



Palo Alto Networks Application Framework - Lab Guide

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Palo Alto Networks Application Framework Lab Deployment via AWS CloudFormation

This document describes how to automatically set up a lab environment on Amazon Web Services that can be used to generate logs for Palo Alto Networks Application Framework. It is meant for Palo Alto Networks Partners that need a quick way to start developing for Application Framework.

It also provides instructions on how to pair the API Explorer application with Application Framework.

Doc Revision: 2018-04-09-03:43:36 (UTC)

Please make sure you always download the latest revision of this document and the required files:

- Documentation PDF (this document): <https://paloaltonetworks.box.com/s/s0hc5umuxsumjb6t3vcwtknzh9isbkcf>
- AWS CFT JSON file: <https://paloaltonetworks.box.com/s/1gn5v5n8p2nkkohb4qw4tz6yiaxz78oi>
- NGFW S3 Bucket Zip: <https://paloaltonetworks.box.com/s/l88f9zonv1r7fb5ihf49kbkrwdw4kfp2>
- LAB Miscellaneous S3 Bucket Zip: <https://paloaltonetworks.box.com/s/rhoyfapsrpza7l9an44s5wwi2kyg61uh>

Prerequisites

This lab environment requires the following:

- A valid Palo Alto Networks Customer Support Portal (CSP) Account with the **Logging Service** and **Directory Sync Service** roles enabled for your organization
- A valid AWS Account
- Palo Alto Networks Licenses:
 - Panorama (serial number and support Auth Code)
 - VM-Series Firewall (2x Auth Codes per firewall (base and bundle)))
 - Logging Services (Auth Code)
- AWS Region with 5 available Elastic IPs (4 if not deploying Kali Linux)
- Files required for deployment (provided by Palo Alto Networks):
 - CloudFormation Template (JSON file)
 - 2 ZIP files containing the S3 bucket data
- (Not mandatory but highly recommended) A second or third level domain configured in AWS Route53 (i.e. lab.yourcompany.com with NS records pointing to AWS Route 53 DNS Servers): ask your Palo Alto Networks representative for more details.

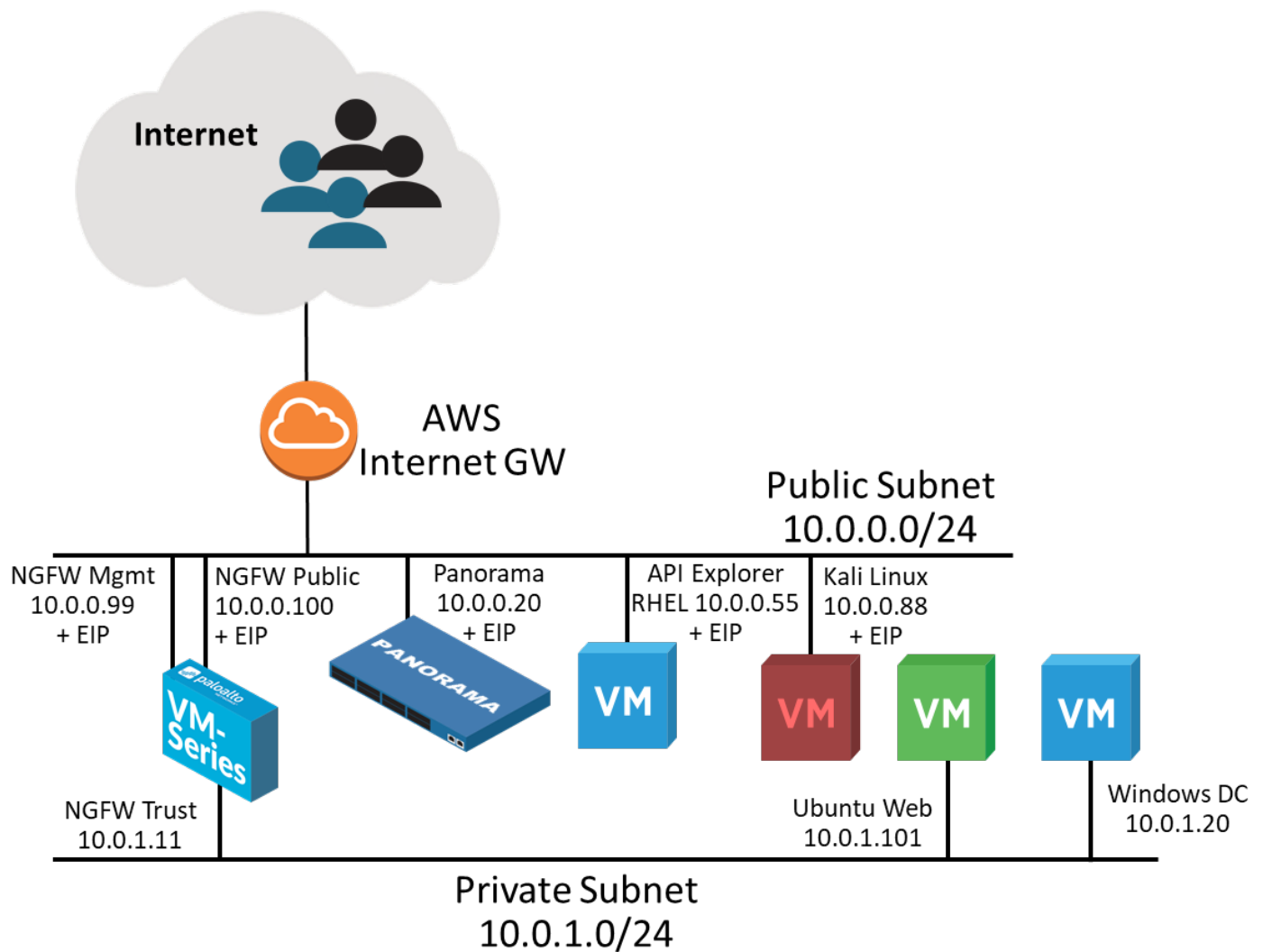
Lab Topology and features

The AWS CloudFormation template automatically deploys a network topology that can be used to generate different logs and events to be sent to the Palo Alto Networks Application Framework.

