



# FortiOS - Azure Administration Guide

Version 6.4

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FortiOS 6.4 Azure Administration Guide

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# About FortiGate-VM for Azure

By combining stateful inspection with a comprehensive suite of powerful security features, FortiGate next generation firewall technology delivers complete content and network protection. This solution is available for deployment on Microsoft Azure.

In addition to advanced features such as an extreme threat database, vulnerability management, and flow-based inspection, features including application control, firewall, antivirus, IPS, web filter, and VPN work in concert to identify and mitigate the latest complex security threats.

FortiGate-VM for Azure supports active/passive high availability (HA) configuration with FortiGate-native unicast HA synchronization between the primary and secondary nodes. When the FortiGate-VM detects a failure, the passive firewall instance becomes active and uses Azure API calls to configure its interfaces/ports.

FortiGate-VM also supports active/active HA using Azure load balancer.

Highlights of FortiGate-VM for Azure include the following:

- Delivers complete content and network protection by combining stateful inspection with a comprehensive suite of powerful security features.
- IPS technology protects against current and emerging network-level threats. In addition to signature-based threat detection, IPS performs anomaly-based detection, which alerts users to any traffic that matches attack behavior profiles.
- Docker application control signatures protect your container environments from newly emerged security threats. See [FortiGate-VM on a Docker environment](#).

## Instance type support

FortiGate supports the following instance types on Azure.

Supported instances on the Azure marketplace listing may change without notice and may vary between bring your own license (BYOL) and pay as you go. Instance types of the A- and D-series no longer appear as deployable instances at the time you install the FortiGate virtual machine (VM) on the marketplace launcher. FortiGate supports compute optimized instances (F-series, Fs-series, and Fsv2-series) and general purpose instances (Dv2-series, DSv2-series, Dv3-series, and Dsv3-series).

For up-to-date information on each instance type, see the following links:

- [Sizes for Linux virtual machines in Azure](#)
- [Compute optimized virtual machine sizes](#)
- [General purpose virtual machine sizes](#)

The following table provides information on compute-optimized instance types:

Instance type	vCPU	Max NIC	Recommended BYOL license
<b>F-series</b>			

Instance type	vCPU	Max NIC	Recommended BYOL license
Standard_F2	2	2	FG-VM02 or FG-VM02v
Standard_F4	4	4	FG-VM04 or FG-VM04v
Standard_F8	8	8	FG-VM08 or FG-VM08v
Standard_F16	16	8	FG-VM16 or FG-VM16v
<b>Fs-series</b>			
Standard_F2s	2	2	FG-VM02 or FG-VM02v
Standard_F4s	4	4	FG-VM04 or FG-VM04v
Standard_F8s	8	8	FG-VM08 or FG-VM08v
Standard_F16s	16	8	FG-VM16 or FG-VM16v
<b>Fsv2-series</b>			
Standard_F2s_v2	2	2	FG-VM02 or FG-VM02v
Standard_F4s_v2	4	2	FG-VM04 or FG-VM04v
Standard_F8s_v2	8	4	FG-VM08 or FG-VM08v
Standard_F16s_v2	16	4	FG-VM16 or FG-VM16v
Standard_F32s_v2	32	8	FG-VM32 or FG-VM32v

The following table provides information on general purpose instance types:

Instance type	vCPU	Max NIC	Recommended BYOL license
<b>Dv2-series</b>			
Standard_D1_v2	1	2	FG-VM01 or FG-VM01v
Standard_D2_v2	2	2	FG-VM02 or FG-VM02v
Standard_D3_v2	4	4	FG-VM04 or FG-VM04v
Standard_D4_v2	8	8	FG-VM08 or FG-VM08v
Standard_D5_v2	16	8	FG-VM16 or FG-VM16v
<b>Dv3-series</b>			
Standard_D2_v3	2	2	FG-VM02 or FG-VM02v
Standard_D4_v3	4	2	FG-VM04 or FG-VM04v
Standard_D8_v3	8	4	FG-VM08 or FG-VM08v
Standard_D16_v3	16	8	FG-VM16 or FG-VM16v
Standard_D32_v3	32	8	FG-VM32 or FG-VM32v

Instance type	vCPU	Max NIC	Recommended BYOL license
<b>DSv2-series</b>			
Standard_DS1_v2	1	2	FG-VM01 or FG-VM01v
Standard_DS2_v2	2	2	FG-VM02 or FG-VM02v
Standard_DS3_v2	4	4	FG-VM04 or FG-VM04v
Standard_DS4_v2	8	8	FG-VM08 or FG-VM08v
Standard_DS5_v2	16	8	FG-VM16 or FG-VM16v
<b>Dsv3-series</b>			
Standard_D2s_v3	2	2	FG-VM02 or FG-VM02v
Standard_D4s_v3	4	2	FG-VM04 or FG-VM04v
Standard_D8s_v3	8	4	FG-VM08 or FG-VM08v
Standard_D16s_v3	16	8	FG-VM16 or FG-VM16v
Standard_D32s_v3	32	8	FG-VM32 or FG-VM32v

FortiOS 6.4.3 and later versions support hot-adding vCPU and RAM. However, Azure may not support this. See [Resize a virtual machine using the Azure portal or PowerShell](#).

## Region support

Azure region support can mean one of the following:

- FortiGate-VM is available for purchase in a specific region.
- You can deploy FortiGate-VM on the data center located in the chosen region within the Azure portal. They are the “locations”.
- You can deploy FortiGate-VM on regional Azure, such as in China, Germany, and U.S. Gov. Each has its own URL domain.

FortiGate-VM is available for purchase in all regions where Azure is commercially available. See the [Azure pricing FAQ](#).

In terms of the location where you deploy FortiGate-VM, ensure that quota is available. Some limits, such as VM cores, exist at a regional level. See [Azure subscription and service limits, quotas, and constraints](#). You can also request that Microsoft increase VM cores if necessary, as explained at [Quota increase requests](#). Choose the instance types supported to deploy FortiGate-VM ([Instance type support on page 6](#)).

## Locations

Subscription filtering behaviour has now changed. To learn more [click here](#).

Subscriptions: All 2 selected

Filter by name... All subscriptions All resource groups All types All locations No grouping

Showing first 2000 items. Filter to refine your results. ☐ Show hidden types

NAME	TYPE	RESOURCE GROUP	SUBSCRIPTION
ABays-Recovery-Vault	Recovery Services vault	ABays-UK-1	Fortinet Engineering
ad.twomblys.com	Azure AD Domain Services	DomainServicesWUS	Fortinet Engineering
adabsaisdiag625	Storage account	adabsais	Pay-As-You-Go
adabsais-vnet	Virtual network	adabsais	Pay-As-You-Go
ADJ-SEA-NET	Virtual network (classic)	Default-Networking	Fortinet Engineering
afaingdiag708	Storage account	afaing	Pay-As-You-Go
afaing-vnet	Virtual network	afaing	Pay-As-You-Go

## Azure regional quota for vCPU cores

You can use each Microsoft Azure resource up to its quota. Each subscription has separate quotas and usage is tracked per subscription. If you reach a quota cap, you can request an increase via Help + Support. [Learn more](#)

3 services All providers All locations Show all

Filter items...

QUOTA	PROVIDER	LOCATION	USAGE
Standard F Family vCPUs	Microsoft.Compute	UK South	40% 8 of 20
Standard F5v2 Family vCPUs	Microsoft.Compute	Australia Southeast	40% 4 of 10
Standard F5v2 Family vCPUs	Microsoft.Compute	East US	40% 4 of 10
Standard FS Family vCPUs	Microsoft.Compute	UK South	30% 6 of 20
Standard F Family vCPUs	Microsoft.Compute	Central US	25% 10 of 40
Standard FS Family vCPUs	Microsoft.Compute	Brazil South	20% 2 of 10
Standard FS Family vCPUs	Microsoft.Compute	Canada East	20% 2 of 10
Standard FS Family vCPUs	Microsoft.Compute	North Europe	20% 2 of 10
Standard F Family vCPUs	Microsoft.Compute	West Europe	10% 1 of 10

## Models

FortiGate-VM is available with different CPU and RAM sizes and you can deploy it on various private and public cloud platforms. The following table shows the models conventionally available to order, also known as bring your own license (BYOL) models. See [Order types on page 11](#).

Model name	vCPU minimum	vCPU maximum
FG-VM01/01v/01s	1	1
FG-VM02/02v/02s	1	2
FG-VM04/04v/04s	1	4
FG-VM08/08v/08s	1	8
FG-VM16/16v/16s	1	16



The v-series and s-series do not support virtual domains (VDOMs) by default. To add VDOMs, you must separately purchase perpetual VDOM addition licenses. You can add and stack VDOMs up to the maximum supported number after initial deployment.

Generally, there are RAM size restrictions to FortiGate-VM BYOL licenses. However, these restrictions do not apply to Azure deployments. Any RAM size with certain CPU models are allowed. Licenses are based on the number of CPUs (the number of vCPU cores for Azure) only.

Previously, platform-specific models such as FortiGate-VM for Azure with an Azure-specific orderable menu existed. However, the common model now applies to all supported platforms.

For information about each model's order information, capacity limits, and adding VDOMs, see the [FortiGate-VM datasheet](#).

The primary requirement for the provisioning of a virtual FortiGate may be the number of interfaces it can accommodate rather than its processing capabilities. In some cloud environments, the options with a high number of interfaces tend to have high numbers of vCPUs.

The licensing for FortiGate-VM does not restrict whether the FortiGate can work on a VM instance in a public cloud that uses more vCPUs than the license allows. The number of vCPUs indicated by the license does not restrict the FortiGate-VM from working, regardless of how many vCPUs are included in the virtual instance. However, only the licensed number of vCPUs process traffic and management tasks. The rest of the vCPUs are unused.

The following shows an example for FGT-VM08:

License	1 vCPU	2 vCPU	4 vCPU	8 vCPU	16 vCPU	32 vCPU
FGT-VM08	OK	OK	OK	OK	The FortiGate-VM uses eight vCPUs used for traffic and management. It does not use the rest.	The FortiGate-VM uses eight vCPUs used for traffic and management. It does not use the rest.

You can provision a VM instance based on the number of interfaces you need and license the FortiGate-VM for only the processors you need.

## Licensing

You must have a license to deploy FortiGate-VM for Azure:

### Order types

On Azure, there are usually two order types: bring your own license (BYOL) and pay as you go (PAYG).

BYOL offers perpetual (normal series and v-series) and annual subscription (s-series) licensing as opposed to PAYG, which is an hourly subscription available with marketplace-listed products. BYOL licenses are available for purchase from resellers or your distributors, and the publicly available price list, which Fortinet updates quarterly, lists prices. BYOL licensing provides the same ordering practice across all private and public clouds, no matter what the platform is. You must activate a license for the first time you access the instance from the GUI or CLI before you can start using various features.

With a PAYG subscription, the FortiGate-VM becomes available for use immediately after you create the instance. The marketplace product page mentions term-based prices (hourly or annual).

In both BYOL and PAYG, cloud vendors charge separately for resource consumption on computing instances, storage, and so on, without the use of software running on top of it (in this case FortiGate).

For BYOL, you typically order a combination of products and services, including support entitlement. S-series SKUs contain the VM base and service bundle entitlements for easier ordering. PAYG includes support, for which you must contact Fortinet Support with your customer information. See *Plans* on the [marketplace product page](#).

To purchase PAYG, all you need to do is subscribe to the product on the marketplace. However, you must contact Fortinet Support with your customer information to obtain support entitlement. See [Creating a support account on page 12](#).



PAYG FortiGate-VM instances do not support the use of virtual domains (VDOMs). If you plan to use VDOMs, deploy BYOL instances instead.



PAYG and BYOL licensing and payment models are not interchangeable. For example, once you spin up a FortiGate-VM PAYG instance, you cannot inject a BYOL license on the same VM. Likewise, you cannot convert a FortiGate-VM BYOL instance to PAYG.

---

When using a FortiGate-VM on-demand instance prior to version 6.4.2, the FortiOS GUI may display expiry dates for FortiGuard services. However, these expiries are automatically extended for as long as the on-demand instance's lifespan. You do not need to be concerned about the expiry of FortiGuard services. For example, the following screenshot shows 2038/01/02.

FortiGuard Distribution Network	
License Information	
Entitlement	Status
FortiCare Support	Not Supported
Firmware & General Updates	Licensed - expires on 2038/01/02
Application Control Signatures	Version 16.00975
Device & OS Identification	Version 1.00110
Internet Service Database Definitions	Version 7.01212
Intrusion Prevention	Licensed - expires on 2038/01/02

FortiOS 6.4.2 and later versions do not display dates.

FortiGuard Distribution Network	
License Information <span style="color: red;">!</span>	
Entitlement	Status
FortiCare Support	Not Registered
Virtual Machine	Valid
Firmware & General Updates	Licensed
Intrusion Prevention	Licensed

## Creating a support account

FortiGate-VM for Azure supports pay as you go (PAYG) and bring your own license (BYOL) licensing models. See [Order types on page 11](#).

PAYG users do not need to register from the FortiGate GUI. If you are using a PAYG licensing model and need to ask technical questions to support, obtain support entitlement by contacting [Fortinet Customer Support](#) after creating the FortiGate-VM instance in Azure, and by providing the following information:

- Your FortiGate-VM instance's serial number
- Your Fortinet account's email ID. If you do not have a Fortinet account, you can create one at [Customer Service & Support](#).

## BYOL

You must obtain a license to activate the FortiGate-VM. If you have not activated the license, you see the license upload screen when you log into the FortiGate-VM and cannot proceed to configure the FortiGate-VM.

You can obtain licenses for the BYOL licensing model through any Fortinet partner. If you do not have a partner, contact [azuresales@fortinet.com](mailto:azuresales@fortinet.com) for assistance in purchasing a license.

After you purchase a license or obtain an evaluation license (60-day term), you receive a PDF with an activation code.

### To register a BYOL license:

1. Go to [Customer Service & Support](#) and create a new account or log in with an existing account.
2. Go to *Register Now* to start the registration process.
3. In the *Registration Code* field, enter your license activation code. Configure other fields as desired, then select *Next* to continue registering the product.



4. If you register the S-series subscription model, the site prompts you to select one of the following:
  - a. Click *Register* to newly register the code to acquire a new serial number with a new license file.
  - b. Click *Renew* to renew and extend the licensed period on top of the existing serial number, so that all features on the VM node continue working uninterrupted upon license renewal.
5. At the end of the registration process, download the license (.lic) file to your computer. You upload this license later to activate the FortiGate-VM.  
 After registering a license, Fortinet servers may take up to 30 minutes to fully recognize the new license. When you upload the license (.lic) file to activate the FortiGate-VM, if you get an error that the license is invalid, wait 30 minutes and try again.

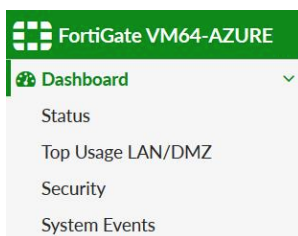
## PAYG

### To register a PAYG license:

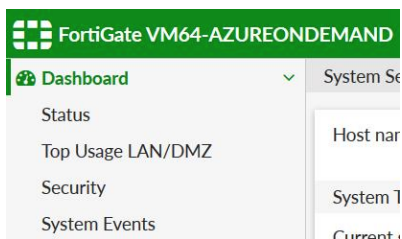
1. Deploy and boot the FortiGate-VM PAYG instance and log into the FortiGate-VM GUI management console.
2. From the Dashboard, copy the VM's serial number.
3. Go to [Customer Service & Support](#) and create a new account or log in with an existing account.
4. Click *Register Now* to start the registration process.
5. In the *Registration Code* field, enter the serial number. Configure other fields as desired, and select *Next* to continue registering the product.
6. After completing registration, contact [Fortinet Customer Support](#) and provide your FortiGate-VM instance's serial number and the email address associated with your Fortinet account.

## Verifying the license type

The top left corner of the FortiOS GUI indicates the FortiGate license type. The following is the GUI for a bring your own license (BYOL) instance:



The following is the GUI for a pay as you go (PAYG) instance:



You can also run the `get system status` command. For a BYOL instance, the output is as follows:

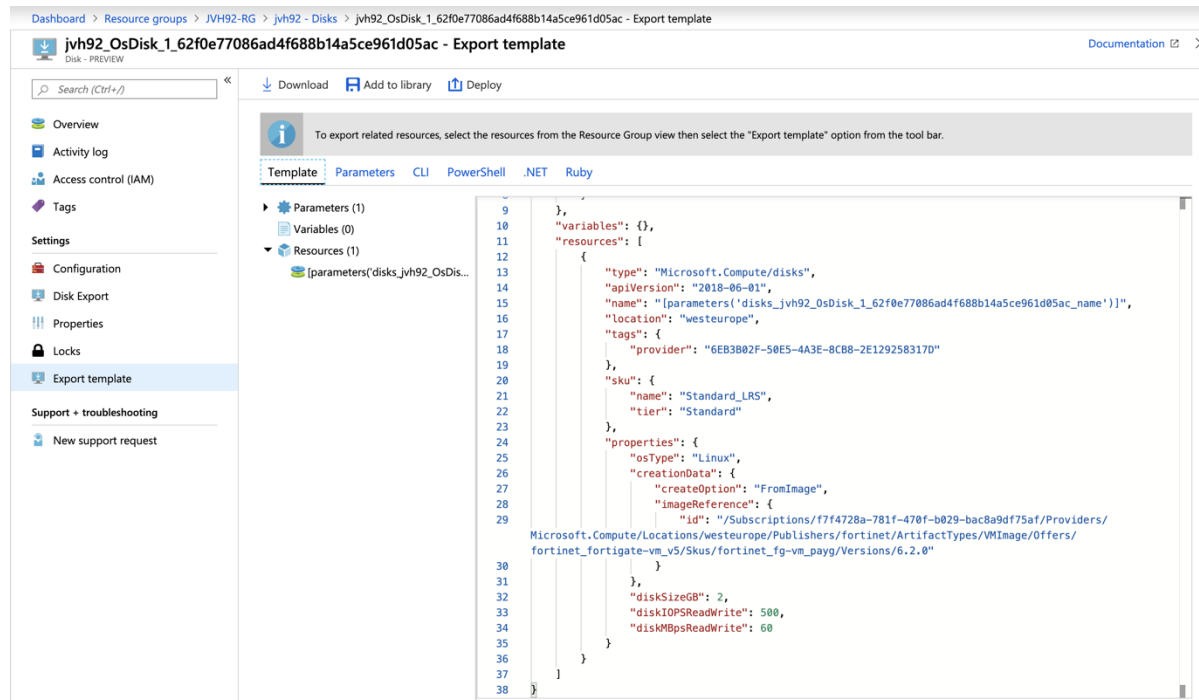
```
Version: FortiGate-VM64-AZURE v6.4.0,build1579,200330 (GA)
```

For a PAYG instance, the output is as follows:

Version: FortiGate-VM64-AZUREONDEMAND v6.4.0,build1579,200330 (GA)

By opening the OS disk, you can also verify the image used during deployment, which indicates the license type. The deployment process clones the disk from a disk image that Fortinet has provided to the Azure marketplace.

Open your deployed VM's OS disk and select *Export template*. In the template, search for `imageReference`. For a BYOL instance, this URI contains `fortinet_fg-vm`. For a PAYG instance, it contains `fortinet_fg-vm_payg_20190624`.



## Migrating a FortiGate-VM instance between license types

When deploying a FortiGate-VM on public cloud, you determine the license type (pay as you go (PAYG) or bring your own license (BYOL)) during deployment. The license type is fixed for the VM's lifetime. The image that you use to deploy the FortiGate-VM on the public cloud marketplace predetermines the license type.

Migrating a FortiGate-VM instance from one license type to another requires a new deployment. You cannot simply switch license types on the same VM instance. However, you can migrate the configuration between two VMs running as different license types. There are also FortiOS feature differences between PAYG and BYOL license types. For example, a FortiGate-VM PAYG instance is packaged with Unified Threat Management protection and does not support virtual domains, whereas a FortiGate-VM BYOL instance supports greater protection levels and features depending on its contract.

### To migrate FortiOS configuration to a FortiGate-VM of another license type:

1. Connect to the FortiOS GUI or CLI and back up the configuration. See [Configuration backups](#).
2. Deploy a new FortiGate-VM instance with the desired license type. You can deploy the instance using one of the following methods:
  - [Azure marketplace](#)
  - [Azure CLI](#)

- [Deploying FortiGate-VM using Azure PowerShell on page 30](#)
- [ARM templates](#)
- [Terraform templates](#)

If deploying a BYOL instance, you must purchase a new license from a Fortinet reseller. You can apply the license after deployment via the FortiOS GUI or bootstrap the license and configuration during initial bootup using custom data as described in [Bootstrapping the FortiGate CLI and BYOL license at initial bootup using user data on page 33](#).

3. Restore the configuration on the FortiGate-VM instance that you deployed in step 2. As with the license, you can inject the configuration during initial bootup. Alternatively, you can restore the configuration in the FortiOS GUI as described in [Configuration backups](#).
4. If you deployed a PAYG instance in step 2, register the license. To receive support for a PAYG license, you must register the license as described in [Creating a support account on page 12](#).

## Obtaining a FortiCare-generated license for Azure on-demand instances

New Azure on-demand and upgraded instances can retrieve a FortiGate serial number and license from FortiCare servers. Using the serial number, users can register the device to their account and start using FortiToken and FortiGate Cloud services.

The FortiGate-VM must be able to reach FortiCare to receive a valid on-demand license. Ensure connectivity to FortiCare (<https://directregistration.fortinet.com/>) by checking all related setup on the virtual network, subnet, network security group, route table, public IP addresses, and so on.

This feature is only available for FortiOS 6.4.2 and later versions.

### To verify cloudinit automatically obtained a license for a newly-deployed instance:

```
# diagnose debug cloudinit show
>> Load VM metadata document
>> Requesting FortiCare license: FGTAZRXXXXXXXXXX
>> VM license install succeeded. Rebooting firewall.
```

```
# diagnose debug vm-print-license
SerialNumber: FGTAZRXXXXXXXXXX
CreateDate: Wed Jul 29 16:48:34 2020
Key: yes
Cert: yes
Key2: yes
Cert2: yes
Model: PG (20)
CPU: 2147483647
MEM: 2147483647
```

```
# execute vm-license
PAYG license exists.
```

If in a closed network, the command execution resembles the following, as the `execute vm-license` command attempts to get a license from FortiCare.

```
# diagnose debug cloudinit show

# diagnose debug vm-print-license
SerialNumber: FGTAZRXXXXXXXXXX
CreateDate: 1597362903
```

```
Model: PG (20)
CPU: 2147483647
MEM: 2147483647
```

```
# execute vm-license
This operation will reboot the system !
Do you want to continue? (y/n)
```

```
Load VM metadata document
Requesting FortiCare license: FGTAZRXXXXXXXXXXXX
```

If the FortiGate-VM connects to FortiCare successfully, the following message displays.

```
VM license install succeeded. Rebooting firewall.
```

### To obtain a license for an upgraded instance or instance from a closed network:

If you created the FortiGate-VM in a closed environment or it cannot reach FortiCare, the FortiGate-VM self-generates a local license as in previous FortiOS versions. You can obtain a FortiCare license, ensure that the FortiGate-VM can connect to FortiCare, then run the `execute vm-license` command to obtain the license from FortiCare.

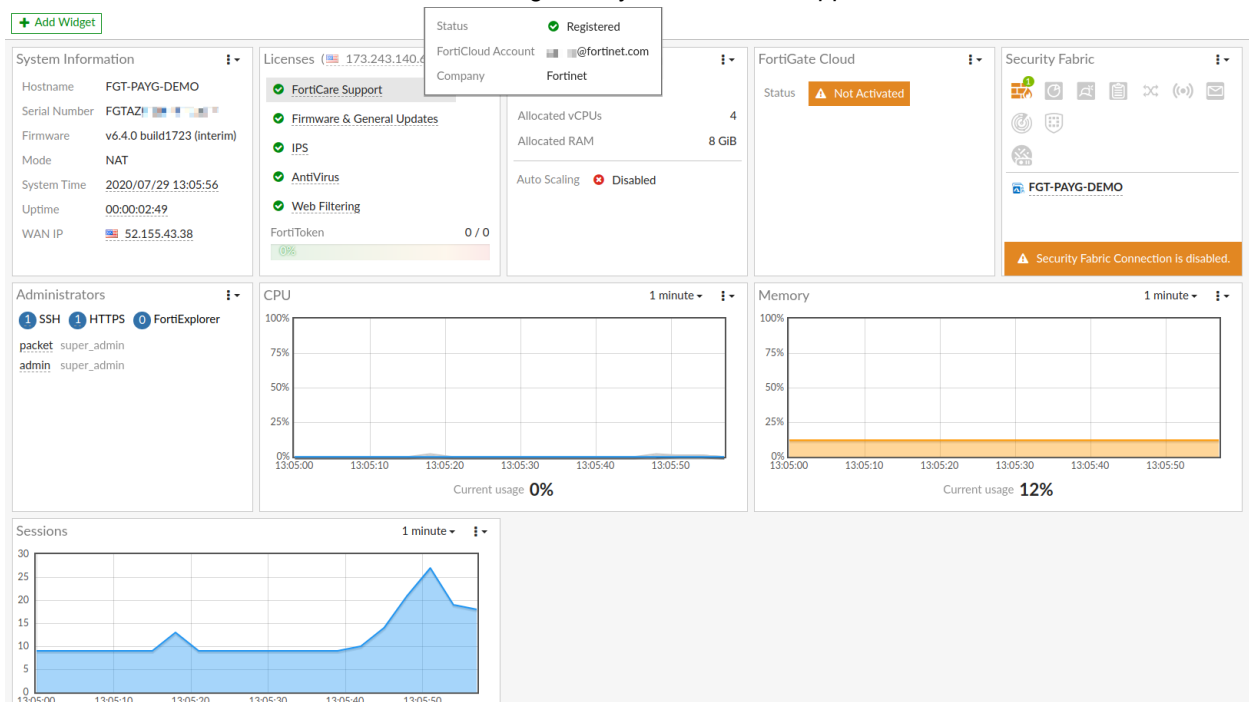
```
# execute vm-license
This operation will reboot the system !
Do you want to continue? (y/n)y
```

```
Load VM metadata document
Requesting FortiCare license: FGTAZRXXXXZXXXXXX
VM license install succeeded. Rebooting firewall.
```

### To register the serial number:

1. Register the license using the serial number in FortiCare (see [Creating a support account on page 12](#)).
2. Obtain the VM ID:
  - In FortiOS, run `diagnose test application azd 6` and search for the VM Instance ID.
  - In Azure, run `az vm show -g Resource-Group-Name -n PAYG-VM-Name --query vmId' -o tsv`.  
It may take up to an hour for the registration status to synchronize and update in the FortiOS GUI.

3. Go *Dashboard > Status* and in the *Licenses* widget verify the *FortiCare Support* status.



4. Once the registration is complete, you can log in to a [FortiGate Cloud](#) account and download the two free tokens that come standard with FortiGates (see [FortiTokens](#)).

# Deploying FortiGate-VM on Azure

You can deploy FortiGate-VM next generation firewall for Azure as a virtual appliance in Azure cloud (infrastructure as a service). See [Single FortiGate-VM deployment on page 114](#).

## Azure services and components

FortiGate-VM for Azure is a Linux VM instance. The following table lists Azure services and components required to be understood when deploying FortiGate-VM. All services and components listed relate to ordinary FortiGate-VM single instance deployment or FortiGate-native active-passive HA deployment.

Service/component	Description
<a href="#">Azure Virtual Network (VNet)</a>	This is where the FortiGate-VM and protected VMs are situated and users control the network. When you deploy FortiGate-VM, you can configure relevant network settings.
VM	FortiGate-VM for Azure is a customized Linux VM instance.
Subnets, route tables	You must appropriately configure the FortiGate-VM with subnets and route tables to handle traffic.  When deploying from the marketplace launcher, there are two subnets for the FortiGate-VM labeled <code>PublicFacingSubnet</code> and <code>InsideSubnet</code> by default.
Resource group	A group of resources where the FortiGate-VM is deployed
<a href="#">Availability Set</a>	An availability set is a logical grouping capability that you can use in Azure to ensure that the VM resources you place within it are isolated from each other when they are deployed within an Azure datacenter. Usually a set intends to accommodate multiple VMs.
Public DNS IP address	You must allocate at least one public IP address to the FortiGate-VM to access and manage it over the Internet.
<a href="#">Security groups</a>	Unlike AWS, you cannot configure Azure security groups at the time of FortiGate-VM deployment. All traffic is allowed inbound to, or outbound from, the subnet, or network interface by default. See <a href="#">Default security rules</a> .
VHD	A special type of deployable image used for Azure. As long as you deploy FortiGate-VM from the marketplace launcher, you do not need VHD files. However, you can launch FortiGate-VM (BYOL) directly from the FortiGate-VM VHD image file instead of using the marketplace. Ask <a href="mailto:azuresales@fortinet.com">azuresales@fortinet.com</a> to find out where you can obtain the VHD images if needed.
<a href="#">ARM Templates</a>	You can deploy FortiGate-VM instances in two ways: <ol style="list-style-type: none"><li>1. Find the FortiGate-VM product listing on the marketplace and launch from it. You do not necessarily see Azure Resource Manager (ARM) templates onscreen but they are used on the backend. You can also download the templates once the deployment process proceeds.</li></ol>

Service/component	Description
	<p>2. Launch custom deployment in the Azure portal. Upload ARM templates of your choice that deploy FortiGate with your desirable topology and configuration.</p> <p>ARM templates are available on <a href="#">GitHub</a>.</p> <p>Fortinet-provided ARM templates are not supported within the regular Fortinet technical support scope. Contact <a href="mailto:azuresales@fortinet.com">azuresales@fortinet.com</a> with questions.</p>
Load Balancer	<p>A network LB automatically distributes traffic across multiple FortiGate-VM instances when configured properly. Topologies differ depending on how you distribute incoming and outgoing traffic.</p> <p>Fortinet provides a FortiGate marketplace product listing that automatically comes along with 2 FortiGate-VM nodes and LB. Check out <a href="#">FortiGate Next-Generation Firewall for Azure LB HA</a>.</p>

## Deploying FortiGate-VM from a VHD image file

You can deploy FortiGate using custom templates or PowerShell from VHD image files.

VHD image files are available from [Fortinet Customer Service & Support](#). Go to *Support > VM Image*, then select *FortiGate* as the *Product* and *Azure* for the *Platform*. The file name is FGT\_VM64\_AZURE-v6-buildXXXX-FORTINET.out.hyperv.zip, where XXXX is the build number.

Once the download is complete, unzip the file and locate the fortios.vhd file. Upload the fortios.vhd file to your blob/storage location as required by your deployment templates.

At a given time, [Fortinet Customer Service & Support](#) hosts only the two latest major versions with two minor versions each. To obtain older files, go to *Support > Firmware Images*, select *FortiGate* as the *Product*, then go to the *Download* tab. Go to the desired version and download the FGT\_VM64\_AZURE-v6-buildXXXX-FORTINET.out.hyperv.zip file.

## Deploying FortiGate with a custom ARM template

You can deploy a FortiGate-VM (BYOL) outside the marketplace product listing using a custom ARM template in the Azure portal. This is an alternative method for if you want to deploy FortiGate-VM on instance types/sizes that you cannot find on the FortiGate-VM marketplace launcher. Some instance types of your choice may not properly boot up or run due to lack of official FortiGate-VM instance support.

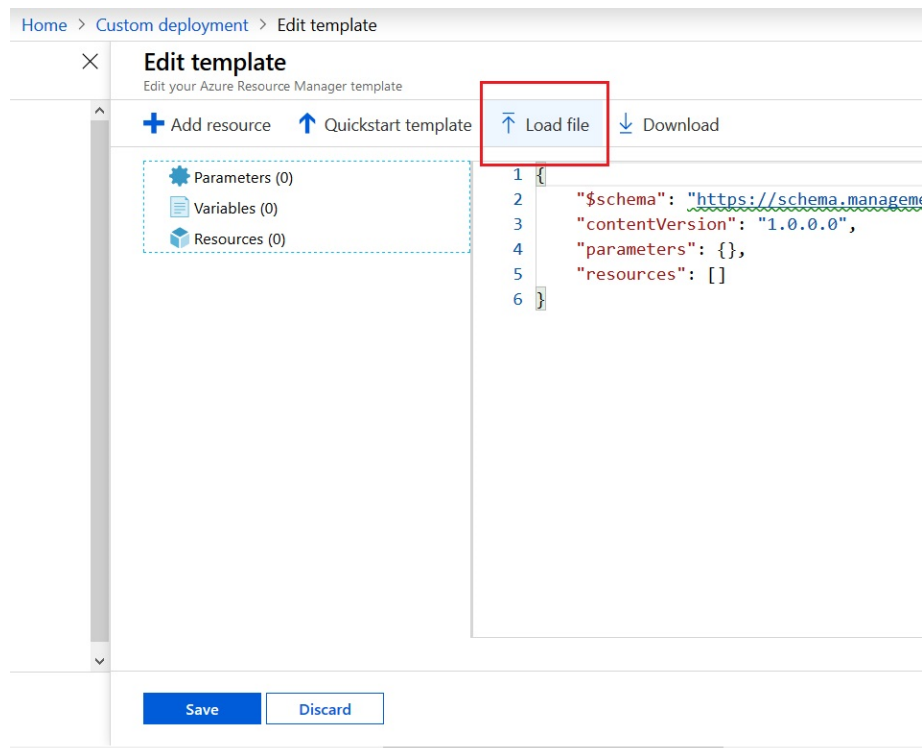
There is a bare minimum set of templates available for your deployment.

You can also specify bootstrapping FortiGate CLI commands within the template and run them at the time of initial bootup.

## Invoking a custom ARM template

To invoke a custom ARM template:

1. Log in to the Azure portal and go to *Custom deployment*.
2. Click *Build your own template in the editor*.
3. From [GitHub](#), copy and paste the template content, or download the template file and load it into the *Edit template* window.





4. Ensure that the template is shown in the screen. Click **Save**.

Home > Custom deployment > Edit template

### Edit template

Edit your Azure Resource Manager template

+ Add resource   ↑ Quickstart template   ↑ Load file   ↓ Download

Parameters (21)

Variables (13)

Resources (10)

- pid-2a6560c5-0fc6-5295-b5f9-8b...
- [variables('compute\_AvailabilitySet...)]
- [parameters('vnetName')] (Micro...
- [parameters('publicIPAddressNam...
- [variables('network\_NIC\_fg11\_Na...
- [variables('network\_NIC\_fg12\_Na...
- UpdateNIC1 (Microsoft.Resources/...
- UpdateNIC2 (Microsoft.Resources/...
- SettingUpVirtualNetwork (Microso...
- [parameters('FortiGateName')] (Mi...

```

1 {
2   "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
3   "contentVersion": "1.0.0.0",
4   "parameters": {
5     "location": {
6       "type": "string",
7       "metadata": {
8         "description": "location - same as above"
9       }
10    },
11    "adminUsername": {
12      "type": "string",
13      "metadata": {
14        "description": "Username for the FortiGate virtual appliance."
15      }
16    },
17    "adminPassword": {
18      "type": "securestring",
19      "metadata": {
20        "description": "Password for the FortiGate virtual appliance."
21      }
22    }
23  }

```

Save Discard

5. Edit the parameters:

- Click *Edit parameters*.
- Copy and paste the parameters from [GitHub](#), or download the file as in step 3. You can manually edit the fields.

Home > Custom deployment > Edit parameters

### Edit parameters

↑ Load file   ↓ Download

```

1 {
2   "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deployr
3   "contentVersion": "1.0.0.0",
4   "parameters": {
5     "location": {
6       "value": ""
7     },
8     "adminUsername": {
9       "value": ""
10    },
11    "adminPassword": {
12      "value": ""
13    },
14    "FortiGateName": {
15      "value": ""
16    },
17    "FortiGateImageSKU": {
18      "value": ""
19    },
20    "FortiGateImageVersion": {
21      "value": ""
22    },
23  }

```

Save Discard

c. Click **Save**.

6. Complete the following fields:

Field	Description
<b>Basics</b>	
Subscription	Enter the subscription that is entitled to purchase marketplace products of your choice. Generally, selecting a subscription that your organization has configured to not be able to purchase Azure resources is advisable. Ensure that you specify the appropriate subscription.
Resource Group	You must create a new resource group. Click <i>Create New</i> and enter a nonexistent resource group.
Location	From the dropdown list, select a region to deploy the FortiGate-VM and related resources.
<b>Settings</b>	
Location	Manually specify the same location as the above by entering the region.
Admin Username	Specify an administrator login name that can log into the FortiGate management console. Azure does not allow names such as root or admin.
Admin Password	Specify an administrator password with some character complexity. The password must be between 12 and 72 characters and contain at least three of the following: one lower-case character, one upper-case character, one number, and one special character.
FortiGate Name	Specify the FortiGate-VM instance name or FortiGate hostname that can be identified on the Azure portal.
FortiGate Image SKU	Leave this as-is.
FortiGate Image version	Select a version. Note that this version points to the one that the FortiGate marketplace listing supports. As the template may contain obsolete versions, specifying <i>Latest</i> is recommended.
Instance Type	Choose an instance type based on the number of virtual CPU cores. Recommended types are the following compute instances: <ul style="list-style-type: none"> <li>Standard_F1</li> <li>Standard_F2</li> <li>Standard_F4</li> <li>Standard_F8</li> <li>Standard_F1s</li> <li>Standard_F2s</li> <li>Standard_F4s</li> <li>Standard_F8s</li> <li>Standard_F16s</li> <li>Standard_F2s_v2</li> <li>Standard_F4s_v2</li> <li>Standard_F8s_v2</li> <li>Standard_F16s_v2</li> </ul>

Field	Description
	<ul style="list-style-type: none"><li>Standard_F32s_v2</li><li>Standard_F64s_v2</li><li>Standard_F72s_v2</li></ul> Instances with over 32 vCPU requires a FG-VMUL license that can support an unlimited number of CPU cores.
Public IP New or Existing or None	Choose <i>New</i> .
Public IP Address Name	Enter a name to distinguish the public IP address.
Public IP Resource Group	Ensure you specify the same resource group as entered in <i>Basics &gt; Resource Group</i> above.
Public IP Address Type	Select <i>Static</i> .
Vnet New or Existing	Select <i>New</i> .
Net Name	Specify the same name as the resource group name.
Vnet Address Prefix	Specify a CIDR that does not overlap with your existing Vnet CIDRs.
Subnet1Name	Enter a name to distinguish the public subnet.
Subnet1Prefix	Specify a CIDR that belongs to the Vnet Address Prefix above.
Subnet2Name	Enter a name to distinguish the private/protected subnet.
Subnet2Prefix	Specify another CIDR that belongs to the Vnet Address Prefix above.
Fortinet Tags	Leave as-is.
Artifacts Base URL	Leave as-is.

Home > Custom deployment

### Custom deployment

Deploy from a custom template

**TEMPLATE**

Customized template  
10 resources

[Edit template](#) [Edit parameters](#) [Learn more](#)

**BASICS**

\* Subscription:

\* Resource group:  [Create new](#)

\* Location:

**SETTINGS**

\* Location:  ✓

\* Admin Username:  ✓

\* Admin Password:  ✓

\* Forti Gate Name:  ✓

Forti Gate Image SKU:

Forti Gate Image Version:

Instance Type:

Public IP New Or Existing Or None:

Public IP Address Name:

Public IP Resource Group:

Public IP Address Type:

Vnet New Or Existing:

\* Vnet Name:  ✓

Vnet Resource Group:

Vnet Address Prefix:  ✓

Subnet1Name:  ✓

Subnet1Prefix:  ✓

Subnet2Name:  ✓

Subnet2Prefix:  ✓

Fortinet Tags:

Artifacts Base URI:

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7. Select the *I agree to the terms and conditions stated above* checkbox. Click *Purchase*. It takes about 10-15 minutes to deploy the FortiGate-VM and related resources. If you encounter an issue, resolve the issue and retry the deployment.
8. After successful deployment, connect to the FortiGate instance using the credentials specified above. See [Connecting to the FortiGate-VM on page 117](#).

## Bootstrapping the FortiGate CLI at initial bootup using user data

You can run FortiGate CLI commands at initial bootup by using custom cloud-init.

1. Download the [ARM template](#) and open in a text editor.
2. Find the variables section and the userData statement as shown. The line number may be different than in the screenshot.
3. After concat, specify FortiGate CLI commands. If they are run across multiple lines (in the FortiGate CLI, these commands are run by using the *Enter* key), separate each line with a backslash and n and enclose the whole statement with single quotes.

```

167         "description": "Base URL of the solution template gallery package",
168         "artifactsBaseUrl": ""
169     }
170 },
171 },
172 "variables": {
173     "subnet1Ref": "[resourceId(parameters('vnetResourceGroup'),'Microsoft.Network/virtualNetworks/subnets', parameters('vnetName'), parameters('vnetSubnet1Name'))]",
174     "subnet2Ref": "[resourceId(parameters('vnetResourceGroup'),'Microsoft.Network/virtualNetworks/subnets', parameters('vnetName'), parameters('vnetSubnet2Name'))]",
175     "publicIPID": "[resourceId(parameters('publicIPResourceGroup'),'Microsoft.Network/publicIPAddresses', parameters('publicIPAddressName'))]",
176     "routeTable1Name": "[concat(parameters('FortiGateName'), '-', parameters('Subnet1Name'), '-routes-', uniquestring(deployment().name))]",
177     "routeTable2Name": "[concat(parameters('FortiGateName'), '-', parameters('Subnet2Name'), '-routes-', uniquestring(deployment().name))]",
178     "network_NIC_fg11_Name": "[concat(parameters('FortiGateName'), '-Nic0-', uniquestring(deployment().name))]",
179     "network_NIC_fg11_Id": "[resourceId('Microsoft.Network/networkInterfaces', variables('network_NIC_fg11_Name'))]",
180     "network_NIC_fg12_Name": "[concat(parameters('FortiGateName'), '-Nic1-', uniquestring(deployment().name))]",
181     "network_NIC_fg12_Id": "[resourceId('Microsoft.Network/networkInterfaces', variables('network_NIC_fg12_Name'))]",
182     "compute_AvailabilitySet_FG_Name": "[concat(parameters('FortiGateName'), '-AvailabilitySet-', uniquestring(deployment().name))]",
183     "compute_AvailabilitySet_FG_Id": "[resourceId('Microsoft.Compute/availabilitySets', variables('compute_AvailabilitySet_FG_Name'))]",
184     "updateIPURI": "[concat(parameters('ArtifactsBaseUrl'), '/update-nic.json')]",
185     "virtualNetworkSetupURL": "[concat(parameters('ArtifactsBaseUrl'), '/vnetsetup.json')]",
186     "userData": "[concat('config system global \n set timezone 03 \n end \n')]"
187 },
188 "resources": [
189     {
190         "apiVersion": "2018-02-01",

```

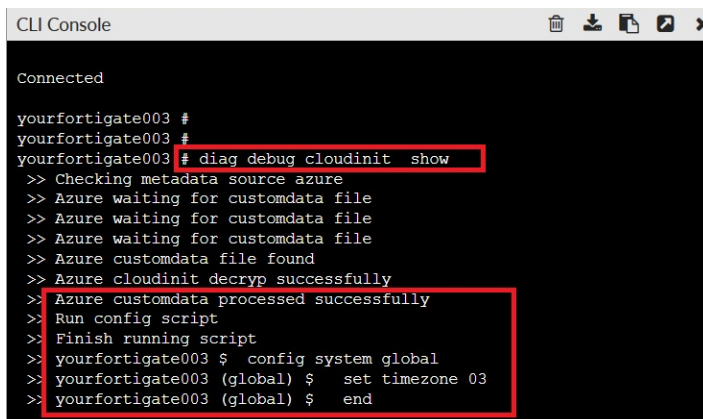
The example above is the same as executing the following in the FortiGate CLI:

```

config system global
  set timezone 03
end

```

4. Load the file as shown in [Invoking a custom ARM template on page 20](#).
5. After deployment, log into the FortiGate.
6. Check if the command was successfully run:
  - a. In the CLI console, enter `diagnose debug cloudinit show`. If the cloud-init was successful, the CLI shows Azure customdata processed successfully. The FortiGate CLI command syntax must be correct.



```

CLI Console
Connected

yourfortigate003 #
yourfortigate003 #
yourfortigate003 # diag debug cloudinit show
>> Checking metadata source azure
>> Azure waiting for customdata file
>> Azure waiting for customdata file
>> Azure waiting for customdata file
>> Azure customdata file found
>> Azure cloudinit decryp successfully
>> Azure customdata processed successfully
>> Run config script
>> Finish running script
>> yourfortigate003 $ config system global
>> yourfortigate003 (global) $ set timezone 03
>> yourfortigate003 (global) $ end

```

If the CLI command fails, you see an error message with `diagnose debug cloudinit show` as above. Resolve it and try again.

- b. Check the timezone by running `config system global` and `get` commands.

```
security-rating-result-submission: enable
security-rating-run-on-schedule: enable
send-pmtu-icmp      : enable
snat-route-change   : disable
special-file-23-support: disable
--More--            ssd-trim-freq      : weekly
ssd-trim-hour       : 1
ssd-trim-min        : Random
ssd-trim-weekday    : sunday
ssh-kex-sha1        : enable
ssl-min-proto-version: TLSv1-2
ssl-static-key-ciphers: enable
sslvpn-cipher-hardware-acceleration: enable
sslvpn-kxp-hardware-acceleration: enable
sslvpn-max-worker-count: 1
sslvpn-plugin-version-check: enable
strict-dirty-session-check: enable
strong-crypto       : enable
switch-controller    : disable
switch-controller-reserved-network: 169.254.0.0 255.255.0.0
sys-perf-log-interval: 5
tcp-halfclose-timer : 120
tcp-halfopen-timer  : 10
tcp-option          : enable
tcp-timewait-timer  : 1
timezone            : (GMT-9:00) Alaska
traffic-priority     : tos
```

As expected, the timezone was changed. This means the bootstrapping CLI command worked.

## Bootstrapping the FortiGate CLI and BYOL license at initial bootup using user data

You can run FortiGate CLI commands and a BYOL license at initial bootup by using custom cloud-init. Use the following sample ARM templates:

- [Template](#)
- [Parameters](#)

For details on using a custom ARM template, see [Deploying FortiGate with a custom ARM template on page 19](#).

First, you must create two text files: one for FortiGate CLI configuration and another for a license file.

1. Create a CLI configuration file:
  - a. In a text editor, create a text file that contains CLI commands like the following:
 

```
config system global
  set timezone 03
end
```
  - b. Save the file as `config.txt` or another desired name. This example sets the timezone as GMT-9 Alaska.
2. Create a license text file:
  - a. Download a FortiGate license from [Customer Service & Support](#) and save the file as `license.txt` or any other desired name. The file contains content that resembles the following:



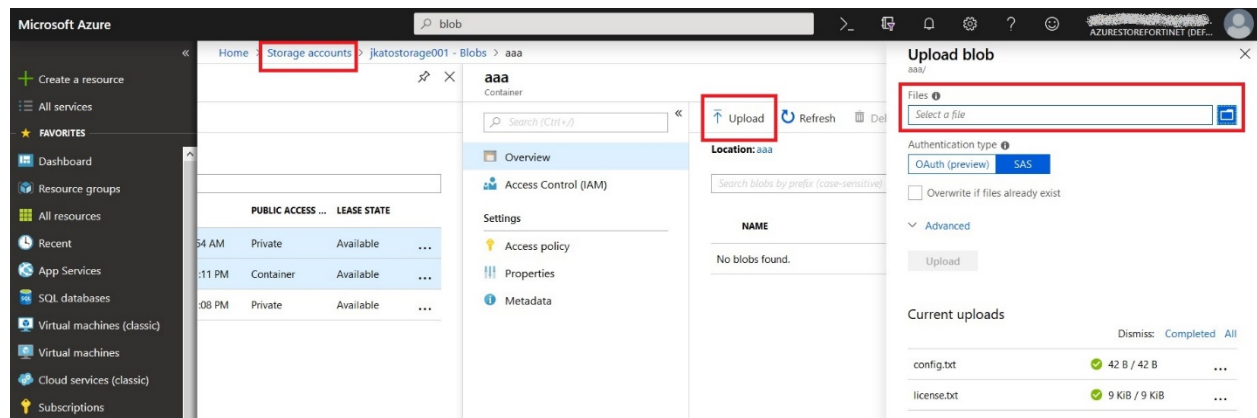
```

-----BEGIN FGT VM LICENSE-----
QAAAABUIztrwrJdUjEe/8C5dNvNmY1w70ZMXPTG7vm2KkYvL4++qL0gED6/q
SQ5PkwPTfIXjAuRGtGyX1VvaTpXgGQAA1pwFdnS6TWJ6dVT7KID8ncufaa3bCw
s8XpML1vzJ4//++C9nqh4fN/KyDweIEIptDMaNsOCm08BrU8HQIDkX+ngeCs3QZ5
ELStRrX11/oxqTB/gorG67ZdybXWvZPhVWJYD55AsI+QK8BHJ+XGhLjHkzBZ4ezU
Hd01HCSm7MKEVVSkauU43s29XESTxqPEInah3yXgYTD4pnV683G4EHCKAdGyMTP
QqDqBMKcT5ae10ooGVAOX8D62C5Zjh+1+tkdpR5YHoVvZHU95hBCNJBroJbMnk7
NogYuaDQEH28MDtpvzXnb24mW1fDQMTJysQwCtzJzmnBnvSB07xNq/i+Ts2QnFB
-----END FGT VM LICENSE-----
03p1zyJ7rMjguXpCB/3v018qAXoqbl5Ks7aQHQTqNuRL25MducwFdl1Abfz7TMW9
bnbRMz3n5VJUIP+eIF1V84yfwOCJ1+M2AP8hqL3DGBt4urwRFV6yndVi3wZG6hn
eV4LIHk3J5T25/b14m9I+fqEXEsSKKKPn7H2wdyroBdw+VLnT9Hk+3H7E3IL29AZ+
+FDMeRM+BooMnHG3y5do6DB+Wi+CIuxqmIAo1n9bullyFH5bcGU92/6APuFFQ8dI
3DNLIC6ZKDPq7j2t179dHoIYxC6S8UsC61310sSwjHg+O6x+YAEtP8//ktuIvh
NeAF1JveJRxbZBJAu1qnjzNc9Wt7Rg9LvDmvVK16Afop2Kt+1cFxRL1gySghWdo
b56XyJbIqAwB/3La6EKmZDn3sWQ4H9K
-----END FGT VM LICENSE-----

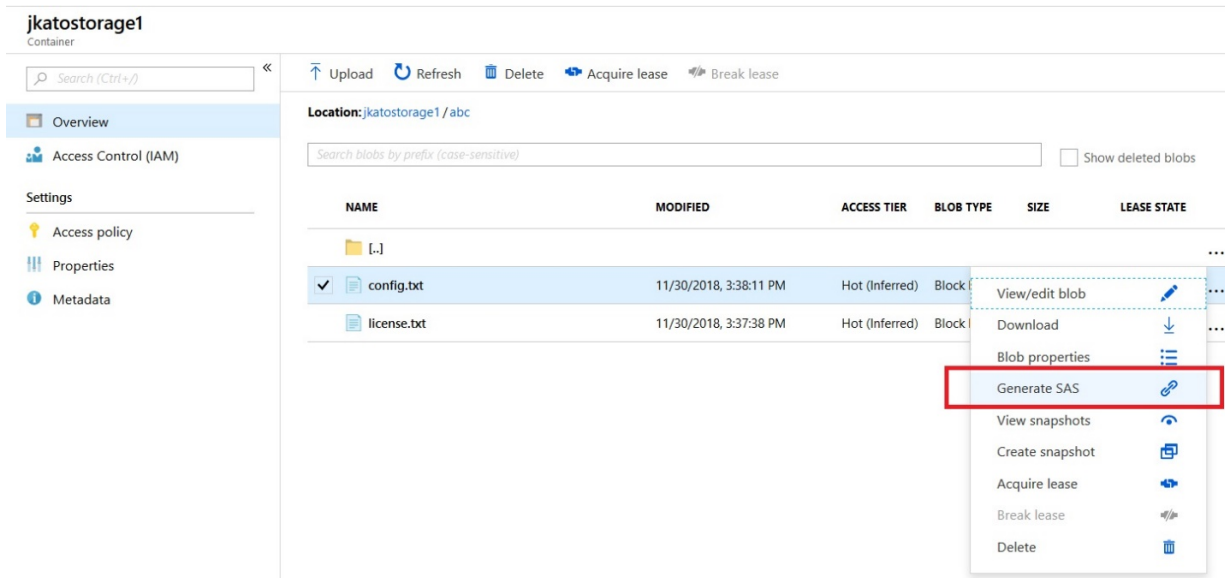
```

3. Place both text files on your Azure blob.
4. In this example, you are required to have the following:
  - Storage account
  - Private container in the blob

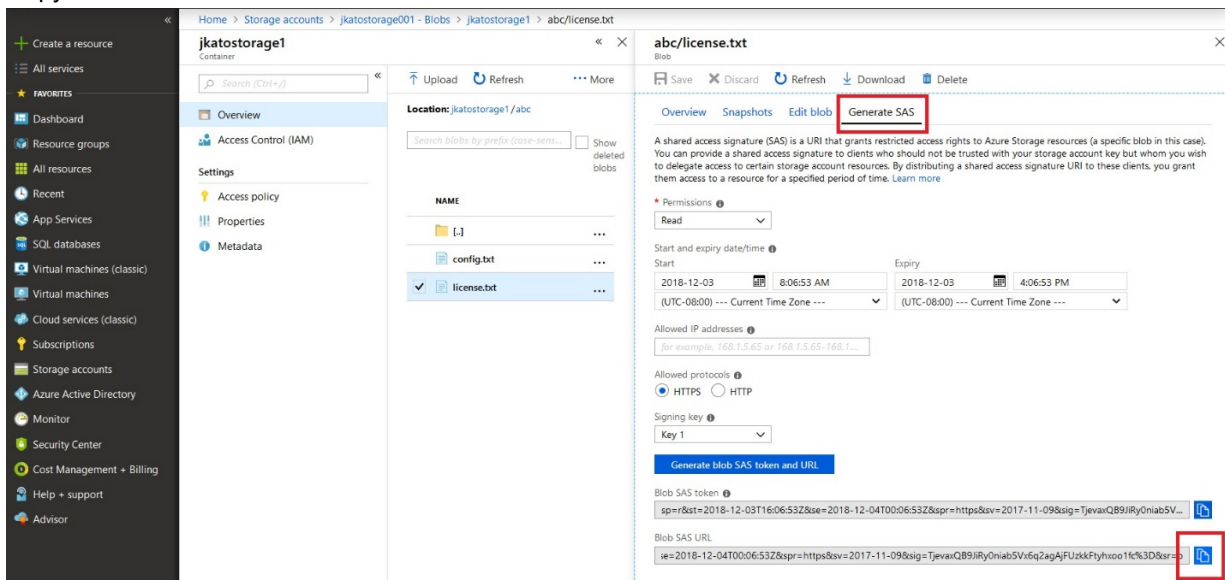
Upload the two text files in a folder with authentication type SAS.



