



# Multiple Datacenter (Primary/Secondary) Deployment for Enterprise

Secure SD-WAN



DEFINE / DESIGN / **DEPLOY** / DEMO



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# Change Log

Date	Change Description
2022-05-10	Initial release.
2022-11-03	Updated <a href="#">Branch BGP signaling</a> .

# Deployment procedures

FortiManager is used to configure SD-WAN for a topology that includes multiple datacenter devices (hubs) and multiple branch devices. The deployment instructions include the following topics:

- [Prerequisites on page 4](#)
- [Recommendations on page 4](#)
- [Planning on page 5](#)
- [Assumptions on page 5](#)
- [Configuration steps on page 5](#)

## Prerequisites

This guide presumes the following prerequisites have been met:

- Hub and branch FortiGates have been imported into FortiManager.
  - The hub and branch devices have active connections to FortiManager.
- ISP links and other interfaces have been configured on all devices.
  - ISP routing is configured where branches have proper routes to reach the Hub.
  - LAN and other directly connected networks have been assigned.

## Recommendations

It is recommended to create a device group in FortiManager for the branch devices before utilizing the SD-WAN Overlay template. With device groups, you can add additional branch devices to the group, and the newly added devices will automatically inherit the configuration for SD-WAN.

In *Device Manager*, use the *Device Group* menu in the banner to create a new device group.

The screenshot shows the FortiManager Device Manager interface. On the left, there is a sidebar with a tree view showing 'Managed FortiGate (4)' with sub-items: Branch1, Branch2, Cloud-Gateway, and HUB1. Below this are links for Scripts, Provisioning Templates, Firmware Templates, and Monitors. The main area displays a table of devices with columns: Device Name, Config Status, Host Name, IP Address, Platform, Description, and Firmware Version. All devices are marked as 'Synchronized'.

Device Name	Config Status	Host Name	IP Address	Platform	Description	Firmware Version
Branch1	✓ Synchronized	Branch1	192.168.100.103	FortiGate-VM64-KVM	FortiGate 7.0.5,build0304 (GA)	FortiGate 7.0.5,build0304 (GA)
Branch2	✓ Synchronized	Branch2	192.168.100.104	FortiGate-VM64-KVM	FortiGate 7.0.5,build0304 (GA)	FortiGate 7.0.5,build0304 (GA)
Cloud-Gateway	✓ Synchronized	Cloud-Gateway	192.168.100.105	FortiGate-VM64-KVM	FortiGate 7.0.5,build0304 (GA)	FortiGate 7.0.5,build0304 (GA)
HUB1	✓ Synchronized	HUB1	192.168.100.101	FortiGate-VM64-KVM	FortiGate 7.0.5,build0304 (GA)	FortiGate 7.0.5,build0304 (GA)

## Planning

The deployment example in this guide uses the following settings, including IP networks, BGP AS number, performance SLA criteria, and so on:

1. Overlay network address space:
  - a. This address space is used for the IP addressing of all Hub and Branch devices.
  - b. The default 10.10.0.0/16 is used.
2. Loopback IP address space:
  - a. These addresses are used for Performance SLAs, Router IDs and other admin operations.
  - b. The default 172.16.0.0/16 is used.
3. Autonomous System number for BGP:
  - a. A private number is used and must remain exclusively for this SD-WAN BGP configuration.
  - b. The default of 65000 is used.

## Assumptions

The deployment example in this guide uses the following ports and IP addresses:

- HUB1 is located at the primary corporate location (Datacenter 1)
- HUB2 is located at the backup corporate location (Datacenter 2)
- ISP1 is connected to port1 on all FortiGates.
- ISP2 is connected to port2 on all FortiGates.
- LAN is connected to port3 on all FortiGates.
- Corporate Datacenter LAN is 192.168.1.0/24.

## Configuration steps

Following is a summary of the steps required to configure SD-WAN using FortiManager:

1. Configure the overlay using the SD-WAN overlay template. See [Creating an overlay template on page 6](#).
2. Assign metadata values to branch devices. See [Assigning meta data values to branch devices on page 9](#).

