FortiOS - AliCloud Cookbook

Version 6.2

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FortiOS 6.2 AliCloud Cookbook
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About FortiGate for AliCloud

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 AliCloud.

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 for AliCloud supports active/passive high availability (HA) configuration using highly available virtual IP addresses (HAVIP). This enables FortiGate synchronization between the primary and secondary nodes for their configurations and sessions, and when the FortiGate detects a failure, the passive firewall instance becomes active.

Highlights of FortiGate for AliCloud 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.
- New Docker application control signatures protect your container environments from newly emerged security threats. See FortiGate-VM on a Docker environment.

Instance type support

You can deploy FortiGate-VM (as bring your own license (BYOL)) on AliCloud on all available instances supported that the FortiGate-VM listing on the AliCloud marketplace supports. Supported instances on AliCloud for new deployments may change without notice.

For up-to-date information of instance type families, see the following:

- Instance type families
- Fortinet FortiGate (BYOL) Next-Generation Firewall

FortiGate-VM (as on-demand or pay-as-you-go (PAYG)) on AliCloud currently supports vCPU-2 and 4 only. For more information, visit:

- Fortinet FortiGate-VM On-Demand (2 vCore CPU)
- Fortinet FortiGate-VM On-Demand (4 vCore CPU)

You can apply a smaller FortiGate-VM license if you are OK with consuming less CPU than is present on your instance. For details, see FortiGate-VM virtual licenses and resources.

Region support

FortiGate-VM is available for purchase in all the regions/datacenters that the AliCloud global marketplace covers. Available regions are:

- Hong Kong
- Asia Pacific SE 1 (Singapore)
- US East 1 (Virginia)
- Asia Pacific NE 1 (Tokyo)
- US West 1 (Silicon Valley)
- EU Central 1 (Frankfurt)
- Middle East 1 (Dubai)
- Asia Pacific SE 2 (Sydney)
- Asia Pacific SE 3 (Kuala Lumpur)
- Asia Pacific SOU 1 (Mumbai)
- Asia Pacific SE 5 (Jakarta)
- North China 1
- North China 2
- China North 3 (Zhangjiakou)
- China North 5 (Huhehaote)
- East China 1
- East China 2
- South China 1

Models

FortiGate-VM is available with different CPU and RAM sizes. You can deploy FortiGate-VM on various private and public cloud platforms. The following table shows the models conventionally available to order, also known as BYOL models. See Order types on page 8.

Model name	vCPU	
	Minimum	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
FG-VM32/32v/32s	1	32
FG-VMUL/ULv/ULs	1	Unlimited

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-BYOL licenses. However, these restrictions are not applicable to AliCloud deployments. Any RAM size with certain CPU models are allowed. Licenses are based on the number of CPUs only.

For information about each model's order information, capacity limits, and adding VDOM, see the FortiGate-VM datasheet.

Licensing

You must have a license to deploy FortiGate for AliCloud.

Order types

On AliCloud, there are usually two order types: BYOL and on-demand.

BYOL offers perpetual (normal series and v-series) and annual subscription (s-series, available starting Q4 2019) licensing as opposed to on-demand. Subscription is month-based whereas PAYG is hour-based. BYOL licenses are available for purchase from resellers or your distributors, and prices are listed in the publicly available price list which is updated quarterly. 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.

On-demand is term-based and has two options: subscription and PAYG. With an on-demand subscription, the FortiGate-VM becomes available for use immediately after you create the instance. Term-based prices (hourly or annually) are mentioned in the marketplace product page.

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

- For BYOL, you typically order a combination of products and services including support entitlement. New s-series SKUs contain the VM base and service bundle entitlements for easier ordering. To proceed with licensing a BYOL deployment, see Registering and downloading licenses on page 9.
- To purchase on-demand, all you need to do is launch 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 8. See *Support* on the marketplace product page.

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

Creating a support account

FortiGate for AliCloud supports both on-demand and BYOL licensing models. See Order types on page 8.

To make use of Fortinet technical support and ensure products function properly, you must complete certain steps to activate your entitlement. Our support team can identify your registration in the system thereafter.

First, if you do not have a Fortinet account, you can create one.

For on-demand deployments, do the following:

1. Deploy and boot up the FortiGate on-demand VM instance and log into the FortiGate GUI management console.
2. On the Dashboard, copy the VM serial number.
3. Go to Fortinet Service & Support and create a new account or log in with an existing account.
4. Go to *Asset* > *Register/Activate* to start the registration process.
5. In the *Specify Registration Code* field, enter the serial number, and select *Next* to continue registering the product. Enter your details in the other fields.
6. After completing registration, contact Fortinet Customer Support and provide your FortiGate instance's serial number and the email address associated with your Fortinet account.

Registering and downloading licenses

Licenses for the BYOL licensing model can be obtained through any Fortinet partner. If you do not have a partner, contact jerrywang@fortinet.com for assistance in purchasing a license.

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

1. Go to Fortinet Service & Support and create a new account or log in with an existing account.
2. Go to *Asset* > *Register/Activate* to start the registration process. In the *Specify Registration Code field*, enter your license activation code and select *Next* to continue registering the product. Enter your details in the other fields.
3. At the end of the registration process, download the license (.lic) file to your computer. You will 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.

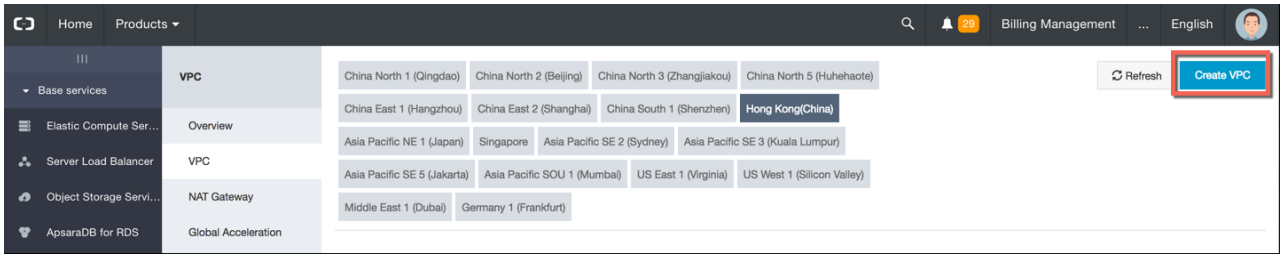
Securing instances on AliCloud

This guide describes FortiGate-VM single deployment on AliCloud. This deployment consists of the following steps:

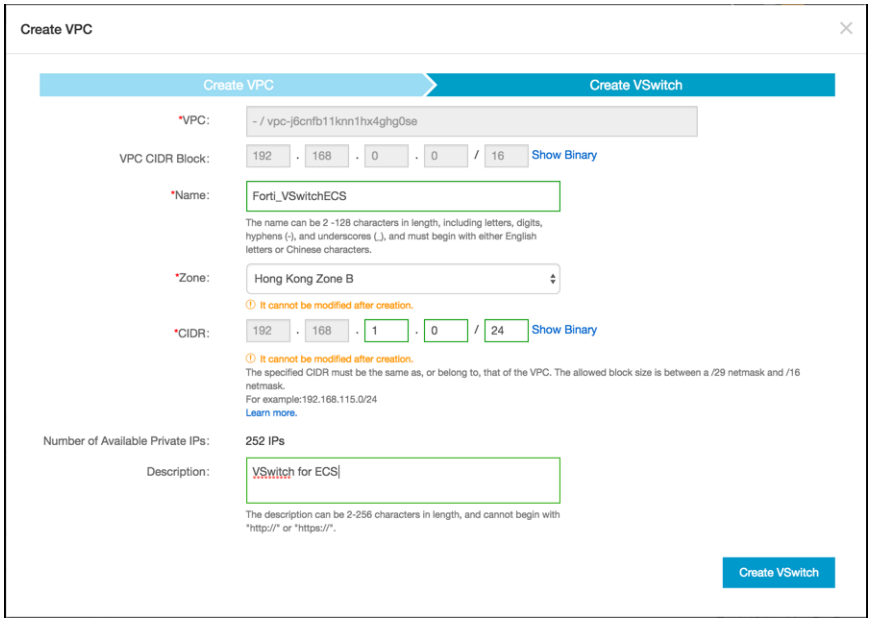
1. Configuring a virtual private cloud on page 10
2. Subscribing to the FortiGate-VM in the marketplace on page 11
3. Configuring routing to the FortiGate-VM on AliCloud on page 14
4. Connectivity test on page 14

Configuring a virtual private cloud

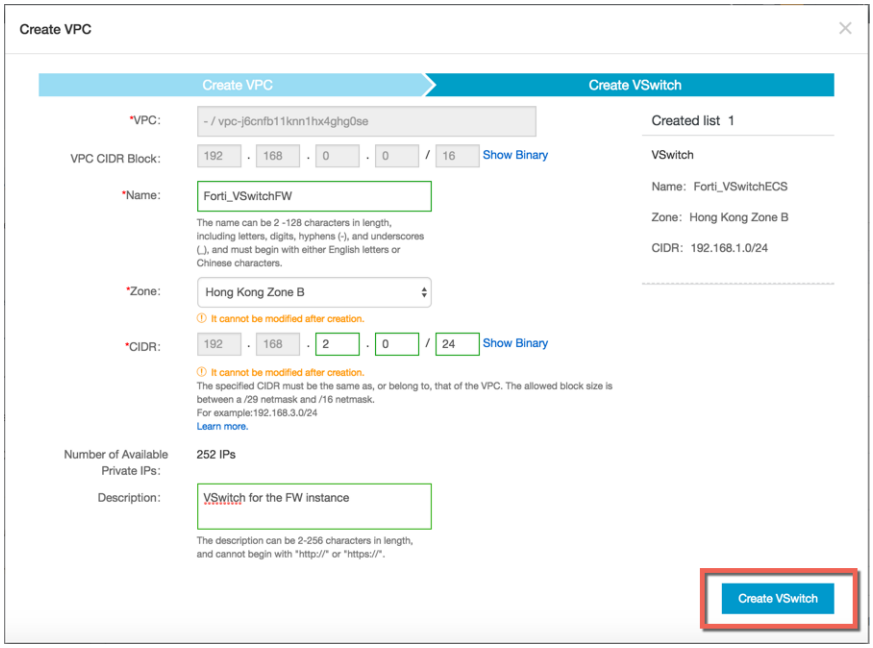
1. Assuming this is a new environment, the first step is to create the virtual private cloud (VPC). In the AliCloud web console, click *Create VPC*.



2. Enter a name for the VPC. Click *Create VPC*.
3. Click *Next Step*.
4. You will require at least two VSwitches: one for the ECS and one for the FortiGate-VM. Create the ECS VSwitch first as shown below.



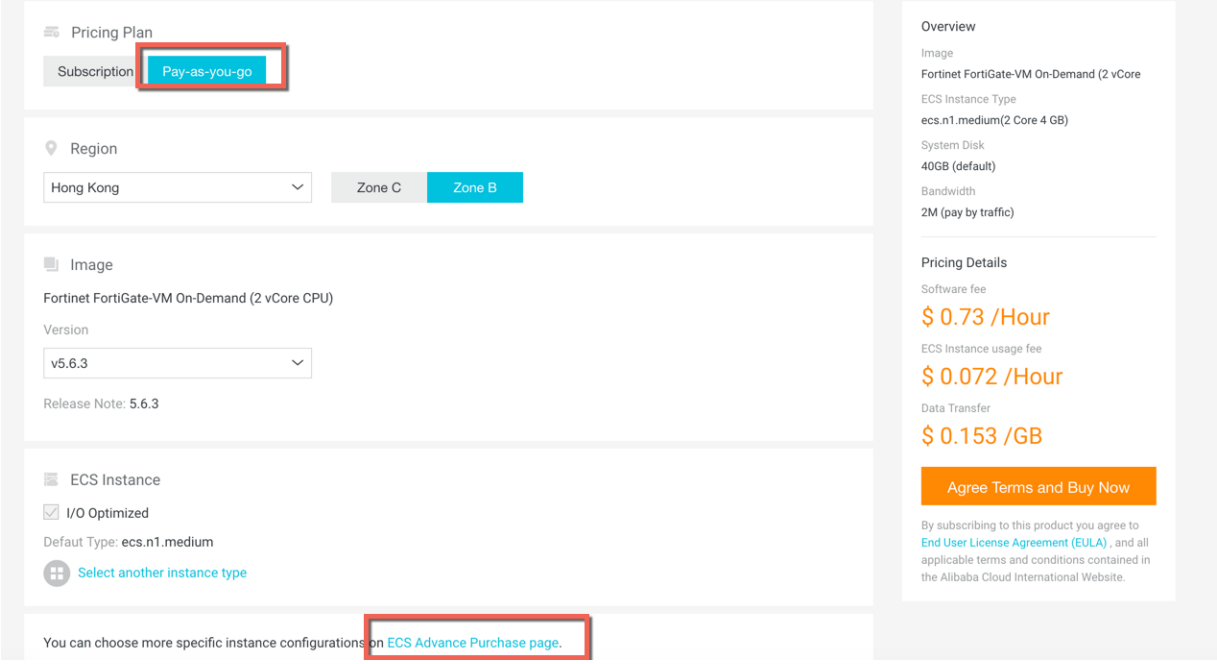
5. Click *Create More*.
6. Configure the VSwitch for the FortiGate-VM as shown below, then click *Create VSwitch*.



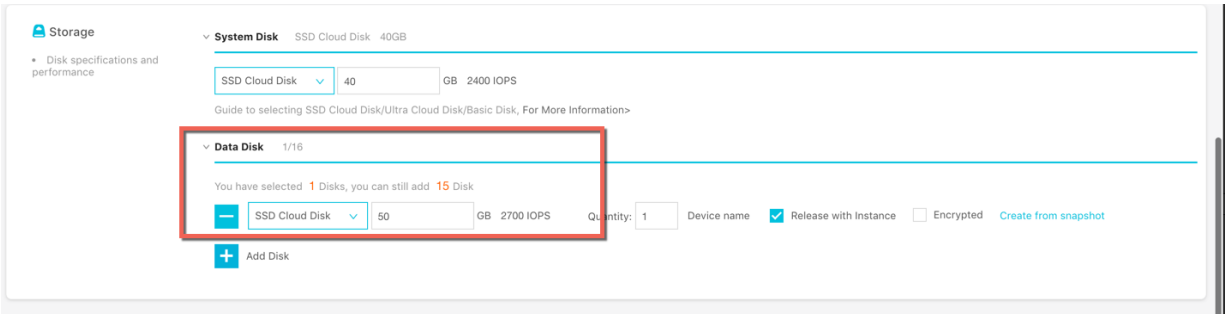
7. Click *Done*. VPC and VSwitch setup is complete.

Subscribing to the FortiGate-VM in the marketplace

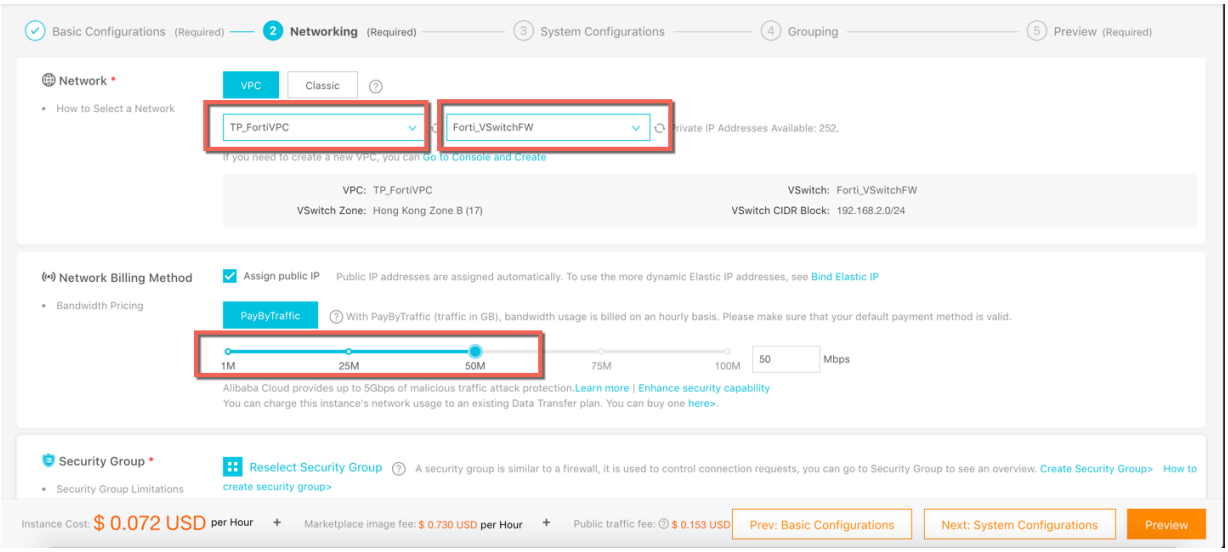
1. Go to the AliCloud Marketplace and search for Fortinet.
2. You will now create the FortiGate-VM instance. If you have your own FortiGate-VM license, select the BYOL image. Otherwise, select the on-demand image.
   a. Click *Choose Your Plan*.
   b. In this example, PAYG, Hong Kong, and Zone B were selected for the pricing plan, region, and zone, respectively. Zone B is the location of the VPC and VSwitches. Click *ECS Advance Purchase page* to customize the data disk and VPC information.



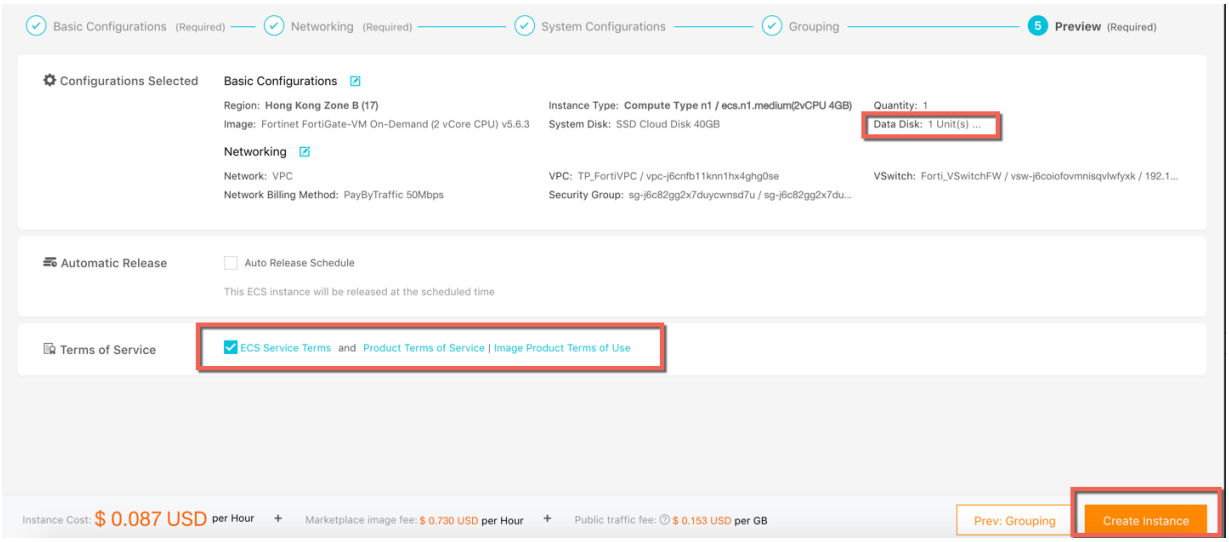
c. Add a data disk for logs. It is suggested to use SSD for better performance.



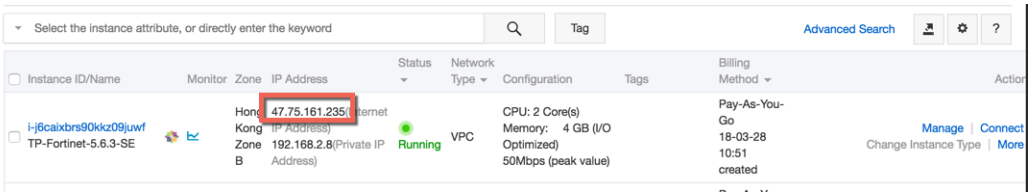
d. In the *Network* section, select TP_FortiVPC and Forti_VSwitchFW. Assign a public IP address to the image.



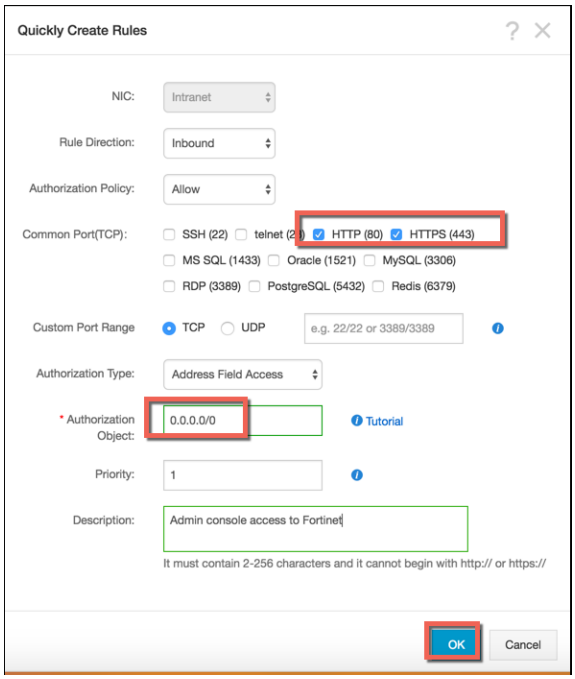
e. Continue to create the instance.



3. Click *Console* to return to the ECS instance list.
4. You can see that the VM has been created. Mark down the public IP address and the instance ID for later use. The instance ID is the FortiGate default password.



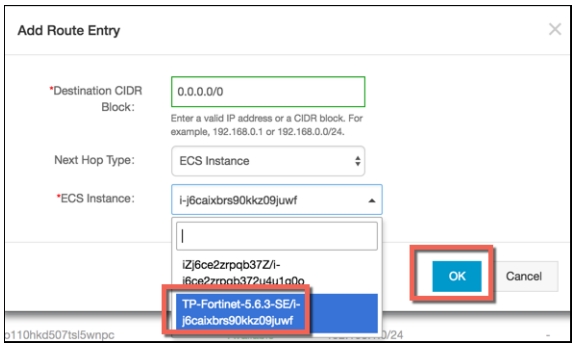
5. You must now configure the default security group. Go to *Security Groups*, then click *Configure Rules*.
   a. Click *Quickly Create Rules*.
   b. Enable ports 80 and 443, then click *OK*.



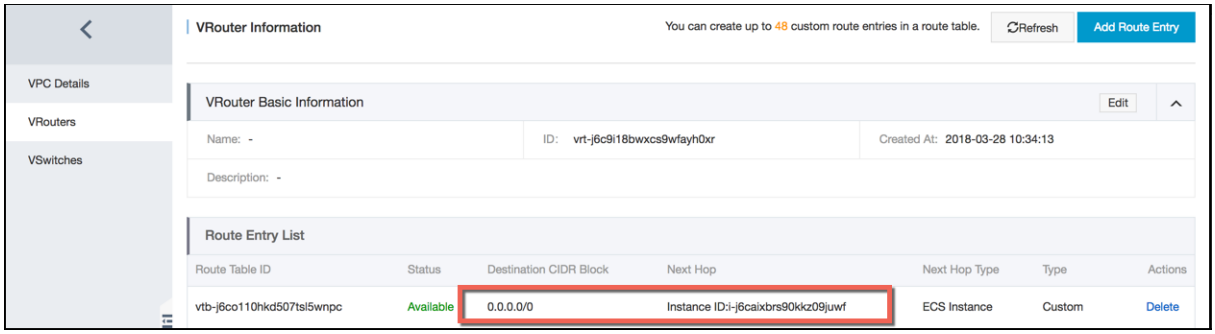
6. You can now access the FortiGate-VM in a web browser using the username "admin". The password is the instance ID.
7. Change the password after the initial login.

Configuring routing to the FortiGate-VM on AliCloud

1. On the VPC entry, click *Manage*.
2. Click *Add Route Entry*.
3. Add 0.0.0.0/0 and point it to the FortiGate-VM.



This ensures ECS outbound traffic goes through the FortiGate.



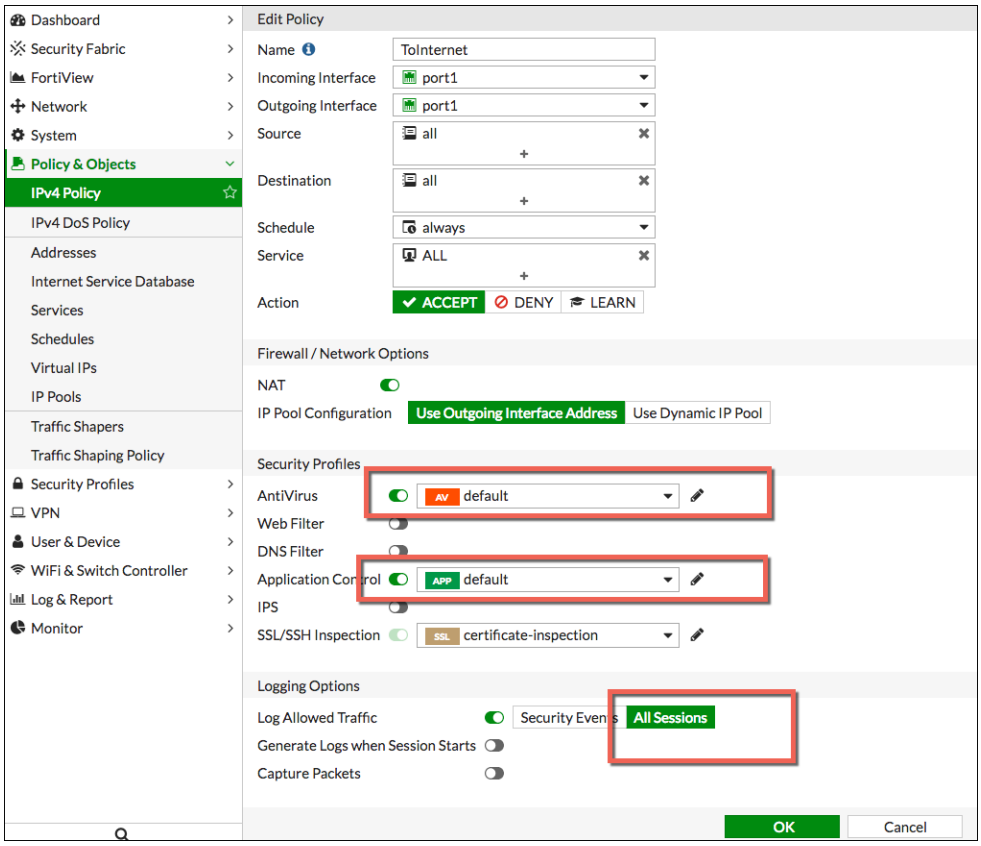
Connectivity test

The following instructions test whether you configured the FortiGate-VM and VPC properly. Complete the following steps in order:

1. Configuring the initial firewall policy on the FortiGate-VM on page 15
2. Configuring an ECS worker VM for VNC access on page 15
3. Testing malware scan for outgoing traffic on page 17
4. Testing application control for outgoing traffic on page 18
5. Enabling NAT inbound protection in FortiOS on page 19

Configuring the initial firewall policy on the FortiGate-VM

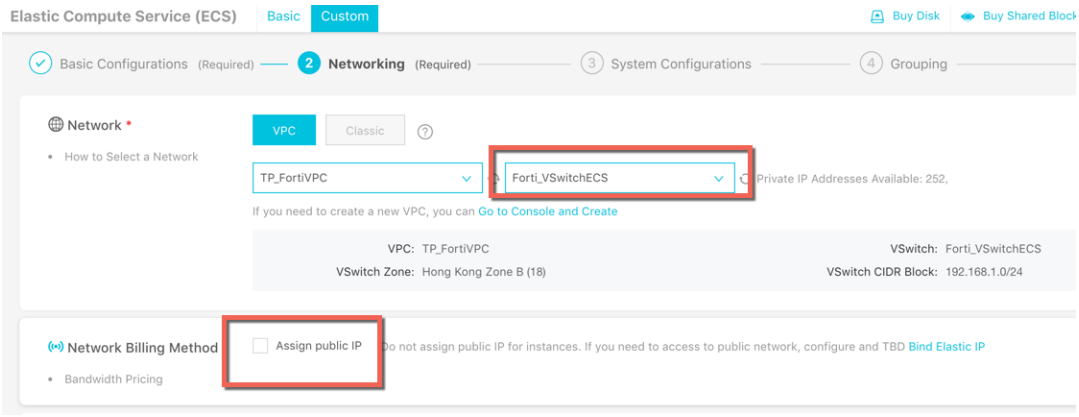
1. In FortiOS, add an IPv4 policy for outbound traffic.
2. Specify the following "ToInternet" policy with AntiVirus, Application Control, and logs allowed for all sessions. Click *OK*.



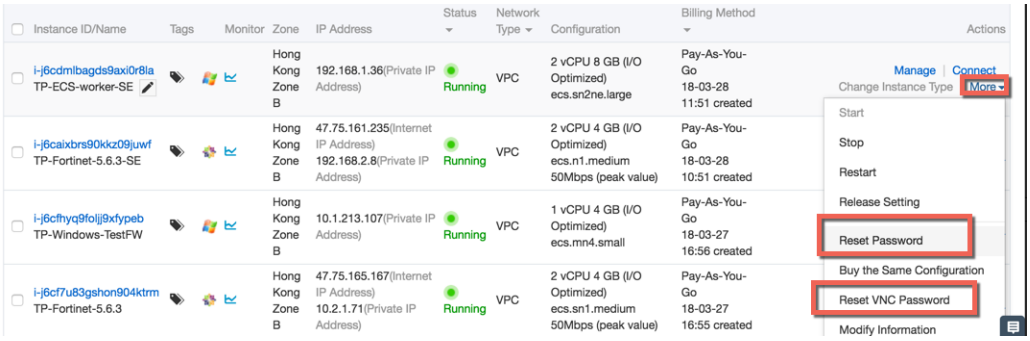
Configuring an ECS worker VM for VNC access

1. In the AliCloud web console, click *Create Instance*.

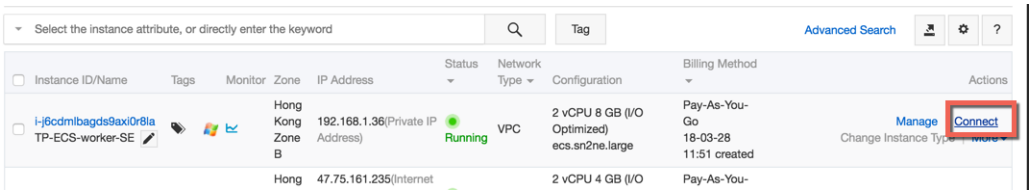
2. Configure the ECS instance so that it does not use the same vSwitch as the FortiGate-VM. In this example, the ECS VSwitch was selected. There is no need to assign a public IP address since an ECS with a public IP address will not route through the FortiGate-VM.



3. Confirm the configuration, then create the instance.
4. Reset the VNC password and login password, then restart the instance.

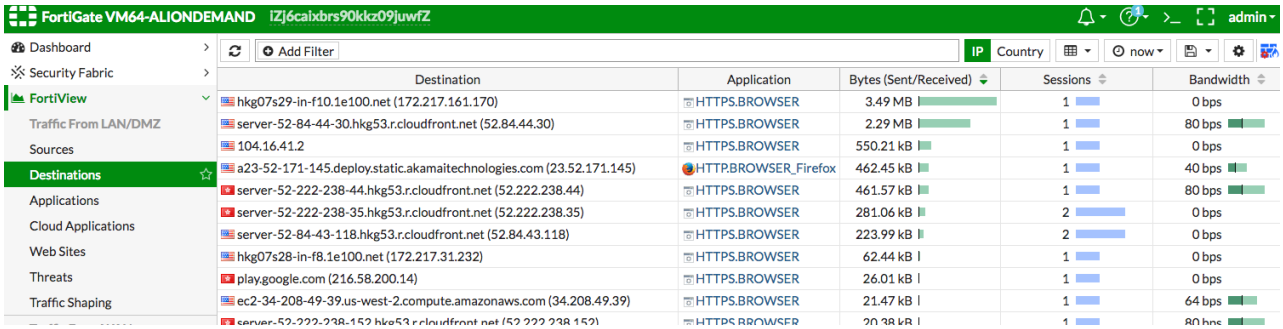


5. Connect to the VNC and log into Windows.



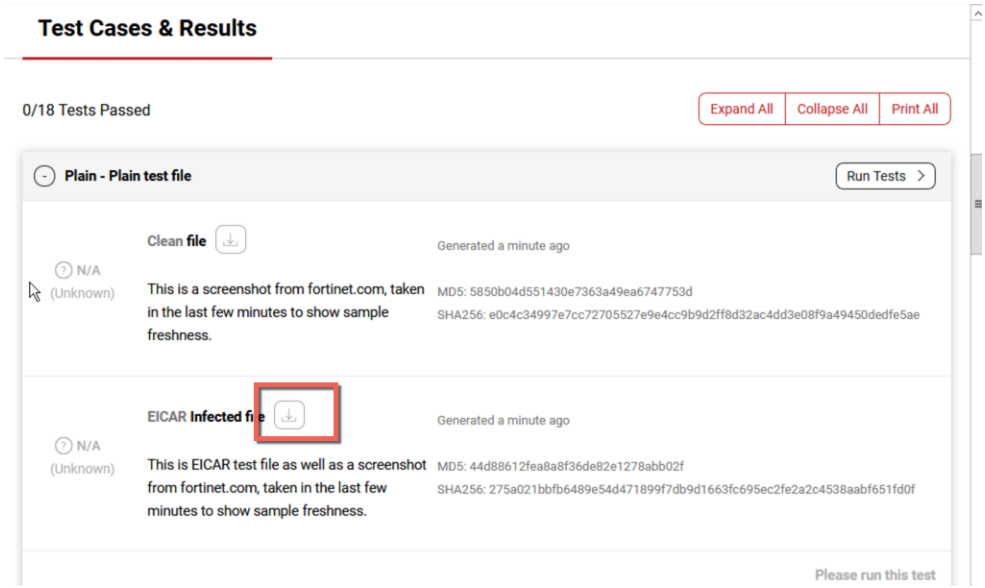
The VM should be able to connect to the Internet through the FortiGate-VM.

