Simplify Branch to Hub Communication using Dynamic Virtual Tunnel Interface (DVTI)

In this chapter, we delve into the practical application of the DVTI in a hub and spoke topology. The use case details the scenario, network topology, best practices, and prerequisites. It also provides a comprehensive end-to-end procedure for seamless implementation.

Route-based VPN in a Hub and Spoke Topology

The Secure Firewall Management Center supports routable logical interfaces called the Virtual Tunnel Interfaces (VTIs). You can use these interfaces to apply static and dynamic routing policies. When using VTI, you do not have to configure static crypto map access lists and map them to interfaces. You no longer have to track all remote subnets and include them in the crypto map access list.

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 threat defense device encrypts or decrypts the traffic from or to the tunnel interface and forwards it according to the routing table.

The management center supports a site-to-site VPN wizard with defaults to configure VTI or route-based VPN.

When it comes to implementing route-based VPN in a hub and spoke topology,Dynamic Virtual Tunnel Interface (DVTI) is configured on the hub and SVTI (Static Virtual Tunnel Interface) is configured on the spoke.

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.

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

Benefits

The benefits of using a VTI-based VPN in a hub and spoke topology are:

1. **Simplified Configuration:** VTI simplifies the configuration of VPN tunnels by providing a logical interface that represents the tunnel itself. This eliminates the need for complex crypto map or access list configurations typically associated with traditional VPN setups.
2. **Simplified Management:** It is easy to manage peer configurations for large enterprise hub and spoke deployments. Only one dynamic VTI is configured on the hub for multiple static VTIs configured on the spokes.
3. **Scalability:** VTI allows for easy scalability. 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.
4. **Dynamic Routing Support:** VTI supports dynamic routing protocols such as Open Shortest Path First (OSPF) allowing for the dynamic exchange of routing information between VPN endpoints. This enables efficient routing decisions based on real-time network conditions.
5. **Dual ISP Redundancy:** SVTI supports backup VTI tunnels.
6. **Load balancing:** SVTI supports load balancing of VPN traffic using ECMP.

Is This Use Case For You?

The intended audience for the DVTI hub and spoke configuration includes network architects, IT administrators, and networking professionals responsible for designing and managing the network infrastructure of an organization. This use case is valuable to those seeking to optimize network connectivity, ensure data security, and streamline network administration by implementing a centralized hub with secure tunnels connecting to remote spoke sites.

Scenario

A medium-sized company has multiple branch offices located in different cities, and they want to establish a secure and efficient network infrastructure to connect these branches with the central headquarters. The company's IT administrator, Alice, is responsible for configuring and managing the network.

What is at risk?

The current network configuration requires manual configuration of multiple point-to-point connections between each branch office and the central headquarters. This approach is time-consuming, error-prone, and makes it challenging to maintain consistency in network settings across all locations. Alice needs a solution that simplifies the configuration process and provides centralized control.

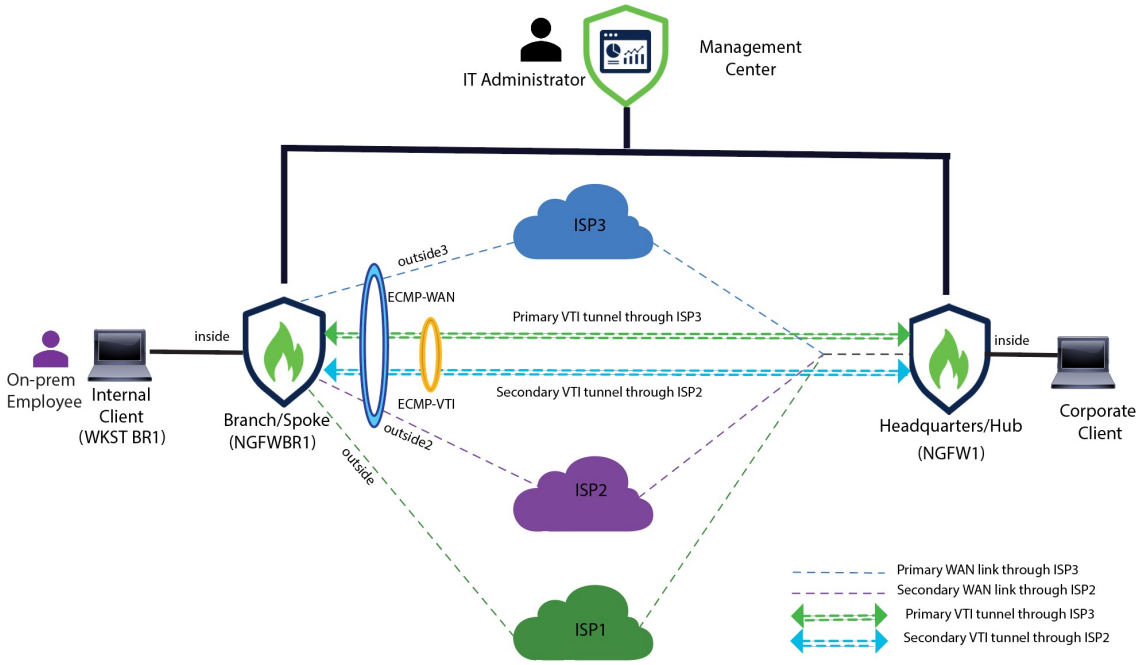
How does a route-based VPN between a branch(spoke) and headquarters (hub) solve the problem?

1. Centralized Configuration: Alice implements DVTI Hub and Spoke topology, centralizing configuration and management at the hub. This simplifies network settings across all locations.
2. Dynamic Routing: Alice sets up dynamic routing protocols (for example, OSPF) automating routing information exchange. Manual configuration of static routes is eliminated, simplifying network administration.
3. Rapid Provisioning: With DVTI, Alice can quickly provision new branch offices by configuring a spoke router and establishing a secure tunnel with the hub. This simplifies the provisioning process and supports network scalability.

By implementing DVTI, Alice simplifies network configuration, centralizes control, ensures consistency, and enables efficient provisioning and scalability in the corporate network.

Network Topology

In this hub spoke topology, a threat defense device is deployed at a branch location. In the figure below, the internal client or branch workstation is labelled WKST BR and the branch (spoke) threat defense is labelled NGFWBR1. The headquarters (hub) is labelled as NGFW1 and is connected to the corporate network. A VPN tunnel is configured between NGFWBR1 and NGFW1. An ECMP zone is configured on the primary and secondary static VTI interfaces on the branch node for link redundancy and loading balancing of VPN traffic.



Best Practices

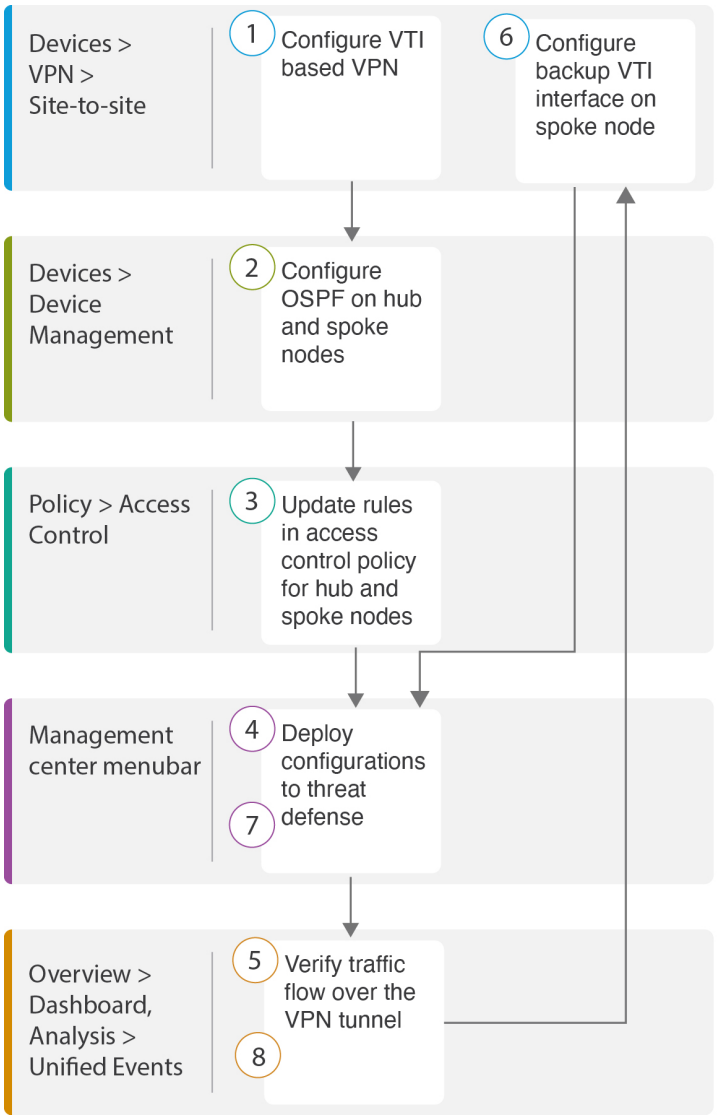
- Ensure that Secure Firewall Threat Defense is runing on version 6.7 and later.
- VTI is supported in routed mode only.
- Configure the Borrow IP for the dynamic interface from a loopback interface.
- Ensure to apply access rules on a VTI interface to control traffic through VTI.
- Configure ECMP zones for SVTIs to load balance VTI traffic.

