Use Cases for SD-WAN Capabilities in Cisco Secure Firewall

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CHAPTER 1

Getting Started

This chapter provides you with a brief overview of the Cisco Secure Firewall features and the supported SD-WAN capabilities.

- About This Publication, on page 1
- Cisco Secure Firewall, on page 1
- Overview of SD-WAN Capabilities, on page 2
- Features, on page 3

About This Publication

This guide details the primary use cases that uses the SD-WAN capabilities supported on Cisco Secure Firewall.

The approaches do not address all of the possible network needs; instead, they provide models on which you can pattern your network. You can choose not to use features presented in the examples, or you can add or substitute features that better suit your needs.

This guide assumes you are familiar with Cisco Secure Firewall. For more information on configurations, see Cisco Secure Firewall Management Center Administration Guide, 7.3 and Cisco Secure Firewall Management Center Device Configuration Guide, 7.3.

Cisco Secure Firewall

Cisco Secure Firewall is an exceptionally robust firewall solution with cutting-edge features such as Snort IPS, URL filtering, and malware defense.

This comprehensive offering greatly simplifies threat protection by enforcing consistent security policies across physical, private, and public cloud environments.

Furthermore, it grants extensive visibility into your network infrastructure, swiftly identifying the origin and activity of potential threats. Armed with this knowledge, you can promptly take action to stop attacks before they have a chance to disrupt your operations.

In addition to traditional firewall capabilities, it provides features as:

1. Application visibility and control

2. User identity awareness and control

3. Intrusion prevention and intrusion detection

4. SSL/TLS decryption
5. Reputation based blocking
6. File and malware protection
7. Virtual Private Network (VPN)

To further secure network deployments, Cisco Secure Firewall provides additional security capabilities in its later releases such as:

- Encrypted Visibility Engine (EVE) that enhance encrypted traffic inspection without the need to implement full main-in-the-middle (MITM) decryption.
- Elephant Flow Detection to detect and remediate elephant flows (flows that are typically larger than 1 GB/10 seconds) and avoid high CPU utilization and packet drops.
- Cisco Secure Dynamic Attribute Connector (CSDAC) that brings agility and intelligence into your security policy management by leveraging tags and labels for policy configuration rather than traditional IP/network-based policy configuration.

Overview of SD-WAN Capabilities

As organizations expand their operations across multiple branch locations, ensuring secure and streamlined connectivity becomes paramount. Deploying a secure branch network infrastructure involves complex configuration and management processes, which can be time-consuming and prone to security vulnerabilities if not handled properly. However, organizations can overcome these challenges by leveraging a secure firewall solution for simplified and secure branch deployment.

In this guide, we explore the concept of simplifying secure branch deployment using a robust firewall solution. By integrating a secure firewall as a foundational component of the branch network architecture, organizations can establish a strong security baseline while simplifying the deployment process. This approach enables organizations to enforce unified security policies, optimize traffic routing, and ensure resilient connectivity.

Some of the SD-WAN capabilities supported on the Cisco Secure Firewall are:

- **Secure Elastic Connectivity:**
  - Route-based (VTI) VPN tunnels between headquarters (hub) and branches (spokes)
  - IPv4 and IPv6 BGP, IPv4 and IPv6 OSPFv2/v3, and IPv4 EIGRP over VTI
  - DVTI support for spokes with static or dynamic IP
- **High availability with near zero network downtime:**
  - Dual ISP configuration
  - Optimal path selection based on application based interface monitoring
- **Increased usable bandwidth:**
  - ECMP support for load balancing across multiple ISPs
  - ECMP support for SVTI

    - Application based load balancing using PBR

- **Direct Internet Access for public cloud and guest user:**
    - Policy based routing using applications as a match criteria
    - Local tunnel ID support for Umbrella

- **Simplified management:**
    - SASE: Umbrella auto tunnel deployment
    - DVTI hub spoke topology simplification

Features

This table list some commonly used WAN features

Feature	Introduced in...
Loopback interface support for VTIs	Release 7.3
Support for dynamic VTI (DVTI) with site-to-site VPN	Release 7.3
Umbrella auto tunnel	Release 7.3
Support for IPv4 and IPv6 BGP, IPv4 and IPv6 OSPFv2/v3, and IPv4 EIGRP for VTIs	Release 7.3
Route-based site-to-site VPN with hub and spoke topology	Release 7.2
Policy-based routing with path monitoring	Release 7.2
The Site to Site VPN Monitoring Dashboard	Release 7.1
Direct Internet Access/Policy Based Routing	Release 7.1
Equal-Cost-Multi-Path (ECMP) zone with WAN interfaces	Release 7.1
Equal-Cost-Multi-Path (ECMP) zone with VTI interfaces	Release 7.1
Backup VTI for route-based site-to-site VPN	Release 7.0
Support for static VTI (SVTI) with site-to-site VPN	Release 6.7

CHAPTER 2

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.

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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.

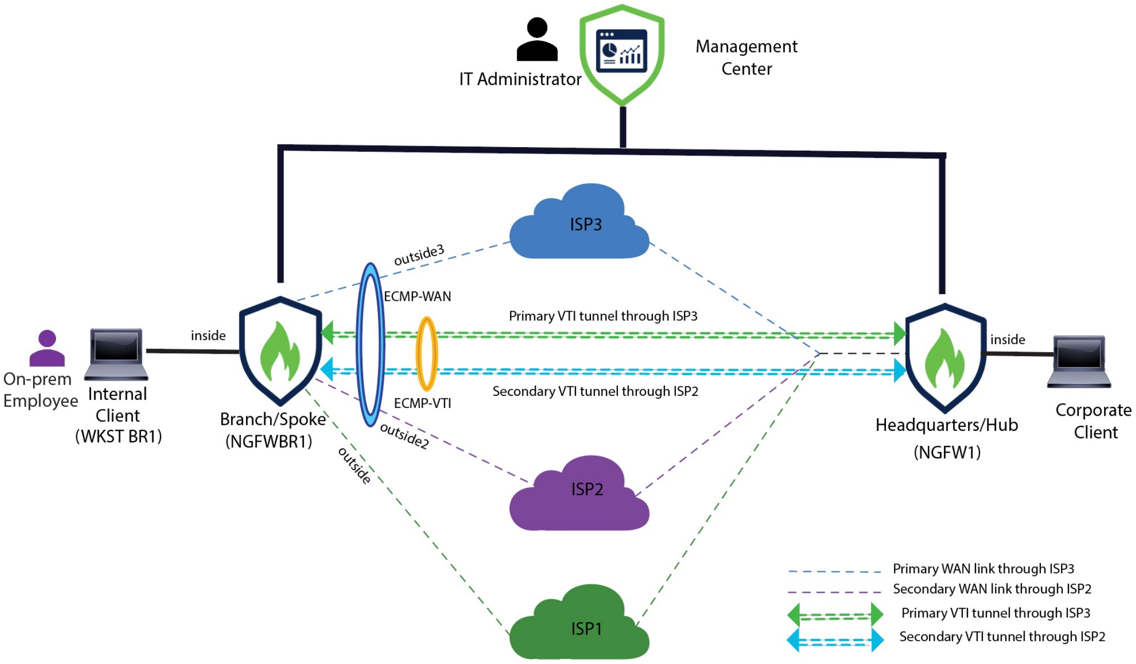
How does a route-based VPN between a branch(spoke) and headquarters (hub) solve the problem?

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.


IT Administrator
Management Center
ISP3
outside3
ECMP-WAN
Primary VTI tunnel through ISP3
inside
On-prem Employee
Internal Client (WKST BR1)
Branch/Spoke (NGFWBR1)
ECMP-VTI
Secondary VTI tunnel through ISP2
outside2
outside
inside
Headquarters/Hub (NGFW1)
Corporate Client
ISP2
ISP1
Primary WAN link through ISP3
Secondary WAN link through ISP2
Primary VTI tunnel through ISP3
Secondary VTI tunnel through ISP2

Best Practices

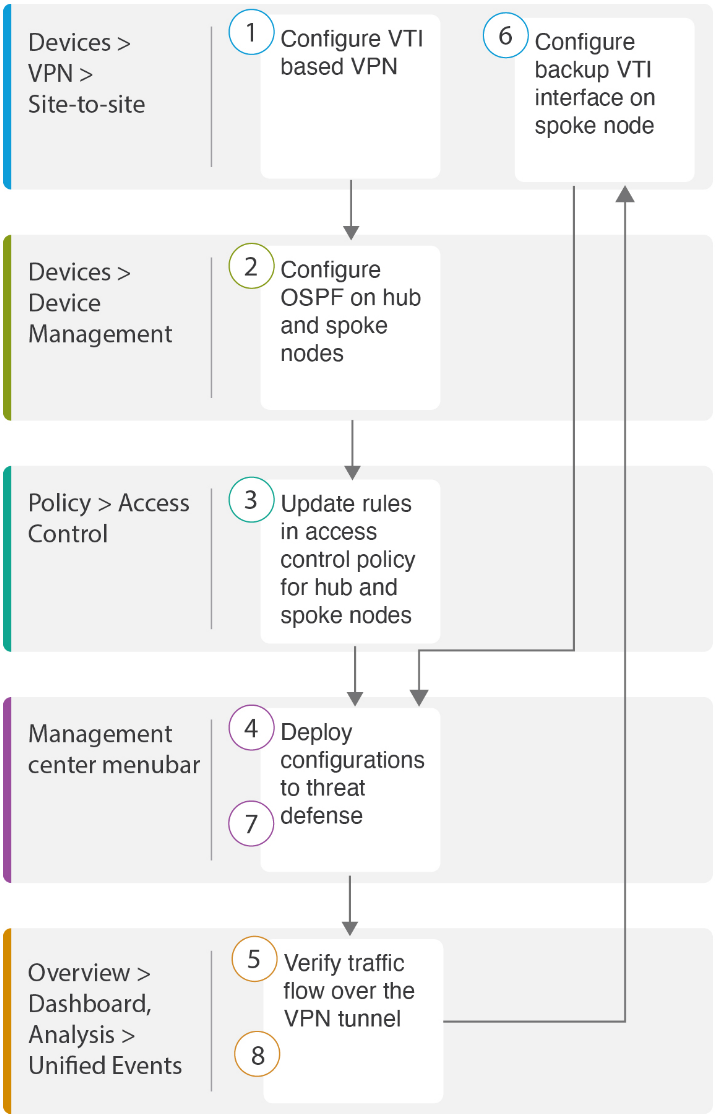
- Ensure that Secure Firewall Threat Defense is runing on version 6.7 and later.
- VTI is supported in routed mode only.
- Configure the Borrow IP for the dynamic interface from a loopback interface.
- Ensure to apply access rules on a VTI interface to control traffic through VTI.
- Configure ECMP zones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


Devices > VPN > Site-to-site
1 Configure VTI based VPN
6 Configure backup VTI interface on spoke node
Devices > Device Management
2 Configure OSPF on hub and spoke nodes
Policy > Access Control
3 Update rules in access control policy for hub and spoke nodes
Management center menubar
4 Deploy configurations to threat defense
7
Overview > Dashboard, Analysis > Unified Events
5 Verify traffic flow over the VPN tunnel
8

Step	Description
1	Configure a VTI based VPN. See • Create a Route-based Site-to-Site VPN, on page 10 • Configure the Endpoint for the Hub Node, on page 11

Step	Description
	- Configure the Endpoint for the Spoke Node, on page 12
2	Configure OSPF on the hub and spoke nodes. See - Configure OSPF on the Hub Node, on page 14 - Configure OSPF on the Spoke Node, on page 16
3	Updates rules in the access control policy for hub and spoke nodes. See Configure the Access Control Policy, on page 17.
4	Deploy configuration to threat defense. See Deploy Configuration, on page 20.
5	Verify traffic flow over VPN tunnel. See Verify Traffic Flow Over the VPN Tunnel, on page 20.
6	Configure backup VTI on spoke node. See Configure the Backup VTI Interface on the Spoke Node, on page 23.
7	Deploy the configuration on Threat Defense. SeeDeploy Configuration, on page 20 .
8	Verify traffic flow over secondary tunnel. See Verify the Primary and Secondary Tunnels, on page 25.

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 11.

Step 5 Configure the endpoint for the spoke node. See Configure the Endpoint for the Spoke Node, on page 12.

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

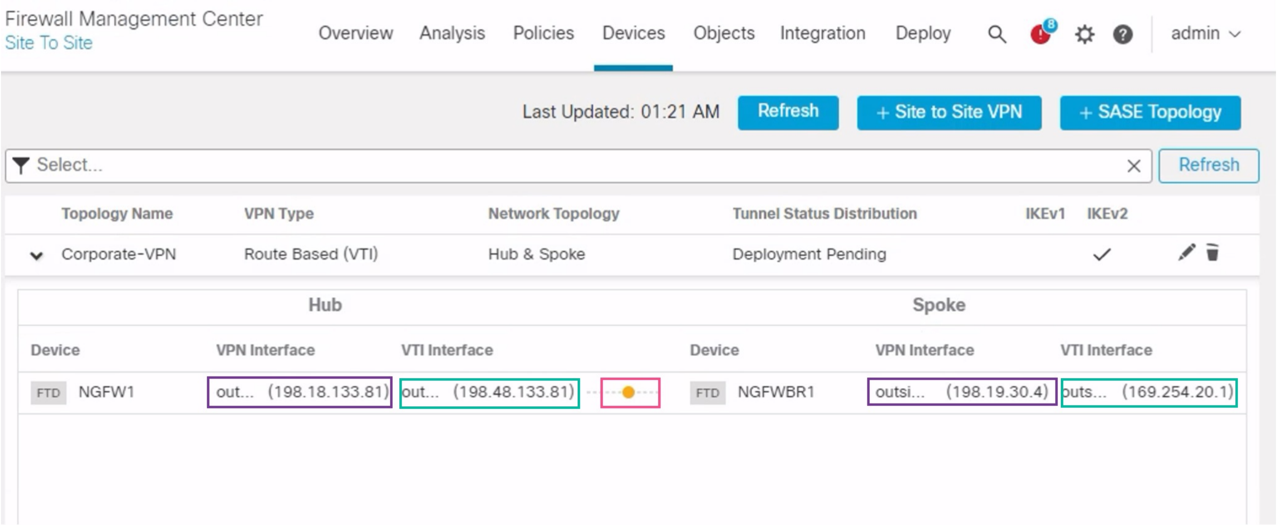
Step 7 Click **Save**.

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.



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Topology Name	VPN Type	Network Topology	Tunnel Status Distribution	IKEv1	IKEv2
Corporate-VPN	Route Based (VTI)	Hub & Spoke	Deployment Pending		✓

Hub				Spoke		
Device	VPN Interface	VTI Interface		Device	VPN Interface	VTI Interface
FTD NGFW1	out... (198.18.133.81)	out... (198.48.133.81)	●	FTD NGFWBR1	outsi... (198.19.30.4)	puts... (169.254.20.1)

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 14 and Configure OSPF on the Spoke Node, on page 16.
- An access control rule to allow encrypted traffic. See Configure the Access Control Policy, on page 17.

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)**.

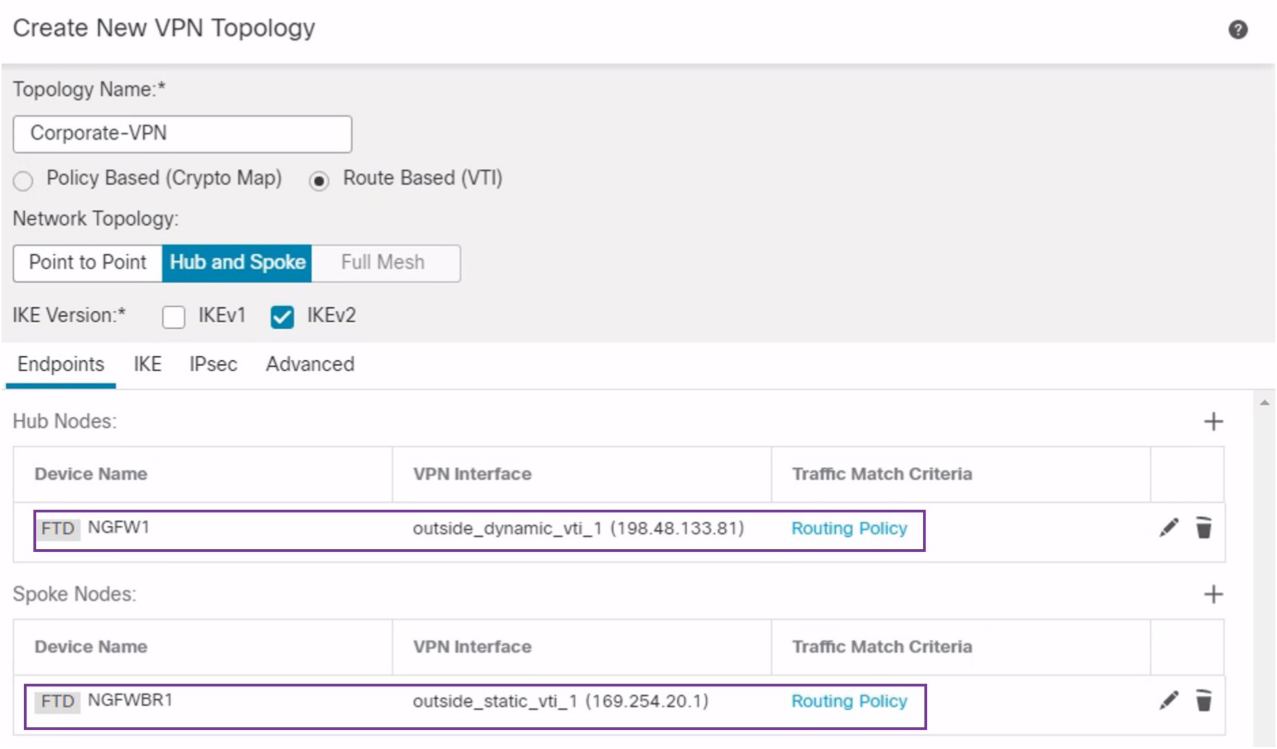
Click **OK** to save the SVTI. A message is displayed that confirms the VTI is created successfully. Click **OK**.

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.



Create New VPN Topology

Topology Name:* Corporate-VPN

○ Policy Based (Crypto Map) ● Route Based (VTI)

Network Topology: Point to Point | **Hub and Spoke** | Full Mesh

IKE Version:* □ IKEv1 ☑ IKEv2

Hub Nodes:

Device Name	VPN Interface	Traffic Match Criteria
FTD NGFW1	outside_dynamic_vti_1 (198.48.133.81)	Routing Policy

Spoke Nodes:

Device Name	VPN Interface	Traffic Match Criteria
FTD NGFWBR1	outside_static_vti_1 (169.254.20.1)	Routing Policy

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**.

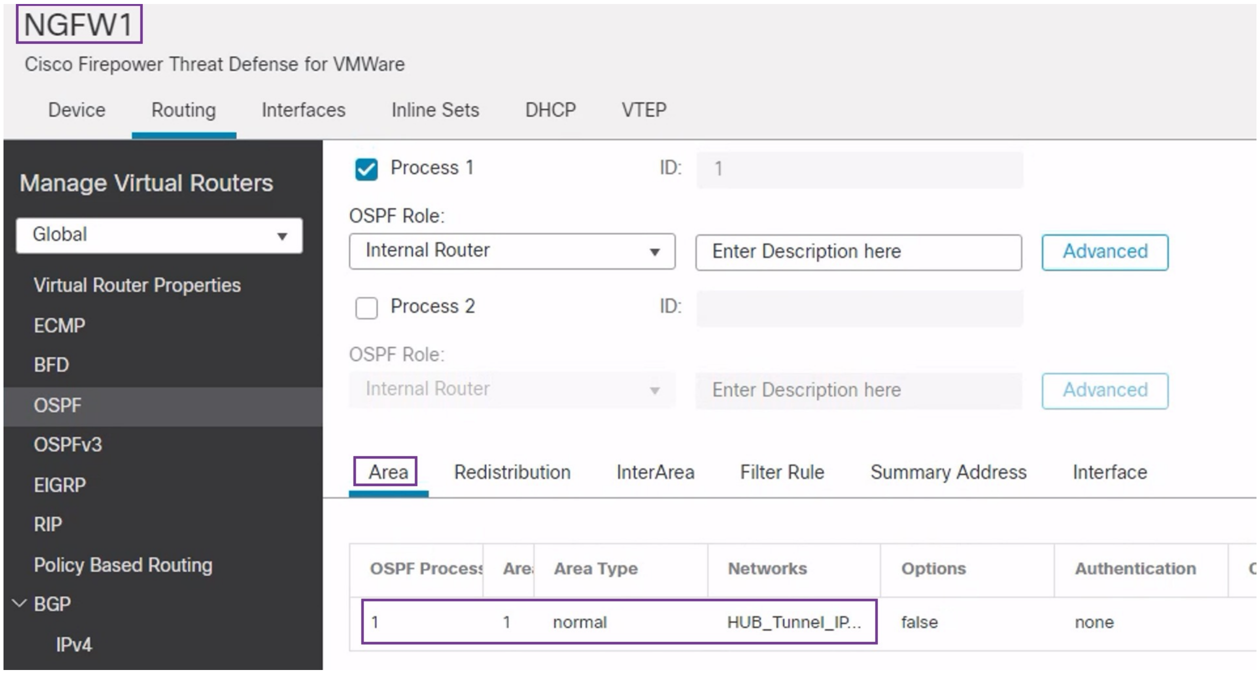
Step 8 Click the **Area** tab.

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.



☑ Process 1 ID: 1
OSPF Role: Internal Router | Enter Description here

□ Process 2 ID:
OSPF Role: Internal Router | Enter Description here

OSPF Process	Area	Area Type	Networks	Options	Authentication
1	1	normal	HUB_Tunnel_IP...	false	none

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.

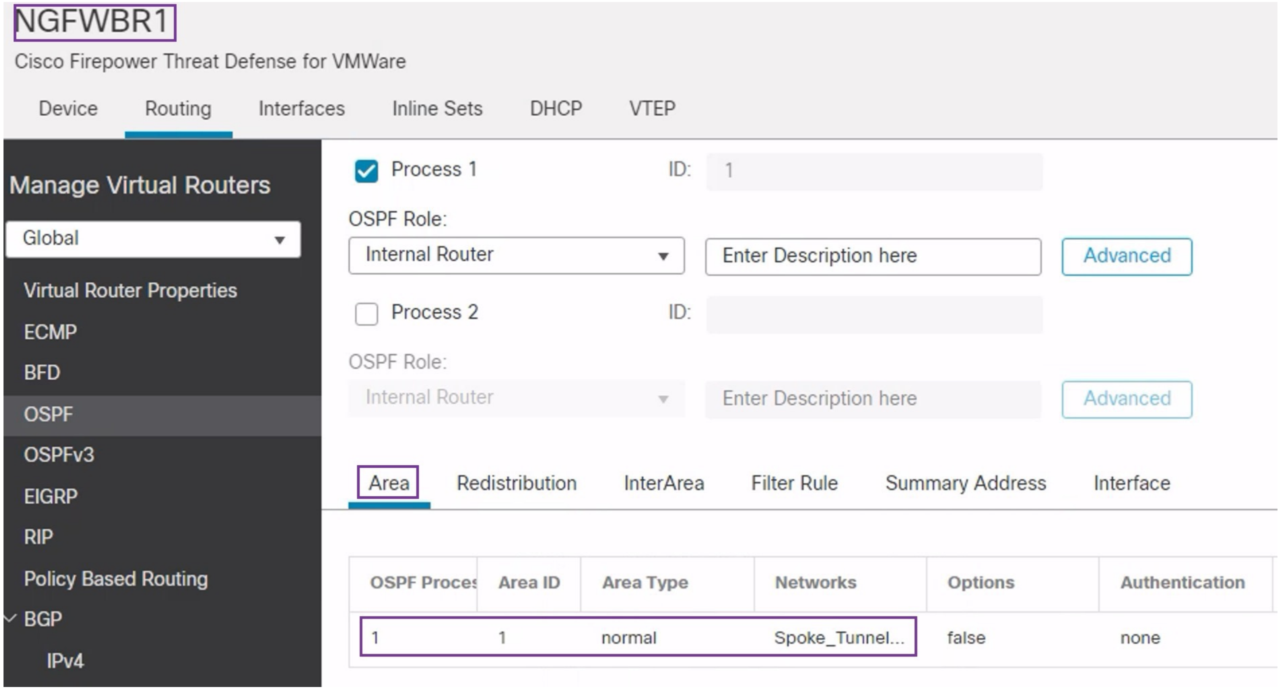
Step 6 Click the **Area** tab.

