

VM-Series for AWS



Auto Scaling GlobalProtect in AWS Deployment Guide

How to deploy GlobalProtect in an AWS Auto Scaling environment

<http://www.paloaltonetworks.com>

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Version History

Version number	Comments
1.0	Initial GitHub check-in
1.1	Add version history table

1. Global Protect

GlobalProtect allows remote users to access corporate resources and internet resources using the same security policy enforcement as though there were on premises. To provide Next-Generation Security Platform closer to the remote users, GlobalProtect gateways can be deployed in AWS. This allows instantiation of portals and gateways near remote users without the additional cost of infrastructure.

Leveraging the global presence and built in redundancy provided by AWS, GlobalProtect can be quickly deployed worldwide where your users are. Traffic is inspected with the same PAN-OS security as the corporate firewall but in a globally diverse deployment. The result is security that follows users – even when they are mobile and a better user experience.

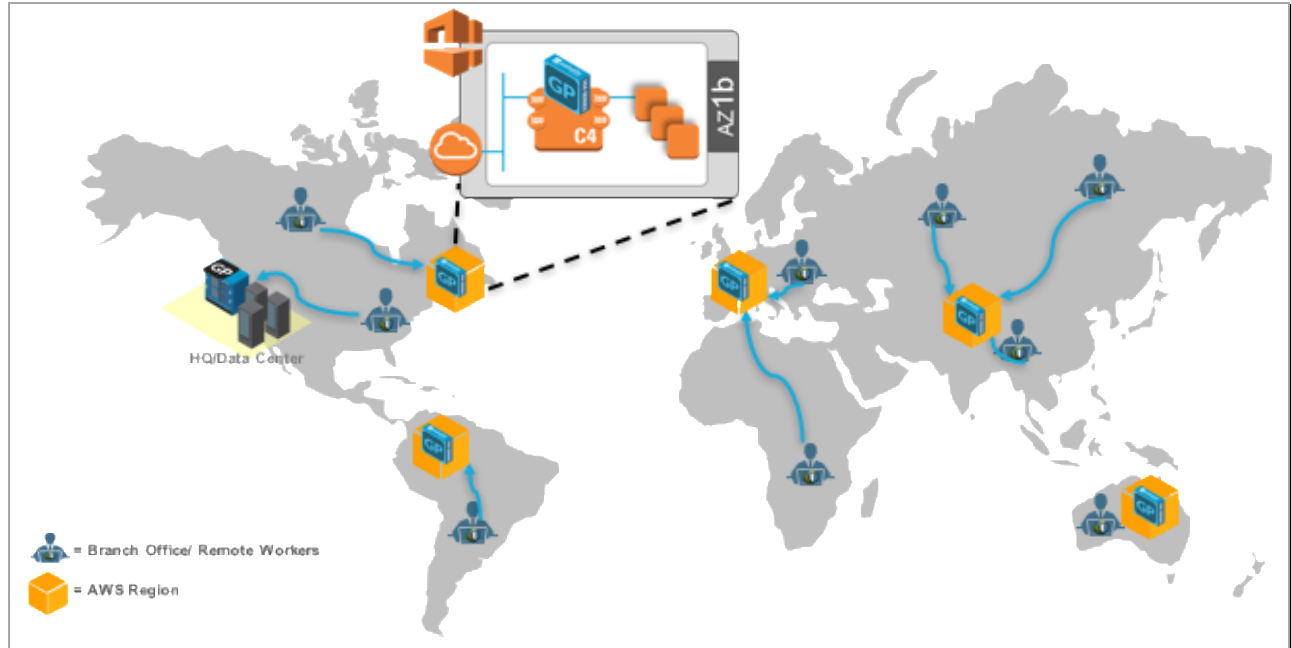
2. Support Policy

This CFT is released under an as-is, best effort, support policy. These scripts should be seen as community supported and Palo Alto Networks will contribute our expertise as and when possible. We do not provide technical support or help in using or troubleshooting the components of the project through our normal support options such as Palo Alto Networks support teams, or ASC (Authorized Support Centers) partners and backline support options. The underlying product used (the VM-Series firewall) by the scripts or templates are still supported, but the support is only for the product functionality and not for help in deploying or using the template or script itself.

Unless explicitly tagged, all projects or work posted in our GitHub repository (at <https://github.com/PaloAltoNetworks>) or sites other than our official Downloads page on <https://support.paloaltonetworks.com> are provided under the best effort policy.

3. GlobalProtect and Auto Scaling

Deploying GlobalProtect on AWS provides the ability to scale as needed to address both planned and unplanned scaling demands. Planned scaling may be need for known events such as the initial login rush that occurs every day and then then drop off that may occur at the end of the day. Another scenario may be a conference or sales kick-off where many users all try to connect at once to a regional gateway. Unplanned demand may be associated with events such as “snowmageddon” where users are snowed in and work from home.



4. About CFTs

AWS CloudFormation Templates (CFTs), are JSON files that can launch nearly all AWS resources including VPCs, subnets, security groups, route tables, plus many more. AWS CFTs are used for ease of deployment and are key to any auto-scaling environment.

For more information on CFTs and sample CFTs refer to Amazon's documentation

<https://aws.amazon.com/cloudformation/aws-cloudformation-templates/>

There are also many sample templates available here

<https://docs.aws.amazon.com/AWSCloudFormation/latest/UserGuide/sample-templates-services-us-west-2.html>

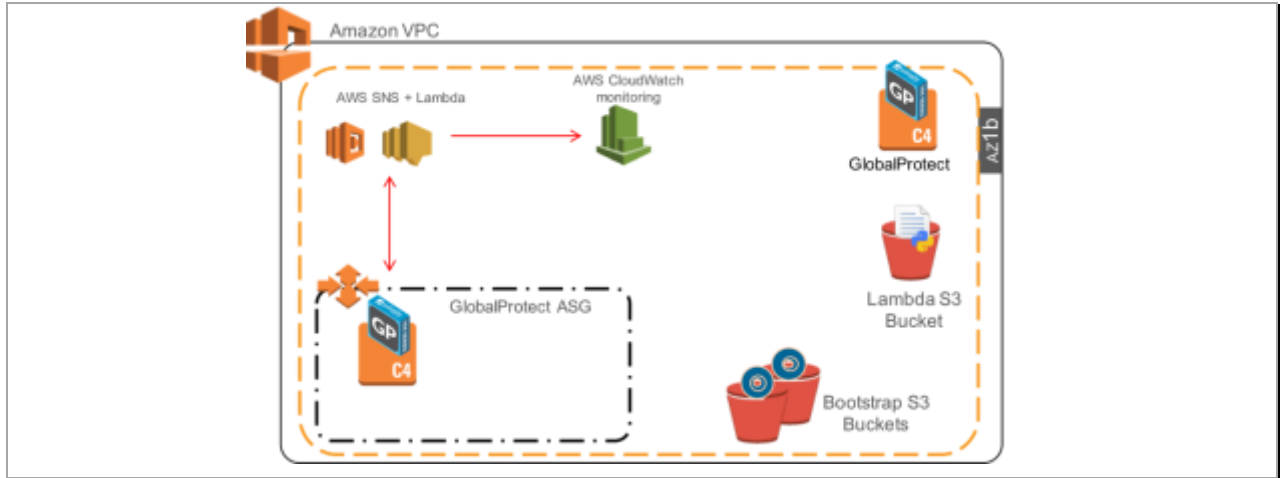
Additional templates provided by Palo Alto Networks can be found on the following GitHub page

<https://github.com/paloaltonetworks/aws>

5. About this guide

This guide will walk through the process of launching an AWS CFT that will deploy a GlobalProtect Portal and an AWS Auto Scaling group with the ability to automatically launch and configure additional GlobalProtect Gateways based on customizable thresholds.

The template referenced by this document will deploy all the resources needed for the purposes of this demo and setup the appropriate permissions and get to the topology below:



This solution provides a good starting point to understand how to deploy a Global Protect solution in AWS w/ dynamic scaling.

If new to Cloudformation templates, please refer to the following guide:

https://s3-us-west-2.amazonaws.com/sample-cft/AWS_CFT_How_To_Guide_v8.docx

6. AWS Services Used

The template utilizes several AWS services. Some of the main ones are:

6.1 AWS Auto Scaling

Auto Scaling is an AWS service designed to launch or terminate Amazon EC2 instances automatically based on user-defined policies, schedules, and health checks. Auto Scaling Groups (ASG) define minimum EC2 instances, maximum EC2 instances, and metrics used to determine when to scale in or scale out.

<https://docs.aws.amazon.com/autoscaling/latest/userguide/WhatIsAutoScaling.html>

6.2 AWS Lambda

AWS lambda is a compute (micro)service that allows a user to run small snippets of code (JavaScript or Python scripts) to accomplish various tasks. This eliminates the use of Linux instances as worker nodes and having to maintain them.

<https://docs.aws.amazon.com/lambda/latest/dg/welcome.html>

Note: AWS Lambda service is currently only available in 4 regions (Northern Virginia, Oregon, Frankfurt, Ireland and Tokyo). Please refer to the following page to check for further updates: <https://aws.amazon.com/about-aws/global-infrastructure/regional-product-services/>

6.3 Amazon S3

Amazon Simple Storage Service is storage service where the necessary scripts and bootstrap files are stored.

<https://docs.aws.amazon.com/AmazonS3/latest/dev/Introduction.html>

6.4 Amazon SNS

Amazon Simple Notification Service is a web service that coordinates and manages the delivery or sending of messages to subscribing endpoints or clients. In this case the service is used to send messages to trigger Lambda functions

<https://docs.aws.amazon.com/sns/latest/dg/welcome.html>

6.5 Amazon CloudWatch

Amazon CloudWatch monitors your Amazon Web Services (AWS) resources and the applications you run on AWS in real-time. You can use CloudWatch to collect and track metrics, which are the variables you want to measure for your resources and applications. CloudWatch alarms send notifications or automatically make changes to the resources you are monitoring based on rules that you define.

<https://docs.aws.amazon.com/AmazonCloudWatch/latest/DeveloperGuide/WhatIsCloudWatch.html>

7. Template Deployment Prerequisites

Here are the prerequisites required to successfully launch this template.

7.1 Create an AWS account

If you do not have an AWS account already, go to <https://aws.amazon.com/console/> and create an account.

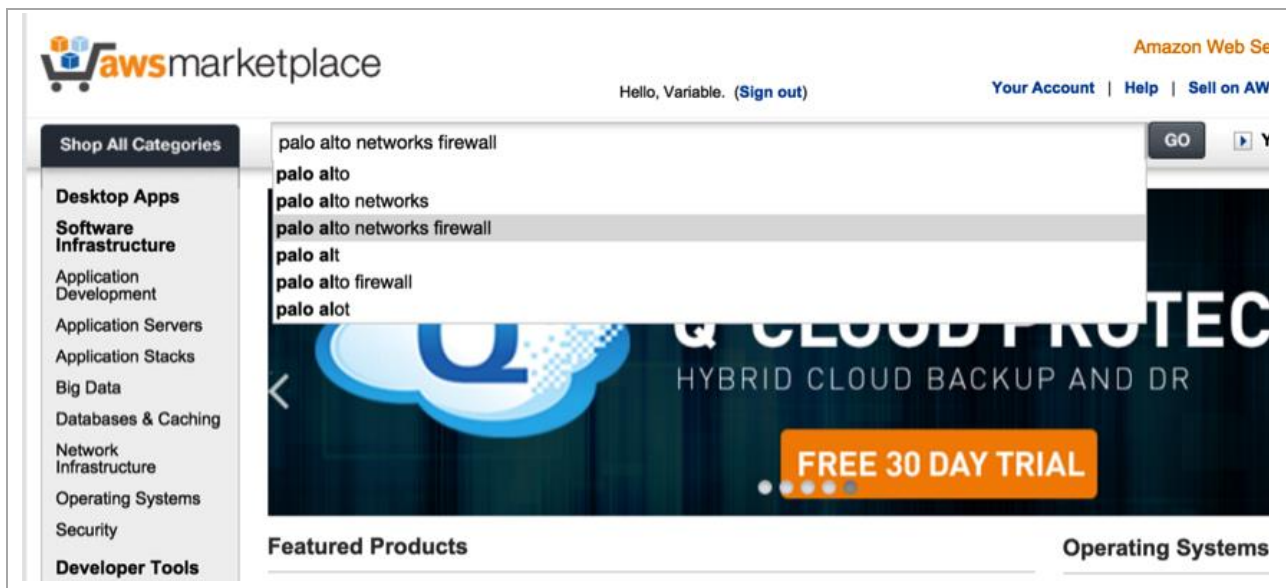
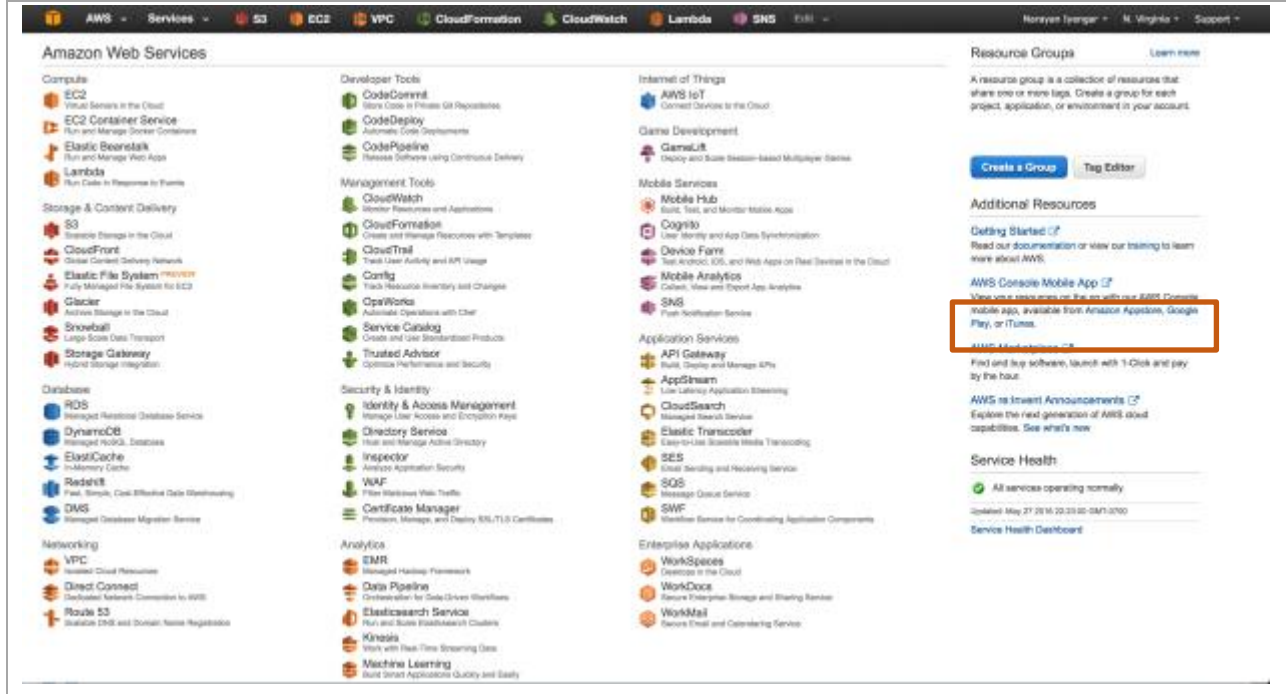
7.2 Add a credit card to your AWS account

In order to continue you will need to add a method of payment to your AWS account. Use the following <https://console.aws.amazon.com/billing/home#/paymentmethods>

If creating a new account, you may receive a phone call from AWS for verification purposes.


7.3 Review and accept the EULA

If this is your first time using AWS to launch a VM-Series firewall bundle, you will need to review and accept the software license agreement for the VM-Series. Click on **AWS Marketplace** and search for **Palo Alto Networks firewall**:




Select VM-Series Next Generation Firewall Bundle 2

palo alto networks firewall (3 results) showing 1 - 3




VM-Series Next-Generation Firewall Bundle 2
 ★★★★★ (1) | Version PAN-OS 7.0.1 | Sold by [Palo Alto Networks](#)
\$1.28/hr or \$4,500/yr (60% savings) for software + AWS usage fees
 The VM-Series for AWS Bundle 2 includes a VM-300 next-generation firewall license, subscriptions for Threat Prevention (includes IPS, AV, malware prevention), WildFire, ...
 Linux/Unix, Other PAN-OS 7.0.1 | 64-bit Amazon Machine Image (AMI)



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Shop All Categories ▾ Search AWS Marketplace **GO** [Your Software](#)

VM-Series Next-Generation Firewall Bundle 2
 Sold by: Palo Alto Networks



15 Day Free Trial Available - The VM-Series for AWS Bundle 2 includes a VM-300 next-generation firewall license, subscriptions for Threat Prevention (includes IPS, AV, malware prevention), WildFire, URL Filtering (PAN-DB), GlobalProtect and Premium Support. The VM-Series for AWS Bundle 2 natively analyzes all traffic in a single pass to determine the application identity, the content within, and the user identity. These business relevant elements are then used as integral components of your security policy, resulting in an improved security posture and a reduction in incident response time. Traffic flowing into, and across ...
[Read more](#)

Customer Rating ★★★★★ (1 Customer Review)

Latest Version PAN-OS 7.0.1

Operating System Linux/Unix, Other PAN-OS 7.0.1

Delivery Method 64-bit Amazon Machine Image (AMI) ([Learn more](#))

Support [See details below](#)

AWS Services Required Amazon EC2, Amazon EBS

Highlights

- Bundle 2 includes everything you need to protect your AWS environment. It includes: a VM-Series 300 firewall license, subscriptions for Threat Prevention, WildFire, URL Filtering,

Continue

You will have an opportunity to review your order before launching or being charged.