Prerequisites

- Complete the Threat Defense Initial Configuration Using the Device Manager
- Assign Licenses to Devices
- Add routes for internet access. See Add a Static Route
- Configure NAT for Threat Defense
- Creating a Basic Access Control Policy

End-to-End Procedure for Configuring a Route-based VPN (Hub and Spoke Topology)

The following flowchart illustrates the workflow for configuring a route-based VPN for a hub spoke topology in Secure Firewall Management Center.



Step	Description
1	Configure a VTI based VPN. See • Create a Route-based Site-to-Site VPN, on page 6 • Configure the Endpoint for the Hub Node, on page 7

Step	Description
	• Configure the Endpoint for the Spoke Node, on page 8
2	Configure OSPF on the hub and spoke nodes. See • Configure OSPF on the Hub Node, on page 10 • Configure OSPF on the Spoke Node, on page 12
3	Updates rules in the access control policy for hub and spoke nodes. See Configure the Access Control Policy, on page 13.
4	Deploy configuration to threat defense. See Deploy Configuration, on page 16.
5	Verify traffic flow over VPN tunnel. See Verify Traffic Flow Over the VPN Tunnel, on page 16.
6	Configure backup VTI on spoke node. See Configure the Backup VTI Interface on the Spoke Node, on page 19.
7	Deploy the configuration on Threat Defense. SeeDeploy Configuration, on page 16 .
8	Verify traffic flow over secondary tunnel. See Verify the Primary and Secondary Tunnels, on page 21.

Create a Route-based Site-to-Site VPN

You can configure a route-based site-to-site VPN between two nodes. To configure a VTI-based VPN you need virtual tunnel interfaces at both the nodes of the tunnel.

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

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

Step 2 Enter the name as **Corporate-VPN** in the **Topology Name** field.

Step 3 Choose **Route Based (VTI)** as the topology type.

Step 4 Configure the endpoint for the hub node. See Configure the Endpoint for the Hub Node, on page 7.

Step 5 Configure the endpoint for the spoke node. See Configure the Endpoint for the Spoke Node, on page 8.

Step 6 The default settings are used in the **IKE**, **IPsec**, and **Advanced** tabs.

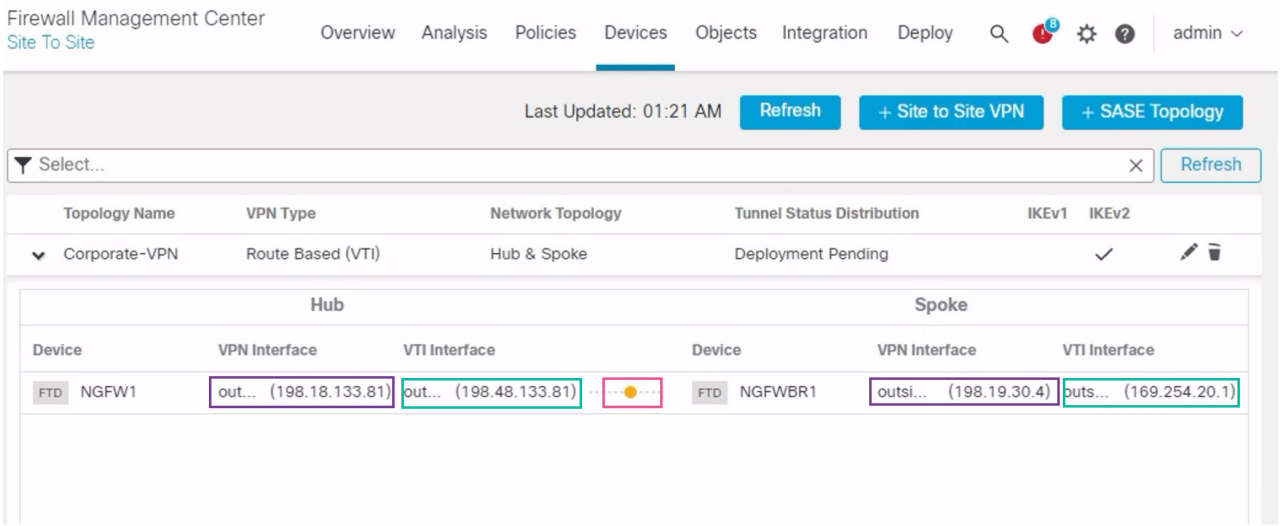
Step 7 Click **Save**.

The Corporate-VPN topology is created successfully.

Step 8 You can view the VPN topology in the Site-to-site VPN listing page by navigating to **Devices** > **Site-to-site VPN**.

Note Click **Refresh** if you do not see the VPN topology that you created.

Step 9 Expand the **Corporate-VPN** node to view all the tunnels in the topology. It displays the **NGFW1** hub and the **NGFWBR1** spoke with details of the physical source and VTI interfaces. Since the configuration has not yet been deployed, it displays **Deployment Pending** and the tunnel displays amber status.



What to do next

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

- A routing protocol to route the VTI traffic between the devices over the VTI tunnel. See Configure OSPF on the Hub Node, on page 10 and Configure OSPF on the Spoke Node, on page 12.
- An access control rule to allow encrypted traffic. See Configure the Access Control Policy, on page 13.

Configure the Endpoint for the Hub Node

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

Step 1 In the **Hub Nodes** section, click +. The **Add Endpoint** dialog box is displayed.

Step 2 Choose **NGFW1** as the hub from the **Device** drop-down list.

Note The device must be running on software version 7.3 or later.

Step 3 Click + next to the **Dynamic Virtual Tunnel Interface** drop-down list to add a new dynamic VTI.

The **Add Virtual Tunnel Interface** dialog box appears with the following pre-populated default configurations.

- **Tunnel Type** is auto-populated with **Dynamic**.

- **Name** is auto-populated as <*tunnel_source interface logical name*>+ dynamic_vti +<*tunnel ID*>. For example, **outside_dynamic_vti_1** .
- The **Enabled** checkbox is checked by default.
- **Security Zone** –To define a security zone for this interface, choose **New…** from the drop-down list. In the **New Security Zone** dialog box, enter **Tunnel_Zone** as the name and click **OK**. Select **Tunnel_Zone** as the security zone for this tunnel interface**.**
- **Template ID** is auto-populated with a unique ID for the DVTI interface.
- **Tunnel Source** is the physical interface that is the source of the DVTI and is auto-populated by default. In this use case, we do not want to set an explicit tunnel source for the DVTI. Clear the selection by choosing **Select Interface** from the drop-down list.
- **IPsec Tunnel Mode** is set to IPv4, by default.
- **IP address** cannot be a static IP address as DVTI is a template interface. We recommend that you configure the Borrow IP for the dynamic interface from a loopback interface. To add a loopback interface, click **+** next to the **Borrow IP (IP unnumbered)** drop-down list. In the **Add Loopback Interface** dialog box:
  a. In the **General** tab, enter the **Name** as **HUB_Tunnel_IP** and **Loopback ID** as **1**.
  b. In the **IPv4** tab, enter the IP address as **198.48.133.81/32** .
  c. Click **OK** to save the loopback interface.

  The Borrow IP is set to **Loopback 1(HUB_Tunnel_IP)**.

Click **OK** to save the DVTI. A message is displayed that confirms the VTI is created successfully. Click **OK**.

The Dynamic Virtual Tunnel Interface is set to **outside_dynamic_vti_1(198.48.133.81)**.

Step 4 Select **GigabitEthernet 0/0 (outside)** from the **Tunnel Source** drop-down list. The IP address of the outside interface (**198.18.133.81)** is auto-populated in the next field.

Step 5 Expand **Advanced Settings** to view the default settings.

Step 6 Click **OK**.

NGFW1 is successfully configured as the hub node.

Configure the Endpoint for the Spoke Node

Step 1 In the **Spoke Nodes** section, click **+**. The **Add Endpoint** dialog box is displayed.

Step 2 Choose **NGFWBR1** as the hub from the **Device** drop-down list.

Note The device must be running on software version 7.3 or later.

Step 3 Click **+** next to the **Static Virtual Tunnel Interface** drop-down list to add a new static VTI.

The **Add Virtual Tunnel Interface** dialog box appears with the following pre-populated default configurations.

- **Tunnel Type** is auto-populated with **Static**.

- **Name** is auto-populated as <*tunnel_source interface logical name*>+ static_vti +<*tunnel ID*>. For example, **outside_static_vti_1** .
- The **Enabled** checkbox is checked by default.
- Select **Tunnel_Zone** from the Security Zone drop-down list.
- **Tunnel ID** is auto-populated with a value as 1.
- Select **GigabitEthernet0/4 (outside3)** from the **Tunnel Source** drop-down list. Select the IP address of the outside 3 interface as **198.19.30.4** from the drop-down list next to it.
- **IPsec Tunnel Mode** is set to IPv4, by default.
- **IP address** can either be a static IP address or a borrow IP. We recommend that you configure the Borrow IP for the static interface from a loopback interface. To add a loopback interface, click **+** next to the **Borrow IP (IP unnumbered)** drop-down list. In the **Add Loopback Interface** dialog box:
  a. In the **General** tab, enter the **Name** as **Spoke_Tunnel_IP** and **Loopback ID** as **1**.
  b. In the **IPv4** tab, enter the IP address as **169.254.20.1/32** .
  c. Click **OK** to save the loopback interface.

  The Borrow IP is set to **Loopback 1(Spoke_Tunnel_IP)**.