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.



NGFWBR1

Cisco Firepower Threat Defense for VMWare

☑ Process 1 ID: 1

OSPF Role: Internal Router

Enter Description here

□ Process 2 ID:

OSPF Role: Internal Router

Enter Description here

OSPF Proces	Area ID	Area Type	Networks	Options	Authentication
1	1	normal	Spoke_Tunnel...	false	none

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)

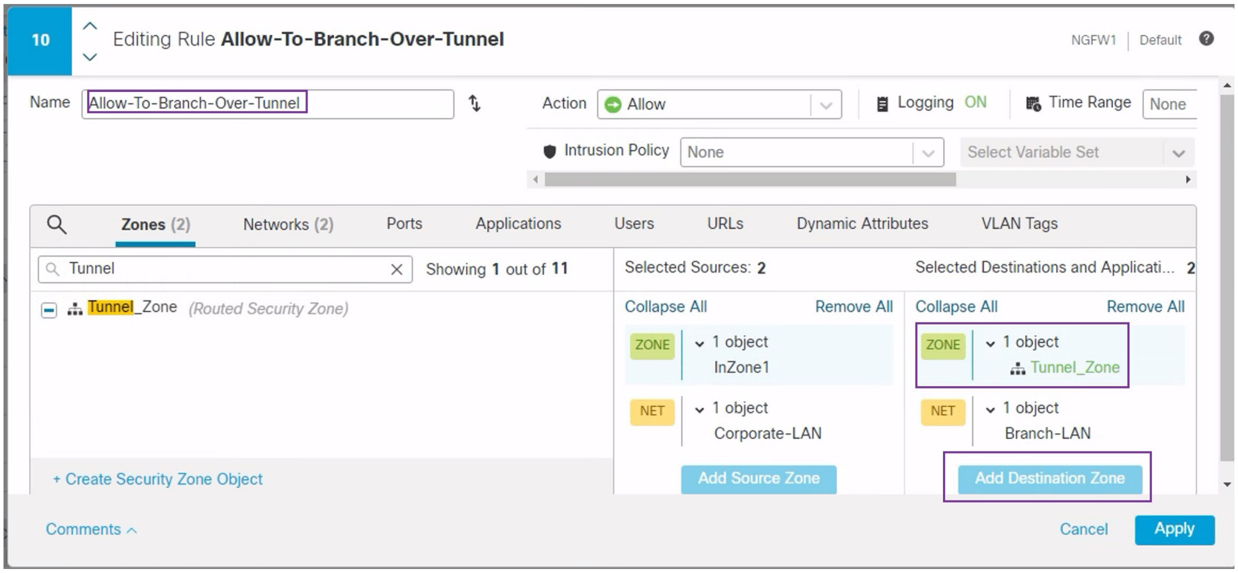
Step 1 To edit the hub node (NGFW1) AC policy, click the **Edit** (✎) icon.

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**.



10 Editing Rule **Allow-To-Branch-Over-Tunnel**

NGFW1 | Default

Name: Allow-To-Branch-Over-Tunnel

Action: Allow

Logging: ON

Time Range: None

Intrusion Policy: None

Select Variable Set

Tunnel — Showing 1 out of 11

Tunnel_Zone (Routed Security Zone)

Selected Sources: 2

- ZONE: 1 object — InZone1
- NET: 1 object — Corporate-LAN

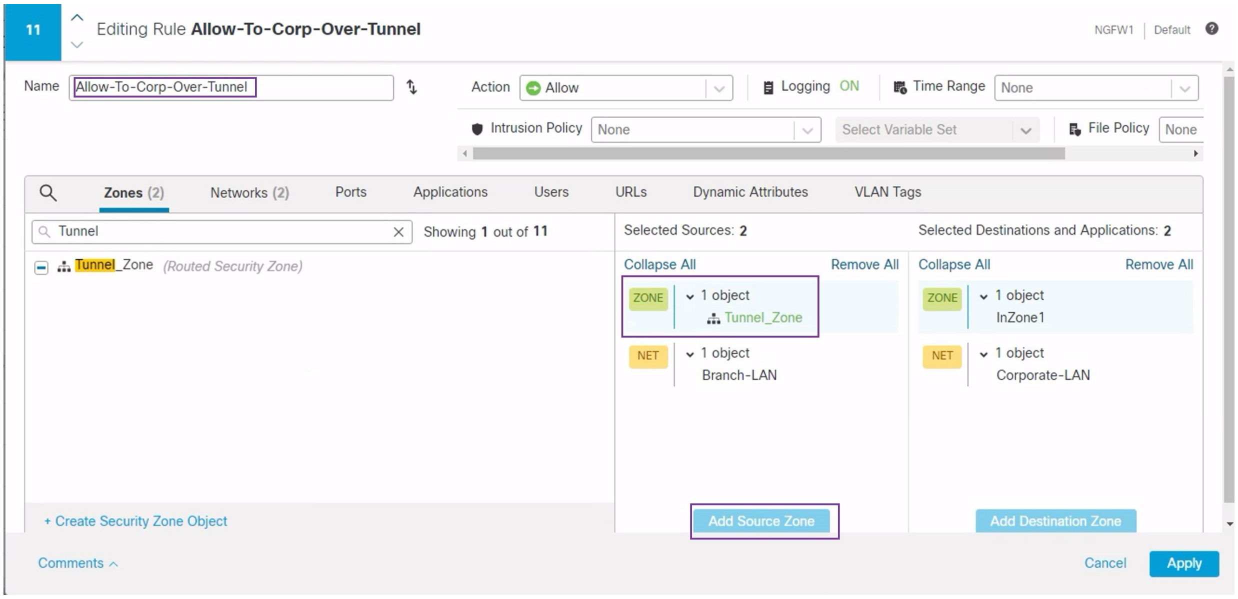
Selected Destinations and Applicati... 2

- ZONE: 1 object — Tunnel_Zone
- NET: 1 object — Branch-LAN

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**.



11 Editing Rule **Allow-To-Corp-Over-Tunnel**

NGFW1 | Default

Name: Allow-To-Corp-Over-Tunnel

Action: Allow

Logging: ON

Time Range: None

Intrusion Policy: None

Select Variable Set

File Policy: None

Tunnel — Showing 1 out of 11

Tunnel_Zone (Routed Security Zone)

Selected Sources: 2

- ZONE: 1 object — Tunnel_Zone
- NET: 1 object — Branch-LAN

Selected Destinations and Applications: 2

- ZONE: 1 object — InZone1
- NET: 1 object — Corporate-LAN

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.

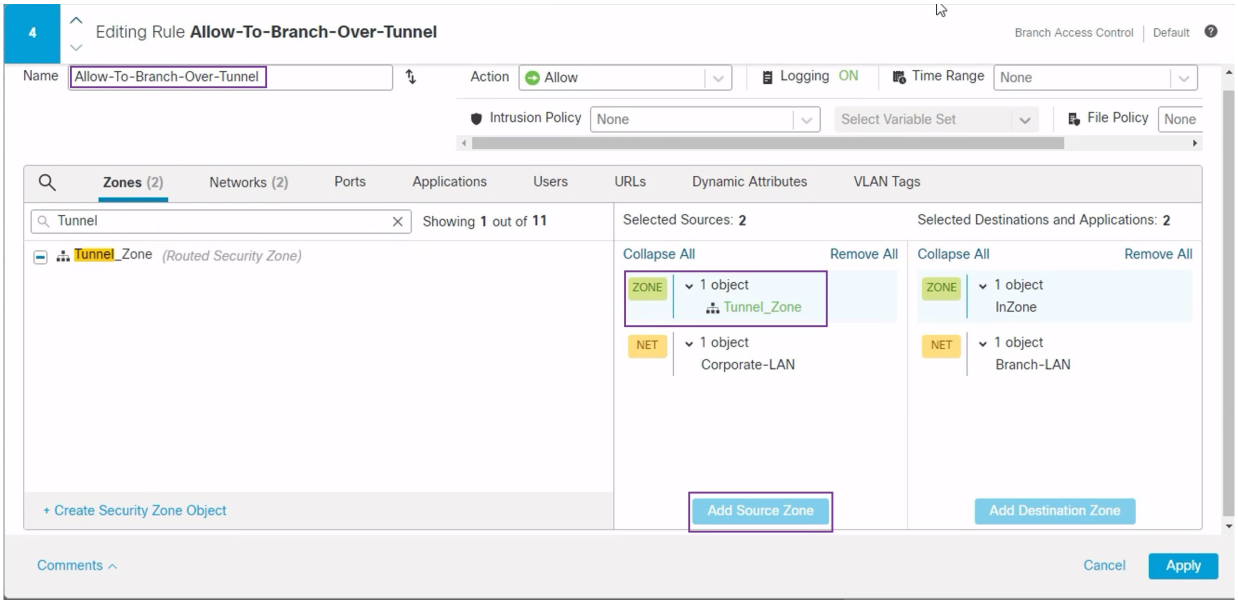
Step 2 To edit the spoke node (NGFWBR1) AC policy, click the **Edit** (✎) icon.

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**.



4 Editing Rule **Allow-To-Branch-Over-Tunnel**

Name: Allow-To-Branch-Over-Tunnel
Action: Allow
Logging: ON
Time Range: None
Intrusion Policy: None
Select Variable Set
File Policy: None

Zones (2) | Networks (2) | Ports | Applications | Users | URLs | Dynamic Attributes | VLAN Tags

Search: Tunnel — Showing 1 out of 11
Tunnel_Zone (Routed Security Zone)

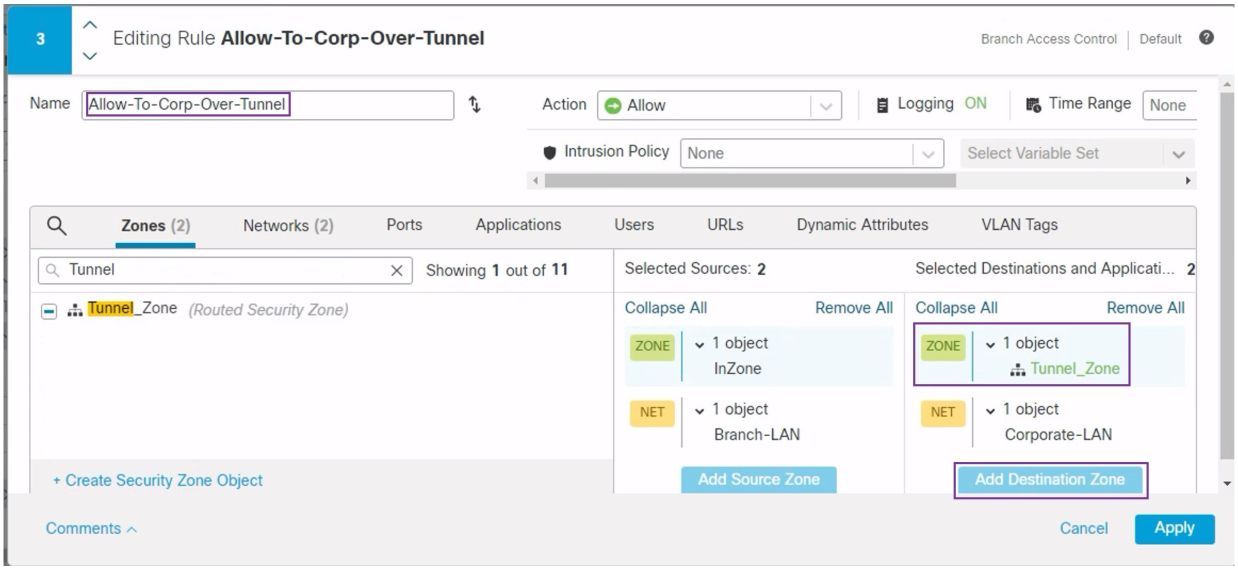
Selected Sources: 2
- ZONE: 1 object — Tunnel_Zone
- NET: 1 object — Corporate-LAN

Selected Destinations and Applications: 2
- ZONE: 1 object — InZone
- NET: 1 object — Branch-LAN

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**.



3 Editing Rule **Allow-To-Corp-Over-Tunnel**

Name: Allow-To-Corp-Over-Tunnel
Action: Allow
Logging: ON
Time Range: None
Intrusion Policy: None
Select Variable Set

Zones (2) | Networks (2) | Ports | Applications | Users | URLs | Dynamic Attributes | VLAN Tags

Search: Tunnel — Showing 1 out of 11
Tunnel_Zone (Routed Security Zone)

Selected Sources: 2
- ZONE: 1 object — InZone
- NET: 1 object — Branch-LAN

Selected Destinations and Applicati... 2
- ZONE: 1 object — Tunnel_Zone
- NET: 1 object — Corporate-LAN

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:

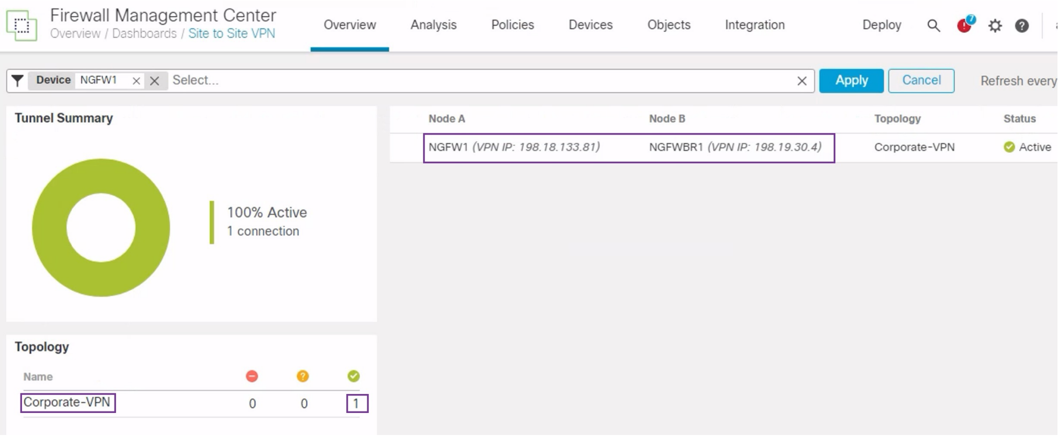
- Proceed with Deploy—Continue deploying without resolving warning conditions. You cannot proceed if the system identifies errors.
- Close—Exit without deploying. Resolve the error and warning conditions, and attempt to deploy the configuration again.

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**.



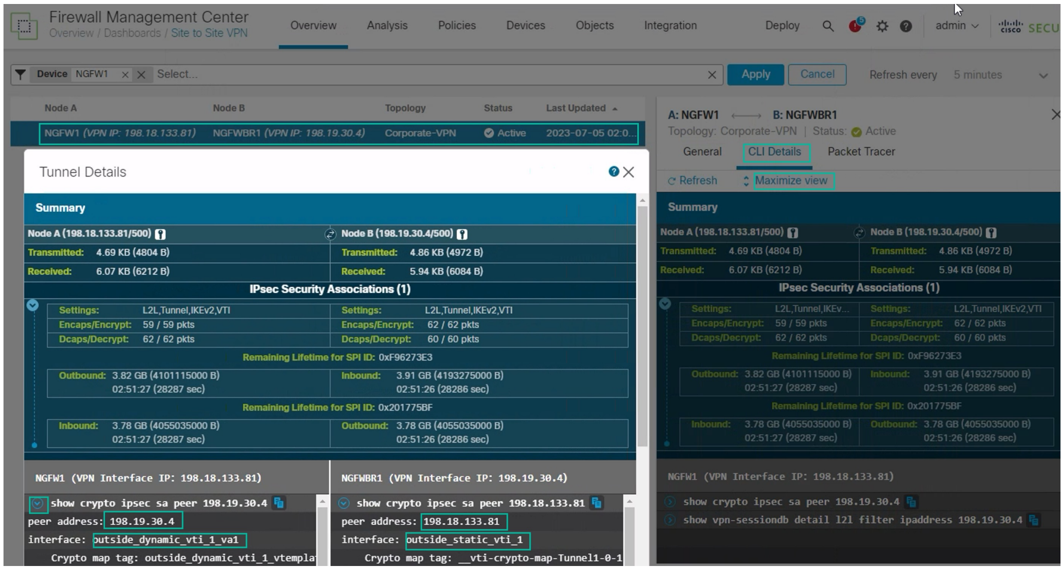
Device NGFW1 × × Select... ×

Node A	Node B	Topology	Status
NGFW1 *(VPN IP: 198.18.133.81)*	NGFWBR1 *(VPN IP: 198.19.30.4)*	Corporate-VPN	✓ Active

Topology

Name	●	?	✓
Corporate-VPN	0	0	1

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.



Node A	Node B	Topology	Status	Last Updated
NGFW1 *(VPN IP: 198.18.133.81)*	NGFWBR1 *(VPN IP: 198.19.30.4)*	Corporate-VPN	Active	2023-07-05 02:0...

Summary

Node A (198.18.133.81/500)		Node B (198.19.30.4/500)	
Transmitted:	4.69 KB (4804 B)	Transmitted:	4.86 KB (4972 B)
Received:	6.07 KB (6212 B)	Received:	5.94 KB (6084 B)

IPsec Security Associations (1)

Settings:	L2L,Tunnel,IKEv2,VTI	Settings:	L2L,Tunnel,IKEv2,VTI
Encaps/Encrypt:	59 / 59 pkts	Encaps/Encrypt:	62 / 62 pkts
Dcaps/Decrypt:	62 / 62 pkts	Dcaps/Decrypt:	60 / 60 pkts

Remaining Lifetime for SPI ID: 0xF96273E3

Outbound:	3.82 GB (4101115000 B) 02:51:27 (28287 sec)	Inbound:	3.91 GB (4193275000 B) 02:51:26 (28286 sec)

Remaining Lifetime for SPI ID: 0x201775BF

Inbound:	3.78 GB (4055035000 B) 02:51:27 (28287 sec)	Outbound:	3.78 GB (4055035000 B) 02:51:26 (28286 sec)

```
NGFW1 (VPN Interface IP: 198.18.133.81)
show crypto ipsec sa peer 198.19.30.4
peer address: 198.19.30.4
interface: outside_dynamic_vti_1_va1
   Crypto map tag: outside_dynamic_vti_1_vtempla
```

```
NGFWBR1 (VPN Interface IP: 198.19.30.4)
show crypto ipsec sa peer 198.18.133.81
peer address: 198.18.133.81
interface: outside_static_vti_1
   Crypto map tag: __vti-crypto-map-Tunnel1-0-1
```

A: NGFW1 ⟷ B: NGFWBR1
Topology: Corporate-VPN | Status: Active

Summary

Node A (198.18.133.81/500)		Node B (198.19.30.4/500)	
Transmitted:	4.69 KB (4804 B)	Transmitted:	4.86 KB (4972 B)
Received:	6.07 KB (6212 B)	Received:	5.94 KB (6084 B)

IPsec Security Associations (1)

Settings:	L2L,Tunnel,IKEv...	Settings:	L2L,Tunnel,IKEv2,VTI
Encaps/Encrypt:	59 / 59 pkts	Encaps/Encrypt:	62 / 62 pkts
Dcaps/Decrypt:	62 / 62 pkts	Dcaps/Decrypt:	60 / 60 pkts

Remaining Lifetime for SPI ID: 0xF96273E3

Outbound:	3.82 GB (4101115000 B) 02:51:27 (28287 sec)	Inbound:	3.91 GB (4193275000 B) 02:51:26 (28286 sec)

Remaining Lifetime for SPI ID: 0x201775BF

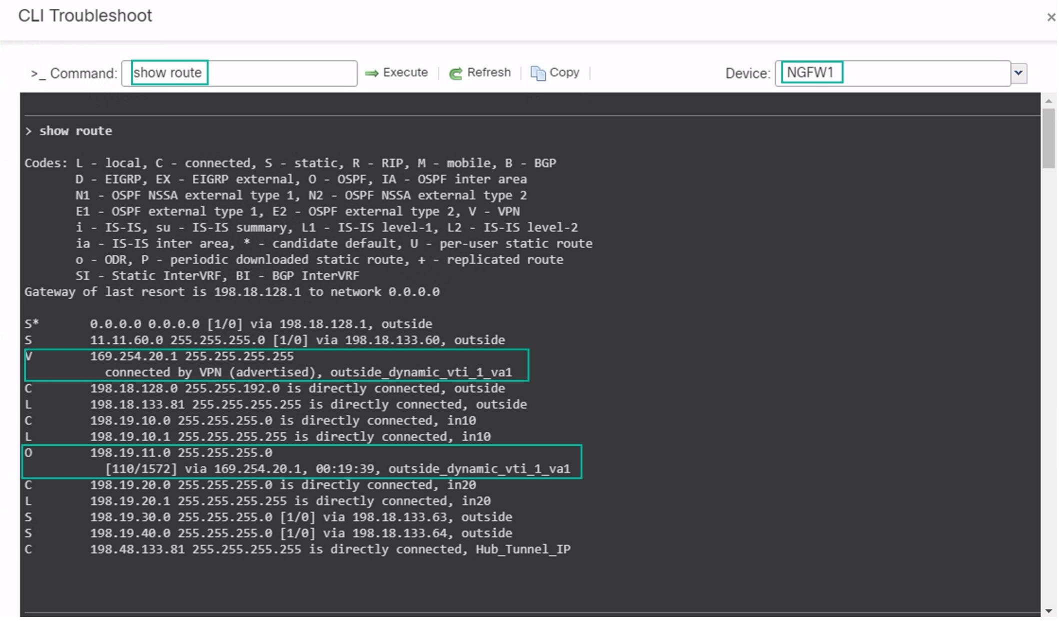
Inbound:	3.78 GB (4055035000 B) 02:51:27 (28287 sec)	Outbound:	3.78 GB (4055035000 B) 02:51:26 (28286 sec)

```
NGFW1 (VPN Interface IP: 198.18.133.81)
show crypto ipsec sa peer 198.19.30.4
show vpn-sessiondb detail l2l filter ipaddress 198.19.30.4
```

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.