5. Copy and paste the SAS URLs into the parameters file:
  - a. After uploading, click the menu icon beside config.txt. Click *Generate SAS* to create an SAS URL link. Repeat this step with the license.txt file.



b. Copy the SAS URLs.



c. Paste the SAS URLs into the `configURI` and `licenseURI` sections of the `parameters-BYOL-CLI-and-license.json` file as shown:

```

62 "configURI": {
63   "value": "https://jkastorage001.blob.core.windows.net/jkastorage1/abc/config.txt?sp=r&st=2018-12-03T14:20:12Z&se=2018-12-03T22:20:12Z&spr=https&sv=2017-11-09&sr=b"
64 },
65 "licenseURI": {
66   "value": "https://jkastorage001.blob.core.windows.net/jkastorage1/abc/license.txt?sp=r&st=2018-12-03T14:21:34Z&se=2018-12-03T22:21:34Z&spr=https&sv=2017-11-09&sr=b"
67 },

```

6. Review all template fields. Ensure the following:

- Your chosen subscription is entitled to purchase the marketplace product.
- The same location is entered under *Settings* and under *Basics*. Ensure that the location has sufficient quota to accommodate the FortiGate-VM with the desired number of CPU cores. For details, see [Region support on page 8](#).
- A new resource group is created and the same name is entered under *Public IP Resource Group* and *Vnet Resource Group*.



- d. The *Fortinet Tags* field is automatically populated. There is no need to manually input information into this field. If this field is empty or shows an error, reload the browser, then load the template and parameter files again.
- e. The license and config files' SAS URLs are not expired.

Once all fields are entered, the template should resemble the following:

**Custom deployment**  
Deploy from a custom template

**TEMPLATE**  
Customized template  
10 resources  
[Edit template](#) [Edit parameters](#) [Learn more](#)

**BASICS**

- \* Subscription: BYOL
- \* Resource group: (New) jkatorsgrp006 [Create new](#)
- \* Location: Korea South

**SETTINGS**

- \* Location: Korea South ✓
- \* Admin Username: fortidadmin ✓
- \* Admin Password: •••••••• ✓
- \* Forti Gate Name: yourfortigate006 ✓
- Forti Gate Image SKU: fortinet\_fg-vm ✓
- Forti Gate Image Version: 6.0.3 ✓
- Instance Type: Standard\_F1 ✓
- Public IP New Or Existing Or None: new ✓
- Public IP Address Name: publicip-fortigate ✓
- Public IP Resource Group: jkatorsgrp006 ✓
- Public IP Address Type: Static ✓
- Vnet New Or Existing: new ✓
- \* Vnet Name: yourvnet006 ✓
- Vnet Resource Group: jkatorsgrp006 ✓
- Vnet Address Prefix: 10.8.0.0/16 ✓
- Subnet1Name: PublicFacingSubnet ✓
- Subnet1Prefix: 10.8.0.0/24 ✓
- Subnet2Name: InsideSubnet ✓
- Subnet2Prefix: 10.8.1.0/24 ✓
- \* Config URI: https://jkatorstorage001.blob.core.windows.net/jkatorstorage1/abc/config.txt?sp=r ... ✓
- \* License URI: https://jkatorstorage001.blob.core.windows.net/jkatorstorage1/abc/license.txt?sp=r ... ✓
- Artifacts Base URI: https://gallery.azure.com/artifact/20151001/fortinet.fortinet-fortigate-singlevmfortig ... ✓
- Fortinet Tags: {"provider": "6EB3B02F-50E5-4A3E-8CB8-2E129258317D"} ✓

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[Purchase](#)

7. Select the checkbox to agree to the terms, then click *Purchase*.

8. After deployment is complete, log into the FortiGate by accessing [https://<IP\\_address>](https://<IP_address>) in your browser.
9. If the license was successfully loaded, you should see the dashboard. If you are prompted to upload a license, this means that bootstrapping the license failed. In this case, you can manually upload the license file, and once the system completes rebooting, log in and invoke the CLI from the dashboard. To check why bootstrapping failed, run the `diag debug cloudinit show` command. See [Bootstrapping the FortiGate CLI at initial bootup using user data on page 25](#).

```
yourfortigate030 # diag debug cloudinit show
>> Checking metadata source azure
>> Azure waiting for customdata file
>> Azure waiting for customdata file
>> Azure waiting for customdata file
>> Azure customdata file found
>> Azure cloudinit decryp successfully
>> Azure Fos-instance-id: 9106abee-4840-443f-b951-2993af73cd3a
>> Azure couldn't find mime link
>> Azure trying to get license from: https://jkatostorage001.blob.core
>> Azure download license successfully
>> Azure trying to get config script from https://jkatostorage001.blob
>> Azure download config script successfully
>> Azure customdata processed successfully
>> Run config script
>> Finish running script
>> yourfortigate030 $ config system global
>> yourfortigate030 (global) $ set timezone 03
>> yourfortigate030 (global) $ end
```

## Deploying FortiGate-VM using Azure PowerShell

You can deploy FortiGate-VM (BYOL) outside the marketplace product listing using Azure PowerShell. This is an alternative method to deploy FortiGate-VM on instance types/sizes that you cannot find on the FortiGate marketplace launcher. Some instance types of your choice may not properly boot up or run due to lack of official FortiGate instance support.

You can also specify bootstrapping FortiGate CLI commands as part of a bootstrapping configuration file that is passed in PowerShell at the time of initial bootup.

Thorough knowledge of PowerShell and various Azure services and features to adopt this deployment method is expected.

## Running PowerShell to deploy FortiGate-VM

The instructions assume that PowerShell is already installed on the Windows machine. For details on installing and running PowerShell, see [Install Azure PowerShell on Windows with PowerShellGet](#).

### To run PowerShell to deploy FortiGate-VM:

1. Log into a Windows machine and invoke the PowerShell console.
2. Obtain the sample PowerShell script file from [GitHub](#).
3. You must edit the content according to your own Azure environment. The `ps1` file contains comments for sections that require modification. Editing the file using Visual Studio with the PowerShell extension installed is recommended. In the `$vm_size` field, enter the desired instance type based on the number of virtual CPU cores. One of the sections you must modify is the `$vm_size` field. Enter the desired instance type here. Recommended types are the following compute-optimized instances:

- Standard\_F1
- Standard\_F2
- Standard\_F4
- Standard\_F8
- Standard\_F1s
- Standard\_F2s
- Standard\_F4s
- Standard\_F8s
- Standard\_F16s
- Standard\_F2s\_v2
- Standard\_F4s\_v2
- Standard\_F8s\_v2
- Standard\_F16s\_v2
- Standard\_F32s\_v2
- Standard\_F64s\_v2
- Standard\_F72s\_v2



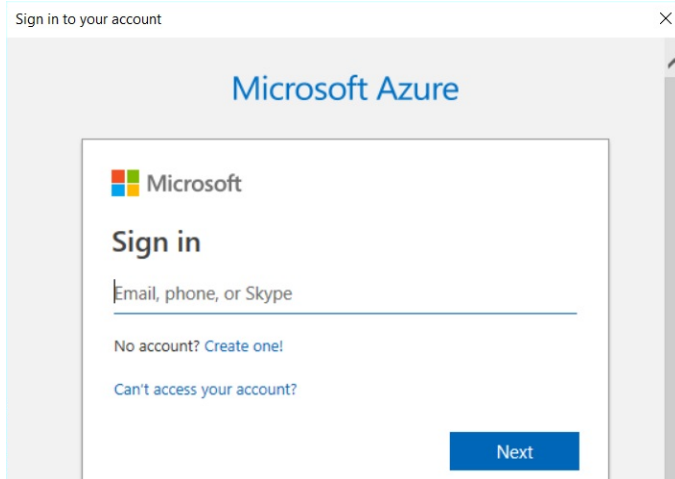
Instances with over 32 vCPU require a FG-VMUL license, which can support an unlimited number of CPU cores.

---

4. This sample file can deploy the FortiGate-VM in an existing VNet under an existing resource group. Before running the ps1 file, you must create the following Azure elements:
  - Resource group
  - VNet with a subnet. If you attach more than one NIC to the FortiGate-VM, create as many subnets as the number of NICs before running the ps1 file.
  - Container to copy your FortiGate-VM image file
  - Blob where to create an OS and a data disk file to launch a FortiGate-VM instance
5. Manually create security groups and route tables after deploying the FortiGate-VM as the sample ps1 file does not create these.
6. Download the FortiGate-VM vhd image:
  - a. Go to [Customer Service & Support > Download > VM Images](#).
  - b. From the *Select Product* dropdown list, select *FortiGate*.
  - c. From the *Select Platform* dropdown list, select *Azure*.
  - d. Select the desired 6.4 version.
  - e. Download the *FGT\_VM64\_AZURE-v6-buildXXXX-FORTINET.out.hyperv.zip* file.
  - f. Unzip the downloaded file. Place the *fortios.vhd* file in the *C:\Azure\vhd*s directory. You can change the path using the *\$sourceVhd* parameter in the ps1 file.
7. Run the ps1 file. In this example, the filename is *fortigate-deploy-powershell.ps1*.

```
PS C:\Users\Administrator> .\fortigate-deploy-powershell.ps1
```

- a. The system prompts you for a number of network instances. Enter a number between 1 and 4.
- b. The system prompts you to log into Azure by entering your username and password. Enter your credentials.



- c. The execution continues. If you encounter an error (shown in red), resolve it, manually clean up newly generated files, then retry the execution. If you do not clean up the files, the next execution attempt results in an error. Manually clean up files by doing the following:
  - i. Remove files created in your container and blob under your storage account.
  - ii. Remove network resources created under your specified resource group.
  - iii. Diagnostic files are created under your storage account. Remove these files if they are unnecessary.

The sample ps1 file is provided for your reference. If you need to modify or author it as your organization requires, you are expected to be able to do so on your own.

```

52 $networkname2 = "port2"
53 $networkname3 = "port3"
54 $networkname4 = "port4"
55 $pipName = "yourpip1" <# Public IP address name #>
56
57 Add-AzureRmAccount
58 #Get-AzureRmSubscription -SubscriptionId $SubscriptionId
59 #Select-AzureRmSubscription -SubscriptionName $SubscriptionName
60 Select-AzureRmSubscription -SubscriptionId $SubscriptionId
61
62 # Upload your local vhd file to Azure - this is "required." VHD has to be 2GB in size.
63 Write-Output "$(Get-Date -f $TimeStampFormat) - Upload"
64 Add-AzureRmVhd -LocalFilePath $SourceVHD -Destination $DestinationVHD -ResourceGroupName $ResourceGroupName -NumberOfUploaderThreads 5
  
```

```

Uploading:
55.6% complete: Remaining Time: 00:00:06: Throughput: 41.5Mbps. 00:00:06 remaining.

Name       : BYOL (2F96c44c-6b1a-485e0c) - azurestore@fortinet.com
Account    : azurestore@fortinet.com
Environment : AzureCloud
Subscription : 2F96c44c-6b1a-485e0c
Tenant     : 942b80cd-1b1a-461ba
TokenCache  : Microsoft.Azure.Commands.Common.Authentication.ProtectedFileTokenCache
VersionProfile : {}
ExtendedProperties : {}

DEBUG: AzureQoSEvent: CommandName - Set-AzureRmContext; IsSuccess - True; Duration - 00:00:01.1919593; Exception - ;
DEBUG: Finish sending metric.
DEBUG: 5:39:05 PM - SetAzureRmContextCommand end processing.
DEBUG: 5:39:05 PM - SetAzureRmContextCommand end processing.
12/06/2018 17:39:05 - Upload
DEBUG: 5:39:05 PM - AddAzureVhdCommand begin processing with ParameterSet '___AllParameterSets'.
DEBUG: 5:39:05 PM - using account id 'azurestore@fortinet.com'...
MD5 hash is being calculated for the file C:\AzureVhds\fortios.vhd.
MD5 hash calculation is completed.
Elapsed time for the operation: 00:00:04
Creating new page blob of size 2147484160...
  
```

Execution takes about ten minutes to complete.

```

    "primary": true
  }
}
},
"diagnosticsProfile": {
  "bootDiagnostics": {
    "enabled": true,
    "storageUri": "https://jkatostorage001.blob.core.windows.net/"
  }
},
"provisioningState": "Succeeded"
},
"type": "Microsoft.Compute/virtualMachines",
"location": "northeurope",
"id": "/subscriptions/2f96c...85e0c/resourceGroups/jkatogr001/providers/Microsoft.Compute/virtualMachines/jkatovmname001",
"name": "jkatovmname001"
}

RequestId      : 
IsSuccessStatusCode : True
StatusCode      : OK
ReasonPhrase     : OK

DEBUG: AzureQoSEvent: CommandName - New-AzureRmVM; IsSuccess - True; Duration - 00:02:46.3283474; Exception - ;
DEBUG: Finish sending metric.
DEBUG: 8:05:18 PM - NewAzureVMCommand end processing.
DEBUG: 8:05:18 PM - NewAzureVMCommand end processing.

```

8. Access the FortiGate-VM after executing the ps1 file:

- Go to the resource group and click the specified VM name.
- Click the FortiGate-VM hostname and find its public IP address.
- In a browser, access <https://<public IP address>>. Enter the admin username and password specified in the ps1 file to log in.

## Bootstrapping the FortiGate CLI and BYOL license at initial bootup using user data

This section explains how to add bootstrapping of FortiGate CLI commands and BYOL license at the time of initial bootup as part of PowerShell deployment.

Thorough knowledge of PowerShell and various Azure services and features is expected to adopt this deployment method. You should be able to author a ps1 file on your own as your organization requires.

You can find a sample PowerShell script that works with bootstrapping on [GitHub](#).

### To bootstrap the FortiOS CLI and BYOL license at initial bootup using user data:

- Create a directory on your PC with the path C:\Azure\misc.
- Create a MIME text file named azureinit.conf in the C:\Azure\misc directory. You can change the directory path and file name using the `$customdataFile = C:\Azure\misc\azureinit.conf` parameter in the ps1 file. azureinit.conf is the text file in MIME format that includes both FortiGate CLI commands and license file content. You can download a sample azureinit.conf from [GitHub](#).

- You can download a license file from [Customer Service & Support](#) after registering your product code. Copy and paste the content of your license file to replace the license portion of `azureinit.conf`. FortiGate-VM license content resembles the following:

```
-----BEGIN FGT VM LICENSE-----
QAAAAUjZtrwrJdUjEe/8C5dWnOvmY1w70ZNXPTG7vm2KKuYvL4++qL0gED6/q
S0SPkwpTFIXjAuRGtGyX1VvaTpXgQAA1pwrFd3nS6TWJ6dVT7K1D8ncufaa3bCw
s8XpmlivzjE4//+C9nqh4fN/KyDweIEIptDMaIsoCmBB0rU8HQIDkX+rgeCs3QZ5
ELStRrX11/oXqTB/gorG67ZdybXwVzPwVwJYDS5AsI+QK8BHJ+xGhLjHkzBZ4ezU
Hd01HCsm7MXEYV5KauU43sZ9XESTxqPEInah3yXgYtd24pnV683G4EHCKAdGyMTP
QqDqBMKcT5aei0ooGVAOX8D62C5Zjh+r1+tkdpRSYHoVYZIU95hBCNjBbroJbMnK7
NogYuaDQEH28MDtpvzXnb24mW1fDQMTJysQwCtwzJzmBnv5Bo7xNq/1nTs2QnFB
-----END FGT VM LICENSE-----
```

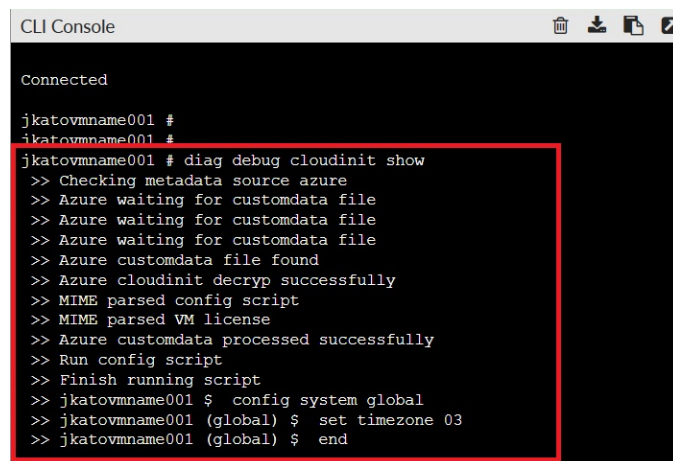
- In the example `ps1` file, the FortiGate CLI command is shown as the following:

```
config system global
set timezone 03
end
```

This example sets the timezone as GMT-9 Alaska. You can replace these lines with your own set of CLI commands.

- After editing the sample `ps1` file to reflect your own Azure environments and `azureinit.conf` file as required, run the `ps1` file. It reads the `conf` file and passes FortiGate CLI commands and the license to the FortiGate-VM deployment using cloud-init user data.
- After the `ps1` file execution ends, log into the FortiGate by accessing `https://<IP_address>` in your browser.
- The system displays the dashboard instead of a license upload window, since the license is already activated. To see how bootstrapping went, check if the command ran successfully. Open the CLI console and enter `diagnose debug cloudinit show`.

If the cloud-init was run successfully, the CLI shows `Azure customdata processed successfully`.

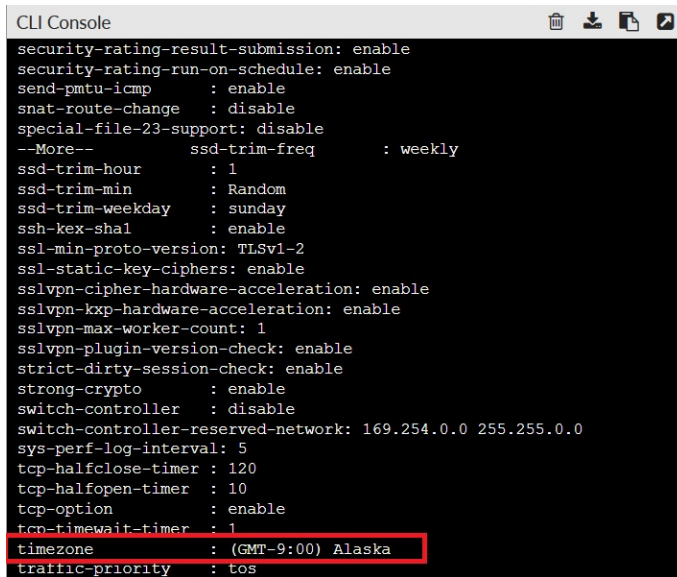


```
CLI Console
Connected
jkatovmname001 #
jkatovmname001 #
jkatovmname001 # diag debug cloudinit show
>> Checking metadata source azure
>> Azure waiting for customdata file
>> Azure waiting for customdata file
>> Azure waiting for customdata file
>> Azure customdata file found
>> Azure cloudinit decrypt successfully
>> MIME parsed config script
>> MIME parsed VM license
>> Azure customdata processed successfully
>> Run config script
>> Finish running script
>> jkatovmname001 $ config system global
>> jkatovmname001 (global) $ set timezone 03
>> jkatovmname001 (global) $ end
```

If you see an error with this `diagnose` command, resolve it and try again by editing `azureinit.conf`. There may be a syntax error.



8. Check the timezone by running `config system global` and `get` commands.



```

CLI Console
security-rating-result-submission: enable
security-rating-run-on-schedule: enable
send-pmtu-icmp      : enable
snat-route-change   : disable
special-file-23-support: disable
--More--            ssd-trim-freq      : weekly
ssd-trim-hour        : 1
ssd-trim-min         : Random
ssd-trim-weekday     : sunday
ssh-kex-shal        : enable
ssl-min-proto-version: TLSv1-2
ssl-static-key-ciphers: enable
sslvpn-cipher-hardware-acceleration: enable
sslvpn-kxp-hardware-acceleration: enable
sslvpn-max-worker-count: 1
sslvpn-plugin-version-check: enable
strict-dirty-session-check: enable
strong-crypto       : enable
switch-controller    : disable
switch-controller-reserved-network: 169.254.0.0 255.255.0.0
sys-perf-log-interval: 5
tcp-halfclose-timer  : 120
tcp-halfopen-timer   : 10
tcp-option           : enable
tcp-timewait-timer   : 1
timezone             : (GMT-9:00) Alaska
traffic-priority      : tos
  
```

The timezone was changed to Alaska as expected, meaning that the bootstrapping CLI command was successful. This assumes that you used the default FortiGate CLI command in step 4. If you modified the command, test it accordingly.

## Deploying FortiGate-VM from the marketplace

### To deploy FortiGate-VM from the marketplace:

1. In the Azure marketplace, search for and select Fortinet FortiGate Next-Generation Firewall.
2. From *Select a plan*, select the desired deployment plan. Click *Create*.
3. On the *Basics* tab, configure the parameters according to your requirements:
  - a. From the *Subscription* dropdown list, select your subscription.
  - b. In *Resource group*, select an existing resource group or create a new one.
  - c. From the *Region* dropdown list, select the desired region.
  - d. In the *FortiGate administrative username* and *password* fields, enter the username and password for the FortiGate administrative profile.
  - e. In the *Fortigate Name Prefix* field, assign a naming prefix for your FortiGate resources.
  - f. From the *Fortigate Image SKU* dropdown list, select BYOL or PAYG.
  - g. From the *Fortigate Image Version* dropdown list, select the FortiGate version to deploy.

h. Click *Next: Instance Type* >.

[Home](#) > [Fortinet FortiGate Next-Generation Firewall \(preview\)](#) >

## Create Fortinet FortiGate Next-Generation Firewall ...

**Basics** Instance Type Networking Public IP Advanced Review + create

**Project details**  
Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription \* ⓘ

Resource group \* ⓘ   
[Create new](#)

**Instance details**

Region \* ⓘ

FortiGate administrative username \* ⓘ

FortiGate password \* ⓘ

Confirm password \* ⓘ

Fortigate Name Prefix \* ⓘ

Fortigate Image SKU ⓘ

Fortigate Image Version ⓘ

[Review + create](#) < Previous Next : Instance Type >

4. On the *Instance Type* tab, select an appropriately sized instance type. Click *Next: Networking* >.
5. On the *Networking* tab, configure the parameters according to your requirements:
  - a. In *Virtual network*, select an existing VNet or create a new one. The FortiGate-VM requires a public and private interface for Internet edge protection.
  - b. Enable or disable *Accelerated Networking*, which refers to SR-IOV support. This depends on the instance type that you selected.
  - c. Click *Next: Public IP* >.
6. On the *Public IP* tab, create a new public IP address or create a new one. Click *Next: Advanced* >.
7. On the *Advanced* tab, configure the parameters according to your requirements:
  - a. If you want FortiManager to manage this FortiGate, enable *Connect to FortiManager* and provide the FortiManager IP address and serial number in the *FortiManager IP address* and *FortiManager Serial Number* fields.
  - b. If you want to provide initial configuration to the FortiGate, enter the desired commands in the *Custom Data* field. These commands are executed during initial bootup.



Home > Fortinet FortiGate Next-Generation Firewall >

### Create Fortinet FortiGate Next-Generation Firewall ...

Basics Instance Type Networking Public IP **Advanced** Review + create

**FortiManager**

Connect to FortiManager

Connect to FortiManager \* ⓘ ☐ yes ☒ no

FortiManager IP address ⓘ



FortiManager Serial Number ⓘ

**Custom Data**

Pass a configuration file into the virtual machine while it is being provisioned. This is additional to the configuration for this architecture.

Custom Data ⓘ 

Add you required additional configuration here.

 The default configuration already included in this deployment can be found on our github page. 

- c. To provide a BYOL license file for the FortiGate, upload it using the *FortiGate License* field. The license file is ignored if you selected PAYG in step 3. Click *Next: Review + create >*.

8. Once validation completes, confirm all values, then click *Create*. Azure creates the resources accordingly.

## Deploying FortiGate-VM on regional Azure clouds

In addition to "global" Azure support, FortiGate-VM supports "regional" Azure support, including China, Germany, and U.S. Gov. FortiGate-VM deployment on regional Azure clouds requires dedicated subscription accounts as they are not covered by global Azure and services are run under URL domains unique to the regional Azure cloud.

FortiGate-VM is not available on regional Azure cloud marketplaces. Instead, you can deploy FortiGate-VM (BYOL) having a VHD file ready and instantiating a FortiGate-VM instance using your PowerShell or ARM deployment templates by pointing to the VHD file.

You can download the VHD file from [Fortinet Customer Service & Support](#). Go to *Support > VM Images*, then select *FortiGate* as the *Product* and *Azure* for the *Platform*. The file name is FGT\_VM64\_AZURE-v6-buildXXXX-FORTINET.out.hyperv.zip, where XXXX is the build number.

Once the download is complete, unzip the file and locate the fortios.vhd file. Upload the fortios.vhd file to your blob/storage location as required by your deployment templates.

## Enabling accelerated networking on the FortiGate-VM

Azure supports SR-IOV, which accelerates networking by allowing VM NICs to bypass the hypervisor and go directly to the PCIe card underneath. FortiOS must understand when it is using SR-IOV and change networking to accommodate SR-IOV.

Azure refers to SR-IOV as *Accelerated Networking*. You can check if it is enabled by checking the NIC attached to the VM through the GUI or CLI.

This feature is available for FortiOS 6.2.1 and later versions.

### To configure accelerated networking:

1. You can enable accelerated networking when instantiating a new VM, or enable it after the VM has been created. Do one of the following:
  - a. To enable accelerated networking using the GUI, create a new VM or select an existing VM. On the *Networking* tab, for *Accelerated networking*, select *On*.

The screenshot shows the 'Create a virtual machine' page in the Azure portal, specifically the 'Networking' tab. The page title is 'Create a virtual machine'. Below the title are tabs for 'Basics', 'Disks', 'Networking' (selected), 'Management', 'Advanced', 'Tags', and 'Review + create'. A description states: 'Define network connectivity for your virtual machine by configuring network interface card (NIC) settings. You can control ports, inbound and outbound connectivity with security group rules, or place behind an existing load balancing solution. [Learn more](#)'. Under 'NETWORK INTERFACE', it says 'When creating a virtual machine, a network interface will be created for you.' The settings include: 'Virtual network' (dropdown with 'Filter virtual networks' and 'Create new' link), 'Public IP' (dropdown with 'None' and 'Create new' link), 'NIC network security group' (radio buttons for 'None', 'Basic' (selected), and 'Advanced'), 'Public inbound ports' (radio buttons for 'None' (selected) and 'Allow selected ports'), and 'Select inbound ports' (dropdown with 'Select one or more ports'). A blue information box states: 'All traffic from the internet will be blocked by default. You will be able to change inbound port rules in the VM > Networking page.' At the bottom, 'Accelerated networking' is set to 'On' (radio button selected).

- b. To enable accelerated networking using the CLI:

```
root@mail:/home/azure/images# az network nic update -g <Resource group name> -n <NIC
Name> --accelerated-networking true
{
  "dnsSettings": {
    "appliedDnsServers": [],
    "dnsServers": [],
    "internalDnsNameLabel": null,
    "internalDomainNameSuffix": "k41kcrl04yeezbyeswqimbxshb.fx.internal.cloudapp.net",
    "internalFqdn": null
  },
  "enableAcceleratedNetworking": true,
```

On the FortiOS side, a virtual interface is created in the format of sriovslv(number) for each NIC that has accelerated networking enabled:

```
<VM name> # fnsysctl ifconfig
port1 Link encap:Ethernet HWaddr 00:0D:3A:B4:87:70
  inet addr:172.29.0.4 Bcast:172.29.0.255 Mask:255.255.255.0
  UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1
  RX packets:5689 errors:0 dropped:0 overruns:0 frame:0
  TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
  collisions:0 txqueuelen:1000
  RX bytes:1548978 (1.5 MB) TX bytes:0 (0 Bytes)
sriovslv0 Link encap:Ethernet HWaddr 00:0D:3A:B4:87:70
  UP BROADCAST RUNNING SLAVE MULTICAST MTU:1500 Metric:1
  RX packets:35007 errors:0 dropped:0 overruns:0 frame:0
```

```
TX packets:33674 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:34705194 (33.1 MB) TX bytes:10303956 (9.8 MB)
```

The NIC shows the driver as `hv_netvsc` with accelerated networking enabled or disabled:

```
<VM name> # diagnose hardware deviceinfo nic port1
```

```
Name: port1
```

```
Driver: hv_netvsc
```

The FortiOS GUI does not display the virtual interface:

FortiGate VM64-AZUREONDEMAND

HomePage

Dashboard

Security Fabric

FortiView

Network

Interfaces

Create New

Edit

Delete

By TypeBy RoleAlphabetically

DNS

Packet Capture

SD-WAN

SD-WAN Rules

Physical (2)

port1

port2

172.29.0.4/255.255.255.0

0.0.0.0/0.0.0.0

Physical Interface

Physical Interface

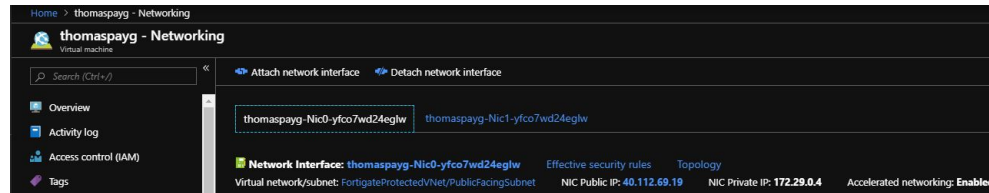
PING HTTPS SSH FMC-Access

0

0

To check if accelerated networking is enabled using the GUI:

1. In the Azure management console, go to the desired VM, then *Networking*.
2. Select the desired NIC. In this example, accelerated networking is shown as enabled.



To check if accelerated networking is enabled using the CLI:

```
root@mail:/home/azure/images# az network nic show -g <Resource group name> -n <NIC name>
```

Check that the following displays as part of the output: "enableAcceleratedNetworking": true,

## Upgrading FortiOS

For the recommended upgrade path, see [Upgrade Path Tool](#). For PAYG, select *FortiGate-VM-AZUREONDEMAND*. For BYOL, select *FortiGate-VM-AZURE*. Select the current and target upgrade versions to see the upgrade path.

# Deploying autoscaling on Azure

You can deploy FortiGate virtual machines (VMs) to support autoscaling on Azure. New resources are created or existing resources are used when specified during the deployment. By integrating FortiAnalyzer, you can consolidate logging and reporting for your FortiGate cluster. Fortinet provides a FortiGate Autoscale for Azure deployment package to facilitate the deployment.

Multiple FortiGate-VM instances form VM scale sets (VMSS) to provide highly efficient clustering at times of high workloads. FortiGate Autoscale for Azure incorporates one or more VMSS, network-related components, and Azure Function App scripts. FortiGate-VM instances are scaled out automatically according to predefined workload levels. When a spike in traffic occurs, FortiGate-VM instances are automatically added to the VMSS. Autoscaling is achieved by using FortiGate-native high availability (HA) features such as `config-sync`, which synchronizes operating system (OS) configurations across multiple FortiGate-VM instances at the time of scale-out events.

FortiGate Autoscale for Azure is available with FortiOS 6.4.5, FortiOS 6.4.7, FortiOS 7.0.0, and FortiOS 7.0.1 and supports any combination of On-Demand (PAYG) and Bring Your Own License (BYOL) instances.

FortiAnalyzer 6.2.5 or FortiAnalyzer 6.4.5 can be incorporated into Fortinet FortiGate Autoscale to use extended features that include storing logs into FortiAnalyzer.

## Overview

### The virtual network

The virtual network (VNet) requires at least one subnet, referred as *Subnet 1*. Other subnets are optional.

- The required subnet is directly associated with FortiGate Autoscale.
- Two FortiGate VMSS will be deployed into *Subnet 1*.
- *Subnet 1* will be associated with *Port 1* on the FortiGate.
- One Network Security Group is be associated with *Subnet 1*.

The FortiGate Autoscale deployment template can configure up to 4 subnets per FortiGate in the cluster.

- Each FortiGate will initially have one Network Interface available per subnet.
- Additional subnets specified in the template will be associated as Port 2, Port 3, and Port 4 (as required) on the FortiGate. The association of ports depends on the order in which the subnet is specified in the template.
  - In a 3-subnet deployment, Port 2 will point to the subnet with the lower number and Port 3 will point to the subnet with the higher number. Port 4 will not be used.
  - In a 2-subnet deployment, Port 2 will point to the subnet. Ports 3 and 4 will not be used.

- Example scenarios are described in the table below.

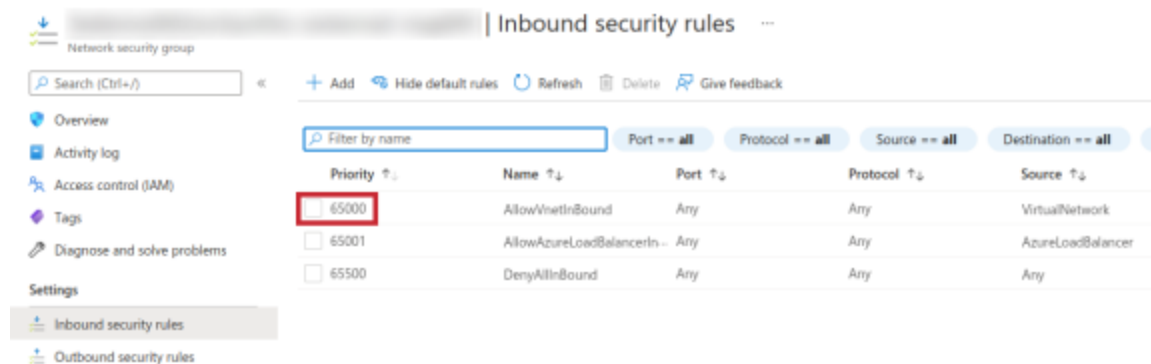
Scenario	Subnet parameter on the template	FortiGate port associations
4-subnet deployment	Subnet 2: ✓ Subnet 3: ✓ Subnet 4: ✓	Port 2 points to Subnet 2. Port 3 points to Subnet 3. Port 4 points to Subnet 4.
3-subnet deployment	Subnet 2: ✓ Subnet 3: ✗ Subnet 4: ✓	Port 2 points to Subnet 2. Port 3 points to Subnet 4.
2-subnet deployment	Subnet 2: ✗ Subnet 3: ✗ Subnet 4: ✓	Port 2 points to Subnet 4.

- FortiGate Autoscale will be only configured for the subnets specified in the virtual network.
  - Users can modify the virtual network after the initial deployment. In this case, additional manual configuration will be required.
- In a multiple subnet deployment scenario, it is recommended that users use one Network Security Group for *Subnet 1*, and another Network Security Group for the other subnets.

The Autoscale resource group must be created in the same region as the VNet resource group specified in the parameter [VNet Resource Group Name on page 66](#).

## Subnet 1 Network Security Group Rule Priority

This parameter refers to the highlighted area of the following image:



When using an existing VNet that has associated a network security group with *Subnet 1* (the subnet that will be used to deploy the Autoscale VMSS) the network security group may already have existing rules. As the template deployment will add new rules to this network security group, specifying the *Subnet 1 Network Security Group Rule Priority* parameter can help users avoid potential rule conflicts. For details on setting the rule priority, refer to the Microsoft article [Network security groups > Security rules](#).

## FortiAnalyzer integration

When FortiAnalyzer integration is selected, a new FortiAnalyzer resource will be created in the virtual network to be used by FortiGate Autoscale. As FortiGate Autoscale and the FortiAnalyzer are configured to work with each other, this FortiAnalyzer is not intended to be replaced.

FortiAnalyzer requires a public IP address resource to work with and the deployment defaults to creating a new resource.

## Using an existing public IP address

By default, the deployment template will create a new public IP address for the FortiAnalyzer (if deploying with FortiAnalyzer integration) and the front-end load balancer. Specifying the ID of a public IP resource will associate the existing resource for use in the FortiGate Autoscale deployment.

### To use an existing public IP address:

1. Ensure the public IP address is available for use.
2. Look up the *Resource ID* of the existing public IP resource. This is found in the Properties of the Azure resource.
3. Specify the full *Resource ID* in the relevant parameter:
  - For the FortiAnalyzer, specify the Resource ID in the parameter [FortiAnalyzer Public IP Address ID on page 62](#).
  - For the Front End Load Balancer, specify the Resource ID in the parameter [Frontend IP Address ID on page 62](#).



Confirm the public IP resource quota before starting a deployment to ensure resource allocation is successful. Not enough IP address resources will result in deployment failures.



The SKU of the public IP address for the FortiAnalyzer isn't restricted. In comparison, the IP address for the external Load Balancer must be of the 'standard' SKU in order to match the VMSS.

---

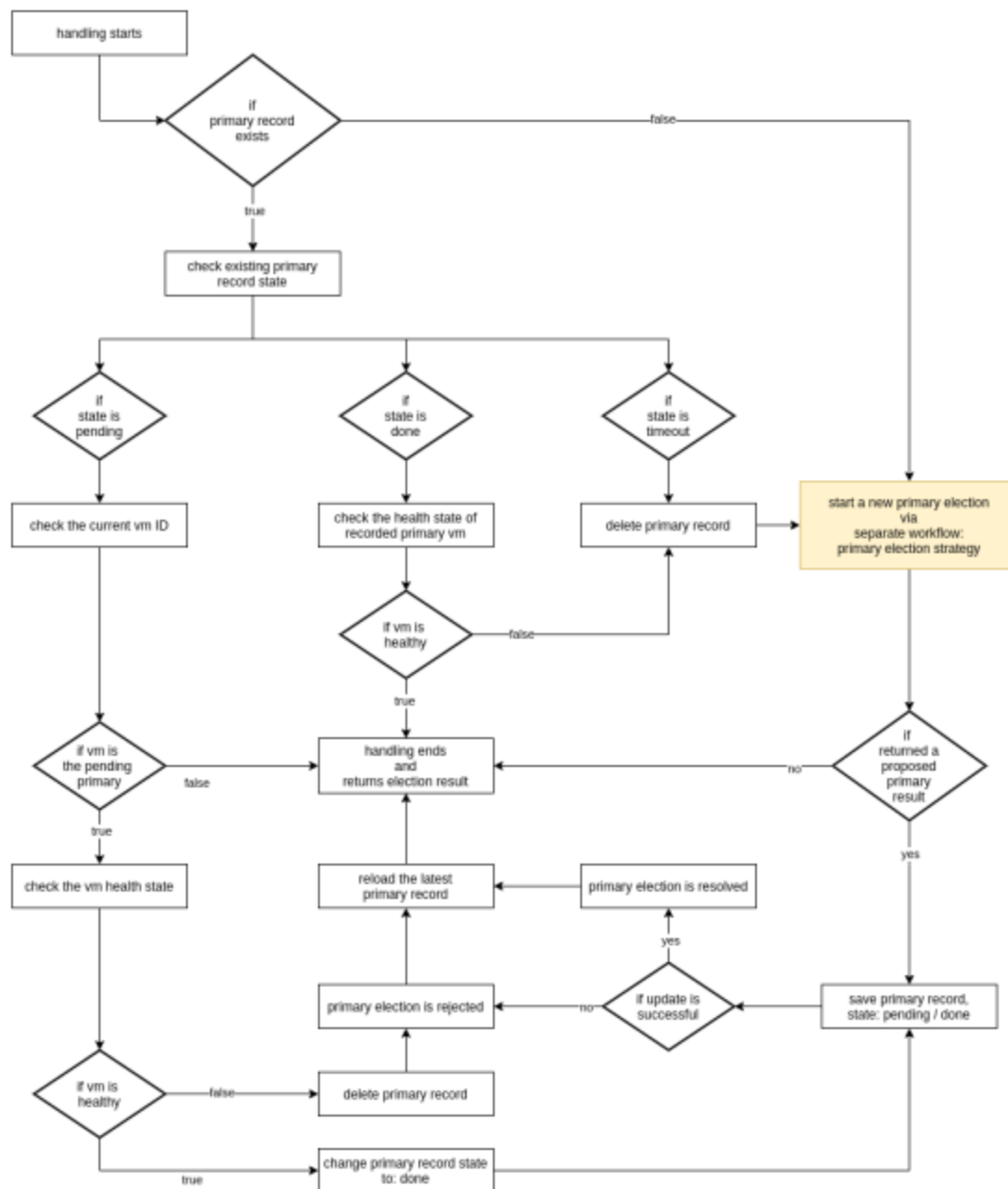
## Election of the primary instance

A core feature of FortiGate Autoscale is the election of the primary instance. FortiGates in the VMSS are constantly monitored and if the conditions of the environment have changed, the election of a new primary instance may be required.

As depicted in the flowchart below, a primary election will happen:

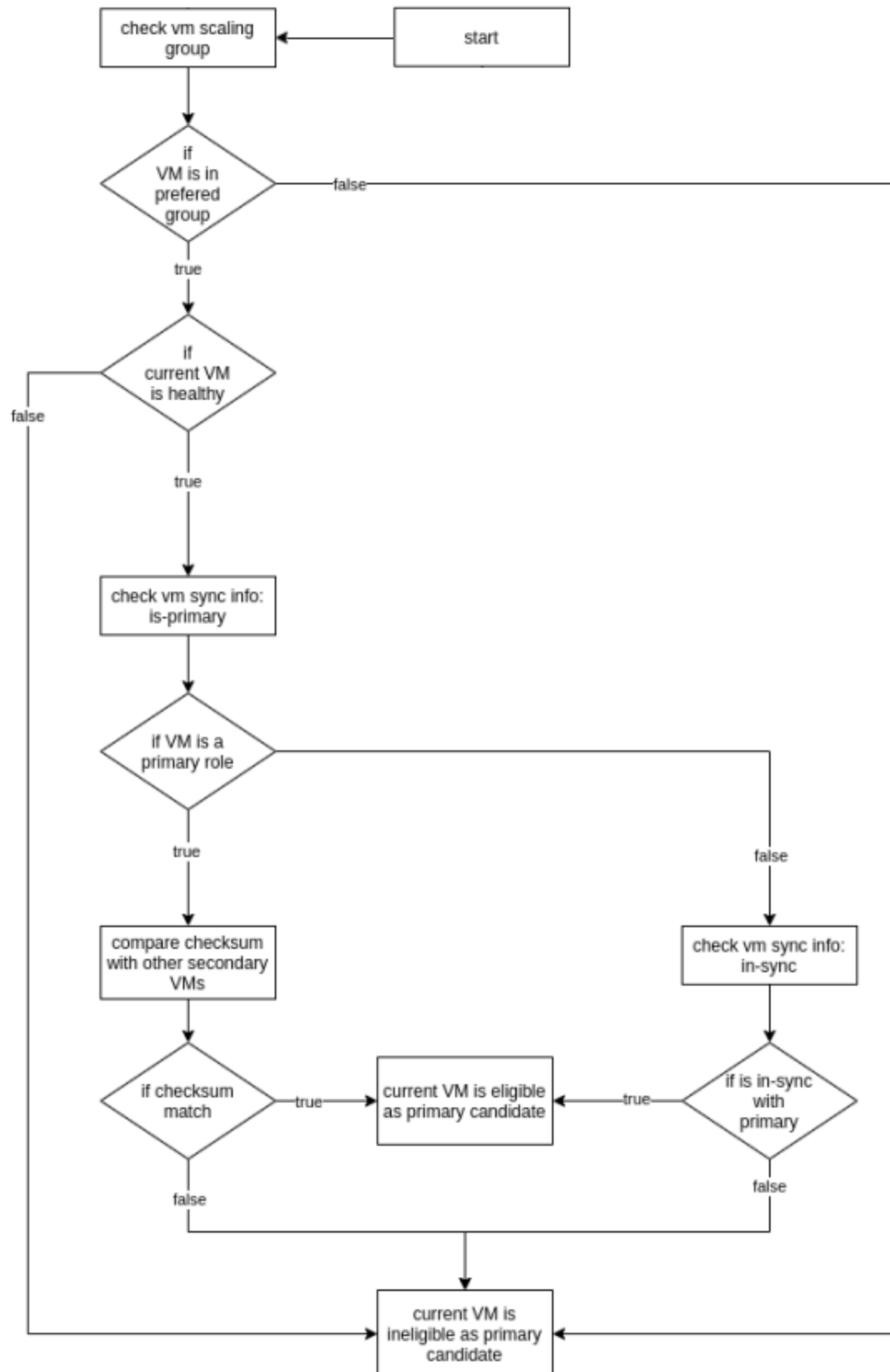
- when no primary record is found in the database
- when the FortiGate noted in the primary record is deemed unhealthy

## Primary Election Handling



The preferred group primary election strategy is depicted in the flowchart below:

Flow: Preferred Group Primary Election strategy





## Heartbeat

FortiGate Autoscale monitors the heartbeat sent from each FortiGate. The default heartbeat interval is 30 seconds, as defined by the parameter [Heart Beat Interval on page 62](#).

### To change the heartbeat interval after deployment:

1. Locate the Settings item with key: *heartbeat-interval*. For details, refer to the section [Modifying the Autoscale settings in Cosmos DB on page 76](#).
2. Update the numeric value to the desired duration.
3. Update the `auto-scale hb-interval` interval on the primary FortiGate to match the value specified in the Cosmos DB using the following:

```
config system auto-scale
set hb-interval <desired interval>
end
```

## Late heartbeat

The FortiGate sends heartbeats to the Autoscale handler via HTTPS. As such, network conditions may result in heartbeats arriving later than expected. When this happens, the heartbeat is considered a late heartbeat and the [Heart Beat Loss Count on page 62](#) will be increased by 1.

## Heartbeat loss count

Any late heartbeat will increase the heartbeat loss count by 1. If this count reaches a defined threshold, the FortiGate will be deemed temporarily unhealthy. Any heartbeat arriving at the handler on time will reset the count to 0. The default heartbeat loss count is 10 (seconds) and is defined in the parameter [Heart Beat Loss Count on page 62](#).

### To change the heartbeat loss count after deployment:

1. Locate the Settings item with key: *heartbeat-loss-count*. For details, refer to the section [Modifying the Autoscale settings in Cosmos DB on page 76](#).
2. Update the numeric value to the desired duration.

## Heartbeat delay allowance

FortiGate Autoscale offsets a certain amount of network latency on the Internet with the parameter [Heart Beat Delay Allowance on page 62](#). The default allowance is 2 seconds.

### To change the heartbeat delay allowance after deployment:

1. Locate the Settings item with key: *heartbeat-delay-allowance*. For details, refer to the section [Modifying the Autoscale settings in Cosmos DB on page 76](#).
2. Update the numeric value to the desired duration.

## Unhealthy state and eligibility for primary role

A FortiGate-VM in an unhealthy state is excluded from participating in the election of the primary instance.

If the current primary FortiGate is deemed unhealthy, it will still work in the primary role until the next Primary Election, after which the primary role will be assigned to another eligible FortiGate and the previous primary FortiGate will change its role to secondary during its next heartbeat.

An unhealthy VM will stay running in the cluster in a secondary role until it recovers from the unhealthy state. This behavior does not cause any scaling activity to happen.

It takes some time, usually within one heartbeat interval, for each FortiGate to be individually notified about the new primary so the change of primary does not happen synchronously on every FortiGate but eventually they will be in-sync with the new primary.

