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IP Security VPN Monitoring

The IP Security VPN Monitoring feature provides VPN session monitoring enhancements that will allow you to troubleshoot the Virtual Private Network (VPN) and monitor the end-user interface. Session monitoring enhancements include the following:

- Ability to specify an Internet Key Exchange (IKE) peer description in the configuration file
- Summary listing of crypto session status
- Syslog notification for crypto session up or down status
- Ability to clear both IKE and IP Security (IPsec) security associations (SAs) using one command-line interface (CLI)

Findings Feature Information, page 1
Prerequisites for IP Security VPN Monitoring, page 2
Restrictions for IP Security VPN Monitoring, page 2
Information About IPsec VPN Monitoring, page 3
How to Configure IP Security VPN Monitoring, page 3
Configuration Examples for IP Security VPN Monitoring, page 6
Additional References, page 7
Feature Information for IP Security VPN Monitoring, page 8

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 IP Security VPN Monitoring

- You should be familiar with IPSec and encryption.
- Your router must support IPSec, and before using the IP Security VPN Monitoring feature, you must have configured IPSec on your router.
Restrictions for IP Security VPN Monitoring

- You must be running Cisco IOS XE k8 or k9 crypto images on your router.

Information About IPsec VPN Monitoring

- Background Crypto Sessions, page 2
- Per-IKE Peer Description, page 2
- Summary Listing of Crypto Session Status, page 2
- Syslog Notification for Crypto Session Up or Down Status, page 3
- IKE and IPsec Security Exchange Clear Command, page 3

Background Crypto Sessions

A crypto session is a set of IPSec connections (flows) between two crypto endpoints. If the two crypto endpoints use IKE as the keying protocol, they are IKE peers to each other. Typically, a crypto session consists of one IKE security association (for control traffic) and at least two IPSec security associations (for data traffic—one per each direction). There may be duplicated IKE security associations (SAs) and IPSec SAs or duplicated IKE SAs or IPSec SAs for the same session in the duration of rekeying or because of simultaneous setup requests from both sides.

Per-IKE Peer Description

The Per-IKE Peer Description function allows you to enter a description of your choosing for an IKE peer. The unique peer description, which can include up to 80 characters, can be used whenever you are referencing that particular IKE peer. To add the peer description, use the `description` command.

Note

IKE peers that “sit” behind a Network Address Translation (NAT) device cannot be uniquely identified; therefore, they have to share the same peer description.

The primary application of this description field is for monitoring purposes (for example, when using `show` commands or for logging [syslog messages]). The description field is purely informational (for example, it cannot act as a substitute for the peer address or FQDN when defining crypto maps).

Summary Listing of Crypto Session Status

You can get a list of all the active VPN sessions by entering the `show crypto session` command. The listing will include the following:

- Interface
- IKE peer description, if available
- IKE SAs that are associated with the peer by whom the IPSec SAs are created
- IPSec SAs serving the flows of a session
Multiple IKE or IPSec SAs may be established for the same peer (for the same session), in which case IKE peer descriptions will be repeated with different values for the IKE SAs that are associated with the peer and for the IPSec SAs that are serving the flows of the session.

You can also use the `show crypto session detail` variant of this command to obtain more detailed information about the sessions.

Syslog Notification for Crypto Session Up or Down Status

The Syslog Notification for Crypto Session Up or Down Status function provides syslog notification every time the crypto session comes up or goes down.

The following is a sample syslog notification showing that a crypto session is up:

```
%CRYPTO-5-SESSION_STATUS: Crypto session is UP. Peer 10.6.6.1:500 fvrf=name10 ivrf=name20 Description: SJC24-2-VPN-Gateway Id: 10.5.5.2
```

The following is a sample syslog notification showing that a crypto session is down:

```
%CRYPTO-5-SESSION_STATUS: Crypto session is DOWN. Peer 10.6.6.1:500 fvrf=name10 ivrf=name20 Description: SJC24-2-VPN-Gateway Id: 10.5.5.2
```

IKE and IPsec Security Exchange Clear Command

The `clear crypto session` command allows you to clear both IKE and IPsec with a single command. To clear a specific crypto session or a subset of all the sessions (for example, a single tunnel to one remote site), you need to provide session-specific parameters, such as a local or remote IP address, a local or remote port, a front door VPN routing and forwarding (FVRF) name, or an inside VRF (IVRF) name. Typically, the remote IP address will be used to specify a single tunnel to be deleted.

If a local IP address is provided as a parameter when you use the `clear crypto session` command, all the sessions (and their IKE SAs and IPSec SAs) that share the IP address as a local crypto endpoint (IKE local address) will be cleared. If you do not provide a parameter when you use the `clear crypto session` command, all IPsec SAs and IKE SAs that are in the router will be deleted.

How to Configure IP Security VPN Monitoring

- Adding the Description of an IKE Peer, page 3
- Verifying Peer Descriptions, page 4
- Clearing a Crypto Session, page 5

Adding the Description of an IKE Peer

To add the description of an IKE peer to an IPsec VPN session, perform the following steps.

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `crypto isakmp peer {ip-address ip-address}`
4. `description`
## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> crypto isakmp peer {ip-address ip-address}</td>
<td>Enables an IPsec peer for IKE querying of authentication, authorization, and accounting (AAA) for tunnel attributes in aggressive mode and enters ISAKMP peer configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router (config)# crypto isakmp peer address 10.2.2.9</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> description</td>
<td>Adds a description for an IKE peer.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router (config-isakmp-peer)# description connection from site A</td>
<td></td>
</tr>
</tbody>
</table>

## Verifying Peer Descriptions

To verify peer descriptions, use the **show crypto isakmp peer** command.

### SUMMARY STEPS

1. enable
2. show crypto isakmp peer

## DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td><strong>Step 2</strong></td>
<td></td>
</tr>
<tr>
<td>show crypto isakmp peer</td>
<td>Displays peer descriptions.</td>
</tr>
</tbody>
</table>

**Example:**

```
Router# show crypto isakmp peer
```

**Examples**

The following output example verifies that the description “connection from site A” has been added for IKE peer 10.2.2.9:

```
Router# show crypto isakmp peer
Peer: 10.2.2.9 Port: 500
   Description: connection from site A
   flags: PEER_POLICY

When the peer at address 10.2.2.9 connects and the session comes up, the syslog status will be shown as follows:

%CRYPTO-5-SESSION_STATUS: Crypto tunnel is UP. Peer 10.2.2.9:500 Description: connection from site A Id: ezvpn

The following output example verifies that the description “connection from site A” has been added for IKE peer 10.2.2.9:

```
Router# show crypto isakmp peer
Peer: 10.2.2.9 Port: 500
   Description: connection from site A
   flags: PEER_POLICY

When the peer at address 10.2.2.9 connects and the session comes up, the syslog status will be shown as follows:

%CRYPTO-5-SESSION_STATUS: Crypto tunnel is UP. Peer 10.2.2.9:500 Description: connection from site A Id: ezvpn
```
DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router&gt; enable</td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> clear crypto session</td>
<td>Deletes crypto sessions (IPSec and IKE SAs).</td>
</tr>
<tr>
<td><strong>Example:</strong> Router# clear crypto session</td>
<td></td>
</tr>
</tbody>
</table>

Configuration Examples for IP Security VPN Monitoring

- show crypto session Command Output Examples, page 6

show crypto session Command Output Examples

The following is sample output for the `show crypto session` output without the `detail` keyword:

```
Router# show crypto session
Crypto session current status
Interface: FastEthernet0/1
Session status: UP-ACTIVE
Peer: 172.0.0.2/500
IKE SA: local 172.0.0.1/500 remote 172.0.0.2/500 Active
    IPSEC FLOW: permit ip 10.10.0.0.255.255.255.0 10.30.0.0/255.255.255.0
    Active SAs: 2, origin: crypto map

The following is sample output using the `show crypto session` command and the `detail` keyword:

```
Router# show crypto session detail
Interface: Tunnel0
Session status: UP-ACTIVE
Peer: 10.1.1.3 port 500 fvr: (none) ivrf: (none)
    Desc: this is my peer at 10.1.1.3:500 Green
    Phase1_id: 10.1.1.3
    IKE SA: local 10.1.1.4/500 remote 10.1.1.3/500 Active
        Capabilities:(none) connid:3 lifetime:22:03:24
    IPSEC FLOW: permit ip 10.1.1.4 host 10.1.1.3
        Active SAs: 4, origin: crypto map
        Inbound: #pkts dec'ed 0 drop 0 life (KB/Sec) 0/0
        Outbound: #pkts enc'ed 0 drop 0 life (KB/Sec) 0/0
    IPSEC FLOW: permit ip host 10.1.1.4 host 10.1.1.3
        Active SAs: 4, origin: crypto map
        Inbound: #pkts dec'ed 4 drop 0 life (KB/Sec) 4605665/2949
        Outbound: #pkts enc'ed 4 drop 1 life (KB/Sec) 4605665/2949
```
Additional References

The following sections provide references related to IP Security VPN Monitoring.

- Related Documents, page 7
- Standards, page 7
- MIBs, page 7
- RFCs, page 7
- Technical Assistance, page 8

Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP security, encryption, and IKE</td>
<td>• Configuring Internet Key Exchange for IPsec VPNs</td>
</tr>
<tr>
<td></td>
<td>• Configuring Security for VPNs with IPsec</td>
</tr>
<tr>
<td>Security commands</td>
<td><em>Cisco IOS Security Command Reference</em></td>
</tr>
</tbody>
</table>

Standards

<table>
<thead>
<tr>
<th>Standards</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No new or modified standards are supported by this feature, and support for exiting standards has not been modified by this feature.</td>
</tr>
</tbody>
</table>

MIBs

<table>
<thead>
<tr>
<th>MIBs Link</th>
<th>MIBs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No new or modified MIBs are supported by this feature, and support for exiting MIBs has not been modified by this feature.</td>
</tr>
</tbody>
</table>

RFCs

<table>
<thead>
<tr>
<th>Title</th>
<th>RFCs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No new or modified RFCs are supported by this feature, and support for exiting RFCs has not been modified by this feature.</td>
</tr>
</tbody>
</table>
Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including</td>
<td><a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a></td>
</tr>
<tr>
<td>documentation and tools for troubleshooting and resolving technical issues</td>
<td></td>
</tr>
<tr>
<td>with Cisco products and technologies.</td>
<td></td>
</tr>
<tr>
<td>To receive security and technical information about your products, you can</td>
<td></td>
</tr>
<tr>
<td>subscribe to various services, such as the Product Alert Tool (accessed from</td>
<td></td>
</tr>
<tr>
<td>Field Notices), the Cisco Technical Services Newsletter, and Really Simple</td>
<td></td>
</tr>
<tr>
<td>Syndication (RSS) Feeds.</td>
<td></td>
</tr>
<tr>
<td>Access to most tools on the Cisco Support website requires a Cisco.com user</td>
<td></td>
</tr>
<tr>
<td>ID and password.</td>
<td></td>
</tr>
</tbody>
</table>

Feature Information for IP Security VPN Monitoring

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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.
### Table 1  Feature Information for IP Security VPN Monitoring

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| IP Security VPN Monitoring    | Cisco IOS XE Release 2.1  | The IP Security VPN Monitoring feature provides VPN session monitoring enhancements that will allow you to troubleshoot the VPN and monitor the end-user interface. Session monitoring enhancements include the following:  
  · Ability to specify an IKE peer description in the configuration file  
  · Summary listing of crypto session status  
  · Syslog notification for crypto session up or down status  
  Ability to clear both IKE and IPsec SAs using one CLI  
  · The following commands were introduced or modified: clear crypto session, description (isakmp peer), show crypto isakmp peer, show crypto session. |

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Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.
IPsec and IKE MIB Support for Cisco VRF-Aware IPsec

The IPsec and IKE MIB Support for the Virtual Private Network routing and forwarding- (VRF-) aware IP security (IPsec) feature allows VRF-aware IPsec to be managed with MIBs, which provide the details of IPsec statistics and performance metrics on a per VRF basis.

- Finding Feature Information, page 11
- Prerequisites for IPsec and IKE MIB Support for Cisco VRF-Aware IPsec, page 11
- Information About IPsec and IKE MIB Support for Cisco VRF-Aware IPsec, page 11
- How to Configure IPsec and IKE MIB Support for Cisco VRF-Aware IPsec, page 12
- Configuration Example for IPsec and IKE MIB Support for Cisco VRF-Aware IPsec, page 13
- Additional References, page 24
- Feature Information for IPsec and IKE MIB Support for Cisco VRF-Aware IPsec, page 25

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.

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Prerequisites for IPsec and IKE MIB Support for Cisco VRF-Aware IPsec

- You should be familiar with configuring Simple Network Management Protocol (SNMP).

Information About IPsec and IKE MIB Support for Cisco VRF-Aware IPsec

- MIBs Supported by the IPsec and IKE MIB Support for Cisco VRF-Aware IPsec Feature, page 12
MIBs Supported by the IPsec and IKE MIB Support for Cisco VRF-Aware IPsec Feature

- CISCO-IPSEC-FLOW-MONITOR-MIB supports IKE and IPSEC per-tunnel history and failure information. The length of this history and failure information can be configured and must be maintained on a per-VRF basis. The table sizes are controlled by using the `crypto mib ipsec flowmib history tunnel size number` and `crypto mib ipsec flowmib history failure size` commands in global configuration mode.
- CISCO-IPSEC-MIB
- CISCO-IPSEC-POLICY-MAP-MIB is supported. However, because this MIB applies to the entire router rather than to a specific VPN VRF instance, it is not VRF aware; therefore, polling of the object identifiers (OIDs) that belong to this MIB is accomplished with respect to the global VRF context.

