

Configuring Multicast Support for a Stub Network

Contents

Overview	12-3
Multicast Applications	12-3
IP Multicasting	12-4
Multicast Addresses	12-5
Host Groups	12-5
IGMP	12-6
IGMP Queries	12-7
IGMP Reports	12-7
Multicast Routing Protocols	12-8
IGMP Proxy	12-9
Configuring IGMP Proxy for Multicast Stub Routing Support	12-11
Enabling IP Multicast Routing	12-12
Setting the Multicast Helper Address	12-12
Determining Which Interfaces are Downstream and Which Upstream	12-13
Configuring a Downstream Interface	12-14
Configuring an IGMP Multicast Agent	12-14
Enabling IGMP Proxy	12-15
Enabling Multicast Forwarding	12-15
Configuring an Upstream Interface	12-16
Configuring Multicast Routing through a Fixed Interface	12-16
Tunneling Multicast Traffic through the Internet	12-17
Adding the Router Stack to a Multicast Group	12-18
Altering IGMP Query Intervals	12-19

Troubleshooting Multicast Stub Routing and IGMP	12-21
Strategies and Tools	12-21
Procedure for Troubleshooting Multicast Stub Routing	12-23
Quick Start	12-26

Overview

This overview describes IP multicasting and Internet Group Management Protocol (IGMP). The overview then explains how the ProCurve Secure Router can support multicasting by running either Protocol Independent Multicast-Sparse Mode (PIM-SM), which is a multicast routing protocol, or IGMP proxy.

This chapter focuses on configuring IGMP proxy for multicast stub routing. A router uses multicast stub routing to forward multicast traffic received from a remote source to directly connected hosts.

Generally, ProCurve Networking recommends that you use PIM-SM as this protocol is usually as simple to configure as IGMP proxy and it provides more capabilities. You *must* configure PIM-SM on your ProCurve Secure Router instead of IGMP proxy if:

- the router may receive multicasts through more than one WAN connection
- the router must transit multicast traffic towards devices running a multicast routing protocol
- your LAN includes a multicast source, from which your router may need to forward traffic

For information on configuring PIM-SM, you should see *Chapter 11: Configuring Multicast Support with PIM-SM*. You can refer to this chapter for information on IGMP, which is automatically enabled when you configure either IGMP proxy or PIM-SM, and for information on configuring IGMP parameters.

Multicast Applications

Many emerging applications rely on delivering the same information to many hosts. LAN TV, video conferencing, collaborative computing, and desktop conferencing all involve transmitting a great deal of information from a source, or many sources, to many hosts. Email systems can more efficiently deliver mail to multiple servers simultaneously rather than one by one. Increasingly, such technologies are turning from delivering information through multiple point-to-point sessions to delivering it through multipoint communication.

IP multicasting allows hosts to send messages to multiple hosts simultaneously. Hosts join multicast host groups to become eligible to receive specific multicasts. The ProCurve Secure Router supports the routing of such multicasts using either PIM-SM or IGMP proxy.

IP Multicasting

LANs, which are often Ethernet networks, are usually broadcast networks: hosts can transmit messages to every other host on the network. When a host sends a broadcast message to all other hosts in the subnet, the destination address in the packet's IP header is the subnet's broadcast address—typically, the network address with all ones for the host bits. The host can send a broadcast message to all subnets by sending a broadcast to 255.255.255.255. (See Figure 12-1.)

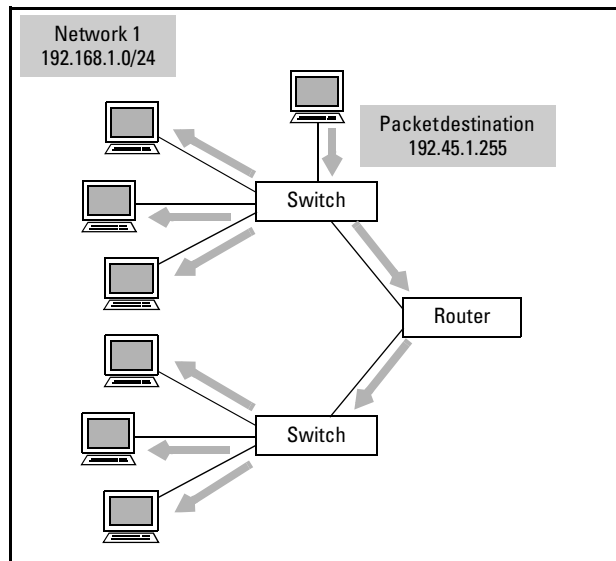


Figure 12-1. Broadcasting

It is not hard to imagine the challenges broadcast messages pose for packet containment. A malfunctioning or misconfigured device can congest an entire network. Even properly functioning devices must flood all hosts with unnecessary information just to send a message to the hosts that do need it.

IP multicasting addresses these problems by allowing a host to send a message to a select group.

