

Virtual Tunnel Interface

This chapter describes how to configure a VTI tunnel.

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About Virtual Tunnel Interfaces

ASA supports a logical interface called the Virtual Tunnel Interface (VTI). As an alternative to policy-based VPN, you can create a VPN tunnel between peers using VTIs. VTIs support route-based VPN with IPsec profiles attached to the end of each tunnel. You can use dynamic or static routes. Egressing traffic from the VTI is encrypted and sent to the peer, and the associated SA decrypts the ingress traffic to the VTI.

Using VTI does away with the requirement of configuring static crypto map access lists and mapping them to interfaces. You no longer have to track all remote subnets and include them in the crypto map access list. Deployments become easier, and having static VTI which supports route-based VPN with dynamic routing protocol also satisfies many requirements of a virtual private cloud.

Static VTI

You can use static VTI configurations for site-to-site connectivity in which a tunnel is always-on between two sites. For a static VTI interface, you must define a physical interface as a tunnel source. You can associate a maximum of 1024 VTIs per device. To create a static VTI interface, see Add a VTI Interface, on page 7.

Dynamic VTI

Dynamic VTI provides highly secure and scalable connectivity for site-to-site VPNs. Dynamic VTI eases the configuration of peers for large enterprise hub and spoke deployments. A single dynamic VTI can replace several static VTI configurations on the hub. You can add new spokes to a hub without changing the hub configuration. Dynamic VTI replaces dynamic crypto maps and the dynamic hub-and-spoke method for establishing tunnels. In the management center, dynamic VTI supports only the hub and spoke topology.

Dynamic VTI uses a virtual template for dynamic instantiation and management of IPsec interfaces. The virtual template dynamically generates the virtual access interface that is unique for each VPN session. Dynamic VTI supports multiple IPsec security associations and accepts multiple IPsec selectors proposed by the spoke. Dynamic VTI also supports dynamic (DHCP) spokes. To create a dynamic VTI interface, see Add a Dynamic VTI Interface, on page 10.

How Does an ASA Create a Dynamic VTI Tunnel for a VPN Session

1. Create a virtual template on ASA (Choose **Configuration > Device Setup > Interface Settings > Interfaces > Add > DVTI Interface**).

   You can use this template for multiple VPN sessions.
2. Attach this template to a tunnel group. You can attach a virtual template to multiple tunnel groups.
3. Spoke initiates a tunnel request with the hub.
4. Hub authenticates the spoke.
5. ASA uses the virtual template to dynamically create a virtual access interface on the hub for the VPN session with the spoke.
6. Hub establishes a dynamic VTI tunnel with the spoke using the virtual access interface.
7. Configure the IKEv2 route set interface option to advertise the VTI interface IP over IKEv2 exchanges. This option enables unicast reachability between the VTI interfaces for BGP or path monitoring to work over the tunnel.
8. After the VPN session ends, the tunnel disconnects and the hub deletes the corresponding virtual access interface.

Guidelines for Virtual Tunnel Interfaces

Context Mode and Clustering

- Supported in single mode only.
- No support for clustering.

Firewall Mode

Supported in routed mode only.

BGP IPv4 and IPv6 Support

Supports IPv4 and IPv6 BGP routing over VTI.

EIGRP Support

Supports IPv4 and IPv6 EIGRP routing over VTI.

OSPF IPv4 and IPv6 Support

Supports IPv4 and IPv6 OSPF routing over VTI.

IPv6 Support

- IPv6 addressed VTIs can be configured.
- Both the tunnel source and the tunnel destination of a VTI can have IPv6 addresses.

- Following combinations of VTI IP (or internal networks IP version) over public IP versions are supported:
  - IPv6 over IPv6
  - IPv4 over IPv6
  - IPv4 over IPv4
  - IPv6 over IPv4
- Only static IPv6 address is supported as the tunnel source and destination.
- The tunnel source interface can have IPv6 addresses and you can specify which address to be used as the tunnel endpoint. If you do not specify, by default, the first IPv6 global address in the list is used as the tunnel endpoint.
- You can specify the tunnel mode as IPv6. When specified, the IPv6 traffic can be tunneled through the VTI. However, the tunnel mode can either be IPv4 or IPv6 for a single VTI.