SNMP Traps Supported by the IPsec and IKE MIB Support for Cisco VRF-Aware IPsec Feature

The following IKE and IPsec tunnel start and stop traps must go with their corresponding VRF:

- IPSEC_TUNNEL_STOP
- IKE_TUNNEL_STOP
- IPSEC_TUNNEL_START
- IKE_TUNNEL_START

The following traps are global traps that have been modified for the Cisco VRF-Aware IPsec feature:

- TOO_MANY_SAS_CREATED
- CRYPTOMAP_ADDED
- CRYPTOMAPSET.Attached
- CRYPTOMAP_DELETED
- CRYPTOMAPSET_DELETED
- ISAKMP_POLICY_ADDED
- ISAKMP_POLICY_DELETED

How to Configure IPsec and IKE MIB Support for Cisco VRF-Aware IPsec

No special configuration is needed for this feature. The SNMP framework can be used to manage VRF-aware IPsec using MIBs. See the Configuration Examples for IPsec and IKE MIB Support for Cisco VRF-Aware IPsec section for more information.

The following section provides information about troubleshooting this feature:

- How to Troubleshoot the IPsec and IKE MIB Support for Cisco VRF-Aware IPsec Feature, page 13
How to Troubleshoot the IPsec and IKE MIB Support for Cisco VRF-Aware IPsec Feature

The following `debug crypto mib` command and keywords may be used to display information about the IPsec and Internet Key Exchange (IKE) MIB as it relates to Cisco VRF-aware IPsec.

**SUMMARY STEPS**

1. `enable`
2. `debug crypto mib detail`
3. `debug crypto mib error`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1 enable</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2 debug crypto mib detail</strong></td>
<td>Displays different events as they occur in the IPsec MIB subsystem.</td>
</tr>
<tr>
<td></td>
<td>• Due consideration should be given to enabling <code>debug crypto mib detail</code> because the output for the <code>detail</code> keyword can be quite long.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# debug crypto mib detail</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3 debug crypto mib error</strong></td>
<td>Displays error events in the MIB agent.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# debug crypto mib error</td>
<td></td>
</tr>
</tbody>
</table>

**Configuration Example for IPsec and IKE MIB Support for Cisco VRF-Aware IPsec**

- Configuration That Has Two VRFs Examples, page 13

**Configuration That Has Two VRFs Examples**

The following output example is for a typical hub configuration that has two VRFs. The output is what you would see if you were to poll for the IPsec security association (SA). Router 3745b is the VRF-aware router.
Two VRFs Configured

The following output shows that two VRFs have been configured (vrf1 and vrf2).

Router3745b# show running-config
Building configuration...
Current configuration : 6567 bytes
!
version 12.4
service timestamps debug datetime msec localtime
service timestamps log uptime
no service password-encryption
!
hostname ipsecf-3745b
!
boot-start-marker
boot-end-marker
!
no logging console
enable password lab
!
no aaa new-model
!
resource policy
!
memory-size iomem 5
!
clock timezone PST -8
!
no subnet-zero
ip cef
!
!
ip vrf vrf1
rd 1:101
context vrf-vrf1-context
route-target export 1:101
route-target import 1:101
!
ip vrf vrf2
rd 2:101
context vrf-vrf2-context
route-target export 2:101
route-target import 2:101
!
no ip domain lookup
!
!
crypto keyring vrf1-1 vrf vrf1
pre-shared-key address 10.1.1.1 255.255.255.0 key vrf1-1
crypto keyring vrf2-1 vrf vrf2
pre-shared-key address 10.1.2.1 255.255.255.0 key vrf2-1
!
crypto isakmp policy 1
authentication pre-share
!
crypto isakmp policy 50
authentication pre-share
!
crypto isakmp key global1-1 address 10.1.151.1
crypto isakmp key global2-1 address 10.1.152.1
!
crypto isakmp profile vrf1-1
keyring vrf1-1
match identity address 10.1.1.1 255.255.255.255 vrf1
!
crypto isakmp profile vrf2-1
keyring vrf2-1
match identity address 10.1.2.1 255.255.255.255 vrf2
!
crypto ipsec security-association lifetime kilobytes 99000
crypto ipsec security-association lifetime seconds 5000
!
crypto ipsec transform-set tset ah-sha-hmac esp-des esp-sha-hmac
crypto map global1-1 10 ipsec-isakmp
  set peer 10.1.151.1
  set transform-set tset
  match address 151
!
crypto map global2-1 10 ipsec-isakmp
  set peer 10.1.152.1
  set transform-set tset
  match address 152
!
crypto map vrf1-1 10 ipsec-isakmp
  set peer 10.1.1.1
  set transform-set tset
  set isakmp-profile vrf1-1
  match address 101
!
crypto map vrf2-1 10 ipsec-isakmp
  set peer 10.1.2.1
  set transform-set tset
  set isakmp-profile vrf2-1
  match address 102
!
interface FastEthernet0/0
  ip address 10.38.25 255.255.255.0
  no ip mroute-cache
duplex auto
  speed auto
  !
interface Serial0/0
  no ip address
  shutdown
clock rate 2000000
  !
interface FastEthernet0/1
  no ip address
  no ip mroute-cache
  shutdown
duplex auto
  speed auto
  !
interface Serial0/1
  no ip address
  shutdown
clock rate 2000000
  !
interface Serial1/0
  no ip address
  encapsulation frame-relay
  no ip route-cache cef
  no ip route-cache
  no ip mroute-cache
  no keepalive
  serial restart-delay 0
clock rate 128000
  no frame-relay inverse-arp
  !
interface Serial1/0.0 point-to-point
  ip vrf forwarding vrf1
  ip address 10.3.1.1 255.255.255.0
  no ip route-cache
  frame-relay interface-dlci 21
  !
interface Serial1/0.1 point-to-point
  ip vrf forwarding vrf1
  ip address 10.3.2.1 255.255.255.0
  no ip route-cache
  frame-relay interface-dlci 22
  !
interface Serial1/0.2 point-to-point
  ip vrf forwarding vrf2
  ip address 10.7.151.1 255.255.255.0
  no ip route-cache
  frame-relay interface-dlci 151
interface Serial1/0.152 point-to-point
ip address 10.7.152.1 255.255.255.0
no ip route-cache
frame-relay interface-dlci 152
!
interface Serial1/1
no ip address
no ip mroute-cache
shutdown
serial restart-delay 0
!
interface Serial1/2
no ip address
encapsulation frame-relay
no ip route-cache cef
no ip route-cache
no ip mroute-cache
no keepalive
serial restart-delay 0
no frame-relay inverse-arp
!
interface Serial1/2.1 point-to-point
ip vrf forwarding vrf1
ip address 10.1.1.2 255.255.255.0
no ip route-cache
frame-relay interface-dlci 21
crypto map vrf1-1
!
interface Serial1/2.2 point-to-point
ip vrf forwarding vrf2
ip address 10.1.2.2 255.255.255.0
no ip route-cache
frame-relay interface-dlci 22
crypto map vrf2-1
!
interface Serial1/2.151 point-to-point
ip address 10.5.151.2 255.255.255.0
no ip route-cache
frame-relay interface-dlci 151
crypto map global1-1
!
interface Serial1/2.152 point-to-point
ip address 10.5.152.2 255.255.255.0
no ip route-cache
frame-relay interface-dlci 152
crypto map global2-1
!
interface Serial1/3
no ip address
no ip mroute-cache
shutdown
serial restart-delay 0
!
ip default-gateway 10.1.38.1
ip classless
ip route 10.1.1.6 255.255.255.255 10.1.151.1
ip route 10.2.1.6 255.255.255.255 10.1.152.1
ip route 10.6.2.1 255.255.255.255 10.7.151.2
ip route 10.6.2.2 255.255.255.255 10.7.152.2
ip route 172.19.216.110 255.255.255.255 FastEthernet0/0
ip route vrf vrf1 10.20.1.1 255.255.255.255 10.1.1.1
ip route vrf vrf1 10.22.1.1 255.255.255.255 10.30.1.1
ip route vrf vrf2 10.20.2.1 255.255.255.255 10.1.2.1
ip route vrf vrf2 10.22.2.1 255.255.255.255 10.30.1.2
!
ip http server
no ip http secure-server
!
ip access-list standard vrf-vrf1-context
ip access-list standard vrf-vrf2-context
!
access-list 101 permit ip host 10.22.1.1 host 10.20.1.1
access-list 102 permit ip host 10.22.2.1 host 10.20.2.1
access-list 151 permit ip host 10.6.2.1 host 10.1.1.6
access-list 152 permit ip host 10.6.2.2 host 10.2.1.6
snmp-server group abc1 v2c context vrf-vrf1-context read view_vrf1 notify
snmp-server group abc2 v2c context vrf-vrf2-context read view_vrf2 notify
snmp-server view view_vrf1 iso included
snmp-server view view_vrf2 iso included
snmp-server community abc1 RW
snmp-server community abc2 RW
snmp-server enable traps tty
snmp-server enable traps config
snmp-server host 172.19.216.110 version 2c abc1
snmp-server host 172.19.216.110 version 2c abc2
snmp-server context vrf-vrf1-context
snmp-server context vrf-vrf2-context
!

snmp mib community-map abc1 context vrf-vrf1-context
snmp mib community-map abc2 context vrf-vrf2-context
!
control-plane
!
!
line con 0
eexec-timeout 0 0
line aux 0
line vty 0 4
login
!

webvpn context Default_context
ssl authenticate verify all
!
no inservice
!
end

Both VRFs Cleared

The following output, for abc1 and abc2, shows that both VRFs have been “cleared” to ensure that all the counters are initialized to a known value.

The following output shows that VRF abc1 has been cleared:

orcas:2> setenv SR_MGR_CONF /users/green1
orcas:3> setenv SR_UTIL_SNMP_VERSION v2c
orcas:5> setenv SR_UTIL_COMMUNITY abc1
orcas:6> setenv SR_MGR_CONF_DIR /users/green1
orcas:7> /auto/sw/packages/snmpr/10.14.2.0/solaris2bin/getmany -v2c 10.1.38.25
cipSecMIBObjects
cipSecMibLevel.0 = 1
cikeGlobalActiveTunnels.0 = 0
cikeGlobalPreviousTunnels.0 = 0
cikeGlobalInOctets.0 = 0
cikeGlobalInPkts.0 = 0
cikeGlobalInDropPkts.0 = 0
cikeGlobalInNotify.fys.0 = 0
cikeGlobalInP2Exchs.0 = 0
cikeGlobalInP2ExchgInvalids.0 = 0
cikeGlobalInP2ExchgRejects.0 = 0
cikeGlobalOutOctets.0 = 0
cikeGlobalOutPkts.0 = 0
The following output shows that VRF abc2 has been cleared:

```
orcas:8> setenv SR_UTIL_COMMUNITY abc2
orcas:9> /auto/sw/packages/snmpr/14.2.0.0/solaris2bin/getmany -v2c 10.1.38.25
```

The following output shows that VRF abc2 has been cleared:

```
orcas:8> setenv SR_UTIL_COMMUNITY abc2
orcas:9> /auto/sw/packages/snmpr/14.2.0.0/solaris2bin/getmany -v2c 10.1.38.25
```
VRF abc1 Pinged

The following output shows that VRF abc1 has been pinged:

Router3745a# ping
Protocol [ip]:
Target IP address: 10.22.1.1
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]:
Source address or interface: 10.20.1.1
Type of service [0]:
Set DF bit in IP header? [no]:
Validate reply data? [no]:
Data pattern [0xABC]:
Loose, Strict, Record, Timestamp, Verbose [none]:
Sweep range of sizes [n]:
Sending 5, 100-byte ICMP Echos to 10.22.1.1, timeout is 2 seconds:
Packet sent with a source address of 10.20.1.1

VRF abc1 Polled

Polling VRF abc1 results in the following output:

Note

After the ping, the counters should show some nonzero values.
cipSecTunRemoteAddr.1 = 0a 01 01 01
cipSecTunKeyType.1 = ike(1)
cipSecTunEncapMode.1 = tunnel(1)
cipSecTunLifeSize.1 = 99000
cipSecTunLifeTime.1 = 5000
cipSecTunActiveTime.1 = 13749
cipSecTunSaLifeSizeThreshold.1 = 64
cipSecTunSaLifeTimeThreshold.1 = 10
cipSecTunTotalRefreshes.1 = 0
cipSecTunExpiredSaInstances.1 = 0
cipSecTunCurrentSaInstances.1 = 4
cipSecTunInSaDiffHellmanGrp.1 = dhGroup1(2)
cipSecTunInSaEncryptAlgo.1 = des(2)
cipSecTunInSaAhAuthAlgo.1 = hmacSha(3)
cipSecTunInSaEspAuthAlgo.1 = hmacSha(3)
cipSecTunInSaDecompAlgo.1 = none(1)
cipSecTunOutSaDiffHellmanGrp.1 = dhGroup1(2)
cipSecTunOutSaEncryptAlgo.1 = des(2)
cipSecTunOutSaAhAuthAlgo.1 = hmacSha(3)
cipSecTunOutSaEspAuthAlgo.1 = hmacSha(3)
cipSecTunOutSaCompAlgo.1 = none(1)
cipSecTunInOctets.1 = 400
cipSecTunHcInOctets.1 = 0x0190
cipSecTunInOctWraps.1 = 0
cipSecTunInDecompOctets.1 = 400
cipSecTunInHcDecompOctets.1 = 0x0190
cipSecTunInDecompOctWraps.1 = 0
cipSecTunInPkts.1 = 4
cipSecTunInDropPkts.1 = 0
cipSecTunInReplayDropPkts.1 = 0
cipSecTunInAuths.1 = 4
cipSecTunInAuthFails.1 = 0
cipSecTunInDecrypts.1 = 4
cipSecTunInDecryptFails.1 = 0
cipSecTunOutOctets.1 = 704
cipSecTunHcOutOctets.1 = 0x02c0
cipSecTunOutOctWraps.1 = 0
cipSecTunOutUncompOctets.1 = 704
cipSecTunHcOutUncompOctets.1 = 0x02c0
cipSecTunOutUncompOctWraps.1 = 0
cipSecTunOutPkts.1 = 4
cipSecTunOutDropPkts.1 = 0
cipSecTunOutAuths.1 = 4
cipSecTunOutAuthFails.1 = 0
cipSecTunOutEncrypts.1 = 4
cipSecTunOutEncryptFails.1 = 0
cipSecTunStatus.1 = active(1)
cipSecEndPtLocalName.1.1 =
cipSecEndPtLocalType.1.1 = singleIpAddr(1)
cipSecEndPtLocalAddr1.1.1 = 16 01 01 01
cipSecEndPtLocalAddr2.1.1 = 16 01 01 01
cipSecEndPtLocalProtocol.1.1 = 0
cipSecEndPtLocalPort.1.1 = 0
cipSecEndPtRemoteName.1.1 =
cipSecEndPtRemoteType.1.1 = singleIpAddr(1)
cipSecEndPtRemoteAddr1.1.1 = 14 01 01 01
cipSecEndPtRemoteAddr2.1.1 = 14 01 01 01
cipSecEndPtRemoteProtocol.1.1 = 0
cipSecEndPtRemotePort.1.1 = 0
cipSecSpiDirection.1.1 = in(1)
cipSecSpiDirection.1.2 = out(2)
cipSecSpiDirection.1.3 = in(1)
cipSecSpiDirection.1.4 = out(2)
cipSecSpiValue.1.1 = 3891970674
cipSecSpiValue.1.2 = 1963217493
cipSecSpiValue.1.3 = 3691920464
cipSecSpiValue.1.4 = 3458912974
cipSecSpiProtocol.1.1 = ah(1)
cipSecSpiProtocol.1.2 = ah(1)
cipSecSpiProtocol.1.3 = esp(2)
cipSecSpiProtocol.1.4 = esp(2)
cipSecSpiStatus.1.1 = active(1)
cipSecSpiStatus.1.2 = active(1)
VRF abc2 Polled