FortiOS should also provide detailed log information.



Testing malware scan for outgoing traffic

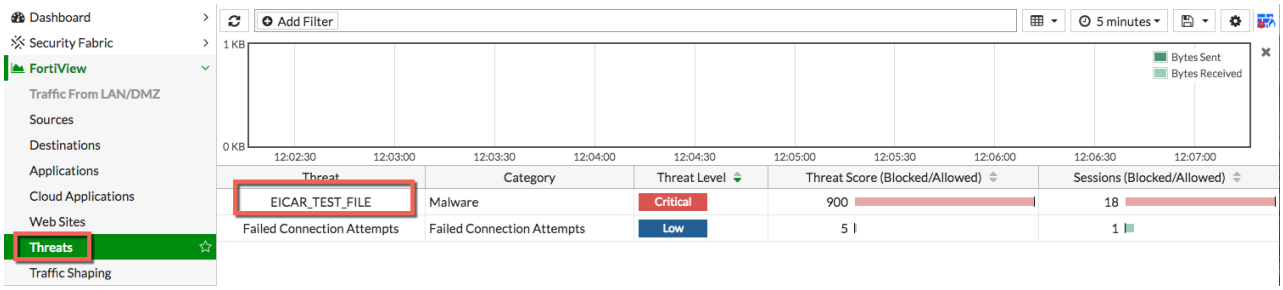
1. On the ECS worker node, visit this website.
2. Click *Run Tests*. If there is no Application Firewall or AntiVirus protection, this test will fail.



FortiGate will block the file from being downloaded.

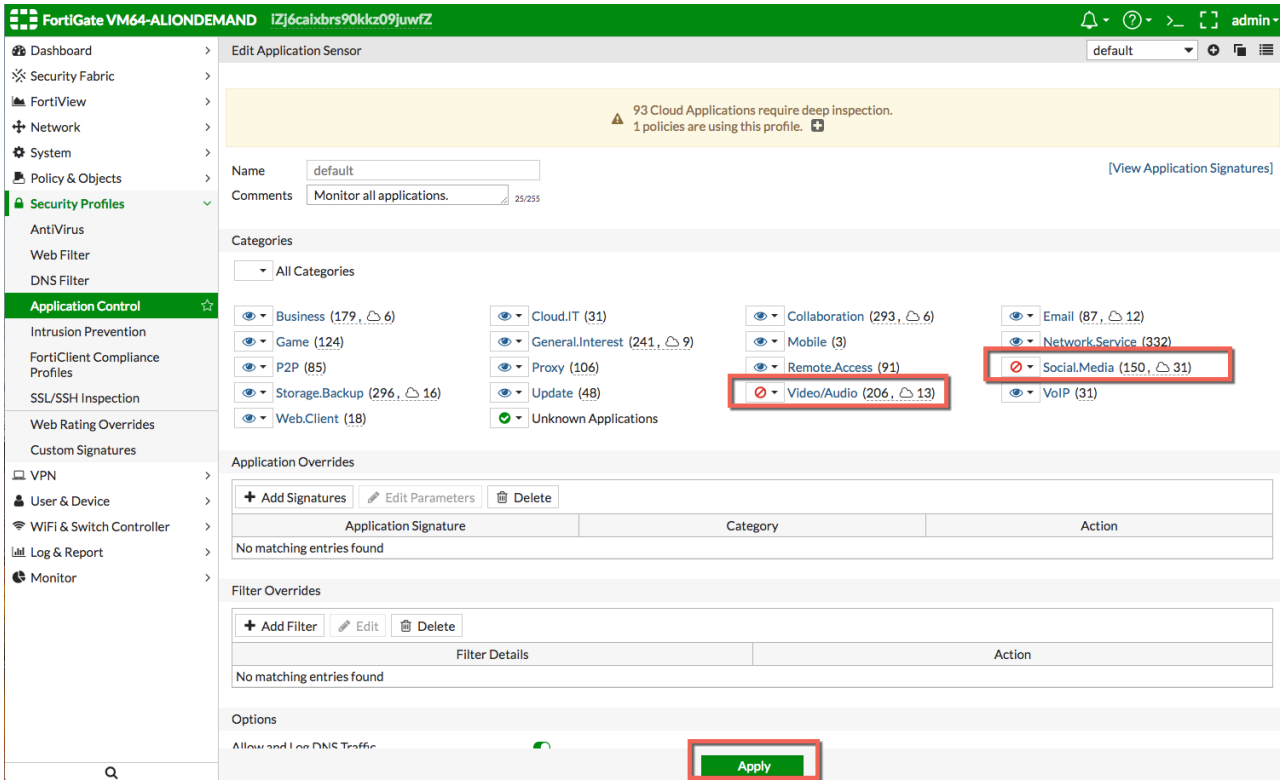
For the best AntiVirus scanning capabilities, ensure the AntiVirus definition is up-to-date in FortiOS.

3. In FortiOS, go to *FortiView* > *Threats*. You should see the attempted file download.

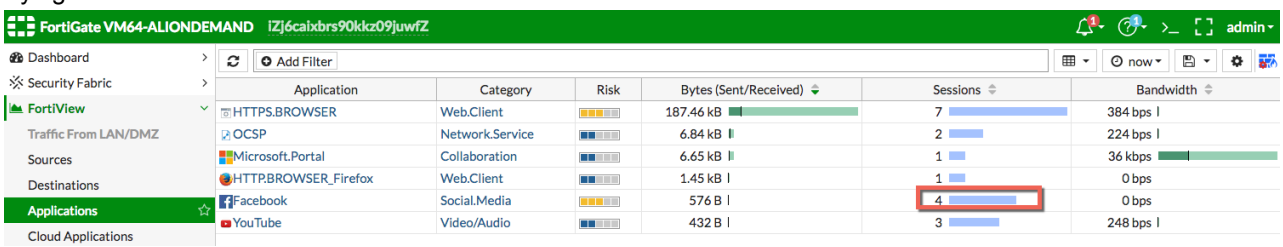


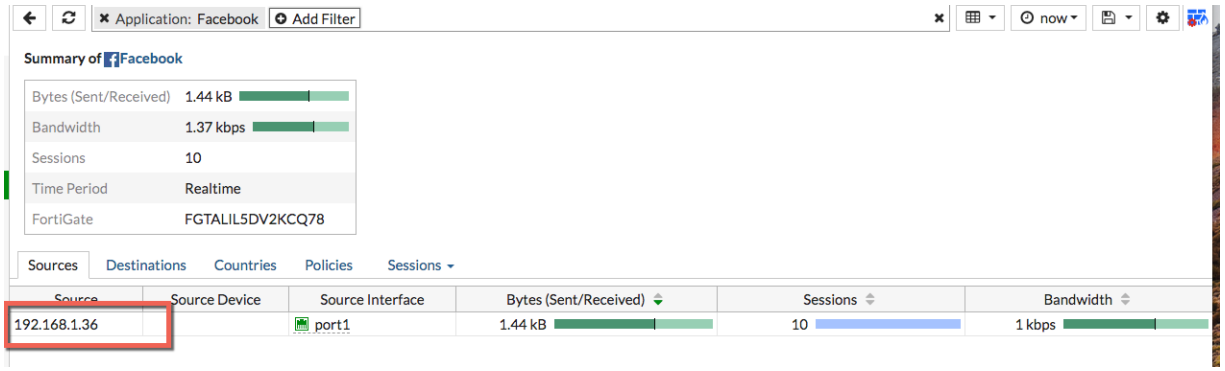
Testing application control for outgoing traffic

1. In FortiOS, go to *Security Profiles* > *Application Control*. Under *Categories*, block *Video/Audio* and *Social Media*. Click *Apply*.



2. On the ECS, attempt to access Facebook and YouTube. It should not be able to connect. FortiOS shows the client trying to connect to Facebook and YouTube.

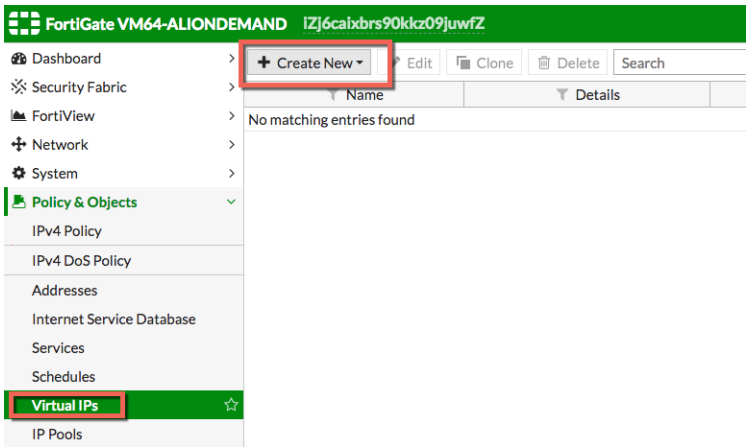




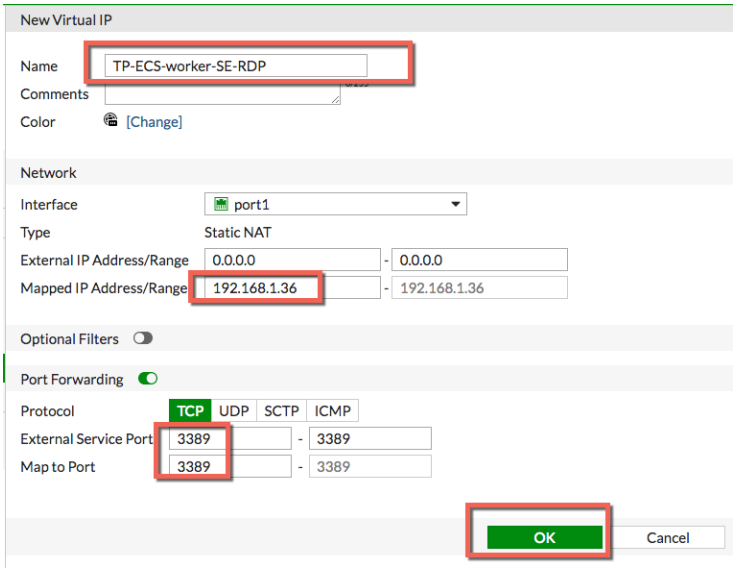
Enabling NAT inbound protection in FortiOS

In this example, you will enable the FortiGate-VM to protect inbound RDP traffic. The same concept can be applied to HTTP/HTTPS and other services. This demonstrates how to configure the FortiGate-VM to monitor inbound and outbound traffic.

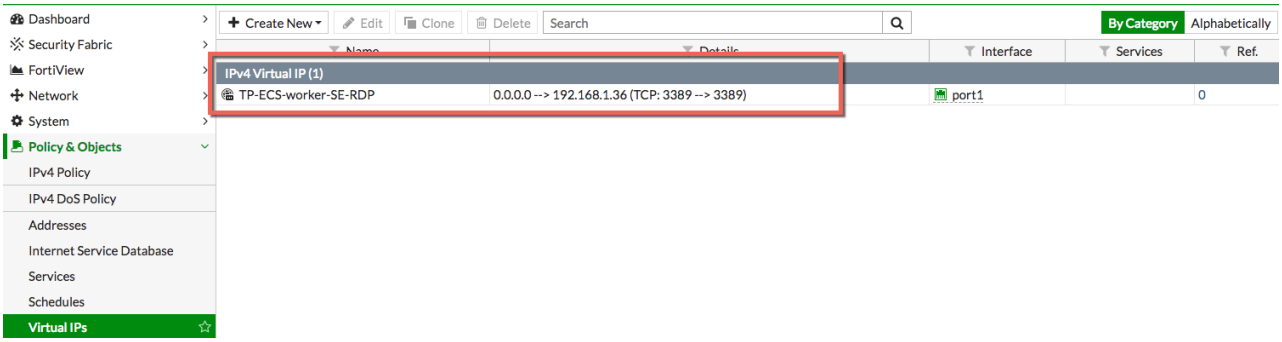
1. In FortiOS, navigate to *Policy & Objects* > *Virtual IPs*.



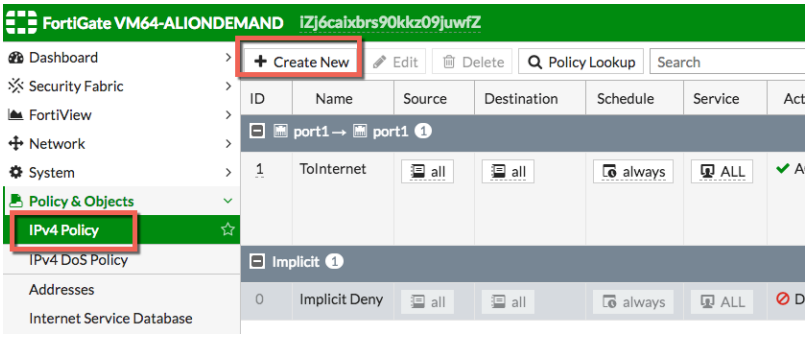
2. Map the FortiGate-VM's 3389 port to the ECS at 192.168.1.36.



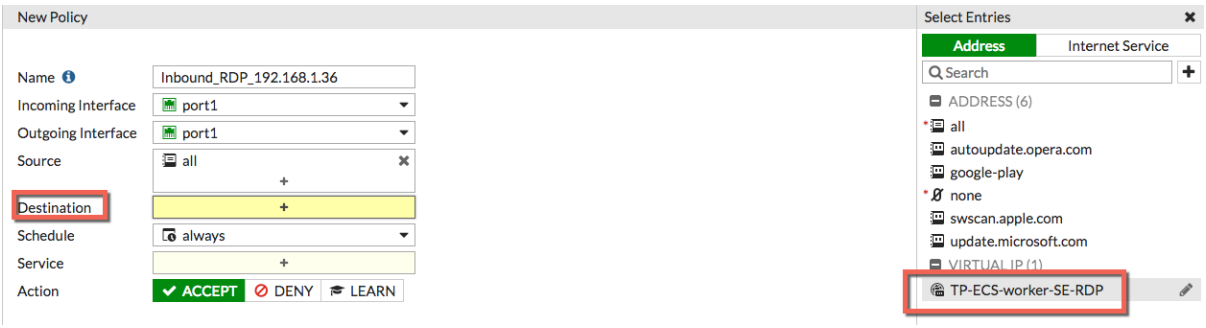
You can now see the newly created virtual IP address.



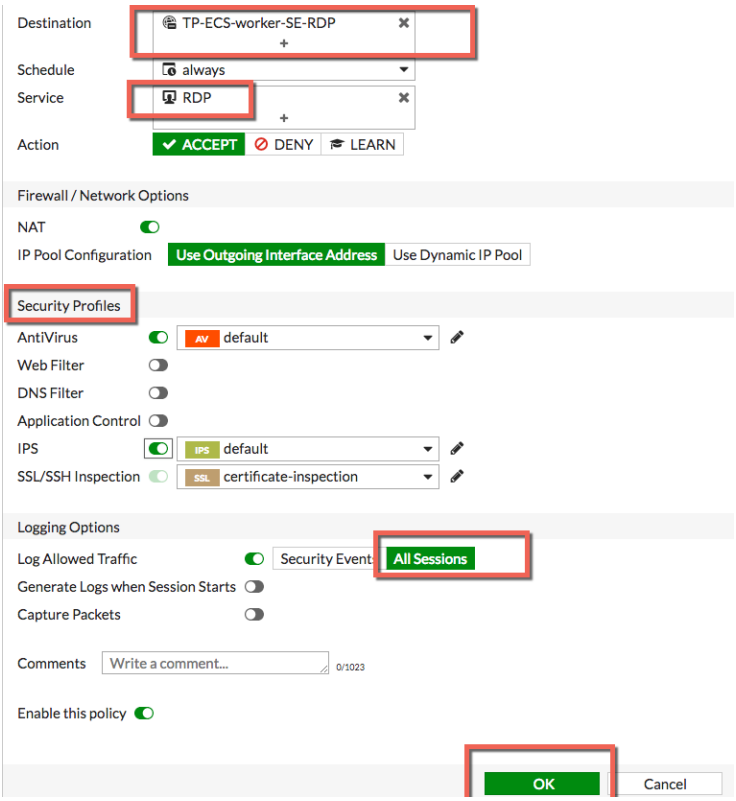
3. Configure the inbound policy for the RDP redirection. Go to *Policy & Objects* > *IPv4 Policy*, then click *Create New*.



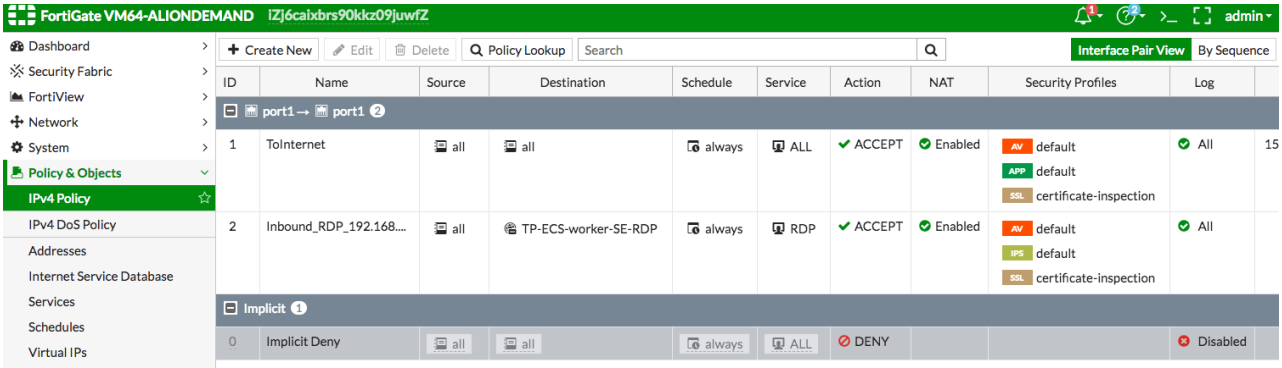
4. Name the rule, then choose the newly created virtual IP address as the destination.



5. Enable the desired security profiles, then log All Sessions for demonstration purposes.



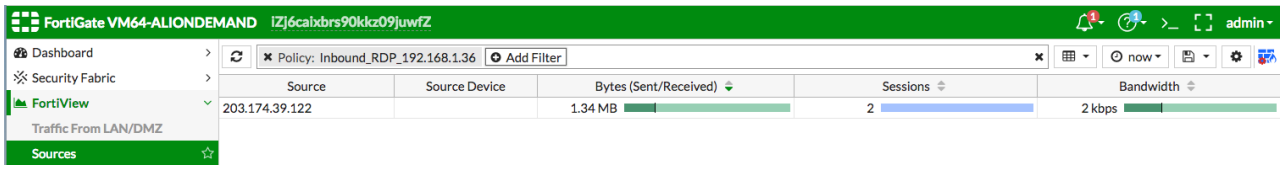
The inbound rule is created successfully.



You can now use the FortiGate public address to RDP into the ECS.

```
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Users\Administrator>ping hk.yahoo.com

Pinging oob-media-router-fp1.prod.media.wg1.b.yahoo.com [106.10.250.11] with 32
bytes of data:
Reply from 106.10.250.11: bytes=32 time=35ms TTL=55
Reply from 106.10.250.11: bytes=32 time=35ms TTL=55

Ping statistics for 106.10.250.11:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 35ms, Maximum = 35ms, Average = 35ms
Control-C
^C
C:\Users\Administrator>
```

You can also view the logs and session information in FortiOS.



HA for FortiGate-VM on AliCloud

There are different ways to configure active-passive HA on FortiGate-VM for AliCloud.

The first deployment scenario, described in Deploying and configuring FortiGate-VM on AliCloud using HAVIP on page 23, depends on the HAVIP function that AliCloud provides. In this scenario, you must locate both the internal and external interface at port1. The primary and secondary FortiGates share the same IP address. Failover may be quicker than in the second scenario, since there are no EIPs or route tables to update. This scenario natively supports session pickup.

The second deployment scenario, described in Deploying FortiGate-VM HA on AliCloud using routing tables and EIPs on page 46, achieves HA by introducing EIP moving and route table updating capabilities. In this scenario, you can locate the internal and external interface on different interfaces. Optionally, you can also leverage HAVIP for external traffic on port1 and internal traffic on port2 for increased efficiency and flexibility. This scenario supports session pickup, but in a more limited way than in the first scenario.

Consider the following when deciding which HA scenario to deploy:

- If you need session pickup capabilities and cannot disable NAT for incoming firewall policies, you must use the first scenario.
- If you need session pickup capabilities and can disable NAT for incoming firewall policies, you can use the second scenario with HAVIP on port1 and attach an EIP to the HAVIP. This scenario does not require EIP moving but does require route table updating for internal traffic. This scenario provides the best balance between flexibility and efficiency.
- If you cannot use port1 for external traffic, you must use the second scenario with EIP moving and route table updating. This may require more failover time.

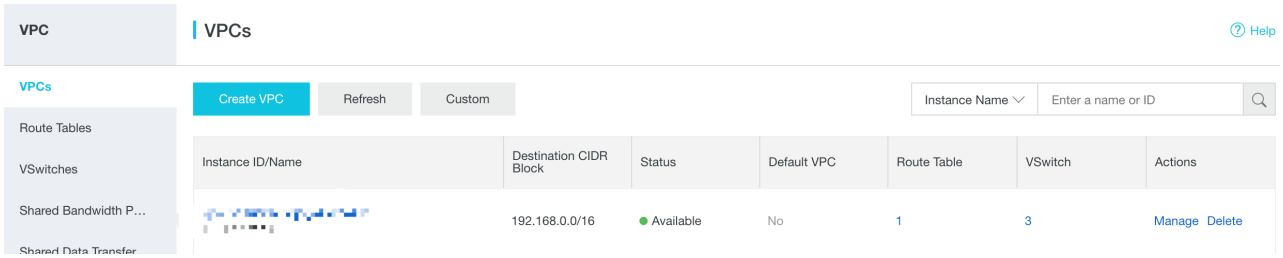
Deploying and configuring FortiGate-VM on AliCloud using HAVIP

You can configure active-passive HA with two FortiGate-VM instances using HAVIP, which is configurable on the AliCloud platform. FortiGate-VM configuration is synchronized between the two instances. When a primary/master FortiGate-VM is down, a failover to a secondary/slave FortiGate-VM occurs while sessions are kept, and the secondary unit is promoted to become the primary unit. HAVIP forwards traffic to the new primary FortiGate-VM while keeping switching time minimal.

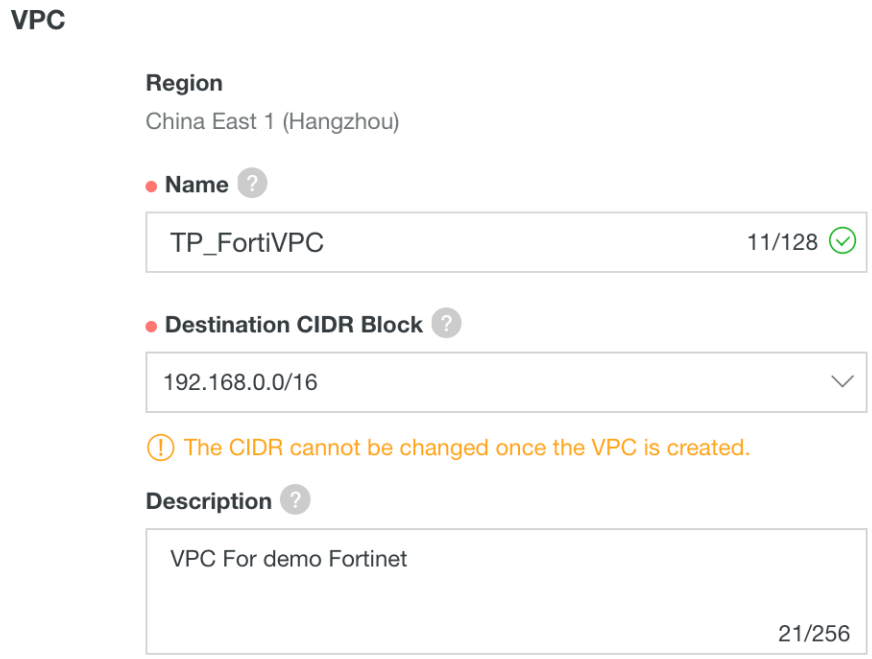
In this scenario, the AliCloud VPC cannot create multiple route tables, and the VPC only supports one-arm deployment mode. HAVIP covers an inter-VPC service, and the VPC default route points to the HAVIP. VPC outbound traffic forwards to the HAVIP, then forwards to the primary FortiGate-VM. You must bind the HAVIP to an EIP for VPC inbound traffic.

Setting up the VPC

1. Assuming this is a new environment, the first step is to create the VPC. Click *Create VPC*.

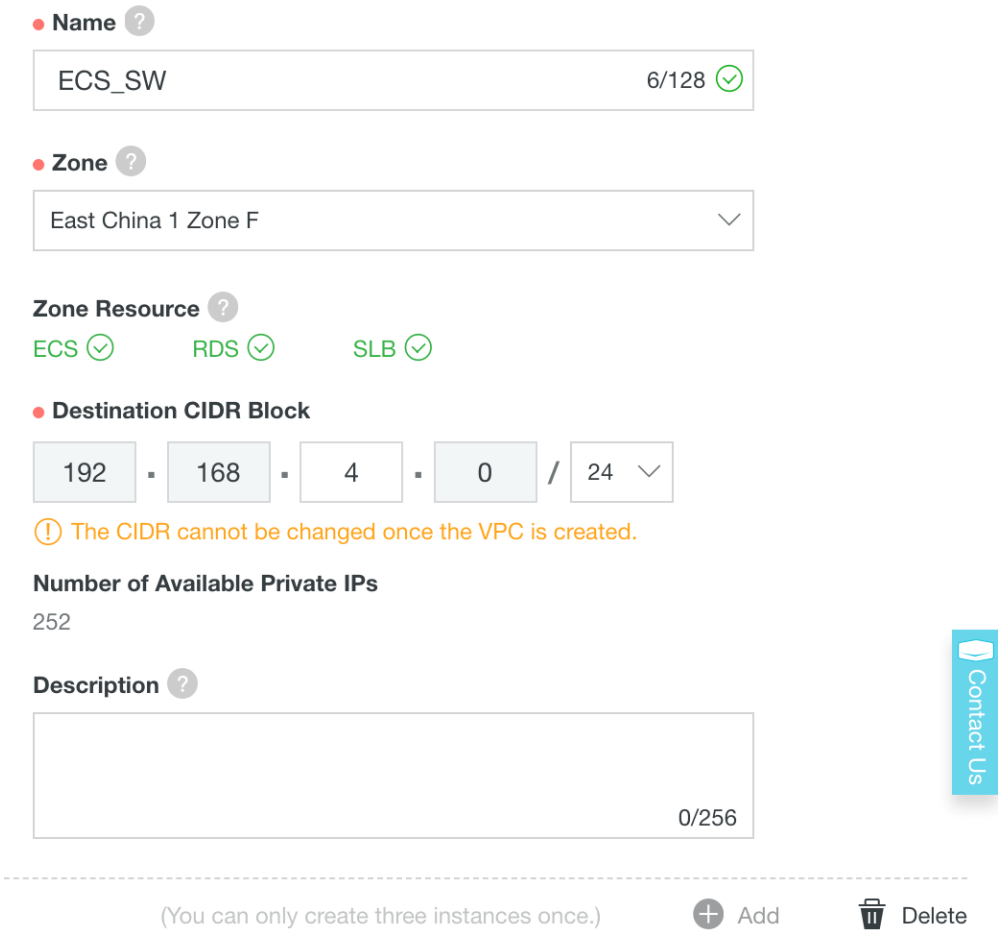


2. Name the VPC TP_FortiVPC.

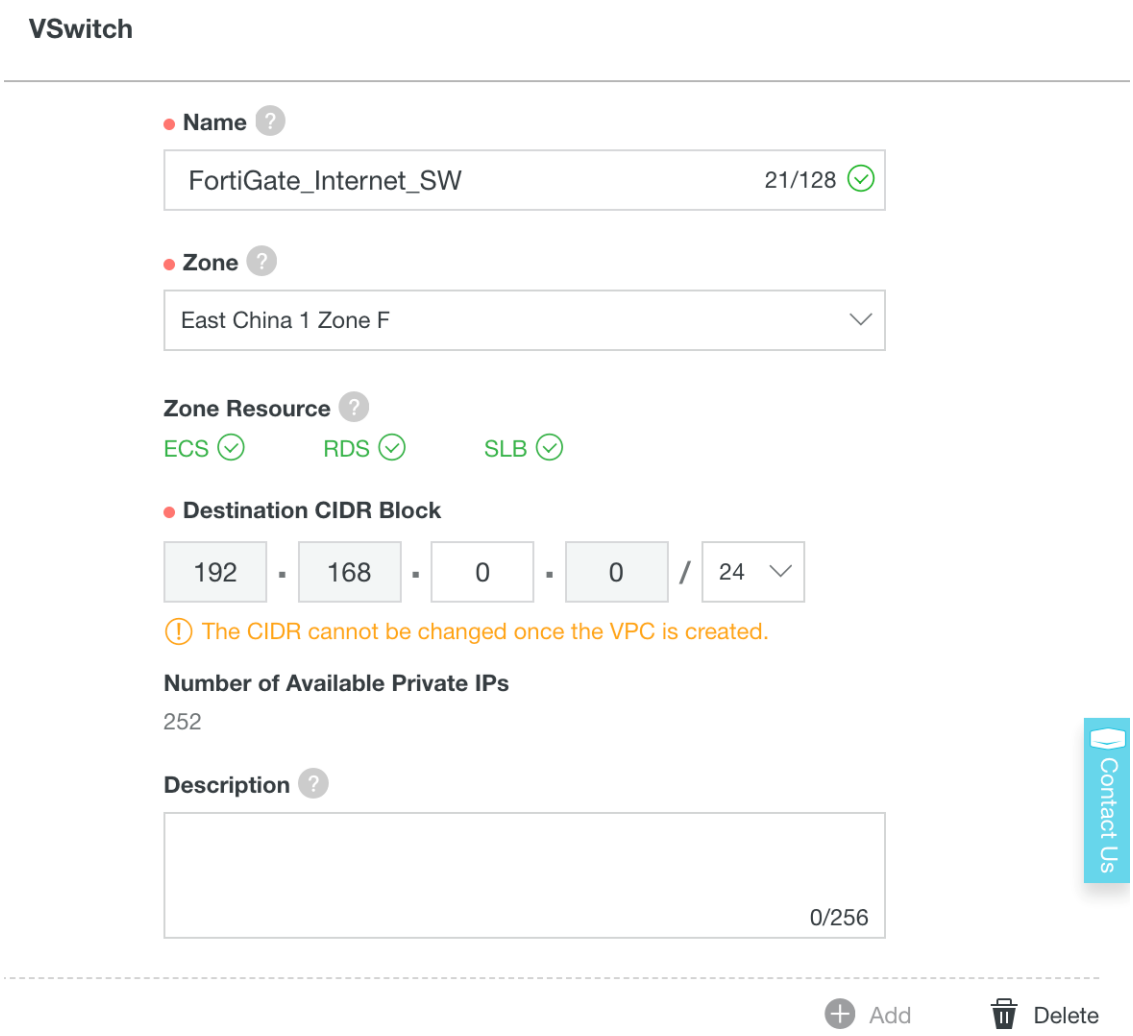


3. In this scenario, you need at least three VSwitches: one for the ECS, one for the FortiGate-VM inbound/outbound interface, and one for the FortiGate-VM HA interface. You can also create a fourth VSwitch for the FortiGate

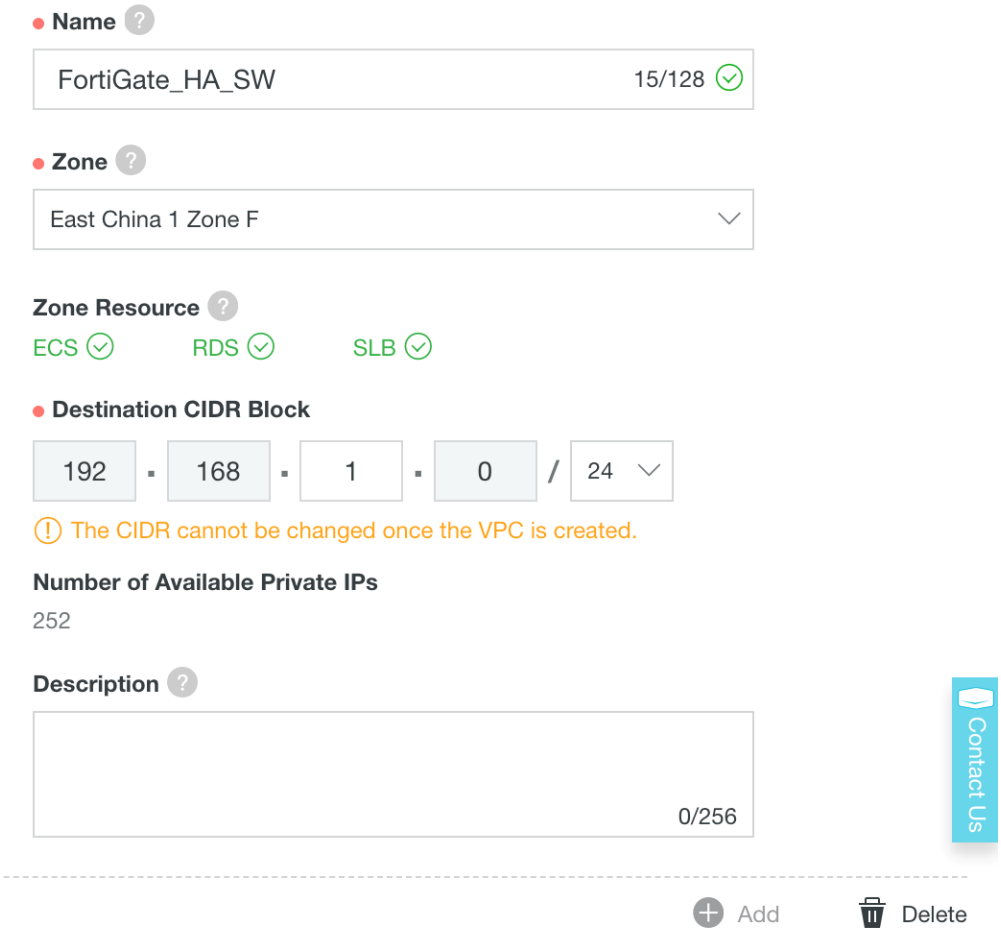
reserved management interface. Create the ECS VSwitch first, as seen below.



