RSVP Message Authentication

Last Updated: July 25, 2011

The Resource Reservation Protocol (RSVP) Message Authentication feature provides a secure method to control quality of service (QoS) access to a network.

History for the RSVP Message Authentication Feature

Release	Modification
12.2(15)T	This feature was introduced.
12.0(26)S	Restrictions were added for interfaces that use Fast Reroute (FRR) node or link protection and for RSVP hellos for FRR for packet over SONET (POS) interfaces.
12.0(29)S	Support was added for per-neighbor keys.
12.2(33)SRA	This feature was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SXH	This feature was integrated into Cisco IOS Release 12.2(33)SXH.

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. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for RSVP Message Authentication

Ensure that RSVP is configured on one or more interfaces on at least two neighboring routers that share a link within the network.

Restrictions for RSVP Message Authentication

- The RSVP Message Authentication feature is only for authenticating RSVP neighbors.
- The RSVP Message Authentication feature cannot discriminate between various QoS applications or users, of which many may exist on an authenticated RSVP neighbor.
- Different send and accept lifetimes for the same key in a specific key chain are not supported; all RSVP key types are bidirectional.
- Authentication for graceful restart hello messages is supported for per-neighbor and per-access control list (ACL) keys, but not for per-interface keys.
- You cannot use the **ip rsvp authentication key** and the **ip rsvp authentication key-chain** commands on the same router interface.
- For a Multiprotocol Label Switching/Traffic Engineering (MPLS/TE) configuration, use per-neighbor keys with physical addresses and router IDs.

Information About RSVP Message Authentication

Feature Design of RSVP Message Authentication

Network administrators need the ability to establish a security domain to control the set of systems that initiate RSVP requests.

The RSVP Message Authentication feature permits neighbors in an RSVP network to use a secure hash to sign all RSVP signaling messages digitally, thus allowing the receiver of an RSVP message to verify the

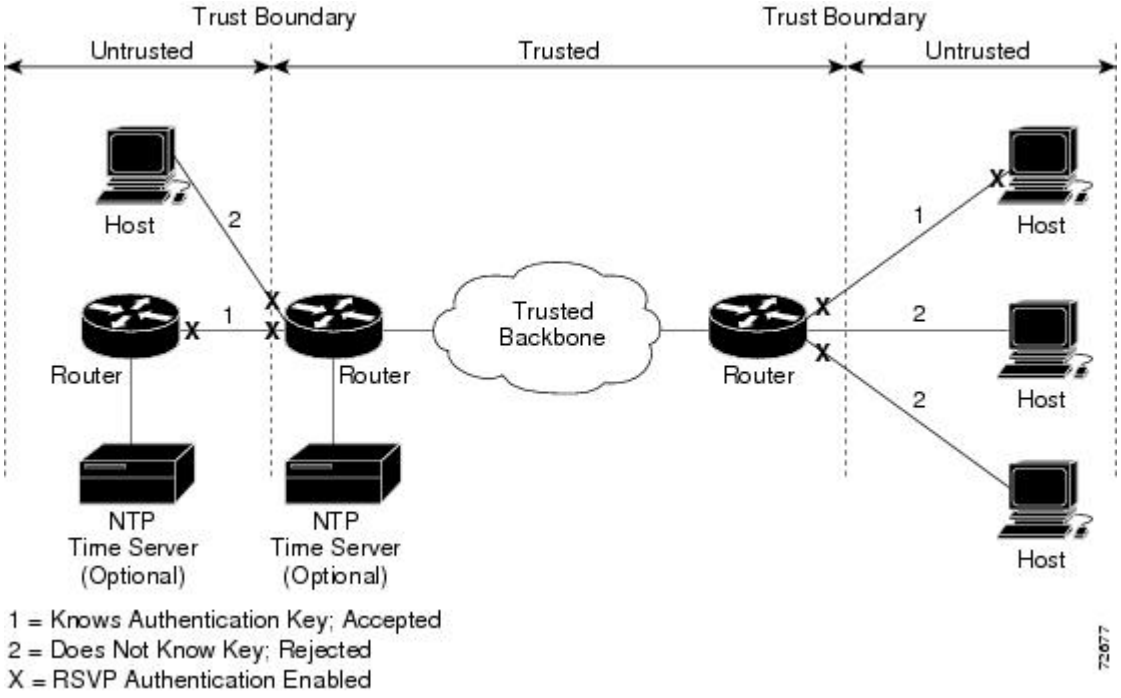
sender of the message without relying solely on the sender's IP address as is done by issuing the **ip rsvp neighbor** command with an ACL.

