Chapter 47

Virtual Router Redundancy Protocol (VRRP)

Introduction

This chapter describes the Virtual Router Redundancy Protocol (VRRP) support provided by the router, and how to configure the router to participate in a virtual router.

One of the functions performed by routers is to act as a gateway to the WAN for hosts on a local LAN. On larger LANs, two or more routers may act as the gateway, and a dynamic routing protocol such as RIP or OSPF is used by hosts to determine the gateway router to use as the next hop in order to reach a specific IP destination. However, there are a number of factors, such as administrative or processing overhead, that may make it undesirable to use a dynamic routing protocol. One alternative is to use static routing. However, if the statically configured first hop router fails, the hosts on the LAN are unable to communicate with hosts on the WAN.

The Virtual Router Redundancy Protocol, defined in RFC 2338, provides a solution to the problem by combining two or more physical routers into a logical grouping called a *virtual router* (VR). The physical routers in the virtual router operate together to provide a single logical gateway for hosts on the LAN.

Some interface and port types mentioned in this chapter may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the Hardware Reference.

Virtual Router Redundancy Protocol

The virtual router has a virtual MAC address known by all the routers participating in the virtual router. The virtual MAC address is derived from the *virtual router identifier*, which is a user defined value from 1 to 255. All hosts on the LAN are configured with an IP address to use as the first hop. Typically this IP address is owned by the preferred router amongst the group of routers that constitute the virtual router. When available, this router is responsible for performing the duties of the virtual router. The router that is currently performing the duties of the virtual router is referred to as the *master*. The router that owns the IP address associated with the virtual router is referred to as the *preferred master*. A virtual router where none of the participating routers owns the IP address can be configured, and such a virtual router has no preferred master.

When a router takes the role of master for a virtual router, it is responsible for:

- Responding to ARP packets for the IP address(es) associated with the virtual router. The ARP response contains the virtual MAC address of the virtual router so that the hosts on the LAN associate the virtual MAC address with their configured first hop IP address.
- Forwarding packets with a destination link layer MAC address equal to the virtual router MAC address.
- Accepting packets addressed to the IP address(es) associated with the virtual router, but only if it actually owns the address(es).
- Broadcasting advertisement packets at regular intervals (the specified advertisement interval) to inform backup routers that it is still acting as the master router.

Each of the other routers participating in the virtual router is considered to be a *backup* router. A router can be part of several different virtual routers on one LAN, provided all the virtual routers have different virtual router identifiers. When a router has the role of backup for a virtual router, it is responsible for:

- Receiving advertisement packets from the master and checking that the information contained in them is consistent with their own configuration; ignoring and discarding advertisement packets that do not match.
- Assuming the role of master for the virtual router if an advertisement packet is not received for a given period, (the "*master-down*" time), based on the specified advertisement interval. The "master-down" time is approximately three times the advertisement interval.
- Assuming the role of master if it receives an advertisement packet from another router with a lower priority than its own, if preempt mode is on.

When the master router fails a backup router assumes control. Traffic is processed by the backup router. The user does not get a response to ping or Telnet to the VRRP unless the router owns this address. This is in accordance to RFC standard.

If a backup router is about to assume the role of master of the VR because it has not received an advertisement for the "master-down" period, it firsts check the operational status of the interface to which the VR is attached. If the interface is 'down', it does not enter the master state. Instead, it stays in the backup state and checks the interface again after another "master-down" period, assuming it does not receive an advertisement during that time.

Interface Monitoring

Specific interfaces can be monitored with the virtual router to change the priority of routers should the master router lose its connection to the outside world. This is known as *interface monitoring*. Interface monitoring reduces the priority of the router when an important interface connection is lost. The reduction in priority causes a backup router with a higher priority to take over as master.

A monitored interface is one that the virtual router is dependent on for full operation. VRRP is informed if the operational status of the interface changes. If the interface is not operational, the router's priority is reduced.

If a master router loses its connection to the outside world, the connection to the LAN is not affected. Advertisement packets are still sent by the master, and received by the backup routers, but the master is actually unable to send data to other networks as its connection to the outside world has been lost. Interface monitoring in this situation reduces the current master's priority, causing a backup router to takeover as master, restoring connectivity.

Port Monitoring

Ports that are part of a VLAN over which a VR is running can be monitored to detect port failure. This is known as *port monitoring*. Port monitoring ensures that if a port fails, or is disabled, the VRRP priority is reduced by a configured step value or by an amount that reflects the proportion of the VLAN's ports that are out of service. If the router is the master, and a backup router has a higher priority, the backup router preempts the master and becomes the new master.

Port monitoring is a way of implementing a connectivity metric. When the connectivity to the VLAN changes, the router drops its priority proportionally or by a specific amount when you use **stepvalue** in the command:

```
set vrrp=vr-identifier [portmonitoring={on|off}]
   [stepvalue={stepvalue|proportional}]
```

If the STEPVALUE parameter is specified, the priority of the VR is reduced by this value each time a VLAN port fails or is disabled.

If **proportional** is specified, the virtual router reduces the priority to a percentage of the original priority in proportion the percentage of available ports. For example, if a router has five ports and a port fails, the router drop its priority by a fifth of the original priority.