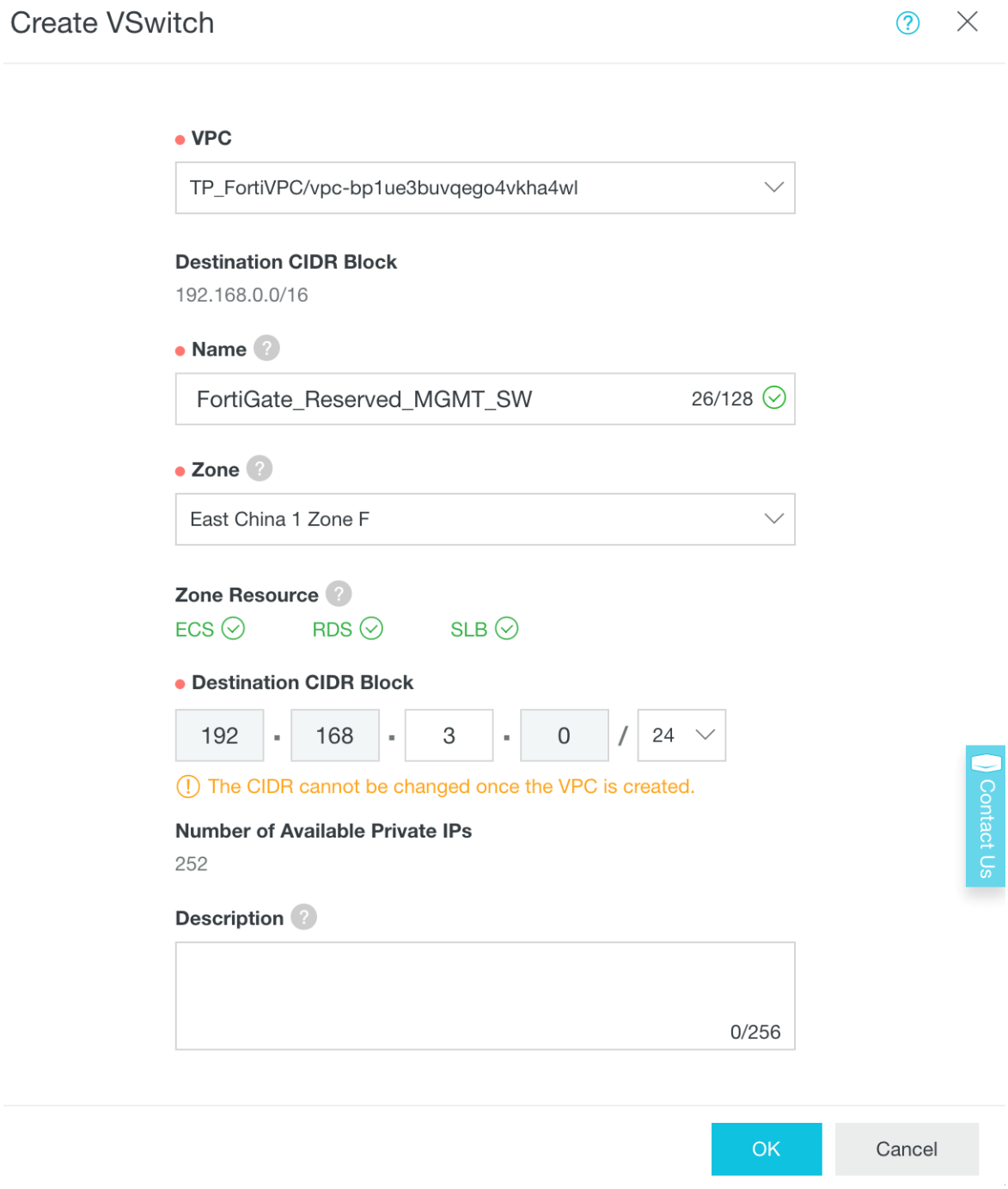
4. Create the VSwitch for the FortiGate-VM inbound/outbound interface, as seen below.



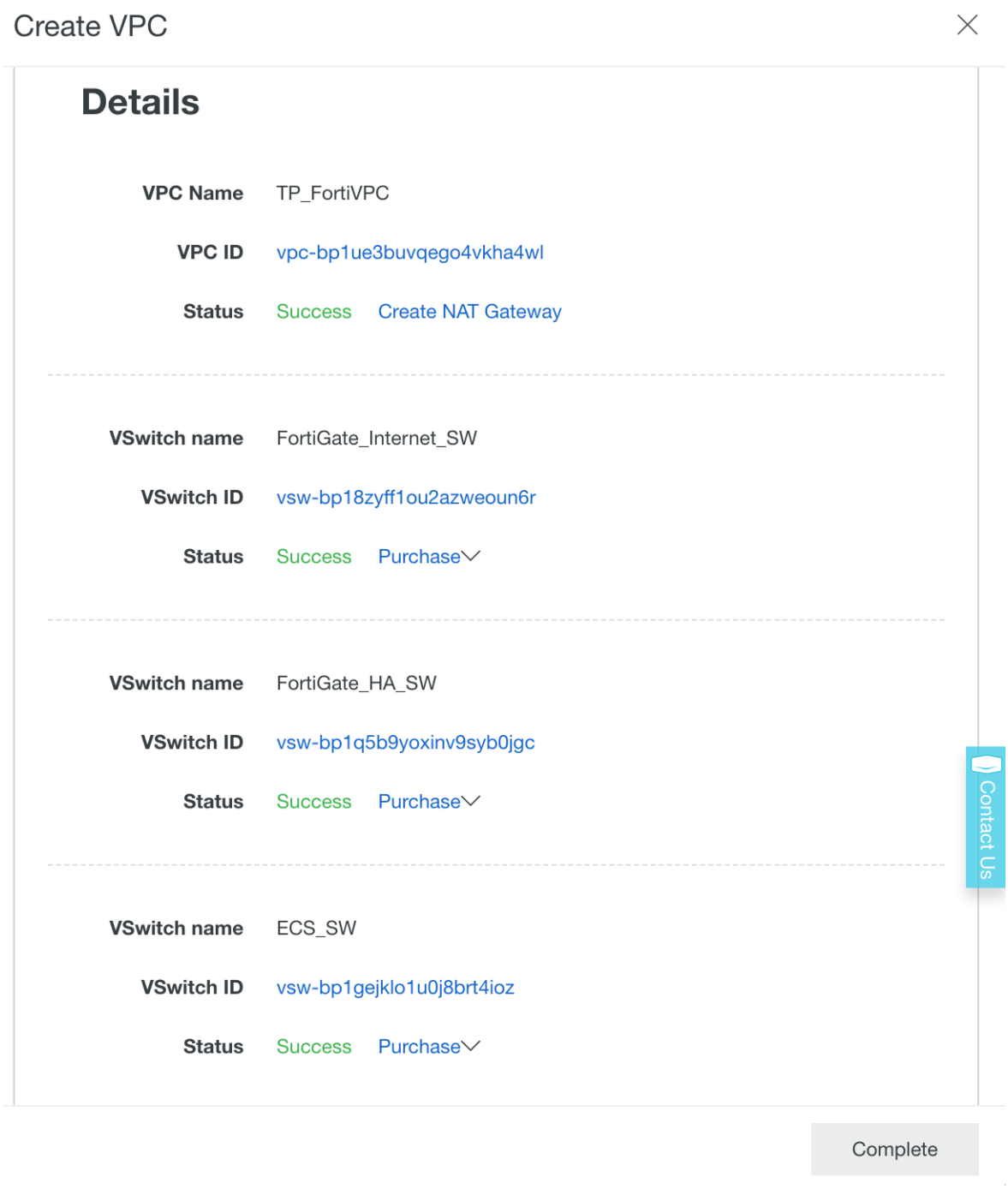
5. Create the VSwitch for the FortiGate-VM HA interface, as seen below.



6. (Optional) Create the VSwitch for the FortiGate reserved management interface.



The VPC is now ready.

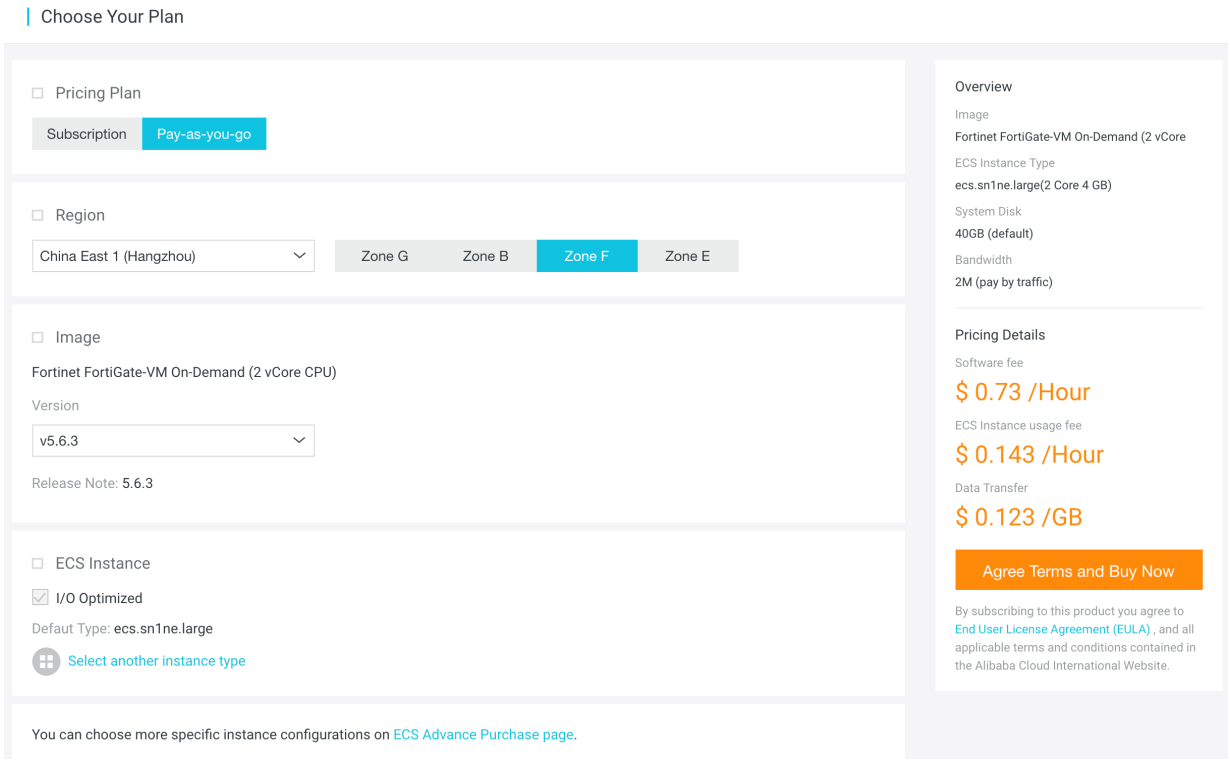


Subscribing to the FortiGate-VM in the marketplace

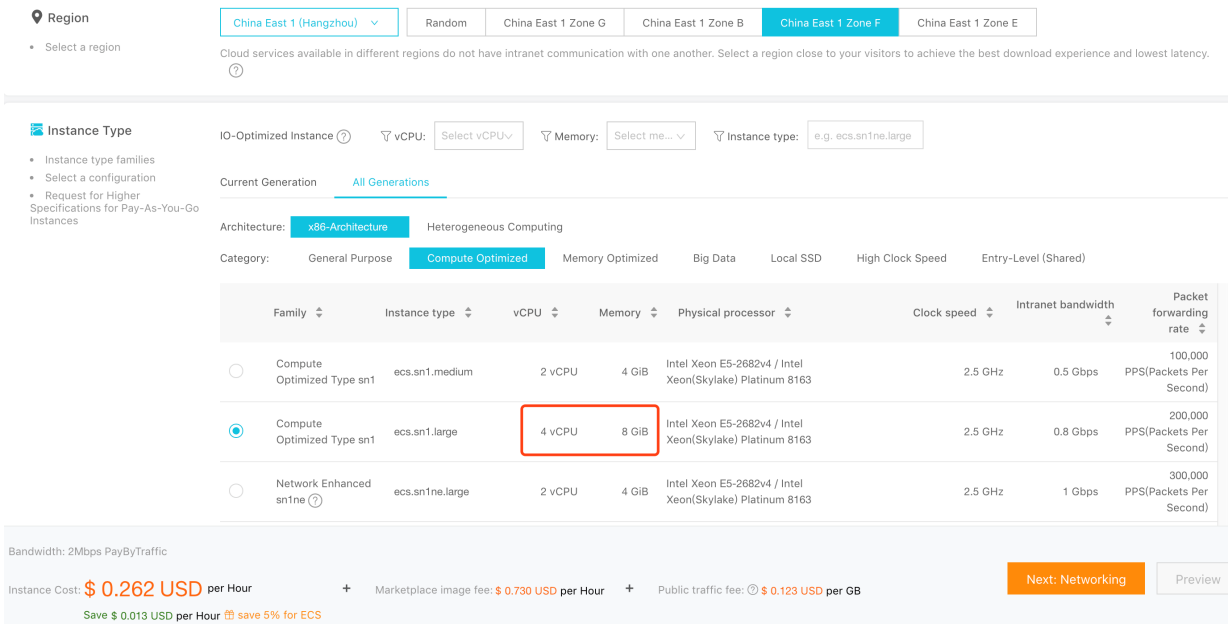
1. Go to the AliCloud Marketplace and search for Fortinet.
2. You will now create the FortiGate-VM instance. If you have your own FortiGate-VM license, select the BYOL image. Otherwise, select the on-demand image.

a. Click *Choose Your Plan*.

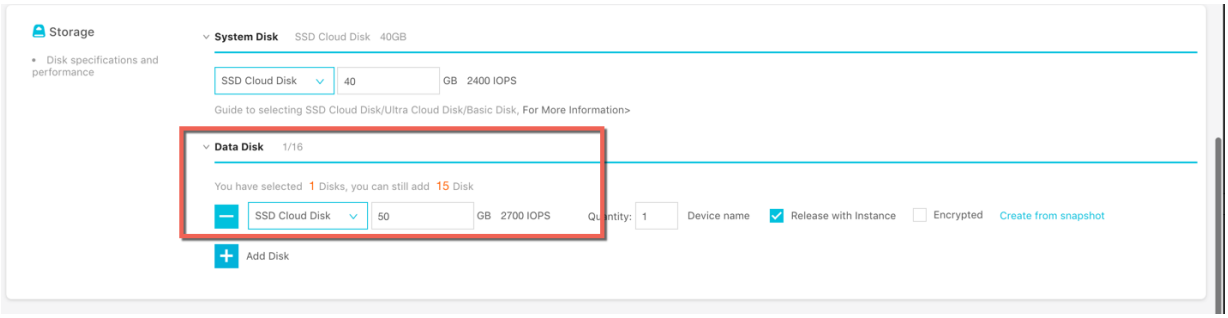
b. In this example, PAYG, China East 1 (Hangzhou), and Zone F were selected for the pricing plan, region, and zone, respectively. Zone F is the location of the VPC and VSwitches. Click *ECS Advance Purchase page* to customize the data disk and VPC information.



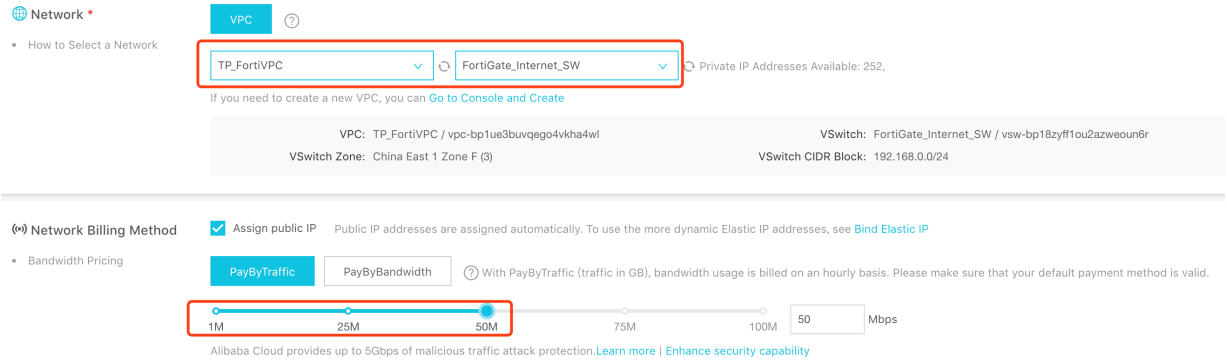
c. Click the ECS type with 4 vCPU to launch the FortiGate instance. The 4 vCPU ECS can support a maximum of 3 NIC, while the 2 vCPU ECS can support 2 NIC. If the FortiGate reserved management interface is required, select the 4 vCPU ECS type.



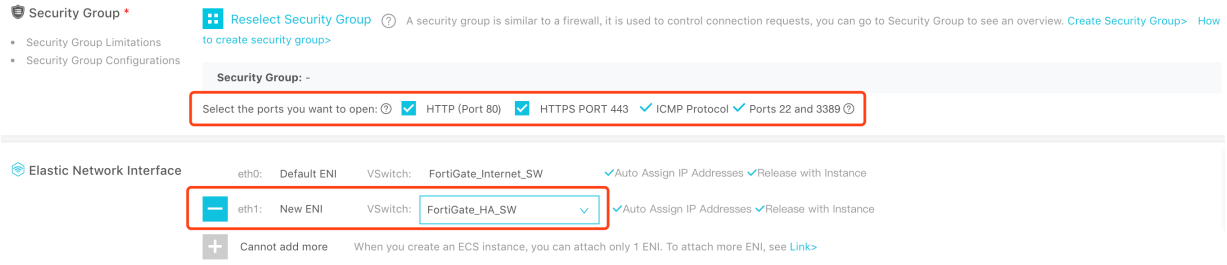
d. Add a data disk for logs. It is suggested to use SSD for better performance.



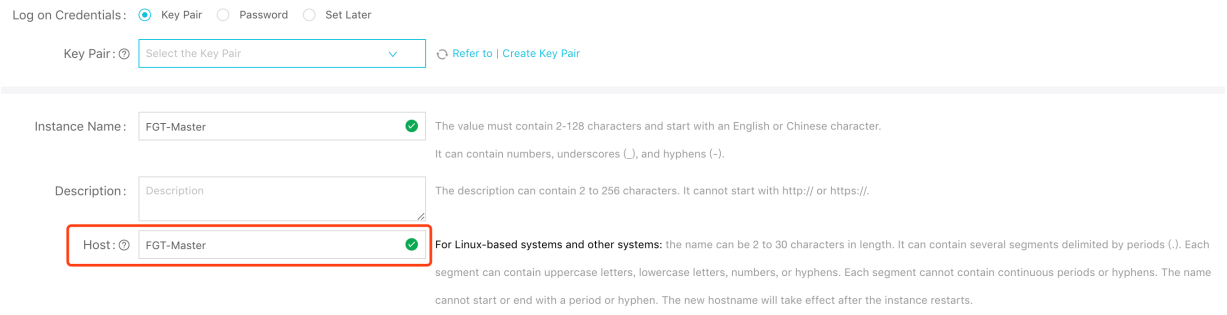
e. In the *Network* section, select TP_FortiVPC and Forti_internet_SW. Assign a public IP address to the image. This NIC will be port1 on the FortiGate-VM, the default ENI.



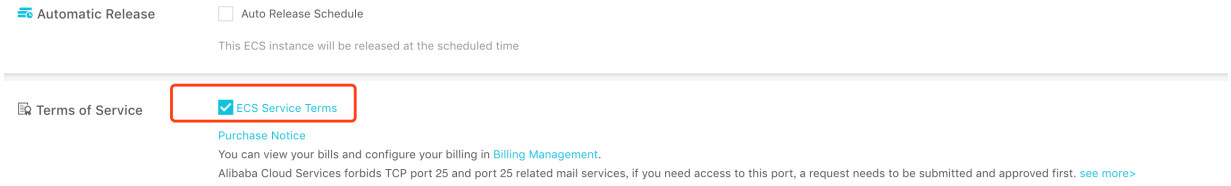
f. Leave the HTTPS, ICMP, and SSH ports and protocols open to allow connection. Add another ENI on FortiGate_HA_SW. This ENI will be port2 on the FortiGate.



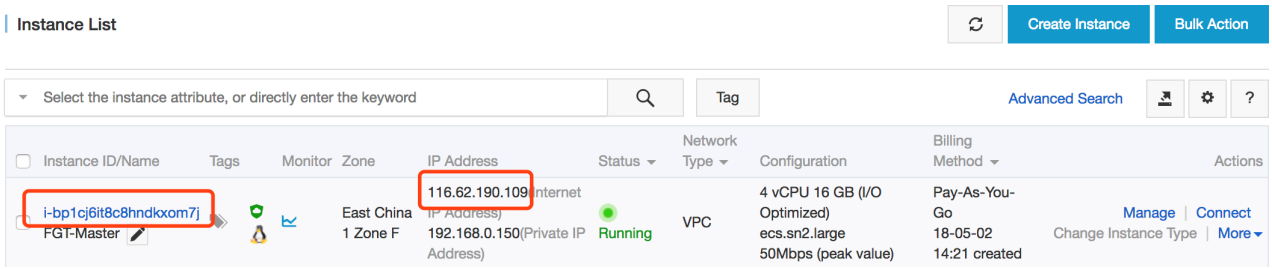
g. In the *Host* field, enter the FortiGate hostname.



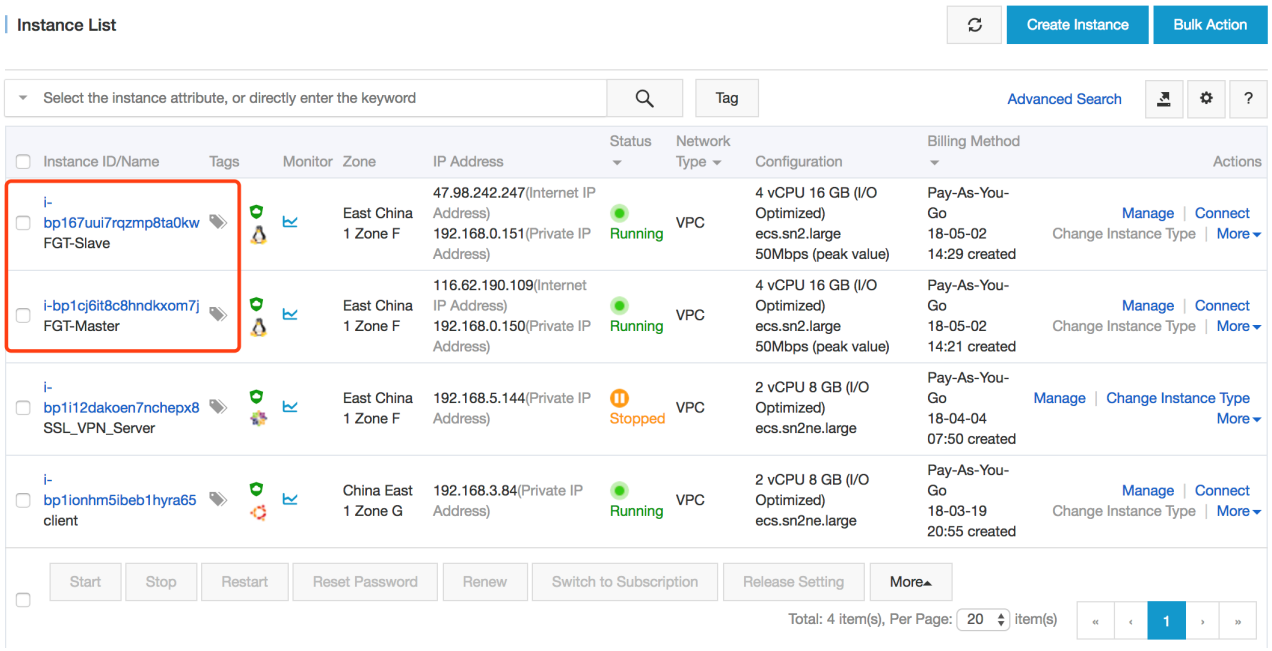
h. Click *ECS Service Terms*.



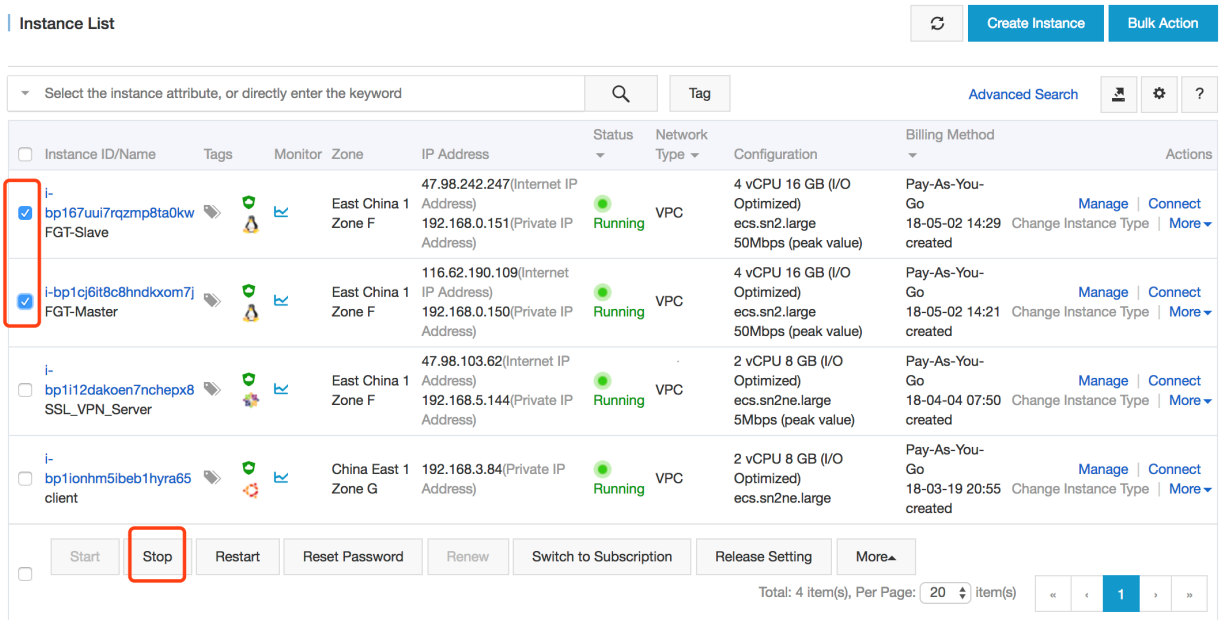
3. Click *Console* to return to the ECS instance list.
4. You can see that the VM has been created. Mark down the public IP address and the instance ID for later use. The instance ID is the FortiGate default password.



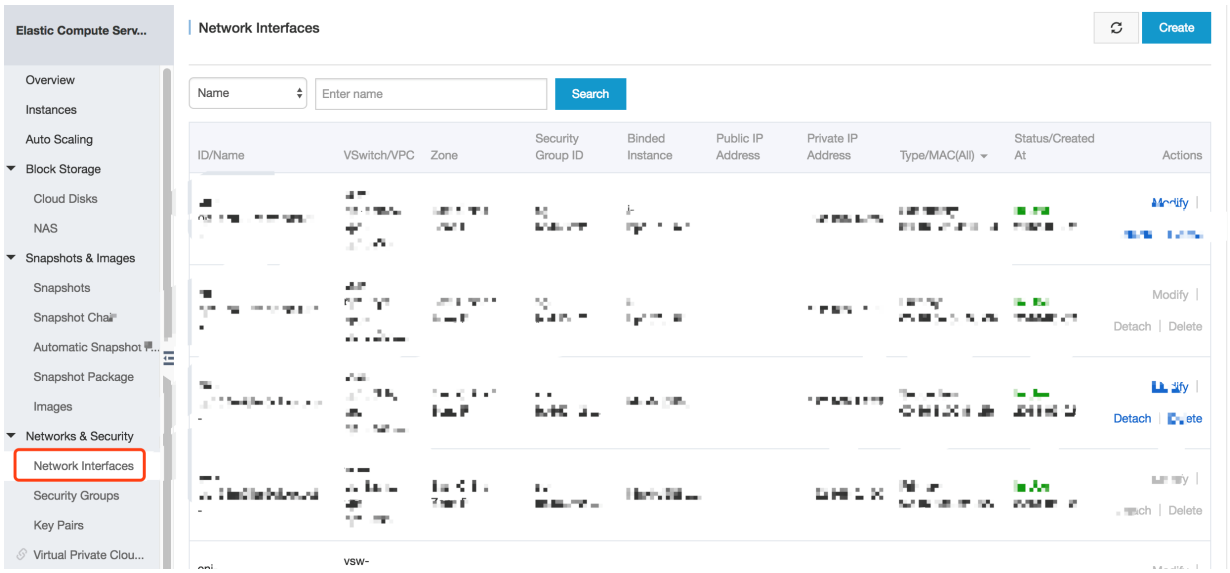
5. Repeat steps 1 and 2 to create another FortiGate instance, named FGT-Slave.