## CONFIGURATION STEPS

3. Configure SD-WAN rules. See [Configuring SD-WAN rules on page 10](#).
4. Create normalized interfaces. See [Creating normalized interfaces on page 11](#).
5. Create policy packages and firewall policies for hub and branch devices. See [Creating policy packages and firewall policies on page 13](#).
6. Install policy packages to devices. See [Installing policy packages on page 17](#).
7. Verify the SD-WAN configuration. See [Verifying the SD-WAN configuration on page 20](#).

## Creating an overlay template

This section describes how to use the SD-WAN overlay template to configure the overlay network.



The SD-WAN overlay provisioning template supports metafields for each input box that displays a magnifying glass.

For more information, see the *FortiManager 7.2 Administration Guide*.

To create an overlay template:

1. In FortiManager, go to *Device Manager > Provisioning Templates > SD-WAN Overlay Templates*.
2. Click *Create New*. The *Create New SD-WAN Overlay Template* dialog box is displayed.

3. Enter a name and description for the template, and click *OK*. The *Region Settings* pane is displayed.
4. Set the region settings:
  - a. Select *Dual Hub (Primary & Secondary)*.
  - b. Expand *Advanced*, and modify the default IP address scheme for loopback and overlay networks, BGP-AS number, and to enable AD-VPN as desired.

- c. Click *Next*. The *Role Assignment* pane is displayed.
5. Set the role assignment:
  - a. Set *Primary HUB* to *HUB1*.
  - b. Set *Secondary HUB* to *HUB2*.
  - c. Set *Device Group Assignment* to *Branches*.

**Create New SD-WAN Overlay Template - Role Assignment (2/5)**

Name: ACME SD-WAN Overlay

Topology: Single HUB **Dual HUB (Primary & Secondary)** Dual HUB (Primary & Primary)

**HUB**

Primary HUB: HUB1

Secondary HUB: HUB2

**Branch**

Device Group Assignment: Branches

< Back Next > Cancel

- d. Click *Next*. The *Network Configuration* pane is displayed.
6. Set the network configuration for the primary HUB:
  - a. Under *Primary HUB*, set *WAN Underlay 1* to *port1*.
  - b. Set *WAN Underlay 2* to *port2*.
  - c. Expand *Advanced*.

**Edit SD-WAN Overlay Template - Network Configuration (3/5)**

Name: ACME SD-WAN Overlay

**HUB**

Primary HUB: HUB1

WAN Underlay 1: ☐ Private Link port1

WAN Underlay 2: ☐ Private Link port2

Network Advertisement: **Connected** Static

Interface: +

**Advanced**

Neighbors

#	Neighbor IP	Remote AS	Route Map In	Route Map Out
1	172.16.1.1	65100		

< Back Next > Cancel

- d. Click *Create New*. The *Create New Neighbor* pane is displayed.
- e. Set *Neighbor IP* to *172.16.1.1*.
- f. Set *Remote AS* to *65100*.
- g. Click *OK*. The BGP neighbor is created.



When entering the port name, it is case sensitive and must match the port as written on the FortiGate exactly.

Select *Private Link* if the port is on a private circuit, and you do not want to create an overlay network utilizing this link.

Select *Override IP* if you want to manually input an IP address that remote branches will connect to. This is commonly used in public cloud providers where interfaces have private IP address or other NAT'd environments.

7. Set the network configuration for the secondary HUB:
  - a. Under *Secondary HUB*, set *WAN Underlay 1* to *port1*.
  - b. Under *Secondary HUB*, set *WAN Underlay 2* to *port2*.
  - c. Expand *Advanced*.
  - d. Click *Create New*. The *Create New Neighbor* pane is displayed.
  - e. Set *Neighbor IP* to *172.16.2.1*.
  - f. Set *Remote AS* to *65100*.
  - g. Click *OK*. The BGP neighbor is created.



A neighbor is configured for the HUBs to learn the route to the Corporate Datacenter LAN (192.168.1.0/24) over BGP. This is also why there is no need to specify a Network Advertisement; routes learned from an eBGP peer are re-advertised to all iBGP and eBGP peers by default.

8. Set the network configuration for the branches device group:
  - a. Scroll down to *Branch Device Group*, and set *WAN Underlay 1* to *port1*.
  - b. Set *WAN Underlay 2* to *port2*.
  - c. Set *Network Advertisement* to *Connected* and *port3*.



This interface will be advertised to the rest of the SD-WAN region. In this example, port3 is our LAN interface for each branch, and so will advertise the branch's LAN subnet.