Pricing Details

For region
 US West (Oregon)

Hourly Fees
 Total hourly fees will vary by instance type and EC2 region.

Fees: Hourly ☒ Annual ☐
 Software annual pricing savings over hourly: 60% ?

Click **Continue**.

Launch on EC2:

VM-Series Next-Generation Firewall Bundle 2

1-Click Launch
Review, modify, and launch

Manual Launch
With EC2 Console, APIs or CLI

Click "Accept Software Terms" to gain access to this software

Once you accept these terms, you will have access to this software in any supported region. You can then launch the AMIs listed below directly from the EC2 console, EC2 APIs, or with other AWS management tools.

Software Pricing

Subscription Term
☒ Hourly
☐ Annual

Applicable Instance Type
Software fee
Varies
Depends on instance type, reference pricing chart.

Usage Instructions

Select a Version

Price for your selections:
Price will be dependent on usage

Accept Software Terms

You will be subscribed to this software and agree that your use of this software is subject to the pricing terms and the seller's End User License Agreement (EULA) and your use of AWS services is subject to the AWS Customer Agreement.

Pricing Details
For region
US West (Oregon)

Your Free Trial has expired

Hourly Fees
Total hourly fees will vary by instance type and EC2 region.

EC2 Instance Type	Software	EC2	Total

Click on **Manual Launch**, Review the agreement and then click **Accept Software Terms**

You should see this screen:

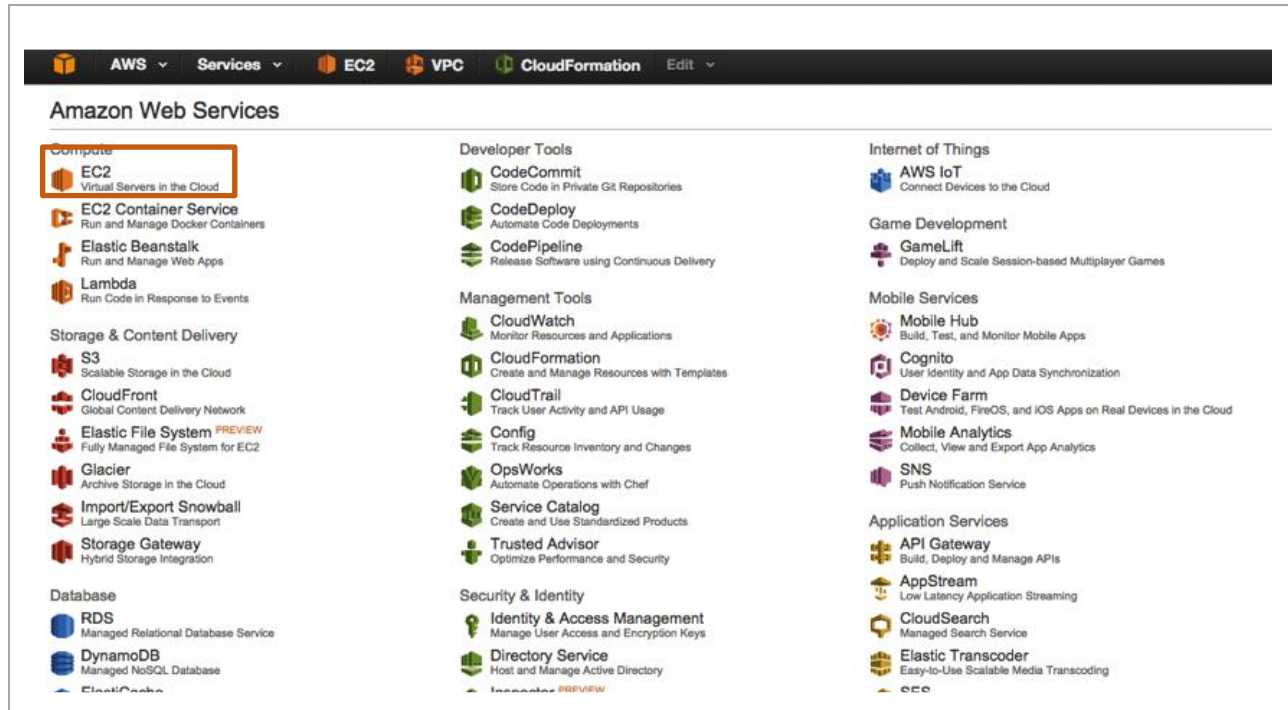
✓ Software and AWS hourly usage fees apply when the instance is running. These fees will appear on your monthly bill. Please refresh this page later to enable launch with ec2 console.

Thank you! Your subscription will be completed in a few moments.

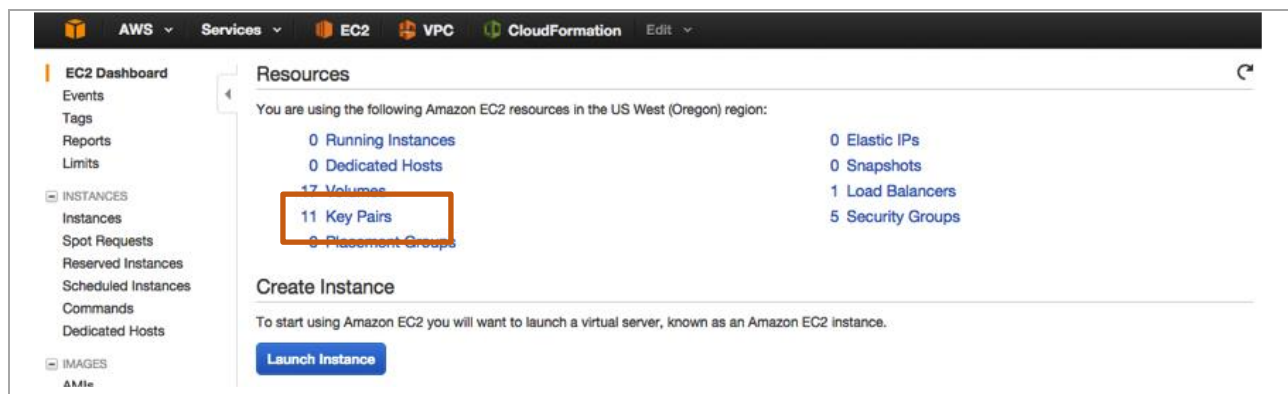
You can now close the browser tab or window and continue with the next step.

7.4 Create and download an SSH keypair

Sign into the AWS console <https://www.amazon.com> and click on **EC2**



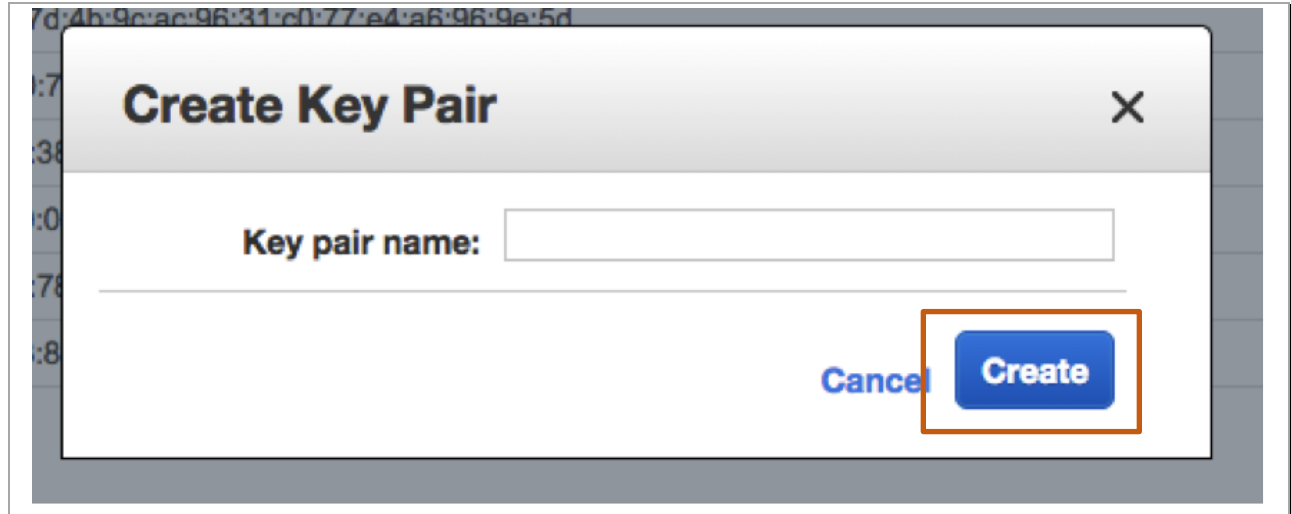
Click **KeyPairs**



Click **Create Key Pair**



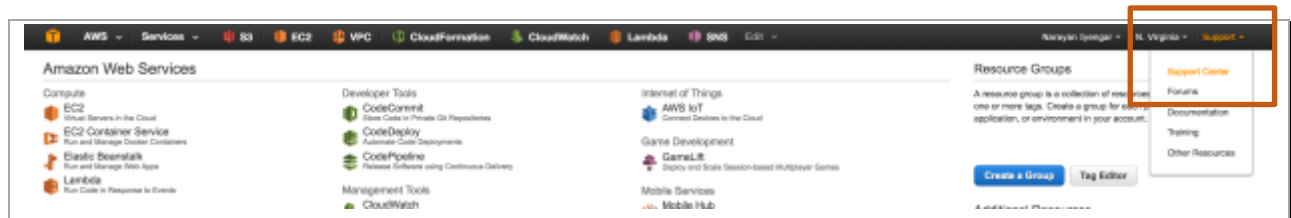
Give the key-pair a name:



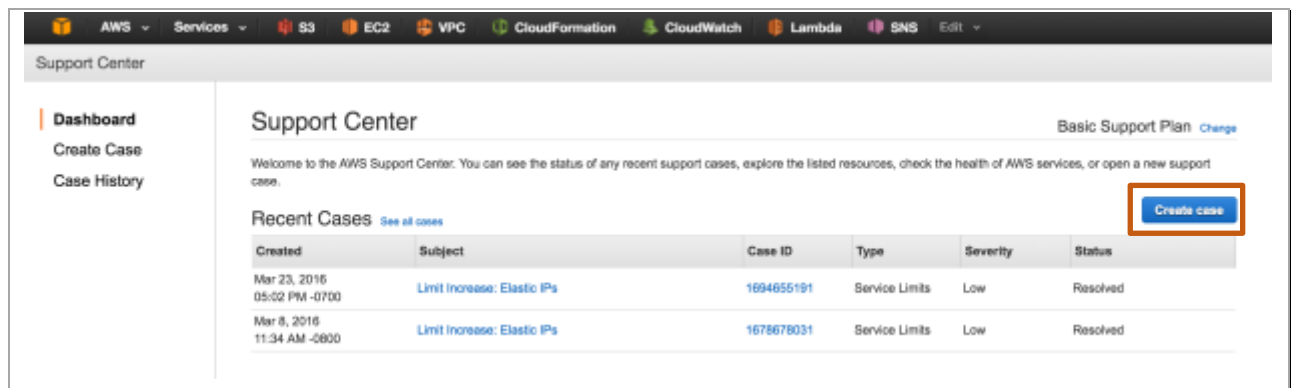
And click **Create**. This should now prompt you to save the just generated private key. Save the key.

7.5 Increase EIP Limit

In order to launch the template, you will need 8 unassociated and unallocated elastic IPs (EIPs). By default, AWS only allows you to create 5 EIPs per region. You will need to request a limit increase in the number of EIPs that you can allocate. In order to do that you will need to open a support case with AWS. In order to do that, log into your AWS console and click on **Support**, then **Support Center**:



Click on **Create Case**:



Then select **Service Limit Increase** and choose **Elastic IPs** for **Limit Type**:

Regarding* ☐ Account and Billing Support ☒ **Service Limit Increase** ☐ Technical Support
Unavailable under the Basic Support Plan

Limit Type* Elastic IPs

Request 1	
Region*	EU (Ireland)
Limit*	New VPC Elastic IP Address Limit
New limit value*	20

Add another request

Then, select the **Region** and select **New VPC Elastic IP Address Limit**. Then enter a **New Limit Value** (greater than 8). You can request limit increases for other regions you may launch the CFT in by click the **Add another request** button and following the above steps.

Then add a **Use Case Description** and select **Phone** as the contact method. Enter your phone number and hit **Submit**.

Use Case Description* I would like to request a limit increase for EIPs in various regions for the purpose of testing

Support Language* English
Please choose your preferred correspondence language for this case.

Contact method* ☐ Web ☒ Phone

Country* United States

Phone Number* 1234567890 Ext.

Submit

You should get a call immediately from AWS, requesting your account number and validation that you did increase a limit increase.

8. PAN-OS Prerequisites

This template relies on the bootstrapping feature that is part of PAN-OS 7.1. For more information on bootstrapping the VM-Series in AWS please refer to the following documentation:

<https://www.paloaltonetworks.com/documentation/71/virtualization/virtualization/bootstra-p-the-vm-series-firewall/bootstrap-the-vm-series-firewall-in-aws>

9. Download the Files

The CloudFormation template can be found here:

<https://github.com/PaloAltoNetworks/aws/blob/master/globalprotect-asg/gp-asg.json>

The bootstrap files can be found here:

<https://github.com/PaloAltoNetworks/aws/blob/master/globalprotect-asg/bootstrap-gateway.zip>

<https://github.com/PaloAltoNetworks/aws/blob/master/globalprotect-asg/bootstrap-portal.zip>

And the accompanying scripts can be found here:

https://github.com/PaloAltoNetworks/aws/blob/master/globalprotect-asg/config_fw.zip

Download and save the gp-asg.json, config_fw.zip, bootstrap-gateway.zip and bootstrap-portal.zip files and store them in a known locations.

Unzip the bootstrap-gateway.zip and bootstrap-portal.zip files into their corresponding directories.

