

## Chapter 13

# Configuring Virtual Routers

E-series routers allow you to create multiple logical or *virtual* routers in a single router. Each virtual router has its own separate set of IP interfaces, forwarding table, and instances of routing protocols.

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### Overview

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Multiple distinct routers are supported within a single router, which allows service providers to configure multiple, separate, secure routers within a single chassis. These routers are identified as *virtual routers (VRs)*. Applications for this function include the creation of individual routers dedicated to wholesale customers, corporate virtual private network (VPN) users, or a specific traffic type.

### Default Virtual Router

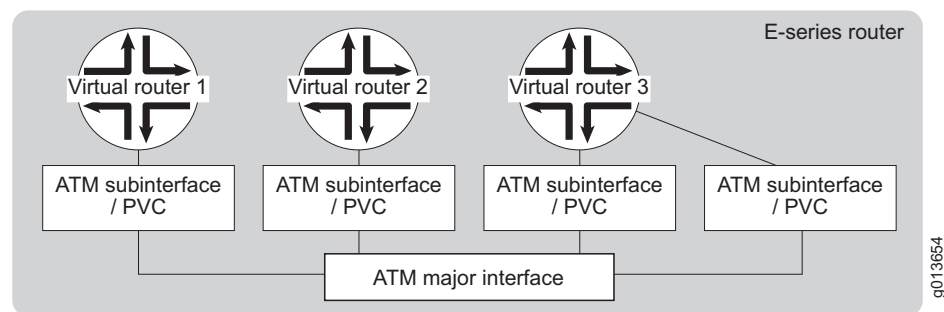
When you first boot your router, it creates a *default* virtual router. The only difference between the default VR and any other router is that you cannot create or delete the default VR. Just like any other router, the default VR gets its IP addresses when you add interfaces to it.

## Virtual Router Instances

E-series routers can support up to 1,000 forwarding tables; that is, up to a total of 1,000 VRs and VPN routing and forwarding (VRF) instances. Each VRF has a forwarding table. A network device attaching to a router detects a router interface. The attaching device has no notion of the *virtual* router behind the interface.

For example, a physical ATM link may have circuits that are connected to different VRs. The physical and data link layers are not aware that there are multiple router instances. See Figure 31.

**Figure 31: Virtual Routers**



VRs and VRFs are tools for implementing VPNs.

## Routing Protocols

Your router implements the VRs by maintaining a separate instance of each data structure for each VR and allowing each protocol (for example, TCP/UDP, RIP, OSPF, and IS-IS) to be enabled on a case-by-case basis. A table of router interfaces associates user connections (for example, PPP or ATM) with one or more IP interfaces within a VR.

## VPNs and VRFs

Your router supports VPNs and VRFs. For information about VPNs and VRFs, see *Configuring BGP VPN Services* and *Monitoring BGP/MPLS VPNs* in *JUNOS BGP and MPLS Configuration Guide, Chapter 3, Configuring BGP-MPLS Applications*.

### VPNs

A VPN is a set of sites attached to a common network, but whose data is handled separately from that common network.

VPNs enable private IP traffic to travel over a public TCP/IP network by tunneling that traffic between VPN member sites. Different levels of security are available depending on the security of the tunnel used between sites.

Your router supports VPNs consisting of VRs or VRFs. See RFC 2547—BGP/MPLS VPNs (March 1999). Additionally, your router supports tunnels built from GRE, IPSec, L2TP, MPLS, and tunnels built from layer 2 circuits, such as Frame Relay and ATM.

## VRFs

A VRF is a virtual routing and forwarding instance that exists within the context of a VR. The VRF provides forwarding information to your router. The system looks up a packet's destination in the VRF associated with the interface on which the packet is received. In general, any application that can be enabled in a VR can be enabled in a VRF. VRFs are generally associated with the VPN behavior described in RFC 2547—BGP/MPLS VPNs (March 1999).

When a VRF receives an update message, it needs to know whether it should add the route to its routing table. Similarly, when a VRF sends update messages, it needs to identify the VPNs that it wants to receive the updates. See *JUNOSe BGP and MPLS Configuration Guide, Chapter 3, Configuring BGP-MPLS Applications*.

## Platform Considerations

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Virtual routers are supported on all E-series routers.

For information about the modules supported on E-series routers:

- See the *ERX Module Guide* for modules supported on ERX-7xx models, ERX-14xx models, and the ERX-310 router.
- See the *E120 and E320 Module Guide* for modules supported on the E120 router and the E320 router.

