



IS-IS Support for an IS-IS Instance per VRF for IP

First Published: August 09, 2004

Last Updated: May 5, 2008

This feature provides multiple VPN routing and forwarding (VRF)-aware Intermediate System-to-Intermediate System (IS-IS) instances. The VRF functionality allows Internet service providers (ISPs) to separate routing protocol information and propagate it to the appropriate routing table and network neighbors. Using one router with VRF functionality is more cost-effective than using separate routers to separate and forward the routing information.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the “[Feature Information for IS-IS Support for an IS-IS Instance per VRF for IP](#)” section on page 14.

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Contents

- [Prerequisites for IS-IS Support for an IS-IS Instance per VRF for IP, page 2](#)
- [Restrictions for IS-IS Support for an IS-IS Instance per VRF for IP, page 2](#)
- [Information About IS-IS Support for an IS-IS Instance per VRF for IP, page 2](#)
- [How to Configure IS-IS Support for an IS-IS Instance per VRF for IP, page 3](#)
- [Configuration Examples for IS-IS Support for an IS-IS Instance per VRF for IP, page 8](#)
- [Additional References, page 12](#)
- [Command Reference, page 13](#)
- [Feature Information for IS-IS Support for an IS-IS Instance per VRF for IP, page 14](#)



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Prerequisites for IS-IS Support for an IS-IS Instance per VRF for IP

- It is presumed that you are running IS-IS on your network.
- The VRF configuration is a prerequisite to associating an IS-IS instance with that specific VRF. However, the VRF configuration is independent of associating it with IS-IS or any other routing protocol. An IS-IS instance cannot be referred to as being VRF-aware until it has been associated with a particular VRF.

Restrictions for IS-IS Support for an IS-IS Instance per VRF for IP

IS-IS VRF support is supported only for IPv4.

When you configure the IS-IS Support for an IS-IS Instance per VRF for IP feature, you must comply with the following nine best practices guidelines:

- IS-IS instances running Connectionless Network Services (CLNS) must have the same system ID.
- An IS-IS instance that is running CLNS or IPv6 cannot be associated with a VRF.
- You can configure only one IS-IS instance to run both CLNS and IP.
- IS-IS instances within the same VRF must have unique system IDs, although IS-IS instances located in separate VRFs can have the same system ID.
- You can associate an IS-IS instance with only one VRF.
- You can configure the **passive-interface default** command only on one IS-IS instance per VRF.
- Redistribution is allowed only within the same VRF.
- You can enable only one IS-IS instance per interface.
- An interface can belong to an IS-IS instance only if they are associated with the same VRF.

**Note**

If you are using LDP, you cannot use the **route-target** command when configuring a VRF. The router will use BGP for Multiprotocol Label Switching (MPLS) labels.

Information About IS-IS Support for an IS-IS Instance per VRF for IP

This section contains the following information:

- [VRF-Aware IS-IS, page 3](#)
- [IS-IS Support for an IS-IS Instance per VRF for IP Feature Operation, page 3](#)

VRF-Aware IS-IS

You can configure IS-IS to be VRF-aware. A VRF consists of an IP routing table, a derived Cisco Express Forwarding (CEF) table, a set of interfaces that use the forwarding table, and a set of rules and routing protocol parameters that control the information that is included in the routing table.

IS-IS Support for an IS-IS Instance per VRF for IP Feature Operation

ISPs have the capability to create multiple VRF-aware IS-IS instances that run on one router, rather than requiring duplicate hardware. IS-IS can be enabled to be VRF-aware, and ISPs can use multiple VRF-aware IS-IS instances to separate customer data while propagating the information to appropriate service providers.

For example, an ISP can create three VRFs—VRF First, VRF Second, and VRF Third—to represent three separate customers. A VRF-aware IS-IS instance is created and associated with each VRF: tagFIRST, tagSECOND, and tagTHIRD. Each instance will have its own routing process, IS-IS database, and routing table, and will calculate its own shortest path first (SPF) tree.

How to Configure IS-IS Support for an IS-IS Instance per VRF for IP

This section contains the following procedures:

- [Creating a VRF, page 3](#) (required)
- [Attaching an Interface to the VRF, page 4](#) (required)
- [Creating VRF Aware IS-IS Instances, page 5](#) (required)

Creating a VRF

This task creates a VRF.

Prerequisites

- It is presumed that you have IS-IS running on your network.
- If CEF is not enabled by default on your platform, you will need to enable CEF in order to associate interfaces with VRF-aware IS-IS instances.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip cef [distributed]**
4. **ip vrf vrf-name**
5. **rd route-distinguisher**

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.
Step 3	ip cef [distributed] Example: Router(config)# ip cef distributed	Enables CEF on the Route Processor card. <ul style="list-style-type: none"> If CEF is not enabled by default on your particular platform, you must configure it with the ip cef command.
Step 4	ip vrf vrf-name Example: Router(config)# ip vrf first	Configures a VRF routing table, and enters VRF configuration mode.
Step 5	rd route-distinguisher Example: Router(config-vrf)# rd 1:1	Creates routing and forwarding tables for a VRF.