Configuring VRRP

By default, the VRRP module is disabled. When a virtual router is created on the router, it is enabled by default, but the VRRP module must be enabled before it is operational. The VRRP module or a specific virtual router can be enabled or disabled afterwards by using the commands:

```
enable vrrp[={vr-identifier|all}]

disable vrrp[={vr-identifier|all}]
```

A virtual router must be created on at least two routers before it operates correctly. To create a virtual router for an IP address over an Ethernet interface, so that the router participates in the virtual router, use the command:

```
create vrrp=vr-identifier over=physical-interface
   ipaddress=ipadd [adinterval=1..255] [adoptvrip={on|off}]
   [authentication={none|plaintext}] [password=password]
   [portmonitoring={on|off} [stepvalue={stepvalue|
   proportional}]] [preempt={on|off}] [priority=1..254]
```

To destroy a virtual router on the LAN, it must be removed from all participating routers. To remove a virtual router so that the router no longer participates in it, use the command:

```
destroy vrrp={vr-identifier|all}
```

If the router in the master role for the virtual router becomes unavailable, the master role is taken by the router with the highest *priority* amongst the available routers. The priority is a value from 1 to 255, with a default of 100. The highest value of 255 is reserved for the router that owns the virtual router's IP address. The new master takes over all the responsibilities of the original master. Hosts on the LAN can continue sending packets to the same virtual MAC address with which they associate the configured first hop IP address,

even though the router that owns the IP address is not currently available. When the preferred router that owns the IP address becomes available again, it resumes the role of master. By default, when a router with a higher priority than the current master becomes available, it takes over as master. This is referred to as *preempt* mode and can be off or on. Even with preempt mode off, the router that owns the IP address always becomes the master when available. (Should two available routers be configured with the same priority value, the one with the highest IP address has higher priority for assuming the master role.) The preempt mode must be the same for all routers in the virtual router. The priority and preempt mode can be set when the virtual router is created on the router, or modified using the commands:

```
set vrrp=vr-identifier [preempt={on|off}] [priority=1..254]
```

The frequency with which the master sends advertisement packets must be set to the same value for all routers in the virtual router. The default advertisement interval of 1 second is recommended for most networks. However, to modify this interval when creating the virtual router or later, use the command:

```
set vrrp=vr-identifier adinterval=1..255
```

Each of the routers in the virtual router can be configured for plaintext authentication, or for no authentication. No authentication is suitable where there is minimal security risk, and the configuration is so simple (for example, two routers on a LAN) that there is little chance of configuration errors. Plaintext password authentication protects against accidental misconfiguration and prevents a router from inadvertently backing up another router. The authentication type and, in the case of plaintext authentication, the password, must be the same value for all routers in the virtual router. By default, the virtual router is no authentication. The authentication is set for the virtual router when it is created on each router. To modify it, use the command:

```
set vrrp=vr-identifier authentication={none|plaintext}
   [password=password]
```

In order for the security level of the LAN to be maintained, each router in the virtual router must have at least the minimum allowable level of security.

VRRP debugging displays data that may be useful for troubleshooting VRRP. To enable or disable VRRP debugging, use the commands:

```
enable vrrp={vr-identifier|all} debug
```

```
disable vrrp={vr-identifier|all} debug
```

A virtual router is always created to backup one primary IP address on all the routers in the virtual router. Up to 16 secondary IP addresses can be backed up by the same virtual router, as long as they are compatible with the IP address and mask associated with the Ethernet interface over which the IP address of the virtual router is operating. Such secondary addresses must be added to all the routers in the virtual router. The virtual router's primary IP address cannot be deleted.

To add or remove secondary IP addresses, use the commands:

```
add vrrp=vr-identifier ipaddress=ipadd
```

```
delete vrrp=vr-identifier ipaddress=ipadd
```

To add or remove a monitored interface to or from a virtual router, use the commands:

```
add vrrp=vr-identifier monitoredinterface=monitored-interface
   [newpriority={1..254}]
```

```
delete vrrp=vr-identifier monitoredinterface=monitored-
   interface
```

A monitored interface is one that the virtual router is dependent on for full operation. VRRP is informed if the operational status of the interface changes. If the interface is not operational, the router's priority is reduced.

It is important that all routers involved in a virtual router be configured with the same values for:

- the VRRP virtual router identifier
- IP address
- advertisement interval
- preempt mode
- authentication type
- password

Inconsistent configuration causes advertisement packets to be rejected and the virtual router does not perform properly.

Adopting the VRRP IP Address

Benefits The VRRP master router can *adopt* the IP address of the virtual router (VR), and respond to the following packets destined for the VR IP address, even if it does not own this IP address on any of its interfaces:

- ICMP echo requests (pings)
- Telnet and SSH connection requests
- HTTP and SSL GUI management requests
- SNMP requests, and
- DNS relay requests

VRRP IP Address Adoption allows continuous accessibility of the VR IP address even as the VR master changes. Using this feature:

- You can easily tell whether the VR is functioning, by pinging the single VR IP address.
- You can easily monitor the performance of the VR, regardless of which participating router is acting as master.
- DNS relay can continue functioning via the same IP address at all times.