Polling VRF abc2 results in the following output:

```
Note

The ping was completed for VRF abc1 only. Therefore, the counters of VRF abc2 should remain in the initialized state.
```

```
setenv SR_UTIL_COMMUNITY abc2
/orcas:15> /auto/sw/packages/snmpr/10.14.2.0/solaris2bin/getmany -v2c 10.1.38.25
cipSecMIBObjects
cipSecMibLevel.0 = 1
cikeGlobalActiveTunnels.0 = 0
cikeGlobalPreviousTunnels.0 = 0
cikeGlobalInOctets.0 = 0
cikeGlobalInPkts.0 = 0
cikeGlobalInDropPkts.0 = 0
cikeGlobalInNotifys.0 = 0
cikeGlobalInP2Exchs.0 = 0
cikeGlobalInP2ExchgInvalids.0 = 0
cikeGlobalInP2ExchgRejects.0 = 0
cikeGlobalInP2SaDelRequests.0 = 0
cikeGlobalOutOctets.0 = 0
cikeGlobalOutPkts.0 = 0
cikeGlobalOutDropPkts.0 = 0
cikeGlobalOutNotifys.0 = 0
cikeGlobalOutP2Exchs.0 = 0
cikeGlobalOutP2ExchgInvalids.0 = 0
cikeGlobalOutP2ExchgRejects.0 = 0
cikeGlobalOutP2SaDelRequests.0 = 0
cikeGlobalInitTunnels.0 = 0
cikeGlobalInitTunnelFails.0 = 0
cikeGlobalRespTunnelFails.0 = 0
cikeGlobalSysCapFails.0 = 0
cikeGlobalAuthFails.0 = 0
cikeGlobalDecryptFails.0 = 0
cikeGlobalHashValidFails.0 = 0
cikeGlobalNoSaFails.0 = 0
cipeSecGlobalActiveTunnels.0 = 0
```

### Additional References

#### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
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</thead>
<tbody>
<tr>
<td>Cisco IOS commands by technology</td>
<td>Cisco IOS Release Command References</td>
</tr>
<tr>
<td>Cisco IOS master commands list</td>
<td>Master Command List</td>
</tr>
<tr>
<td>Configuring SNMP</td>
<td>The chapter “Configuring SNMP Support” in the Cisco IOS Network Management Configuration Guide.</td>
</tr>
<tr>
<td>Configuring VRF-Aware IPsec</td>
<td>VRF-Aware IPsec</td>
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</table>

#### Standards

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<td>None.</td>
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### MIBs

<table>
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<tr>
<th>MIB</th>
<th>MIBs Link</th>
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<tbody>
<tr>
<td>CISCO-IPSEC-FLOW-MONITOR-MIB</td>
<td>To locate and download MIBs for selected platforms, Cisco IOS software releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
</tr>
<tr>
<td>CISCO-IPSEC-MIB</td>
<td></td>
</tr>
<tr>
<td>The CISCO-IPSEC-POLICY-MAP-MIB</td>
<td></td>
</tr>
</tbody>
</table>

### RFCs

<table>
<thead>
<tr>
<th>RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>None.</td>
<td>--</td>
</tr>
</tbody>
</table>

### Technical Assistance

**Description**

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.

**Link**


---

**Feature Information for IPsec and IKE MIB Support for Cisco VRF-Aware IPsec**

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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.
**Table 2**  
Feature Information for Feature Information for IPsec and IKE MIB Support for Cisco VRF-Aware IPsec

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPsec and IKE MIB Support for Cisco VRF-Aware IPsec</td>
<td>IOS XE 3.1S</td>
<td>The IPsec and IKE MIB Support for the Virtual Private Network routing and forwarding-(VRF-) aware IP security (IPsec) feature allows VRF-aware IPsec to be managed with MIBs, which provide the details of IPsec statistics and performance metrics on a per VRF basis. This feature was introduced in Cisco IOS Release 12.4(4)T. This feature was integrated into Cisco IOS Release XE 3.1S. The following commands were introduced or modified: <code>debug crypto mib</code>.</td>
</tr>
</tbody>
</table>

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Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.
IPsec SNMP Support

The IP Security (IPsec) SNMP Support feature introduces support for industry-standard IPsec MIBs and Cisco IOS XE-software specific IPsec MIBs.

The commands in this feature allow you to examine the version of the IPsec MIB feature, to enable and disable SNMP traps, and to monitor and control the size of the buffers used by this feature.

Note

This document focuses on Cisco IOS XE CLI support for the Cisco IPsec MIBs. This document also lists which elements of the MIBs are currently supported. This document does not describe SNMP configuration (from a Network Management Station) of the Cisco IPsec MIBs.

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.

Restrictions for IPsec SNMP Support

- Only the following tunnel setup failure logs are supported with the IPsec--SNMP Support feature:
  - NOTIFY_MIB_IPSEC_PROPOSAL_INVALID
  - “A tunnel could not be established because the peer did not supply an acceptable proposal.”
  - NOTIFY_MIB_IPSEC_ENCRYPT_FAILURE
"A tunnel could not be established because it failed to encrypt a packet to be sent to a peer."
- NOTIFY_MIB_IPSEC_SYSCAP_FAILURE
- "A tunnel could not be established because the system ran out of resources."
- NOTIFY_MIB_IPSEC_LOCAL_FAILURE
- "A tunnel could not be established because of an internal error."

Note that these failure notices are recorded in the failure tables, but are not available as SNMP notifications (traps).

- The following functions are not supported with the IPsec MIB feature:
  - Checkpointing
  - The Dynamic Cryptomap table of the CISCO-IPSEC-MIB
- The CISCO-IPSEC-POLICY-MAP-MIB (ciscoIpSecPolMap) defines no notifications (the “IPSec Policy Map Notifications Group” is empty).

### Information About IPsec SNMP Support

The IP Security (IPsec) SNMP Support feature introduces support for industry-standard IPsec MIBs and Cisco IOS XE-software specific IPsec MIBs.

The IPsec MIBs allow IPsec configuration monitoring and IPsec status monitoring using SNMP, and can be integrated in a variety of Virtual Private Network (VPN) management solutions.

For example, this feature allows you to specify the desired size of a tunnel history table or a tunnel failure table using the Cisco IOS XE CLI. The history table archives attribute and statistic information about the tunnel; the failure table archives tunnel failure reasons along with the time failure occurred. A failure history table can be used as a simple method to distinguish between a normal and an abnormal tunnel termination. That is, if a tunnel entry in the tunnel history table has no associated failure record, the tunnel must have terminated normally. However, a tunnel history table does not accompany every failure table because every failure does not correspond to a tunnel. Thus, supported setup failures are recorded in the failure table, but an associated history table is not recorded because a tunnel was never set up.

This feature also provides IPsec Simple Network Management Protocol (SNMP) notifications for use with network management systems.

- Related Features and Technologies, page 28

### Related Features and Technologies

The IPsec--SNMP Support feature was designed to support the VPN Device Manager (VDM). VDM enables network administrators to manage and configure site-to-site VPNs on a single device from a web browser and to see the effects of changes in real time. VDM implements a wizard-based graphical user interface (GUI) to simplify the process of configuring site-to-site VPNs using the IPsec protocol. VDM software is installed directly on Cisco VPN routers, and is designed for use and compatibility with future Device Manager products.

### How to Configure IPsec SNMP Support

- Enabling IPsec SNMP Notifications, page 29
- Configuring IPsec Failure History Table Size, page 30
Enabling IPsec SNMP Notifications

To enable IPsec SNMP notifications, perform the following steps.

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `snmp-server enable traps ipsec cryptomap [add | delete | attach | detach]`
4. `snmp-server enable traps isakmp [policy {add | delete} | tunnel {start | stop}]`
5. `snmp-server host host-address traps community-string ipsec`

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Router&gt; enable</code></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Step 2</strong> <code>configure terminal</code></td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Router# configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> `snmp-server enable traps ipsec cryptomap [add</td>
<td>delete</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Router (config)# snmp-server enable traps ipsec cryptomap add</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> `snmp-server enable traps isakmp [policy {add</td>
<td>delete}</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Router (config)# snmp-server enable traps isakmp policy add</code></td>
<td></td>
</tr>
</tbody>
</table>
### Configuring IPsec Failure History Table Size

The default failure history table size is 200. To change the size of the failure history table, perform the following steps.

**SUMMARY STEPS**
1. `enable`
2. `configure terminal`
3. `crypto mib ipsec flowmib history failure size number`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
</tbody>
</table>
| **Example:**
  ```
  Router> enable
  ``` |
| **Step 2** `configure terminal` | Enters global configuration mode. |
| **Example:**
  ```
  Router# configure terminal
  ``` |
| **Step 3** `crypto mib ipsec flowmib history failure size number` | Changes the size of the IPsec failure history table. |
| **Example:**
  ```
  Router (config)# crypto mib ipsec flowmib history failure size 220
  ``` |

### Configuring IPsec Tunnel History Table Size

The default tunnel history table size is 200. To change the size of the tunnel history table, perform the following steps.
SUMMARY STEPS

1. enable
2. configure terminal
3. crypto mib ipsec flowmib history tunnel size number

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 crypto mib ipsec flowmib history tunnel size number</td>
<td>Changes the size of the IPsec tunnel history table.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router (config)# crypto mib ipsec flowmib history tunnel size</td>
<td></td>
</tr>
</tbody>
</table>

Verifying IPsec MIB Configuration

To verify that the IPsec MIB feature is configured properly, perform the following tasks:

• Enter the `show crypto mib ipsec flowmib history failure size` privileged EXEC command to display the size of the failure history table:

  Router# show crypto mib ipsec flowmib history failure size
  IPSec Failure Window Size: 140

• Enter the `show crypto mib ipsec flowmib history tunnel size` privileged EXEC command to display the size of the tunnel history table:

  Router# show crypto mib ipsec flowmib history tunnel size
  IPSec History Window Size: 130

• Enter the `show crypto mib ipsec flowmib version` privileged EXEC command to display the MIB version used by the management applications to identify the feature set:

  Router# show crypto mib ipsec flowmib version
  IPSec Flow MIB Version: 1
Enter the `debug crypto mib` command to display the IPsec MIB debug message notifications:

```
Router# debug crypto mib
Crypto IPSec Mgmt Entity debugging is on
```

**Monitoring and Maintaining IPsec MIB**

To monitor the status of IPsec MIB information, use any of the following commands.

**SUMMARY STEPS**

1. `enable`
2. `show crypto mib ipsec flowmib history failure size`
3. `show crypto mib ipsec flowmib history tunnel size`
4. `show crypto mib ipsec flowmib version`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1 enable</strong></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
</tbody>
</table>
| ```
Router> enable
``` | • Enter your password if prompted. |
| **Step 2 show crypto mib ipsec flowmib history failure size** | Displays the size of the IPsec failure history table. |
| **Example:**     |         |
| ```
Router# show crypto mib ipsec flowmib history failure size
``` | |
| **Step 3 show crypto mib ipsec flowmib history tunnel size** | Displays the size of the IPsec tunnel history table. |
| **Example:**     |         |
| ```
Router# show crypto mib ipsec flowmib history tunnel size
``` | |
| **Step 4 show crypto mib ipsec flowmib version** | Displays the IPsec Flow MIB version used by the router. |
| **Example:**     |         |
| ```
Router# show crypto mib ipsec flowmib version
``` | |

**Configuration Examples for IPsec SNMP Support**

- Enabling IPsec Notifications Examples, page 33
Enabling IPsec Notifications Examples

In the following example, IPsec notifications are enabled:

```snmp-server enable traps ipsec isakmp```

In the following example, the router is configured to send IPsec notifications to the host nms1.example.com:

```snmp-server host nms1.example.com public ipsec isakmp
Translating "nms1.example.com"...domain server (172.00.0.01) [OK]```

Specifying History Table Size Examples

In the following example, the specified failure history table size is 140:

```crypto mib ipsec flowmib history failure size 140```

In the following example, the specified tunnel history table size is 130:

```crypto mib ipsec flowmib history tunnel size 130```

Additional References

The following sections provide references related to the IPsec--SNMP Support feature.

### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPsec and related security information</td>
<td>“Configuring Security for VPNs with IPsec” module in the <em>Cisco IOS XE Security Configuration Guide: Secure Connectivity</em></td>
</tr>
<tr>
<td>Security commands</td>
<td><em>Cisco IOS Security Command Reference</em></td>
</tr>
<tr>
<td>SNMP configuration information</td>
<td>“Configuring SNMP Support” module in the <em>Cisco IOS XE Network Management Configuration Guide</em></td>
</tr>
<tr>
<td>IOS command index, including SNMP commands</td>
<td><em>Cisco IOS Master Command List, All Releases</em></td>
</tr>
</tbody>
</table>

### Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.</td>
</tr>
</tbody>
</table>

---

*IPsec Management Configuration Guide, Cisco IOS XE Release 3S*
MIBs

<table>
<thead>
<tr>
<th>MIB</th>
<th>MIBs Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following MIBs are supported</td>
<td>To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL:</td>
</tr>
<tr>
<td>by the IPsec--SNMP Support feature:</td>
<td><a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
</tr>
<tr>
<td>• CISCO-IPSEC-FLOW-MONITOR-MIB</td>
<td></td>
</tr>
<tr>
<td>• CISCO-IPSEC-MIB</td>
<td></td>
</tr>
<tr>
<td>• CISCO-IPSEC-POLICY-MAP-MIB</td>
<td></td>
</tr>
</tbody>
</table>

RFCs

<table>
<thead>
<tr>
<th>RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.</td>
<td>--</td>
</tr>
</tbody>
</table>

Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</td>
<td><a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a></td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</td>
<td></td>
</tr>
</tbody>
</table>

Feature Information for IPsec SNMP Support

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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.
### Table 3  Feature Information for IPsec SNMP Support

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPsec SNMP Support</td>
<td>Cisco IOS XE Release 2.1</td>
<td>The IP Security (IPsec) SNMP Support feature introduces support for industry-standard IPsec MIBs and Cisco IOS XE-software specific IPsec MIBs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The following commands were introduced or modified: crypto mib ipsec flowmib history failure size, crypto mib ipsec flowmib history tunnel size, debug crypto mib, show crypto mib ipsec flowmib history failure size, show crypto mib ipsec flowmib history tunnel size, show crypto mib ipsec flowmib version, snmp-server enable traps ipsec, snmp-server enable traps isakmp, snmp-server host.</td>
</tr>
</tbody>
</table>

### Glossary

**CA** -- certificate authority. A certificate authority (CA) is an entity in a network that issues and manages security credentials and public keys (in the form of X509v3 certificates) for message encryption. As part of a public key infrastructure (PKI), a CA checks with a registration authority (RA) to verify information provided by the requestor of a digital certificate. If the RA verifies the requestor’s information, the CA can then issue a certificate. Certificates generally include the owner’s public key, the expiration date of the certificate, the owner’s name, and other information about the public key owner.

**IP Security**-- See IPsec.

**IPsec**-- Internet Protocol Security. A framework of open standards that provides data confidentiality, data integrity, and data authentication between participating peers. IPsec provides these security services at the IP layer. IPsec uses Internet Key Exchange (IKE) to handle negotiation of protocols and algorithms based on local policy and to generate the encryption and authentication keys to be used by IPsec. IPsec can be used to protect one or more data flows between a pair of hosts, between a pair of security gateways, or between a security gateway and a host.

**Management Information Base**-- See MIB.

**MIB**-- Management Information Base. Database of network management information that is used and maintained by a network management protocol such as Simple Network Management Protocol (SNMP) or Common Management Information Protocol (MIP). The value of a MIB object can be changed or retrieved using SNMP or CMIP commands, usually through a graphical user interface (GUI) network management system (NMS). MIB objects are organized in a tree structure that includes public (standard) and private (proprietary) branches.

**Simple Network Management Protocol**-- See SNMP.
SNMP—Simple Network Management Protocol. An application-layer protocol that provides a message format for communication between SNMP managers and agents.

trap—Message sent by an SNMP agent to a network management system, console, or terminal to indicate the occurrence of a significant event, such as a specifically defined condition or a threshold that was reached.

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Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.
IPsec VPN Accounting

The IPsec VPN Accounting feature allows for a session to be accounted for by indicating when the session starts and when it stops.

A VPN session is defined as an Internet Key Exchange (IKE) security association (SA) and the one or more SA pairs that are created by the IKE SA. The session starts when the first IP Security (IPsec) pair is created and stops when all IPsec SAs are deleted.

Session identifying information and session usage information is passed to the Remote Authentication Dial-In User Service (RADIUS) server through standard RADIUS attributes and vendor-specific attributes (VSAs).

- Finding Feature Information, page 37
- Prerequisites for IPsec VPN Accounting, page 37
- Information About IPsec VPN Accounting, page 38
- How to Configure IPsec VPN Accounting, page 42
- Configuration Examples for IPsec VPN Accounting, page 48
- Additional References, page 52
- Related Documents, page 52
- Feature Information for IPsec VPN Accounting, page 54
- Glossary, page 55

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 IPsec VPN Accounting

- Understand how to configure RADIUS and authentication, authorization, and accounting (AAA) accounting.
- Understand how to configure IPsec accounting.
Information About IPsec VPN Accounting

- RADIUS Accounting, page 38
- IKE and IPsec Subsystem Interaction, page 40

RADIUS Accounting

For many large networks, it is required that user activity be recorded for auditing purposes. The method that is used most is RADIUS accounting.

RADIUS accounting allows for a session to be accounted for by indicating when the session starts and when it stops. Additionally, session identifying information and session usage information is passed to the RADIUS server through RADIUS attributes and VSAs.

- RADIUS Start Accounting, page 38
- RADIUS Stop Accounting, page 39
- RADIUS Update Accounting, page 40

RADIUS Start Accounting

The RADIUS Start packet contains many attributes that generally identify who is requesting the service and of what the property of that service consists. The table below represents the attributes required for the start.

<table>
<thead>
<tr>
<th>RADIUS Attributes Value</th>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>user-name</td>
<td>Username used in extended authentication (XAUTH). The username may be NULL when XAUTH is not used.</td>
</tr>
<tr>
<td>4</td>
<td>nas-ip-address</td>
<td>Identifying IP address of the network access server (NAS) that serves the user. It should be unique to the NAS within the scope of the RADIUS server.</td>
</tr>
<tr>
<td>5</td>
<td>nas-port</td>
<td>Physical port number of the NAS that serves the user.</td>
</tr>
<tr>
<td>8</td>
<td>framed-ip-address</td>
<td>Private address allocated for the IP Security (IPsec) session.</td>
</tr>
<tr>
<td>40</td>
<td>acct-status-type</td>
<td>Status type. This attribute indicates whether this accounting request marks the beginning (start), the end (stop), or an update of the session.</td>
</tr>
</tbody>
</table>
RADIUS Attributes

<table>
<thead>
<tr>
<th>Value</th>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>acct-delay-time</td>
<td>Number of seconds the client has been trying to send a particular record.</td>
</tr>
<tr>
<td>44</td>
<td>acct-session-id</td>
<td>Unique accounting identifier that makes it easy to match start and stop records in a log file.</td>
</tr>
<tr>
<td>26</td>
<td>vrf-id</td>
<td>String that represents the name of the Virtual Route Forwarder (VRF).</td>
</tr>
<tr>
<td>26</td>
<td>isakmp-initiator-ip</td>
<td>Endpoint IP address of the remote Internet Key Exchange (IKE) initiator (V4).</td>
</tr>
<tr>
<td>26</td>
<td>isakmp-group-id</td>
<td>Name of the VPN group profile used for accounting.</td>
</tr>
<tr>
<td>26</td>
<td>isakmp-phase1-id</td>
<td>Phase 1 identification (ID) used by IKE (for example, domain name [DN], fully qualified domain name [FQDN], IP address) to help identify the session initiator.</td>
</tr>
</tbody>
</table>

RADIUS Stop Accounting

The RADIUS Stop packet contains many attributes that identify the usage of the session. Table 2 represents the additional attributes required for the RADIUS stop packet. It is possible that only the stop packet is sent without the start if configured to do so. If only the stop packet is sent, this allows an easy way to reduce the number of records going to the AAA server.

Table 5  RADIUS Accounting Stop Packet Attributes

<table>
<thead>
<tr>
<th>Value</th>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>acct-input-octets</td>
<td>Number of octets that have been received from the Unity client over the course of the service that is being provided.</td>
</tr>
<tr>
<td>43</td>
<td>acct-output-octets</td>
<td>Number of octets that have been sent to the Unity client in the course of delivering this service.</td>
</tr>
</tbody>
</table>
### RADIUS Attributes

<table>
<thead>
<tr>
<th>Value</th>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>acct-session-time</td>
<td>Length of time (in seconds) that the Unity client has received service.</td>
</tr>
<tr>
<td>47</td>
<td>acct-input-packets</td>
<td>Quantity of packets that have been received from the Unity client in the course of delivering this service.</td>
</tr>
<tr>
<td>48</td>
<td>acct-output-packets</td>
<td>Quantity of packets that have been sent to the Unity client in the course of delivering this service.</td>
</tr>
<tr>
<td>49</td>
<td>acct-terminate-cause</td>
<td>For future use.</td>
</tr>
<tr>
<td>52</td>
<td>acct-input-gigawords</td>
<td>How many times the Acct-Input-Octets counter has wrapped around the 232 (2 to the 32nd power) over the course of this service.</td>
</tr>
<tr>
<td>52</td>
<td>acct-output-gigawords</td>
<td>How many times the Acct-Input-Octets counter has wrapped around the 232 (2 to the 32nd power) over the course of this service.</td>
</tr>
</tbody>
</table>

#### RADIUS Update Accounting

RADIUS accounting updates are supported. Packet and octet counts are shown in the updates.

#### IKE and IPsec Subsystem Interaction

- Accounting Start, page 40
- Accounting Stop, page 41
- Accounting Updates, page 42

#### Accounting Start

If IPsec accounting is configured, after IKE phases are complete, an accounting start record is generated for the session. New accounting records are not generated during a rekeying.

The following is an account start record that was generated on a router and that is to be sent to the AAA server that is defined:

*Aug 23 04:06:20.131: RADIUS(00000002): sending
*Aug 23 04:06:20.131: RADIUS(00000002): Send Accounting-Request to 10.1.1.4:1646 id 4, len 220
Accounting Stop

An accounting stop packet is generated when there are no more flows (IPsec SA pairs) with the remote peer.

The accounting stop records contain the following information:

- Packets out
- Packets in
- Octets out
- Gigawords in
- Gigawords out

Below is an account start record that was generated on a router. The account start record is to be sent to the AAA server that is defined.

```
*Aug 23 04:06:20.131: RADIUS: authenticator 38 F5 EB 46 4D BE 4A 6F - 45 EB EF 7D B7 19 FB 3F
*Aug 23 04:06:20.139: RADIUS: Received from id 21645/4 10.1.1.4:1646, Accounting-response, len 20
*Aug 23 04:06:20.139: RADIUS: authenticator B7 E3 D0 F5 61 9A 89 D8 - 99 A6 8A 8A 98 79 9D 5D
```
Accounting Updates

If accounting updates are enabled, accounting updates are sent while a session is “up.” The update interval is configurable. To enable the accounting updates, use the aaa accounting command.

The following is an accounting update record that is being sent from the router:

Router#
*Aug 23 21:46:05.263: RADIUS(00000004): Using existing nas_port 0
*Aug 23 21:46:05.263: RADIUS(00000004): Config NAS IP: 100.1.1.147
*Aug 23 21:46:05.263: RADIUS(00000004): sending
*Aug 23 21:46:05.263: RADIUS(00000004): Send Accounting-Request to 100.1.1.4:1646 id 22, len 200
*Aug 23 21:46:05.263: RADIUS(00000004): authenticator 30 FA 48 86 8E 43 8E 4B - F9 09 71 04 4A F1 52 25
*Aug 23 21:46:05.263: RADIUS: Acct-Session-Id [44] 10 *00000003*
*Aug 23 21:46:05.267: RADIUS: Received from id 21645/22 100.1.1.4:1646, Accounting-response, len 20
*Aug 23 21:46:05.267: RADIUS: authenticator 51 6B BB 27 A4 F5 D7 61 - A7 03 73 D3 0A AC 1C

How to Configure IPsec VPN Accounting

- Configuring IPsec VPN Accounting, page 42
- Configuring Accounting Updates, page 47
- Troubleshooting for IPsec VPN Accounting, page 48

Configuring IPsec VPN Accounting

IPsec must be configured first before configuring IPsec VPN accounting.
SUMMARY STEPS

1. enable
2. configure terminal
3. aaa new-model
4. aaa authentication login list-name method
5. aaa authorization network list-name method
6. aaa accounting network list-name start-stop [broadcast] group group-name
7. aaa session-id common
8. crypto isakmp profile profile-name
9. vrf ivrf
10. match identity group group-name
11. client authentication list list-name
12. isakmp authorization list list-name
13. client configuration address [initiate | respond]
14. accounting list-name
15. exit
16. crypto dynamic-map dynamic-map-name dynamic-seq-num
17. set transform-set transform-set-name
18. set isakmp-profile profile-name
19. reverse-route [remote-peer]
20. exit
21. crypto map map-name ipsec-isakmp dynamic dynamic-template-name
22. radius-server host ip-address [auth-port port-number] [acct-port port-number]
23. radius-server key string
24. radius-server vsa send accounting
25. interface type slot / port
26. crypto map map-name

