

Configure Security Parameters

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Configure Security Parameters

This section describes how to change security parameters for the control plane and the data plane in the Cisco Catalyst 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 Cisco SD-WAN Controller to be a server, firewalls protect TCP servers better than UDP servers.

You configure the control plane tunnel protocol on a Cisco SD-WAN Controller:

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

With this change, all control plane tunnels between the Cisco SD-WAN Controller and the routers and between the Cisco SD-WAN Controller and Cisco SD-WAN Manager use TLS. Control plane tunnels to Cisco Catalyst SD-WAN Validator always use DTLS, because these connections must be handled by UDP.

In a domain with multiple Cisco SD-WAN Controllers, when you configure TLS on one of the Cisco SD-WAN 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 Cisco SD-WAN Controllers, if you have not configured TLS on them, they use TLS on the control plane tunnel only to that

one Cisco SD-WAN Controller, and they use DTLS tunnels to all the other Cisco SD-WAN Controllers and to all their connected routers. To have all Cisco SD-WAN Controllers use TLS, configure it on all of them.

By default, the Cisco SD-WAN 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 Cisco SD-WAN 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 in Cisco SD-WAN Manager

If you configure the Cisco SD-WAN Manager 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 Cisco SD-WAN Manager. 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 Cisco SD-WAN Manager 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 Cisco SD-WAN Manager, up to a maximum of 8.

Configure Security Parameters Using the Security Feature Template

Table 1: Feature History

Feature Name	Release Information	Description
Rekey Time increase to match OMP graceful-restart timer increase	Cisco IOS XE Catalyst SD-WAN Release 17.18.1a Cisco Catalyst SD-WAN Manager Release 20.18.1	This feature enables an increased IPsec Rekey timer support to 63113904 seconds (730 days) to match the change for the OMP graceful restart Timer increase to 604800 seconds (365 days).

Use the Cisco Security feature template for all Cisco IOS XE Catalyst SD-WAN devices. On the edge routers and on Cisco SD-WAN Validator, use this template to configure IPsec for data plane security. On Cisco SD-WAN Manager and Cisco SD-WAN Controller, use the Security feature template to configure DTLS or TLS for control plane security.

Configure Security Parameters

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**.
2. Click **Feature Templates** and then click **Add Template**.

Note In Cisco vManage Release 20.7.1 and earlier releases, **Feature Templates** is called **Feature**.

3. From the Devices list in the left pane, choose a device.

   The templates applicable to the selected device appear in the right pane.
4. Click **Cisco Security** to open the template.
5. In the **Template Name** field, enter a name for the template. The name can be up to 128 characters and can contain only alphanumeric characters.
6. In the **Template Description** field, enter a description of the template. The description can be up to 2048 characters and can contain only alphanumeric characters.

When you first open a feature template, for each parameter that has a default value, the scope is set to Default (indicated by a check mark), and the default setting or value is shown. To change the default or to enter a value, click the scope drop-down menu to the left of the parameter field and choose one of the following:

Table 2:

Parameter Scope	Scope Description
Device Specific (indicated by a host icon)	Use a device-specific value for the parameter. For device-specific parameters, you cannot enter a value in the feature template. You enter the value when you attach a Viptela device to a device template . When you click Device Specific, the Enter Key box opens. This box displays a key, which is a unique string that identifies the parameter in a CSV file that you create. This file is an Excel spreadsheet that contains one column for each key. The header row contains the key names (one key per column), and each row after that corresponds to a device and defines the values of the keys for that device. You upload the CSV file when you attach a Viptela device to a device template. For more information, see Create a Template Variables Spreadsheet . To change the default key, type a new string and move the cursor out of the Enter Key box. Examples of device-specific parameters are system IP address, hostname, GPS location, and site ID.
Global (indicated by a globe icon)	Enter a value for the parameter, and apply that value to all devices. Examples of parameters that you might apply globally to a group of devices are DNS server, syslog server, and interface MTUs.

Configure Control Plane Security

Note The Configure Control Plane Security section is applicable to Cisco SD-WAN Manager and Cisco SD-WAN Controller only.

To configure the control plane connection protocol on a Cisco SD-WAN Manager instance or a Cisco SD-WAN Controller, choose the **Basic Configuration** area and configure the following parameters:

Table 3:

Parameter Name	Description
Protocol	Choose the protocol to use on control plane connections to a Cisco SD-WAN Controller: • DTLS (Datagram Transport Layer Security). This is the default. • TLS (Transport Layer Security)
Control TLS Port	If you selected TLS, configure the port number to use:*Range:* 1025 through 65535 *Default:* 23456

Click **Save**

Configure Data Plane Security

Configure various data plane security parameters under the relevant areas of the template:

Table 4: Basic Configuration

Parameter Name	Description
Rekey Time	Specify how often a device changes the AES key used on its secure DTLS connection to the Cisco SD-WAN Controller. If OMP graceful restart is enabled, the rekeying time must be at least twice the value of the OMP graceful restart timer.*Range:* 10 through 63113904 seconds (730 days) *Default:* 86400 seconds (24 hours)
Replay Window	Specify the size of the sliding replay window. *Values:* 64, 128, 256, 512, 1024, 2048, 4096, 8192 packets. *Default:* 512 packets
Extended Anti Replay	This is turned off by default. Click **On** to turn it on.
IPsec pairwise-keying	This is turned off by default. Click **On** to turn it on.