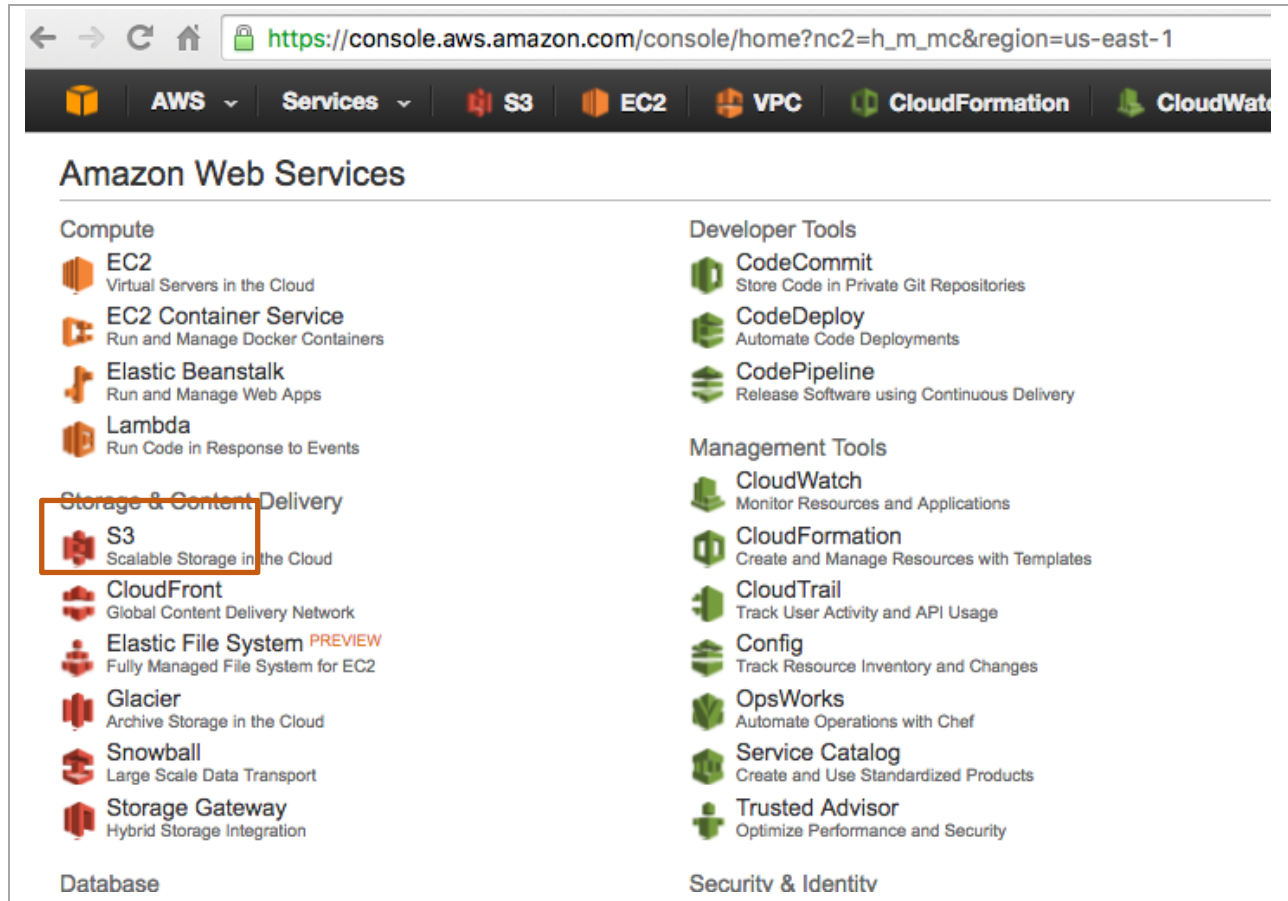
The “bootstrap-gateway” and “bootstrap-portal” directories have bootstrapping and configuration information for the gateways and portal respectively.

They also have configuration information that configures the firewall as a GlobalProtect Gateway or GlobalProtect Portal.

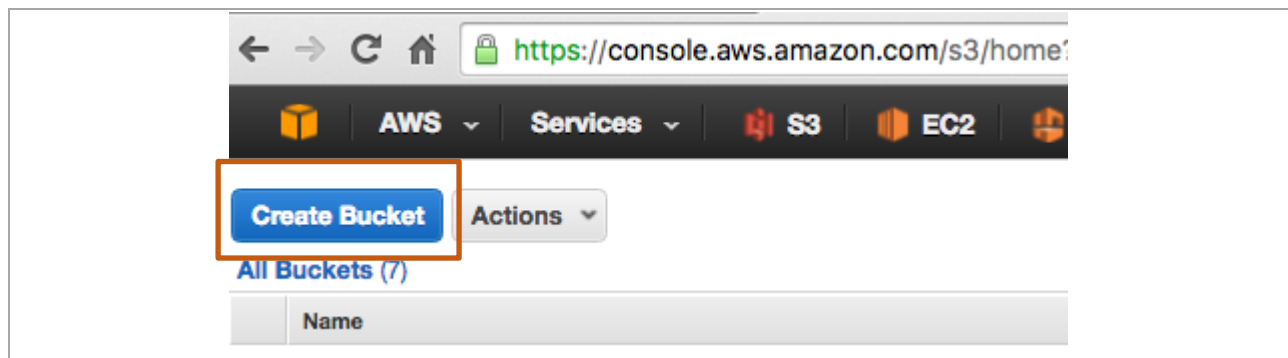
The config_fw.zip file contains all the necessary lambda scripts.

10. Create S3 Buckets

In order to launch the demo template three S3 buckets will be required. Log into the AWS console and click on **S3**:



And click “**Create Bucket**” button:



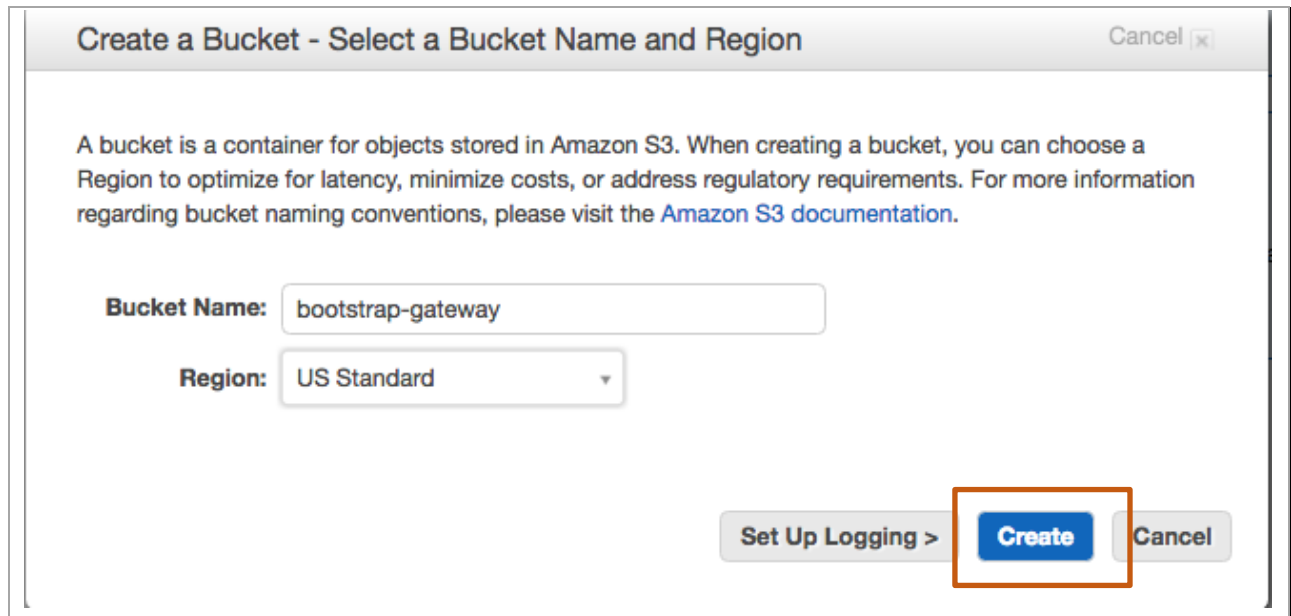
Type-in a bucket name (needs to be unique) and select the region in which the bucket will reside. This should be the same region where the template will be deployed **and**

Lambda is available. This bucket will be used to store bootstrap files for the GP Gateway.

Note: Keep in mind that as of writing this document AWS lambda is only supported in 5 regions (N. Virginia, Oregon, Ireland, Frankfurt, and Tokyo). Please check here for additional regions that may have been added

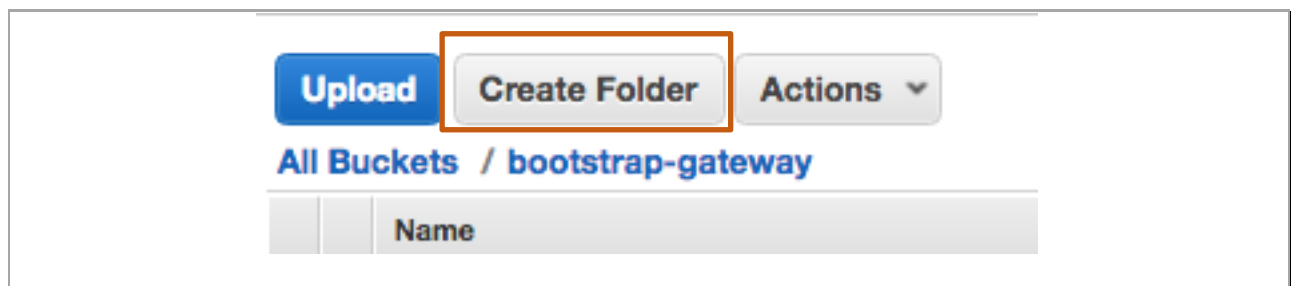
http://docs.aws.amazon.com/general/latest/gr/rande.html#lambda_region

Note: If launching the CFT in N. Virginia, select the region as “US Standard”

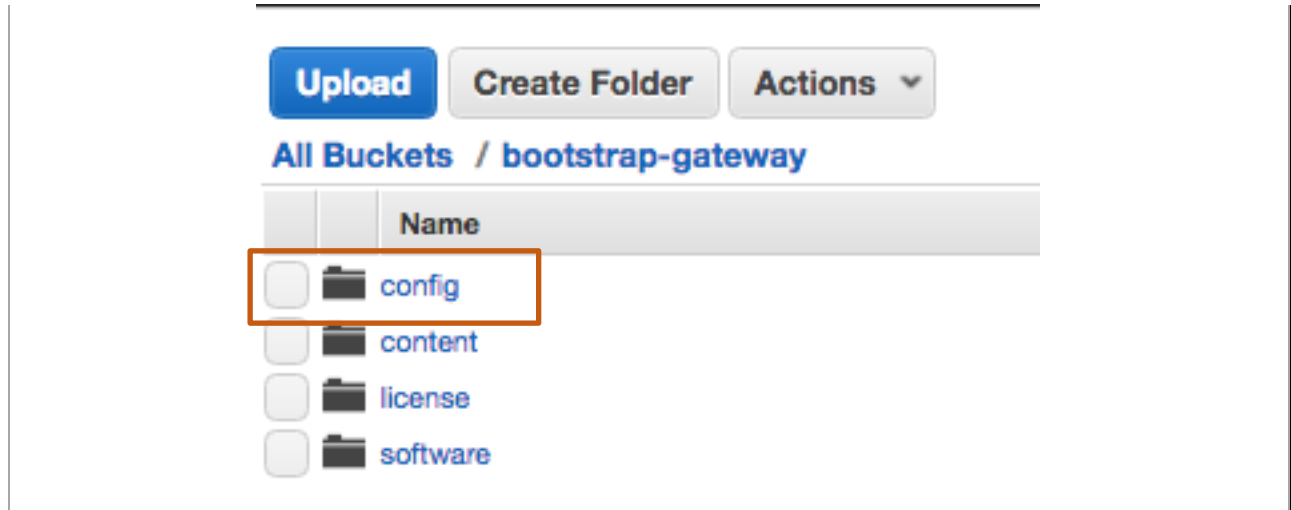


The screenshot shows the 'Create a Bucket' dialog box in the AWS S3 console. The title bar reads 'Create a Bucket - Select a Bucket Name and Region'. Below the title, there is a descriptive paragraph about buckets. The 'Bucket Name' field contains 'bootstrap-gateway' and the 'Region' dropdown is set to 'US Standard'. At the bottom right, there are three buttons: 'Set Up Logging >', 'Create' (highlighted with an orange box), and 'Cancel'.

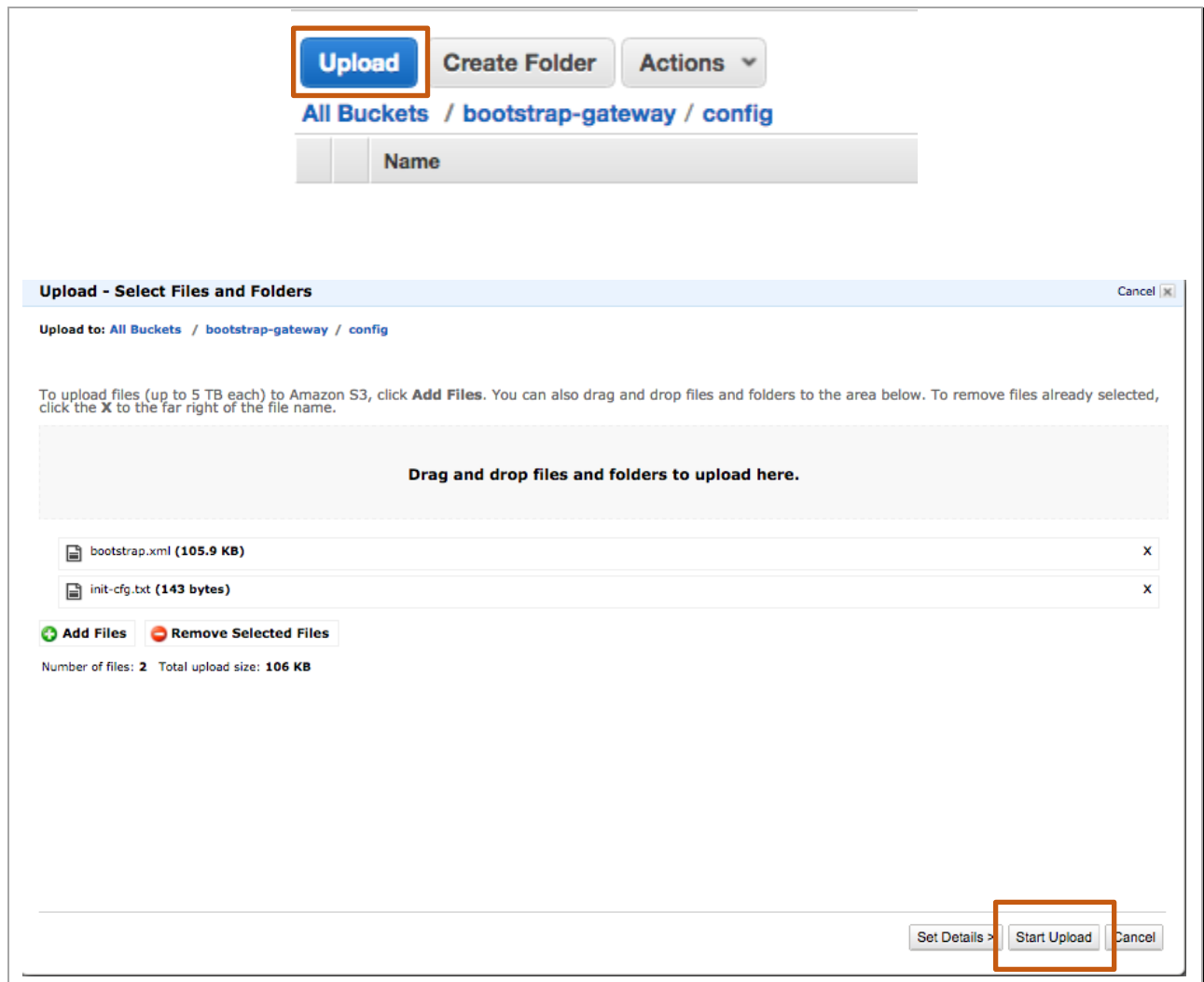
Once the bucket is created, click on the bucket name to navigate to the bucket and create **four** sub-buckets called **config**, **content**, **license** and **software** respectively. Navigate to the **config** bucket and click “Upload”



The screenshot shows the AWS S3 console interface for a bucket named 'bootstrap-gateway'. At the top, there are three buttons: 'Upload' (blue), 'Create Folder' (highlighted with an orange box), and 'Actions' (dropdown). Below the buttons, the breadcrumb navigation shows 'All Buckets / bootstrap-gateway'. A table with the header 'Name' is visible at the bottom.

