Constraining IP Multicast in Switched Ethernet

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Prerequisites for Constraining IP Multicast in a Switched Ethernet Network

Before using the tasks in this module, you should be familiar with the concepts described in the IP Multicast Routing Technology Overview module.

Information About IP Multicast in a Switched Ethernet Network

IP Multicast Traffic and Layer 2 Switches

The default behavior for a Layer 2 switch is to forward all multicast traffic to every port that belongs to the destination LAN on the switch. This behavior reduces the efficiency of the switch, whose purpose is to limit traffic to the ports that need to receive the data. This behavior requires a constraining mechanism to reduce unnecessary multicast traffic, which improves switch performance.

Cisco Group Management Protocol (CGMP), Router Group Management Protocol (RGMP), and IGMP snooping efficiently constrain IP multicast in a Layer 2 switching environment.

- CGMP and IGMP snooping are used on subnets that include end users or receiver clients.
- RGMP is used on routed segments that contain only routers, such as in a collapsed backbone.
- RGMP and CGMP cannot interoperate. However, Internet Group Management Protocol (IGMP) can interoperate with CGMP and RGMP snooping.

CGMP on Catalyst Switches for IP Multicast

CGMP is a Cisco-developed protocol used on device connected to Catalyst switches to perform tasks similar to those performed by IGMP. CGMP is necessary for those Catalyst switches that do not distinguish between IP multicast data packets and IGMP report messages, both of which are addressed to the same group address at the MAC level. The switch can distinguish IGMP packets, but would need to use software on the switch, greatly impacting its performance.

You must configure CGMP on the multicast device and the Layer 2 switches. The result is that, with CGMP, IP multicast traffic is delivered only to those Catalyst switch ports that are attached to interested receivers. All other ports that have not explicitly requested the traffic will not receive it unless these ports are connected to a multicast router. Multicast router ports must receive every IP multicast data packet.

Using CGMP, when a host joins a multicast group, it multicasts an unsolicited IGMP membership report message to the target group. The IGMP report is passed through the switch to the router for normal IGMP processing. The router (which must have CGMP enabled on this interface) receives the IGMP report and processes it as it normally would, but also creates a CGMP Join message and sends it to the switch. The Join message includes the MAC address of the end station and the MAC address of the group it has joined.

The switch receives this CGMP Join message and then adds the port to its content-addressable memory (CAM) table for that multicast group. All subsequent traffic directed to this multicast group is then forwarded out the port for that host.

The Layer 2 switches are designed so that several destination MAC addresses could be assigned to a single physical port. This design allows switches to be connected in a hierarchy and also allows many multicast destination addresses to be forwarded out a single port.

The device port also is added to the entry for the multicast group. Multicast device must listen to all multicast traffic for every group because IGMP control messages are also sent as multicast traffic. The rest of the multicast traffic is forwarded using the CAM table with the new entries created by CGMP.

IGMP Snooping

IGMP snooping is an IP multicast constraining mechanism that runs on a Layer 2 LAN switch. IGMP snooping requires the LAN switch to examine, or “snoop,” some Layer 3 information (IGMP Join/Leave messages) in the IGMP packets sent between the hosts and the router. When the switch receives the IGMP host report from a host for a particular multicast group, the switch adds the port number of the host to the associated multicast table entry. When the switch hears the IGMP Leave group message from a host, the switch removes the table entry of the host.

Because IGMP control messages are sent as multicast packets, they are indistinguishable from multicast data at Layer 2. A switch running IGMP snooping must examine every multicast data packet to determine if it contains any pertinent IGMP control information. IGMP snooping implemented on a low-end switch with a slow CPU could have a severe performance impact when data is sent at high rates. The solution is to implement IGMP snooping on high-end switches with special application-specific integrated circuits (ASICs) that can perform the IGMP checks in hardware. CGMP is a better option for low-end switches without special hardware.

Router-Port Group Management Protocol (RGMP)

CGMP and IGMP snooping are IP multicast constraining mechanisms designed to work on routed network segments that have active receivers. They both depend on IGMP control messages that are sent between the hosts and the routers to determine which switch ports are connected to interested receivers.

Switched Ethernet backbone network segments typically consist of several routers connected to a switch without any hosts on that segment. Because routers do not generate IGMP host reports, CGMP and IGMP snooping will not be able to constrain the multicast traffic, which will be flooded to every port on the VLAN. Routers instead generate Protocol Independent Multicast (PIM) messages to Join and Prune multicast traffic flows at a Layer 3 level.