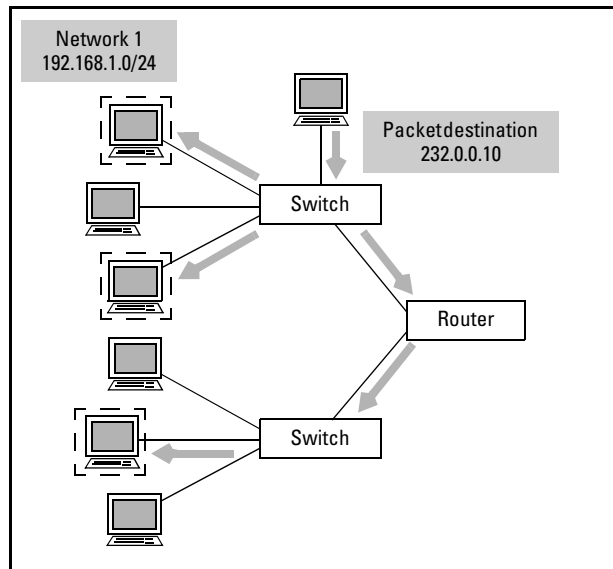


Figure 12-2. Multicasting

Multicast Addresses

The destination address in the IP header of a multicast message is the multicast address. Only hosts that have joined the group for this multicast address receive the message. (See Figure 12-2.)

Multicast addresses fall between 224.0.0.0 and 239.255.255.255. The addresses between 224.0.0.0 and 224.0.0.255 are reserved for routing messages and are intended for groups such as all routers on a subnet, all Open Shortest Path First (OSPF) routers, or all Dynamic Host Configuration Protocol (DHCP) servers. Private organizations can designate other multicast addresses for their own purposes. Private multicast addresses for local networks range from 239.255.0.0 to 239.255.255.255. (For a list of multicast addresses, visit <http://www.iana.org/assignments/multicast-addresses>.)

Host Groups

Network nodes forward multicast packets to the proper host group. The host group for a multicast address is the set of hosts who receive messages sent to that address. Group membership is dynamic. Hosts can join and leave a group. They can belong to more than one group at once, and groups can contain any number of hosts at any location in the network.

IGMP

IGMP helps a router to determine which host groups have members in which networks so that the router can properly forward multicast messages. Some multicast routing protocols (including the protocol supported on the ProCurve Secure Router) suppress multicasts unless a router or network specifically requests them. IGMP also enables a router to determine the groups for which it needs to request traffic.

Figures 12-3 and 12-4 illustrate how IGMP contains packets by allowing routers to only forward multicast messages into networks that need them.

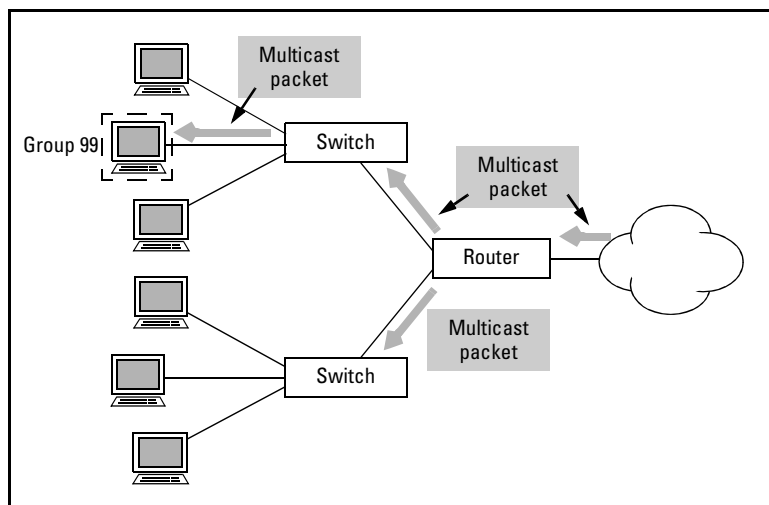


Figure 12-3. Multicasting Without IGMP

An IGMP multicast agent, which is also called a querier, sends queries to determine which host groups exist in the stub networks to which it directly connects. The ProCurve Secure Router can act as an IGMP multicast agent. Each subnet should have only one multicast agent to minimize overhead. (Devices automatically defer a router to act as the agent and, if a network includes more than one router, to the router with the lowest IP address.)

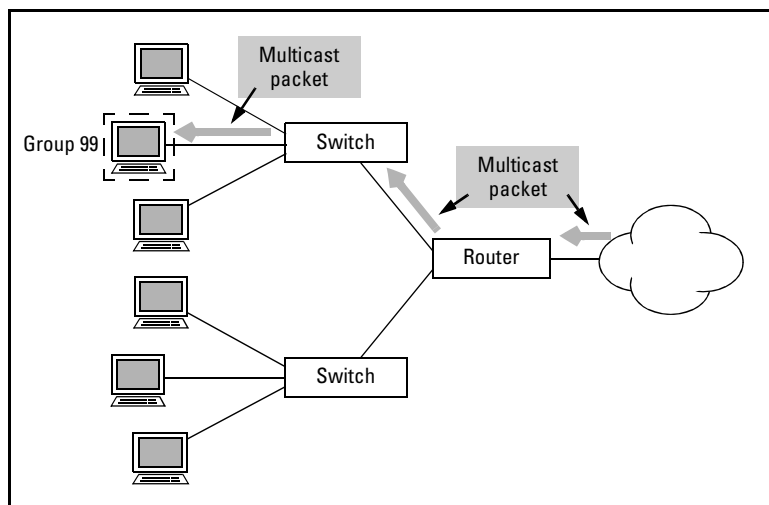


Figure 12-4. Multicasting with IGMP

IGMP Queries

On the ProCurve Secure Router, you enable an interface to act as a multicast agent when you do one of the following:

- configure the interface as a multicast stub downstream interface
- enable PIM-SM on the interface

The multicast agent broadcasts IGMP queries to all hosts, asking them to generate a report for each host group to which they belong. The multicast agent only forwards packets destined to a certain multicast address into the networks from which it has received a report for that address.

