Deploy the Firepower Threat Defense Virtual Auto Scale for AWS

This document explains how to deploy serverless components for the FTDv Auto Scale Manager in AWS.

Important Read the entire document before starting deployment. Make sure the prerequisites are met before starting deployment.

Auto Scale Solution for FTDv on AWS

The following sections describe how the components of the Auto Scale solution work for the FTDv on AWS.

About the Auto Scale Solution

Cisco provides CloudFormation Templates and scripts for deploying an auto-scaling group of FTDv firewalls using several AWS services, including Lambda, auto scaling groups, Elastic Load Balancing (ELB), Amazon S3 Buckets, SNS, and CloudWatch.

FTDv Auto Scale in AWS is a complete serverless implementation (i.e. no helper VMs involved in the automation of this feature) that adds horizontal auto scaling capability to FTDv instances in the AWS environment.

The FTDv Auto Scale solution is a CloudFormation template-based deployment that provides:

- Completely automated FTDv instance registration and de-registration with the FMC.
- NAT policy, Access Policy, and Routes automatically applied to scaled-out FTDv instances.
- Support for Load Balancers and multi-availability zones.
- Support for enabling and disabling the Auto Scale feature.

- Works only with FMC; the Firepower Device Manager is not supported.

Enhancements to Auto Scale (Version 6.7)

- Custom Metric Publisher—A new Lambda function polls the FMC every 2nd minute for memory consumption of all FTDv instances in the Auto Scale group, then publishes the value to CloudWatch Metric; see Input Parameters, on page 8 for a description.
- A new scaling policy based on memory consumption is available.
- FTDv private IP connectivity for SSH and Secure Tunnel to the FMC.
- FMC configuration validation.
- Support for opening more Listening ports on ELB.
- Modified to Single Stack deployment. All Lambda functions and AWS resources are deployed from a single stack for a streamlined deployment.

Supported Software Platforms

The FTDv Auto Scale solution is applicable to the FTDv managed by the FMC, and is software version agnostic. The Cisco Firepower Compatibility Guide provides Cisco Firepower software and hardware compatibility, including operating system and hosting environment requirements.

- The Firepower Management Centers: Virtual table lists Firepower compatibility and virtual hosting environment requirements for the FMCv on AWS.
- The Firepower Threat Defense Virtual Compatibility table lists Firepower compatibility and virtual hosting environment requirements for FTDv on AWS.

Note For purposes of deploying the AWS Auto Scale solution, the minimum supported Firepower version for FTDv on AWS is Version 6.4. The FMC must be running Version 6.6+ at a minimum to use memory-based scaling.

Auto Scale Use Case

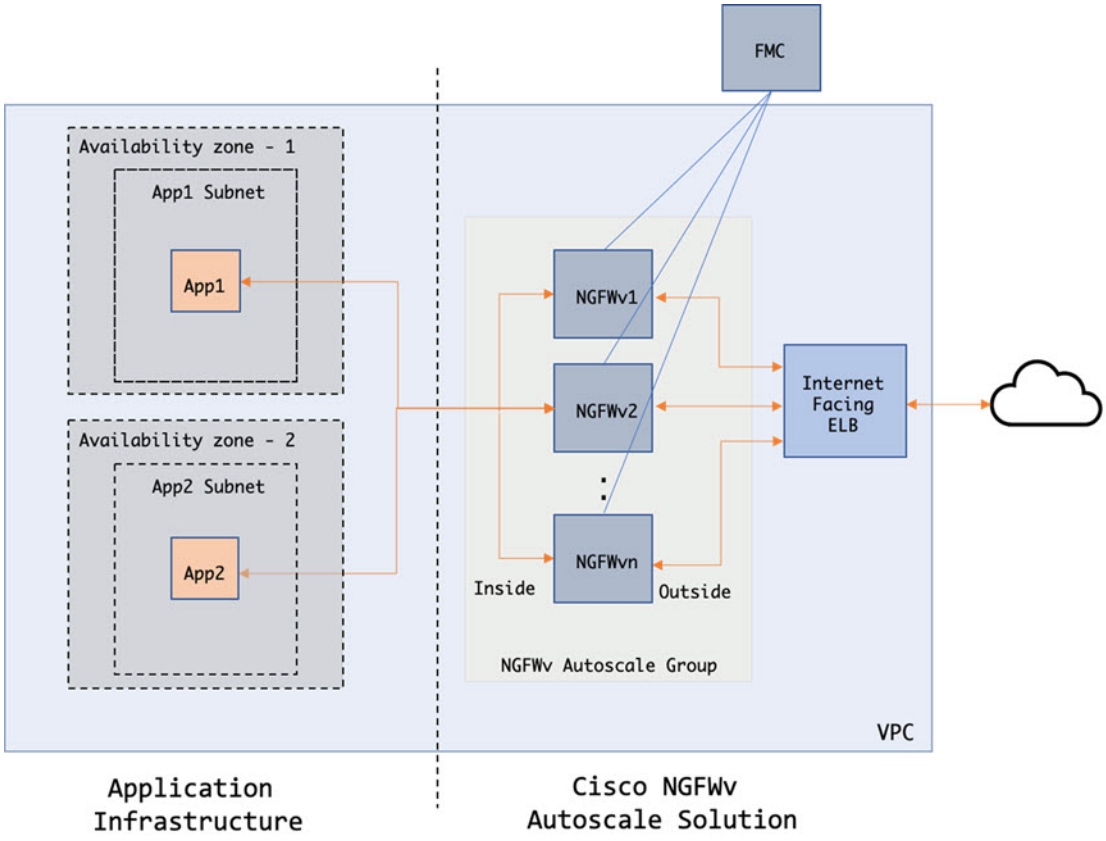
The Use Case for this FTDv AWS Auto Scale Solution is shown in Figure 1: FTDv Auto Scale Use Case Diagram, on page 3. Because the AWS Load Balancer allows only Inbound-initiated connections, only externally generated traffic is allowed to pass inside via the Cisco FTDv firewall.

