Deploy the Threat Defense Virtual Auto Scale for AWS

Auto Scale Solution for the Threat Defense Virtual on AWS

The following sections describe how the components of the auto scale solution work for the threat defense virtual on AWS.

About the Auto Scale Solution

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

The threat defense virtual 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 threat defense virtual instances in the AWS environment. Starting from version 6.4, the threat defense virtual auto scale solution is supported on threat defense virtual managed by management center.

The threat defense virtual auto scale solution is a CloudFormation template-based deployment that provides:

- Completely automated threat defense virtual instance registration and de-registration with the management center.
- NAT policy, Access Policy, and Routes automatically applied to the scaled-out threat defense virtual instances.
- Support for Load Balancers and multi-availability zones.
- Support for enabling and disabling the auto scale feature.
- Works only with the management center; the device manager is not supported.

Enhancements to Auto Scale (Version 6.7)

- Custom Metric Publisher—A new Lambda function polls the management center every 2nd minute for memory consumption of all the threat defense virtual instances in the auto scale group, then publishes the value to CloudWatch Metric; see Input Parameters, on page 9 for a description.
- A new scaling policy based on memory consumption is available.
- Threat Defense Virtual private IP connectivity for SSH and Secure Tunnel to the management center.
- Management Center 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.

Auto Scale Use Case

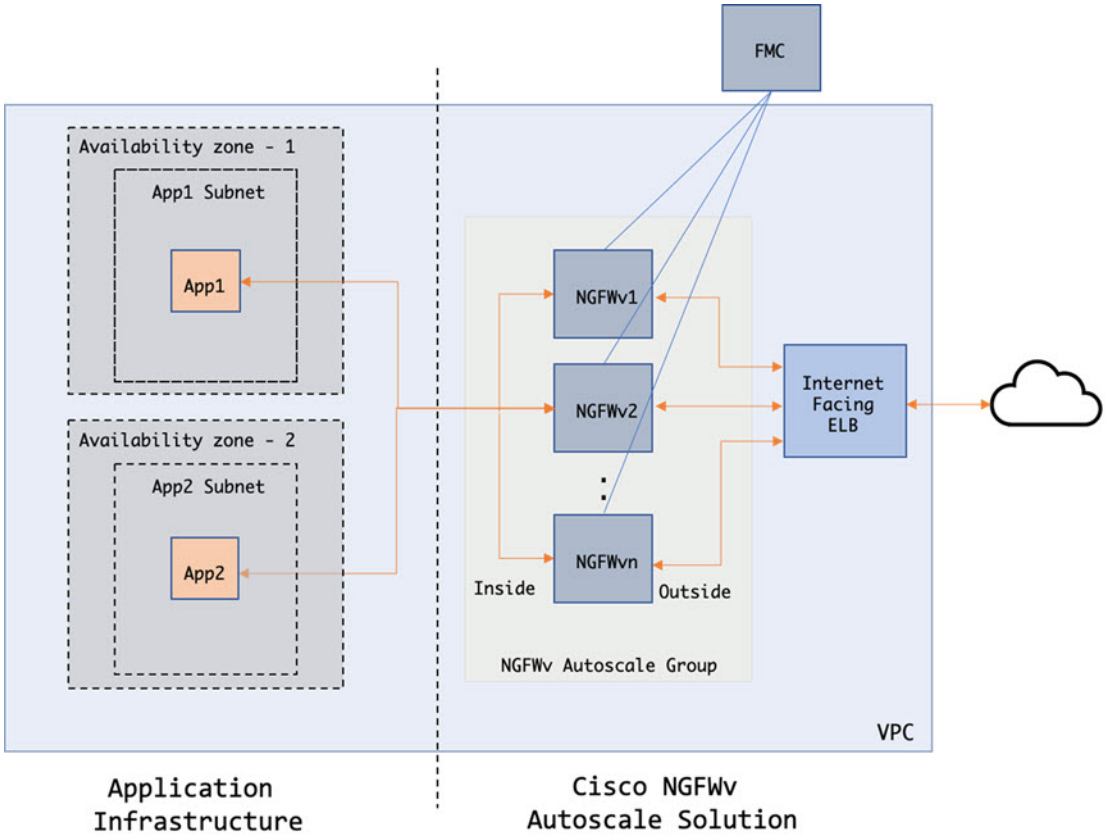
The Use Case for this threat defense virtual AWS Auto Scale Solution is shown in Figure 1: Threat Defense Virtual Auto Scale Use Case Diagram, on page 3. Because the AWS Load Balancer allows only Inbound-initiated connections, only externally generated traffic is allowed to pass inside via the Cisco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

Note Secured ports need an SSL/TLS certificate, as described SSL Server Certificate, on page 8 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 threat defense virtual templates. The left side is completely user-defined.

Note Application-initiated outbound traffic will not go through the threat defense virtual.