The ProCurve Secure Router stores a list of the group memberships in connected networks and a timer for each membership. When the membership expires, the IGMP interface sends a new query.

IGMP Reports

When a host receives an IGMP query, it replies with IGMP reports. Each report contains the multicast address of a group to which the host belongs. Hosts minimize IGMP reports, which might otherwise flood the network, in two ways:

- Instead of immediately sending a report for every group to which it belongs, the host staggers them. It sets a random timer for when it should send each report.

- Hosts send their IGMP reports to the multicast address rather than simply to the multicast agent. When the other hosts in the group receive this report, they cancel the report they would otherwise send out.

In this way, the multicast agent should receive one, and only one, report for each multicast address for which a host group exists on a stub network.

When a host joins a group, it immediately sends a report in case it is the first host in the group. Hosts send a leave message to their multicast agent when they leave a group.

IGMP runs in version 1 and 2. The ProCurve Secure Router supports both. Version 2 is the default.

Multicast Routing Protocols

A multicast routing protocol enables the router to determine *every* interface through which it must forward traffic for a particular group. A router can use IGMP to determine which directly connected networks need the traffic, but generally it must run a multicast routing protocol to determine which directly connected devices need the traffic. In other words, the multicast routing protocol enables network devices to build trees over which traffic flows end-to-end, from a source to all receivers.

Multicast routes are different from unicast routes because traffic destined to a multicast address usually corresponds with many host addresses. Therefore a router may need to copy a multicast packet and forward it out several interfaces. Multicast routes also change relatively often as hosts join and leave a group. In addition, multicast traffic often runs unidirectionally from a source to receivers rather than bi-directionally as does unicast traffic. Multicast routes can therefore be source-specific, and a router can use a multicast routing protocol to determine through which interface traffic destined to a particular group will arrive.

The ProCurve Secure Router supports Protocol-Independent Multicast-Sparse Mode (PIM-SM), which relies on the unidirectional flow of typical multicast traffic. PIM-SM router uses IGMP to determine for which groups it needs to receive multicast traffic. The router then joins a unique multicast tree for each active multicast group. The tree is rooted at a rendezvous point (RP), to which all sources must send multicasts for that group, and branches out towards all hosts in the group. PIM-SM also lets routers generate a unidirectional tree from an active source to all receivers.

The ProCurve Secure Router also supports IGMP proxy, which stub routers can run in lieu of a multicast routing protocol. Like PIM-SM, IGMP proxy allows a router to generate to receive and forward multicasts along a struc-

tured, unidirectional path. However, a router running IGMP proxy cannot establish different routes for different multicast groups. It must receive all multicasts on the same incoming, or upstream, interface. In addition, a router running IGMP proxy cannot transit multicast traffic. The router *can* forward the multicasts through various outgoing, or downstream, interfaces depending on the memberships for that group in the connecting networks.

Because PIM-SM enables more functions than IGMP proxy and is often as simple to configure, it is usually recommended that you configure your router to use PIM-SM rather than IGMP proxy for multicast support. See *Chapter 11: Configuring Multicast Support with PIM-SM*.

IGMP Proxy

IGMP proxy allows a stub router to act as a multicast host on behalf of connected clients to a remote multicast source or to a remote router running a multicast routing protocol. The stub router receives multicasts from the source just as a typical host would. The stub router can then forward this traffic out the necessary interfaces.

Only stub routers should use IGMP proxy for multicast support. A stub router serves as a gateway to a stub network—that is, a network that originates and terminates, but does not transit, traffic. Because the router will only receive multicasts on one interface, the router does not need to determine where to send joins for a particular group. It can simply forward all IGMP reports to the default helper address. This address is the address of the multicast source or any of device that runs a multicast routing protocol and receives traffic from the source.

The stub router uses IGMP alone to determine outgoing interfaces for multicast traffic. Because it is a stub router, it does not need to receive the PIM-SM joins that would allow it to pass multicast traffic to other routers in a multicast tree.

IGMP proxy organizes a router's interfaces into upstream and downstream interfaces, providing an ordered flow for multicast messages.

A router connects to stub networks through downstream interfaces. The downstream interfaces run IGMP, sending queries to and receiving report, join, and leave messages from multicast hosts.

A router connects to remote multicast sources through an upstream interface. When downstream interfaces receive IGMP messages, the upstream interface copies them, inserts its own address as the messages' source address, and forwards the messages to the helper address. The multicast router or source

at the helper address considers the upstream interface to be a multicast host that is a member of every group to which at least one host in the stub networks belongs.