Note Secured ports need an SSL/TLS certificate, as described SSL Server Certificate, on page 7 in the Prerequisites.

The Internet-facing load balancer can be a Network Load Balancer or an Application Load Balancer. All of the AWS requirements and conditions hold true for either case. As indicated in the Use Case diagram, the right side of the dotted line is deployed via the FTDv templates. The left side is completely user-defined.

Note Application-initiated outbound traffic will not go through the FTDv.

Figure 1: FTDv Auto Scale Use Case Diagram



Port-based bifurcation for traffic is possible. This can be achieved via NAT rules; see Configure Objects, Device Group, NAT Rules, Access Policies in FMC, on page 14. For example, traffic on Internet-facing LB DNS, Port: 80 can be routed to Application-1; Port: 88 traffic can be routed to Application-2.

How the Auto Scale Solution Works

To scale FTDv instances in and out, an external entity called the Auto Scale Manager monitors metrics, commands an auto scale group to add or delete FTDv instances, registers and deregisters the FTDv devices with the managing FMC, and configures FTDv instances.

The Auto Scale Manager is implemented using AWS Serverless architecture and communicates with AWS resources, the FTDv, and the FMC. We provide CloudFormation templates to automate the deployment of Auto Scale Manager components. The template also deploys other resources required for complete solution to work.

Note Serverless Auto Scale scripts are only invoked by CloudWatch events, hence they only run when an instance is launched.

Auto Scale Solution Components

The following components make up the Auto Scale solution.

CloudFormation Template

The CloudFormation template is used to deploy resources required by Auto Scale solution in AWS. The template consists of:

- Auto Scale Group, Load Balancer, Security Groups, and other miscellaneous components.
- The template takes user input to customize the deployment.

Note The template has limitations in validating user input, hence it is the user's responsibility to validate input during deployment.

Lambda Functions

The Auto Scale solution is a set of Lambda functions developed in Python, which gets triggered from Lifecycle hooks, SNS, CloudWatch event/alarm events. The basic functionality includes:

- Add/Remove Diag, Gig0/0, and Gig 0/1 interfaces to instance.
- Register Gig0/1 interface to Load Balancer's Target Groups.
- Register a new FTDv with the FMC.
- Configure and deploy a new FTDv via FMC.
- Unregister (remove) a scaled-in FTDv from the FMC.
- Publish the memory metric from the FMC.

Lambda Functions are delivered to customer in the form of a Python package.

Lifecycle Hooks

- Lifecycle hooks are used to get lifecycle change notification about an instance.
- In the case of instance launch, a Lifecycle hook is used to trigger a Lambda function which can add interfaces to an FTDv instance, and register outside interface IPs to target groups.
- In the case of instance termination, a Lifecycle hook is used to trigger a Lambda function to deregister an FTDv instance from the target group.

Simple Notification Service (SNS)

- Simple Notification Service (SNS) from AWS is used to generate events.
- Due to the limitation that there is no suitable orchestrator for Serverless Lambda functions in AWS, the solution uses SNS as a kind of function chaining to orchestrate Lambda functions based on events.