Figure 1: Threat Defense Virtual 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 Management Center, on page 15. 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.

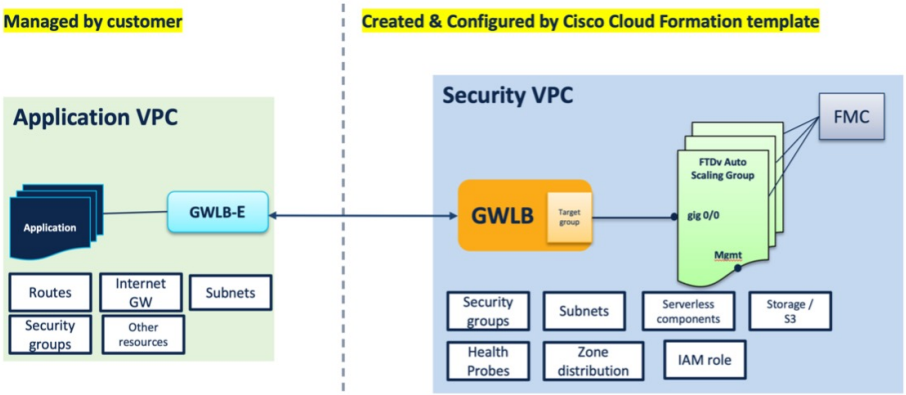
AWS Gateway Load Balancer Auto Scale Use Case

The Use Case for this threat defense virtual AWS Gateway Load Balancer (GWLB) Auto Scale Solution is shown in the use case diagram. The AWS Gateway Load Balancer allows both Inbound and Outbound connections, hence both internally and externally generated traffic is allowed to pass inside via the Cisco threat defense virtual firewall.

The Internet-facing load balancer can be a AWS Gateway Load Balancer Endpoint (GWLBe). The GWLBe sends traffic to the GWLB, and then to the threat defense virtual for inspection. 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 threat defense virtual GWLB Autoscale solution deployed via the threat defense virtual templates. The left side is completely user-defined.

Note Application-initiated outbound traffic will not go through the threat defense virtual.

Figure 2: AWS GWLB Auto Scale Use Case Diagram



How the Auto Scale Solution Works

To scale the threat defense virtual instances in and out, an external entity called the Auto Scale Manager monitors metrics, commands an auto scale group to add or delete the threat defense virtual instances, registers and deregisters the threat defense virtual devices with the management center, and configures the threat defense virtual instances.

The Auto Scale Manager is implemented using AWS Serverless architecture and communicates with AWS resources, the threat defense virtual, and the management center. 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 threat defense virtual with the management center.
- Configure and deploy a new threat defense virtual via management center.
- Unregister (remove) a scaled-in threat defense virtual from the management center.
- Publish the memory metric from the management center.

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 threat defense virtual 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 threat defense virtual 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 threat defense virtual auto scale for AWS solution. Deployment scripts and templates for your version are available in the GitHub repository.

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 and **infrastructure_gwlb.yaml** files can be found in the 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.

The **infrastructure_gwlb.yaml** template deploys AWS GWLB auto scale solution.

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 threat defense virtual machine 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 a default route with '0.0.0.0/0' to the Internet gateway. This will contain the Outside interface of the threat defense virtual, 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 the threat defense virtual 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 the threat defense virtual 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 includes the threat defense virtual Management interface. If you are using the management center on this subnet, then assigning an elastic IP address (EIP) to the threat defense virtual is optional. The diagnostic interface is also on this subnet.

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	Management Center to Threat Defense Virtual 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 Management Center Instance

