



SD-WAN Capabilities

This chapter describes the SD-WAN capabilities supported in the management center.

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Overview of SD-WAN Capabilities

Software-Defined WAN (SD-WAN) solutions replace traditional WAN routers and are agnostic to WAN transport technologies. SD-WAN provides dynamic, policy-based, application path selection across multiple WAN connections and supports service chaining for additional services such as WAN optimization and firewalls.

As organizations expand their operations across multiple branch locations, ensuring secure and streamlined connectivity becomes paramount. Deploying a secure branch network infrastructure involves complex configurations, which can be time-consuming and prone to security vulnerabilities if not handled properly. However, organizations can overcome these challenges by leveraging the Cisco Secure Firewall Management Center (management center) and the Cisco Secure Firewall Threat Defense (threat defense) devices for a 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:

- **Simplified management:**
 - SD-WAN Wizard
 - SASE: Umbrella auto tunnel deployment
 - Dynamic VTI (DVTI) hub spoke topology simplification
- **Application awareness:**
 - Direct Internet Access (DIA) for public cloud and guest user

- Policy based routing (PBR) using applications as a match criteria
- Local tunnel ID support for Umbrella
- **Increased usable bandwidth:**
 - ECMP support for load balancing across multiple ISPs and VTIs
 - Application-based load balancing using PBR
- **High availability with near zero network downtime:**
 - Dual ISP configuration
 - Optimal path selection based on application-based interface monitoring.
- **Secure Elastic Connectivity:**
 - Route-based (VTI) VPN tunnels between headquarters (hub) and branches (spokes)
 - IPv4 and IPv6 BGP, IPv4 and IPv6 OSPF, and IPv4 EIGRP over VTI
 - DVTI hubs that support spokes with static or dynamic IP

Features

The following table lists some commonly used SD-WAN features:

Feature	Introduced in	More Information
SD-WAN Wizard	Release 7.6	Deploy a Secure Branch Network Using SD-WAN Wizard, on page 3
Application monitoring using SD-WAN Summary dashboard	Release 7.4.1	SD-WAN Summary Dashboard
SD-WAN Summary Dashboard	Release 7.4	SD-WAN Summary Dashboard
Policy-based routing with user identity and SGTs	Release 7.4	Policy Based Routing
Policy-based routing using HTTP path monitoring	Release 7.4	Policy Based Routing
Loopback interface support for VTIs	Release 7.3	Configure a Loopback Interface
Support for dynamic VTI (DVTI) with site-to-site VPN	Release 7.3	Dynamic VTI
Umbrella auto tunnel	Release 7.3	Deploy a SASE Tunnel on Umbrella

Feature	Introduced in	More Information
Support for IPv4 and IPv6 BGP, IPv4 and IPv6 OSPF, and IPv4 EIGRP for VTIs	Release 7.3	BGP, OSPF, EIGRP
Route-based site-to-site VPN with hub and spoke topology	Release 7.2	Create a Route-based Site-to-Site VPN
Policy-based routing with path monitoring	Release 7.2	Policy Based Routing
The Site to Site VPN Monitoring Dashboard	Release 7.1	Monitoring the Site-to-Site VPNs
Direct Internet Access/Policy Based Routing	Release 7.1	Policy Based Routing
Equal-Cost-Multi-Path (ECMP) zone with WAN interfaces	Release 7.1	About ECMP
ECMP zone with VTI interfaces	Release 7.1	About ECMP
Backup VTI for route-based site-to-site VPN	Release 7.0	Route Traffic Through a Backup VTI Tunnel
Support for static VTI (SVTI) with site-to-site VPN	Release 6.7	Static VTI

Deploy a Secure Branch Network Using SD-WAN Wizard

Management Center allows you to easily configure VPN tunnels between your centralized headquarters (hubs) and remote branch sites (spokes) using the new SD-WAN wizard.

What are Hubs and Spokes?

Hubs: Devices that enable secure VPN connectivity to and from one or more remote branch devices or spokes. Hubs also act as a gateway for spokes to communicate with each other.

Spokes: Devices in remote branches that connect over VPN to a hub to securely access the corporate resources behind the hub. Spokes communicate with each other through the hub.

Benefits of Using SD-WAN Wizard

- Simplifies and automates the VPN and routing configuration of your SD-WAN overlay network.
- Creates route-based VPN tunnels and simplifies the configuration process by automating tasks such as:
 - Generating tunnel interfaces of the branches.
 - Assigning IP addresses to the tunnel interfaces.
 - Configuring BGP for the SD-WAN overlay network. These configurations ensure seamless connection between hubs and spokes.