Auto Scale Solution Prerequisites

Download Deployment Files

Download the files required to launch the FTDv Auto Scale for AWS solution. Deployment scripts and templates for your Firepower version are available from the GitHub repository at:

- https://github.com/CiscoDevNet/cisco-ftdv/tree/master/autoscale/aws

Attention Note that Cisco-provided deployment scripts and templates for auto scale are provided as open source examples, and are not covered within the regular Cisco TAC support scope. Check GitHub regularly for updates and ReadMe instructions.

Infrastructure Configuration

In a cloned/downloaded GitHub repository, the **infrastructure.yaml** file can be found in template folder. This CFT can be used to deploy VPCs, subnets, routes, ACLs, security groups, VPC end-points, and S3 buckets with bucket policies. This CFT can be modified to fit your requirements.

The following sections provide more information about these resources and their use in Auto Scale. You can manually deploy these resources and also use them in Auto Scale.

Note The **infrastructure.yaml** template deploys VPCs, subnets, ACLs, security groups, S3 buckets, and VPC end-points only. It does not create the SSL certificate, Lambda layer, or KMS key resources.

VPC

You should create the VPC as required for your application requirements. It is expected that the VPC have an Internet gateway with at least one subnet attached with a route to the Internet. Refer to the appropriate sections for the requirements for Security Groups, Subnets, etc.

Subnets

Subnets can be created as needed for the requirements of the application. The FTDv VM requires 3 subnets for operation as shown in the Use Case.

Note If multiple availability zone support is needed, then subnets are needed for each zone as subnets are zonal properties within the AWS Cloud

Outside Subnet

The Outside subnet should have route with '0.0.0.0/0' to the Internet gateway. This will contain the Outside interface of the FTDv, and also the Internet-facing NLB will be in this subnet.

Inside Subnet

This can be similar to the Application subnets, with or without NAT/Internet gateway. Please note that for FTDv health probes, it should be possible to reach the AWS Metadata Server (169.254.169.254) via port 80.

Note In this AutoScale solution, Load Balancer health probes are redirected to the AWS Metadata Server via inside/Gig0/0 interface. However, you can change this with your own application serving the health probe connections sent to FTDv from the Load Balancer. In that case, you need to replace the AWS Metadata Server object to the respective application IP address to provide the health probes response.

Management Subnet

This subnet is the FTDv Management interface. It's optional for you to have an Internet gateway (default route) or not. To the situation where the FMC is available to devices in this subnet, then assigning an elastic IP address (EIP) to the FTDv will be optional. The same subnet IP address will be used for the diagnostic interface as well.

Lambda Subnets

The AWS Lambda function requires two subnets having the NAT gateway as the default gateway. This makes the Lambda function private to the VPC. Lambda subnets do not need to be as wide as other subnets. Please refer to AWS documentation for best practices on Lambda subnets.

Application Subnets

There is no restriction imposed on this subnet from the Auto Scale solution, but in case the application needs Outbound connections outside the VPC, there should be respective routes configured on the subnet. This is because outbound-initiated traffic does not pass through Load Balancers. See the AWS Elastic Load Balancing User Guide.

Security Groups

All connections are allowed in the provided Auto Scale Group template. You need only the following connections for the Auto Scale Solution to work.

Table 1: Required Ports

Port	Usage	Subnet
8305	FMC to FTDv Secured tunnel connection	Management subnets
Health Probe port (default: 8080)	Internet-facing Load Balancer health probes	Outside, Inside Subnets
Application ports	Application data traffic	Outside, Inside Subnets

Security Groups or ACLs for the FMC Instance

To allow HTTPS connections between Lambda Functions and the FMC. Because Lambda Functions are to be kept in Lambda subnets having a NAT gateway as the default route, the FMC should be allowed to have inbound HTTPS connections from the NAT gateway IP address.

Amazon S3 Bucket

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers industry-leading scalability, data availability, security, and performance. You can place all the required files for both the firewall template and the application template in the S3 bucket.

When templates are deployed, Lambda functions get created referencing Zip files in the S3 bucket. Hence the S3 bucket should be accessible to the user account.