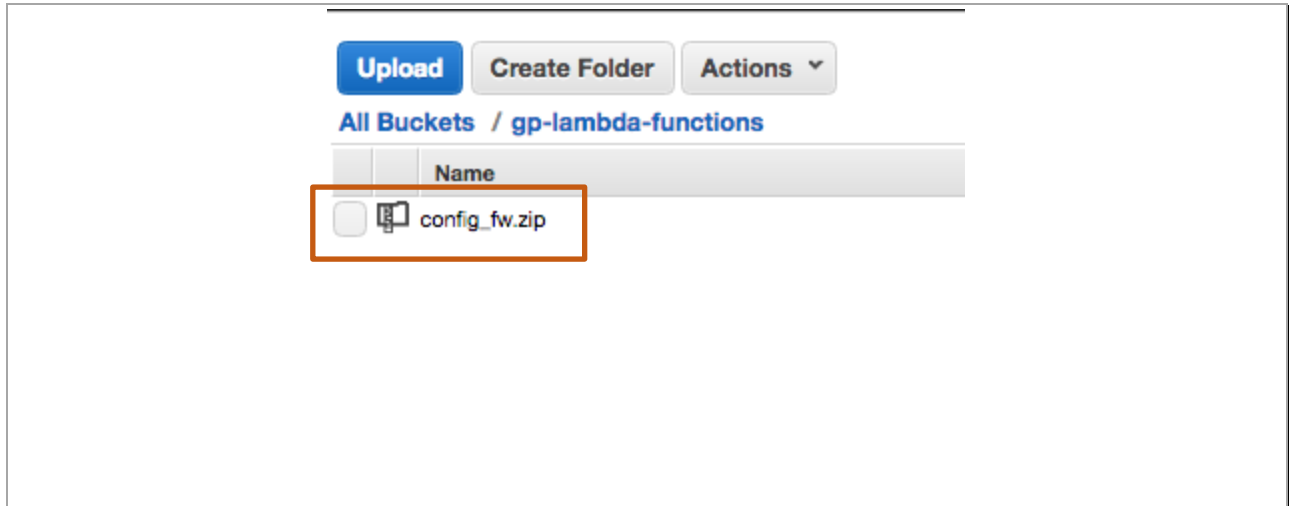


In the next dialog box, drag and drop the two files – **init-cfg.txt** and **bootstrap.xml** from the **gateway** folder created in the [previous step](#) and click “**Start Upload**”:



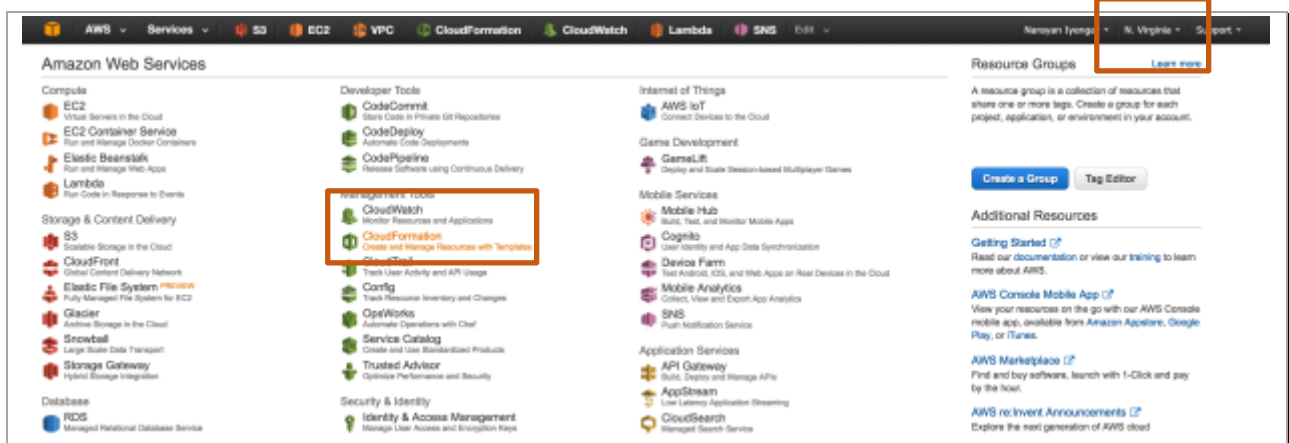
Repeat the above steps and create a bucket to upload the portal's bootstrap configuration files.

Lastly create an S3 bucket in the same region as the gateway and portal bootstrap buckets and upload the **config_fw.zip** file into that bucket (this is the bucket where the lambda scripts reside). Do not extract the zip file.



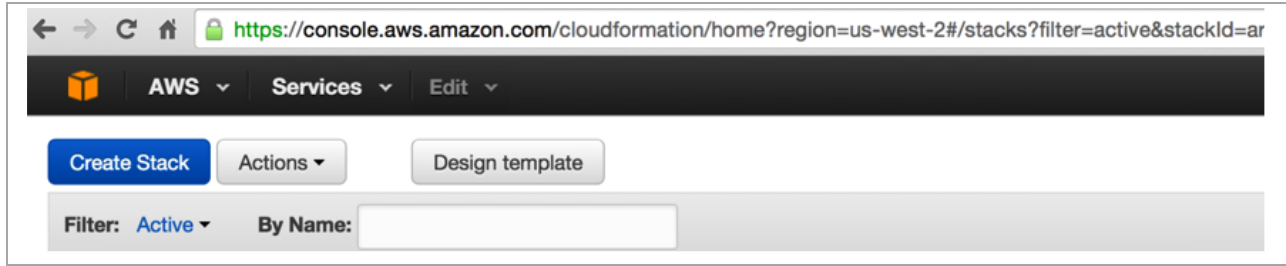
11. Launch the CFT

Login in to the AWS console <https://console.aws.amazon.com> and click on **CloudFormation**

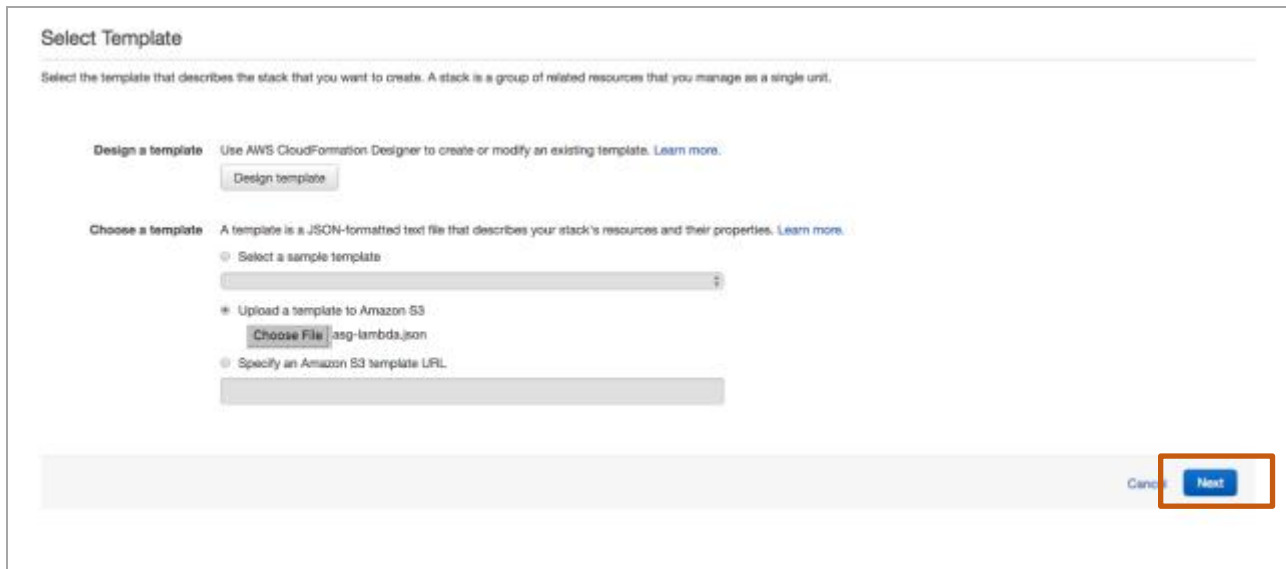


Note: Please make sure that your region (on the top right) is set to a region where Lambda is available (and the S3 buckets were created).

Click **Create Stack**:



Select **“Upload a template to S3”** and click the **“Choose File”** button. Then select the gp-asg.json template file. Then, click **Next**:



In the next screen specify a **“Stack Name”**. Specify the gateway bootstrap bucket name for the **GatewayBootstrapBucketName** parameter, portal bootstrap bucket name for the **PortalBootstrapBucketName** parameter and the bucket name where the lambda scripts reside for the **LambdaBucketName** parameter.

Select a **Serverkey** for which you have the private key. Refer to [section 2.4](#) on how to generate a keypair. Once satisfied, click **Next**.

Create stack

Select Template

Specify Details

Options

Review

Specify Details

Specify a stack name and parameter values. You can use or change the default parameter values, which are defined in the AWS CloudFormation template. [Learn more.](#)

Stack name

Parameters

GatewayBootstrapBucketName Bucket name for GP Gateway bootstrap configuration

LambdaBucketName Bucket name where lambda scripts reside

PortalBootstrapBucketName Bucket name for GP Portal bootstrap configuration

ServerKeyName Name of an existing EC2 KeyPair to enable SSH access to the instances from SecurityController

[Cancel](#) [Previous](#) [Next](#)

On the next screen you can specify tags (optional) otherwise click **Next**. You can create Key Value pairs that allow you to filter instances based on those tags. Tags provide a convenient, filtered view of just the instances launched by the template.

Options

Tags

You can specify tags (key-value pairs) for resources in your stack. You can add up to 10 unique key-value pairs for each stack. [Learn more.](#)

	Key (127 characters maximum)	Value (255 characters maximum)	
1	<input type="text"/>	<input type="text"/>	+

► Advanced

You can set additional options for your stack, like notification options and a stack policy. [Learn more.](#)

[Cancel](#) [Previous](#) [Next](#)

Next, review and check acknowledge at the bottom and click **Create**.

Review

Template

Template URL: <https://us-east-1.amazonaws.com/cloud-formation/templates/1-ekuzc90m0y-us-east-1/2016148RVV-ang-lambda.json>
 Description: GlobalProtect AutoScaling Demo.
 Estimate cost: Cost

Details

Stack name: gp-ang-demo
 ServerKeyName: aws-keypair-virginia
 Create IAM resources: Yes

Options

Tags
 No tags provided

Advanced

Notification: none
 Timeout: none
 Rollback on failure: Yes

Capabilities

i The following resource(s) require capabilities: [AWS::IAM::InstanceProfile, AWS::IAM::Policy, AWS::IAM::Role]
 This template might create Identity and Access Management (IAM) resources, which can include groups, IAM users, and IAM roles with certain permissions. Ensure that the template you are using is from a trusted source. [Learn more.](#)

☒ I acknowledge that this template might cause AWS CloudFormation to create IAM resources.

Cancel Previous **Create**

Once launched you should be able to monitor the stack creation progress in the next screen by clicking on the **Events** tab.

Note: The template takes about 10-15 minutes to fully deploy and be operational.

Create Stack Actions Design template

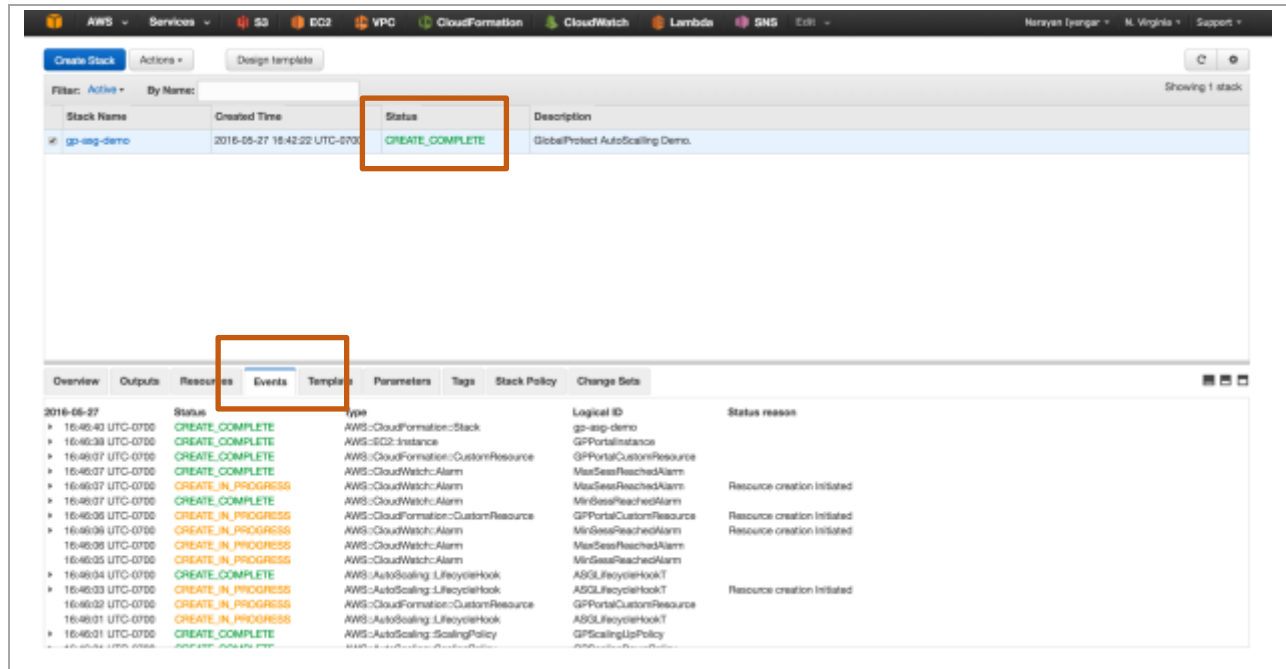
Filter: Active By Name: Showing 1 stack

Stack Name	Created Time	Status	Description
gp-ang-demo	2016-05-27 16:42:22 UTC-0700	CREATE_IN_PROGRESS	GlobalProtect AutoScaling Demo.

Overview Outputs **Resources** Events Template Parameters Tags Stack Policy Change Sets

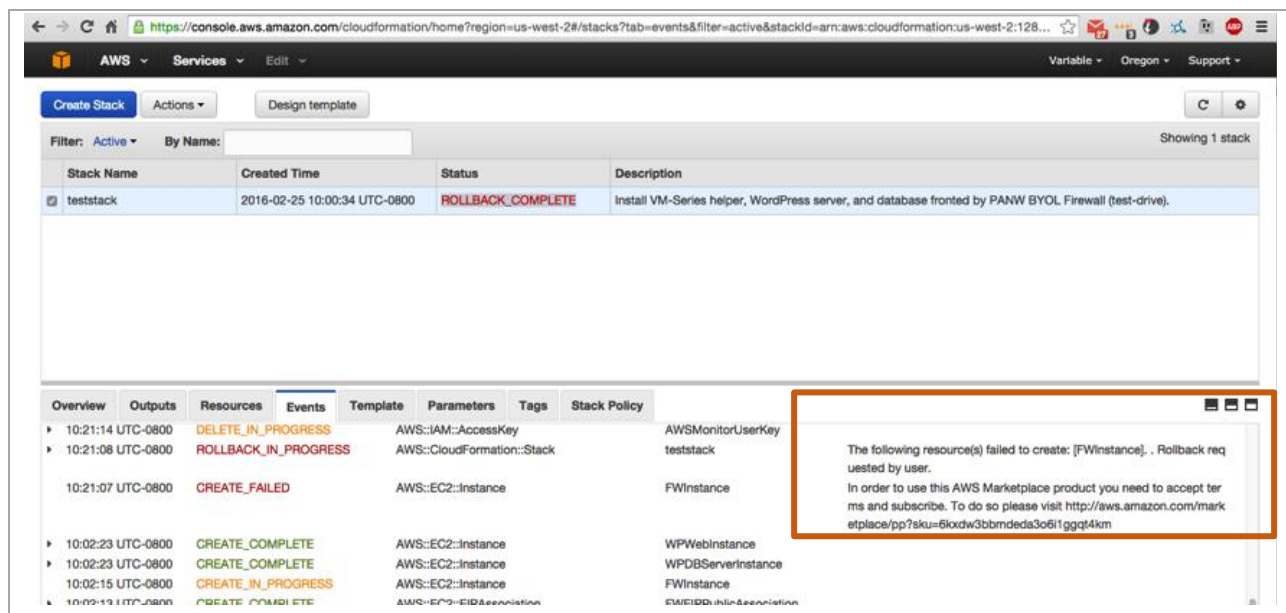
Time	Type	Logical ID	Status reason
2016-05-27 16:42:22 UTC-0700	AWS::CloudFormation::Stack	gp-ang-demo	User initiated

If the CFT was successfully launched, you should see an event as below:



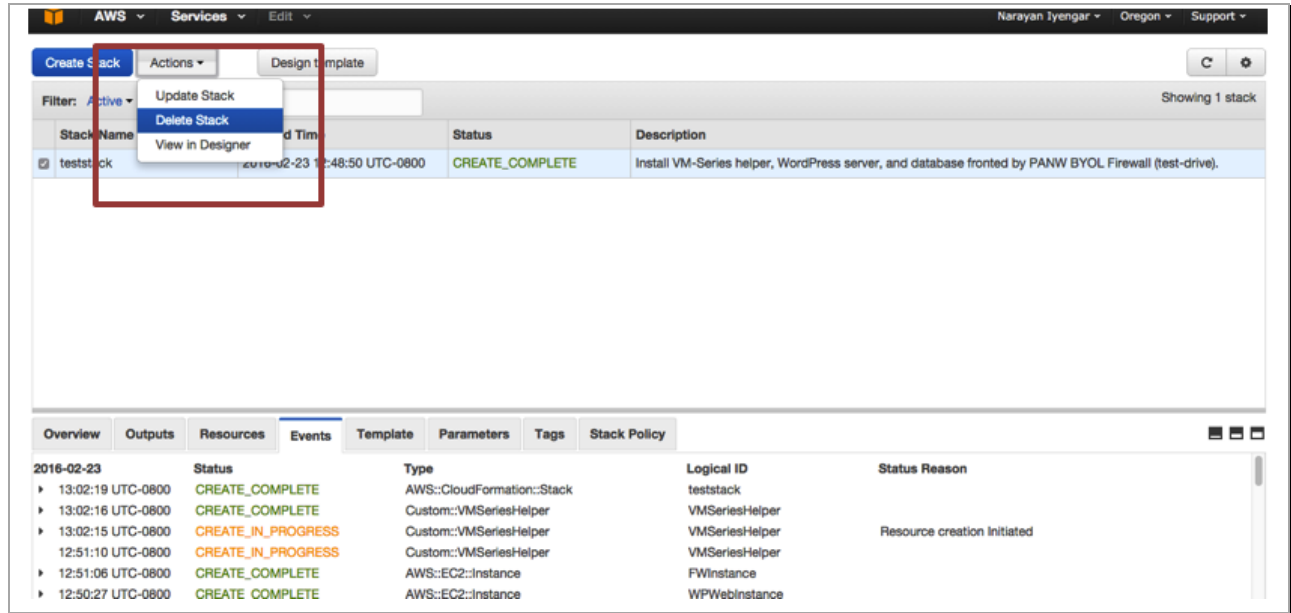
If there were any errors during the creation of the stack, you will need to drill down to the specific event in the **Events** tab and **Outputs** tab to debug and then create a new stack after fixing any errors. Scroll through the logs and find the chronologically first error. Normally, subsequent errors are a result of the initial error and the first error is the actual issue.

