

Can PowerConnect Switches Be Used in IP Multicast Networks?

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

- PowerConnect 33xx
- PowerConnect 52xx

Abstract

This Application Note explains how to use Dell PowerConnect switches in networks running IP multicast services. This document provides sample configurations for implementing and tuning multicast bridging.

Applicable Network Scenarios

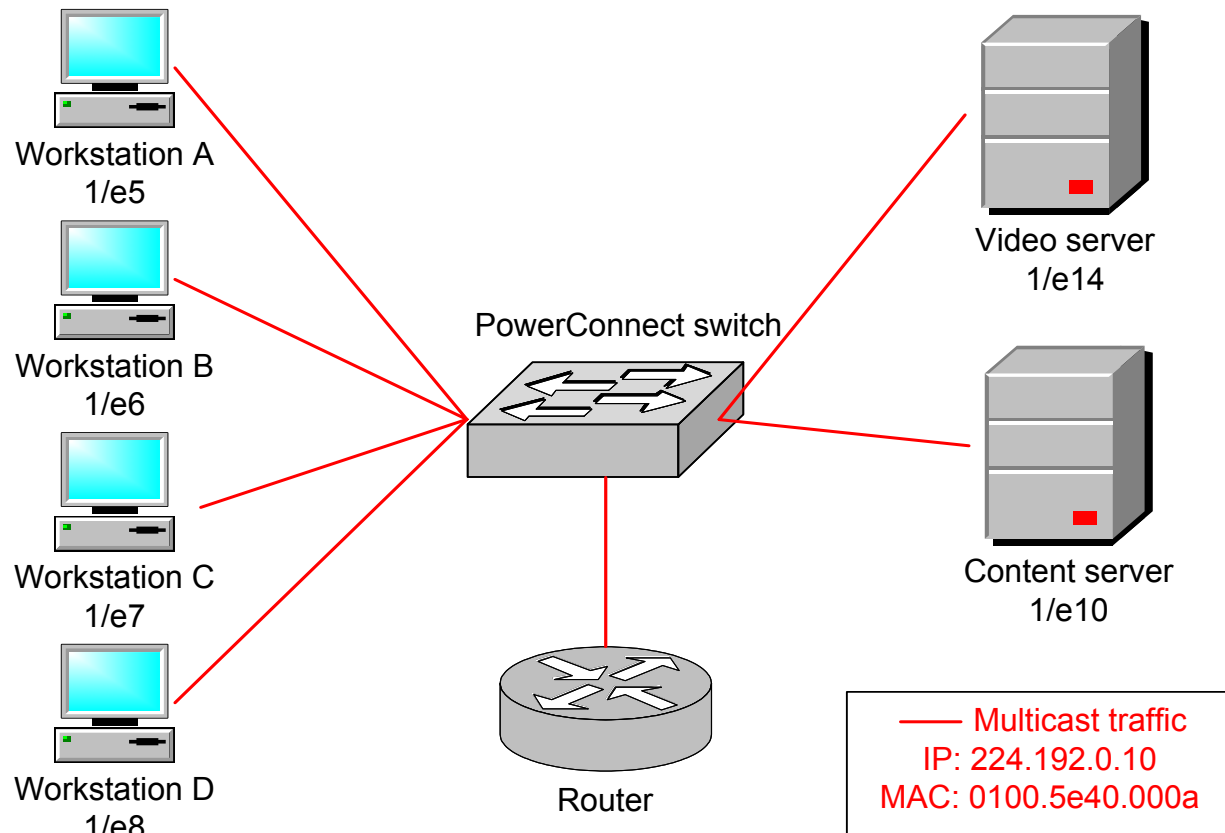
IP multicast services are commonly used to deliver streaming media applications, such as those carrying voice and/or video traffic. Multicast support can help reduce network traffic for many bandwidth-intensive applications.

Consider the example given in the diagram below. In this scenario, the lack of IP multicast support can lead to excessive network traffic and degraded application performance.

A video server attached to a Dell PowerConnect switch streams data from a separate content server using IP multicast. Workstations A, B, and C subscribe to the streaming service, but workstation D does not, nor does the content server that provides data to the streaming server.

The switch is configured in a default virtual LAN (VLAN) configuration, meaning all interfaces share a common broadcast domain. Note also that the switch is connected to a router. For IP multicast to work, at least one router must be present and all switches must be configured to support multicast traffic.