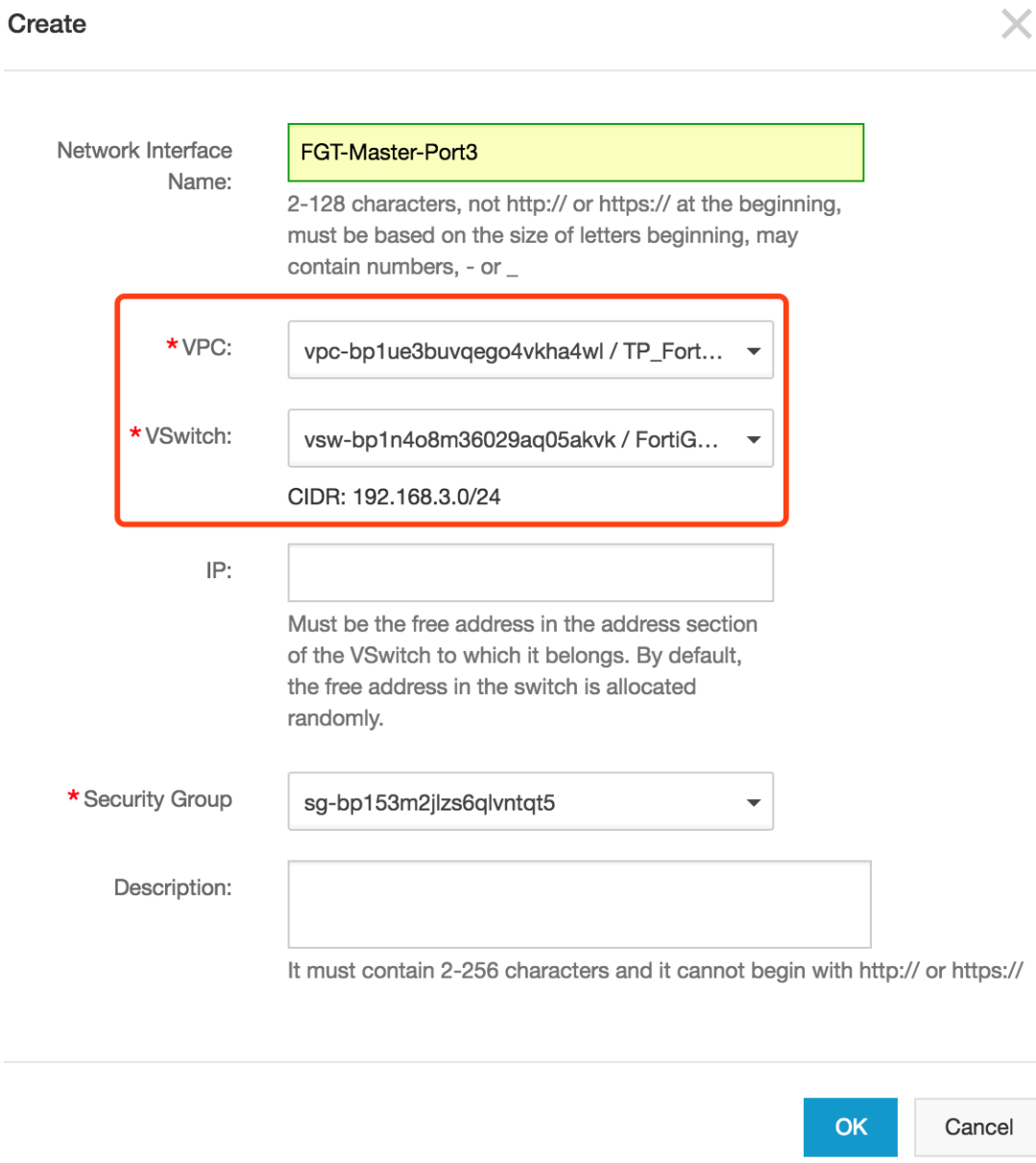


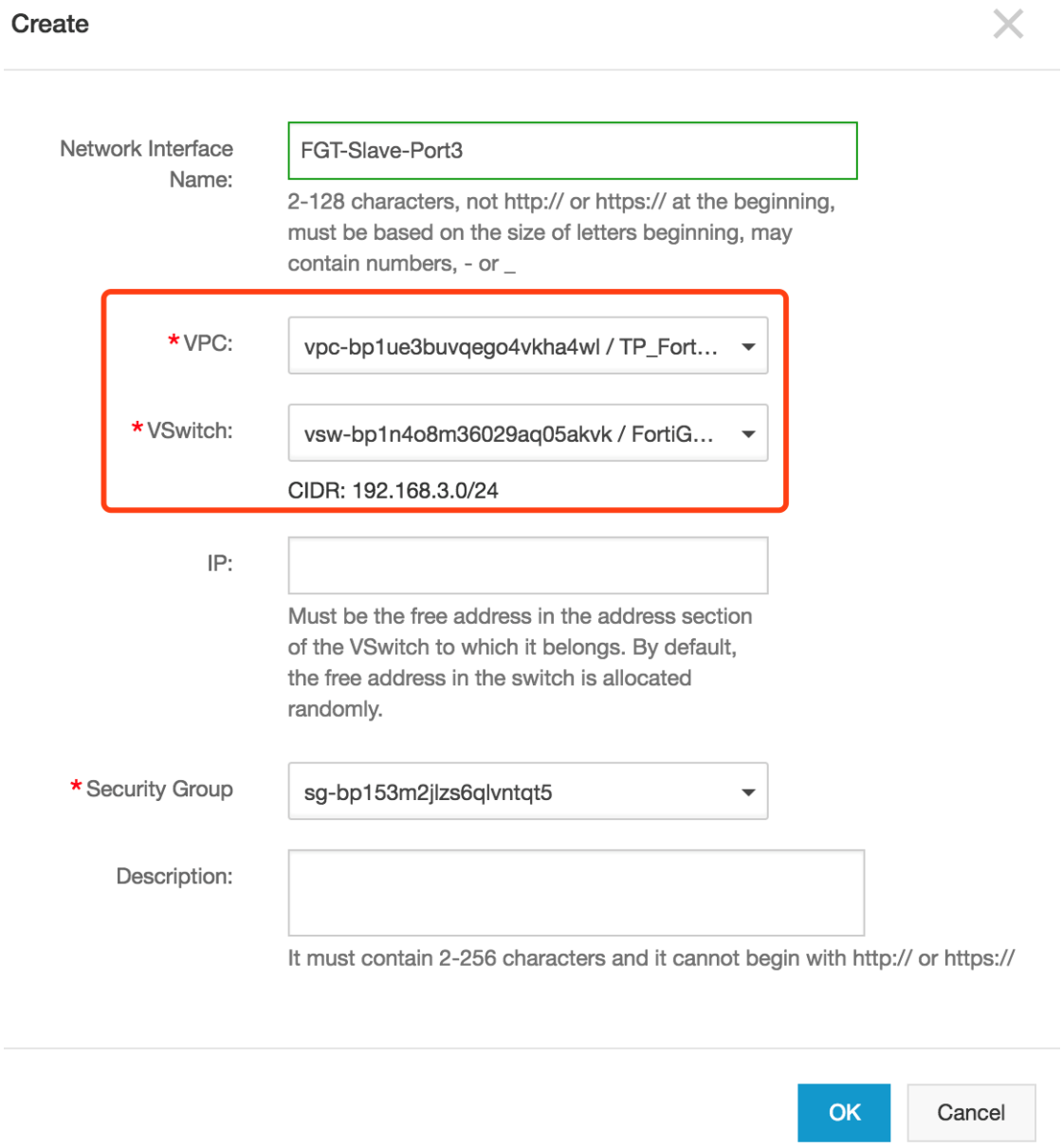
6. You can create two ENI and attach them to the FortiGate instances. This step is optional.
   a. Stop the two FortiGate instances.



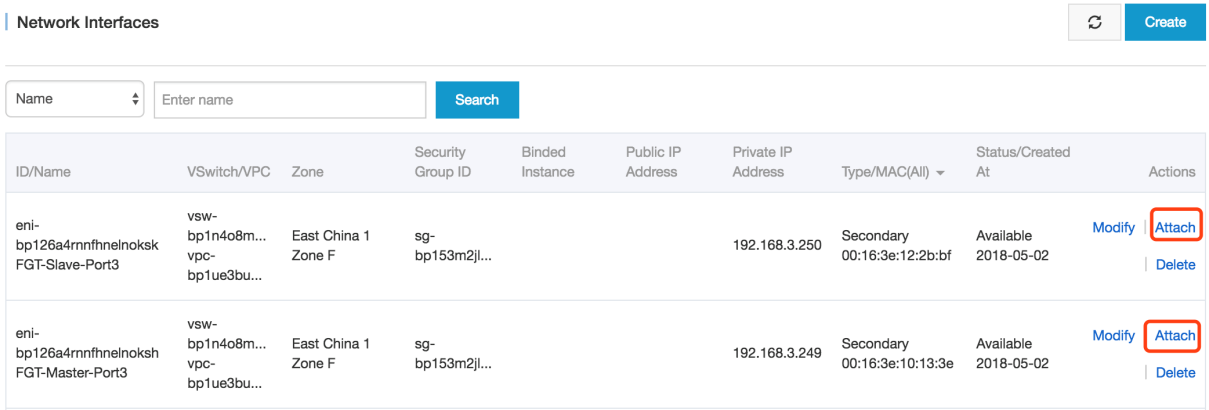
   b. Go to *Networks & Security* > *Network Interfaces* and create two ENI.

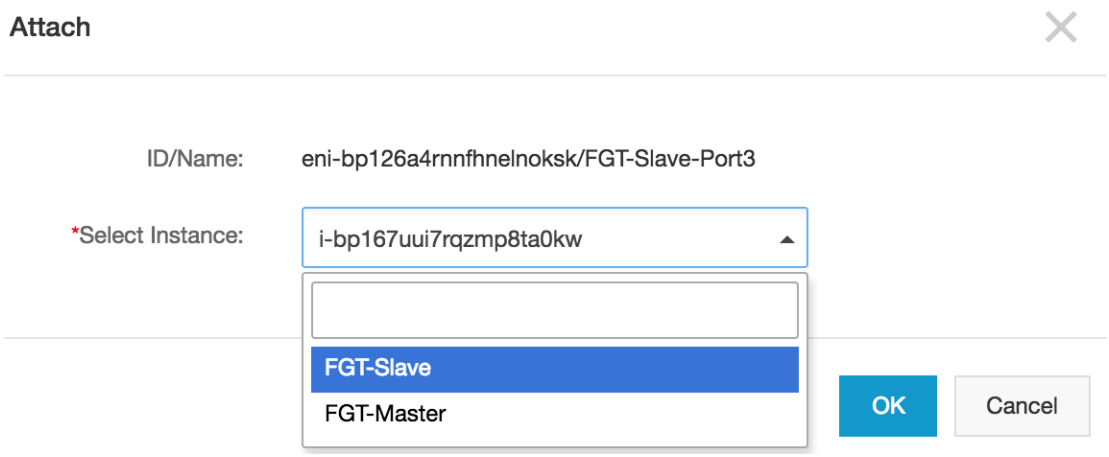


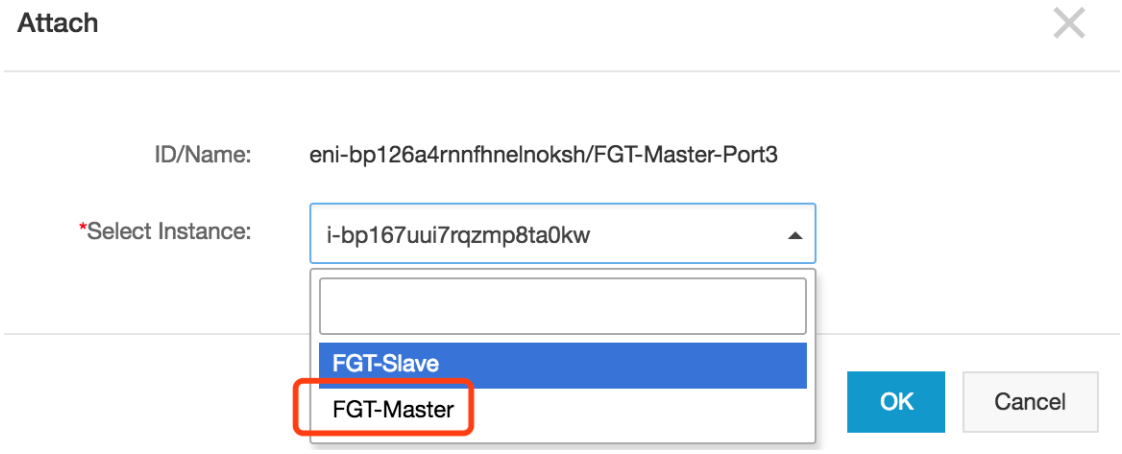

Create
Network Interface Name:
FGT-Master-Port3
2-128 characters, not http:// or https:// at the beginning, must be based on the size of letters beginning, may contain numbers, - or _
* VPC:
vpc-bp1ue3buvqego4vkha4wl / TP_Fort...
* VSwitch:
vsw-bp1n4o8m36029aq05akvk / FortiG...
CIDR: 192.168.3.0/24
IP:
Must be the free address in the address section of the VSwitch to which it belongs. By default, the free address in the switch is allocated randomly.
* Security Group
sg-bp153m2jlzs6qlvntqt5
Description:
It must contain 2-256 characters and it cannot begin with http:// or https://
OK
Cancel

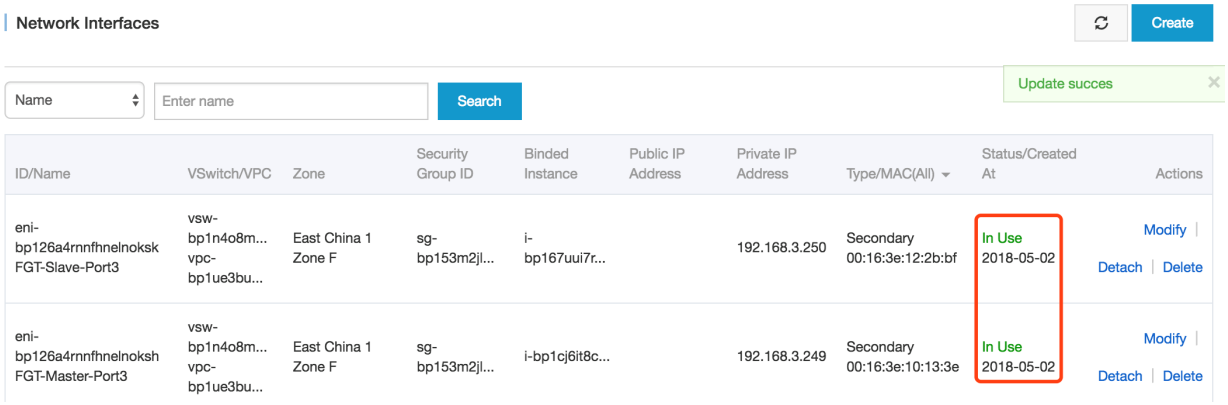


c. Attach the two new ENI to the two FortiGate instances.

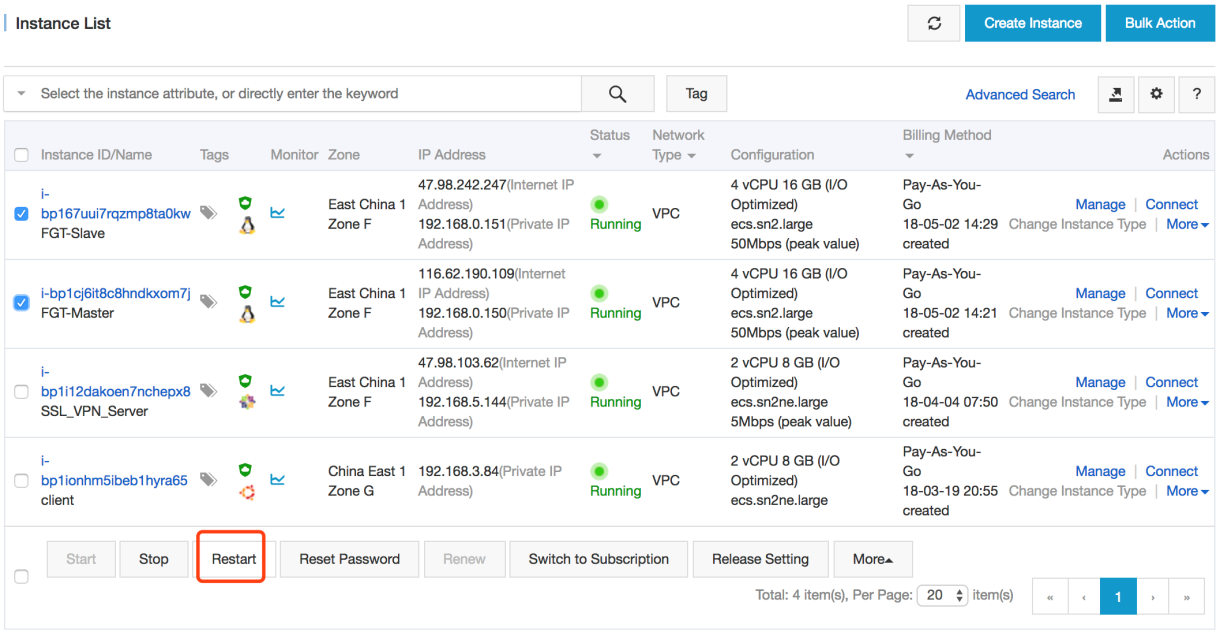



Attach
ID/Name:
eni-bp126a4rnnfhnelnoksk/FGT-Slave-Port3
*Select Instance:
i-bp167uui7rqzmp8ta0kw
FGT-Slave
FGT-Master
OK
Cancel

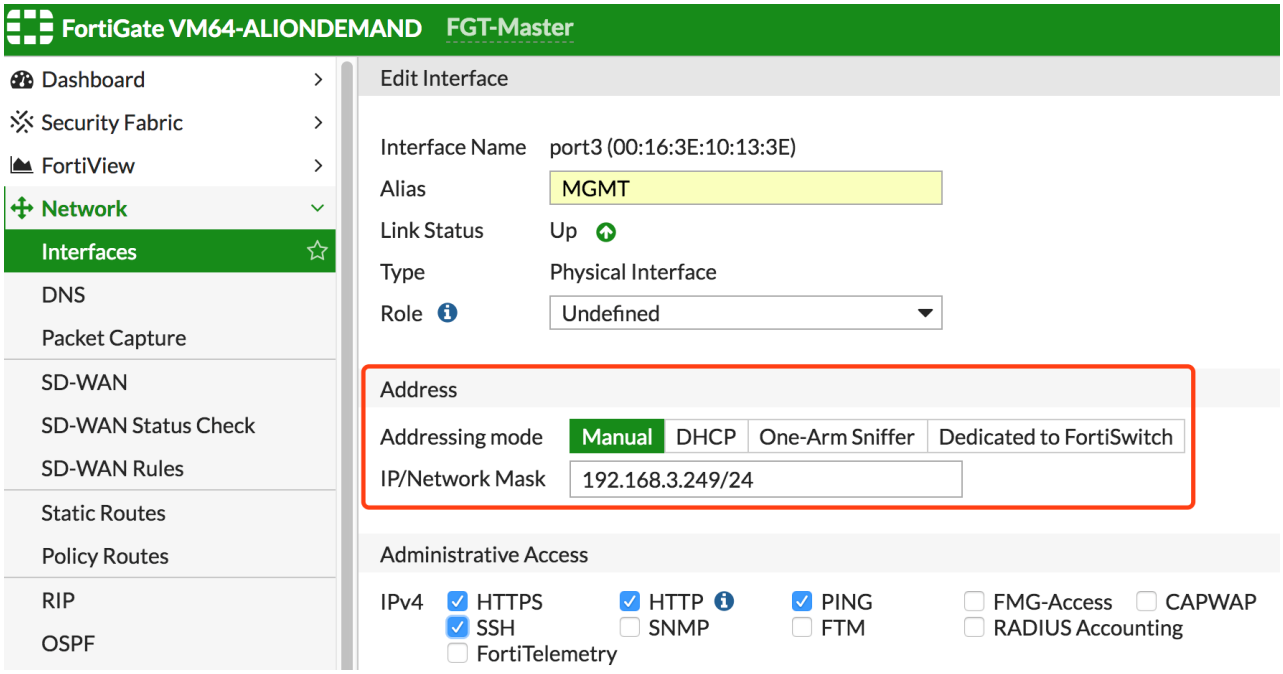

Attach
ID/Name:
eni-bp126a4rnnfhnelnoksh/FGT-Master-Port3
*Select Instance:
i-bp167uui7rqzmp8ta0kw
FGT-Slave
FGT-Master
OK
Cancel

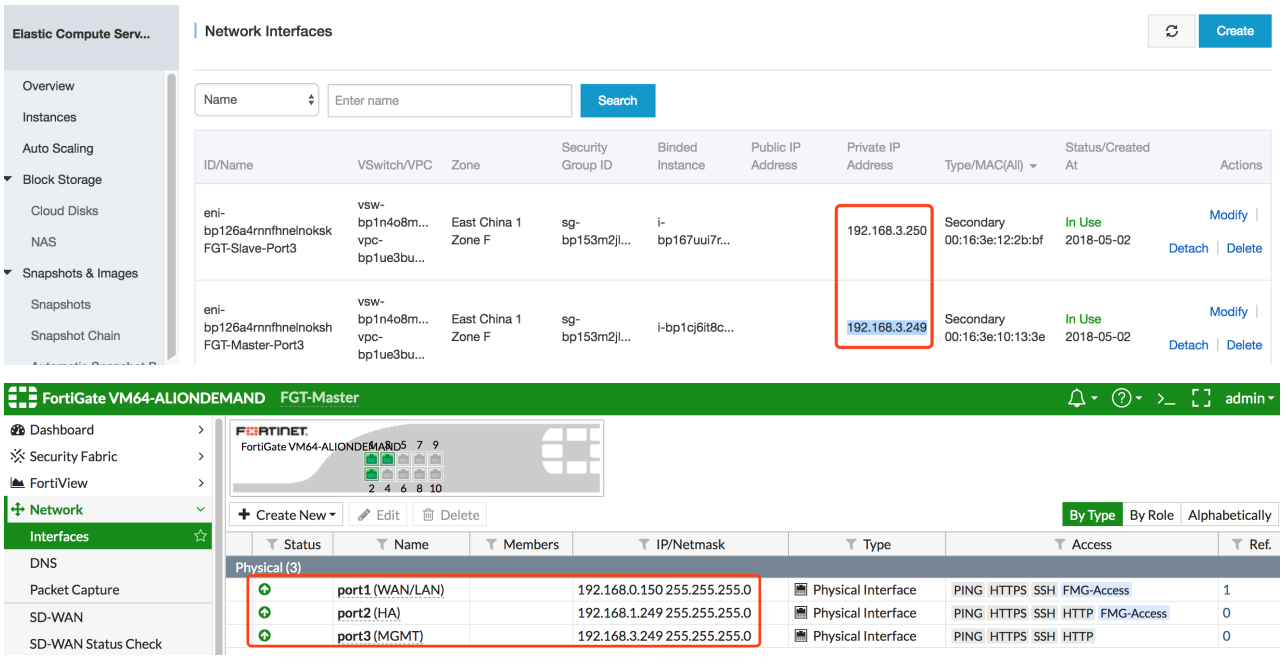

Network Interfaces
Create
Update succes
Name
Enter name
Search
ID/Name
VSwitch/VPC
Zone
Security Group ID
Binded Instance
Public IP Address
Private IP Address
Type/MAC(All)
Status/Created At
Actions
eni-bp126a4rnnfhnelnoksk FGT-Slave-Port3
vsw-bp1n4o8m... vpc-bp1ue3bu...
East China 1 Zone F
sg-bp153m2jl...
i-bp167uui7r...
192.168.3.250
Secondary 00:16:3e:12:2b:bf
In Use 2018-05-02
Modify
Detach
Delete
eni-bp126a4rnnfhnelnoksh FGT-Master-Port3
vsw-bp1n4o8m... vpc-bp1ue3bu...
East China 1 Zone F
sg-bp153m2jl...
i-bp1cj6it8c...
192.168.3.249
Secondary 00:16:3e:10:13:3e
In Use 2018-05-02
Modify
Detach
Delete

d. Restart the two FortiGate instances.



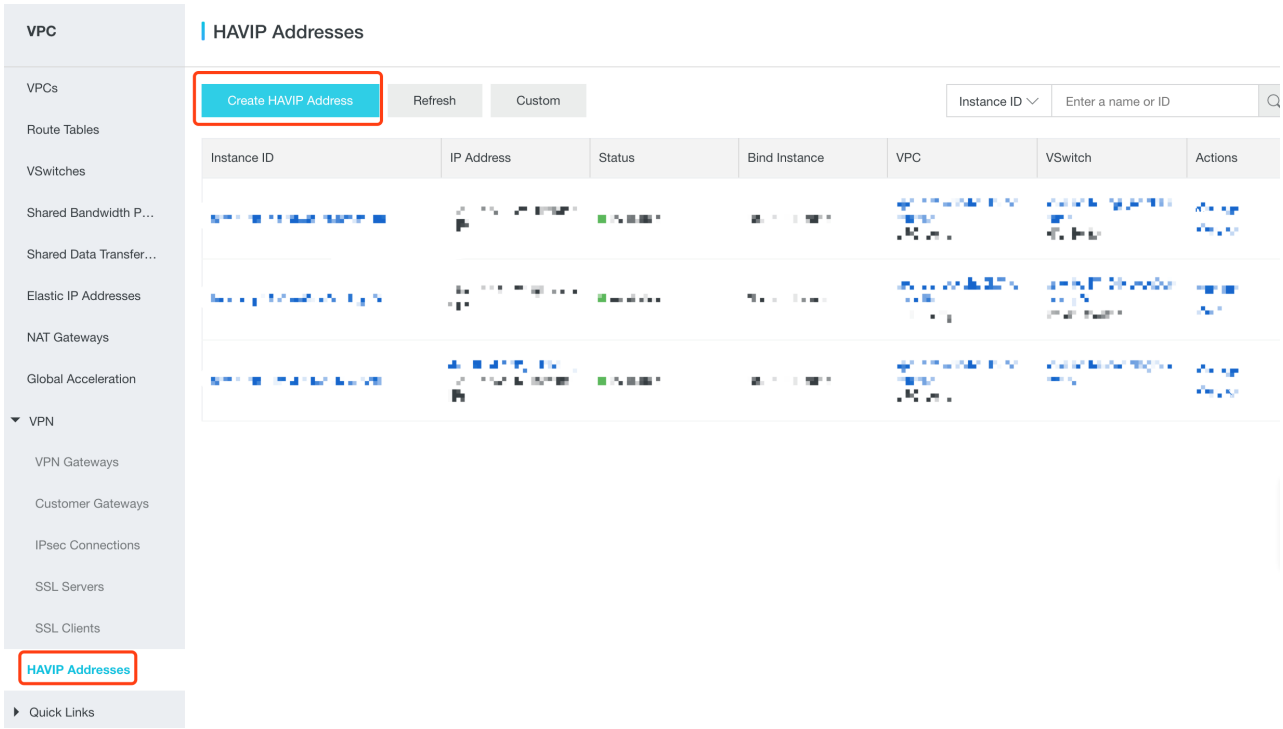
7. You can now access the FortiGate-VM in a web browser using the username "admin". The password is the instance ID.
8. Change the password after the initial login.
9. Set the IP address on three interfaces on the FortiGate.

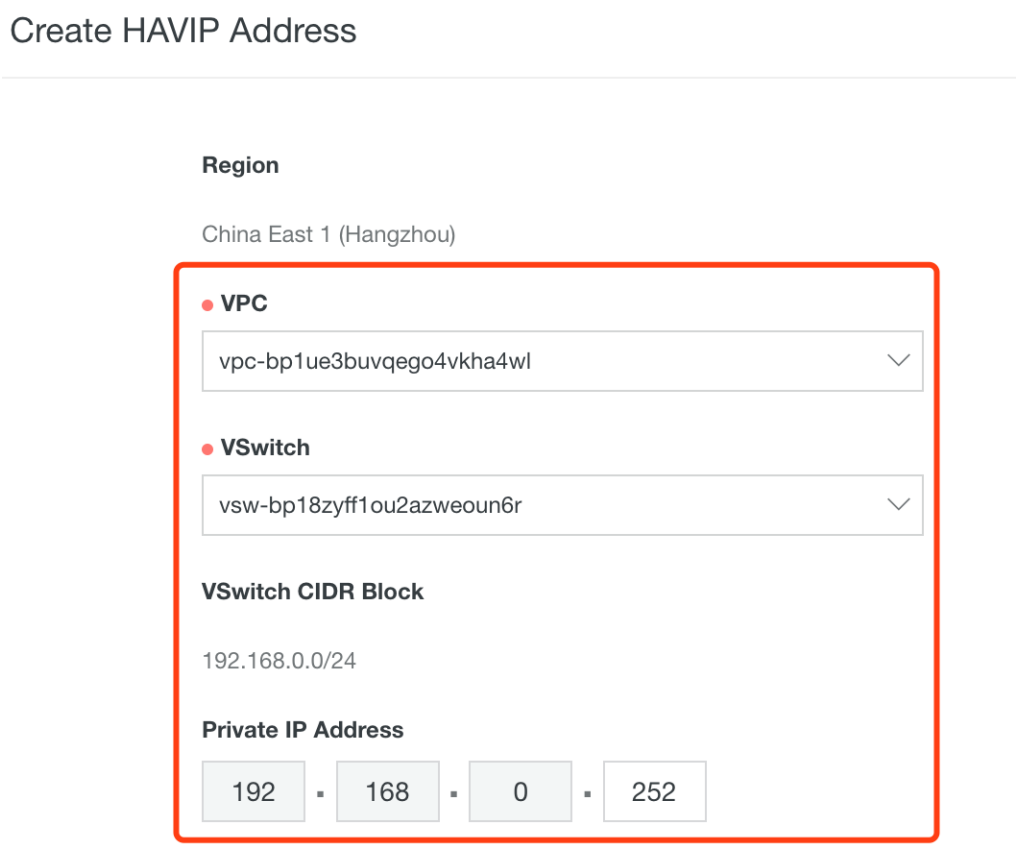




Configuring the HAVIP on the AliCloud web console

1. Create a new HAVIP address. Select the VPC and FortiGate-VM port1 VSwitch, and set the HAVIP address.





2. Set the HA configuration on the FortiGate via the VNC console on the AliCloud Web GUI, or via SSH.
   a. Set the configuration on the primary FortiGate-As follows. In this example, 192.168.3.253 is the gateway on the VSwitch, while 192.168.1.250 is the secondary FortiGate's port2's IP address. Note the FortiGate with a higher priority value will be the primary FortiGate.

```
config system ha
   set group-name "ha"
   set mode a-p
   set hbdev "port2" 0
   set session-pickup enable
   set ha-mgmt-status enable
   config ha-mgmt-interface
      edit 1
         set interface “port3”
         set gateway 192.168.3.253
      next
   end
   set priority 200
   set monitor "port1"
   set unicast-hb enable
   set unicast-hb-peerip 192.168.1.250
end
```

   b. Set the configuration on the secondary FortiGate-As follows. Here, 192.168.1.249 is the primary FortiGate's port2's IP address.

```
config system ha
   set group-name "ha"
   set mode a-p
```

```
        set hbdev "port2" 0
        set session-pickup enable
        set ha-mgmt-status enable
        config ha-mgmt-interface
           edit 1
              set interface “port3”
              set gateway 192.168.3.253
           next
        end
        set priority 100
        set monitor "port1"
        set unicast-hb enable
        set unicast-hb-peerip 192.168.1.249
     end
```

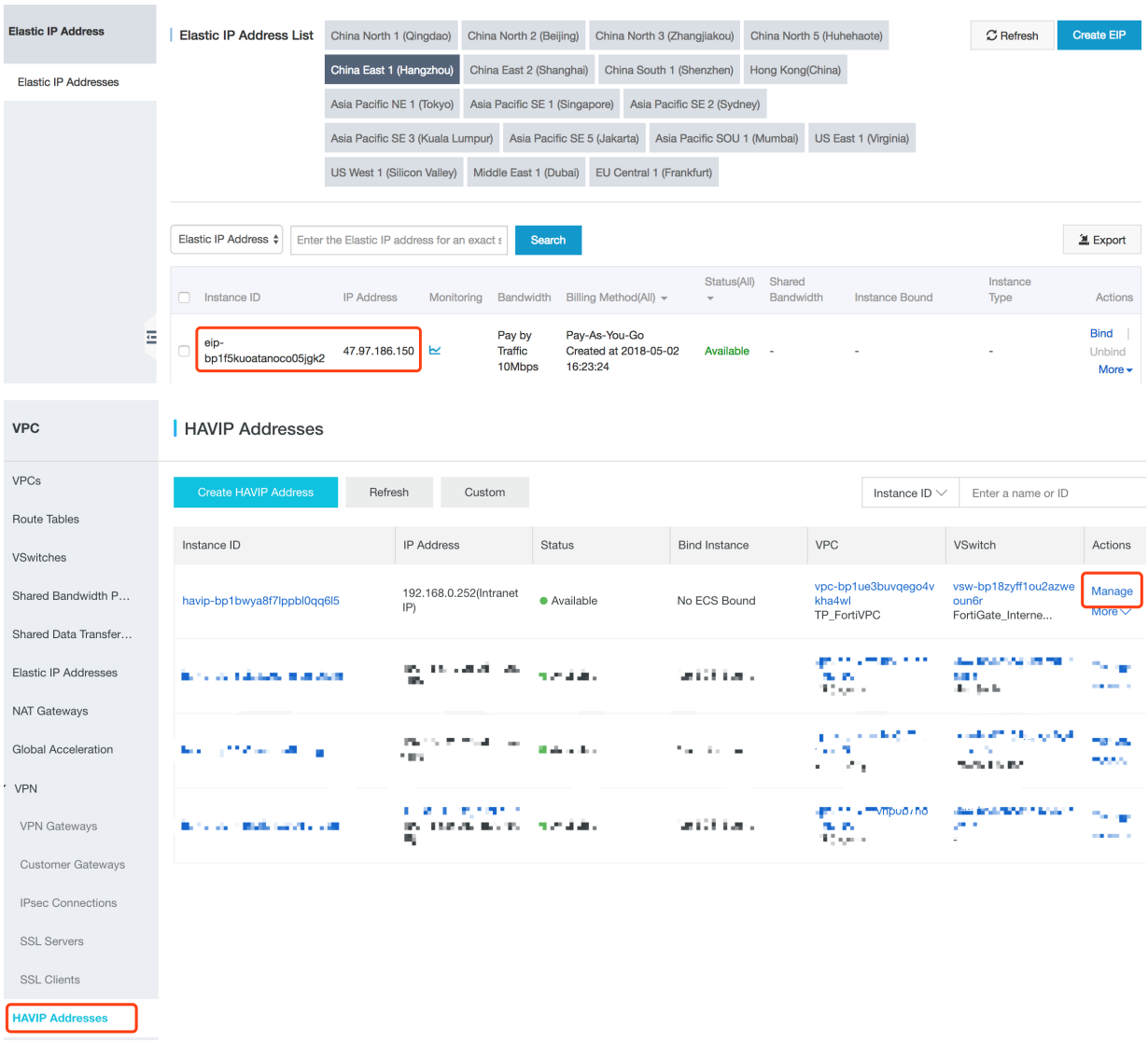
3. Reboot the two FortiGates.
4. Check the HA status by running `diagnose sys ha status` in the CLI. It should show the following:

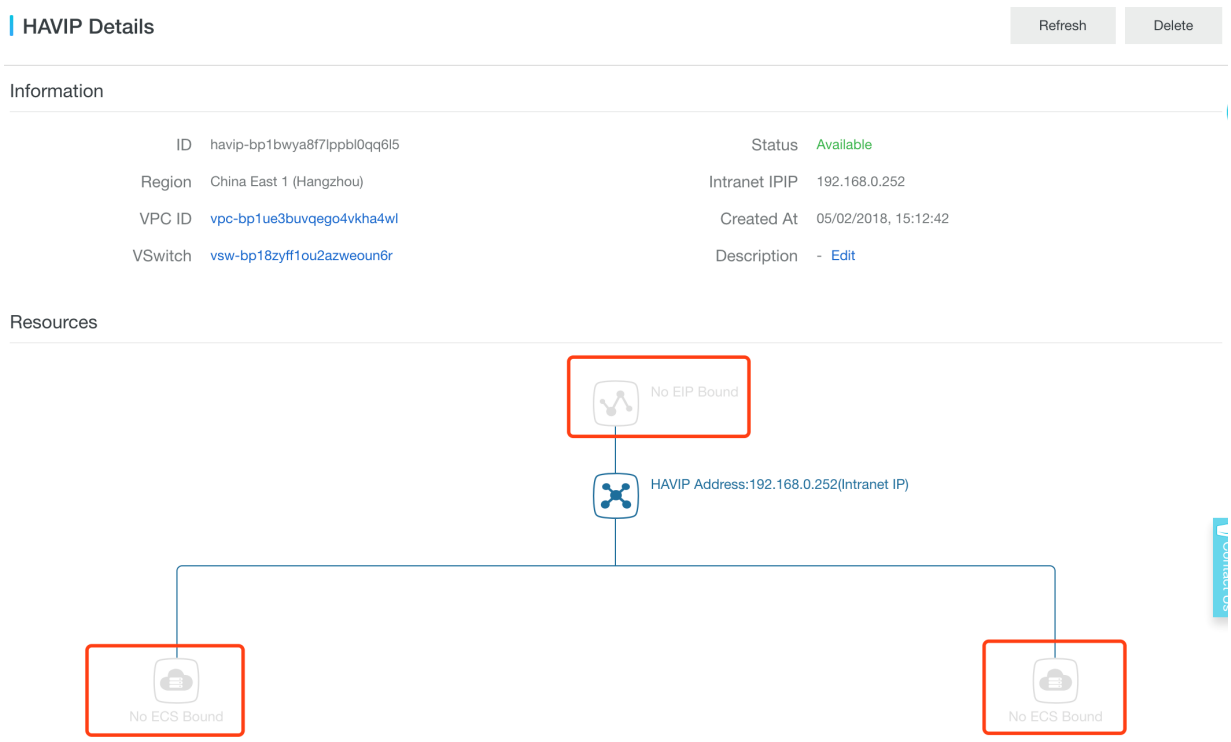
```
FGT-Master # diagnose sys ha status
HA information
Statistics
        traffic.local = s:0 p:20456 b:7590378
        traffic.total = s:0 p:20467 b:7591052
        activity.fdb  = c:0 q:0

Model=90019, Mode=2 Group=0 Debug=0
nvcluster=1, ses_pickup=1, delay=0

[Debug_Zone HA information]
HA group member information: is_manage_master=1.
FGTALIG8XFM4RR79: Master, serialno_prio=1, usr_priority=200, hostname=FGT-Master
FGTALIZT2A540C07:  Slave, serialno_prio=0, usr_priority=100, hostname=FGT-Slave

[Kernel HA information]
vcluster 1, state=work, master_ip=192.168.1.249, master_id=0:
FGTALIG8XFM4RR79: Master  ha_prio/o_ha_prio=0/0
FGTALIZT2A540C07:  Slave  ha_prio/o_ha_prio=1/1
```

5. Set the HAVIP address to the port1 secondary IP address on the two FortiGates. On both FortiGates, configure the following. The secondary IP address configured below should be the same as the HAVIP address.