## Sync recovery count

FortiGate Autoscale helps an unhealthy FortiGate recover by counting the on-time heartbeats it sends. When the counter reaches the sync recovery count, the FortiGate is deemed healthy and is again eligible to be elected the primary instance.

### To change the sync recovery count after deployment:

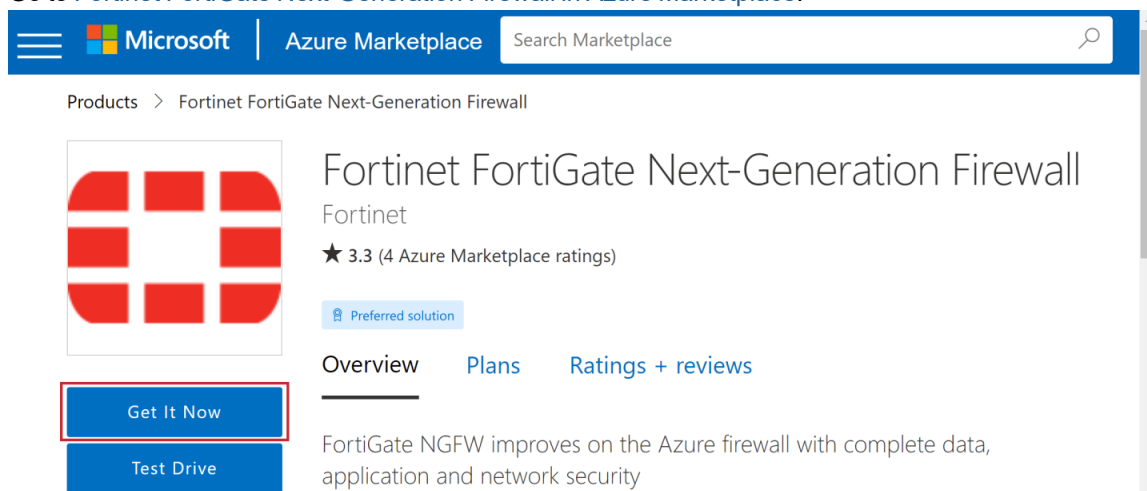
1. Locate the Settings item with key: *sync-recovery*. For details, refer to the section [Modifying the Autoscale settings in Cosmos DB on page 76](#).
2. Update the numeric value to the desired duration.

## Selecting the instance type

The size of the FortiGate and the size of the FortiAnalyzer (optional) are specified in the [Instance Type on page 62](#) and [FortiAnalyzer Instance Type on page 61](#) parameters. The string value entered in these parameters is created from the words of the size.

### To select the instance type for FortiGate:


1. Go to [Fortinet FortiGate Next-Generation Firewall in Azure Marketplace](#).



2. Click *Get It Now*.

3. Click *Continue*.

### Create this app in Azure

**Fortinet FortiGate Next-Generation Firewall**  
By Fortinet

Software plan

Single VM

Pricing: This solution template deploys software components and Azure infrastructure components. The price is the cost of those components.

Details: FortiGate NGFW improves on the Azure firewall with complete data, application and network security

This app requires some basic profile information. You have provided the information already so you're good to go! [Edit](#)

By clicking "Continue", I grant Microsoft permission to share my supplied contact information with the provider so that they can contact me regarding this product and related products. The shared information will be handled in accordance with the provider's [terms](#) and [privacy statement](#).

Continue

4. Click *Create* using *Plan: Single VM*.


Microsoft Azure

Search resources, services, and docs (G+/)

Home >

## Fortinet FortiGate Next-Generation Firewall

Fortinet

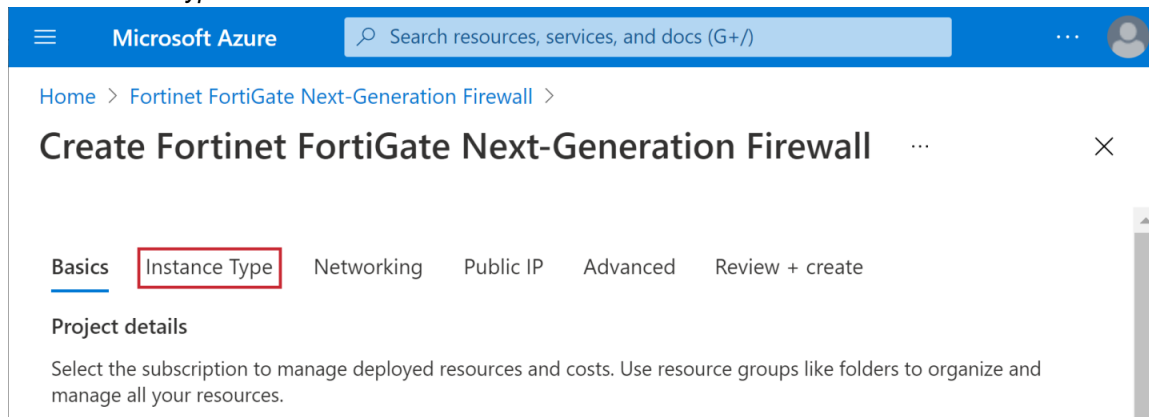
**Fortinet FortiGate Next-Generation Firewall**  
Fortinet  
★ 3.3 (4 Azure ratings)  
[Preferred solution](#)

Plan

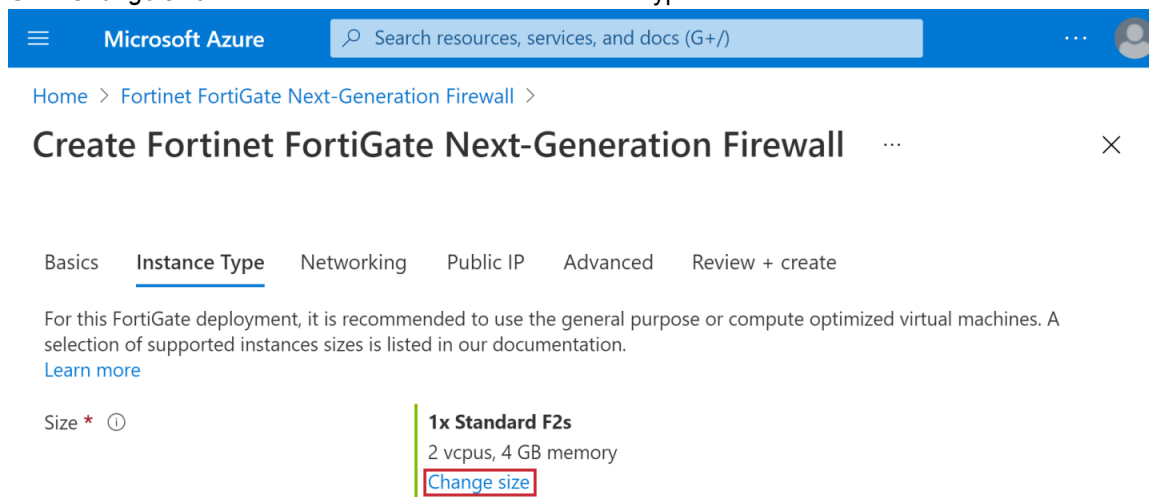
Single VM

Create

5. Click *Instance Type* as illustrated.



6. Click *Change size* to view the full list of available Instance types.



7. Review the information and capacity of the VM sizes and select the best one for your deployment.



For BYOL VM sizes, users should also match the vCPU capacity of the selected *Instance Type* with the limit of the FortiGate license. Each license has a limit for the maximum number of vCPU per VM.

In the example below, *F16s\_v2* is chosen.

Microsoft Azure Search resources, services, and docs (G+)

## Select a VM size

Search by VM size... Display cost: **Monthly** vCPUs: **All** RAM (GiB): **All** Add filter

Showing 413 of 414 VM sizes. Subscription: PAYG-DevOps Region: East US Current size: Standard\_F2s Learn more about VM sizes Guidance choosing a region or VM size Group by series

VM Size	Family	vCPUs	RAM (GiB)	Data disks	Max IOPS	Temp storage (GiB)
E-Series v4 The 4th generation E family sizes for your high memory needs						
F-Series v2 Up to 2X performance boost for vector processing workloads						
F2s_v2	Compute optimized	2	4	4	3200	16
F4s_v2	Compute optimized	4	8	8	6400	32
F8s_v2	Compute optimized	8	16	16	12800	64
<b>F16s_v2</b>	Compute optimized	<b>16</b>	<b>32</b>	<b>32</b>	<b>25600</b>	<b>128</b>
F32s_v2	Compute optimized	32	64	32	51200	256

**Select** Prices presented are estimates in your local currency that include Azure infrastructure applicable software costs, as well as any discounts for the subscription and location. Final charges will appear in your local currency in cost analysis and billing views. [View Azure pricing calculator.](#)

8. Click **Select**.


### To select the instance type for FortiAnalyzer:

1. Go to [FortiAnalyzer Centralized Log Analytics in Azure Marketplace](#).

Microsoft Azure Marketplace

Search Marketplace

Products > FortiAnalyzer Centralized Log Analytics



**FortiAnalyzer Centralized Log Analytics**

Fortinet

★ 1.0 (2 Azure Marketplace ratings) | ★ 4.5 (2 external ratings)

Preferred solution

Overview Plans Ratings + reviews

**Get It Now**


Pricing information

Fortinet FortiAnalyzer delivers centralized network logging, analytics, and reporting

2. Click **Get It Now**.

3. Click *Continue*.

Create this app in Azure

**FortiAnalyzer Centralized Log Analytics**  
By Fortinet

Software plan

**Fortinet FortiAnalyzer Centralized Log Analytics**

Pricing: This solution template deploys software components and Azure infrastructure components. The price is the cost of those components.

Details: Fortinet FortiAnalyzer delivers centralized network logging, analytics, and reporting

This app requires some basic profile information. You have provided the information already so you're good to go! [Edit](#)

By clicking "Continue", I grant Microsoft permission to share my supplied contact information with the provider so that they can contact me regarding this product and related products. The shared information will be handled in accordance with the provider's [terms](#) and [privacy statement](#).

Continue

4. Click *Create*.

Microsoft Azure


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...

[Home](#) >

# FortiAnalyzer Centralized Log Analytics

Fortinet

**FortiAnalyzer Centralized Log Analytics**

Fortinet

★ 1.0 (2 Azure ratings) | ★ 4.5 (2 external ratings)

Preferred solution

Create

5. Click *Network and Instance Settings* as illustrated.

Microsoft Azure

Search resources, services, and docs (G+/)

...

[Home](#) > [FortiAnalyzer Centralized Log Analytics](#) >

## Create FortiAnalyzer Centralized Log Analytics

...

Basics

Network and Instance Settings

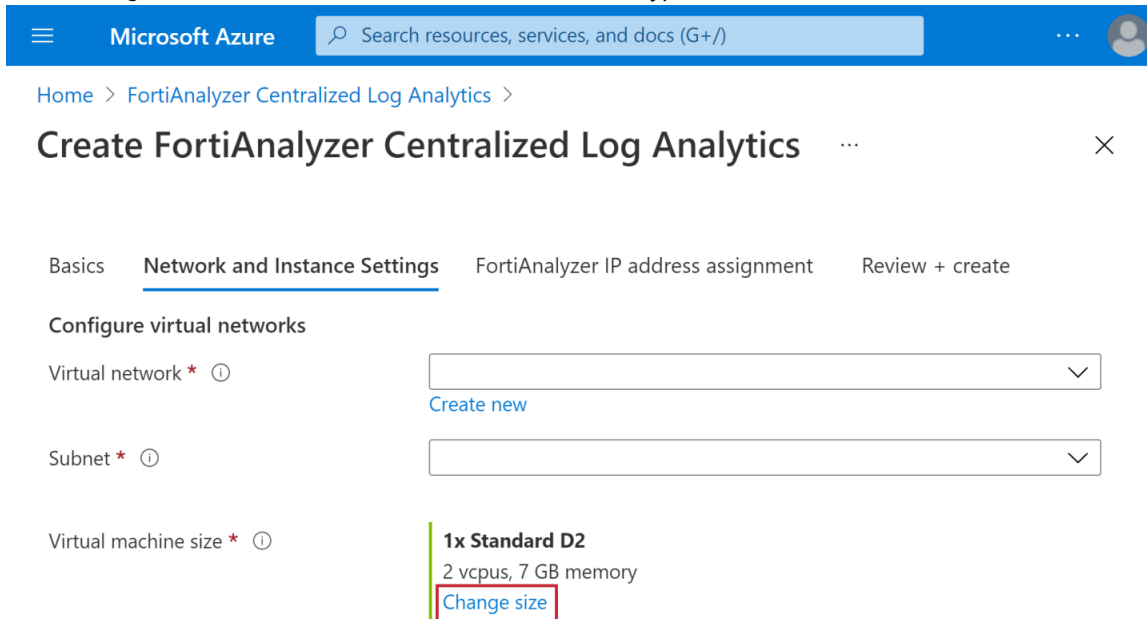
FortiAnalyzer IP address assignment

Review + create

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

6. Click *Change size* to view the full list of available instance types.



Microsoft Azure Search resources, services, and docs (G+)

Home > FortiAnalyzer Centralized Log Analytics >

## Create FortiAnalyzer Centralized Log Analytics

Basics **Network and Instance Settings** FortiAnalyzer IP address assignment Review + create

Configure virtual networks

Virtual network \* ⓘ  [Create new](#)

Subnet \* ⓘ

Virtual machine size \* ⓘ

**1x Standard D2**  
2 vcpus, 7 GB memory  
[Change size](#)

7. Review the information and capacity of the VM sizes and select the best one for your deployment.



For BYOL VM sizes, users should also match the vCPU capacity of the selected Instance Type with their FortiGate License. The License has a limit for the maximum number of vCPU per VM.

8. Click *Select*.

### To create the instance type string:

During the template deployment the FortiGate instance type is entered in the parameter [Instance Type on page 62](#) and the FortiAnalyzer instance type is entered in the parameter [FortiAnalyzer Instance Type on page 61](#). The value of each instance type is constructed by creating a string by joining the words of the Size (Virtual machine size) with an underscore ( \_ ). In the screen shot below, these word are highlighted. The constructed string for *Standard F16s v2* is

Standard\_F16s\_v2.

Microsoft Azure

Search resources, services, and docs (G+)

Home > Fortinet FortiGate Next-Generation Firewall >

## Create Fortinet FortiGate Next-Generation Firewall

Basics **Instance Type** Networking Public IP Advanced Review + create

For this FortiGate deployment, it is recommended to use the general purpose or compute optimized virtual machines. A selection of supported instances sizes is listed in our documentation. [Learn more](#)

Size \* ⓘ

**1x Standard F16s v2**  
16 vcpus, 32 GB memory  
[Change size](#)



## Prerequisites

Installing and configuring FortiGate Autoscale for Azure requires knowledge of the following:

- Configuring a FortiGate using the CLI
- Azure deployment templates
- Azure Functions

That FortiGate Autoscale for Azure will be deployed by DevOps engineers or advanced system administrators who are familiar with the above is expected.

## Before you begin

Before starting the deployment, the following steps must be carried out:

1. Log into your Azure account. If you do not already have one, [create one](#) by following the on-screen instructions.
2. [Create a service principal](#) for Autoscale to interact with the different Azure services. The creation of the service principal may be done by a different Azure account.



The service principal requires *read* and *write* permissions which can be granted by adding the *Contributor* role to the service principal. In order to grant the service principal such permissions, the Azure account used to create the service principal requires the following permissions:

- *Microsoft.Authorization/roleAssignments/write* (to add role assignments)
- *Microsoft.Authorization/roleAssignments/delete* (to remove role assignments)

These permissions are included in the roles *User Access Administrator* and *Owner*. For details, refer to the Microsoft article [Add or remove role assignments using Azure RBAC and the Azure portal](#).

Note the following items as you need them to deploy the Function App:

Item	Where to find it	Relevant FortiOS parameter
Application ID	You can find this item in Azure Active Directory > App registrations > (your app).	<a href="#">Service Principal App ID on page 64</a>
Application secret	Only appears once. You cannot retrieve the application secret.	<a href="#">Service Principal App Secret on page 64</a>
Object ID	Open the Azure CLI and enter the command <code>az ad sp show --id &lt;the service principal client id&gt;</code> . The object ID displayed may differ from the object ID displayed in Azure Active Directory > App registrations > (your-app). Use the value from the Azure CLI.	<a href="#">Service Principal Object ID on page 64</a>

3. Confirm that you have a valid subscription to the [PAYG and/or BYOL marketplace listings](#) for FortiGate, as required for your deployment.



Without the valid subscriptions, the deployment will fail with errors.

---

## Requirements when using an existing VNet

When using an existing VNet, ensure that the following FortiGate Autoscale for Azure requirements have been satisfied:

- IP address ranges in the VNets satisfy the Microsoft requirements listed in the article [What address ranges can I use in my VNets?](#)
- The VNet can contain 1 or more subnets but only up to 4 subnets can be used by the template deployment.
  - The FortiGate VMSS will be deployed in the subnet specified in Subnet 1 Name. This subnet will be referred as 'Subnet 1'. This subnet must:
    - be a clean subnet (i.e. is not used by any other resource.)
    - have two service endpoints that have been manually enabled, one for Microsoft.AzureCosmosDB, and one for Microsoft.Web. If this requirement is not met, the template will automatically add the two service endpoints to the subnet (i.e. Subnet 1).
  - Up to 3 other subnets will be protected by the FortiGate VMSS.
- One Network Security Group is associated with Subnet 1.
- (Optional) One available (i.e. not associated with any resource) public IP address to be used for the external load balancer that will be created during template deployment.
  - This IP address must be of the 'standard' SKU in order to match the VMSS.
  - This requirement is optional as a new IP address can be created during template deployment, if the template parameter [Frontend IP Address ID on page 62](#) is intentionally left empty.
- All the above components reside in the same resource group.
  - The location of the resource group should match the location of the deployment resource group.

## Requirements when creating a new VNet

Subnet 1 is always required because the Autoscale VMSS is deployed into subnet 1. Subnets 2, 3, and 4 are optional. If created, they will be protected by the FortiGate VMSS. If you specify input for subnet 2, a subnet will be created and used as 'subnet 2'. Similarly, 'subnet 3' and 'subnet 4' will be created if input is specified.

The following parameters are used to specify input:

- *Subnet 1 Address Range* is always required.
- *Subnet 1 Name* is used to enter a name of your choice. Leave it empty and a name will be generated.
- *Subnet 2/3/4 Address Range*, if provided, will assume the creation of subnet 2/3/4.
- *Subnet 2/3/4 Name* is used to enter a name of your choice. If the subnet is being created and this parameter is left empty, a name will be generated.

The parameters for subnet 2 to subnet 4 can be used in any combination. That is to say, the following combinations are valid:

- For a 2-subnet deployment:
  - Subnet 1 + subnet 2
  - Subnet 1 + subnet 3
  - Subnet 1 + subnet 4

- For a 3-subnet deployment:
  - Subnet 1 + subnet 2 + subnet 3
  - Subnet 1 + subnet 2 + subnet 4
  - Subnet 1 + subnet 3 + subnet 4
- For a 4-subnet deployment, subnet 1 + subnet 2 + subnet 3 + subnet 4 are used.

## Obtaining the deployment package

The FortiGate Autoscale for Azure deployment package is located in the Fortinet Autoscale for Azure [GitHub project](#). Go to the [project release page](#) and download `fortigate-autoscale-azure.zip` for the latest version.

Unzip this file on your local PC. Extracted content used in the deployment is described below:

Extracted Item	Description
assets	This folder contains <i>configset</i> files which can be modified as needed to meet your network requirements. For details on the allowable modifications, refer to the bullet for <i>The Blob Containers</i> in the section Appendix > <a href="#">Major components on page 86</a> . In the section <a href="#">Uploading files to the Storage account on page 66</a> these files are loaded as the initial configuration of a new FortiGate-VM instance.
templates	This folder contains deployment templates. The files <code>deploy_fortigate_autoscale.hybrid_licensing.*</code> are used to deploy FortiGate Autoscale for Azure.
fortigate-autoscale-azure-funcapp.zip	This is the function source file. This file should be uploaded to an online file host so that it is accessible to Azure. During the deployment you will specify the URL to this file in the parameter <a href="#">Package Res URL on page 63</a> .

# Deploying FortiGate Autoscale for Azure

Deploying FortiGate Autoscale for Azure involves [Creating a template deployment on page 56](#) and [Uploading files to the Storage account on page 66](#).

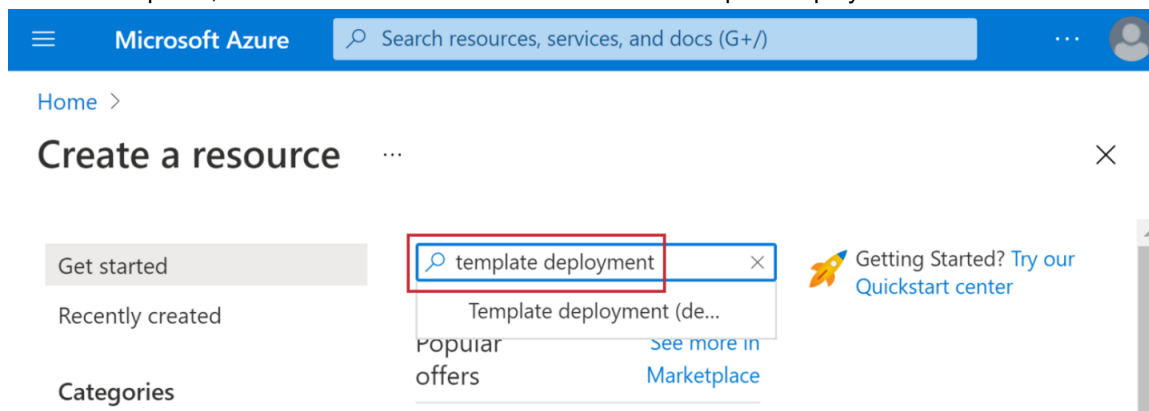
## To deploy FortiGate Autoscale for Azure:

1. Create a template deployment using the template file `deploy_fortigate_autoscale.hybrid_licensing.json` and the parameter file `deploy_fortigate_autoscale.hybrid_licensing.params.json`.
2. Upload `configset` files to the Storage account.
3. If you will be using BYOL instances, upload `license` files to the Storage account.
4. Verify the deployment as described in the section [Verifying the deployment on page 68](#).
5. Start the VMSS as described in the section [Starting a VMSS on page 77](#).

## Creating a template deployment

### To create a template deployment:

1. In the Azure portal, select *Create a resource* and search for "Template deployment".



2. Click *Create*.

The screenshot shows the Microsoft Azure portal interface. At the top, there's a blue header with the Microsoft Azure logo and a search bar. Below the header, the breadcrumb navigation shows 'Home > Create a resource > Marketplace'. The main heading is 'Marketplace'. On the left, there's a sidebar with 'Recently created', 'Service Providers', 'Private Offers + Plans', and 'Categories'. Under 'Categories', 'Get Started' is highlighted. The main content area shows search results for 'template deployment'. It includes a search bar with the text 'template deployment', an 'Add filter' button, and the text 'Showing results for 'template deployment''. Below that, it says 'Showing 1 to 20 of 58 results.' The first result is 'Template deployment (deploy using custom templates)' by Microsoft, categorized as an 'Azure Service'. The description is 'Customize your template and build for the cloud'. A red box highlights the 'Create' button, and a heart icon is next to it.

3. Click *Build your own template in the editor*.

The screenshot shows the Microsoft Azure portal interface for the 'Custom deployment' page. At the top, there's a blue header with the Microsoft Azure logo and a search bar. Below the header, the breadcrumb navigation shows 'Home > Create a resource > Marketplace > Custom deployment'. The main heading is 'Custom deployment', with the subtitle 'Deploy from a custom template'. Below the heading, there are tabs: 'Select a template', 'Basics', and 'Review + create'. The 'Select a template' tab is active. The main content area contains the text: 'Automate deploying resources with Azure Resource Manager templates in a single, coordinated operation. Create or select a template below to get started. [Learn more about template deployment](#)'. A red box highlights the link 'Build your own template in the editor' which is preceded by a pencil icon.

4. Click *Load file* to load the provided template file; then click *Save*.

Microsoft Azure Search resources, services, and docs (G+)

Home > Create a resource > Marketplace > Custom deployment >

## Edit template

Edit your Azure Resource Manager template

+ Add resource ↑ Quickstart template **↑ Load file** ↓ Download

Parameters (0)  
Variables (0)  
Resources (0)

```
1 {  
2   "$schema": "https://schema.management.  
3   azure.com/schemas/2019-04-01/  
4   deploymentTemplate.json#",  
5   "contentVersion": "1.0.0.0",  
6   "parameters": {},  
   "resources": []  
}
```

**Save** Discard

5. (Optional) In the *Custom deployment* screen, click *Edit parameters*.

Microsoft Azure Search resources, services, and docs (G+)

Home > Create a resource > Marketplace >

## Custom deployment

Deploy from a custom template

Select a template **Basics** Review + create

Template

**Customized template** 22 resources

Edit template **Edit parameters** Visualize

Click *Load file* to load a predefined `.params.json` file; then click *Save*.

Microsoft Azure Search resources, services, and docs (G+/)

Home > Create a resource > Marketplace > Custom deployment >

## Edit parameters

Load file Download

```
1 {
2   "$schema": "https://schema.management.azure.com/schemas/2019-04-01/
deploymentParameters.json#",
3   "contentVersion": "1.0.0.0",
4   "parameters": {
```

Save Discard

6. Review and update parameters. Parameter are described in the section [Configurable variables on page 60](#).

Microsoft Azure Search resources, services, and docs (G+/)

Home > Create a resource > Marketplace >

## Custom deployment

Deploy from a custom template

Customized template 22 resources

Edit template Edit parameters Visualize

### Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription \* ⓘ

Resource group \* ⓘ

Create new

### Instance details

Region \* ⓘ

Review + create < Previous Next : Review + create >

7. Click *Review + create*. If parameter validation has not passed, click *Previous* and make the necessary corrections.

8. Review the Azure Marketplace Terms, optionally review the parameters again, and click *Create*.



The screenshot shows the Azure portal interface for a custom deployment. At the top, the navigation bar includes the Microsoft Azure logo and a search bar. Below the navigation bar, the breadcrumb trail reads: Home > Create a resource > Marketplace >. The main heading is 'Custom deployment' with a close button (X) to its right. Below the heading, it says 'Deploy from a custom template'. A green box with a checkmark and the text 'Validation Passed' is displayed. Below this, there are three tabs: 'Select a template', 'Basics', and 'Review + create' (which is selected). Under the 'Review + create' tab, there is a 'Summary' section showing a 'Customized template' with '22 resources'. Below the summary is the 'Terms' section, which includes a link to 'Azure Marketplace Terms' and a link to 'Azure Marketplace'. The terms text states: 'By clicking "Create," I (a) agree to the applicable legal terms associated with the offering; (b) authorize Microsoft to charge or bill my current payment method for the fees associated the offering(s), including applicable taxes, with the same billing frequency as my Azure subscription, until I discontinue use of the offering(s); and (c) agree that, if the deployment involves 3rd party offerings, Microsoft may share my contact information and other details of such deployment with the publisher of that offering.' Below the terms, a disclaimer states: 'Microsoft assumes no responsibility for any actions performed by third-party templates and does not provide'. At the bottom, there are three buttons: 'Create' (highlighted with a red box), '< Previous', and 'Next'.



## Configurable variables





Following is a list of variables used during deployment and referenced throughout this guide.


Parameter name	Default value	Description
Subscription	Requires input	The Azure subscription FortiGate Autoscale for Azure will be deployed in.
Resource Group	Requires input	The resource group FortiGate Autoscale for Azure will be deployed in. Referred to as the <i>Autoscale resource group</i> .
Region	Requires input	The region where you deploy FortiGate Autoscale for Azure resources. Not every resource is available in every region.






Parameter name	Default value	Description
Access Restriction IP Range	Requires input	<p>IP address ranges (single IPv4 address or Classless Inter-Domain Routing (CIDR) range) to allow access from the Internet or from your on-premises network to the CosmosDB and Function App. For security purposes, at least one entry must be specified. For multiple entries, each entry must be separated by a comma and no trailing comma is allowed.</p> <hr/> <div>  <p>0.0.0.0/0 accepts connections from any IP address. We recommend that you use a constrained CIDR range to reduce the potential of inbound attacks from unknown IP addresses.</p> </div> <hr/>
Admin Password	Requires input	FortiGate administrator password on all VMs as well as FortiAnalyzer if FortiAnalyzer integration is enabled. FortiGate and Azure VM password policy must be followed and the password must be 11 - 26 characters in length with at least one uppercase letter, one lowercase letter, one digit, and one special character such as @ # \$ % ^ & * - _ ! + =.
Admin Username	azureadmin	FortiGate administrator username on all VMs as well as FortiAnalyzer if FortiAnalyzer integration is enabled.
BYOL Instance Count	2	<p>Number of FortiGate instances the BYOL VMSS should have at any time. For High Availability in BYOL-only and Hybrid use cases, ensure at least 2 FortiGates are in the group. For specific use cases, set to 0 for PAYG-only, and &gt;= 2 for BYOL-only or hybrid licensing.</p> <hr/> <div>  <p>Users can set the size to less than or equal to the number of valid licenses they own and the number should not exceed the <i>Max BYOL Instance Count</i>. Licenses can be purchased from FortiCare.</p> </div> <hr/>
FortiAnalyzer Autoscale Admin Password	Requires input	Password for the <a href="#">FortiAnalyzer Autoscale Admin Username on page 61</a> . The password must conform to the FortiAnalyzer password policy and have a minimum length of 8 and a maximum length of 128. If you need to enable KMS encryption, refer to the documentation.
FortiAnalyzer Autoscale Admin Username	Requires input	Name of the secondary administrator-level account in FortiAnalyzer. FortiGate Autoscale uses this account to connect to FortiAnalyzer to authorize any FortiGate device in the Auto Scaling group. To conform to the FortiAnalyzer naming policy, the user name can only contain numbers, lowercase letters, uppercase letters, and hyphens. It cannot start or end with a hyphen (-).
FortiAnalyzer Custom Private IP Address	Requires input	Custom private IP address that FortiAnalyzer uses. Must be within the Public subnet 1 CIDR range. Required if <a href="#">FortiAnalyzer Integration Options on page 62</a> is set to 'yes'. If <a href="#">FortiAnalyzer Integration Options on page 62</a> is set to 'no', any input will be ignored.
FortiAnalyzer Instance Type	Requires input	FortiAnalyzer-VM size. For details on selecting the size, refer to the section <a href="#">Selecting the instance type on page 46</a>

Parameter name	Default value	Description
 <p>Not all instance types are supported. Review <a href="#">FortiAnalyzer instance type support</a> prior to selecting an instance.</p>		
FortiAnalyzer Integration Options	yes	Choose 'yes' to incorporate FortiAnalyzer into FortiGate Autoscale for Azure to use extended features that include storing logs into FortiAnalyzer.
FortiAnalyzer Public IP Address ID	Requires input	ID of the public IP address to associate with FortiAnalyzer. If left empty, a new public IP address is allocated in the resource group that contains FortiAnalyzer.
FortiAnalyzer Version	6.4.5	FortiAnalyzer version supported by FortiGate Autoscale for Azure.
FortiGate PSK Secret	Requires input	Secret key used by FortiGate instances to securely communicate with each other. Must contain numbers and letters and may contain special characters. Maximum length is 128.
 <p>Changes to the PSK secret after FortiGate Autoscale for Azure has been deployed are not reflected here. For new instances to be spawned with the changed PSK secret, this environment variable will need to be manually updated.</p>		
FOS Version	7.0.1	FortiOS version supported by FortiGate Autoscale for Azure.
Frontend IP Address ID	Requires input	When the ID of a Public IP Address is provided, the Public IP Address will be used as the Frontend IP address associated with the external load balancer. If left empty, a new Public IP Address will be allocated in the resource group that contains the virtual network components.
Heart Beat Delay Allowance	30	Maximum amount of time in seconds allowed for network latency of the FortiGate heartbeat arriving at the Autoscale handler function. Minimum is 30.
Heart Beat Interval	60	Length of time in seconds that FortiOS waits between sending heartbeat requests to the Autoscale handler function. Minimum is 30. Maximum is 120.
Heart Beat Loss Count	3	Number of consecutively lost heartbeats. When the Heart Beat Loss Count has been reached, the VM is deemed unhealthy and failover activities will commence.
Instance Type	Standard_F4	Size of the VMs in the VMSS. The default is Standard_F4. For more options, refer to the Microsoft article <a href="#">Sizes for virtual machines in Azure</a> . For details on selecting the size, refer to the section <a href="#">Selecting the instance type on page 46</a>
Max BYOL Instance Count	2	Maximum number of FortiGate instances in the BYOL VMSS. For specific use cases, set to 0 for PAYG-only, and $\geq 2$ for BYOL-only or hybrid licensing. This number must be greater than or equal to the <a href="#">Min BYOL Instance Count on page 63</a> .

Parameter name	Default value	Description
		 <p>Users can set the size to match the number of valid licenses they own. Licenses can be purchased from FortiCare.</p>
Max PAYG Instance Count	6	Maximum number of FortiGate instances in the PAYG VMSS. For specific use cases, set to 0 for BYOL-only, $\geq 2$ for PAYG-only, and $\geq 0$ for hybrid licensing. This number must be greater than or equal to the <a href="#">Min PAYG Instance Count on page 63</a> .
Min BYOL Instance Count	2	<p>Minimum number of FortiGate instances in the BYOL VMSS. For specific use cases, set to 0 for PAYG-only, and <math>\geq 2</math> for BYOL-only or hybrid licensing.</p>  <p>For BYOL-only and hybrid licensing deployments, this parameter must be at least 2. If set to 1 and the instance fails to work, the current FortiGate configuration will be lost.</p>
Min PAYG Instance Count	0	<p>Minimum number of FortiGate instances in the PAYG VMSS. For specific use cases, set to 0 for BYOL-only, <math>\geq 2</math> for PAYG-only, and <math>\geq 0</math> for hybrid licensing.</p>  <p>For PAYG-only deployments, this parameter must be at least 2. If it is set to 1 and the instance fails to work, the current FortiGate configuration will be lost.</p>
PAYG Instance Count	0	Number of FortiGate instances the PAYG VMSS should have at any time. For High Availability in a PAYG-only use case, ensure at least 2 FortiGates are in the group. For specific use cases, set to 0 for BYOL-only, $\geq 2$ for PAYG-only, and $\geq 0$ for hybrid licensing.
Package Res URL	Requires input	<p>Public URL of the function source file <code>fortigate-autoscale-azure-funcapp.zip</code>. The default value points to the source file available in the release assets of the GitHub repo <code>fortinet/fortigate-autoscale-azure</code>.</p>  <p>This URL must be accessible by Azure.</p>
Primary Election Timeout	90	Maximum time (in seconds) to wait for the election of the primary instance to complete.
Resource Name Prefix	Requires input	Prefix for all applicable resource names. Can only contain lowercase letters and numbers. Maximum length is 10.
Scale In Threshold	20	Percentage of CPU utilization at which scale-in should occur.

Parameter name	Default value	Description
Scale Out Threshold	80	Percentage of CPU utilization at which scale-out should occur.
Service Plan Tier	Premium (P1V2)	<p>Pricing tier for the function service plan.</p> <hr/> <div>  <p>The Free plan is for trial and demo only. Do not use it in a production environment.</p> </div> <hr/>
Service Principal App ID	Requires input	<p><i>Application ID</i> for the Registered app used as the Autoscale Function App API request service principal.</p> <p>This is the value that was noted when creating a service principal in the section <a href="#">Prerequisites on page 53</a>.</p>
Service Principal App Secret	Requires input	<p>Password (<i>Authentication key</i>) for the Registered app used as the Autoscale Function App API request service principal.</p> <p>This is the value that was noted when creating a service principal in the section <a href="#">Prerequisites on page 53</a>.</p>
Service Principal Object ID	Requires input	<p><i>Object ID</i> for the Registered app used as the Autoscale Function App API request service principal.</p> <p>This is the value that was noted when creating a service principal in the section <a href="#">Prerequisites on page 53</a>.</p>
Storage Account Type	Standard_LRS	Storage account type.
Subnet 1 Address Range	Requires input	<p>Defines the <i>Subnet 1 Address Range</i> in CIDR notation. When creating a new VNet, the address range must be contained by the address space of the virtual network as defined in <a href="#">VNet Address Space on page 65</a>. When using an existing VNet, the value must match the address range of the subnet specified in <a href="#">Subnet 1 Name on page 64</a>. After deployment, the address range of a subnet which is in use can't be edited.</p>
Subnet 1 Name		<p>Name of subnet 1. The FortiGate Autoscale VMSS is deployed in this subnet. When creating a new VNet, the input value is used as the Subnet 1 name; if left empty, a name will be generated. When using an existing VNet, a valid non-empty input will assume the association of the target subnet with FortiGate Autoscale, and the target subnet will be associated as Subnet 1.</p>
Subnet 1 Network Security Group Name	Requires input	<p>Name of the Network Security Group (NSG) associated with the subnet 1. The FortiGate Autoscale VMSS is deployed in this subnet. Required when using an existing VNet. When creating a new VNet, any input will be ignored.</p>
Subnet1 Network Security Group Rule Priority	1000	<p>Starting number for the rule priority of the Network Security Group (NSG) associated with subnet 1 where the Autoscale related rules will be deployed. When using an existing VNet, assign a number that does not conflict with the priority of any existing rule in the NSG specified in the <a href="#">Subnet 1 Network Security Group Name on page 64</a>.</p>

Parameter name	Default value	Description
Subnet 2 Address Range	Conditionally requires input	<p>The <i>Subnet # Address Range</i> parameters define the address range for the subnet, in CIDR notation. The address range must be contained by the address space of the virtual network as defined in <a href="#">VNet Address Space on page 65</a>.</p> <ul style="list-style-type: none"> <li>When creating a new VNet, a valid non-empty input will assume the creation of subnet #.</li> <li>When using an existing VNet, the value should match the address range of the target subnet.</li> </ul> <p>After deployment, the address range of a subnet which is in use can't be edited.</p>
Subnet 3 Address Range	Conditionally requires input	
Subnet 4 Address Range	Conditionally requires input	
Subnet 2 Name	Conditionally requires input	<p>(Optional) The <i>Subnet # Name</i> parameters specify the name of the subnet. If subnet # is created, the FortiGate has a network interface in this subnet. When creating a new VNet that contains the subnet, the input value is used as the Subnet # name. If left empty, a name will be generated. When using an existing VNet, a valid non-empty input will assume the association of the target subnet with FortiGate Autoscale, and the target subnet will be associated as 'Subnet #'.</p>
Subnet 3 Name	Conditionally requires input	
Subnet 4 Name	Conditionally requires input	
VMSS Availability Zones		<p>Availability zones to use "strict zone balancing", in array format. For example: [1], [1, 3], [1, 2, 3]. To use "best effort zone balancing", leave empty. If zone balancing is not applicable, set to a single zone - for example [2].</p> <hr/> <div>  <p>The template does not validate the input availability zone(s) against the region. To ensure the correct number of availability zones for your region, refer to the Microsoft articles <a href="#">Azure regions with availability zones</a> and <a href="#">Zone Balancing</a>.</p> </div> <hr/>
VMSS Placement Groups	single	VMSS placement group options. For more information, please refer to the Microsoft article <a href="#">Create a virtual machine scale set that uses Availability Zones</a> .
VNet Address Space		IP address space of the VNet in CIDR notation. E.g. 10.0.0.0/16. Required when using an existing VNet; the value should match the address space of the target VNet.
VNet Deployment Method	create new	<p>Options for Virtual Network (VNet) deployment:</p> <ul style="list-style-type: none"> <li>create new</li> <li>use existing</li> </ul>



Parameter name	Default value	Description
		 <p>The VNet resource group (specified in the <a href="#">VNet Resource Group Name on page 66</a> parameter) must be in the same region as the Autoscale resource group (specified in the <a href="#">Configurable variables on page 60</a> parameter). If using an existing VNet, refer to the section <a href="#">Requirements when using an existing VNet on page 54</a>.</p>
VNet Name	Conditionally requires input	Name of the Azure VNet to connect to FortiGate Autoscale. Required when using an existing VNet. When creating a new VNet, this parameter can be left empty and a name will be generated.
VNet Resource Group Name	Conditionally requires input	 <p>Name of the resource group that contains the VNet and related network components.  Required if the VNet is not in the Autoscale resource group (specified in the parameter <a href="#">Resource Group on page 60</a>). If not specified, the Autoscale resource group will be used. For details, refer to the description for the parameter <a href="#">VNet Deployment Method on page 65</a>. This resource group must be in the same region as the Autoscale resource group.</p>






## Uploading files to the Storage account

The template deployment creates the storage container `fortigate-autoscale` in the resource group you selected or created in step 6 of the section [Creating a template deployment on page 56](#).

To upload files to the storage container:

1. From the Resource group, load the Storage account by clicking its name.
2. From the Storage account navigation column, under *Data storage*, click *Containers*. The `fortigate-autoscale` container will be listed.

| Containers



+ Container
 Change access level
 Restore containers

 Refresh
|
 Delete

Search containers by prefix
☐

Name	Last modified	Public access level	Lease state
<input type="checkbox"/> <code>secure-fortigates-https</code>	4/24/2021, 12:00:56 AM	Private	Available
<input type="checkbox"/> <code>fortigate-autoscale</code>	4/23/2021, 11:59:38 PM	Private	Available

3. Click the `fortigate-autoscale` container.
4. Click *Upload*.

5. In the *Upload blob*, click *Advanced* to display more options.

## Upload blob

fortigate-autoscale/

Files ⓘ

Select a file

☐ Overwrite if files already exist

^ Advanced

Authentication type ⓘ

Azure AD user account Account key

Blob type ⓘ

Block blob

☒ Upload .vhd files as page blobs (recommended)

Block size ⓘ

4 MB

Upload to folder

Encryption scope

☒ Use existing default container scope

☐ Choose an existing scope

Upload

6. Specify the folder to upload to in *Upload to folder*:
- For *configset* files, enter `assets/configset`.
  - For *license* files, enter `assets/license-files/fortigate`.

7. Select a file or files to upload:

- For *configset* files, select all the files in the *configset* folder of the deployment package.
- For *license* files, select your BYOL license file(s).



If you provide two license files with the same content, only one of them will be used, the other one will be ignored.

If you upload a file with the same name but different content, there are two outcomes:

- If the old license has not been distributed, the new file replaces the old one.
- If the old license has been distributed, the new file is treated as a new license. The old license is still valid, but it cannot be redistributed in the future.

8. Click *Upload*.

---

## Verifying the deployment

FortiGate Autoscale for Azure deploys the following components:

- 1 public load balancer. This load balancer is associated with the FortiGate subnet and the frontend public IP address to receive inbound traffic.
- 1 network security group
- 1 virtual machine scale set (VMSS) for bring your own license (BYOL)
- 1 VMSS for pay as you go
- 1 virtual network (VNet) (only if deployed with creating a new VNet)
- 1 public IP address
- 1 Azure Cosmos DB account
- 1 function app
- 1 application insights (automatically enabled if your region supports it)
- 1 app service plan
- 1 key vault
- 1 storage account

If deploying with FortiAnalyzer integration, FortiGate Autoscale for Azure also deploys the following:

- 1 VM for FortiAnalyzer
- 1 network interface for FortiAnalyzer
- 1 public IP address for FortiAnalyzer (only if [FortiAnalyzer Public IP Address ID on page 62](#) is left empty)
- 2 disk components for use by FortiAnalyzer

For deployments that have two resource groups, FortiGate Autoscale for Azure deploys the network related components to the VNet resource group and the database (DB), storage account, and function app related components to the Autoscale resource group.

FortiGate Autoscale for Azure is fully deployed once you verify the following components:

- [Function app](#)
- [DB](#)
- [Primary election](#)

### To load a resource group:

1. In the Azure console, from the left navigation column, select *Resource groups*.
2. Locate the desired resource group by scrolling through the list or by using one or more of the name, subscription, and location filters. In the example, this is *fgtasg-rg*.



Microsoft Azure

Search resources, services, and docs (G+)

Home >

## Resource groups

Default Directory

+ Create | ⚙️ Manage view | ↻ Refresh | ⬇️ Export to CSV | 🔗 Open query | 🏷️ Assign tags | 💡 Feedback

Subscription == all Location == all [Add filter](#)

Showing 1 to 1 of 1 records. No grouping List view

<input type="checkbox"/> Name ↑↓	Subscription ↑↓	Location ↑↓
<input type="checkbox"/> fgtasg-rg	Subscription ID	Central US

- Click the name to load the resource group *Overview* page. In the example deployment, the VNet resource group is the same as the Autoscale resource group.

Home > Resource groups > fgtasg-rg

### fgtasg-rg

Resource group

+ Add | Edit columns | Delete resource group | Refresh | Move | Export to CSV | Assign tags | More

Subscription (change) Deployments Succeeded

Subscription ID

Tags (change) [Click here to add tags](#)

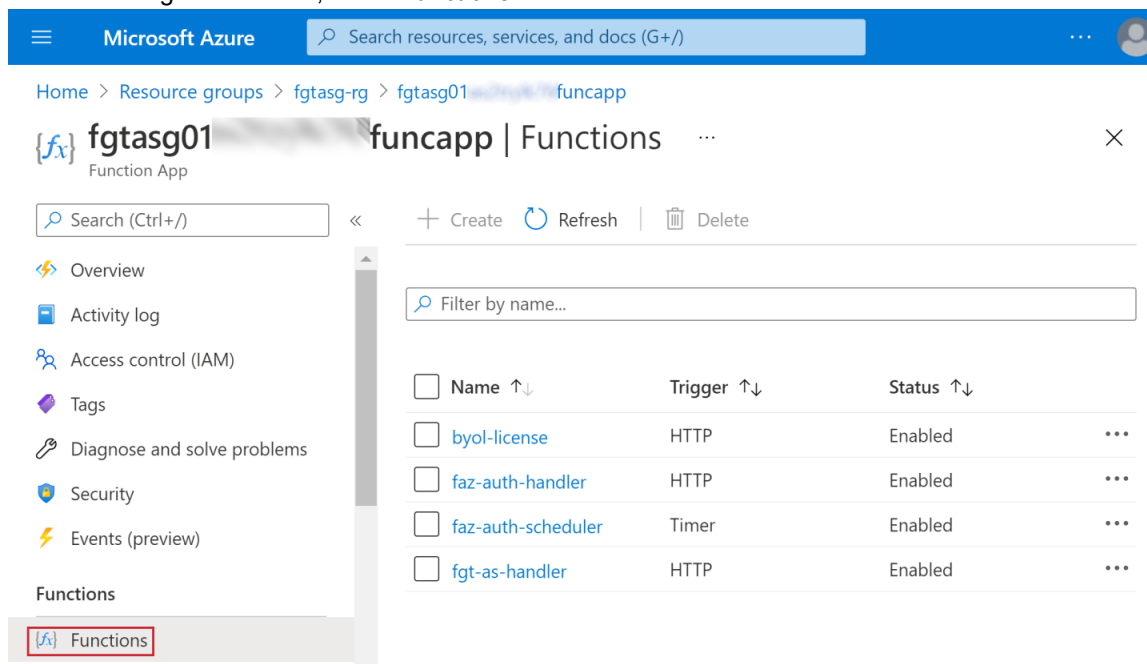
Filter by name... Type == all Location == all [Add filter](#)

Showing 1 to 15 of 15 records. ☐ Show hidden types

<input type="checkbox"/> Name ↑↓	Type ↑↓	Location ↑↓
<input type="checkbox"/> fgtasg01-external-load-balancer	Load balancer	West US
<input type="checkbox"/> fgtasg01-internal-load-balancer	Load balancer	West US
<input type="checkbox"/> fgtasg01-network-security-group	Network security group	West US
<input type="checkbox"/> fgtasg01byol	Virtual machine scale set	West US
<input type="checkbox"/> fgtasg01payg	Virtual machine scale set	West US
<input type="checkbox"/> fgtasg01-virtual-network	Virtual network	West US
<input type="checkbox"/> fgtasg01-virtual-network-ext-lb-public-ip	Public IP address	West US
<input type="checkbox"/> fgtasg01-virtual-network-subnet1-route-table	Route table	West US
<input type="checkbox"/> fgtasg01-virtual-network-subnet2-route-table	Route table	West US
<input type="checkbox"/> fgtasg01-virtual-network-subnet3-route-table	Route table	West US
<input type="checkbox"/> fgtasg01-dba001	Azure Cosmos DB account	West US
<input type="checkbox"/> fgtasg01-funcapp	Function App	West US
<input type="checkbox"/> fgtasg01-funcapp-insights	Application Insights	West US
<input type="checkbox"/> fgtasg01-funcapp-service-plan	App Service plan	West US
<input type="checkbox"/> fgtasg01-sta001	Storage account	West US

### To verify the function app:

1. From the autoscale resource group *Overview* page, load the function app by clicking the name of the item of type *Function App*.
2. From the navigation column, select *Functions*.



You should see four functions on the right:

- *byol-license*: function to distribute BYOL licenses.
- *faz-auth-handler*: function to handle FortiGate authorization in FortiAnalyzer.
- *faz-auth-scheduler*: function to handle FortiGate authorization in FortiAnalyzer on a timely basis.
- *fgt-as-handler*: main autoscaling function.

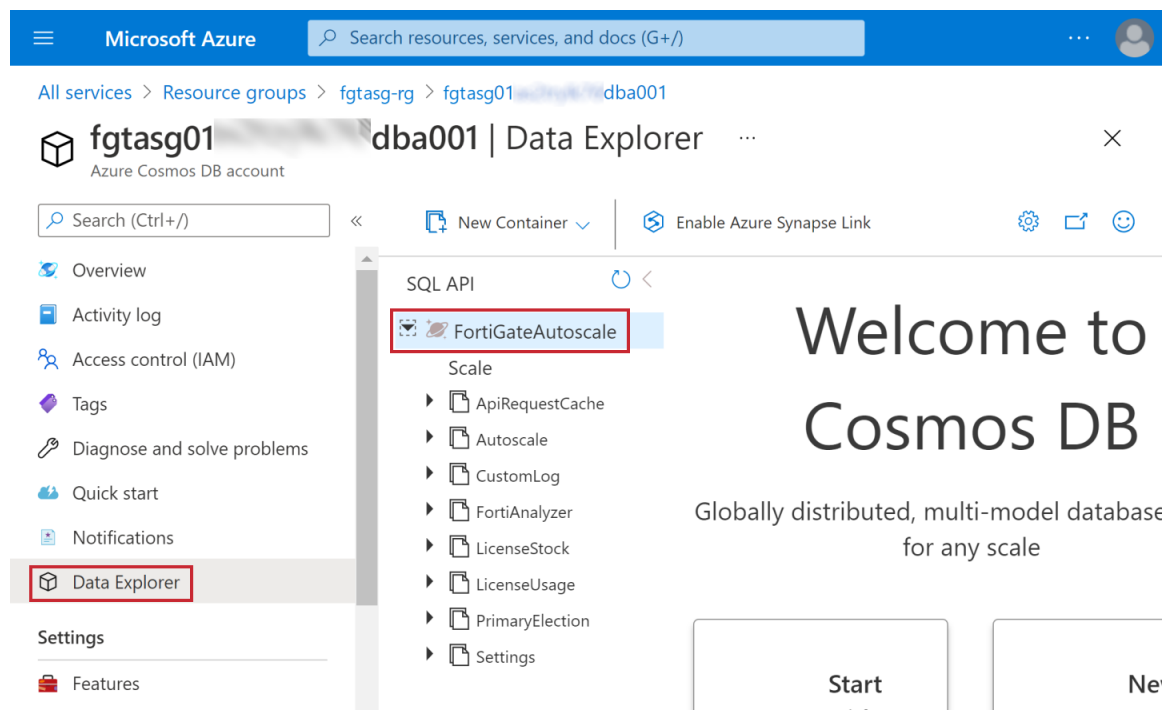
### To verify the database:

1. From the Autoscale resource group *Overview* page, click the *Azure Cosmos DB account* name.
2. From the navigation column, click *Data Explorer*.
3. Expand the database *FortiGateAutoscale*.

