FortiOS - Cookbook

Version 6.0.0

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June 24, 2020
FortiOS 6.0.0 Cookbook
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Change log

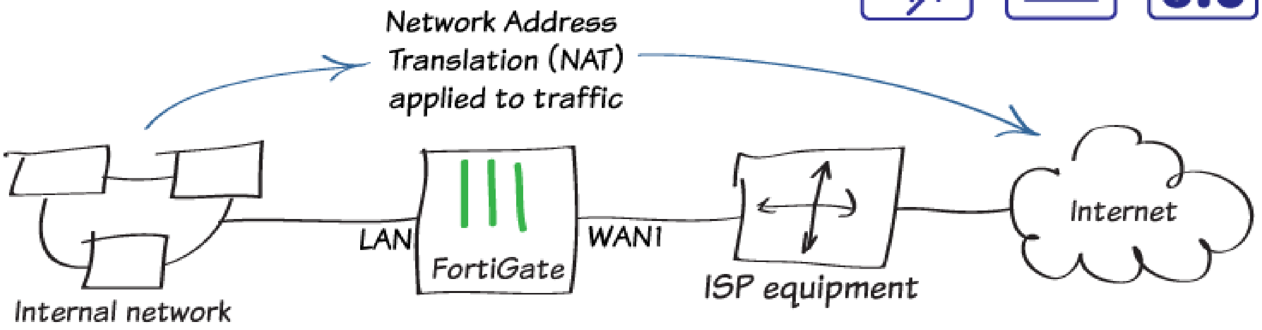
Date	Change Description
2019-03-04	Initial release.
2019-05-09	Added Blocking malicious domains using threat feeds on page 119.
2019-05-22	Added Replacing the Fortinet_Wifi certificate on page 350.
2019-06-10	Updated London FortiDNS server IP address in DNS Filtering on page 207 and related topics.
2019-09-24	Updated to remove outdated topic.
2019-11-08	Added video links.
2020-03-24	Added SSL VPN quick start on page 246 section.
2020-06-24	Added SSL VPN for remote users with MFA and user case sensitivity on page 335.

Getting started

This section contains information about installing and setting up a FortiGate, as well common network configurations.

Installing a FortiGate in NAT mode

FORTIOS VERSION 6.0



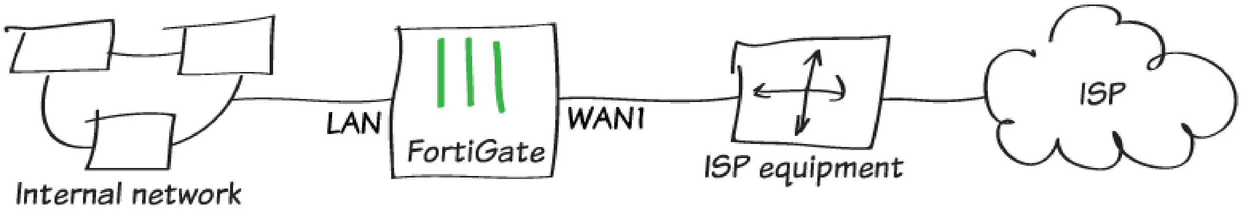
In this example, you connect and configure a new FortiGate in NAT mode, to securely connect a private network to the Internet.

In NAT mode, you install a FortiGate as a gateway, or router, between two networks. Typically, you set the FortiGate up between a private network and the Internet, which allows the FortiGate to hide the IP addresses of the private network using NAT.

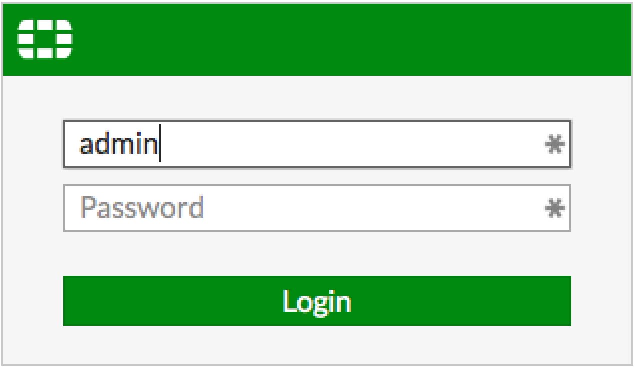
NAT mode is the most commonly used operating mode for a FortiGate.

Connecting network devices

1. Connect the FortiGate to your ISP-supplied equipment using the Internet-facing interface. This is typically WAN or WAN1, depending on your model.
2. Connect a PC to the FortiGate, using an internal port (in the example, port 3).



3. Power on the ISP equipment, the FortiGate, and the PC on the internal network.
4. Use the PC to connect to the FortiGate GUI using either FortiExplorer or an Internet browser. For more information about connecting to the GUI, see the QuickStart Guide for you FortiGate model.
5. Log in using an admin account. The default admin account has the username *admin* and no password.

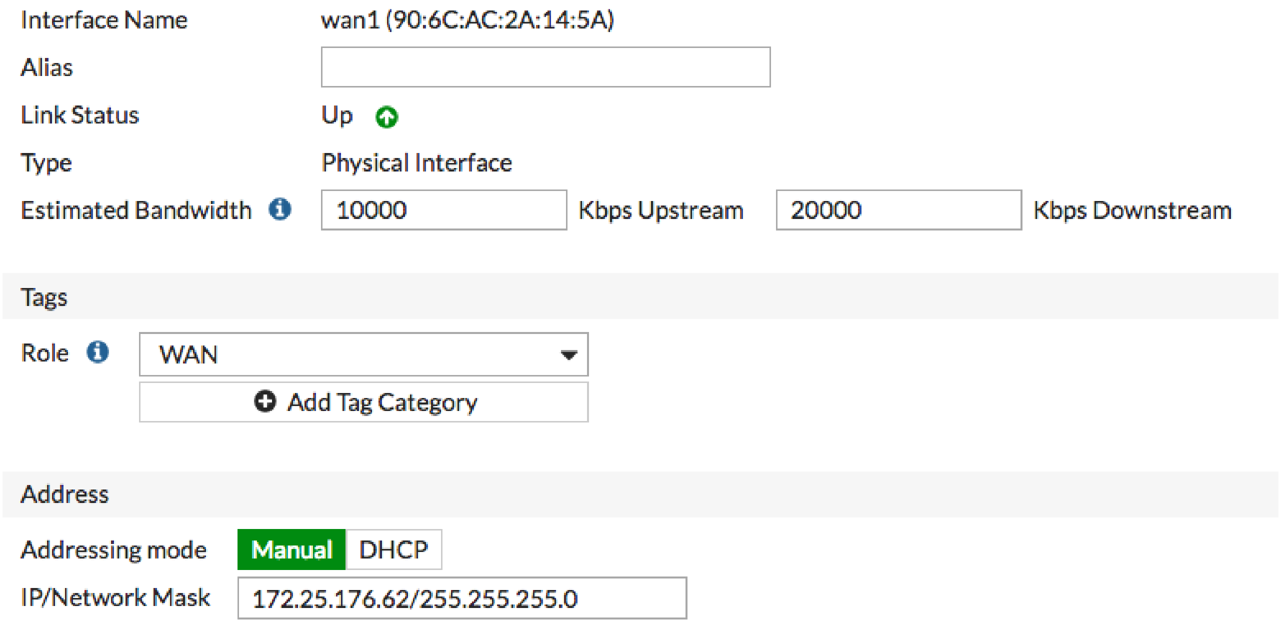


admin

Password

Configuring interfaces

1. To edit the Internet-facing interface (in the example, wan1), go to **Network > Interfaces**.
2. Set the **Estimated Bandwidth** for the interface based on your Internet connection.
3. Set **Role** to **WAN**.



Interface Name	wan1 (90:6C:AC:2A:14:5A)			
Alias				
Link Status	Up			
Type	Physical Interface			
Estimated Bandwidth	10000	Kbps Upstream	20000	Kbps Downstream

Tags

Role	WAN

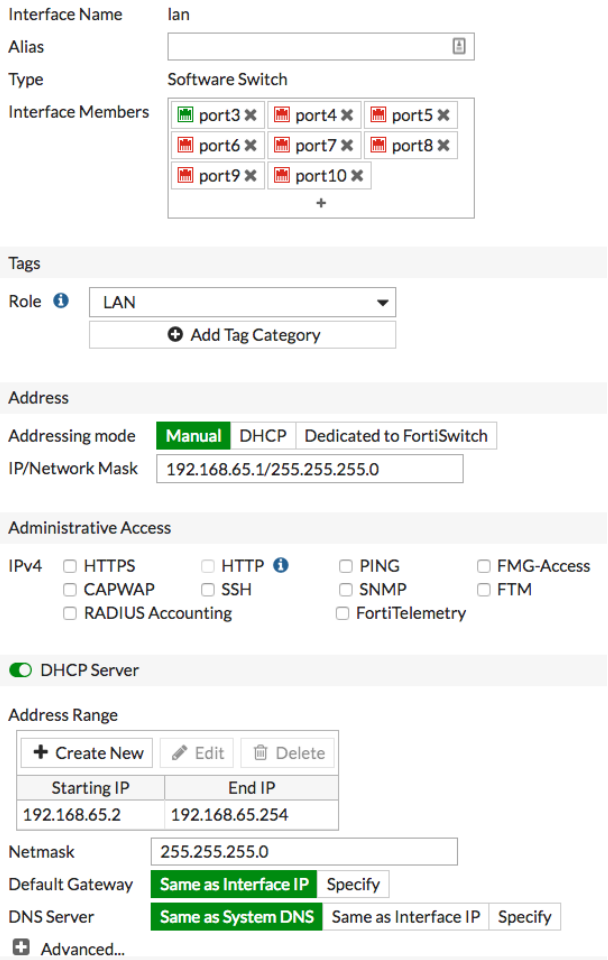
Address

Addressing mode	Manual DHCP
IP/Network Mask	172.25.176.62/255.255.255.0

4. To determine which **Addressing mode** to use, check if your ISP provides an IP address for you to use or if the ISP equipment uses DHCP to assign IP addresses.
   a. If your ISP provides an IP address, set **Addressing mode** to **Manual** and set the **IP/Network Mask** to that IP address.
   b. If your ISP equipment uses DHCP, set **Addressing mode** to **DHCP** to allow the equipment to assign an IP address to WAN1.
5. Edit the **lan** interface, which is called **internal** on some FortiGate models.

If your FortiGate doesn't have a default LAN interface, for this step, you can use either an individual interface or create a software switch to combine the separate interfaces into a single virtual interface.

6. Set **Role** to **LAN**.
7. Set **Addressing mode** to **Manual** and set the **IP/Network Mask** to the private IP address that you want to use for the FortiGate.
8. If you need to assign IP addresses to devices on your internal network, enable **DHCP Server**.



Interface Name	lan
Alias	
Type	Software Switch
Interface Members	port3 port4 port5 port6 port7 port8 port9 port10

Tags

Role: LAN

Add Tag Category

Address

Addressing mode: [✓ Manual] DHCP Dedicated to FortiSwitch

IP/Network Mask: 192.168.65.1/255.255.255.0

Administrative Access

IPv4 □ HTTPS □ HTTP □ PING □ FMG-Access □ CAPWAP □ SSH □ SNMP □ FTM □ RADIUS Accounting □ FortiTelemetry

● DHCP Server

Address Range

Starting IP	End IP
192.168.65.2	192.168.65.254

Netmask: 255.255.255.0

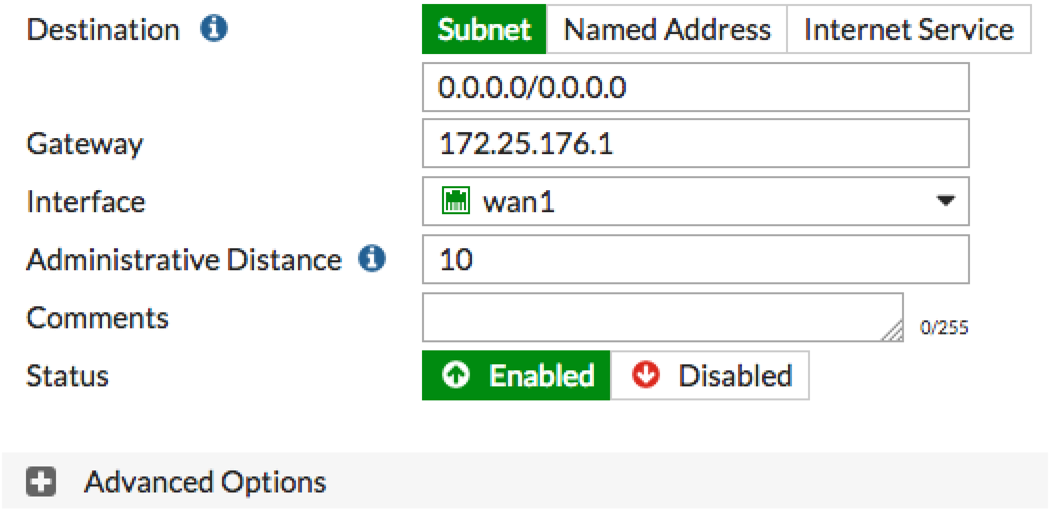
Default Gateway: [✓ Same as Interface IP] Specify

DNS Server: [✓ Same as System DNS] Same as Interface IP Specify

Adding a default route

1. To create a new default route, go to **Network > Static Routes**. Typically, you have only one default route. If the static route list already contains a default route, you can edit it, or delete the route and add a new one.
2. Set **Destination** to **Subnet** and leave the destination IP address set to 0.0.0.0/0.0.0.0.

3. Set **Gateway** to the IP address provided by your ISP and **Interface** to the Internet-facing interface.



Destination: Subnet | Named Address | Internet Service

0.0.0.0/0.0.0.0

Gateway: 172.25.176.1

Interface: wan1

Administrative Distance: 10

Comments: 0/255

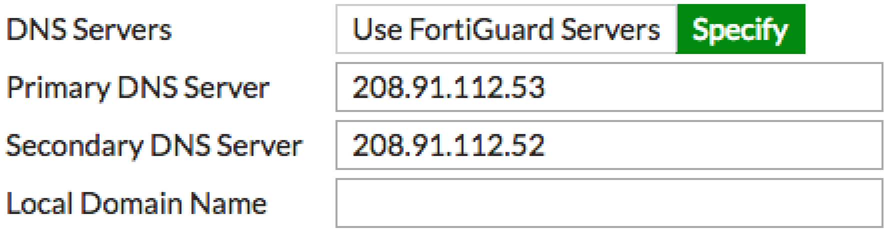
Status: Enabled | Disabled

Advanced Options

Selecting DNS servers (optional)

The FortiGate DNS settings are configured to use FortiGuard DNS servers by default, which is sufficient for most networks.

If you need to change the DNS servers, go to **Network > DNS**, select **Specify**, and add **Primary** and **Secondary** servers.



DNS Servers: Use FortiGuard Servers | Specify

Primary DNS Server: 208.91.112.53

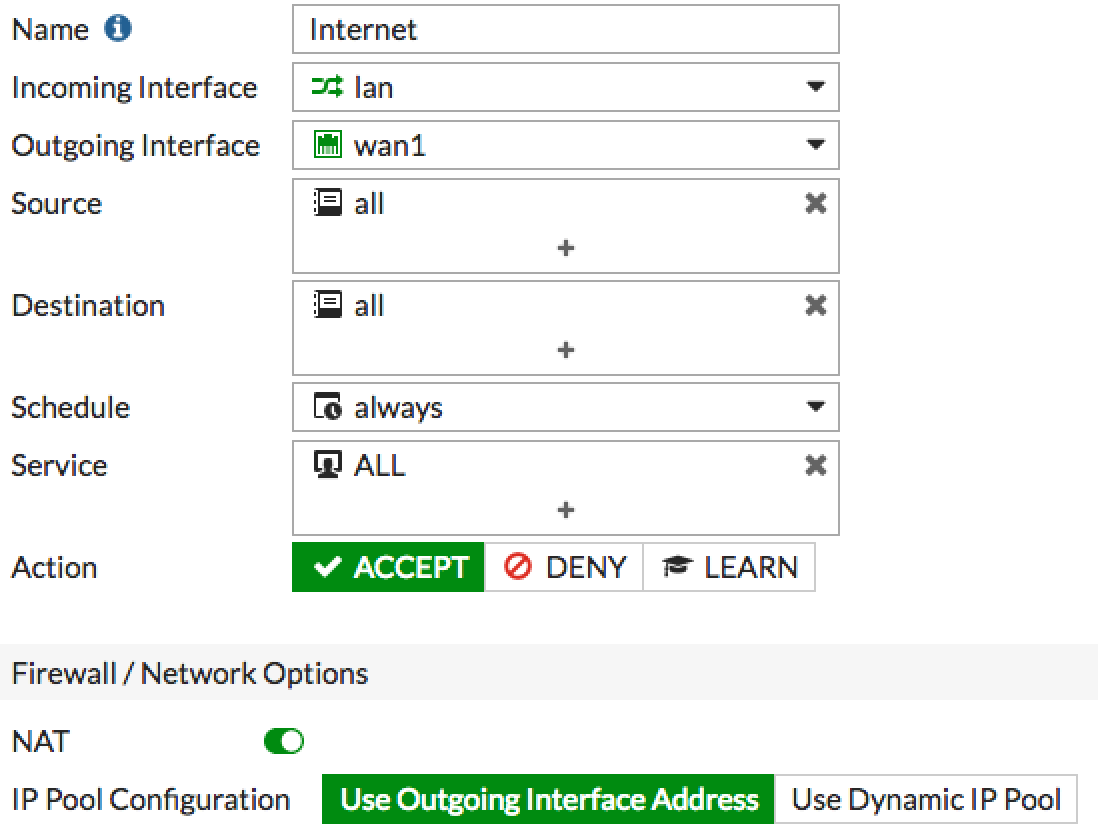
Secondary DNS Server: 208.91.112.52

Local Domain Name:

Creating a policy

Some FortiGate models include an IPv4 security policy in the default configuration. If you have one of these models, edit it to include the logging options shown below, then proceed to the results section.

1. To create a new policy, go to **Policy & Objects > IPv4 Policy**. Give the policy a **Name** that indicates that the policy will be for traffic to the Internet (in the example, Internet).
2. Set the **Incoming Interface** to **lan** and the **Outgoing Interface** to **wan1**. Set **Source**, **Destination Address**, **Schedule**, and **Services**, as required.
3. Ensure the **Action** is set to **ACCEPT**.
4. Turn on **NAT** and select **Use Outgoing Interface Address**.

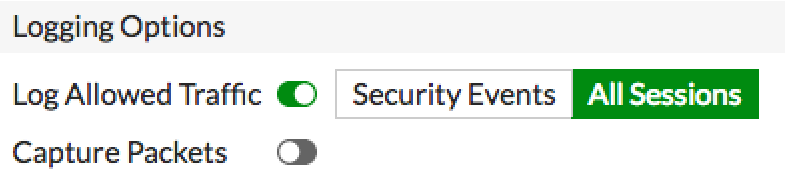


Name	Internet
Incoming Interface	lan
Outgoing Interface	wan1
Source	all
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT / DENY / LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

5. Scroll down to view the **Logging Options**. To view the results later, enable **Log Allowed Traffic** and select **All Sessions**.

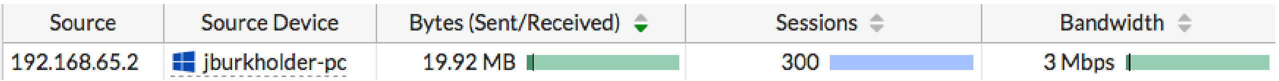


Logging Options

Log Allowed Traffic ●	Security Events [✓ All Sessions]
Capture Packets ○	

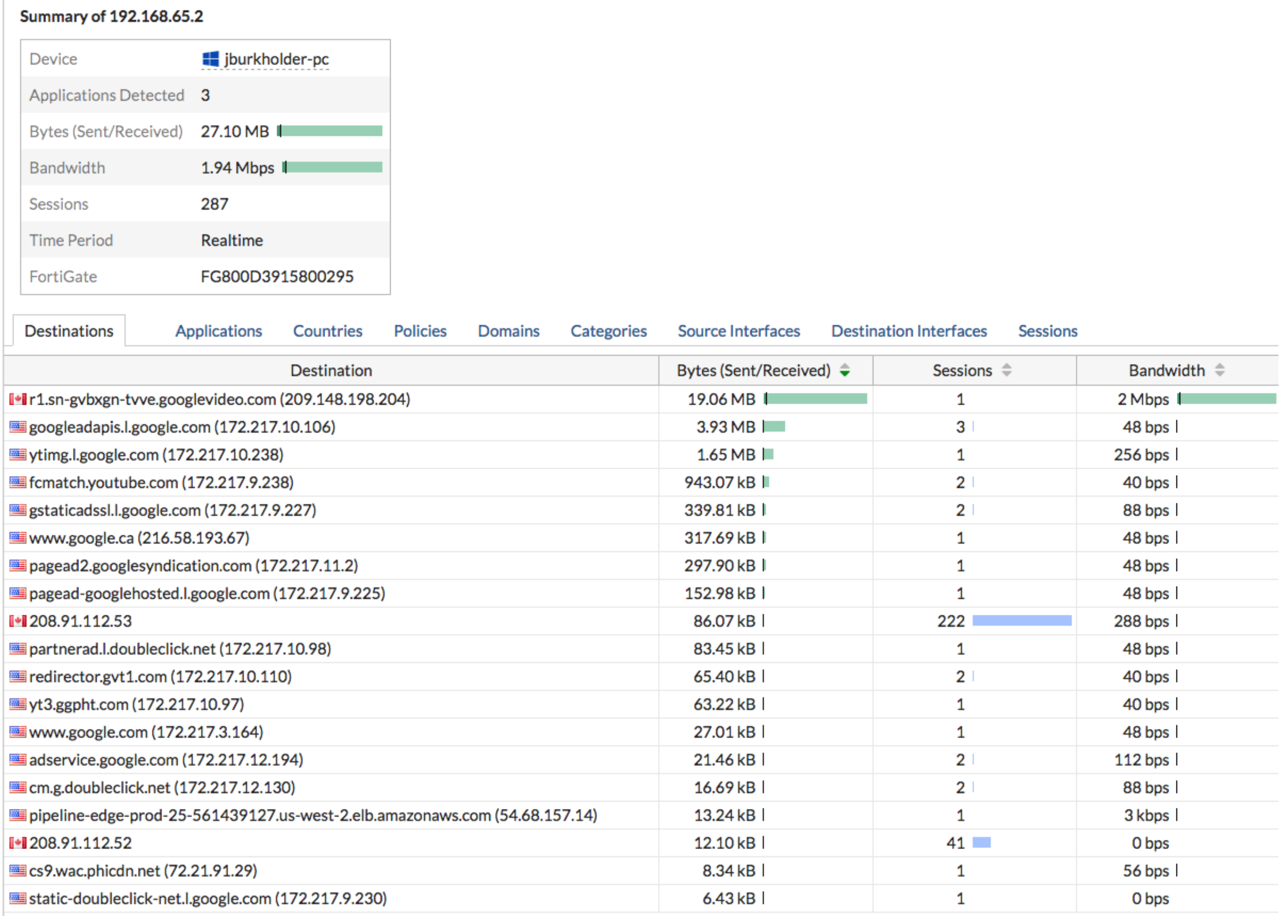
Results

1. Browse the Internet using the PC on the internal network.
2. If you can't connect to the Internet, see FortiGate installation troubleshooting.
3. To view information about FortiGate traffic, go to **FortiView > Traffic from LAN/DMZ > Sources**. The PC appears on the list of sources.



Source	Source Device	Bytes (Sent/Received)	Sessions	Bandwidth
192.168.65.2	jburkholder-pc	19.92 MB	300	3 Mbps

4. To view more detailed information about the traffic from the PC, right-click the entry for the PC and select **Drill Down to Details**.



Summary of 192.168.65.2

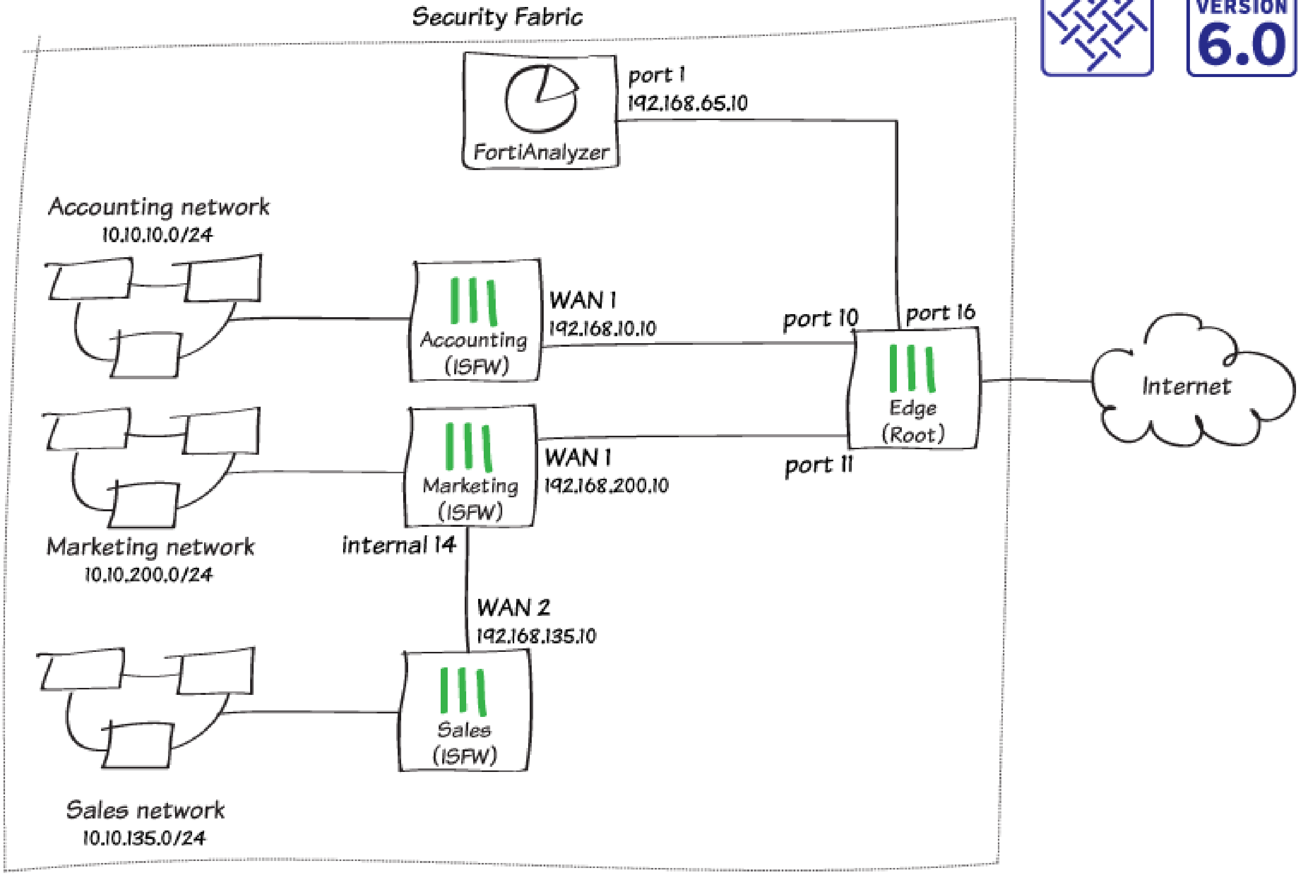
Device	jburkholder-pc
Applications Detected	3
Bytes (Sent/Received)	27.10 MB
Bandwidth	1.94 Mbps
Sessions	287
Time Period	Realtime
FortiGate	FG800D3915800295

Destination	Bytes (Sent/Received)	Sessions	Bandwidth
r1.sn-gvbxgn-tvve.googlevideo.com (209.148.198.204)	19.06 MB	1	2 Mbps
googleadapis.l.google.com (172.217.10.106)	3.93 MB	3	48 bps
ytimg.l.google.com (172.217.10.238)	1.65 MB	1	256 bps
fcmatch.youtube.com (172.217.9.238)	943.07 kB	2	40 bps
gstaticadssl.l.google.com (172.217.9.227)	339.81 kB	2	88 bps
www.google.ca (216.58.193.67)	317.69 kB	1	48 bps
pagead2.googlesyndication.com (172.217.11.2)	297.90 kB	1	48 bps
pagead-googlehosted.l.google.com (172.217.9.225)	152.98 kB	1	48 bps
208.91.112.53	86.07 kB	222	288 bps
partnerad.l.doubleclick.net (172.217.10.98)	83.45 kB	1	48 bps
redirector.gvt1.com (172.217.10.110)	65.40 kB	2	40 bps
yt3.ggpht.com (172.217.10.97)	63.22 kB	1	40 bps
www.google.com (172.217.3.164)	27.01 kB	1	48 bps
adservice.google.com (172.217.12.194)	21.46 kB	2	112 bps
cm.g.doubleclick.net (172.217.12.130)	16.69 kB	2	88 bps
pipeline-edge-prod-25-561439127.us-west-2.elb.amazonaws.com (54.68.157.14)	13.24 kB	1	3 kbps
208.91.112.52	12.10 kB	41	0 bps
cs9.wac.phicdn.net (72.21.91.29)	8.34 kB	1	56 bps
static-doubleclick-net.l.google.com (172.217.9.230)	6.43 kB	1	0 bps

5. If your FortiGate model has internal storage and disk logging enabled, a drop-down menu in the top corner allows you to view historical logging information for the previous **5 minutes**, **1 hour**, and **24 hours**.
6. If you’re not sure whether your model supports disk logging, check the FortiGate Feature/Platform Matrix.

For further reading, check out NAT mode installation.

Fortinet Security Fabric installation



In this recipe, you configure a Fortinet Security Fabric that consists of four FortiGate devices and a FortiAnalyzer. One of the FortiGate devices acts as the network edge firewall and root FortiGate of the Security Fabric, while the other FortiGate devices function as Internal Segmentation Firewalls (ISFWs).

The example network uses the following FortiGate aliases:

- **Edge**: the root FortiGate in the Security Fabric. This FortiGate is named “Edge” because it’s the only FortiGate that directly connects to the Internet. This role is also known as the gateway FortiGate.

This FortiGate has already been installed in NAT mode using Installing a FortiGate in NAT mode on page 10.

- **Accounting**: an ISFW FortiGate that connects to Edge.
- **Marketing**: an ISFW FortiGate that connects to Edge.
- **Sales**: an ISFW FortiGate that connects to Marketing.

Not all FortiGate models can run the FortiGuard Security Rating Service if they are the root FortiGate in a Security Fabric. For more information, see the FortiOS 6.0 Release Notes.

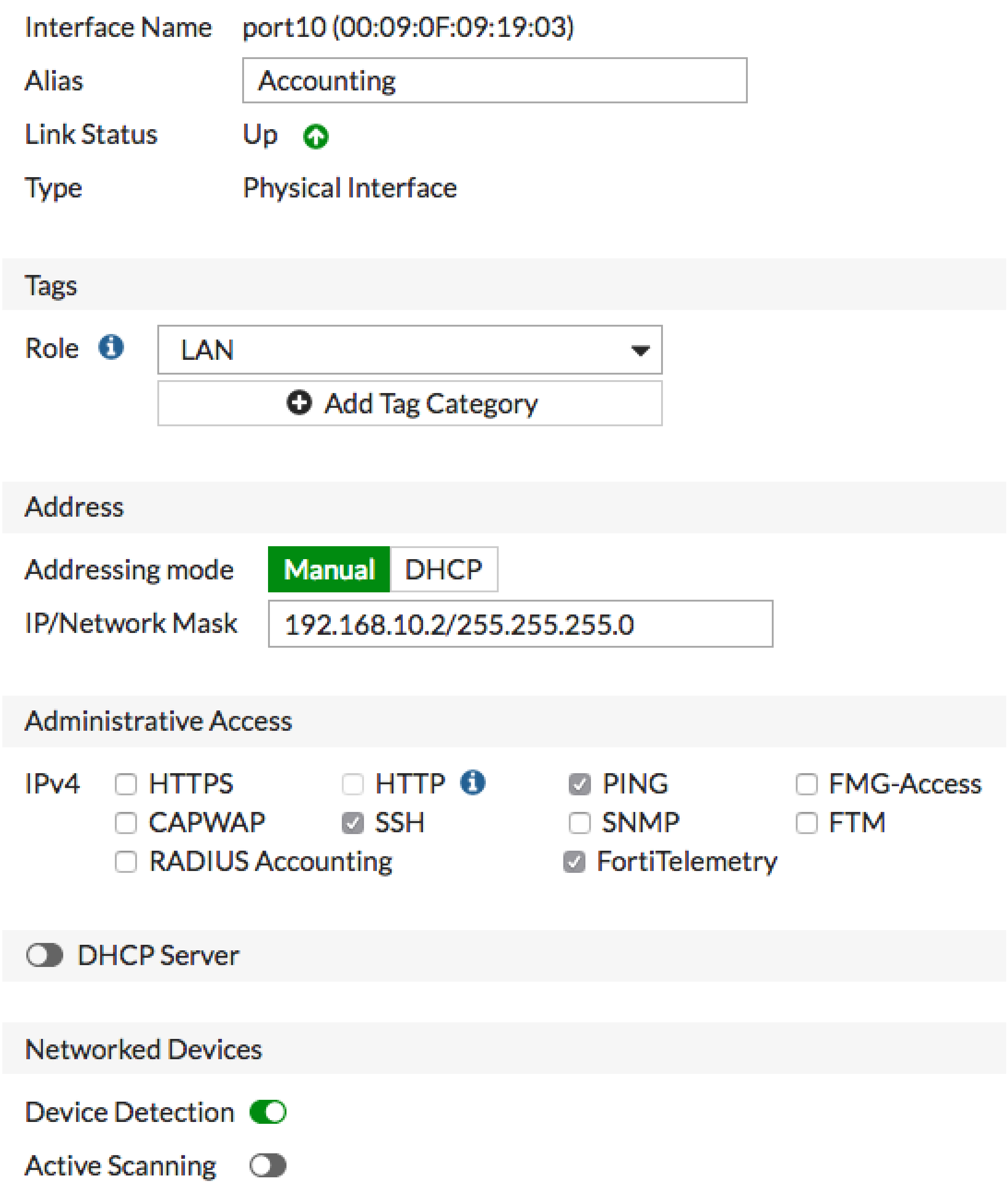
Configuring Edge

In the Security Fabric, Edge is the root FortiGate. This FortiGate receives information from the other FortiGates in the Security Fabric.

In the example, the following interfaces on Edge connect to other network devices:

- Port 9 connects to the Internet (this interface was configured when Edge was installed)
- Port 10 connects to Accounting (IP address: 192.168.10.2)
- Port 11 connects to Marketing (IP address: 192.168.200.2)
- Port 16 connects to the FortiAnalyzer (IP address: 192.168.55.2)

1. To edit port 10 on Edge, go to **Network > Interfaces**. Set an **IP/Network Mask** for the interface (in the example, *192.168.10.2/255.255.255.0*).
2. Set **Administrative Access** to allow **FortiTelemetry**, which is required so that FortiGate devices in the Security Fabric can communicate with each other.



Interface Name port10 (00:09:0F:09:19:03)

Alias Accounting

Link Status Up

Type Physical Interface

Tags

Role LAN

Address

Addressing mode [✓ Manual] DHCP

IP/Network Mask 192.168.10.2/255.255.255.0

Administrative Access

IPv4 ☐ HTTPS ☐ HTTP ☑ PING ☐ FMG-Access ☐ CAPWAP ☑ SSH ☐ SNMP ☐ FTM ☐ RADIUS Accounting ☑ FortiTelemetry

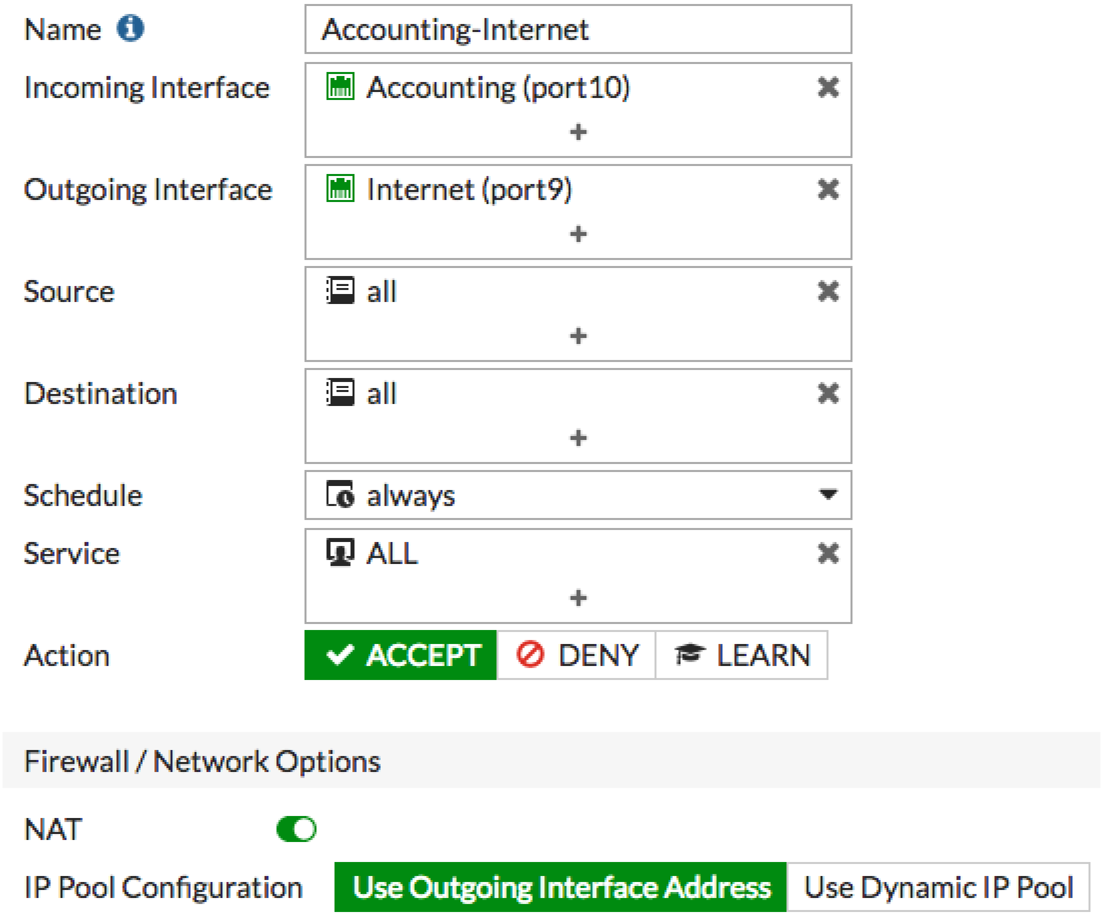
DHCP Server: off

Networked Devices

Device Detection: on

Active Scanning: off

3. Repeat the previous steps to configure the other interfaces with the appropriate IP addresses, as listed above.
4. To create a policy for traffic from Accounting to the Internet, go to **Policy & Objects > IPv4 Policy** and select **Create New**.
5. Set **Incoming Interface** to **port 10** and **Outgoing Interface** to **port 9**.
6. Enable **NAT**.

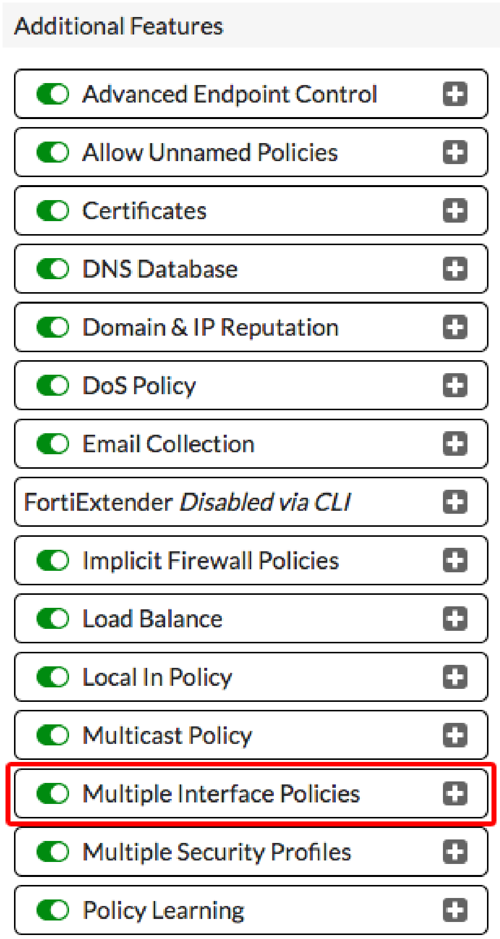


Name	Accounting-Internet
Incoming Interface	Accounting (port10)
Outgoing Interface	Internet (port9)
Source	all
Destination	all
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

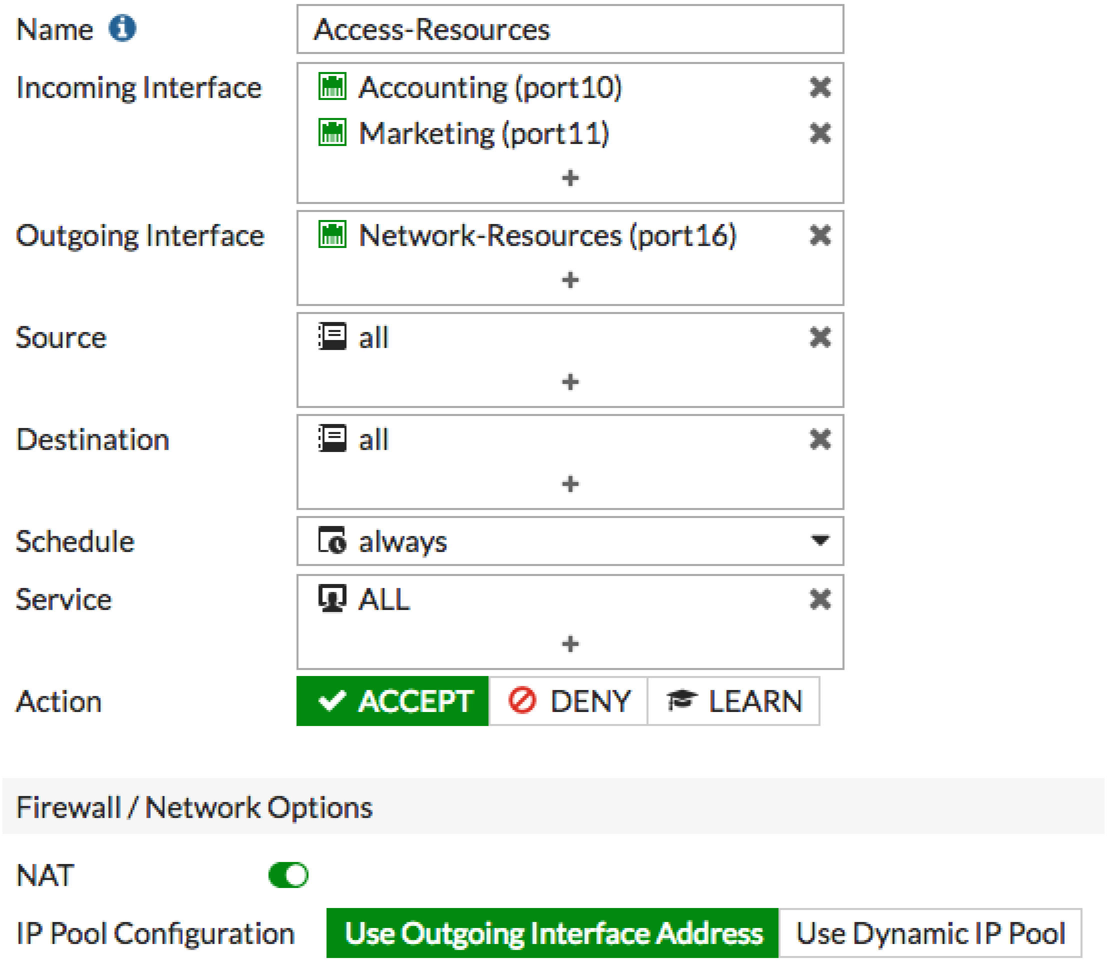
7. Repeat the previous steps to create a similar policy for Marketing.
8. On Edge, go to **System > Feature Select.** Under **Additional Features**, enable **Multiple Interface Policies**.



Additional Features

- Advanced Endpoint Control
- Allow Unnamed Policies
- Certificates
- DNS Database
- Domain & IP Reputation
- DoS Policy
- Email Collection
- FortiExtender *Disabled via CLI*
- Implicit Firewall Policies
- Load Balance
- Local In Policy
- Multicast Policy
- Multiple Interface Policies
- Multiple Security Profiles
- Policy Learning

9. To create a policy that allows Accounting and Marketing to access the FortiAnalyzer, go to **Policy & Objects > IPv4 Policy**.

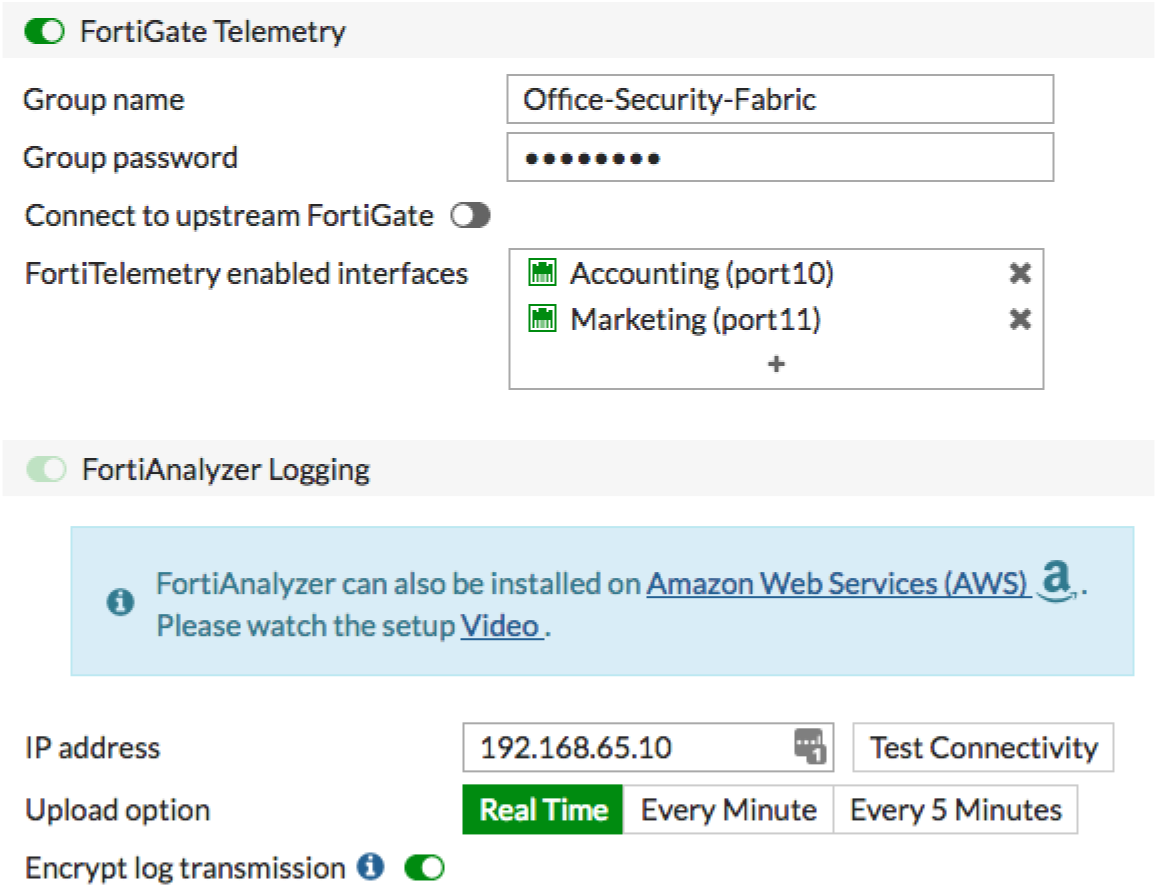


Name	Access-Resources
Incoming Interface	Accounting (port10) Marketing (port11)
Outgoing Interface	Network-Resources (port16)
Source	all
Destination	all
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

10. To enable communication between the FortiGate devices in the Security Fabric, go to **Security Fabric > Settings** and enable **FortiGate Telemetry**. Set a **Group name** and **Group password** (the **Group password** option isn't available isn't available in FortiOS 6.0.3 and later).
11. **FortiAnalyzer Logging** is enabled by default. Set **IP address** to an internal address that will later be assigned to port 1 on the FortiAnalyzer (in the example, *192.168.65.10*). Set **Upload option** to **Real Time**.



● FortiGate Telemetry

Group name: Office-Security-Fabric

Group password: •••••••••

Connect to upstream FortiGate ○

FortiTelemetry enabled interfaces: Accounting (port10) ✖
Marketing (port11) ✖
+

● FortiAnalyzer Logging

ℹ FortiAnalyzer can also be installed on Amazon Web Services (AWS). Please watch the setup Video.

IP address: 192.168.65.10 [Test Connectivity]

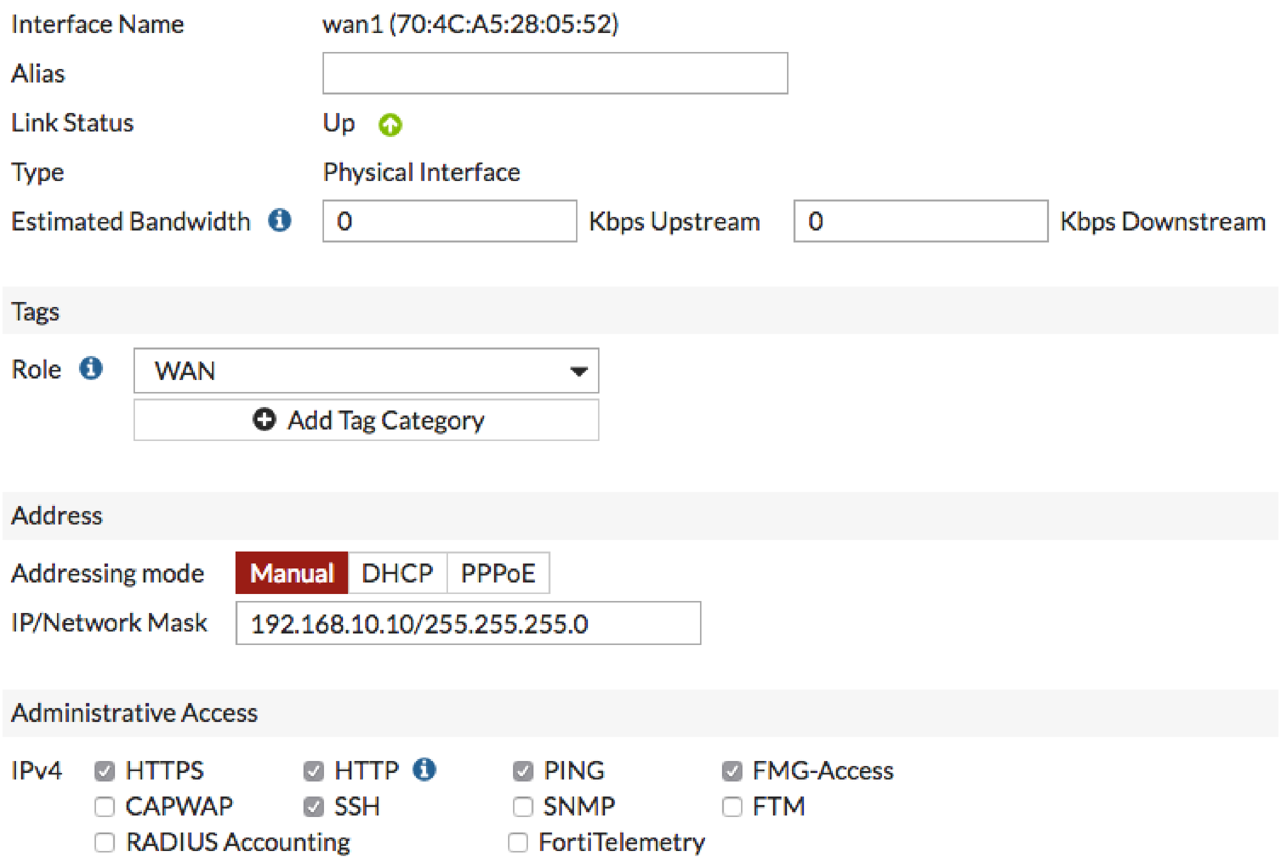
Upload option: [✓ Real Time] Every Minute Every 5 Minutes

Encrypt log transmission ℹ ●

12. Select **Test Connectivity**. An error appears because the FortiGate isn't yet authorized on the FortiAnalyzer. This authorization is configured in a later step.

Installing Accounting and Marketing

1. To edit **wan1** on **Accounting**, go to **Network > Interfaces**.
2. Set an **IP/Network Mask** for the interface that is on the same subnet as port 10 on Edge (in the example, *192.168.10.10/255.255.255.0*).
3. Under **Administrative Access**, select **HTTPS** and **SSH** to allow Edge to use this interface to manage the FortiGate.



Interface Name	wan1 (70:4C:A5:28:05:52)
Alias	
Link Status	Up
Type	Physical Interface
Estimated Bandwidth	0 Kbps Upstream 0 Kbps Downstream

Tags

Role	WAN
	Add Tag Category

Address

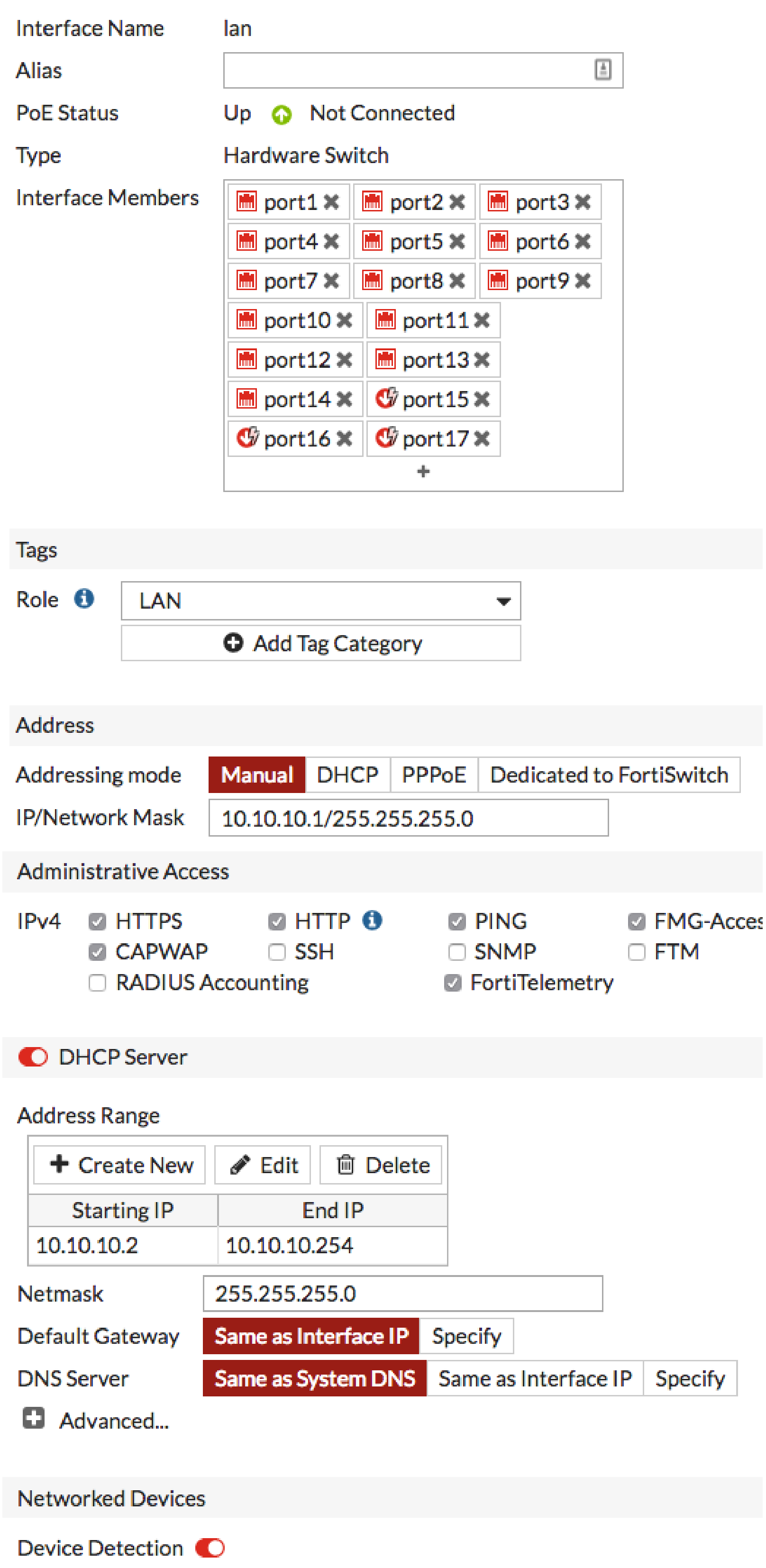
Addressing mode	[✓ Manual] DHCP PPPoE
IP/Network Mask	192.168.10.10/255.255.255.0

Administrative Access

IPv4	☑ HTTPS	☑ HTTP	☑ PING	☑ FMG-Access
	□ CAPWAP	☑ SSH	□ SNMP	□ FTM
	□ RADIUS Accounting		□ FortiTelemetry	

4. Edit the **lan** interface.
5. Set **Addressing mode** to **Manual** and set the **IP/Network Mask** to a private IP address (in the example, *10.10.10.1/255.255.255.0*).
6. Set **Administrative Access** to allow **FortiTelemetry**.
7. If you require the FortiGate to provide IP addresses using DHCP to devices that connect to this interface, enable **DHCP Server**.
8. Under **Networked Devices**, enable **Device Detection**.

It's a best practice to enable **Device Detection** on all interfaces classified as **LAN** or **DMZ**.



Interface Name: lan

Alias:

PoE Status: Up Not Connected

Type: Hardware Switch

Interface Members: port1, port2, port3, port4, port5, port6, port7, port8, port9, port10, port11, port12, port13, port14, port15, port16, port17

Tags

Role: LAN

Address

Addressing mode: [✓ Manual] DHCP PPPoE Dedicated to FortiSwitch

IP/Network Mask: 10.10.10.1/255.255.255.0

Administrative Access

IPv4: ☑ HTTPS ☑ HTTP ☑ PING ☑ FMG-Acces

☑ CAPWAP □ SSH □ SNMP □ FTM

□ RADIUS Accounting ☑ FortiTelemetry

DHCP Server

Address Range

Starting IP	End IP
10.10.10.2	10.10.10.254

Netmask: 255.255.255.0

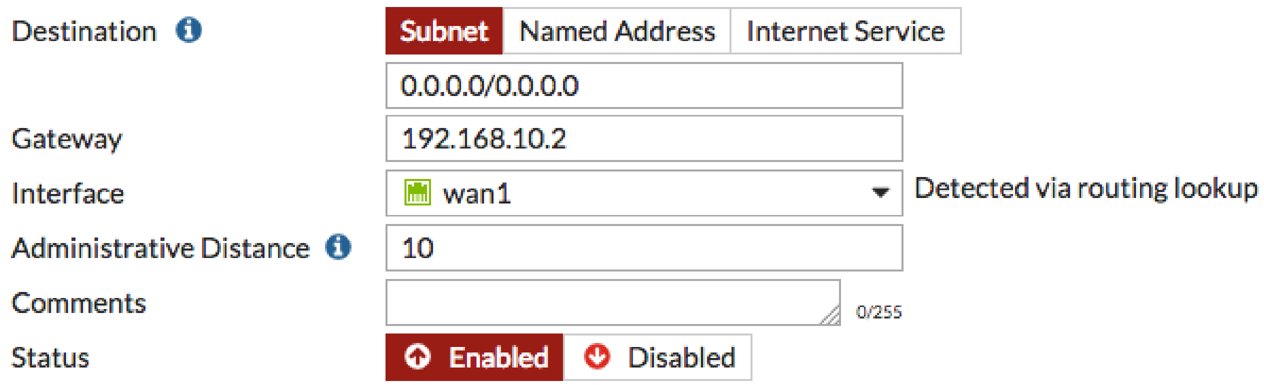
Default Gateway: [✓ Same as Interface IP] Specify

DNS Server: [✓ Same as System DNS] Same as Interface IP Specify

Networked Devices

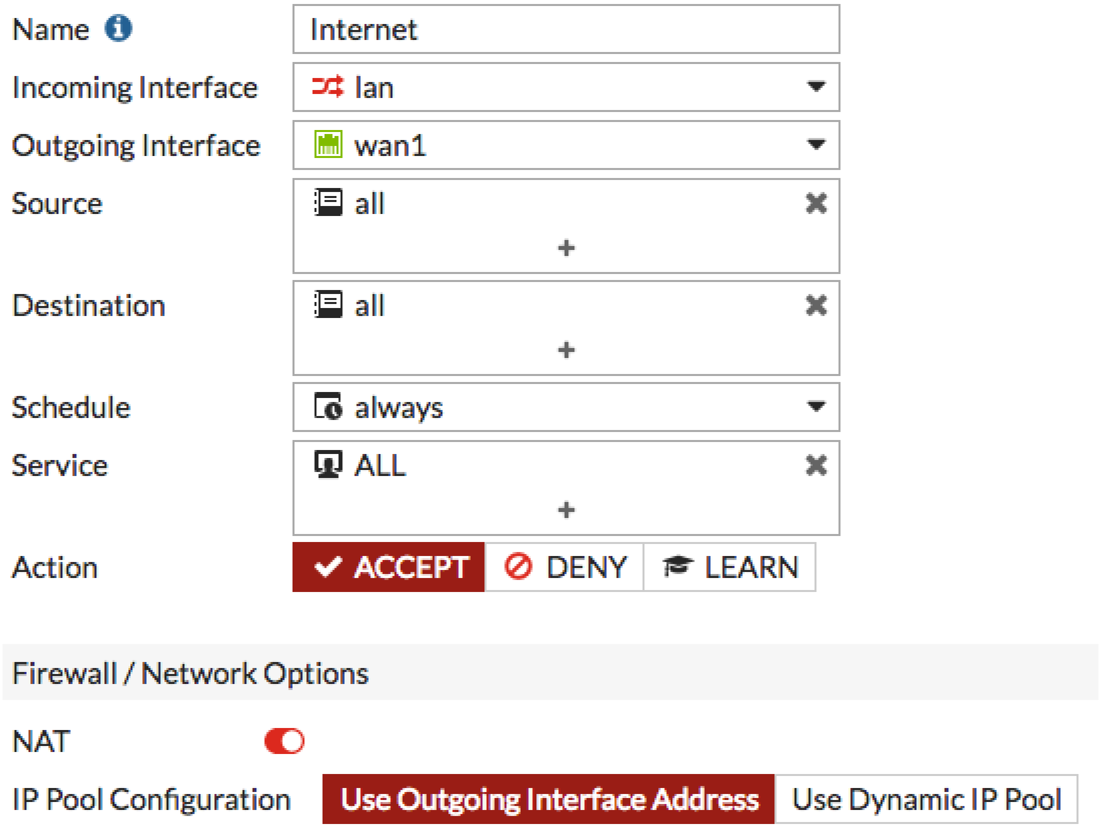
Device Detection

9. To add a static route, go to **Network > Static Routes**. Set **Gateway** to the IP address of port 10 on Edge.



Destination	**Subnet** / Named Address / Internet Service 0.0.0.0/0.0.0.0
Gateway	192.168.10.2
Interface	wan1 — Detected via routing lookup
Administrative Distance	10
Comments	0/255
Status	**Enabled** / Disabled

10. To create a policy to allow users on the Accounting network to access Edge, go to **Policy & Objects > IPv4 Policy**.

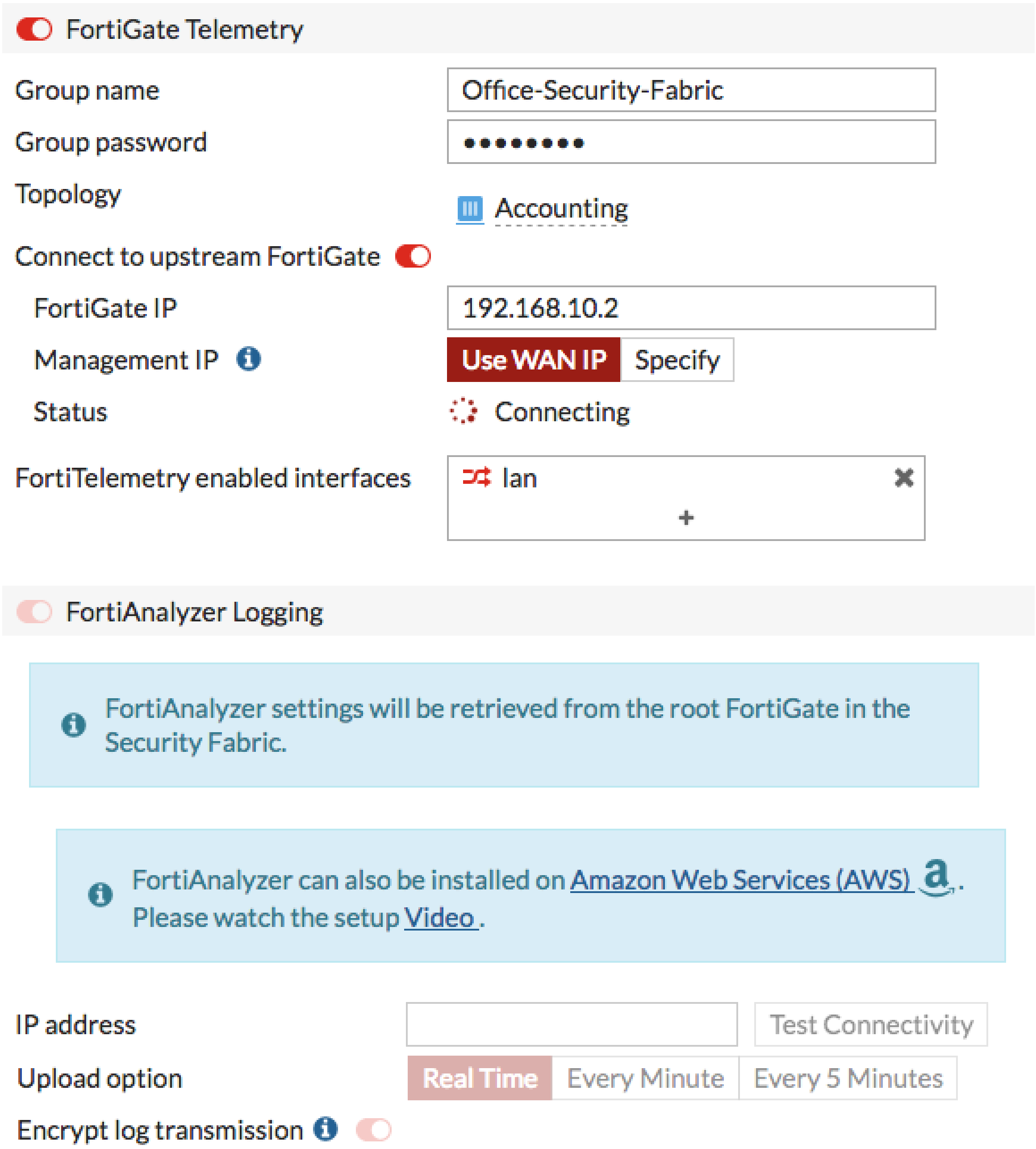


Name	Internet
Incoming Interface	lan
Outgoing Interface	wan1
Source	all
Destination	all
Schedule	always
Service	ALL
Action	**✓ ACCEPT** / DENY / LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	**Use Outgoing Interface Address** / Use Dynamic IP Pool

11. To add Accounting to the Security Fabric, go to **Security Fabric > Settings**. Enable **FortiGate Telemetry**, then enter the same **Group name** and **Group password** that you set previously on Edge (the **Group password** option isn’t available isn’t available in FortiOS 6.0.3 and later).
12. Enable **Connect to upstream FortiGate** and enter the IP address of port 10 on Edge.
13. **FortiAnalyzer Logging** is enabled by default. Settings for the FortiAnalyzer are retrieved when Accounting connects to Edge.



FortiGate Telemetry

Group name: Office-Security-Fabric

Group password: ●●●●●●●●●

Topology: Accounting

Connect to upstream FortiGate

FortiGate IP: 192.168.10.2

Management IP: Use WAN IP | Specify

Status: Connecting

FortiTelemetry enabled interfaces: lan

FortiAnalyzer Logging

FortiAnalyzer settings will be retrieved from the root FortiGate in the Security Fabric.

FortiAnalyzer can also be installed on Amazon Web Services (AWS) . Please watch the setup Video .

IP address: Test Connectivity

Upload option: Real Time | Every Minute | Every 5 Minutes

Encrypt log transmission

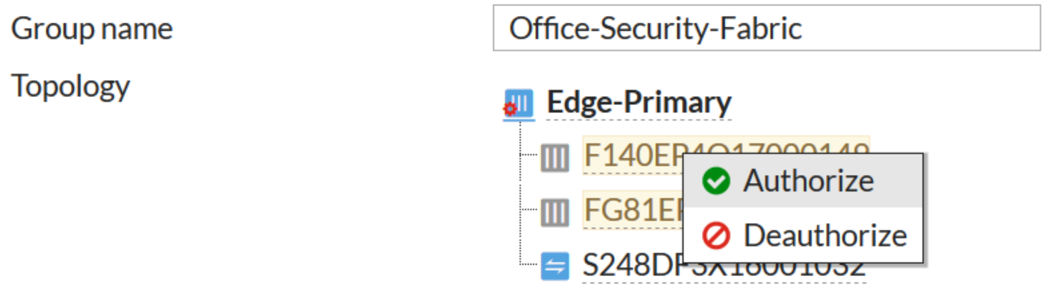
14. Connect WAN 1 on Accounting to port 10 on Edge.
15. Connect and configure Marketing, using the same method that you used to configure Accounting. Make sure you complete the following steps:
    - Configure WAN 1 to connect to Edge (IP address: 192.168.200.10/255.255.255.0) and allow HTTPS and SSH access.
    - Configure the LAN interface for the Marketing network (IP address: 10.10.200.2/255.255.255.0).

    a. Create a static route pointing traffic to port 11 on Edge.

    b. Create a policy to allow users on the Marketing network to access Edge.

    c. Add Marketing to the Security Fabric.
16. If you're using FortiOS 6.0.3 and later, connect to Edge and go to **Security Fabric > Settings**. Authorize both

Accounting and Marketing to join the Security Fabric.



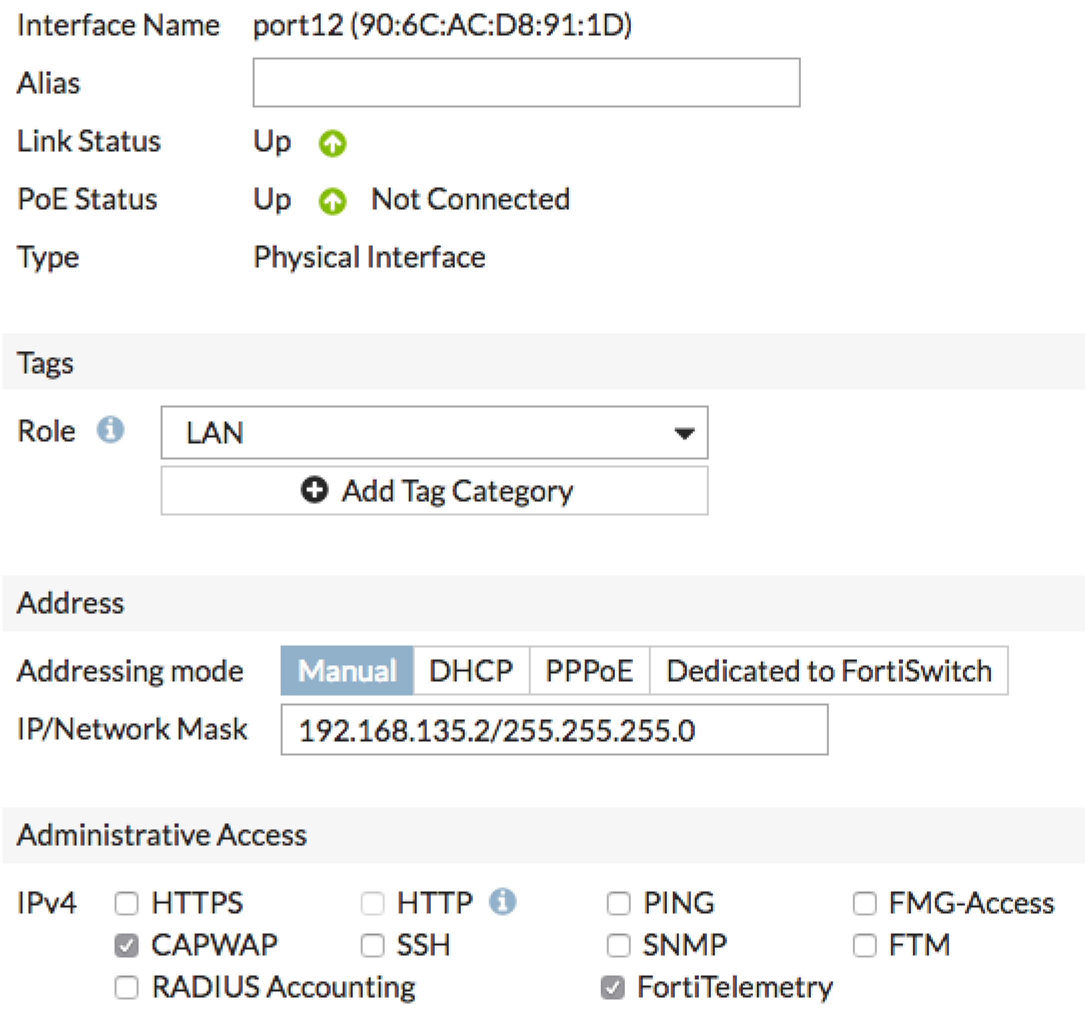
Group name: Office-Security-Fabric

Topology:

- Edge-Primary
  - F140EP4Q17000148
  - FG81EF
  - S248DF3X16001032

Installing Sales

1. To edit the interface on Marketing that connects to Sales (in the example, port12), go to **Network > Interfaces**.
2. Set an **IP/Network Mask** for the interface (in the example, *192.168.135.2/255.255.255.0*).
3. Set **Administrative Access** to allow **FortiTelemetry**.



Interface Name	port12 (90:6C:AC:D8:91:1D)
Alias	
Link Status	Up
PoE Status	Up Not Connected
Type	Physical Interface

Tags

Role: LAN

Address

Addressing mode: [✓ Manual] DHCP PPPoE Dedicated to FortiSwitch

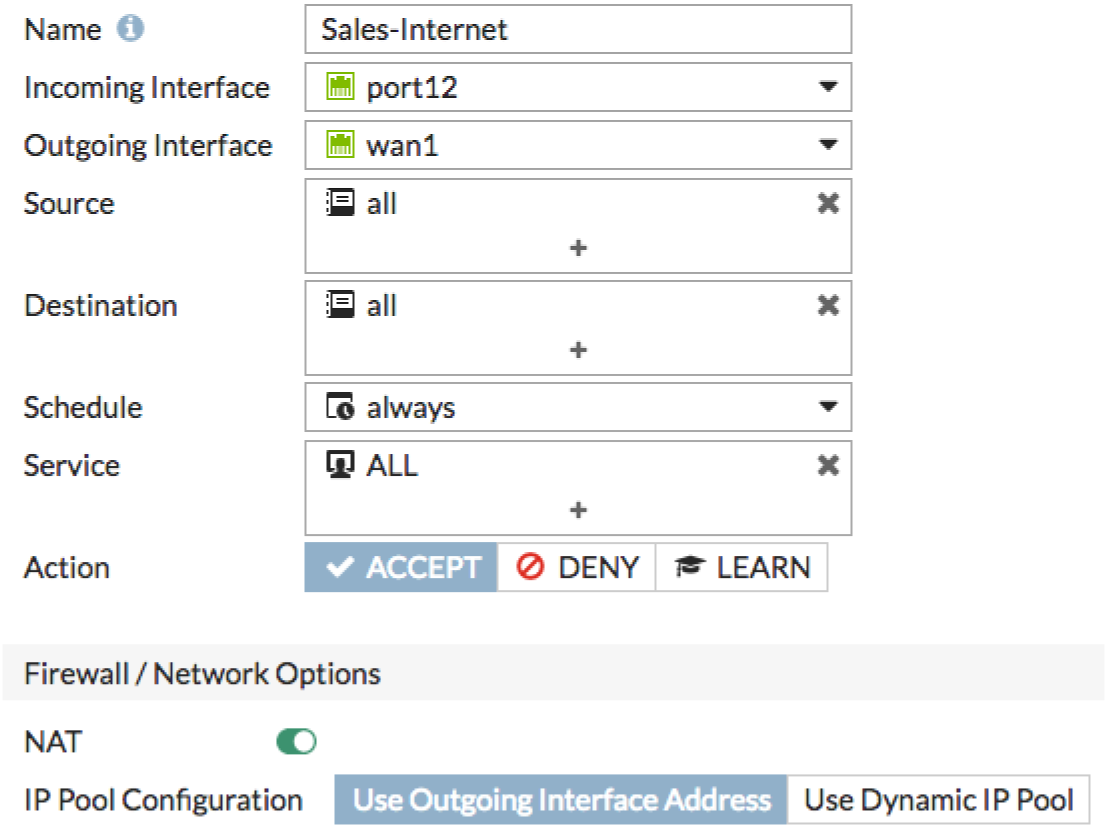
IP/Network Mask: 192.168.135.2/255.255.255.0

Administrative Access

IPv4 □ HTTPS □ HTTP □ PING □ FMG-Access ☑ CAPWAP □ SSH □ SNMP □ FTM □ RADIUS Accounting ☑ FortiTelemetry

4. To create a policy for traffic from Sales to Edge, go to **Policy & Objects > IPv4 Policy**.

5. Enable **NAT**.

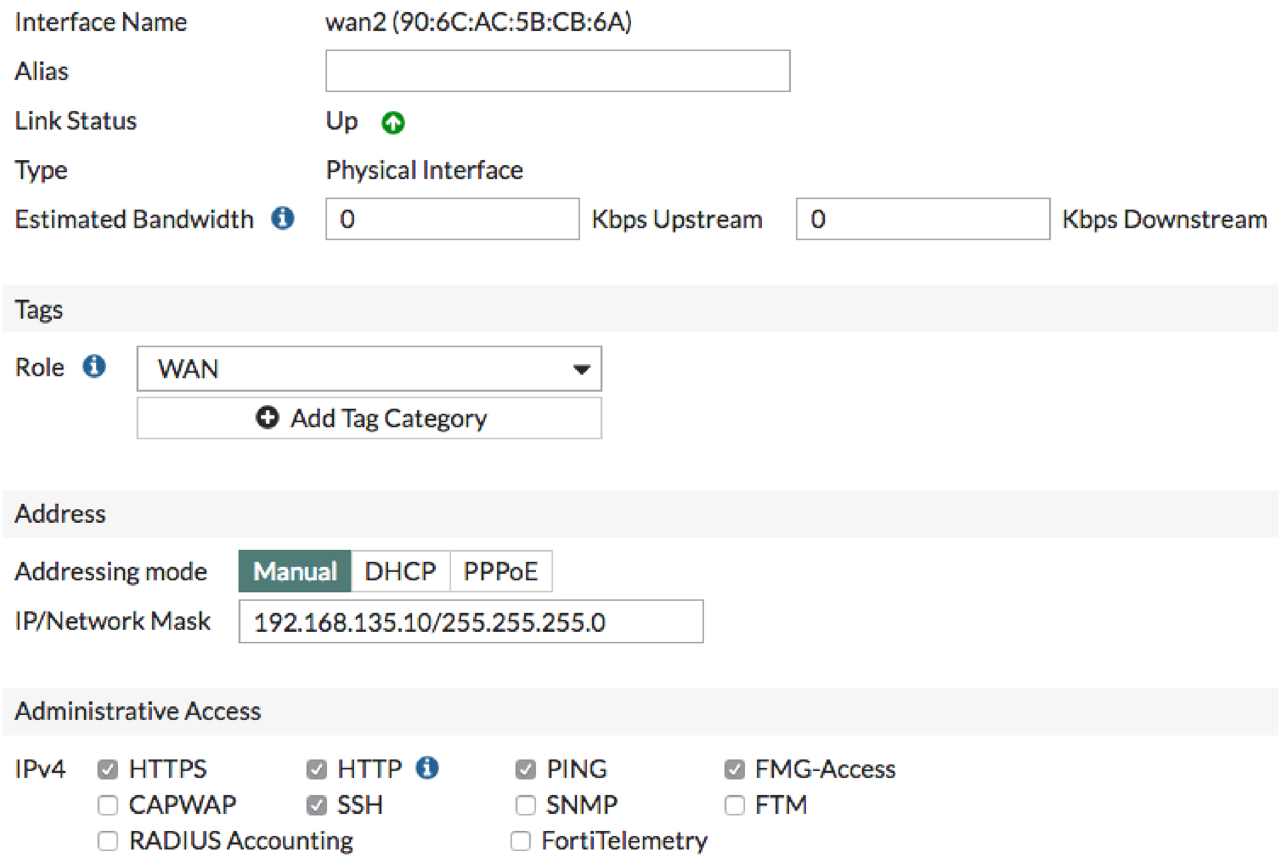


Name	Sales-Internet
Incoming Interface	port12
Outgoing Interface	wan1
Source	all
Destination	all
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

6. To edit wan2 on Sales, go to **Network > Interfaces**.
7. Set an **IP/Network Mask** for the interface that's on the same subnet as the internal 14 interface on Marketing (in the example, *192.168.135.10/255.255.255.0*).
8. Under **Administrative Access**, select **HTTPS** and **SSH**.



Interface Name wan2 (90:6C:AC:5B:CB:6A)

Alias

Link Status Up

Type Physical Interface

Estimated Bandwidth 0 Kbps Upstream 0 Kbps Downstream

Tags

Role WAN

Add Tag Category

Address

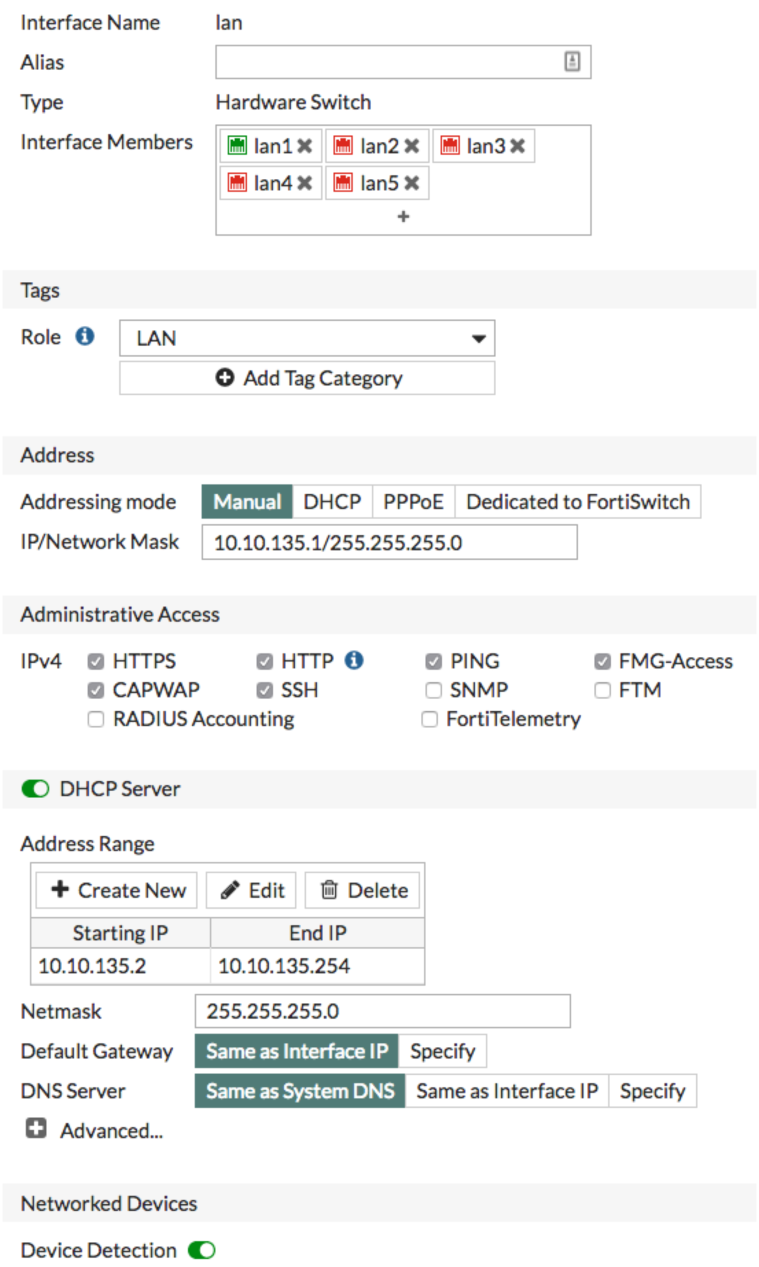
Addressing mode [✓ Manual] DHCP PPPoE

IP/Network Mask 192.168.135.10/255.255.255.0

Administrative Access

IPv4 ☑ HTTPS ☑ HTTP ☑ PING ☑ FMG-Access
□ CAPWAP ☑ SSH □ SNMP □ FTM
□ RADIUS Accounting □ FortiTelemetry

9. Edit the **lan** interface.
10. Set **Addressing Mode** to **Manual**, and set the **IP/Network Mask** to a private IP address (in the example, *10.10.135.1*/255.255.255.0).
11. Set **Administrative Access** to allow **FortiTelemetry**.
12. If you require the FortiGate to provide IP addresses, using DHCP, to devices that connect to this interface, enable **DHCP Server**.
13. Under **Networked Devices**, enable **Device Detection**.



Interface Name lan

Alias

Type Hardware Switch

Interface Members lan1 ✖ lan2 ✖ lan3 ✖ lan4 ✖ lan5 ✖ +

Tags

Role LAN

Add Tag Category

Address

Addressing mode [✓ Manual] DHCP PPPoE Dedicated to FortiSwitch

IP/Network Mask 10.10.135.1/255.255.255.0

Administrative Access

IPv4 ☑ HTTPS ☑ HTTP ☑ PING ☑ FMG-Access ☑ CAPWAP ☑ SSH □ SNMP □ FTM □ RADIUS Accounting □ FortiTelemetry

DHCP Server

Address Range

Create New Edit Delete

Starting IP	End IP
10.10.135.2	10.10.135.254

Netmask 255.255.255.0

Default Gateway [✓ Same as Interface IP] Specify

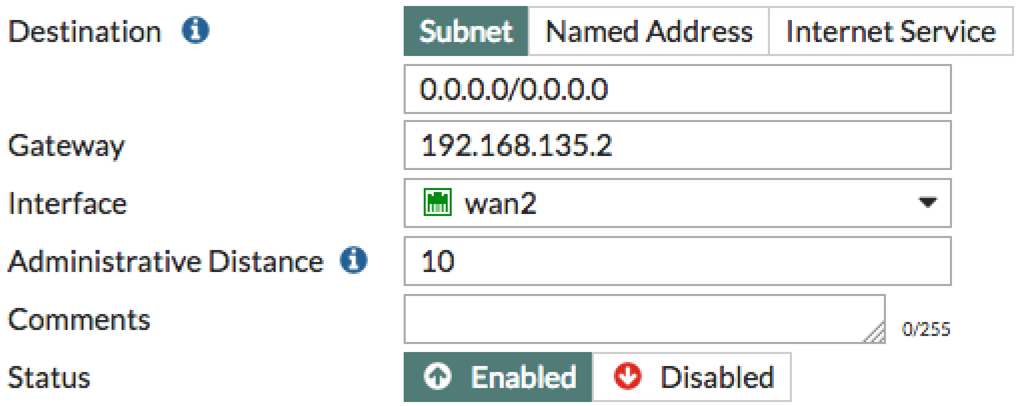
DNS Server [✓ Same as System DNS] Same as Interface IP Specify

Advanced...

Networked Devices

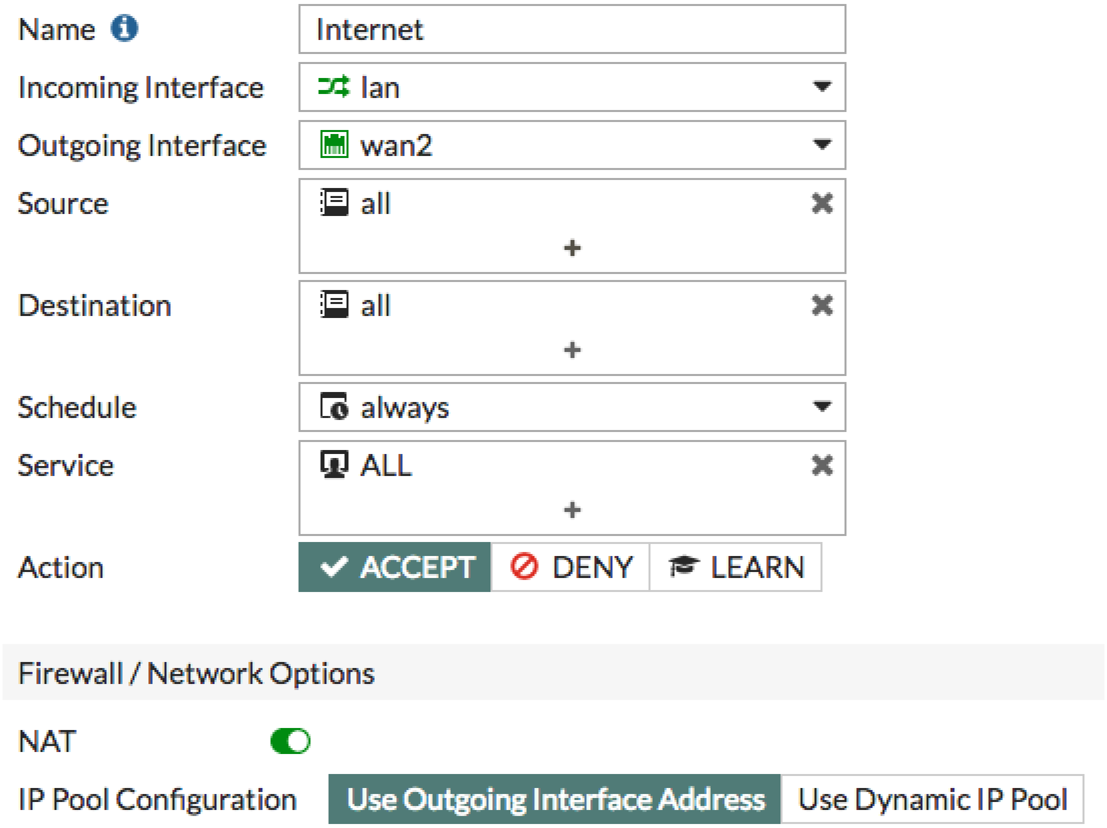
Device Detection

14. To add a default route, go to **Network > Static Routes** and select **Create New**. Set **Gateway** to the IP address of the internal 14 interface on Marketing.



Destination	[✓ Subnet] Named Address Internet Service
	0.0.0.0/0.0.0.0
Gateway	192.168.135.2
Interface	wan2
Administrative Distance	10
Comments	0/255
Status	[✓ Enabled] Disabled

15. To create a policy that allow users on the Sales network to access Marketing, go to **Policy & Objects > IPv4 Policy**.

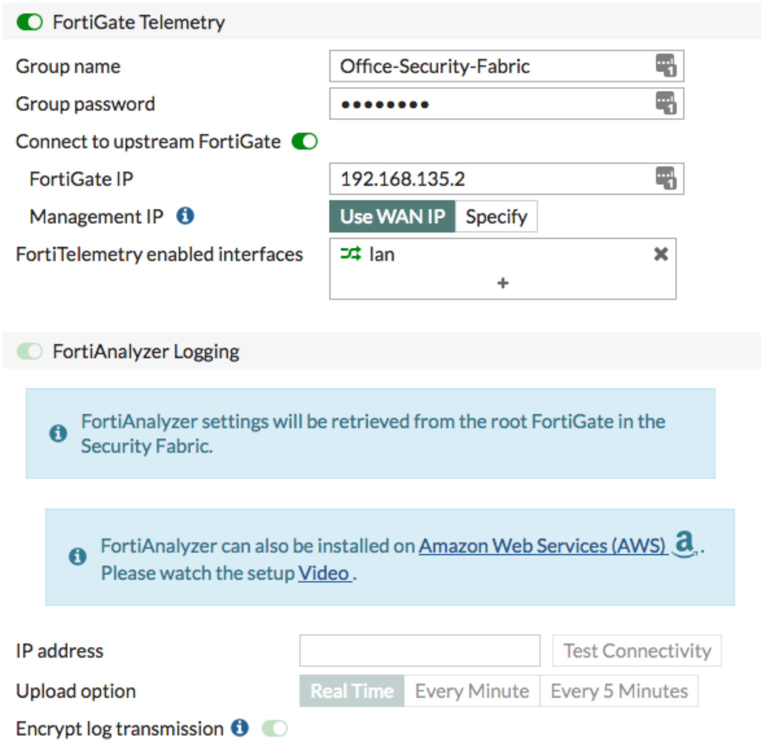


Name	Internet
Incoming Interface	lan
Outgoing Interface	wan2
Source	all
Destination	all
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

16. To add Sales to the Security Fabric, go to **Security Fabric > Settings**. Enable **FortiGate Telemetry**, then enter the same **Group name** and **Group password** that you set previously..
17. Enable **Connect to upstream FortiGate** and enter the IP address of the internal 14 interface on Marketing.
18. **FortiAnalyzer Logging** is enabled by default. Settings for the FortiAnalyzer are retrieved when Sales connects to Edge.



FortiGate Telemetry

Group name	Office-Security-Fabric
Group password	••••••••
Connect to upstream FortiGate	●
FortiGate IP	192.168.135.2
Management IP	Use WAN IP / Specify
FortiTelemetry enabled interfaces	lan

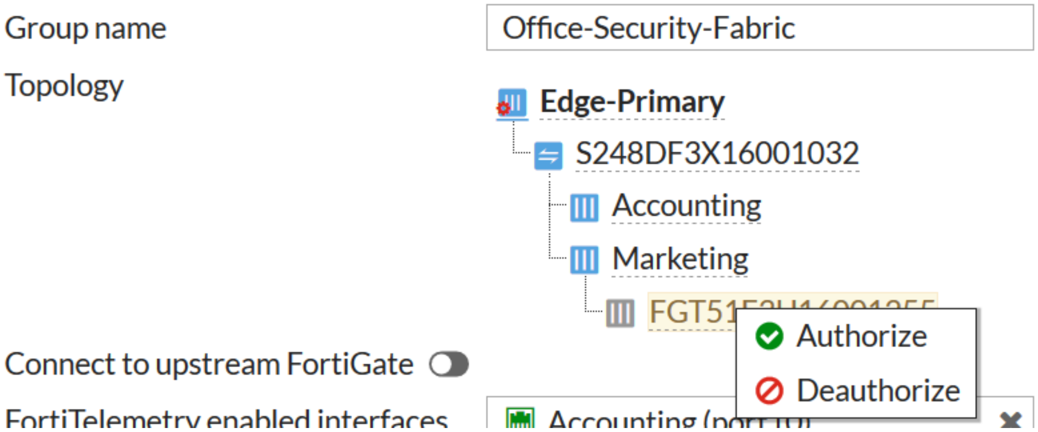
FortiAnalyzer Logging

FortiAnalyzer settings will be retrieved from the root FortiGate in the Security Fabric.

FortiAnalyzer can also be installed on Amazon Web Services (AWS). Please watch the setup Video.

IP address	Test Connectivity
Upload option	Real Time / Every Minute / Every 5 Minutes
Encrypt log transmission	

19. Connect WAN 2 on Sales to internal 14 on Marketing.
20. If you’re using FortiOS 6.0.3 and later, connect to Edge and go to **Security Fabric > Settings**. Authorize Sales to join the Security Fabric.



Group name	Office-Security-Fabric
Topology	Edge-Primary S248DF3X16001032 Accounting Marketing FGT51
Connect to upstream FortiGate	○
FortiTelemetry enabled interfaces	Accounting (po

Configuring the FortiAnalyzer

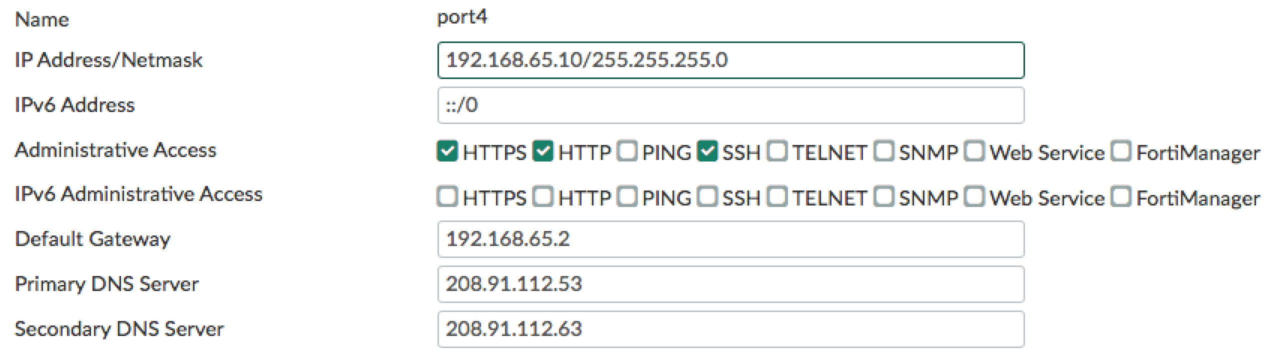
To use the FortiAnalyzer in the Security Fabric, make sure that the firmware is compatible with the version of FortiOS on the FortiGates. To check for compatibility, see the FortiAnalyzer Release Notes.

1. To edit the port on FortiAnalyzer that connects to Edge (in the example, port4), go to **System Settings > Network** and select **All Interfaces**.
2. Set **IP Address/Netmask** to the IP address that you use to configure the Security Fabric settings on Edge

(*192.168.65.10/255.255.255.0*).

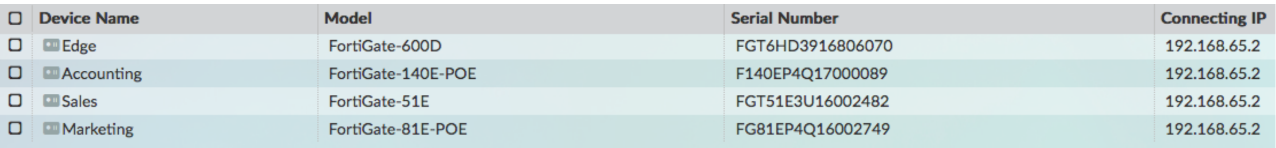
3. Add a **Default Gateway**, using the IP address of port 16 on Edge.

> The **Default Gateway** setting may not appear until you save the settings with the new IP address.



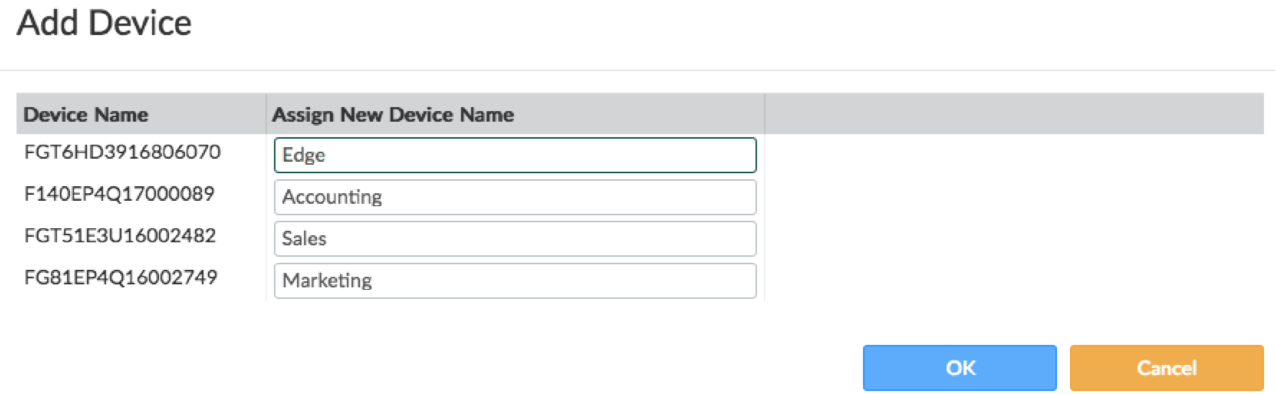
Name	port4
IP Address/Netmask	192.168.65.10/255.255.255.0
IPv6 Address	::/0
Administrative Access	☑ HTTPS ☑ HTTP □ PING ☑ SSH □ TELNET □ SNMP □ Web Service □ FortiManager
IPv6 Administrative Access	□ HTTPS □ HTTP □ PING □ SSH □ TELNET □ SNMP □ Web Service □ FortiManager
Default Gateway	192.168.65.2
Primary DNS Server	208.91.112.53
Secondary DNS Server	208.91.112.63

4. Go to **Device Manager**. The FortiGate devices are listed as **Unregistered**.



□	Device Name	Model	Serial Number	Connecting IP
□	Edge	FortiGate-600D	FGT6HD3916806070	192.168.65.2
□	Accounting	FortiGate-140E-POE	F140EP4Q17000089	192.168.65.2
□	Sales	FortiGate-51E	FGT51E3U16002482	192.168.65.2
□	Marketing	FortiGate-81E-POE	FG81EP4Q16002749	192.168.65.2

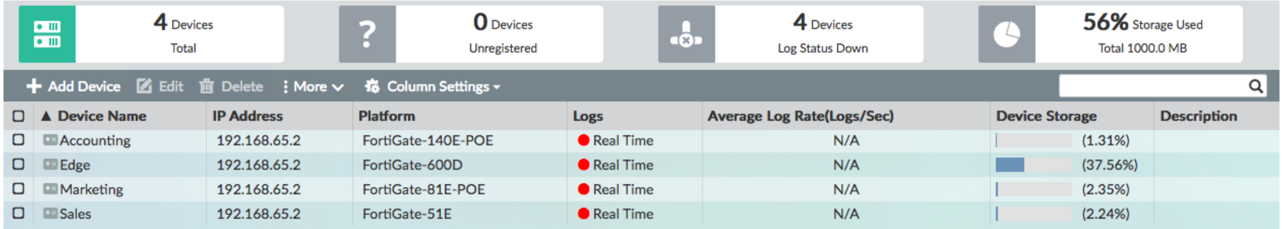
5. Select the FortiGate devices, then select **+Add**.



Add Device

Device Name	Assign New Device Name
FGT6HD3916806070	Edge
F140EP4Q17000089	Accounting
FGT51E3U16002482	Sales
FG81EP4Q16002749	Marketing

6. The FortiGate devices now appear as **Registered**.

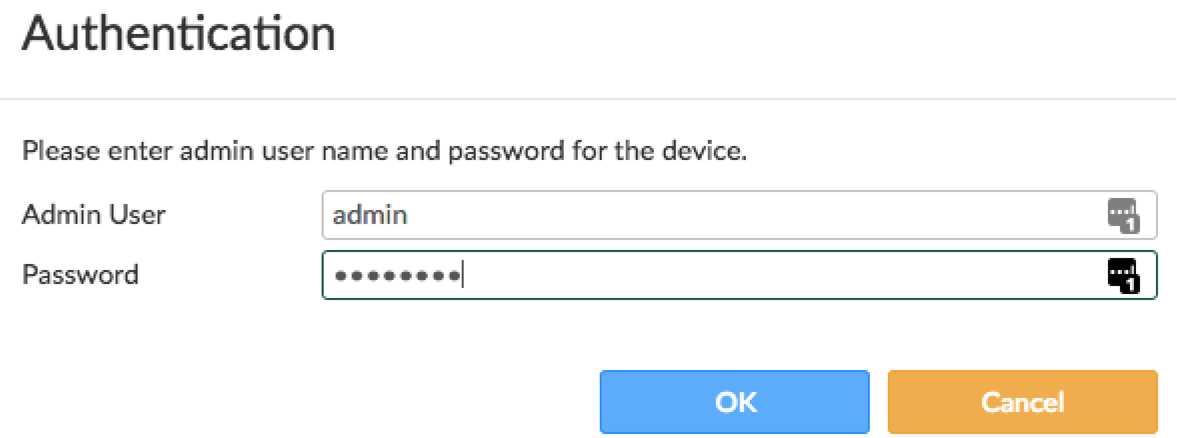


□	▲ Device Name	IP Address	Platform	Logs	Average Log Rate(Logs/Sec)	Device Storage	Description
□	Accounting	192.168.65.2	FortiGate-140E-POE	● Real Time	N/A	(1.31%)	
□	Edge	192.168.65.2	FortiGate-600D	● Real Time	N/A	(37.56%)	
□	Marketing	192.168.65.2	FortiGate-81E-POE	● Real Time	N/A	(2.35%)	
□	Sales	192.168.65.2	FortiGate-51E	● Real Time	N/A	(2.24%)	

7. After a moment, a warning icon appears beside Edge because the FortiAnalyzer needs administrative access to the root FortiGate in the Security Fabric.

You may need to refresh the page before the icon appears.

8. Double-click on the FortiGate to enter the **Authentication** information.



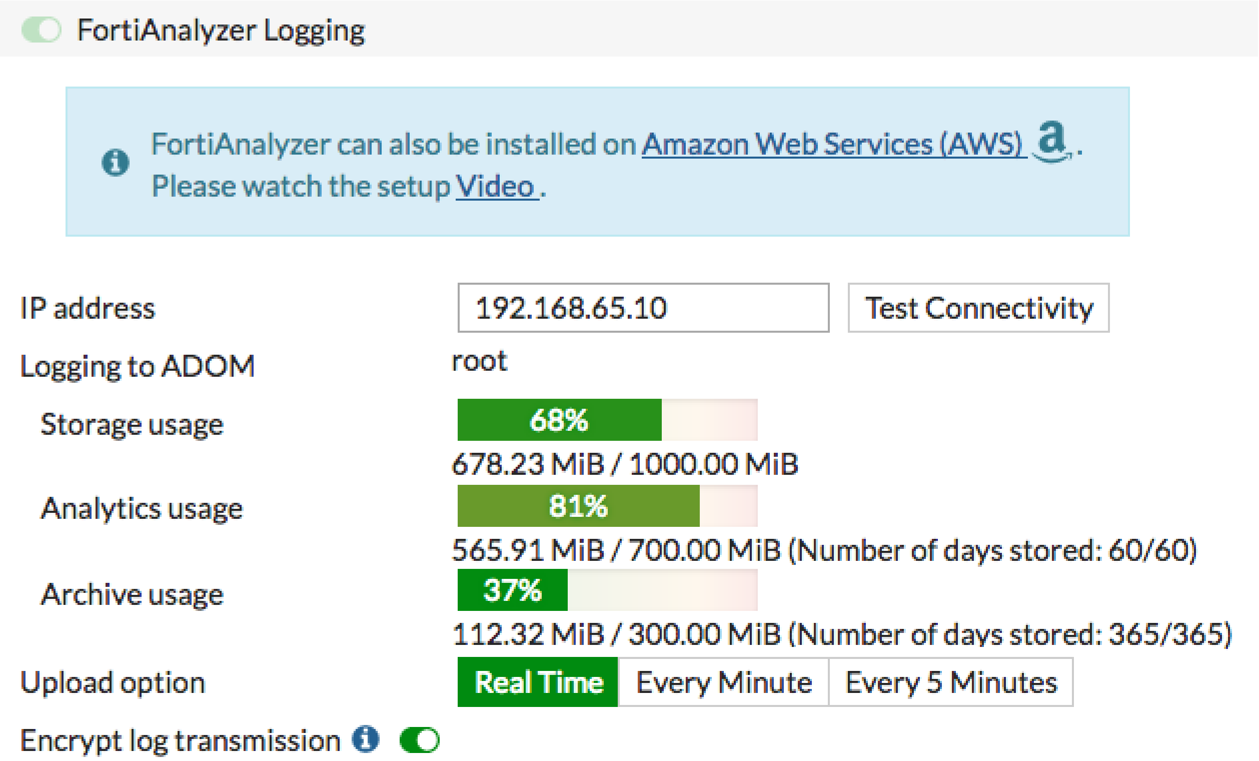
Authentication

Please enter admin user name and password for the device.

Admin User: admin

Password: ••••••••

9. On Edge, go to **Security Fabric > Settings**. **FortiAnalyzer Logging** now shows **Storage usage** information.



FortiAnalyzer Logging

FortiAnalyzer can also be installed on Amazon Web Services (AWS). Please watch the setup Video.

IP address: 192.168.65.10

Logging to ADOM: root

Storage usage: 68% — 678.23 MiB / 1000.00 MiB

Analytics usage: 81% — 565.91 MiB / 700.00 MiB (Number of days stored: 60/60)

Archive usage: 37% — 112.32 MiB / 300.00 MiB (Number of days stored: 365/365)

Upload option: Real Time | Every Minute | Every 5 Minutes

Encrypt log transmission

Adding security profiles (optional)

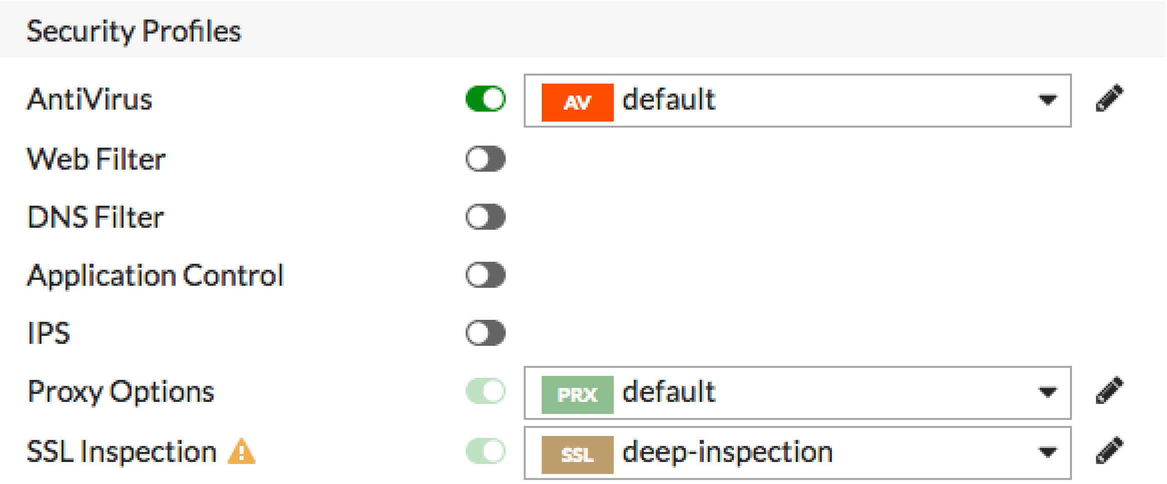
The Security Fabric allows you to distribute security profiles to different FortiGates in your network, which can lessen the workload of each device and avoid creating bottlenecks. For example, you can implement antivirus scanning on Edge while the ISFW FortiGates apply application control and web filtering.

This results in distributed processing between the FortiGates in the Security Fabric, which reduces the load on each one. It also allows you to customize the web filtering and application control for the specific needs of the Accounting network since other internal networks may have different application control and web filtering requirements.

This configuration may result in threats getting through Edge, which means you should very closely limit access to the network connections between the FortiGates in the network.

1. To edit the policy that allows traffic from Accounting to the Internet, connect to Edge and go to **Policy & Objects > IPv4 Policy**.
2. Under **Security Profiles**, enable **AntiVirus** and select the **default** profile.
3. **SSL Inspection** is enabled by default. Set it to the **deep-inspection** profile.

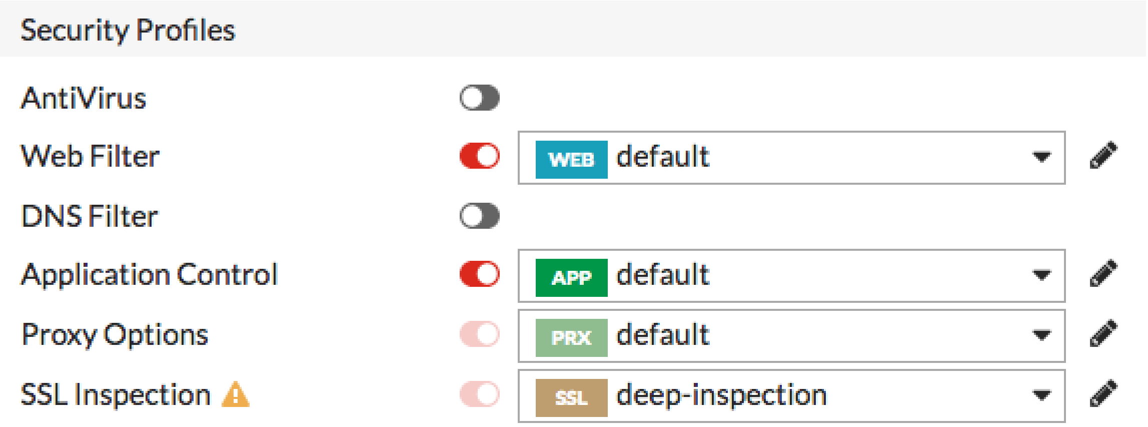
Using the **deep-inspection** profile may cause certificate errors.



Security Profiles

AntiVirus	●	AV default
Web Filter	○	
DNS Filter	○	
Application Control	○	
IPS	○	
Proxy Options	●	PRX default
SSL Inspection ⚠	●	SSL deep-inspection

4. Do the same for the policy that allows traffic from Marketing to the Internet.
5. To edit the policy that allows traffic from the Accounting network to Edge, connect to Accounting and go to **Policy & Objects > IPv4 Policy**.
6. Under **Security Profiles**, enable **Web Filter** and **Application Control**. Select the **default** profile for both.
7. **SSL Inspection** is enabled by default. Set it to the **deep-inspection** profile.



Security Profiles

AntiVirus	○	
Web Filter	●	WEB default
DNS Filter	○	
Application Control	●	APP default
Proxy Options	●	PRX default
SSL Inspection ⚠	●	SSL deep-inspection

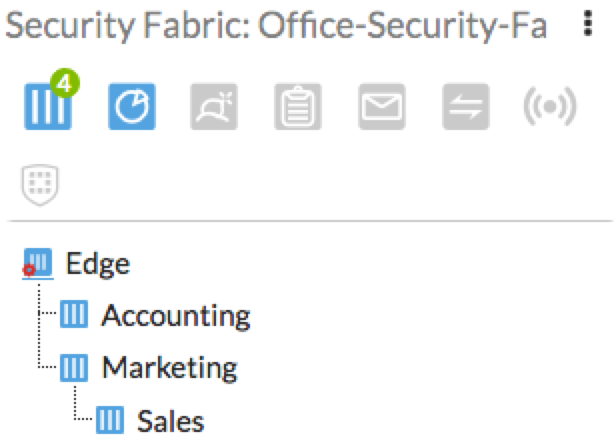
8. Repeat this step for both Marketing and Sales.

Results

1. On Edge, go to **Dashboard > Main**. The Security Fabric widget displays the names of the FortiGates in the Security Fabric.

   The icons on the top of the widget indicate the other Fortinet devices that can be used in a Security Fabric. Devices in blue are detected in your network, devices in gray aren't detected in your network, and devices in red are also not detected in your network but are recommended for a Security Fabric.

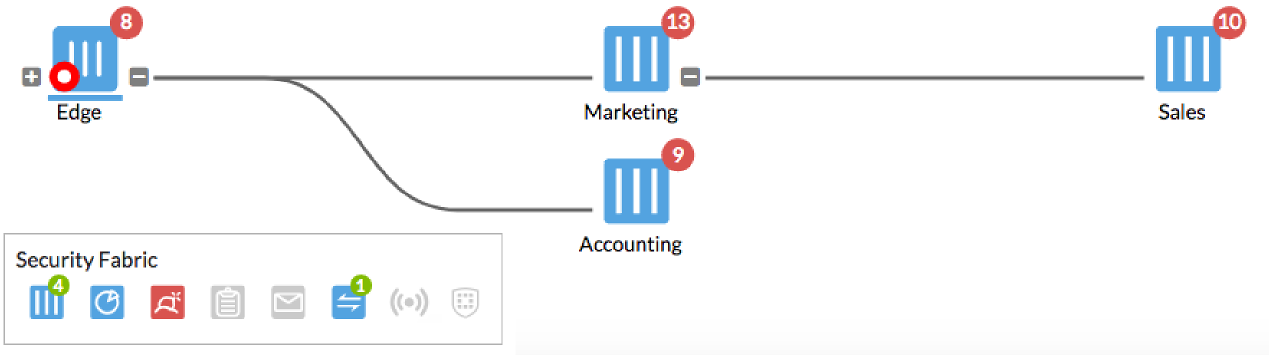
   If either of this widgets doesn't appear on your dashboard, you can add them using the settings button in the bottom right corner.



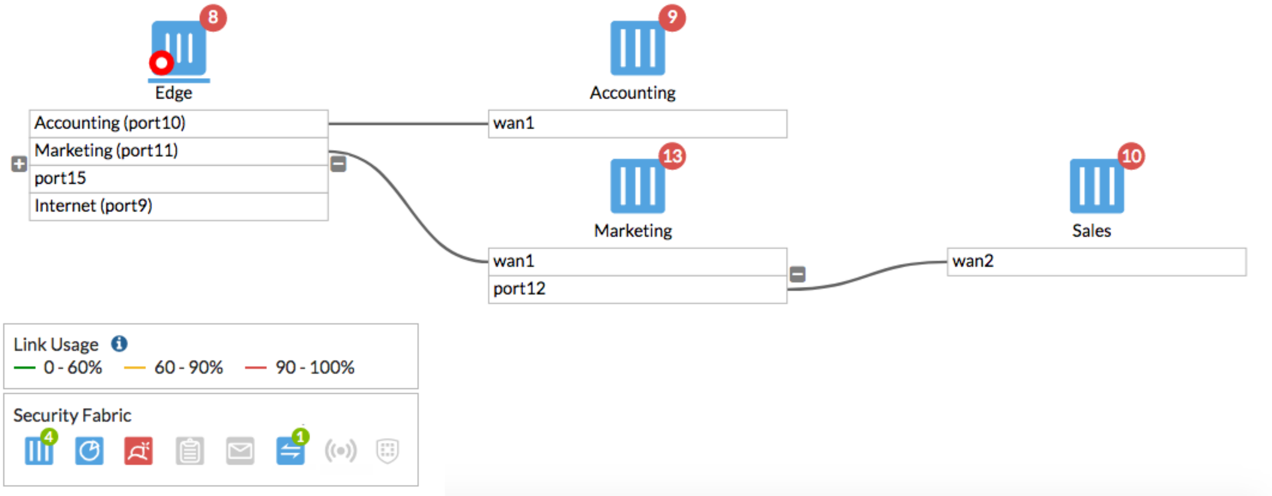
Security Fabric: Office-Security-Fa

- Edge
  - Accounting
  - Marketing
    - Sales

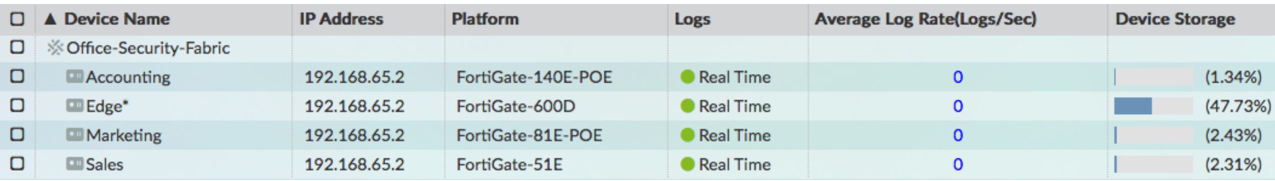
2. Go to **Security Fabric > Physical Topology**. This page shows a visualization of access layer devices in the Security Fabric.



3. Go to **Security Fabric > Logical Topology**. This dashboard displays information about the interface (logical or physical) that each device in the Security Fabric connects.

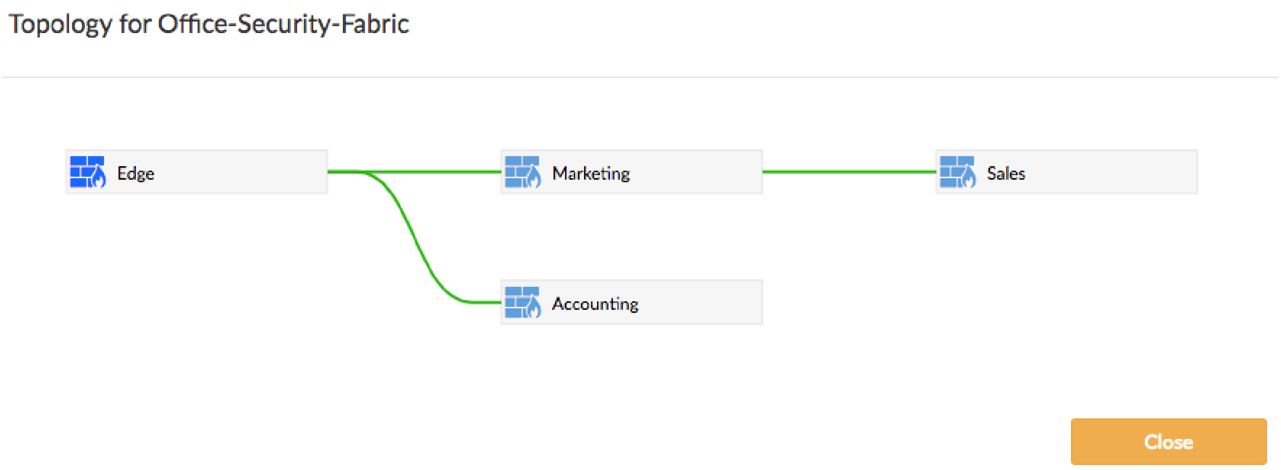


4. On the FortiAnalyzer, go to **Device Manager**. The FortiGates are now shown as part of a Security Fabric group. The * beside Edge indicates that it's the root FortiGate in the Security Fabric.



☐	▲ Device Name	IP Address	Platform	Logs	Average Log Rate(Logs/Sec)	Device Storage
☐	Office-Security-Fabric					
☐	Accounting	192.168.65.2	FortiGate-140E-POE	● Real Time	0	(1.34%)
☐	Edge*	192.168.65.2	FortiGate-600D	● Real Time	0	(47.73%)
☐	Marketing	192.168.65.2	FortiGate-81E-POE	● Real Time	0	(2.43%)
☐	Sales	192.168.65.2	FortiGate-51E	● Real Time	0	(2.31%)

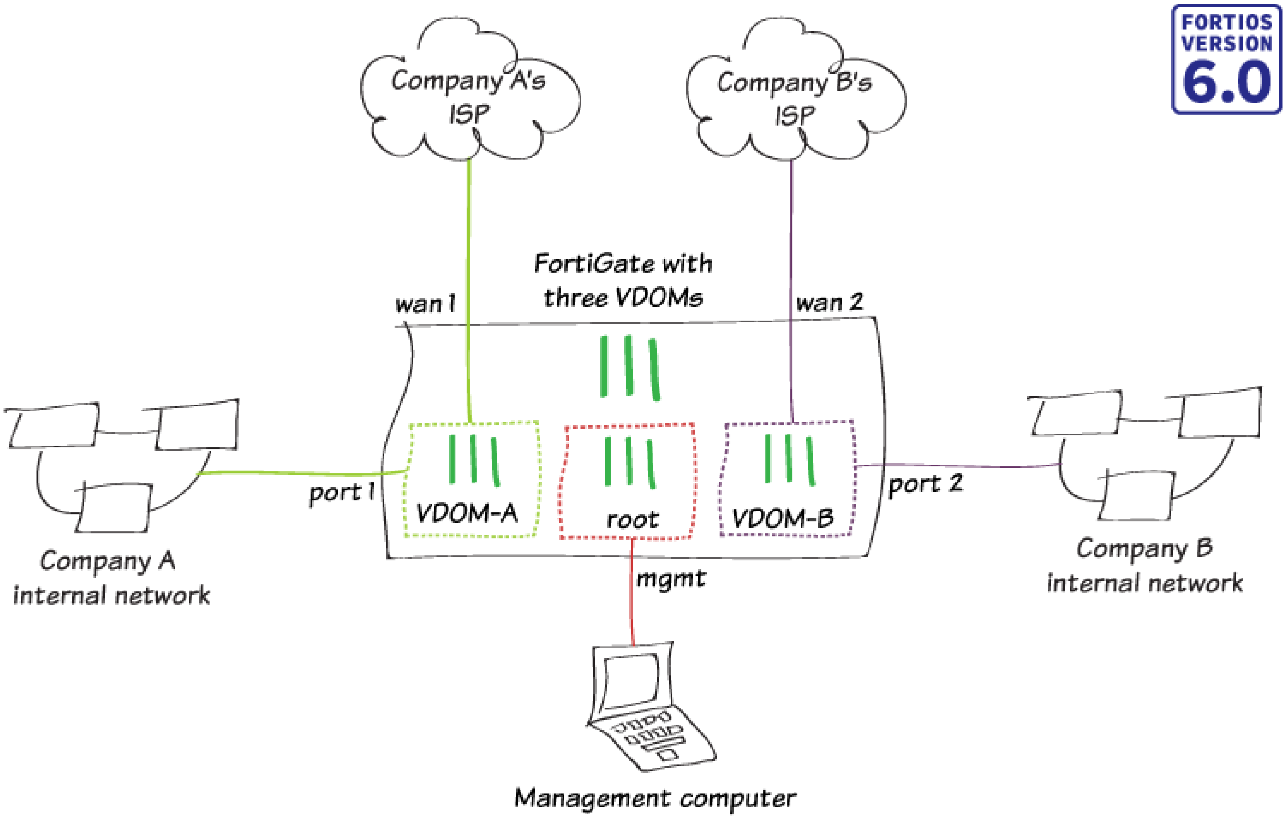
5. Right-click on the Security Fabric group and select **Fabric Topology**. The topology of the Security Fabric is displayed.



For further reading, check out Configuring the Security Fabric in the FortiOS 6.0 Online Help.

VDOM configuration

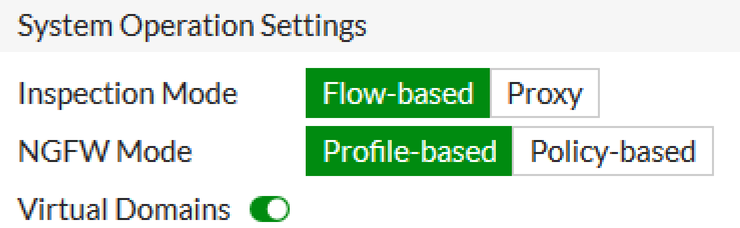
FORTIOS VERSION 6.0



In this recipe, you use virtual domains (VDOMs) to provide Internet access for two different companies (called Company A and Company B) using a single FortiGate.

Enabling and creating VDOMs

1. To enable VDOMs, go to **System > Settings**. Under **System Operation Settings**, enable **Virtual Domains**.
2. Select **OK** to confirm the VDOM mode change. When the change is applied, you are logged out of the FortiGate.



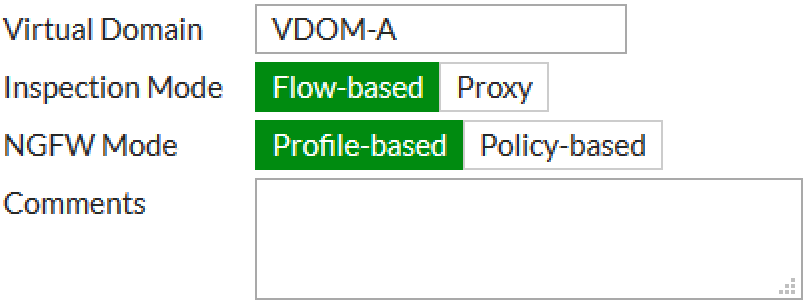
System Operation Settings

Inspection Mode [✓ Flow-based] Proxy

NGFW Mode [✓ Profile-based] Policy-based

Virtual Domains ●

3. Log back in. To edit global settings, select **Global** from the dropdown menu located in the top-left corner.
4. To create a new VDOM, go to **System > VDOM** and select **Create New**. Enter a name (*VDOM-A*).



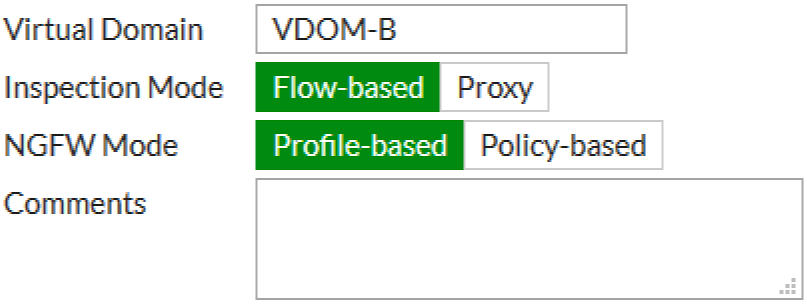
Virtual Domain VDOM-A

Inspection Mode [✓ Flow-based] Proxy

NGFW Mode [✓ Profile-based] Policy-based

Comments

5. Create a second VDOM, called *VDOM-B*.



Virtual Domain VDOM-B

Inspection Mode [✓ Flow-based] Proxy

NGFW Mode [✓ Profile-based] Policy-based

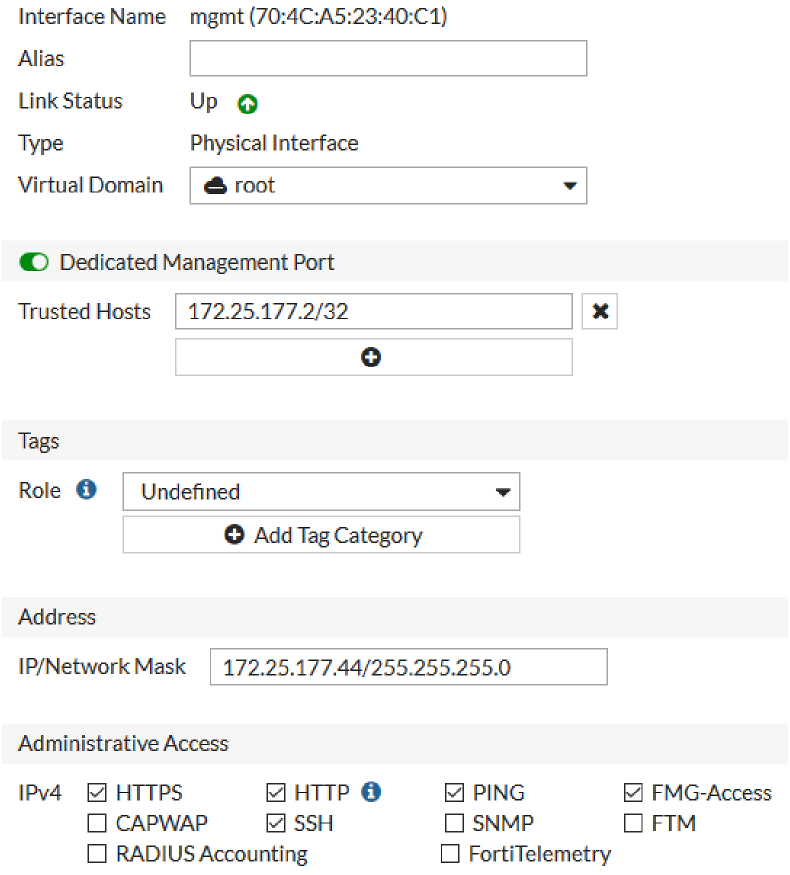
Comments

Configuring a management interface

By default, **root** is the management VDOM. You use the management VDOM to access the global settings for the FortiGate as well as the settings for each VDOM.

1. To configure an interface to connect to the management VDOM, go to **Global > Network > Interfaces** and edit an interface (in the example, **mgmt**).
2. Enable **Dedicated Management Port** and add the management computers as **Trusted Host**.

3. Set **Administrative Access** to **HTTPS**, **PING**, and **SSH**.



Interface Name	mgmt (70:4C:A5:23:40:C1)
Alias	
Link Status	Up
Type	Physical Interface
Virtual Domain	root

Dedicated Management Port

Trusted Hosts	172.25.177.2/32

Tags

Role	Undefined

Address

IP/Network Mask	172.25.177.44/255.255.255.0

Administrative Access

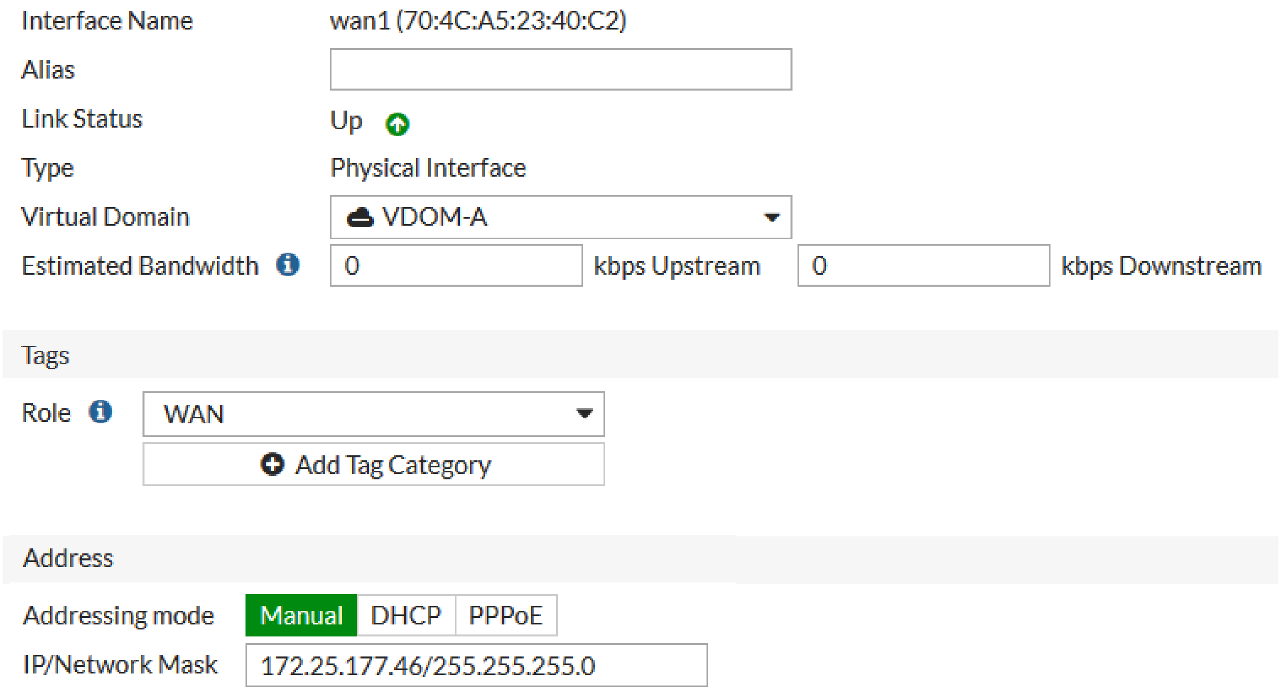
IPv4	☑ HTTPS	☑ HTTP	☑ PING	☑ FMG-Access
	☐ CAPWAP	☑ SSH	☐ SNMP	☐ FTM
	☐ RADIUS Accounting		☐ FortiTelemetry	

Assigning interfaces

In this example, you assign two interfaces each to VDOM-A and VDOM-B: one for Internet access and one for use by the local network.

You can't change the VDOM assignment if an interface is used in an existing FortiGate configuration. You may need to delete existing policies and routes in order to add a particular interface, as some FortiGate models have default configurations.

1. To assign an interface that provides VDOM-A with Internet access, go to **Network > Interfaces** and edit an interface (in the example, **wan 1**).
2. Set **Virtual Domain** to **VDOM-A** and **Role** to **WAN**.
3. Check if your ISP provides an IP address for you to use or if the ISP equipment uses DHCP to assign IP addresses.
   - If your ISP provides an IP address, set **Addressing mode** to **Manual** and set the **IP/Network Mask** to that IP address.
   - If your ISP equipment uses DHCP, set **Addressing mode** to **DHCP** to allow the equipment to assign an IP address to WAN1.



Interface Name	wan1 (70:4C:A5:23:40:C2)
Alias	
Link Status	Up
Type	Physical Interface
Virtual Domain	VDOM-A
Estimated Bandwidth	0 kbps Upstream 0 kbps Downstream

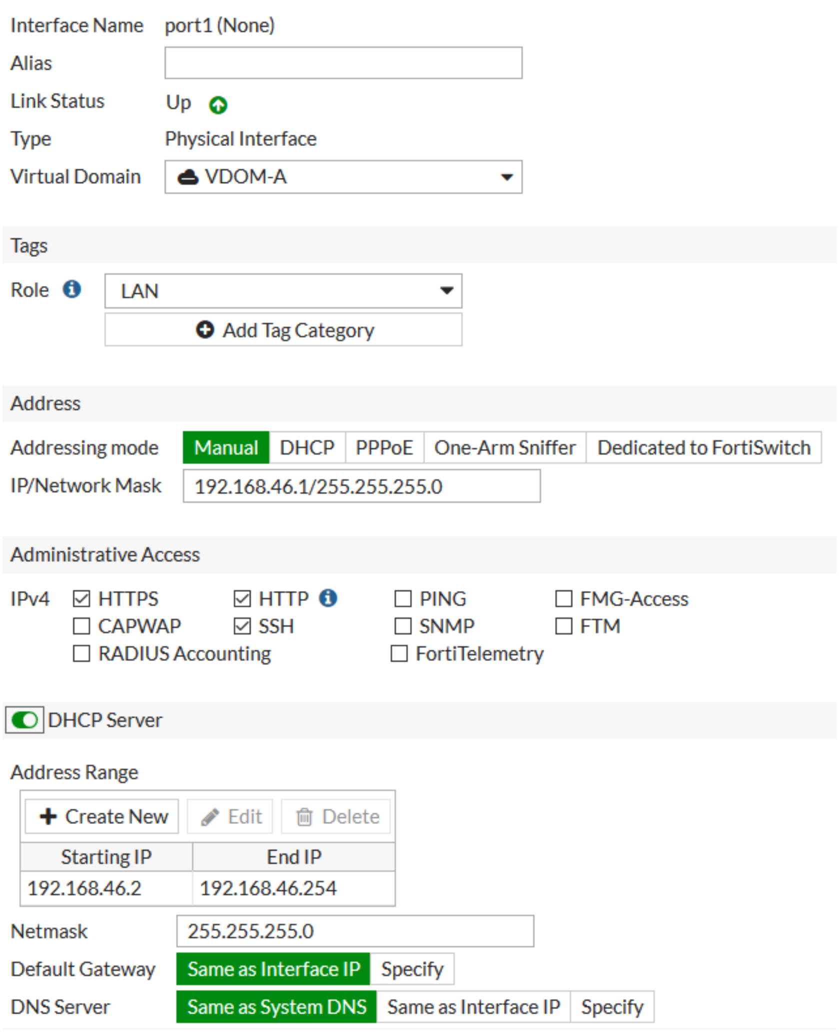
Tags

Role	WAN
	Add Tag Category

Address

Addressing mode	Manual DHCP PPPoE
IP/Network Mask	172.25.177.46/255.255.255.0

4. To assign an interface for the VDOM-A internal network, go to **Network > Interfaces** and edit the interface (in the example, **port 1**).
5. Set **Virtual Domain** to **VDOM-A** and **Role** to **LAN**.
6. Set **Addressing Mode** to **Manual**, assign an **IP/Network Mask** to the interface (in the example, *192.168.46.1/255.255.255.0*), and set **Administrative Access** to **HTTPS**, **PING**, and **SSH**.
7. If you need to assign IP addresses to devices on your internal network, enable **DHCP Server**.



Interface Name port1 (None)

Alias

Link Status Up

Type Physical Interface

Virtual Domain VDOM-A

Tags

Role LAN

Add Tag Category

Address

Addressing mode [✓ Manual] DHCP PPPoE One-Arm Sniffer Dedicated to FortiSwitch

IP/Network Mask 192.168.46.1/255.255.255.0

Administrative Access

IPv4 ☑ HTTPS ☑ HTTP ☐ PING ☐ FMG-Access
☐ CAPWAP ☑ SSH ☐ SNMP ☐ FTM
☐ RADIUS Accounting ☐ FortiTelemetry

DHCP Server

Address Range

Starting IP	End IP
192.168.46.2	192.168.46.254

Netmask 255.255.255.0

Default Gateway [✓ Same as Interface IP] Specify

DNS Server [✓ Same as System DNS] Same as Interface IP Specify

8. Repeat the above steps to assign interfaces to VDOM-B.

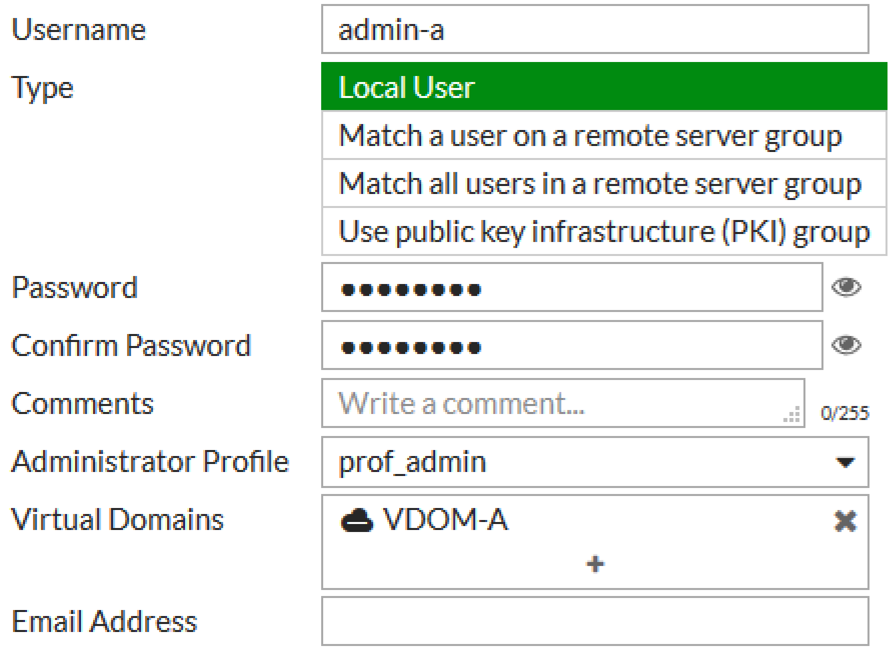
Creating per-VDOM administrators

Per-VDOM administrator accounts only allow administrative access to specific VDOMs. By creating per-VDOM administrators, you allow both Company A and Company B to manage their respective VDOMs without allowing access to settings for other VDOMs or the global settings.

1. To create a per-VDOM administrator for VDOM-A, go to **System > Administrators** and select **Create New > Administrator**.
2. Enter a **Username** and set **Type** to **Local User**. Enter and confirm a **Password**. Set **Administrator Profile** to **prof_admin**.

> You must use either the **prof_admin** or a custom profile for per-VDOM administrators.

3. Remove the **root** VDOM from the **Virtual Domains** list and add **VDOM-A**.

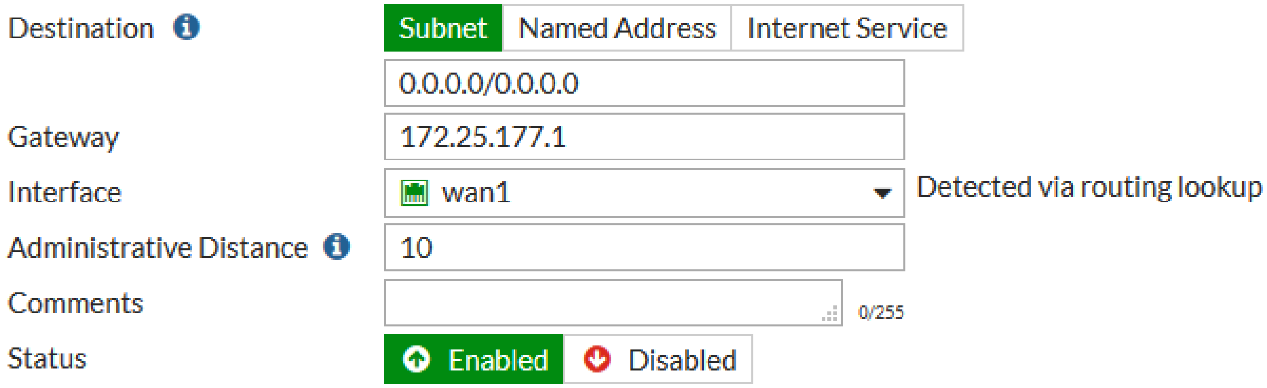


Username	admin-a
Type	Local User Match a user on a remote server group Match all users in a remote server group Use public key infrastructure (PKI) group
Password	●●●●●●●●
Confirm Password	●●●●●●●●
Comments	Write a comment... 0/255
Administrator Profile	prof_admin
Virtual Domains	VDOM-A ✖ +
Email Address	

4. Repeat the above steps to create a per-VDOM administrator for VDOM-B.

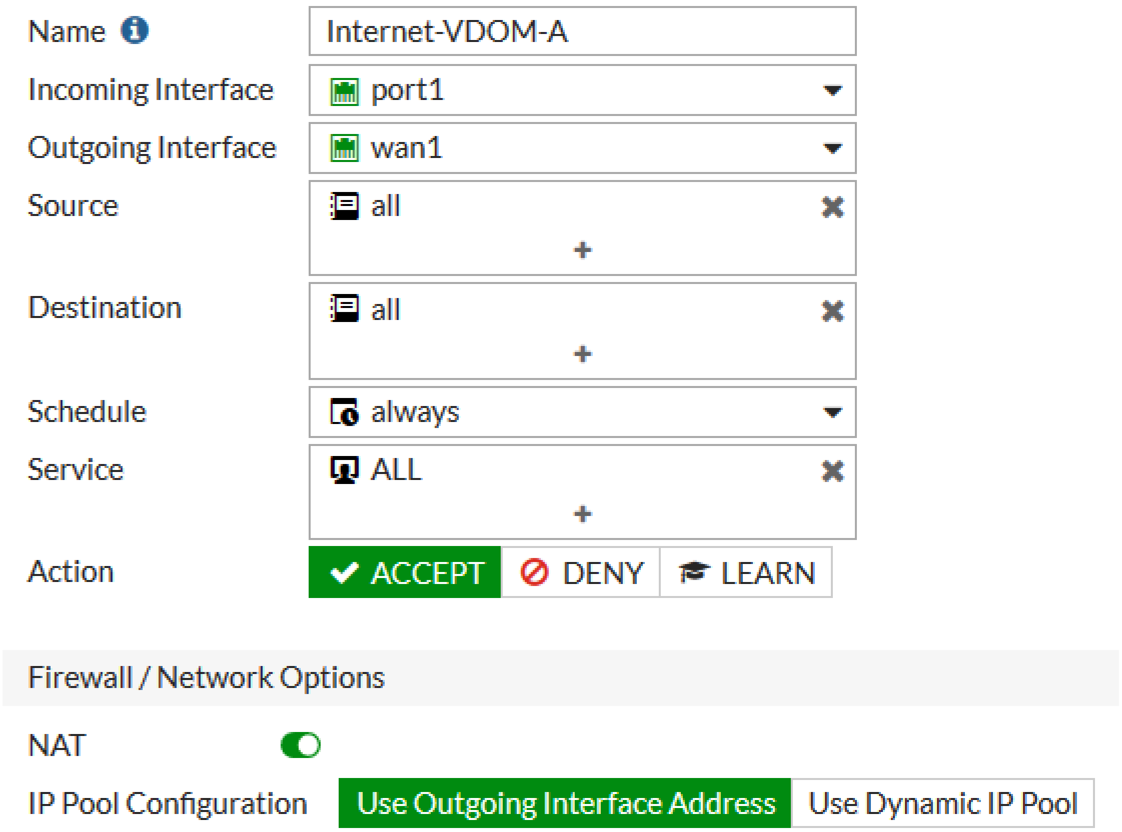
Configuring the VDOMs

1. Access VDOM-A using the dropdown menu located in the top-left corner.
2. To add a static route, go to **Network > Static Routes** and select **Create New**.
3. Set **Destination** to **Subnet** and leave the destination IP address set to 0.0.0.0/0.0.0.0.
4. Set **Gateway** to the IP address provided by your ISP and **Interface** to the Internet-facing interface.



Destination ℹ	Subnet | Named Address | Internet Service 0.0.0.0/0.0.0.0
Gateway	172.25.177.1
Interface	wan1 Detected via routing lookup
Administrative Distance ℹ	10
Comments	0/255
Status	Enabled | Disabled

5. To create a new policy, go to **Policy & Objects > IPv4 Policy** and select **Create New**.
6. Set the **Incoming Interface** to **port 1** and set the **Outgoing Interface** to **wan 1**.



Name	Internet-VDOM-A
Incoming Interface	port1
Outgoing Interface	wan1
Source	all
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT / DENY / LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	Use Outgoing Interface Address / Use Dynamic IP Pool

7. Repeat the above steps to configure VDOM-B.

Configuring global security profiles

You can create two types of security profiles for VDOMs: per-VDOM profiles that are only available to a specific VDOM, and global security profiles which are available for use by multiple VDOMs. You can use both types of profiles for your configuration.

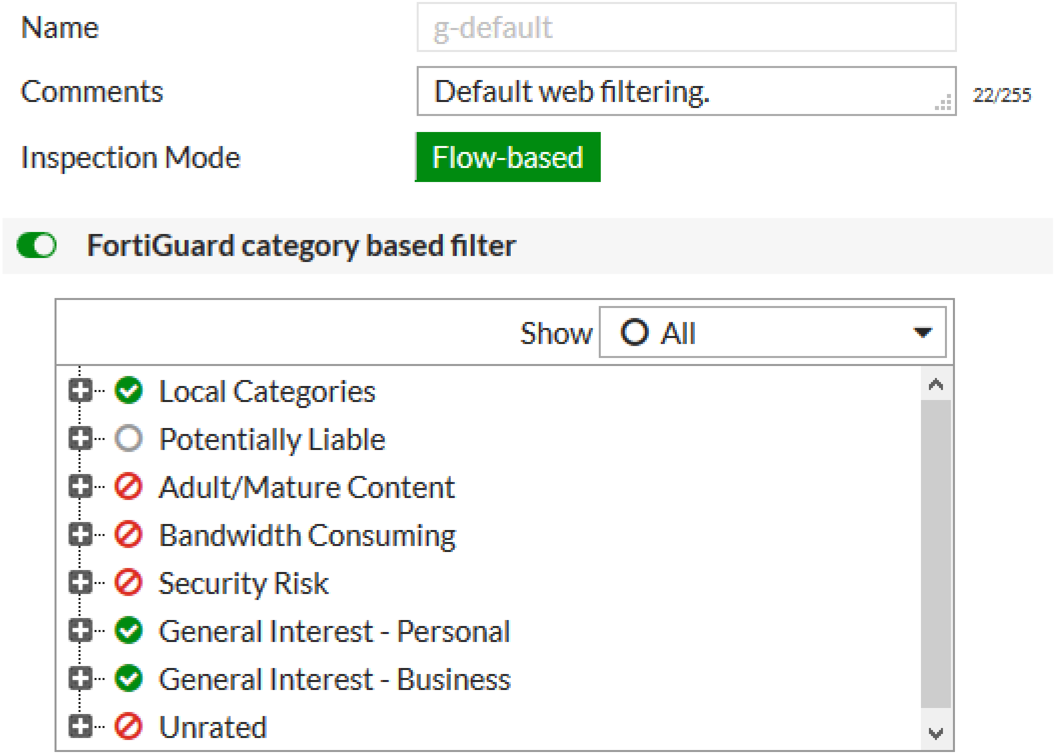
Global profiles are available for the following security features:

- Antivirus
- Application control
- Data leak prevention
- Intrusion prevention
- Web filtering

Each security feature has at least one default global profile. Global profiles are identified by the “g-” at the beginning of the profile name.

Some security profile features, such as URL filters, are not available for use in a global profile.

1. To edit the default global web filter, go to **Global > Security Profiles > Web Filter** and edit **g-default**.
2. Right-click the **Bandwidth Consuming** category and select **Block**.



Name	g-default
Comments	Default web filtering. 22/255
Inspection Mode	Flow-based

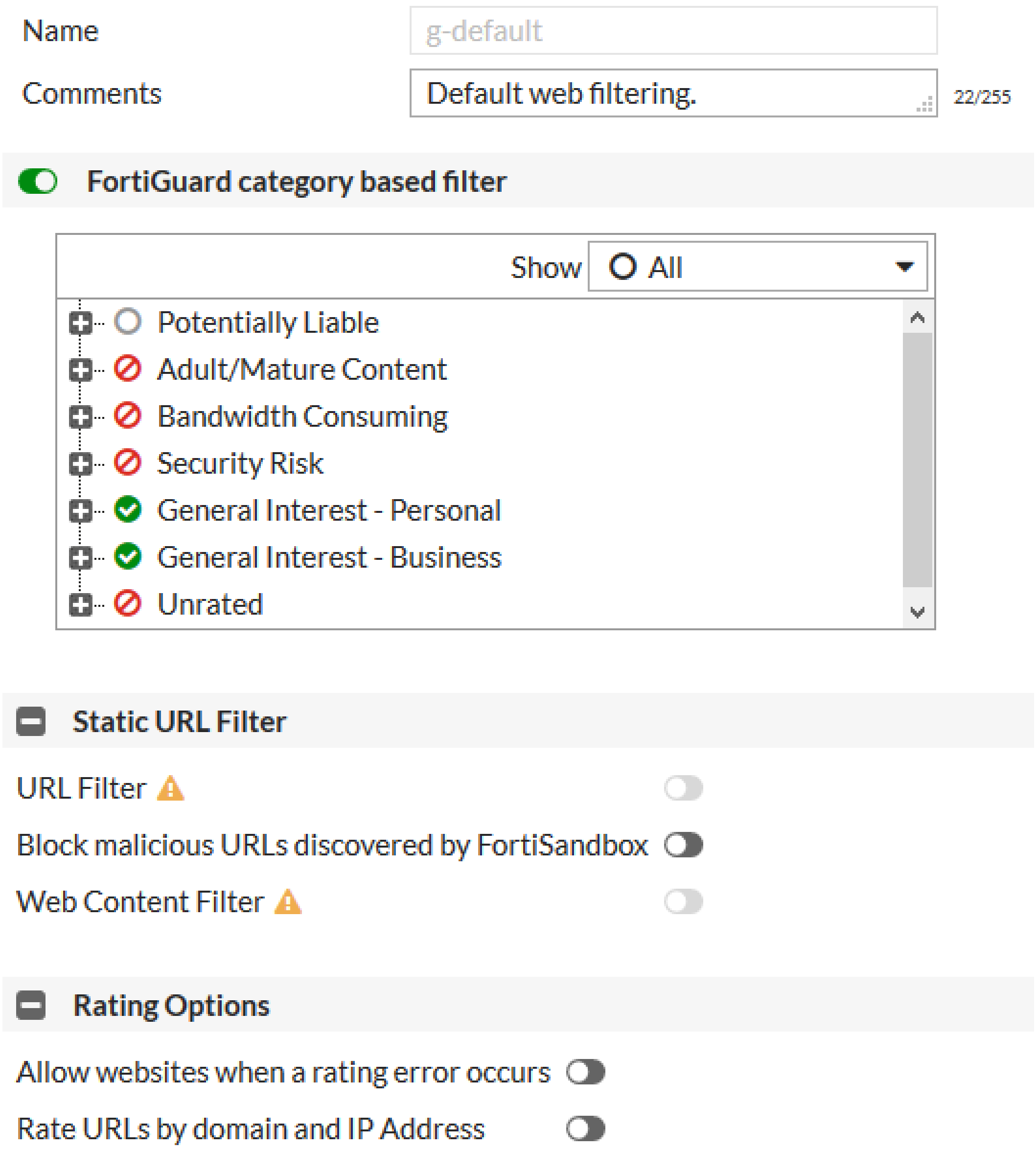
● FortiGuard category based filter

Show ○ All

- ✓ Local Categories
- ○ Potentially Liable
- ⊘ Adult/Mature Content
- ⊘ Bandwidth Consuming
- ⊘ Security Risk
- ✓ General Interest - Personal
- ✓ General Interest - Business
- ⊘ Unrated

Results

1. Connect to VDOM-A and log in using the VDOM-A administrator account. Only the per-VDOM options are shown.
2. To view the default global web filter, go to **Security Profiles > Web Filter** and select **g-default**. The VDOM-A administrator can't edit the profile.



Name	g-default
Comments	Default web filtering. 22/255

FortiGuard category based filter

Show ○ All

- ○ Potentially Liable
- ⊘ Adult/Mature Content
- ⊘ Bandwidth Consuming
- ⊘ Security Risk
- ✓ General Interest - Personal
- ✓ General Interest - Business
- ⊘ Unrated

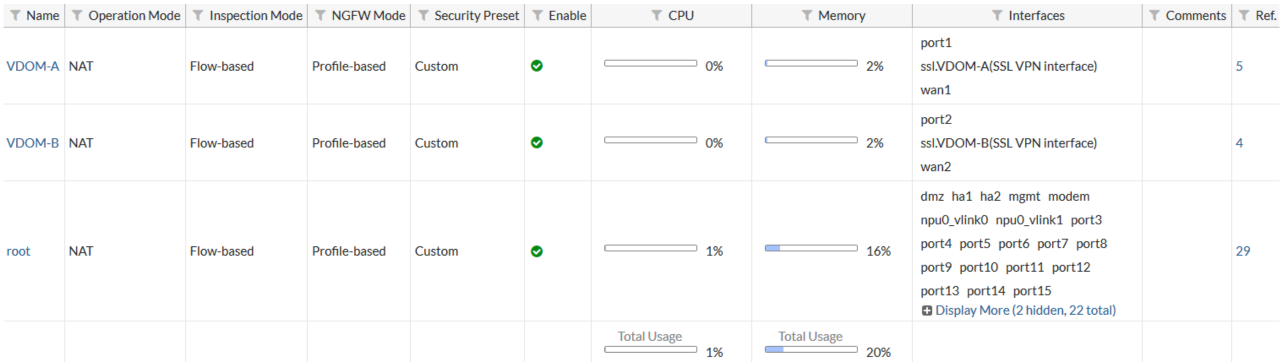
Static URL Filter

- URL Filter ⚠
- Block malicious URLs discovered by FortiSandbox
- Web Content Filter ⚠

Rating Options

- Allow websites when a rating error occurs
- Rate URLs by domain and IP Address

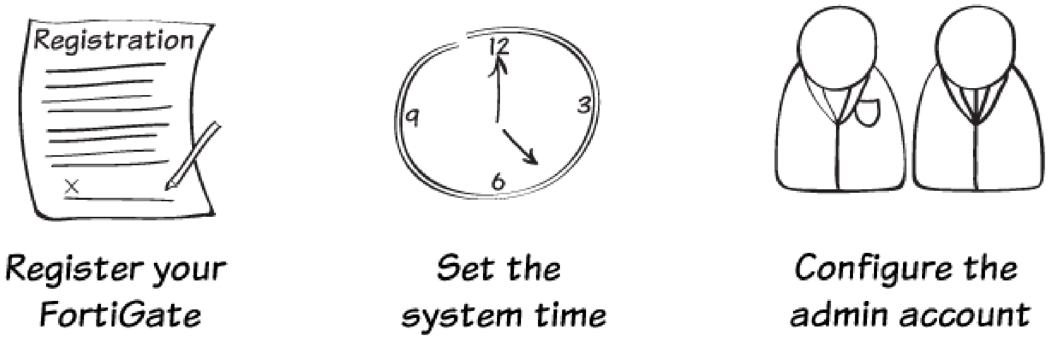
3. To view a summary of the VDOM configuration, connect to the management VDOM and go to **Global > System > VDOM**.



Name	Operation Mode	Inspection Mode	NGFW Mode	Security Preset	Enable	CPU	Memory	Interfaces	Comments	Ref.
VDOM-A	NAT	Flow-based	Profile-based	Custom	✓	0%	2%	port1 ssl.VDOM-A(SSL VPN interface) wan1		5
VDOM-B	NAT	Flow-based	Profile-based	Custom	✓	0%	2%	port2 ssl.VDOM-B(SSL VPN interface) wan2		4
root	NAT	Flow-based	Profile-based	Custom	✓	1%	16%	dmz ha1 ha2 mgmt modem npu0_vlink0 npu0_vlink1 port3 port4 port5 port6 port7 port8 port9 port10 port11 port12 port13 port14 port15 Display More (2 hidden, 22 total)		29
						Total Usage 1%	Total Usage 20%			

For further reading, check out Virtual domains overview in the FortiOS 6.0 Online Help.

FortiGate registration and basic settings



In this recipe, you will complete these following basic administrative tasks to get a newly installed FortiGate ready for use:

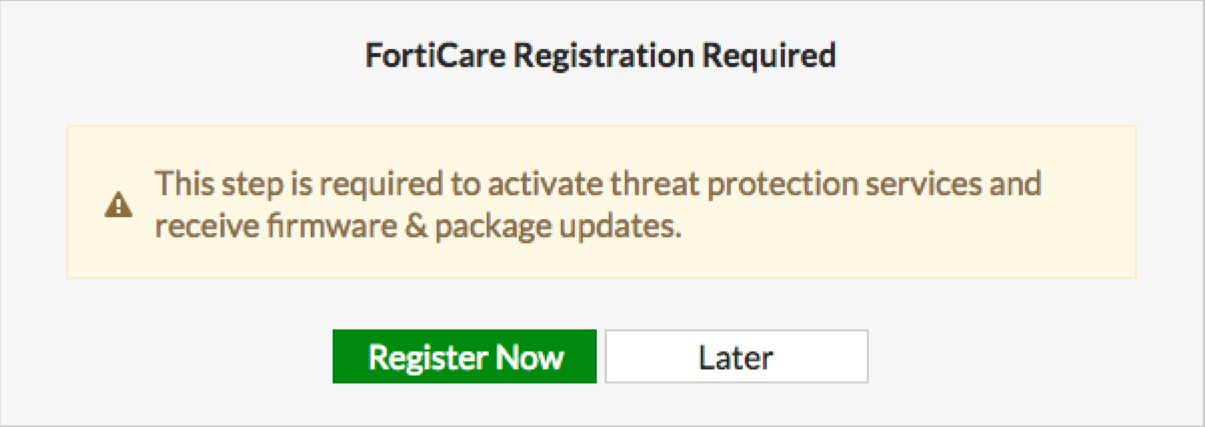
- Register your FortiGate with a Fortinet Support account.
- Set the system time.
- Create a new administrator and edit the default account.
- Restrict administrative access to a trusted host (optional).

Registering your FortiGate

You must register your FortiGate to receive firmware upgrades, FortiGuard updates, and access to Fortinet Support.

Before you register your FortiGate, it must be connected to the Internet.

1. Connect to your FortiGate. A message appears that states that FortiCare registration is required. Select **Register Now**.

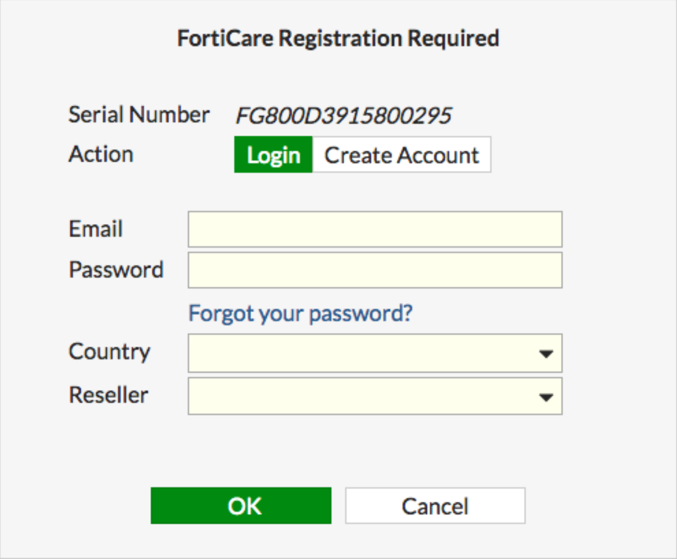


FortiCare Registration Required

⚠ This step is required to activate threat protection services and receive firmware & package updates.

2. To allow Fortinet Support to keep a complete list of your devices, you should use one account to register all of your Fortinet products.

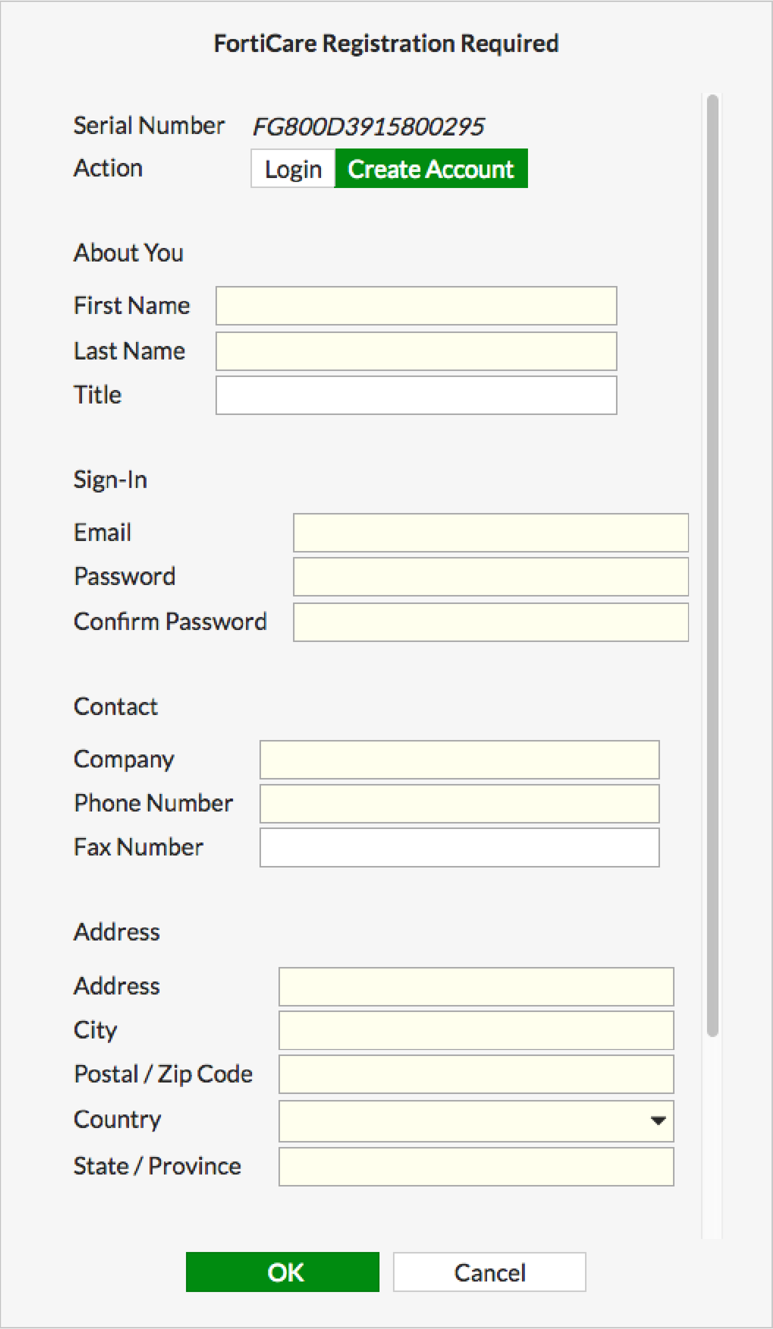
   If you have a Fortinet Support account, set **Action** to **Login**.



FortiCare Registration Required

Serial Number	*FG800D3915800295*
Action	Login | Create Account
Email	
Password	
	Forgot your password?
Country	
Reseller	

   If you need to create an account, set **Action** to **Create Account**.