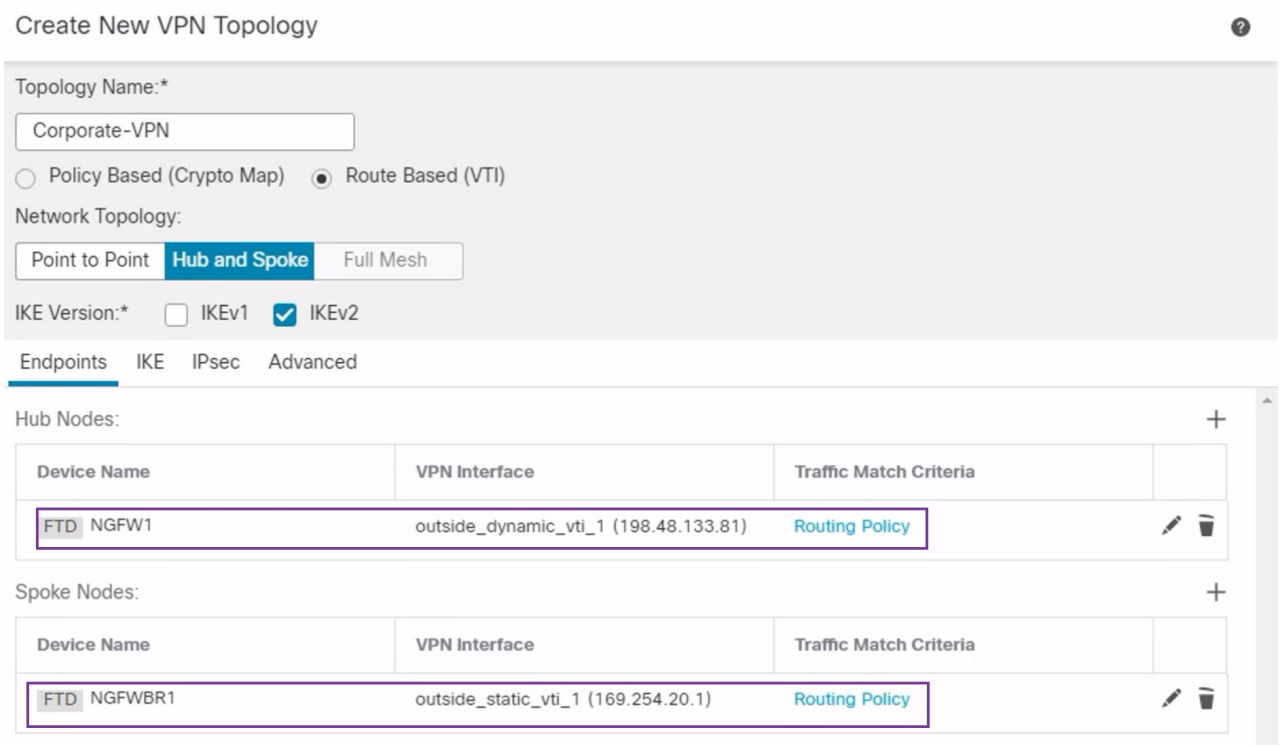
Click **OK** to save the SVTI. A message is displayed that confirms the VTI is created successfully. Click **OK**.

The Static Virtual Tunnel Interface is set to **outside_static_vti_1(169.254.20.1)**.

Step 4 Expand **Advanced Settings** to view the default settings. Both checkboxes must be checked.

Step 5 Click **OK**.

NGFWBR1 is successfully configured as the spoke node.



Configure OSPF on the Hub Node

OSPF is configured between Hub and Spoke device to allow traffic to be sent across the VPN tunnel. For reference, static routing is underlay, over which Spoke to Hub tunnel is established and OSPF is considered as overlay.

Step 1 To edit the hub node, choose **Devices** > **Device Management** and click the **Edit** (✎) icon for the NGFW1 node.

Step 2 In the **Interfaces** tab, verify the **Loopback1** interface that was created earlier and serves as the IP address for the DVTI interface.

Step 3 Click **Routing**.

Step 4 Click **OSPF** in the left panel.

Step 5 Check the **Process 1** checkbox to enable an OSPF instance.

Step 6 Click the **Interface** tab.

Step 7 Click **+Add**. The **Add Interface** dialog box appears. Modify the following fields:

- **Interface**—Select the DVTI interface **outside_dynamic_vti_1** from the drop-down list.
- **Point-to-point**—Check the checkbox to transmit OSPF routes over VPN tunnels.

  The rest of the fields use default values.
- Click **OK**.

A row is added in the **Interface** tab for **outside_dynamic_vti_1**.

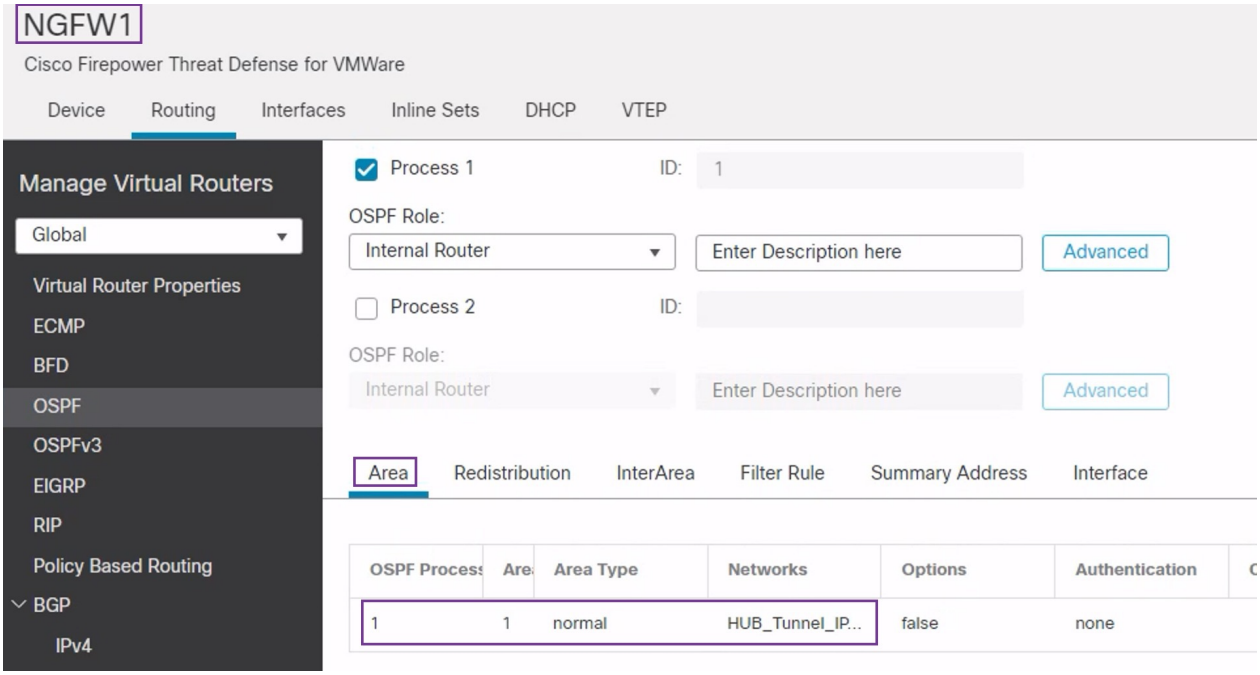
Step 8 Click the **Area** tab.

Step 9 Click **+Add**. The **Add Area** dialog box appears. Modify the following fields:

- **OSPF Process**—Choose the process ID as 1.
- **Area ID**—Ensure the value is 1.

  The rest of the fields use default values.
- **Available Network**— To add networks to be advertised over the tunnel:
  - To add a new network object, click +. Enter these details:
    - **Name**—Enter the name as **HUB_Tunnel_IP**.
    - **Network**—Select the **Host** option and enter the host IP as **198.48.133.81**.
    - Click **Save**.
  - Enter **HUB** in the search area of the **Available Network** field. The newly added network object (**HUB_Tunnel_IP**) is listed. Select the object and click **Add** to add it to the **Selected Network** list.
  - Enter **Corporate** in the search area of the **Available Network** field. The **Corporate_LAN** network object is listed. Select the object and click **Add** to add it to the **Selected Network** list.
- Click **OK**.

A row is added in the **Area** tab.



Step 10 Click **Save** to save the OSPF configuration for the hub node.

Configure OSPF on the Spoke Node

Step 1 To edit the spoke node, choose **Devices** > **Device Management** and click the **Edit** ( ) icon for the NGFWBR1 node.

Step 2 In the **Interfaces** tab:

- Verify the details of **Tunnel1** interface that was created earlier in the spoke configuration.
- Verify the details of the **Loopback1** interface that was created earlier and serves as the IP address for Tunnel1.

Step 3 Click **Routing**.

Step 4 Click **OSPF** in the left panel.

Step 5 Check the **Process 1** checkbox to enable an OSPF instance.