SSL Server Certificate

If the Internet-facing Load Balancer has to support TLS/SSL, a Certificate ARN is required. Refer to the following links for more information:

- Working with Server Certificates
- Create a Private Key and Self-Signed Certificate for Testing
- Create AWS ELB with Self-Signed SSL Cert (Third-party link)

Example of ARN: arn:aws:iam::[AWS Account]:server-certificate/[Certificate Name]

Lambda Layer

The ***autoscale_layer.zip*** can be created in a Linux environment, such as Ubuntu 18.04 with Python 3.6 installed.

```
#!/bin/bash
mkdir -p layer
virtualenv -p /usr/bin/python3.6 ./layer/
source ./layer/bin/activate
pip3 install pycrypto==2.6.1
pip3 install paramiko==2.7.1
pip3 install requests==2.23.0
pip3 install scp==0.13.2
pip3 install jsonschema==3.2.0
echo "Copy from ./layer directory to ./python\n"
```

```
mkdir -p ./python/.libs_cffi_backend/
cp -r ./layer/lib/python3.6/site-packages/* ./python/
cp -r ./layer/lib/python3.6/site-packages/.libs_cffi_backend/* ./python/.libs_cffi_backend/
zip -r autoscale_layer.zip ./python
```

The resultant ***autoscale_layer.zip*** file should be copied to the *lambda-python-files* folder.

KMS Master Key

This is required if the FMC and FTDv passwords are in encrypted format. Otherwise this component is not required. Passwords should be encrypted using only the KMS provided here. If KMS ARN is entered on CFT, then passwords have to be encrypted. Otherwise passwords should be plain text.

For more information about master keys and encryption, see the AWS document Creating keys and the AWS CLI Command Reference about password encryption and KMS.

Example:

```
$ aws kms encrypt --key-id <KMS-ARN> --plaintext 'MyC0mplIc@tedProtect1oN'
{
    "KeyId": "KMS-ARN",
    "CiphertextBlob":
"AQICAHgcQFAGtz/hvaxMtJvY/x/rfHnKI3clFPpSXUU7HQRnCAFwfXhXHJAHL8tcVmDqurALAAAAajBoBgkqhki
G9w0BBwagWzBZAgEAMFQGCSqGSIb3DQEHATAeBglghkgBZQMEAS4wEQQM45AIkTqjSekX2mniAgEQgCcOav6Hhol
+wxpWKtXY4y1Z1d0z1P4fx0jTdosfCbPnUExmNJ4zdx8="
}
$
```

The value of *CiphertextBlob* key should be used as a password.

Python 3 Environment

A ***make.py*** file can be found in the cloned repository top directory. This will Zip the python files into a Zip file and copy to a target folder. In order to do these tasks, the Python 3 environment should be available.

Auto Scale Deployment

Preparation

It is expected that the Application is either deployed or its deployment plan is available.

Input Parameters

The following input parameters should be collected prior to deployment.

Table 2: Auto Scale Input Parameters

Parameter	Allowed Values/Type	Description
PodNumber	String Allowed Pattern: '^\d{1,3}$'	This is the pod number. This will be suffixed to the Auto Scale Group name (FTDv-Group-Name). For example, if this value is '1', then the group name will be *FTDv-Group-Name-1*. It should be at least 1 numerical digit but not more than 3 digits. Default: 1
AutoscaleGrpNamePrefix	String	This is the Auto Scale Group Name Prefix. The pod number will be added as a suffix. Maximum: 18 characters Example: Cisco-FTDv-1
NotifyEmailID	String	Auto Scale events will be sent to this email address. You need to accept a subscription email request. Example: admin@company.com
VpcId	String	The VPC ID in which the device needs to be deployed. This should be configured as per AWS requirements. Type: AWS::EC2::VPC::Id If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.
LambdaSubnets	List	The subnets where Lambda functions will be deployed. Type: List<AWS::EC2::Subnet::Id> If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.
LambdaSG	List	The Security Groups for Lambda functions. Type: List<AWS::EC2::SecurityGroup::Id> If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.
S3BktName	String	The S3 bucket name for files. This should be configured in your account as per AWS requirements. If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.

Parameter	Allowed Values/Type	Description
LoadBalancerType	String	The type of Internet-facing Load Balancer, either “application” or “network”. Example: application
LoadBalancerSG	String	The Security Groups for the Load Balancer. In the case of a network load balancer, it won't be used. But you should provide a Security Group ID. Type: List<AWS::EC2::SecurityGroup::Id> If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.
LoadBalancerPort	Integer	The Load Balancer port. This port will be opened on LB with either HTTP/HTTPS or TCP/TLS as the protocol, based on the chosen Load Balancer type. Make sure the port is a valid TCP port, it will be used to create the Load Balancer listener. Default: 80
SSLcertificate	String	The ARN for the SSL certificate for secured port connections. If not specified, a port opened on the Load Balancer will be TCP/HTTP. If specified, a port opened on the Load Balancer will be TLS/HTTPS.
TgHealthPort	Integer	This port is used by the Target group for health probes. Health probes arriving at this port on FTDv will be routed to the AWS Metadata server and should not be used for traffic. It should be a valid TCP port. If you want your application itself to reply to health probes, then accordingly NAT rules can be changed for the FTDv. In such a case, if the application does not respond, the FTDv will be marked as unhealthy and deleted due to the Unhealthy instance threshold alarm. Example: 8080
AssignPublicIP	Boolean	If selected as "true" then a public IP will be assigned. In case of a BYOL-type FTDv, this is required to connect to https://tools.cisco.com. Example: TRUE