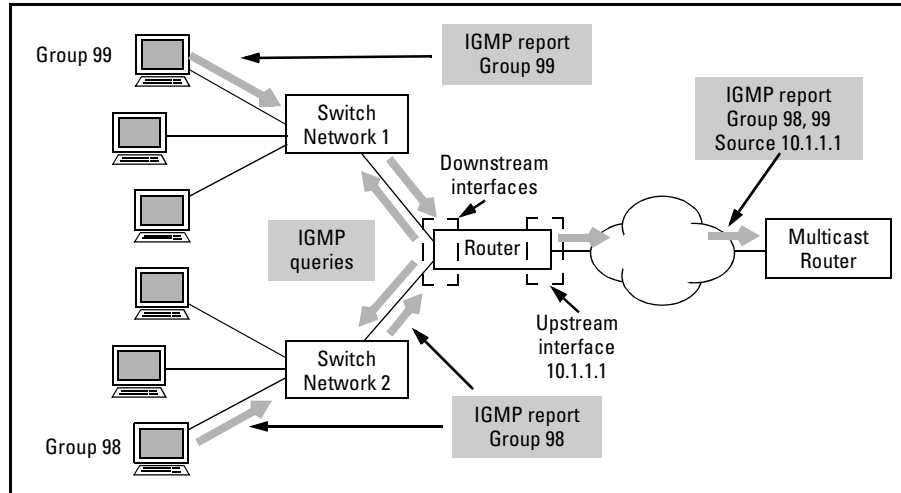


Figure 12-5. IGMP Proxy

When an upstream interface receives a multicast packet, the router forwards it through the downstream interfaces on networks for which the relevant group is active. This function is called multicast forwarding.

Figure 12-5 illustrates how IGMP reports and multicast messages flow.

Configuring IGMP Proxy for Multicast Stub Routing Support

You should not use IGMP proxy for multicast support unless your ProCurve Secure Router acts as a stub router. (Even when your router is a stub router, it can be a good idea to enable a multicast routing protocol such as PIM-SM.)

A stub router is a router in a stub network. When a WAN router, such as the ProCurve Secure Router, has a single connection to a remote, central site, it usually acts as a stub router: it does not receive traffic for any network except local ones.

A central, non-stub site would provide the multicast routers and sources. The stub router simply needs to be able to forward multicasts that arrive on the single WAN interface to stub networks on which the appropriate host network exists.

As an example, your organization's headquarters has a streaming video server. Hosts in the local stub network run the corresponding video client, which join the correct multicast group. You would configure the Ethernet interface on the ProCurve Secure Router to be a downstream interface. It would request IGMP reports from hosts in the local networks. The router would then forward these reports through the upstream WAN interface to a helper address and towards the multicast source, which is the streaming video server. This server would then send video packets towards the local router, which would forward them on to the LAN.

To configure the ProCurve Secure Router to receive multicasts, you must configure IGMP proxy. Complete these steps:

1. Enable IP multicast routing.
2. Set the global multicast helper address.
3. Determine which interfaces are downstream interfaces and which are upstream interfaces.
4. Configure one or more downstream interfaces:
 - a. Enable and configure the IGMP agent.
 - b. Enable multicast forwarding.
5. Configure an upstream interface:
 - a. Enable multicast forwarding.
 - b. Enable IGMP proxy.

You can also:

- have the router stack join an IGMP group
- alter IGMP intervals (for experienced administrators only)

Enabling IP Multicast Routing

The ProCurve Secure Router must implement multicast routing to keep track of which interfaces forward packets destined to certain multicast addresses. By default, multicast routing is disabled.

From the global configuration mode context, enter:

```
ProCurve(config)# ip multicast-routing
```

When multicast routing is enabled, the router stores a list of multicast routes. The router creates an entry for each multicast address for which a host group exists on a downstream network. All entries include a single incoming interface, which is the upstream interface. An active entry also includes one or more outgoing interfaces, which are the downstream interfaces through which multicasts received on the incoming interface should be forwarded.

Setting the Multicast Helper Address

The helper address is the address to which all downstream interfaces forward the IGMP reports and leave messages that they receive from connected hosts. The helper address can be any upstream interface between the downstream interface and the multicast source. It is often a router at an organization's headquarters that runs a multicast routing protocol.

To the helper address, the local router sends one report and one leave message for each active multicast group. As far as the device at the helper address is concerned, the local router is a multicast host, and the helper device routes the appropriate multicasts to it.

Set the global helper address by entering:

Syntax: `ip mcast-stub helper-address <A.B.C.D>`

The router can only have one multicast helper address. (This is why you can only configure IGMP proxy for multicast support if all multicasts will be received from the same next-hop router.)

For example, to set the helper address for the router in Figure 12-6, you would enter:

```
ProCurve(config)# ip mcast-stub helper-address 10.1.1.2
```

Note

The router must know a route to the helper address.