The signature is accomplished on a per-RSVP-hop basis with an RSVP integrity object in the RSVP message as defined in RFC 2747. This method provides protection against forgery or message modification. However, the receiver must know the security key used by the sender in order to validate the digital signature in the received RSVP message.

Network administrators manually configure a common key for each RSVP neighbor interface on the shared network. A sample configuration is shown in the figure below.

Figure 1

RSVP Message Authentication Configuration



Global Authentication and Parameter Inheritance

You can configure global defaults for all authentication parameters including key, type, window size, lifetime, and challenge. These defaults are inherited when you enable authentication for each neighbor or interface. However, you can also configure these parameters individually on a per-neighbor or per-interface basis in which case the inherited global defaults are ignored.

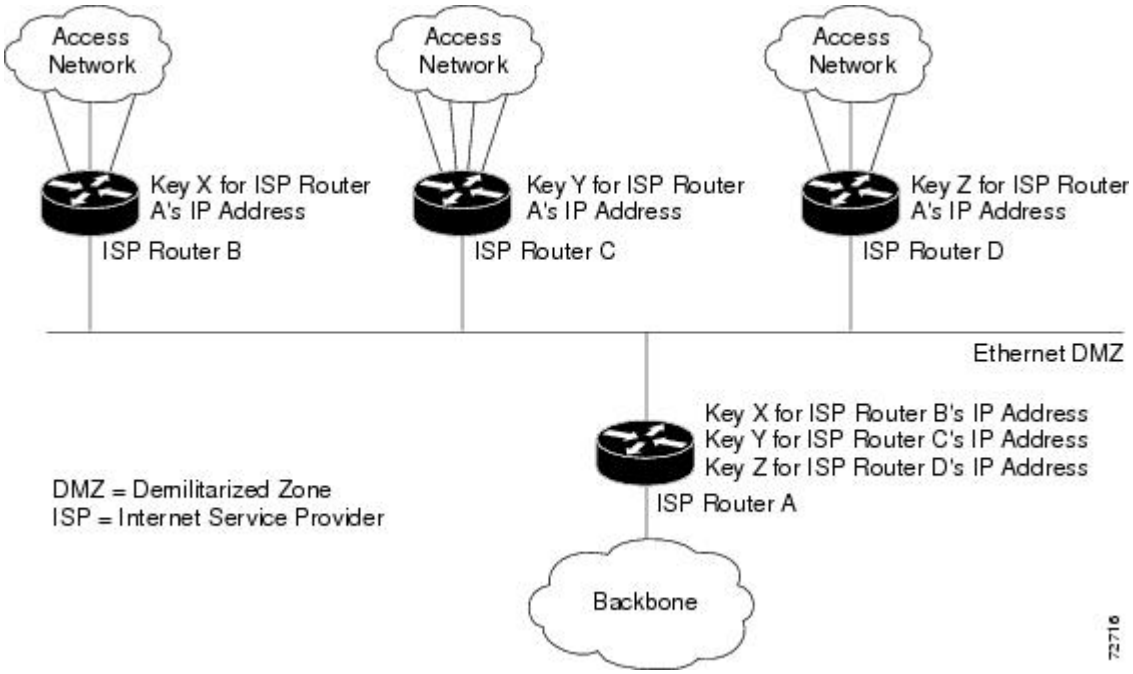
Using global authentication and parameter inheritance can simplify configuration because you can enable or disable authentication without having to change each per-neighbor or per-interface attribute. You can activate authentication for all neighbors by using two commands, one to define a global default key and one to enable authentication globally. However, using the same key for all neighbors does not provide the best network security.

Note RSVP uses the following rules when choosing which authentication parameter to use when that parameter is configured at multiple levels (per-interface, per-neighbor, or global). RSVP goes from the most specific to the least specific; that is, per-neighbor, per-interface, and then global. The rules are slightly different when searching the configuration for the right key to authenticate an RSVP message-- per-neighbor, per-ACL, per-interface, and then global.

Per-Neighbor Keys

In the figure below, to enable authentication between Internet service provider (ISP) Routers A and B, A and C, and A and D, the ISPs must share a common key. However, sharing a common key also enables authentication between ISP Routers B and C, C and D, and B and D. You may not want authentication among all the ISPs because they might be different companies with unique security domains.

Figure 2



On ISP Router A, you create a different key for ISP Routers B, C, and D and assign them to their respective IP addresses using RSVP commands. On the other routers, create a key to communicate with ISP Router A’s IP address.