Parameter	Allowed Values/Type	Description
InstanceType	String	The Amazon Machine Image (AMI) supports different instance types, which determine the size of the instance and the required amount of memory. Only AMI instance types that support FTDv should be used. See the Firepower Release Notes. Example: c4.2xlarge
LicenseType	String	The FTDv license type, either BYOL or PAYG. Make sure the related AMI ID is of the same licensing type. Example: BYOL
AmiId	String	The FTDv AMI ID (a valid Cisco FTDv AMI ID). Type: AWS::EC2::Image::Id Please choose the correct AMI ID as per the region and desired version of the image. The Auto Scale feature supports Firepower version 6.4+, BYOL/PAYG images. In either case you should have accepted a License in the AWS marketplace. In the case of BYOL, please update 'licenseCaps' key in Configuration JSON with features such as 'BASE', 'MALWARE', 'THREAT', 'URLFilter' etc.
NoOfAZs	Integer	The number of availability zones that FTDv should span across, between 1 and 3. In the case of an ALB deployment, the minimum value is 2, as required by AWS. Example: 2
ListOfAzs	Comma separated string	A comma-separated list of zones in order. **Note** The order in which these are listed matters. Subnet lists should be given in the same order. If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value. Example: us-east-1a, us-east-1b, us-east-1c
MgmtInterfaceSG	String	The Security Group for the FTDv Management interface. Type: List<AWS::EC2::SecurityGroup::Id> If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.

Parameter	Allowed Values/Type	Description
InsideInterfaceSG	String	The Security Group for the FTDv inside interface. Type: AWS::EC2::SecurityGroup::Id If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.
OutsideInterfaceSG	String	The Security Group for the FTDv outside interface. Type: AWS::EC2::SecurityGroup::Id If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value. Example: sg-0c190a824b22d52bb
MgmtSubnetId	Comma separated list	A comma-separated list of management subnet-ids. The list should be in the same order as the corresponding availability zones. Type: List<AWS::EC2::SecurityGroup::Id> If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.
InsideSubnetId	Comma separated list	A comma-separated list of inside/Gig0/0 subnet-ids. The list should be in the same order as the corresponding availability zones. Type: List<AWS::EC2::SecurityGroup::Id> If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.
OutsideSubnetId	Comma separated list	A comma-separated list of outside/Gig0/1 subnet-ids. The list should be in the same order as the corresponding availability zones. Type: List<AWS::EC2::SecurityGroup::Id> If the "*infrastructure.yaml*" file is used to deploy the infrastructure, the output section of the stack will have this value. Please use that value.

Parameter	Allowed Values/Type	Description
KmsArn	String	The ARN of an existing KMS (AWS KMS key to encrypt at rest). If specified, the FMC and FTDv passwords should be encrypted. The password encryption should be done using only the specified ARN. Generating Encrypted Password Example: " aws kms encrypt --key-id <KMS ARN> --plaintext <password> ". Please used such generated passwords as shown. Example: arn:aws:kms:us-east-1:[AWS Account]:key/7d586a25-5875-43b1-bb68-a452e2f6468e
ngfwPassword	String	All FTDv instances come up with a default password, which is entered in the *Userdata* field of the Launch Template (Autoscale Group). This input will change the password to new provided password once the FTDv is accessible. Please use a plain text password if KMS ARN is not used. If KMS ARN is used, then an encrypted password should be used. Example: Cisco123789! or AQIAgcQFAGtz/hvaxMtJvY/x/rfHnI3lPpSXU
fmcServer	Numeric string	The IP address of the managing FMC, which is reachable to both Lambda functions and the FTDv management interface. Example: 10.10.17.21
fmcOperationsUsername	String	The Network-Admin or higher privileged user created in the managing FMC. See the information about creating users and roles in the Firepower Management Center Configuration Guide. Example: apiuser-1
fmcOperationsPassword	String	Please use a plain text password if KMS ARN is not mentioned. If mentioned, then an encrypted password should be used. Example: Cisco123@ or AQICAHgcQAtz/hvaxMtJvY/x/rnKI3clFPpSXUHQRnCAajB
fmcDeviceGrpName	String	The FMC device group name. Example: AWS-Cisco-NGFW-VMs-1