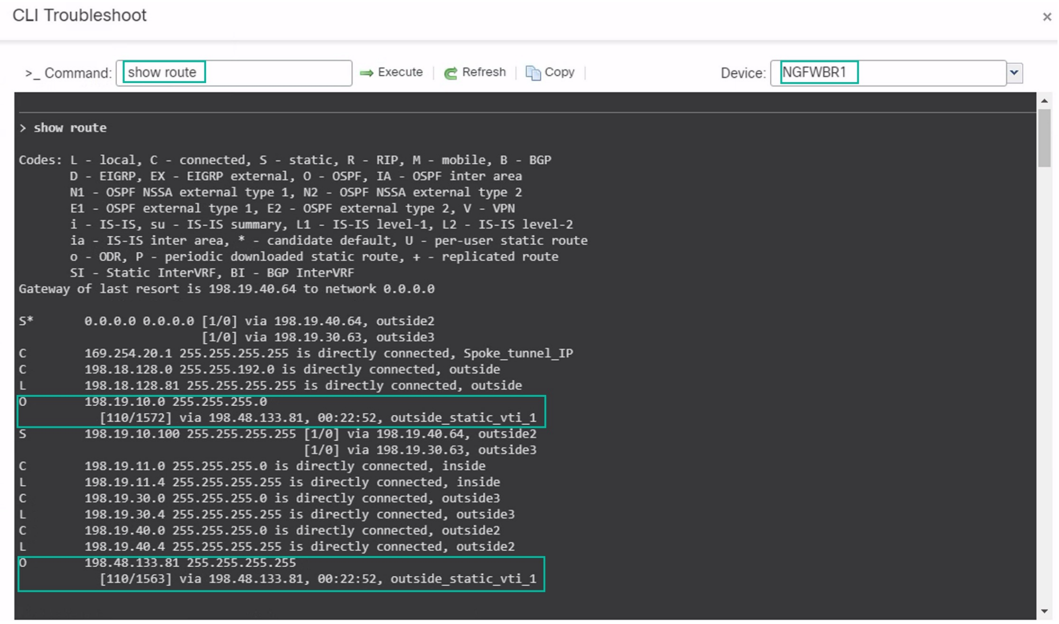


>_ Command: show route

Device: NGFW1

```
> show route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, V - VPN
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, + - replicated route
       SI - Static InterVRF, BI - BGP InterVRF
Gateway of last resort is 198.18.128.1 to network 0.0.0.0

S*       0.0.0.0 0.0.0.0 [1/0] via 198.18.128.1, outside
S        11.11.60.0 255.255.255.0 [1/0] via 198.18.133.60, outside
V        169.254.20.1 255.255.255.255
           connected by VPN (advertised), outside_dynamic_vti_1_va1
C        198.18.128.0 255.255.192.0 is directly connected, outside
L        198.18.133.81 255.255.255.255 is directly connected, outside
C        198.19.10.0 255.255.255.0 is directly connected, in10
L        198.19.10.1 255.255.255.255 is directly connected, in10
O        198.19.11.0 255.255.255.0
           [110/1572] via 169.254.20.1, 00:19:39, outside_dynamic_vti_1_va1
C        198.19.20.0 255.255.255.0 is directly connected, in20
L        198.19.20.1 255.255.255.255 is directly connected, in20
S        198.19.30.0 255.255.255.0 [1/0] via 198.18.133.63, outside
S        198.19.40.0 255.255.255.0 [1/0] via 198.18.133.64, outside
C        198.48.133.81 255.255.255.255 is directly connected, Hub_Tunnel_IP
```

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.



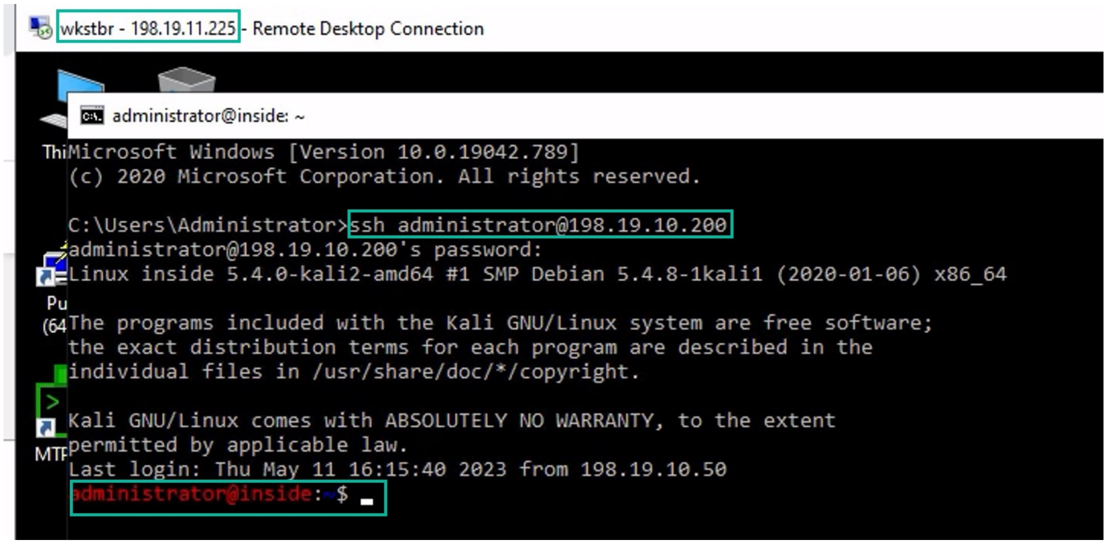
>_ Command: show route

Device: NGFWBR1

```
> show route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, V - VPN
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, + - replicated route
       SI - Static InterVRF, BI - BGP InterVRF
Gateway of last resort is 198.19.40.64 to network 0.0.0.0

S*       0.0.0.0 0.0.0.0 [1/0] via 198.19.40.64, outside2
                         [1/0] via 198.19.30.63, outside3
C        169.254.20.1 255.255.255.255 is directly connected, Spoke_tunnel_IP
C        198.18.128.0 255.255.192.0 is directly connected, outside
L        198.18.128.81 255.255.255.255 is directly connected, outside
O        198.19.10.0 255.255.255.0
           [110/1572] via 198.48.133.81, 00:22:52, outside_static_vti_1
S        198.19.10.100 255.255.255.255 [1/0] via 198.19.40.64, outside2
                                       [1/0] via 198.19.30.63, outside3
C        198.19.11.0 255.255.255.0 is directly connected, inside
L        198.19.11.4 255.255.255.255 is directly connected, inside
C        198.19.30.0 255.255.255.0 is directly connected, outside3
L        198.19.30.4 255.255.255.255 is directly connected, outside3
C        198.19.40.0 255.255.255.0 is directly connected, outside2
L        198.19.40.4 255.255.255.255 is directly connected, outside2
O        198.48.133.81 255.255.255.255
           [110/1563] via 198.48.133.81, 00:22:52, outside_static_vti_1
```

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

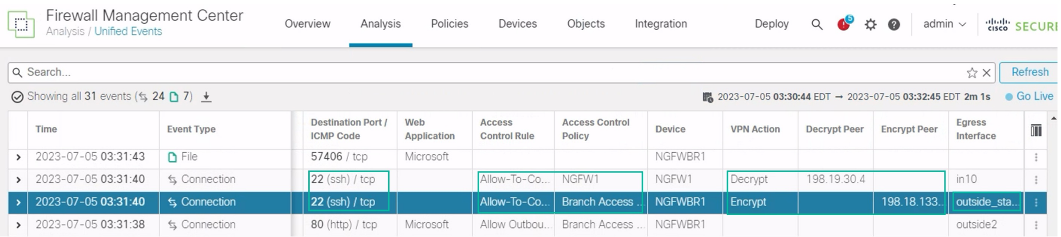
  Log into the WKST BR workstation (198.19.11.225) and SSH to the host (198.19.10.200) behind NGFW1. Ensure that you are able to SSH successfully to the host.



```
Microsoft Windows [Version 10.0.19042.789]
(c) 2020 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>ssh administrator@198.19.10.200
administrator@198.19.10.200's password:
Linux inside 5.4.0-kali2-amd64 #1 SMP Debian 5.4.8-1kali1 (2020-01-06) x86_64

The programs included with the Kali GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Kali GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu May 11 16:15:40 2023 from 198.19.10.50
administrator@inside:~$
```

- **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.



Showing all 31 events (24 7)

2023-07-05 03:30:44 EDT → 2023-07-05 03:32:45 EDT 2m 1s

Time	Event Type	Destination Port / ICMP Code	Web Application	Access Control Rule	Access Control Policy	Device	VPN Action	Decrypt Peer	Encrypt Peer	Egress Interface
2023-07-05 03:31:43	File	57406 / tcp	Microsoft			NGFWBR1				
2023-07-05 03:31:40	Connection	22 (ssh) / tcp		Allow-To-Co...	NGFW1	NGFW1	Decrypt	198.19.30.4		in10
2023-07-05 03:31:40	Connection	22 (ssh) / tcp		Allow-To-Co...	Branch Access ...	NGFWBR1	Encrypt		198.18.133...	outside_sta...
2023-07-05 03:31:38	Connection	80 (http) / tcp	Microsoft	Allow Outbou...	Branch Access ...	NGFWBR1				outside2

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.

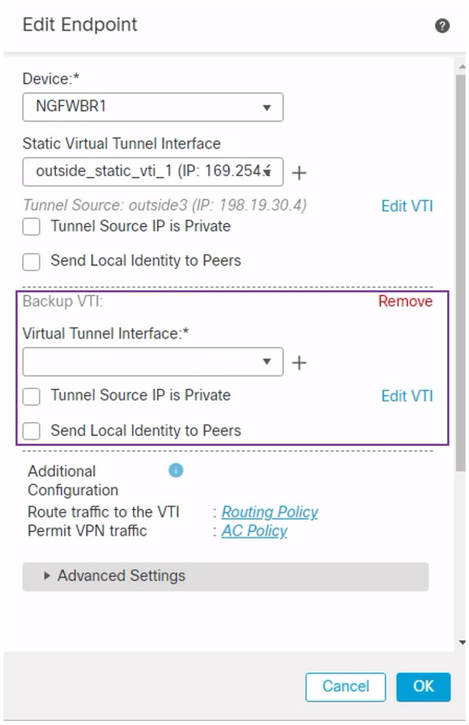
Configure the Backup VTI Interface on the Spoke Node

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.



Edit Endpoint

Device:* NGFWBR1

Static Virtual Tunnel Interface: outside_static_vti_1 (IP: 169.254

Tunnel Source: outside3 (IP: 198.19.30.4)

□ Tunnel Source IP is Private

□ Send Local Identity to Peers

Backup VTI:

Virtual Tunnel Interface:*

□ Tunnel Source IP is Private

□ Send Local Identity to Peers

Additional Configuration

Route traffic to the VTI : Routing Policy

Permit VPN traffic : AC Policy

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**).

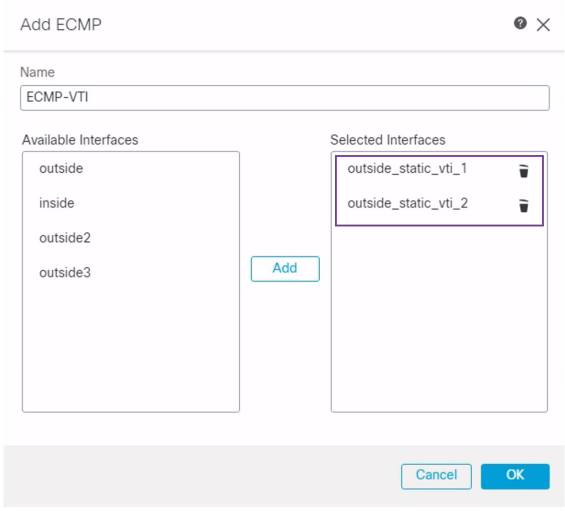
Step 2 Click the **Routing** tab on the interface view of NGFWBR1.

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.

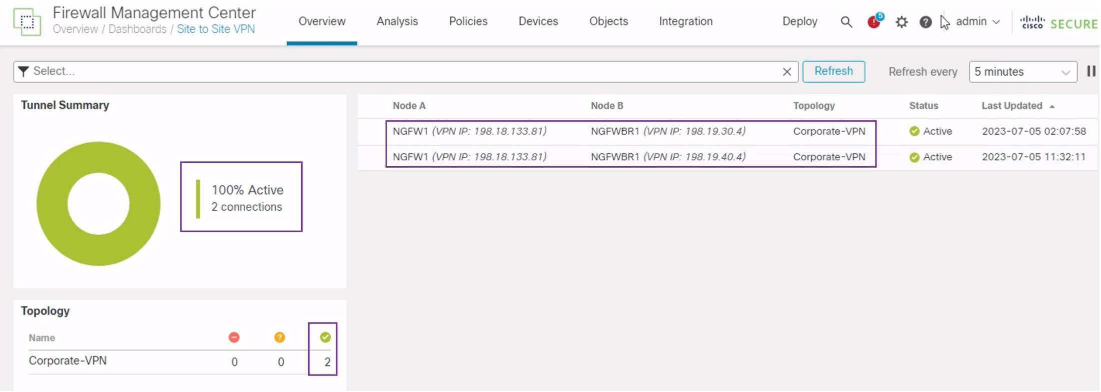
Step 8 Click **Save**.

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**.



Node A	Node B	Topology	Status	Last Updated
NGFW1 *(VPN IP: 198.18.133.81)*	NGFWBR1 *(VPN IP: 198.19.30.4)*	Corporate-VPN	✓ Active	2023-07-05 02:07:58
NGFW1 *(VPN IP: 198.18.133.81)*	NGFWBR1 *(VPN IP: 198.19.40.4)*	Corporate-VPN	✓ Active	2023-07-05 11:32:11

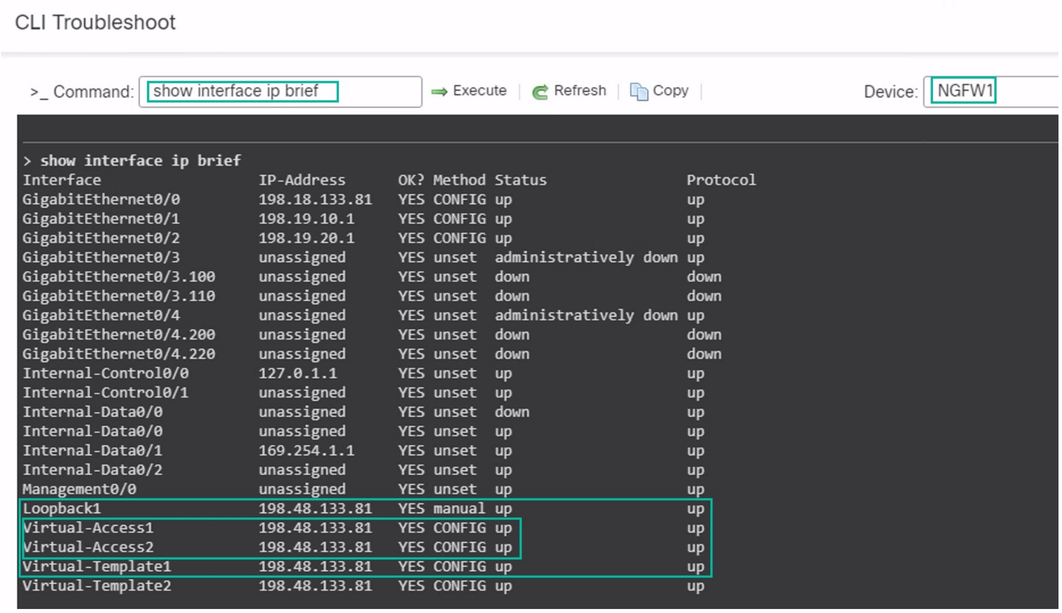
100% Active
2 connections

Name	⊖	?	✓
Corporate-VPN	0	0	2

- **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.

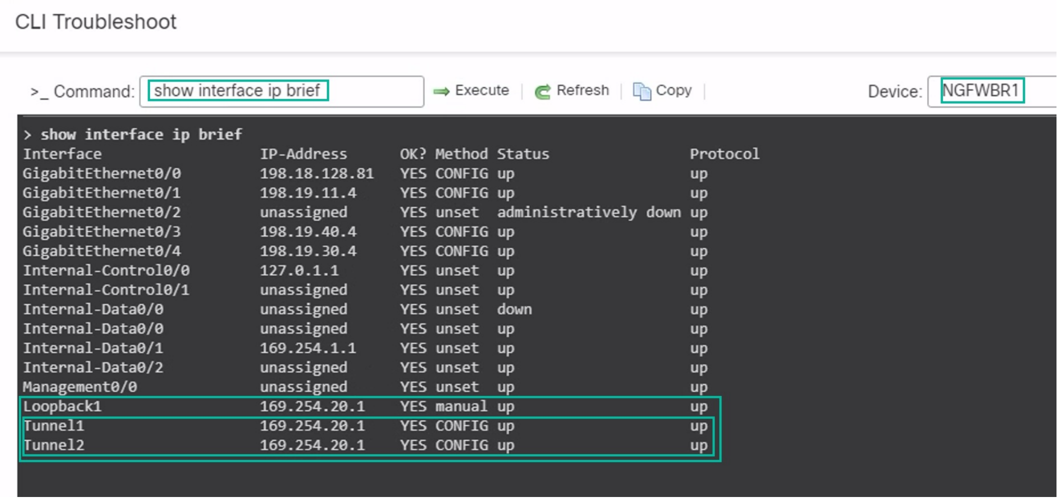


>_ Command: show interface ip brief

Device: NGFW1

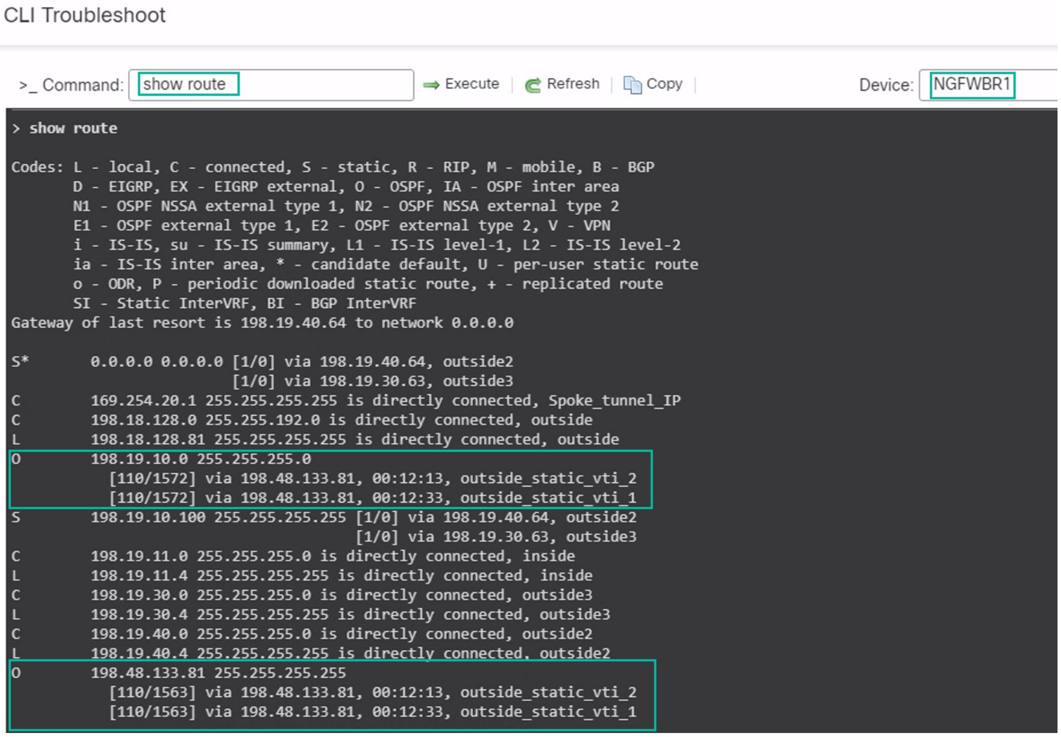
```
> show interface ip brief
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         198.18.133.81   YES CONFIG up                    up
GigabitEthernet0/1         198.19.10.1     YES CONFIG up                    up
GigabitEthernet0/2         198.19.20.1     YES CONFIG up                    up
GigabitEthernet0/3         unassigned      YES unset  administratively down up
GigabitEthernet0/3.100     unassigned      YES unset  down                  down
GigabitEthernet0/3.110     unassigned      YES unset  down                  down
GigabitEthernet0/4         unassigned      YES unset  administratively down up
GigabitEthernet0/4.200     unassigned      YES unset  down                  down
GigabitEthernet0/4.220     unassigned      YES unset  down                  down
Internal-Control0/0        127.0.1.1       YES unset  up                    up
Internal-Control0/1        unassigned      YES unset  up                    up
Internal-Data0/0           unassigned      YES unset  down                  up
Internal-Data0/0           unassigned      YES unset  up                    up
Internal-Data0/1           169.254.1.1     YES unset  up                    up
Internal-Data0/2           unassigned      YES unset  up                    up
Management0/0              unassigned      YES unset  up                    up
Loopback1                  198.48.133.81   YES manual up                    up
Virtual-Access1            198.48.133.81   YES CONFIG up                    up
Virtual-Access2            198.48.133.81   YES CONFIG up                    up
Virtual-Template1          198.48.133.81   YES CONFIG up                    up
Virtual-Template2          198.48.133.81   YES CONFIG up                    up
```

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.



```
> show interface ip brief
Interface                  IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0         198.18.128.81   YES CONFIG up                    up
GigabitEthernet0/1         198.19.11.4     YES CONFIG up                    up
GigabitEthernet0/2         unassigned      YES unset  administratively down up
GigabitEthernet0/3         198.19.40.4     YES CONFIG up                    up
GigabitEthernet0/4         198.19.30.4     YES CONFIG up                    up
Internal-Control0/0        127.0.1.1       YES unset  up                    up
Internal-Control0/1        unassigned      YES unset  up                    up
Internal-Data0/0           unassigned      YES unset  down                  up
Internal-Data0/0           unassigned      YES unset  up                    up
Internal-Data0/1           169.254.1.1     YES unset  up                    up
Internal-Data0/2           unassigned      YES unset  up                    up
Management0/0              unassigned      YES unset  up                    up
Loopback1                  169.254.20.1    YES manual up                    up
Tunnel1                    169.254.20.1    YES CONFIG up                    up
Tunnel2                    169.254.20.1    YES CONFIG up                    up
```

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



```
> show route

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, V - VPN
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, + - replicated route
       SI - Static InterVRF, BI - BGP InterVRF
Gateway of last resort is 198.19.40.64 to network 0.0.0.0

S*       0.0.0.0 0.0.0.0 [1/0] via 198.19.40.64, outside2
                         [1/0] via 198.19.30.63, outside3
C        169.254.20.1 255.255.255.255 is directly connected, Spoke_tunnel_IP
C        198.18.128.0 255.255.192.0 is directly connected, outside
L        198.18.128.81 255.255.255.255 is directly connected, outside
O        198.19.10.0 255.255.255.0
           [110/1572] via 198.48.133.81, 00:12:13, outside_static_vti_2
           [110/1572] via 198.48.133.81, 00:12:33, outside_static_vti_1
S        198.19.10.100 255.255.255.255 [1/0] via 198.19.40.64, outside2
                                       [1/0] via 198.19.30.63, outside3
C        198.19.11.0 255.255.255.0 is directly connected, inside
L        198.19.11.4 255.255.255.255 is directly connected, inside
C        198.19.30.0 255.255.255.0 is directly connected, outside3
L        198.19.30.4 255.255.255.255 is directly connected, outside3
C        198.19.40.0 255.255.255.0 is directly connected, outside2
L        198.19.40.4 255.255.255.255 is directly connected, outside2
O        198.48.133.81 255.255.255.255
           [110/1563] via 198.48.133.81, 00:12:13, outside_static_vti_2
           [110/1563] via 198.48.133.81, 00:12:33, outside_static_vti_1
```

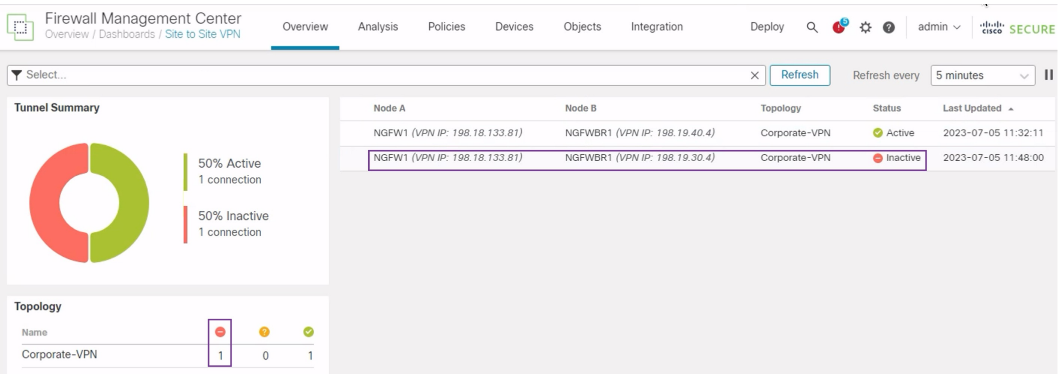
- Note that the **Corporate_LAN** (198.19.10.0/24) has been learnt over OSPF on both the primary (**outside_static_vti_1**) and secondary (**outside_static_vti_2**) VTIs.
- Note that the DVTI Tunnel IP (198.48.133.81) has also been learnt over OSPF on both the primary and secondary VTIs.

