Configuring VRF Support

First Published: December 2, 2008
Last Updated: March 3, 2011

Virtual Route Forwarding (VRF) divides a physical router into multiple logical routers, each having its own set of interfaces and routing and forwarding tables. VRF support in voice networks can be used to split Cisco Unified Communications Manager Express (Cisco Unified CME) into multiple virtual systems for SIP and SCCP endpoints and TAPI-based client applications and softphones on your PC.

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 VRF Support" section on page 1613.

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.

Contents

Prerequisites for Configuring VRF Support

- Cisco Unified CME 7.0(1) or a later version must be configured on the Cisco router.
- VRF-Aware H.323 and SIP must be configured on the Cisco Unified CME router, including the following:
  - Up to five VRFs must be configured on the Cisco Unified CME router by using the **ip vrf** command. For configuration information, see *VRF-Aware H.323 and SIP for Voice Gateways*.
  - One of the groups must be designated as a global voice VRF (SIP Trunk) by using the **voice vrf** command. For configuration information, see *VRF-Aware H.323 and SIP for Voice Gateways*.

  Example:

  ```
  voice vrf voice-vrf
  ip vrf data-vrf1
   rd 801:1
   route-target export 801:1
   route-target import 1000:1
  !
  ip vrf data-vrf2
   rd 802:1
   route-target export 802:1
   route-target import 1000:1
  !
  ip vrf voice-vrf
   rd 1000:1
   route-target export 1000:1
   route-target import 801:1
   route-target import 802:1
  !
  ```

- Interfaces on the router must be configured for the VRFs by using the **ip vrf forwarding** command.

  > **Note** SIP phones must register through the global voice VRF. Only global voice VRF is supported for SIP trunk.

  Example:

  ```
  interface GigabitEthernet0/0.301
   encapsulation dot1Q 301
   ip vrf forwarding data-vrf1
   ip address 10.1.10.1 255.255.255.0
  !
  interface GigabitEthernet0/0.302
   encapsulation dot1Q 302
   ip vrf forwarding data-vrf1
   ip address 10.2.10.1 255.255.255.0
  !
  interface GigabitEthernet0/0.303
   encapsulation dot1Q 303
   ip vrf forwarding voice-vrf
   ip address 10.3.10.1 255.255.255.0
  ```

- VRFs must be mapped to IP addresses using DHCP. For configuration information, see "Defining DHCP" on page 92.

  Example:

  ```
  !<=== no ip dhcp command required only if "ip vrf forward" is specified under ip dhcp
  no ip dhcp use vrf connected pool===>
  !<=== Associate subnets with VRFs. Overlapping IP addresses are NOT supported.===>
  ```

```
ip dhcp pool vcme1
   network 10.1.10.0 255.255.255.0
   default-router 10.1.10.1
   option 150 ip 10.1.10.1
   class vcme1
      address range 10.1.10.10 10.1.10.250
!
ip dhcp pool vcme2
   network 10.2.10.0 255.255.255.0
   default-router 10.2.10.1
   option 150 ip 10.2.10.1
   class vcme2
      address range 10.2.10.10 10.2.10.250
```

For more configuration examples, see the

- Dial peers for H323 and SIP trucks must be routed through the global voice VRF.

Note Dial peers are global resources belonging to the voice VRF and shared with and accessible from any VRF. There is no need to configure a dial peer for each individual VRF.

Restrictions for Configuring VRF Support

- For SIP phones in Cisco Unified CME: SIP proxy and registrar must be in the same VRF.

- IP-address overlap between VRFs is not supported.

- Cross-VRF video is not supported.

- The following call types are not supported for a voice VRF:
  - IP-to-IP gateway and gatekeeper configured on the same router.
  - IP-to-IP gateway with a VRF configured on one call leg and not on another call leg.
  - IP-to-IP gateway with one VRF configured for the H.323 call leg and a different VRF configured for the SIP call leg.
  - For H.323 calls, only TCP is supported. H.323 UDP signaling is not supported. SIP calls support both TCP and UDP signaling.

- The following features are not supported by on a VRF:
  - Call-fallback and RSVP features.
  - H.323 Annex E calls.
  - AAA and DNS components in voice-capable access routers. These routers communicate with AAA and DNS using the default routing table.

- If a global voice VRF is not configured, signaling and media packets are sent using the default routing table.

- SIP phones must register through the global voice VRF. Only the global voice VRF is supported for SIP phones (SIP trunk).

- Cisco Unity Express on the Cisco Unified CME router must belong to the global voice VRF.