Parameter	Allowed Values/Type	Description
fmcPublishMetrics	Boolean	If set to "TRUE", then a Lambda function will be created which runs once in every 2 minutes to fetch the memory consumption of registered FTDv sensors in the provided device group. Allowed values: TRUE, FALSE Example: TRUE
fmcMetricsUsername	String	The unique FMC user name for metric publication to AWS CloudWatch. See the information about creating users and roles in the Firepower Management Center Configuration Guide. If the "fmcPublishMetrics' is set to "FALSE" then there is no need to provide this input. Example: publisher-1
fmcMetricsPassword	String	The FMC password for metric publication to AWS CloudWatch. Please use a plain text password if KMS ARN is not mentioned. If mentioned, then an encrypted password should be used. If the "fmcPublishMetrics' is set to "FALSE" then there is no need to provide this input. Example: Cisco123789!
CpuThresholds	Comma separated integers	The lower CPU threshold and the upper CPU threshold. The minimum value is 0 and maximum value is 99. Defaults: 10, 70 Please note that the lower threshold should be less than the upper threshold. Example: 30,70
MemoryThresholds	Comma separated integers	The lower MEM threshold and the upper MEM threshold. The minimum value is 0 and maximum value is 99. Defaults: 40, 70 Please note that the lower threshold should be less than the upper threshold. If the "fmcPublishMetrics" parameter is "FALSE" then this has no effect. Example: 40,50

Configure Objects, Device Group, NAT Rules, Access Policies in FMC

You can manage the FTDv using the Firepower Management Center (FMC), a full-featured, multidevice manager on a separate server. The FTDv registers and communicates with the FMC on the Management

interface that you allocated to the FTDv virtual machine. See About Firepower Threat Defense Virtual with Firepower Management Center for more information.

All the objects used for FTDv configuration should be created by user.

Important A device group should be created and rules should be applied on it. All the configurations applied on device group will be pushed to FTDv instances.

Objects

Create the following objects:

Table 3: FMC Configuration Objects for FTDv Management

Object Type	Name	Value
Host	aws-metadata-server	169.254.169.254
Port	health-check-port	8080/any other port as required
Zone	Inside/ any other name	—
Zone	Outside/ any other name	—

NAT Policy

A typical NAT rule converts internal addresses to a port on the outside interface IP address. This type of NAT rule is called interface Port Address Translation (PAT). See Configure NAT in Managing the Firepower Threat Defense Virtual with the Firepower Management Center for information about the NAT policy.

One mandatory rule is required in your NAT policy:

- Source Zone: Outside Zone
- Dest Zone: Inside Zone
- Original-sources: any-ipv4
- Original source port: Original/default
- Original Destinations: Interface
- Original-destination-port: 8080/or any health port that user configures
- Translated-sources: any-ipv4
- Translated source port: Original/default
- Translated-destination: aws-metadata-server
- Translated-destination-port: 80/HTTP

Similarly, any data-traffic NAT rules can be added, so that this configuration will be pushed to FTDv devices.

Important NAT Policy created should be applied on the device group; FMC validation from the Lambda function verifies this.

Access Policy

Configure access control to allow traffic from inside to outside. An Access Policy with all required policies can be created, health port object should be allowed such that traffic on this port is allowed to reach. See Configure Access Control in Managing the Firepower Threat Defense Virtual with the Firepower Management Center for information about the Access Policy.

Update the Configuration JSON file

The ***Configuration.json*** file can be found in the ***lambda_python_files*** folder, which is part of the archive Zip obtained from the GitHub repository. Please note the JSON key should not be changed. Any static routes for the FTDv VM should be configured in the JSON file.

See the following for an example of a static route configuration.

```
{
  "interface": "inside",
  "network": "any-ipv4",
  "gateway": "",
  "metric": "1"
}
```

All the values in the JSON file are modifiable according to your requirements, except the default FTDv password.

Upload Files to Amazon Simple Storage Service (S3)

All the files in the *target* directory should be uploaded to the Amazon S3 bucket. Optionally, you can use the CLI to upload all of the files in the *target* directory to the Amazon S3 bucket.

```
$ cd ./target
$ aws s3 cp . s3://<bucket-name> --recursive
```

Deploy Stack

After all of the prerequisites are completed for deployment, you can create the AWS CloudFormation stack.

Use the *deploy_ngfw_autoscale.yaml* file in the *target* directory.

Provide the parameters as collected in Input Parameters, on page 8.

Validate Deployments

Once the template deployment is successful, you should validate that the Lambda functions and the CloudWatch events are created. By default, the Auto Scale Group has the minimum and maximum number of instances as zero. You should edit the Auto Scale group in the AWS EC2 console with how many instances you want. This will trigger the new FTDv instances.