Attaching an Interface to the VRF

This task associates an interface with the VRF.

SUMMARY STEPS

- enable**
- configure terminal**
- interface** *type number*
- ip vrf forwarding** *vrf-name*

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.
Step 3	interface <i>type number</i> Example: Router(config)# interface FastEthernet 0/2	Configures an interface type and enters interface configuration mode.
Step 4	ip vrf forwarding <i>vrf-name</i> Example: Router(config-if)# ip vrf forwarding vrffirst	Associates a VPN routing and forwarding instance (VRF) with an interface or subinterface.

Creating VRF Aware IS-IS Instances

The tasks in these sections create VRF-aware IS-IS instances. You can create VRF-aware IS-IS instances either in interface configuration mode or in router configuration mode. Perform the tasks described in one of the following two sections to create one or more instances:

- [Creating a VRF-Aware IS-IS Instance in Interface Configuration Mode, page 5](#)
- [Creating a VRF-Aware IS-IS Instance in Router Configuration Mode, page 7](#)

Prerequisites

Before you create VRF-aware IS-IS instances, you need to enable IP routing on the router.



Note

Only one instance within the VRF can be configured as the passive interface default.

Creating a VRF-Aware IS-IS Instance in Interface Configuration Mode


This task creates a VRF-aware IS-IS instance in interface configuration mode.

SUMMARY STEPS

- enable**
- configure terminal**
- interface** *type number*

4. **ip address** *ip-address mask [secondary]*
5. **ip router isis** *process-tag*
6. **no shutdown**
7. **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.
Step 3	interface <i>type number</i> Example: Router(config)# interface FastEthernet 0/2	Configures an interface type and enters interface configuration mode.
Step 4	ip address <i>ip-address mask [secondary]</i> Example: Router(config-if)# ip address 172.16.11.1 255.255.255.255	Sets a primary or secondary IP address for an interface.
Step 5	ip router isis <i>process-tag</i> Example: Router(config-if)# ip router isis tagfirst	Configures an IS-IS routing process for IP on an interface and attaches a tag to the routing process. <ul style="list-style-type: none"> • A new IS-IS instance with the process tag tagfirst will be created and will be displayed when you enter the show running-config command. (It is presumed that the VRF called vrffirst was already configured on the router as in the, “Creating a VRF” section on page 3.)
		 <p>Note The configuration of the interface-mode ip router isis command will overwrite the prior configuration on that interface, but only if the new configuration is attempting to change the interface ownership to a different instance that is in the same VRF as the currently configured owner instance. The configuration will be rejected if the attempted change is between two instances that are associated with different VRFs.</p>

	Command or Action	Purpose
Step 6	no shutdown Example: Router(config-if)# no shutdown	Restarts a disabled interface.
Step 7	end Example: Router(config-if)# end	Exits interface configuration mode.

Creating a VRF-Aware IS-IS Instance in Router Configuration Mode

This task creates a VRF-aware IS-IS instance in router configuration mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router isis** *process-tag*
4. **vrf** *vrf-name*
5. **net** *network-entity-title*
6. **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.
Step 3	router isis <i>process-tag</i> Example: Router(config-if)# router isis tagFirst	Enables the IS-IS routing protocol, specifies an IS-IS process, and enters router configuration mode. <ul style="list-style-type: none"> • It is presumed that the VRF named First was previously created.
Step 4	vrf <i>vrf-name</i> Example: Router(config-router)# vrf first	Associates an IS-IS instance with a VRF.

	Command or Action	Purpose
Step 5	<pre>net network-entity-title</pre> <p>Example: Router(config-router)# net 49.000b.0000.0001.0002.00 </p>	Configures an IS-IS NET for a CLNS routing process.
Step 6	<pre>end</pre> <p>Example: Router(config-router)# end </p>	Exits router configuration mode.