For instance, if you did not accept the VM-Series EULA, then you will get an error as seen below



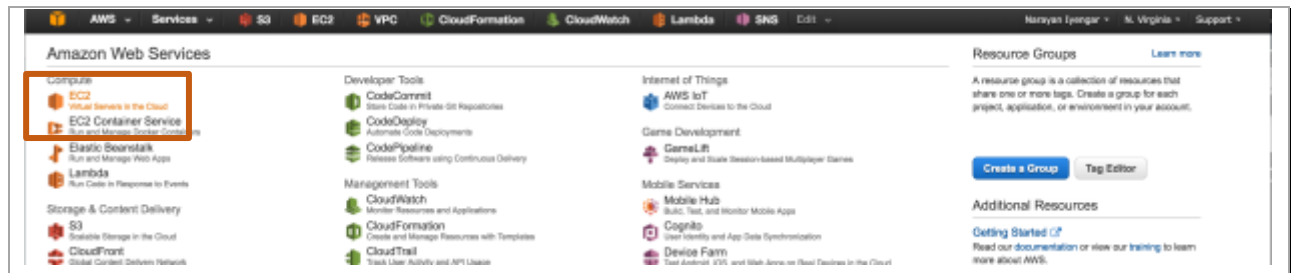
Refer to [section 2.3](#) to review and accept the EULA for the VM-Series NGFW

Note: If you need to relaunch the CFT, first delete the current stack under Actions, Delete Stack.



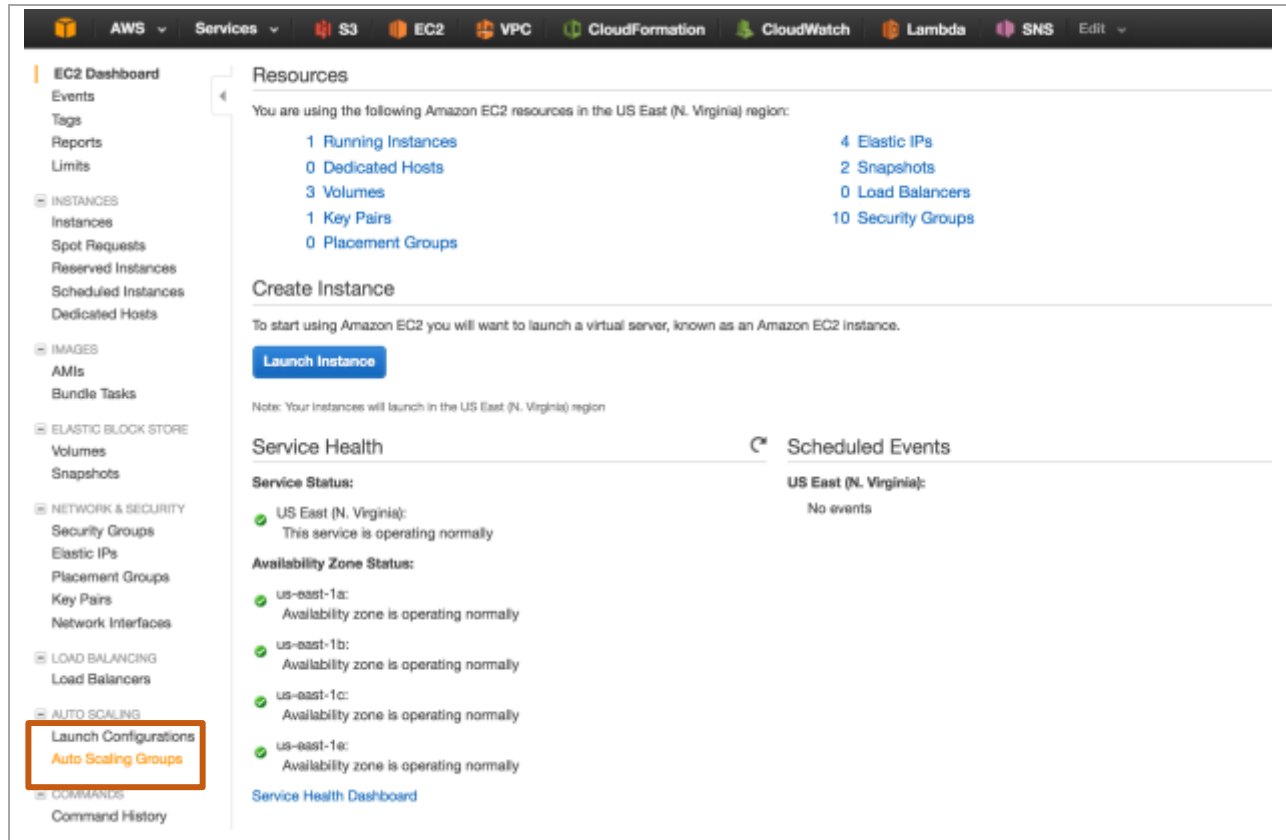
12. Launch the First Gateway

After the template has been deployed successfully, go back to the console and click on “EC2”:

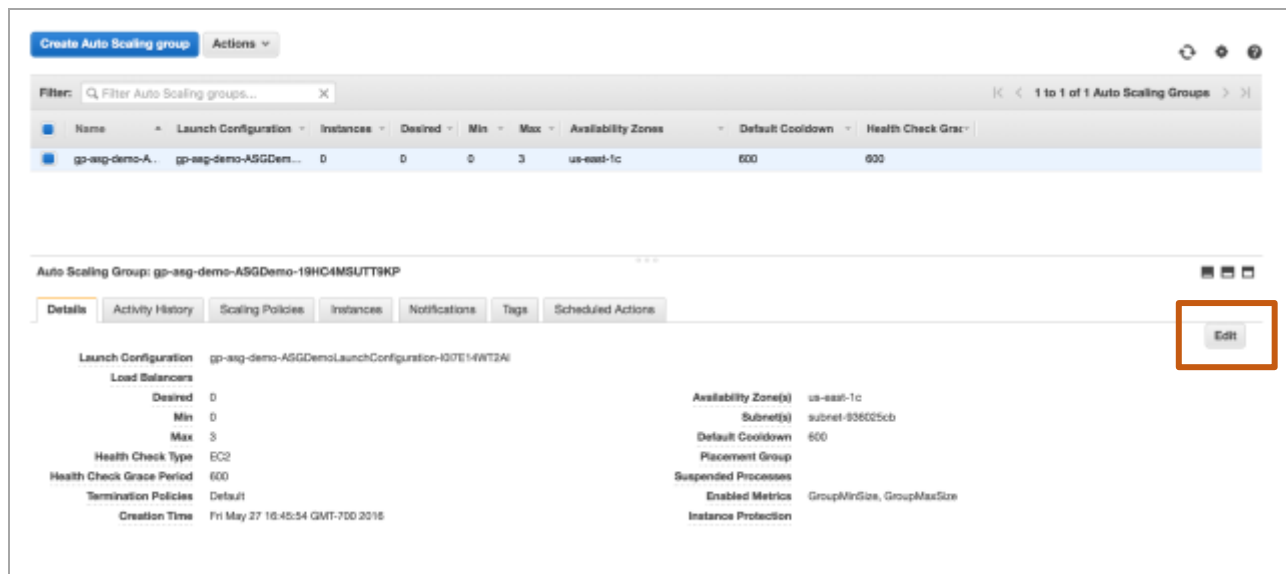


And click on “Auto Scaling Groups”

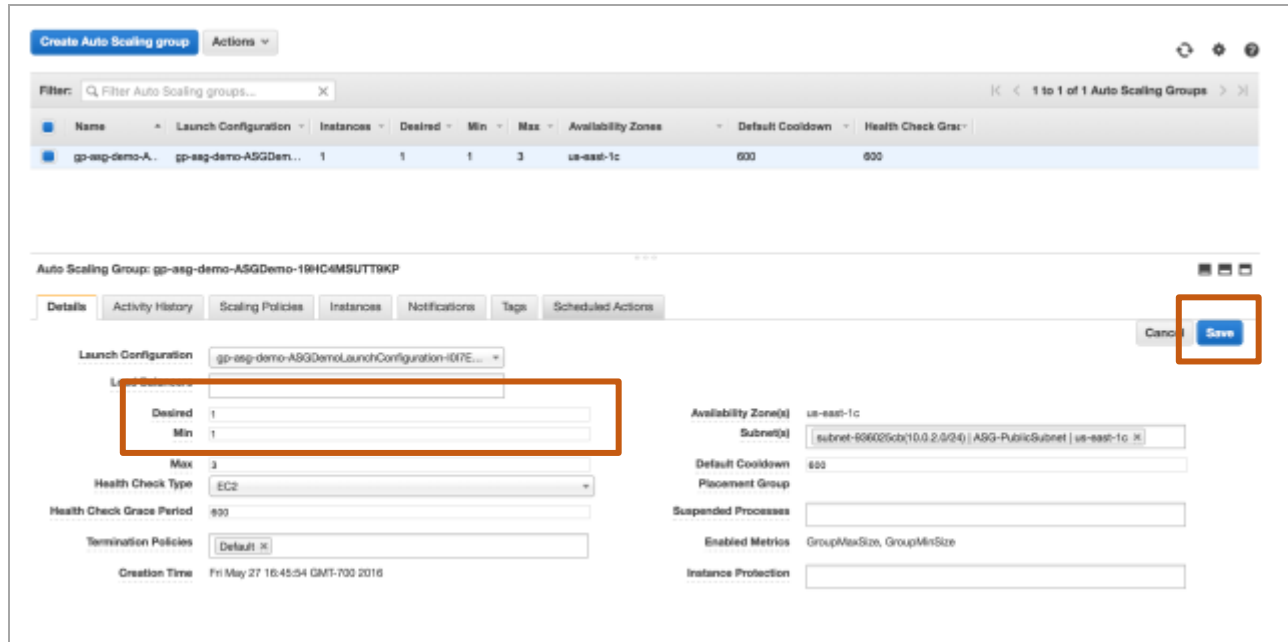
Auto Scaling GlobalProtect in AWS Deployment Guide



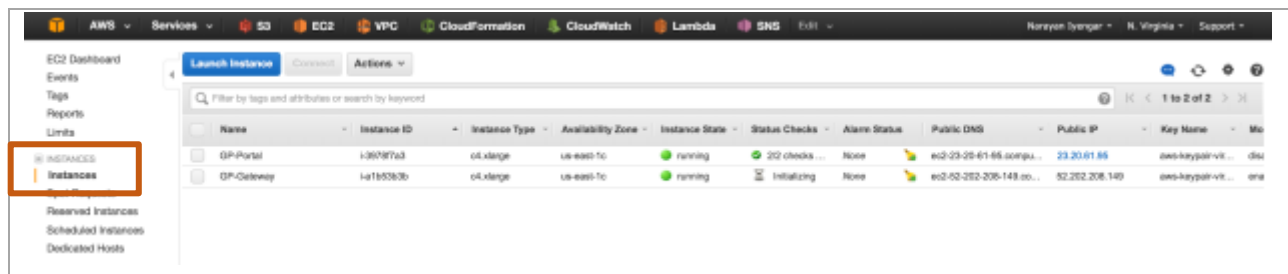
You should see the auto scaling group created by the template. Click **Edit**



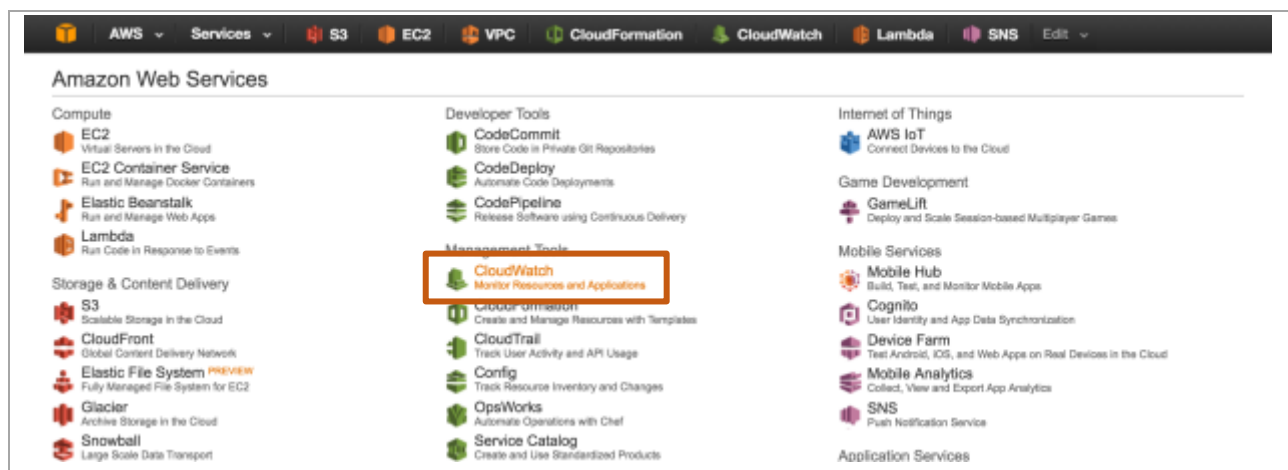
and change the **Desired** and **Min** fields to **1** and click **Save**:



This will trigger an auto scale event and launch a new VM-Series firewall and bootstrap it as a GlobalProtect Gateway. You can see this by clicking on “**Instances**” on the left:



From launch to configured, it takes about 10 minutes. You can monitor the logs if so desired by clicking on “**CloudWatch**” on the AWS console

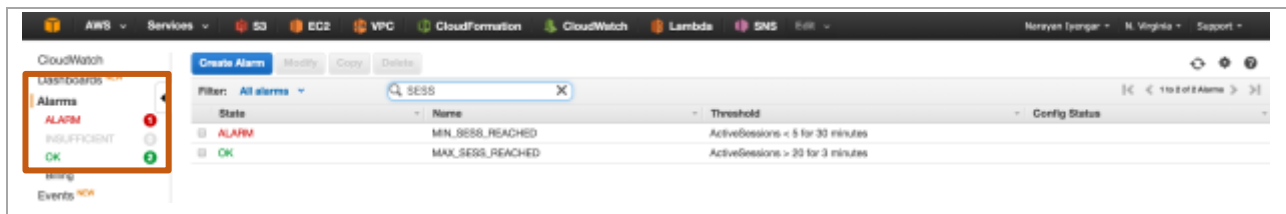


13. Scale-out/Scale-In Policy

In order to determine when to scale-out (add new gateways) or scale-in (remove gateways from service) the number of active sessions on a gateway is published to CloudWatch. Each gateway that is part of the Auto Scale Group will publish its active session count per minute.

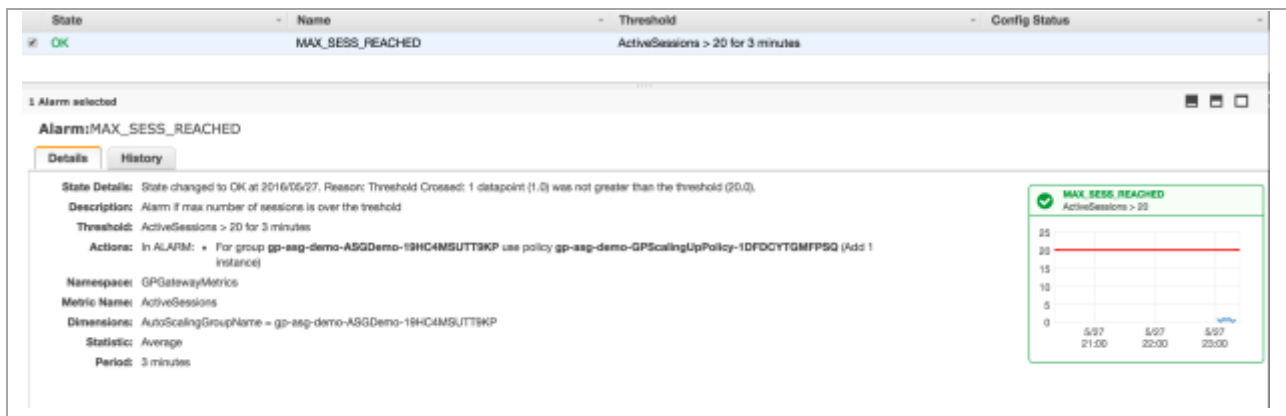
The template – for demonstration purposes – has set a very low threshold for an auto scale event to occur.

