

Router Redundancy with VRRP

This Application Notes relates to the following Dell PowerConnect™ products:

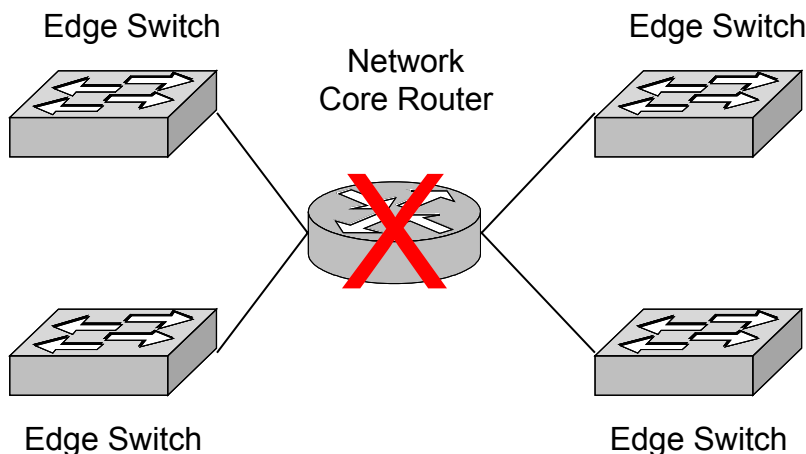
- PowerConnect 6024 and 6024F

Abstract

This Application Note describes the Virtual Router Redundancy Protocol (VRRP), a method for increasing network uptime through the use of a backup router failover mechanism. In addition to discussing the mechanics of VRRP, this Application Note provides step-by-step instructions for setting up the protocol on Dell PowerConnect 6024 devices.

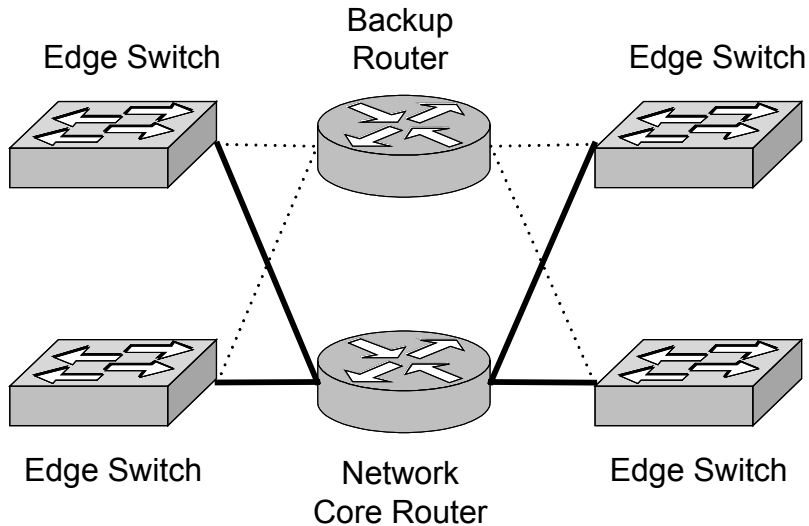
Applicable Network Scenarios

As shown in the figure below, a single router at the core of a network represents a single point of failure. The inherent danger of this network design is obvious: if the router fails, large portions of the network become unreachable.

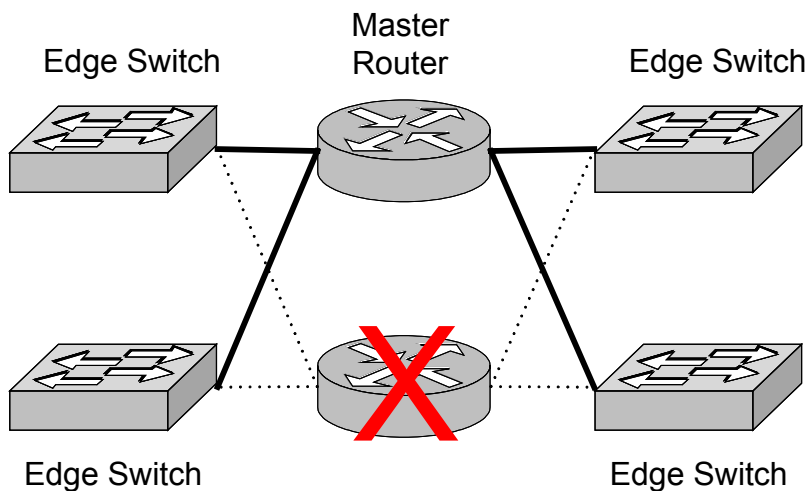


One option is simply to add a second router. This would provide redundancy, but also complicate device and address management. Typically, network managers configure hosts such as PCs and servers with a single static route – the default gateway. It is technically possible for hosts to use dynamic routing protocols, and doing so would allow hosts to recognize a secondary router upon the failure of the primary router. However, this option is difficult to manage and is seldom used in practice.

A better choice is to use the Virtual Router Redundancy Protocol (VRRP), which eliminates the single point of failure while maintaining a single router's ease of administration. Let's look at the same network running VRRP. In the figure below, all edge switches are now "dual-homed," meaning each connects to two routers. As before, the original router normally forwards traffic, but now there is a backup router standing by.



