Configuring SSM

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

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Prerequisites for Configuring SSM

The following are the prerequisites for configuring source-specific multicast (SSM) and SSM mapping:

- Before you configure SSM mapping, you must perform the following tasks:
  - Enable IP multicast routing. For information about this procedure, see Configuring Basic IP Multicast Routing
  - Enable PIM sparse mode. For information about this procedure, see How to Configure PIM
  - Configure SSM. For information about this procedure, see Configuring SSM, on page 6

- Before you configure static SSM mapping, you must configure access control lists (ACLs) that define the group ranges to be mapped to source addresses.
- Before you can configure and use SSM mapping with DNS look ups, you must be able to add records to a running DNS server. If you do not already have a DNS server running, you need to install one.

Note You can use a product such as *Cisco Network Registrar* to add records to a running DNS server.

Restrictions for Configuring SSM

The following are the restrictions for configuring SSM:

- To run SSM with IGMPv3, SSM must be supported in the Cisco IOS router, the host where the application is running, and the application itself.
- The SSM mapping feature does not have all the benefits of full SSM. Because SSM mapping takes a group join from a host and identifies this group with an application associated with one or more sources, it can only support one such application per group. Full SSM applications can still share the same group as in SSM mapping.
- Enable IGMPv3 carefully on the last hop router when you rely solely on SSM mapping as a transition solution for full SSM. When you enable both SSM mapping and IGMPv3 and the hosts already support IGMPv3 (but not SSM), the hosts send IGMPv3 group reports. SSM mapping does not support these IGMPv3 group reports, and the router does not correctly associate sources with these reports.
- Existing applications in a network predating SSM do not work within the SSM range unless they are modified to support (S, G) channel subscriptions. Therefore, enabling SSM in a network can cause problems for existing applications if they use addresses within the designated SSM range.
- IGMPv3 uses new membership report messages that might not be correctly recognized by older IGMP snooping switches.
- Address management is still necessary to some degree when SSM is used with Layer 2 switching mechanisms. Cisco Group Management Protocol (CGMP), IGMP snooping, or Router-Port Group Management Protocol (RGMP) support only group-specific filtering, not (S, G) channel-specific filtering. If different receivers in a switched network request different (S, G) channels sharing the same group, they do not benefit from these existing mechanisms. Instead, both receivers receive all (S, G) channel traffic and filter out the unwanted traffic on input.

  Because SSM can re-use the group addresses in the SSM range for many independent applications, this situation can lead to decreased traffic filtering in a switched network. For this reason, it is important to use random IP addresses from the SSM range for an application to minimize the chance for re-use of a single address within the SSM range between different applications. For example, an application service providing a set of television channels should, even with SSM, use a different group for each television (S, G) channel. This setup guarantees that multiple receivers to different channels within the same application service never experience traffic aliasing in networks that include Layer 2 switches.
- In PIM-SSM, the last hop router continues to periodically send (S, G) join messages if appropriate (S, G) subscriptions are on the interfaces. Therefore, as long as receivers send (S, G) subscriptions, the shortest path tree (SPT) state from the receivers to the source is maintained, even if the source does not send traffic for longer periods of time (or even never).

The opposite situation occurs with PIM-SM, where (S, G) state is maintained only if the source is sending traffic and receivers are joining the group. If a source stops sending traffic for more than 3 minutes in PIM-SM, the (S, G) state is deleted and only reestablished after packets from the source arrive again through the RPT (rendezvous point tree). Because no mechanism in PIM-SSM notifies a receiver that a source is active, the network must maintain the (S, G) state in PIM-SSM as long as receivers are requesting receipt of that channel.

Information About SSM

The source-specific multicast (SSM) feature is an extension of IP multicast in which datagram traffic is forwarded to receivers from only those multicast sources that the receivers have explicitly joined. For multicast groups configured for SSM, only SSM distribution trees (no shared trees) are created.

SSM Components Overview

SSM is a datagram delivery model that best supports one-to-many applications, also known as broadcast applications. SSM is a core networking technology for the Cisco implementation of IP multicast solutions targeted for audio and video broadcast application environments. The switch supports the following components that support SSM implementation:

- Protocol independent multicast source-specific mode (PIM-SSM)

  PIM-SSM is the routing protocol that supports the implementation of SSM and is derived from PIM sparse mode (PIM-SM).

