Configure Security Parameters

This section describes how to change security parameters for the control plane and the data plane in the Cisco SD-WAN overlay network.

Configure Control Plane Security Parameters

By default, the control plane uses DTLS as the protocol that provides privacy on all its tunnels. DTLS runs over UDP.

You can change the control plane security protocol to TLS, which runs over TCP. The primary reason to use TLS is that, if you consider the vSmart controller to be a server, firewalls protect TCP servers better than UDP servers.

You configure the control plane tunnel protocol on a vSmart controller:

```
vSmart(config)# security control protocol tls
```

With this change, all control plane tunnels between the vSmart controller and the routers and between the controller and vManage use TLS. Control plane tunnels to vBond orchestrators always use DTLS, because these connections must be handled by UDP.

In a domain with multiple vSmart controllers, when you configure TLS on one of the vSmart controllers, all control plane tunnels from that controller to the other controllers use TLS. Said another way, TLS always takes precedence over DTLS. However, from the perspective of the other vSmart controllers, if you have not configured TLS on them, they use TLS on the control plane tunnel only to that one vSmart controller, and they use DTLS tunnels to all the other vSmart controllers and to all their connected routers. To have all vSmart controllers use TLS, configure it on all of them.

By default, the vSmart controller listens on port 23456 for TLS requests. To change this:

```
vSmart(config)# security control tls-port number
```

The port can be a number from 1025 through 65535.

To display control plane security information, use the **show control connections** command on the vSmart controller. For example:

```
vSmart-2# show control connections
```

```
                                                                      PEER                  PEER
PEER    PEER     PEER            SITE   DOMAIN  PEER          PRIVATE  PEER          PUBLIC
TYPE    PROTOCOL SYSTEM IP       ID     ID      PRIVATE IP    PORT     PUBLIC IP     PORT
REMOTE COLOR  STATE  UPTIME
-------------------------------------------------------------------------------------------
vedge   dtls     172.16.255.11  100    1       10.0.5.11     12346    10.0.5.11     12346
lte             up    0:07:48:58
vedge   dtls     172.16.255.21  100    1       10.0.5.21     12346    10.0.5.21     12346
lte             up    0:07:48:51
vedge   dtls     172.16.255.14  400    1       10.1.14.14    12360    10.1.14.14    12360
lte             up    0:07:49:02
vedge   dtls     172.16.255.15  500    1       10.1.15.15    12346    10.1.15.15    12346
default         up    0:07:47:18
vedge   dtls     172.16.255.16  600    1       10.1.16.16    12346    10.1.16.16    12346
default         up    0:07:41:52
vsmart  tls      172.16.255.19  100    1       10.0.5.19     12345    10.0.5.19     12345
default         up    0:00:01:44
vbond   dtls     -              0      0       10.1.14.14    12346    10.1.14.14    12346
default         up    0:07:49:08

vSmart-2# control connections

                                                                       PEER                  PEER
PEER     PEER     PEER            SITE   DOMAIN  PEER          PRIVATE  PEER          PUBLIC
TYPE     PROTOCOL SYSTEM IP       ID     ID      PRIVATE IP    PORT     PUBLIC IP     PORT
 REMOTE COLOR  STATE   UPTIME
-------------------------------------------------------------------------------------------
vedge    tls      172.16.255.11  100    1       10.0.5.11     12345    10.0.5.11     12345
 lte            up     0:00:01:18
vedge    tls      172.16.255.21  100    1       10.0.5.21     12345    10.0.5.21     12345
 lte            up     0:00:01:18
vedge    tls      172.16.255.14  400    1       10.1.14.14    12345    10.1.14.14    12345
 lte            up     0:00:01:18
vedge    tls      172.16.255.15  500    1       10.1.15.15    12345    10.1.15.15    12345
 default        up     0:00:01:18
vedge    tls      172.16.255.16  600    1       10.1.16.16    12345    10.1.16.16    12345
 default        up     0:00:01:18
vsmart   tls      172.16.255.20  200    1       10.0.12.20    23456    10.0.12.20    23456
 default        up     0:00:01:32
vbond    dtls     -              0      0       10.1.14.14    12346    10.1.14.14    12346
 default        up     0:00:01:33
```

Configure DTLS on vManage

If you configure the vManage to use TLS as the control plane security protocol, you must enable port forwarding on your NAT. If you are using DTLS as the control plane security protocol, you do not need to do anything.