- Provides seamless routing because hubs act as route reflectors and enable the following:
 - Provide connectivity between the spokes.
 - Determine the best routing path based on the spokes' active and backup tunnels.
- Requires minimal user input.
- Easily add multiple branches at a time.
- Provides easy dual ISP configurations.
- Enables network scaling.

Guidelines and Limitations for Using SD-WAN Wizard

Guidelines

- When you configure the DVTIs of two hubs, ensure that they have the same IPsec tunnel mode (IPv4 or IPv6).
- In a dual-hub SD-WAN topology, the hubs can be in different geographic locations and have different protected networks behind them. To ensure direct communication between these networks, ensure that you configure the following:
 - A point-to-point route-based VPN topology between the two hubs (**Devices > Site-to-site > Add > Route-Based VPN**).
 - A dynamic routing protocol between the hubs (**Device > Device Management > Routing**).
- When you configure IP address pools for spokes, ensure the following:
 - The **Allow Overrides** check box must be unchecked.
 - If you are using multiple pools, the IP addresses of the pools must not overlap.
 - IP addresses must not overlap with any of the interfaces on the spoke.
- When you create security zones or interface groups, choose **Routed** as the **Interface Type**.
- Use the spoke security zone to configure an access control policy that allows tunnel traffic to and from the spokes.
- Configure the spokes' VPN interfaces in an ECMP zone to load balance the application traffic. If you do not configure the ECMP zone, the remaining paths act as backup paths when the primary path goes down.
- In SD-WAN topologies with dual ISPs, the tunnel identity and the tunnel source of the spokes must be unique.
- If a device has only IPv6 address configurations, you must configure the BGP router ID with a loopback or physical interface that has an IPv4 address (**Device > Device Management > Routing > General Settings > BGP**).

Limitations

- You can configure a maximum of two hubs in an SD-WAN topology using the SD-WAN wizard.
- For each spoke, you can use only one WAN interface per topology. However, for dual-ISP setups, you can configure a second SD-WAN topology with the second WAN interface. For more information, see [Configuration Examples for SD-WAN Wizard, on page 13](#).
- SD-WAN wizard does not support the following:
 - IKEv1
 - Cluster devices are not supported on the hub and spoke because VTI is not supported on cluster devices.
 - Extranet hubs and spokes such as ASA, Cisco IOS, Cisco Viptela, Umbrella, Meraki, or vendor devices.

Prerequisites for Using the SD-WAN Wizard

- Management Center Essentials (formerly Base) license must allow export-controlled functionality. Choose **System > Licenses > Smart Licenses** to verify this functionality in the management center.
- You must be an Admin user.
- Hub devices must be Version 7.6.0 and later.
- Spoke devices must be Version 7.3.0 and later.
- The threat defense devices must have an internet-routable public IP address.
- Assign appropriate logical names and IP addresses to the interfaces of the threat defense devices. For example, use *inside* for the interface connected to the LAN, and *outside* for the interface connected to the internet or WAN.
- If you are using certificate-based authentication, you must enroll the certificates in the hub and spokes.
- Configure routing, NAT, and AC policies to ensure underlay connectivity between the devices.

Configure an SD-WAN Topology Using the SD-WAN Wizard

The SD-WAN wizard allows you to easily configure VPN tunnels between your centralized headquarters and remote branch sites.

Before you begin

Ensure that you review [Prerequisites for Using the SD-WAN Wizard, on page 5](#) and [Guidelines and Limitations for Using SD-WAN Wizard, on page 4](#).

Procedure

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- Step 1** Choose **Devices > Site To Site**, and click **Add**.

Step 2 Enter a name for the SD-WAN VPN topology in the **Topology Name** field.

Step 3 Click the **SD-WAN Topology** radio button and click **Create**.

Step 4 Configure a hub:

- a) Click **Add Hub**.
- b) From the **Device** drop-down list, choose a hub.
- c) Click + next to the **Dynamic Virtual Tunnel Interface (DVTI)** drop-down list to add a dynamic VTI for the hub.

The **Add Virtual Tunnel Interface** dialog box is prepopulated with default configurations. However, you must configure the **Tunnel Source**, and the **Borrow IP Address**. For more information, see [Add a Dynamic Virtual Tunnel Interface for a Hub, on page 9](#).

- d) In the **Hub Gateway IP Address** field, enter the public IP address of the hub's VPN interface or the tunnel source of the dynamic VTI to which the spokes connect.