Risks When VR IP Address Adoption is used, the master router accepts packets destined for the virtual router, even though it may not own this IP address. This does not conform to RFC 2338. Because the same IP address refers to different devices at different times, there is a risk of confusion arising. This risk can be reduced by a suitable network management policy.

Recommendations Before using VR IP address adoption, consider the following guidelines to avoid confusion:

- Ensure that the VR has an IP address that is different from the interface IP addresses of any of the individual routers in the VR.
- Ensure that all routers in the virtual router use VRRP IP Address Adoption (or that none do).

- Use the VR IP address to monitor the VR master. Be aware that this does not give information about one particular participating router, but about the current VR master, whichever participating router is acting as the master at the time.
- When changing the configuration of the participating routers using Telnet, GUI or SNMP, configure each device individually by pointing to their individual IP addresses.
- When changing the configuration of the participating routers, do not use the VR IP address. Only one device, the VR master, is responding to this IP address, and you may not know which device it is.

Configuration

To configure VR IP Address Adoption, use **adoptvrip** in the **create vrrp** or **set vrrp** commands:

```
create vrrp=vr-identifier over=physical-interface
   ipaddress=ipadd [adoptvrip={on|off}] [other-vrrp-
   parameters]

set vrrp=vr-identifier [adoptvrip={on|off}] [other-vrrp-
   parameters]
```

Adoptvrip specifies that when the switch is acting as the VRRP master it should respond to requests directed at any IP address that it is backing up, even if it does not own that address. If it does not own the address the access requests that the switch will permit are limited to: ICMP echo requests (pings), Telnet, SSH, HTTP and SSL GUI, SNMP and DNS relay. All other types of access to the address will be ignored. The default is OFF.

Configure all the routers in a virtual router with the same values for:

- the VRRP virtual router identifier
- IP address
- adopt VR IP address mode
- advertisement interval
- preempt mode
- authentication type
- password

Inconsistent configuration causes advertisement packets to be rejected and the virtual router does not perform properly.

To display the value of **adoptvrip**, use the command:

```
show vrrp
```

Triggers

The Trigger Facility can be used to automatically run specified command scripts when particular triggers are activated. When a trigger is activated by an event, parameters specific to the event are passed to the script that is run. For a full description of the Trigger Facility, see Chapter 30, Trigger Facility. Triggers can be created for two VRRP events: when the router becomes a master, and when it ceases to be a master and becomes a backup router for a virtual router.

Module To identify the module as VRRP in trigger commands use the parameter **module={vrrp|88}**.

Event DOWNMASTER

Description A virtual router has been disabled or destroyed on a router with a priority of 255, or the router has been superseded as master for a virtual router by another router with a higher priority, and has become a backup.

Parameters The following command parameter(s) can be specified in the **create/set trigger** commands:

Parameter	Description
vrid=0..255	The virtual router identifier of the virtual router for which the router has ceased to be master, and become a backup. This parameter is required in the **create trigger** command for VRRP triggers, and is optional in the **set trigger** command.

Script Arguments The trigger passes the following argument(s) to the script:

Argument	Description
%1	The virtual router identifier.

Event UPMASTER

Description A virtual router has been created or enabled on a router with a priority of 255, or the router has assumed the role of master for the virtual router because it has the highest priority of the routers currently available to participate in the virtual router.

Parameters The following command parameter(s) can be specified in the **create/set trigger** commands:

Parameter	Description
vrid=0..255	The virtual router identifier of the virtual router for which the router has become the master. This parameter is required in the **create trigger** command for VRRP triggers, and is optional in the **set trigger** command.

Script Arguments The trigger passes the following argument(s) to the script:

Argument	Description
%1	The virtual router identifier for which the event occurs.

To create or modify a module trigger, use the commands:

```
create trigger=trigger-id module=module event=event [module-
   parameters...] [after=hh:mm] [before=hh:mm] [{date=date|
   days=day-list}] [name=name] [repeat={yes|no|once|forever|
   count}] [script=filename...] [state={enabled|disabled}]
   [test={yes|no|on|off|true|false}]

set trigger=trigger-id [module] [module-parameters...]
   [after=hh:mm] [before=hh:mm] [{date=date|days=day-list}]
   [name=name] [repeat={yes|no|once|forever|count}]
   [test={yes|no|on|off|true|false}]
```

Example To create trigger 1 that activates whenever the router becomes the master of the virtual router with a VRID of 25, initiating the script MAST.SCP, use the command:

```
cre trig=1 mod=vrrp ev=upmaster vrid=25 sc=mast.scp rep=yes
```

To modify trigger 1 to activate whenever the router becomes the master for virtual router 26, use the command:

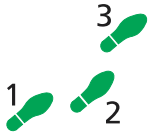
```
set trig=1 vrid=26
```

Configuration Example

The following examples illustrate how to configure a virtual router in a LAN.

Preferred master with a backup router

This example illustrates how to configure a virtual router with a preferred master and a backup. Router A owns the IP address of the virtual router, and always assumes the role of master whenever it is available. Router B is the backup, and assumes the role of master, backing up this IP address if A becomes unavailable. No authentication is used for this simple virtual router.



