OSPF Support for Multi-VRF on CE Routers

The OSPF Support for Multi-VRF on CE Routers feature provides the capability of suppressing provider edge (PE) checks that are needed to prevent loops when the PE is performing a mutual redistribution of packets between the OSPF and BGP protocols. When VPN routing and forward (VRF) is used on a router that is not a PE (that is, one that is not running BGP), the checks can be turned off to allow for correct population of the VRF routing table with routes to IP prefixes.

OSPF multi-VRF allows you to split the router into multiple virtual routers, where each router contains its own set of interfaces, routing table, and forwarding table.

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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 table.

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

Information About OSPF Support for Multi-VRF on CE Routers

The OSPF Support for Multi-VRF on CE Routers feature provides the capability of suppressing provider edge (PE) checks that are needed to prevent loops when the PE is performing a mutual redistribution of packets between the OSPF and BGP protocols. When VPN routing and forward (VRF) is used on a router that is not
a PE (that is, one that is not running BGP), the checks can be turned off to allow for correct population of the VRF routing table with routes to IP prefixes.

OSPF multi-VRF allows you to split the router into multiple virtual routers, where each router contains its own set of interfaces, routing table, and forwarding table. OSPF multi-VRF gives you the ability to segment parts of your network and configure those segments to perform specific functions, yet still maintain correct routing information.

# How to Configure OSPF Support for Multi-VRF on CE Routers

## Configuring the Multi-VRF Capability for OSPF Routing

**Before You Begin**

CEF must be running on the network.

### SUMMARY STEPS

1. `enable`
2. `show ip ospf [process-id]`
3. `configure terminal`
4. `router ospf process-id [vrf vpn-name]`
5. `capability vrf-lite`

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
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<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>Enables higher privilege levels, such as privileged EXEC mode.</td>
</tr>
<tr>
<td><code>enable</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td>Displays the status of the router. If the display indicates that the router is connected to the VPN backbone, you can use the <code>capability vrf-lite</code> command to decouple the PE router from the VPN backbone.</td>
</tr>
<tr>
<td><code>show ip ospf [process-id]</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router&gt; show ip ospf 1</td>
</tr>
<tr>
<td><strong>Step 3</strong></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><code>configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router# configure terminal</td>
</tr>
<tr>
<td><strong>Step 4</strong></td>
<td>Enables OSPF routing and enters router configuration mode.</td>
</tr>
<tr>
<td><code>router ospf process-id [vrf vpn-name]</code></td>
<td></td>
</tr>
</tbody>
</table>
### Purpose

**Command or Action**

<table>
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<tr>
<th>Example:</th>
<th>Purpose</th>
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</thead>
</table>
| Router(config)# router ospf 1 vrf grc | - The `process-id` argument identifies the OSPF process.  
- Use the `vrf` keyword and `vpn-name` argument to identify a VPN. |

**Step 5**
- `capability vrf-lite`

<table>
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<tr>
<th>Example:</th>
<th>Applies the multi-VRF capability to the OSPF process.</th>
</tr>
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<tr>
<td>Router(config)# capability vrf-lite</td>
<td></td>
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</table>

### Verifying the OSPF Multi-VRF Configuration

No specific `debug` or `show` commands are associated with this feature. You can verify the success of the OSPF multi-VRF configuration by using the `show ip ospf [process-id]` command to verify that the router is not connected to the VPN backbone.

This output from the `show ip ospf process` command indicates that the PE router is currently connected to the backbone.

```
Router# show ip ospf 12
Routing Process "ospf 12" with ID 151.1.1.1 and Domain ID 0.0.0.12
Supports only single TOS(TOS0) routes
Supports opaque LSA
Connected to MPLS VPN Superbackbone
SPF schedule delay 5 secs, Hold time between two SPFss 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
Number of external LSA 0. Checksum Sum 0x0
Number of opaque AS LSA 0. Checksum Sum 0x0
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 0. 0 normal 0 stub 0 nssa
External flood list length 0
```

When the OSPF VRF process is configured with the `capability vrf-lite` command under the `router ospf` command, the "Connected to MPLS VPN Superbackbone" line will not be present in the display.