FortiCare Registration Required

Serial Number	*FG800D3915800295*
Action	Login / Create Account

About You

First Name	
Last Name	
Title	

Sign-In

Email	
Password	
Confirm Password	

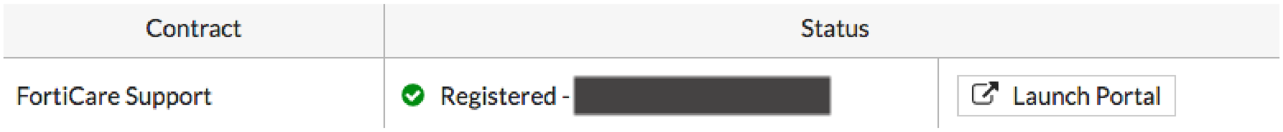
Contact

Company	
Phone Number	
Fax Number	

Address

Address	
City	
Postal / Zip Code	
Country	
State / Province	

3. Go to **System > FortiGuard**. In **License Information**, **FortiCare Support** appears as **Registered**.

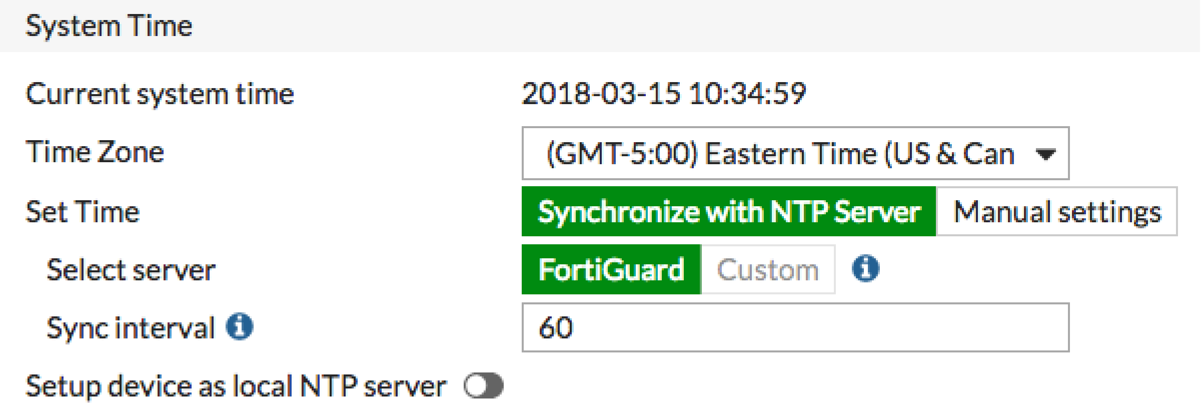


Contract	Status	
FortiCare Support	✓ Registered - [redacted]	Launch Portal

4. Your other FortiGuard licenses now show as licensed. There may be a delay before all of them appear as licensed.

Setting system time

1. Go to **System > Settings**. Under **System Time**, select your **Time Zone** and either set the time manually or select **Synchronize with NTP Server**.



System Time

Current system time 2018-03-15 10:34:59

Time Zone (GMT-5:00) Eastern Time (US & Can

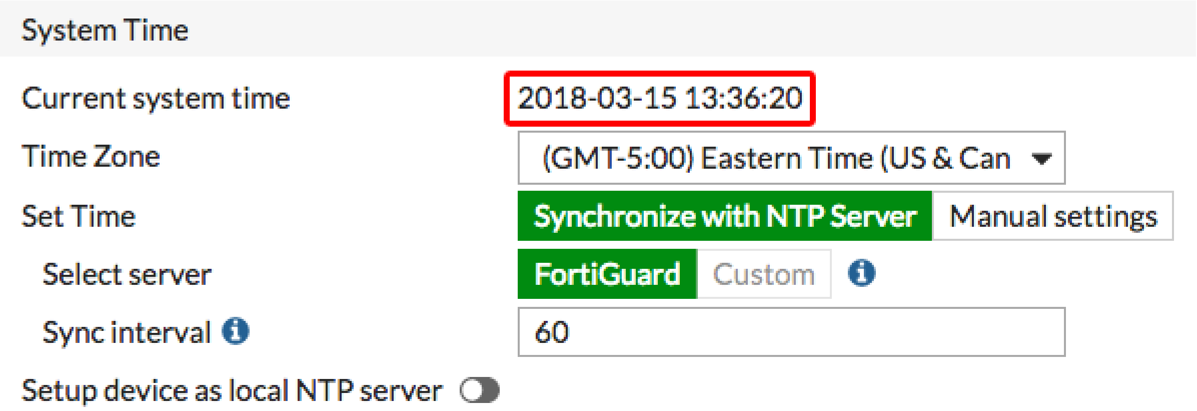
Set Time: Synchronize with NTP Server | Manual settings

Select server: FortiGuard | Custom

Sync interval: 60

Setup device as local NTP server

2. **Current system time** displays the correct time.



System Time

Current system time 2018-03-15 13:36:20

Time Zone (GMT-5:00) Eastern Time (US & Can

Set Time: Synchronize with NTP Server | Manual settings

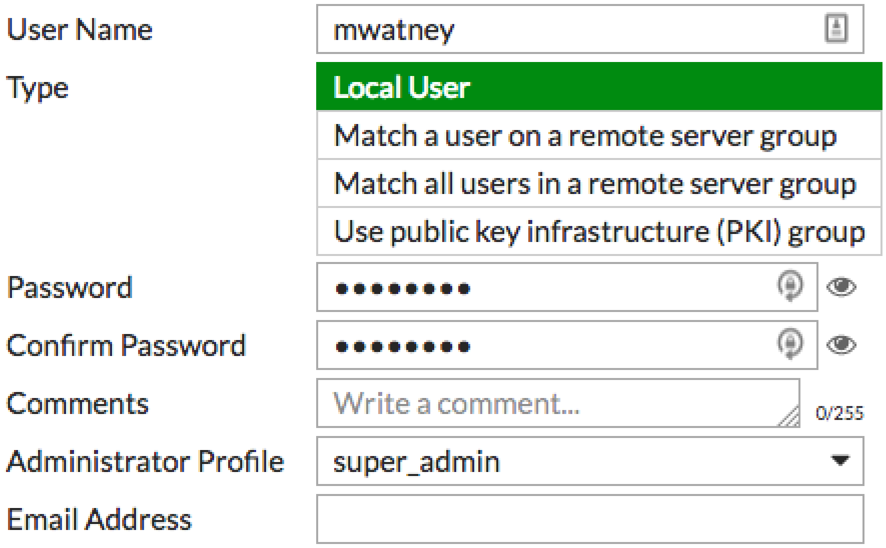
Select server: FortiGuard | Custom

Sync interval: 60

Setup device as local NTP server

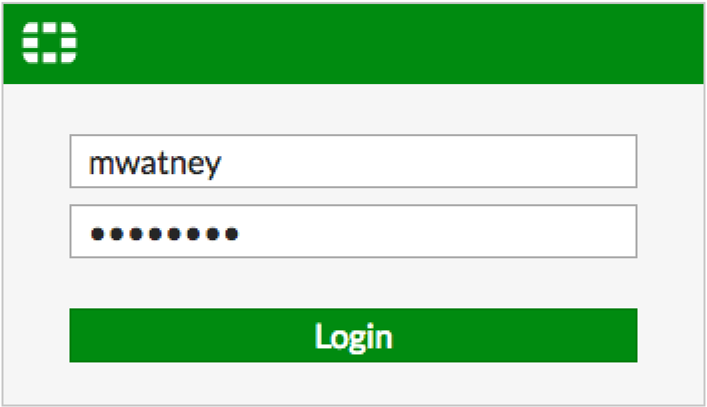
Creating administrators

1. Go to **System > Administrators** and create a new account. Set **User Name** and **Password**.
2. Set **Administrator Profile** to **super_admin**. This profile allows the administrator full access to configure the FortiGate.



User Name	mwatney
Type	**Local User** Match a user on a remote server group Match all users in a remote server group Use public key infrastructure (PKI) group
Password	●●●●●●●●●
Confirm Password	●●●●●●●●●
Comments	Write a comment... 0/255
Administrator Profile	super_admin
Email Address	

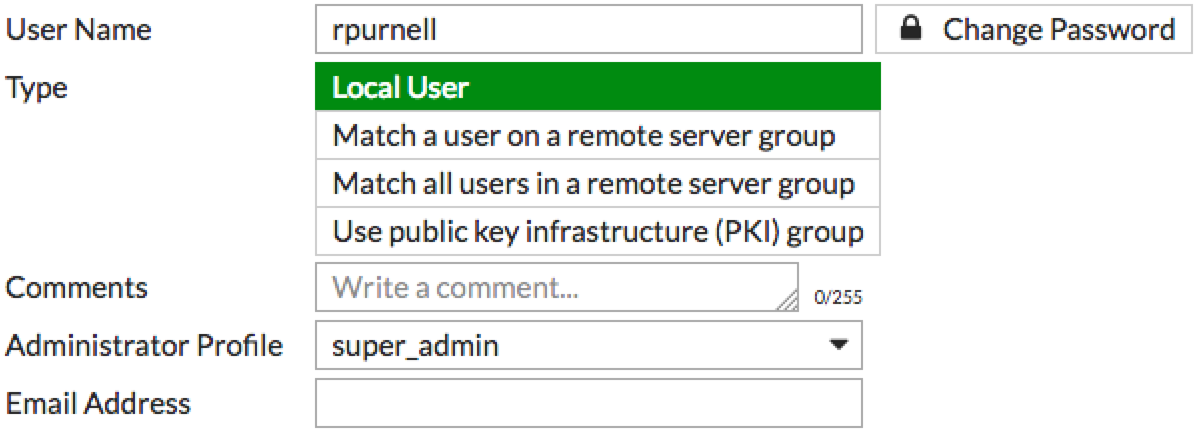
3. Log out of the FortiGate and log in using your new account.



mwatney

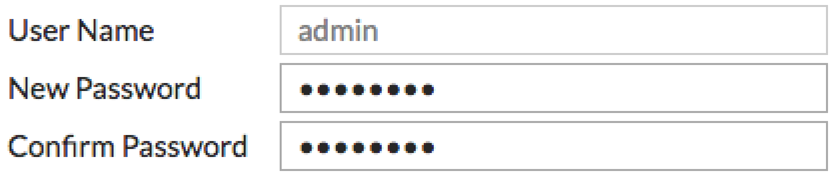
●●●●●●●●●

4. To secure your FortiGate, it’s recommended that you change the name and password of the default admin account. Go to **System > Administrators** and edit the default account. Change the **User Name**.



User Name	rpurnell	Change Password
Type	**Local User** Match a user on a remote server group Match all users in a remote server group Use public key infrastructure (PKI) group	
Comments	Write a comment... 0/255	
Administrator Profile	super_admin	
Email Address		

5. Select **Change Password** to add a password to this account.

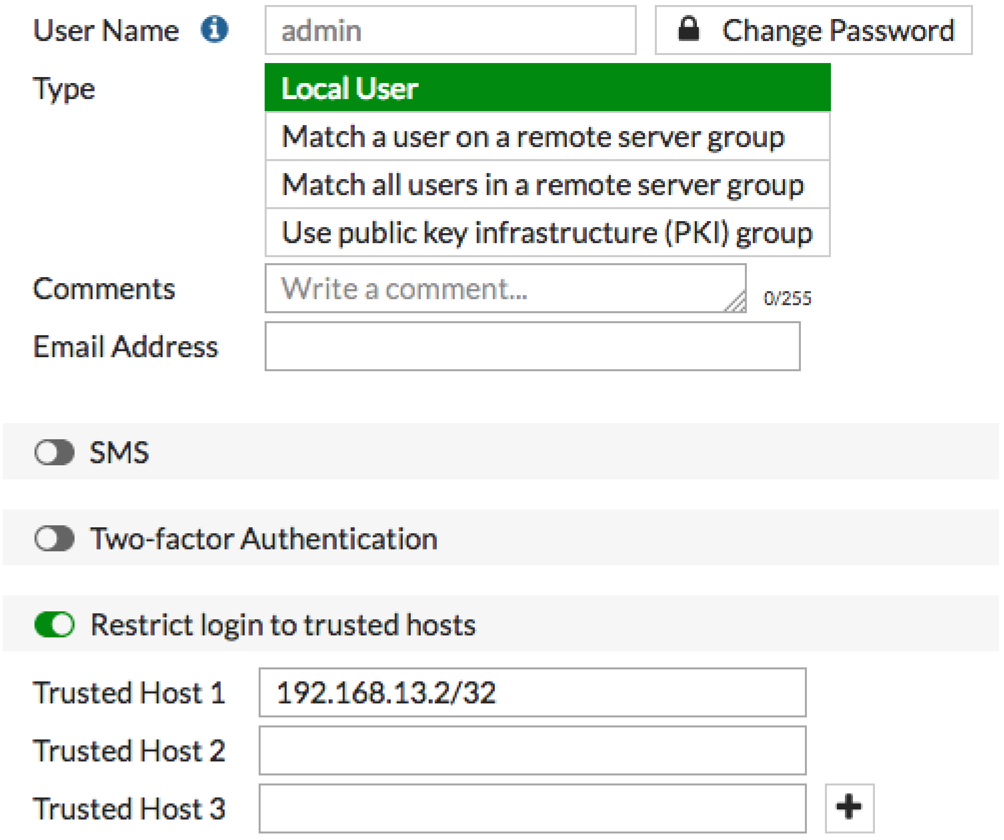


User Name	admin
New Password	●●●●●●●●●
Confirm Password	●●●●●●●●●

Using a trusted host (optional)

You can configure an administrative account to be accessible only to someone who is using a trusted host. You can set a specific IP address for the trusted host or use a subnet.

1. Go to **System > Administrators** and edit the default admin account.
2. Enable **Restrict login to trusted hosts**. Set **Trusted Host 1** to the static IP address of the computer you use to administer the FortiGate.
3. If required, set additional trusted hosts.



User Name	admin
Type	Local User Match a user on a remote server group Match all users in a remote server group Use public key infrastructure (PKI) group
Comments	Write a comment... 0/255
Email Address	

○ SMS

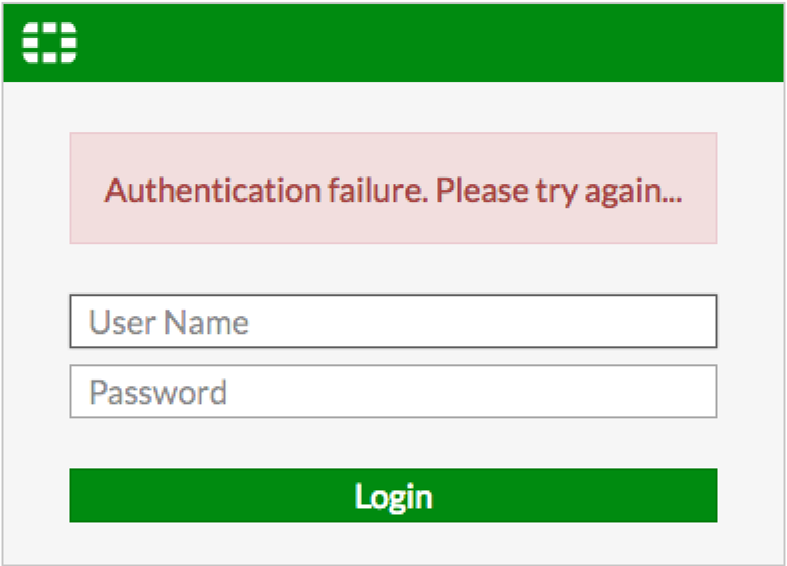
○ Two-factor Authentication

● Restrict login to trusted hosts

Trusted Host 1	192.168.13.2/32
Trusted Host 2	
Trusted Host 3	

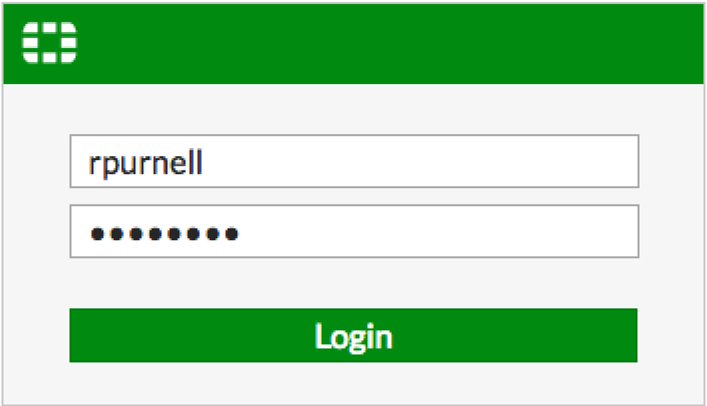
Results

1. Attempt to log in using the original credentials for the default account. Access is denied.



Authentication failure. Please try again...

2. Log in using the new credentials for the default account. Access is granted.

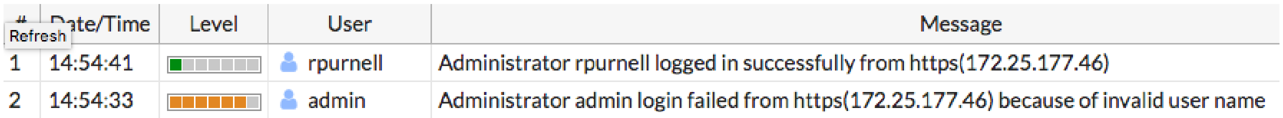


rpurnell

●●●●●●●●●

3. Go to **Log & Report > System Events**. You can see the successful and failed login attempts in the events list.

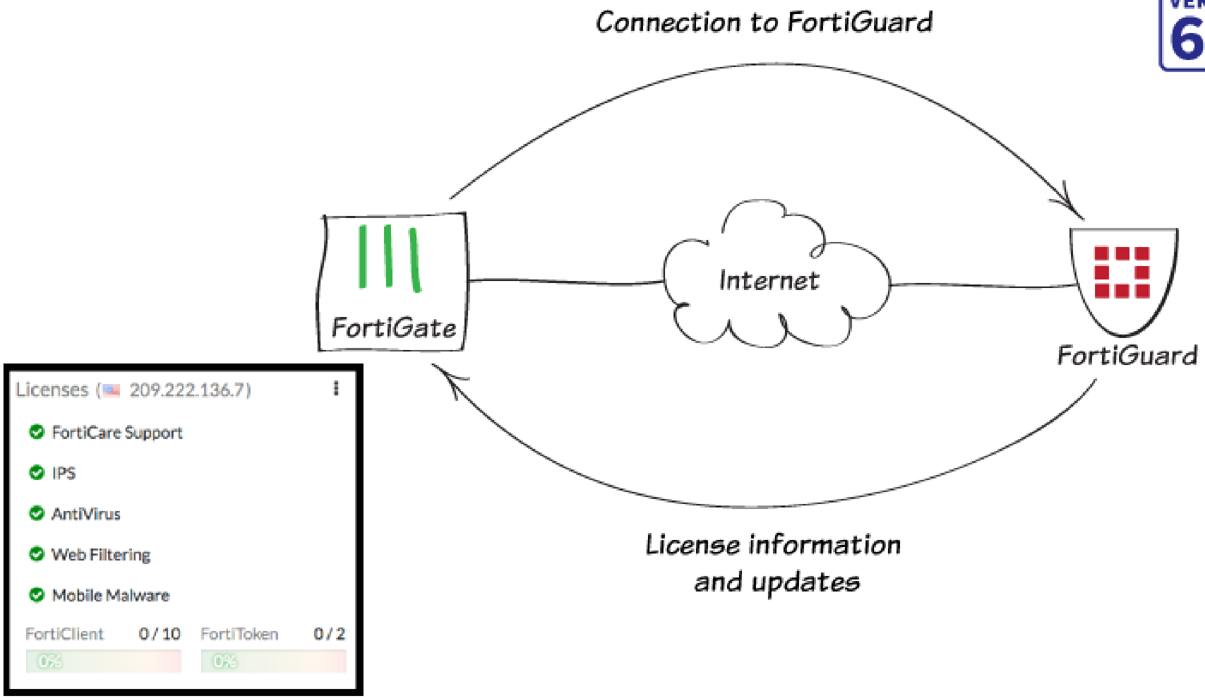
For system events to appear in the GUI, you must configure disk logging in the log settings on the FortiGate. This option is only available on FortiGate models that have an internal hard drive.



#	Date/Time	Level	User	Message
1	14:54:41	🟩	rpurnell	Administrator rpurnell logged in successfully from https(172.25.177.46)
2	14:54:33	🟧	admin	Administrator admin login failed from https(172.25.177.46) because of invalid user name

For further reading, check out Basic Administration in the FortiOS 6.0 Online Help.

Verifying FortiGuard licenses and troubleshooting



Licenses (209.222.136.7)

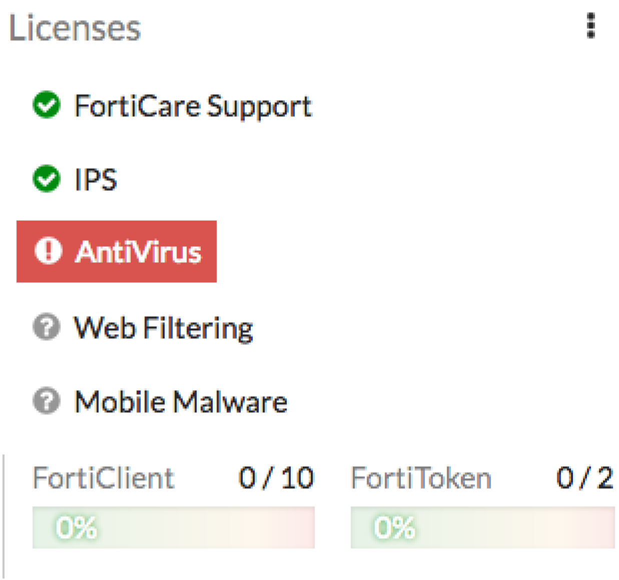
- ✓ FortiCare Support
- ✓ IPS
- ✓ AntiVirus
- ✓ Web Filtering
- ✓ Mobile Malware

FortiClient 0 / 10 0%
FortiToken 0 / 2 0%

In this recipe, you verify that your FortiGate displays the correct FortiGuard licenses and troubleshoot any errors. You must register your FortiGate before it can show your FortiGuard licenses.

Viewing your licenses

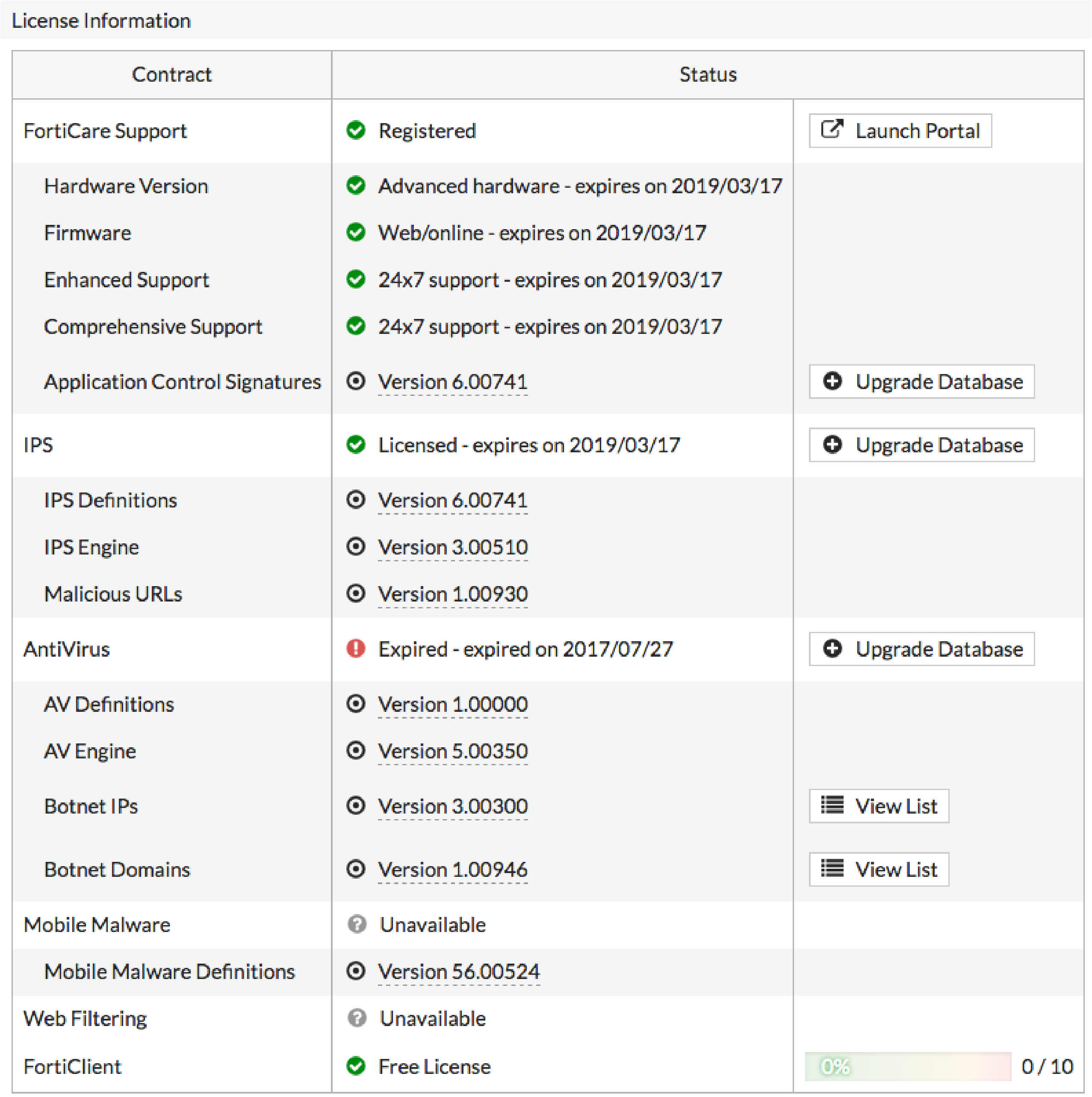
1. To view your licenses, go to the **Dashboard** and find the **Licenses** widget. The FortiGuard licenses are listed, with their status indicated:
   - A green check mark indicates an active license.
   - A gray question mark indicates an unavailable license.
   - A license highlighted in orange is either unlicensed or expires soon.
   - A license highlighted in red is expired.



2. The widget only displays licenses for features you enabled in feature visibility. To enable more features, go to **System > Feature Visibility**.
3. The **Web Filtering** license only appears as active when a web filter profile is applied to a firewall policy.

When you apply the profile, a warning will appear stating that web filtering doesn't have a valid license. You can ignore this for the moment.

4. You can also view FortiGuard license information by going to **System > FortiGuard**.



License Information

Contract	Status	
FortiCare Support	✓ Registered	Launch Portal
Hardware Version	✓ Advanced hardware - expires on 2019/03/17	
Firmware	✓ Web/online - expires on 2019/03/17	
Enhanced Support	✓ 24x7 support - expires on 2019/03/17	
Comprehensive Support	✓ 24x7 support - expires on 2019/03/17	
Application Control Signatures	⊙ Version 6.00741	Upgrade Database
IPS	✓ Licensed - expires on 2019/03/17	Upgrade Database
IPS Definitions	⊙ Version 6.00741	
IPS Engine	⊙ Version 3.00510	
Malicious URLs	⊙ Version 1.00930	
AntiVirus	! Expired - expired on 2017/07/27	Upgrade Database
AV Definitions	⊙ Version 1.00000	
AV Engine	⊙ Version 5.00350	
Botnet IPs	⊙ Version 3.00300	View List
Botnet Domains	⊙ Version 1.00946	View List
Mobile Malware	? Unavailable	
Mobile Malware Definitions	⊙ Version 56.00524	
Web Filtering	? Unavailable	
FortiClient	✓ Free License	0% 0 / 10

Troubleshooting

If you need to add or renew a subscription, go to Fortinet Support.

If a license that should be active isn't currently available, you can use the following steps to troubleshoot your connection. After each troubleshooting step, go to **System > FortiGuard** to check if the licenses are now showing as available.

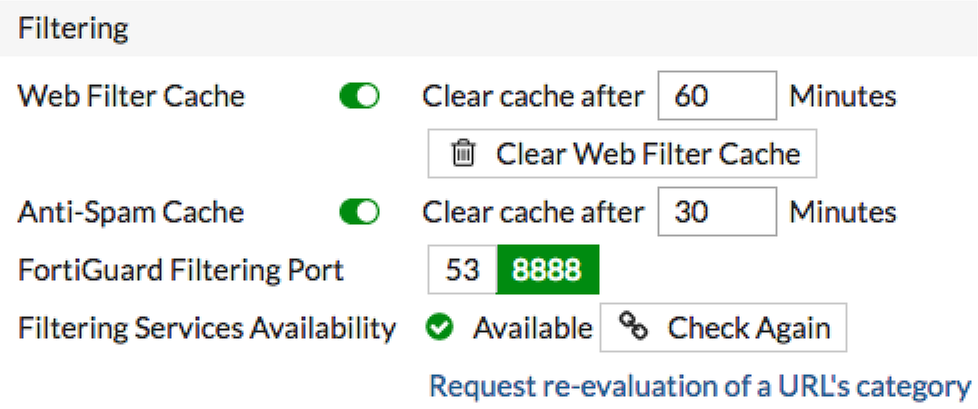
Connecting to FortiGuard

1. To prompt your FortiGate to connect to FortiGuard, connect to the CLI and use the following command:
```
diagnose debug application update -1
diagnose debug enable
execute update-now
```
2. If your FortiGate has multiple VDOMs, make sure that you use the management VDOM and that the VDOM has Internet access. To set the proper VDOM as the management VDOM, use the following command:
```
config system global
   set management-vdom
end
```

Checking FortiGuard filtering

1. To test if FortiGuard is reachable, go to **System > FortiGuard**.
2. Under **Filtering**, check **Filtering Services Availability.** If you don't see a green check mark, select **Check Again**.
3. If you still don't see a green check mark, change the **FortiGuard Filtering Port** to the alternate port (8888). Select **Apply** and see if the services become available.

If you're updating FortiGuard using a FortiManager, the **FortiGuard Filtering Port** can also be 80.



Filtering

Web Filter Cache ● Clear cache after 60 Minutes

Clear Web Filter Cache

Anti-Spam Cache ● Clear cache after 30 Minutes

FortiGuard Filtering Port 53 [✓ 8888]

Filtering Services Availability ✓ Available Check Again

Request re-evaluation of a URL's category

Testing the DNS

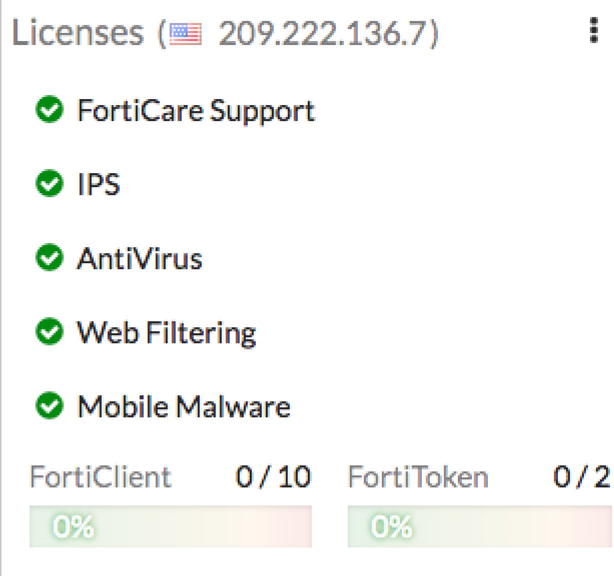
1. To test if your DNS can reach FortiGuard, use the following CLI command:
```
execute ping guard.fortinet.net
```
2. If you can reach the address, run the following command:
```
diagnose debug application update -1
diagnose debug enable
execute update-now
```
3. If you can't reach the address, go to **System > DNS** and verify that the settings are correct. Then run the PING test again.

Contacting Support

If you still can’t connect, contact Fortinet Support.

Results

1. Go to the **Dashboard** and view the **Licenses** widget. Any subscribed services should have a green check mark beside it.



Licenses (209.222.136.7)

✓ FortiCare Support

✓ IPS

✓ AntiVirus

✓ Web Filtering

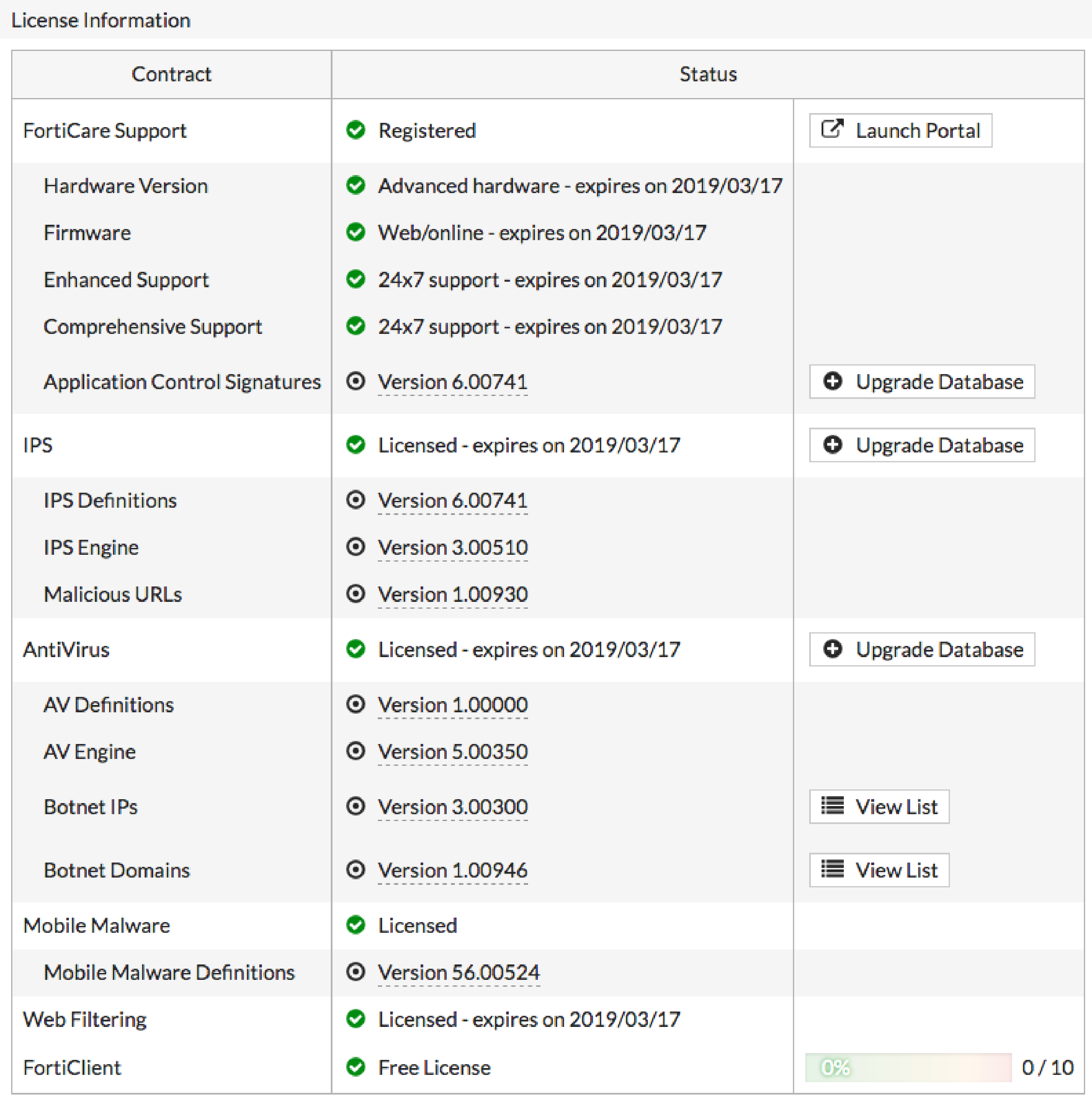
✓ Mobile Malware

FortiClient 0 / 10 0%

FortiToken 0 / 2 0%

2. Go to **System > FortiGuard**. Features and services you’re subscribed to should have a green check mark beside

them.

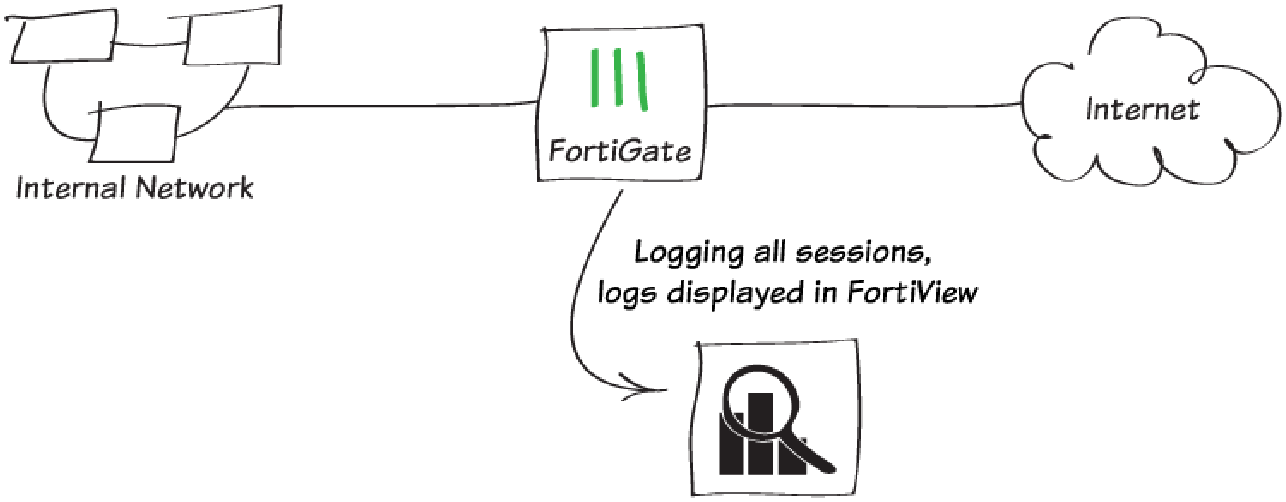


License Information

Contract	Status	
FortiCare Support	✓ Registered	Launch Portal
Hardware Version	✓ Advanced hardware - expires on 2019/03/17	
Firmware	✓ Web/online - expires on 2019/03/17	
Enhanced Support	✓ 24x7 support - expires on 2019/03/17	
Comprehensive Support	✓ 24x7 support - expires on 2019/03/17	
Application Control Signatures	⊙ Version 6.00741	⊕ Upgrade Database
IPS	✓ Licensed - expires on 2019/03/17	⊕ Upgrade Database
IPS Definitions	⊙ Version 6.00741	
IPS Engine	⊙ Version 3.00510	
Malicious URLs	⊙ Version 1.00930	
AntiVirus	✓ Licensed - expires on 2019/03/17	⊕ Upgrade Database
AV Definitions	⊙ Version 1.00000	
AV Engine	⊙ Version 5.00350	
Botnet IPs	⊙ Version 3.00300	View List
Botnet Domains	⊙ Version 1.00946	View List
Mobile Malware	✓ Licensed	
Mobile Malware Definitions	⊙ Version 56.00524	
Web Filtering	✓ Licensed - expires on 2019/03/17	
FortiClient	✓ Free License	0% 0 / 10

For further reading, check out FortiGuard in the FortiOS 6.0 Handbook.

Logging FortiGate traffic and using FortiView



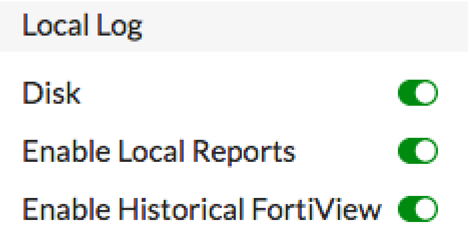
In this example, you will configure logging to record information about sessions processed by your FortiGate. You will then use FortiView to look at the traffic logs and see how your network is being used.

FortiView is a logging tool that contains dashboards that show real time and historical logs. You can filter the dashboards to show specific results and also drill down for more information about a particular session. Each dashboard focuses on a different aspect of your network traffic, such as traffic sources of WiFi clients.

Some FortiView dashboards, such as applications and web sites, require you to apply security profiles to traffic before you can view results.

Configuring log settings

1. To configure log settings, go to **Log & Report > Log Settings**.
2. Select where you want to record log messages. This example uses **Local Log**, because it is required by FortiView. You can also use **Remote Logging and Archiving** to send logs to either a FortiAnalyzer/FortiManager, FortiCloud, or a syslog server.
3. Enable **Disk**, **Local Reports**, and **Historical FortiView**.



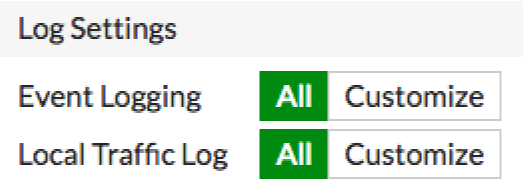
Local Log

Disk ●

Enable Local Reports ●

Enable Historical FortiView ●

4. Under **Log Settings**, set both **Event Logging** and **Local Traffic Log** to **All**.



Log Settings

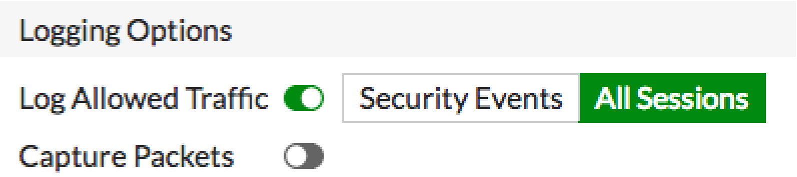
Event Logging [✓ All] Customize

Local Traffic Log [✓ All] Customize

Enabling logging

Because logging all sessions uses more system resources, it is typically recommended to log only security events. However, for the purpose of this recipe, all sessions will be logged to ensure that logging has been configured correctly.

1. To edit the Internet policy, go to **Policy & Objects > IPv4 Policy**.
2. Under **Logging Options**, enable **Log Allowed Traffic** and select **All Sessions**.



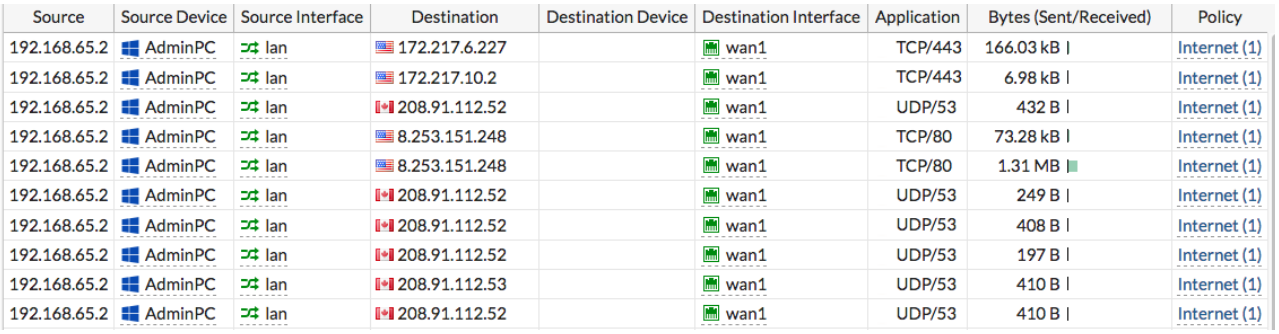
Logging Options

Log Allowed Traffic ● Security Events [✓ All Sessions]

Capture Packets ○

Results

1. Browse the Internet to generate traffic through the FortiGate.
2. To view a realtime display of all active sessions, go to **FortiView > All Segments > All Sessions**.

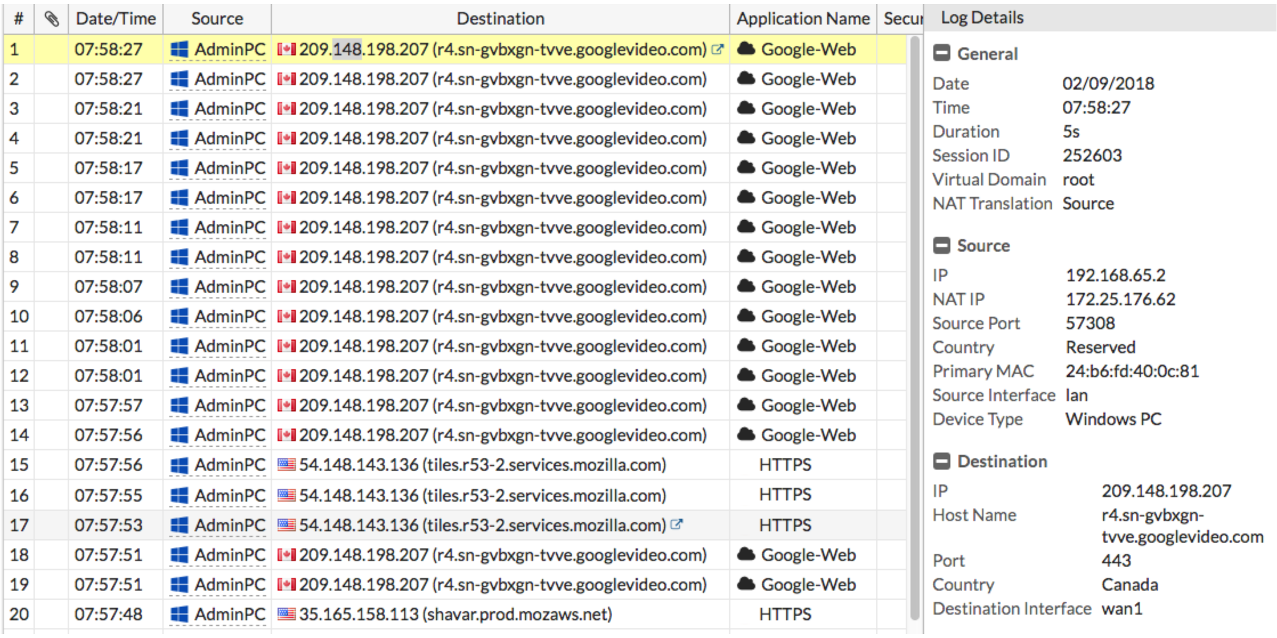


Source	Source Device	Source Interface	Destination	Destination Device	Destination Interface	Application	Bytes (Sent/Received)	Policy
192.168.65.2	AdminPC	lan	172.217.6.227		wan1	TCP/443	166.03 kB	Internet (1)
192.168.65.2	AdminPC	lan	172.217.10.2		wan1	TCP/443	6.98 kB	Internet (1)
192.168.65.2	AdminPC	lan	208.91.112.52		wan1	UDP/53	432 B	Internet (1)
192.168.65.2	AdminPC	lan	8.253.151.248		wan1	TCP/80	73.28 kB	Internet (1)
192.168.65.2	AdminPC	lan	8.253.151.248		wan1	TCP/80	1.31 MB	Internet (1)
192.168.65.2	AdminPC	lan	208.91.112.52		wan1	UDP/53	249 B	Internet (1)
192.168.65.2	AdminPC	lan	208.91.112.52		wan1	UDP/53	408 B	Internet (1)
192.168.65.2	AdminPC	lan	208.91.112.52		wan1	UDP/53	197 B	Internet (1)
192.168.65.2	AdminPC	lan	208.91.112.53		wan1	UDP/53	410 B	Internet (1)
192.168.65.2	AdminPC	lan	208.91.112.52		wan1	UDP/53	410 B	Internet (1)

3. If you right-click a session in the list, you can choose to end the session, end all sessions, ban the source IP, or filter logs by the source device.
4. Select the **24 hours view**. You can see a historical view of your traffic. To see more information, doubleclick a

session.

Historical views are only available on FortiGate models with internal hard drives.



#		Date/Time	Source	Destination	Application Name	Secur
1		07:58:27	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
2		07:58:27	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
3		07:58:21	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
4		07:58:21	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
5		07:58:17	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
6		07:58:17	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
7		07:58:11	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
8		07:58:11	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
9		07:58:07	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
10		07:58:06	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
11		07:58:01	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
12		07:58:01	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
13		07:57:57	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
14		07:57:56	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
15		07:57:56	AdminPC	54.148.143.136 (tiles.r53-2.services.mozilla.com)	HTTPS	
16		07:57:55	AdminPC	54.148.143.136 (tiles.r53-2.services.mozilla.com)	HTTPS	
17		07:57:53	AdminPC	54.148.143.136 (tiles.r53-2.services.mozilla.com)	HTTPS	
18		07:57:51	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
19		07:57:51	AdminPC	209.148.198.207 (r4.sn-gvbxgn-tvve.googlevideo.com)	Google-Web	
20		07:57:48	AdminPC	35.165.158.113 (shavar.prod.mozaws.net)	HTTPS	

Log Details

General

Date	02/09/2018
Time	07:58:27
Duration	5s
Session ID	252603
Virtual Domain	root
NAT Translation	Source

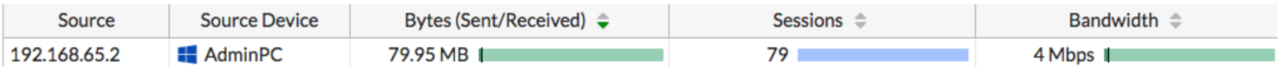
Source

IP	192.168.65.2
NAT IP	172.25.176.62
Source Port	57308
Country	Reserved
Primary MAC	24:b6:fd:40:0c:81
Source Interface	lan
Device Type	Windows PC

Destination

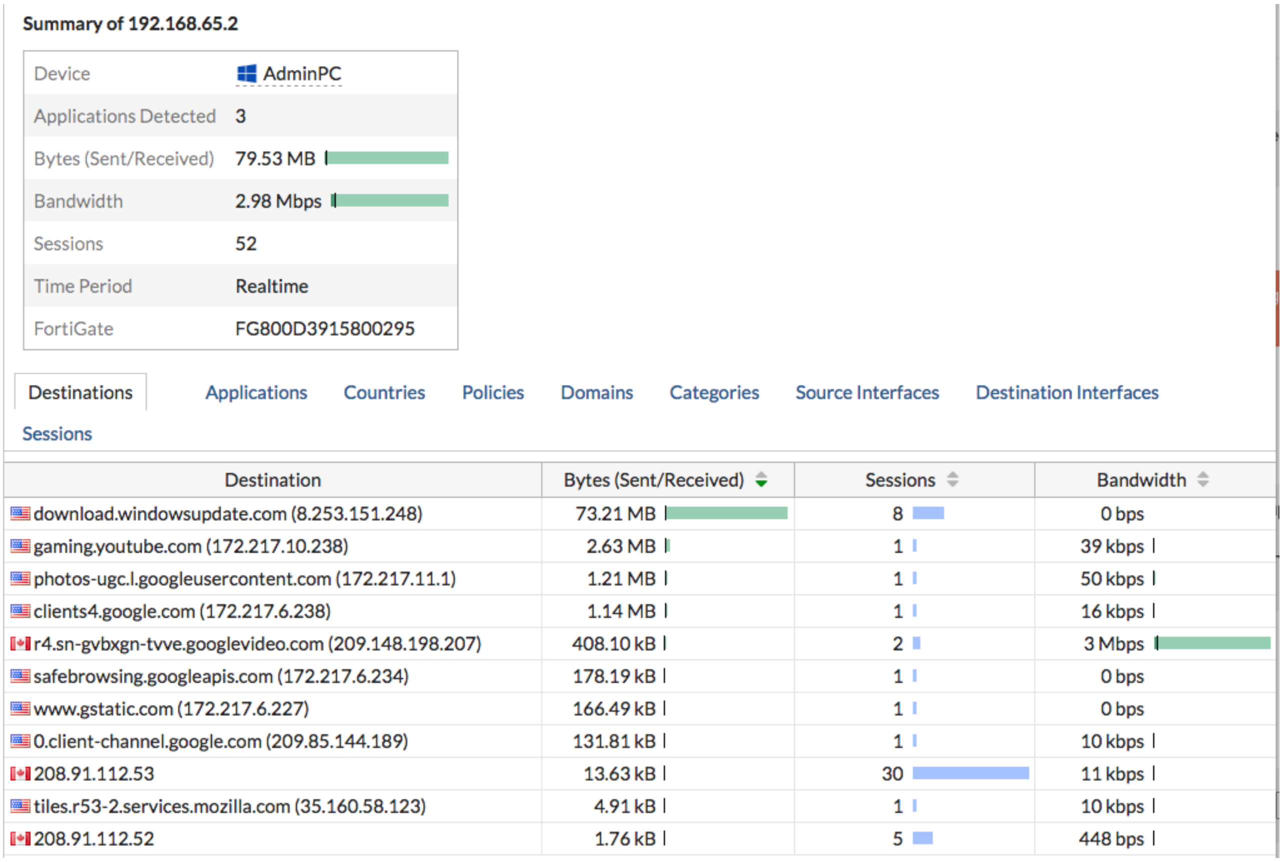
IP	209.148.198.207
Host Name	r4.sn-gvbxgn-tvve.googlevideo.com
Port	443
Country	Canada
Destination Interface	wan1

5. To view a list of the sources in your network traffic, go to **FortiView > Traffic from LAN/DMZ > Sources**.



Source	Source Device	Bytes (Sent/Received)	Sessions	Bandwidth
192.168.65.2	AdminPC	79.95 MB	79	4 Mbps

6. Right-click on any source listed and select Drill Down to Details. You can view a variety of information about the source address, including traffic destinations, security policies used, and if any threats are linked to traffic from this address.



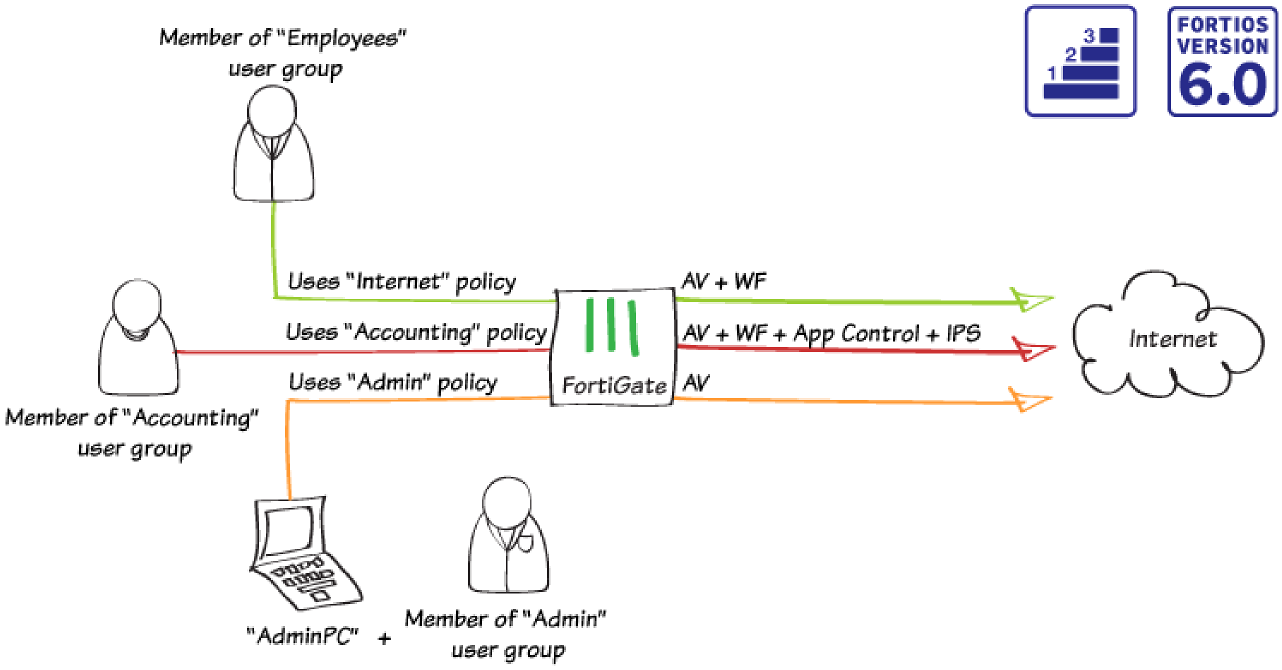
Summary of 192.168.65.2

Device	AdminPC
Applications Detected	3
Bytes (Sent/Received)	79.53 MB
Bandwidth	2.98 Mbps
Sessions	52
Time Period	Realtime
FortiGate	FG800D3915800295

Destination	Bytes (Sent/Received)	Sessions	Bandwidth
download.windowsupdate.com (8.253.151.248)	73.21 MB	8	0 bps
gaming.youtube.com (172.217.10.238)	2.63 MB	1	39 kbps
photos-ugc.l.googleusercontent.com (172.217.11.1)	1.21 MB	1	50 kbps
clients4.google.com (172.217.6.238)	1.14 MB	1	16 kbps
r4.sn-gvbxgn-tvve.googlevideo.com (209.148.198.207)	408.10 kB	2	3 Mbps
safebrowsing.googleapis.com (172.217.6.234)	178.19 kB	1	0 bps
www.gstatic.com (172.217.6.227)	166.49 kB	1	0 bps
0.client-channel.google.com (209.85.144.189)	131.81 kB	1	10 kbps
208.91.112.53	13.63 kB	30	11 kbps
tiles.r53-2.services.mozilla.com (35.160.58.123)	4.91 kB	1	10 kbps
208.91.112.52	1.76 kB	5	448 bps

For further reading, check out FortiView in the FortiOS 6.0 Online Help.

Creating security policies for different users


Member of "Employees" user group
Uses "Internet" policy
AV + WF
Uses "Accounting" policy
AV + WF + App Control + IPS
Uses "Admin" policy
AV
FortiGate
Internet
Member of "Accounting" user group
"AdminPC" +
Member of "Admin" user group

In this recipe, you will create multiple security policies, which will apply security inspection to different users based on which user group they belong to.

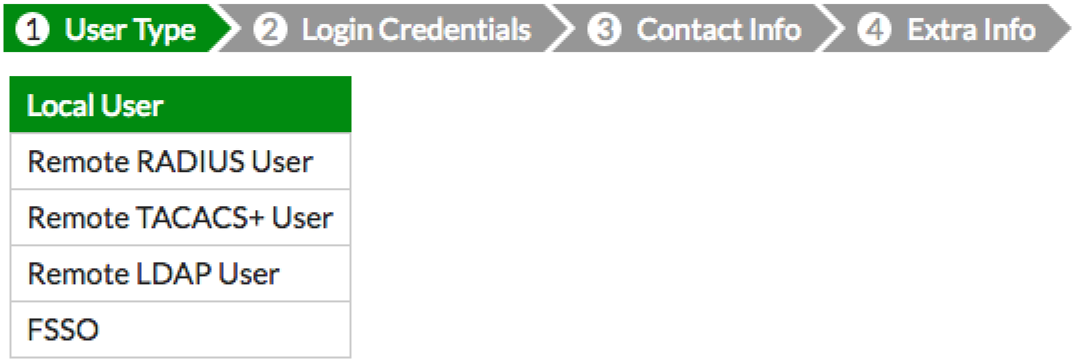
This example contains three IPv4 policies:

- *Internet*: The policy that the *Employee* user group uses to access the Internet. You use the FortiGate to apply some security inspection to traffic.
- *Accounting*: The policy that the *Accounting* user group uses to access the Internet. You use the FortiGate to apply increased security inspection to protect sensitive information.
- *Admin*: The policy that the *Admin* user group uses, connecting from a specific computer, to access the Internet. You use the FortiGate to apply limited security inspection.

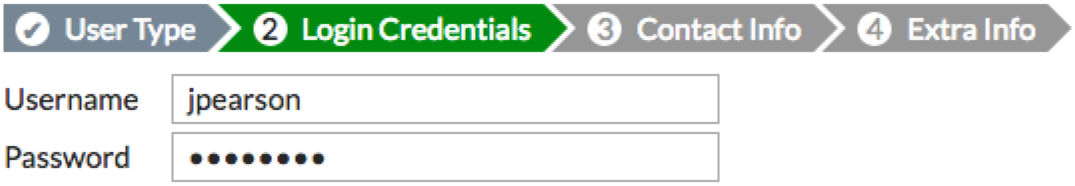
For information about creating the Internet policy, see Installing a FortiGate in NAT mode on page 10.

Creating the Employee user and policy

1. To create a new user, go to **User & Device > User Definition** (in the example, this account is called *jpearson*).
2. In the **User Type** section, select **Local User**.



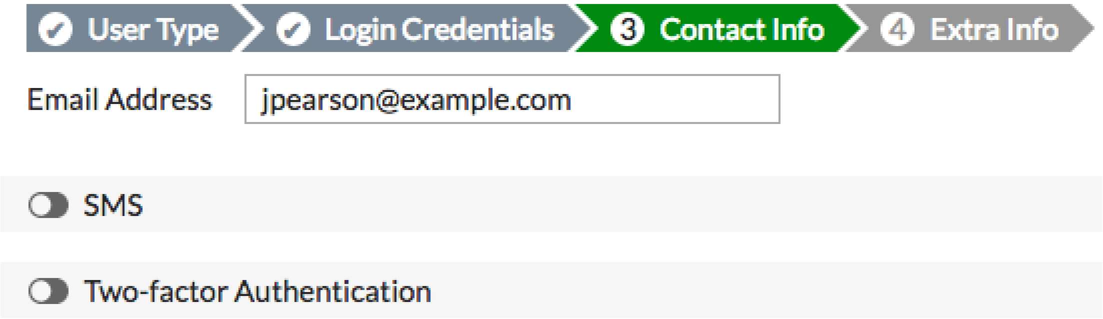
3. In the **Login Credentials** section, set **Username** and set a **Password**.



Username: jpearson

Password: ●●●●●●●●●

4. In the **Contact info** section, set the user's **Email Address**.

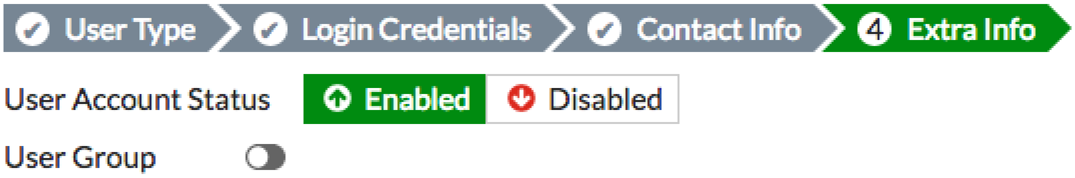


Email Address: jpearson@example.com

○ SMS

○ Two-factor Authentication

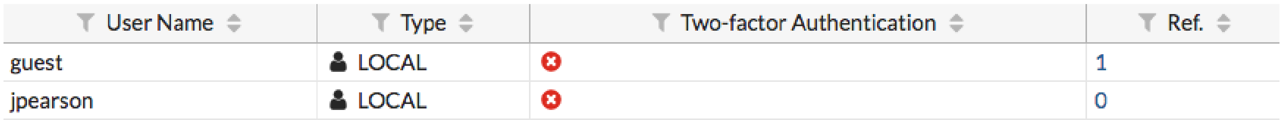
5. In the **Extra Info** section, verify that **User Account Status** is **Enabled**.



User Account Status: [✓ Enabled] Disabled

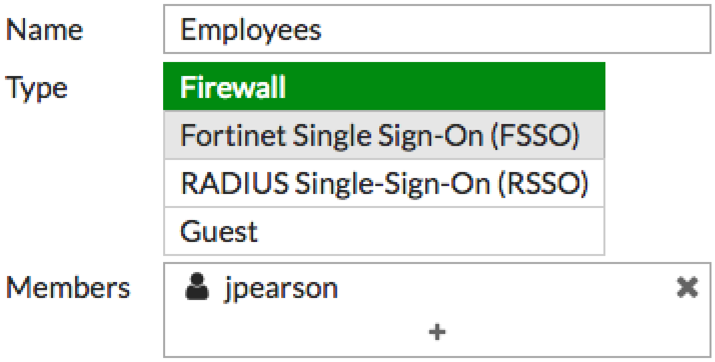
User Group ○

6. Your FortiGate now lists the new user.



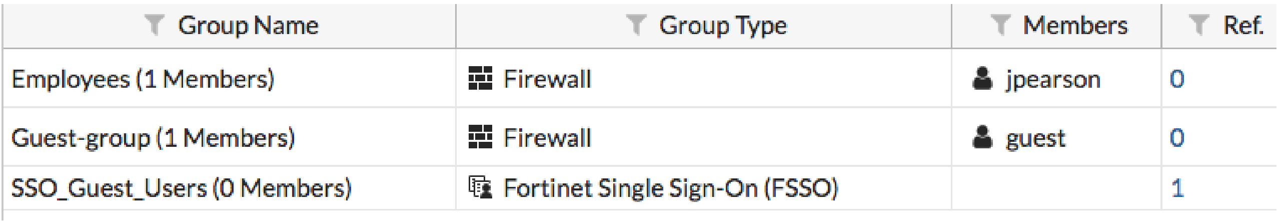
User Name	Type	Two-factor Authentication	Ref.
guest	LOCAL	✖	1
jpearson	LOCAL	✖	0

7. To create a new user group, go to **User & Device > User Groups** (in the example, this group is called *Employees*). Add user **jpearson** to the **Members** list.



Name	Employees
Type	Firewall Fortinet Single Sign-On (FSSO) RADIUS Single-Sign-On (RSSO) Guest
Members	jpearson ✖ +

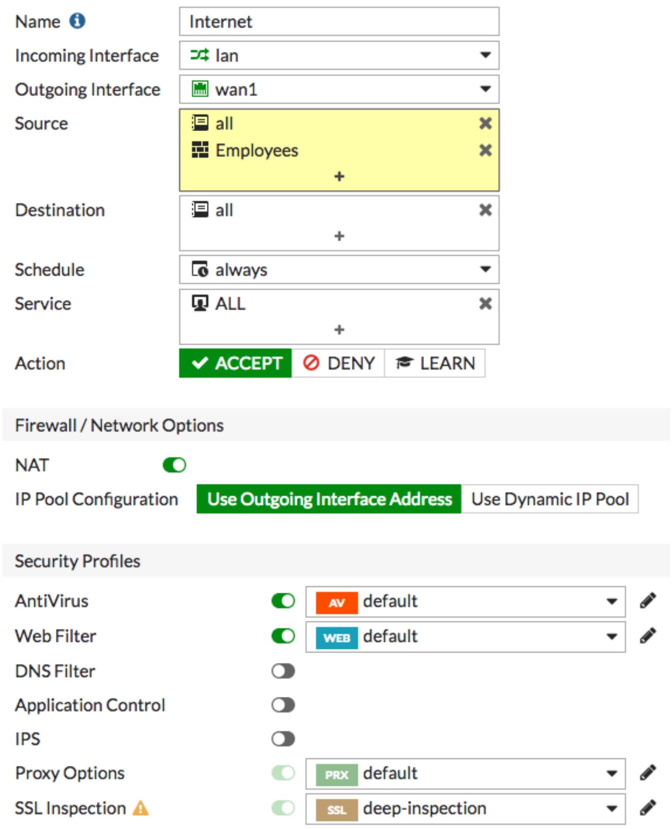
8. The FortiGate now lists the new user group.



Group Name	Group Type	Members	Ref.
Employees (1 Members)	Firewall	jpearson	0
Guest-group (1 Members)	Firewall	guest	0
SSO_Guest_Users (0 Members)	Fortinet Single Sign-On (FSSO)		1

9. To edit the Internet policy, go to **Policy & Objects > IPv4 Policy**.
10. For **Source**, set **Address** to **all** and **User** to the **Employees** group.
11. Under **Security Profiles**, enable **AntiVirus** and **Web Filter**. Set both to use the default profile.
12. **SSL Inspection** is enabled by default. Set it to the **deep-inspection** profile.

Using the **deep-inspection** profile may cause certificate errors.



Name	Internet
Incoming Interface	lan
Outgoing Interface	wan1
Source	all Employees
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT / DENY / LEARN

Firewall / Network Options

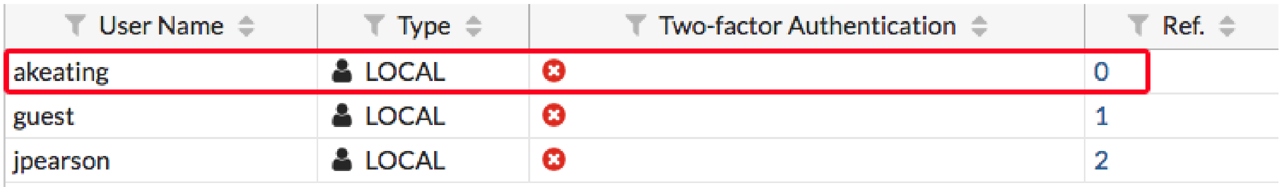
NAT	●
IP Pool Configuration	Use Outgoing Interface Address / Use Dynamic IP Pool

Security Profiles

AntiVirus	●	AV default
Web Filter	●	WEB default
DNS Filter	○	
Application Control	○	
IPS	○	
Proxy Options	●	PRX default
SSL Inspection ⚠	●	SSL deep-inspection

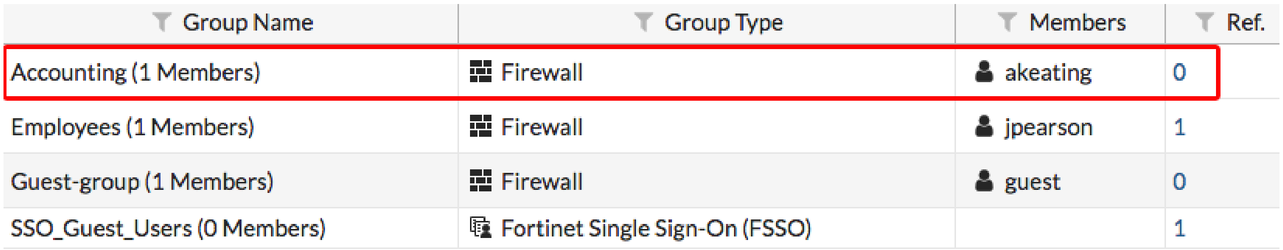
Creating the Accounting user and policy

1. To create another user, go to **User & Device > User Definition** and select **Create New** (in the example, *akeating*).



User Name	Type	Two-factor Authentication	Ref.
akeating	LOCAL	☒	0
guest	LOCAL	☒	1
jpearson	LOCAL	☒	2

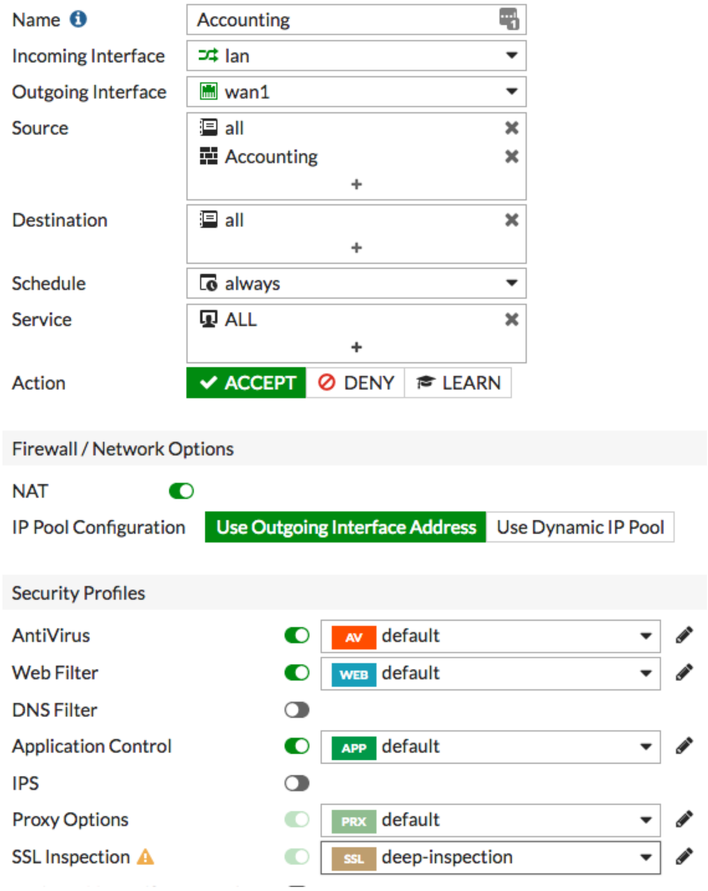
2. To create another user group, go to **User & Device > User Groups** and select **Create New** (in the example, *Accounting*). Add user **akeating** to the **Members** list.



Group Name	Group Type	Members	Ref.
Accounting (1 Members)	Firewall	akeating	0
Employees (1 Members)	Firewall	jpearson	1
Guest-group (1 Members)	Firewall	guest	0
SSO_Guest_Users (0 Members)	Fortinet Single Sign-On (FSSO)		1

3. To create a new *Accounting* policy, go to **Policy & Objects > IPv4 Policy** and **select Create New.**
4. For **Source**, set **Address** to **all** and **User** to the **Accounting** group.

5. Under **Security Profiles**, enable **AntiVirus**, **Web Filter**, **Application Control**, and **IPS**. Set all of these to use the **default** profile.
6. **SSL Inspection** is enabled by default. Set it to the **deep-inspection** profile.



Name: Accounting

Incoming Interface: lan

Outgoing Interface: wan1

Source: all, Accounting

Destination: all

Schedule: always

Service: ALL

Action: ACCEPT | DENY | LEARN

Firewall / Network Options

NAT: on

IP Pool Configuration: Use Outgoing Interface Address | Use Dynamic IP Pool

Security Profiles

AntiVirus: on, AV default

Web Filter: on, WEB default

DNS Filter: off

Application Control: on, APP default

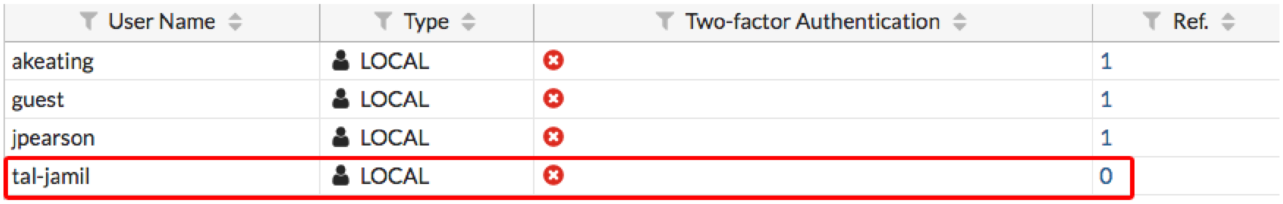
IPS: off

Proxy Options: PRX default

SSL Inspection: SSL deep-inspection

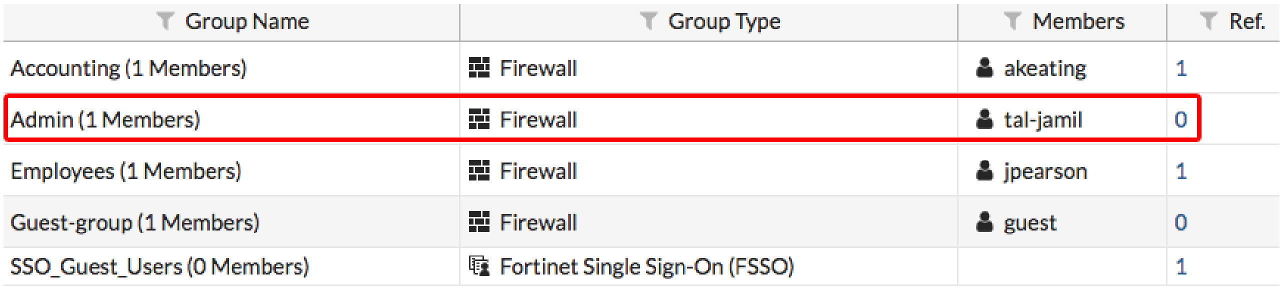
Creating the Admin user, device, and policy

1. To create another user, go to **User & Device > User Definition** and select **Create New** (in the example, *tal-jamil*).



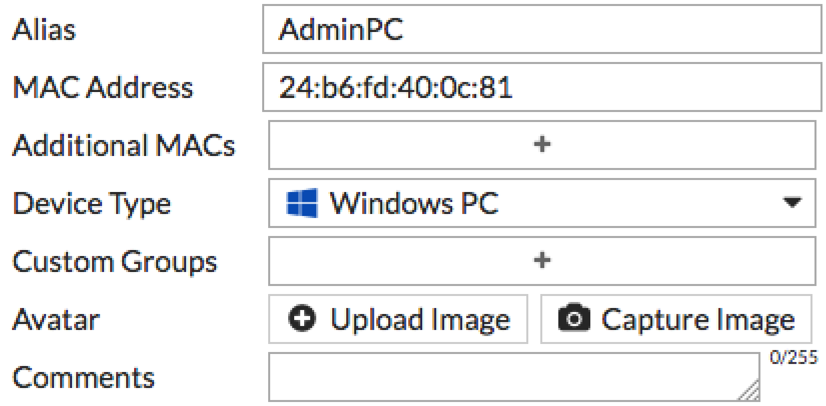
User Name	Type	Two-factor Authentication	Ref.
akeating	LOCAL	✗	1
guest	LOCAL	✗	1
jpearson	LOCAL	✗	1
tal-jamil	LOCAL	✗	0

2. To create another user group, go to **User & Device > User Groups** and select **Create New** (in the example, *Admin*). Add user **tal-jamil** to the Members list.



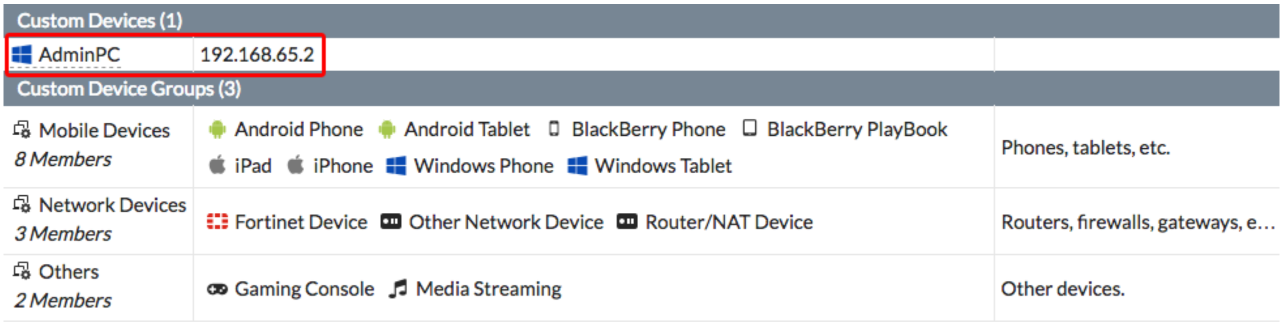
Group Name	Group Type	Members	Ref.
Accounting (1 Members)	Firewall	akeating	1
Admin (1 Members)	Firewall	tal-jamil	0
Employees (1 Members)	Firewall	jpearson	1
Guest-group (1 Members)	Firewall	guest	0
SSO_Guest_Users (0 Members)	Fortinet Single Sign-On (FSSO)		1

3. To add a new device, go to **User & Device > Custom Devices & Groups** and select **Create New**.
4. Set **Alias** to *AdminPC* and enter the **MAC Address** of the PC. Select the appropriate **Device Type**.



Alias	AdminPC
MAC Address	24:b6:fd:40:0c:81
Additional MACs	+
Device Type	Windows PC
Custom Groups	+
Avatar	Upload Image · Capture Image
Comments	0/255

5. The PC is now listed under **Custom Devices**.



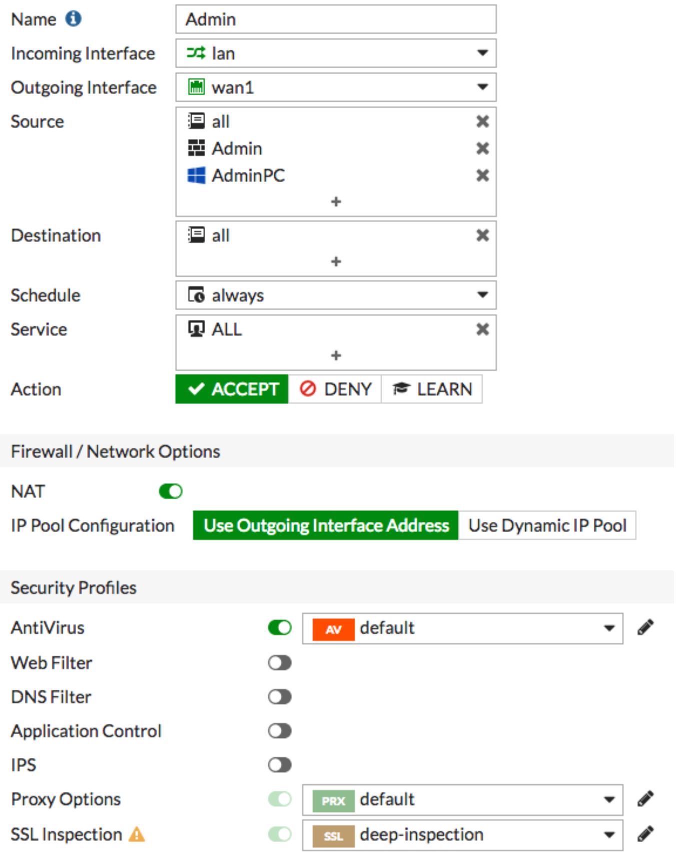
Custom Devices (1)

AdminPC	192.168.65.2	

Custom Device Groups (3)

Mobile Devices *8 Members*	Android Phone, Android Tablet, BlackBerry Phone, BlackBerry PlayBook, iPad, iPhone, Windows Phone, Windows Tablet	Phones, tablets, etc.
Network Devices *3 Members*	Fortinet Device, Other Network Device, Router/NAT Device	Routers, firewalls, gateways, e…
Others *2 Members*	Gaming Console, Media Streaming	Other devices.

6. To create a new *Admin* policy, go to **Policy & Objects > IPv4 Policy** and select **Create New**.
7. For **Source**, set **Address** to **all**, **User** to the **Admin** group, and **Device** to the **AdminPC**.
8. Under **Security Profiles**, enable **AntiVirus** and set it to use the **default** profile.
9. **SSL Inspection** is enabled by default. Set it to the **deep-inspection** profile.



Name	Admin
Incoming Interface	lan
Outgoing Interface	wan1
Source	all Admin AdminPC
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT / DENY / LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

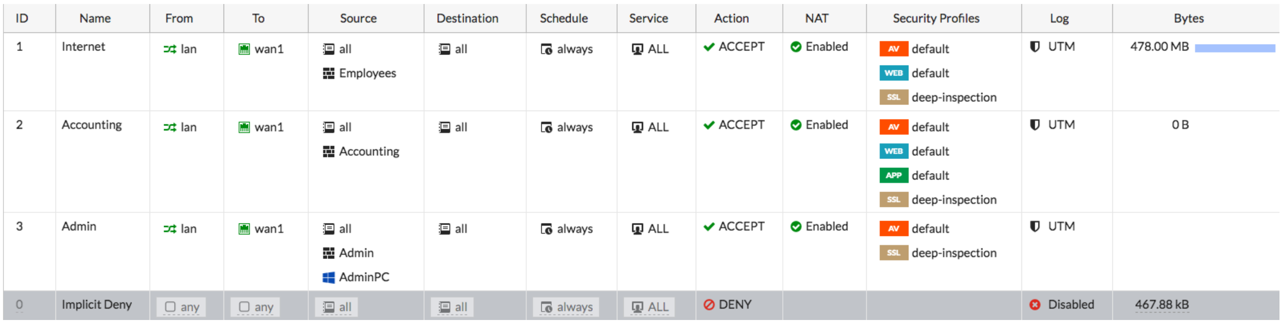
Security Profiles

AntiVirus	●	AV default
Web Filter	○	
DNS Filter	○	
Application Control	○	
IPS	○	
Proxy Options	●	PRX default
SSL Inspection ⚠	●	SSL deep-inspection

Ordering the policy table

1. To view the policy table, go to **Policy & Objects > IPv4 Policy**. Select the **By Sequence** view, which shows the policies in the order that they are used by your FortiGate.

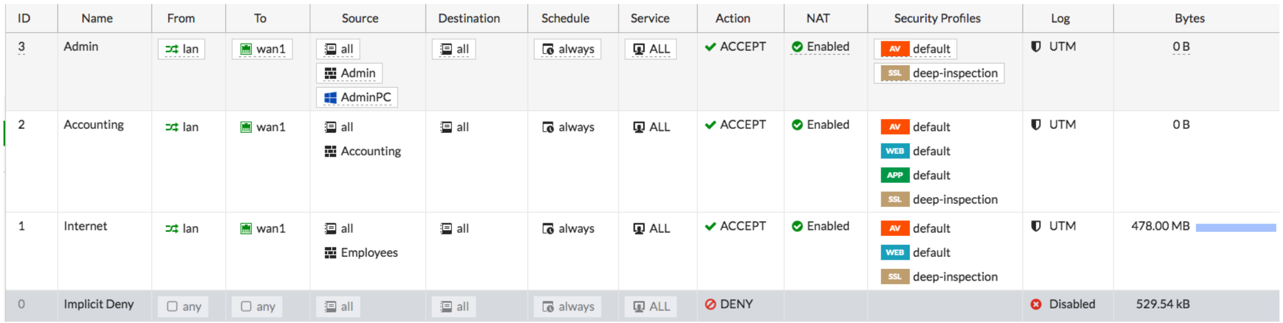
   Currently, the policies are arranged in the order you created them, with the oldest policy at the top of the list.



ID	Name	From	To	Source	Destination	Schedule	Service	Action	NAT	Security Profiles	Log	Bytes
1	Internet	lan	wan1	all Employees	all	always	ALL	✓ ACCEPT	Enabled	AV default WEB default SSL deep-inspection	UTM	478.00 MB
2	Accounting	lan	wan1	all Accounting	all	always	ALL	✓ ACCEPT	Enabled	AV default WEB default APP default SSL deep-inspection	UTM	0 B
3	Admin	lan	wan1	all Admin AdminPC	all	always	ALL	✓ ACCEPT	Enabled	AV default SSL deep-inspection	UTM	
0	Implicit Deny	any	any	all	all	always	ALL	DENY			Disabled	467.88 kB

2. To have the correct traffic flowing through each policy, you must arrange them so that the more specific policies are located at the top.

   To rearrange the policies, select the column on the far left (in the example, ID) and drag the policy to the required position, as shown on the right.

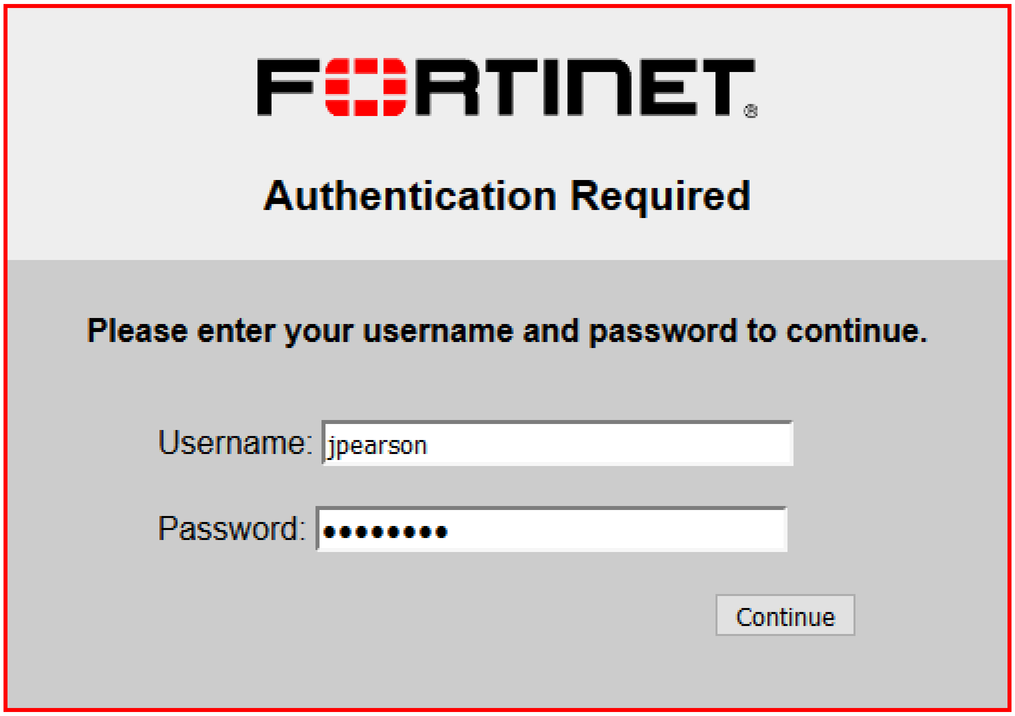


ID	Name	From	To	Source	Destination	Schedule	Service	Action	NAT	Security Profiles	Log	Bytes
3	Admin	lan	wan1	all Admin AdminPC	all	always	ALL	✓ ACCEPT	Enabled	AV default SSL deep-inspection	UTM	0 B
2	Accounting	lan	wan1	all Accounting	all	always	ALL	✓ ACCEPT	Enabled	AV default WEB default APP default SSL deep-inspection	UTM	0 B
1	Internet	lan	wan1	all Employees	all	always	ALL	✓ ACCEPT	Enabled	AV default WEB default SSL deep-inspection	UTM	478.00 MB
0	Implicit Deny	any	any	all	all	always	ALL	DENY			Disabled	529.54 kB

Results

1. From any PC in the internal network, attempt to browse the Internet. A log in screen will appear. Use the **jpearson** account to log in. After authentication, you can connect to the Internet.

> If a certificate error occurs during the authentication process, browse to a different site and re-attempt user authentication.



FORTINET

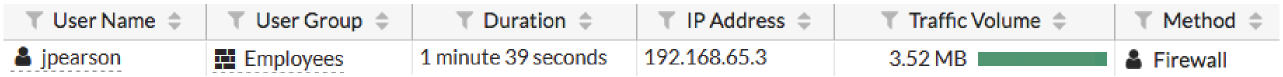
Authentication Required

Please enter your username and password to continue.

Username: jpearson

Password: ••••••••

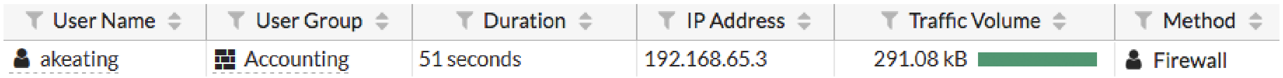
2. Go to **Monitor > Firewall User Monitor**. The list shows **jpearson** is online.



User Name	User Group	Duration	IP Address	Traffic Volume	Method
jpearson	Employees	1 minute 39 seconds	192.168.65.3	3.52 MB	Firewall

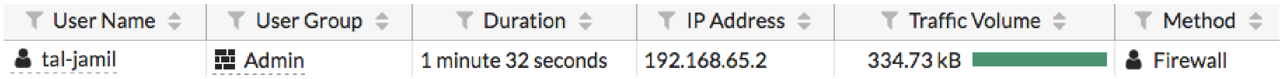
3. Right-click the account and select **Deauthenticate**.
4. On the same PC, attempt to browse the Internet again. This time, log in using the **akeating** account.

5. The **Firewall User Monitor** now shows **akeating** is online and you can access the Internet.



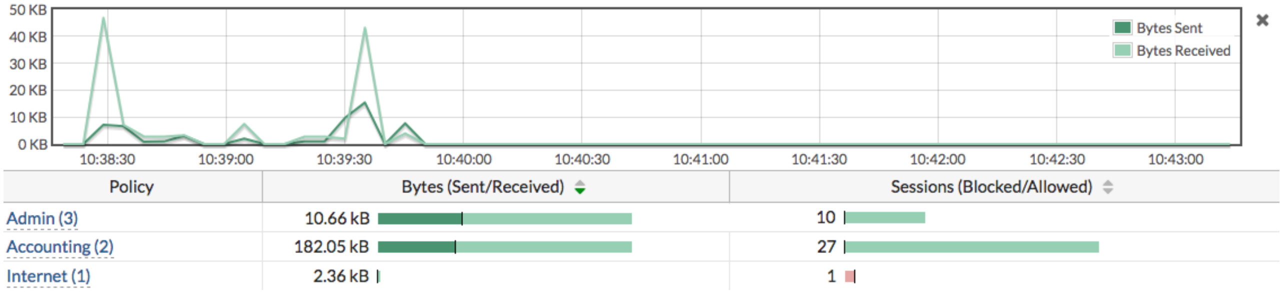
User Name	User Group	Duration	IP Address	Traffic Volume	Method
akeating	Accounting	51 seconds	192.168.65.3	291.08 kB	Firewall

6. From the **AdminPC**, attempt to browse the Internet. Log in using the **tal-jamil** account.
7. The **Firewall User Monitor** now shows **tal-jamil** is online and you can access the Internet.



User Name	User Group	Duration	IP Address	Traffic Volume	Method
tal-jamil	Admin	1 minute 32 seconds	192.168.65.2	334.73 kB	Firewall

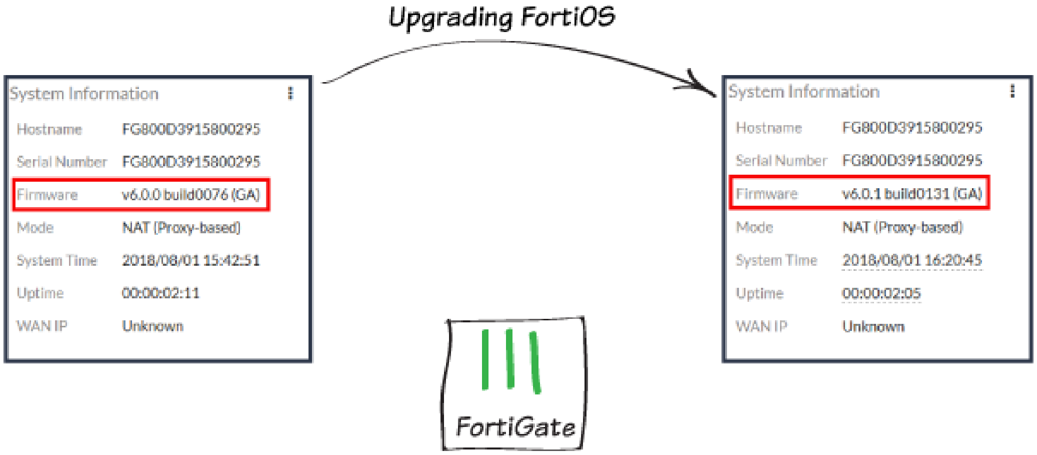
8. If you attempt to log in from any other device using the **tal-jamil** account, the account will authenticate; however, you will not have Internet access.
9. Go to **FortiView >All Segments> Policies** and select the **5 minutes** view. You can see traffic hitting all three policies and that each user's traffic is flowing through the correct policy.



Policy	Bytes (Sent/Received)	Sessions (Blocked/Allowed)
Admin (3)	10.66 kB	10
Accounting (2)	182.05 kB	27
Internet (1)	2.36 kB	1

For further reading, check out Firewall policies in the FortiOS 6.0 Online Help.

Upgrading FortiGate firmware



System Information

Hostname	FG800D3915800295
Serial Number	FG800D3915800295
Firmware	v6.0.0 build0076 (GA)
Mode	NAT (Proxy-based)
System Time	2018/08/01 15:42:51
Uptime	00:00:02:11
WAN IP	Unknown

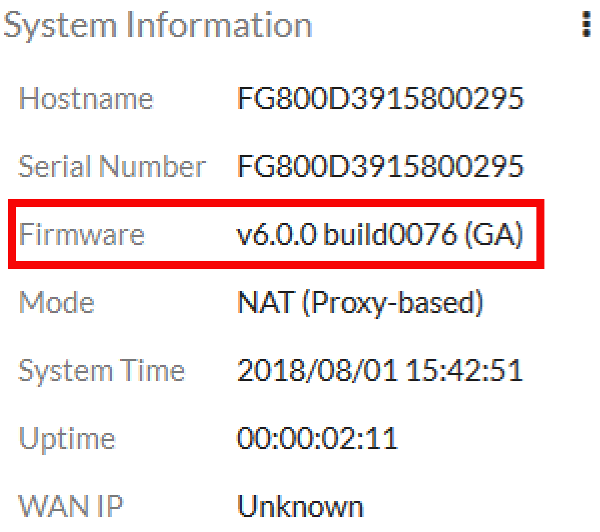
System Information

Hostname	FG800D3915800295
Serial Number	FG800D3915800295
Firmware	v6.0.1 build0131 (GA)
Mode	NAT (Proxy-based)
System Time	2018/08/01 16:20:45
Uptime	00:00:02:05
WAN IP	Unknown

In this example, you upgrade your FortiGate firmware from FortiOS 6.0.0 to 6.0.1.

Checking the current FortiOS firmware

1. To check which firmware version you’re using, go to the **Dashboard** and view the **System Information** widget, which shows the current **Firmware**.

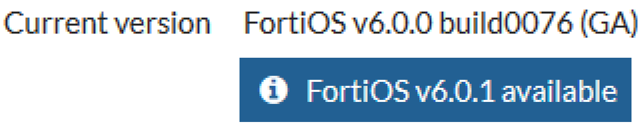


System Information

Hostname	FG800D3915800295
Serial Number	FG800D3915800295
Firmware	v6.0.0 build0076 (GA)
Mode	NAT (Proxy-based)
System Time	2018/08/01 15:42:51
Uptime	00:00:02:11
WAN IP	Unknown

2. To find out if a new FortiOS version is available, go to **System > Firmware**. If new firmware is available, a notice appears under **Current version**.

When a new FortiOS version is released, it may not be listed on your FortiGate right away. If this occurs, download the firmware from Fortinet Support, then use **Upload Firmware** to upgrade your FortiGate.



Current version FortiOS v6.0.0 build0076 (GA)

FortiOS v6.0.1 available

Upgrading to the latest version

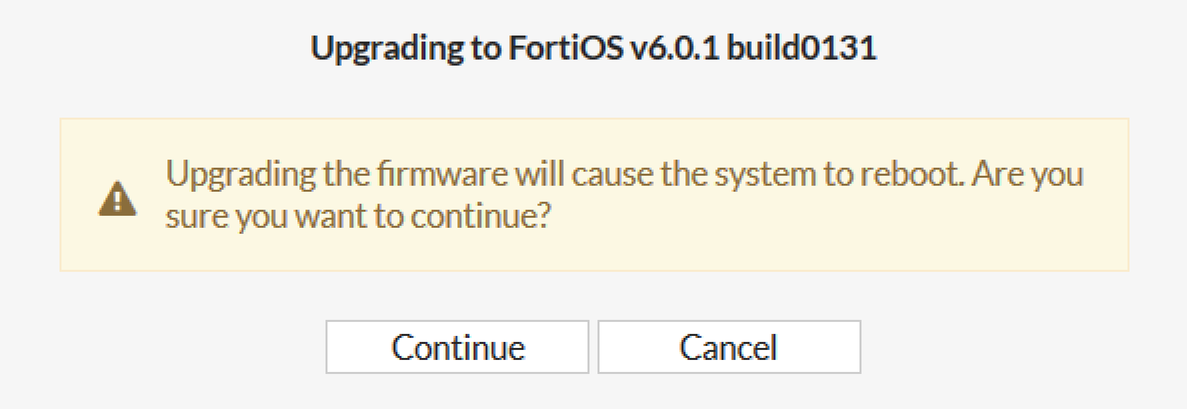
1. Under **FortiGuard Firmware**, select Latest. A notice may appear stating that there is no valid upgrade path for this firmware version. If this is the case, select All available instead and find a suitable firmware version for your FortiGate.

   For more information about the upgrade path, go to Fortinet Support.
2. If no warning appears, select **Release notes** to learn more about the firmware build. Release notes are also available at the Fortinet Documentation Library.

FortiOS - Release Notes

Version 6.0.1

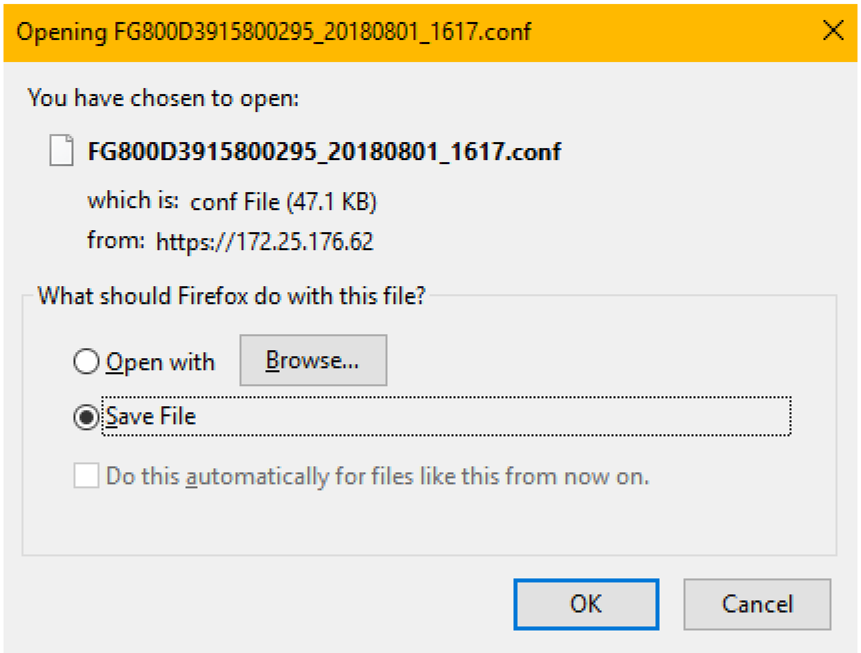
3. To upgrade your FortiGate, select **Backup config and upgrade**. When prompted, select **Continue**.



Upgrading to FortiOS v6.0.1 build0131

Upgrading the firmware will cause the system to reboot. Are you sure you want to continue?

4. Save the backup of your current FortiGate configuration, in case you need to restore it after the upgrade process.



Opening FG800D3915800295_20180801_1617.conf

You have chosen to open:

FG800D3915800295_20180801_1617.conf

which is: conf File (47.1 KB)

from: https://172.25.176.62

What should Firefox do with this file?

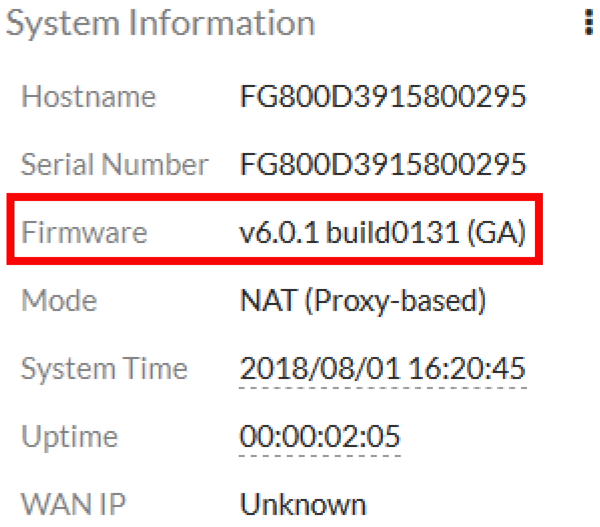
○ Open with Browse...

● Save File

□ Do this automatically for files like this from now on.

Results

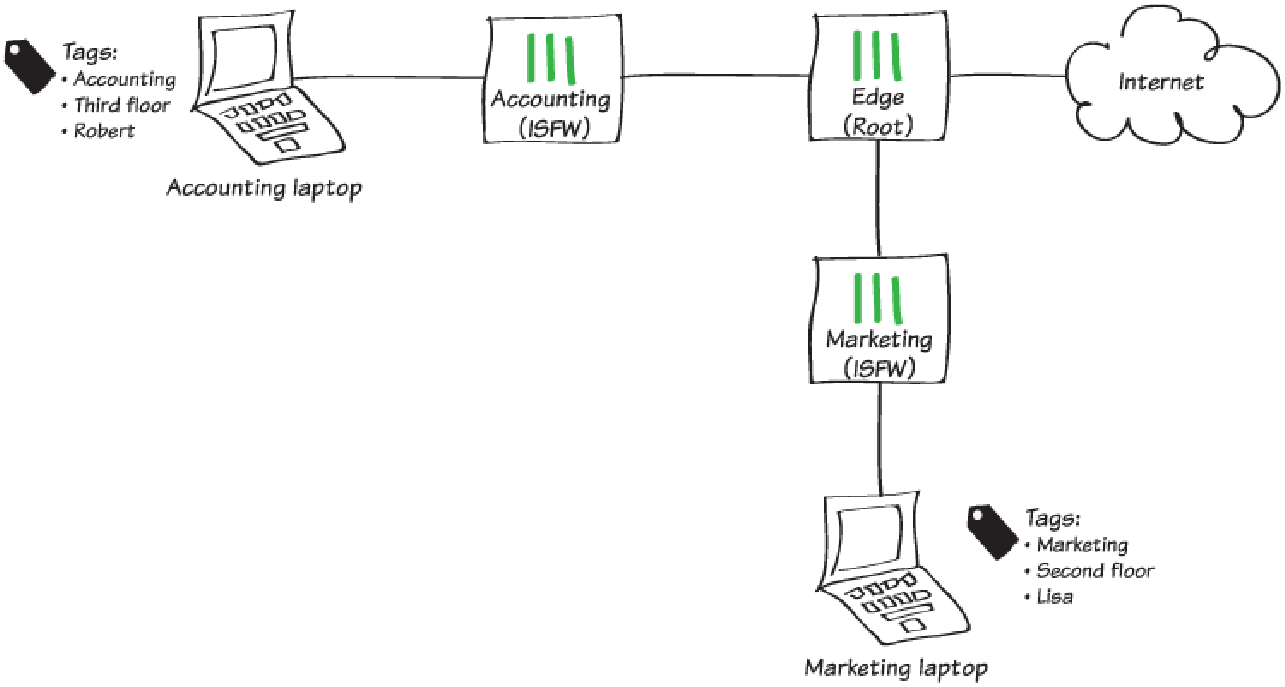
1. The FortiGate uploads and installs the firmware, then restarts. This process takes a few minutes. When the firmware is installed, the FortiGate login appears.
2. Go to the **Dashboard**. The **System Information** widget shows the new **Firmware** version.



System Information

Hostname	FG800D3915800295
Serial Number	FG800D3915800295
Firmware	v6.0.1 build0131 (GA)
Mode	NAT (Proxy-based)
System Time	2018/08/01 16:20:45
Uptime	00:00:02:05
WAN IP	Unknown

Tags in the Fortinet Security Fabric



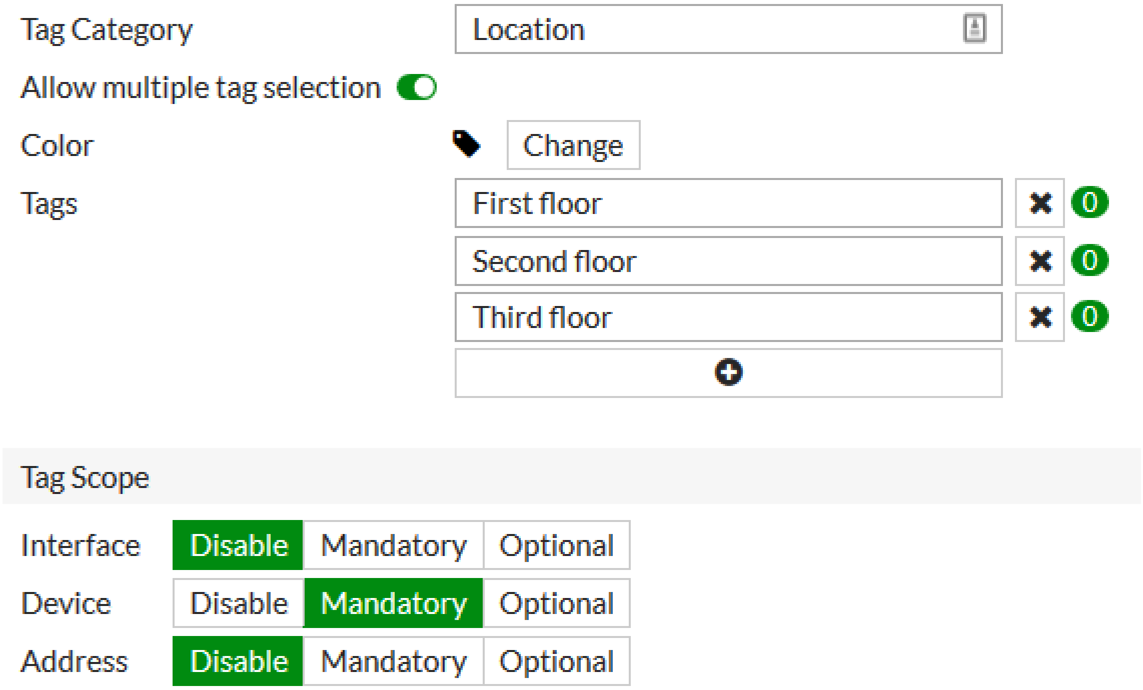
In this recipe, you create tag categories and tags for your network. By applying these tags to different devices, interfaces, and addresses, you identify the location and function of each part of your Security Fabric and increase network visibility.

Creating tag categories and tags

In this example, you use tags to identify the following things about devices in the Security Fabric:

- Physical location
- Department
- Network administrators

1. To create the tag category for physical location, connect to Edge and go to **System > Tags**.
2. Set **Tag Category** to **Location**. Because each device in the network can only have one location, disable **Allow multiple tag selection**.
3. Add **Tags** for the first floor, second floor, and third floor.
4. Under **Tag Scope**, set **Device** to **Mandatory**.



Tag Category: Location

Allow multiple tag selection ●

Color

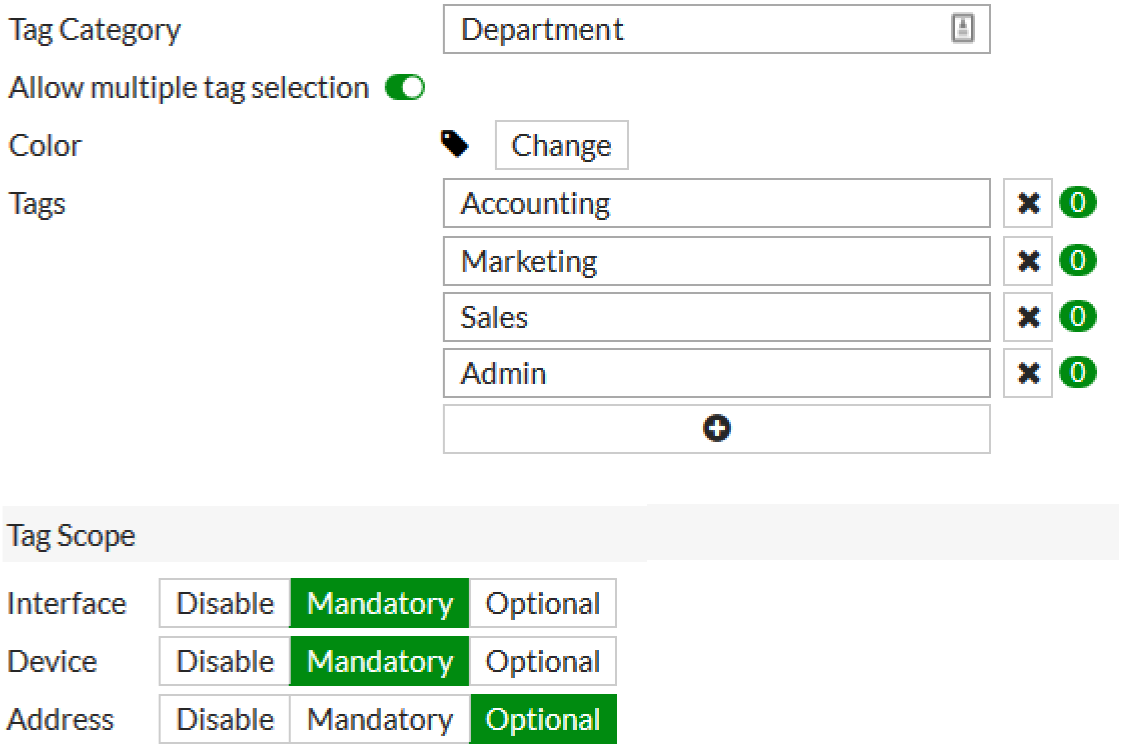
Tags:

- First floor 0
- Second floor 0
- Third floor 0

Tag Scope

Interface	[✓ Disable]	Mandatory	Optional
Device	Disable	[✓ Mandatory]	Optional
Address	[✓ Disable]	Mandatory	Optional

5. For the department tag, enable **Allow multiple tag selection**.
6. Add **Tags** for the following departments: *Accounting*, *Marketing*, *Sales*, and *Admin*.
7. Under **Tag Scope**, set **Interface** to **Mandatory** and set **Device** to **Mandatory**. Because the FortiGate configuration includes default addresses, set **Address** to **Optional**.



Tag Category: Department

Allow multiple tag selection ●

Color

Tags:

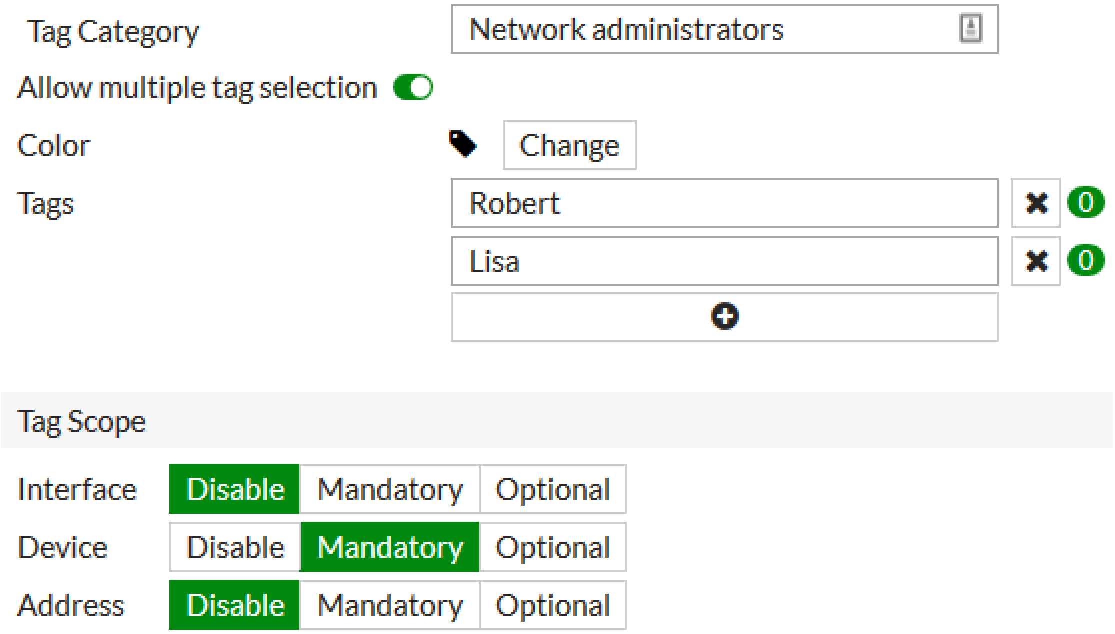
- Accounting 0
- Marketing 0
- Sales 0
- Admin 0

Tag Scope

Interface	Disable	[✓ Mandatory]	Optional
Device	Disable	[✓ Mandatory]	Optional
Address	Disable	Mandatory	[✓ Optional]

8. For the network administrators tag, enable **Allow multiple tag selection**.

9. Add **Tags** for *Robert* and *Lisa*.
10. Under **Tag Scope**, set **Device** to **Mandatory**.



Tag Category: Network administrators

Allow multiple tag selection: ●

Color: Change

Tags: Robert ✖ 0
 Lisa ✖ 0

Tag Scope

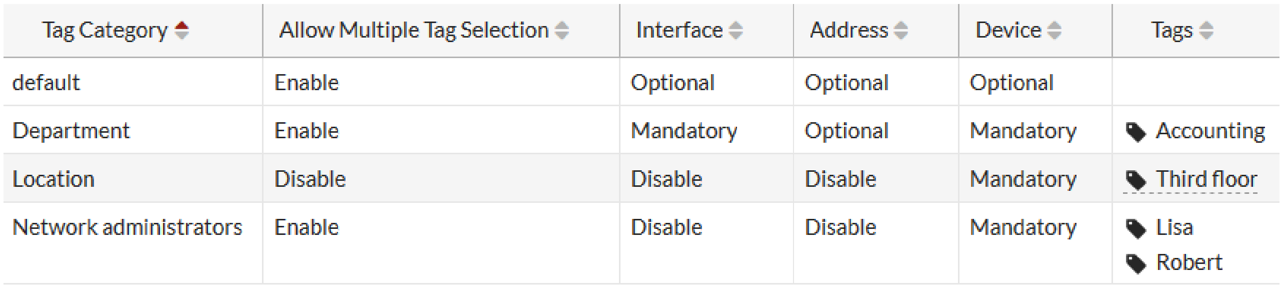
Interface: [✓ Disable] Mandatory Optional

Device: Disable [✓ Mandatory] Optional

Address: [✓ Disable] Mandatory Optional

11. Because the configuration of tag categories and tags isn't synchronized across the Security Fabric, you must connect to each FortiGate device separately and add the appropriate tags for the part of your network that uses that FortiGate.

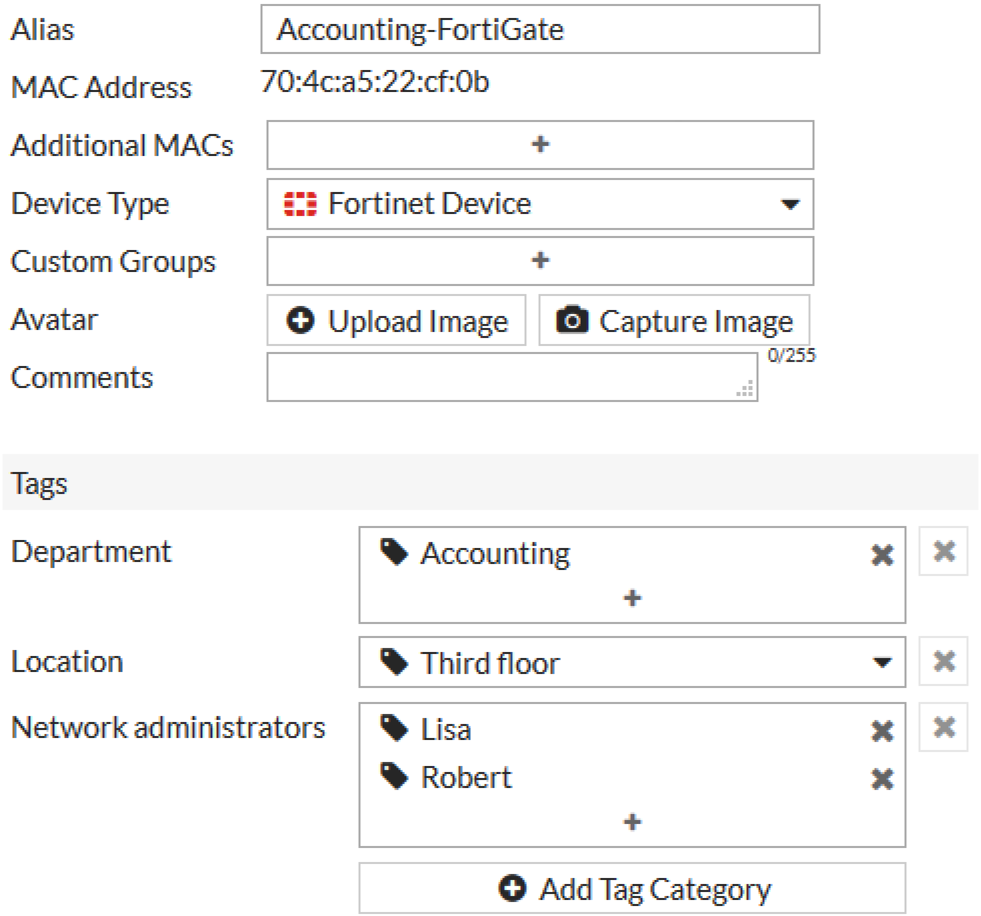
    Connect to Accounting and repeat the previous steps to create the tags that are shown.



Tag Category	Allow Multiple Tag Selection	Interface	Address	Device	Tags
default	Enable	Optional	Optional	Optional	
Department	Enable	Mandatory	Optional	Mandatory	Accounting
Location	Disable	Disable	Disable	Mandatory	Third floor
Network administrators	Enable	Disable	Disable	Mandatory	Lisa Robert

Applying tags

1. To apply tags to devices in your network, go to **User & Device > Device Inventory**.
2. Edit the Accounting FortiGate.
3. Under **Tags**, add the following tags:
   - For **Department**, add the **Accounting** tag
   - For **Location**, add the **Third floor tag**
   - For **Network administrators**, add the **Robert** and **Lisa** tags



Alias: Accounting-FortiGate

MAC Address: 70:4c:a5:22:cf:0b

Additional MACs: +

Device Type: Fortinet Device

Custom Groups: +

Avatar: Upload Image | Capture Image

Comments: 0/255

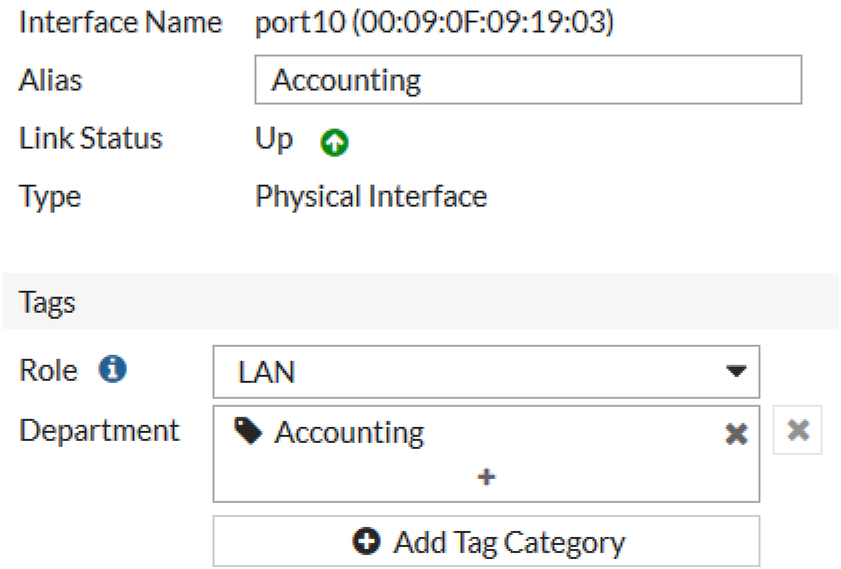
Tags

Department: Accounting

Location: Third floor

Network administrators: Lisa
Robert

4. Edit all other devices listed and apply the appropriate tags for department, location, and administrators.
5. To apply tags to interfaces in your network, go to **Network > Interfaces**. Edit the interface that connects Edge and Accounting (in the example, **port 10**).
6. Under **Tags**, set **Department** to **Accounting**.



Interface Name: port10 (00:09:0F:09:19:03)

Alias: Accounting

Link Status: Up

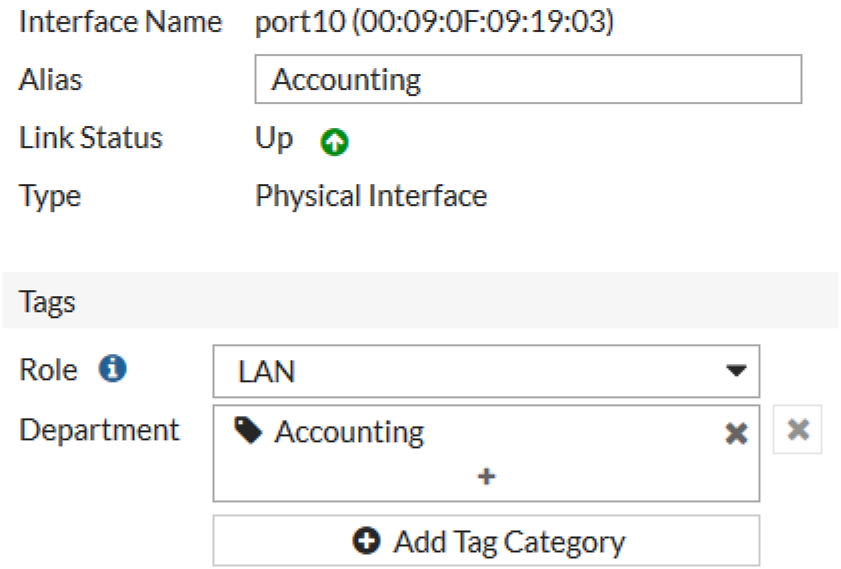
Type: Physical Interface

Tags

Role: LAN

Department: Accounting

7. Edit all other interfaces and apply the appropriate tag for department.
8. To apply tags to addresses in your network, go to **Policy & Objects > Addresses**. Edit the address for the Accounting subnet.
9. Under **Tags**, set **Department** to **Accounting**.



Interface Name port10 (00:09:0F:09:19:03)

Alias Accounting

Link Status Up

Type Physical Interface

Tags

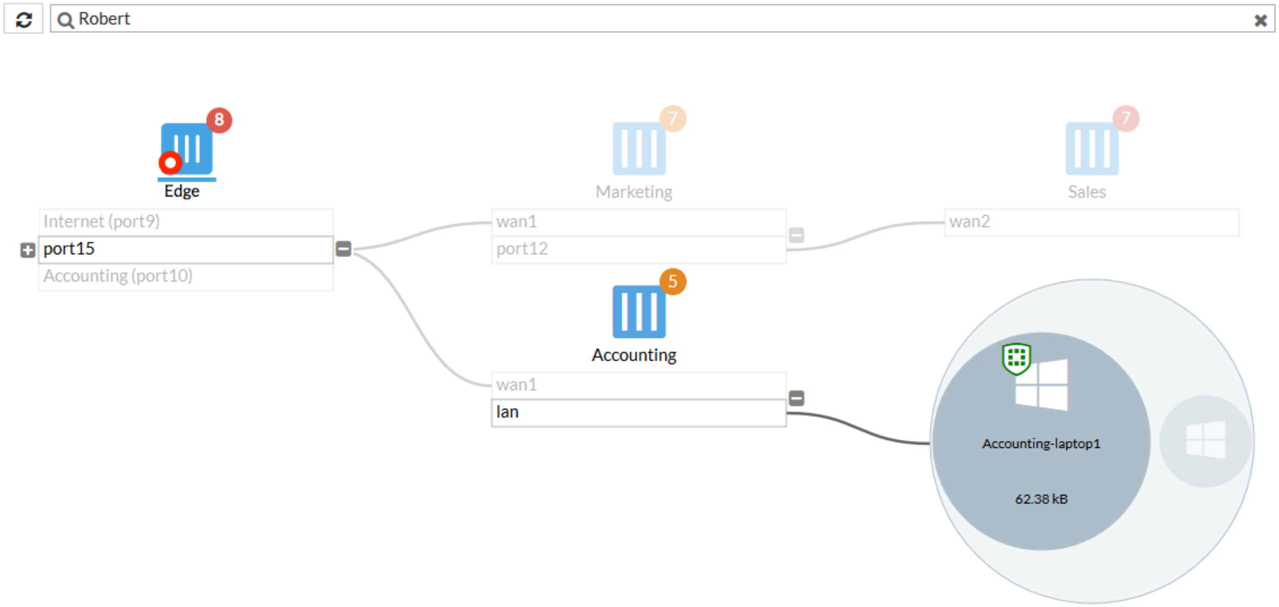
Role LAN

Department Accounting

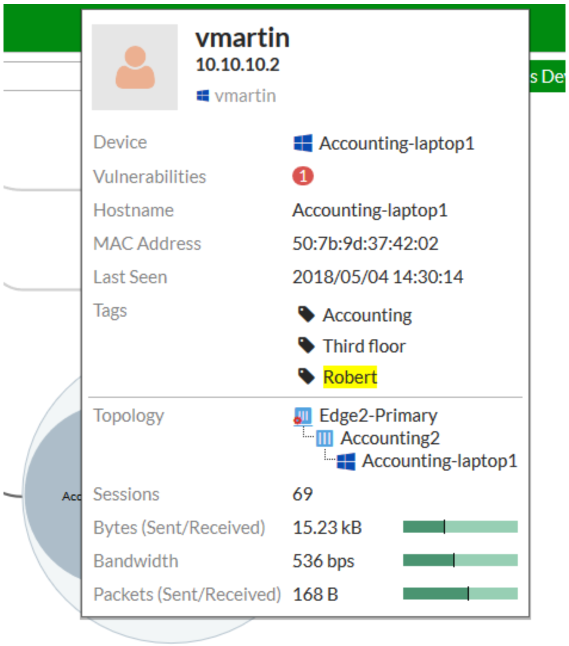
10. Edit all other addresses and apply the appropriate tag for department.
11. To apply tags to devices in on the accounting network, connect to Accounting and go to **User & Device > Device Inventory**.
12. Edit a computer on this network.
13. Under **Tags**, add the following tags:
    - For **Department**, add the **Accounting** tag
    - For **Location**, add the **Third floor** tag
    - For **Network administrators**, add the **Robert** tag
14. Apply the appropriate tags to other devices, interfaces, and addresses on this network.

Results

1. To sort devices and interfaces by tags, connect to Edge and go to **Security Fabric > Logical Topology**.
2. In the **Search** field, enter *Robert*. The devices that have the **Robert** tag are highlighted.

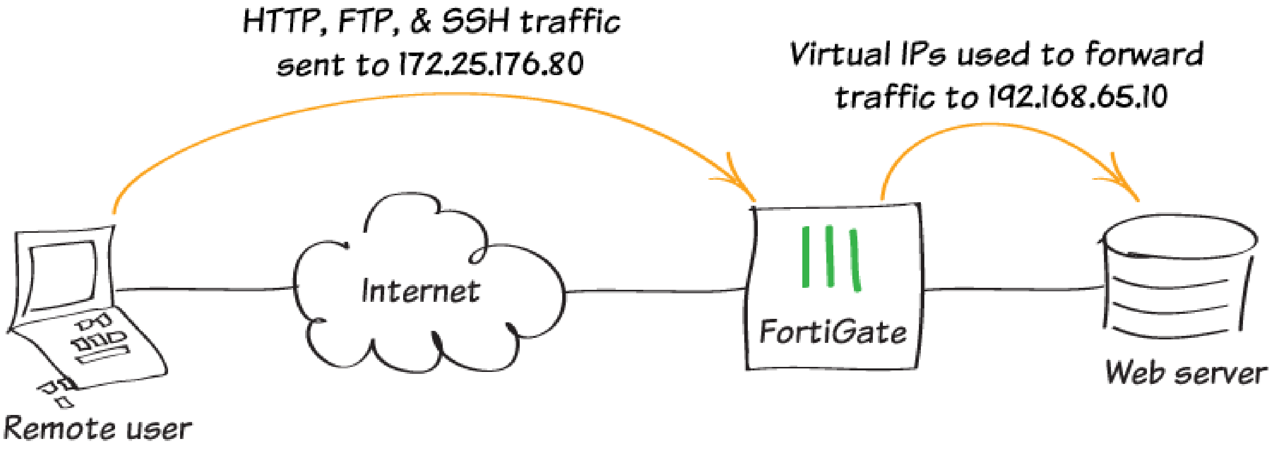


3. To view more information about a highlighted device, including tags, hover over that device in the topology. The **Robert** tag is highlighted.


vmartin
10.10.10.2
vmartin

Device	Accounting-laptop1
Vulnerabilities	1
Hostname	Accounting-laptop1
MAC Address	50:7b:9d:37:42:02
Last Seen	2018/05/04 14:30:14
Tags	Accounting Third floor Robert
Topology	Edge2-Primary Accounting2 Accounting-laptop1
Sessions	69
Bytes (Sent/Received)	15.23 kB
Bandwidth	536 bps
Packets (Sent/Received)	168 B

Port forwarding

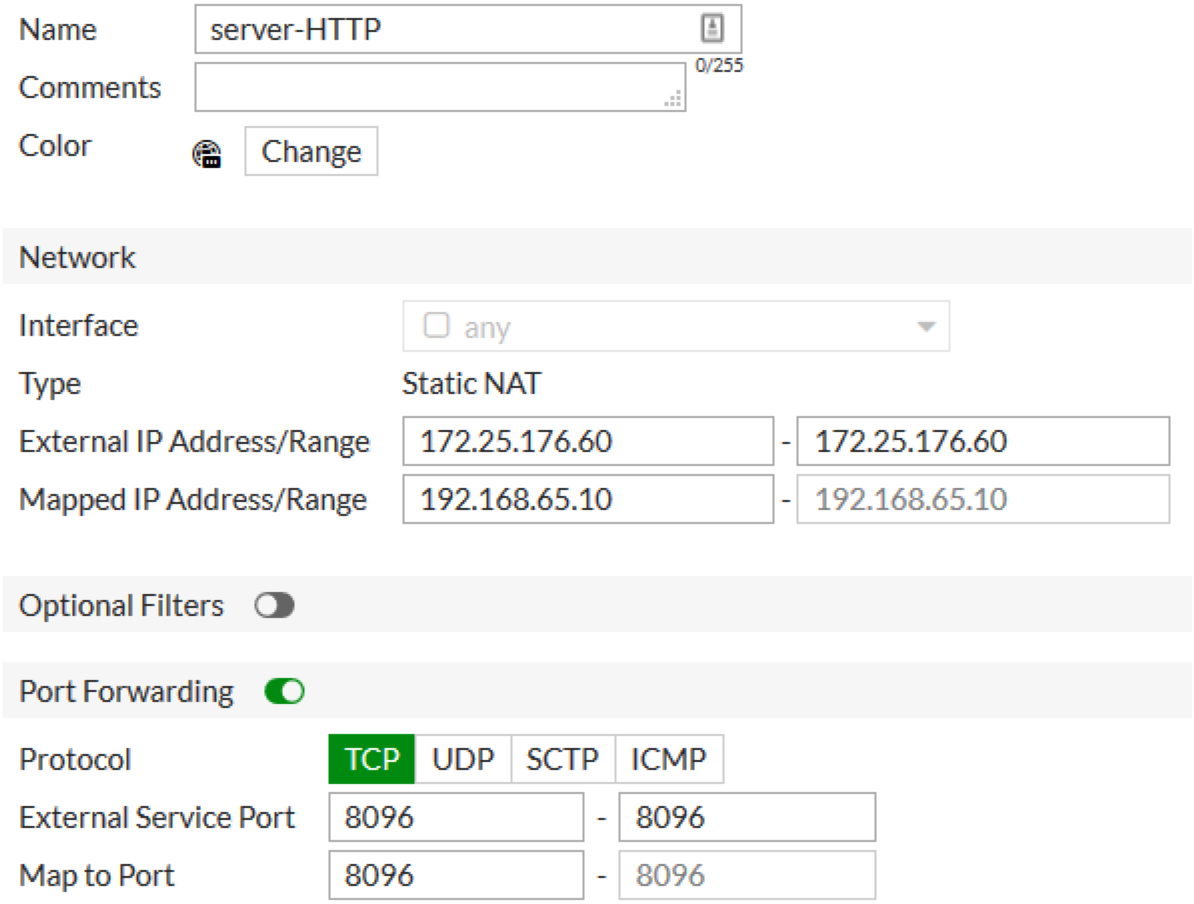

HTTP, FTP, & SSH traffic sent to 172.25.176.80
Virtual IPs used to forward traffic to 192.168.65.10
Internet
FortiGate
Web server
Remote user

In this recipe, you configure port forwarding to open specific ports and allow connections from the Internet to reach a server located behind the FortiGate. This allows Internet users to reach the server through the FortiGate without knowing the server's internal IP address. Users can also connect using only the ports that you choose.

Creating virtual IP addresses

In this example, you open TCP ports 8096 (HTTP), 21 (FTP), and 22 (SSH) for remote users to communicate with the server behind the firewall. The external IP address of the server is 172.25.176.60, which is mapped to the internal IP address 192.168.70.10.

1. To create a virtual IP (VIP) address for port 8096, go to **Policy & Objects > Virtual IPs** and create a new virtual IP address.
2. Set **External IP Address/Range** to *172.25.176.60* and set **Mapped IP Address/Range** to *192.168.65.10*.
3. Enable **Port Forwarding**. Set **Protocol** to **TCP**, set **External Service Port** to **8096**, and set **Map to Port** to *8096*.



Name	server-HTTP		
	0/255		
Comments			
Color	Change		

Network

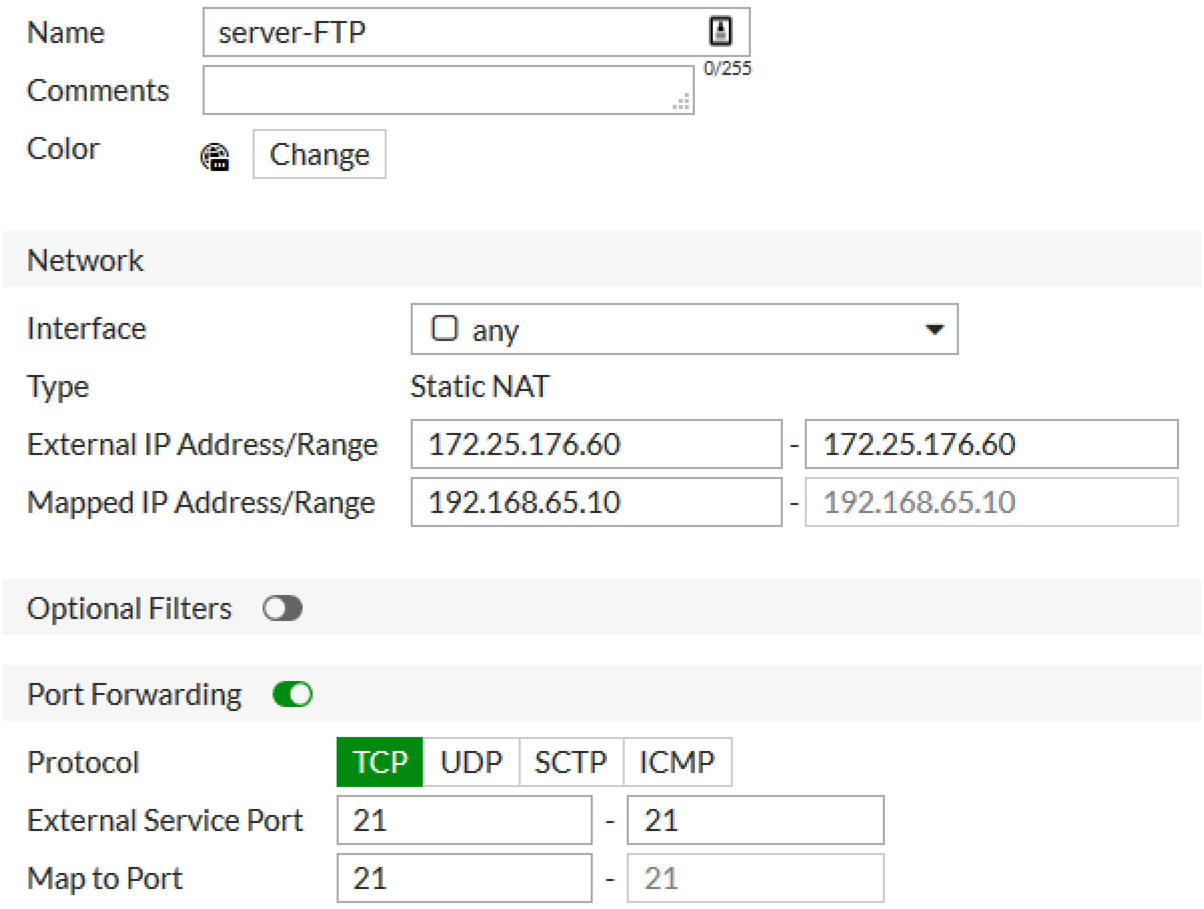
Interface	☐ any		
Type	Static NAT		
External IP Address/Range	172.25.176.60	-	172.25.176.60
Mapped IP Address/Range	192.168.65.10	-	192.168.65.10

Optional Filters ○

Port Forwarding ●

Protocol	[✓ TCP] UDP SCTP ICMP		
External Service Port	8096	-	8096
Map to Port	8096	-	8096

4. Create a second VIP address for port 21. Set both **External Service Port** and **Map to Port** to *21*.



Name	server-FTP		
Comments			
Color	Change		

0/255

Network

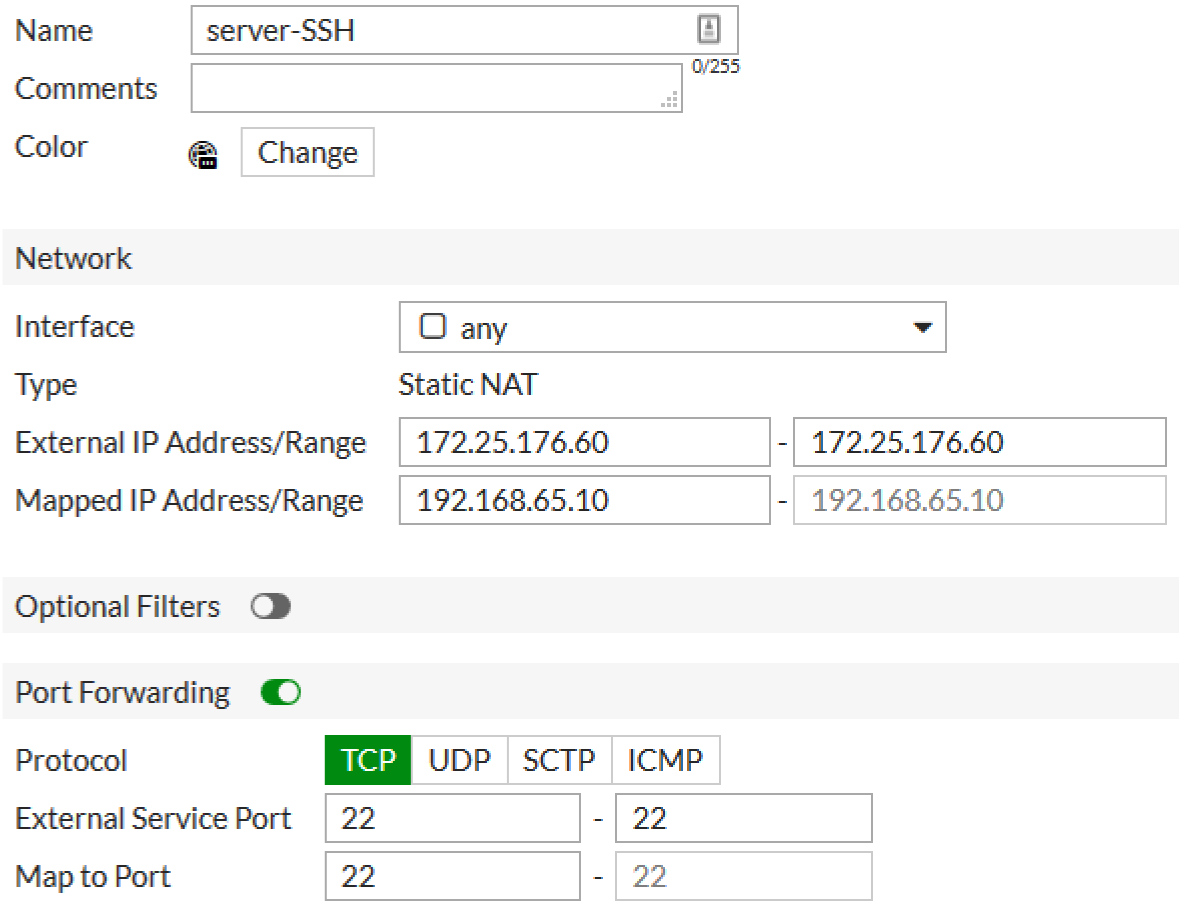
Interface	□ any		
Type	Static NAT		
External IP Address/Range	172.25.176.60	-	172.25.176.60
Mapped IP Address/Range	192.168.65.10	-	192.168.65.10

Optional Filters ○

Port Forwarding ●

Protocol	TCP / UDP / SCTP / ICMP		
External Service Port	21	-	21
Map to Port	21	-	21

5. Create a third VIP address for port 22. Set both **External Service Port** and **Map to Port** to *22*.



Name: server-SSH

Comments: 0/255

Color: Change

Network

Interface: □ any

Type: Static NAT

External IP Address/Range: 172.25.176.60 - 172.25.176.60

Mapped IP Address/Range: 192.168.65.10 - 192.168.65.10

Optional Filters ○

Port Forwarding ●

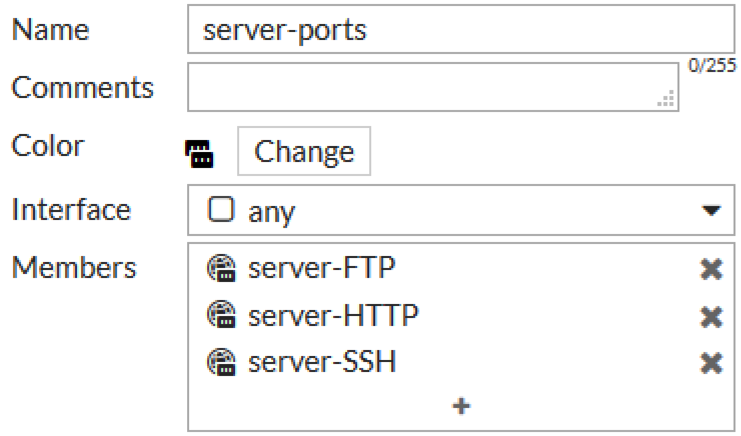
Protocol: [✓ TCP] UDP SCTP ICMP

External Service Port: 22 - 22

Map to Port: 22 - 22

Creating a virtual IP group

1. To add the new virtual IP addresses to a virtual IP group, go to **Policy & Objects > Virtual IPs** and create a new group.
2. Set the new virtual IP addresses as **Members** of the group.



Name: server-ports

Comments: 0/255

Color: Change

Interface: □ any

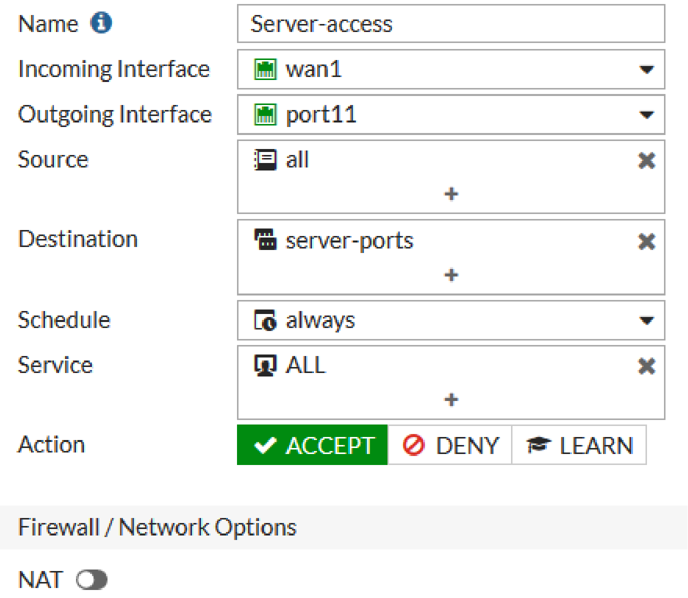
Members:
- server-FTP ✖
- server-HTTP ✖
- server-SSH ✖

Creating a security policy

1. To allow Internet users to reach the server, go to **Policy & Objects > IPv4 Policy** and create a new policy.
2. Set **Incoming Interface** to your Internet-facing interface, **Outgoing Interface** to the interface connected to the server, and **Destination Address** to the VIP group.

   NAT is disabled for this policy so that the server sees the original source addresses of the packets it receives. This is the preferred setting for a number of reasons. For example, the server logs are more meaningful if they record the actual source addresses of your users.

If the FortiGate has Central NAT enabled, the VIP objects won't be available for selection in the policy editing window.



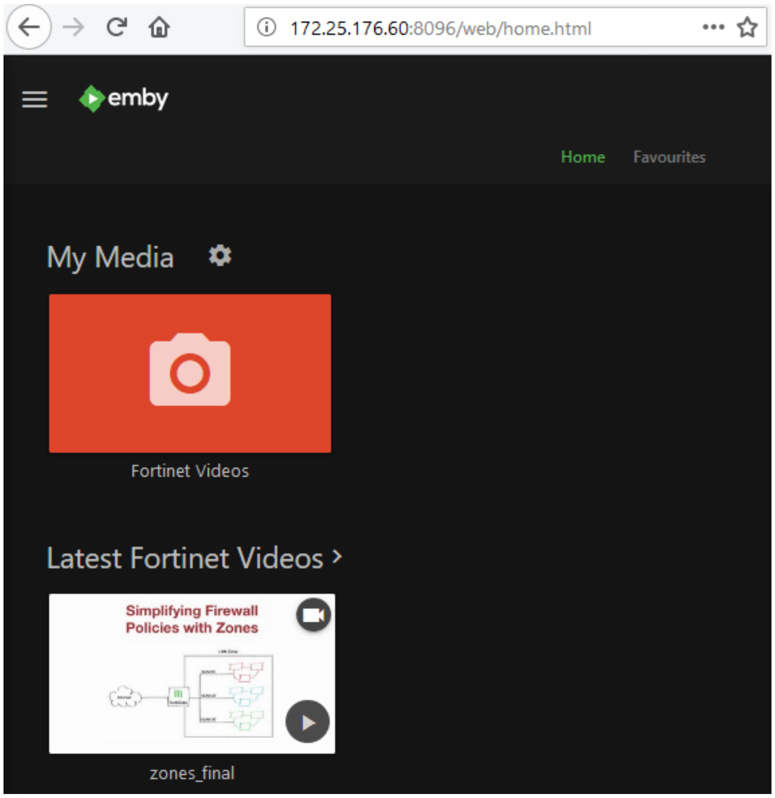
Name	Server-access
Incoming Interface	wan1
Outgoing Interface	port11
Source	all
Destination	server-ports
Schedule	always
Service	ALL
Action	✓ ACCEPT / DENY / LEARN

Firewall / Network Options

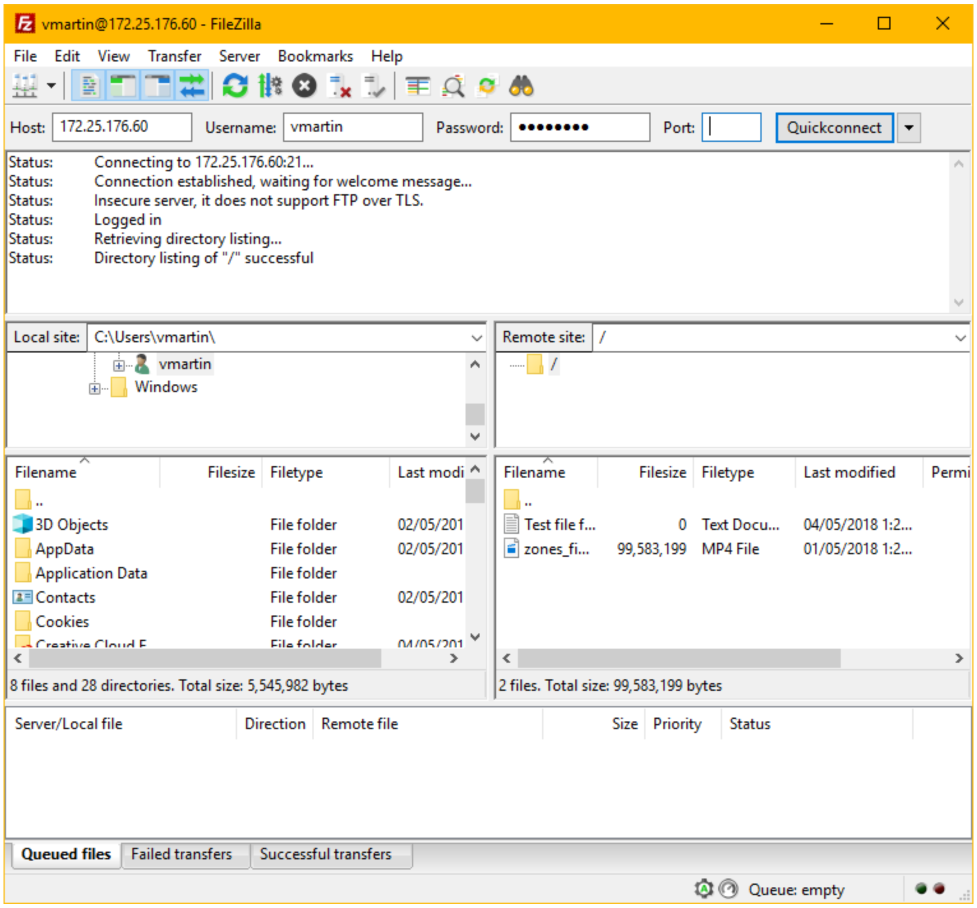
NAT ○

Results

1. To ensure that TCP port 8096 is open, browse to http://172.25.176.60:8096.



2. Next, ensure that TCP port 21 is open by using an FTP client to connect to the FTP server from a remote connection on the other side of the firewall.



Host: 172.25.176.60 Username: vmartin Password: •••••••• Port:

```
Status:	Connecting to 172.25.176.60:21...
Status:	Connection established, waiting for welcome message...
Status:	Insecure server, it does not support FTP over TLS.
Status:	Logged in
Status:	Retrieving directory listing...
Status:	Directory listing of "/" successful
```

Local site: C:\Users\vmartin\

- vmartin
- Windows

Remote site: /

- /

Filename	Filesize	Filetype	Last modi
..			
3D Objects		File folder	02/05/201
AppData		File folder	02/05/201
Application Data		File folder	
Contacts		File folder	02/05/201
Cookies		File folder	
Creative Cloud F...		File folder	04/05/201

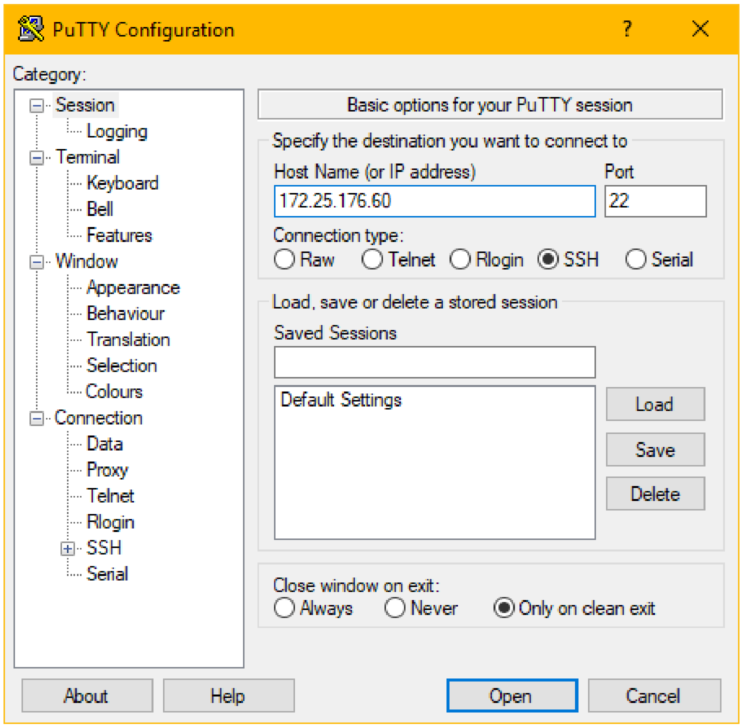
8 files and 28 directories. Total size: 5,545,982 bytes

Filename	Filesize	Filetype	Last modified	Permi
..				
Test file f...	0	Text Docu...	04/05/2018 1:2...	
zones_fi...	99,583,199	MP4 File	01/05/2018 1:2...	

2 files. Total size: 99,583,199 bytes

Server/Local file	Direction	Remote file	Size	Priority	Status

3. Finally, ensure that TCP port 22 is open by connecting to the SSH server from a remote connection on the other side of the firewall.



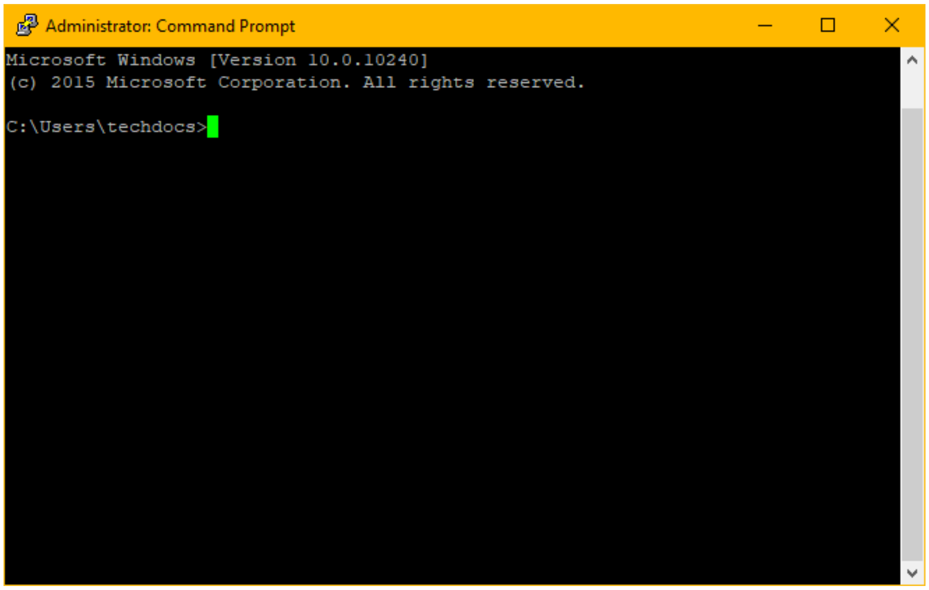
Specify the destination you want to connect to

Host Name (or IP address): 172.25.176.60

Port: 22

Connection type:
○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

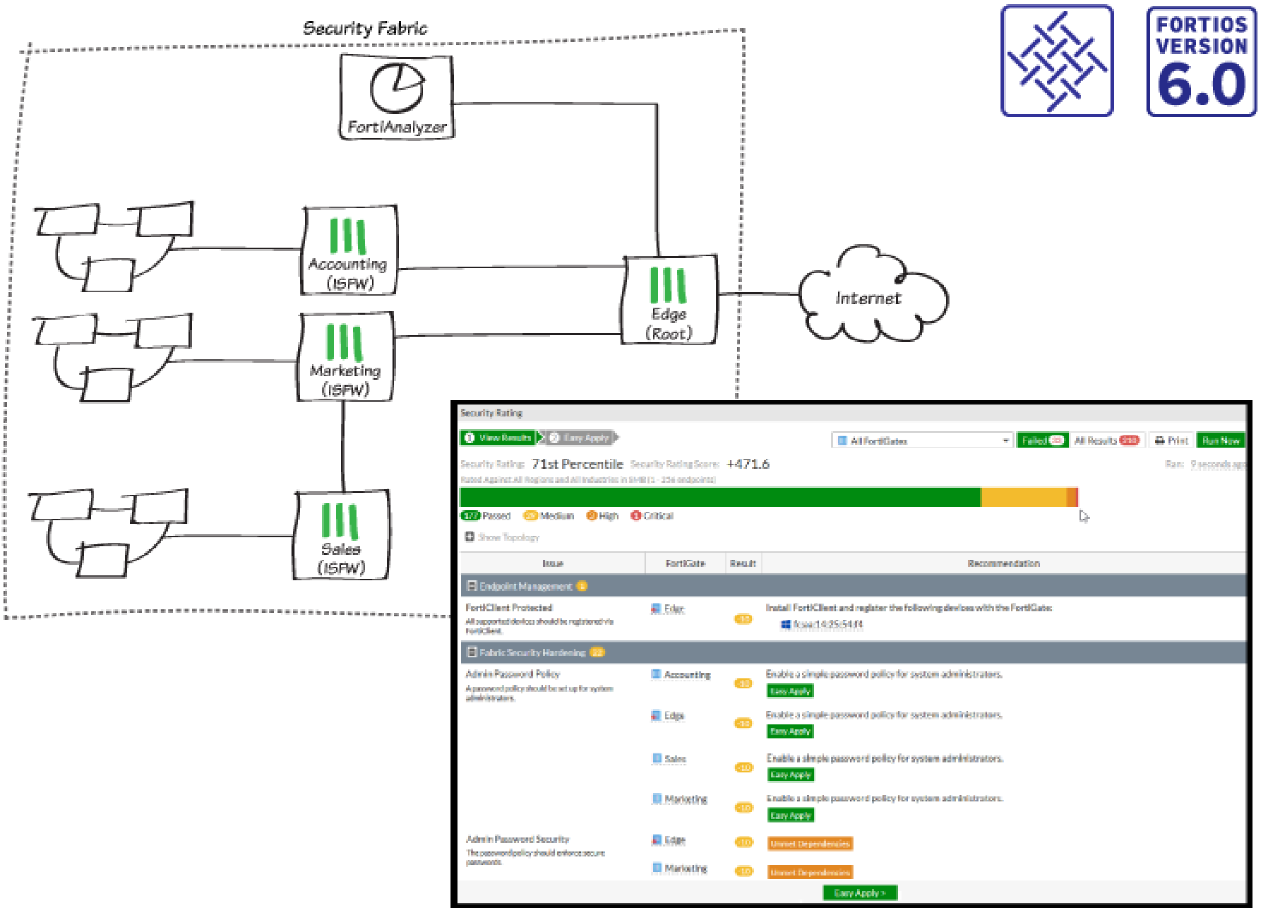
Close window on exit:
○ Always ○ Never ● Only on clean exit



```
Microsoft Windows [Version 10.0.10240]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Users\techdocs>
```

For further reading, check out Virtual IPs in the FortiOS 6.0 Online Help.

Security Rating



Security Rating

① View Results ② Easy Apply | All FortiGates | Failed | All Results | Print | Run Now

Security Rating: 71st Percentile Security Rating Score: +471.6 Ran: 9 seconds ago

Rated Against All Regions and All Industries in SMB (1 - 256 endpoints)

177 Passed 29 Medium 2 High 1 Critical

Show Topology

Issue	FortiGate	Result	Recommendation
Endpoint Management			
FortiClient Protected All supported devices should be registered via FortiClient.	Edge	-10	Install FortiClient and register the following devices with the FortiGate: fcaa:14:25:54:f4
Fabric Security Hardening			
Admin Password Policy A password policy should be set up for system administrators.	Accounting	-10	Enable a simple password policy for system administrators. Easy Apply
	Edge	-10	Enable a simple password policy for system administrators. Easy Apply
	Sales	-10	Enable a simple password policy for system administrators. Easy Apply
	Marketing	-10	Enable a simple password policy for system administrators. Easy Apply
Admin Password Security The password policy should enforce secure passwords.	Edge	-10	Unmet Dependencies
	Marketing	-10	Unmet Dependencies

Easy Apply >

In this recipe, you run a Security Rating check, which analyzes the Fortinet Security Fabric deployment to identify potential vulnerabilities and highlight best practices.

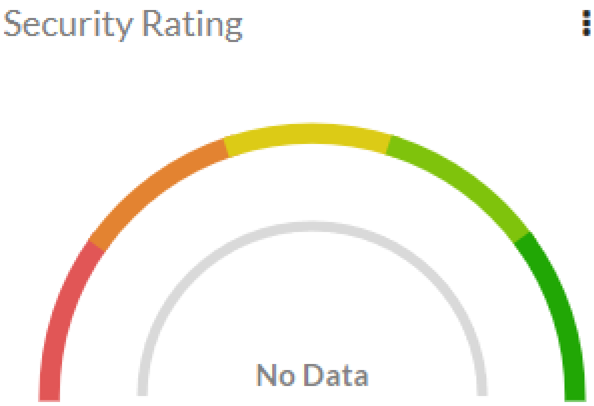
Using the Security Rating can help you improve your network configuration, deploy new hardware and software, and gain more visibility and control over your network. By regularly checking your Security Rating and your Security Rating Score, and making the recommended improvements, you can have confidence that your network is getting more secure over time.

To run all available checks, you must have a valid Security Rating license from FortiGuard. If you don’t have a license, only certain checks are available. For more information about these checks, see Security Best Practices & Security Rating Feature.

Not all FortiGate models can run the FortiGuard Security Rating Service if they are the root FortiGate in a Security Fabric. For more information, see the FortiOS 6.0 Release Notes.

Checking the Security Rating widget

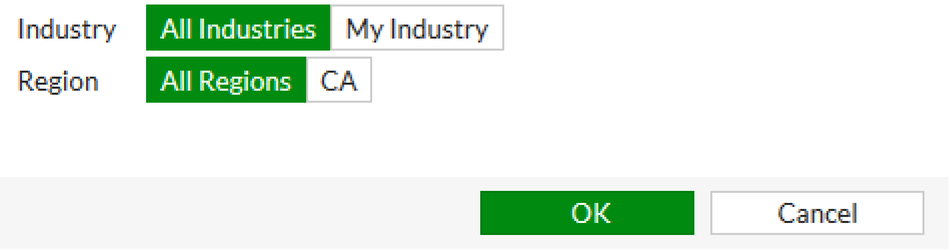
1. Go to the **Dashboard** and locate the **Security Rating** widget. In the example, the widget doesn’t display any information because it’s not properly configured.



2. Once you configure the widget, it displays a comparison between your Security Rating and the ratings of other organizations. You can compare your rating to the ratings of organizations that belong to all industries or the same industry as your organization. You can also compare your rating with organizations in your region or all regions.

Your FortiCare account settings determine your industry categorization.

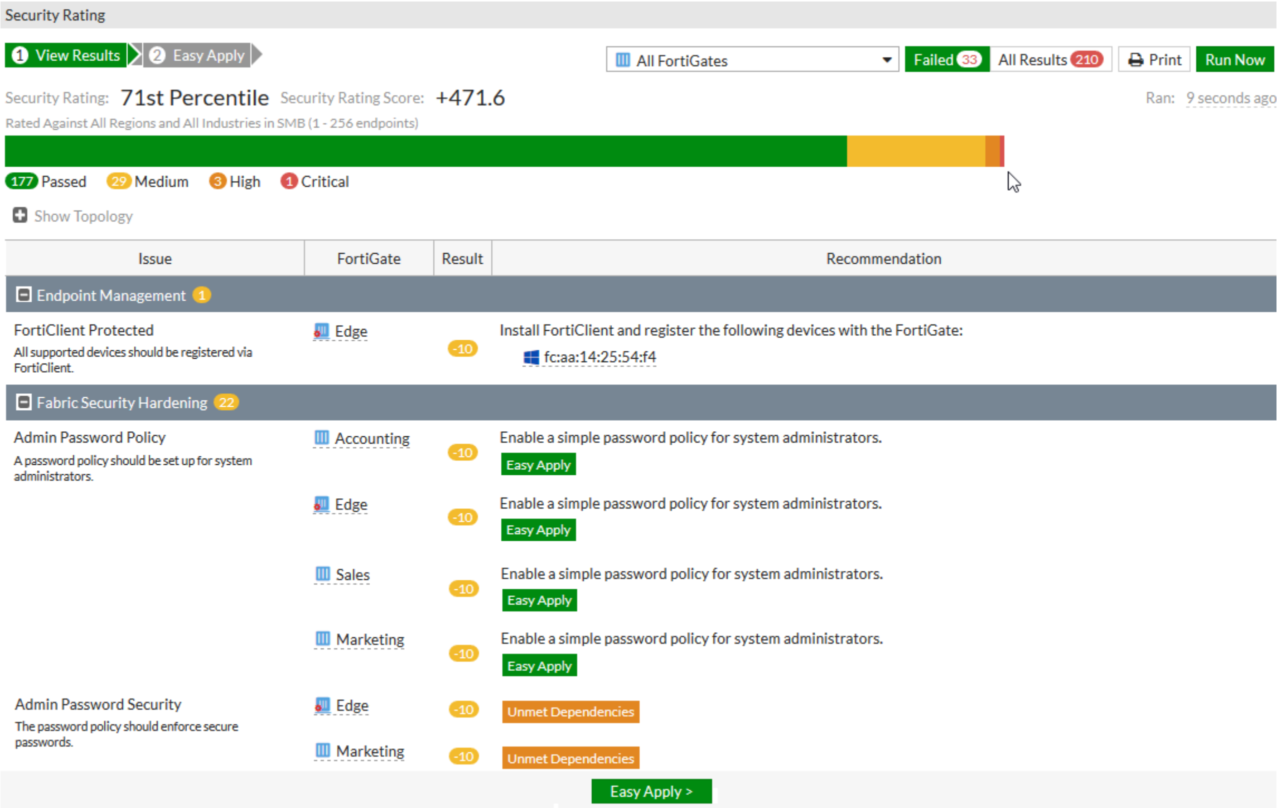
3. To change which organizations your score is compared to, select the options menu in the top right corner, then select **Settings**.