To configure a virtual router with a preferred master and a backup router

1. **Configure IP.**

   On router A, add an IP interface to the physical interface for the virtual router.

   ```
   enable ip

   add ip interface=eth0 ipaddress=192.168.1.1
   ```

   On router B, add a different IP interface to the physical interface for the virtual router.

   ```
   enable ip

   add ip interface=eth0 ipaddress=192.168.1.2
   ```

2. Create the virtual router.

On router A, create the virtual router for this IP address with a virtual router identifier of 1.

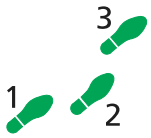
```
enable vrrp
create vrrp=1 over=eth0 ipaddress=192.168.1.1
```

On router B, create the same virtual router.

```
enable vrrp
create vrrp=1 over=eth0 ipaddress=192.168.1.1
```

Authenticated virtual router with no preferred master

This example illustrates how to configure a virtual router with its own IP address. The address is not owned by any of the routers participating in the virtual router. Router A has a higher priority for becoming the master, Router B has the next highest priority, and Router C takes the master role when neither A nor B are available. The default preempt mode ensures that the highest priority router resumes the master role when available, from a lower priority router acting as master. Plaintext authentication protects against accidental misconfiguration.



To configure a virtual router with a preferred master and a backup router

1. Configure IP.

On router A, add an IP interface to the physical interface for the virtual router.

```
enable ip
add ip interface=eth0 ipaddress=192.168.1.1
```

On router B, add a different IP interface to the physical interface.

```
enable ip
add ip interface=eth0 ipaddress=192.168.1.2
```

On router C, add a third IP interface.

```
enable ip
add ip interface=eth0 ipaddress=192.168.1.3
```

2. Create the virtual router.

On router A, create virtual router 2 with IP address 192.168.1.4, plaintext authentication with password "trip4e", and a high priority.

```
enable vrrp
create vrrp=2 over=eth0 ipaddress=192.168.1.4
   authentication=plaintext password=trip4e priority=254
```

On router B, create the same virtual router, with a lower priority.

```
enable vrrp
create vrrp=2 over=eth0 ipaddress=192.168.1.4
   authentication=plaintext password=trip4e priority=200
```

On router C, create the same virtual router, with the default priority of 100.

```
enable vrrp
create vrrp=2 over=eth0 ipaddress=192.168.1.4
   authentication=plaintext password=trip4e
```

The default preempt mode makes sure the highest priority router available always takes the master role. If there are no significant disadvantages to the lower priority routers having the master role, and changes where the router takes the master role are to be avoided (for instance, if there is a high cost associated with each change), turn the preempt mode off on all three routers by using the command: **`set vrrp=2 preempt=off`**.

Command Reference

This section describes the commands available on the router to configure and manage virtual routers using VRRP.

VRRP requires the IP module to be enabled and configured correctly. See Chapter 14, Internet Protocol (IP) for detailed descriptions of the commands required to enable and configure IP.

Some interface and port types mentioned in this chapter may not be supported on your router. The interface and port types that are available vary depending on your product's model, and whether an expansion unit (PIC, NSM) is installed. For more information, see the Hardware Reference.

The shortest valid command is denoted by capital letters in the Syntax section. See "Conventions" on page -xcv of , Preface in the front of this manual for details of the conventions used to describe command syntax. See Appendix A, Messages, for a complete list of messages and their meanings.

add vrrp

Syntax `ADD VRRP=`*`vr-identifier`* `IPaddress=`*`ipadd`*

where:

- *vr-identifier* is a decimal number from 1 to 255.
- *ipadd* is an IP address in dotted decimal form.

Description This command adds a secondary IP address to the group of IP addresses that are backed up by the specified virtual router. The maximum number of secondary IP addresses is 16.

The IPADDRESS parameter specifies the new IP address to be added to the group of IP addresses backed up by the virtual router. The IP address must be compatible with the IP address and mask associated with the Ethernet interface over which the virtual router is operating.

The new IP address must be added to all the routers participating in the virtual router.

Examples To add the IP address 202.36.163.159 to the group of IP addresses that are backed up by the virtual router whose VRID is 25, use the command:

```
add vrrp=25 ip=202.36.163.159
```

Related Commands **delete vrrp**
show vrrp

add vrrp monitoredinterface

Syntax

```
ADD VRRP=vr-identifier
   MONitoredinterface=monitored-interface
   [Newpriority={1..254}]
```

where:

- *vr-identifier* is a decimal number from 1 to 255.
- *monitored-interface* is a valid interface name .

Description This command adds a new monitored interface to a virtual router. The monitored interface is one that the VR is dependent on for full operation. VRRP is informed of changes in the interface's operational status. If the interface is not operational, the router's priority is reduced. If the interface becomes operational again, the router's priority is restored. If several monitored interfaces are down, the lowest new priority value is used.

The maximum number of interfaces that may be monitored by a virtual router is 60.

The VRRP parameter specifies the VRID of the VR that is dependent on the interface.