The primary router may fail, or the network may face the more common problem of the failure of a *link* to the primary router. Either way, VRRP helps ensure that the backup router will automatically take over forwarding responsibilities, with no interruption in connectivity.



Technology Background

The Internet Engineering Task Force (IETF) defined VRRP in [Request for Comments 2338 \(RFC 2338\)](#).

VRRP introduces the concept of a “virtual router,” an abstract object consisting of a virtual router identifier (VRID) and one or more IP addresses. Hosts use the virtual router’s IP address(es) as their default gateway(s), just as they would with a single router. The virtual router also has a virtual MAC address; the virtual router’s responses to address resolution protocol (ARP) requests use this virtual MAC address.

VRRP requires a “master router” and one or more “backup routers.” Typical deployments use only one backup router.

Routers running VRRP dynamically elect master and backup routers. The master router will always be the router with IP address(es) on its real interface(s) matching those of the virtual router, and others will be elected as backup routers.

Network managers also can force assignment of master and backup routers using priorities from 1 to 255, with 255 being the highest priority. The value of 255 is reserved for use by the master router in cases where its real interface address(es) match those of the virtual router's address(es).

In VRRP operation, the master router sends advertisements to backup routers at regular intervals. The default interval is 1 second. If a backup router does not receive an advertisement for a set period (the default is slightly longer than 3 seconds), the backup router with the next highest priority takes over as master and begins forwarding packets.

The time to "fail over" to the new master router is very short. RFC 2338 (Virtual Router Redundancy Protocol) describes a typical failover interval of less than 1 second.

If the original router comes back online, there are two methods to handle recovery. First, the original router can resume its role as master; this is the default if the original router has a higher priority than the backup router(s).

Second, the original router may continue to function as a backup router. The second method may be more desirable, since it allows network managers to investigate an outage without disrupting service. Through the use of a VRRP feature called preemption, network managers can prevent the transition back to a higher-priority router.

Proposed Solution

Overview

The following steps show how to configure VRRP using two Dell PowerConnect 6024 routers. Interface g23 on each router will be in the 10.0.0.0/8 network, while interface g24 will be in the 20.0.0.0/8 network.

To set up VRRP you can take the following actions:

1. Configure the first router's IP addresses.
2. Configure the first router's VRRP settings.
3. Configure the second (backup) router's IP addresses.
4. Configure the second (backup) router's VRRP settings.

Step-By-Step Instructions

1. Configure the first router's IP addresses. This will be the master router, so the IP address of the first interface will be the same as the IP address of the virtual router. Also configure the second interface IP address.

```
Dell-6024-1> enable
Dell-6024-1# configure
Dell-6024-1(config)# interface ethernet g23
Dell-6024-1(config-if)# ip address 10.1.1.1 255.0.0.0
Dell-6024-1(config-if)# exit
Dell-6024-1(config)# interface ethernet g24
Dell-6024-1(config-if)# ip address 20.1.1.1 255.0.0.0
Dell-6024-1(config-if)# exit
```

2. Configure the first router's VRRP settings. Since this is the master router, we set the priority high (255). Also, since this device supports multiple virtual routers, we must assign a virtual router identifier (VRID). We will use a VRID of 1.

```
Dell-6024-1(config)# interface ethernet g23
Dell-6024-1(config-if)# vrrp 1 10.1.1.1          <- Virtual router IP address
Dell-6024-1(config-if)# vrrp 1 priority 255
Dell-6024-1(config-if)# vrrp 1 source-ip 10.1.1.1 <- Real interface IP address
```

```
Dell-6024-1(config-if)# end
Dell-6024-1# copy running-config startup-config
```

3. Configure the second (backup) router's IP addresses. Note that the interface IP address(es) of the backup router *must* be different than the IP address(es) of the virtual router.

```
Dell-6024-2> enable
Dell-6024-2# configure
Dell-6024-2(config)# interface ethernet g23
Dell-6024-2(config-if)# ip address 10.1.1.2 255.0.0.0
Dell-6024-2(config-if)# exit
Dell-6024-2(config)# interface ethernet g24
Dell-6024-2(config-if)# ip address 20.1.1.2 255.0.0.0
Dell-6024-2(config-if)# exit
```

4. Configure the second (backup) router's VRRP settings. The VRID must be the same on both routers, and the backup router must have a lower priority than the master router.

```
Dell-6024-2(config)# interface ethernet g23
Dell-6024-2(config-if)# vrrp 1 10.1.1.1           <- Virtual router IP address
Dell-6024-2(config-if)# vrrp 1 priority 100
Dell-6024-2(config-if)# vrrp 1 source-ip 10.1.1.2 <- Real interface IP address
Dell-6024-2(config-if)# end
Dell-6024-2# copy running-config startup-config
```

Conclusion

The devices are now fully configured for redundancy using VRRP. In the event of a failure of the first router, or the circuits attached to the first router, the second router will take over forwarding responsibilities, typically in less than 1 second.

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