The number of ports forwarded depends on the number of vdaemon processes running on the vManage. To display information about these processes and about and the number of ports that are being forwarded, use the **show control summary** command shows that four vdaemon processes are running:

```
vManage# show control summary
          VBOND      VMANAGE    VSMART    VEDGE
INSTANCE  COUNTS     COUNTS     COUNTS    COUNTS
------------------------------------------------
0           2          0           2        7
1           2          0           0        5
2           2          0           0        5
3           2          0           0        4
```

To see the listening ports, use the **show control local-properties** command:

```
vManage# show control local-properties

organization-name            Cisco SD-WAN Inc Test
certificate-status           Installed
root-ca-chain-status         Installed

certificate-validity         Valid
certificate-not-valid-before May 20 00:00:00 2015 GMT
certificate-not-valid-after  May 20 23:59:59 2016 GMT

dns-name                     vbond.cisco.com
site-id                      5000
domain-id                    0
protocol                     dtls
tls-port                     23456
...
...
...
number-active-wan-interfaces 1

                PUBLIC       PUBLIC PRIVATE       PRIVATE
  ADMIN  OPERATION LAST
INDEX INTERFACE IP           PORT   IP            PORT    VSMARTS  VMANAGES COLOR  CARRIER
  STATE  STATE     CONNECTION
-----------------------------------------------------------------------------------------
0     eth0      72.28.108.37 12361  172.16.98.150 12361   2        0        silver default
  up     up       0:00:00:08
```

This output shows that the listening TCP port is 23456. If you are running vManage behind a NAT, you should open the following ports on the NAT device:

- 23456 (base - instance 0 port)
- 23456 + 100 (base + 100)
- 23456 + 200 (base + 200)
- 23456 + 300 (base + 300)

Note that the number of instances is the same as the number of cores you have assigned for the vManage, up to a maximum of 8.

Configure Data Plane Security Parameters

In the data plane, IPsec is enabled by default on all routers, and by default IPsec tunnel connections use a modified version of the Encapsulating Security Payload (ESP) protocol for authentication on IPsec tunnels. On the routers, you can change the type of authentication, the IPsec rekeying timer, and the size of the IPsec anti-replay window.

Configure Allowed Authentication Types

By default, IPsec tunnel connections use a modified version of the Encapsulating Security Payload (ESP) protocol for authentication. To modify the negotiated authentication types or to disable authentication, use the following command:

```
Device(config)# security ipsec authentication-type (ah-sha1-hmac | ah-no-id | sha1-hmac |
| none)
```

By default, IPsec tunnel connections use AES-GCM-256, which provides both encryption and authentication.

Configure each authentication type with a separate **security ipsec authentication-type** command. The command options map to the following authentication types, which are listed in order from most strong to least strong:

Note The `sha1` in the configuration options is used for historical reasons. The authentication options indicate over how much of the packet integrity checking is done. They do not specify the algorithm that checks the integrity. Except for the encryption of multicast traffic, the authentication algorithms supported by Cisco SD-WAN do not use SHA1.

- **ah-sha1-hmac** enables encryption and encapsulation using ESP. However, in addition to the integrity checks on the ESP header and payload, the checks also include the outer IP and UDP headers. Hence, this option supports an integrity check of the packet similar to the Authentication Header (AH) protocol. All integrity and encryption is performed using AES-256-GCM.
- **ah-no-id** enables a mode that is similar to **ah-sha1-hmac**, however the ID field of the outer IP header is ignored. This option accommodates some non-Cisco SD-WAN devices, including the Apple AirPort Express NAT, that have a bug that causes the ID field in the IP header, a non-mutable field, to be modified. Configure the **ah-no-id** option in the list of authentication types to have the Cisco SD-WAN AH software ignore the ID field in the IP header so that the Cisco SD-WAN software can work in conjunction with these devices.
- **sha1-hmac** enables ESP encryption and integrity checking.
- **none** maps to no authentication. This option should only be used if it is required for temporary debugging. You can also choose this option in situations where data plane authentication and integrity are not a concern. Cisco does not recommend using this option for production networks.

For information about which data packet fields are affected by these authentication types, see Data Plane Integrity.