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router&gt; enable</td>
<td>- Enter your password if prompted.</td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> aaa new-model</td>
<td>Enables periodic interim accounting records to be sent to the accounting server.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router (config)# aaa new-model</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> aaa authentication login list-name method</td>
<td>Enforces authentication, authorization, and accounting (AAA) authentication for extended authorization (XAUTH) through RADIUS or local.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router (config)# aaa authentication login cisco-client group radius</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> aaa authorization network list-name method</td>
<td>Sets AAA authorization parameters on the remote client from RADIUS or local.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router (config)# aaa authorization network cisco-client group radius</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong> aaa accounting network list-name start-stop [broadcast] group group-name</td>
<td>Enables AAA accounting of requested services for billing or security purposes when RADIUS or TACACS + is used.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router (config)# aaa accounting network acc start-stop broadcast group radius</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong> aaa session-id common</td>
<td>Specifies whether the same session ID is used for each AAA accounting service type within a call or whether a different session ID is assigned to each accounting service type.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router (config)# aaa session-id common</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> crypto isakmp profile profile-name</td>
<td>Audits IP security (IPsec) user sessions and enters isakmp-profile submode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Route (config)# crypto isakmp profile cisco</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

<table>
<thead>
<tr>
<th>Step</th>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 9</td>
<td><strong>vrf</strong> ivrf</td>
<td>Associates the on-demand address pool with a Virtual Private Network (VPN) routing and forwarding (VRF) instance name.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router (conf-isa-prof)# vrf cisco</td>
<td></td>
</tr>
<tr>
<td>Step 10</td>
<td>match identity group group-name</td>
<td>Matches an identity from a peer in an ISAKMP profile.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-isa-prof)# match identity group cisco</td>
<td></td>
</tr>
<tr>
<td>Step 11</td>
<td>client authentication list list-name</td>
<td>Configures Internet Key Exchange (IKE) extended authentication (XAUTH) in an Internet Security Association and Key Management Protocol (ISAKMP) profile.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-isa-prof)# client authentication list list-name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cisco</td>
<td></td>
</tr>
<tr>
<td>Step 12</td>
<td>isakmp authorization list list-name</td>
<td>Configures an IKE shared secret and other parameters using the AAA server in an ISAKMP profile. The shared secret and other parameters are generally pushed to the remote peer through mode configuration (MODECFG).</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-isa-prof)# isakmp authorization list list-name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cisco-client</td>
<td></td>
</tr>
<tr>
<td>Step 13</td>
<td>client configuration address [initiate</td>
<td>respond]</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-isa-prof)# client configuration address respond</td>
<td></td>
</tr>
<tr>
<td>Step 14</td>
<td>accounting list-name</td>
<td>Enables AAA accounting services for all peers that connect through this ISAKMP profile.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-isa-prof)# accounting acc</td>
<td></td>
</tr>
<tr>
<td>Step 15</td>
<td>exit</td>
<td>Exits isakmp-profile submode.</td>
</tr>
<tr>
<td></td>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Router(conf-isa-prof)# exit</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>Step 16 <strong>crypto dynamic-map</strong> <em>dynamic-map-name</em> <em>dynamic-seq-num</em></td>
<td>Creates a dynamic crypto map template and enters the crypto map configuration command mode.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# crypto dynamic-map mymap 10 ipsec-isakmp</td>
<td></td>
</tr>
<tr>
<td>Step 17 <strong>set transform-set</strong> <em>transform-set-name</em></td>
<td>Specifies which transform sets can be used with the crypto map template.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-crypto-map)# set transform-set aswan</td>
<td></td>
</tr>
<tr>
<td>Step 18 <strong>set isakmp-profile</strong> <em>profile-name</em></td>
<td>Sets the ISAKMP profile name.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-crypto-map)# set isakmp-profile cisco</td>
<td></td>
</tr>
<tr>
<td>Step 19 <strong>reverse-route</strong> <em>remote-peer</em></td>
<td>Allows routes (ip addresses) to be injected for destinations behind the VPN remote tunnel endpoint and may include a route to the tunnel endpoint itself (using the <strong>remote-peer</strong> keyword for the crypto map).</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-crypto-map)# reverse-route</td>
<td></td>
</tr>
<tr>
<td>Step 20 <strong>exit</strong></td>
<td>Exits dynamic crypto map configuration mode.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config-crypto-map)# exit</td>
<td></td>
</tr>
<tr>
<td>Step 21 <strong>crypto map</strong> <em>map-name</em> <strong>ipsec-isakmp dynamic</strong> <em>dynamic-template-name</em></td>
<td>Enters crypto map configuration mode</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# crypto map mymap ipsec-isakmp dynamic dmap</td>
<td></td>
</tr>
<tr>
<td>Step 22 <strong>radius-server host</strong> <em>ip-address</em> [<strong>auth-port</strong> <em>port-number</em>] [<strong>acct-port</strong> <em>port-number</em>]</td>
<td>Specifies a RADIUS server host.</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Router(config)# radius-server host 172.16.1.4</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action | Purpose
---|---
Step 23 `radius-server key string` | Sets the authentication and encryption key for all RADIUS communications between the router and the RADIUS daemon.  
**Example:**  
```
Router(config)# radius-server key nsite
```

Step 24 `radius-server vsa send accounting` | Configures the network access server to recognize and use vendor-specific attributes.  
**Example:**  
```
Router(config)# radius-server vsa send accounting
```

Step 25 `interface type slot/port` | Configures an interface type and enters interface configuration mode.  
**Example:**  
```
Router(config)# interface FastEthernet 1/0
```

Step 26 `crypto map map-name` | Applies a previously defined crypto map set to an interface.  
**Example:**  
```
Router(config-if)# crypto map mymap
```

---

### Configuring Accounting Updates

To send accounting updates while a session is “up,” perform the following optional task:

IPsec VPN accounting must be configured before accounting updates are configured. See Configuring IPsec VPN Accounting, page 42 for more information.

**SUMMARY STEPS**

1. enable  
2. configure terminal  
3. aaa accounting update periodic `number`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| Step 1 `enable` | Enables privileged EXEC mode.  
- Enter your password if prompted.  
**Example:**  
```
Router> enable
```
### Troubleshooting for IPsec VPN Accounting

To display messages about IPsec accounting events, perform the following optional task:

**SUMMARY STEPS**

1. enable
2. debug crypto isakmp aaa

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> debug crypto isakmp aaa</td>
<td>Displays messages about Internet Key Exchange (IKE) events.</td>
</tr>
<tr>
<td></td>
<td>• The aaa keyword specifies accounting events.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# debug crypto isakmp aaa</td>
<td></td>
</tr>
</tbody>
</table>

### Configuration Examples for IPsec VPN Accounting

- Accounting and ISAKMP-Profile Example, page 49
- Accounting Without ISAKMP Profiles Example, page 50
Accounting and ISAKMP-Profile Example

The following example shows a configuration for supporting remote access clients with accounting and ISAKMP profiles:

```
version 2.1
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname sheep
!
! aaa accounting network ipsecaaa start-stop group radius
aaa accounting update periodic 1
aaa session-id common
ip subnet-zero
ip cef
!
no ip domain lookup
ip domain name cisco.com
ip name-server 172.29.2.133
ip name-server 172.29.11.48
!
crypto isakmp policy 1
authentication pre-share
group 2
!
crypto isakmp policy 10
hash md5
authentication pre-share
lifetime 200
crypto isakmp key cisco address 172.31.100.2
crypto iakmp client configuration group cclient
key jegjegjhrg
pool addressA
crypto-isakmp profile groupA
vrf cisco
match identity group cclient
isakmp authorization list cisco-client
isakmp authentication list cisco-client
isakmp authorization address respond accounting acc
!
crypto ipsec transform-set esp-des-md5 esp-des esp-md5-hmac
!
crypto dynamic-map remotes 1
set peer 172.31.100.2
set security-association lifetime seconds 120
set transform-set esp-des-md5
reverse-route
!
crypto map test 10 ipsec-isakmp dynamic remotes
!
voice call carrier capacity active
!
interface Loopback0
ip address 10.20.20.20 255.255.255.0
no ip route-cache
no ip mroute-cache
!
interface FastEthernet0/0
ip address 10.2.80.203 255.255.255.0
no ip mroute-cache
```
load-interval 30
duplex full
!
interface FastEthernet1/0
ip address 192.168.219.2 255.255.255.0
no ip mroute-cache
duplex auto
speed auto
!
interface FastEthernet1/1
ip address 172.28.100.1 255.255.255.0
no ip mroute-cache
duplex auto
speed auto
crypto map test
!
no fair-queue
ip default-gateway 10.2.80.1
ip classless
ip route 10.0.0.0 0.0.0.0 10.2.80.1
ip route 10.20.0.0 255.0.0.0 10.2.80.56
ip route 10.10.10.0 255.255.255.0 172.31.100.2
ip route 10.20.20.0 255.255.255.0 172.31.100.73
ip local pool addressA 192.168.1.1 192.168.1.253
no ip http server
ip pim bidir-enable
!
ip access-list extended encrypt
permit ip host 10.0.0.1 host 10.5.0.1
!
access-list 101 permit ip host 10.20.20.20 host 10.10.10.10
!
radius-server host 172.27.162.206 auth-port 1645 acct-port 1646 key cisco123
radius-server retransmit 3
radius-server authorization permit missing Service-Type
radius-server vsa send accounting
call rsvp-sync
!
mgcp profile default
!
dial-peer cor custom
!

gatekeeper
shutdown
!
line con 0
exec-timeout 0 0
exec prompt timestamp
line aux 0
line vty 5 15
ntp server 172.31.150.52
end

Accounting Without ISAKMP Profiles Example

The following example shows a full Cisco IOS XE configuration that supports accounting remote access peers when ISAKMP profiles are not used:

version 2.1
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption

hostname sheep

aaa new-model
aaa accounting network ipseccaa start-stop group radius
aaa accounting update periodic 1
aaa session-id common
ip subnet-zero
ip cef
!
no ip domain lookup
ip domain name cisco.com
ip name-server 172.29.2.133
ip name-server 172.29.11.48
!
crypto isakmp policy 1
  authentication pre-share
  group 2
!
crypto isakmp policy 10
  hash md5
  authentication pre-share
  lifetime 200
  crypto isakmp key cisco address 172.31.100.2
  
  crypto ipsec transform-set esp-des-md5 esp-des esp-md5-hmac
  
crypto map test client accounting list ipseccaa
  crypto map test 10 ipsec-isakmp
  set peer 172.31.100.2
  set security-association lifetime seconds 120
  set transform-set esp-des-md5
  match address 101
  
voice call carrier capacity active
! interface Loopback0
  ip address 10.20.20.20 255.255.255.0
  no ip route-cache
  no ip mroute-cache
!
interface FastEthernet0/0
  ip address 10.2.80.203 255.255.255.0
  no ip route-cache
  load-interval 30
  duplex full
!
interface FastEthernet1/0
  ip address 192.168.219.2 255.255.255.0
  no ip mroute-cache
  duplex auto
  speed auto
!
interface FastEthernet1/1
  ip address 172.28.100.1 255.255.255.0
  no ip mroute-cache
  duplex auto
  speed auto
  crypto map test
!
no fair-queue
ip default-gateway 10.2.80.1
ip classless
ip route 10.0.0.0 0.0.0.0 10.2.80.1
ip route 10.30.0.0 255.0.0.0 10.2.80.56
ip route 10.10.10.0 255.255.255.0 172.31.100.2
ip route 10.0.0.2 255.255.255.255 10.2.80.73
no ip http server
ip pim bidir-enable
!
!
interface Loopback0
ip address 10.20.20.20 255.255.255.0
no ip route-cache
no ip mroute-cache
!
interface FastEthernet0/0
ip address 10.2.80.203 255.255.255.0
no ip route-cache
load-interval 30
duplex full
!
interface FastEthernet1/0
ip address 192.168.219.2 255.255.255.0
no ip mroute-cache
duplex auto
speed auto
!
interface FastEthernet1/1
ip address 172.28.100.1 255.255.255.0
no ip mroute-cache
duplex auto
speed auto
crypto map test
!
no fair-queue
ip default-gateway 10.2.80.1
ip classless
ip route 10.0.0.0 0.0.0.0 10.2.80.1
ip route 10.30.0.0 255.0.0.0 10.2.80.56
ip route 10.10.10.0 255.255.255.0 172.31.100.2
ip route 10.0.0.2 255.255.255.255 10.2.80.73
no ip http server
ip pim bidir-enable
!
!
ip access-list extended encrypt
permit ip host 10.0.0.1 host 10.5.0.1
!
access-list 101 permit ip host 10.20.20.20 host 10.10.10.10
!
radius-server host 172.27.162.206 auth-port 1645 acct-port 1646 key cisco123
radius-server retransmit 3
radius-server authorization permit missing Service-Type
call rsvp-sync
!
mgcp profile default
!
dial-peer cor custom
!
gatekeeper
  shutdown
!
line con 0
  exec-timeout 0 0
  exec prompt timestamp
line aux 0
line vty 5 15
!
exception core-file ioscrypto/core/sheep-core
exception dump 172.25.1.129
ntp clock-period 17208229
ntp server 172.71.150.52
!
end

Additional References

Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuring AAA accounting</td>
<td>“Configuring Accounting” module in the <em>Cisco IOS XE Security Configuration Guide: Securing User Services</em></td>
</tr>
<tr>
<td>Configuring basic AAA RADIUS</td>
<td>“Configuring RADIUS” module in the <em>Cisco IOS XE Security Configuration Guide: Securing User Services</em></td>
</tr>
<tr>
<td>Configuring ISAKMP profiles</td>
<td>“VRF-Aware IPsec” module in the <em>Cisco IOS XE Security Configuration Guide: Secure Connectivity</em></td>
</tr>
</tbody>
</table>
### Related Topic
Privilege levels with TACACS+ and RADIUS

- “Configuring TACACS+” module in the *Cisco IOS XE Security Configuration Guide: Securing User Services*
- “Configuring RADIUS” module in the *Cisco IOS XE Security Configuration Guide: Securing User Services*

<table>
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<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>IP security, RADIUS, and AAA commands</td>
<td><em>Cisco IOS Security Command Reference</em></td>
</tr>
<tr>
<td>- Standards, page 53</td>
<td></td>
</tr>
<tr>
<td>- MIBs, page 53</td>
<td></td>
</tr>
<tr>
<td>- RFCs, page 53</td>
<td></td>
</tr>
<tr>
<td>- Technical Assistance, page 54</td>
<td></td>
</tr>
</tbody>
</table>

### Standards

<table>
<thead>
<tr>
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<th>Title</th>
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</thead>
<tbody>
<tr>
<td>None.</td>
<td>--</td>
</tr>
</tbody>
</table>

### MIBs

<table>
<thead>
<tr>
<th>MIB</th>
<th>MIBs Link</th>
</tr>
</thead>
</table>
| None. | To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL:  
http://www.cisco.com/go/mibs |

### RFCs

<table>
<thead>
<tr>
<th>RFC</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>None.</td>
<td></td>
</tr>
</tbody>
</table>
Technical Assistance

<table>
<thead>
<tr>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></td>
</tr>
</tbody>
</table>

Feature Information for IPsec VPN Accounting

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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.
Table 6  Feature Information for IPsec VPN Accounting

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
</thead>
</table>
| IPsec VPN Accounting | Cisco IOS XE Release 2.1 | The IPsec VPN Accounting feature allows for a session to be accounted for by indicating when the session starts and when it stops.