Bidirectional Forwarding Detection (BFD) for IPsec tunnel interface Guidelines

- For a Static VTI interface with a BFD template, configure only one IP address type, either IPv4 or IPv6. If the BFD neighbor does not come up due to dual IP address types, remove and re-add the tunnel interface with a single IP address type.
- Enable BFD only on the tunnel interface for Static VTI interface and on the tunnel group for Dynamic VTI interface. You must not configure BFD neighbor under router BGP for the same overlay neighbor IP address.
- For BFD-enabled tunnels, set the Dead Peer Detection (DPD) interval to 60 seconds or more, depending on the total number of BFD tunnels on the device.

General Configuration Guidelines

- If you use dynamic crypto maps and dynamic VTIs in your LAN-to-LAN VPNs, only the dynamic VTI tunnels will come up. This behaviour occurs because both the crypto maps and dynamic VTIs try to use the default tunnel group.

  We recommend that you do one of the following:
  - Migrate your LAN-to-LAN VPNs to dynamic VTIs.
  - Use static crypto maps with their own tunnel-groups.
- VTIs are only configurable in IPsec mode. To terminate GRE tunnels on an ASA is unsupported.
- You can use static, BGP, OSPF or EIGRP IPv4 routes for traffic using the tunnel interface.
- For static and dynamic VTI, ensure that you do not use the borrow IP interface as the tunnel source IP address for any VTI interface.
- The MTU for VTIs is automatically set, according to the underlying physical interface. However, if you change the physical interface MTU after the VTI is enabled, you must disable and reenable the VTI to use the new MTU setting.

- For dynamic VTI, the virtual access interface inherits the MTU from the configured tunnel source interface. If you do not specify the tunnel source interface, the virtual access interface inherits the MTU from the source interface from which ASA accepts the VPN session request.
- For static VTIs, you can configure a maximum of 1024 VTIs on a device. While calculating the VTI count, consider the following:
  - Include nameif subinterfaces to derive the total number of VTIs that can be configured on the device.
  - You cannot configure nameif on member interfaces of a portchannel. Therefore, the tunnel count is reduced by the count of actual main portchannel interfaces alone and not any of its member interfaces.
  - Even if a platform supports more than 1024 interfaces, the VTI count is limited to the number of VLANs configurable on that platform. For example, if a model supports 500 VLANs, then the tunnel count would be 500 minus the number of physical interfaces configured.
- For dynamic VTIs, the maximum number of dynamically-created virtual access interfaces can be 1024 or the total interface limit of the platform, whichever is less.
- VTI supports IKE versions v1, v2, and uses IPsec for sending and receiving data between the tunnel's source and destination.
- If NAT has to be applied, the IKE and ESP packets are encapsulated in the UDP header.
- IKE and IPsec security associations will be re-keyed continuously regardless of data traffic in the tunnel. This ensures that VTI tunnels are always up.
- The tunnel group name must match what the peer sends as its IKEv1 or IKEv2 identity.
- For IKEv1 in site-to-site tunnel groups, you can use names which are not IP addresses, if the tunnel authentication method is digital certificates and/or the peer is configured to use aggressive mode.
- VTI and crypto map configurations can co-exist on the same physical interface, provided the peer address configured in the crypto map and the tunnel destination for the VTI are different.
- Access rules can be applied on a VTI interface to control traffic through VTI.
- ICMP ping is supported between VTI interfaces.
- If the peer device for an IKEv2 site-to-site VPN tunnel sends IKEv2 configuration request payloads, the ASA cannot establish an IKEv2 tunnel with the device. You must disable the config-exchange request on the peer device for the ASA to establish a VPN tunnel with the peer device.
- Dynamic VTI supports HA and IKEv2.

Default Settings

- By default, all traffic through VTI is encrypted.
- By default, the security level for VTI interfaces is 0. You cannot configure the security level.

Limitations for VTI

ASA drops Security Group Tag (SGT) frames and packets after VTI decryption.

Dynamic VTI does not support:

- ECMP and VRF
- Clustering
- IKEv1
- QoS

For dynamic VTIs, if a tunnel source is not specified, IKEv2 will be enabled on all interfaces of the device except management-only and failover interfaces.