The following components are included in the template:

- Panorama (10.0.0.20 + EIP assigned for remote reachability)
- Next-Generation Firewall VM Series with the following interfaces:
 - Management: 10.0.0.99 (+ EIP assigned for remote reachability)
 - Public (10.0.0.100) (+ EIP assigned for remote reachability)
 - Internal (10.0.1.11)
- API Explorer VM running RHEL (10.0.0.55 + EIP assigned for remote reachability)
- Kali Linux VM (10.0.0.88 + EIP assigned for remote reachability)
- Ubuntu Web Server behind the firewall (10.0.1.101, reachable via SSH through the firewall Public EIP on port 221)
- Windows Server 2012 R2 Domain Controller behind the firewall (10.0.1.20, reachable via RDP through the firewall Public EIP on port 3389)

The network topology is depicted in the following diagram:



Once created, the environment automatically starts generating traffic through a web crawler installed on the Ubuntu Web server VM. It automatically and periodically updates the User-to-IP mapping on the firewall via API, so the traffic logs will appear with "user1" as source user. The crawler also periodically downloads a sample test PE from the Palo Alto Networks web site, that will trigger a Wildfire event. SSL Decryption is automatically enabled on the firewall with SSL Forward Proxy, and all the web requests from the VMs in the private subnet are decrypted: both the Ubuntu Web server VM and the Windows Domain Controller trust the Firewall pre-created certificate for SSL Decryption. The certificate used by the NGFW for decryption is static and has been pre-added in the environment configuration to simplify the automation: it is possible to replace it post deployment (instructions are not provided in this document).

- For details on VM information and useful commands, see [Appendix A](#)
- For details on EIP associations, see [Appendix B](#)

Some URL categories (sports, finance) are configured to be blocked or to generate alerts on the firewall, and the web crawler will hit those categories, to automatically generate URL filter events.

A Kali Linux VM is also deployed and can be used to generate attacks on the Ubuntu Web Server VM, in order to generate Threat Logs on the Firewall (need to be done manually, see [Appendix A](#)).

NAT rules are configured on the Firewall Public Interface (10.0.1.100, with an EIP associated to it) that allow reachability to the VMs behind it:

- **Port 3389** to RDP into the Windows Domain Controller
- **Port 22** to SSH on the ubuntu Web VM

The CloudFormation template allows to specify an Administrative password that is automatically configured on the following systems:

- Next-Generation Firewall (for the *admin* user)
- Panorama (for the *admin* user)
- API Explorer VM (for the *ec2-user* user)
- API Explorer application (for the *admin* user)
- Kali Linux VM (for the *ec2-user* user)
- Windows Domain Controller:
 - Domain Admin user (specified at deployment, default is 'paloalto')
 - Other users (user1, user2, user3 -- also with Domain Admin privileges)

Since the password is used widely, it's recommended to select one with a good level of complexity.

Note: if you delete the Stacks deployed through this CFT, make sure you manually delete the EC2 Volumes that are left, otherwise you will end up using space unnecessarily.

Security Hardening Considerations

This environment is meant for development use only, it's not security hardened for production. Specifically, the following security considerations should be known:

- Password authentication via SSH is enabled on both API Explorer (ec2-user user) and Ubuntu Web server (ubuntu user) VMs, using the Administrative password
- Active Directory Password Complexity is disabled
- Administrative password is provided as an environment variable for the installation scripts on the API Explorer and Ubuntu Web Server VMs, so it may be visible in some of the log files (i.e. /tmp/panorama_setup.log on the API Explorer VM)
- The Panorama/NGFW SSH private key must be uploaded in the S3 bucket to automate the password reset process

To perform manual hardening of the environment, the following post-deployment steps are suggested:

- Manually change all the passwords
- Replace the SSH key for authentication on NGFW and Panorama for admin users
- Disable Password based authentication on API Explorer and Ubuntu Web Server VMs
- Re-enable Password complexity on Domain Controller
- Replace the Decryption SSL certificate on NGFW, and import it on both Ubuntu Web Server VMs and Domain Controller

This document is not meant to provide instructions for the above steps.

Palo Alto Networks Customer Support Portal Configuration

This section describes how to register the licenses and activate the services on the Palo Alto Networks Customer Support Portal (CSP)

1. Login to support.paloaltonetworks.com using your CSP (Customer Support Portal) account
2. Navigate to **"Assets"** and click on **"Register New Device"**, then select **"Register device using Serial Number or Authorization Code"**, then **"Submit"**

TECHNICAL BUSINESS DEVELOPMENT

HOME | COMPANY ACCOUNT | MEMBERS | **ASSETS** | GR 1

Devices | Spares | Advanced Endpoint Protection | VM-Series Auth-Codes | Cloud Services | Site Licenses | Enterprise Agreements | Asset History | Search All

Register New Device ? Deactivate License(s)

Export To CSV

Serial Number

0007SE0

0153000

DEVICE TYPE

SELECT DEVICE TYPE

☒ Register device using Serial Number or Authorization Code 3

☐ Register usage-based VM-Series models (hourly/annual) purchased from public cloud Marketplace or Cloud Security Service Provider (CSSP)

Submit

WildFire License

3. Insert your Panorama serial number and fill in the other required fields. Then click on **Agree and Submit**:

4. You will need to associate the Panorama Support Authcode with the Panorama serial that you registered. From the **Devices** page under the **Assets** tab, click on the **Actions** icon on the line that correspond to the Panorama serial number you just added:

5. Select **"Activate Auth-Code"**, insert the Panorama support Auth-Code (the one that corresponds to the PAN-SVC-NFR-PRA-25 SKU) and click on **"Agree and Submit"**:



DEVICE LICENSES

Serial Number: [REDACTED]

Model: PAN-PRA-25-NFR

Device Name: testing PRANFR

ACTIVATE LICENSES

☒ Activate Auth-Code

1

☐ Is the Panorama Offline?

AUTH-CODE ACTIVATION

Authorization

Code:

*

2

EULA

By clicking "Agree and Submit" below, you agree to the terms and conditions of our [END USER LICENSE AGREEMENT](#) and [SUPPORT AGREEMENT](#).

3

Agree and Submit

Refuse

6. Navigate to **"Assets"**, then go to **"VM-Series Auth-Codes"**, select **"Add VM-Series Auth-Code"**. Enter the VM-Series Auth-Code (the one that corresponds to the PAN-VM-100-NFR SKU) and click on **"Agree and Submit"**:

TECHNICAL BUSINESS DEVELOPMENT

HOME | COMPANY ACCOUNT | MEMBERS | **ASSETS** | GROUPS

Devices | Spares | Advanced Endpoint Protection | **VM-Series Auth-Codes** | Cloud Services

Add VM-Series Auth-Code ? Deactivate License(s) Released VM License Auth Codes

Export To CSV

VM-SERIES AUTH-CODE

ACTIVATE VM AUTH-CODE

Authorization
Code:

EULA

By clicking "Agree and Submit" below, you agree to the terms and conditions of our [END USER LICENSE AGREEMENT](#) and [SUPPORT AGREEMENT](#).