Table 5: Authentication Type

Parameter Name	Description
Authentication Type	Select the authentication types from the **Authentication List**, and click the arrow pointing right to move the authentication types to the **Selected List** column. Authentication types supported from Cisco IOS XE Catalyst SD-WAN Release 17.6.1a: • **esp**: Enables Encapsulating Security Payload (ESP) encryption and integrity checking on the ESP header. • **ip-udp-esp:** Enables ESP encryption. In addition to the integrity checks on the ESP header and payload, the checks also include the outer IP and UDP headers. • **ip-udp-esp-no-id**: Ignores the ID field in the IP header so that Cisco Catalyst SD-WAN can work in conjunction with the non-Cisco devices. • **none**: Turns integrity checking off on IPSec packets. We don't recommend using this option. Authentication types supported in Cisco IOS XE Catalyst SD-WAN Release 17.5.1a and earlier: • **ah-no-id**: Enable an enhanced version of AH-SHA1 HMAC and ESP HMAC-SHA1 that ignores the ID field in the packet's outer IP header. • **ah-sha1-hmac**: Enable AH-SHA1 HMAC and ESP HMAC-SHA1. • **none**: Select no authentication. • **sha1-hmac**: Enable ESP HMAC-SHA1. **Note** For an edge device running on Cisco IOS XE Catalyst SD-WAN Release 17.5.1a or earlier, you may have configured authentication types using a **Cisco Security** template. When you upgrade the device to Cisco IOS XE Catalyst SD-WAN Release 17.6.1a or later, update the selected authentication types in the **Cisco Security** template to the authentication types supported from Cisco IOS XE Catalyst SD-WAN Release 17.6.1a . To update the authentication types, do the following: **1.** From the Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**. **2.** Click **Feature Templates**. **3.** Find the **Cisco Security** template to update and click … and click **Edit**. **4.** Click **Update**. Do not modify any configuration. Cisco SD-WAN Manager updates the **Cisco Security** template to display the supported authentication types.

Key Chain and Key ID

To add a new key chain, click **New Key Chain** and specify the following:

Table 6: Key Chain

Parameter Name	Description
Keychain Name	Enter a name for the key chain
Key ID	Specify a key ID

Click **Save**.

Configure Data Plane Security Parameters

In the data plane, IPsec is enabled by default on all routers, and by default IPsec tunnel connections use an enhanced 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

Authentication Types in Cisco IOS XE Catalyst SD-WAN Release 17.6.1a and Later

From Cisco IOS XE Catalyst SD-WAN Release 17.6.1a Cisco SD-WAN Release 20.6.1, the following integrity types are supported:

- **esp:** This option enables Encapsulating Security Payload (ESP) encryption and integrity checking on the ESP header.
- **ip-udp-esp:** This option enables ESP encryption. In addition to the integrity checks on the ESP header and the payload, the checks also include the outer IP and UDP headers.
- **ip-udp-esp-no-id:** This option is is similar to ip-udp-esp, however, the ID field of the outer IP header is ignored. Configure this option in the list of integrity types to have the Cisco Catalyst SD-WAN software ignore the ID field in the IP header so that the Cisco Catalyst SD-WAN can work in conjunction with non-Cisco devices.
- **none:** This option turns integrity checking off on IPSec packets. We don't recommend using this option.

By default, IPsec tunnel connections use an enhanced version of the Encapsulating Security Payload (ESP) protocol for authentication. To modify the negotiated interity types, use the following command:

When you change the authentication-type from CLI, the configuration change works well but the new authentication-change doesn't show in the running configuration. We recommend you to change the authentication type to integrity type from Cisco SD-WAN Manager during the template push.

security ipsec integrity-type { **none** | **ip-udp-esp** | **ip-udp-esp-no-id** | **esp** }

When you modify the **security ipsec integrity-type** configuration, it temporarily brings down and then re-establishes all IPSec tunnels with the new integrity type. This tunnel recreation process can be lengthy on low-end platforms, particularly those with multiple features enabled and operating at full scale. This may also lead to some BFD sessions becoming stuck in a down state.

Therefore, we strongly recommend performing integrity-type configuration changes only during a scheduled maintenance window. If BFD sessions remain in a down state after such a change, execute the **clear sdwan omp all** command to trigger a reset and facilitate recovery.

Authentication Types Before Cisco IOS XE Catalyst SD-WAN Release 17.6.1a

By default, IPsec tunnel connections use an enhanced version of the Encapsulating Security Payload (ESP) protocol for authentication. To modify the negotiated authentication types, use the following command:

```
Device(config)# security ipsec authentication-type (ah-sha1-hmac | ah-no-id | sha1-hmac |
)
```

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. The authentication algorithms supported by Cisco Catalyst 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 Catalyst 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 Catalyst SD-WAN AH software ignore the ID field in the IP header so that the Cisco Catalyst SD-WAN software can work in conjunction with these devices.
- **sha1-hmac** enables ESP encryption and integrity checking.

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

Cisco IOS XE Catalyst 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.

For the unicast traffic, the encryption algorithm on IPSec tunnel connections is AES-256-GCM. From Cisco IOS XE SD-WAN Release 17.2.1r, the multicast traffic also supports AES-256-GCM encryption algorithm. You cannot modify the encryption algorithm choice made by the software.

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

Change the Rekeying Timer

Before Cisco IOS XE Catalyst 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 platform software sdwan 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 sdwan 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 platform software sdwan 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 platform software sdwan security ipsec-rekey
Device# show sdwan 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 Cisco SD-WAN Controllers using DTLS or TLS. The Cisco SD-WAN Controllers 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.

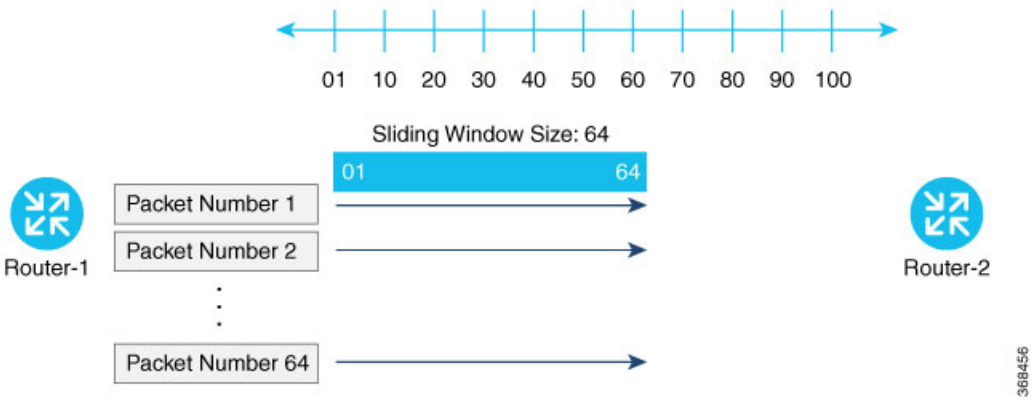
To stop using the old key immediately, issue the **request platform software sdwan security ipsec-rekey** command twice, in quick succession. This sequence of commands removes both SPI 256 and 257 and sets the SPI to 258. The router then uses the associated key of SPI 258. Note, however, that some packets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

```
Device# request platform software sdwan security ipsec-rekey
Device# request platform software sdwan security ipsec-rekey
Device# show sdwan ipsec local-sa
                                          SOURCE           SOURCE
```