A VPN session is defined as an IKE SA and the one or more SA pairs that are created by the IKE SA. The session starts when the first IPsec pair is created and stops when all IPsec SAs are deleted.

Session identifying information and session usage information is passed to the RADIUS server through standard RADIUS attributes and VSAs.

The following commands were introduced or modified: 
client authentication list, 
client configuration address, 
crypto isakmp profile, 
crypto map (global IPsec), 
debug crypto isakmp, 
isakmp authorization list, 
match identity, 
set isakmp-profile, 
vrf.

Glossary

**IKE** --Internet Key Exchange. IKE establishes a shared security policy and authenticates keys for services (such as IP security [IPsec]) that require keys. Before any IPsec traffic can be passed, each router, firewall, and host must verify the identity of its peer. This can be done by manually entering preshared keys into both hosts or by a certification authority (CA) service.

**IPsec** --IP security. IPsec is a framework of open standards that provides data confidentiality, data integrity, and data authentication between participating peers. IPsec provides these security services at the IP layer. IPsec uses IKE to handle the negotiation of protocols and algorithms based on local policy and to generate the encryption and authentication keys to be used by IPsec. IPsec can protect one or more data flows between a pair of hosts, between a pair of security gateways, or between a security gateway and a host.

**ISAKMP** --Internet Security Association and Key Management Protocol. ISAKMP is an Internet IPsec protocol (RFC 2408) that negotiates, establishes, modifies, and deletes security associations. It also exchanges key generation and authentication data (independent of the details of any specific key generation technique), key establishment protocol, encryption algorithm, or authentication mechanism.
**L2TP session** --Layer 2 Transport Protocol. L2TP are communications transactions between the L2TP access concentrator (LAC) and the L2TP network server (LNS) that support tunneling of a single PPP connection. There is a one-to-one relationship among the PPP connection, L2TP session, and L2TP call.

**NAS** --network access server. A NAS is a Cisco platform (or collection of platforms, such as an AccessPath system) that interfaces between the packet world (for example, the Internet) and the circuit world (for example, the public switched telephone network [PSTN]).

**PFS** --perfect forward secrecy. PFS is a cryptographic characteristic associated with a derived shared secret value. With PFS, if one key is compromised, previous and subsequent keys are not compromised because subsequent keys are not derived from previous keys.

**QM** --Queue Manager. The Cisco IP Queue Manager (IP QM) is an intelligent, IP-based, call-treatment and routing solution that provides powerful call-treatment options as part of the Cisco IP Contact Center (IPCC) solution.

**RADIUS** --Remote Authentication Dial-In User Service. RADIUS is a database for authenticating modem and ISDN connections and for tracking connection time.

**RSA** --Rivest, Shamir, and Adelman. Rivest, Shamir, and Adelman are the inventors of the Public-key cryptographic system that can be used for encryption and authentication.

**SA** --security association. A SA is an instance of security policy and keying material that is applied to a data flow.

**TACACS+** --Terminal Access Controller Access Control System Plus. TACACS+ is a security application that provides centralized validation of users attempting to gain access to a router or network access server.

**VPN** --Virtual Private Network. A VPN enables IP traffic to travel securely over a public TCP/IP network by encrypting all traffic from one network to another. A VPN uses "tunneling" to encrypt all information at the IP level.

**VRF** --A VPN routing/forwarding instance. A VRF consists of an IP routing table, a derived forwarding table, a set of interfaces that use the forwarding table, and a set of rules and routing protocols that determine what goes into the forwarding table. In general, a VRF includes the routing information that defines a customer VPN site that is attached to a PE router.

**VSA** --vendor-specific attribute. A VSA is an attribute that has been implemented by a particular vendor. It uses the attribute Vendor-Specific to encapsulate the resulting AV pair: essentially, Vendor-Specific = protocol:attribute = value.

**XAUTH** --Extended authentication. XAUTH is an optional exchange between IKE Phase 1 and IKE Phase 2, in which the router demands additional authentication information in an attempt to authenticate the actual user (as opposed to authenticating the peer).
IPsec Usability Enhancements

The IPsec Usability Enhancements feature introduces functionality that eases the configuration and monitoring of your IPsec virtual private network (VPN). Benefits of this feature include intelligent defaults for IPsec and Internet Key Exchange (IKE) and the ability to easily verify and troubleshoot IPsec VPNs.

- Finding Feature Information, page 57
- Prerequisites for IPsec Usability Enhancements, page 57
- Information About IPsec Usability Enhancements, page 57
- How to Utilize IPsec Usability Enhancements, page 59
- Configuration Examples for IPsec Usability Enhancements, page 73
- Additional References, page 76
- Feature Information for IPsec Usability Enhancements, page 77
- Glossary, page 78

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 IPsec Usability Enhancements

- You must be familiar with IPsec, IKE, and encryption.
- You must have configured IPsec and enabled IKE on your router.
- You must be running Cisco IOS XE k9 crypto image on your router.

Information About IPsec Usability Enhancements

- IPsec Overview, page 58
- IPsecOperation, page 58
IPsec Overview

IPsec is a framework of open standards developed by the Internet Engineering Task Force (IETF), which provides security for transmission of sensitive information over public networks. IPsec acts at the network layer, protecting and authenticating IP packets between participating IPsec devices (peers), such as Cisco routers.

IPsec provides secure tunnels between two peers. You may define which packets are considered sensitive and should be sent through these secure tunnels. You may also define the parameters that should be used to protect these sensitive packets by specifying characteristics of the tunnels. When an IPsec peer detects a sensitive packet, it sets up the appropriate secure tunnel and sends the packet through the tunnel to the remote peer.

IPsecOperation

An IPsec operation involves five basic steps: identifying interesting traffic, IKE phase-1, IKE phase-2, establishing the tunnel or IPsec session, and finally tearing down the tunnel.

Step 1: Identifying Interesting Traffic

The VPN devices recognize the traffic, or sensitive packets, to detect. IPsec is either applied to the sensitive packet, the packet is bypassed, or the packet is dropped. Based on the traffic type, if IPsec is applied then IKE phase-1 is initiated.

Step 2: IKE Phase-1

There are three exchanges between the VPN devices to negotiate an IKE security policy and establish a secure channel.

During the first exchange, the VPN devices negotiate matching IKE transform sets to protect the IKE exchange resulting in establishing an Internet Security Association and Key Management Protocol (ISAKMP) policy to utilize. The ISAKMP policy consists of an encryption algorithm, a hash algorithm, an authentication algorithm, a Diffie-Hellman (DH) group, and a lifetime parameter.

There are eight default ISAKMP policies supported. For more information on default ISAKMP policies, see the Verifying IKE Phase-1 ISAKMP Default Policies, page 59.

The second exchange consists of a Diffie-Hellman exchange, which establishes a shared secret.

The third exchange authenticates peer identity. After the peers are authenticated, IKE phase-2 begins.

Step 3: IKE Phase-2

The VPN devices negotiate the IPsec security policy used to protect the IPsec data. IPsec transform sets are negotiated.

A transform set is a combination of algorithms and protocols that enact a security policy for network traffic. For more information on default transform sets, see the Verifying Default IPsec Transform-Sets, page 62. A VPN tunnel is ready to be established.

Step 4: Establishing the Tunnel--IPsec Session

The VPN devices apply security services to IPsec traffic and then transmit the IPsec data. Security associations (SAs) are exchanged between peers. The negotiated security services are applied to the tunnel traffic while the IPsec session is active.
Step 5: Terminating the Tunnel

The tunnel is torn down when an IPsec SA lifetime time-out occurs or if the packet counter is exceeded. The IPsec SA is removed.

How to Utilize IPsec Usability Enhancements

- Verifying IKE Phase-1 ISAKMP Default Policies, page 59
- Verifying Default IPsec Transform-Sets, page 62
- Verifying and Troubleshooting IPsec VPNs, page 64

Verifying IKE Phase-1 ISAKMP Default Policies

When IKE negotiation begins, the peers try to find a common policy, starting with the highest priority policy as specified on the remote peer. The peers negotiate the policy sets until there is a match. If peers have more than one policy set in common, the lowest priority number is used.

There are three groups of IKE phase-1, ISAKMP, policies as defined by policy priority ranges and behavior:

- Default ISAKMP policies, which are automatically enabled.
- User configured ISAKMP policies, which you may configure with the `crypto isakmp policy` command.
- Easy VPN ISAKMP policies, which are made available during Easy VPN configuration.

This section describes the three groups of ISAKMP policies, how they behave in relationship to one another, how to determine which policies are in use with the appropriate `show` command, and how to disable the default ISAKMP policies.

- Default IKE Phase-1 Policies, page 59
- User Configured IKE Policies, page 60
- Easy VPN ISAKMP Policies, page 60

Default IKE Phase-1 Policies

There are eight default IKE phase-1, ISAKMP, policies supported (see the table below) that are enabled automatically. If you have neither manually configured IKE policies with the `crypto isakmp policy` command nor disabled the default IKE policies with the `no crypto isakmp default policy` command, the default IKE policies will be used during peer IKE negotiations. You can verify that the default IKE policies are in use by issuing either the `show crypto isakmp policy` command or the `show crypto isakmp default policy` command.

The default IKE policies define the following policy set parameters:

- The priority, 65507-65514, where 65507 is the highest priority and 65514 is the lowest priority.
- The authentication method, Rivest, Shamir, and Adelman (RSA) or preshared keys (PSK).
- The encryption method, Advanced Encryption Standard (AES) or Triple Data Encryption Standard (3DES).
- The hash function, Secure Hash Algorithm (SHA-1) or Message-Digest algorithm 5 (MD5).
- The DH group specification DH2 or DH5
  - DH2 specifies the 768-bit DH group.
DH5 specifies the 1536-bit DH group.

Table 7  Default IKE Phase-1, ISAKMP, Policies

<table>
<thead>
<tr>
<th>Priority</th>
<th>Authentication</th>
<th>Encryption</th>
<th>Hash</th>
<th>Diffie-Hellman</th>
</tr>
</thead>
<tbody>
<tr>
<td>65507</td>
<td>RSA</td>
<td>AES</td>
<td>SHA</td>
<td>DH5</td>
</tr>
<tr>
<td>65508</td>
<td>PSK</td>
<td>AES</td>
<td>SHA</td>
<td>DH5</td>
</tr>
<tr>
<td>65509</td>
<td>RSA</td>
<td>AES</td>
<td>MD5</td>
<td>DH5</td>
</tr>
<tr>
<td>65510</td>
<td>PSK</td>
<td>AES</td>
<td>MD5</td>
<td>DH5</td>
</tr>
<tr>
<td>65511</td>
<td>RSA</td>
<td>3DES</td>
<td>SHA</td>
<td>DH2</td>
</tr>
<tr>
<td>65512</td>
<td>PSK</td>
<td>3DES</td>
<td>SHA</td>
<td>DH2</td>
</tr>
<tr>
<td>65513</td>
<td>RSA</td>
<td>3DES</td>
<td>MD5</td>
<td>DH2</td>
</tr>
<tr>
<td>65514</td>
<td>PSK</td>
<td>3DES</td>
<td>MD5</td>
<td>DH2</td>
</tr>
</tbody>
</table>

User Configured IKE Policies

You may configure IKE policies with the `crypto isakmp policy` command. User configured IKE policies are uniquely identified and configured with a priority number ranging from 1-10000, where 1 is the highest priority and 10000 the lowest priority.

Once you have configured one or more IKE policies with a priority of 1-10000:

- The user configured policies will be used during peer IKE negotiations.
- The default IKE policies will no longer used during peer IKE negotiations.
- The user configured policies may be displayed by issuing the `show crypto isakmp policy` command.

Easy VPN ISAKMP Policies

If you have configured Easy VPN (see the Easy VPN ISAKMP Policies, page 60), the default Easy VPN ISAKMP policies in use are uniquely identified with a priority number ranging from 65515-65535, where 65515 is the highest priority and 65535 is the lowest priority.