- Internet Group Management Protocol version 3 (IGMPv3)

SSM and Internet Standard Multicast (ISM)

The current IP multicast infrastructure in the Internet and many enterprise intranets is based on the PIM-SM protocol and Multicast Source Discovery Protocol (MSDP). These protocols have the limitations of the Internet Standard Multicast (ISM) service model. For example, with ISM, the network must maintain knowledge about which hosts in the network are actively sending multicast traffic.

The ISM service consists of the delivery of IP datagrams from any source to a group of receivers called the multicast host group. The datagram traffic for the multicast host group consists of datagrams with an arbitrary IP unicast source address (S) and the multicast group address (G) as the IP destination address. Systems receive this traffic by becoming members of the host group. Membership in a host group simply requires signaling the host group through IGMP version 1, 2, or 3.

In SSM, delivery of datagrams is based on (S, G) channels. In both SSM and ISM, no signaling is required to become a source. However, in SSM, receivers must subscribe or unsubscribe to (S, G) channels to receive or not receive traffic from specific sources. In other words, receivers can receive traffic only from (S, G) channels to which they are subscribed, whereas in ISM, receivers need not know the IP addresses of sources from which they receive their traffic. The proposed standard approach for channel subscription signaling uses IGMP and includes modes membership reports, which are supported only in IGMP version 3.

SSM IP Address Range

SSM can coexist with the ISM service by applying the SSM delivery model to a configured subset of the IP multicast group address range. Cisco IOS software allows SSM configuration for the IP multicast address range of 224.0.0.0 through 239.255.255.255. When an SSM range is defined, existing IP multicast receiver applications do not receive any traffic when they try to use an address in the SSM range (unless the application is modified to use an explicit (S, G) channel subscription).

SSM Operations

An established network, in which IP multicast service is based on PIM-SM, can support SSM services. SSM can also be deployed alone in a network without the full range of protocols required for interdomain PIM-SM (for example, MSDP, Auto-RP, or bootstrap router [BSR]) if only SSM service is needed.

If SSM is deployed in a network already configured for PIM-SM, only the last-hop routers support SSM. Routers that are not directly connected to receivers do not require support for SSM. In general, these not-last-hop routers must only run PIM-SM in the SSM range and might need additional access control configuration to suppress MSDP signalling, registering, or PIM-SM shared tree operations from occurring within the SSM range.

Use the **ip pim ssm** global configuration command to configure the SSM range and to enable SSM. This configuration has the following effects:

- For groups within the SSM range, (S, G) channel subscriptions are accepted through IGMPv3 include-mode membership reports.
- PIM operations within the SSM range of addresses change to PIM-SSM, a mode derived from PIM-SM. In this mode, only PIM (S, G) join and prune messages are generated by the router, and no (S, G) rendezvous point tree (RPT) or (*, G) RPT messages are generated. Incoming messages related to RPT operations are ignored or rejected, and incoming PIM register messages are immediately answered with register-stop messages. PIM-SSM is backward-compatible with PIM-SM unless a router is a last-hop router. Therefore, routers that are not last-hop routers can run PIM-SM for SSM groups (for example, if they do not yet support SSM).
- No MSDP source-active (SA) messages within the SSM range are accepted, generated, or forwarded.

IGMPv3 Host Signalling

In IGMPv3, hosts signal membership to last hop routers of multicast groups. Hosts can signal group membership with filtering capabilities with respect to sources. A host can either signal that it wants to receive traffic from all sources sending to a group except for some specific sources (called exclude mode), or that it wants to receive traffic only from some specific sources sending to the group (called include mode).

IGMPv3 can operate with both Internet Standard Multicast (ISM) and Source Specific Multicast (SSM). In ISM, both exclude and include mode reports are applicable. In SSM, only include mode reports are accepted by the last-hop router. Exclude mode reports are ignored.

SSM Mapping

In a typical set-top box (STB) deployment, each TV channel uses one separate IP multicast group and has one active server host sending the TV channel. A single server can send multiple TV channels, but each to a different group. In this network environment, if a router receives an IGMPv1 or IGMPv2 membership report for a particular group, the report addresses the well-known TV server for the TV channel associated with the multicast group.

When SSM mapping is configured, if a router receives an IGMPv1 or IGMPv2 membership report for a particular group, the router translates this report into one or more channel memberships for the well-known sources associated with this group.

When the router receives an IGMPv1 or IGMPv2 membership report for a group, the router uses SSM mapping to determine one or more source IP addresses for the group. SSM mapping then translates the membership report as an IGMPv3 report and continues as if it had received an IGMPv3 report. The router then sends PIM joins and continues to be joined to these groups as long as it continues to receive the IGMPv1 or IGMPv2 membership reports, and the SSM mapping for the group remains the same.