This IP address is auto populated if the interface has a static IP address. If hub is behind a NAT device, you must manually configure the post-NAT IP address.

- e) From the **Spoke Tunnel IP Address Pool** drop-down list, choose an IP address pool or click + to create an address pool.

When you add spokes, the wizard auto generates tunnel interfaces, and assigns IP addresses to these interfaces from this IP address pool.

- f) Click **Add** to save the hub configuration.
- g) (Optional) To add a secondary hub, repeat Step 4a to Step 4f.
- h) Click **Next**.

Step 5 Configure spokes:

Click **Add Spoke** to add a single spoke device, or click **Add Spokes (Bulk Addition)** to add multiple spokes to your topology.

- Click **Add Spoke**. In the **Add Spoke** dialog box, configure the following parameters:
 - a. From the **Device** drop-down list, choose a spoke.
 - b. From the **VPN Interface** drop-down list, choose a WAN-facing or internet-facing physical interface to establish a VPN connection with the hub.
 - c. Check the **Local Tunnel (IKE) Identity** check box to enable a unique and configurable identity for the VPN tunnel from this device to the remote peer. By default, this option is enabled.
 - d. Choose one of the following options from the **Identity Type** drop-down list:
 - **Key ID**—(Default value) This value is auto populated as `<sd-wan topologyname>_<device_IP_address>`, for example, `sdwantopo1_192.168.0.200`. You can also specify a key ID of your choice.
 - **Email ID**—Specify an email ID up to 127 characters.
 - **IP Address**—IP address of the spoke's VPN interface.
 - **Auto**—IP address of the spoke's VPN interface for pre-shared key authentication or the certificate Distinguished Name (DN) for certificate-based authentication.
 - **Hostname**—Fully qualified hostname of the spoke.

- e. Click **Save** to save the spoke configuration.
- Click **Add Spokes (Bulk Addition)**. In the **Add Bulk Spokes** dialog box, configure the following parameters:
 - a. Choose one or more devices from the **Available Devices** list and click **Add** to move the devices to **Selected Devices**.
 - b. Use one of the following methods to select the VPN interfaces of the spokes:
 - Click the **Interface Name Pattern** radio button and specify a string to match the logical name of the internet or WAN interface of the spokes, for example, `outside*`, `wan*`.

If the spoke has multiple interfaces with the same pattern, the first interface that matches the pattern is selected for the topology.
 - Click the **Security Zone** radio button and choose a security zone with the VPN interfaces of the spokes from the drop-down list, or click **+** to create a security zone.
 - c. Click **Next**.

The wizard validates if the spokes have interfaces with the specified pattern. Only the validated devices are added to the topology.
 - d. Click **Add**.
 - e. Click **Next**.

For each spoke, the wizard automatically selects the hub's DVTI as the tunnel source IP address.

Note If the hub's tunnel source IP address is an IPv6 address, the wizard automatically selects the first IPv6 address of the spokes' selected interface. To edit the IPv6 address of a spoke's tunnel source, click the edit icon next to a spoke, choose an IPv6 address from the **IP Address** drop-down list, and click **Save**.

Step 6 Configure authentication settings for the devices in the SD-WAN topology:

- a) **Authentication Type**—For device authentication, you can use a manual pre-shared key, an auto-generated pre-shared key, or a certificate.
 - **Pre-shared Manual Key**—Specify the pre-shared key for the VPN connection. To configure a hex value for the key, check the **Use hex-based Pre-shared key** check box.
 - **Pre-shared Automatic Key**—(Default value) The wizard automatically defines the pre-shared key for the VPN connection. Specify the key length in the **Pre-shared Key Length** field. The range is 1 to 127.
 - **Certificate**—When you use certificates as the authentication method, the peers obtain digital certificates from a CA server in your PKI infrastructure, and use them to authenticate each other.
- b) Choose one or more algorithms from the **Transform Sets** drop-down list.
- c) Choose one or more algorithms from the **IKEv2 Policies** drop-down list.
- d) Click **Next**.

Step 7 Configure the SD-WAN settings:

This step involves the auto generation of spoke tunnel interfaces, and BGP configuration of the overlay network.