## References

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For more information about virtual routers, VPNs, or VRFs, consult the following resources:

- *JUNOSe Release Notes, Appendix A, System Maximums*—Refer to the Release Notes corresponding to your software release for information about maximum values.
- *JUNOSe BGP and MPLS Configuration Guide, Chapter 3, Configuring BGP-MPLS Applications*
- RFC 2547—BGP/MPLS VPNs (March 1999)
- RFC 2917—A Core MPLS IP Architecture (September 2000)

## Configuring Virtual Routers

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This section provides examples of some of the more common virtual router tasks.

There are different uses of the **virtual-router** command. You can create or access VRs and VRFs in Global Configuration mode or map a VR to a domain map in Domain Map Configuration mode. After you have created a VR, you can continue to work in different command modes and configure the same user interface parameters as before the virtual router was created.

For information about the many VR tasks you can configure, see the related chapter; for example, *JUNOS IP, IPv6, and IGP Configuration Guide, Chapter 1, Configuring IP* or *JUNOS BGP and MPLS Configuration Guide, Chapter 1, Configuring BGP Routing*.

To configure a virtual router:

- Create and name a VR in Configuration mode.

```
host1(config)#virtual-router western
host1:western(config)#
```

- Create a VRF to provide forwarding information to your router. In this example, the VRF created is in context with the VR created above.

```
host1:western(config)#ip vrf eastern
Proceed with new VRF creation? [confirm]
host1:western(config-vrf)#virtual-router:eastern
host1:western:eastern(config)#
```

- Access a VRF from the context of a different VR.

```
host1(config)#virtual-router western:eastern
host1:western:eastern(config)#
```

- View your configuration choices from a VR or VRF context.

```
host1:western:eastern(config)#?
aaa                                Configure authentication, authorization,
                                and accounting characteristics
access-list                       Configure an access list entry
arp                               Configure a static ARP entry
bandwidth                         Configure slot-group bandwidth control
banner                           Define a banner line
baseline                         Configure baseline operations
boot                             Configure boot time behavior
bulkstats                        Configure bulkstats parameters
classifier-list                   Configure a classifier list entry
clns                             Configure CLNS characteristics
clock                            Set the system's clock
controller                       Configure controller parameters
crypto                           Configure cryptographic parameters
disable-autosync                 Disable automatic synchronization of
                                redundant system controller file system
disable-switch-on-error          Disable automatic switch to redundant system
                                controller upon software/hardware error
enable                           Configure security related options
end                               Exit Global Configuration mode
exception                        Configure core dump
exclude-subsystem                Exclude copying a subsystem from the release
exit                              Exit from the current command mode
ftp-server                       Configure FTP Server characteristics
help                             Describe the interactive help system
host                             Add/modify an entry to the host table
hostname                         Set the host (system) name
interface                        Enter Interface Configuration mode
ip                               Configure IP characteristics
l2tp                             Configure L2TP parameters
license                          Configure licenses
```

```

line                Enter Line Configuration mode
log                 Configure logging settings
macro               Run a CLI macro
map-list            Create an NBMA static map
memory              Configure and administer memory operations
mpls                Configure MPLS global parameters
no                  Negate a command or set its default(s)
ntp                 Configure the Network Time Protocol
policy-list         Enter Policy Configuration mode
pppoe               Configure PPPoE
profile             Specify a profile
radius              Configure RADIUS server
rate-limit-profile  Enter rate limit profile configuration mode
redundancy           Perform a redundancy configuration
route-map           Configure a route map
router              Configure a routing protocol
rtr                 Configure rtr parameters
service             Configure system-level services
set                 Configure
sleep               Make the Command Interface pause for a
                    specified duration
slot                Configure and administer slot operation
snmp-server          Configure SNMP parameters
sscc                 The SSC Client
telnet              telnet daemon configuration
timing              Configure network timing
traffic-shape-profile Enter traffic shape profile configuration mode
virtual-router       Specify a virtual router
host1:western:eastern(config)#

```

- View the VRF configuration choices from VRF Configuration mode.

```

host1:western(config-vrf)#?
exit                Exit from the current command mode
export              Specify VRF export characteristics
help                Describe the interactive help system
import              Specify VRF import characteristics
log                 Configure logging settings
macro               Run a CLI macro
no                  Negate a command or set its default(s)
rd                  Specify route distinguisher
route-target         Specify VPN extended community Target
sleep               Make the Command Interface pause for a
                    specified duration
host1:western(config-vrf)#

```

- Access a VR to configure it with an interior gateway protocol (IGP) or exterior gateway protocol (EGP) to learn routes from a customer edge (CE) device. See the related routing protocol chapters for detailed information.