SSM mapping enables the last hop router to determine the source addresses either by a statically configured table on the router or through a DNS server. When the statically configured table or the DNS mapping changes, the router leaves the current sources associated with the joined groups.

Static SSM Mapping

With static SSM mapping, you can configure the last hop router to use a static map to determine the sources that are sending to groups. Static SSM mapping requires that you configure ACLs to define group ranges. After configuring the ACLs to define group ranges, you can then map the groups permitted by those ACLs to sources by using the **ip igmp ssm-map static** global configuration command.

You can configure static SSM mapping in smaller networks when a DNS is not needed or to locally override DNS mappings. When configured, static SSM mappings take precedence over DNS mappings.

Related Topics

Configuring Static SSM Mapping, on page 8

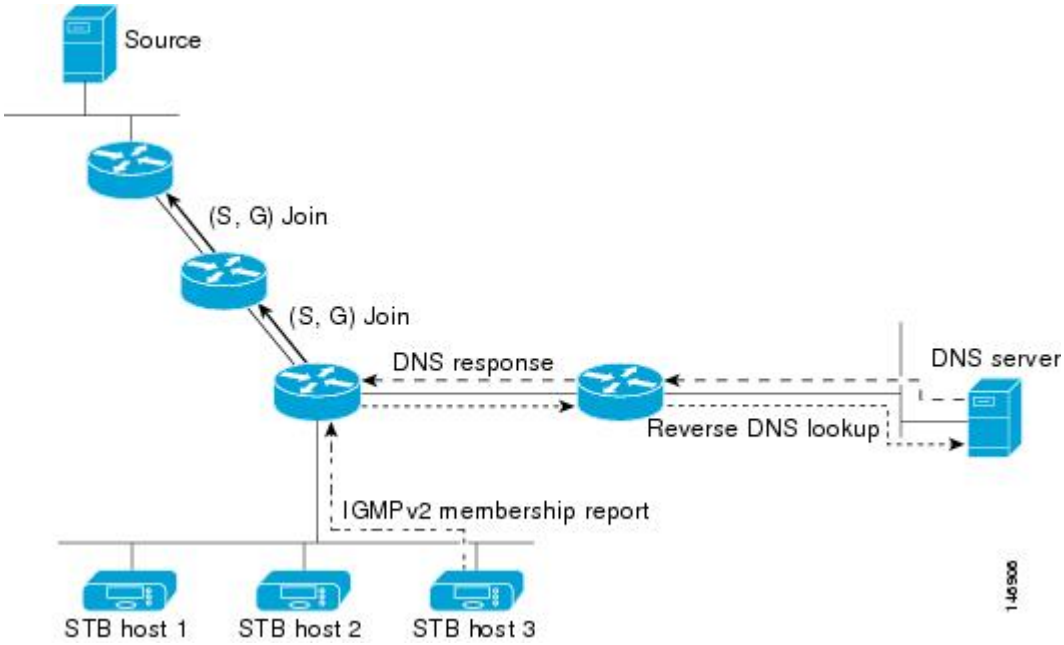
Configuring Static Traffic Forwarding with SSM Mapping, on page 11

DNS-Based SSM Mapping

You can use DNS-based SSM mapping to configure the last hop router to perform a reverse DNS lookup to determine sources sending to groups. When DNS-based SSM mapping is configured, the router constructs a domain name that includes the group address and performs a reverse lookup into the DNS. The router looks up IP address resource records and uses them as the source addresses associated with this group. SSM mapping supports up to 20 sources for each group. The router joins all sources configured for a group.

The following figure displays DNS-based SSM mapping.

Figure 1: DNS-Based SSM Mapping



The SSM mapping mechanism that enables the last hop router to join multiple sources for a group can provide source redundancy for a TV broadcast. In this context, the last hop router provides redundancy using SSM mapping to simultaneously join two video sources for the same TV channel. However, to prevent the last hop router from duplicating the video traffic, the video sources must use a server-side switchover mechanism. One video source is active, and the other backup video source is passive. The passive source waits until an active source failure is detected before sending the video traffic for the TV channel. Thus, the server-side switchover mechanism ensures that only one of the servers is actively sending video traffic for the TV channel.