The MONITOREDINTERFACE parameter specifies the interface that the VR is dependent upon. This is usually an interface that provides a WAN link to the router and must not be the same interface over which the VR is operating (specified by the OVER parameter in the **create vrrp** command on page 54-14). Valid interfaces are:

- eth (e.g. eth0)
- FR (e.g. fr0)
- PPP (e.g. ppp0)
- syn (e.g. syn0)
- VLAN (e.g. vlan1)
- X.25T (e.g. x25t0)

The interface must already exist. To see a list of all currently available interfaces, use the show interface command on page 11-100 of *Chapter 11, Interfaces*.

The NEWPRIORITY parameter specifies the value that is to be used as the router's priority if the interface specified by the MONITOREDINTERFACE parameter becomes inoperative. The default is 50.

Examples To add the interface PPP1 to the group of interfaces monitored by the VR with VRID 5, use the command:

```
add vrrp=5 mon=ppp1 n=30
```

The NEWPRIORITY parameter indicates that, should interface PPP1 become inoperative, the new priority value for the router is 30.

Related Commands

create vrrp
delete vrrp monitoredinterface
destroy vrrp
show vrrp

create vrrp

Syntax

```
CREate VRRP=vr-identifier OVER=physical-interface
   IPaddress=ipadd [ADINTerval=1..255] [ADOPTvrip={ON|
   OFF}] [AUTHentication={NONE|PLAINtext}]
   [PASSword=password] [PORTMOnitoring={ON|OFF}
   [STEPVALue={stepvalue|PRoportional}]] [PREEmpt={ON|
   OFF}] [PRIOrity=1..254]
```

where:

- *vr-identifier* is a decimal number from 1 to 255.
- *physical-interface* is a valid physical interface name.
- *ipadd* is an IP address in dotted decimal form.
- *password* is the password to use for authentication 1 to 8 characters long. It may contain any printable character, and is case sensitive.
- *stepvalue* is a decimal number from 1 to 254.

Description This command creates a VRRP virtual router with the specified *vr-identifier* (VRID). If other VRRP virtual routers have been created on the LAN with the same VRID, the combined group forms a single virtual router. The combined virtual router performs the functions associated with the virtual router redundancy protocol. Note that the virtual router must be created on at least two routers for VRRP to operate correctly.

It is important that all routers involved in a virtual router be configured with the same values for:

- the VRRP virtual router identifier
- IP address
- adopt VR IP address mode
- advertisement interval
- preempt mode
- authentication type
- password

Inconsistent configuration causes advertisement packets to be rejected and the virtual router does not perform properly.

The ADINTERVAL parameter specifies the time interval in seconds between advertisement packets. The default is 1 second. Note that all routers participating in the same virtual router must be configured with the same value for this parameter.

The ADOPTVRIP parameter specifies that when the router is acting as the VRRP master it should respond to requests directed at any IP address that it is backing up, even if it does not own that address. If it does not own the address, the access requests that the switch permits are limited to: ICMP echo requests, Telnet, GUI, SNMP, and DNS relay. All other types of access to the address are ignored. The default is OFF.

Note that setting ADOPTVRIP to ON contradicts the RFC 2338 requirement that it "MUST NOT accept packets addressed to the IP address(es) associated with the virtual router if it is not the IP address owner".

Extreme caution should be exercised with this feature due to the confusion that may arise from the adoption of the IP address. When used, we recommend that the virtual router IP addresses be assigned to none of the participating switches and that accesses to the IP address(es) be restricted to monitoring operation and not used to configure the switches.

The AUTHENTICATION parameter specifies the type of authentication to be used by VRRP. If NONE is specified, no authentication is used. If PLAINTEXT is specified, a plaintext password is included in all transmitted VRRP packets. VRRP packets without the password are discarded when received. If PLAINTEXT is specified, then the PASSWORD parameter is required. The default is NONE. All routers in the same virtual router must be configured with the same password.

The IPADDRESS parameter specifies the primary IP address backed up by the virtual router. The IP address must be compatible with the IP address and mask associated with the Ethernet interface over which the virtual router is operating. All routers in the same virtual router must be configured with the same IP address.

The OVER parameter specifies the Ethernet interface over which the virtual router sends and receives packets. Valid interfaces are:

- eth (e.g. eth0)
- VLAN (e.g. vlan1)

The interface must already exist. To see a list of interfaces that are currently available, use the **show interface** command on page 7-66 of Chapter 7, Interfaces.

The PASSWORD parameter specifies the character string to be used to authenticate the VRRP packets that are exchanged. If authentication is PLAINTEXT, the PASSWORD parameter is required. If authentication is NONE, the PASSWORD parameter is invalid. All routers in the same virtual router must be configured with the same password.

The PORTMONITORING parameter is specified when the VR is providing redundancy over a VLAN. The PORTMONITORING parameter specifies whether the VRRP should monitor the ports of the VLAN and alter the priority value if ports fail or are disabled. If the PORTMONITORING parameter is set to ON, the STEPVALUE parameter may also be specified. The default is OFF.