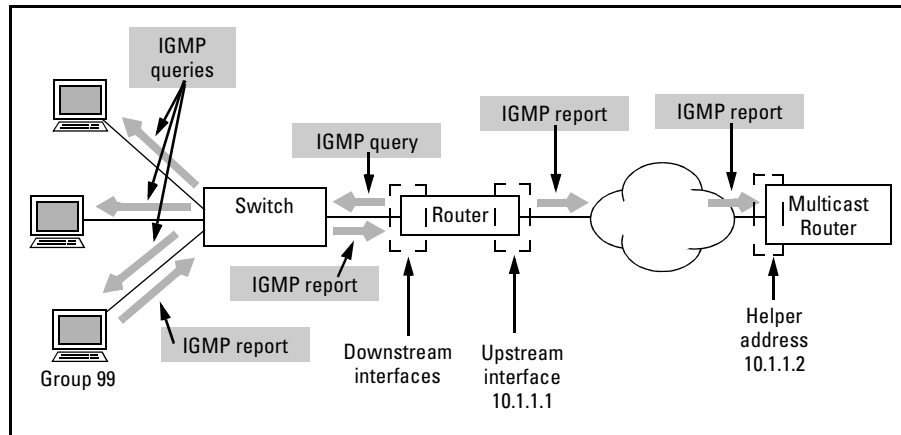


Figure 12-6. Identifying Upstream and Downstream Interfaces and Helper Address

Determining Which Interfaces are Downstream and Which Upstream

Downstream interfaces connect to the stub networks with multicast hosts. Generally, these are Ethernet interfaces. Downstream interfaces run IGMP as a multicast agent and receive IGMP reports from local hosts. Downstream interfaces also forward multicast messages into networks for which a host group exists.

The upstream interface is the interface through which the router connects to remote multicast sources. The upstream interface acts as the IGMP host on behalf of hosts connected to the downstream interfaces. The router only uses one upstream interface to forward IGMP joins received on downstream interfaces towards the multicast source.

Figure 12-6 displays downstream and upstream interfaces on a stub router in a simplified example network.

Configuring a Downstream Interface

First, move to the configuration mode context for the interface:

Syntax: interface <interface ID>

For example:

```
ProCurve(config)# int eth 0/1
```

A downstream interface typically should perform three functions:

- IGMP multicast agent—send IGMP queries and listen for IGMP messages
- IGMP proxy—forward IGMP messages to a remote multicast server
- multicast forwarding—forward multicast messages if the corresponding host group exists on the connecting network

Configuring an IGMP Multicast Agent

This command both enables the interface to run IGMP and to forward multicast messages:

```
ProCurve(config-eth 0/1)# ip mcast-stub downstream
```

The interface will send IGMP queries and listen for reports and leave messages to determine which host groups are active on its network.

By default, downstream interfaces run IGMP version 2. You can change the version an interface uses with this command, entered from a logical interface configuration mode context:

Syntax: ip igmp version [1 | 2]

For example, if your network used version 1, you could configure an Ethernet interface to run IGMP version 1:

```
ProCurve(config-eth 0/1)# ip igmp version 1
```

You can also alter settings such as how often the interface issues IGMP queries and how long it waits after a group membership expires to remove that group from its IGMP table. These configuration tasks are aimed at containing packets and are not necessary. (See “Altering IGMP Query Intervals” on page 12-19.)

Enabling IGMP Proxy

If you want a stub network to receive multicast messages from a remote network, you must enable IGMP proxy on the interface connecting to the stub network.

The following command enables the downstream interface to forward IGMP reports to the multicast server at the helper address:

```
ProCurve(config-eth 0/1)# ip mcast-stub helper-enable
```

You must set the actual helper address globally. (See “Setting the Multicast Helper Address” on page 12-12.)

If you do not enter this command, the upstream interface send joins towards the multicast source; the router will not forward multicasts to local hosts because it will not itself receive the multicast traffic.

Note

Even though you have enabled the router to act as a multicast host to a remote router, the downstream interface still acts as a multicast agent for directly connected local hosts.

Enabling Multicast Forwarding

Entering **ip mcast-stub downstream** automatically enables multicast forwarding through the interface. When the interface, acting as a multicast agent, determines that the connected network contains hosts for a specific multicast address, the router adds that address to its multicast routing table. The entry includes the downstream interface as the “outgoing” interface. When the router receives a packet destined to the multicast address, it forwards it out the outgoing interfaces listed in the multicast table.

Note

You must enable IP multicast routing globally in order for an interface to forward multicast messages. (See “Enabling IP Multicast Routing” on page 12-12. Multicast routing is disabled by default.) If IP multicast routing is disabled, the interface will only run IGMP.

Configuring an Upstream Interface

An upstream interface is a forwarding helper interface: an interface through which the router reaches the helper address. The multicast server considers the upstream interface to be the multicast host. Although you can configure more than one upstream interface, the router only uses one (the interface that is the least number of hops from the helper address). Otherwise, the router would receive multicast source on more than one interface and would not know how to set the incoming interface for entries in its multicast routing table.

Upstream interfaces on a stub router should fulfill two functions:

- Multicast forwarding—The interface receives multicast messages from the multicast source at a remote site.
- IGMP proxy—The interface acts as a multicast host to the multicast server and forwards IGMP reports, joins, and leaves with its own source address. The interface also runs an IGMP agent.

To configure an upstream interface (typically, the WAN interface), move to the logical interface configuration mode context. (You can configure any Layer 2 interface as an upstream interface.)

You enable both IGMP proxy and multicast forwarding functions with the following command:

```
ProCurve(config-ppp 1)# ip mcast-stub upstream
```

You should *not* enter the **ip mcast-stub helper-enable** command. Downstream interfaces enabled for IGMP proxy will automatically forward IGMP messages through the upstream interface closest to their helper address.