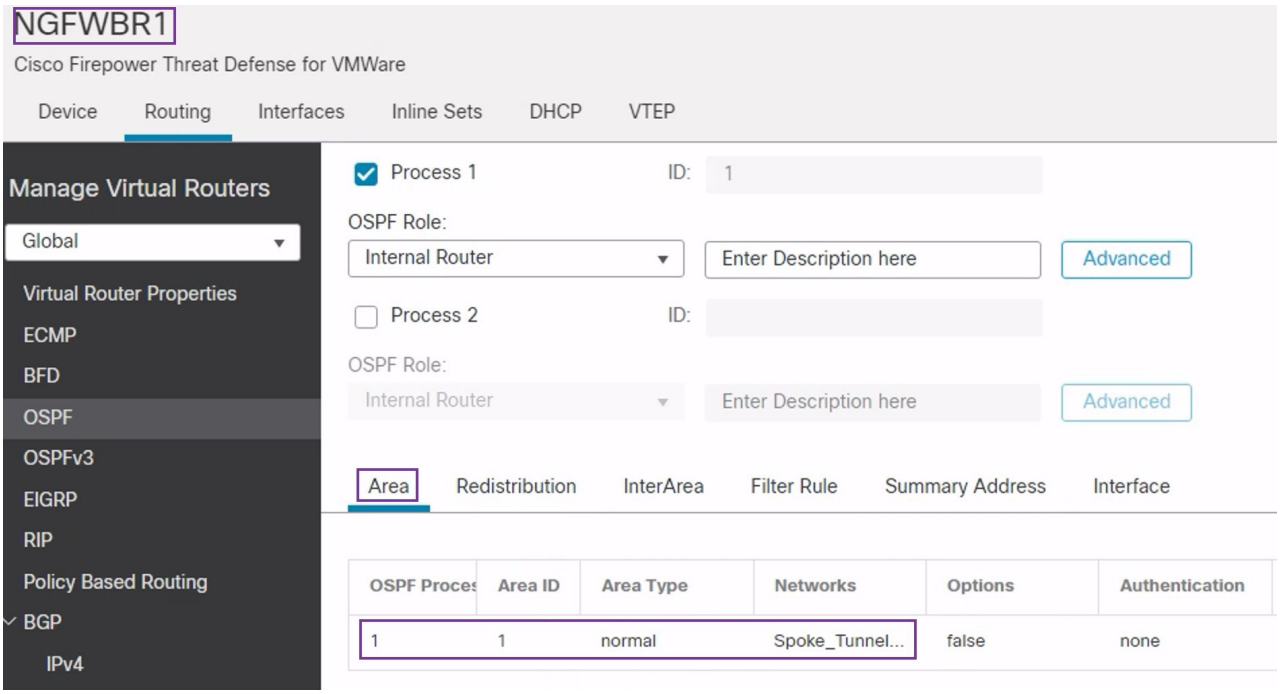
Step 6 Click the **Area** tab.

Step 7 Click +**Add**. The **Add Area** dialog box appears. Modify the following fields:

- **OSPF Process**—Choose the process ID as 1.
- **Area ID**—Ensure the value is 1.

  The rest of the fields use default values.
- **Available Network**— To add networks to be advertised over the tunnel:
  - To add a new network object, click +. Enter these details:
    - **Name**—enter the name as **Spoke_Tunnel_IP**.
    - **Network**—Select the **Host** option and enter the host IP as **169.254.20.1**.
    - Click **Save**.
  - Enter **Spoke** in the search area of the **Available Network** field. The newly added network object (**Spoke_Tunnel_IP**) is listed. Select the object and click **Add** to add it to the **Selected Network** list.
  - Enter **Branch** in the search area of the **Available Network** field. The **Branch_LAN** network object is listed. Select the object and click **Add** to add it to the **Selected Network** list.
- Click **OK**.

A row is added in the **Area** tab.



Step 8 Click **Save** to save the OSPF configuration for the spoke node.

Configure the Access Control Policy

Before proceeding, ensure that the VTI interfaces on **NGFW1** and **NGFWBR1** nodes are associated to a new zone labeled as **Tunnel_Zone**.

Navigate to **Policies > Access Control** to review the access control policies. The following access control policies must be updated for both the hub and spoke to allow the VPN traffic to and from the tunnel.

- **NGFW1**—Access control policy for the hub node (NGFW1)
- **Branch Access Control** —Access control policy for the spoke node (NGFWBR1)

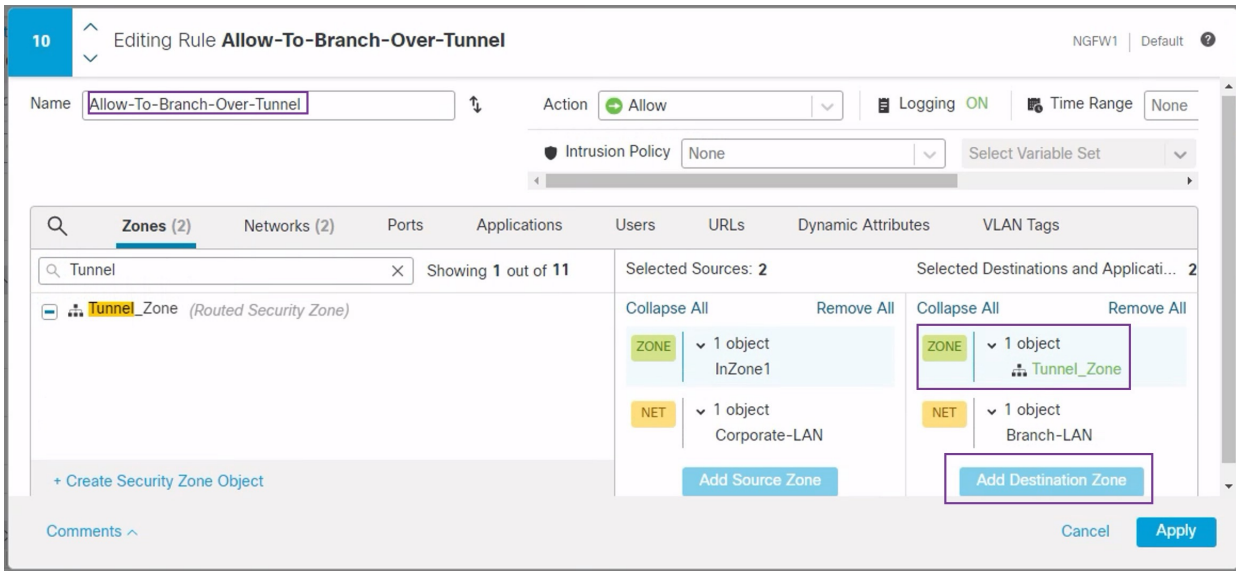
Step 1 To edit the hub node (NGFW1) AC policy, click the **Edit** (✎) icon.

The existing rules that must be modified for this use case are:

- **Allow-To-Branch-Over-Tunnel**
- **Allow-To-Corp-Over-Tunnel**

a. To edit the **Allow-To-Branch-Over-Tunnel** policy, click the **Edit** (✎) icon.

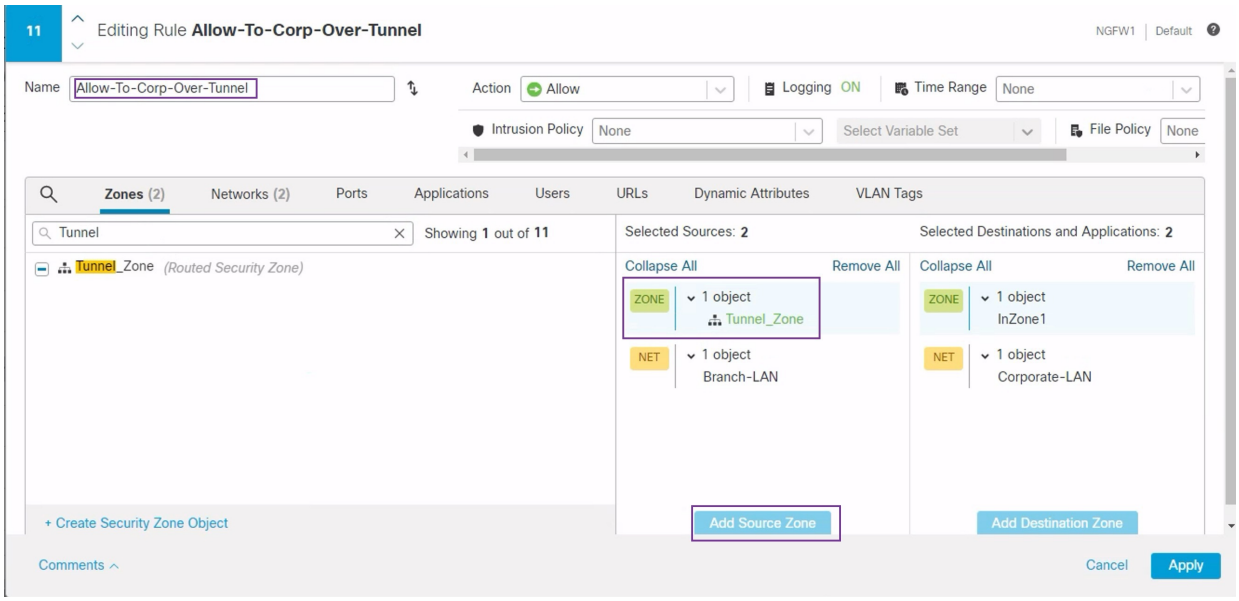
b. In the **Zones** tab, search for **Tunnel_Zone**, select it, and click **Add Destination Zone**.



c. Click **Apply** to save the rule.

d. To edit the **Allow-To-Corp-Over-Tunnel** policy, click the **Edit** (✎) icon.

e. In the **Zones** tab, search for **Tunnel_Zone**, select it, and click **Add Source Zone**.



f. Click **Apply** to save the rule.

g. Verify the updated rules in NGFW1.

h. Click **Save** the AC policy.

i. Click **Return to Access Conrol Policy Management** to return the policy page.