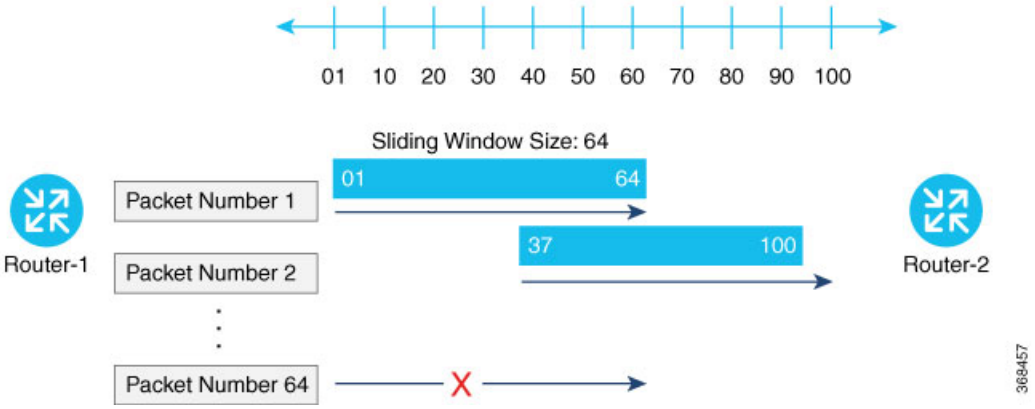
```
TLOC ADDRESS      TLOC COLOR        SPI      IP               PORT     KEY HASH
-------------------------------------------------------------------------------
172.16.255.15     lte               258      10.1.15.15       12346    *****b93a
```

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.

Anti-Replay Recovery Support

Feature Name	Release Information	Description
Anti-Replay Recovery Support	Cisco IOS XE Catalyst SD-WAN Release 17.18.1a Cisco Catalyst SD-WAN Manager Release 20.18.1	This feature enables recovery support when there is anti-replay packet drops in the data plane with IPsec due to packets delivered out of order outside of the anti-replay window.

The Auto Anti-Replay Recovery feature in Cisco's IPsec implementation is designed to handle packet drops that occur due to the anti-replay mechanism when Quality of Service (QoS) is configured. This feature helps in avoiding unnecessary packet drops by automatically recovering from situations where packets are dropped due to sequence number mismatches caused by QoS reordering or other network conditions. The recovery is typically quick, and normal traffic flow resumes shortly after the drops occur .

The anti-replay mechanism is a security feature that prevents attackers from capturing and replaying packets to disrupt communications. It works by assigning a sequence number to each packet, and the receiving device checks these numbers to ensure packets are received in order and are not duplicated.

At times, the 64-packet window size is not sufficient. For example, Cisco quality of service (QoS) gives priority to high-priority packets, which causes some low-priority packets to be discarded when they arrive outside of the 64 packet replay window at the decryptor. The IPsec Anti-Replay Recovery feature allows you to expand the window size, allowing the decryptor to keep track of more than 64 packets.

Increasing the anti-replay window size has no impact on throughput and security. The impact on memory is insignificant because only an extra 128 bytes per incoming IPsec SA is needed to store the sequence number on the decryptor. It is recommended that you use the full 1024 window size to eliminate any future anti-replay problems. The feature is disabled by default. The feature is enabled when the replay window size is set to 8192. Any other replay window size will disable this feature.

After changing the replay window size configuration, it is necessary to execute the command **clear sdwan omp all** to ensure that a new tunnel is created with the updated window size.

Note Auto anti-replay recovery feature is not supported on Cisco ASR 1001-HX and ASR 1002-HX platforms as they use octeon processors which offer dedicated hardware acceleration for IPsec. The IPSec datapath automatically detects IPSec packets dropped due to out-of-sequence errors within a tunnel based on the following criteria:

Class 0 (Control Packets): Triggers after 64 consecutive lost packets. This threshold remains fixed at 64, regardless of the configured Anti-Replay (AR) window size.

Class 1 and Class 2 (Data Packets): Triggers after losing twice the configured AR window size in consecutive packets.

The following example shows the effective AR window of 64:

- Class 0 (Control): 64 consecutive lost packets.
- Class 1 and Class 2 (Data): 128 consecutive lost packets (2 x 64).

Enable Auto Anti-Replay Recovery

Auto anti-replay recovery is enabled only when the replay window size is set to 8192. Any other window size disables the feature. This feature can be enabled explicitly using the CLI command:

```
Device# config-t
Device(config)# platform ipsec auto-ar-recovery
Device(config)# commit
Device(config)#
```

```
Device# config-t
Device(config)# no platform ipsec auto-ar-recovery
Device(config)# commit
Device(config)#
```

Configuration Example for Auto Anti-Replay Recovery

The following example shows that the anti-replay recovery configuration:

```
Device# show platform hardware qfp active feature ipsec datapath crypto-sa 1556
Crypto Context Handle: d469560
 Flow id: 1037
 debug condition flow id: 0
 debug anti-replay: off
 debug hmac-drop: off
 peer sa handle: 0
 anti-replay enabled
 extended anti-replay disabled
 esn enabled
 H32 seq_num in ESP IV is enabled
 Auth_ah_no_id is FALSE
 Auth_ah is TRUE
 qfp sa ppe: 0
 Inbound SA
 Total SNS: 8
 Space                highest ar number
 ---------------------------------------
   0                             1001032
   1                                   0
   2                             1006659
   3                                   0
```

```
   4                                   0
   5                                   0
   6                                   0
   7                                   0
 Total inbound SA add received: 519, added: 519, deleted: 1
 Total outbound SA add received: 519, added: 519, deleted: 1'
```