Note Telnet is used to access Cisco Unity Express on the global voice VRF because the Service-Engine Service-Engine 1/0 session command is for non-VRF aware Cisco Unified CME only. To access the Cisco Unity Express module for defining voice-mail users on global voice VRF, telnet through the global voice VRF. For example: telnet 10.10.10.5 2066 /vrf vrf. For more information, see the "Installing Cisco Unity Express Software" chapter in the appropriate *Cisco Unity Express Administrator Guide for Cisco Unified CME*.

Information About VRF Support

To configure transcoding support, you should understand the following concepts:

- VRF-Aware Cisco Unified CME, page 1604

VRF-Aware Cisco Unified CME

VRF implementations enable you to consolidate voice communication into one logically-partitioned network to separate voice and data communication on a converged multimedia network.

In Cisco Unified CME 7.0(1) and later versions, VRF in voice networks can be used to share a Cisco Unified CME among multiple closed-users groups with different requirements. The actual call processing rules can be applied by voice on a per VRF basis. A virtual Cisco Unified CME on each VRF is a collection of phones in VRF groups that register in Cisco Unified CME through the VRF. All SCCP and SIP phones connected to Cisco Unified CME register through the global voice VRF. TAPI-based client applications and softphones on a PC must register through a data VRF and can communicate with phones on the voice VRF.

VRF Support on Cisco Unified CME provides the following enhancements to the VRF-Aware H.323 and SIP for Voice Gateways feature:

- Line side support for up to 5 VRFs.
- Interworks with the global voice VRF on an H323 or SIP Trunk.
- Line side VRF can be a global voice VRF.
- VRFs are assigned on a per-phone level.
- Support for cross-VRF shared-lines.

For configuration information, see the "How to Configure VRF Support" section on page 1604

How to Configure VRF Support

This section contains the following tasks:

- Creating VRF Groups, page 1605 (required)
- Adding Cisco Unified CME Phones to a VRF Group, page 1606 (required)

Creating VRF Groups

To configure up to five VRF groups for users and phones in Cisco Unified CME, perform the following steps for each group to be configured.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **telephony-service**
4. **group** *group-tag* [**vrf** *vrfname*]
5. **ip source-address** *ip-address* [**port** *port*]
6. **url** {**authentication** | **directories** | **idle** | **information** | **messages** | **proxy-server** | **services**} *url*
7. **service phone webAccess 0**
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**telephony-service** **Example:** Router(config)# telephony-service	Enters telephony-service configuration mode.
Step 4	**group** *group-tag* [**vrf** *vrfname*] **Example:** Router(config-telephony)# group 1	Creates a VRF group for Cisco Unified CME users and phones. • *group-tag*—Unique identifier for VRF group being configured. Range: 1 to 5. • (Optional) **vrf** *vrfname*—Name of previously configured VRF to which this group is associated. • By default, VRF groups are associated with a global voice VRF unless otherwise specified by using the **vrf** *vrfname* keyword and argument combination.
Step 5	**ip source-address** *ip-address* [**port** *port*] **Example:** Router(conf-tele-group)# ip source-address 10.1.10.1 port 2000	Associates VRF group with Cisco Unified CME. • *ip address* and **port** through which Cisco Unified IP phones communicate with Cisco Unified CME.

	Command or Action	Purpose
Step 6	`url {authentication	directories	idle	information	messages	proxy-server	services} url`  **Example:** `Router(conf-tele-group)# url directories http://10.1.10.1/localdirectory`	Provisions uniform resource locators (URLs) for Cisco Unified IP phones connected to Cisco Unified CME.

Step 7	`service phone webAccess 0`
	
	Example:
	`Router(conf-tele-group)# service phone webAccess 0`
		Enables webAccess for IP phones. This is required for 9.x firmware, since the web server is disabled by default. 8.x firmware and lower had the web server enabled by default.

Step 8	`end`
	
	Example:
	`Router(conf-tele-group)# end`
		Returns to privileged EXEC mode.

Examples

The following partial output from the **show running-config** commands shows how to define three VRF groups for Cisco Unified CME. Group 1 is on the global voice VRF and the other two groups are on data VRFs.

```
telephony-service
 sdspfarm conference mute-on # mute-off #
 sdspfarm units 4
 sdspfarm transcode sessions 10
 sdspfarm tag 1 xcode101
 sdspfarm tag 2 conf103
 group  1
  ip source-address 10.1.10.1 port 2000
  url directories http://10.1.10.1/localdirectory
 !
 group  2 vrf data-vrf1
  ip source-address 10.2.10.1 port 2000
 !
 group  3 vrf data-vrf2
  ip source-address 10.3.10.1 port 2000
```

Adding Cisco Unified CME Phones to a VRF Group

To add an SCCP Cisco Unified IP phone, TAPI-based client, or softphone in Cisco Unified CME to a VRF group, perform the following steps for each phone to be added.