To verify click on “**Alarms**” on the left and click on the “**OK**” link:



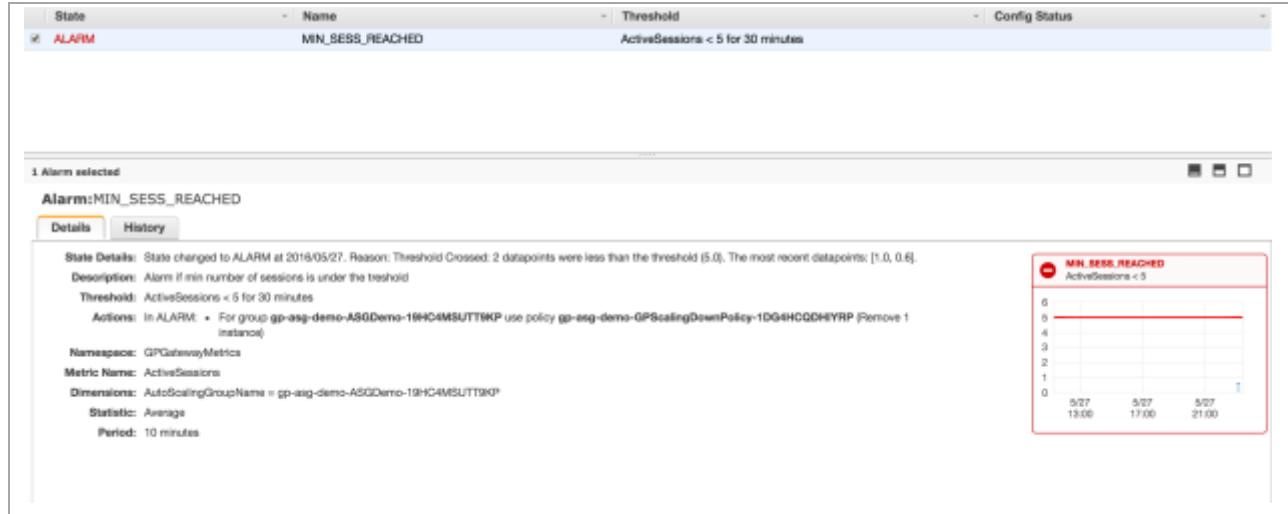
In the above screen capture, you see two alarms. MAX_SESS_REACHED and MIN_SESS_REACHED. These alarms are triggered based on metrics published by the gateways in the Auto Scale Group.

If the number of active sessions is greater than 20 for more than 3 minutes, the MAX_SESS_REACHED alarm is triggered, which in turn triggers scale-out event, which deploys a new GP gateway within the Auto Scale Group



Similarly, if the number of sessions is less than 5 and stays that way for 30 minutes, the MIN_SESS_REACHED alarm is triggered (as in the screenshot above) and a scale-in event happens and a GP gateway is terminated.

Note: There will always be at least one gateway (depending on your configuration for the minimum number of gateways)



14. Trigger an Auto Scale Event

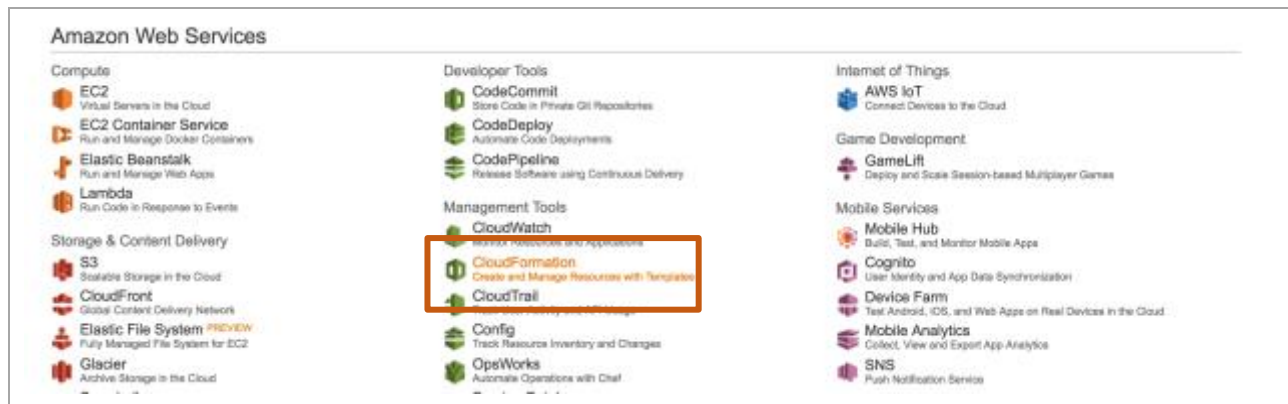
To trigger an auto scale event, you will need to establish connection with the newly deployed GP Portal. To avoid any disruption of other activity, it is recommended to use a virtual machine (Windows or Mac), if available.

To download the GP Client for your particular operating system refer to this link:

<https://www.paloaltonetworks.com/documentation/31/globalprotect/gp-agent-user-guide>

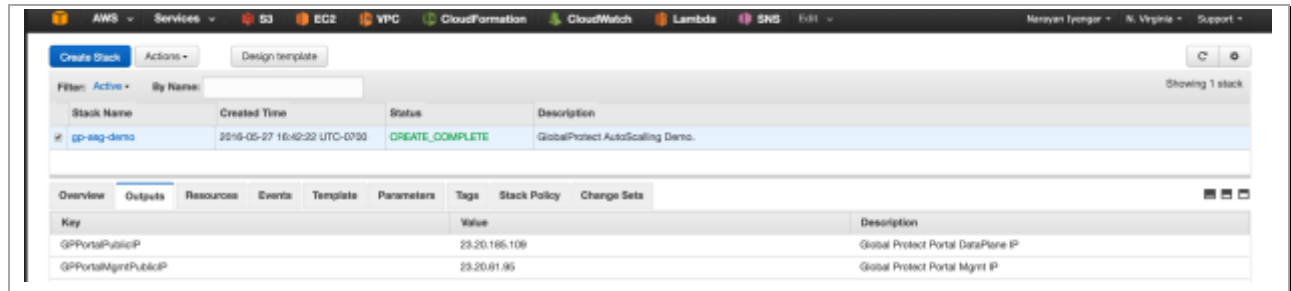
For the purpose of this guide and demonstration, a Windows VM was used.

To determine the GP Portal address, head on over to CloudFormation in the AWS console



and select the stack that was just deployed. Under the “**Outputs**” tab note the **GPPortalPublicIP** address

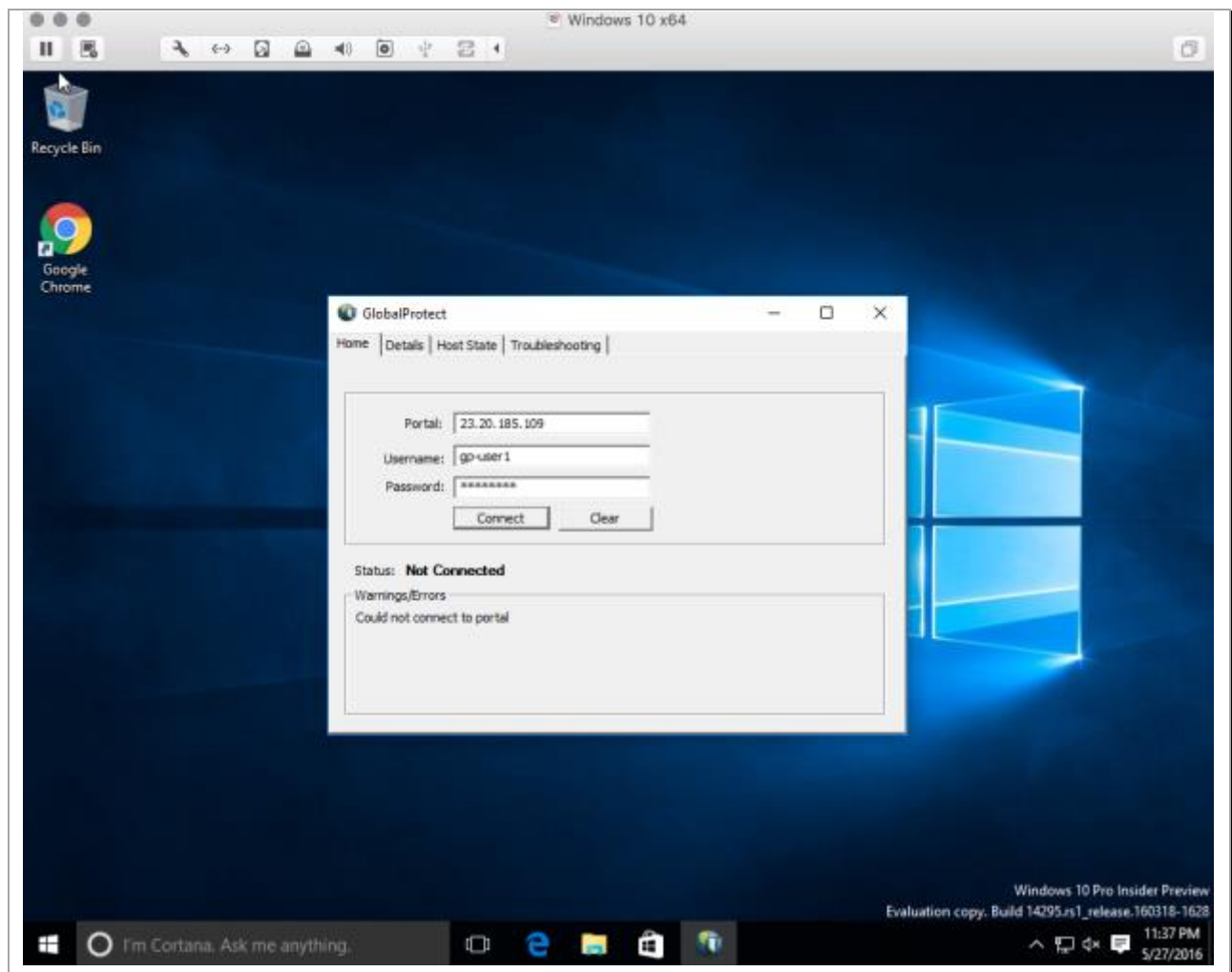
Auto Scaling GlobalProtect in AWS Deployment Guide



Download and install the self-signed certificate as a trusted certificate from the GitHub repo:

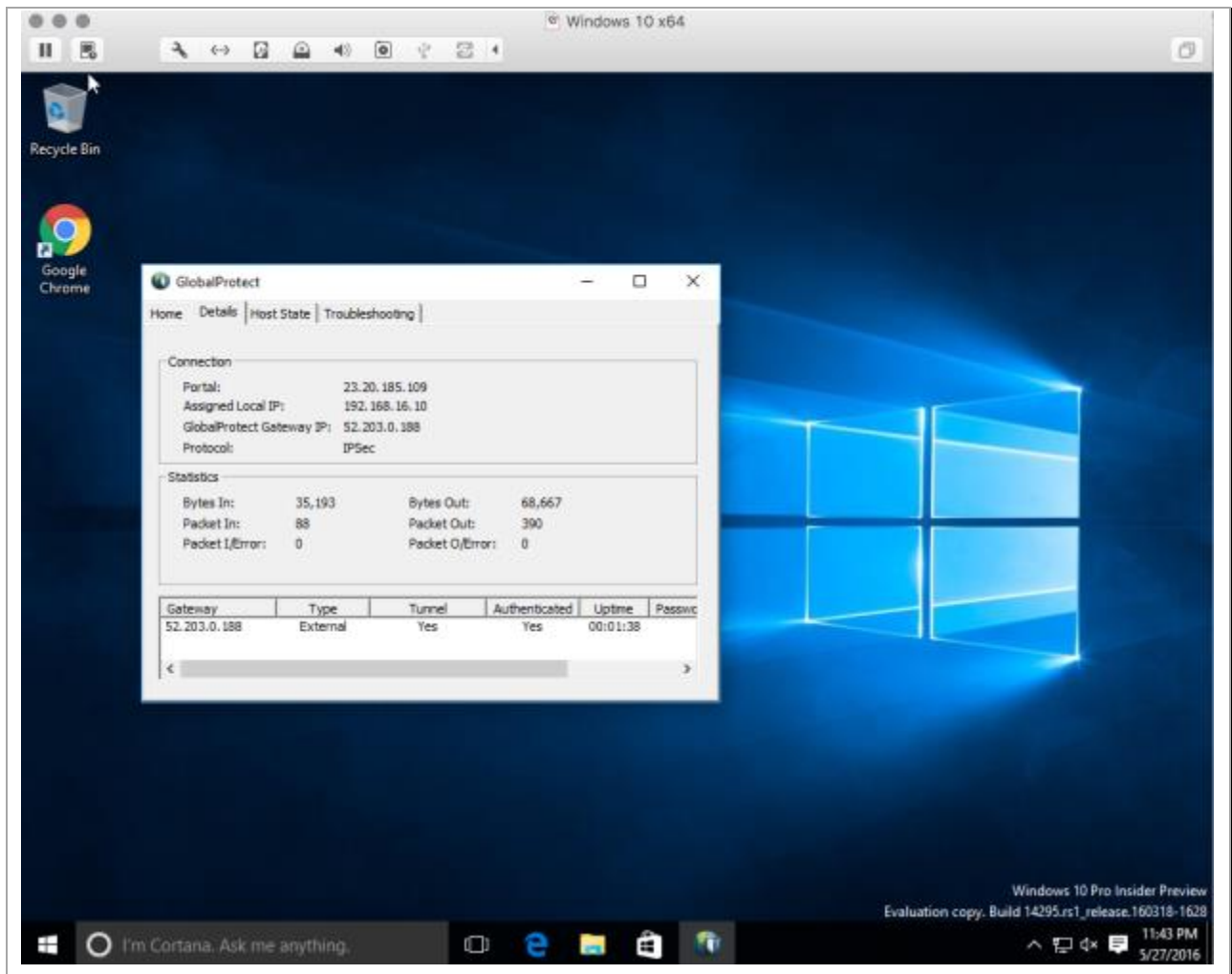
https://github.com/PaloAltoNetworks/aws/blob/master/globalprotect-asg/cert_rootCA.crt

In the GlobalProtect client panel specify the above **GPPortalPublicIP** address as the Portal address. The username and password is gp-user1/paloalto or gp-user2/paloalto

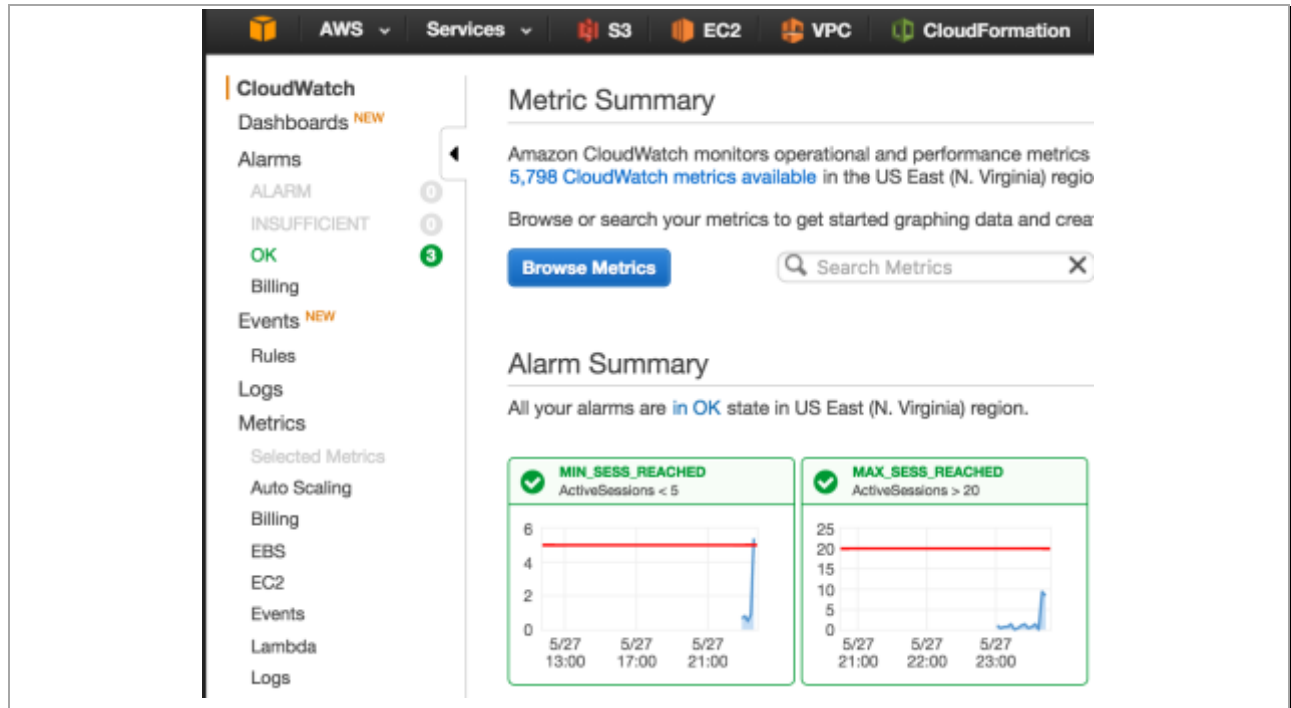


If you get an error (as seen above) that the client could not connect to the portal, you may need to disable the GlobalProtect client on your host machine. The portal and gateways use self-signed certificate and so corporate firewalls may not allow the connection to go through.