Key Chains

For each RSVP neighbor, you can configure a list of keys with specific IDs that are unique and have different lifetimes so that keys can be changed at predetermined intervals automatically without any disruption of service. Automatic key rotation enhances network security by minimizing the problems that could result if an untrusted source obtained, deduced, or guessed the current key.

Note If you use overlapping time windows for your key lifetimes, RSVP asks the Cisco IOS software key manager component for the next live key starting at time T. The key manager walks the keys in the chain until it finds the first one with start time S and end time E such that S <= T <= E. Therefore, the key with the smallest value (E-T) may not be used next.

Benefits of RSVP Message Authentication

Improved Security

The RSVP Message Authentication feature greatly reduces the chance of an RSVP-based spoofing attack and provides a secure method to control QoS access to a network.

Multiple Environments

The RSVP Message Authentication feature can be used in traffic engineering (TE) and non-TE environments as well as with the subnetwork bandwidth manager (SBM).

Multiple Platforms and Interfaces

The RSVP Message Authentication feature can be used on any supported RSVP platform or interface.

How to Configure RSVP Message Authentication

The following configuration parameters instruct RSVP on how to generate and verify integrity objects in various RSVP messages.

Note There are two configuration procedures: full and minimal. There are also two types of authentication procedures: interface and neighbor.

Per-Interface Authentication--Full Configuration

Perform the following procedures for a full configuration for per-interface authentication:

Per-Interface Authentication--Minimal Configuration

Perform the following tasks for a minimal configuration for per-interface authentication:

Per-Neighbor Authentication--Full Configuration

Perform the following procedures for a full configuration for per-neighbor authentication:

Per-Neighbor Authentication--Minimal Configuration

Perform the following tasks for a minimal configuration for per-neighbor authentication:

- Enabling RSVP on an Interface, page 6
- Configuring an RSVP Authentication Type, page 7

Enabling RSVP on an Interface

Perform this task to enable RSVP on an interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. ip rsvp bandwidth [*interface-kbps* [*single-flow-kbps*]]
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface Ethernet0/0`	Enters interface configuration mode. • The *type number*argument identifies the interface to be configured.

	Command or Action	Purpose
Step 4	ip rsvp bandwidth [*interface-kbps* [*single-flow-kbps*]] **Example:** `Router(config-if)# ip rsvp bandwidth 7500 7500`	Enables RSVP on an interface. • The optional *interface-kbps* and *single-flow-kbps* arguments specify the amount of bandwidth that can be allocated by RSVP flows or to a single flow, respectively. Values are from 1 to 10,000,000. **Note** Repeat this command for each interface that you want to enable.
Step 5	**end** **Example:** `Router(config-if)#` **end**	Returns to privileged EXEC mode.

Configuring an RSVP Authentication Type

Perform this task to configure an RSVP authentication type.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. Do one of the following:
   - **ip rsvp authentication type** {**md5** | **sha-1**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Command or Action	Purpose
Step 3 **interface** *type number* **Example:** `Router(config)# interface Ethernet0/0`	Enters interface configuration mode. • The *type number*argument identifies the interface to be configured. **Note** Omit this step if you are configuring an authentication type for a neighbor or setting a global default.

Command or Action	Purpose

Step 4 Do one of the following:
• **ip rsvp authentication type** {**md5** | **sha-1**
 	
Example:
`For interface authentication:`
 	
Example:
`Router(config-if)#` **ip rsvp authentication type sha-1**
 	
Example:
 	
Example:
`For neighbor authentication:`
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor address 10.1.1.1 type sha-1**
 	
Example:
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor access-list 1 type sha-1**
 	
Example:
 	
Example:
`For a global default:`
	Specifies the algorithm used to generate cryptographic signatures in RSVP messages on an interface or globally.
	• The algorithms are **md5**, the default, and **sha-1**, which is newer and more secure than **md5**.
	Note Omit the **neighbor address** *address*or the **neighbor access-list** *acl-name*or *acl-number*to set the global default.

Command or Action	Purpose
Example: `Router(config)# ip rsvp authentication type sha-1`	
Step 5 **end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

Configuring an RSVP Authentication Key

Perform this task to configure an RSVP authentication key.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip rsvp authentication key passphrase**
5. **exit**
6. Do one of the following:
   - **ip rsvp authentication key-chain** *chain*
7. **end**

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2 **configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode. **Note** If you want to configure a key, proceed to Step 3; if you want to configure a key chain, proceed to Step 6.

