Site-to-Site VPN

About Site-to-Site VPN

Secure Firewall Threat Defense site-to-site VPN supports the following features:

- Both IPsec IKEv1 & IKEv2 protocols.
- Certificates and automatic or manual preshared keys for authentication.
- IPv4 & IPv6. All combinations of inside and outside are supported.
- IPsec IKEv2 Site-to-Site VPN topologies provide configuration settings to comply with security certifications.
- Static and dynamic Interfaces.
- HA environments for both Firewall Management Center and Firewall Threat Defense.
- VPN alerts when the tunnel goes down.
- Tunnel statistics available using the Firewall Threat Defense Unified CLI.
- IKEv1 and IKEv2 back-up peer configuration for point-to-point extranet and hub-and-spoke VPNs.
- Extranet device as hub in 'Hub and Spokes' deployments.
- Dynamic IP address for a managed endpoint pairing with extranet device in 'Point to Point' deployments.
- Dynamic IP address for extranet device as an endpoint.

- Hub as extranet in 'Hub and Spokes' deployments.

VPN Topology

To create a new site-to-site VPN topology you must, specify a unique name, a topology type, choose the IKE version that is used for IPsec IKEv1 or IKEv2, or both. Also, determine your authentication method. Once configured, you deploy the topology to Firewall Threat Defense devices. The Secure Firewall Management Center configures site-to-site VPNs on Firewall Threat Defense devices only.

You can select from three types of topologies, containing one or more VPN tunnels:

- Point-to-point (PTP) deployments establish a VPN tunnel between two endpoints.
- Hub and Spoke deployments establish a group of VPN tunnels connecting a hub endpoint to a group of spoke nodes.
- Full Mesh deployments establish a group of VPN tunnels among a set of endpoints.

IPsec and IKE

In the Secure Firewall Management Center, site-to-site VPNs are configured based on IKE policies and IPsec proposals that are assigned to VPN topologies. Policies and proposals are sets of parameters that define the characteristics of a site-to-site VPN, such as the security protocols and algorithms that are used to secure traffic in an IPsec tunnel. Several policy types may be required to define a full configuration image that can be assigned to a VPN topology.

Authentication

For authentication of VPN connections, configure a preshared key in the topology, or a trustpoint on each device. Preshared keys allow for a secret key, used during the IKE authentication phase, to be shared between two peers. A trustpoint includes the identity of the CA, CA-specific parameters, and an association with a single enrolled identity certificate.

Extranet Devices

Each topology type can include extranet devices, devices that you don’t manage in Firewall Management Center. These include:

- Cisco devices that Secure Firewall Management Center supports, but for which your organization isn’t responsible. Such as spokes in networks managed by other organizations within your company, or a connection to a service provider or partner's network.
- Non-Cisco devices. You can’t use Secure Firewall Management Center to create and deploy configurations to non-Cisco devices.

Add non-Cisco devices, or Cisco devices not managed by the Secure Firewall Management Center, to a VPN topology as "Extranet" devices. Also specify the IP address of each remote device.

Secure Firewall Threat Defense Site-to-site VPN Guidelines and Limitations

- Site-to-site VPN supports ECMP zone interfaces.
- You must configure all nodes in a topology with either crypto ACL or a protected network. You cannot configure a topology with crypto ACL on one node and protected network on another.

- You can configure a VPN connection across domains by using an extranet peer for the endpoint not in the current domain.
- You can backup Firewall Threat Defense VPNs using the Firewall Management Center backup.
- IKEv1 does not support CC/UCAPL-compliant devices. We recommend that you use IKEv2 for these devices.
- You cannot move a VPN topology between domains.
- VPN does not support network objects with a 'range' option.
- Firewall Threat Defense VPNs do not currently support PDF export and policy comparison.
- There is no per-tunnel or per-device edit option for Firewall Threat Defense VPNs, you can edit only the whole topology.
- The Firewall Management Center does not verify the device interface address verification for transport mode when you select a crypto ACL.
- There is no support for automatic mirror ACE generation. Mirror ACE generation for the peer is a manual process on either side.
- With crypto ACL, the Firewall Management Center supports only point to point VPN and does not support tunnel health events.
- Whenever IKE ports 500/4500 are in use or when there are some active PAT translations, you cannot configure a site-to-site VPN on the same ports as it fails to start the service on those ports.
- Tunnel status is not updated in realtime, but at an interval of five minutes in the Firewall Management Center.
- You cannot use the character " (double quote) as part of pre-shared keys. If you have used " in a pre-shared key, ensure that you change the character.
- In a site-to-site VPN configuration with two devices managed by the same Firewall Management Center, you cannot configure the devices as backup peers. You must configure one of peer devices in the topology as an extranet device.
- Configure unique local IKE identity for all tunnels across all your VPN topologies.

Types of Site-to-Site VPN Topologies

Site-to-Site VPN Topology	Description	More Information
SD-WAN Topology	Configure a secure branch network using the SD-WAN wizard. This wizard simplifies and automates VPN and routing configuration of your network using a hub and spoke topology, enabling SD-WAN capabilities.	Using SD-WAN Wizard for Secure Branch Network Deployment

Site-to-Site VPN Topology	Description	More Information
Route-Based VPN	Configure secure traffic dynamically between peers in a network based on routing over Virtual Tunnel Interfaces (VTIs).	Create a Route-based Site-to-Site VPN, on page 28
Policy-Based VPN	Configure secure traffic between peers in a network based on a static policy using protected networks.	Configure a Policy-based Site-to-Site VPN, on page 6
SASE Topology	Configure an IPsec IKEv2 tunnel from a Firewall Threat Defense device to Secure Access or an Umbrella Secure Internet Gateway (SIG). This tunnel forwards all internet-bound traffic to Secure Access or Umbrella SIG for inspection and filtering.	Configure a SASE Tunnel for Umbrella, on page 49

License Requirements for Site-to-Site VPN

License Requirements for Policy-Based and Route-Based VPN

With the Essentials license, you can set up policy-based and route-based VPNs on your Firewall Threat Defense devices.

Depending on whether export-controlled functionality is enabled in your Smart License account, Firewall Management Center determines whether to allow or block the usage of strong crypto on devices. To verify if export-controlled functionality is enabled for your Smart License account, choose **System** (⚙) > **Licenses** > **Smart Licenses**.

Note If you use an evaluation license, or if you have not enabled the export-controlled functionality, you cannot use strong encryption for your VPN connections.

License Requirements for Deploying a SASE Tunnel on Umbrella

To deploy SASE tunnels on Umbrella from Firewall Management Center, you must enable your Smart License account with the export-controlled functionality. If this functionality is not enabled, you can only create a SASE topology, you cannot deploy tunnels on Umbrella.

Requirements and Prerequisites for Site-to-Site VPN

Model support

Firewall Threat Defense

Supported domains

Leaf

User roles

Admin

Supported Interfaces

Topology Type	Interface Type

Policy-Based	• Physical interfaces
	  • Non-management
	  • Interface Mode must be either Routed or None
	• Subinterface interfaces
	• Redundant interfaces
	• Etherchannel interfaces
	• VLAN interfaces

Route-Based	Static Virtual Tunnel Interfaces

Manage Site-to-Site VPNs

The Site-to-Site VPN page provides a snapshot of site-to-site VPN tunnels. You can view the status of the tunnels and filter the tunnels based on the device, topology, or tunnel type. The page lists 20 topologies per page and you can navigate between pages to view more topology details. You can click individual VPN topologies to expand and view details of the endpoints.

Before you begin

For certificate authentication of your site-to-site VPNs, you must prepare the devices by allocating trustpoints as described in Certificates.

Procedure

Select **Devices** > **VPN** > **Site to Site** to manage your Firewall Threat Defense site-to-site VPN configurations and deployments.

The page lists the site-to-site VPNs topologies and indicates the status of tunnels using color codes:

- Active (Green)–There is an active IPsec Tunnel.
- Unknown (Amber)–No tunnel establishment event has been received from the device yet.
- Down (Red)–There are no active IPsec tunnels.

- Deployment Pending–Topology has not been deployed on the device yet.

Choose from the following:

- **Refresh**—View the updated status of the VPNs.
- **Add**—Create new policy based or route-based Site to Site VPNs.
- **Edit**—Modify the settings of an existing VPN topology.

  Note
  You cannot edit the topology type after you initially save it. To change the topology type, delete the topology and create a new one.

  Two users shouldn't edit the same topology simultaneously; however, the web interface doesn't prevent simultaneous editing.

- **Delete**—To delete a VPN deployment, click **Delete** ( ).
- Deploy—Choose **Deploy** > **Deploy**; see Deploy Configuration Changes.

  Note
  Some VPN settings are validated only during deployment. Be sure to verify that your deployment was successful.

Configure a Policy-based Site-to-Site VPN

Procedure

Step 1 Choose **Devices** > **Site To Site**. Then click **+ Site To Site VPN**, or edit a listed VPN topology.

Step 2 Enter a unique **Topology Name**. We recommend naming your topology to indicate that it is a Firewall Threat Defense VPN, and its topology type.

Step 3 Click the **Policy Based (Crypto Map)** radio button.

Step 4 Choose the **Network Topology** for this VPN.

Step 5 Choose the IKE versions to use during IKE negotiations. Check the **IKEv1** or **IKEv2** check box.

Default is IKEv2. Select either or both options as appropriate; select IKEv1 if any device in the topology doesn't support IKEv2.

You can also configure a backup peer for point-to-point extranet VPNs. For more information, see Firewall Threat Defense VPN Endpoint Options, on page 7.

Step 6 Required: Add Endpoints for this VPN deployment by clicking **Add** ( ) for each node in the topology.

Configure each endpoint field as described in Firewall Threat Defense VPN Endpoint Options, on page 7.

- For Point to point, configure **Node A** and **Node B**.

- For Hub and Spoke, configure a **Hub Node** and **Spoke Nodes**
- For Full Mesh, configure multiple **Nodes**

Step 7 (Optional) Specify non-default IKE options for this deployment as described in Firewall Threat Defense VPN IKE Options, on page 11

Step 8 (Optional) Specify non-default IPsec options for this deployment as described in Firewall Threat Defense VPN IPsec Options, on page 14

Step 9 (Optional) Specify non-default Advanced options for this deployment as described in Firewall Threat Defense Advanced Site-to-site VPN Deployment Options, on page 16.

Step 10 Click **Save**.
The endpoints are added to your configuration.

What to do next

Deploy configuration changes.

Note Some VPN settings are validated only during deployment. Be sure to verify that your deployment was successful.

If you get an alert that your VPN tunnel is inactive even when the VPN session is up, follow the VPN troubleshooting instructions to verify and ensure that your VPN is active. .

Firewall Threat Defense VPN Endpoint Options

Navigation Path

Devices > Site To Site. Then click **+ Site To Site VPN**, or edit a listed VPN topology. Click the **Endpoints** tab.

Fields

Device

Choose an endpoint node for your deployment:

- A Firewall Threat Defense device managed by this Firewall Management Center
- A Firewall Threat Defense high availability container managed by this Firewall Management Center
- An **Extranet** device, any device (Cisco or third party) not managed by this Firewall Management Center.

Device Name

For extranet devices only, provide a name for this device. We recommend naming it such that it is identifiable as an unmanaged device.

Interface

If you chose a managed device as your endpoint, choose an interface on that managed device.

For 'Point to Point' deployments, you can also configure an endpoint with dynamic interface. An endpoint with a dynamic interface can pair only with an extranet device and can't pair with an endpoint, which has a managed device.

You can configure device interfaces at **Devices** > **Device Management, Add/Edit device** > **Interfaces**.

IP Address

- If you choose an extranet device, a device **not** managed by the Firewall Management Center, specify an IP address for the endpoint.

  For an extranet device, select **Static** and specify an IP address or select **Dynamic** to allow dynamic extranet devices.
- If you chose a managed device as an endpoint, choose a single IPv4 address or multiple IPv6 addresses from the drop-down list. These IP addresses are already assigned to this interface on the managed device.
- All endpoints in a topology must have the same IP addressing scheme. IPv4 tunnels can carry IPv6 traffic and vice versa. The Protected Networks define which addressing scheme the tunneled traffic uses.
- If the managed device is a high-availability container, choose from a list of interfaces.

This IP is Private

Check the check box if the endpoint resides behind a firewall with network address translation (NAT).

Note Use this option only when the peer is managed by the same Firewall Management Center and don't use this option if the peer is an extranet device.

Public IP address

If you checked the **This IP is Private** check box, specify a public IP address for the firewall. If the endpoint is a responder, specify this value.

Connection Type

Specify the allowed negotiation as bidirectional, answer-only, or originate-only. Supported combinations for the connection type are:

Table 1: Connection Type Supported Combinations

Remote Node	Central Node
Originate-Only	Answer-Only
Bi-Directional	Answer-Only
Bi-Directional	Bi-Directional

Certificate Map

Choose a preconfigured certificate map object, or click **Add** (+) to add a certificate map object. The certificate map defines what information is necessary in the received client certificate to be valid for VPN connectivity. See Certificate Map Objects for details.

Protected Networks

Caution Hub and Spoke topology—To avoid traffic drop for a dynamic crypto map, ensure that you don't select the protected network *any* for both the endpoints.

If the protected network is configured as *any*, on both the endpoints, the crypto ACL that works upon the tunnel is not generated.

Defines the networks that are protected by this VPN endpoint. Select the networks by selecting the list of Subnet/IP Address that define the networks that are protected by this endpoint. Click **Add** (+) to select from available Network Objects or add new Network Objects. See Creating Network Objects. Access control lists are generated from the choices made here.

- **Subnet/IP Address (Network)**—VPN endpoints can't have the same IP address and protected networks in a VPN endpoint pair cannot overlap. If protected networks for an endpoint contain IPv4 or IPv6 entries, the other endpoint's protected network must have at least one entry of the same type (IPv4 or IPv6). If it doesn't, the other endpoint's IP address must be of the same type and not overlap with the entries in the protected network. (Use /32 CIDR address blocks for IPv4 and /128 CIDR address blocks for IPv6.) If both of these checks fail, the endpoint pair is invalid.

Note By default, **Reverse Route Injection is enabled** is enabled in Firewall Management Center.

Subnet/IP Address (Network) remains the default selection.

When you've selected Protected Networks as *Any* and observe default route traffic being dropped, disable the Reverse Route Injection. Choose **VPN** > **Site to Site**. Edit a VPN and then click **IPsec** > **Enable Reverse Route Injection**. Deploy the configuration changes to remove set reverse-route (Reverse Route Injection) from the crypto map configuration and remove the VPN-advertised reverse route that causes the reverse tunnel traffic to be dropped.

- **Access List (Extended)**—An extended access list provides the capability to control the type of traffic that will be accepted by this endpoint, like GRE or OSPF traffic. Traffic may be restricted either by address or port. Click **Add** (+) to add access control list objects.

Note Access Control List is supported only in the point to point topology.

Exempt VPN traffic from network address translation

Check this check box to exempt the VPN traffic from the Network Address Translation (NAT) rules.

If you do not exempt the VPN traffic from the NAT rules, the traffic gets dropped or is not routed through the VPN tunnel to the remote device. After you enable this option, you can view the NAT exemptions for the device in the NAT policy page (**Devices** > **NAT**, and click **NAT Exemptions**).

Inside interfaces directly connected to the internal network

Specify the security zone or interface group for the inside interface(s) where the protected networks reside. By default, the inside interface is any.

Click **+** to configure one or more interfaces from a security zone or an interface group that can map to one or more inside interfaces. Ensure that the interface type of the security zone or an interface group is Routed.

Advanced Settings

Enable Dynamic Reverse Route Injection—Reverse Route Injection (RRI) enables routes to be automatically inserted into the routing process, for the networks and hosts protected by a remote tunnel endpoint. Dynamic RRI routes are created only upon the successful establishment of IPsec security associations (SA's).

Note

- Dynamic RRI is supported only on IKEv2, and not supported on IKEv1 or IKEv1 + IKEv2.
- Dynamic RRI isn't supported on originate-only peer, Full Mesh topology, and Extranet peer.
- In Point-to-Point, only one peer can have dynamic RRI enabled.
- Between Hub and Spoke, only one of the endpoints can have dynamic RRI enabled.
- Dynamic RRI cannot be combined with a dynamic crypto map.