Create a VTI Tunnel

To configure a VTI tunnel, create an IPsec proposal (transform set). You will need to create an IPsec profile that references the IPsec proposal, followed by a VTI interface with the IPsec profile. Configure the remote peer with identical IPsec proposal and IPsec profile parameters. SA negotiation will start when all tunnel parameters are configured.

Note For the ASA which is a part of both the VPN VTI domains, and has BGP adjacency on the physical interface:

When a state change is triggered due to the interface health check, the routes in the physical interface will be deleted until BGP adjacency is re-established with the new active peer. This behavior does not apply to logical VTI interfaces.

Access control lists can be applied on a VTI interface to control traffic through VTI. To permit any packets that come from an IPsec tunnel without checking ACLs for the source and destination interfaces, enter the sysopt connection permit-vpn command in global configuration mode.

You can use the following command to enable IPsec traffic through the ASA without checking ACLs:

hostname(config)# sysopt connection permit-vpn

When an outside interface and VTI interface have the security level of 0, if you have ACL applied on VTI interface, it will not be hit if you do not have same-security-traffic configured.

To configure this feature, use the **same-security-traffic** command in global configuration mode with its **intra-interface** argument.

Procedure

Step 1 Add an IPsec Proposal (Transform Sets).

Step 2 Add an IPsec Profile.

Step 3 Add a VTI Tunnel.

Add an IPsec Proposal (Transform Sets)

A transform set is required to secure traffic in a VTI tunnel. Used as a part of the IPsec profile, it is a set of security protocols and algorithms that protects the traffic in the VPN.

Before you begin

- You can use either pre-shared key or certificates for authenticating the IKE session associated with a VTI. IKEv2 allows asymmetric authentication methods and keys. For both IKEv1 and IKEv2, you must configure the pre-shared key under the tunnel group used for the VTI.
- For certificate based authentication using IKEv1, you must specify the trustpoint to be used at the initiator. For the responder, you must configure the trustpoint in the tunnel-group command. For IKEv2, you must configure the trustpoint to be used for authentication under the tunnel group command for both initiator and responder.

Procedure

Step 1 Choose **Configuration** > **Site-to-Site VPN** > **Advanced** > **IPsec Proposals (Transform Sets)**.

Step 2 Configure IKEv1 or IKEv2 to establish the security association.

- Configure IKEv1.

a) In the IKEv1 IPsec Proposals (Transform Sets) panel, click **Add**.
b) Enter the **Set Name**.
c) Retain the default selection of the **Tunnel** check box.
d) Select **ESP Encryption** and **ESP Authentication**.
e) Click **OK**.

- Configure IKEv2.

a) In the IKEv2 IPsec Proposals panel, click **Add**.
b) Enter the **Name**, and **Encryption**.
c) Choose the **Integrity Hash**.
d) Click **OK**.

Add an IPsec Profile

An IPsec profile contains the required security protocols and algorithms in the IPsec proposal or transform set that it references. This ensures a secure, logical communication path between two site-to-site VTI VPN peers.

Procedure

Step 1 Choose **Configuration** > **Site-to-Site VPN** > **Advanced** > **IPsec Proposals (Transform Sets)**.

Step 2 In the **IPsec Profile** panel, click **Add**.

Step 3 Enter the IPsec profile **Name**.

Step 4 Enter the **IKE v1 IPsec Proposal** or the **IKE v2 IPsec Proposal** created for the IPsec profile. You can choose either an IKEv1 transform set or an IKEv2 IPsec proposal.

Step 5 If you need an end of the VTI tunnel to act only as a responder, check the **Responder only** check box.

- You can configure one end of the VTI tunnel to perform only as a responder. The responder-only end will not initiate the tunnel or rekeying.
- If you are using IKEv2, set the duration of the security association lifetime greater than the lifetime value in the IPsec profile in the initiator end. This is to facilitate successful rekeying by the initiator end and ensure that the tunnels remain up.
- If the rekey configuration in the initiator end is unknown, remove the responder-only mode to make the SA establishment bi-directional, or configure an infinite IPsec lifetime value in the responder-only end to prevent expiry.

Step 6 (Optional) Check the **Enable security association lifetime** check box, and enter the security association duration values in **kilobytes** and **seconds**.

Step 7 (Optional) Check the **PFS Settings** check box to enable PFS, and select the required Diffie-Hellman Group.