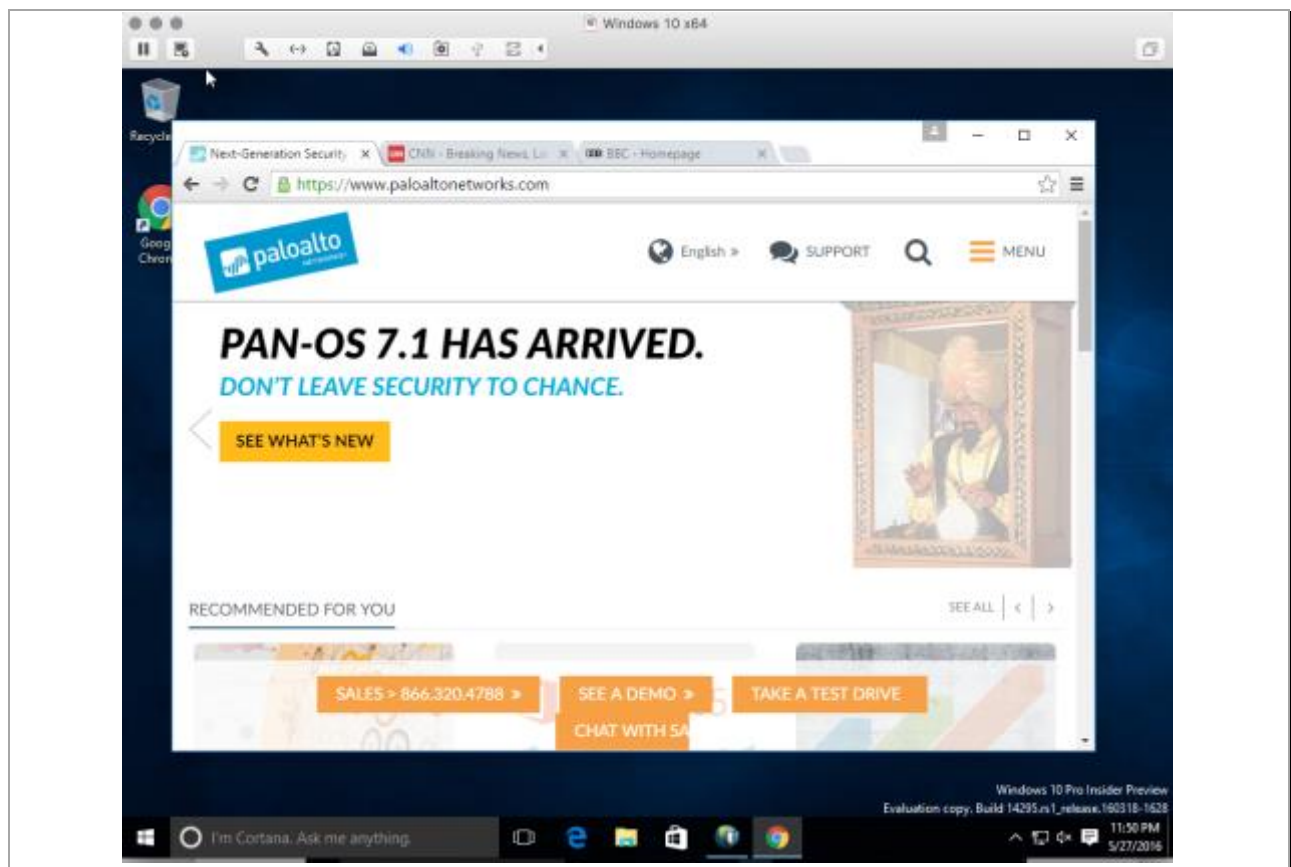
Once connected you should see the GlobalProtect Portal and Gateway information in the client **"Details"** tab:



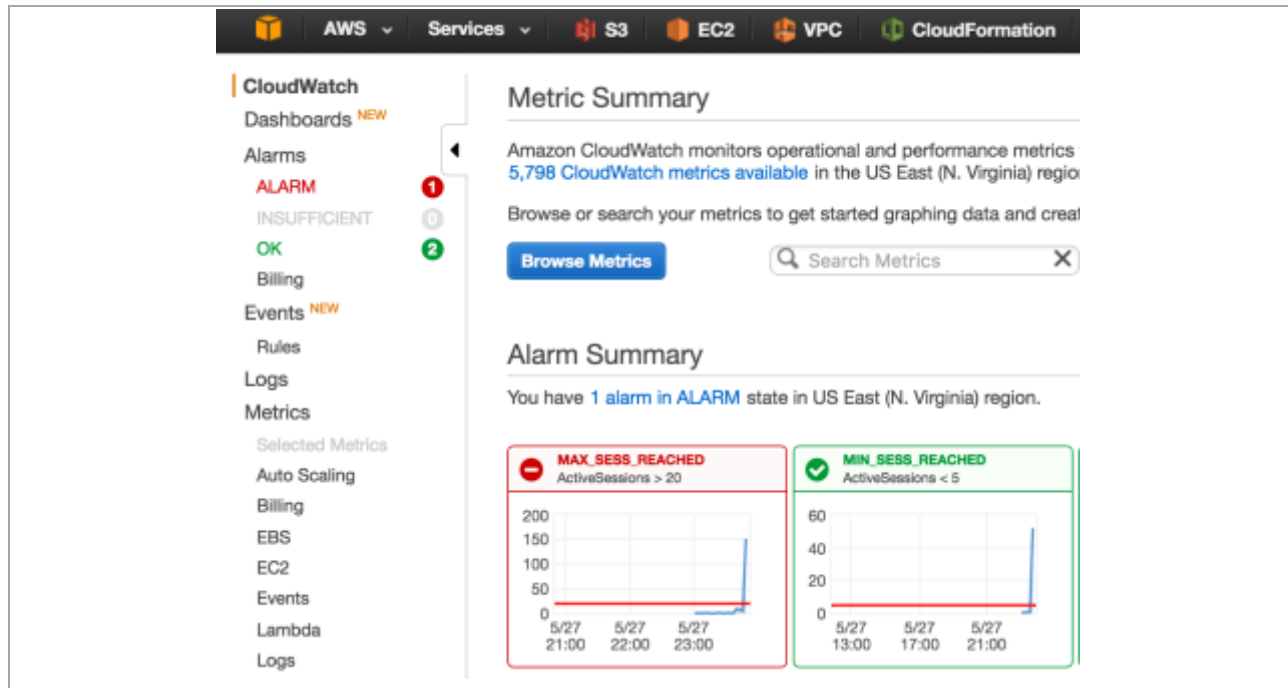
To verify that by connecting to the gateway the session count goes up head on over the AWS console and click on CloudWatch and you should see a small spike in the metrics for MAX_SESSION_REACHED:



To trigger an event, in the VM open up a web browser and pick a few of your favorite websites to visit:



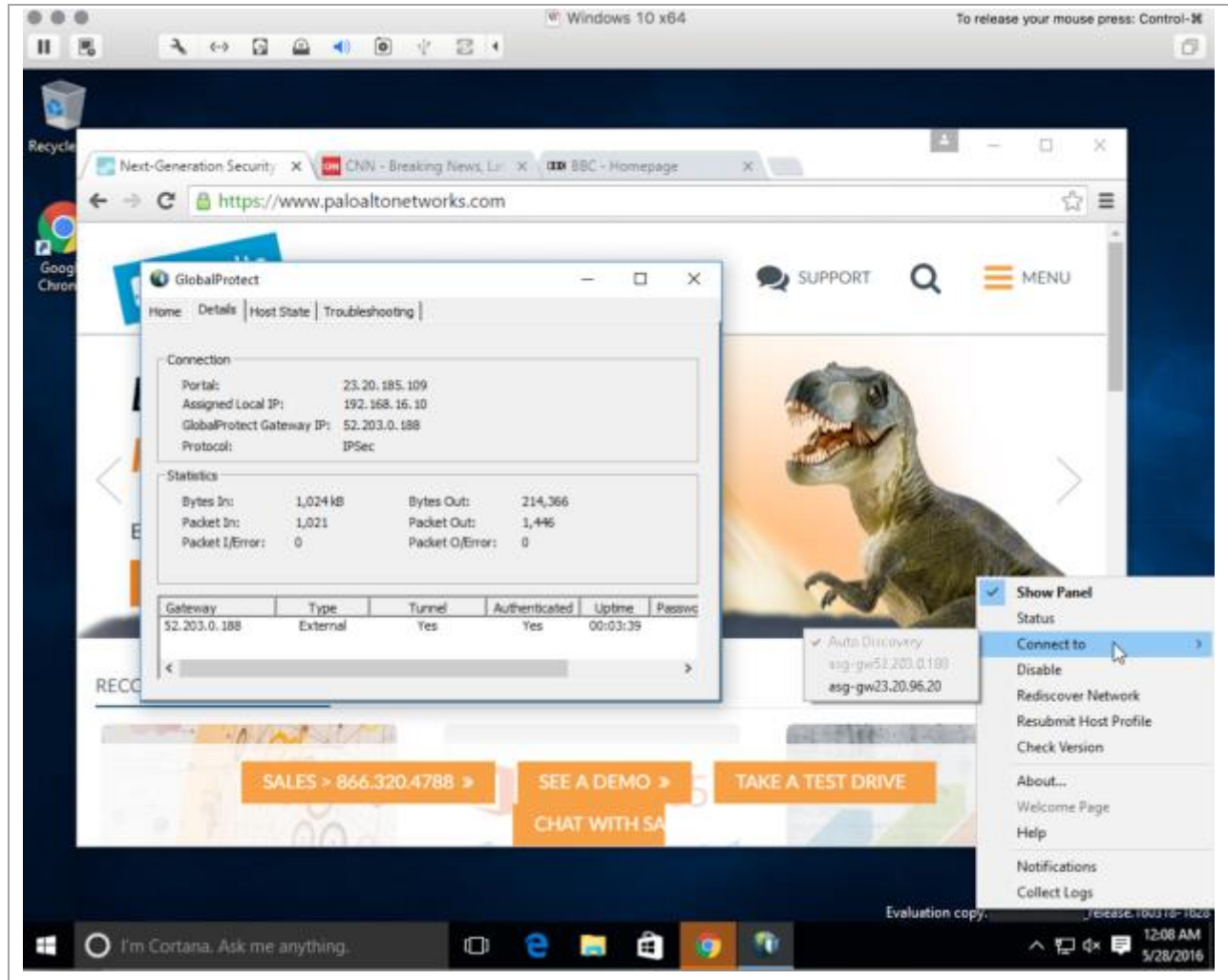
This will cause the session count to go up, trigger the alarm and cause a scale-out event and a new gateway will be provisioned, bootstrapped, configured and added to the Auto Scale Group.



The screenshot shows the AWS EC2 console 'Instances' page. A table lists the instances, including their names, IDs, types, availability zones, states, and public IPs.

Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS	Public IP	Key Name	Mo
GP-Portal	i-39797a3	c4.xlarge	us-east-1c	running	2/2 checks ...	None	ec2-33-20-61-95.compu...	23.20.61.95	aws-keypair-vit...	dis
GP-Gateway	i-e1b53b3b	c4.xlarge	us-east-1c	running	2/2 checks ...	None	ec2-52-202-208-148.co...	52.202.208.148	aws-keypair-vit...	ena
GP-Gateway	i-d154da4b	c4.xlarge	us-east-1c	running	Initializing	None	ec2-33-20-3-133.compu...	23.20.3.133	aws-keypair-vit...	ena

Once the new gateway is up, it will be added to the pool of gateways. Verify this in the GP Client by selecting **“Rediscover Network”**:



To trigger a scale-in event, close all the browser sessions (or shutdown the VM) and that will trigger a scale-in event

The screenshot shows the AWS CloudWatch console interface. On the left, the navigation menu includes CloudWatch, Dashboards, Alarms, Events, Rules, Logs, Metrics, Selected Metrics, Auto Scaling, Billing, EBS, EC2, Events, Lambda, and Logs. The main content area is divided into two sections: Metric Summary and Alarm Summary.

Metric Summary: Amazon CloudWatch monitors operational and performance metrics. It states that 5,830 CloudWatch metrics are available in the US East (N. Virginia) region. A search bar and a 'Browse Metrics' button are present.

Alarm Summary: You have 1 alarm in ALARM state in US East (N. Virginia) region. Two line graphs are shown:

- MIN_SESS_REACHED:** ActiveSessions < 5. The graph shows a sharp spike in sessions around 5/28 00:00, reaching approximately 250.
- MAX_SESS_REACHED:** ActiveSessions > 20. The graph shows a sharp spike in sessions around 5/28 00:00, reaching approximately 150.

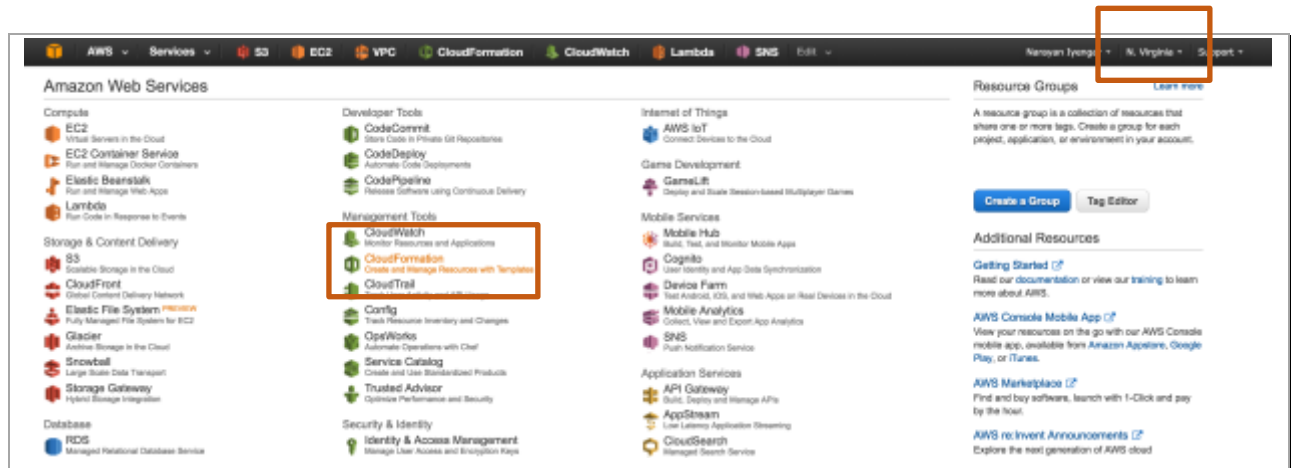
and a gateway will be removed from service

The screenshot shows the AWS EC2 console interface. The left sidebar includes EC2 Dashboard, Events, Tags, Reports, Limits, INSTANCES, Spot Requests, and --. The main content area shows a table of EC2 instances.