Send Local Identity to Peers—Select this option to send local identity information to the peer device. Select one of the following **Local Identity Configuration** from the list and configure the local identity:

- **IP address**—Use the IP address of the interface for the identity.
- **Auto**—Use the IP address for pre-shared key and Cert DN for certificate-based connections.
- **Email ID**—Specify the email ID to use for the identity. The email ID can be up to 127 characters.
- **Hostname**—Use the fully qualified hostname.
- **Key ID**—Specify the key-id to use for the identity. The key ID must be fewer than 65 characters.

The local identity is used to configure a unique identity per IKEv2 tunnel, instead of a global identity for all the tunnels. The unique identity allows Firewall Threat Defense to have multiple IPsec tunnels behind a NAT to connect to the Cisco Umbrella Secure Internet Gateway (SIG).

For information about configuring a unique tunnel ID on Umbrella, see **Cisco Umbrella SIG User Guide**.

VPN Filter—Select an extended access list from the list or click **Add** to create a new extended access list object to filter the site-to-site VPN traffic.

The VPN filter provides more security and filters site-to-site VPN data using an extended access list. The extended access list object selected for the VPN filter lets you filter pre-encrypted traffic before entering the VPN tunnel and decrypted traffic that exits a VPN tunnel. The **sysopt permit-vpn** option, when enabled, would bypass the access control policy rules for the traffic coming from the VPN tunnel. When the **sysopt permit-vpn** option is enabled, the VPN filter helps in identifying and filtering the site-to-site VPN traffic.

Note The VPN filter is supported only on Point to Point, and Hub and Spoke topologies. It isn't supported on Mesh topology.

For Hub and Spoke topology, you can choose to override the hub VPN filter on the spoke endpoints in case a different VPN filter needs to enabled on a specific tunnel.

Select the **Override VPN Filter on the Hub** option to override the hub VPN filter on the spokes. Select the **Remote VPN Filter** extended access list object or create an access list to override.

Note For an extranet device as a spoke, only the **Override VPN filter on the Hub** option is available.

For more information about sysopt permit-VPN, see Firewall Threat Defense Advanced Site-to-site VPN Tunnel Options, on page 18.

NAT Traversal (NAT-T)

NAT-T allow seamless communication between the peer Firewall Threat Defense devices when there are NAT devices between these devices. You cannot disable NAT Traversal (NAT-T) per VPN using the Firewall Management Center UI. This option is available from Version 7.4.1. You can use FlexConfig to disable NAT-T. You can add the **crypto map** *map-name seq-num* **set nat-t-disable** command in the FlexConfig object. For example, **crypt map CSM_outside_map 1 set nat-t-disable**.

Note You must create the FlexConfig object with Deployment as 'EveryTime' and Type as 'Append'. This setting removes the command and adds it back for each deployment. If you configure Deployment as 'Once', then the command will be removed in the next deployment. You must be careful when you configure the FlexConfig object with this command. If Firewall Management Center changes the sequence number, the deployment will fail.

Firewall Threat Defense VPN IKE Options

For the versions of IKE you have chosen for this topology, specify the **IKEv1/IKEv2 Settings**.

Note Settings in this dialog apply to the entire topology, all tunnels, and all managed devices.

Navigation Path

Devices > Site To Site. Then click **+ Site To Site VPN**, or edit a listed VPN topology. Click the **IKE** tab.

Fields

Policy

Choose the required IKEv1 or IKEv2 policy objects from the predefined list or create new objects to use. You can choose multiple IKEv1 and IKEv2 policies. IKEv1 and IKEv2 support a maximum of 20

IKE policies, each with a different set of values. Assign a unique priority to each policy that you create. The lower the priority number, the higher the priority.
We recommend that you do not use values such as 10, 20 and so on because the default IKEv2 policy for remote access VPN can have these values as its priority value. Before deployment, verify that the priority values of the IKE policies (site-to-site and remote access VPN) do not conflict.

Note When upgrading from Version 7.4.x or earlier—where the IKEv2 policy priority field is optional—to Version 7.6.x or later—where it is mandatory—leaving the priority field blank may lead to IKEv2 policy configuration issues and affect network traffic. To avoid these problems, ensure that a priority value is set for all IKEv2 policies either before or after the upgrade.

For details, see IKE Policies

Authentication Type

Site-to-site VPN supports two authentication methods, pre-shared key and certificate. For an explanation of the two methods, see Deciding Which Authentication Method to Use.

Note In a VPN topology that supports IKEv1, the **Authentication Method** specified in the chosen IKEv1 Policy object becomes the default in the IKEv1 **Authentication Type** setting. These values must match, otherwise, your configuration will error.

- **Pre-shared Automatic Key**—The Firewall Management Center automatically defines the pre-shared key for this VPN. Specify the **Pre-shared Key Length**, the number of characters in the key, 1-27.

  The character " (double quote) isn't supported as part of pre-shared keys. If you've used " in a pre-shared key, ensure that you change the character after you upgrade to Secure Firewall Threat Defense 6.30 or higher.

- **Pre-shared Manual Key**—Manually assign the pre-shared key for this VPN. Specify the **Key** and then reenter the same to **Confirm Key**.

  When you choose this option for IKEv2, the **Enforce hex-based pre-shared key only** check box appears, check if desired. If enforced, you must enter a valid hex value for the key, an even number of 2-256 characters, using numerals 0-9, or A-F.

- **Certificate**—When you use certificates as the authentication method for VPN connections, peers obtain digital certificates from a CA server in your PKI infrastructure, and trade them to authenticate each other.

  In the **Certificate** field, select a preconfigured certificate enrollment object. This enrollment object generates a trustpoint with the same name on the managed device. The certificate enrollment object should be associated with and installed on the device, post which the enrollment process is complete, and then a trustpoint is created.

  A trustpoint is a representation of a CA or identity pair. A trustpoint includes the identity of the CA, CA-specific configuration parameters, and an association with one enrolled identity certificate.

  Before you select this option, note the following:

  - Ensure you've enrolled a certificate enrollment object on all the endpoints in the topology—A certificate enrollment object contains the Certification Authority (CA) server information and enrollment parameters that are required for creating Certificate Signing Requests (CSRs) and

obtaining Identity Certificates from the specified CA. Certificate Enrollment Objects are used to enroll your managed devices into your PKI infrastructure, and create trustpoints (CA objects) on devices that support VPN connections. For instructions on creating a certificate enrollment object, see Adding Certificate Enrollment Objects, and for instructions on enrolling the object on the endpoints see one of the following as applicable:

- Installing a Certificate Using Self-Signed Enrollment
- Installing a Certificate using EST Enrollment
- Installing a Certificate Using SCEP Enrollment
- Installing a Certificate Using Manual Enrollment
- Installing a Certificate Using a PKCS12 File

Note For a site-to-site VPN topology, ensure that the same certificate enrollment object is enrolled in all the endpoints in the topology. For further details, see the table below.

- Refer the following table to understand the enrollment requirement for different scenarios. Some of the scenarios require you to override the certificate enrollment object for specific devices. See Managing Object Overrides to understand how to override objects.

Certificate Enrollment Types	Device identity certificate for all endpoints is from the same CA		Device identity certificate for all endpoints is from different CAs
	Device-specific parameters are NOT specified in the certificate enrollment object	Device-specific parameters are specified in the certificate enrollment object	
Manual	No override required	Override required	Override required
EST	No override required	Override required	Override required
SCEP	No override required	Override required	Override required
PKCS	Override required	Override required	Override required
Self-signed	Not applicable	Not applicable	Not applicable

- Understand the VPN certificate limitations mentioned in Secure Firewall Threat Defense VPN Certificate Guidelines and Limitations.

Note If you use a Windows Certificate Authority (CA), the default application policies extension is **IP security IKE intermediate**. If you use this default setting, you must select the **Ignore IPsec Key Usage** option in the Advanced Settings section on the **Key** tab in the **PKI Certificate Enrollment** dialog box for the object you select. Otherwise, the endpoints can't complete the site-to-site VPN connection.

Firewall Threat Defense VPN IPsec Options

Note Settings in this dialog apply to the entire topology, all tunnels, and all managed devices.

Configure the basic parameters for a point-to-point topology in a route-based VPN as described in Configure Endpoints for a Point to Point Topology and click the **IPsec** tab.

Crypto-Map Type

A crypto map combines all the components required to set up IPsec security associations (SA). When two peers try to establish an SA, they must each have at least one compatible crypto map entry. The IPsec security negotiation uses the proposals defined in the crypto map entry to protect the data flows specified by that crypto map's IPsec rules. Choose static or dynamic for this deployment's crypto-map:

- **Static**—Use a static crypto map in a point-to-point or full mesh VPN topology.
- **Dynamic**—Dynamic crypto-maps essentially create a crypto map entry without all the parameters configured. The missing parameters are later dynamically configured (as the result of an IPsec negotiation) to match a remote peer's requirements.

  Dynamic crypto map policies are applicable to both hub-and-spoke and point-to-point VPN topologies. To apply these policies, specify a dynamic IP address for one of the peers in the topology and ensure that the dynamic crypto-map is enabled on this topology. In a full mesh VPN topology, you can apply only static crypto map policies.

IKEv2 Mode

For IPsec IKEv2 only, specify the encapsulation mode for applying ESP encryption and authentication to the tunnel. This determines what part of the original IP packet has ESP applied.

- **Tunnel mode**—(default) Encapsulation mode is set to tunnel mode. Tunnel mode applies ESP encryption and authentication to the entire original IP packet (IP header and data), hiding the ultimate source and destination addresses and becoming the payload in a new IP packet.

  The major advantage of tunnel mode is that you don't need to modify the end systems to receive the benefits of IPsec. This mode allows a network device, such as a router, to act as an IPsec proxy. That is, the router performs encryption on behalf of the hosts. The source router encrypts packets and forwards them along the IPsec tunnel. The destination router decrypts the original IP datagram and forwards it onto the destination system. Tunnel mode also protects against traffic analysis; with tunnel mode, an attacker can only determine the tunnel endpoints and not the true source and destination of the tunneled packets, even if they are the same as the tunnel endpoints.
- **Transport preferred**—Encapsulation mode is set to transport mode with an option to fall back to tunnel mode if the peer doesn't support it. In transport mode only the IP payload is encrypted, and

the original IP headers are left intact. Therefore, the admin must select a protected network that matches the VPN interface IP address.

This mode has the advantages of adding only a few bytes to each packet and allowing devices on the public network to see the final source and destination of the packet. With transport mode, you can enable special processing (for example, QoS) on the intermediate network based on the information in the IP header. However, the layer 4 header is encrypted, which limits examination of the packet.

- **Transport required**— Encapsulation mode is set to transport mode only, falling back to tunnel mode is allowed. If the endpoints can't successfully negotiate transport mode, due to one endpoint not supporting it, the VPN connection is not made.

Proposals

Click **Edit** ( ) to specify the proposals for your chosen IKEv1 or IKEv2 method. Select from the available **IKEv1 IPsec Proposals** or **IKEv2 IPsec Proposals** objects, or create and then select a new one. See Configure IKEv1 IPsec Proposal Objects and Configure IKEv2 IPsec Proposal Objects for details.

Enable Security Association (SA) Strength Enforcement

Enabling this option ensures that the encryption algorithm used by the child IPsec SA isn't stronger (in terms of the number of bits in the key) than the parent IKE SA.

Enable Reverse Route Injection

Reverse Route Injection (RRI) enables static routes to be automatically inserted into the routing process for those networks and hosts protected by a remote tunnel endpoint.

Enable Perfect Forward Secrecy

Whether to use Perfect Forward Secrecy (PFS) to generate and use a unique session key for each encrypted exchange. The unique session key protects the exchange from subsequent decryption, even if the entire exchange was recorded and the attacker has obtained the preshared or private keys used by the endpoint devices. If you select this option, also select the Diffie-Hellman key derivation algorithm to use when generating the PFS session key in the Modulus Group list.

Modulus Group

The Diffie-Hellman group to use for deriving a shared secret between the two IPsec peers without transmitting it to each other. A larger modulus provides higher security but requires more processing time. The two peers must have a matching modulus group. For a full explanation of the options, see Deciding Which Diffie-Hellman Modulus Group to Use.

Lifetime Duration

The number of seconds a security association exists before expiring. The default is 28,800 seconds.

Lifetime Size

The volume of traffic (in kilobytes) that can pass between IPsec peers using a given security association before it expires. The default is 4,608,000 kilobytes. Infinite data isn't allowed.

ESPv3 Settings

Validate incoming ICMP error messages

Choose whether to validate ICMP error messages received through an IPsec tunnel and destined for an interior host on the private network.

Enable 'Do Not Fragment' Policy

Define how the IPsec subsystem handles large packets that have the do-not-fragment (DF) bit set in the IP header.

Policy

- Copy DF bit—Maintains the DF bit.
- Clear DF bit—Ignores the DF bit.
- Set DF bit—Sets and uses the DF bit.

Enable Traffic Flow Confidentiality (TFC) Packets

Enable dummy TFC packets that mask the traffic profile which traverses the tunnel. Use the **Burst**, **Payload Size**, and **Timeout** parameters to generate random length packets at random intervals across the specified SA.

Note You can enable dummy Traffic Flow Confidentiality (TFC) packets at random lengths and intervals on an IPsec security association (SA). You must have an IKEv2 IPsec proposal set before enabling TFC.

Enabling TFC packets prevents the VPN tunnel from being idle. Thus the VPN idle timeout configured in the group policy doesn't work as expected when you enable the TFC packets.

Firewall Threat Defense Advanced Site-to-site VPN Deployment Options

The following sections describe the advanced options you can specify in your site-to-site VPN deployment. These settings apply to the entire topology, all tunnels, and all managed devices.

Firewall Threat Defense VPN Advanced IKE Options

Advanced > IKE > ISAKAMP Settings

IKE Keepalive

Enable or disables IKE Keepalives. You can set this option to EnableInfinite so that the device never starts the keepalive monitoring itself.

Threshold

Specifies the IKE keep alive confidence interval. This interval is the number of seconds allowing a peer to idle before beginning keepalive monitoring. The minimum and default interval is 10 seconds; the maximum interval is 3600 seconds.

Retry Interval

Specifies number of seconds to wait between IKE keep alive retries. The default is 2 seconds, the maximum is 10 seconds.

Identity Sent to Peers:

Choose the identity that the peers will use to identify themselves during IKE negotiations:

- **autoOrDN**(default)—Determines IKE negotiation by connection type: IP address for preshared key, or Cert DN for certificate authentication (not supported).
- **ipAddress**—Uses the IP addresses of the hosts exchanging ISAKMP identity information.
- **hostname**—Uses the fully qualified domain name of the hosts exchanging ISAKMP identity information. This name comprises the hostname and the domain name.

Note Enable or disable this option for all your VPN connections.

Peer Identity Validation

During IKE tunnel establishment, the peer provides its identity: either an IP address, a Fully Qualified Domain Name (FQDN), or a Distinguished Name (DN). It also presents a certificate, which contains none, some, or all of these fields.

If IKE peer identity validation is enabled, the Firewall Threat Defense compares the peer's identity to the respective field in the certificate to see if the information matches. If the information matches, then the peer's identity is validated and the Firewall Threat Defense establishes the tunnel. If the information does not match, the tunnel is not established.

- **Do not check**—Firewall Threat Defense does not validate the peer identity.
- **Required**—Firewall Threat Defense validates the peer identity.
- **If supported by cert**—Firewall Threat Defense validates the peer identity only if the peer provides a certificate.

Enable Aggressive Mode

Select this negotiation method for exchanging key information if the IP address isn't known and DNS resolution might not be available on the devices. Negotiation is based on hostname and domain name.

Enable Notification on Tunnel Disconnect

Allows an administrator to enable or disable the sending of an IKE notification to the peer when an inbound packet that is received on an SA does not match the traffic selectors for that SA. This notification is disabled by default.

Advanced > IKE > IVEv2 Security Association (SA) Settings

More session controls are available for IKE v2 that limit the number of open SAs. By default, there's no limit to the number of open SAs.

Cookie Challenge

Whether to send cookie challenges to peer devices in response to SA initiate packets, which can help thwart denial of service (DoS) attacks. The default is to use cookie challenges when 50% of the available SAs are in negotiation. Select one of these options:

- Custom
- Never (default)
- Always

Threshold to Challenge Incoming Cookies

The percentage of the total allowed SAs that are in-negotiation. This triggers cookie challenges for any future SA negotiations. The range is zero to 100%.