To look up one or more source addresses for a group that includes G1, G2, G3, and G4, you must configure these DNS records on the DNS server:

```
G4.G3.G2.G1 [multicast-domain] [timeout] IN A source-address-1
 IN A source-address-2
 IN A source-address-n
```

See your DNS server documentation for more information about configuring DNS resource records.

Related Topics

Configuring DNS-Based SSM Mapping, on page 9

How to Configure SSM

Configuring SSM

This procedure is optional.

SUMMARY STEPS

1. **configure terminal**
2. **ip pim ssm** [**default** | **range** *access-list*]
3. **interface** *type number*
4. **ip pim** {**sparse-mode** | **sparse-dense-mode**}
5. **ip igmp version 3**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**ip pim ssm** [**default**	**range** *access-list*] **Example:** `Switch(config)# ip pim ssm range 20`	Defines the SSM range of IP multicast addresses.
Step 3	**interface** *type number* **Example:** `Switch(config)# interface gigabitethernet 1/0/1`	Selects an interface that is connected to hosts on which IGMPv3 can be enabled, and enters the interface configuration mode.
Step 4	**ip pim** {**sparse-mode**	**sparse-dense-mode**} **Example:** `Switch(config-if)# ip pim sparse-dense-mode`	Enables PIM on an interface. You must use either sparse mode or sparse-dense mode.
Step 5	**ip igmp version 3** **Example:** `Switch(config-if)# ip igmp version 3`	Enables IGMPv3 on this interface. The default version of IGMP is set to Version 2.

Configuring Source Specific Multicast Mapping

The Source Specific Multicast (SSM) mapping feature supports SSM transition when supporting SSM on the end system is impossible or unwanted due to administrative or technical reasons. You can use SSM mapping

to leverage SSM for video delivery to legacy STBs that do not support IGMPv3 or for applications that do not use the IGMPv3 host stack.

Configuring Static SSM Mapping

The following procedure describes how to configure static SSM mapping.

SUMMARY STEPS

1. **configure terminal**
2. **ip igmp ssm-map enable**
3. **no ip igmp ssm-map query dns**
4. **ip igmp ssm-map static** *access-list source-address*
5. Repeat Step 4 to configure additional static SSM mappings, if required.
6. **end**
7. **show running-config**
8. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**ip igmp ssm-map enable** **Example:** `Switch(config)# ip igmp ssm-map enable`	Enables SSM mapping for groups in the configured SSM range. **Note** By default, this command enables DNS-based SSM mapping.
Step 3	**no ip igmp ssm-map query dns** **Example:** `Switch(config)# no ip igmp ssm-map dns`	(Optional) Disables DNS-based SSM mapping. **Note** Disable DNS-based SSM mapping if you only want to rely on static SSM mapping. By default, the **ip igmp ssm-map** global configuration command enables DNS-based SSM mapping.
Step 4	**ip igmp ssm-map static** *access-list source-address* **Example:** `Switch(config)# ip igmp ssm-map static`	Configures static SSM mapping. The ACL supplied for *access-list* defines the groups to be mapped to the source IP address entered for the *source-address*.

	Command or Action	Purpose
	`11 172.16.8.11`	**Note** You can configure additional static SSM mappings. If additional SSM mappings are configured and the router receives an IGMPv1 or IGMPv2 membership report for a group in the SSM range, the switch determines the source addresses associated with the group by using each configured **ip igmp ssm-map static** command. The switch associates up to 20 sources per group.
Step 5	Repeat Step 4 to configure additional static SSM mappings, if required.	—
Step 6	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode.
Step 7	**show running-config** **Example:** `Switch# show running-config`	Verifies your entries.
Step 8	**copy running-config startup-config** **Example:** `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Related Topics

Static SSM Mapping, on page 5

Configuring DNS-Based SSM Mapping

To configure DNS-based SSM mapping, you need to create a DNS server zone or add records to an existing zone. If the routers that are using DNS-based SSM mapping are also using DNS for other purposes, you should use a normally configured DNS server. If DNS-based SSM mapping is the only DNS implementation being used on the router, you can configure a false DNS setup with an empty root zone or a root zone that points back to itself.