- **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.



Node A	Node B	Topology	Status	Last Updated
NGFW1 *(VPN IP: 198.18.133.81)*	NGFWBR1 *(VPN IP: 198.19.40.4)*	Corporate-VPN	✓ Active	2023-07-05 11:32:11
NGFW1 *(VPN IP: 198.18.133.81)*	NGFWBR1 *(VPN IP: 198.19.30.4)*	Corporate-VPN	● Inactive	2023-07-05 11:48:00

Name	●	●	✓
Corporate-VPN	1	0	1

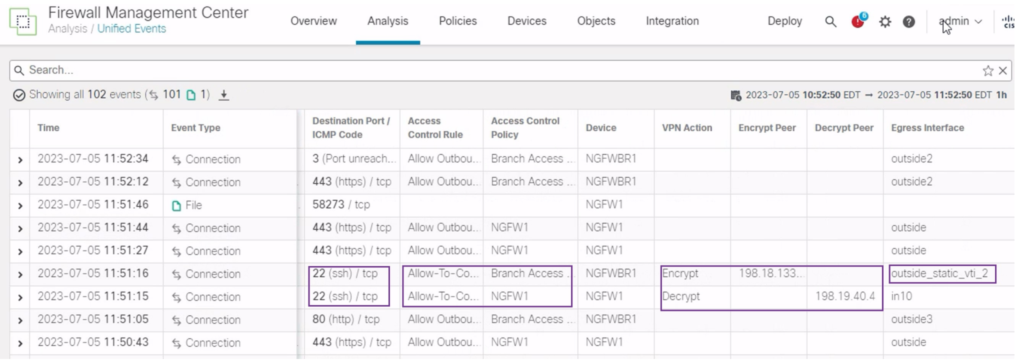
3. Initiate traffic from Branch to Hub. Log in to the WKST BR workstation and SSH to the host behind NGFW1. Ensure that you are able to SSH successfully to the host.

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.



Showing all 102 events (⇆ 101 🗋 1) 2023-07-05 10:52:50 EDT → 2023-07-05 11:52:50 EDT 1h

Time	Event Type	Destination Port / ICMP Code	Access Control Rule	Access Control Policy	Device	VPN Action	Encrypt Peer	Decrypt Peer	Egress Interface
2023-07-05 11:52:34	⇆ Connection	3 (Port unreach...	Allow Outbou...	Branch Access ...	NGFWBR1				outside2
2023-07-05 11:52:12	⇆ Connection	443 (https) / tcp	Allow Outbou...	Branch Access ...	NGFWBR1				outside2
2023-07-05 11:51:46	🗋 File	58273 / tcp			NGFW1				
2023-07-05 11:51:44	⇆ Connection	443 (https) / tcp	Allow Outbou...	NGFW1	NGFW1				outside
2023-07-05 11:51:27	⇆ Connection	443 (https) / tcp	Allow Outbou...	NGFW1	NGFW1				outside
2023-07-05 11:51:16	⇆ Connection	22 (ssh) / tcp	Allow-To-Co...	Branch Access ...	NGFWBR1	Encrypt	198.18.133...		outside_static_vti_2
2023-07-05 11:51:15	⇆ Connection	22 (ssh) / tcp	Allow-To-Co...	NGFW1	NGFW1	Decrypt		198.19.40.4	in10
2023-07-05 11:51:05	⇆ Connection	80 (http) / tcp	Allow Outbou...	Branch Access ...	NGFWBR1				outside3
2023-07-05 11:50:43	⇆ Connection	443 (https) / tcp	Allow Outbou...	NGFW1	NGFW1				outside

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

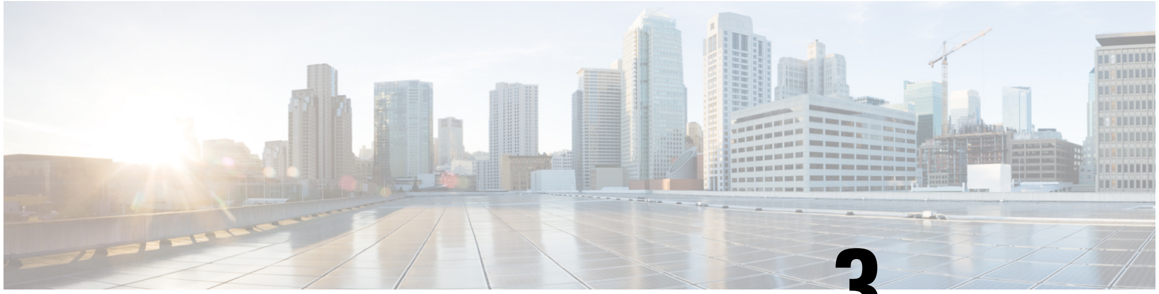
After the deployment, use the following CLI to debug issues related to route-based VPN tunnels on Secure Firewall Threat Defense.

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



CHAPTER 3

Route Application Traffic from the Branch to the Internet Using Direct Internet Access (DIA)

In this chapter, we delve into the practical application of Direct Internet Access (DIA) using two use cases. Each use case details the scenario, network topology, best practices, and prerequisites. It also provides a comprehensive end-to-end procedure for seamless implementation.

- Direct Internet Access, on page 31
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- Is This Use Case For You?, on page 33
- Components for Direct Internet Access, on page 33
- Best Practices, on page 34
- Prerequisites, on page 34
- Scenario 1: Direct Internet Access, on page 34
- Scenario 2: Direct Internet Access With Path Monitoring, on page 37
- Configure a Trusted DNS Server, on page 40
- Configure Interface Priority, on page 41
- Create an ECMP Zone, on page 41
- Configure an Equal Cost Static Route, on page 41
- Configure Path Monitoring Settings, on page 42
- Configure an Extended ACL Object for YouTube, on page 43
- Configure an Extended ACL Object for WebEx, on page 43
- Configure a Policy Based Routing Policy for YouTube, on page 44
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Direct Internet Access

Digital innovation is transforming the way businesses operate, communicate, and interact with customers. It has led to the creation of new applications and technologies to improve collaboration and customer experience and require high bandwidth and low latency connections.

Challenges with Traditional Networks

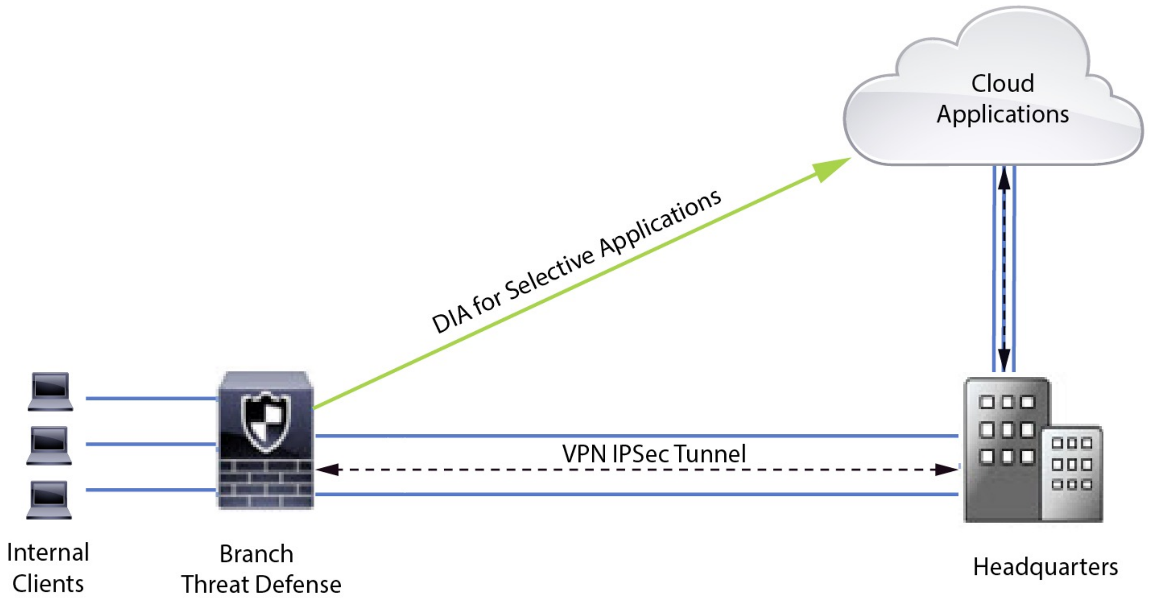
Traditionally, network deployments leverage a perimeter firewall on a central site to provide secure access to local and branch users. This architecture provides the desired connectivity, though it transports all internet traffic to the central site as encrypted traffic through a VPN tunnel resulting in packet latency, drops, and jitter. In addition, the network is constantly challenged with high costs and bandwidth utilization that is associated with deployment and complex network management.

Solution

One of the ways to overcome these challenges is to use Direct Internet Access (DIA). DIA is a component of the Simplified Branch feature of the Cisco Secure Firewall. DIA uses Policy Based Routing (PBR). DIA is also referred to as application aware routing.

In a DIA topology, application traffic from the branch office is routed directly to the internet thereby bypassing the latency of tunneling internet-bound traffic to the headquarters. The branch Secure Firewall Threat Defense is configured with an internet exit point. The PBR policy is applied on the ingress interface to identify the traffic based on the applications defined in the extended access control list. Correspondingly, the traffic is forwarded through the egress interfaces directly to the internet.

Figure 1: Direct Internet Access Through Specific Egress Interfaces



Why Policy based Routing?

You can use PBR to classify and securely break out traffic for specified applications. It also allows you to specify a path for certain traffic. You can configure a PBR policy in the Secure Firewall Management Center user interface to allow the applications to be directly accessed.

PBR and Path Monitoring

Typically, in PBR, traffic is forwarded through egress interfaces based on the priority value (interface cost) configured on them. In Secure Firewall Management Center version 7.2 and later versions, PBR uses path monitoring to collect performance metrics (RTT, jitter, packet loss, and MOS) of the egress interfaces. PBR uses these metrics to determine the best path (egress interface) for forwarding the traffic. Path monitoring periodically notifies PBR about the monitored interface when the metrics get modified. PBR retrieves the latest metric values for the monitored interfaces from the path monitoring database and updates the data path.

You must enable path monitoring for the interface, configure the monitoring type for the egress interface, and configure the application traffic to leverage path monitoring that uses the metrics values.

To understand path monitoring, see Scenario 2: Direct Internet Access With Path Monitoring, on page 37.

Benefits

Benefits of using DIA include

- Improved internet speeds and branch office user experience.
- Reduced complexity, making network management easier and cheaper.
- Cost-effective as it reduces bandwidth usage and eliminates the need for expensive hardware.
- Dynamic path selection using real-time metrics.
- Best egress path guaranteed without manual intervention.
- Continuous monitoring of link health and network state.
- Increased agility, allowing organizations to adapt quickly to changing business needs.

Is This Use Case For You?

The intended audience for this use case is network design engineers, network operations personnel, and security operations personnel who wish to implement Direct Internet Access within each remote site to allow local breakout of internet-bound traffic directly from the branch.

Components for Direct Internet Access

Some of the important components that the branch firewall uses for DIA are :

- **Trusted DNS Server**—Application detection in DIA feature relies on DNS snooping to resolve applications or a group of applications. To ensure that DNS requests are not resolved by rogue DNS servers and are indeed locked to the desired DNS servers, the management center allows you to configure a Trusted DNS server for Threat Defense.
- **Interface Priority**—Cisco Secure Firewall uses interface priority to determine the optimal internet path. Priority, lower the better, determines the preference of a particular ISP when sending the traffic out to the internet. The management center allows you to configure the interface priority for Threat Defense.
- **Network Service**—Object associated with a particular application that is used within policy based routing. This object is automatically created.
- **Network Service Group (NSG)**—Network Service Groups are a group of applications that the firewall uses to determine the path based on the configuration. Multiple network service objects can be part of a single NSG. The management center auto generates NSGs based on the extended access lists configured for policy based routing.

Best Practices

- Secure Firewall Threat Defense must run version 7.1 and higher.
- Trusted DNS servers must be configured to ensure DNS snooping is performed through trusted DNS servers to support application traffic flow.
- DNS requests passing through Threat Defense must be in a clear-text format and not encrypted to allow DNS snooping to facilitate PBR flows.
- ECMP zones must be configured for active/active load balancing of application traffic.
- ECMP is supported only in the routed firewall mode and a device can have a maximum of 256 ECMP zones.
- Only routed interfaces must be used. Each interface must belong to only a single ECMP zone.
- Make sure that interfaces belong to the virtual router where ECMP is being configured.
- Interfaces used in the ECMP zone configuration must have logical names defined within the interface configuration.
- Validate that no more than eight interfaces per ECMP zone are configured for PBR on Secure Firewall Threat Defense.
- Secure Firewall Threat Defense must not be deployed in a cluster because PBR is not supported in this mode.
- PBR must be configured for the global virtual router as it is not supported on user-defined virtual routers.
- Ensure that interfaces used in ingress and egress interface within PBR are either routed interfaces or non management-only interfaces and they belong to the global virtual router.

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

Scenario 1: Direct Internet Access

Bob is an account manager and Ann is a help desk specialist. Both work at a branch office of a large corporation. Recently, they have been experiencing latency issues while using web conferencing tools like Webex and streaming platforms like YouTube.

What is at risk?

Network latency and network congestion results in reduced performance and user experience of web conferencing and streaming sessions. This may impact the productivity and efficiency of employees at the branch office, potentially leading to a negative impact on the overall business operations.

How does DIA with PBR solve the problem?

Alice, the IT administrator, used policy based routing in conjunction with DIA to reduce latency in the network.

Direct Internet Access allowed branch offices to access the internet directly, without routing traffic through a central site or data center. This reduced latency by providing a more direct and optimized internet connection for branch users.

Policy based routing separated Webex and YouTube traffic on different egress interfaces. This ensured that the traffic was directed through different paths, reducing the burden on a single interface and improving application performance.

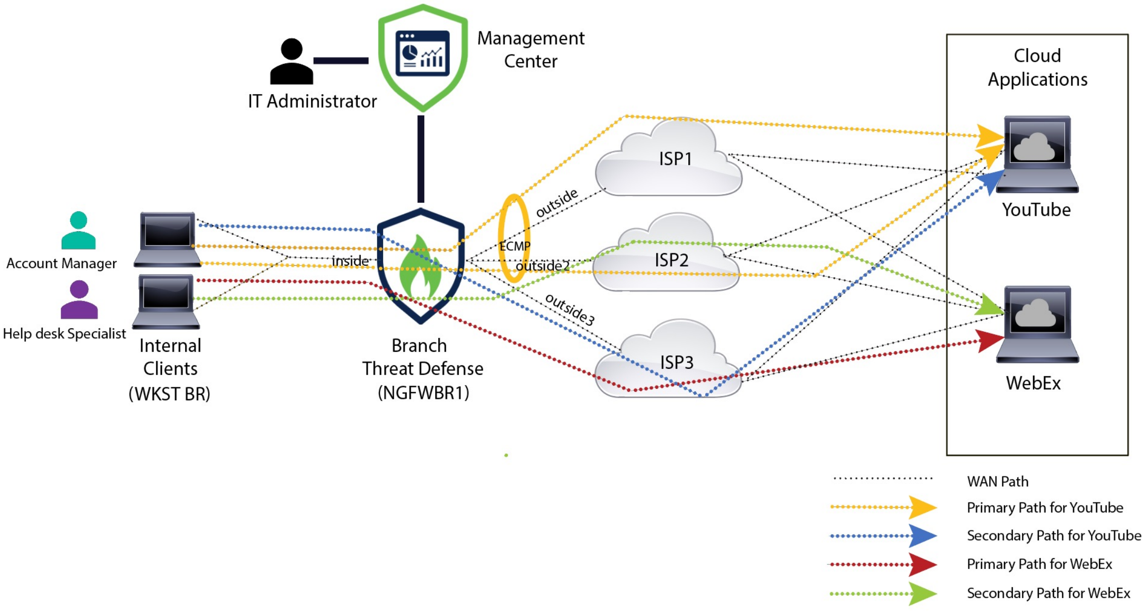
Network Topology for DIA

In this topology, a threat defense device is deployed at a branch location with three egress interfaces. The device is configured for DIA using PBR.

In the figure below, the internal client or branch workstation is labelled **WKST BR** and the branch threat defense is labeled **NGFWBR1**. The ingress interface of **NGFWBR1** is named **inside** and the egress interfaces are named **outside**, **outside2**, and **outside3** respectively.

Load balancing between the **outside** and **outside2** interfaces is achieved by configuring an ECMP zone and static routes.

Figure 2: Direct Internet Access Topology



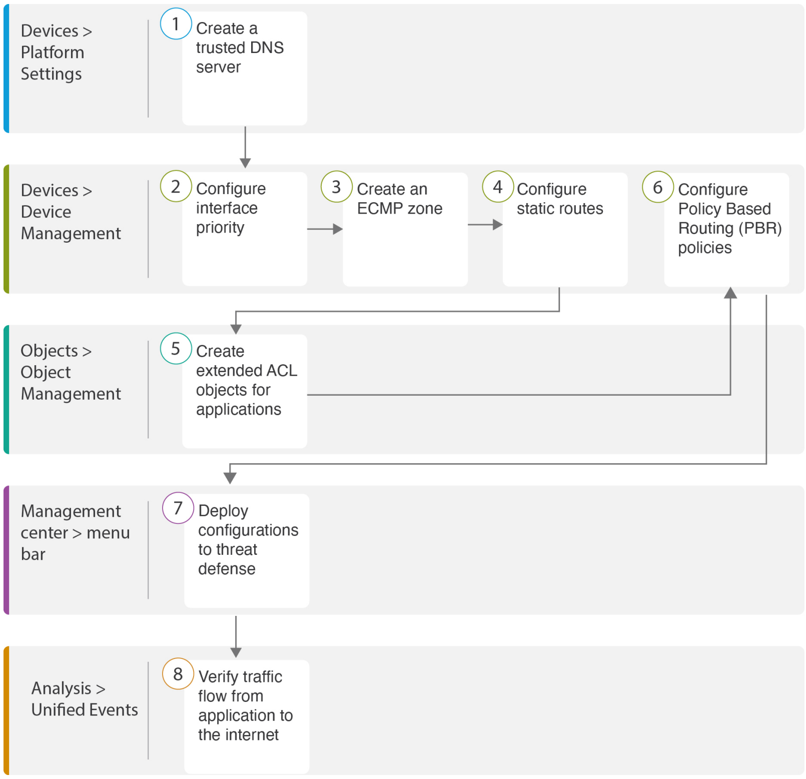
With DIA, users behind the branch firewall are allowed to access:

1. Social media application traffic (for example, **YouTube**) that is load balanced using two egress interfaces (**outside** and **outside2**). If both the interfaces fail, then traffic falls back to the third egress interface (**outside3**).

2. Collaboration application traffic (for example, **WebEx**) is forwarded through the **outside3** interface and if this link fails, traffic is forwarded through the **outside2** interface.

End-to-End Procedure for Configuring DIA

The following flowchart illustrates the workflow for configuring DIA in Secure Firewall Management Center.


Devices > Platform Settings
1 Create a trusted DNS server
Devices > Device Management
2 Configure interface priority
3 Create an ECMP zone
4 Configure static routes
6 Configure Policy Based Routing (PBR) policies
Objects > Object Management
5 Create extended ACL objects for applications
Management center > menu bar
7 Deploy configurations to threat defense
Analysis > Unified Events
8 Verify traffic flow from application to the internet

Step	Description
1	(*Prerequisite*) Configure a Trusted DNS server. See Configure a Trusted DNS Server, on page 40.
2	(*Prerequisite*) Configure interface priority. See Configure Interface Priority, on page 41.
3	(*Prerequisite*) Create an ECMP zone. See Create an ECMP Zone, on page 41.
4	(*Prerequisite*) Configure static routes. See Configure an Equal Cost Static Route, on page 41.
5	Configure extended ACL objects for applications. See • Configure an Extended ACL Object for YouTube, on page 43 • Configure an Extended ACL Object for WebEx, on page 43

Step	Description
6	Configure PBR policies for applications. See • Configure a Policy Based Routing Policy for YouTube, on page 44 • Configure a Policy Based Routing Policy for WebEx, on page 45
7	Deploy the configuration on threat defense. See Deploy Configuration, on page 46.
8	Verify YouTube and WebEx traffic flow. See Verify Application Traffic Flow, on page 47.

Scenario 2: Direct Internet Access With Path Monitoring

Ann is a help desk specialist and works at a branch office of a large corporation. Ann has been experiencing connection drops and lags while using WebEx.

What is at risk?

WebEx meetings rely on real-time data transmission, including audio and video streams, between the meeting host and attendees. This real-time data is sensitive to network latency and packet loss. If the network experiences high packet loss, it can lead to audio and video quality issues such as freezing, lagging, or delays, which can negatively impact the meeting experience.

How PBR with path monitoring resolve the problem?