- d. Click *Next*. The *SD-WAN Template Options* pane is displayed.
9. Set the SD-WAN template options:
  - a. Enable *Add Overlay Objects to SD-WAN Template*.
  - b. In the list, click *Create New* to create a new SD-WAN template named *Branch\_SDWAN*.  
No configuration of the template is needed at this time.

## CONFIGURATION STEPS

- c. Enable *Add Overlay Interfaces and Zones*.
- d. Enable *Add Healthcheck Servers for Each Hub as Performance SLA*.

Create New SD-WAN Overlay Template - SD-WAN Template Options (4/5)

Add Overlay Objects to SD-WAN Template	<input checked="" type="checkbox"/>	Branch_SDWAN
Add Overlay Interfaces and Zones	<input checked="" type="checkbox"/>	
Add Healthcheck Servers for Each HUB as Performance SLA	<input checked="" type="checkbox"/>	

- e. Click *Next*. The *Summary* pane is displayed.
10. Click *Finish* to save the template.

## Assigning meta data values to branch devices



Each branch must have a unique *branch\_id* mapping value in order to successfully utilize the SD-WAN overlay provisioning template.

To assign meta data values to branch devices:

1. In FortiManager, go to *Device Manager > Device & Groups*, and expand *Managed FortiGates*.
2. Set the variable for Branch1:
  - a. In the content pane, right-click *Branch1* and select *Edit Variable Mapping*. The *Edit Metadata Variable Mapping* dialog box is displayed.
  - b. Click the *Mapping Value* cell, type *1*, and select the checkmark to set the value.

Edit Metadata Variable Mapping - Branch1(global)

#	Variable Name	Mapping Value	Default Value
1	\$(branch_id)	1	<input checked="" type="checkbox"/>

The value is set.

Edit Metadata Variable Mapping - Branch1(global)

#	Variable Name	Mapping Value	Default Value
1	\$(branch_id)	1	<input type="checkbox"/>

OK Cancel

- c. Click *OK* to save the changes.
3. Repeat to set *Branch2* to *2*.

## Configuring SD-WAN rules

In this section we are going to edit the SD-WAN template to create a new performance SLA target as well as new SD-WAN rules.

To configure SD-WAN rules:

1. In FortiManager, go to *Provisioning Templates > SD-WAN Templates*.
2. Double-click the *Branch\_SDWAN* template to open it for editing.
3. Create a rule named *Corporate\_Traffic*:
  - a. Under *SD-WAN Rules*, and click *Create New*. The *Create New SD-WAN Rule* pane opens.
  - b. Set the following options, and click *OK*:

Name	Corporate_Traffic
Source	Branch Network, 10.1.0.0/16 (Create new Address Object)
Destination	Datacenter LAN1, 192.168.100.0/24 (Create new Address Object)
Strategy	Lowest Cost SLA
Interface Preference	HUB1-VPN1, HUB1-VPN2, HUB2-VPN1, HUB2-VPN2
Required SLA Target	HUB1_HC#1, HUB2_HC#1

The SD-WAN rule is created.

4. Define an SLA target for internet traffic:
  - a. Under *Performance SLA*, and click *Create New*. The *Create New Performance SLA* pane opens.
  - b. Set the following options, and click *OK*:

Name	Internet
Server	1.1.1.1
Participants	port1, port2
SLA Targets	<ul style="list-style-type: none"><li>• Latency threshold: 300</li><li>• Jitter Threshold: 55</li><li>• Packet Loss Threshold: 3%</li></ul>

The SLA target is created.

5. Create a rule named *Internet Traffic*:
  - a. Under *SD-WAN Rules*, and click *Create New*. The *Create New SD-WAN Rule* pane opens.
  - b. Set the following options, and click *OK*:

Name	Internet_Traffic
Source	Branch Network
Destination	all
Strategy	Lowest Cost SLA
Interface Preference	WAN1, WAN2
Required SLA Target	Internet

The SD-WAN rule is created.

6. Click *OK* to save the SD-WAN template.

## Creating normalized interfaces

Because the policy package uses interface objects instead of directly referring to the interface, we must link the interface objects with the actual interfaces on any/all devices. We do this by creating normalized interfaces with per-platform mappings.