* Required

Agree and Submit Refuse

7. Navigate to **"Assets"**, then select **"Cloud Services"** and click on **"Activate Cloud Services Auth-Code"**.
8. Enter the Logging Service Auth-Code. Then select the serial number of the Panorama device that you entered in the previous step, and the region **americas**. Then click on **"Agree and Submit"**:

ACTIVATE CLOUD SERVICES AUTH-CODE

Upon activation of your Cloud Service, please go to the Logging Service app on [Cloud Services Portal](#) to adjust log quota for this app. [More details](#)

Authorization

Code: * 1

Panorama: * 2

Logging Region: * 3

EULA

By clicking "Agree and Submit" below, you agree to the terms and conditions of our [END USER LICENSE AGREEMENT](#) and [SUPPORT AGREEMENT](#).

* Required

4

Agree and Submit

Refuse

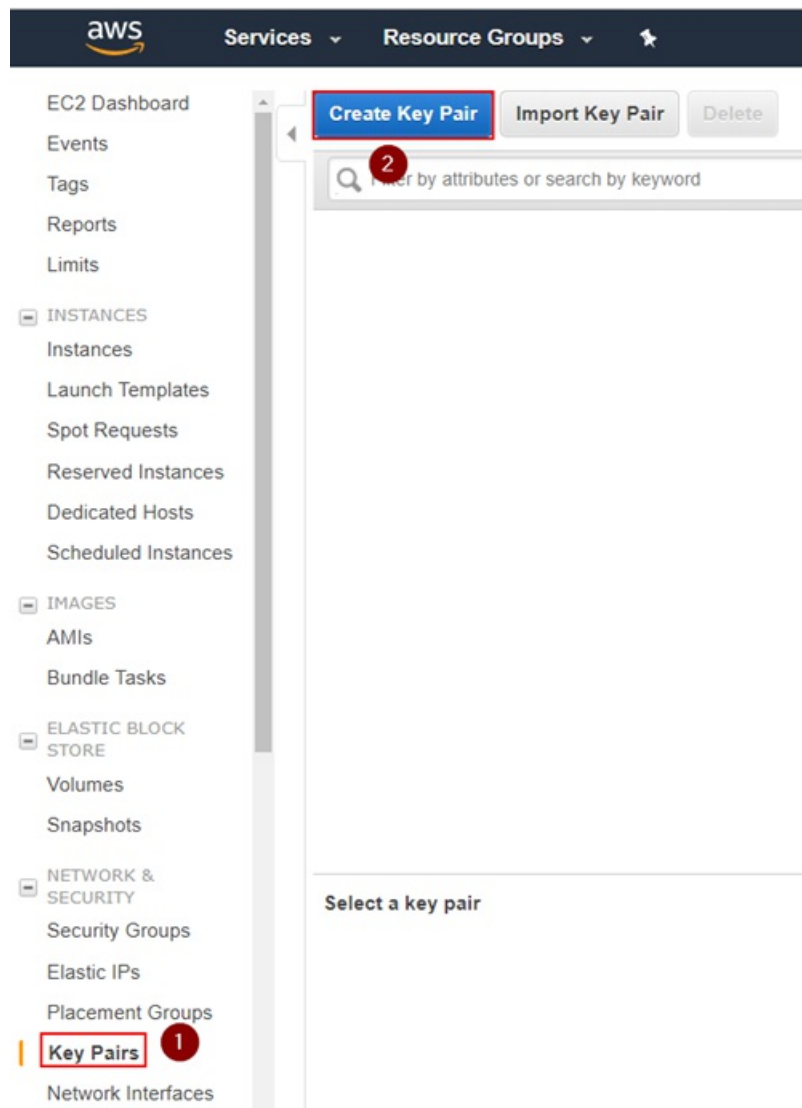
Note: If you don't see the option to activate the Cloud Services, you might not have the required permissions in CSP.

##AWS Configuration

This section describes the configuration of the AWS required components to deploy the lab components. You'll need a KeyPair, two S3 buckets and (optional) a Route53 Hosted Zone. You'll also need to accept the terms for Palo Alto Networks VM-Series, Panorama and Kali Linux.

Key Pair Creation

1. Navigate to your selected region (i.e. us-east-1), select the **EC2** service and under **"Network & Security"** select **"Key Pairs"** and click on **"Create Key Pair"**:



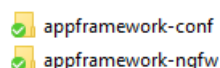
2. Insert a keypair name and click on "Create". In the example, we use "paloalto". This will create a "paloalto.pem" private key and the AWS Web UI will prompt you to download it.



3. Download the Private Key to your local machine. The file name of this example will be **paloalto.pem**, but you can choose an arbitrary name. You will need to upload this file in an S3 bucket later.

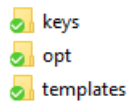
S3 Bucket Pre-Configuration

Palo Alto Networks should have provided you two URLs to download the required files, that you will need to upload into 2 separate S3 buckets. One is used for the Firewall provisioning and the other for the miscellaneous lab configurations. Download and unzip the archives in two separate folders that correspond to the two buckets:

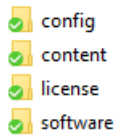


In the example we use **appframework-ngfw** for the firewall configuration and **appframework-conf** for the lab miscellaneous configuration. You can use any arbitrary name for the S3 buckets, but they will have to be unique in AWS.

If you look inside the **configuration** bucket folder (appframework-conf in the example), you will see 3 sub-folders (keys, opt, templates):



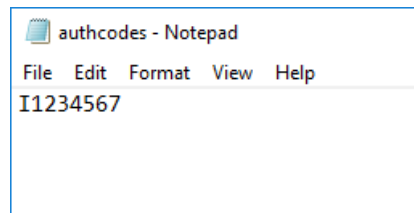
If you look inside the **NGFW** bucket folder (appframework-ngfw in the example), you will see 4 folders (config, content, license, software):



Most of the files should be left untouched, however there are two actions required before uploading the files to AWS S3.

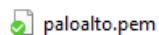
To prepare the configuration files do the following:

1. Add the Firewall Auth-Code:
2. On your local machine, navigate to the folder that corresponds to the NGFW configuration bucket (appframework-ngfw in the example), go to the **license** sub-folder and edit the **authcodes** file and insert (without any newlines) the NGFW Auth-Code you received from Palo Alto Networks:



Note: you will need to use the authcode that corresponds to the **PAN-VM-100-NFR** SKU, the same one you previously registered in the Customer Support Portal.