Perfect Forward Secrecy (PFS) generates a unique session key for each encrypted exchange. This unique session key protects the exchange from subsequent decryption. To configure PFS, you have to select the Diffie-Hellman key derivation algorithm to use when generating the PFS session key. The key derivation algorithms generate IPsec security association (SA) keys. Each group has a different size modulus. A larger modulus provides higher security, but requires more processing time. You must have matching Diffie-Hellman groups on both peers.

This establishes the strength of the of the encryption-key-determination algorithm. The ASA uses this algorithm to derive the encryption and hash keys.

Step 8 (Optional) Check the **Enable sending certificate** check box, and select a **Trustpoint** that defines the certificate to be used while initiating a VTI tunnel connection. Check the **Chain** check box, if required.

Step 9 Check the **Enable Reverse Route Injection** check box to enable Reverse Route Injection (RRI) for this IPsec profile.

RRI populates the routing table of an internal router that runs dynamic routing protocols such as OSPF, EIGRP if you run ASA, or RIP for remote VPN clients or LAN to LAN sessions. RRI is done upon configuration and is considered static, remaining in place until the configuration changes or is removed. ASA automatically adds static routes to the routing table and announces these routes to its private network or border routers using OSPF. Do not enable RRI if you specify any source/destination (0.0.0.0/0.0.0.0) as the protected network, because this will impact traffic that uses your default route.

Step 10 Check the **Dynamic** check box to set the reverse route as dynamic.

Step 11 Click **OK**.

Step 12 In the **IPsec Proposals (Transform Sets)** main panel, click **Apply**.

Step 13 In the **Preview CLI Commands** dialog box, click **Send**.

Add a VTI Interface

To create a new VTI interface and establish a VTI tunnel, perform the following steps:

Note Implement IP SLA to ensure that the tunnel remains up when a router in the active tunnel is unavailable. See Configure Static Route Tracking in the ASA General Operations Configuration Guide in http://www.cisco.com/go/asa-config.

Procedure

Step 1 Choose **Configuration** > **Device Setup** > **Interface Settings** > **Interfaces**.

Step 2 Choose **Add** > **VTI Interface**. The **Add VTI Interface** window appears.

Step 3 In the **General** tab:

a) Enter the **VTI ID**. The range is from 0 to 10413. Up to 10413 VTI interfaces are supported.
b) Enter the **Interface Name**.
c) Ensure that the **Enable Interface** check box is checked.
d) Choose **IPv4** or **IPv6** from the **Path Monitoring** drop-down list and enter the IP address of the peer.
e) Enter the **Cost**. The range is from 1 to 65535.

The cost determines the priority to load balance the traffic across multiple VTIs. The lowest number has the highest priority.

f) For configuring the IP address:

Click the **Address** radio button to configure an IP address and the subnet mask.

Or

Click the **Unnumbered** radio button to choose an interface from the **IP Unnumbered** drop-down list to borrow its IP address. You can choose a loopback interface or a physical interface from the list.

Step 4 In the **Advanced** tab.

a) Enter the **Destination IP**.
b) Choose the tunnel source interface from the **Source Interface** drop-down list.

You can select a loopback interface or a physical interface.

c) Select the IPsec policy in the **Tunnel Protection with IPsec Policy** field.
d) Select the IPsec profile in the **Tunnel Protection with IPsec Profile** field.
e) Check the **Ensure the Enable Tunnel Mode IPv4 IPsec** check box.

Step 5 Click **OK**.

Step 6 In the **Interfaces** panel, click **Apply**.

Step 7 In the **Preview CLI Commands** dialog box, click **Send**.

After the updated configuration is loaded, the new VTI appears in the list of interfaces. This new VTI can be used to create an IPsec site-to-site VPN.