Cisco IOS XE SD-WAN devices and Cisco vEdge devices advertise their configured authentication types in their TLOC properties. The two routers on either side of an IPsec tunnel connection negotiate the authentication to use on the connection between them, using the strongest authentication type that is configured on both of the routers. For example, if one router advertises the `ah-sha1-hmac` and `ah-no-id` types, and a second router advertises the `ah-no-id` type, the two routers negotiate to use `ah-no-id` on the IPsec tunnel connection between them. If no common authentication types are configured on the two peers, no IPsec tunnel is established between them.

The encryption algorithm on IPsec tunnel connections depends on the type of traffic:

- For unicast traffic, the encryption algorithm is AES-256-GCM.
- For multicast traffic, the encryption algorithm is AES-256-CBC with SHA1-HMAC.

When the IPsec authentication type is changed, the AES key for the data path is changed.

Change the Rekeying Timer

Before Cisco IOS XE SD-WAN devices and Cisco vEdge devices can exchange data traffic, they set up a secure authenticated communications channel between them. The routers use IPSec tunnels between them as the channel, and the AES-256 cipher to perform encryption. Each router generates a new AES key for its data path periodically.

By default, a key is valid for 86400 seconds (24 hours), and the timer range is 10 seconds through 1209600 seconds (14 days). To change the rekey timer value:

```
Device(config)# security ipsec
rekey seconds
```

The configuration looks like this:

```
security
    ipsec
      rekey seconds
    !
```

If you want to generate new IPsec keys immediately, you can do so without modifying the configuration of the router. To do this, issue the **request security ipsec-rekey** command on the compromised router.

For example, the following output shows that the local SA has a Security Parameter Index (SPI) of 256:

```
Device# show ipsec local-sa

                                          SOURCE           SOURCE
TLOC ADDRESS     TLOC COLOR       SPI     IP               PORT    KEY HASH
------------------------------------------------------------------------------
172.16.255.15    lte              256     10.1.15.15       12346   *****b93a
```

A unique key is associated with each SPI. If this key is compromised, use the **request security ipsec-rekey** command to generate a new key immediately. This command increments the SPI. In our example, the SPI changes to 257 and the key associated with it is now used:

```
Device# request security ipsec-rekey
Device# show ipsec local-sa
                                          SOURCE           SOURCE
TLOC ADDRESS     TLOC COLOR       SPI     IP               PORT    KEY HASH
------------------------------------------------------------------------------
172.16.255.15    lte              257     10.1.15.15       12346   *****b93a
```

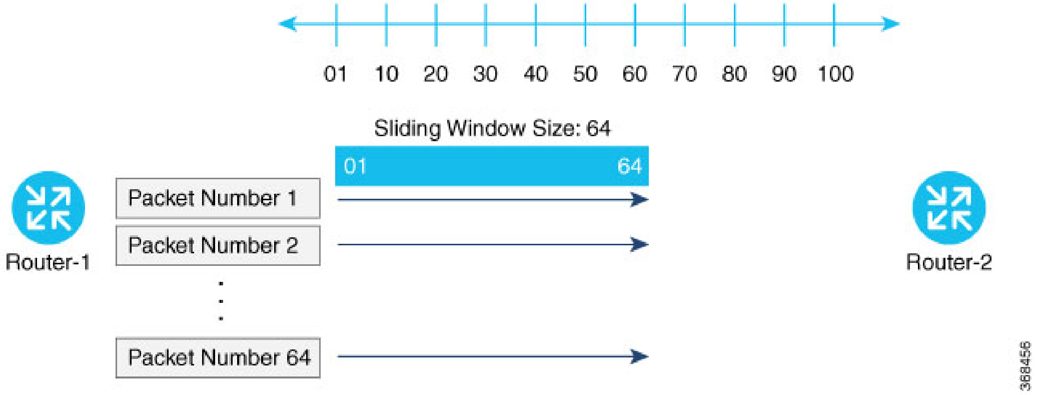
After the new key is generated, the router sends it immediately to the vSmart(s) using DTLS or TLS. The vSmart(s) send the key to the peer routers. The routers begin using it as soon as they receive it. Note that the key associated with the old SPI (256) will continue to be used for a short period of time, until it times out.