### Configuration Examples for OSPF Support for Multi-VRF on CE Routers

#### Example Configuring the Multi-VRF Capability

This example shows a basic OSPF network with a VRF named grc configured. The `capability vrf-lite` command is entered to suppress the PE checks.

```
!  
ip cef
```
ip vrf grc
  rd 1:1
interface Serial2/0
  ip vrf forwarding grc
  ip address 192.168.1.1 255.255.255.252
!
interface Serial3/0
  ip vrf forwarding grc
  ip address 192.168.2.1 255.255.255.252
!
router ospf 9000 vrf grc
  log-adjacency-changes
  capability vrf-lite
  redistribute rip metric 1 subnets
  network 192.168.1.0 0.0.0.255 area 0
!
router rip
  address-family ipv4 vrf grc
  redistribute ospf 9000 vrf grc
  network 192.168.2.0
  no auto-summary
end
Device# show ip route vrf grc
Routing Table: grc
Codes: C = connected, S = static, R = RIP, M = mobile, B = BGP
D = EIGRP, EX = EIGRP external, O = OSPF, IA = OSPF inter area
N1 = OSPF NSSA external type 1, N2 = OSPF NSSA external type 2
E1 = OSPF external type 1, E2 = OSPF external type 2
I = IS-IS, su = IS-IS summary, L1 = IS-IS level-1, L2 = IS-IS level-2
* = IS-IS inter area, = candidate default, U = per-user static route
G = OSPF, P = periodic downloaded static route
Gateway of last resort is not set
O IA 192.168.192.0/24 [110/138] via 192.168.1.13, 00:06:08, Serial2/0
  [110/138] via 192.168.1.9, 00:06:08, Serial3/0
O IA 192.168.242.0/24 [110/74] via 192.168.1.13, 00:06:08, Serial2/0
O IA 192.168.193.0/24 [110/148] via 192.168.1.13, 00:06:08, Serial2/0
  [110/148] via 192.168.1.9, 00:06:08, Serial3/0
O IA 192.168.128.0/24 [110/74] via 192.168.1.19, 00:06:08, Serial3/0
O IA 192.168.129.0/24 [110/94] via 192.168.1.19, 00:06:08, Serial3/0
O IA 192.168.130.0/24 [110/94] via 192.168.1.19, 00:06:08, Serial3/0
  172.16.0.0/24 is subnetted, 2 subnets
  O E2 172.16.9.0 [110/5] via 192.168.1.13, 00:06:08, Serial2/0
  O E2 172.16.10.0 [110/5] via 192.168.1.13, 00:06:08, Serial2/0
O IA 192.168.131.0/24 [110/94] via 192.168.1.19, 00:06:20, Serial3/0
  192.168.1.0/30 is subnetted, 4 subnets
  C 192.168.1.8 is directly connected, Serial3/0
  C 192.168.1.12 is directly connected, Serial2/0
O 192.168.1.0 [110/128] via 192.168.1.9, 00:06:20, Serial3/0
O 192.168.1.4 [110/128] via 192.168.1.13, 00:06:20, Serial2/0

Example Verifying the OSPF Multi-VRF Configuration

This example illustrates the output display from the show ip ospf command after OSPF multi-VRF has been configured on the router.

Device# show ip ospf 9000
Routing Process "ospf 9000" with ID 10.0.0.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Supports area transit capability
Supports NSSA (compatible with RFC 3101)
Event-log disabled
It is an autonomous system boundary router
Redistributing External Routes from
  rip with metric mapped to 1, includes subnets in redistribution
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPF s 10000 msecs
Maximum wait time between two consecutive SPF s 10000 msecs
Incremental-SPF disabled
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Number of areas transit capable is 0
External flood list length 0
IETF NSF helper support enabled
Cisco NSF helper support enabled
Reference bandwidth unit is 100 mbps
Area BACKBONE(0) (Inactive)
  Number of interfaces in this area is 1
  Area has no authentication
  SPF algorithm last executed 00:00:10.264 ago
  SPF algorithm executed 1 times
  Area ranges are
  Number of LSA 1. Checksum Sum 0x00B674
  Number of opaque link LSA 0. Checksum Sum 0x000000
  Number of DCbitless LSA 0
  Number of indication LSA 0
  Number of DoNotAge LSA 0
  Flood list length 0

Additional References

Related Documents

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<th>Related Topic</th>
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<tbody>
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<td>Configuring OSPF</td>
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<tr>
<td>Multiprotocol Label Switching (MPLS)</td>
<td>MPLS Multi-VRF (VRF Lite) Support</td>
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Standards

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<th>Standards</th>
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<tr>
<td>No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.</td>
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MIBs

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<td>No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.</td>
<td>To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
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RFCs

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Technical Assistance

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<td>The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
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Feature Information for OSPF Support for Multi-VRF on CE Routers

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature. Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.
The OSPF Support for Multi-VRF on CE Routers feature provides the capability to suppress provider edge (PE) checks that are needed to prevent loops when the PE is performing a mutual redistribution of packets between the OSPF and BGP protocols. When VPN routing and forwarding (VRF) is used on a router that is not a PE (that is, one that is not running BGP), the checks can be turned off to allow for correct population of the VRF routing table with routes to IP prefixes.

The following commands are introduced or modified in the feature documented in this module:

- capability vrf-lite

### Glossary

**CE Router** -- Customer Edge router, an edge router in the C network, defined as a C router which attaches directly to a P router.

**C Network** -- Customer (enterprise or service provider) network.

**C Router** -- Customer router, a router in the C network.

**LSA** -- link-state advertisement. Broadcast packet used by link-state protocols that contains information about neighbors and path costs. LSAs are used by the receiving routers to maintain their routing tables.

**PE Router** -- Provider Edge router, an edge router in the P network, defined as a P router which attaches directly to a C router.

**P Network** -- MPLS-capable service provider core network. P routers perform MPLS.

**P Router** -- Provider router, a router in the P network.

**SPF** -- shortest path first. A routing algorithm that iterates on length of path to determine a shortest-path spanning tree.

**VPN** -- Virtual Private Network. Enables IP traffic to travel securely over a public TCP/IP network by encrypting all traffic from one network to another.

**VRF** -- VPN Routing and Forwarding.