You see the following database and tables:

- *Database*: FortiGateAutoscale
- *Tables*:
  - ApiRequestCache
  - Autoscale
  - CustomLog
  - FortiAnalyzer
  - LicenseStock
  - LicenseUsage
  - PrimaryElection
  - Settings

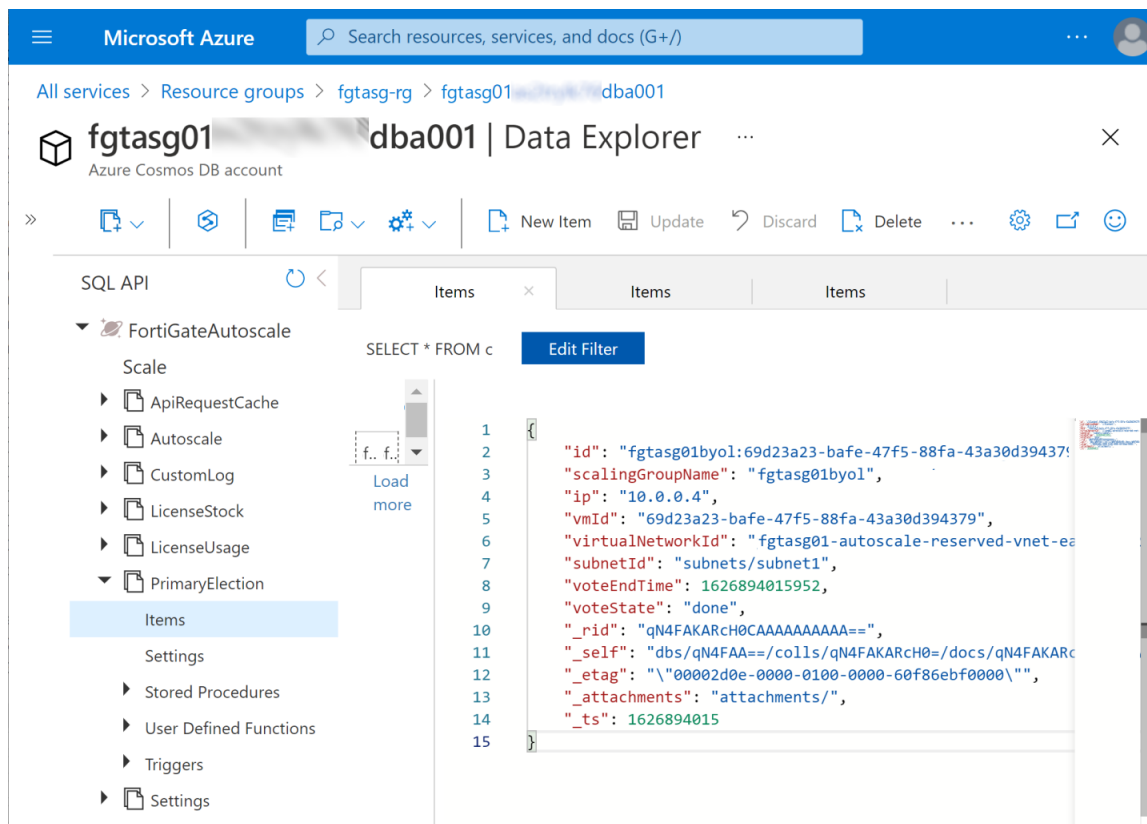
The database *Data Explorer* page looks as shown:



### To verify the primary election:

The elected primary FortiGate-VM is logged in the CosmosDB *FortiGateAutoscale* in the table *FortiGatePrimaryElection*.

1. Expand the *FortiGatePrimaryElection* table and click on *Items*.
2. Click the one item in the table.



- *id* is the unique identifier of a database record.
- *scalingGroupName* is the name of the Scale Set in which the primary FortiGate-VM is located.
- *ip* is the primary private IP address of the current primary FortiGate-VM.
- *vmId* is the index of the FortiGate-VM in the Scale Set.
- *virtualNetworkId* is the ID of the Virtual Network in which the primary FortiGate-VM instance is located.
- *subnetId* is the ID of the subnet in which the primary FortiGate-VM is located.
- *voteEndTime* is the Unix time stamp for when this primary election should expire if the vote state cannot change to *done* by this time.
- *voteState* is the state of the voting process.
  - *pending*: election of the primary instance is still in progress. You should wait for its completion. At this point in time, the final primary instance is not yet known.
  - *done*: the primary election process has completed.

## Security features for network communication

Security features are automatically enabled and configured as described in the following sections.

## Database

Firewalls are set for IP address ranges and the VNet. The firewall only allow interactions with the DB tables from the FortiGate subnet, Function App additional outbound IP addresses, and user-defined IPv4 IP ranges.

To view the firewalls, load the Cosmos DB. From the *Settings* section of the left navigation tree, click *Networking* and then click *Firewall and virtual networks*.

Home > fgtasg-rg > fgtasg01 dba001 - Firewall and virtual networks

fgtasg01 dba001 - Firewall and virtual networks

Allow access from

☐ All networks ☒ Selected networks

Configure network security for your Azure Cosmos DB account. [Learn more.](#)

Virtual networks

Secure your Azure Cosmos DB account with virtual networks. [+ Add existing virtual network](#) [+ Add new virtual network](#)

Virtual Network	Subnet	Address range	Endpoint Status	Resource Group	Subscription
> fgtasg01...	1	10.0.0.0/16		fgtasg-rg	...

Firewall

Add IP ranges to allow access from the internet or your on-premises networks. [+ Add my current IP \( \)](#) ⓘ

IP (Single IPv4 or CIDR range)

0.0.0.0/0	...
104. .55	...
40 .137	...
40 .40	...
40 .54	...
40. .103	...
40. .196	...
40. .145	...
40 .99	...

Exceptions

☐ Accept connections from within public Azure datacenters ⓘ

☐ Allow access from Azure Portal ⓘ

The IP addresses listed in the Firewall section include the set of all possible Function App outbound IP addresses as obtained from the *Additional Outbound IP Addresses* field of the Function App *Properties*. To view these IP addresses, load the Function App, click the *Platform features* tab and then click *Properties*. Each IP address in the list has been added as an entry in the Cosmos DB firewall.

Home > fgtasg-rg > fgtasg01 > funcapp > Properties

### Properties

fgtasg01 funcapp

Status  
Running

URL  
fgtasg01 funcapp.azurewebsites.net

Virtual IP address  
104. .55

Mode  
Consumption

**Additional Outbound IP Addresses**

①

104. .55,40. .137,40. .40,40. .54,40. .103,40. .196,40. .145,40. .99



If Function App *Additional Outbound IP Addresses* change, the Cosmos DB firewall must be manually updated so that each IP address has a corresponding entry in the Cosmos DB firewall. Any IP address not listed in the Cosmos DB firewall will be blocked, thus causing the Autoscale function to be blocked. For details on when Function App outbound IP addresses change, refer to the Microsoft article [When outbound IPs change](#).

## Function App

Requests are restricted by source. Incoming requests are only allowed from the FortiGate subnet and from user-defined IPv4 IP ranges.

To view *Access Restrictions*, load the Function App. In the right hand pane, click the *Platform features* tab and then click *All settings*. From the *Settings* section of the left navigation tree, click *Networking* and then click *Configure Access Restrictions*.

Home > fgtasg01 > funcapp > fgtasg01 > funcapp - Networking > Access Restrictions

## Access Restrictions

Remove Refresh

### Access Restrictions

Access restrictions allow you to define lists of allow/deny rules to control traffic to your app. Rules are evaluated in priority order. If there are no rules defined then your app will accept traffic from any address. [Learn more](#)

fgtasg01 funcapp.azurewebsites.net fgtasg01 funcapp.scm.azurewebsites.net

+ Add rule

<input type="checkbox"/>	Priority	Name	Source	Endpoint status	Action	
<input type="checkbox"/>	100	allow-FortiGate-subnet	fgtasg01 -virtual-netw...	Enabled	✓ Allow	...
<input type="checkbox"/>	101	allow-external-ipv4-1	0.0.0.0/0		✓ Allow	...
<input type="checkbox"/>	2147483647	Deny all	Any		✗ Deny	

## Virtual Network

The service endpoints for Azure services are enabled. Service endpoints should be enabled for the minimum number of Azure services required for Autoscale.

Home > fgtasg-rg > fgtasg01 -virtual-network - Service endpoints

## fgtasg01 -virtual-network - Service endpoints

Virtual network

Search (Ctrl+/,) + Add

Filter service endpoints

Service	Subnet	Status	Locations
Microsoft.AzureCosmo...	1		...
	fgtasg01 -virtual...	Succeeded	*
Microsoft.Web	1		...
	fgtasg01 -virtual...	Succeeded	*

Tags

Diagnose and solve problems

Settings

- DNS servers
- Peerings
- Service endpoints**
- Private endpoints

# Modifying the Autoscale settings in Cosmos DB

To modify Autoscale settings:

1. Locate the Autoscale settings in the *FortiGate Autoscale* database. For details, refer to the section [To verify the database: on page 70](#).
2. Expand the Settings container
3. Click the *id* of the *Settings* key you wish to modify. Content will be shown on the right:

Microsoft Azure | Cosmos DB > jl01asckeeh5s6-dba001

SQL API

FortiGateAutoscale

Scale

ApiRequestCache

Autoscale

CustomLog

FortiAnalyzer

LicenseStock

LicenseUsage

PrimaryElection

Settings

Items

Settings

Stored Procedures

User Defined Functions

SELECT \* FROM c

Edit Filter

id	/settingKey
byoi-scaling-group-name	byoi-scaling-group-name
enable-internal-elb	enable-internal-elb
enable-second-nic	enable-second-nic
enable-vm-info-cache	enable-vm-info-cache
heartbeat-interval	heartbeat-interval
heartbeat-delay-allowance	heartbeat-delay-allowance
heartbeat-loss-count	heartbeat-loss-count
primary-scaling-group-name	primary-scaling-group-name
primary-election-timeout	primary-election-timeout
scaling-group-desired-capacity	scaling-group-desired-capacity

```
1 {
2   "settingKey": "heartbeat-interval",
3   "settingValue": "60",
4   "description": "The length of time (
5   "jsonEncoded": false,
6   "editable": true,
7   "id": "heartbeat-interval",
8   "_rid": " ",
9   "_self": " ",
10  "_etag": " ",
11  "_attachments": "attachments/",
12  "_ts": " "
13 }
```

4. Update the value of the property *settingValue*.
5. Click on the *Update* button located on the menu bar above.



Each Autoscale setting has a property of *editable*. It is recommended that items with *editable* set to *false* not be modified.

If it is necessary to modify one of these settings (for example, the FortiAnalyzer IP address has changed), please leave a question in the GitHub project *Issues* tab so that assistance can be provided.



## Starting a VMSS

Your deployment will have two Virtual machine scale sets (VMSS), one for BYOL instances and one for PAYG instances. For deployments using only one instance type, start that VMSS. For Hybrid licensing deployments, start both VMSS.

### To start a VMSS:

1. Load the resource group that contains the VMSS. In deployments with one resource group, this value is specified in the *Resource group* parameter in step 6 of the section [Creating a template deployment on page 56](#). If your deployment has a separate resource group for the VNet, load that one instead. That resource group is specified in the [VNet Resource Group Name on page 66](#) parameter.
2. Load the *Virtual machine scale set* by clicking its name.
3. From the Virtual machine scale set account navigation column, under *Settings*, click *Scaling*.
4. Under *Choose how to scale your resource*, click *Custom autoscale*.
5. Adjust values as required.
6. Click *Save*.

The BYOL *Custom autoscale* appears as shown in the image:

Home > Resource groups > fgtasg-rg > fgtasg01byol - Scaling

## fgtasg01byol - Scaling

Virtual machine scale set

Search (Ctrl+/)

Save Discard Refresh

Configure Run history JSON Notify Diagnostics logs

**Choose how to scale your resource**

**Manual scale**  
Maintain a fixed instance count

**Custom autoscale**  
Scale on any schedule, based on any metrics

Custom autoscale

Autoscale setting name fgtasg01 -autoscale-payg

Resource group fgtasg-rg

Instance count 0

**Default** fgtasg01 -deployed-profile

Delete warning ⓘ The very last or default recurrence rule cannot be deleted. Instead, you can disable autoscale to turn off autoscale.

Scale mode ☐ Scale based on a metric ☒ Scale to a specific instance count

Instance count

Schedule **This scale condition is executed when none of the other scale condition(s) match**

[+ Add a scale condition](#)

The PAYG *Custom autoscale* appears as shown in the image:

Home > Resource groups > fgtasg-rg > fgtasg01payg - Scaling

## fgtasg01payg - Scaling

Virtual machine scale set

Search (Ctrl+/)

Save Discard Refresh

Configure Run history JSON Notify Diagnostics logs

### Choose how to scale your resource

**Manual scale**  
 Maintain a fixed instance count

**Custom autoscale**  
 Scale on any schedule, based on any metrics

#### Custom autoscale

Autoscale setting name fgtasg01 -autoscale-payg

Resource group fgtasg-rg

Instance count 0

**Default** fgtasg01 -deployed-profile

**Delete warning** The very last or default recurrence rule cannot be deleted. Instead, you can disable autoscale to turn off autoscale.

**Scale mode** ☒ Scale based on a metric ☐ Scale to a specific instance count

**Scale out**

When	Condition	Action
fgtasg01byol	(Average) Percentage CPU > 80	Increase count by 1
Or	fgtasg01payg (Average) Percentage CPU > 80	Increase count by 1

**Scale in**

When	Condition	Action
fgtasg01byol	(Average) Percentage CPU < 20	Decrease count by 1
And	fgtasg01payg (Average) Percentage CPU < 20	Decrease count by 1

+ Add a rule

**Instance limits**

Minimum	Maximum	Default
0	6	0

**Schedule** This scale condition is executed when none of the other scale condition(s) match

+ Add a scale condition

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Instances

**Scaling**

Storage

Operating system

Security

Size

Extensions

Continuous delivery (Preview)

Upgrade policy

Health and repair

Identity

Properties

Locks

Export template

Monitoring

Insights (preview)

Alerts

Metrics

Support + troubleshooting

Resource health

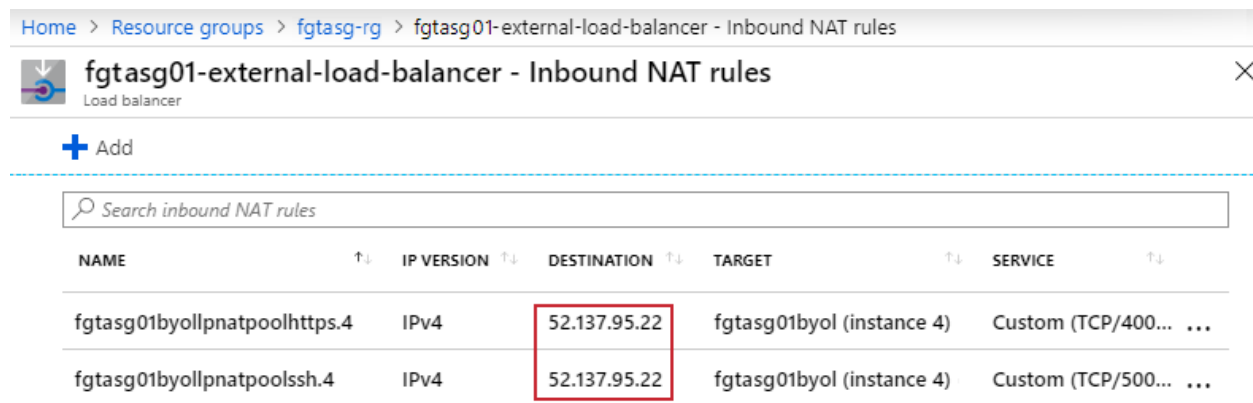
## Connecting to the FortiGate-VM instances

To connect to a FortiGate-VM, you can use SSH commands or the web GUI using HTTPS with the IPv4 public IP address.


From the resource group *Overview* page, click the external load balancer name to load it. From the navigation column, click *Inbound NAT Rules*. For each instance in the scale set you will see two rules:

- One rule for SSH access to the instance.
- One rule for HTTPS access to the instance.


The *Inbound NAT Rules* page will look as shown below:




Home > Resource groups > fgtasg-rg > fgtasg01-external-load-balancer - Inbound NAT rules

 **fgtasg01-external-load-balancer - Inbound NAT rules** ×

Load balancer

 Add

 Search inbound NAT rules




NAME	IP VERSION	DESTINATION	TARGET	SERVICE
fgtasg01byollpnatpoolhttps.4	IPv4	52.137.95.22	fgtasg01byol (instance 4)	Custom (TCP/400... ...
fgtasg01byollpnatpoolssh.4	IPv4	52.137.95.22	fgtasg01byol (instance 4)	Custom (TCP/500... ...

To access a FortiGate-VM instance, you need the Frontend IP address and port number of the instance you wish to connect to. The Frontend IP address is listed on the *Inbound NAT Rules* page. To obtain the port number, click the entry for the method you will use to access the instance (SSH or HTTPS). The port number will be listed midway down the page. (The IP address is also listed).

An example of an SSH access rule is shown below:

## fgtag01byollpnatpoolhttps.4

D1-external-load-balancer

 Save  Discard  Delete

NAT rule name

fgtag01byollpnatpoolhttps.4

Frontend IP address ⓘ

LoadBalancerFrontEnd (52.137.95.22) ▼

IP Version ⓘ

IPv4

Service

Custom ▼

Protocol

TCP

UDP

\* Port

50030

Target virtual machine ⓘ

▼

Network IP configuration ⓘ

fgtag01config (10.0.0.4) ▼

Port mapping ⓘ

Default

Custom

Floating IP (direct server return) ⓘ

Disabled

Enabled

\* Target port

22

# Troubleshooting

## Determining the FortiGate Autoscale release version

To determine the release version of a deployment, go to the *Microsoft.Template Outputs* by following the steps in [Locating deployment Outputs on page 82](#). The release version is in the `deploymentPackageVersion`.

## Election of the primary FortiGate was not successful

If the election of the primary FortiGate is not successful, reset the elected primary FortiGate. If the reset does not solve the problem, please contact support.

## Locating deployment Outputs

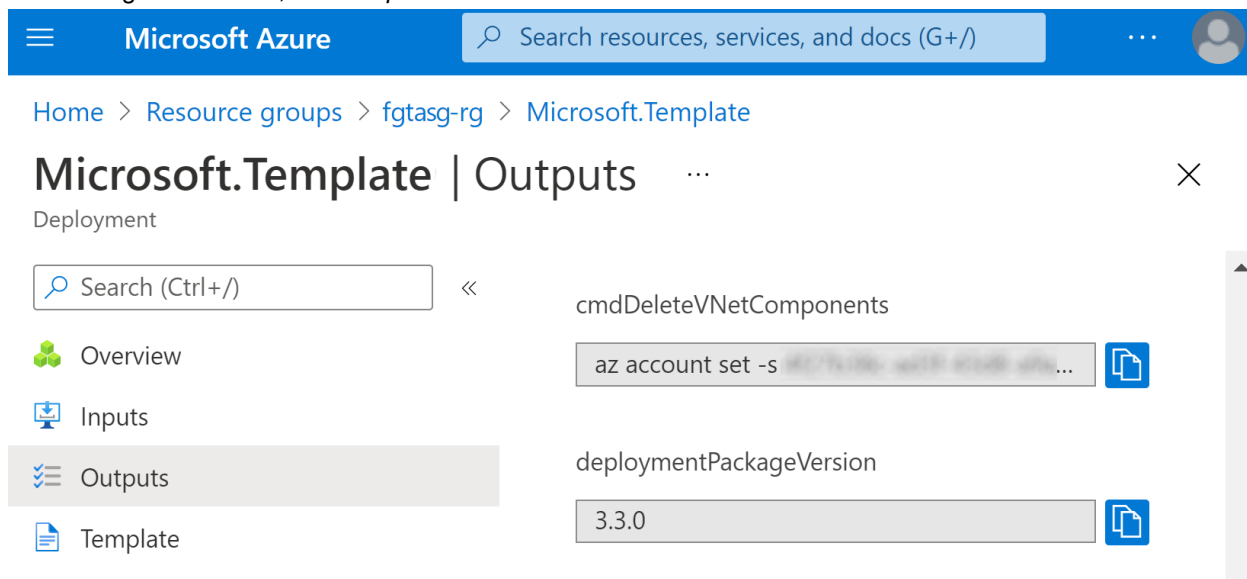
1. Load the resource group *Overview* page. For details, refer to the section [To load a resource group: on page 68](#).
2. Click the link under *Deployments*.

The screenshot shows the Microsoft Azure portal interface. At the top, there's a navigation bar with the Microsoft Azure logo and a search bar. Below the navigation bar, the breadcrumb 'Home >' is visible. The main content area displays the 'fgtasg-rg' resource group overview. On the left, there's a sidebar with 'Essentials' and 'Deployments' sections. The 'Deployments' section is expanded, showing a table with columns for 'Subscription (change)', 'Subscription ID', 'Deployments', 'Location', and 'Status'. The 'Deployments' column has a red box around the 'Succeeded' status. The 'Location' column shows 'East US'.

3. From the *Deployments* page, click the *Microsoft.Template*.

The screenshot shows the 'fgtasg-rg | Deployments' page in the Microsoft Azure portal. The page has a sidebar on the left with 'Tags', 'Events', 'Settings', and 'Deployments' sections. The 'Deployments' section is expanded, showing a table with columns for 'Deployment name' and 'Status'. The 'Deployment name' column has a red box around the 'Microsoft.Template' deployment. The 'Status' column shows a green checkmark and the word 'Succeeded'.

4. In the navigation column, click *Outputs*.



Microsoft Azure

Search resources, services, and docs (G+)

Home > Resource groups > fgtag-rg > Microsoft.Template

## Microsoft.Template | Outputs

Deployment

Search (Ctrl+)

Overview

Inputs

Outputs

Template

cmdDeleteVNetComponents

az account set -s ...

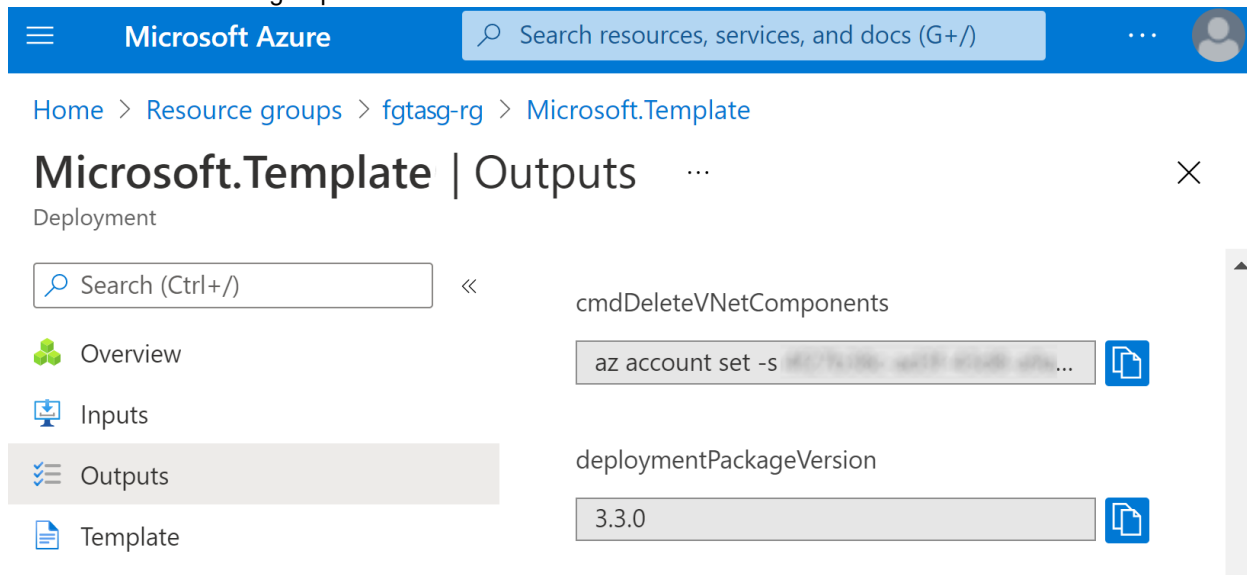
deploymentPackageVersion

3.3.0

## Redeploying with an existing VNet fails

Prior to redeploying with your existing VNet, you must ensure that the VNet meets the [Requirements when using an existing VNet on page 54](#). You must also perform a VNet related cleanup using the following steps:

1. Load the deployment Outputs for the VNet resource group. If your deployment only has one resource group, this is the Autoscale resource group.



Microsoft Azure

Search resources, services, and docs (G+)

Home > Resource groups > fgtag-rg > Microsoft.Template

## Microsoft.Template | Outputs

Deployment

Search (Ctrl+)

Overview

Inputs

Outputs

Template

cmdDeleteVNetComponents

az account set -s ...

deploymentPackageVersion

3.3.0

2. Copy the value of `cmdDeleteVNetComponents` and run it as an Azure CLI command (click `>` to launch the CLI) to perform the required cleanup.
3. If your deployment has two resource groups, delete the Autoscale resource group. Otherwise, delete the following components:
  - Azure Cosmos DB account
  - App Service

- 
- Application Insights (if present)
  - App Service plan
  - Storage account
4. Delete the following components from the VNet resource group:
- the Public Load balancer
  - the Internal Load balancer
  - the Virtual machine scale set for BYOL
  - the Virtual machine scale set for PAYG
  - the Public IP address (if created by the autoscale deployment and you don't want to reuse it)

## Resetting the elected primary FortiGate

To reset the elected primary FortiGate, go to the CosmosDB *FortiGateAutoscale* and open the table *FortiGatePrimaryElection* and delete the only item in the table.

A new primary FortiGate will be elected and a new record will be created as a result.

For details on locating the CosmosDB *FortiGateAutoscale* and the table *FortiGatePrimaryElection*, refer to the section [Verifying the deployment on page 68](#).

## Stack has stopped working

If the stack stops working when it previously used to work, look up the Function App *Additional Outbound IP Addresses* and ensure that each listed IP address has a corresponding entry in the Cosmos DB firewall. Any IP address not listed in the Cosmos DB firewall will be blocked, thus causing the Autoscale function to be blocked.

For details on how the Cosmos DB firewall is configured, refer to the section [Security features for network communication on page 72](#).

For details on when Function App outbound IP addresses change, refer to the Microsoft article [When outbound IPs change](#).

## Troubleshooting using Application Insights

Application Insights can help you troubleshoot the deployment. It is automatically enabled if your region supports it.

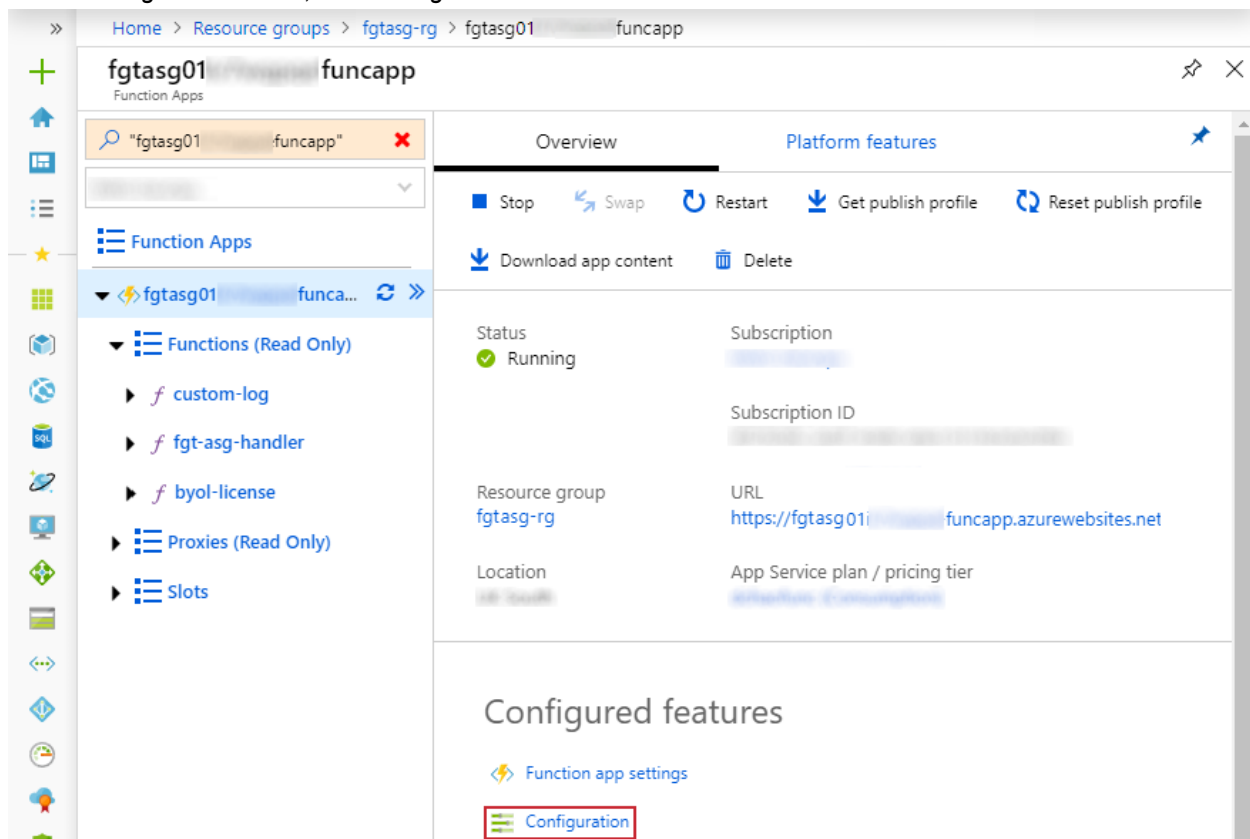
## Troubleshooting using environment variables

Environment variables are available to assist in troubleshooting the current FortiGate Autoscale deployment. These variables and details on how to use them are listed in the section [Troubleshooting environment variables on page 88](#)

1. Load the Function App. For detailed steps, refer to the Function App portion of the section [Verifying the deployment on page 68](#).



2. Under *Configured features*, click *Configuration*.



The screenshot shows the Azure portal interface for a Function App named 'funcapp' in the 'fgtasg01' resource group. The left sidebar contains navigation icons and a search bar. The main content area is divided into two tabs: 'Overview' and 'Platform features'. The 'Overview' tab is active, displaying the app's status as 'Running' and various configuration details. The 'Configured features' section at the bottom is highlighted with a red box, and the 'Configuration' link is also highlighted with a red box.

Home > Resource groups > fgtag01 > fgtag01 funcapp

fgtag01 funcapp

Function Apps

fgtag01 funcapp

Functions (Read Only)

- custom-log
- fgt-asg-handler
- byol-license

Proxies (Read Only)

Slots

Overview Platform features

Stop Swap Restart Get publish profile Reset publish profile

Download app content Delete

Status Running

Subscription

Subscription ID

Resource group fgtag01

URL https://fgtag01-funcapp.azurewebsites.net

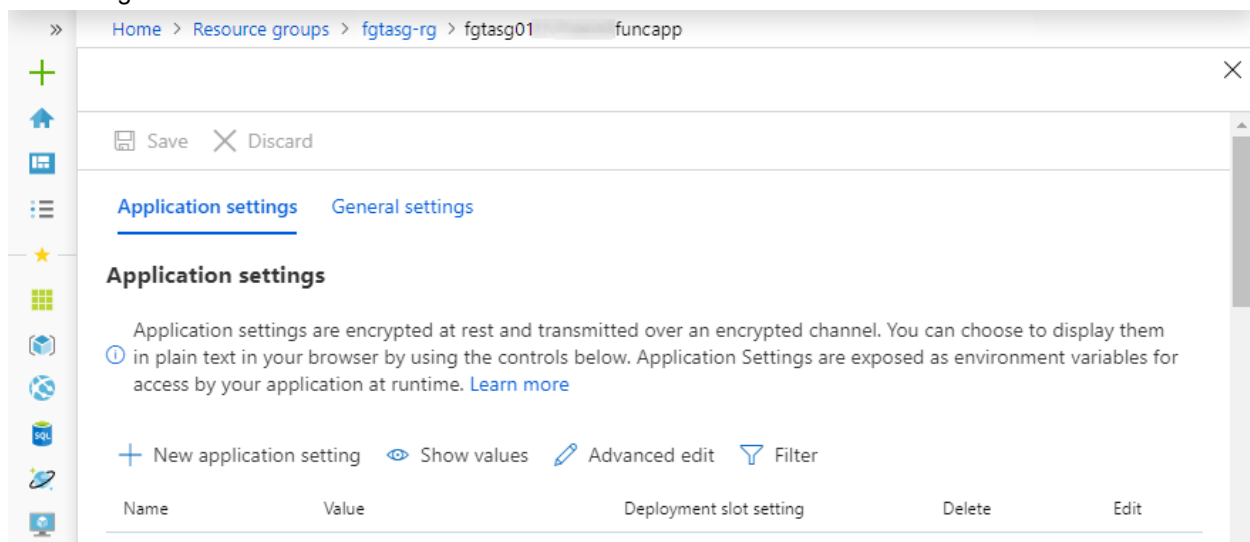
Location App Service plan / pricing tier

Configured features

Function app settings

Configuration

3. Edit settings as needed.



The screenshot shows the 'Application settings' page for the 'funcapp' Function App. The page has a 'Save' button and a 'Discard' button. The 'Application settings' tab is active, displaying a list of settings. The 'Name' column is highlighted, and the 'Value' column is visible. The 'Deployment slot setting' column is also visible. The 'Delete' and 'Edit' columns are visible. The 'Name' column is highlighted, and the 'Value' column is visible. The 'Deployment slot setting' column is also visible. The 'Delete' and 'Edit' columns are visible.

Home > Resource groups > fgtag01 > fgtag01 funcapp

Save Discard

Application settings General settings

Application settings

Application settings are encrypted at rest and transmitted over an encrypted channel. You can choose to display them in plain text in your browser by using the controls below. Application Settings are exposed as environment variables for access by your application at runtime. [Learn more](#)

+ New application setting Show values Advanced edit Filter

Name	Value	Deployment slot setting	Delete	Edit
------	-------	-------------------------	--------	------



Changing environment variables other than the troubleshooting ones can cause unexpected behavior. Modify them at your own risk.

# Appendix

## FortiGate Autoscale for Azure features

### Major components

- *The Function App.* The Function App handles all the autoscaling features including: primary/secondary role assignment, license distribution, and failover management.
- *The BYOL Scale Set.* This scale set contains 0 to many FortiGate-VMs of the BYOL licensing model and is a VMSS with a fixed size. Users can set the size to match the number of valid licenses they own. Licenses can be purchased from FortiCare.



For BYOL-only and hybrid licensing deployments, the *BYOL instance Count* must be at least 2. These FortiGate-VMs are the main instances and are fixed and running 7x24. If it is set to 1 and the instance fails to work, the current FortiGate-VM configuration will be lost.

- 
- *The PAYG Scale Set.* The Scale Set contains 0 to many FortiGate-VMs of the PAYG licensing model and will dynamically scale-out or scale-in based on the scaling metrics specified by the parameters *Scale Out Threshold* and *Scale in Threshold*.



For PAYG-only deployments, the *PAYG instance Count* must be at least 2. These FortiGate-VMs are the main instances and are fixed and running 7x24. If it is set to 1 and the instance fails to work, the current FortiGate-VM configuration will be lost.

- 
- *The Blob Containers.*
    - The *configset* container contains files that are loaded as the initial configuration of a new FortiGate-VM instance.
      - *baseconfig* is the base configuration. This file can be modified as needed to meet your network requirements. Placeholders such as {SYNC\_INTERFACE} are explained in the [Configset placeholders on page 87](#) table below.
      - *httproutingpolicy* and *httpsroutingpolicy* are provided as part of the base configset - for a common use case - and specify the FortiGate firewall policy for VIPs for *http* routing and *https* routing respectively. This common use case includes a VIP on port 80 and a VIP on port 443 with a policy that points to an internal load balancer.
      - *extrastaticroute* is empty by default. Configurations for static routes can be added if they are needed in a network. An example of manually adding a static route:

```
# config router static
edit 1
set dst 168.63.129.16 255.255.255.255
set gateway <subnet gateway>
set priority <any number>
set device "<port name>"
next
end
```
    - The *fgt-asg-license* container contains the BYOL license files.

- **Database tables.** These tables are required to store information such as health check monitoring, primary election, state transitions, etc. These records should not be modified unless required for troubleshooting purposes.
- **Networking Components.**
  - One virtual network
  - Two Load Balancers (with names ending with *-external-load-balancer* and *-internal-load-balancer*)
  - One network security group (with a name ending with *-network-security-group*)
  - One public IP address
  - Four route tables

## Configset placeholders

When the FortiGate-VM requests the configuration from the Autoscaling handler function, the placeholders in the table below will be replaced with actual values for the Autoscaling group.

Placeholder	Type	Description
{SYNC_INTERFACE}	Text	The interface for FortiGate-VMs to synchronize information. Specify as port1, port2, port3, etc. All characters must be lowercase.
{CALLBACK_URL}	URL	The full URL of the Autoscaling handler function.
{PSK_SECRET}	Text	The Pre-Shared Key used in FortiOS.
{ADMIN_PORT}	Number	The admin port will be replaced with 443.
{HEART_BEAT_INTERVAL}	Number	The time interval (in seconds) that the FortiGate-VM waits between sending heartbeat requests to the Autoscale handler function. This placeholder is only in the hybrid licensing deployment.

## Function App environment variables

### Azure infrastructure related environment variables

The variables in the table below hold information that enables the function to use the required Azure services. Changing their values may cause services to be unreachable by the function. Modify them at your own risk.

Variable name	Description
RESOURCE_GROUP	Name of the resource group where the template is deployed in.
CLIENT_ID	Descriptions of these variables are identical to those of the related parameters which are described in the section <a href="#">Configurable variables on page 60</a> . <ul style="list-style-type: none"> <li>• REST_APP_ID: <a href="#">Service Principal App ID on page 64</a></li> <li>• REST_APP_SECRET: <a href="#">Service Principal App Secret on page 64</a></li> <li>• WEBSITE_RUN_FROM_ZIP: <a href="#">Package Res URL on page 63</a></li> </ul>
CLIENT_SECRET	
WEBSITE_RUN_FROM_ZIP	
AUTOSCALE_DB_PRIMARY_KEY	
AUTOSCALE_DB_PRIMARY_KEY	This is the CosmosDB account access key automatically created with the CosmosDB account.

Variable name	Description
TENANT_ID	The Azure Directory ID for the Active Directory of your current subscription.
SUBSCRIPTION_ID	Your Azure Subscription ID.
AUTOSCALE_DB_ACCOUNT	The CosmosDB account created for the current FortiGate Autoscale deployment.
AZURE_STORAGE_ACCOUNT	This is the Blob Storage account name automatically created during the deployment.
AZURE_STORAGE_ACCESS_KEY	This is the Blob Storage account access key automatically created with the Blob Storage account.

## FortiGate Autoscale required environment variables

Changing the values of the following variables can cause unexpected function behavior. Modify them at your own risk.

Variable name	Description
UNIQUE_ID	Reserved, empty string.
CUSTOM_ID	Reserved, empty string.
RESOURCE_TAG_PREFIX	An Autoscaling feature variable that is automatically created. Reserved for future use.
AUTOSCALE_KEY_VAULT_NAME	Name of the Key Vault service.

## Troubleshooting environment variables

The following variables assist in troubleshooting the current FortiGate Autoscale deployment.

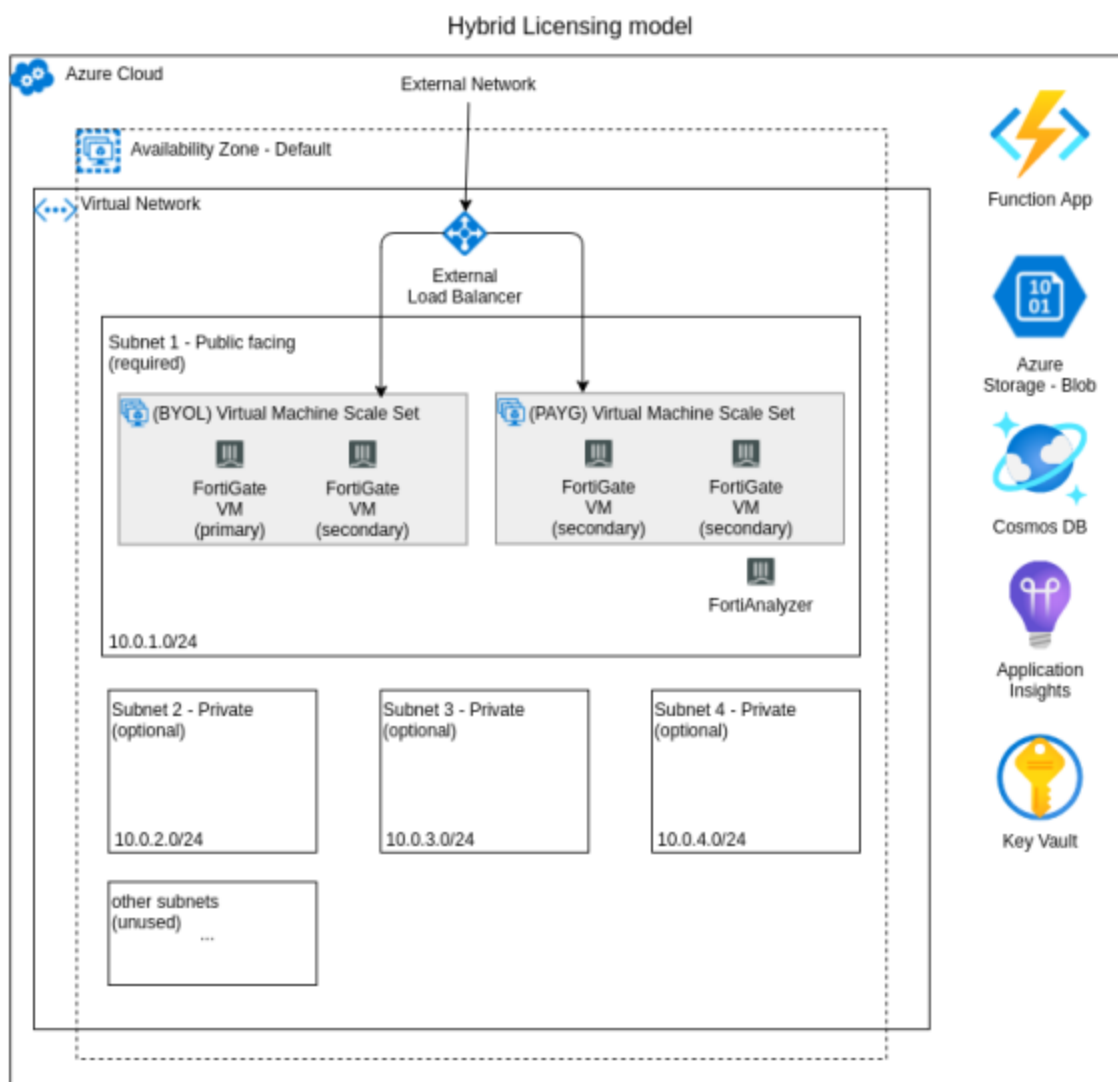
Variable name	Description
DEBUG_SAVE_CUSTOM_LOG	Set to <i>true</i> to save script logs to the DB table <i>CUSTOM_LOG</i> . This is the default behavior. Set to <i>false</i> to disable this feature.
DEBUG_LOGGER_OUTPUT_QUEUE_ENABLED	Set to <i>true</i> to concatenate all log output into one (1) log item in the Azure logging system. Set to <i>false</i> for every log output to have its own log item in the Azure logging system. This is the default behavior.
DEBUG_LOGGER_TIMEZONE_OFFSET	Set to the UTC offset of the current deployment location for a better logging display time.

For details on how to modify the troubleshooting environment variables, refer to the section [Troubleshooting using environment variables on page 84](#).

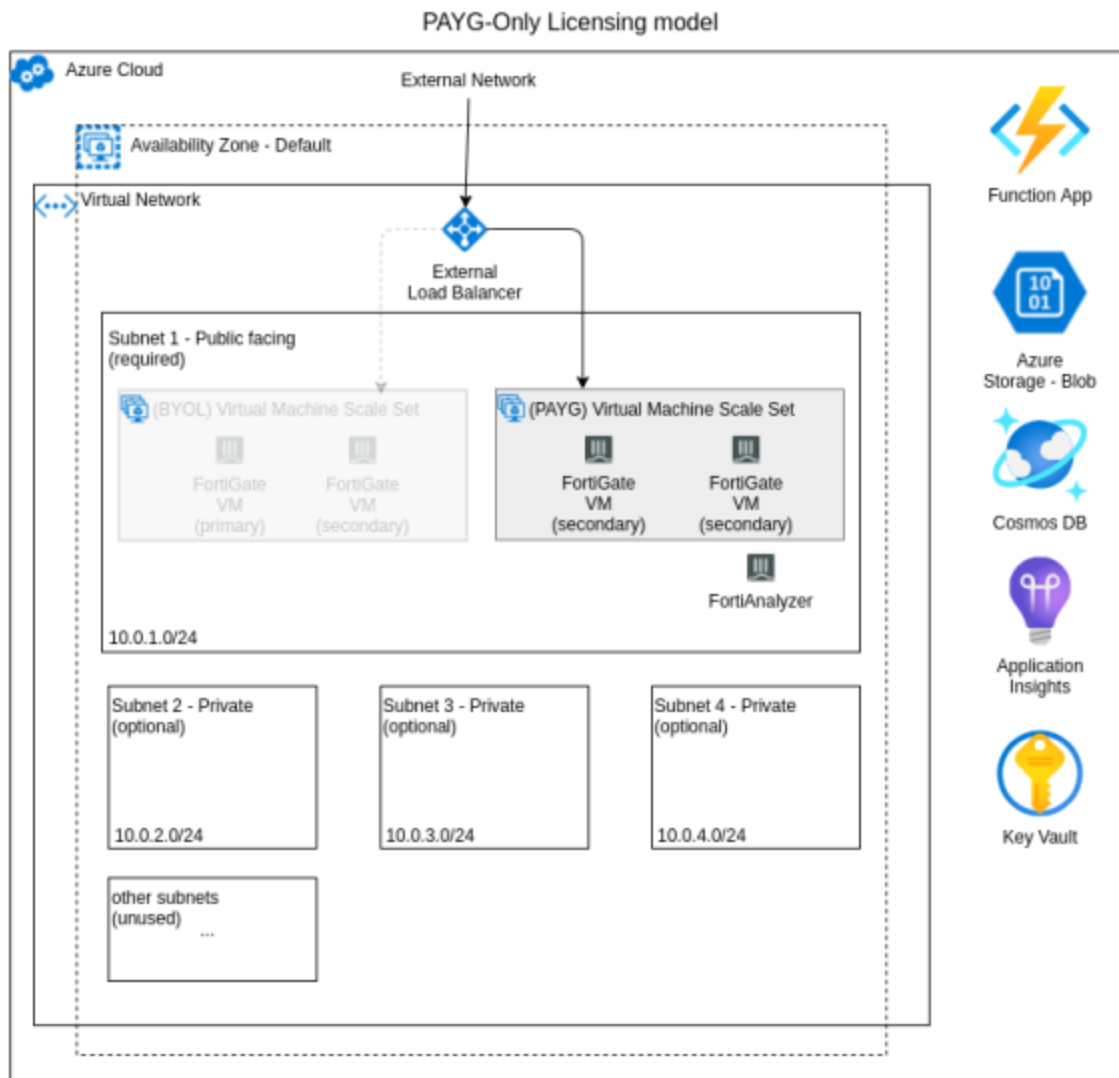
## Architectural diagrams

The following diagrams illustrate the different aspects of the architecture of FortiGate Autoscale for .