Number of SAs Allowed in Negotiation

Limits the maximum number of SAs that can be in negotiation at any time. If used with Cookie Challenge, configure the cookie challenge threshold lower than this limit for an effective cross-check.

Maximum number of SAs Allowed

Limits the number of allowed IKEv2 connections. Default is unlimited.

Enable Notification on Tunnel Disconnect
Allows an administrator to enable or disable the sending of an IKE notification to the peer when an inbound packet that is received on an SA doesn't match the traffic selectors for that SA. Sending this notification is disabled by default.

Firewall Threat Defense VPN Advanced IPsec Options

Advanced > IPsec > IPsec Settings

Enable Fragmentation Before Encryption
This option lets traffic travel across NAT devices that don't support IP fragmentation. It doesn't impede the operation of NAT devices that do support IP fragmentation.

Path Maximum Transmission Unit Aging
Check to enable Path Maximum Transmission Unit (PMTU) Aging, the interval to reset the PMTU of a Security Association (SA).

Value Reset Interval
Enter the number of minutes at which the PMTU value of an SA is reset to its original value. Valid range is 10 to 30 minutes, default is unlimited.

Firewall Threat Defense Advanced Site-to-site VPN Tunnel Options

Navigation Path

Devices > Site To Site, then click **+ Site To Site VPN**, or edit a listed VPN Topology. Click the **Advanced** tab, and select **Tunnel** in the navigation pane.

Tunnel Options

Only available for Hub and Spoke, and Full Mesh topologies. This section doesn't appear for Point to Point configurations.

- **Enable Spoke to Spoke Connectivity through Hub**—Disabled by default. Choosing this field enables the devices on each end of the spokes to extend their connection through the hub node to the other device.

NAT Settings

- **Keepalive Messages Traversal** —Enabled by default. This parameter is a global setting that enables NAT-T for all endpoints within a topology. Check this check box to enable keepalive messages for NAT traversal. NAT traversal keepalive is used for the transmission of keepalive messages when there's a device (middle device) located between a VPN-connected hub and spoke, and that device performs NAT on the IPsec flow.

  NAT traversal allows seamless communication between the peer Firewall Threat Defense devices when there are NAT devices between these devices. For hub and spoke topologies, this option is available only for the spoke.

  If you select this option, configure the **Interval**, in seconds, between the keepalive signals sent between the spoke and the middle device to indicate that the session is active. The value can be from 5 to 3600 seconds. The default is 20 seconds.

TrustSec (SGT) Settings

- **Enable SGT propagation over Virtual Tunnel Interfaces**—Cisco TrustSec uses Security Group Tags (SGTs) to control access and enforce traffic on a network. This option enables SGT propagation over SVTIs and DVTIs of the VPN topology. To enable SGT propagation on a specific SVTI or DVTI, configure it in individual devices. Note that the Firewall Threat Defense device must be Version 10.0.0 and later.

Access Control for VPN Traffic

Bypass Access Control policy for decrypted traffic (sysopt permit-vpn)—By default, the Firewall Threat Defense applies access control policy inspection on the decrypted traffic. Enable this option to bypass the ACL inspection. The Firewall Threat Defense still applies the VPN Filter ACL and authorization ACL downloaded from the AAA server to the VPN traffic.

Enable or disable the option for all your VPN connections. If you disable this option, ensure that the traffic is allowed by the access control policy or prefilter policy.

Note For route-based VPNs, **sysopt permit-vpn** does not work. You must always create access control rules to allow route-based VPN traffic.

Certificate Map Settings

- **Use the certificate map configured in the Endpoints to determine the tunnel**—If this option is enabled (checked), the tunnel is determined by matching the contents of the received certificate to the certificate map objects configured in the endpoint nodes.
- **Use the certificate OU field to determine the tunnel**—Indicates that if a node isn't determined based on the configured mapping (the above option) if selected, then use the value of the organizational unit (OU) in the subject distinguished name (DN) of the received certificate to determine the tunnel.
- **Use the IKE identity to determine the tunnel**—Indicates that if a node isn't determined based on a rule matching or taken from the OU (the above options) if selected, then the certificate-based IKE sessions are mapped to a tunnel based on the content of the phase1 IKE ID.
- **Use the peer IP address to determine the tunnel**—Indicates that if a tunnel isn't determined based on a rule matching or taken from the OU or IKE ID methods (the above options) if selected, then use the established peer IP address.

Configure Virtual Tunnel Interfaces

Firewall Management Center supports a routable logical interface called the Virtual Tunnel Interface (VTI).

About Virtual Tunnel Interfaces

Firewall Management Center supports a routable logical interface called the Virtual Tunnel Interface (VTI). VTIs do not require a static mapping of IPsec sessions to a physical interface. The IPsec tunnel endpoint is

associated with a virtual interface. You can use these interfaces like other interfaces and apply static and dynamic routing policies.

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. VTIs use static or dynamic routes. The device encrypts or decrypts the traffic from or to the tunnel interface and forwards it according to the routing table. Deployments become easier, and having VTI which supports route-based VPN with dynamic routing protocol also satisfies many requirements of a virtual private cloud. Firewall Management Center enables you to easily migrate from crypto-map based VPN configuration to VTI-based VPN.

You can configure route-based VPN with static or dynamic VTI using the site-to-site VPN wizard. Traffic is encrypted using static route, BGP, OSPFv2/v3, or EIGRP.

You can create a routed security zone, add VTI interfaces to it, and define access control rules for the decrypted traffic control over the VTI tunnel.

You can create VTI-based VPNs between:

- Two Firewall Threat Defense devices.
- A Firewall Threat Defense and public cloud.
- One Firewall Threat Defense and another Firewall Threat Defense with service provider redundancy.
- A Firewall Threat Defense and any other device with VTI interfaces.
- A Firewall Threat Defense and another device with policy-based VPN configuration.

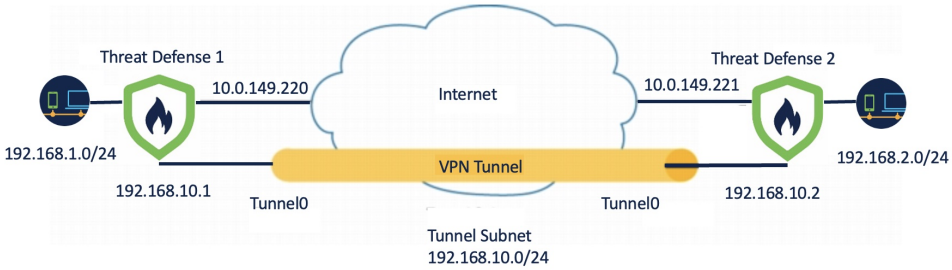
There are two types of VTI interfaces: static VTI and dynamic VTI.

For more information, see Static VTI, on page 20 and Dynamic VTI, on page 21.

Static VTI

Static VTI uses tunnel interfaces to create a tunnel that is always-on between two sites. You must define a physical interface as a tunnel source for a static VTI. You can associate a maximum of 1024 VTIs per device. To create a static VTI interface in the management center, see Add a VTI Interface, on page 27.

The figure below shows a VPN topology using static VTIs.



On Threat Defense 1:

- Static VTI IP address is 192.168.10.1
- Tunnel source is 10.0.149.220
- Tunnel destination is 10.0.149.221

On Threat Defense 2:

- Static VTI IP address is 192.168.10.2
- Tunnel source is 10.0.149.221
- Tunnel destination is 10.0.149.220

Benefits

- Minimizes and simplifies configuration.

  You do not have to track all remote subnets for a crypto map access list, and configure complex access lists or crypto maps.

- Provides a routable interface.

  Supports IP routing protocols such as BGP, EIGRP, and OSPFv2/v3, and static routes.

- Supports backup VPN tunnels
- Supports load balancing using ECMP.
- Supports virtual routers.
- Provides differential access control for VPN traffic.

  You can configure a VTI with a security zone and use it in an AC policy. This configuration:

  - Allows you to classify and differentiate VPN traffic from clear-text traffic and permit VPN traffic selectively.
  - Provides differential access-control for VPN traffic across different VPN tunnels.

Dynamic VTI

Dynamic VTI uses a virtual template for dynamic instantiation and management of IPsec interfaces. The virtual template dynamically generates a unique virtual access interface for each VPN session. Dynamic VTI supports multiple IPsec security associations and accepts multiple IPsec selectors proposed by the spoke.

Benefits

- Minimizes and simplifies configuration.

  You do not have to configure complex access lists or crypto maps.

- Simplifies management.
  - Easily manage peer configuration for large enterprise hub and spoke deployments.
  - Use only one dynamic VTI for multiple spokes, instead of configuring one static VTI per spoke.
- Provides a routable interface.

  Supports IP routing protocols such as BGP, EIGRP, and OSPFv2/v3.

- Simplifies scaling

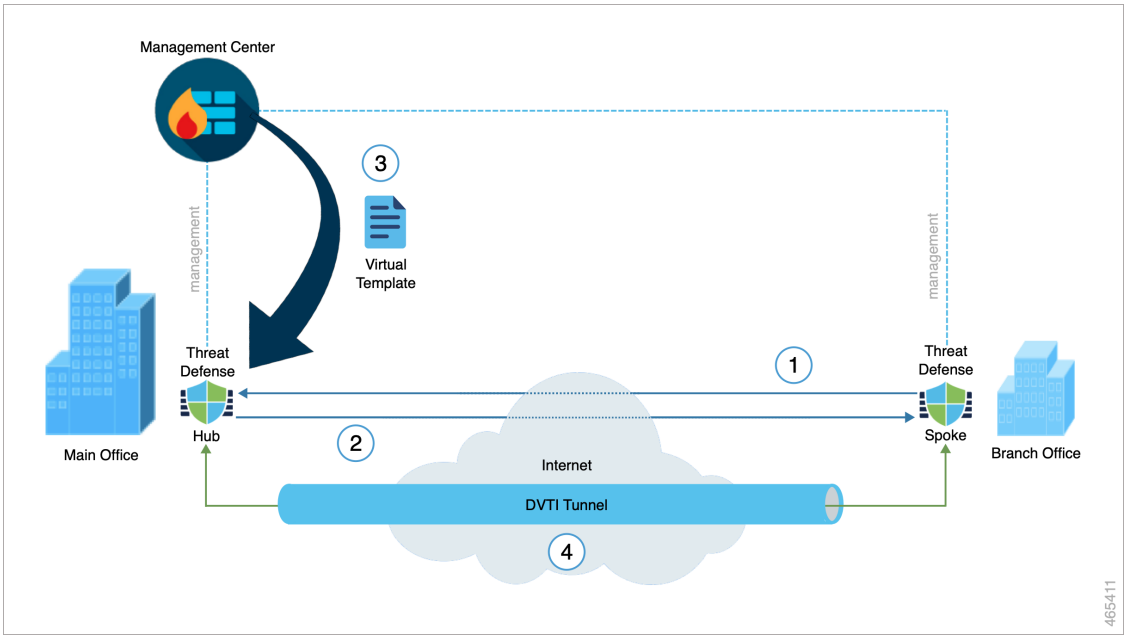
Addition of new spokes does not require any additional VPN configuration on the hub. You may need to update NAT and routing configurations depending upon the setup.

- Support for backup VPN tunnels.
- Supports dynamic spokes.

  You do not have to update the hub configuration for spoke's DHCP IP address changes.
- Conserves IP addresses.
  - Uses the IP unnumbered interface functionality to borrow the IP address from another physical or loopback interface.
  - All virtual access interfaces associated to a dynamic VTI use the same IP address.
- Supports virtual routers.
- Provides differential access control for VPN traffic.

  You can configure a VTI with a security zone and use it in an AC policy. This configuration:
  - Allows you to classify and differentiate VPN traffic from clear-text traffic and permit VPN traffic selectively.
  - Provides differential access-control for VPN traffic across different VPN tunnels.

How Does the Firewall Management Center Create a Dynamic VTI Tunnel for a VPN Session



When a spoke initiates a tunnel request with the hub:

1. The spoke initiates an IKE exchange with the hub for a VPN connection.
2. The hub authenticates the spoke.

3. The Firewall Management Center assigns a dynamic virtual template on the hub for the spoke.

   The virtual template dynamically generates a virtual access interface on the hub. This interface is unique for the VPN session with the spoke.

4. The hub establishes a dynamic VTI tunnel with the spoke using the virtual access interface.

   a. The hub and spoke exchange traffic over the tunnel using:

      - Specific traffic proposed by the spokes over IKE exchanges.
      - BGP/OSPF/EIRGP protocols over the IPsec tunnel.

   b. After the VPN session ends, the tunnel disconnects and the hub deletes the corresponding virtual access interface.

To create a dynamic VTI interface in the Firewall Management Center, see Add a VTI Interface, on page 27.

To configure a route-based site-to-site VPN using dynamic VTI, see Configure Dynamic VTI for a Route-based Site-to-Site VPN, on page 41.

Virtual Routers and Dynamic VTI

You can create virtual routers, associate dynamic VTIs with these virtual routers, and extend the capabilities of dynamic VTIs in your network. You can associate dynamic VTIs either with global or user-defined virtual routers. You can assign a dynamic VTI to only one virtual router.

A virtual router associated with:

- A dynamic VTI is called an Indoor VRF (IVRF).
- A tunnel source interface is known as Front Door VRF (FVRF).

A dynamic VTI and its corresponding protected network interface must be part of the same virtual router. You must map the borrow IP interface and the dynamic VTI to the same virtual router. A tunnel source interface can be part of multiple virtual routers.

To configure virtual routers using dynamic VTI for a route-based site-to-site VPN, see How to Configure a Virtual Router with Dynamic VTI.

For more information about a configuration example, see How to Secure Traffic from Networks with Multiple Virtual Routers over a Site-to-Site VPN with Dynamic VTI

Guidelines and Limitations for Virtual Tunnel Interfaces

IPv6 Support

- VTI supports IPv6.
- You can use an IPv6 address for the tunnel source interface and use the same address as the tunnel endpoint.
- The Firewall Management Center supports the following combinations of VTI IP (or internal networks IP version) over public IP versions:
  - IPv6 over IPv6

  - IPv4 over IPv6
  - IPv4 over IPv4
  - IPv6 over IPv4
- VTI supports static and dynamic IPv6 addresses as the tunnel source and destination.
- The tunnel source interface can have IPv6 addresses and you can specify the tunnel endpoint address. If you don’t specify the address, by default, the Firewall Threat Defense uses the first IPv6 global address in the list as the tunnel endpoint.

BGP IPv6 Support

VTI supports IPv6 BGP.

EIGRP IPv4 Support

VTI supports IPv4 EIGRP.

OSPFv2 and OSPFv3 IPv6/IPv4 Support

VTI supports IPv4 and IPv6 OSPF.

ECMP Support

- Configure the spokes' static VTIs in an ECMP zone to load balance the application traffic. If you do not configure the ECMP zone, the remaining paths act as backup paths when the primary path goes down.

Multi-instance and Clustering

- VTI is supported in multi-instance.
- VTIs aren’t supported with clustering.

Firewall Mode

VTI is supported in routed mode only.

Limitations for Static VTI

- Only 20 unique IPSec profiles are supported.
- In policy-based routing, you can configure VTI only as an egress interface.
- You cannot configure a VTI interface as a network interface for a remote access VPN policy.

Limitations for Dynamic VTI

- Dynamic VTI does not support:
  - ECMP
  - VRF in multi-instance

- Clustering
- IKEv1
- QoS

- If a spoke has a dynamic IP address and a hub has a dynamic VTI behind a NAT, the tunnel status will be unknown.
- For a dynamic extranet, when multiple spokes establish a connection, the site-to-site monitoring dashboard does not show the individual tunnels.
- If you configure a hub with dynamic VTI behind NAT with dynamic spokes, the VPN monitoring data will not be accurate.
- You cannot configure a VTI interface as a network interface for a remote access VPN policy.

General Configuration Guidelines for Static and Dynamic VTI

- If you use dynamic crypto maps and dynamic VTIs in your site-to-site 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 site-to-site VPNs to dynamic VTIs.
  - Use static crypto maps with their own tunnel-groups.