Configuring Multicast Routing through a Fixed Interface

Instead of, or in addition to, specifying downstream interfaces, you can specify fixed interfaces. A fixed interface is an interface on which traffic for a specific multicast group or groups is always forwarded. Because static multicast settings take precedence over dynamic settings, the router will always forward the specified multicast traffic through the fixed interface, no matter what IGMP activity occurs in the LAN.

Because the fixed interface is an alternative to a downstream interface, you should remember to configure these settings before configuring a fixed interface:

- enable multicast routing
- specify the helper address
- configure the upstream interface

Then, move to the configuration mode context for the interface that you want to forward the multicast traffic. For example, if you want the Ethernet 0/1 interface to act as a fixed interface, enter:

```
ProCurve(config)# interface ethernet 0/1
```

Then, enter this command:

Syntax: ip mcast-stub fixed

Next, configure the interface as a static member of one or more multicast groups. This allows the interface to receive and forward multicast packets associated with that group, regardless of whether any receivers join the group using IGMP.

To make an interface a member of a static multicast group, enter the following command from the interface configuration mode context:

Syntax: ip igmp static-group <A.B.C.D>

Replace <A.B.C.D> with the IP address of the static multicast group.

The interface has now joined the group. You must now enable it to forward the join to the multicast helper address. Enter this command from the interface configuration mode context:

Syntax: ip mcast-stub helper-enable

Tunneling Multicast Traffic through the Internet

In a WAN, multicast packets may travel through networks, such as the Internet, that do not support multicasting. In this case, you must establish a tunnel through which the router can send the multicasts.

The ProCurve Secure Router supports Generic Routing Encapsulation (GRE) tunneling. When a packet arrives on one tunnel endpoint, the router encapsulates it with a new IP header, which includes the IP address of the

remote tunnel endpoint, and a GRE header. The router then forwards the packet. Routers in the non-multicast network can read the delivery header to forward the multicast packet to the tunnel endpoint.

The router at the remote endpoint removes the GRE header from the packet and forwards the multicast packet through the correct interfaces to members of the multicast host group.

You can configure the tunnel interface as an upstream interface. The tunnel will then receive multicasts from the multicast source for clients connected to the router.

You should enable PIM-SM on the tunnel interface on the remote multicast router.

See *Chapter 11: Configuring a Tunnel with Generic Routing Encapsulation* to learn more about configuring a GRE tunnel.

Adding the Router Stack to a Multicast Group

The ProCurve Secure Router typically distinguishes between multicast packets delivering actual data and IGMP packets, which are also destined for multicast addresses. To save processing power, the router processes IGMP packets only, simply forwarding the multicast packets without processing them.

When troubleshooting, you can have the router itself join a multicast host group. The router becomes a host in the multicast group and begins to process all multicast packets. It can then answer Internet Control Message Protocol (ICMP) echo requests and respond to pings sent to the multicast address. To have the router join a multicast group, enter this command from the global configuration mode context:

Syntax: `ip igmp join <A.B.C.D>`

Replace **<A.B.C.D>** with the IP address of the multicast group. For example:

```
ProCurve(config)# ip igmp join 239.255.0.234
```

Having the router join a multicast host group can be useful for troubleshooting. You can use the **ping** and **debug** commands to determine the node that fails to forward multicast messages.

Altering IGMP Query Intervals

IGMP involves trade-offs. The protocol contains packets by giving multicast routers up-to-date information on which networks actually need specific multicasts. On the other hand, the IGMP queries that maintain this information also consume bandwidth.

Although the default settings are usually adequate, you can alter IGMP intervals. For example, in a network with relatively stable group memberships, you may determine that routers are sending too many IGMP messages. In that case, you could raise the IGMP query interval. Or, you may determine that hosts are not receiving multicasts quickly enough after joining a group. In this case, you could lower the IGMP query interval so that the router receives an updated IGMP report more quickly.

You can also reduce overhead by enabling the **immediate leave** option when an interface connects to a single host. When this host leaves a group, the router assumes the group has expired without sending any query messages. You can also enable this option when the router connects to a switch that uses IGMP snooping. Such a switch forwards all multicasts until it specifically receives a leaves from all connected hosts. Therefore, if an IGMP snooping switch *does* sends a leave for a group, the router does not need to check whether other hosts still need the multicasts.

Table 12-1 explains how to alter IGMP intervals. You enter these commands from the logical interface configuration context.

Caution

You should not alter intervals unless you have experience working with IGMP. Whenever you adjust these intervals, you risk making a router's list of group memberships and multicast routes less accurate. The timers on interfaces in the same subnet need to be consistent. For example, if you raise one interface's query interval, you need to ensure that other interfaces running IGMP have a correspondingly greater query timeout. Otherwise, they will periodically flood the network with unnecessary messages, believing that the designated multicast agent has gone down.