We recommend that you launch only one instance and check its workflow and validate its behavior as to whether it is working as expected. Post that actual requirements of the FTDv can be deployed, they can also be verified for the behavior. The minimum number of FTDv instances can be marked as Scale-In protected to avoid their removal by AWS Scaling policies.

Auto Scale Maintenance Tasks

Scaling Processes

This topic explains how to suspend and then resume one or more of the scaling processes for your Auto Scale group.

Start and Stop Scale Actions

To start and stop scale out/in actions, follow these steps.

- For AWS Dynamic Scaling—Refer to the following link for information to enable or disable scale out actions:

  Suspending and Resuming Scaling Processes

Health Monitor

Every 60 minutes, a CloudWatch Cron job triggers the Auto Scale Manager Lambda for the Health Doctor module:

- If there are unhealthy IPs which belong to a valid FTDv VM, that instance gets deleted if the FTDv is more than an hour old.
- If those IPs are not from a valid FTDv VM, then only IPs are removed from the Target Group.

The health monitor also validates the FMC configuration for device group, access policy, and NAT rules. In case of an unhealthy IP/instance, or if FMC validation fails, the health monitor sends an email to the user.

Disable Health Monitor

To disable a health monitor, in ***constant.py*** make the constant as “True”.

Enable Health Monitor

To enable a health monitor, in ***constant.py*** make the constant as “False”.

Disable Lifecycle Hooks

In the unlikely event that Lifecycle hook needs to be disabled, if disabled it won’t add additional interfaces to Instances. It can also cause a series of failed deployment of FTDv instances.

Disable Auto Scale Manager

To disable Auto Scale Manager, respective CloudWatch Events “notify-instance-launch” and “notify-instance-terminate” should be disabled. Disabling this won’t trigger Lambda for any new events. But already executing Lambda actions will continue. There is no abrupt stop of Auto Scale Manager. Trying abrupt stopping by stack deletion or deleting resources can cause an indefinite state.

Load Balancer Targets

Because the AWS Load Balancer does not allow instance-type targets for instances having more than one network interface, the Gigabit0/1 interface IP is configured as a target on Target Groups. As of now however, the AWS Auto Scale health checks work only for instance-type targets, not IPs. Also, these IPs are not automatically added or removed from target groups. Hence our Auto Scale solution programmatically handles both of these tasks. But in the case of maintenance or troubleshooting, there could be a situation demanding manual effort to do so.

Register a Target to a Target Group

To register an FTDv instance to the Load Balancer, its Gigabit0/1 instance IP (outside subnet) should be added as a target in Target Group(s). See Register or Deregister Targets by IP Address.

Deregister a Target from a Target Group

To deregister an FTDv instance to the Load Balancer, its Gigabit0/1 instance IP (outside subnet) should be deleted as a target in Target Group(s). See Register or Deregister Targets by IP Address.

Instance Stand-by

AWS does not allow instance reboot in the Auto Scale group, but it does allow a user to put an instance in Stand-by and perform such actions. However, this works best when the Load Balancer targets are instance-type. However, FTDv VMs cannot be configured as instance-type targets, because of multiple network interfaces.

Put an Instance in Stand-by

If an instance is put into stand-by, its IP in Target Groups will still continue to be in the same state until the health probes fail. Because of this, it is recommended to deregister respective IPs from the Target Group before putting the instance into stand-by state; see Deregister a Target from a Target Group, on page 18 for more information.

Once the IPs are removed, see Temporarily Removing Instances from Your Auto Scaling Group.

Remove an Instance from Stand-by

Similarly you can move an instance from stand-by to running state. After removal from stand-by state, the instance's IP should be registered to Target Group targets. See Register a Target to a Target Group, on page 18.

For more information about how to put instances into stand-by state for troubleshooting or maintenance, see the AWS News Blog.

Remove/Detach Instance from Auto Scale Group

To remove an instance from the Auto Scale group, first it should be moved to stand-by state. See "Put Instances on Stand-by". Once the instance is in the stand-by state it can be removed or detached. See Detach EC2 Instances from Your Auto Scaling Group.

There won't be any changes on the FMC side. Any changes required should be performed manually.

Terminate an Instance

To terminate an instance it should be put into stand-by state; see Instance Stand-by, on page 18. Once the instance is in stand-by, you can proceed to terminate.

Instance Scale-In Protection

To avoid an accidental removal of any particular instance from the Auto Scale group, it can be made as Scale-In protected. If an instance is Scale-In protected, it won't be terminated due to a Scale-In event.