- a) From the **Spoke Tunnel Interface Security Zone** drop-down list, choose a security zone or click + to create a security zone to which the wizard automatically adds the spokes' auto-generated Static Virtual Tunnel Interfaces (SVTIs).
- b) Check the **Enable BGP on the VPN Overlay Topology** check box to automate BGP configurations such as neighbor configurations between the overlay tunnel interfaces and basic route redistribution from the directly connected inside interfaces of the hubs and spokes.
- c) In the **Autonomous System Number** field, enter an Autonomous System (AS) number.
 AS number is a unique number for a network with a single routing policy. BGP uses AS numbers to identify networks. The spoke's BGP neighbor configuration is generated based on the corresponding hub's AS number. Range is from 0 to 65536.
 - If all the hubs and spokes are in the same region, by default, **64512** is the AS number.
 - If the primary and secondary hubs are in different regions, the primary hub and the spokes are configured with **64512** as the AS number, and the secondary hub is configured with a different AS number.
- d) In the **Community Tag for Local Routes** field, enter the BGP community attribute to tag connected and redistributed local routes. This attribute enables easy route filtering.
- e) Check the **Redistribute Connected Interfaces** check box and choose an interface group from the drop-down list or click + to create an interface group with connected inside or LAN interfaces for BGP route redistribution in the overlay topology.
- f) Check the **Enable Multiple Paths for BGP** check box to allow multiple BGP routes to be used at the same time to reach the same destination. This option enables BGP to load-balance traffic across multiple links.
- g) (Optional) Check the **Secondary Hub is in Different Autonomous System** check box. This check box appears only if you have a secondary hub in this topology.
- h) In the **Autonomous System Number** field, enter the AS number for the secondary hub.
- i) In the **Community Tag for Learned Routes** field, enter the BGP community attribute to tag routes learned from other SD-WAN peers over the VPN tunnel. This attribute is required only for eBGP configuration when the secondary hub has a different AS number. This check box appears only if you have a secondary hub in this topology.
- j) Click **Next**.

Step 8 Click **Finish** to save and validate the SD-WAN topology.

You can view the topology in the **Site-to-Site VPN Summary** page (**Devices > Site-to-site VPN**). After you deploy the configurations to all the devices, you can see the status of all the tunnels in this page.

What to do next

- View the auto-generated spoke SVTIs and their IP addresses—Click the edit icon next to the spoke configuration and click **View Generated Tunnel Interfaces**.
- Deploy the configurations on the hub and spokes. Choose **Deploy**. Select devices and click **Deploy**.
- Verify the SD-WAN topology tunnel statuses. For more information, see [Verify Tunnel Statuses of an SD-WAN Topology, on page 9](#).
- Configure ACLs for the spokes' tunnel interface security zones. Choose **Policies > Access Control**.

- For more information about configuration examples using SD-WAN wizard, see [Configuration Examples for SD-WAN Wizard, on page 13](#)
- Configure a PBR policy on each spoke for application-aware routing based on the application performance metrics of the WAN interfaces. For more information, see [Route Application Traffic from the Branch to the Internet Using Direct Internet Access \(DIA\)](#).

Add a Dynamic Virtual Tunnel Interface for a Hub

In the SD-WAN wizard, you must configure a DVTI for each hub. DVTI uses a virtual template to dynamically generate a unique virtual access interface for each VPN session.

Before you begin

In the SD-WAN wizard, click **Add Hub**, and choose a hub from the **Device** drop-down list.

Procedure

-
- Step 1** Click + next to the **Dynamic Virtual Tunnel Interface (DVTI)** drop-down list to add a DVTI for the hub. The **Add Virtual Tunnel Interface** dialog box appears with the following prepopulated default configurations.
- Tunnel Type:** Dynamic.
 - Name:** `<tunnel_source_interface_logical_name>_dynamic_vti_<tunnel_ID>`. For example, `outside_dynamic_vti_1`.
 - Enabled** check box: Checked by default.
 - Template ID:** Unique ID for the DVTI.
 - Tunnel Source:** Physical interface that is the source of the DVTI and is auto populated by default.
 - IPsec Tunnel Mode:** IPv4, by default.
- Step 2** Choose a security zone for the dynamic VTI from the **Security Zone** drop-down list.
- Step 3** Choose a physical or loopback interface from the **Borrow IP** drop-down list, the dynamic VTI interface inherits this IP address.
- Ensure that you use an IP address different from the tunnel source IP address. We recommend that you use a loopback IP address to overcome path failures.
- Step 4** Click **OK** to save the dynamic VTI.
-

Verify Tunnel Statuses of an SD-WAN Topology

Verify Tunnel Statuses on the Site-to-Site VPN Summary Page

To verify if the VPN tunnels of the SD-WAN topologies are up, choose **Device > VPN > Site-to-Site**.