In the current configuration, the switch forwards all traffic to all ports in the VLAN. Since video streaming can consume copious amounts of bandwidth for long periods of time, the unnecessary multicast traffic sent to workstation D and the content server can lead to degraded performance, especially for the content server.



Technology Background

IP multicast enables network devices to send a single packet to multiple destinations. Unlike broadcast traffic, which is forwarded to all nodes on a given segment, multicast traffic is forwarded only to nodes participating in a multicast group. Since a node must process every frame it receives, multicast conserves not only network bandwidth but also processing cycles on all machines attached to the network.

IP multicast uses the concepts of groups, transmitters, and receivers. A multicast group consists of one transmitting node and zero or more receiving nodes. Before a node can receive multicast traffic, it sends network routers and switches a “group join” message using the Internet group multicast protocol (IGMP). The routers and switches then forward multicast traffic only to those nodes that have joined the group.

Multicast frames have special destination addresses. Destination IP addresses for multicast traffic fall within the range of 224.0.0.1 through 239.255.255.255 (although some addresses within this range are reserved). Destination Ethernet addresses for multicast traffic begin with 01:00:5E and end with the low-order 23 bits of the destination IP address.

For example, the IP multicast address 224.192.0.10 would use an Ethernet destination address of 01:00:5E:40:00:0A. Because an IP address has 32 bits and Ethernet multicast addresses use only the low-order 23 bits, the first octet (224) is ignored and only the low-order 7 bits of the second octet are used. Thus 192 (expressed as 1100 0000 in binary notation) loses its high-order bit and becomes 64 (100 0000 in binary, or 0x40 in hexadecimal notation). For the next octet, 0 becomes 0x00 in hexadecimal notation. For the final octet, 10 in hexadecimal notation is 0x0A. Thus the multicast destination Ethernet address is 01:00:5E:40:00:0A.

By default, Dell PowerConnect switches forward multicast Ethernet frames to all interfaces in a given VLAN. Although this allows for transmission of IP multicast traffic, it is a suboptimal configuration since



traffic goes to all nodes in the VLAN, not just the multicast receivers. In this regard, the default configuration offers no benefit over simple broadcast traffic.

To avoid unnecessary bandwidth consumption and application performance degradation, switches should be configured to forward multicast traffic only to multicast receivers.

If a switch is attached to an IGMP-capable router, it can use a feature called IGMP snooping to dynamically glean information about which interfaces participate in a multicast group. IGMP snooping gives the switch multicast awareness; more importantly it enables the switch to filter out multicast traffic on all nonparticipating interfaces.

If the switch is not attached to a router, network managers can configure bridge filters to statically designate interfaces that should receive multicast traffic.

Proposed Solution

To optimize bandwidth utilization and increase performance, two methods can be used:

- I. IGMP snooping (dynamic)
- II. Bridge filtering (static)

Overview

- I. Dynamically detect hosts participating in multicast services using IGMP snooping

On Dell PowerConnect switches:

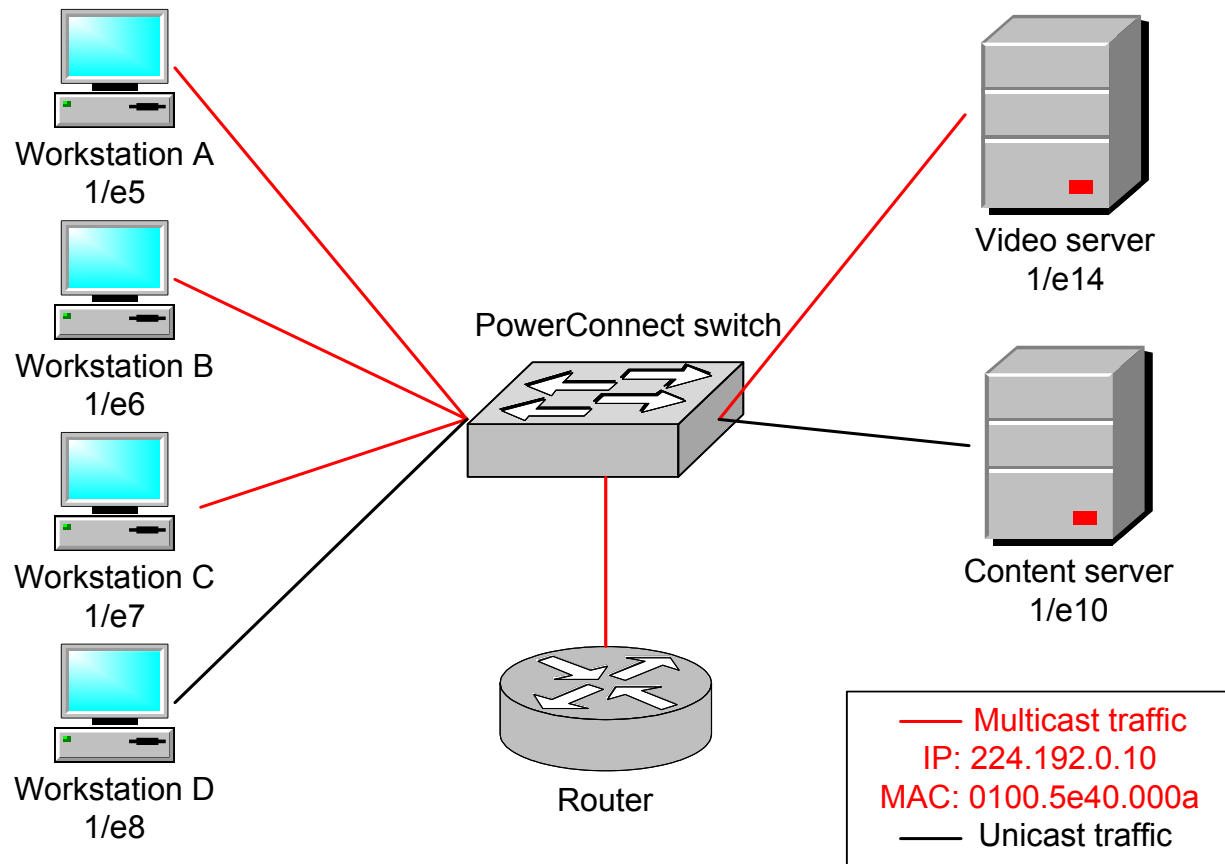
- 1) Enable IGMP snooping.
- 2) Enable bridge multicast filtering.
- 3) Enable automatic learning of multicast router ports.

- II. Statically configure bridge filtering on a per-interface basis.

- 1) Enable bridge multicast filtering.
- 2) Add necessary interfaces to the multicast address table.

Typical Network Designs

With either the static or dynamic methods, multicast traffic only reaches those nodes subscribed to a multicast group – workstations A, B, and C. Workstation D and the content server no longer receive superfluous multicast traffic.



Step-By-Step Instructions

The following configuration guidelines work with any Dell PowerConnect 33xx or 52xx switch. IGMP support also must be enabled on a router or layer-3 switch. Switches and routers from Cisco Systems and other vendors support IGMP in their default configurations.

I. IGMP snooping (dynamic method):

1. Enable IGMP snooping.

PowerConnect 33xx:

```
console# config
console(config)# ip igmp snooping
```

PowerConnect 52xx:

```
console# config
console(config)# ip igmp snooping
console(config)# ip igmp snooping querier
```

2. Enable bridge multicast filtering.

PowerConnect 33xx:

```
console(config)# bridge multicast filtering
```



On the PowerConnect 52xx, no action is needed; bridge multicast filtering is enabled by default.

3. Enable automatic learning of multicast router ports.

PowerConnect 33xx:

```
console(config)# interface vlan 1
console(config-if)# ip igmp snooping mrouter learn-pim-dvmrp
```

On the PowerConnect 52xx, no action is needed; bridge multicast filtering is enabled by default.

II. Static bridge filtering:

1. Enable bridge filtering.

PowerConnect 33xx:

```
console# config
console(config)# bridge multicast filtering
```

On the PowerConnect 52xx, no action is needed; bridge multicast filtering is enabled by default.

2. Add necessary interfaces to multicast address table:

PowerConnect 33xx:

```
console(config)# int vlan 1
console(config-if)# bridge multicast address 0100.5e40.000a add ethernet
1/e5, 1/e6, 1/e7
```

PowerConnect 52xx:

```
console(config)# ip igmp snooping vlan 1 static 224.0.0.10 ethernet 1/5
console(config)# ip igmp snooping vlan 1 static 224.0.0.10 ethernet 1/6
console(config)# ip igmp snooping vlan 1 static 224.0.0.10 ethernet 1/7
```

Conclusion

Either the dynamic or static method will result in multicast traffic being forwarded only to those stations that subscribe to the multicast service. The end results can be significantly reduced network traffic and decreased load on nonparticipating nodes.

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