Verify Auto Anti-Replay Recovery

```
Device# show logging
*Feb 20 07:54:58.899: %IPSEC-3-OUT_WINDOW_ERROR: F0: cpp_cp_svr: IPSec AR receives out of
window error, DP Handle 1556, SPI 0x102, SNS_IDX 2QFP:0.0 Thread:001 TS:00000000665468936504
*Feb 20 07:54:58.901: %VDAEMON-6-IPSEC_REKEY: R0/0: vdaemon: IPSec SA auto-recover rekey
done for tunnel established via GigabitEthernet1 (color: lte)


Device# show platform hardware qfp active feature ipsec state
QFP IPSEC state:

Message counter:
  Type                  Request          Reply (OK)       Reply (Error)
  ---------------------------------------------------------------------------
...
Out-Window Notf       0                1                0            <<<<<<<<<< how many
rekey notification sent from DP


Device# show sdwan ftm interfaces | in Gi
 IfName            HwIf IfIndex VR  Port  Qtag                    Hash  MTU  MSS Type
 Color AR_rec_rcv Ar_rec_perfm
GigabitEthernet1    2       7   0     0     0    0    0   528 1500 1420  Wan        lte
       1           1
GigabitEthernet2    3       8   0     0     0    0    0   528 1500 1420  Wan public-internet
     0           0
GigabitEthernet5    6      11   0     0     0    0    0   528 1500 1420  Lan    invalid
       0           0
GigabitEthernet3   14       9   3     0     0    0    0   528 1500 1420  Lan    invalid
       0           0
AR_rec_rcv means how many notification received
Ar_rec_perfm means how many rekey performed.
```

This enables the feature regardless of the replay window size configured. The replay window size can be set to values other than 8192 (for example, 512), and the feature remains enabled. This example output shows where the replay window is 512, yet the feature is active.

```
Device# show version
Cisco IOS XE Software, Version 17.18.02
Device# show sdwan security-info
security-info authentication-type deprecated
security-info rekey  86400
security-info replay-window 512
security-info encryption-supported AES_GCM_256
security-info fips-mode Disabled
security-info pairwise-keying Disabled
security-info pwk-sym-rekey Enabled
security-info extended-ar-window Disabled
security-info integrity-type "ip-udp-esp esp"
Device# show run | i  auto-ar-recovery
platform ipsec auto-ar-recovery
```

Configure Fabric Security Using a Configuration Group

Use this feature to configure security parameters for the data plane in the Cisco Catalyst SD-WAN overlay network.

See Configure Fabric Security Using a Configuration Group

The following tables describe the options for configuring the Fabric Security feature.

Before you begin

On the **Configuration** > **Configuration Groups** page, choose **SD-WAN** as the solution type.

Procedure

Step 1 From the Cisco SD-WAN Manager menu, choose **Configuration** > **Configuration Groups**.

Step 2 Create and configure a Fabric Security feature in a System profile.

	Field	Description
a)	**Rekey Time (seconds)**	Specify how often a device changes the AES key. Before Cisco IOS XE Catalyst 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. Range: 10 through 63113904 seconds (730 days) Default: 86400 seconds (24 hours)
	Extended AR Window	Enabling an extended AR window causes a router to add a time stamp to each packet using the IPsec tunnel. This prevents valid packets from being dropped if they arrive out of sequence. This option is turned off by default. Click **On** to enable it. Enabling the feature displays the **Extended Anti-Replay Window** field. Range: 10 ms to 2048 ms Default: 256 ms
	Replay Window	Specify the size of the sliding replay window. Values: 64, 128, 256, 512, 1024, 2048, 4096, 8192 packets. Default: 512 packets
	IPsec pairwise-keying	This option is turned off by default. Click **On** to enable it.
	IKEV2	Select **IKEv2** to use IKEv2 to manage encryption keys for IPsec data-plane tunnels.

Field	Description
Post quantum encryption	Select the post-quantum encryption option to use: • **None**: Select **None** to use IKEv2 without enabling PQC or PPK. • **PQC**: Select **PQC** to use an ML-KEM algorithm during IKEv2 key negotiation. • **PPK**: Select **PPK** to use post-quantum preshared keys retrieved from an external SKIP or quantum-key-distribution key server.
Fallback to non pqc	Enable this field to allow the devices to use a classical algorithm if they cannot negotiate PQC. Disable it to require PQC.
Algorithm	Select the ML-KEM algorithm to use: **ML-KEM-512**, **ML-KEM-768**, or **ML-KEM-1024**.
Service VPN	Enter the service VPN identifier that provides connectivity to the external key server.
IP Address	Enter the IPv4 address of the external SKIP or quantum-key-distribution key server.
TCP Port	Enter the TCP port used to establish the secure SKIP connection to the external key server.
TLS PSK ID	Enter the identifier used for TLS preshared-key authentication between the device and the SKIP server.
TLS PSK Key	Enter the preshared key used to authenticate the device and encrypt the secure connection for retrieving and managing PPKs.

b)

Field	Description
Integrity Type	Choose one of the following integrity types: • **esp**: Enables Encapsulating Security Payload (ESP) encryption and integrity checking on the ESP header. • **ip-udp-esp**: Enables ESP encryption. In addition to the integrity checks on the ESP header and payload, the checks include the outer IP and UDP headers. • **ip-udp-esp-no-id**: Ignores the ID field in the IP header so that Cisco Catalyst SD-WAN can work with the non-Cisco devices. • **none**: Turns integrity checking off on IPSec packets. We don't recommend using this option.

c)

Field	Description
Add Key Chain	
Key ID*	Select a key chain ID.
Key Chain Name*	Select a key chain name.