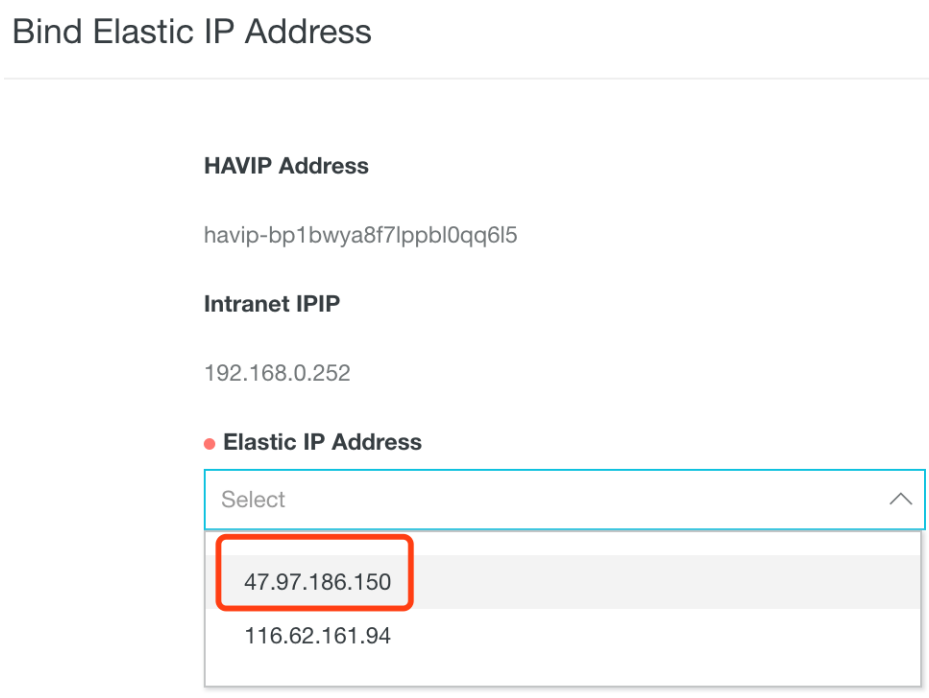
```
config system interface
   edit "port1"
      set secondary-IP enable
      config secondaryip
         edit 1
            set ip 192.168.0.252 255.255.255.0
            set allowaccess ping https ssh
         next
      end
   next
end
```

6. Bind the elastic IP address and the two FortiGate ECS to HAVIP.
   a. Create a new EIP.

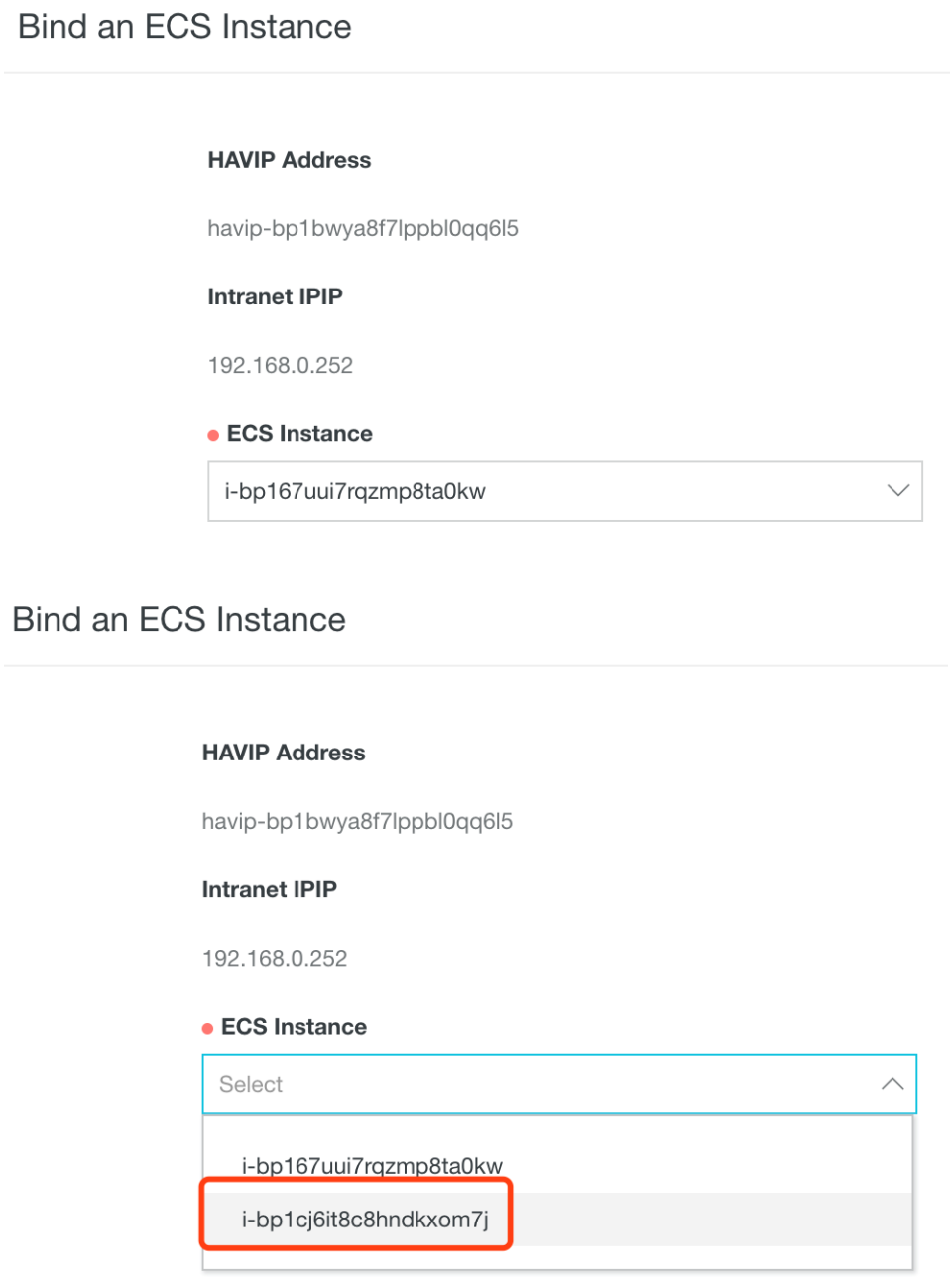


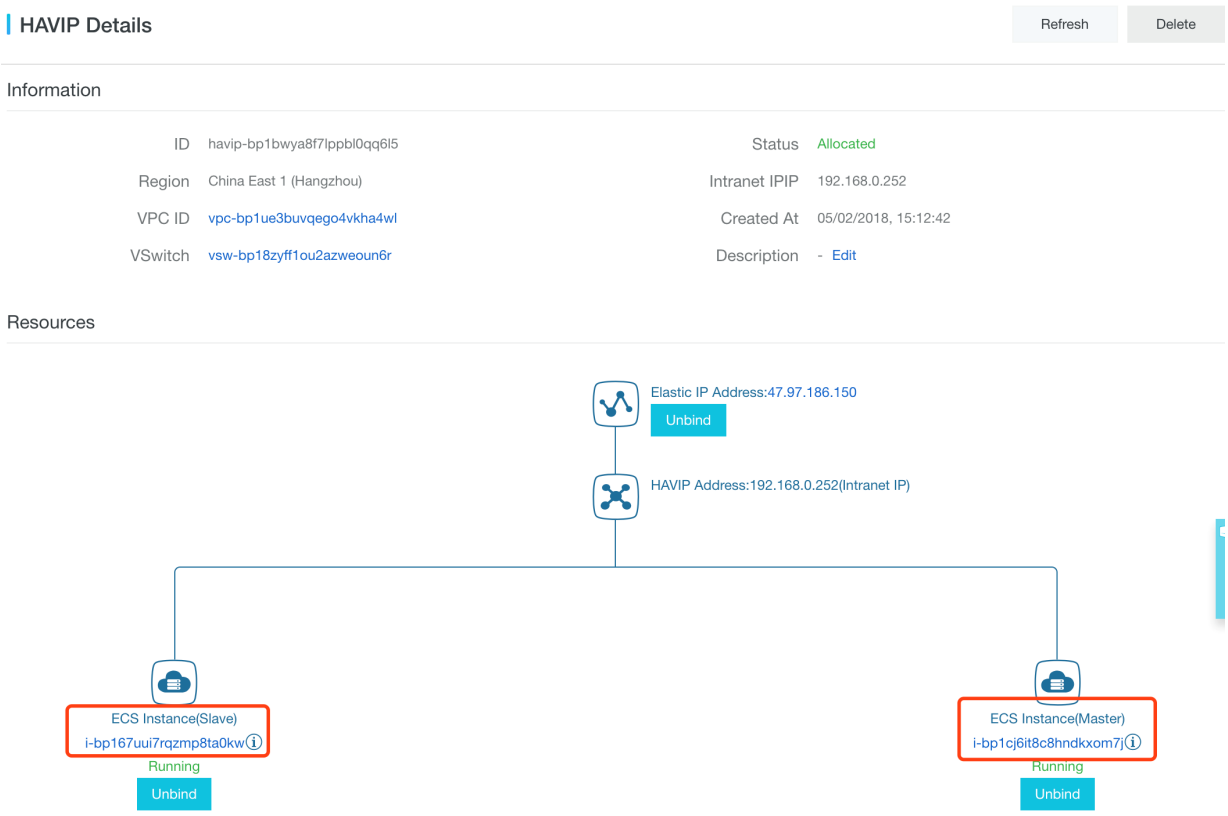


b. Bind the EIP to the HAVIP.

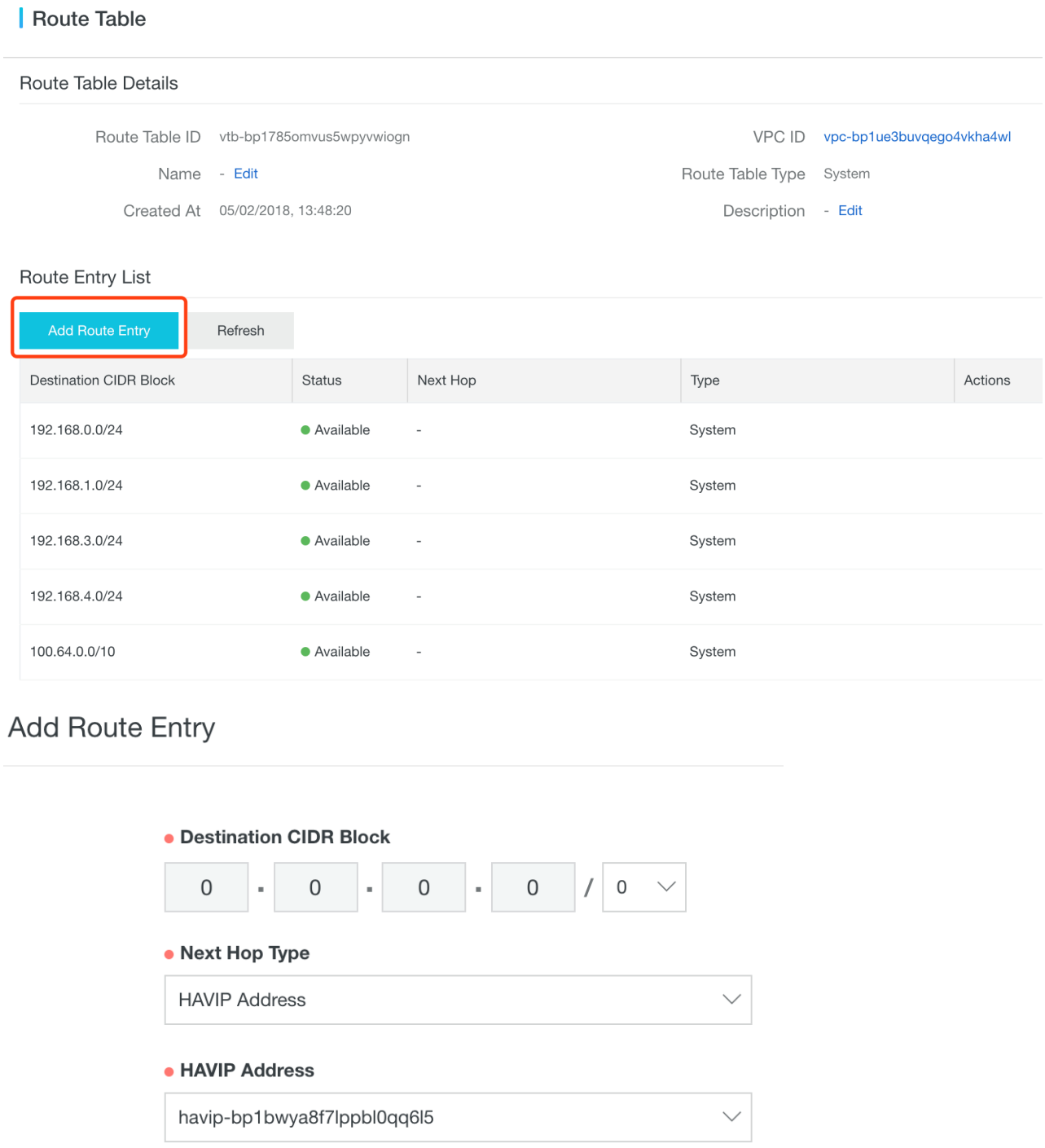


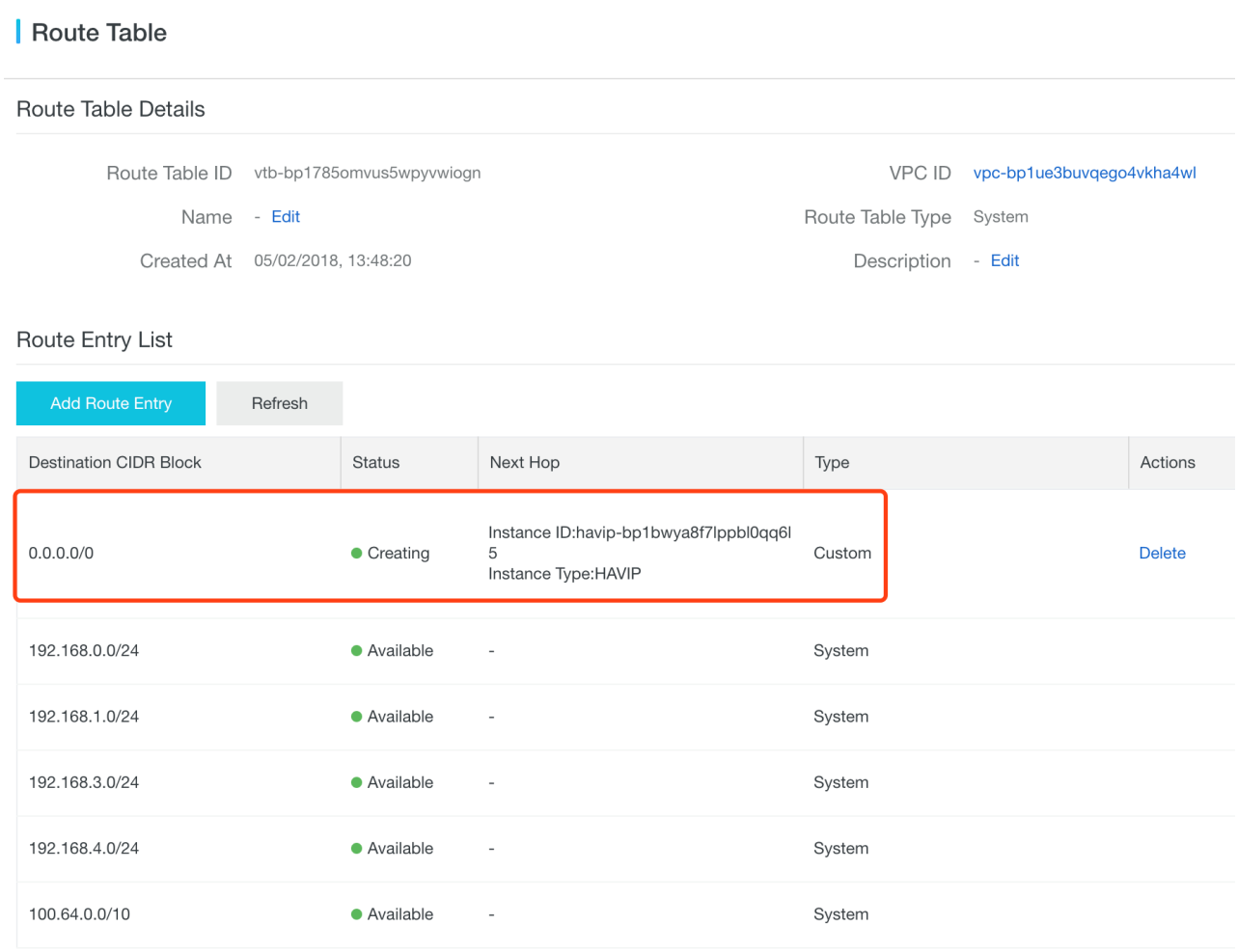
c. Bind the two FortiGates to the HAVIP.




HAVIP Details
Refresh
Delete
Information
ID havip-bp1bwya8f7lppbl0qq6l5
Status Allocated
Region China East 1 (Hangzhou)
Intranet IPIP 192.168.0.252
VPC ID vpc-bp1ue3buvqego4vkha4wl
Created At 05/02/2018, 15:12:42
VSwitch vsw-bp18zyff1ou2azweoun6r
Description - Edit
Resources
Elastic IP Address:47.97.186.150
Unbind
HAVIP Address:192.168.0.252(Intranet IP)
ECS Instance(Slave)
i-bp167uui7rqzmp8ta0kw
Running
Unbind
ECS Instance(Master)
i-bp1cj6it8c8hndkxom7j
Running
Unbind

7. You must add the route entry to the FortiGate to ensure all outgoing traffic from ECS goes through the FortiGate.





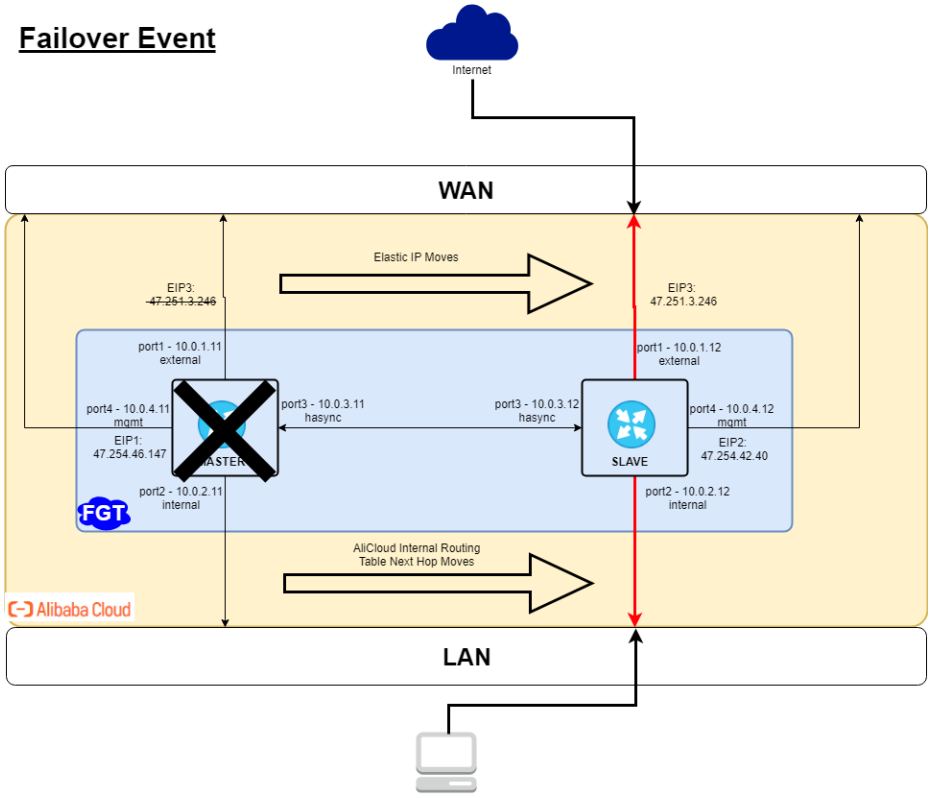
Connectivity test

You can test whether you configured the FortiGate-VM instances and VPC properly. See Connectivity test on page 14.

Deploying FortiGate-VM HA on AliCloud using routing tables and EIPs

This guide provides a sample configuration of active-passive FortiGate-VM HA on AliCloud within one availability zone.

The following depicts the network topology for this sample deployment:



The following lists the IP address assignments for this sample deployment for FortiGate-A:

Port	AliCloud primary address	Subnet
port1	10.0.1.11	10.0.1.0/24 EIP3
port2	10.0.2.11	10.0.2.0/24
port3	10.0.3.11	10.0.3.0/24
port4	10.0.4.11	10.0.4.0/24 EIP1

The following lists the IP address assignments for this sample deployment for FortiGate-B:

Port	AliCloud primary address	Subnet
port1	10.0.1.12	10.0.24.0
port2	10.0.2.12	10.0.21.0/24
port3	10.0.3.12	10.0.22.0/24
port4	10.0.4.12	10.0.23.0/24

To check the prerequisites:

The following prerequisites must be met for this deployment:

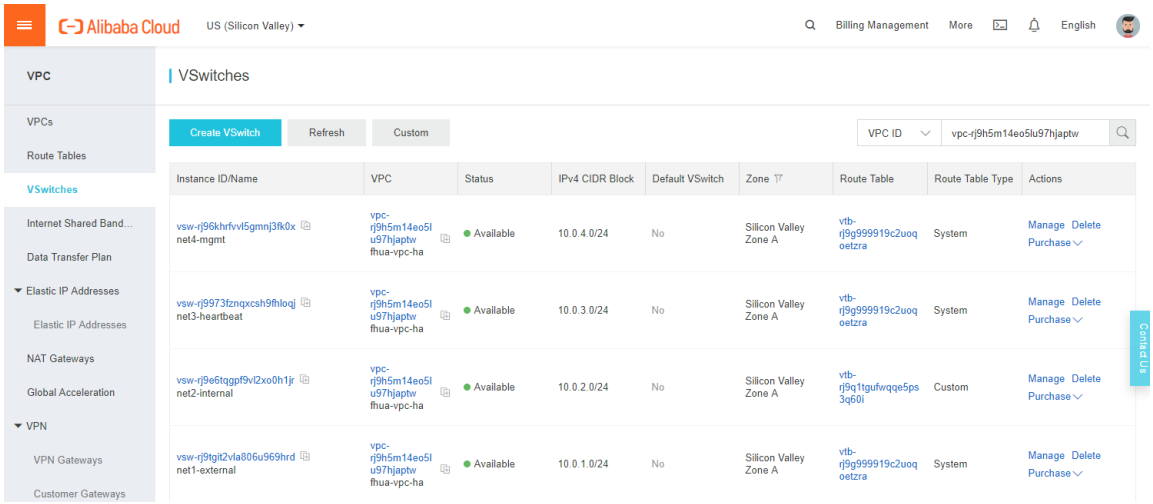
- One VPC with one subnet each for management, external, internal, and heartbeat purposes
- Three public IP addresses:
  - EIP1 and EIP2 for FortiGate-A and FortiGate-B management
  - EIP3 for the HA external traffic IP address
- Two FortiGate-VM instances, both PAYG or BYOL
- The following summarizes minimum sufficient RAM roles for this deployment:
  - AliyunECSFullAccess
  - AliyunEIPFullAccess
  - AliyunVPCFullAccess

Actual role configurations may differ depending on your environments. Check with your company's public cloud administrators for more details.

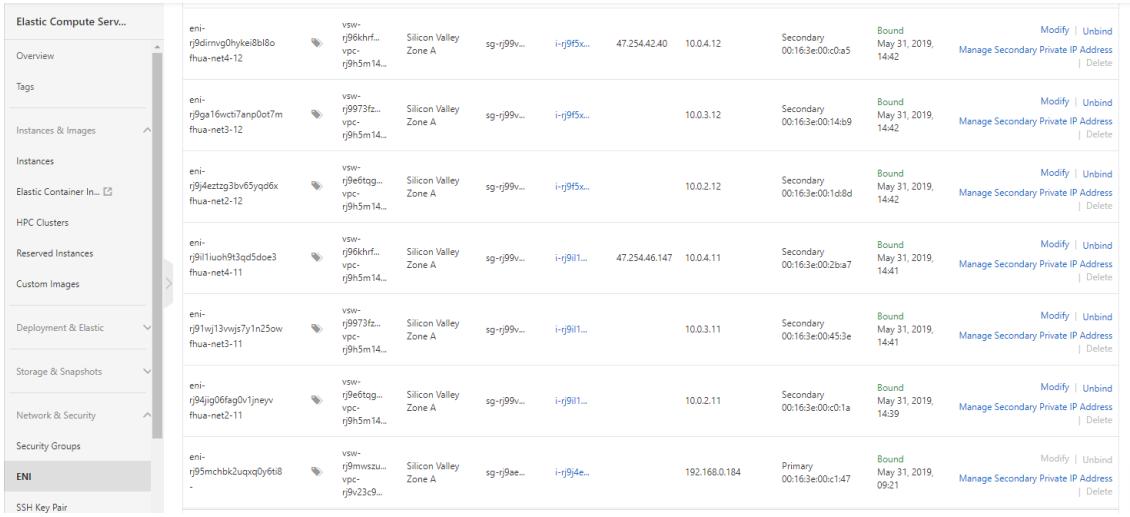
To configure FortiGate-VM HA in AliCloud:

1. In the AliCloud management console, create a VPC with four VSwitches:

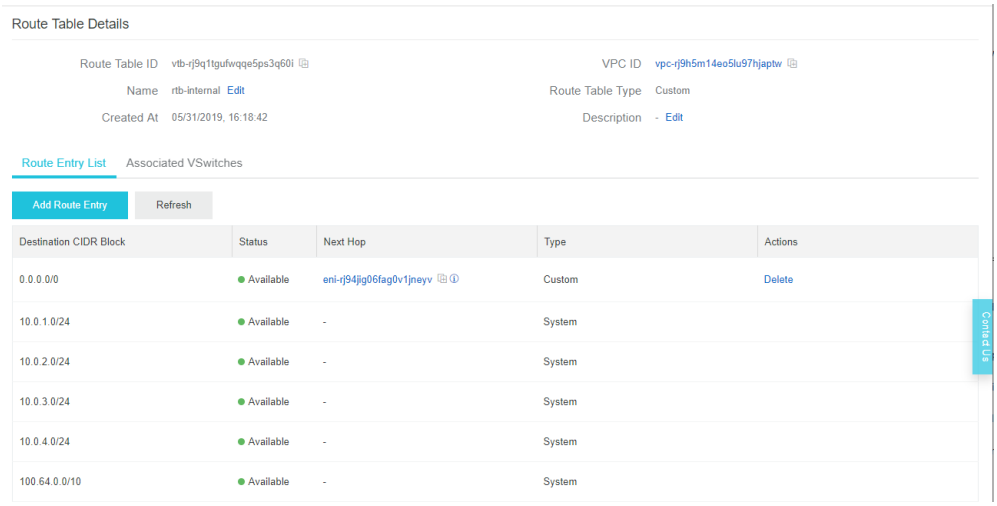
VSwitch	Purpose
net1-external	External data traffic on the public network-facing side.
net2-internal	External data traffic on the public network-facing side.
net3-heartbeat	Heartbeat between two FortiGate nodes. This is unicast communication.
net4-mgmt	Dedicated management interface.



2. Add six ENIs.

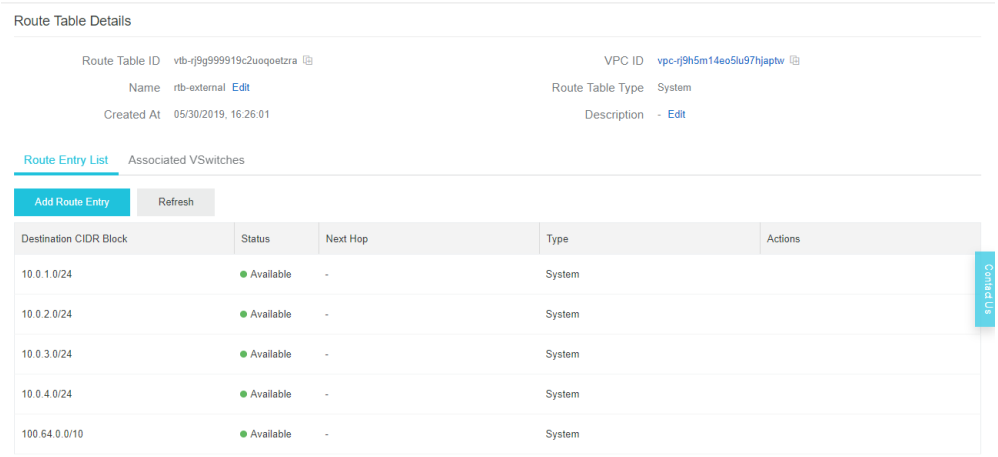


3. Create two routing tables:
   a. Create a routing table called "rtb-internal" for the net2-internal VSwitch. Set the NIC2 secondary IP address (10.0.2.23) as rtb-internal's default gateway. You can create this routing table after configuring NIC2 on FortiGate-A. Ensure that the default gateway is FortiGate-A's port2 ENI.



   b. Create a routing table called "rtb-external" for the remaining VSwitches. Set this VCN's Internet gateway as its

default gateway. Ensure that this routing table can access the Internet.