Example

Example configuration of a VTI tunnel (with IKEv2) between ASA and an IOS device:

```
ASA:

crypto ikev2 policy 1
 encryption aes-gcm-256
 integrity null
 group 21
 prf sha512
 lifetime seconds 86400
!
crypto ipsec ikev2 ipsec-proposal gcm256
 protocol esp encryption aes-gcm-256
 protocol esp integrity null
!
crypto ipsec profile asa-vti
 set ikev2 ipsec-proposal gcm256
!
interface Tunnel 100
 nameif vti
 ip address 10.10.10.1 255.255.255.254
 tunnel source interface [asa-source-nameif]
 tunnel destination [router-ip-address]
 tunnel mode ipsec ipv4
 tunnel protection ipsec profile asa-vti
!
tunnel-group [router-ip-address] ipsec-attributes
 ikev2 remote-authentication pre-shared-key cisco
 ikev2 local-authentication pre-shared-key cisco
!
crypto ikev2 enable [asa-interface-name]


IOS:

!
crypto ikev2 proposal asa-vti
 encryption aes-gcm-256
 prf sha512
 group 21
!
crypto ikev2 policy asa-vti
 match address local [router-ip-address]
 proposal asa-vti
!
crypto ikev2 profile asa-vti
 match identity remote address [asa-ip-address] 255.255.255.255
 authentication local pre-share key cisco
 authentication remote pre-share key cisco
 no config-exchange request
!
crypto ipsec transform-set gcm256 esp-gcm 256
!
```

```
crypto ipsec profile asa-vti
 set ikev2-profile asa-vti
 set transform-set gcm256
!
interface tunnel 100
 ip address 10.10.10.0 255.255.255.254
 tunnel mode ipsec ipv4
 tunnel source [router-interface]
 tunnel destination [asa-ip-address]
 tunnel protection ipsec profile asa-vti
!
```

Add a Dynamic VTI Interface

To create a virtual template for dynamic VTI:

Note Implement IP SLA to ensure that the tunnel remains up when a router in the active tunnel is unavailable. See "Configure Static Route Tracking" in the ASA General Operations Configuration Guide in http://www.cisco.com/go/asa-config.

Before you begin

Ensure that you have configured an IPsec profile and an IP unnumbered interface.

Procedure

Step 1 Choose **Configuration** > **Device Setup** > **Interface Settings** > **Interfaces**.

Step 2 Choose **Add** > **DVTI Interface**. The **Add DVTI Interface** window appears.

Step 3 In the **General** tab:

a) Enter the **DVTI ID**. This ID can be any value from 1 to 10413. Up to 1024 VTI interfaces are supported per device.

b) Enter the **Interface Name**.

c) Ensure that you check the **Enable Interface** check box.

d) Choose an interface from the **IP Unnumbered** drop-down list.

The virtual template inherits the IP address of the selected interface. Ensure that you use an IP address different from the tunnel source IP address. You can choose any physical interface or a loopback address configured on the device.

e) Enter the description for the dynamic VTI in the **Description** field.

Step 4 In the **Advanced** tab:

a) Choose a tunnel source interface from the **Source Interface** drop-down list. The IP address of this interface will be the destination IP address for the spoke. You can select only physical and loopback interfaces from the list.

b) Check the **Enable IPv6 Source Address** check box to accept VPN session requests only from the interface configured with the tunnel source IP address. If you do not enable this option, ASA accepts VPN session requests from any interface.

The virtual access interface also inherits the MTU from the configured tunnel source interface. If you do not enable the above option, the virtual access interface inherits the MTU from the source interface from which ASA accepts the VPN session request.

c) Choose the IPsec profile from the **Tunnel Protection with IPsec Profile** drop-down list.

d) Check the **Enable Tunnel Mode IP Overlay for IPSec** check box and select the **IPv4** or **IPv6** radio button to enable the IPsec tunnel mode.

Step 5 In the **IPv6** tab:

a) Click the **IPv6 Address Unnumbered** browse button and choose an IPv6 address from the list.

All virtual access interfaces cloned from the virtual template will have the same IP address.

b) Click **OK**.

Step 6 In the **Preview CLI Commands** dialog box, you can view the virtual template commands.

Step 7 Click **Send**.

What to do next

Attach this template to a tunnel group. For more information, see Site-to-Site Tunnel Groups.