	Command or Action	Purpose
Step 3	**interface** *type number* **Example:** `Router(config)# interface Ethernet0/0`	Enters interface configuration mode. • The *type number*argument identifies the interface to be configured. **Note** Omit this step and go to Step 6 if you want to configure only a key chain.
Step 4	**ip rsvp authentication key passphrase** **Example:** `Router(config-if)# ip rsvp authentication key 11223344` **Example:**	Specifies the data string (key) for the authentication algorithm. • The key consists of 8 to 40 characters. It can include spaces and multiple words. It can also be encrypted or appear in clear text when displayed. **Note** Omit this step if you want to configure a key chain.
Step 5	**exit** **Example:** `Router(config-if)# exit`	Exits to global configuration mode.

Command or Action	Purpose

Step 6 Do one of the following:
• **ip rsvp authentication key-chain** *chain*
 	
Example:
`For neighbor authentication:`
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor address 10.1.1.1 key-chain xzy**
 	
Example:
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor access-list 1 key-chain xzy**
 	
Example:
 	
Example:
`For a global default:`
 	
Example:
`Router(config)#` **ip rsvp authentication key-chain xzy**
	Specifies the data string (key chain) for the authentication algorithm.
	• The key chain must have at least one key, but can have up to 2,147,483647 keys.
	Note You cannot use the **ip rsvp authentication key** and the **ip rsvp authentication key-chain** commands on the same router interface. The commands supersede each other; however, no error message is generated.
	Note Omit the **neighbor address** *address*or the **neighbor access-list** *acl-name*or *acl-number*to set the global default.

Step 7 **end** **Example:** `Router(config)#` **end**	Returns to privileged EXEC mode.

Enabling RSVP Key Encryption

Perform this task to enable RSVP key encryption when the key is stored in the router configuration. (This prevents anyone from seeing the clear text key in the configuration file.)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **key config-key 1** *string*
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**key config-key 1** *string* **Example:** `Router(config)# key config-key 1 11223344`	Enables key encryption in the configuration file. **Note** The *string* argument can contain up to eight alphanumeric characters.
Step 4	**end** **Example:** `Router(config)#` **end**	Returns to privileged EXEC mode.

Enabling RSVP Authentication Challenge

Perform this task to enable RSVP authentication challenge.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. Do one of the following:
   - **ip rsvp authentication challenge**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface Ethernet0/0`	Enters interface configuration mode. • The *type number*argument identifies the interface to be configured. **Note** Omit this step if you are configuring an authentication challenge for a neighbor or setting a global default.

Command or Action	Purpose

Step 4 Do one of the following:
• **ip rsvp authentication challenge**
 	
Example:
`For interface authentication:`
 	
Example:
`Router(config-if)#` **ip rsvp authentication challenge**
 	
Example:
 	
Example:
`For neighbor authentication:`
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor address 10.1.1.1 challenge**
 	
Example:
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor access-list 1 challenge**
 	
Example:
 	
Example:
`For a global default:`
	Makes RSVP perform a challenge-response handshake on an interface or globally when RSVP learns about any new challenge-capable neighbors on a network.
	Note Omit the **neighbor address** *address*or the **neighbor access-list** *acl-name*or *acl-number*to set the global default.

Command or Action	Purpose
Example: `Router(config)# ip rsvp authentication challenge`	
Step 5 **end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

Configuring RSVP Authentication Lifetime

Perform this task to configure the lifetimes of security associations between RSVP neighbors.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. Do one of the following:
   - **ip rsvp authentication lifetime** *hh* **:** *mm* **:** *ss*
5. **end**

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2 **configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Command or Action	Purpose
Step 3 **interface** *type number* **Example:** `Router(config)# interface Ethernet0/0`	Enters interface configuration mode. **Note** Omit this step if you are configuring an authentication lifetime for a neighbor or setting a global default. • The *type number* argument identifies the interface to be configured.

Command or Action	Purpose

Step 4 Do one of the following:
• **ip rsvp authentication lifetime** *hh* **:** *mm* **:** *ss*
 	
Example:
`For interface authentication:`
 	
Example:
`Router(config-if)#` **ip rsvp authentication lifetime 00:05:00**
 	
Example:
 	
Example:
`For neighbor authentication:`
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor address 10.1.1.1 lifetime 00:05:00**
 	
Example:
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor access-list 1 lifetime 00:05:00**
 	
Example:
 	
Example:
`For a global default:`
	Controls how long RSVP maintains security associations with RSVP neighbors on an interface or globally.
	• The default security association for **hh:mm:ss** is 30 minutes; the range is 1 second to 24 hours.
	Note Omit the **neighbor address** *address*or the **neighbor access-list** *acl-name*or *acl-number*to set the global default.