**Example 1**  
**VR with an IGP**

```

host1(config)#virtual-router miami
host1:miami(config)#router ospf 5
host1:miami(config-router)#

```

**Example 2**  
**VR with an EGP**

```

host1(config)#virtual-router western
host1:western(config)#router bgp 359
host1:western(config-router)#

```

- Configure a Telnet daemon to listen in VRs other than the default VR.

```
host1(config)#virtual-router boston
host1:boston(config)#telnet listen port 23
```

- List all VRs and VRFs on the router.

```
host1#show virtual-router
Virtual Router : default
Virtual Router : thursday
Virtual Router : western
                  VRF : eastern
Virtual Router : boston
Virtual Router : miami
Virtual Router : northern
                  VRF : southern
host1#
```

- Map a VR to a user domain name in Domain Map Configuration mode. The VR must already exist.

```
host1(config)#aaa domain-map jacksonville
host1(config-domain-map)#virtual-router western
host1(config-domain-map)#
```

### ***aaa domain-map***

- Use to map a user domain name to a virtual router.
- Examples

```
host1-0-1-90(config)#aaa domain-map juniper.net vrouter_1
host1-0-1-90(config)#aaa domain-map none vrouter__all_purpose
host1-0-1-90(config)#aaa domain-map DEFAULT vrouter_all_purpose
```

- Use the **no** version to delete the domain map.

### ***ip vrf***

- Use to create a VRF or access VRF Configuration mode to configure a VRF.
- You must specify a route distinguisher after you create a VRF. Otherwise, the VRF will not operate.
- Example
 

```
host1-00-02-80:boston(config)#ip vrf vpn-A
```
- Use the **no** version to remove a VRF.

### ***telnet listen***

- Use to create a Telnet daemon to listen in a virtual router.
- Example
 

```
host1(config)#virtual-router 3
host1:3(config)#telnet listen port 3223
```
- Use the **no** version to delete the daemon.

**virtual-router**

- From Global Configuration mode, use this command to create a virtual router or access the context of a previously created virtual router or a VRF.
- From Domain Map Configuration mode, use this command to map the VR to a user domain name. Use the **no** version in this mode to delete the VR parameter and assign the default VR.
- A VR name consists of 1–32 alphanumeric characters.
- After you are in the context of a particular VR or VRF (indicated by the change in the prompt), all subsequent commands you enter apply to that context until you exit the context.
- Use the **no** version of the command only to delete the VR and return the router to the default VR. Issuing the command **no virtual-router vrName.vrfName** has no effect.
- Issuing a **no** version of this command (**no virtual-router :vrfName** or **no virtual-router vrName:vrfName**) that specifies an existing VRF displays only the error message: “Cannot delete a VRF with this command.” You must use the **no ip vrf** command to remove a VRF.



**NOTE:** See the *JUNOS Command Reference Guide* for additional information.

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- Use the **wait-for-completion** keyword with the **no** version if you require a synchronous deletion of a VR, such as when executing Telnet or console commands through an external script. Alternatively, you might want to use this keyword if the VR being deleted has many configured VRFs and someone might attempt to re-create the VR before all the VRFs have been deleted. If you do not issue the **wait-for-completion** keyword in those circumstances, a **virtual-router** command issued as soon as the prompt appears could fail because the router is still deleting VRFs. You can specify a period during which the CLI waits before it returns a prompt. If you do not specify a wait time, then the CLI does not return a prompt until the operation is complete. You can press Ctrl + c to break out of the wait period early.

## Monitoring Virtual Routers

Use the **show virtual-router**, the **show configuration virtual-router**, and **show aaa domain-map** commands to display virtual router and user-domain-to-virtual-router mapping information. Use the **show ip forwarding table** command to display information about memory usage by virtual routers.