Following are the five VPN topologies of an SD-WAN topology with two hubs and four spokes in different regions that are connected to dual ISPs:

Verify Tunnel Statuses of an SD-WAN Topology

Topology Name	VPN Type	Network Topology	Tunnel Status Distribution	IKEv1	IKEv2
> EBGP-Topo1	Route Based (VTI)	SD-WAN Topology	4-Tunnels	✓	✗
> EBGP-Topo2	Route Based (VTI)	SD-WAN Topology	4-Tunnels	✓	✗
> EBGP-Topo3	Route Based (VTI)	SD-WAN Topology	4-Tunnels	✓	✗
> EBGP-Topo4	Route Based (VTI)	SD-WAN Topology	4-Tunnels	✓	✗
▼ SVTI-SVTI-1	Route Based (VTI)	Point-to-Point	1-Tunnels	✓	✗

Node A			Node B		
Device	VPN Interface	VTI Interface	Device	VPN Interface	VTI Interface
FTD HUB-HA1	hub_link (20.0.0.1)	hub_link... (22.22.21.2)	FTD HUB-HA2	hub_link (20.0.0.2)	hub_lin... (42.42.42.2)

Verify Tunnel Statuses on the Site-to-Site VPN Dashboard

To view details of the SD-WAN VPN tunnels, choose **Overview > Dashboards > Site-to-site VPN**.

Following are the VPN tunnels for an SD-WAN topology with two hubs and four spokes in different regions that are connected to dual ISPs:

Node B	Topology	Status	Last Upda...
HUB-HA1[10.10.4.226] (VP...	HUB-HA2[10.10.4.229] (VP...	SVTI-SVTI-1	Acti... 2024-02-20 1...
10.10.4.231 (VPN IP: 11.1.1.1)	HUB-HA2[10.10.4.229] (VP...	EBGP-Topo1	Acti... 2024-02-21 0...
10.10.4.231 (VPN IP: 11.2.1.1)	HUB-HA2[10.10.4.229] (VP...	EBGP-Topo3	Acti... 2024-02-21 0...
10.10.4.232 (VPN IP: 12.1.1.1)	HUB-HA2[10.10.4.229] (VP...	EBGP-Topo1	Acti... 2024-02-21 0...
10.10.4.232 (VPN IP: 12.2.1.1)	HUB-HA2[10.10.4.229] (VP...	EBGP-Topo3	Acti... 2024-02-21 0...
10.10.4.233 (VPN IP: 21.1.1.1)	HUB-HA2[10.10.4.229] (VP...	EBGP-Topo2	Acti... 2024-02-21 0...
10.10.4.233 (VPN IP: 21.1.1.1)	HUB-HA1[10.10.4.226] (VP...	EBGP-Topo2	Acti... 2024-02-21 0...
10.10.4.231 (VPN IP: 11.1.1.1)	HUB-HA1[10.10.4.226] (VP...	EBGP-Topo1	Acti... 2024-02-21 0...
10.10.4.232 (VPN IP: 12.1.1.1)	HUB-HA1[10.10.4.226] (VP...	EBGP-Topo1	Acti... 2024-02-21 0...
10.10.4.231 (VPN IP: 11.2.1.1)	HUB-HA1[10.10.4.226] (VP...	EBGP-Topo3	Acti... 2024-02-21 0...
10.10.4.232 (VPN IP: 12.2.1.1)	HUB-HA1[10.10.4.226] (VP...	EBGP-Topo3	Acti... 2024-02-21 0...
10.10.4.233 (VPN IP: 21.2.1.1)	HUB-HA1[10.10.4.226] (VP...	EBGP-Topo4	Acti... 2024-02-21 0...
10.10.4.234 (VPN IP: 22.1.1.1)	HUB-HA1[10.10.4.226] (VP...	EBGP-Topo2	Acti... 2024-02-21 0...

To view more details of each VPN tunnel:

1. Hover over a tunnel.
2. Click the **View Full Information** icon. A pane with tunnel details and more actions appears.
3. Click the **CLI Details** tab in the side pane to view the show commands and details of the IPsec security associations.