Industry: All Industries | My Industry

Region: All Regions | CA

Checking your Security Rating

1. On Edge, go to **Security Fabric > Security Rating**. The Security Rating runs automatically on the root FortiGate. However, if you want more recent results, select **Run Now** to run another Security Rating.
2. You can also select whether to run the Security Rating on **All FortiGates** or on specific FortiGate devices in the Security Fabric.



Security Rating: 71st Percentile Security Rating Score: +471.6

Ran: 9 seconds ago

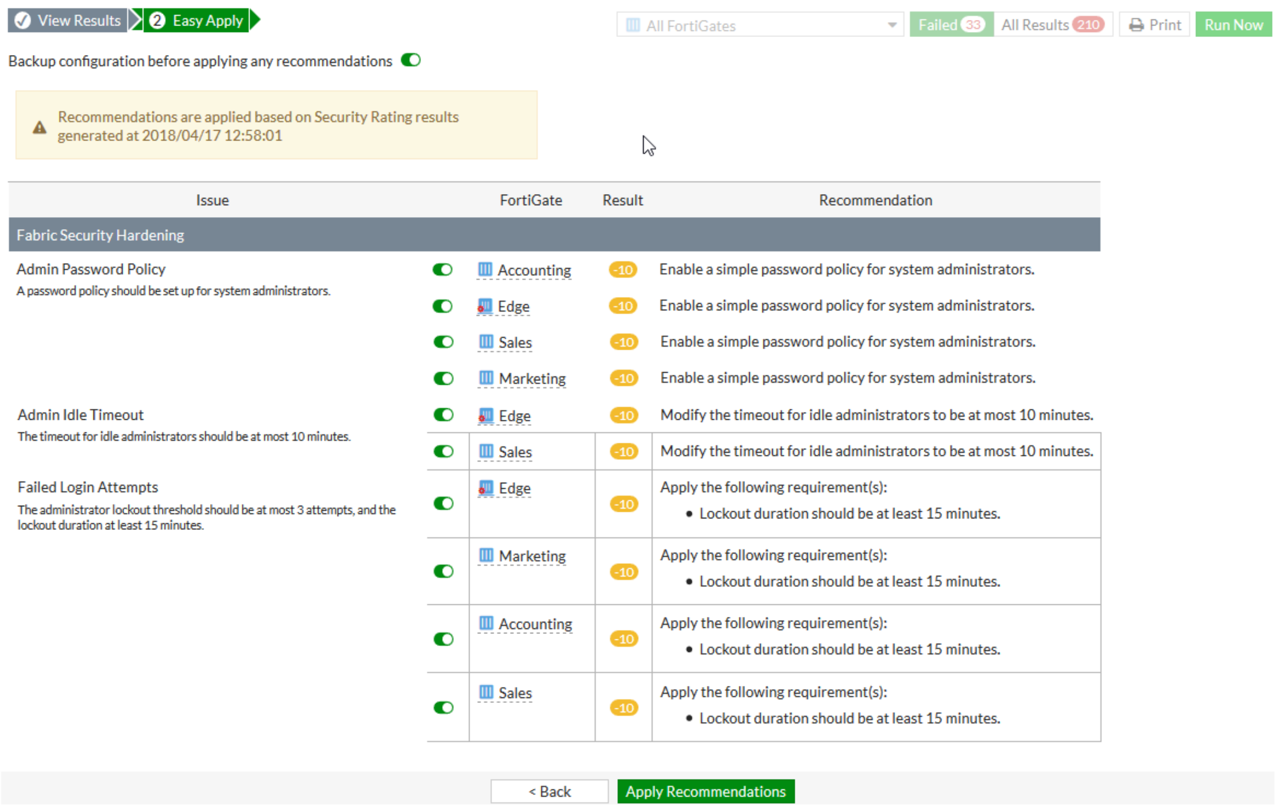
Rated Against All Regions and All Industries in SMB (1 - 256 endpoints)

177 Passed 29 Medium 3 High 1 Critical

Show Topology

Issue	FortiGate	Result	Recommendation
Endpoint Management 1			
FortiClient Protected All supported devices should be registered via FortiClient.	Edge	-10	Install FortiClient and register the following devices with the FortiGate: fc:aa:14:25:54:f4
Fabric Security Hardening 22			
Admin Password Policy A password policy should be set up for system administrators.	Accounting	-10	Enable a simple password policy for system administrators. Easy Apply
	Edge	-10	Enable a simple password policy for system administrators. Easy Apply
	Sales	-10	Enable a simple password policy for system administrators. Easy Apply
	Marketing	-10	Enable a simple password policy for system administrators. Easy Apply
Admin Password Security The password policy should enforce secure passwords.	Edge	-10	Unmet Dependencies
	Marketing	-10	Unmet Dependencies

3. At the top of the page, you can see your network's **Security Rating**, which shows which percentile your network is in compared to other organizations. You can also see your **Security Rating Score**, which is based on how many checks your Security Fabric passed or failed, and how many FortiGate units are in your network.
4. Further down the page, you can see information about each failed check, including which FortiGate failed the check, the effect on your Security Rating Score, and recommendations for how you can the issue.
5. In the next step of the Security Rating, you can apply recommendations marked as **Easy Apply** to any FortiGate in the Security Fabric. However, if the Security Rating results are older than 30 minutes, you must first run it again to make sure all information is current and accurate.
6. By using **Easy Apply**, you can change the configuration of any FortiGate in the Security Fabric from the root FortiGate.
7. Select all the changes that you want to make, then select **Apply Recommendations**.



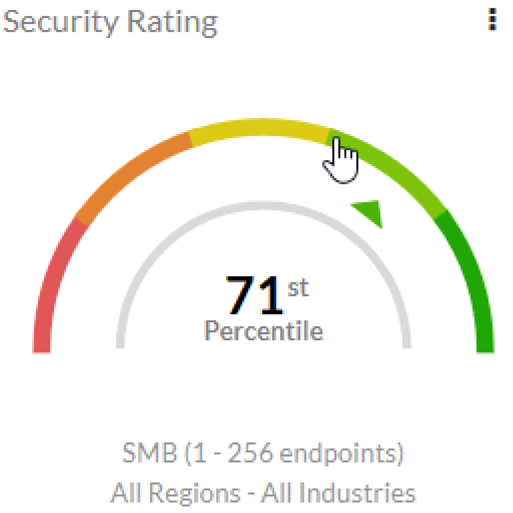
Backup configuration before applying any recommendations

Recommendations are applied based on Security Rating results generated at 2018/04/17 12:58:01

Issue	FortiGate	Result	Recommendation
Fabric Security Hardening			
Admin Password Policy A password policy should be set up for system administrators.	Accounting	-10	Enable a simple password policy for system administrators.
	Edge	-10	Enable a simple password policy for system administrators.
	Sales	-10	Enable a simple password policy for system administrators.
	Marketing	-10	Enable a simple password policy for system administrators.
Admin Idle Timeout The timeout for idle administrators should be at most 10 minutes.	Edge	-10	Modify the timeout for idle administrators to be at most 10 minutes.
	Sales	-10	Modify the timeout for idle administrators to be at most 10 minutes.
Failed Login Attempts The administrator lockout threshold should be at most 3 attempts, and the lockout duration at least 15 minutes.	Edge	-10	Apply the following requirement(s): • Lockout duration should be at least 15 minutes.
	Marketing	-10	Apply the following requirement(s): • Lockout duration should be at least 15 minutes.
	Accounting	-10	Apply the following requirement(s): • Lockout duration should be at least 15 minutes.
	Sales	-10	Apply the following requirement(s): • Lockout duration should be at least 15 minutes.

Results

1. Go to the **Dashboard**. The **Security Rating** widget displays information from the most recent Security Rating check.



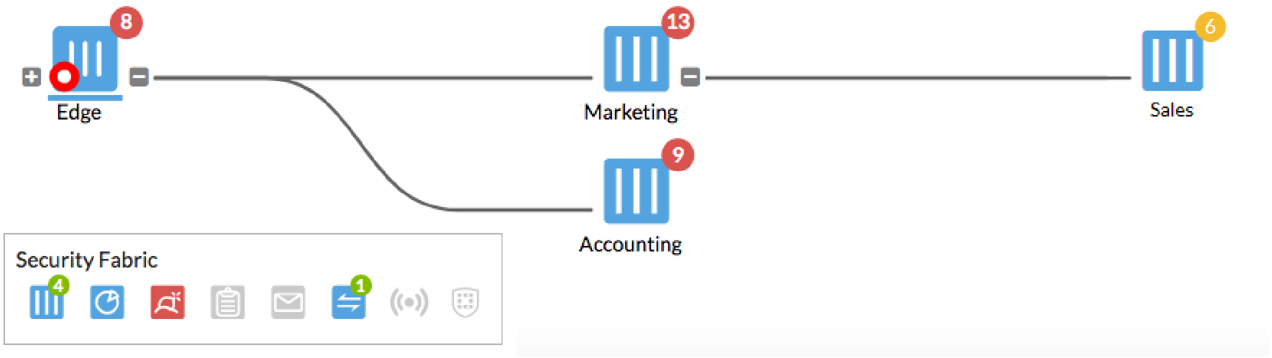
Security Rating

71st Percentile

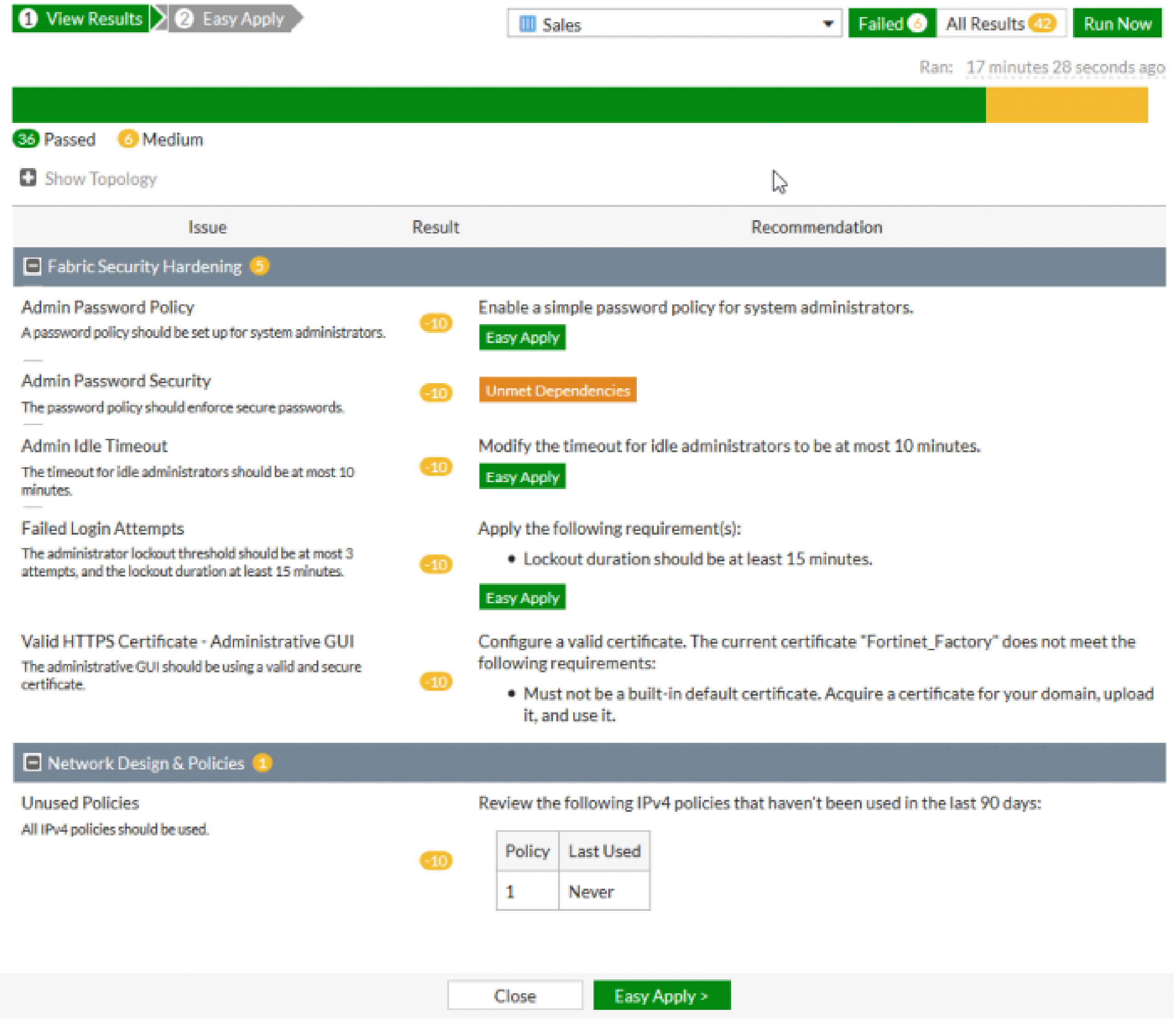
SMB (1 - 256 endpoints)

All Regions - All Industries

2. Go to **Security Fabric > Physical Topology**. Each FortiGate has a Security Rating indicator, which is circle that contains a number. The number shows how many checks the FortiGate failed and the color shows the severity of failed checks (red for critical, orange for high, yellow for medium, and blue for low).



3. To view the failed checks on a specific FortiGate device, select the Security Rating indicator on the FortiGate in the topology.
4. A screen appears, showing the Security Rating recommendations for that unit. You can also apply **Easy Apply** recommendations from here.



Ran: 17 minutes 28 seconds ago

36 Passed 6 Medium

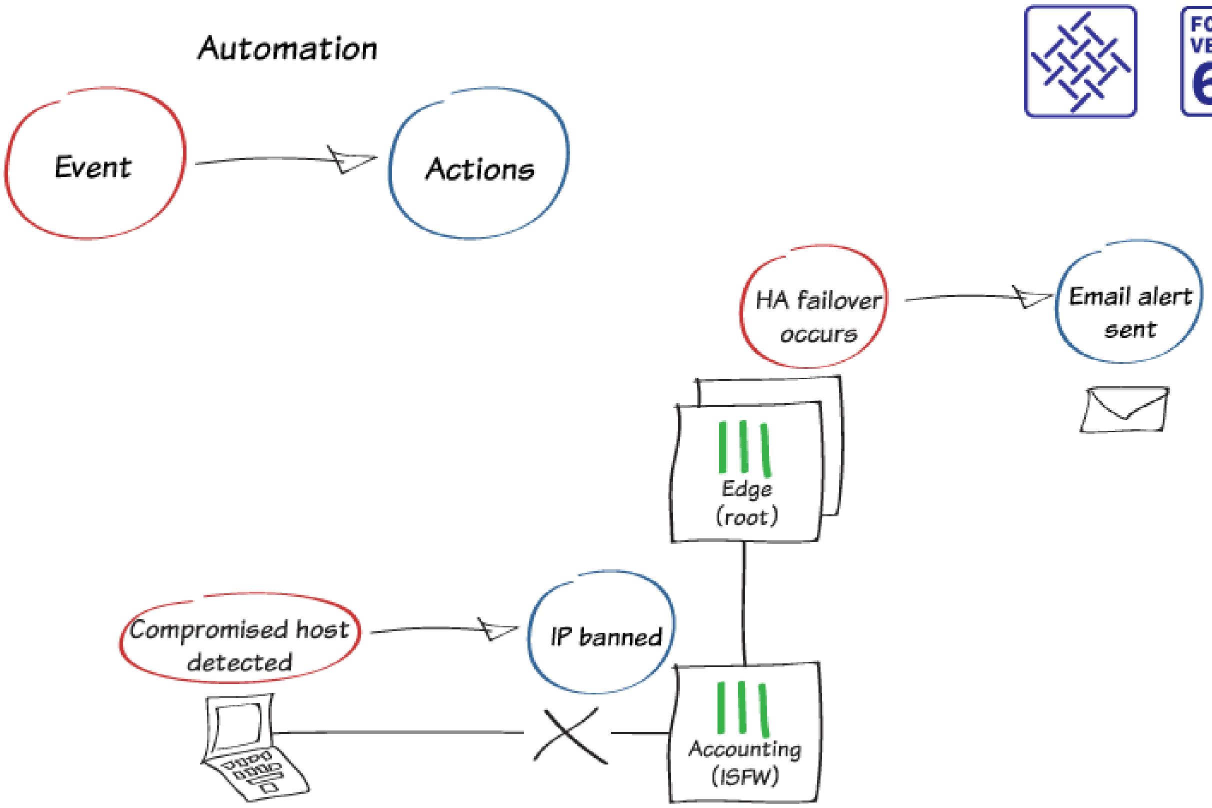
Show Topology

Issue	Result	Recommendation
Fabric Security Hardening 5		
Admin Password Policy A password policy should be set up for system administrators.	-10	Enable a simple password policy for system administrators. Easy Apply
Admin Password Security The password policy should enforce secure passwords.	-10	Unmet Dependencies
Admin Idle Timeout The timeout for idle administrators should be at most 10 minutes.	-10	Modify the timeout for idle administrators to be at most 10 minutes. Easy Apply
Failed Login Attempts The administrator lockout threshold should be at most 3 attempts, and the lockout duration at least 15 minutes.	-10	Apply the following requirement(s): • Lockout duration should be at least 15 minutes. Easy Apply
Valid HTTPS Certificate - Administrative GUI The administrative GUI should be using a valid and secure certificate.	-10	Configure a valid certificate. The current certificate "Fortinet_Factory" does not meet the following requirements: • Must not be a built-in default certificate. Acquire a certificate for your domain, upload it, and use it.
Network Design & Policies 1		
Unused Policies All IPv4 policies should be used.	-10	Review the following IPv4 policies that haven't been used in the last 90 days:

Policy	Last Used
1	Never

For further reading, check out Running a Security Fabric Rating in the FortiOS 6.0 Online Help.

Automation stitches



In this recipe, you configure Automation stitches for your Fortinet Security Fabric. Each Automation pairs an event trigger and one or more actions, which allows you to monitor your network and take appropriate action when the Security Fabric detects a threat. You can use Automation stitches to detect events from any source in the Security Fabric and apply actions to any destination.

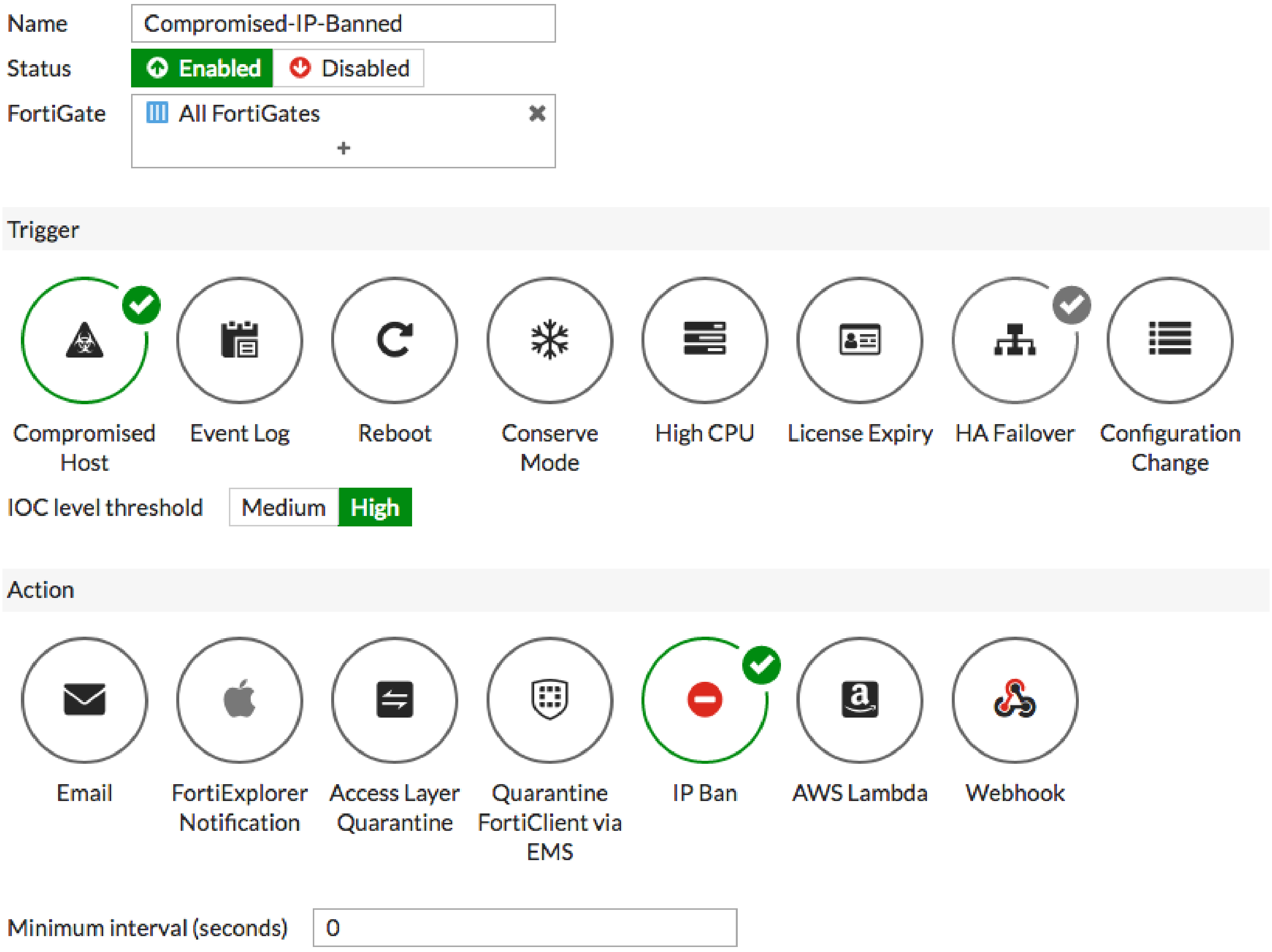
In this example, you create the following Automation stitches:

- Ban a compromised host's IP address.
- Send an email alert when HA failover occurs.

In this example, the Security Fabric consists of Edge, an HA cluster that is the root FortiGate of the Security Fabric, and three ISFW FortiGate devices (Accounting, Marketing, and Sales). You configure the Automation stitches on the root FortiGate and the settings are synchronized with the other FortiGate devices in the Security Fabric.

Creating the Automation stitches

1. To create a new Automation that bans the IP address of a compromised host, go to **Security Fabric > Automation** and select **Create New**.
2. Set **FortiGate** to **All FortiGates**.
3. Set **Trigger** to **Compromised Host**. Set **IOC level threshold** to **High**.
4. Set **Action** to **IP Ban**.



Name: Compromised-IP-Banned

Status: [✓ Enabled] Disabled

FortiGate: All FortiGates

Trigger: Compromised Host ✓

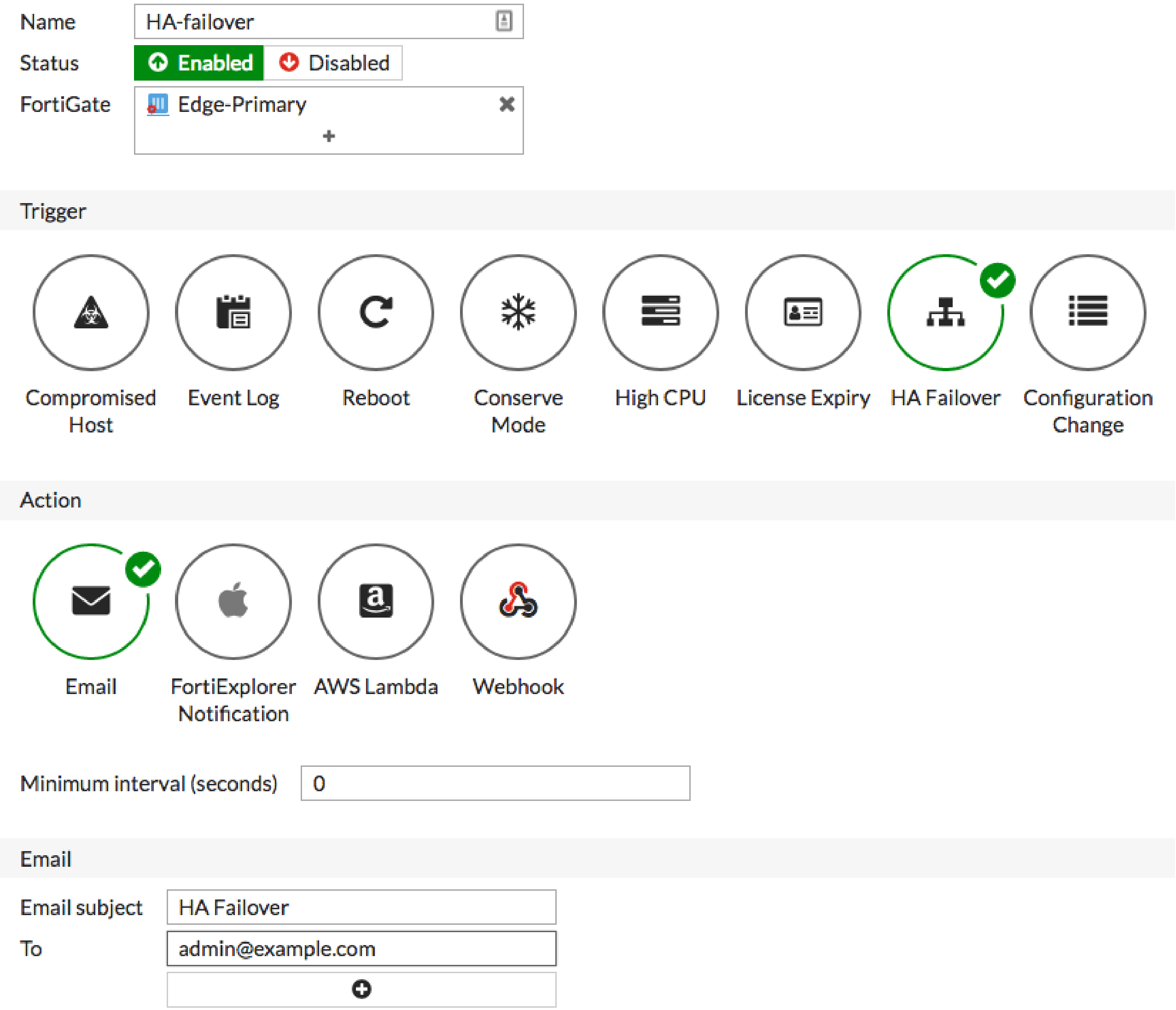
IOC level threshold: Medium [✓ High]

Action: IP Ban ✓

Minimum interval (seconds): 0

5. Create a second Automation that sends an email alert when HA failover occurs.
6. Set **FortiGate** to **Edge-Primary**, which is part of the only HA cluster in the Security Fabric.
7. Set **Trigger** to **HA Failover**. Set **Action** to **Email**.

8. Set the **Email subject** and **email address**.



Name: HA-failover

Status: Enabled | Disabled

FortiGate: Edge-Primary

Trigger

Action

Minimum interval (seconds): 0

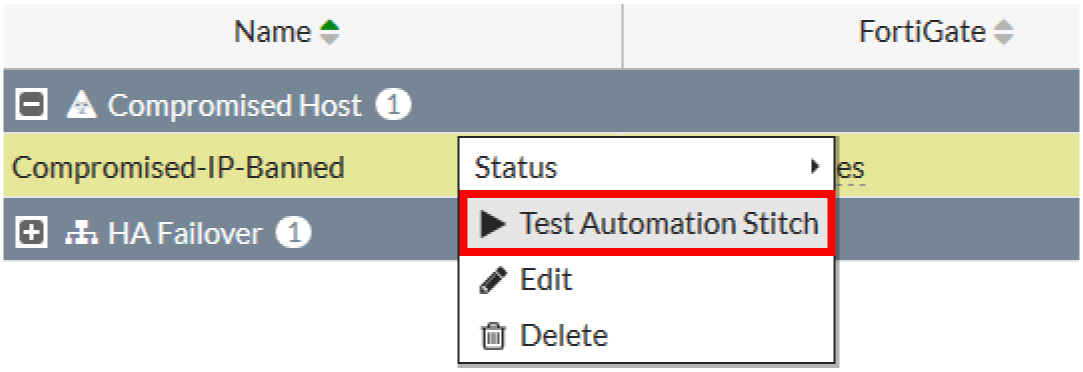
Email

Email subject: HA Failover

To: admin@example.com

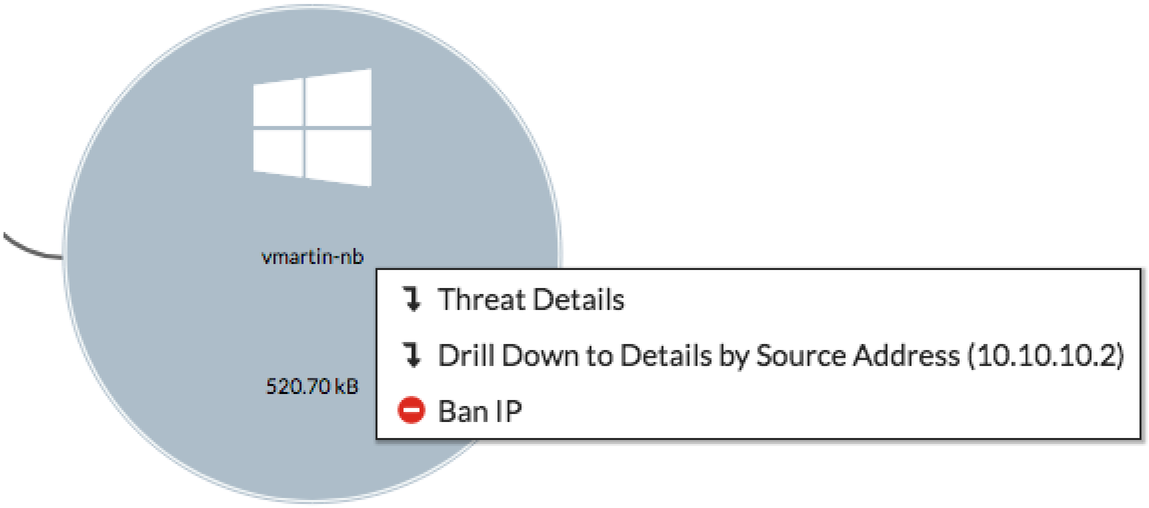
Testing the Automation stitches

1. If your FortiOS version is 6.0.2 or higher, to test the Automation stitches go to **Security Fabric > Automation**, right-click the Automation, and select **Test Automation Stitch**.

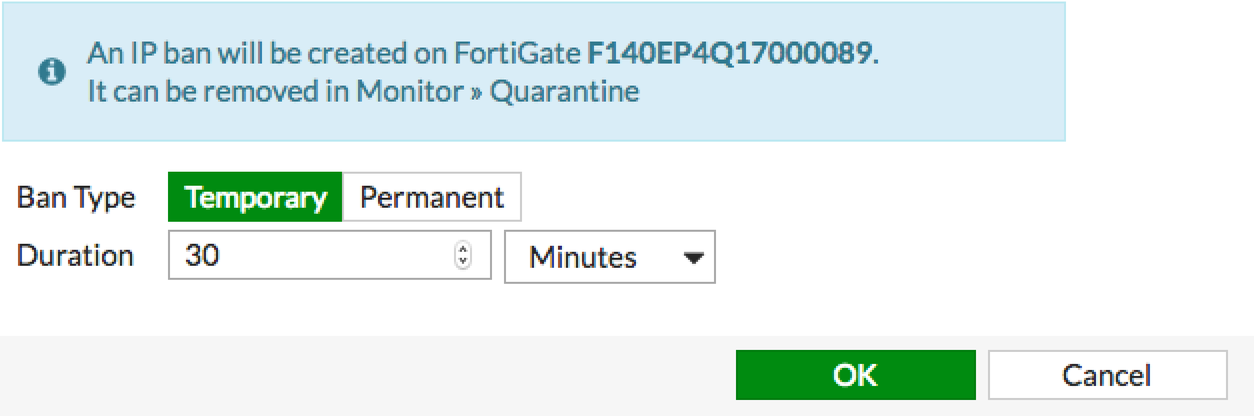


2. If your FortiOS version is 6.0.0 or 6.0.1, use the following instructions to test the automation stitches.

   Instead of testing the Automation that blocks compromised hosts, the following steps simulate its effects by manually blocking the IP address of a PC on your network. Go to **Security Fabric > Physical Topology** and locate a PC on your network. Right-click the PC and select **Ban IP**.



3. Set **Ban Type** to **Temporary**. Set **Duration** to **30 minutes**.



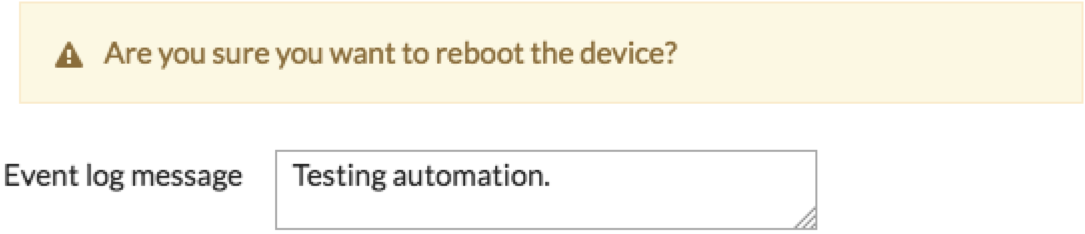
An IP ban will be created on FortiGate **F140EP4Q17000089**.
It can be removed in Monitor » Quarantine

Ban Type: Temporary | Permanent (Temporary selected)

Duration: 30 Minutes

4. To test the Automation for HA failover, go to Edge-Primary. In the administrative drop-down menu, select **System > Reboot**.

5. Set an **Event log message**.

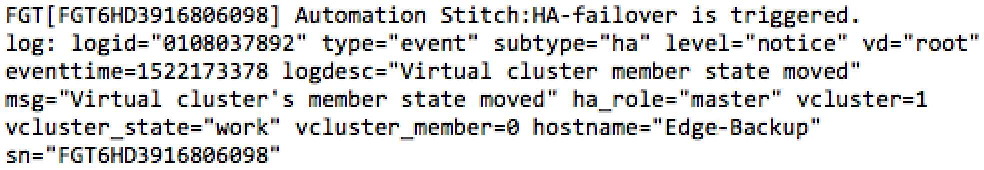


⚠ Are you sure you want to reboot the device?

Event log message: Testing automation.

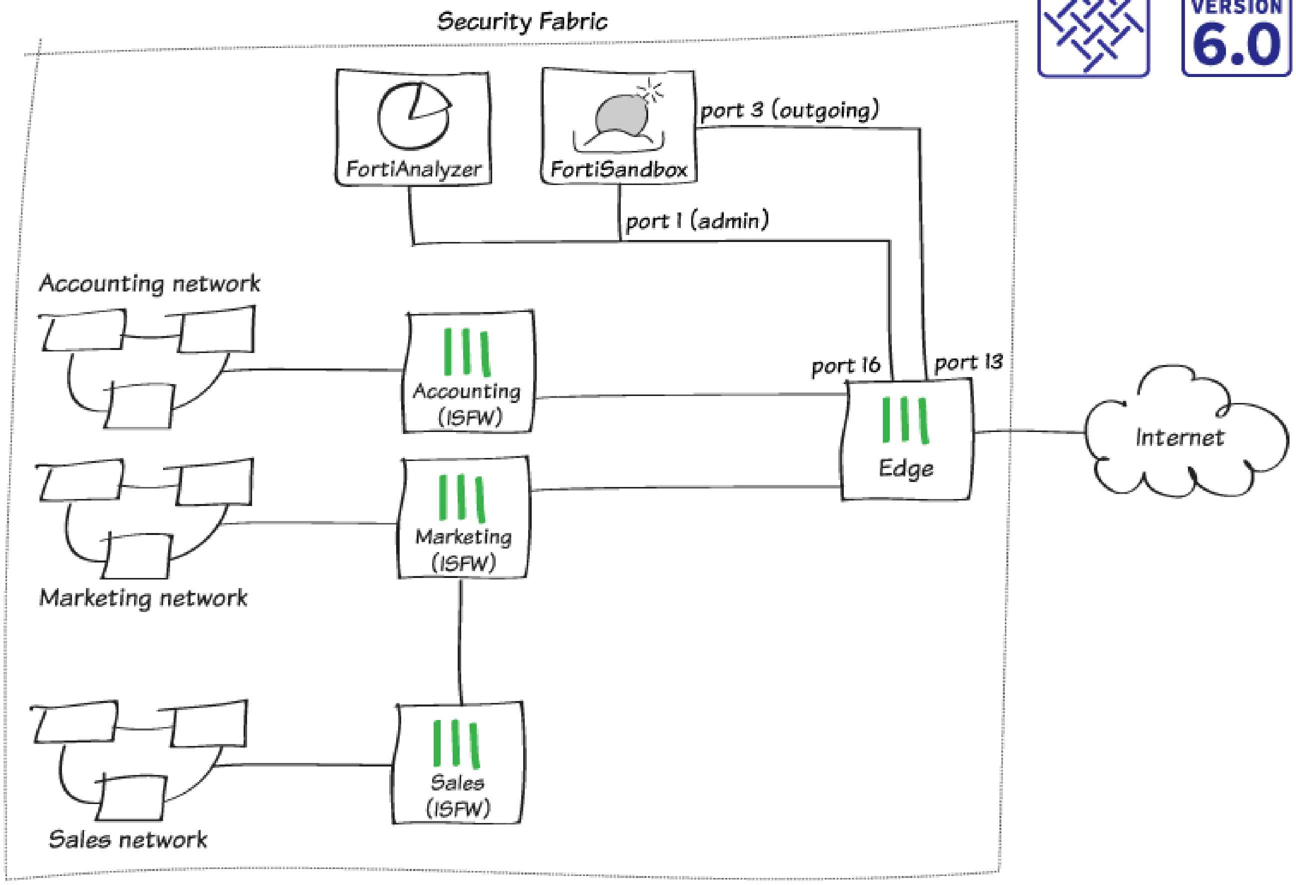
Results

1. If you have simulated the the Automation that blocks compromised hosts, the banned device can no longer access the Internet.
2. When HA failover occurs or when the Automation is tested, an email similar to the one shown is sent to the email that you configured in the Automation.



```
FGT[FGT6HD3916806098] Automation Stitch:HA-failover is triggered.
log: logid="0108037892" type="event" subtype="ha" level="notice" vd="root"
eventtime=1522173378 logdesc="Virtual cluster member state moved"
msg="Virtual cluster's member state moved" ha_role="master" vcluster=1
vcluster_state="work" vcluster_member=0 hostname="Edge-Backup"
sn="FGT6HD3916806098"
```

FortiSandbox in the Fortinet Security Fabric



In this recipe, you will add a FortiSandbox to the Fortinet Security Fabric and configure each FortiGate in the network to send suspicious files to FortiSandbox for sandbox inspection. The FortiSandbox scans and tests these files in isolation from your network.

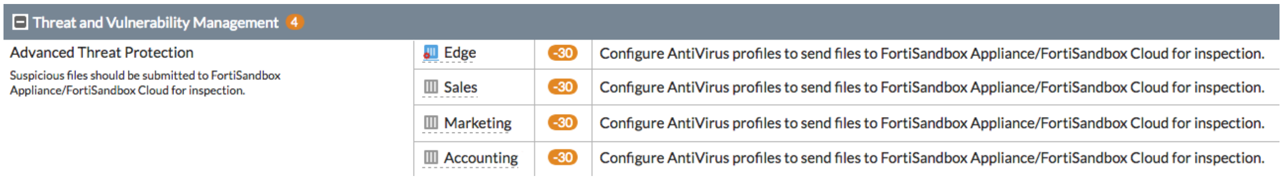
This example uses the Security Fabric configuration created in Fortinet Security Fabric installation on page 16. The FortiSandbox connects to the root FortiGate in the Security Fabric, known as Edge. There are two connections between the devices:

- FortiSandbox port 1 (administration port) connects to Edge port 16
- FortiSandbox port 3 (VM outgoing port) connects to Edge port 13

If possible, you can also use a separate Internet connection for FortiSandbox port 3, rather than connecting through the Edge FortiGate to use your main Internet connection. This configuration avoids having IP addresses from your main network blacklisted if malware that’s tested on the FortiSandbox generates an attack. If you use this configuration, you can skip the steps listed for FortiSandbox port 3.

Checking your Security Rating

1. On Edge (the root FortiGate in the Security Fabric), go to **Security Fabric > Security Rating**.
2. Since you haven't yet installed a FortiSandbox in your network, the Security Fabric fails the **Advanced Threat Protection** check. In the example, the **Security Rating Score** decreases by 30 points for each of the four FortiGates in the Security Fabric.

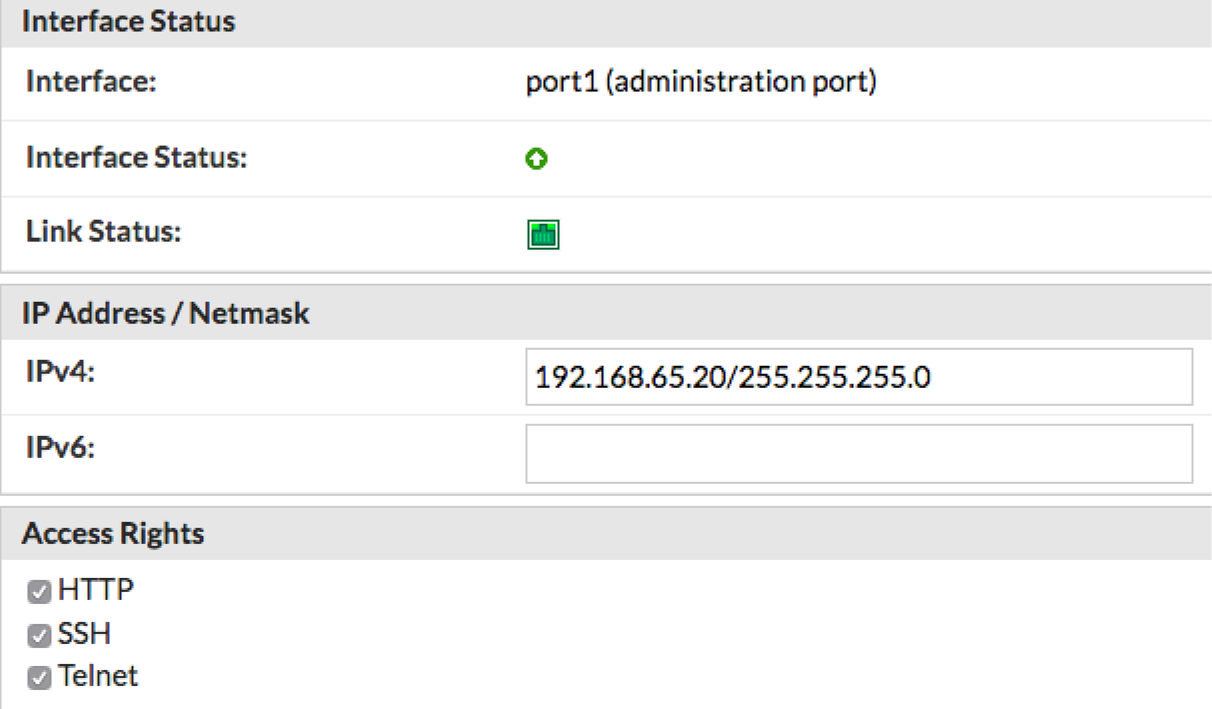


⊟ Threat and Vulnerability Management 4

Advanced Threat Protection Suspicious files should be submitted to FortiSandbox Appliance/FortiSandbox Cloud for inspection.	Edge	-30	Configure AntiVirus profiles to send files to FortiSandbox Appliance/FortiSandbox Cloud for inspection.
	Sales	-30	Configure AntiVirus profiles to send files to FortiSandbox Appliance/FortiSandbox Cloud for inspection.
	Marketing	-30	Configure AntiVirus profiles to send files to FortiSandbox Appliance/FortiSandbox Cloud for inspection.
	Accounting	-30	Configure AntiVirus profiles to send files to FortiSandbox Appliance/FortiSandbox Cloud for inspection.

Connecting the FortiSandbox

1. Connect to the FortiSandbox.
2. To edit **port 1**, which is used for communication between the FortiSandbox and the rest of the Security Fabric, go to **Network > Interfaces**.
3. Set **IP Address/Netmask** to an internal IP address. In this example, the FortiSandbox connects to the same subnet as the FortiAnalyzer that you installed previously, using the IP address *192.168.65.20*.



Interface Status

Interface:	port1 (administration port)
Interface Status:	●
Link Status:	🟩

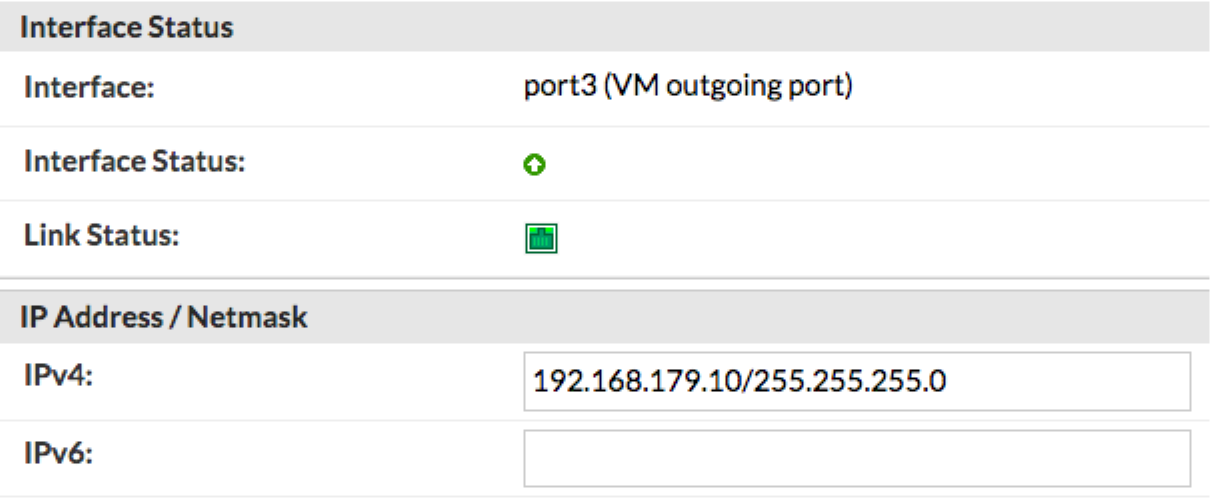
IP Address / Netmask

IPv4:	192.168.65.20/255.255.255.0
IPv6:	

Access Rights

☑ HTTP
☑ SSH
☑ Telnet

4. Edit **port 3**. This port is used for outgoing communication by the virtual machines (VMs) running on the FortiSandbox. It's recommended that you connect this port to a dedicated interface on your FortiGate to protect the rest of the network from threats that the FortiSandbox is currently investigating.
5. Set **IP Address/Netmask** to an internal IP address (in the example, *192.168.179.10/255.255.255.0*).



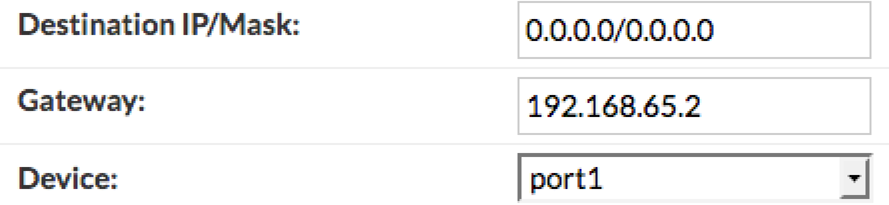
Interface Status

Interface:	port3 (VM outgoing port)
Interface Status:	●
Link Status:	🟩

IP Address / Netmask

IPv4:	192.168.179.10/255.255.255.0
IPv6:	

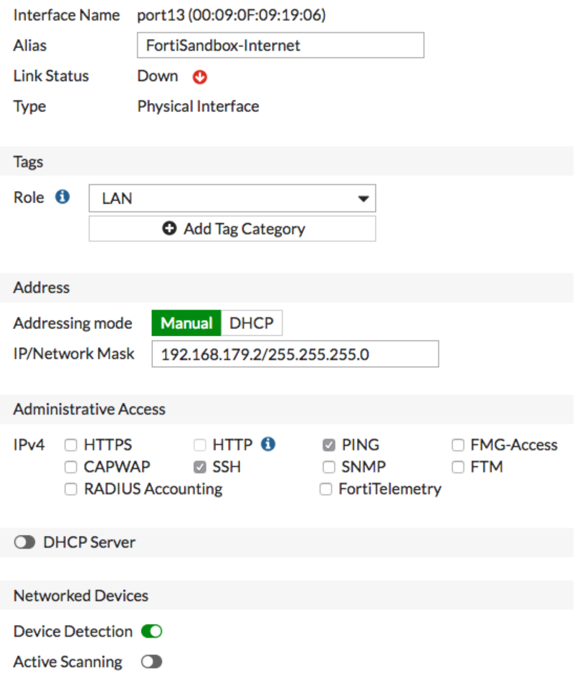
6. To add a static route, go to **Network > System Routing**. Set **Gateway** to the IP address of the FortiGate interface that port 1 connects to (in the example, *192.168.65.2*).



Destination IP/Mask:	0.0.0.0/0.0.0.0
Gateway:	192.168.65.2
Device:	port1

7. Connect to Edge.

8. To configure the port that connects to port3 on the FortiSandbox (in the example, port13), go to **Network > Interfaces**. Set **IP/Network Mask** to an address on the same subnet as port 3 on the FortiSandbox (in the example, *192.168.179.2/255.255.255.0*)



Interface Name	port13 (00:09:0F:09:19:06)
Alias	FortiSandbox-Internet
Link Status	Down ●
Type	Physical Interface

Tags

Role	LAN

Address

Addressing mode	Manual
IP/Network Mask	192.168.179.2/255.255.255.0

Administrative Access

IPv4	□ HTTPS	□ HTTP	☑ PING	□ FMG-Access
	□ CAPWAP	☑ SSH	□ SNMP	□ FTM
	□ RADIUS Accounting		□ FortiTelemetry	

DHCP Server: off

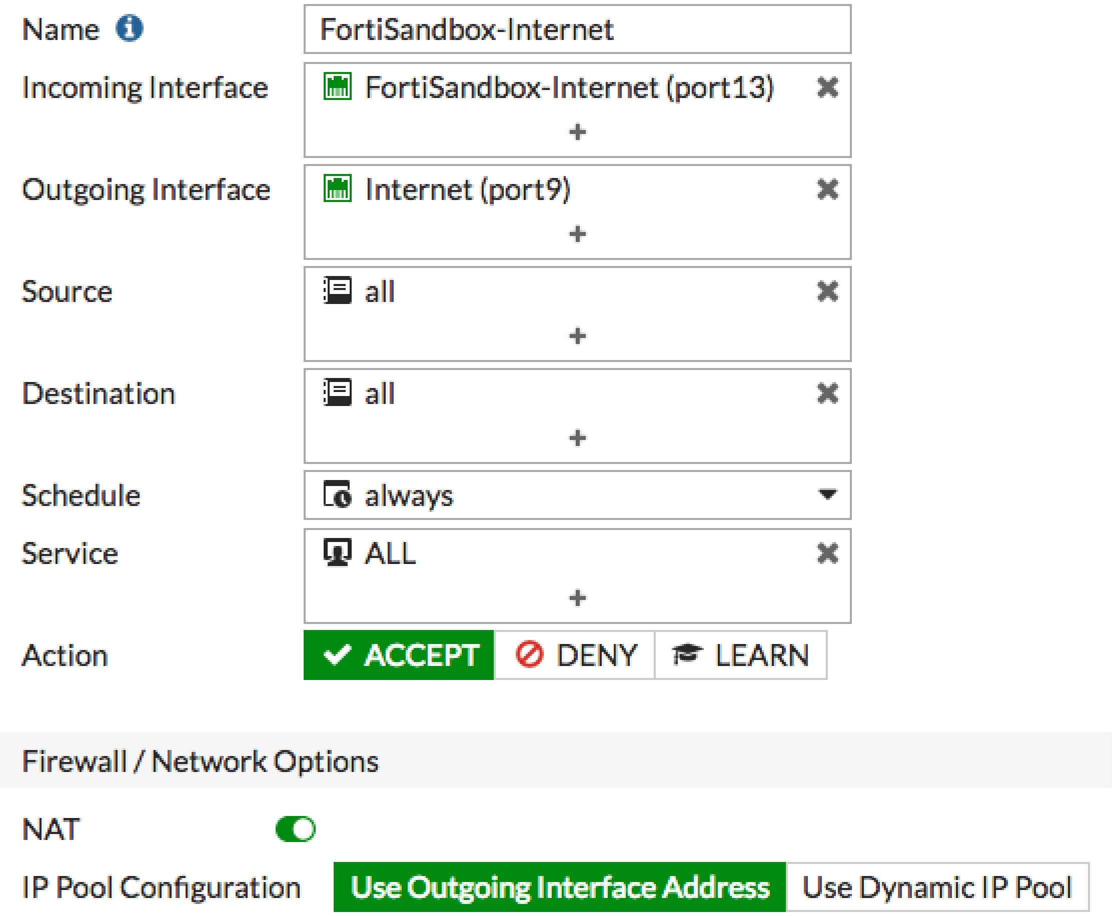
Networked Devices

Device Detection	on
Active Scanning	off

9. Connect the FortiSandbox to the Security Fabric.

Allowing VM Internet access

1. Connect to Edge.
2. To create a policy that allows connections from the FortiSandbox to the Internet, go to **Policy & Objects > IPv4 Policy**.



Name: FortiSandbox-Internet

Incoming Interface: FortiSandbox-Internet (port13)

Outgoing Interface: Internet (port9)

Source: all

Destination: all

Schedule: always

Service: ALL

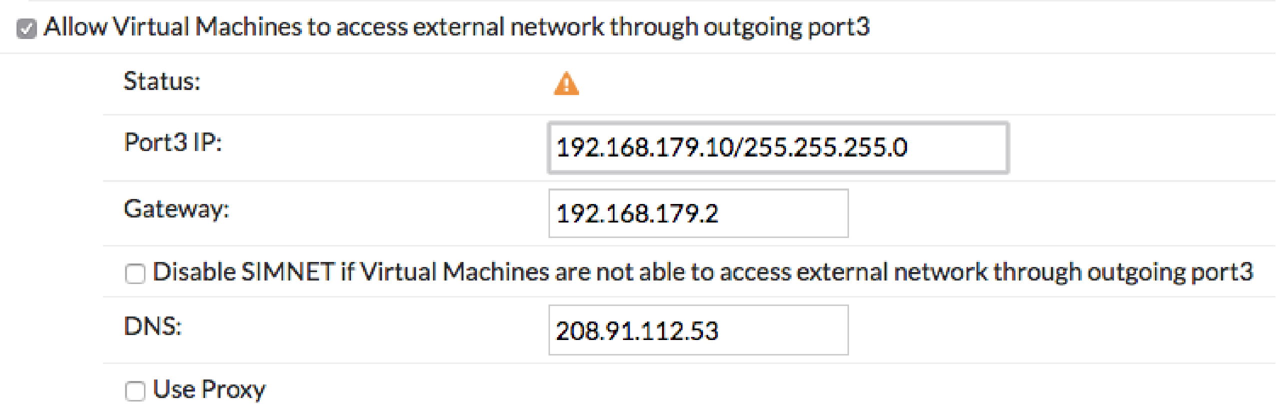
Action: [✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT: ●

IP Pool Configuration: [✓ Use Outgoing Interface Address] Use Dynamic IP Pool

3. Connect to FortiSandbox.
4. Go to **Scan Policy > General** and select **Allow Virtual Machines** to access external network through outgoing port3. Set **Gateway** to the IP address of port 13 on the FortiGate.



☑ Allow Virtual Machines to access external network through outgoing port3

Status: ⚠

Port3 IP: 192.168.179.10/255.255.255.0

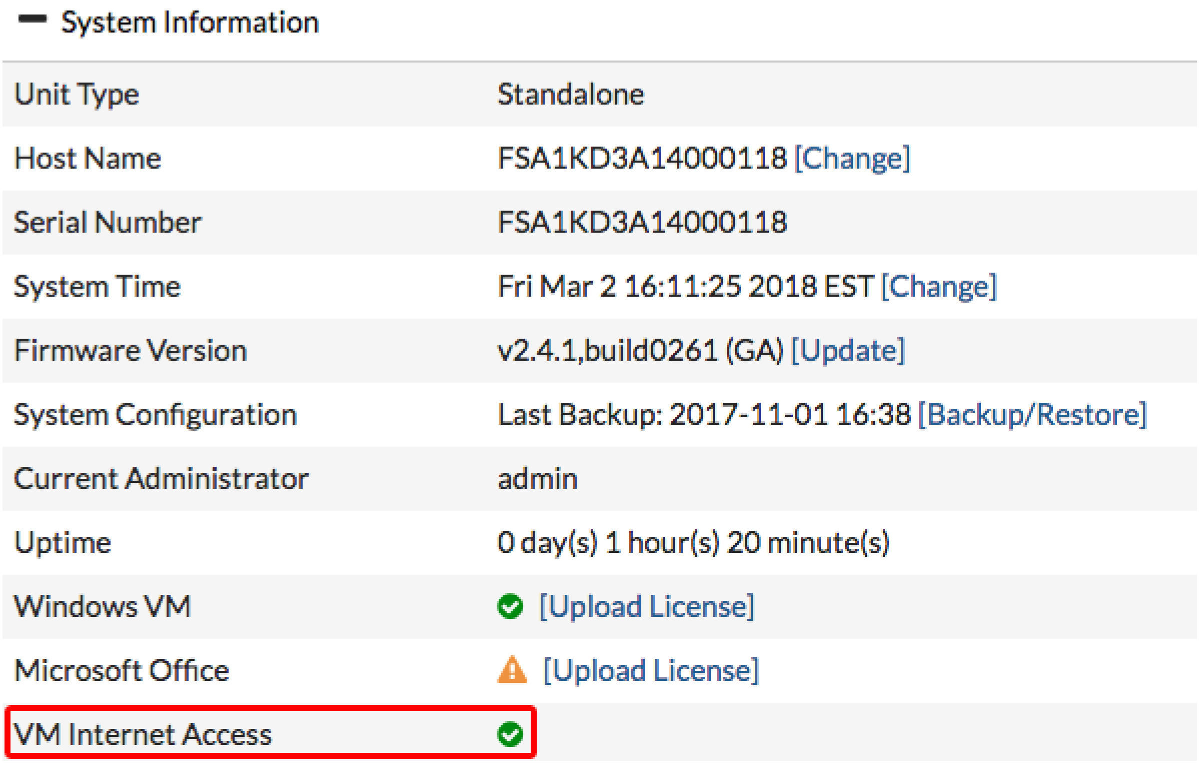
Gateway: 192.168.179.2

□ Disable SIMNET if Virtual Machines are not able to access external network through outgoing port3

DNS: 208.91.112.53

□ Use Proxy

5. Go to the **Dashboard** and locate the **System Information** widget. Verify that **VM Internet Access** has a green check mark beside it.

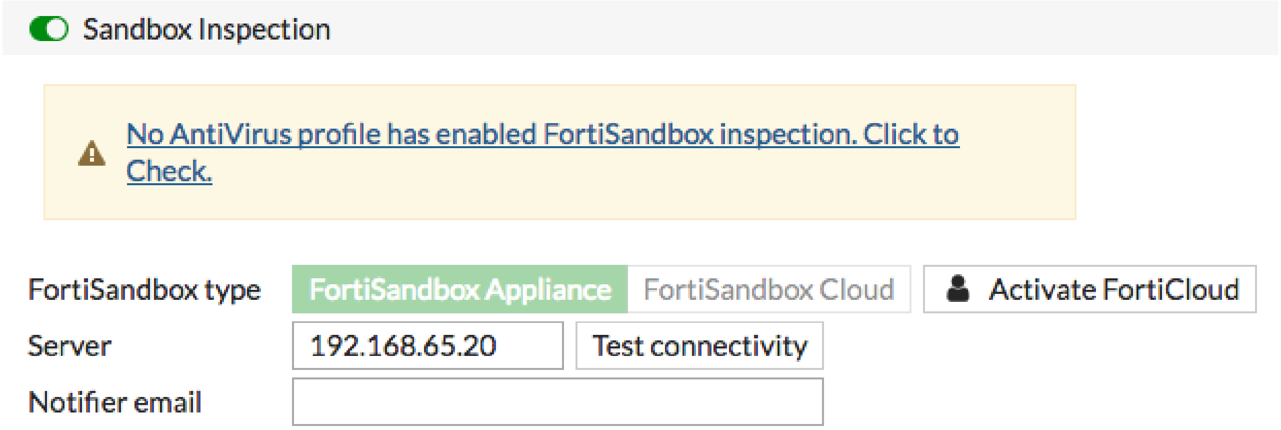


System Information

Unit Type	Standalone
Host Name	FSA1KD3A14000118 [Change]
Serial Number	FSA1KD3A14000118
System Time	Fri Mar 2 16:11:25 2018 EST [Change]
Firmware Version	v2.4.1,build0261 (GA) [Update]
System Configuration	Last Backup: 2017-11-01 16:38 [Backup/Restore]
Current Administrator	admin
Uptime	0 day(s) 1 hour(s) 20 minute(s)
Windows VM	✓ [Upload License]
Microsoft Office	⚠ [Upload License]
VM Internet Access	✓

Adding FortiSandbox to the Security Fabric

1. Connect to Edge.
2. To add FortiSandbox to the Security Fabric, go to **Security Fabric > Settings**. Enable **Sandbox Inspection**.
3. Make sure **FortiSandbox Appliance** is selected and set **Server** to the IP address of port 1 on the FortiSandbox.

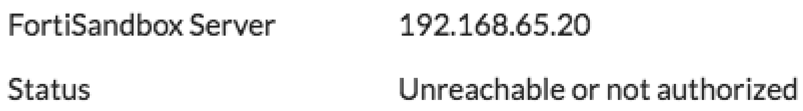


Sandbox Inspection

⚠ No AntiVirus profile has enabled FortiSandbox inspection. Click to Check.

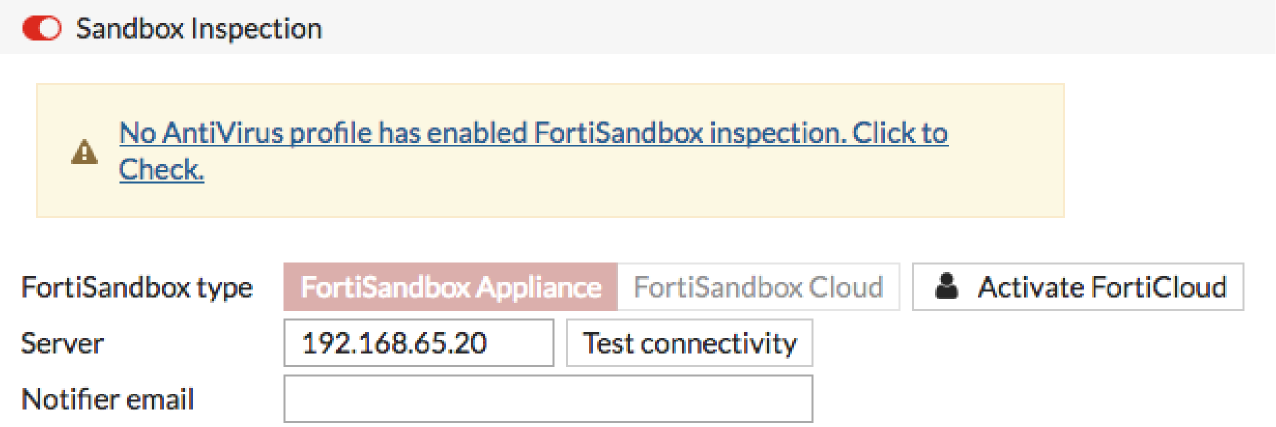
FortiSandbox type	FortiSandbox Appliance / FortiSandbox Cloud / Activate FortiCloud
Server	192.168.65.20 Test connectivity
Notifier email	

4. Select **Test Connectivity**. An error message appears because Edge hasn't been authorized on the FortiSandbox.



FortiSandbox Server	192.168.65.20
Status	Unreachable or not authorized

5. Edge, as the root FortiGate, pushes FortiSandbox settings to the other FortiGates in the Security Fabric. To verify this, connect to Accounting and go to **Security Fabric > Settings**.

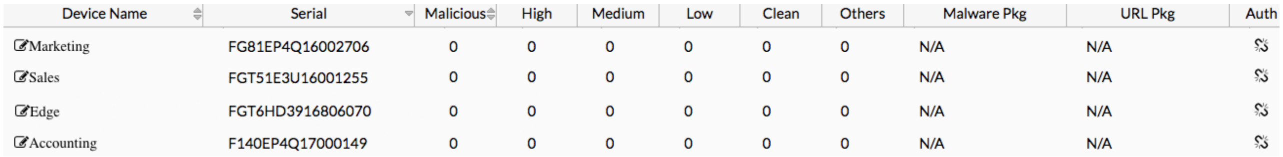


Sandbox Inspection

⚠ No AntiVirus profile has enabled FortiSandbox inspection. Click to Check.

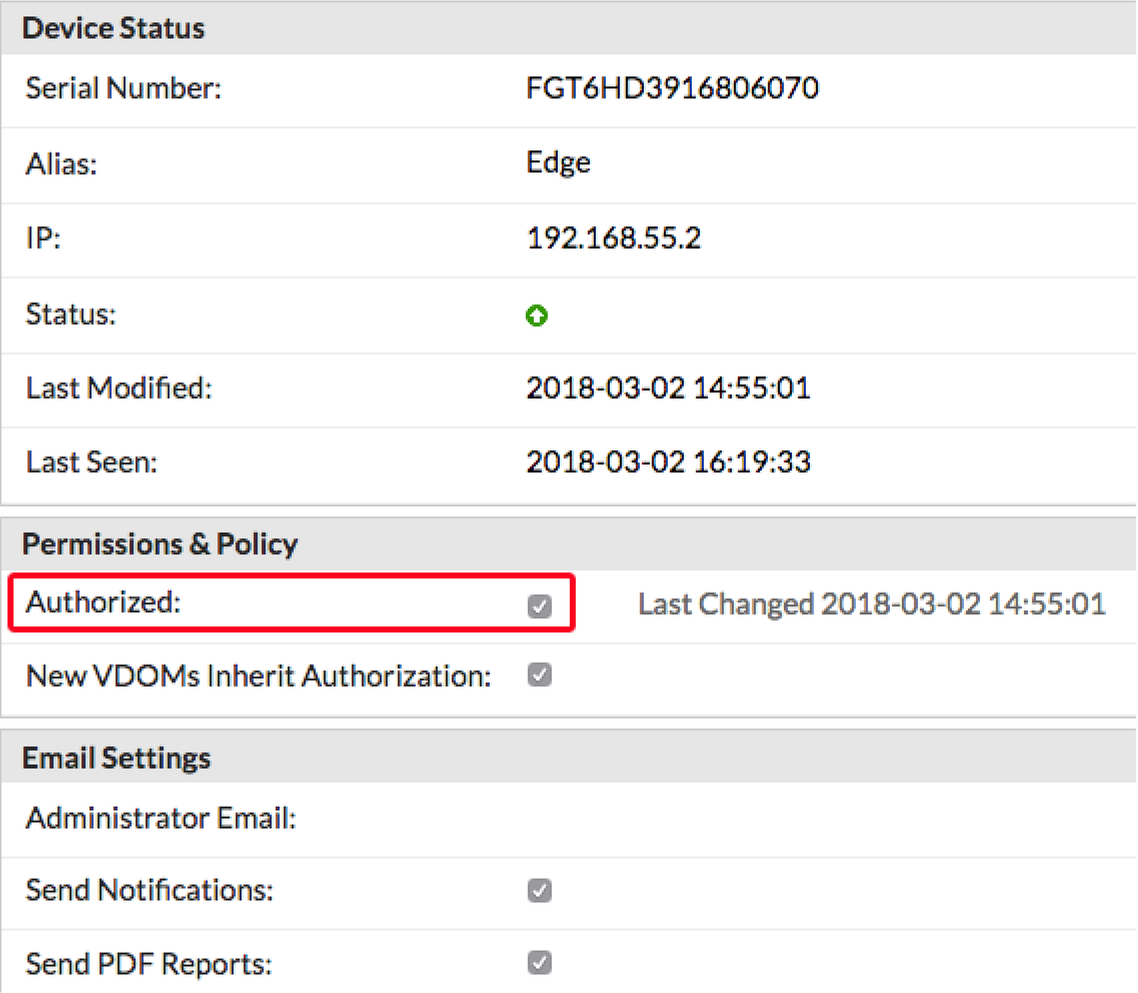
FortiSandbox type	FortiSandbox Appliance / FortiSandbox Cloud
Server	192.168.65.20
Notifier email	

6. On the FortiSandbox, go to **Scan Input > Device**. The FortiGates in the Security Fabric (Edge, Accounting, Marketing, and Sales) are listed but the **Auth** column indicates that the devices are unauthorized.



Device Name	Serial	Malicious	High	Medium	Low	Clean	Others	Malware Pkg	URL Pkg	Auth
Marketing	FG81EP4Q16002706	0	0	0	0	0	0	N/A	N/A	
Sales	FGT51E3U16001255	0	0	0	0	0	0	N/A	N/A	
Edge	FGT6HD3916806070	0	0	0	0	0	0	N/A	N/A	
Accounting	F140EP4Q17000149	0	0	0	0	0	0	N/A	N/A	

7. Select and edit **Edge**. Under **Permissions & Policies**, select **Authorized**.



Device Status

Serial Number:	FGT6HD3916806070
Alias:	Edge
IP:	192.168.55.2
Status:	●
Last Modified:	2018-03-02 14:55:01
Last Seen:	2018-03-02 16:19:33

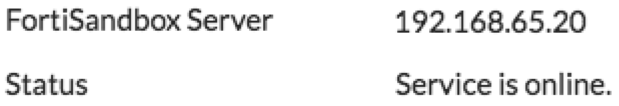
Permissions & Policy

Authorized:	☑	Last Changed 2018-03-02 14:55:01
New VDOMs Inherit Authorization:	☑	

Email Settings

Administrator Email:	
Send Notifications:	☑
Send PDF Reports:	☑

8. Repeat this for the other FortiGate devices.
9. On Edge, go to **Security Fabric > Settings** and test the **Sandbox Inspection** connectivity again. Edge is now connected to the FortiSandbox.



FortiSandbox Server	192.168.65.20
Status	Service is online.

Adding sandbox inspection to security profiles

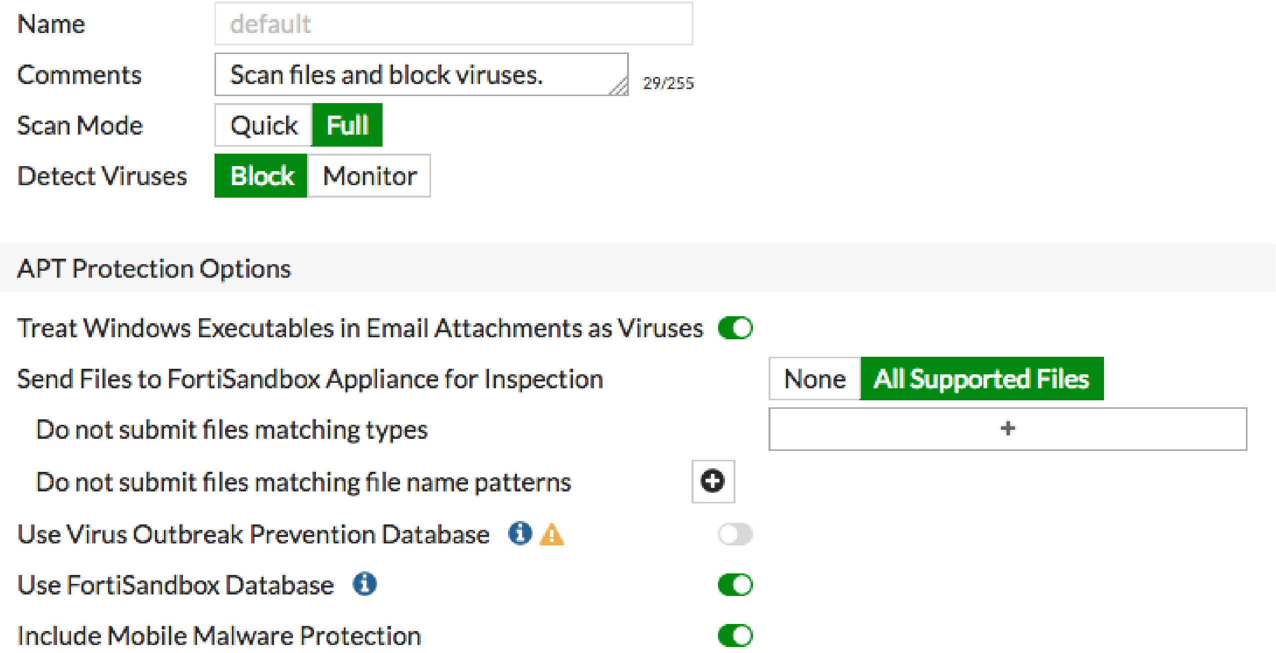
You can apply sandbox inspection with three types of security inspection: antivirus, web filter, and FortiClient compliance profiles. In this step, you add sandbox to all FortiGate devices in the Security Fabric individually, using the profiles that each FortiGate applies to network traffic.

In order to pass the **Advanced Threat Protection** check, you must add sandbox inspection to antivirus profiles for all FortiGate devices in the Security Fabric.

1. Go to **Security Profiles > AntiVirus** and edit the **default** profile.
2. Under **Inspection Options**, set **Send Files to FortiSandbox Appliance for Inspection** to **All Supported**

Files.

3. Enable **Use FortiSandbox Database**, so that if the FortiSandbox discovers a threat, it adds a signature for that file to the antivirus signature database on the FortiGate.



Name: default

Comments: Scan files and block viruses. 29/255

Scan Mode: Quick [✓ Full]

Detect Viruses: [✓ Block] Monitor

APT Protection Options

Treat Windows Executables in Email Attachments as Viruses ☑

Send Files to FortiSandbox Appliance for Inspection: None [✓ All Supported Files]

Do not submit files matching types: +

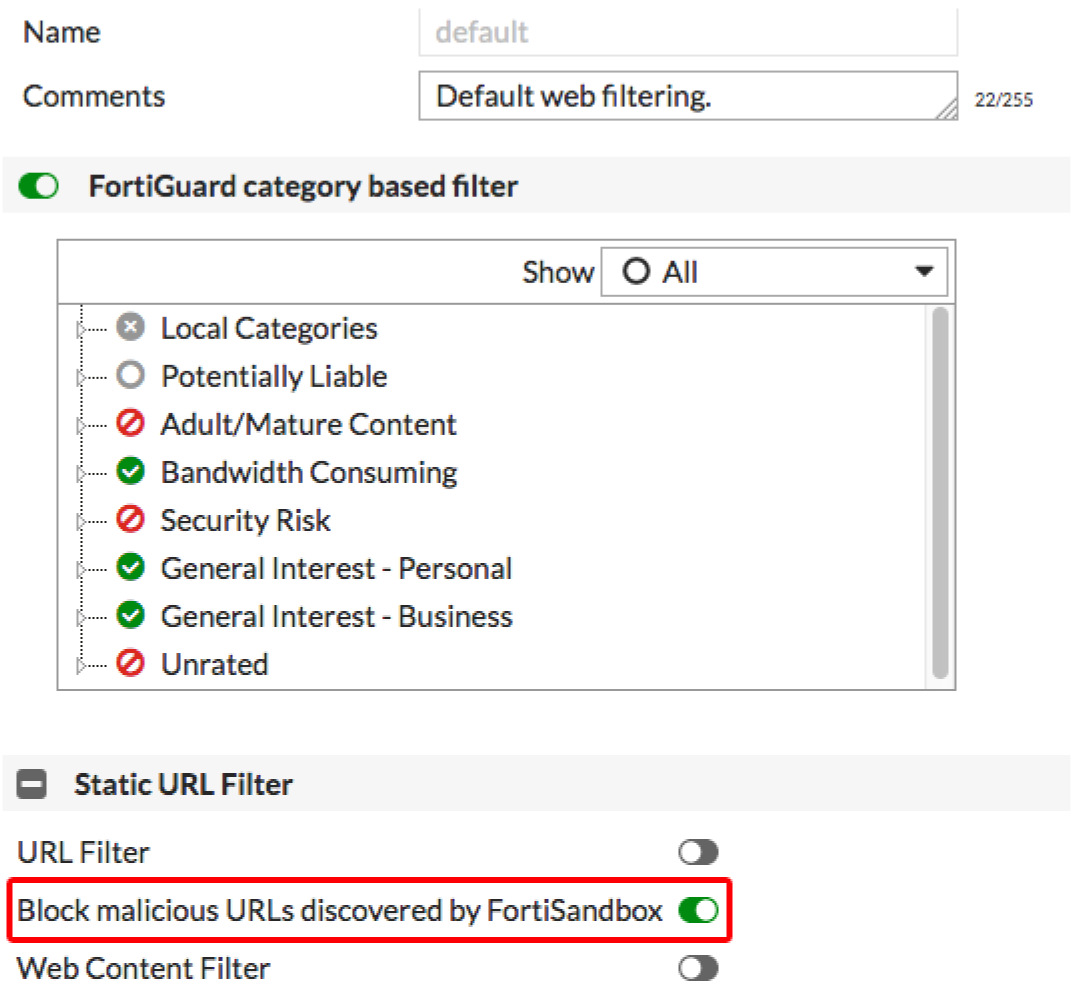
Do not submit files matching file name patterns: +

Use Virus Outbreak Prevention Database ℹ ⚠ ☐

Use FortiSandbox Database ℹ ☑

Include Mobile Malware Protection ☑

4. Go to **Security Profiles > Web Filter** and edit the **default** profile.
5. Under **Static URL Filter**, enable **Block malicious URLs discovered by FortiSandbox**. If the FortiSandbox discovers a threat, the URL that threat came from is added to the list of URLs that are blocked by the FortiGate.



Name: default

Comments: Default web filtering. 22/255

FortiGuard category based filter

Show: All

- Local Categories
- Potentially Liable
- Adult/Mature Content
- Bandwidth Consuming
- Security Risk
- General Interest - Personal
- General Interest - Business
- Unrated

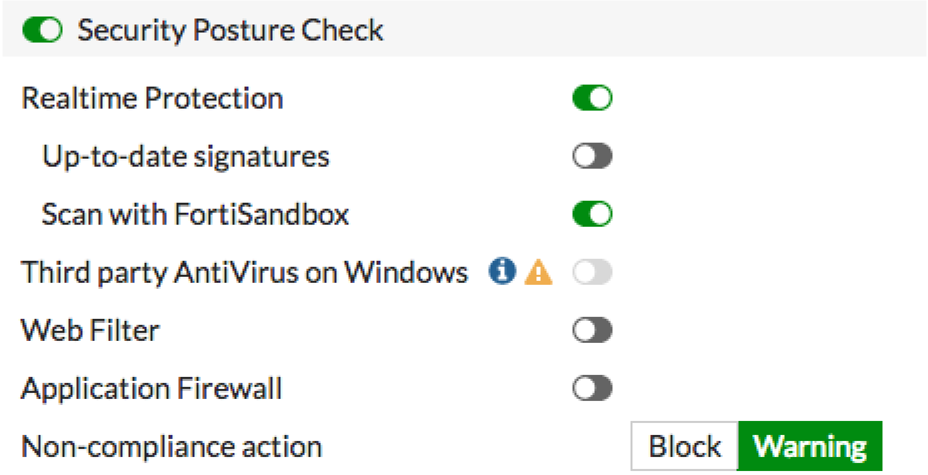
Static URL Filter

URL Filter

Block malicious URLs discovered by FortiSandbox

Web Content Filter

6. Go to **Security Profiles > FortiClient Compliance Profiles** and edit the **default** profile. Enable **Security Posture Check**.
7. Enable **Realtime Protection** and **Scan with FortiSandbox**.



Security Posture Check

Realtime Protection

Up-to-date signatures

Scan with FortiSandbox

Third party AntiVirus on Windows

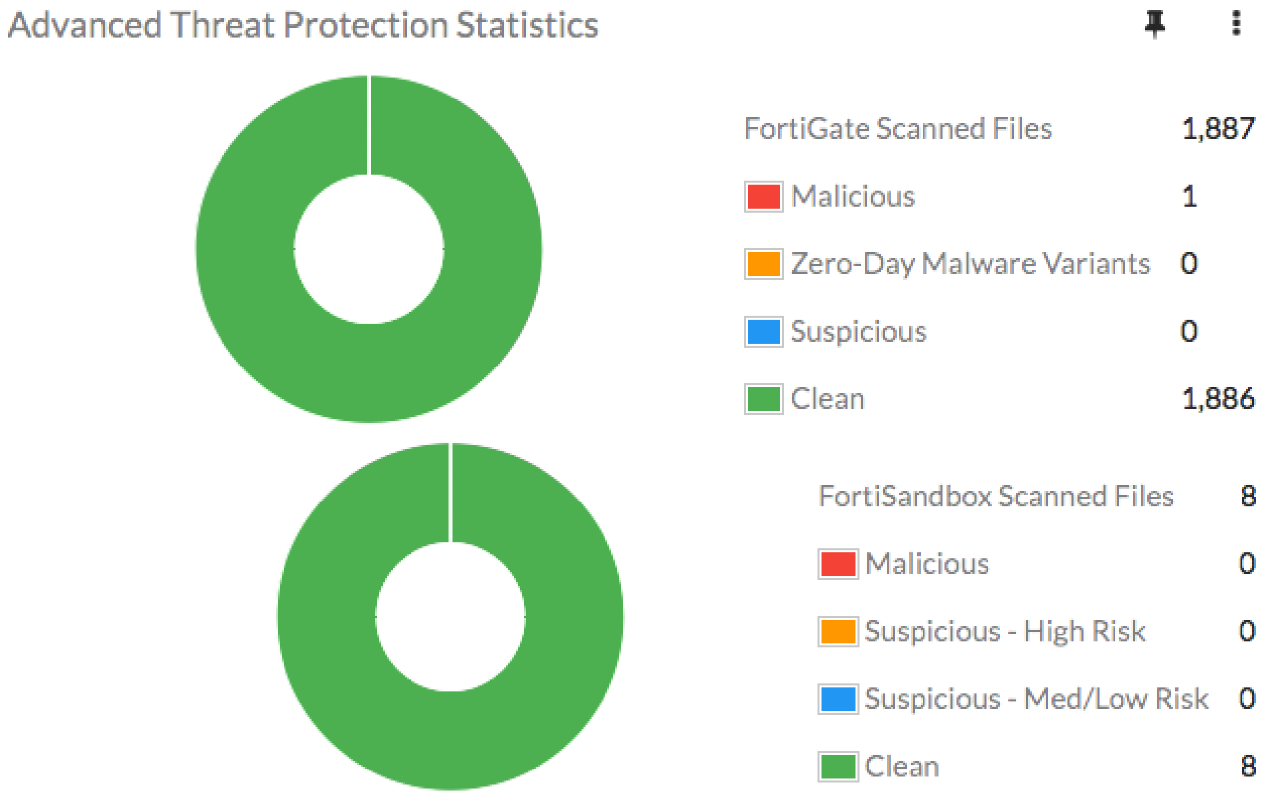
Web Filter

Application Firewall

Non-compliance action: Block [✓ Warning]

Results

1. If a FortiGate in the Security Fabric discovers a suspicious file, it sends the file to the FortiSandbox.
   You can view information about scanned files on either the FortiGate that sent the file or the FortiSandbox. On one of the FortiGate devices, go to the **Dashboard** and locate the **Advanced Threat Protection Statistics** widget. This widget shows files that both the FortiGate and FortiSandbox scan.

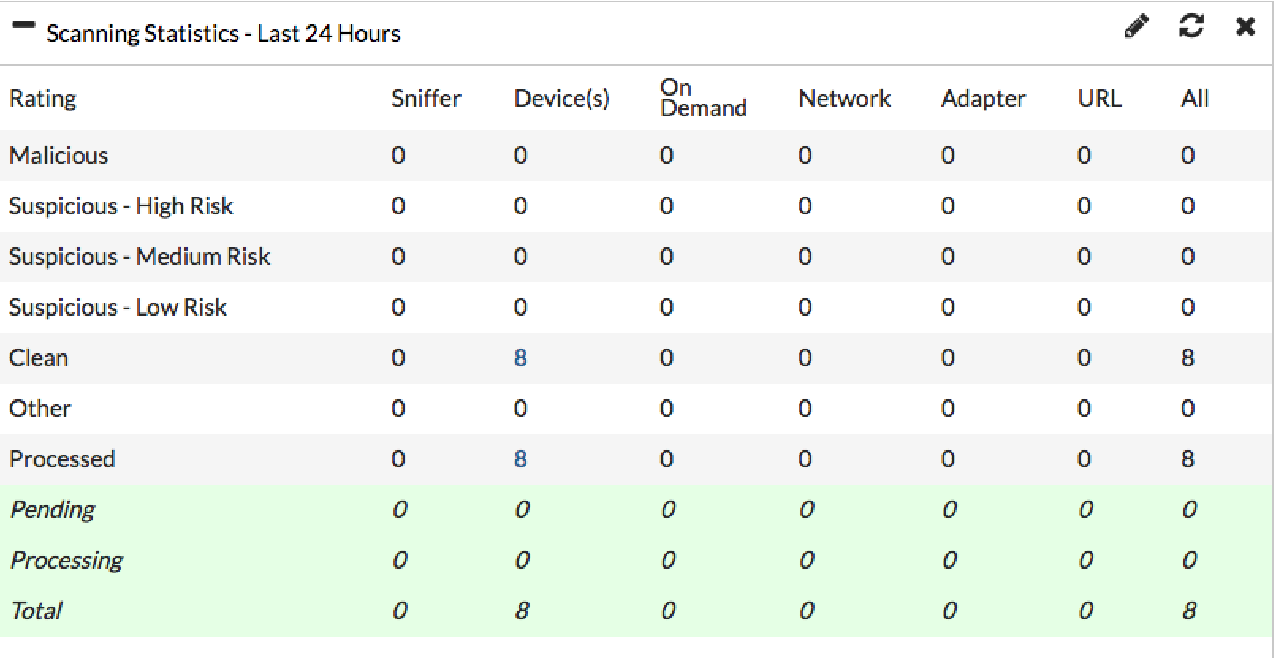


Advanced Threat Protection Statistics

FortiGate Scanned Files	1,887
🟥 Malicious	1
🟧 Zero-Day Malware Variants	0
🟦 Suspicious	0
🟩 Clean	1,886

FortiSandbox Scanned Files	8
🟥 Malicious	0
🟧 Suspicious - High Risk	0
🟦 Suspicious - Med/Low Risk	0
🟩 Clean	8

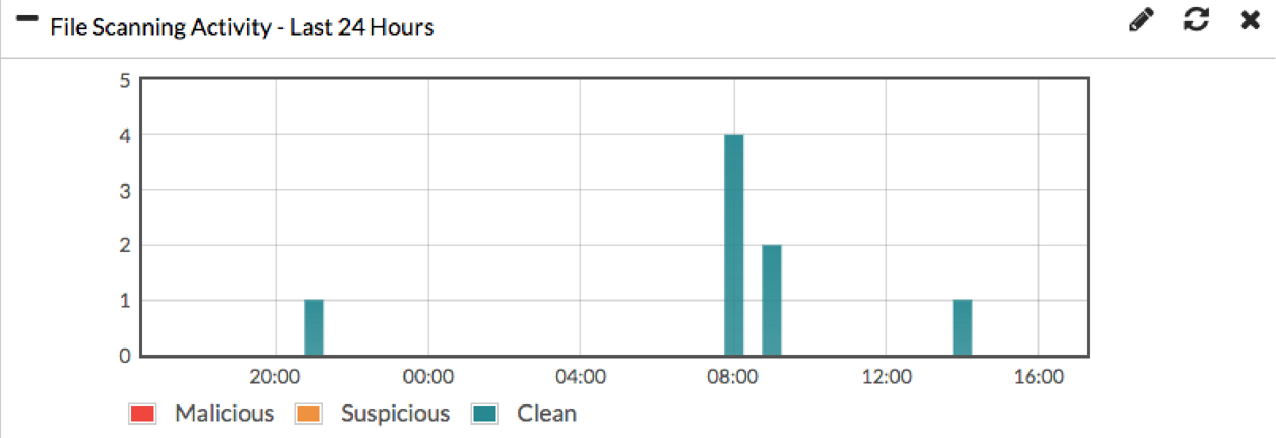
2. On the FortiSandbox, go to **System > Status** and view the **Scanning Statistics** widget for a summary of scanned files.



Scanning Statistics - Last 24 Hours

Rating	Sniffer	Device(s)	On Demand	Network	Adapter	URL	All
Malicious	0	0	0	0	0	0	0
Suspicious - High Risk	0	0	0	0	0	0	0
Suspicious - Medium Risk	0	0	0	0	0	0	0
Suspicious - Low Risk	0	0	0	0	0	0	0
Clean	0	8	0	0	0	0	8
Other	0	0	0	0	0	0	0
Processed	0	8	0	0	0	0	8
Pending	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Processing	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total	*0*	*8*	*0*	*0*	*0*	*0*	*8*

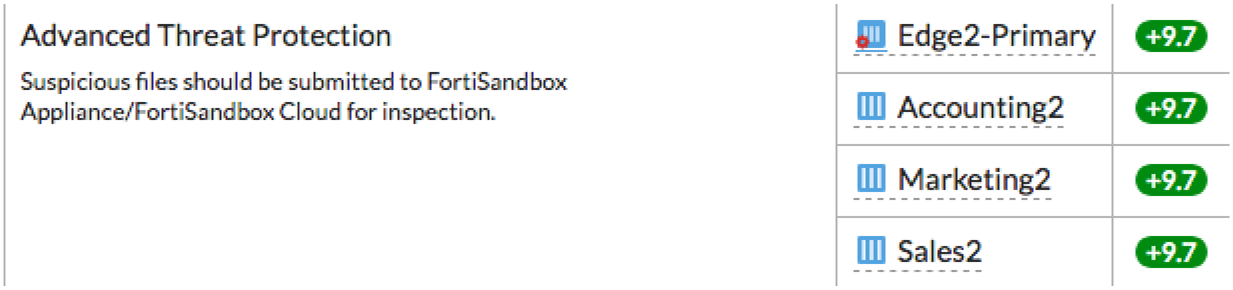
3. You can also view a timeline of scanning in the **File Scanning Activity** widget.



File Scanning Activity - Last 24 Hours

4. On Edge, go to **Security Fabric > Security Rating** and run a rating. When it is finished, select the **All Results** view.

   In the example, all four FortiGate devices in the Security Fabric pass the **Advanced Threat Protection** check and the **Security Rating Score** increases by 9.7 points for each FortiGate.

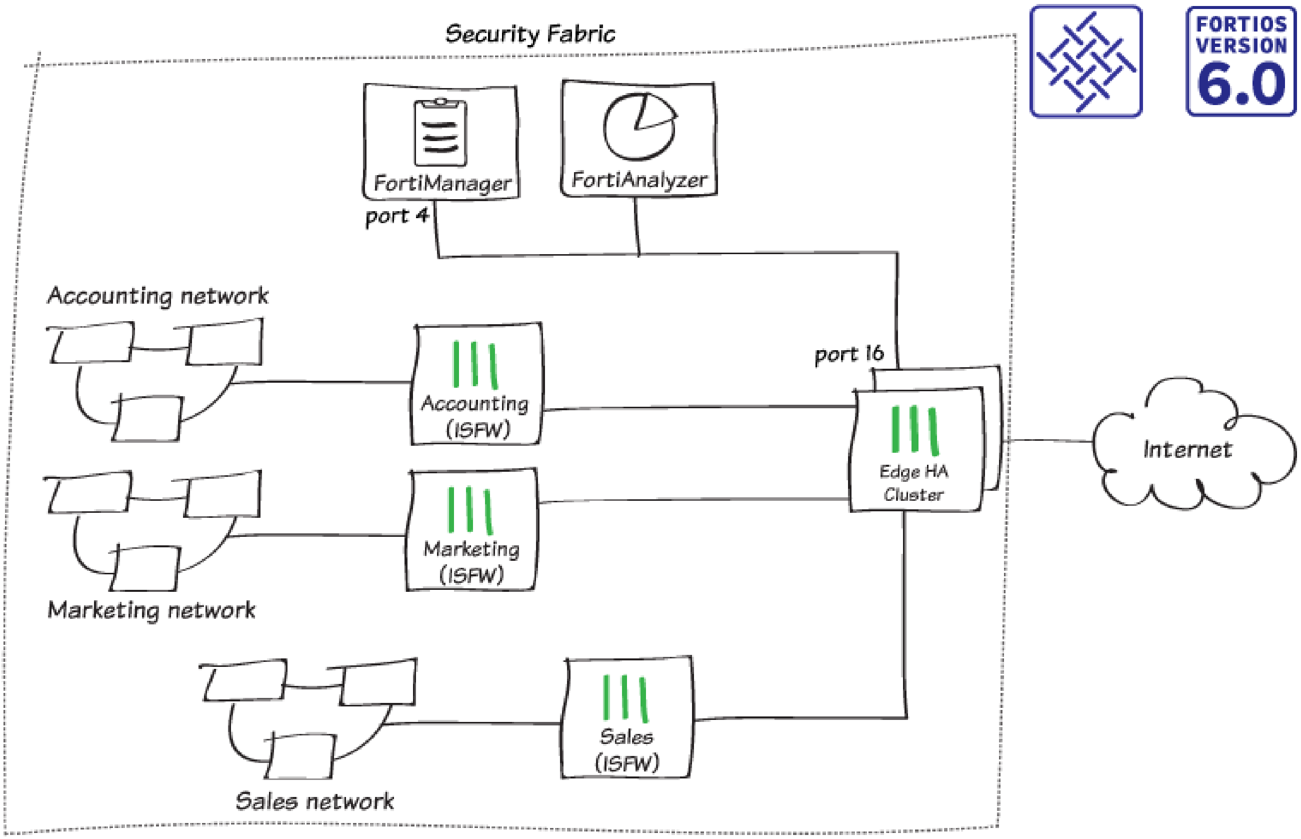


Advanced Threat Protection

Suspicious files should be submitted to FortiSandbox Appliance/FortiSandbox Cloud for inspection.

Edge2-Primary	+9.7
Accounting2	+9.7
Marketing2	+9.7
Sales2	+9.7

FortiManager in the Fortinet Security Fabric



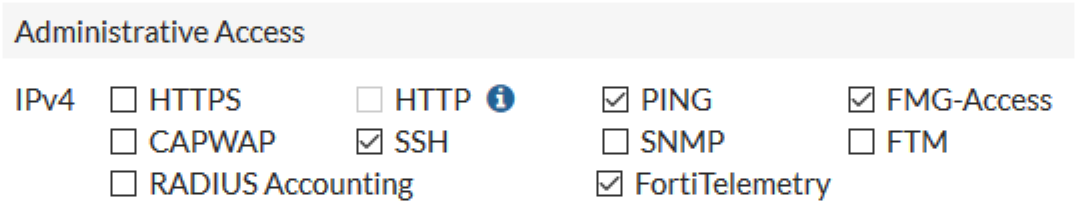
In this recipe, you add a FortiManager to the Security Fabric. This simplifies network administration because you manage all of the FortiGate devices in your network from the FortiManager.

In this example, you add the FortiManager to an existing Security Fabric, with an HA cluster called Edge as the root FortiGate and three internal FortiGates: Accounting, Marketing, and Sales. Network resources, such as a FortiManager, are located on the subnet 192.168.65.x.

Connecting the FortiManager

In this example, port 16 on Edge connects to port 4 on the FortiManager.

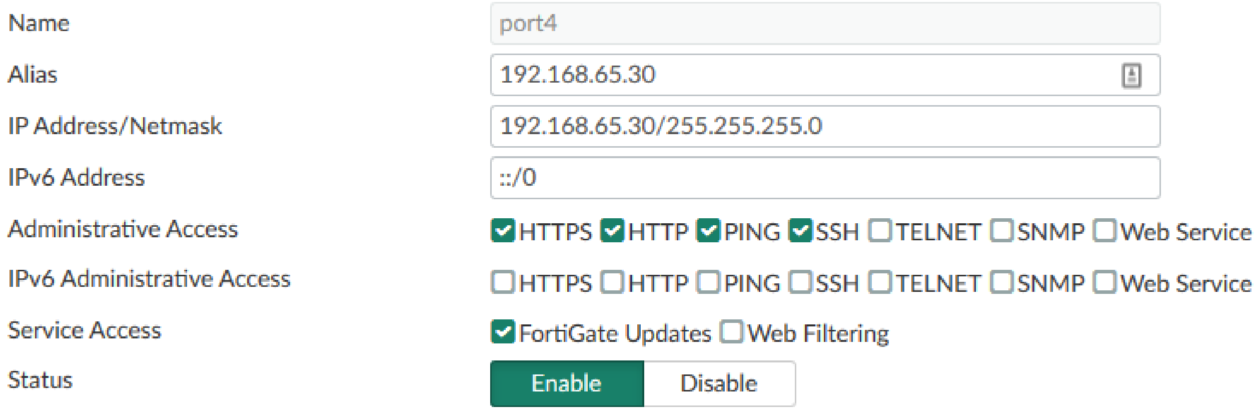
1. To configure the interface on the root FortiGate, connect to Edge, go to **Network > Interfaces**, and edit **port 16**.
2. Configure **Administrative Access** to allow **FMG-Access** and **FortiTelemetry**.



Administrative Access

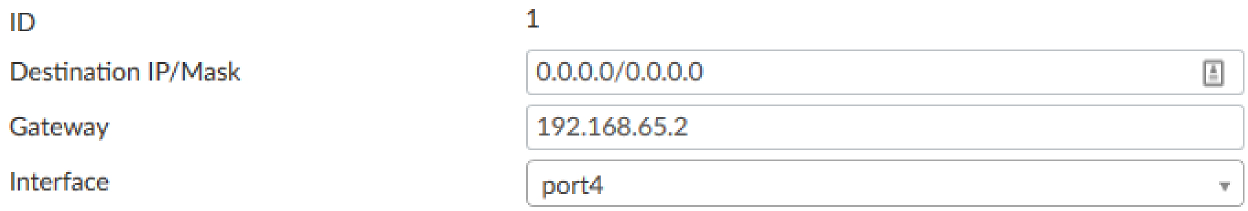
IPv4 □ HTTPS □ HTTP ℹ ☑ PING ☑ FMG-Access
□ CAPWAP ☑ SSH □ SNMP □ FTM
□ RADIUS Accounting ☑ FortiTelemetry

3. To configure the interface on the FortiManager, connect to the FortiManager, go to **System Settings > Network**, select **All Interfaces**, and edit **port 4**.
4. Set **IP Address/Netmask** to an internal IP address (in the example, *192.168.65.30/255.255.255.0*).



Name	port4
Alias	192.168.65.30
IP Address/Netmask	192.168.65.30/255.255.255.0
IPv6 Address	::/0
Administrative Access	☑HTTPS ☑HTTP ☑PING ☑SSH ☐TELNET ☐SNMP ☐Web Service
IPv6 Administrative Access	☐HTTPS ☐HTTP ☐PING ☐SSH ☐TELNET ☐SNMP ☐Web Service
Service Access	☑FortiGate Updates ☐Web Filtering
Status	Enable Disable

5. Select **Routing Table** and add a default route for port 4. Set **Gateway** to the IP address of port 16 on Edge.



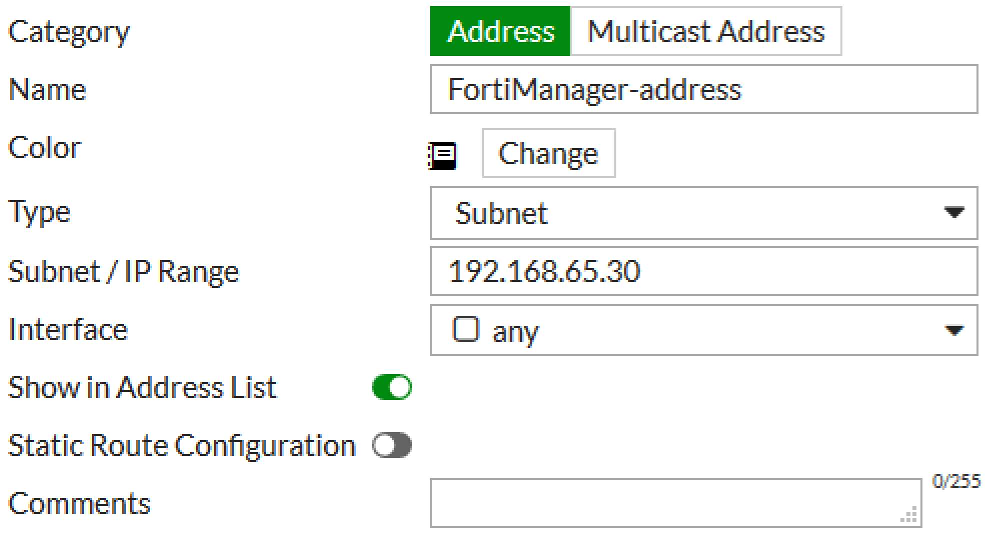
ID	1
Destination IP/Mask	0.0.0.0/0.0.0.0
Gateway	192.168.65.2
Interface	port4

6. If you haven't already done so, connect the FortiManager and Edge.

Allowing Internet access

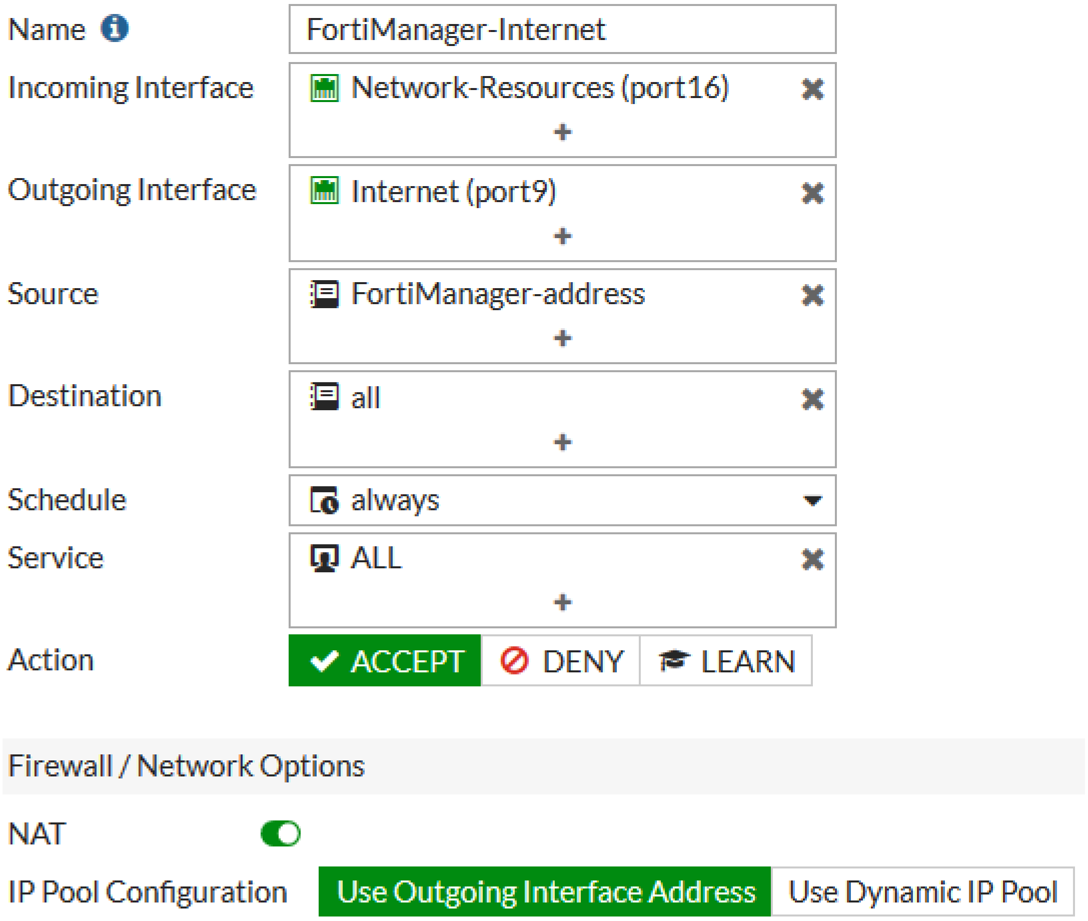
In order to communicate with FortiGuard, the FortiManager requires Internet access.

1. To create an address for the FortiManager, connect to Edge, go to **Policy & Objects > Addresses**, and create a new address.



Category	Address Multicast Address
Name	FortiManager-address
Color	Change
Type	Subnet
Subnet / IP Range	192.168.65.30
Interface	☐ any
Show in Address List	●
Static Route Configuration	○
Comments	0/255

2. To allow the FortiManager to access the Internet, go to **Policy & Objects > IPv4 Policy**, and create a new policy.



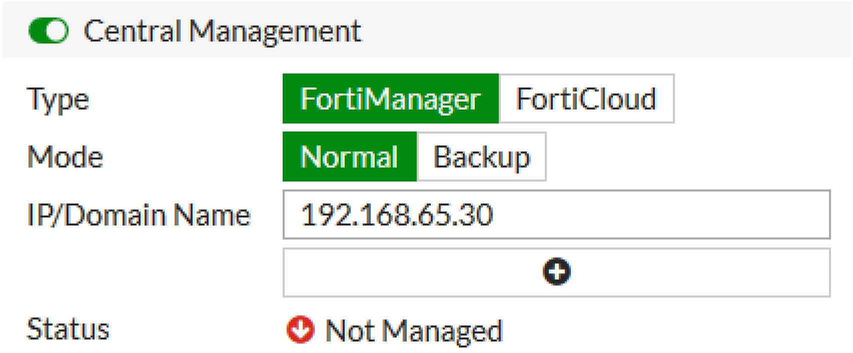
Name	FortiManager-Internet
Incoming Interface	Network-Resources (port16)
Outgoing Interface	Internet (port9)
Source	FortiManager-address
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT / DENY / LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	Use Outgoing Interface Address / Use Dynamic IP Pool

Configuring central management

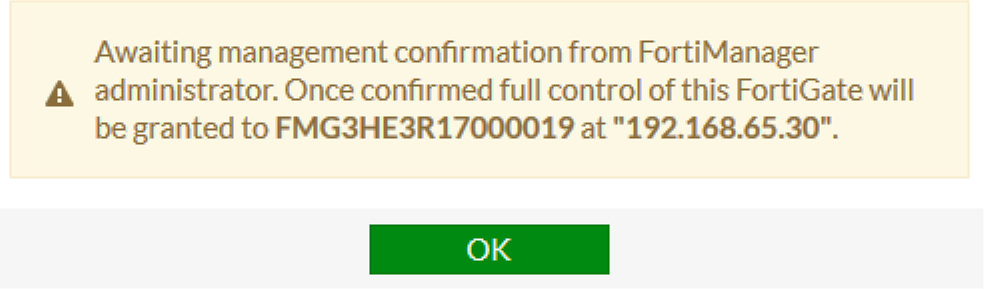
1. To enable central management, connect to Edge, go to **Security Fabric > Settings**, and enable **Central Management**.
2. Set **Type** to **FortiManager**, **Mode** to **Normal**, and set **IP/Domain Name** to the IP address of port 4 on the FortiManager.



● Central Management

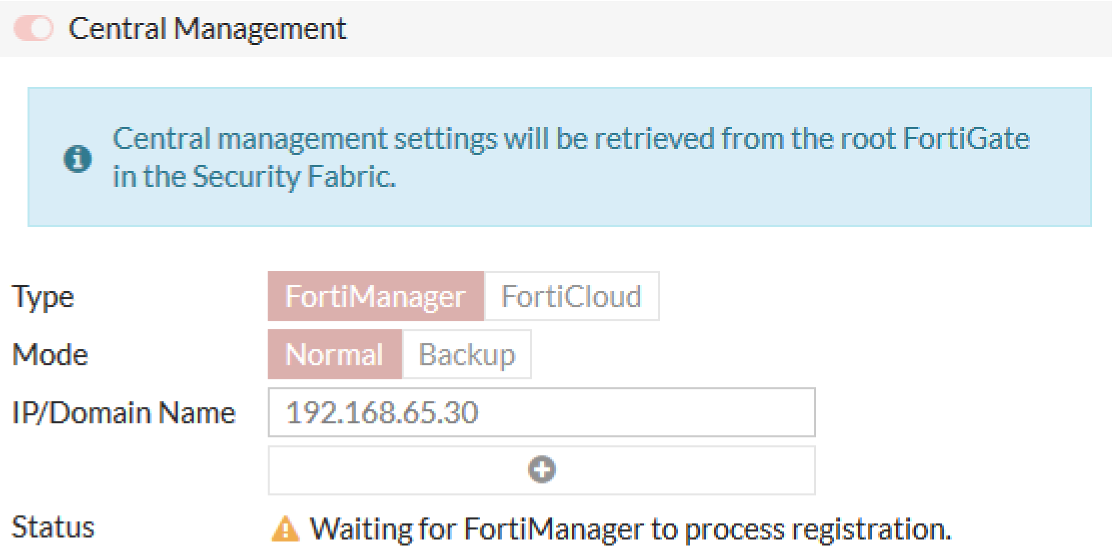
Type	FortiManager / FortiCloud
Mode	Normal / Backup
IP/Domain Name	192.168.65.30
Status	Not Managed

3. After you select **Apply**, a message appears stating that the FortiManager received the message and Edge is waiting for management confirmation.



⚠ Awaiting management confirmation from FortiManager administrator. Once confirmed full control of this FortiGate will be granted to **FMG3HE3R17000019** at **"192.168.65.30"**.

4. Edge, as the root FortiGate, pushes FortiManager settings to the other FortiGate devices in the Security Fabric. To verify this, connect to Accounting and go to **Security Fabric > Settings**.

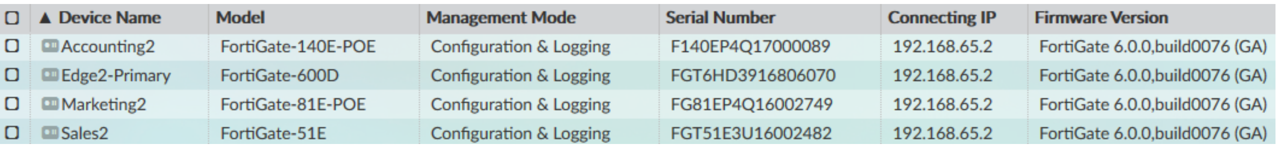


Central Management

ℹ Central management settings will be retrieved from the root FortiGate in the Security Fabric.

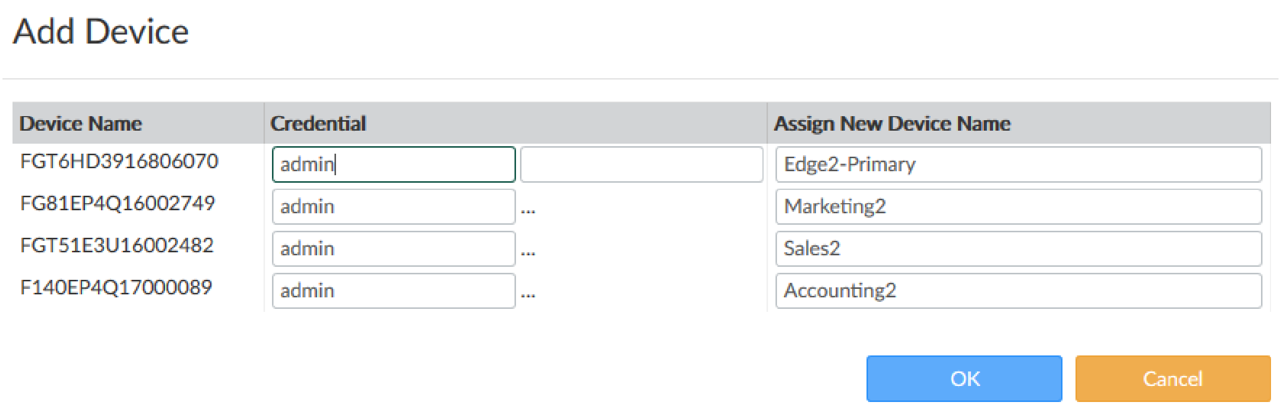
Type: FortiManager | FortiCloud
Mode: Normal | Backup
IP/Domain Name: 192.168.65.30
Status: ⚠ Waiting for FortiManager to process registration.

5. To confirm the management connection, connect to the FortiManager and go to **Device Manager > Unregistered Devices**. Select the FortiGate devices and select **+ Add**.



□	▲ Device Name	Model	Management Mode	Serial Number	Connecting IP	Firmware Version
□	Accounting2	FortiGate-140E-POE	Configuration & Logging	F140EP4Q17000089	192.168.65.2	FortiGate 6.0.0,build0076 (GA)
□	Edge2-Primary	FortiGate-600D	Configuration & Logging	FGT6HD3916806070	192.168.65.2	FortiGate 6.0.0,build0076 (GA)
□	Marketing2	FortiGate-81E-POE	Configuration & Logging	FG81EP4Q16002749	192.168.65.2	FortiGate 6.0.0,build0076 (GA)
□	Sales2	FortiGate-51E	Configuration & Logging	FGT51E3U16002482	192.168.65.2	FortiGate 6.0.0,build0076 (GA)

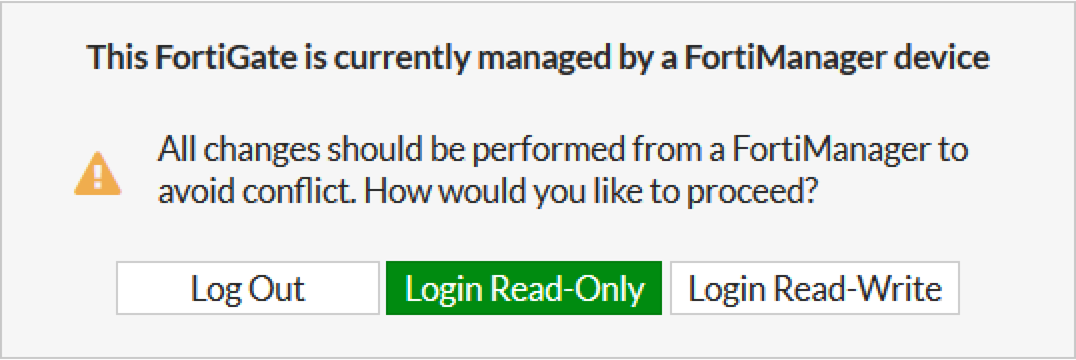
6. Add the FortiGate devices to the FortiManager.



Add Device

Device Name	Credential		Assign New Device Name
FGT6HD3916806070	admin		Edge2-Primary
FG81EP4Q16002749	admin	...	Marketing2
FGT51E3U16002482	admin	...	Sales2
F140EP4Q17000089	admin	...	Accounting2

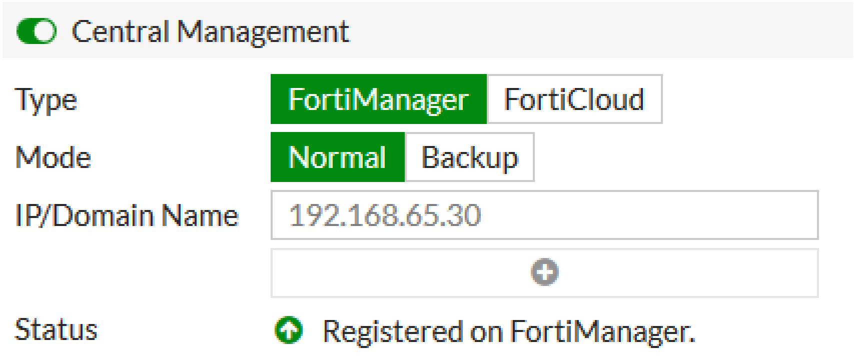
7. Connect to Edge. A warning message appears stating that the FortiGate is now managed by a FortiManager. Select **Login Read-Only**.



This FortiGate is currently managed by a FortiManager device

All changes should be performed from a FortiManager to avoid conflict. How would you like to proceed?

8. Go to **Security Fabric > Settings**. Under **Central Management**, the **Status** is now **Registered on FortiManager**.



Central Management

Type: FortiManager | FortiCloud

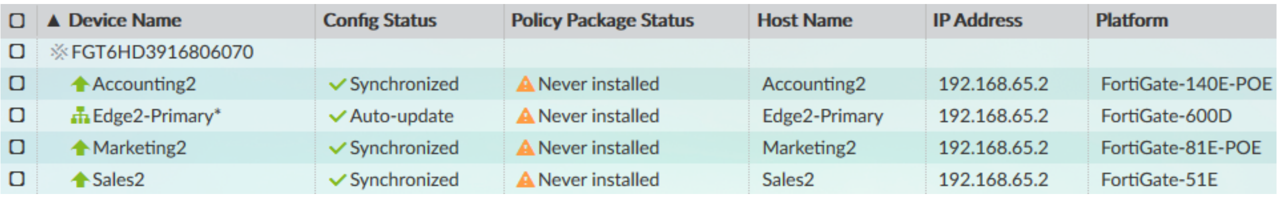
Mode: Normal | Backup

IP/Domain Name: 192.168.65.30

Status: Registered on FortiManager.

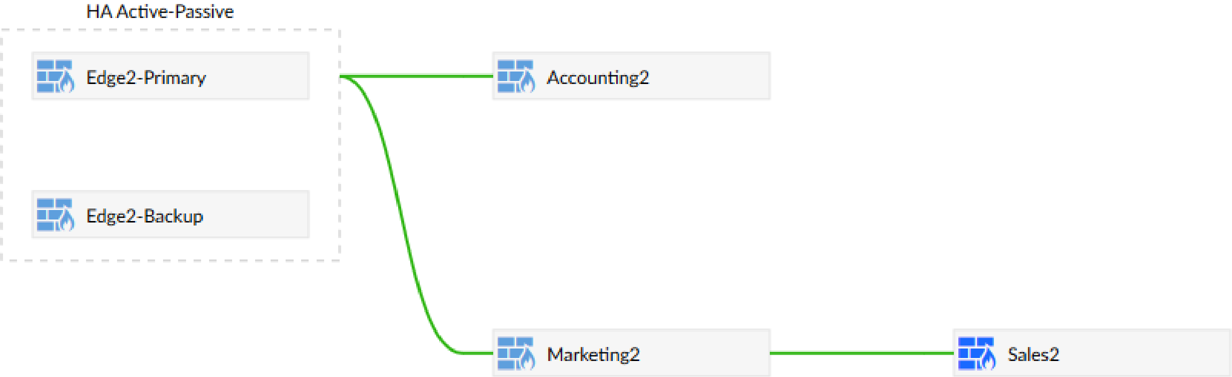
Results

1. The FortiGate devices are on the **Managed FortiGate** list and appear as part of a Security Fabric group. The * beside Edge indicates that it's the root FortiGate in the Security Fabric.

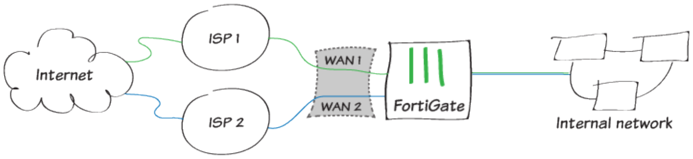


☐	▲ Device Name	Config Status	Policy Package Status	Host Name	IP Address	Platform
☐	FGT6HD3916806070					
☐	Accounting2	✓ Synchronized	⚠ Never installed	Accounting2	192.168.65.2	FortiGate-140E-POE
☐	Edge2-Primary*	✓ Auto-update	⚠ Never installed	Edge2-Primary	192.168.65.2	FortiGate-600D
☐	Marketing2	✓ Synchronized	⚠ Never installed	Marketing2	192.168.65.2	FortiGate-81E-POE
☐	Sales2	✓ Synchronized	⚠ Never installed	Sales2	192.168.65.2	FortiGate-51E

2. Right-click on any of the FortiGate devices and select **Fabric Topology**. The topology of the Security Fabric is displayed.

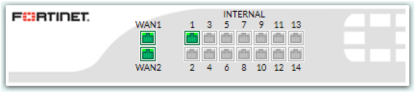


Redundant Internet with SD-WAN



This recipe provides an example of how you can configure redundant Internet connectivity for your network using SD-WAN. This allows you to load balance your Internet traffic between multiple ISP links and provides redundancy for your network's Internet connection if your primary ISP is unavailable.

1. Connect the FortiGate to your ISP devices by connecting the Internet-facing (WAN) ports on the FortiGate to your ISP devices. Connect WAN1 to the ISP that you want to use for most traffic, and connect WAN2 to the other ISP.



2. Before you can configure FortiGate interfaces as SD-WAN members, you must remove or redirect existing configuration references to those interfaces in routes and security policies. This includes the default Internet access policy that's included with many FortiGate models. Note that after you remove the routes and security policies, traffic can't reach the WAN ports through the FortiGate. Redirecting the routes and policies to reference other interfaces avoids your having to create them again later. After you configure SD-WAN, you can reconfigure the routes and policies to reference the SD-WAN interface. Remove existing configuration references to interfaces:

   a. Go to *Network > Static Routes* and delete any routes that use WAN1 or WAN2.

   b. Go to *Policy & Objects > IPv4 Policy* and delete any policies that use WAN1 or WAN2.

3. Create the SD-WAN interface:

   a. Go to *Network > SD-WAN* and set *Status* to *Enable*.

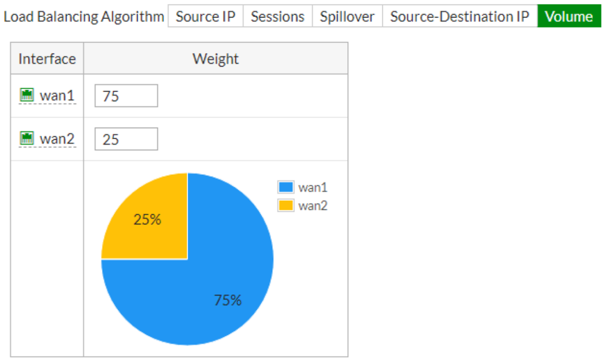
   b. Under *SD-WAN Interface Members*, select + and select *wan1*. Set the *Gateway* to the default gateway for this interface. This is usually the default gateway IP address of the ISP that this interface is connected to. Repeat these steps to add *wan2*.

   c. Go to *Network > Interfaces* and verify that the virtual interface for *SD-WAN* appears in the interface list. You can expand SD-WAN to view the ports that are included in the SD-WAN interface.

4. Configure SD-WAN load balancing:

   a. Go to *Network > SD-WAN Rules* and edit the rule named sd-wan.

   b. In the *Load Balancing Algorithm* field, select *Volume*, and prioritize WAN1 to serve more traffic. the example, the ISP connected to WAN1 is a 40Mb link, and the ISP connected to WAN2 is a 10Mb link, so we balance the weight 75% to 25% in favor of WAN1.



Load Balancing Algorithm: Source IP | Sessions | Spillover | Source-Destination IP | **Volume**

Interface	Weight
wan1	75
wan2	25

5. Create a static route for the SD-WAN interface:

   a. Go to *Network > Static Routes* and create a new route.

   b. In the *Destination* field, select *Subnet*, and leave the destination IP address and subnet mask as 0.0.0.0/0.0.0.0.

   c. In the *Interface* field, select the SD-WAN interface from the dropdown list.

   d. Ensure that *Status* is set to *Enable*. If you previously removed or redirected existing references in routes to interfaces that you wanted to add as SD-WAN interface members, you can now reconfigure those routes to reference the SD-WAN interface.

6. Configure a security policy that allows traffic from your organization’s internal network to the SD-WAN interface.

   a. Go to *Policy & Objects > IPv4 Policy* and create a new policy.

   b. Set *Incoming Interface* to the interface that connects to your organization’s internal network and set *Outgoing Interface* to the SD-WAN interface.

   c. Enable *NAT* and apply *Security Profiles* as required.

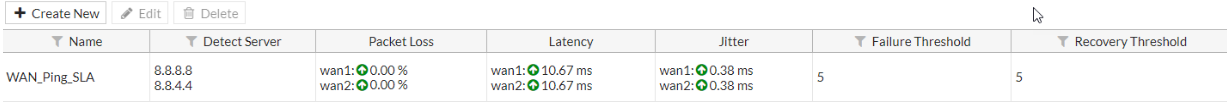
   d. Enable *Log Allowed Traffic* for *All Sessions* to allow you to verify the results later. If you previously removed or redirected existing references in security policies to interfaces that you wanted to add as SD-WAN interface members, you can now reconfigure those policies to reference the SD-WAN interface.

7. You can configure link health monitoring to verify the health and status of the links that make up the SD-WAN link:

   a. Go to *Network > Performance SLA* and create a new performance SLA.

   b. Set the *Protocol* for the health checks. In the *Server* fields, enter the IP addresses of up to two servers that you want to use to test the health of each SD-WAN member interface.* In the *Participants* field, select the SD-WAN interface members that you want the health check to apply to.

c. You can view link quality measurements on the *Performance SLA* page. The table displays information about configured health checks. The values in the *Packet Loss*, *Latency*, and *Jitter* columns apply to the server that the FortiGate is using to test the health of the SD-WAN member interfaces. The green (up) arrows indicate only that the server is responding to the health checks, regardless of the packet loss, latency, and jitter values, and do not indicate that the health checks are being met.

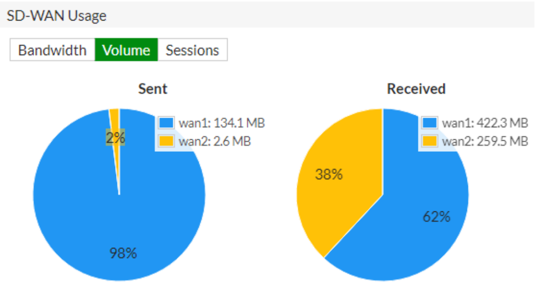


Name	Detect Server	Packet Loss	Latency	Jitter	Failure Threshold	Recovery Threshold
WAN_Ping_SLA	8.8.8.8 8.8.4.4	wan1: ⬆ 0.00 % wan2: ⬆ 0.00 %	wan1: ⬆ 10.67 ms wan2: ⬆ 10.67 ms	wan1: ⬆ 0.38 ms wan2: ⬆ 0.38 ms	5	5

8. View the results:

   a. Browse the Internet using a computer on your internal network and then go to *Network > SD-WAN*.

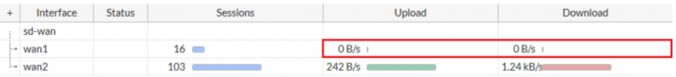
   b. In the *SD-WAN Usage* section, you can see the bandwidth, volume, and sessions for traffic on the SD-WAN interfaces.



   c. Go to *Monitor > SD-WAN Monitor* to view the number of sessions, bit rate, and more information for each interface.

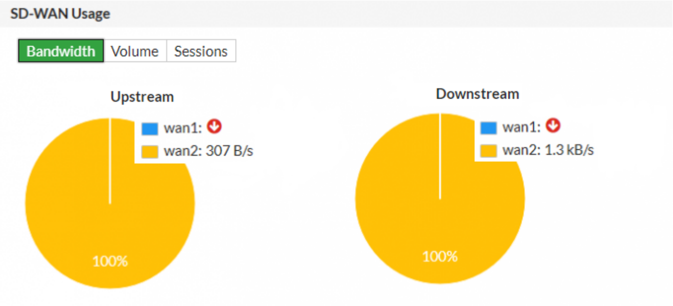
9. To test failover of the redundant Internet configuration, you must simulate a failed Internet connection to one of the ports. Do so by physically disconnecting the Ethernet cable connected to WAN1:

   a. Verify that users still have Internet access by navigating to *Monitor > SD-WAN Monitor*. The *Upload* and *Download* values for WAN1 show that traffic is not going through that interface.



+	Interface	Status	Sessions	Upload	Download
	sd-wan				
	wan1		16	0 B/s	0 B/s
	wan2		103	242 B/s	1.24 kB/s

   b. Go to *Network > SD-WAN*. In the *SD-WAN Usage* section, you can see that bandwidth, volume, and sessions have diverted entirely through WAN2.



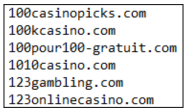
   c. Users on the internal network should not notice the WAN1 failure. Likewise, if you are using the WAN1 gateway IP address to connect to the admin dashboard, nothing should change from your perspective. It appears as though you are still connecting through WAN1. After you verify successful failover, reconnect the WAN1 Ethernet cable.

Blocking malicious domains using threat feeds

This example uses a domain name threat feed and FortiGate DNS filtering to block malicious domains. The text file in this example is a list of gambling site domain names.

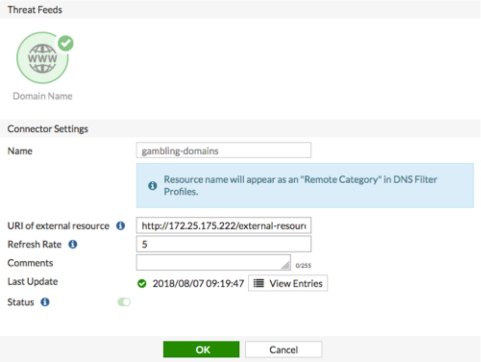
Threat feeds allow you to dynamically import external block lists in the form of a text file into your FortiGate. These text files, stored on an HTTP server, can contain a list of web addresses or domains. You can use threat feeds to deny access to a source or destination IP address in Web Filter and DNS Filter profiles, SSL inspection exemptions, and as a source/destination in proxy policies. You can use Fabric connectors for FortiGates that do not belong to a Fortinet Security Fabric.

1. Create an external block list. The external block list should be a plain text file with one domain name per line. The use of simple wildcards is supported. You can create your own text file or download it from an external service. Upload the text file to the HTTP file server.



```
100casinopicks.com
100kcasino.com
100pour100-gratuit.com
1010casino.com
123gambling.com
123onlinecasino.com
```

2. Configure the threat feed:
   a. In FortiOS, go to *Security Fabric > Fabric Connectors*. Click *Create New*.
   b. Under *Threat Feeds*, select *Domain Name*.
   c. Configure the *Name*, *URI of external resource*, and *Refresh Rate* fields. In the *URI of external resource* field, enter the location of the text file on the HTTP file server. By default, the FortiGate rereads the file and uploads any changes every five minutes.



Name: gambling-domains

Resource name will appear as an "Remote Category" in DNS Filter Profiles.

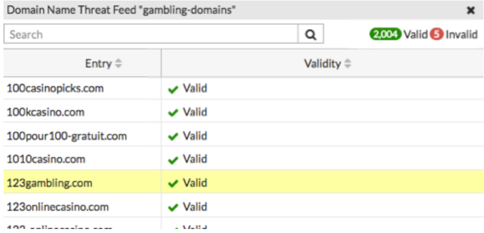
URI of external resource: http://172.25.175.222/external-resour

Refresh Rate: 5

Comments: 0/255

Last Update: 2018/08/07 09:19:47

   d. Click *View Entries* to see the text file's domain list.

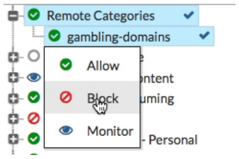


Domain Name Threat Feed "gambling-domains"

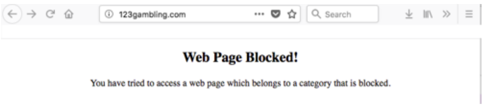
Entry	Validity
100casinopicks.com	✓ Valid
100kcasino.com	✓ Valid
100pour100-gratuit.com	✓ Valid
1010casino.com	✓ Valid
123gambling.com	✓ Valid
123onlinecasino.com	✓ Valid

   e. Click *OK*.

3. Add the threat feed to the DNS filter:
   a. Go to *Security Profiles > DNS Filter*.
   b. Scroll to the list of preconfigured FortiGuard filters.
   c. The resource file uploaded earlier is listed under *Remote Categories*. Set the action for this category to *Block*.



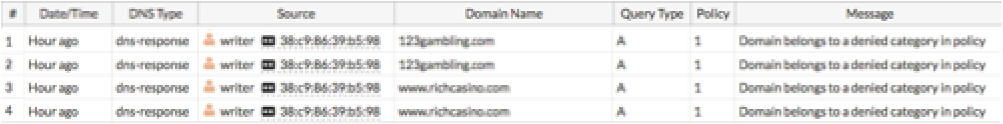
4. Configure the outgoing Internet policy:
   a. Go to *Policy & Objects > IPv4 Policy*.
   b. Under *Security Profiles*, enable *DNS Filter*.
   c. From the *SSL Inspection* dropdown list, select an SSL inspection profile.
5. View the results:
   a. Visit a domain on the external resource file. This example visits 123gambling.com. A *Web Page Blocked!* message appears.



Web Page Blocked!

You have tried to access a web page which belongs to a category that is blocked.

   b. In FortiOS, go to *Log & Report > DNS Query*. The logs show that the 123gambling.com domain belongs to a blocked category.

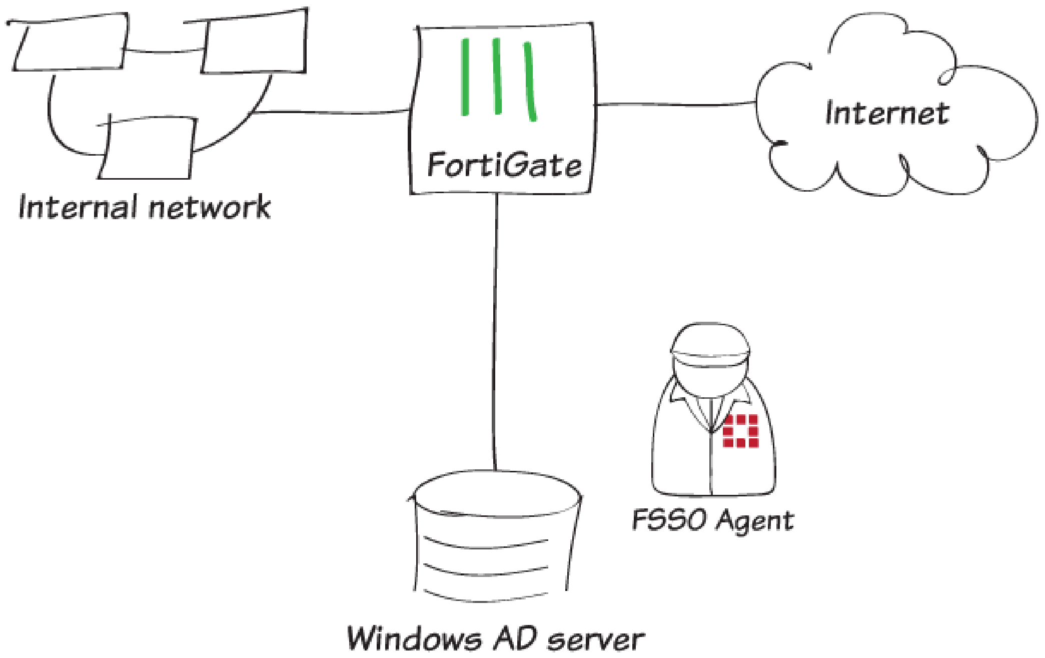


#	Date/Time	DNS Type	Source	Domain Name	Query Type	Policy	Message
1	Hour ago	dns-response	writer 38:c9:86:39:b5:98	123gambling.com	A	1	Domain belongs to a denied category in policy
2	Hour ago	dns-response	writer 38:c9:86:39:b5:98	123gambling.com	A	1	Domain belongs to a denied category in policy
3	Hour ago	dns-response	writer 38:c9:86:39:b5:98	www.richcasino.com	A	1	Domain belongs to a denied category in policy
4	Hour ago	dns-response	writer 38:c9:86:39:b5:98	www.richcasino.com	A	1	Domain belongs to a denied category in policy

Authentication

This section contains information about authenticating users and devices.

Agent-based FSSO for Windows AD



FORTIOS VERSION 6.0

In this recipe, you use agent-based Fortinet single sign-on (FSSO) to allow users to login to the network once with their Windows AD credentials and seamlessly access all appropriate network resources.

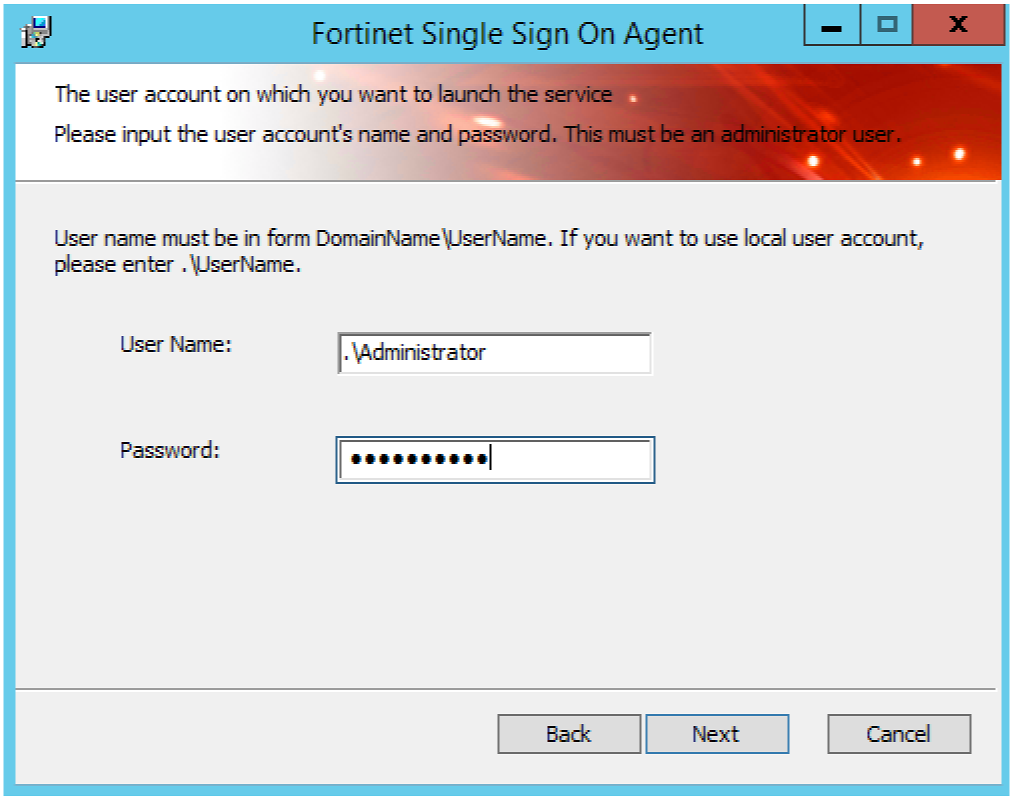
This example uses the FSSO agent in advanced mode. The main difference between advanced and standard mode is the naming convention used when referring to username information. Standard mode uses Windows convention: Domain\Username. Advanced mode uses LDAP convention: CN=User, OU=Name, DC=Domain.

Advanced mode is required for multi-domains environments.

Installing the FSSO agent

Connect to the Windows AD server and download the FSSO agent from Fortinet Support.

1. To install the agent, open the installer file and use the installation wizard.
2. Set a **User Name** and **Password** for the FSSO domain administrator.



Fortinet Single Sign On Agent

The user account on which you want to launch the service

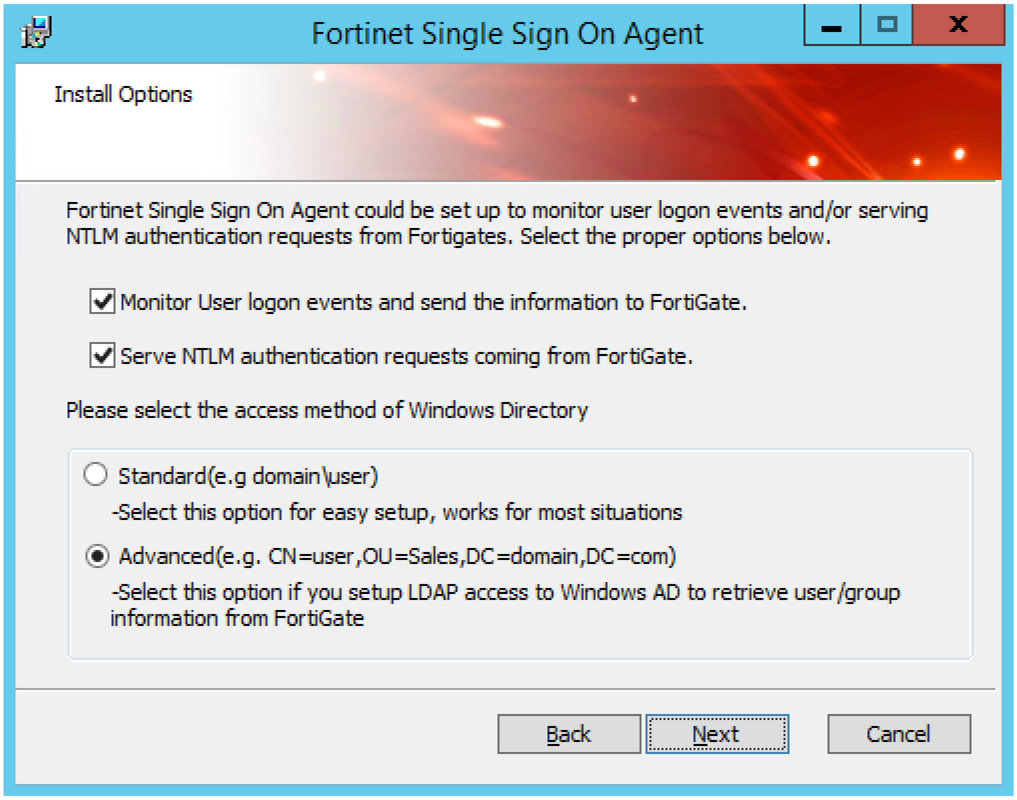
Please input the user account's name and password. This must be an administrator user.

User name must be in form DomainName\UserName. If you want to use local user account, please enter .\UserName.

User Name: .\Administrator

Password: •••••••••••

3. For the **Install Options**, select **Advanced** to use advanced mode instead of standard.



Fortinet Single Sign On Agent

Install Options

Fortinet Single Sign On Agent could be set up to monitor user logon events and/or serving NTLM authentication requests from Fortigates. Select the proper options below.

☑ Monitor User logon events and send the information to FortiGate.

☑ Serve NTLM authentication requests coming from FortiGate.

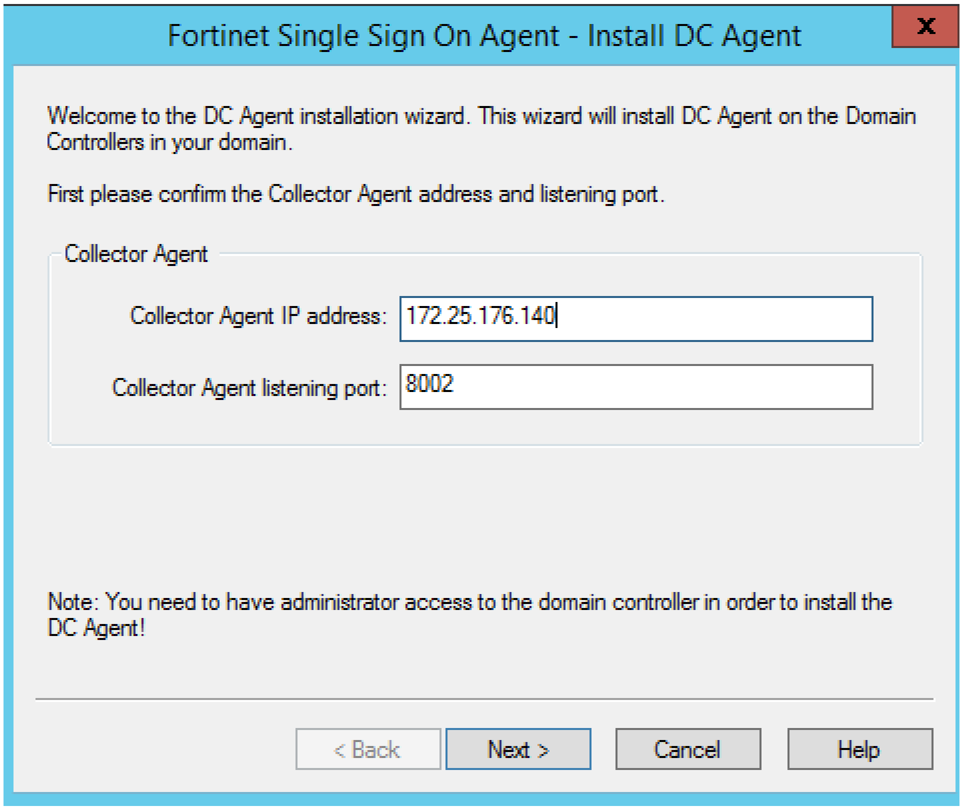
Please select the access method of Windows Directory

○ Standard(e.g domain\user)
-Select this option for easy setup, works for most situations

● Advanced(e.g. CN=user,OU=Sales,DC=domain,DC=com)
-Select this option if you setup LDAP access to Windows AD to retrieve user/group information from FortiGate

4. After installing the FSSO agent, run **Install DC Agent**.

5. Set the **Collector Agent IP address** and the **Collector Agent listening port**.



Fortinet Single Sign On Agent - Install DC Agent

Welcome to the DC Agent installation wizard. This wizard will install DC Agent on the Domain Controllers in your domain.

First please confirm the Collector Agent address and listening port.

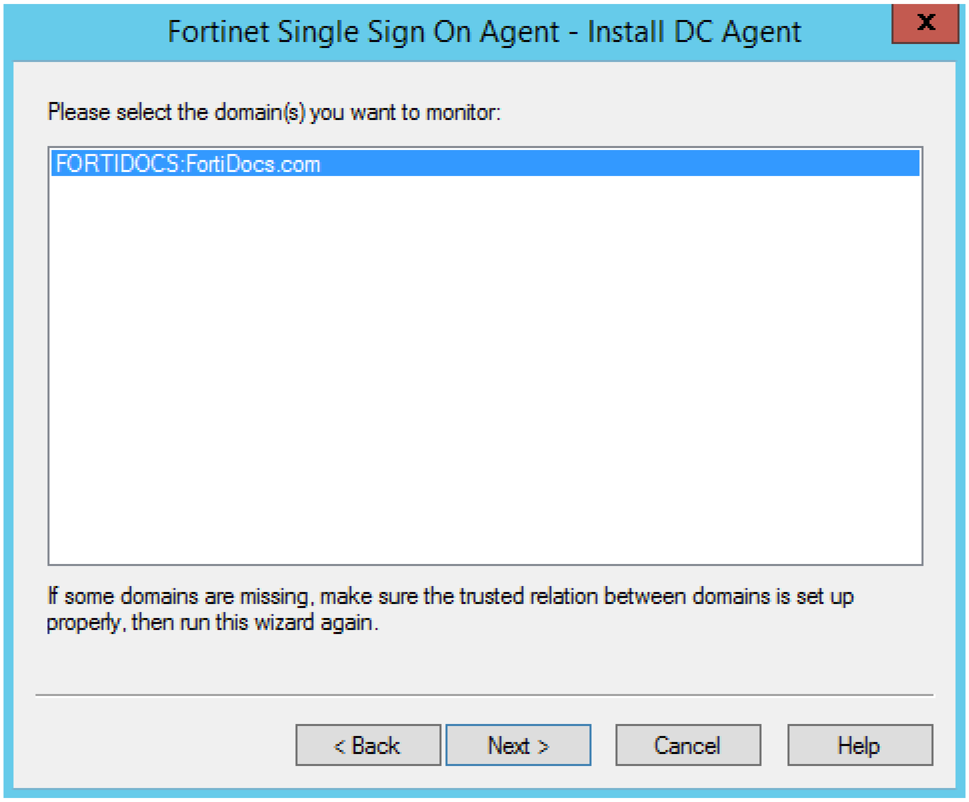
Collector Agent

Collector Agent IP address: 172.25.176.140

Collector Agent listening port: 8002

Note: You need to have administrator access to the domain controller in order to install the DC Agent!

6. Select the domain you wish to monitor.



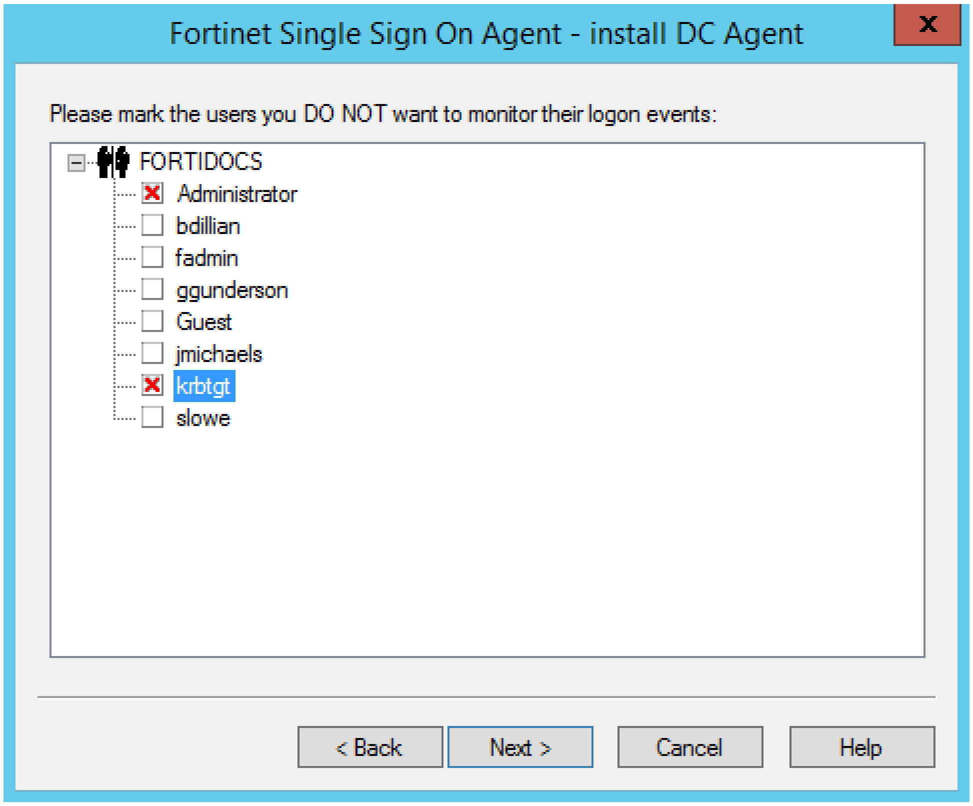
Fortinet Single Sign On Agent - Install DC Agent

Please select the domain(s) you want to monitor:

FORTIDOCS:FortiDocs.com

If some domains are missing, make sure the trusted relation between domains is set up properly, then run this wizard again.

7. Exclude any users that you don't want to monitor, including the administrator.

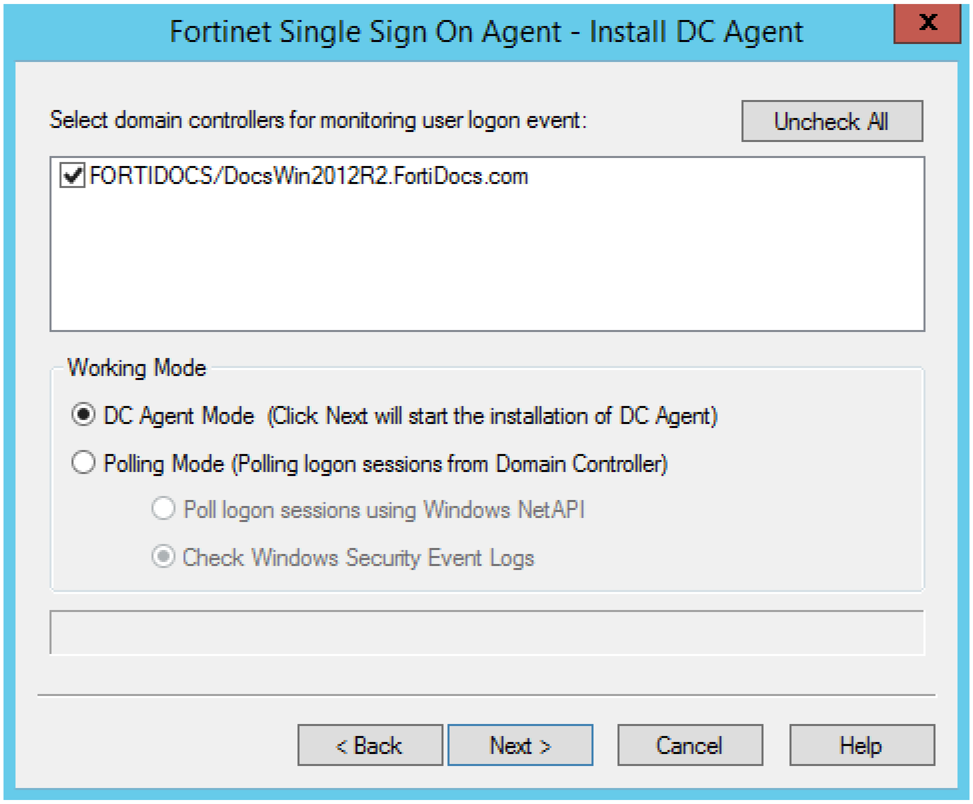


Fortinet Single Sign On Agent - install DC Agent

Please mark the users you DO NOT want to monitor their logon events:

- FORTIDOCS
  - ☒ Administrator
  - □ bdillian
  - □ fadmin
  - □ ggunderson
  - □ Guest
  - □ jmichaels
  - ☒ krbtgt
  - □ slowe

8. Set **Working Mode** to **DC Agent Mode**



Fortinet Single Sign On Agent - Install DC Agent

Select domain controllers for monitoring user logon event:

☑ FORTIDOCS/DocsWin2012R2.FortiDocs.com

Working Mode

● DC Agent Mode (Click Next will start the installation of DC Agent)

○ Polling Mode (Polling logon sessions from Domain Controller)

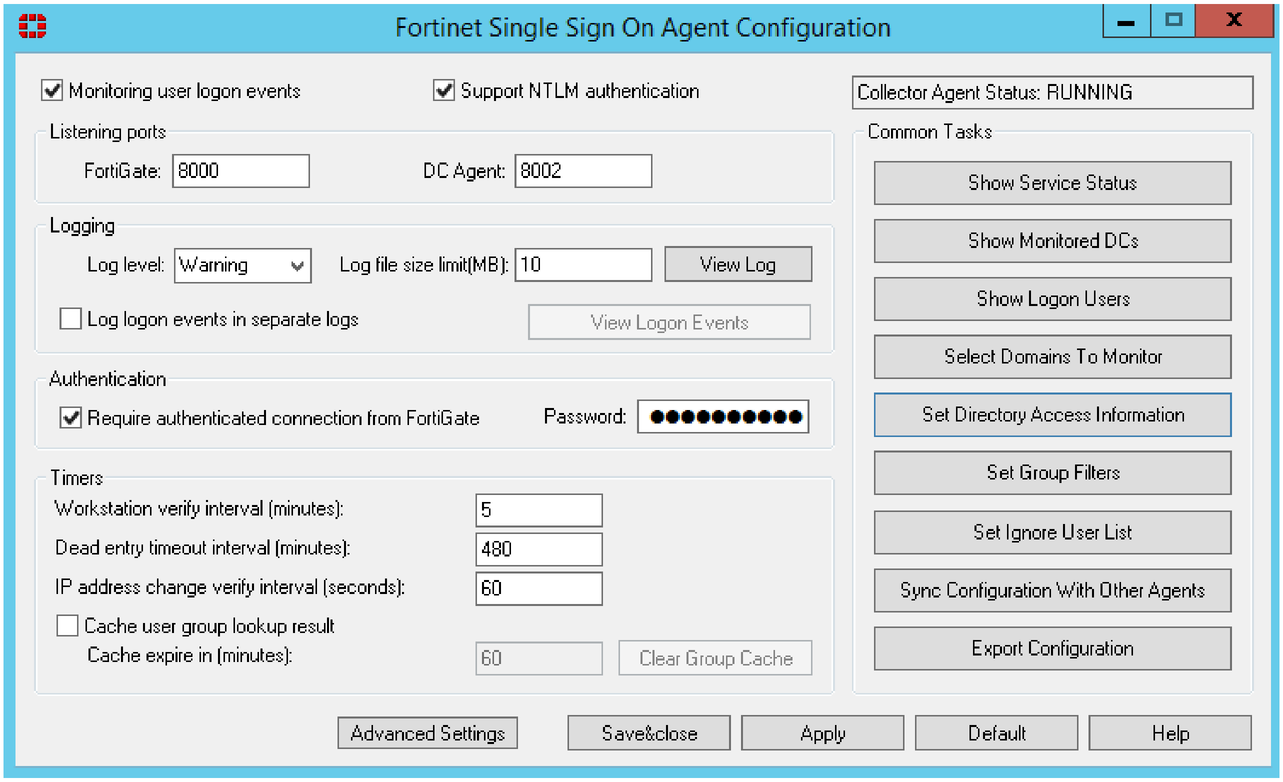
○ Poll logon sessions using Windows NetAPI

● Check Windows Security Event Logs

9. Restart your server to apply all changes.

Configuring the FSSO agent

1. To configure the settings for your network, open the FSSO agent. You can use the default for most settings.



Fortinet Single Sign On Agent Configuration

☑ Monitoring user logon events ☑ Support NTLM authentication

Collector Agent Status: RUNNING

Listening ports

FortiGate: 8000 DC Agent: 8002

Logging

Log level: Warning Log file size limit(MB): 10

☐ Log logon events in separate logs

Authentication

☑ Require authenticated connection from FortiGate Password: ●●●●●●●●●●●

Timers

Workstation verify interval (minutes): 5

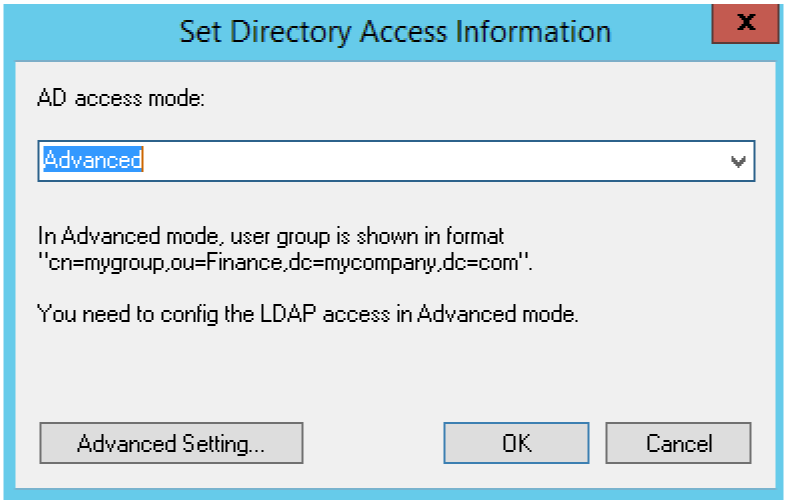
Dead entry timeout interval (minutes): 480

IP address change verify interval (seconds): 60

☐ Cache user group lookup result

Cache expire in (minutes): 60

2. Select **Set Directory Access Information**. Set **AD access mode** to **Advanced**.



Set Directory Access Information

AD access mode:

Advanced

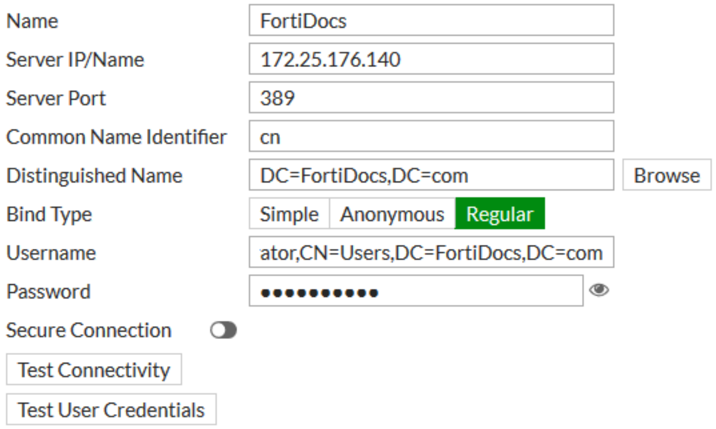
In Advanced mode, user group is shown in format "cn=mygroup,ou=Finance,dc=mycompany,dc=com".

You need to config the LDAP access in Advanced mode.

Setting up your FortiGate for FSSO

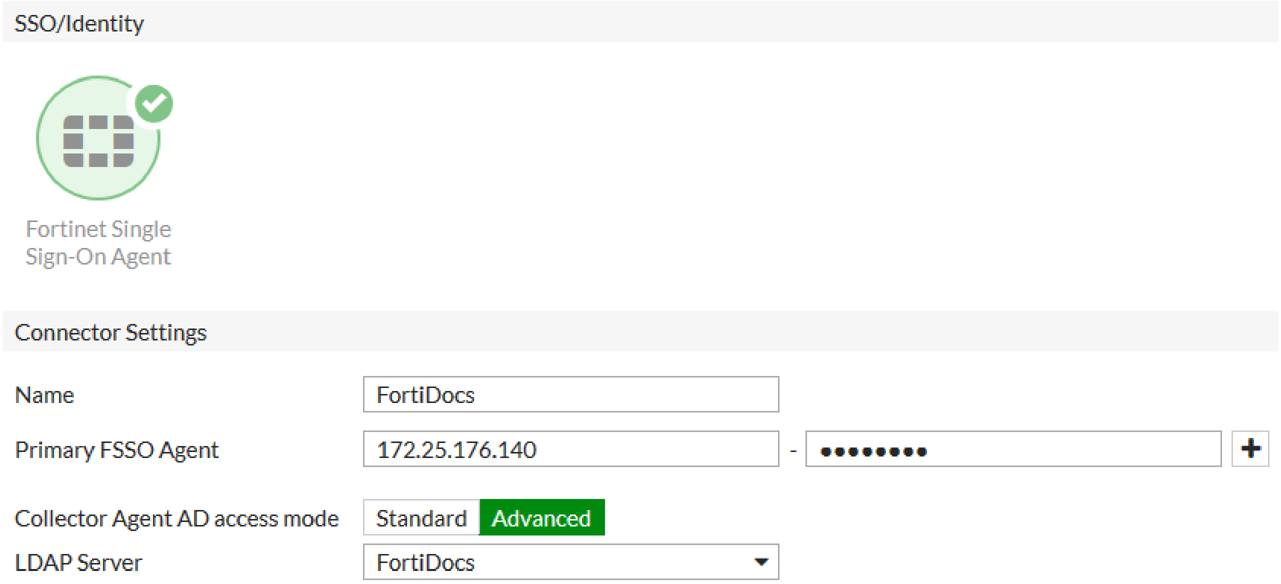
Because you have installed FSSSO in advanced mode, you need to configure LDAP to use with FSSO.

1. To configure the LDAP service, go to **User & Device > LDAP Servers** and select **Create New**.
2. Enter all information about your LDAP server. Select **Test Connectivity**. If your information is correct, **Connection status** is **Successful**.



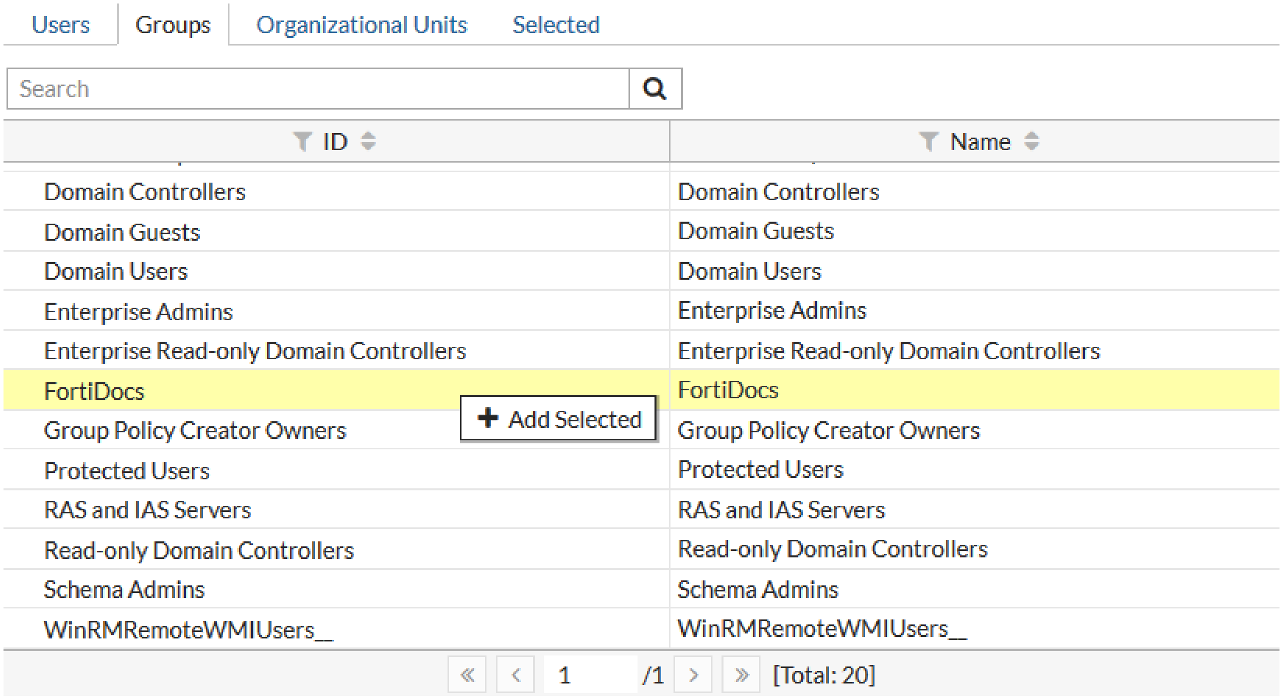
Name	FortiDocs
Server IP/Name	172.25.176.140
Server Port	389
Common Name Identifier	cn
Distinguished Name	DC=FortiDocs,DC=com
Bind Type	Simple Anonymous [✓ Regular]
Username	ator,CN=Users,DC=FortiDocs,DC=com
Password	••••••••••
Secure Connection	○

3. Create a Fabric Connector to the FSSO agent by going to **Security Fabric > Fabric Connectors** and select **+ Create New**.
4. Under **SSO/Identity**, select **Fortinet Single Sign-On Agent**.
5. Set the **Name** and enter the IP address and password for the **Primary FSSO Agent**.
6. Set **Collector Agent AD access mode** to **Advanced** and set **LDAP Server** to the new LDAP service.



Name	FortiDocs
Primary FSSO Agent	172.25.176.140 - ••••••••
Collector Agent AD access mode	Standard [✓ Advanced]
LDAP Server	FortiDocs

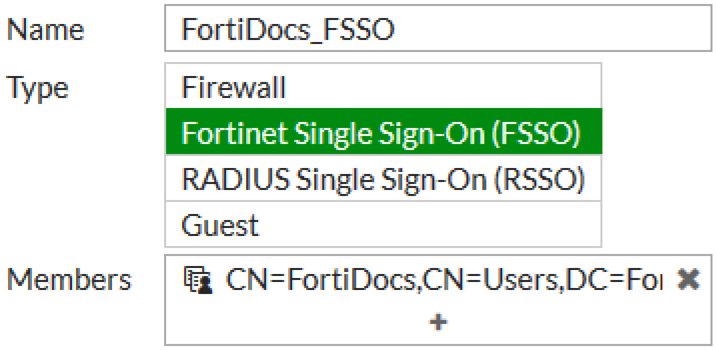
7. Your FortiGate displays information retrieved from the AD server. Select **Groups**, then right-click the FSSO group and select **+ Add Selected**.
8. Select **Selected**.
   The FSSO group is shown.



ID	Name
Domain Controllers	Domain Controllers
Domain Guests	Domain Guests
Domain Users	Domain Users
Enterprise Admins	Enterprise Admins
Enterprise Read-only Domain Controllers	Enterprise Read-only Domain Controllers
FortiDocs	FortiDocs
Group Policy Creator Owners	Group Policy Creator Owners
Protected Users	Protected Users
RAS and IAS Servers	RAS and IAS Servers
Read-only Domain Controllers	Read-only Domain Controllers
Schema Admins	Schema Admins
WinRMRemoteWMIUsers__	WinRMRemoteWMIUsers__

« ‹ 1 /1 › » [Total: 20]

9. To create a user group for FSSO users, go to **User & Device > User Groups** and select **Create New**.
10. Enter a group **Name** and set **Type** to **Fortinet Single Sign-On (FSSO)**. Add the FSSO users to **Members**.