- VTIs are only configurable in IPsec mode.
- Dynamic VTI supports only the hub and spoke topology in the management center.
- Dynamic VTI supports only threat defense devices from version 7.3.
- We recommend that you configure only a single hub for a route-based hub and spoke topology. To configure a topology with multiple hubs for a set of spokes, with one hub as the backup hub, configure multiple topologies with a single hub and the same set of spokes. For more information, see Configure Multiple Hubs in a Route-based VPN, on page 35.
- You can use static, BGP, EIGRP IPv4, OSPFv2/v3 routes for traffic using the tunnel interface.
- In an HA configuration with dynamic routing, the standby device cannot access the known subnets through the VTI tunnels as these tunnels are created with the active IP address.
- You can configure a maximum of 1024 static and dynamic 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 can’t configure nameif on the 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.
  - The VTI count on a platform is limited to the number of VLANs configurable on that platform. For example, Firepower 1120 supports 512 VLANs, the tunnel count is 512 *minus* the number of physical interfaces configured.

- If you're configuring more than 400 VTIs on a device in a high-availability setup, you must configure 45 seconds as the unit holdtime for the Firewall Threat Defense HA.
- The MTU for VTIs is automatically set, according to the underlying physical interface.
- For dynamic VTI, the virtual access interface inherits the MTU from the configured tunnel source interface. If you don't specify the tunnel source interface, the virtual access interface inherits the MTU from the source interface from which the threat defense accepts the VPN session request.
- Static VTI supports IKE versions v1, v2, and uses IPsec for sending and receiving data between the tunnel's source and destination.
- Dynamic VTI supports only IKE version v2, and uses IPsec for sending and receiving data between the tunnel's source and destination.
- For static and dynamic VTI, ensure that you don't use the borrow IP interface as the tunnel source IP address for any VTI interface.
- When you configure a route-based site-to-site VPN using static or dynamic VTI interfaces, ensure that the value of the TTL hop is more than one if you use BGP.
- If NAT has to be applied, the IKE and ESP packets are encapsulated in the UDP header.
- IKE and IPsec security associations are re-keyed continuously regardless of data traffic in the tunnel. This ensures that VTI tunnels are always up.
- Tunnel group name must match what the peer sends as its IKEv1 or IKEv2 identity.
- For IKEv1 in LAN-to-LAN tunnel groups, you can use names which aren't 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 coexist on the same physical interface, if the peer address configured in the crypto map and the tunnel destination for the VTI are different.
- By default, all traffic sent through a VTI is encrypted.
- Access rules can be applied on a VTI interface to control traffic through VTI.
- You can associate VTI interfaces with ECMP zones and configure ECMP static routes to achieve the following:
  - Load balancing (Active/Active VTIs)—Connection can flow over any of the parallel VTI tunnels.
  - Seamless connection migration—When a VTI tunnel becomes unreachable, the flows are seamlessly migrated to another VTI interface that is configured in the same zone.
  - Asymmetric routing—Forward traffic flow through one VTI interface and configure the reverse traffic flow through another VTI interface.

  For information on configuring ECMP, see Configure an Equal Cost Static Route.
- For route-based VPNs, Bypass Access Control policy for decrypted traffic (**sysopt connection permit-vpn**) does not work. You must always create access control rules to allow route-based VPN traffic.
- Ensure that you remove unused transform sets from route-based IKE VPN configurations. If you have unused transform sets, the VPN tunnels may not come up and encapsulation and decapsulation will not happen. Use `show run crypto` and `show vpn-sessiondb detail l2l` commands to view the transform sets.

Backup VTI Guidelines and Limitations

- Flow resiliency across tunnel failovers isn't supported. For example, the clear text TCP connection gets lost after a tunnel failover, and you need to reinitiate any FTP transfer that took place during the failover.
- Certificate authentication isn't supported in backup VTI.

Guidelines for Dynamic VTI and Virtual Routers

- A dynamic VTI and its corresponding protected network interface must be part of the same virtual router.
- You must map the borrow IP interface and the dynamic VTI to the same virtual router.
- User-defined virtual routers support only BGPv4/v6 and OSPFv2 routing protocols.
- A tunnel source interface can be in a different user-defined virtual router than that associated with the dynamic VTI.

Related Topics

Guidelines and Limitations for Loopback Interfaces
Create a Route-based Site-to-Site VPN, on page 28

Add a VTI Interface

For configuring a route-based site-to-site VPN, you must create a VTI interface on the devices at both the nodes of the VTI tunnel.

When you specify the tunnel type as dynamic and configure the related parameters, the Firewall Management Center generates a dynamic virtual template. The virtual template dynamically generates the virtual access interface that is unique for each VPN session.

Before you begin

Configure a loopback interface for redundancy of static and dynamic VTI VPN tunnels. For more information, see Configure a Loopback Interface.

For a Secure Firewall 1200/3100/4200device, IPsec flow offload is also used when the device's VTI loopback interface is enabled.

Procedure

Step 1 Choose **Devices** > **Device Management**.

Step 2 Click the **Edit** icon next to the device on which you want to create a VTI interface.

Step 3 Choose **Add Interfaces > Virtual Tunnel Interface**.

Step 4 Select the **Tunnel Type** as **Static** or **Dynamic**.

Step 5 Enter the name and description for the interface. By default, the interface is enabled.

Ensure that you specify a name that is not longer than 28 characters.

Step 6 (Optional) Choose a security zone from the **Security Zone** drop-down list to add the static VTI or dynamic VTI interface to that zone.

If you want to perform traffic inspection based on a security zone, add the VTI interface to the security zone and configure an access control (AC) rule. To permit the VPN traffic over the tunnel, you need to add an AC rule with this security zone as the source zone.

Step 7 In the **Priority** field, enter the priority to load balance the traffic across multiple VTIs.

The range is from 0 to 65535. The lowest number has the highest priority. This option is not applicable for dynamic VTI.

Step 8 Depending on the tunnel type, do one of the following:

- For a dynamic VTI, enter a unique ID in the range of 1 to 10413 in the **Template ID** field.
- For a static VTI, enter a unique tunnel ID in the range of 0 to 10413 in the **Tunnel ID** field.

Step 9 (Optional for dynamic VTI) Choose the tunnel source interface from the **Tunnel Source** drop-down list.

The VPN tunnel terminates at this interface, a physical or loopback interface. Choose the IP address of the interface from the drop-down list. You can select the IP address irrespective of the IPsec tunnel mode. In case of multiple IPv6 addresses, select the address that you want to use as the tunnel endpoint.

Step 10 Under **IPSec Tunnel Mode**, click the **IPv4** or **IPv6** radio button to specify the traffic type over the IPsec tunnel.

Step 11 Under **IP Address**:

- **Configure IP**: Enter the IPv4 or IPv6 address for the static VTI interface. You cannot configure an IP address for a dynamic VTI interface. Use the **Borrow IP** field for the dynamic VTI interface.
- **Borrow IP (IP unnumbered)**: Choose a physical or loopback interface from the drop-down list, the VTI interface inherits this IP address.

  Ensure that you use an IP address different from the tunnel source IP address. You can use this option for a static or dynamic VTI interface.

  Click Add ＋ to configure a loopback interface. 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.

Step 12 Click **OK**.

Step 13 Click **Save**.

Create a Route-based Site-to-Site VPN

You can configure a route-based site-to-site VPN for the following two topologies:

- **Point to Point** : Configure VTIs on both nodes of the tunnel and use the wizard to configure the VPN.
- **Hub and Spoke**: Configure VTIs on the hub and the spokes. Configure the hub with a dynamic VTI and spokes with static VTIs.

You can configure an extranet device as the hub and managed devices as spokes. You can configure multiple hubs and spokes, and also configure backup hubs and spokes.

- For extranet hubs and spokes, you can configure multiple IPs as backup.

- For managed spokes, you can configure a backup static VTI interface along with the primary VTI interface.

For more information on VTI, see About Virtual Tunnel Interfaces, on page 19.

Note All references to VTI stands for static VTI and dynamic VTI, unless mentioned.

Procedure

Step 1 Choose **Devices** > **VPN** > **Site to Site**.

Step 2 Click **+ Site To Site VPN**.

Step 3 Enter a name for the VPN topology in the **Topology Name** field.

Step 4 Choose **Route Based (VTI)** and do one of the following:

- Select **Point to Point** as the network topology. To configure endpoints for a route-based **Point to Point** topology, see Configure Endpoints for a Point to Point Topology, on page 29.
- Select **Hub and Spoke** as the network topology. To configure endpoints for a route-based **Hub and Spoke** topology, see Configure Endpoints for a Hub and Spoke Topology, on page 32.

Step 5 (Optional) Specify the **IKE** options for the deployment as described in Firewall Threat Defense VPN IKE Options, on page 11.

Step 6 (Optional) Specify the **IPsec** options for the deployment as described in Firewall Threat Defense VPN IPsec Options, on page 14.

Step 7 (Optional) Specify the **Advanced** options for the deployment as described in Firewall Threat Defense Advanced Site-to-site VPN Deployment Options, on page 16.

Step 8 Click **Save**.

What to do next

After you configure VTI interfaces and VTI tunnel on both the devices, you must configure:

- A routing policy to route the VTI traffic between the devices over the VTI tunnel. For more information, see Configure Routing and AC Policies for VTI, on page 41.
- An access control rule to allow encrypted traffic. Choose **Policies > Access Control**.

Configure Endpoints for a Point to Point Topology

Configure the following parameters to configure endpoints for a route-based site-to-site VPN for the **Point to Point** topology nodes:

Before you begin

Configure the basic parameters for a point-to-point topology in a route-based VPN as described in Create a Route-based Site-to-Site VPN, on page 28 and click the **Endpoints** tab.

Procedure

Step 1 Under **Node A**, in the **Device** drop-down menu, select the name of the registered device (Firewall Threat Defense) or extranet as the first endpoint of your VTI tunnel.

For an extranet peer, specify the following parameters:

a. Specify the name of the device.

b. Enter the primary IP address in the **Endpoint IP address** field. If you configure a backup VTI, add a comma and, specify the backup IP address.

c. Click **OK**.

After configuring the above parameters for the extranet hub, specify the pre-shared key for the extranet in the **IKE** tab.

Note
The AWS VPC has **AES-GCM-NULL-SHA-LATEST** as the default policy. If the remote peer connects to AWS VPC, select **AES-GCM-NULL-SHA-LATEST** from the **Policy** drop-down list to establish the VPN connection without changing the default value in AWS.

Step 2 For a registered device, you can specify the VTI interface for Node A from the **Virtual Tunnel Interface** drop-down list.

The selected tunnel interface is the source interface for Node A and the tunnel destination for Node B.

If you want to create a new interface on Node A, click the Add + icon and configure the fields as described in Add a VTI Interface, on page 27.

If you want to edit the configuration of an existing VTI, select the VTI in the **Virtual Tunnel Interface** drop-down field and click **Edit VTI**.

Step 3 If your Node A device is behind a NAT device, check the **Tunnel Source IP is Private** check box. In the **Tunnel Source Public IP Address** field, enter the tunnel source public IP address.

Step 4 **Send Local Identity to Peers**—Select this option to send local identity information to the peer device. Select one of the following **Local Identity Configuration** from the list and configure the local identity:

- **IP address**—Use the IP address of the interface for the identity.
- **Auto**—Use the IP address for pre-shared key and Cert DN for certificate-based connections.
- **Email ID**—Specify the email ID to use for the identity. The email ID can be up to 127 characters.
- **Hostname**—Use the fully qualified hostname.
- **Key ID**—Specify the key-id to use for the identity. The key ID must be fewer than 65 characters.

The local identity is used to configure a unique identity per IKEv2 tunnel, instead of a global identity for all the tunnels. The unique identity allows Firewall Threat Defense to have multiple IPsec tunnels behind a NAT to connect to a Cisco Umbrella Secure Internet Gateway (SIG).

For information about configuring a unique tunnel ID on Umbrella, see **Cisco Umbrella SIG User Guide**.

Step 5 (Optional) Click **Add Backup VTI** to specify an extra VTI as the backup interface and configure the parameters.

Note
Ensure that both peers of the topology do not have the same tunnel source for the backup VTI. A device cannot have two VTIs with the same tunnel source and tunnel destination; hence, configure a unique tunnel source and tunnel destination combination.

Though the virtual tunnel interface is specified under Backup VTI, the routing configuration determines which tunnel to be used as primary or backup.

Step 6 Expand **Advance Settings** to configure additional configurations for the device. For more information, see Advanced Configurations for a Point to Point Topology in a Route-based VPN, on page 31.

Step 7 Repeat the above procedure for Node B.

Step 8 Click **OK**.

What to do next

- (Optional) Specify the **IKE** options for the deployment as described in Firewall Threat Defense VPN IKE Options, on page 11.
- (Optional) Specify the **IPsec** options for the deployment as described in Firewall Threat Defense VPN IPsec Options, on page 14.
- (Optional) Specify the **Advanced** options for the deployment as described in Firewall Threat Defense Advanced Site-to-site VPN Deployment Options, on page 16.
- Click **Save**.
- To route traffic to the VTI, choose **Devices** > **Device Management**, edit the threat defense device and click the **Routing** tab.

  You can configure the static routes, or use BGP, OSPF v2/v3, or EIGRP for routing the VPN traffic.
- To permit VPN traffic, choose **Policies** > **Access Control heading** > **Access Control**. Add a rule specifying the security zone of the VTI. For a backup VTI, ensure that you include the backup VTI in the same security zone as that of the primary VTI.

Advanced Configurations for a Point to Point Topology in a Route-based VPN

Configure the following advanced configurations for a point-to-point topology in a route-based VPN:

Before you begin

Configure the basic parameters for a point-to-point topology in a route-based VPN as described in Configure Endpoints for a Point to Point Topology, on page 29 and expand **Advance Settings**.

Procedure

Step 1 Check the **Send Virtual Tunnel Interface IP to the peers** check box to send the VTI IP address to the peer device.

Step 2 Check the **Allow incoming IKEv2 routes from the peers** check box to allow incoming IKEv2 routes from the spokes and peers.

Step 3 Choose one of the following from the **Connection Type** drop-down list:

Answer Only: The device can only respond when a peer device initiates a connection, it can't initiate any connection.

Bidirectional: The device can initiate or respond to a connection. This is the default option.

Configure Endpoints for a Hub and Spoke Topology

You can create a route-based site-to-site VPN using dynamic VTI only for hub and spoke topologies. The hub can use only a dynamic VTI and the spokes can use only static VTI interfaces. You can also configure an extranet device as a hub.

Configure the following parameters to configure endpoints for a route-based site-to-site VPN for the **Hub and Spoke** topology nodes:

Before you begin

Configure the basic parameters for a hub and spoke topology in a route-based VPN as described in Create a Route-based Site-to-Site VPN, on page 28 and click the **Endpoints** tab.

Procedure

Step 1 Under **Hub Nodes**:

a) Click Add + to configure the hub node in the **Add Endpoint** dialog box.

b) Choose a hub from the **Device** drop-down list.

Note
A Firewall Threat Defense device running on software version 7.2 can't be configured as a hub. It must be an extranet or a device running on software version 7.3 or later.

For an extranet hub, specify the following parameters:

1. Enter the name of the device.
2. Enter the primary IP address. If you configure a backup VTI, add a comma, and then specify the backup IP address.
3. Click **OK**.

After configuring the above parameters for the extranet hub, specify the pre-shared key for the extranet in the **IKE** tab.

Note
The AWS VPC has **AES-GCM-NULL-SHA-LATEST** as the default policy. If the remote peer connects to AWS VPC, select **AES-GCM-NULL-SHA-LATEST** from the **Policy** drop-down list to establish the VPN connection without changing the default value in AWS.

c) Choose a dynamic VTI from the **Dynamic Virtual Tunnel Interface** drop-down list.

Tunnel source configuration is mandatory for a dynamic VTI as the management center needs this information to determine the tunnel destination of the spoke.

Click Add + to add a new dynamic VTI. We recommend that you configure the Borrow IP for the dynamic interface from a loopback interface.

If you want to edit an existing dynamic VTI, select the interface, and click **Edit VTI**.

d) (Optional) If your endpoint device is behind a NAT device, check the **Tunnel Source IP is Private** check box and configure the tunnel source IP address in the **Tunnel Source Public IP Address** field.
e) Click **Routing Policy** to configure the routing policy for the hub.
f) Click **AC Policy** to configure the access control policy.
g) Expand **Advance Settings** to configure additional configurations on the hub. For more information, see Advanced Configurations for Hub and Spokes in a Route-based VPN, on page 34.
h) Click **OK**.