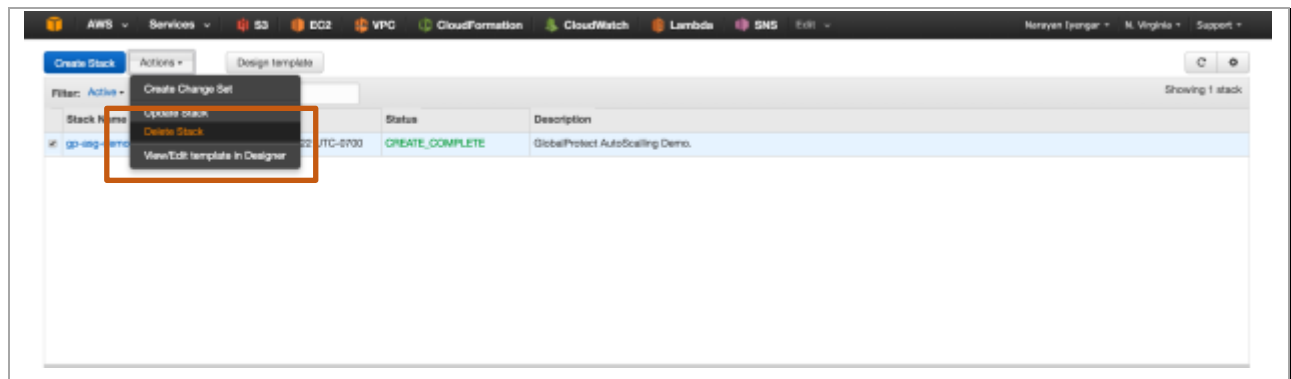
Name	Instance ID	Instance Type	Availability Zone	Instance State	Status Checks	Alarm Status	Public DNS	Public IP	Key Name	Mo
GP-Portal	i-90797a3	c4.xlarge	us-east-1c	running	2/2 checks ...	None	ec2-23-20-81-85.comps...	23.28.81.85	aws-keypair-vir...	dis
GP-Gateway	i-11553b36	c4.xlarge	us-east-1c	terminated	2/2 checks ...	None	ec2-23-20-3-133.comps...	23.20.3.133	aws-keypair-vir...	ene
GP-Gateway	i-11553b36	c4.xlarge	us-east-1c	running	2/2 checks ...	None	ec2-23-20-3-133.comps...	23.20.3.133	aws-keypair-vir...	ene

15. Cleanup

Once done with the template, feel free to play around with various things. If done, cleanup as follows. In the AWS management console, click on **CloudFormation**:

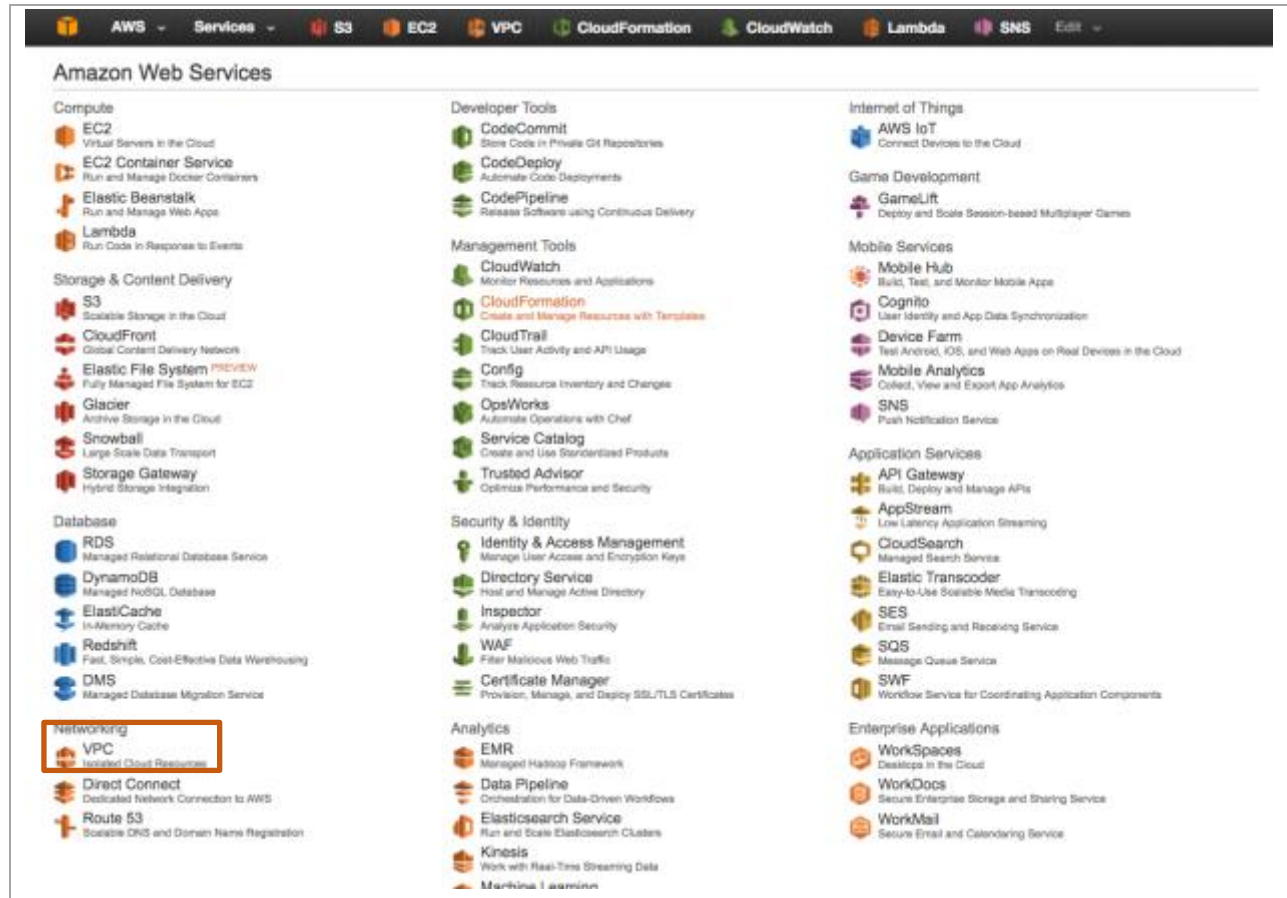


Under **Actions**, click **Delete Stack**:

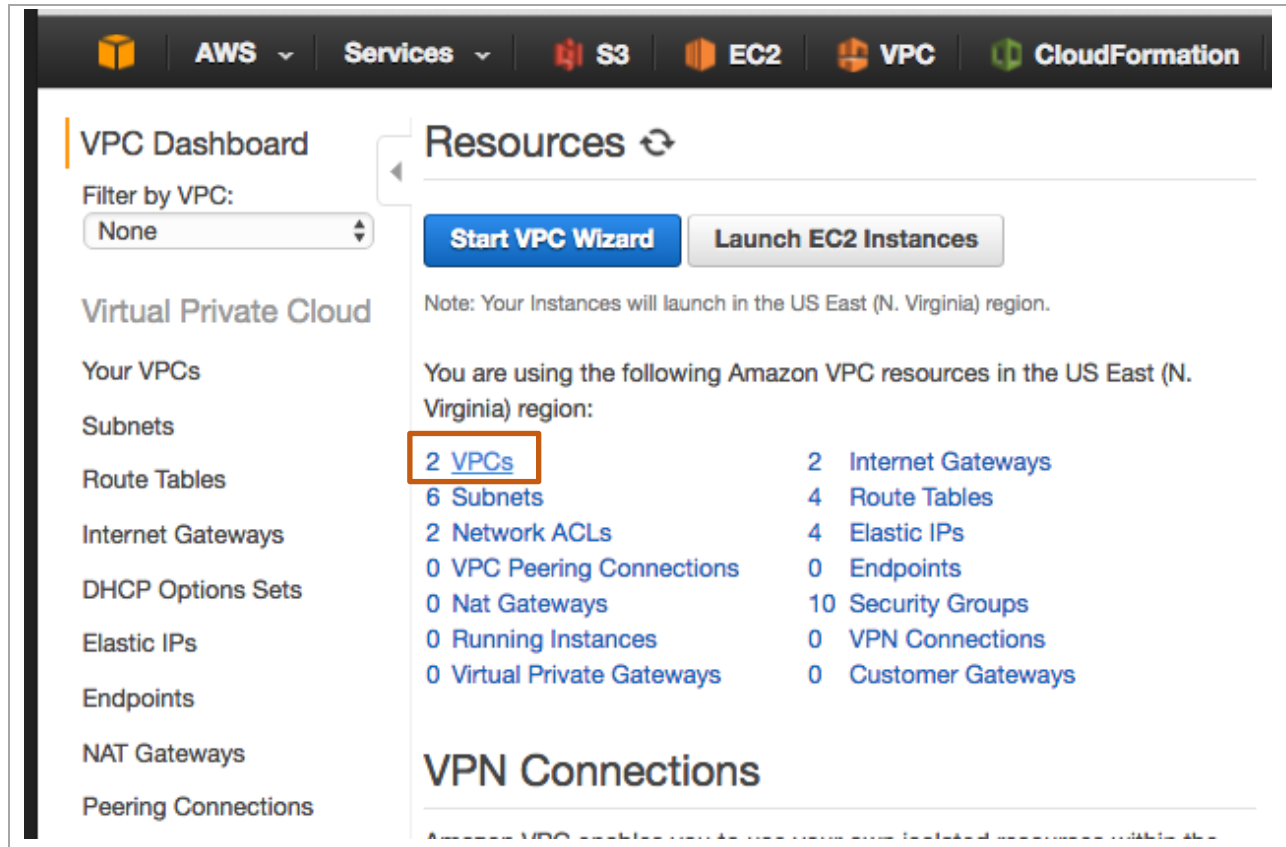


This should delete all the resources created via the template.

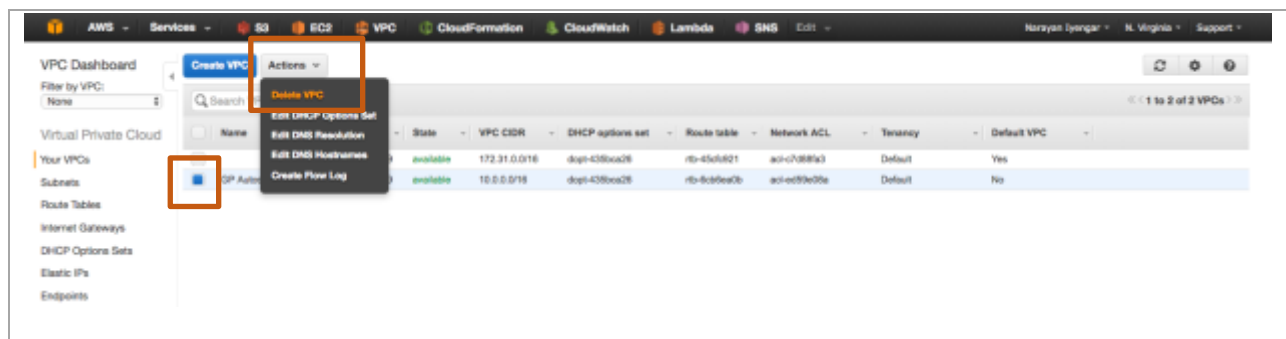
Note: There are cases when deleting a stack fails due to some dependencies that AWS is not able to automatically delete. So, if stack deletion fails, head on over to the VPC console

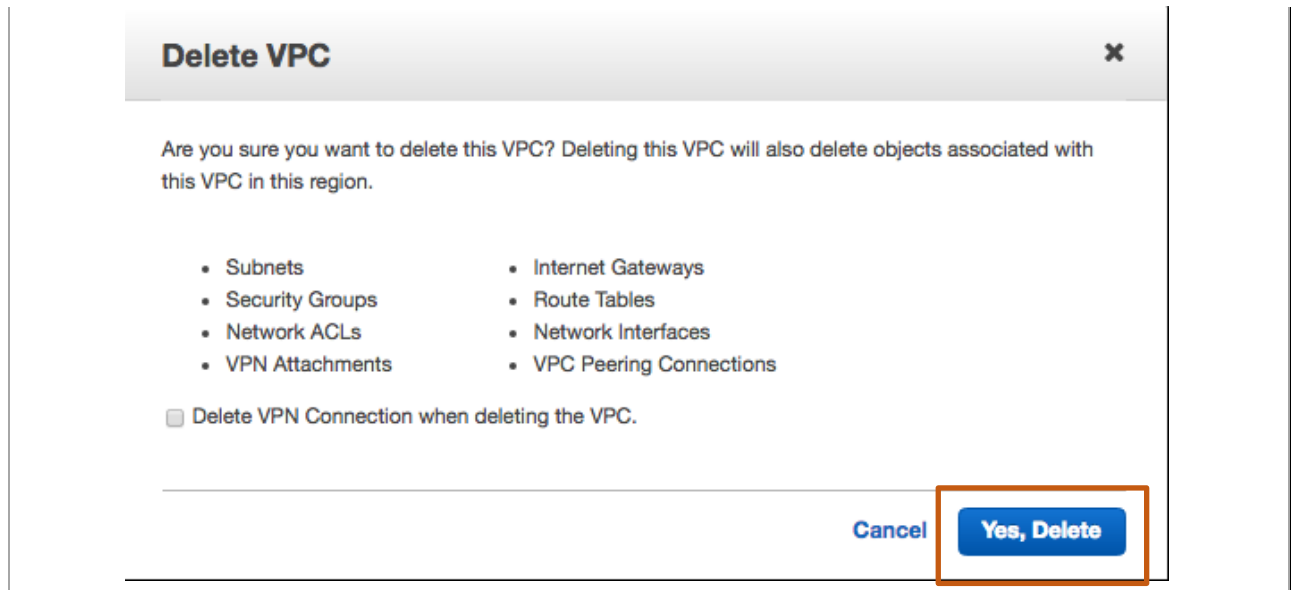


and select **VPCs**



Select the VPC in question and select **“Delete VPC”** from the **“Actions”** menu and click **“Yes, Delete”**





Now, try and delete the stack again.

16. Conclusion

You have successfully deployed and demonstrated GlobalProtect in an AWS Auto Scaling environment

Appendix A

Troubleshooting tips

1. [Stack creation fails](#)

Occasionally stack creation fails due to various unknown reasons. Maybe AWS is updating their software, maybe that particular region is having a service outage. These errors are usually transient in nature and generally will go away when the stack is deleted and re-launched (OR launched in a different region) If the errors are consistent, then please read on for other troubleshooting tips.

2. [EIP Exhaustion](#)

If the account does not have a minimum of 8 unallocated elastic IPs, stack creation may fail.



Timestamp	Event Type	Resource	Change Set	Description
09/09/01 UTC-0600	CREATE_COMPLETE	AWS::EC2::NetworkACL	act0765d6d2	
09/09/02 UTC-0600	CREATE_IN_PROGRESS	AWS::EC2::VPCHCPOptionsAssociation	dchpassoc1	Resource creation initiated
09/09/02 UTC-0600	CREATE_IN_PROGRESS	AWS::EC2::RouteTable	rtb059a2460	Resource creation initiated
09/09/02 UTC-0600	CREATE_FAILED	AWS::EC2::EIP	ManagementElasticIP	The maximum number of addresses has been reached.
09/09/02 UTC-0600	CREATE_FAILED	AWS::EC2::EIP	PublicElasticIP	The maximum number of addresses has been reached.
09/09/02 UTC-0600	CREATE_IN_PROGRESS	AWS::EC2::RouteTable	rtb049a2461	Resource creation initiated
09/09/01 UTC-0600	CREATE_IN_PROGRESS	AWS::EC2::NetworkACL	act0765d6d2	Resource creation initiated
09/09/01 UTC-0600	CREATE_IN_PROGRESS	AWS::EC2::VPCHCPOptionsAssociation	dchpassoc1	
09/09/01 UTC-0600	CREATE_IN_PROGRESS	AWS::EC2::RouteTable	rtb059a2460	

If you don't have enough elastic IPs it is possible that stack creation may succeed, but GlobalProtect Gateways may not be getting launched correctly. One symptom maybe that no gateways are in the auto scaling group and the activity history for the autoscaling group shows gateways spinning up and then being terminated.

It is also possible that you had just enough elastic IPs to launch a Portal and Gateway, but not any subsequent auto scaled gateways. A good indicator is new gateways not being added/visible to the Global Protect client

3. [Bootstrapping not working](#)

If the VM-Series firewall is up and you are able to access the login page, but unable to login using the username/password: apiuser/Pal0Alt0, then chances are bootstrapping has failed. There could be several reasons:

a. [Corrupt configuration files](#)

Please ensure that the bootstrap.xml and init-cft.txt files mentioned in [Section 9](#) are not corrupted.

b. Incorrect bootstrap bucket-name

Another reason for bootstrapping to fail is that the bootstrap bucket names (Parameters: GatewayBootstrapBucketName or PortalBootstrapBucketName) were mentioned incorrectly during stack creation (template launch). Please make sure the bucket name created in [Section 9](#) is mentioned when launching the template.