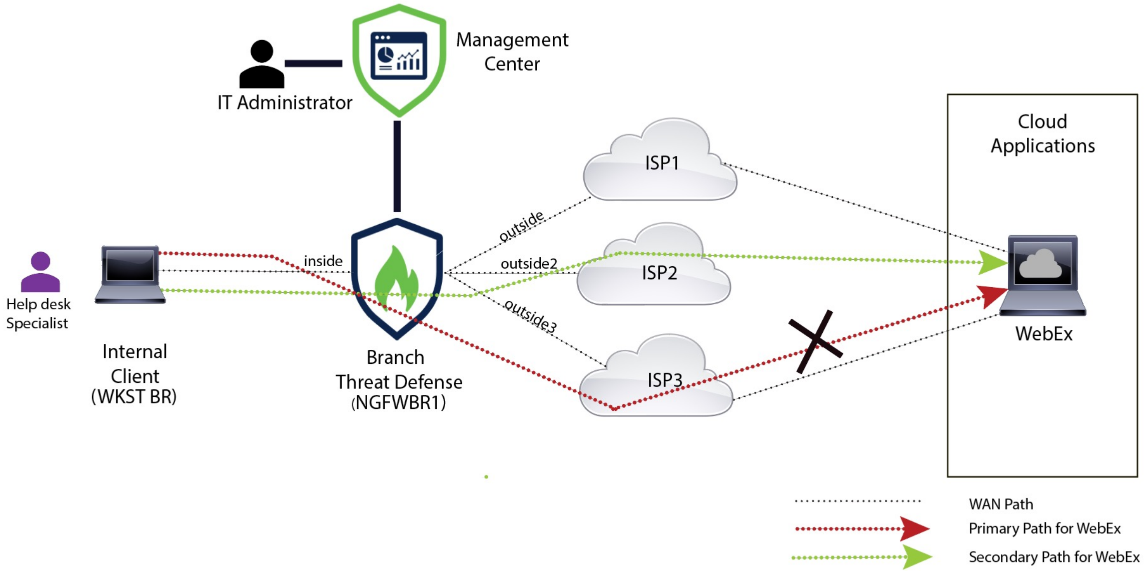
Alice, the IT administrator, used policy based routing with path monitoring to steer WebEx application traffic to the internet through the egress interface with minimal packet loss ensuring the best possible meeting experience for attendees.

Network Topology-DIA With Path Monitoring

In this topology, a threat defense device is deployed at a branch location with three egress interfaces. The device is configured for Direct Internet Access using Policy Based Routing.

In the figure below, the internal client or branch workstation is labeled **WKST BR** and the branch threat defense is labeled **NGFWBR1**. The ingress interface of **NGFWBR1** is named **inside** and the egress interfaces are named **outside**, **outside2**, and **outside3** respectively.

Figure 3: Direct Internet Access Topology (With Path Monitoring)



The **outside2**, and **outside3** egress interfaces are enabled with path monitoring. The PBR policy for WebEx is configured so that traffic is routed to the egress interface with minimal packet loss.

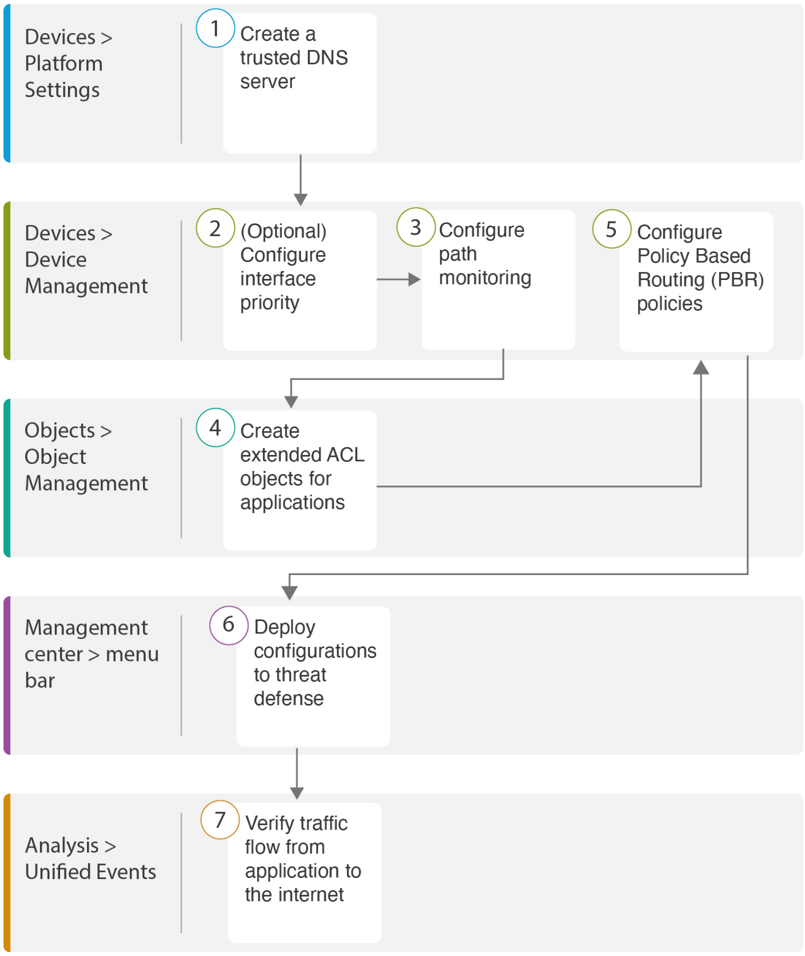
In this scenario, to validate path monitoring, packet loss can be induced by restricting outbound traffic that is sourced from the **outside3** interface going to internet either through an access control list on the upstream device or by shutting down the **outside3** interface for Secure Firewall Threat Defense from Firewall Management Center.

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

As a result of packet loss, the link that is associated with the **outside3** interface goes down. Collaboration application traffic is forwarded through the **outside2** interface instead of the **outside3** interface.

End-to-End Procedure for Configuring DIA With Path Monitoring

The following flowchart illustrates the workflow for configuring DIA with path monitoring in Secure Firewall Management Center.


Devices > Platform Settings
1 Create a trusted DNS server
Devices > Device Management
2 (Optional) Configure interface priority
3 Configure path monitoring
5 Configure Policy Based Routing (PBR) policies
Objects > Object Management
4 Create extended ACL objects for applications
Management center > menu bar
6 Deploy configurations to threat defense
Analysis > Unified Events
7 Verify traffic flow from application to the internet

Step	Description
1	(*Prerequisite*) Configure a Trusted DNS server. See Configure a Trusted DNS Server, on page 40.
2	[*Prerequisite (Optional)*] Configure interface priority. See Configure Interface Priority, on page 41.
3	Configure path monitoring. See Configure Path Monitoring Settings, on page 42.
4	Configure an extended ACL object for the application. See Configure an Extended ACL Object for WebEx, on page 43.
5	Configure a PBR policy for the application. See Configure a Policy Based Routing Policy With Path Monitoring for Webex, on page 45.
6	Deploy the configuration on threat defense. See Deploy Configuration, on page 46.
7	Verify WebEx traffic flow. See Verify Application Traffic Flow, on page 47.

Configure a Trusted DNS Server

Application detection in Direct Internet Access feature relies on DNS snooping to map the application domains to IPs in order to detect the application or a group of applications. To ensure that DNS requests are not resolved by rogue DNS servers and are indeed locked to desired DNS servers, Cisco Secure Firewall Management Center allows you to configure Trusted DNS Servers for Cisco Secure Firewall Threat Defense. Thus, the firewall only snoops the traffic that goes to trusted DNS servers. Apart from configuring the trusted DNS servers, you can include the already configured servers in DNS server group, DHCP pool, DHCP relay, and DHCP client as trusted DNS servers.

You can configure trusted DNS services for DNS snooping using the Trusted DNS Servers tab.

Note For an application-based PBR, you must configure trusted DNS servers. You must also ensure that the DNS traffic passes through threat defense in a clear-text format (encrypted DNS is not supported) so that domains can be resolved to detect applications.

Before you begin

- Ensure you have created one or more DNS server groups. For more information, see Creating DNS Server Group Objects.
- Ensure you have created interface objects to connect to the DNS servers.
- Ensure that the managed device has appropriate static or dynamic routes to access the DNS servers.

Step 1 Choose **Devices** > **Platform Settings** and edit a threat defense policy.

Step 2 Click the **Edit** (✎) icon.

Step 3 Click **DNS**.

Step 4 To configure the trusted DNS servers, click the **Trusted DNS Servers** tab.

Step 5 To choose **DNS_Server** from the existing host objects, under **Available Host Objects**, search for it using the search field, and click **Add** to include it to the **Selected DNS Servers** list.

Note **DNS_Server** is the DNS server configured in this example.

Step 6 Click **Save**. The added DNS server is displayed in the **Trusted DNS Servers** page.

Step 7 Click **Policy Assignments** to ensure **NGFWBR1** is already in the **Selected Devices** list.

Step 8 Click **OK** to confirm the changes.

Step 9 Click **Save** to write the changes for platform settings.

Configure Interface Priority

Cisco Secure Firewall Threat Defense uses interface priority to determine the optimal internet path. Priority ranges from 0 to 65535, and determines the preference of a particular ISP when sending the traffic out to the internet. The traffic is forwarded based on the priority of the interfaces. Traffic is routed to the interface with the least priority value first. When an interface is not available, traffic is forwarded to the interface with the next lowest priority value. For example, let us assume that outside2 and outside3 are configured with priority values 10 and 20 respectively. The traffic is forwarded to outside2. If outside2 becomes unavailable, the traffic is then forwarded to outside3.

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 **Policy Based Routing**.

Step 4 Click **Configure Interface Priority**.

Step 5 In the dialog box, provide the priority number against the interfaces.

When the priority value is the same for all the interfaces, the traffic is balanced among the interfaces.

Step 6 Click **Save**.

Create an ECMP Zone

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-WAN** for the ECMP zone.

Step 6 To associate interfaces, select the interface 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**.

Configure an Equal Cost Static Route

You can assign interfaces of a virtual router, both global and user-defined, to an ECMP zone for the device.

Before you begin

- To configure an equal cost static route for an interface, ensure to associate it with an ECMP zone. See Create an ECMP Zone, on page 41.
- You cannot define a static route for interfaces with same destination and metric without associating the interfaces with an ECMP zone.

Step 1 From the **Devices** > **Device Management** page and edit the threat defense device (**NGFWBR1**).

Step 2 Click the **Routing** tab.

Step 3 From the drop-down list, select the virtual router whose interfaces are associated with an ECMP zone.

Step 4 To configure the equal cost static route for the interfaces, click **Static Route**.

Step 5 Click **Add Route** to add a new route, or click **Edit** (✎) for an existing route.

Step 6 From the **Interface** drop-down, select the interface belonging to the virtual router and an ECMP zone.

Step 7 Select the destination network from the **Available Networks** box and click **Add**.

Step 8 Enter a gateway for the network.

Step 9 Enter a metric value. It can be a number that ranges between 1 and 254.

Step 10 To save the settings, click **Save**.

Step 11 To configure equal cost static routing, repeat the steps to configure the static route for another interface in the same ECMP zone with the same destination network and metric value. Remember to provide a different gateway.

Configure Path Monitoring Settings

The PBR policy relies on flexible metrics, such as round trip time (RTT), jitter, mean opinion score (MOS), and packet loss of the interfaces to identify the best routing path for its traffic. Path monitoring collects these metrics on the specified interfaces. On the **Interfaces** page, you can configure interfaces with settings for path monitoring to send the probes for metrics collection.

Step 1 Select **Devices** > **Device Management** and click **Edit** (✎) for the threat defense device (**NGFWBR1**).

Step 2 Click **Edit** (✎) for the interface you want to edit (**outside**).

Step 3 Click the **Path Monitoring** tab.

Step 4 Check the **Enable IP based Path Monitoring** check box.

Step 5 From the **Monitoring Type** drop-down list, select the relevant option. In this example, we use the default value, **Next-hop of default route out of interface (Auto)**.

Step 6 Click **Ok**.

Step 7 Repeat Steps 2 through 8 for the **outside2** and **outside3** interfaces.

Step 8 Click **Save**.

Configure an Extended ACL Object for YouTube

The access list is configured for YouTube traffic to be steered towards the internet from different egress interfaces with the help of policy based routing.

Step 1 Select **Objects** > **Object Management** and choose **Access Lists** > **Extended** from the table of contents.

Step 2 Click **Add Extended Access List** to create an extended access list for social media traffic.

Step 3 In the Extended ACL Object dialog box, enter a name (**DIA_SocialMedia**) for the object.

Step 4 Click **Add** to create a new Extended Access List.

Step 5 Configure the following access control properties:

a. Select the **Action** to Allow (match) the traffic criteria.

b. Click the **Application** tab and search for **YouTube** in the **Available Applications** list.

c. Select **YouTube** and click **Add to Rule**.

d. Click **Add** to add the entry to the object.

e. Click **Save**.

Configure an Extended ACL Object for WebEx

The access list is configured for WebEx traffic to be steered towards the internet from different egress interfaces with the help of policy based routing.

Step 1 Select **Objects** > **Object Management** and choose **Access Lists** > **Extended** from the table of contents.

Step 2 Click **Add Extended Access List** to create an extended access list for collaboration traffic.

Step 3 In the Extended ACL Object dialog box, enter a name (**DIA_Collaboration**) for the object.

Step 4 Click **Add** to create a new Extended Access List.

Step 5 Configure the following access control properties:

a. Select the **Action** to Allow (match) the traffic criteria.

b. Click the **Application** tab and search for **Webex** in the **Available Applications** list.

c. Select **Webex** and click **Add to Rule**.

d. Click **Add** to add the entry to the object.

e. Click **Save**.

Configure a Policy Based Routing Policy for YouTube

You can configure the PBR policy in the Policy Based Routing page by specifying the ingress interfaces, match criteria (Extended Access Control List), and egress interfaces to route YouTube traffic.

The YouTube traffic is load balanced between the **outside** and **outside2** interfaces and falls back to the **outside3** if both the links fail.

Step 1 Select **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 **Policy Based Routing**.

The Policy Based Routing page displays the configured policy. The grid displays the list of ingress interfaces and a combination of the policy-based route access list, and egress interfaces.

Step 4 To configure the policy, click **Add**.

Step 5 In the **Add Policy Based Route** dialog box, select **inside** from the **Ingress Interface** drop-down list.

Note Only interfaces that have logical names and that belong to a global virtual router are listed in the drop-down.

Step 6 To specify the match criteria and the forward action in the policy, click **Add**.

Step 7 In the **Add Forwarding Actions** dialog box, do the following:

a) From the **Match ACL** drop-down, choose **DIA_SocialMedia**.

b) To select the configured interfaces, choose **Egress Interfaces** from the **Send To** drop-down list.

c) Choose **By Priority** from the **Interface Ordering** drop-down list.

Traffic is routed to the interface with the least priority value first. When the interface is not available, the traffic is then forwarded to the interface with the next lowest priority value. For example, let us assume that outside2 and outside3 are configured withpriority values 10 and 20 respectively. The traffic is forwarded to outside2. If outside2 becomes unavailable, the traffic is then forwarded to outside3.

d) In the **Available Interfaces** box, all the interfaces with their priority values are listed. Click the **Add** (+) icon to add the selected egress interface.

For our scenario:

1. From Available Interfaces, click the **Add** (+) icon adjacent to **outside** and **outside2** interfaces to move it to **Selected Egress Interfaces**.
2. Then click the **Add** (+) icon adjacent to **outside3** interface to move it to **Selected Egress Interfaces**.

e) Click **Save** to write the changes for the match criteria.

f) Review the configuration and click **Save** to write all the configuration changes for policy based routing.

Step 8 Click **Save**.

Configure a Policy Based Routing Policy for WebEx

You can configure the PBR policy in the Policy Based Routing page by specifying the ingress interfaces, match criteria (Extended Access Control List), and egress interfaces to route WebEx application traffic.

The WebEx application traffic is routed to **outside3** and falls back to the **outside2** if the primary link fails.

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 **Policy Based Routing**.

The Policy Based Routing page displays the configured policy. The grid displays the list of ingress interfaces and a combination of the policy-based route access list, and egress interfaces.

Step 4 To edit the policy, click the **Edit** (✎) icon.

Step 5 To specify the match criteria and the forward action in the policy, click **Add**.

Step 6 In the **Add Forwarding Actions** dialog box, do the following:

a) From the **Match ACL** drop-down, choose **DIA_Collaboration**.

b) To select the configured interfaces, choose **Egress Interfaces** from the **Send To** drop-down list.

c) Choose **Order** from the **Interface Ordering** drop-down list.

The traffic is forwarded based on the sequence of the interfaces specified here.

d) In the **Available Interfaces** box, all the interfaces with their priority values are listed. Click the **Add** (+) icon to add the selected egress interface.

For our scenario:

1. From Available Interfaces, click the **Add** (+) icon adjacent to **outside3** interface to move it to **Selected Egress Interfaces**.

2. Then click the **Add** (+) icon adjacent to **outside2** interface to move it to **Selected Egress Interfaces**.

e) Click **Save** to write the changes for the match criteria.

f) Review the configuration and click **Save** to write all the configuration changes for policy based routing.

Step 7 Click **Save**.

Configure a Policy Based Routing Policy With Path Monitoring for Webex

You can configure the PBR policy with path monitoring in the Policy Based Routing page. In this example, WebEx application traffic is forwarded to the interface that has the least traffic loss.

Before you begin

To use the path monitoring metrics for configuring the traffic forwarding priority over egress interfaces, you must configure the path monitoring settings for the interfaces. See Configure Path Monitoring Settings, on page 42.

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 **Policy Based Routing**.

The Policy Based Routing page displays the configured policy. The grid displays the list of ingress interfaces and a combination of the policy-based route access list, and egress interfaces.

Step 4 To configure the policy, click **Add**.

Step 5 In the **Add Policy Based Route** dialog box, select **inside** from the **Ingress Interface** drop-down list.

Note Only interfaces that have logical names and that belong to a global virtual router are listed in the drop-down.

Step 6 To specify the match criteria and the forward action in the policy, click **Add**.

Step 7 In the **Add Forwarding Actions** dialog box, do the following:

a) From the **Match ACL** drop-down, choose **DIA_Collaboration**.

b) To select the configured interfaces, choose **Egress Interfaces** from the **Send To** drop-down list.

c) Choose **Minimal Packet Loss** from the **Interface Ordering** drop-down list.

The traffic is forwarded to the interface that has the minimal packet loss.

d) In the **Available Interfaces** box, all the interfaces are listed. From the list of interfaces, click the **Add** (+)icon to add the selected egress interface.

For our scenario:

1. From Available Interfaces, click the **Add** (+) icon adjacent to **outside3** interface to move it to **Selected Egress Interfaces**.

2. Then click the **Add** (+) icon adjacent to **outside2** interface to move it to **Selected Egress Interfaces**.

e) Click **Save** to write the changes for the match criteria.

f) Review the configuration and click **Save** to write all the configuration changes for policy based routing.

Step 8 Click **Save**.

Deploy Configuration

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

Step 1 On the management center menu bar, click **Deploy**.

Step 2 Check the checkbox adjacent to NGFWBR1 on which you want to deploy configuration changes.

Step 3 Click **Deploy**.

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 Application Traffic Flow

Step 1 In the management center interface, select **Analysis** > **Unified Events**.

Step 2 Customize the columns using the column picker by selecting the **Web Application** and **Egress Interface** and click **Apply**.

Step 3 Reorder the columns for ease of verification.

Step 4 Within the **Web Application** filter, enter the name **WebEx** and click **Apply** .

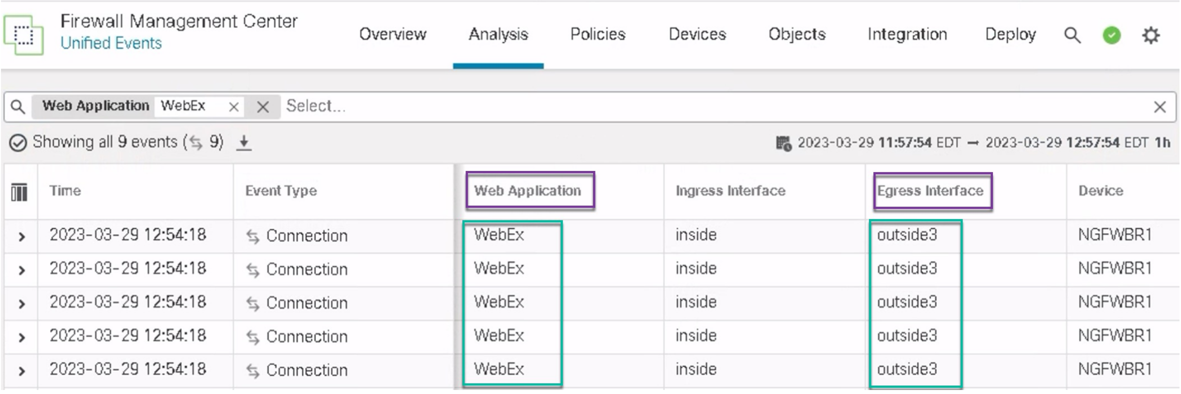
Step 5 Within the **Web Application** filter, enter the name **YouTube** and click **Apply** .

Step 6 Initiate traffic for the **YouTube** and **WebEx** applications on a host behind the Secure Firewall. In our scenario, launch the Google Chrome browser and navigate to https://youtube.com and https://webex.com in different tabs on the branch workstation **WKST BR1**.

Step 7 In the management center, verify the traffic flow for both the applications.

a. For DIA:

- **WebEx** application traffic is sent out through the **outside3** interface as per the configuration as seen in the figure below.



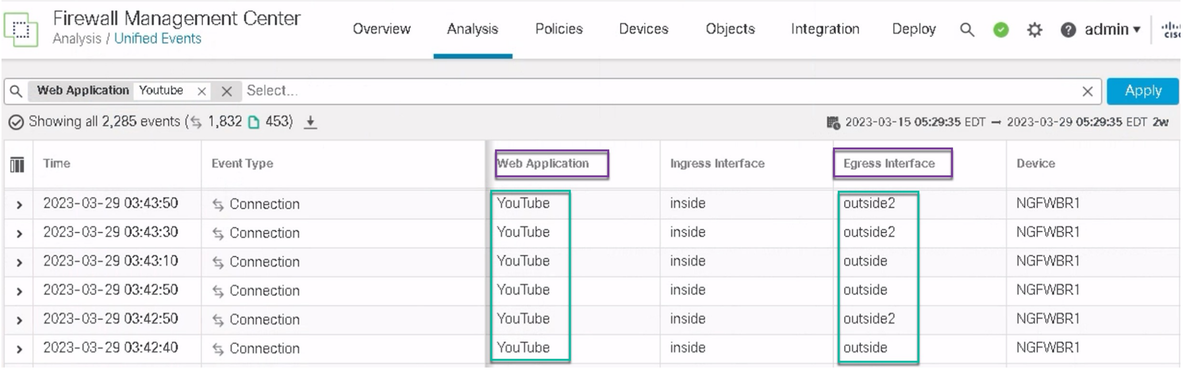
Web Application WebEx × | Select...

Showing all 9 events (⇆ 9)

2023-03-29 11:57:54 EDT → 2023-03-29 12:57:54 EDT 1h

	Time	Event Type	Web Application	Ingress Interface	Egress Interface	Device
›	2023-03-29 12:54:18	⇆ Connection	WebEx	inside	outside3	NGFWBR1
›	2023-03-29 12:54:18	⇆ Connection	WebEx	inside	outside3	NGFWBR1
›	2023-03-29 12:54:18	⇆ Connection	WebEx	inside	outside3	NGFWBR1
›	2023-03-29 12:54:18	⇆ Connection	WebEx	inside	outside3	NGFWBR1
›	2023-03-29 12:54:18	⇆ Connection	WebEx	inside	outside3	NGFWBR1

- **YouTube** application traffic is load balanced between the **outside** and **outside2** interfaces as per the configuration as seen in the figure below.