SUMMARY STEPS

1. **configure terminal**
2. **ip igmp ssm-map enable**
3. **ip igmp ssm-map query dns**
4. **ip domain multicast** *domain-prefix*
5. **ip name-server** *server-address1* [*server-address2... server-address6*]
6. Repeat Step 5 to configure additional DNS servers for redundancy, if required.
7. **end**
8. **show running-config**
9. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**ip igmp ssm-map enable** **Example:** `Switch(config)# ip igmp ssm-map enable`	Enables SSM mapping for groups in a configured SSM range.
Step 3	**ip igmp ssm-map query dns** **Example:** `Switch(config)# ip igmp ssm-map query dns`	(Optional) Enables DNS-based SSM mapping. By default, the **ip igmp ssm-map** command enables DNS-based SSM mapping. Only the **no** form of this command is saved to the running configuration. **Note** Use this command to reenable DNS-based SSM mapping if DNS-based SSM mapping is disabled.
Step 4	**ip domain multicast** *domain-prefix* **Example:** `Switch(config)# ip domain multicast ssm-map.cisco.com`	(Optional) Changes the domain prefix used by the switch for DNS-based SSM mapping. By default, the switch uses the *ip-addr.arpa* domain prefix.
Step 5	**ip name-server** *server-address1* [*server-address2... server-address6*] **Example:** `Switch(config)# ip name-server`	Specifies the address of one or more name servers to use for name and address resolution.

	Command or Action	Purpose
	`172.16.1.111 172.16.1.2`	
Step 6	Repeat Step 5 to configure additional DNS servers for redundancy, if required.	—
Step 7	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode.
Step 8	**show running-config** **Example:** `Switch# show running-config`	Verifies your entries.
Step 9	**copy running-config startup-config** **Example:** `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Related Topics

DNS-Based SSM Mapping, on page 5

Configuring Static Traffic Forwarding with SSM Mapping

Use static traffic forwarding with SSM mapping to statically forward SSM traffic for certain groups.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *type number*
3. **ip igmp static-group** *group-address* **source ssm-map**
4. **end**
5. **show running-config**
6. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters the global configuration mode.
Step 2	**interface** *type number* **Example:** `Switch(config)# interface gigabitethernet 1/0/1`	Selects an interface on which to statically forward traffic for a multicast group using SSM mapping, and enters interface configuration mode. **Note** Static forwarding of traffic with SSM mapping works with either DNS-based SSM mapping or statically configured SSM mapping.
Step 3	**ip igmp static-group** *group-address* **source ssm-map** **Example:** `Switch(config-if)# ip igmp static-group 239.1.2.1 source ssm-map`	Configures SSM mapping to statically forward a (S, G) channel from the interface. Use this command if you want to statically forward SSM traffic for certain groups. Use DNS-based SSM mapping to determine the source addresses of the channels.
Step 4	**end** **Example:** `Switch(config-if)# end`	Returns to privileged EXEC mode.
Step 5	**show running-config** **Example:** `Switch# show running-config`	Verifies your entries.
Step 6	**copy running-config startup-config** **Example:** `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Related Topics

Static SSM Mapping, on page 5

Monitoring SSM

Use the privileged EXEC commands in the following table to monitor SSM.

Table 1: Commands for Monitoring SSM

Command	Purpose
show ip igmp groups detail	Displays the (S, G) channel subscription through IGMPv3.
show ip mroute	Displays whether a multicast group supports SSM service or whether a source-specific host report was received.

Monitoring SSM Mapping

Use the privileged EXEC commands in the following table to monitor SSM mapping.

Table 2: SSM Mapping Monitoring Commands

Command	Purpose
show ip igmp ssm-mapping	Displays information about SSM mapping.
show ip igmp ssm-mapping *group-address*	Displays the sources that SSM mapping uses for a particular group.
show ip igmp groups [*group-name* | *group-address* | *interface-type interface-number*] [**detail**]	Displays the multicast groups with receivers that are directly connected to the router and that were learned through IGMP.
show host	Displays the default domain name, the style of name lookup service, a list of name server hosts, and the cached list of hostnames and addresses.
debug ip igmp *group-address*	Displays the IGMP packets received and sent and IGMP host-related events.

Where to Go Next

You can configure the following for your IP multicast configuration:

- IGMP feature support

- PIM feature support
- IP Multicast Routing

Additional References

Related Documents

Related Topic	Document Title
For complete syntax and usage information for the commands used in this chapter.	*Catalyst 2960-XR Switch IP Multicast Command Reference*

Standards and RFCs

Standard/RFC	Title
—	—

MIBs

MIB	MIBs Link
All supported MIBs for this release.	To locate and download MIBs for selected platforms, Cisco IOS 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 website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/support

Feature History and Information for SSM

Release	Modification
Cisco IOS 15.0(2)EX1	This feature was introduced.