### **show aaa domain-map**

- Use to display the mapping between user domains and virtual routers.
- The following keywords have significance when used as user domains:
  - **none**—All client requests with no user domain name are associated with the virtual router mapped to the *none* entry
  - **default**—All client requests with a domain present that has no map are associated with the virtual router mapped to the *default* entry

#### ■ Example

```
host1#show aaa domain-map
```

```
Domain: boston; virtual-router: default
```

Tunnel Tag	Peer	Source	Type	Medium	Password	Tunnel Id	Hostname
31	<null>	<null>	12tp	ipv4	<null>	<null>	<null>

Tunnel Tag	Tunnel Server Name	Tunnel Preference
31	<null>	2000

### **show configuration virtual-router**

- Use to display configuration information for the virtual routers configured on your router.
- You can create a configuration script from the output by saving it as a file with the .scr extension.
- You can exclude information about a particular type of interface.
- You can use the output filtering feature of the **show** command to include or exclude lines of output based on a text string that you specify. See *Chapter 2, Command-Line Interface*, for details.

#### ■ Example

```
host1#show configuration virtual-router default
```

```
virtual-router default
ip domain-lookup
ip name-server 10.2.0.3
ip domain-name "junipercom.com"
!
host f 10.10.0.129 ftp anonymous null
interface null 0
!
interface fastEthernet 0/0
ip address 192.168.1.155 255.255.255.0
!
ip route 0.0.0.0 0.0.0.0 192.168.1.1
```



```

no ip multicast-routing
!
mpls rsvp profile default
mpls ldp profile default
!
rtr 1
  type echo protocol ipIcmpEcho 10.5.0.200 source fastEthernet0/0
  frequency 1
  samples-of-history-kept 5
  timeout 10000
!

```

### **show ip forwarding-table slot**

- Use to display the memory used by each VR configured on a line module and free memory available on the line module.
- Field descriptions
  - Free Memory—Amount of memory free on the line module, in kilobytes
  - Virtual Router—Name of the virtual routers configured on the line module
  - Memory (KB)—Amount of memory consumed by the VR, in kilobytes
  - Load Errors—Counts errors made while loading the routing table on the line module
  - Status—Indicates whether the routing table for the VR is valid
- Example

host1#show ip forwarding-table slot 9

Free Memory = 14,328KB

Virtual Router	Memory (KB)	Load Errors	Status
vr1	4128	0	Valid
vr2	3136	0	Valid
vr3	2256	0	Valid
vr4	1512	0	Valid
default	1024	0	Valid

### **show virtual-router**

- Use to display the virtual routers and VRFs configured on your router.
- Use the **summary** keyword to display only the total number of virtual routers and the total number of VRF instances.
- Use the **detail** keyword to display the status of the routing protocols configured for each virtual router.
- Use the **summary** keyword with the **detail** keyword to display the number of VRF instances for each virtual router.
- Use the output filtering feature of the **show** command to include or exclude lines of output based on a text string you specify. See *Chapter 2, Command-Line Interface*, for details.

■ Example 1

```

host1#show virtual-router
Virtual Router : default
Virtual Router : vr1
    VRF : eastern
    VRF : western
    VRF : northern
    VRF : southern
Virtual Router : vr2
    VRF : eastern
    VRF : western
    VRF : northern
    VRF : southern
Virtual Router : vr3
    VRF : eastern
    VRF : western
    VRF : northern
    VRF : southern

```

■ Example 2

```

host1#show virtual-router detail
Virtual Router : default
    Ip:      Present
    Ipv6:    Not Present
    Mgtm:    Not Present
    Mgtmv6:  Not Present
    Bgp:     Not Present
    Isis:    Present
    Ospf:    Not Present
    Pim:     Not Present
    Rip:     Not Present
    Igmp:    Not Present
    Mld:     Not Present
    Dvmrp:   Not Present
Virtual Router : vr1
    Ip:      Present
    Ipv6:    Not Present
    Mgtm:    Present
    Mgtmv6:  Not Present
    Bgp:     Not Present
    Isis:    Present
    Ospf:    Present
    Pim:     Present
    Rip:     Not Present
    Igmp:    Not Present
    Mld:     Not Present
    Dvmrp:   Not Present

```

■ Example 3

```

host1#show virtual-router summary detail
Virtual Router default      VRF Count: 0
Virtual Router vr1         VRF Count: 4
Virtual Router vr2         VRF Count: 4
Virtual Router vr3         VRF Count: 4

Total VR Count: 4
    VRs with    VRFs Count: 3
    VRs without VRFs Count: 1
Total VRF Count: 12
Total Count    : 16

```