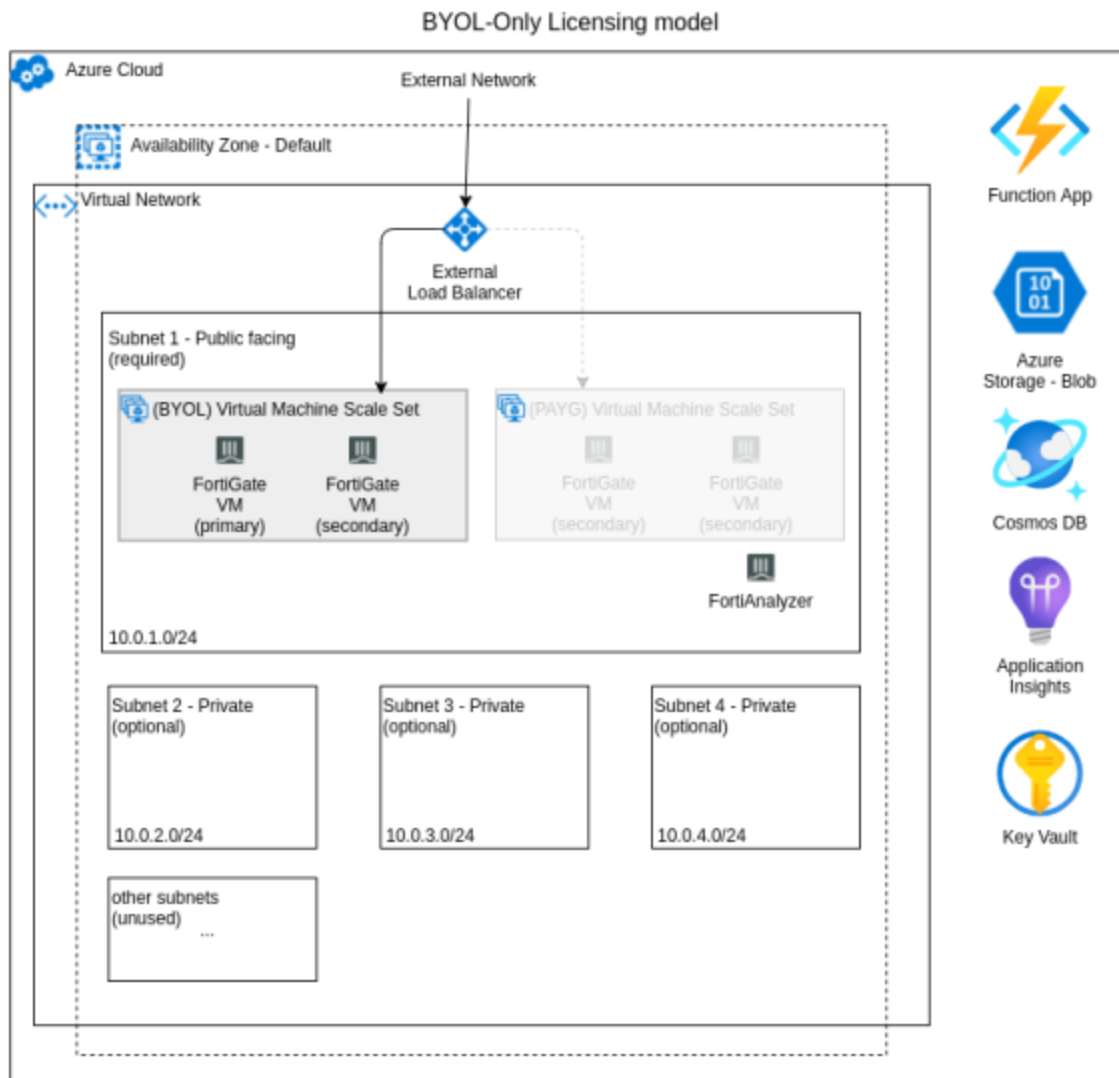
### FortiGate Autoscale for Azure architecture (hybrid licensing)



## FortiGate Autoscale for Azure architecture (PAYG instances only)

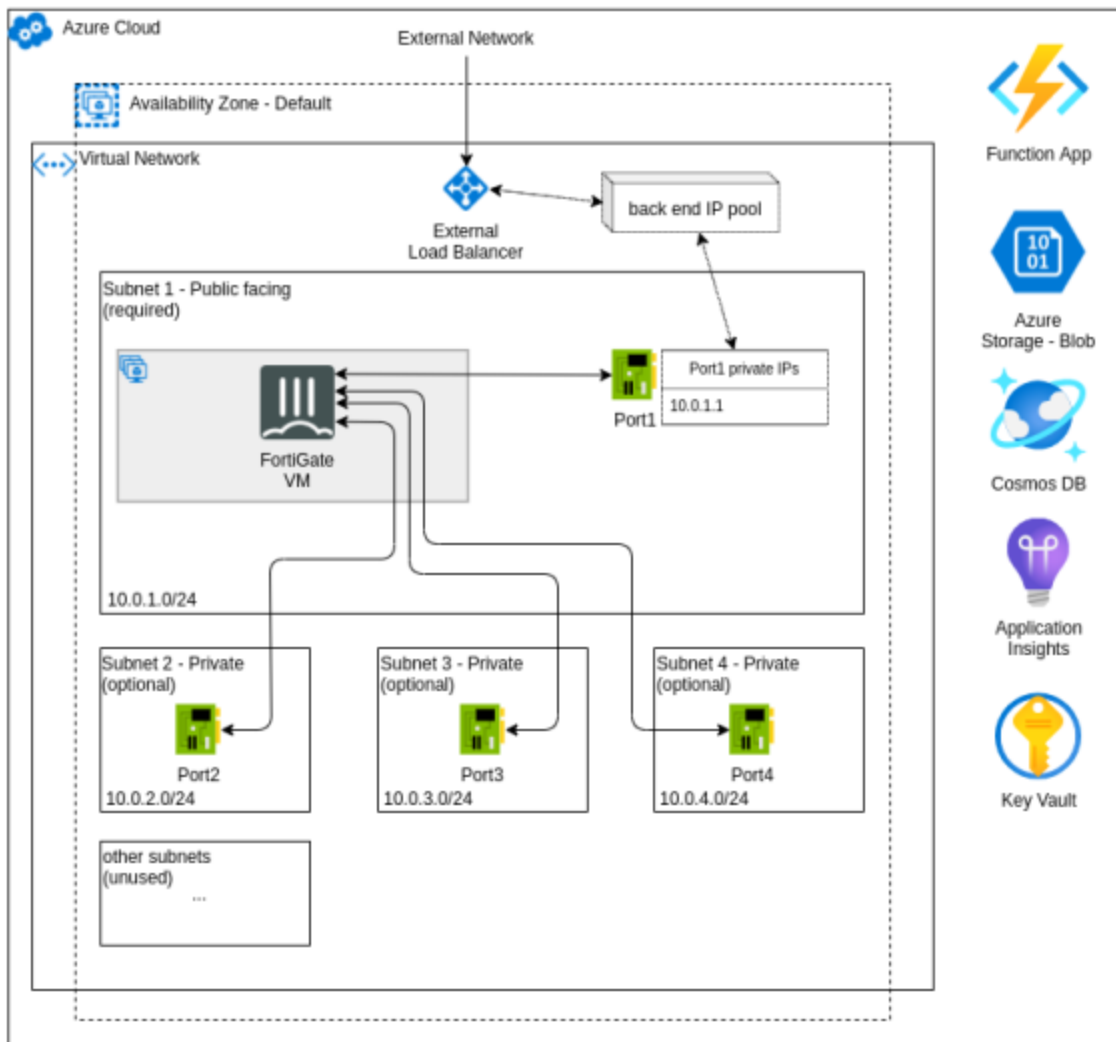


## FortiGate Autoscale for Azure architecture (BYOL instances only)



## FortiGate ports diagram

FortiGate Autoscale for Azure (3.4.0)  
FortiGate Ports





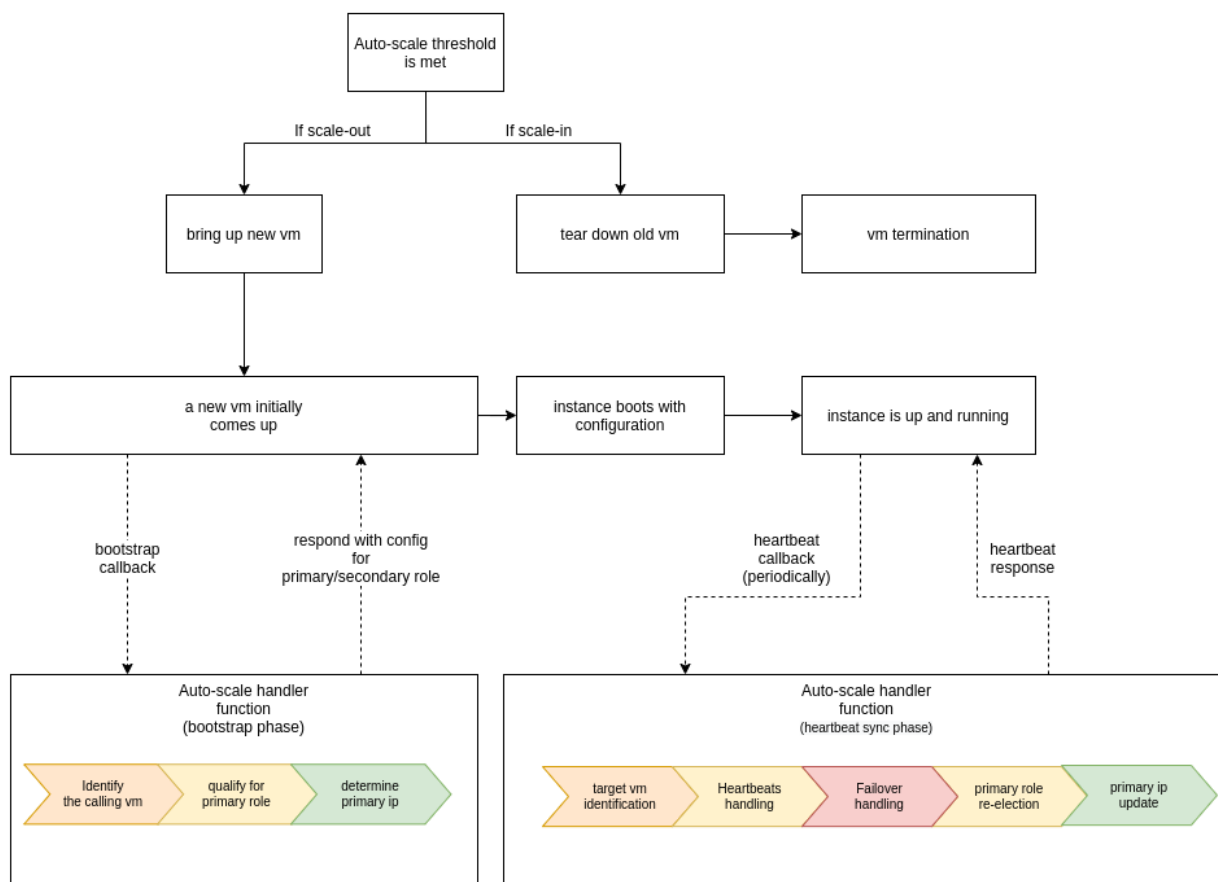
Components diagram

FortiGate Autoscale for Azure (3.4.0)  
Components



Autoscale handler flowchart

## Autoscale handler flowchart



## Replacing the FortiAnalyzer

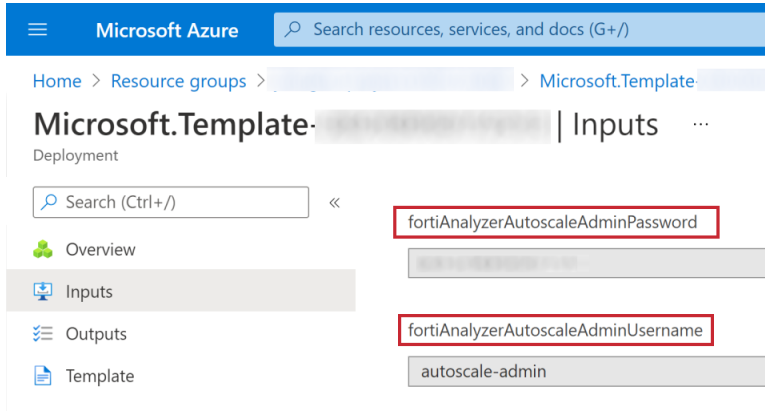
### To replace the FortiAnalyzer:

1. Create a new FortiAnalyzer resource in Azure in a location accessible by the FortiGate-VM in Subnet 1.
2. Upload a valid license for the FortiAnalyzer. For details on how to do so, refer to the section [Uploading files to the Storage account on page 66](#).
3. Log in into the FortiAnalyzer-VM.
4. (Optional) Restore a configuration from a backup.
5. If necessary, create an admin user for FortiGate Autoscale to use. To retrieve the ones from the initial deployment, refer to the section [Retrieving the FortiAnalyzer administrator username and password on page 95](#).
6. Update the FortiAnalyzer public IP address resource by first dissociating the public IP address from the previous FortiAnalyzer and then associating the public IP address with the new FortiAnalyzer.
7. If it is necessary to replace the public IP address, you will need to:
  - a. Locate the Settings item with key: *faz-ip*. For details, refer to the section [Modifying the Autoscale settings in Cosmos DB on page 76](#).
  - b. Update the value to the new public IP address.
  - c. Wait up to 60 seconds for the change to become effective.

## Retrieving the FortiAnalyzer administrator username and password

During the initial deployment, these were specified in the template parameters *FortiAnalyzer Autoscale Admin Username* and *FortiAnalyzer Autoscale Admin Password*. These values can be retrieved after deployment using each of these methods:

- Look them up in the deployment Inputs. For details, refer to the section [Locating deployment Outputs on page 82](#).



- Use the FortiAnalyzer CLI commands:  

```
config system admin user  
show
```

The first line of the output contains the *FortiAnalyzer Autoscale Admin Username*.
- Retrieve them from *Key Vault > secrets*. The *FortiAnalyzer Autoscale Admin Username* is stored as *faz-autoscale-admin-username*. For details, refer to the section [Viewing and modifying secrets in the Key vault on page 95](#).

## Viewing and modifying secrets in the Key vault

The first time you load the Key vault Secrets, you may need to grant permissions to your account.

### To locate the Key vault secrets:

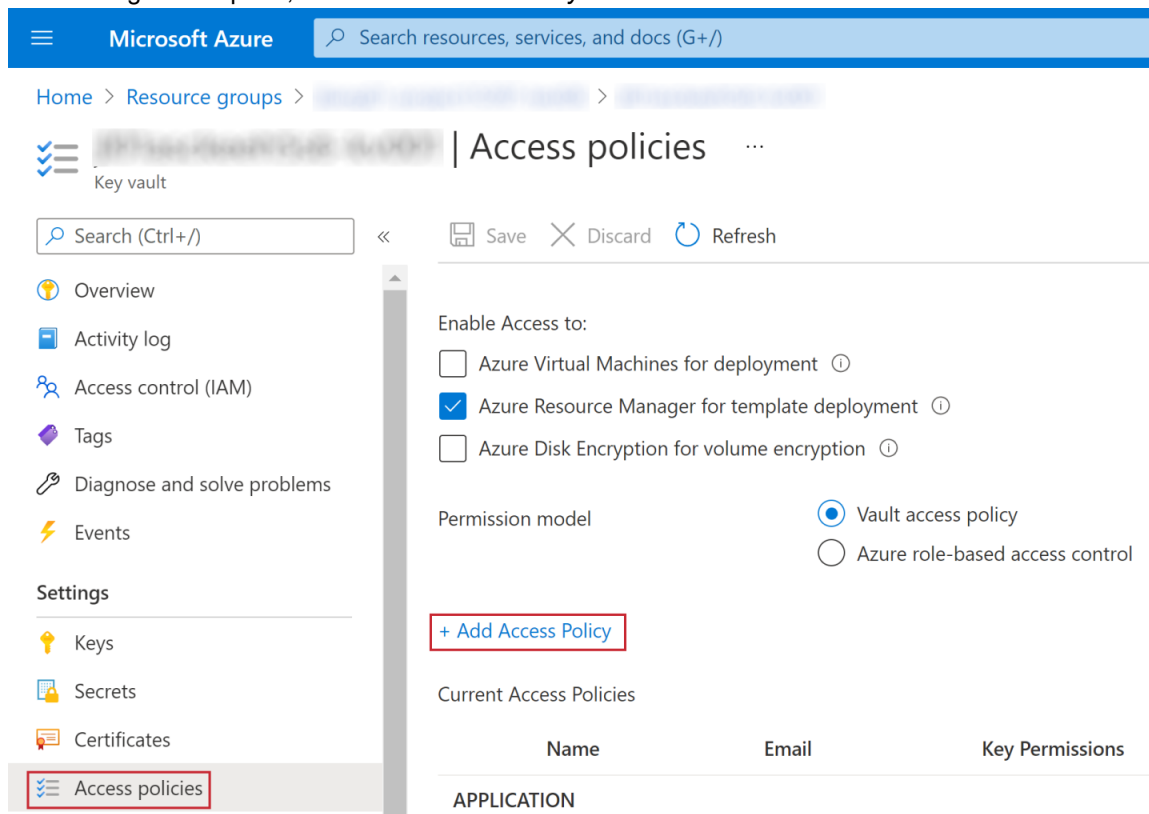
- Load the Autoscale resource group. For details, refer to the section [To load a resource group: on page 68](#).
- Click the name of the item of type *Key vault*.
- From the navigation column, under *Settings*, select *Secrets*.

4. If the warning “You are unauthorized to view these contents” is displayed, you will need to grant permissions to your account. For details on how to do this, refer to the section [To grant permissions to your account: on page 97](#).

The screenshot shows the Microsoft Azure portal interface. At the top, there is a blue header bar with the Microsoft Azure logo and a search bar. Below the header, the breadcrumb navigation shows 'Home > Resource groups > [Resource Group Name] > [Key Vault Name]'. The main content area is titled 'Secrets' and includes a search bar and several action buttons: '+ Generate/Import', 'Refresh', 'Restore Backup', and 'Manage deleted secrets'. A warning message is displayed: 'The operation "List" is not enabled in this key vault's access policy.' Below the warning, a table with columns 'Name' and 'Type' is shown, but it contains the message 'You are unauthorized to view these contents.' The left sidebar shows the navigation menu with 'Secrets' highlighted.

**To grant permissions to your account:**

1. From the navigation column, under *Settings*, select *Access Policies*.
2. From the right hand pane, click *+ Add Access Policy*.



3. For *Configure from template (optional)*, select *Secret Management*.

Microsoft Azure Search resources, services, and docs (G+ /)

Home > Resource groups > [Resource Group] > [Secret Management]

## Add access policy

Add access policy

Configure from template (optional) **Secret Management**

Key permissions 0 selected

Secret permissions 7 selected

Certificate permissions 0 selected

Select principal \* **None selected**

Authorized application ⓘ None selected

**Add**

4. For *Select principal \**, click *None selected* and choose your account.
5. Leave the *Authorized application* as is.
6. Click *Add*.
7. Click *Save* to apply the changes of granting your account permissions to the Secrets.

### To view a stored secret:

1. Click the secret you want to modify. In the example below, *faz-autoscale-admin-username* is selected.

Microsoft Azure Search resources, services, and docs (G+ /)

Home > [Key vault]

## Secrets

Key vault

Search (Ctrl+/) << + Generate/Import Refresh Restore Backup Manage

Name	Type
faz-autoscale-admin-password	
<b>faz-autoscale-admin-username</b>	

Events

Settings

Keys

**Secrets**

Certificates

2. Click the item under *CURRENT VERSION*.

The screenshot shows the Microsoft Azure portal interface. At the top, there is a blue header with the 'Microsoft Azure' logo and a search bar. Below the header, the breadcrumb trail reads 'Home > faz-autoscale-admin-username >'. The main content area displays the 'faz-autoscale-admin-username' resource, which is a 'Secret Version'. Below the resource name, there are several action buttons: '+ New Version', 'Refresh', 'Delete', and 'Download Backup'. A table below these buttons shows the 'CURRENT VERSION' with a red box highlighting the version identifier and a status of '✓ Enabled'.

Version	Status
<b>CURRENT VERSION</b>	
	✓ Enabled

3. Click *Show Secret Value*.

The screenshot shows the Microsoft Azure portal interface for the 'faz-autoscale-admin-username' resource. The breadcrumb trail reads 'Home > faz-autoscale-admin-username >'. The main content area displays the 'Secret Version' resource. Below the resource name, there are several action buttons: 'Save' and 'Discard changes'. The 'Properties' section shows the 'Created' and 'Updated' dates as '11/3/2021, 5:08:52 PM'. The 'Settings' section includes checkboxes for 'Set activation date' and 'Set expiration date', and a toggle for 'Enabled' set to 'Yes'. The 'Tags' section shows '0 tags'. The 'Secret' section includes a 'Content type (optional)' field and a 'Show Secret Value' button, which is highlighted with a red box. Below the 'Show Secret Value' button, the 'Secret value' is displayed as a series of asterisks.

Properties

Created 11/3/2021, 5:08:52 PM

Updated 11/3/2021, 5:08:52 PM

Secret Identifier

Settings

Set activation date ☐

Set expiration date ☐

Enabled ☒ Yes ☐ No

Tags 0 tags

Secret

Content type (optional)

**Show Secret Value**

Secret value

4. In this example, the secret value is *autoscale-admin*.

The screenshot displays the Microsoft Azure portal interface for configuring a secret. At the top, the navigation bar shows 'Microsoft Azure' and a search bar. Below the navigation bar, the breadcrumb trail indicates the path: 'Home > > faz-autoscale-admin-username >'. A 'Secret Version' section is visible, showing a lock icon and a 'Secret Version' label. Below this, there are 'Save' and 'Discard changes' buttons. The main configuration area is divided into sections: 'Properties', 'Settings', 'Tags', and 'Secret'. The 'Properties' section shows 'Created' and 'Updated' timestamps as '11/3/2021, 5:08:52 PM'. The 'Secret Identifier' field is empty. The 'Settings' section includes checkboxes for 'Set activation date' and 'Set expiration date', both of which are unchecked. The 'Enabled' section has a toggle switch set to 'Yes'. The 'Tags' section shows '0 tags'. The 'Secret' section includes a 'Content type (optional)' field, which is empty. Below this, there is a 'Hide Secret Value' button. The 'Secret value' field is highlighted with a red box, showing the value 'autoscale-admin'.

Microsoft Azure Search resources, services, and docs (G+/)

Home > > faz-autoscale-admin-username >

Secret Version

Save Discard changes

Properties

Created 11/3/2021, 5:08:52 PM

Updated 11/3/2021, 5:08:52 PM

Secret Identifier

Settings

Set activation date ☐

Set expiration date ☐

Enabled Yes No

Tags 0 tags

Secret

Content type (optional)

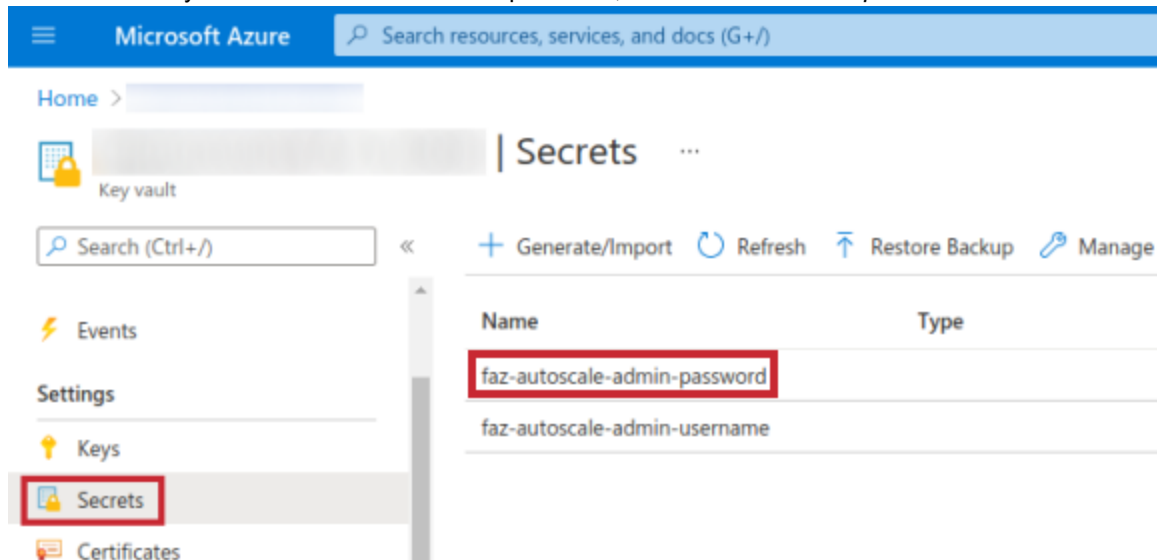
Hide Secret Value

Secret value autoscale-admin

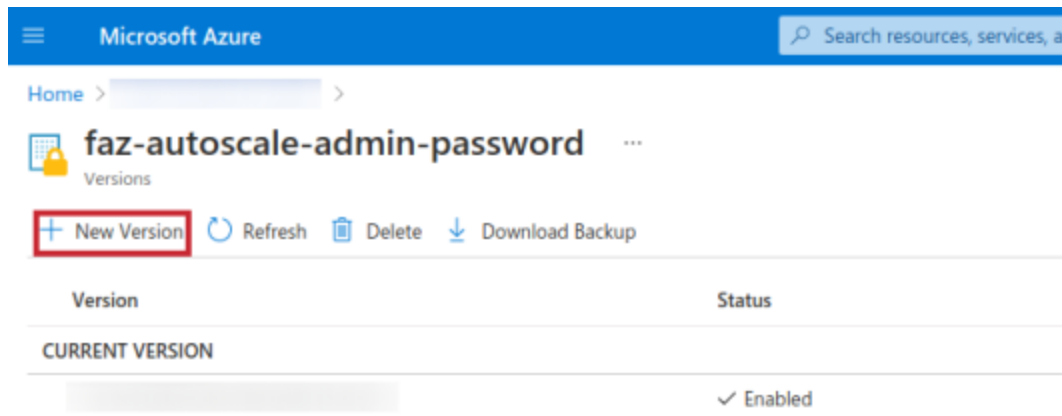


**To modify a secret:**

1. Click the secret you want to view. In the example below, *faz-autoscale-admin-password* is selected.



2. Click + *New Version*.



3. Enter the new secret in the *Value* \* field and then click *Create*.

Microsoft Azure Search resources, services, and docs (G+)

Home > > faz-autoscale-admin-password >

## Create a secret ...

Upload options	Manual
Name ⓘ	faz-autoscale-admin-password
Value * ⓘ	Enter the secret. ⓘ
Content type (optional)	
Set activation date ⓘ	<input type="checkbox"/>
Set expiration date ⓘ	<input type="checkbox"/>
Enabled	<input checked="" type="radio"/> Yes <input type="radio"/> No
Tags	0 tags

Create

## Cloud-init

In Auto Scaling, a FortiGate uses the `cloud-init` feature to pre-configure the instances when they first come up. During template deployment, an internal API Gateway endpoint will be created.

A FortiGate sends requests to the endpoint to retrieve necessary configuration after initialization.

Use this FOS CLI command to display information for your devices:

```
# diagnose debug cloudinit show
```

VPN output can be retrieved with this FOS CLI command:

```
# diagnose vpn tun list
```

## Upgrading the deployment

An existing FortiGate Autoscale for Azure deployment can be upgraded in one specific scenario:

- It was deployed with the 2.0.9 template.

To determine which template was used in your deployment, refer to the section [Determining the FortiGate Autoscale release version on page 82](#).



Read these instructions completely before starting an upgrade.

---

A deployment with the 2.0.9 template can be upgraded only to the 3.3.2 template. During the upgrade, users can optionally consolidate logging and reporting for the FortiGate cluster by integrating FortiAnalyzer 6.2.5 or FortiAnalyzer 6.4.5.

### Prerequisites for upgrading

- Linux Operating System
- NodeJS 14
- Azure CLI
- FortiGate Autoscale for Azure upgrade templates

### Obtaining the upgrade templates

The FortiGate Autoscale for Azure upgrade templates are located in the Fortinet Autoscale for Azure [GitHub project](#). Go to the [2.0.9 upgrade \(3.3.2\)](#) release and download `fortigate-autoscale-azure.zip`.

Unzip this file on your local PC. The `templates` folder will contain these files:

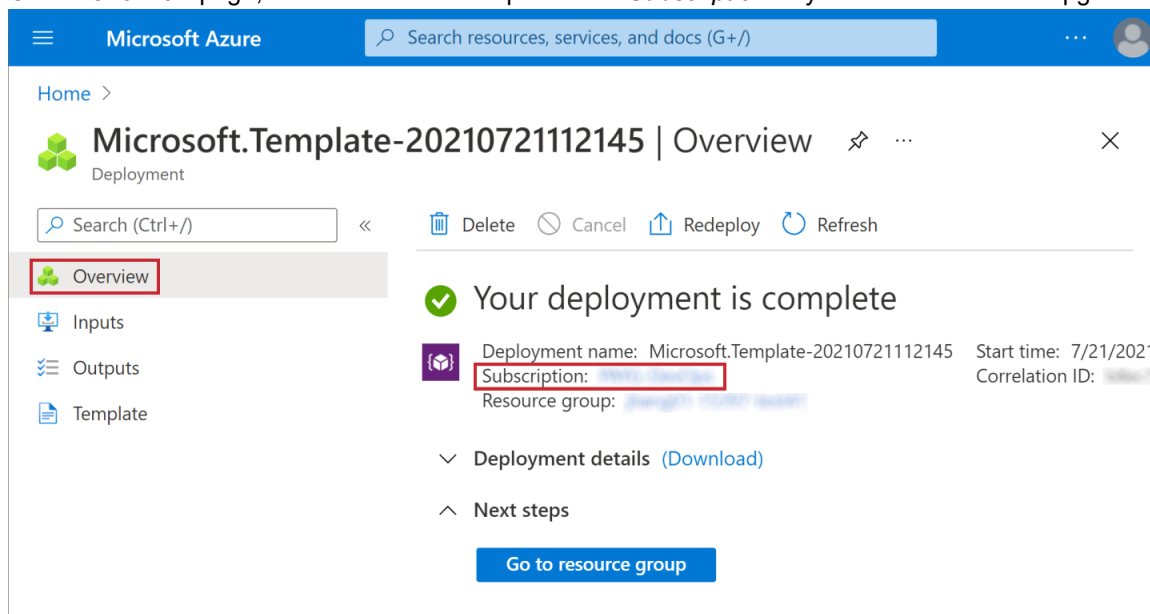
- `upgrade_fortigate_autoscale_from_2.0.9_to_3.3.2.preparation.json`  
This template prepares the environment for the upgrade.
- `upgrade_fortigate_autoscale_from_2.0.9_to_3.3.2.json`  
This template performs the upgrade from the 2.0.9 template to the 3.3.2 template and pairs with the optional parameter template.
- (optional) `upgrade_fortigate_autoscale_from_2.0.9_to_3.3.2.params.json`  
This parameter template pairs with the upgrade template.
- `upgrade_fortigate_autoscale_from_2.0.9_to_3.3.2.cleanup.json`  
This template finalizes the upgrade process.

### Before you start an upgrade

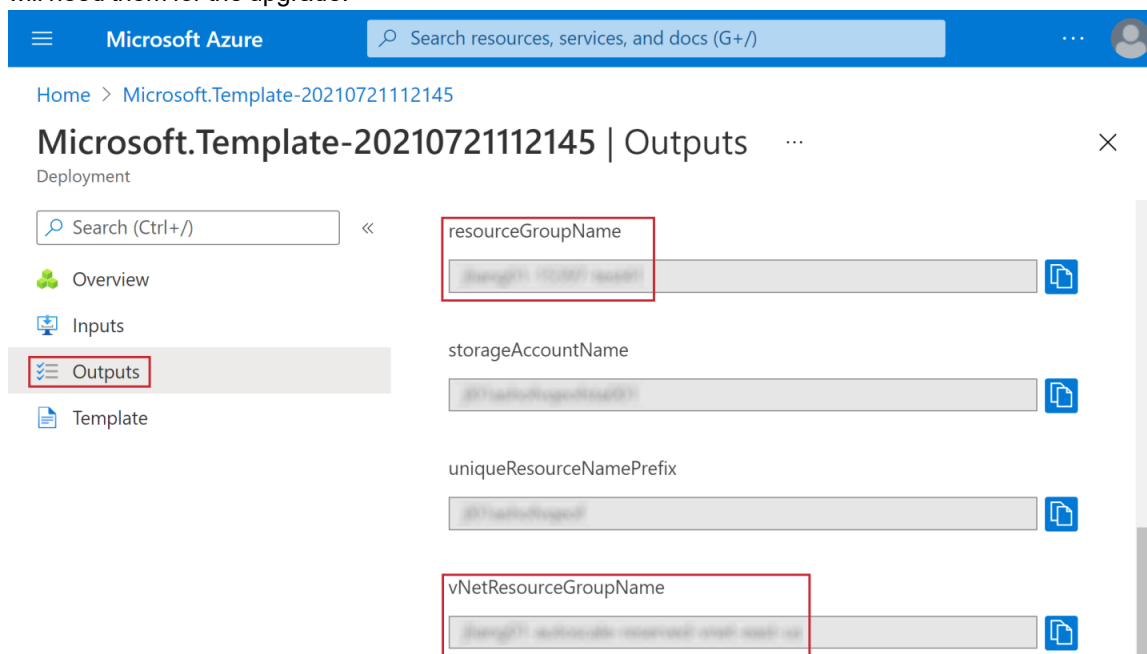
Upgrading the deployment requires values from the existing 2.0.9 deployment. The following sections describe how to locate these values.

## Locating values from the 2.0.9 deployment

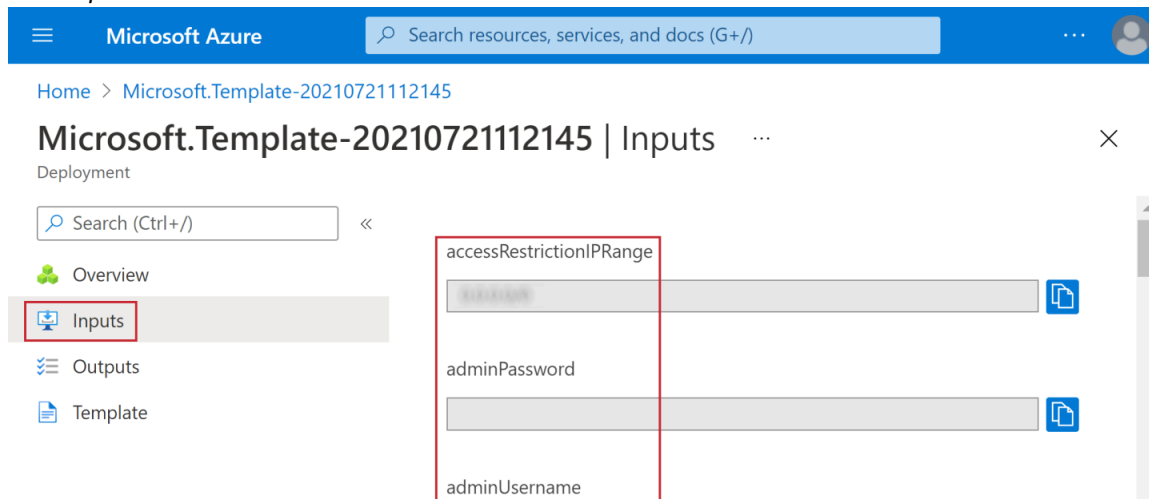
1. Go to the *Microsoft.Template Overview* by following the steps 1-3 of the section [Locating deployment Outputs on page 82](#).
2. On the *Overview* page, note the value for the parameter *Subscription* as you will need it for the upgrade.



3. Click *Outputs* and note the values for the parameters *resourceGroupName* and *vNetResourceGroupName* as you will need them for the upgrade.



4. Click *Inputs*.



5. Make note of values on this page as you will need them for the upgrade.

## Upgrade iteration

*Upgrade Iteration* is an important parameter throughout the entire process. The allowable values for *Upgrade Iteration* are limited to the numbers 2 thru 9. This value is used to form a unique name for the new resources related to the upgrade. If there are errors during the upgrade, the entire stack can be rolled back - the *Upgrade Iteration* value is used to remove the resources which were created.

When performing the upgrade for the first time, set *Upgrade Iteration* to 2. If errors occur, rollback the upgrade and start over with *Upgrade Iteration* set to 3. Repeat if necessary, increasing the value of *Upgrade Iteration* each time.



When a deployment is rolled back, the Key Vault will be **soft-deleted**. Once the Key Vault is permanently deleted, the *Upgrade Iteration* number can be reused. To permanently delete the Key Vault, open the AzureCLI and run the `upgradeIterationCmdDeleteKeyVaultPermanent` command from the *Outputs* of the cleanup template.

## Performing the upgrade

The upgrade solution described here is a rollback-capable solution for preparing, creating, and removing resources. The steps below will guide you through the upgrade process.



Before starting an upgrade, ensure that the values for the 2.0.9 template deployment have been located.

1. Deploy the preparation template as described in the section [Deploying the preparation template on page 106](#).
2. Deploy the upgrade template as described in the section [Deploying the upgrade template on page 106](#).
3. Verify the newly deployed resources. For details, refer to the section [Verifying the upgrade deployment on page 109](#).



Do not start the BYOL or PAYG VMSS until you initialize the database. In other words, ensure the instance number of the VMSS is set to 0.

4. Initialize the database. For details, refer to the section [Initializing the database on page 109](#).
5. Start the two new VMSS. For details, refer to the section [Starting a VMSS on page 77](#).
6. Observe the FortiGate-VMs running in the two VMSS and ensure they are running correctly.
7. Deploy the cleanup template. For details, refer to the section [Deploying the cleanup template on page 111](#).

## Deploying the preparation template

1. Create a template deployment using the preparation template. For details, refer to the section [Creating a template deployment on page 56](#). When prompted for parameters, use values as described in the table below:

Parameter display name	2.0.9 template Input	2.0.9 template Output	Value to use
Subscription	*	*	Use the value from the 2.0.9 template deployment. Do not change it.
Resource group		resourceGroupName	
Resource Name Prefix	resourceNamePrefix		
Vnet Resource Group Name		vNetResourceGroupName	
Region	*	*	This value cannot be changed. It is tied to the Resource group.
Upgrade Iteration	*	*	Refer to the section <a href="#">Upgrade iteration on page 105</a> .

\* indicates that there isn't a value present in the 2.0.9 template Inputs or Outputs.

2. When deployment of the preparation template has completed, go to *Outputs*. For details, refer to the section [Locating deployment Outputs on page 82](#).
3. Copy the `cmdUpdateAllInOne` command.
4. Open a terminal in your Linux OS.
5. Log in to your Azure account with the command `az login`.
6. Run the command `cmdUpdateAllInOne`.
7. Wait for the command to be fully finished.

## Deploying the upgrade template

1. Create a template deployment using the upgrade template. For details, refer to the section [Creating a template deployment on page 56](#). For descriptions of the variables, refer to the section [Configurable variables on page 60](#). When prompted for parameters, use values as described in the table used when creating a template deployment with the preparation template and from the table below:

Parameter display name	2.0.9 template Input	Value to use
Access Restriction IP Range	accessRestrictionIPRange	Use the value from the 2.0.9 template deployment. May be adjusted to meet the new needs.
Admin Password	adminPassword	Requires manual input. The value from the 2.0.9 template deployment is recommended; a new value may be entered.
Admin Username	adminUsername	Use the value from the 2.0.9 template deployment.
BYOL Instance Count	byollInstanceCount	Use the value from the 2.0.9 template deployment. May be adjusted to meet the new needs.
FOS Version	fosVersion	Use values from the drop-down list. The latest version is recommended.
Forti Analyzer Autoscale Admin Password	*	Follow the instructions in the parameter description.
Forti Analyzer Autoscale Admin Username	*	
Forti Analyzer Custom Private IP Address	*	
Forti Analyzer Instance Type	*	
Forti Analyzer Integration Options	*	
Forti Analyzer Version	*	Requires manual input. The value from the 2.0.9 template deployment is recommended; a new value may be entered.
Forti Gate PSK Secret	fortiGatePSKSecret	
Heart Beat Delay Allowance	heartBeatDelayAllowance	Use the value from the 2.0.9 template deployment. May be adjusted to meet the new needs.
Heart Beat Interval	heartBeatInterval	
Heart Beat Loss Count	heartBeatLossCount	
Instance Type	instanceType	
Key Vault Name	*	Follow the instructions in the parameter description.

Parameter display name	2.0.9 template Input	Value to use
Max BYOL Instance Count	maxBYOLInstanceCount	Use the value from the 2.0.9 template deployment. May be adjusted to meet the new needs.
Max PAYG Instance Count	maxPAYGInstanceCount	
Min BYOL Instance Count	minBYOLInstanceCount	
Min PAYG Instance Count	minPAYGInstanceCount	
PAYG Instance Count	PAYGInstanceCount	Use the template default value. Do not change it.
Package Res URL	packageResURL	
Primary Election Timeout	masterElectionTimeout	
Scale In Threshold	scaleInThreshold	
Scale Out Threshold	scaleOutThreshold	Follow the instructions in the parameter description.
Service Plan Tier	*	
Service Principal App ID	restAppID	
Service Principal App Secret	restAppSecret	
Service Principal Object ID	*	Use the value from the 2.0.9 template deployment. May be adjusted to meet the new needs.
Storage Account Type	storageAccountType	
Subnet1Name	subnet1Name	
Subnet2Name	subnet2Name	
Subnet3Name	subnet3Name	Follow the instructions in the parameter description.
Subnet4Name	subnet4Name	
Vnet Address Space	vnetAddressSpace	Use the value from the 2.0.9 template deployment. Do not change it.
Vnet Name	vnetName	

If the deployment does not complete successfully, go to the section [Troubleshooting the upgrade on page 112](#).

2. Upload `configset` files to the Storage account. For details, refer to the section [Uploading files to the Storage account on page 66](#).
3. If you will be using BYOL instances, upload `license` files to the Storage account.



License files from the 2.0.9 deployment can be reused . However, re-using a license will invalidate the FortiGate which is currently using the license.



## Verifying the upgrade deployment

The FortiGate Autoscale for Azure 3.3.2 template will be deployed into the Resource Group and a new set of the following 6 resources will be created:

- Function App
- App Service plan
- Application Insights
- Storage account
- Azure Cosmos DB account
- Virtual machine scale set (BYOL)
- Virtual machine scale set (PAYG)

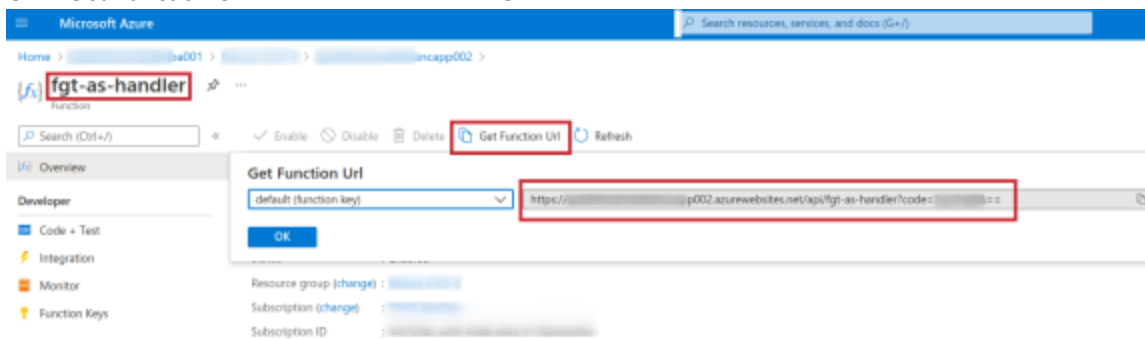
These resources will be created with the same name as the previous 2.0.9 resources with the iteration number appended. For example, if the Upgrade Iteration is 2, the number appended is 002. Verify that they have been created. For details on verifying components, refer to the section [Verifying the deployment on page 68](#).

## Initializing the database



Do not scale out the BYOL or PAYG VMSS until you initialize the database.

1. Go to the `fgt-as-handler` function. For details on how to do this, refer to the section [To verify the function app: on page 70](#).
2. Click *Get Function Url* to obtain the Function URL:



- 
3. Open a web browser to run the URL. The expected response is an error as shown below:



## This page isn't working

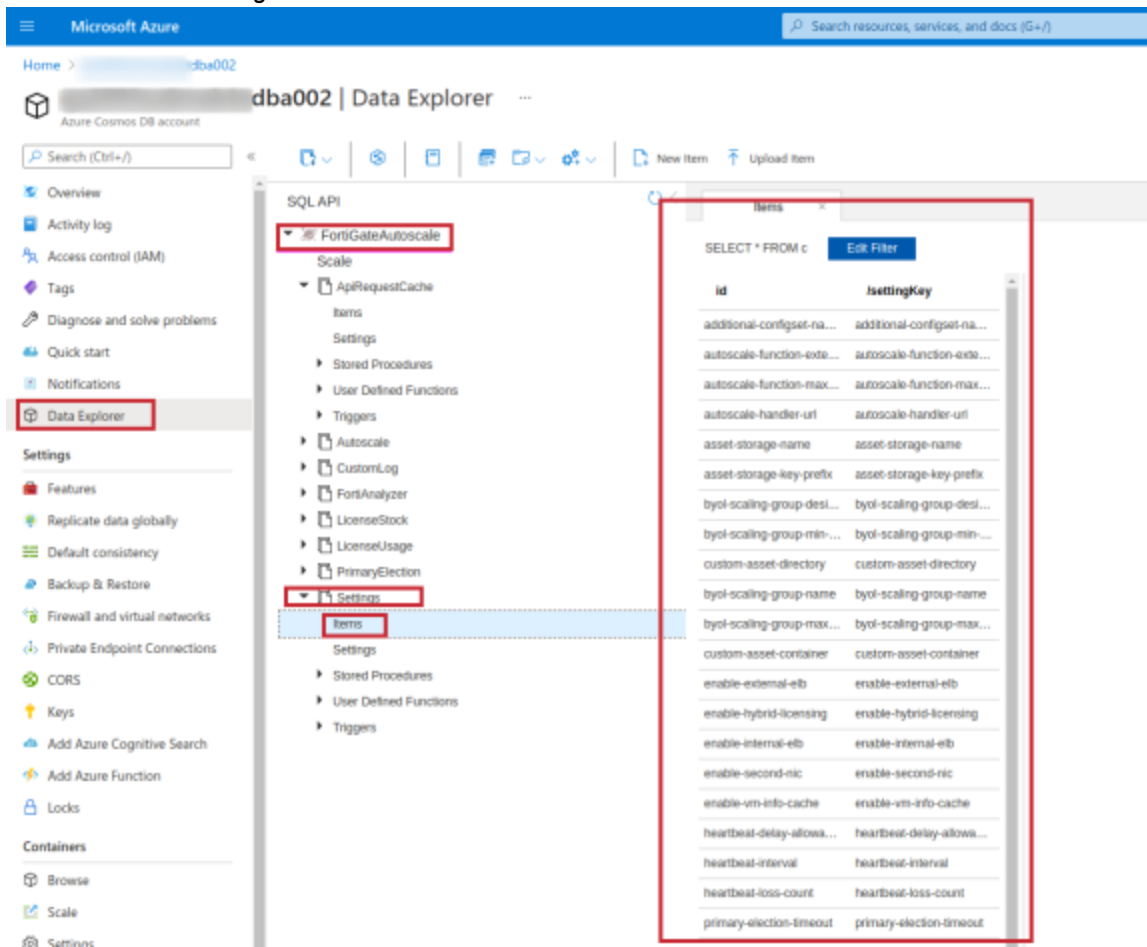
██████████02.azurewebsites.net is currently unable to handle this request.

HTTP ERROR 500

Reload

4. Go to the cosmos DB account of the current upgrade iteration. For details on how to do this, refer to steps 1 and 2 in the section [To verify the database: on page 70](#).
5. On the right hand side, expand the database *FortiGateAutoscale*.
6. Expand the container *Settings*.
7. Click on *Items*.

8. Confirm that the *Settings* container has items.



## Deploying the cleanup template

1. Create a template deployment using the cleanup template. For details, refer to the section [Creating a template deployment on page 56](#). When prompted for parameters, use values as described in the table below:

Parameter display name	2.0.9 template Input	2.0.9 template Ouput	Value to use
Subscription	*	*	
Resource group		resourceGroupName	Use the value from the 2.0.9 template deployment. Do not change it.
Resource Name Prefix	resourceNamePrefix		
Vnet Resource Group Name		vNetResourceGroupName	
Region	*	*	This value cannot be changed. It is tied to the Resource group.

Parameter display name	2.0.9 template Input	2.0.9 template Ouput	Value to use
Upgrade Iteration	*	*	Use the iteration number for the upgrade iteration you want to continue with

\* indicates that there isn't a value present in the 2.0.9 template Inputs or Outputs.

- When deployment of the cleanup template completes, go to the *Outputs*.
- Copy the command appropriate for your activity:
  - To finalize the upgrade, copy the `cleanUpOldComponentCmdDeleteAllInOne` command.
  - To roll back the upgrade, copy the `upgradeIterationCmdDeleteAllInOne` command.
- Open a terminal in your Linux OS.
- Log in to your Azure account with the command `az login`.
- Run the copied command.
- Wait for the command to be fully finished.

## Troubleshooting the upgrade

As long as an upgrade process isn't finalized, it is regarded as an incomplete upgrade iteration. Reasons for not finalizing can include errors and user intervention.

In the case of an incomplete upgrade iteration, roll back the upgrade iteration and perform the upgrade again with a different value for *Upgrade Iteration*. It is suggested that the value be increased by 1 with each successive deployment.

## Rolling back an incomplete upgrade iteration

Users have the option of rolling back an upgrade iteration by deploying the cleanup template. When deployed, newly created resources related to the upgrade iteration will be released. It is recommended to rollback right away before starting a new upgrade iteration. This option must be used if all the allowable *Upgradte Iteration* values (2-9) have been used up.



When a deployment is rolled back, the Key Vault will be **soft-deleted**. Once the Key Vault is permanently deleted, the *Upgrade Iteration* number can be reused. To permanently delete the Key Vault, open the AzureCLI and run the `upgradeIterationCmdDeleteKeyVaultPermanent` command from the *Outputs* of the cleanup template.

## Document history

Template	Date Released	Details
3.4.0	November 19, 2021	Added support for deployment of 1 - 4 subnets. (Previously 4 were deployed). Added support for failover recovery. (Updated Failover management parameters).
special release	August 25, 2021	This special release is for upgrading from the 2.0.9 template to the 3.3.2 template. The upgrade release package is located on the Fortinet Autoscale for Azure release page tag <a href="#">2.0.9 upgrade (3.3.2)</a> .
3.3.2	June 11, 2021	Documentation was not updated.
3.3.0	May 25, 2021	Added support for FortiAnalyzer.
3.1.1	February 4, 2021	Added support for FortiOS 6.4.3. Removed support for FortiOS 6.2.x.
3.0.0	September 23, 2020	Added support for FortiOS 6.2.3.
2.0.5	February 25, 2020	Added support for FortiOS 6.0.9.
2.0	October 8, 2019	FortiGate Autoscale 2.0.0 General Availability Added support for Hybrid Licensing (any combination of BYOL and/or PAYG instances).
1.0	April 19, 2019	FortiGate Autoscale General Availability Supports auto scaling for PAYG instances only. Requires FortiOS 6.0.6 or FortiOS 6.2.1. Documentation is no longer maintained and is only available as a PDF: <ul style="list-style-type: none"><li>• <a href="#">Deploying auto scaling on Azure 1.0</a></li></ul>

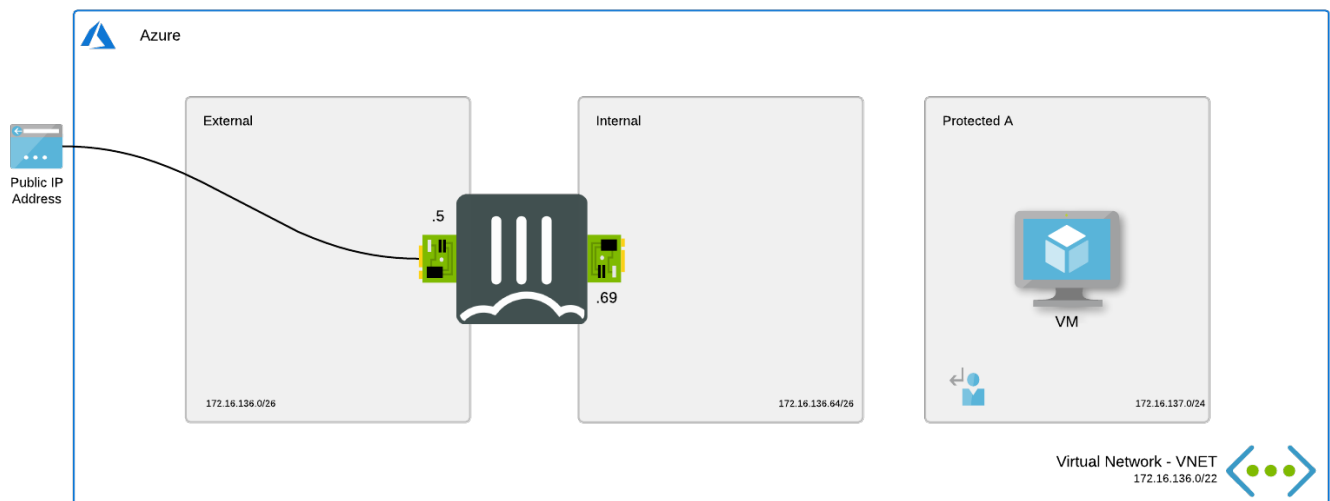
# Single FortiGate-VM deployment

You can deploy FortiGate-VM NGFW for Azure as a virtual appliance in the Azure cloud (IaaS). This section shows you how to install and configure a single instance FortiGate-VM in Azure to provide a full NGFW/unified threat management (UTM) security solution in front of Azure IaaS resources.