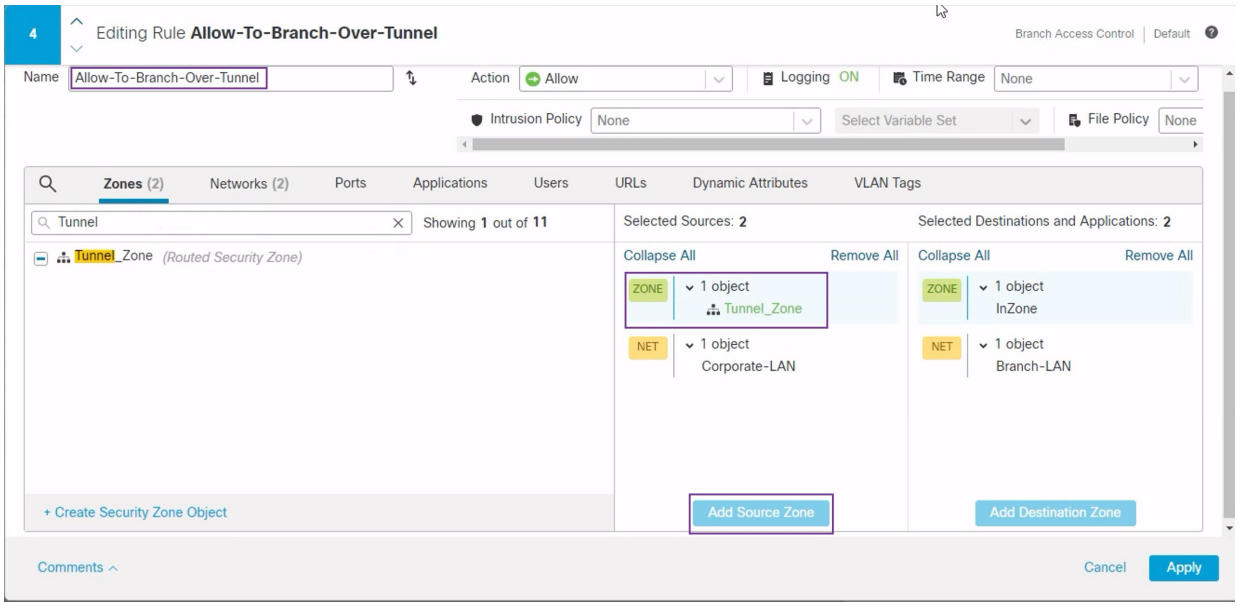
Step 2 To edit the spoke node (NGFWBR1) AC policy, click the **Edit** (✎) icon.

The rules that must be edited for this example are:

- **Allow-To-Branch-Over-Tunnel**
- **Allow-To-Corp-Over-Tunnel**

a. To edit the **Allow-To-Branch-Over-Tunnel** policy, click the **Edit** (✎) icon.

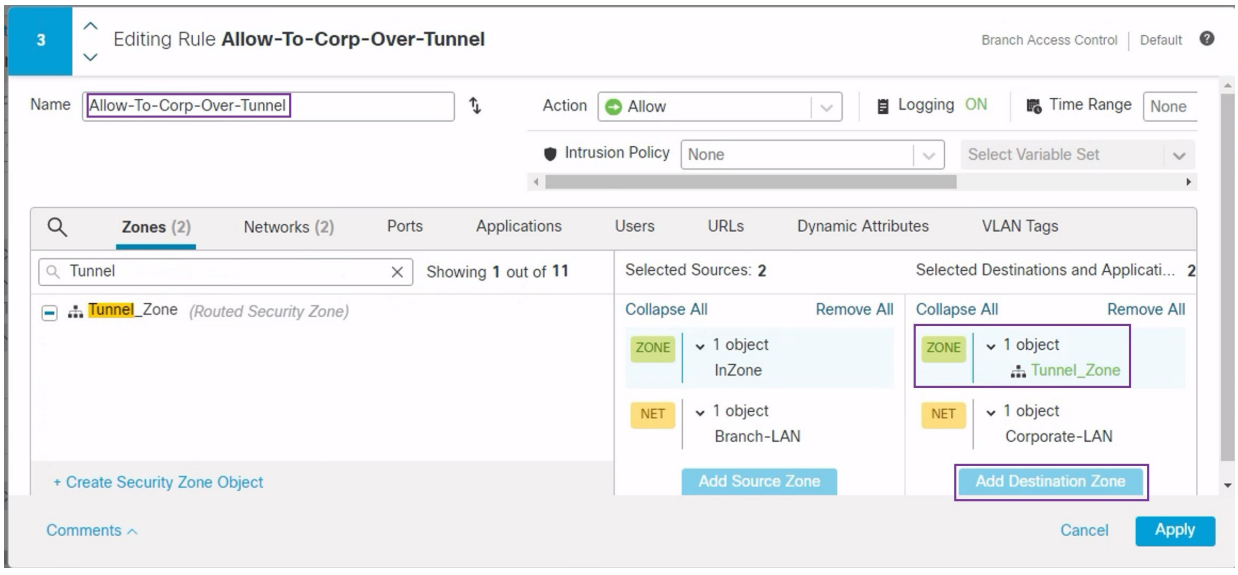
b. In the **Zones** tab, search for **Tunnel_Zone**, select it, and click **Add Souce Zone**.



c. Click **Apply** to save the rule.

d. To edit the **Allow-To-Corp-Over-Tunnel** policy, click the **Edit** (✎) icon.

e. In the **Zones** tab, search for **Tunnel_Zone**, select it, and click **Add Destination Zone**.



f. Click **Apply** to save the rule.

g. Verify the updated rules in NGFWBR1.

h. Click **Save** the AC policy.

Deploy Configuration

After you complete all the configurations, deploy them to the managed device.

Step 1 On the management center menu bar, click **Deploy**. This displays the list of devices that are Ready for Deployment.

Step 2 Check the checkboxes adjacent to NGFWBR1 and NGFW1 on which you want to deploy configuration changes.

Step 3 Click **Deploy**. Wait till the deployment is marked Completed on the Deploy dialog box.

Step 4 If the system identifies errors or warnings in the changes to be deployed, it displays them in the **Validation Errors** or **Validation Warnings** window. To view complete details, click the Validation Errors or Validation Warnings link.

You have the following choices:

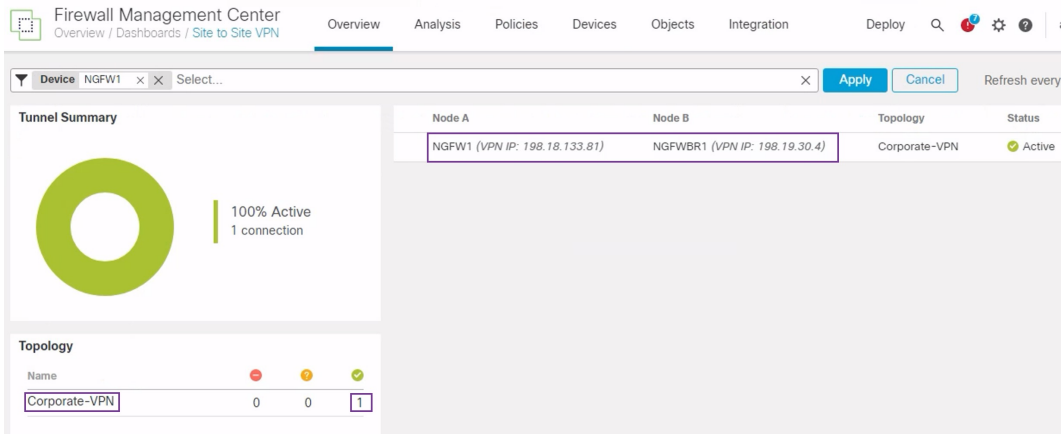
- Proceed with Deploy—Continue deploying without resolving warning conditions. You cannot proceed if the system identifies errors.
- Close—Exit without deploying. Resolve the error and warning conditions, and attempt to deploy the configuration again.

Verify Traffic Flow Over the VPN Tunnel

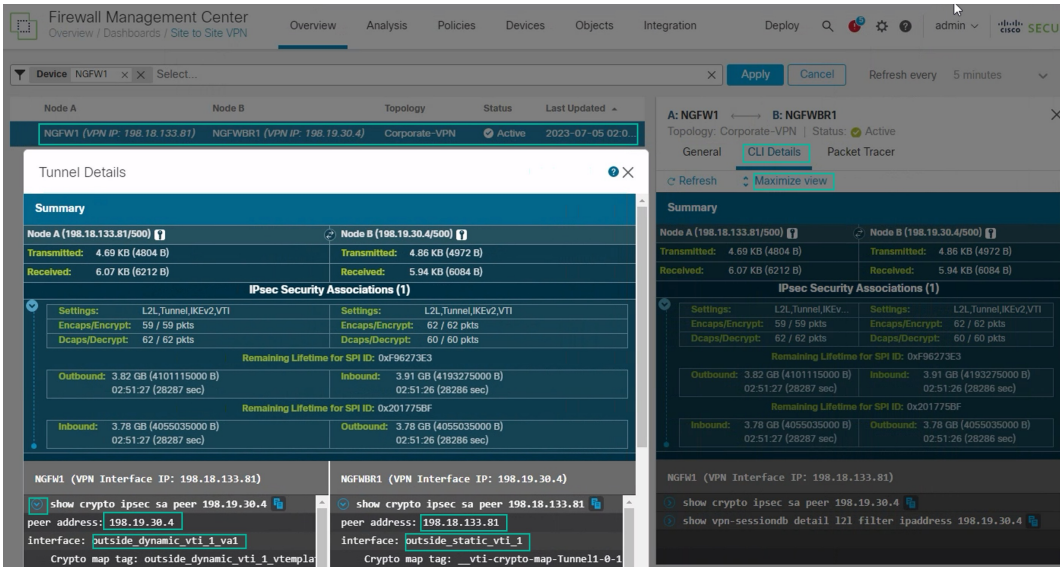
Perform the following verifications for the VPN tunnel.