Tunnel Details ? X

Summary

Node A	Node B
Transmitted: 14.83 MB (15552256 B)	Transmitted: 14.83 MB (15552416 B)
Received: 33.37 MB (34992576 B)	Received: 33.37 MB (34992720 B)

IPsec Security Associations (1)

L2L Tunnel PFS Group 21 IKEv2 VTI

Encaps/Encrypt: 486008 / 486008 pkts	Encaps/Encrypt: 486013 / 486013 pkts
Dcaps/Decrypt: 486008 / 486008 pkts	Dcaps/Decrypt: 486010 / 486010 pkts
Remaining Lifetime for SPI ID: 0x944D58CF	
Outbound: 5.25 GB (5637438000 B) 10:14:04 (17044 sec)	Inbound: 4.91 GB (5277438000 B) 10:14:03 (17043 sec)
Remaining Lifetime for SPI ID: 0xA6F557B8	
Inbound: 5.08 GB (5457438000 B) 10:14:04 (17044 sec)	Outbound: 4.86 GB (5217438000 B) 10:14:03 (17043 sec)

(VPN Interface IP: ...)) (VPN Interface IP: ...)
<ul style="list-style-type: none"> ➤ show crypto ipsec sa peer ➤ show vpn-sessiondb detail l2l filter ip... 	<ul style="list-style-type: none"> ➤ show crypto ipsec sa peer ➤ show vpn-sessiondb detail l2l filter ip...

Close
Refresh

View Virtual Tunnel Interfaces of the Devices

To view the dynamic VTIs of hubs and static VTIs of spokes:

1. Choose **Devices > Device Management**.
2. Click the edit icon for a hub or a spoke device.
3. Click the **Interface** tab.
4. Click the **Virtual Tunnels** tab.

For each VTI, you can view details such as name, IP address, IPsec mode, tunnel source interface details, topology, and remote peer IP.

Following image shows an example of the virtual access interfaces created dynamically by a hub's DVTI:

Verify Tunnel Statuses of an SD-WAN Topology

Virtual Tunnel/Interface Template					Tunnel Source Interface			Topology	Remote Peer IP	Path Monitoring	Round Trip Time
Tunnel Interface Name	Enable	Logical Name	IPsec Mode	IP Address	Hardware Name	Logical Name					
Tunnel10	●	hub_link...	IPV4	22.22.21.2/24	GigabitEthernet...	hub_link	20.0.0.1/24	SVTI-SVTI-1	20.0.0.2	Disabled	RTT
Virtual-Template1	●	VTI_1	IPV4	10.1.0.3/24	GigabitEthernet...	TUNNEL_SRC_1	100.1.1/24	EBGP-Topo2	Any	Disabled	
Virtual-Access1	●	VTI_1_va...	IPV4	10.1.0.3/24	GigabitEthernet...	TUNNEL_SRC_1	100.1.1/24	EBGP-Topo2	Any	Disabled	
Virtual-Access3	●	VTI_1_va...	IPV4	10.1.0.3/24	GigabitEthernet...	TUNNEL_SRC_1	100.1.1/24	EBGP-Topo2	Any	Disabled	
Virtual-Access5	●	VTI_1_va...	IPV4	10.1.0.3/24	GigabitEthernet...	TUNNEL_SRC_1	100.1.1/24	EBGP-Topo2	Any	Disabled	
Virtual-Access6	●	VTI_1_va...	IPV4	10.1.0.3/24	GigabitEthernet...	TUNNEL_SRC_1	100.1.1/24	EBGP-Topo2	Any	Disabled	

Following image shows an example of the static tunnel virtual interfaces (SVTIs) created on a spoke by the SD-WAN wizard:

Virtual Tunnel/Interface Template					Tunnel Source Interface			Topology	Remote Peer IP	Path Monitoring	Round Trip Time
Tunnel Interface Name	Enable	Logical Name	IPsec Mode	IP Address	Hardware Name	Logical Name					
Tunnel1	●	outside1...	IPV4	25.1.1/24	GigabitEthernet...	outside1	11.1.1/24	EBGP-Topo1	100.1.1	Disabled	RTT
Tunnel2	●	outside1...	IPV4	26.1.1/24	GigabitEthernet...	outside1	11.1.1/24	EBGP-Topo1	200.1.1	Disabled	RTT
Tunnel3	●	outside2...	IPV4	56.1.1/24	GigabitEthernet...	outside2	11.2.1/24	EBGP-Topo3	100.1.1	Disabled	RTT
Tunnel4	●	outside2...	IPV4	57.1.1/24	GigabitEthernet...	outside2	11.2.1/24	EBGP-Topo3	200.1.1	Disabled	RTT

The SD-WAN wizard assigns IP addresses to these tunnel interfaces from the IP address pool of the hub.