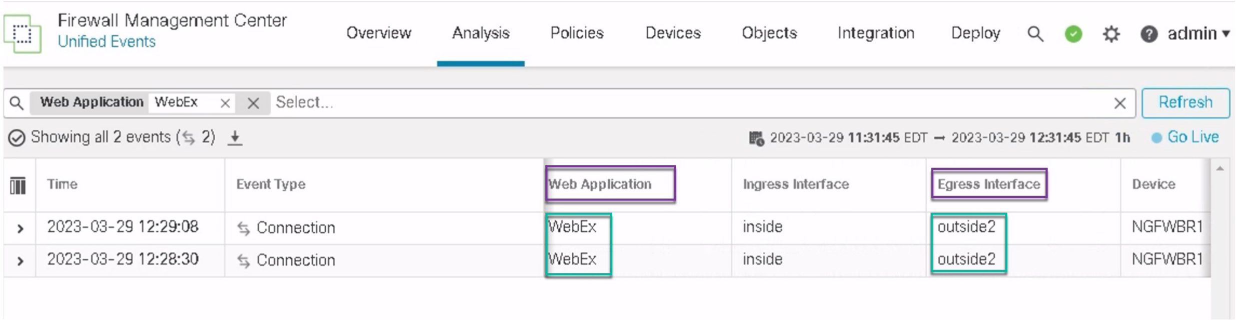
Showing all 2,285 events (1,832 453)

2023-03-15 05:29:35 EDT → 2023-03-29 05:29:35 EDT 2w

Time	Event Type	Web Application	Ingress Interface	Egress Interface	Device
2023-03-29 03:43:50	Connection	YouTube	inside	outside2	NGFWBR1
2023-03-29 03:43:30	Connection	YouTube	inside	outside2	NGFWBR1
2023-03-29 03:43:10	Connection	YouTube	inside	outside	NGFWBR1
2023-03-29 03:42:50	Connection	YouTube	inside	outside	NGFWBR1
2023-03-29 03:42:50	Connection	YouTube	inside	outside2	NGFWBR1
2023-03-29 03:42:40	Connection	YouTube	inside	outside	NGFWBR1

b. For DIA with path monitoring:

WebEx application traffic is sent out through the **outside2** interface as there is packet loss on the **outside3** interface as seen in the figure below.



Showing all 2 events (2)

2023-03-29 11:31:45 EDT → 2023-03-29 12:31:45 EDT 1h

Time	Event Type	Web Application	Ingress Interface	Egress Interface	Device
2023-03-29 12:29:08	Connection	WebEx	inside	outside2	NGFWBR1
2023-03-29 12:28:30	Connection	WebEx	inside	outside2	NGFWBR1

Monitor and Troubleshoot Policy Based Routing

After the deployment, use the following CLI to monitor and troubleshoot issues related to policy based routing on Secure Firewall Threat Defense.

How ...	CLI Command
To log in to Secure Firewall Threat Defense Lina CLI	**system support diagnostic-cli**
To view the pre-defined network service objects that are pushed from the management center to threat defense during the deployment	• **show object network-service** • **show object network-service detail**
To view a particular network service object (NSG) related to configured applications	• **show object id YouTube** • **show object id WebEx**
To verify the network service group (NSG) pushed to Secure Firewall	**show run object-group network-service**

How ...	CLI Command
To view the route-map associated to policy based routing	**show run route-map**
To verify the interface configuration details like interface name and interface priority	**show run interface**
To verify the trusted DNS server configuration	**show dns**
To determine the path taken the traffic	**debug policy-route** **Important** Run the debug command with caution, especially in production environments as it may have verbose output based on the traffic.
To stop debugging the route	**undebug all**

To view the pre-defined network service objects, use the following command:

```
ngfwbr1# show object network-service
object network-service "ADrive" dynamic
 description Online file storage and backup.
 app-id 17
 domain adrive.com (bid=0) ip (hitcnt=0)
object network-service "Amazon" dynamic
 description Online retailer of books and most other goods.
 app-id 24
 domain amazon.com (bid=0) ip (hitcnt=0)
 domain amazon.jobs (bid=0) ip (hitcnt=0)
 domain amazon.in (bid=0) ip (hitcnt=0)
.
.
.
output snipped
.
.
.
object network-service "Logitech" dynamic
 description Company develops Computer peripherals and accessories.
 app-id 4671
 domain logitech.com (bid=0) ip (hitcnt=0)
object network-service "Lenovo" dynamic
 description Company manufactures/markets computers, software and related services.
 app-id 4672
 domain lenovo.com (bid=0) ip (hitcnt=0)
 domain lenovo.com.cn (bid=0) ip (hitcnt=0)
 domain lenovomm.com (bid=0) ip (hitcnt=0)
ngfwbr1#
```

To view specific network service objects such as YouTube and WebEx, use the following command:

```
ngfwbr1# show object id YouTube
object network-service "YouTube" dynamic
 description A video-sharing website on which users can upload, share, and view videos.
 app-id 929
 domain youtubei.googleapis.com (bid=592729) ip (hitcnt=0)
 domain yt3.ggpht.com (bid=709809) ip (hitcnt=102)
 domain youtube.com (bid=830871) ip (hitcnt=101)
 domain ytimg.com (bid=1035543) ip (hitcnt=93)
 domain googlevideo.com (bid=1148165) ip (hitcnt=466)
 domain youtu.be (bid=1247981) ip (hitcnt=0)
ngfwbr1# show object id WebEx
object network-service "WebEx" dynamic
 description Cisco's online meeting and web conferencing application.
 app-id 905
 domain files-prod-us-east-2.webexcontent.com (bid=182837) ip (hitcnt=0)
 domain webex.com (bid=290507) ip (hitcnt=30)
 domain avatar-prod-us-east-2.webexcontent.com (bid=452667) ip (hitcnt=0)
ngfwbr1#
```

To verify the NSG is pushed to Threat Defense, use the following command:

```
ngfwbr1# show run object-group network-service
object-group network-service FMC_NSG_292057776181
 network-service-member "WebEx"
object-group network-service FMC_NSG_292057776200
 network-service-member "YouTube"
ngfwbr1#
```

To verify the route map associated with PBR, use the following command:

```
ngfwbr1# show run route-map
!
route-map FMC_GENERATED_PBR_1678091359817 permit 5
 match ip address DIA_Collaboration
 set interface outside3 outside2

!
route-map FMC_GENERATED_PBR_1678091359817 permit 10
 match ip address DIA_SocialMedia
 set adaptive-interface cost outside outside2 outside3
!
ngfwbr1#
```

To verify the interface configuration and interface priority details, use the following command:

```
ngfwbr1# show run interface
!
interface GigabitEthernet0/0
 nameif outside
 cts manual
  propagate sgt preserve-untag
  policy static sgt disabled trusted
 security-level 0
  zone-member ECMP-WAN
 ip address 198.18.128.81 255.255.192.0
 policy-route cost 10
!
interface GigabitEthernet0/1
 nameif inside
 cts manual
  propagate sgt preserve-untag
  policy static sgt disabled trusted
 security-level 0
 ip address 198.19.11.4 255.255.255.0
 policy-route route-map FMC_GENERATED_PBR_1678091359817
!
interface GigabitEthernet0/2
 shutdown
 no nameif
 no security-level
 no ip address
!
interface GigabitEthernet0/3
```

```
 nameif outside2
 cts manual
  propagate sgt preserve-untag
  policy static sgt disabled trusted
 security-level 0
 zone-member ECMP-WAN
 ip address 198.19.40.4 255.255.255.0
 policy-route cost 10
!
interface GigabitEthernet0/4
 nameif outside3
 cts manual
  propagate sgt preserve-untag
  policy static sgt disabled trusted
 security-level 0
 ip address 198.19.30.4 255.255.255.0
 policy-route cost 20
!
interface Management0/0
 management-only
 nameif diagnostic
 cts manual
  propagate sgt preserve-untag
  policy static sgt disabled trusted
 security-level 0
 no ip address
ngfwbr1#
```

To verify the trusted DNS configuration, use the following command:

```
ngfwbr1# show dns

DNS Trusted Source enabled for DHCP Server Configured
DNS Trusted Source enabled for DHCP Client Learned
DNS Trusted Source enabled for DHCP Relay Learned
DNS Trusted Source enabled for DNS Server Configured
DNS Trusted Source not enabled for Trust-any
DNS Trusted Source: Type: IPs : Interface : Idle/Timeout (sec)
    DNS Server Configured: 198.19.10.100: <ifc-not-specified> : N/A
Trusted Source Configured: 198.19.10.100: <ifc-not-specified> : N/A
DNS snooping IP cache: 0 in use, 37 most used
Address                              Idle(sec) Timeout(sec) Hit-count          Branch(es)
ngfwbr1#
```

To debug policy route, use the following command:

```
ngfwbr1# debug policy-route
debug policy-route  enabled at level 1
ngfwbr1# pbr: policy based route lookup called for 198.19.11.225/58119 to 198.19.10.100/53
 proto 17 sub_proto 0 received on interface inside, NSGs, nsg_id=none
pbr: no route policy found; skip to normal route lookup
.
output-snipped
.
pbr: policy based route lookup called for 198.19.11.225/61482 to 63.140.48.151/443 proto 6
 sub_proto 0 received on interface inside
                                                         , NSGs, nsg_id=1
pbr: First matching rule from ACL(2)
pbr: route map FMC_GENERATED_PBR_1678091359817, sequence 5, permit; proceed with policy
routing
pbr: evaluating interface outside3
pbr: policy based routing applied; egress_ifc = outside3 : next_hop = 198.19.30.63

ngfwbr1#
```

The debug example above is for WebEx traffic. Note that the traffic is routed through the outside3 interface before PBR changes the route path to the outside2 interface.

To stop the debug process, use the following command:

```
ngfwbr1# undebug all
```

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

CHAPTER 4

Secure Internet Traffic Using Umbrella Auto Tunnel

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

- Cisco Umbrella Auto Tunnel , on page 53
- Benefits, on page 54
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- End-to-end Procedure for Configuring Umbrella Auto Tunnel, on page 58
- Configure a SASE Tunnel for Umbrella, on page 59
- Configure a Static Route, on page 63
- Configure an Extended ACL for DNS and Web Traffic, on page 63
- Configure a PBR Policy for DNS and Web Traffic , on page 64
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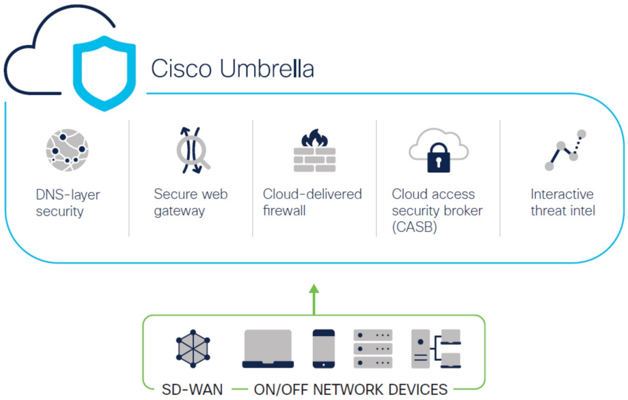
Cisco Umbrella Auto Tunnel

Domain Name System (DNS) is an internet protocol often used in attacks. 90% of malware uses DNS (Source: Cisco Security Research Report). However, many organizations do not monitor their DNS or use DNS-focused security.

Figure 4: Cisco Umbrella



Cisco Umbrella is a cloud based secure internet gateway platform that provides multiple levels of defense against internet based threats. Umbrella integrates DNS layer security, Cloud Access Security Border (CASB) functionality, cloud-delivered firewall, and secure web gateway to deliver highly scalable security regardless of branch resources. Internet bound traffic can be sent securely automatically from the branch to the nearest Umbrella point of presence for inspection prior to being allowed or denied access to the internet.

From Release 7.3, the Secure Firewall Management Center supports Auto Tunnel configuration for Umbrella Secure Internet Gateway (SIG) integration that enables a network device to forward DNS and web traffic to Umbrella SIG for inspection and filtering through the SIG tunnel.

DNS and web policies defined within Cisco Umbrella can be applied to connections through Secure Firewall This enables you to apply and validate requests based on their domain names.

The management center provides a new simplified intuitive wizard-based interface to build this tunnel thus minimizing the configuration steps on Firewall Threat Defense and Cisco Umbrella.

The management center leverages uses Umbrella APIs to configure the network tunnels using parameters in the Cisco Umbrella Connection configuration. Then management center fetches the list of Umbrella datacenters and displays them in the user interface for selection as a hub in the SASE Topology. The network tunnel is deployed on the threat defense device and automatically created on Cisco Umbrella after the deployment is complete in the management center. This helps to apply uniform DNS and web policies for on premise users and roaming users.

Benefits

Benefits of securing internet traffic using Cisco Umbrella include :

- Securing users and applications at the DNS layer before any connections are established thus reducing consequent packet processing resulting in faster protection.
- Uniform DNS control policies are applied for hybrid users (on premise users and roaming users).
- Umbrella blocks web requests as well as requests to malware, ransomware, phishing attempts, and botnets even before a connection is established thereby stopping threats before they hit your network or endpoints. This results in a dramatic reduction in the number of infections and alerts you need to remediate.
- Eliminates the need for advanced firewall features such as URL filtering and TLS decryption.
- Auto tunnel setup requires minimal configuration in the management center.

- Automatic network tunnel configuration on the Umbrella dashboard.

Is This Use Case For You?

The intended audience for the Umbrella SASE Auto Tunnel Configuration is IT teams, network administrators, and security professionals who are responsible for managing and securing the network infrastructure of an organization. They are interested in exploring advanced solutions for secure remote access and simplifying the configuration and management of secure tunnels. The Umbrella SASE Auto Tunnel Configuration description would appeal to those seeking to enhance network security, streamline remote connectivity, and improve the overall user experience for their organization's remote workforce.

Scenario

Alice, the IT administrator is responsible for managing the organization's IT infrastructure and ensuring its security. Alice is aware of the growing threats in cyberspace and wants to implement robust security measures to prevent any potential cyber attacks such as malware, ransomware, and phishing.

Sally is an employee who works in the branch office and uses the organization's network to access the internet for work-related activities.

What is at risk?

Without proper security measures, employees may unknowingly access malicious websites and download harmful software, which can compromise the organization's network security and data privacy.

How does SIG integration solve the problem?

Alice implemented a two-layer security approach using a branch firewall and Cisco Umbrella. The firewall provided inbound security for the network from web and non-web based attacks. Umbrella provided outbound security by blocking malicious domains, IPs, and URLs at the DNS and web layers.

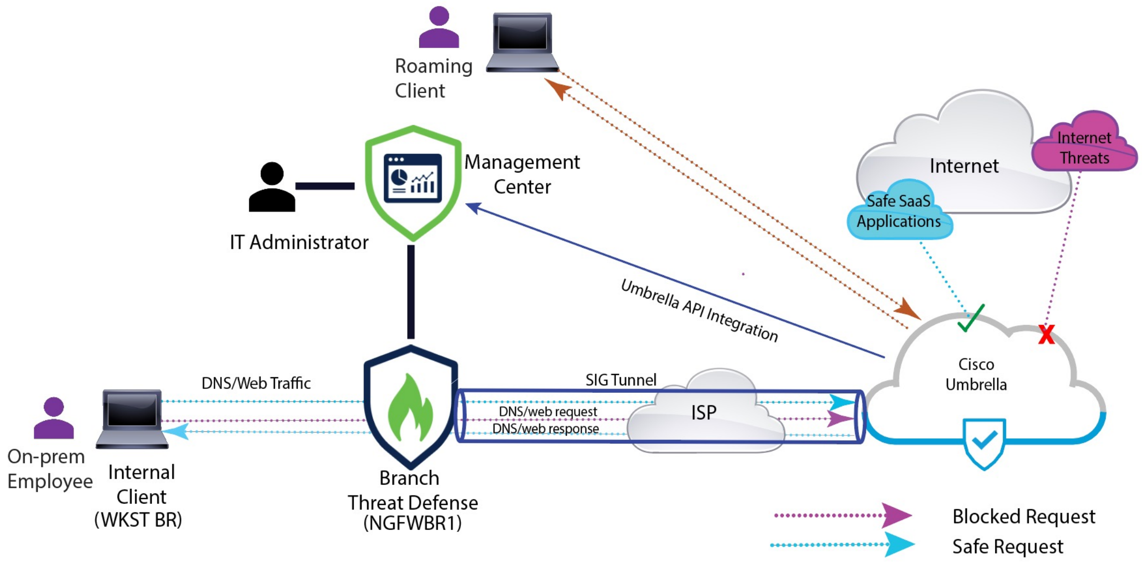
Sally notices that some websites are now being blocked by the firewall and Umbrella.

Both on-prem and remote users are subject to the same DNS and web policy defined within the Umbrella dashboard. As a result of this implementation, the organization's network is now more secure and protected against potential cyber attacks.

Network Topology

In this 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 threat defense is labelled NGFWBR1. A SIG auto tunnel is configured between NGFWBR1 and Cisco Umbrella.

Figure 5: Network Topology for Umbrella Auto Tunnel Configuration



All DNS and web traffic is sent through the SIG tunnel to Cisco Umbrella to be validated and allowed or blocked based on the Umbrella DNS and web policy. This provides two layers of protection, one locally enforced by the Cisco Secure Threat Defense and the other cloud-delivered by Cisco Umbrella.

In the case of DNS traffic:

1. If Cisco Umbrella detects a DNS request for a domain that has not been classified, it will query the domain's reputation.
2. If the domain is classified as malicious, the DNS request is blocked, and the end user is prevented from accessing the website.
3. If the domain is classified as safe, the DNS request is resolved, and the website is accessible to the end user.

Best Practices for SASE Umbrella Tunnels

- Ensure that the base license is enabled with export-controlled features in the management center.
- We recommend that the threat defense interfaces facing the internet be named or prefixed with **outside**.
- Do not edit or delete the SASE topology if the deployment to Umbrella is running for that topology.
- To configure backup Umbrella DC, replicate the same topology with same threat defense endpoints using backup Umbrella DC.
- To configure backup interface on the threat defense endpoint, replicate the same topology with the same Umbrella DC with the same threat defense endpoint using VTI on the backup interface.

Prerequisites for Configuring Umbrella SASE Tunnels

- 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
- You must have a Cisco Umbrella Secure Internet Gateway (SIG) Essentials subscription or a free SIG trial version.
- You must enable your Smart License account with the export-controlled features to deploy tunnels on Umbrella from the management center.
- Log into Umbrella at http://login.umbrella.com, and obtain the required information to establish a connection to Cisco Umbrella. Ensure the management center can reach management.api.umbrella.com.
- You must register your Cisco Umbrella organisation with the management center and configure the management key and the management secret in the Cisco Umbrella Connection advanced settings. This fetches 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 general settings.

  For more information, see:

  - Configure Cisco Umbrella Connection Settings
  - Map Management Center Umbrella Parameters and Cisco Umbrella API Keys

- Ensure that Umbrella data center is reachable from the threat defense.
- Ensure the threat defense supports route-based VPN with local tunnel ID support (Version 7.1.0 and later). You can deploy a SASE tunnel with local tunnel ID support in management center version 7.3.0 and later.

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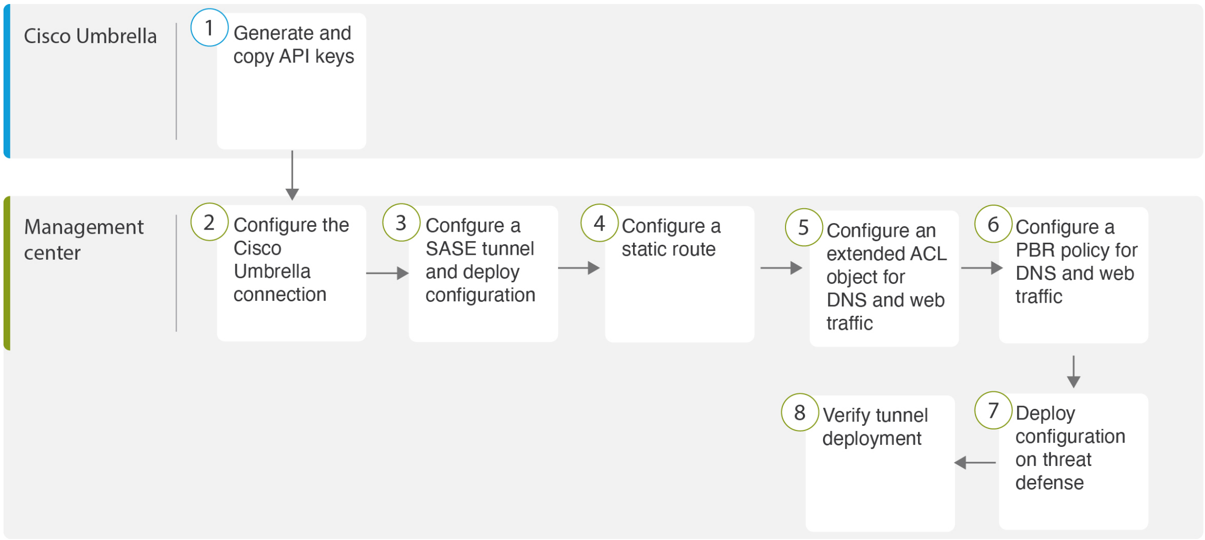
End-to-end Procedure for Configuring Umbrella Auto Tunnel

The following flowchart illustrates the workflow for configuring the SASE tunnel in Secure Firewall Management Center.


Cisco Umbrella
1 Generate and copy API keys
Management center
2 Configure the Cisco Umbrella connection
3 Configure a SASE tunnel and deploy configuration
4 Configure a static route
5 Configure an extended ACL object for DNS and web traffic
6 Configure a PBR policy for DNS and web traffic
7 Deploy configuration on threat defense
8 Verify tunnel deployment

Step	Description
1	(*Prerequisite*) Generate and copy the API keys in Cisco Umbrella. See Map Management Center Umbrella Parameters and Cisco Umbrella API Keys .
2	(*Prerequisite*) Configure the Cisco Umbrella connection. See Configure Cisco Umbrella Connection Settings.
3	Create the SASE tunnel and deploy the configuration on threat defense. See Configure a SASE Tunnel for Umbrella, on page 59.
4	Configure a static route. See Configure a Static Route, on page 63.
5	Configure an extended ACL object for DNS and web traffic. See Configure an Extended ACL for DNS and Web Traffic, on page 63
6	Configure a PBR policy for DNS and web traffic. See Configure a PBR Policy for DNS and Web Traffic , on page 64
7	Deploy configuration on threat defense. See Deploy Configuration, on page 20.
8	Verify tunnel deployment. See Verify SASE Umbrella Tunnel Deployment, on page 65.

Configure a SASE Tunnel for Umbrella

Before you begin

Ensure that you review Prerequisites for Configuring Umbrella SASE Tunnels, on page 56 and Best Practices for SASE Umbrella Tunnels, on page 56.