This section covers the deployment of simple web servers, but you can use this deployment type for any type of public resource protection with only slight modifications. With this architecture as a starting point, you can implement more advanced solutions, including multitiered solutions.

The example in this document creates three subnets:

Subnet	Description
Subnet1	External subnet used to connect the FortiGate-VM to the Internet.
Subnet2	Internal subnet used as a transit network to one or multiple protected networks containing backend services, such as the web server.
Subnet3	Protected subnet used to deploy services. You can deploy multiples of these subnets. The traffic is sent to the FortiGate for inspection using UDR.



## Registering and downloading your license

FortiGate-VM for Azure supports both BYOL and PAYG licensing models. If you are deploying a FortiGate-VM in the Azure marketplace with BYOL, you must obtain a license to activate it.

You can obtain licenses through any Fortinet partner. If you do not have a partner, contact [azuresales@fortinet.com](mailto:azuresales@fortinet.com) for assistance in purchasing a license.

See [Creating a support account on page 12](#).

## Deploying the FortiGate-VM

There are different deployment methods for the FortiGate-VM related to the different deployment methods that the Azure platform supports. This guide focuses on the Azure portal. This offers a convenient and guided deployment. For more automated deployment, ARM templates or Terraform are available on the Fortinet GitHub.

### To deploy the FortiGate-VM:

1. In the Azure dashboard, select *Create a resource* and search for FortiGate.
2. Locate the Fortinet FortiGate Next-Generation Firewall listing and select it.
3. From the *Select a plan* dropdown list, select *Single VM*. Click *Create*.
4. Configure the options on the *Basics* tab according to your requirements:
  - a. For *Resource Group*, create a new resource group or select an existing one. Deploying the solution to a new or empty resource group is recommended. You can deploy the solution to an existing resource group that already contains resources, but this may overwrite existing resources.
  - b. From the *Region* dropdown list, select the desired region. FortiGate-VM is available in all public regions of Azure and the China and Gov regions. Availability depends on the access rights of the Azure subscription used for deployment.
  - c. In the *FortiGate administrative username* field, enter the username that will be used to manage the FortiGate. The username cannot be a common username such as root, admin, or administrator. After deployment, you can reset the username and password from the Azure portal interface, resulting in a system reboot.
  - d. In the *FortiGate password* field, enter the password used to manage the FortiGate via the GUI or CLI. The password must be at least twelve characters and contain one or more of the following tokens: uppercase letters, lowercase letters, digits, and special characters: ~!@#\$%^&\* \_-+=`|(){}[]:;'"<>,.?/.
  - e. In the *Fortigate Name Prefix* field, enter the desired prefix. All resources will contain the prefix in their name.
  - f. From the *Fortigate Image SKU* dropdown list, select the license type. PAYG is billed through Azure as an additional charge to compute usage.
  - g. From the *Fortigate Image Version* dropdown list, select the desired FortiGate version. The default option installs the latest FortiGate version.

#### Create Fortinet FortiGate Next-Generation Firewall ...

Basics Instance Type Networking Public IP Advanced Review + create

**Project details**

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription \* ⓘ EMEA-CSE

Resource group \* ⓘ (New) FGTDGC-RG  
[Create new](#)

**Instance details**

Region \* ⓘ West Europe

FortiGate administrative username \* ⓘ azureuser

FortiGate password \* ⓘ

Confirm password \* ⓘ

Fortigate Name Prefix \* ⓘ FGT

Fortigate Image SKU ⓘ Bring Your Own License

Fortigate Image Version ⓘ latest

5. For *Instance Type*, select the instance type according to the purchased BYOL license or the anticipated cost per hour. Licensing is based on the number of utilized vCPUs. You can resize the VM later if needed. See [Instance type support on page 6](#).
6. On the *Networking* tab, configure the following:
  - a. Configure the networks. You can deploy the FortiGate in an existing VNet or create a new VNet. If deploying to an existing VNet, you must already have three subnets to use for the FortiGate-VM. The FortiGate-VM requires a public and private interface for Internet edge protection. Ensuring that the external and internal subnets of the FortiGate are empty or do not contain other networking devices that require routing is recommended.
  - b. Enable *Accelerated Networking* if desired. You can enable this option to have a direct path from the VM to the Azure infrastructure NIC and allows for better performance. This is only available for specific instance types. See [Enabling accelerated networking on the FortiGate-VM on page 37](#).

#### Create Fortinet FortiGate Next-Generation Firewall ...

Basics Instance Type **Networking** Public IP Advanced Review + create

**Configure Internal Networking**

Create a new or select an existing virtual network with the required subnets.

**Configure virtual networks**

Virtual network \* ⓘ FGT-VNET ▼  
[Create new](#)

External Subnet \* ⓘ ExternalSubnet (172.16.136.0/26) ▼  
[Manage subnet configuration](#)

Internal subnet \* ⓘ InternalSubnet (172.16.136.64/26) ▼  
[Manage subnet configuration](#)

Protected subnet \* ⓘ ProtectedSubnet (172.16.137.0/24) ▼  
[Manage subnet configuration](#)

**i** The external subnet will have a public IP attached to the FortiGate network interface. The internal subnet is a transit subnet containing only the FortiGate interfaces for traffic to and from the internal networks. Internal systems should be installed in a protected subnet with user defined route configuration. ⓘ

**Accelerated networking**

Enables SR-IOV support allowing direct access from the NIC in the Azure infrastructure to the FortiGate VM.  
[Learn more](#)

Accelerated Networking ⓘ ☒ Enabled ☐ Disabled

**i** Accelerated Networking is supported on most general purpose and compute-optimized instance sizes with 2 or more vCPUs. On instances that support hyperthreading, Accelerated Networking is supported on VM instances with 4 or more vCPUs. Deployment with the accelerated networking feature enabled on a host that doesn't support it will result in a failure to connect to it. The accelerated networking can be disabled after deployment from the Azure Portal or Azure CLI. ⓘ

7. On the *Public IP* tab, create a new public IP address or select an existing unattached public IP address. The public IP address can be a basic or standard SKU public IP address. A highly available setup requires a standard SKU public IP address. Upgrading from a basic to a standard SKU public IP address is supported. See [Upgrade public IP addresses](#).
8. On the *Advanced* tab, configure the following:
  - a. In the *FortiManager* section, provide FortiManager details if desired. During deployment, the FortiGate can reach out and register itself to a FortiManager using the provided details.
  - b. In the *Custom Data* field, add additional configuration if desired. This provides a configuration to the FortiGate during deployment. For example, you can enter FortiOS CLI commands.
  - c. If using a BYOL license, upload the license so that it can be provided during deployment to the FortiGate.



9. Launch the FortiGate deployment:
  - a. You are finished configuring the options. Once validation is passed, click *OK*.



If you want to download the template, click *Download template and parameters*.

---

- b. Click *Create*. After deploying the template, you should see the deployment progress and the parameters and template that Azure is progressing. Once deployed, the new resources show in the resource group.

## Connecting to the FortiGate-VM

### To connect to the FortiGate-VM:

1. Open the FGTPublicIP resource and copy the IP address that Azure assigned.
2. In a web browser, connect to the IP address using HTTPS on port 443. You can also use an SSH client on port 22.
3. The system displays a warning that the certificate is not trusted. This is expected since the FortiGate-VM is using a self-signed certificate. If desired, replace the certificate with a signed certificate.
4. Sign in with the credentials specified in the Azure template parameters.
5. If you chose a BYOL deployment, you must upload a license and reboot the FortiGate-VM before continuing. See [Registering and downloading your license on page 114](#).

## Azure routing and network interfaces

On the Azure platform and the FortiGate-VM, the private IP addresses of both interfaces are configured using static assignment using deployment.

In the static routing, a default route has been configured towards the default gateway of the external network on port1. All internal networks are routed to the internal/transit network on port2. The gateway IP address on the Microsoft side is always the first IP address in the subnet IP address range.

Azure uses the 168.63.129.16 address for various services. You can configure an additional route to ensure that this traffic always leaves via port1. See [What is IP address 168.63.129.16?](#)

During deployment, a route table is created and attached to the protected subnet. This routing table contains three user-defined routes. The default route 0.0.0.0/0 points to the FortiGate-VM internal IP address. This catches all traffic except for the virtual network traffic and sends it to the FortiGate-VM for inspection.

The virtual network is created as well and forces traffic for additional protected networks to pass through the FortiGate-VM. As Azure applies these subnet routes to each VM, an additional route is needed for the local subnet to send its traffic directly to the VNet. If this route is omitted, you will have microsegmentation sending all traffic between the VMs in the protected subnet also via the FortiGate-VM.

If no internal segmentation is required, you can delete the VNet routes.

Verify that the route table is attached to the ProtectedSubnet. Also ensure that the UDR routes include the destination networks.

To verify and troubleshoot routing, the effective route tables can be requested from each network interface of a running VM. The screenshot shows that the default routes have been invalidated by the UDR deployed within the FortiGate.

Home > FGTLNX > fgtlrx617

**fgtlrx617** | Effective routes ✦ ...

Network interface

Search (Cmd+/) << Download Refresh

Overview

Activity log

Access control (IAM)

Tags

Settings

IP configurations

DNS servers

Network security group

Properties

Locks

Monitoring

Alerts

Metrics

Diagnostic settings

Automation

Tasks (preview)

Export template

Support + troubleshooting

Effective security rules

Effective routes

Scope: Network interface (fgtlrx617)

Associated route table: FGT-RT-PROTECTED

Effective routes

Source	State	Address Prefixes	Next Hop Type	Next Hop IP Address	User Defined Route Name
User	Active	172.16.137.0/24	Virtual network	-	Subnet
Default	Invalid	172.16.136.0/22	Virtual network	-	-
Default	Invalid	0.0.0.0/0	Internet	-	-
User	Active	172.16.136.0/22	Virtual appliance	172.16.136.68	VirtualNetwork
User	Active	0.0.0.0/0	Virtual appliance	172.16.136.68	Default

## Using public IP addresses

Azure does not publicly route IP addresses within a VNet, so you cannot assign a public IP address to another VM and still filter that traffic through a FortiGate-VM on Azure. Instead, you must assign the public IP addresses to the vNICs associated with the FortiGate-VM, then configure the FortiGate-VM to forward that traffic. Further, in most cases, Azure provides 1:1 NAT between the assigned public IP address and the assigned local IP address. Thus, the FortiGate-VM must forward packets using the local IP address.

A single FortiGate-VM deployment from the Azure marketplace includes one Azure IP address configuration containing a public IP address and a local IP address. Azure performs 1:1 NAT between the two as traffic enters and exits the VNet. This configuration is called an instance-level public IP address. All types of protocols are forwarded using NAT from an external public IP address to the FortiGate private IP address that is linked to it in the network interface on Azure.

The following shows the default Azure vNIC and FortiOS configurations:

Home > Resource groups > FGTD0C-RG > FGT-FGT-A

## FGT-FGT-A | Networking

Virtual machine

Search (Cmd+ /)

Attach network interface Detach network interface

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

### Settings

- Networking
- Connect
- Disks
- Size
- Security
- Advisor recommendations
- Extensions
- Continuous delivery

FGT-FGT-A-Nic1 FGT-FGT-A-Nic2

IP configuration

ipconfig1 (Primary)

**Network Interface: FGT-FGT-A-Nic1** Effective security rules Troubleshoot VM connection issues Topology  
Virtual network/subnet: FGT-VNET/ExternalSubnet NIC Public IP: 51.137.82.25 NIC Private IP: 172.16.136.4 Accelerated networking: Enabled

Inbound port rules Outbound port rules Application security groups Load balancing

Network security group FGT-hynhxfquhcouy-NSG (attached to network interface: FGT-FGT-A-Nic1)  
Impacts 0 subnets, 2 network interfaces

Add inbound port rule

Priority	Name	Port	Protocol	Source	Destination
100	AllowAllInbound	Any	Any	Any	Any
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork
65001	AllowAzureLoadBalancerInBou...	Any	Any	AzureLoadBalancer	Any
65500	DenyAllInBound	Any	Any	Any	Any

Home > Resource groups > FGTD0C-RG > FGT-FGT-A > FGT-FGT-A-Nic1

## ipconfig1

FGT-FGT-A-Nic1

Save Discard

### Public IP address settings

Public IP address

Disassociate Associate

Public IP address \*

FGTPublicIP (51.137.82.25)

Create new

### Private IP address settings

Virtual network/subnet


FGT-VNET/ExternalSubnet

Assignment


Dynamic Static


IP address \*


172.16.136.4

Name  port1

Alias

Type  Physical Interface

VRF ID  0

Role  Undefined

---

Address



Addressing mode **Manual** DHCP Auto-managed by FortiIPAM


IP/Netmask


Secondary IP address ☐

---

Administrative Access

IPv4 ☒ HTTPS ☐ FMG-Access ☐ FTM ☐ HTTP  ☒ SSH ☐ RADIUS Accounting ☒ PING ☐ SNMP ☐ Security Fabric Connection 

Receive LLDP  Use VDOM Setting Enable Disable


Transmit LLDP  Use VDOM Setting Enable Disable

---

☐ DHCP Server

---

Network

Device detection  ☐

Security mode ☐

---

Traffic Shaping

Outbound shaping profile ☐

---

Miscellaneous

Comments  8/255

Status **Enabled** Disabled


To use this public IP address for public access to an internal server, you must configure a virtual IP address, which enables a DNAT conversion of packets, and a policy to allow the traffic.

Edit Virtual IP

VIP type IPv4


Name

Comments  0/255


Color 

---

Network

Interface  port1

Type Static NAT

External IP address/range 


Mapped IP address/range

---

☐ Optional Filters

☒ Port Forwarding

Protocol **TCP** UDP SCTP ICMP

External service port 

Map to port

The external IP address matches the local IP address assigned to port1. The mapped IP address in this case is the internal web server's IP address, and only TCP port 80 is set to forward. You can also use PAT here to modify the original destination port in cases where there is a mismatch with the internal server's destination port. Using this feature, you can configure multiple virtual IP addresses to internal web servers using TCP port 80 by using custom external ports (8080 in this example). However, for each assigned local IP address, you can only use any given external TCP port once.

The screenshot shows the FortiGate WebUI Firewall Policy configuration page. The policy is named "InboundHTTP". The Incoming Interface is "port1" and the Outgoing Interface is "port2". The Source is set to "all" and the Destination is "Port80to ProtectedServer". The Schedule is "always" and the Service is "ALL". The Action is set to "ACCEPT". The Inspection Mode is "Flow-based". Under Firewall / Network Options, NAT is disabled and Protocol Options are set to "default". Under Security Profiles, AntiVirus, Web Filter, DNS Filter, Application Control, IPS, and File Filter are all disabled. SSL Inspection is set to "no-inspection".

Here the policy is set to allow traffic coming in port1 to exit port2 if it is destined to the previously created virtual IP address.

To add a public IP address, create a new IP address configuration for the vNIC in the Azure portal. Click the *Add* button in *IP configurations* in the vNIC resource view.

### Add IP configuration

FGT-FGT-A-Nic1

Name \*

ipconfig2

Type

Primary Secondary

Primary IP configuration already exists

Private IP address settings

Allocation

Dynamic Static

IP address \*

172.16.136.5

Public IP address

Disassociate Associate

Public IP address \*

Choose public IP address

Create new

#### Add a public IP address

Name \*

FGT-PIP2

SKU \*

Basic Standard

Assignment \*

Dynamic Static

OK

Cancel

The new local address should be static and must be in the same subnet as the primary IP address configuration. Enable the public IP address and create a new public IP address resource or select an existing one. If you have an existing public IP address assigned to an internal server, you can first dissociate it from that vNIC, then assign it here.

Once you have configured both IP addresses on the Azure side, you can create an additional virtual IP address on the FortiGate-VM. You do not need to modify the interface configuration on the FortiGate-VM.

**Edit Virtual IP**

VIP type: IPv4

Name: SecondPIP

Comments: Write a comment... 0/255

Color: Change

**Network**

Interface: port1

Type: Static NAT

External IP address/range: 172.16.136.5

Mapped IP address/range: 172.16.137.5

☐ Optional Filters

☐ Port Forwarding

In this example, port forwarding is not enabled. You can enable port forwarding if you want to forward only a specific TCP or UDP port or port range. If you do not enable port forwarding, this enables forwarding of all ports designated to the new public IP address to the internal server, in this case at 172.16.137.5

**New Policy**

Name: InboundServer2

Incoming Interface: port1

Outgoing Interface: port2

Source: all

Destination: SecondPIP

Schedule: always

Service: ALL

Action: ☒ ACCEPT ☐ DENY

Inspection Mode: **Flow-based** Proxy-based

**Firewall / Network Options**

NAT: ☐

Protocol Options: **PROT** default

**Security Profiles**

AntiVirus: ☐

Web Filter: ☐

DNS Filter: ☐

Application Control: ☐

IPS: ☐

File Filter: ☐

SSL Inspection: **SSL** no-inspection

**Logging Options**

Log Allowed Traffic: ☒ **Security Events** All Sessions

Generate Logs when Session Starts: ☐

Capture Packets: ☐

Comments: Write a comment... 0/1023

Enable this policy: ☒

This policy matches the new virtual IP address destination and also allows all services to be forwarded. You can repeat this process for adding as many public IP addresses as needed, although you may run into Azure quota limitations.

When configuring an outbound rule for your server, you can create a general rule. All traffic will be NATed behind the external interface private IP address. Azure will SNAT these packets subsequently to the linked instance-level public IP address.

Outgoing traffic for the secondary server behind the secondary VIP, without the port configuration, will automatically SNAT behind the external IP address in the VIP.

New Policy

Name	Outbound
Incoming Interface	port2
Outgoing Interface	port1
Source	all
Destination	all
Schedule	always
Service	ALL
Action	<input checked="" type="checkbox"/> ACCEPT <input type="checkbox"/> DENY
Inspection Mode	<input checked="" type="checkbox"/> Flow-based <input type="checkbox"/> Proxy-based

Firewall / Network Options

NAT ☒

IP Pool Configuration ☒ Use Outgoing Interface Address ☐ Use Dynamic IP Pool

Preserve Source Port ☐

Protocol Options



# HA for FortiGate-VM on Azure

You can use FortiGate-VM in different scenarios to protect assets that are deployed in Azure virtual networks:

- Secure hybrid cloud
- Cloud security services hub
- Logical intent-based segmentation
- Secure remote access

See [Cloud Security for Azure](#) for a general overview of different public cloud use cases.

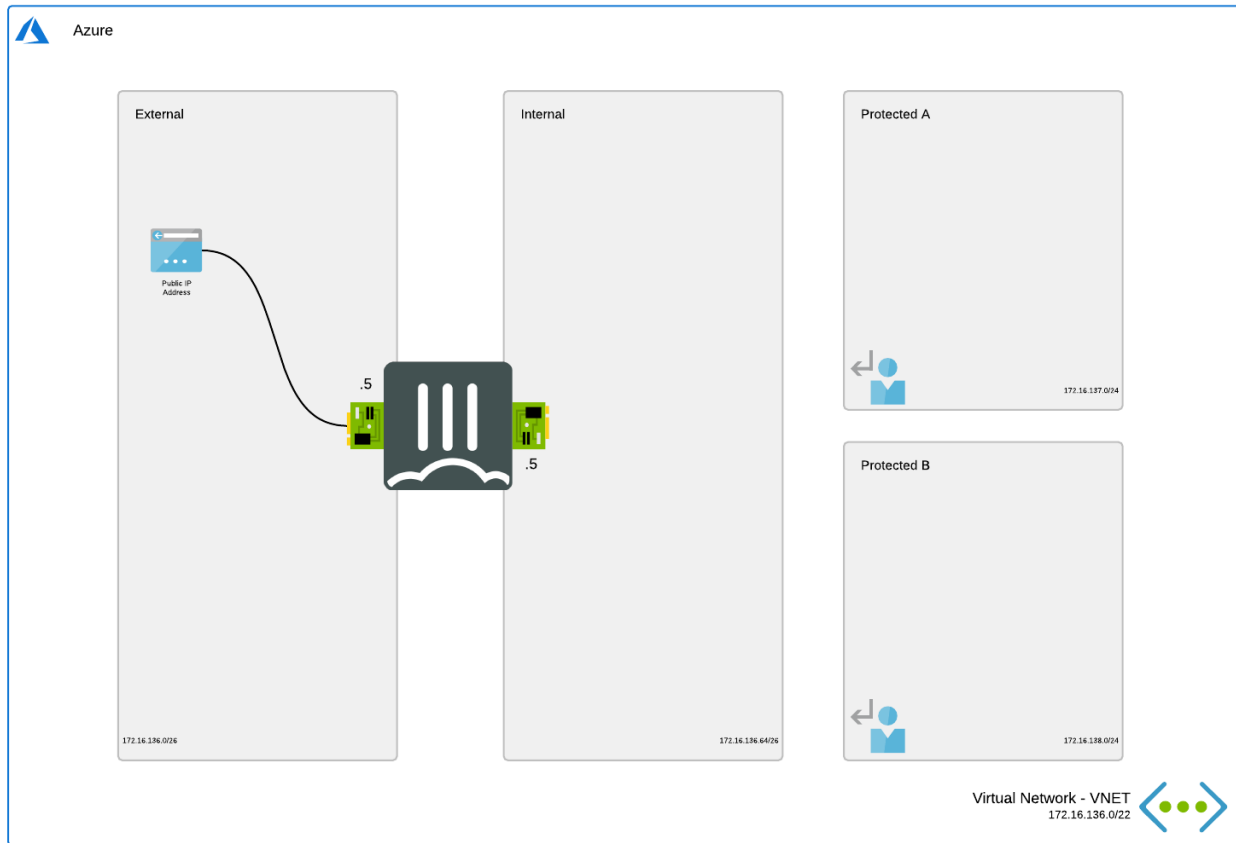
When designing a reliable architecture in Azure, you must take resiliency and high availability (HA) into account. See Microsoft's [Overview of the reliability pillar](#). Running the FortiGate next generation firewall inside Azure offers different reliability levels depending on the building blocks that you use.

Microsoft offers different [SLAs](#) on Azure based on the deployment that you use:

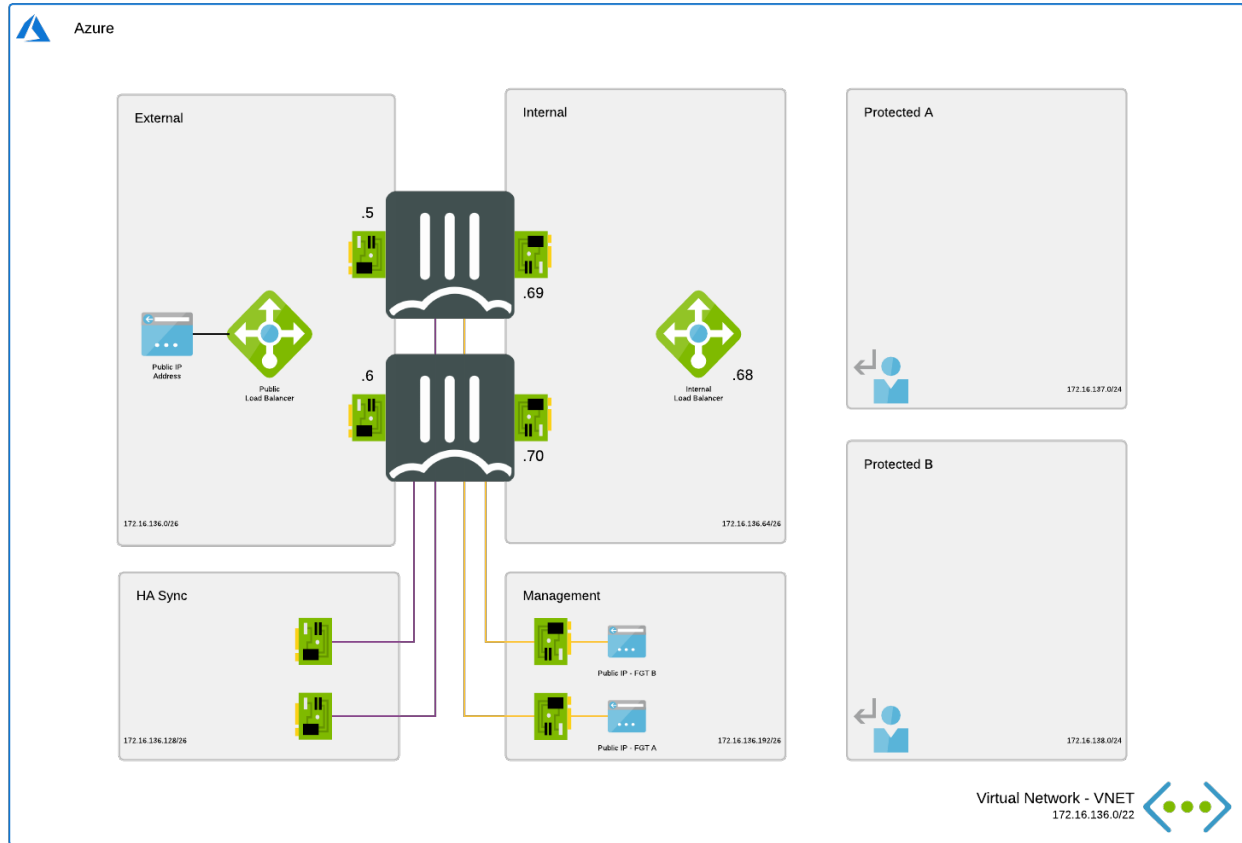
- [Availability zone](#) (AZ) (different datacenter in the same region): 99.99%
- Availability set (different rack and power): 99.95%
- Single VM with premium SSD: 99.9%

## Building blocks

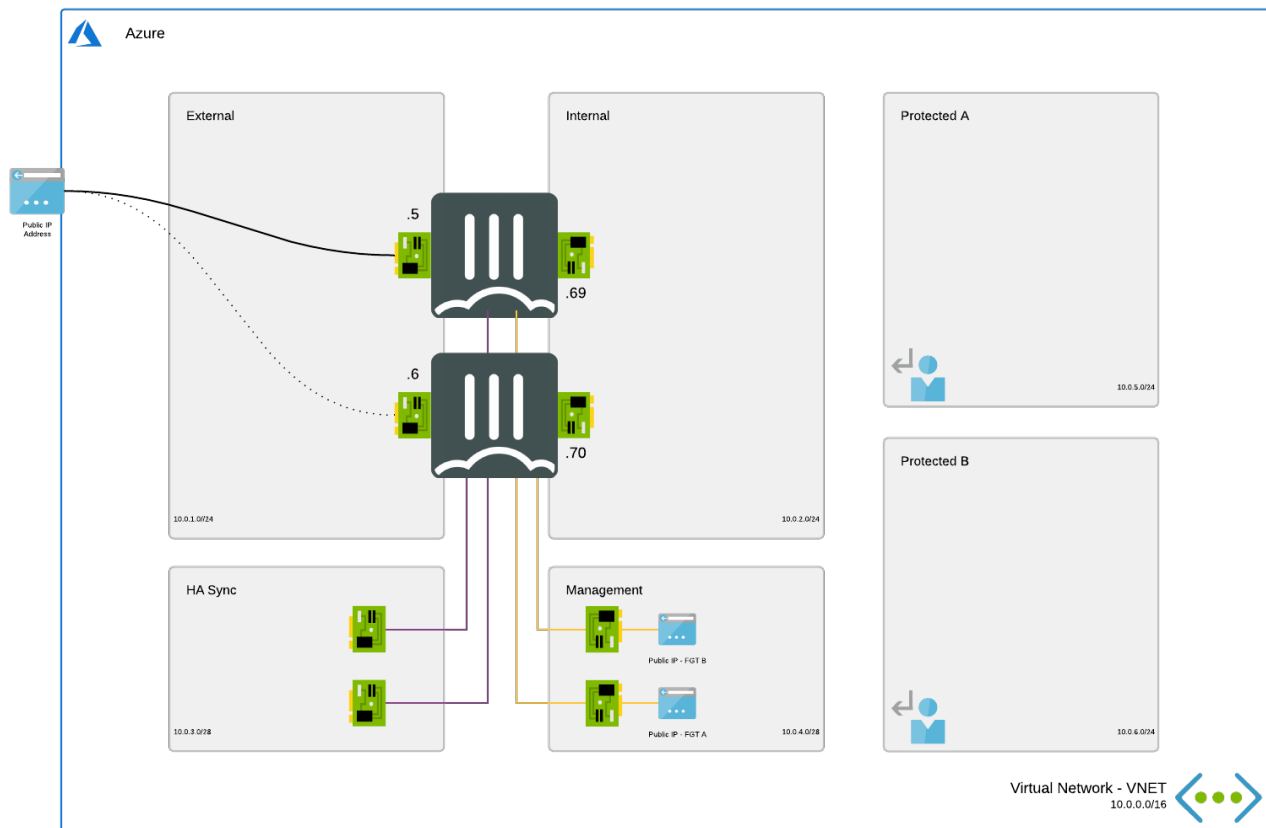
- **Single VM:** single FortiGate-VM processes all the traffic and becomes a single point of failure during operations and upgrades. You can also use this block in an architecture with multiple regions where a FortiGate is deployed in each region. This setup provides an SLA of 99.9% when using a premium SSD disk. See [Single FortiGate-VM deployment on page 114](#).



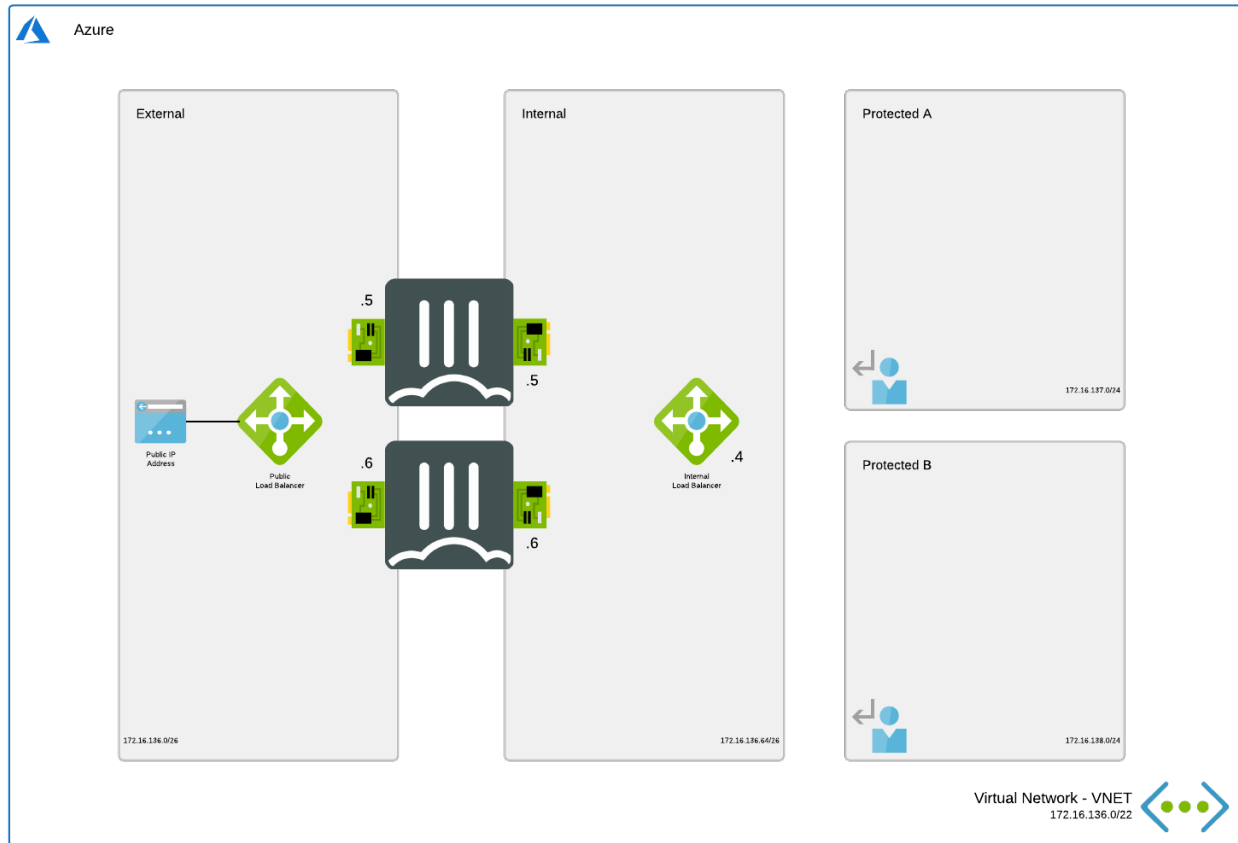
- Active-passive with external and internal Azure load balancer:** This design deploys two FortiGate-VMs in active-passive mode connected using Unicast FGCP HA protocol. In this setup, the Azure load balancer handles traffic failover using a health probe towards the FortiGate-VMs. The failover times are based on the health probe of the Azure load balancer: 2 failed attempts per 5 seconds with a maximum of 15 seconds. The public IP addresses are configured on the Azure load balancer and provide ingress and egress flows with inspection from the FortiGate. Microsoft provides [guidance](#) on this architecture.



- Active-passive HA with SDN connector failover:** This design deploys two FortiGate-VMs in active-passive mode connected using the Unicast FGCP HA protocol. This protocol synchronizes the configuration. On failover, the passive FortiGate takes control and issues API calls to Azure to shift the public IP address and update the internal user-defined routing to itself. Shifting the public IP address and gateway IP addresses of the routes takes time for Azure to complete. Microsoft provides a [general architecture](#). In FortiGate's case, the API calls logic is built-in instead of requiring additional outside logic like Azure Functions or ZooKeeper nodes.



- Active-active with external and internal Azure load balancer:** This design deploys two FortiGate-VMs in active-active as two independent systems. In this setup, the Azure load balancer handles traffic failover using a health probe towards the FortiGate-VMs. The public IP addresses are configured on the Azure load balancer and provide ingress and egress flows with inspection from the FortiGate. You can use a FortiManager or local replication to synchronize configuration in this setup. Microsoft provides [guidance](#) on this architecture.



Availability zones and availability sets are available as options in the Azure marketplace and on the [ARM Templates on GitHub](#). You can select them during deployment.

## Architecture

You can deploy the FortiGate-VM in Azure in different architectures. Each architecture has specific properties that can be advantages or disadvantages in your environment:

Architecture	Description
Single VNet	All building blocks above are ready to deploy in a new or existing VNet. Select your block to get started.
Cloud Security Services Hub (VNet peering)	With VNet peering, you can have different islands deploying different services managed by different internal and/or external teams, while maintaining a single point of control going to on-premise, other clouds, or public Internet. The VNets are connected in a hub-spoke setup where the hub controls all traffic. See <a href="#">VNET-Peering</a> .
Autoscaling	For applications that are fluid in the amount of resources they consume, you can deploy the FortiGate-VM in an autoscaling architecture. See <a href="#">Deploying autoscaling on Azure on page 40</a> .



In active-passive HA scenarios on Azure, you must set the physical interface IP address (port1) and local tunnel interface IP addresses manually on the secondary FortiGate. HA does not automatically sync these IP addresses. You must also manually copy loopback interface configuration from the HA primary to the secondary FortiGate. Configuring a VDOM exception for "system.interface" does not affect behavior.

---

## Subscribing to the FortiGate-VM

See [Deploying FortiGate-VM from the marketplace on page 35](#).

# SDN connector integration with Azure

## Configuring an SDN connector in Azure

In this section, you configure FortiGate software-defined network (SDN) connector for use with Azure.

In the FortiGate interface, these connectors provide integration and orchestration of Fortinet products with key SDN solutions. The Fortinet Security Fabric provides visibility into your security posture across multiple cloud networks, spanning private, public, and software-as-a-service clouds. In SDNs like Azure, dynamic objects and resources can be cumbersome to secure using traditional firewall policies. By using the SDN connector with the Azure IaaS, changes to attributes in the Azure environment can be automatically updated in the Security Fabric. This helps integrate and orchestrate FortiOS IPv4 policies going forward.

Before installing and configuring the Azure SDN connector, the following Azure infrastructure and Fortinet FortiGate-VM components should be in place:

- Valid Azure account and subscription. The account can be one that your organization established or simply one of the [free trial options available from Azure](#). If you do not specify the resource group, you can find all resources that the account has access to.
- FortiGate-VM deployed in Azure.
- IPv4 outbound policy from the FortiGate-VM on port2 (internal) to port1 (external)
- VM instance of a resource in the Azure environment

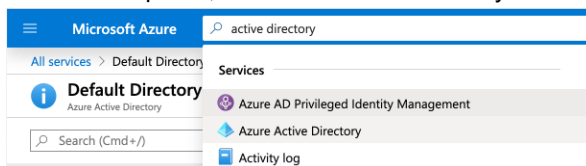
This section describes configuring an Azure SDN connector to connect the FortiGate to connect to the Azure backend. This allows easy reference of dynamic Azure objects when creating FortiOS firewall policies. If the FortiGate is a virtual device in one of those environments, it is likely to be the only connector configured.

## Azure SDN connector service principal configuration requirements

To configure an Azure software-defined network (SDN) connector using service principal authentication, you must obtain the tenant and client IDs and client secret from the Azure portal.

### To obtain the tenant and client IDs and client secret:

1. Go to the Azure portal. You can find information required to configure the Azure SDN connector, such as the tenant and client IDs and client secret, in the Azure portal. Find the tenant and client IDs:
  - a. In the Azure portal, search for active directory. Click *Azure Active Directory*.



- b. Go to *App registration*.
- c. Click *New registration*.
- d. In the *Name* field, enter the desired name. In this example, the name is fgtsdn.

- e. Click **Register**. The overview of the newly created app registration shows the tenant and client ID that the Azure SDN connector requires.

The screenshot displays the Azure portal interface for the 'fgtsdn' app registration. The top navigation bar shows 'All services > Default Directory - App registrations > fgtsdn'. The left sidebar includes 'Overview', 'Quickstart', and 'Manage'. The main content area shows the app registration details, including the display name 'fgtsdn', application (client) ID '9d71fff0-afb4-42f1-8b8e-11e8-844974058a42', and directory (tenant) ID '83a7137e-fed0-4b21-b1f1-1448f4529112'. Below this, the 'Edit Fabric Connector' section is visible, showing the 'Public SDN' status and 'Connector Settings'. The 'Connector Settings' section includes fields for 'Name' (fgtsdn), 'Status' (Enabled), 'Update Interval' (Use Default), 'Server region' (Global), 'Tenant ID' (83a7137e-fed0-4b21-b1f1-1448f4529112), 'Client ID' (9d71fff0-afb4-42f1-8b8e-11e8-844974058a42), and 'Client secret' (This field is required). The 'Resource path' is also visible.

2. Assign a role to the fgtsdn application:
  - a. In the Azure portal, search for subscriptions to assign the level of scope to assign this application to.
  - b. Click **Pay-As-You-Go**.
  - c. Go to **Access control (IAM)**.
  - d. Click **Add role assignment**.
  - e. From the **Role** dropdown list, select **Contributor**.
  - f. In the **Select** field, enter the app name. In this example, it is fgtsdn.
  - g. Click **Save**.
3. Generate the client secret value:
  - a. Repeat steps 2a-b.
  - b. Click the fgtsdn user.
  - c. Go to **Certificates & secrets**.
  - d. Click the **New client secret** button.
  - e. In the **Description** field, enter the desired description.
  - f. Under **Expires**, select the desired expiry period.
  - g. Click **Add**.



4. Copy the newly created client secret value in to the *Client secret* field in FortiOS.

#### Client secrets


A secret string that the application uses to prove its identity when requesting a token. Also can be referred to as application password.

+ New client secret

Description	Expires	Value
fgtsdn	12/31/2299	yu0xg450-Gue...

New Fabric Connector

Public SDN



Microsoft  
Azure

Connector Settings

Name:

Status: Enabled Disabled

Update Interval: Use Default Specify

Azure Connector

Server region: Global

Tenant ID: 83a7137e-fed0-4...

Client ID: 9d71fff0-afb4-42...

Client secret: .....

Resource path:

## Configuring an SDN connector using a managed identity

The Microsoft Entra ID (formerly known as Azure Active Directory) managed identities for Azure resources feature solves the problem of storing service principal credentials in cloud applications like FortiGate next generation firewall VMs running in Azure.

Instead of authentication using service principal credentials, the SDN connector uses a service principal that the system assigns. The system creates the service principal when you enable managed identities on the VM. Afterward, Entra ID manages the service principal until you destroy the VM.

### Configuring a managed identity on Azure

You can enable managed identities on Azure during or after deployment:

- [Enabling managed identities on Azure during deployment on page 133](#)
- [Enabling managed identities on Azure after deployment on page 134](#)

After deployment, you must give the FortiGate-VM access to Azure resources. See [Azure portal on page 135](#).

### Enabling managed identities on Azure during deployment

On the Azure platform, you can enable managed identities from the Azure portal as well as ARM templates during deployment, Azure CLI, PowerShell, or Azure Cloud Shell.

To enable system-assigned managed identities, the Microsoft.Compute/virtualMachines resource for the FortiGate must have the "identity" property added at the same level as the "type" : "Microsoft.Compute/virtualMachines" property.

```
"identity": {
  "type": "SystemAssigned"
},
```

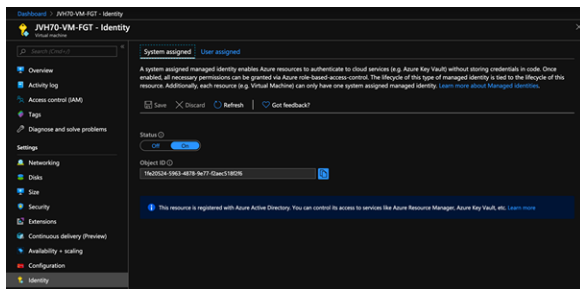
See [Configure managed identities for Azure resources on an Azure VM using templates](#).

## Enabling managed identities on Azure after deployment

On a FortiGate previously deployed on Azure, you can enable managed identities using different interaction methods, including the Azure portal, Azure CLI, PowerShell, or a REST API.

### Azure portal

The most common method is to use the Azure portal. In the FortiGate-VM resource in the Azure portal, go to *Identity*. On the *System assigned* tab, toggle the *Status* to *On*.



### Azure CLI

You can adapt the following command to reflect your VM and resource group names. You can use this command in the Azure CLI installed on Azure Cloud Shell or your local system:

```
az vm identity assign -g myResourceGroup -n myVm
```

See [Configure managed identities for Azure resources on an Azure VM using Azure CLI](#).

## Access control

After deployment, you must give the FortiGate-VM access to Azure resources. The SDN connector has the following functions:

Function	Description
<a href="#">Dynamic address</a>	The SDN connector can search for private and/or public IP addresses based on different properties, such as tag, VM name, network security group, resource group, and location in the current Azure subscription. You must assign the reader role to the resources that the SDN connector needs access to.
<a href="#">HA</a>	One HA setup includes moving public IP addresses from the active to the passive FortiGate-VM. You must update the user-defined routes to point to the passive FortiGate-VM private IP address. These actions require elevated access to some resources.

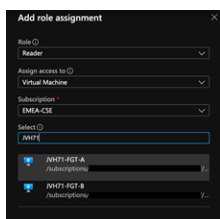
If you want to resolve dynamic addresses in multiple subscriptions in a Cloud Security Services HUB (VNet peering), you must assign the Reader role to each subscription.

### Dynamic address

You must assign the Reader role to the whole subscription, as the SDN connector needs access to all resources in the subscription.

#### To assign access control in the Azure portal:

1. In the Azure portal, go to *Access control (IAM)*.
2. Click *Add a role assignment*.
3. From the *Role* dropdown list, select *Reader*.
4. From the *Assign access to* dropdown list, select *Virtual Machine*.
5. From the *Select* dropdown list, select the desired FortiGate-VM.



#### To assign access control in the Azure CLI:

You must assign the role to both FortiGate-VMs in an active-active or active-passive setup. You must apply the Reader role since the VM principal ID must be retrieved. This action assigns required access rights for the service principal that Microsoft Entra ID (formerly known as Azure AD) is managing specific for the FortiGate-VM to access Azure resources in the Azure subscription.

```
$ spID=$(az resource list -n {<FortiGate-VM name>} --query [*].identity.principalId --out tsv)
$ az role assignment create --assignee $spID --role 'Reader' --scope /subscriptions/{Azure subscription ID}
```

### HA

## Azure portal

In case of active-passive failover using the SDN connector, the FortiGate-VMs should have write access with the Network Contributor role to the following resources:

- FortiGate-VM network interfaces
- Routing tables that point to the FortiGate-VM internal interface
- Network security group attached to the FortiGate-VM network interface NIC1
- Public IP address attached to the FortiGate-VM network interface NIC1
- VNet or subnet that has the public IP address attached

The Network Contributor access rights are used to update the routing tables and public IP address in case of failover.

### To assign access control in the Azure CLI:

For HA, the SDN connector requires additional rights on different Azure resources. You can use the Network Contributor role or a more precise custom role.

You must assign the Fortinet FortiGate SDN Connector RW role to both FortiGate-VMs when in an active-active or active-passive setup. You must apply this role since the VM principal ID must be retrieved. This action assigns required access rights for the service principal that Entra ID is managing specific for the FortiGate-VM to access Azure resources in the Azure subscription.

Create a JSON file that contains the following:

```
{
  "Name": "Fortinet FortiGate SDN Fabric Connector RW",
  "IsCustom": true,
  "Description": "Role to update the public ip address and user defined routes",
  "Actions": [
    "**/read",
    "Microsoft.Network/routeTables/write",
    "Microsoft.Network/routeTables/routes/write",
    "Microsoft.Network/routeTables/routes/delete",
    "Microsoft.Network/publicIPAddresses/write",
    "Microsoft.Network/publicIPAddresses/join/action",
    "Microsoft.Network/networkInterfaces/write",
    "Microsoft.Network/networkSecurityGroups/join/action",
    "Microsoft.Network/virtualNetworks/subnets/join/action"
  ],
  "DataActions": [],
  "NotActions": [],
  "NotDataActions": [],
  "AssignableScopes": [
    "/subscriptions/{<Azure subscription ID>}"
  ]
}
```

This action assigns required access rights for the service principal that Entra ID is managing specific for the FortiGate-VM to access Azure resources in the Azure subscription.

```
$ az role definition create --role-definition azure_SDN_iamrole_rw.json
$ spID=$(az resource list -n {<FortiGate-VM name>} --query [*].identity.principalId --out
  tsv)
$ az role assignment create --assignee $spID --role 'Reader' --scope /subscriptions/{Azure
  subscription ID}
```

## Configuring the managed identity on the FortiGate-VM

You must enable the SDN connector using the CLI. You do not need to add a tenant ID, client ID, or client key as the connector retrieves these automatically from the Azure instance metadata service.

```
config system sdn-connector
  edit AzureSDN
    set type azure
  end
end
```

## Configuring an Azure SDN connector for Azure resources

IP address resolving functionality is available for the following Azure resources:

- VM network interfaces (including VM scale sets)
- Internet-facing load balancers
- Internal load balancers
- Application gateways



VPN gateways are currently not supported.

The following example demonstrates configuring an Internet-facing load balancer.

### To configure an Internet-facing load balancer address in the GUI:

1. Configure the Azure SDN connector:
  - a. Go to *Security Fabric > External Connectors*.
  - b. Click *Create New*, and select *Microsoft Azure*.
  - c. Enter the settings based on your deployment, and click *OK*. The update interval is in seconds.

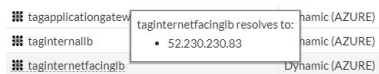
2. Create the dynamic firewall address:
  - a. Go to *Policy & Objects > Addresses*.
  - b. Click *Create New > Address* and enter a name.
  - c. Configure the following settings:
    - i. For *Type*, select *Dynamic*.
    - ii. For *Sub Type*, select *Fabric Connector Address*.
    - iii. For *SDN Connector*, select *azure-dev*.
    - iv. For *SDN address type*, select *All*.
    - v. For *Filter*, enter `Tag.dev1b=1bkeyvalue`.

## d. Click OK.

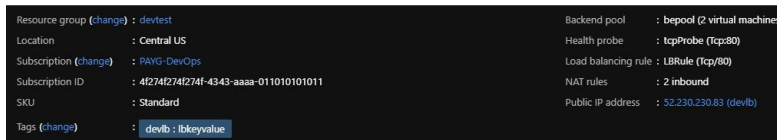
FortiOS dynamically updates and resolves the corresponding IP addresses after applying the tag filter.

## 3. Ensure that the connector resolves the dynamic firewall IP address:

- Go to **Policy & Objects > Addresses**.
- In the address table, hover over the address created in step 2 to view what IP address it resolves to:



## c. In Azure, verify to confirm the IP address matches:



## To configure an Internet-facing load balancer in the CLI:

## 1. Configure the Azure SDN connector:

```
config system sdn-connector
  edit "azure-dev"
    set status enable
    set type azure
    set azure-region global
    set tenant-id "942b80cd-1b14-42a1-8dcf-4b21dece61ba"
    set client-id "44e79db7-621d-46f3-8625-58e209654e58"
    set client-secret xxxxxxxxxxxx
    set update-interval 60
  next
end
```

## 2. Create the dynamic firewall address:

```
config firewall address
  edit "tagInternetfacinglb"
    set type dynamic
    set sdn "azure-dev"
    set filter "Tag.dev1b=lbkeyvalue"
    set sdn-addr-type all
  next
end
```

The corresponding IP addresses are dynamically updated and resolved after applying the tag filter.

### 3. Confirm that the connector resolves the dynamic firewall IP address:

```
config firewall address
    edit "tagInternetfacinglb"
        show
        config firewall address
            edit "tagInternetfacinglb"
                set uuid df391760-3bb6-51ea-f775-421df18f368d
                set type dynamic
                set sdn "azure-dev"
                set filter "Tag.devlb=lbkeyvalue"
                set sdn-addr-type all
            config list
                edit "52.230.230.83"
                next
            end
        next
    end
end
next
end
next
end
```

## Azure SDN connector using ServiceTag and Region filter keys

The *ServiceTag* and *Region* filter keys can be used in Azure SDN connectors to filter service tag IP ranges. You can use these in dynamic firewall addresses.

### To use the new filters keys in the GUI:

#### 1. Create an Azure SDN connector:

- a. Go to *Security Fabric > External Connectors* and click *Create New*.
- b. Select *Microsoft Azure*.
- c. Configure the connector:

- d. Click *OK*.