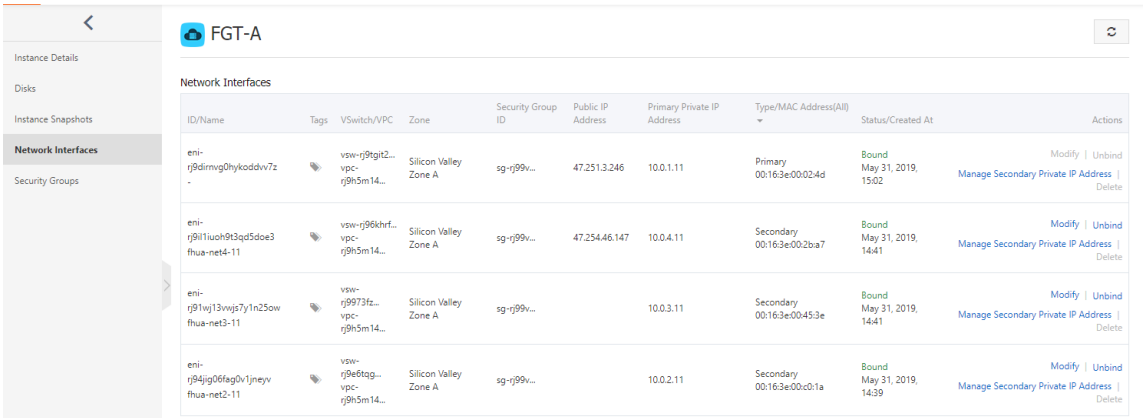
To deploy the FortiGate-VMs in AliCloud:

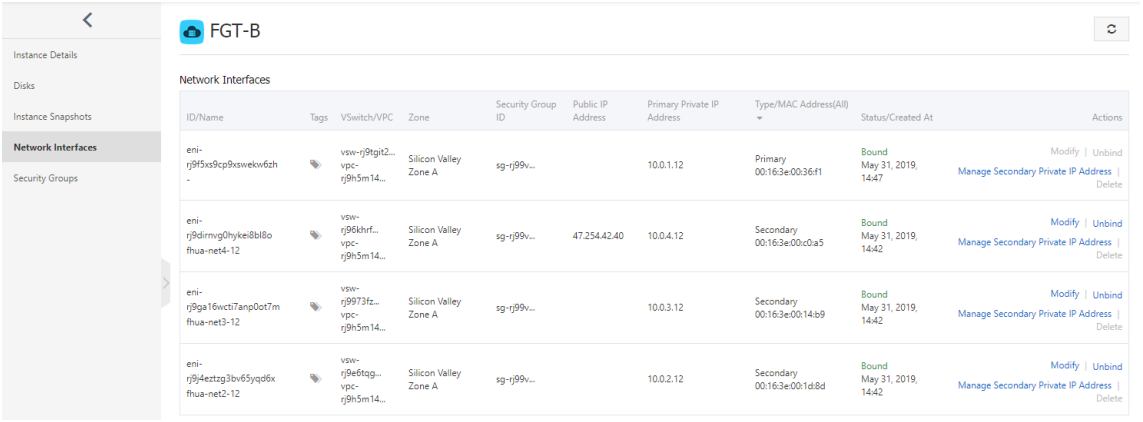
To take advantage of A-P HA, you need four vNICs (port1 to port4) on each FortiGate-VM that constitutes an A-P HA cluster. Configure all required network interfaces (AliCloud ENIs and FortiGate-VM network interface configuration) that support A-P HA. You must choose an AliCloud instance type that supports at least four vNICs.

Ensure the following:

- You have configured the security group on each subnet for egress and ingress interfaces appropriately. It is particularly important that the management interfaces have egress Internet access for API calls to the AliCloud metadata server.
- You attached four NICs for each FortiGate-VM, and assigned the static private IP address.
- EIP1 was bound to the FortiGate-A port4 management interface.
- EIP3 was bound to the FortiGate-A port1 external interface.
- EIP2 was bound to the FortiGate-B port4 management interface.

You can attach a public IP address on the primary FortiGate-VM's external interface instead of an EIP by creating an HAVIP address in the VPC, then binding this HAVIP address to both FortiGates' external interfaces. This approach may shorten the failover time depending on the network environment.





To configure FortiGate-A using the CLI:

The next steps show you how to configure A-P HA settings by using CLI commands on the GUI or via SSH. If using SSH, the FortiGate may lose connection due to routing table changes, so configuring HA via the GUI is recommended.

```
config system interface
    edit "port1"
        set mode static
        set ip 10.0.1.11 255.255.255.0
        set allowaccess ping https ssh snmp http fgfm
    next
    edit "port2"
        set ip 10.0.2.11 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
    edit "port3"
        set ip 10.0.3.11 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
    edit "port4"
        set ip 10.0.4.11 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
end

config router static
    edit 1
        set gateway 10.0.1.1
        set device "port1"
    next
end

config firewall policy
    edit 1
        set srcintf "port2"
        set dstintf "port1"
        set srcaddr "all"
        set dstaddr "all"
        set action accept
        set schedule "always"
        set service "ALL"
        set nat enable
```

```
    next
end

config system ha
    set group-name "FGT-HA"
    set mode a-p
    set hbdev "port3" 50
    set ha-mgmt-status enable
    config ha-mgmt-interfaces
        edit 1
            set interface "port4"
            set gateway 10.0.4.1
        next
    end
    set priority 128
    set unicast-hb enable
    set unicast-hb-peerip 10.0.3.12
end
```

To configure FortiGate-B using the CLI:

The next steps show you how to configure A-P HA settings by using CLI commands on the GUI or via SSH. If using SSH, the FortiGate may lose connection due to routing table changes, so configuring HA via the GUI is recommended.

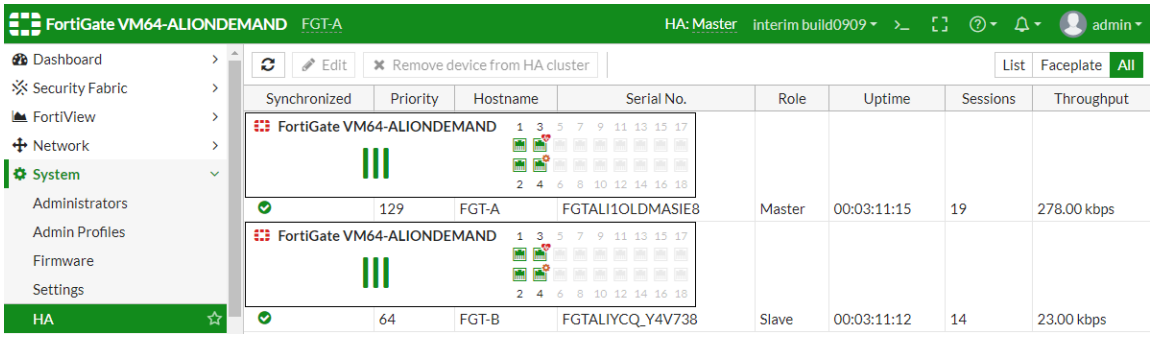
```
config system interface
    edit "port1"
        set mode static
        set ip 10.0.1.12 255.255.255.0
        set allowaccess ping https ssh snmp http fgfm
    next
    edit "port2"
        set ip 10.0.2.12 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
    edit "port3"
        set ip 10.0.3.12 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
    edit "port4"
        set ip 10.0.4.12 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
end

config router static
    edit 1
        set gateway 10.0.1.1
        set device "port1"
    next
end

config firewall policy
    edit 1
        set srcintf "port2"
        set dstintf "port1"
        set srcaddr "all"
        set dstaddr "all"
        set action accept
```

```
        set schedule "always"
        set service "ALL"
        set nat enable
    next
end

config system ha
    set group-name "FGT-HA"
    set mode a-p
    set hbdev "port3" 50
    set ha-mgmt-status enable
    config ha-mgmt-interfaces
        edit 1
            set interface "port4"
            set gateway 10.0.4.1
        next
    end
    set priority 64
    set unicast-hb enable
    set unicast-hb-peerip 10.0.3.21
end
```

You must set the FortiGate-B HA priority to a value lower than FortiGate-A's priority level. The node with the lower priority level is determined as the secondary node.

To check the HA status and function:

1. In FortiOS on the primary FortiGate, go to *System* > *HA*. Check that the HA status is synchronized.



2. Log into a PC that is located in the internal subnet. Verify that the PC can access the Internet via FortiGate-A when FortiGate-A is the primary node.
3. Shut down FortiGate-A. Verify that FortiGate-B becomes the primary node. Use an API call to verify that the secondary private IP address moves to FortiGate-B.
4. Log into the PC. Verify that the PC can access the Internet via FortiGate-B when FortiGate-B is the primary node.
5. You can use the following diagnose commands to see if the secondary private IP address moves from FortiGate-A to FortiGate-B during failover:

```
FGT-B # diagnose debug application alicloud-ha -1
Debug messages will be on for 30 minutes.

FGT-B # Become HA master mode 2
```

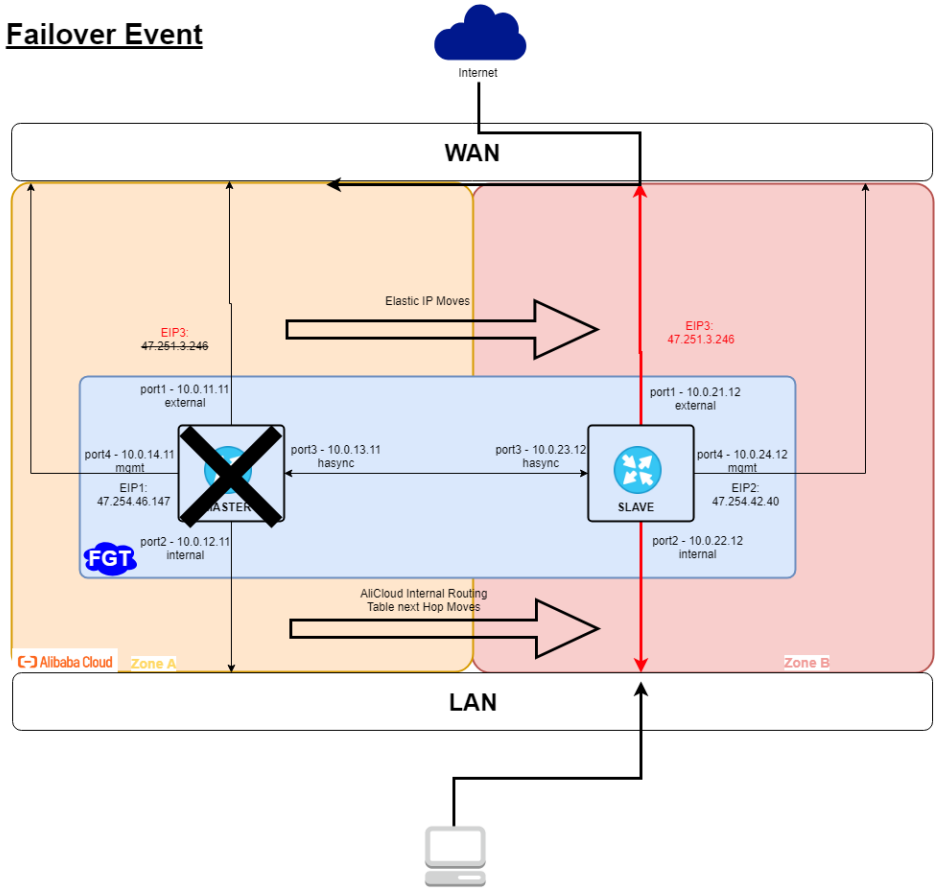
```
===== start acs ha failover =====
send_vip_arp: vd root master 1 intf port1 ip 10.0.1.12
send_vip_arp: vd root master 1 intf port2 ip 10.0.2.12
acs meta info [instance id]: i-rj9f5xs9cp9xsweedlcs
acs meta info [ram role]: fhua-ecs-role
acs meta info [region]: us-west-1
acs meta info [vpc id]: vpc-rj9h5m14eo5lu97hjaptw
acs ecs endpoint is resolved at ecs.us-west-1.aliyuncs.com:47.88.73.18
acs vpc endpoint is resolved at vpc.aliyuncs.com:106.11.61.112
acs is parsing page 1 of total 3(1 page) instances
acs is checking tags on instance FGT-A
    Tag.FGT_port1: eni-rj9dirnvg0hykoddvv7z
    Tag.FGT_port2: eni-rj94jig06fag0v1jneyv
    Tag.FGT_port3: eni-rj91wj13vwjs7y1n25ow
    Tag.FGT_port4: eni-rj9il1iuoh9t3qd5doe3
acs is checking tags on instance FGT-B
    Tag.FGT_port1: eni-rj9f5xs9cp9xswekw6zh
    Tag.FGT_port2: eni-rj9j4eztzg3bv65yqd6x
    Tag.FGT_port3: eni-rj9ga16wcti7anp0ot7m
    Tag.FGT_port4: eni-rj9dirnvg0hykei8bl8o
acs is parsing page 1 of total 13(1 page) EIPs
acs local instance: FGT-B(i-rj9f5xs9cp9xsweedlcs)
    eni: 0, 10.0.1.12(eni-rj9f5xs9cp9xswekw6zh, port1)
    eni: 1, 10.0.2.12(eni-rj9j4eztzg3bv65yqd6x, port2)
    eni: 2, 10.0.3.12(eni-rj9ga16wcti7anp0ot7m, port3)
    eni: 3, 10.0.4.12(eni-rj9dirnvg0hykei8bl8o, port4) <--- eip(47.254.42.40)
acs peer instance: FGT-A(i-rj9il1iuoh9t408i1a60)
    eni: 0, 10.0.1.11(eni-rj9dirnvg0hykoddvv7z, port1) <--- eip(47.251.3.246)
    eni: 1, 10.0.2.11(eni-rj94jig06fag0v1jneyv, port2)
    eni: 2, 10.0.3.11(eni-rj91wj13vwjs7y1n25ow, port3)
    eni: 3, 10.0.4.11(eni-rj9il1iuoh9t3qd5doe3, port4) <--- eip(47.254.46.147)
acs is moving eip(47.251.3.246) from eni0(10.0.1.11) to eni0(10.0.1.12)
acs eip(47.251.3.246) status: Unassociating
acs eip(47.251.3.246) status: Unassociating
acs eip(47.251.3.246) status: Available
acs unassociated eip(47.251.3.246) from instance FGT-A successfully
acs eip(47.251.3.246) status: Associating
acs eip(47.251.3.246) status: Associating
acs eip(47.251.3.246) status: InUse
acs associated eip(47.251.3.246) to instance FGT-B successfully
acs local instance: FGT-B(i-rj9f5xs9cp9xsweedlcs)
    eni: 0, 10.0.1.12(eni-rj9f5xs9cp9xswekw6zh, port1) <--- eip(47.251.3.246)
    eni: 1, 10.0.2.12(eni-rj9j4eztzg3bv65yqd6x, port2)
    eni: 2, 10.0.3.12(eni-rj9ga16wcti7anp0ot7m, port3)
    eni: 3, 10.0.4.12(eni-rj9dirnvg0hykei8bl8o, port4) <--- eip(47.254.42.40)
acs peer instance: FGT-A(i-rj9il1iuoh9t408i1a60)
    eni: 0, 10.0.1.11(eni-rj9dirnvg0hykoddvv7z, port1)
    eni: 1, 10.0.2.11(eni-rj94jig06fag0v1jneyv, port2)
```

```
    eni: 2, 10.0.3.11(eni-rj91wj13vwjs7y1n25ow, port3)
    eni: 3, 10.0.4.11(eni-rj9il1iuoh9t3qd5doe3, port4) <--- eip(47.254.46.147)
acs route table: vtb-rj9q1tgufwqqe5ps3q60i
    rule: cidr: 0.0.0.0/0, nexthop: 10.0.2.11(eni-rj94jig06fag0v1jneyv)
acs is deleting route table entry: 0.0.0.0/0 via 10.0.2.11
acs route table entry deleting
acs route table entry deleted
acs deleted route table entry: 0.0.0.0/0 via 10.0.2.11 successfully
acs is creating route table entry: 0.0.0.0/0 via 10.0.2.12
acs route table entry created
acs created route table entry: 0.0.0.0/0 via 10.0.2.12 successfully
acs route table: vtb-rj9q1tgufwqqe5ps3q60i
    rule: cidr: 0.0.0.0/0, nexthop: 10.0.2.12(eni-rj9j4eztzg3bv65yqd6x)
===== exit acs ha failover =====
```

Deploying FortiGate-VM HA on AliCloud between availability zones

This guide provides sample configuration of active-passive FortiGate-VM HA on AliCloud between availability zones (AZ)s:

The following depicts the network topology for this sample deployment:



The following lists the IP address assignments for this sample deployment for FortiGate-A:

Port	AliCloud primary address	Subnet
port1	10.0.11.11	10.0.11.0/24 EIP3
port2	10.0.12.11	10.0.12.0/24
port3	10.0.13.11	10.0.13.0/24
port4	10.0.14.11	10.0.14.0/24 EIP1

The following lists the IP address assignments for this sample deployment for FortiGate-B:

Port	AliCloud primary address	Subnet
port1	10.0.21.12	10.0.21.0/24
port2	10.0.22.12	10.0.22.0/24
port3	10.0.23.12	10.0.23.0/24
port4	10.0.24.12	10.0.24.0/24 EIP2

To check the prerequisites:

The following prerequisites must be met for this deployment:

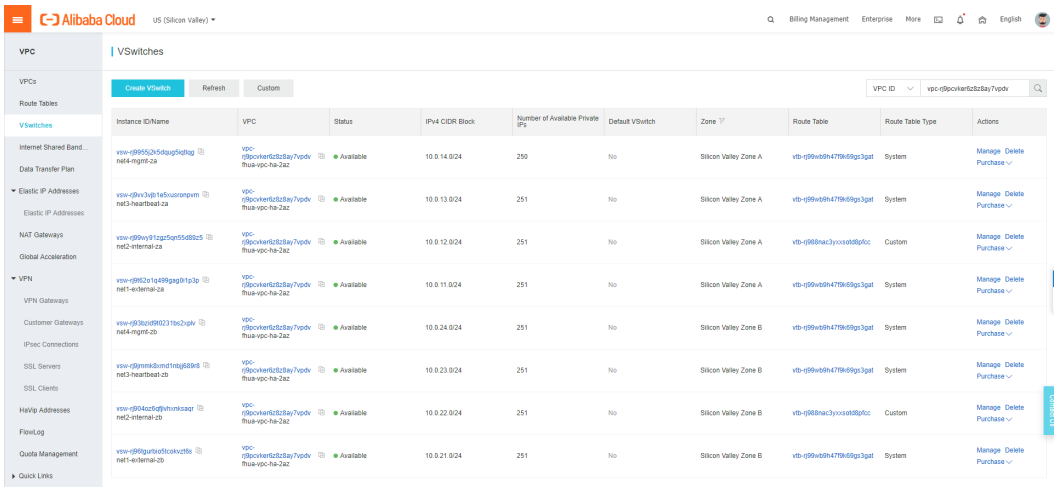
- One VPC with one subnet each for management, external, internal, and heartbeat purposes for each AZ
- Three public IP addresses:
  - EIP1 and EIP2 for FortiGate-A and FortiGate-B management
  - EIP3 for the HA external traffic IP address
- Two FortiGate-VM instances, both PAYG or BYOL
- The following summarizes minimum sufficient RAM roles for this deployment:
  - AliyunECSFullAccess
  - AliyunEIPFullAccess
  - AliyunVPCFullAccess

Actual role configurations may differ depending on your environments. Check with your company's public cloud administrators for more details.

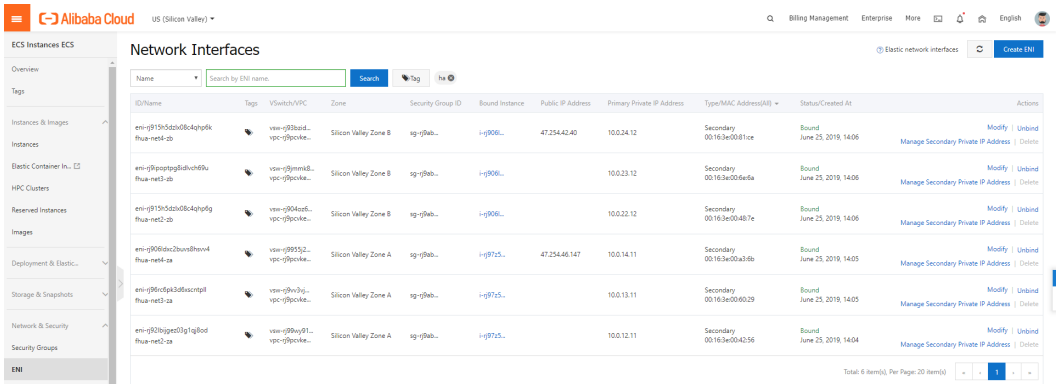
To configure FortiGate-VM HA in AliCloud:

1. In the AliCloud management console, create a VPC with eight VSwitches (four for each AZ):

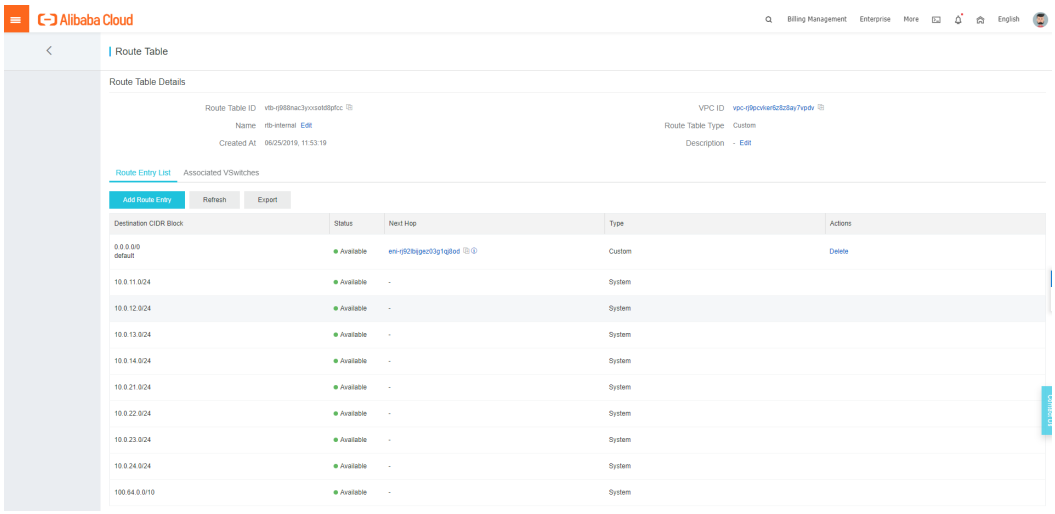
VSwitch	Purpose
net1-external-za	External data traffic on the public network-facing side.
net2-internal-za	Internal data traffic interface on the protected/trusted network-facing side.
net3-heartbeat-za	Heartbeat between two FortiGate nodes. This is unicast communication.
net4-mgmt-za	Dedicated management interface.
net1-external-zb	External data traffic on the public network-facing side.
net2-internal-zb	Internal data traffic interface on the protected/trusted network-facing side.
net3-heartbeat-zb	Heartbeat between two FortiGate nodes. This is unicast communication.
net4-mgmt-zb	Dedicated management interface.



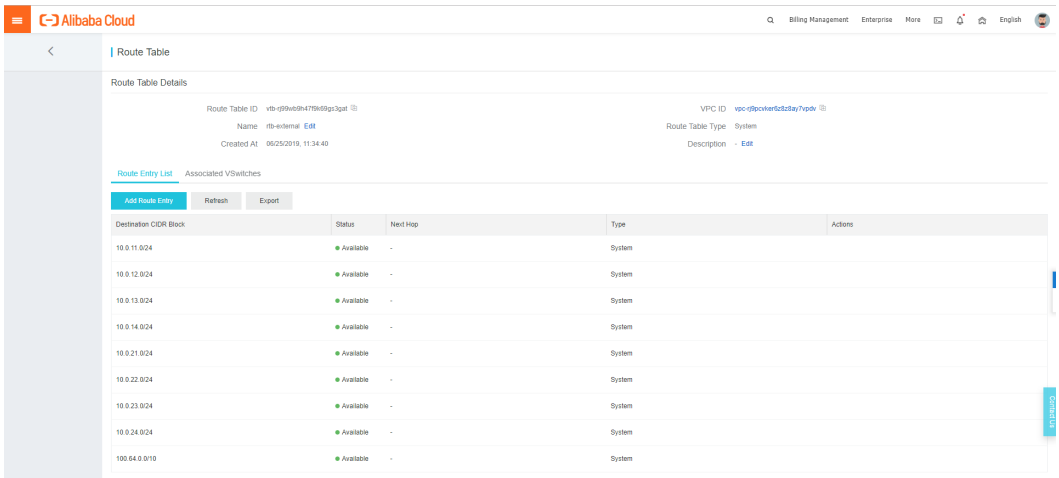
2. Add six ENIs: three for each AZ:



3. Create two routing tables:
   a. Create a routing table called "rtb-internal" for the net2-internal VSwitch. Set the NIC2 secondary IP address (10.0.2.23) as rtb-internal's default gateway. You can create this routing table after configuring NIC2 on FortiGate-A. Ensure that the default gateway is FortiGate-A's port2 ENI.



b. Create a routing table called "rtb-external" for the remaining VSwitches. Set this VCN's Internet gateway as its default gateway. Ensure that this routing table can access the Internet.

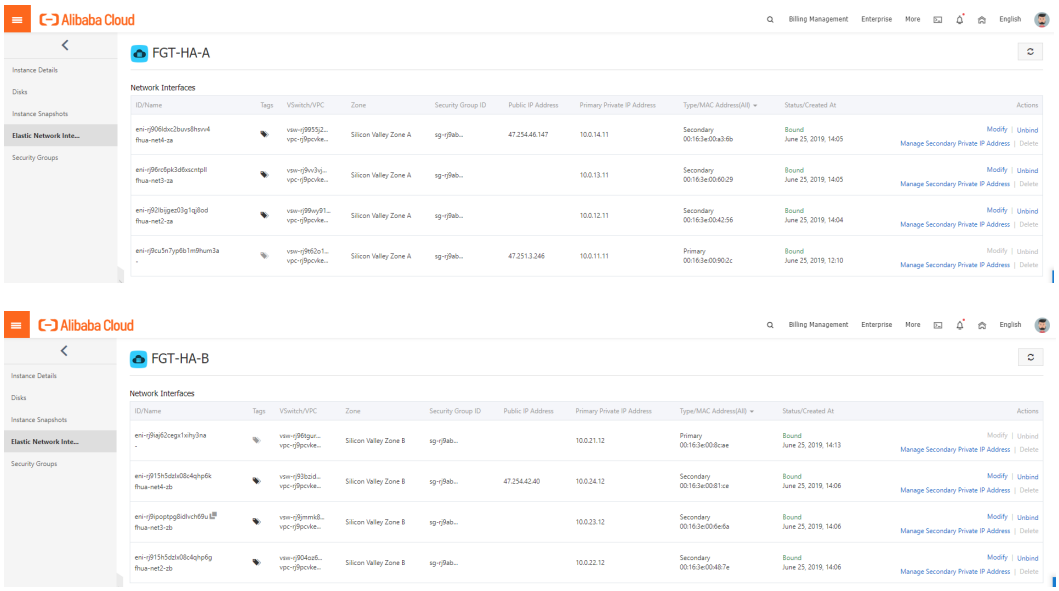


To deploy the FortiGate-VMs in AliCloud:

To take advantage of A-P HA, you need four vNICs (port1 to port4) on each FortiGate-VM that constitutes an A-P HA cluster. Configure all required network interfaces (AliCloud ENIs and FortiGate-VM network interface configuration) that support A-P HA. You must choose an AliCloud instance type that supports at least four vNICs.

Ensure the following:

- You have configured the security group on each subnet for egress and ingress interfaces appropriately. It is particularly important that the management interfaces have egress Internet access for API calls to the AliCloud metadata server.
- You attached four NICs for each FortiGate-VM, and assigned the static private IP address.
- EIP1 was bound to the FortiGate-A port4 management interface.
- EIP3 was bound to the FortiGate-A port1 external interface.
- EIP2 was bound to the FortiGate-B port4 management interface.



To configure FortiGate-A using the CLI:

The next steps show you how to configure A-P HA settings by using CLI commands on the GUI or via SSH. If using SSH, the FortiGate may lose connection due to routing table changes, so configuring HA via the GUI is recommended.

```
config system interface
    edit "port1"
        set mode static
        set ip 10.0.11.11 255.255.255.0
        set allowaccess ping https ssh snmp http fgfm
    next
    edit "port2"
        set ip 10.0.12.11 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
    edit "port3"
        set ip 10.0.13.11 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
    edit "port4"
        set ip 10.0.14.11 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
end

config router static
    edit 1
        set gateway 10.0.11.1
        set device "port1"
    next
end

config firewall policy
    edit 1
        set srcintf "port2"
        set dstintf "port1"
```

```
        set srcaddr "all"
        set dstaddr "all"
        set action accept
        set schedule "always"
        set service "ALL"
        set nat enable
    next
end
```

```
config system ha
    set group-name "FGT-HA"
    set mode a-p
    set hbdev "port3" 50
    set ha-mgmt-status enable
    config ha-mgmt-interfaces
        edit 1
            set interface "port4"
            set gateway 10.0.14.1
        next
    end
    set priority 192
    set unicast-hb enable
    set unicast-hb-peerip 10.0.23.12
end
```

To configure FortiGate-B using the CLI:

The next steps show you how to configure A-P HA settings by using CLI commands on the GUI or via SSH. If using SSH, the FortiGate may lose connection due to routing table changes, so configuring HA via the GUI is recommended.

```
config system interface
    edit "port1"
        set mode static
        set ip 10.0.21.12 255.255.255.0
        set allowaccess ping https ssh snmp http fgfm
    next
    edit "port2"
        set ip 10.0.22.12 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
    edit "port3"
        set ip 10.0.23.12 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
    edit "port4"
        set ip 10.0.24.12 255.255.255.0
        set allowaccess ping https ssh snmp http telnet
    next
end
```

```
config router static
    edit 1
        set gateway 10.0.21.1
        set device "port1"
    next
end
```

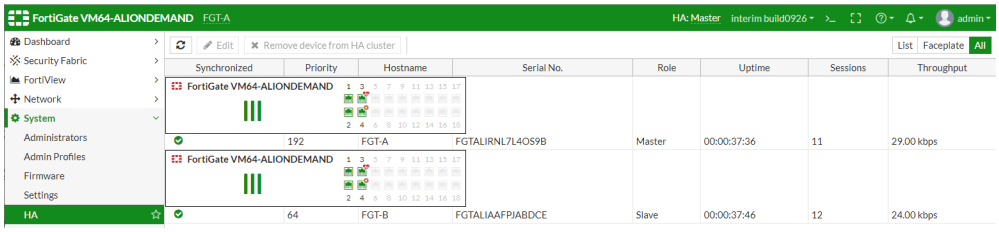
```
config firewall policy
    edit 1
        set srcintf "port2"
        set dstintf "port1"
        set srcaddr "all"
        set dstaddr "all"
        set action accept
        set schedule "always"
        set service "ALL"
        set nat enable
    next
end
```

```
config system ha
    set group-name "FGT-HA"
    set mode a-p
    set hbdev "port3" 50
    set ha-mgmt-status enable
    config ha-mgmt-interfaces
        edit 1
            set interface "port4"
            set gateway 10.0.24.1
        next
    end
    set priority 64
    set unicast-hb enable
    set unicast-hb-peerip 10.0.13.21
end
```

You must set the FortiGate-B HA priority to a value lower than FortiGate-A's priority level. The node with the lower priority level is determined as the secondary node.

To check the HA status and function:

1. In FortiOS on the primary FortiGate, go to *System* > *HA*. Check that the HA status is synchronized.



2. Log into a PC that is located in the internal subnet. Verify that the PC can access the Internet via FortiGate-A when FortiGate-A is the primary node.
3. Shut down FortiGate-A. Verify that FortiGate-B becomes the primary node. Use an API call to verify that the secondary private IP address moves to FortiGate-B.
4. Log into the PC. Verify that the PC can access the Internet via FortiGate-B when FortiGate-B is the primary node.
5. You can use the `diagnose debug application alicloud-ha -1` command to see if the secondary private IP address moves from FortiGate-A to FortiGate-B during failover.

Deploying auto scaling on AliCloud

You can deploy FortiGate-VM to support Auto Scaling on AliCloud.

Multiple FortiGate-VM instances can form an Auto Scaling group (ASG) to provide highly efficient clustering at times of high workloads. FortiGate-VM instances will be scaled out automatically according to predefined workload levels. Auto Scaling 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 AliCloud is available with FortiOS 6.2 and later versions for On-Demand (PAYG) instances. The standard deployment contains the following:

- A highly available architecture that spans two AZs
- A virtual private cloud (VPC) configured with public and private subnets
- A NAT gateway allowing egress traffic from the protected servers
- An external facing network load balancer is created as part of the deployment process. An internal facing network load balancer is optional.
- AliCloud Function Compute, which runs Fortinet-provided scripts for running Auto Scaling. Functions are used to handle Auto Scaling and failover management
- A TableStore (OTS) database which stores information on the Auto Scaling configurations such as the master or slave IP addresses

Planning

The easiest way to deploy FortiGate Autoscale for AliCloud is with Terraform.

This deployment was tested using:

- Terraform 0.11
- Terraform provider for AliCloud 1.48.0

Acronyms

The following acronyms are used throughout this document.