Field	Description
d) **Add Key ID**	
ID*	Select a key chain ID.
Name*	Select a key chain name.
Include TCP Options	This field indicates whether a TCP option other than TCP Authentication Option (TCP-AO) is used to calculate Message Authentication Codes (MACs). A MAC is computed for a TCP segment using a configured MAC algorithm, relevant traffic keys, and the TCP segment data prefixed with a pseudoheader. When options are included, the content of all options is included in the MAC with TCP-AO's **MAC** field is filled with zeroes. When the options aren't included, all options other than TCP-AO are excluded from all MAC calculations.
Key String	Specify the master key for deriving the traffic keys. The master keys must be identical on both the peers. If the master keys do not match, authentication fails and segments may be rejected by the receiver. Range: 0 through 80 characters.
Receiver ID*	Specify the receive identifier for the key. Range: 0 through 255.
Send ID*	Specify the send identifier for the key. Range: 0 through 255.
TCP	Specify the algorithm to compute MACs for TCP segments. You can choose one of the following: • **aes-128-cmac** • **hmac-sha-1** • **hmac-sha-256**
Accept AO Mismatch	This field indicates whether the receiver must accept the segments for which the MAC in the incoming TCP-AO does not match the MAC that is generated on the receiver.
Accept Lifetime	The following fields appear when you click this field: • **Accept Local**: This option is disabled by default. Click **On** to enable it. • **Accept Start Epoch**: Specify the time in seconds that is entered in Cisco SD-WAN Manager for which the key to be accepted for TCP-AO authentication is valid. Specify the start time in the local time zone. By default, the start time corresponds to UTC time. • **End Time Format**: You can specify the end time in three ways—infinite (no expiry), duration (1 through 2147483646 sec), or exact (either UTC or local).

Field	Description
Send Lifetime	The following fields appear when you click this field: • **Send Local**: This option is disabled by default. Click **On** to enable it. • **Send Start Epoch**: Specify the time in seconds that is entered in Cisco SD-WAN Manager for which the key to be used in TCP-AO authentication is valid. Specify the start time in the local time zone. By default, the start time corresponds to UTC time. • **End Time Format**: You can specify the end time in three ways—infinite (no expiry), duration (1 through 2147483646 sec), or exact time (either UTC or local).

Step 3

What to do next

Also see Deploy a Configuration Group

Configure Security Parameters Using the Security Feature Template

Table 7: Feature History

Feature Name	Release Information	Description
Rekey Time increase to match OMP graceful-restart timer increase	Cisco IOS XE Catalyst SD-WAN Release 17.18.1a Cisco Catalyst SD-WAN Manager Release 20.18.1	This feature enables an increased IPsec Rekey timer support to 63113904 seconds (730 days) to match the change for the OMP graceful restart Timer increase to 604800 seconds (365 days).

Use the Cisco Security feature template for all Cisco IOS XE Catalyst SD-WAN devices. On the edge routers and on Cisco SD-WAN Validator, use this template to configure IPsec for data plane security. On Cisco SD-WAN Manager and Cisco SD-WAN Controller, use the Security feature template to configure DTLS or TLS for control plane security.

Configure Security Parameters

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**.
2. Click **Feature Templates** and then click **Add Template**.

Note In Cisco vManage Release 20.7.1 and earlier releases, **Feature Templates** is called **Feature**.

3. From the Devices list in the left pane, choose a device.

   The templates applicable to the selected device appear in the right pane.
4. Click **Cisco Security** to open the template.
5. In the **Template Name** field, enter a name for the template. The name can be up to 128 characters and can contain only alphanumeric characters.
6. In the **Template Description** field, enter a description of the template. The description can be up to 2048 characters and can contain only alphanumeric characters.

When you first open a feature template, for each parameter that has a default value, the scope is set to Default (indicated by a check mark), and the default setting or value is shown. To change the default or to enter a value, click the scope drop-down menu to the left of the parameter field and choose one of the following:

Table 8:

Parameter Scope	Scope Description
Device Specific (indicated by a host icon)	Use a device-specific value for the parameter. For device-specific parameters, you cannot enter a value in the feature template. You enter the value when you attach a Viptela device to a device template . When you click Device Specific, the Enter Key box opens. This box displays a key, which is a unique string that identifies the parameter in a CSV file that you create. This file is an Excel spreadsheet that contains one column for each key. The header row contains the key names (one key per column), and each row after that corresponds to a device and defines the values of the keys for that device. You upload the CSV file when you attach a Viptela device to a device template. For more information, see Create a Template Variables Spreadsheet . To change the default key, type a new string and move the cursor out of the Enter Key box. Examples of device-specific parameters are system IP address, hostname, GPS location, and site ID.
Global (indicated by a globe icon)	Enter a value for the parameter, and apply that value to all devices. Examples of parameters that you might apply globally to a group of devices are DNS server, syslog server, and interface MTUs.

Configure Control Plane Security

Note The Configure Control Plane Security section is applicable to Cisco SD-WAN Manager and Cisco SD-WAN Controller only.

To configure the control plane connection protocol on a Cisco SD-WAN Manager instance or a Cisco SD-WAN Controller, choose the **Basic Configuration** area and configure the following parameters:

Table 9:

Parameter Name	Description
Protocol	Choose the protocol to use on control plane connections to a Cisco SD-WAN Controller: • DTLS (Datagram Transport Layer Security). This is the default. • TLS (Transport Layer Security)
Control TLS Port	If you selected TLS, configure the port number to use:*Range:* 1025 through 65535 *Default:* 23456

Click **Save**

Configure Data Plane Security

Configure various data plane security parameters under the relevant areas of the template:

Table 10: Basic Configuration

Parameter Name	Description
Rekey Time	Specify how often a device changes the AES key used on its secure DTLS connection to the Cisco SD-WAN Controller. If OMP graceful restart is enabled, the rekeying time must be at least twice the value of the OMP graceful restart timer.*Range:* 10 through 63113904 seconds (730 days) *Default:* 86400 seconds (24 hours)
Replay Window	Specify the size of the sliding replay window. *Values:* 64, 128, 256, 512, 1024, 2048, 4096, 8192 packets. *Default:* 512 packets
Extended Anti Replay	This is turned off by default. Click **On** to turn it on.
IPsec pairwise-keying	This is turned off by default. Click **On** to turn it on.