To stop using the old key immediately, issue the **request security ipsec-rekey** command twice, in quick succession. This sequence of commands removes both SPI 256 and 257 and sets the SPI to 258. The router then uses the associated key of SPI 258. Note, however, that some packets will be dropped for a short period of time, until all the remote routers learn the new key.

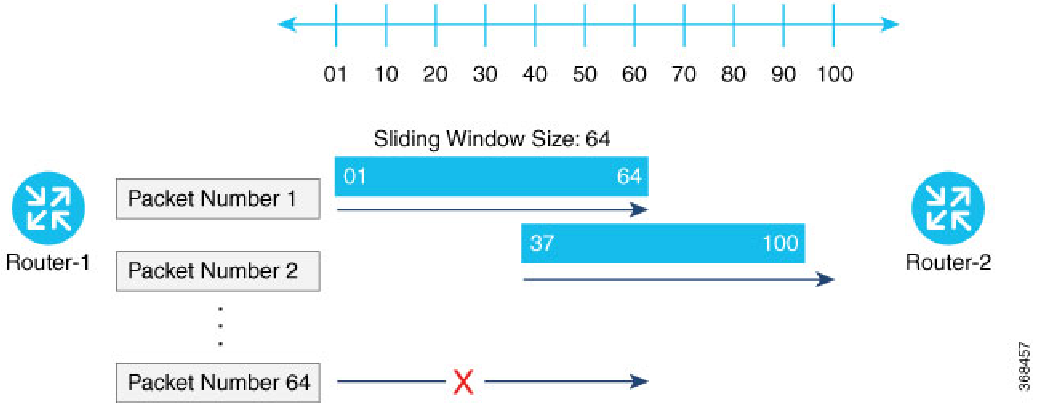
```
Device# request security ipsec-rekey
Device# request security ipsec-rekey
Device# ipsec local-sa
                                          SOURCE           SOURCE
TLOC ADDRESS     TLOC COLOR       SPI     IP               PORT    KEY HASH
------------------------------------------------------------------------------
172.16.255.15    lte              258     10.1.15.15       12346   *****b93a
```

Change the Size of the Anti-Replay Window

IPsec authentication provides anti-replay protection by assigning a unique sequence number to each packet in a data stream. This sequence numbering protects against an attacker duplicating data packets. With anti-replay protection, the sender assigns monotonically increasing sequence numbers, and the destination checks these sequence numbers to detect duplicates. Because packets often do not arrive in order, the destination maintains a sliding window of sequence numbers that it will accept.



Packets with sequence numbers that fall to the left of the sliding window range are considered old or duplicates, and the destination drops them. The destination tracks the highest sequence number it has received, and adjusts the sliding window when it receives a packet with a higher value.



By default, the sliding window is set to 512 packets. It can be set to any value between 64 and 4096 that is a power of 2 (that is, 64, 128, 256, 512, 1024, 2048, or 4096). To modify the anti-replay window size, use the **replay-window** command, specifying the size of the window:

```
Device(config)# security ipsec replay-window
number
```

The configuration looks like this:

```
security
   ipsec
     replay-window number
   !
!
```

To help with QoS, separate replay windows are maintained for each of the first eight traffic channels. The configured replay window size is divided by eight for each channel.

If QoS is configured on a router, that router might experience a larger than expected number of packet drops as a result of the IPsec anti-replay mechanism, and many of the packets that are dropped are legitimate ones. This occurs because QoS reorders packets, giving higher-priority packets preferential treatment and delaying lower-priority packets. To minimize or prevent this situation, you can do the following:

- Increase the size of the anti-replay window.
- Engineer traffic onto the first eight traffic channels to ensure that traffic within a channel is not reordered.

Configure IKE-Enabled IPsec Tunnels

To securely transfer traffic from the overlay network to a service network, you can configure IPsec tunnels that run the Internet Key Exchange (IKE) protocol. IKE-enabled IPsec tunnels provide authentication and encryption to ensure secure packet transport.

You create an IKE-enabled IPsec tunnel by configuring an IPsec interface. IPsec interfaces are logical interfaces, and you configure them just like any other physical interface. You configure IKE protocol parameters on the IPsec interface, and you can configure other interface properties.

Note Cisco recommends using IKE Version 2.