The PREEMPT parameter specifies whether a higher priority router preempts a lower priority router acting as the master. If ON is specified, preempt mode is used. If OFF is specified, preempt mode is not used. The preferred master (with a priority of 255) always assumes the master role when it is available, regardless of the setting of this parameter. The default is ON. Note that all routers in the same virtual router must be configured with the same value for this parameter.

The PRIORITY parameter specifies the router's priority for becoming the master for the virtual router. The higher the value the greater the priority of the router. The value of 255 is reserved for the router that is the preferred master (the router owning the virtual router's IP address), and this value cannot be specified by the user. The PRIORITY parameter defaults to 255 for the preferred master, regardless of the value specified with this command. The default for all other routers is 100.

The STEPVALUE parameter specifies the value by which the priority of the VR should be decremented each time a VLAN port fails, or is disabled when the PORTMONITORING parameter is set to ON. If PROPORTIONAL is specified, the VR reduces the priority in proportion to the percentage of available ports.

Examples To create a virtual router with a virtual router identifier of 25 and a priority of 130 to back up the IP address 202.36.163.156, use the command:

```
cre vrrp=25 ip=202.36.163.156 prio=130
```

To create a virtual router with a virtual router identifier of 7, an IP address of 10.8.0.2 over *vlan1*, with the PORTMONITORING option enabled and a stepvalue of 45, use the command:

```
cre vrrp=7 over=vlan1 ip=10.0.8.2 portmo=ON stepval=45
```

Related Commands

add vrrp
destroy vrrp
set vrrp
show vrrp

delete vrrp

Syntax `DELete VRRP=`*`vr-identifier`* `IPaddress=`*`ipadd`*

where:

- *vr-identifier* is a decimal number from 1 to 255.
- *ipadd* is an IP address in dotted decimal form.

Description This command deletes a secondary IP address from the group of IP addresses backed up by the specified virtual router.

The IPADDRESS parameter specifies the IP address that is to be deleted from the group of secondary IP addresses backed up by the virtual router. This IP address must also be deleted from all other routers involved in the specified virtual router. It is impossible to delete the virtual router's primary IP address, specified when the virtual router was created.

Examples To delete IP address 202.36.163.159 from the group of IP addresses backed up by virtual router 25, use the command:

```
del vrrp=25 IP=202.36.163.159
```

Related Commands
add vrrp
disable vrrp
show vrrp

delete vrrp monitoredinterface

Syntax `DELete VRRP=`*`vr-identifier`* `MONitoredinterface=`*`monitored-interface`*

where:

- *vr-identifier* is a decimal number from 1 to 255.
- *monitored-interface* is a valid interface name.

Description This command deletes a monitored interface from a virtual router. The monitored interface is one that the VR is no longer dependent on for full operation. Valid interfaces are:

- eth (e.g. eth0)
- FR (e.g. fr0)
- PPP (e.g. ppp0)
- syn (e.g. syn0)
- VLAN (e.g. vlan1)
- X.25T (e.g. x25t0)

The interface must already have been assigned and configured. To see a list of all currently available interfaces, use the **show interface** command on page 7-66 of Chapter 7, Interfaces.

Examples To delete the interface PPP0 from the group of interfaces monitored by the VR with VRID 5, use the command:

```
del vrrp=5 mon=ppp0
```

Related Commands
create vrrp
add vrrp monitoredinterface
destroy vrrp
show vrrp

destroy vrrp

Syntax `DESTroy VRRP={`*`vr-identifier`*`|ALL}`

where *vr-identifier* is a decimal number from 1 to 255

Description This command removes the specified VRRP virtual router from the group that forms the specified VRRP virtual router. If ALL is specified the router is removed from all the virtual routers in which it is participating. To completely destroy a virtual router on the LAN, you must destroy all the routers participating in it.

Examples To stop the router participating in virtual router 25, use the command:

```
dest vrrp=25
```

Related Commands
create vrrp
disable vrrp
show vrrp

disable vrrp

Syntax `DISable VRRP[={`*`vr-identifier`*`|ALL}]`

where *vr-identifier* is a decimal number from 1 to 255

Description This command disables the VRRP module on the router, or disables the router's participation in the specified virtual router. An error message is displayed if an attempt is made to disable a VRRP module that is already disabled. If ALL is specified, the router's participation in all its current virtual routers is disabled. The VRRP module is disabled by default, and virtual routers are enabled by default when they are created. Both the VRRP module and the virtual router must be enabled for the virtual router to operate.

Examples To disable the VRRP module on the router, use the command:

```
dis vrrp
```

To disable the router from participating in virtual router 25, use the command:

```
dis vrrp=25
```

Related Commands
destroy vrrp
enable vrrp
set vrrp
show vrrp

disable vrrp debug

Syntax `DISable VRRP={`*`vr-identifier`*`|ALL} DEBug`

where *vr-identifier* is a decimal number from 1 to 255

Description This command disables the display of debugging data for the specified virtual router or all virtual routers. VRRP debugging is disabled by default.