	Command or Action	Purpose
	Example: `Router(config)#` **ip rsvp authentication 00:05:00**	
Step 5	**end** **Example:** `Router(config-if)#` **end**	Returns to privileged EXEC mode.

Configuring RSVP Authentication Window Size

Perform this task to configure the RSVP authentication window size.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. Do one of the following:
   - **ip rsvp authentication window-size n**
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Command or Action	Purpose
Step 3 **interface** *type number* **Example:** `Router(config)# interface Ethernet0/0`	Enters interface configuration mode. • The *type number*argument identifies the interface to be configured. **Note** Omit this step if you are configuring a window size for a neighbor or setting a global default.

Command or Action	Purpose

Step 4 Do one of the following:
• **ip rsvp authentication window-size n**
 	
Example:
`For interface authentication:`
 	
Example:
`Router(config-if)# ip rsvp authentication window-size 2`
 	
Example:
 	
Example:
`For neighbor authentication:`
 	
Example:
`Router(config)# ip rsvp authentication neighbor address 10.1.1.1 window-size 2`
 	
Example:
 	
Example:
`Router(config)# ip rsvp authentication neighbor access-list 1 window-size`
 	
Example:
 	
Example:
`For a global default:`
	Specifies the maximum number of authenticated messages that can be received out of order on an interface or globally.
	• The default value is one message; the range is 1 to 64 messages.
	Note Omit the **neighbor address** *address*or the **neighbor access-list** *acl-name*or *acl-number*to set the global default.

Command or Action	Purpose
Example: `Router(config)# ip rsvp authentication window-size 2`	
Step 5 **end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

Activating RSVP Authentication

Perform this task to activate RSVP authentication.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. Do one of the following:
   - **ip rsvp authentication**
5. **end**

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2 **configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Command or Action	Purpose
Step 3 **interface** *type number* **Example:** `Router(config)# interface Ethernet0/0`	Enters interface configuration mode. • The *type number*argument identifies the interface to be configured. **Note** Omit this step if you are configuring authentication for a neighbor or setting a global default.

Command or Action	Purpose

Step 4 Do one of the following:
• **ip rsvp authentication**
 	
Example:
`For interface authentication:`
 	
Example:
`Router(config-if)#` **ip rsvp authentication**
 	
Example:
 	
Example:
`For neighbor authentication:`
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor address 10.1.1.1**
 	
Example:
 	
Example:
`Router(config)#` **ip rsvp authentication neighbor access-list 1**
 	
Example:
 	
Example:
`For a global default:`
	Activates RSVP cryptographic authentication on an interface or globally.
	Note Omit the **neighbor address** *address*or the **neighbor access-list** *acl-name*or *acl-number*to set the global default.

	Command or Action	Purpose
	Example: `Router(config)#` **ip rsvp authentication**	
Step 5	**end** **Example:** `Router(config-if)#` **end**	Returns to privileged EXEC mode.

Verifying RSVP Message Authentication

Perform this task to verify that the RSVP Message Authentication feature is functioning.

SUMMARY STEPS

1. **enable**
2. **show ip rsvp interface [detail] [interface-type interface-number]**
3. **show ip rsvp authentication** [**detail**] [**from**{*ip-address* | *hostname*}] [**to** {*ip-address* | *hostname*}]
4. **show ip rsvp counters** [**authentication** | **interface** *interface-unit* | **neighbor** | **summary**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ip rsvp interface [detail] [interface-type interface-number]** **Example:** `Router# show ip rsvp interface detail`	Displays information about interfaces on which RSVP is enabled, including the current allocation budget and maximum available bandwidth. • The optional **detail** keyword displays the bandwidth, signaling, and authentication parameters.

	Command or Action	Purpose
Step 3	**show ip rsvp authentication** [**detail**] [**from**{*ip-address* | *hostname*}] [**to** {*ip-address* | *hostname*}] **Example:** `Router# show ip rsvp authentication detail`	Displays the security associations that RSVP has established with other RSVP neighbors. • The optional **detail** keyword displays state information that includes IP addresses, interfaces enabled, and configured cryptographic authentication parameters about security associations that RSVP has established with neighbors.