Configuration Examples for IS-IS Support for an IS-IS Instance per VRF for IP

This section provides the following configuration examples:

- [Configuring Multiple VRF-Aware IS-IS Instances: Example, page 8](#)
- [Creating an IS-IS Instance Without a Process Tag: Example, page 10](#)
- [Redistributing Routes from an IS-IS Instance: Example, page 11](#)
- [Changing the Interface Ownership: Example, page 11](#)

Configuring Multiple VRF-Aware IS-IS Instances: Example

In the following example, the VRF Second is created and an IS-IS instance is created explicitly by entering the **router isis** command on the router:

```
Router(config)# ip cef distributed
Router(config)# ip routing
Router(config)# ip vrf Second
Router(config-vrf)# rd 1:1
Router(config-if)# router isis tagSecond
Router(config-router)# vrf Second
Router(config-router)# net 49.000b.0000.0001.0002.00
```

The VRF Third is created and a VRF-aware IS-IS instance is automatically created when the **ip router isis** command is entered:

```
Router(config)# ip vrf Third
Router(config-vrf)# rd 1:1
Router(config-if)# interface FastEthernet0/2
Router(config-if)# ip vrf forwarding Third
Router(config-if)# ip address 172.16.10.1 255.255.255.0
Router(config-if)# ip router isis tagThird
Router(config-if)# no shutdown
```

A new IS-IS instance with the process tag tagThird will automatically be created and associated with the VRF Third. When the **show running-config** command is entered, the following information for the new IS-IS instance will be displayed:

```
Router# show running-config
```

```

Building configuration...
router isis tagThird
  vrf Third

Router(config)# router isis tagThird
Router(config-router)# net 49.000b.0000.0001.0001.00

```

The following sample output verifies information for the VRF-aware IS-IS instances that were created in the previous examples:

```
Router# show isis tagThird topology
```

```
Tag tagThird:
```

```
IS-IS paths to level-2 routers
```

System Id	Metric	Next-Hop	Interface	SNPA
router-02	10	router-02	Fa4/3	0010.0ddc.e00b
router-03	10	router-03	Et0/2	0006.0e03.0c45
router-04	10	router-04	Fa4/0	000a.f3c3.1c70
.		router-04	Fa4/1	000a.f3c3.1c71
.				
.				
.				

```
Router# show clns tagSecond neighbors
```

```
Tag tagSecond:
```

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
router-03	Fa0/2	00d0.2b7f.9502	Up	9	L2	IS-IS
router-03	PO2/2.1	DLCI 211	Up	27	L2	IS-IS
router-02	PO2/0.1	DLCI 131	Up	29	L2	IS-IS
router-11	Fa0/4	000e.d79d.7920	Up	7	L2	IS-IS
router-11	Fa0/5	000e.d79d.7921	Up	8	L2	IS-IS
router-11	PO3/2.1	DLCI 451	Up	24	L2	IS-IS
.						
.						
.						

```
Router# show isis tagThird database level-2
```

```
Tag tagThird:
```

```
IS-IS Level-2 Link State Database:
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
router-01.00-00	0x0000000A	0x5E73	914	0/0/0
router-01.03-00	0x00000001	0x8E41	894	0/0/0
router-01.04-00	0x00000001	0x8747	894	0/0/0
router-03.00-00	* 0x00000005	0x55AD	727	0/0/0
router-03.02-00	* 0x00000001	0x3B97	727	0/0/0
router-02.00-00	0x00000004	0xC1FB	993	0/0/0
router-02.01-00	0x00000001	0x448D	814	0/0/0
router-04.00-00	0x00000004	0x76D0	892	0/0/0

```
Router# show isis tagThird database level-1
```

```
Tag tagThird:
```

```
IS-IS Level-1 Link State Database:
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
router-03.00-00	* 0x0000000B	0xBDF6	1005	1/0/0
router-03.02-00	* 0x00000001	0xC473	940	0/0/0
router-07.00-00	0x00000006	0x403A	940	0/0/0

```

Router# show clns tagSecond protocol

IS-IS Router: tagSecond
  System Id: 0000.0001.0002.00  IS-Type: level-2-only
  Manual area address(es):
    49.000b
  Routing for area address(es):
    49.000b
  Interfaces supported by IS-IS:
    FastEthernet4/1 - IP
    FastEthernet4/0 - IP
    Ethernet0/2 - IP
    FastEthernet4/3 - IP
  Redistributing:
    static
  Distance: 110
  RRR level: none
  Generate narrow metrics: level-1-2
  Accept narrow metrics:  level-1-2
  Generate wide metrics:  none
  Accept wide metrics:    none

```

```

Router# show clns tagThird protocol

IS-IS Router: tagThird
  System Id: 0000.0001.0001.00  IS-Type: level-1-2
  Manual area address(es):
    49.000b
  Routing for area address(es):
    49.000b
  Interfaces supported by IS-IS:
    POS2/2.1 - IP
    FastEthernet0/2 - IP
    FastEthernet0/4 - IP
    POS2/0.1 - IP
    FastEthernet0/5 - IP
    POS3/2.1 - IP
  Redistributing:
    static
  Distance: 110
  RRR level: none
  Generate narrow metrics: none
  Accept narrow metrics:  none
  Generate wide metrics:  level-1-2
  Accept wide metrics:    level-1-2