Examples To disable the display of debugging data for virtual router 25, use the command:

```
dis vrrp=25 deb
```

Related Commands
enable vrrp debug
show vrrp

enable vrrp

Syntax `ENAble VRRP[={`*`vr-identifier`*`|ALL}]`

where *vr-identifier* is a decimal number from 1 to 255

Description This command enables the VRRP module on the router, or enables the router's participation in the specified virtual router. An error message is displayed if an attempt is made to enable a VRRP module that is already enabled. If ALL is specified, the router's participation in all its current virtual routers is enabled. The VRRP module is disabled by default, and virtual routers are enabled by default when they are created. Both the VRRP module and the virtual router must be enabled for the virtual router to operate.

Examples To enable the router to participate in virtual router 25, use the command:

```
ena vrrp=25
```

Related Commands
add vrrp
create vrrp
disable vrrp
show vrrp

enable vrrp debug

Syntax `ENAble VRRP={`*`vr-identifier`*`|ALL} DEBug`

where *vr-identifier* is a decimal number from 1 to 255

Description This command enables the display of debugging data for the specified virtual router or all virtual routers. The data displayed includes:

- The contents of advertisement packets that are sent
- The contents of advertisement packets that are received
- Notification of state changes that occur within the VRRP state machine
- Information about bad VRRP advertisement packets that are received.

VRRP debugging is disabled by default.

Example To enable the display of debugging information for all the virtual routers in which the router is participating, use the command:

```
ena vrrp=all deb
```

Related Commands **disable vrrp debug**
show vrrp

set vrrp

Syntax
```
SET VRRP=vr-identifier [ADINTerval=1..255] [ADOPTvrip={ON|
   OFF}] [AUTHentication={NONE|PLAINtext}]
   [PASSword=password] [PORTMOnitoring={ON|OFF}
   [STEPVALue={stepvalue|PRoportional}]] [PREEmpt={ON|
   OFF}] [PRIOrity=1..254]
```

where:

- *vr-identifier* is a decimal number from 1 to 255.
- *password* is the password to use for authentication 1 to 8 characters long. It may contain any printable character, and is case sensitive.
- *stepvalue* is a decimal number from 1 to 254.

Description This command changes the parameters of the specified virtual router after the virtual router has been created.

It is important that all routers involved in a virtual router be configured with the same values for:

- the VRRP virtual router identifier
- IP address
- adopt VR IP address mode
- advertisement interval

- preempt mode
- authentication type
- password

Inconsistent configuration causes advertisement packets to be rejected and the virtual router does not perform properly.

The ADINTERVAL parameter specifies the interval in seconds between advertisement packets. The default is 1 second. Note that all routers participating in the same virtual router must be configured with the same value for this parameter.

The ADOPTVRIP parameter specifies that when the router is acting as the VRRP master, it should respond to requests directed at all IP addresses that it is backing up, even if it does not own the address. If it does not own the address, requests that the switch permits are limited to: ICMP echo requests, Telnet, GUI, SNMP and DNS relay. Other types of access to the address are ignored. The default is OFF.

Note that setting ADOPTVRIP to ON contradicts the RFC 2338 requirement that it "MUST NOT accept packets addressed to the IP address(es) associated with the virtual router if it is not the IP address owner".

Extreme caution should be exercised with this feature due to the confusion that may arise from the adoption of the IP address. When used, we recommend that the virtual router IP addresses be assigned to none of the participating switches and that accesses to the IP address(es) be restricted to monitoring operation and not used to configure the switches.

The AUTHENTICATION parameter specifies the type of authentication to be used by VRRP. If NONE is specified, no authentication is used. If PLAINTEXT is specified, a plaintext password is included in all transmitted VRRP packets.VRRP packets without the password are discarded when received. If PLAINTEXT is specified, then the PASSWORD parameter is required. The default is NONE. All routers in the same virtual router must be configured with the same password.

The PASSWORD parameter specifies the character string to be used to authenticate the VRRP packets that are exchanged. This parameter is valid if authentication is PLAINTEXT. All routers in the same virtual router must be configured with the same password.

The PORTMONITORING parameter is valid when the VR is providing redundancy over a VLAN. The PORTMONITORING parameter specifies whether the VRRP should monitor the ports of the VLAN and alter the priority value if ports fail or are disabled. If the PORTMONITORING parameter is set to ON, the STEPVALUE parameter may also be specified. The default is OFF.

The PREEMPT parameter specifies whether a higher priority router preempts a lower priority router acting as the master. If ON is specified, preempt mode is used. If OFF is specified, preempt mode is not used. The preferred master (with a priority of 255) always assumes the master role when it is available, regardless of the setting of this parameter. The default is ON. Note that all routers participating in the same virtual router must be configured with the same value for this parameter.

The PRIORITY parameter specifies the router's priority for becoming the master for the virtual router. The higher the value, the greater the priority of the router. The value of 255 is reserved for the router that is the preferred master (the router owning the virtual router's IP address), and this value cannot be specified by the user. The PRIORITY parameter defaults to 255 for the preferred master, regardless of the value specified with this command. The default for all other routers is 100.

The STEPVALUE parameter specifies the value by which the priority of the VR should be decremented each time a VLAN port fails, or is disabled when the PORTMONITORING parameter is set to ON. If a number is specified, the priority of the VR is reduced by this value each time a VLAN port fails or is disabled. If PROPORTIONAL is specified, the VR reduces the priority to a percentage of the original priority in proportion to the percentage of available ports. The value specified for the STEPVALUE parameter is retained when port monitoring is disabled.