Table 12-1. IGMP Intervals

Interval	Function	Default	Range	Command Syntax
query interval	The query interval is how often the interface broadcasts queries to hosts on the connected network.	60 seconds	0 to 65,535 seconds	ip igmp query-interval <seconds>
query timeout	Only one router on a subnet acts as the designated querier. However, other interfaces still listen for IGMP queries. The query timeout is the time an interface waits for a query before it assumes the querier is down and begins sending its own queries. The querytimeout should be at least twice the query interval so that a router can miss one message without being timed out.	2 times the query interval	60 to 300 seconds	ip igmp querier-timeout <seconds>
query maximum response time	The interface includes a maximum response time in its queries. Multicast hosts must stagger their reports somewhere within this limit.	10 seconds	0 to 25 seconds	ip igmp query-max-response-time <seconds>
last member query interval	When an interface receives a leave message from a multicast host, it sends out a query for that group to determine whether it still has any members on the network. The last member query interval specifies how often the interface sends such queries. Usually, this interval is more rapid than that for routine queries. After sending two such queries, the interface waits up to a second longer for a response. If it does not receive one, the router removes the interface from the multicast list entry for that group's address.	1000 milliseconds	100 to 65,535 milliseconds	ip igmp last-member-query-interval <milliseconds>

Interval	Function	Default	Range	Command Syntax
immediate-leave	This command is used when an interface connects to a single host or to an IGMP snooping switch. It minimizes last member queries by allowing the router to remove the interface from a group immediately after the interface receives a leave message for that group.		—	ip igmp immediate-leave

Troubleshooting Multicast Stub Routing and IGMP

This section gives strategies for troubleshooting multicast support on the stub router only. If you determine that a problem originates on one of the remote routers running the multicast routing protocol, then you must troubleshoot that router and protocol. (See *Chapter 11: Configuring Multicast Support with PIM-SM*.)

This section also describes how to troubleshoot IGMP, which is used both by routers that run PIM-SM and those that run IGMP proxy.

Strategies and Tools

When hosts are not receiving multicast messages as they should, you need to ascertain where the multicast messages are being lost.

Is the router receiving messages, but not forwarding them? In this case, the router may not believe that the group exists on a network on which it does exist, and IGMP functions might be at fault.

Is the router not receiving multicast messages at all? In this case, IGMP proxy may be to blame; the helper device is not receiving reports from the router telling it to send those multicast messages.

If you cannot locate the problem on the local router, you should, if possible, troubleshoot the next-hop upstream router. See *Chapter 11: Configuring Multicast Support with PIM-SM* for tips on troubleshooting PIM-SM.

When troubleshooting multicast stub routing, you should follow the general procedure described below. You will use the **show** and **debug** commands summarized in Table 12-2.

Note

You enter **show** and **debug** commands from the enable mode context. You can also add **do** to the commands to enter them from any configuration mode context.

Table 12-2. Multicast and IGMP Troubleshooting Commands

View	Command Syntax	Displays	Function
group memberships stored on the router	show ip igmp groups	• multicast address • connecting (downstream) interface • uptime and expiration time • host that last reported on the group	verify that the router knows that a group exists on a network
multicast routing table	show ip mroute	for each route: • uptime and expiration time • incoming interface • list of outgoing interfaces	verify that: • the router can forward multicasts • the router will forward multicasts out the correct downstream interfaces
IGMP interfaces	show ip igmp interface	for each downstream interface: • IP address • whether IGMP is enabled • IGMP version number • IGMP intervals • helper address	• verify that the interface can run IGMP in the version used on the network • check for problems with IGMP intervals • view the helper address
real-time IGMP messages	debug ip igmp	• IGMP reports from hosts • IGMP queries	verify that the router is receiving IGMP messages
real-time IGMP messages for a specific group	debug ip igmp <A.B.C.D>	• IGMP reports from hosts • IGMP queries	verify that the router is receiving IGMP messages for a specific group

Procedure for Troubleshooting Multicast Stub Routing

1. Identify the multicast address and network in question.
2. Verify that the router believes a host group exists for that address on that network. You do so by viewing IGMP group memberships:

ProCurve# show ip igmp groups

The resulting display lists groups by their multicast address. Check that an entry exists for the multicast address. The entry should also include the interface that connects to the network in question.

3. If the interface in question does not have the group membership, the router will not forward the multicasts into the network. The lack of the entry could stem from several sources:
 - The Ethernet (or WAN) interface connecting to the network has not been configured as a downstream interface, so it is not listening for IGMP messages. Enter the following command to view the interfaces configured as IGMP interfaces:

ProCurve# show ip igmp interface

Figure 12-7 illustrates an example of the output from this command.

```
ProCurve# show ip igmp interface
eth 0/1 is UP
Ip Address is 10.22.120.47, netmask is 255.255.255.0
IGMP is enabled on interface
Current IGMP version is 2
IGMP query interval is 60 seconds
IGMP querier timeout is 120 seconds
IGMP max query response time is 10 seconds
Last member query count is 2
Last member query response interval is 1000 ms
IGMP activity: 548 joins, 0 leaves
IGMP querying router is 0.0.0.0
IGMP helper address is disabled
```

Figure 12-7. Viewing IGMP Interfaces

- The downstream interface is running a version of IGMP incompatible with that used on the network. Enter **show ip igmp interface** and view the IGMP version. You can change the version for a particular interface by entering this command from the logical interface configuration mode context:

Syntax: ip igmp version [1 | 2]