2. Create a dynamic firewall address for the Azure connector, filtering based on the servicetag and region:
  - a. Go to **Policy & Objects > Addresses** and click **Create New > Address**.
  - b. Configure the address, adding two filters: **ServiceTag=ApiManagement** and **Region=canadacentral**:

- c. Click **OK**.
- d. Hover the cursor over the address name to see the dynamic IP addresses that are resolved by the connector:

Address	Type	Sub Type	SDN Connector	Filter	Interface	Resolved To	Ref.
azure-address-sertag1-o-region1	Dynamic	Fabric Connector Address	azure1	ServiceTag=ApiManagement   Region=canadacentral	any	102.133.0.79/32 102.133.130.197/32 102.133.154.4/31	1
						102.133.156.0/28 102.133.26.4/31 102.133.28.0/28	0
						104.211.146.68/31 104.211.147.144/28 104.211.81.240/28	0
						104.211.81.28/31 104.214.18.172/31 104.214.19.224/28	3
						104.41.217.243/32 104.41.218.160/32 13.64.39.16/32	7
						13.66.138.92/31 13.66.140.176/28 13.67.8.108/31	0
						13.67.9.208/28 13.69.227.76/31 13.69.229.80/28	1
						13.69.64.76/31 13.69.66.144/28 13.70.72.240/28	3
						13.70.72.28/31 13.71.170.44/31 13.71.172.144/28	1
						13.71.194.116/31 13.71.196.32/28 13.71.49.1/32	1
						13.75.217.184/32 13.75.221.78/32 13.75.34.148/31	1
						13.75.38.16/28 13.77.50.68/31 13.77.52.224/28	0
						13.78.106.92/31 13.78.108.176/28 13.84.189.17/32	1
						13.85.22.63/32 13.86.102.66/32 13.87.122.84/31	0
						13.87.123.144/28 13.87.56.84/31 13.87.57.144/28	1
						13.89.170.204/31 13.89.174.64/28 137.117.160.56/32	0
						191.233.203.240/28 191.233.203.28/31 191.233.24.179/32	1
						191.233.50.192/28 191.238.241.97/32 20.150.170.224/28	0
						20.188.77.119/32 20.192.234.160/28 20.193.202.160/28	0

## To use the new filters keys in the CLI:

1. Create an Azure SDN connector:

```
config system sdn-connector
  edit "azure1"
    set type azure
    set tenant-id "942b80cd-1b14-42a1-8dcf-4b21dece61ba"
    set client-id "44e79db7-621d-46f3-8625-58e209654e58"
    set client-secret xxxxxx
  next
end
```

2. Create a dynamic firewall address for the Azure connector, filtering based on the servicetag and region:

```
config firewall address
  edit "azure-address-sertag1-o-region1"
    set type dynamic
    set sdn "azure1"
    set color 2
    set filter "ServiceTag=ApiManagement | Region=canadacentral"
```



```

    next
end

```

### 3. View the dynamic IP addresses that are resolved by the connector:

```

# show firewall address azure-address-sertag1
config firewall address
    edit "azure-address-sertag1"
        set uuid 50a0afd4-b1bf-51ea-651b-f9ba7f6db455
        set type dynamic
        set sdn "azure1"
        set color 2
        set filter "ServiceTag=ApiManagement | Region=canadacentral"
    config list
        edit "102.133.0.79/32"
        next
        edit "102.133.130.197/32"
        next
        ...
        edit "13.78.108.176/28"
        next
        edit "13.86.102.66/32"
        next
        ...
    end
next
end

```

## Troubleshooting Azure SDN connector



Output messages may differ depending on your setup.

You can use the `diagnose sys sdn status` command to view the status of your SDN connectors.

You can check if API calls are made successfully by running the following commands in the CLI:

```

diagnose debug enable
diagnose debug application azd -1

```

Open the FortiGate GUI in your browser. Try to disable, then enable the SDN connector.

Wait a few minutes. If you configured the SDN connector incorrectly, the CLI displays the following error:

```

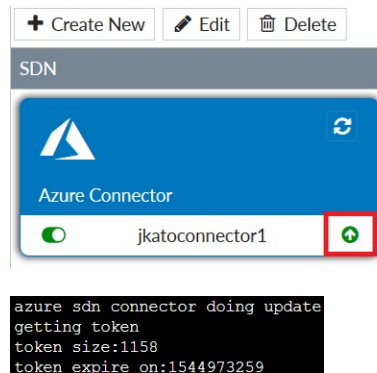
fgtha6p-A #
fgtha6p-A # azure sdn connector doing update
getting token
{"error":"invalid_client","error_description":"AADSTS70002: Error valid
get token failed
azd failed to get token
azd failed to get ip addr list
safeguard_fn()-1701
azure sdn connector doing update
getting token
{"error":"invalid_client","error_description":"AADSTS70002: Error valid
get token failed
azd failed to get token
azd failed to get ip addr list
safeguard_fn()-1701

```

Check the following and see if any required configuration is missing or incorrect:

- Did you enter all required fields such as tenant ID, client ID, client secret, subscription ID, and resource groups without error?
- Create a new client secret, then use the new secret for configuration.
- Does the registered application have access to the resource group?

Once you successfully configure the SDN connector, the indicator turns green and the CLI output no longer shows an error when enabling and disabling the SDN connector.



## SDN connector in Azure Kubernetes (AKS)

Azure SDN connectors support dynamic address groups based on Azure Kubernetes (AKS) filters. See the [FortiOS Administration Guide](#).

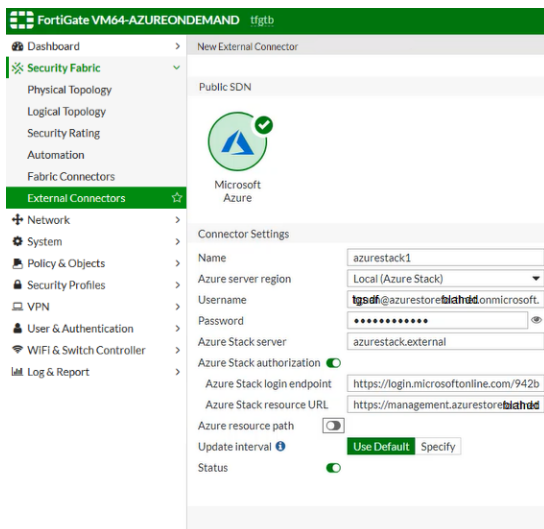
# SDN connector in Azure Stack

FortiOS automatically updates dynamic addresses for Azure Stack on-premise environments using an Azure Stack SDN connector, including mapping the following attributes from Azure Stack instances to dynamic address groups in FortiOS:

- vm
- tag
- size
- securitygroup
- vnet
- subnet
- resourcegroup
- vmss

## To configure Azure Stack SDN connector using the GUI:

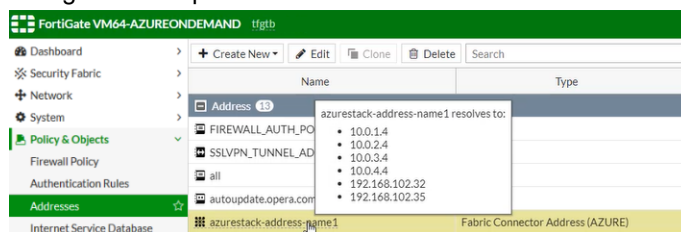
1. Configure the Azure Stack SDN connector:
  - a. Go to *Security Fabric > External Connectors*.
  - b. Click *Create New*, and select *Microsoft Azure*.
  - c. Configure as shown, substituting the Azure Stack settings for your deployment. The update interval is in seconds.



2. Create a dynamic firewall address for the configured Azure Stack SDN connector:
  - a. Go to *Policy & Objects > Addresses*.
  - b. Click *Create New*, then select *Address*.
  - c. Configure the address as shown, selecting the desired filter in the *Filter* dropdown list. In this example, the Azure Stack SDN connector will automatically populate and update IP addresses only for instances that are

named tfgta:

3. Ensure that the Azure Stack SDN connector resolves dynamic firewall IP addresses:
  - a. Go to *Policy & Objects > Addresses*.
  - b. Hover over the address created in step 2 to see a list of IP addresses for instances that are named tfgta as configured in step 2:



### To configure Azure Stack SDN connector using CLI commands:

1. Configure the Azure Stack SDN connector:

```
config system sdn-connector
  edit "azurestack1"
    set type azure
    set azure-region local
    set server "azurestack.external"
    set username "username@azurestoreexamplecompany.onmicrosoft.com"
    set password xxxxx
    set log-in endpoint "https://login.microsoftonline.com/942b80cd-1b14-42a1-8dcf-4b21dece61ba"
    set resource-url
      "https://management.azurestoreexamplecompany.onmicrosoft.com/12b6fedd-9364-4cf0-822b-080d70298323"
    set update-interval 30
  next
end
```

2. Create a dynamic firewall address for the configured Azure Stack SDN connector with the supported Azure Stack filter. In this example, the Azure Stack SDN Connector will automatically populate and update IP addresses only for instances that are named tfgta:

```
config firewall address
  edit "azurestack-address-name1"
    set type dynamic
    set sdn "azurestack1"
```

```
        set filter "vm=tfgta"
    next
end
```

**3. Confirm that the Azure Stack SDN connector resolves dynamic firewall IP addresses using the configured filter:**

```
config firewall address
    edit "azurestack-address-name1"
        set type dynamic
        set sdn "azurestack1"
        set filter "vm=tfgta"
        config list
            edit "10.0.1.4"
            next
            edit "10.0.2.4"
            next
            edit "10.0.3.4"
            next
            edit "10.0.4.4"
            next
            edit "192.168.102.32"
            next
            edit "192.168.102.35"
            next
        end
    end
next
end
```

# VPN for FortiGate-VM on Azure

## Connecting a local FortiGate to an Azure VNet VPN

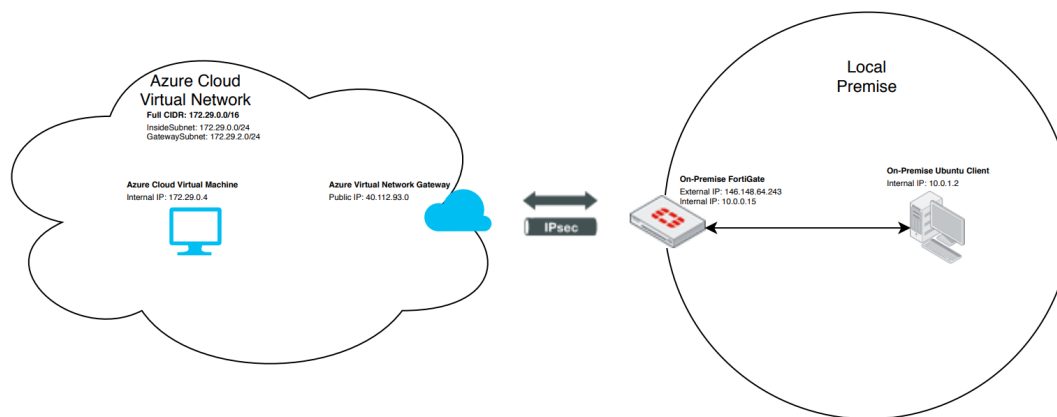
This recipe provides sample configuration of a site-to-site VPN connection from a local FortiGate to an Azure VNet VPN via IPsec VPN with static or border gateway protocol (BGP) routing.

Instances that you launch into an Azure VNet can communicate with your own remote network via site-to-site VPN between your on-premise FortiGate and Azure VNet VPN. You can enable access to your remote network from your VNet by configuring a virtual private gateway (VPG) and customer gateway to the VNet, then configuring the site-to-site VPC VPN.

The following prerequisites must be met for this configuration:

- Azure VNet with some configured subnets, routing tables, security group rules, and so on
- On-premise FortiGate with an external IP address

The following demonstrates the topology for this recipe:



This recipe consists of the following steps:

1. [Create a gateway subnet.](#)
2. [Create a VPN gateway.](#)
3. [Create a local network gateway.](#)
4. [Create a connection for the VNet gateway.](#)
5. [Configure the on-premise FortiGate.](#)
6. [Verify the connection.](#)
7. [Troubleshoot the connection.](#)

### To create a gateway subnet:

A gateway subnet is a subnet in your VNet that contains the IP addresses for the Azure VNet gateway resources and services. Azure requires a gateway subnet for VNet gateways to function.

1. In the Azure management console, go to your VNet, then *Subnets* > + *Gateway subnet*. You do not need to configure any fields on the *Add subnet* screen. You cannot change the name, as it must be GatewaySubnet for the

VNet gateway to function. Azure should automatically populate the *Address range (CIDR block)* field with a subnet within your VNet. In this example, the VNet is 172.29.0.0/16, while the subnet is 172.29.2.0/24. You do not need to configure a route table or security group unless your environment needs special handling.

### To create a VPN gateway:

You must create a VPN gateway to configure the Azure side of the VPN connection.

1. Go to *Create a resource*. Search for *Virtual network gateway*. Click *Create*.
2. On the *Create virtual network gateway* screen, configure the following:
  - a. From the *Subscription* dropdown list, select the correct subscription.
  - b. In the *Name* field, enter a name.
  - c. From the *Region* dropdown list, select the VNet gateway region. You should select the same region as the VNet.
  - d. For *Gateway type*, select *VPN*.
  - e. For *VPN type*, select *Policy-based*.
  - f. For *SKU*, at the time of publishing this guide, you can only select *Basic* for policy-based VPN.
  - g. From the *Virtual network* dropdown list, select the desired VNet to connect to. Azure should automatically detect the gateway subnet created earlier.
  - h. Under *PUBLIC IP ADDRESS*, create a new public IP address or select an existing public IP address for the VPN gateway.
  - i. If desired, configure BGP. The BGP peer IP address is based on the VNet gateway's gateway subnet.

Azure may take up to 45 minutes to create the VPN gateway.

### To create a local network gateway:

The local gateway refers to your local side of the VPN settings. You can configure a local network gateway to let Azure know your on-premise-side settings.

1. Go to *Create a resource*. Search for *Local network gateway*. Click *Create*.
2. On the *Create local network gateway* screen, configure the following:
  - a. In the *Name* field, enter a name.
  - b. In the *IP address* field, enter the on-premise FortiGate's external IP address.
  - c. In the *Address space* field, enter the CIDR of the network behind the on-premise FortiGate that will access the Azure VNet.
  - d. If desired, enable *Configure BGP settings*. You define the BGP peer IP address for the local network gateway, but there are restrictions. See [About BGP with Azure VPN Gateway](#).
  - e. From the *Subscription* dropdown list, select the correct subscription.
  - f. From the *Resource group* dropdown list, select the resource group. This example uses the resource group that the other resources belong to.
  - g. From the *Location* dropdown list, select the location. This example uses the location that the VNet resides in, but this is not a requirement.

### To create a connection for the VNet gateway:

A VNet gateway can have multiple connections to multiple VPN endpoints. These connections share the resource of the VNet gateway. To connect to an on-premise FortiGate, you must configure a connection.

1. Go to the *VNet gateway page > Connections > Add*.
2. On the *Add connection* screen, configure the following:
  - a. In the *Name* field, enter a name.
  - b. From the *Connection type* dropdown list, select *Site-to-site (IPsec)*.
  - c. Azure should automatically populate and lock the *Virtual network gateway* field.
  - d. For *Local network gateway*, select the local network gateway created earlier.
  - e. In the *Shared key (PSK)* field, enter the key. You must configure this on the on-premise FortiGate as well.
  - f. Azure should automatically populate and lock the *Resource group* field.



## To configure the on-premise FortiGate:

On the on-premise FortiGate, you must configure the phase-1 and phase-2 interfaces, firewall policy, and routing to complete the VPN connection. For Azure requirements for various VPN parameters, see [Configure your VPN device](#).

### 1. Configure the phase-1 interface as follows in the FortiOS CLI:

- a. Set the interface to the external-facing interface.
- b. If your FortiGate is behind NAT, enter the interface's local private IP address for `local-gw`. Otherwise, this step is unnecessary.
- c. For `proposal` and Diffie-Hellman groups, use the ones that Azure supports as described in [Default IPsec/IKE parameters](#).
- d. For the remote gateway, use the VNet gateway's public IP address.
- e. For the PSK secret, use the one configured when creating a connection for the VNet gateway in Azure.
- f. If desired, configure dead peer detection. This is not necessary.

```
config vpn ipsec phase1-interface
edit "azurephase1"
set interface "port1"
set local-gw 10.0.0.15
set keylife 28800
set peertype any
set proposal aes256-sha256 3des-sha1 aes128-sha1 aes256-sha1
set dhgrp 2
set remote-gw 40.112.93.0
set psksecret ENC
    VI0OQ084K91BwEqYp7kzBnMpEfNM1Gg5MnlcTSfxwn4kR5Lsc7QHo0bDAUtqDQMpSrL3bbDBesSxp
    gezyTrlEbzukP5wZHU66uzrG90RARM+f2yZlkEMljw/X3QWl75SAIA4/eSEib3h6M2PqEYvKZf190
    /tiBihS1ilBM81RblyFI2l2tNLoSatODgRGv8nXkvKVA==
set dpd-retryinterval 10
next
end
```

If configuring BGP routing, also run the following commands. Here, 10.1.254.1 255.255.255.255 is the local network gateway BGP peer IP address. 172.0.0.254 255.255.255.255 is the VNet gateway BGP peer IP address:

```
config system interface
edit "azurephase1"
set vdom "root"
set ip 10.1.254.1 255.255.255.255
set tcp-mss 1350
set remote-ip 172.0.0.254 255.255.255.255
next
end
```

### 2. Configure the phase-2 interface as follows:

- a. For `phase1name`, enter the phase-1 interface name as configured in step 1.
- b. For `proposal`, use the ones that Azure supports as described in [Default IPsec/IKE parameters](#).
- c. Disable PFS. Azure does not support it on policy-based mode connections.
- d. You can enable auto-negotiation.
- e. Set the key life to 3600 seconds.
- f. Configure the source subnet to the one behind the on-premise FortiGate.
- g. Configure the destination subnet to the Azure VNet's CIDR.

```
config vpn ipsec phase2-interface
edit "azurephase2"
set phase1name "azurephase1"
set proposal aes256-sha1 3des-sha1 aes256-sha256 aes128-sha1
set pfs disable
```

```

        set auto-negotiate enable
        set keylifeseconds 3600
        set src-subnet 10.0.1.0 255.255.255.0
        set dst-subnet 172.29.0.0 255.255.0.0
    next
end

```

### 3. Configure ingress and egress firewall policy to the VPN interface:

```

config firewall policy
    edit 1
        set uuid cd18116c-9215-51e9-8398-3398085fff69
        set srcintf "azurephase1"
        set dstintf "port2"
        set srcaddr "all"
        set dstaddr "all"
        set action accept
        set schedule "always"
        set service "ALL"
    next
    edit 2
        set uuid dadd6cd4-9215-51e9-288b-73a4336e9600
        set srcintf "port2"
        set dstintf "azurephase1"
        set srcaddr "all"
        set dstaddr "all"
        set action accept
        set schedule "always"
        set service "ALL"
    next
end

```

### 4. Configure the route for traffic to enter the VPN tunnel:

#### a. Configure a static route for traffic to enter the VPN tunnel:

```

config router static
    edit 1
        set dst 172.29.0.0 255.255.0.0
        set device "azurephase1"
    next
end

```

#### b. Configure BGP. The example uses the following values:

Value	Description
64521	Local network gateway BGP ASN
172.0.0.254	VNet gateway BGP peer IP address
64520	VNet gateway BGP ASN

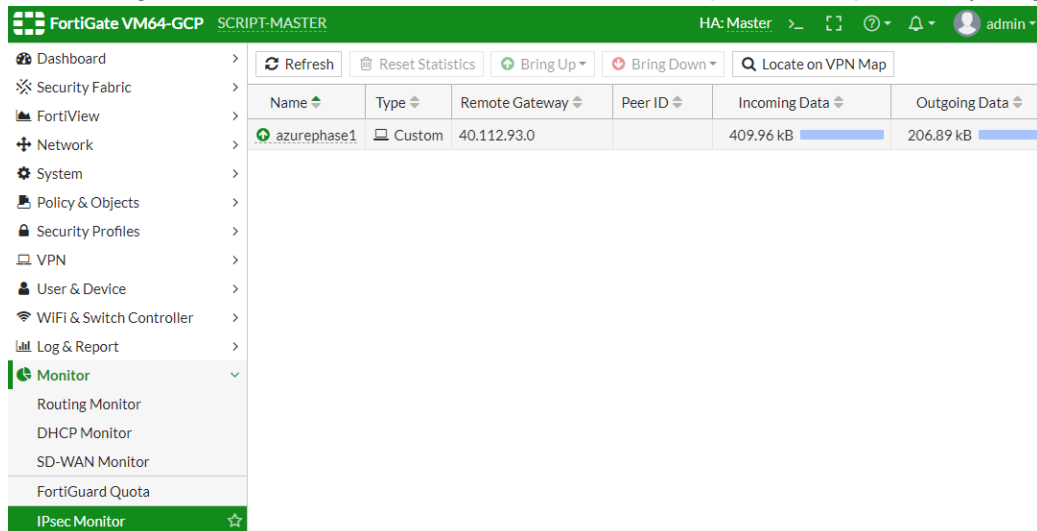
```

config router bgp
    set as 64521
    config neighbor
        edit "172.0.0.254"
            set soft-reconfiguration enable
            set remote-as 64520
            set update-source "azurephase1"
        next
    end
end

```

**To verify the connection:**

1. In FortiOS, go to *Monitor > IPsec Monitor* to see if the tunnel is up. If it is not up, manually bring up the tunnel.



2. On the Ubuntu client, conduct a ping test to a resource in the Azure VNet:

```
root@ubuntu-internal:~# ping 172.29.0.4
PING 172.29.0.4 (172.29.0.4) 56(84) bytes of data.
64 bytes from 172.29.0.4: icmp_seq=1 ttl=253 time=101 ms
64 bytes from 172.29.0.4: icmp_seq=2 ttl=253 time=101 ms
64 bytes from 172.29.0.4: icmp_seq=3 ttl=253 time=101 ms
```

3. Verify that the on-premise FortiGate forwards ICMP traffic through the Azure VPN tunnel:

```
EXAMPLE-FGT # diagnose sniffer packet any 'icmp' 4
interfaces=[any]
filters=[icmp]
9.537389 port2 in 10.0.1.2 -> 172.29.0.4: icmp: echo request
9.537453 azurephase1 out 10.0.1.2 -> 172.29.0.4: icmp: echo request
9.638766 azurephase1 in 172.29.0.4 -> 10.0.1.2: icmp: echo reply
9.638800 port2 out 172.29.0.4 -> 10.0.1.2: icmp: echo reply
```

4. If you configured BGP routing, verify the BGP connection between the peers:

```
diagnose sniffer packet azurephase1
interfaces=[azurephase1]
filters=[none]

2.608265 10.1.254.1.3965 -> 172.0.0.254.179: syn 3528484722
2.610865 172.0.0.254.179 -> 10.1.254.1.3965: syn 330055282 ack 3528484723
2.610889 10.1.254.1.3965 -> 172.0.0.254.179: ack 330055283
2.610910 10.1.254.1.3965 -> 172.0.0.254.179: psh 3528484723 ack 330055283
2.616039 172.0.0.254.179 -> 10.1.254.1.3965: psh 330055283 ack 3528484784
2.616051 10.1.254.1.3965 -> 172.0.0.254.179: ack 330055346
2.616061 172.0.0.254.179 -> 10.1.254.1.3965: psh 330055346 ack 3528484784
2.616064 10.1.254.1.3965 -> 172.0.0.254.179: ack 330055365
```

```

get router info bgp summary
BGP router identifier 10.1.1.37, local AS number 64521
BGP table version is 2
2 BGP AS-PATH entries
0 BGP community entries

Neighbor      V      AS MsgRcvd MsgSent   TblVer  InQ  OutQ  Up/Down
State/PfxRcd
172.0.0.254    4      64520   1586    1596       1    0    0 00:01:08      1

Total number of neighbors 1

get router info routing-table bgp
Routing table for VRF=0
B      172.0.0.0/16 [20/0] via 172.0.0.254, azurephase1, 00:01:38

```

### To troubleshoot the connection:

If any aspects of the VPN are incorrectly configured, you must troubleshoot the Azure and on-premise FortiGate sides.

For Azure-side help, see the [Azure documentation](#).

For the on-premise FortiGate, use debugging to see possible problems:

```

EXAMPLE-FGT # diagnose debug enable
EXAMPLE-FGT # diagnose debug application ike -1
Debug messages will be on for 30 minutes.
EXAMPLE-FGT # ike 0: cache rebuild start
ike 0:azurephase1: cached as static-ddns
ike 0: cache rebuild done
ike shrank heap by 106496 bytes
ike 0:azurephase1: NAT keep-alive 3 10.0.0.15->94.245.93.197:4500.
ike 0:azurephase1:125: out FF
ike 0:azurephase1:125: sent IKE msg (keepalive): 10.0.0.15:4500->94.245.93.197:4500, len=1,
    id=ff00000000000000/0000000000000000
ike 0:azurephase1:azurephase2: IPsec SA connect 3 10.0.0.15->94.245.93.197:4500
ike 0:azurephase1:azurephase2: using existing connection
ike 0:azurephase1:azurephase2: config found
ike 0:azurephase1:azurephase2: IPsec SA connect 3 10.0.0.15->94.245.93.197:4500 negotiating

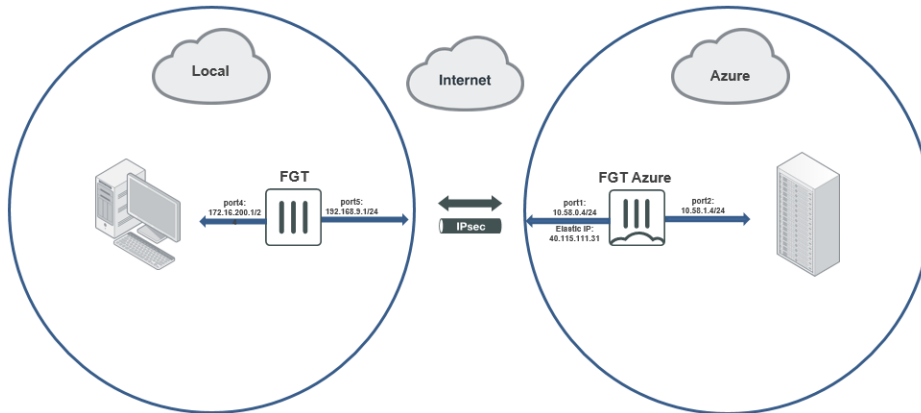
```

Common issues include misconfiguring the local gateway parameter, mismatching security proposals and protocols, and mismatching phase-2 source and destination subnets.

# Connecting a local FortiGate to an Azure FortiGate via site-to-site VPN

This guide provides a sample configuration of a site-to-site VPN connection from a local FortiGate to an Azure FortiGate via site-to-site IPsec VPN with static routing.

The following shows the topology for this sample configuration:



This topology consists of the following:

- A local FortiGate is located in a local environment. Determine if your FortiGate has a publicly accessible IP address or if it is behind NAT. In this sample configuration, the local FortiGate is behind NAT.
- A FortiGate located in Azure with port1 connected to WAN and port2 connected to local LAN.

This recipe consists of the following steps:

1. Configure the local FortiGate:
  - a. Configure the interfaces.
  - b. Configure a static route to connect to the Internet.
  - c. Configure IPsec VPN.
2. Configure the Azure FortiGate:
  - a. Configure the interface.
  - b. Configure IPsec VPN.
3. Bring up the VPN tunnel on the local FortiGate.
4. Verify the VPN tunnel on both the local FortiGate and the Azure FortiGate.
5. Run diagnose commands.

## Configuring the local FortiGate

### To configure the interfaces:

To configure the interfaces using the GUI, do the following:

1. In FortiOS on the local FortiGate, go to *Network > Interfaces*.
2. Edit *port5*. Set the role to *WAN* and set an *IP/Network Mask* of 192.168.5.1/255.255.255.0. This is for the interface connected to the Internet.
3. Edit *port4*. Set the role to *LAN* and set an *IP/Network Mask* of 172.16.200.1/255.255.255.0. This is for the interface connected to the local subnet.

To configure the interfaces using the CLI, run the following commands:

```
FGTA-1 # show system interface port5
config system interface
    edit "port5"
        set vdom "root"
        set ip 192.168.9.1 255.255.255.0
        set allowaccess ping https ssh
        set type physical
        set lldp-reception enable
        set role wan
        set snmp-index 7
    next
end
FGTA-1 # show system interface port4
config system interface
    edit "port4"
        set vdom "root"
        set ip 172.16.200.1 255.255.255.0
        set allowaccess ping https ssh
        set type physical
        set device-identification enable
        set lldp-transmission enable
        set role lan
        set snmp-index 6
    next
end
```

### To configure a static route to connect to the Internet:

To configure a static route using the GUI, do the following:

1. Go to *Network > Static Routes*.
2. Click *Create New*.
3. Set the *Destination* to 0.0.0.0/0.0.0.0.
4. For the *Interface*, select *port5*.
5. Set the *Gateway Address* to 192.168.9.254.

To configure a static route using the CLI, run the following commands:

```
FGTA-1 # show router static
config router static
    edit 1
        set gateway 192.168.9.254
        set device "port5"
    next
end
```

### To configure IPsec VPN:

To configure IPsec VPN using the GUI, do the following:

1. Go to *VPN > IPsec Wizard*.
2. Configure *VPN Setup*:
  - a. Enter the desired VPN name. In the example, this is "to\_cloud".
  - b. For *Template Type*, select *Site to Site*.
  - c. For the *Remote Device Type*, select *FortiGate*.
  - d. For *NAT Configuration*, select *This site is behind NAT*. For non dial-up situations where your local FortiGate has a public external IP address, you must choose *No NAT between sites*.
  - e. Click *Next*.
3. Configure *Authentication*:
  - a. For *Remote Device*, select *IP Address*.
  - b. Enter an IP address of 40.115.111.31, which is the Azure FortiGate's port1 public IP address.
  - c. For *Outgoing Interface*, select *port5*.
  - d. Set the *Authentication Method* to *Pre-shared Key*.
  - e. Enter a pre-shared key of 123456.
  - f. Click *Next*.
4. Configure *Policy & Routing*:
  - a. For *Local Interface*, select *port4*.
  - b. FortiOS automatically populates *Local Subnets* with 172.16.200.0/24.
  - c. Set the *Remote Subnets* to 10.58.1.0/24, which is the Azure FortiGate's port2 subnet.
  - d. For *Internet Access*, select *None*.
  - e. Click *Create*.

To configure IPsec VPN using the CLI, run the following commands:

```
FGTA-1 # show vpn ipsec phase1-interface to_cloud
config vpn ipsec phase1-interface
edit "to_cloud"
    set interface "port5"
    set peertype any
    set net-device enable
    set proposal aes128-sha256 aes256-sha256 aes128-sha1 aes256-sha1
    set comments "VPN: to_cloud (Created by VPN wizard)"
    set wizard-type static-fortigate
    set remote-gw 40.115.111.31
    set psksecret ENC xxxxxx
next
end
FGTA-1 # show vpn ipsec phase2-interface to_cloud
config vpn ipsec phase2-interface
edit "to_cloud"
    set phase1name "to_cloud"
    set proposal aes128-sha1 aes256-sha1 aes128-sha256 aes256-sha256 aes128gcm aes256gcm
        chacha20poly1305
    set comments "VPN: to_cloud (Created by VPN wizard)"
    set src-addr-type name
    set dst-addr-type name
    set src-name "to_cloud_local"
    set dst-name "to_cloud_remote"
next
end
FGTA-1 # show router static
config router static
edit 2
```

```

        set device "to_cloud"
        set comment "VPN: to_cloud (Created by VPN wizard)"
        set dstaddr "to_cloud_remote"
    next
    edit 3
        set distance 254
        set comment "VPN: to_cloud (Created by VPN wizard)"
        set blackhole enable
        set dstaddr "to_cloud_remote"
    next
end
FGTA-1 # show firewall policy
config firewall policy
    edit 1
        set name "vpn_to_cloud_local"
        set uuid ef98b6d8-41d9-51e9-20c5-7a31a66dd557
        set srcintf "port4"
        set dstintf "to_cloud"
        set srcaddr "to_cloud_local"
        set dstaddr "to_cloud_remote"
        set action accept
        set schedule "always"
        set service "ALL"
        set comments "VPN: to_cloud (Created by VPN wizard)"
    next
    edit 2
        set name "vpn_to_cloud_remote"
        set uuid ef9b260c-41d9-51e9-cf9c-0a082dc52660
        set srcintf "to_cloud"
        set dstintf "port4"
        set srcaddr "to_cloud_remote"
        set dstaddr "to_cloud_local"
        set action accept
        set schedule "always"
        set service "ALL"
        set comments "VPN: to_cloud (Created by VPN wizard)"
    next
end

```

## Configuring the Azure FortiGate

### To configure the interface:

To configure the interface using the GUI, do the following:

1. In FortiOS on the Azure FortiGate, go to *Network > Interfaces*.
2. Edit *port2*. Set the role to *LAN* and set an *IP/Network Mask* of 10.58.1.4/255.255.255.0. This is for the interface connected to the Azure local subnet.

To configure the interfaces using the CLI, run the following commands:

```

FGT-Azure # show system interface port2
config system interface
    edit "port2"
        set vdom "root"
        set ip 10.58.1.4 255.255.255.0
    next
end

```



```

        set allowaccess ping https ssh snmp http telnet fgfm radius-acct probe-response capwap
        ftm
        set type physical
        set snmp-index 2
    next
end

```

## To configure IPsec VPN:

To configure IPsec VPN using the GUI, do the following:

1. Go to *VPN > IPsec Wizard*.
2. Configure *VPN Setup*:
  - a. Enter the desired VPN name. In the example, this is "to\_local".
  - b. For *Template Type*, select *Site to Site*.
  - c. For the *Remote Device Type*, select *FortiGate*.
  - d. For *NAT Configuration*, select *This site is behind NAT*. For non dial-up situations where your local FortiGate has a public external IP address, you must choose *No NAT between sites*.
  - e. Click *Next*.
3. Configure *Authentication*:
  - a. For *Incoming Interface*, select *port1*.
  - b. Set the *Authentication Method* to *Pre-shared Key*.
  - c. Enter a pre-shared key of 123456.
  - d. Click *Next*.
4. Configure *Policy & Routing*:
  - a. For *Local Interface*, select *port2*.
  - b. FortiOS automatically populates *Local Subnets* with 10.58.1.0/24.
  - c. Set the *Remote Subnets* to 172.16.200.0/24, which is the local FortiGate's port4 subnet.
  - d. For *Internet Access*, select *None*.
  - e. Click *Create*.

To configure IPsec VPN using the CLI, run the following commands:

```

FGT-Azure # show vpn ipsec phase1-interface
config vpn ipsec phase1-interface
    edit "to_local"
        set type dynamic
        set interface "port1"
        set peertype any
        set net-device enable
        set proposal aes128-sha256 aes256-sha256 aes128-sha1 aes256-sha1
        set dpd on-idle
        set comments "VPN: to_local (Created by VPN wizard)"
        set wizard-type dialup-fortigate
        set psksecret ENC xxxxxx
        set dpd-retryinterval 60
    next
end
FGT-Azure # show vpn ipsec phase2-interface
config vpn ipsec phase2-interface
    edit "to_local"
        set phase1name "to_local"

```

```

        set proposal aes128-sha1 aes256-sha1 aes128-sha256 aes256-sha256 aes128gcm aes256gcm
        chacha20poly1305
        set comments "VPN: to_local (Created by VPN wizard)"
        set src-addr-type name
        set dst-addr-type name
        set src-name "to_local_local"
        set dst-name "to_local_remote"
    next
end
FGT-Azure # show firewall policy
config firewall policy
    edit 1
        set name "vpn_to_local_local"
        set uuid 032b6000-41f4-51e9-acb8-b7e32128bb70
        set srcintf "port2"
        set dstintf "to_local"
        set srcaddr "to_local_local"
        set dstaddr "to_local_remote"
        set action accept
        set schedule "always"
        set service "ALL"
        set comments "VPN: to_local (Created by VPN wizard)"
    next
    edit 2
        set name "vpn_to_local_remote"
        set uuid 0343ee4a-41f4-51e9-a06a-d4a15d35a0a2
        set srcintf "to_local"
        set dstintf "port2"
        set srcaddr "to_local_remote"
        set dstaddr "to_local_local"
        set action accept
        set schedule "always"
        set service "ALL"
        set comments "VPN: to_local (Created by VPN wizard)"
    next
end

```

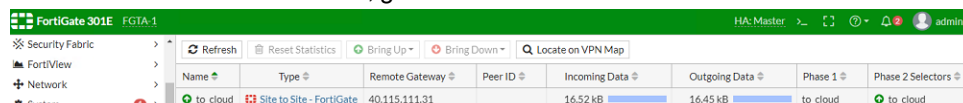
### To bring up the VPN tunnel on the local FortiGate:

The tunnel is down until you initiate connection from the local FortiGate.

1. In FortiOS on the local FortiGate, go to *Monitor > IPsec Monitor*.
2. Click the to\_cloud tunnel.
3. Click *Bring Up* to bring up the VPN tunnel.

### To verify the VPN tunnel on both the local FortiGate and the Azure FortiGate:

1. In FortiOS on the local FortiGate, go to *Monitor > IPsec Monitor*. It should look like the following:



Name	Type	Remote Gateway	Peer ID	Incoming Data	Outgoing Data	Phase 1	Phase 2 Selectors
to_cloud	Site to Site - FortiGate	40.115.111.31		16.52 kB	16.45 kB	to_cloud	to_cloud

2. In FortiOS on the Azure FortiGate, go to *Monitor > IPsec Monitor*. It should look like the following:

Name	Type	Remote Gateway	Peer ID	Incoming Data	Outgoing Data	Phase 1	Phase 2 Selectors
to_local_0	Dialup - FortiGate	208.91.115.10		53.44 kB	28.06 kB	to_local	to_local

## To run diagnose commands:

1. To show the local FortiGate's VPN status, run the following commands:

```
FGTA-1 # diagnose vpn ike gateway list
vd: root/0
name: to_cloud
version: 1
interface: port5 13
addr: 192.168.9.1:4500 -> 40.115.111.31:4500
created: 1042s ago
nat: me peer
IKE SA: created 1/1 established 1/1 time 400/400/400 ms
IPsec SA: created 1/1 established 1/1 time 130/130/130 ms
  id/spi: 365 cc00c782040e9ec9/e07668adc21bd6a7
  direction: initiator
  status: established 1042-1041s ago = 400ms
  proposal: aes128-sha256
  key: 2793ba055ddab07a-83c804230bffd8de
  lifetime/rekey: 86400/85058
  DPD sent/recvd: 00000000/0000000a
FGTA-1 # diagnose vpn tunnel list
list all ipsec tunnel in vd 0
-----
name=to_cloud ver=1 serial=2 192.168.9.1:4500->40.115.111.31:4500 dst_mtu=1500
bound_if=13 lgwy=static/1 tun=intf/0 mode=auto/1 encap=none/536 options[0218]=npu
  create_dev frag-rfc accept_traffic=1
proxyid_num=1 child_num=0 refcnt=11 ilast=18 olast=58 ad=/0
stat: rxp=1 txp=2 rxb=16516 txb=16450
dpd: mode=on-demand on=1 idle=20000ms retry=3 count=0 seqno=0
natt: mode=keepalive draft=32 interval=10 remote_port=4500
proxyid=to_cloud proto=0 sa=1 ref=2 serial=1
  src: 0:172.16.200.0/255.255.255.0:0
  dst: 0:10.58.1.0/255.255.255.0:0
SA: ref=6 options=10226 type=00 soft=0 mtu=1422 expire=42217/0B replaywin=2048
seqno=3 esn=0 replaywin_lastseq=00000002 itn=0 qat=0
life: type=01 bytes=0/0 timeout=42903/43200
dec: spi=394f6923 esp=aes key=16 4ac11dd0916496e2e1edd610d83c7017
ah=sha1 key=20 8d0c08ab1ed0d96ae29d521ed954a6bcc270f863
enc: spi=5dc261b2 esp=aes key=16 c1b49a1251aa9bdb8b0ea205a687c794
ah=sha1 key=20 0693c8988ef609bc410d6024e72e576366b53fef
dec:pkts/bytes=1/16440, enc:pkts/bytes=2/16602
npu_flag=03 npu_rgwy=40.115.111.31 npu_lgwy=192.168.9.1 npu_selid=1 dec_npuid=1 enc_
npuid=1
```

2. To show the Azure FortiGate's VPN status, run the following commands:

```
FGT-Azure # diagnose vpn ike gateway list

vd: root/0
name: to_local_0
version: 1
interface: port1 3
```

```

addr: 10.58.0.4:4500 -> 208.91.115.10:64916
created: 1085s ago
nat: me peer
IKE SA: created 1/1 established 1/1 time 270/270/270 ms
IPsec SA: created 1/1 established 1/1 time 140/140/140 ms

    id/spi: 0 cc00c782040e9ec9/e07668adc21bd6a7
    direction: responder
    status: established 1085-1084s ago = 270ms
    proposal: aes128-sha256
    key: 2793ba055ddab07a-83c804230bffd8de
    lifetime/rekey: 86400/85045
    DPD sent/rcv: 0000000b/00000000

FGT-Azure # diagnose vpn tunnel list
list all ipsec tunnel in vd 0
-----
name=to_local ver=1 serial=1 10.58.0.4:0->0.0.0.0:0 dst_mtu=0
bound_if=3 lgwy=static/1 tun=intf/0 mode=dialup/2 encap=none/528 options[0210]=create_
    dev frag-rfc accept_traffic=1

proxyid_num=0 child_num=1 refcnt=11 ilast=1096 olast=1096 ad=/0
stat: rxp=0 txp=0 rxb=0 txb=0
dpd: mode=on-idle on=0 idle=60000ms retry=3 count=0 seqno=0
natt: mode=none draft=0 interval=0 remote_port=0
-----
name=to_local_0 ver=1 serial=2 10.58.0.4:4500->208.91.115.10:64916 dst_mtu=1500
bound_if=3 lgwy=static/1 tun=intf/0 mode=dial_inst/3 encap=none/976 options
    [03d0]=create_dev no-sysctl rgwy-chg rport-chg frag-rfc accept_traffic=1

parent=to_local index=0
proxyid_num=1 child_num=0 refcnt=14 ilast=38 olast=38 ad=/0
stat: rxp=334 txp=334 rxb=53440 txb=28056
dpd: mode=on-idle on=1 idle=60000ms retry=3 count=0 seqno=11
natt: mode=keepalive draft=32 interval=10 remote_port=64916
proxyid=to_local proto=0 sa=1 ref=2 serial=1 add-route
    src: 0:10.58.1.0/255.255.255.0:0
    dst: 0:172.16.200.0/255.255.255.0:0
    SA: ref=3 options=282 type=00 soft=0 mtu=1422 expire=42460/0B replaywin=2048
    seqno=14f esn=0 replaywin_lastseq=0000014f itn=0 qat=0
    life: type=01 bytes=0/0 timeout=43187/43200
    dec: spi=5dc261b2 esp=aes key=16 c1b49a1251aa9bdb8b0ea205a687c794
    ah=sha1 key=20 0693c8988ef609bc410d6024e72e576366b53fef
    enc: spi=394f6923 esp=aes key=16 4ac11dd0916496e2e1edd610d83c7017
    ah=sha1 key=20 8d0c08ab1ed0d96ae29d521ed954a6bcc270f863
    dec:pkts/bytes=334/28056, enc:pkts/bytes=334/53440

```

## vWAN

Azure virtual WAN (vWAN) is an Azure-managed service that provides automated branch connectivity to and through Azure. You can leverage the Azure backbone to connect branches and enjoy branch-to-virtual network connectivity. Azure regions serve as hubs that you can use to connect your branches to.

This guide explains how to configure FortiOS to connect to Azure vWAN. It also explains how to access virtual networks in Azure and employ branch-to-branch connectivity.

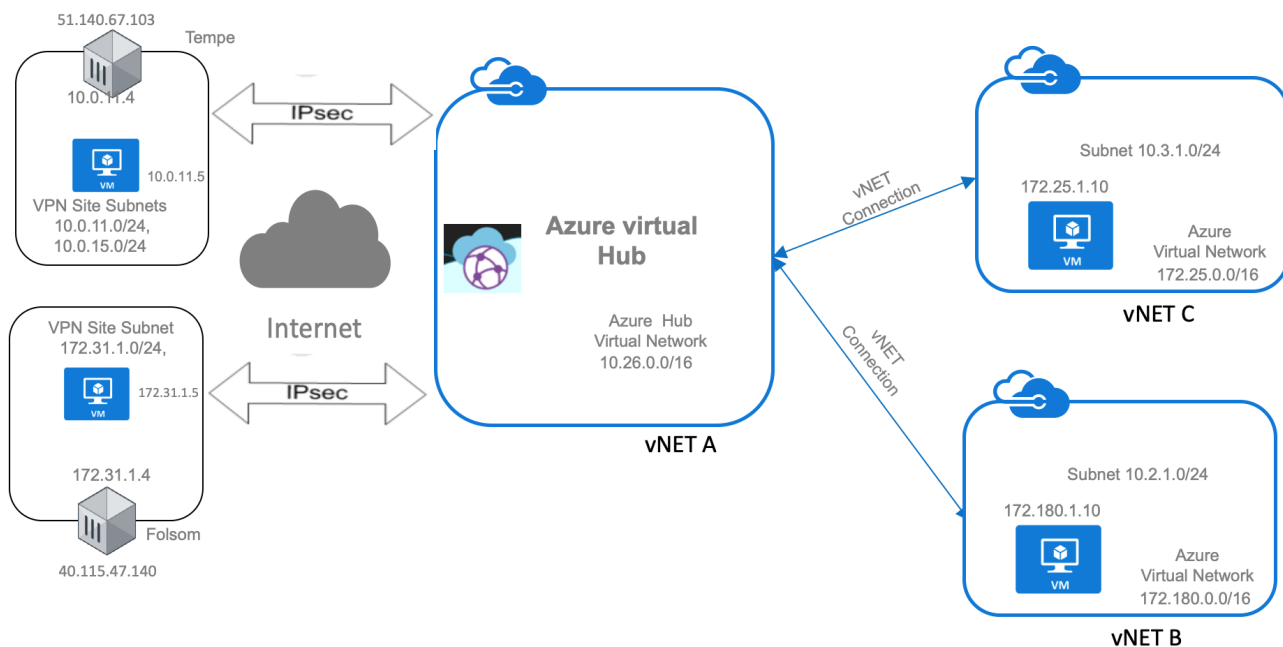
## vWAN architecture diagram

The Azure vWAN architecture consists of the following important resources:

Resource	Description
vWAN	Virtual overlay of the Azure network. It contains resources that include all links to the vWAN hub.
Virtual hub	<p>Microsoft-managed virtual network. The hub contains various service endpoints to enable connectivity from your on-premise network (vpnsite). An Azure region can only have one hub. Creating a vWAN hub from the portal creates a virtual hub virtual network (VNet) and a virtual hub VPN gateway.</p> <p>A hub gateway is not the same as a virtual network gateway that is used for ExpressRoute and VPN gateway. For example, when using vWAN, you do not create a site-to-site connection from the on-premise site directly to the virtual network. Instead, you create a site-to-site connection to the hub so that the traffic always passes through the hub gateway. Your VNets do not need their own virtual network gateway. With vWAN, your VNets can take advantage of scaling easily through the virtual hub and virtual hub gateway.</p>
Hub VNet connection	Used to connect the hub seamlessly to the VNet. You can only connect virtual networks within the same hub region to the vWAN hub.
Site	Used only for site-to-site connection. The site resource is vpnsite. It represents your on-premise VPN device and its settings.

The following Azure vWAN architecture diagram represents remote sites Tempe and Folsom, which connect to the vWAN hub. The hub network is connected to two VNets: B and C. Connecting to the vWAN hub enables the Tempe and Folsom sites to access both VNets in Azure and to connect with each other through the vWAN hub.

Redundant VPN tunnels from each branch to the vWAN hub enhance connectivity. Border Gateway Protocol (BGP) handles routing.



## Creating the vWAN

### To create the vWAN:

1. You must create the vWAN hub within your subscription via the Azure portal. Log in to the [Azure portal](#).
2. Click *Create a new resource* > *Virtual WAN*.
3. Complete the fields as desired. The *Name* and *Resource group* fields do not support special characters or upper case letters. Click *Create*.
4. To enable branches to communicate with each other through the vWAN hub, go to *Configuration* and click *Allow branch to branch traffic*.
5. Go to *Hubs*, then click *+New Hub*.
6. In this example architecture, branch offices connect to the vWAN hub through IPsec VPN using site-to-site connectivity. This requires creating a VPN gateway. On the *Site to Site* tab, create a VPN gateway. Site-to-site connectivity uses the following settings. You can choose the gateway scale units depending on traffic needs.

Create virtual hub

✓

Validation passed

Basics

Site to site

Point to site

ExpressRoute

Routing

Tags

Review + create

The hub will be created under the same subscription and resource group as the vWAN.

Basics

Region

West US

Name

HQ

Hub private address space

10.26.0.0/24

Site to site

Site to site (VPN gateway)

Enabled

AS Number

65515

Gateway scale units

1 scale unit - 500 Mbps x 2

Point to site

Point to site (VPN gateway)

Disabled

ExpressRoute

ExpressRoute gateway

Disabled

Routing

Inbound routing table

Disabled

ⓘ

Creating a hub with a gateway will take 30 minutes.

Create

Previous

Next

Download a template for automation

On the *Point to site* tab, you can configure settings to connect end user devices to the vWAN hub using OpenVPN and other VPN clients. On the *ExpressRoutes* tab, you can create an ExpressRoute gateway to connect ExpressRoutes to the vWAN hub. On the *Routing* tab, you can set up routing tables for advanced routing using the hub. Since the example architecture only pertains to site-to-site connection and does not use routing using the hub, point-to-site and ExpressRoute gateway creation and route tables will remain disabled.

7. Click *Create*. Creating a vWAN hub can take up to 30 minutes.

## Adding VNet connections to the vWAN hub

You must identify virtual networks (VNet) that must connect to the virtual WAN (vWAN) hub to enable end-to-end connectivity.

### To add VNet connections to the vWAN hub:

1. On the vWAN page, go to *Virtual network connections*.
2. Click *Add connection*.
3. Select the VNets to connect to the vWAN hub. After the VNets connect to the vWAN hub, they appear as

connections.

+ Add connection				
HUB	HUB REGION	VIRTUAL NETWORK	VIRTUAL NETWORK CONNE...	VIRTUAL NETWORK CONNE...
HQ	West US	▼ Virtual networks (2)		Succeeded (2) ...
		applicationvnet	AppVnet	Succeeded ...
		security	Securityvnet	Succeeded ...