Note From Cisco SD-WAN 19.2.x release onwards, the pre-shared key needs to be at least 16 bytes in length. The IPsec tunnel establishment fails if the key size is less than 16 characters when the router is upgraded to version 19.2.

The Cisco SD-WAN software supports IKE, Version 1, as defined in RFC 2409, *Internet Key Exchange*, and IKE, Version 2, as defined in RFC 7296, *Internet Key Exchange Protocol, Version 2*.

One use for IPsec tunnels is to allow vEdge Cloud router VM instances running on Amazon AWS to connect to the Amazon virtual private cloud (VPC). You must configure IKE Version 1 on these routers.

Note Cisco vEdge devices support only route-based VPNs in an IPSec configuration because these devices cannot define traffic selectors in the encryption domain.

Configure an IPsec Tunnel

To configure an IPsec tunnel interface for secure transport traffic from a service network, you create a logical IPsec interface:

```
vEdge(config)# vpn vpn-id interface ipsec number
vEdge(config-interface-ipsec)# ip address ipv4-prefix/length
vEdge(config-interface-ipsec)# tunnel-source ip-address | tunnel-source-interface
interface-name)
```

```
vEdge(config-interface-ipsec)# tunnel-destination ipv4-address
vEdge(config-interface-ipsec)# no shutdown
```

You can create the IPsec tunnel in the transport VPN (VPN 0) and in any service VPN (VPN 1 through 65530, except for 512).

The IPsec interface has a name in the format **ipsec** number, where *number* can be from 1 through 255.

Each IPsec interface must have an IPv4 address. This address must be a /30 prefix. All traffic in the VPN that is within this IPv4 prefix is directed to a physical interface in VPN 0 to be sent securely over an IPsec tunnel.

To configure the source of the IPsec tunnel on the local device, you can specify either the IP address of the physical interface (in the **tunnel-source** command) or the name of the physical interface (in the **tunnel-source-interface** command). Ensure that the physical interface is configured in VPN 0.

To configure the destination of the IPsec tunnel, specify the IP address of the remote device in the **tunnel-destination** command.

The combination of a source address (or source interface name) and a destination address defines a single IPsec tunnel. Only one IPsec tunnel can exist that uses a specific source address (or interface name) and destination address pair.

Configure an IPsec Static Route

To direct traffic from the service VPN to an IPsec tunnel in the transport VPN (VPN 0), you configure an IPsec-specific static route in a service VPN (a VPN other than VPN 0 or VPN 512) :

```
vEdge(config)# vpn vpn-id
vEdge(config-vpn)# ip ipsec-route prefix/length vpn 0 interface
ipsec number [ipsec number2]
```

The VPN ID is that of any service VPN (VPN 1 through 65530, except for 512).

prefix/length is the IP address or prefix, in decimal four-part-dotted notation, and prefix length of the IPsec-specific static route.

The interface is the IPsec tunnel interface in VPN 0. You can configure one or two IPsec tunnel interfaces. If you configure two, the first is the primary IPsec tunnel, and the second is the backup. With two interfaces, all packets are sent only to the primary tunnel. If that tunnel fails, all packets are then sent to the secondary tunnel. If the primary tunnel comes back up, all traffic is moved back to the primary IPsec tunnel.

Enable IKE Version 1

When you create an IPsec tunnel on a vEdge router, IKE Version 1 is enabled by default on the tunnel interface. The following properties are also enabled by default for IKEv1:

- Authentication and encryption—AES-256 advanced encryption standard CBC encryption with the HMAC-SHA1 keyed-hash message authentication code algorithm for integrity
- Diffie-Hellman group number—16
- Rekeying time interval—4 hours
- SA establishment mode—Main

By default, IKEv1 uses IKE main mode to establish IKE SAs. In this mode, six negotiation packets are exchanged to establish the SA. To exchange only three negotiation packets, enable aggressive mode:

Note IKE aggressive mode with pre-shared keys should be avoided wherever possible. Otherwise a strong pre-shared key should be chosen.