- **Verify Tunnel Status on the Site-to-site VPN Dashboard**

1. To verify that the VPN tunnel is up and green, choose **Overview** > **Dashboards** > **Site-to-site VPN**.

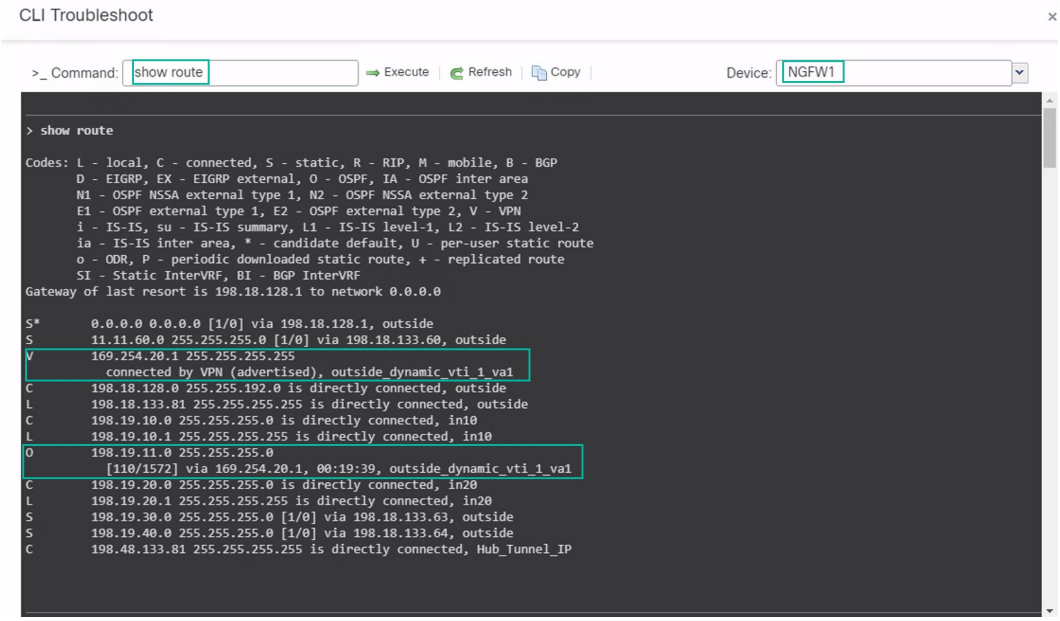


2. Hover over NGFW1. The **View Full Information** icon is displayed next to NGFW1.
3. Click the **View Full Information** icon.A side pane with tunnel details and additional actions appears.
4. Click the **CLI Details** tab in the side pane.
5. Click **Maximize View** to display a maximized dialog box that contains the details of the IPSec security associations.
6. You can expand the CLI for the show commands in the lower portion of the dialog box to view the VTI interfaces on the devices.

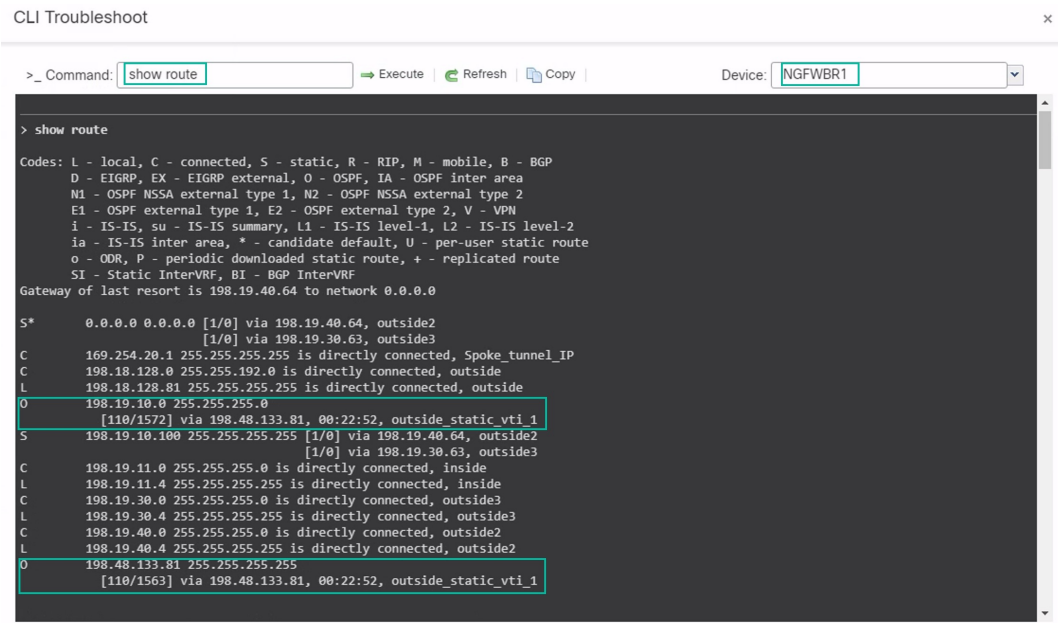


7. Click **Close** to terminate the Tunnel Details window.

- **Verify Routing on the Hub and Branch Nodes**-To verify that the OSPF routes have been correctly learned on the **NGFW1** and **NGFWBR1.** nodes:
  1. Choose **Devices** > **Device Management**.
  2. To edit NGFW1, click the **Edit** (✎) icon.
  3. Click the **Device** tab.
  4. Click the **CLI** button in the **General** card. The **CLI Troubleshoot** window appears
  5. Enter **show route** in the **Command** field and click **Execute** .
  6. Review the routes on the NGFW1 node and confirm the VPN route for the spoke's VTI IP (169.254.20.1) and OSPF learnt route for the Branch_LAN (198.19.11.0/24) as displayed in the figure below.

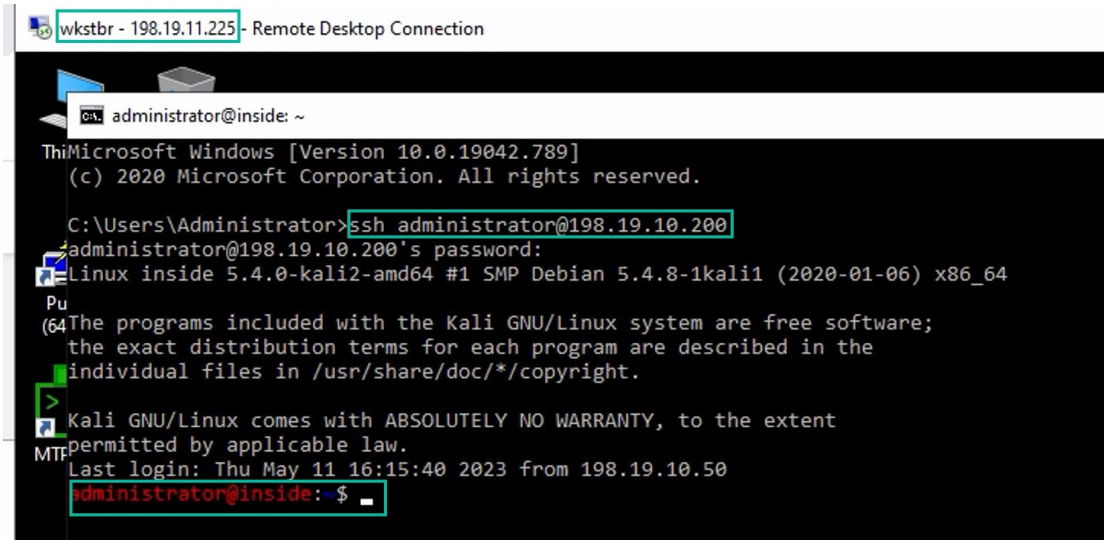


7. Repeat Steps 2 through 5 for the NGFWBR1 node.
8. Review the routes on the NGFWBR1 node. Confirm the OSPF routes learnt for the hub's VTI IP (198.48.133.81) and for the Corporate_LAN (198.19.10.0/24) as displayed in the figure below.



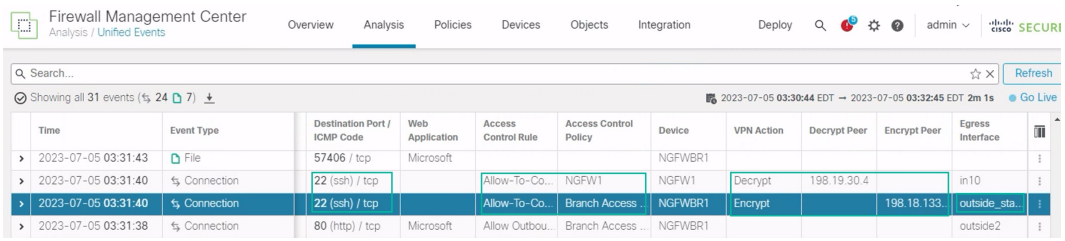
- **Verify Traffic between Protected Networks Behind the Spoke and Hub Nodes**

  Log into the WKST BR workstation (198.19.11.225) and SSH to the host (198.19.10.200) behind NGFW1. Ensure that you are able to SSH successfully to the host.



- **Verify Connectivity Between Branch and Spoke Nodes Using Unified Events**

1. Choose **Analysis > Unified Events**.
2. Add the **VPN Action, Encrypt Peer, Decrypt Peer**, and **Egress Interface** columns using the column picker.
3. Reorder and resize the new columns along with the columns, **Destination Port/ICMP Code, Access Control Rule, Access Control Policy**, and **Device** as seen in the figure below.



4. To view the events related to the SSH connection from the **WKST BR** to **Corporate Host** choose the row with **22 (ssh/tcp)** in the **Destination Port/ICMP Code** column. Note the **Encrypt** action on **NGFWBR1** over the **outside_static_vti_1** interface followed by the **Decrypt** action on the **NGFW1** as shown in the figure above.