Acronym	Expansion
CIDR	Classless Inter-Domain Routing
DMZ	Demilitarized Zone
EIP	Elastic IP
ECS	Elastic Compute Service
ENI	Elastic Network Interface
ESS	Auto Scaling
FC	Function Compute
FGT	FortiGate
OSS	Object Storage Service
OTS	Open Table Service or TableStore, a NoSQL database by AliCloud
PAYG	Pay As You Go
RAM	Resource Access Management
SLB	Server Load Balancer

Requirements

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

- Configuring a FortiGate using the CLI
- AliCloud services
- Terraform

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

RAM account permissions

The solution can be deployed with an administrator account. As an administrator account has full permission to all resources under your AliCloud account, you may wish to create a separate RAM account with the following minimum required permissions:

- AliyunVPCFullAccess
- AliyunEIPFullAccess
- AliyunOSSFullAccess
- AliyunECSFullAccess
- AliyunSLBFullAccess
- AliyunOTSFullAccess
- AliyunESSFullAccess
- AliyunFCFullAccess
- AliyunRAMFullAccess
- AliyunBSSOrderAccess

Region requirements

To deploy a FortiGate Auto Scaling cluster in AliCloud the region must support the following:

- TableStore
- OSS
- Function Compute
- Auto Scaling
- NAT Gateway

Supported regions

The following regions contain all of the necessary services to run FortiGate Autoscale for AliCloud:

Acronym	Expansion
Asia Pacific NE 1 (Tokyo)	m-6weakry8j13jxmjlmi4o
Asia Pacific SE 2 (Sydney)	m-p0wb4dw13d6qc1sndaj6
Asia Pacific SOU 1 (Mumbai)	m-a2dbkrpr8wsobn9ygddc
EU Central 1 (Frankfurt)	m-gw8cizn7dguyeikpgozb
US East 1 (Virginia)	m-0xif6xxwhjlqhoaqjrr6
US West 1 (Silicon Valley)	m-rj91iqplyxdp7crb0gvj

Deployment information

Terraform will deploy the following resources:

- A VPC with two subnets split over two zones
- Two vswitches
- A NAT gateway
- An AutoScale cluster
- An AutoScale configuration
- Two AutoScale rules: Scale in and Scale out
- An OSS bucket
- A Function Compute service, function and HTTP trigger
- Two security groups: *Allow all*, and *Allow only internal connections*
- A TableStore instance and 5 tables
- Three Elastic IP addresses
- A RAM role with the ability to describe and create ENIs
- An external-facing server load balancer

Deployment

1. Log into your AliCloud account. If you do not already have one, create one by following the instructions in the AliCloud article Create a RAM user. The RAM account must have the minimum required permissions as listed in the section RAM account permissions on page 64.
2. Create an AliCloud AccessKey. For details on creating one, refer to the AliCloud article Create an AccessKey. This will create an AccessKeyID and an AccessKeySecret.
3. Install Terraform. For installation details, refer to the HashiCorp article Installing Terraform.
4. Obtain the FortiGate Autoscale for AliCloud deployment package. Visit the GitHub project release page and download the `fortigate-autoscale-alicloud.zip` release for the version you want to use.
5. Unzip the file on your local PC. The following files and folders will be extracted:

```
├── alicloud_function_compute
├── alicloud_terraform
├── core
├── dist
├── LICENSE
├── node_modules
├── package.json
├── scripts
└── test
```

6. In your terminal, change to the *alicloud_terraform* folder:

```
cd alicloud_terraform
```

The *alicloud_terraform* folder contains the following files:

```
├── assets
│   └── configset
│       ├── baseconfig
│       ├── httproutingpolicy
│       ├── httpsroutingpolicy
│       ├── internalelbweb
│       └── storelogtofaz
├── main.tf
└── vars.tf
```

- *baseconfig* contains the `cloud-init` configuration for the FortiGate-VM and can be adjusted to support more advanced setups.
- *main.tf* contains the majority of the deployment code. As part of the deployment it will upload the *baseconfig* to an OSS bucket to be used by the FortiGate-VM instances.
- *vars.tf* contains the variables required for the deployment. For example: image ID (instance_ami), cluster name, instance, region, etc. For descriptions of the included variables, refer to the section Terraform variables on page 67.

7. Edit the *vars.tf* file and customize variables for the deployment.

The OSS bucket name must be lowercase.

The Function Compute URL may not be more than 127 characters. The variable *cluster_name* is used to create this URL.

8. Initialize the providers and modules with the command `terraform init`:

```
terraform init
```

9. Submit the Terraform plan using the command below.

```
terraform plan -var "access_key=<access_key>" -var "secret_key=<secret_key>" -var
"region=<region>"
```

10. Confirm and apply the plan:

```
terraform apply -var "access_key=<access_key>" -var "secret_key=<secret_key>" -var
"region=<region>"
```

Output will be similar to below. A randomly generated three letter suffix is added to all resources and can be used to help identify your cluster resources.

```
Apply complete! Resources: 48 added, 0 changed, 0 destroyed.

Outputs:

Auto Scaling Group ID = asg-0xi1g2hk9z048yn6cuu1
AutoScale External Load Balancer IP = 47.89.136.18
PSK Secret = !_YfA7FQ@b_aYuei
Scale In Threshold = 35
Scale Out Threshold = 70
VPC name = FortigateAutoScale-rrr
```

Terraform variables

Following are variables listed in the *vars.tf* file. They can be changed to suit the needs of your cluster.

Resource	Default	Description
access_key	Requires input	AliCloud AccessKey. For details on creating an AccessKey, refer to the AliCloud article Create an AccessKey.
secret_key	Requires input	AliCloud Secret key created with the AccessKey. Used to access the API.
region	us-east-1	The AliCloud Region.
scale_in_threshold	35	Default aggregate CPU threshold (percentage) to scale in (remove) 1 instance.
scale_out_ threshold	70	Default aggregate CPU threshold (percentage) to scale out (add) 1 instance.
alicloud_account	AliCloud account number	(datatype)
cluster_name	FortigateAutoScale	Name of the cluster to be used across objects.
bucket_name	fortigateautoscale	Name of the OSS bucket. Must be lowercase.
instance_ami	Requires input	If specified, this will be the image used by the build. Otherwise, the script will obtain the latest FortiGate AMI.

Resource	Default	Description
instance	ecs.sn1ne	The instance Family type to be used by the Auto Saling configuration.
vpc_cidr	172.16.0.0/16	VPC CIDR block, it is divided into two /21 subnets.
vswitch_cidr_1	172.16.0.0/21	First Vswitch located in zone A of the region.
vswitch_cidr_2	172.16.8.0/21	Second Vswitch located in zone B of the region.
table_store_ instance_type	Capacity	Accepted values are *HighPerformance* or *Capacity*.

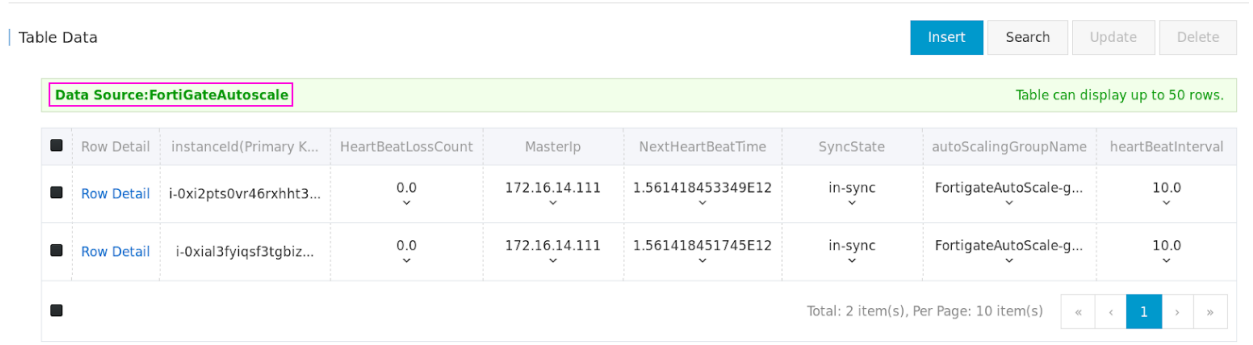
Variables can also be referenced from the command line using:

```
terraform plan -var "<var name>=<value>"
```

Verify the deployment

1. Log in to the AliCloud console and navigate to *TableStore*.
2. Navigate to the *FortiGateMasterElection* table.
3. Make note of the master FortiGate-VM IP address and ensure the *voteState* is *done*. See below for an example:

4. Navigate to the *FortiGateAutoscale* table and confirm that instances that have been added to the cluster. Following is an example of a healthy cluster:

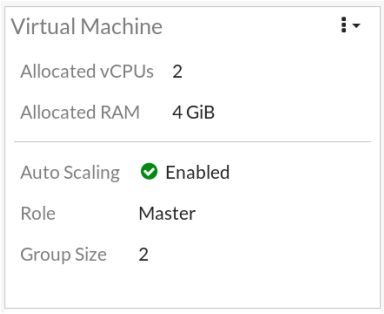


The *MasterIp* column displays the IP address of the master FortiGate-VM.

When an instance is removed from a cluster its record will not be erased from this table.

5. Log in to the master FortiGate-VM instance using the public IP address from step 3. The default admin port is *8443* and the default username/password will be *admin/<instance-id>*.

6. From the web interface you can tell the Instance role and current cluster size:



7. From the CLI type the following to get the role status and current *callback-url*:

```
get system auto-scale
```

Output will be similar to the following:

```
status              : enable
role                : master
sync-interface      : port1
callback-url        : https://**********.ap-southeast-5-internal.fc.aliyuncs.com/2016-08-
15/proxy/FortigateAutoScale-smc/FortiGateASG-rrr/
hb-interval         : 10
psksecret           : *
```

Destroying the cluster

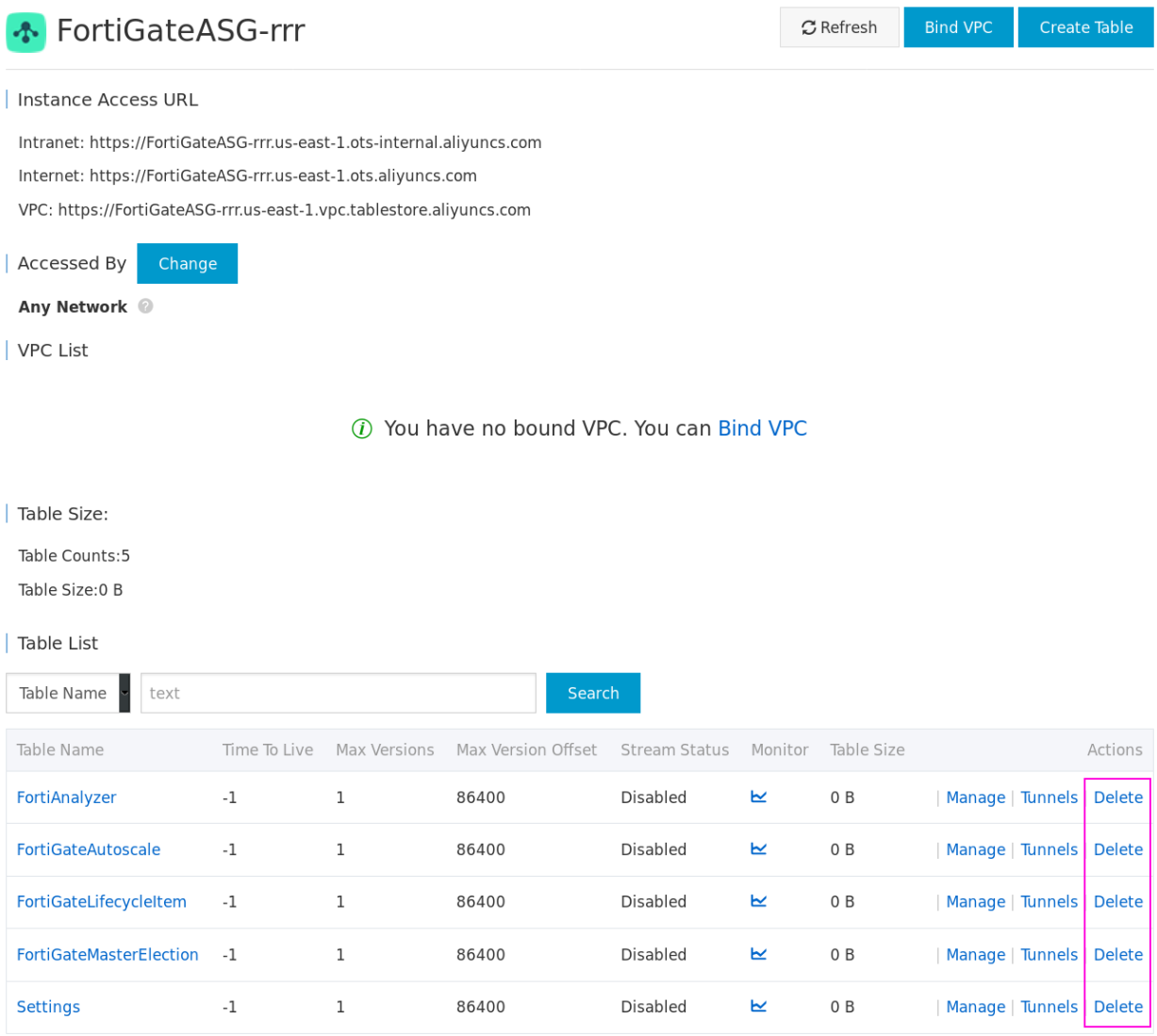
To destroy the cluster, first enter and verify:

```
terraform destroy  -var "access_key=<access_key>" -var "secret_key=<secret_key>" -var "region-
n=<region>"
```

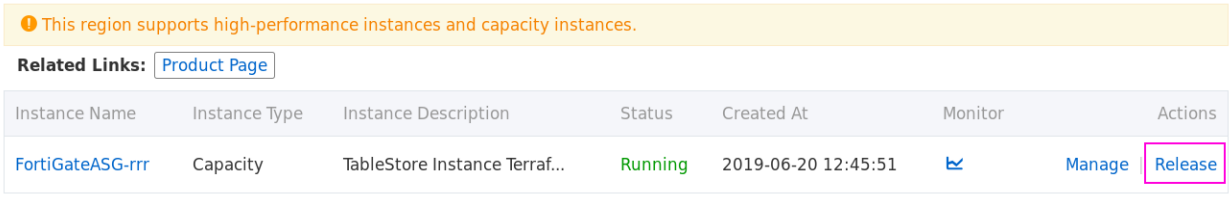
There are restrictions on deleting tables when they have data. As such, TableStore must then be deleted manually from the console.

To remove TableStore:

1. Navigate to your Table and click *Delete* for each table:



2. After deleting the tables, return to the *Instance* page and click *Release*:



Troubleshooting

Debugging cloud-init

Retrieving the `cloud-init` log can be useful when issues are occurring at boot up. To retrieve the log, log in to the FortiGate-VM and type the following into the CLI:

```
diag debug cloudinit show
```

Output will look similar to the following:

```
 >> Checking metadata source ali
 >> ALI user data obtained
 >> Fos-instance-id: i-p0w3dr3bf9rck4jub4vb
 >> Cloudinit trying to get config script from https://************.ap-southeast-2-intern-
al.fc.aliyuncs.com/2016-08-15/proxy/FortigateAutoScale-wke/FortigateAutoScale-rrr/
 >> Cloudinit download config script successfully
 >> Found metadata source: ali
 >> Run config script
 >> Finish running script
 >> FortiGate-VM64-ALI $  config system dns
 >> FortiGate-VM64-ALI (dns) $     unset primary
 >> FortiGate-VM64-ALI (dns) $     unset secondary
 >> FortiGate-VM64-ALI (dns) $  end
 >> FortiGate-VM64-ALI $  config system auto-scale
 >> FortiGate-VM64-ALI (auto-scale) $     set status enable
 >> FortiGate-VM64-ALI (auto-scale) $     set sync-interface port 1
 >> FortiGate-VM64-ALI (auto-scale) $     set role  master
 >> FortiGate-VM64-ALI (auto-scale) $     set callback-url
 https://************.ap-southeast-2-internal.fc.aliyuncs.com/2016-08-15/proxy/Fortig-
ateAutoScale-wke/FortigateAutoScale-rrr/
```

TableStore destroy time

TableStore deletion can take up to 10 minutes and may appear as follows:

```
alicloud_ots_instance.tablestore: Still destroying... (ID: FortiGateASG-rrr, 7m0s elapsed)
alicloud_ots_instance.tablestore: Still destroying... (ID: FortiGateASG-rrr, 7m10s elapsed)
alicloud_ots_instance.tablestore: Still destroying... (ID: FortiGateASG-rrr, 7m20s elapsed)
```

If you are seeing these messages after 10 minutes, it is likely that TableStore contains data. You will need to manually delete TableStore and then re-run the `terraform destroy` command. For details on manually deleting TableStore, refer to the section Destroying the cluster on page 71.

Resource availability

If a region runs out of a specified resource an error like the one below will be displayed. In this case the cluster will need to be deployed into a different region.

```
 1 error occurred:
       * alicloud_slb.default: 1 error occurred:
       * alicloud_slb.default: [ERROR] terraform-provider-alicloud/alicloud/resource_alicloud_
slb.go:324: Resource alicloud_slb CreateLoadBalancer Failed!!! [SDK alibaba-cloud-sdk-go
ERROR]:
SDK.ServerError
ErrorCode: OperationFailed.ZoneResourceLimit
Recommend:
RequestId: 83972A94-0640-49DA-8586-DCF535D14886
Message: The operation failed because of resource limit of the specified zone.
```

Timeout

If a timeout such as the one below occurs, re-run the command.

```
Error: Error applying plan:

1 error occurred:
       * alicloud_vswitch.vsw2: 1 error occurred:
       * alicloud_vswitch.vsw2: [ERROR] terraform-provider-alicloud/alicloud/resource_alicloud_
vswitch.go:58:
[ERROR] terraform-provider-alicloud/alicloud/resource_alicloud_vswitch.go:170:
[ERROR] terraform-provider-alicloud/alicloud/service_alicloud_ecs.go:51: Resource us-east-1b
DescribeZones Failed!!! [SDK alibaba-cloud-sdk-go ERROR]:
net/http: request canceled (Client.Timeout exceeded while reading body)
```

How to reset the master election

To reset the master election, refer to the section Verify the deployment on page 69 to locate the master record and delete the record. A new master FortiGate-VM will be elected and a new record will be created as a result.

Appendix

FortiGate Autoscale for AliCloud features

Major components

- *The Auto Scaling group*. The Auto Scaling group contains one to many FortiGate-VMs (PAYG licensing model). This Auto Scaling group will dynamically scale-out or scale-in based on the scaling metrics specified in the scaling rules.
- The *configset* folder contains files that are loaded as the initial configuration for 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 74 table below.
- *Tables in TableStore*. These tables are required to store information such as health check monitoring, master election, state transitions, etc. These records should not be modified unless required for troubleshooting purposes.

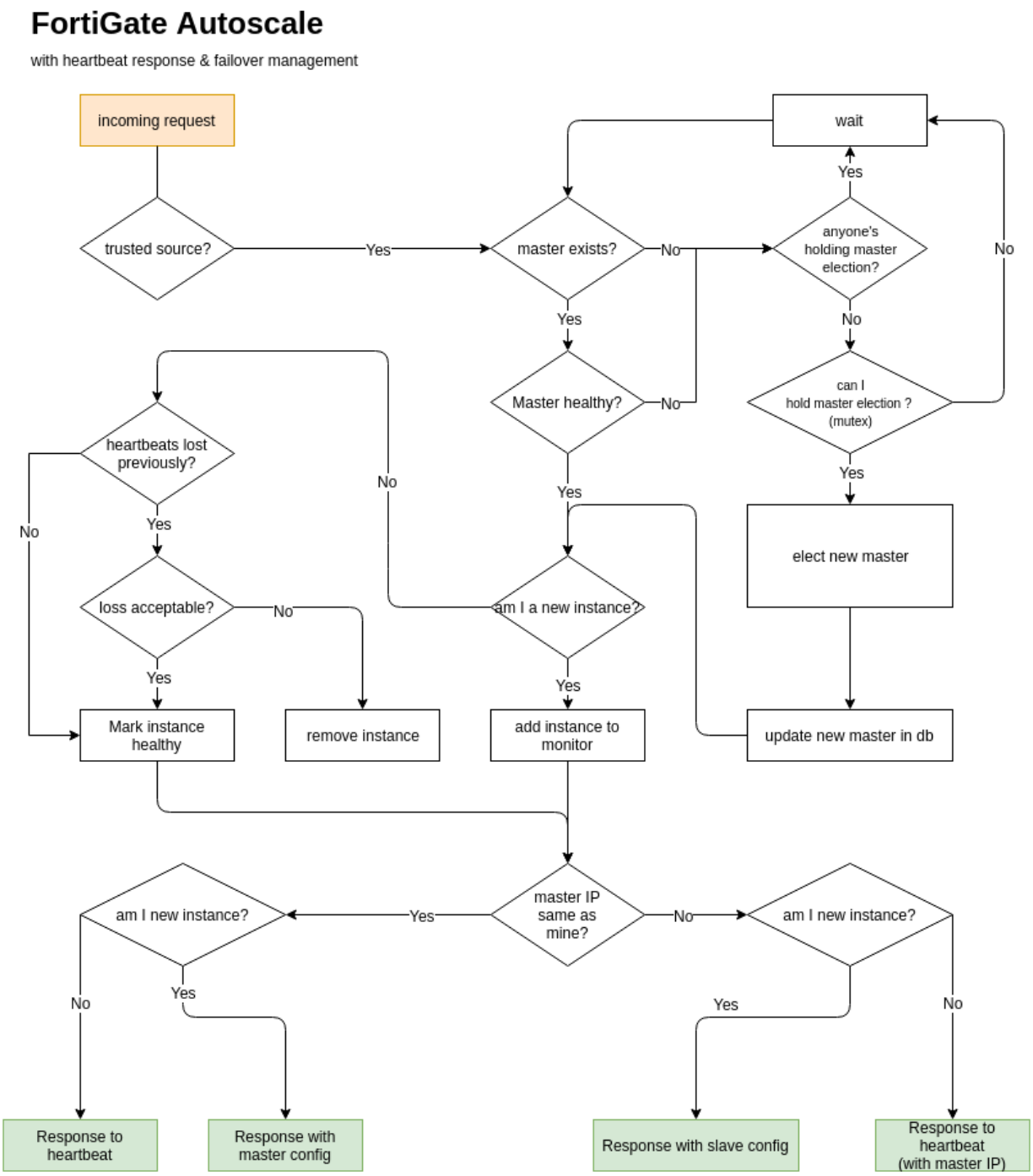
Configset placeholders

When the FortiGate-VM requests the configuration from the Auto Scaling function, the placeholders in the table below will be replaced with associated environment variables stored in Function Compute.

Placeholder	Type	Description
{SYNC_ INTERFACE}	Text	The interface for FortiGate-VMs to synchronize information. All characters must be lowercase.
{CALLBACK_URL}	URL	The endpoint URL to interact with the Auto Scaling handler script. Automatically generated during the Terraform deployment.
{PSK_SECRET}	Text	The Pre-Shared key used in FortiOS. Randomly generated during the Terraform deployment.  Changes to the PSK secret after FortiGate Autoscale for AliCloud 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.
{ADMIN_PORT}	Number	A port number specified for administration login. A positive integer such as 443 etc. Default value: 8443.  Changes to the admin port after deployment are not reflected here. For new instances to be spawned with the changed admin port, this environment variable will need to be updated.

Architectural diagram

Master election



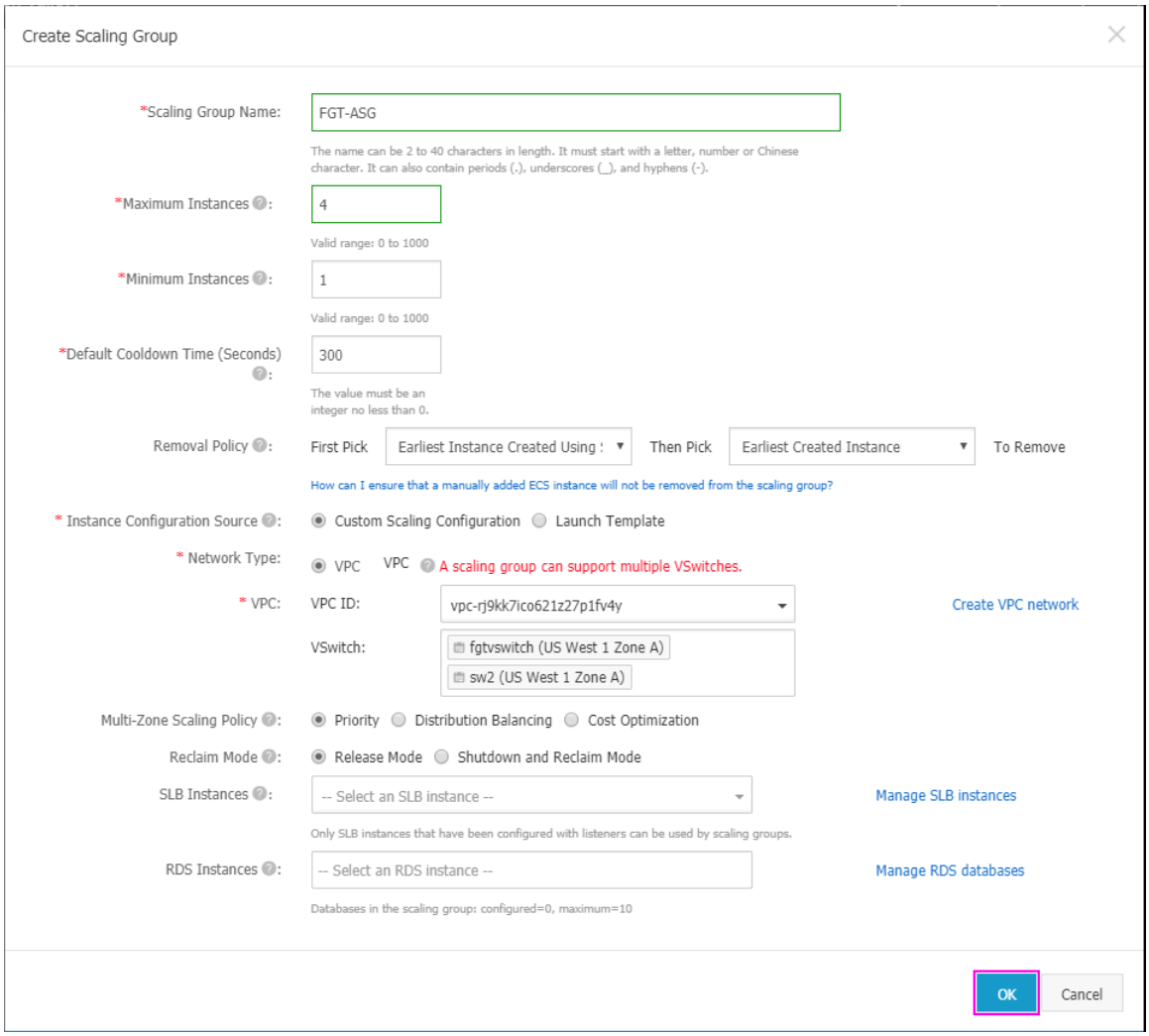
Manual deployment of auto scaling on AliCloud

Following is a sample configuration for deploying Auto Scaling on AliCloud:

1. Create a scaling group in the AliCloud console.
2. Create a scaling configuration in the AliCloud console.
3. Create scaling rules in the AliCloud console.
4. Configure a FortiGate-VM in the Auto Scaling group as the primary member.
5. Scale out a new FortiGate-VM, configure it as a secondary member, and synchronize the configuration from the primary to the secondary FortiGate-VM.
6. Run diagnose commands to confirm that Auto Scaling is functioning.

To create a scaling group in the AliCloud console:

1. Log into the AliCloud console.
2. Go to *Auto Scaling* > *Scaling Groups* > *Create Scaling Group*.
3. Set the following parameters for the Auto Scaling group:
   a. *Scaling Group Name*: Enter a name for the scaling group. The sample configuration is named *FGT-ASG*.
   b. *Maximum Instances*: Enter the maximum number of instances that can comprise the group. In the sample configuration, four (4) is the maximum number.
   c. *Minimum Instances*: Enter the minimum number of instances that can comprise the group. In the sample configuration, one (1) is the minimum number.
   d. *Instance Configuration Source*: Leave at the default value.
   e. *Network Type*: Leave at the default value, which is VPC.
   f. Select the VPC and VSwitch as desired.

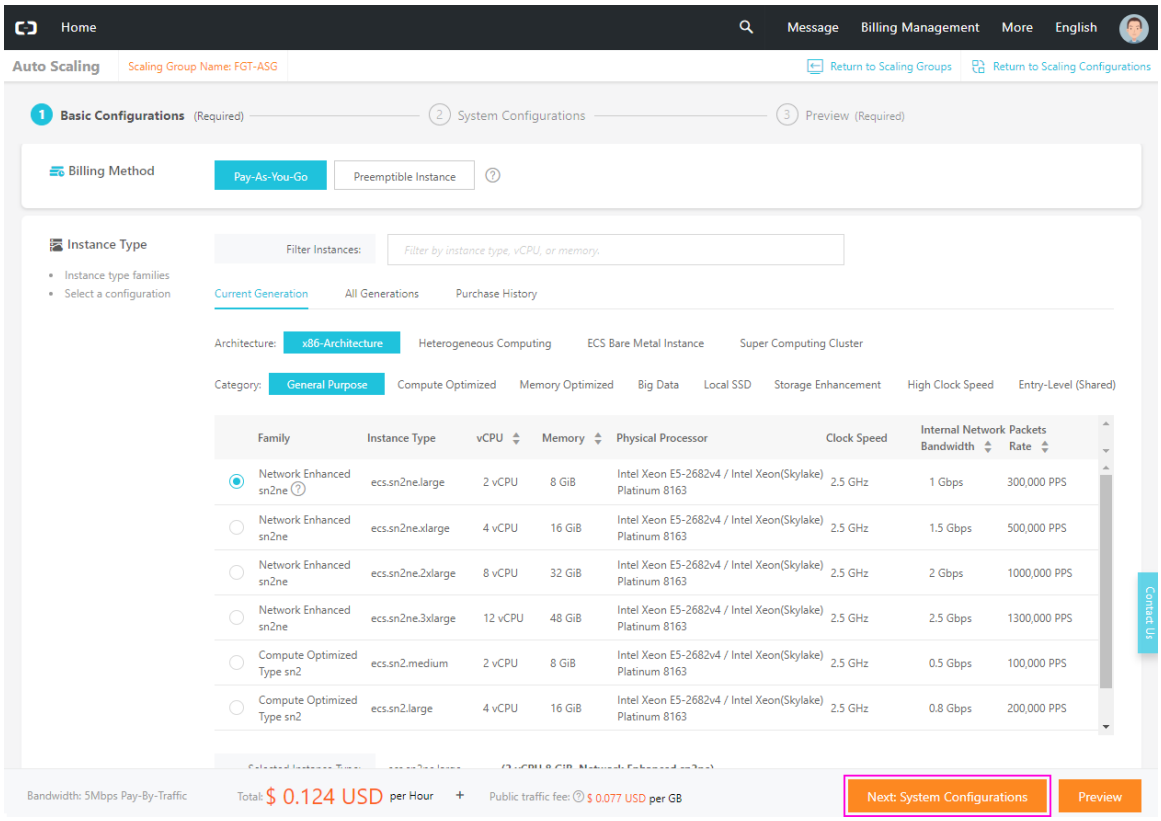


4. Click *OK*.

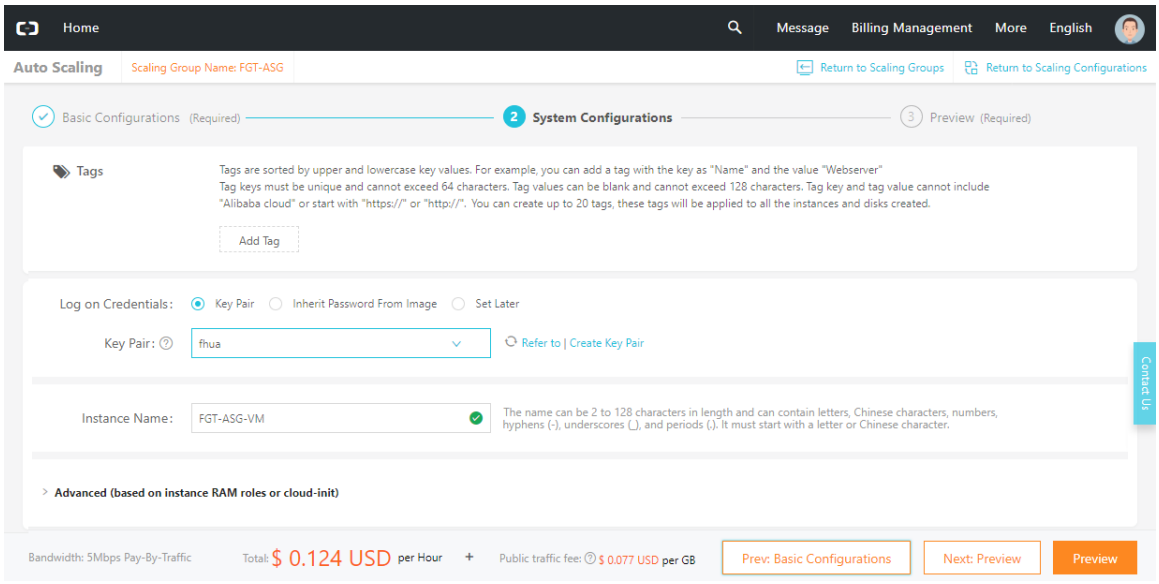
To create a scaling configuration in the AliCloud console:

1. After creating an Auto Scaling group, AliCloud displays a popup for creating a new scaling configuration before activating Auto Scaling. In the popup, click *Create Now*.
2. Select the instance type.
3. Select the desired FortiGate-VM image.
4. Ensure that *Assign Public IP* is selected.
5. Select the desired security group.