```

Creating an IS-IS Instance Without a Process Tag: Example

In the following example, an IS-IS instance was created without the optional process tag. When an IS-IS instance is created without the optional process tag, you can display its information by entering the commands such as **show clns protocol** with “null” specified for the *process-tag* argument.

```

Router(config)# router isis
Router(config-router)# vrf first
Router(config-router)# net 49.000b.0000.0001.ffff.00
Router(config-router)# is-type level-1

Router(config)# interface POS 6/1
Router(config-if)# ip vrf forwarding first
Router(config-if)# ip address 172.16.2.1 255.255.255.0

```

```
Router(config-if)# ip router isis
Router(config-if)# no shutdown
```

Because the IS-IS instance is created without the optional process tag, its information is displayed when the **show clns protocol** command is entered with “null” specified for the *process-tag* argument:

```
Router# show clns null protocol

IS-IS Router: <Null Tag>
  System Id: 0000.0001.FFFF.00  IS-Type: level-1
  Manual area address(es):
    49.000b
  Routing for area address(es):
    49.000b
  Interfaces supported by IS-IS:
    POS6/1 - IP
  Redistributing:
    static
  Distance: 110
  RRR level: none
  Generate narrow metrics: level-1-2
  Accept narrow metrics:   level-1-2
  Generate wide metrics:   none
  Accept wide metrics:     none
```

Redistributing Routes from an IS-IS Instance: Example

In the following sample configuration, routes have been redistributed from the IS-IS instance “null” into the IS-IS instance named tagBLUE. Routes from an OSPF process in VRF Blue have been redistributed into the IS-IS instance named tagBLUE.

```
Router(config)# router isis tagBLUE
Router(config-router)# redistribute isis null ip metric 10 route-map isisMAP1
Router(config-router)# redistribute ospf 1 vrf BLUE metric 1 metric-type external
level-1-2
.
.
.

Router(config)# route-map isisMAP1 permit 10
Router(config-route-map)# match route-type level-2 level-1
Router(config-route-map)# set level level-2
```

Changing the Interface Ownership: Example

In the following sample configuration, POS interface 6/1 was originally enabled for IS-IS IP routing for a “null” instance that does not have a process tag, which is in vrfSecond. The new configuration changes the ownership of POS interface 6/1 to another instance tagSecond, which is also in vrfSecond.



Note

Note that use of the **ip router isis** command in interface configuration mode will overwrite the prior configuration on that interface, but only if the new configuration is attempting to change the interface ownership to a different instance that is in the same VRF as the currently configured owner instance. The configuration will be rejected if the attempted change is between two instances that are associated with different VRFs.

Additional References

```
Router(config)# interface POS 6/1
Router(config-if)# ip router isis tagSecond
%ISIS: Interface detached from null and to be attached to instance tagBLUE.
```

Additional References

The following sections provide references related to the IS-IS Support for an IS-IS Instance per VRF for IP feature.

Related Documents

Related Topic	Document Title
IS-IS commands: complete command syntax, command mode, defaults, command history, usage guidelines, and examples	Cisco IOS IP Routing Protocols Command Reference
Roadmap of IS-IS features	“Integrated IS-IS Features Roadmap” module
Overview of Cisco IS-IS conceptual information with links to all the individual IS-IS modules	“Integrated IS-IS Routing Protocol Overview” module
ISO CLNS commands	Cisco IOS ISO CLNS Command Reference

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/techsupport</p>

Command Reference

The following commands are introduced or modified in the feature or features documented in this module. For information about these commands, see the *Cisco IOS IP Routing Protocols Command Reference* at http://www.cisco.com/en/US/docs/ios/iproute/command/reference/irp_book.html. For information about all Cisco IOS commands, go to the Command Lookup Tool at <http://tools.cisco.com/Support/CLILookup> or to the *Cisco IOS Master Commands List*.

- **show clns neighbors**
- **show clns protocol**
- **show isis database**
- **show isis topology**
- **vrf (router configuration)**

Feature Information for IS-IS Support for an IS-IS Instance per VRF for IP

Table 1 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

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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 IS-IS Support for an IS-IS Instance per VRF for IP

Feature Name	Releases	Feature Information
IS-IS Support for an IS-IS Instance per VRF for IP	12.0(29)S 12.2(33)SRB	This feature provides multiple VPN routing and forwarding (VRF)-aware Intermediate System-to-Intermediate System (IS-IS) instances. The VRF functionality allows Internet service providers (ISPs) to separate routing protocol information and propagate it to the appropriate routing table and network neighbors. Using one router with VRF functionality is more cost-effective than using separate routers to separate and forward the routing information.

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