Once a user has configured Easy VPN:

- The default Easy VPN ISAKMP policies and the default IKE policies will be used during peer IKE negotiations.
- The Easy VPN ISAKMP policies and the default IKE policies will be displayed by issuing the `show crypto isakmp policy` command.
- Default ISAKMP policies will be displayed by issuing the `show crypto isakmp default policy` command unless they have been disabled by issuing the `no crypto isakmp default policy` command.
SUMMARY STEPS
1. enable
2. show crypto isakmp default policy
3. configure terminal
4. no crypto isakmp default policy

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>Enter your password if prompted.</td>
</tr>
<tr>
<td><code>Router&gt; enable</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> show crypto isakmp default policy</td>
<td>(Optional) Displays default ISAKMP policies if no policy with a priority of 1-10000 is configured.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Router# show crypto isakmp default policy</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Router# configure terminal</code></td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> no crypto isakmp default policy</td>
<td>(Optional) Turns off default ISAKMP policies with priorities 65507-65514.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td><code>Router(config)# no crypto isakmp default policy</code></td>
<td></td>
</tr>
</tbody>
</table>

Examples
The following is sample output of the `show crypto isakmp default policy` command. The default policies are displayed because the default policies have not been disabled.

```
Router# show crypto isakmp default policy

Default IKE policy
Default protection suite of priority 65507
  hash algorithm: Secure Hash Standard
  authentication method: Rivest-Shamir-Adleman Signature
  Diffie-Hellman group: #5 (1536 bit)
  lifetime: 86400 seconds, no volume limit
Default protection suite of priority 65508
  hash algorithm: Secure Hash Standard
  authentication method: Pre-Shared Key
  Diffie-Hellman group: #5 (1536 bit)
```
The following example disables the default IKE policies then shows the resulting output of the `show crypto isakmp default policy` command, which is blank:

```
Router# configure terminal
Router(config)# no crypto isakmp default policy
Router(config)# exit
Router# show crypto isakmp default policy
Router#
!There is no output since the default IKE policies have been disabled.
```

The following is an example system log message that is generated whenever the default ISAKMP policies are in use:

```
%CRYPTO-6-IKMP_POLICY_DEFAULT: Using ISAKMP Default policies
```

### Verifying Default IPsec Transform-Sets

A transform set represents a certain combination of security protocols and algorithms. During the IPsec SA negotiation, the peers agree to use a particular transform set for protecting a particular data flow.

During IPsec SA negotiations with IKE, the peers search for a transform set that is the same at both peers. When such a transform set is found, it is selected and is applied to the protected traffic as part of the IPsec SAs of both peers.

- Default Transform Sets, page 63
Default Transform Sets

A default transform set will be used by any crypto map or IPsec profile where no other transform set has been configured and if the following is true:

- The default transform sets have not been disabled with the `no crypto ipsec default transform-set` command.
- The crypto engine in use supports the encryption algorithm.

The two default transform sets each define an Encapsulation Security Protocol (ESP) encryption transform type and an ESP authentication transform type as shown in the table below.

Table 8  Default Transform Sets and Parameters

<table>
<thead>
<tr>
<th>Default Transform Name</th>
<th>ESP Encryption Transform and Description</th>
<th>ESP Authentication Transform and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#!default_transform_set_0</td>
<td>esp-3des</td>
<td>esp-sha-hmac</td>
</tr>
<tr>
<td></td>
<td>(ESP with the 168-bit 3DES or Triple DES encryption algorithm)</td>
<td></td>
</tr>
<tr>
<td>#!default_transform_set_1</td>
<td>esp-aes</td>
<td>esp-sha-hmac</td>
</tr>
<tr>
<td></td>
<td>(ESP with the 128-bit AES encryption algorithm)</td>
<td>(ESP with the SHA-1, hash message authentication code [HMAC] variant authentication algorithm)</td>
</tr>
</tbody>
</table>

SUMMARY STEPS

1. `enable`
2. `show crypto ipsec default transform-set`
3. `configure terminal`
4. `no crypto ipsec default transform-set`

DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> <code>enable</code></td>
<td>Enables privileged EXEC mode.</td>
</tr>
<tr>
<td></td>
<td>• Enter your password if prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> <code>show crypto ipsec default transform-set</code></td>
<td>(Optional) Displays the default IPsec transform sets currently in use by IKE.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router# show crypto ipsec default transform-set</td>
<td></td>
</tr>
</tbody>
</table>
Verifying and Troubleshooting IPsec VPNs

Perform one of the following optional tasks in this section, depending on whether you want to verify IKE phase-1 or IKE phase-2 tunnels or troubleshoot your IPsec VPN:

- **Verifying IKE Phase-1 ISAKMP**, page 64
- **Verifying IKE Phase-2**, page 68
- **Troubleshooting IPsec VPNs**, page 72

### Verifying IKE Phase-1 ISAKMP

To display statistics for ISAKMP tunnels, use the following optional commands.
### SUMMARY STEPS

1. `show crypto mib isakmp flowmib failure [ vrf vrf-name ]`
2. `show crypto mib isakmp flowmib global [ vrf vrf-name ]`
3. `show crypto mib isakmp flowmib history [ vrf vrf-name ]`
4. `show crypto mib isakmp flowmib peer [ index peer-mib-index ] [ vrf vrf-name ]`
5. `show crypto mib isakmp flowmib tunnel [ index tunnel-mib-index ] [ vrf vrf-name ]`

### DETAILED STEPS

#### Step 1

**show crypto mib isakmp flowmib failure [ vrf vrf-name ]**

For ISAKMP tunnel failures, this command displays event information. The following is sample output for this command:

**Example:**

```
Router# show crypto mib isakmp flowmib failure
vrf Global
Index:                       1
Reason:                      peer lost
Failure time since reset:    00:07:27
Local type:                  ID_IPV4_ADDR
Local value:                 192.0.2.1
Remote type:                 ID_IPV4_ADDR
Remote Value:                192.0.2.2
Local Address:               192.0.2.1
Remote Address:              192.0.2.2

Index:                       2
Reason:                      peer lost
Failure time since reset:    00:07:27
Local type:                  ID_IPV4_ADDR
Local value:                 192.0.3.1
Remote type:                 ID_IPV4_ADDR
Remote Value:                192.0.3.2
Local Address:               192.0.3.1
Remote Address:              192.0.3.2

Index:                       3
Reason:                      peer lost
Failure time since reset:    00:07:32
Local type:                  ID_IPV4_ADDR
Remote type:                 ID_IPV4_ADDR
Remote Value:                192.0.2.2
Local Address:               192.0.2.1
Remote Address:              192.0.2.2
```

#### Step 2

**show crypto mib isakmp flowmib global [ vrf vrf-name ]**

Global ISAKMP tunnel statistics are displayed by issuing this command. The following is sample output for this command:

**Example:**

```
Router# show crypto mib isakmp flowmib global
vrf Global
Active Tunnels:                          3
Previous Tunnels:                        0
In octets:                               2856
Out octets:                              3396
In packets:                              16
```
Step 3  

Show crypto mib isakmp flowmib history [ vrf vrf-name ]

For information about ISAKMP tunnels that are no longer active, this command displays event information including the reason that the tunnel was terminated. The following is sample output for this command:

Example:

Router# show crypto mib isakmp flowmib history
vrf Global
Reason: peer lost
Index: 2
Local type: ID_IPV4_ADDR
Local address: 192.0.2.1
Remote type: ID_IPV4_ADDR
Remote address: 192.0.2.2
Negotiation mode: Main Mode
Diffie Hellman Grp: 2
Encryption algo: des
Hash algo: sha
Auth method: psk
lifetime: 86400
Active time: 00:06:30
Policy priority: 1
Keepalive enabled: Yes
In octets: 3024
In packets: 22
In drops: 0
In notifs: 18
In P2 exchanges: 1
In P2 exchg invalids: 0
In P2 exchg rejected: 0
In P2 SA delete reqs: 0
Out octets: 4188
Out packets: 33
Out drops: 0
Out notifs: 28
Out P2 exchgs: 2
Out P2 exchg invalids: 0
Out P2 exchg rejects: 0
Out P2 Sa delete requests: 0
Reason: peer lost
Index: 3
Local type: ID_IPV4_ADDR
Local address: 192.0.3.1
Remote type: ID_IPV4_ADDR
Remote address: 192.0.3.2
Negotiation mode: Main Mode
Diffie Hellman Grp: 2

Out packets: 19
In packets drop: 0
Out packets drop: 0
In notifs: 4
Out notifs: 7
In P2 exchg: 3
Out P2 exchg: 6
In P2 exchg invalids: 0
Out P2 exchg invalids: 0
In P2 exchg rejects: 0
Out P2 exchg rejects: 0
In IPSEC delete: 0
Out IPSEC delete: 0
SAs locally initiated: 3
SAs locally initiated failed: 0
SAs remotely initiated failed: 0
System capacity failures: 0
Authentication failures: 0
Decrypt failures: 0
Hash failures: 0
Invalid SPI: 0
Encryption algo:  
Hash algo:  
Auth method:  
Lifetime:  
Active time:  
Policy priority:  
Keepalive enabled:  
In octets:  
In packets:  
In drops:  
In notifies:  
In P2 exchanges:  
In P2 exchg invalids:  
In P2 exchg rejected:  
In P2 SA delete reqs:  
Out octets:  
Out packets:  
Out drops:  
Out notifies:  
Out P2 exchgs:  
Out P2 exchg invalids:  
Out P2 exchg rejects:  
Out P2 Sa delete requests:  

### Step 4

**show crypto mib isakmp flowmib peer [ index peer-mib-index ] [ vrf vrf-name ]**

For active ISAKMP peer associations, this command displays information including indexes, type of connection, and IP addresses. The following is sample output for this command:

**Example:**

```
Router# show crypto mib isakmp flowmib peer
vrf Global
Index:              1
Local type:         ID_IPV4_ADDR
Local address:      192.0.2.1
Remote type:        ID_IPV4_ADDR
Remote address:     192.0.2.2
Index:              2
Local type:         ID_IPV4_ADDR
Local address:      192.0.3.1
Remote type:        ID_IPV4_ADDR
Remote address:     192.0.3.1
Index:              3
Local type:         ID_IPV4_ADDR
Local address:      192.0.4.1
Remote type:        ID_IPV4_ADDR
Remote address:     192.0.4.1
```

### Step 5

**show crypto mib isakmp flowmib tunnel [ index tunnel-mib-index ] [ vrf vrf-name ]**

For active ISAKMP tunnels, this command displays tunnel statistics. The following is sample output for this command:

**Example:**

```
Router# show crypto mib isakmp flowmib tunnel
vrf Global
Index:              1
Local type:         ID_IPV4_ADDR
Local address:      192.0.2.1
Remote type:        ID_IPV4_ADDR
Remote address:     192.0.2.2
Negotiation mode:   Main Mode
Diffie Hellman Grp: 2
Encryption algo:    des
Hash algo:          sha
```

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Verifying IKE Phase-2

To display statistics for IPsec phase-2 tunnels, use the following optional commands.

**SUMMARY STEPS**

1. `show crypto mib ipsec flowmib endpoint [vrf vrf-name]`
2. `show crypto mib ipsec flowmib failure [vrf vrf-name]`
3. `show crypto mib ipsec flowmib global [vrf vrf-name]`
4. `show crypto mib ipsec flowmib history [vrf vrf-name]`
5. `show crypto mib ipsec flowmib spi [vrf vrf-name]`
6. `show crypto mib ipsec flowmib tunnel [index tunnel-mib-index] [vrf vrf-name]`

**DETAILED STEPS**

**Step 1**

`show crypto mib ipsec flowmib endpoint [vrf vrf-name]`

Information for each active endpoint, local or remote device, associated with an IPsec phase-2 tunnel is displayed by issuing this command. The following is sample output for this command:

**Example:**

```
Router# show crypto mib ipsec flowmib endpoint
vrf Global
   Index: 1
   Local type: Single IP address
   Local address: 192.1.2.1
   Protocol: 0
   Local port: 0
   Remote type: Single IP address
   Remote address: 192.1.2.2
   Remote port: 0
   Index: 2
```
Step 2  show crypto mib ipsec flowmib failure [ vrf vrf-name ]
For ISAKMP tunnel failures, this command displays event information. The following is sample output for this command:

Example:

Router# show crypto mib ipsec flowmib failure
vrf Global
  Index:                        1
  Reason:                       Operation request
  Failure time since reset:     00:25:18
  Src address:                  192.1.2.1
  Destination address:          192.1.2.2
  SPI:                          0

Step 3  show crypto mib ipsec flowmib global [ vrf vrf-name ]
Global IKE phase-2 tunnel statistics are displayed by issuing this command. The following is sample output for this command:

Example:

Router# show crypto mib ipsec flowmib global
vrf Global
  Active Tunnels:                     2
  Previous Tunnels:                   0
  In octets:                          800
  Out octets:                         1408
  In packets:                         8
  Out packets:                        8
  Uncompressed encrypted bytes: 1408
  In packets drops:                   0
  Out packets drops:                  2
  In replay drops:                    0
  In authentications:                 8
  Out authentications:                8
  In decrypts:                       8
  Out encrypts:                       8
  Compressed bytes:                   0
  Uncompressed bytes:                 0
  In uncompressed bytes:              0
  Out uncompressed bytes:             0
  In decrypt failures:                0
  Out encrypt failures:               0
  No SA failures:                     0
! Number of SA Failures.
  Protocol use failures:             0
  System capacity failures:          0
  In authentication failures:        0
  Out authentication failures:       0

Step 4  show crypto mib ipsec flowmib history [ vrf vrf-name ]
For information about IKE phase-2 tunnels that are no longer active, this command displays event information including the reason that the tunnel was terminated. The following is sample output for this command:
### Step 5  
**show crypto mib ipsec flowmib spi [ vrf vrf-name ]**  
The security protection index (SPI) table contains an entry for each active and expiring security IKE phase-2 association. The following is sample output for this command, which displays the SPI table:

**Example:**

```plaintext
Router# show crypto mib ipsec flowmib spi vrf Global  
Tunnel Index: 1  
SPI Index: 1  
SPI Value: 0xCC57D053  
SPI Direction: In  
SPI Protocol: AH  
SPI Status: Active  
SPI Index: 2  
SPI Value: 0x68612DF  
SPI Direction: Out  
SPI Protocol: AH  
SPI Status: Active  
SPI Index: 3
```
SPI Value: 0x56947526
SPI Direction: In
SPI Protocol: ESP
SPI Status: Active
SPI Index: 4
SPI Value: 0x8D7C2204
SPI Direction: Out
SPI Protocol: ESP
SPI Status: Active

Step 6  show crypto mib ipsec flowmib tunnel [index tunnel-mib-index] [ vrf vrf-name ]

For active IKE phase-2 tunnels, this command displays tunnel statistics. The following is sample output for this command:

Example:

Router# show crypto mib ipsec flowmib tunnel
vrf Global
    Index: 1
    Local address: 192.0.2.1
    Remote address: 192.0.2.2
    IPSEC keying: IKE
    Encapsulation mode: 1
    Lifetime (KB): 4608000
    Lifetime (Sec): 3600
    Active time: 00:05:46
    Lifetime threshold (KB): 64
    Lifetime threshold (Sec): 10
    Total number of refreshes: 0
    Expired SA instances: 0
    Current SA instances: 4
    In SA DH group: 1
    In SA encrypt algorithm: des
    In SA auth algorithm: rsig
    In SA ESP auth algo: ESP_HMAC_SHA
    In SA uncompress algorithm: None
    Out SA DH group: 1
    Out SA encryption algorithm: des
    Out SA auth algorithm: ESP_HMAC_SHA
    Out SA ESP auth algorithm: ESP_HMAC_SHA
    Out SA uncompress algorithm: None
    In octets: 400
    Decompressed octets: 400
    In packets: 4
    In drops: 0
    In replay drops: 0
    In authentications: 4
    In authentication failures: 0
    In decrypts: 4
    In decrypt failures: 0
    Out octets: 704
    Out uncompressed octets: 704
    Out packets: 4
    Out drops: 1
    Out authentications: 4
    Out authentication failures: 0
    Out encryptions: 4
    Out encryption failures: 0
    Compressed octets: 0
    Decompressed octets: 0
    Out uncompressed octets: 704
Troubleshooting IPsec VPNs

The `show tech-support ipsec` command simplifies the collection of the IPsec related information if you are troubleshooting a problem.