Step 2 Under **Spoke Nodes**:

a) Click Add + to configure the spoke in the **Add Endpoint** dialog box.
b) Choose a spoke from the **Device** drop-down list.

For an extranet spoke, specify the following parameters:

1. Enter the name of the device.
2. Under **Endpoint IP Address**, choose one of the following:
   - **Static**: Enter the IP address of the device, and the backup IP address, if required.
   - **Dynamic**: Choose this option to dynamically assign the IP addresses for the extranet spokes.
3. Click **OK**.

c) Choose a static VTI from the **Static Virtual Tunnel Interface** drop-down list.

Click Add + to add a new static VTI. Tunnel IP of the static VTI is auto populated, ensure that this IP address is unique for the spoke.

If you want to edit an existing static VTI, select the interface, and click **Edit VTI**.

d) (Optional) If your endpoint device is behind a NAT device, check the **Tunnel Source IP is Private** check box. The management center needs the tunnel source interface address to configure the tunnel destination IP address on the spokes. In the **Tunnel Source Public IP Address** field, enter the tunnel source public IP address.
e) (Optional) **Send Local Identity to Peers**—Check this check box to send the local identity information to the peer device. Choose one of the following parameters from the **Local Identity Configuration** drop-down list and configure the local identity:
   - **IP address**—Use the IP address of the interface for the identity.
   - **Auto**—Use the IP address for pre-shared key and Cert DN for certificate-based connections.
   - **Email ID**—Specify the email ID to use for the identity. The email ID can be up to 127 characters.
   - **Hostname**—Use the fully qualified hostname.
   - **Key ID**—Specify the key-id to use for the identity. The key ID must be less than 65 characters.

The local identity is used to configure a unique identity per IKEv2 tunnel, instead of a global identity for all the tunnels. The unique identity allows Firewall Threat Defense to have multiple IPsec tunnels behind a NAT to connect to the Cisco Umbrella Secure internet Gateway (SIG).

For more information about configuring a unique tunnel ID on Umbrella, see *Cisco Umbrella SIG User Guide*.

f) (Optional) Click **Add Backup VTI** to specify an extra VTI interface as the backup interface.

Note
Ensure that both peers of the topology do not have backup VTI configured on the same tunnel source. For instance, if Peer A is having two VTIs (primary and a backup) configured with a single tunnel source interface, say, 10.10.10.1/30, then Peer B also can't have its 2 VTIs with a single tunnel source IP, say 20.20.20.1/30.

Though the virtual tunnel interface is specified under backup VTI, the routing configuration determines which tunnel to be used as primary or backup.

g) Click **Routing Policy** to configure the routing policy for the spoke.
h) Click **AC Policy** to configure the access control policy.
i) Expand **Advance Settings** to configure additional configurations on the spoke. For more information, see Advanced Configurations for Hub and Spokes in a Route-based VPN, on page 34.
j) Click **OK**.

What to do next

- (Optional) Specify the **IKE** options for the deployment as described in Firewall Threat Defense VPN IKE Options, on page 11.
- (Optional) Specify the **IPsec** options for the deployment as described in Firewall Threat Defense VPN IPsec Options, on page 14.
- (Optional) Specify the **Advanced** options for the deployment as described in Firewall Threat Defense Advanced Site-to-site VPN Deployment Options, on page 16.
- Click **Save**.

Advanced Configurations for Hub and Spokes in a Route-based VPN

Configure the following advanced configurations for a hub and spoke in a route-based VPN:

Before you begin

Configure the basic parameters for a hub and spoke in a route-based VPN as described in Configure Endpoints for a Hub and Spoke Topology, on page 32 and expand **Advance Settings**.

Note Only the **Connection Type** field is applicable to the device running on software version 7.2. The remaining fields don't apply to this version of the device.

Procedure

Step 1 Check the **Send Virtual Tunnel Interface IP to the peers** check box to send the VTI IP address to the peer device.

For a hub, you must check this check box if you use BGP as the routing protocol. This configuration ensures that the loopback IP address is shared in the BGP routing table.

For a spoke, this option is enabled by default.

Step 2 Add the **Protected Networks** to define the networks protected by the VPN endpoint. Click Add + to select a protected network.

For a hub, configure the protected networks behind the hub. This information and the spoke's protected network generate the spoke access list.

You cannot create a static route for a virtual access interface on a hub with dynamic VTI. The hub creates and deletes these interfaces dynamically during tunnel establishment and termination.

For a spoke, configure the spoke's protected network.

To enable static routing for the spokes, after you configure the endpoints for your topology, click the **IPsec** tab and check the **Enable Reverse Route Injection** check box.

You do not need this option if you use BGP, OSPF, or EIGRP.

Step 3 Check the **Allow incoming IKEv2 routes from the peers** check box to allow incoming IKEv2 routes from the spokes and peers.

For a hub: During an IKE exchange, the hub advertises the dynamically created virtual access interfaces to the spokes, and the spokes advertise their VTI IP addresses to the hub.

For a spoke: By default, this option is enabled.

Step 4 In the **Connection Type** drop-down list, choose one of the following:

Answer Only: The device can only respond when a peer device initiates a connection, it can’t initiate any connection.

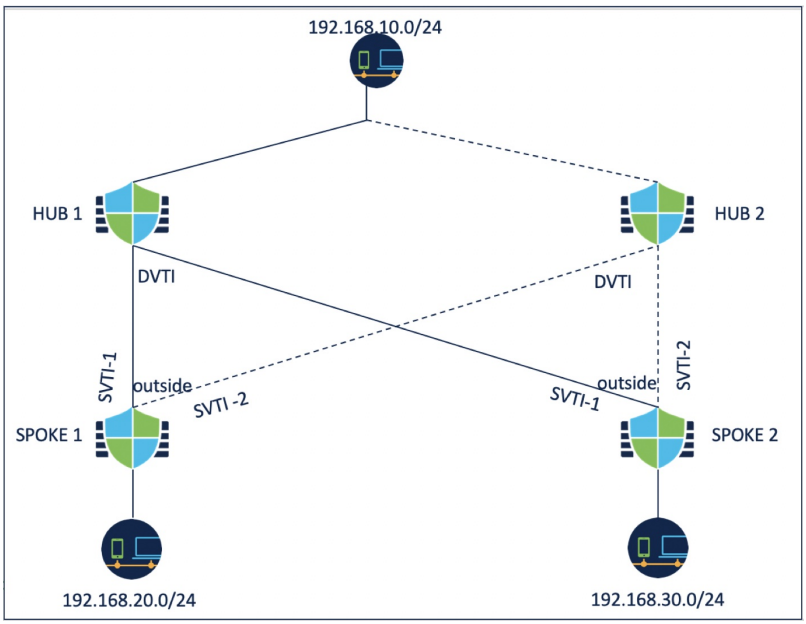
Bidirectional: The device can initiate or respond to a connection. This is the default option.

Configure Multiple Hubs in a Route-based VPN

You can configure a topology with multiple hubs for a set of spokes. With one hub as the backup hub, you can configure multiple topologies with a single hub and the same set of spokes.

In the following example, there are two hubs connected to the same set of spokes. Hub 1 is the primary hub and Hub 2 is the secondary hub. To configure this network in the Firewall Management Center, you must configure two route-based hub and spoke topologies:

- Topology 1: Hub 1 connected to spoke 1 and spoke 2.
- Topology 2: Hub 2 connected to spoke 1 and spoke 2.



To configure topology 1:

Procedure

Step 1 Choose **Devices** > **VPN** > **Site to Site**.

Step 2 Click **+ Site To Site VPN**.

Step 3 Enter a name for the VPN topology in the **Topology Name** field.

Step 4 Choose **Route Based (VTI)** and do one of the following:

- Select **Point to Point** as the network topology. To configure endpoints for a route-based **Point to Point** topology, see Configure Endpoints for a Point to Point Topology, on page 29.
- Select **Hub and Spoke** as the network topology. To configure endpoints for a route-based **Hub and Spoke** topology, see Configure Endpoints for a Hub and Spoke Topology, on page 32.

Step 5 Configure the IKE version.

Step 6 Click the **Endpoints** tab.

Step 7 Under **Hub Nodes**:

a) Click Add + to add the hub.

b) Choose Hub 1 from the **Device** drop-down list.

c) Choose a dynamic VTI from the **Dynamic Virtual Tunnel Interface** drop-down list or click Add + to add a new dynamic VTI.

We recommend that you configure the Borrow IP for the dynamic interface from a loopback interface.

d) (Optional) If your endpoint device is behind a NAT device, check the **Tunnel Source IP is Private** check box and configure the tunnel source IP address in the **Tunnel Source Public IP Address** field.

e) Click **Routing Policy** to configure the routing policy for the hub. You can configure dynamic routing using BGP.

f) Expand **Advance Settings**. You can configure the following advanced settings for the hub to enable IKEv2 routing, which can be used if you do not use dynamic routing.

- (Optional) Check the **Send Virtual Tunnel Interface IP to the peers** check box.
- Check the **Allow incoming IKEv2 routes from the peers** check box for the hub to accept routes from the spokes and update the routing table.
- Choose **Connection Type** as Bidirectional from the drop-down list.

g) Click **OK**.

Step 8 Under **Spoke Nodes**:

a) Click Add + to add a spoke.
b) Choose Spoke 1 from the **Device** drop-down list.
c) Choose SVTI-1 as the static VTI for the spoke from the **Static Virtual Tunnel Interface** drop-down list or click Add + to add a new static VTI.

Choose the outside interface as the tunnel source of SVTI-1. Tunnel IP of SVTI-1 is autopopulated, ensure that this IP address is unique for spoke 1 across peers in both the topologies.

d) Expand **Advance Settings**. If you do not use dynamic routing, you can configure these settings to enable IKEv2 routing for the spoke.

- Check the **Send Virtual Tunnel Interface IP to the peers** check box to send the VTI IP address to the peer device.
- Check the **Allow incoming IKEv2 routes from the peers** check box to allow incoming IKEv2 routes from the peers.
- Choose **Connection Type** as Bidirectional from the drop-down list.

e) Click **OK**.
f) Repeat steps 5a to 5e to add spoke 2. Configure SVTI-1 as the static VTI of spoke 2.

Step 9 Configure the IKE and IPSec parameters as required or use the default values.

What to do next

1. Configure topology 2 with hub 2, spoke 1, and spoke 2.

   Configure SVTI-2 as the static VTI of spoke 1 and SVTI-2 as the static VTI of spoke 2 (refer the above illustration). Tunnel source for SVTI-2 should be the same outside interface.

2. For each spoke, configure the routing policy. For more information, see Configure Routing for Multiple Hubs in a Route-based VPN, on page 37.

3. Verify the configuration and tunnel statuses. For more information, see Verify the Multiple Hubs Configuration in a Route-based VPN, on page 39.

Configure Routing for Multiple Hubs in a Route-based VPN

The following procedure explains how to configure dynamic routing on the hub and spokes, and configure Policy Based Routing on the spokes.

Before you begin

Configure topology 1 and 2 as explained in Configure Multiple Hubs in a Route-based VPN, on page 35.

Procedure

Step 1 Configure dynamic routing for the hub using BGP.

a) Choose **Devices** > **Device Management**, and click **Edit** ( ) then click the **Routing** tab.
b) On the left pane, choose **General Settings > BGP**.
c) Check the **Enable BGP** check box and enter the **AS number**.

You can configure the other fields as per your requirement.

d) Click **Save**.
e) On the left pane, choose **BGP > IPv4**.
f) Check the **Enable IPv4** check box.
g) Click the **Neighbor** tab, click **Add** and configure the parameters.

1. **IP Address**: Enter the tunnel interface IP address of Spoke 1.
2. **Remote AS**: AS number of Spoke 1.
3. Check the **Enabled Address** check box.
4. Click **OK**.

Repeat the above steps to add Spoke 2 as a neighbor.

h) Click **Save**.
i) Click the **Networks** tab and click **Add** to advertise the network behind the hub to the peers.

Step 2 Configure dynamic routing for the spokes using BGP.

The BGP configuration for the spokes is similar to that of the hub except for the following differences:

- Configure Hub 1 and Hub 2 as the neighbors for both the spokes and use the tunnel interface IP address of the hubs.
- When you configure networks, use the network behind each spoke.

Step 3 Configure Policy Based Routing on the spokes.

a) On the left pane, choose **Policy Based Routing** and click **Add**.
b) Choose the **Ingress Interface** from the drop-down list.
c) Click **Add** to configure a Match ACL.

For example, for spoke 1, source network is 192.168.20.0/24 and destination network is 192.168.10.0/24.

d) Choose Egress Interfaces from the **Send to** drop-down list.
e) Choose Order from the **Interface Ordering** drop-down list.
f) Select the SVTI-1 and SVTI-2 interfaces as the egress interfaces.
g) Click **Save**.

If you want to use the hubs as a load-balancing pair, you must configure ECMP.

Step 4 Deploy the configurations on the hub and spokes.

What to do next

Verify the configurations and tunnel statuses. For more information, see Verify the Multiple Hubs Configuration in a Route-based VPN, on page 39.

Verify the Multiple Hubs Configuration in a Route-based VPN

To verify the multiple hub configurations and the tunnel statuses:

- After the deployment, check the tunnel status.
- Use the following show commands for each endpoint to verify the configurations:
  - **show run route-map**
  - **show run access-list**
  - **show route-map**
  - **show route**

Route Traffic Through a Backup VTI Tunnel

Secure Firewall Threat Defense supports the configuration of a backup tunnel for the route-based (VTI) VPN. When the primary VTI is unable to route the traffic, the traffic in the VPN is tunneled through the backup VTI.

You can deploy the backup VTI tunnel in the following scenarios:

- Both peers having service provider redundancy backup.

  In this case, there are two physical interfaces, acting as the tunnel sources for the two VTIs of the peers.
- Only one of the peers having service provider redundancy backup.

  In this case, there's an interface backup on only one side of the peer and on the other end, there is only one tunnel source interface.

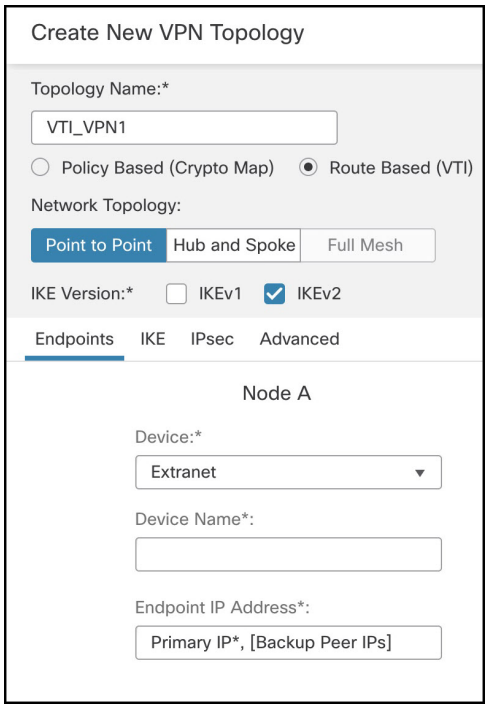
Step	Do This	More Info
1	Review the guidelines and limitations.	Guidelines and Limitations for Virtual Tunnel Interfaces, on page 23
2	Create the VTI interface.	Add a VTI Interface, on page 27
3	In the **Add Endpoint** dialog box of the **Create New VPN Topology** wizard, click **Add Backup VTI** to configure the respective backup interface for each peer.	• Configure Endpoints for a Point to Point Topology, on page 29 • Configure Endpoints for a Hub and Spoke Topology, on page 32

Step	Do This	More Info
4	Configure the routing policy.	• Choose **Devices** > **Device Management**, and edit the threat defense device. • Click **Routing**.
5	Configure the access control policy.	• Choose **Policies** > **Access Control**.

Guidelines for Configuring a Backup VTI Tunnel

- For an extranet peer, you can specify the tunnel source IP address of the backup interface and configure the tunnel destination IP on the managed peer.

  You can specify the backup peer IP address in the **Endpoint IP Address** field of the **Create New VPN Topology** wizard.



- After you configure the backup interfaces, configure the routing policy and access control policy for routing traffic.

  Though primary and backup VTIs are always available, traffic flows only through the tunnel that is configured in the routing policy. For detailed information, see Configure Routing and AC Policies for VTI, on page 41.