Prerequisites

- All ephone configurations to be included in a VRF group must be already configured in Cisco Unified CME. For configuration information, see "Configuring Phones to Make Basic Calls" on page 189.

Restrictions

- All SCCP phones in Cisco Unified CME must register through the global voice VRF and must be added to the VRF group on the global voice VRF only.

- Analog phones connected to FXS ports on a IOS gateway must register through the global voice VRF and must be added to the VRF group on the global voice VRF only.

- TAPI-based client applications and softphones on a PC must register through the data VRF and must be added to a VRF group on a data VRF only.

- VRF groups do not support identical IP addresses or shared lines.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ephone** *phone-tag*
4. **description** *string*
5. **mac-address** [*mac-address*]
6. **group phone** *group-tag* [**tapi** *group-tag*]
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. - Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**ephone** *phone-tag* **Example:** Router(config)# ephone 11	Enters ephone configuration mode for a Cisco Unified IP phone.
Step 4	**description** *string* **Example:** Router(config-ephone)# description cme-2801 srst	(Optional) Includes descriptive text about the interface.
Step 5	**mac-address** [*mac-address*] **Example:** Router(config-ephone)# mac-address 0012.8055.d2EE	Associates the MAC address of a Cisco Unified IP phone with an ephone configuration.

	Command or Action	Purpose
Step 6	**group phone** *group-tag* [**tapi** *group-tag*] **Example:** Router(config-ephone)# group phone 1	Adds a phone, TAPI-based client, or softphone to a VRF group. • *group-tag*—Unique identifier for VRF group that was previously configured by using the **group** command in telephony-service configuration mode. Range: 1 to 5. • This command can also be configured in ephone-template configuration mode and applied to one or more phones. The ephone configuration has priority over the ephone-template configuration.
Step 7	**end** **Example:** Router(config-ephone)# end	Returns to privileged EXEC mode.

Examples

The following example shows how to add phones to VRF groups. Phones 1 and 3 are in VRF group 1 on the global voice VRF. Phone 1 TAPI client and softphone 3 are in group 1 on the data-vrf2. Phone 3 TAPI client and softphone 4 are in group 3 on data-vrf 2.

```
telephony-service
 sdspfarm conference mute-on # mute-off #
 sdspfarm units 4
 sdspfarm transcode sessions 10
 sdspfarm tag 1 xcode101
 sdspfarm tag 2 conf103
 group  1 vrf voice-vrf
  ip source-address 10.1.10.1 port 2000
  url directories http://10.1.10.1/localdirectory
  !
 group  2 vrf data-vrf1
  ip source-address 10.2.10.1 port 2000
  !
group  3 vrf data-vrf2
  ip source-address 10.3.10.1 port 2000
  !
.
.
ephone-template 1
 group phone 1 tapi 2
ephone-template 2
 group phone 2
...
ephone 1
 ephone-template 1
ephone 2
 ephone-template 2
ephone 3
 group phone 1 tapi 3
ephone 4
 group phone 3
ephone  201
 group phone 1
 type anl
```

Configuration Examples for Configuring VRF Support

This sections contains the following examples:

Mapping IP Address Ranges to VRF Using DHCP: Example

Note Duplicate IP addresses, with or without specifying a VRF, are not supported in Cisco Unified CME 7.0(1).

There are three ways to assign DHCP addresses: global address allocation; VRF pool; or individual host

With a global address allocation scheme, you must use the **no ip dhcp use vrf connected** command.

```
no ip dhcp use vrf connected
!
ip dhcp pool vcme1
   network 209.165.201.10 255.255.255.224
   option 150 ip 209.165.201.9
   default-router 209.165.201.9
   class vcme1
      address range 209.165.201.1 209.165.201.30
!
```

The following example shows how to assign addresses from VRF pool vcme1.

```
ip dhcp use vrf connected
!
ip dhcp pool vcme1
   vrf data-vrf1
   network 209.165.201.10 255.255.255.224
   option 150 ip 209.165.201.9
   default-router 209.165.201.9
   class vcme1
      address range 209.165.201.1 209.165.201.30
!
```

The following example show how to assign an address by an individual host. You must replace the first two hexadecimal digits of a host MAC address with **01**.

```
ip dhcp pool phone3
   host 209.165.201.15 255.255.255.224
   client-identifier 0100.0ed7.4ce6.3d
   default-router 209.165.201.11
   option 150 ip 209.165.201.11
!
```

VRF-Aware Hardware Conferencing: Example

Hardware Conferencing with Internal DSP Farm

- The internal DSPFarm must be registered through a local loopback interface.