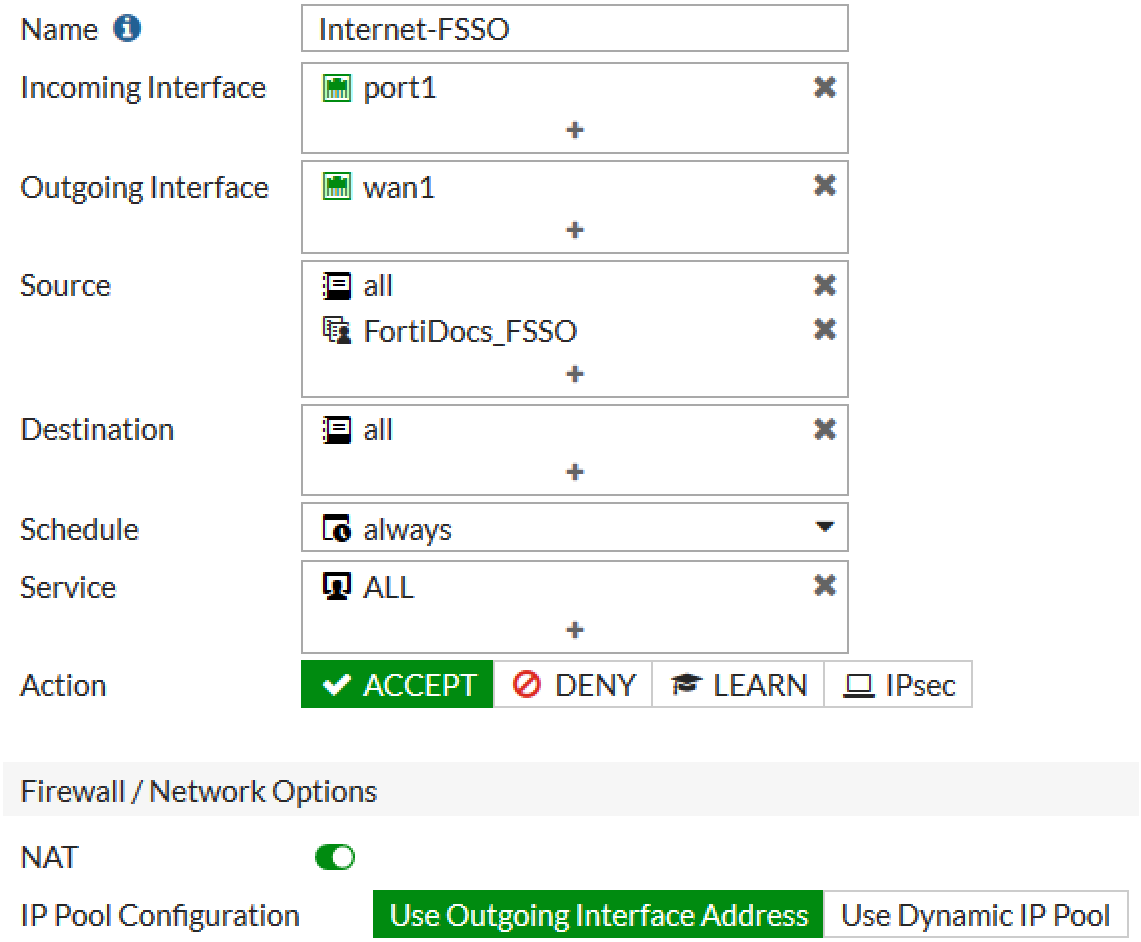


Name FortiDocs_FSSO

Type
- Firewall
- Fortinet Single Sign-On (FSSO)
- RADIUS Single Sign-On (RSSO)
- Guest

Members CN=FortiDocs,CN=Users,DC=Foı ✖

11. To create a policy for FSSO users, go to **Policy & Objects > IPv4 Policy** and select **Create New**.
12. For **Source**, set **User** to the FSSO user group.



Name	Internet-FSSO
Incoming Interface	port1
Outgoing Interface	wan1
Source	all FortiDocs_FSSO
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT

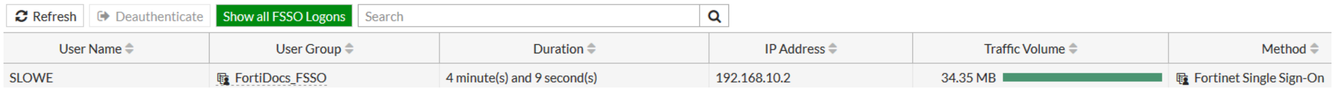
Firewall / Network Options

NAT	●
IP Pool Configuration	Use Outgoing Interface Address

Results

Log into a computer on the domain and access the Internet. The FortiGate uses FSSO for authentication and doesn’t require your credentials to be entered again.

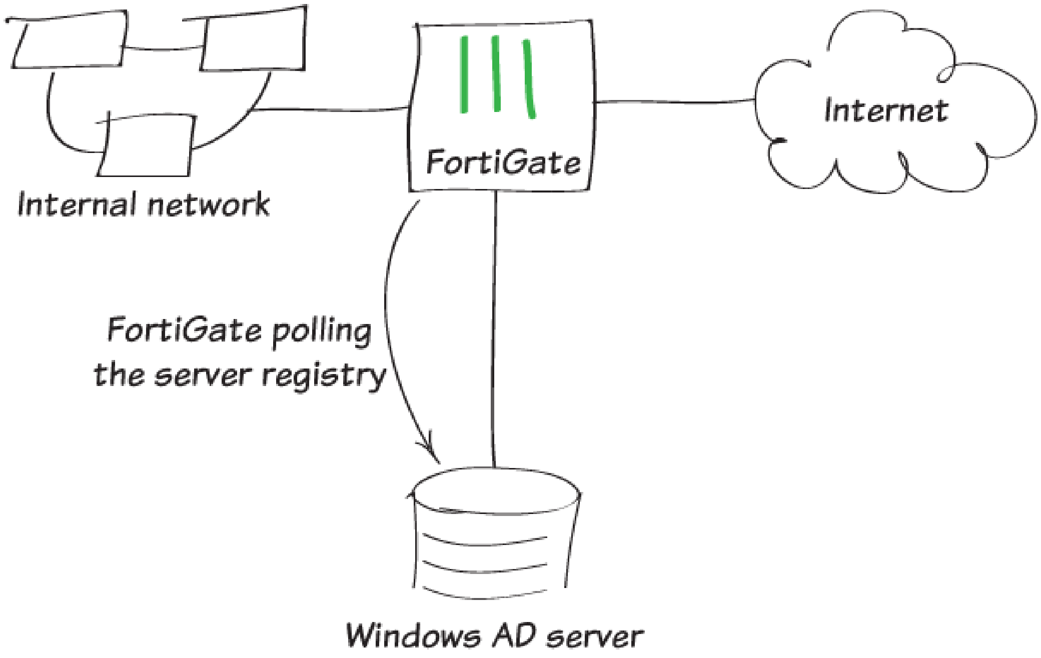
On the FortiGate, go to **Monitor > Firewall User Monitor** and select **Show all FSSO Logons**.



User Name	User Group	Duration	IP Address	Traffic Volume	Method
SLOWE	FortiDocs_FSSO	4 minute(s) and 9 second(s)	192.168.10.2	34.35 MB	Fortinet Single Sign-On

FSSO in polling mode for Windows AD

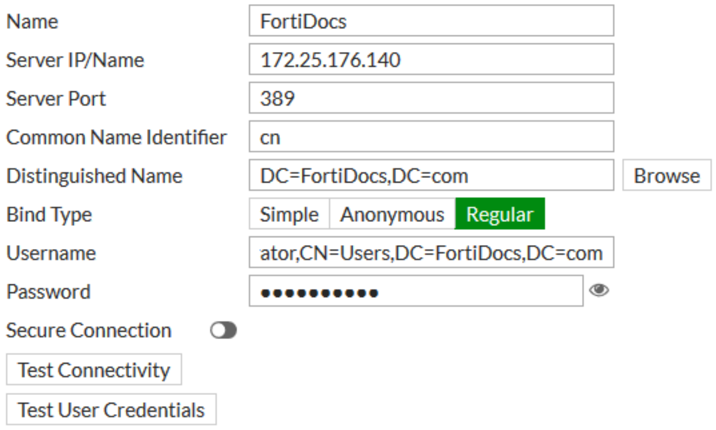
FORTIOS VERSION 6.0



In this recipe, you use Fortinet single sign-on (FSSO) in polling mode to allow users to log in to the network once with their Windows Active Directory (AD) credentials and seamlessly access all appropriate network resources.

Creating a Fabric Connector

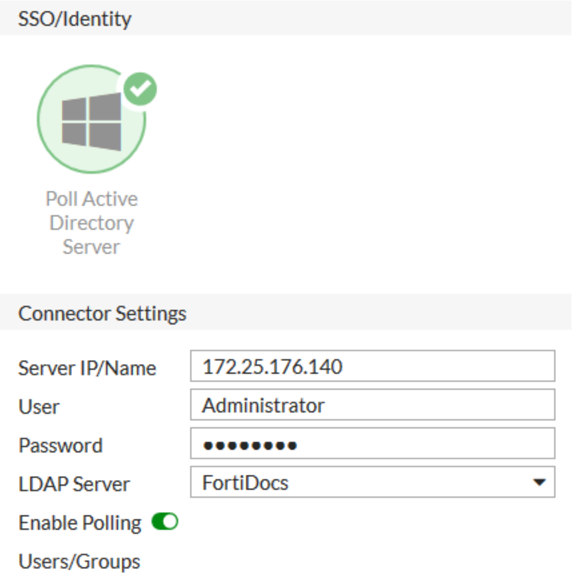
1. To configure the LDAP service, go to **User & Device > LDAP Servers** and select **Create New**.
2. Enter all information about your LDAP server. Select **Test Connectivity**. If your information is correct, **Connection status** is **Successful**.



Name	FortiDocs	
Server IP/Name	172.25.176.140	
Server Port	389	
Common Name Identifier	cn	
Distinguished Name	DC=FortiDocs,DC=com	Browse
Bind Type	Simple Anonymous [✓ Regular]	
Username	ator,CN=Users,DC=FortiDocs,DC=com	
Password	●●●●●●●●●●●	
Secure Connection	○	

3. To create a Fabric Connector, go to **Security Fabric > Fabric Connectors** and select **Create New**.

4. Under **SSO/Identity**, select **Poll Active Directory Server**.
5. Set the **Server IP/Name** and enter the credentials for the administrator account. Set **LDAP Server** to the new LDAP service.



SSO/Identity

Connector Settings

Server IP/Name: 172.25.176.140

User: Administrator

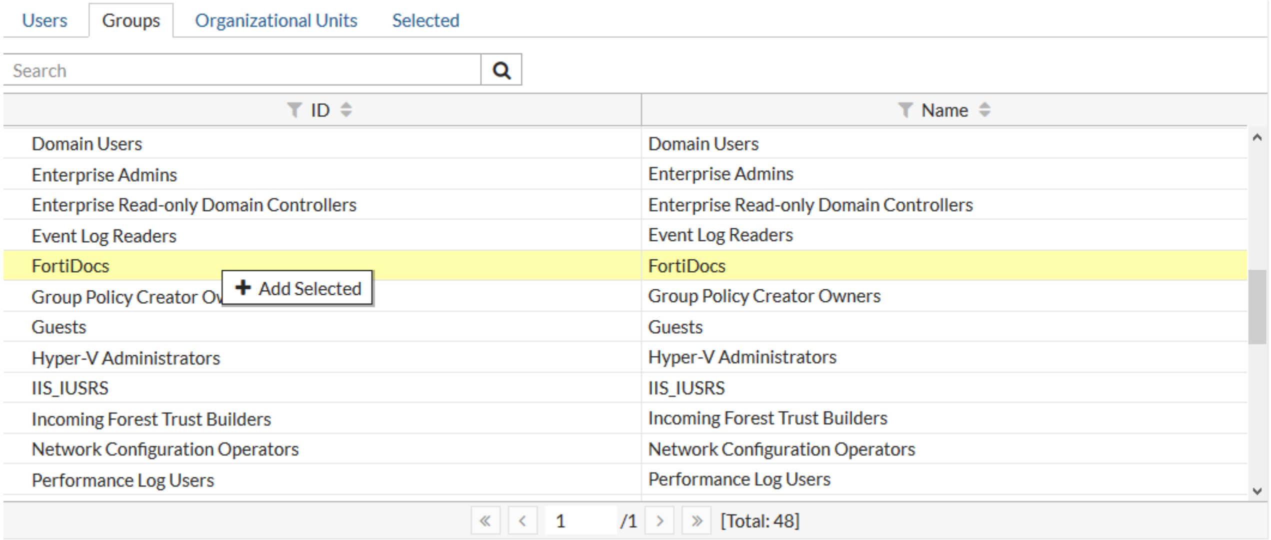
Password: ●●●●●●●●●

LDAP Server: FortiDocs

Enable Polling: on

Users/Groups

6. Your FortiGate displays information retrieved from the AD server. Select **Groups**, then right-click the FSSO group and select **+ Add Selected**.
7. Select **Selected**. The list includes the FSSO group.

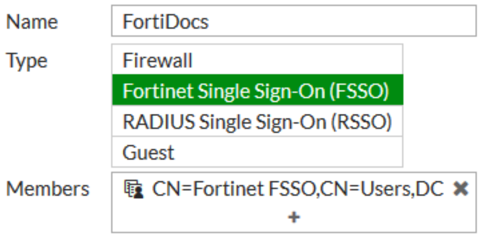


ID	Name
Domain Users	Domain Users
Enterprise Admins	Enterprise Admins
Enterprise Read-only Domain Controllers	Enterprise Read-only Domain Controllers
Event Log Readers	Event Log Readers
FortiDocs	FortiDocs
Group Policy Creator Ov	Group Policy Creator Owners
Guests	Guests
Hyper-V Administrators	Hyper-V Administrators
IIS_IUSRS	IIS_IUSRS
Incoming Forest Trust Builders	Incoming Forest Trust Builders
Network Configuration Operators	Network Configuration Operators
Performance Log Users	Performance Log Users

1 /1 [Total: 48]

Creating a user group

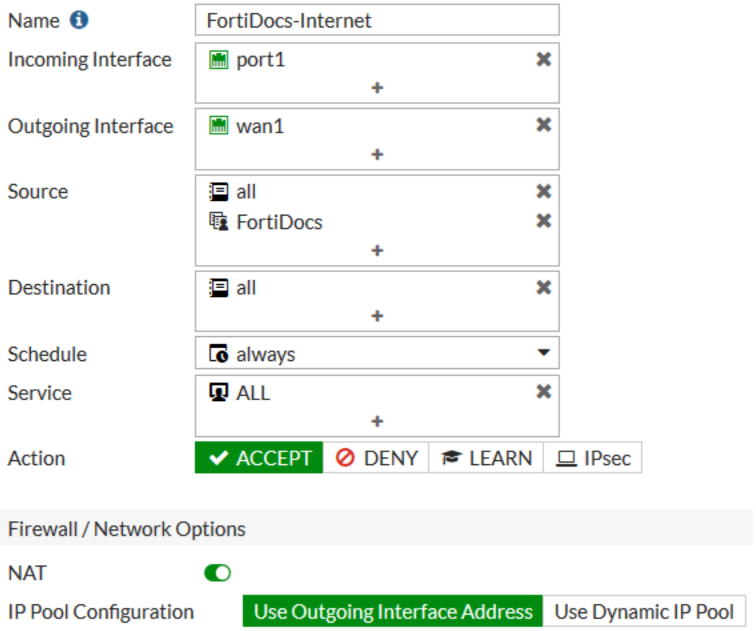
1. To create a user group for FSSO users, go to **User & Device > User Groups** and select **Create New**.
2. Enter a group **Name** and set **Type** to **Fortinet Single Sign-On (FSSO)**. Add the FSSO users to **Members**.



Name	FortiDocs
Type	Firewall Fortinet Single Sign-On (FSSO) RADIUS Single Sign-On (RSSO) Guest
Members	CN=Fortinet FSSO,CN=Users,DC

Creating a policy

1. To create a policy for FSSO users, go to **Policy & Objects > IPv4 Policy** and select **Create New**.
2. For **Source**, set **User** to the FSSO user group.



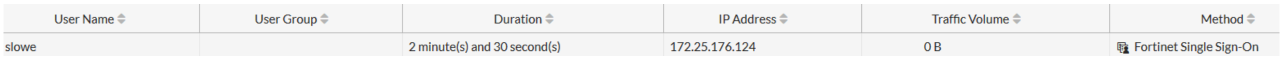
Name	FortiDocs-Internet
Incoming Interface	port1
Outgoing Interface	wan1
Source	all FortiDocs
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT · DENY · LEARN · IPsec

Firewall / Network Options

NAT	●
IP Pool Configuration	Use Outgoing Interface Address · Use Dynamic IP Pool

Results

1. Log in to a computer on the domain and access the Internet. The FortiGate uses FSSO for authentication and doesn’t require your credentials to be entered again.
2. On the FortiGate, go to **Monitor > Firewall User Monitor** and select **Show all FSSO Logons**.



User Name	User Group	Duration	IP Address	Traffic Volume	Method
slowe		2 minute(s) and 30 second(s)	172.25.176.124	0 B	Fortinet Single Sign-On

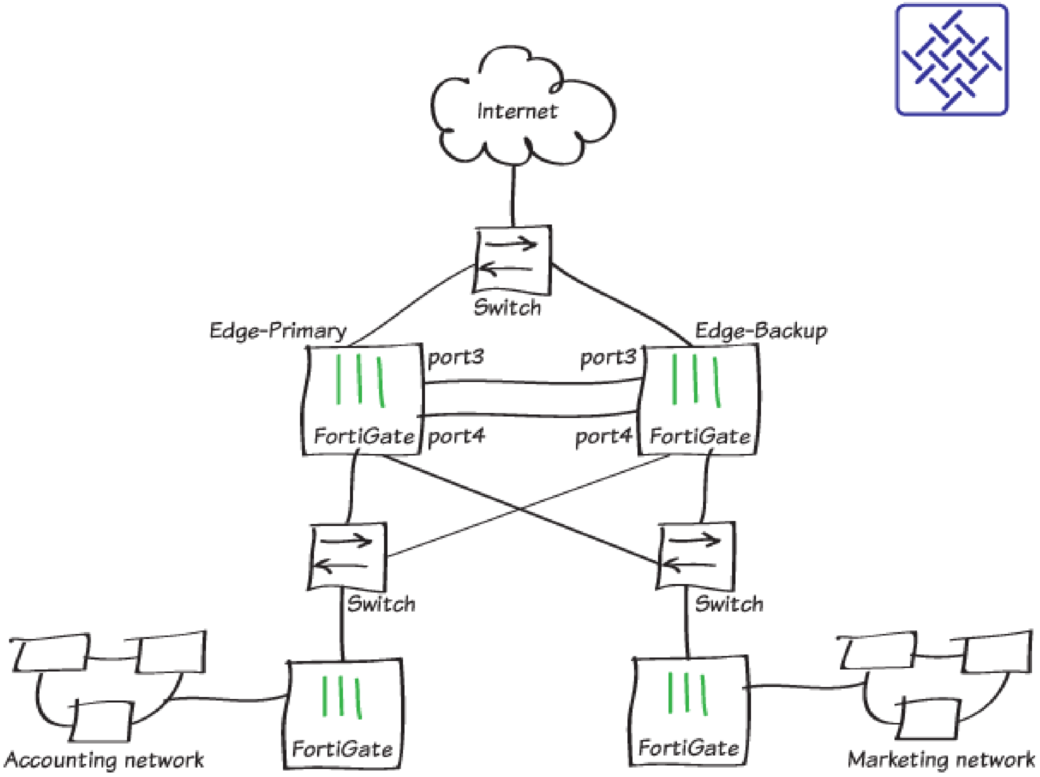
For further reading, check out Single sign-on to Windows AD in the FortiOS 6.0 Online Help.

High availability

This section includes recipes about how you can use high availability (HA) with your FortiGate.

High availability with two FortiGates

FORTIOS VERSION 6.0



This recipe describes how to add a backup FortiGate to a previously installed FortiGate, to form a high availability (HA) cluster to improve network reliability.

Before you begin, make sure that the FortiGates are running the same FortiOS firmware version and interfaces are not configured to get their addresses from DHCP or PPPoE. Also, you can't use a switch port as an HA heartbeat interface. If necessary, convert the switch port to individual interfaces.

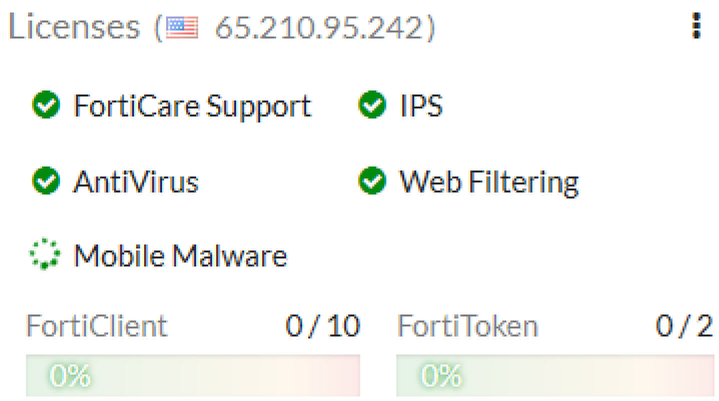
This recipe is in the Fortinet Security Fabric collection. It can also be used as a standalone recipe.

This recipe uses the FortiGate Clustering Protocol (FGCP) for HA. After you complete this recipe, the original FortiGate continues to operate as the primary FortiGate and the new FortiGate operates as the backup FortiGate.

For a more advanced HA recipe that includes CLI steps and involves using advanced options such as override to maintain the same primary FortiGate, see High Availability with FGCP (expert) on page 140.

Setting up registration and licensing

1. Make sure both FortiGates are running the same FortiOS firmware version. Register and apply licenses to the new FortiGate unit before you add it to the HA cluster.



Licenses (65.210.95.242)

✓ FortiCare Support ✓ IPS

✓ AntiVirus ✓ Web Filtering

Mobile Malware

FortiClient 0 / 10 0%

FortiToken 0 / 2 0%

This includes licensing for **FortiCare Support**, **IPS**, **AntiVirus**, **Web Filtering**, **Mobile Malware**, **FortiClient**, **FortiCloud**, and additional **virtual domains** (VDOMs).

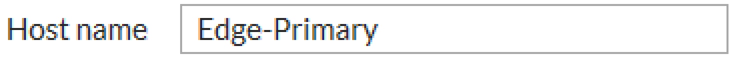
All FortiGates in the cluster must have the same level of licensing for FortiGuard, FortiCloud, FortiClient, and VDOMs. You can add **FortiToken** licenses at any time because they're synchronized to all cluster members.

If the FortiGates in the cluster will run FortiOS Carrier, apply the FortiOS Carrier license before you configure the cluster (and before you apply other licenses). When you apply the FortiOS Carrier license, the FortiGate resets its configuration to factory defaults, requiring you to repeat steps performed before applying the license.

2. You can also install any third-party certificates on the primary FortiGate before you form the cluster. Once the cluster is running, the FGCP synchronizes third-party certificates to the backup FortiGate.

Configuring the primary FortiGate for HA

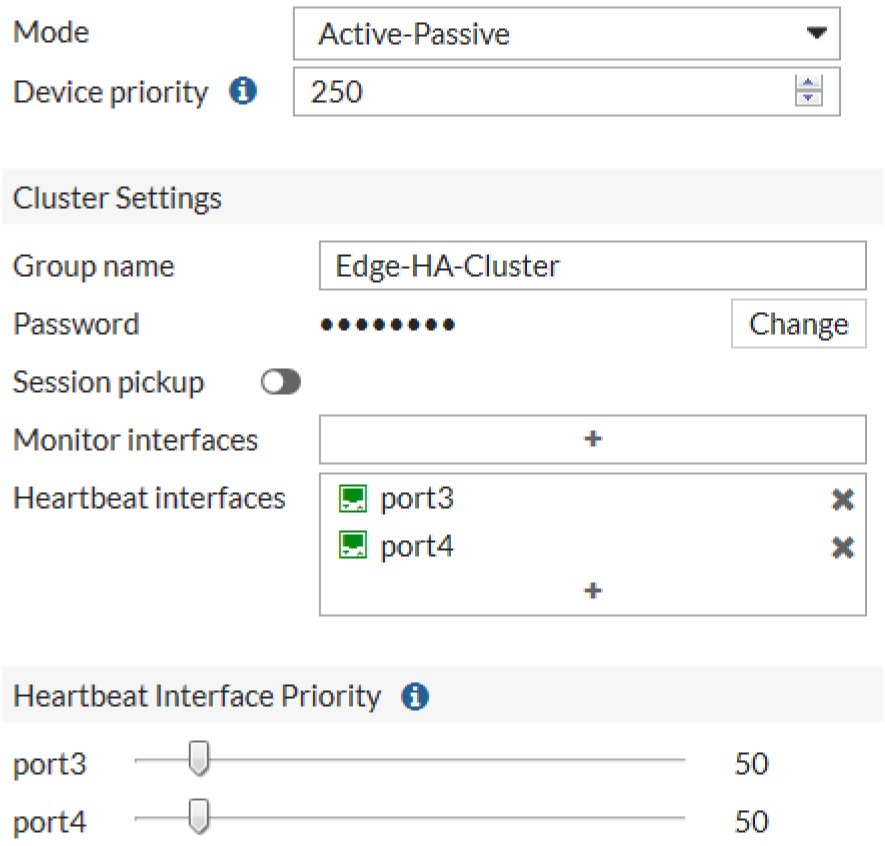
1. On the primary FortiGate, go to **System > Settings** and change the **Host name** to identify this as the primary FortiGate in the HA cluster.



Host name: Edge-Primary

2. Go to **System > HA** and set the **Mode** to **Active-Passive**. Set the **Device priority** to a higher value than the default (in the example, 250) to make sure this FortiGate will always be the primary FortiGate. Also, set a **Group name** and **Password**.

Make sure you select **Heartbeat interfaces** (in the example, port3 and port4). Set the **Heartbeat Interface Priority** for each interface to 50.



Mode: Active-Passive

Device priority: 250

Cluster Settings

Group name: Edge-HA-Cluster

Password: •••••••• Change

Session pickup: ○

Monitor interfaces: +

Heartbeat interfaces: port3, port4 +

Heartbeat Interface Priority

port3: 50

port4: 50

Since the backup FortiGate isn't available, when you save the HA configuration, the primary FortiGate forms a cluster of one FortiGate but keeps operating normally.

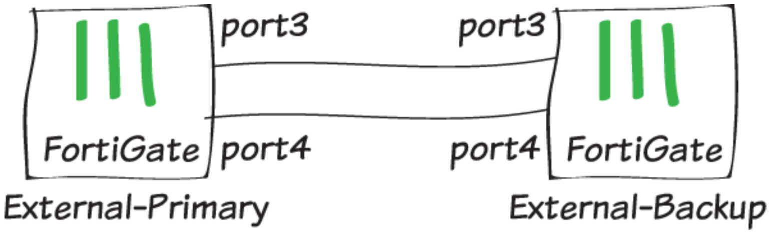
If these steps don't start HA mode, make sure that none of the FortiGate interfaces use DHCP or PPPoE addressing.

If there are other FortiOS HA clusters on your network, you may need to change the cluster group ID, using this CLI command:

```
config system ha
   set group-id 25
end
```

Connecting the backup FortiGate

Connect the backup FortiGate to the primary FortiGate and to the network, as shown in the network diagram at the start of this use case.



Since these connections disrupt traffic, you should make the connections when the network isn’t processing a lot of traffic. If possible, make direct Ethernet connections between the heartbeat interfaces of the two FortiGate units.

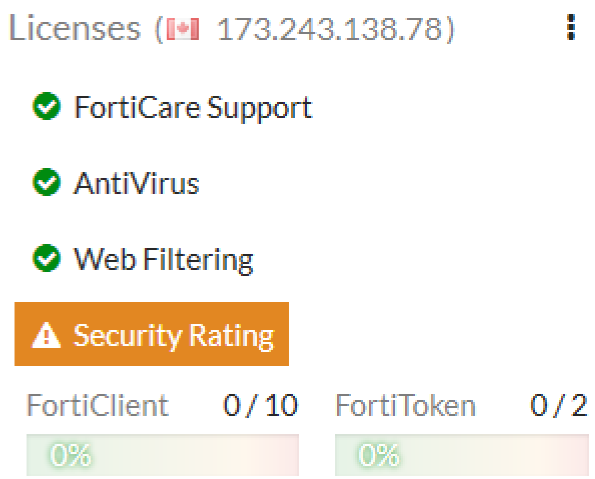
This example uses two FortiGate-600Ds and the default heartbeat interfaces (port3 and port4). You can use any interfaces for HA heartbeat interfaces. A best practice is to use interfaces that don't process traffic, but this is not a requirement. If you are setting up HA between two FortiGates in a VM environment (for example, VMware or Hyper-V) you must enable promiscuous mode and allow mac address changes for heartbeat communication to work. Since the HA heartbeat interfaces must be on the same broadcast domain, for HA between remote data centers (called distributed clustering) you must support layer 2 extensions between the remote data centers, using technology such as MPLS or virtual extensible LAN (VXLAN).

You must use switches between the cluster and the Internet, and between the cluster and the internal networks, as shown in the network diagram. You can use any good quality switches to make these connections. You can also use one switch for all of these connections, as long as you configure the switch to separate traffic from the different networks.

Configuring the backup FortiGate

1. If required, change the firmware running on the new FortiGate to be the same version as is running on the primary FortiGate.
2. Enter the following command to reset the new backup FortiGate to factory default settings.
   ```
   execute factoryreset
   ```
   You can skip this step if the new FortiGate is fresh from the factory. But if its configuration has been changed at all, it's a best practice to reset your FortiGate to factory defaults to reduce the chance of synchronization problems.
3. Register and apply licenses to the backup FortiGate before configuring it for HA operation. This includes licensing for **FortiCare Support**, **IPS**, **AntiVirus**, **Web Filtering**, **Mobile Malware**, **FortiClient**, **FortiCloud**, **Security Rating**, **Outbreak Prevention**, and additional **virtual domains** (VDOMs). All FortiGates in the cluster must have the same level of licensing for FortiGuard, FortiCloud, FortiClient, and VDOMs. You can add **FortiToken** licenses at any time because they're synchronized to all cluster members.

   If the FortiGates in the cluster will run FortiOS Carrier, apply the FortiOS Carrier license before you configure the cluster (and before applying other licenses). When you applying the FortiOS Carrier license the FortiGate resets its configuration to factory defaults, requiring you to repeat steps performed before applying the license.



Licenses (173.243.138.78)

✓ FortiCare Support

✓ AntiVirus

✓ Web Filtering

⚠ Security Rating

FortiClient 0 / 10 0%

FortiToken 0 / 2 0%

4. Click on the **System Information** dashboard widget and select **Configure settings in System > Settings**. Change the FortiGate's **Host name** to identify it as the backup FortiGate.

Host name: Backup

You can also enter this CLI command:

```
config system global
   set hostname Backup
end
```

Duplicate the primary FortiGate HA settings, except set the Device Priority to a lower value (for example, 50) and do not enable override.

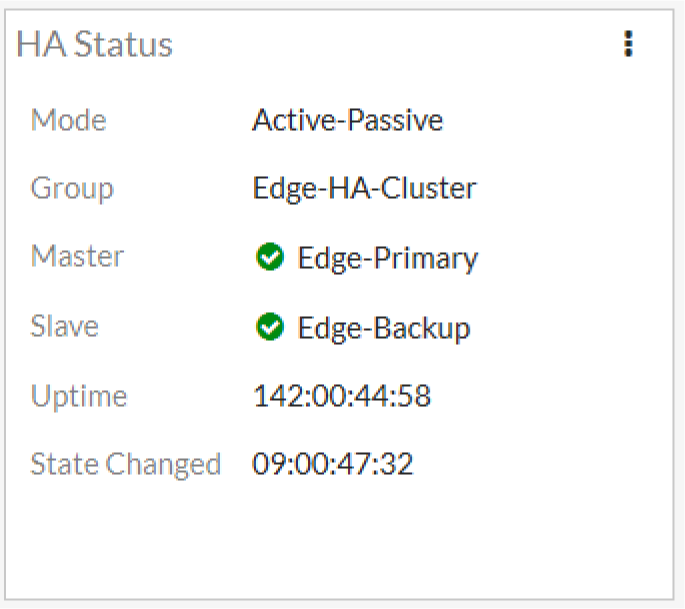
```
config system ha
   set mode a-p
   set group-id 100
   set group-name My-cluster
   set password <password>
   set priority 50
   set hbdev lan4 200 lan5 100
end
```

Similar to when configuring the primary FortiGate, once you enter the CLI command the backup FortiGate negotiates to establish an HA cluster. You may temporarily lose connectivity with the FortiGate as FGCP negotiation takes place and the MAC addresses of the FortiGate interfaces are changed to HA virtual MAC addresses.

If these steps don't start HA mode, make sure that none of the FortiGate's interfaces use DHCP or PPPoE addressing.

Viewing the status of the HA cluster

Connect to the GUI of the primary FortiGate. The **HA Status** widget shows the cluster mode (**Mode**) and group name (**Group**).

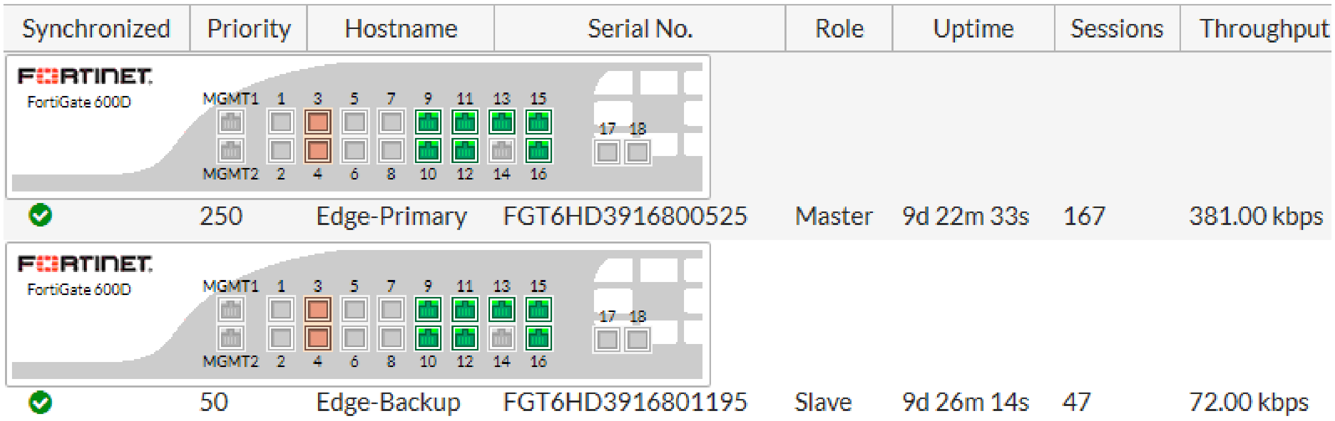


HA Status

Mode	Active-Passive
Group	Edge-HA-Cluster
Master	✓ Edge-Primary
Slave	✓ Edge-Backup
Uptime	142:00:44:58
State Changed	09:00:47:32

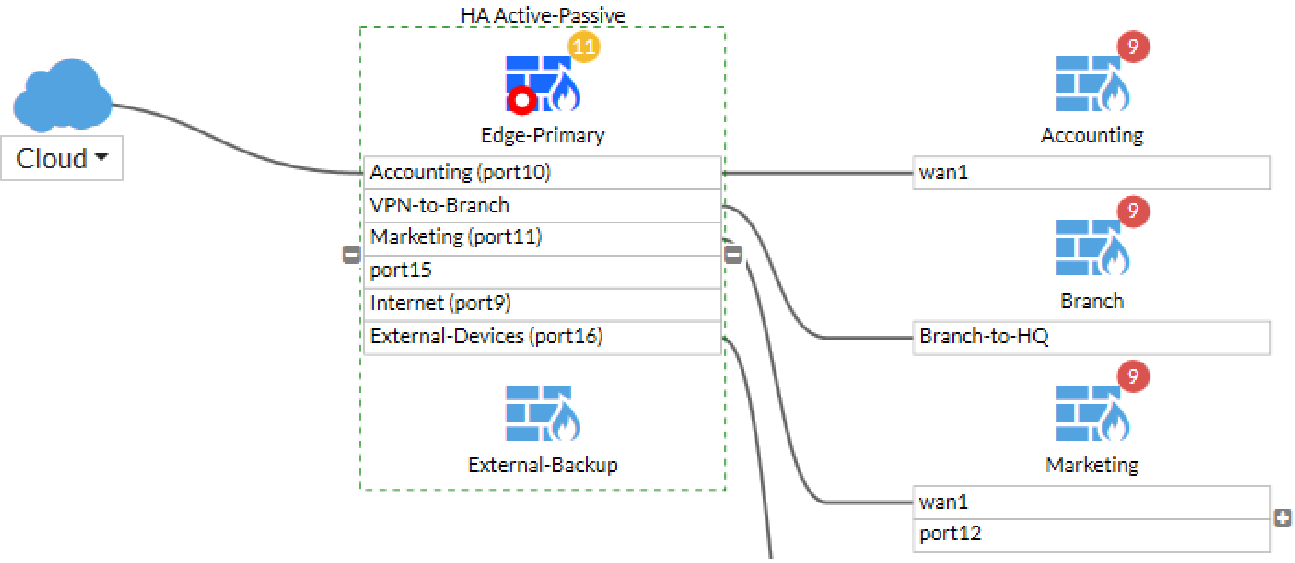
It also shows the host name of the primary FortiGate, which you can hover over to verify that the cluster is synchronized and operating normally. You can click on the widget to change the HA configuration or view a list of recently recorded cluster events, such as members joining or leaving the cluster.

To view the cluster status, click on the **HA Status** widget and select **Configure settings in System > HA** (or go to **System > HA**).



Synchronized	Priority	Hostname	Serial No.	Role	Uptime	Sessions	Throughput
✓	250	Edge-Primary	FGT6HD3916800525	Master	9d 22m 33s	167	381.00 kbps
✓	50	Edge-Backup	FGT6HD3916801195	Slave	9d 26m 14s	47	72.00 kbps

If the cluster is part of a Security Fabric, the FortiView Physical and Logical Topology views show information about the cluster status.



Results

All traffic should now be flowing through the primary FortiGate. If the primary FortiGate becomes unavailable, traffic fails over to the backup FortiGate. When the primary FortiGate rejoins the cluster, the backup FortiGate should continue operating as the primary FortiGate.

To test this, ping a reliable IP address from a PC on the internal network. After a moment, power off the primary FortiGate.

If you are using port monitoring, you can also unplug the primary FortiGate's Internet-facing interface to test failover

You will see a momentary pause in the ping results, until traffic diverts to the backup FortiGate, allowing the ping traffic to continue.

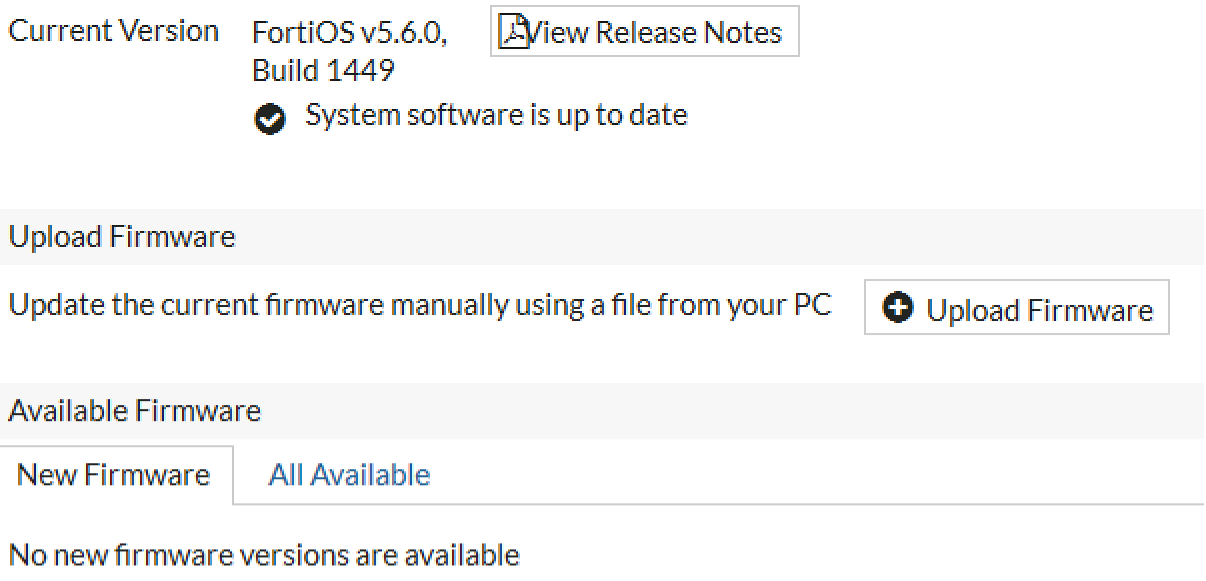
```
64 bytes from 184.25.76.114: icmp_seq=69 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=70 ttl=52 time=8.822 ms\
64 bytes from 184.25.76.114: icmp_seq=71 ttl=52 time=9.034 ms\
64 bytes from 184.25.76.114: icmp_seq=72 ttl=52 time=9.536 ms\
64 bytes from 184.25.76.114: icmp_seq=73 ttl=52 time=8.877 ms\
64 bytes from 184.25.76.114: icmp_seq=74 ttl=52 time=8.901 ms\
Request timeout for icmp_seq 75\
64 bytes from 184.25.76.114: icmp_seq=76 ttl=52 time=8.860 ms\
64 bytes from 184.25.76.114: icmp_seq=77 ttl=52 time=9.174 ms\
64 bytes from 184.25.76.114: icmp_seq=78 ttl=52 time=10.108 ms\
64 bytes from 184.25.76.114: icmp_seq=79 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=80 ttl=52 time=10.861 ms\
64 bytes from 184.25.76.114: icmp_seq=81 ttl=52 time=10.757 ms\
64 bytes from 184.25.76.114: icmp_seq=82 ttl=52 time=8.158 ms\
64 bytes from 184.25.76.114: icmp_seq=83 ttl=52 time=8.639 ms}
```

You can log into the cluster GUI or CLI using the same IP address as you had been using to the log into the primary FortiGate. If the primary FortiGate is powered off you will be logging into the backup FortiGate. Check the host name to verify the FortiGate that you have logged into. The FortiGate continues to operate in HA mode and if you restart the primary FortiGate, after a few minutes it should rejoin the cluster and operate as the backup FortiGate. Traffic should not be disrupted when the restarted primary unit rejoins the cluster.

(Optional) Upgrading the firmware for the HA cluster

Upgrading the firmware on the primary FortiGate automatically upgrades the firmware on the backup FortiGate. Both FortiGates are updated with minimal traffic disruption. Always review the Release Notes before you install new firmware.

1. Click the **System Information** widget and select **Update firmware in System > Firmware**. Back up the configuration and update the firmware from FortiGuard or upload a firmware image file. The firmware installs onto both the primary and backup FortiGates.



Current Version FortiOS v5.6.0, Build 1449

✓ System software is up to date

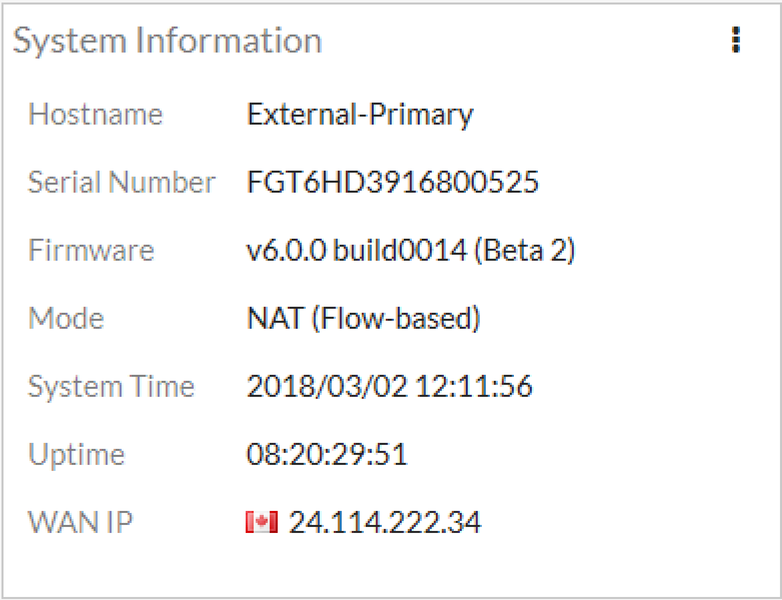
Upload Firmware

Update the current firmware manually using a file from your PC

Available Firmware

No new firmware versions are available

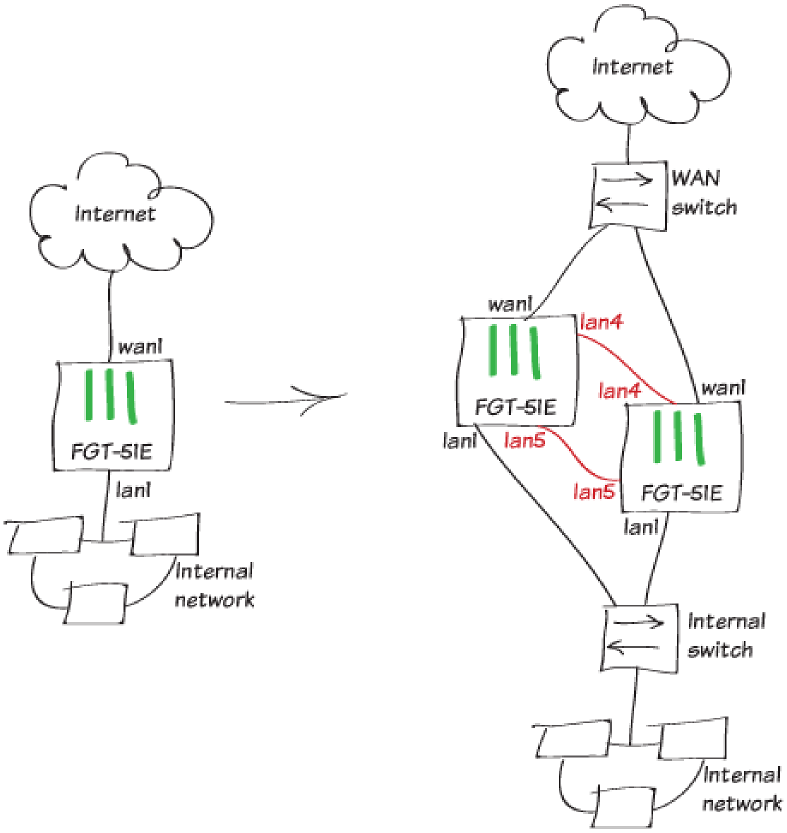
After the upgrade completes, verify that the **System Information** widget shows the new firmware version.



System Information

Hostname	External-Primary
Serial Number	FGT6HD3916800525
Firmware	v6.0.0 build0014 (Beta 2)
Mode	NAT (Flow-based)
System Time	2018/03/02 12:11:56
Uptime	08:20:29:51
WAN IP	24.114.222.34

High Availability with FGCP (expert)



This recipe describes how to enhance the reliability of a network protected by a FortiGate by adding a second FortiGate and setting up a FortiGate Clustering Protocol (FGCP) High Availability cluster.

You will configure the FortiGate already on the network to become the primary FortiGate by:

1. Licensing it (if required)
2. Enabling HA
3. Increasing its device priority
4. Enabling override

You will prepare the new FortiGate by:

1. Setting it to factory defaults to wipe any configuration changes
2. Licensing it (if required)
3. Enabling HA without changing the device priority and without enabling override
4. Connecting it to the FortiGate already on the network

The new FortiGate becomes the backup FortiGate and its configuration is overwritten by the primary FortiGate.

This recipe describes best practices for configuring HA and involves extra steps that are not required for a basic HA setup. If you are looking for a basic HA recipe see High availability with two FortiGates on page 132.

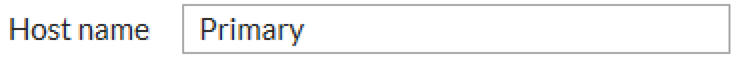
Before you start, the FortiGates should be running the same FortiOS firmware version and their interfaces should not be configured to get addresses from DHCP or PPPoE.

This recipe features two FortiGate-51Es. FortiGate-51Es have a 5-port switch lan interface. Before configuring HA, the lan interface was converted to 5 separate interfaces (lan1 to lan5). The lan1 interface connects to the internal network and the wan1 interface connects to the Internet. The lan4 and lan5 interfaces will become the HA heartbeat interfaces.

The FGCP does not support using a switch interface for the HA heartbeat. As an alternative to using the lan4 and lan5 interfaces as described in this recipe, you can use the wan1 and wan2 interfaces for the HA heartbeat.

Configuring the primary FortiGate

1. Connect to the primary FortiGate, click on the **System Information** dashboard widget and select **Configure settings in System > Settings**.
2. Change the **Host name** to identify this FortiGate as the primary FortiGate.



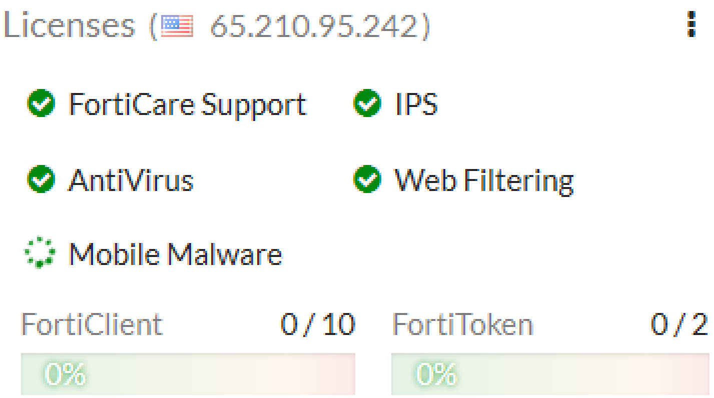
Host name Primary

You can also enter this CLI command:

```
config system global
   set hostname Primary
end
```

3. Register and apply licenses to the primary FortiGate before configuring it for HA operation. This includes licensing for **FortiCare Support**, **IPS**, **AntiVirus**, **Web Filtering**, **Mobile Malware**, **FortiClient**, **FortiCloud**, **Security Rating**, **Outbreak Prevention**, and additional **virtual domains** (VDOMs). All FortiGates in the cluster must have the same level of licensing for FortiGuard, FortiCloud, FortiClient, and VDOMs. You can add **FortiToken** licenses at any time because they're synchronized to all cluster members.

If the FortiGates in the cluster will run FortiOS Carrier, apply the FortiOS Carrier license before you configure the cluster (and before applying other licenses). When you applying the FortiOS Carrier license the FortiGate resets its configuration to factory defaults, requiring you to repeat steps performed before applying the license.



Licenses (65.210.95.242)

✓ FortiCare Support ✓ IPS

✓ AntiVirus ✓ Web Filtering

Mobile Malware

FortiClient 0 / 10 0%

FortiToken 0 / 2 0%

You can also install any third-party certificates on the primary FortiGate before forming the cluster. Once the cluster is formed, third-party certificates are synchronized to the backup FortiGate(s).

4. Enter this CLI command to set the HA mode to active-passive, set a group id, group name and password, increase the device priority to a higher value (for example, 250) and enable override.

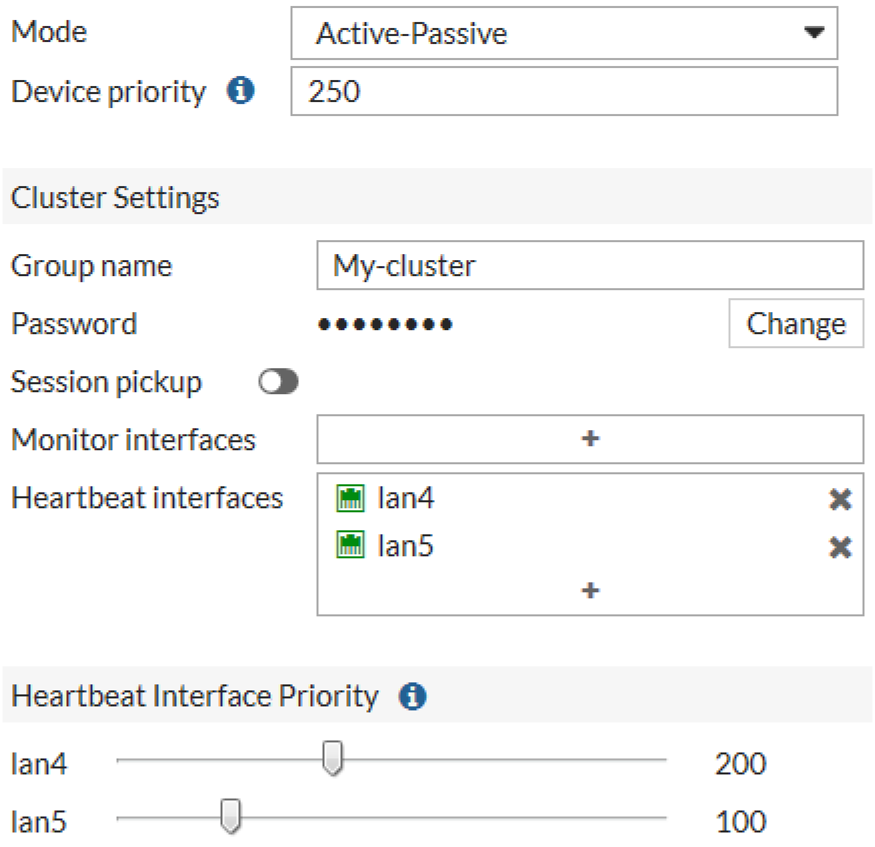
```
config system ha
   set mode a-p
   set group-id 100
   set group-name My-cluster
   set password <password>
   set priority 250
   set override enable
   set hbdev lan4 200 lan5 100
end
```

Enabling override and increasing the device priority means this FortiGate always becomes the primary unit.

This configuration also selects lan4 and lan5 to be the heartbeat interfaces and sets their priorities to 200 and 100 respectively. Its a best practice to set different priorities for the heartbeat interfaces (but not a requirement).

If you have more than one cluster on the same network, each cluster should have a different group id. Changing the group id changes the cluster interface virtual MAC addresses. If your group id causes a MAC address conflict on your network, you can select a different group id.

You can also configure most of these settings from the GUI (go to **System > HA**).



Mode: Active-Passive

Device priority: 250

Cluster Settings

Group name: My-cluster

Password: ●●●●●●●●●

Session pickup: ○

Monitor interfaces:

Heartbeat interfaces: lan4, lan5

Heartbeat Interface Priority

lan4: 200

lan5: 100

Override and the group id can only be configured from the CLI.

```
config system ha
   set group-id 100
   set override enable
end
```

After you enter the CLI command or make the GUI changes, the FortiGate negotiates to establish an HA cluster. You may temporarily lose connectivity with the FortiGate as FGCP negotiation takes place and the MAC addresses of the FortiGate interfaces are changed to HA virtual MAC addresses.

If these steps don't start HA mode, make sure that none of the FortiGate's interfaces use DHCP or PPPoE addressing.

To reconnect sooner, you can update the ARP table of your management PC by deleting the ARP table entry for the FortiGate unit (or just deleting all ARP table entries). You can usually delete the ARP table from a command prompt using a command similar to `arp -d`.

The FGCP uses virtual MAC addresses for failover. The virtual MAC address assigned to each FortiGate interface depends on the HA group ID. A group ID of 100 sets FortiGate interfaces to the following MAC addresses: 00:09:0f:09:64:00, 00:09:0f:09:64:01, 00:09:0f:09:64:02 and so on.

You can verify that the FGCP has set the virtual MAC addresses by viewing the configuration of each FortiGate interface from the GUI (go to **Network > Interfaces**) or by entering the following CLI command (shown below for lan2 on a FortiGate-51E):

```
get hardware nic lan2
...
Current_HWaddr 00:09:0f:09:64:01
Permanent_HWaddr 70:4c:a5:98:11:54
...
```

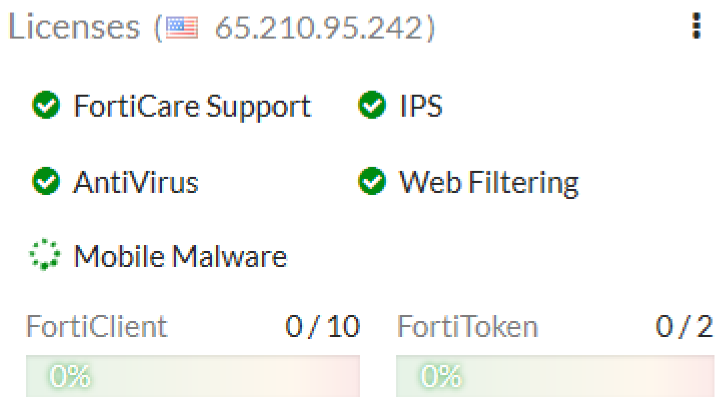
You can also use the `diagnose hardware deviceinfo nic lan2` command to display this information.

The output shows the current hardware (MAC) address (the virtual MAC set by the FGCP) and the permanent hardware (MAC) address for the interface.

Configuring the backup FortiGate

1. If required, change the firmware running on the new FortiGate to be the same version as is running on the primary FortiGate.
2. Enter the following command to reset the new backup FortiGate to factory default settings.
   ```
   execute factoryreset
   ```
   You can skip this step if the new FortiGate is fresh from the factory. But if its configuration has been changed at all, it's a best practice to reset your FortiGate to factory defaults to reduce the chance of synchronization problems.
3. Register and apply licenses to the backup FortiGate before configuring it for HA operation. This includes licensing for **FortiCare Support**, **IPS**, **AntiVirus**, **Web Filtering**, **Mobile Malware**, **FortiClient**, **FortiCloud**, **Security Rating**, **Outbreak Prevention**, and additional **virtual domains** (VDOMs). All FortiGates in the cluster must have the same level of licensing for FortiGuard, FortiCloud, FortiClient, and VDOMs. You can add **FortiToken** licenses at any time because they're synchronized to all cluster members.

   If the FortiGates in the cluster will run FortiOS Carrier, apply the FortiOS Carrier license before you configure the cluster (and before applying other licenses). When you applying the FortiOS Carrier license the FortiGate resets its configuration to factory defaults, requiring you to repeat steps performed before applying the license.

   Licenses (65.210.95.242)

   ✓ FortiCare Support ✓ IPS

   ✓ AntiVirus ✓ Web Filtering

   Mobile Malware

   FortiClient 0 / 10 0%

   FortiToken 0 / 2 0%

4. Click on the **System Information** dashboard widget and select **Configure settings in System > Settings**. Change the FortiGate's **Host name** to identify it as the backup FortiGate.

   Host name: Backup

   You can also enter this CLI command:
   ```
   config system global
      set hostname Backup
   ```

```
end
```

9. Duplicate the primary FortiGate HA settings, except set the Device Priority to a lower value (for example, 50) and do not enable override.

```
config system ha
   set mode a-p
   set group-id 100
   set group-name My-cluster
   set password <password>
   set priority 50
   set hbdev lan4 200 lan5 100
end
```

Similar to when configuring the primary FortiGate, once you enter the CLI command the backup FortiGate negotiates to establish an HA cluster. You may temporarily lose connectivity with the FortiGate as FGCP negotiation takes place and the MAC addresses of the FortiGate interfaces are changed to HA virtual MAC addresses.

If these steps don't start HA mode, make sure that none of the FortiGate's interfaces use DHCP or PPPoE addressing.

If the group ID is the same, the backup FortiGate interfaces get the same virtual MAC addresses as the primary FortiGate. You can check **Network > Interfaces** on the GUI or use the `get hardware nic` command to verify.

Connecting the primary and backup FortiGates

Connect the primary and backup FortiGates together and to your network as shown in the network diagram at the start of the use case. Making these connections disrupts network traffic as you disconnect and re-connect cables.

Switches must be used between the cluster and the Internet and between the cluster and the internal network as shown in the network diagram. You can use any good quality switches to make these connections. You can also use one switch for all of these connections as long as you configure the switch to separate traffic from the different networks.

The example shows the recommended configuration of direct connections between the lan4 heartbeat interfaces and between the lan5 heartbeat interfaces.

When the heartbeat interfaces are connected, the FortiGates find each other and negotiate to form a cluster. The primary FortiGate synchronizes its configuration to the backup FortiGate. The cluster forms automatically with minimal or no additional disruption to network traffic.

The cluster will have the same IP addresses as the primary FortiGate had. You can log into the cluster by logging into the primary FortiGate CLI or GUI using one of the original IP addresses of the primary FortiGate.

Checking cluster operation

Check the cluster synchronization status to make sure the primary and backup FortiGates both have the same configuration.

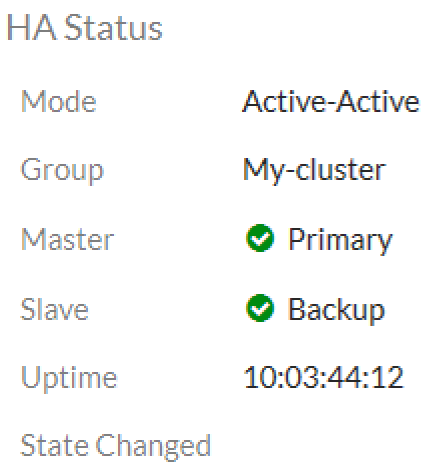
1. Log into the primary FortiGate CLI and enter this command:

```
diagnose sys ha checksum cluster
```

The command output lists all cluster members' configuration checksums. If both cluster members have identical checksums you can be sure that their configurations are synchronized. If the checksums are different, wait a short while and enter the command again. Repeat until the checksums are identical. It may take a while for some parts of the configuration to be synchronized.

If the checksums never become identical visit the Fortinet Support website for assistance.

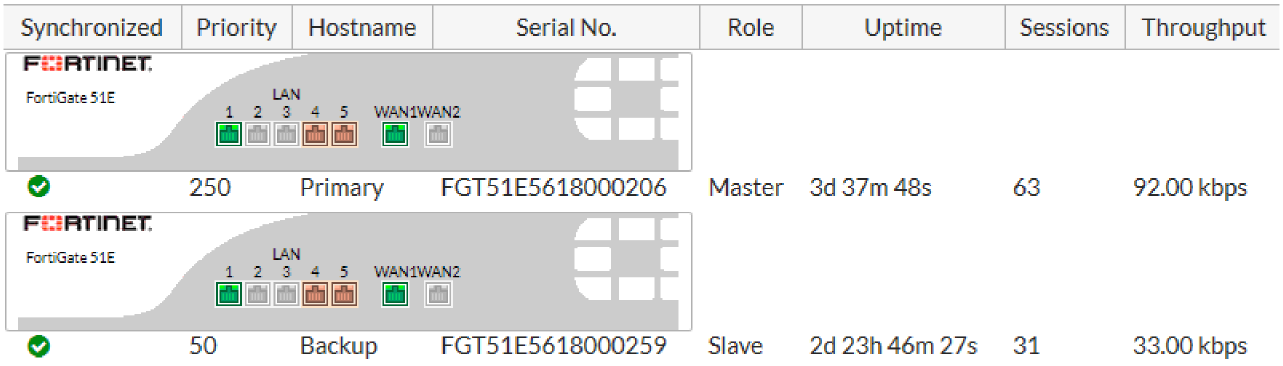
2. The **HA Status** dashboard widget also shows synchronization status. Mouse over the host names of each FortiGate in the widget to verify that they are synchronized and both have the same checksum.



HA Status

Mode	Active-Active
Group	My-cluster
Master	✓ Primary
Slave	✓ Backup
Uptime	10:03:44:12
State Changed	

3. To view more information about the cluster status, click on the **HA Status** widget and select **Configure Settings in System > HA** (or go to **System > HA**).



Synchronized	Priority	Hostname	Serial No.	Role	Uptime	Sessions	Throughput
✓	250	Primary	FGT51E5618000206	Master	3d 37m 48s	63	92.00 kbps
✓	50	Backup	FGT51E5618000259	Slave	2d 23h 46m 27s	31	33.00 kbps

Disabling override (recommended)

When the checksums are identical, disable override on the primary FortiGate by entering the following command:

```
config system ha
   set override disable
end
```

FGCP clusters dynamically respond to network conditions. If you keep override enabled, the same FortiGate always becomes the primary FortiGate. With override enabled; however, the cluster may negotiate more often to keep the same FortiGate as the primary FortiGate, potentially increasing traffic disruptions.

If you disable override it is more likely that the backup FortiGate could become the primary FortiGate. Disabling override is recommended unless its important that the same FortiGate remains the primary FortiGate

To see how enabling override can cause minor traffic disruptions, with override enabled set up a continuous ping through the cluster. Then disconnect power to the backup unit. You will most likely notice a brief disruption in the ping traffic. Try the same thing with override disabled and you shouldn't see this traffic disruption.

With override enabled, the disruption is minor and shouldn't be noticed by most users. For smoother operation, the best practice is to disable override.

Results

All traffic should now be flowing through the primary FortiGate. If the primary FortiGate becomes unavailable, traffic fails over to the backup FortiGate. When the primary FortiGate rejoins the cluster, the backup FortiGate should continue operating as the primary FortiGate.

To test this, ping a reliable IP address from a PC on the internal network. After a moment, power off the primary FortiGate.

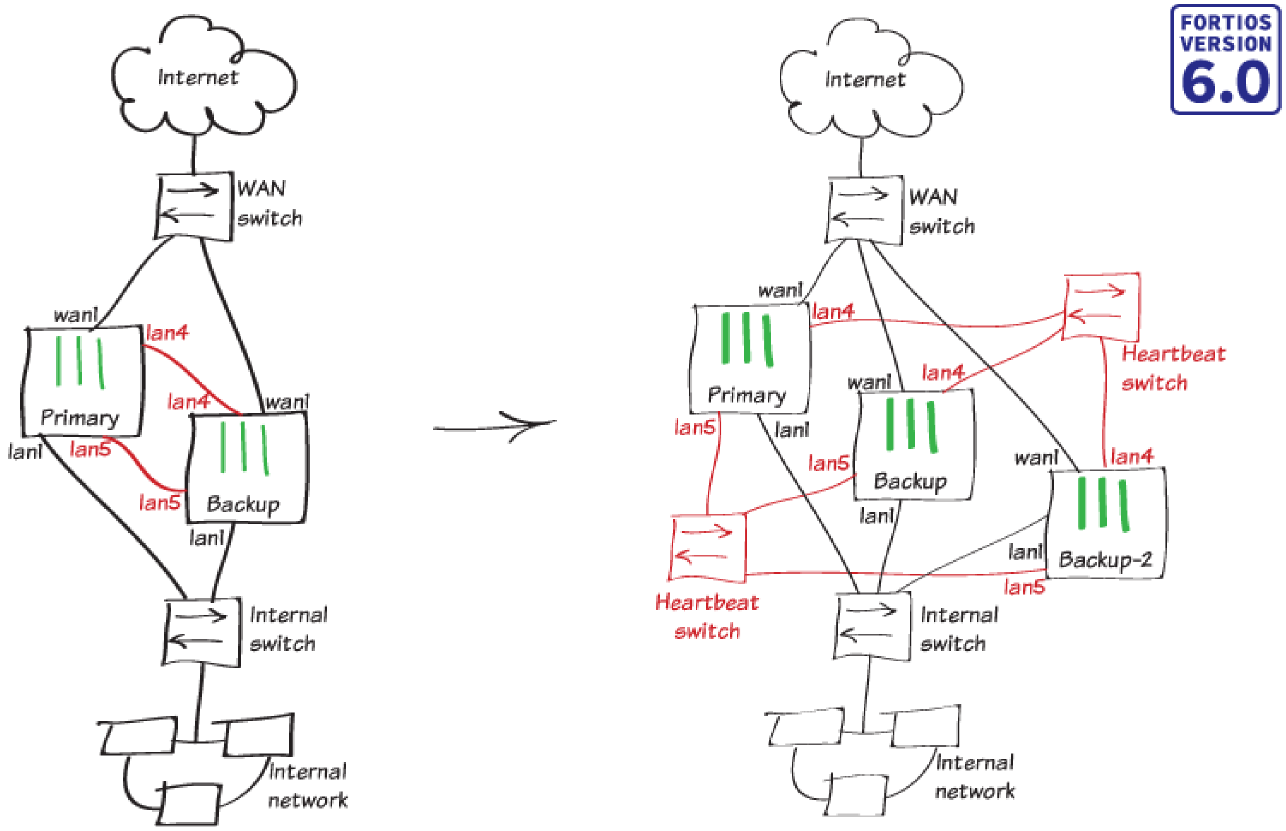
If you are using port monitoring, you can also unplug the primary FortiGate's Internet-facing interface to test failover

You will see a momentary pause in the ping results, until traffic diverts to the backup FortiGate, allowing the ping traffic to continue.

```
64 bytes from 184.25.76.114: icmp_seq=69 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=70 ttl=52 time=8.822 ms\
64 bytes from 184.25.76.114: icmp_seq=71 ttl=52 time=9.034 ms\
64 bytes from 184.25.76.114: icmp_seq=72 ttl=52 time=9.536 ms\
64 bytes from 184.25.76.114: icmp_seq=73 ttl=52 time=8.877 ms\
64 bytes from 184.25.76.114: icmp_seq=74 ttl=52 time=8.901 ms\
Request timeout for icmp_seq 75\
64 bytes from 184.25.76.114: icmp_seq=76 ttl=52 time=8.860 ms\
64 bytes from 184.25.76.114: icmp_seq=77 ttl=52 time=9.174 ms\
64 bytes from 184.25.76.114: icmp_seq=78 ttl=52 time=10.108 ms\
64 bytes from 184.25.76.114: icmp_seq=79 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=80 ttl=52 time=10.861 ms\
64 bytes from 184.25.76.114: icmp_seq=81 ttl=52 time=10.757 ms\
64 bytes from 184.25.76.114: icmp_seq=82 ttl=52 time=8.158 ms\
64 bytes from 184.25.76.114: icmp_seq=83 ttl=52 time=8.639 ms}
```

You can log into the cluster GUI or CLI using the same IP address as you had been using to the log into the primary FortiGate. If the primary FortiGate is powered off you will be logging into the backup FortiGate. Check the host name to verify the FortiGate that you have logged into. The FortiGate continues to operate in HA mode and if you restart the primary FortiGate, after a few minutes it should rejoin the cluster and operate as the backup FortiGate. Traffic should not be disrupted when the restarted primary unit rejoins the cluster.

Adding a third FortiGate to an FGCP cluster (expert)



This use case describes how to add a third FortiGate to an already established FGCP cluster (the cluster fromHigh Availability with FGCP (expert) on page 140) and configure active-active HA.

You prepare the new FortiGate by:

1. Setting it to factory defaults to wipe any configuration changes.
2. Licensing it (if required).
3. Enabling HA without changing the device priority and without enabling override.
4. Connecting it to the FGCP cluster already on the network.

The new FortiGate becomes a second backup FortiGate; its configuration synchronized to match the configuration of the cluster.

Before you start, the new FortiGate should be running the same FortiOS firmware version as the cluster and its interfaces should not be configured to get addresses from DHCP or PPPoE.

After the third FortiGate joins the cluster, this recipe also describes how to switch the cluster to operate in active-active (or a-a) mode. Active-active HA enables proxy-based NGFW/UTM load-balancing to allow the three FortiGates to share proxy-based NGFW/UTM processing. If the cluster handles a large amount of NGFW/UTM traffic, active-active HA with three FortiGates may enhance performance.

This use case features three FortiGate-51Es. These FortiGate models include a 5-port switch lan interface. Before configuring HA, the lan interface was converted to five separate interfaces (lan1 to lan5). The lan1 interface connects to the internal network and the wan1 interface connects to the Internet. The lan4 and lan5 interfaces become the HA heartbeat interfaces.

The FGCP does not support using a switch interface for the HA heartbeat. As an alternative to using the lan4 and lan5 interfaces as described in this recipe, you can use the wan1 and wan2 interfaces for the HA heartbeat.

Enabling override on the primary FortiGate (optional)

Before adding the third FortiGate to the cluster, enable override on the primary FortiGate. In most cases this step would not be necessary but it is a best practice because enabling override makes sure the configuration of the primary FortiGate is not overwritten by the configuration of the new backup FortiGate.

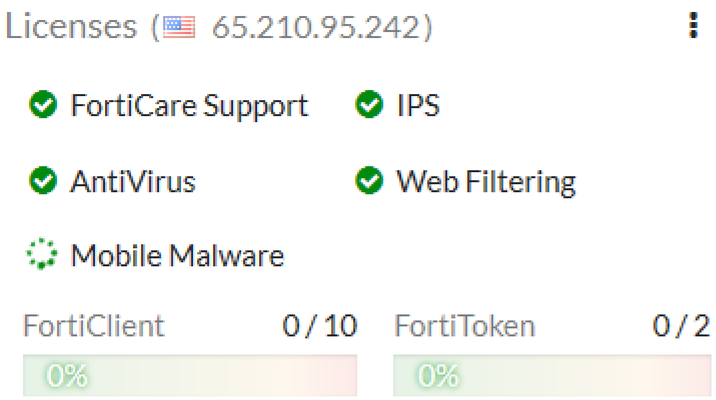
To enable override, log into the primary FortiGate CLI and enter this command:

```
config system ha
   set override enable
end
```

Configuring the new FortiGate

1. Enter this command to reset the new FortiGate to factory default settings:
   `execute factoryreset`
   You can skip this step if the new FortiGate is fresh from the factory. But if its configuration has been changed at all it's recommended to set it back to factory defaults to reduce the chance of synchronization problems.
2. If required, change the firmware running on the new FortiGate to match the cluster firmware version.
3. Register and apply licenses to the new FortiGate before configuring it for HA operation. This includes licensing for **FortiCare Support**, **IPS**, **AntiVirus**, **Web Filtering**, **Mobile Malware**, **FortiClient**, **FortiCloud**, **Security Rating**, **Outbreak Prevention**, and additional **virtual domains** (VDOMs). All FortiGates in the cluster must have the same level of licensing for FortiGuard, FortiCloud, FortiClient, and VDOMs. You can add **FortiToken** licenses at any time because they're synchronized to all cluster members.

   If the FortiGates in the cluster will run FortiOS Carrier, apply the FortiOS Carrier license before you configure the cluster (and before applying other licenses). When you applying the FortiOS Carrier license the FortiGate resets its configuration to factory defaults, requiring you to repeat steps performed before applying the license.



Licenses (65.210.95.242)

✓ FortiCare Support ✓ IPS

✓ AntiVirus ✓ Web Filtering

Mobile Malware

FortiClient 0 / 10 0%

FortiToken 0 / 2 0%

4. Change the host name of the new FortiGate to identify it as **Backup-2** by clicking on the **System Information** dashboard widget and selecting **Configure settings in System > Settings** and changing the **Host name**.

Host name Backup-2

You can also enter this CLI command:

```
config system global
   set hostname Backup-2
end
```

5. Duplicate the primary FortiGate HA settings, except set the Device Priority to a lower value (for example, 50) and do not enable override.

```
config system ha
   set mode a-p
   set group-id 100
   set group-name My-cluster
   set password <password>
   set priority 50
   set hbdev lan4 200 lan5 100
end
```

Once you enter the CLI command the new FortiGate negotiates to establish an HA cluster. You may temporarily lose connectivity with the FortiGate while FGCP negotiation takes place and the FortiGate interface MAC addresses change to HA virtual MAC addresses.

If these steps don't start HA mode, make sure that none of the FortiGate's interfaces use DHCP or PPPoE addressing.

If the group ID is the same, the backup FortiGate interfaces get the same virtual MAC addresses as the primary FortiGate. You can check **Network > Interfaces** on the GUI or use the `get hardware nic` command.

Connecting the new FortiGate to the cluster

Connect the new FortiGate to the cluster and your network as shown in the network diagram at the start of this use case. Making these connections disrupts network traffic as you disconnect and re-connect the heartbeat interfaces. If you have already added switches to connect the heartbeat interfaces, you can connect the new FortiGate without disrupting network traffic.

When you add a third FortiGate to a cluster you need to connect the heartbeat interfaces together using switches. You can use separate switches for each heartbeat interface (recommended for redundancy) or you can use the same switch for both heartbeat interfaces as long as you separate the traffic from each heartbeat interface.

When you connect the heartbeat interfaces of the new FortiGate, the cluster re-negotiates. If you have enabled override on the primary FortiGate and set its priority highest, the primary FortiGate synchronizes its configuration to the new FortiGate. The cluster automatically forms with minimal or no additional disruption to network traffic.

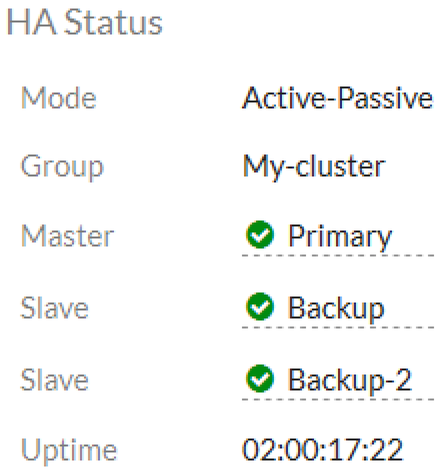
The new cluster will have the same IP addresses as the primary FortiGate. You can log into the cluster by logging into the primary FortiGate CLI or GUI.

Checking cluster operation

Check the cluster synchronization status to make sure the primary and backup FortiGates both have the same configuration.

1. Log into the primary FortiGate CLI and enter this command:
   ```
   diagnose sys ha checksum cluster
   ```
   The command output lists all cluster members' configuration checksums. If they all have identical checksums, you can be sure that the configurations are synchronized. If the checksums are different, wait a short while and enter the command again. Repeat until the checksums are identical. It may take a while for some parts of the configuration to be synchronized.

   If the checksums never become identical visit the Fortinet Support website for assistance.
2. The **HA Status** dashboard widget also shows synchronization status. Mouse over the host names of each FortiGate in the widget to verify that they are synchronized and both have the same checksum.

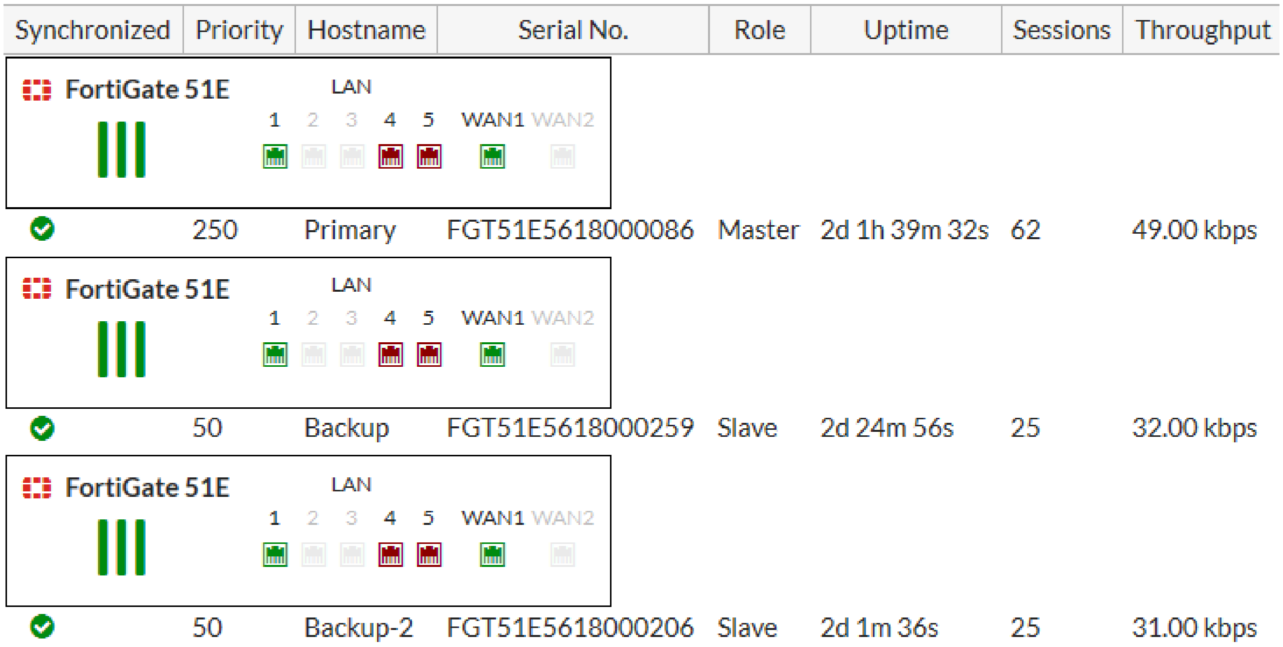


HA Status

Mode	Active-Passive
Group	My-cluster
Master	✓ Primary
Slave	✓ Backup
Slave	✓ Backup-2
Uptime	02:00:17:22

3. To view more information about the cluster status, click on the **HA Status** widget and select **Configure Settings**

in System > HA (or go to **System > HA**).



Synchronized	Priority	Hostname	Serial No.	Role	Uptime	Sessions	Throughput
✓	250	Primary	FGT51E5618000086	Master	2d 1h 39m 32s	62	49.00 kbps
✓	50	Backup	FGT51E5618000259	Slave	2d 24m 56s	25	32.00 kbps
✓	50	Backup-2	FGT51E5618000206	Slave	2d 1m 36s	25	31.00 kbps

Disabling override (recommended)

When the checksums are identical, disable override on the primary FortiGate by entering the following command:

```
config system ha
   set override disable
end
```

FGCP clusters dynamically respond to network conditions. If you keep override enabled, the same FortiGate always becomes the primary FortiGate. With override enabled; however, the cluster may negotiate more often to keep the same FortiGate as the primary FortiGate, potentially increasing traffic disruptions.

If you disable override it is more likely that the backup FortiGate could become the primary FortiGate. Disabling override is recommended unless its important that the same FortiGate remains the primary FortiGate

To see how enabling override can cause minor traffic disruptions, with override enabled set up a continuous ping through the cluster. Then disconnect power to the backup unit. You will most likely notice a brief disruption in the ping traffic. Try the same thing with override disabled and you shouldn't see this traffic disruption.

With override enabled, the disruption is minor and shouldn't be noticed by most users. For smoother operation, the best practice is to disable override.

Converting to an active-active cluster

Log into the primary FortiGate CLI and enter this command to convert the cluster from an active-passive to an active-active cluster. The cluster changes modes without any traffic interruption.

```
config system ha
   set mode a-a
```

```
end
```

Active-active HA load-balancing distributes proxy-based NGFW/UTM processing to all cluster members. Proxy-based NGFW/UTM processing is CPU and memory-intensive. Distributing NGFW/UTM processing in this way may result in higher throughput.

Results

Most traffic should now be flowing through the primary FortiGate with proxy-based NGFW/UTM sessions distributed to all three FortiGates in the cluster. If the primary FortiGate becomes unavailable, traffic fails over to the backup FortiGate. When the primary FortiGate rejoins the cluster, the backup FortiGate should continue operating as the primary FortiGate.

To test this, ping a reliable IP address from a PC on the internal network. After a moment, power off the primary FortiGate.

If you are using port monitoring, you can also unplug the primary FortiGate's Internet-facing interface to test failover.

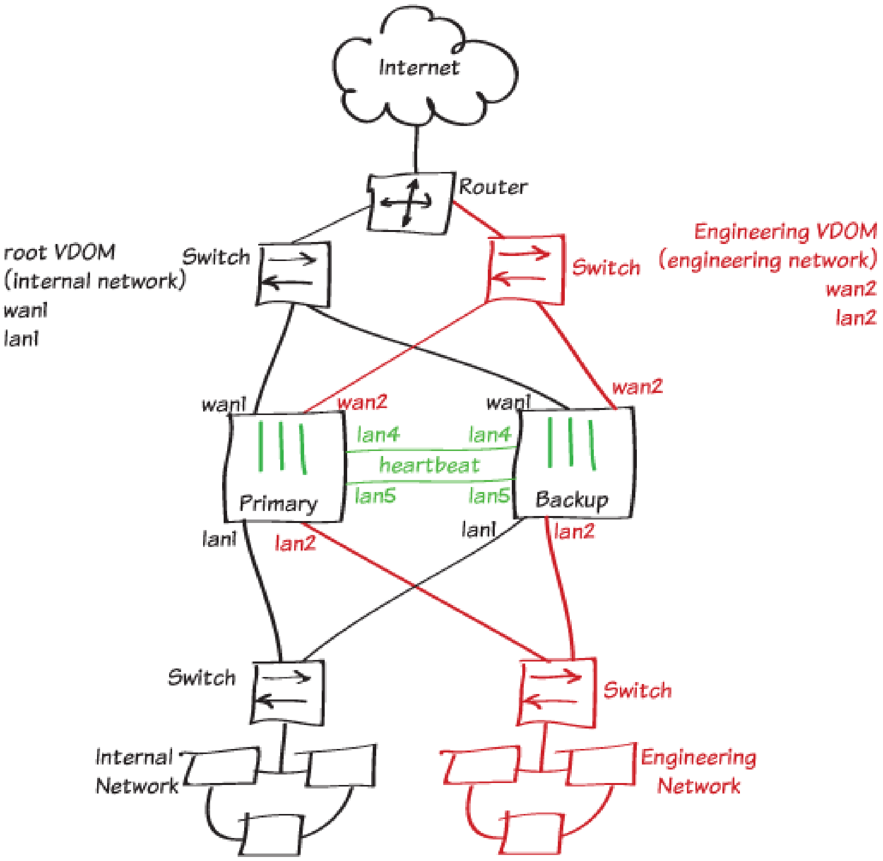
You will see a momentary pause in the ping results, until traffic diverts to the backup FortiGate, allowing the ping traffic to continue.

```
64 bytes from 184.25.76.114: icmp_seq=69 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=70 ttl=52 time=8.822 ms\
64 bytes from 184.25.76.114: icmp_seq=71 ttl=52 time=9.034 ms\
64 bytes from 184.25.76.114: icmp_seq=72 ttl=52 time=9.536 ms\
64 bytes from 184.25.76.114: icmp_seq=73 ttl=52 time=8.877 ms\
64 bytes from 184.25.76.114: icmp_seq=74 ttl=52 time=8.901 ms\
Request timeout for icmp_seq 75\
64 bytes from 184.25.76.114: icmp_seq=76 ttl=52 time=8.860 ms\
64 bytes from 184.25.76.114: icmp_seq=77 ttl=52 time=9.174 ms\
64 bytes from 184.25.76.114: icmp_seq=78 ttl=52 time=10.108 ms\
64 bytes from 184.25.76.114: icmp_seq=79 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=80 ttl=52 time=10.861 ms\
64 bytes from 184.25.76.114: icmp_seq=81 ttl=52 time=10.757 ms\
64 bytes from 184.25.76.114: icmp_seq=82 ttl=52 time=8.158 ms\
64 bytes from 184.25.76.114: icmp_seq=83 ttl=52 time=8.639 ms}
```

You can log into the cluster GUI or CLI using the same IP address as you had been using to the log into the primary FortiGate. If the primary FortiGate is powered off you will be logging into the backup FortiGate. Check the host name to verify the FortiGate that you have logged into. The FortiGate continues to operate in HA mode and if you restart the primary FortiGate, after a few minutes it should rejoin the cluster and operate as the backup FortiGate. Traffic should not be disrupted when the restarted primary unit rejoins the cluster.

FGCP Virtual Clustering with two FortiGates (expert)

FORTIOS VERSION 6.0



In this use case you set up a FortiGate Clustering Protocol (FGCP) virtual clustering configuration with two FortiGates to provide redundancy and failover protection for two networks. The FortiGate configuration includes two VDOMs. The root VDOM handles internal network traffic and the Engineering VDOM handles Engineering network traffic. This use case describes a very simple two-VDOM configuration. However, the same principles described in this example apply to a virtual cluster with more VDOMs.

In this virtual cluster configuration the primary FortiGate processes all internal network traffic and the backup FortiGate processes all Engineering network traffic. Virtual clustering enables override and uses device priorities to distribute traffic between the primary and backup FortiGates in the virtual cluster.

This use case describes the recommended steps for setting up a virtual cluster of two FortiGates. You can follow the procedure described in High Availability with FGCP (expert) on page 140 to configure virtual clustering by converting a FortiGate with VDOMs to HA mode and then adding another FortiGate to form a cluster. However, taking this approach with virtual clustering is not as foolproof as a normal HA configuration. If you accidentally add the management VDOM to virtual cluster 2 before adding the backup FortiGate, the configuration of the primary FortiGate can be overwritten by the backup FortiGate. If want to experiment with this approach, make sure you don't add the management VDOM to virtual cluster 2 until all of the FortiGates have joined the cluster.

Before you start, the FortiGates should be running the same FortiOS firmware version and their interfaces should not be configured to get addresses from DHCP or PPPoE.

This user case features two FortiGate-51Es. FortiGate-51Es have a 5-port switch lan interface. Before configuring HA, the lan interface was converted to 5 separate interfaces (lan1 to lan5).

The FGCP does not support using a switch interface for the HA heartbeat. As an alternative to using the lan4 and lan5 interfaces as described in this recipe, you can use the wan1 and wan2 interfaces for the HA heartbeat.

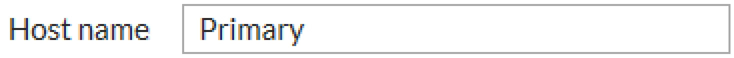
Preparing the FortiGates

1. If required, upgrade the firmware running on the FortiGates. Both FortiGates should be running the same version of FortiOS.
2. On each FortiGate, enter the following command to reset them factory default settings.

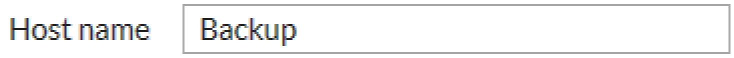
   ```
   execute factoryreset
   ```

   You can skip this step if the FortiGates are fresh from the factory. But if their configurations have changed at all, it's a best practice to reset them to factory defaults to reduce the chance of synchronization problems.

   In some cases, after resetting to factory defaults you may want to make some initial configuration changes to connect the FortiGates to the network or for other reasons. To write this recipe, the lan switch on the FortiGate-51Es was converted to separate lan1 to lan5 interfaces.
3. Change the primary FortiGate **Host name** to identify it as the primary FortiGate by going to **System > Settings**.

   Host name: Primary
4. Change the backup FortiGate **Host name** to identify it as the backup FortiGate by going to **System > Settings**.

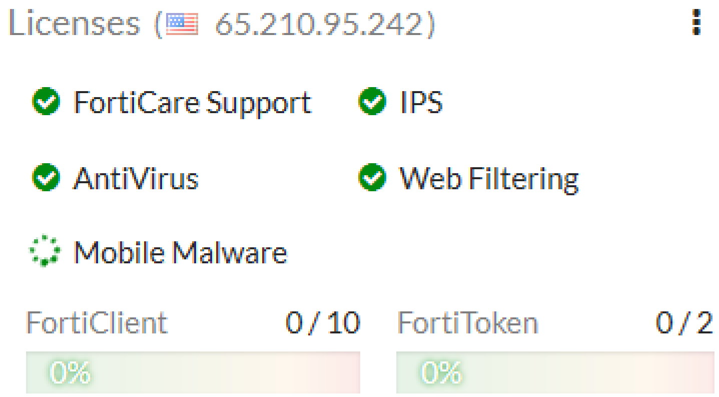
   Host name: Backup

   You can also use the CLI to change the host name. From the Primary FortiGate:

   ```
   config system global
      set hostname Primary
   end
   ```

   From the Backup-1 FortiGate:

   ```
   config system global
      set hostname Backup
   end
   ```
5. Register and apply licenses to the FortiGates before configuring the cluster. This includes licensing for **FortiCare Support**, **IPS**, **AntiVirus**, **Web Filtering**, **Mobile Malware**, **FortiClient**, **FortiCloud**, **Security Rating**, **Outbreak Prevention**, and additional **virtual domains** (VDOMs).

   Licenses (65.210.95.242)

   ✓ FortiCare Support ✓ IPS

   ✓ AntiVirus ✓ Web Filtering

   Mobile Malware

   FortiClient 0 / 10 — 0%

   FortiToken 0 / 2 — 0%

Both FortiGates in the cluster must have the same level of licensing for FortiGuard, FortiCloud, FortiClient, and VDOMs. You can add **FortiToken** licenses at any time because they're synchronized to all cluster members.

If the FortiGates in the cluster will run FortiOS Carrier, apply the FortiOS Carrier license before you configure the cluster (and before applying other licenses). When you applying the FortiOS Carrier license the FortiGate resets its configuration to factory defaults, requiring you to repeat steps performed before applying the license.

Configuring clustering

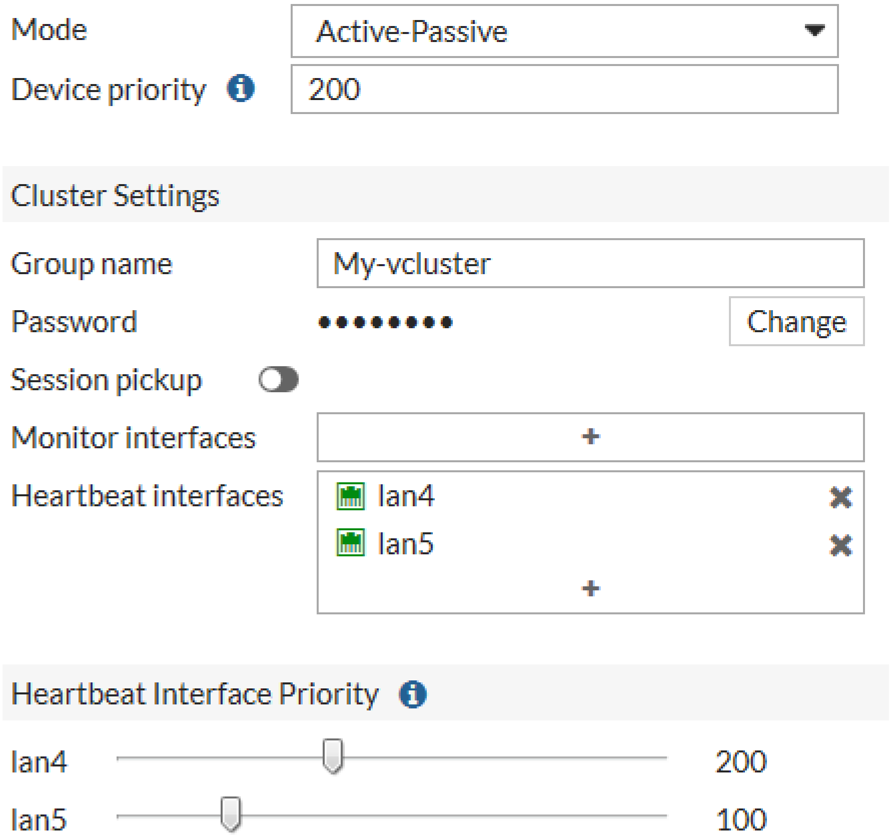
1. On the primary FortiGate, enter the following CLI command to set the HA mode to active-passive, set a group-id, group name, and password, increase the device priority to 200, enable override, and configure the heartbeat interfaces (lan4 and lan5 in this example).

```
config system ha
   set mode a-p
   set group-id 88
   set group-name My-vcluster
   set password <password>
   set priority 200
   set override enable
   set hbdev lan4 200 lan5 100
end
```

If you have more than one cluster on the same network, each cluster should have a different group id. Changing the group id changes the cluster interface virtual MAC addresses. If your group id causes a MAC address conflict on your network, you can select a different group id.

Enabling override is optional; but it makes sure the FortiGate with the highest device priority becomes the primary unit.

You can also configure most of these settings from the GUI (go to **Global > System > HA**). The group-id and override can only be configured from the CLI.



Mode: Active-Passive

Device priority: 200

Cluster Settings

Group name: My-vcluster

Password: ●●●●●●●●● Change

Session pickup ○

Monitor interfaces: +

Heartbeat interfaces: lan4, lan5

Heartbeat Interface Priority

lan4: 200

lan5: 100

2. On the backup FortiGate, duplicate the primary FortiGate HA mode, group-id, group-name, password, override, and heartbeat device settings. Set the device priority to 50.

```
config system ha
   set mode a-p
   set group-id 88
   set group-name My-vcluster
   set password <password>
   set priority 50
   set override enable
   set hbdev lan4 200 lan5 100
end
```

After you enable HA, each FortiGate negotiates to establish an HA cluster. You may temporarily lose connectivity as FGCP negotiation takes place and the MAC addresses of the FortiGate interfaces change to HA virtual MAC addresses.

If these steps don't start HA mode, make sure that none of the FortiGate's interfaces use DHCP or PPPoE addressing.

To reconnect sooner, you can update the ARP table of your management PC by deleting the ARP table entry for the FortiGate (or just deleting all ARP table entries). You can usually delete the ARP table from a command prompt using a command similar to arp -d.

The FGCP uses virtual MAC addresses for failover. The virtual MAC address assigned to each FortiGate interface depends on the HA group ID. A group ID of 88 sets FortiGate interfaces to the following MAC addresses:

00:09:0f:09:58:00, 00:09:0f:09:58:01, 00:09:0f:09:58:02 and so on. For details, see Cluster virtual MAC addresses.

You can verify that the FGCP has set the virtual MAC addresses by viewing the configuration of each FortiGate interface from the GUI (go to Network > Interfaces) or by entering the following CLI command (shown below for lan2 on a FortiGate-51E):

```
get hardware nic lan2
...
Current_HWaddr 00:09:0f:09:58:01
Permanent_HWaddr 70:4c:a5:98:11:54
...
```

You can also use the `diagnose hardware deviceinfo nic lan2` command to display this information.

The output shows the current hardware (MAC) address (the virtual MAC set by the FGCP) and the permanent hardware (MAC) address for the interface.

Connecting and verifying cluster operation

Connect the FortiGates together and to your networks as shown in the network diagram at the start of the use case. Making these connections disrupts network traffic as you disconnect and re-connect cables.

Switches must be used between the cluster and the Internet, between the cluster and the internal network, and between the cluster and the Engineering network as shown in the diagram. You can use any good quality switches to make these connections.

To make HA heartbeat connections, connect all of the lan4 interfaces to the same switch and all of the lan5 interfaces to another switch.

You can also use fewer switches for all of these connections as long as you configure the switches to separate traffic from the different networks.

When you connect the heartbeat interfaces and power on the FortiGates, they find each other and negotiate to form a cluster. The cluster will have the same IP addresses as the primary FortiGate. You can log into the cluster by logging into the primary FortiGate GUI or CLI using one of the original IP addresses of the primary FortiGate.

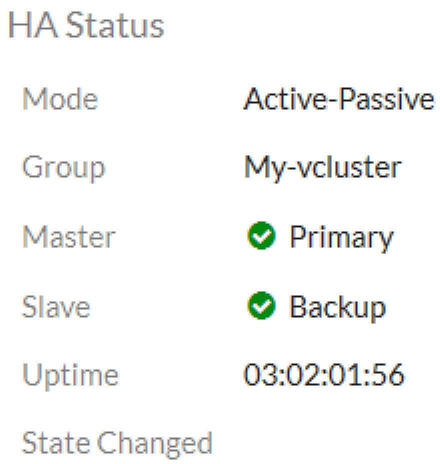
Check the cluster synchronization status to make sure the primary and backup FortiGates both have the same configuration. Log into the primary FortiGate CLI and enter this command:

```
diagnose sys ha checksum cluster
```

The command output lists all cluster members' configuration checksums. If both cluster members have identical checksums you can be sure that their configurations are synchronized. If the checksums are different, wait a short while and enter the command again. Repeat until the checksums are identical. It may take a while for some parts of the configuration to be synchronized. If the checksums never become identical you can use the information in Synchronizing the configuration to troubleshoot the problem or visit the Fortinet Support website for assistance.

You can also use the `get system ha status` command to display detailed information about the cluster. .

The **HA Status** dashboard widget also shows synchronization status. Hover over the host names of each FortiGate in the widget to verify that they are synchronized and both have the same checksum.



HA Status

Mode	Active-Passive
Group	My-vcluster
Master	✓ Primary
Slave	✓ Backup
Uptime	03:02:01:56
State Changed	

Adding VDOMs and setting up virtual clustering

1. Enable VDOMs by going to **System > Settings > System Operation Settings** and enabling **Virtual Domains**. Or enter the following CLI command.

```
config system global
   set vdom-admin enable
end
```

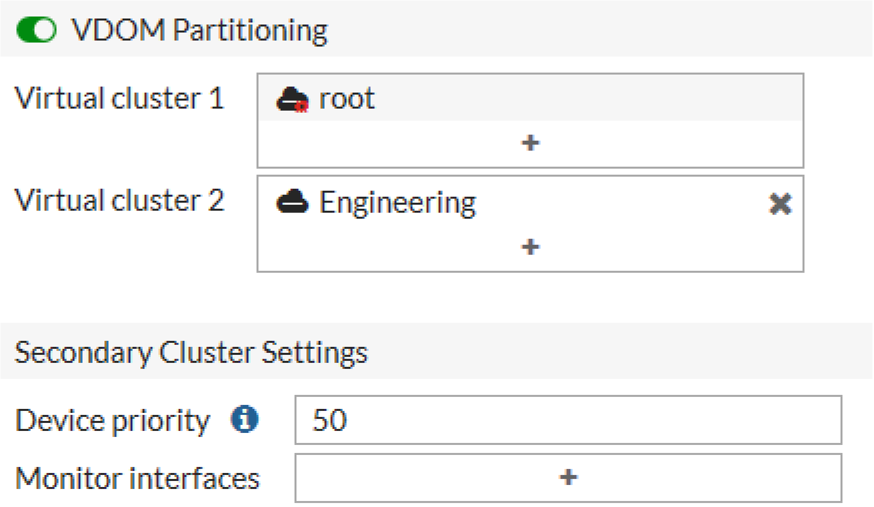
2. Add VDOMs as required. Go to **Global > System > VDOM** and select **Create New**. Or enter the following CLI command to add the Engineering VDOM.

```
config global
   edit Engineering
end
```

3. Configure virtual clustering and VDOM partitioning on the primary FortiGate. The following command enables virtual cluster 2, adds the Engineering VDOM to virtual cluster 2, and sets the virtual cluster 2 device priority of the primary FortiGate to 50.

```
config global
   config system ha
      set vcluster2 enable
      config secondary-vcluster
         set vdom Engineering
         set priority 50
      end
   end
```

   You can also configure virtual clustering and VDOM partitioning from the GUI by going to **Global > System > HA**.



VDOM Partitioning

Virtual cluster 1: root

Virtual cluster 2: Engineering

Secondary Cluster Settings

Device priority: 50

Monitor interfaces: +

4. Set the virtual cluster 2 priority of the backup FortiGate to a relatively high value (in this example, 200) so that this FortiGate processes traffic for the VDOMs in virtual cluster 2. The FGCP synchronizes all other HA settings from the primary FortiGate.
   You can only configure the virtual cluster 2 priority of the backup FortiGate from the CLI. Use `execute ha manage` to access the backup FortiGate CLI.

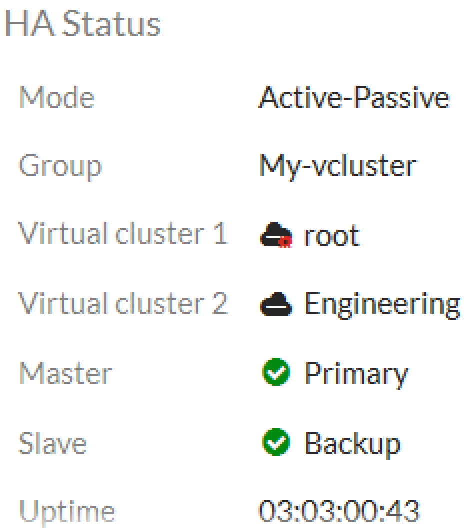
```
config global
   config system ha
      config secondary-vcluster
         set priority 200
      end
   end
```

The root VDOM can only be associated with virtual cluster 1.

The VDOM that is assigned as the management VDOM can also only be associated with virtual cluster 1.

Checking virtual cluster operation

1. Once again use the `diagnose sys ha checksum` cluster command and the `get system ha status` command to check the cluster synchronization status to make sure the primary and backup FortiGates both have the same configuration.
   The **HA Status** dashboard widget shows the VDOMs in the virtual clusters. You can hover over the VDOM names to see status information for the VDOMs. You can hover over the host names of each FortiGate to verify that they are synchronized and both have the same checksum.

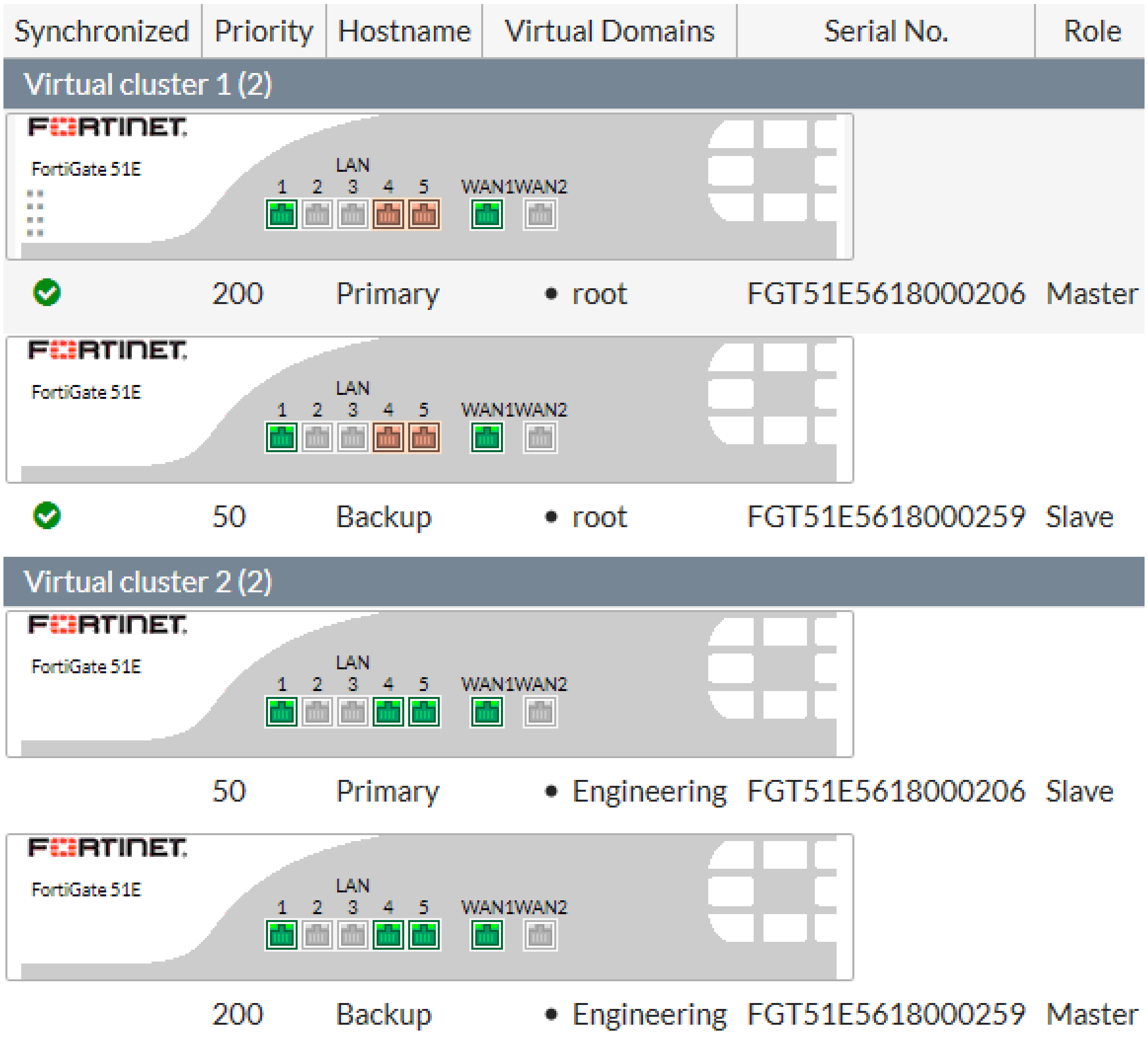


HA Status

Mode	Active-Passive
Group	My-vcluster
Virtual cluster 1	root
Virtual cluster 2	Engineering
Master	✓ Primary
Slave	✓ Backup
Uptime	03:03:00:43

2. To view more information about the cluster status, click on the **HA Status** widget and select **Configure Settings in System > HA** (or go to **System > HA**).

   The HA status page shows both FortiGates in the cluster. It also shows that Primary is the primary FortiGate for the root VDOM (so the primary FortiGate processes all root VDOM traffic). The page also shows that Backup is the primary FortiGate for the Engineering VDOM (so the backup FortiGate processes all Engineering VDOM traffic).



Synchronized	Priority	Hostname	Virtual Domains	Serial No.	Role
Virtual cluster 1 (2)					
✓	200	Primary	● root	FGT51E5618000206	Master
✓	50	Backup	● root	FGT51E5618000259	Slave
Virtual cluster 2 (2)					
	50	Primary	● Engineering	FGT51E5618000206	Slave
	200	Backup	● Engineering	FGT51E5618000259	Master

Results

All traffic should now be flowing through the primary FortiGate. If the primary FortiGate becomes unavailable, traffic fails over to the backup FortiGate. When the primary FortiGate rejoins the cluster, the backup FortiGate should continue operating as the primary FortiGate.

To test this, ping a reliable IP address from a PC on the internal network. After a moment, power off the primary FortiGate.

If you are using port monitoring, you can also unplug the primary FortiGate's Internet-facing interface to test failover

You will see a momentary pause in the ping results, until traffic diverts to the backup FortiGate, allowing the ping traffic to continue.

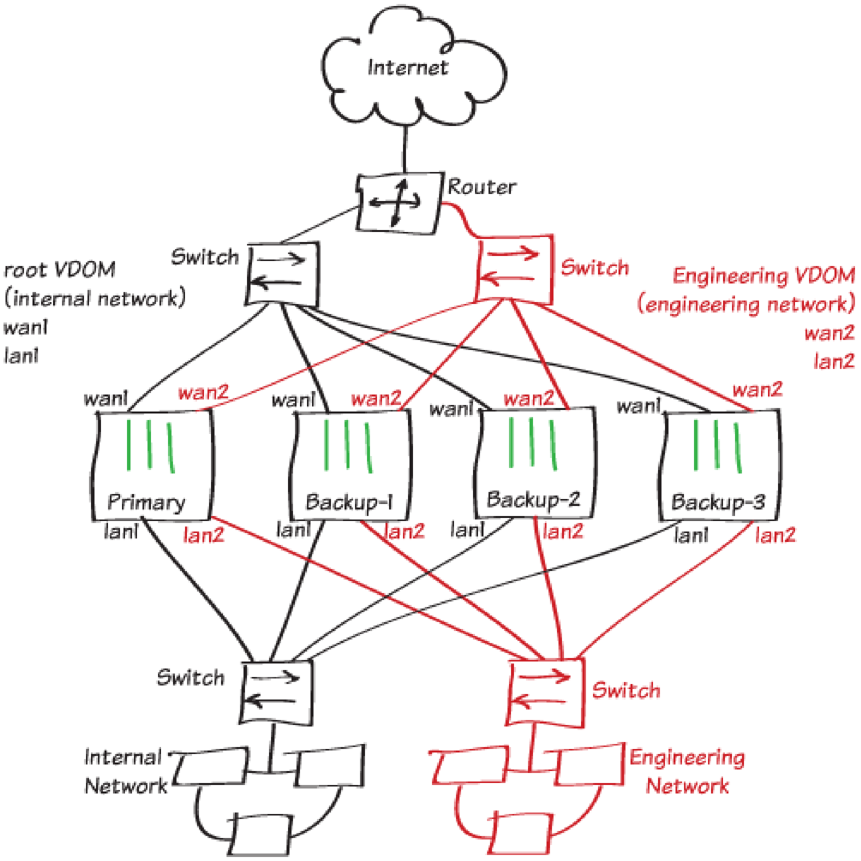
```
64 bytes from 184.25.76.114: icmp_seq=69 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=70 ttl=52 time=8.822 ms\
64 bytes from 184.25.76.114: icmp_seq=71 ttl=52 time=9.034 ms\
64 bytes from 184.25.76.114: icmp_seq=72 ttl=52 time=9.536 ms\
64 bytes from 184.25.76.114: icmp_seq=73 ttl=52 time=8.877 ms\
64 bytes from 184.25.76.114: icmp_seq=74 ttl=52 time=8.901 ms\
Request timeout for icmp_seq 75\
64 bytes from 184.25.76.114: icmp_seq=76 ttl=52 time=8.860 ms\
64 bytes from 184.25.76.114: icmp_seq=77 ttl=52 time=9.174 ms\
64 bytes from 184.25.76.114: icmp_seq=78 ttl=52 time=10.108 ms\
64 bytes from 184.25.76.114: icmp_seq=79 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=80 ttl=52 time=10.861 ms\
64 bytes from 184.25.76.114: icmp_seq=81 ttl=52 time=10.757 ms\
64 bytes from 184.25.76.114: icmp_seq=82 ttl=52 time=8.158 ms\
64 bytes from 184.25.76.114: icmp_seq=83 ttl=52 time=8.639 ms}
```

You can log into the cluster GUI or CLI using the same IP address as you had been using to the log into the primary FortiGate. If the primary FortiGate is powered off you will be logging into the backup FortiGate. Check the host name to verify the FortiGate that you have logged into.

When you restart the primary FortiGate, after a few minutes it should rejoin the cluster and because override is enabled, the original virtual cluster configuration should be re-established. Traffic may be temporarily disrupted when the restarted primary FortiGate rejoins the cluster.

FGCP Virtual Clustering with four FortiGates (expert)

FORTIOS VERSION 6.0



In this use case you set up a FortiGate Clustering Protocol (FGCP) virtual clustering configuration with four FortiGates to provide redundancy and failover protection for two networks. The FortiGate configuration includes two VDOMs. The root VDOM handles internal network traffic and the Engineering VDOM handles Engineering network traffic. This recipe describes a very simple two-VDOM configuration. However, the same principles described in this example apply to a virtual cluster with more VDOMs.

In this virtual cluster configuration the primary FortiGate processes all internal network traffic and the backup FortiGate processes all Engineering network traffic. Virtual clustering enables override and uses device priorities to distribute traffic between the primary and backup FortiGates in the virtual cluster.

The third FortiGate (the recipe names it Backup-2) acts as a backup to the primary FortiGate; if the primary FortiGate fails, all primary FortiGate network traffic transfers to the Backup-2 FortiGate, which becomes the new primary FortiGate.

The fourth FortiGate (Backup-3) acts as a backup to the backup FortiGate; if the backup FortiGate fails, all backup FortiGate network traffic transfers to the Backup-3 FortiGate, which becomes the new backup FortiGate.

This recipe describes the recommended steps for setting up a virtual cluster of four FortiGates. You can follow the procedure described in High Availability with FGCP (expert) on page 140 to configure virtual clustering by converting a FortiGate with VDOMs to HA mode and then adding another FortiGate to form a cluster. However, taking this approach with virtual clustering is not as foolproof as a normal HA configuration. If you accidentally add the management VDOM to virtual cluster 2 before adding the backup FortiGate, the configuration of the primary FortiGate can be overwritten by the backup FortiGate. If want to experiment with this approach, make sure you don't add the management VDOM to virtual cluster 2 until all of the FortiGates have joined the cluster.

Before you start, the FortiGates should be running the same FortiOS firmware version and their interfaces should not be configured to get addresses from DHCP or PPPoE.

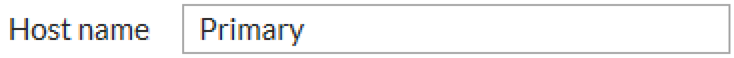
This recipe features four FortiGate-51Es. FortiGate-51Es have a 5-port switch lan interface. Before configuring HA, the lan interface was converted to 5 separate interfaces (lan1 to lan5).

The FGCP does not support using a switch interface for the HA heartbeat. As an alternative to using the lan4 and lan5 interfaces as described in this recipe, you can use the wan1 and wan2 interfaces for the HA heartbeat.

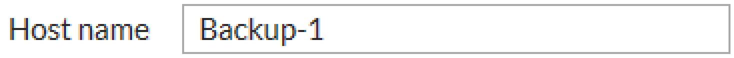
Preparing the FortiGates

1. If required, upgrade the firmware running on the FortiGates. All of the FortiGates should be running the same version of FortiOS.
2. On each FortiGate, enter the following command to reset them factory default settings.
   ```
   execute factoryreset
   ```
   You can skip this step if the FortiGates are fresh from the factory. But if their configurations have changed at all, it's a best practice to reset them to factory defaults to reduce the chance of synchronization problems.

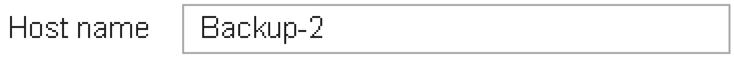
   In some cases, after resetting to factory defaults you may want to make some initial configuration changes to connect the FortiGates to the network or for other reasons. To write this recipe, the lan switch on the FortiGate-51Es was converted to separate lan1 to lan5 interfaces.
3. Change the primary FortiGate **Host name** to identify it as the primary FortiGate by going to **System > Settings**.

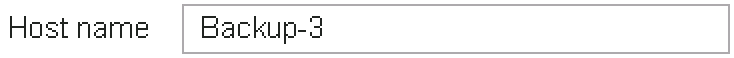
   Host name: Primary
4. Change the backup FortiGate **Host name** to identify it as Backup-1 by going to **System > Settings**.

   Host name: Backup-1
5. Change the third FortiGate **Host name** to identify it as Backup-2 by going to **System > Settings**.

   Host name: Backup-2
6. Change the fourth FortiGate **Host name** to identify it as Backup-3 by going to **System > Settings**.

   Host name: Backup-3

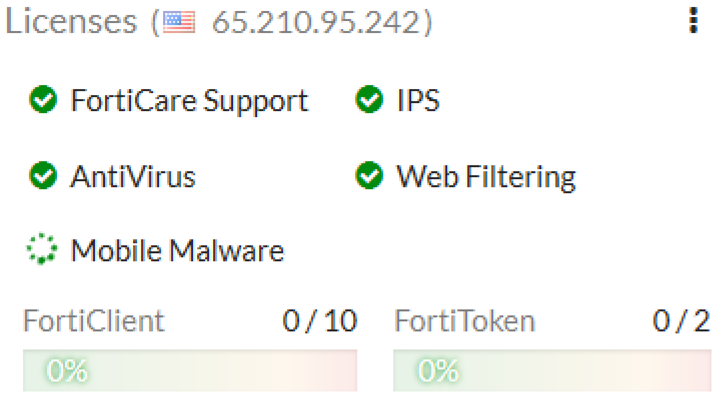
   You can also use the CLI to change the host name. From the Primary FortiGate:
   ```
   config system global
      set hostname Primary
   end
   ```
   From the Backup-1 FortiGate:
   ```
   config system global
      set hostname Backup-1
   end
   ```
   From the Backup-2 FortiGate:
   ```
   config system global
   ```

```
   set hostname Backup-2
end
```

From the Backup-3 FortiGate:

```
config system global
   set hostname Backup-3
end
```

7. Register and apply licenses to the FortiGates before configuring the cluster. This includes licensing for **FortiCare Support**, **IPS**, **AntiVirus**, **Web Filtering**, **Mobile Malware**, **FortiClient**, **FortiCloud**, **Security Rating**, **Outbreak Prevention**, and additional **virtual domains** (VDOMs).



Licenses (65.210.95.242)

✓ FortiCare Support ✓ IPS

✓ AntiVirus ✓ Web Filtering

Mobile Malware

FortiClient 0 / 10 FortiToken 0 / 2

0% 0%

All FortiGates in the cluster must have the same level of licensing for FortiGuard, FortiCloud, FortiClient, and VDOMs. You can add **FortiToken** licenses at any time because they're synchronized to all cluster members.

If the FortiGates in the cluster will run FortiOS Carrier, apply the FortiOS Carrier license before you configure the cluster (and before applying other licenses). When you applying the FortiOS Carrier license the FortiGate resets its configuration to factory defaults, requiring you to repeat steps performed before applying the license.

Configuring clustering

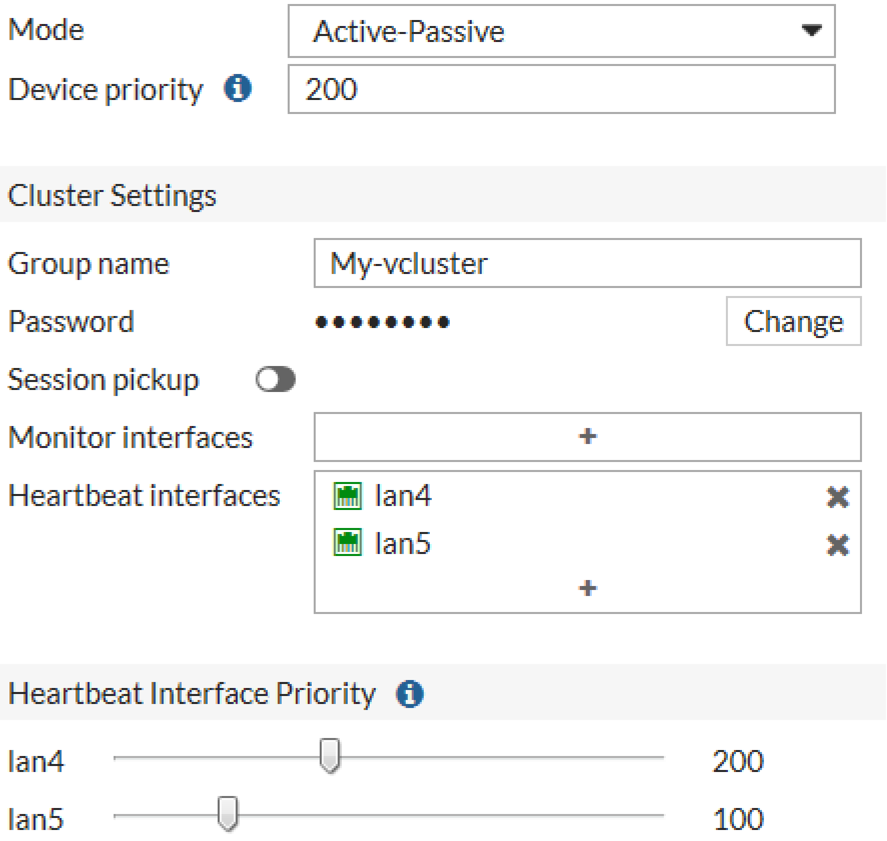
1. On the primary FortiGate, enter the following CLI command to set the HA mode to active-passive, set a group-id, group name, and password, increase the device priority to 200, enable override, and configure the heartbeat interfaces (lan4 and lan5 in this example).

```
config system ha
   set mode a-p
   set group-id 88
   set group-name My-vcluster
   set password <password>
   set priority 200
   set override enable
   set hbdev lan4 200 lan5 100
end
```

If you have more than one cluster on the same network, each cluster should have a different group id. Changing the group id changes the cluster interface virtual MAC addresses. If your group id causes a MAC address conflict on your network, you can select a different group id.

Enabling override is optional; but it makes sure the FortiGate with the highest device priority becomes the primary unit.

You can also configure most of these settings from the GUI (go to **Global > System > HA**). The group-id and override can only be configured from the CLI.



Mode: Active-Passive

Device priority: 200

Cluster Settings

Group name: My-vcluster

Password: •••••••••

Session pickup

Monitor interfaces

Heartbeat interfaces: lan4, lan5

Heartbeat Interface Priority

lan4: 200

lan5: 100

2. On the Backup-1 FortiGate, duplicate the primary FortiGate HA mode, group-id, group-name, password, override, and heartbeat device settings. Set the device priority to 50. Setting the device priority to a relatively low value means the Backup-1 FortiGate will most likely always become the backup FortiGate.

```
config system ha
   set mode a-p
   set group-id 88
   set group-name My-vcluster
   set password <password>
   set priority 50
   set override enable
   set hbdev lan4 200 lan5 100
end
```

3. On the Backup-2 FortiGate, duplicate the primary FortiGate HA mode, group-id, group-name, password, override, and heartbeat device settings. Set the device priority to 150. A device priority of 150 is almost as high as the device priority of the primary FortiGate. So if the primary FortiGate fails, the Backup-2 FortiGate should become the new primary FortiGate.

```
config system ha
   set mode a-p
   set group-id 88
   set group-name My-vcluster
   set password <password>
   set priority 150
   set override enable
   set hbdev lan4 200 lan5 100
end
```

4. On the Backup-3 FortiGate, duplicate the primary FortiGate HA mode, group-id, group-name, password, override, and heartbeat device settings. Set the device priority to 100. A device priority of 100 means that if the backup FortiGate fails, the Backup-3 FortiGate will have the lowest device priority so will become the new backup FortiGate.

   ```
   config system ha
      set mode a-p
      set group-id 88
      set group-name My-vcluster
      set password <password>
      set priority 100
      set override enable
      set hbdev lan4 200 lan5 100
   end
   ```

   After you enable HA, each FortiGate negotiates to establish an HA cluster. You may temporarily lose connectivity as FGCP negotiation takes place and the MAC addresses of the FortiGate interfaces change to HA virtual MAC addresses.

   If these steps don't start HA mode, make sure that none of the FortiGate's interfaces use DHCP or PPPoE addressing.

   To reconnect sooner, you can update the ARP table of your management PC by deleting the ARP table entry for the FortiGate (or just deleting all ARP table entries). You can usually delete the ARP table from a command prompt using a command similar to arp -d.

   The FGCP uses virtual MAC addresses for failover. The virtual MAC address assigned to each FortiGate interface depends on the HA group ID. A group ID of 88 sets FortiGate interfaces to the following MAC addresses: 00:09:0f:09:58:00, 00:09:0f:09:58:01, 00:09:0f:09:58:02 and so on. For details, see Cluster virtual MAC addresses.

   You can verify that the FGCP has set the virtual MAC addresses by viewing the configuration of each FortiGate interface from the GUI (go to Network > Interfaces) or by entering the following CLI command (shown below for lan2 on a FortiGate-51E):

   ```
   get hardware nic lan2
   ...
   Current_HWaddr 00:09:0f:09:58:01
   Permanent_HWaddr 70:4c:a5:98:11:54
   ...
   ```

   You can also use the `diagnose hardware deviceinfo nic lan2` command to display this information.

   The output shows the current hardware (MAC) address (the virtual MAC set by the FGCP) and the permanent hardware (MAC) address for the interface.

Connecting and verifying cluster operation

Connect the FortiGates together and to your networks as shown in the network diagram at the start of the use case. Making these connections disrupts network traffic as you disconnect and re-connect cables.

Switches must be used between the cluster and the Internet, between the cluster and the internal network, and between the cluster and the Engineering network as shown in the diagram. You can use any good quality switches to make these connections.

To make HA heartbeat connections, connect all of the lan4 interfaces to the same switch and all of the lan5 interfaces to another switch.

You can also use fewer switches for all of these connections as long as you configure the switches to separate traffic from the different networks.

When you connect the heartbeat interfaces and power on the FortiGates, they find each other and negotiate to form a cluster. The cluster will have the same IP addresses as the primary FortiGate. You can log into the cluster by logging into the primary FortiGate GUI or CLI using one of the original IP addresses of the primary FortiGate.

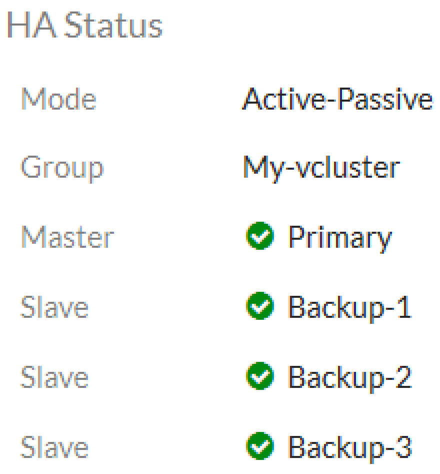
Check the cluster synchronization status to make sure the primary and backup FortiGates both have the same configuration. Log into the primary FortiGate CLI and enter this command:

```
diagnose sys ha checksum cluster
```

The command output lists all cluster members' configuration checksums. If both cluster members have identical checksums you can be sure that their configurations are synchronized. If the checksums are different, wait a short while and enter the command again. Repeat until the checksums are identical. It may take a while for some parts of the configuration to be synchronized. If the checksums never become identical you can use the information in Synchronizing the configuration to troubleshoot the problem or visit the Fortinet Support website for assistance.

You can also use the `get system ha status` command to display detailed information about the cluster. .

The **HA Status** dashboard widget also shows synchronization status. Hover over the host names of each FortiGate in the widget to verify that they are synchronized and both have the same checksum.



HA Status

Mode	Active-Passive
Group	My-vcluster
Master	✓ Primary
Slave	✓ Backup-1
Slave	✓ Backup-2
Slave	✓ Backup-3

Adding VDOMs and setting up virtual clustering

1. Enable VDOMs by going to **System > Settings > System Operation Settings** and enabling **Virtual Domains**. Or enter the following CLI command.

```
config system global
   set vdom-admin enable
end
```

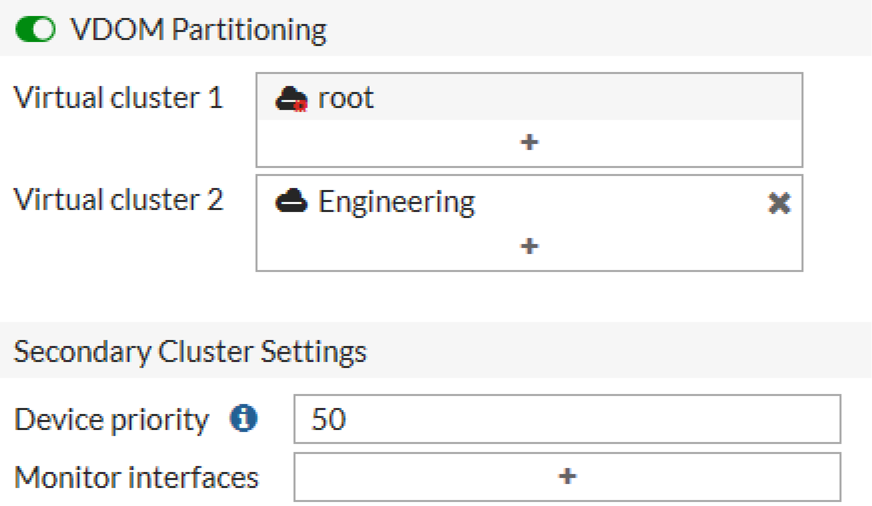
2. Add VDOMs as required. Go to **Global > System > VDOM** and select **Create New**. Or enter the following CLI command to add the Engineering VDOM.

```
config global
   edit Engineering
end
```

3. Configure virtual clustering and VDOM partitioning on the primary FortiGate. The following command enables virtual cluster 2, adds the Engineering VDOM to virtual cluster 2, and sets the virtual cluster 2 device priority of the primary FortiGate to 50.

```
config global
   config system ha
      set vcluster2 enable
         config secondary-vcluster
            set vdom Engineering
            set priority 50
         end
```

You can also configure virtual clustering and VDOM partitioning from the GUI by going to **Global > System > HA**.



VDOM Partitioning

Virtual cluster 1: root

Virtual cluster 2: Engineering

Secondary Cluster Settings

Device priority: 50

Monitor interfaces

4. Set the virtual cluster 2 priority of the Backup-1 FortiGate to a relatively high value (in this example, 200) so that this FortiGate processes traffic for the VDOMs in virtual cluster 2. The FGCP synchronizes all other HA settings from the primary FortiGate.

You can only configure the virtual cluster 2 priority of the backup FortiGate from the CLI. Use `execute ha manage` to access the backup FortiGate CLI.

```
config global
   config system ha
      config secondary-vcluster
         set priority 200
   end
```

5. Set the virtual cluster 2 priority of the Backup-2 FortiGate to 100 so that if the primary FortiGate fails, Backup-2 will become the primary FortiGate but will have the lowest virtual cluster 2 priority. The FGCP synchronizes all other HA settings from the primary FortiGate.

You can only configure the virtual cluster 2 priority of the Backup-2 FortiGate from the CLI. Use execute ha manage to access the backup FortiGate CLI.

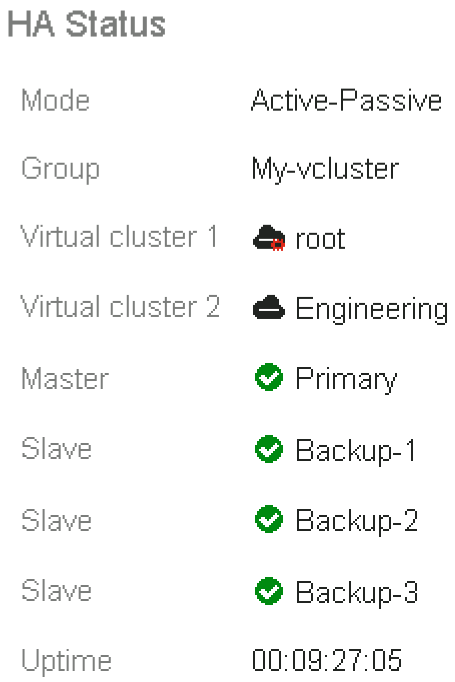
```
config global
   config system ha
      config secondary-vcluster
         set priority 100
      end
```

6. Set the virtual cluster 2 priority of the Backup-3 FortiGate to 150 so that if the backup FortiGate fails, Backup-3 will have the highest virtual cluster 2 device priority. The FGCP synchronizes all other HA settings from the primary FortiGate.
   You can only configure the virtual cluster 2 priority of the backup FortiGate from the CLI. Use execute ha manage to access the backup FortiGate CLI.

```
config global
   config system ha
      config secondary-vcluster
         set priority 150
      end
```

Checking virtual cluster operation

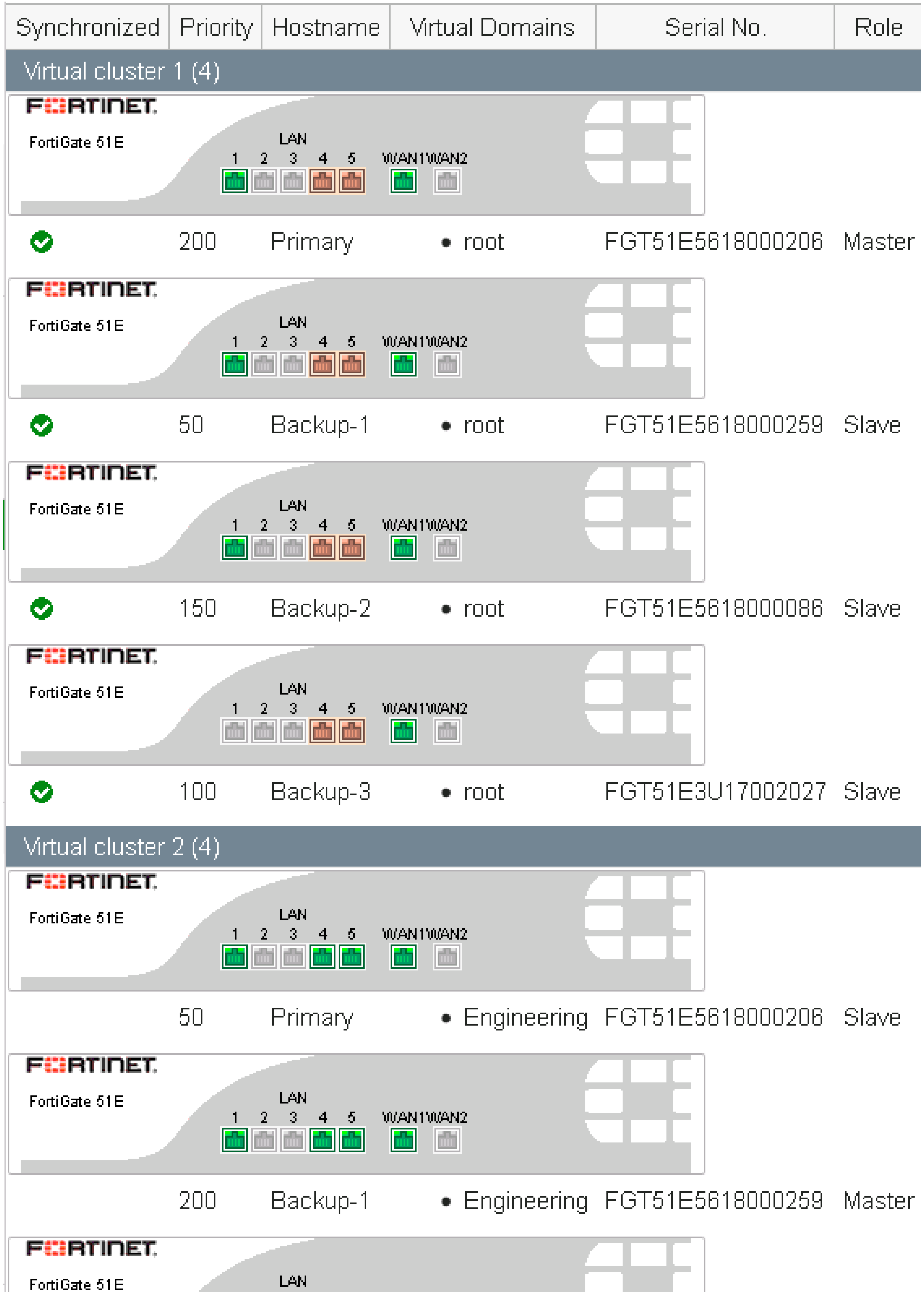
1. Once again use the `diagnose sys ha checksum` cluster command and the `get system ha status` command to check the cluster synchronization status to make sure the primary and backup FortiGates both have the same configuration.
   The **HA Status** dashboard widget shows the VDOMs in the virtual clusters. You can hover over the VDOM names to see status information for the VDOMs. You can hover over the host names of each FortiGate to verify that they are synchronized and both have the same checksum.



HA Status

Mode	Active-Passive
Group	My-vcluster
Virtual cluster 1	root
Virtual cluster 2	Engineering
Master	✓ Primary
Slave	✓ Backup-1
Slave	✓ Backup-2
Slave	✓ Backup-3
Uptime	00:09:27:05

2. To view more information about the cluster status, click on the **HA Status** widget and select **Configure Settings in System > HA** (or go to **System > HA**).
   The HA status page shows all four FortiGates in the cluster. It also shows that Primary is the primary FortiGate for the root VDOM (so the primary FortiGate processes all root VDOM traffic). The page also shows that Backup-1 is the primary FortiGate for the Engineering VDOM (so the backup FortiGate processes all Engineering VDOM traffic).



Synchronized	Priority	Hostname	Virtual Domains	Serial No.	Role
Virtual cluster 1 (4)					
✓	200	Primary	● root	FGT51E5618000206	Master
✓	50	Backup-1	● root	FGT51E5618000259	Slave
✓	150	Backup-2	● root	FGT51E5618000086	Slave
✓	100	Backup-3	● root	FGT51E3U17002027	Slave
Virtual cluster 2 (4)					
	50	Primary	● Engineering	FGT51E5618000206	Slave
	200	Backup-1	● Engineering	FGT51E5618000259	Master

Results

All root VDOM traffic should now be flowing through the primary FortiGate and Engineering VDOM traffic should be flowing through the backup FortiGate. If the primary FortiGate becomes unavailable, the cluster negotiates and traffic fails over and all traffic would be processed by the backup FortiGate.

To test this, ping a reliable IP address from a PC on the internal network. After a moment, power off the primary FortiGate.

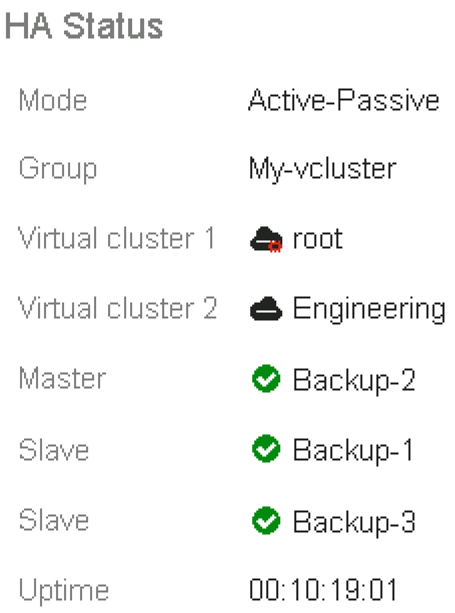
If you are using port monitoring, you can also unplug the primary FortiGate's Internet-facing interface to test failover.

You will see a momentary pause in the ping results, until traffic diverts to the backup FortiGate, allowing the ping traffic to continue.

```
64 bytes from 184.25.76.114: icmp_seq=69 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=70 ttl=52 time=8.822 ms\
64 bytes from 184.25.76.114: icmp_seq=71 ttl=52 time=9.034 ms\
64 bytes from 184.25.76.114: icmp_seq=72 ttl=52 time=9.536 ms\
64 bytes from 184.25.76.114: icmp_seq=73 ttl=52 time=8.877 ms\
64 bytes from 184.25.76.114: icmp_seq=74 ttl=52 time=8.901 ms\
Request timeout for icmp_seq 75\
64 bytes from 184.25.76.114: icmp_seq=76 ttl=52 time=8.860 ms\
64 bytes from 184.25.76.114: icmp_seq=77 ttl=52 time=9.174 ms\
64 bytes from 184.25.76.114: icmp_seq=78 ttl=52 time=10.108 ms\
64 bytes from 184.25.76.114: icmp_seq=79 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=80 ttl=52 time=10.861 ms\
64 bytes from 184.25.76.114: icmp_seq=81 ttl=52 time=10.757 ms\
64 bytes from 184.25.76.114: icmp_seq=82 ttl=52 time=8.158 ms\
64 bytes from 184.25.76.114: icmp_seq=83 ttl=52 time=8.639 ms}
```

You can log into the cluster GUI or CLI using the same IP address as you had been using to the log into the primary FortiGate. If the primary FortiGate is powered off you will be logging into the Backup-1 FortiGate. Check the host name to verify the FortiGate that you have logged into.

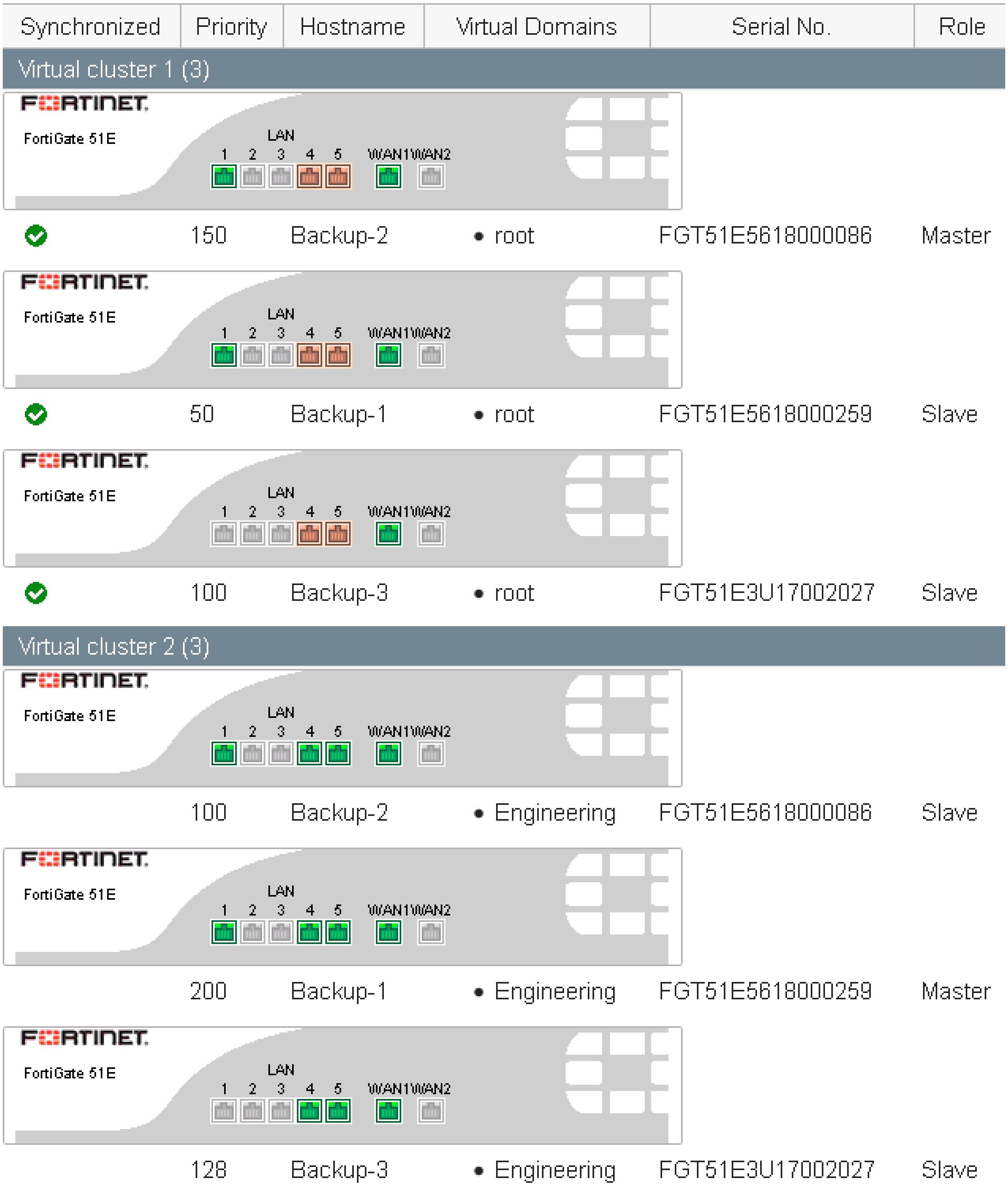
After the primary FortiGate fails the **HA Status** dashboard widget shows that the Backup-2 has become the primary FortiGate.



HA Status

Mode	Active-Passive
Group	My-vcluster
Virtual cluster 1	root
Virtual cluster 2	Engineering
Master	✓ Backup-2
Slave	✓ Backup-1
Slave	✓ Backup-3
Uptime	00:10:19:01

The **System > HA** page shows that the Backup-2 FortiGate has become the primary FortiGate for virtual cluster 1. This page also shows that the Backup-1 FortiGate continues to process virtual cluster 2 traffic.



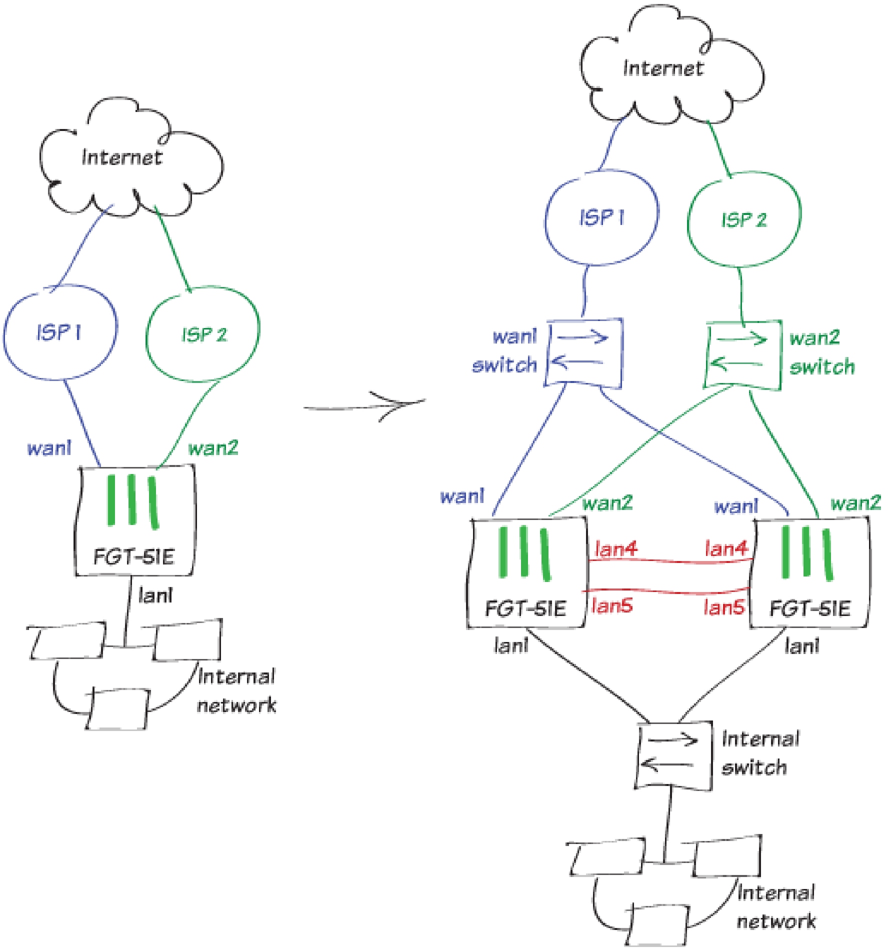
Synchronized	Priority	Hostname	Virtual Domains	Serial No.	Role
Virtual cluster 1 (3)					
✓	150	Backup-2	• root	FGT51E5618000086	Master
✓	50	Backup-1	• root	FGT51E5618000259	Slave
✓	100	Backup-3	• root	FGT51E3U17002027	Slave
Virtual cluster 2 (3)					
	100	Backup-2	• Engineering	FGT51E5618000086	Slave
	200	Backup-1	• Engineering	FGT51E5618000259	Master
	128	Backup-3	• Engineering	FGT51E3U17002027	Slave

If you restart the primary FortiGate, after a few minutes it should rejoin the cluster and because override is enabled, the original virtual cluster configuration should be re-established. Traffic may be temporarily disrupted when the restarted primary FortiGate rejoins the cluster.

You can also try powering off other FortiGates in the virtual cluster to see how the cluster adapts to the failover. Because of the device priority configuration, if two FortiGates are operating, virtual cluster 1 and virtual cluster 2 traffic will be distributed between them.

SD-WAN with FGCP HA (expert)

FORTIOS VERSION 6.0

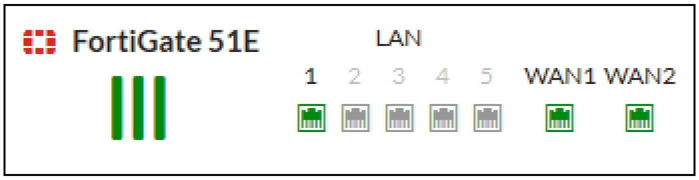


This use case provides an example of how to set up a FortiGate for redundant Internet connectivity using SD-WAN and then convert this single FortiGate into an FGCP HA cluster of two FortiGates. This SD-WAN HA configuration allows you to load balance your Internet traffic between multiple ISP links and provides redundancy for your network's Internet connection if your primary ISP is unavailable or if one of the FortiGates in the HA cluster fails.

This use case features two FortiGate-51Es, which have a 5-port switch lan interface. Before starting the steps in this recipe, we converted the lan interface to 5 separate interfaces (lan1 to lan5). The lan1 interface connects to the internal network, the wan1 interface connects to one Internet service provider (ISP) and the wan2 to a second ISP. For the FGCP HA configuration, the lan4 and lan5 interfaces become HA heartbeat interfaces.

Connecting the FortiGate to your ISPs

Connect the Internet-facing ports (WAN ports) on the FortiGate to your ISP devices. Connect WAN1 to the ISP that you want to use for most traffic. Connect WAN2 to the other ISP.



Removing existing configuration references to interfaces

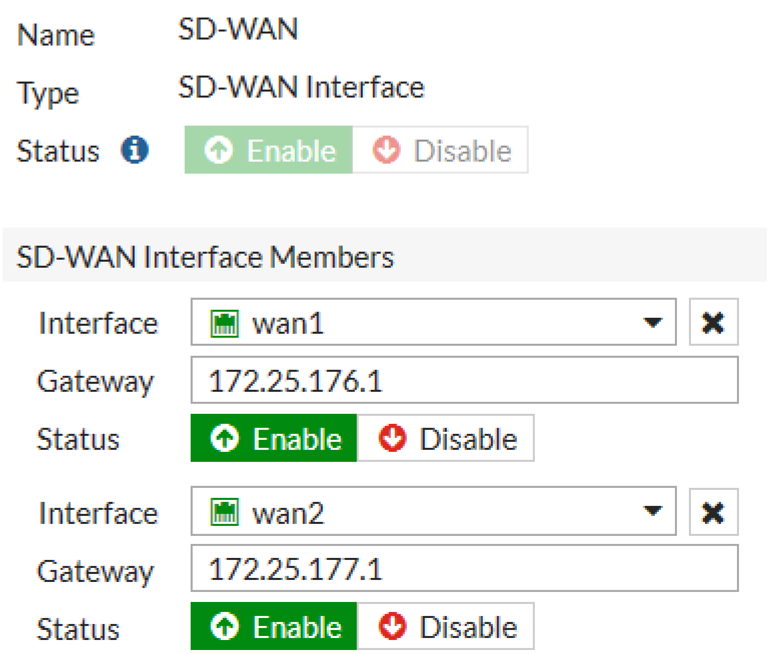
Before you can configure FortiGate interfaces as SD-WAN members, you must remove or redirect existing configuration references to those interfaces in routes and security policies. This includes the default Internet access policy that's included with many FortiGate models. Note that after you remove the routes and security policies, traffic can't reach the WAN ports through the FortiGate.

Redirecting the routes and policies to reference other interfaces avoids your having to create them again later. After you configure SD-WAN, you can reconfigure the routes and policies to reference the SD-WAN interface.

1. Go to **Network > Static Routes** and delete any routes that use WAN1 or WAN2.
2. Go to **Policy & Objects >IPv4 Policy** and delete any policies that use WAN1 or WAN2.

Creating the SD-WAN interface

1. Go to **Network > SD-WAN** and set **Status** to **Enable**.
   Under SD-WAN Interface Members, select + and select wan1. Set the Gateway to the default gateway for this interface. This is usually the default gateway IP address of the ISP that this interface is connected to. Repeat these steps to add wan2.



Name SD-WAN

Type SD-WAN Interface

Status ● Enable ○ Disable

SD-WAN Interface Members

Interface wan1 ✖

Gateway 172.25.176.1

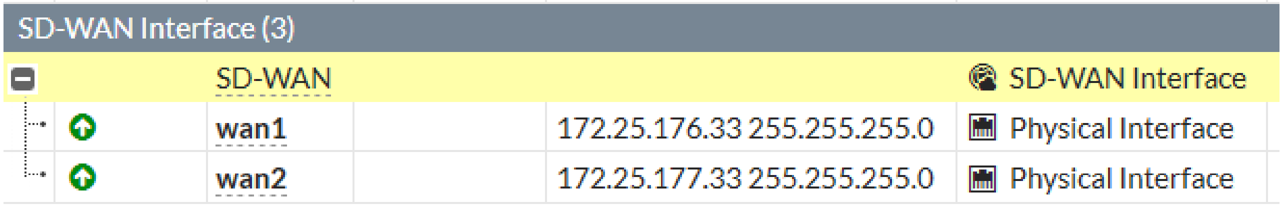
Status ● Enable ○ Disable

Interface wan2 ✖

Gateway 172.25.177.1

Status ● Enable ○ Disable

2. Go to **Network > Interfaces** and verify that the virtual interface for SD-WAN appears in the interface list. You can expand SD-WAN to view the ports that are included in the SD-WAN interface.

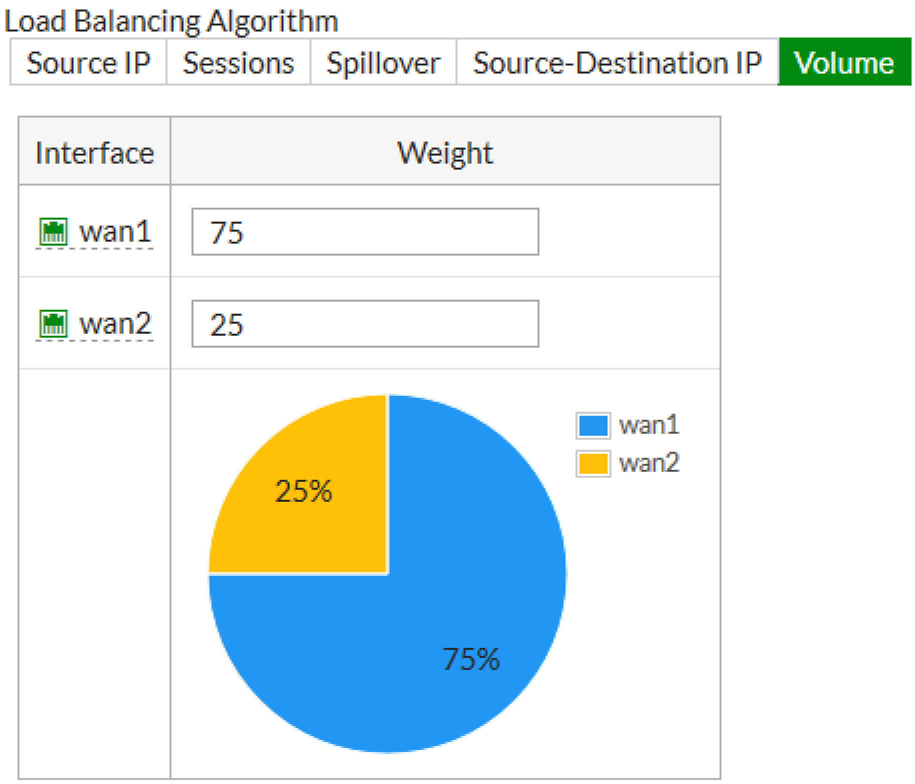


SD-WAN Interface (3)

⊟	SD-WAN			SD-WAN Interface
✓	wan1		172.25.176.33 255.255.255.0	Physical Interface
✓	wan2		172.25.177.33 255.255.255.0	Physical Interface

Configuring SD-WAN load balancing

1. Go to **Network > SD-WAN Rules** and edit the rule named **sd-wan**.
2. In the **Load Balancing Algorithm** field, select **Volume**, and prioritize WAN1 to serve more traffic.
   In the example, the ISP connected to WAN1 is a 40Mb link, and the ISP connected to WAN2 is a 10Mb link, so we balance the weight 75% to 25% in favor of WAN1.

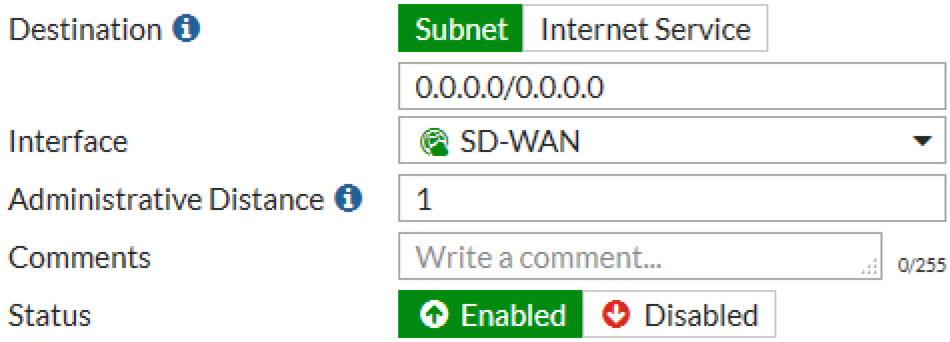


Load Balancing Algorithm: Source IP | Sessions | Spillover | Source-Destination IP | **Volume**

Interface	Weight
wan1	75
wan2	25

Creating a static route for the SD-WAN interface

1. Go to **Network > Static Routes** and create a route.
2. In the **Destination** field, select **Subnet**, and leave the destination IP address and subnet mask as 0.0.0.0/0.0.0.0.
3. In the Interface field, select the SD-WAN interface from the drop-down menu.
4. Ensure that **Status** is set to **Enable**.

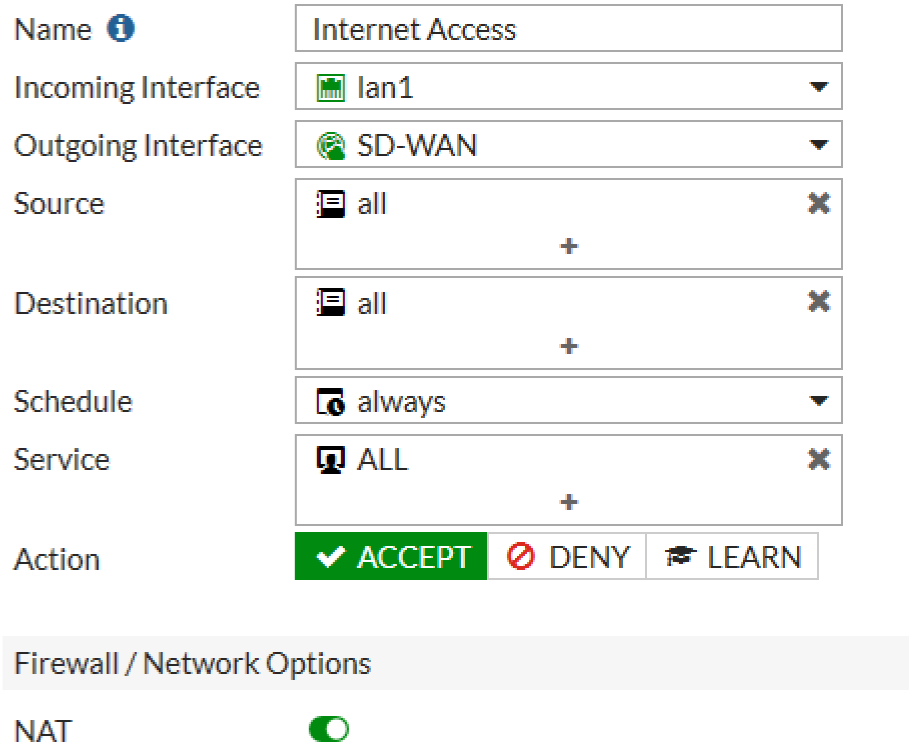


Destination	**Subnet** | Internet Service 0.0.0.0/0.0.0.0
Interface	SD-WAN
Administrative Distance	1
Comments	Write a comment... 0/255
Status	**Enabled** | Disabled

5. If you previously removed or redirected existing references in routes to interfaces that you wanted to add as SD-WAN interface members, you can now reconfigure those routes to reference the SD-WAN interface.

Configuring a security policy for SD-WAN

1. Configure a security policy that allows traffic from your organization’s internal network to the SD-WAN interface.
2. Go to **Policy & Objects >IPv4 Policy** and create a policy.
3. Set **Incoming Interface** to the interface that connects to your organization's internal network, and set **Outgoing Interface** to the SD-WAN interface.
4. Enable **NAT** and apply **Security Profiles** as required.
5. Configure other policy options as required.



Name: Internet Access

Incoming Interface: lan1

Outgoing Interface: SD-WAN

Source: all

Destination: all

Schedule: always

Service: ALL

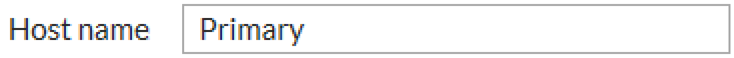
Action: ✓ ACCEPT | DENY | LEARN

Firewall / Network Options

NAT: ●

Configuring the FortiGate for HA

1. Change the **Host name** to identify this FortiGate as the primary FortiGate. From the **System Information** dashboard widget, select **Configure settings in System > Settings**.

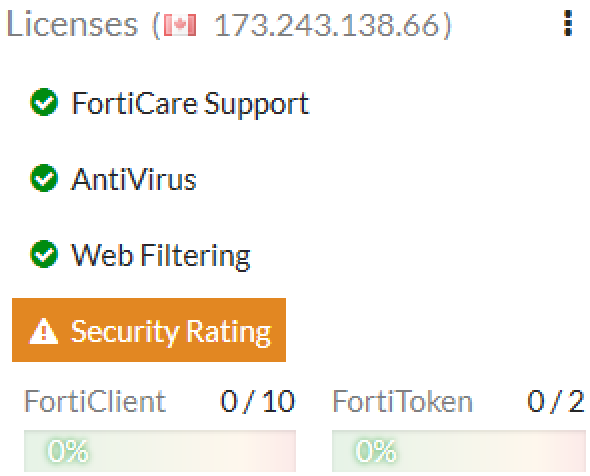


Host name: Primary

You can also enter this CLI command:

```
config system global
   set hostname Primary
end
```

2. Register and apply licenses to the primary FortiGate before configuring it for HA operation.


Licenses (173.243.138.66)

✓ FortiCare Support

✓ AntiVirus

✓ Web Filtering

Security Rating

FortiClient 0 / 10 0%

FortiToken 0 / 2 0%

3. Enter this CLI command to set the HA mode to active-passive; set a group ID, group name and password; increase the device priority to a higher value (for example, 250); and enable override.

```
config system ha
set mode a-p
   set group-id 100
   set group-name My-cluster
   set password <password>
   set priority 250
   set override enable
   set hbdev lan4 200 lan5 100
end
```

Enabling override and increasing the device priority means this FortiGate always becomes the primary unit.

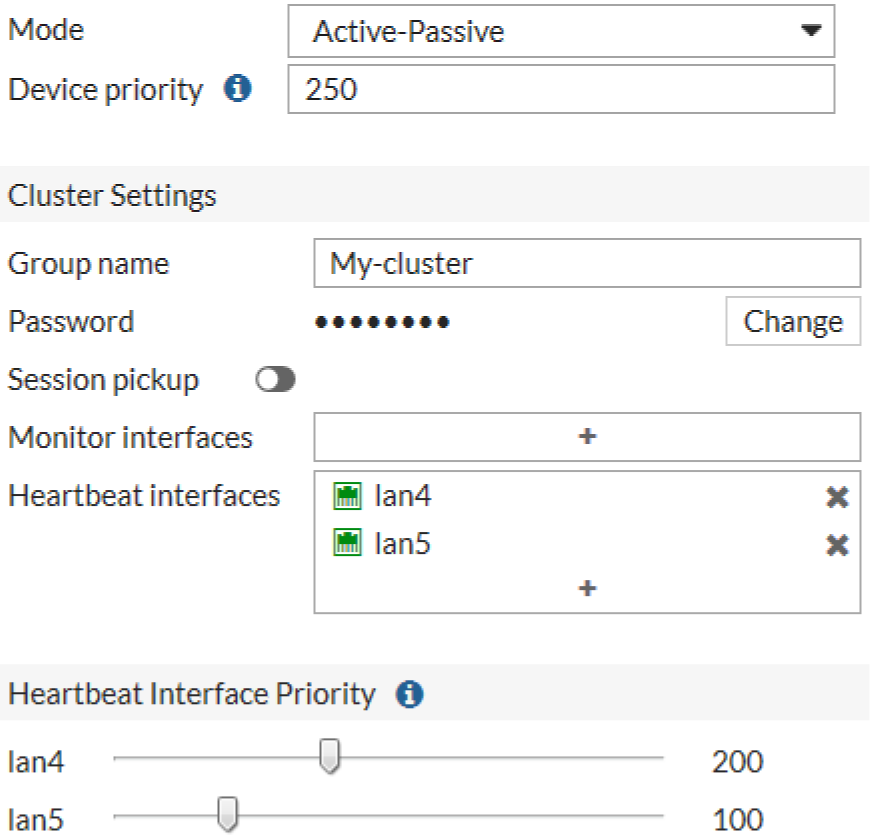
This configuration also selects lan4 and lan5 to be the heartbeat interfaces and sets their priorities to 200 and 100 respectively. It's a best practice to set different priorities for the heartbeat interfaces (but not a requirement).

If you have more than one cluster on the same network, each cluster should have a different group ID. Changing the group id changes the cluster interface virtual MAC addresses. If your group ID causes a MAC address conflict on your network, you can select a different group ID.

Override and the group ID can only be configured from the CLI.

```
config system ha
   set group-id 100
   set override enable
end
```

4. You can also configure most of these settings from the GUI (go to **System > HA**).



Mode: Active-Passive

Device priority: 250

Cluster Settings

Group name: My-cluster

Password: •••••••• Change

Session pickup: off

Monitor interfaces: +

Heartbeat interfaces: lan4, lan5

Heartbeat Interface Priority

lan4: 200

lan5: 100

After you enter the CLI command or make changes from the GUI, the FortiGate negotiates to establish an HA cluster. You may temporarily lose connectivity with the FortiGate as FGCP negotiation takes place and the MAC addresses of the FortiGate interfaces are changed to HA virtual MAC addresses.