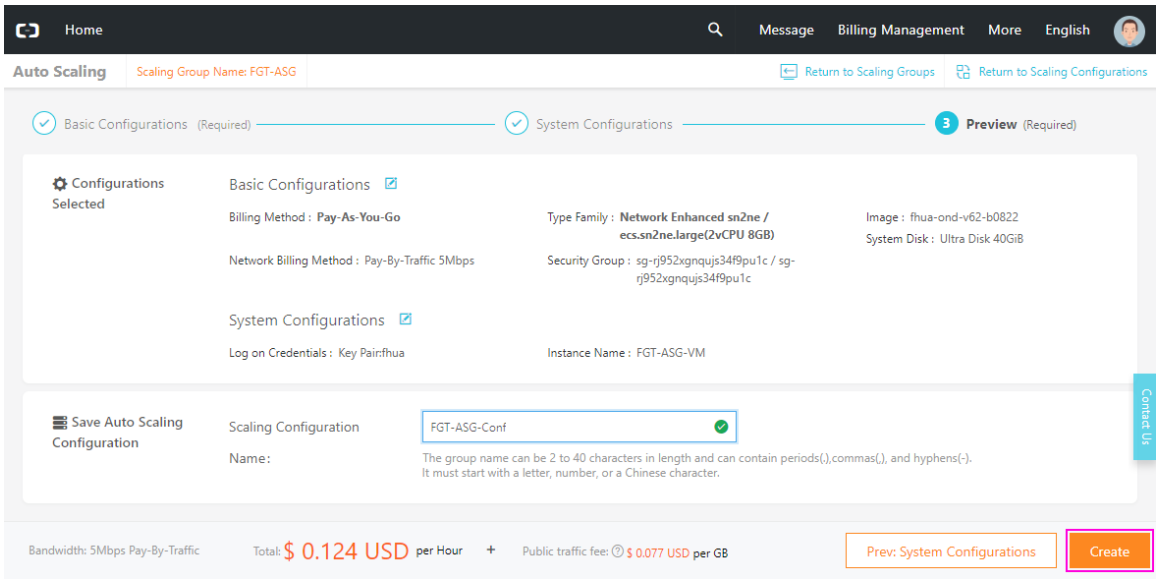
6. Click *Next: System Configurations*.



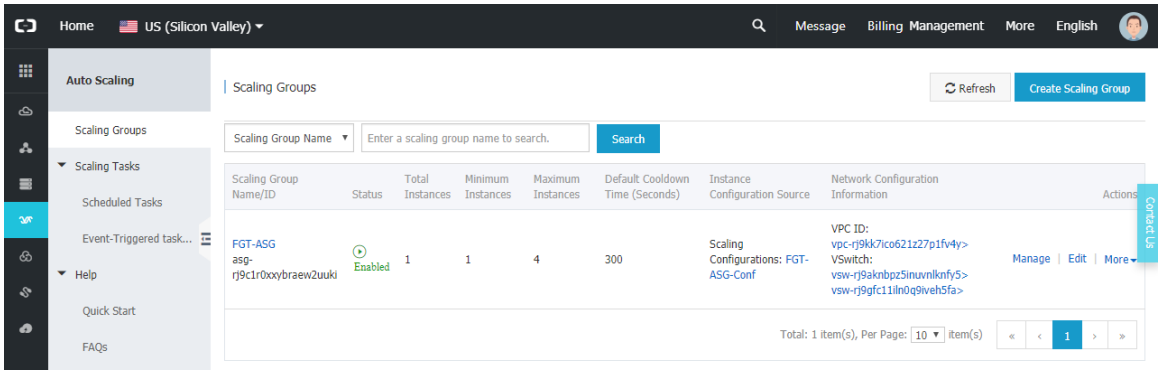
7. (Optional) set the key pair.



8. Preview the scaling configuration, then click *Create* and *Enable Configuration*.



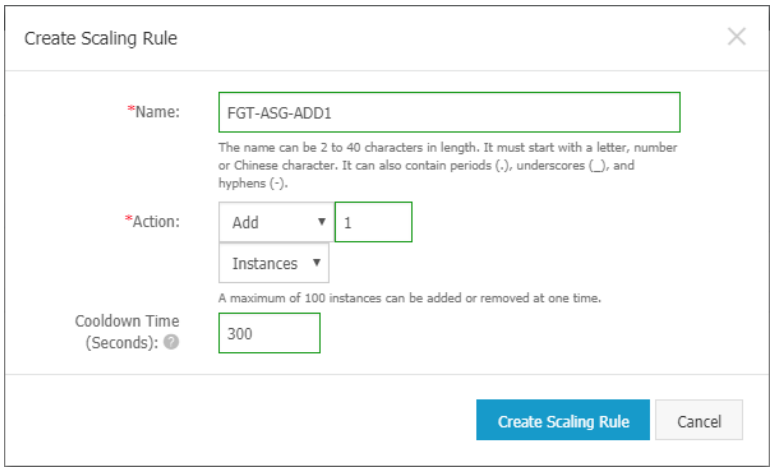
9. Go to *Auto Scaling* > *Scaling Groups* to ensure that AliCloud has created the Auto Scaling group and that the first FortiGate-VM has been automatically launched under the group.



To create scaling rules in the AliCloud console:

1. In *Auto Scaling* > *Scaling Groups*, click the group name.
2. Click *Scaling Rules* from the right-side menu.
3. In the *Create Scaling Rule* dialog, enter a scaling rule name.
4. Configure an action. In the sample configuration, the scaling rule is configured to add one (1) FortiGate-VM instance.
5. Enter a cool down time, then click *Create Scaling Rule*. You could also configure another scaling rule which can be

executed to remove one (1) FortiGate-VM instance.



To configure a FortiGate-VM in the Auto Scaling group as the primary member:

1. Log into the FortiGate-VM.
2. Run the following commands in the CLI to enable Auto Scaling and configure this FortiGate-VM as the primary member of the Auto Scaling group:

```
config system auto-scale
   set status enable
   set role master
   set sync-interface "port1"
   set psksecret xxxxxx
end
```

To scale out a new FortiGate-VM, configure it as a secondary member, and synchronize the configuration:

1. In *Auto Scaling* > *Scaling Groups*, click the group name, then execute the scaling rule created earlier. AliCloud creates a new FortiGate-VM instance.
2. Log into the new FortiGate-VM.
3. Run the following commands in the CLI to enable Auto Scaling and configure this FortiGate-VM as the secondary member of the Auto Scaling group. The `master-ip` value should be the primary FortiGate-VM's private IP address:

```
config system auto-scale
   set status enable
   set role slave
   set sync-interface "port1"
   set master-ip 192.168.1.204
   set psksecret xxxxxx
end
```

   The secondary FortiGate-VM will be synced with the primary FortiGate-VM. The secondary FortiGate-VM can receive configurations from the primary FortiGate-VM.

To run diagnose commands:

You can run the following `diagnose` commands to determine if the primary and secondary FortiGate-VMs are able to synchronize configurations:

```
FortiGate-VM64-ALION~AND # diag deb app hasync -1
slave's configuration is not in sync with master's, sequence:0
```

```
slave's configuration is not in sync with master's, sequence:1
slave's configuration is not in sync with master's, sequence:2
slave's configuration is not in sync with master's, sequence:3
slave's configuration is not in sync with master's, sequence:4
slave starts to sync with master
logout all admin users
```

Security Fabric connector integration with AliCloud

Configuring AliCloud Fabric connector using RAM roles

See the *FortiOS Cookbook* for information on the AliCloud Fabric connector.

The following summarizes minimum sufficient RAM roles for Fabric connector integration with AliCloud:

- AliyunECSReadOnlyAccess
- AliyunEIPReadOnlyAccess
- AliyunVPCReadOnlyAccess

Actual role configurations may differ depending on your environments. Check with your company's public cloud administrators for more details.

Pipelined automation using AliCloud Function Compute

See GitHub.

VPN for FortiGate-VM on AliCloud

Connecting a local FortiGate to an AliCloud VPC VPN

This recipe provides sample configuration of a site-to-site VPN connection from a local FortiGate to an AliCloud VPC VPN via IPsec with static routing.

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

The following prerequisites must be met for this configuration:

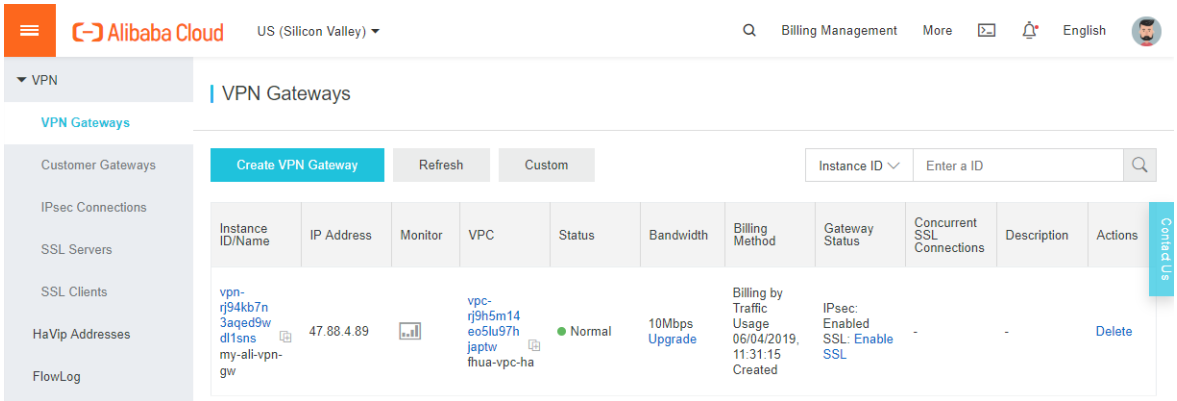
- An AliCloud VPC with some configured subnets, routing tables, security group rules, and so on
- An on-premise FortiGate with an external IP address

This recipe consists of the following steps:

1. Create a VPN gateway.
2. Create a customer gateway.
3. Create a site-to-site VPN connection on AliCloud.
4. Configure the on-premise FortiGate.
5. Run diagnose commands.

To create a VPN gateway:

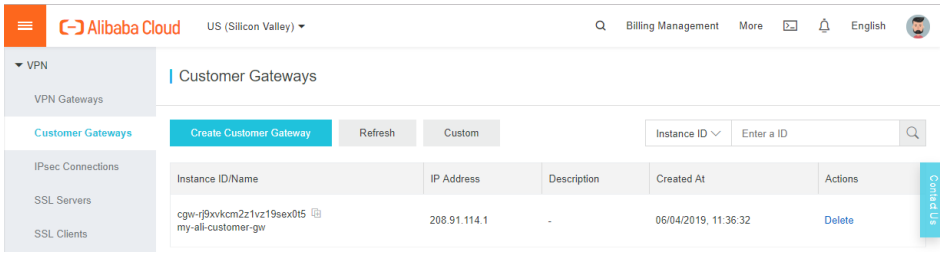
1. In the AliCloud management console, go to *VPN* > *VPN Gateways*.
2. Click *Create VPN Gateway*.
3. Create a virtual private gateway and attach it to the VPC from which you want to create the site-to-site VPN connection.



To create a customer gateway:

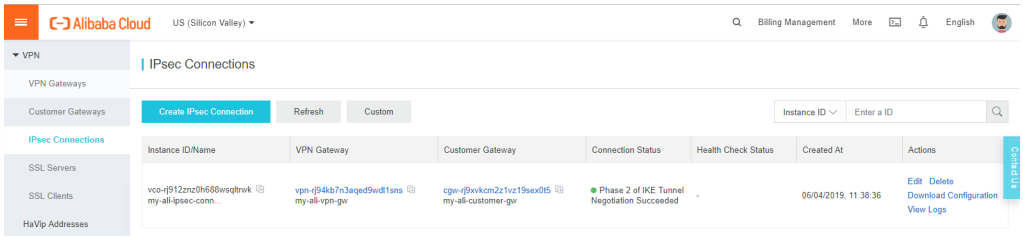
This example refers to the on-premise FortiGate for the VPC VPN to connect to as the customer gateway.

1. Go to *VPN* > *Customer Gateways*.
2. Click *Create Customer Gateway*.
3. Configure the customer gateway as shown:



To create a site-to-site VPN connection on AliCloud:

1. Go to *VPN* > *IPsec Connections*.
2. Click *Create IPsec Connection*.
3. Create an IPsec connection between the VPN and customer gateways.
4. Under *Actions*, click *Download Configuration*.



5. Note the IPsec-related parameters. You will use these parameters to configure the on-premise FortiGate in the next step:

```
{
  "LocalSubnet": "0.0.0.0/0",
  "RemoteSubnet": "0.0.0.0/0",
  "IpsecConfig": {
    "IpsecPfs": "group2",
    "IpsecEncAlg": "aes",
    "IpsecAuthAlg": "sha1",
    "IpsecLifetime": 86400
  },
  "Local": "x.x.x.x",
  "Remote": "47.88.4.89",
  "IkeConfig": {
    "IkeAuthAlg": "sha1",
    "LocalId": "x.x.x.x",
    "IkeEncAlg": "aes",
    "IkeVersion": "ikev1",
    "IkeMode": "main",
    "IkeLifetime": 86400,
    "RemoteId": "47.88.4.89",
    "Psk": "xxxxxxxxxxxxxxx",
    "IkePfs": "group2"
```

```
  }
}
```

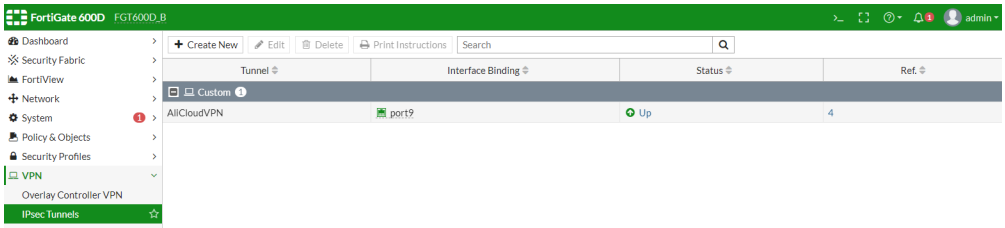
To configure the on-premise FortiGate:

1. In the FortiOS CLI, configure the on-premise FortiGate with the above IPsec-related parameters. When setting `remote-gw` and `psksecret`, use the values found for `RemoteId` and `Psk` above, respectively. The example on-premise FortiGate uses port9 as its external interface:

```
config vpn ipsec phase1-interface
    edit "AliCloudVPN"
        set interface "port9"
        set keylife 86400
        set peertype any
        set net-device enable
        set proposal aes128-sha1
        set dhgrp 14 2
        set remote-gw 47.88.4.89
        set psksecret xxxxxxxxxxxxxxx
    next
end
config vpn ipsec phase2-interface
    edit "AliCloudVPN"
        set phase1name "AliCloudVPN"
        set proposal aes128-sha1
        set dhgrp 14 2
        set keepalive enable
        set keylifeseconds 3600
    next
end
config firewall address
    edit "AliCloudVPN-local-subnet-1"
        set allow-routing enable
        set subnet 10.6.30.0 255.255.255.0
    next
end
config firewall address
    edit "AliCloudVPN-remote-subnet-1"
        set allow-routing enable
        set subnet 10.0.1.0 255.255.255.0
    next
end
config router static
    edit 2
        set device "AliCloudVPN"
        set dstaddr "AliCloudVPN-remote-subnet-1"
    next
end
config firewall policy
    edit 10
```

```
            set name "AliCloudVPN-local-ali"
            set srcintf "mgmt1"
            set dstintf "AliCloudVPN"
            set srcaddr "AliCloudVPN-local-subnet-1"
            set dstaddr "AliCloudVPN-remote-subnet-1"
            set action accept
            set schedule "always"
            set service "ALL"
        next
        edit 20
            set name "AliCloudVPN-ali-local"
            set srcintf "AliCloudVPN"
            set dstintf "mgmt1"
            set srcaddr "AliCloudVPN-remote-subnet-1"
            set dstaddr "AliCloudVPN-local-subnet-1"
            set action accept
            set schedule "always"
            set service "ALL"
        next
    end
```

2. If the IPsec tunnel does not appear automatically, run the `diagnose vpn tunnel up AliCloudVPN` command.
3. In the FortiOS GUI, go to *VPN* > *IPsec Tunnels*. Verify that the tunnel is up. The on-premise FortiGate can now access the AliCloud VM with its private IP address. The AliCloud VM can also access the on-premise FortiGate with its private IP address.



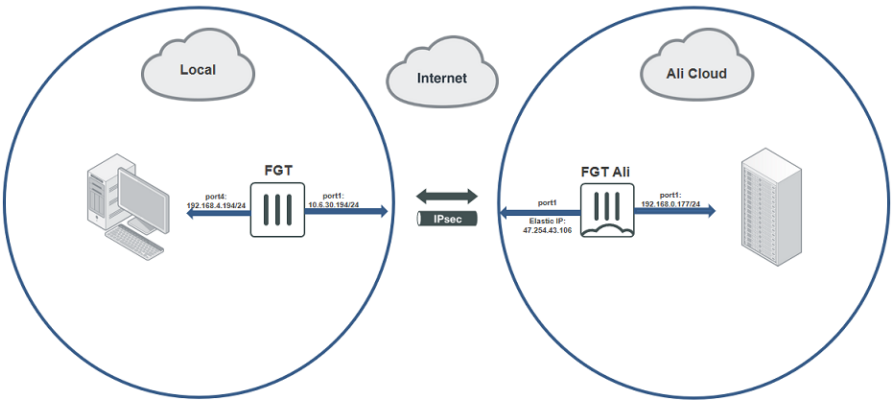
To run diagnose commands:

```
FGT600D_B # diagnose vpn ike gateway list

vd: root/0
name: AliCloudVPN
version: 1
interface: port9 10
addr: 172.16.200.212:4500 -> 47.88.4.89:4500
created: 1087s ago
nat: me peer
IKE SA: created 1/1  established 1/1  time 9110/9110/9110 ms
IPsec SA: created 1/2  established 1/1  time 30/30/30 ms

  id/spi: 0 d9d4ae9111a51b0b/de39f4ac9deffc18
  direction: initiator
  status: established 1087-1078s ago = 9110ms
  proposal: aes128-sha1
  key: 9bf9b58431949e77-a0c21ded48368db1
```

```
  lifetime/rekey: 28800/27421
  DPD sent/recv: 00000000/00000000

FGT600D_B # diagnose vpn tunnel list
list all ipsec tunnel in vd 0
------------------------------------------------------
name=AliCloudVPN ver=1 serial=1 172.16.200.212:4500->47.88.4.89:4500 dst_mtu=1500
bound_if=10 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=14 ilast=1084 olast=270 ad=/0
stat: rxp=1 txp=43 rxb=16452 txb=4389
dpd: mode=on-demand on=0 idle=20000ms retry=3 count=0 seqno=0
natt: mode=keepalive draft=32 interval=10 remote_port=4500
proxyid=AliCloudVPN proto=0 sa=1 ref=2 serial=1
  src: 0:0.0.0.0/0.0.0.0:0
  dst: 0:0.0.0.0/0.0.0.0:0
  SA:  ref=6 options=10227 type=00 soft=0 mtu=1422 expire=2399/0B replaywin=2048
       seqno=2c esn=0 replaywin_lastseq=00000001 itn=0 qat=0
  life: type=01 bytes=0/0 timeout=3298/3600
  dec: spi=ac5426a9 esp=aes key=16 417b83810bf1f17b30e8b0974716d37d
       ah=sha1 key=20 a3e1d5ca5d85907a35c7720e9c640d0fafbb0ee3
  enc: spi=c999e156 esp=aes key=16 837b20f727c957f700f6c89acbb9e9a9
       ah=sha1 key=20 7f4634601d6962575c00761f7270d36a683c3d65
  dec:pkts/bytes=1/16376, enc:pkts/bytes=43/7648
  npu_flag=03 npu_rgwy=47.88.4.89 npu_lgwy=172.16.200.212 npu_selid=0 dec_npuid=1 enc_npuid=1
```

Connecting a local FortiGate to an AliCloud FortiGate via site-to-site VPN

This guide provides sample configuration of a site-to-site VPN connection from a local FortiGate to an AliCloud FortiGate via site-to-site IPsec VPN with static routing. The following depicts the network topology for this sample deployment:



The following prerequisites must be met for this configuration:

- A FortiGate located on AliCloud with port1 connected to local LAN and a public IP address mapped to port1.
- A local FortiGate in a local environment. Determine if your FortiGate has a publicly accessible IP address or if it is behind NAT. In this example, the on-premise FortiGate is behind NAT.

This recipe consists of the following steps:

1. Configure the local FortiGate.
2. Configure the AliCloud FortiGate.
3. Establish a VPN connection between the local and AliCloud FortiGates.
4. Run diagnose commands.

Configuring the local FortiGate

To configure the local FortiGate using the GUI:

1. Configure the interfaces:
   a. In FortiOS, go to *Network* > *Interfaces*.
   b. Edit port1. From the *Role* dropdown list, select *WAN*. In the *IP/Network Mask* field, enter 10.6.30.194/255.255.255.0 for the interface that is connected to the Internet.
   c. Edit port4. From the *Role* dropdown list, select *LAN*. In the *IP/Network Mask* field, enter 192.168.4.194/255.255.255.0 for the interface that is connected to the local subnet.
2. Configure a static route to connect to the Internet:
   a. Go to *Network* > *Static Routes*.
   b. Click *Create New*.
   c. In the *Destination* field, enter 0.0.0.0/0.0.0.0.
   d. From the *Interface* dropdown list, select *port1*.
   e. In the *Gateway Address* field, enter 10.6.30.254.
3. Configure IPsec VPN:
   a. Go to *VPN* > *IPsec Wizard*.
   b. Configure *VPN Setup*:
      i. In the *Name* field, enter the desired name.
      ii. For *Template Type*, select *Site to Site*.
      iii. For *Remote Device Type*, select *FortiGate*.
      iv. For *NAT Configuration*, select *This site is behind NAT*. Click *Next*. For non-dialup situations where the local FortiGate has an external IP address, select *No NAT between sites*.
   c. Configure *Authentication*:
      i. For *Remote Device*, select *IP Address*.
      ii. In the *IP Address* field, enter 47.254.43.106. This is the AliCloud FortiGate port1 public IP address.
      iii. From the *Outgoing Interface* dropdown list, select *port1*.
      iv. For *Authentication Method*, select *Pre-shared Key*.
      v. In the *Pre-shared Key* field, enter 123456. Click *Next*.
   d. Configure *Policy & Routing*:
      i. From the *Local Interface* dropdown list, select *port4*. This autofills the *Local Subnets* field with 192.168.4.0/24.

ii. In the *Remote Subnets* field, enter 192.168.4.0/24. This is the AliCloud FortiGate port1 subnet.

iii. For *Internet Access*, select *None*. Click *Create*.

To configure the local FortiGate using the CLI:

1. Configure the interfaces:

```
config system interface
    edit "port1"
        set vdom "root"
        set ip 10.6.30.194 255.255.255.0
        set allowaccess ping https ssh http fgfm
        set type physical
        set role wan
        set snmp-index 1
    next
    edit "port4
        set vdom "root"
        set ip 192.168.4.194 255.255.255.0
        set allowaccess ping https ssh snmp fgfm ftm
        set type physical
        set device-identification enable
        set lldp-transmission enable
        set role lan
        set snmp-index 4
    next
end
```

2. Configure a static route to connect to the Internet:

```
config router static
    edit 1
        set gateway 10.6.30.254
        set device "port1"
    next
end
```

3. Configure IPsec VPN:

```
config vpn ipsec phase1-interface
    edit "to_ali"
        set interface "port1"
        set peertype any
        set net-device enable
        set proposal aes128-sha256 aes256-sha256 aes128-sha1 aes256-sha1
        set comments "VPN: to_ali (Created by VPN wizard)"
        set wizard-type static-fortigate
        set remote-gw 47.254.43.106
        set psksecret xxxxxx
    next
end
```

```
config vpn ipsec phase2-interface
    edit "to_ali"
        set phase1name "to_ali"
        set proposal aes128-sha1 aes256-sha1 aes128-sha256 aes256-sha256
aes128gcm aes256gcm chacha20poly1305
        set comments "VPN: to_ali (Created by VPN wizard)"
        set src-addr-type name
        set dst-addr-type name
        set src-name "to_ali_local"
        set dst-name "to_ali_remote"
    next
end
config router static
    edit 2
        set device "to_ali"
        set comment "VPN: to_ali (Created by VPN wizard)"
        set dstaddr "to_ali_remote"
    next
    edit 3
        set distance 254
        set comment "VPN: to_ali (Created by VPN wizard)"
        set blackhole enable
        set dstaddr "to_ali_remote"
    next
end
config firewall policy
    edit 1
        set name "vpn_to_ali_local"
        set uuid c6b2d36e-6c65-51e9-5a78-9a0881a0b07c
        set srcintf "port4"
        set dstintf "to_ali"
        set srcaddr "to_ali_local"
        set dstaddr "to_ali_remote"
        set action accept
        set schedule "always"
        set service "ALL"
        set comments "VPN: to_ali (Created by VPN wizard)"
    next
    edit 2
        set name "vpn_to_ali_remote"
        set uuid c6bf126e-6c65-51e9-8652-cb88546929b4
        set srcintf "to_ali"
        set dstintf "port4"
        set srcaddr "to_ali_remote"
        set dstaddr "to_ali_local"
        set action accept
        set schedule "always"
        set service "ALL"
```

```
            set comments "VPN: to_ali (Created by VPN wizard)"
        next
    end
```

Configuring the AliCloud FortiGate

To configure the AliCloud FortiGate using the GUI:

1. Configure the interface:
   a. In FortiOS, go to *Network* > *Interfaces*.
   b. Edit port1.
   c. From the *Role* dropdown list, select *LAN*.
   d. Ensure that *Addressing mode* is set to *DHCP* and that the FortiGate can list the assigned IP address.
2. Configure IPsec VPN:
   a. Go to *VPN* > *IPsec Wizard*.
   b. Configure *VPN Setup*:
      i. In the *Name* field, enter the desired name.
      ii. For *Template Type*, select *Site to Site*.
      iii. For *Remote Device Type*, select *FortiGate*.
      iv. For *NAT Configuration*, select *The remote site is behind NAT*. Click *Next*.
   c. Configure *Authentication*:
      i. From the *Incoming Interface* dropdown list, select *port1*.
      ii. For *Authentication Method*, select *Pre-shared Key*.
      iii. In the *Pre-shared Key* field, enter 123456. Click *Next*.
   d. Configure *Policy & Routing*:
      i. From the *Local Interface* dropdown list, select *port1*. This autofills the *Local Subnets* field with 192.168.4.0/24.
      ii. In the *Remote Subnets* field, enter 192.168.4.0/24. This is the local FortiGate port4 subnet.
      iii. For *Internet Access*, select *None*. Click *Create*.

To configure the AliCloud FortiGate using the CLI:

1. Configure the interface and ensure that the FortiGate can list the assigned IP address:

```
config system interface
    edit "port1"
        set vdom "root"
        set mode dhcp
        set allowaccess ping https ssh fgfm
        set type physical
        set device-identification enable
        set lldp-transmission enable
        set role lan
        set snmp-index 1
    next
```

```
end

diagnose ip address list
IP=192.168.0.177->192.168.0.177/255.255.255.0 index=3 devname=port1
```

2. Configure IPsec VPN:

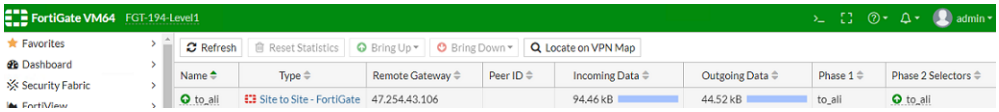
```
config vpn ipsec phase1-interface
    edit "to_local"
        set type dynamic
        set interface "port1"
        set peertype any
        set net-device enable
        set proposal aes128-sha256 aes256-sha256 aes128-sha1 aes256-sha1
        set dpd on-idle
        set comments "VPN: to_local (Created by VPN wizard)"
        set wizard-type dialup-fortigate
        set psksecret xxxxxx
        set dpd-retryinterval 60
    next
end
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
config firewall policy
    edit 1
        set name "vpn_to_local_local"
        set uuid e07aaa72-833c-51e9-ad33-4c1e96b656da
        set srcintf "port1"
        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 e086b2b8-833c-51e9-3aaf-49e3cd4c5c70
        set srcintf "to_local"
```

```
        set dstintf "port1"
        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
```

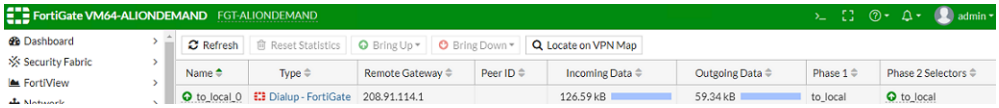
To establish the VPN connection between the FortiGates:

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 created tunnel.
3. Click *Bring Up*. The tunnel is up.



4. In FortiOS on the AliCloud FortiGate, go to *Monitor* > *IPsec Monitor* to verify that the tunnel is up.



To run diagnose commands:

1. Show the local FortiGate VPN status:

```
FGT-194-Level1 # diagnose vpn ike gateway list
vd: root/0
name: to_ali
version: 1
interface: port1 3
addr: 10.6.30.194:4500 -> 47.254.43.106:4500
created: 4057s ago
nat: me peer
IKE SA: created 1/1  established 1/1  time 21180/21180/21180 ms
IPsec SA: created 1/3  established 1/3  time 20/26/30 ms
  id/spi: 2 fd018d163ea303aa/9d7a245f889ee6c4
  direction: initiator
  status: established 4057-4036s ago = 21180ms
  proposal: aes128-sha256
  key: c7bab4dd8883b727-3b249220088216f8
  lifetime/rekey: 86400/82063
  DPD sent/recv: 00000000/00000009
FGT-194-Level1 # diagnose vpn tunnel list
list all ipsec tunnel in vd 0
------------------------------------------------------
```

```
name=to_ali ver=1 serial=1 10.6.30.194:4500->47.254.43.106:4500 dst_mtu=1500
bound_if=3 lgwy=static/1 tun=intf/0 mode=auto/1 encap=none/528 options
[0210]=create_dev frag-rfc  accept_traffic=1
proxyid_num=1 child_num=0 refcnt=14 ilast=0 olast=0 ad=/0
stat: rxp=3382 txp=3404 rxb=432896 txb=204240
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_ali proto=0 sa=1 ref=2 serial=3
  src: 0:192.168.4.0/255.255.255.0:0
  dst: 0:192.168.0.0/255.255.255.0:0
  SA:  ref=3 options=10226 type=00 soft=0 mtu=1422 expire=39471/0B
replaywin=2048
       seqno=d14 esn=0 replaywin_lastseq=00000d0d itn=0 qat=0
  life: type=01 bytes=0/0 timeout=42903/43200
  dec: spi=8427ce41 esp=aes key=16 961323608ef02c111ce4cc393cd79293
       ah=sha1 key=20 9cffabaa0163df6a92e1917efa333148b58ff9da
  enc: spi=e2723047 esp=aes key=16 f93b233906039c179924923a4f09ebae
       ah=sha1 key=20 c2c6225e26927de6381bf44c6ccd6d0a325e2e27
  dec:pkts/bytes=3325/199500, enc:pkts/bytes=3347/428416
```

2. Show the AliCloud FortiGate VPN status:

```
FGT-ALIONDEMAND # diagnose vpn ike gateway list
vd: root/0
name: to_local_0
version: 1
interface: port1 3
addr: 192.168.0.177:4500 -> 208.91.114.1:64916
created: 4103s ago
nat: me peer
IKE SA: created 1/1  established 1/1  time 120/120/120 ms
IPsec SA: created 1/3  established 1/3  time 20/26/30 ms
  id/spi: 0 fd018d163ea303aa/9d7a245f889ee6c4
  direction: responder
  status: established 4103-4103s ago = 120ms
  proposal: aes128-sha256
  key: c7bab4dd8883b727-3b249220088216f8
  lifetime/rekey: 86400/82026
  DPD sent/recv: 00000009/00000000
FGT-ALIONDEMAND # diagnose vpn tunnel list
list all ipsec tunnel in vd 0
------------------------------------------------------
name=to_local ver=1 serial=1 192.168.0.177:0->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=4118 olast=4118 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=2 192.168.0.177:4500->208.91.114.1:64916 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=0 olast=0 ad=/0
stat: rxp=3459 txp=3459 rxb=442752 txb=207540
dpd: mode=on-idle on=1 idle=60000ms retry=3 count=0 seqno=9
natt: mode=keepalive draft=32 interval=10 remote_port=64916
proxyid=to_local proto=0 sa=1 ref=2 serial=3 add-route
  src: 0:192.168.0.0/255.255.255.0:0
  dst: 0:192.168.4.0/255.255.255.0:0
  SA:  ref=3 options=282 type=00 soft=0 mtu=1422 expire=39694/0B replaywin=2048
       seqno=d4b esn=0 replaywin_lastseq=00000d52 itn=0 qat=0
  life: type=01 bytes=0/0 timeout=43187/43200
  dec: spi=e2723047 esp=aes key=16 f93b233906039c179924923a4f09ebae
       ah=sha1 key=20 c2c6225e26927de6381bf44c6ccd6d0a325e2e27
  enc: spi=8427ce41 esp=aes key=16 961323608ef02c111ce4cc393cd79293
       ah=sha1 key=20 9cffabaa0163df6a92e1917efa333148b58ff9da
  dec:pkts/bytes=3402/204120, enc:pkts/bytes=3402/435456
```

Change log

Date	Change Description
2019-03-26	Initial release.
2019-06-05	Added Connecting a local FortiGate to an AliCloud VPC VPN on page 83 and Connecting a local FortiGate to an AliCloud FortiGate via site-to-site VPN on page 87.
2019-06-07	Added Deploying FortiGate-VM HA on AliCloud using routing tables and EIPs on page 46.
2019-06-28	Added Security Fabric connector integration with AliCloud on page 82.
2019-07-02	Updated Instance type support on page 6.
2019-07-22	Updated Deploying FortiGate-VM HA on AliCloud using routing tables and EIPs on page 46 and Security Fabric connector integration with AliCloud on page 82.
2019-07-30	Updated Deploying auto scaling on AliCloud on page 62. Added Deploying FortiGate-VM HA on AliCloud between availability zones on page 55.
2019-09-26	Added Pipelined automation using AliCloud Function Compute on page 82.
2019-10-17	Updated Deploying auto scaling on AliCloud on page 62.
2019-11-29	Updated Order types on page 8 and Models on page 7.