Step 4	**show ip rsvp counters** [**authentication** | **interface** *interface-unit* | **neighbor** | **summary**]
	
	Example:
	`Router# show ip rsvp counters summary`
	
	Example:
	
	Example:
	`Router# show ip rsvp counters authentication`
		Displays all RSVP counters.
		Note The errors counter increments whenever an authentication error occurs, but can also increment for errors not related to authentication.
		• The optional **authentication** keyword shows a list of RSVP authentication counters.
		• The optional **interface** *interface-unit* keyword argument combination shows the number of RSVP messages sent and received by the specific interface.
		• The optional **neighbor**keyword shows the number of RSVP messages sent and received by the specific neighbor.
		• The optional **summary**keyword shows the cumulative number of RSVP messages sent and received by the router. It does not print per-interface counters.

Configuring a Key Chain

Perform this task to configure a key chain for neighbor authentication.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **key chain** *name-of-chain*
4. {**key** [*key-ID*] | **key-string** [*text*] | **accept-lifetime** [*start-time* {**infinite** | *end-time* | **duration** *seconds*}] | **send-lifetime** [*start-time* {**infinite** | *end-time* | **duration** *seconds*}]
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**key chain** *name-of-chain* **Example:** `Router(config)# key chain neighbor_V`	Enters key-chain mode.

Step 4	{**key** [*key-ID*] | **key-string** [*text*] | **accept-lifetime** [*start-time* {**infinite** | *end-time* | **duration** *seconds*}] | **send-lifetime** [*start-time* {**infinite** | *end-time* | **duration** *seconds*}]
	
	Example:
	`Router(config-keychain)# key 1`
	
	Example:
	
	Example:
	`Router(config-keychain)# key-string ABcXyz`
		Selects the parameters for the key chain. (These are submodes.)
		Note For details on these parameters, see the Cisco IOS IP Command Reference, Volume 2 of 4, Routing Protocols, Release 12.3T.
		Note **accept-lifetime** is ignored when a key chain is assigned to RSVP.

Step 5	**end** **Example:** `Router(config-keychain)# end`	Returns to privileged EXEC mode.

Binding a Key Chain to an RSVP Neighbor

Perform this task to bind a key chain to an RSVP neighbor for neighbor authentication.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
   - ip rsvp authentication neighbor address *address* **key-chain** *key-chain-name*
   -
   - **ip rsvp authentication neighbor access-list** *acl-name* **or** *acl-number* **key-chain** *key-chain-name*
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	Do one of the following: • ip rsvp authentication neighbor address *address* **key-chain** *key-chain-name* • • **ip rsvp authentication neighbor access-list** *acl-name* **or** *acl-number* **key-chain** *key-chain-name* **Example:** `Router(config)# ip rsvp authentication neighbor access-list 1 key-chain neighbor_V`	Binds a key chain to an IP address or to an ACL and enters key-chain mode. **Note** If you are using an ACL, you must create it before you bind it to a key chain. See the ip rsvp authentication command in the Glossary, page 34 section for examples.
Step 4	**end** **Example:** `Router(config-keychain)# end`	Returns to privileged EXEC mode.

Troubleshooting Tips

After you enable RSVP authentication, RSVP logs system error events whenever an authentication check fails. These events are logged instead of just being displayed when debugging is enabled because they may indicate potential security attacks. The events are generated when:

- RSVP receives a message that does not contain the correct cryptographic signature. This could be due to misconfiguration of the authentication key or algorithm on one or more RSVP neighbors, but it may also indicate an (unsuccessful) attack.
- RSVP receives a message with the correct cryptographic signature, but with a duplicate authentication sequence number. This may indicate an (unsuccessful) message replay attack.
- RSVP receives a message with the correct cryptographic signature, but with an authentication sequence number that is outside the receive window. This could be due to a reordered burst of valid RSVP messages, but it may also indicate an (unsuccessful) message replay attack.
- Failed challenges result from timeouts or bad challenge responses.

To troubleshoot the RSVP Message Authentication feature, use the following commands in privileged EXEC mode.

Command	Purpose
`Router# debug ip rsvp authentication`	Displays output related to RSVP authentication.
`Router# debug ip rsvp dump signalling`	Displays brief information about signaling (Path and Resv) messages.
`Router# debug ip rsvp errors`	Displays error events including authentication errors.