Feature History for Virtual Tunnel Interface

Feature Name	Releases	Feature Information
Dynamic Virtual Tunnel Interface support	9.19(1)	You can create a dynamic VTI and use it to configure a route-based site-to-site VPN in a hub and spoke topology. Dynamic VTI eases the configuration of peers for large enterprise hub and spoke deployments. A single dynamic VTI can replace several static VTI configurations on the hub. You can add new spokes to a hub without changing the hub configuration. New/Modified screens: **Configuration > Device Setup > Interface Settings > Interfaces > Add > DVTI Interface**
OSPF IPv4 and IPv6 support	9.19(1)	Supports OSPF IPv4 and IPv6 routing protocol over a VTI.
EIGRP support	9.19(1)	Supports EIGRP IPv4 and IPv6 routing protocol over a VTI.
Loopback interface support for static and dynamic VTIs	9.19(1)	You can now set a loopback interface as the source interface for a VTI. Support has also been added to inherit the IP address from a loopback interface instead of a statically configured IP address. The loopback interface helps to overcome path failures. If an interface goes down, you can access all interfaces through the IP address assigned to the loopback interface. New/Modified screens: **Configuration** > **Device Setup** > **Interface Settings** > **Interfaces** > **Add VTI Interface** > **Advanced**

Feature Name	Releases	Feature Information
Local tunnel ID support	9.17(1)	ASA supports unique local tunnel ID that allows ASA to have multiple IPsec tunnel behind a NAT to connect to Cisco Umbrella Secure Internet Gateway (SIG). The local identity is used to configure a unique identity per IKEv2 tunnel, instead of a global identity for all the tunnels.
Support for IPv6 on Static VTI	9.16(1)	ASA supports IPv6 addresses in Virtual Tunnel Interfaces (VTI) configurations. A VTI tunnel source interface can have an IPv6 address, which you can configure to use as the tunnel endpoint. If the tunnel source interface has multiple IPv6 addresses, you can specify which address to be used, else the first IPv6 global address in the list is used by default. The tunnel mode can be either IPv4 or IPv6, but it must be the same as IP address type configured on VTI for the tunnel to be active. An IPv6 address can be assigned to the tunnel source or the tunnel destination interface in a VTI.
Support for 1024 VTI interfaces per device	9.16(1)	The number of maximum VTIs to be configured on a device has been increased from 100 to 1024. Even if a platform supports more than 1024 interfaces, the VTI count is limited to the number of VLANs configurable on that platform. For example, ASA 5510 supports 100 VLANs, the tunnel count would be 100 minus the number of physical interfaces configured. New/Modified screens: None
DHCP Relay Server Support on VTI	9.14(1)	ASA allows VTI interfaces to be configured as DHCP relay server connecting interfaces. We modified the following screen to specify a VTI interface for DHCP relay: **Configuration** > **Device Management** > **DHCP** > **DHCP Relay** > **DHCP Relay Interface Servers**
Support for IKEv2, certificate based authentication, and ACL in VTI	9.8.(1)	Virtual Tunnel Interface (VTI) now supports BGP (static VTI). You can now use IKEv2 in standalone and high availability modes. You can use certificate based authentication by setting up a trustpoint in the IPsec profile. You can also apply access lists on VTI using access-group commands to filter ingress traffic. We introduced options to select the trustpoint for certificate based authentication in the following screen: **Configuration** > **Site-to-Site VPN** > **Advanced** > **IPsec Proposals (Transform Sets)** > **IPsec Profile** > **Add**

Feature Name	Releases	Feature Information
Virtual Tunnel Interface (VTI) support	9.7.(1)	The ASA is enhanced with a new logical interface called Virtual Tunnel Interface (VTI), used to represent a VPN tunnel to a peer. This supports route based VPN with IPsec profiles attached to each end of the tunnel. Using VTI does away with the need to configure static crypto map access lists and map them to interfaces. We introduced the following screens: **Configuration** > **Site-to-Site VPN** > **Advanced** > **IPsec Proposals (Transform Sets)** > **IPsec Profile** **Configuration** > **Site-to-Site VPN** > **Advanced** > **IPsec Proposals (Transform Sets)** > **IPsec Profile** > **Add** > **Add IPsec Profile** **Configuration** > **Device Setup** > **Interface Settings** > **Interfaces** > **Add** > **VTI Interface** **Configuration** > **Device Setup** > **Interface Settings** > **Interfaces** > **Add** > **VTI Interface** > **General** **Configuration** > **Device Setup** > **Interface Settings** > **Interfaces** > **Add** > **VTI Interface** > **Advanced**