Verify Routing on the Hub and Branches

To verify the BGP configuration of the hubs and spokes of the SD-WAN topologies:

1. Choose **Devices > Device Management**.
2. Click the edit icon for a hub or a spoke device.
3. Click the **Device** tab.
4. Click **CLI** in the **General** card. The **CLI Troubleshoot** window appears.
5. Enter the following commands in the **Command** field and click **Execute**:
 - **show route**
 - **show bgp summary**

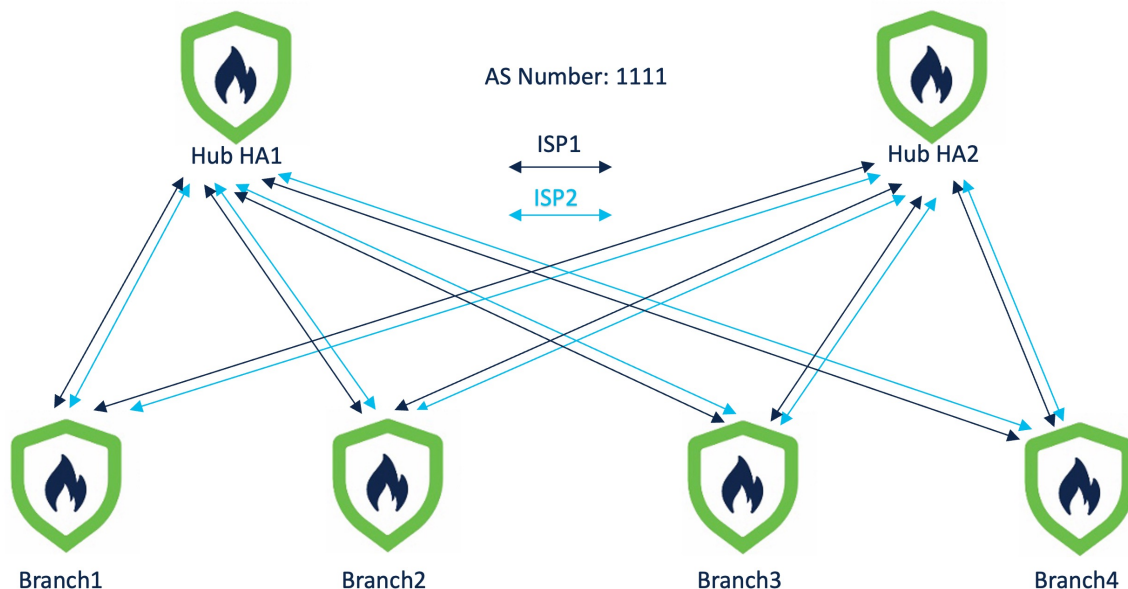
Configuration Examples for SD-WAN Wizard

Dual ISP Deployment: Two Hubs and Four Spokes in the Same Region

In the following dual ISP topology, the hubs and the spokes are in a single region, with AS number as 1111. The hubs and spokes use Internal Border Gateway Protocol (iBGP) as the routing protocol to exchange routing information.

- Hub HA1 and Hub HA2 are hub threat defense devices at the headquarters.
- Branch1, Branch2, Branch3, and Branch4 are spoke threat defense devices at the branches.
- ISP1 is the VPN interface of each spoke to ISP1.
- ISP2 is the VPN interface of each spoke to ISP2.

Figure 1: Dual ISP Topology with Two Hubs and Four Spokes in the Same Region



To configure this topology, you must create the following two SD-WAN topologies using the SD-WAN wizard:

Table 1: SD-WAN Topology 1

Primary Hub	Hub HA1
Secondary Hub	Hub HA2
Spokes	Branch1, Branch2, Branch3, Branch4
AS Number	1111
Spoke Tunnel Source	ISP1
Number of Tunnels	8

Table 2: SD-WAN Topology 2

Primary Hub	Hub HA1
Secondary Hub	Hub HA2
Spokes	Branch1, Branch2, Branch3, Branch4
AS Number	1111
Spoke Tunnel Source	ISP2
Number of Tunnels	8

The total number of tunnels is 16.