Examples

To change the authentication settings of virtual router 25 to plaintext password authentication with password *baN8na*, use the following command:

```
set vrrp=25 auth=plain pass=baN8na
```

To enable the PORTMONITORING feature on the virtual router number 10 and set the step value to 100, use the following command:

```
set vrrp vrid=10 portmo=ON stepval=100
```

Related Commands

add vrrp
create vrrp
delete vrrp
destroy vrrp
disable vrrp
enable vrrp
show vrrp

show vrrp

Syntax

`SHow VRRP[=`*`vr-identifier`*`]`

where *vr-identifier* is a decimal number from 1 to 255

Description

This command displays information about the specified virtual router or all the virtual routers in which the router is participating (Figure 54-1 on page 54-22, Table 54-1 on page 54-23).

Figure 47-1: Example output from the **show vrrp** command

```
------------------------------------------------------------
Virtual Router Identifier ..... 1
  Configuration:
  VR MAC ADDRESS ................... 00-00-5E-00-01-01
  Interface ........................ ppp0
  Priority ......................... 255
  State ............................ INITIAL
  Authentication ................... None
  Password ......................... NOT SET
  IP Address(es)
  ................................. 202.36.163.156
  Advertisement Interval ........... 1
  Preempt Mode...................... ON
Port Monitoring .................... ON
  Step value ....................... 40
Monitored Interfaces:
  Interface ........................ ppp1
    New Priority ................... 40
  Interface ........................ ppp4
    New Priority ................... 55

Triggers:
  UpMaster Trigger ID .............. 0
  Down Master Trigger ID ........... 4

Counters:
  Good Advertisements Received ..... 0
  Bad Advertisements Received ...... 0
  Master Periods ................... 0
  Advertisements Sent .............. 0
  Up Master Trigger Activations ..... 0
  Down Master Trigger Activations ... 1
------------------------------------------------------------
```

Table 47-1: Parameters in the output of the **show vrrp** command

Parameter	Meaning
Virtual Router Identifier	Virtual router identifier.
VR MAC Address	Virtual router's MAC address, derived from the virtual router identifier
Interface	LAN interface the VR is operating on.
Priority	Priority of the router for assuming the master role for the virtual router
State	Current state of the router within the virtual router. MASTER indicates that it is currently the master of the virtual router. BACKUP indicates that it is currently a backup router for the virtual router. INITIAL indicates that it is currently in the initial state: either the virtual router or the VRRP module is disabled.
Master IP Address	The IP address of the router that is currently the master. This is not displayed when the router is the master.
Authentication	The type of authentication in use by the virtual router; either NONE or PLAINTEXT.
Password	Whether the authentication password is set; either SET or NOT SET.

Table 47-1: Parameters in the output of the **show vrrp** command (continued)

Parameter	Meaning
Adopt VR IP Address(es)	Whether the switch should respond to ICMP echo, Telnet, GUI, SNMP and DNS relay service requests targeted at the VR IP address(es) associated with the virtual router, even if it does not own those address(es).
IP Address(es)	Shows the IP address(es) associated with the virtual router.
Advertisement Interval	Period in seconds between advertisement packets.
Preempt Mode	Preempt mode for the virtual router, determining whether a higher priority router assumes the master role over a lower priority router; either ON or OFF.
Port Monitoring	Whether the port monitoring feature is on. This parameter is displayed when the VR operates over a VLAN interface.
Step value	If a number is shown (e.g. "40"), this indicates the value by which the priority of the VR is reduced for each VLAN port that fails or is disabled. If "PROPORTIONAL" is shown, the priority is reduced in proportion to the percentage of VLAN ports that are out of service.
Monitored Interfaces	List of interfaces on which the VR is dependant and those that VRRP monitors.
Interface	Name of an interface being monitored by VRRP for this VR.
New Priority	New priority that the router uses when this interface becomes inoperative.
Triggers	
Up Master Trigger ID	ID number of the trigger to be activated when the VR becomes the Master Router (UPMASTER trigger).
Down Master Trigger ID	ID number of the trigger to be activated when the VR ceases to be the Master Router (DOWNMASTER trigger).
Counters	
Original Priority	The original priority of the port before being affected by either the port monitoring or monitored interface feature.
Good Advertisements Received	Number of acceptable advertisement packets received by the router for this virtual router.
Bad Advertisements Received	Number of unacceptable advertisement packets received by the router for this virtual router.
Master Periods	Number of periods when the router has been the master router.
Advertisements Sent	Number of advertisement packets sent by the router.
Up Master Trigger Activations	Number of times an UPMASTER trigger has been activated for this VR.
Down Master Trigger Activations	Number of times a DOWNMASTER trigger has been activated for this VR.

Examples To display information about a virtual router whose VRID is 25, use the command:

```
sh vrrp vrid=25
```

Related Commands

add vrrp
create vrrp
delete vrrp
destroy vrrp
disable vrrp
disable vrrp debug
enable vrrp
enable vrrp debug
set vrrp