- When you configure a backup VTI, ensure that you include the backup tunnel to the same security zone as that of the primary VTI. No specific settings are required for the backup VTI in the AC policy page.

- If you configure a static route for the backup tunnel, configure a static route with a different metric to handle the failover of the traffic flow over the backup tunnel.

Configure Dynamic VTI for a Route-based Site-to-Site VPN

To configure dynamic VTI for a route-based site-to-site VPN in the management center:

Step	Do This	More Information
1	Create a dynamic VTI interface on the hub.	Add a VTI Interface, on page 27
2	Create static VTI interfaces on the spokes.	Add a VTI Interface, on page 27
3	Create a route-based site-to-site VPN.	Create a Route-based Site-to-Site VPN, on page 28
4	Configure the routing policy and the access control policy.	Configure Endpoints for a Hub and Spoke Topology, on page 32

How to Configure a Virtual Router with Dynamic VTI

To configure a virtual router with dynamic VTI for a route-based site-to-site VPN in the management center:

Step	Do This	More Information
1	Create a route-based site-to-site VPN with a dynamic VTI interface on the hub and static VTI(s) on the spoke(s).	Create a Route-based Site-to-Site VPN, on page 28
2	Create a virtual router.	Create a Virtual Router
3	Assign the interfaces to the virtual router.	Configure a Virtual Router
4	Configure routing policies for the hub and spoke.	Configure Endpoints for a Hub and Spoke Topology, on page 32
5	Configure access control policies for the hub and spoke.	Configure Endpoints for a Hub and Spoke Topology, on page 32

Configure Routing and AC Policies for VTI

After you configure VTI interfaces and the VTI tunnel on both the devices, you must configure:

- A routing policy to route VTI traffic between the devices over the VTI tunnel.
- An access control rule to allow encrypted traffic.

Routing Configuration for VTI

For the VTI interfaces, you can configure static route or routing protocols such as BGP, EIGRP, OSPF/OSPFv3.

1. Choose **Devices** > **Device Management**, and edit the Firewall Threat Defense device.
2. Click **Routing**.
3. Configure static route, or BGP, EIGRP, OSPF/OSPFv3.

Routing	Parameters	More Information
Static Route	• **Interface**—Select the VTI interface. For a backup tunnel, select the backup VTI interface. • **Selected Network**—Remote peer's protected network. • **Gateway**—Remote peer's tunnel interface IP address. For a backup tunnel, select the remote peer's backup tunnel interface IP address. • **Metric**—For a backup tunnel, configure a different metric to handle the failover of the traffic flow over the backup tunnel. **Note** DVTI does not support static routes.	Add a Static Route

BGP	• Under **General Settings** > **BGP**, enable BGP, provide the AS number of the local device, and add Router ID (if you choose Manual).
	• Under **BGP**, enable IPv4/IPv6 and click the **Neighbor** tab to configure the neighbors.
	  • **IP Address**—Remote peer's VTI interface IP address. For a backup tunnel, add a neighbor with the remote peer's backup VTI interface IP address.
	  • **Remote AS**—Remote peer's AS number.
	• Click the **Redistribution** tab, select the **Source Protocol** as Connected to enable connected route redistribution.
		Configure BGP

Routing	Parameters	More Information
EIGRP	• Enable EIGRP, provide the AS number of the local device, and select the networks or hosts that participate in the EIGRP routing process. • Click the **Neighbors** tab and define the static neighbors for the EIGRP process. • To advertise summary addresses from a VTI interface, click the **Summary Address** tab, choose the VTI interface from the **Interface** drop-down. From the **Network** drop-down, choose the network to be summarized. • Click the **Interfaces** tab to configure the interface-specific EIGRP routing properties for the VTI interface. To enable EIGRP split-horizon on the interface, check the **Split Horizon** check box. You can also configure the **Hold Time** that is advertised by the device in the EIGRP hello packets.	
OSPF	• Check the **Process 1** check box, and choose the OSPF role. • Click the **Interface** tab and choose a VTI interface.	Configure OSPFv2
OSPFv3	• Check the **Process 1** and **Enable Process 1** check boxes, and choose the OSPFv3 role. • Click the **Interface** tab and choose a VTI interface.	Configure OSPFv3

AC Policy Rule

Add an access control rule to the access control policy on the device to allow encrypted traffic between the VTI tunnels with the following settings:

1. Create the rule with the Allow action.

2. Select the VTI security zone of the local device as the source zone and the VTI security zone of the remote peer as the destination zone.
3. Select the VTI security zone of the remote peer as the source zone and the VTI security zone of the local device as the destination zone.

For more information about configuring an access control rule, see Create and edit access control rules.

View Virtual Tunnel Information

You can view details of dynamic and static VTIs of route-based VPNs on the device. For every VPN topology, you can also view details of all the dynamically generated virtual access interfaces associated with each dynamic VTI.

Before you begin

- For static VTIs: Firewall Threat Defense Version 7.0 and later
- For dynamic VTIs: Firewall Threat Defense Version 7.3 and later

Procedure

Step 1 Select **Devices** > **Device Management** and click **Edit** (✎) for your Firewall Threat Defense device. The **Interfaces** page is selected by default.

Step 2 Click the **Virtual Tunnels** tab.

For each VTI, you can view details such as name, IP address, IPsec mode, tunnel source interface details, topology, and remote peer IP. You can also view if path monitoring is enabled for each interface.

Deploy a SASE Tunnel on Umbrella

Cisco Umbrella is Cisco's cloud-based Secure Internet Gateway (SIG) platform that provides multiple levels of defense against internet-based threats. Umbrella integrates secure web gateway, DNS-layer security, and cloud access security broker (CASB) functionality to protect your systems against threats.

You can establish an IPsec IKEv2 tunnel from a threat defense device to Umbrella using the management center. This tunnel forwards all internet-bound traffic to the Umbrella SIG for inspection and filtering. This solution provides centralized security management so that network administrators don’t have to separately manage the security settings of each branch.

To directly configure and deploy Umbrella tunnels from a threat defense device, you can create a SASE topology using a simple wizard. SASE topology is a new type of site-to-site VPN topology that supports:

- Static VTI-based site-to-site VPN.
- Hub and spoke topology, where Umbrella is the hub and the managed threat defense devices are the spokes.

- Pre-shared key based authentication.
- Firewall Threat Defense deployed in HA mode.
- Multi-instance: In a multi-instance deployment, you can integrate only one Umbrella account.

For high availability, you can configure two tunnels from a threat defense device and use the second tunnel as the backup tunnel. Ensure that you configure different local tunnel IDs for each tunnel.

For ease of configuration, the management center configures the default IPsec and IKEv2 policies.

Default IKEv2 policy configuration:

- Integrity Algorithm: NULL
- Encryption Algorithm: AES-GCM-256
- PRF Algorithm: SHA-256
- DH Group: 19, 20

Default IKEv2 IPsec policy configuration:

- ESP Hash: SHA-256
- ESP Encryption: AES-GCM-256

Related Topics

How to Deploy a SASE Tunnel on Umbrella, on page 46

Guidelines and Limitations for Configuring SASE Tunnels on Umbrella

SASE topology supports:

- Only PSK-based authentication
- IKEv2
- High availability

General Configuration Guidelines

- The Firewall Management Center does not discover tunnels created directly on Umbrella or by other applications.
- You can add only devices managed by the Firewall Management Center as endpoints for the SASE topology. You cannot add extranet devices.

  For high availability pairs, the HA pair names appear in the endpoint list.
- When you delete a tunnel from the Firewall Management Center and if it is unable to delete the tunnel from Umbrella, you must manually delete it by logging into Umbrella.
- You cannot edit or delete a SASE topology if the deployment to Umbrella is in progress. You can view the tunnel deployment status in the:
  - Cisco Umbrella Configuration dialog box of the wizard

- Notifications page under the Deployments and Tasks tabs
- Site to Site VPN Monitoring dashboard

- If you check the **Deploy configuration on threat defense nodes** check box in the wizard, the Umbrella SASE topology configuration is deployed on the Firewall Threat Defense only after the tunnels are deployed on Umbrella.

  The Firewall Management Center requires the local tunnel ID to deploy the Umbrella configuration on the Firewall Threat Defense. Umbrella generates the complete tunnel ID (<*prefix*>@<*umbrella generated ID*>-umbrella.com) only after the Firewall Management Center deploys the tunnel on Umbrella.
- The Firewall Management Center does not recognize topologies with the Umbrella data center as an extranet hub, created before version 7.3, as SASE topologies. You must create new SASE topologies in version 7.3 and delete the existing topology.

Limitations

SASE topology does not support:

- Clustering
- Certificate-based authentication
- IKEv1

How to Deploy a SASE Tunnel on Umbrella

This section provides instructions to deploy a SASE tunnel on Umbrella from a Firewall Threat Defense device using the Firewall Management Center.

Step	Do This	More Info
1	Review the guidelines and limitations.	Guidelines and Limitations for Configuring SASE Tunnels on Umbrella, on page 45
2	Ensure that you meet the prerequisites.	Prerequisites for Configuring Umbrella SASE Tunnels, on page 46
3	Configure Cisco Umbrella connection settings.	• Configure Cisco Umbrella Connection Settings • Map Management Center Umbrella Parameters and Cisco Umbrella API Keys, on page 47
4	Configure a SASE tunnel on Umbrella.	Configure a SASE Tunnel for Umbrella, on page 49
5	View the status of the SASE tunnel.	View SASE Tunnel Status, on page 50

Prerequisites for Configuring Umbrella SASE Tunnels

- You must have a Cisco Umbrella Secure Internet Gateway (SIG) Essentials subscription.

- You must enable your Smart License account with the export-controlled features to deploy tunnels on Umbrella from the Firewall Management Center. If this license is not enabled, you can only create a SASE topology. You cannot deploy tunnels on Umbrella.
- You must establish an account with Cisco Umbrella at https://umbrella.cisco.com, log into Umbrella at http://login.umbrella.com, and obtain the required information to establish connection to Cisco Umbrella.
- You must register Cisco Umbrella with the Firewall Management Center and configure the management key and the management secret in the Cisco Umbrella Connection Settings. The management center requires the management key and management secret to fetch the datacenter details from the Cisco Umbrella cloud. You must also configure the Organization ID, Network Device Key, Network Device Secret, and the Legacy Network Device Token in the Cisco Umbrella Connection Settings.

  For more information, see:

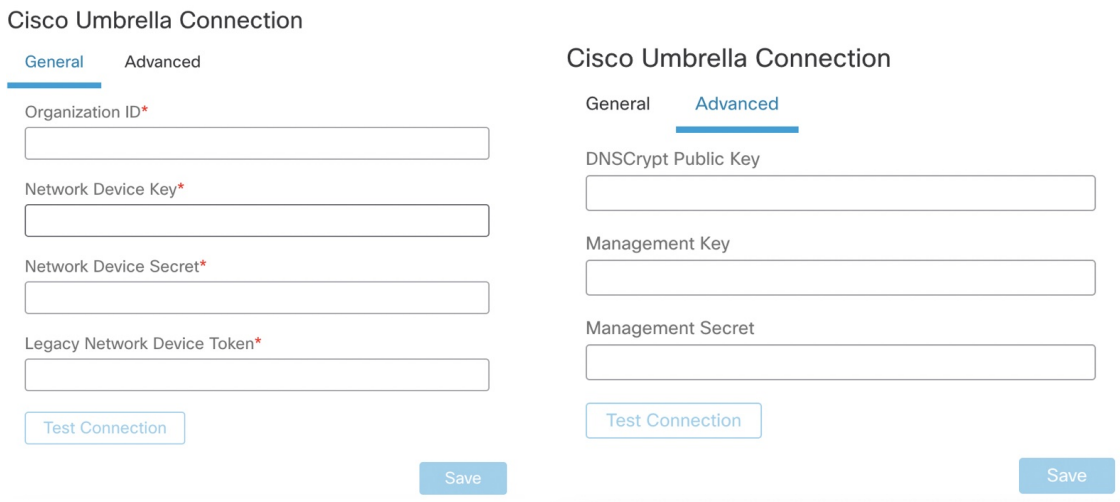
  - Configure Cisco Umbrella Connection Settings
  - Map Management Center Umbrella Parameters and Cisco Umbrella API Keys, on page 47
- Ensure that Umbrella data center is reachable from the Firewall Threat Defense.
- You can deploy a tunnel only between Cisco Umbrella and a Firewall Threat Defense version 7.1.0 and later.

Map Management Center Umbrella Parameters and Cisco Umbrella API Keys

To register the Cisco Umbrella with the Firewall Management Center and configure the Umbrella parameters in the Firewall Management Center, you must:

1. Log in to Cisco Umbrella.
2. Choose **Admin > API Keys > Legacy Keys**.
3. Generate and copy the required API keys.
4. Use the API keys to configure the Cisco Umbrella connection parameters in the Firewall Management Center.

The figure below shows the parameters that you must configure in the Cisco Umbrella Connection in the Firewall Management Center. DNScrypt Public Key is an optional parameter.



The figure below shows the Cisco Umbrella API keys that you must use to register the Cisco Umbrella with the Firewall Management Center.

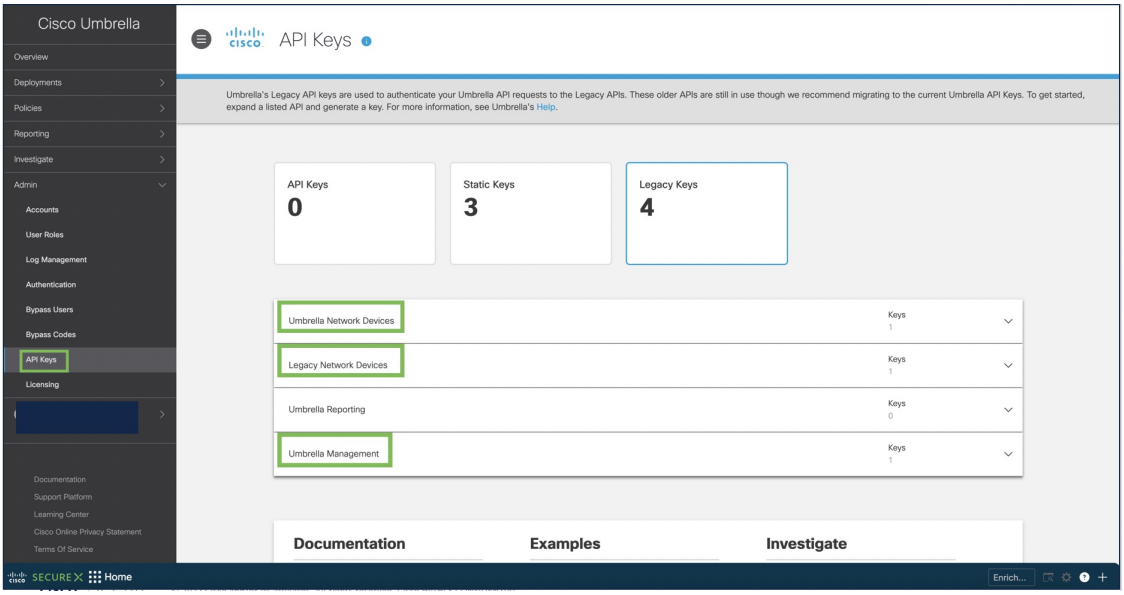


Table 2: Map Firewall Management Center Umbrella Parameters and Cisco Umbrella API Keys

Management Center Parameter	Cisco Umbrella API Keys
Network Device Key Network Device Secret	Umbrella Network Devices
Legacy Network Device Token	Legacy Network Devices
Management Key Management Secret	Umbrella Management

Configure a SASE Tunnel for Umbrella

Before you begin

Ensure that you review the prerequisites and guidelines in Prerequisites for Configuring Umbrella SASE Tunnels, on page 46 and Guidelines and Limitations for Configuring SASE Tunnels on Umbrella, on page 45.

Procedure

Step 1 Choose **Devices** > **VPN** > **Site to Site**.

Step 2 Click **+ SASE Topology**.

Step 3 Enter a unique **Topology Name**.

Step 4 **Pre-shared Key**: This key is auto-generated according to the Umbrella PSK requirements. For a single topology, the pre-shared key is common for all threat defense spokes and Umbrella.