To allow HTTPS connections between Lambda Functions and the management center. Because Lambda Functions are to be kept in Lambda subnets having a NAT gateway as the default route, the management center 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 3.9 installed.

```
#!/bin/bash
mkdir -p layer
virtualenv -p /usr/bin/python3.9 ./layer/
source ./layer/bin/activate
pip3 install cffi==1.15.1
pip3 install cryptography==2.9.1
pip3 install paramiko==2.7.1
pip3 install requests==2.23.0
pip3 install scp==0.13.2
pip3 install jsonschema==3.2.0
pip3 install pycryptodome==3.15.0
echo "Copy from ./layer directory to ./python\n"
cp -r ./layer/lib/python3.9/site-packages/* ./python/
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 management center and threat defense virtual 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.

Note For AWS Gateway Load Balancer (GWLB), the **LoadBalancerType**, **LoadBalancerSG**, **LoadBalancerPort**, and **SSLcertificate** parameters are not applicable.

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 (threat defense virtual-Group-Name). For example, if this value is '1', then the group name will be *threat defense virtual-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-threat defense virtual-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.

Parameter	Allowed Values/Type	Description
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.
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.

Parameter	Allowed Values/Type	Description
TgHealthPort	Integer	This port is used by the Target group for health probes. Health probes arriving at this port on the threat defense virtual 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 threat defense virtual. In such a case, if the application does not respond, the threat defense virtual 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 threat defense virtual, this is required to connect to https://tools.cisco.com. Example: TRUE
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 the threat defense virtual should be used. Example: c4.2xlarge
LicenseType	String	The threat defense virtual license type, either BYOL or PAYG. Make sure the related AMI ID is of the same licensing type. Example: BYOL
AmiId	String	The threat defense virtual AMI ID (a valid Cisco threat defense virtual 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 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.

Parameter	Allowed Values/Type	Description
NoOfAZs	Integer	The number of availability zones that the threat defense virtual 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 threat defense virtual 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.
InsideInterfaceSG	String	The Security Group for the threat defense virtual 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 threat defense virtual 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

Parameter	Allowed Values/Type	Description
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.
KmsArn	String	The ARN of an existing KMS (AWS KMS key to encrypt at rest). If specified, the management center and threat defense virtual 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

Parameter	Allowed Values/Type	Description
ngfwPassword	String	All the threat defense virtual 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 threat defense virtual 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 managing the management center, which is reachable to both Lambda functions and the threat defense virtual management interface. Example: 10.10.17.21
fmcOperationsUsername	String	The Network-Admin or higher privileged user created in managing the management center. See the information about creating users and roles in the Cisco Secure Firewall Management Center Device 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/mKI3clFPpSXUHQRnCAajB
fmcDeviceGrpName	String	The management center device group name. Example: AWS-Cisco-NGFW-VMs-1
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 threat defense virtual sensors in the provided device group. Allowed values: TRUE, FALSE Example: TRUE

Parameter	Allowed Values/Type	Description
fmcMetricsUsername	String	The unique management center user name for metric publication to AWS CloudWatch. See the information about creating users and roles in the Cisco Secure Firewall Management Center Device Configuration Guide. If the "fmcPublishMetrics' is set to "FALSE" then there is no need to provide this input. Example: publisher-1
fmcMetricsPassword	String	The management center 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 Management Center

You can manage the threat defense virtual using the management center, a full-featured, multidevice manager on a separate server. The threat defense virtual registers and communicates with the management center on the Management interface that you allocated to the threat defense virtual virtual machine. See About Secure Firewall Threat Defense Virtual with the Secure Firewall Management Center for more information.

All the objects used for the threat defense virtual 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 the threat defense virtual instances.

Objects

Create the following objects:

Table 3: Management Center Configuration Objects for Threat Defense Virtual 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 Secure Firewall Threat Defense Virtual with the Secure Firewall 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 the threat defense virtual devices.

Important NAT Policy created should be applied on the device group. The management center 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 Secure Firewall Threat Defense Virtual with the Secure Firewall 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 threat defense virtual 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 threat defense virtual 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.

Use the file in the *target* directory for Geneve Autoscale.

Note Before you deploy *deploy_ngfw_autoscale_with_gwlb.yaml* file, you must deploy **infrastructure_gwlb.yaml** file for AWS GWLB auto scale solution.

You must create the Gateway Loadbalancer Endpoint (GWLB-E) by choosing the GWLB that is created during *deploy_autoscale_with_gwlb.yaml* template deployment. After creating the GWLBe, you must update the default route to use GWLBe for Application Subnet and default Route table.

For more information, see https://docs.amazonaws.cn/en_us/vpc/latest/privatelink/create-endpoint-service-gwlbe.html.

Provide the parameters as collected in Input Parameters, on page 9.

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 threat defense virtual 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 threat defense virtual can be deployed, they can also be verified for the behavior. The minimum number of threat defense virtual 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 threat defense virtual VM, that instance gets deleted if the threat defense virtual is more than an hour old.
- If those IPs are not from a valid threat defense virtual machine, then only IPs are removed from the Target Group.

The health monitor also validates the management center configuration for device group, access policy, and NAT rules. In case of an unhealthy IP/instance, or if the management center 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 the threat defense virtual 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 the threat defense virtual 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 the threat defense virtual 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, the threat defense virtual machines 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 19 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 19.

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 management center 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 19. 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 Management Center User Name and Password

In the case of changes to the management center 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 Threat Defense Virtual Admin Password

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

Change Registration and NAT IDs

For new threat defense virtual devices to be onboarded with different registration and NAT IDs, for the management center 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 threat defense virtual instances you need to manually push configuration changes and deploy them from the management center.

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 management center configuration. For more information, see Troubleshoot a Classic Load Balancer: Health checks.

Traffic Issues

To troubleshoot traffic issues with your threat defense virtual instances, you should check the Load Balancer rules, the NAT rules, and the static routes configured in the threat defense virtual 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 Management Center Failed

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

Device Failed to Register with the Management Center

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

Unable to SSH into the Threat Defense Virtual

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