To create normalized interfaces:

1. In FortiManager, go to *Policy & Objects > Object Configurations > Normalized Interface*.
2. In the content pane, click *Create New*.  
The *Create New Normalized Interface* pane opens.
3. Set *Name* to *HUB1*.
4. Under *Per-Platform Mapping*, click *Create New*.  
The *Create New Per-Platform Mapping* dialog box is displayed.

## CONFIGURATION STEPS

Create New Per-Platform Mapping

Matched Platform

Click to select

Mapped Interface Name

No Advanced Options Available

OK
Cancel

- Set the following options, and click **OK**:

Matched Platform Select *all*.

Mapped Interface Name Type *HUB1*.



The mapped interface is case sensitive. It must exactly match the interface on the target FortiGate.

The per-platform mapping is created.

- Repeat this procedure to the following per-platform mappings:

Normalized Interface	Matching Type	Mapped Interface/Zone
HUB1	Matched Platform: all	HUB1
HUB2	Matched Platform: all	HUB2
VPN1	Matched Platform: all	VPN1
VPN2	Matched Platform: all	VPN2
WAN1	Matched Platform: all	WAN1
WAN2	Matched Platform: all	WAN2
HUB-Loopback	Matched Device: HUB1	HUB1-Lo
	Mapped Device: HUB2	HUB2-Lo
LAN	Matched Platform: all	port3

All the per-platform mappings are created:

Policy Packages >

Object Configurations >

Normalized Interface

Normalized Interface

Virtual Wire Pair

Firewall Objects

Security Profiles

Fabric Connectors

User & Authentication

+ Create New Edit Delete Expand All More View

Normalized Interface	Mapping Rule	Mapped Interface/Zone
LAN		
	Per-device (Cloud-Gateway (root))	port2
	Default	port3
HUB-Loopback		
	Per-device (HUB1 (root))	HUB1-Lo
	Per-device (Cloud-Gateway (root))	HUB2-Lo
	Default	HUB-Loopback
WAN2		
	Default	WAN2
WAN1		
	Default	WAN1
VPN2		
	Per-device (Cloud-Gateway (root))	VPN1-2
	Default	VPN2
VPN1		
	Default	VPN1
HUB2		
	Default	HUB2
HUB1		
	Default	HUB1



If you are using different ports for LAN between branches, you can leverage per-device mapping to override the matched platform: all.

## Creating policy packages and firewall policies



The following policies are provided to allow traffic to flow between branches and hub. They require further security configuration to secure the communication.

Following is a summary of how to create the policy package:

1. Create a policy package for branch devices. See [Creating the branch policy package and policies on page 13](#).  
These firewall policies leverage the SD-WAN zones and interfaces.
2. Create a policy package for the hub device. See [Creating the hub policy package and policies on page 16](#).

### Creating the branch policy package and policies

To create the branch policy package and policies:

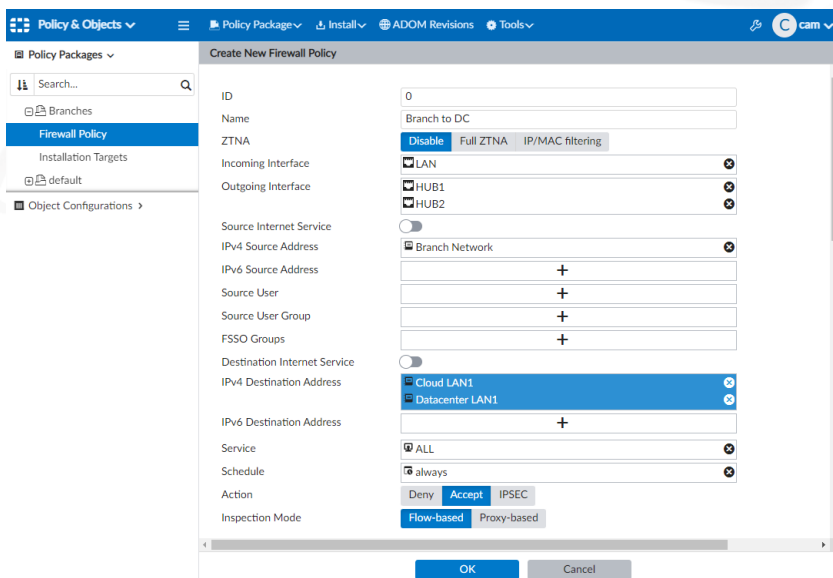
1. In FortiManager, go to *Policy & Objects*.
2. Create a policy package named *Branches*:
  - a. From the *Policy Package* menu, select *New*.  
The *Create New Policy Package* dialog box is displayed.
  - b. Set name to *Branches*, and click *OK*.