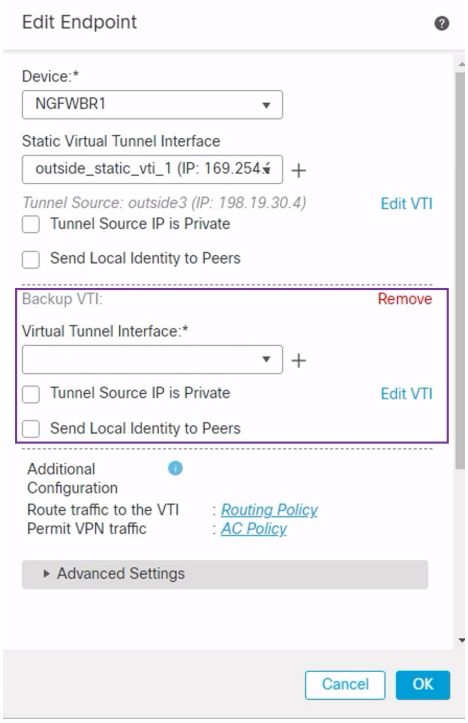
Configure the Backup VTI Interface on the Spoke Node

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.

Step 1 Choose **Devices** > **Site-to-site VPN** to view the configured Corporate-VPN VPN topology and click the **Edit** (✎) icon. The Edit VPN Topology window appears.

Step 2 In the Spoke Nodes section, click the **Edit** (✎) icon for the **NGFWBR1** node. The **Edit Endpoint** dialog box appears.

Step 3 Click the **Add Backup VTI** link to add the secondary VTI tunnel. The link displays the Backup VTI section.



Step 4 Click + next to the **Virtual Tunnel Interface** drop-down list to add a new VTI.

The **Add Virtual Tunnel Interface** dialog box appears with the following pre-populated default configurations.

- **Tunnel Type** is auto-populated with **Static**.
- **Name** is auto-populated as <*tunnel_source interface logical name*>+ static_vti +<*tunnel ID*>. For example, **outside_static_vti_2** .
- The **Enabled** checkbox is checked by default.
- Select **Tunnel_Zone** from the Security Zone drop-down list.
- **Tunnel ID** is auto-populated with a value as 2.
- Select **GigabitEthernet0/3 (outside2)** from the **Tunnel Source** drop-down list. Select the IP address of the outside 3 interface as **198.19.40.4** from the drop-down list next to it.
- **IPsec Tunnel Mode** is set to IPv4, by default.
- **IP address** can either be a static IP address or a borrow IP. We recommend that you configure the Borrow IP for the static interface from a loopback interface. To add a loopback interface, click select **Loopback 1(Spoke_Tunnel_IP)** from the drop-down list.

Click **OK** to save the VTI. A message is displayed that confirms the VTI is created successfully. Click **OK**.

The Backup VTI Interface is set to **outside_static_vti_2(169.254.20.1)**.

Step 5 Click **OK** to save the spoke configuration.

Step 6 Click **Save** to save the VPN topology.

Configure an ECMP Zone for the Primary and Secondary VTI Interfaces

Configure ECMP on the primary and secondary static VTI interfaces on the branch node for link redundancy and for load balancing the VPN traffic.

Step 1 Choose **Devices** > **Device Management**, and edit the Threat Defense device (**NGFWBR1**).

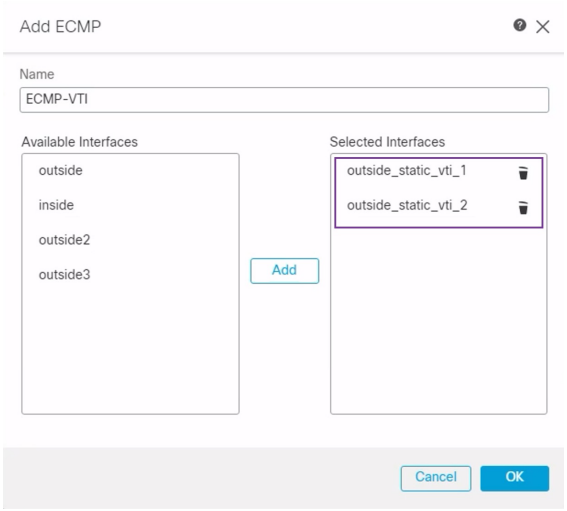
Step 2 Click the **Routing** tab on the interface view of NGFWBR1.

Step 3 Click **ECMP**.

Step 4 Click **Add**.

Step 5 In the **Add ECMP** box, enter a name, **ECMP-VTI** for the ECMP zone.

Step 6 To associate interfaces, select the interfaces **outside_static_vti_1** and **outside_static_vti_2** under the **Available Interfaces** box, and then click **Add**.



Step 7 Click **OK**.

The ECMP page now displays the newly created ECMP zone.

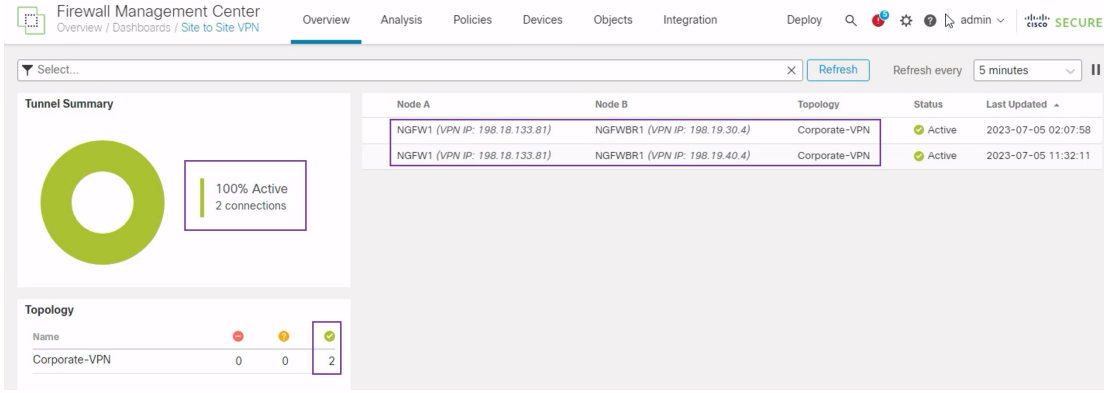
Step 8 Click **Save**.

Verify the Primary and Secondary Tunnels

Verify that both the primary and secondary VTI tunnels between the branch node and the hub node are configured, up, and active.

- **Verify Tunnel Status on the Site-to-site VPN Dashboard**

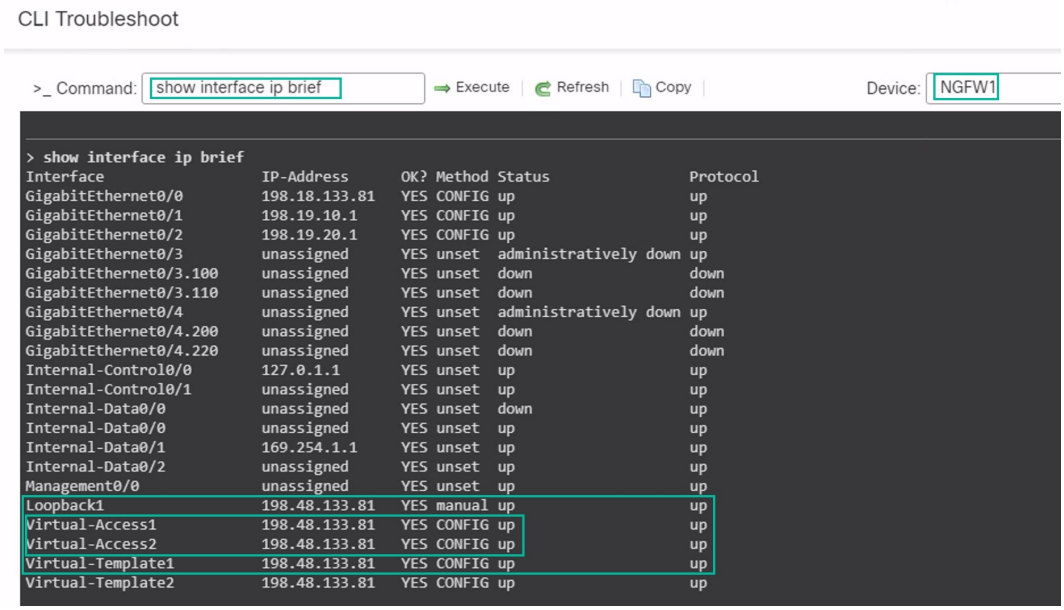
  To verify that the VPN tunnel is up and green, choose **Overview** > **Dashboards** > **Site-to-site VPN**.