Step 1 Log in to the management center, choose **Devices > VPN > Site To Site**.

Step 2 Click **+ SASE Topology** to open the SASE topology wizard.

Step 3 Enter a unique **Topology Name** For our example, enter **VPN-MumbaiUmbrella**.

Step 4 **Pre-shared Key**: This key is auto-generated according to the Umbrella PSK requirements.

The device and Umbrella share this secret key, and IKEv2 uses it for authentication. You can override the auto-generated key. 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. The Umbrella data centers are auto populated with the region and IP addresses.

Step 6 Click **Add** to add a threat defense node as an endpoint in the SASE topology.

a) Choose a threat defense device (**NGFWBR1**) from the **Device** drop-down list.

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

To create a new static VTI interface (for example, **Outside_static_vti_1**), click **+**. The **Add Virtual Tunnel Interface** dialog box appears with the following pre-populated default configurations.

- Tunnel Type is set to **Static** by default.
- Name is <*tunnel_source interface logical name*>+ static_vti +<*tunnel ID*>. For example, Outside_static_vti_1.
- Tunnel is **Enabled** by default.
- Security zone is configured as **Outside** by default.
- Tunnel ID is auto-populated with an unique ID.
- Tunnel Source Interface is auto-populated with an interface with an 'outside' prefix.

  Note Ensure the tunnel source is set to **GigabitEthernet0/0**

  Note You can also set the Tunnel Source Interface to a different interface.

- IPsec tunnel mode is IPv4 by default.
- Unused IP address is picked from the 169.254.x.x/30 private IP address range. In our example, **169.254.2.1/30** is selected.

  Note When the /30 subnet is used, only two IP addresses are available. The first IP address is the auto tunnel VTI IP and the second IP address is used as the next hop IP while configuring the static route to the Umbrella DC. In our example, 169.254.2.1 is the VTI IP and 169.254.2.2 is used for the static route. See Configure a Static Route, on page 63.

- Click **OK**.

Choose **outside_static_vti_1** from the VPN Interface drop-down list.

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.

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

- **Endpoints** pane: Displays the summary of the configured threat defense endpoints.
- **Encryption Settings** pane: Displays the encryption settings for the SASE tunnel.

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 only occurs after the tunnels are deployed on Umbrella. Local tunnel ID is required for the threat defense deployment.

Step 9 Click **Save**.

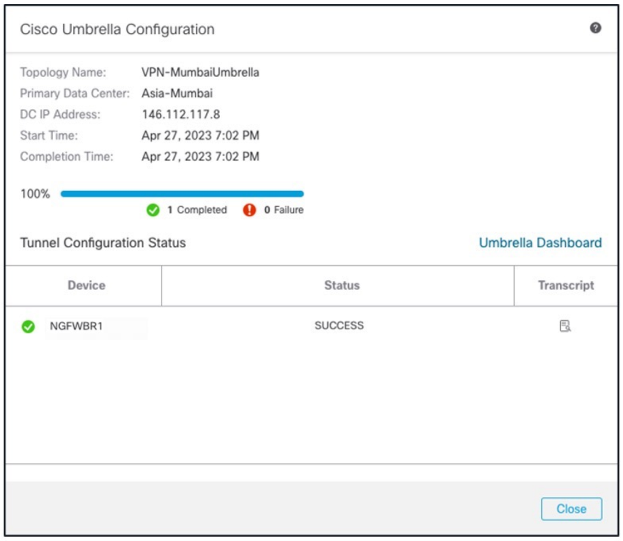
This action:

a. Saves the SASE topology in the management center.

b. Triggers deployment of the network tunnels for each threat defense endpoint to 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.



Cisco Umbrella Configuration

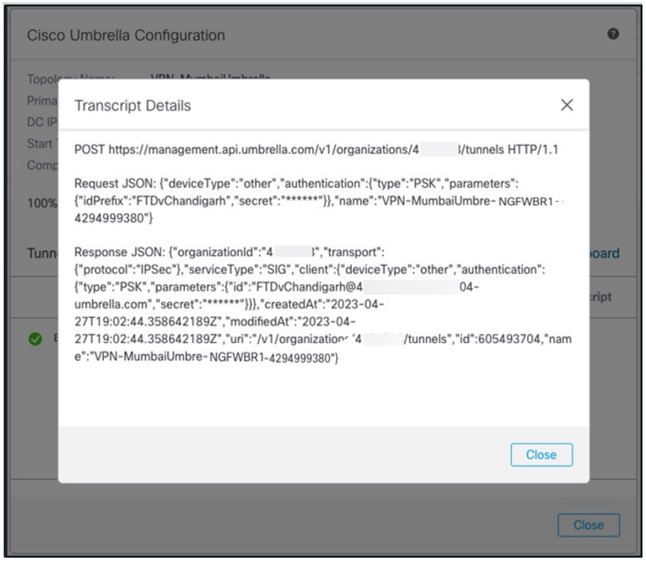
Topology Name: VPN-MumbaiUmbrella
Primary Data Center: Asia-Mumbai
DC IP Address: 146.112.117.8
Start Time: Apr 27, 2023 7:02 PM
Completion Time: Apr 27, 2023 7:02 PM

100%
1 Completed 0 Failure

Tunnel Configuration Status

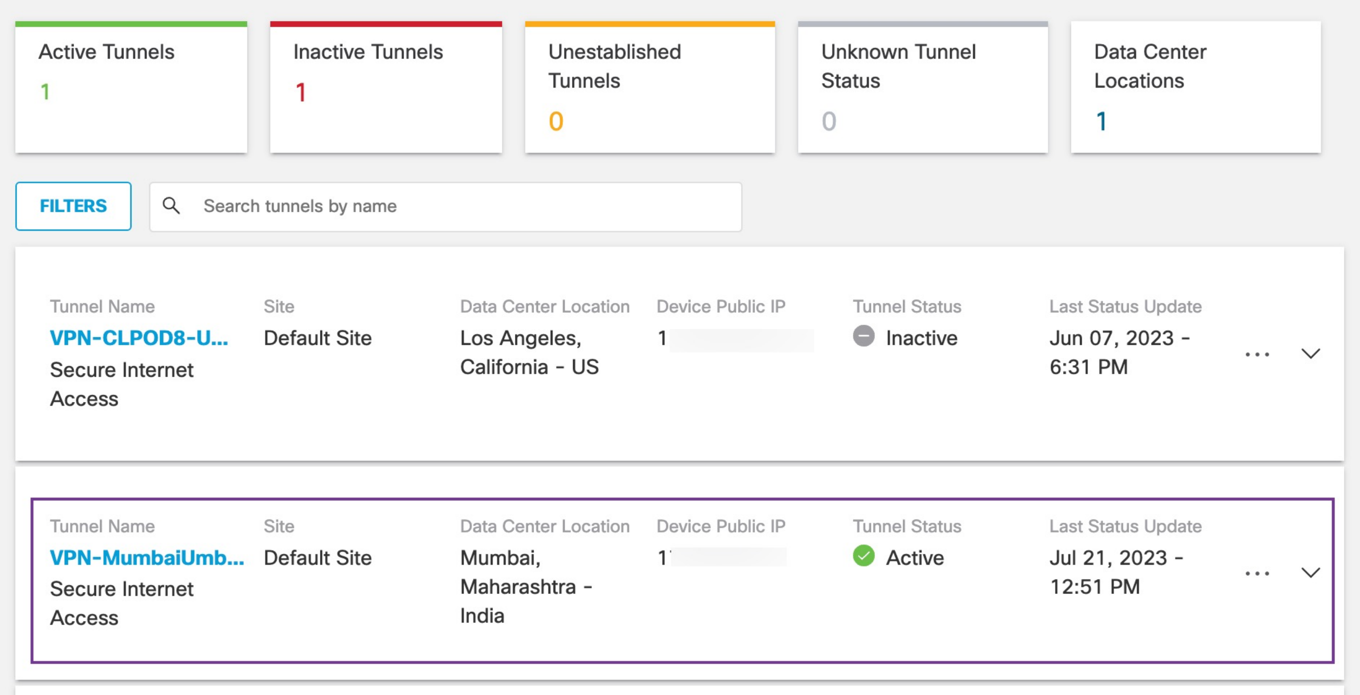
Device	Status	Transcript
✓ NGFWBR1	SUCCESS	

To view the details of the deployment, click the **Transcript** button to view the transcript details such as the APIs, request payload, and the response received from Umbrella.



```
POST https://management.api.umbrella.com/v1/organizations/4[redacted]/tunnels HTTP/1.1

Request JSON: {"deviceType":"other","authentication":{"type":"PSK","parameters":
{"idPrefix":"FTDvChandigarh","secret":"******"}},"name":"VPN-MumbaiUmbre- NGFWBR1-
4294999380"}

Response JSON: {"organizationId":"4[redacted]","transport":
{"protocol":"IPSec"},"serviceType":"SIG","client":{"deviceType":"other","authentication":
{"type":"PSK","parameters":{"id":"FTDvChandigarh@4[redacted]04-
umbrella.com","secret":"******"}}},"createdAt":"2023-04-
27T19:02:44.358642189Z","modifiedAt":"2023-04-
27T19:02:44.358642189Z","uri":"/v1/organization '4[redacted]/tunnels","id":605493704,"nam
e":"VPN-MumbaiUmbre- NGFWBR1-4294999380"}
```

Click the **Umbrella Dashboard** link to view the Network Tunnels page in Umbrella.



Active Tunnels	Inactive Tunnels	Unestablished Tunnels	Unknown Tunnel Status	Data Center Locations
1	1	0	0	1

Tunnel Name	Site	Data Center Location	Device Public IP	Tunnel Status	Last Status Update
VPN-CLPOD8-U... Secure Internet Access	Default Site	Los Angeles, California - US	1[redacted]	Inactive	Jun 07, 2023 - 6:31 PM
VPN-MumbaiUmb... Secure Internet Access	Default Site	Mumbai, Maharashtra - India	1[redacted]	Active	Jul 21, 2023 - 12:51 PM

What to do next

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

Configure a Static Route

You must configure a static route from the auto tunnel to the Umbrella DC.

Step 1 From the **Devices** > **Device Management** page and edit the threat defense device (**NGFWBR1**).

Step 2 Click the **Routing** tab.

Step 3 Click **Static Route**.

Step 4 Click **Add Route** to add a new route.

Step 5 Select **outside_static_vti_1** as the interface from the **Interface** drop-down list.

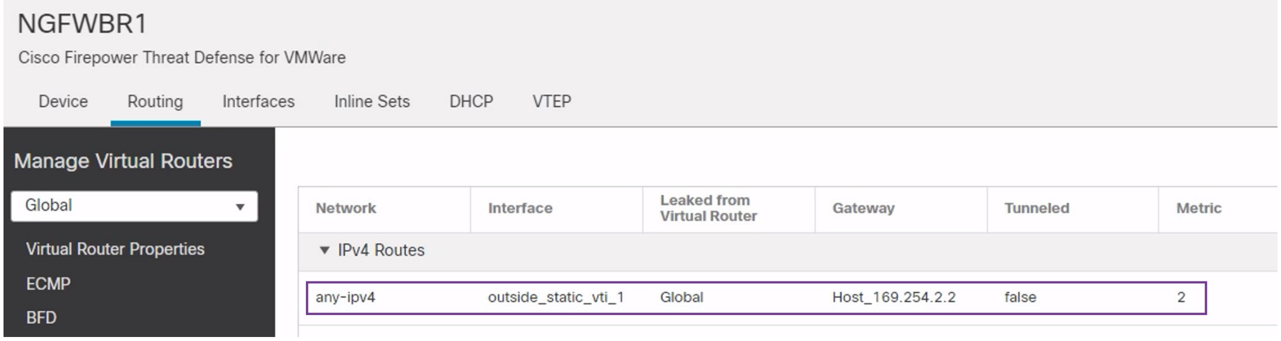
Step 6 Select **any-ipv4** as the the destination network from the **Available Networks** box and click **Add**.

Step 7 Enter a gateway for the network. For this example, enter **169.254.2.2**.

Step 8 Enter a metric value. It can be a number that ranges between 1 and 254. For this example, enter the value as 2.

Step 9 To save the settings, click **Save**.

The static route is created as seen in the figure below.



Network	Interface	Leaked from Virtual Router	Gateway	Tunneled	Metric
any-ipv4	outside_static_vti_1	Global	Host_169.254.2.2	false	2

Configure an Extended ACL for DNS and Web Traffic

The access list is configured for DNS and web traffic to be steered towards the internet from the egress interface with the help of policy based routing.

Step 1 Select **Objects** > **Object Management** and choose **Access Lists** > **Extended** from the table of contents.

Step 2 Click **Add Extended Access List** to create an extended access list for social media traffic.

Step 3 In the Extended ACL Object dialog box, enter a name (**LAN_to_Internet**) for the object.

Step 4 Click **Add** to create a new Extended Access List.

Step 5 Configure the following access control properties:

a. Select the **Action** to Allow (match) the traffic criteria.

b. Click the **Port** tab and search for **HTTP, HTTPS, DNS_over_UDP, DNS_over_TCP** in the **Available Ports** list.

c. Select the ports and click **Add to Destination**.

d. Click the **Network** tab and search for the branch LAN in the **Available Networks** list.

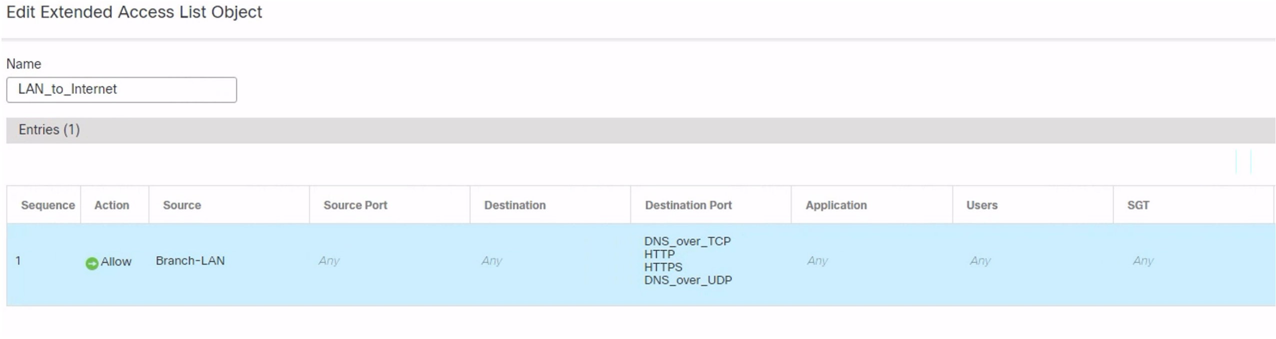
Note In our example, the network is **Branch-LAN**.

e. Select **Branch-LAN** and click **Add to Source**.

f. Click **Add** to add the entry to the object.

g. Click **Save**.

The ACL object is created as seen in the figure below.



Edit Extended Access List Object

Name: LAN_to_Internet

Entries (1)

Sequence	Action	Source	Source Port	Destination	Destination Port	Application	Users	SGT
1	Allow	Branch-LAN	Any	Any	DNS_over_TCP HTTP HTTPS DNS_over_UDP	Any	Any	Any

Configure a PBR Policy for DNS and Web Traffic

You can configure the PBR policy in the Policy Based Routing page by specifying the ingress interfaces, match criteria (Extended Access Control List), and egress interfaces to route DNS and web 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 **Policy Based Routing**.

Step 4 In the **Add Policy Based Route** dialog box, select the **Ingress Interface** from the drop-down list.

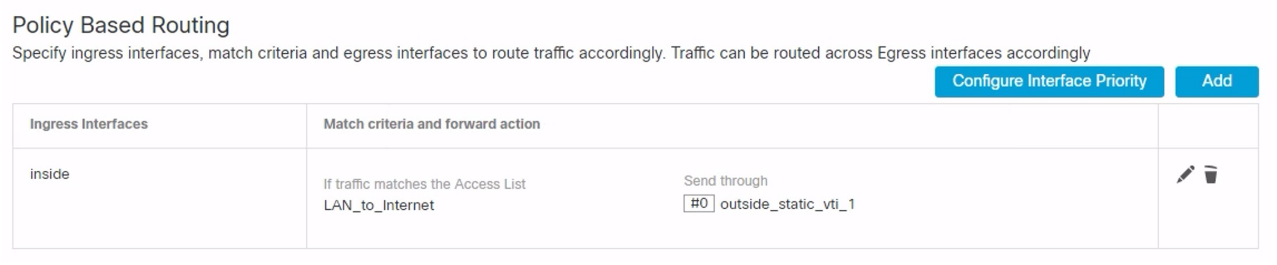
Step 5 To specify the match criteria and the forward action in the policy, click **Add**.

Step 6 In the **Add Forwarding Actions** dialog box, do the following:

a) From the **Match ACL** drop-down, choose **LAN_to_Internet**.
b) To select the configured interfaces, choose **Egress Interfaces** from the **Send To** drop-down list.
c) From **Available Interfaces**, click the **Add** (+) icon adjacent to **Outside_static_vti_1** interface to move it to **Selected Egress Interfaces**.
d) Click **Save** to write the changes for the match criteria.
e) Review the configuration and click **Save** to write all the configuration changes for policy based routing.

Step 7 Click **Save**.

The PBR policy is created as seen in the figure below.



Policy Based Routing

Specify ingress interfaces, match criteria and egress interfaces to route traffic accordingly. Traffic can be routed across Egress interfaces accordingly

Ingress Interfaces	Match criteria and forward action		
inside	If traffic matches the Access List LAN_to_Internet	Send through #0 outside_static_vti_1	

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.

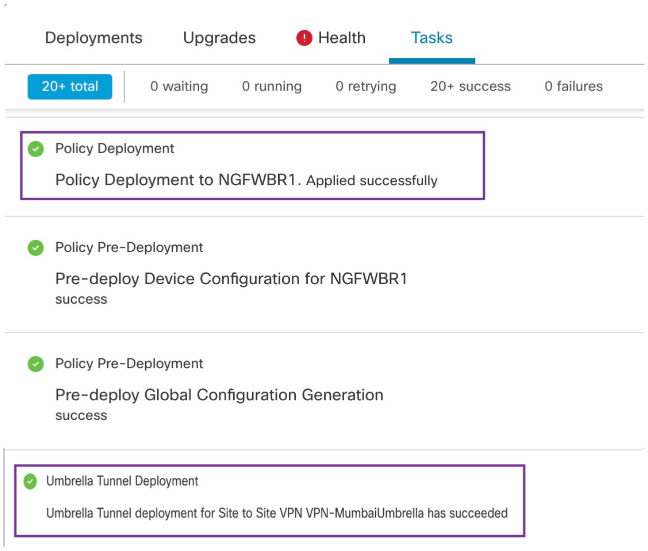
Step 4 If the system identifies errors or warnings in the changes to be deployed, it displays them in the **Validation Errors** or **Validation Warnings** window. To view complete details, click the Validation Errors or Validation Warnings link.

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 SASE Umbrella Tunnel Deployment

In the management center, go to **Notifications** > **Tasks** to view the status of the Umbrella tunnel deployment and policy deployment on the threat defense device (NGFWBR1).



Policy Deployment

Policy Deployment to NGFWBR1. Applied successfully

Policy Pre-Deployment

Pre-deploy Device Configuration for NGFWBR1
success

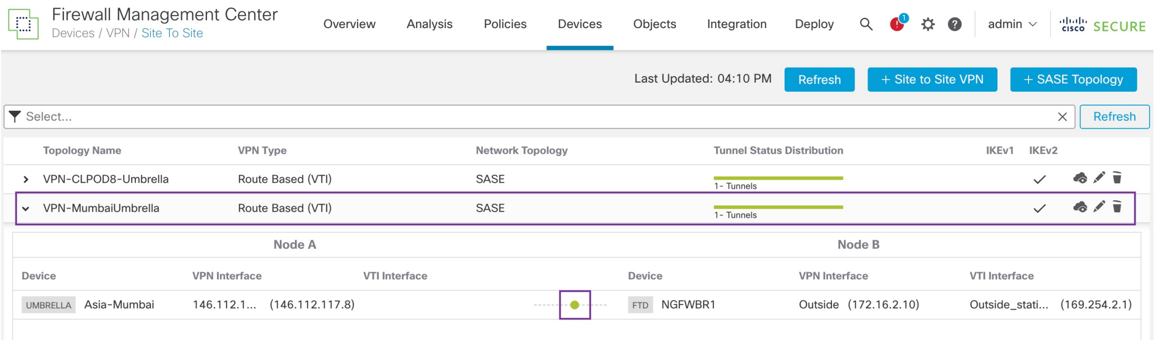
Policy Pre-Deployment

Pre-deploy Global Configuration Generation
success

Umbrella Tunnel Deployment

Umbrella Tunnel deployment for Site to Site VPN VPN-MumbaiUmbrella has succeeded

To check the SASE auto tunnel status in the management center, choose **Devices** > **VPN** > **Site To Site**.

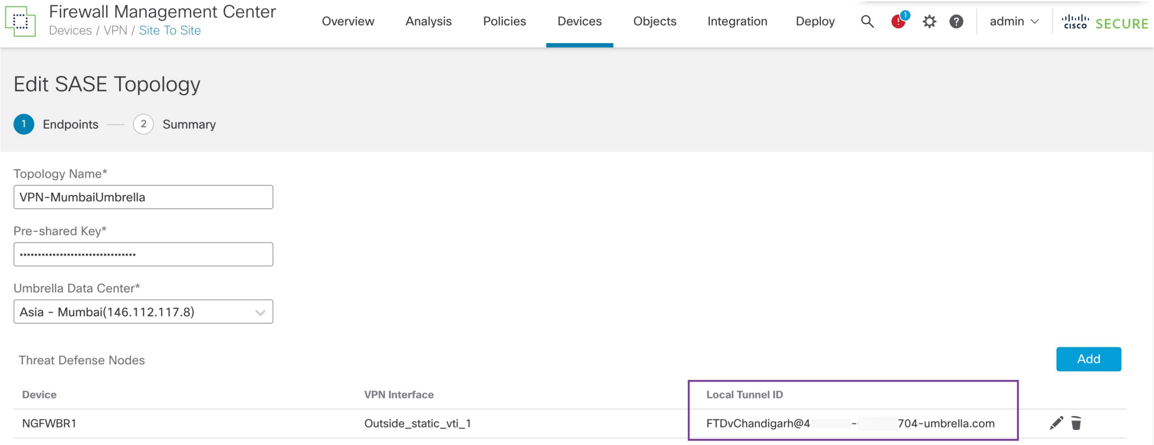


Last Updated: 04:10 PM

	Topology Name	VPN Type	Network Topology	Tunnel Status Distribution	IKEv1	IKEv2
›	VPN-CLPOD8-Umbrella	Route Based (VTI)	SASE	1- Tunnels		✓
⌄	VPN-MumbaiUmbrella	Route Based (VTI)	SASE	1- Tunnels		✓

Node A			Node B		
Device	VPN Interface	VTI Interface	Device	VPN Interface	VTI Interface
UMBRELLA Asia-Mumbai	146.112.1... (146.112.117.8)		FTD NGFWBR1	Outside (172.16.2.10)	Outside_stati... (169.254.2.1)

To check the updated SASE topology in the management center, choose **Devices** > **VPN** > **Site To Site** > **Edit SASE Topology**. The local Tunnel ID is updated after the deployment to Umbrella.