If these steps don't start HA mode, make sure that none of the FortiGate's interfaces use DHCP or PPPoE addressing.

To reconnect sooner, you can update the ARP table of your management PC by deleting the ARP table entry for the FortiGate unit (or just deleting all ARP table entries). You can usually delete the ARP table from a command prompt using a command similar to `arp -d`.

Configuring the backup FortiGate

If required, change the firmware running on the new FortiGate to the same version as is running on the primary FortiGate.

Enter the following command to reset the new backup FortiGate to factory default settings.

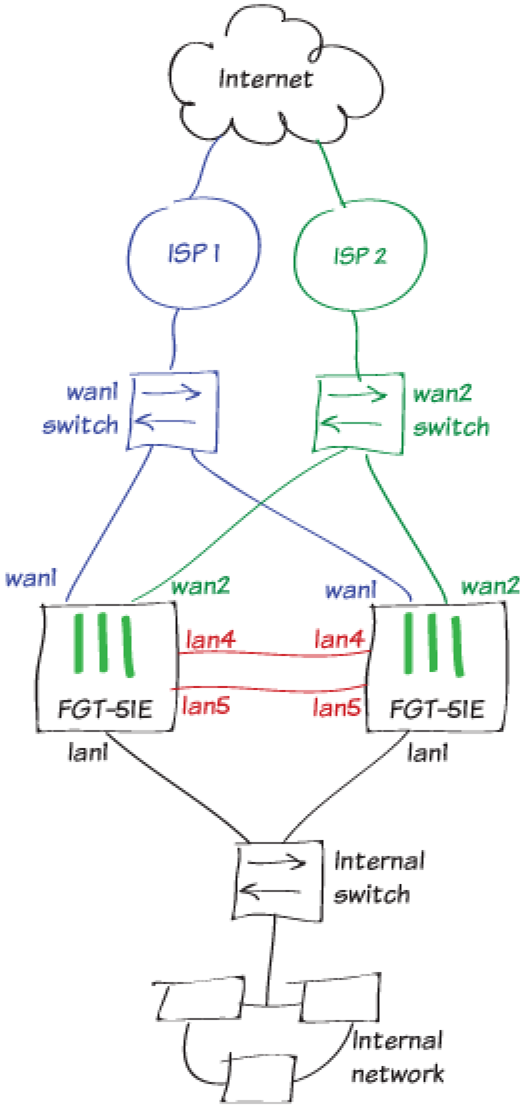
```
execute factoryreset
```

You can skip this step if the new FortiGate is fresh from the factory. But if its configuration has been changed at all, it's a best practice to reset your FortiGate to factory defaults to reduce the chance of synchronization problems.

Connecting the primary and backup FortiGates

Connect the primary and backup FortiGates to each other and to your network as shown. Making these connections disrupts network traffic as you disconnect and re-connect cables.

Switches must be used between the cluster and the ISPs and between the cluster and the internal network as shown in the network diagram. You can use any good quality switches to make these connections. You can also use one switch for all of these connections as long as you configure the switch to separate traffic from the different networks.



The example shows the recommended configuration of direct connections between the lan4 heartbeat interfaces and between the lan5 heartbeat interfaces.

When the heartbeat interfaces are connected, the FortiGates find each other and negotiate to form a cluster. The primary FortiGate synchronizes its configuration to the backup FortiGate. The cluster forms automatically with minimal or no additional disruption to network traffic.

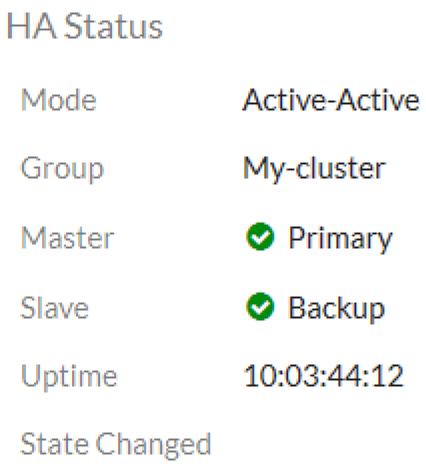
The cluster will have the same IP addresses as the primary FortiGate had. You can log into the cluster by logging into the primary FortiGate CLI or GUI using one of the original IP addresses of the primary FortiGate.

Checking cluster operation

Check the cluster synchronization status to make sure the primary and backup FortiGates both have the same configuration.

1. Log into the primary FortiGate CLI and enter this command:
   ```
   diagnose sys ha checksum cluster
   ```
   The command output lists all cluster members' configuration checksums. If both cluster members have identical checksums you can be sure that their configurations are synchronized. If the checksums are different, wait a short while and enter the command again. Repeat until the checksums are identical. It may take a while for some parts of the configuration to be synchronized.

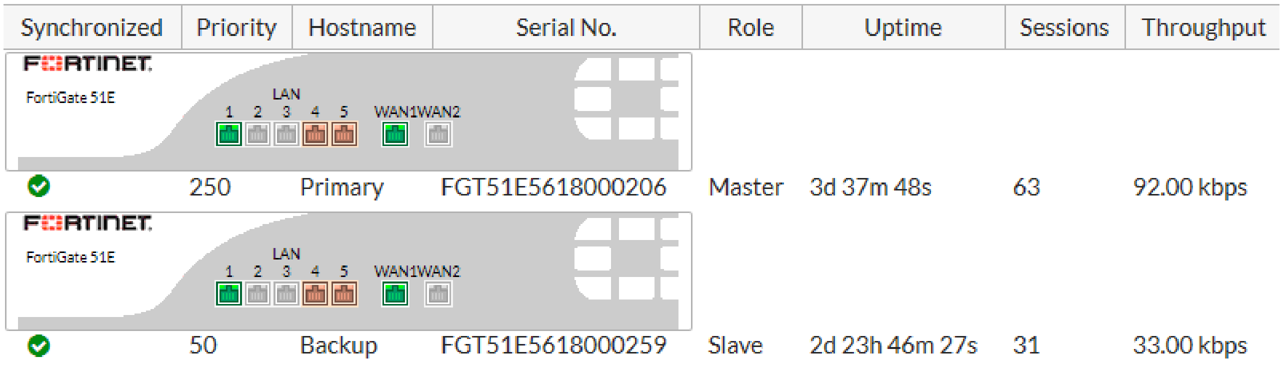
   If the checksums never become identical visit the Fortinet Support website for assistance.
2. The **HA Status** dashboard widget also shows synchronization status. Mouse over the host names of each FortiGate in the widget to verify that they are synchronized and both have the same checksum.



HA Status

Mode	Active-Active
Group	My-cluster
Master	✓ Primary
Slave	✓ Backup
Uptime	10:03:44:12
State Changed	

3. To view more information about the cluster status, click on the **HA Status** widget and select **Configure Settings in System > HA** (or go to **System > HA**).



Synchronized	Priority	Hostname	Serial No.	Role	Uptime	Sessions	Throughput
✓	250	Primary	FGT51E5618000206	Master	3d 37m 48s	63	92.00 kbps
✓	50	Backup	FGT51E5618000259	Slave	2d 23h 46m 27s	31	33.00 kbps

Disabling override (recommended)

When the checksums are identical, disable override on the primary FortiGate by entering the following command:

```
config system ha
   set override disable
end
```

FGCP clusters dynamically respond to network conditions. If you keep override enabled, the same FortiGate always becomes the primary FortiGate. With override enabled; however, the cluster may negotiate more often to keep the same FortiGate as the primary FortiGate, potentially increasing traffic disruptions.

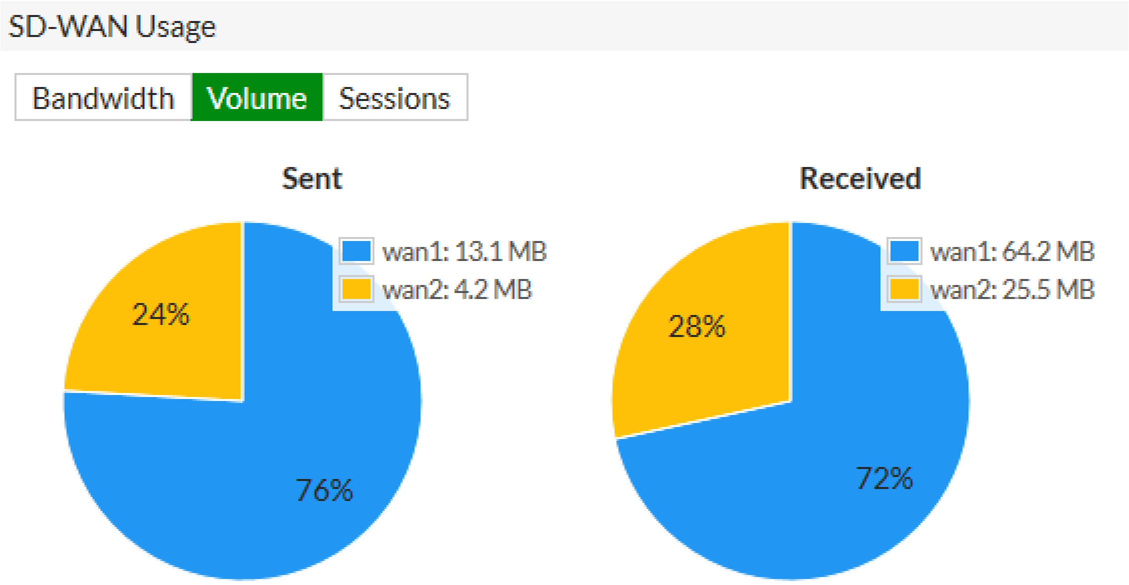
If you disable override it is more likely that the backup FortiGate could become the primary FortiGate. Disabling override is recommended unless its important that the same FortiGate remains the primary FortiGate

To see how enabling override can cause minor traffic disruptions, with override enabled set up a continuous ping through the cluster. Then disconnect power to the backup unit. You will most likely notice a brief disruption in the ping traffic. Try the same thing with override disabled and you shouldn't see this traffic disruption.

With override enabled, the disruption is minor and shouldn't be noticed by most users. For smoother operation, the best practice is to disable override.

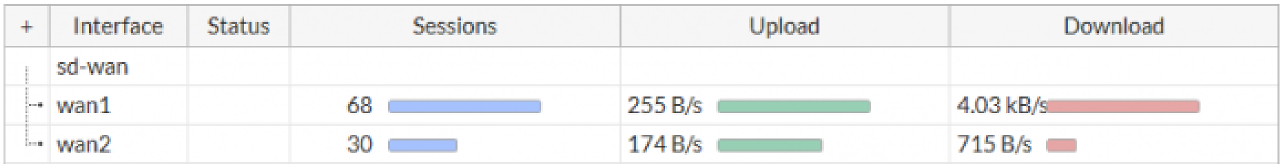
Results

1. Browse the Internet using a computer on your internal network.
2. Go to **Network > SD-WAN**.
   In the **SD-WAN Usage** section, you can see the bandwidth, volume, and sessions for traffic on the SD-WAN interfaces.



3. Go to **Monitor > SD-WAN Monitor** to view the number of sessions, bit rate, and more information for each

interface.



+	Interface	Status	Sessions	Upload	Download
	sd-wan				
	wan1		68	255 B/s	4.03 kB/s
	wan2		30	174 B/s	715 B/s

Testing HA failover

All traffic should now be flowing through the primary FortiGate. If the primary FortiGate becomes unavailable, traffic fails over to the backup FortiGate. When the primary FortiGate rejoins the cluster, the backup FortiGate should continue operating as the primary FortiGate.

To test this, ping a reliable IP address from a PC on the internal network. After a moment, power off the primary FortiGate.

If you are using port monitoring, you can also unplug the primary FortiGate's Internet-facing interface to test failover

You will see a momentary pause in the ping results, until traffic diverts to the backup FortiGate, allowing the ping traffic to continue.

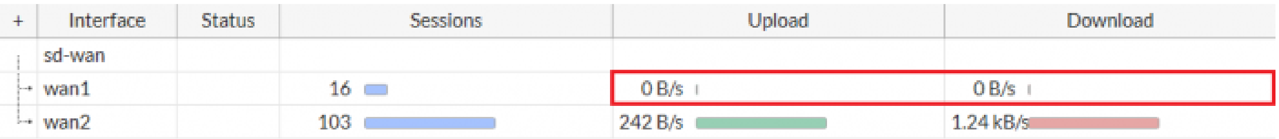
```
64 bytes from 184.25.76.114: icmp_seq=69 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=70 ttl=52 time=8.822 ms\
64 bytes from 184.25.76.114: icmp_seq=71 ttl=52 time=9.034 ms\
64 bytes from 184.25.76.114: icmp_seq=72 ttl=52 time=9.536 ms\
64 bytes from 184.25.76.114: icmp_seq=73 ttl=52 time=8.877 ms\
64 bytes from 184.25.76.114: icmp_seq=74 ttl=52 time=8.901 ms\
Request timeout for icmp_seq 75\
64 bytes from 184.25.76.114: icmp_seq=76 ttl=52 time=8.860 ms\
64 bytes from 184.25.76.114: icmp_seq=77 ttl=52 time=9.174 ms\
64 bytes from 184.25.76.114: icmp_seq=78 ttl=52 time=10.108 ms\
64 bytes from 184.25.76.114: icmp_seq=79 ttl=52 time=8.719 ms\
64 bytes from 184.25.76.114: icmp_seq=80 ttl=52 time=10.861 ms\
64 bytes from 184.25.76.114: icmp_seq=81 ttl=52 time=10.757 ms\
64 bytes from 184.25.76.114: icmp_seq=82 ttl=52 time=8.158 ms\
64 bytes from 184.25.76.114: icmp_seq=83 ttl=52 time=8.639 ms}
```

You can log into the cluster GUI or CLI using the same IP address as you had been using to the log into the primary FortiGate. If the primary FortiGate is powered off you will be logging into the backup FortiGate. Check the host name to verify the FortiGate that you have logged into. The FortiGate continues to operate in HA mode and if you restart the primary FortiGate, after a few minutes it should rejoin the cluster and operate as the backup FortiGate. Traffic should not be disrupted when the restarted primary unit rejoins the cluster.

Testing ISP failover

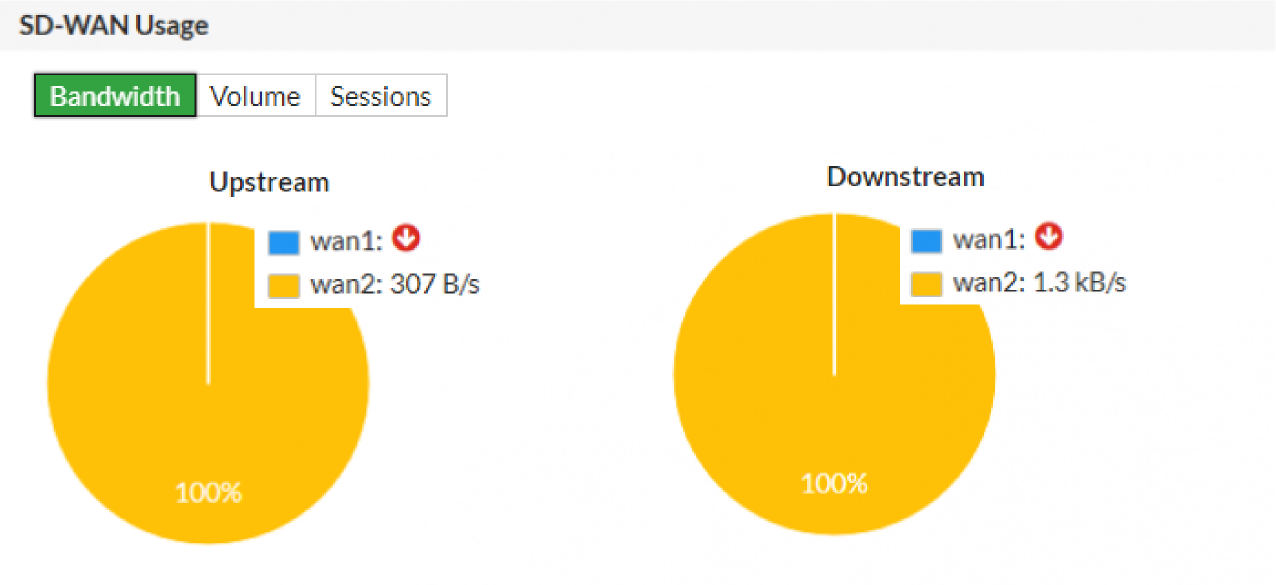
1. To test failover of the redundant Internet configuration, you must simulate a failed Internet connection to one of the ports. You can do so by disconnecting power from the wan1 switch or otherwise disconnecting the wan1 interfaces of both FortiGates from ISP 1.

2. Verify that users still have Internet access by navigating to **Monitor > SD-WAN Monitor.** The **Upload** and **Download** values for WAN1 show that traffic isn't going through that interface.



+	Interface	Status	Sessions	Upload	Download
	sd-wan				
	wan1		16	0 B/s	0 B/s
	wan2		103	242 B/s	1.24 kB/s

3. Go to **Network > SD-WAN**. In the **SD-WAN Usage** section, you can see that bandwidth, volume, and sessions have diverted entirely through WAN2.



Users on the internal network shouldn't notice the WAN1 failure. Likewise, if you're using the WAN1 gateway IP address to connect to the admin dashboard, nothing should change from your perspective. It appears as though you're still connecting through WAN1.

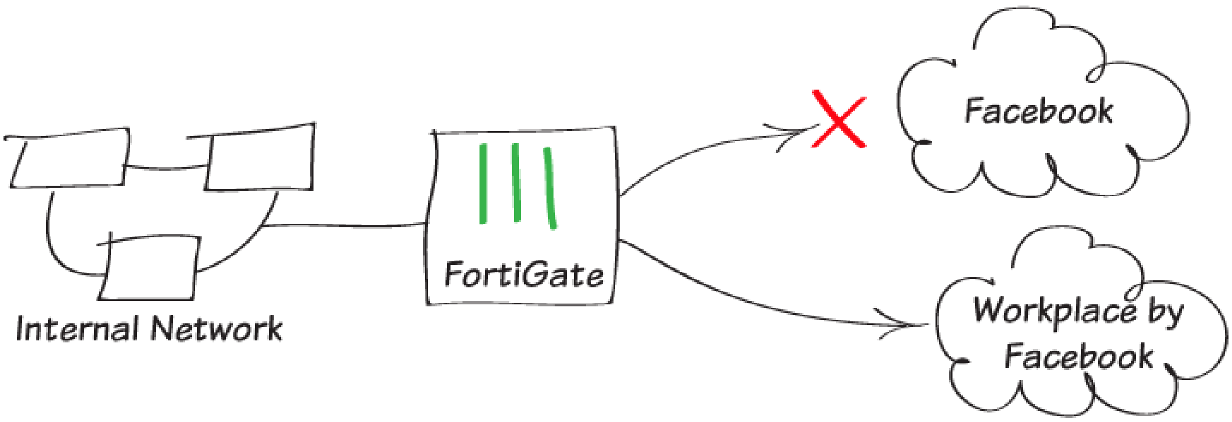
4. After you verify successful failover, re-establish the connection to ISP 1.

Security profiles

This section contains information about using FortiOS security features to protect your network.

Blocking Facebook while allowing Workplace by Facebook

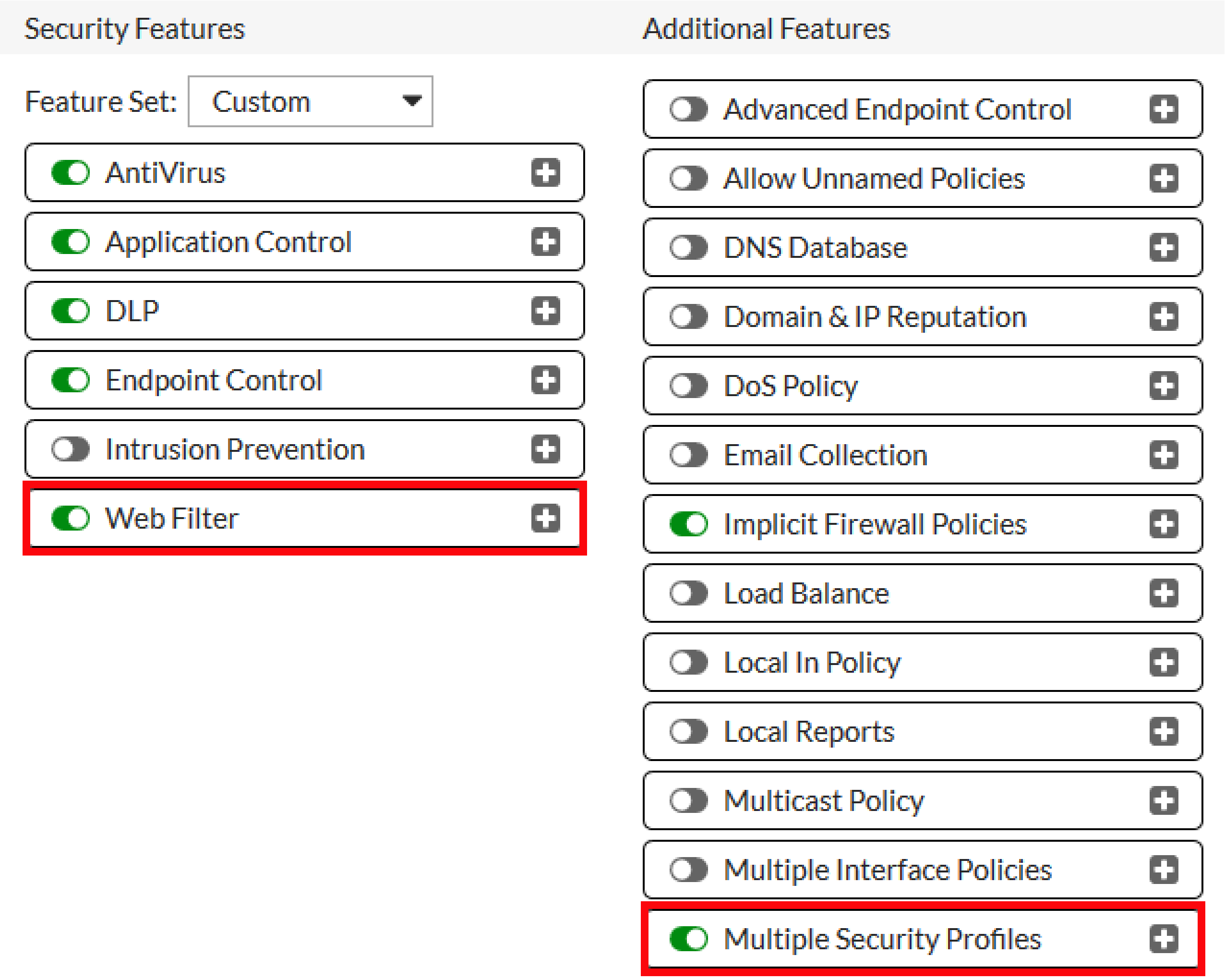
FORTIOS VERSION 6.0



In this recipe, you block access to Facebook using web filtering, while making an exception to allow access to Workplace by Facebook.

Creating a web filter profile

1. To make sure the features you need are available in the GUI, go to **System > Feature Visibility**. Under **Security Features**, enable **Web Filter**. Under **Additional Features**, enable **Multiple Security Profiles**.



Security Features

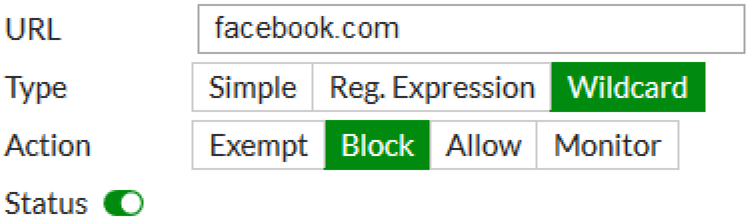
Feature Set: Custom

- ● AntiVirus
- ● Application Control
- ● DLP
- ● Endpoint Control
- ○ Intrusion Prevention
- ● Web Filter

Additional Features

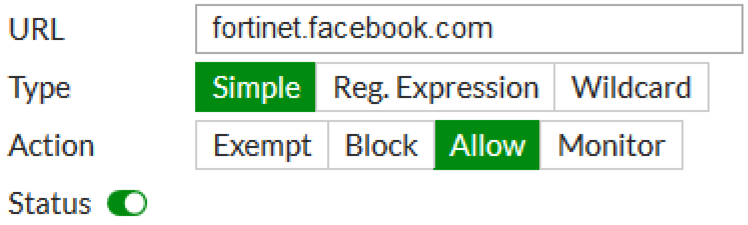
- ○ Advanced Endpoint Control
- ○ Allow Unnamed Policies
- ○ DNS Database
- ○ Domain & IP Reputation
- ○ DoS Policy
- ○ Email Collection
- ● Implicit Firewall Policies
- ○ Load Balance
- ○ Local In Policy
- ○ Local Reports
- ○ Multicast Policy
- ○ Multiple Interface Policies
- ● Multiple Security Profiles

2. To create a web filter profile, go to **Security Profiles > Web Filter** and select ⊕.
3. Enter a **Name** for the profile. Under **Static URL Filter**, enable **URL Filter**. Create a new URL filter to block Facebook. Set **URL** to *facebook.com*, **Type** to **Wildcard**, and **Action** to **Block**.



URL	facebook.com
Type	Simple / Reg. Expression / [✓ Wildcard]
Action	Exempt / [✓ Block] / Allow / Monitor
Status	●

4. Create a **URL** filter to allow Workplace by Facebook. Set URL to your Workplace by Facebook site (in the example, *fortinet.facebook.com*), **Type** to **Simple**, and **Action** to **Allow**.



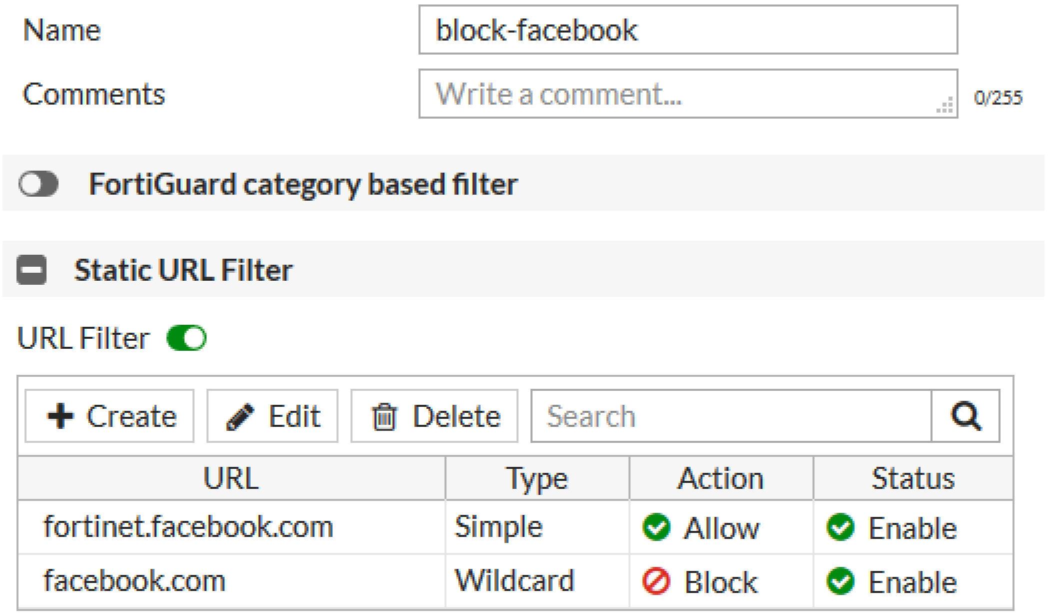
URL: fortinet.facebook.com

Type: Simple

Action: Allow

Status: enabled

URL filters are applied in the order that they are listed. Make sure the filter allowing Workplace by Facebook is located above the filter blocking Facebook.



Name: block-facebook

Comments: Write a comment... 0/255

FortiGuard category based filter: disabled

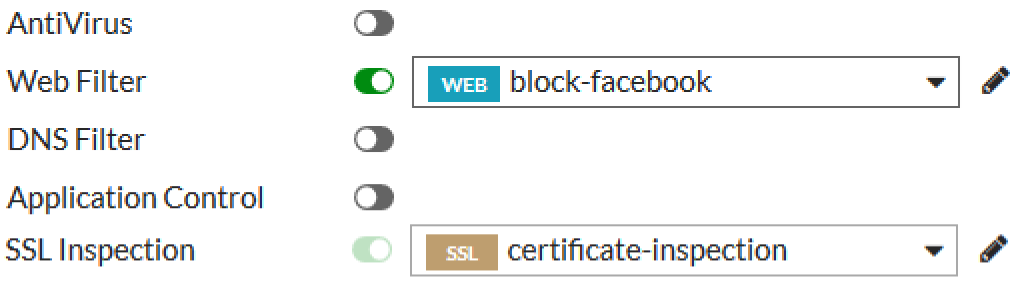
Static URL Filter

URL Filter: enabled

URL	Type	Action	Status
fortinet.facebook.com	Simple	✓ Allow	✓ Enable
facebook.com	Wildcard	⊘ Block	✓ Enable

Applying the security profiles

1. To apply the security profiles to traffic, go to **Policy > IPv4 Policy** and edit the policy allowing Internet access.
2. Under **Security Profiles**, enable **Web Filter** and set it to use the new profiles.
3. Set **SSL Inspection** to **certificate-inspection**.



AntiVirus: disabled

Web Filter: enabled, WEB block-facebook

DNS Filter: disabled

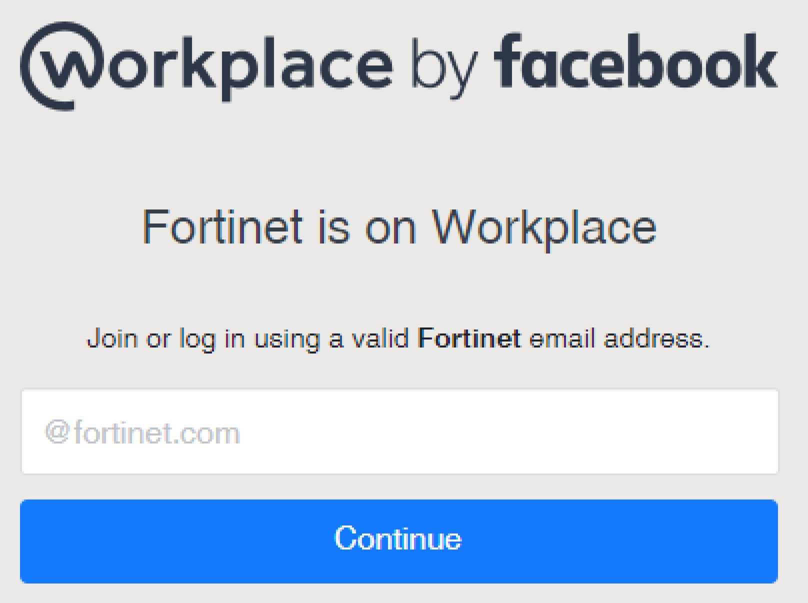
Application Control: disabled

SSL Inspection: enabled, SSL certificate-inspection

Results

Attempt to access www.facebook.com. Access is blocked. Access is also blocked for the Facebook app.

Browse to your Workplace by Facebook site. Access is allowed.



Workplace by facebook

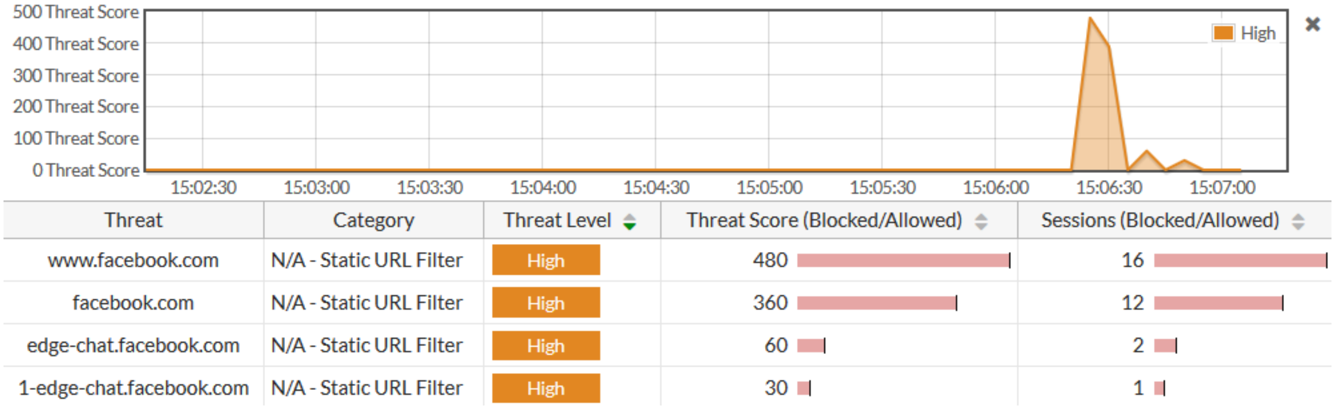
Fortinet is on Workplace

Join or log in using a valid **Fortinet** email address.

@fortinet.com

Continue

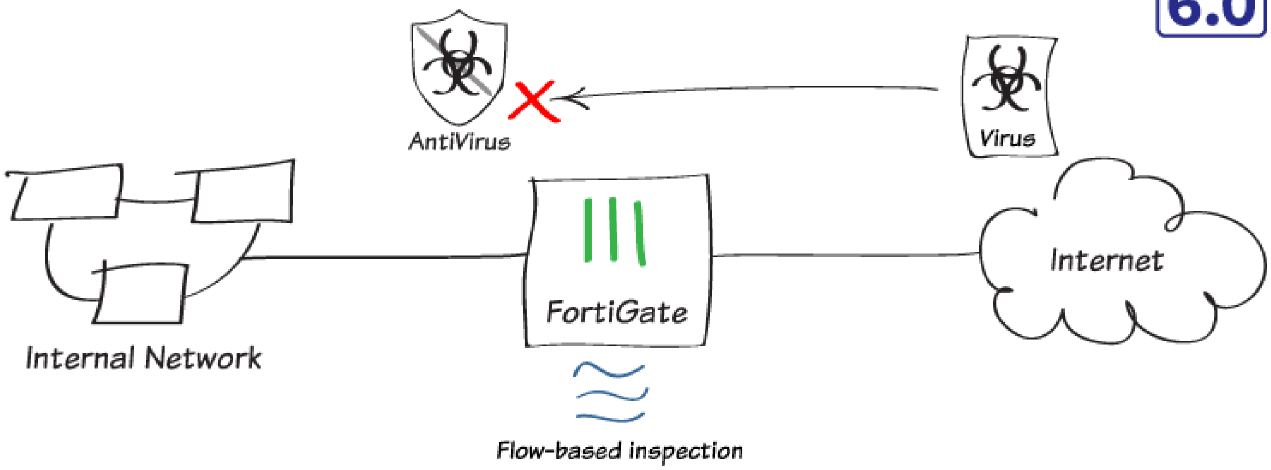
To view information about the blocked traffic, go to **FortiView > Threats**. The page shows the blocked attempts to access Facebook.



Threat	Category	Threat Level	Threat Score (Blocked/Allowed)	Sessions (Blocked/Allowed)
www.facebook.com	N/A - Static URL Filter	High	480	16
facebook.com	N/A - Static URL Filter	High	360	12
edge-chat.facebook.com	N/A - Static URL Filter	High	60	2
1-edge-chat.facebook.com	N/A - Static URL Filter	High	30	1

Antivirus scanning using flow-based inspection

FORTIOS VERSION 6.0

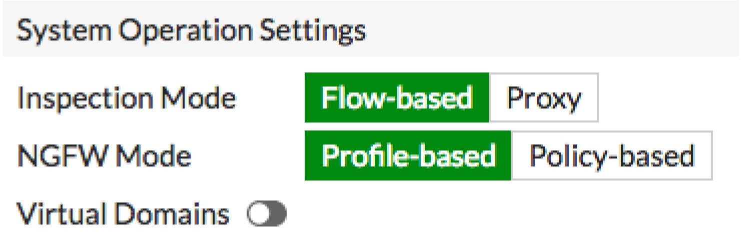


In this recipe, you will turn on flow-based inspection on your FortiGate and apply flow-based antivirus scanning to network traffic.

For more information about the different antivirus inspection modes available in FortiOS, see FortiOS antivirus inspection modes.

Verifying the inspection mode

1. Flow-based is the default inspection mode for FortiOS. To verify that your FortiGate is in this mode, go to **System > Settings** and locate **System Operations Settings**.
2. Verify that **Inspection Mode** is set to **Flow-based** and **NGFW Mode** is set to **Profile-based**.



System Operation Settings

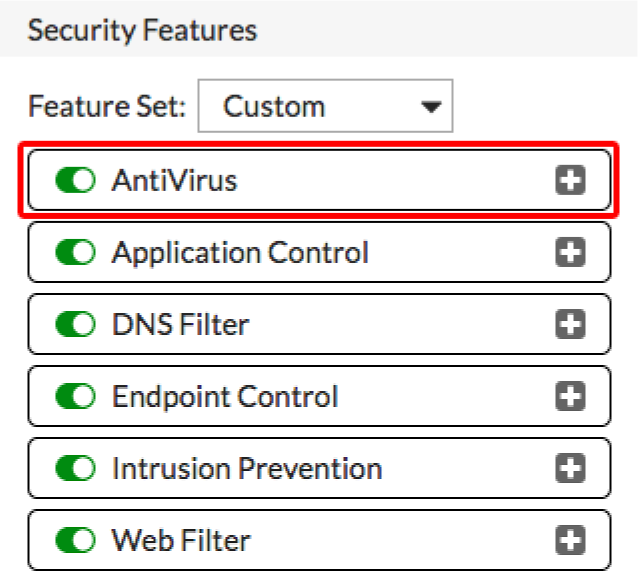
Inspection Mode [✓ Flow-based] Proxy

NGFW Mode [✓ Profile-based] Policy-based

Virtual Domains ○

Configuring the AntiVirus profile

1. Go to **System > Feature Visibility** and verify that **AntiVirus** is enabled under **Security Features**.

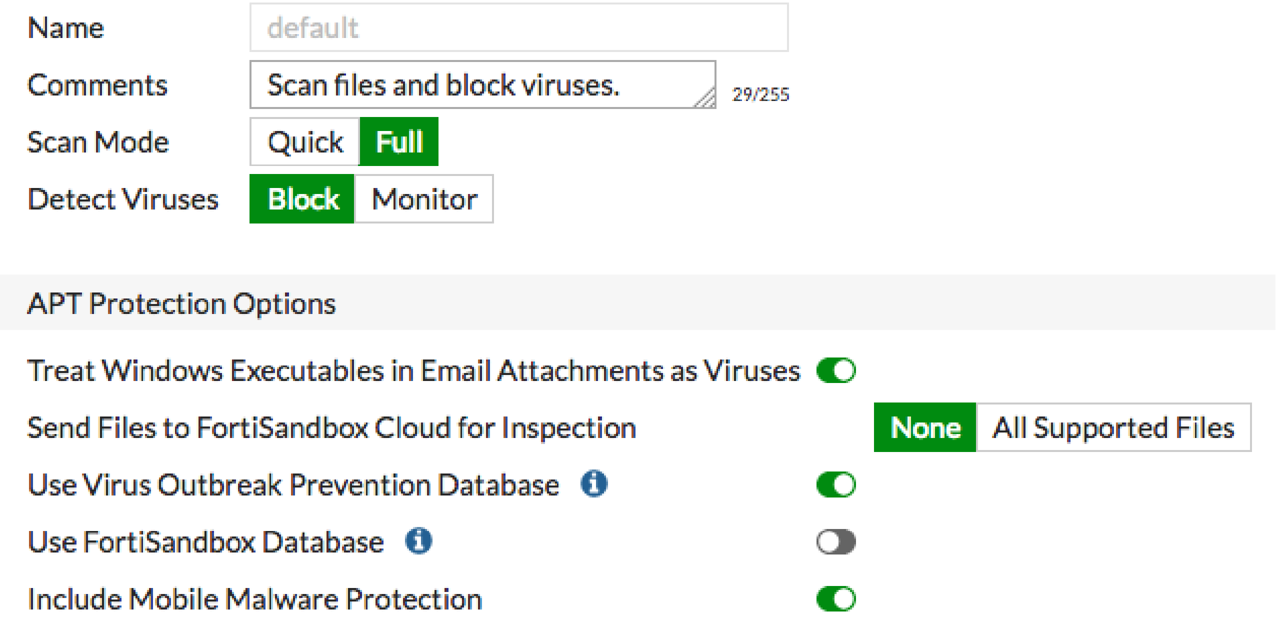


Security Features

Feature Set: Custom

- ● AntiVirus
- ● Application Control
- ● DNS Filter
- ● Endpoint Control
- ● Intrusion Prevention
- ● Web Filter

2. To edit the default antivirus profile, go to **Security > Profiles AntiVirus**.
3. Set **Scan Mode** to **Full** and **Detect Viruses** to **Block**.
4. Under **APT Protection Options**, enable **Use Virus Outbreak Prevention Database** to provide an additional layer of protection from early stage virus outbreaks.



Name: default

Comments: Scan files and block viruses. 29/255

Scan Mode: Quick [✓ Full]

Detect Viruses: [✓ Block] Monitor

APT Protection Options

Treat Windows Executables in Email Attachments as Viruses ●

Send Files to FortiSandbox Cloud for Inspection [✓ None] All Supported Files

Use Virus Outbreak Prevention Database ●

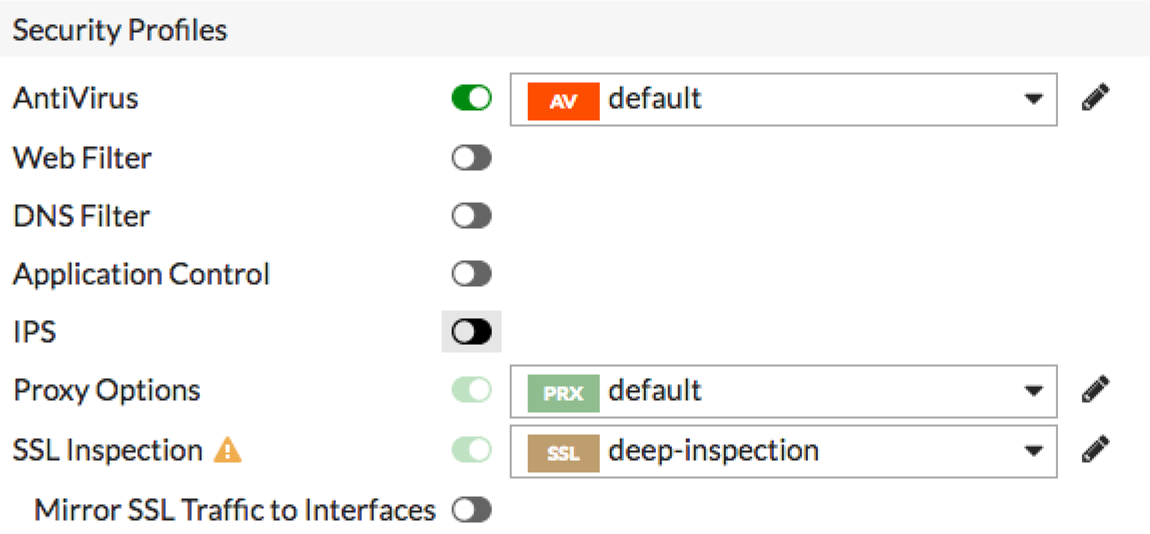
Use FortiSandbox Database ○

Include Mobile Malware Protection ●

Enabling antivirus in a policy

Delete this text and replace it with your own content.

1. To edit your Internet access policy, go to **Policy & Objects > IPv4 Policy**.
2. Under **Security Profiles**, enable **AntiVirus** and select the **default** profile.
3. **SSL Inspection** is enabled by default. Select **deep-inspection**.



Security Profiles

AntiVirus ● AV default

Web Filter ○

DNS Filter ○

Application Control ○

IPS ○

Proxy Options ● PRX default

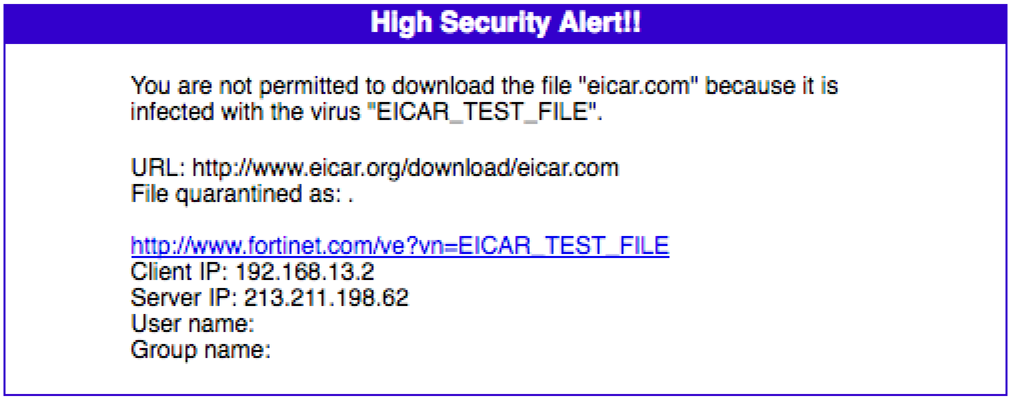
SSL Inspection ⚠ ● SSL deep-inspection

Mirror SSL Traffic to Interfaces ○

Using the deep-inspection profile may cause certificate errors. See **Preventing certification warnings** for more information.

Results

1. To test the antivirus scanning, go to www.eicar.org and attempt to download a test file. The browser will display a message denying permission to download the file.



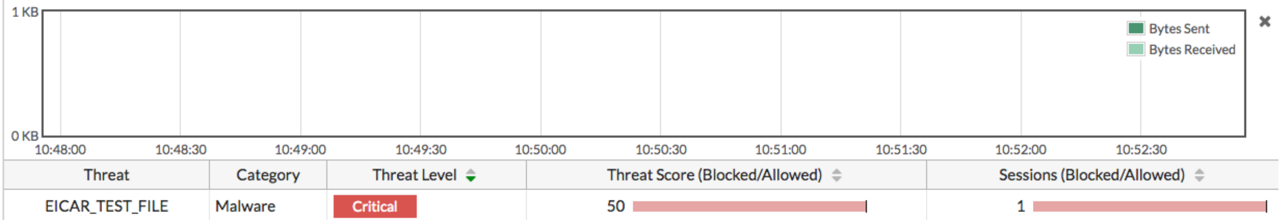
High Security Alert!!

You are not permitted to download the file "eicar.com" because it is infected with the virus "EICAR_TEST_FILE".

URL: http://www.eicar.org/download/eicar.com
File quarantined as: .

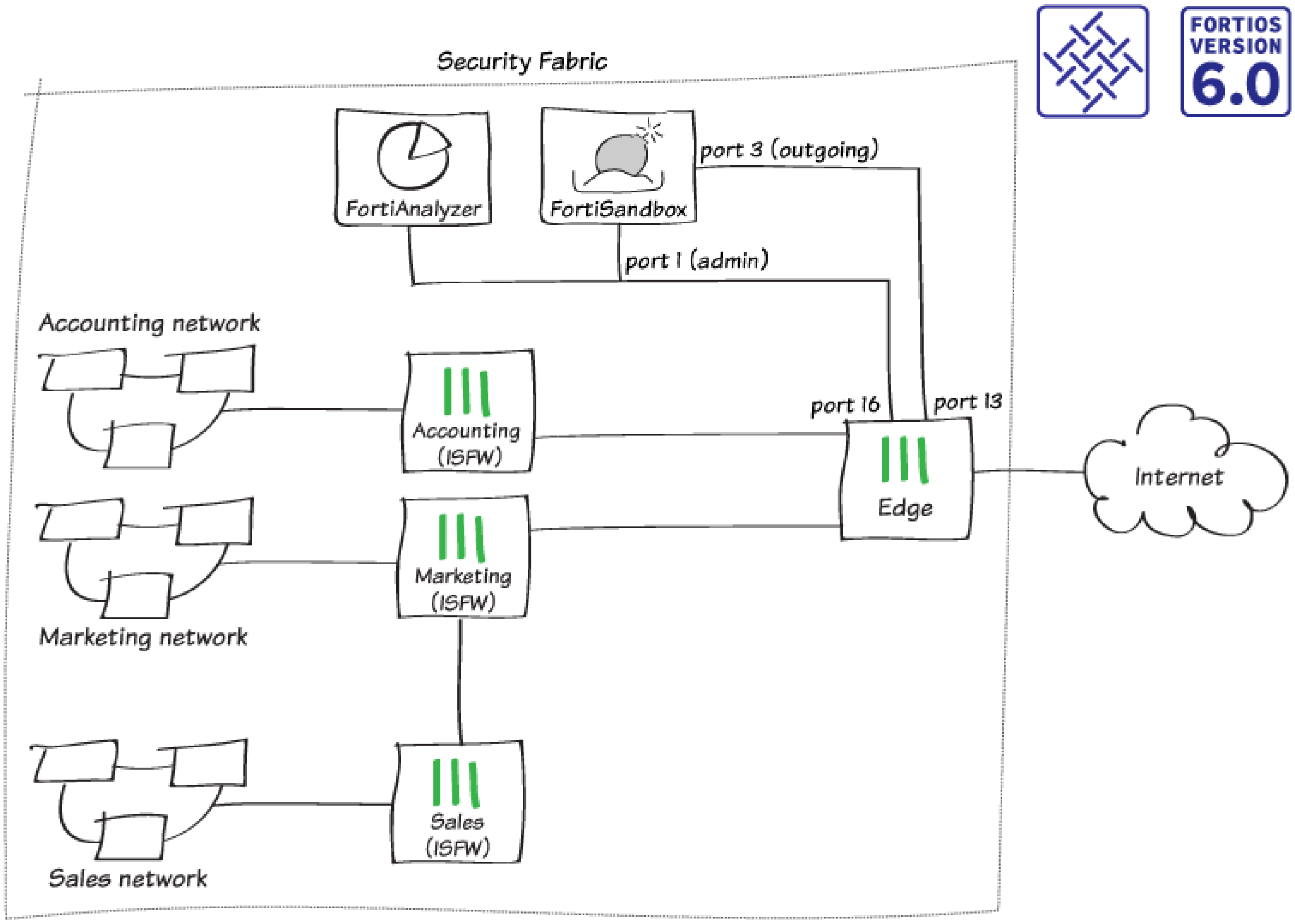
http://www.fortinet.com/ve?vn=EICAR_TEST_FILE
Client IP: 192.168.13.2
Server IP: 213.211.198.62
User name:
Group name:

2. To view information about the blocked file, go to **FortiView > Traffic from LAN/DMZ > Threats**.



Threat	Category	Threat Level	Threat Score (Blocked/Allowed)	Sessions (Blocked/Allowed)
EICAR_TEST_FILE	Malware	Critical	50	1

FortiSandbox in the Fortinet Security Fabric



In this recipe, you will add a FortiSandbox to the Fortinet Security Fabric and configure each FortiGate in the network to send suspicious files to FortiSandbox for sandbox inspection. The FortiSandbox scans and tests these files in isolation from your network.

This example uses the Security Fabric configuration created in the Fortinet Security Fabric collection recipe. The FortiSandbox connects to the root FortiGate in the Security Fabric, known as External. There are two connections between the devices:

- FortiSandbox port 1 (administration port) connects to Edge port 16
- FortiSandbox port 3 (VM outgoing port) connects to Edge port 13

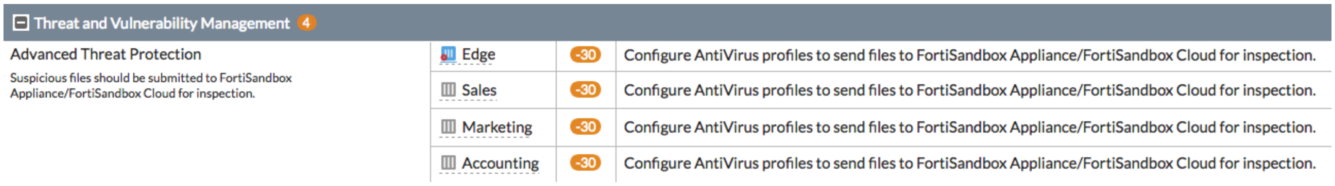
If possible, you can also use a separate Internet connection for FortiSandbox port 3, rather than connecting through the Edge FortiGate to use your main Internet connection. This configuration avoids having IP addresses from your main network blacklisted if malware that’s tested on the FortiSandbox generates an attack. If you use this configuration, you can skip the steps listed for FortiSandbox port 3.

Checking the Security Rating

On Edge (the root FortiGate in the Security Fabric), go to **Security Fabric > Security Rating**.

Since you haven’t yet installed a FortiSandbox in your network, the Security Fabric fails the **Advanced Threat Protection** check.

In the example, the **Security Rating Score** decreases by 30 points for each of the four FortiGates in the Security Fabric.

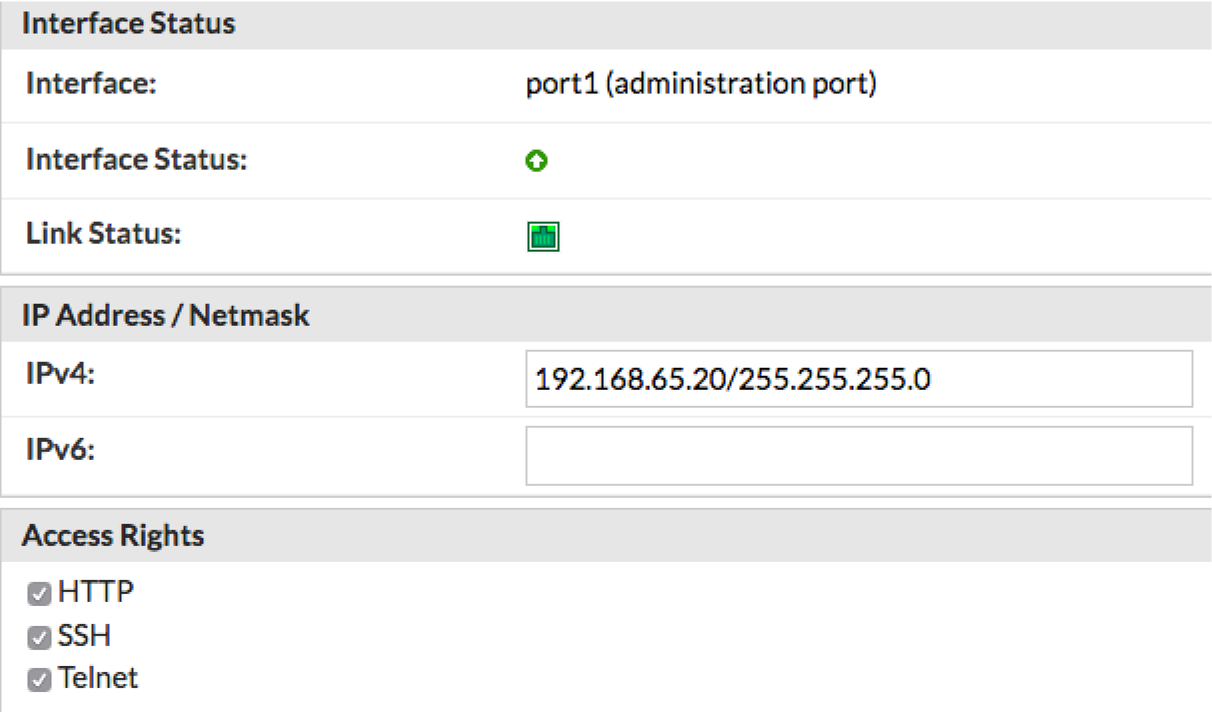


⊟ Threat and Vulnerability Management 4

Advanced Threat Protection Suspicious files should be submitted to FortiSandbox Appliance/FortiSandbox Cloud for inspection.	Edge	-30	Configure AntiVirus profiles to send files to FortiSandbox Appliance/FortiSandbox Cloud for inspection.
	Sales	-30	Configure AntiVirus profiles to send files to FortiSandbox Appliance/FortiSandbox Cloud for inspection.
	Marketing	-30	Configure AntiVirus profiles to send files to FortiSandbox Appliance/FortiSandbox Cloud for inspection.
	Accounting	-30	Configure AntiVirus profiles to send files to FortiSandbox Appliance/FortiSandbox Cloud for inspection.

Connecting the FortiSandbox and Edge

1. Connect to the FortiSandbox.
2. To edit **port1**, which is used for communication between the FortiSandbox and the rest of the Security Fabric, go to **Network > Interfaces**.
3. Set **IP Address/Netmask** to an internal IP address.
   In this example, the FortiSandbox connects to the same subnet as the FortiAnalyzer that you installed previously, using the IP address 192.168.65.20.



Interface Status

Interface:	port1 (administration port)
Interface Status:	●
Link Status:	🟩

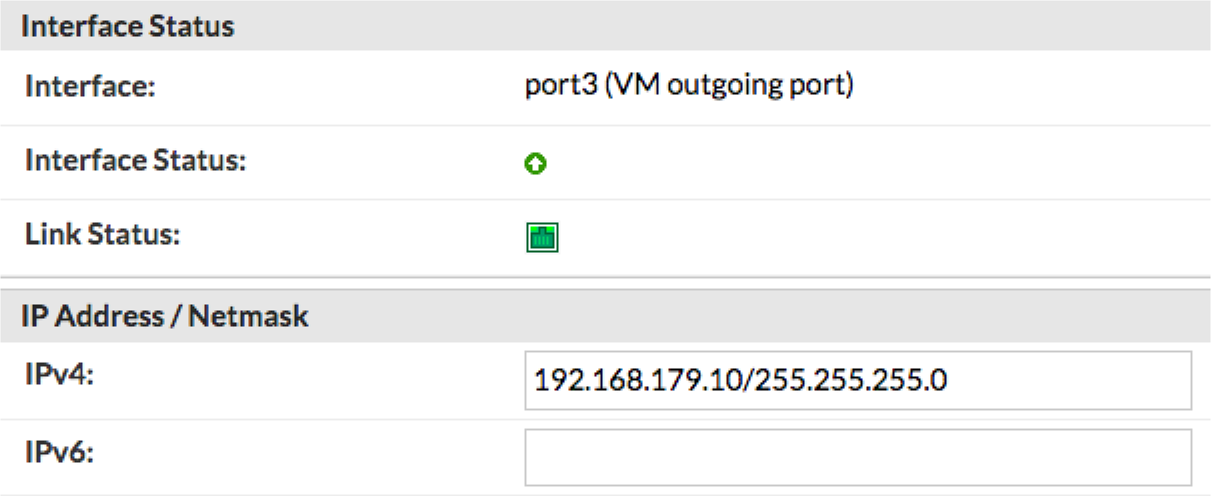
IP Address / Netmask

IPv4:	192.168.65.20/255.255.255.0
IPv6:	

Access Rights

☑ HTTP
☑ SSH
☑ Telnet

4. Edit **port3**.
   This port is used for outgoing communication by the virtual machines (VMs) running on the FortiSandbox. It's recommended that you connect this port to a dedicated interface on your FortiGate to protect the rest of the network from threats that the FortiSandbox is currently investigating.
5. Set **IP Address/Netmask** to an internal IP address (in the example, 192.168.179.10/255.255.255.0).



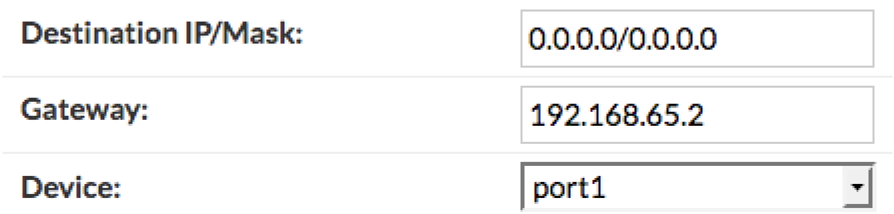
Interface Status

Interface:	port3 (VM outgoing port)
Interface Status:	●
Link Status:	🟩

IP Address / Netmask

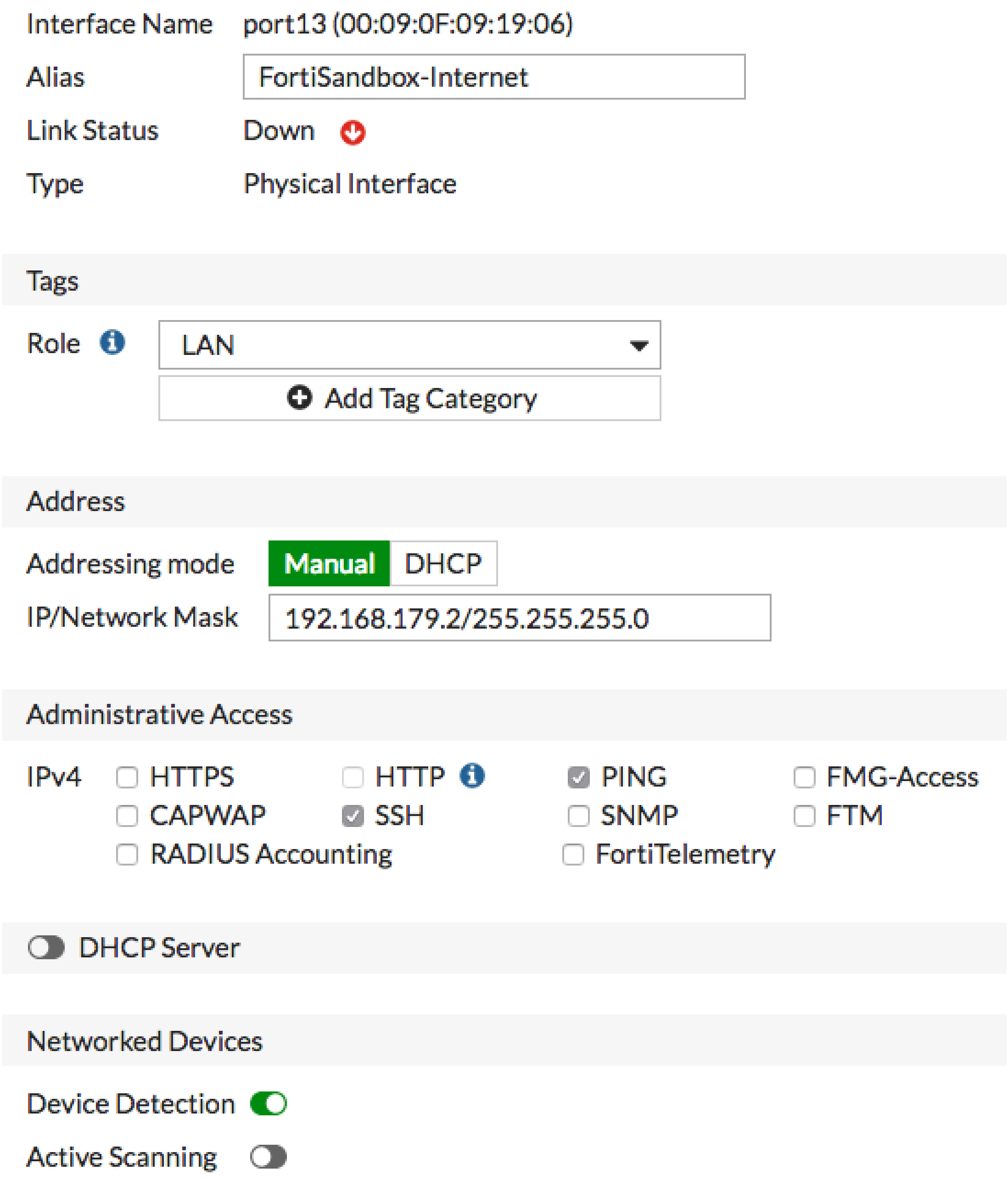
IPv4:	192.168.179.10/255.255.255.0
IPv6:	

6. To add a static route, go to **Network > System Routing**. Set **Gateway** to the IP address of the FortiGate interface that port 1 connects to (in the example, 192.168.65.2).



Destination IP/Mask:	0.0.0.0/0.0.0.0
Gateway:	192.168.65.2
Device:	port1

7. Connect to Edge.
8. To configure the port that connects to port3 on the FortiSandbox (in the example, **port13**), go to **Network > Interfaces**. Set **IP/Network Mask** to an address on the same subnet as port 3 on the FortiSandbox (in the example, 192.168.179.2/255.255.255.0)



Interface Name	port13 (00:09:0F:09:19:06)
Alias	FortiSandbox-Internet
Link Status	Down
Type	Physical Interface

Tags

Role	LAN

Address

Addressing mode	Manual DHCP
IP/Network Mask	192.168.179.2/255.255.255.0

Administrative Access

IPv4 ☐ HTTPS ☐ HTTP ☑ PING ☐ FMG-Access
☐ CAPWAP ☑ SSH ☐ SNMP ☐ FTM
☐ RADIUS Accounting ☐ FortiTelemetry

○ DHCP Server

Networked Devices

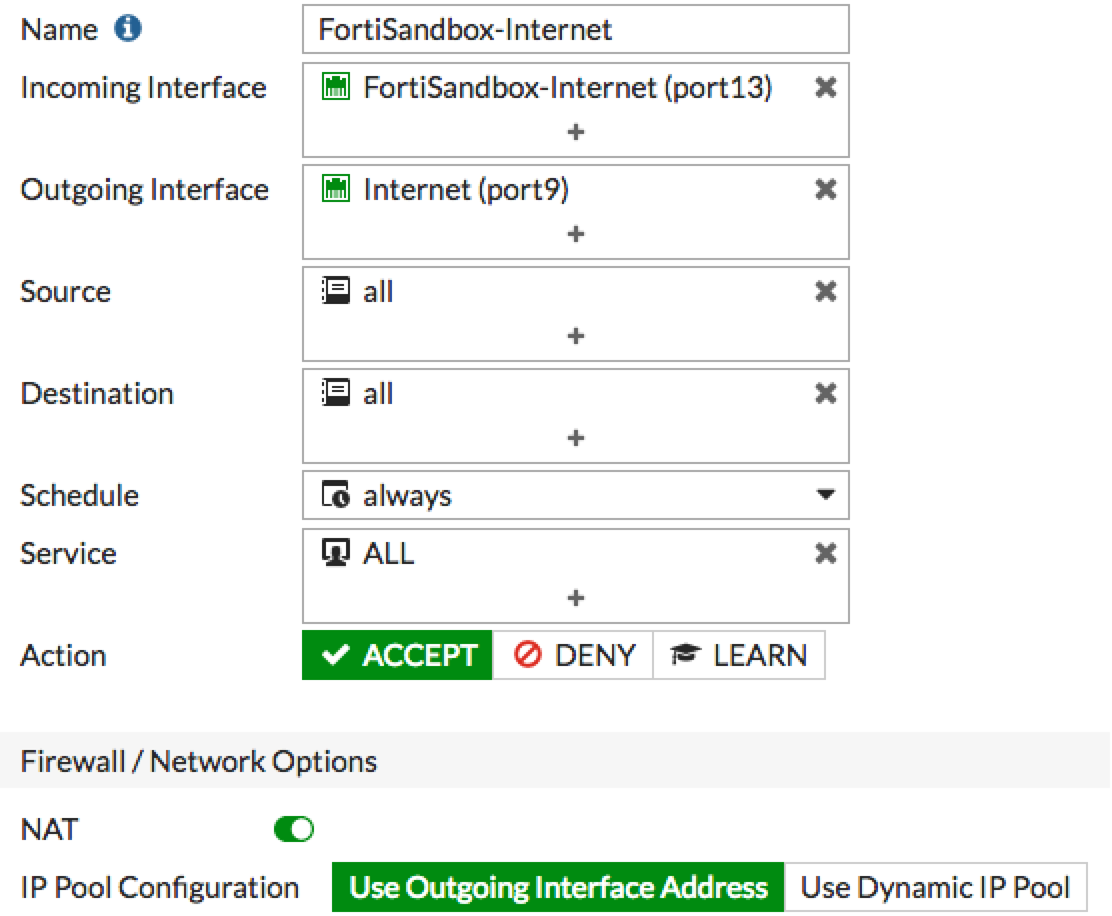
Device Detection ●

Active Scanning ○

9. Connect the FortiSandbox to the Security Fabric.

Allowing VM Internet access

1. Connect to Edge.
2. To create a policy that allows connections from the FortiSandbox to the Internet, go to **Policy & Objects > IPv4 Policy**.

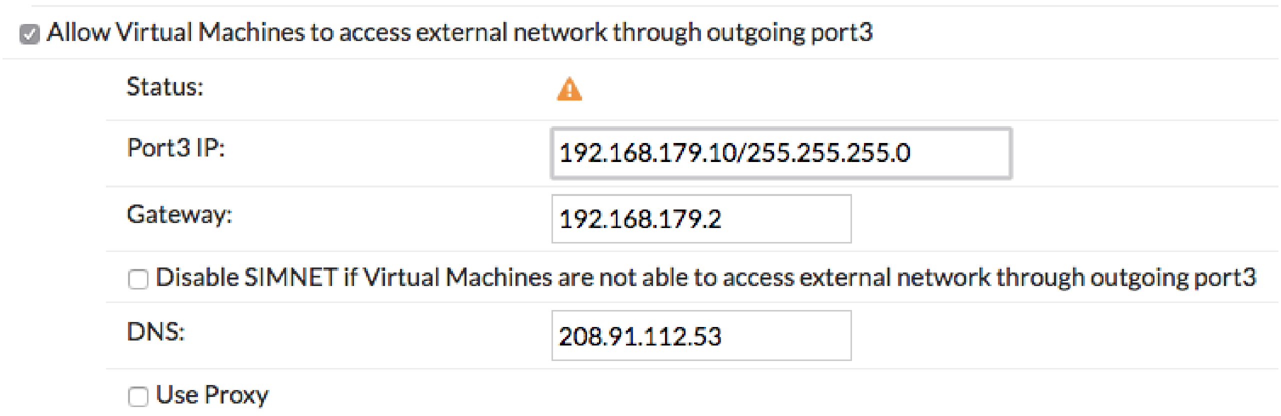


Name	FortiSandbox-Internet
Incoming Interface	FortiSandbox-Internet (port13)
Outgoing Interface	Internet (port9)
Source	all
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT

Firewall / Network Options

NAT	●
IP Pool Configuration	Use Outgoing Interface Address

3. Connect to FortiSandbox.
4. Go to **Scan Policy > General** and select **Allow Virtual Machines to access external network through outgoing port3**. Set **Gateway** to the IP address of port 13 on the FortiGate.



☑ Allow Virtual Machines to access external network through outgoing port3

Status: ⚠

Port3 IP: 192.168.179.10/255.255.255.0

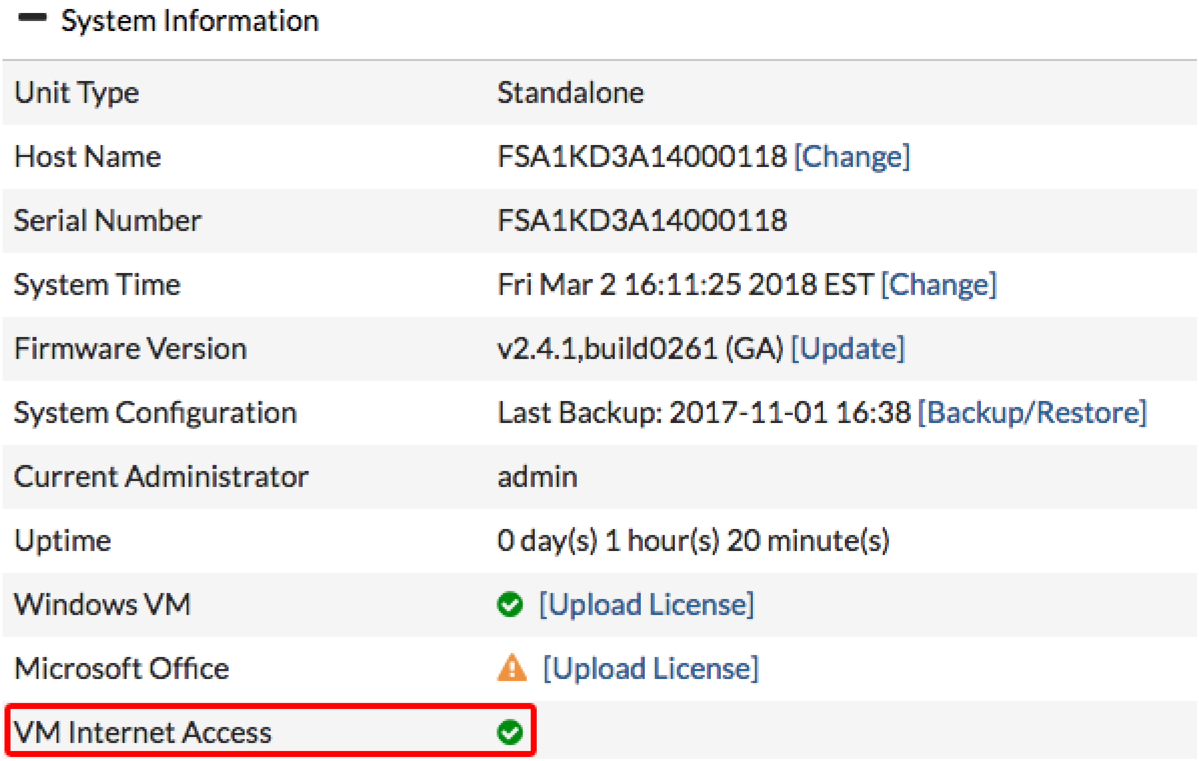
Gateway: 192.168.179.2

☐ Disable SIMNET if Virtual Machines are not able to access external network through outgoing port3

DNS: 208.91.112.53

☐ Use Proxy

5. Go to the **Dashboard** and locate the **System Information** widget. Verify that **VM Internet Access** has a green checkmark beside it.



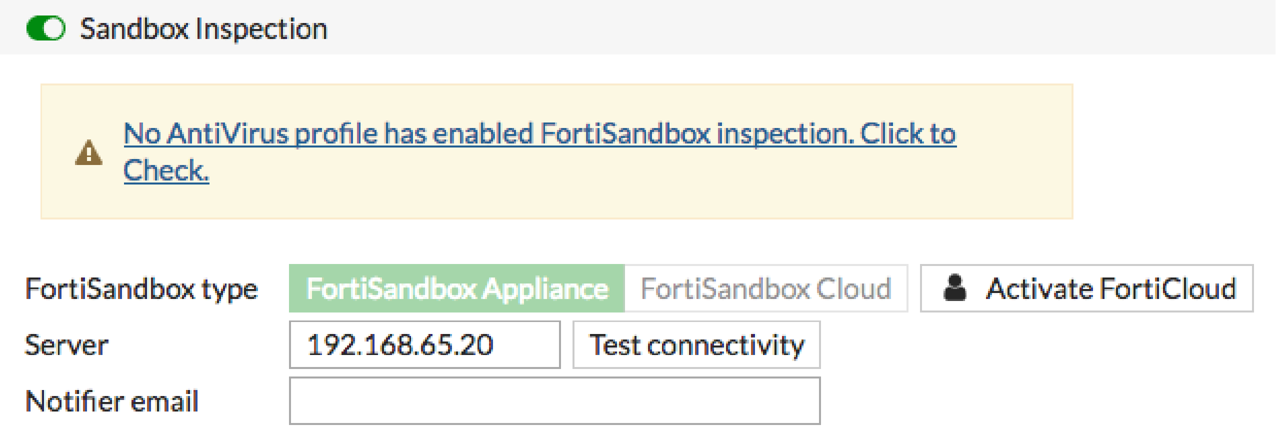
− System Information

Unit Type	Standalone
Host Name	FSA1KD3A14000118 [Change]
Serial Number	FSA1KD3A14000118
System Time	Fri Mar 2 16:11:25 2018 EST [Change]
Firmware Version	v2.4.1,build0261 (GA) [Update]
System Configuration	Last Backup: 2017-11-01 16:38 [Backup/Restore]
Current Administrator	admin
Uptime	0 day(s) 1 hour(s) 20 minute(s)
Windows VM	✓ [Upload License]
Microsoft Office	⚠ [Upload License]
VM Internet Access	✓

Adding the FortiSandbox to the Security Fabric

1. Connect to Edge.
2. To add FortiSandbox to the Security Fabric, go to **Security Fabric > Settings**. Enable **Sandbox Inspection**.

3. Make sure **FortiSandbox Appliance** is selected and set **Server** to the IP address of port 1 on the FortiSandbox.



Sandbox Inspection

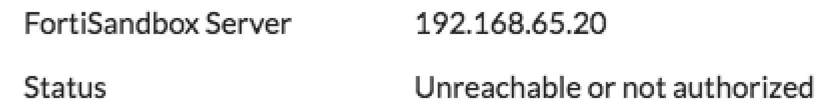
No AntiVirus profile has enabled FortiSandbox inspection. Click to Check.

FortiSandbox type: FortiSandbox Appliance | FortiSandbox Cloud | Activate FortiCloud

Server: 192.168.65.20 | Test connectivity

Notifier email:

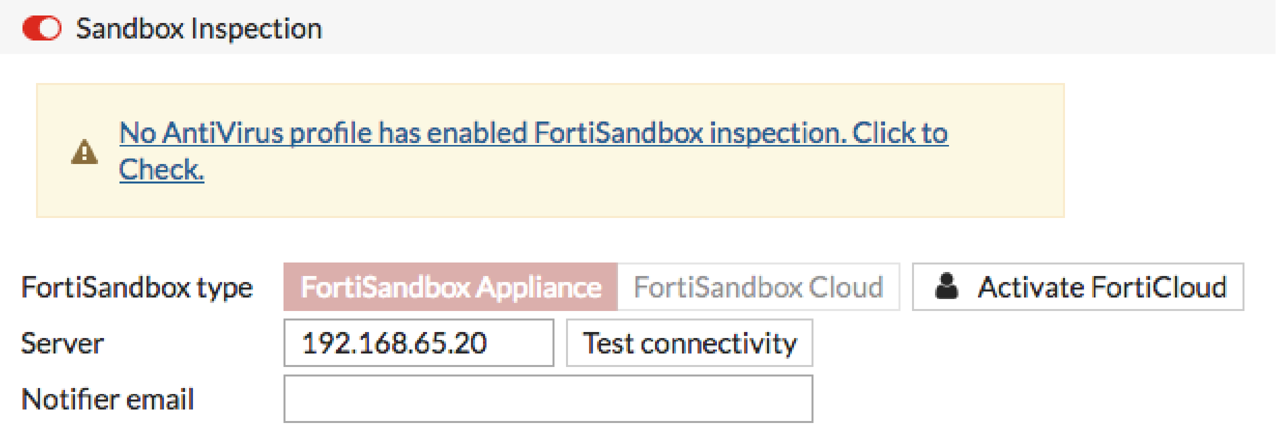
4. Select **Test Connectivity**. An error message appears because Edge hasn't been authorized on the FortiSandbox.



FortiSandbox Server 192.168.65.20

Status Unreachable or not authorized

5. Edge, as the root FortiGate, pushes FortiSandbox settings to the other FortiGates in the Security Fabric. To verify this, connect to Accounting and go to **Security Fabric > Settings**.



Sandbox Inspection

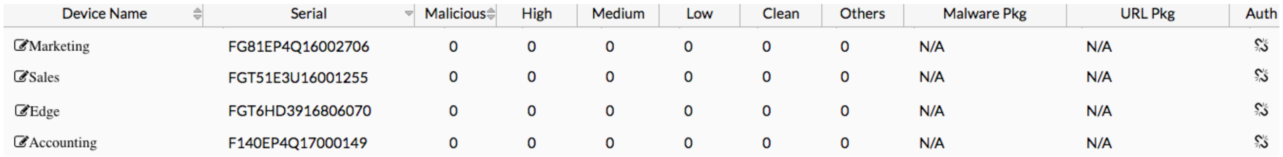
No AntiVirus profile has enabled FortiSandbox inspection. Click to Check.

FortiSandbox type: FortiSandbox Appliance | FortiSandbox Cloud | Activate FortiCloud

Server: 192.168.65.20 | Test connectivity

Notifier email:

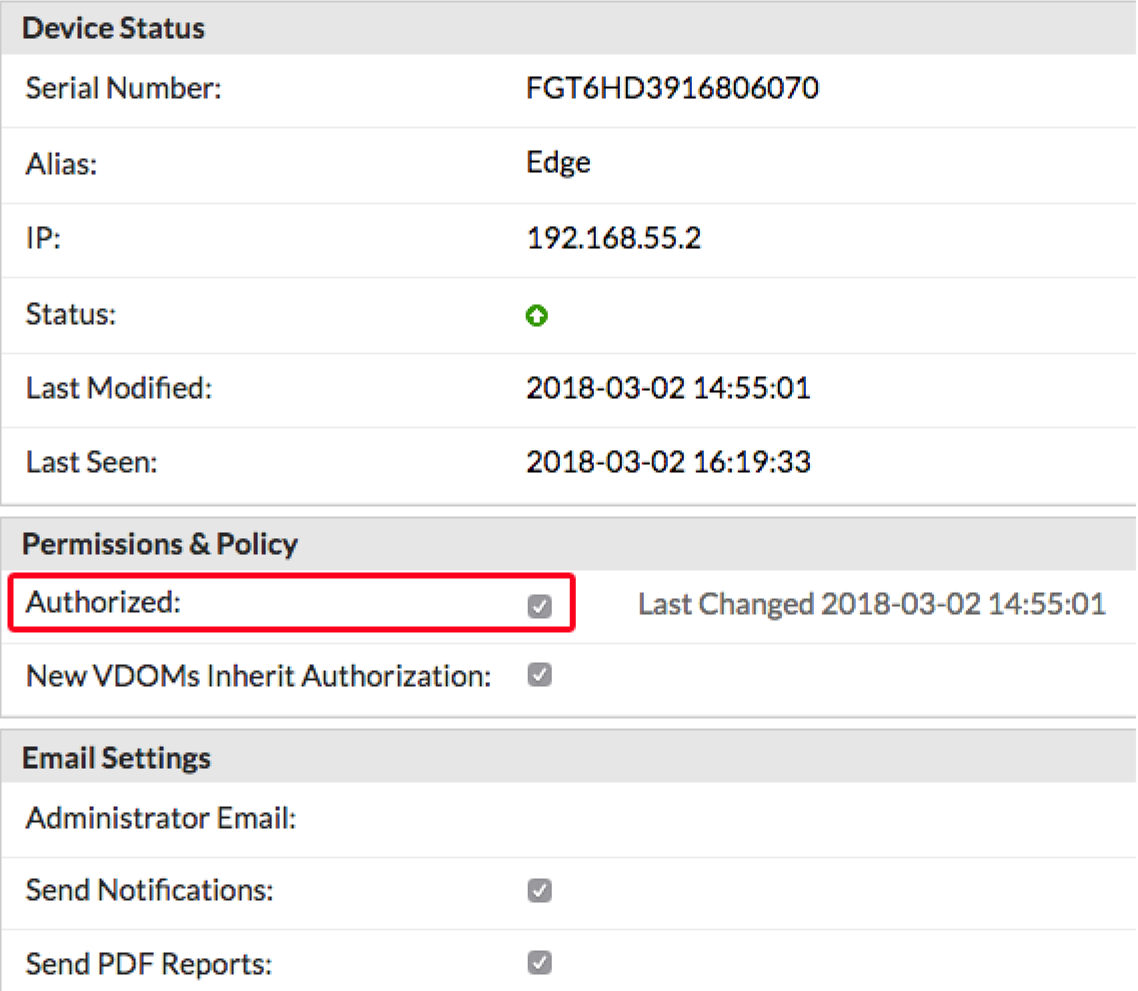
6. On the FortiSandbox, go to **Scan Input > Device**. The FortiGates in the Security Fabric (Edge, Accounting, Marketing, and Sales) are listed but the **Auth** column indicates that the devices are unauthorized.



Device Name	Serial	Malicious	High	Medium	Low	Clean	Others	Malware Pkg	URL Pkg	Auth
Marketing	FG81EP4Q16002706	0	0	0	0	0	0	N/A	N/A	⛓
Sales	FGT51E3U16001255	0	0	0	0	0	0	N/A	N/A	⛓
Edge	FGT6HD3916806070	0	0	0	0	0	0	N/A	N/A	⛓
Accounting	F140EP4Q17000149	0	0	0	0	0	0	N/A	N/A	⛓

7. Select and edit Edge. Under **Permissions & Policies**, select **Authorized**.

8. Repeat this for the other FortiGates.



Device Status

Serial Number:	FGT6HD3916806070
Alias:	Edge
IP:	192.168.55.2
Status:	●
Last Modified:	2018-03-02 14:55:01
Last Seen:	2018-03-02 16:19:33

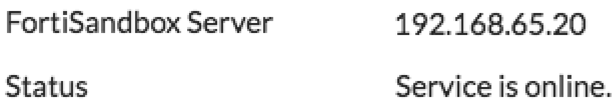
Permissions & Policy

Authorized:	☑	Last Changed 2018-03-02 14:55:01
New VDOMs Inherit Authorization:	☑	

Email Settings

Administrator Email:	
Send Notifications:	☑
Send PDF Reports:	☑

9. On Edge, go to **Security Fabric > Settings** and test the **Sandbox Inspection** connectivity again. External is now connected to the FortiSandbox.



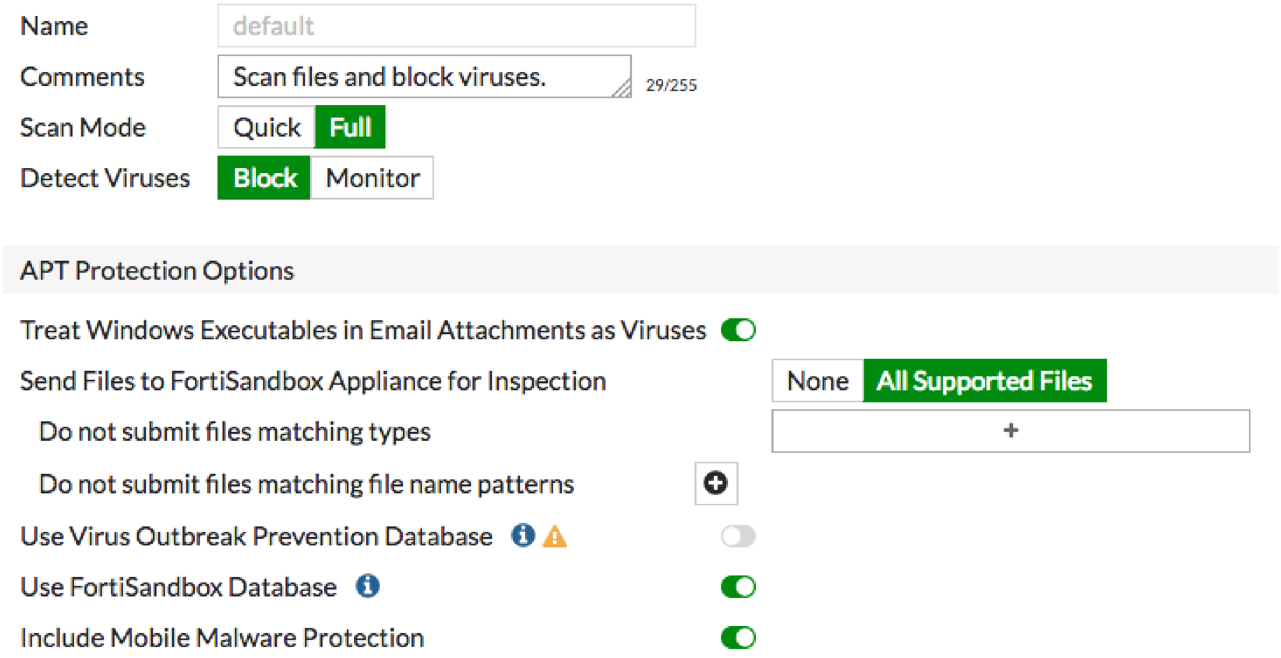
FortiSandbox Server	192.168.65.20
Status	Service is online.

Adding sandbox inspection to security profiles

You can apply sandbox inspection with three types of security inspection: antivirus, web filter, and FortiClient compliance profiles. In this step, you add sandbox to all FortiGate devices in the Security Fabric individually, using the profiles that each FortiGate applies to network traffic.

In order to pass the **Advanced Threat Protection** check, you must add sandbox inspection to antivirus profiles for all FortiGate devices in the Security Fabric.

1. Go to **Security Profiles > AntiVirus** and edit the **default** profile.
2. Under **Inspection Options**, set **Send Files to FortiSandbox Appliance for Inspection** to **All Supported Files**.



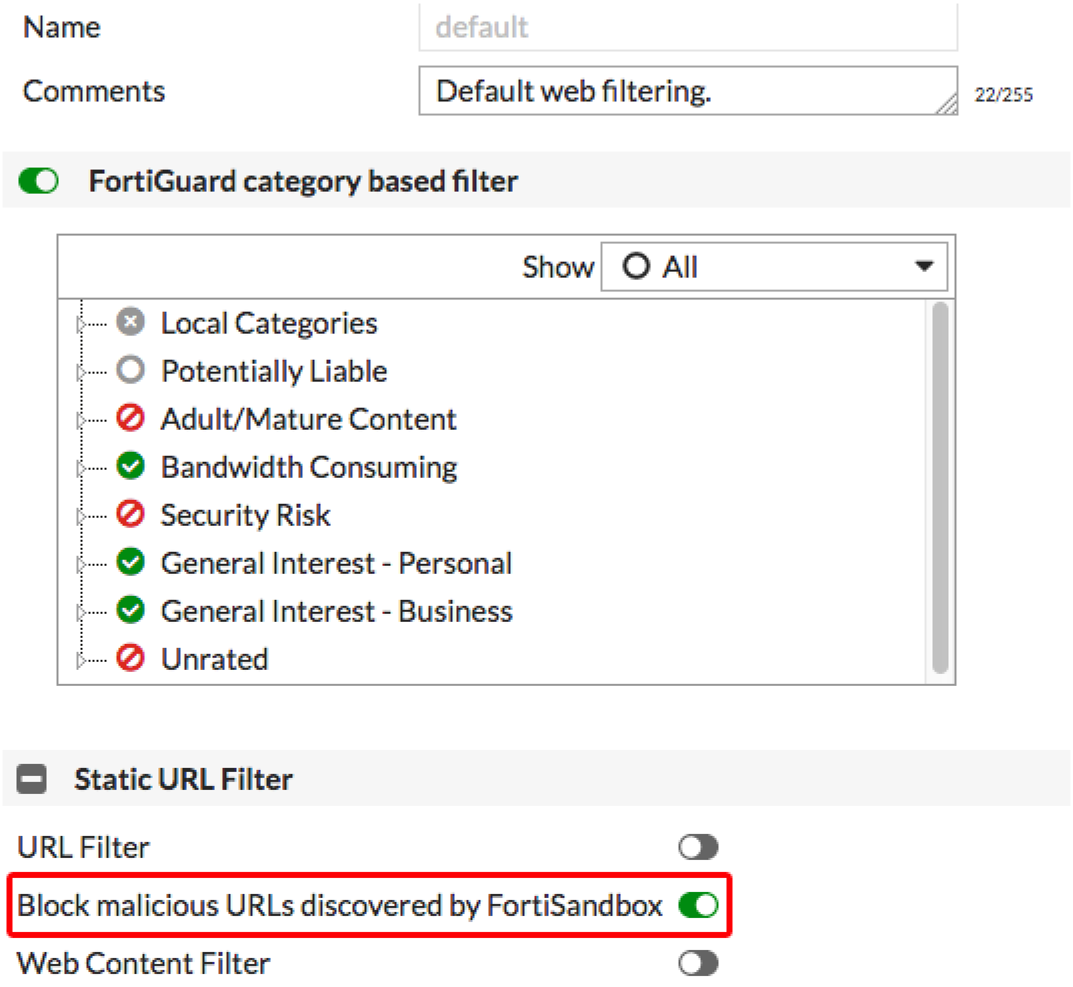
Name	default
Comments	Scan files and block viruses. 29/255
Scan Mode	Quick [✓ Full]
Detect Viruses	[✓ Block] Monitor

APT Protection Options

Treat Windows Executables in Email Attachments as Viruses	●
Send Files to FortiSandbox Appliance for Inspection	None [✓ All Supported Files]
Do not submit files matching types	+
Do not submit files matching file name patterns	⊕
Use Virus Outbreak Prevention Database	○
Use FortiSandbox Database	●
Include Mobile Malware Protection	●

Enable **Use FortiSandbox Database**, so that if the FortiSandbox discovers a threat, it adds a signature for that file to the antivirus signature database on the FortiGate.

3. Go to **Security Profiles > Web Filter** and edit the **default** profile.
4. Under **Static URL Filter**, enable **Block malicious URLs discovered by FortiSandbox**.



Name	default
Comments	Default web filtering. 22/255

● FortiGuard category based filter

Show ○ All

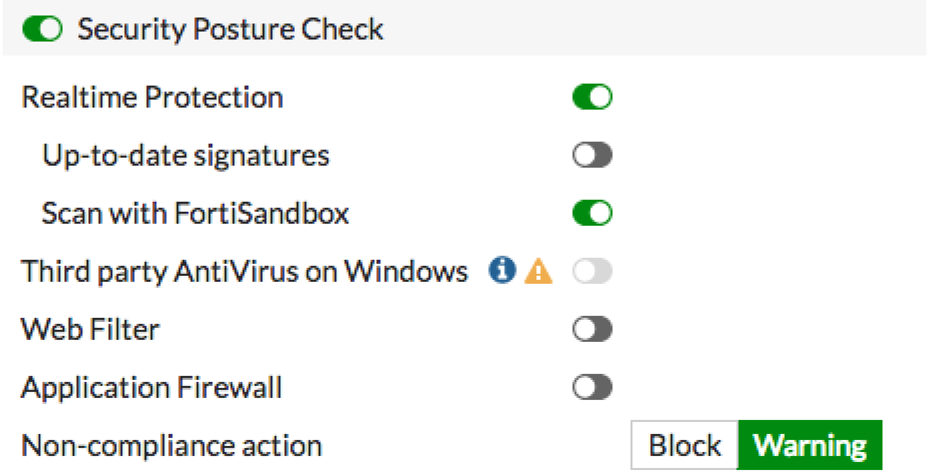
- Local Categories
- Potentially Liable
- ⊘ Adult/Mature Content
- ✓ Bandwidth Consuming
- ⊘ Security Risk
- ✓ General Interest - Personal
- ✓ General Interest - Business
- ⊘ Unrated

Static URL Filter

URL Filter	○
Block malicious URLs discovered by FortiSandbox	●
Web Content Filter	○

If the FortiSandbox discovers a threat, the URL that threat came from is added to the list of URLs that are blocked by the FortiGate.

5. Go to **Security Profiles > FortiClient Compliance Profiles** and edit the default profile. Enable **Security Posture Check**.
6. Enable **Realtime Protection** and **Scan with FortiSandbox**.



● Security Posture Check

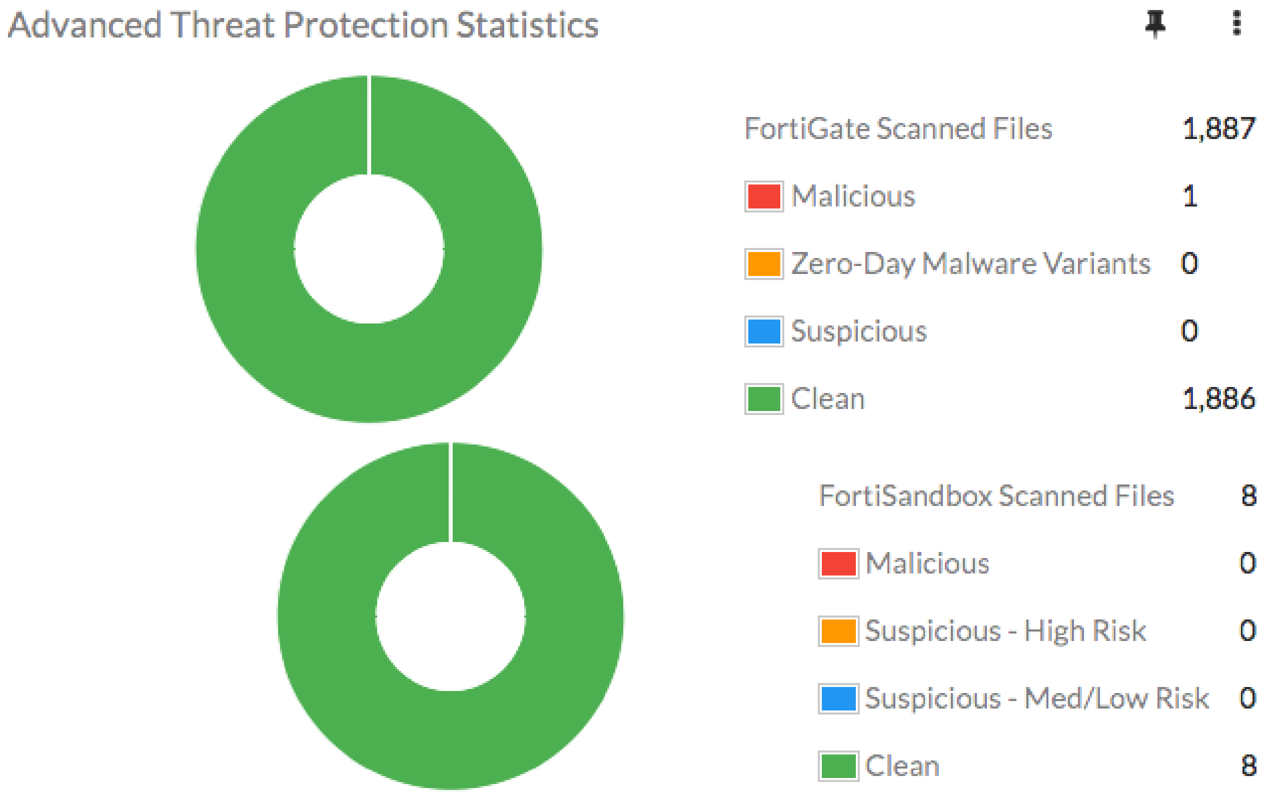
Realtime Protection	●
Up-to-date signatures	○
Scan with FortiSandbox	●
Third party AntiVirus on Windows	○
Web Filter	○
Application Firewall	○
Non-compliance action	Block [✓ Warning]

Results

If a FortiGate in the Security Fabric discovers a suspicious file, it sends the file to the FortiSandbox.

You can view information about scanned files on either the FortiGate that sent the file or the FortiSandbox.

1. On one of the FortiGate devices, go to the Dashboard and locate the Advanced Threat Protection Statistics widget. This widget shows files that both the FortiGate and FortiSandbox scan.

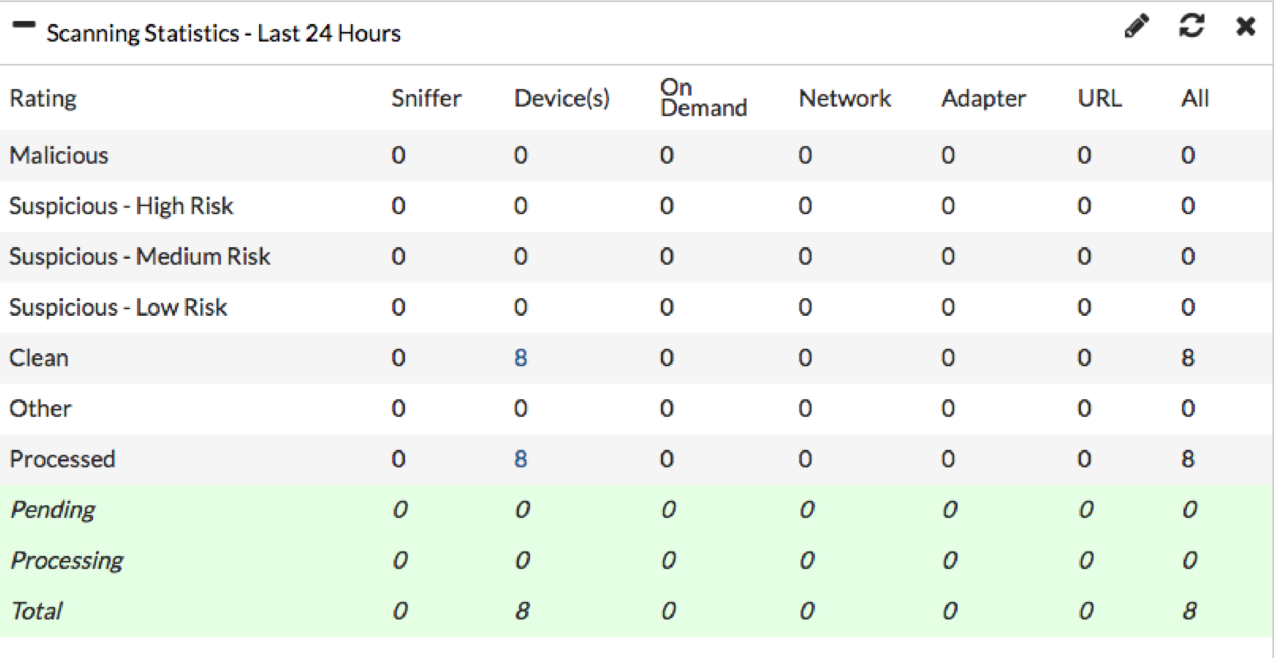


Advanced Threat Protection Statistics

FortiGate Scanned Files	1,887
🟥 Malicious	1
🟧 Zero-Day Malware Variants	0
🟦 Suspicious	0
🟩 Clean	1,886

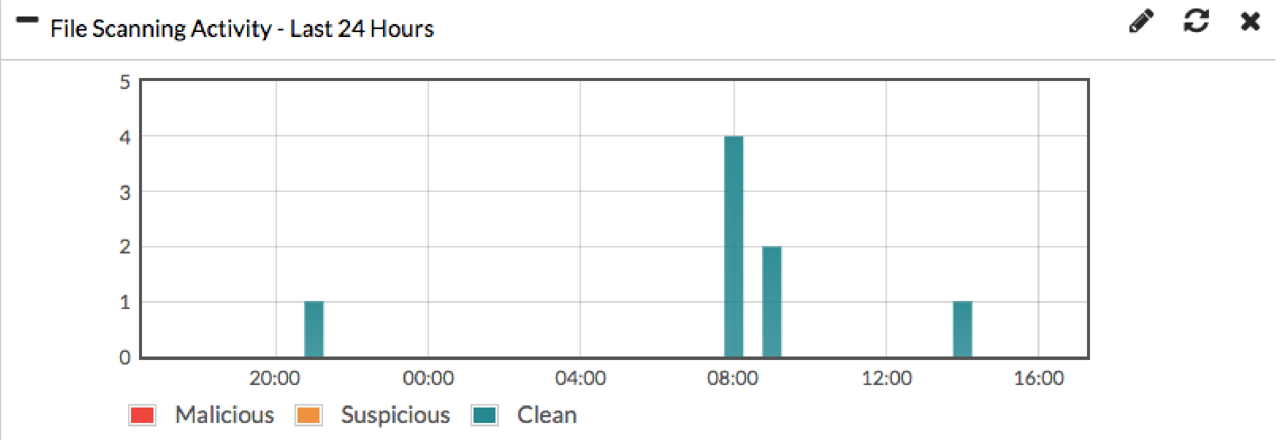
FortiSandbox Scanned Files	8
🟥 Malicious	0
🟧 Suspicious - High Risk	0
🟦 Suspicious - Med/Low Risk	0
🟩 Clean	8

2. On the FortiSandbox, go to System > Status and view the Scanning Statistics widget for a summary of scanned files.



Scanning Statistics - Last 24 Hours

Rating	Sniffer	Device(s)	On Demand	Network	Adapter	URL	All
Malicious	0	0	0	0	0	0	0
Suspicious - High Risk	0	0	0	0	0	0	0
Suspicious - Medium Risk	0	0	0	0	0	0	0
Suspicious - Low Risk	0	0	0	0	0	0	0
Clean	0	8	0	0	0	0	8
Other	0	0	0	0	0	0	0
Processed	0	8	0	0	0	0	8
Pending	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Processing	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total	*0*	*8*	*0*	*0*	*0*	*0*	*8*

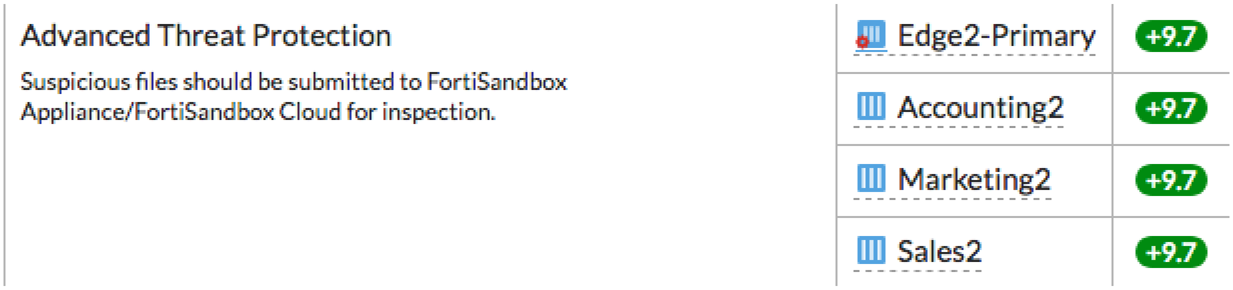


File Scanning Activity - Last 24 Hours

You can also view a timeline of scanning in the File Scanning Activity widget.

3. On Edge, go to Security Fabric > Security Rating and run a rating. When it is finished, select the All Results view.

In the example, all four FortiGate devices in the Security Fabric pass the Advanced Threat Protection check and the Security Rating Score increases by 9.7 points for each FortiGate.

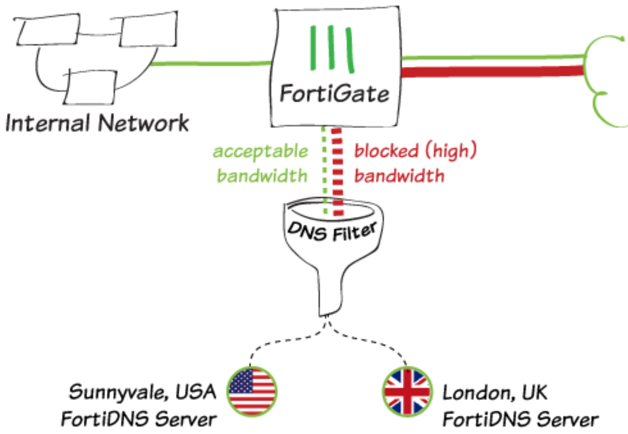


Advanced Threat Protection

Suspicious files should be submitted to FortiSandbox Appliance/FortiSandbox Cloud for inspection.

Edge2-Primary	+9.7
Accounting2	+9.7
Marketing2	+9.7
Sales2	+9.7

DNS Filtering



In this recipe you will set up DNS filtering to block access to bandwidth consuming websites.

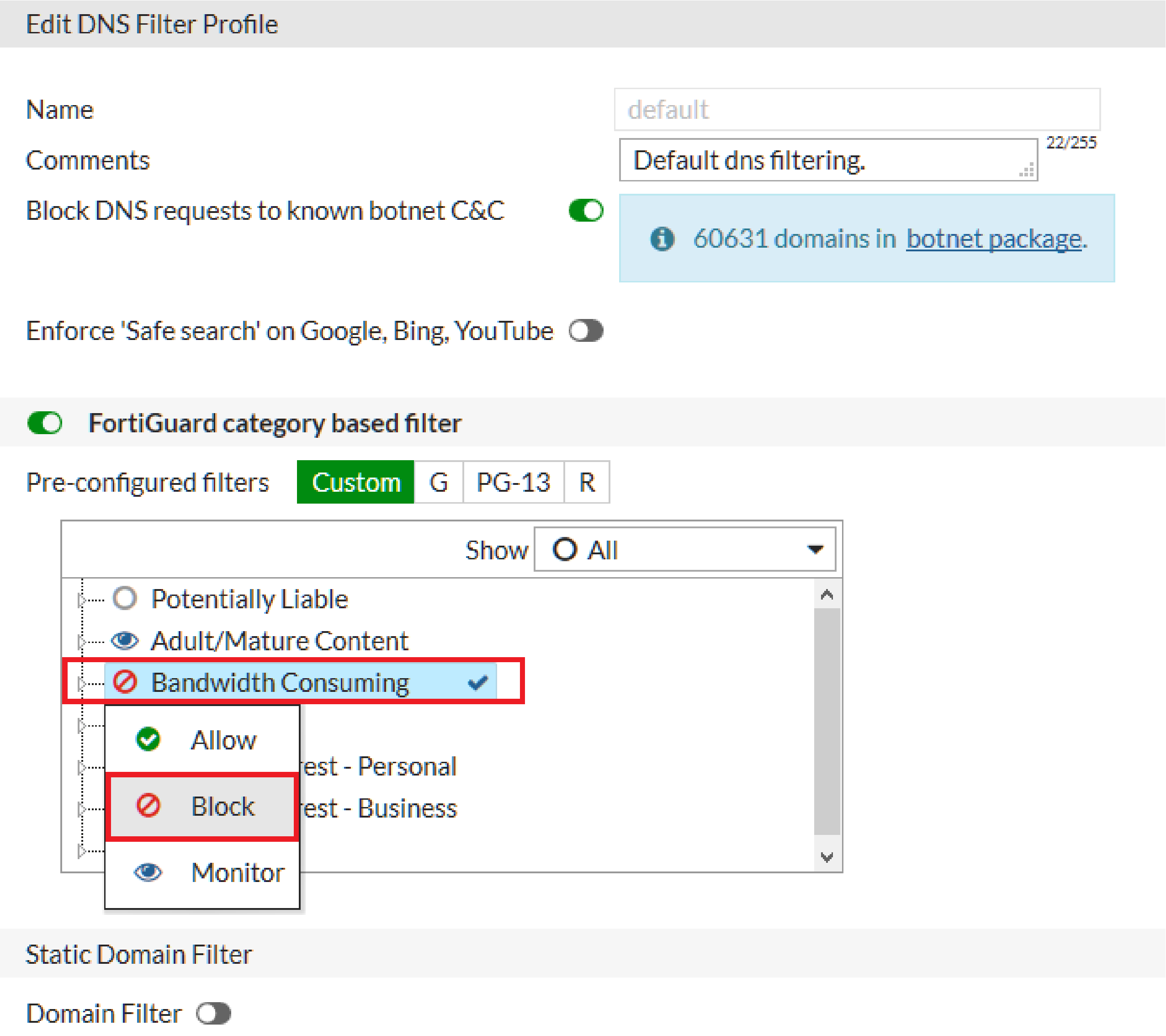
Following the results section, you will find instructions for changing the FortiDNS server that your FortiGate will use to verify domains, as well as troubleshooting information.

If DNS Filter is not listed under **Security Profiles**, go to **System > Feature Visibility**, and enable **DNS Filter** under **Security Features**.

DNS Filter

Creating a DNS web filter profile

1. Go to **Security Profiles > DNS Filter**, and edit the default profile.
2. Enable **FortiGuard category based filter**, right-click **Bandwidth Consuming**, and set it to **Block**.



Edit DNS Filter Profile

Name: default

Comments: Default dns filtering. 22/255

Block DNS requests to known botnet C&C: ●

60631 domains in botnet package.

Enforce 'Safe search' on Google, Bing, YouTube: ○

● FortiGuard category based filter

Pre-configured filters: [✓ Custom] G PG-13 R

Static Domain Filter

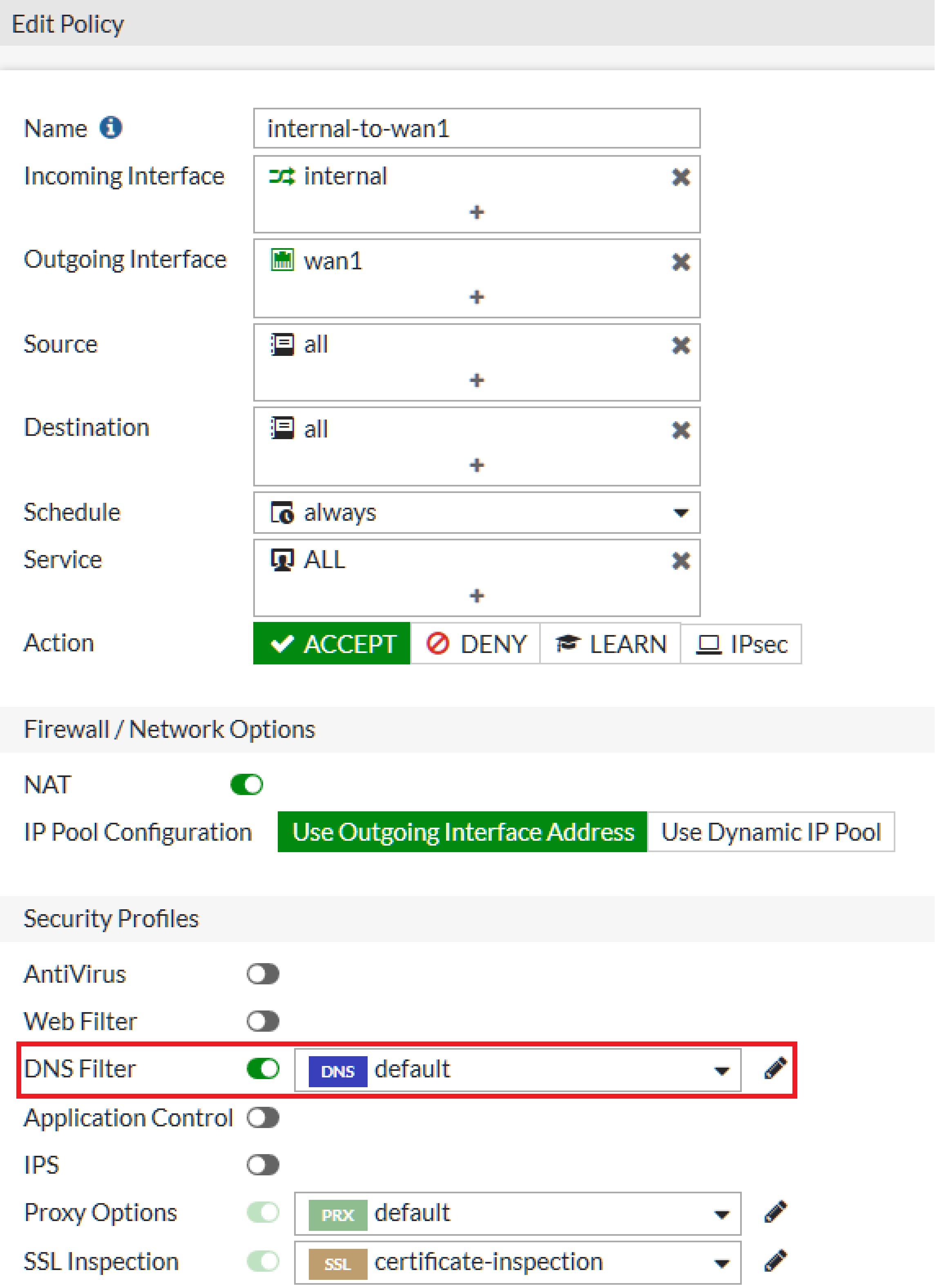
Domain Filter: ○

Enabling DNS filtering in a security policy

All traffic that matches this policy will be redirected to the FortiDNS server.

1. Go to **Policy & Objects > IPv4 Policy**, and edit the outgoing policy that allows Internet access.
2. Under **Security Profiles**, enable **DNS Filter** and set it to **default**.

Proxy Options and **SSL Inspection** profiles are automatically enabled.



Edit Policy

Name	internal-to-wan1
Incoming Interface	internal
Outgoing Interface	wan1
Source	all
Destination	all
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN IPsec

Firewall / Network Options

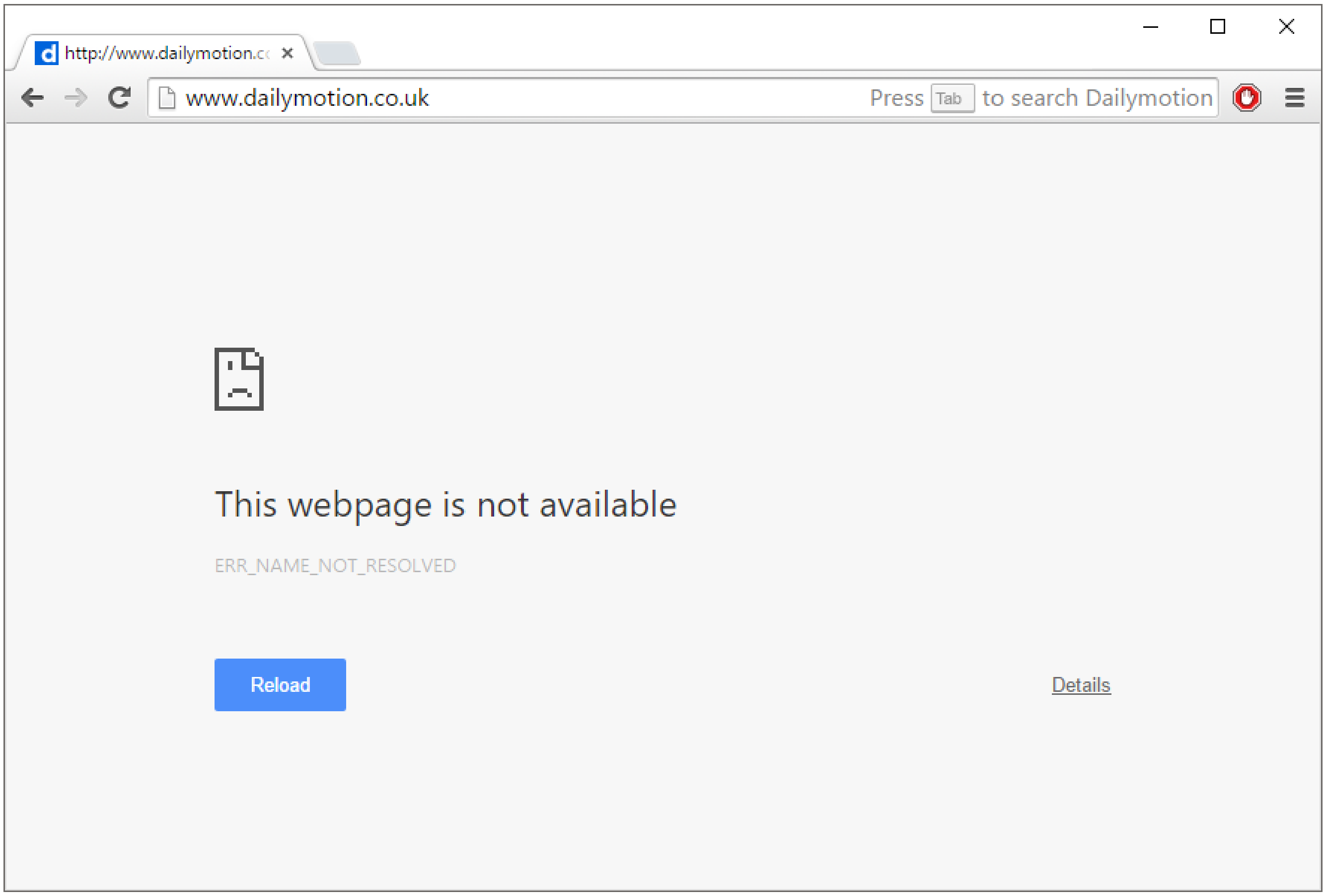
NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

Security Profiles

AntiVirus	○	
Web Filter	○	
DNS Filter	●	DNS default
Application Control	○	
IPS	○	
Proxy Options	●	PRX default
SSL Inspection	●	SSL certificate-inspection

Results

Open a browser using a computer on the internal network and navigate to dailymotion.co.uk. The page will be blocked.



This webpage is not available

ERR_NAME_NOT_RESOLVED

Enter the following CLI command to sniff packets with a destination URL that does not belong to the bandwidth consuming category:

```
diagnose sniffer packet any 'port 53 and host 194.153.110.160' 4
```

The resulting output should indicate that the IP (in this example, paris.fr) was allowed by FortiGuard:

```
interfaces=[any]
filters=[port 53]
2.851628 172.20.121.56.59046 -> 208.91.112.52.53: udp 43
2.916281 208.91.112.52.53 -> 172.20.121.56.59046: udp 436
3.336945 10.1.2.102.51755 -> 208.91.112.53.53: udp 37
3.338611 208.91.112.53.53 -> 10.1.2.102.51755: udp 37
```

(Optional) Changing the FortiDNS server and port

You can use the default FortiDNS server located in Sunnyvale, USA (IP address 208.91.112.220), or you can switch to the server in London, UK (IP address 45.75.200.89).

Communication between your FortiGate and the FortiDNS server uses Fortinet’s proprietary DNS communication protocol.

```
config system fortiguard
   set sdns-server-ip 208.91.112.220
end
```

The North American server should work in most cases, however you can switch to the European server to see if it improves latency.

You can also change the port used to communicate with the FortiDNS server using the following command:

```
config system fortiguard
   set sdns-server-port <value>
end
```

Troubleshooting

The Security Profiles > DNS Filter menu is missing

Go to **System > Feature Visibility** and enable **DNS Filter**.

You Configured DNS Filtering, but it is not working

Verify that **DNS Filter** is enabled in a policy and **SSL Inspection** has been applied as needed (SSL inspection is required in order to block traffic to sites that use HTTPS).

If both settings are enabled, verify that the policy is being used for the correct traffic and that traffic is flowing by going to the policy list and viewing the **Sessions** column.

If the above settings are correct, verify that DNS requests are going through the policy, rather than to an internal DNS server. Also verify that proxy options and SSL/SSH inspection settings have both HTTP and HTTPS enabled and use the correct ports.

Communication with the FortiDNS server fails

Verify that the correct FortiDNS server is configured using the following diagnose command:

```
diag test application dnsproxy 3
```

The resulting output should indicate that communication with the correct FortiDNS server was established. For example:

```
FWF60D4615016384 # diag test application dnsproxy 3

vdom: root, index=0, is master, vdom dns is enabled, mip-169.254.0.1 dns_log=1

dns64 is disabled

dns-server:208.91.112.53:53 tz=0 req=919160 to=545900 res=117880 rt=1800 secure=0
ready=1

dns-server:208.91.112.52:53 tz=0 req=913029 to=520111 res=134810 rt=6 secure=0
ready=1

dns-server:208.91.112.220:53 tz=-480 req=0 to=0 res=0 rt=0 secure=1 ready=1

dns-server:45.75.200.89:53 tz=0 req=0 to=0 res=0 rt=0 secure=1 ready=1

vfid=0, interface=wan1, ifindex=6, recursive, dns

DNS_CACHE: hash-size=2048, ttl=1800, min-ttl=60, max-num=5000
```

```
DNS FD: udp_s=12 udp_c=14:15 ha_c=18 unix_s=19, unix_nb_s=20, unix_nc_s=21, v6_udp_
s=11, v6_udp_c=16:17

DNS FD: tcp_s=24, tcp_s6=23

FQDN: hash_size=1024, current_query=1024

DNS_DB: response_buf_sz=131072

LICENSE: expiry=2016-08-15, expired=0, type=2

FDG_SERVER:208.91.112.220:53

SERVER_LDB: gid=6d61, tz=-480

FGD_REDIR:208.91.112.55
```

This CLI result shows that the DNS server IP is set to the North American server, and is being accessed through port 53 (208.91.112.220:53).

Next, verify that bandwidth consuming sites are blocked, while other URLs are allowed.

Go to the CLI Console and enter the following:

```
diagnose sniffer packet any 'port 53' and 'host 195.8.215.138' 4
```

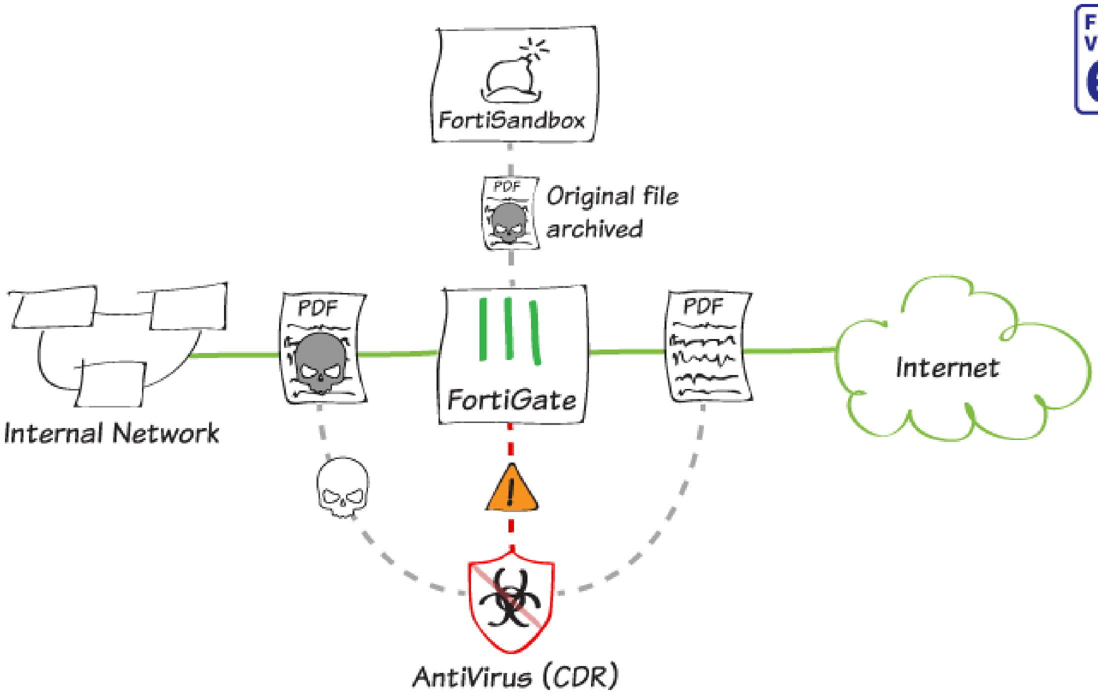
The resulting output should indicate that the IP (in this example, dailymotion.co.uk) was blocked by the FortiDNS server:

```
interfaces=[any]
filters=[port 53]
2.026733 172.20.121.56.59046 -> 208.91.112.220.53: udp 117
2.027316 172.20.121.56.59046 -> 45.75.200.89.53: udp 112
2.028480 172.20.121.56.59046 -> 208.91.112.220.53: udp 116
2.029591 172.20.121.56.59046 -> 208.91.112.220.53: udp 117
```

FortiGuard has the wrong categorization for a website

If you believe a website has been placed in the wrong category by FortiGuard, you can submit the URL for re-classification by going to the FortiGuard website.

Content Disarm and Reconstruction (CDR)



In this recipe you will configure the default AntiVirus security profile to include a new FortiOS 6.0 feature: Content Disarm and Reconstruction (CDR). You will apply this security profile to the Internet access policy so that exploitable content leaving the network is stripped from documents and replaced with content that is known to be safe.

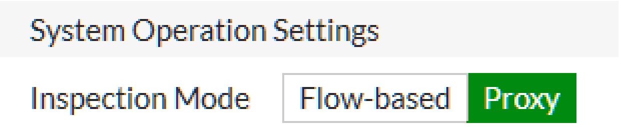
In the example, we will use FortiSandbox as the original file destination, where the original file is archived and can be retrieved if necessary. The CDR feature works without FortiSandbox configured, but only if you wish to discard the original file.

Content that can be scanned includes PDF and Microsoft Office files leaving the network on CDR-supported protocols* (for more information, refer to the Security Profiles handbook).

Note that the FortiGate must be in Proxy inspection mode for CDR to function.

Setting the system inspection mode

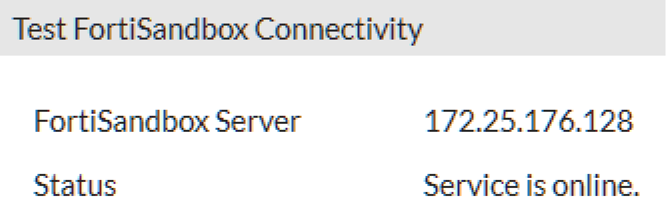
Go to **System > Settings** and set **System Operation Settings > Inspection Mode** to **Proxy**.


System Operation Settings

Inspection Mode: Flow-based | **Proxy**

Testing FortiSandbox connectivity

1. On the FortiGate, go to **Security Fabric > Settings** and enable **Sandbox Inspection**.
2. Select your **FortiSandbox type** and **Server** address.
3. Confirm that the service is available by selecting **Test connectivity**.
   The Status should read "*Service is online.*"

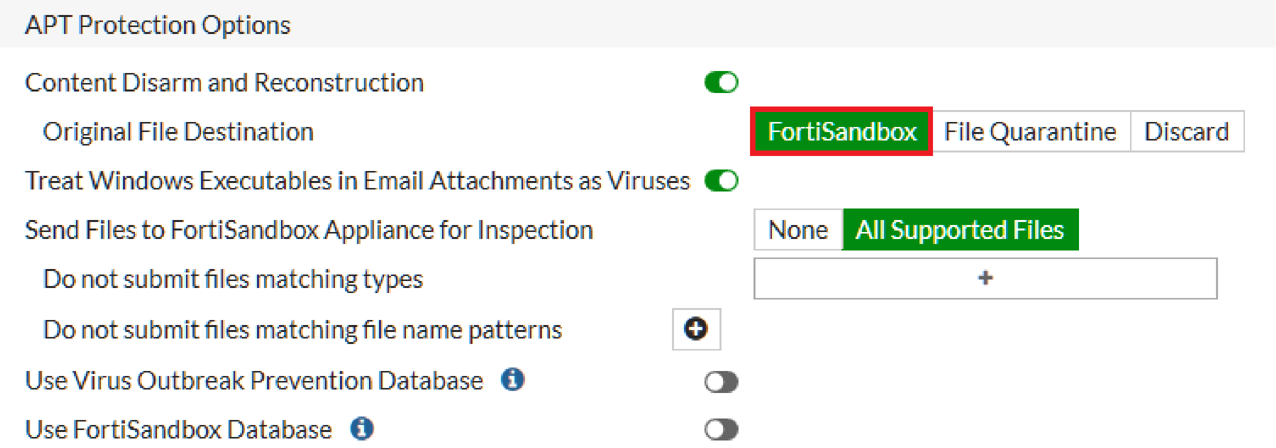


Test FortiSandbox Connectivity

FortiSandbox Server	172.25.176.128
Status	Service is online.

Enabling Content Disarm and Reconstruction

1. Go to **Security Profiles > AntiVirus**.
2. Under **APT Protection Options**, enable **Content Disarm and Reconstruction** and select the **Original File Destination**.



APT Protection Options

Content Disarm and Reconstruction	●
Original File Destination	[✓ FortiSandbox] File Quarantine Discard
Treat Windows Executables in Email Attachments as Viruses	●
Send Files to FortiSandbox Appliance for Inspection	None [✓ All Supported Files]
Do not submit files matching types	+
Do not submit files matching file name patterns	+
Use Virus Outbreak Prevention Database	○
Use FortiSandbox Database	○

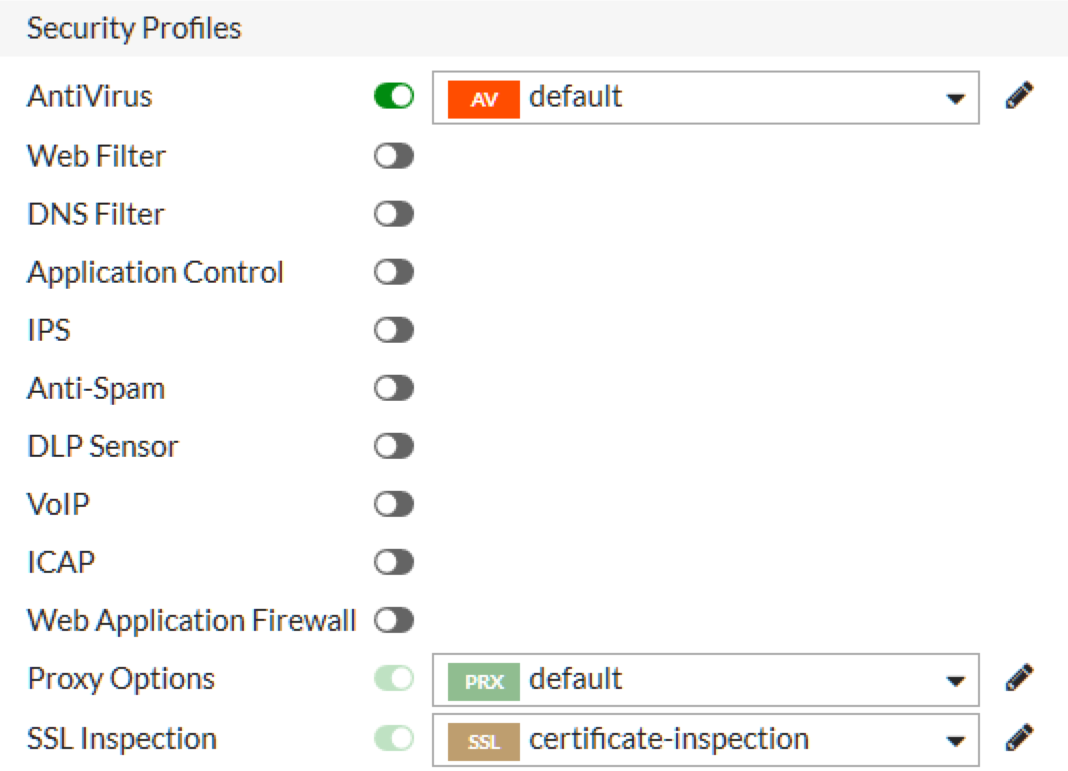
If you enable **FortiSandbox** as the file destination, original files caught by the AntiVirus profile are archived on the FortiSandbox. The FortiSandbox administrator can retrieve the original files, but only for a short time.

If you enable either **File Quarantine** or **Discard** as the file destination, original files caught by the AntiVirus profile are lost. Only the disarmed content is made available.

Configuring the Internet access policy

1. Go to **Policy & Objects** > **IPv4 Policy** and **Edit** the Internet access policy.
2. Under **Security Profiles**, enable the default **AntiVirus** profile. **Proxy Options** and **SSL Inspection** are

automatically enabled.



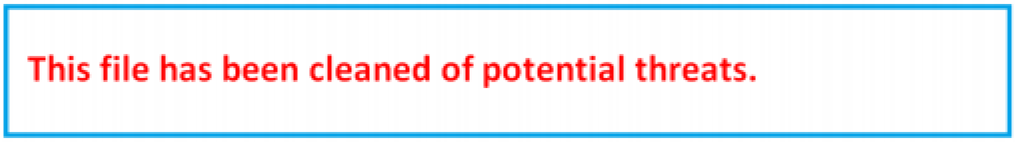
Security Profiles

AntiVirus	●	AV default
Web Filter	○	
DNS Filter	○	
Application Control	○	
IPS	○	
Anti-Spam	○	
DLP Sensor	○	
VoIP	○	
ICAP	○	
Web Application Firewall	○	
Proxy Options	●	PRX default
SSL Inspection	●	SSL certificate-inspection

Results

As the AntiVirus profile scans files using CDR, it replaces content that is deemed malicious or unsafe with content that will allow the traffic to continue but not put the recipient at risk.

CDR appends a new cover page to the malicious/unsafe content that includes a replacement message.



This file has been cleaned of potential threats.

If you wish to disable the cover page, enter the following commands in the CLI Console:

```
config antivirus profile
   edit default
      config content-disarm
         set cover-page disable
   end
end
```

Troubleshooting

The feature is not visible in the GUI

Confirm that the **Inspection Mode** is set to **Proxy** under **System > Settings**.

Also check that the AntiVirus profile inspection mode is set to proxy using the **CLI Console**:

```
config antivirus profile
   edit default
      set inspection-mode proxy
   next
end
```

Error messages and/or conflicts

If you receive an error message when attempting to enable Content Disarm and Reconstruction on the AntiVirus profile, check the Proxy Options settings in the **CLI Console** and disable `splice` and `clientcomfort` on CDR-supported protocols:

```
>config firewall profile-protocol-options
   >edit default
      >config smtp
         >unset options splice
      >next
      >config http
         >unset options clientcomfort
      >next
   >end
>end
```

You should also confirm the AntiVirus profile's protocol settings under `config antivirus profile:`

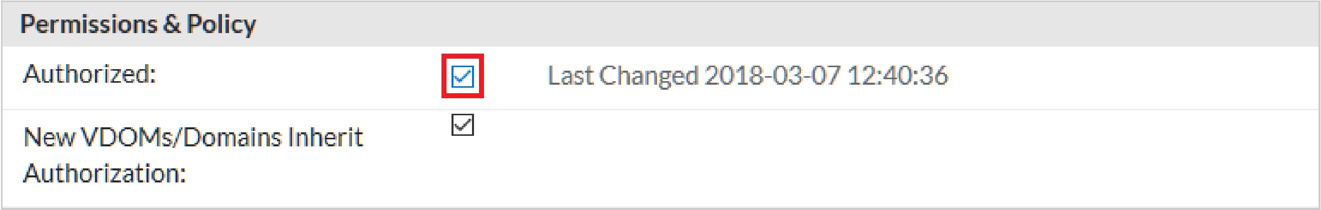
- ensure that `set options scan` is enabled on CDR-supported protocols
- if `set options av-monitor` is configured on a CDR-supported protocol, it overrides the `config content-disarm detect-only` setting (and CDR will not occur)

The FortiSandbox service is unreachable

If testing the FortiSandbox connectivity returns a "*Service is unreachable*" error message, then you may need to authorize the FortiGate on the FortiSandbox.

On the FortiSandbox, go to **Scan Input > Device** and edit the entry for the FortiGate.

Under **Permissions & Policy**, enable **Authorized**.

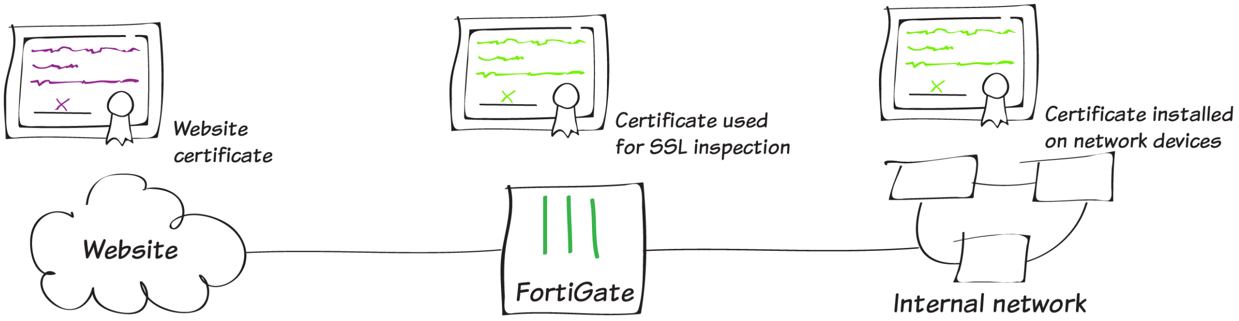


Permissions & Policy

Authorized:	☑	Last Changed 2018-03-07 12:40:36
New VDOMs/Domains Inherit Authorization:	☑	

Preventing certificate warnings (CA-signed certificate)

FORTIOS VERSION 6.0


Website certificate
Certificate used for SSL inspection
Certificate installed on network devices
Website
FortiGate
Internal network

In this recipe, you prevent users from receiving a security certificate warning when your FortiGate performs full SSL inspection on incoming traffic. There are several methods for doing this, depending on whether you're using a CA-signed certificate, as presented here, your FortiGate default certificate (see Preventing certificate warnings (default certificate) on page 228, or a self-signed certification (see Preventing certificate warnings (self-signed) on page 235).

When you enable full SSL inspection, your FortiGate impersonates the recipient of the originating SSL session, then decrypts and inspects the content. The FortiGate then re-encrypts the content, creates a new SSL session between the FortiGate and the recipient by impersonating the sender, and sends the content to the end user. This is the same process used in "man-in-the-middle" attacks, which is why a user's device may show a security certificate warning.

For more information about SSL inspection, see Why you should use SSL inspection on page 243.

Often, when users receive security certificate warnings, they simply select **Continue** without understanding why the error is occurring. To avoid encouraging this habit, you can prevent the warning from appearing in the first place.

Using a CA-signed certificate

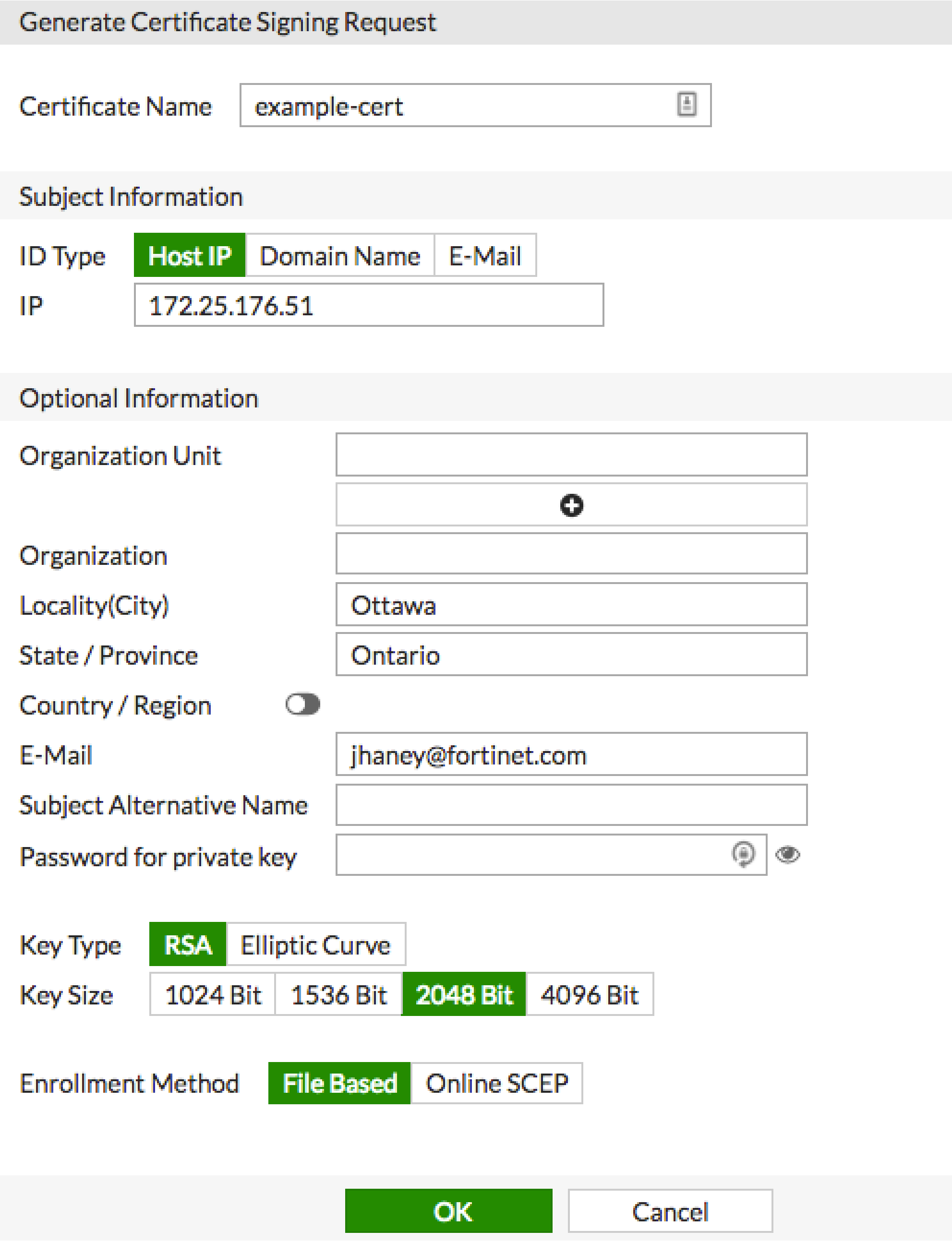
In this method, you obtain a CA-signed certificate and install this certificate on your FortiGate to use with SSL inspection. In order to implement SSL inspection, you also need to add another security profile to your policy controlling Internet traffic. You can use either FortiAuthenticator as your CA or a trusted private CA.

If you use FortiAuthenticator as a CA, you generate a certificate signing request (CSR) on your FortiGate, have it signed on the FortiAuthenticator, import the certificate into your FortiGate, and configure your FortiGate to use the certificate for SSL deep inspection of HTTPS traffic.

If you use a trusted private CA, you generate a CSR on your FortiGate, apply for an SSL certificate from the trusted private CA, import the certificate into your FortiGate, and configure your FortiGate so the certificate can be used for SSL deep inspection of HTTPS traffic.

Generating a CSR on a FortiGate

1. On your FortiGate, create a new CSR by going to **System > Certificates** and select **Generate**.
2. Enter a **Certificate Name**, the external IP of your FortiGate, and a valid email address.
3. To ensure the certificate is securely encrypted, set **Key Type** to **RSA** and **Key Size** to **2048 Bit** (the industry standard).



Generate Certificate Signing Request

Certificate Name: example-cert

Subject Information

ID Type: [✓ Host IP] Domain Name E-Mail

IP: 172.25.176.51

Optional Information

Organization Unit:

Organization:

Locality(City): Ottawa

State / Province: Ontario

Country / Region: ○

E-Mail: jhaney@fortinet.com

Subject Alternative Name:

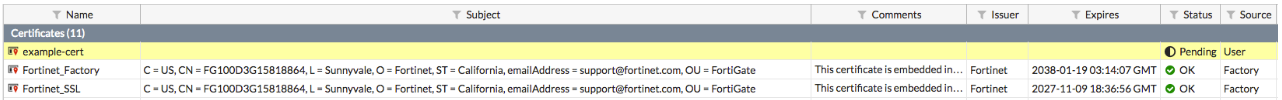
Password for private key:

Key Type: [✓ RSA] Elliptic Curve

Key Size: 1024 Bit 1536 Bit [✓ 2048 Bit] 4096 Bit

Enrollment Method: [✓ File Based] Online SCEP

Once generated, the certificate shows a Status of Pending. To save the .csr file to your local drive, highlight the certificate and select Download.



Name	Subject	Comments	Issuer	Expires	Status	Source
Certificates (11)						
example-cert					◐ Pending	User
Fortinet_Factory	C = US, CN = FG100D3G15818864, L = Sunnyvale, O = Fortinet, ST = California, emailAddress = support@fortinet.com, OU = FortiGate	This certificate is embedded in…	Fortinet	2038-01-19 03:14:07 GMT	✓ OK	Factory
Fortinet_SSL	C = US, CN = FG100D3G15818864, L = Sunnyvale, O = Fortinet, ST = California, emailAddress = support@fortinet.com, OU = FortiGate	This certificate is embedded in…	Fortinet	2027-11-09 18:36:56 GMT	✓ OK	Factory

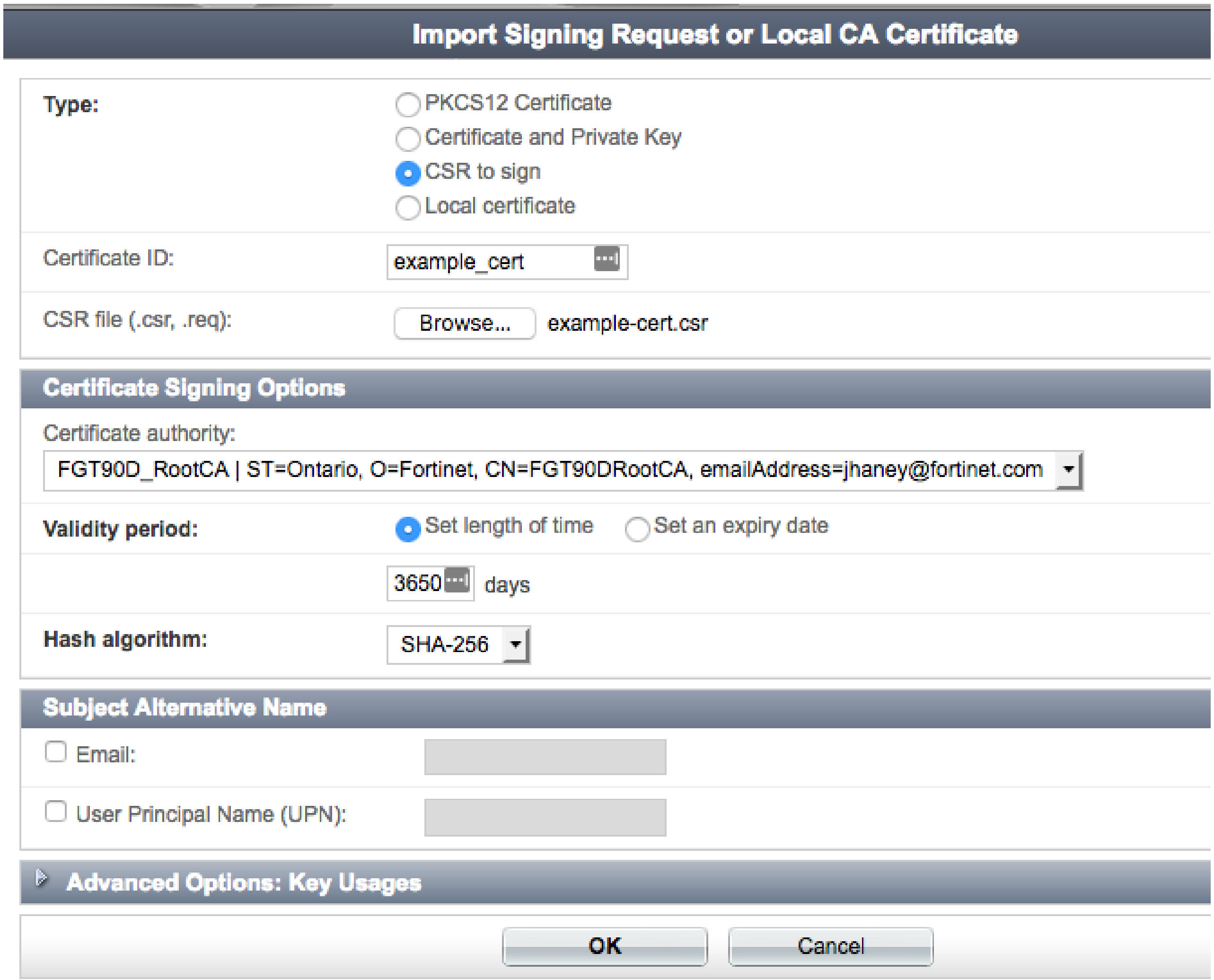
Getting the certificate signed by a CA

Trusted private CA:

If you want to use a trusted private CA to sign the certificate, use the CSR to apply for an SSL certificate with your trusted private CA.

FortiAuthenticator:

1. If you want to use a FortiAuthenticator as a CA to sign the certificate, on the FortiAuthenticator, go to **Certificate Management > Certificate Authorities > Local CAs** and select **Import**.
2. Set **Type** to **CSR to sign**, enter a **Certificate ID**, and import the **example-cert.csr** file. Make sure to select the **Certificate authority** from the drop-down menu and set the **Hash algorithm** to **SHA-256**.



Import Signing Request or Local CA Certificate

Type:
○ PKCS12 Certificate
○ Certificate and Private Key
● CSR to sign
○ Local certificate

Certificate ID: example_cert

CSR file (.csr, .req): example-cert.csr

Certificate Signing Options

Certificate authority: FGT90D_RootCA | ST=Ontario, O=Fortinet, CN=FGT90DRootCA, emailAddress=jhaney@fortinet.com

Validity period: ● Set length of time ○ Set an expiry date

3650 days

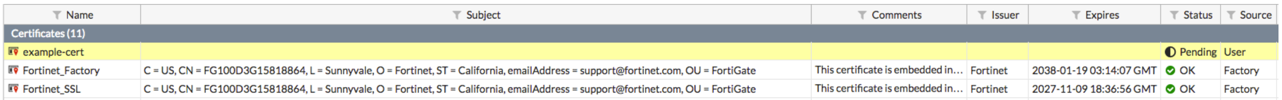
Hash algorithm: SHA-256

Subject Alternative Name

□ Email:

□ User Principal Name (UPN):

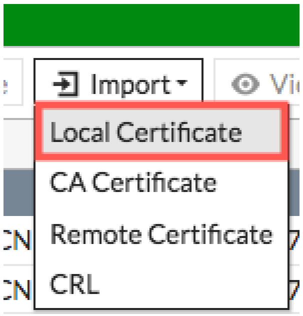
3. Once imported, you should see that **example_cert** has been signed by the FortiAuthenticator, showing a **Status** of **Active**, and with the **CA Type** of **Intermediate (non-signing) CA**. Highlight the certificate and select **Export**. This will save the **example_cert.crt** file to your local drive.



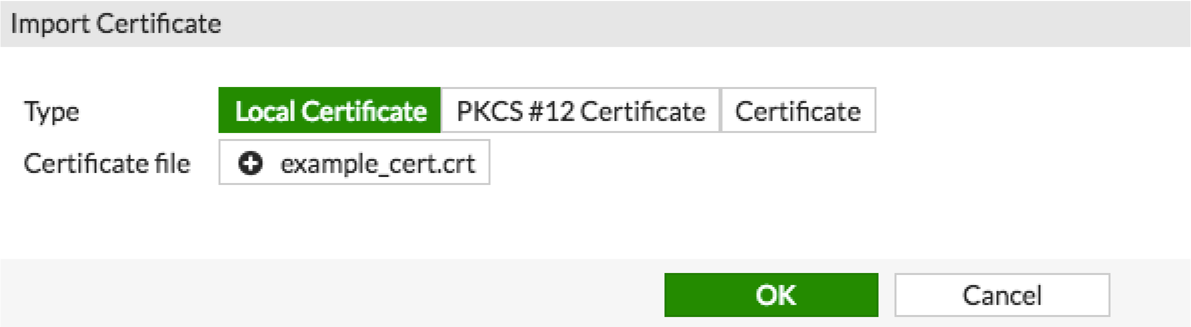
Name	Subject	Comments	Issuer	Expires	Status	Source
Certificates (11)						
example-cert					Pending	User
Fortinet_Factory	C = US, CN = FG100D3G15818864, L = Sunnyvale, O = Fortinet, ST = California, emailAddress = support@fortinet.com, OU = FortiGate	This certificate is embedded in…	Fortinet	2038-01-19 03:14:07 GMT	✓ OK	Factory
Fortinet_SSL	C = US, CN = FG100D3G15818864, L = Sunnyvale, O = Fortinet, ST = California, emailAddress = support@fortinet.com, OU = FortiGate	This certificate is embedded in…	Fortinet	2027-11-09 18:36:56 GMT	✓ OK	Factory

Importing the signed certificate to your FortiGate

1. On your FortiGate, go to **System > Certificates** and select **Local Certificate** from the Import drop-down menu.



2. Browse to the certificate file and select **OK**.

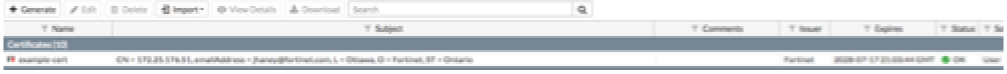


Import Certificate

Type: Local Certificate | PKCS #12 Certificate | Certificate

Certificate file: example_cert.crt

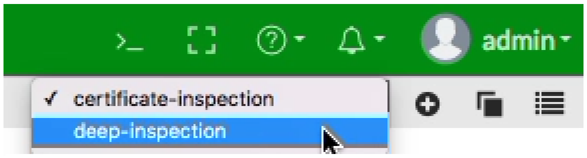
You should now see that the certificate has a Status of **OK**.



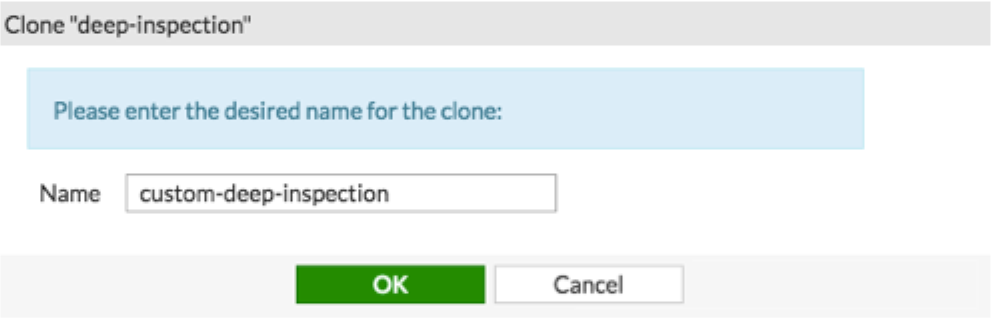
Name	Subject	Comments	Issuer	Expires	Status
Certificates (10)					
example-cert	CN = 172.25.176.51, emailAddress = [illegible]@fortinet.com, L = Ottawa, O = Fortinet, ST = Ontario		Fortinet	[illegible]	OK

Editing the SSL inspection profile

1. To use your certificate in an SSL inspection profile go to **Security Profiles > SSL/SSH Inspection**. Use the dropdown menu in the top right corner to select **deep-inspection**.



2. The **deep-inspection** profile is read-only. To use the CA-signed certificate for SSL inspection, you must clone the deep-inspection profile and configure the new profile to use your certificate. To clone an existing profile, select the Clone icon (one page behind another) and enter a new name when prompted. In this example, the name of the profile is *custom-deep-inspection*.

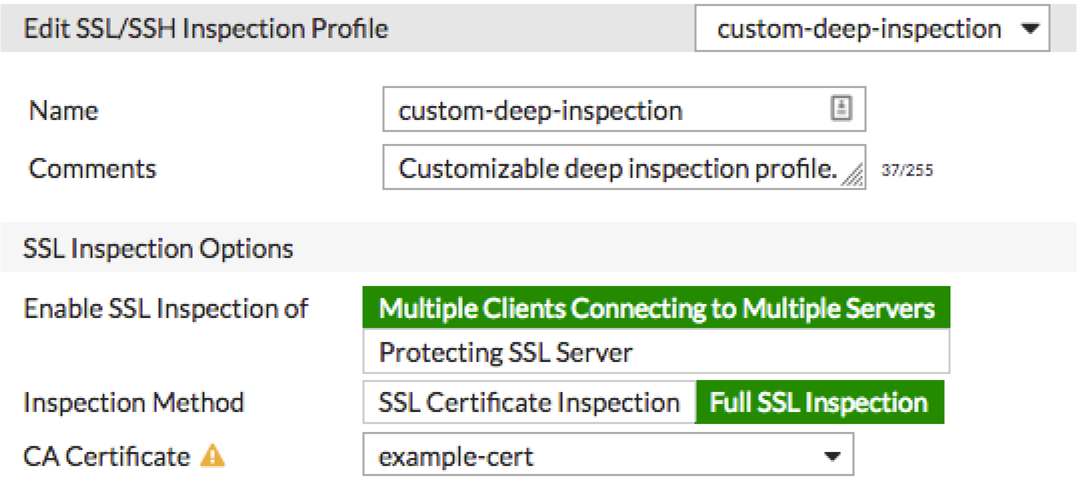


Clone "deep-inspection"

Please enter the desired name for the clone:

Name: custom-deep-inspection

3. Set **CA Certificate** to use the new certificate.



Edit SSL/SSH Inspection Profile: custom-deep-inspection

Name: custom-deep-inspection

Comments: Customizable deep inspection profile. 37/255

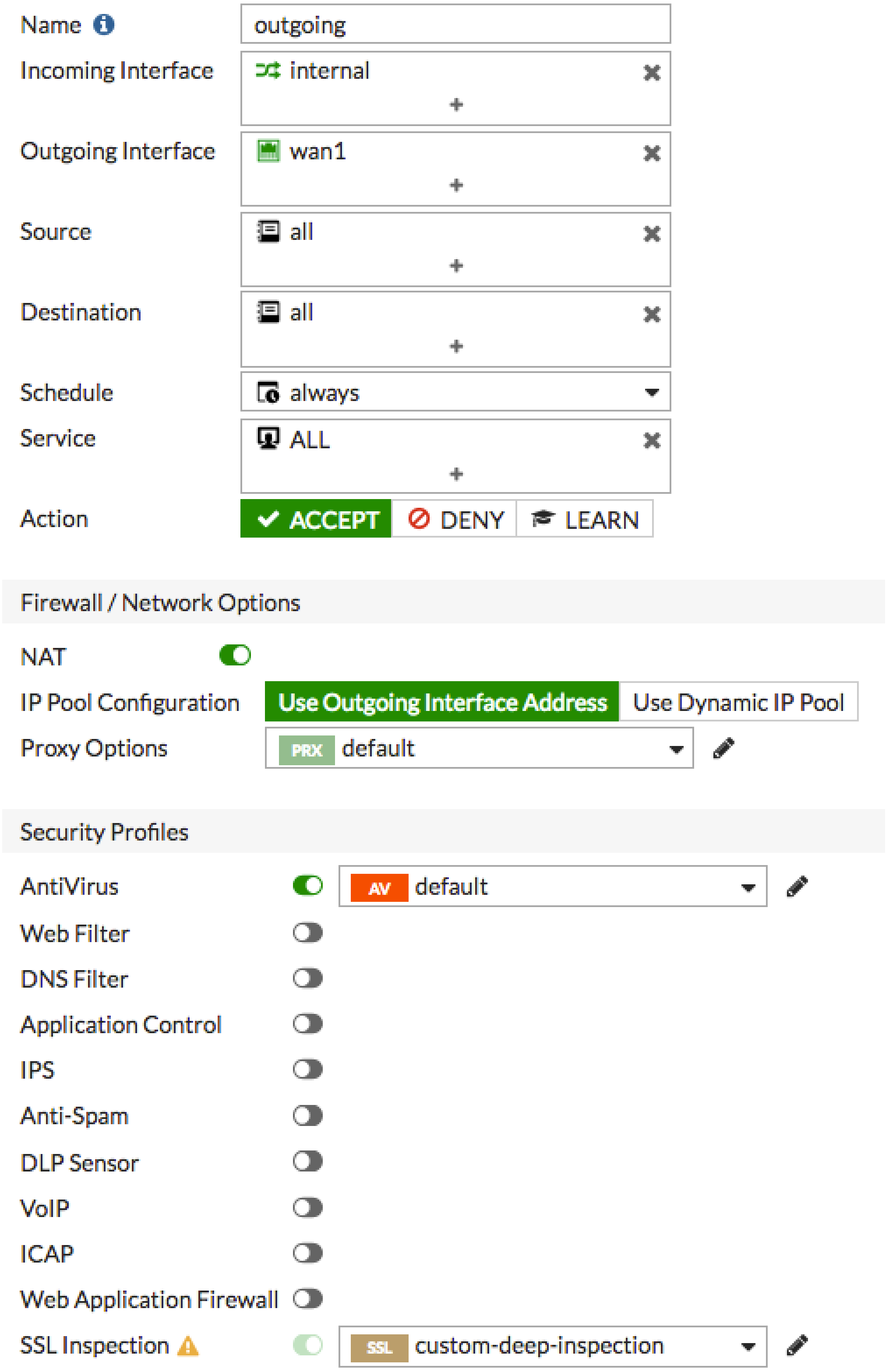
SSL Inspection Options

Enable SSL Inspection of: Multiple Clients Connecting to Multiple Servers

Inspection Method: Full SSL Inspection

CA Certificate: example-cert

4. Verify that SSL inspection is applied to your policy that controls traffic to the Internet. You must also apply at least one other security profile to that policy in order to implement SSL inspection. In this example, we apply antivirus.



Name	outgoing
Incoming Interface	internal
Outgoing Interface	wan1
Source	all
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT / DENY / LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool
Proxy Options	PRX default

Security Profiles

AntiVirus	●	AV default
Web Filter	○	
DNS Filter	○	
Application Control	○	
IPS	○	
Anti-Spam	○	
DLP Sensor	○	
VoIP	○	
ICAP	○	
Web Application Firewall	○	
SSL Inspection ⚠	●	SSL custom-deep-inspection

Importing the certificate into web browsers

Once your certificate is signed by FortiAuthenticator, you need to import the certificate into users' browsers.

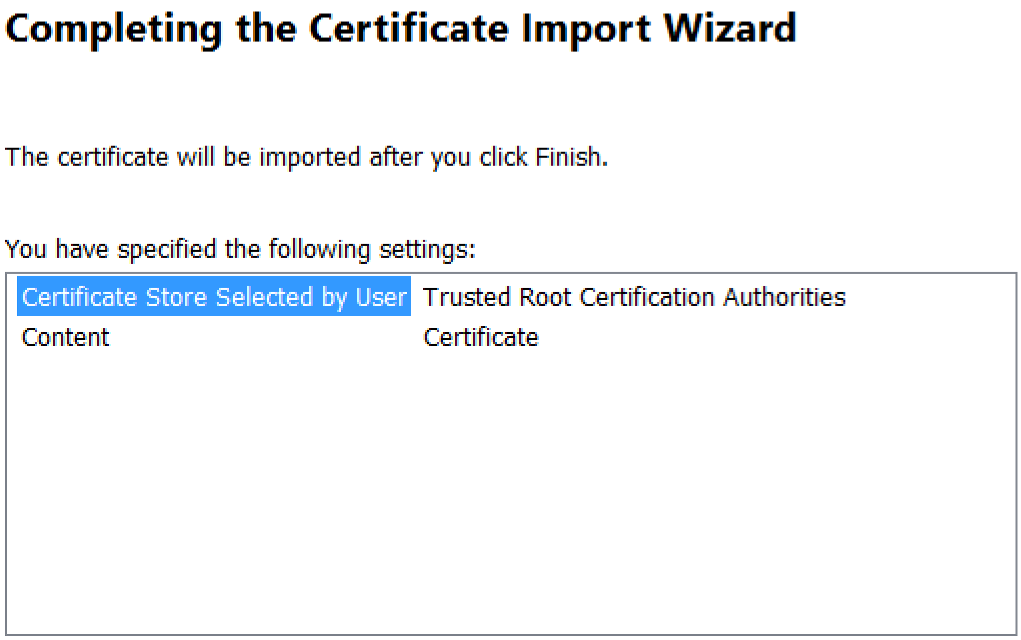
If you have the right environment, such as the Windows Group Policy Management Console, you can push the certificate to users' browsers using the Windows Group Policy Editor. In this case, you do not have to import the certificate into users' browsers.

The method you use for importing the certificate varies depending on the type of browser.

Internet Explorer, Chrome, and Safari (on Windows and macOS):

Internet Explorer, Chrome, and Safari use the operating system's certificate store for Internet browsing. If users will be using these browsers, you must install the certificate into the certificate store for the OS.

1. If you are using Windows 7/8/10, double-click the certificate file and select **Open**. Select **Install Certificate** to launch the **Certificate Import Wizard**.
2. Use the wizard to install the certificate into the **Trusted Root Certificate Authorities** store. If a security warning appears, select **Yes** to install the certificate.



Completing the Certificate Import Wizard

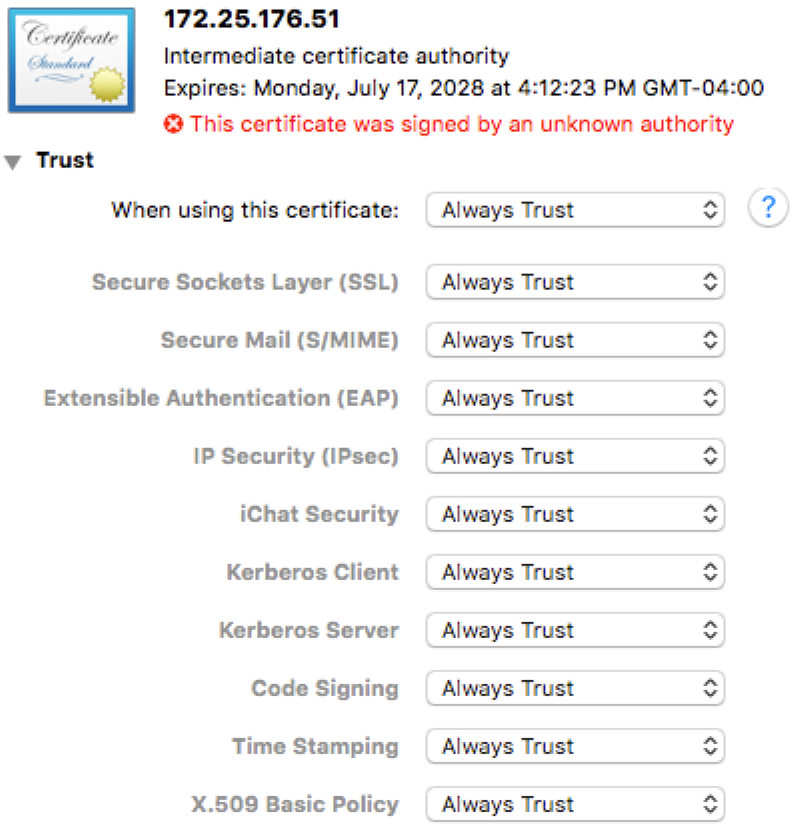
The certificate will be imported after you click Finish.