Table 11: Authentication Type

Parameter Name	Description
Authentication Type	Select the authentication types from the **Authentication List**, and click the arrow pointing right to move the authentication types to the **Selected List** column. Authentication types supported from Cisco IOS XE Catalyst SD-WAN Release 17.6.1a: • **esp**: Enables Encapsulating Security Payload (ESP) encryption and integrity checking on the ESP header. • **ip-udp-esp:** Enables ESP encryption. In addition to the integrity checks on the ESP header and payload, the checks also include the outer IP and UDP headers. • **ip-udp-esp-no-id**: Ignores the ID field in the IP header so that Cisco Catalyst SD-WAN can work in conjunction with the non-Cisco devices. • **none**: Turns integrity checking off on IPSec packets. We don't recommend using this option. Authentication types supported in Cisco IOS XE Catalyst SD-WAN Release 17.5.1a and earlier: • **ah-no-id**: Enable an enhanced version of AH-SHA1 HMAC and ESP HMAC-SHA1 that ignores the ID field in the packet's outer IP header. • **ah-sha1-hmac**: Enable AH-SHA1 HMAC and ESP HMAC-SHA1. • **none**: Select no authentication. • **sha1-hmac**: Enable ESP HMAC-SHA1. **Note** For an edge device running on Cisco IOS XE Catalyst SD-WAN Release 17.5.1a or earlier, you may have configured authentication types using a **Cisco Security** template. When you upgrade the device to Cisco IOS XE Catalyst SD-WAN Release 17.6.1a or later, update the selected authentication types in the **Cisco Security** template to the authentication types supported from Cisco IOS XE Catalyst SD-WAN Release 17.6.1a . To update the authentication types, do the following: **1.** From the Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**. **2.** Click **Feature Templates**. **3.** Find the **Cisco Security** template to update and click … and click **Edit**. **4.** Click **Update**. Do not modify any configuration. Cisco SD-WAN Manager updates the **Cisco Security** template to display the supported authentication types.

Key Chain and Key ID

To add a new key chain, click **New Key Chain** and specify the following:

Table 12: Key Chain

Parameter Name	Description
Keychain Name	Enter a name for the key chain
Key ID	Specify a key ID

Click **Save**.

VPN Interface IPsec

Use the VPN Interface IPsec feature template to configure IPsec tunnels on Cisco IOS XE service VPNs that are being used for Internet Key Exchange (IKE) sessions. You can configure IPsec on tunnels for VPNs in:

Range: 1 to 65525, excluding 512. For details see the VRF range behavior change described here.

Cisco Cisco IOS XE Catalyst SD-WAN devices use VRFs in place of VPNs. However, the following steps still apply to configure Cisco IOS XE Catalyst SD-WAN devices through Cisco SD-WAN Manager. In Cisco SD-WAN Manager, the system automatically maps the VPN configurations to VRF configurations.

In controller mode, only Route based IPSec tunnels are supported.

Create VPN IPsec Interface Template

Procedure

Step 1 From the Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**.

Step 2 Click **Feature Templates**.

Note In Cisco vManage Release 20.7.x and earlier releases, **Feature Templates** is titled **Feature**.

Step 3 Click **Add Template**.

Step 4 Choose a Cisco IOS XE Catalyst SD-WAN device from the list.

Step 5 From the VPN section, click **VPN Interface IPsec**. The Cisco VPN Interface IPsec template displays.

Step 6 In **Template Name**, enter a name for the template. The name can be up to 128 characters and can contain only alphanumeric characters.

Step 7 In **Template Description**, enter a description of the template. The description can be up to 2048 characters and can contain only alphanumeric characters.

Changing the Scope for a Parameter Value

When you first open a feature template, for each parameter that has a default value, the scope is set to Default (a), and the default setting or value is shown. To change the default or to enter a value, click the **scope** drop-down to the left of the parameter field and choose one of the following:

Parameter Name	Description
Device Specific	Use a device-specific value for the parameter. For device-specific parameters, you cannot enter a value in the feature template. You enter the value when you attach a device to a device template. When you click Device Specific, the Enter Key box opens. This box displays a key, which is a unique string that identifies the parameter in a CSV file that you create. This file is an Excel spreadsheet that contains one column for each key. The header row contains the key names (one key per column), and each row after that corresponds to a device and defines the values of the keys for that device. Upload the CSV file when you attach a device to a device template. To change the default key, type a new string and move the cursor out of the Enter Key box. Examples of device-specific parameters are system IP address, hostname, GPS location, and site ID.
Global	Enter a value for the parameter, and apply that value to all devices. Examples of parameters that you might apply globally to a group of devices are DNS server, syslog server, and interface MTUs.

Once you have created and named the template, enter the following values. Parameters marked with an asterisk are required.

Configure IPsec Tunnel Parameters

To configure the IPsec tunnel that carries Internet Key Exchange (IKE) traffic, click IPsec and configure the following parameters:

Note Some configurations and protocols are identified as insecure and is a security risk for Cisco devices. Existing deployments continue to function, but new installations require intentional enablement. For more information on remediation, refer to Resilient Infrastructure: Cisco Catalyst SD-WAN and Routing

Parameter Name	Options	Description
IPsec Rekey Interval	3600 - 1209600 seconds	Specify the interval for refreshing IKE keys. Range: 1 hour through 14 days Default: 3600 seconds

Parameter Name	Options	Description
IKE Replay Window	64, 128, 256, 512, 1024, 2048, 4096, 8192	Specify the replay window size for the IPsec tunnel. Default: 512
IPsec Cipher Suite	aes256-cbc-sha1 aes256-gcm null-sha1	Specify the authentication and encryption to use on the IPsec tunnel Default: aes256-gcm
Perfect Forward Secrecy	**2** 1024-bit modulus **14** 2048-bit modulus **15** 3072-bit modulus **16** 4096-bit modulus **none**	Specify the PFS settings to use on the IPsec tunnel. Choose one of the following Diffie-Hellman prime modulus groups: 1024-bit – group-2 2048-bit – group-14 3072-bit – group-15 4096-bit – group-16 none –disable PFS. *Default*: group-16

Note Starting from Cisco IOS XE Catalyst SD-WAN Release 17.11.1a, as part of the security hardening, the weaker ciphers are deprecated. As part of this change, the option to configure Diffie-Hellman (DH) groups 1, 2, and 5 is no longer supported. DH groups are used in IKE to establish session keys and are also available in IPsec as support for perfect forward secrecy.

To save the feature template, click **Save**.