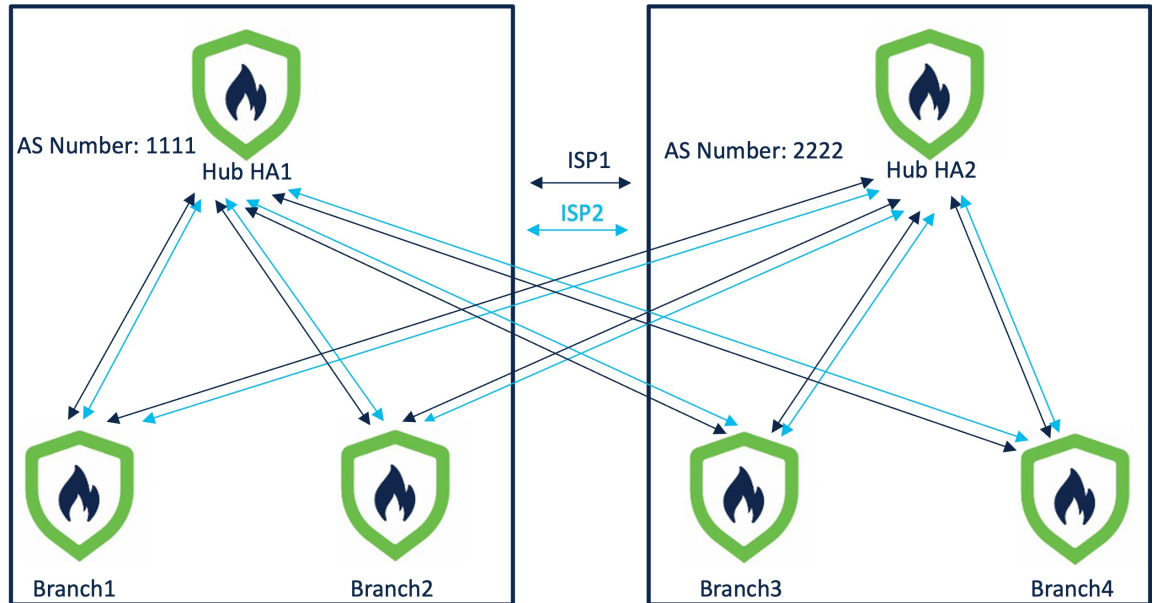
Note If the hubs are in different geographic locations and have different protected networks behind them, to ensure direct communication between these networks, configure a point-to-point route-based VPN topology between the two hubs using the route-based VPN wizard.

Dual ISP Deployment: Two Hubs and Four Spokes in Different Regions

In the following dual ISP topology, the hubs are in different regions, and have two directly connected spokes each. The hubs and their directly connected spokes use Internal Border Gateway Protocol (iBGP) as the routing protocol, and the hubs use External Border Gateway Protocol (eBGP) to exchange routing information.

- Hub HA1 and Hub HA2 are hub threat defense devices at the headquarters.
- Branch1, Branch2, Branch3, and Branch4 are spoke threat defense devices at the branches.
- HQ1, Branch1, and Branch2 are in a single region with AS number as 1111.
- HQ2, Branch3, and Branch4 are in a single region with AS number as 2222.
- ISP1 is the VPN interface of each spoke to ISP1.
- ISP2 is the VPN interface of each spoke to ISP2.

Figure 2: Dual ISP Topology with Two Hubs and Four Spokes in Different Regions



To configure this topology, you must create the following four SD-WAN topologies using the SD-WAN wizard:

Table 3: SD-WAN Topology 1

Primary Hub	Hub HA1
Secondary Hub	Hub HA2
Spokes	Branch1, Branch2
AS Number	1111
Secondary AS Number	2222
Spoke Tunnel Source	ISP1
Number of Tunnels	4

Table 4: SD-WAN Topology 2

Primary Hub	Hub HA1
Secondary Hub	Hub HA2
Spokes	Branch1, Branch2
AS Number	1111
Secondary AS Number	2222
Spoke Tunnel Source	ISP2

Number of Tunnels	4
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Table 5: SD-WAN Topology 3

Primary Hub	Hub HA2
Secondary Hub	Hub HA1
Spokes	Branch3, Branch4
AS Number	2222
Secondary AS Number	1111
Spoke Tunnel Source	ISP1
Number of Tunnels	4

Table 6: SD-WAN Topology 4

Primary Hub	Hub HA2
Secondary Hub	Hub HA1
Spokes	Branch3, Branch4
AS Number	2222
Secondary AS Number	1111
Spoke Tunnel Source	ISP2
Number of Tunnels	4

The total number of tunnels is 16.



Note If the hubs are in different geographic locations and have different protected networks behind them, to ensure direct communication between these networks, configure a point-to-point route-based VPN topology between the two hubs using the route-based VPN wizard.

Use Cases for SD-WAN Capabilities

- [Simplify Branch to Hub Communication using Dynamic Virtual Tunnel Interface \(DVTI\)](#)
- [Route Application Traffic from the Branch to the Internet Using Direct Internet Access \(DIA\)](#)
- [Secure Internet Traffic Using Umbrella Auto Tunnel](#)