Topology Name*
VPN-MumbaiUmbrella

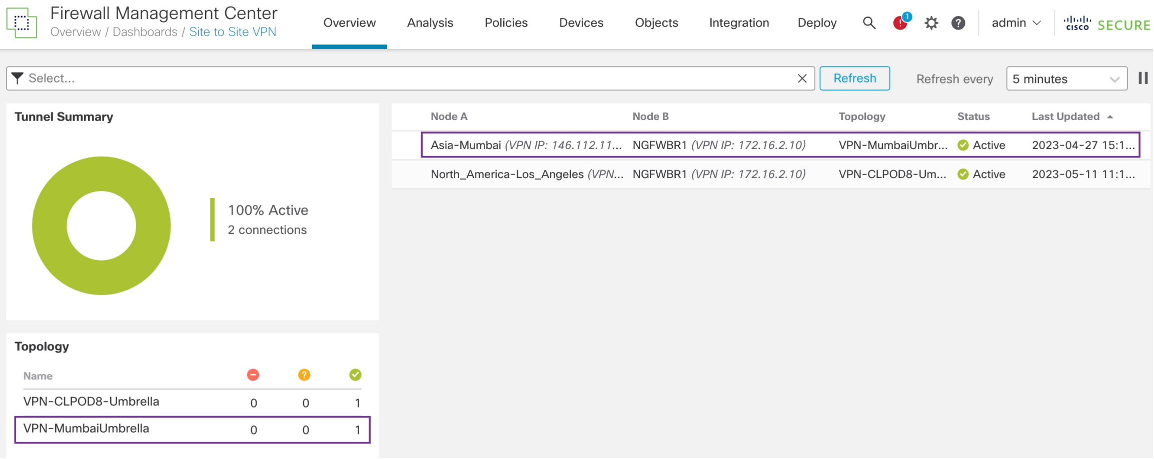
Pre-shared Key*
································

Umbrella Data Center*
Asia - Mumbai(146.112.117.8)

Threat Defense Nodes

Device	VPN Interface	Local Tunnel ID
NGFWBR1	Outside_static_vti_1	FTDvChandigarh@4 - 704-umbrella.com

To view the Site To Site VPN dashboard in the management center, choose **Overview** > **Dashboard** > **Site to Site VPN**.



Name	⛔	?	✓
VPN-CLPOD8-Umbrella	0	0	1
VPN-MumbaiUmbrella	0	0	1

Node A	Node B	Topology	Status	Last Updated
Asia-Mumbai *(VPN IP: 146.112.11...*	NGFWBR1 *(VPN IP: 172.16.2.10)*	VPN-MumbaiUmbr...	✓ Active	2023-04-27 15:1...
North_America-Los_Angeles *(VPN...*	NGFWBR1 *(VPN IP: 172.16.2.10)*	VPN-CLPOD8-Um...	✓ Active	2023-05-11 11:1...

Use the following CLI commands to verify SASE Umbrella Tunnel on threat defense:

- To verify the details of the SASE tunnel, use the following command:

```
> show running-config interface tunnel 1
!
interface Tunnel1
 nameif Outside_static_vti_1
 ip address 169.254.2.1 255.255.255.252
 tunnel source interface Outside
 tunnel destination 146.112.117.8
 tunnel mode ipsec ipv4
 tunnel protection ipsec profile FMC_IPSEC_PROFILE_1
```

- To verify the IPSec profile and the associated proposal, use the following command:

```
> show running-config crypto ipsec
crypto ipsec ikev2 ipsec-proposal CSM_IP_1
 protocol esp encryption aes-gcm-256
 protocol esp integrity sha-256
crypto ipsec profile FMC_IPSEC_PROFILE_1
 set ikev2 ipsec-proposal CSM_IP_1
 set ikev2 local-identity email-id FTDvChandigarh@41xxxxx-xxxxxxxxx-umbrella.com
 set reverse-route
crypto ipsec security-association pmtu-aging infinite
```

- To verify the IKeV2 policy set, use the following command:

```
> show running-config crypto ikev2
crypto ikev2 policy 15
 encryption aes-gcm-256
 integrity null
 group 20 19
 prf sha256
 lifetime seconds 86400
crypto ikev2 enable Outside
```

- To verify the tunnel statistics including Tx and Rx data, use the following command:

```
> show vpn-sessiondb l2l
Session Type: LAN-to-LAN
Connection   : 146.112.117.8
Index        : 19                     IP Addr      : 146.112.117.8
Protocol     : IKEv2 IPsecOverNatT
Encryption   : IKEv2: (1)AES-GCM-256  IPsecOverNatT: (1)AES-GCM-256
Hashing      : IKEv2: (1)none  IPsecOverNatT: (1)none
Bytes Tx     : 234                      Bytes Rx     : 446
```

```
Login Time   : 19:14:51 UTC Thu Apr 27 2023
Duration     : 0h:55m:16s
Tunnel Zone  : 0
```

- To check the tunnel status, use the following command:

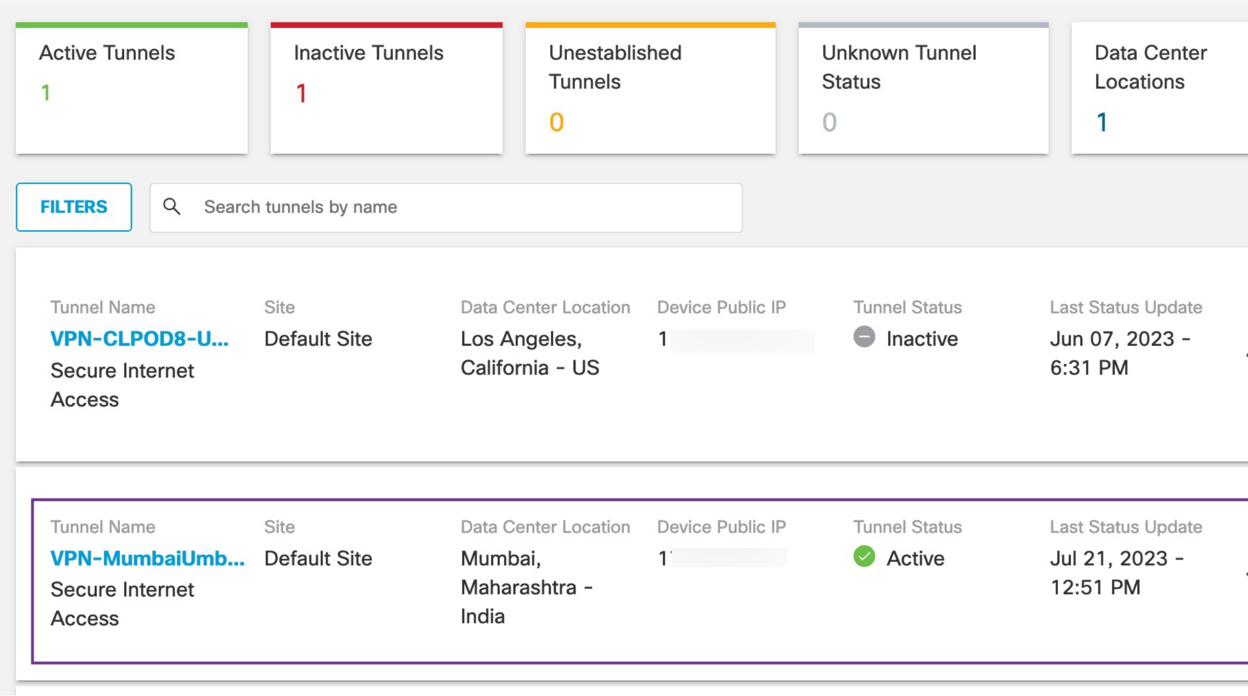
```
> show interface ip brief

Interface                  IP-Address      OK? Method Status                Protocol
Internal-Control0/0        127.0.1.1       YES unset  up                    up
Internal-Control0/1        unassigned      YES unset  up                    up
Internal-Data0/0           unassigned      YES unset  down                  up
Internal-Data0/0           unassigned      YES unset  up                    up
Internal-Data0/1           169.254.1.1     YES unset  up                    up
Internal-Data0/2           unassigned      YES unset  up                    up
Management0/0              203.0.113.130   YES unset  up                    up
TenGigabitEthernet0/0      172.16.2.10     YES manual up                    up
TenGigabitEthernet0/1      172.16.3.10     YES manual up                    up
TenGigabitEthernet0/2      unassigned      YES unset  administratively down up
Tunnel1                    169.254.2.1     YES manual up                    up
```

- To check the IPSec SA associated to the VTI tunnel, use the following command:

```
> show crypto ipsec sa
interface: outside_static_vti_1
    Crypto map tag: __vti-crypto-map-Tunnel1-0-1, seq num: 65280, local addr:
198.18.128.81

      Protected vrf (ivrf): Global
      local ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)
      remote ident (addr/mask/prot/port): (0.0.0.0/0.0.0.0/0/0)
      current_peer: 146.112.117.8


      #pkts encaps: 705, #pkts encrypt: 705, #pkts digest: 705
      #pkts decaps: 743, #pkts decrypt: 743, #pkts verify: 743
      #pkts compressed: 0, #pkts decompressed: 0
      #pkts not compressed: 705, #pkts comp failed: 0, #pkts decomp failed: 0
      #pre-frag successes: 0, #pre-frag failures: 0, #fragments created: 0
      #PMTUs sent: 0, #PMTUs rcvd: 0, #decapsulated frgs needing reassembly: 0
      #TFC rcvd: 0, #TFC sent: 0
      #Valid ICMP Errors rcvd: 0, #Invalid ICMP Errors rcvd: 0
      #send errors: 0, #recv errors: 0

     local crypto endpt.: 198.18.128.81/4500, remote crypto endpt.: 146.112.117.8/4500

      path mtu 1500, ipsec overhead 63(44), media mtu 1500
      PMTU time remaining (sec): 0, DF policy: copy-df
      ICMP error validation: disabled, TFC packets: disabled
      current outbound spi: C76F91B4
      current inbound spi : 64907273

    inbound esp sas:
      spi: 0x2BF92601 (737748481)
         SA State: active
         transform: esp-aes-gcm-256 esp-null-hmac no compression
         in use settings ={L2L, Tunnel,  NAT-T-Encaps, IKEv2, VTI, }
         slot: 0, conn_id: 32, crypto-map: __vti-crypto-map-Tunnel1-0-1
         sa timing: remaining key lifetime (kB/sec): (4331520/27987)
         IV size: 8 bytes
         replay detection support: Y
         Anti replay bitmap:
          0x00000000 0x00000001
    outbound esp sas:
      spi: 0xCA2DC006 (3391995910)
```

```
SA State: active
transform: esp-aes-gcm-256 esp-null-hmac no compression
in use settings ={L2L, Tunnel,  NAT-T-Encaps, IKEv2, VTI, }
slot: 0, conn_id: 32, crypto-map: __vti-crypto-map-Tunnel1-0-1
sa timing: remaining key lifetime (kB/sec): (4101072/27987)
IV size: 8 bytes
replay detection support: Y
Anti replay bitmap:
 0x00000000 0x00000001
```

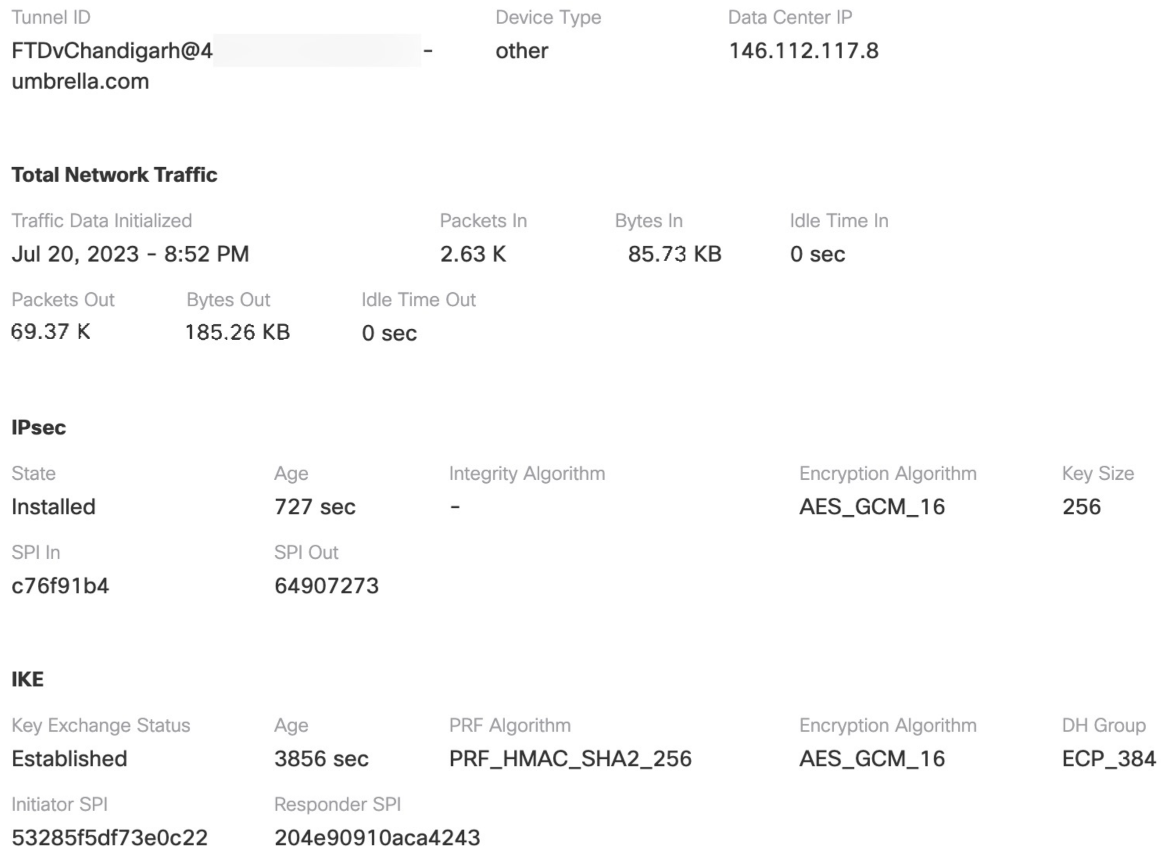
To view the SASE tunnel in Umbrella, log in to Cisco Umbrella and navigate to **Deployments** > **Core Identities** > **Network Tunnels**. The network tunnel from the threat defense to Umbrella is displayed as shown in the figure below.



Active Tunnels	Inactive Tunnels	Unestablished Tunnels	Unknown Tunnel Status	Data Center Locations
1	1	0	0	1

Tunnel Name	Site	Data Center Location	Device Public IP	Tunnel Status	Last Status Update
VPN-CLPOD8-U... Secure Internet Access	Default Site	Los Angeles, California - US	1[redacted]	Inactive	Jun 07, 2023 - 6:31 PM
VPN-MumbaiUmb... Secure Internet Access	Default Site	Mumbai, Maharashtra - India	1[redacted]	Active	Jul 21, 2023 - 12:51 PM

Expand the section to view the details of the tunnel.



Tunnel ID	Device Type	Data Center IP
FTDvChandigarh@4[redacted]-umbrella.com	other	146.112.117.8

Total Network Traffic

Traffic Data Initialized	Packets In	Bytes In	Idle Time In
Jul 20, 2023 - 8:52 PM	2.63 K	85.73 KB	0 sec

Packets Out	Bytes Out	Idle Time Out
69.37 K	185.26 KB	0 sec

IPsec

State	Age	Integrity Algorithm	Encryption Algorithm	Key Size
Installed	727 sec	-	AES_GCM_16	256

SPI In	SPI Out
c76f91b4	64907273

IKE

Key Exchange Status	Age	PRF Algorithm	Encryption Algorithm	DH Group
Established	3856 sec	PRF_HMAC_SHA2_256	AES_GCM_16	ECP_384

Initiator SPI	Responder SPI
53285f5df73e0c22	204e90910aca4243

Troubleshoot Umbrella Auto Tunnels

After the deployment, use the following CLI to debug issues related to Umbrella auto 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**

How to...	CLI Command
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

CHAPTER 5

Empower Remote Workers with Secure Connectivity: DIA, Umbrella Auto Tunnel, and DVTI in Action

In this chapter, we delve into the practical application of using DIA, Umbrella auto tunnel, and DVTI. The use case details the scenario, network topology, and the end-to-end procedure for seamless implementation.

- Enhancing Connectivity and Security for Remote Workers with DIA, Umbrella SASE Auto Tunnel, and DVTI, on page 73
- Is This Use Case For You?, on page 73
- Scenario, on page 74
- Topology, on page 74
- End-to-end Procedure for Configuring DIA, Umbrella Auto Tunnel, and DVTI, on page 75
- Additional Resources, on page 75

Enhancing Connectivity and Security for Remote Workers with DIA, Umbrella SASE Auto Tunnel, and DVTI

In today's interconnected and remote work environment, organizations face the challenge of providing seamless connectivity, secure access, and optimized performance for their distributed workforce. This use case explores the implementation of DIA (Direct Internet Access), Umbrella SASE auto tunnel, and DVTI (Dynamic Virtual Tunnel Interface) technologies to overcome network connectivity issues, enhance collaboration, protect sensitive information, and empower the remote users to work efficiently from any location.

Is This Use Case For You?

The intended audience for this use case is IT professionals, network administrators, and decision-makers responsible for managing and securing the network infrastructure, as well as organizations looking to optimize connectivity and security for their remote workforce. It provides insights into the implementation of DIA, Umbrella SASE auto tunnel, and DVTI technologies and highlights the benefits they offer in addressing the challenges faced by remote workers.

Scenario

Sally works as a remote sales representative for a global company that relies heavily on real-time collaboration and data access. She frequently travels to different client locations, but faces challenges in accessing sales data and communicating with colleagues.

What is at risk?

The company's existing network infrastructure is unable to provide seamless connectivity and secure access across multiple locations, resulting in delays, data inconsistency, and communication breakdowns.

How does a solution consisting of DIA, Umbrella auto tunnel, and DVTI in a hub and spoke topology solve the problem?

To address the challenges faced by remote workers like Sally, her company implements a comprehensive solution using DIA, Umbrella SASE auto tunnel, and DVTI.

1. **DIA:** DIA allows Sally to connect directly to the internet without routing through the corporate network. This provides her with faster and more reliable internet access, enabling quick access to cloud-based applications and services. It offloads network traffic from the corporate network, reducing congestion and optimizing performance.

2. **Umbrella Auto tunnel:** By leveraging the Umbrella Auto Tunnel configuration, Sally's company ensures that uniform security policies are applied to traffic regardless of whether Sally is remotely connected or behind a branch firewall. It eliminates the need for manual configuration of VPN connections and reduces the complexity and potential errors associated with traditional tunnel setups. This technology offers simplicity, convenience, and enhanced security for Sally and other remote workers in the organization

3. **DVTI:** DVTI in a hub and spoke topology enables the dynamic creation of secure IPsec tunnels between the branch office and the corporate network. These tunnels encrypt data transmission, ensuring secure access to corporate resources while working remotely. DVTI also optimizes network performance by intelligently routing traffic through the most efficient path and providing redundancy for uninterrupted connectivity.

By combining DIA, Umbrella SASE auto tunnel, and DVTI, Sally's company enhances her connectivity, security, and productivity as a remote worker. She can access cloud applications quickly, collaborate seamlessly with colleagues, and enjoy a secure and reliable connection to corporate resources, regardless of her location. The IT team benefits from centralized security management, reduced network complexity, and improved visibility into remote workers' activities.

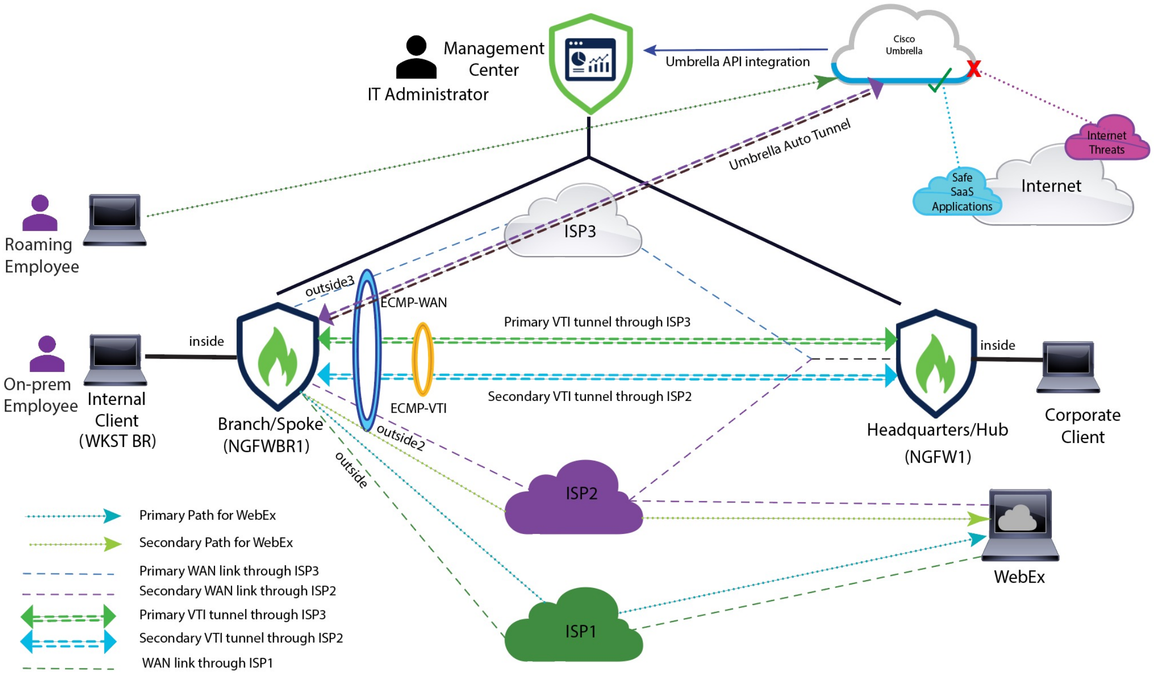
Topology

In this topology, the internal client or branch workstation is labeled as WKST BR that is connected to the branch threat defense labeled as NGFWBR1. The headquarters threat defense is labeled NGFW1. The corporate network is reachable through NGFW1. The ingress interface of NGFWBR1 is named inside and the egress interfaces are named outside, outside2, and outside3 respectively.

A Umbrella auto tunnel is configured between NGFWBR1 and Cisco Umbrella.

All DNS and web traffic is sent through the Umbrella auto tunnel to Cisco Umbrella to be allowed or blocked based on the Umbrella DNS and web policy. This provides two layers of protection, one locally enforced by the Cisco Secure Threat Defense and the other cloud-delivered by Cisco Umbrella.

For the hub spoke configuration, 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.



End-to-end Procedure for Configuring DIA, Umbrella Auto Tunnel, and DVTI

To configure the solution with DIA, Umbrella SASE auto tunnel, and DVTI:

- **Configure Direct Internet Access**: End-to-End Procedure for Configuring DIA With Path Monitoring, on page 38
- **Configure Umbrella SIG Auto Tunnel**:End-to-end Procedure for Configuring Umbrella Auto Tunnel, on page 58
- **Configure DVTI Hub and Spoke Topology**: End-to-End Procedure for Configuring a Route-based VPN (Hub and Spoke Topology), on page 9

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

Resource	URL
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