Please refer to the following link to put an instance into Scale-In protected state.

https://docs.aws.amazon.com/autoscaling/ec2/userguide/as-instance-termination.html

Important It is recommended to make the minimum number of instances which are healthy (the target IP should be healthy, not just the EC2 instance) as Scale-In protected.

Change Credentials and Registration IDs

Any changes in configuration won't be automatically reflected on already running instances. Changes will be reflected on upcoming devices only. Any such changes should be manually pushed to already existing devices.

Change the FMC User Name and Password

In the case of changes to the FMC IP, username, or password—the respective changes should be performed on Auto Scale Manager Lambda function and custom metric publisher Lambda function environment variables. See Using AWS Lambda Environment Variables.

When Lambda runs next time, it will reference the changed environment variables.

Note Environment variables are directly fed to Lambda functions. There is no password complexity check here.

Change the FTDv Admin Password

A change to the FTDv password requires the user to change it on each device manually for running instances. For new FTDv devices to be onboarded, the FTDv password will be taken from the Lambda environment variables. See Using AWS Lambda Environment Variables.

Change Registration and NAT IDs

For new FTDv devices to be onboarded with different registration and NAT IDs, for FMC registration this information should be changed in Configuration.json file. The Configuration.json file can be located in Lambda resource page.

Changes to Access Policy and NAT Policy

Any changes to Access policies or NAT policies are automatically applied to upcoming instances with the help of the Device Group assignment. However, to update existing FTDv instances you need to manually push configuration changes and deploy them from the FMC.

Changes to AWS Resources

You can change many things in AWS post deployment, such as the Auto Scale Group, Launch Configuration, CloudWatch events, Scaling Policies etc. You can import your resources into a CloudFormation stack or create a new stack from your existing resources.

See Bringing Existing Resources Into CloudFormation Management for more information about how to manage changes performed on AWS resources.

Collect and Analyze CloudWatch Logs

In order to export CloudWatch logs please refer to Export Log Data to Amazon S3 Using the AWS CLI.

Auto Scale Troubleshooting and Debugging

AWS CloudFormation Console

You can verify the input parameters to your CloudFormation stack in the AWS CloudFormation Console, which allows you to create, monitor, update and delete stacks directly from your web browser.

Navigate to the required stack and check the parameter tab. You can also check inputs to Lambda Functions on the Lambda Functions environment variables tab. The *configuration.json* file can also be viewed on the Auto Scale Manager Lambda function itself.

To learn more about the AWS CloudFormation console, see the *AWS CloudFormation User Guide*.

Amazon CloudWatch Logs

You can view logs of individual Lambda functions. AWS Lambda automatically monitors Lambda functions on your behalf, reporting metrics through Amazon CloudWatch. To help you troubleshoot failures in a function, Lambda logs all requests handled by your function and also automatically stores logs generated by your code through Amazon CloudWatch Logs.

You can view logs for Lambda by using the Lambda console, the CloudWatch console, the AWS CLI, or the CloudWatch API. To learn more about log groups and accessing them through the CloudWatch console, see the Monitoring system, application, and custom log files in the *Amazon CloudWatch User Guide*.

Load Balancer Health Check Failure

The load balancer health check contains information such as the protocol, ping port, ping path, response timeout, and health check interval. An instance is considered healthy if it returns a 200 response code within the health check interval.

If the current state of some or all your instances is `OutOfService` and the description field displays the message that the `Instance has failed at least the Unhealthy Threshold number of health checks consecutively`, the instances have failed the load balancer health check.

You should check the health probe NAT rule in the FMC configuration. For more information, see Troubleshoot a Classic Load Balancer: Health checks.

Traffic Issues

To troubleshoot traffic issues with your FTDv instances, you should check the Load Balancer rules, the NAT rules, and the static routes configured in the FTDv instances.

You should also check the AWS virtual network/subnets/gateway details provided in the deployment template, including security group rules, etc. You can also refer to AWS documentation, for example, Troubleshooting EC2 instances.

Connection to the FMC Failed

If the management connection is disrupted, you should check the FMC configuration and credentials. See "Requirements and Prerequisites for Device Management" in *Firepower Management Center Configuration Guide*.

Device Failed to Register with the FMC

If the device fails to register with the FMC fails, you need to determine if the FMC configuration is faulty/unreachable, or if the FMC has the capacity to accommodate a new device. See "Add a Device to the FMC" in *Firepower Management Center Configuration Guide*.

Unable to SSH into the FTDv

If you are unable to SSH into the FTDv, check to see if the complex password was passed to FTDv via the template.