You have specified the following settings:

Certificate Store Selected by User	Trusted Root Certification Authorities
Content	Certificate

3. If you are using macOS, double-click the certificate file to launch **Keychain Access**.
4. Locate the certificate in the **Certificates** list and select it. Expand **Trust** and select **Always Trust**. If necessary,

enter the administrative password for your computer to make this change.



172.25.176.51

Intermediate certificate authority

Expires: Monday, July 17, 2028 at 4:12:23 PM GMT-04:00

This certificate was signed by an unknown authority

▼ Trust

When using this certificate:	Always Trust
Secure Sockets Layer (SSL)	Always Trust
Secure Mail (S/MIME)	Always Trust
Extensible Authentication (EAP)	Always Trust
IP Security (IPsec)	Always Trust
iChat Security	Always Trust
Kerberos Client	Always Trust
Kerberos Server	Always Trust
Code Signing	Always Trust
Time Stamping	Always Trust
X.509 Basic Policy	Always Trust

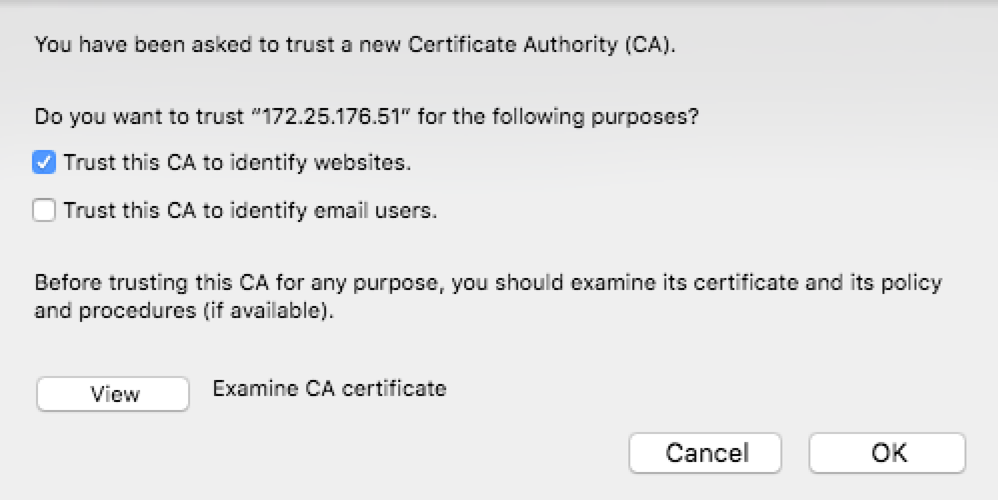
Firefox (on Windows and macOS)

Firefox has its own certificate store. To avoid errors in Firefox, the certificate must be installed in this store, rather than in the OS.

If users are using Firefox, instead of being pushed to all of their devices, the certificate must be installed on each device.

1. In Firefox, go to **Options > Privacy & Security** (Windows) or **Preferences > Privacy & Security** (macOS).
2. Scroll down to the **Certificates** section. Select **View Certificates**, select the **Authorities** list. **Import** the

certificate and set it to be trusted for website identification.



You have been asked to trust a new Certificate Authority (CA).

Do you want to trust "172.25.176.51" for the following purposes?

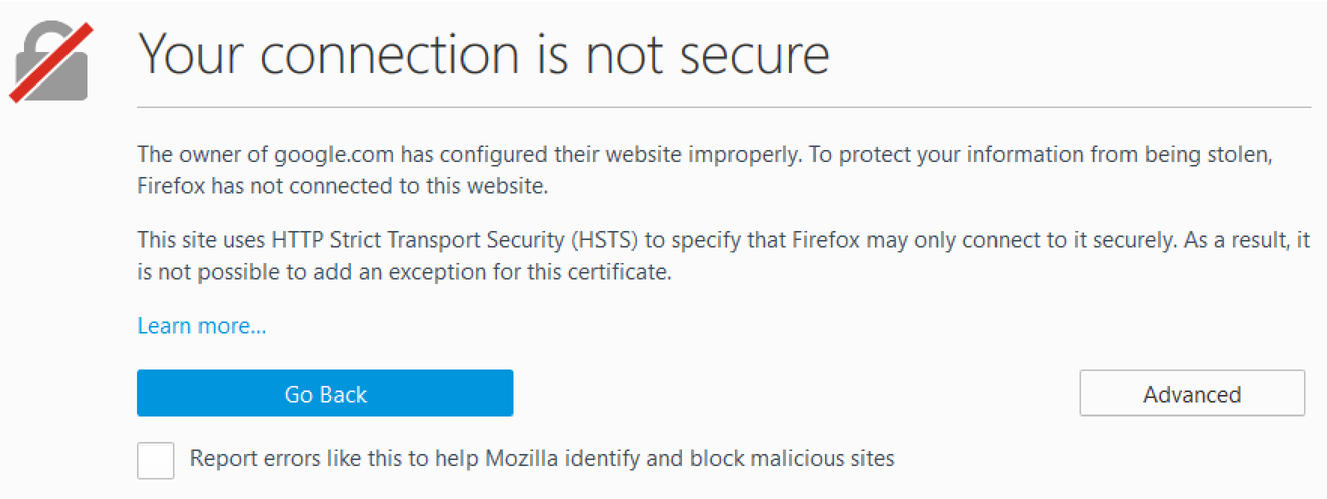
☑ Trust this CA to identify websites.

□ Trust this CA to identify email users.

Before trusting this CA for any purpose, you should examine its certificate and its policy and procedures (if available).

Results

Before you install the certificate, an error message appears in users' browsers when they access a site that uses HTTPS (this example shows an error message in Firefox).



Your connection is not secure

The owner of google.com has configured their website improperly. To protect your information from being stolen, Firefox has not connected to this website.

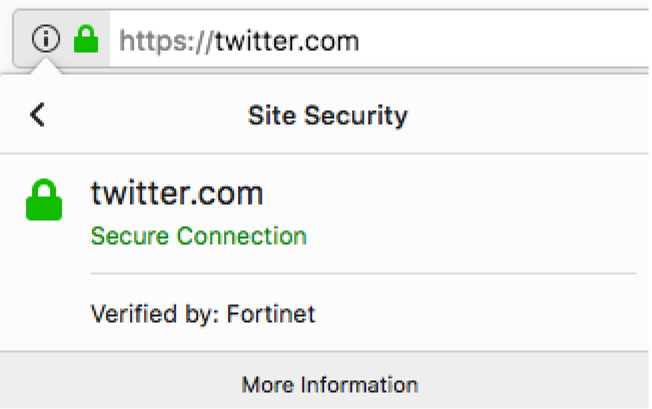
This site uses HTTP Strict Transport Security (HSTS) to specify that Firefox may only connect to it securely. As a result, it is not possible to add an exception for this certificate.

□ Report errors like this to help Mozilla identify and block malicious sites

After you install the certificate, users shouldn't experience a certificate security issue when they browse to sites that the FortiGate performs SSL content inspection on.

Users can view information about the connection and the certificate that's used.

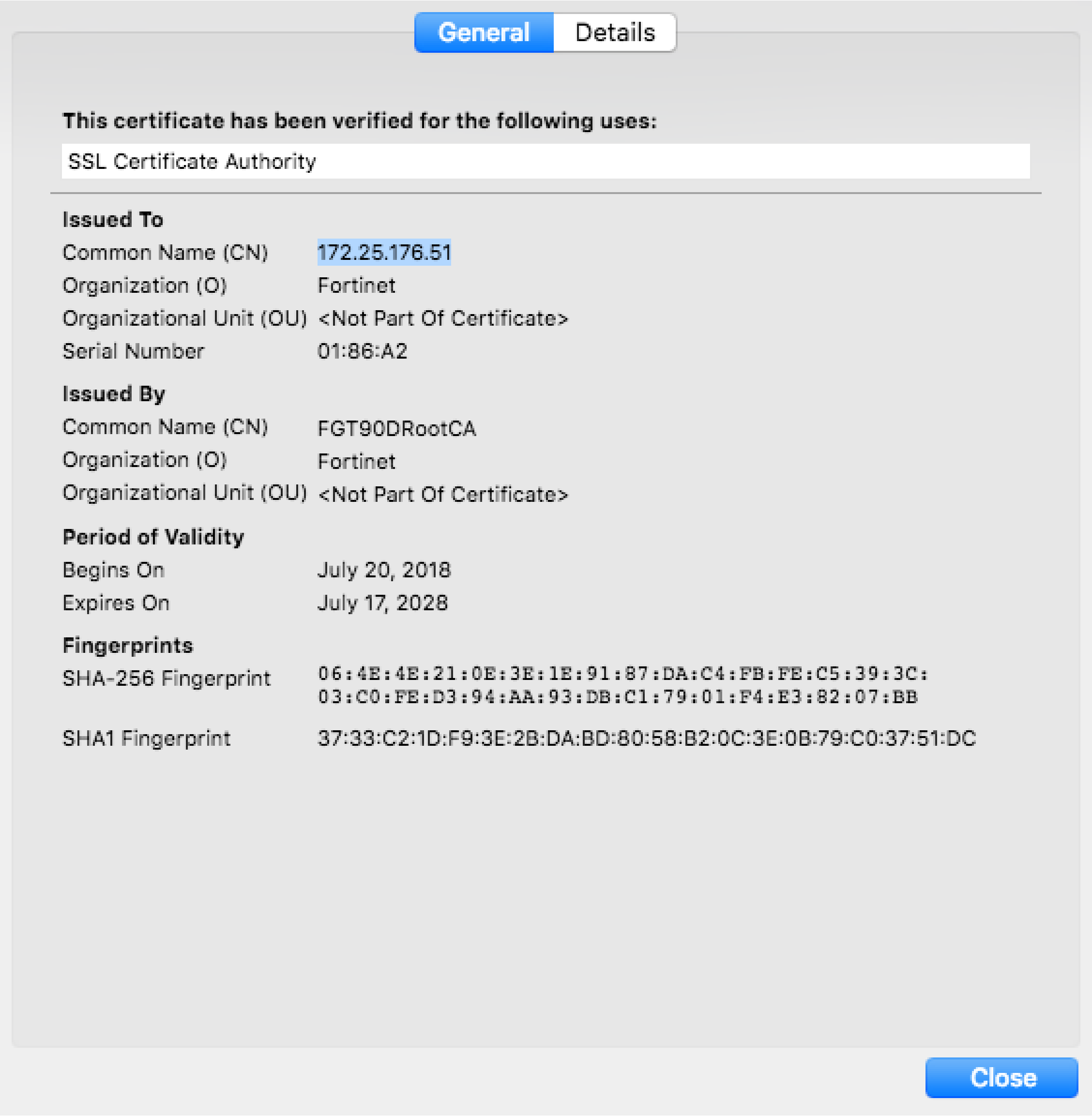
When users view information about the connection, they'll see that it's verified by Fortinet.



twitter.com
Secure Connection

Verified by: Fortinet

When users view the certificate in the browser, they will see which certificate is used and information about that certificate.



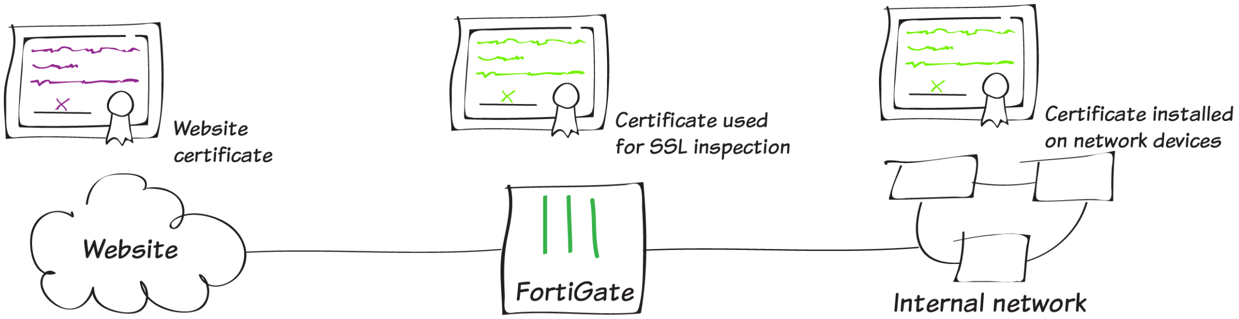
This certificate has been verified for the following uses:

SSL Certificate Authority

Issued To	
Common Name (CN)	172.25.176.51
Organization (O)	Fortinet
Organizational Unit (OU)	<Not Part Of Certificate>
Serial Number	01:86:A2
Issued By	
Common Name (CN)	FGT90DRootCA
Organization (O)	Fortinet
Organizational Unit (OU)	<Not Part Of Certificate>
Period of Validity	
Begins On	July 20, 2018
Expires On	July 17, 2028
Fingerprints	
SHA-256 Fingerprint	06:4E:4E:21:0E:3E:1E:91:87:DA:C4:FB:FE:C5:39:3C: 03:C0:FE:D3:94:AA:93:DB:C1:79:01:F4:E3:82:07:BB
SHA1 Fingerprint	37:33:C2:1D:F9:3E:2B:DA:BD:80:58:B2:0C:3E:0B:79:C0:37:51:DC

Preventing certificate warnings (default certificate)

FORTIOS VERSION 6.0


Website certificate
Certificate used for SSL inspection
Certificate installed on network devices
Website
FortiGate
Internal network

In this recipe, you prevent users from receiving a security certificate warning when your FortiGate performs full SSL inspection on incoming traffic. There are several methods for doing this, depending on whether you're using your ForiGate default certificate, as presented here, your a CA-signed certificate (see Preventing certificate warnings (CA-signed certificate) on page 217, or a self-signed certification (see Preventing certificate warnings (self-signed) on page 235).

When you enable full SSL inspection, your FortiGate impersonates the recipient of the originating SSL session, then decrypts and inspects the content. The FortiGate then re-encrypts the content, creates a new SSL session between the FortiGate and the recipient by impersonating the sender, and sends the content to the end user. This is the same process used in "man-in-the-middle" attacks, which is why a user's device may show a security certificate warning.

For more information about SSL inspection, see Why you should use SSL inspection on page 243.

Often, when users receive security certificate warnings, they simply select **Continue** without understanding why the error is occurring. To avoid encouraging this habit, you can prevent the warning from appearing in the first place.

Using the default certificate

All FortiGate devices have a default certificate that’s used for full SSL inspection. This certificate is also used in the default **deep-inspection** profile. To prevent users from seeing certificate warnings, you can install this certificate on users’ devices.

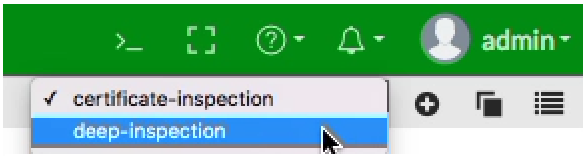
Generating a unique certificate

Run the following CLI command to generate an SSL certificate that’s unique to your FortiGate:

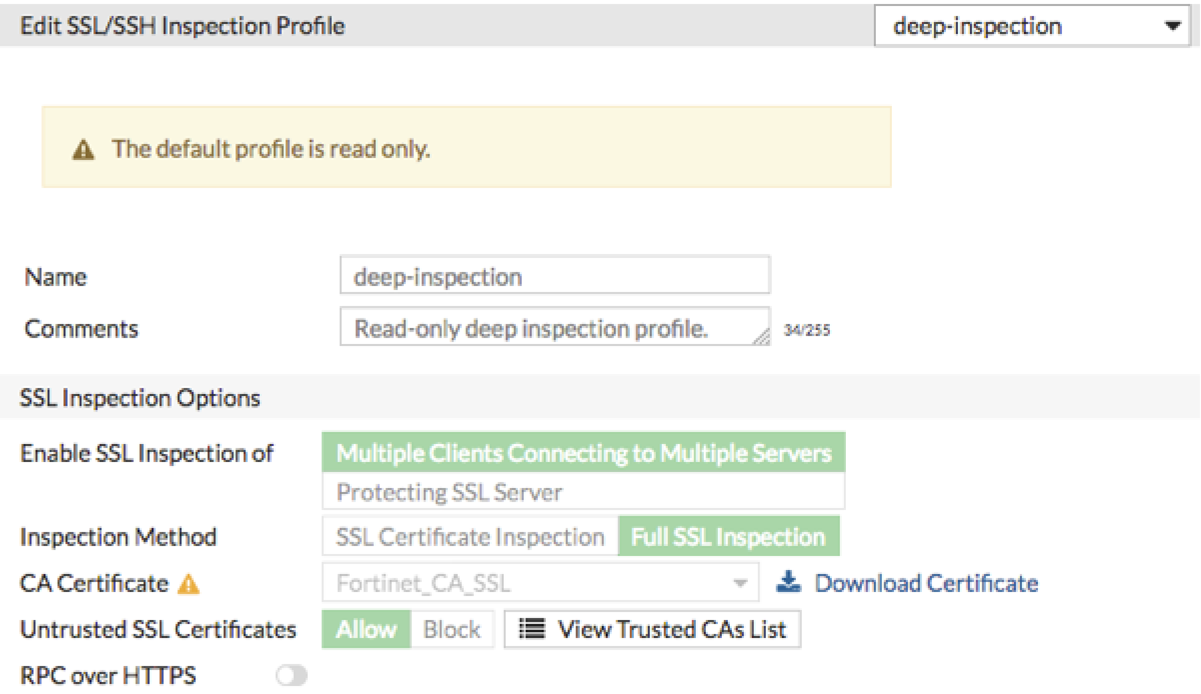
```
exec vpn certificate local generate default-ssl-ca
```

Downloading the certificate

1. Go to **Security Profiles > SSL/SSH Inspection**. Use the drop-down menu in the top right corner to select **deep-inspection**, which is the profile used to apply full SSL inspection.



2. The default FortiGate certificate is listed as the **CA Certificate**. Select **Download Certificate**.



Edit SSL/SSH Inspection Profile — deep-inspection

⚠ The default profile is read only.

Name	deep-inspection
Comments	Read-only deep inspection profile. 34/255

SSL Inspection Options

Enable SSL Inspection of	Multiple Clients Connecting to Multiple Servers (selected) Protecting SSL Server
Inspection Method	SSL Certificate Inspection / Full SSL Inspection (selected)
CA Certificate ⚠	Fortinet_CA_SSL — Download Certificate
Untrusted SSL Certificates	Allow (selected) / Block — View Trusted CAs List
RPC over HTTPS	○

Applying SSL inspection to a policy

Before you import the certificate, verify that SSL inspection is applied to your policy that controls traffic to the Internet. You must also apply at least one other security profile to that policy in order to implement SSL inspection

Importing the certificate into web browsers

Once you have your FortiGate device’s default certificate, you need to import the certificate into users’ browsers.

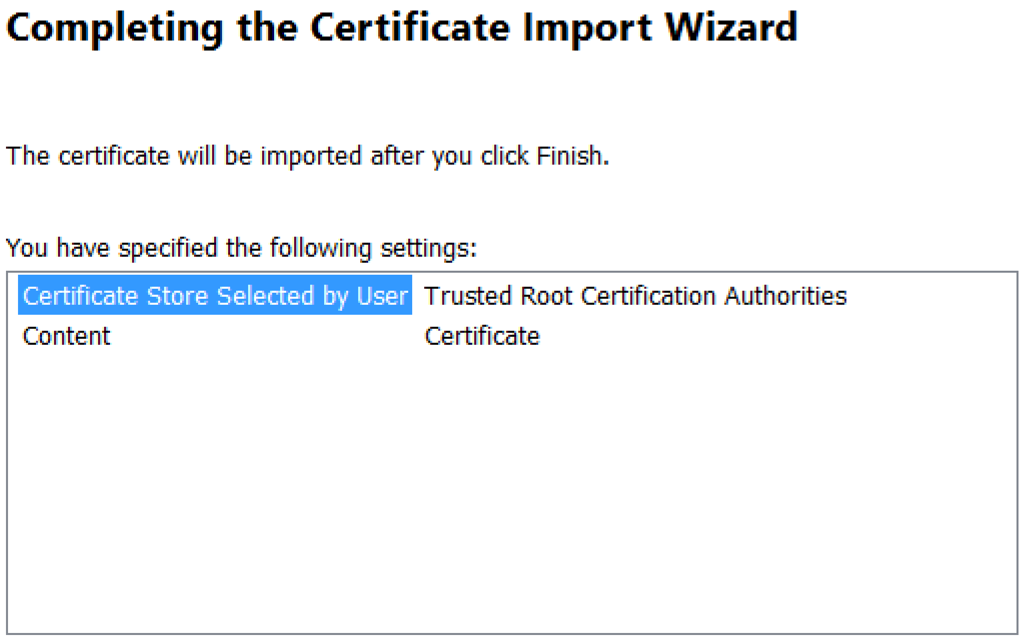
> If you have the right environment, such as the Windows Group Policy Management Console, you can push the certificate to users' browsers using the Windows Group Policy Editor. In this case, you do not have to import the certificate into users' browsers.

The method you use for importing the certificate varies depending on the type of browser.

Internet Explorer, Chrome, and Safari (on Windows and macOS):

Internet Explorer, Chrome, and Safari use the operating system's certificate store for Internet browsing. If users will be using these browsers, you must install the certificate into the certificate store for the OS.

1. If you are using Windows 7/8/10, double-click the certificate file and select **Open**. Select **Install Certificate** to launch the **Certificate Import Wizard**.
2. Use the wizard to install the certificate into the **Trusted Root Certificate Authorities** store. If a security warning appears, select **Yes** to install the certificate.



Completing the Certificate Import Wizard

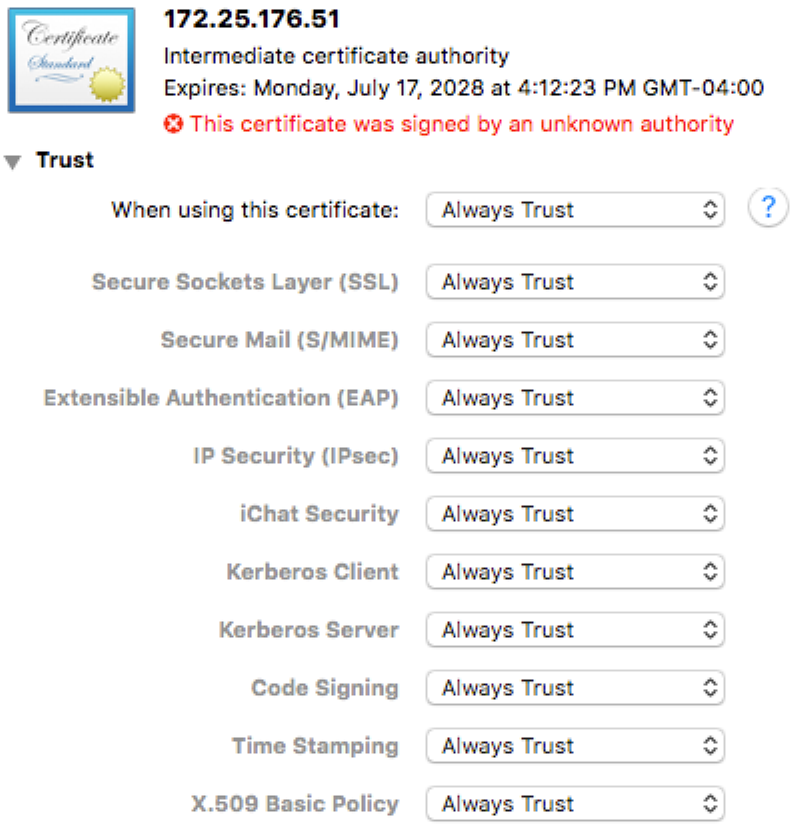
The certificate will be imported after you click Finish.

You have specified the following settings:

Certificate Store Selected by User	Trusted Root Certification Authorities
Content	Certificate

3. If you are using macOS, double-click the certificate file to launch **Keychain Access**.
4. Locate the certificate in the **Certificates** list and select it. Expand **Trust** and select **Always Trust**. If necessary,

enter the administrative password for your computer to make this change.



172.25.176.51
Intermediate certificate authority
Expires: Monday, July 17, 2028 at 4:12:23 PM GMT-04:00
This certificate was signed by an unknown authority

▼ Trust

When using this certificate:	Always Trust
Secure Sockets Layer (SSL)	Always Trust
Secure Mail (S/MIME)	Always Trust
Extensible Authentication (EAP)	Always Trust
IP Security (IPsec)	Always Trust
iChat Security	Always Trust
Kerberos Client	Always Trust
Kerberos Server	Always Trust
Code Signing	Always Trust
Time Stamping	Always Trust
X.509 Basic Policy	Always Trust

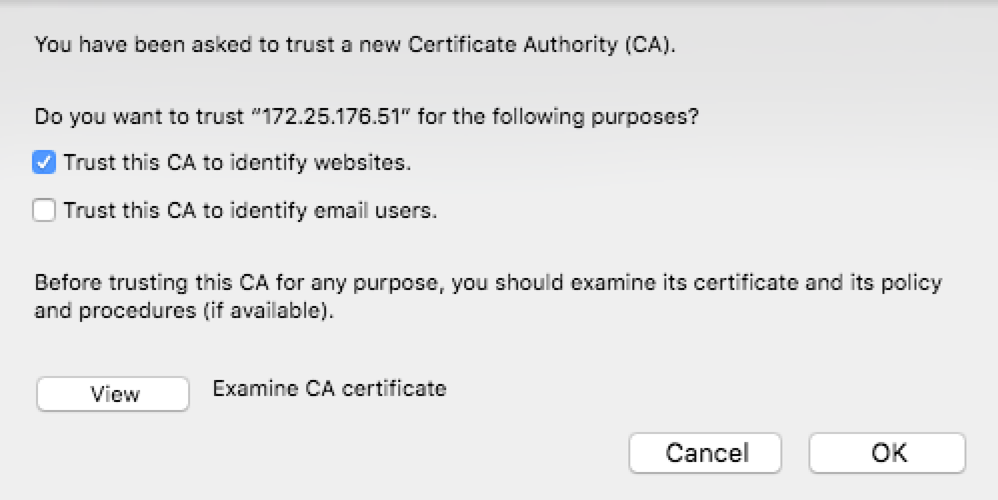
Firefox (on Windows and macOS)

Firefox has its own certificate store. To avoid errors in Firefox, the certificate must be installed in this store, rather than in the OS.

If users are using Firefox, instead of being pushed to all of their devices, the certificate must be installed on each device.

1. In Firefox, go to **Options > Privacy & Security** (Windows) or **Preferences > Privacy & Security** (macOS).
2. Scroll down to the **Certificates** section. Select **View Certificates**, select the **Authorities** list. **Import** the

certificate and set it to be trusted for website identification.



You have been asked to trust a new Certificate Authority (CA).

Do you want to trust "172.25.176.51" for the following purposes?

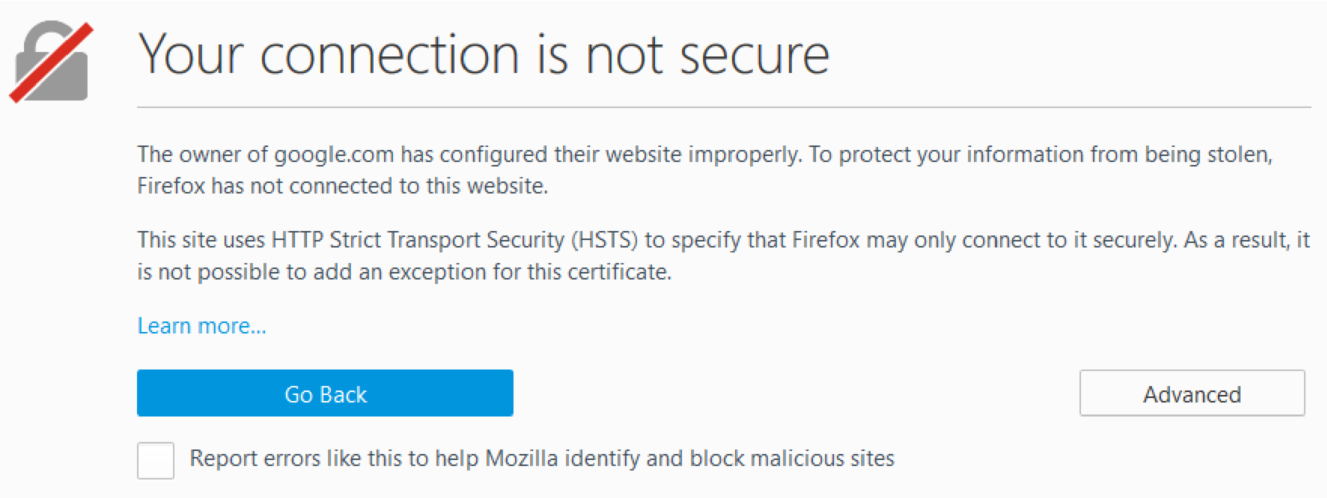
☑ Trust this CA to identify websites.

□ Trust this CA to identify email users.

Before trusting this CA for any purpose, you should examine its certificate and its policy and procedures (if available).

Results

Before you install the certificate, an error message appears in users' browsers when they access a site that uses HTTPS (this example shows an error message in Firefox).



Your connection is not secure

The owner of google.com has configured their website improperly. To protect your information from being stolen, Firefox has not connected to this website.

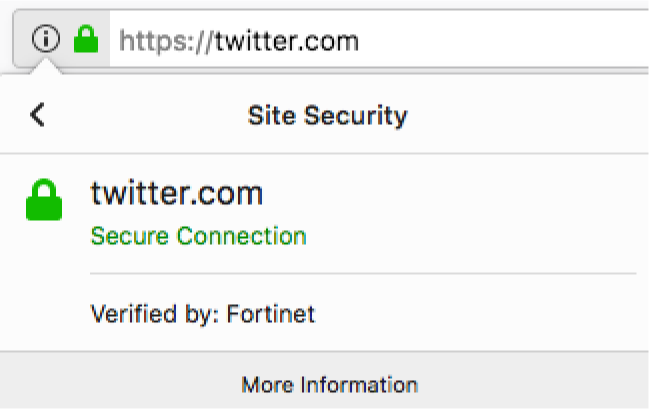
This site uses HTTP Strict Transport Security (HSTS) to specify that Firefox may only connect to it securely. As a result, it is not possible to add an exception for this certificate.

□ Report errors like this to help Mozilla identify and block malicious sites

After you install the certificate, users shouldn't experience a certificate security issue when they browse to sites that the FortiGate performs SSL content inspection on.

Users can view information about the connection and the certificate that's used.

When users view information about the connection, they'll see that it's verified by Fortinet.



https://twitter.com

Site Security

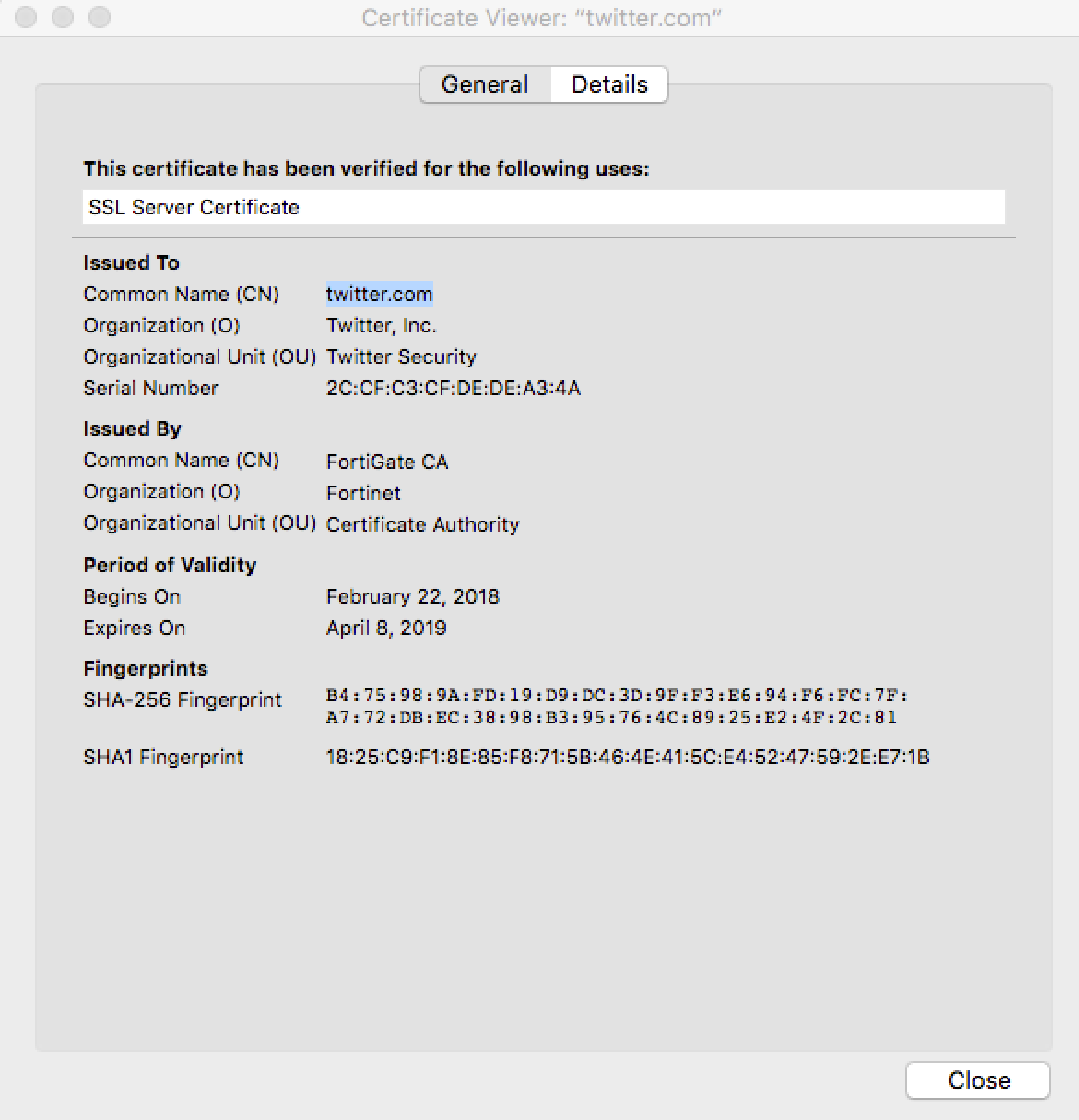
twitter.com

Secure Connection

Verified by: Fortinet

More Information

When users view the certificate in the browser, they will see which certificate is used and information about that certificate.



This certificate has been verified for the following uses:

SSL Server Certificate

Issued To

Common Name (CN)	twitter.com
Organization (O)	Twitter, Inc.
Organizational Unit (OU)	Twitter Security
Serial Number	2C:CF:C3:CF:DE:DE:A3:4A

Issued By

Common Name (CN)	FortiGate CA
Organization (O)	Fortinet
Organizational Unit (OU)	Certificate Authority

Period of Validity

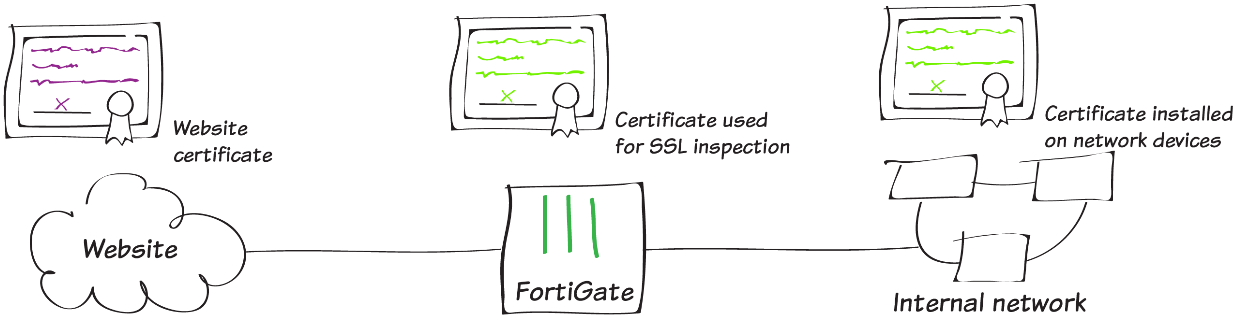
Begins On	February 22, 2018
Expires On	April 8, 2019

Fingerprints

SHA-256 Fingerprint	B4:75:98:9A:FD:19:D9:DC:3D:9F:F3:E6:94:F6:FC:7F: A7:72:DB:EC:38:98:B3:95:76:4C:89:25:E2:4F:2C:81
SHA1 Fingerprint	18:25:C9:F1:8E:85:F8:71:5B:46:4E:41:5C:E4:52:47:59:2E:E7:1B

Preventing certificate warnings (self-signed)

FORTIOS VERSION 6.0


Website certificate
Certificate used for SSL inspection
Certificate installed on network devices
Website
FortiGate
Internal network

In this recipe, you prevent users from receiving a security certificate warning when your FortiGate performs full SSL inspection on incoming traffic. There are several methods for doing this, depending on whether you're using a self-signed certificate, as presented here, your FortiGate default certificate (see Preventing certificate warnings (default certificate) on page 228, or a CA-signed certification (see Preventing certificate warnings (CA-signed certificate) on page 217).

When you enable full SSL inspection, your FortiGate impersonates the recipient of the originating SSL session, then decrypts and inspects the content. The FortiGate then re-encrypts the content, creates a new SSL session between the FortiGate and the recipient by impersonating the sender, and sends the content to the end user. This is the same process used in "man-in-the-middle" attacks, which is why a user's device may show a security certificate warning.

For more information about SSL inspection, see Why you should use SSL inspection on page 243.

Often, when users receive security certificate warnings, they simply select **Continue** without understanding why the error is occurring. To avoid encouraging this habit, you can prevent the warning from appearing in the first place.

Creating a certificate with OpenSSL

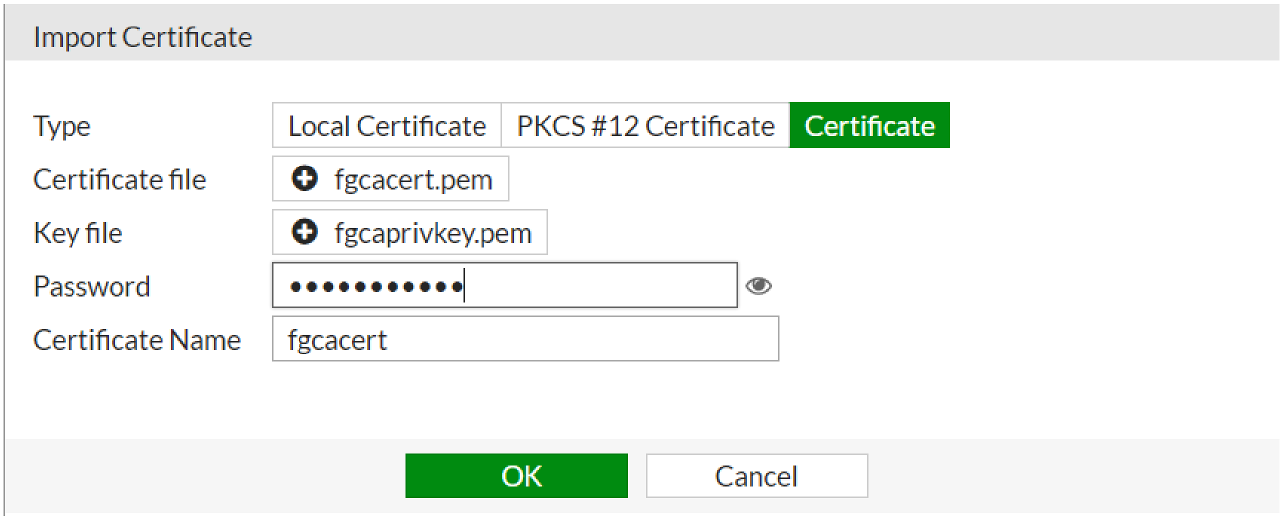
1. If necessary, download and install Open SSL. Make sure that the *openssl.cnf* file is located in the BIN folder for OpenSSL.
2. Using a command prompt (CMD), navigate to the BIN folder.
   In this example, the command is:
   ```
   cd c:\OpenSSL\bin
   ```
3. Generate an RSA key with the following command:
   openssl genrsa -aes256 -out fgcaprivkey.pem 2048 -config openssl cnf

   This RSA key uses AES-256 encryption and a 2048-bit key.
4. When prompted, enter a passphrase for encrypting the private key.
   Use the following command to launch OpenSSL, submit a new certificate request, and sign the request:
   ```
   openssl req -new -x509 -days 3650 -extensions v3_ca -key fgcaprivkey.pem -out fgcacert.pem
        -config openssl.cnf
   ```
   The result is a standard x509 binary certificate that’s valid for 3650 days (approximately 10 years).

5. When prompted, re-enter the passphrase for encryption, then enter the details required for the certificate request, such as location and organization name.
   Two new files are created: a public certificate (*fgcacert.pem*) and a private key (*fgcaprivkey.pem*).

Importing the self-signed certificate

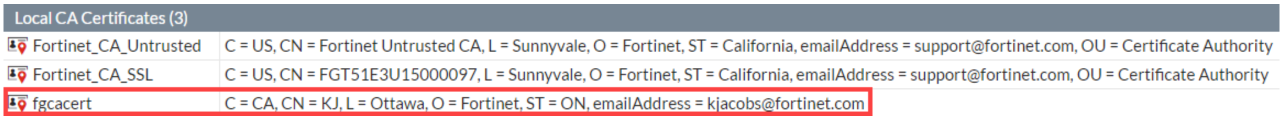
1. Go to **System > Certificates** and select **Import > Local Certificate**.
2. Set **Type** to **Certificate**, then select your **Certificate file** and Key file. Enter the **Password** that you set when you created the certificate.



Import Certificate

Type	Local Certificate / PKCS #12 Certificate / **Certificate**
Certificate file	fgcacert.pem
Key file	fgcaprivkey.pem
Password	●●●●●●●●●●●
Certificate Name	fgcacert

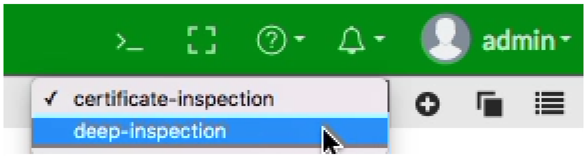
The certificate now appears in the **Local CA Certificates** list.



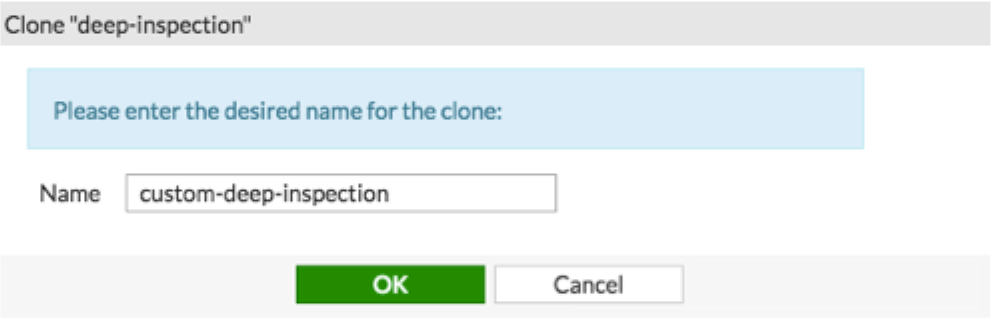
Local CA Certificates (3)	
Fortinet_CA_Untrusted	C = US, CN = Fortinet Untrusted CA, L = Sunnyvale, O = Fortinet, ST = California, emailAddress = support@fortinet.com, OU = Certificate Authority
Fortinet_CA_SSL	C = US, CN = FGT51E3U15000097, L = Sunnyvale, O = Fortinet, ST = California, emailAddress = support@fortinet.com, OU = Certificate Authority
fgcacert	C = CA, CN = KJ, L = Ottawa, O = Fortinet, ST = ON, emailAddress = kjacobs@fortinet.com

Editing the SSL inspection profile

1. To use your certificate in an SSL inspection profile go to **Security Profiles > SSL/SSH Inspection**. Use the dropdown menu in the top right corner to select **deep-inspection**.



2. The **deep-inspection** profile is read-only. To use the CA-signed certificate for SSL inspection, you must clone the deep-inspection profile and configure the new profile to use your certificate. To clone an existing profile, select the Clone icon (one page behind another) and enter a new name when prompted. In this example, the name of the profile is *custom-deep-inspection*.

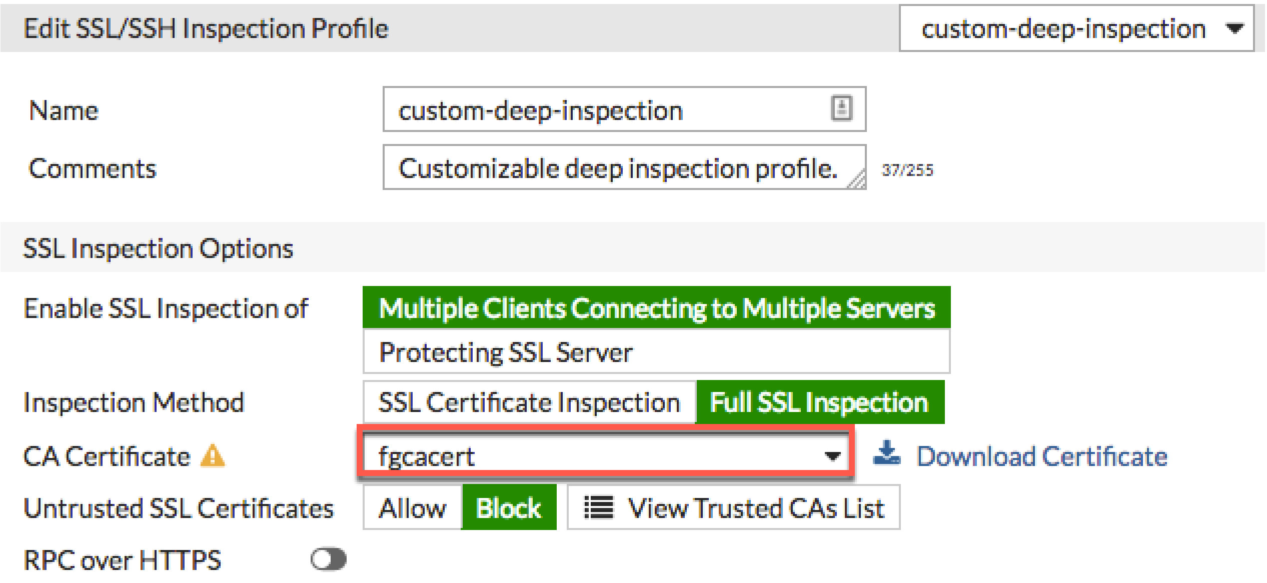


Clone "deep-inspection"

Please enter the desired name for the clone:

Name: custom-deep-inspection

3. Set **CA Certificate** to use the new certificate.
4. Select **Download Certificate**, to download the certificate file.



Edit SSL/SSH Inspection Profile — custom-deep-inspection

Name: custom-deep-inspection

Comments: Customizable deep inspection profile. 37/255

SSL Inspection Options

Enable SSL Inspection of: Multiple Clients Connecting to Multiple Servers | Protecting SSL Server

Inspection Method: SSL Certificate Inspection | Full SSL Inspection

CA Certificate: fgcacert

Untrusted SSL Certificates: Allow | Block

RPC over HTTPS

Applying SSL inspection to a policy

Before you import the certificate, verify that SSL inspection is applied to your policy that controls traffic to the Internet. You must also apply at least one other security profile to that policy in order to implement SSL inspection.

Importing the certificate into web browsers

Once you have your self-signed certificate, you need to import the certificate into users' browsers.

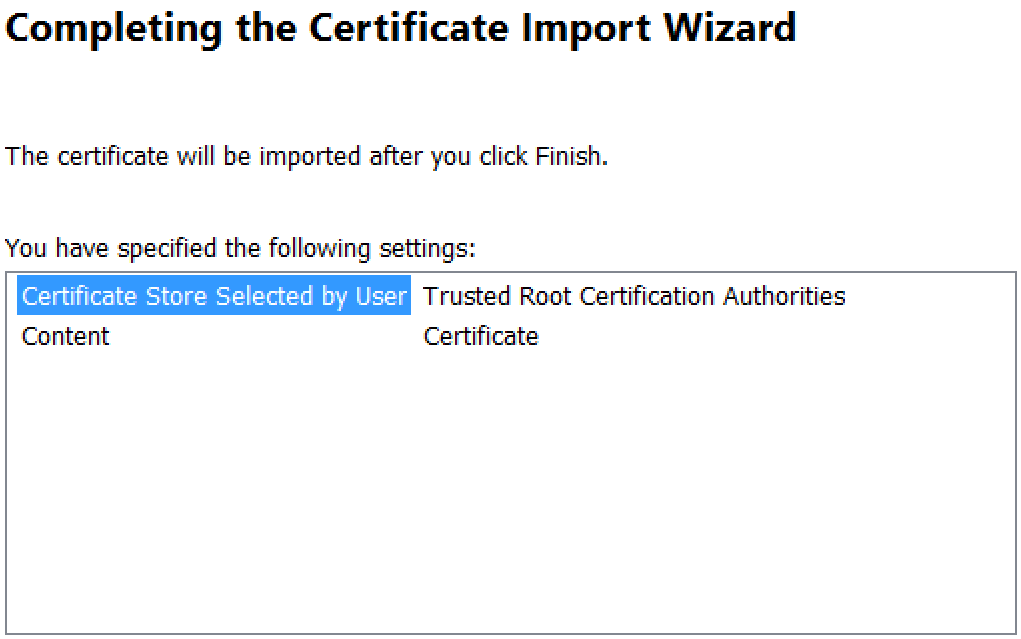
If you have the right environment, such as the Windows Group Policy Management Console, you can push the certificate to users' browsers using the Windows Group Policy Editor. In this case, you do not have to import the certificate into users' browsers.

The method you use for importing the certificate varies depending on the type of browser.

Internet Explorer, Chrome, and Safari (on Windows and macOS):

Internet Explorer, Chrome, and Safari use the operating system's certificate store for Internet browsing. If users will be using these browsers, you must install the certificate into the certificate store for the OS.

1. If you are using Windows 7/8/10, double-click the certificate file and select **Open**. Select **Install Certificate** to launch the **Certificate Import Wizard**.
2. Use the wizard to install the certificate into the **Trusted Root Certificate Authorities** store. If a security warning appears, select **Yes** to install the certificate.



Completing the Certificate Import Wizard

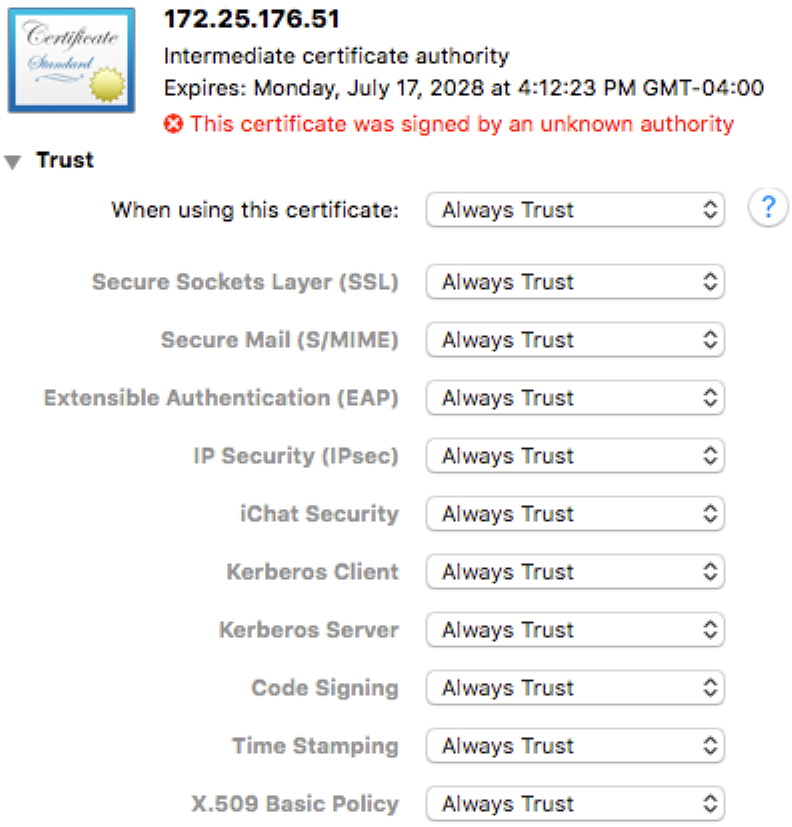
The certificate will be imported after you click Finish.

You have specified the following settings:

Certificate Store Selected by User	Trusted Root Certification Authorities
Content	Certificate

3. If you are using macOS, double-click the certificate file to launch **Keychain Access**.
4. Locate the certificate in the **Certificates** list and select it. Expand **Trust** and select **Always Trust**. If necessary,

enter the administrative password for your computer to make this change.



172.25.176.51
Intermediate certificate authority
Expires: Monday, July 17, 2028 at 4:12:23 PM GMT-04:00
This certificate was signed by an unknown authority

Trust

When using this certificate:	Always Trust
Secure Sockets Layer (SSL)	Always Trust
Secure Mail (S/MIME)	Always Trust
Extensible Authentication (EAP)	Always Trust
IP Security (IPsec)	Always Trust
iChat Security	Always Trust
Kerberos Client	Always Trust
Kerberos Server	Always Trust
Code Signing	Always Trust
Time Stamping	Always Trust
X.509 Basic Policy	Always Trust

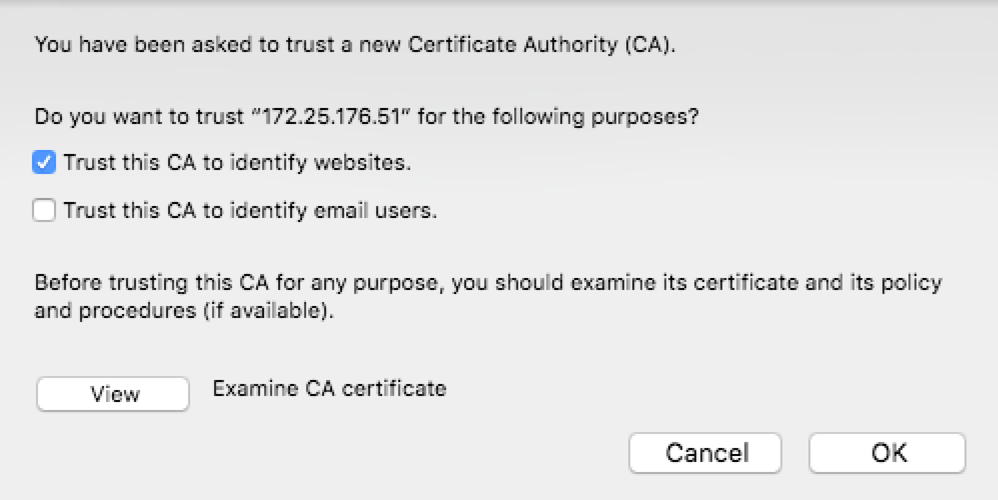
Firefox (on Windows and macOS)

Firefox has its own certificate store. To avoid errors in Firefox, the certificate must be installed in this store, rather than in the OS.

If users are using Firefox, instead of being pushed to all of their devices, the certificate must be installed on each device.

1. In Firefox, go to **Options > Privacy & Security** (Windows) or **Preferences > Privacy & Security** (macOS).
2. Scroll down to the **Certificates** section. Select **View Certificates**, select the **Authorities** list. **Import** the

certificate and set it to be trusted for website identification.



You have been asked to trust a new Certificate Authority (CA).

Do you want to trust "172.25.176.51" for the following purposes?

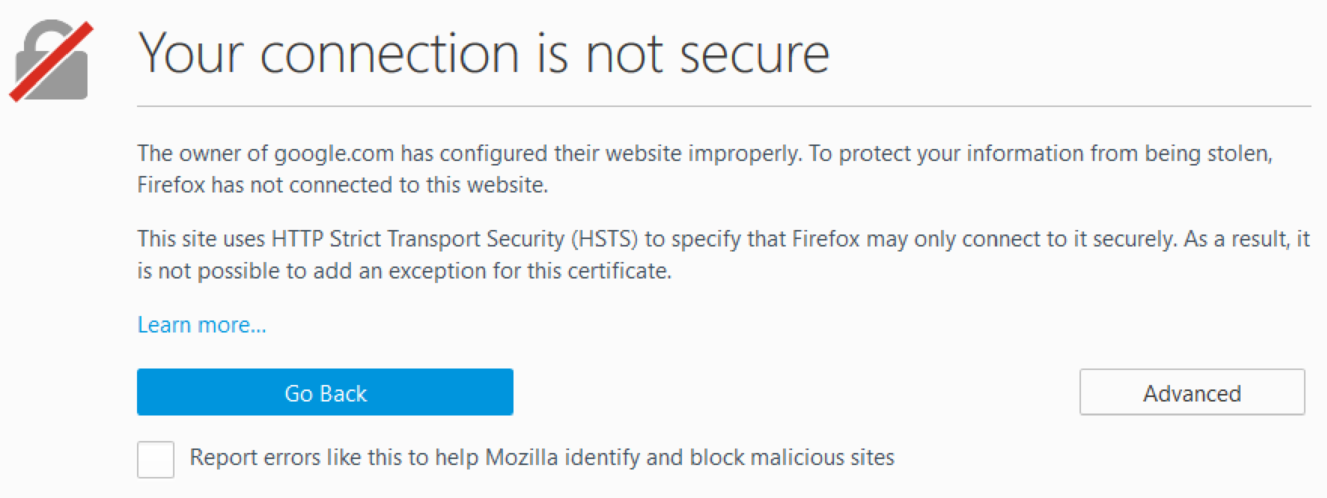
☑ Trust this CA to identify websites.

□ Trust this CA to identify email users.

Before trusting this CA for any purpose, you should examine its certificate and its policy and procedures (if available).

Results

Before you install the certificate, an error message appears in users' browsers when they access a site that uses HTTPS (this example shows an error message in Firefox).



Your connection is not secure

The owner of google.com has configured their website improperly. To protect your information from being stolen, Firefox has not connected to this website.

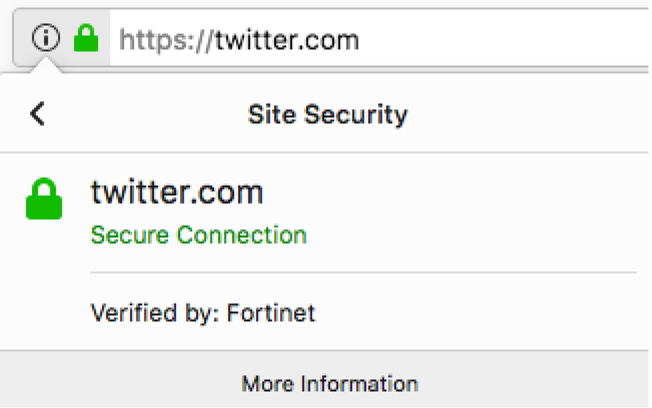
This site uses HTTP Strict Transport Security (HSTS) to specify that Firefox may only connect to it securely. As a result, it is not possible to add an exception for this certificate.

□ Report errors like this to help Mozilla identify and block malicious sites

After you install the certificate, users shouldn't experience a certificate security issue when they browse to sites that the FortiGate performs SSL content inspection on.

Users can view information about the connection and the certificate that's used.

When users view information about the connection, they'll see that it's verified by Fortinet.



https://twitter.com

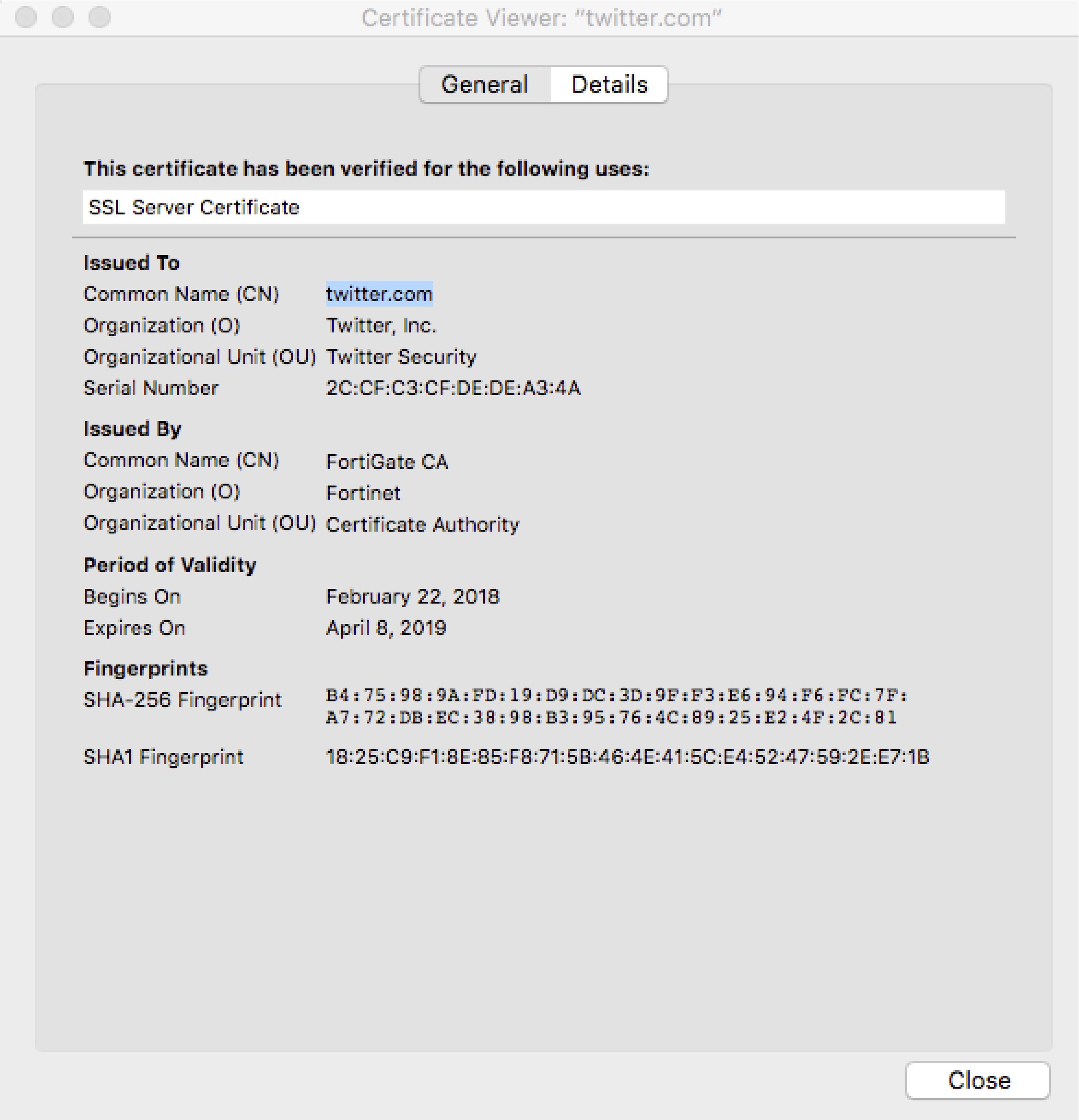
Site Security

twitter.com

Secure Connection

Verified by: Fortinet

When users view the certificate in the browser, they will see which certificate is used and information about that certificate.

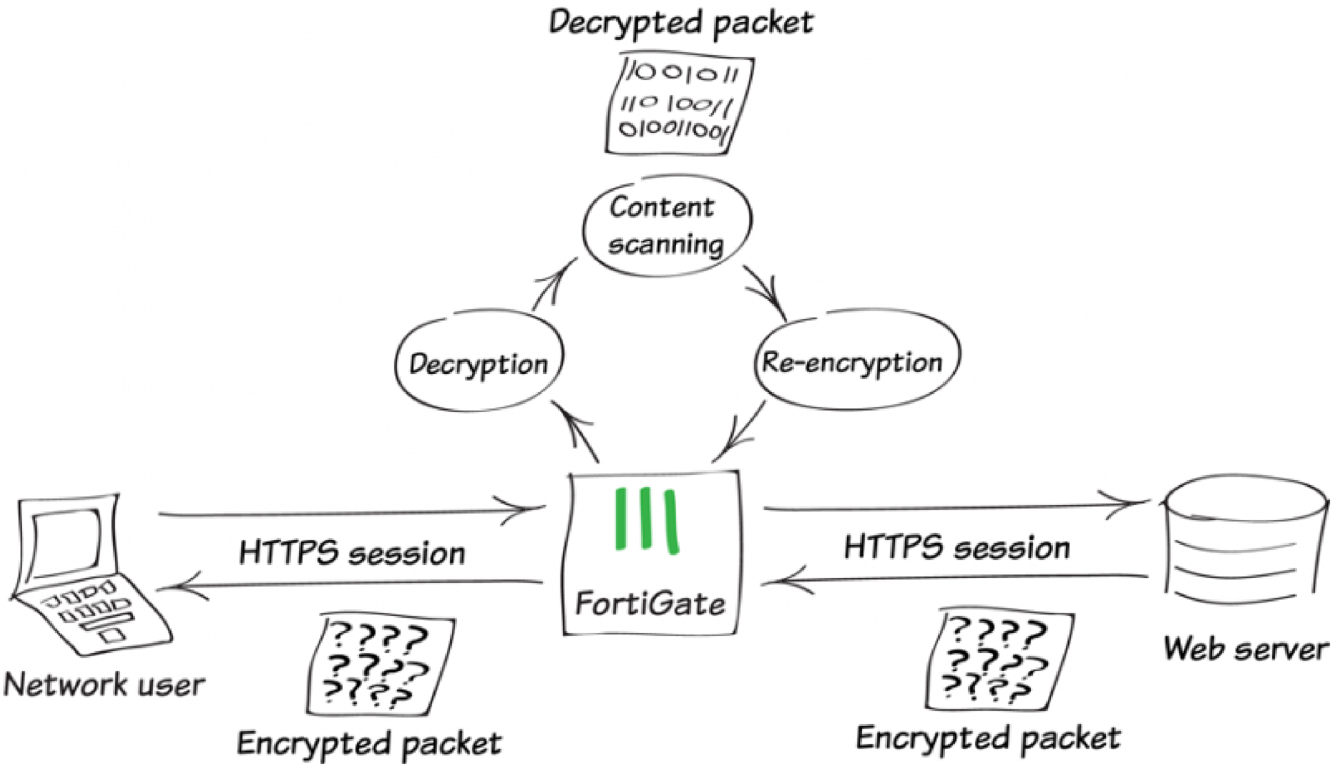


This certificate has been verified for the following uses:

SSL Server Certificate

Issued To	
Common Name (CN)	twitter.com
Organization (O)	Twitter, Inc.
Organizational Unit (OU)	Twitter Security
Serial Number	2C:CF:C3:CF:DE:DE:A3:4A
Issued By	
Common Name (CN)	FortiGate CA
Organization (O)	Fortinet
Organizational Unit (OU)	Certificate Authority
Period of Validity	
Begins On	February 22, 2018
Expires On	April 8, 2019
Fingerprints	
SHA-256 Fingerprint	B4:75:98:9A:FD:19:D9:DC:3D:9F:F3:E6:94:F6:FC:7F: A7:72:DB:EC:38:98:B3:95:76:4C:89:25:E2:4F:2C:81
SHA1 Fingerprint	18:25:C9:F1:8E:85:F8:71:5B:46:4E:41:5C:E4:52:47:59:2E:E7:1B

Why you should use SSL inspection



Most of us are familiar with HTTPS and how it protects a variety of activities on the Internet by applying SSL encryption to the web traffic.

Using HTTPS provides the benefit of using encryption keeps your private data safe from prying eyes. However, there are risks associated with its use, since encrypted traffic can be used to get around your normal defenses.

For example, you might download a file containing a virus during an e-commerce session. Or you could receive a phishing email containing a seemingly harmless downloader file that, when launched, creates an encrypted session to a C&C server and downloads malware onto your computer. Because the sessions in these attacks are encrypted, they might get past your network’s security measures.

To protect your network from these threats, SSL inspection is the key your FortiGate uses to unlock encrypted sessions, see into encrypted packets, find threats, and block them. SSL inspection not only protects you from attacks that use HTTPS, but also from other commonly used encrypted protocols, such as SMTPS, POP3S, IMAPS, and FTPS.

Full SSL inspection

To make sure that all encrypted content is inspected, you must use full SSL inspection (also known as deep inspection). When full SSL inspection is used, the FortiGate impersonates the recipient of the originating SSL session, then decrypts and inspects the content. The FortiGate then re-encrypts the content, creates a new SSL session between the FortiGate and the recipient by impersonating the sender, and sends the content to the sender.

When the FortiGate re-encrypts the content it uses a certificate stored on the FortiGate. The client must trust this certificate to avoid certificate errors. Whether or not this trust exists depends on the client, which can be the computer’s OS, a browser, or another application, which will likely maintain its own certificate repository.

There are two deployment methods for full SSL inspection:

1. Multiple Clients Connecting to Multiple Servers:

- Uses a CA certificate (which can be uploaded using the Certificates menu)
- Typically applied to outbound policies where destinations are unknown (i.e. normal web traffic)
- Address and web category whitelists can be configured to bypass SSL inspection

2. Protecting SSL Server

- Uses a server certificate (which can be uploaded using the Certificates menu) to protect a single server
- Typically used on inbound policies to protect servers available externally through Virtual IPs
- Since this is typically deployed “outside-in” (clients on the Internet accessing server(s) on the internal side of the FortiGate), server certificates using the public FQDN of the server are often purchased from a commercial Certificate Authority and uploaded to the FortiGate. This avoids client applications generating SSL certificate errors due to certificate mismatch.

More detail is available in the FortiOS Online Help. Also, check the Fortinet Knowledge Base for these technical notes:

- How to Enable SSL inspection from the CLI and Apply it to a Policy
- How to block web-based chat on Gmail webmail using App Sensor + SSL inspection

SSL certificate inspection

The FortiGate also supports a second type of SSL inspection, called SSL certificate inspection. When certificate inspection is used, the FortiGate inspects only the header information of the packets.

Certificate inspection is used to verify the identity of web servers and can be used to make sure that HTTPS protocol is not used as a workaround to access sites you have blocked using web filtering.

The only security feature that can be applied using SSL certificate inspection mode is web filtering. However, since only the packet header is inspected, this method does not introduce certificate errors and can be a useful alternative to full SSL inspection when web filtering is used.

When using SSL certificate inspection, you may get certificate errors for blocked websites, due to your FortiGate attempting to display a replacement message for that site using HTTPS. To prevent these errors, you must install the certificate that the FortiGate uses for encryption in your browser. By default, this is the same certificate used for SSL inspection.

For more information, see:

- Preventing certificate warnings (CA-signed certificate) on page 217.
- Preventing certificate warnings (default certificate) on page 228.
- Preventing certificate warnings (self-signed) on page 235

Troubleshooting

The most common problem with SSL inspection is users receiving SSL errors when the certificate is not trusted. This is because, by default, the FortiGate uses a certificate that is not trusted by the client. There are several methods to fix this, depending on whether you are using your FortiGate's default certificate, a self-signed certificate, or a CA-signed certificate.

Best practices

Because all traffic needs to be decrypted, inspected, and re-encrypted, using SSL inspection can reduce the overall performance of your FortiGate. To avoid using too many resources for SSL inspection, do the following:

- **Know your traffic** – Know how much traffic is expected and what percentage of the traffic is encrypted. You can also limit the number of policies that allow encrypted traffic.
- **Be selective** – Use whitelists or trim your policy to apply SSL inspection only where it is needed.
- **Use hardware acceleration** – FortiGate models with either the CP6 or CPU processor have an SSL/TLS protocol processor for SSL content scanning and SSL acceleration. For more information about this, see the Hardware Acceleration handbook.
- **Test real-world SSL inspection performance yourself** – Use the flexibility of FortiGate's security policy to gradually deploy SSL inspection, rather than enabling it all at once.

VPNs

This section contains information about creating and using a virtual private network (VPN).

SSL VPN quick start

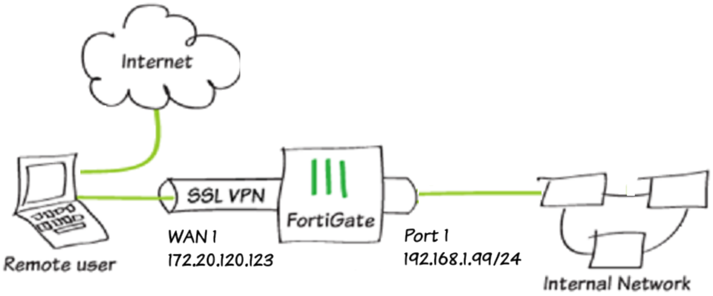
The following topics provide introductory instructions on configuring SSL VPN:

- SSL VPN split tunnel for remote user on page 246
- Connecting from FortiClient VPN client on page 249
- Set up FortiToken two-factor authentication on page 251
- Connecting from FortiClient with FortiToken on page 252

SSL VPN split tunnel for remote user

This is a sample configuration of remote users accessing the corporate network and internet through an SSL VPN by tunnel mode using FortiClient but accessing the Internet without going through the SSL VPN tunnel.

Sample topology



Sample configuration

WAN interface is the interface connected to ISP. This example shows static mode. You can also use DHCP or PPPoE mode. The SSL VPN connection is established over the WAN interface.

To configure SSL VPN using the GUI:

1. Configure the interface and firewall address. The port1 interface connects to the internal network.
   a. Go to *Network* > *Interfaces* and edit the *wan1* interface.
   b. Set *IP/Network Mask* to *172.20.120.123/255.255.255.0*.
   c. Edit *port1* interface and set *IP/Network Mask* to *192.168.1.99/255.255.255.0*.

   d. Click *OK*.
   e. Go to *Policy & Objects* > *Address* and create an address for internal subnet *192.168.1.0*.
2. Configure user and user group.
   a. Go to *User & Device* > *User Definition* to create a local user *sslvpnuser1*.
   b. Go to *User & Device* > *User Groups* to create a group *sslvpngroup* with the member *sslvpnuser1*.
3. Configure SSL VPN web portal.
   a. Go to *VPN* > *SSL-VPN Portals* to create a tunnel mode only portal *my-split-tunnel-portal*.
   b. Enable *Split Tunneling*.
   c. Select *Routing Address* to define the destination network that will be routed through the tunnel. Leave undefined to use the destination in the respective firewall policies.
4. Configure SSL VPN settings.
   a. Go to *VPN* > *SSL-VPN Settings*.
   b. For *Listen on Interface(s)*, select *wan1*.
   c. Set *Listen on Port* to *10443*.
   d. Optionally, set *Restrict Access* to *Limit access to specific hosts*, and specify the addresses of the hosts that are allowed to connect to this VPN.
   e. Choose a certificate for *Server Certificate*. The default is *Fortinet_Factory*.
   f. In *Authentication/Portal Mapping All Other Users/Groups*, set the *Portal* to *tunnel-access*.
   g. Create new *Authentication/Portal Mapping* for group *sslvpngroup* mapping portal *my-split-tunnel-portal*.
5. Configure SSL VPN firewall policy.
   a. Go to *Policy & Objects* > *IPv4 Policy*.
   b. Fill in the firewall policy name. In this example, *sslvpn split tunnel access*.
   c. Incoming interface must be *SSL-VPN tunnel interface(ssl.root)*.
   d. Choose an *Outgoing Interface*. In this example, *port1*.
   e. Set the *Source* to *SSLVPN_TUNNEL_ADDR1* and group to *sslvpngroup*. The source address references the tunnel IP addresses that the remote clients are using.
   f. In this example, the *Destination* is *192.168.1.0*.
   g. Set *Schedule* to *always*, *Service* to *ALL*, and *Action* to *Accept*.
   h. Click *OK*.

To configure SSL VPN using the CLI:

1. Configure the interface and firewall address.

```
config system interface
    edit "wan1"
        set vdom "root"
        set ip 172.20.120.123 255.255.255.0
    next
end
```

2. Configure internal interface and protected subnet, then connect the port1 interface to the internal network.

```
config system interface
    edit "port1"
        set vdom "root"
        set ip 192.168.1.99 255.255.255.0
    next
end
```

```
config firewall address
    edit "192.168.1.0"
        set subnet 192.168.1.0 255.255.255.0
    next
end
```

3. Configure user and user group.

```
config user local
    edit "sslvpnuser1"
        set type password
        set passwd your-password
    next
end
```

```
config user group
    edit "sslvpngroup"
        set member "sslvpnuser1"
    next
end
```

4. Configure SSL VPN web portal.

```
config vpn ssl web portal
    edit "my-split-tunnel-portal"
        set tunnel-mode enable
        set split-tunneling  enable
        set split-tunneling-routing-address "192.168.1.0"
        set ip-pools "SSLVPN_TUNNEL_ADDR1"
    next
end
```

5. Configure SSL VPN settings.

```
config vpn ssl settings
    set servercert "Fortinet_Factory"
    set tunnel-ip-pools "SSLVPN_TUNNEL_ADDR1"
    set tunnel-ipv6-pools "SSLVPN_TUNNEL_IPv6_ADDR1"
    set source-interface "wan1"
    set source-address "all"
    set source-address6 "all"
    set default-portal "full-access"
    config authentication-rule
        edit 1
            set groups "sslvpngroup"
            set portal "my-split-tunnel-portal"
        next
    next
end
```

Optionally, to restrict access to specific hosts:

```
config vpn ssl settings
    set source-address <address> <address> ... <address>
    set source-address6 <address> <address> ... <address>
end
```

6. Configure one SSL VPN firewall policy to allow remote user to access the internal network. Traffic is dropped from internal to remote client.

```
config firewall policy
    edit 1
        set name "sslvpn split tunnel access"
        set srcintf "ssl.root"
        set dstintf "port1"
        set srcaddr "SSLVPN_TUNNEL_ADDR1"
        set dstaddr "192.168.1.0"
        set groups “sslvpngroup”
        set action accept
        set schedule "always"
        set service "ALL"
    next
end
```

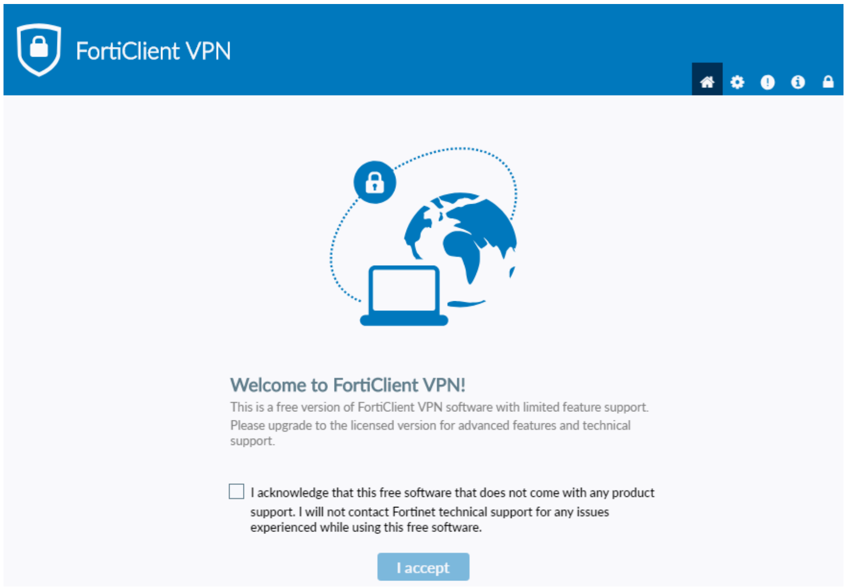
Connecting from FortiClient VPN client

For FortiGate administrators, a free version of FortiClient VPN is available which supports basic IPsec and SSL VPN and does not require registration with EMS. This version does not include central management, technical support, or some advanced features.

Downloading and installing the standalone FortiCient VPN client

You can download the free VPN client from FNDN or FortiClient.com.

When the free VPN client is run for the first time, it displays a disclaimer. You cannot configure or create a VPN connection until you accept the disclaimer and click *I accept*:



Welcome to FortiClient VPN!

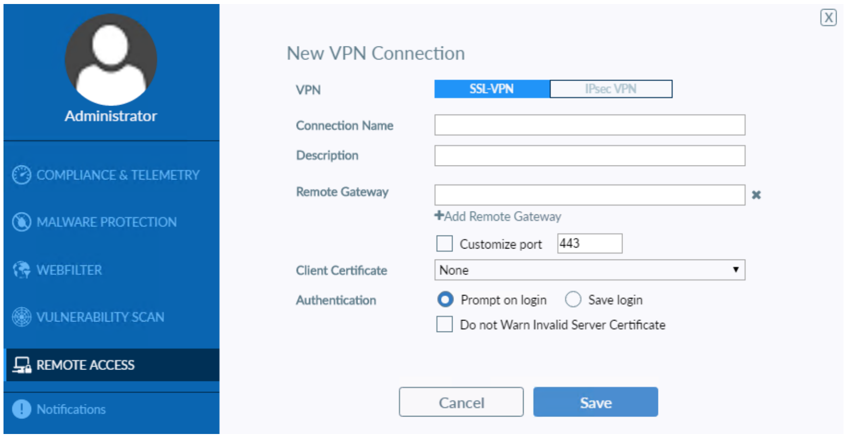
This is a free version of FortiClient VPN software with limited feature support. Please upgrade to the licensed version for advanced features and technical support.

□ I acknowledge that this free software that does not come with any product support. I will not contact Fortinet technical support for any issues experienced while using this free software.

Configuring an SSL VPN connection

To configure an SSL VPN connection:

1. On the *Remote Access* tab, click on the settings icon and then *Add a New Connection*.



New VPN Connection

VPN: SSL-VPN | IPsec VPN

Connection Name

Description

Remote Gateway

+Add Remote Gateway

□ Customize port 443

Client Certificate: None

Authentication: ● Prompt on login ○ Save login

□ Do not Warn Invalid Server Certificate

2. Select *SSL-VPN*, then configure the following settings:

Connection Name	SSLVPNtoHQ
Description	(Optional)
Remote Gateway	172.20.120.123
Customize port	10443
Client Certificate	Select *Prompt on connect* or the certificate from the dropdown list.
Authentication	Select *Prompt on login* for a prompt on the connection screen

3. Click *Save* to save the VPN connection.

Connecting to SSL VPN

To connect to SSL VPN:

1. On the *Remote Access* tab, select the VPN connection from the dropdown list.
   Optionally, you can right-click the FortiTray icon in the system tray and select a VPN configuration to connect.
2. Enter your username and password.
3. Click the *Connect* button.
4. After connecting, you can now browse your remote network. Traffic to 192.168.1.0 goes through the tunnel, while other traffic goes through the local gateway. FortiClient displays the connection status, duration, and other relevant information.
5. Click the *Disconnect* button when you are ready to terminate the VPN session.

Checking the SSL VPN connection

To check the SSL VPN connection using the GUI:

1. On the FortiGate, go to *VPN > Monitor > SSL-VPN Monitor* to verify the list of SSL users.
2. On the FortiGate, go to *Log & Report > Forward Traffic* to view the details of the SSL entry.

To check the tunnel log in using the CLI:

```
get vpn ssl monitor
SSL VPN Login Users:
 Index    User           Auth Type     Timeout    From           HTTP in/out   HTTPS in/out
 0        sslvpnuser1    1(1)          291        10.1.100.254   0/0           0/0

SSL VPN sessions:
 Index    User           Source IP      Duration    I/O Bytes      Tunnel/Dest IP
 0        sslvpnuser1    10.1.100.254   9           22099/43228    10.212.134.200
```

Set up FortiToken two-factor authentication

This configuration adds two-factor authentication (2FA) to the split tunnel configuration (SSL VPN split tunnel for remote user on page 246). It uses one of the two free mobile FortiTokens that is already installed on the FortiGate.

To configure 2FA using the GUI:

1. Configure a user and user group.
   a. Go to *User & Device > User Definition* and edit local user *sslvpnuser1*.
   b. Enter the user's *Email Address*.
   c. Enable *Two-factor Authentication* and select one mobile *Token* from the list,
   d. Enable *Send Activation Code* and select *Email*.
   e. Click *Next* and click *Submit*.
2. Activate the mobile token.
   When a FortiToken is added to user *sslvpnuser1*, an email is sent to the user's email address. Follow the instructions to install your FortiToken mobile application on your device and activate your token.

To configure 2FA using the CLI:

1. Configure a user and user group.

```
config user local
    edit "sslvpnuser1"
        set type password
        set two-factor fortitoken
        set fortitoken <select mobile token for the option list>
        set email-to <user's email address>
        set passwd <user's password>
    next
end
config user group
    edit "sslvpngroup"
```

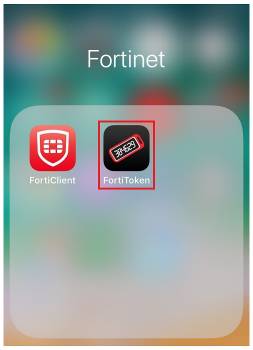
```
        set member "sslvpnuser1"
    next
end
```

2. Activate the mobile token.
   When a FortiToken is added to user *sslvpnuser1*, an email is sent to the user's email address. Follow the instructions to install your FortiToken mobile application on your device and activate your token.

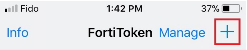
Connecting from FortiClient with FortiToken

To activate your FortiToken:

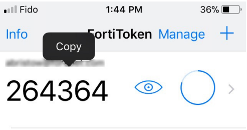
1. On your device, open FortiToken Mobile. If this is your first time opening the application, it may prompt you to create a PIN for secure access to the application and tokens.



2. You should have received your notification via email, select + and use the device camera to scan the token QR code in your email.



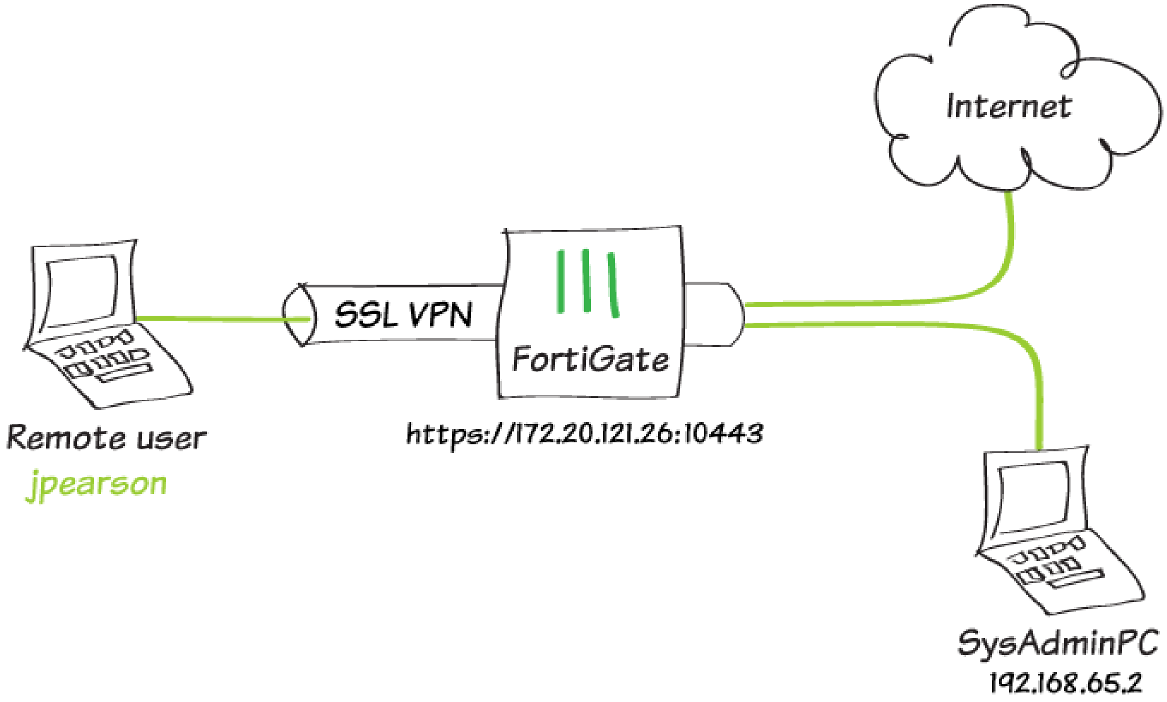
3. FortiToken Mobile provisions and activates your token and generates token codes immediately. To view the OTP's digits, select the eye icon. After you open the application, FortiToken Mobile generates a new six-digit OTP every 30 seconds.



To connect to SSL VPN:

1. On the *Remote Access* tab, select the VPN connection from the dropdown list.
   Optionally, you can right-click the FortiTray icon in the system tray and select a VPN configuration to connect.
2. Enter your username and password.
3. Click the *Connect* button.
4. A Token field will appear, prompting you for the FortiToken code. Enter the FortiToken code from your Mobile device.
5. After connecting, you can now browse your remote network. Traffic to 192.168.1.0 goes through the tunnel, while other traffic goes through the local gateway. FortiClient displays the connection status, duration, and other relevant information.
6. Click the *Disconnect* button when you are ready to terminate the VPN session.

SSL VPN using web and tunnel mode



In this example, you will allow remote users to access the corporate network using an SSL VPN, connecting either by web mode using a web browser or tunnel mode using FortiClient.

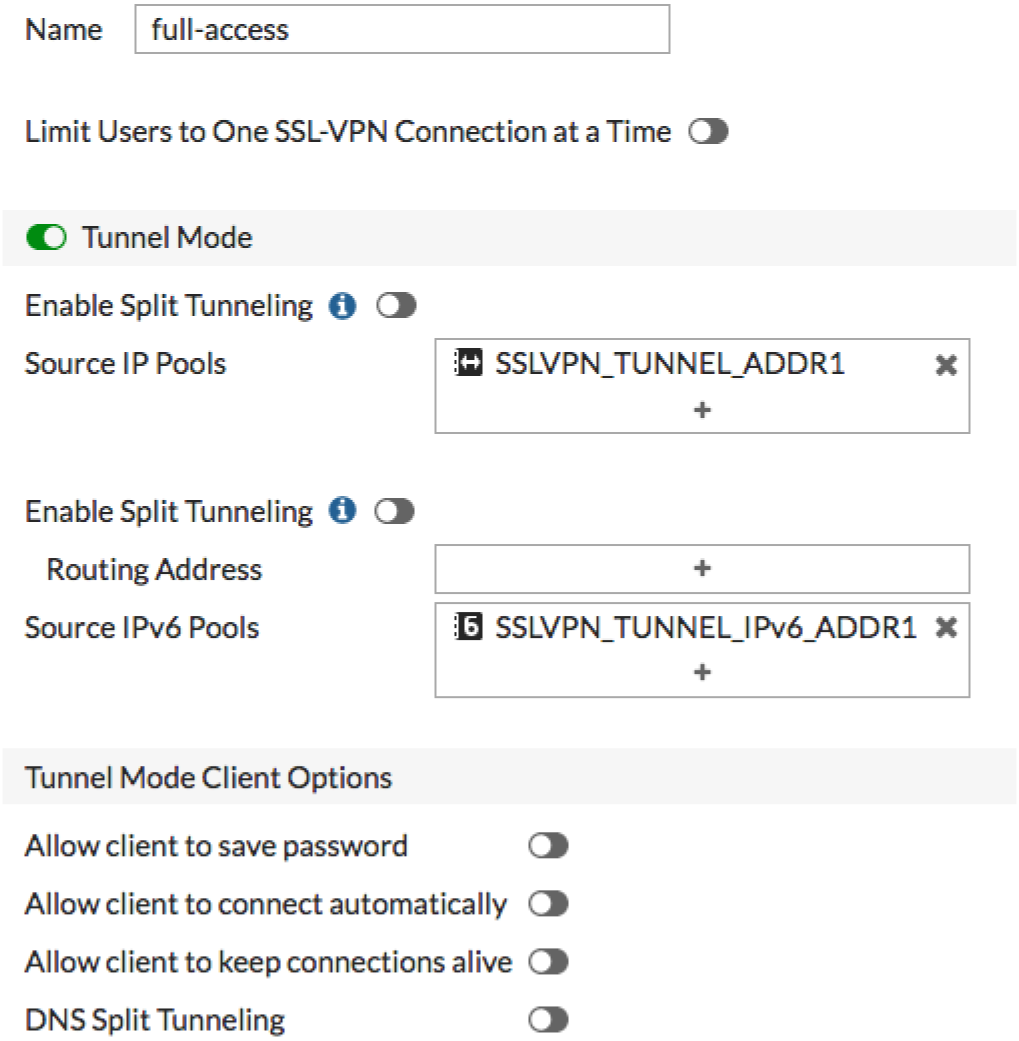
Web mode allows users to access network resources, such as the the AdminPC used in this example.

For users connecting via tunnel mode, traffic to the Internet will also flow through the FortiGate, to apply security scanning to this traffic. During the connecting phase, the FortiGate will also verify that the remote user’s antivirus software is installed and up-to-date.

This recipe is in the Basic FortiGate network collection. You can also use it as a standalone recipe.

Editing the SSL VPN portal

1. To edit the **full-access** SSL VPN portal, go to **VPN** > **SSL-VPN Portals**. The **full-access** portal allows the use of tunnel mode and web mode.
2. Under **Tunnel Mode**, disable **Enable Split Tunneling** for both IPv4 and IPv6 traffic to ensure all Internet traffic will go through the FortiGate.
3. Set **Source IP Pools** to use the default IP range **SSLVPN_TUNNEL_ADDR1**.



Name: full-access

Limit Users to One SSL-VPN Connection at a Time ○

● Tunnel Mode

Enable Split Tunneling ○

Source IP Pools: SSLVPN_TUNNEL_ADDR1

Enable Split Tunneling ○

Routing Address:

Source IPv6 Pools: SSLVPN_TUNNEL_IPv6_ADDR1

Tunnel Mode Client Options

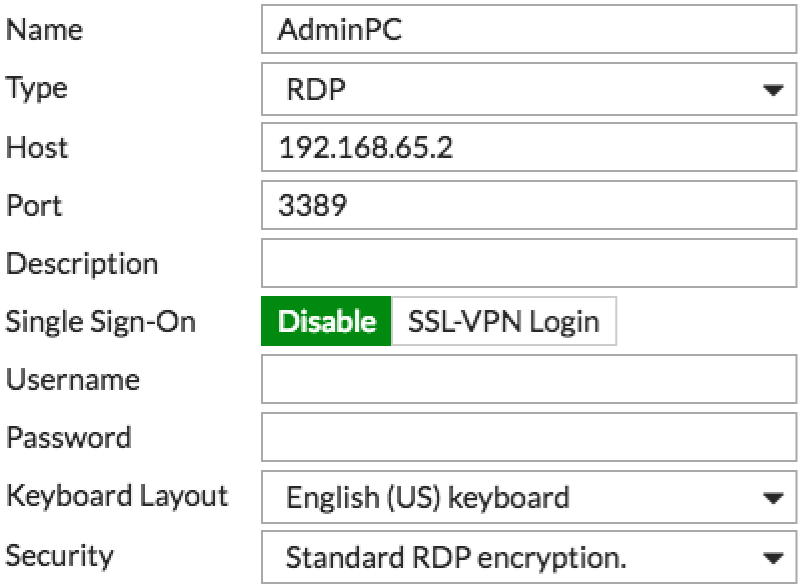
Allow client to save password ○

Allow client to connect automatically ○

Allow client to keep connections alive ○

DNS Split Tunneling ○

4. Under **Enable Web Mode**, create **Predefined Bookmarks** for any internal resources that the SSL VPN users need to access. In the example, the bookmark allows the remote user RDP access to a computer on the internal network.

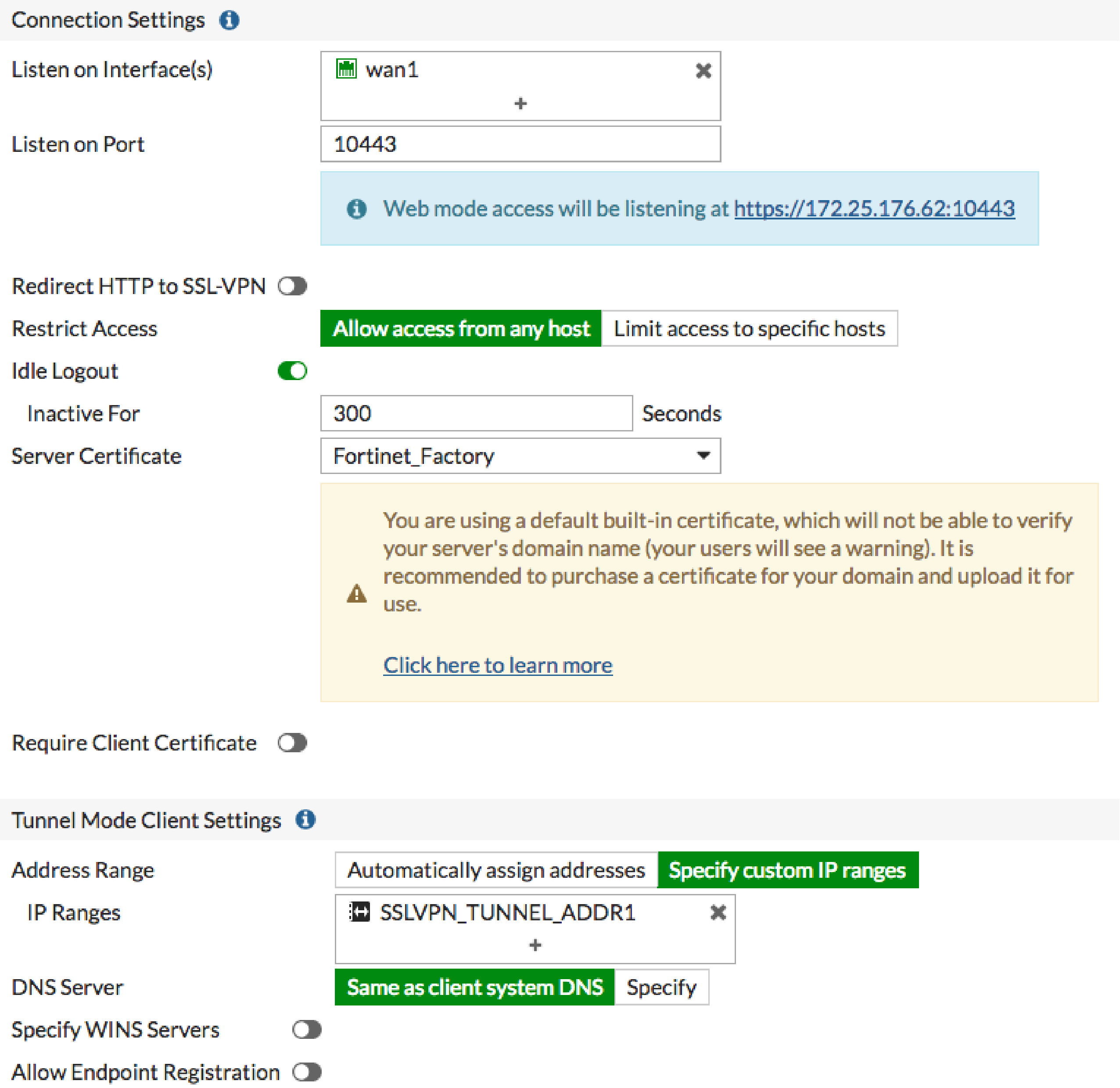


Name	AdminPC
Type	RDP
Host	192.168.65.2
Port	3389
Description	
Single Sign-On	[✓ Disable] SSL-VPN Login
Username	
Password	
Keyboard Layout	English (US) keyboard
Security	Standard RDP encryption.

Configuring the SSL VPN tunnel

1. To configure the SSL VPN tunnel, go to **VPN > SSL-VPN** Settings.
2. Set **Listen on Interface(s)** to **wan1**. To avoid port conflicts, set **Listen on Port** to **10443**.
3. Set **Restrict Access** to **Allow access from any host**
   Optionally, set **Restrict Access** to **Limit access to specific hosts** and specify the addresses of the hosts that are allowed to connect to this VPN.
4. In the example, the **Fortinet_Factory** certificate is used as the **Server Certificate**. To ensure that traffic is secure, you should use your own CA-signed certificate. For more information about using certificates, see Preventing certificate warnings (CA-signed certificates).

5. Under **Tunnel Mode Client Settings**, set **IP Ranges** to use the default IP range **SSLVPN_TUNNEL-ADDR1**.



Connection Settings

Listen on Interface(s): wan1

Listen on Port: 10443

Web mode access will be listening at https://172.25.176.62:10443

Redirect HTTP to SSL-VPN: ○

Restrict Access: [✓ Allow access from any host] Limit access to specific hosts

Idle Logout: ●

Inactive For: 300 Seconds

Server Certificate: Fortinet_Factory

You are using a default built-in certificate, which will not be able to verify your server's domain name (your users will see a warning). It is recommended to purchase a certificate for your domain and upload it for use.

Click here to learn more

Require Client Certificate: ○

Tunnel Mode Client Settings

Address Range: Automatically assign addresses [✓ Specify custom IP ranges]

IP Ranges: SSLVPN_TUNNEL_ADDR1

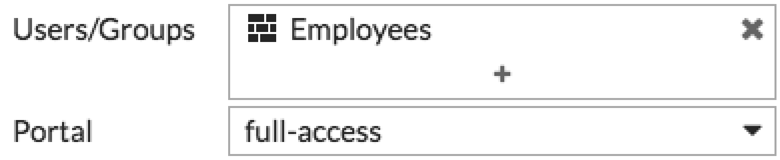
DNS Server: [✓ Same as client system DNS] Specify

Specify WINS Servers: ○

Allow Endpoint Registration: ○

6. Under **Authentication/Portal Mapping**, click Create New to add the *Employee* user group and map it to the **full-access** portal.

7. If necessary, map a portal for **All Other Users/Groups**.

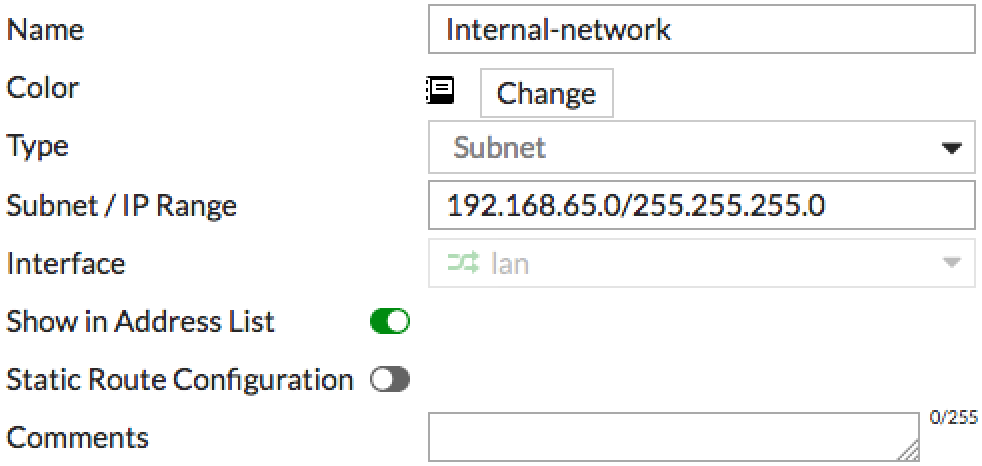


Users/Groups: Employees

Portal: full-access

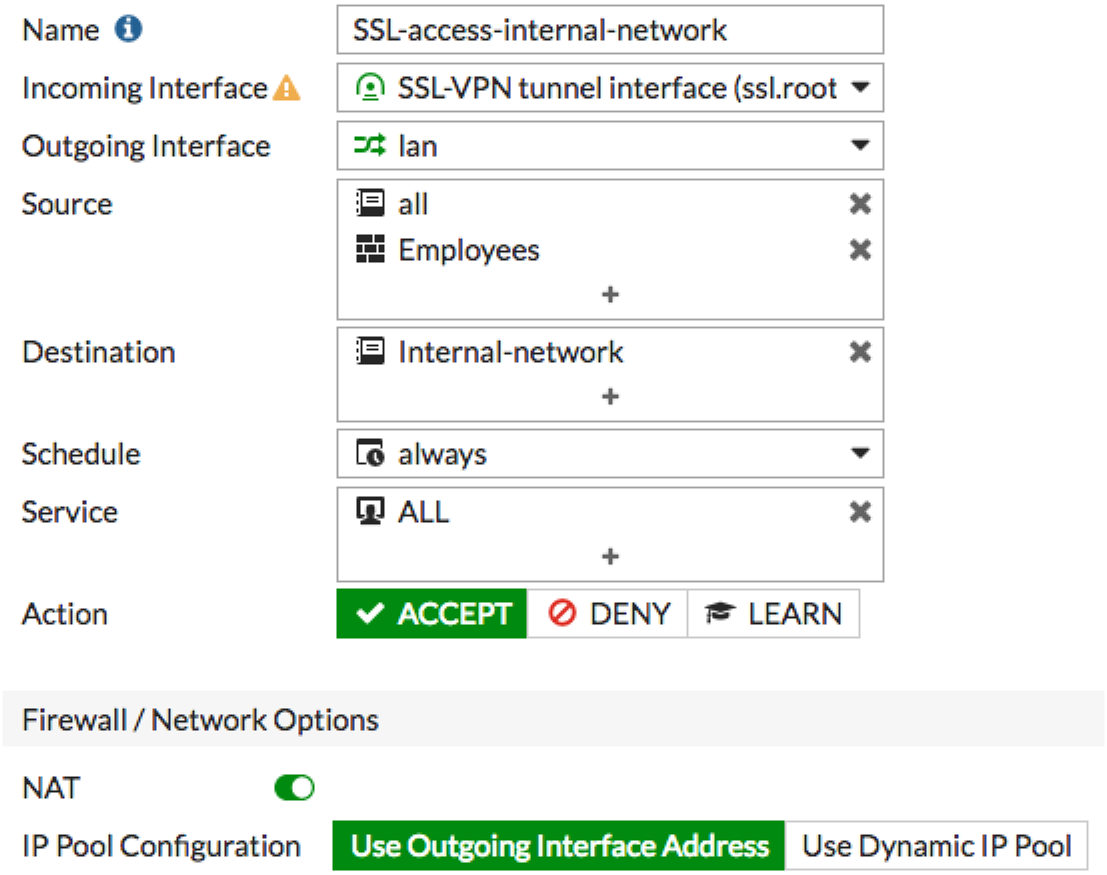
Adding security policies

1. To add an address for the local network, go to **Policy & Objects > Addresses**.
2. Set **Type** to **Subnet**, **Subnet/IP Range** to the local subnet, and **Interface** to **lan**.



Name	Internal-network
Color	Change
Type	Subnet
Subnet / IP Range	192.168.65.0/255.255.255.0
Interface	lan
Show in Address List	●
Static Route Configuration	○
Comments	0/255

3. To create a security policy allowing access to the internal network through the VPN tunnel interface, go to **Policy & Objects** > **IPv4 Policy**.
4. Set **Incoming Interface** to **ssl.root** and **Outgoing Interface** to **lan**. Select **Source** and set **Address** to **all** and **User** to the *Employee* user group. Set **Destination** to the local network address, **Service** to **ALL**, and enable **NAT**.



Name	SSL-access-internal-network
Incoming Interface	SSL-VPN tunnel interface (ssl.root
Outgoing Interface	lan
Source	all Employees
Destination	Internal-network
Schedule	always
Service	ALL
Action	✓ ACCEPT ⊘ DENY LEARN

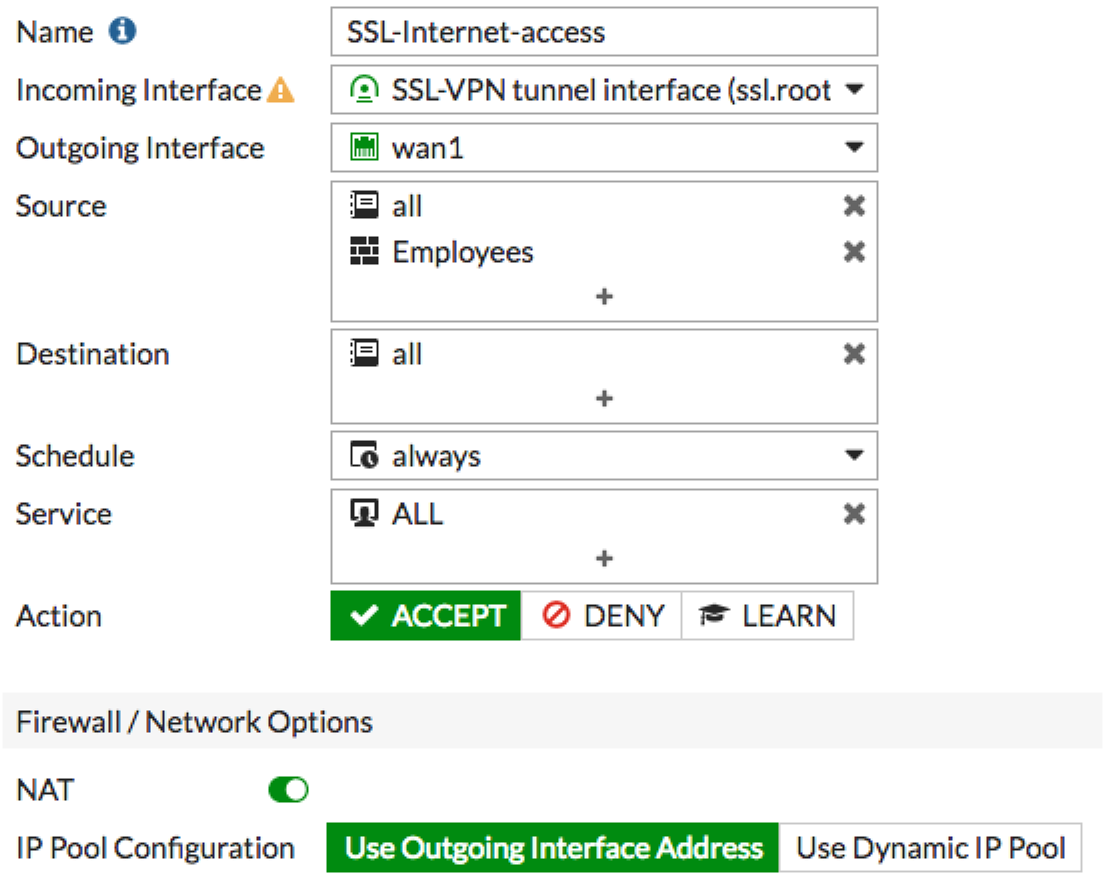
Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

5. Add a second security policy allowing SSL VPN access to the Internet.

> If you are allowing split tunneling, this policy is not required.

6. For this policy, set **Incoming Interface** to **ssl.root** and **Outgoing Interface** to **wan1**. Select **Source** and set **Address** to **all** and **User** to the *Employee* user group.



Name: SSL-Internet-access

Incoming Interface: SSL-VPN tunnel interface (ssl.root

Outgoing Interface: wan1

Source: all
Employees

Destination: all

Schedule: always

Service: ALL

Action: [✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT: ●

IP Pool Configuration: [✓ Use Outgoing Interface Address] Use Dynamic IP Pool

Verifying remote user OS and software

To verify that remote users are using up-to-date devices to connect to your network, you can configure a host check for both operating system (supported for Windows and Mac OS) and software.

You can configure an OS host check for specific OS versions. This check includes the following options: allow the device to connect, block the device, or check that the OS is up-to-date. The default action for all OS versions is allow.

The software host can verify whether the device has AntiVirus software recognized by Windows Security Center, firewall software recognized by Windows Security Center, both, or a custom setting.

Configure both checks using the CLI:

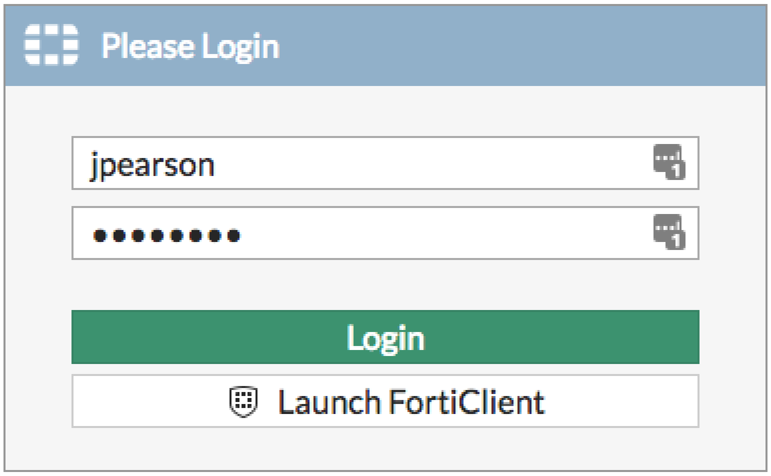
```
config vpn ssl web portal
   edit full-access
      set os-check enable
         config os-check-list {macos-high-sierra-10.13 | macos-sierra-10.12 | os-x-el-capitan-
               10.11 | os-x-mavericks-10.9 | os-x-yosemite-10.10 |windows-7 | windows-8 |
               windows-8.1 | windows-10 | windows-2000 | windows-vista | windows-xp}
            set action {deny | allow | check-up-to-date}
         end
      set host-check {av | fw | av-fw| custom}
   end
```

Results

The steps for connecting to the SSL VPN differ depending on whether you are using a web browser or FortiClient.

Web browsers

1. Using a supported Internet browser, connect to the SSL VPN web portal using the remote gateway configured in the SSL VPN settings (in the example, https://172.25.176.62:10443).
2. Log in to the SSL VPN.

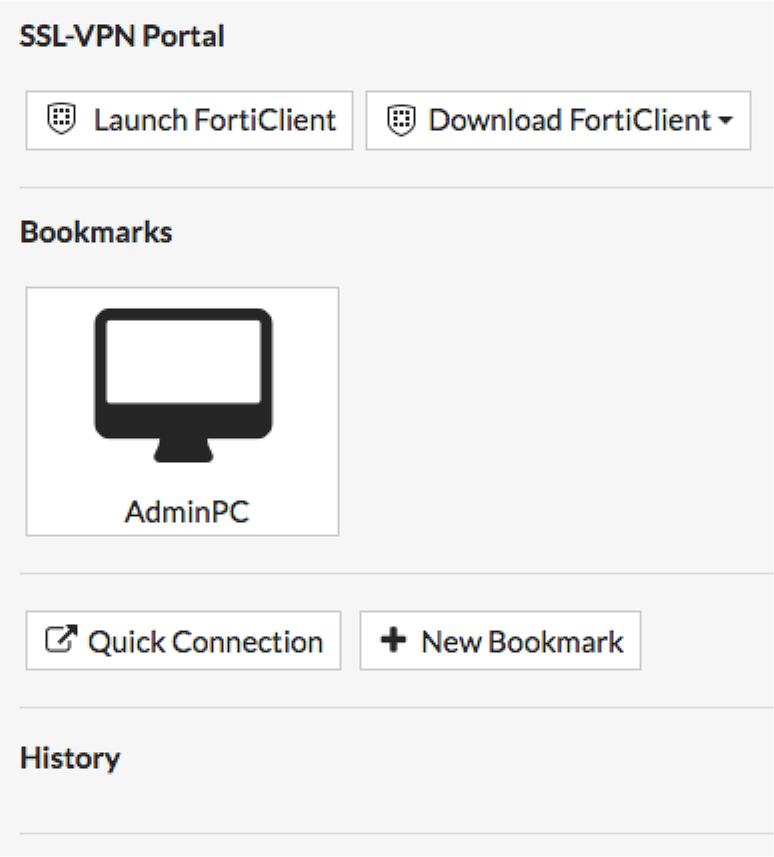


Please Login

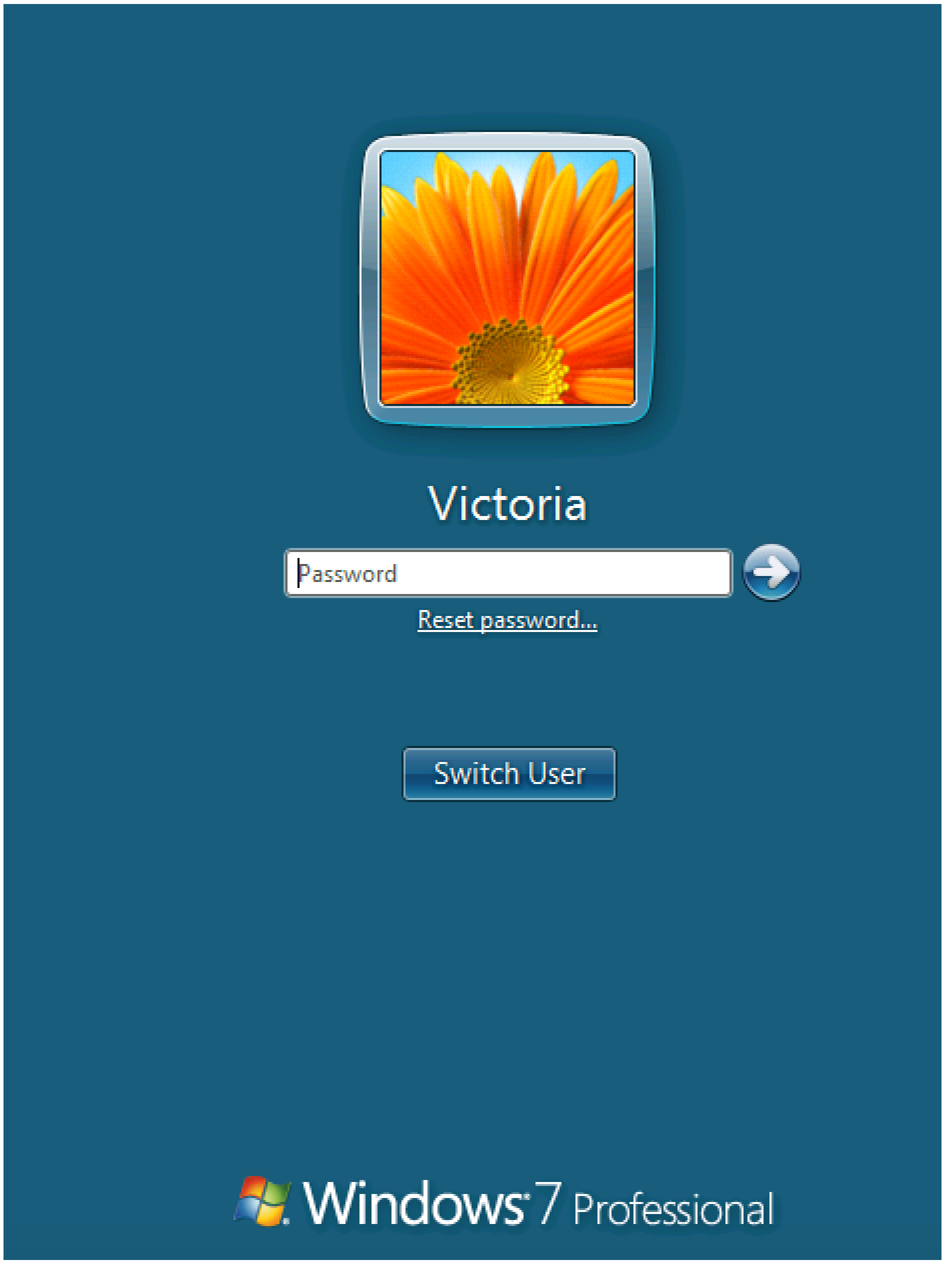
jpearson

•••••••••

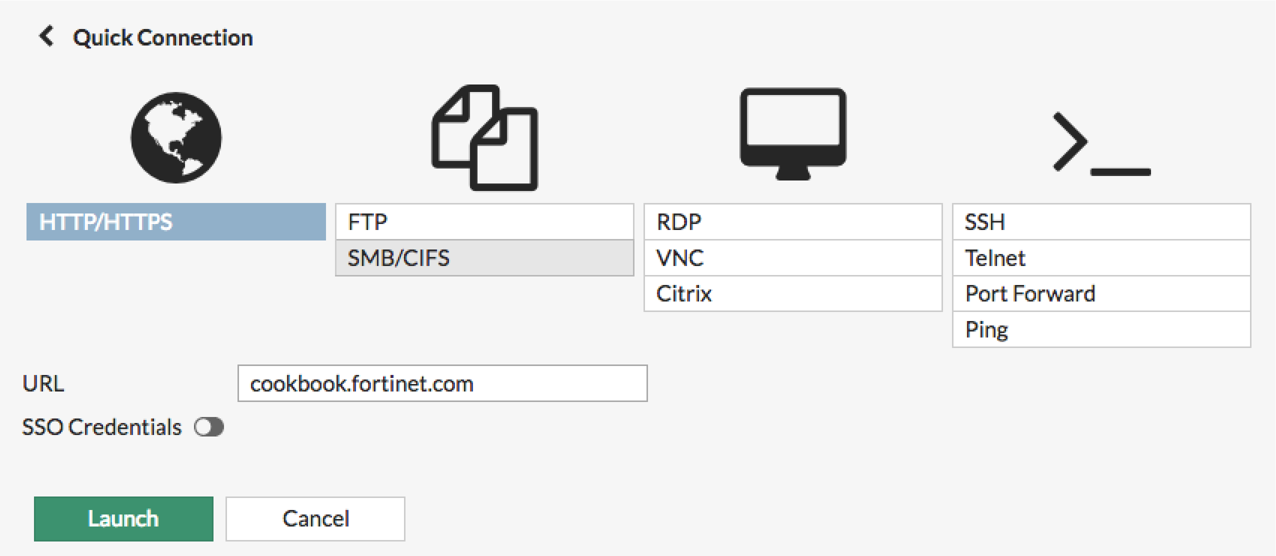
3. After authenticating, you can access the **SSL-VPN Portal**. From this portal, you can launch or download FortiClient, access **Bookmarks**, or connect to other resources using the **Quick Connection** tool.



In this example, selecting the bookmark enables you to connect to the AdminPC.



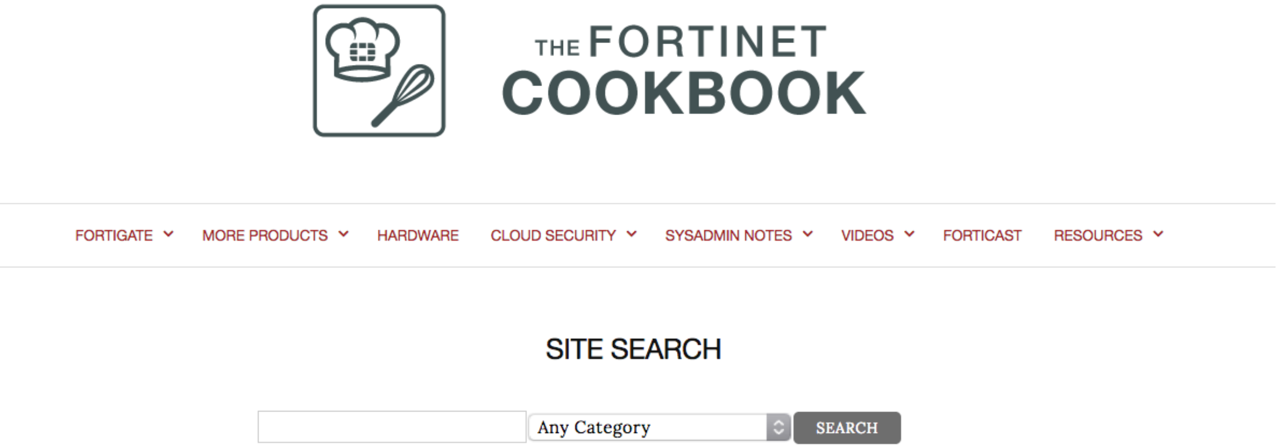
4. To connect to the Internet, select **Quick Connection**. Select **HTTP/HTTPS**, then enter the **URL** and select **Launch**.



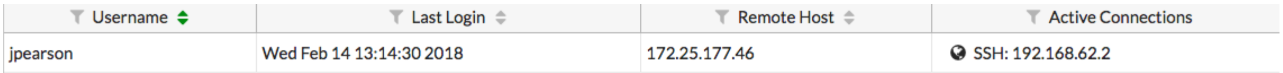
URL: cookbook.fortinet.com

SSO Credentials ○

The website loads.

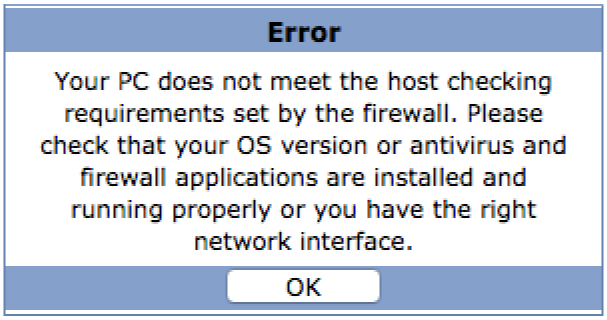


5. To view the list of users currently connected to the SSL VPN, go to **Monitor > SSL-VPN Monitor**. The user is connected to the VPN.



Username	Last Login	Remote Host	Active Connections
jpearson	Wed Feb 14 13:14:30 2018	172.25.177.46	SSH: 192.168.62.2

6. If a remote device fails the OS or host check, a warning message appears after authentication instead of the portal.

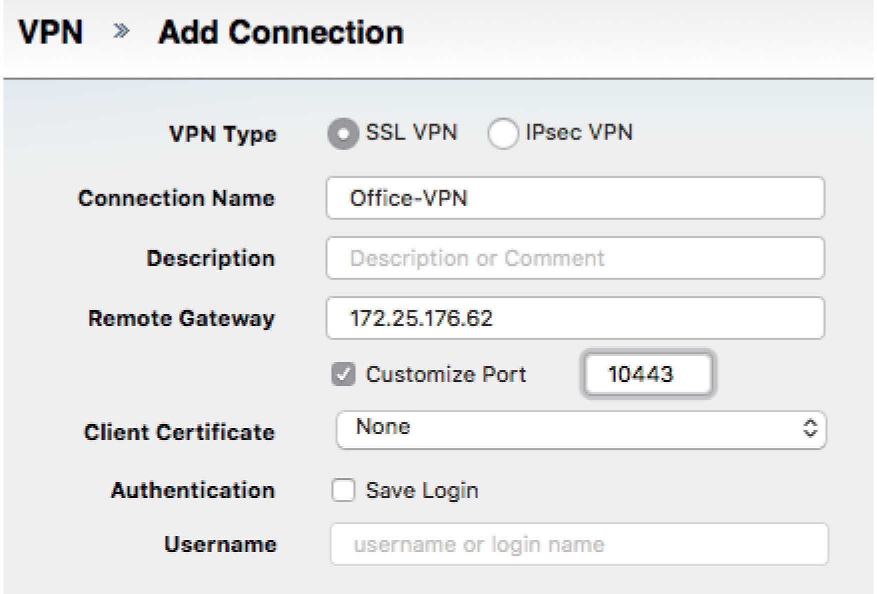


Error

Your PC does not meet the host checking requirements set by the firewall. Please check that your OS version or antivirus and firewall applications are installed and running properly or you have the right network interface.

FortiClient

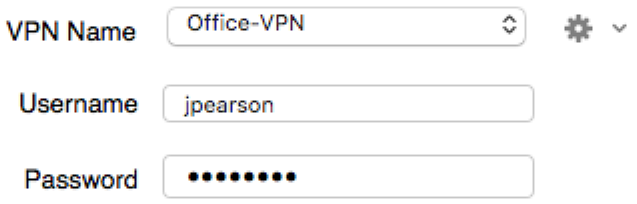
1. If you have not done so already, download FortiClient from www.forticlient.com.
2. Open the FortiClient Console and go to **Remote Access**. Add a new connection.
3. Set **VPN Type** to **SSL VPN**, set **Remote Gateway** to the IP of the listening FortiGate interface (in the example, 172.25.176.62). Select **Customize Port** and set it to **10443**.
4. Select **Add**.



VPN » Add Connection

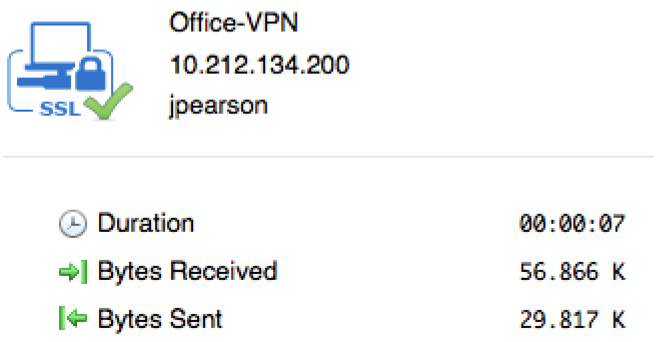
VPN Type	● SSL VPN ○ IPsec VPN
Connection Name	Office-VPN
Description	Description or Comment
Remote Gateway	172.25.176.62
	☑ Customize Port 10443
Client Certificate	None
Authentication	□ Save Login
Username	username or login name

5. Log in to the SSL VPN.



VPN Name	Office-VPN
Username	jpearson
Password	•••••••••

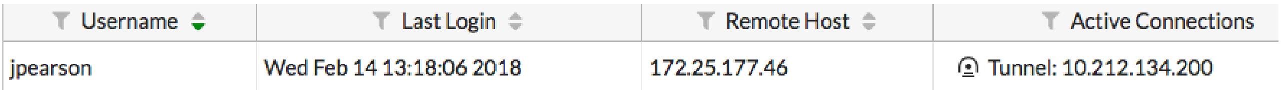
You are able to connect to the VPN tunnel.



Office-VPN
10.212.134.200
jpearson

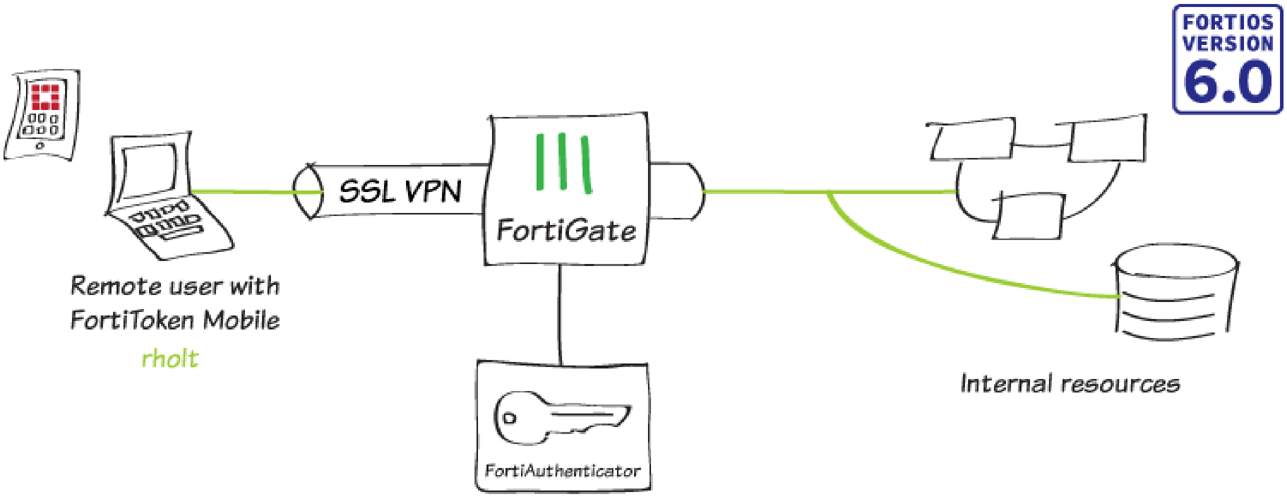
Duration	00:00:07
Bytes Received	56.866 K
Bytes Sent	29.817 K

6. To view the list of users currently connected to the SSL VPN, go to **Monitor > SSL-VPN Monitor**. The user is connected to the VPN.



Username	Last Login	Remote Host	Active Connections
jpearson	Wed Feb 14 13:18:06 2018	172.25.177.46	Tunnel: 10.212.134.200

SSL VPN with RADIUS and FortiToken

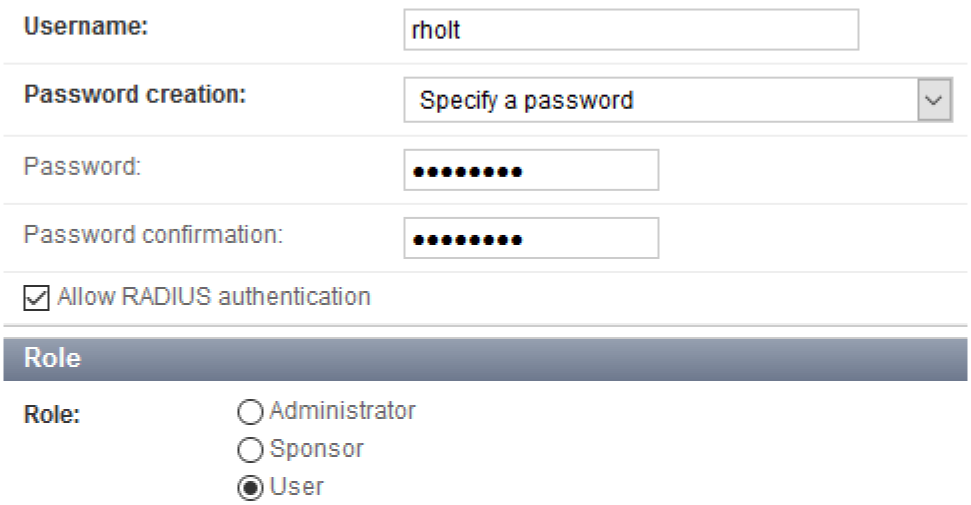


In this recipe, you configure a FortiAuthenticator as a RADIUS server to use with a FortiGate SSL VPN. Remote users connect to the SSL VPN using FortiClient and use FortiToken for two-factor authentication.

If you do not already have an SSL VPN tunnel configured, see SSL VPN using web and tunnel mode.

Creating a user and a user group

1. To create a user account, connect to the FortiAuthenticator, go to **Authentication > User Management > Local Users**, and select **Create New**.



Username: rholt

Password creation: Specify a password

Password: ●●●●●●●●●

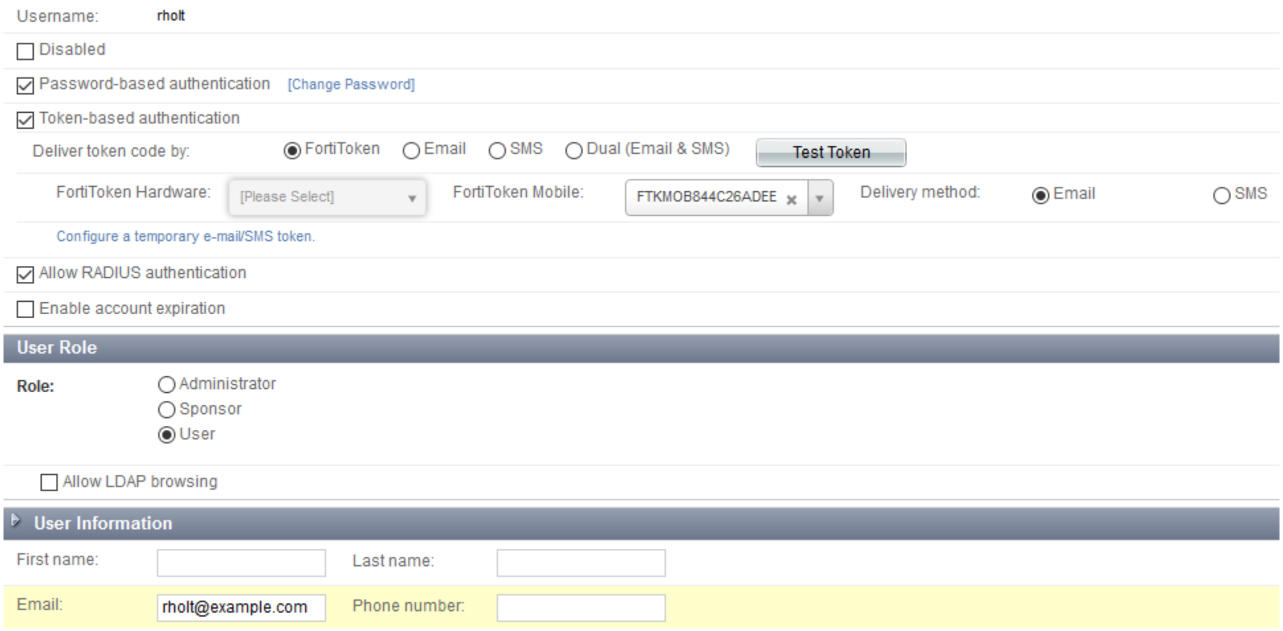
Password confirmation: ●●●●●●●●●

☑ Allow RADIUS authentication

Role

Role: ○ Administrator
○ Sponsor
● User

2. Enter a **Username** and set **Password creation** to **Specify a password**. Enter and confirm the password. Enable **Allow RADIUS authentication** and set **Role** to **User**.
3. After you create the user, more options are available. Edit the account and enable **Token-based authentication**.



Username: rholt

□ Disabled

☑ Password-based authentication [Change Password]

☑ Token-based authentication

Deliver token code by: ● FortiToken ○ Email ○ SMS ○ Dual (Email & SMS) Test Token

FortiToken Hardware: [Please Select] FortiToken Mobile: FTKMOB844C26ADEE Delivery method: ● Email ○ SMS

Configure a temporary e-mail/SMS token.

☑ Allow RADIUS authentication

□ Enable account expiration

User Role

Role: ○ Administrator
○ Sponsor
● User

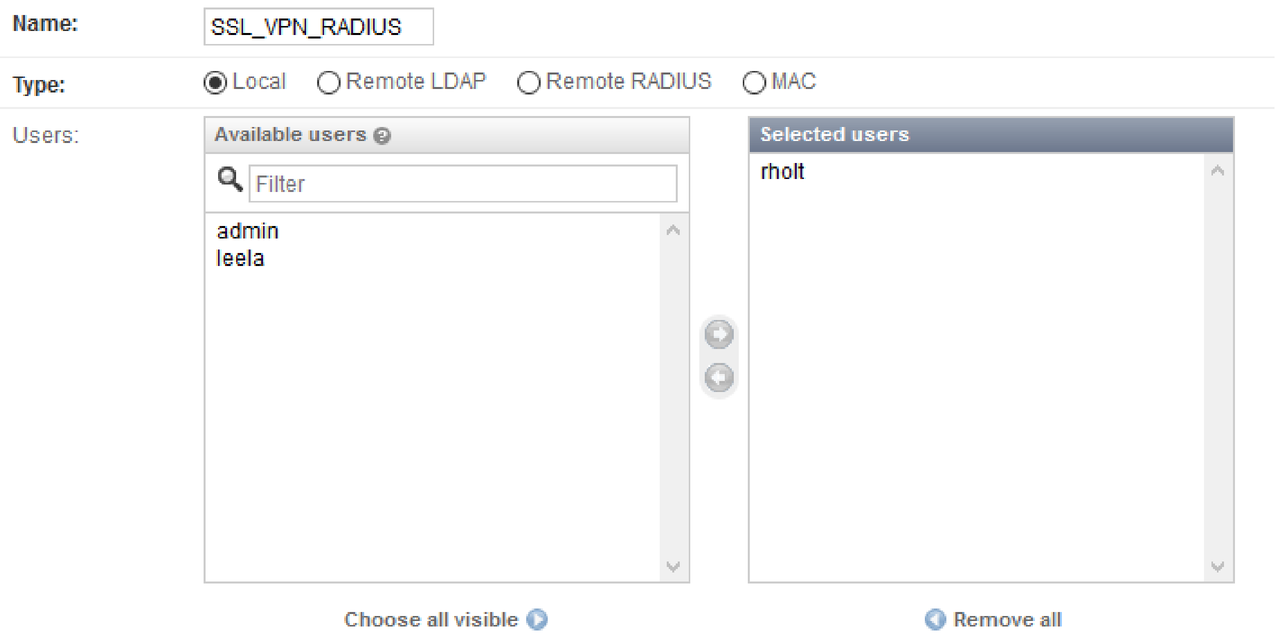
□ Allow LDAP browsing

User Information

First name: Last name:

Email: rholt@example.com Phone number:

4. Set **Deliver token code by** to **FortiToken**. Set **FortiToken Mobile** to an available FortiToken. Set **Delievery method** to **Email**.
5. Under **User Information**, set **Email** to the user's email address.
6. To create a user group, go to **Authentication > User Management > User Groups** and select **Create New**. Add the new user to the group.



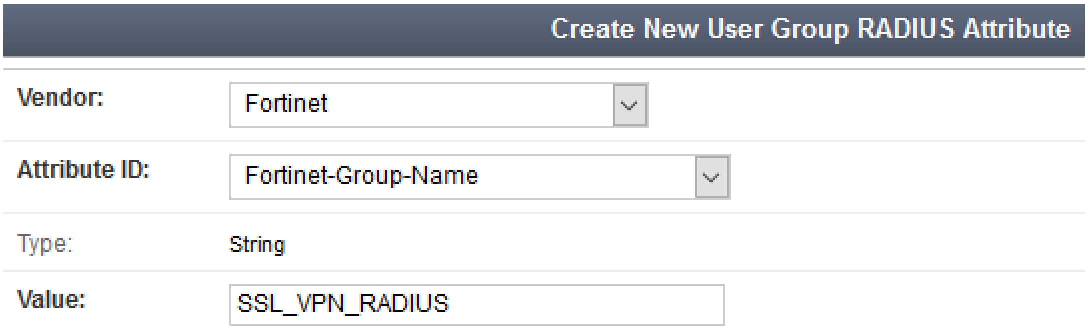
Name: SSL_VPN_RADIUS

Type: ● Local ○ Remote LDAP ○ Remote RADIUS ○ MAC

Users:

Available users	Selected users
admin leela	rholt

7. After you create the user group, more options are available. Edit the group and create a new RADIUS attribute. Set **Vendor** to **Fortinet**, set **Attribute ID** to **Fortinet-Group-Name**, and set **Value** to the name of the group (in the example, *SSL_VPN_RADIUS*).

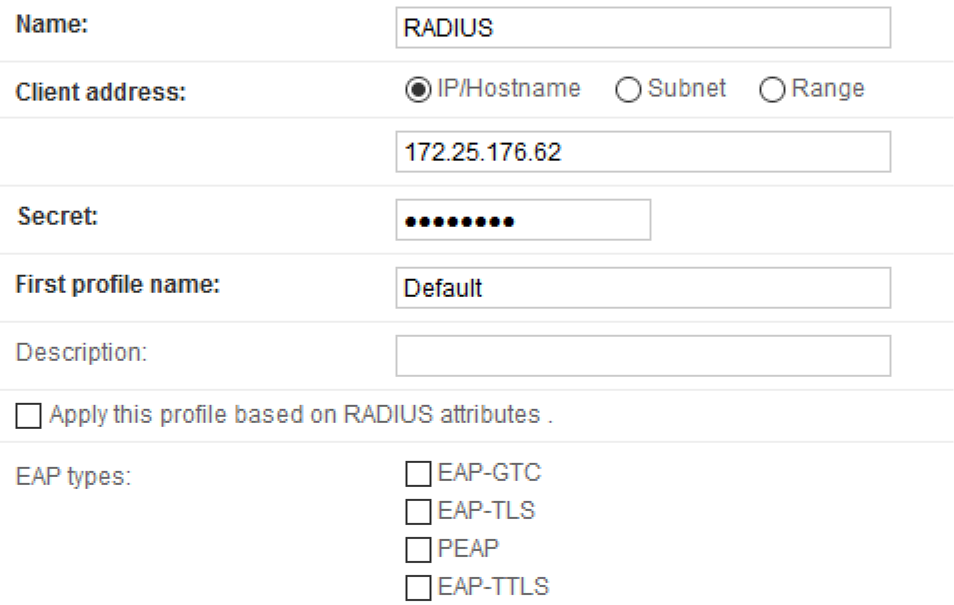


Create New User Group RADIUS Attribute

Vendor:	Fortinet
Attribute ID:	Fortinet-Group-Name
Type:	String
Value:	SSL_VPN_RADIUS

Creating the RADIUS client

1. To create a RADIUS client, go **to Authentication > RADIUS Service > Clients**, and select **Create New**.
2. Enter a **Name** for the client. Set **Client address** to **IP/Hostname** and enter the IP address of the FortiGate (in the example, 172.25.176.62). Set a **Secret** for the client.

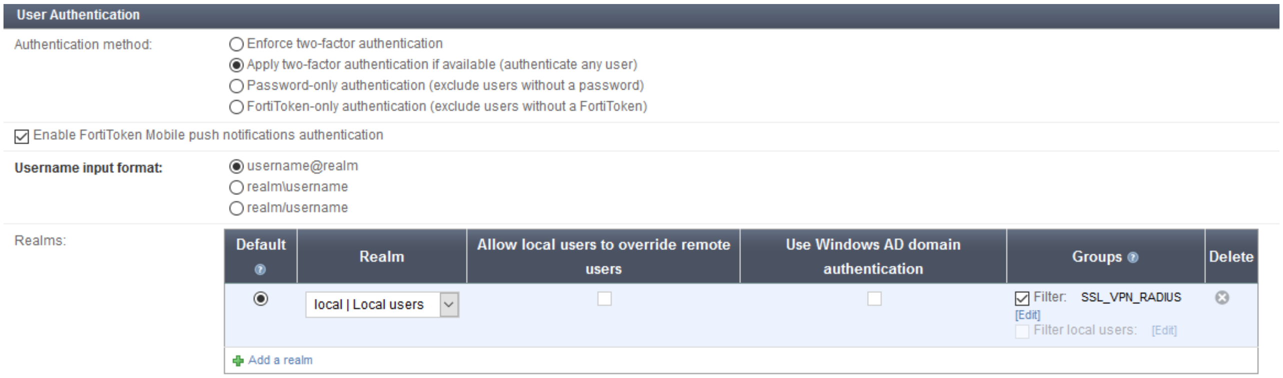


Name:	RADIUS
Client address:	● IP/Hostname ○ Subnet ○ Range
	172.25.176.62
Secret:	••••••••
First profile name:	Default
Description:	

□ Apply this profile based on RADIUS attributes .

EAP types:
□ EAP-GTC
□ EAP-TLS
□ PEAP
□ EAP-TTLS

3. Under **User Authentication**, set **Authentication method** to **Apply two-factor authentication if available**. Select **Enable FortiToken Mobile push notifications authentication**.



User Authentication

Authentication method:
○ Enforce two-factor authentication
● Apply two-factor authentication if available (authenticate any user)
○ Password-only authentication (exclude users without a password)
○ FortiToken-only authentication (exclude users without a FortiToken)

☑ Enable FortiToken Mobile push notifications authentication

Username input format:
● username@realm
○ realm\username
○ realm/username

Realms:

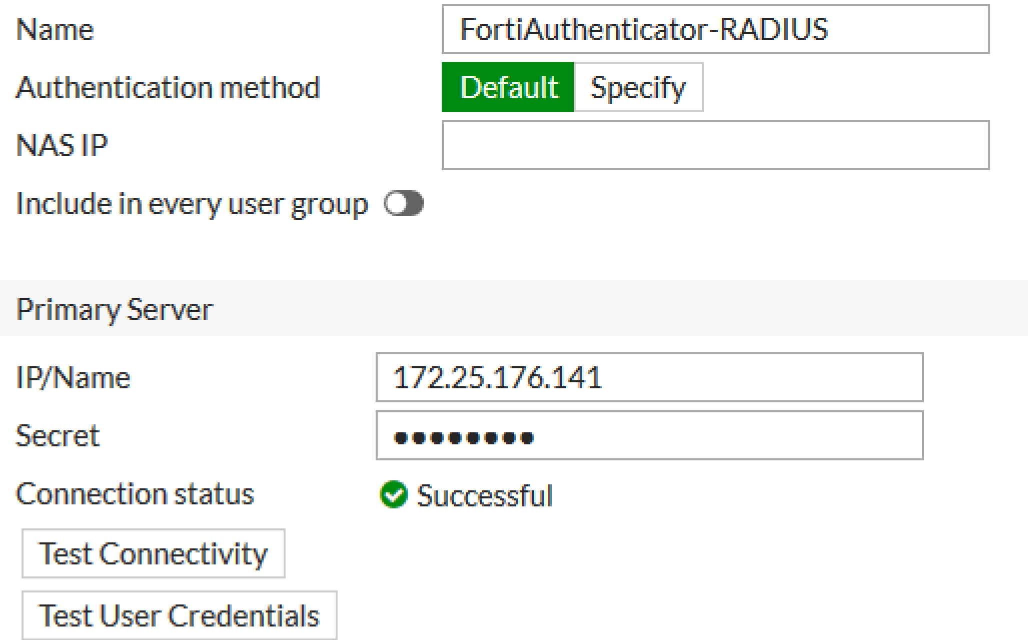
Default	Realm	Allow local users to override remote users	Use Windows AD domain authentication	Groups	Delete
●	local | Local users	□	□	☑ Filter: SSL_VPN_RADIUS [Edit] □ Filter local users: [Edit]	

4. For **Realms**, set the default realm to **local | Local users**. Under **Groups**, enable **Filter** and set it to the user group.

Connecting the FortiGate to FortiAuthenticator

1. To add the FortiAuthenticator as a RADIUS server for FortiGate, connect to the FortiGate, go to **User & Device > RADIUS Servers** and select **Create New**.

2. Set a **Name** for the server and set **Authentication method** to **Default**.

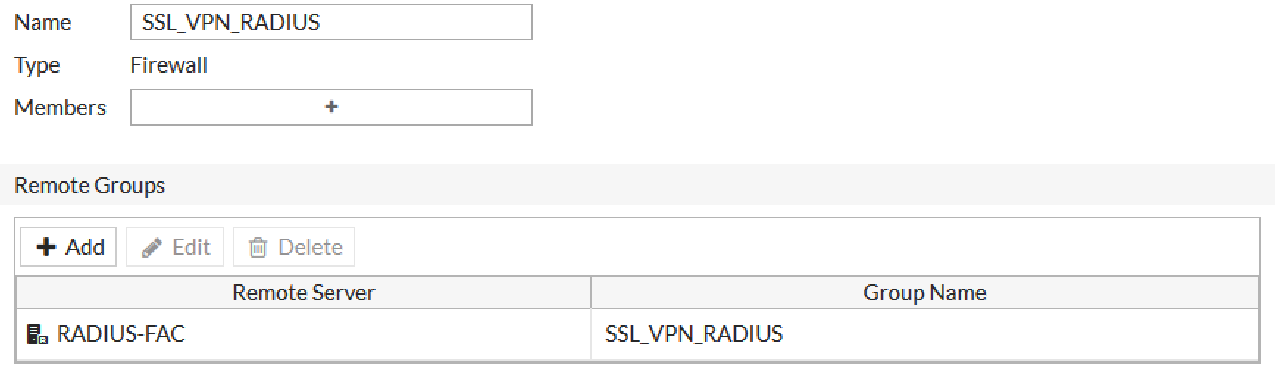


Name	FortiAuthenticator-RADIUS
Authentication method	Default Specify
NAS IP	
Include in every user group	○

Primary Server

IP/Name	172.25.176.141
Secret	●●●●●●●●●
Connection status	✓ Successful

3. Under **Primary Server,** set **IP/Name** to the IP address of the FortiAuthenticator (in this example, 172.25.176.141) and set **Secret** to the same secret you configured on the FortiAuthenticator.
4. Select **Test Connectivity** to make sure you used the proper settings.
5. To import the user group, go to **User & Device > User Groups** and create a new group.



Name	SSL_VPN_RADIUS
Type	Firewall
Members	+

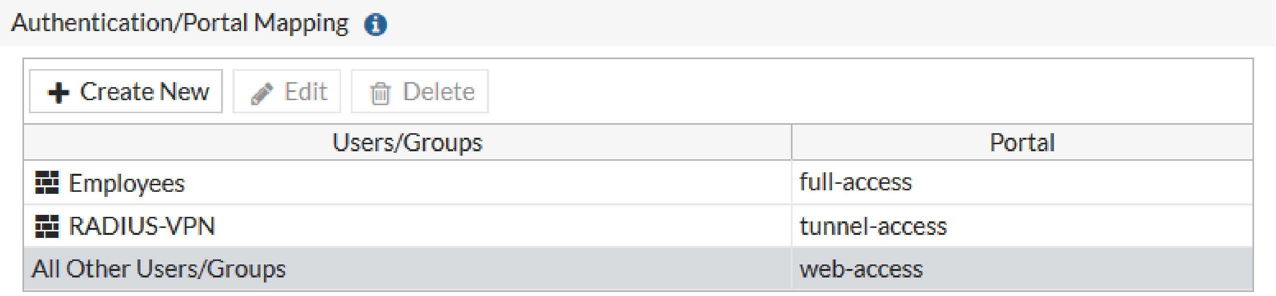
Remote Groups

Remote Server	Group Name
RADIUS-FAC	SSL_VPN_RADIUS

6. Set a **Name** for the group. Under **Remote Groups**, select **+Add** and select the RADIUS server. Set **Groups** to the RADIUS attribute you assigned to the group (in the example, *SSL_VPN_RADIUS*).

Allowing users to connect to the VPN

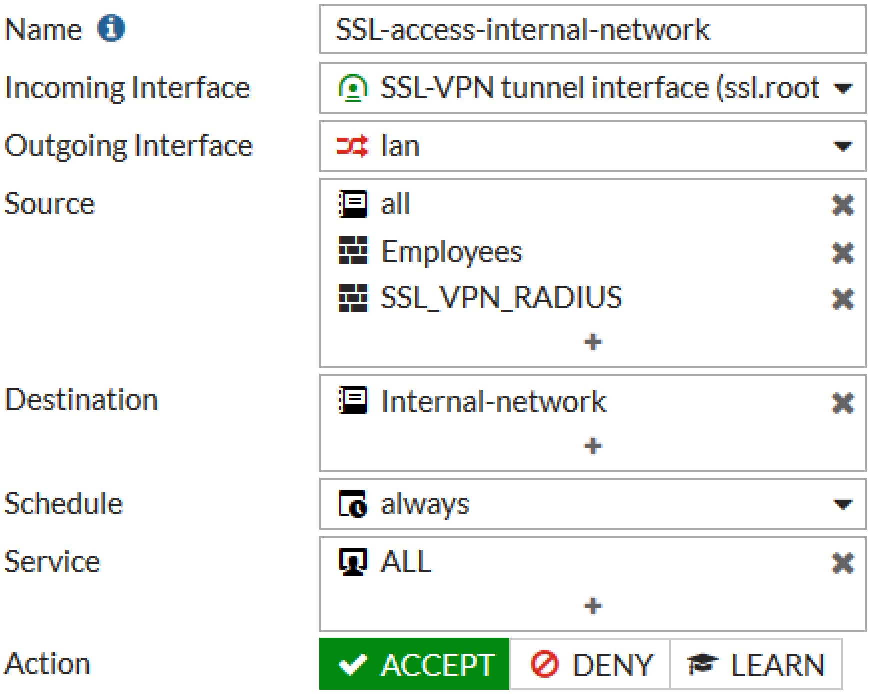
1. To configure SSL VPN authentication, go **to VPN > SSL-VPN Settings**.



Authentication/Portal Mapping

Users/Groups	Portal
Employees	full-access
RADIUS-VPN	tunnel-access
All Other Users/Groups	web-access

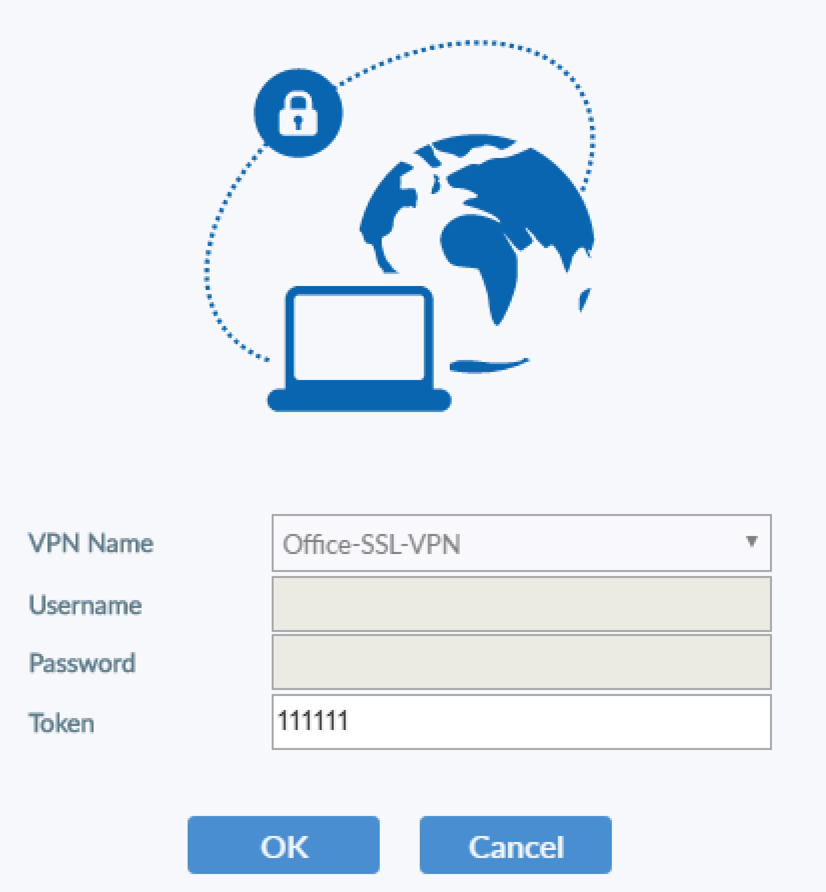
2. Under **Authentication/Portal Mapping**, create a new entry for the RADIUS group. Set **Portal** to **tunnel-access**, which allows users to connect using FortiClient.
3. To allow the new group access to the VPN, go to **Policy & Objects > IPv4 Policy** and edit the policy for the SSL VPN. Select **Source** and set **User** to include the RADIUS group.



Name	SSL-access-internal-network
Incoming Interface	SSL-VPN tunnel interface (ssl.root
Outgoing Interface	lan
Source	all Employees SSL_VPN_RADIUS
Destination	Internal-network
Schedule	always
Service	ALL
Action	✓ ACCEPT

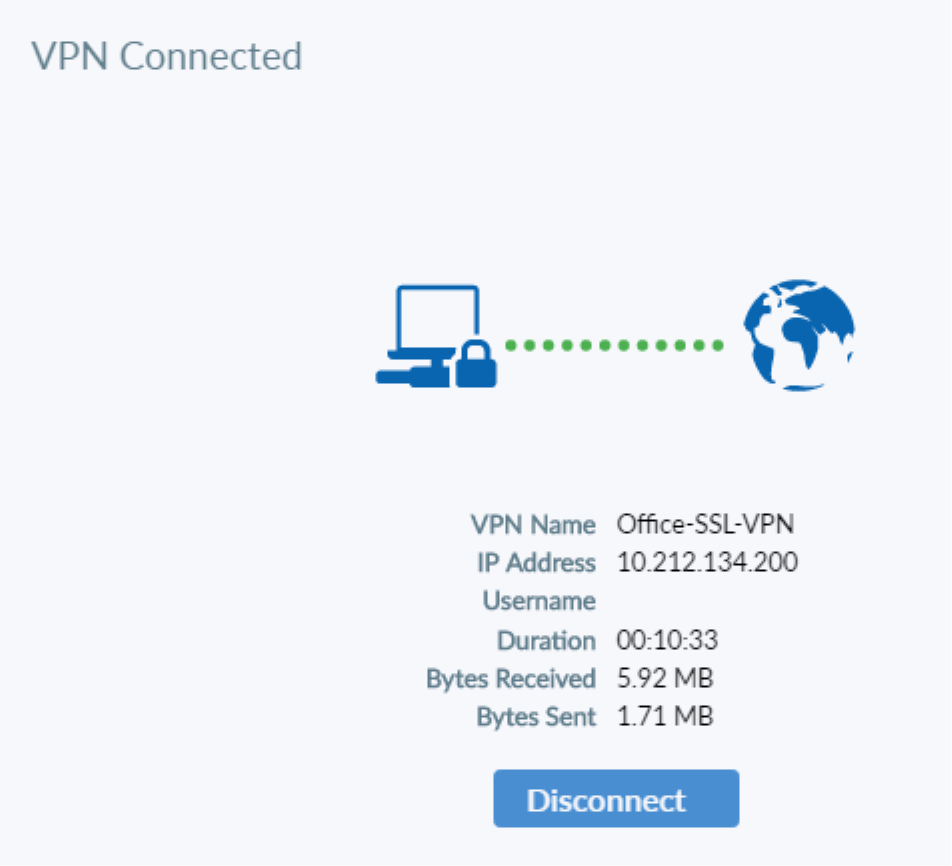
Results

1. Log in to the SSL VPN.
2. Enter the FortiToken code when it is requested.



VPN Name	Office-SSL-VPN ▾
Username	
Password	
Token	111111

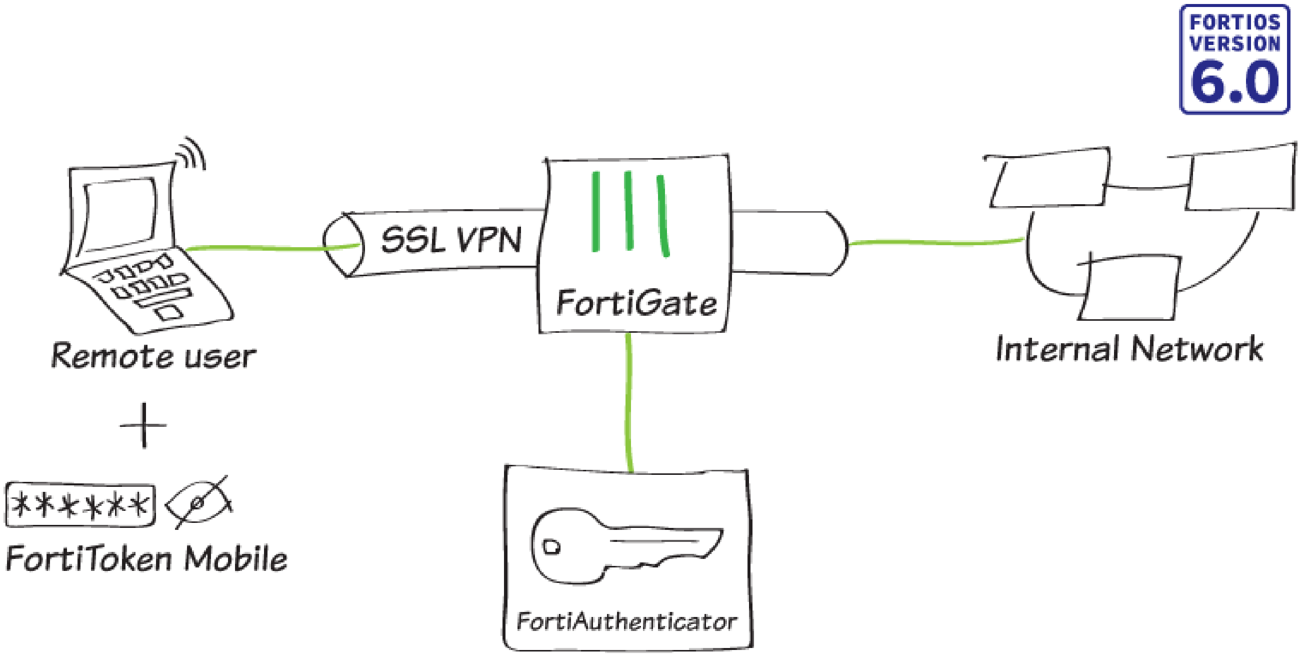
3. You are connected to the VPN tunnel.



VPN Connected

VPN Name Office-SSL-VPN
IP Address 10.212.134.200
Username
Duration 00:10:33
Bytes Received 5.92 MB
Bytes Sent 1.71 MB

FortiToken Mobile Push for SSL VPN



In this recipe, you set up FortiAuthenticator to function as a RADIUS server to authenticate SSL VPN users using FortiToken Mobile Push two-factor authentication. With Push notifications enabled, the user can easily accept or deny the authentication request.

For this configuration, you:

- Create a user on the FortiAuthenticator.
- Assign a FortiToken Mobile license to the user.
- Create the RADIUS client (FortiGate) on the FortiAuthenticator, and enable FortiToken Mobile Push notifications.
- Connect the FortiGate to the RADIUS server (FortiAuthenticator).
- Create an SSL VPN on the FortiGate, allowing internal access for remote users.

The following names and IP addresses are used:

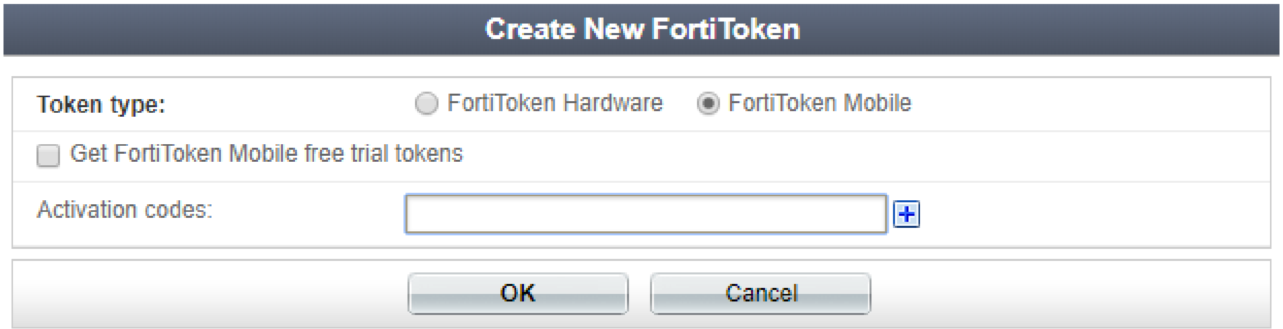
- Username: gthreepwood
- User group: RemoteFTMGroup
- RADIUS server: OfficeRADIUS
- RADIUS client: OfficeServer
- SSL VPN user group: SSLVPNGroup
- FortiAuthenticator: 172.25.176.141
- FortiGate: 172.25.176.92

For the purposes of this recipe, a FortiToken Mobile free trial token is used. This recipe also assumes that the user has already installed the FortiToken Mobile application on their smartphone. You can install the application for Android and iOS. For details, see:

- FortiToken Mobile for Android
- FortiToken Mobile for iOS

Adding FortiToken to FortiAuthenticator

1. On the FortiAuthenticator, go to **Authentication > User Management > FortiTokens**, and select **Create New**.
2. Set **Token type** to **FortiToken Mobile**, and enter the FortiToken **Activation codes** in the field provided.