**SUMMARY STEPS**

1. `show tech-support ipsec`

**DETAILED STEPS**

The `show tech-support ipsec` command:

There are three variations of the `show tech-support ipsec` command:

- `show tech-support ipsec`
- `show tech-support ipsec peer ipv4address`
- `show tech-support ipsec vrf vrf-name`

For a sample display of the output from the `show tech-support ipsec` command for the individual `show` commands listed below for each variation see the Troubleshooting IPsec VPNs, page 72.

Output of the `show tech-support ipsec` Command

If you enter the `show tech-support ipsec` command without any keywords, the command output displays the following `show` commands, in order of output:

- `show version`
- `show running-config`
- `show crypto isakmp sa count`
- `show crypto ipsec sa count`
- `show crypto session summary`
- `show crypto session detail`
- `show crypto isakmp sa detail`
- `show crypto ipsec sa detail`
- `show crypto isakmp peers`
- `show crypto ruleset detail`
- `show processes memory | include Crypto IKMP`
- `show processes cpu | include Crypto IKMP`
- `show crypto eli`
- `show crypto engine accelerator statistic`

Output of the `show tech-support ipsec peer` Command

If you enter the `show tech-support ipsec peer` command with the `peer` keyword and the `ipv4address` argument, the output displays the following `show` commands, in order of output for the specified peer:

- `show version`
- `show running-config`
- `show crypto session remote ipv4address detail`
- `show crypto isakmp sa peer ipv4address detail`
- `show crypto ipsec sa peer ipv4address detail`
- `show crypto isakmp peers ipv4address`
• show crypto ruleset detail
• show processes memory | include Crypto IKMP
• show processes cpu | include Crypto IKMP
• show crypto eli
• show crypto engine accelerator statistic

Output of the show tech-support ipsec vrf Command

If you enter the `show tech-support ipsec vrf` command with the `vrf` keyword and the `vrf-name` argument, the output displays the following `show` commands, in order of output for the specified Virtual Routing and Forwarding (VRF):

• show version
• show running-config
• show crypto isakmp sa count vrf `vrf-name`
• show crypto ipsec sa count vrf `vrf-name`
• show crypto session ivrf `ivrf-name` detail
• show crypto session fvrf `fvrf-name` detail
• show crypto isakmp sa vrf `vrf-name` detail
• show crypto ipsec sa vrf `vrf-name` detail
• show crypto ruleset detail
• show processes memory | include Crypto IKMP
• show processes cpu | include Crypto IKMP
• show crypto eli
• show crypto engine accelerator statistic

Example:

---

**Configuration Examples for IPsec Usability Enhancements**

• IKE Default Policies Example, page 74
• Default Transform Sets Example, page 75
IKE Default Policies Example

In the following example, crypto maps are configured on RouterA and RouterB and default IKE policies are in use. Traffic is routed from Pagent A to Pagent B. Checking the system log on Peer A and Peer B confirms that the default IKE policies are in use on both peers (see the figure below).

**Figure 1** Example Site to Site Topology

```
! Configuring RouterA.
RouterA(config)# crypto isakmp key identity address 209.165.200.226
RouterA(config)# crypto map testmap 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer and a valid access list have been configured.
RouterA(config-crypto-map)# set peer 209.165.200.226
RouterA(config-crypto-map)# match address 101
RouterA(config-crypto-map)# exit
RouterA(config)# ip route 209.165.200.225 255.255.255.224 209.165.200.226
RouterA(config)# access-list 101 permit ip host 209.165.200.227 host 209.165.200.225
RouterA(config)# interface FastEthernet1/2
RouterA(config-if)# crypto map testmap
RouterA(config-if)# end
RouterA(config)# crypto ipsec transform test_transf esp-aes esp-sha-hmac
RouterA(config-crypto-trans)# mode tunnel
RouterA(config-crypto-trans)# end
RouterA(config)# crypto map testmap 10
RouterA(config-crypto-map)# set transform-set test_transf
RouterA(config-crypto-map)# end

! Configuring RouterB.
RouterB(config)# crypto isakmp key identity address 209.165.200.228
RouterB(config)# crypto dynamic-map dyn_testmap 10
RouterB(config-crypto-map)# crypto map testmap 10 ipsec-isakmp dynamic dyn_testmap
RouterB(config)# ip route 209.165.200.227 255.255.255.224 209.165.200.228
RouterB(config)# interface GigabitEthernet0/1
RouterB(config-if)# crypto map testmap
RouterB(config-if)# end
RouterB(config)# crypto ipsec transform test_transf esp-aes esp-sha-hmac
RouterB(config-crypto-trans)# mode tunnel
RouterB(config-crypto-trans)# end
RouterB(config)# crypto dynamic-map dyn_testmap 10
RouterB(config-crypto-map)# set transform-set test_transf
RouterB(config-crypto-map)# end

! Routing traffic from PagentA to PagentB.
PagentA(config)# ip route 209.165.200.225 255.255.255.224 209.165.200.229
PagentA(config)# end

! Routing traffic from PagentB to PagentA.
PagentB(config)# ip route 209.165.200.227 255.255.255.224 209.165.200.230
PagentB(config)# end

! Checking the system log on RouterA confirms that the default IKE policies are in use.
RouterA# show log | include %CRYPTO-6-IKMP_POLICY_DEFAULT*
Jun  5 09:17:59.251 PDT: %CRYPTO-6-IKMP_POLICY_DEFAULT: Using ISAKMP Default policies
RouterA# show log | include %CRYPTO-6-IKMP_POLICY_DEFAULT*
Jun  5 09:17:59.979 PDT: %CRYPTO-6-IKMP_POLICY_DEFAULT: Using ISAKMP Default policies
```
Default Transform Sets Example

In the following example, static crypto maps are configured on RouterA and dynamic crypto maps are configured on RouterB. Traffic is routed from Pagent A to Pagent B. The IPsec SAs negotiate with default transform sets and the traffic is encrypted. Executing the `show crypto map` command on both peers verifies that the default transform sets are in use (see Default Transform Sets Example, page 75).

! Configuring RouterA.
RouterA(config)## crypto isakmp key identify address 209.165.200.225
RouterA(config)## crypto map testmap 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
 and a valid access list have been configured.
RouterA(config-crypto-map)# set peer 209.165.200.225
RouterA(config-crypto-map)# match address 101
RouterA(config-crypto-map)# exit
RouterA(config)# ip route 209.165.200.226 255.255.255.255 209.165.200.225
RouterA(config)# access-list 101 permit ip host 209.165.200.227 host 209.165.200.226
RouterA(config)#
RouterA(config)# interface FastEthernet1/2
RouterA(config-if)# crypto map testmap
RouterA(config-if)#
RouterA(config)#
RouterA(config)# crypto isakmp policy 10
RouterA(config-isakmp)# encryption aes
RouterA(config-isakmp)# authentication pre-share
RouterA(config-isakmp)# hash sha
RouterA(config-isakmp)# group 5
RouterA(config-isakmp)# exit
! Configuring RouterB.
RouterB(config)# crypto isakmp key identity address 209.165.200.229
RouterB(config)## crypto dynamic-map dyn_testmap 10 ipsec-isakmp dynamic dyn_testmap
RouterB(config)# ip route 209.165.200.227 255.255.255.255 209.165.200.229
RouterB(config)#
RouterB(config)# interface GigabitEthernet0/1
RouterB(config-if)# crypto map testmap
RouterB(config-if)#
RouterB(config)# crypto isakmp policy 10
RouterB(config-isakmp)# encryption aes
RouterB(config-isakmp)# authentication pre-share
RouterB(config-isakmp)# hash sha
RouterB(config-isakmp)# group 5
RouterB(config-isakmp)# exit
! The SA is using the default transform set and traffic is encrypted on RouterA.
RouterA## show crypto isakmp sa detail | include 209.165.200.229.*209.165.200.225.*ACTIVE
13006 209.165.200.229 209.165.200.225 ACTIVE aes sha psk 5 0
13005 209.165.200.229 209.165.200.225 ACTIVE aes sha psk 5 0
! The SA is using the default transform set and traffic is encrypted on RouterB.
RouterB## show crypto isakmp sa detail | include 209.165.200.225.*209.165.200.229.*ACTIVE
7006 209.165.200.225 209.165.200.229 ACTIVE aes sha psk 5 0
7005 209.165.200.225 209.165.200.229 ACTIVE aes sha psk 5 0
! Verifying that the default transform sets are in use on RouterA.
RouterA## show crypto map
Crypto Map "testmap" 10 ipsec-isakmp
Peer = 209.165.200.225
 Extended IP access list 101 permit ip host 209.165.200.227 host 209.165.200.226
 Current peer: 209.165.200.225
 Security association lifetime: 4608000 kilobytes/3600 seconds
 PFS (Y/N): N
 Transform sets={
   @$!default_transform_set_1: { esp-aes esp-sha-hmac },
   @$!default_transform_set_0: { esp-3des esp-sha-hmac },
 }
 Interfaces using crypto map testmap:
   FastEthernet1/2
! Verifying that the default transform sets are in use on RouterB.
RouterB## show crypto map
Crypto Map "testmap" 10 ipsec-isakmp
Dynamic map template tag: dyn_testmap
Crypto Map "testmap" 65536 ipsec-isakmp
Peer = 209.165.200.229
Extended IP access list
   access-list permit ip host 209.165.200.226 host 209.165.200.227
dynamic (created from dynamic map dyn_testmap/10)
Current peer: 209.165.200.229
Security association lifetime: 4608000 kilobytes/3600 seconds
PFS (Y/N): N
Transform sets={
   #default_transform_set_1:  { esp-aes esp-sha-hmac },
}
Interfaces using crypto map testmap:
   GigabitEthernet0/1

Additional References

The following sections provide references related to the IPsec Usability Enhancement feature.

### Related Documents

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
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</thead>
<tbody>
<tr>
<td>IKE configuration</td>
<td>Configuring Internet Key Exchange for IPsec VPNs module in the Cisco IOS XE Security Configuration Guide: Secure Connectivity</td>
</tr>
<tr>
<td>Cisco IOS XE security commands</td>
<td>Cisco IOS Security Command Reference</td>
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### Standards

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<td>No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.</td>
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### MIBs

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<th>MIBs Link</th>
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<td>No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.</td>
<td>To locate and download MIBs for selected platforms, Cisco IOS XE releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a></td>
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RFCs

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<td>for existing RFCs has not been modified by this feature.</td>
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Technical Assistance

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<tr>
<td>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.</td>
<td><a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a></td>
</tr>
</tbody>
</table>

Feature Information for IPsec Usability Enhancements

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

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.
### Feature Information for IPsec Usability Enhancements

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
</tr>
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<tbody>
<tr>
<td>IPsec Usability Enhancements</td>
<td>Cisco IOS XE Release 2.4</td>
<td>This feature introduces intelligent defaults for IKE and IPsec, and show commands to access MIB statistics and to aid in troubleshooting. The following commands were introduced or modified: crypto ipsec default transform-set, crypto isakmp default policy, crypto isakmp policy, show crypto ipsec default transform-set, show crypto ipsec transform-set, show crypto isakmp default policy, show crypto isakmp policy, show crypto map (IPsec), show crypto mib ipsec flowmib endpoint, show crypto mib ipsec flowmib failure, show crypto mib ipsec flowmib global, show crypto mib ipsec flowmib history, show crypto mib ipsec flowmib spi, show crypto mib ipsec flowmib tunnel, show crypto mib isakmp flowmib failure, show crypto mib isakmp flowmib global, show crypto mib isakmp flowmib history, show crypto mib isakmp flowmib peer, show crypto mib isakmp flowmib tunnel, show tech-support ipsec.</td>
</tr>
</tbody>
</table>

**Glossary**

- **peer**—In the context of this module, a router or other device that participates in IPsec.
- **SA**—security association. Description of how two or more entities use security services in the context of a particular security protocol (AH or ESP) to communicate securely on behalf of a particular data flow. The transform and the shared secret keys are used for protecting the traffic.
- **transform**—List of operations performed on a dataflow to provide data authentication, data confidentiality, and data compression. For example, one transform is the ESP protocol with the HMAC-MD5 authentication algorithm; another transform is the AH protocol with the 56-bit DES encryption algorithm and the ESP protocol with the HMAC-SHA authentication algorithm.
tunnel--In the context of this module, a secure communication path between two peers, such as two routers. It does not refer to using IPsec in tunnel mode.

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