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)# mode aggressive
```

By default, IKEv1 uses Diffie-Hellman group 16 in the IKE key exchange. This group uses the 4096-bit more modular exponential (MODP) group during IKE key exchange. You can change the group number to 2 (for 1024-bit MODP), 14 (2048-bit MODP), or 15 (3072-bit MODP):

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)# group number
```

By default, IKE key exchange uses AES-256 advanced encryption standard CBC encryption with the HMAC-SHA1 keyed-hash message authentication code algorithm for integrity. You can change the authentication:

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)# cipher-suite suite
```

The authentication *suite* can be one of the following:

- **aes128-cbc-sha1**—AES-128 advanced encryption standard CBC encryption with the HMAC-SHA1 keyed-hash message authentication code algorithm for integrity
- **aes128-cbc-sha2**—AES-128 advanced encryption standard CBC encryption with the HMAC-SHA256 keyed-hash message authentication code algorithm for integrity
- **aes256-cbc-sha1**—AES-256 advanced encryption standard CBC encryption with the HMAC-SHA1 keyed-hash message authentication code algorithm for integrity; this is the default.
- **aes256-cbc-sha2**—AES-256 advanced encryption standard CBC encryption with the HMAC-SHA256 keyed-hash message authentication code algorithm for integrity

By default, IKE keys are refreshed every 1 hours (3600 seconds). You can change the rekeying interval to a value from 30 seconds through 14 days (1209600 seconds). It is recommended that the rekeying interval be at least 1 hour.

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)# rekey seconds
```

To force the generation of new keys for an IKE session, issue the **request ipsec ike-rekey** command.

```
vEdge(config)# vpn vpn-id interfaceipsec number ike
```

For IKE, you can also configure preshared key (PSK) authentication:

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)# authentication-type pre-shared-key pre-shared-secret password
```

password is the password to use with the preshared key. It can be an ASCII or a hexadecimal string from 1 through 127 characters long.

If the remote IKE peer requires a local or remote ID, you can configure this identifier:

```
vEdge(config)# vpn vpn-id interface ipsec number ike authentication-type
vEdge(config-authentication-type)# local-id id
vEdge(config-authentication-type)# remote-id id
```

The identifier can be an IP address or any text string from 1 through 63 characters long. By default, the local ID is the tunnel's source IP address and the remote ID is the tunnel's destination IP address.

Enable IKE Version 2

When you configure an IPsec tunnel to use IKE Version 2, the following properties are also enabled by default for IKEv2:

- Authentication and encryption—AES-256 advanced encryption standard CBC encryption with the HMAC-SHA1 keyed-hash message authentication code algorithm for integrity
- Diffie-Hellman group number—16
- Rekeying time interval—4 hours

By default, IKEv2 uses Diffie-Hellman group 16 in the IKE key exchange. This group uses the 4096-bit more modular exponential (MODP) group during IKE key exchange. You can change the group number to 2 (for 1024-bit MODP), 14 (2048-bit MODP), or 15 (3072-bit MODP):

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)# group number
```

By default, IKE key exchange uses AES-256 advanced encryption standard CBC encryption with the HMAC-SHA1 keyed-hash message authentication code algorithm for integrity. You can change the authentication:

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)# cipher-suite suite
```

The authentication *suite* can be one of the following:

- **aes128-cbc-sha1**—AES-128 advanced encryption standard CBC encryption with the HMAC-SHA1 keyed-hash message authentication code algorithm for integrity
- **aes128-cbc-sha2**—AES-128 advanced encryption standard CBC encryption with the HMAC-SHA256 keyed-hash message authentication code algorithm for integrity
- **aes256-cbc-sha1**—AES-256 advanced encryption standard CBC encryption with the HMAC-SHA1 keyed-hash message authentication code algorithm for integrity; this is the default.
- **aes256-cbc-sha2**—AES-256 advanced encryption standard CBC encryption with the HMAC-SHA256 keyed-hash message authentication code algorithm for integrity

By default, IKE keys are refreshed every 4 hours (14,400 seconds). You can change the rekeying interval to a value from 30 seconds through 14 days (1209600 seconds):

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)#  rekey seconds
```

To force the generation of new keys for an IKE session, issue the **request ipsec ike-rekey** command.

For IKE, you can also configure preshared key (PSK) authentication:

```
vEdge(config)# vpn vpn-id interface ipsec number ike
vEdge(config-ike)# authentication-type pre-shared-key pre-shared-secret password
```

password is the password to use with the preshared key. It can be an ASCII or a hexadecimal string, or it can be an AES-encrypted key.