The device and Umbrella share this secret key, and IKEv2 uses it for authentication. If you want to configure this key, it must be between 16 and 64 characters in length, include at least one uppercase letter, one lowercase letter, one numeral, and have no special characters. Each topology must have a unique pre-shared key. If a topology has multiple tunnels, all the tunnels have the same pre-shared key.

Step 5 Choose a data center from the **Umbrella Data center** drop-down list. (Configure routing on the Firewall Threat Defense to ensure reachability of the umbrella DC from the Firewall Threat Defense.)

Step 6 Click **Add** to add a Firewall Threat Defense node.

a) Choose a Firewall Threat Defense from the **Device** drop-down list.

Only devices managed by the Firewall Management Center appear in the list. For high availability pairs, the HA pair names appear in the endpoint list.

b) Choose a static VTI interface from the **VPN Interface** drop-down list.

To create a new static VTI interface, click Add +. The **Add Virtual Tunnel Interface** dialog box appears with the following pre-populated default configurations.

- Tunnel Type is static.
- Name is <*tunnel_source interface logical name*>+ static_vti +<*tunnel ID*>. For example, outside_static_vti_2.
- Tunnel ID is auto-populated with a unique ID.
- Tunnel Source Interface is auto-populated with an interface with an 'outside' prefix.
- IPsec tunnel mode is IPv4.
- IP address is from the 169.254.x.x/30 private IP address range.

c) Enter a prefix for the local tunnel ID in the **Local Tunnel ID** field.

The prefix can have a minimum of eight characters and a maximum of 100 characters. Umbrella generates the complete tunnel ID (<*prefix*>@<*umbrella generated ID*>-umbrella.com) after the management center deploys the tunnel on Umbrella. The management center then retrieves and updates the complete tunnel ID and deploys it on the threat defense device. Each tunnel has a unique local tunnel ID.

d) Click **Save** to add the endpoint device to the topology.

You can add multiple endpoints in a SASE topology.

Step 7 Click **Next** to view the summary of the Umbrella SASE tunnel configuration.

- **Endpoints** pane: Displays the summary of the configured endpoints.
- **Encryption Settings** pane: Displays the default IKEv2 policies and IKEv2 IPsec transform sets for the topology.

Step 8 Check the **Deploy configuration on threat defense nodes** check box to trigger deployment of the network tunnels to the threat defense. This deployment occurs after the tunnels are deployed on Umbrella. Local tunnel ID is required for the threat defense deployment.

Step 9 Click **Save**.

This action:

a. Saves the topology in the management center.

b. Triggers deployment of the network tunnels to the Umbrella.

c. Triggers deployment of the network tunnels to the threat defense devices, if the option is enabled. This action commits and deploys all the updated configurations and policies, including non-VPN policies, since the last deployment on the device.

d. Opens the **Cisco Umbrella Configuration** window and displays the status of the tunnel deployment on Umbrella. For more details, see View SASE Tunnel Status, on page 50.

What to do next

For the interesting traffic intended to flow through the SASE tunnel, configure a PBR policy with a specific match criteria to send the traffic through the VTI interface.

Ensure that you configure a PBR policy for each endpoint of the SASE topology.

View SASE Tunnel Status

Procedure

Step 1 Choose **Devices** > **VPN** > **Site to Site**.

Step 2 Click **+ SASE Topology**.

Step 3 Enter a unique **Topology Name**, **Pre-shared Key**, choose a data center, add a device, and click **Next**.

Step 4 View the summary of the Umbrella SASE Tunnel configuration and click **Save**. The **Cisco Umbrella Configuration** window appears.

You can view the topology details such as name, data center, data center IP address, start, and end time of the tunnel deployment.

You can view the deployment status of the tunnels on Umbrella. The different tunnel deployment statuses are:

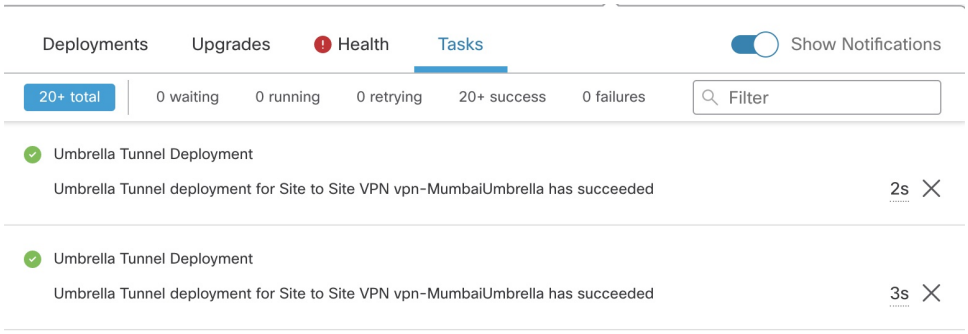
- Pending: The management center hasn't pushed the configuration to Umbrella.
- Success: The management center successfully configured a tunnel on Umbrella.
- In Progress: The management center is deploying the tunnel on Umbrella.
- Failure: The management center couldn't configure a tunnel on Umbrella.

If the status appears as pending, or failure, use the transcript to troubleshoot the tunnel creation. Click the **Transcript** button to view the transcript details such as the APIs, request payload, and the response received from Umbrella.

Step 5 Click **Umbrella Dashboard** to view the network tunnels in Cisco Umbrella.

Step 6 View the Umbrella tunnel deployment status in:

- The **Notifications** page under the **Deployments** and **Tasks** tabs.



Secure traffic using Cisco Secure Access and Firewall Threat Defense devices

Cisco Secure Access is a cloud-based security service edge (SSE) solution that protects against internet threats and enables secure access to the internet, SaaS applications, and private resources from any location.

Secure Firewall seamlessly integrates with Secure Access for various use cases primarily for:

- **Enhanced visibility and control for remote users**: Secure Access extends security policies beyond the physical branch perimeter to protect users regardless of location, providing the same level of threat protection and access controls equivalent to on-premises, creating consistent security enforcement.
- **Simplified security architecture**: Secure Access integrates with a Firewall Threat Defense device to consolidate multiple security functions such as Secure Web Gateway, Cloud Access Security Broker (CASB), Data Loss Prevention (DLP), and cloud firewall. This consolidation provides a single-pane-of-glass experience for policy management across branch deployments and cloud-delivered security services.

Firewall Management Center simplifies IPsec IKEv2 tunnel configuration from Firewall Threat Defense devices to Secure Access with the new SASE wizard, automating and streamlining the process.

License for setting up an automatic tunnel between Secure Access and Firewall Threat Defense devices

- Firewall Management Center Essentials (formerly Base) license must allow export-controlled functionality.
  Choose **System** (⚙) > **Licenses** > **Smart Licenses** to verify this functionality in the Firewall Management Center.

  Evaluation license does not support this feature.
- Cisco Secure Access Essentials subscription license must be available.

Prerequisites for setting up an automatic tunnel between Secure Access and Firewall Threat Defense devices

- Integrate a Cisco Security Cloud Control tenant with a Secure Access organization.
- Configure basic routing and AC policies to route traffic between the Secure Access data center and the Firewall Threat Defense device.
- Firewall Threat Defense devices must be Version 7.2.0 and later.

Guidelines for setting up an automatic tunnel between Secure Access with Firewall Threat Defense devices

General guidelines

- Set up routing on the Firewall Threat Defense device to route traffic over the tunnel.
- Delete the Firewall Threat Defense device from the topology and add it again with the required routing configuration to update routing settings in a SASE topology.
- When change management is enabled, tunnels are not deployed automatically to Secure Access. Manually deploy tunnels to Secure Access from the **Site-to-Site VPN** page after the change management ticket is approved.

Multi-ISP SASE topology guidelines

- To create a multi-ISP SASE topology, you must establish multiple tunnels from a Firewall Threat Defense device to the same Secure Access region using different interfaces. Since each SASE topology supports only one WAN interface, use the SASE wizard to create multiple topologies.
- When you configure multi-ISP SASE topologies that use the same region and device but different VPN interfaces, ensure all topologies have identical settings. The tunnel ID prefix, passphrase, and routing configurations match across all topologies.
- To update routing settings in a multi-ISP SASE topology, delete the Firewall Threat Defense device from each topology and add it again with the required configuration. Ensure routing settings are consistent across all topologies.

Limitations

- Clustering is not supported.

Configure an automatic tunnel between Secure Access and Firewall Threat Defense devices using SASE wizard

This wizard simplifies tunnel creation from Firewall Threat Defense devices to Secure Access by automating multiple steps.

Before you begin

Ensure that you review Prerequisites for setting up an automatic tunnel between Secure Access and Firewall Threat Defense devices, on page 52.

Procedure

Step 1 Choose **Devices** > **VPN** > **Site to Site**, and click **Add**.

Step 2 In the **Topology Name** field, enter a name for the SASE topology.

Step 3 Click the **SASE Topology** radio button and click **Create**.

Step 4 Configure a Secure Access region. From the **Region** drop-down list, choose a Secure Access region.

A Secure Access region is a cluster of data centers in a specific geographic area.

Step 5 Click **Next**.

Step 6 Configure Firewall Threat Defense nodes.

a) Click **Add**. Configure the parameters in the **Add Threat Defense Node** dialog box.

b) From the **Device** drop-down list, choose a Firewall Threat Defense device.

Only Firewall Threat Defense devices managed by the Firewall Management Center appear in this list. Extranet devices won't appear in the list.

c) From the **VPN Interface** drop-down list, choose a WAN-facing or internet-facing physical interface that establishes a VPN connection with Secure Access.

Step 7 Configure **Tunnel ID and passphrase**.

a) In the **Prefix for tunnel ID** field, enter the prefix containing 8 to 30 characters. The prefix can contain alphabets, numbers, period (.), underscore (_), and dash (-).

Secure Access uses this prefix to generate the complete tunnel ID after the Firewall Management Center deploys the tunnel on Secure Access. The tunnel ID format is <*prefix*>@<*org*><*hub*>.sse.cisco.com.

b) In the **Passphrase** field, enter the passphrase containing 16 to 64 characters. The passphrase must contain at least one upper-case alphabet, one lower-case alphabet, and one number, and cannot include special characters..

The passphrase is auto generated. However, you can regenerate or enter a different passphrase.

c) Confirm the passphrase.

d) Click **Next**.

Step 8 Configure **NAT or routing**.

a) Check the **Enable NAT/outbound only** check box to enable Network Address Translation (NAT) for correct routing and identification.

Use this option if the IP address of the subnet behind this tunnel group overlaps with the IP address in your network. When this option is selected, the tunnel group supports outbound traffic only and cannot provide access to private applications hosted at this site.

Note
Routing options are unavailable when the network contains overlapping subnets.

b) Configure one of these options for **Routing**:

- Click the **Static routing** radio button.

  Use the **Network IP addresses** field to add IP addresses of networks for this tunnel group. Add all public and private addresses used internally by your organization.

- Click the **Dynamic routing** radio button.

  Use this option to advertise your internal networks over BGP.

  In the **AS number** field, enter the AS number of the device. This value must match the device BGP AS number in the routing settings of the device.

c) Click **Next**.

Step 9 Check the **Deploy to Threat Defense devices** check box to trigger deployment of all configurations besides the Secure Access auto tunnel configurations that are yet to be deployed on the device.

Step 10 Click **Finish** to save and validate the configurations, and create the SASE topology.

This wizard now performs these actions:

- Saves all Firewall Threat Defense device configurations in Firewall Management Center.
- Pushes the configuration to Secure Access.
- Creates virtual tunnel interfaces (VTIs) on the device.
- Creates a SASE VPN topology.
- Triggers deployment of all configurations besides the Secure Access auto tunnel configurations that are yet to be deployed on the device if the **Deploy to Threat Defense devices** option is enabled.
- Opens the **Configuration of Secure Access Tunnels** dialog box which displays the status of the tunnel deployment on Secure Access.

  Click the **Transcript Details** ( ) button to view the transcript details such as the APIs, request payload, and the response received from Secure Access.

You can view the SASE topology in the **Site-to-Site VPN & SD-WAN** page (**Devices** > **VPN** > **Site to Site**).

What to do next

1. Create an extended Access Control List (ACL).

This ACL defines the specific DNS and web traffic intended for routing through the tunnel to Secure Access. For more information, see Configure Extended ACL Objects.

2. Create a policy-based routing (PBR) policy.

   Use the above extended ACL within a policy-based routing policy to direct the defined DNS and web traffic through the tunnel to Secure Access for security inspection. For more information, see Configure policy-based routing policy.

3. When you create multiple SASE topologies for a multi-ISP setup, configure ECMP zones with the VPN interfaces to load balance application traffic.

4. Validate Secure Access integration with Firewall Threat Defense devices, on page 55.

Validate Secure Access integration with Firewall Threat Defense devices

Verify tunnel statuses in Firewall Management Center

To view the SASE topology tunnels details in the site-to-site VPN dashboard, choose **Overview** > **Dashboards** > **Site to Site VPN**.

To see more details about each tunnel:

1. For each tunnel, hover your cursor over a topology and click the **View** ( ) icon.
2. Click the **CLI Details** tab.
3. Click **Maximize View**. You can view the output of the following commands:
   - **show crypto ipsec sa peer**: Shows the number of packets that are transmitted through the tunnel.
   - **show vpn-sessiondb detail l2l filter ipaddress**: Shows more detailed data for the VPN connection.

Verify tunnel statuses in Secure Access

1. In Secure Access, choose **Connect > Network Connections > Network Tunnel Groups**.
2. Click the network tunnel group to view more details.

   In the **Network Tunnels** area, the primary and secondary tunnels will be displayed:

   - **Primary1** tunnel originates from the branch's outside interface and is destined for the primary Secure Access data center.
   - **Secondary1** tunnel also originates from the branch’s outside interface and connects to the secondary data center, serving as a standby for continuous connectivity.

View transcript details

In the **Configuration of Secure Access Tunnels** dialog box, click the **Transcript Details** ( ) button to view the transcript details such as the APIs, request payload, and the response received from Secure Access.

Transcript details are not available in these scenarios:

- When you delete a Network Tunnel Group (NTG) or an endpoint.

- When you configure any multi ISP tunnel after configuring the primary tunnel.

Monitoring Site-to-Site Topologies

Monitor Site-to-Site VPNs using Site-to-Site VPN Summary Page

You can view a summary of your site-to-site VPN topologies in the **Site-to-Site VPN Summary** page. For each topology, you can view details such as VPN type, network topology, VPN interfaces, VPN devices, and tunnel statuses.

You can edit or delete the topology using the edit and delete buttons. For SASE topology VPNs, you have options to deploy, edit and delete any topology.

Monitor Site-to-Site VPNs Using Site-to-Site VPN Dashboard

Choose **Overview** > **Dashboards** > **Site to Site VPN** to open the site to site dashboard.

The Secure Firewall Management Center provides a snapshot of the site-to-site VPN tunnels , including SASE topology tunnels, to determine the status of the site-to-site VPN tunnels. You can view the list of tunnels between peer devices and the status of each tunnel: Active, Inactive, or No Active Data. You can filter the data in the table according to the topology, device, and status. The table in the monitoring dashboard presents live data and you can configure to refresh the data at a specified interval. The table shows the peer-to-peer, hub and spoke, and full mesh topologies for crypto map-based VPNs. The tunnel information also contains the data for the route-based VPNs or Virtual Tunnel Interfaces (VTIs).

You can use this data to:

- Identify problematic VPN tunnels and troubleshoot.
- Verify connectivity between the site to site VPN peers devices.
- Monitor the health of the VPN tunnels to provide uninterrupted VPN connectivity between sites.

The site-to-site VPN dashboard displays the following widgets for the site-to-site VPN tunnels:

- **Tunnel Status**—A table listing the tunnel status of the site-to-site VPNs , including the SASE tunnels for Umbrella, configured using the Firewall Management Center
- **Tunnel Summary**—Aggregated status of the tunnels in a donut graph.
- **Topology**—Status of tunnels summarized by topology.

Guidelines and Limitations

- The table shows the list of site-to-site , including SASE topology, VPNs that are deployed. It does not show the tunnels that are created and not deployed.
- The table does not show the information about the backup tunnels of policy-based VPNs and backup VTIs.

- For cluster deployments, the table does not show director change in real-time data. It shows only the director information that existed when the VPN was deployed. The director change reflects in the table only after the tunnel AM redeployed after the change.