Create New FortiToken

Token type: ○ FortiToken Hardware ● FortiToken Mobile

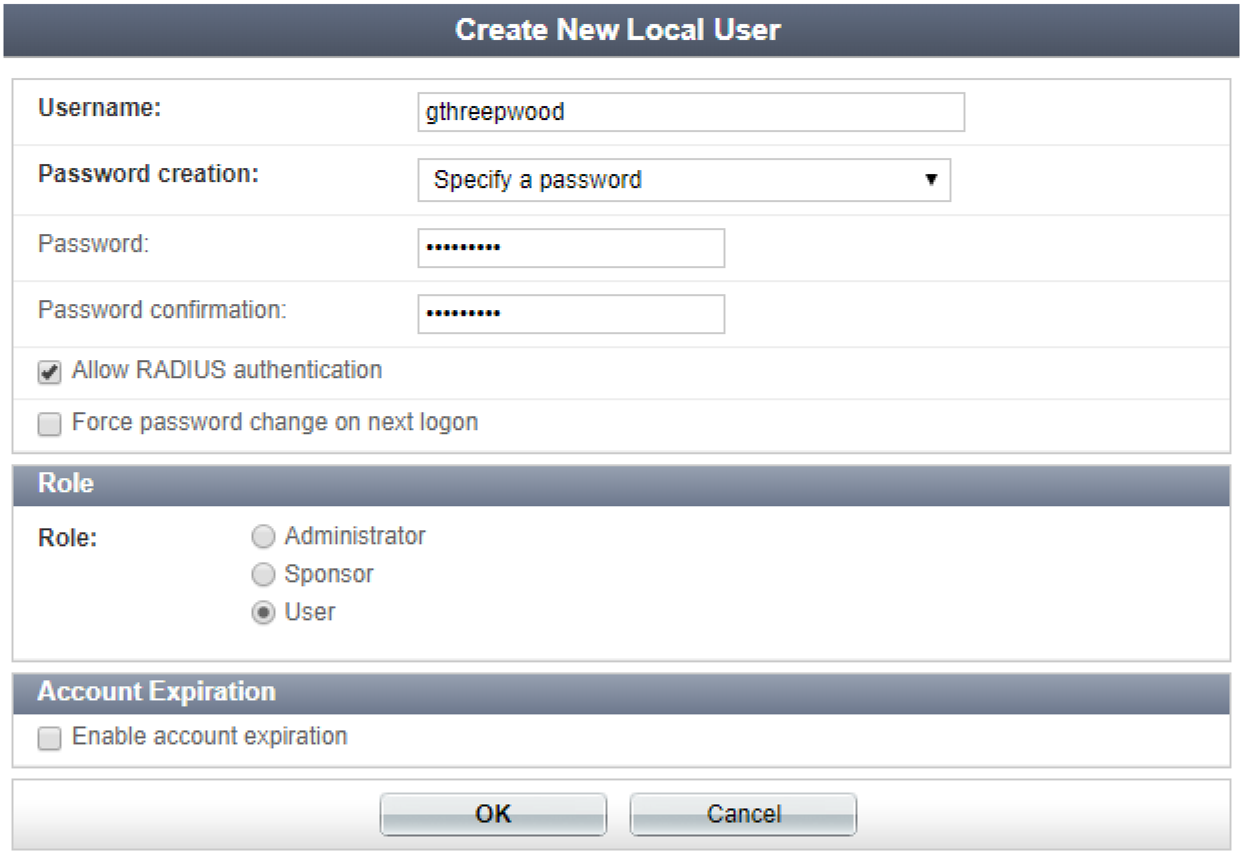
□ Get FortiToken Mobile free trial tokens

Activation codes:

Adding user to FortiAuthenticator

1. On the FortiAuthenticator, go to **Authentication > User Management > Local Users**, and select **Create New**.
2. Enter a **Username** (*gthreepwood*) and enter and confirm the user password.

3. Enable **Allow RADIUS authentication**, and select **OK** to access additional settings.



Create New Local User

Username: gthreepwood

Password creation: Specify a password

Password: •••••••••

Password confirmation: •••••••••

☑ Allow RADIUS authentication

□ Force password change on next logon

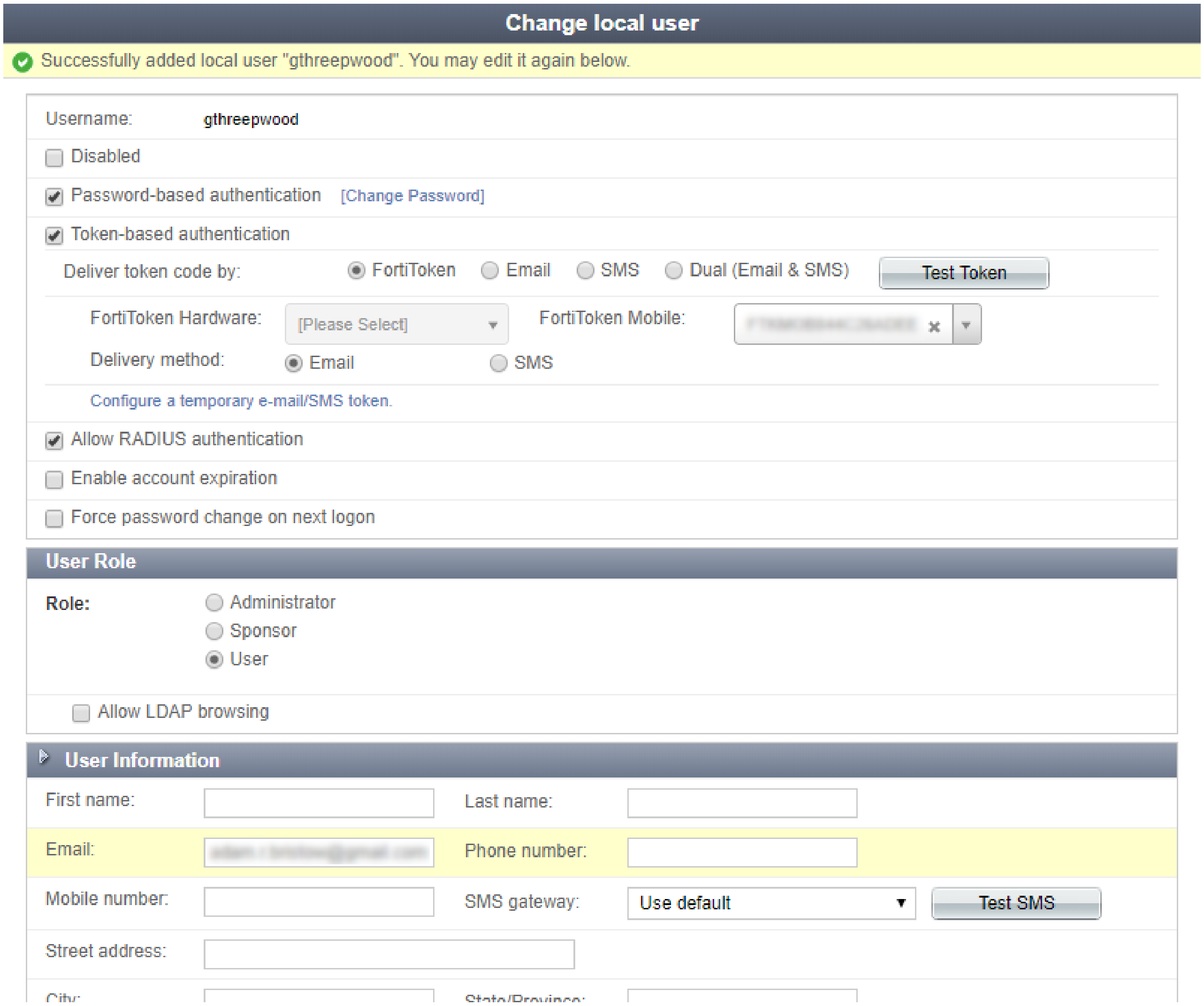
Role

Role: ○ Administrator ○ Sponsor ● User

Account Expiration

□ Enable account expiration

4. Enable **Token-based authentication** and select to deliver the token code by **FortiToken**. Select the FortiToken added earlier from the **FortiToken Mobile** drop-down menu.
5. Set **Delivery method** to **Email**. This will automatically open the **User Information** section where you can enter the user email address in the field provided.



Change local user

Successfully added local user "gthreepwood". You may edit it again below.

Username: gthreepwood

□ Disabled

☑ Password-based authentication [Change Password]

☑ Token-based authentication

Deliver token code by: ● FortiToken ○ Email ○ SMS ○ Dual (Email & SMS) Test Token

FortiToken Hardware: [Please Select] FortiToken Mobile: [redacted]

Delivery method: ● Email ○ SMS

Configure a temporary e-mail/SMS token.

☑ Allow RADIUS authentication

□ Enable account expiration

□ Force password change on next logon

User Role

Role: ○ Administrator ○ Sponsor ● User

□ Allow LDAP browsing

User Information

First name: Last name:

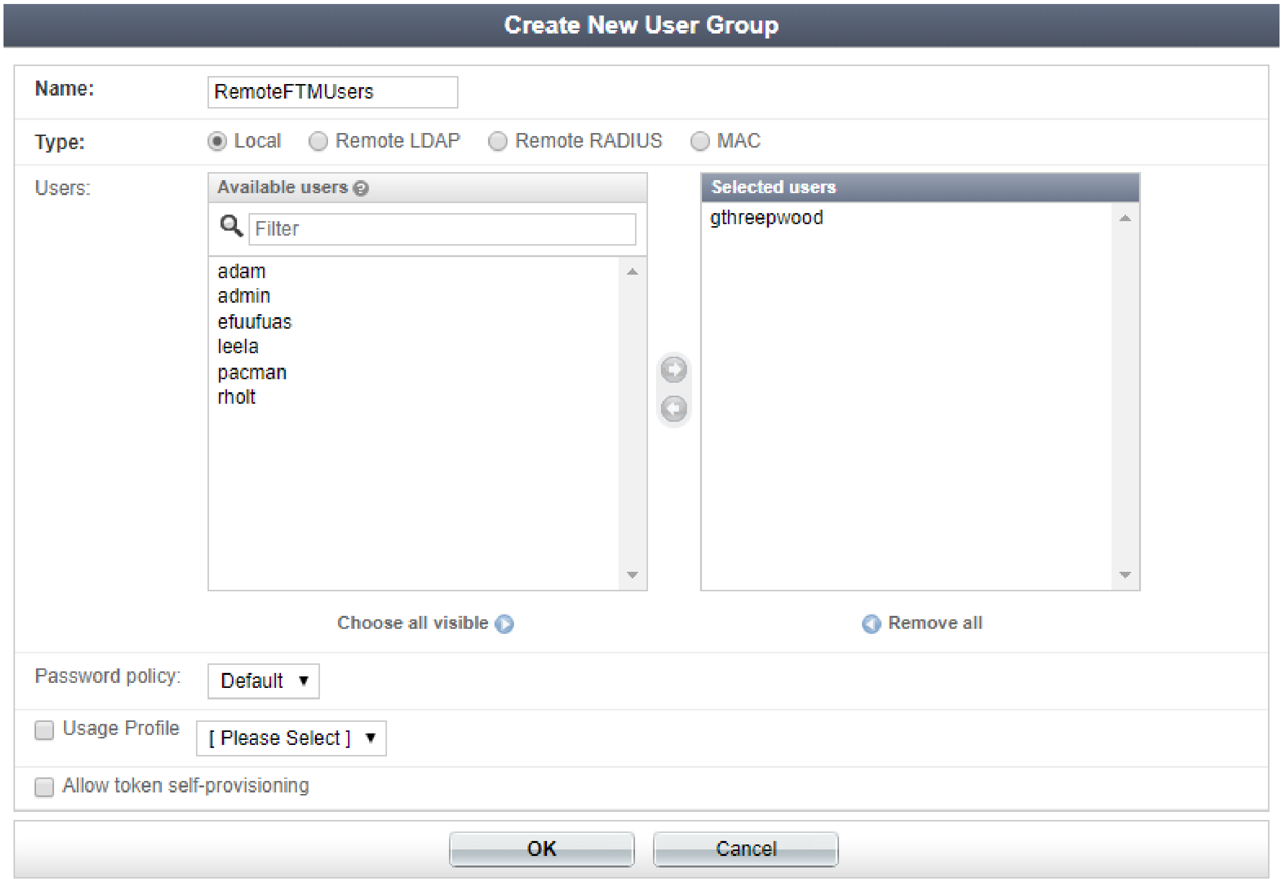
Email: [redacted] Phone number:

Mobile number: SMS gateway: Use default Test SMS

Street address:

City: State/Province:

6. Next, go to **Authentication > User Management > User Groups**, and select **Create New**.
7. Enter a **Name** (*RemoteFTMUsers*) and add **gthreepwood** to the group by moving the user from **Available users** to **Selected users**.



Create New User Group

Name: RemoteFTMUsers

Type: ● Local ○ Remote LDAP ○ Remote RADIUS ○ MAC

Users:

Available users: adam, admin, efuufuas, leela, pacman, rholt

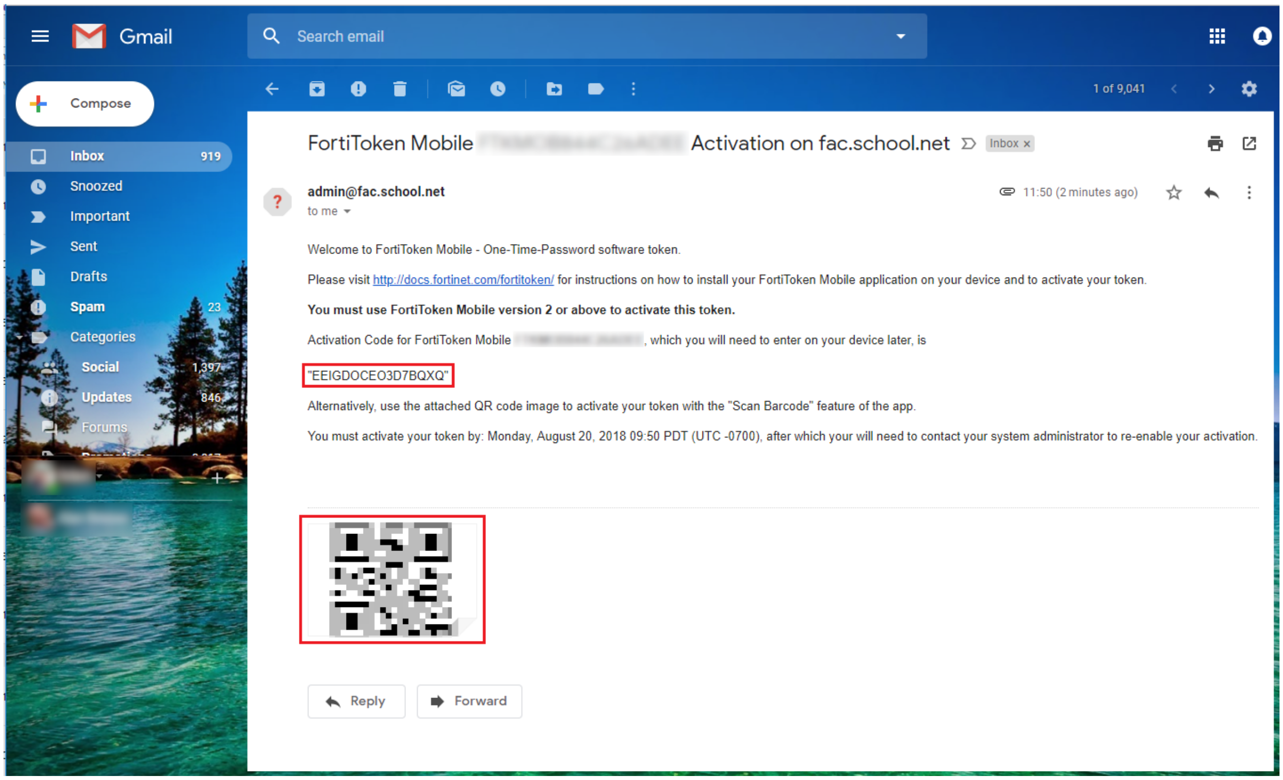
Selected users: gthreepwood

Password policy: Default

□ Usage Profile [Please Select]

□ Allow token self-provisioning

8. The FortiAuthenticator sends the FortiToken Mobile activation to the user's email address. If the email does not appear in the inbox, check the spam folder.
9. The user activates their FortiToken Mobile through the FortiToken Mobile application by either entering the activation code provided or by scanning the QR code attached.



FortiToken Mobile [redacted] Activation on fac.school.net

admin@fac.school.net
to me

11:50 (2 minutes ago)

Welcome to FortiToken Mobile - One-Time-Password software token.

Please visit http://docs.fortinet.com/fortitoken/ for instructions on how to install your FortiToken Mobile application on your device and to activate your token.

You must use FortiToken Mobile version 2 or above to activate this token.

Activation Code for FortiToken Mobile [redacted], which you will need to enter on your device later, is

"EEIGDOCEO3D7BQXQ"

Alternatively, use the attached QR code image to activate your token with the "Scan Barcode" feature of the app.

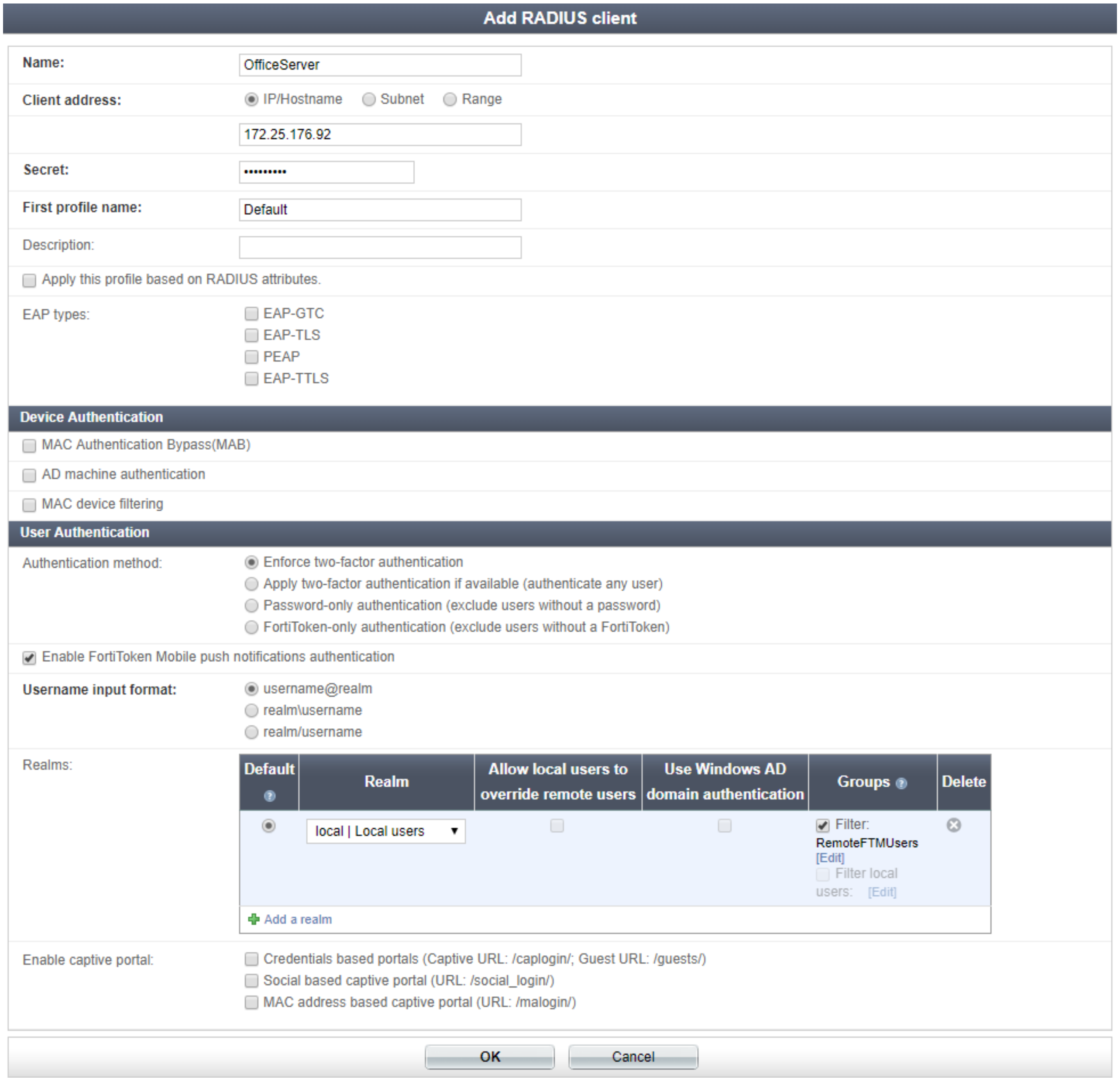
You must activate your token by: Monday, August 20, 2018 09:50 PDT (UTC -0700), after which your will need to contact your system administrator to re-enable your activation.

Creating the RADIUS client on FortiAuthenticator

1. On the FortiAuthenticator, go to **Authentication > RADIUS Service > Clients**, and select **Create New** to add the FortiGate as a RADIUS client.
2. Enter a **Name** (*OfficeServer*), the IP address of the FortiGate, and set a **Secret**. The secret is a pre-shared secure password that the FortiGate will use to authenticate to the FortiAuthenticator.
3. Set **Authentication method** to **Enforce two-factor authentication** and check the **Enable FortiToken Mobile push notifications authentication** checkbox.

Note the **Username input format**. This is the format that the user must use to enter their username in the web portal, made up of their username and realm. In this example, the full username for gthreepwood is "**gthreepwood@local**".

4. Set **Realms** to **local | Local users**, and add **RemoteFTMUsers** to the **Groups** filter.



Add RADIUS client

Name:	OfficeServer
Client address:	● IP/Hostname ○ Subnet ○ Range
	172.25.176.92
Secret:	•••••••••
First profile name:	Default
Description:	
□ Apply this profile based on RADIUS attributes.	
EAP types:	□ EAP-GTC □ EAP-TLS □ PEAP □ EAP-TTLS

Device Authentication

□ MAC Authentication Bypass(MAB)

□ AD machine authentication

□ MAC device filtering

User Authentication

Authentication method:	● Enforce two-factor authentication ○ Apply two-factor authentication if available (authenticate any user) ○ Password-only authentication (exclude users without a password) ○ FortiToken-only authentication (exclude users without a FortiToken)
☑ Enable FortiToken Mobile push notifications authentication	
Username input format:	● username@realm ○ realm\username ○ realm/username

Realms:

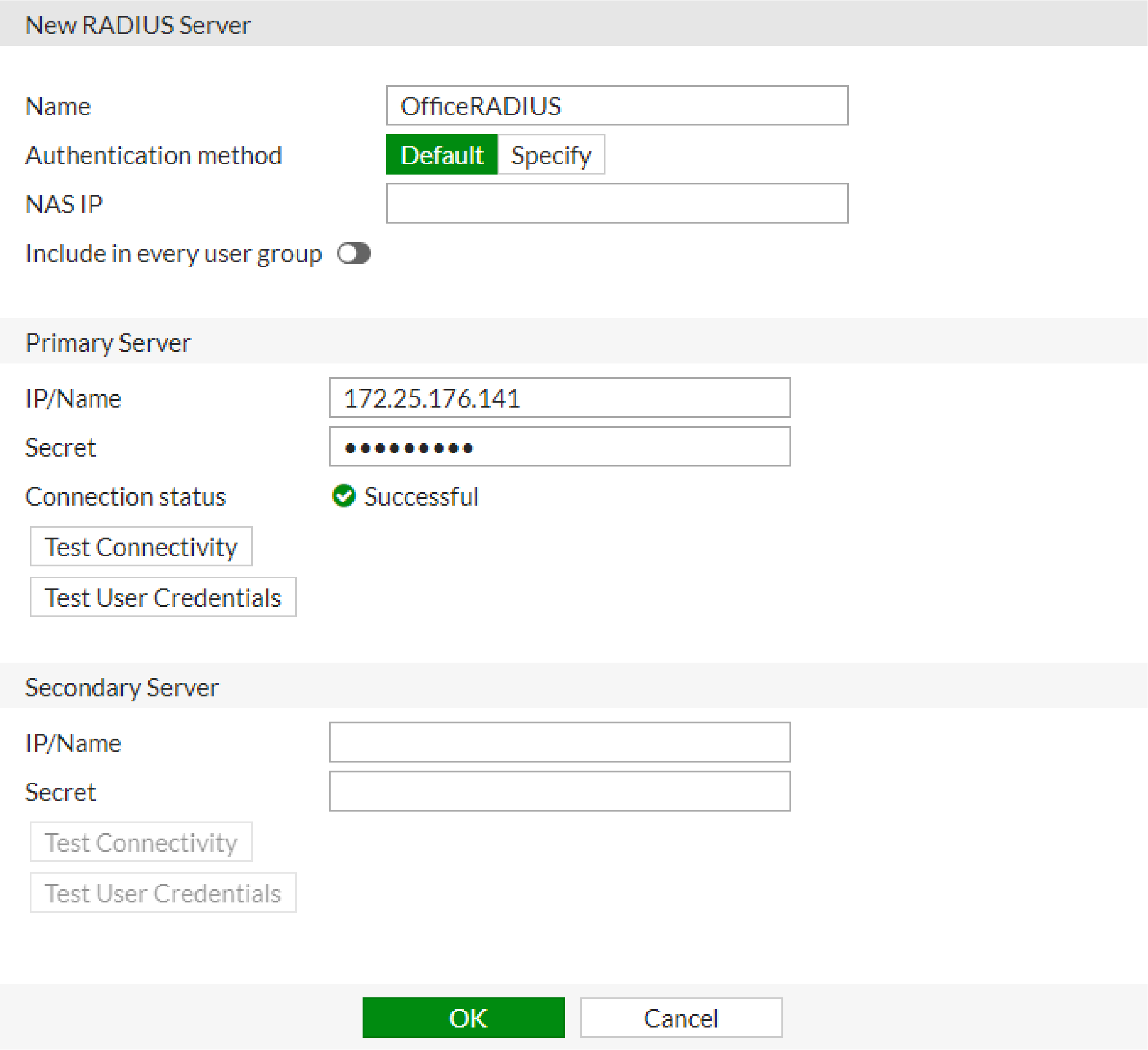
Default	Realm	Allow local users to override remote users	Use Windows AD domain authentication	Groups	Delete
●	local | Local users ▼	□	□	☑ Filter: RemoteFTMUsers [Edit] □ Filter local users: [Edit]	⊗

+ Add a realm

Enable captive portal:	□ Credentials based portals (Captive URL: /caplogin/; Guest URL: /guests/) □ Social based captive portal (URL: /social_login/) □ MAC address based captive portal (URL: /malogin/)

Connecting the FortiGate to the RADIUS server

1. On the FortiGate, go to **User & Device > RADIUS Servers**, and select **Create New** to connect to the RADIUS server (FortiAuthenticator).
2. Enter a **Name** (*OfficeRADIUS*), the IP address of the FortiAuthenticator, and enter the **Secret** created before.
3. Select **Test Connectivity** to be sure you can connect to the RADIUS server. Then select **Test User Credentials** and enter the credentials for **gthreepwood**.



New RADIUS Server

Name	OfficeRADIUS
Authentication method	Default Specify
NAS IP	
Include in every user group	○

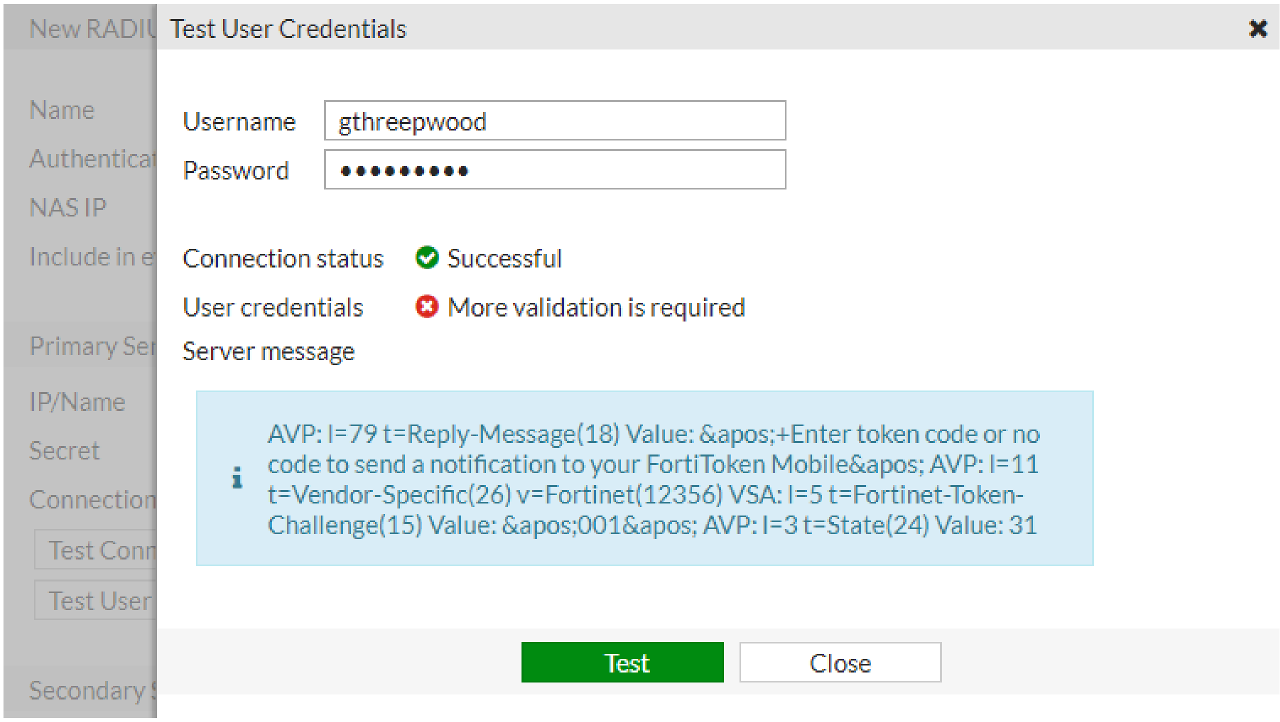
Primary Server

IP/Name	172.25.176.141
Secret	•••••••••
Connection status	✓ Successful

Secondary Server

IP/Name	
Secret	

4. Because the user has been assigned a FortiToken, the test should come stating that **More validation is required**.
5. The FortiGate can now connect to the FortiAuthenticator as the RADIUS client configured earlier.



Test User Credentials

Username: gthreepwood

Password: •••••••••

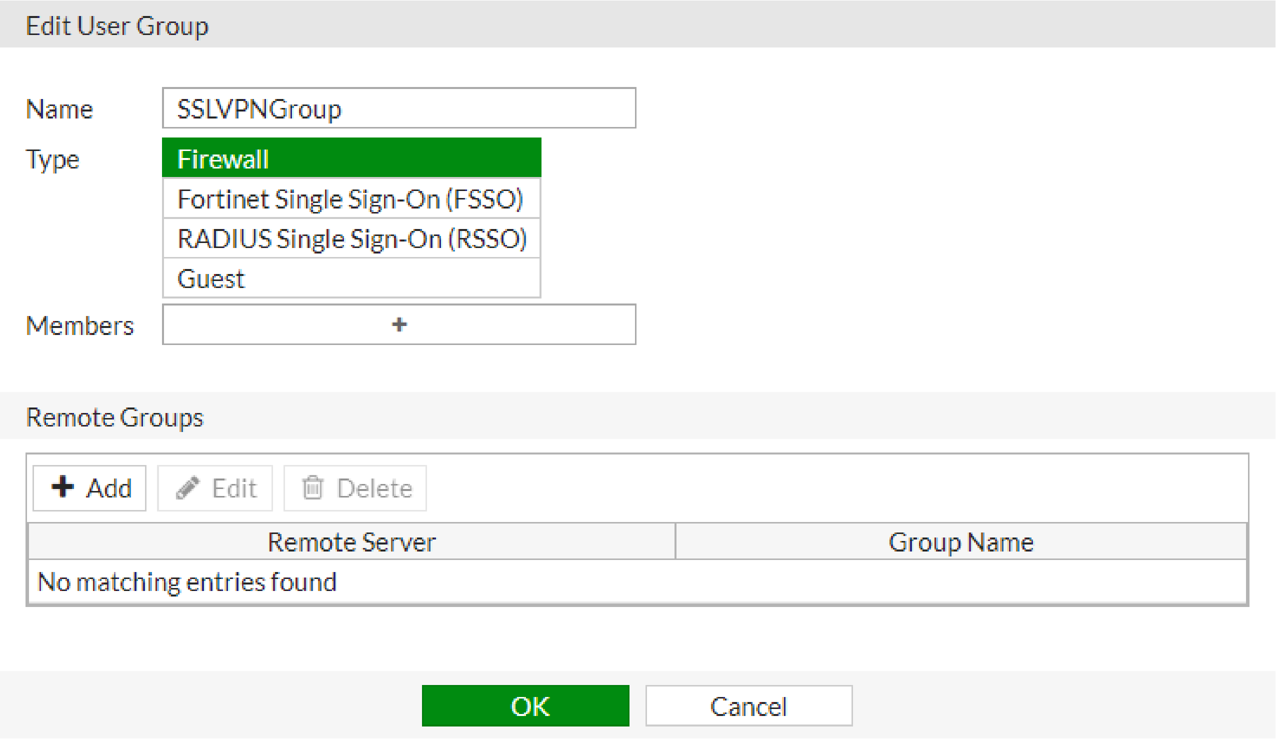
Connection status: ✓ Successful

User credentials: ✖ More validation is required

Server message

AVP: l=79 t=Reply-Message(18) Value: &apos;+Enter token code or no code to send a notification to your FortiToken Mobile&apos; AVP: l=11 t=Vendor-Specific(26) v=Fortinet(12356) VSA: l=5 t=Fortinet-Token-Challenge(15) Value: &apos;001&apos; AVP: l=3 t=State(24) Value: 31

6. Then go to **User & Device > User Groups**, and select **Create New** to map authenticated remote users to a user group on the FortiGate.
7. Enter a **Name** (*SSLVPNGroup*) and select **Add** under **Remote Groups**.



Edit User Group

Name: SSLVPNGroup

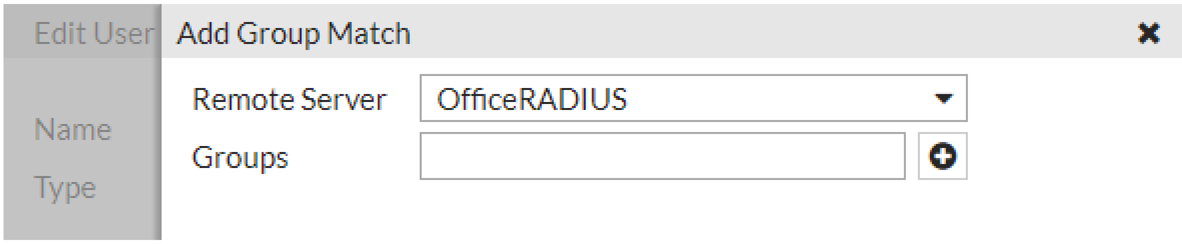
Type: [✓ Firewall] Fortinet Single Sign-On (FSSO) RADIUS Single Sign-On (RSSO) Guest

Members: +

Remote Groups

Remote Server	Group Name
No matching entries found	

8. Select **OfficeRADIUS** under the **Remote Server** drop-down menu, and leave the **Groups** field blank.



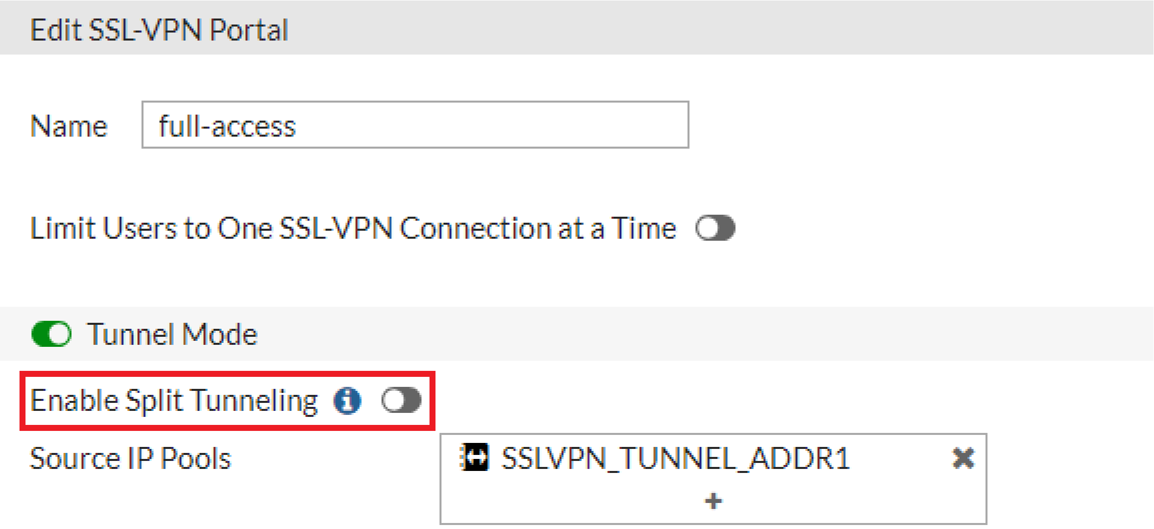
Add Group Match

Remote Server: OfficeRADIUS

Groups:

Configuring the SSL VPN

1. On the FortiGate, go to **VPN > SSL-VPN Portals**, and edit the **full-access** portal.
2. Toggle **Enable Split Tunneling** so that it is disabled.



Edit SSL-VPN Portal

Name: full-access

Limit Users to One SSL-VPN Connection at a Time ○

● Tunnel Mode

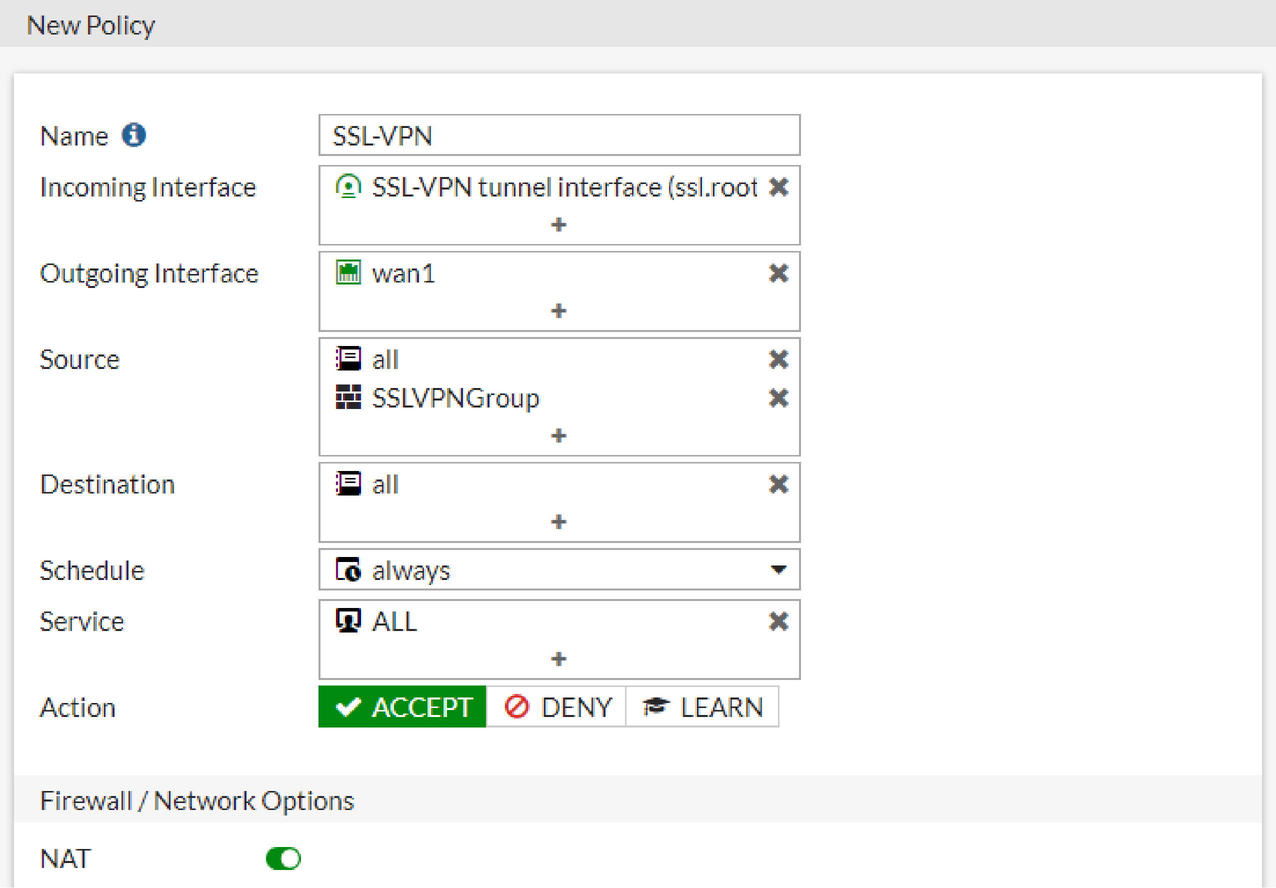
Enable Split Tunneling ○

Source IP Pools: SSLVPN_TUNNEL_ADDR1

3. Then go to **VPN > SSL-VPN Settings**.
4. Under **Connection Settings** set **Listen on Interface(s)** to **wan1** and **Listen on Port** to **10443**.
5. Under **Tunnel Mode Client Settings**, select **Specify custom IP ranges**. The **IP Ranges** should be set to **SSLVPN_TUNNEL_ADDR1** and the IPv6 version by default.
6. Under **Authentication/Portal Mapping**, select **Create New**.
7. Set the **SSLVPNGroup** user group to the **full-access** portal, and assign **All Other Users/Groups** to **web-**

access — this will grant all other users access to the web portal *only*.

8. Go to **Policy & Objects > IPv4 Policy** and create a new SSL VPN policy.
9. Set **Incoming Interface** to the **SSL-VPN tunnel interface** and set **Outgoing Interface** to the Internet-facing interface (in this case, **wan1**).
10. Set **Source** to the **SSLVPNGroup** user group and the **all** address.
11. Set **Destination Address** to **all**, **Schedule** to **always**, **Service** to **ALL**, and enable **NAT**.



New Policy

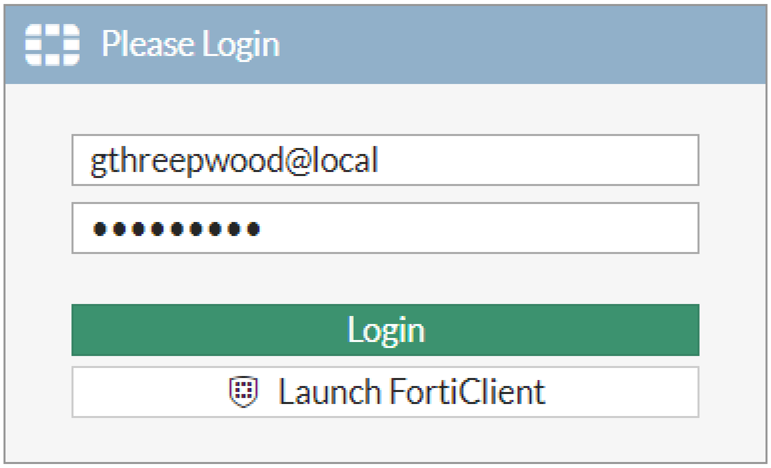
Name	SSL-VPN
Incoming Interface	SSL-VPN tunnel interface (ssl.root
Outgoing Interface	wan1
Source	all SSLVPNGroup
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT / DENY / LEARN

Firewall / Network Options

NAT ●

Results

1. From a remote device, open a web browser and navigate to the SSL VPN web portal *(https://<fortigate-ip>:10443*).
2. Enter **gthreepwood**'s credentials and select **Login**. Use the correct format (in this case, username@realm), as per the client configuration on the FortiAuthenticator.



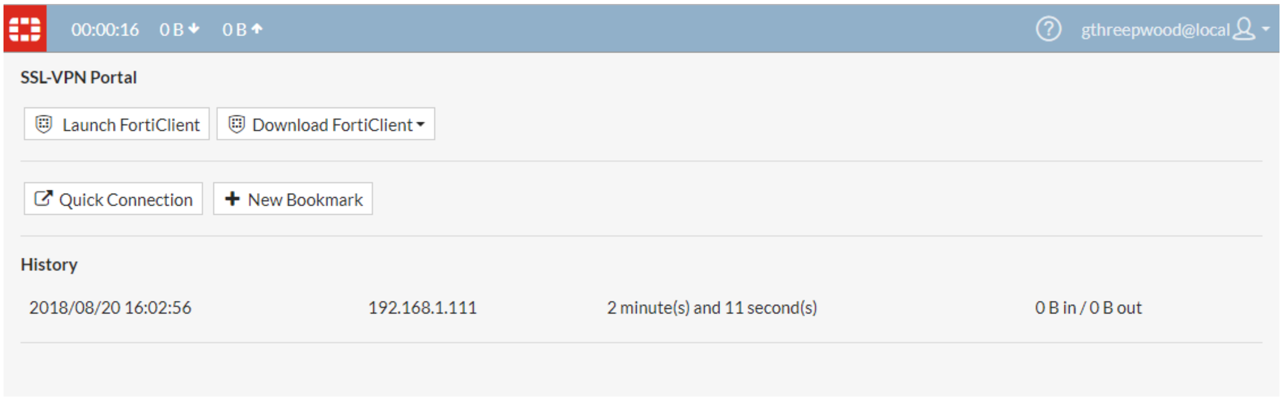
gthreepwood@local

●●●●●●●●●●

3. The FortiAuthenticator will then push a login request notification through the FortiToken Mobile application. Select

Approve.

4. Upon approving the authentication, **gthreepwood** is successfully logged into the SSL VPN portal.

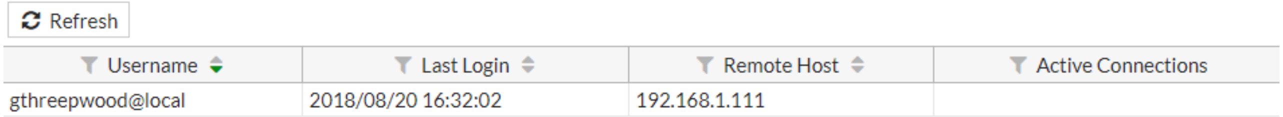


SSL-VPN Portal

History

2018/08/20 16:02:56	192.168.1.111	2 minute(s) and 11 second(s)	0 B in / 0 B out

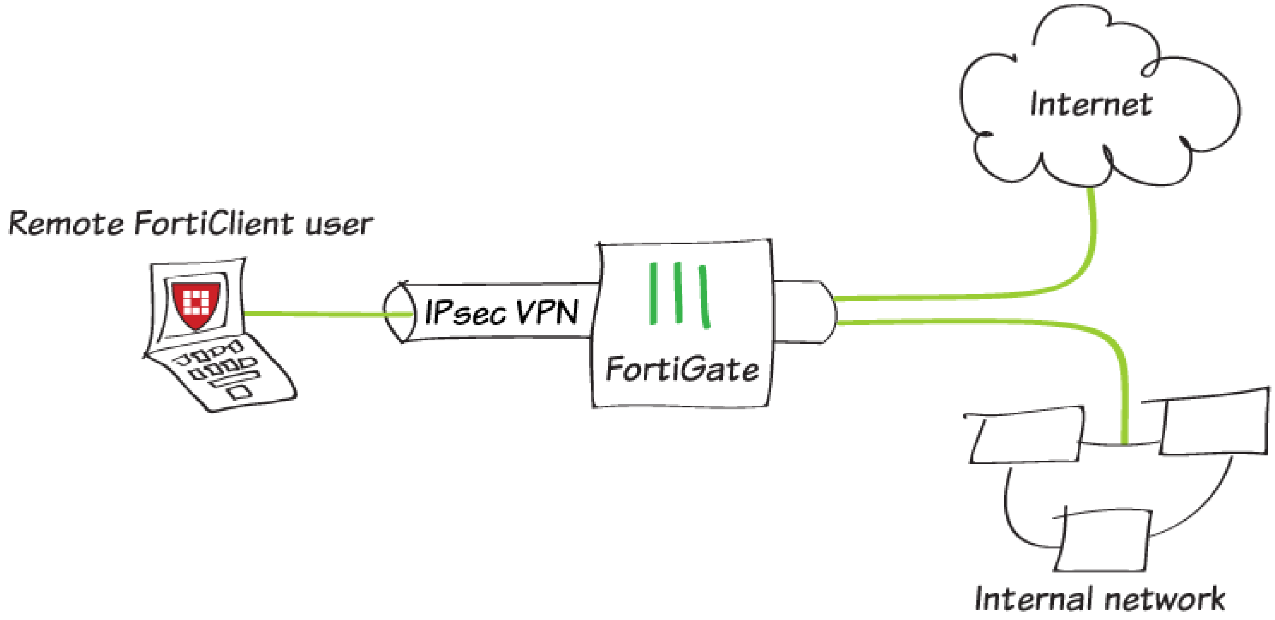
5. On the FortiGate, go **to Monitor > SSL-VPN Monitor** to confirm the user’s connection.



Username	Last Login	Remote Host	Active Connections
gthreepwood@local	2018/08/20 16:32:02	192.168.1.111	

IPsec VPN with FortiClient

FORTIOS VERSION 6.0



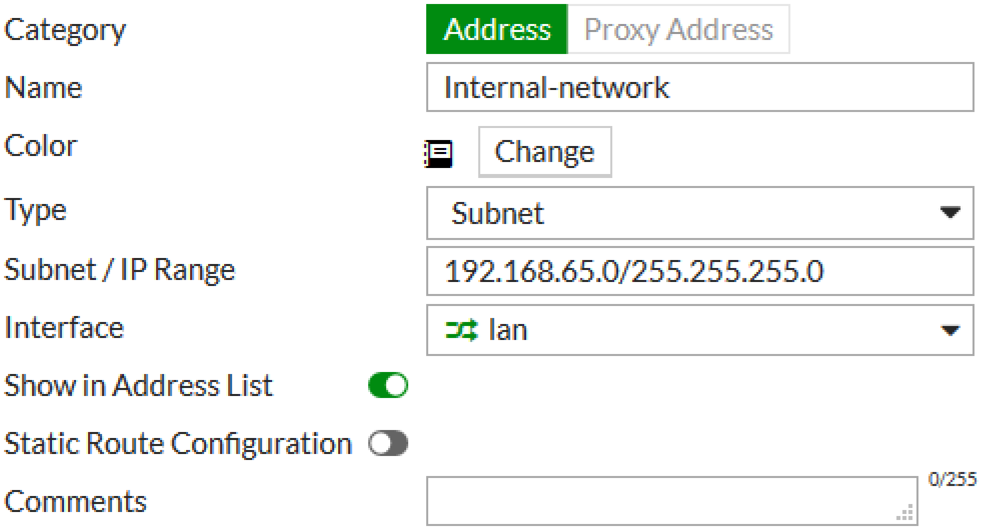
In this example, you allow remote users to access the corporate network using an IPsec VPN that they connect to using FortiClient. The remote user Internet traffic is also routed through the FortiGate (split tunneling will not be enabled).

Optionally, you can create a user that uses two factor authentication, and an user LDAP user.

Adding a firewall address

1. To create a new firewall address, go to **Policy & Objects > Addresses** and select **Create New > Address**.
2. Set **Category** to **Address** and enter a **Name**. Set **Type** to **Subnet**, **Subnet/IP Range** to the local subnet, and

Interface to **lan**.



Category: Address | Proxy Address

Name: Internal-network

Color: Change

Type: Subnet

Subnet / IP Range: 192.168.65.0/255.255.255.0

Interface: lan

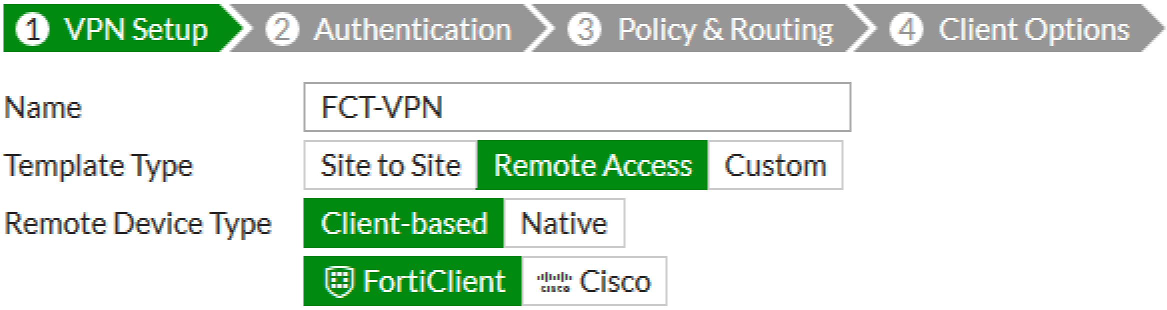
Show in Address List: ●

Static Route Configuration: ○

Comments: 0/255

Configuring the IPsec VPN

1. To create the VPN, go to **VPN > IPsec Wizard** and create a new tunnel using a pre-existing template.
2. Name the VPN. The tunnel name cannot include any spaces or exceed 13 characters. Set **Template** to **Remote Access**, and set **Remote Device Type** to **FortiClient VPN for OS X, Windows, and Android**.



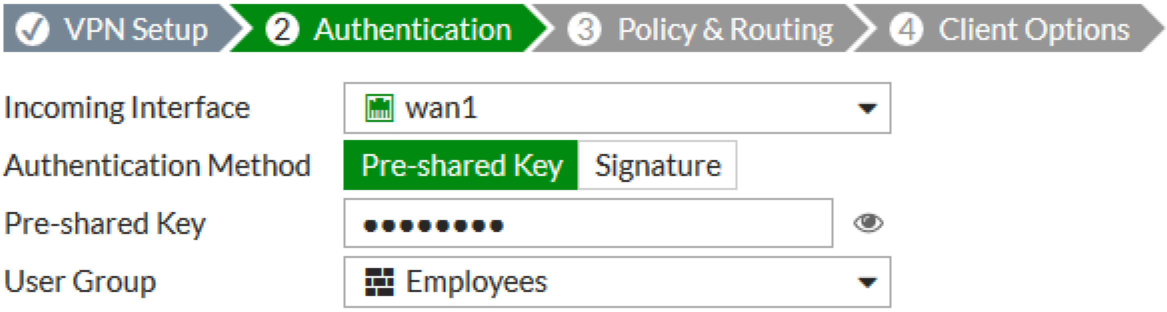
Name: FCT-VPN

Template Type: Site to Site | Remote Access | Custom

Remote Device Type: Client-based | Native

FortiClient | Cisco

3. Set the **Incoming Interface** to **wan1** and **Authentication Method** to **Pre-shared Key**.
4. Enter a pre-shared key. This pre-shared key is a credential for the VPN and should differ from the user password. Select the **Employees** group.



Incoming Interface: wan1

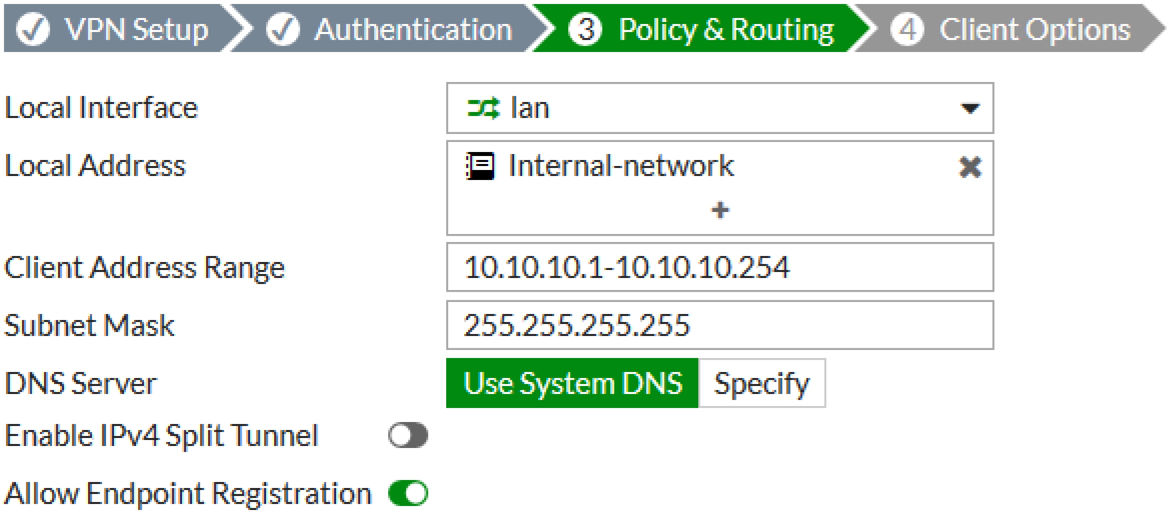
Authentication Method: Pre-shared Key | Signature

Pre-shared Key: ●●●●●●●●

User Group: Employees

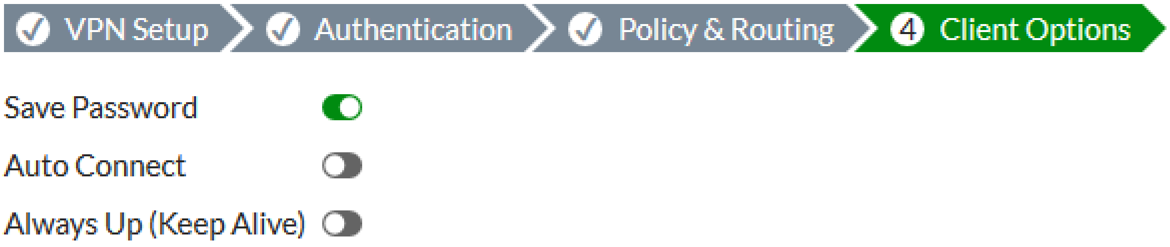
5. Set **Local Interface** to **lan** and set **Local Address** to the local network address.

6. Enter a **Client Address Range** for VPN users. The IP range you enter here prompts FortiOS to create a new firewall object for the VPN tunnel using the name of your tunnel followed by the _range suffix (in the example, *IPsec-FCT_range*).
7. Make sure **Enable IPv4 Split Tunnel** is *not* selected, so that all Internet traffic will go through the FortiGate. If you do select **Enable Split Tunneling**, traffic not intended for the corporate network will not flow through the FortiGate or be subject to the corporate security profiles.



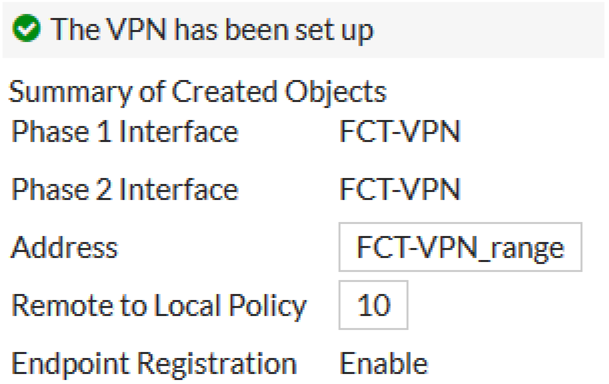
Local Interface	lan
Local Address	Internal-network
Client Address Range	10.10.10.1-10.10.10.254
Subnet Mask	255.255.255.255
DNS Server	Use System DNS | Specify
Enable IPv4 Split Tunnel	○
Allow Endpoint Registration	●

8. Select **Client Options** as desired.



Save Password	●
Auto Connect	○
Always Up (Keep Alive)	○

9. After you create the tunnel, a summary page appears listing the objects which have been added to the FortiGate's configuration by the wizard.



✓ The VPN has been set up

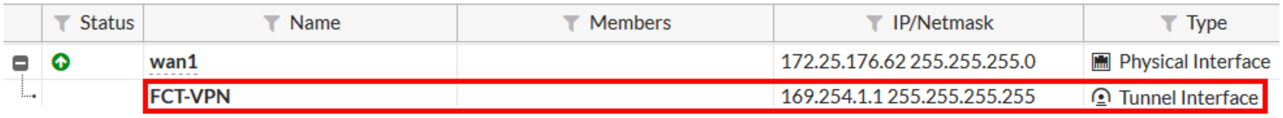
Summary of Created Objects

Phase 1 Interface	FCT-VPN
Phase 2 Interface	FCT-VPN
Address	FCT-VPN_range
Remote to Local Policy	10
Endpoint Registration	Enable

10. If multiple dialup IPsec VPNs are defined for the same dialup server interface, each phase1 configuration must define a unique peer ID to distinguish the tunnel that the remote client is connecting to:
    a. Go to **VPN > IPsec Tunnels** and edit the just created tunnel.
    b. Click **Convert To Custom Tunnel**.

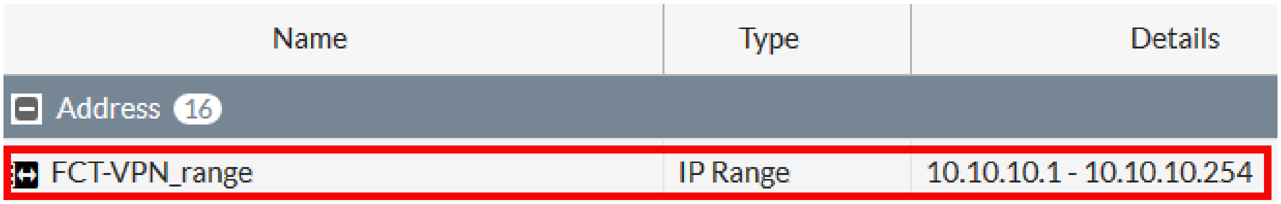
   c. In the **Authentication** section, click **Edit**.
   d. Under **Peer Options**, set **Accept Types** to **Specific peer ID**.
   e. In the **Peer ID** field, enter a unique ID, such as **dialup1**.
   f. Click **OK**.

11. To view the VPN interface created by the wizard, go to **Network > Interfaces**.



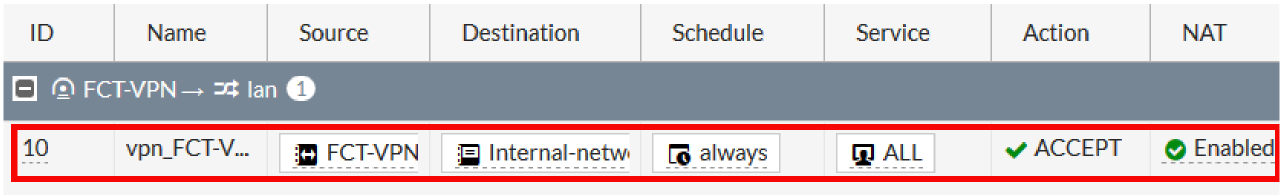
	Status	Name	Members	IP/Netmask	Type
⊟	●	wan1		172.25.176.62 255.255.255.0	Physical Interface
		FCT-VPN		169.254.1.1 255.255.255.255	Tunnel Interface

12. To view the firewall address created by the wizard, go to **Policy & Objects > Addresses**.



Name	Type	Details
⊟ Address 16		
FCT-VPN_range	IP Range	10.10.10.1 - 10.10.10.254

13. To view the security policy created by the wizard, go to **Policy & Objects > IPv4 Policy**.



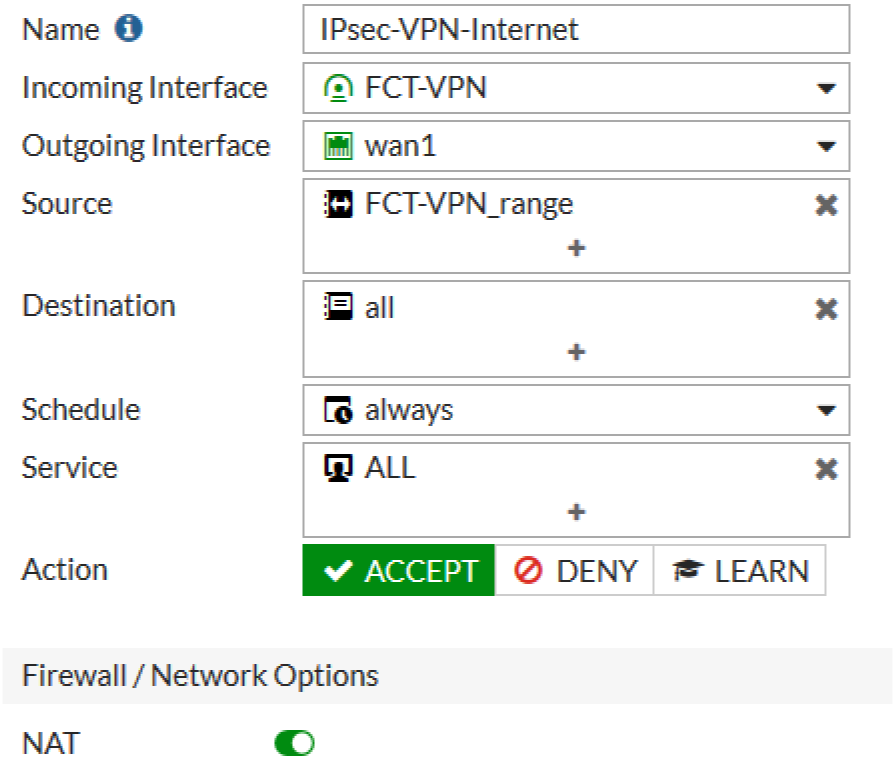
ID	Name	Source	Destination	Schedule	Service	Action	NAT
⊟ FCT-VPN → lan 1							
10	vpn_FCT-V...	FCT-VPN	Internal-netw	always	ALL	✓ ACCEPT	✓ Enabled

Creating a security policy

The IPsec wizard automatically created a security policy allowing IPsec VPN users to access the internal network. However, since split tunneling is disabled, another policy must be created to allow users to access the Internet through the FortiGate.

1. To create a new policy, go to **Policy & Objects > IPv4 Policies** and select **Create New**. Set a policy name that will identify what this policy is used for (in the example, *IPsec-VPN-Internet*).
2. Set **Incoming Interface** to the tunnel interface and **Outgoing Interface** to **wan1**. Set **Source** to the IPsec client address range, **Destination Address** to **all**, **Service** to **ALL**, and enable **NAT**.

3. Configure any remaining firewall and security options as desired.



Name	IPsec-VPN-Internet
Incoming Interface	FCT-VPN
Outgoing Interface	wan1
Source	FCT-VPN_range
Destination	all
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT	☑

Add FortiToken two-factor authentication

This configuration adds two-factor authentication (2FA) to the FortiClient dialup VPN configuration (Configuring the IPsec VPN on page 287). It uses one of the two free mobile FortiTokens that is already installed on the FortiGate.

To configure 2FA using the GUI:

1. Configure a user:
   a. Go to **User & Device > User Definition** and create or edit local user **twoFAuser1**.
   b. Enter the user's **Email Address**.
   c. Enable **Two-factor Authentication** and select one mobile **Token** from the list,
   d. Enable **Send Activation Code** and select **Email**.
   e. Click **Next** and click **Submit**.
2. Add the user to the group:
   a. Go to **User & Device > User Groups** and edit the **Employees**.
   b. Add **twoFAuser1** to the **Members** list.
   c. Click **OK**.
3. Activate the mobile token.
   a. When a FortiToken is added to user **twoFAuser1**, an email is sent to the user's email address. Follow the instructions to install your FortiToken mobile application on your device and activate your token.

To configure 2FA using the CLI:

1. Configure a user and user group.

   ```
   config user local
       edit "twoFAuser1"
           set type password
           set two-factor fortitoken
           set fortitoken <select mobile token for the option list>
           set email-to <user's email address>
           set passwd <user's password>
       next
   end
   config user group
       edit "Employees"
           append member "twoFAuser1"
       next
   end
   ```

2. Activate the mobile token.
   1. When a FortiToken is added to user **twoFAuser1**, an email is sent to the user's email address. Follow the instructions to install your FortiToken mobile application on your device and activate your token.

Add LDAP user authentication

This configuration adds LDAP user authentication to the FortiClient dialup VPN configuration (Configuring the IPsec VPN on page 287). You must have already generated and exported a CA certificate from your AD server.

To configure LDAP user authentication using the GUI:

1. Import the CA certificate into FortiGate:
   1. Go to **System > Certificates**.
      If the **Certificates** option is not visible, enable it in **Feature Visibility**.
   2. Click **Import > CA Certificate**.
   3. Set **Type** to **File**.
   4. Click **Upload** then find and select the certificate file.
   5. Click **OK**.
      The CA certificate now appears in the list of **External CA Certificates**. In this example, it is called **CA_Cert_1**.
   6. Optionally, rename the system generated **CA_Cert_1** to something more descriptive:

      ```
      config vpn certificate ca
          rename CA_Cert_1 to LDAPS-CA
      end
      ```

2. Configure the LDAP user:
   1. Go to **User & Device > LDAP Servers** and click **Create New**.
   2. Set **Name** to **ldaps-server** and specify **Server IP/Name**.
   3. Specify **Common Name Identifier** and **Distinguished Name**.
   4. Set **Bind Type** to **Regular**.
   5. Specify **Username** and **Password**.

   f. Enable **Secure Connection** and set **Protocol** to **LDAPS**.
   g. For **Certificate**, select **LDAP server CA LDAPS-CA** from the list.
   h. Click **OK**.
3. Add the LDAP user to the user group:
   a. Go to **User & Device > User Groups** and edit the **Employees** group.
   b. In **Remote Groups**, click **Add** to add the **ldaps-server** remote server.
   c. Click **OK**.

To configure LDAP user authentication using the CLI:

1. Import the CA certificate using the GUI.
2. Configure the LDAP user:

```
config user ldap
    edit "ldaps-server"
        set server "172.20.120.161"
        set cnid "cn"
        set dn "cn=Users,dc=qa,dc=fortinet,dc=com"
        set type regular
        set username "CN=Administrator,cn=users,DC=qa,DC=fortinet,DC=com"
        set password **********
        set group-member-check group-object
        set secure ldaps
        set ca-cert "LDAPS-CA"
        set port 636
    next
end
```

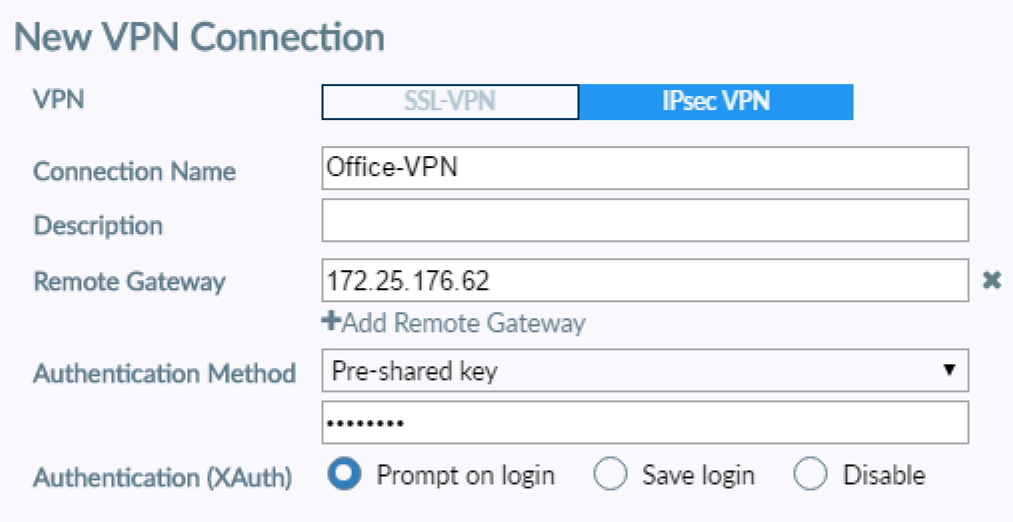
3. Add the LDAP user to the user group:

```
config user group
    edit "Employees"
        append member "ldaps-server"
    next
end
```

Configuring FortiClient

1. To add the VPN connection, open FortiClient, go to **Remote Access** and click **Add a new connection**.
2. Set the **VPN** to **IPsec VPN** and **Remote Gateway** to the FortiGate IP address.

3. Set **Authentication Method** to **Pre-Shared Key** and enter the key below.



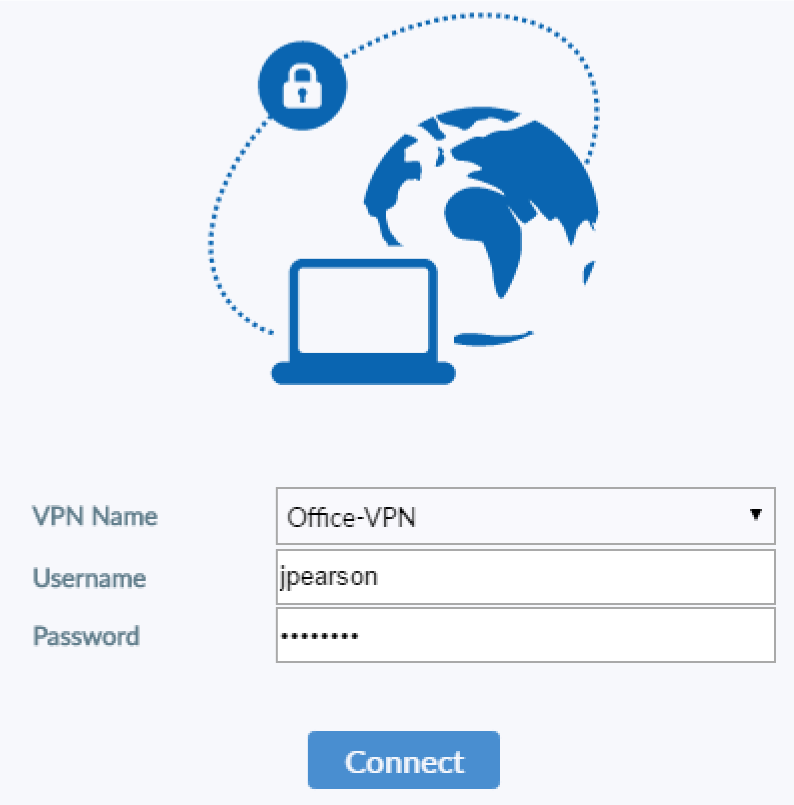
New VPN Connection

VPN	SSL-VPN / **IPsec VPN**
Connection Name	Office-VPN
Description	
Remote Gateway	172.25.176.62
	+Add Remote Gateway
Authentication Method	Pre-shared key
	••••••••
Authentication (XAuth)	● Prompt on login ○ Save login ○ Disable

4. Expand **Advanced Settings > Phase 1** and in the **Local ID** field, enter **dialup1**.
5. Configure remaining settings as needed, then click **Save**.

Results

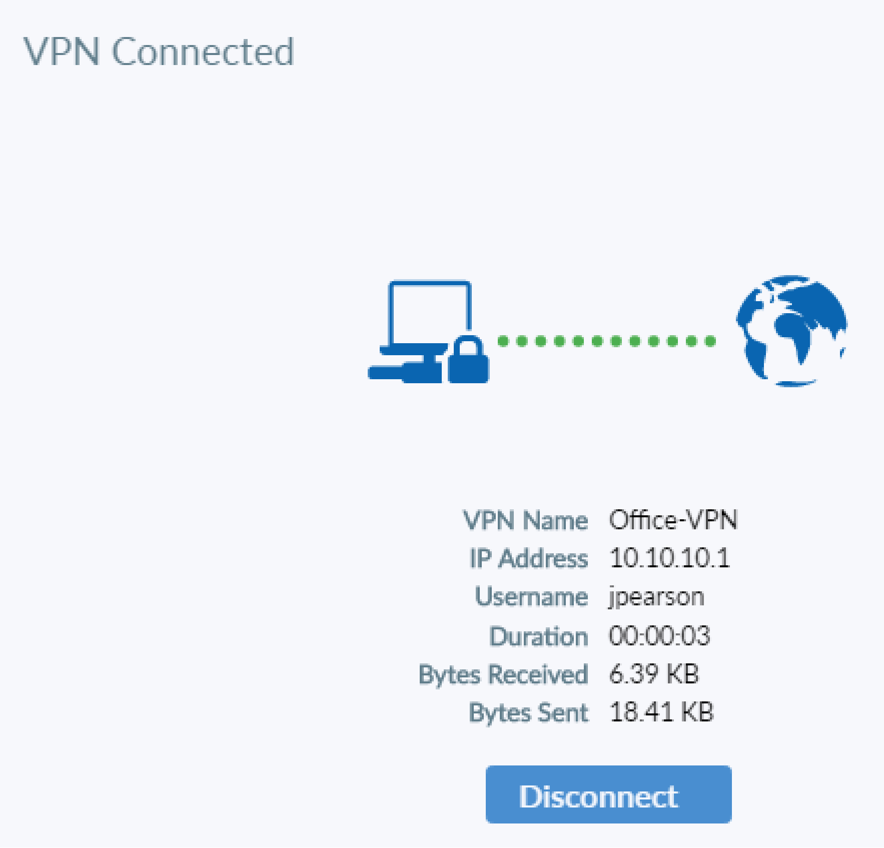
1. On FortiClient, select the VPN, enter the username and password, and select **Connect**.



VPN Name	Office-VPN
Username	jpearson
Password	••••••••

2. If 2FA is configured, a **Token** field will appear, prompting you for the FortiToken code. Enter the FortiToken code from your mobile device.

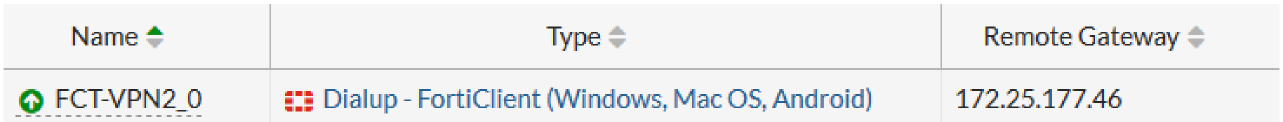
3. Once the connection is established, the FortiGate assigns the user an IP address and FortiClient displays the status of the connection, including the IP address, connection duration, and bytes sent and received.



VPN Connected

VPN Name Office-VPN
IP Address 10.10.10.1
Username jpearson
Duration 00:00:03
Bytes Received 6.39 KB
Bytes Sent 18.41 KB

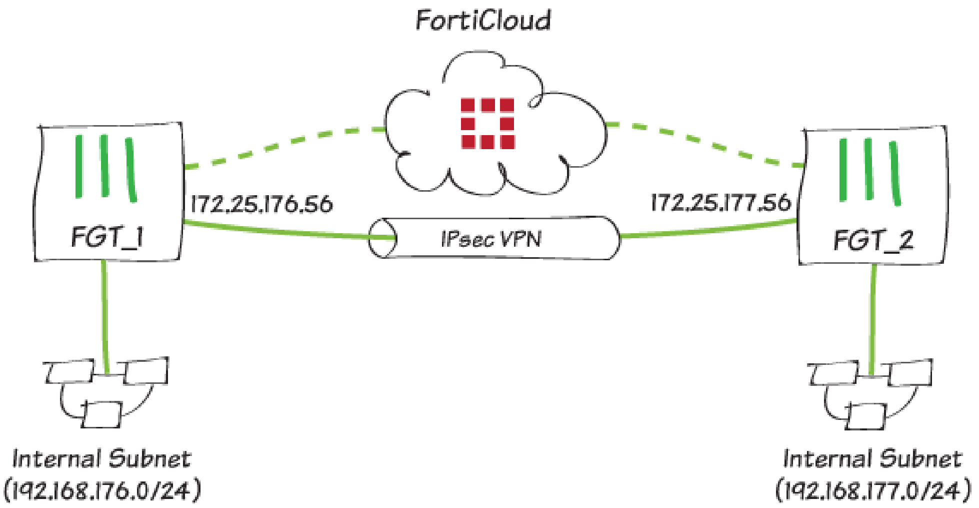
4. On the FortiGate, go to **Monitor > IPsec Monitor** and verify that the tunnel **Status** is **Up**.
5. Under **Remote Gateway**, the monitor shows the FortiClient user's assigned gateway IP address.



Name	Type	Remote Gateway
FCT-VPN2_0	Dialup - FortiClient (Windows, Mac OS, Android)	172.25.177.46

One-Click VPN (OCVPN)

FORTIOS VERSION 6.0



In this recipe, you use the cloud-assisted OCVPN solution to greatly simplify the provisioning and configuration of IPsec VPN.

Note the following limitations:

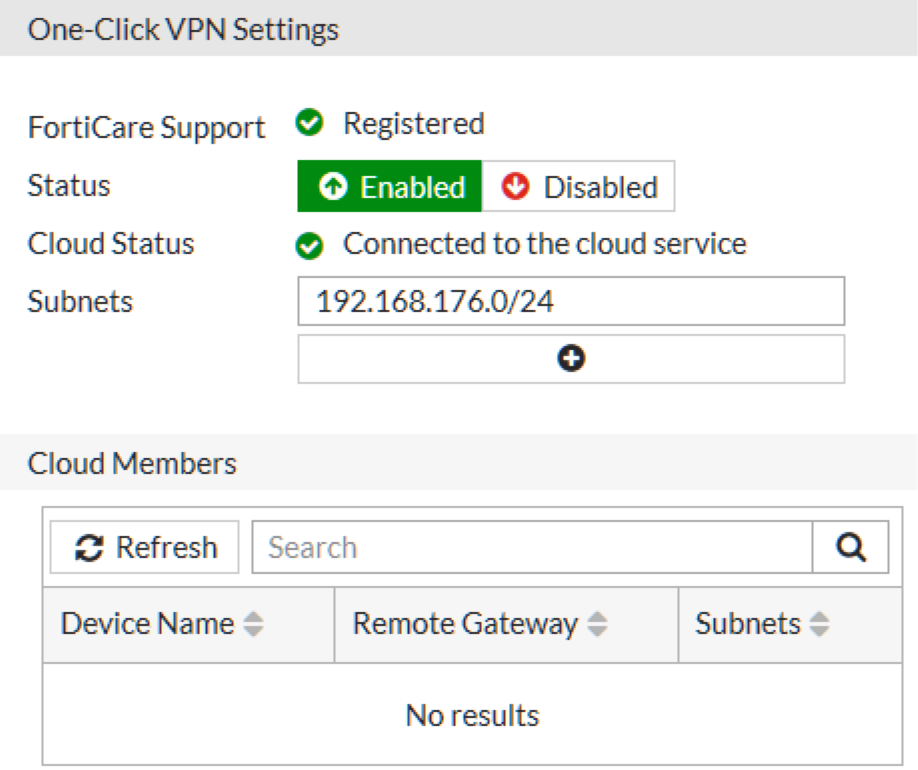
- The FortiGate must be registered with a valid FortiCare Support license. You can verify the status of your FortiCare Support contract under **System > FortiGuard**.
- Only full-mesh VPN configurations using PSK cryptography are supported.
- Public IPs must be used (FortiGates behind NAT cannot participate).
- Non-root VDOMs and FortiGate VMs are not supported.
- Up to 16 nodes can be added to the OCVPN cloud, each with a maximum of 16 subnets.
- OCVPN with SD-WAN is not currently supported.

You can repeat the "Enabling OCVPN" section to add up to 16 nodes to the OCVPN cloud (barring the above limitations), but you will configure only two nodes in this example.

Enabling OCVPN

1. On FGT_1, go to **VPN > One-Click VPN Settings**.
2. Set **Status** to **Enabled** and confirm **Cloud Status**. This may take a minute or two.
3. As indicated, a green checkmark appears along with the message **Connected to the cloud service**.

4. Finally, add the required **Subnets** from FGT_1.



One-Click VPN Settings

FortiCare Support ✓ Registered

Status [✓ Enabled] Disabled

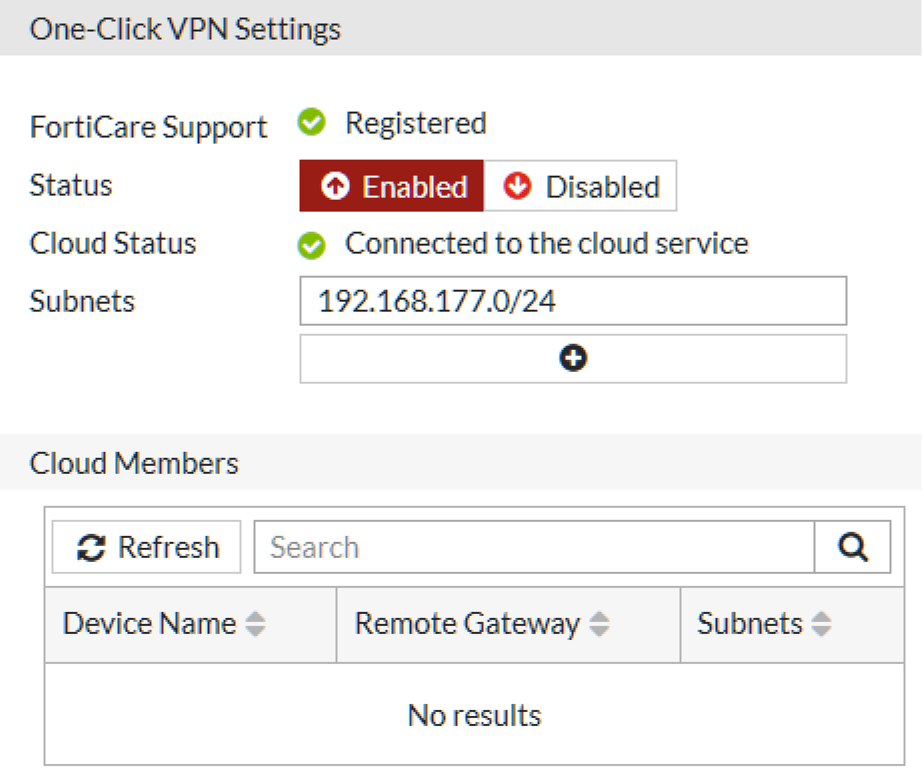
Cloud Status ✓ Connected to the cloud service

Subnets 192.168.176.0/24

Cloud Members

Device Name	Remote Gateway	Subnets
No results		

5. On FGT_2, repeat steps 1 to 4.
6. Enable and confirm connection to the cloud service, and then add the required subnets from FGT_2.



One-Click VPN Settings

FortiCare Support ✓ Registered

Status [✓ Enabled] Disabled

Cloud Status ✓ Connected to the cloud service

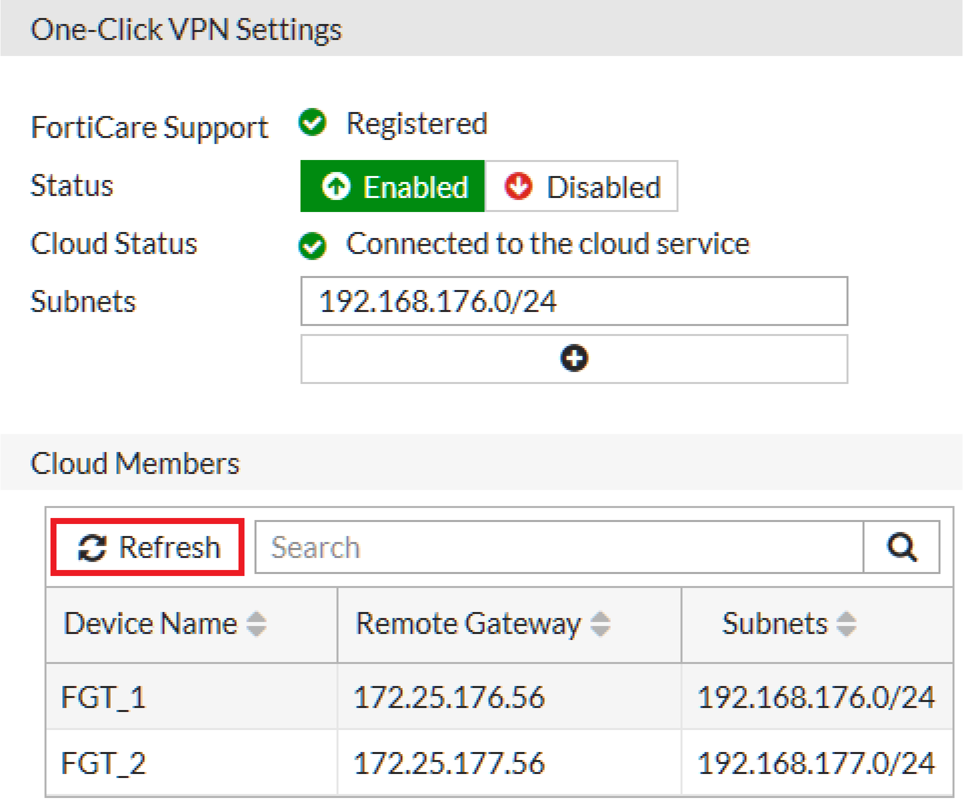
Subnets 192.168.177.0/24

Cloud Members

Device Name	Remote Gateway	Subnets
No results		

Confirming cloud membership

1. In the Cloud Members table on FGT_1, click **Refresh** and confirm the entries.
   The remote gateway and corresponding subnets for each device should populate the list.



One-Click VPN Settings

FortiCare Support ✓ Registered

Status Enabled | Disabled

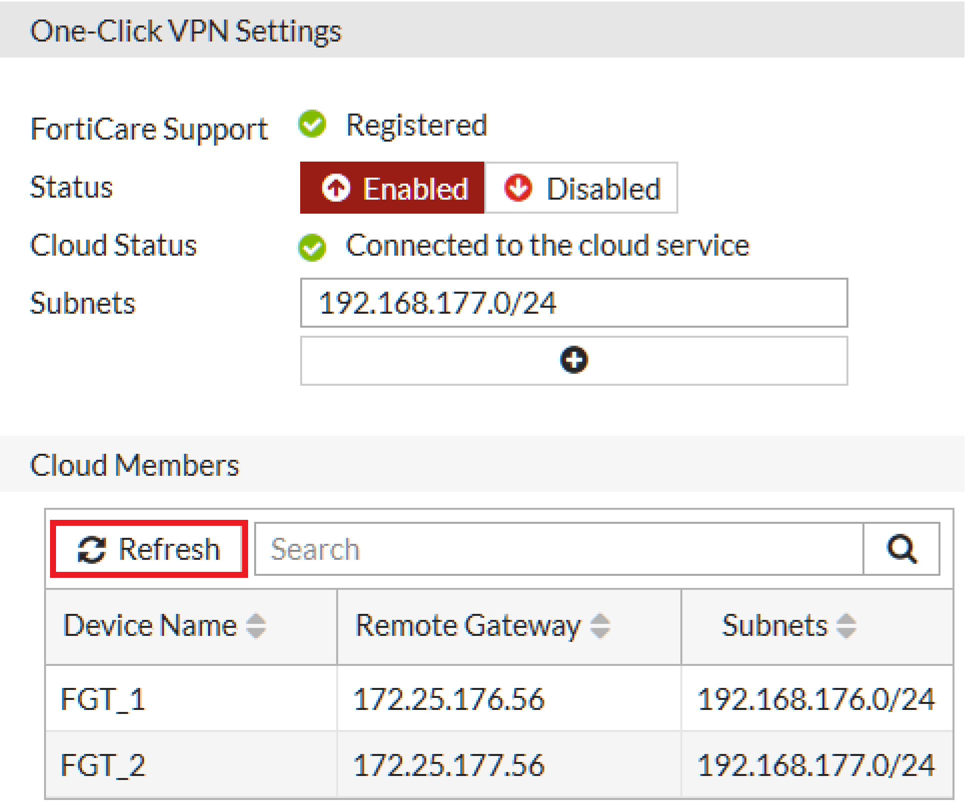
Cloud Status ✓ Connected to the cloud service

Subnets 192.168.176.0/24

Cloud Members

Device Name	Remote Gateway	Subnets
FGT_1	172.25.176.56	192.168.176.0/24
FGT_2	172.25.177.56	192.168.177.0/24

2. You can perform step 1 on any FortiGate that is a member of the OCVPN cloud.
   FGT_2 should return the same results as in step 1.



One-Click VPN Settings

FortiCare Support: ✓ Registered

Status: Enabled | Disabled

Cloud Status: ✓ Connected to the cloud service

Subnets: 192.168.177.0/24

Cloud Members

Refresh | Search

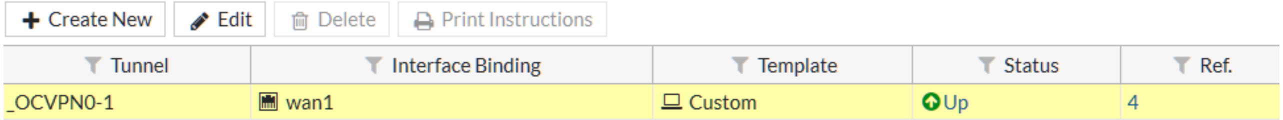
Device Name	Remote Gateway	Subnets
FGT_1	172.25.176.56	192.168.176.0/24
FGT_2	172.25.177.56	192.168.177.0/24

Results

As the Cloud Members table populates, the OCVPN cloud updates each member automatically.

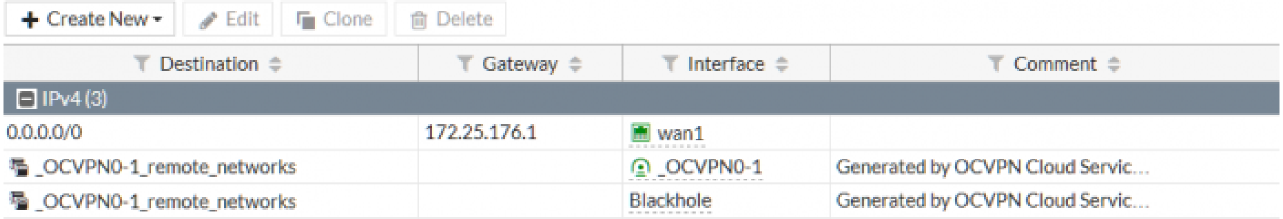
You can now verify that the remainder of the configuration has also been created, and proceed to test the tunnel.

1. On either FortiGate, go to **VPN > IPsec Tunnels** and confirm the entry of a new tunnel with the prefix **_OCVPN**.



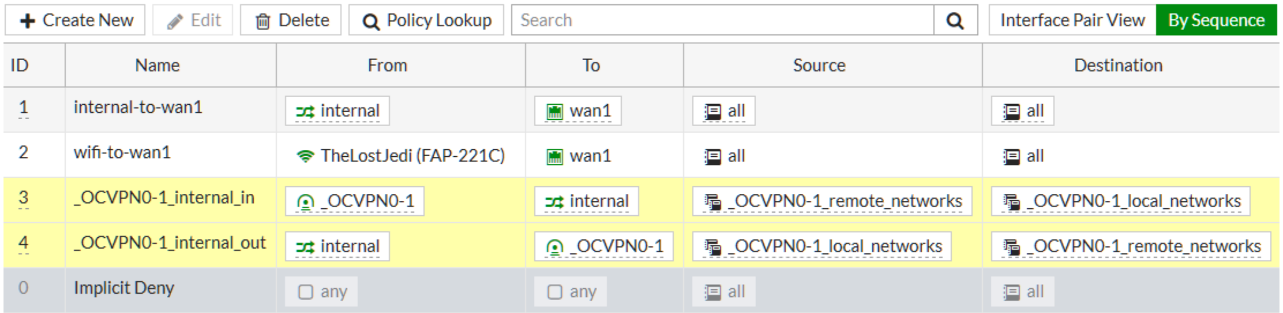
Tunnel	Interface Binding	Template	Status	Ref.
_OCVPN0-1	wan1	Custom	Up	4

2. Go to **Network > Static Routes** and confirm the new static routes.



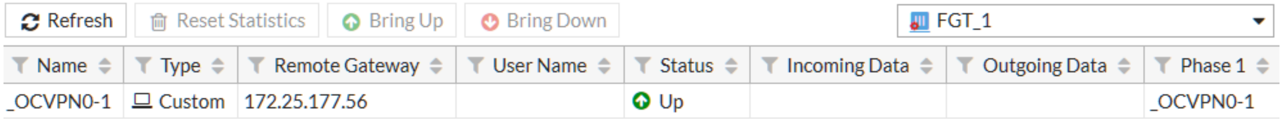
Destination	Gateway	Interface	Comment
IPv4 (3)			
0.0.0.0/0	172.25.176.1	wan1	
_OCVPN0-1_remote_networks		_OCVPN0-1	Generated by OCVPN Cloud Servic...
_OCVPN0-1_remote_networks		Blackhole	Generated by OCVPN Cloud Servic...

3. Go to **Policy & Objects > IPv4 Policy** and confirm the new policies.



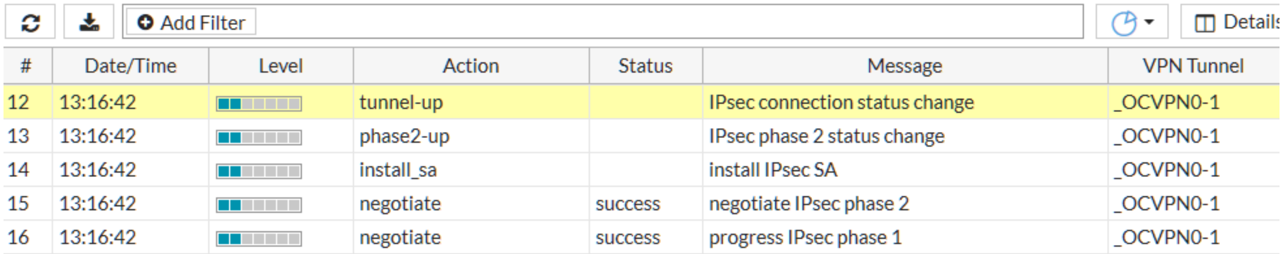
ID	Name	From	To	Source	Destination
1	internal-to-wan1	internal	wan1	all	all
2	wifi-to-wan1	TheLostJedi (FAP-221C)	wan1	all	all
3	_OCVPN0-1_internal_in	_OCVPN0-1	internal	_OCVPN0-1_remote_networks	_OCVPN0-1_local_networks
4	_OCVPN0-1_internal_out	internal	_OCVPN0-1	_OCVPN0-1_local_networks	_OCVPN0-1_remote_networks
0	Implicit Deny	any	any	all	all

4. Go to **Monitor > IPsec Monitor** and verify that the tunnel status is **Up**.



Name	Type	Remote Gateway	User Name	Status	Incoming Data	Outgoing Data	Phase 1
_OCVPN0-1	Custom	172.25.177.56		Up			_OCVPN0-1

5. Go to **Log & Report > VPN Events** and view the tunnel statistics.

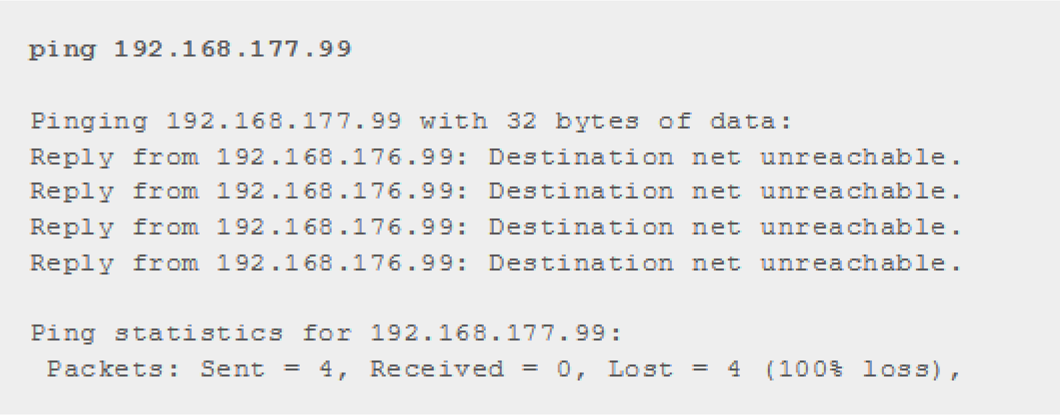


#	Date/Time	Level	Action	Status	Message	VPN Tunnel
12	13:16:42	▮▮▯▯▯▯	tunnel-up		IPsec connection status change	_OCVPN0-1
13	13:16:42	▮▮▯▯▯▯	phase2-up		IPsec phase 2 status change	_OCVPN0-1
14	13:16:42	▮▮▯▯▯▯	install_sa		install IPsec SA	_OCVPN0-1
15	13:16:42	▮▮▯▯▯▯	negotiate	success	negotiate IPsec phase 2	_OCVPN0-1
16	13:16:42	▮▮▯▯▯▯	negotiate	success	progress IPsec phase 1	_OCVPN0-1

6. Using **Command Prompt/Terminal**, attempt a ping from one internal network to the other. Ping should be successful:

```
ping 192.168.177.99

Pinging 192.168.177.99 with 32 bytes of data:
Reply from 192.168.177.99: bytes=32 time=5ms TTL=254
Reply from 192.168.177.99: bytes=32 time=1ms TTL=254
Reply from 192.168.177.99: bytes=32 time<1ms TTL=254
Reply from 192.168.177.99: bytes=32 time<1ms TTL=254

Ping statistics for 192.168.177.99:
 Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
 Minimum = 0ms, Maximum = 5ms, Average = 1ms
```

7. Now, disable OCVPN (**VPN > One-Click VPN Settings**) and repeat the ping attempt to confirm that OCVPN was indeed responsible for the successful ping above:



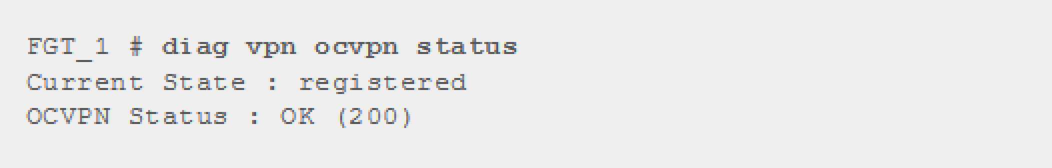
```
ping 192.168.177.99

Pinging 192.168.177.99 with 32 bytes of data:
Reply from 192.168.176.99: Destination net unreachable.
Reply from 192.168.176.99: Destination net unreachable.
Reply from 192.168.176.99: Destination net unreachable.
Reply from 192.168.176.99: Destination net unreachable.

Ping statistics for 192.168.177.99:
 Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

8. Re-enable OCVPN.

Troubleshooting

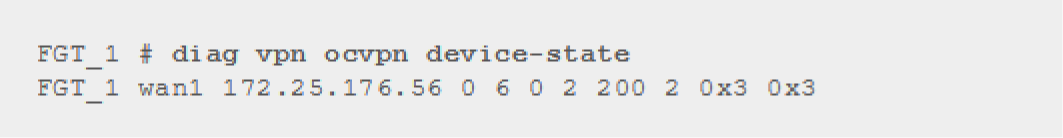
The following diagnose commands can be useful.

To verify OCVPN status, use the following command:



```
FGT_1 # diag vpn ocvpn status
Current State : registered
OCVPN Status : OK (200)
```

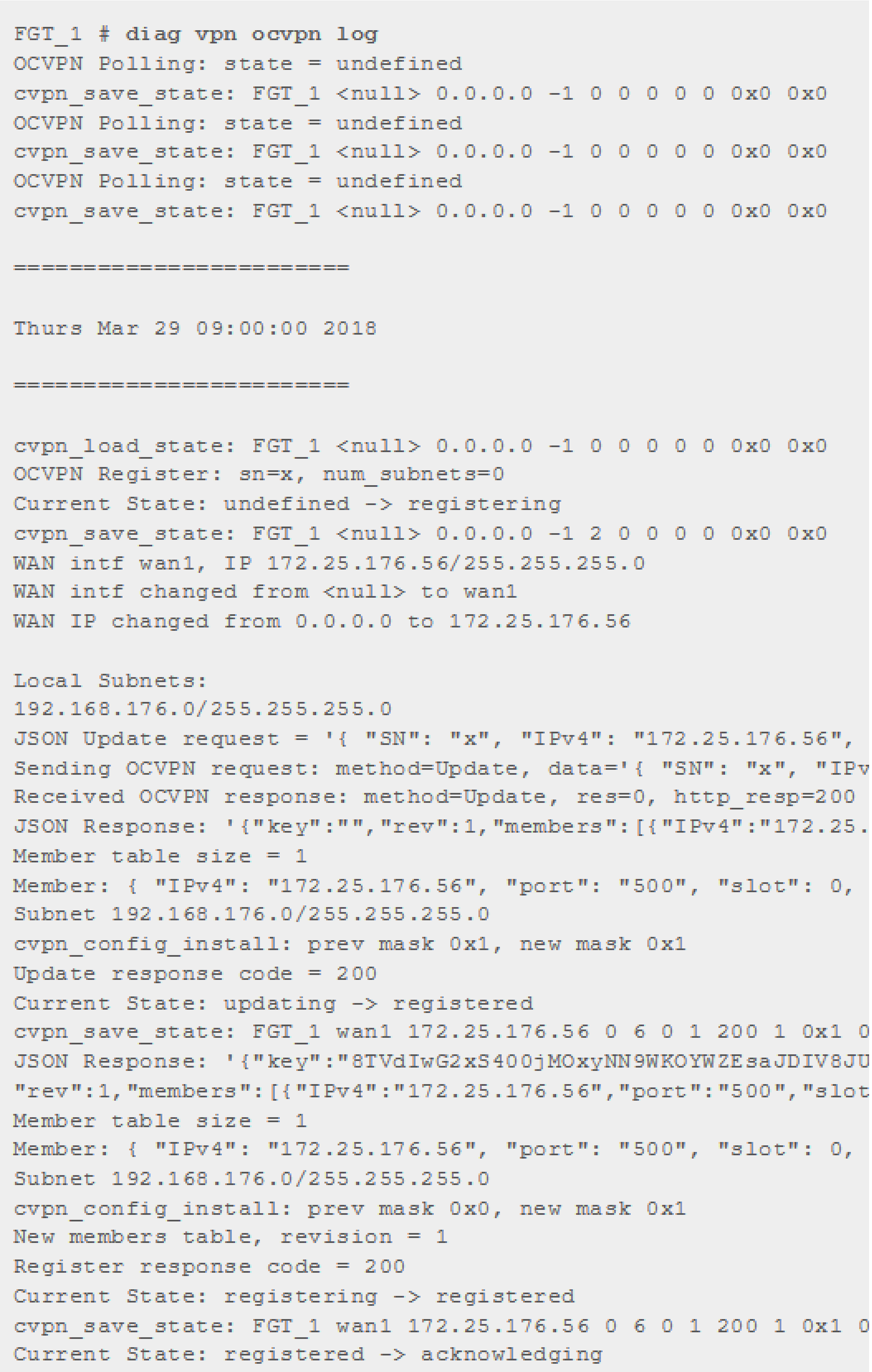
To view device states, use the following command:



```
FGT_1 # diag vpn ocvpn device-state
FGT_1 wan1 172.25.176.56 0 6 0 2 200 2 0x3 0x3
```

The log report example is truncated.

To print a log report, use the following command:



```
FGT_1 # diag vpn ocvpn log
OCVPN Polling: state = undefined
cvpn_save_state: FGT_1 <null> 0.0.0.0 -1 0 0 0 0 0 0x0 0x0
OCVPN Polling: state = undefined
cvpn_save_state: FGT_1 <null> 0.0.0.0 -1 0 0 0 0 0 0x0 0x0
OCVPN Polling: state = undefined
cvpn_save_state: FGT_1 <null> 0.0.0.0 -1 0 0 0 0 0 0x0 0x0

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Thurs Mar 29 09:00:00 2018

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cvpn_load_state: FGT_1 <null> 0.0.0.0 -1 0 0 0 0 0 0x0 0x0
OCVPN Register: sn=x, num_subnets=0
Current State: undefined -> registering
cvpn_save_state: FGT_1 <null> 0.0.0.0 -1 2 0 0 0 0 0x0 0x0
WAN intf wan1, IP 172.25.176.56/255.255.255.0
WAN intf changed from <null> to wan1
WAN IP changed from 0.0.0.0 to 172.25.176.56

Local Subnets:
192.168.176.0/255.255.255.0
JSON Update request = '{ "SN": "x", "IPv4": "172.25.176.56",
Sending OCVPN request: method=Update, data='{ "SN": "x", "IPv
Received OCVPN response: method=Update, res=0, http_resp=200
JSON Response: '{"key":"","rev":1,"members":[{"IPv4":"172.25.
Member table size = 1
Member: { "IPv4": "172.25.176.56", "port": "500", "slot": 0,
Subnet 192.168.176.0/255.255.255.0
cvpn_config_install: prev mask 0x1, new mask 0x1
Update response code = 200
Current State: updating -> registered
cvpn_save_state: FGT_1 wan1 172.25.176.56 0 6 0 1 200 1 0x1 0
JSON Response: '{"key":"8TVdIwG2xS400jMOxyNN9WKOYWZEsaJDIV8JU
"rev":1,"members":[{"IPv4":"172.25.176.56","port":"500","slot
Member table size = 1
Member: { "IPv4": "172.25.176.56", "port": "500", "slot": 0,
Subnet 192.168.176.0/255.255.255.0
cvpn_config_install: prev mask 0x0, new mask 0x1
New members table, revision = 1
Register response code = 200
Current State: registering -> registered
cvpn_save_state: FGT_1 wan1 172.25.176.56 0 6 0 1 200 1 0x1 0
Current State: registered -> acknowledging
```
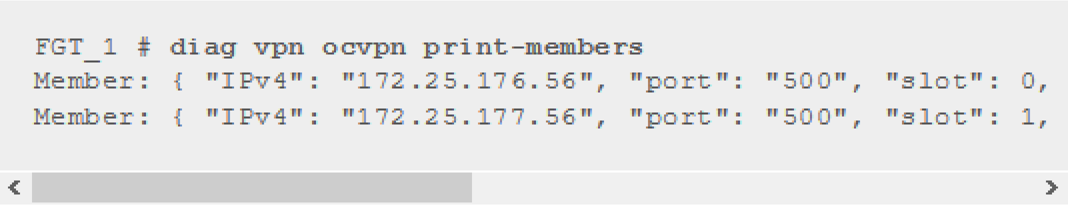
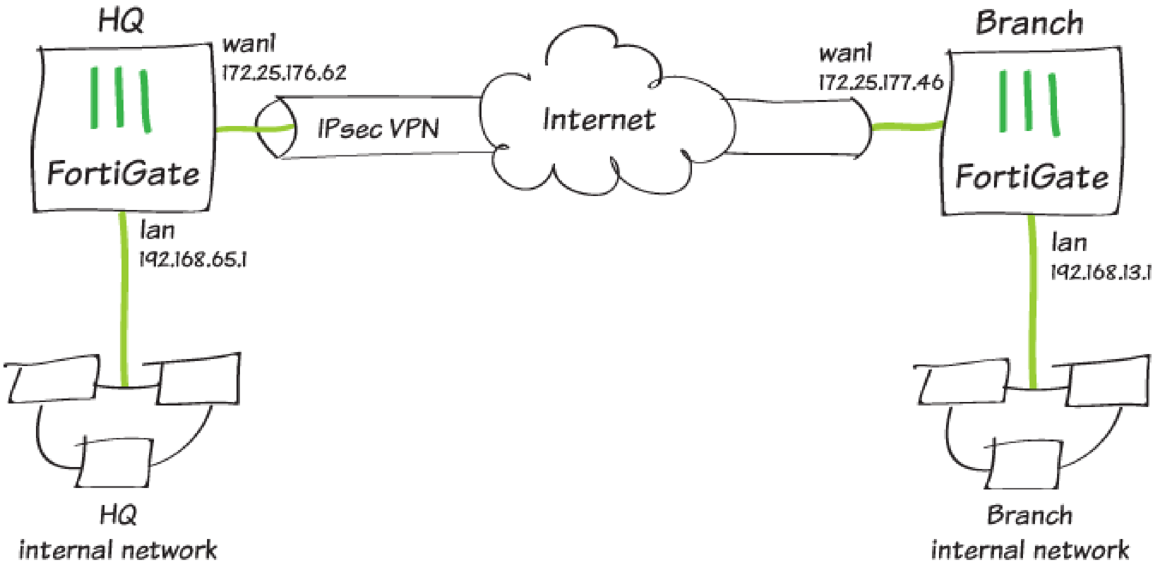

To view a list of OCVPN cloud members, use the following command:



```
FGT_1 # diag vpn ocvpn print-members
Member: { "IPv4": "172.25.176.56", "port": "500", "slot": 0,
Member: { "IPv4": "172.25.177.56", "port": "500", "slot": 1,
```

Site-to-site IPsec VPN with two FortiGate devices

FORTIOS VERSION 6.0

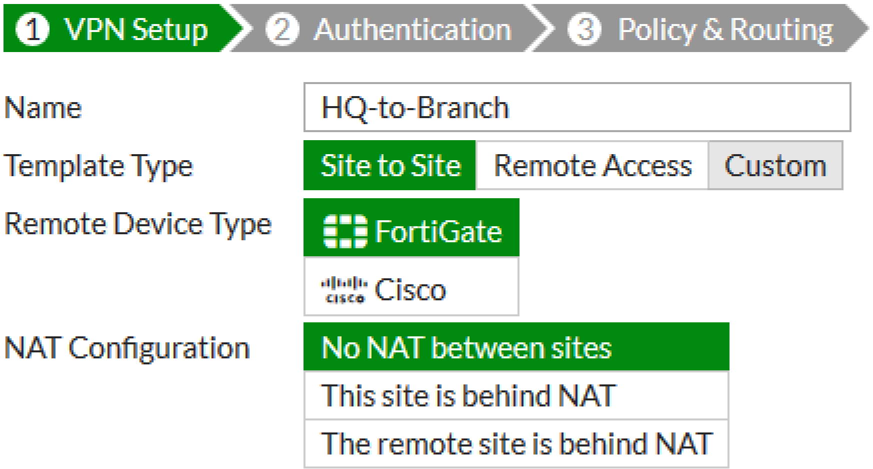


In this recipe, you create a site-to-site IPsec VPN tunnel to allow communication between two networks that are located behind different FortiGate devices. You use the VPN Wizard's **Site to Site – FortiGate** template to create the VPN tunnel on both FortiGate devices.

In this example, one FortiGate is called HQ and the other is called Branch.

Configuring IPsec VPN on HQ

1. To create a new IPsec VPN tunnel, connect to HQ, go to **VPN > IPsec Wizard**, and create a new tunnel.
2. In the **VPN Setup** step, set **Template Type** to **Site to Site**, set **Remote Device Type** to **FortiGate**, and set **NAT Configuration** to **No NAT between sites**.



① VPN Setup ② Authentication ③ Policy & Routing

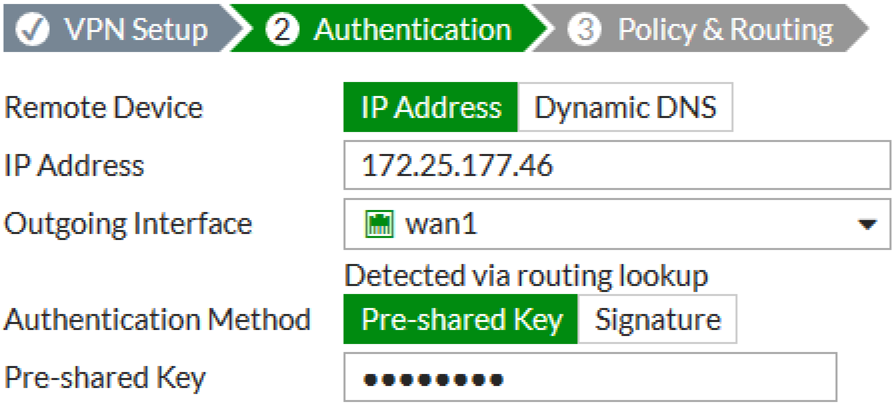
Name: HQ-to-Branch

Template Type: [✓ Site to Site] Remote Access Custom

Remote Device Type: [✓ FortiGate] Cisco

NAT Configuration: [✓ No NAT between sites] This site is behind NAT The remote site is behind NAT

3. In the **Authentication** step, set **IP Address** to the public IP address of the Branch FortiGate (in the example, 172.25.177.46).
4. After you enter the IP address, the wizard automatically assigns an interface as the **Outgoing Interface**. If you want to use a different interface, select it from the drop-down menu.
5. Set a secure **Pre-shared Key**.



✓ VPN Setup ② Authentication ③ Policy & Routing

Remote Device: [✓ IP Address] Dynamic DNS

IP Address: 172.25.177.46

Outgoing Interface: wan1

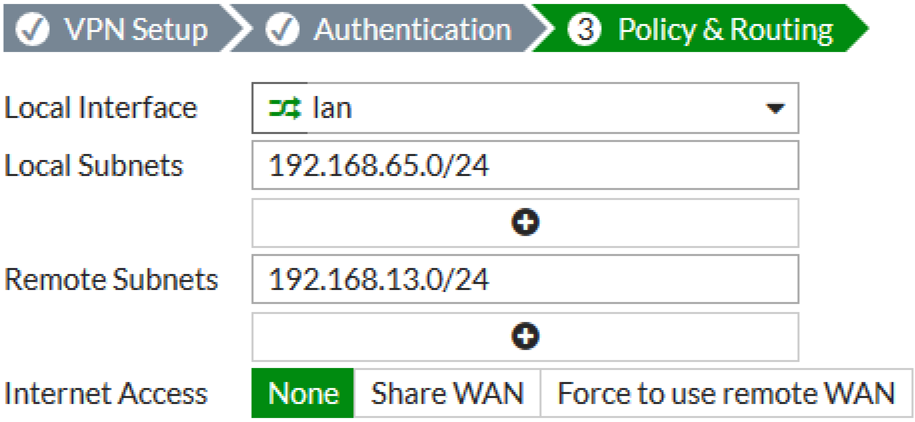
Detected via routing lookup

Authentication Method: [✓ Pre-shared Key] Signature

Pre-shared Key: ●●●●●●●●

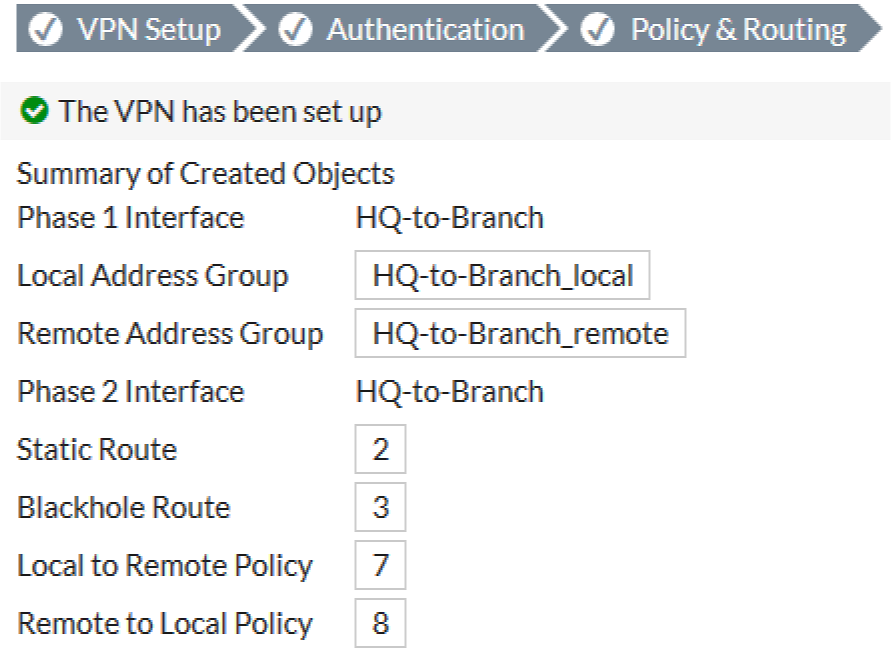
6. In the **Policy & Routing** step, set **Local Interface** to **lan**. The wizard adds the local subnet automatically. Set **Remote Subnets** to the Branch network's subnet (in the example, 192.168.13.0/24).

7. Set **Internet Access** to **None**.



Local Interface	lan
Local Subnets	192.168.65.0/24
Remote Subnets	192.168.13.0/24
Internet Access	[✓ None] Share WAN Force to use remote WAN

8. A summary page shows the configuration created by the wizard, including interfaces, firewall addresses, routes, and policies.

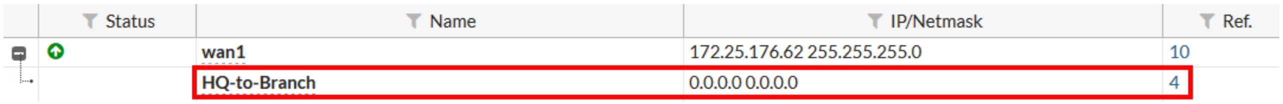


The VPN has been set up

Summary of Created Objects

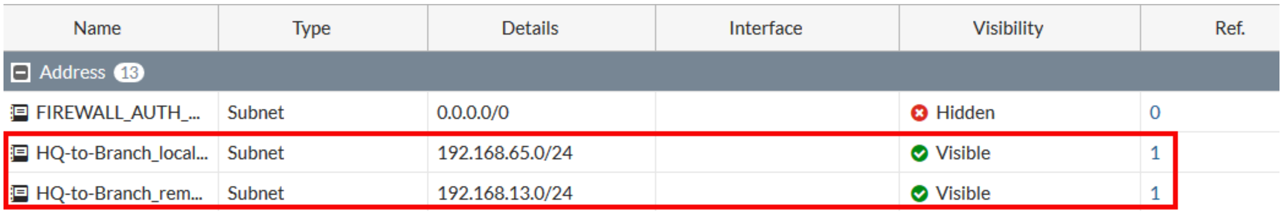
Phase 1 Interface	HQ-to-Branch
Local Address Group	HQ-to-Branch_local
Remote Address Group	HQ-to-Branch_remote
Phase 2 Interface	HQ-to-Branch
Static Route	2
Blackhole Route	3
Local to Remote Policy	7
Remote to Local Policy	8

9. To view the VPN interface created by the wizard, go to **Network > Interfaces**.



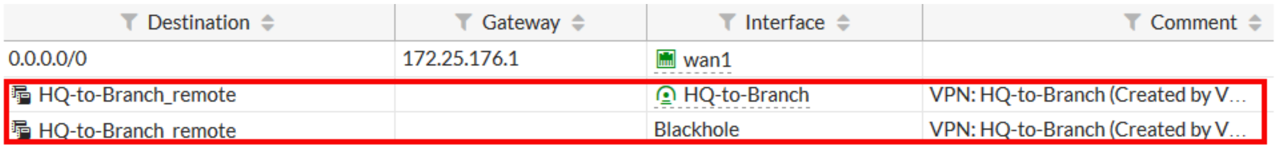
Status	Name	IP/Netmask	Ref.
●	wan1	172.25.176.62 255.255.255.0	10
	HQ-to-Branch	0.0.0.0 0.0.0.0	4

10. To view the firewall addresses created by the wizard, go to **Policy & Objects > Addresses**.



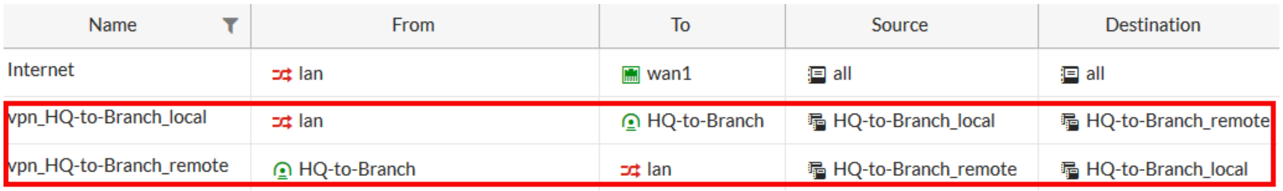
Name	Type	Details	Interface	Visibility	Ref.
Address 13					
FIREWALL_AUTH_...	Subnet	0.0.0.0/0		Hidden	0
HQ-to-Branch_local...	Subnet	192.168.65.0/24		Visible	1
HQ-to-Branch_rem...	Subnet	192.168.13.0/24		Visible	1

11. To view the routes created by the wizard, go to **Network > Static Routes**.



Destination	Gateway	Interface	Comment
0.0.0.0/0	172.25.176.1	wan1	
HQ-to-Branch_remote		HQ-to-Branch	VPN: HQ-to-Branch (Created by V…
HQ-to-Branch_remote		Blackhole	VPN: HQ-to-Branch (Created by V…

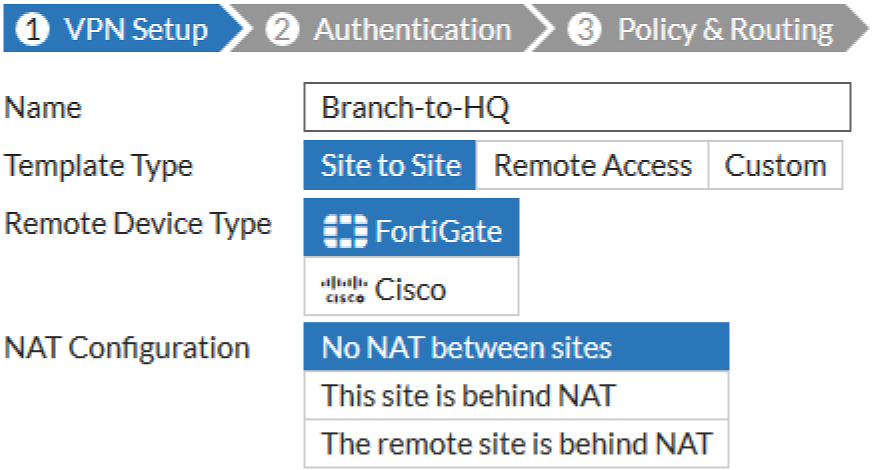
12. To view the policies created by the wizard, go to **Policy & Objects > IPv4 Policy**.



Name	From	To	Source	Destination
Internet	lan	wan1	all	all
vpn_HQ-to-Branch_local	lan	HQ-to-Branch	HQ-to-Branch_local	HQ-to-Branch_remote
vpn_HQ-to-Branch_remote	HQ-to-Branch	lan	HQ-to-Branch_remote	HQ-to-Branch_local

Configuring IPsec VPN on Branch

1. To create a new IPsec VPN tunnel, connect to Branch, go to **VPN > IPsec Wizard**, and create a new tunnel.
2. In the **VPN Setup** step, set **Template Type** to **Site to Site**, set **Remote Device Type** to **FortiGate**, and set **NAT Configuration** to **No NAT between sites**.



Name: Branch-to-HQ

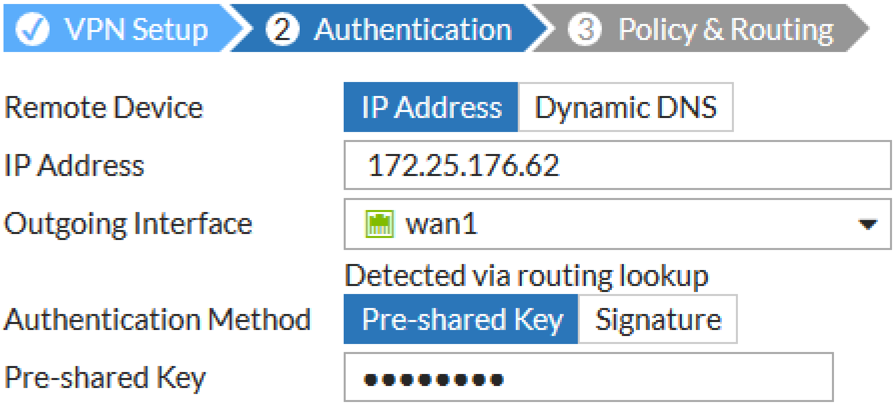
Template Type: [✓ Site to Site] Remote Access Custom

Remote Device Type: [✓ FortiGate] Cisco

NAT Configuration: [✓ No NAT between sites] This site is behind NAT The remote site is behind NAT

3. In the **Authentication** step, set **IP Address** to the public IP address of the HQ FortiGate (in the example, 172.25.176.62).
4. After you enter the IP address, the wizard automatically assigns an interface as the **Outgoing Interface**. If you want to use a different interface, select it from the drop-down menu.

5. Set the secure **Pre-shared Key** that was used for the VPN on HQ.



Remote Device: IP Address | Dynamic DNS

IP Address: 172.25.176.62

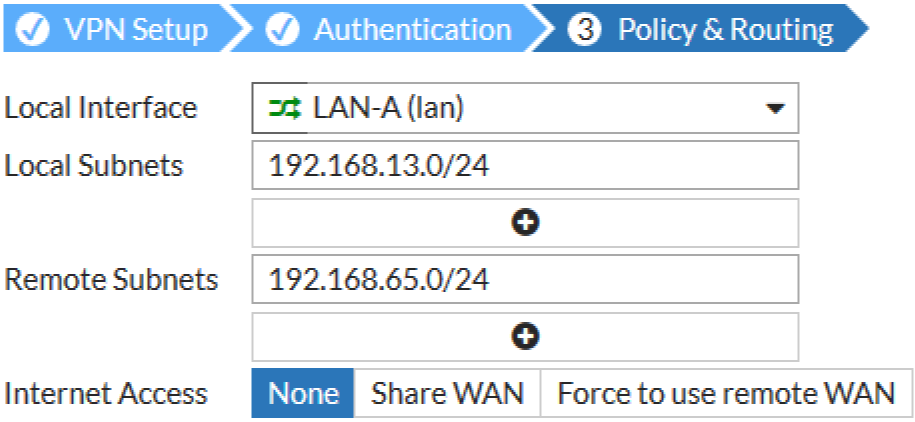
Outgoing Interface: wan1

Detected via routing lookup

Authentication Method: Pre-shared Key | Signature

Pre-shared Key: ●●●●●●●●●

6. In the **Policy & Routing** step, set **Local Interface** to **lan**. The wizard adds the local subnet automatically. Set **Remote Subnets** to the HQ network's subnet (in the example, 192.168.65.0/24).
7. Set **Internet Access** to **None**.



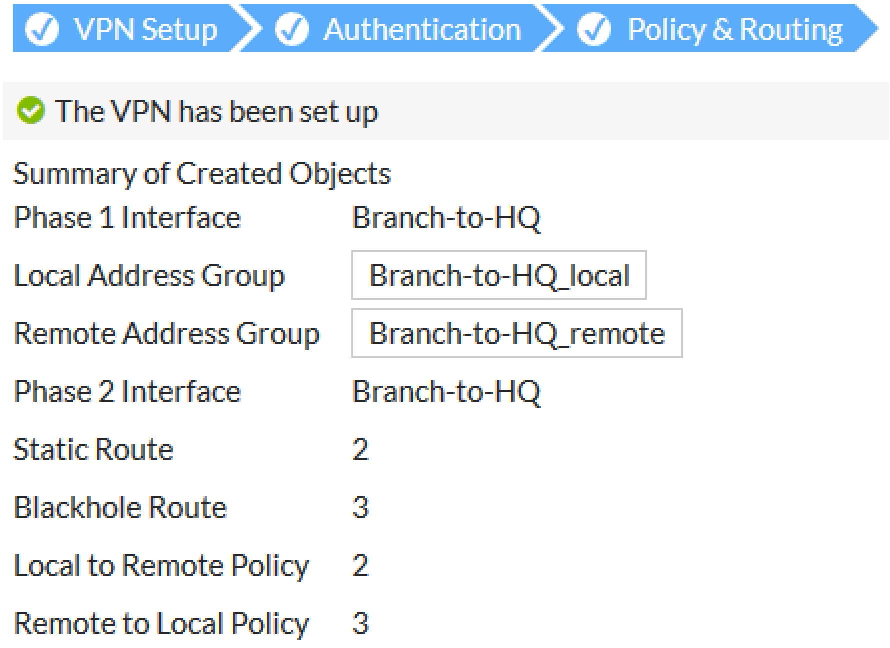
Local Interface: LAN-A (lan)

Local Subnets: 192.168.13.0/24

Remote Subnets: 192.168.65.0/24

Internet Access: None | Share WAN | Force to use remote WAN

8. A summary page shows the configuration created by the wizard, including interfaces, firewall addresses, routes, and policies.

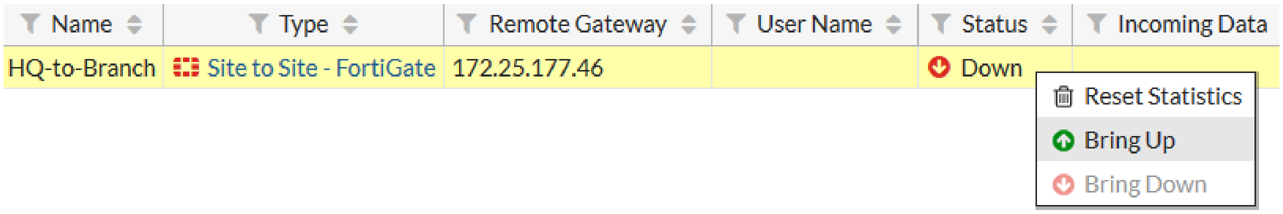


✓ The VPN has been set up

Summary of Created Objects

Phase 1 Interface	Branch-to-HQ
Local Address Group	Branch-to-HQ_local
Remote Address Group	Branch-to-HQ_remote
Phase 2 Interface	Branch-to-HQ
Static Route	2
Blackhole Route	3
Local to Remote Policy	2
Remote to Local Policy	3

9. To bring the VPN tunnel up, go to **Monitor > IPsec Monitor**. Right-click under **Status** and select **Bring Up**.

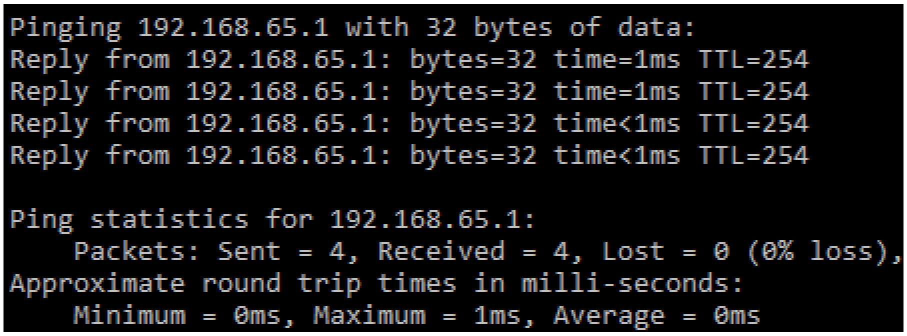


Name	Type	Remote Gateway	User Name	Status	Incoming Data
HQ-to-Branch	Site to Site - FortiGate	172.25.177.46		Down	

Results

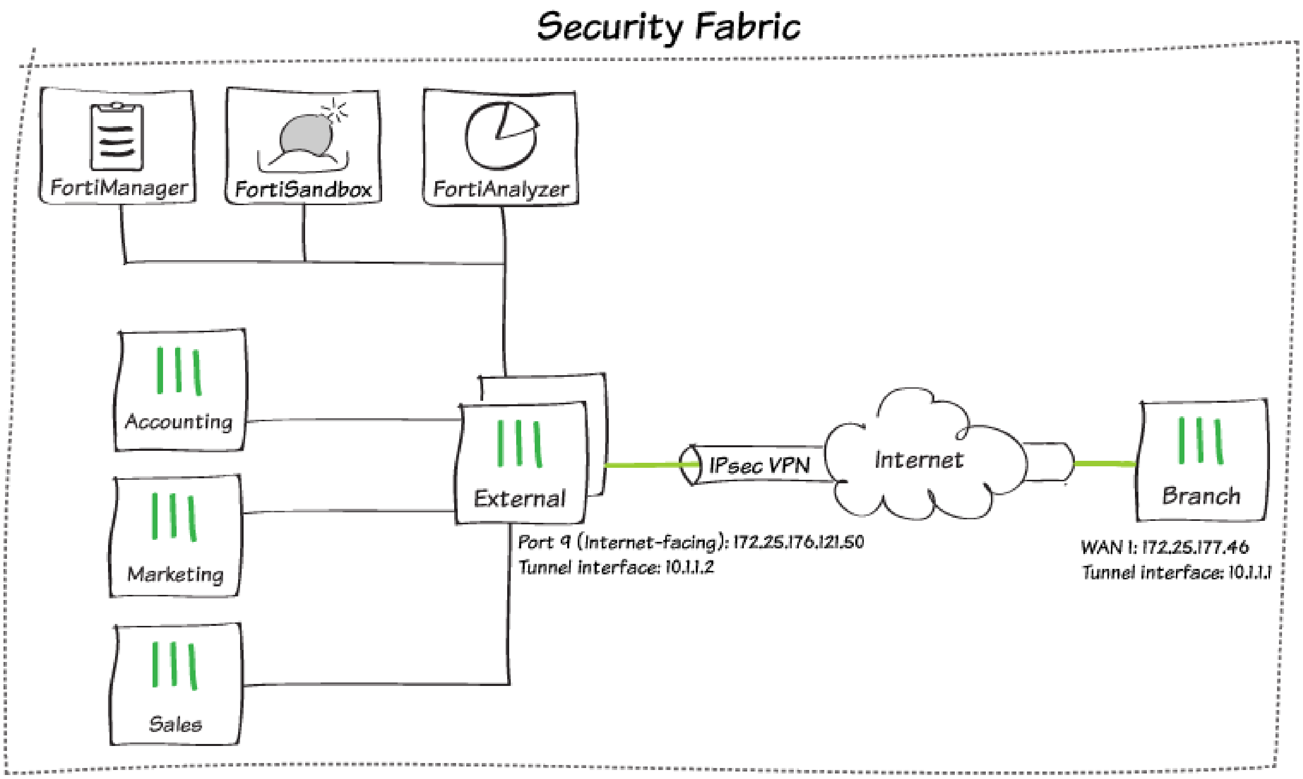
Users on the HQ internal network can access resources on the Branch internal network and vice versa.

To test the connection, ping HQ's LAN interface from a device on the Branch internal network.



```
Pinging 192.168.65.1 with 32 bytes of data:
Reply from 192.168.65.1: bytes=32 time=1ms TTL=254
Reply from 192.168.65.1: bytes=32 time=1ms TTL=254
Reply from 192.168.65.1: bytes=32 time<1ms TTL=254
Reply from 192.168.65.1: bytes=32 time<1ms TTL=254

Ping statistics for 192.168.65.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Fortinet Security Fabric over IPsec VPN



In this recipe, you add FortiTelemetry traffic to an existing IPsec VPN site-to-site tunnel between two FortiGate devices, in order to add a remote FortiGate to the Security Fabric. You also allow the remote FortiGate to access the FortiAnalyzer for logging.

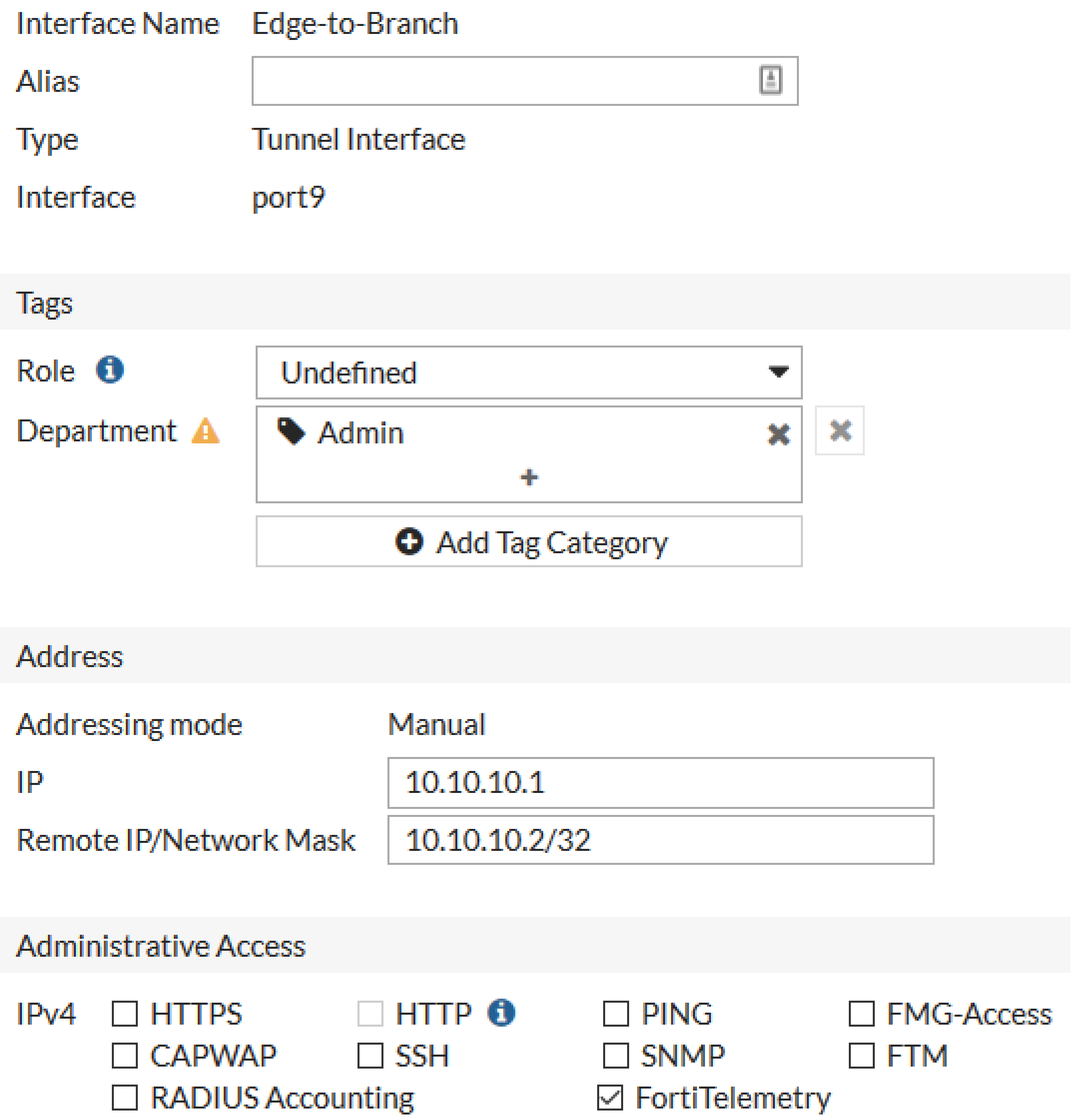
If you do not already have a site-to-site VPN created, see Site-to-site IPsec VPN with two FortiGate devices on page 302

In this example, an HA cluster called Edge is the root FortiGate in the Security Fabric and a FortiGate called Branch is the remote FortiGate.

Configuring tunnel interfaces

1. To configure Edge to listen for FortiTelemetry traffic over the VPN, connect to Edge, go to **Network > Interfaces**, and edit the tunnel interface.
2. Set **IP** to the local IP address for this interface (10.10.10.1) and **Remote IP/Network mask** to the IP address for the Branch tunnel interface (10.10.10.2/32).

3. Under **Administrative Access**, enable **FortiTelemetry**.



Interface Name Edge-to-Branch

Alias

Type Tunnel Interface

Interface port9

Tags

Role Undefined

Department Admin

Address

Addressing mode Manual

IP 10.10.10.1

Remote IP/Network Mask 10.10.10.2/32

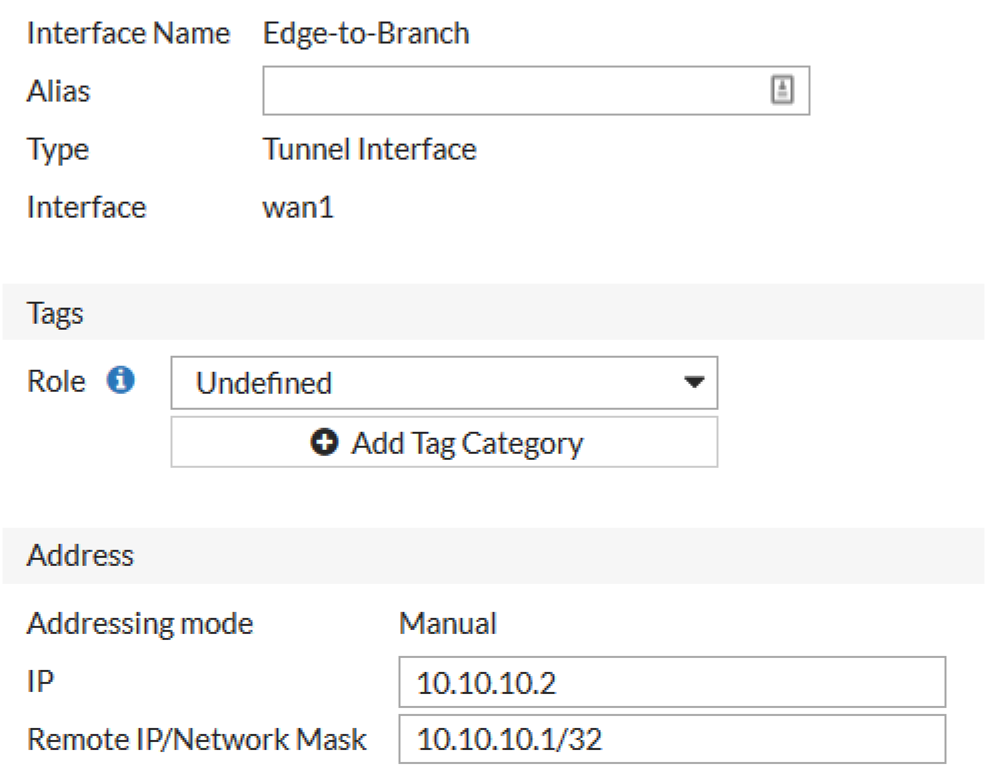
Administrative Access

IPv4 □ HTTPS □ HTTP □ PING □ FMG-Access

□ CAPWAP □ SSH □ SNMP □ FTM

□ RADIUS Accounting ☑ FortiTelemetry

4. Connect to Branch, go to **Network > Interfaces**, and edit the tunnel interface.
5. Set **IP** to the local IP address for this interface (10.10.10.2) and **Remote IP/Network mask** to the IP address for the Edge tunnel interface (10.10.10.1/32).



Interface Name	Edge-to-Branch
Alias	
Type	Tunnel Interface
Interface	wan1

Tags

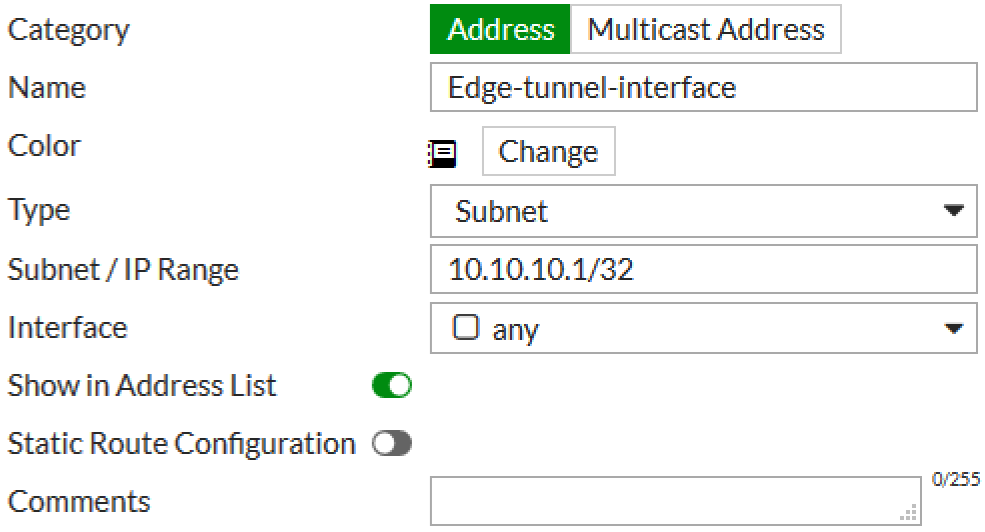
Role	Undefined
	Add Tag Category

Address

Addressing mode	Manual
IP	10.10.10.2
Remote IP/Network Mask	10.10.10.1/32

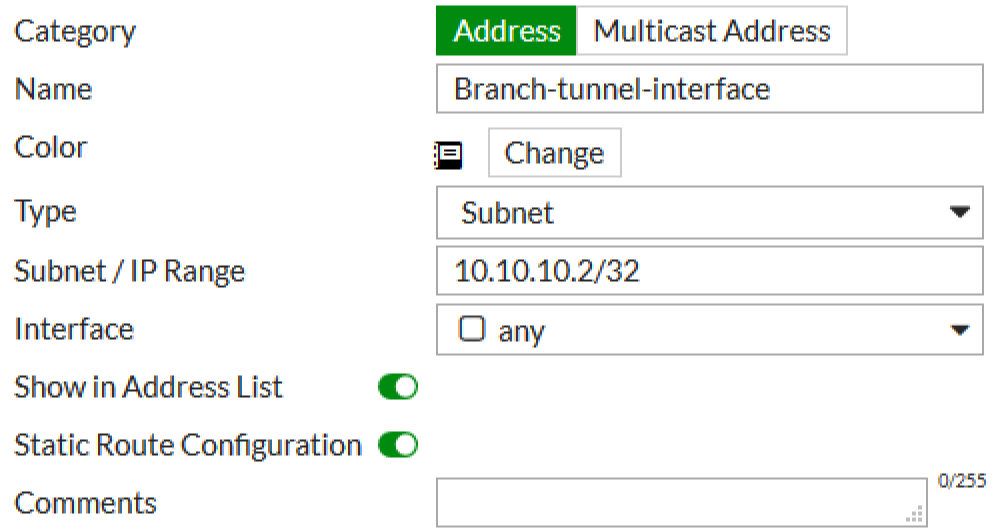
Adding tunnel interfaces to the VPN

1. To create an address for the Edge tunnel interface, connect to Edge, go to **Policy & Objects > Addresses**, and create a new address.
2. Set **Category** to **Address** and set **Subnet/IP Range** to the IP address for the Edge tunnel interface (10.10.10.1/32).



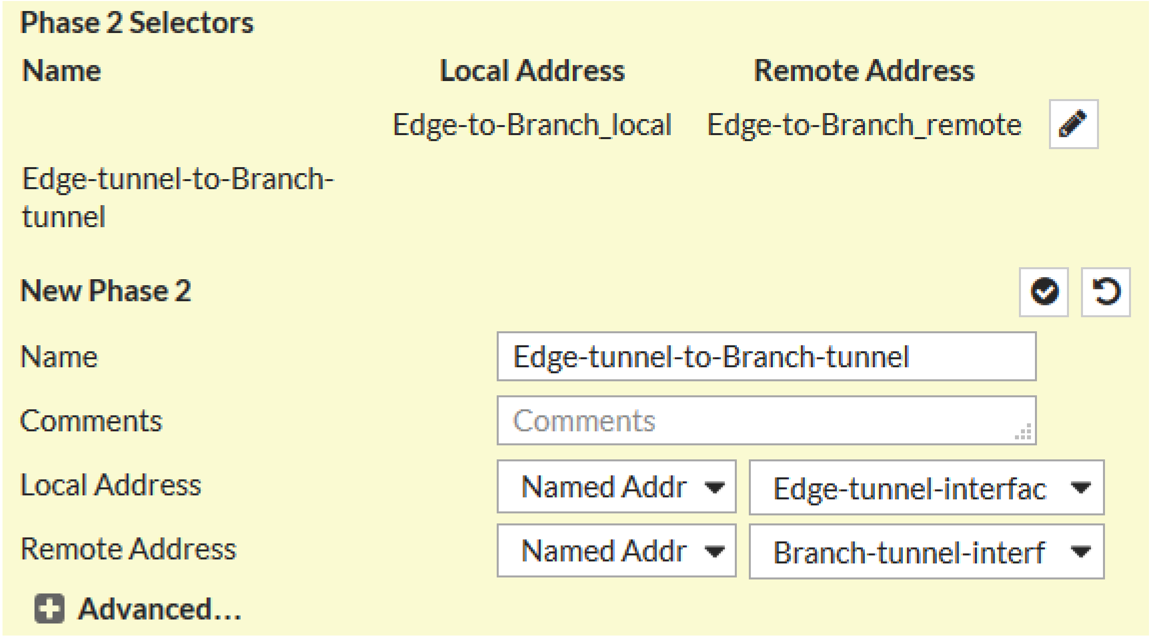
Category	Address / Multicast Address
Name	Edge-tunnel-interface
Color	Change
Type	Subnet
Subnet / IP Range	10.10.10.1/32
Interface	□ any
Show in Address List	●
Static Route Configuration	○
Comments	0/255

3. Create a second address for the Branch tunnel interface. For this address, enable **Static Route Configuration**.



Category	Address / Multicast Address
Name	Branch-tunnel-interface
Color	Change
Type	Subnet
Subnet / IP Range	10.10.10.2/32
Interface	□ any
Show in Address List	●
Static Route Configuration	●
Comments	0/255

4. To allow VPN traffic between the Edge tunnel interface and the Branch tunnel interface, go to **VPN > IPsec Tunnels**, and edit the VPN tunnel. Select **Convert To Custom Tunnel**.
5. Under **Phase 2 Selectors**, create a new Phase 2. Set **Local Address** to use a **Named Address** and select the address for the Edge tunnel interface. Set **Remote Address** to use a **Named Address**, and select the address for the Branch tunnel interface.



Phase 2 Selectors

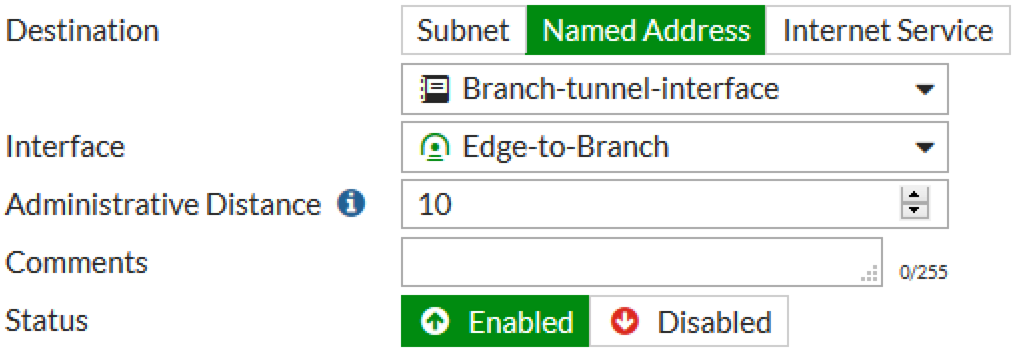
Name	Local Address	Remote Address
Edge-tunnel-to-Branch-tunnel	Edge-to-Branch_local	Edge-to-Branch_remote

New Phase 2

Name	Edge-tunnel-to-Branch-tunnel	
Comments	Comments	
Local Address	Named Addr	Edge-tunnel-interfac
Remote Address	Named Addr	Branch-tunnel-interf

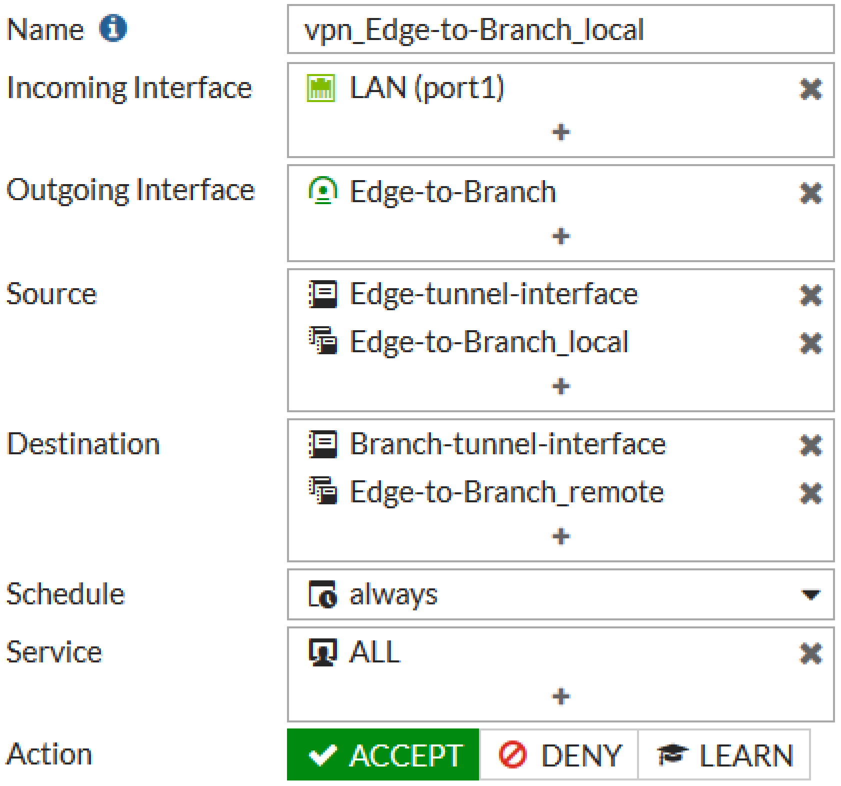
Advanced...

6. To route traffic to the Branch tunnel interface, go to **Network > Static Routes**, and create a new route.
7. Set **Destination** to **Named Address**, and select the address for the Branch tunnel interface. Set **Device** to the tunnel interface.



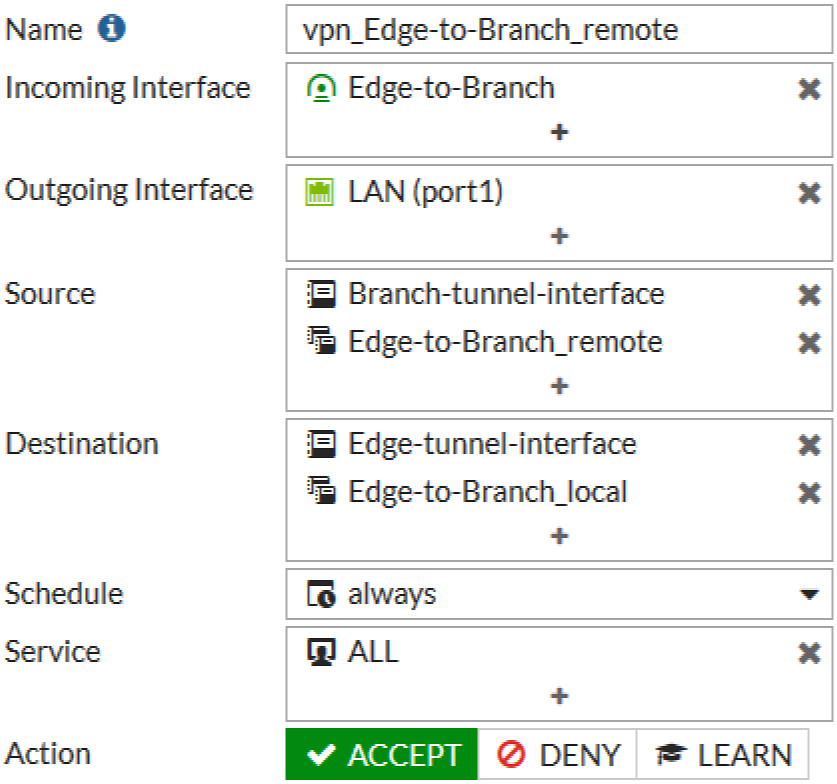
Destination	Subnet / **Named Address** / Internet Service Branch-tunnel-interface
Interface	Edge-to-Branch
Administrative Distance	10
Comments	0/255
Status	**Enabled** / Disabled

8. To allow traffic between the tunnel interfaces, go to **Policy & Objects > IPv4 Policy** and edit the policy allowing local VPN traffic.
9. Set **Source** to include the Edge tunnel interface and **Destination** to include the Branch tunnel interface. To configure this, you must have Multiple Interface Policies enabled. If you have not done this already, go to **System > Feature Visibility**.



Name	vpn_Edge-to-Branch_local
Incoming Interface	LAN (port1)
Outgoing Interface	Edge-to-Branch
Source	Edge-tunnel-interface Edge-to-Branch_local
Destination	Branch-tunnel-interface Edge-to-Branch_remote
Schedule	always
Service	ALL
Action	**✓ ACCEPT** / DENY / LEARN

10. Edit the policy allowing remote VPN traffic to include the tunnel interfaces.



Name	vpn_Edge-to-Branch_remote
Incoming Interface	Edge-to-Branch
Outgoing Interface	LAN (port1)
Source	Branch-tunnel-interface Edge-to-Branch_remote
Destination	Edge-tunnel-interface Edge-to-Branch_local
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN

11. On Branch, repeat steps 1 to 10 to include the following:
    - Addresses for both tunnel interfaces (enable **Static Route Configuration** for the Edge tunnel interface address)
    - A Phase 2 that allows traffic between the Branch tunnel interface and the Edge tunnel interface
    - A static route to the Edge tunnel interface
    - Edited policies that allow traffic to flow between the tunnel interfaces
12. To allow the new phase 2 to take effect, go to **Monitor > IPsec Monitor**, and restart the VPN tunnel.

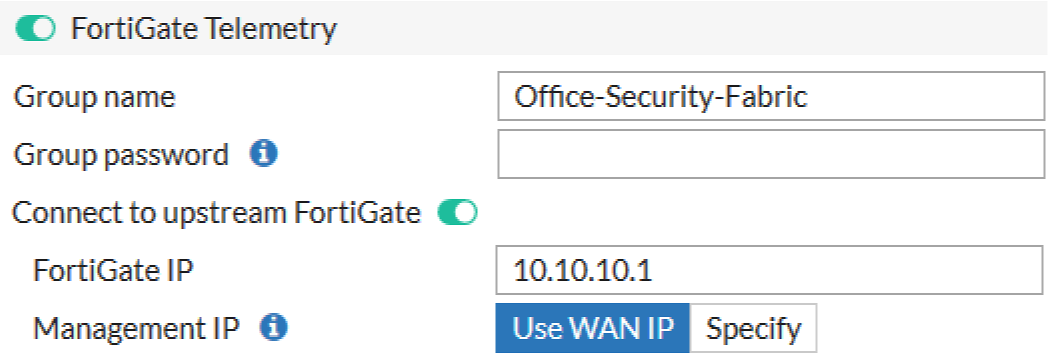
Authorizing Branch for the Security Fabric

1. You can authorize a FortiGate, FortiAP, or FortiSwitch to join the Security Fabric by using the device's serial number, rather than sharing the password for the Security Fabric (the **Group password** option is not available FortiOS 6.0.3 and later). To authorize Branch, connect to Edge, and enter the following CLI command:

```
config system csf
  config trusted-list
    edit <serial_number>
  end
end
```

2. To add Branch to the Security Fabric, connect to Branch, and go to **Security Fabric > Settings**.

3. Enable **FortiGate Telemetry**. Set the **Group name**. Leave **Group password** blank (the **Group password** option is not available in FortiOS 6.0.3 and later). Enable **Connect to upstream FortiGate**. Set **FortiGate IP** to the IP address of the Edge tunnel interface.



FortiGate Telemetry: enabled

Group name: Office-Security-Fabric

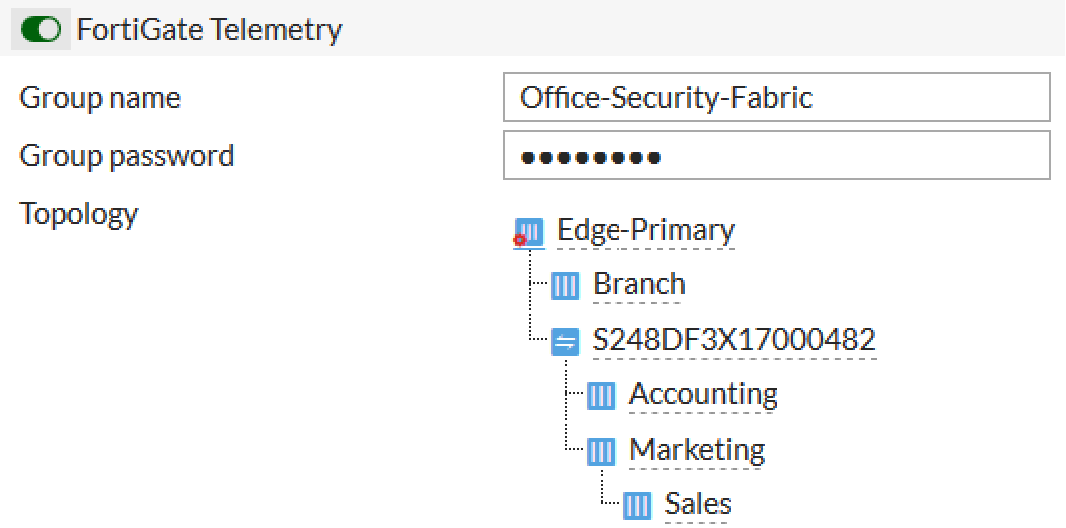
Group password:

Connect to upstream FortiGate: enabled

FortiGate IP: 10.10.10.1

Management IP: Use WAN IP | Specify

4. To verify that Branch is now part of the Security Fabric, connect to Edge, and go to **Security Fabric > Settings**. Branch appears in the **Topology**.



FortiGate Telemetry: enabled

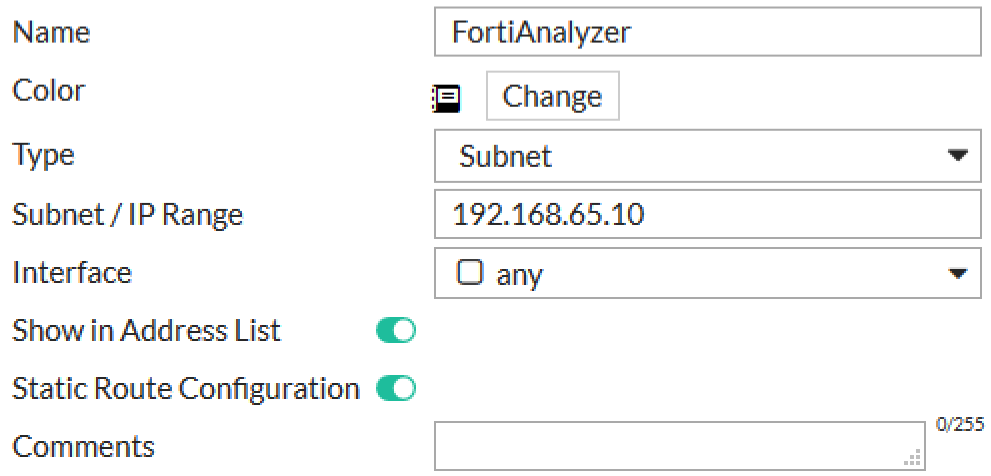
Group name: Office-Security-Fabric

Group password: ●●●●●●●●●

Topology

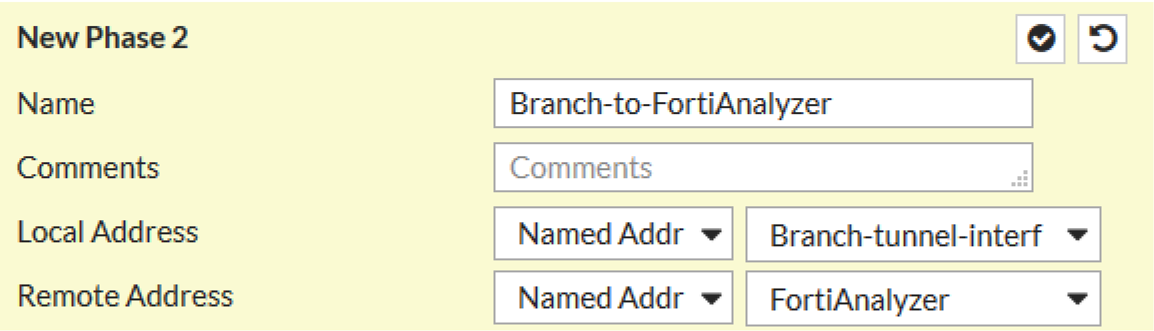
Allowing Branch to access the FortiAnalyzer

1. To create an address for the FortiAnalyzer, connect to Branch, go to **Policy & Objects > Addresses**, and create a new address. Enable **Static Route Configuration**.



Name	FortiAnalyzer
Color	Change
Type	Subnet
Subnet / IP Range	192.168.65.10
Interface	□ any
Show in Address List	●
Static Route Configuration	●
Comments	0/255

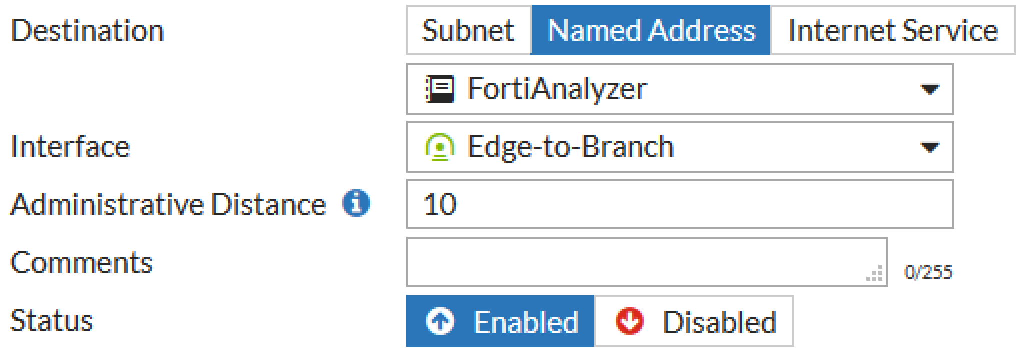
2. To allow VPN traffic between the FortiAnalyzer and the Branch tunnel interface, go to **VPN > IPsec Tunnels**, and create a new Phase 2.