If the remote IKE peer requires a local or remote ID, you can configure this identifier:

```
vEdge(config)# vpn vpn-id interface ipsec number ike authentication-type
vEdge(config-authentication-type)# local-id id
vEdge(config-authentication-type)# remote-id id
```

The identifier can be an IP address or any text string from 1 through 64 characters long. By default, the local ID is the tunnel's source IP address and the remote ID is the tunnel's destination IP address.

Configure IPsec Tunnel Parameters

By default, the following parameters are used on the IPsec tunnel that carries IKE traffic:

- Authentication and encryption—AES-256 algorithm in GCM (Galois/counter mode)
- Rekeying interval—4 hours
- Replay window—32 packets

You can change the encryption on the IPsec tunnel to the AES-256 cipher in CBC (cipher block chaining mode, with HMAC-SHA1-96 keyed-hash message authentication or to null, to not encrypt the IPsec tunnel used for IKE key exchange traffic:

```
vEdge(config-interface-ipsecnumber)# ipsec
vEdge(config-ipsec)# cipher-suite (aes256-cbc-sha1 | aes256-gcm | null-sha1)
```

By default, IKE keys are refreshed every 4 hours (14,400 seconds). You can change the rekeying interval to a value from 30 seconds through 14 days (1209600 seconds):

```
vEdge(config-interface-ipsecnumber)# ipsec
vEdge(config-ipsec)#  rekey seconds
```

To force the generation of new keys for an IPsec tunnel, issue the **request ipsec ipsec-rekey** command.

By default, perfect forward secrecy (PFS) is enabled on IPsec tunnels, to ensure that past sessions are not affected if future keys are compromised. PFS forces a new Diffie-Hellman key exchange, by default using the 4096-bit Diffie-Hellman prime module group. You can change the PFS setting:

```
vEdge(config-interface-ipsecnumber)# ipsec
vEdge(config-ipsec)# perfect-forward-secrecy pfs-setting
```

pfs-setting can be one of the following:

- **group-2**—Use the 1024-bit Diffie-Hellman prime modulus group.
- **group-14**—Use the 2048-bit Diffie-Hellman prime modulus group.
- **group-15**—Use the 3072-bit Diffie-Hellman prime modulus group.
- **group-16**—Use the 4096-bit Diffie-Hellman prime modulus group. This is the default.
- **none**—Disable PFS.

By default, the IPsec replay window on the IPsec tunnel is 512 bytes. You can set the replay window size to 64, 128, 256, 512, 1024, 2048, or 4096 packets:

```
vEdge(config-interface-ipsecnumber)# ipsec
vEdge(config-ipsec)# replay-window number
```

Modify IKE Dead-Peer Detection

IKE uses a dead-peer detection mechanism to determine whether the connection to an IKE peer is functional and reachable. To implement this mechanism, IKE sends a Hello packet to its peer, and the peer sends an acknowledgment in response. By default, IKE sends Hello packets every 10 seconds, and after three unacknowledged packets, IKE declares the neighbor to be dead and tears down the tunnel to the peer. Thereafter, IKE periodically sends a Hello packet to the peer, and re-establishes the tunnel when the peer comes back online.

You can change the liveness detection interval to a value from 0 through 65535, and you can change the number of retries to a value from 0 through 255.

Note For transport VPNs, the liveness detection interval is converted to seconds by using the following formula:

Interval for retransmission attempt number N = *interval* * 1.8^{N-1}

For example, if the interval is set to 10 and retries to 5, the detection interval increases as follows:

- Attempt 1: 10 * 1.8$^{1-1}$= 10 seconds
- Attempt 2: 10 * 1.8$^{2-1}$= 18 seconds
- Attempt 3: 10 * 1.8$^{3-1}$= 32.4 seconds
- Attempt 4: 10 * 1.8$^{4-1}$= 58.32 seconds
- Attempt 5: 10 * 1.8$^{5-1}$= 104.976 seconds

```
vEdge(config-interface-ipsecnumber)# dead-peer-detection interval retries number
```

Configure Other Interface Properties

For IPsec tunnel interfaces, you can configure only the following additional interface properties:

```
vEdge(config-interface-ipsec)# mtu bytes
vEdge(config-interface-ipsec)# tcp-mss-adjust bytes
```