The policy package named *Branches* is created.

3. In the branches policy package, create a firewall policy named *Branch to DC*:
  - a. Select the *Branches* policy package, and click *Create New*. The *Create New Firewall Policy* pane opens.
  - b. Set the following options, and click *OK*:

Name	Branch to DC
Incoming Interface	LAN
Outgoing Interface	HUB1, HUB2

IPv4 Source Address	Branch network
IPv4 Destination Address	Datacenter LAN1
Action	Accept



The firewall policy is created.

4. In the branches policy package, create a firewall policy named *Direct Internet Access*:
  - a. Select the *Branches* policy package, and click *Create New*. The *Create New Firewall Policy* pane opens.
  - b. Set the following options, and click *OK*:

Name	Direct Internet Access
Incoming Interface	LAN
Outgoing Interface	WAN1, WAN2
IPv4 Source Address	Branch network
IPv4 Destination Address	all
Action	Accept
NAT	Enable

## CONFIGURATION STEPS

The firewall policy is created.

5. Assign the branches policy package to the branch device group:
  - a. On the *Policy & Objects* pane, expand the *Branches* policy package, and select *Installation Targets*.
  - b. In the toolbar, click *Edit*. The *Edit Installation Targets* dialog box opens.
  - c. In the *Available Entries* list, select the *Branches* group, and click the right arrow (>) to move it to the *Selected Entries* list.

- d. Click *OK*.

The installation target for the branches policy package is the *Branches* device group.

## Creating the hub policy package and policies

To create the hub policy package and policies:

1. In FortiManager, go to *Policy & Objects*.
2. Create a policy package named *HUB*:
  - a. From the *Policy Package* menu, select *New*.  
The *Create New Policy Package* dialog box is displayed.
  - b. Set name to *HUB*, and click *OK*.  
The policy package named *HUB* is created.
3. In the *HUB* policy package, create a firewall policy named *SLA-HealthCheck* :
  - a. Select the *HUB* policy package, and click *Create New*. The *Create New Firewall Policy* pane opens.
  - b. Set the following options, and click *OK*:

Name	SLA-HealthCheck
Incoming Interface	VPN1, VPN2
Outgoing Interface	HUB-Loopback
IPv4 Source Address	Overlay Tunnels, 10.10.0.0/16 (create new address object)
IPv4 Destination Address	all
Action	Accept

The screenshot shows the 'Edit Firewall Policy' dialog box in FortiManager. The policy name is 'SLA-HealthCheck'. The 'ZTNA' tab is selected. The 'Incoming Interface' is set to 'VPN1' and 'VPN2'. The 'Outgoing Interface' is set to 'HUB-Loopback'. The 'Source Internet Service' is set to 'Overlay Tunnels'. The 'IPv4 Source Address' is set to 'all'. The 'IPv4 Destination Address' is set to 'all'. The 'Service' is set to 'ALL'. The 'Schedule' is set to 'always'. The 'Action' is set to 'Accept'. The 'Inspection Mode' is set to 'Flow-based'. The 'OK' button is highlighted.

The firewall policy is created.

4. In the *HUB* policy package, create a firewall policy named *Branch to Datacenter*:
  - a. Select the *HUB* policy package, and click *Create New*. The *Create New Firewall Policy* pane opens.
  - b. Set the following options, and click *OK*:

Name	Branch to Datacenter
Incoming Interface	VPN1, VPN2
Outgoing Interface	LAN

IPv4 Source Address	Branch Network
IPv4 Destination Address	Datacenter LAN1
Action	Accept

Edit Firewall Policy

ID

2

Name

Branch to Datacenter

ZTNA

Disable

Full ZTNA

IP/MAC filtering

Incoming Interface

☒ VPN1

☒ VPN2

☒ LAN

Outgoing Interface

☒ LAN

Source Internet Service

☐

IPv4 Source Address

IPv6 Source Address

Source User

Source User Group

FSSO Groups

Destination Internet Service

☐

IPv4 Destination Address

IPv6 Destination Address

Service

☒ ALL

Schedule

☒ always

Action

Deny

Accept

IPSEC

Inspection Mode

Flow-based

Proxy-based

OK

Cancel

The firewall policy is created.