New Phase 2

Name	Branch-to-FortiAnalyzer	
Comments	Comments	
Local Address	Named Addr	Branch-tunnel-interf
Remote Address	Named Addr	FortiAnalyzer

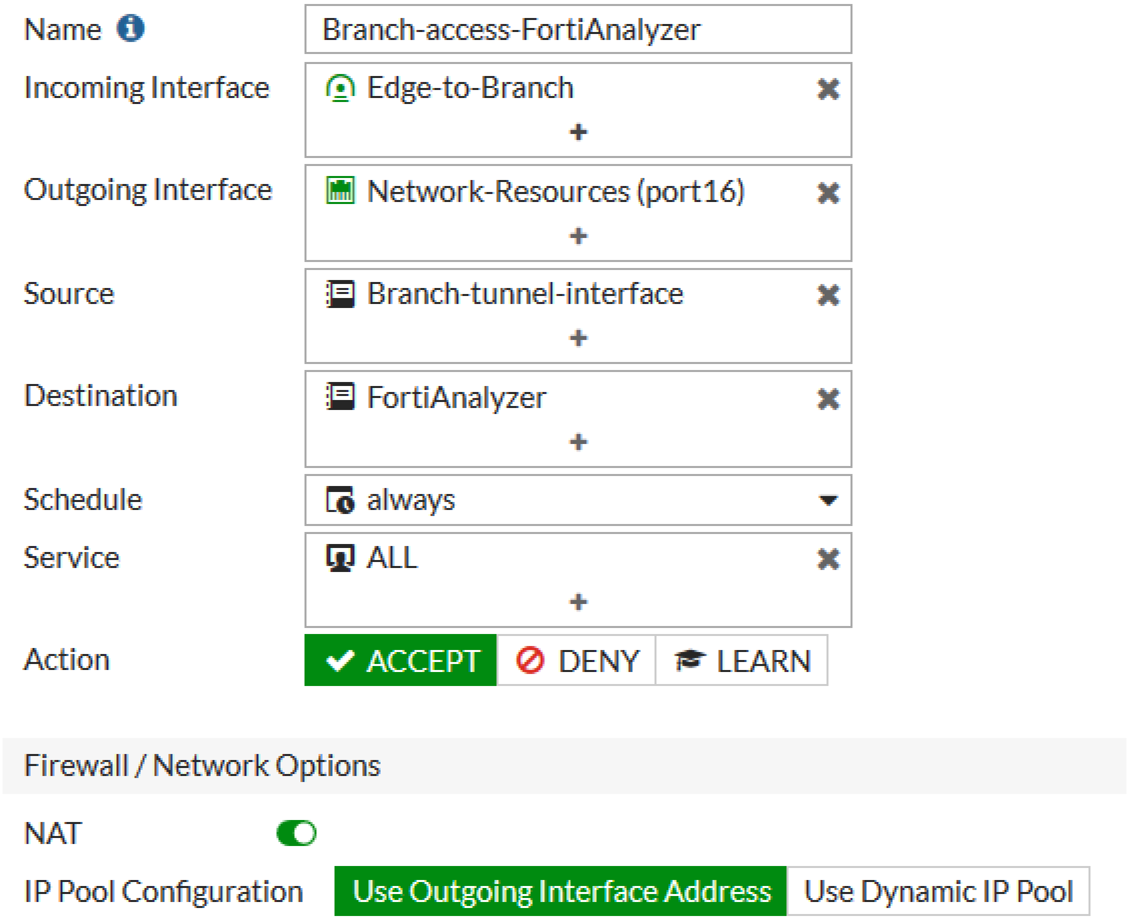
3. To route traffic to the FortiAnalyzer, go to **Network > Static Routes**, and create a new route.



Destination	Subnet **Named Address** Internet Service
	FortiAnalyzer
Interface	Edge-to-Branch
Administrative Distance	10
Comments	0/255
Status	**Enabled** Disabled

4. On Edge, repeat this step to create an address for FortiAnalyzer and a new Phase 2 that allows traffic between the FortiAnalyzer and the Branch tunnel interface. Edge doesn't require a new static route.
5. To allow traffic between Branch and the FortiAnalyzer, go to **Policy & Objects > IPv4 Policy**, and create a new policy.
6. Set **Incoming Interface** to the VPN interface, and set **Outgoing Interface** to the interface that connects to the FortiAnalyzer (in the example, **port16**). Set **Source** to the Branch tunnel interface, and set **Destination** to the FortiAnalyzer.

7. Enable **NAT** for this policy.

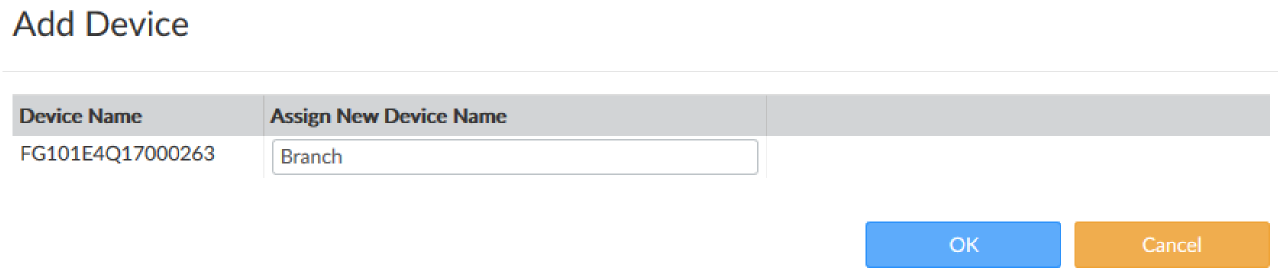


Name	Branch-access-FortiAnalyzer
Incoming Interface	Edge-to-Branch
Outgoing Interface	Network-Resources (port16)
Source	Branch-tunnel-interface
Destination	FortiAnalyzer
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

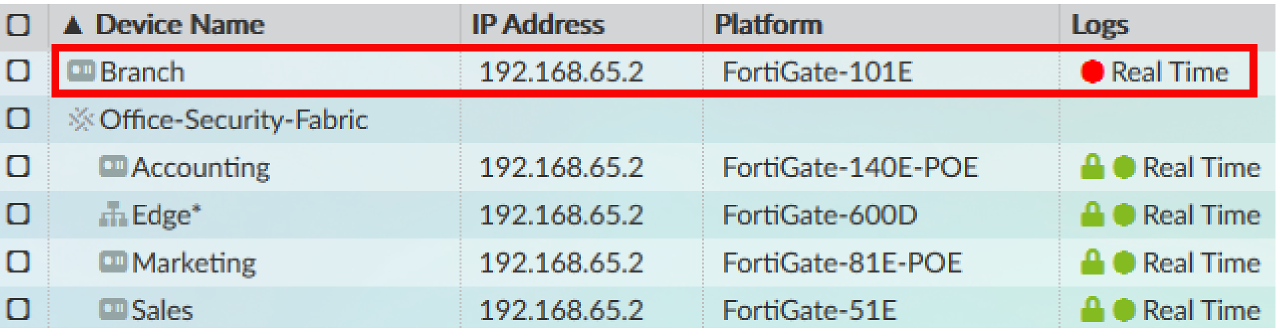
8. To authorize the Branch FortiGate on the FortiAnalyzer, connect to the FortiAnalyzer, and go to **Device Manager > Unregistered**.
9. Select Branch, then select **+Add** to register Branch.



Add Device

Device Name	Assign New Device Name
FG101E4Q17000263	Branch

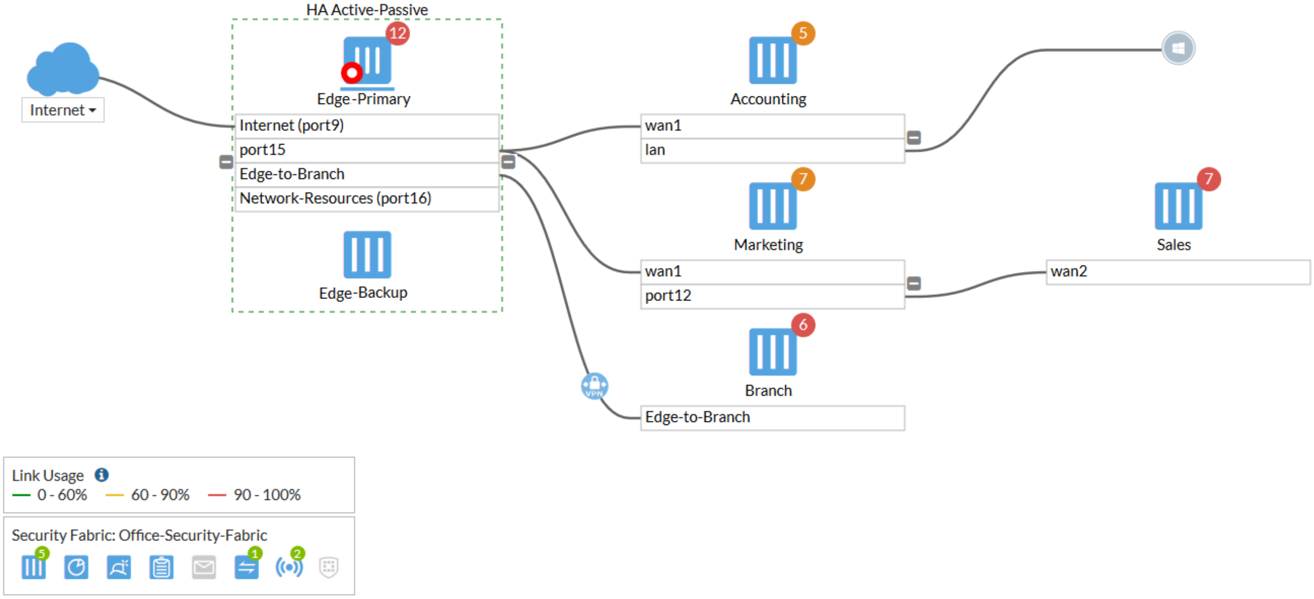
10. Branch now appears as **Registered**.



□	▲ Device Name	IP Address	Platform	Logs
□	Branch	192.168.65.2	FortiGate-101E	● Real Time
□	Office-Security-Fabric			
□	Accounting	192.168.65.2	FortiGate-140E-POE	🔒 ● Real Time
□	Edge*	192.168.65.2	FortiGate-600D	🔒 ● Real Time
□	Marketing	192.168.65.2	FortiGate-81E-POE	🔒 ● Real Time
□	Sales	192.168.65.2	FortiGate-51E	🔒 ● Real Time

Results

To view Branch as part of the Security Fabric topology, connect to Edge and go to **Security Fabric > Logical Topology**. Branch is shown as part of the Security Fabric, connecting over the IPsec VPN tunnel.



Desynchronizing settings for Branch (optional)

1. If you don't want Branch to automatically use the settings that Edge pushes for the FortiAnalyzer, FortiSandbox, and FortiManager, use the following CLI command to configure these settings locally:

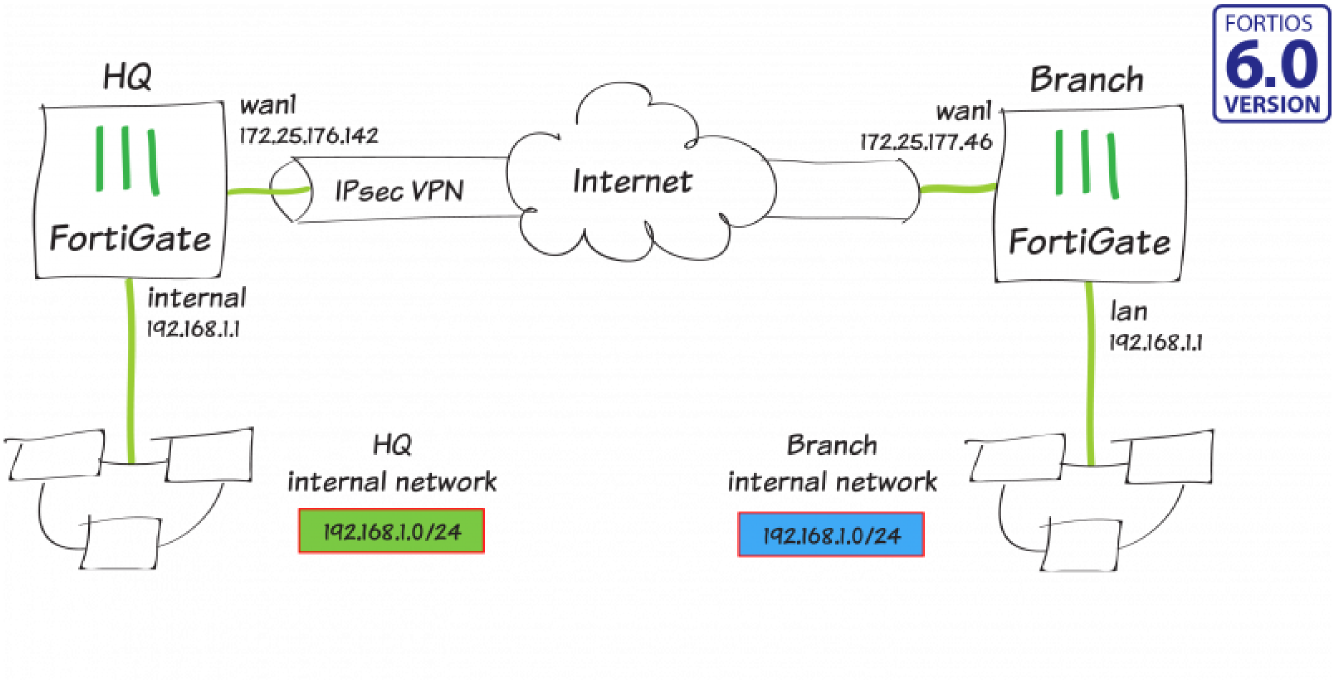
```
config system csf
  set configuration-sync local
end
```

2. Go to **Security Fabric > Settings**. You can now configure the settings for **FortiAnalyzer logging, Central**

Management, and S**andbox Inspection**. You can also choose to use local logging rather than sending logs to a FortiAnalyzer.

This option is available for all FortiGate devices in the Security Fabric, except for the root FortiGate.

Site-to-site IPsec VPN with overlapping subnets



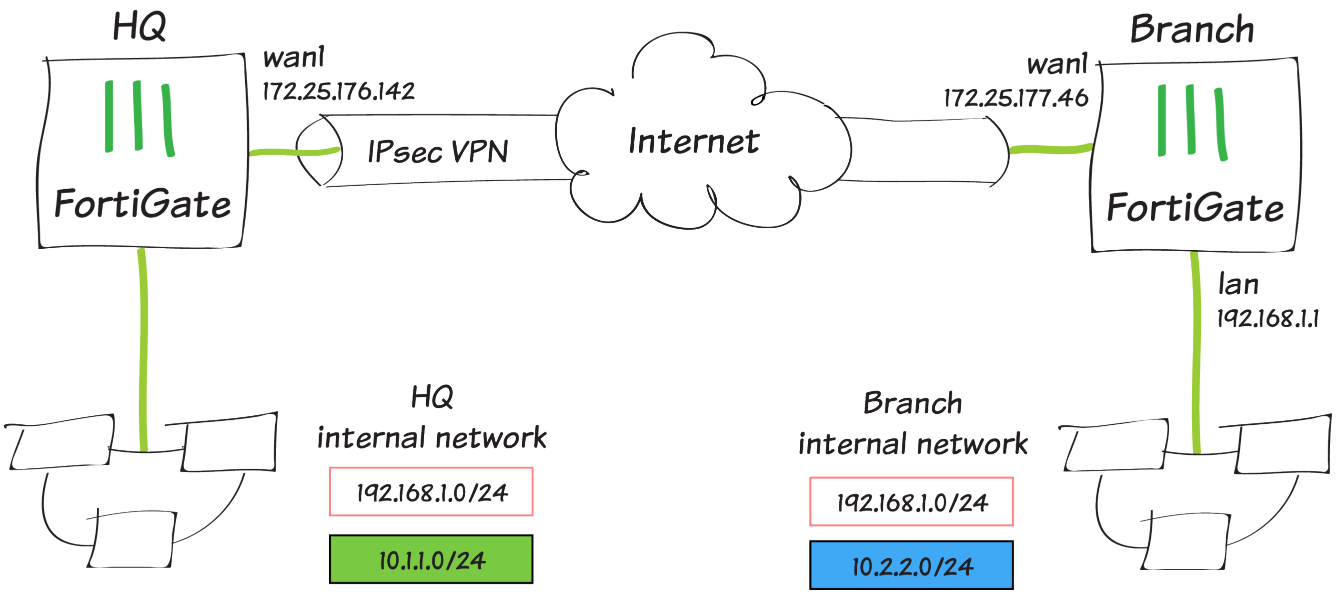
In this recipe, you create a route-based IPsec VPN tunnel, as well as configure both source and destination NAT, to allow transparent communication between two overlapping networks that are located behind different FortiGates.

In this example, one FortiGate will be referred to as HQ and the other as Branch. They both have 192.168.1.0/24 in use as their internal network (LAN), but both LANs need to be able to communicate to each other through the IPsec tunnel.

Planning the new addressing scheme

In order for overlapping subnets to be able to communicate over a route-based IPsec tunnel, new virtual subnets of equal size must be decided upon and used for all communication between the two overlapping subnets.

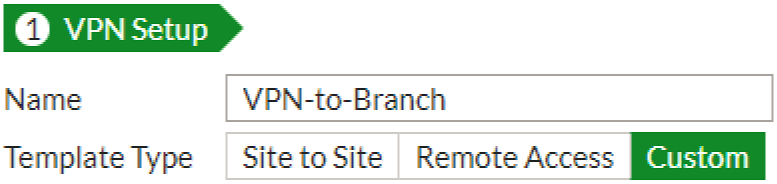
Devices on both local networks DO NOT need their IP addresses changed. However, the devices/users will need to be sure to use the new subnet range of the remote network when communicating across the tunnel.



In this example, you perform a one-to-one mapping of HQ's 192.168.1.0/24 network to 10.1.1.0/24, and Branch's 192.168.1.0/24 network to 10.2.2.0/24. This will allow HQ clients to use Branch's new subnet to communicate to Branch clients, and vice-versa.

Configuring the IPsec VPN on HQ

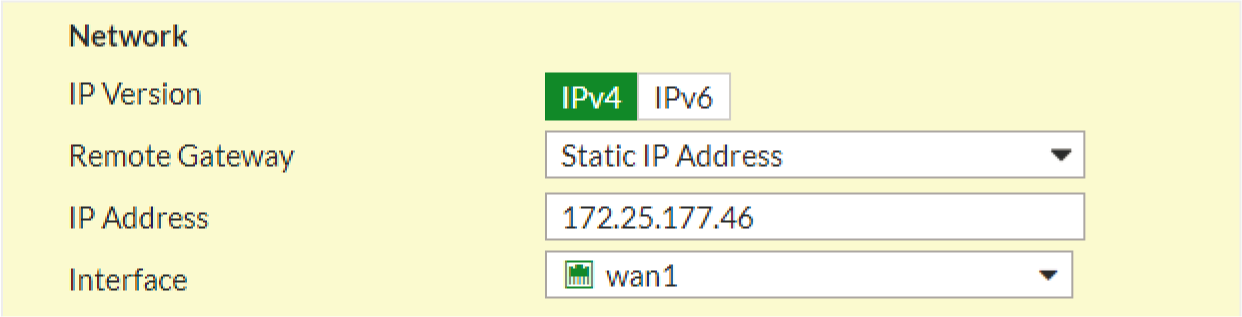
1. To create the tunnel on HQ, connect to HQ and go to **VPN > IPsec Tunnels**.
2. In the **VPN Setup** step, set **Template Type** to **Custom** and enter VPN-to-Branch for the **Name**.



Name: VPN-to-Branch

Template Type: Site to Site | Remote Access | Custom

3. Enter Branch's public IP address (in the example, 172.25.177.46) for the **IP Address**, and select HQ's WAN interface for **Interface** (in the example, wan1).


Network

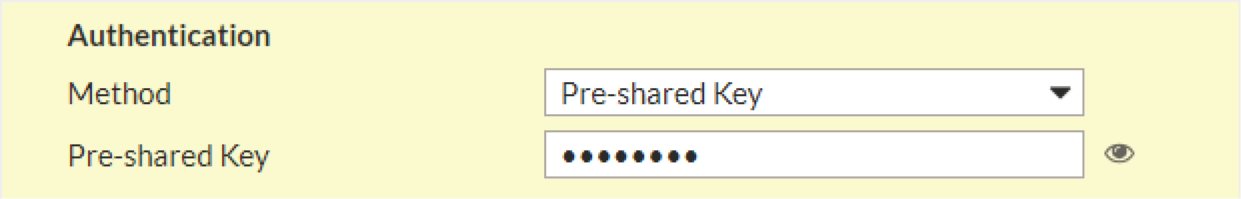
IP Version: IPv4 | IPv6

Remote Gateway: Static IP Address

IP Address: 172.25.177.46

Interface: wan1

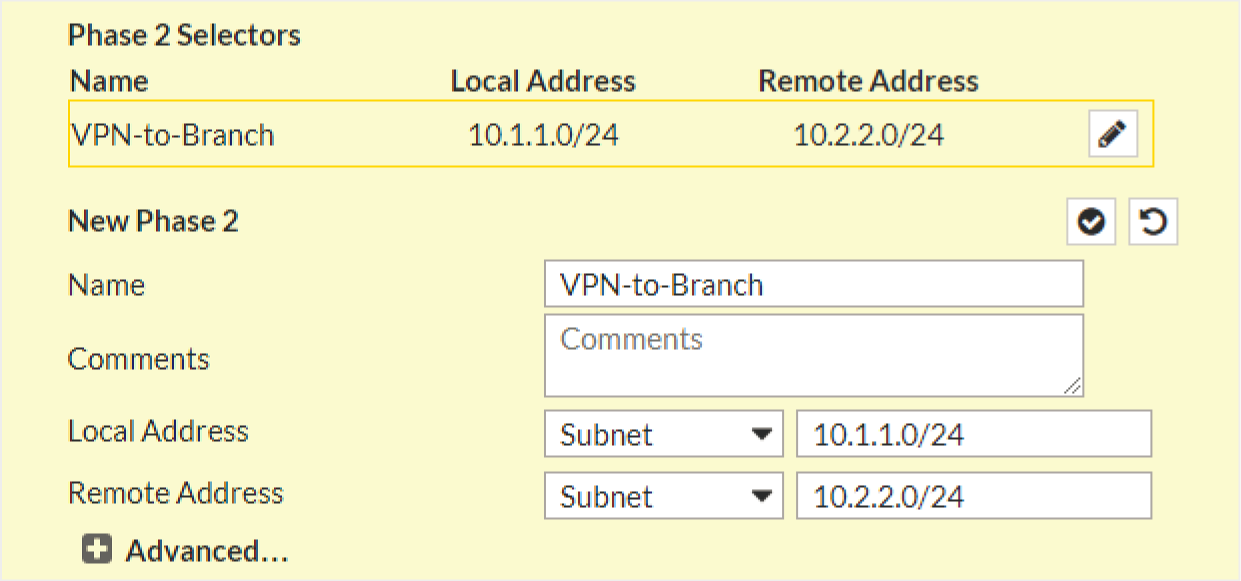
4. Enter a secure key for the **Pre-shared Key**. Later, you will enter the same key in the "Configuring the IPsec VPN on Branch" section.



Authentication

Method	Pre-shared Key
Pre-shared Key	•••••••••

5. Type the new address ranges selected in the "Planning the new addressing scheme" section for HQ and Branch’s LAN in the **Local Address** and **Remote Address** fields (in the example, 10.1.1.0/24 and 10.2.2.0/24, respectively).



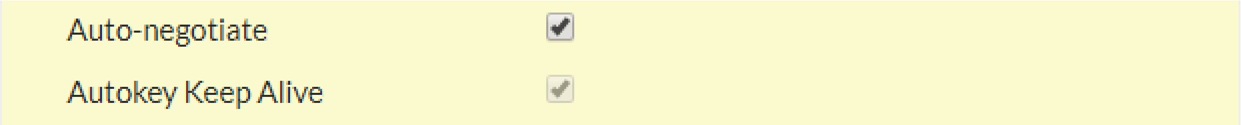
Phase 2 Selectors

Name	Local Address	Remote Address
VPN-to-Branch	10.1.1.0/24	10.2.2.0/24

New Phase 2

Name	VPN-to-Branch	
Comments	Comments	
Local Address	Subnet	10.1.1.0/24
Remote Address	Subnet	10.2.2.0/24

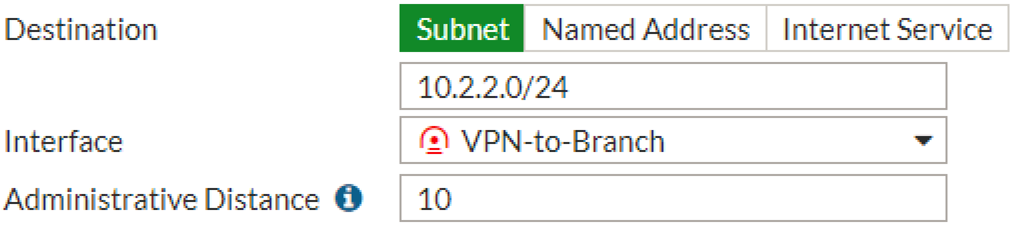
6. Optionally, expand **Advanced** and enable **Auto-negotiate**.



Auto-negotiate	☑
Autokey Keep Alive	☑

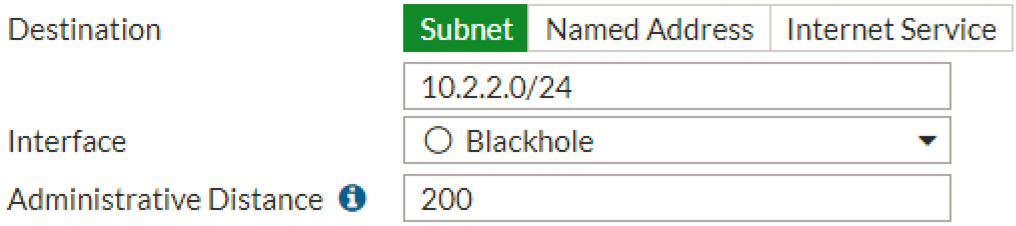
Configuring static routes on HQ

1. To create the necessary routes on HQ, go **to Network > Static Routes** and select **Create New**.
2. Enter the new subnet created in the "Planning the new addressing scheme" section for Branch’s LAN in the **Destination** field, and select the VPN tunnel created in the "Configuring the IPsec VPN on HQ" section as the **Interface** (in the example, this is 10.2.2.0/24 and VPN-to-Branch).



Destination	Subnet
	10.2.2.0/24
Interface	VPN-to-Branch
Administrative Distance	10

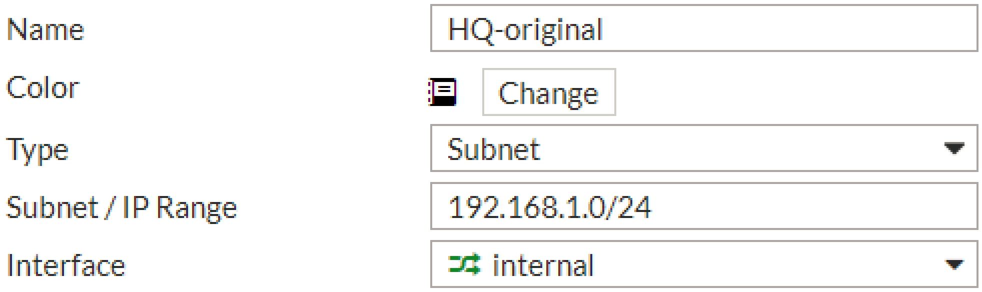
3. Create an additional route with the same **Destination** as the previous route, but this time change the **Administrative Distance** to 200 and select Blackhole as the **Interface**. This is the best practice for route-based IPsec VPN tunnels, as it ensures traffic for the remote FortiGate's subnet is not sent using the default route in the event that the IPsec tunnel goes down.



Destination	Subnet / Named Address / Internet Service 10.2.2.0/24
Interface	○ Blackhole
Administrative Distance	200

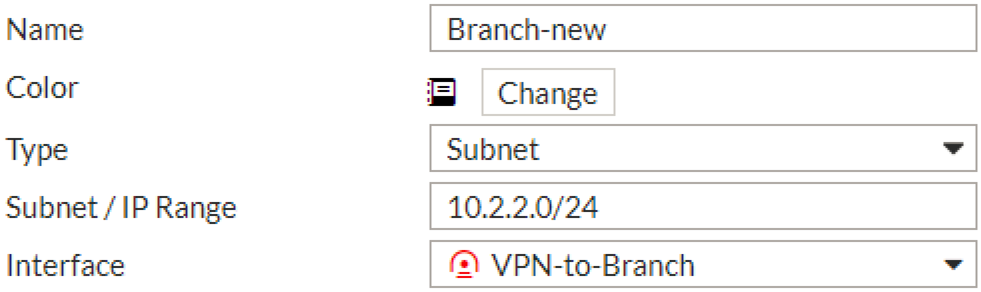
Configuring address objects on HQ

1. To create address objects you will utilize in a later step, navigate to **Policy & Objects > Addresses** and select **Create New > Address**.
2. Enter *HQ-original* for the **Name**, the original LAN subnet of HQ for **Subnet** (in the example, 192.168.1.0/24), and select the LAN-side interface for **Interface** (in the example, internal).



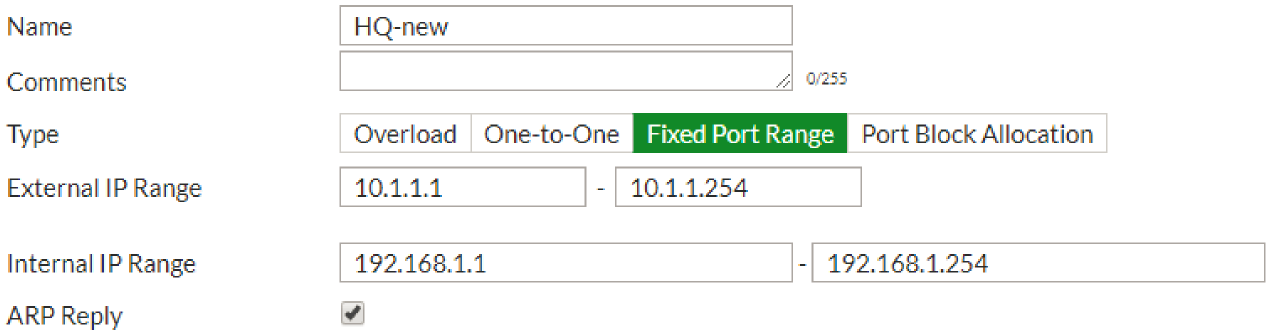
Name	HQ-original
Color	Change
Type	Subnet
Subnet / IP Range	192.168.1.0/24
Interface	internal

3. Repeat the process to create an additional new address object.
4. Enter *Branch-new* for the **Name**, the new LAN subnet of Branch for **Subnet** (in the example, 10.2.2.0/24), and select the VPN interface for **Interface** (in the example, VPN-to-Branch).



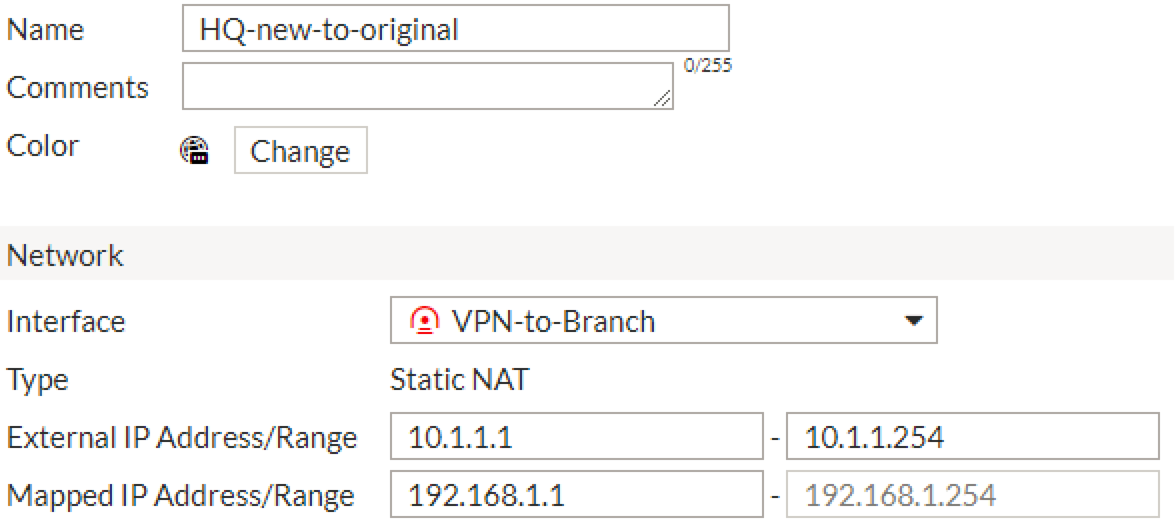
Name	Branch-new
Color	Change
Type	Subnet
Subnet / IP Range	10.2.2.0/24
Interface	VPN-to-Branch

5. To create an IP Pool, navigate to **Policy & Objects > IP Pools** and select **Create New**.
6. Enter *HQ-new* for the **Name** and select **Fixed Port Range** for **Type**. For the **External IP Range** enter the new subnet for HQ (in the example, 10.1.1.1 – 10.1.1.254). You do not need to include the network address or the broadcast address for the subnet in the External IP Range of the IP Pool. For the **Internal IP Range**, enter the original subnet for HQ (in the example, 192.168.1.1 – 192.168.1.254).



Name	HQ-new
Comments	0/255
Type	Overload One-to-One [✓ Fixed Port Range] Port Block Allocation
External IP Range	10.1.1.1 - 10.1.1.254
Internal IP Range	192.168.1.1 - 192.168.1.254
ARP Reply	☑

7. Finally, to create a Virtual IP, navigate to **Policy & Objects > Virtual IPs** and select **Create New > Virtual IP**.
8. Enter *HQ-new-to-original* for the **Name** and select the VPN interface for **Interface** (in the example, VPN-to-Branch). For the **External IP Address/Range** enter the new subnet for HQ (in the example, 10.1.1.1 – 10.1.1.254). You do not need to include the network address or the broadcast address for the subnet in the External IP Range of the Virtual IP. For the **Mapped IP Address/Range**, enter the original subnet (in the example, 192.168.1.1 – 192.168.1.254).



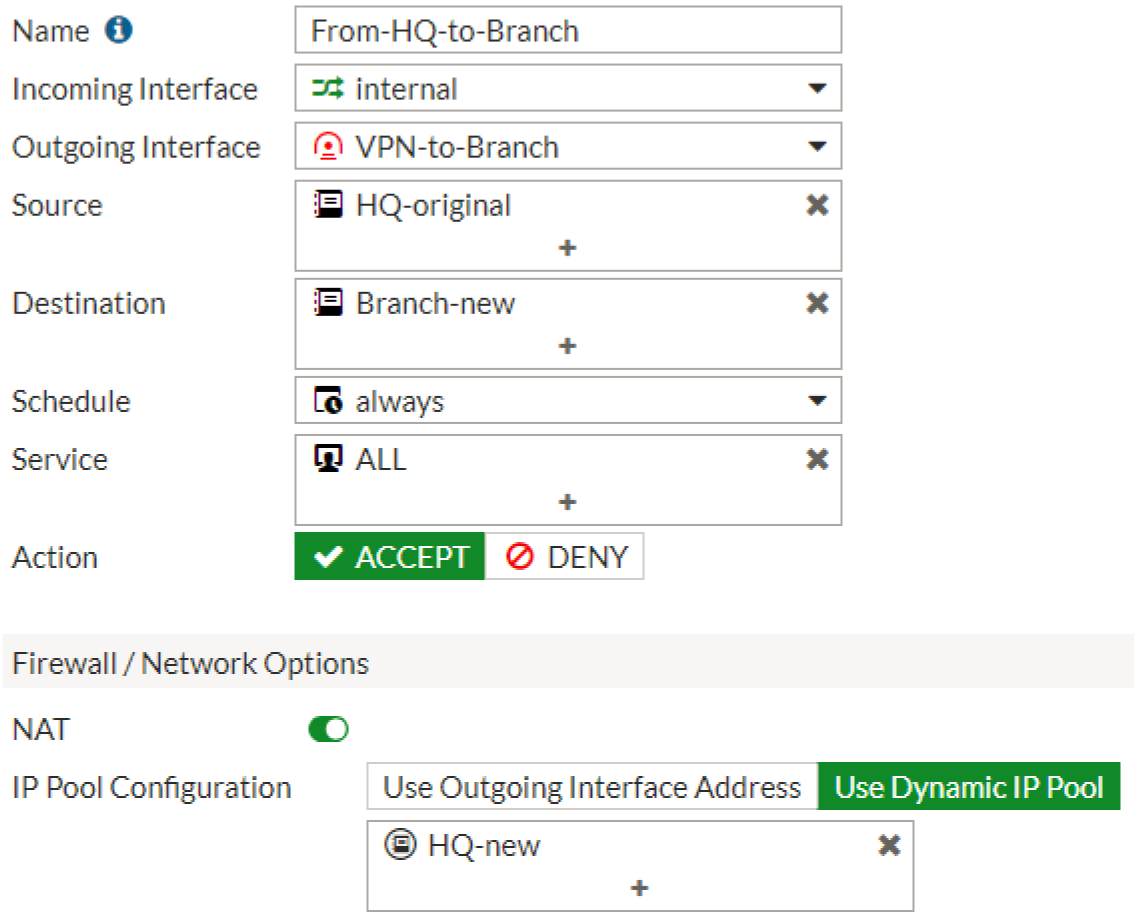
Name	HQ-new-to-original
Comments	0/255
Color	Change

Network

Interface	VPN-to-Branch
Type	Static NAT
External IP Address/Range	10.1.1.1 - 10.1.1.254
Mapped IP Address/Range	192.168.1.1 - 192.168.1.254

Configuring firewall policies on HQ

1. To create firewall policies on HQ, go to **Policy & Objects > IPv4 Policies** and select **Create New**.
2. Enter *From-HQ-to-Branch* for the **Name**, the LAN-side interface on HQ for **Incoming Interface** (in the example, internal), and the VPN tunnel interface for **Outgoing Interface** (in the example, VPN-to-Branch).

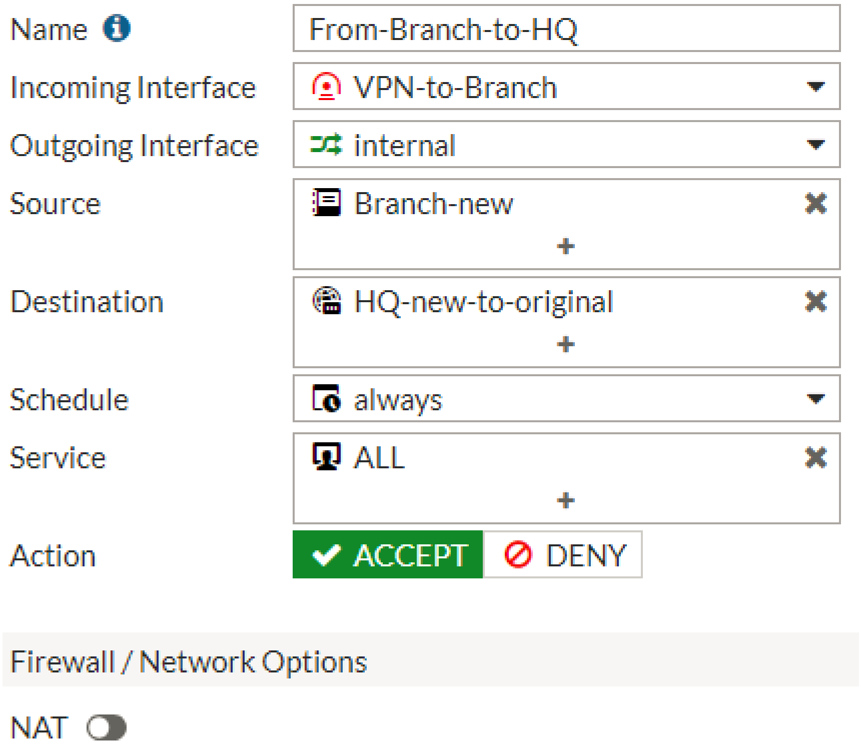


Name	From-HQ-to-Branch
Incoming Interface	internal
Outgoing Interface	VPN-to-Branch
Source	HQ-original
Destination	Branch-new
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY

Firewall / Network Options

NAT	●
IP Pool Configuration	Use Outgoing Interface Address [✓ Use Dynamic IP Pool] HQ-new

3. For the **Source**, select HQ-original, for the **Destination** select Branch-new, and for the **Service** select ALL.
4. Finally, enable **NAT**, select **Use Dynamic IP Pool**, and select the HQ-new IP Pool.
5. Repeat the process to create an additional new IPv4 Policy.
6. Enter *From-Branch-to-HQ* for the **Name**, the VPN interface for **Incoming Interface** (in the example, VPN-to-Branch), and the LAN-side interface for **Outgoing Interface** (in the example, internal).



Name: From-Branch-to-HQ

Incoming Interface: VPN-to-Branch

Outgoing Interface: internal

Source: Branch-new

Destination: HQ-new-to-original

Schedule: always

Service: ALL

Action: ✓ ACCEPT | DENY

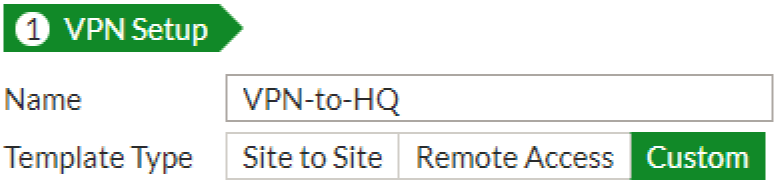
Firewall / Network Options

NAT ○

7. For the **Source**, select Branch-new, for the **Destination** select HQ-new-to-original (the Virtual IP object you created in the "Configuring static routes on HQ" section), and for the **Service** select ALL.
8. Note for this policy, you **do not** need to enable **NAT**.

Configuring IPsec VPN on Branch

1. To create the tunnel on Branch, connect to Branch, and go to **VPN > IPsec Tunnels** and create a new tunnel.
2. In the **VPN Setup** step, set **Template Type** to **Custom** and enter *VPN-to-HQ* for the **Name**.

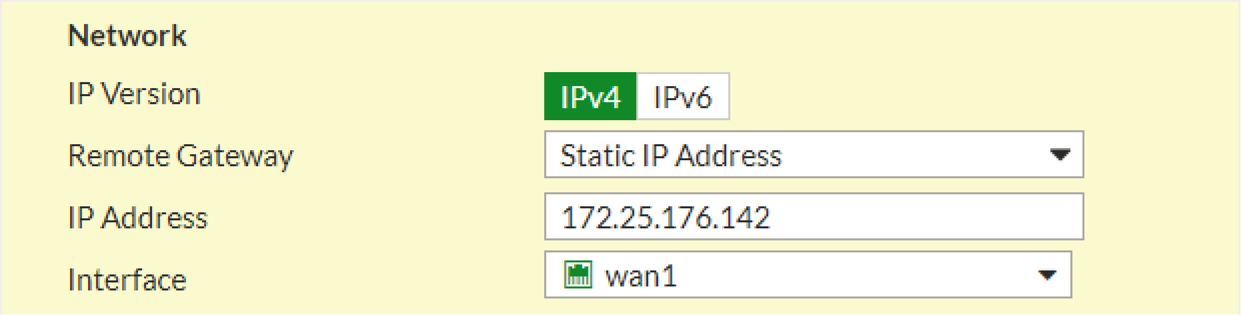


1 VPN Setup

Name: VPN-to-HQ

Template Type: Site to Site | Remote Access | Custom

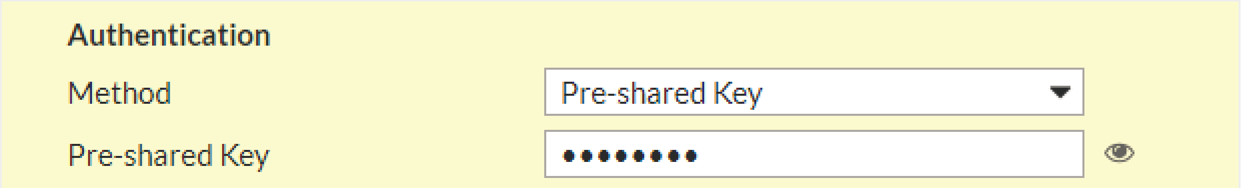
3. Enter HQ’s public IP address (in the example, 172.25.176.142) for the **IP Address**, and select Branch’s WAN interface for **Interface** (in the example, wan1).



Network

IP Version	IPv4 | IPv6
Remote Gateway	Static IP Address
IP Address	172.25.176.142
Interface	wan1

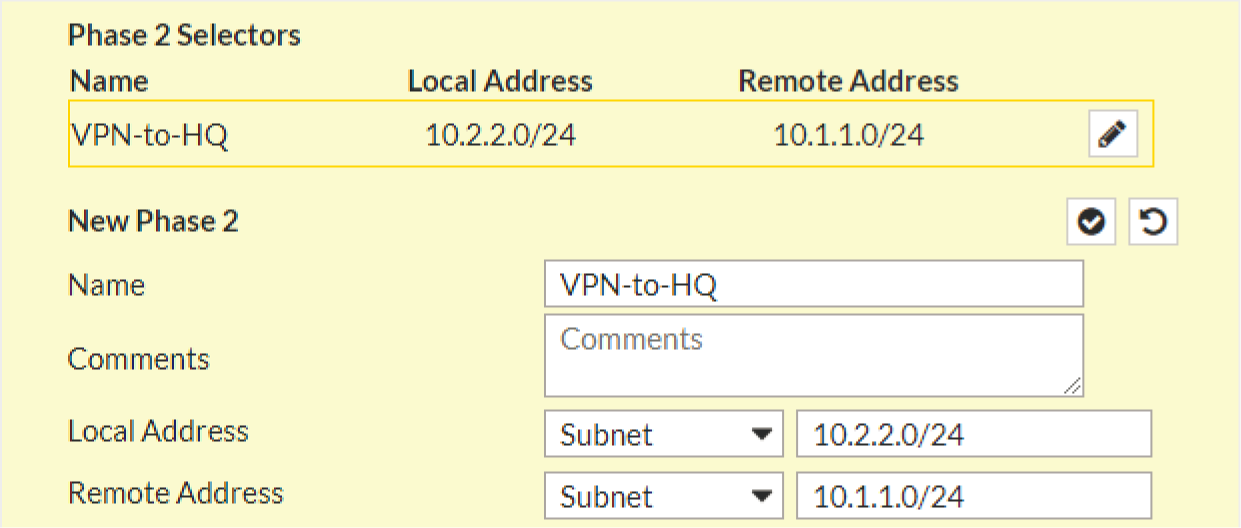
4. Enter a matching secure key for the **Pre-shared Key**.



Authentication

Method	Pre-shared Key
Pre-shared Key	●●●●●●●●●

5. Type the new address ranges selected in the "Planning the new addressing scheme" section for Branch and HQ's LAN in the **Local Address** and **Remote Address** fields (in the example, 10.2.2.0/24 and 10.1.1.0/24, respectively). The Local and Remote Address fields are the reverse of what you created in the "Configuring the IPsec VPN on HQ" section.



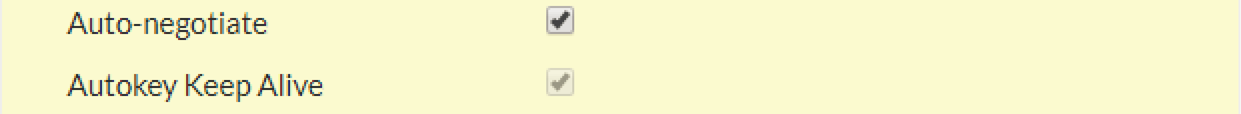
Phase 2 Selectors

Name	Local Address	Remote Address
VPN-to-HQ	10.2.2.0/24	10.1.1.0/24

New Phase 2

Name	VPN-to-HQ	
Comments	Comments	
Local Address	Subnet	10.2.2.0/24
Remote Address	Subnet	10.1.1.0/24

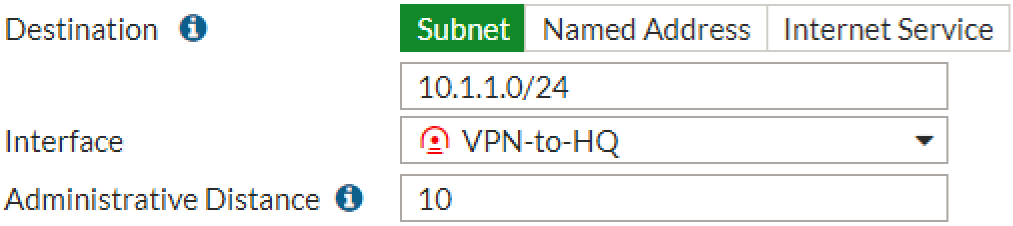
6. Optionally, expand **Advanced** and enable **Auto-negotiate**.



Auto-negotiate	☑
Autokey Keep Alive	☑

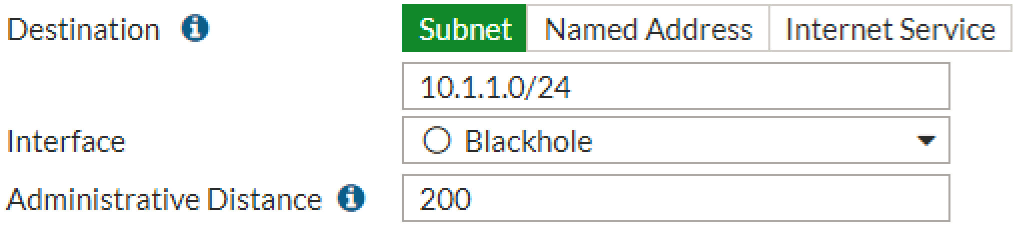
Configuring static routes on Branch

1. To create the necessary routes on Branch, go to **Network > Static Routes** and select **Create New**.
2. Enter the new subnet created in the "Planning the new addressing scheme" section for HQ's LAN in the **Destination** field, and select the VPN tunnel created in the "Configuring the IPsec VPN on Branch" section as the **Interface** (in the example, this is 10.1.1.0/24 and VPN-to-HQ).



Destination	[✓ Subnet] Named Address Internet Service
	10.1.1.0/24
Interface	VPN-to-HQ
Administrative Distance	10

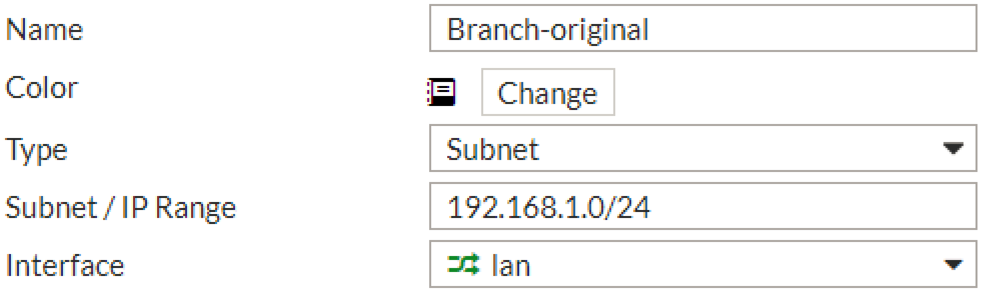
3. Create an additional route with the same **Destination** as the previous route, but this time change the **Administrative Distance** to 200 and select Blackhole as the **Interface**.



Destination	[✓ Subnet] Named Address Internet Service
	10.1.1.0/24
Interface	○ Blackhole
Administrative Distance	200

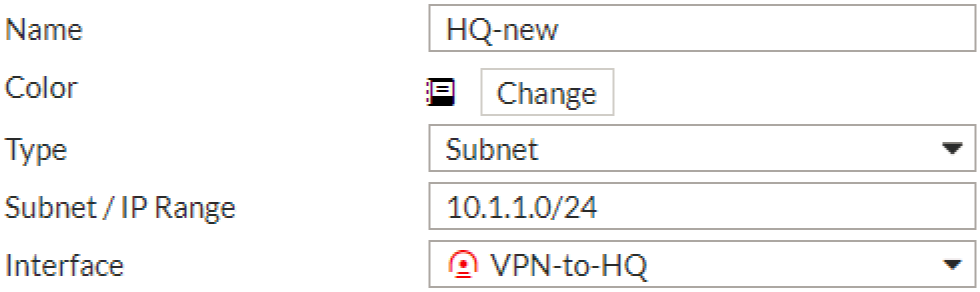
Configuring address objects on Branch

1. To create address objects you will utilize in a later step, navigate to **Policy & Objects > Addresses** and select **Create New > Address**.
2. Enter *Branch-original* for the **Name**, the original LAN subnet of Branch for **Subnet** (in the example, 192.168.1.0/24), and select the LAN-side interface for **Interface** (in the example, lan).



Name	Branch-original
Color	Change
Type	Subnet
Subnet / IP Range	192.168.1.0/24
Interface	lan

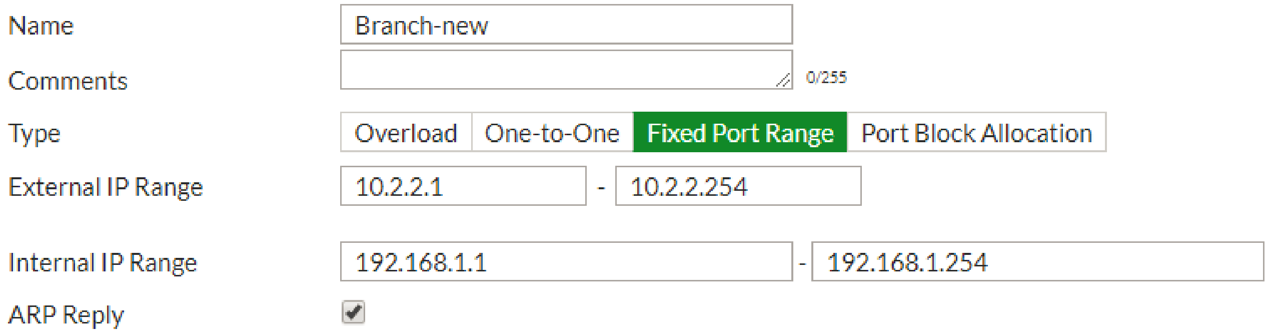
3. Repeat the process to create an additional new address object.
4. Enter *HQ-new* for the **Name**, the new LAN subnet of HQ for **Subnet** (in the example, 10.1.1.0/24), and select the VPN interface for **Interface** (in the example, VPN-to-HQ).



Name	HQ-new
Color	Change
Type	Subnet
Subnet / IP Range	10.1.1.0/24
Interface	VPN-to-HQ

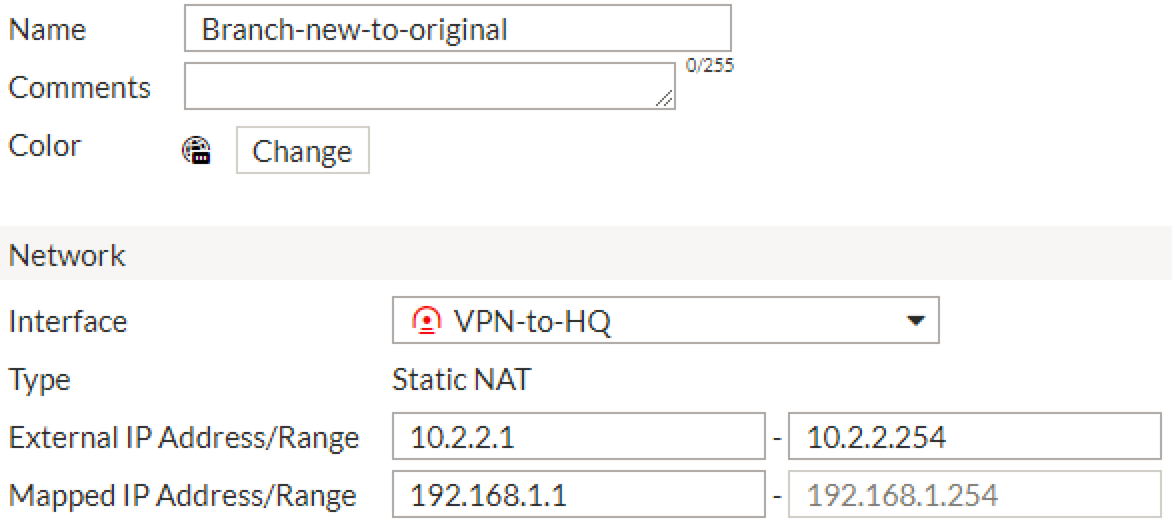
5. To create an IP Pool, navigate to **Policy & Objects > IP Pools** and select **Create New**.

6. Enter *Branch-new* for the **Name** and select **Fixed Port Range** for **Type**. For the **External IP Range** enter the new subnet for Branch (in the example, 10.2.2.1 – 10.2.2.254), and enter the original subnet for Branch in the **Internal IP Range** (in the example, 192.168.1.1 – 192.168.1.254).



Name	Branch-new
Comments	0/255
Type	Overload / One-to-One / [✓ Fixed Port Range] / Port Block Allocation
External IP Range	10.2.2.1 - 10.2.2.254
Internal IP Range	192.168.1.1 - 192.168.1.254
ARP Reply	☑

7. Finally, to create a Virtual IP, navigate to **Policy & Objects > Virtual IPs** and select **Create New > Virtual IP**.
8. Enter *Branch-new-to-original* for the **Name** and select the VPN interface for **Interface** (in the example, VPN-to-HQ). For the **External IP Range** enter the new subnet for Branch (in the example, 10.2.2.1 – 10.2.2.254), and enter the original subnet for Branch in the **Internal IP Range** (in the example, 192.168.1.1 – 192.168.1.254).



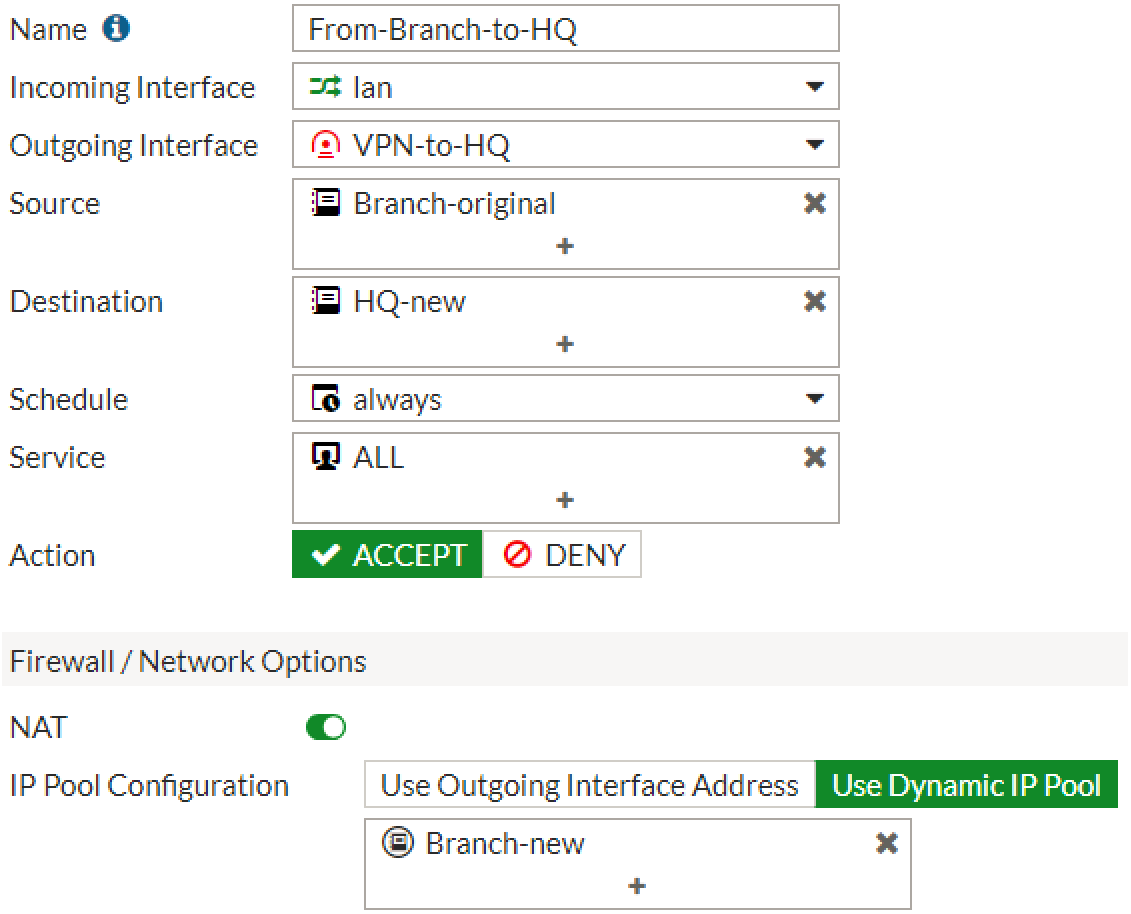
Name	Branch-new-to-original
Comments	0/255
Color	Change

Network

Interface	VPN-to-HQ
Type	Static NAT
External IP Address/Range	10.2.2.1 - 10.2.2.254
Mapped IP Address/Range	192.168.1.1 - 192.168.1.254

Configuring firewall policies on Branch

1. To create firewall policies on Branch, navigate to **Policy & Objects > IPv4 Policies** and select **Create New**.
2. Enter *From-Branch-to-HQ* for the **Name**, the LAN-side interface on Branch for **Incoming Interface** (in the example, lan), and the VPN tunnel interface for **Outgoing Interface** (in the example, VPN-to-HQ).

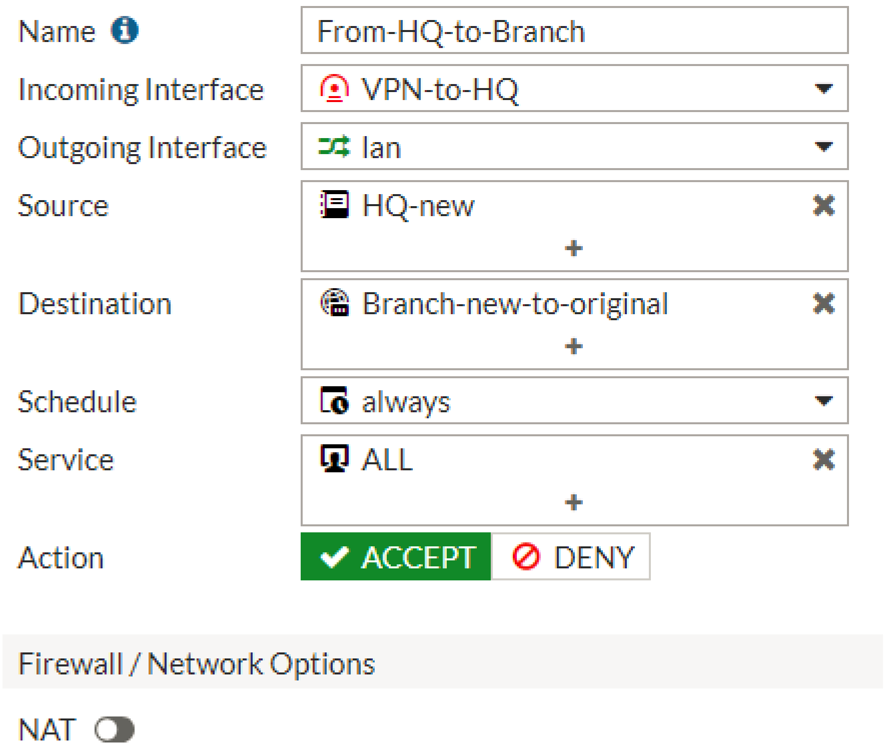


Name	From-Branch-to-HQ
Incoming Interface	lan
Outgoing Interface	VPN-to-HQ
Source	Branch-original
Destination	HQ-new
Schedule	always
Service	ALL
Action	ACCEPT DENY

Firewall / Network Options

NAT	●
IP Pool Configuration	Use Outgoing Interface Address [✓ Use Dynamic IP Pool]
	Branch-new

3. For the **Source**, select Branch-original, for the **Destination** select HQ-new, and for the **Service** select ALL.
4. Finally, enable **NAT**, select **Use Dynamic IP Pool**, and select the Branch-new IP Pool.
5. Repeat the process to create an additional new IPv4 Policy.
6. Enter *From-HQ-to-Branch* for the **Name**, the VPN interface for **Incoming Interface** (in the example, VPN-to-HQ), and the LAN-side interface for **Outgoing Interface** (in the example, lan).



Name	From-HQ-to-Branch
Incoming Interface	VPN-to-HQ
Outgoing Interface	lan
Source	HQ-new
Destination	Branch-new-to-original
Schedule	always
Service	ALL
Action	✓ ACCEPT ⊘ DENY

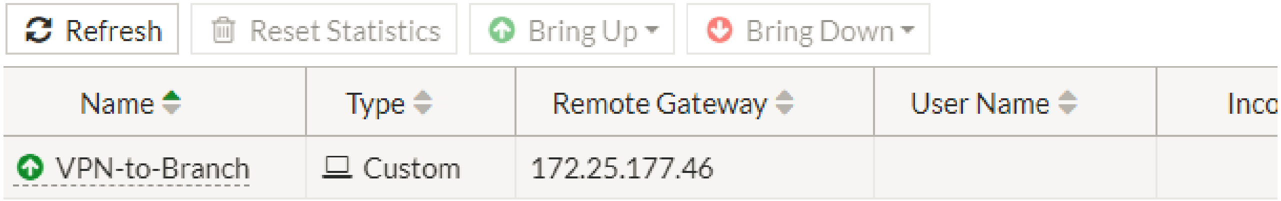
Firewall / Network Options

NAT ○

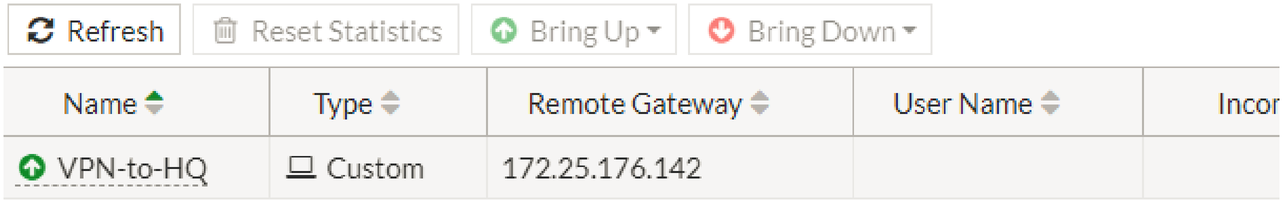
7. For the **Source**, select HQ-new, for the **Destination** select Branch-new-to-original (the Virtual IP object you created in the "Configuring address objects, Virtual IPs, and IP Pools on Branch" section), and for the **Service** select ALL.
8. Note for this policy, you **do not** need to enable **NAT**.

Results

1. The IPsec tunnels should now be up on both sides, which you can verify under **Monitor > IPsec Monitor**. If you did not enable auto-negotiate in the "Configuring the IPsec VPN on HQ" section or "Configuring the IPsec VPN on Branch" section earlier, then you may have to highlight the tunnel and select **Bring Up**.

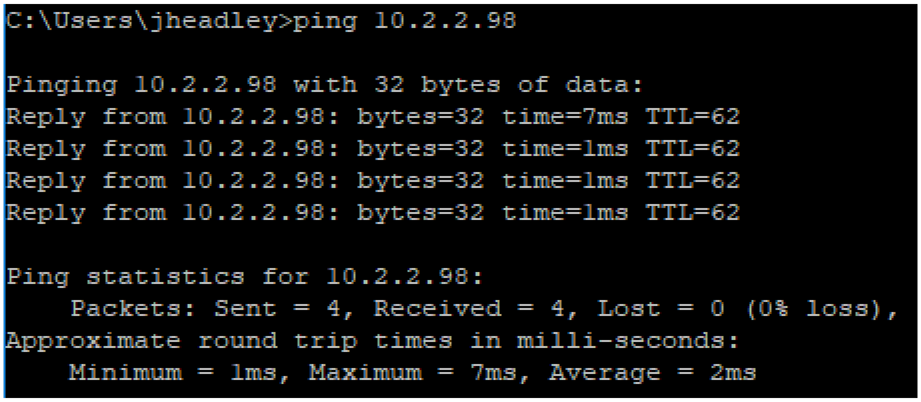


Name	Type	Remote Gateway	User Name	Inco
VPN-to-Branch	Custom	172.25.177.46		



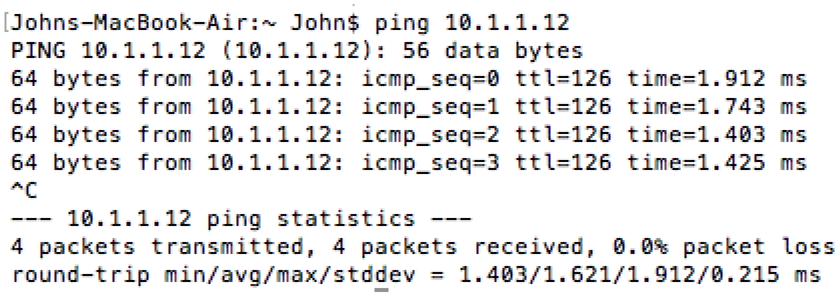
Name	Type	Remote Gateway	User Name	Incor
VPN-to-HQ	Custom	172.25.176.142		

2. From a PC on the HQ network, try to ping a PC on the Branch network using the new IP for the Branch PC. The ping should be successful.



```
C:\Users\jheadley>ping 10.2.2.98

Pinging 10.2.2.98 with 32 bytes of data:
Reply from 10.2.2.98: bytes=32 time=7ms TTL=62
Reply from 10.2.2.98: bytes=32 time=1ms TTL=62
Reply from 10.2.2.98: bytes=32 time=1ms TTL=62
Reply from 10.2.2.98: bytes=32 time=1ms TTL=62

Ping statistics for 10.2.2.98:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 7ms, Average = 2ms
```

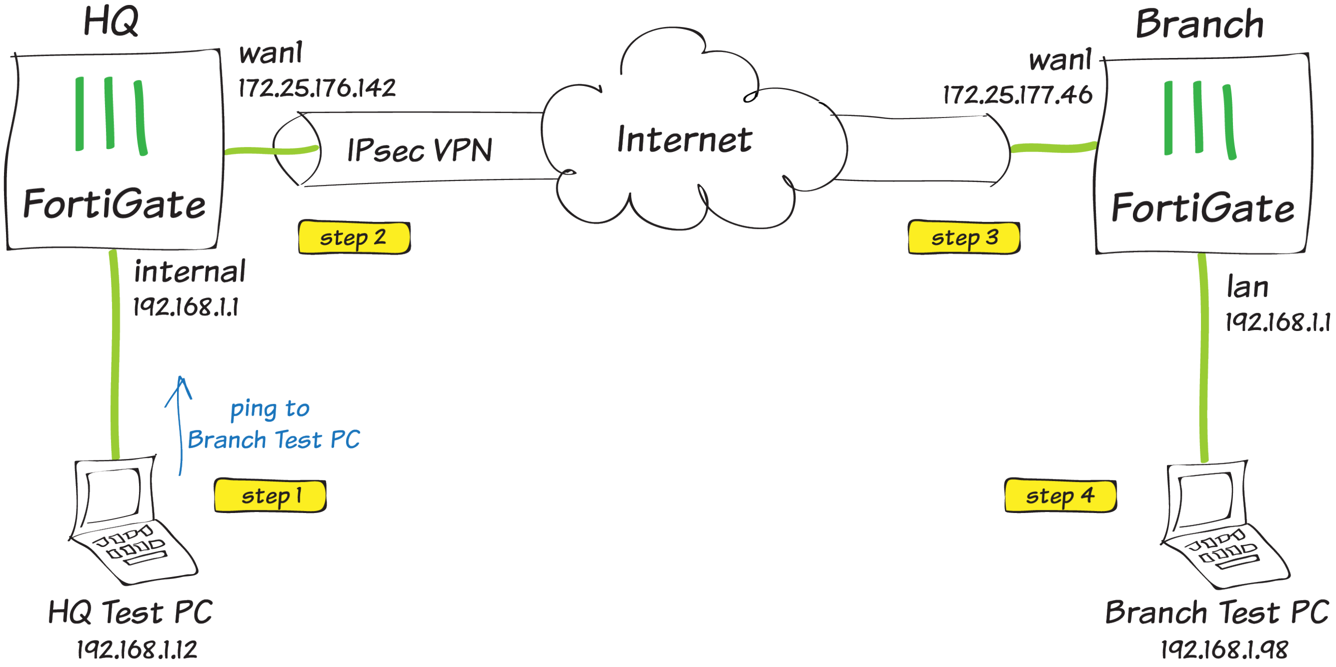
3. From a PC on the Branch network, try to ping a PC on the HQ network using the new IP for the HQ PC. The ping should be successful.



```
Johns-MacBook-Air:~ John$ ping 10.1.1.12
PING 10.1.1.12 (10.1.1.12): 56 data bytes
64 bytes from 10.1.1.12: icmp_seq=0 ttl=126 time=1.912 ms
64 bytes from 10.1.1.12: icmp_seq=1 ttl=126 time=1.743 ms
64 bytes from 10.1.1.12: icmp_seq=2 ttl=126 time=1.403 ms
64 bytes from 10.1.1.12: icmp_seq=3 ttl=126 time=1.425 ms
^C
--- 10.1.1.12 ping statistics ---
4 packets transmitted, 4 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 1.403/1.621/1.912/0.215 ms
```

Explanation

Using the two example PCs below, the source and destination NAT that is performed in order to allow these two PCs in overlapping subnets to communicate is explained.



Step 1 – Ping Request: HQ Test PC sends a ping destined for Branch Test PC’s new IP address of 10.2.2.98.

Src IP: 192.168.1.12

Dst IP: 10.2.2.98

Step 2 – Source NAT: The HQ FortiGate receives the ping, and after a route lookup, matches the traffic to firewall policy From-HQ-to-Branch that you created in the "Configuring firewall policies on HQ" section of the recipe.

Since the policy has NAT enabled and the HQ-new IP Pool selected, the HQ FortiGate will perform source NAT on HQ Test PC’s IP address before sending into the IPsec tunnel.

Src IP: 10.1.1.12

Dst IP: 10.2.2.98

When you created an IP Pool with Type of Fixed Port Range, and then selected an External IP Range and Internal IP Range of equal size, the last octet of the IP addresses after SNAT will not change. This means 192.168.1.12 will be changed to 10.1.1.12, which makes using the new address range as simple as possible.

Step 3 – Destination NAT: Branch FortiGate receives the traffic on the IPsec tunnel, and before a policy is matched, the Virtual IP (VIP) you created called Branch-new-to-original performs destination NAT (DNAT).

Similar to our Fixed Port Range IP Pool, a VIP will exactly map the External IP Range to the Mapped IP Range. This means that 10.2.2.98 will DNAT to 192.168.1.98.

After DNAT, a route lookup is performed, and the traffic will match the From-HQ-to-Branch policy that you created in the "Configuring firewall policies on Branch" section of the recipe.

Src IP: 10.1.1.12

Dst IP: 192.168.1.98

Step 4 – Ping Reply: Branch Test PC receives the ping request from HQ Test PC and sends the ping reply back to 10.1.1.12.

The FortiGate is a stateful firewall, and the same firewall policy that was used when the session was initiated will be used on the way back (the From-HQ-to-Branch policy on both FortiGates).

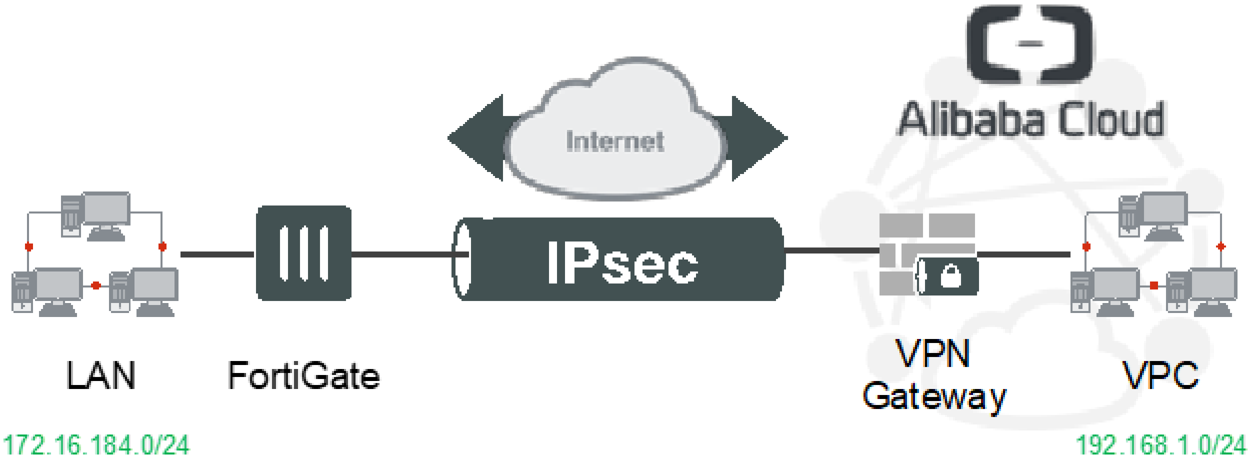
The session table on each FortiGate remembers the SNAT or DNAT that was performed in the "Configuring the IPsec VPN on HQ" section and "Configuring static routes on HQ" section, and will perform the reverse operation on the reply traffic.

Src IP: 192.168.1.98

Dst IP: 10.1.1.12

IPsec VPN to Alibaba Cloud (AliCloud)

The following recipe demonstrates how to configure a site-to-site IPsec VPN tunnel to Alibaba Cloud (AliCloud).



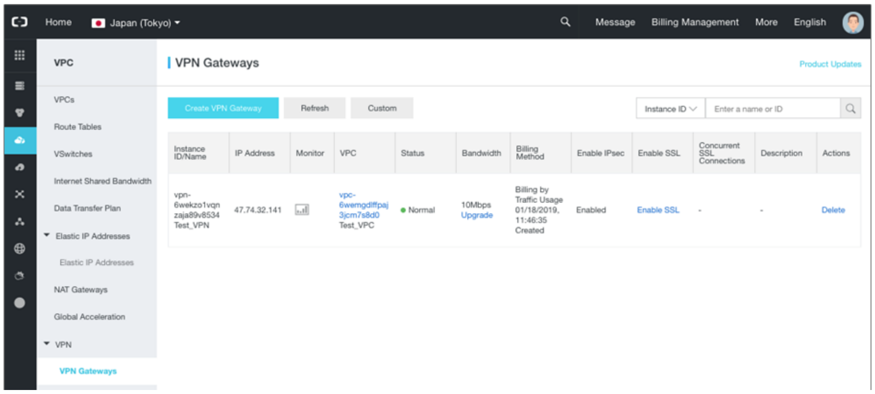
Using FortiOS 6.0.0, the example describes how to configure the tunnel between each site, avoiding overlapping subnets, so that a secure tunnel can be established.

The following is required for this recipe:

- One FortiGate (physical or virtual) with an Internet-facing IP address
- One valid Alibaba Cloud (AliCloud) account
- One VPC that has already been created

Configuring the Alibaba Cloud (AliCloud) VPN gateway

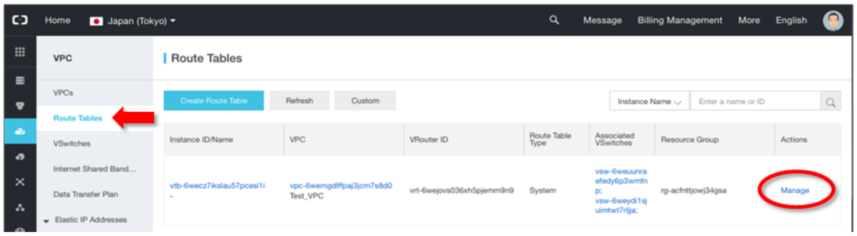
1. Log into Alibaba Cloud (AliCloud) and go to *Products & Services* > *VPN Gateway*.
2. Ensure that the correct region is selected in the top left corner. Otherwise, you cannot see your VPC. Verify that the VPC has already been configured.
3. Create the VPN gateway:
   a. Click *Create VPN Gateway*.
   b. In the *Name* field, enter the desired name.
   c. From the *VPC* dropdown list, select the desired *VPC*.
   d. For *IPsec VPN*, select *Enable*.
   e. Click *Buy Now*.
   f. Select *VPN Gateway Agreement of Service*.
   g. Click *Activate*.
4. Return to the Alibaba Cloud (AliCloud) management console and verify that the VPN gateway has been created under *VPNs* > *VPN Gateways*.



VPN Gateways

Instance ID/Name	IP Address	Monitor	VPC	Status	Bandwidth	Billing Method	Enable IPsec	Enable SSL	Concurrent SSL Connections	Description	Actions
vpn-6wekzo1vqnzaja89v8534 Test_VPN	47.74.32.141		vpc-6wemgdlffpaj3jcm7s8d0 Test_VPC	● Normal	10Mbps Upgrade	Billing by Traffic Usage 01/18/2019, 11:46:35 Created	Enabled	Enable SSL	-	-	Delete

5. An IP address has been assigned to the VPN gateway. Note down this IP address, as you will need it later in the process.
6. Register the FortiGate on your site as the customer gateway:
   a. Go to *VPN > Customer Gateways*, then click *Create Customer Gateway*.
   b. In the *Name* field, enter the FortiGate name.
   c. In the *IP Address* field, enter the FortiGate's Internet-facing interface.
   d. Click *OK*.
7. Set parameters for the IPsec tunnel:
   a. Go to *VPN > IPsec Connections*, then click *Create IPsec Connection*.
   b. In the *Name* field, enter the IPsec connection name.
   c. For *VPN Gateway* and *Customer Gateway*, select those created in steps 3 and 6.
   d. In the *Local Network* field, enter the VPC subnet address.
   e. In the *Remote Network* field, enter the subnet address of the LAN on your site.
   f. Set *Effective Immediately* to *Yes*. If this option is set to *No*, the VPN gateway attempts to establish IPsec tunnel connection only when traffic occurs and may cause delays in sending traffic.
   g. Configure advanced settings:
      i. Click *Advanced Configuration*.
      ii. Enter the *Pre-Shared Key* for authentication purposes. Your FortiGate will require this keyword in a later step.
      iii. From the *Version* dropdown list, select *ikev2*.
      iv. Leave the other parameters as-is.
      v. Under *IPsec Configurations*, modify *SA Life Cycle (seconds)* to 43200 so that it matches the FortiGate default value. *Advanced Configuration* contains two *SA Life Cycle (seconds)* fields: one for IKE configuration and one for IPsec configuration. Ensure that you are modifying the one under IPsec configuration.
      vi. Click *OK*.
8. Configure a static route that will route traffic to the IPsec tunnel:
   a. Go to *VPC > Route Tables*. You will see a routing table for your VPC. Click *Manage*.



Route Tables

Instance ID/Name	VPC	VRouter ID	Route Table Type	Associated VSwitches	Resource Group	Actions

vtb-6wecz7ikslau57pcesi1i
-
	vpc-6wemgdlffpaj3jcm7s8d0
	Test_VPC
		vrt-6wejovs036xh5pjemm9n9	System	vsw-6weuunraefedy6p3wmfnp;
				vsw-6weydi1sjuimtwt7rljja;
					rg-acfnttjowj34gsa	Manage

- **b.** Click *Add Route Entry*.
- **c.** In the *Destination CIDR Block* field, enter the subnet address of the LAN on your site.
- **d.** From the *Next Hop Type* dropdown list, select *VPN Gateway*.
- **e.** From the *VPN Gateway* dropdown list, select the VPN gateway created in step 3.
- **f.** Click *OK*.

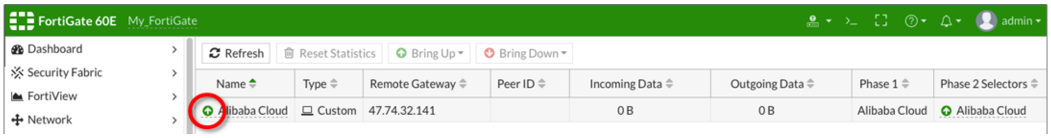
Configuring the FortiGate

1. Log into FortiOS.
2. Create the IPsec tunnel:
   - **a.** Go to *VPN > IPsec Tunnels*, then click *Create New*.
   - **b.** Configure the basic settings:
     - **i.** In the *Name* field, enter the desired name.
     - **ii.** For *Template Type*, select *Custom*.
     - **iii.** Click *Next*.
   - **c.** Configure the network settings:
     - **i.** In the *IP Address* field, enter the VPN gateway's IP address as provided by Alibaba Cloud (AliCloud) in step 5 of Configuring the Alibaba Cloud (AliCloud) VPN gateway on page 332.
     - **ii.** From the *Interface* dropdown list, select an Internet-facing interface, such as *wan1*.
     - **iii.** If you want to automatically check the available of the remote VPN gateway, set *Dead Peer Detection* to *On Idle*.
   - **d.** Configure authentication:
     - **i.** *Authentication*, from the *Method* dropdown list, select *Pre-shared Key*.
     - **ii.** In the *Pre-Shared Key* field, enter the pre-shared key entered for the Alibaba Cloud (AliCloud) VPN gateway in step 7 of Configuring the Alibaba Cloud (AliCloud) VPN gateway on page 332.
     - **iii.** For *IKE Version*, select *2*.
   - **e.** Under *Diffie-Hellman Groups*, select *2*. The Alibaba Cloud (AliCloud) VPN gateway's default DH group is 2. Leave the other parameters as-is.
   - **f.** For *Local Address*, select *Subnet* from the dropdown list, then enter the LAN subnet address.
   - **g.** For *Remote Address*, select *Subnet*, then enter the VPC subnet address on Alibaba Cloud (AliCloud).
   - **h.** Under *Advanced*, also select *2* under *Diffie-Hellman Groups*. Leave the other parameters as-is, then click *OK*.
3. To pass traffic to and from the IPsec tunnel, you must create a policy that allow transaction between the FortiGate and Alibaba Cloud (AliCloud). You must first create an address object which represents the subnet on your VPC:
   - **a.** Go to *Policy & Objects > Addresses*, then click *Create New > Address*.
   - **b.** In the *Name* field, enter the address object's name.
   - **c.** From the *Type* dropdown list, select *Subnet*.
   - **d.** In the *Subnet/IP Range* field, enter the VPC subnet address.
   - **e.** Enable *Static Route Configuration*. This allows you to use this address object as a static route destination in a later step.
4. Create a policy that permits outgoing sessions to the IPsec tunnel.
   - **a.** Go to *Policy & Objects > IPv4 Policy*, then click *Create New*.
   - **b.** In the *Name* field, enter the desired policy name.
   - **c.** In the *Incoming Interface* field, select your local LAN interface.
   - **d.** In the *Outgoing Interface* field, select the IPsec tunnel created in step 2.

   e. For *Source*, select *all*, or specify any address objects if you want to allow access only from specific addresses.
   f. For *Destination*, select the address object created for your VPC subnet in step 3.
   g. For *Service*, select all or specify any services you want to allow.
   h. Ensure that NAT is not enabled.
   i. Click *OK*.
5. Create a policy for incoming sessions from the VPC. Repeat the steps above, except for the following:
   a. In the *Incoming Interface* field, select the IPsec tunnel created in step 2.
   b. In the *Outgoing Interface* field, select your local LAN interface.
   c. For *Source*, select subnets on your VPC.
6. To avoid packet drops and fragmentation, it is recommended to limit the TCP maximum segment size (MSS) being sent and received. For both firewall policies, configure the following in the CLI console:

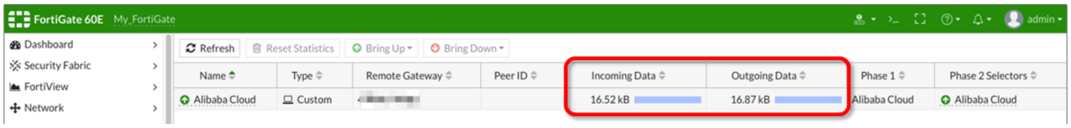
```
config firewall policy
   edit <policy-id>
      set tcp-mss-sender 1350
      set tcp-mss-receiver 1350
   next
end
```

7. Go to *Monitor > IPsec Monitor*. If all configuration is complete as desired, the IP tunnel displays as being up. Otherwise, you must review and correct your settings.



Name	Type	Remote Gateway	Peer ID	Incoming Data	Outgoing Data	Phase 1	Phase 2 Selectors
Alibaba Cloud	Custom	47.74.32.141		0 B	0 B	Alibaba Cloud	Alibaba Cloud

8. Create a static route to forward traffic from the LAN to Alibaba Cloud (AliCloud):
   a. Go to *Network > Static Routes*, then select *Create New*.
   b. For *Destination*, select *Named Address*. From the list, select your remote subnet.
   c. From the *Interface* dropdown list, select the IPsec tunnel created in step 2.
   d. Click *OK*.
9. FortiOS is now connected to Alibaba Cloud (AliCloud) via IPsec. You should see the traffic counter in *Monitor > IPsec Monitor*.



Name	Type	Remote Gateway	Peer ID	Incoming Data	Outgoing Data	Phase 1	Phase 2 Selectors
Alibaba Cloud	Custom	[redacted]		16.52 kB	16.87 kB	Alibaba Cloud	Alibaba Cloud

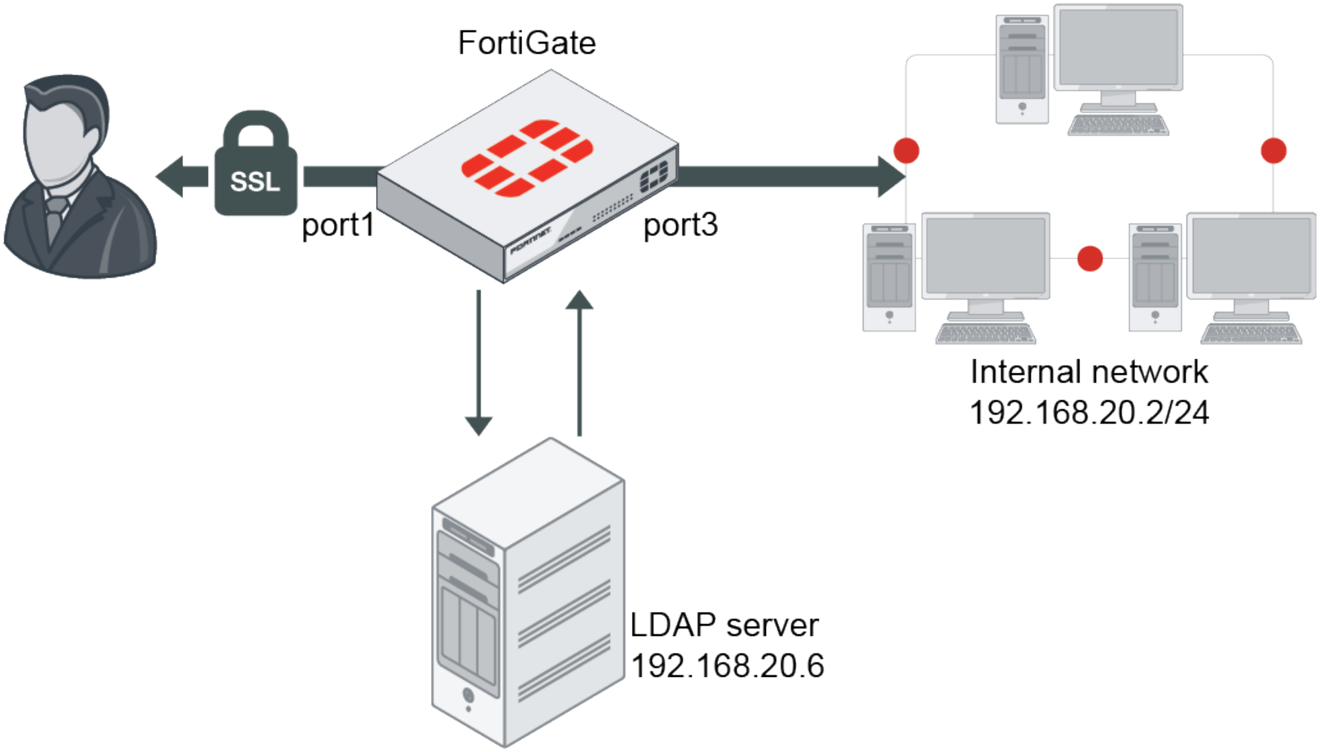
SSL VPN for remote users with MFA and user case sensitivity

By default, remote LDAP and RADIUS user names are case sensitive. When a remote user object is applied to SSL VPN authentication, the user must type the exact case that is used in the user definition on the FortiGate.

Case sensitivity can be disabled by disabling the `username-case-sensitivity` CLI command, allowing the remote user object to match any case that the end user types in.

In this example, a remote user is configured with multi-factor authentication (MFA). The user group includes the LDAP user and server, and is applied to SSL VPN authentication and the policy.

Topology



Example configuration

To configure the LDAP server:

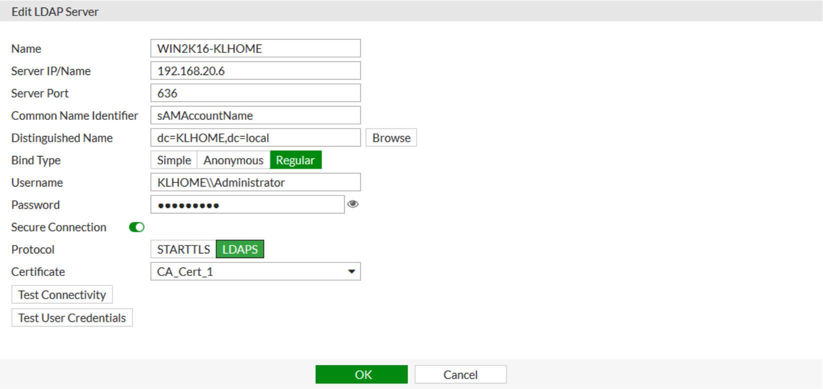
1. Generate and export a CA certificate from the AD server .
2. Import the CA certificate into FortiGate:
   a. Go to *System* > *Features Visibility* and ensure *Certificates* is enabled.
   b. Go to *System* > *Certificates* and select *Import* > *CA Certificate*.
   c. Select *Local PC* and then select the certificate file.
      The CA certificate now appears in the list of *External CA Certificates*. In this example, it is called *CA_Cert_1*.
   d. If you want, you can use CLI commands to rename the system-generated *CA_Cert_1* to be more descriptive:

```
config vpn certificate ca
    rename CA_Cert_1 to LDAPS-CA
end
```

3. Configure the LDAP user:
   a. Go to *User & Device* > *LDAP Servers* and click *Create New*.
   b. Configure the following options for this example:

Name	WIN2K16-KLHOME
Server IP/Name	192.168.20.6

Server Port	636
Common Name Identifier	sAMAccountName
Distinguished Name	dc=KLHOME,dc=local
Bind Type	Regular
Username	KLHOME\\Administrator
Password	*********
Secure Connection	Enable
Protocol	LDAPS
Certificate	CA_Cert_1 This is the CA certificate that you imported in step 2.



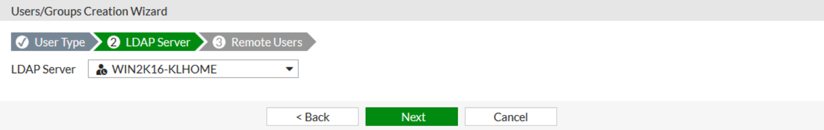
Edit LDAP Server

Name: WIN2K16-KLHOME
Server IP/Name: 192.168.20.6
Server Port: 636
Common Name Identifier: sAMAccountName
Distinguished Name: dc=KLHOME,dc=local
Bind Type: Simple | Anonymous | Regular
Username: KLHOME\\Administrator
Password: •••••••••
Secure Connection: ●
Protocol: STARTTLS | LDAPS
Certificate: CA_Cert_1

c. Click *OK*.

To configure an LDAP user with MFA:

1. Go to *User & Device* > *User Definition* and click *Create New*.
2. Select *Remote LDAP User*, then click *Next*.
3. Select the just created LDAP server, then click *Next*.

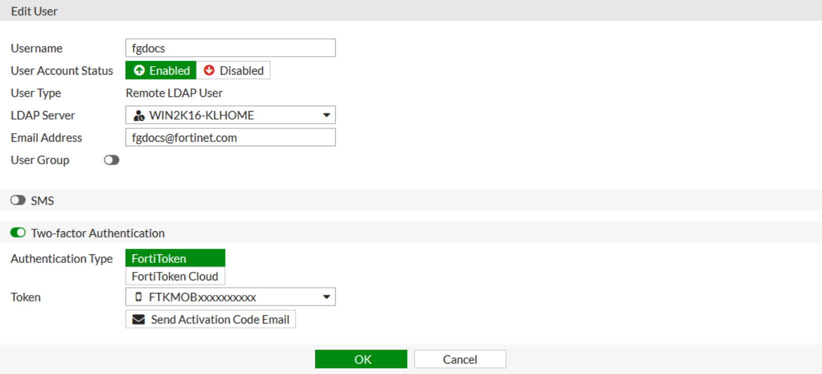


Users/Groups Creation Wizard

LDAP Server: WIN2K16-KLHOME

4. Right click to add the selected user, then click *Submit*.
5. Edit the user that you just created.
   The username will be pulled from the LDAP server with the same case as it has on the server.
6. Set the *Email Address* to the address that FortiGate will send the FortiToken to.
7. Enable *Two-factor Authentication*.
8. Set *Authentication Type* to *FortiToken*.

9. Set *Token* to a FortiToken device. See FortiToken Mobile Push for SSL VPN on page 273 for more information.



Edit User

Username: fgdocs

User Account Status: ● Enabled ○ Disabled

User Type: Remote LDAP User

LDAP Server: WIN2K16-KLHOME

Email Address: fgdocs@fortinet.com

User Group: ○

○ SMS

● Two-factor Authentication

Authentication Type: FortiToken | FortiToken Cloud

Token: FTKMOBxxxxxxxxxx

10. Click *OK*.

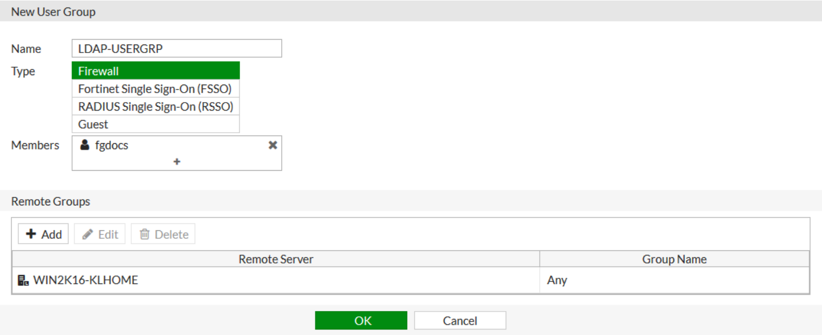
To disable case sensitivity on the remote user:

This can only be configured in the CLI.

```
config user local
    edit "fgdocs"
        set type ldap
        set two-factor fortitoken
        set fortitoken "FTKMOBxxxxxxxxxx"
        set email-to "fgdocs@fortinet.com"
        set username-case-sensitivity disable
        set ldap-server "WIN2K16-KLHOME"
    next
end
```

To configure a user group with the remote user and the LDAP server:

1. Go to *User & Device > User Groups* and click *Create New*.
2. Set the *Name* to *LDAP-USERGRP*.
3. Set *Members* to the just created remote user.
4. In the *Remote Groups* table, click *Add*:
   a. Set *Remote Server* to the LDAP server.
   b. Set the group or groups that apply, and right click to add them.
   c. Click *OK*.



New User Group

Name: LDAP-USERGRP

Type: Firewall | Fortinet Single Sign-On (FSSO) | RADIUS Single Sign-On (RSSO) | Guest

Members: fgdocs

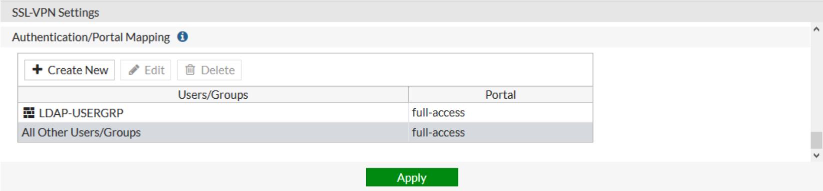
Remote Groups

Remote Server	Group Name
WIN2K16-KLHOME	Any

5. Click *OK*.

To apply the user group to the SSL VPN portal:

1. Go to *VPN* > *SSL-VPN Settings*.
2. In the *Authentication/Portal Mapping* table, click *Create New*.
   a. Set *Users/Groups* to the just created user group.
   b. Configure the remaining settings as required.
   c. Click *OK*.



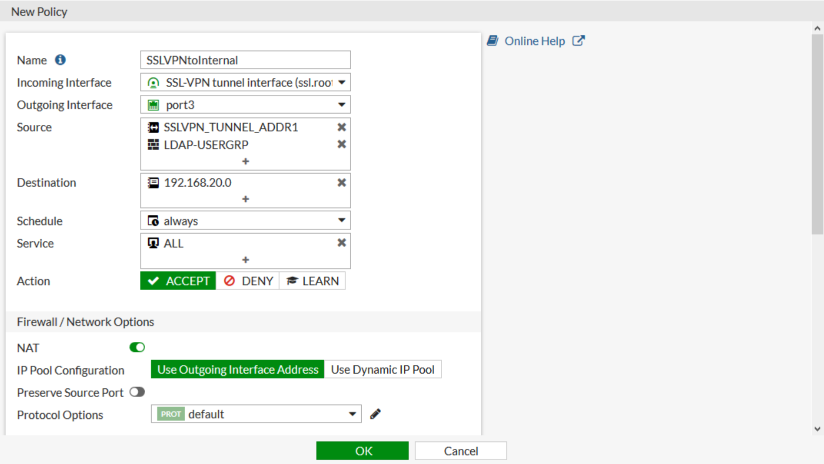
Users/Groups	Portal
LDAP-USERGRP	full-access
All Other Users/Groups	full-access

3. Click *Apply*.

To apply the user group to a firewall policy:

1. Go to *Policy & Objects* > *IPv4 Policy* and click *Create New*.
2. Configure the following:

Name	SSLVPNtoInteral
Incoming Interface	SSL-VPN tunnel interface (ssl.root)
Outgoing Interface	port3
Source	Address - SSLVPN_TUNNEL_ADDR1 User - LDAP-USERGRP
Destination	The address of the internal network. In this case: 192.168.20.0.
Schedule	always
Service	ALL
Action	ACCEPT
NAT	Enabled



New Policy

Name: SSLVPNtoInternal
Incoming Interface: SSL-VPN tunnel interface (ssl.roo
Outgoing Interface: port3
Source: SSLVPN_TUNNEL_ADDR1
LDAP-USERGRP
Destination: 192.168.20.0
Schedule: always
Service: ALL
Action: ✓ ACCEPT | DENY | LEARN

Firewall / Network Options

NAT: ●
IP Pool Configuration: Use Outgoing Interface Address | Use Dynamic IP Pool
Preserve Source Port: ○
Protocol Options: PROT default

3. Configuring the remaining settings as required.
4. Click *OK*.

To configure this example in the CLI:

1. Configure the LDAP server:

```
config user ldap
    edit "WIN2K16-KLHOME"
        set server "192.168.20.6"
        set cnid "sAMAccountName"
        set dn "dc=KLHOME,dc=local"
        set type regular
        set username "KLHOME\\Administrator"
        set password *********
        set secure ldaps
        set ca-cert "CA_Cert_1"
        set port 636
    next
end
```

2. Configure an LDAP user with MFA:

```
config user local
    edit "fgdocs"
        set type ldap
        set two-factor fortitoken
        set fortitoken "FTKMOBxxxxxxxxxx"
        set email-to "fgdocs@fortinet.com"
        set username-case-sensitivity disable
        set ldap-server "WIN2K16-KLHOME"
    next
end
```

3. Disable case sensitivity on the remote user:

```
config user local
    edit "fgdocs"
        set type ldap
        set two-factor fortitoken
        set fortitoken "FTKMOBxxxxxxxxxx"
        set email-to "fgdocs@fortinet.com"
        set username-case-sensitivity disable
        set ldap-server "WIN2K16-KLHOME"
    next
end
```

4. Configure a user group with the remote user and the LDAP server:

```
config user group
    edit "LDAP-USERGRP"
        set member "fgdocs" "WIN2K16-KLHOME"
    next
end
```

5. Apply the user group to the SSL VPN portal:

```
config vpn ssl settings
    set servercert <server certificate>
    set tunnel-ip-pools "SSLVPN_TUNNEL_ADDR1"
    set source-interface "port1"
    set source-address "all"
    set default-portal "web-access"
    config authentication-rule
        edit 1
            set groups "LDAP-USERGRP"
            set portal "full-access"
        next
    end
end
```

6. Apply the user group to a firewall policy:

```
config firewall policy
    edit 5
        set name "SSLVPNtoInternal"
        set srcintf "ssl.root"
        set dstintf "port3"
        set srcaddr "SSLVPN_TUNNEL_ADDR1"
        set dstaddr "192.168.20.0"
        set action accept
        set schedule "always"
        set service "ALL"
        set groups "LDAP-USERGRP"
        set nat enable
    next
end
```

Verification

To setup the VPN connection:

1. Download FortiClient from www.forticlient.com.
2. Open the FortiClient Console and go to *Remote Access*.
3. Add a new connection:
   a. Set the connection name.
   b. Set *Remote Gateway* to the IP of the listening FortiGate interface.

   c. If required, set the *Customize Port*.

4. Save your settings.

To test the connection with case sensitivity disabled:

1. Connect to the VPN:
   a. Log in to the tunnel with the username, using the same case that it is on the FortiGate.
   b. When prompted, enter your FortiToken code.
   You should now be connected.
2. Check the web portal log in using the CLI:

```
# get vpn ssl monitor
SSL VPN Login Users:
 Index   User    Group   Auth Type      Timeout         From     HTTP in/out   HTTPS in/out
 0       fgdocs          LDAP-USERGRP    16(1)           289     192.168.2.202 0/0      0/0

SSL VPN sessions:
 Index   User    Group   Source IP      Duration        I/O Bytes       Tunnel/Dest IP
 0       fgdocs          LDAP-USERGRP    192.168.2.202   45      99883/5572
10.212.134.200
```

3. Disconnect from the VPN connection.
4. Reconnect to the VPN:
   a. Log in to the tunnel with the username, using a different case than on the FortiGate.
   b. When prompted, enter your FortiToken code.
   You should now be connected.
5. Check the web portal log in using the CLI:

```
# get vpn ssl monitor
SSL VPN Login Users:
 Index   User    Group   Auth Type      Timeout         From     HTTP in/out   HTTPS in/out
 0       FGDOCS          LDAP-USERGRP    16(1)           289     192.168.2.202 0/0      0/0

SSL VPN sessions:
 Index   User    Group   Source IP      Duration        I/O Bytes       Tunnel/Dest IP
 0       FGDOCS          LDAP-USERGRP    192.168.2.202   45      99883/5572
10.212.134.200
```

In both cases, the remote user is matched against the remote LDAP user object and prompted for multi-factor authentication.

To test the connection with case sensitivity enabled:

1. Enable case sensitivity for the user:

```
config user local
    edit "fgdocs"
        set username-case-sensitivity enable
    next
end
```

2. Connect to the VPN
   a. Log in to the tunnel with the username, using the same case that it is on the FortiGate.
   b. When prompted, enter your FortiToken code.
      You should now be connected.
3. Check the web portal log in using the CLI:

```
# get vpn ssl monitor
SSL VPN Login Users:
 Index   User    Group   Auth Type      Timeout         From     HTTP in/out   HTTPS in/out
 0       fgdocs          LDAP-USERGRP    16(1)           289     192.168.2.202 0/0      0/0

SSL VPN sessions:
 Index   User    Group   Source IP      Duration        I/O Bytes       Tunnel/Dest IP
 0       fgdocs          LDAP-USERGRP    192.168.2.202   45      99883/5572
10.212.134.200
```

1. Disconnect from the VPN connection.
2. Reconnect to the VPN:
   a. Log in to the tunnel with the username, using a different case than on the FortiGate.
      You will not be prompted for your FortiToken code. You should now be connected.
3. Check the web portal log in using the CLI:

```
# get vpn ssl monitor
SSL VPN Login Users:
 Index   User    Group   Auth Type      Timeout         From     HTTP in/out   HTTPS in/out
 0       FGdocs          LDAP-USERGRP    16(1)           289     192.168.2.202 0/0      0/0

SSL VPN sessions:
 Index   User    Group   Source IP      Duration        I/O Bytes       Tunnel/Dest IP
 0       FGdocs          LDAP-USERGRP    192.168.2.202   45      99883/5572
10.212.134.200
```

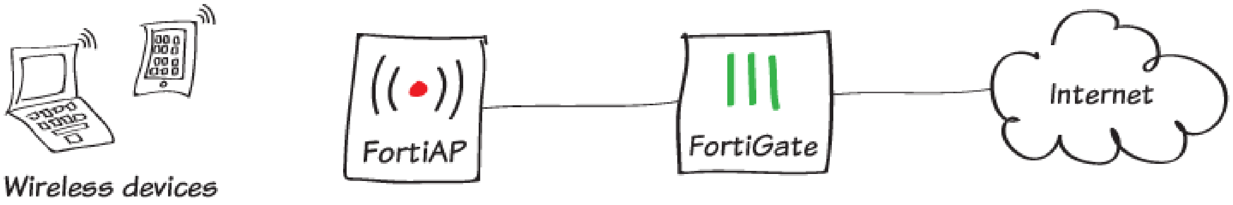
In this case, the user is allowed to log in without a FortiToken code because the entered user name did not match the name defined on the remote LDAP user object. Authentication continues to be evaluated against the LDAP server though, which is not case sensitive.

WiFi

This section contains information about creating and configuring WiFi networks.

Setting up WiFi with FortiAP

FORTIOS VERSION 6.0

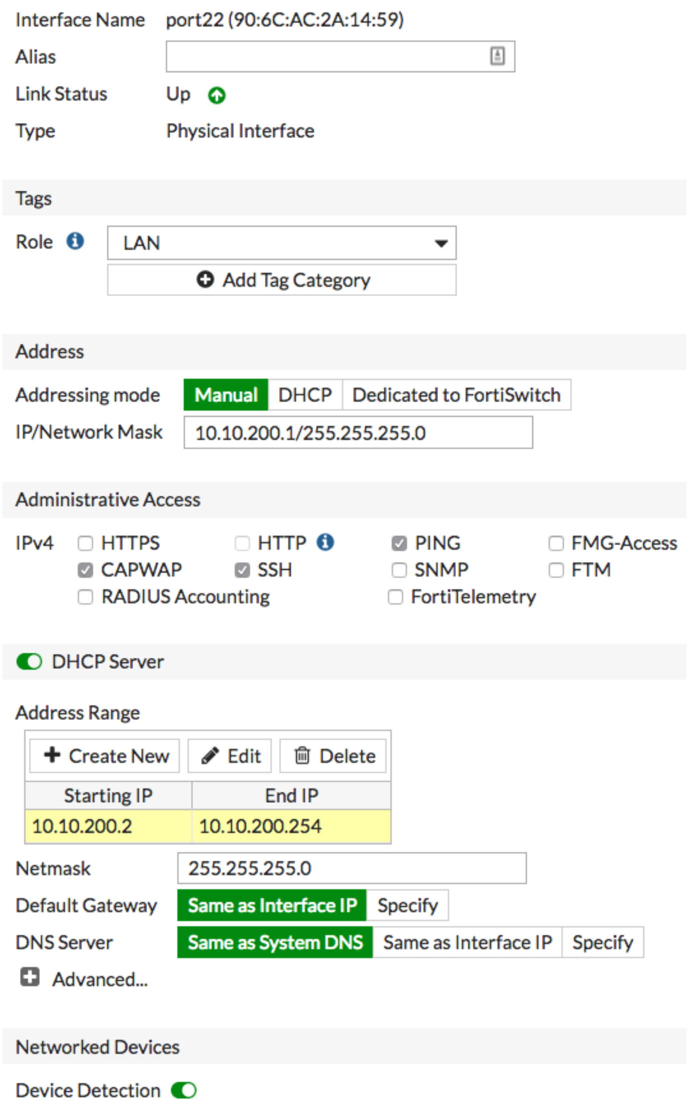


In this recipe, you will set up a WiFi network with by adding a FortiAP in Tunnel mode to your network.

You can configure a FortiAP in either Tunnel mode (default) or Bridge mode. When a FortiAP is in Tunnel mode, a wireless-only subnet is used for wireless traffic. When a FortiAP is in Bridge mode, the Ethernet and WiFi interfaces are connected (or bridged), allowing wired and wireless networks to be on the same subnet.

Connecting FortiAP

1. To edit the interface that will connect to the FortiAP (in the example, **port 22**), go to **Network > Interfaces**.
2. Set **Role** to **LAN** and **Addressing Mode** to **Manual**. Set **IP/Network Mask** to a private IP address (in the example *10.10.200.1/255.255.255.0*).
3. Under **Administrative Access**, enable **CAPWAP**.
4. Enable **DHCP Server**.
5. Under **Networked Devices**, enable **Device Detection**.



Interface Name	port22 (90:6C:AC:2A:14:59)
Alias	
Link Status	Up
Type	Physical Interface

Tags

Role LAN

Add Tag Category

Address

Addressing mode [✓ Manual] DHCP Dedicated to FortiSwitch

IP/Network Mask 10.10.200.1/255.255.255.0

Administrative Access

IPv4 □ HTTPS □ HTTP ☑ PING □ FMG-Access
☑ CAPWAP ☑ SSH □ SNMP □ FTM
□ RADIUS Accounting □ FortiTelemetry

DHCP Server

Address Range

Create New Edit Delete

Starting IP	End IP
10.10.200.2	10.10.200.254

Netmask 255.255.255.0

Default Gateway [✓ Same as Interface IP] Specify

DNS Server [✓ Same as System DNS] Same as Interface IP Specify

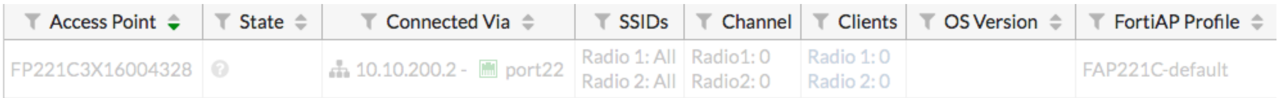
Advanced...

Networked Devices

Device Detection

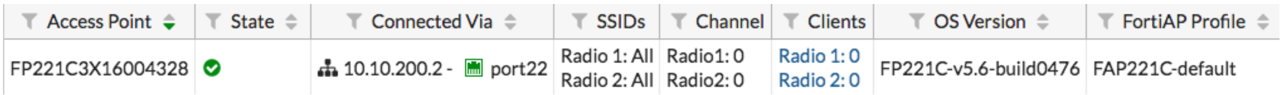
6. Connect the FortiAP unit to the interface.
7. To view the list of managed FortiAPs, go to **WiFi & Switch Controller > Managed FortiAPs**. The newFortiAP appears in the list but it is grayed out because it is not authorized. If the FortiAP does not appear, wait a few minutes, then refresh the page.

   Select the FortiAP, and select **Authorize**.



Access Point	State	Connected Via	SSIDs	Channel	Clients	OS Version	FortiAP Profile
FP221C3X16004328		10.10.200.2 - port22	Radio 1: All Radio 2: All	Radio1: 0 Radio2: 0	Radio 1: 0 Radio 2: 0		FAP221C-default

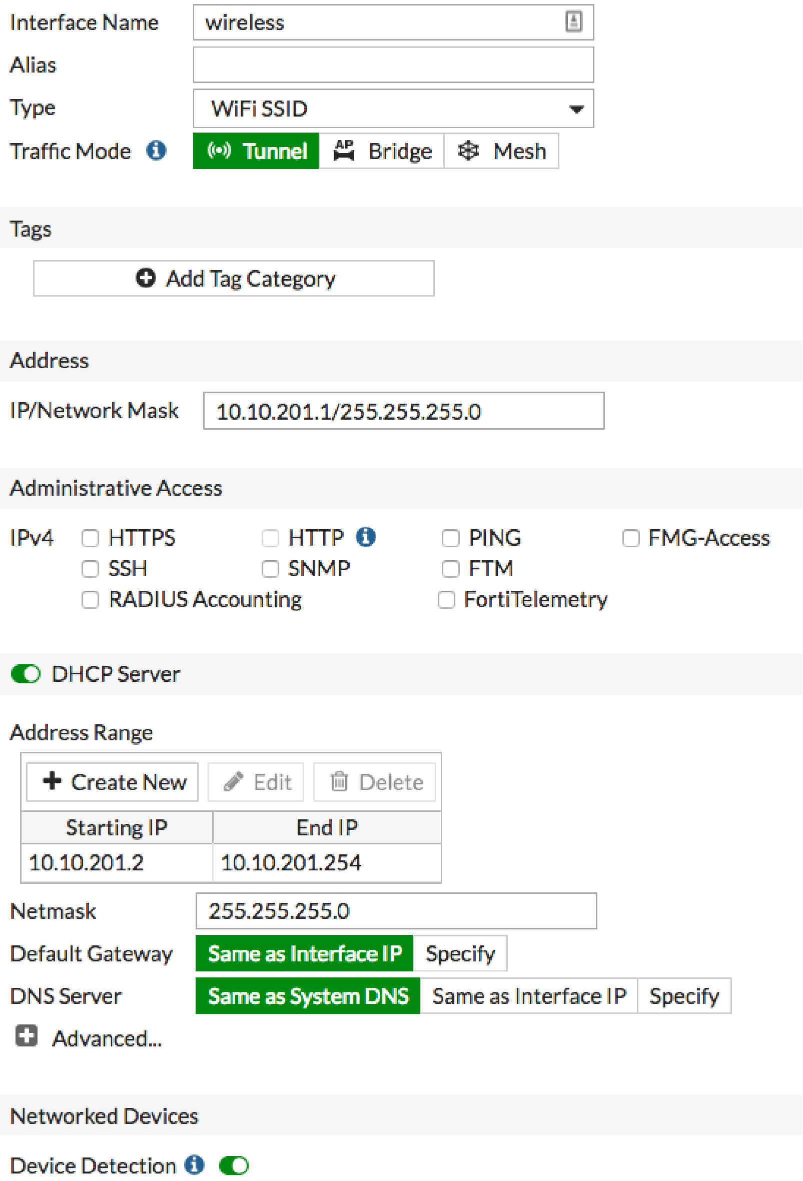
8. After a few minutes, select **Refresh**. The FortiGate shows the FortiAP as authorized.



Access Point	State	Connected Via	SSIDs	Channel	Clients	OS Version	FortiAP Profile
FP221C3X16004328	✓	10.10.200.2 - port22	Radio 1: All Radio 2: All	Radio1: 0 Radio2: 0	Radio 1: 0 Radio 2: 0	FP221C-v5.6-build0476	FAP221C-default

Creating an SSID

1. To create a new SSID to be broadcast for WiFi users, go to **WiFi & Switch Controller > SSID**.
2. Set **Traffic Mode** to **Tunnel** and set **IP/Network Mask** to a private IP address (in the example *10.10.201.1/255.255.255.0*).
3. Enable **DHCP Server** and **Device Detection**.



Interface Name	wireless
Alias	
Type	WiFi SSID
Traffic Mode	[✓ Tunnel] Bridge Mesh

Tags

Add Tag Category

Address

IP/Network Mask	10.10.201.1/255.255.255.0

Administrative Access

IPv4 □ HTTPS □ HTTP □ PING □ FMG-Access
□ SSH □ SNMP □ FTM
□ RADIUS Accounting □ FortiTelemetry

DHCP Server

Address Range

Create New Edit Delete

Starting IP	End IP
10.10.201.2	10.10.201.254

Netmask	255.255.255.0
Default Gateway	[✓ Same as Interface IP] Specify
DNS Server	[✓ Same as System DNS] Same as Interface IP Specify

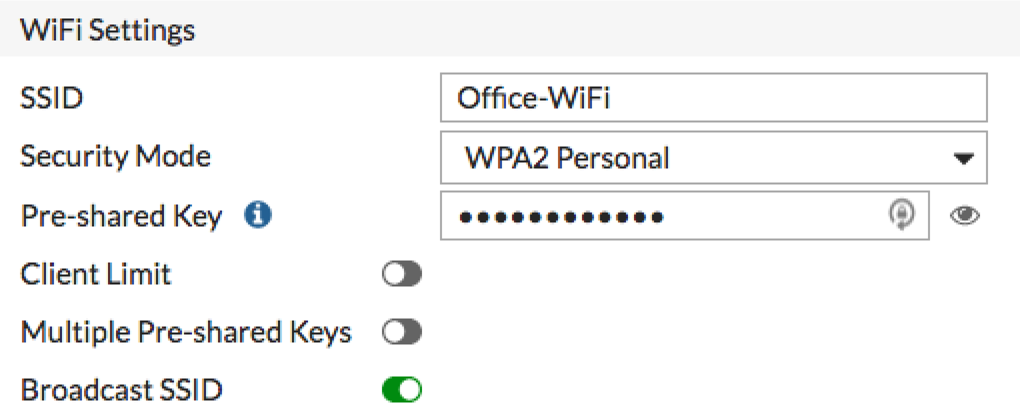
Advanced...

Networked Devices

Device Detection

4. Under **WiFi Settings**, name the **SSID** (in the example, *Office-WiFi*) and set a secure **Pre-shared Key**.

5. Enable **Broadcast SSID**.

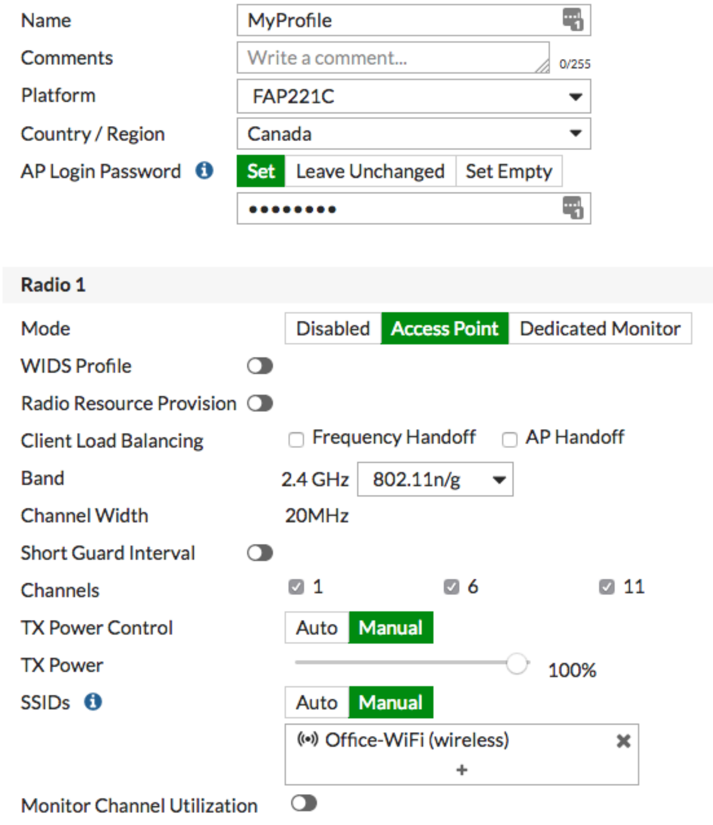


WiFi Settings

SSID	Office-WiFi
Security Mode	WPA2 Personal
Pre-shared Key	•••••••••••••
Client Limit	○
Multiple Pre-shared Keys	○
Broadcast SSID	●

Creating a custom FortiAP profile

1. To create a new FortiAP profile, go **to WiFi & Switch Controller > FortiAP Profiles**.
2. Set Platform to the FortiAP model you are using (in the example, **FAP221C**) and **Country/Region** to the appropriate location.
3. Set an **AP Login Password** to secure the FortiAP.
4. Under **Radio 1**, set **Mode** to **Access Point** and **SSIDs** to **Manual**. Add your new SSID.



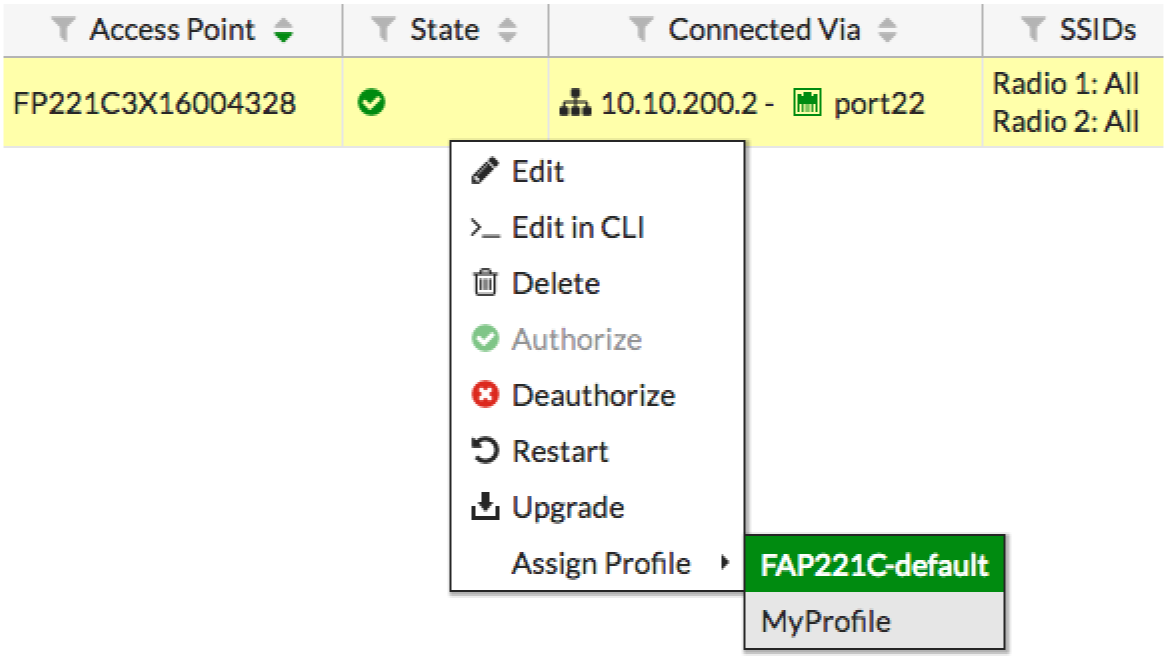
Name	MyProfile
Comments	Write a comment... 0/255
Platform	FAP221C
Country / Region	Canada
AP Login Password	[✓ Set] Leave Unchanged Set Empty ••••••••

Radio 1

Mode	Disabled [✓ Access Point] Dedicated Monitor
WIDS Profile	○
Radio Resource Provision	○
Client Load Balancing	□ Frequency Handoff □ AP Handoff
Band	2.4 GHz 802.11n/g
Channel Width	20MHz
Short Guard Interval	○
Channels	☑ 1 ☑ 6 ☑ 11
TX Power Control	Auto [✓ Manual]
TX Power	100%
SSIDs	Auto [✓ Manual] Office-WiFi (wireless) ✖ +
Monitor Channel Utilization	○

5. To assign the new profile, go to **WiFi & Switch Controller > Managed FortiAPs** and right-click the FortiAP.

Select **Assign Profile** and set the FortiAP to use the new profile.

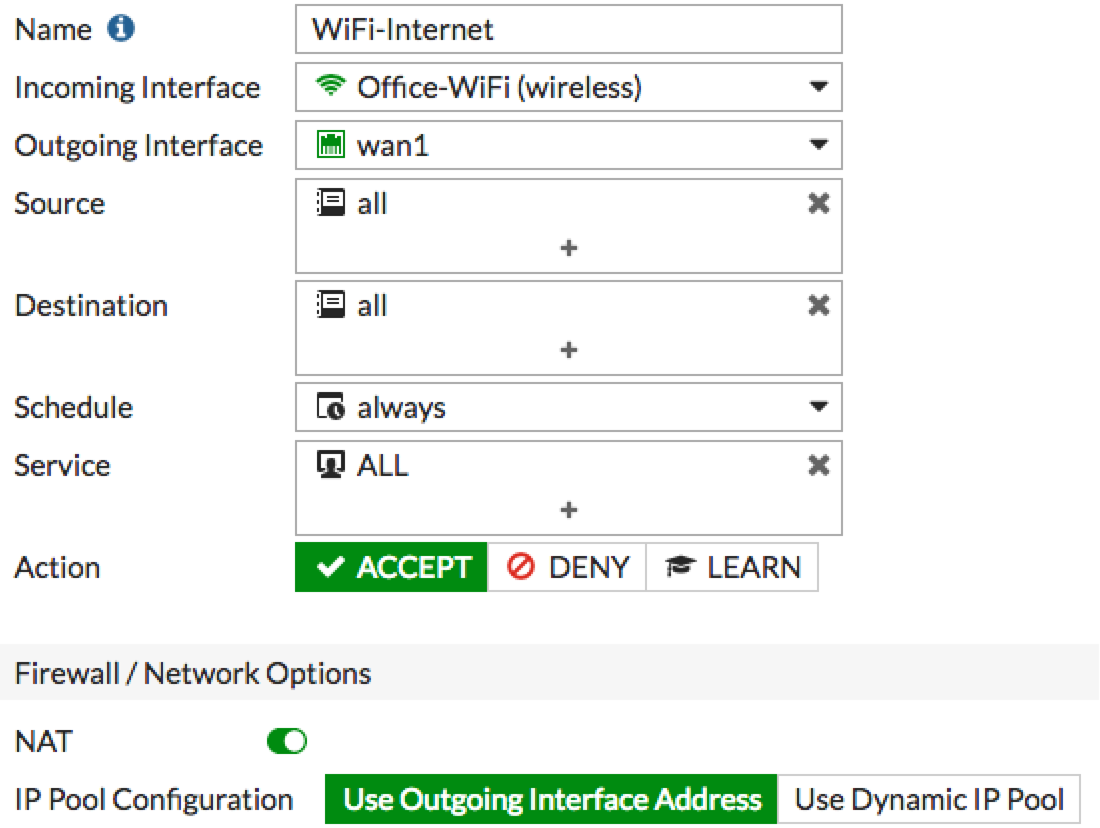


Access Point	State	Connected Via	SSIDs
FP221C3X16004328	✓	10.10.200.2 - port22	Radio 1: All Radio 2: All

Creating a security policy

1. To create a new policy for wireless Internet access, go **to Policy & Objects > IPv4 Policy** and select **Create New**.
2. Set **Incoming Interface** to the SSID and **Outgoing Interface** to your Internet-facing interface.

3. Enable **NAT**.



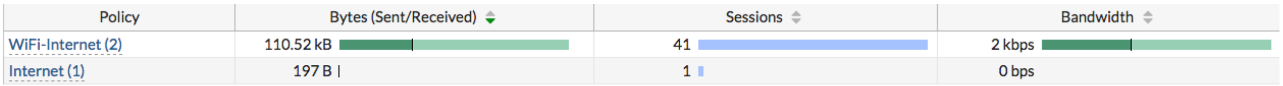
Name	WiFi-Internet
Incoming Interface	Office-WiFi (wireless)
Outgoing Interface	wan1
Source	all
Destination	all
Schedule	always
Service	ALL
Action	[✓ ACCEPT] DENY LEARN

Firewall / Network Options

NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

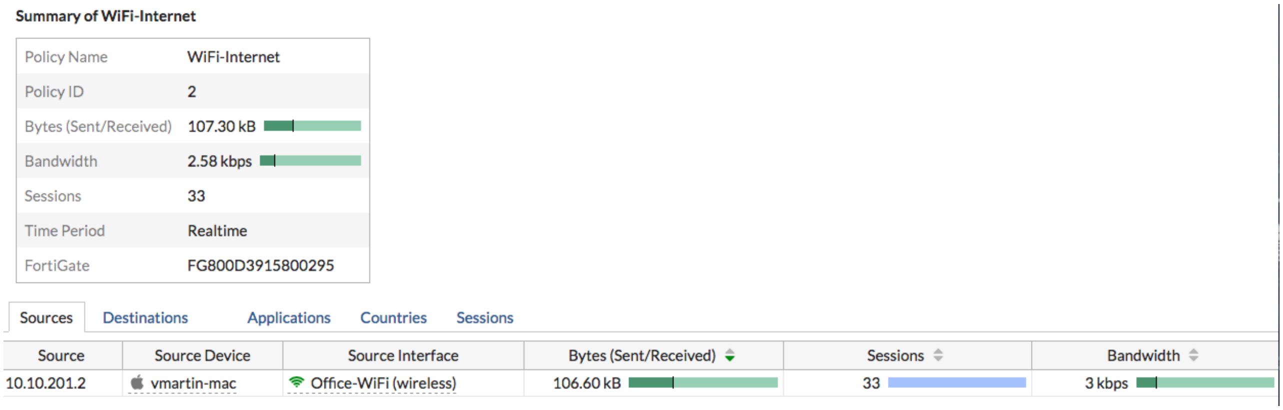
Results

1. Connect to the SSID with a wireless device. After a connection is established, browse the Internet to generate traffic.
2. To view the traffic using the wireless Internet access policy, go to **FortiView > All Segments > Polices**.



Policy	Bytes (Sent/Received)	Sessions	Bandwidth
WiFi-Internet (2)	110.52 kB	41	2 kbps
Internet (1)	197 B	1	0 bps

3. To view more information about this traffic, right-click the policy and select **Drill Down to Details**.



Summary of WiFi-Internet

Policy Name	WiFi-Internet
Policy ID	2
Bytes (Sent/Received)	107.30 kB
Bandwidth	2.58 kbps
Sessions	33
Time Period	Realtime
FortiGate	FG800D3915800295

Source	Source Device	Source Interface	Bytes (Sent/Received)	Sessions	Bandwidth
10.10.201.2	vmartin-mac	Office-WiFi (wireless)	106.60 kB	33	3 kbps

For further reading, check out Configuring a WiFi LAN in the FortiOS 6.0 Online Help.

Replacing the Fortinet_Wifi certificate

These instruction apply to FortiWiFi devices using internal WiFi radios and FortiGate/FortiWiFi devices configured as WiFi Controllers that are managing FortiAP devices, and have WiFi clients that are connected to WPA2-Enterprise SSID and authenticated with local user groups.

On FortiOS, the built-in *Fortinet_Wifi* certificate is a publicly signed certificate that is only used in WPA2-Enterprise SSIDs with local user-group authentication. The default WiFi certificate configuration is:

```
config system global
    set wifi-ca-certificate "Fortinet_Wifi_CA"
    set wifi-certificate "Fortinet_Wifi"
end
```

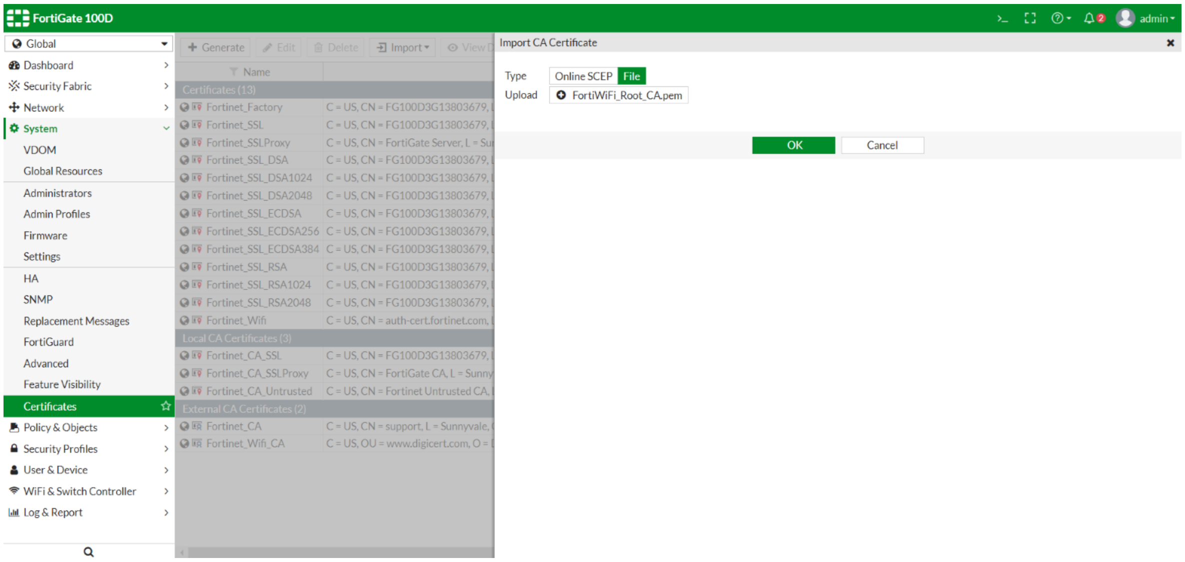
WiFi administrators must consider the following factors:

- The *Fortinet_Wifi* certificate is issued to *Fortinet Inc.* with common name (CN) *auth-cert.fortinet.com*. If a company or organization requires their own CN in their WiFi deployment, they must replace it with their own certificate.
- The *Fortinet_Wifi* certificate has an expire date. When it is expiring, it must be renewed or replaced with a new certificate.

To replace the Fortinet_Wifi certificate:

1. Get new certificate files, including a root CA certificate, a certificate signed by the CA, and the corresponding private key file:
   Purchase a publicly signed certificate from a commercial certificate service provider, or generate a self-signed certificate.
2. Import the new certificate files into FortiOS:
   a. On the FortiGate, go to *System* > *Certificates*.
      If VDOMs are enable, got to *Global* > *System* > *Certificates*.
   b. Click *Import* > *CA Certificate*.

c. Set the *Type* to *File* and upload the CA certificate file from the management computer.



Import CA Certificate

Type: Online SCEP | **File**

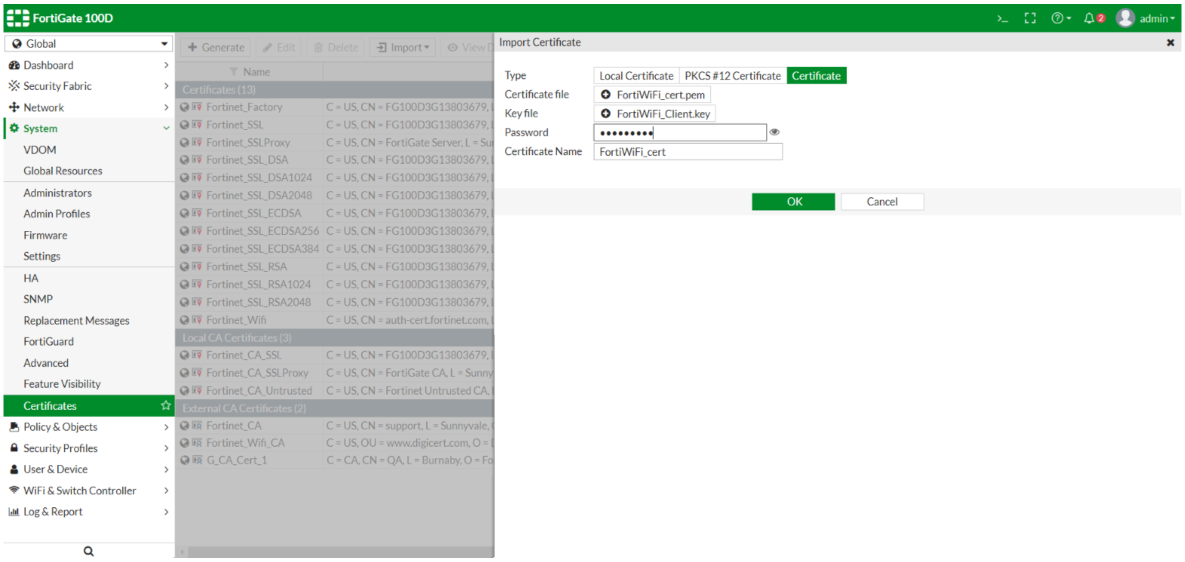
Upload: FortiWiFi_Root_CA.pem

d. Click *OK*.

The imported CA certificate is named *CA_Cert_N*, or *G_CA_Cert_N* when VDOMs are enabled, where *N* starts from *1* and increments for each imported certificate, and *G* stands for global range.

e. Click *Import* > *Local Certificate*.

f. Set the *Type* to *Certificate*, upload the certificate file and key file, enter the password, and enter the certificate name.



Import Certificate

Type: Local Certificate | PKCS #12 Certificate | **Certificate**

Certificate file: FortiWiFi_cert.pem

Key file: FortiWiFi_Client.key

Password: •••••••••

Certificate Name: FortiWiFi_cert

g. Click *OK*.

The imported certificates are listed on the *Certificates* page.

3. Change the WiFi certificate settings:

```
config system global
    set wifi-ca-certificate <name of the imported CA certificate>
    set wifi-certificate <name of the imported certificate signed by the CA>
end
```

Notes

If necessary, the factory default certificates can also be used to replace the certificates:

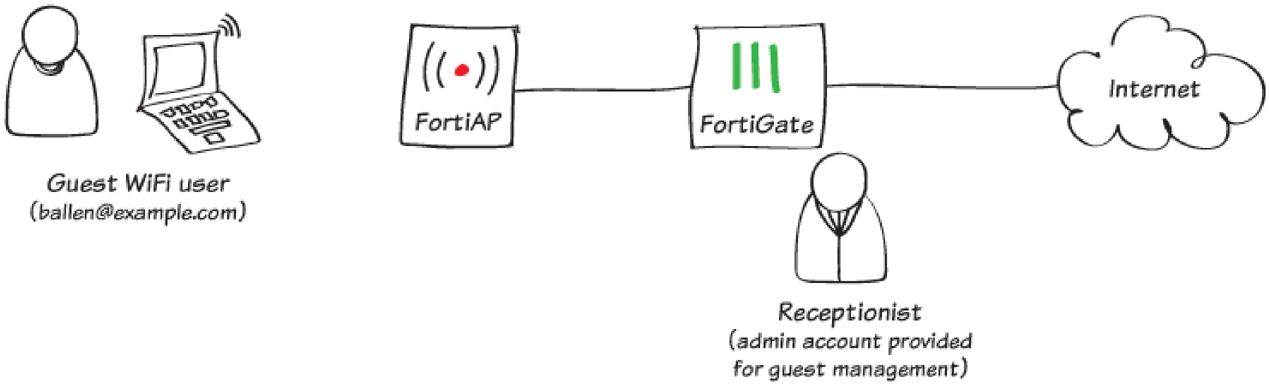
```
config system global
    set wifi-ca-certificate "Fortinet_CA"
    set wifi-certificate "Fortinet_Factory"
end
```

As the factory default certificates are self-signed, WiFi clients will need to accept it at the connection prompt, or import the *Fortinet_CA* certificate to validate it.

If the built-in *Fortinet_Wifi* certificate has expired and not been renewed or replaced, WiFi clients can still connect to the WPA2-Enterprise SSID with local user-group authentication by ignoring any prompted warning messages or bypassing *Validate server certificate* (or similar) options.

With FortiOS 6.0.1 and later, the *Fortinet_Wifi* certificate can be updated automatically through the FortiGuard service certificate bundle update.

Guest WiFi accounts

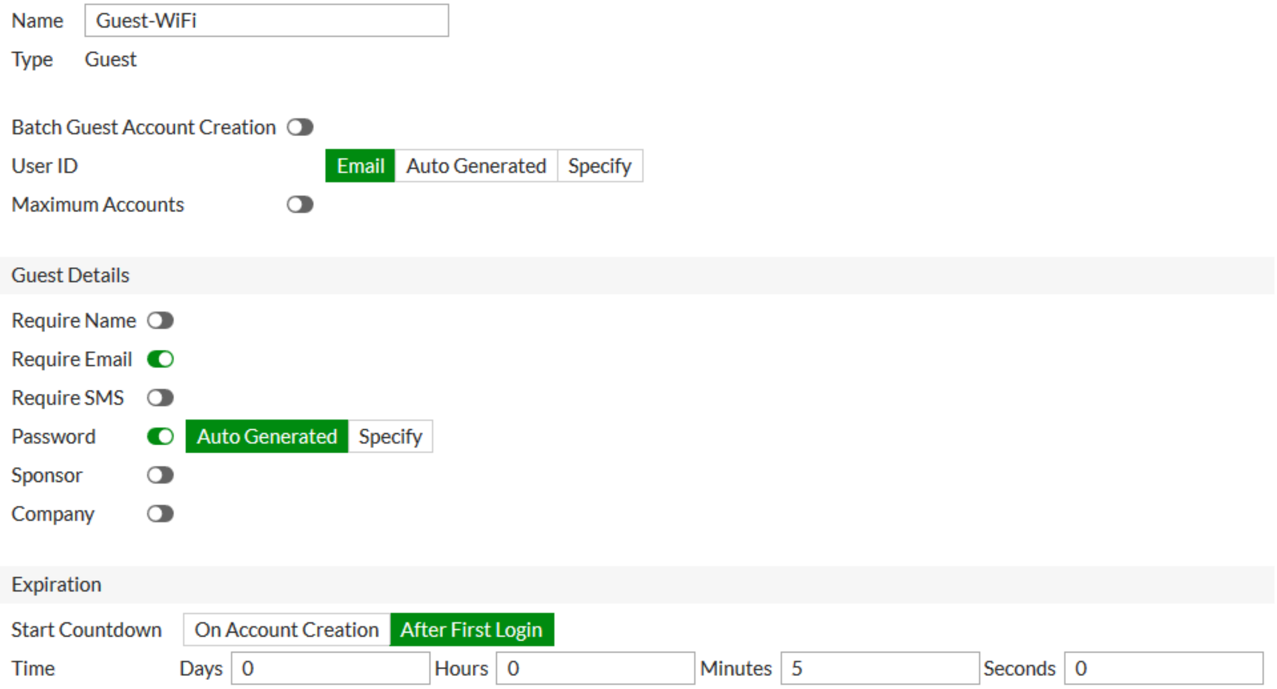


In this recipe, you create temporary guest accounts that can connect to your WiFi network after authenticating using a captive portal. To make management easier, you also create a separate administrative account that can only be used to manage guest accounts.

This example uses a FortiAP in Tunnel mode to provide WiFi access to guests. For information about configuring the FortiAP, see Setting up WiFi with FortiAP on page 344.

Creating a guest user group

1. To create a guest user group, go to **User & Device > User Groups** and create a new group.
2. Set **Type** to **Guest** and set **User ID** to **Email**.
3. Under **Guest Details**, enable **Require Email**, enable **Password**, and set the password to **Auto Generated**.
4. Under **Expiration**, set **Start Countdown to After First Login** and set **Time** to 5 minutes for testing purposes.



Name: Guest-WiFi
Type: Guest

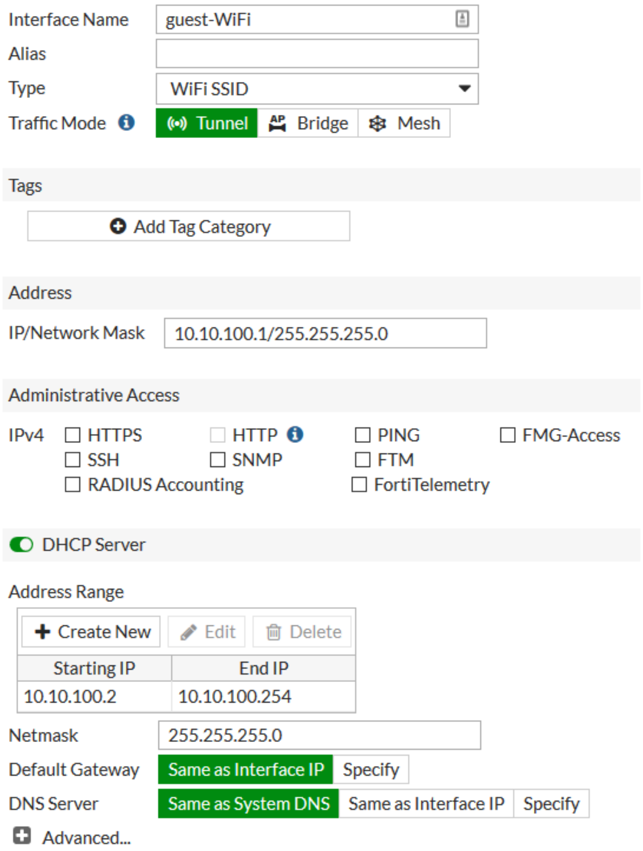
Batch Guest Account Creation ○
User ID: [✓ Email] Auto Generated Specify
Maximum Accounts ○

Guest Details
Require Name ○
Require Email ●
Require SMS ○
Password ● [✓ Auto Generated] Specify
Sponsor ○
Company ○

Expiration
Start Countdown: On Account Creation [✓ After First Login]
Time: Days 0 Hours 0 Minutes 5 Seconds 0

Creating an SSID

1. To create an SSID for guest users, go to **WiFi & Switch Controller > SSID** and create a new SSID.
2. Set **Traffic Mode** to **Tunnel**. Assign an **IP/Network Mask** to the interface and enable **DHCP Server**.



Interface Name: guest-WiFi

Alias:

Type: WiFi SSID

Traffic Mode: [✓ Tunnel] Bridge Mesh

Tags

Add Tag Category

Address

IP/Network Mask: 10.10.100.1/255.255.255.0

Administrative Access

IPv4 □ HTTPS □ HTTP □ PING □ FMG-Access □ SSH □ SNMP □ FTM □ RADIUS Accounting □ FortiTelemetry

DHCP Server

Address Range

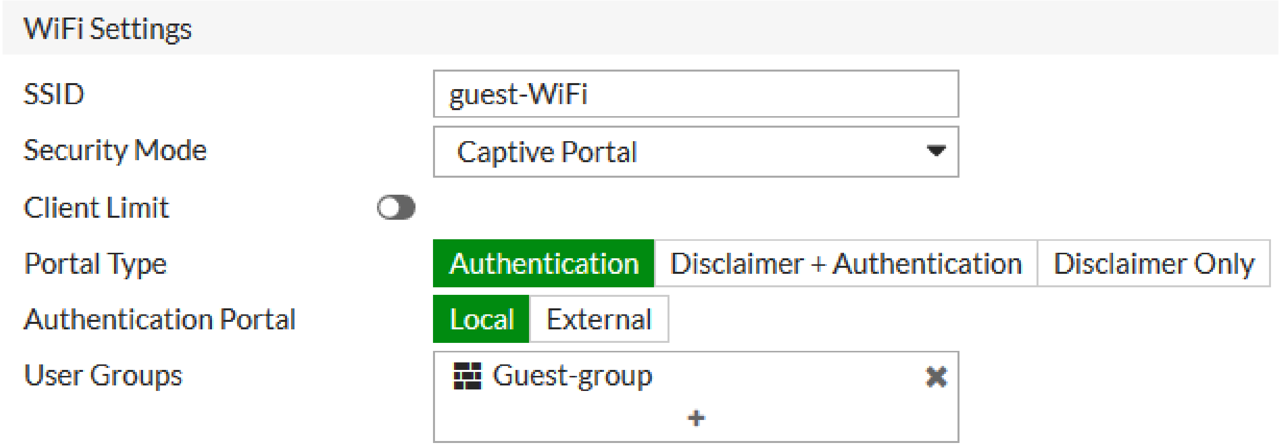
Starting IP	End IP
10.10.100.2	10.10.100.254

Netmask: 255.255.255.0

Default Gateway: [✓ Same as Interface IP] Specify

DNS Server: [✓ Same as System DNS] Same as Interface IP Specify

3. Under WiFi Settings, set the following:
   - **Security Mode** to **Captive Portal**
   - **Portal Type** to **Authentication**
   - **User Groups** to the guest user group



WiFi Settings

SSID: guest-WiFi

Security Mode: Captive Portal

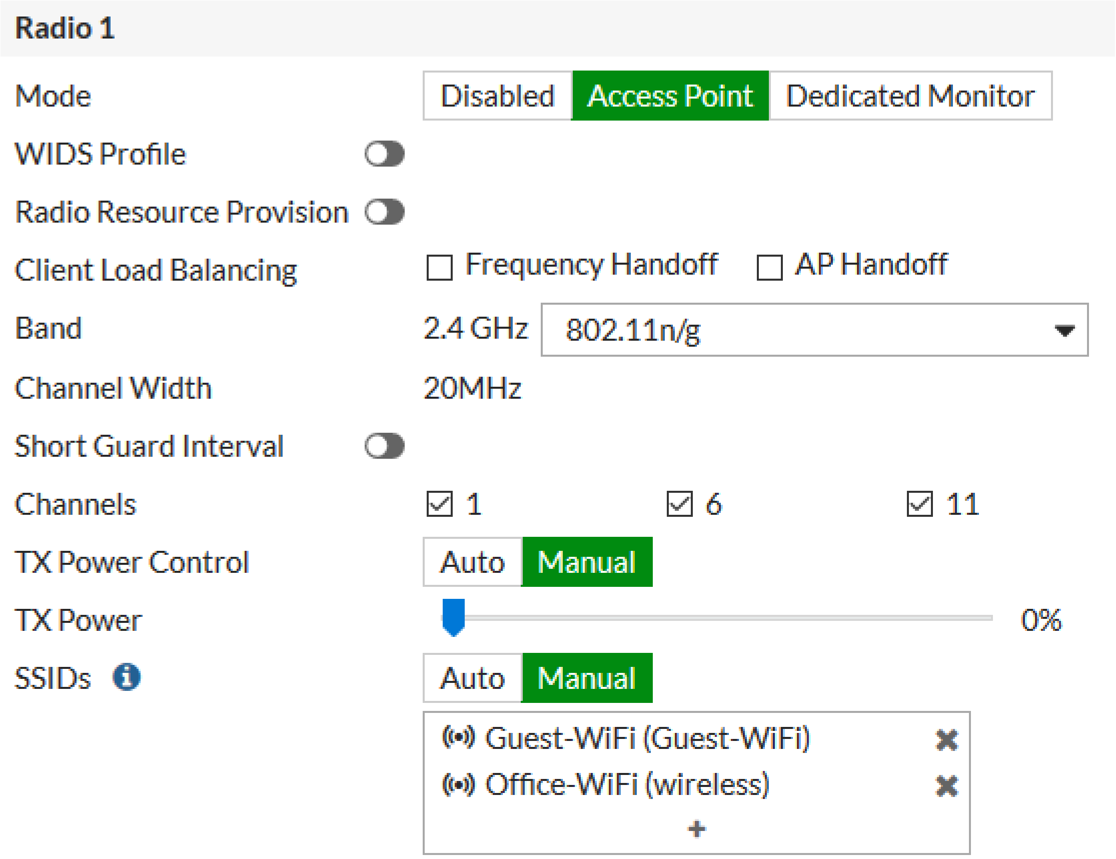
Client Limit: ○

Portal Type: [✓ Authentication] Disclaimer + Authentication Disclaimer Only

Authentication Portal: [✓ Local] External

User Groups: Guest-group

4. To broadcast the new SSID, go to **WiFi & Switch Controller > FortiAP Profiles** and edit the profile used by the FortiAP.
5. Under **Radio 1** set **SSIDs** to include the new SSID.



Radio 1

Mode: Disabled | **Access Point** | Dedicated Monitor

WIDS Profile: ○

Radio Resource Provision: ○

Client Load Balancing: □ Frequency Handoff □ AP Handoff

Band: 2.4 GHz 802.11n/g

Channel Width: 20MHz

Short Guard Interval: ○

Channels: ☑ 1 ☑ 6 ☑ 11

TX Power Control: Auto | **Manual**

TX Power: 0%

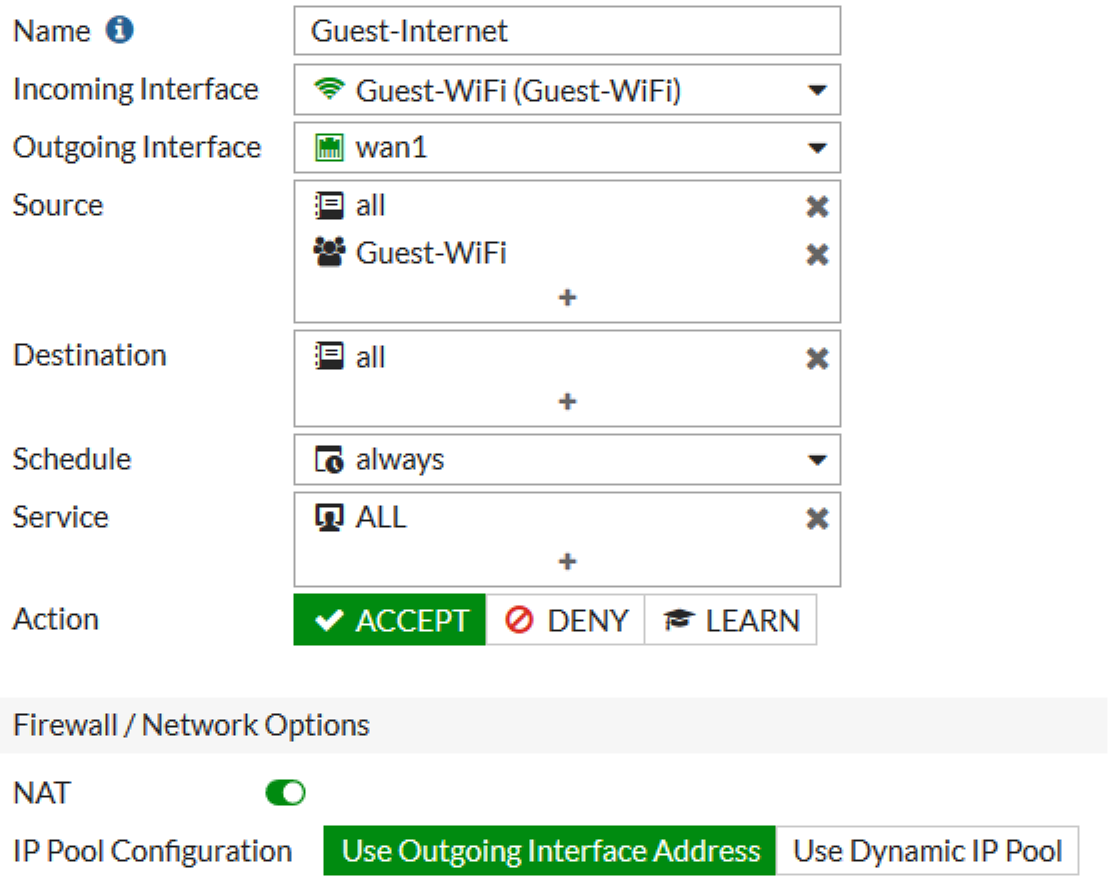
SSIDs: Auto | **Manual**

- Guest-WiFi (Guest-WiFi)
- Office-WiFi (wireless)

Creating a security policy

1. To allow WiFi guest users to access the Internet, go to **Policy & Objects > IPv4 Policy** and create a new policy.
2. Set **Incoming Interface** to the guest SSID and set **Outgoing Interface** to your Internet-facing interface. Select **Source** and set **Address** to **all** and **User** to the guest user group.

3. Enable **NAT**.



Name	Guest-Internet
Incoming Interface	Guest-WiFi (Guest-WiFi)
Outgoing Interface	wan1
Source	all Guest-WiFi
Destination	all
Schedule	always
Service	ALL
Action	✓ ACCEPT ● DENY ● LEARN

Firewall / Network Options

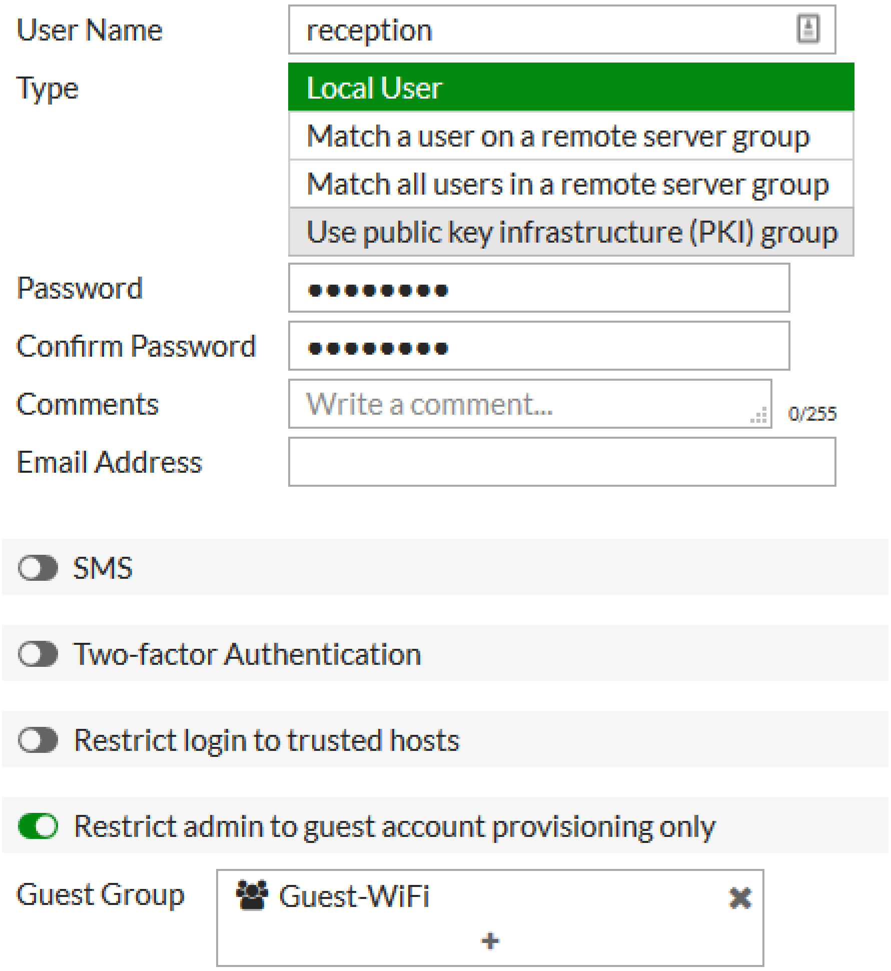
NAT	●
IP Pool Configuration	[✓ Use Outgoing Interface Address] Use Dynamic IP Pool

Creating a guest user management account

To simplify guest account creation, you can create an admin account that is only used for guest user management. This allows new accounts to be made as needed without requiring full administrative access to the FortiGate. In this example, the account is made for use by receptionist.

1. To create the guest management account, go to **System > Administrators** and create a new account.
2. Set a **User Name** and set **Type** to **Local User**. Set and confirm a **Password**.
3. Enable **Restrict admin to guest account provisioning only** and set **Guest Group** to the WiFi guest user

group.



User Name	reception
Type	Local User
Password	••••••••
Confirm Password	••••••••
Comments	Write a comment... 0/255
Email Address	

○ SMS

○ Two-factor Authentication

○ Restrict login to trusted hosts

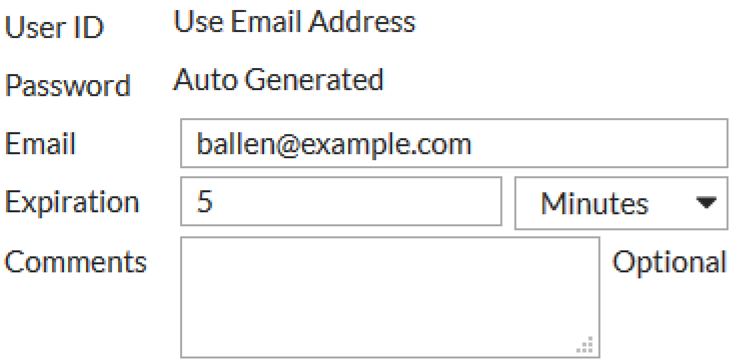
● Restrict admin to guest account provisioning only

Guest Group: Guest-WiFi

Match a user on a remote server group
Match all users in a remote server group
Use public key infrastructure (PKI) group
+

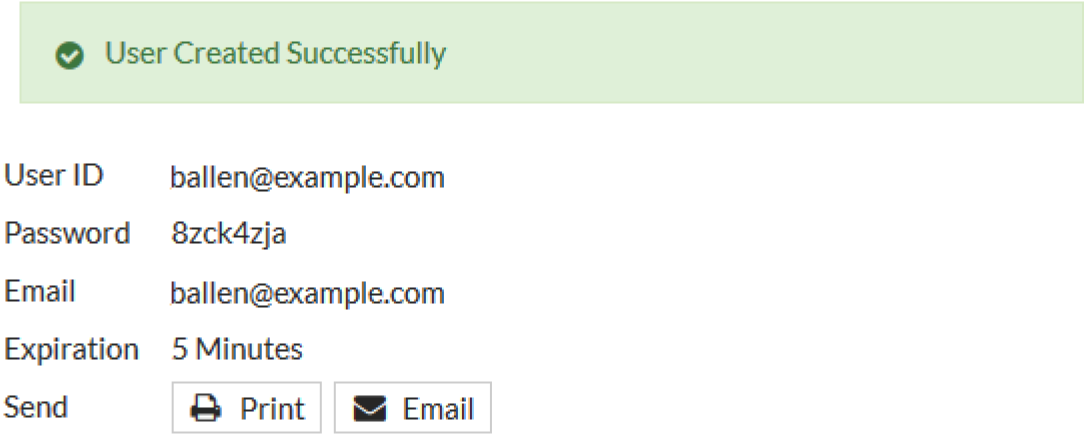
Creating a guest user account

1. Using the receptionist account, create a guest account.
2. Set **Email** to the user's email address (in the example, ballen@example.com). To test the account, set **Expiration** to **5 Minutes**.



User ID	Use Email Address
Password	Auto Generated
Email	ballen@example.com
Expiration	5 Minutes
Comments	Optional

3. After you select **OK**, a **User Created Successfully** notice appears that shows the new account's **Password**. This password can then be printed or emailed to the guest user. You can also view the password by editing the user account.

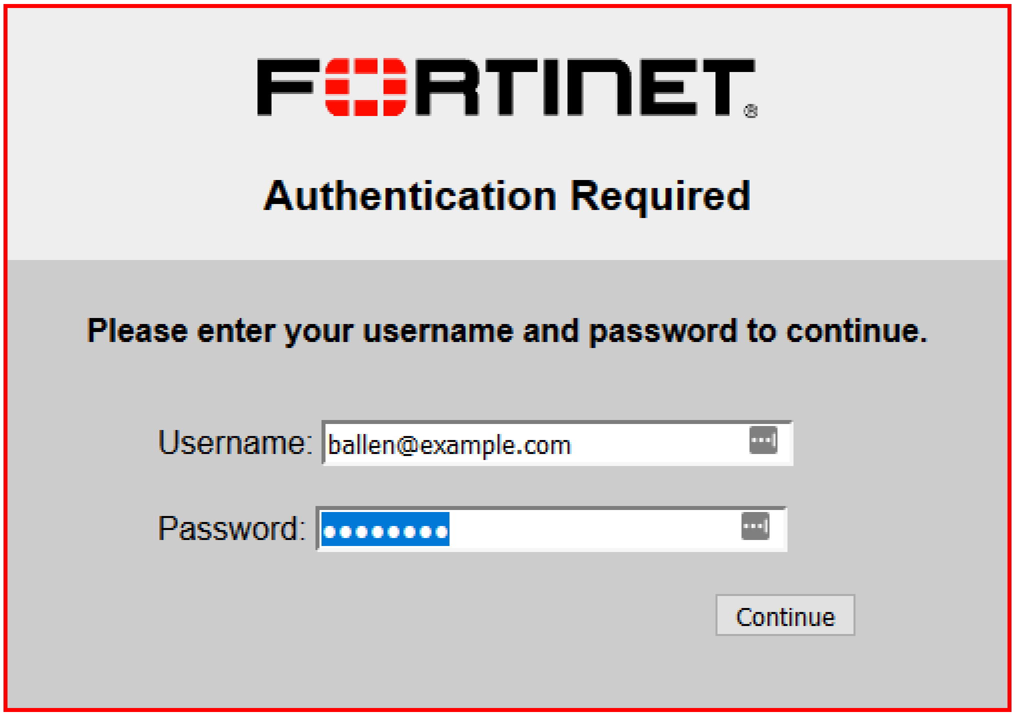


User Created Successfully

User ID	ballen@example.com
Password	8zck4zja
Email	ballen@example.com
Expiration	5 Minutes
Send	Print Email

Results

1. On a PC, connect to the guest SSID and attempt to browse the Internet. When the authentication screen appears, log in using the guest user's credentials.



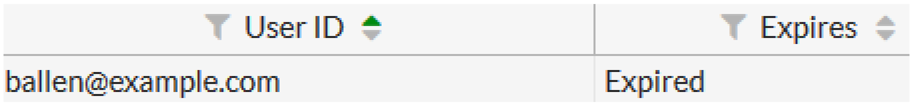
Authentication Required

Please enter your username and password to continue.

Username: ballen@example.com

Password: ••••••••

2. After the account is authenticated, you can connect to the Internet.
3. Five minutes after the initial login, the guest user account will expire and you will no longer be able to log in using those credentials.
4. Use the reception account to log on to the FortiGate. The guest account is listed as **Expired**.



User ID	Expires
ballen@example.com	Expired