CLI Equivalent

```
crypto
   ipsec
      profile ipsec_profile_name
         set ikev2-profile ikev2_profile_name
         set security-association
            lifetime {seconds 120-2592000 | kilobytes disable}
            replay {disable | window-size {64 | 128 | 256 | 512 | 1024 | 4096 | 8192}
         set pfs group {2 | 14 | 15 | 16 | none}
         set transform-set transform_set_name
```

Configure Dead-Peer Detection

To configure Internet key exchange (IKE) dead-peer detection (DPD) to determine whether the connection to an IKE peer is functional and reachable, click DPD and configure the following parameters:

Parameter Name	Description
DPD Interval	Specify the interval for IKE to send Hello packets on the connection. Range: 10 through 3600 seconds Default: Disabled
DPD Retries	Specify how many unacknowledged packets to accept before declaring an IKE peer to be dead and then tearing down the tunnel to the peer. Range: 2 through 60 Default: 3

To save the feature template, click **Save**.

CLI Equivalent

```
crypto
   ikev2
      profile ikev2_profile_name
         dpd 10-3600 2-60 {on-demand | periodic}
```

Configure IKE

Table 13: Feature History

Feature Name	Release Information	Description
SHA256 Support for IPSec Tunnels	Cisco IOS XE Catalyst SD-WAN Release 17.2.1r	This feature adds support for `HMAC_SHA256` algorithms for enhanced security.

To configure IKE, click **IKE** and configure the following parameters:

Note When you create an IPsec tunnel on a Cisco IOS XE Catalyst SD-WAN device, IKE Version 1 is enabled by default on the tunnel interface.

IKE Version 1 and IKE Version 2

To configure the IPsec tunnel that carries IKEv1 and IKEv2 traffic, click **IPSEC** and configure the following parameters:

Parameter Name	Options	Description
IKE Version	**1** IKEv1 **2** IKEv2	Enter **1** to choose IKEv1. Enter **2** to choose IKEv2. *Default*: IKEv1 **Note** In IKEv2 Preshared Keys (PSK), the '\' character is not supported and should not be used.
IKE Mode	**Aggressive mode** **Main mode**	For IKEv1 only, specify one of the following modes: • Aggressive mode - Negotiation is quicker, and the initiator and responder ID pass in the clear. • Establishes an IKE SA session before starting IPsec negotiations. **Note** For IKEv2, there is no mode. **Note** IKE aggressive mode with pre-shared keys should be avoided where possible. Otherwise a strong pre-shared key should be chosen. *Default*: Main mode
IPsec Rekey Interval	3600 - 1209600 seconds	Specify the interval for refreshing IKE keys. *Range*: 1 hour through 14 days *Default*: 14400 seconds (4 hours)

Parameter Name	Options	Description
IKE Cipher Suite	• AES 256 CBC SHA 256 • AES 256 CBC SHA 384 • AES 256 CBC SHA 512 • AES 256 CBC SHA 1 • AES 256 GCM • Nul SHA 256 • Nul SHA 384 • Nul SHA 512 • Nul SHA 1	Specify the type of authentication and encryption to use during IKE key exchange. *Default*: AES 256 CBC SHA 1
IKE Diffie-Hellman Group	**2** **14** **15** **16**	Specify the Diffie-Hellman group to use in IKE key exchange, whether IKEv1 or IKEv2. • 1024-bit modulus • 2048-bit modulus • 3072-bit modulus • 4096-bit modulus *Default*: 4096-bit modulus
IKE Authentication	Configure IKE authentication.	
	Preshared Key	Enter the password to use with the preshared key.
	IKE ID for Local End Point	If the remote IKE peer requires a local end point identifier, specify it. *Range*: 1 through 64 characters *Default*: Tunnel's source IP address
	IKE ID for Remote End Point	If the remote IKE peer requires a remote end point identifier, specify it. *Range*: 1 through 64 characters *Default*: Tunnel's destination IP address

Note When you are pushing authentication from Cisco SD-WAN Manager, use the authentication string configured for the source and destination stations in double quotes as special characters are not supported. The string can be up to eight characters long.

To save the feature template, click **Save**.

Change the IKE Version from IKEv1 to IKEv2

To change the IKE version, do the following:

1. From the Cisco SD-WAN Manager menu, choose **Configuration** > **Templates**.
2. Click **Feature Templates**, and then click **Add Template**.

Note In Cisco vManage Release 20.7.x and earlier releases, **Feature Templates** is called **Feature**.

3. Choose the device for which you are creating the template.
4. Click **Basic Configuration**.
5. Use the **shutdown** parameter with the **yes** option (**yes shutdown**) to shut down the tunnel.
6. Remove the ISAKMP profile from the IPsec profile.
7. Attach the IKEv2 profile with the IPsec profile.

Note Perform this step if you already have an IKEv2 profile. Otherwise, create an IKEv2 profile first.

8. Use the **shutdown** parameter with the **no** option (**no shutdown**) to start up the tunnel.

Note You must issue the **shutdown** operations in two separate operations.

Note There is no single CLI for changing the IKE version. You need to follow the sequence of steps listed in the Change the IKE Version from IKEv1 to IKEv2 section.

CLI Equivalents for IKEv1

ISAKMP CLI Configuration for IKEv1

```
crypto
   isakmp
      keepalive 60-86400 2-60 {on-demand | periodic}
      policy policy_num
```

```
         encryption {AES128-CBC-SHA1 | AES256-CBC-SHA1}
         hash {sha384 | sha256 | sha}
         authentication pre-share
         group {2 | 14 | 16 | 19 | 20 | 21}
         lifetime 60-86400
      profile ikev1_profile_name
         match identity address ip_address [mask]
         keyring keyring_name
```

IPsec CLI Configuration for IKEv1

```
profile ipsec_profile_name
         set transform-set transform_set_name
         set isakmp-profile ikev1_profile_name
         set security-association
            lifetime {kilobytes disable | seconds 120-2592000}
            replay {disable | window-size [64 | 128 | 256 | 512 | 1024]}
         set pfs group {14 | 16 | 19 | 20 | 21}
   keyring keyring_name
      pre-shared-key address ip_address [mask] key key_string
   ipsec transform-set transform_set_name {esp-gcm 256 | esp-aes 256 [esp-sha384-hmac |
esp-sha256-hmac] mode tunnel
```