5. Assign the HUB policy package to the HUB1 and HUB2 devices:
  - a. On the *Policy & Objects* pane, expand the *HUB* policy package, and select *Installation Targets*.
  - b. In the toolbar, click *Edit*. The *Edit Installation Targets* dialog box opens.
  - c. In the *Available Entries* list, select the *HUB1* and *HUB2* devices, and click the right arrow (>) to move it to the *Selected Entries* list.
  - d. Click *OK*.

The installation target for the HUB policy package is the *HUB1* and *HUB2* devices.

## Installing policy packages

Because the HUB and branches use separate policy packages, we will install each policy package one one at a time:

1. Install the HUB policy package to the HUB1 device. See [Installing the HUB policy package on page 17](#).
2. Install the branch policy package to branch device group. See [Installing the branch policy package on page 18](#).

### Installing the HUB policy package

In this step, we install the HUB policy package to the HUB1 device.

To install the HUB policy package:

1. Go to *Device Manager*, and click *Install Wizard* in the toolbar.  
The *Install Wizard* dialog box opens.

## CONFIGURATION STEPS

2. Set the following options, and click *Next*:

Install Policy Package & Device Settings

Select

Policy Package

HUB

Install Wizard

☒ Install Policy Package & Device Settings

Install a selected policy package. Any device specific settings for devices associated with the package will also be installed.

Policy Package: HUB

Comment: 0/127

☐ Create ADOM Revision

☐ Schedule Install

☒ Install Device Settings (only)

Next > Cancel

The wizard moves to the next screen:

3. Verify that *HUB1* and *HUB2* are selected, and click *Next*.

The wizard moves to the installation preparation page. When the installation preparation completes, you should see three, green checkmarks that indicate the policy package is ready to install.

4. Review the page, and click *Install*.

You can click *Install Preview* to view more details before installing the policy package.

Installation is complete when the status indicates *install and save finished status=OK*.

## Installing the branch policy package

In this step, we install the branch policy package to the branch device group.

To install the branch policy package:

1. Go to *Device Manager*, and click *Install Wizard* in the toolbar.  
The *Install Wizard* dialog box opens.
2. Set the following options, and click *Next*:

Install Policy Package & Device Settings

Select

Policy Package

Branches

## CONFIGURATION STEPS

**Install Wizard**

☒ **Install Policy Package & Device Settings**  
Install a selected policy package. Any device specific settings for devices associated with the package will also be installed.

Policy Package: Branches

Comment: 0/127

☐ Create ADOM Revision

☐ Schedule Install

☐ Install Device Settings (only)

Next > Cancel

The wizard moves to the next screen:

**Install Wizard - Policy Package and Device Setting (Branches)**

Please select one or more devices to install (Use checkbox or Ctrl or Shift key for multiple selections)

<input type="checkbox"/>	Device Name	IP Address	Platform
<input checked="" type="checkbox"/>	Branches		

< Back Next > Cancel

3. Verify that *Branches* is selected, and click *Next*.

The wizard moves to the installation preparation page. When the installation preparation completes, you should see three, green checkmarks that indicate the policy package is ready to install.

**Install Wizard - Policy Package (Branches)**

Installation Preparation Total: 3/3, Success: 3, Warning: 0, Error: 0

- ✓ Interface Validation
- ✓ Policy and Object Validation
- ✓ Ready to Install.

<input type="checkbox"/>	Device Name	Status	Action
<input checked="" type="checkbox"/>	Branch1[root]	Connection Up	
<input checked="" type="checkbox"/>	Branch2[root]	Connection Up	

Install Cancel

4. Review the page, and click *Install*.

You can click *Install Preview* to view more details before installing the policy package.

Installation is complete when the status indicates *install and save finished status=OK*.