- The loopback allows Cisco Unified CME to access the media path in global routing table.

The boldface commands in the following configuration example show that the signaling and media paths are accessed through the global routing table and the loopback interface is in default routing table.

```
interface Loopback5
 ip address 12.5.10.1 255.255.255.255
!
sccp local Loopback5
sccp ccm 12.5.10.1 identifier 2 version 4.1
sccp
!
sccp ccm group 2
 bind interface Loopback5
 associate ccm 2 priority 1
 associate profile 103 register conf103
 associate profile 101 register xcode101
!
telephony-service
 sdspfarm conference mute-on # mute-off #
 sdspfarm units 4
 sdspfarm transcode sessions 10
 sdspfarm tag 1 xcode101
 sdspfarm tag 2 conf103
 group  1 vrf vrf1
   ip source-address 10.1.10.1 port 2000
!
 group  2 vrf vrf2
   ip source-address 10.2.10.1 port 2000
!
group  3 vrf vrf3
   ip source-address 10.3.10.1 port 2000
!
group  4 vrf vrf4
   ip source-address 10.4.10.1 port 2000
!
 group  5
   ip source-address 12.5.10.1 port 2000
!
conference hardware
max-ephones 240
max-dn 480
voicemail 7710
max-conferences 8 gain -6
```

Hardware Conferencing with External DSP Farm

- Configure DSP farm as usual on a Cisco router.

- The external DSP farm must be registered to Cisco Unified CME through the interface or subinterface assigned to the global voice VRF. Make sure the connection path is coming in through the voice VRF.

- The router on which the external DSP farm is configured does not have to be VRF-aware.

For information about configuring DSP Farms, see "How to Configure Transcoding Resources" on page 454.

Cisco Unity Express on Global Voice VRF: Example

```
voice vrf vrf2
 ip vrf data-vrf2
 rd 100:2
 route-target export 100:2
 route-target import 100:2
!
Interface loop back 0
ip vrf forwarding data-vrf2
Ip address 21.10.10.2
!<==The following config puts CUE in the voice vrf. Service-engine interface and
service-module must have an IP address.===>
!
interface Service-Engine1/0
 ip vrf forwarding voice-vrf3 ip address 21.10.10.5 255.255.255.0
 service-module ip address 21.10.10.6 255.255.255.0
 service-module ip default-gateway 21.10.10.2!
 ip route 21.10.10.6 255.255.255.255 Service-Engine1/0
…
line 66
no activation-character
```

Additional References

The following sections provide references related to Virtual Route Forwarding.

Related Documents

Related Topic	Document Title
Troubleshooting VRF-aware services	*VRF-Aware System Message Logging*
IP Application Services Configuration	*Cisco IOS IP Application Services Configuration Guide 12.4*
IP Application Services Command Reference	*Cisco IOS IP Application Services Command Reference 12.4*
MPLS VPNs	*MPLS Virtual Private Networks Configuration Guide 12.0(5)T*
MPLS Command Reference	*Cisco IOS Multiprotocol Label Switching Command Reference 12.4*
Cisco Unified CME Command Reference	*Cisco Unified Communications Manager Express Command Reference*
All other Cisco IOS Command Reference guides	Various titles located at http://www.cisco.com/en/US/products/ps6350/prod_command_reference_list.html
VRF-lite	*Catalyst 4500 Series Switch Cisco IOS Software Configuration Guide, 12.2(25)SG, Configuring VRF-Lite*

Standards

Standard	Title
H.323 Annex E	Multiplexed call signaling over UDP (within H.323v4 and later).

MIBs

MIB	MIBs Link
No new or modified MIBs are supported, and support for existing MIBs has not been modified.	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

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

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. 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. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for VRF Support

Table 98 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.

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 98 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 98 Feature Information for Virtual Route Forwarding

Feature Name	Cisco Unified CME Version	Feature Information
VRF Support in Cisco Unified CME	7.0(1)	VRF supports Cisco Unified CME, conferencing, transcoding, and RSVP components. VRF also allows soft phones in data VRF resources to communicate with phones in a VRF voice gateway.