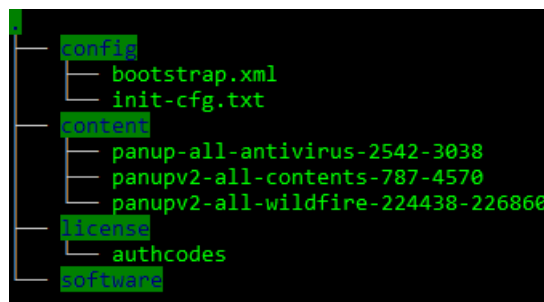
- Save the file
- Add the Firewall and Panorama AWS Private Key
- On your local machine, navigate to the folder that corresponds to the lab configuration bucket (appframework-conf in the example), go to the **keys** sub-folder and copy in it the private key file that you previously generated and downloaded from the AWS UI (paloalto.pem in the example):



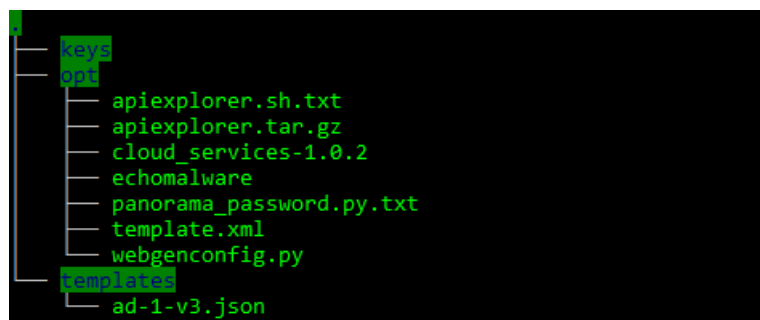
- You can name your key filename however you prefer, but that exact filename will have to be entered as the input to the CFT file later in the deployment process.

Once you've updated the files, the trees of both folders should look similar to the following:

1. NGFW Configuration Folder (filenames in the **content** folder might differ):



2. Lab Configuration folder:

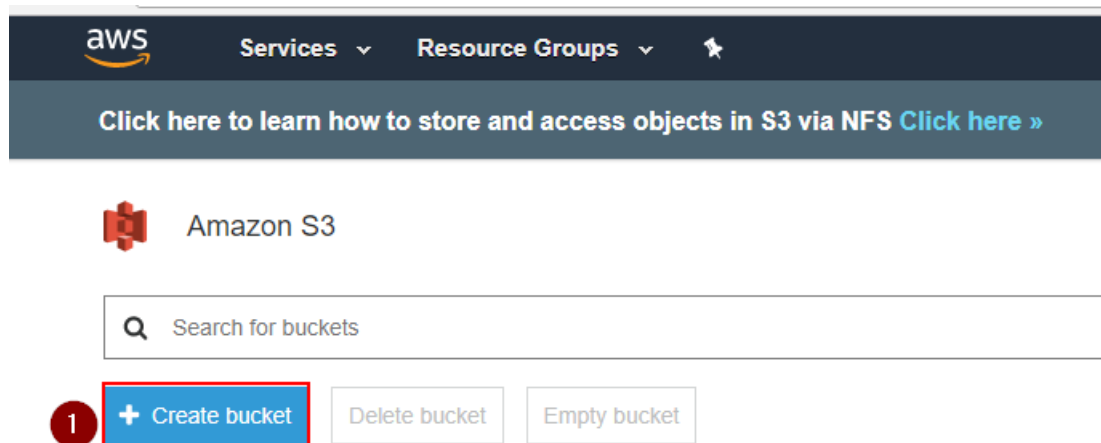


You are now ready to create the S3 Buckets in AWS and upload these files.

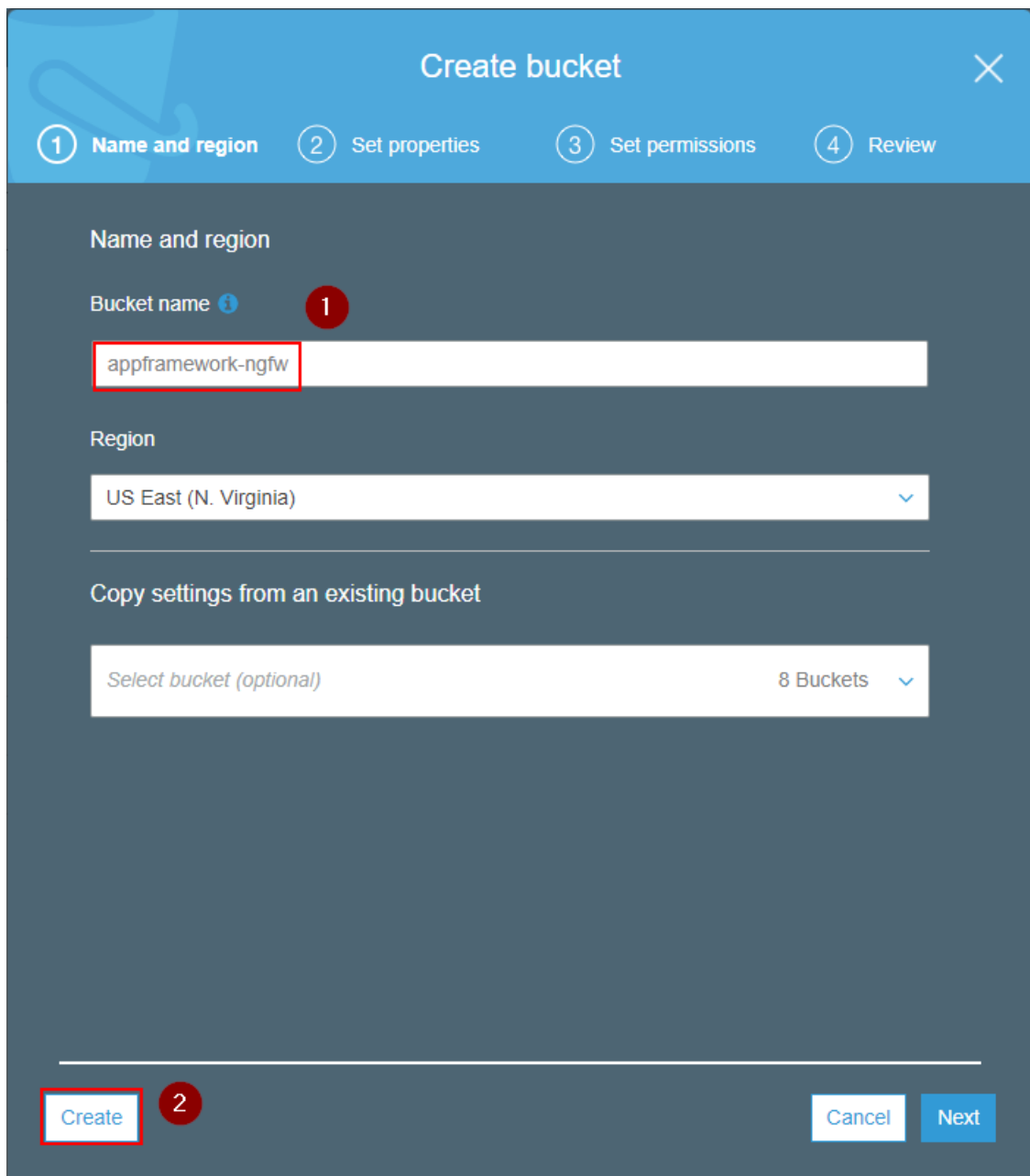
S3 Bucket Creation and Upload

To create the S3 Buckets and upload the files, go through the following steps:

1. Go to AWS S3 and create two S3 buckets for the NGFW and lab configuration respectively **appframework-ngfw** and **appframework-conf** in the example). To create an S3 bucket, click on "Create Bucket":



2. Enter the name of the Firewall configuration bucket (appframework-ngfw in the example) and select **Create**:



3. Repeat the same process for the Miscellaneous lab configuration S3 bucket (appframework-conf in the example):

Create bucket

1

Name and region

2

Set properties

3

Set permissions

4

Review

Name and region

Bucket name ⓘ

appframework-conf1

Region

US East (N. Virginia) ▾

Copy settings from an existing bucket

Select bucket (optional)

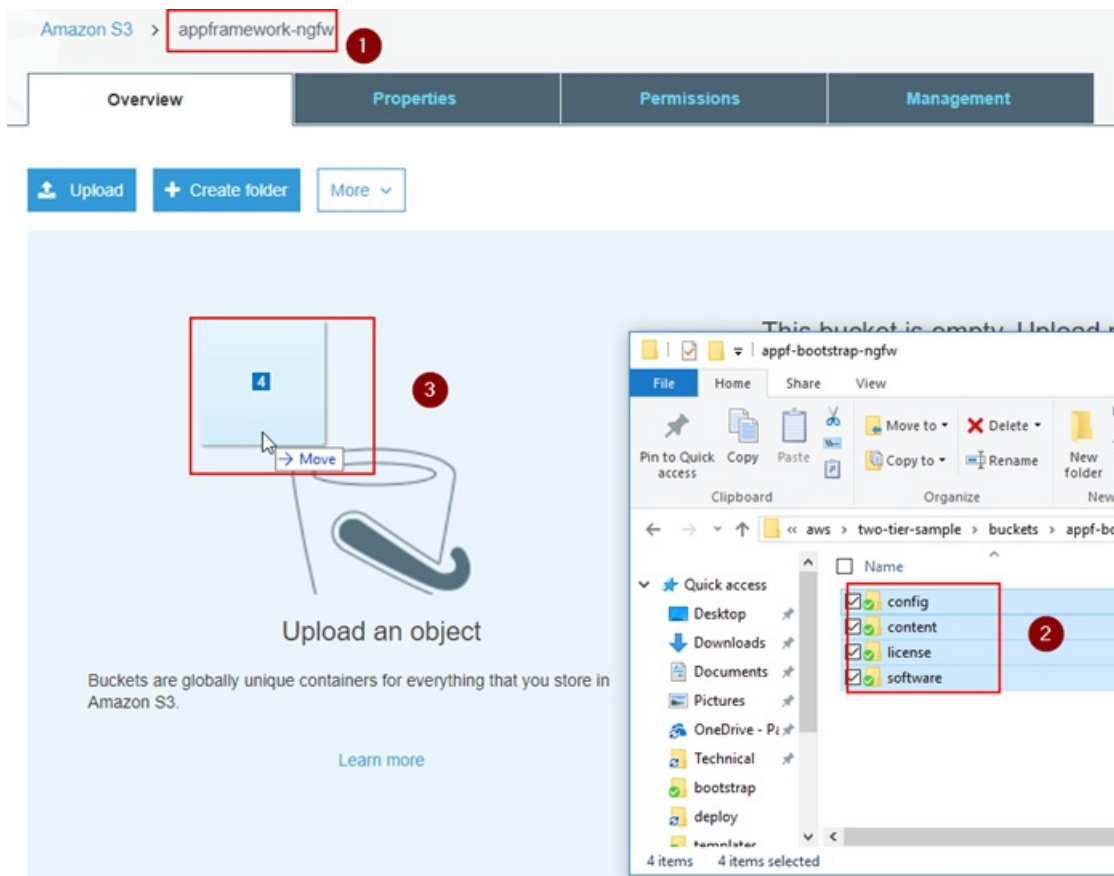
9 Buckets ▾

Create2

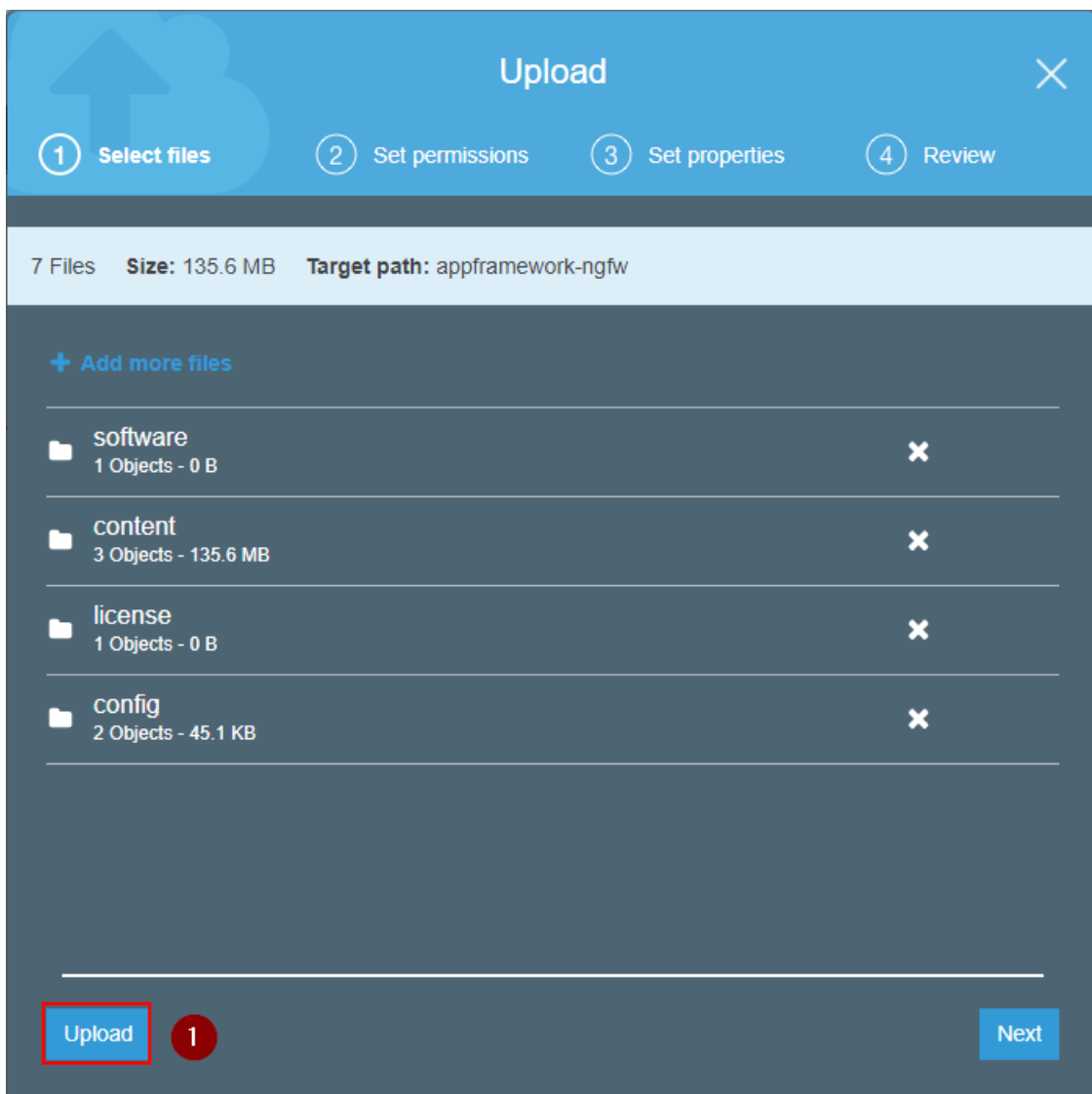
Cancel

Next

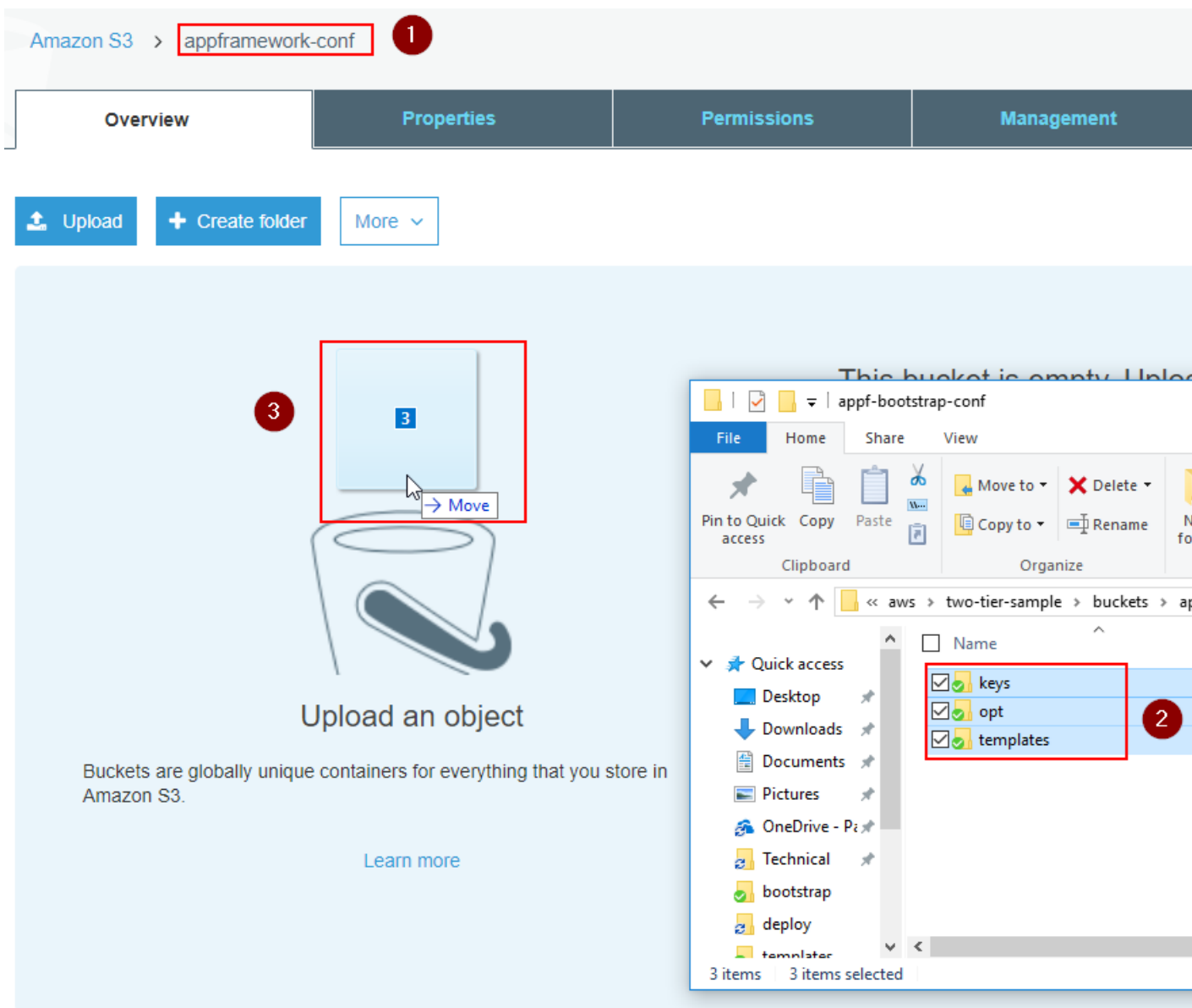
4. You can now upload the content in the respective buckets by dragging and dropping the files from your computer using the AWS S3 UI. The next picture shows the appframework-ngfw bucket:

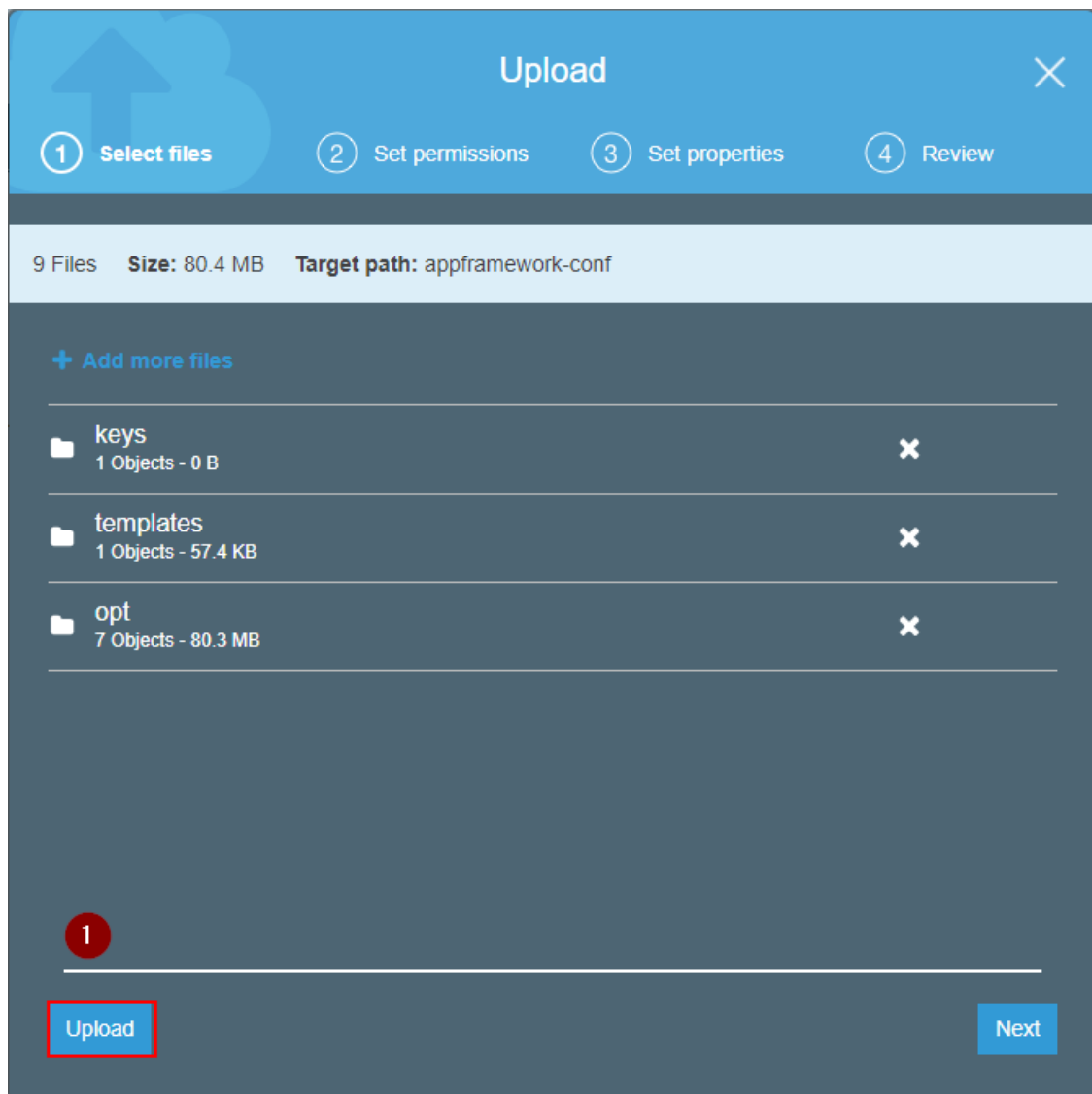


5. Make sure the 4 folders (config, content, license, software) are copied in the root of the S3 bucket, and click **Upload**":



6. Repeat the process for the lab configuration bucket:





Route53 Zone Configuration

The CloudFormation Template deploys a series of VMs (Firewall, Panorama, API Explorer, Kali Linux, etc.) and AWS can automatically associate DNS names to the Elastic IPs that are used by EC2. To do that, you need a Route53 public Hosted Zone configured in your AWS environment. This step is optional: you can just connect to the VMs via their Elastic IP addresses, or manually configure your DNS entries at a later stage if you're not using Route53. However, this step is highly recommended.

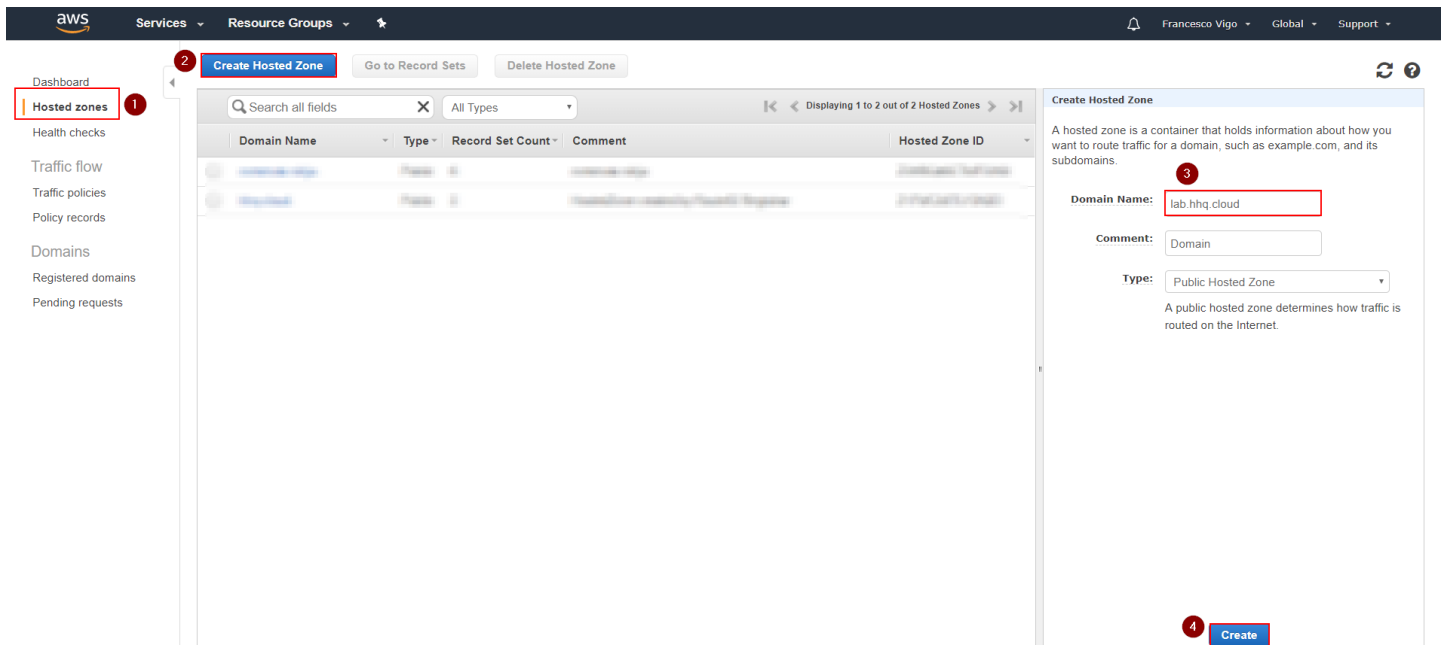
The public DNS zone you use can either be an existing second-level domain (i.e. yourcompanylab.com), or a third-level domain (lab.yourcompany.com). It must be publicly resolvable, so you need to be the registered owner of the domain. As an option, you can register a new domain directly through the AWS console and add it automatically in Route53.

If you don't have the opportunity to use a second or third level domain in Route53, ask your Palo Alto Networks contact for support to get a fourth level domain delegated to your Route53 DNS Servers.