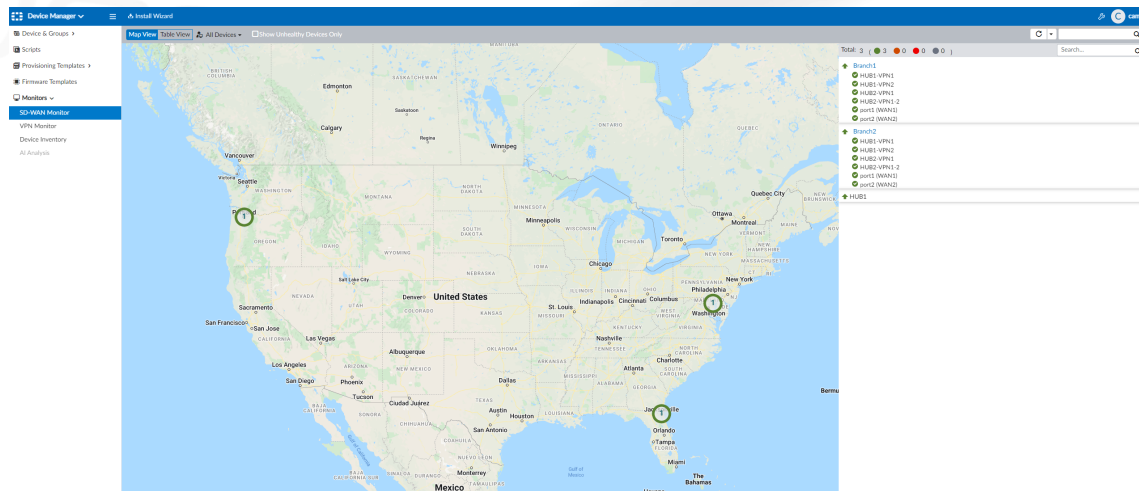
## Verifying the SD-WAN configuration

You can verify the SD-WAN and overlay configuration in the *Device Manager > Monitor > SD-WAN Monitor* pane.

To verify:

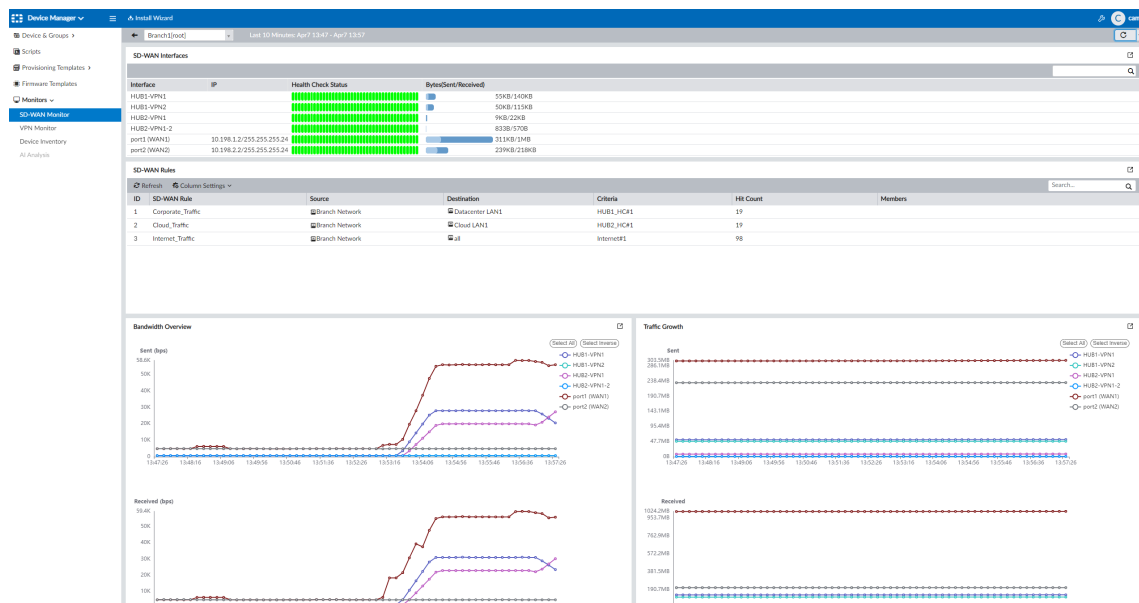
1. Go to *Device Manager > Monitors > SD-WAN Monitor*.

A list of FortiGates are displayed in the map and on the right-hand side.



2. Select a FortiGate to view its SD-WAN status.

In addition to the current SD-WAN selection and status, the monitor section provides a historical view of the link health and SLA server health.





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