Summary Steps

1. enable
2. configure terminal
3. crypto isakmp policy *priority*
4. encryption {des | 3des | aes | aes 192 | aes 256 }
5. hash {sha | sha256 | sha384 | md5 }
6. authentication {rsa-sig | rsa-encr | pre-share }
7. group {1 | 2 | 5 | 14 | 15 | 16 | 19 | 20 | 24 }
8. lifetime *seconds*
9. exit
10. exit

CLI Equivalent for IKE2

```
crypto
   ikev2
      proposal proposal_name
         encryption {3des | aes-cbc-128 | aes-cbc-192 | aes-cbc-256 | des}
         integrity {sha256 | sha384 | sha512}
         group {2 | 14 | 15 | 16}
      keyring idev2_keyring_name
         peer peer_name
         address tunnel_dest_ip [mask]
         pre-shared-key key_string
      profile ikev2_profile_name
         match identity remote address ip_address
         authentication {remote | local} pre-share
         keyring local ikev2_keyring_name
         lifetime 120-86400
```

SSH Encryption Algorithms

Table 14: Feature History Table

Feature Name	Release Information	Feature Description
Disable Weak SSH Encryption Algorithms on Cisco SD-WAN Manager	Cisco vManage Release 20.9.1	This feature allows you to disable weaker SSH algorithms on Cisco SD-WAN Manager that may not comply with certain data security standards.
Disabled Weak SSH Encryption Algorithms	Cisco IOS XE Catalyst SD-WAN Release 17.16.1a Cisco Catalyst SD-WAN Control Components Release 20.16.1	For better security, certain weak SSH encryption algorithms are disabled by default on port 22 and port 830 for devices in the Cisco Catalyst SD-WAN overlay.

Information About SSH Encryption Algorithms

When Cisco Catalyst SD-WAN Control Components establish control connections with each device in the network, they use an encryption algorithm that each device supports.

Weak SSH Encryption Algorithms

To improve security, from Cisco IOS XE Catalyst SD-WAN Release 17.16.1a, some SSH encryption algorithms are disabled by default.

- For port 22, the SSH-RSA algorithm is disabled.
- For port 830, these algorithms are disabled.
  - AES128-CBC
  - AES256-CBC
  - diffie-hellman-group14-sha1
  - HMAC-SHA1
  - SSH-RSA

Information About Disabling Weak SSH Encryption Algorithms on Cisco SD-WAN Manager

Minimum supported releases: Cisco vManage Release 20.9.1

Cisco SD-WAN Manager provides an SSH client for communication with components in the network, including controllers and edge devices. The SSH client provides an encrypted connection for secure data transfer, based on a variety of encryption algorithms. Many organizations require stronger encryption than that provided by SHA-1, AES-128, and AES-192.

From Cisco vManage Release 20.9.1, you can disable these weak encryption algorithms so that an SSH client does not use these algorithms:

- SHA-1
- AES-128
- AES-192

Starting from Cisco Catalyst SD-WAN Manager Release 20.16.1, the SHA-1 algorithm is disabled by default in Cisco SD-WAN Manager. Use the question mark (?) online help function on the CLI to find alternative algorithms to SHA-1.

Before disabling these encryption algorithms, ensure that Cisco vEdge devices, if any, in the network, are using a software release later than Cisco SD-WAN Release 18.4.6.

Note You cannot change the SSH KEX and cipher algorithms on the Cisco SD-WAN Controller and the Cisco Catalyst SD-WAN Validator through the CLI. It is only supported on Cisco SD-WAN Manager.

Note Starting from Cisco Catalyst SD-WAN Manager Release 20.18.1, you can disable weak SSH encryption algorithms for Cisco SD-WAN Validator and Cisco SD-WAN Controller.

Benefits of Disabling Weak SSH Encryption Algorithms on Cisco SD-WAN Manager

Disabling weaker SSH encryption algorithms improves the security of SSH communication, and ensures that organizations using Cisco Catalyst SD-WAN are compliant with strict security regulations.

Disable Weak SSH Encryption Algorithms on Cisco SD-WAN Manager Using CLI

1. From the Cisco SD-WAN Manager menu, choose **Tools** > **SSH Terminal**.
2. Choose the Cisco SD-WAN Manager device on which you wish to disable weaker SSH algorithms.
3. Enter the username and password to log in to the device.
4. Enter SSH server mode.

   ```
   vmanage# config terminal
   vmanage(config)# system
   vmanage(config-system)# ssh-server
   ```

5. Do one of the following to disable an SSH encryption algorithm:
   - Disable SHA-1:
     a. `vmanage(config-ssh-server)# no kex-algo sha1`
     b. `vmanage(config-ssh-server)# commit`

The following warning message is displayed:

```
The following warnings were generated:
'system ssh-server kex-algo sha1': WARNING: Please ensure all your edges run code
 version > 18.4.6 which negotiates better than SHA1 with vManage. Otherwise those
 edges may become offline.
Proceed? [yes,no] yes
```

c. Ensure that any Cisco vEdge devices in the network are running Cisco SD-WAN Release 18.4.6 or later and enter **yes**.

- Disable AES-128 and AES-192:

a. `vmanage(config-ssh-server)# no cipher aes-128-192`

b. `vmanage(config-ssh-server)# commit`

The following warning message is displayed:

```
The following warnings were generated:
'system ssh-server cipher aes-128-192': WARNING: Please ensure all your edges
run code version > 18.4.6 which negotiates better than AES-128-192 with vManage.
 Otherwise those edges may become offline.
Proceed? [yes,no] yes
```

c. Ensure that any Cisco vEdge devices in the network are running Cisco SD-WAN Release 18.4.6 or later and enter **yes**.

Verify that Weak SSH Encryption Algorithms Are Disabled on Cisco SD-WAN Manager Using the CLI

1. From the Cisco SD-WAN Manager menu, choose **Tools** > **SSH Terminal**.
2. Select the Cisco SD-WAN Manager device you wish to verify.
3. Enter the username and password to log in to the device.
4. Run the following command:

   ```
   show running-config system ssh-server
   ```

5. Confirm that the output shows one or more of the commands that disable weaker encryption algorithms:
   - no cipher aes-128-192
   - no kex-algo sha1