Router-Port Group Management Protocol (RGMP) is an IP multicast constraining mechanism for router-only network segments. RGMP must be enabled on the routers and on the Layer 2 switches. A multicast router indicates that it is interested in receiving a data flow by sending an RGMP Join message for a particular group. The switch then adds the appropriate port to its forwarding table for that multicast group--similar to the way it handles a CGMP Join message. IP multicast data flows will be forwarded only to the interested router ports. When the router no longer is interested in that data flow, it sends an RGMP Leave message and the switch removes the forwarding entry.

If there are any routers that are not RGMP-enabled, they will continue to receive all multicast data.

How to Constrain Multicast in a Switched Ethernet Network

Configuring Switches for IP Multicast

If you have switching in your multicast network, consult the documentation for the switch you are working with for information about how to configure IP multicast.

Configuring IGMP Snooping

No configuration is required on the router. Consult the documentation for the switch you are working with to determine how to enable IGMP snooping and follow the provided instructions.

Enabling CGMP

CGMP is a protocol used on devices connected to Catalyst switches to perform tasks similar to those performed by IGMP. CGMP is necessary because the Catalyst switch cannot distinguish between IP multicast data packets and IGMP report messages, which are both at the MAC level and are addressed to the same group address.

Note

- CGMP should be enabled only on 802 or ATM media, or LAN emulation (LANE) over ATM.
- CGMP should be enabled only on devices connected to Catalyst switches.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:**	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
	`Device> enable`	
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface ethernet 1`	Selects an interface that is connected to hosts on which IGMPv3 can be enabled.
Step 4	**ip cgmp** [**proxy** | **router-only**] **Example:** `Device(config-if)# ip cgmp proxy`	Enables CGMP on an interface of a device connected to a Cisco Catalyst 5000 family switch. • The **proxy** keyword enables the CGMP proxy function. When enabled, any device that is not CGMP-capable will be advertised by the proxy router. The proxy router advertises the existence of other non-CGMP-capable devices by sending a CGMP Join message with the MAC address of the non-CGMP-capable device and group address of 0000.0000.0000.
Step 5	**end** **Example:** `Device(config-if)# end`	Ends the current configuration session and returns to EXEC mode.
Step 6	**clear ip cgmp** [*interface-type interface-number*] **Example:** `Device# clear ip cgmp`	(Optional) Clears all group entries from the caches of Catalyst switches.

Configuring IP Multicast in a Layer 2 Switched Ethernet Network

Perform this task to configure IP multicast in a Layer 2 Switched Ethernet network using RGMP.

Procedure

	Command or Action	Purpose
Step 1	**enable** **Example:**	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
	`Device> enable`	
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Device(config)# interface ethernet 1`	Selects an interface that is connected to hosts.
Step 4	**ip rgmp** **Example:** `Device(config-if)# ip rgmp`	Enables RGMP on Ethernet, Fast Ethernet, and Gigabit Ethernet interfaces.
Step 5	**end** **Example:** `Device(config-if)# end`	Ends the current configuration session and returns to EXEC mode.
Step 6	**debug ip rgmp** **Example:** `Device# debug ip rgmp`	(Optional) Logs debug messages sent by an RGMP-enabled device.
Step 7	**show ip igmp interface** **Example:** `Device# show ip igmp interface`	(Optional) Displays multicast-related information about an interface.

Configuration Examples for Constraining IP Multicast in a Switched Ethernet Network

RGMP Configuration Example

The following example shows how to configure RGMP on a router:

```
ip multicast-routing
ip pim sparse-mode
interface ethernet 0
 ip rgmp
```

Additional References for Constraining IP Multicast in a Switched Ethernet Network

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	See the IP Multicast Routing Commands section of the *Command Reference (Catalyst 9500 Series Switches)*

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by these features, and support for existing MIBs has not been modified by these features.	To locate and download MIBs for selected platforms, Cisco IOS XE releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature History for Constraining IP Multicast in Switched Ethernet

This table provides release and related information for the features explained in this module.

These features are available in all the releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Everest 16.5.1a	Constraining IP Multicast in Switched Ethernet	IP multicast in switched ethernet provides a constraining mechanism to reduce unnecessary multicast traffic, which improves switch performance. Support for this feature was introduced on the C9500-12Q, C9500-16X, C9500-24Q, C9500-40X models of the Cisco Catalyst 9500 Series Switches.
Cisco IOS XE Fuji 16.8.1a	Constraining IP Multicast in Switched Ethernet	Support for this feature was introduced on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.
Cisco IOS XE Cupertino 17.7.1	Constraining IP Multicast in Switched Ethernet	This feature was implemented on the C9500X-28C8D model.
Cisco IOS XE Dublin 17.10.1b	Constraining IP Multicast in Switched Ethernet	This feature was implemented on the C9500X-60L4D model.

Use the Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to https://cfnng.cisco.com/.