For example:

```
ProCurve(config-eth 0/1)# ip igmp version 1
```

- The downstream interface is not waiting long enough for reports from hosts. Try returning IGMP query intervals to their defaults. (See “Altering IGMP Query Intervals” on page 12-19 for a discussion of these intervals.)
 - The host that you believe should be receiving messages has not actually joined the correct multicast group. In this case, you would need to troubleshoot the host.
4. If the correct group membership exists, then the router should know to forward multicast messages into the host’s network. You should verify that the router is receiving the multicast messages. View the status of the upstream interface with the **show interfaces** command and check that it is receiving multicast packets.
 5. If the router is not receiving messages, you may have a problem with IGMP proxy. Hosts in a stub network can only receive multicasts from remote networks if the stub router runs IGMP proxy. IGMP proxy problems include:
 - The downstream interface is not running IGMP proxy. Enter **show ip igmp interface** and look for the helper address. (See Figure 12-7.)
 - If the helper address is “disabled,” move to the configuration mode context for the interface and enter:

```
ProCurve(config-eth 0/1)# ip mcast-stub helper-enable
```

If you have not done so, you must also configure the helper address from the global configuration mode context:

```
ProCurve(config)# ip mcast-stub helper-address 10.10.10.1
```

- If the helper address is “enabled,” the interface is running IGMP proxy. Verify that the helper address is correct in the running config. Also check connectivity using the **ping** command. The router must, of course, be able to reach the multicast device at the central site. If necessary, troubleshoot a connection. (See the *Basic Management and Configuration Guide*, Chapter 6: *Configuring the Data Link Layer Protocol for E1, T1, and Serial Interfaces*, Chapter 7: *ADSL WAN Connections*, and Chapter 8: *Configuring Demand Routing for Primary ISDN Modules*.)
 - In an inactive network, you can add the router stack to the multicast group (**ip igmp join <A.B.C.D>**) and use the **ping**, **debug**, and **tracert** commands to determine whether the multicast source is receiving joins from the router.
6. If the router is receiving messages but is not forwarding them, try viewing the multicast routing table. Enter:

```
ProCurve# show ip mroute
```

It should include the interface that directly connects to the network in question as an outgoing interface and the upstream interface as the incoming interface.

If the table does not exist, multicast routing may not be enabled. You must enable multicast routing in order for downstream interfaces to forward multicast messages. Enter:

```
ProCurve(config)# ip multicast-routing
```

Make sure that you have configured an upstream interface. View the portion of the running config for the upstream interface (for example, enter **show run int ppp 1**) and look for ip mcast-stub upstream.

Quick Start

This section provides the commands you must enter to quickly configure support for multicasting.

Only a minimal explanation is provided. If you need additional information about any of these options, check “Contents” on page 12-1 to locate the section that contains the explanation you need.

If you so choose, you can print and fill out Table 12-3 with information for your network. You can then use this worksheet to complete the quick start commands.

Table 12-3. Multicast Settings

Information Required	Setting	Your Setting
multicast router (helper address)	IP address	
downstream interfaces	interface ID: • Ethernet interface – <slot> – <port> • WAN interface: – <interface type> – <interface number>	
upstream interfaces	interface ID: • Ethernet interface – <slot> – <port> • WAN interface: – <interface type> – <interface number>	
IGMP version	1 or 2	

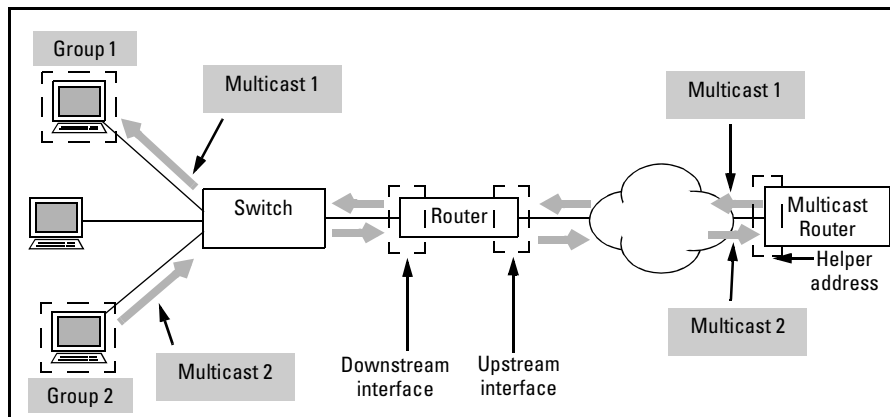


Figure 12-8. Sample Multicast Configuration

1. Enable multicast routing:
ProCurve(config)# ip multicast-routing
2. Set the helper address, which is the address of the multicast router. (See Figure 12-8.)

Syntax: ip mcast-stub helper-address <A.B.C.D>

For example:

```
ProCurve(config)# ip mcast-stub helper-address 10.1.1.2
```

Note

The local router must, of course, know a route to this address.

3. Move to the configuration mode context of the downstream interface. (See Figure 12-8.)

Syntax: interface <interface ID>

4. Enable IGMP and multicast forwarding.
ProCurve(config-eth 0/1)# ip mcast-stub downstream
5. Enable IGMP proxy to the helper address.
ProCurve(config-eth 0/1)# ip mcast-stub helper-enable
6. If so desired, configure another downstream interface. Repeat steps 3 through 5.

7. Move to the configuration mode context of the upstream interface. (See Figure 12-8.)

Syntax: interface <interface ID>

8. Enable IGMP proxy and multicast forwarding.

Syntax: ip mcast-stub upstream