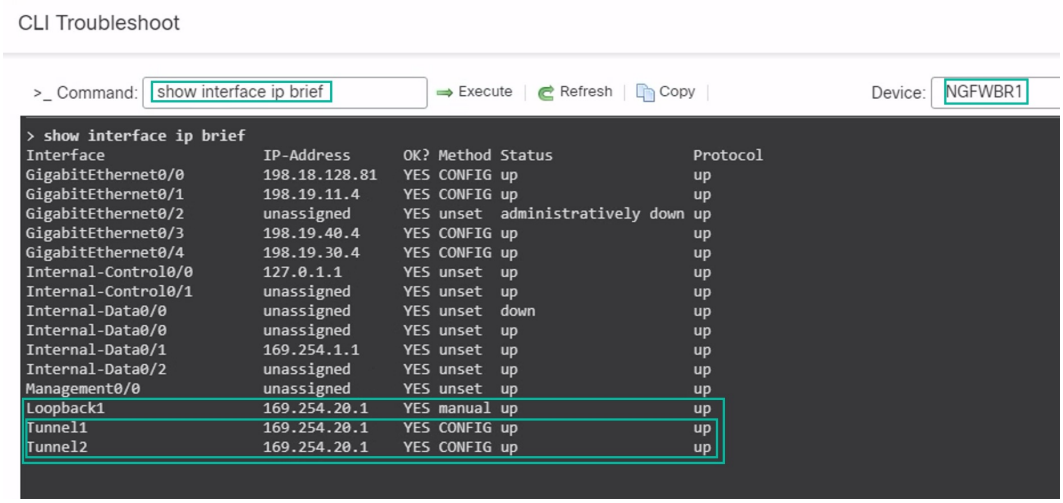
- **Verify Routing on the Hub and Branch Nodes**

  1. Choose **Devices** > **Device Management**.
  2. To edit NGFW1, click the Edit icon.
  3. Click the **Device** tab.
  4. Click the **CLI** button in the **General** card. The **CLI Troubleshoot** window appears
  5. Enter **show interface ip brief** in the **Command** field and click **Execute** to view the dynamic Virtual Access interfaces that were created from the DVTI on the hub.

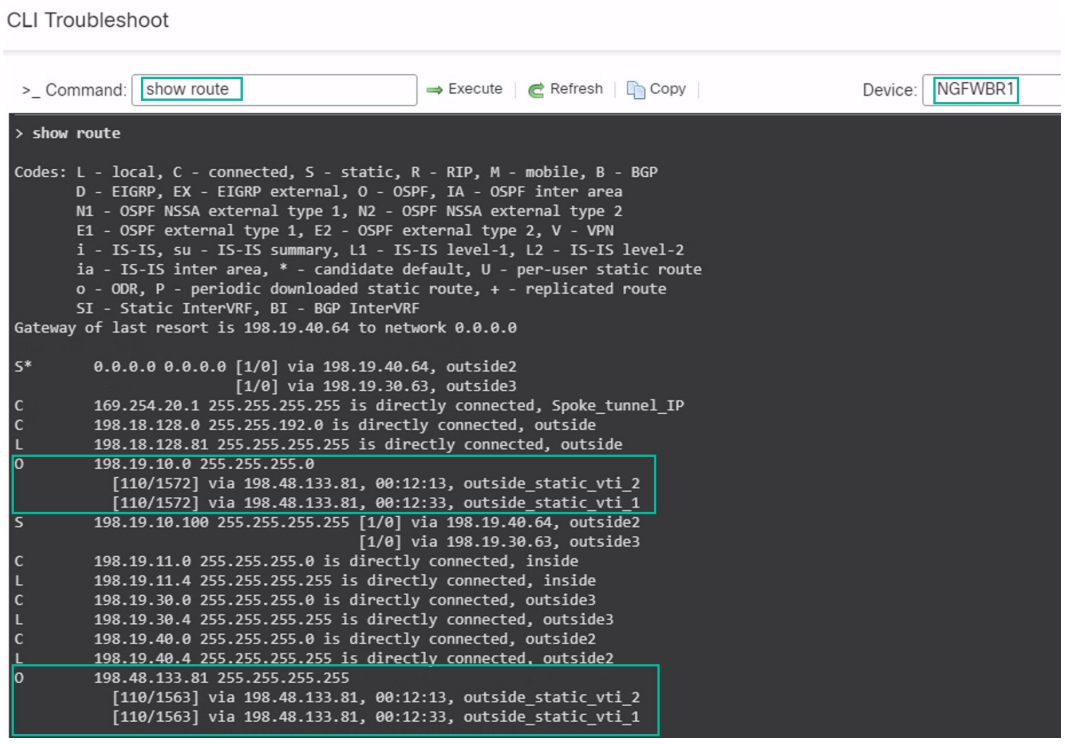
Note The Virtual-Access2 interface gets generated from the same DVTI when **NGFWBR1** connects to NGFW1 over the secondary VTI connection.



6. Repeat Steps 2 through 5 for the NGFWBR1 node to view the static VTI interfaces **Tunnel1** and **Tunnel2** as shown in the figure below.



7. Enter **show route** in the **Command** field and click **Execute** to view the routes after the addition of the secondary VTI tunnel.



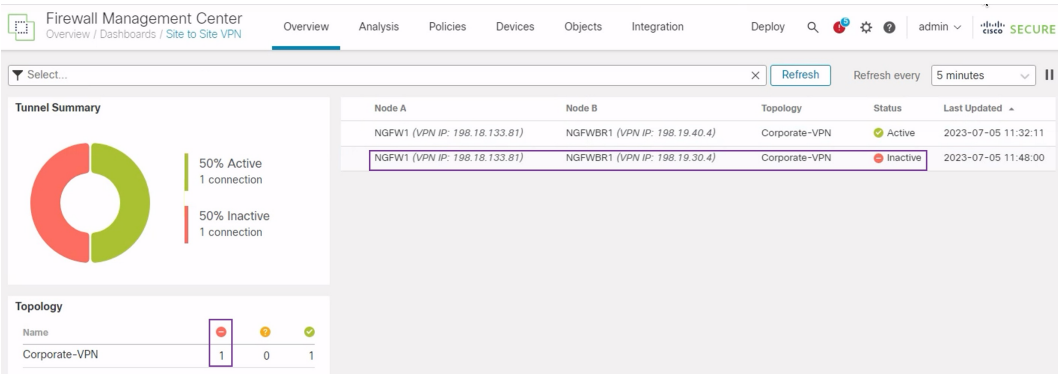
- Note that the **Corporate_LAN** (198.19.10.0/24) has been learnt over OSPF on both the primary (**outside_static_vti_1**) and secondary (**outside_static_vti_2**) VTIs.
- Note that the DVTI Tunnel IP (198.48.133.81) has also been learnt over OSPF on both the primary and secondary VTIs.

- **Verify Failover to Secondary Tunnel When the Primary Tunnel Goes Down**

1. In this example, to validate failover to the secondary tunnel, packet loss can be induced by restricting outbound traffic sourced from the outside3 interface going to internet either through an access control list on the upstream device or by shutting down the outside3 interface for threat defense from the management center.

Note Shutting down an interface is network intrusive and must not be tried in a production network.

2. In the Site-to-site VPN Dashboard, the primary tunnel is down as shown in the figure below.



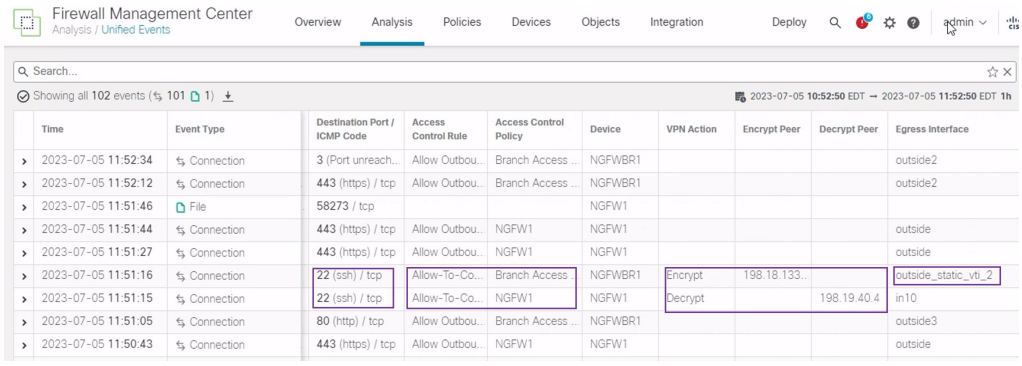
3. Initiate traffic from Branch to Hub. Log in to the WKST BR workstation and SSH to the host behind NGFW1. Ensure that you are able to SSH successfully to the host.

4. Verify the egress path of the traffic using the Unified Event Viewer:

   a. Choose **Analysis > Unified Events**.

   b. Add the **VPN Action, Encrypt Peer, Decrypt Peer**, and **Egress Interface** columns using the column picker.

   c. Reorder and resize the new columns along with the columns, **Destination Port/ICMP Code, Access Control Rule, Access Control Policy**, and **Device** as seen in the figure below.



Notice that the egress interface on the **NGFWBR1** for the SSH (Port 22) is now displayed as the secondary interface (**outside_static_vti_2**).

Troubleshoot Route-based VPN Tunnels

After the deployment, use the following CLI to debug issues related to route-based VPN tunnels on Secure Firewall Threat Defense.

Note Proceed with caution when you run debug commands on the threat defense device in production environments.You can set various debug levels on the device that may have verbose outputs.

How to...	CLI Command
Enable conditional debugging for a particular peer	**debug crypto condition peer <peer-IP>**
Debug the Virtual Tunnel Interface information	**debug vti 255**
Debug the IKEv2 protocol related transactions	**debug crypto ikev2 protocol 255**
Debug the IKEv2 platform related transactions	**debug crypto ikev2 platform 255**
Debug the common IKE related transactions	**debug crypto ike-common 255**
Debug the IPSec related transactions	**debug crypto ipsec 255**

Additional Resources

Resource	URL
Secure Firewall Threat Defense Release Notes	https://www.cisco.com/c/en/us/support/security/firepower-ngfw/products-release-notes-list.html
All New and Deprecated Features	http://www.cisco.com/go/whatsnew-fmc
Secure Firewall on Cisco.com	http://www.cisco.com/go/firewall
Secure Firewall on YouTube	https://www.youtube.com/cisco-netsec
Secure Firewall Essentials	https://secure.cisco.com/secure-firewall