Status of VPN Tunnels

The site-to-site monitoring dashboard lists the VPN tunnels in the following states:

- **Inactive**—A policy-based (crypto map-based) VPN tunnel is inactive if all the IPSec tunnels are down. A VTI or and SASE topology VPN tunnel is down if the tunnel encounters any configuration or connectivity issues.
- **Active**—In the Firewall Management Center, policy-based site-to-site VPNs are configured based on IKE policies and IPsec proposals that are assigned to VPN topologies. A policy-based VPN tunnel is in the Active state if the Firewall Management Center identifies interesting traffic through the tunnel after the deployment. An IKE tunnel is up only if a minimum of one IPsec tunnel is up.

  Route-based VPN (VTI) and SASE topology VPN tunnels do not require interesting traffic to be in the Active state. They are in the Active state if they are configured and deployed without errors.
- **No Active Data**—Policy-based and SASE topology VPN tunnels remain in the No Active Data state until there is a traffic flow event through the tunnel for the first time. The No Active Data state also lists the policy-based and route-based VPNs that have been deployed with errors.

Important Notes About Tunnel Statuses in the Firewall Management Center

- The VPN statuses in the Firewall Management Center are event-based. The Firewall Management Center does not initiate status updates. Hence, there might be mismatches between the tunnel statuses in the dashboard and the Firewall Threat Defense. You can view the correct status in the **CLI Details** tab of the **Tunnel Status** widget.
- When a Firewall Threat Defense switches over to a secondary Firewall Threat Defense, there is a mismatch between the status of the VPN tunnels in the Firewall Management Center and the Firewall Threat Defense. When the device switches back to the primary device, the correct tunnel status appears.
- The Firewall Management Center does not update the tunnel status of Firewall Threat Defense devices earlier than 7.3 after the devices reboot. We recommend that you bring the tunnel down using the command **vpn-sessiondb logoff index** and bring it up using the packet tracer.

Tunnel Status

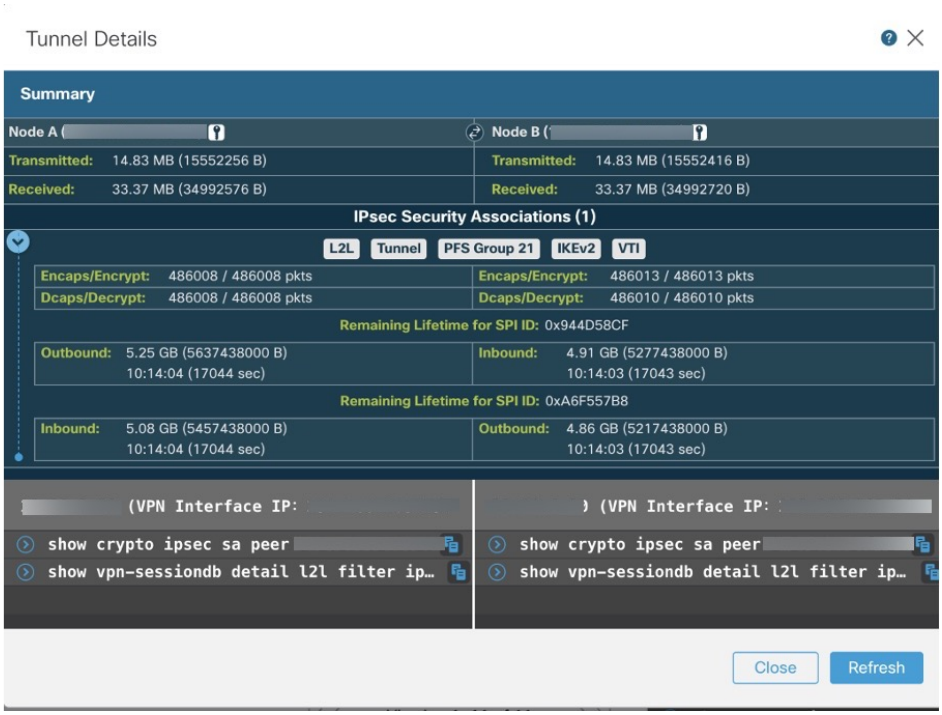
This table lists the site-to-site VPNs, including SASE topology VPN, configured using the Firewall Management Center. Hover over a topology and click **View** ( ) to view the following details about the topology:

- **General**—Displays more information about the nodes such as IP address and interface name.
- **CLI Details**—Displays the CLI outputs for the following commands:
  - **show crypto ipsec sa peer** <*node A/B_ip_address*>: Displays the IPsec SAs built between Node A and B.
  - **show vpn-sessiondb l2l filter ipaddress** <*node A/B_ip_address*>: Displays information about VPN sessions.

  For an extranet device, no command output appears.

Important details about the IKE and IPsec sessions, derived from the above command outputs, appear in a summarized, and user-friendly format. You can view the details of both nodes at a time. The icon next to the node name specifies the authentication type: preshared key or client certificate. The details include IKE statistics per tunnel and IPsec SA statistics as shown below:

Figure 1: Tunnel Status > View > CLI Details

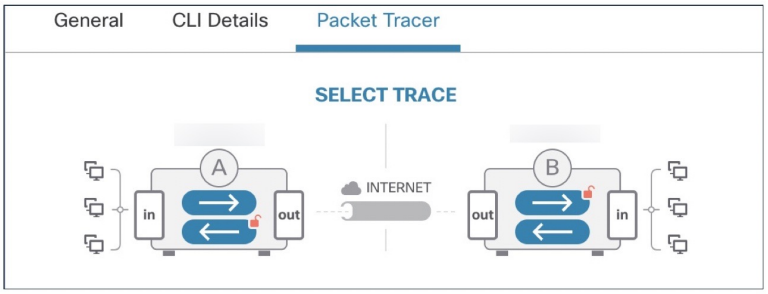


- **Packet Tracer**—Use packet tracer to troubleshoot the threat defense VPN tunnels.

Packet Tracer

Packet tracer allows you to troubleshoot VPN tunnels between two threat defense devices. You can check if the VPN connection between device A and device B is up. This tool injects a packet into the device and tracks the packet flow from the ingress to the egress ports. The tool simulates traffic after you configure the ingress interfaces of the devices along with the protected networks. Packet tracer evaluates the packet against modules such as flow and route lookups, ACLs, protocol inspection, NAT, and QoS.

Figure 2: Packet Tracer



For each device, the tool runs an encrypted trace and a decrypted trace (packet is treated as decrypted VPN traffic). You can run four different traces between the ingress and egress ports of the devices. Click the individual encrypt and decrypt options to enable or disable the trace.

When you run the trace, the tool executes the trace sequentially in the following order:

1. Encrypted trace of A.
2. Decrypted trace of B.
3. Encrypted trace of B.
4. Decrypted trace of A.

After the trace completes, you can view the output of the trace with the results of each module.

Note You cannot run a decrypt trace for route-based (VTI-based) VPNs.

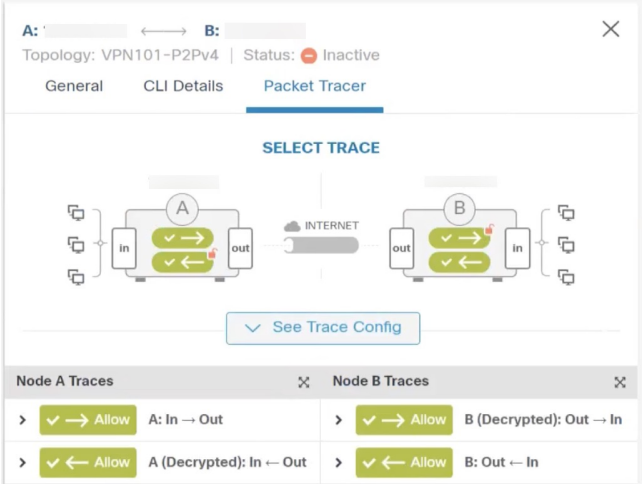
To run the Packet Tracer:

1. Click **See Detailed Config** to view the VPN interface name, VPN interface IP address, VTI interface name, and the VTI Interface IP address.
2. (Optional) Choose a protocol from the **Protocol** drop-down list. You can choose ICMP/8/0, TCP, or UDP.

   ICMP/8/0 is the default option. If you choose ICMP/8/0, 8 indicates the ICMP type as Echo Request and 0 indicates the ICMP code. If you choose TCP or UDP, choose the destination port from the **Destination Port** drop-down list. The range is from 0 to 65535.
3. Choose the ingress interface for both the devices on which to trace the packet from the **Ingress Interface** drop-down lists.
4. Enter an IP address from the same subnet as the ingress interface in the **Protected Network IP Address** fields.
5. Click **Trace Now**.

   After you initiate the trace, you can view if the trace is successful or not for each module. If the tunnel is down, the path appears in red. If the tunnel is up, the path appears in green. If a tunnel is down, click **Re-trace** to run the tool again. For a crypto-map based VPN, when the tunnel is inactive with no interesting traffic, the initial trace can be red. Click **Re-trace** to run the trace again.

Figure 3: Packet Tracer after a Successful Trace



Extranet Nodes: You can initiate a packet trace for VPN tunnels with one node as an extranet. For an extranet node, you cannot choose the ingress interface. The remaining steps for the packet trace are the same. You can't run trace on the extranet side.

For example, if Node A is a managed threat defense and Node B is an extranet:

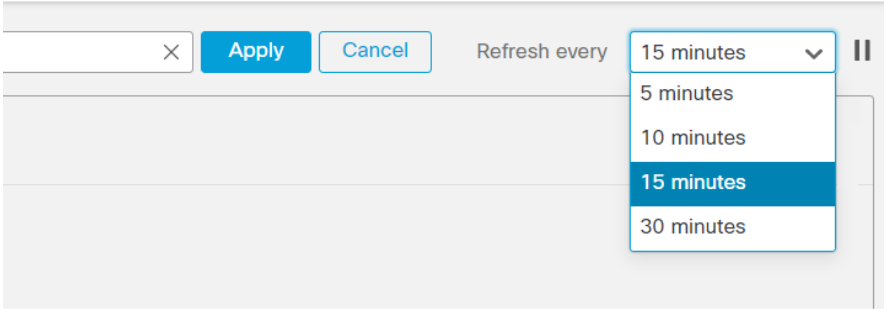
- Configure the ingress interface for node A.
- Configure the protected network for Node A and B.
- Click **Trace Now**. The traces appear for Node A and not for Node B.

Automatic Data Refresh

The site to site VPN data in the table refreshes periodically. You can configure the refresh interval of the VPN monitoring data at a specific interval or turn the automatic data refresh off.

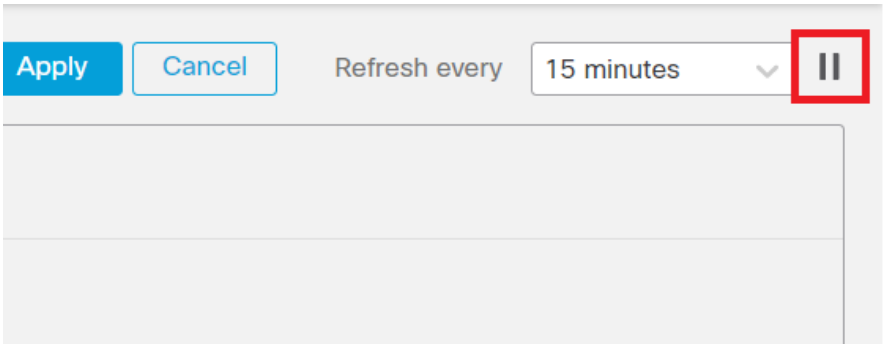
Click the **Refresh** interval drop-down to select from the available intervals to refresh the data in the table.

Figure 4: Refresh the Tunnel Data



Click **Pause** to stop the automatic data refresh for as long as you want. You can click the same button to resume refreshing the tunnel data.

Figure 5: Pause the Periodic Data Refresh



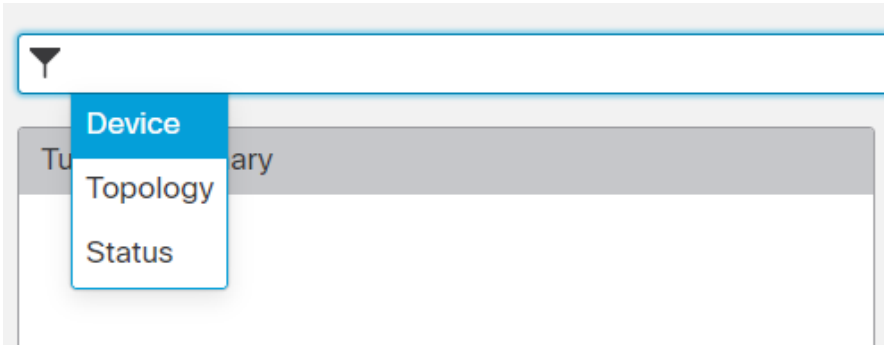
Filter and Sort the Site to Site VPN Monitoring Data

You can filter and view the data in the VPN monitoring table by topology, device, and status.

For example, you can view the tunnels that are in the Down state in a specific topology.

Click within the filter box to choose the filter criteria and then specify the values to filter.

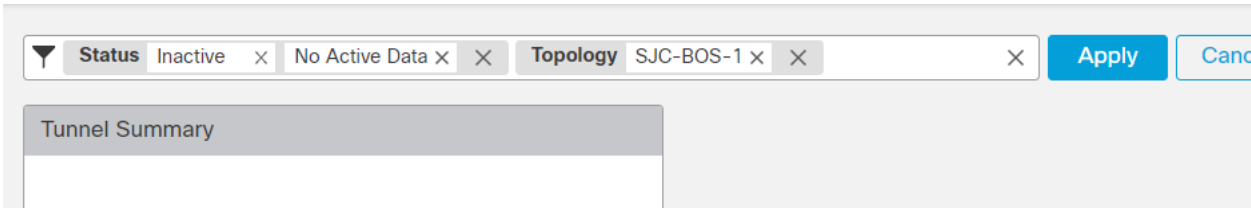
Figure 6: Filter the Tunnel Data



You can use multiple filtering criteria to view the data based on your requirement.

For example, you can choose to view only the tunnels that are in the Up and Down states, and ignore the ones in the Unknown state.

Figure 7: Example: Filter Tunnel Data



Sort the data—To sort the data by a column, click the column heading.

Related Topics

About Site-to-Site VPN, on page 1
About Virtual Tunnel Interfaces, on page 19

Site to Site VPN Connection Event Monitoring

The site-to-site VPN connection event allows you to know if the VPN encrypts or do not encrypts the connection and helps you to troubleshoot connectivity issues, especially in multi-hop VPN deployments. The event dashboard of the Firewall Management Center displays the IP address of the VPN peer (peer's IKE address) which encrypts or decrypts the traffic and displays the VPN action as follows:

- If the connection is decrypted by the VPN, the column **Decrypt Peer** displays the IP address of the peer's address from where the flow was received and displays **Decrypt** as the VPN action.
- If the connection is encrypted by the VPN, the column **Encrypt Peer** displays the IP address of the VPN peer to which the flow is sent and displays **Encrypt** as the VPN action.
- If the VPN server cascades the connection, it gets decrypted on one tunnel and gets re-encrypted on another tunnel. In this case, both **Encrypt Peer** and **Decrypt Peer** IP addresses get appears in the event. The column **VPN Action** displays **VPN Routing** as the action to indicate that the connection transit through the VPN server.

If you enable the bypass Access Control Policy for decrypted traffic (sysopt permit-vpn) option, the system bypasses the Access Control Policy and do not log events for decrypted traffic. This option is disabled by default and all decrypted traffic in the VPN tunnel undergoes ACL inspection.

View Site to Site VPN Connection Events

Access the connection event viewer of the Firewall Management Center to know if the VPN encrypts or do not encrypts the connection traffic and to retrieve the VPN peer details.

Before you begin

Ensure that you enable logging of connection events at the beginning of connection and at the end of connection in the access control rule.

Procedure

Step 1 Choose **Analysis** > **Connections** > **Events**.

Step 2 Go to **Table View of Connection Events** tab.

Step 3 In the table view of events, multiple fields are hidden by default. To change the fields that appear, click the **x** icon in any column name to display a field chooser.

Step 4 Choose the following columns:

- Decrypt Peer
- Encrypt Peer
- VPN Action

Step 5 Click **Apply**.

See *Connection and Security-Related Connection Events* in the Secure Firewall Management Center Administration Guide for more information on the connection events.