express Forwarding is the other mode of Cisco Express Forwarding operation.

distributed Cisco Express Forwarding—A mode of Cisco Express Forwarding operation in which line cards (such as Versatile Interface Processor [VIP] line cards) maintain identical copies of the forwarding information base (FIB) and adjacency tables. The line cards perform the express forwarding between port adapters; this relieves the Route Switch Processor of involvement in the switching operation.

FIB—forwarding information base. A component of Cisco Express Forwarding that is conceptually similar to a routing table or information base. The router uses the FIB lookup table to make destination-based switching decisions during Cisco Express Forwarding operation. The router maintains a mirror image of the forwarding information in an IP routing table.

LSP—label switched path. A sequence of hops (Router 0...Router n). A packet travels from R0 to Rn by means of label switching mechanisms. An LSP can be chosen dynamically, based on normal routing mechanisms, or you can configure the LSP manually.

prefix—The network address portion of an IP address. A prefix is specified by a network and mask and is generally represented in the format network/mask. The mask indicates which bits are the network bits. For example, 1.0.0.0/16 means that the first 16 bits of the IP address are masked, making them the network bits. The remaining bits are the host bits. In this example, the network number is 10.0.

RIB—Routing Information Base. A central repository of routes that contains Layer 3 reachability.

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