Configuration Examples for RSVP Message Authentication

Example RSVP Message Authentication Per-Interface

In the following example, the cryptographic authentication parameters, including type, key, challenge, lifetime, and window size are configured; and authentication is activated:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface e0/0
Router(config-if)# ip rsvp bandwidth 7500 7500
Router(config-if)# ip rsvp authentication type sha-1
Router(config-if)# ip rsvp authentication key 11223344
Router(config-if)# ip rsvp authentication challenge
Router(config-if)# ip rsvp authentication lifetime 00:30:05
Router(config-if)# ip rsvp authentication window-size 2
Router(config-if)# ip rsvp authentication
```

In the following output from the **show ip rsvp interface detail** command, notice the cryptographic authentication parameters that you configured for the Ethernet0/0 interface:

```
Router# show ip rsvp interface detail
Et0/0:
   Bandwidth:
     Curr allocated: 0 bits/sec
     Max. allowed (total): 7500K bits/sec
     Max. allowed (per flow): 7500K bits/sec
     Max. allowed for LSP tunnels using sub-pools: 0 bits/sec
     Set aside by policy (total): 0 bits/sec
   Neighbors:
     Using IP encap: 0.  Using UDP encap: 0
   Signalling:
     Refresh reduction: disabled
   Authentication: enabled
     Key:         11223344
     Type:        sha-1
     Window size: 2
     Challenge:   enabled
```

In the preceding example, the authentication key appears in clear text. If you enter the **key-config-key 1** *string* command, the key appears encrypted, as in the following example:

```
Router# show ip rsvp interface detail
 Et0/0:
   Bandwidth:
     Curr allocated: 0 bits/sec
Max. allowed (total): 7500K bits/sec
     Max. allowed (per flow): 7500K bits/sec
     Max. allowed for LSP tunnels using sub-pools: 0 bits/sec
     Set aside by policy (total): 0 bits/sec
   Neighbors:
     Using IP encap: 0.  Using UDP encap: 0
   Signalling:
     Refresh reduction: disabled
   Authentication: enabled
     Key:         <encrypted>
     Type:        sha-1
     Window size: 2
     Challenge:   enabled
```

In the following output, notice that the authentication key changes from encrypted to clear text after the **no key config-key 1** command is issued:

```
Router# show running-config interface e0/0
Building configuration...
Current configuration :247 bytes
!
interface Ethernet0/0
 ip address 192.168.101.2 255.255.255.0
 no ip directed-broadcast
 ip pim dense-mode
 no ip mroute-cache
 no cdp enable
 ip rsvp bandwidth 7500 7500
 ip rsvp authentication key 7>70>9:7<872>?74
 ip rsvp authentication
end
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# no key config-key 1

Router(config)# end


Router# show running-config
*Jan 30  08:02:09.559:%SYS-5-CONFIG_I:Configured from console by console
int e0/0
Building configuration...
```

```
Current configuration :239 bytes
!
interface Ethernet0/0
 ip address 192.168.101.2 255.255.255.0
 no ip directed-broadcast
 ip pim dense-mode
 no ip mroute-cache
 no cdp enable
 ip rsvp bandwidth 7500 7500
 ip rsvp authentication key 11223344
 ip rsvp authentication
end
```

Example RSVP Message Authentication Per-Neighbor

In the following example, a key chain with two keys for each neighbor is defined, then an access list and a key chain are created for neighbors V, Y, and Z and authentication is explicitly enabled for each neighbor and globally. However, only the neighbors specified will have their messages accepted; messages from other sources will be rejected. This enhances network security.

For security reasons, you should change keys on a regular basis. When the first key expires, the second key automatically takes over. At that point, you should change the first key's key-string to a new value and then set the send lifetimes to take over after the second key expires. The router will log an event when a key expires to remind you to update it.

The lifetimes of the first and second keys for each neighbor overlap. This allows for any clock synchronization problems that might cause the neighbors not to switch keys at the right time. You can avoid these overlaps by configuring the neighbors to use Network Time Protocol (NTP) to synchronize their clocks to a time server.

For an MPLS/TE configuration, physical addresses and router IDs are given.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# key chain neighbor_V
Router(config-keychain)# key 1
Router(config-keychain-key)# key-string R72*UiAXy
Router(config-keychain-key)# send-life 02:00:00 1 jun 2003 02:00:00 1 aug 2003
Router(config-keychain-key)# exit
Router(config-keychain)# key 2
Router(config-keychain-key)# key-string Pl349&DaQ
Router(config-keychain-key)# send-life 01:00:00 1 jun 2003 02:00:00 1 aug 2003
Router(config-keychain-key)# exit
Router(config-keychain)# exit
Router(config)# key chain neighbor_Y
Router(config-keychain)# key 3
Router(config-keychain-key)# key-string *ZXFwR!03
Router(config-keychain-key)# send-life 02:00:00 1 jun 2003 02:00:00 1 aug 2003
Router(config-keychain-key)# exit
Router(config-keychain)# key 4
Router(config-keychain-key)# key-string UnGR8f&lOmY
Router(config-keychain-key)# send-life 01:00:00 1 jun 2003 02:00:00 1 aug 2003
Router(config-keychain-key)# exit
Router(config-keychain)# exit
Router(config)# key chain neighbor_Z
Router(config-keychain)# key 5
Router(config-keychain-key)# key-string P+T=77&/M
Router(config-keychain-key)# send-life 02:00:00 1 jun 2003 02:00:00 1 aug 2003
Router(config-keychain-key)# exit
Router(config-keychain)# key 6
Router(config-keychain-key)# key-string payattention2me
Router(config-keychain-key)# send-life 01:00:00 1 jun 2003 02:00:00 1 aug 2003
Router(config-keychain-key)# exit
Router(config-keychain)# exit
Router(config)# end
```