## Deploying the vWAN ARM template

You must complete the following to deploy the vWAN Azure Resource Manager template:

1. [Completing the prerequisites on page 164](#)
2. [Uploading Remote\\_sites.txt to a storage account on page 165](#)
3. [Deploying the ARM template on page 166](#)

## Completing the prerequisites

Before deploying the Azure Resource Manager (ARM) template, complete the following prerequisites:

### Creating a service principal

**To create a service principal:**

1. Log in to your Azure account.
2. Create a [service principal](#). Note the following items as you need them to deploy the Function App:

Item	Description	Relevant FortiOS parameter
Tenant ID	You can find this item in Azure Active Directory > Properties > Directory ID. A hybrid licensing deployment does not require this item.	Tenant ID
Application ID	You can find this item in Azure Active Directory > App registrations > (your app).	Service Principal ID
Application secret	Only appears once. You cannot retrieve the application secret.	Service Principal Secret

For details on the FortiOS parameters, see [Configurable variables on page 60](#).

## Obtaining vWAN details

Obtain the following details about the vWAN service:



- vWAN name
- Resource group name

## Creating the Remote\_sites.txt file

The Remote\_sites.txt file serves as the input for Azure functions. The file contains information about all sites that want to connect to vWAN. You will store the file in a storage blob. You must include the following information in the file:

- Site name (Azure uses this as an identifier)
- FortiGate public IP address
- Internal networks behind the FortiGate that need access to the vWAN
- BGP ASN and peering IP address to use
- VDOM
- Login credentials

The following is an example of the content of a Remote\_Sites.txt file:

```
1) Tempe 51.140.67.103 10.0.11.0/24,10.0.15.0/24 azureadmin Password!234 root 169.254.24.24
    7224
2) Folsom 40.115.47.140 172.31.1.0/24 azureadmin Password!234 root 169.254.24.25 7225
```

## Uploading Remote\_sites.txt to a storage account

To upload Remote\_sites.txt to a storage account:

1. Create a storage account:
  - a. In the Azure portal, click *Create a resource*.
  - b. Search for "storage account" and select storage account resource creation. Click *Create*.
  - c. From the *Resource group* dropdown list, select the desired resource group, or create a new one. The storage account will reside in this location.
  - d. In the *Storage account name* field, enter a unique name. Each storage account requires a unique name as each storage account URL is unique.
  - e. (Optional) On the *Advanced* Tab, configure options to enforce access restrictions on the storage account. You can use any combination of the following options depending on the required security level or type:
    - i. (Optional) Deselect *Enable blob public access* to disable anonymous access to blobs in the storage account.
    - ii. (Optional) Select *Enable infrastructure encryption* to enable a second encryption layer when at rest. For details, see [Enable infrastructure encryption for double encryption of data](#).
    - iii. (Optional) Select *Default to Azure Active Directory authorization in the Azure portal*. When this property is enabled, the Azure portal authorizes requests to blobs, queues, and tables via RBAC. For details, see [Assign an Azure role for access to blob data](#). When this option is enabled, files may not be visible from the Azure portal GUI. You may need to use [Azure Storage Explorer](#) instead.



These steps are recommended to store files more securely.

---

- f. (Optional) From the *Replication* dropdown list, select *Locally-redundant storage (LRS)*.
- g. Leave all other fields unchanged. Click *Review + create*.

2. Once Azure completes configuring the storage account, go to the storage account *Blobs* section. Click + *Container*. Create a container that allows read access to blobs.
3. Click the container name, then click *Upload*.
4. In the *Files* field, select the Remote\_sites.txt file. Click *Upload*.
5. Right-click the file and select *Blob properties*.
6. Copy the value in the URL field. This is one of the ARM template parameters.

## Deploying the ARM template

### To deploy the ARM template:

1. Download the [template](#).
2. Log in to the Azure portal.
3. Click *Create new resource*.
4. Search for "template deployment" and select *Template deployment (deploy using custom templates)*. Click *Create*.
5. Click *Build your own template in the editor*. In the editor, delete the default JSON content. Paste the deploy\_vwan\_automation.json file contents. Click *Save*. The template to deploy the vWAN solution appears and you can enter the parameters described in [To create a service principal: on page 164](#).
6. Click *Create*. Once Azure completes deployment, Azure displays a function app, its corresponding application lights, a storage account, and the service plan that Azure automatically generates for Linux function apps.

## Associating VPN sites with the vWAN hub

Azure creates the VPN sites from the Remote\_sites.txt file. You must associate the sites with the vWAN hub.

### To associate VPN sites with the vWAN hub:

1. On the vWAN page, go to the *VPN sites* tab.
2. Select the desired VPN sites, then click *New hub association*.
3. Select the desired vWAN hub and PSK. The default PSK chosen during vWAN creation is used.
4. Click *Confirm*. Once Azure completes creating the association, the VPN site status displays as shown.

SITE	PUBLIC IP ADDRESS	STATUS	HUB	RESOURCE GROUP LOCATION	SITE AS NUMBER
Folsom	40.115.47.140	See hub association status	1 hubs	West US	7225
			HQ - Connecting		...
Tempe	51.140.67.103	See hub association status	1 hubs	West US	7224
			HQ - Connecting		...

Azure functions configure the remote sites with the correct VPN, BGP, and firewall policies by logging in to a FortiGate. Azure checks for new remote sites and corresponding hub associations every 30 minutes. Azure functions configure new sites and connect them to the vWAN solution. Once configuration completes, VPN site statuses change to All connected.

## Verifying vWAN configuration

The following shows FortiOS screenshots from a VPN site configured with Azure vWAN automation. You can see that the redundant VPN tunnels, corresponding IPv4 policies, and BGP routing have been created.

**FortiGate VM64-AZUREONDEMAND** Tempe

- Favorites
- Dashboard
- Security Fabric
- FortiView
- Network
- System
- Policy & Objects
- Security Profiles
- VPN
  - Overlay Controller VPN
  - Ipssec Tunnels

Tunnel	Interface Binding	Status	Ref.
<b>Custom 2</b>			
Tempe0	port1	Up	5
Tempe1	port1	Up	5

port2 → Tempe0 2										
3		localTempe0	all	always	ALL	ACCEPT	Disabled	SSL no-inspection	All	OB
7		localTempe1	all	always	ALL	ACCEPT	Disabled	SSL no-inspection	All	OB

port2 → Tempe1 2										
4		localTempe0	all	always	ALL	ACCEPT	Disabled	SSL no-inspection	All	OB
8		localTempe1	all	always	ALL	ACCEPT	Disabled	SSL no-inspection	All	OB

Tempe0 → port2 2										
5		all	localTempe0	always	ALL	ACCEPT	Disabled	SSL no-inspection	All	OB
11		all	localTempe1	always	ALL	ACCEPT	Disabled	SSL no-inspection	All	OB

Tempe1 → port2 2										
6		all	localTempe0	always	ALL	ACCEPT	Disabled	SSL no-inspection	All	OB
12		all	localTempe1	always	ALL	ACCEPT	Disabled	SSL no-inspection	All	OB

The BGP routing table shows that this VPN site has access not only to the connected VNets on Azure, but also other remote sites.

Type	Network	Gateway IP	Interfaces	Distance
BGP	10.26.0.0/24	10.26.0.7	Tempe0	20
BGP	169.254.24.25/32	10.26.0.7	Tempe0	20
BGP	172.25.0.0/16	10.26.0.7	Tempe0	20
BGP	172.31.1.0/24	10.26.0.7	Tempe0	20
BGP	172.180.0.0/16	10.26.0.7	Tempe0	20

Pinging from one site to another succeeds, showing communication between the two branch offices.

```

Tempo #
Tempo # Tempo # execute ping-options source 10.0.11.4

Tempo # execute ping 172.31.1.5
PING 172.31.1.5 (172.31.1.5): 56 data bytes
64 bytes from 172.31.1.5: icmp_seq=0 ttl=63 time=282.7 ms
64 bytes from 172.31.1.5: icmp_seq=1 ttl=63 time=282.9 ms
64 bytes from 172.31.1.5: icmp_seq=2 ttl=63 time=282.9 ms
64 bytes from 172.31.1.5: icmp_seq=3 ttl=63 time=282.5 ms
64 bytes from 172.31.1.5: icmp_seq=4 ttl=63 time=283.0 ms

--- 172.31.1.5 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss
round-trip min/avg/max = 282.5/282.8/283.0 ms

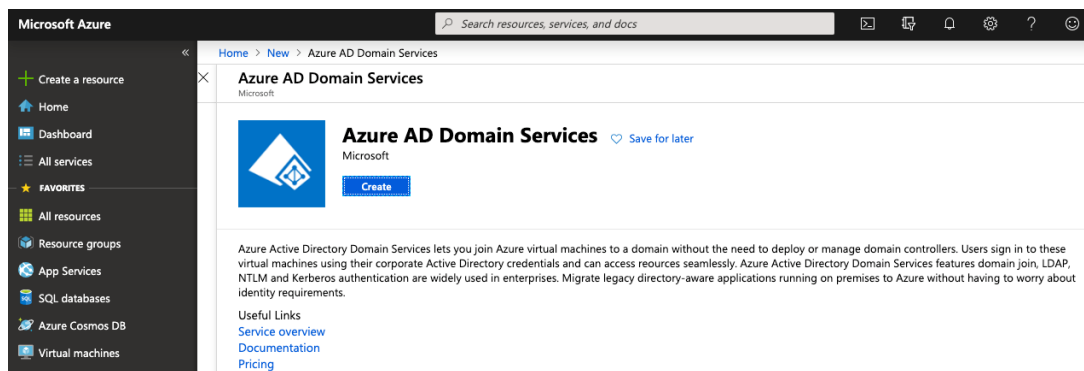
```

## Configuring integration with Azure AD domain services for VPN

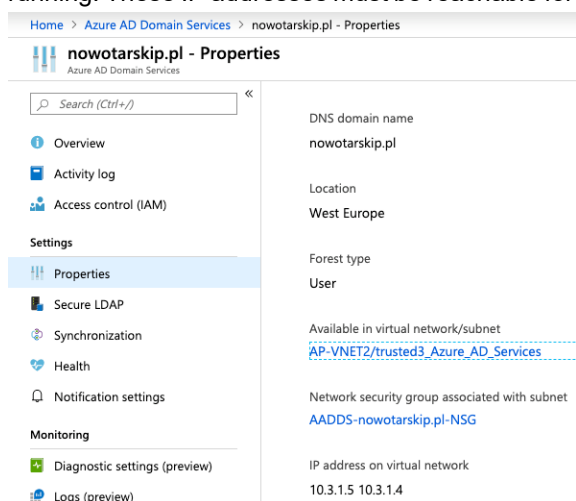
Configuring an integration with Azure AD domain services consists of the following:

**To configure Azure AD domain services:**

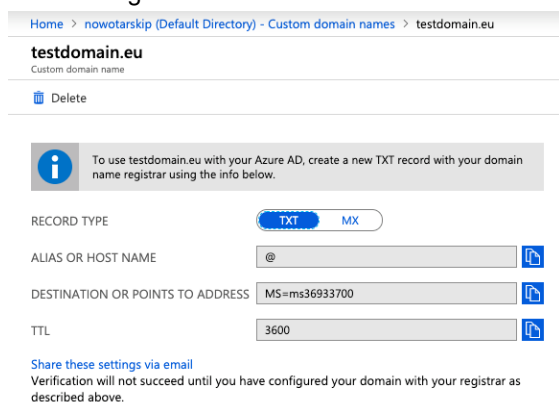
1. In the Azure management portal, create Azure AD domain services. You can deploy it to a new or existing resource group. For information about Azure AD domain services, see [Azure AD Domain Services documentation](#). It can take up to 60 minutes for Azure to create your AD domain.

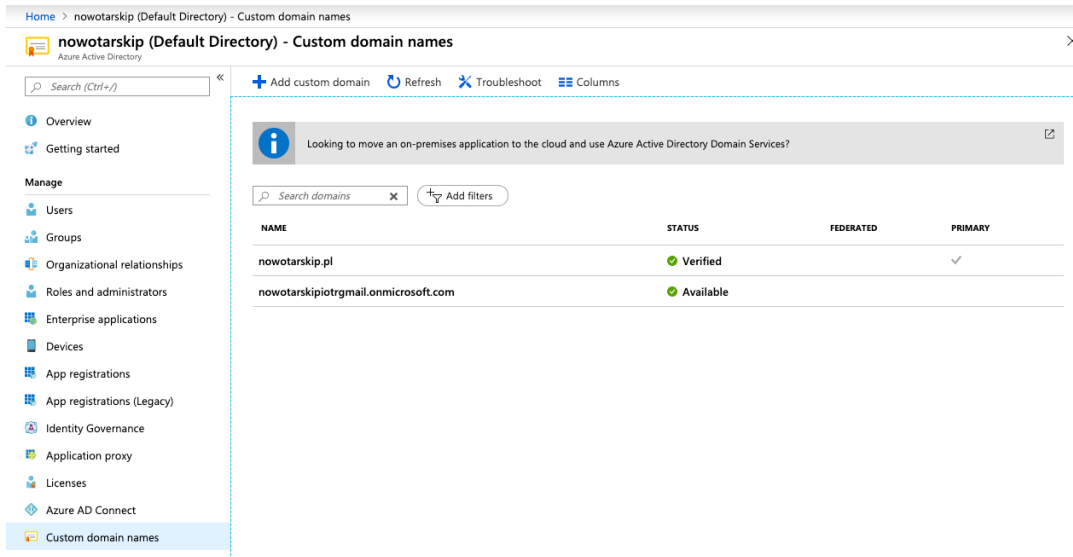


2. Go to *Azure AD Domain Services > Synchronization*. Configure whether to synchronize all Azure AD users and groups or scoped groups and members.
3. Go to *Azure AD Domain Services > Properties*. You can find IP addresses on which Azure AD domain services are running. These IP addresses must be reachable for your FortiGate for the setup to work.



4. Verify your domain in *Azure Active Directory > Custom domain names* by adding a TXT or MX record to your DNS settings.





5. Create users in *Azure Active Directory* > *Users* > *New User*. Write down the user password as it is required to log in to <https://portal.office.com> and you must change the password after initial login.

**User**  
nowotarskip (Default Directory)

\* Name: testuser ✓

\* User name: testuser@nowotarskip.pl ✓

Profile: Not configured >

Properties: Default >

Groups: 0 groups selected >

Directory role: User >

Password: Vogu7936 [Show Password]

6. In *Azure Active Directory* > *Groups*, create a new group and assign the user created in step 5 to this group.

**New Group**

\* Group type: Security ✓

\* Group name: vpn\_access ✓

Group description: SSL VPN and Client to Site VPN access group ✓

\* Membership type: Assigned ✓

Owners: >

Members: 1 member selected >

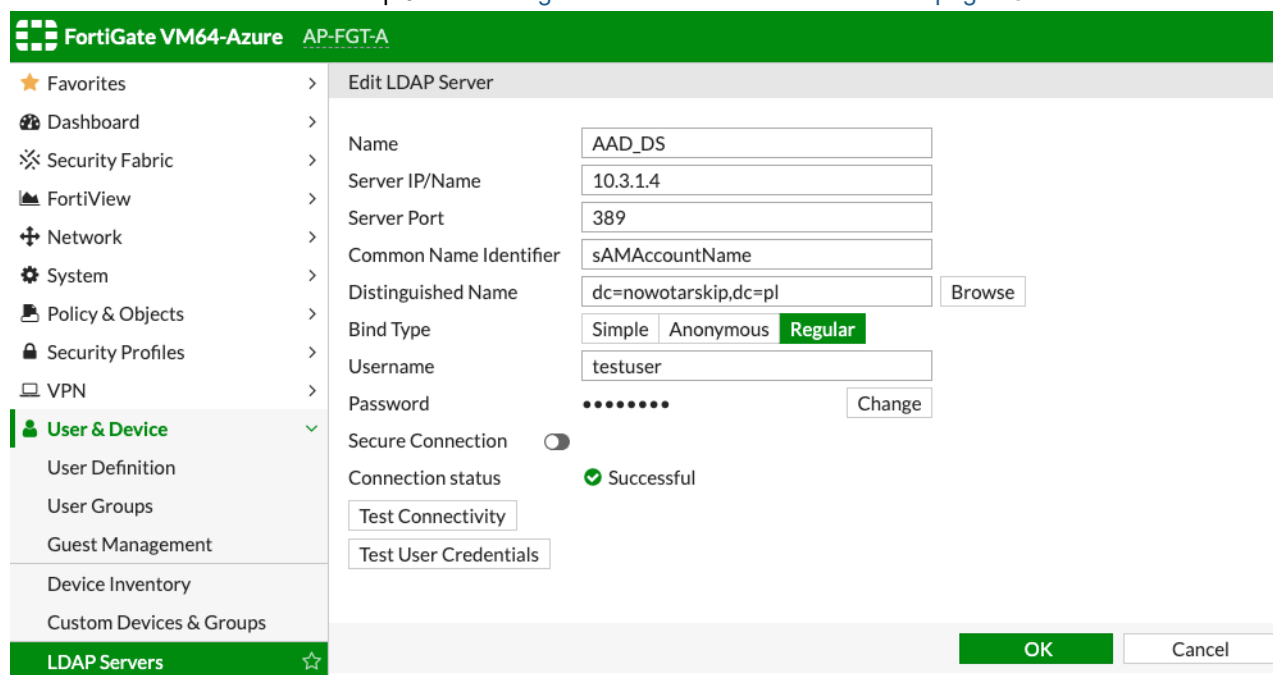
**Add members**

Select member or invite an external user: testuser ✓

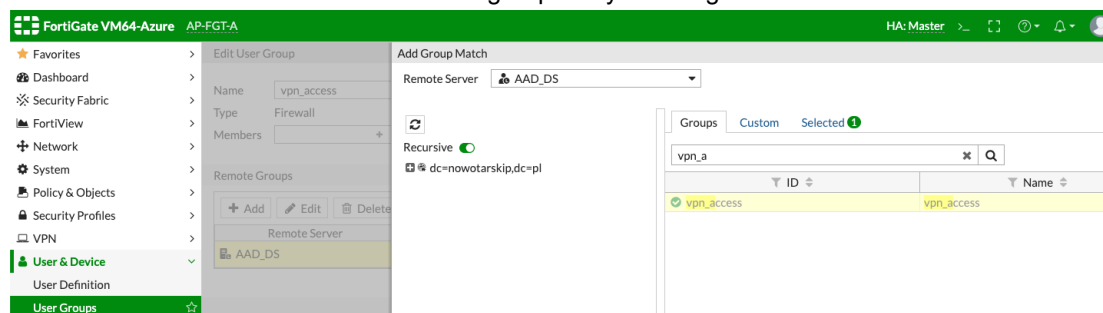
testuser  
testuser@nowotarskip.pl

## To configure the FortiGate-VM for integration with Azure AD domain services:

1. In FortiOS, go to *User & Device > LDAP Servers* and configure the LDAP server based on the Azure AD domain service IP address obtained in step 3 of [To configure Azure AD domain services: on page 167](#).



2. Go to *User & Device > User Groups* and configure the user group that you will be using for the SSL VPN portal or client-to-site VPN connection based on the group that you configured in Azure AD.



3. You can also define a user in *User & Device > User Definition* that corresponds to the user that you created in step 5 of [To configure Azure AD domain services: on page 167](#). You can use this user in firewall policies for SSL VPN or client-to-site VPN connections.
4. Go to *VPN > SSL-VPN Settings* and enable an SSL VPN portal on the WAN interface. See [SSL VPN web mode for remote user](#).



Self-signed certificates are provided by default to simplify initial installation and testing. Acquiring a signed certificate for your installation is **HIGHLY** recommended.

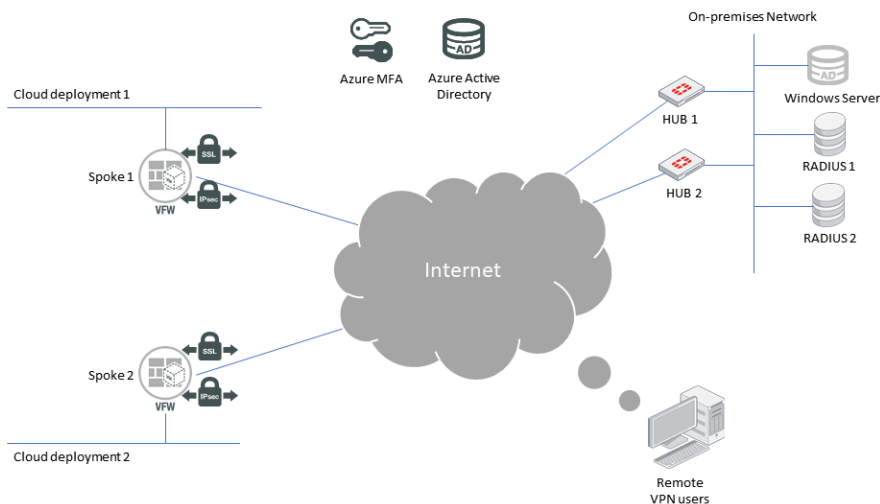
Continuing to use these certificates can result in your connection being compromised, allowing attackers to steal your information, such as credit card details.

For more information, review [Use a non-factory SSL certificate for the SSL VPN portal](#) and learn how to [Procure and import a signed SSL certificate](#).

5. Go to *Policy & Objects* and edit the SSL VPN policy. For the source, select the user group and/or user that you configured in steps 2 and 3. Define what applications, protocols, and resources to allow for SSL VPN users.
6. Log in to the SSL VPN portal as the Azure AD user.
7. To configure client-to-site VPN access using FortiClient, go to *VPN > IPsec Wizard* and select the user group created in step 2. Azure AD creates and manages this group's members. See [FortiClient as dialup client](#) for details on configuring FortiClient.
8. You can use Azure AD users as administrator accounts to manage your FortiGate. Go to *System > Administrators* and configure a new administrator from a remote server that belongs to the remote user group on Azure AD that you configured in step 2.

## Configuring FortiClient VPN with multifactor authentication

This guide outlines how to integrate Azure multifactor authentication (MFA) to existing on-premise and cloud-based user authentication and VPN infrastructure.



This setup consists of the following components:

- On-premise Windows Servers acting as Active Directory (AD) domain controllers with domain name "qa-labs.ca" configured
- Two domain-joined network policy servers (NPS) for RADIUS service
- Cloud-deployed FortiGate-VM spoke nodes with AD VPN connection to the FortiGate-VM hub node for centralized network service accessibility

When a remote VPN user starts FortiClient for VPN connection to any spoke node, the on-premise RADIUS service verifies the user credentials. Integrating Azure MFA to the existing on-premise NPS adds the following [MFA methods](#) to the legacy username and password pairs for user authentication:

- Call to phone (wireless or landline phone numbers)
- Text message to phone
- Mobile app token
- Mobile app notification

When the on-premise AD is synced to the Microsoft Entra ID (formerly known as Azure AD) and [NPS extension for Azure is integrated with the NPS](#), FortiClient VPN authentication flow results, as follows:

1. FortiClient initiates a VPN connection request to the FortiGate-VM with username and password pairs.
2. The FortiGate-VM sends a RADIUS access request message to NPS servers with several attribute value pairs (AVP) parameters, which includes username and encrypted password.
3. The NPS server connects to the local AD for primary authentication for the RADIUS request, if all NPS policies are met.
4. The local AD returns the authentication result to the NPS server. One of the following occurs:
  - a. If the credentials are incorrect, the NPS server sends a RADIUS access rejection message to the FortiGate-VM. See step 9.
  - b. If the credentials are correct, the NPS server forwards the request to the NPS extension.
5. The NPS extension triggers a request to Azure MFA for secondary authentication. Azure MFA checks if the user has MFA enabled. One of the following occurs:
  - a. If the user does not have MFA enabled, go to step 8.
  - b. If the user has MFA enabled, go to step 6.
6. Azure MFA retrieves the user details from Entra ID and performs the secondary authentication per the user's predefined methods, such as phone call, text message, mobile app notification, or mobile app one-time password. Azure MFA returns the challenge result to the NPS extension.
7. The NPS server that has the extension installed sends a RADIUS message to the FortiGate-VM. One of the following occurs:
  - a. If successful, a RADIUS access accept message is sent. Go to step 8.
  - b. If unsuccessful, a RADIUS access reject message is sent. Go to step 9.
8. The user access is granted and an encrypted VPN tunnel is established.
9. The VPN connection from FortiClient is disconnected.

This setup requires the following prerequisites:

- On-premise Windows domain controller and AD
- On-premise RADIUS service provided by NPS
- On-premise FortiGate at center, branch offices with Internet connections
- Azure subscription
- Azure MFA license
- FortiGate-VM on the cloud. Spoke 1 and Spoke 2 have VPN connections to Hub 1 and Hub 2
- Remote VPN users
- Smartphone with Microsoft Authenticator installed

The following example uses the following settings:

- FortiClient 6.0.9
- FortiGate-600D with FortiOS 6.2.2
- FortiGate-VM pay-as-you-go (PAYG) for Azure with FortiOS 6.2.2
- Windows Server 2016, domain controller, domain-joined NPS
- Azure PAYG-DevOps subscription

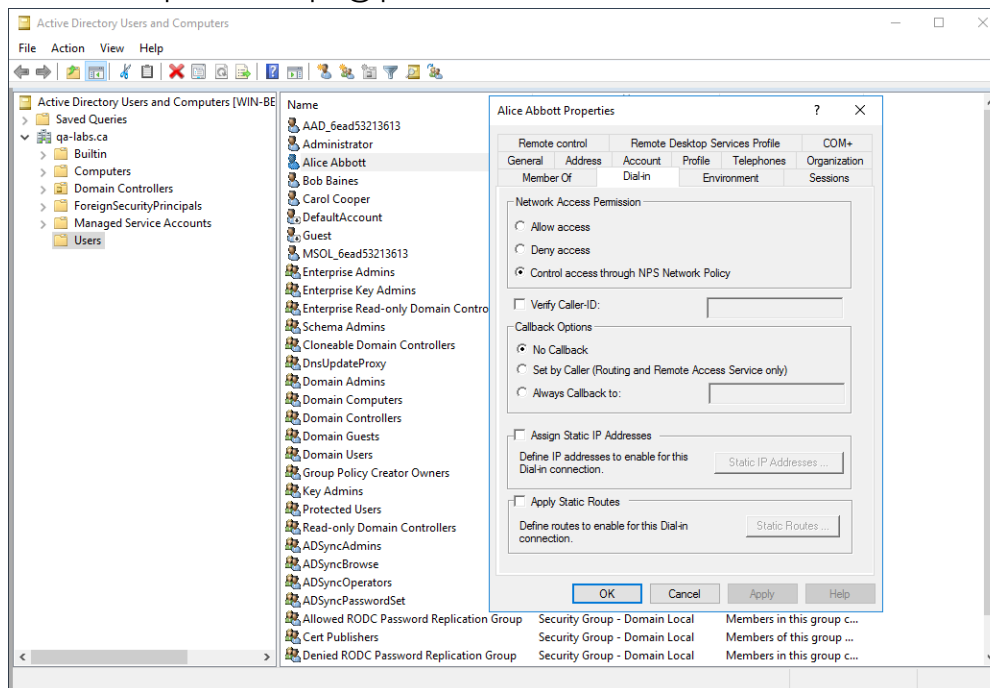
### **To configure FortiClient VPN with MFA:**

1. Sign in to the Azure portal as a global administrator for the Entra ID. Add your domain name to the Entra ID as a custom domain name so that your users can keep their sign-in username unchanged.
2. Sign in to your on-premise domain controller as the domain administrator. Download and install the Entra ID connect tool to sync your domain users to Entra ID.
3. Download and install the NPS extension to your on-premise NPS server.



4. Add several usernames to your on-premise domain controller for testing purposes. All users should have dial-in control access through NPS network policy under *Network Access Permission*. This example adds the following users:

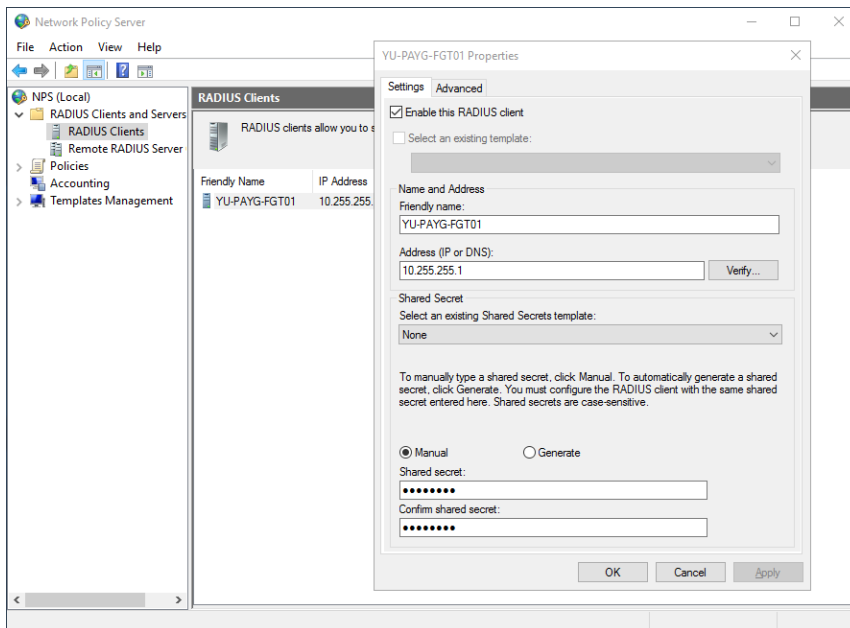
- Alice Abbott: aliceabbott@qa-labs.ca
- Bob Baines: bobbaines@qa-labs.ca
- Carol Cooper: carolcooper@qa-labs.ca



5. Go to the Azure portal. Click *Azure Active Directory > Users > Multi-Factor Authentication*. Search and enable MFA for the users you created in step 5.
6. Install Microsoft Authenticator on your smartphone.
7. Sign in to [aka.ms/MFASetup](https://aka.ms/MFASetup) as each account that you added in step 5. Enable a different MFA method for each user. This example configures the following:
- Sign in as Alice Abbott and enable text message.
  - Sign in as Bob Baines and enable mobile app token.
  - Sign in as Carol Cooper and enable mobile app notification.

## 8. Configure the on-premise NPS:

### a. Add the remote FortiGate-VM as a RADIUS client.



### b. Enable PAP as a RADIUS authentication method.

## 9. Configure dialup VPN and the SSL VPN portal on the spoke FortiGate-VM with user authenticated against on-premise RADIUS/NPS.

Azure MFA with the RADIUS NPS extension deployment supports the following password encryption algorithms used between the RADIUS client (VPN, NetScaler server, and so on) and the NPS server:

- PAP supports all Azure MFA authentication methods in the cloud: phone call, text, message, mobile app notification, and mobile app verification code.
- CHAPv2 supports phone call and mobile app notifications.
- This deployment does not support EAP.

When FortiOS authenticates a user against a remote RADIUS server, by default, it selects PAP for SSL VPN and MS-CHAPv2 for IPsec VPN. Users who have mobile app token configured as their MFA method may have trouble connecting to IPsec VPN because the mobile app notification or phone call verification may not reach them.

Select PAP for all RADIUS user authentication in your FortiGate-VM configuration:

- For IPsec VPN, run `set xauthtype pap` in your phase1-interface configuration:

```
config vpn ipsec phase1-interface
edit "Dialup_RAS"
set type dynamic
set interface "port1"
set mode aggressive
set peertype any
set net-device disable
set mode-cfg enable
set proposal aes128-sha256 aes256-sha256 aes128-sha1 aes256-sha1
set dpd on-idle
set comments "VPN: Dialup_RAS (Created by VPN wizard)"
set wizard-type dialup-forticlient
set xauthtype pap
set authusrgrp "Azure_MFA_Usergroup"
```

```

        set ipv4-start-ip 172.31.6.1
        set ipv4-end-ip 172.31.6.254
        set dns-mode auto
        set ipv4-split-include "Dialup_RAS_split"
        set save-password enable
        set client-auto-negotiate enable
        set client-keep-alive enable
        set psksecret Nobody_Knows
        set dpd-retryinterval 60
    next
end

```

- For RADIUS server settings, run `set auth-type pap` and `set timeout 30`:

```

config vpn ssl settings
    set servercert "qa-labs.ca"
    set idle-timeout 4800
    set tunnel-ip-pools "SSLVPN_Tunnel_172.31.7.0/24"
    set source-interface "port1"
    set source-address "all"
    set source-address6 "all"
    set default-portal "web-access"
    config authentication-rule
        edit 1
            set groups "Azure_MFA_Usergroup"
            set portal "0595363 SSLVPN Portal"
        next
    end
end
config user group
    edit "Azure_MFA_Usergroup"
        set member "on-premises_NPS"
    next
end
config user radius
    edit "on-premises_NPS"
        set server "172.31.248.16"
        set secret Nobody_Knows
        set timeout 30
        set nas-ip 10.255.255.1
        set auth-type pap
        set source-ip "10.255.255.1"
    next
end

```

### To verify that MFA is configured correctly:

```

diagnose test authserver radius on-premises_NPS pap aliceabbott@qa-labs.ca <password>
Enter Your Microsoft verification code*****
authenticate 'aliceabbott@qa-labs.ca' against 'pap' succeeded, server=primary assigned_rad_
    session_id=1070819755 session_timeout=0 secs idle_timeout=0 secs!
diagnose test authserver radius on-premises_NPS pap bobbaines@qa-labs.ca <password>
authenticate 'bobbaines@qa-labs.ca' against 'pap' succeeded, server=primary assigned_rad_
    session_id=1070819758 session_timeout=0 secs idle_timeout=0 secs!

```

# Entra ID acting as SAML IdP

Microsoft Entra ID (formerly known as Azure Active Directory) can act as a SAML identity provider (IdP) in the following configurations:

## SAML SSO login for FortiOS administrators with Entra ID acting as SAML IdP

See [Configuring SAML SSO login for FortiGate administrators with Azure AD acting as SAML IdP](#).

## Configuring SAML SSO login for SSL VPN with Entra ID acting as SAML IdP

This guide provides supplementary instructions on using SAML single sign on (SSO) to authenticate against Microsoft Entra ID (formerly known as Azure Active Directory) with SSL VPN SAML user via tunnel and web modes. You can find the initial Azure configuration in [Tutorial: Microsoft Entra SSO integration with FortiGate SSL VPN](#)

Before you begin the FortiOS configuration, ensure that you have collected the following information from Azure to use in the SAML configuration:

FortiGate SAML CLI setting	Equivalent Azure configuration
Service provider (SP) entity ID (entity-id)	Identifier (entity ID)
SP single sign on (SSO) URL (single-sign-on-url)	Reply URL (assertion consumer service URL)
SP single logout URL (single-logout-url)	Logout URL
Identity provider (IdP) entity ID (idp-entity-id)	Azure login URL
IdP SSO URL (idp-single-sign-on-url)	Entra ID identifier
IdP single logout URL (idp-single-logout-url)	Azure logout URL
IdP certificate (idp-cert)	Base64 SAML certificate

FortiGate SAML CLI setting	Equivalent Azure configuration
Username attribute (user-name)	username
Group name attribute (group-name)	group

### To configure SAML SSO:

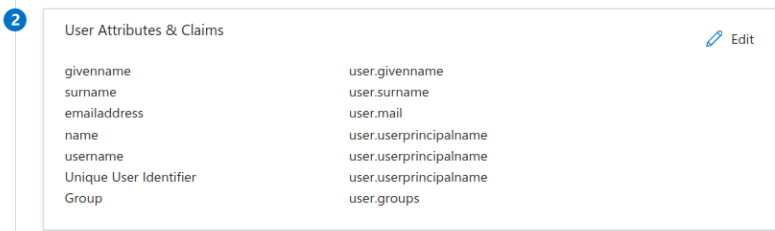
1. In FortiOS, download the Azure IdP certificate as [Configure Microsoft Entra SSO](#) describes.
2. Upload the certificate as [Upload the Base64 SAML Certificate to the FortiGate appliance](#) describes.
3. In the FortiOS CLI, configure the SAML user:

```
config user saml
  edit "azure"
    set cert "Fortinet_Factory"
    set entity-id "https://<FortiGate IP or FQDN address>:<Custom SSL VPN
      port>/remote/saml/metadata"
    set single-sign-on-url "https://<FortiGate IP or FQDN address>:<Custom SSL VPN
      port>/remote/saml/login"
    set single-logout-url "https://<FortiGate IP or FQDN address>:<Custom SSL VPN
      port>/remote/saml/logout "
    set idp-entity-id "<Entra ID identifier>"
    set idp-single-sign-on-url "<Azure login URL>"
    set idp-single-logout-url "<Azure logout URL>"
    set idp-cert "<Base64 SAML certificate name>"
    set user-name "username"
    set group-name "group"
  next
end
```

In this example, assuming that the FortiGate IP address is 104.40.18.242, the commands are as follows:

```
config user saml
  edit "azure"
    set cert "Fortinet_Factory"
    set entity-id "https://104.40.18.242:10443/remote/saml/metadata"
    set single-sign-on-url "https://104.40.18.242:10443/remote/saml/login"
    set single-logout-url "https://104.40.18.242:10443/remote/saml/logout"
    set idp-entity-id "https://sts.windows.net/04e..."
    set idp-single-sign-on-url "https://login.microsoftonline.com/xxxxx-xxxxx-xxxxx-
      xxxxx-xxxxx/saml2"
    set idp-single-logout-url "https://login.microsoftonline.com/xxxxx-xxxxx-xxxxx-
      xxxxx-xxxxx/saml2"
    set idp-cert "<Base64 SAML certificate name>"
    set user-name "username"
    set group-name "group"
  next
end
```

The `user-name` and `group-name` attributes configured on the FortiGate entry should exactly match the username and group attributes that Entra ID returns. You can configure the list of SAML attributes that Entra ID returns under *Username Attributes & Claims* in the Azure portal.



FortiGate can optionally map users to specific groups based on the returned SAML user.groups attribute. The example shows group matching based on Entra ID Group ObjectId, using the `set group-name` command:

```
config user group
  edit FortiGateAccess
    set member azure
    config match
      edit 1
        set server-name azure
        set group-name <object ID>
      next
    end
  next
end
```

You can find the full list of group claims in [Configure group claims for applications by using Microsoft Entra ID](#).

Configure the remote authentication timeout value as needed:

```
config system global
  set remoteauthtimeout 60
end
```

### To configure SSL VPN settings:

1. Go to *VPN > SSL VPN Settings*. Enable SSL VPN.
2. Configure the *Listen on Interface(s)*.
3. Configure the *Listen on Port*. This port should be the port used in the SP URLs in the SAML configurations.
4. Select a server certificate. FortiOS uses Fortinet\_Factory by default. This certificate should match the SP certificate used in the SAML configurations.



Self-signed certificates are provided by default to simplify initial installation and testing. Acquiring a signed certificate for your installation is **HIGHLY** recommended.

Continuing to use these certificates can result in your connection being compromised, allowing attackers to steal your information, such as credit card details.

For more information, review [Use a non-factory SSL certificate for the SSL VPN portal](#) and learn how to [Procure and import a signed SSL certificate](#).

5. Under *Authentication/Portal Mapping*, click *Create New*.
6. Set *Users/Groups* to the user group that you defined earlier. In this example, it is FortiGateAccess.
7. Set *Portal* to the desired SSL VPN portal.
8. Click *OK*.
9. Click *Apply*.

### To configure a firewall policy:

1. Go to *Policy & Objects > Firewall Policy*. Click *Create new* to create a new SSL VPN firewall policy.
2. Select the incoming and outgoing interfaces. The outgoing interface is the SSL VPN tunnel interface (ssl.root).
3. For *Source*, select the SSL VPN tunnel address group and FortiGateAccess user group.
4. Configure other settings as desired.
5. Click *OK*.

### To connect in web mode:

1. Go to `https://<FortiGate IP address>:10443` in a browser.
2. Click *Single Sign-On*. The browser redirects to the Azure login portal.
3. Sign in with your Azure account and password. Once logged in, the browser redirects to the SSL VPN portal.

### To connect in tunnel mode with FortiClient:

1. In FortiClient, go to *Remote Access*.
2. Add a new connection:
  - a. Enter the desired connection name and description.
  - b. Set the remote gateway to the FortiGate's fully qualified domain name or IP address.
  - c. Enable *Customize port*, then specify the SSL VPN port.
  - d. Select *Enable Single Sign On (SSO) for VPN Tunnel*.
  - e. (Optional) Enable *Use external browser as user-agent for saml user authentication* if you want users to use their browser session for login.
  - f. Click *Save*.
3. Click *SAML Login*. FortiClient redirects the user to the Azure login portal.
4. Sign in with your Azure account and password. Once logged in, the browser redirects to the SSL VPN portal.

### To troubleshoot:

```
diagnose debug application samld -1
diagnose debug application sslvpn -1
```

The output should resemble the following:

```
samld_send_common_reply [123]: Attr: 17, 27, magic=a8111ca2943ecd0c
samld_send_common_reply [120]: Attr: 10, 95,
    'http://schemas.microsoft.com/identity/claims/tenantid' 'xxxxxx-xxxxxx-xxxxxx-xxxxxx-xxxxxx'
samld_send_common_reply [120]: Attr: 10, 103,
    'http://schemas.microsoft.com/identity/claims/objectidentifier' 'xxxxxx-xxxxxx-xxxxxx-xxxxxx-xxxxxx'
samld_send_common_reply [120]: Attr: 10, 128,
    'http://schemas.microsoft.com/identity/claims/identityprovider'
    'https://sts.windows.net/xxxxxx-xxxxxx-xxxxxx-xxxxxx-xxxxxx/'
samld_send_common_reply [120]: Attr: 10, 142,
    'http://schemas.microsoft.com/claims/authnmethodsreferences'
    'http://schemas.microsoft.com/ws/2008/06/identity/authenticationmethod/password'
samld_send_common_reply [120]: Attr: 10, 49, 'Username'
    'mremini@innovcenter.onmicrosoft.com'
samld_send_common_reply [120]: Attr: 10, 51, 'UserGroup' '3a0e3f1c-93c6-4be6-bdbe-b5d28a20cfa0'
```

```
saml_send_common_reply [120]: Attr: 10, 51, 'UserGroup' '8fb8c5ee-b253-44cc-a88f-4bd62dfaf2d2'
[924:root:5c]req: /remote/saml/start
[924:root:5c]rmt_web_auth_info_parser_common:470 no session id in auth info
[924:root:5c]rmt_web_get_access_cache:804 invalid cache, ret=4103
[924:root:5c]sslvpn_auth_check_usrgroup:2039 forming user/group list from policy.
[924:root:5c]sslvpn_auth_check_usrgroup:2145 got user (1) group (1:0).
[924:root:5c]sslvpn_validate_user_group_list:1642 validating with SSL VPN authentication rules (0), realm ((null)).
[924:root:5c]sslvpn_validate_user_group_list:1963 got user (1:0), group (1:0) peer group (0).
[924:root:0]total sslvpn policy count: 1
[924:root:5c]req: /remote/saml/login
[924:root:5c]stmt: http://schemas.microsoft.com/identity/claims/tenantid
[924:root:5c]stmt: http://schemas.microsoft.com/identity/claims/objectidentifier
[924:root:5c]stmt: http://schemas.microsoft.com/identity/claims/displayname
[924:root:5c]stmt: http://schemas.microsoft.com/identity/claims/identityprovider
[924:root:5c]stmt: http://schemas.microsoft.com/claims/authnmethodsreferences
[924:root:5c]stmt: http://schemas.xmlsoap.org/ws/2005/05/identity/claims/givenname
[924:root:5c]stmt: http://schemas.xmlsoap.org/ws/2005/05/identity/claims/surname
[924:root:5c]stmt: http://schemas.xmlsoap.org/ws/2005/05/identity/claims/name
[924:root:5c]rmt_web_session_create:781 create web session, idx[0]
[924:root:5c]User Agent: Mozilla/5.0 (X11; Ubuntu; Linux x86_64; rv:71.0) Gecko/20100101 Firefox/71.0
[924:root:5c]deconstruct_session_id:426 decode session id ok, user=[ssl-azure-saml],group=[sslvpn],authserver=[],portal=[web-access],host=[208.91.115.10],realm=[],idx=0,auth=256,sid=1424c6b9,login=1576802935,access=1576802935,sa$
l_logout_url=no
[924:root:5c]deconstruct_session_id:426 decode session id ok, user=[ssl-azure-saml],group=[sslvpn],authserver=[],portal=[web-access],host=[208.91.115.10],realm=[],idx=0,auth=256,sid=1424c6b9,login=1576802935,access=1576802935,sa$
l_logout_url=no
[924:root:5c]deconstruct_session_id:426 decode session id ok, user=[ssl-azure-saml],group=[sslvpn],authserver=[],portal=[web-access],host=[208.91.115.10],realm=[],idx=0,auth=256,sid=1424c6b9,login=1576802935,access=1576802935,sa$
l_logout_url=no
[924:root:5c]req: /sslvpn/portal.html
[924:root:5c]mza: 0x28587b0 /sslvpn/portal.html
[924:root:5c]deconstruct_session_id:426 decode session id ok, user=[ssl-azure-saml],group=[sslvpn],authserver=[],portal=[web-access],host=[208.91.115.10],realm=[],idx=0,auth=256,sid=1424c6b9,login=1576802935,access=1576802935,sam
l_logout_url=yes
[924:root:5c]req: /dc7a2776ac5e60eb4eeda4c1de45b5cb/js/req
[924:root:5c]mza: 0x2858620 /dc7a2776ac5e60eb4eeda4c1de45b5cb/js/require_all.js
[924:root:5c]deconstruct_session_id:426 decode session id ok, user=[ssl-azure-saml],group=[sslvpn],authserver=[],portal=[web-access],host=[208.91.115.10],realm=[],idx=0,auth=256,sid=1424c6b9,login=1576802935,access=1576802935,sam
l_logout_url=yes
[919:root:0]allocSSLConn:289 sconn 0x7f5962887000 (0:root)
total sslvpn policy count: 1
[925:root:0]total sslvpn policy count: 1
[923:root:7b]req: /remote/logout
[923:root:7b]deconstruct_session_id:426 decode session id ok, user=[ssl-azure-saml],group=[sslvpn],authserver=[],portal=[web-access],host=[208.91.115.10],realm=[],idx=0,auth=256,sid=a205b36,login=1576804178,access=1576804178,saml_logout_url=yes
[923:root:7b]session removed s: 0x7f5962887000 (root)
```



```
[923:root:7b]deconstruct_session_id:426 decode session id ok, user=[ssl-azure-saml],group=[
sslvpn],authserver=[],portal=[web-access],host=[208.91.115.10],realm=
[],idx=0,auth=256,sid=a205b36,login=1576804178,access=1576804178,saml_logout_url=no
[923:root:0]sslvpn_internal_remove_one_web_session:2848 web session (root:ssl-azure-
saml:sslvpn:208.91.115.10:0 0) removed for User requested termination of service
[924:root:7a]rmt_check_conn_session:2129 delete connection 0x7f5962887000 w/ web session 0
[924:root:7a]Destroy sconn 0x7f5962887000, connSize=1. (root)
[924:root:7b]rmt_check_conn_session:2129 delete connection 0x7f5962888900 w/ web session 0
[924:root:7b]Destroy sconn 0x7f5962888900, connSize=0. (root)
[923:root:7c]rmt_check_conn_session:2129 delete connection 0x7f5962888900 w/ web session 0
[923:root:7c]Destroy sconn 0x7f5962888900, connSize=1. (root)
[923:root:7b]rmt_check_conn_session:2129 delete connection 0x7f5962887000 w/ web session 0
[923:root:7b]Destroy sconn 0x7f5962887000, connSize=0. (root)
[925:root:7a]SSL state:warning close notify (208.91.115.10)
[925:root:7a]sslConnGotoNextState:305 error (last state: 1, closeOp: 0)
[925:root:7a]Destroy sconn 0x7f5962887000, connSize=1. (root)
dchaofgt # [925:root:7b]SSL state:warning close notify (208.91.115.10)
[925:root:7b]sslConnGotoNextState:305 error (last state: 1, closeOp: 0)
[925:root:7b]Destroy sconn 0x7f5962888900, connSize=0. (root)
```

# Azure Sentinel

## Sending FortiGate logs for analytics and queries

See [Fortinet connector for Microsoft Sentinel](#).

# Change log

Date	Change description
2020-03-31	Initial release.
2020-05-05	Updated <a href="#">Creating a support account on page 12</a> .
2020-05-08	Updated <a href="#">To configure multizone active-passive HA in Azure</a> .
2020-05-13	Added <a href="#">Verifying the license type on page 13</a> and <a href="#">Migrating a FortiGate-VM instance between license types on page 14</a> . Updated <a href="#">Order types on page 11</a> .
2020-05-15	Updated <a href="#">Order types on page 11</a> .
2020-06-05	Updated <a href="#">Checking the prerequisites and To configure multizone active-passive HA in Azure</a> .
2020-06-08	Updated <a href="#">Connecting a local FortiGate to an Azure VNet VPN on page 146</a> .
2020-07-03	Updated <a href="#">Configuring FortiClient VPN with multifactor authentication on page 171</a> .
2020-07-09	Added <a href="#">To configure a VDOM exception</a> .
2020-08-14	Added <a href="#">Obtaining a FortiCare-generated license for Azure on-demand instances on page 15</a> .
2020-10-09	Updated <a href="#">Deploying autoscaling on Azure on page 40</a> .
2020-10-28	Updated <a href="#">Configuring SAML SSO login for SSL VPN with Entra ID acting as SAML IdP on page 176</a> .
2020-10-30	Updated <a href="#">Configuring integration with Azure AD domain services for VPN on page 167</a> and <a href="#">Entra ID acting as SAML IdP on page 176</a> .
2020-11-27	Updated <a href="#">Configuring SAML SSO login for SSL VPN with Entra ID acting as SAML IdP on page 176</a> .
2020-12-08	Updated <a href="#">Order types on page 11</a> . Updated <a href="#">Deploying autoscaling on Azure on page 40</a> .
2020-12-11	Updated <a href="#">Creating a support account on page 12</a> .
2021-01-06	Updated <a href="#">HA for FortiGate-VM on Azure on page 125</a> .
2021-02-04	Updated <a href="#">Configuring SAML SSO login for SSL VPN with Entra ID acting as SAML IdP on page 176</a> .
2020-02-10	Updated <a href="#">Deploying autoscaling on Azure on page 40</a> .
2021-02-19	Updated <a href="#">SDN connector in Azure Stack on page 143</a> .
2021-02-23	Updated <a href="#">SDN connector integration with Azure on page 131</a> .
2021-05-14	Added <a href="#">Deploying FortiGate-VM from the marketplace on page 35</a> . Updated <a href="#">Single FortiGate-VM deployment on page 114</a> .

Date	Change description
2021-05-20	Updated <a href="#">Deploying autoscaling on Azure on page 40</a> to add support for FortiAnalyzer.
2021-08-25	Updated <a href="#">Deploying autoscaling on Azure on page 40</a> to add support for upgrading from the 2.0.9 template to the 3.3.2 template.
2021-11-19	Updated <a href="#">Deploying autoscaling on Azure on page 40</a> .
2022-05-31	Updated <a href="#">Configuring SAML SSO login for SSL VPN with Entra ID acting as SAML IdP on page 176</a> .



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