Note You can use the **key-config-key 1** *string* command to encrypt key chains for an interface, a neighbor, or globally.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# ip access-list standard neighbor_V
Router(config-std-nacl)# permit 10.0.0.1
<------- physical address
Router(config-std-nacl)# permit 10.0.0.2
<------- physical address
Router(config-std-nacl)# permit 10.0.0.3
<------- router ID
Router(config-std-nacl)# exit
Router(config)# ip access-list standard neighbor_Y
Router(config-std-nacl)# permit 10.0.0.4
<------- physical address
Router(config-std-nacl)# permit 10.0.0.5
<------- physical address
Router(config-std-nacl)# permit 10.0.0.6
<------- router ID
Router(config-std-nacl)# exit
Router(config)# ip access-list standard neighbor_Z
Router(config-std-nacl)# permit 10.0.0.7
<------- physical address
Router(config-std-nacl)# permit 10.0.0.8
<------- physical address
Router(config-std-nacl)# permit 10.0.0.9
<------- router ID
Router(config-std-nacl)# exit
Router(config)# ip rsvp authentication neighbor access-list neighbor_V key-chain
neighbor_V
Router(config)# ip rsvp authentication neighbor access-list neighbor_Y key-chain
neighbor_Y
Router(config)# ip rsvp authentication neighbor access-list neighbor_Z key-chain
neighbor_Z
Router(config)# ip rsvp authentication
Router(config)# end
```

Additional References

The following sections provide references related to the RSVP Message Authentication feature.

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
RSVP commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS Quality of Service Solutions Command Reference*
QoS features including signaling, classification, and congestion management	"Quality of Service Overview" module
Inter-AS features including local policy support and per-neighbor keys authentication	"MPLS Traffic Engineering--Inter-AS-TE" module

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	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

RFCs

RFCs	Title
RFC 1321	*The MD5 Message Digest Algorithm*
RFC 2104	*HMAC: Keyed-Hashing for Messaging Authentication*
RFC 2205	*Resource Reservation Protocol*
RFC 2209	*RSVP--Version 1 Message Processing Rules*
RFC 2401	*Security Architecture for the Internet Protocol*
RFC 2747	*RSVP Cryptographic Authentication*
RFC 3097	*RSVP Crytographic Authentication--Updated Message Type Value*
RFC 3174	*US Secure Hash Algorithm 1 (SHA1)*

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

Glossary

bandwidth --The difference between the highest and lowest frequencies available for network signals. The term also is used to describe the rated throughput capacity of a given network medium or protocol.

DMZ--demilitarized zone. The neutral zone between public and corporate networks.

flow --A stream of data traveling between two endpoints across a network (for example, from one LAN station to another). Multiple flows can be transmitted on a single circuit.

key --A data string that is combined with source data according to an algorithm to produce output that is unreadable until decrypted.

QoS --quality of service. A measure of performance for a transmission system that reflects its transmission quality and service availability.

router --A network layer device that uses one or more metrics to determine the optimal path along which network traffic should be forwarded. Routers forward packets from one network to another based on network layer information.

RSVP --Resource Reservation Protocol. A protocol that supports the reservation of resources across an IP network. Applications running on IP end systems can use RSVP to indicate to other nodes the nature (bandwidth, jitter, maximum burst, and so on) of the packet streams they want to receive.

security association --A block of memory used to hold all the information RSVP needs to authenticate RSVP signaling messages from a specific RSVP neighbor.

spoofing --The act of a packet illegally claiming to be from an address from which it was not actually sent. Spoofing is designed to foil network security mechanisms, such as filters and access lists.

TE --traffic engineering. The techniques and processes used to cause routed traffic to travel through the network on a path other than the one that would have been chosen if standard routing methods had been used.

trusted neighbor --A router with authorized access to information.