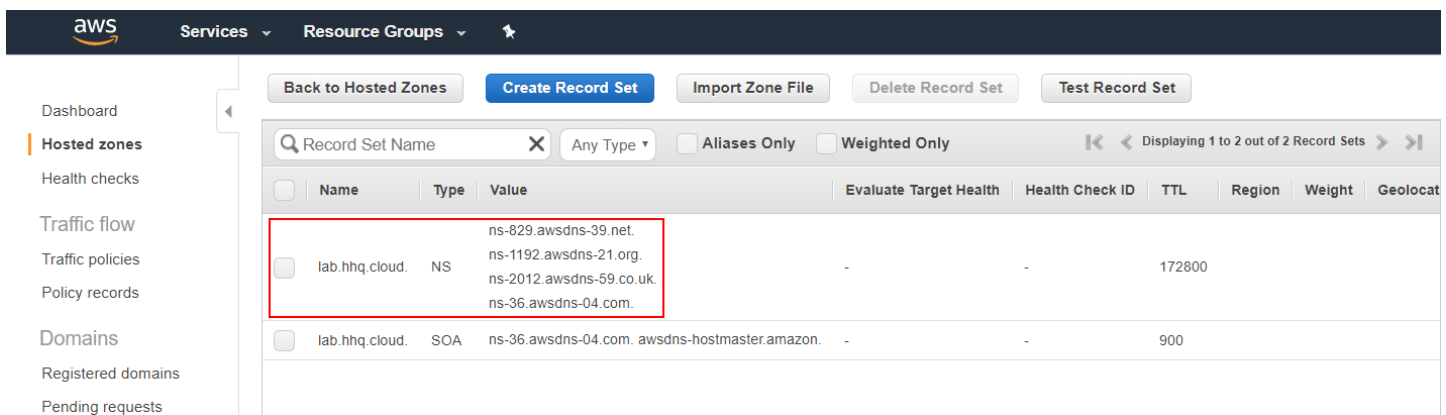
Note: the CFT can automate the creation and registration of a valid SSL certificate that corresponds to the FQDN of your API Explorer instance (this way the browser won't provide warnings when you connect to it), through a free service called "Let's Encrypt" (<https://letsencrypt.org>). If you want to automatically generate the Let's Encrypt certificate through the CFT, you must have the Route53 configuration enabled, otherwise the process will fail. Hence, if you don't want to use Route53 for this step, the API Explorer certificate must be a self-signed one. The CFT parameters provide options to disable the configuration of Route53 and Let's Encrypt.

To configure a Hosted zone in AWS Route 53, proceed through the following steps:

1. Navigate to AWS **"Route53"**, go to **"Hosted zones"** and click on **"Create Hosted Zone"**. Enter the domain name: it must be a public domain name (second or third level) where you have permissions configure name servers for (i.e. yourcompanylab.com or lab.yourcompany.com). The type must be **"Public Hosted Zone."** Then click on **Create**:



2. Look at the AWS Name Servers listed in the NS record and configure your Domain Hosting provider platform to use them for the selected domain:



In this example we are using the third-level domain 'lab.hhq.cloud'.

Note: if you registered the domain through AWS, you don't need any additional configuration as it will be automatically registered in Route

53. If you're using a different domain hosting platform (i.e. GoDaddy, NameCheap, etc), the configuration on how to configure your domain to use AWS Route53 DNS servers will be different depending on your provider.

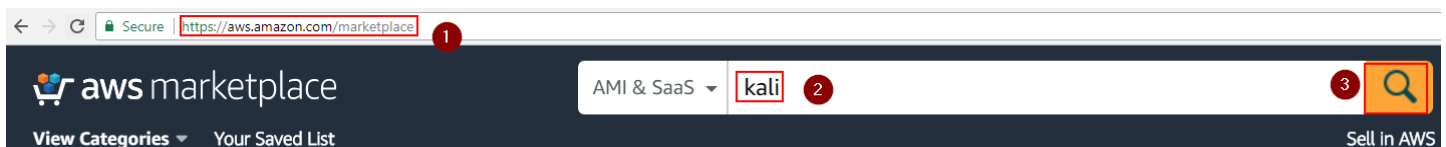
If you're being helped by Palo Alto Networks to use a fourth level domain, please provide the Name Servers to your contact.

Activate Kali Linux and Palo Alto Networks VMs Series on AWS Marketplace

To deploy some of the VMs, you first need to activate them on the AWS marketplace. Note that deploying Kali Linux is optional (is useful to generate threats in the firewall logs) so, if you don't need it, you can skip the step for Kali Linux (but not for NGFW and Panorama).

To activate the solutions on the AWS Marketplace, follow this procedure:

1. Navigate to the AWS Marketplace (<https://aws.amazon.com/marketplace>), search for "kali" and click on the search icon:



2. In the results page, click on 'Kali Linux':

kali (1 result) showing 1 - 1



Kali Linux

1


★★★★★ (5) | Version Kali Linux 2018.1* | Sold by Kali Linux

Kali Linux is a Debian-based Linux distribution aimed at advanced Penetration Testing and Security Auditing. Kali contains several hundred tools targeted towards

Linux/Unix, Other 2018.1 - 64-bit Amazon Machine Image (AMI)

showing 1 - 1

3. In the Kali Linux page, click on "Continue to Subscribe":



Kali Linux

Sold by: [Kali Linux](#) Latest Version: Kali Linux 2018.1*

Kali Linux is a Debian-based Linux distribution aimed at advanced Penetration Testing and Security Auditing.

Linux/Unix ★★★★★ (5) [Free Tier](#)

1

[Continue to Subscribe](#)

[Save to List](#)

Typical Total Price

\$0.046/hr

Total pricing per instance for services hosted on t2.medium in US East (N. Virginia). [View Details](#)

4. Select "Manual Launch" and click on "Accept Software Terms":

1

[Manual Launch](#)
With EC2 Console, API or CLI

[Service Catalog](#)
Copy to SC and Launch

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.

Price for your Selections:

Price will be dependent on usage

2

[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](#).

5. Repeat the same procedure for both Palo Alto Networks "VM-Series Next-Generation Firewall (BYOL)" and "Palo Alto Networks Panorama"

VM-Series Next-Generation Firewall (BYOL)

Manual Launch

With EC2 Console, API or CLI

Service Catalog

Copy to SC and Launch

Launch Options

You can click the "Launch with EC2 Console" buttons below and follow the instructions to launch an instance of this software.

You can also find and launch these AMIs by searching for the AMI IDs (shown below) in the "Community AMIs" tab of the EC2 Console Launch Wizard.

You can view this information at a later time by visiting the Your Software page. For help, see step-by-step instructions for launching Marketplace Products from the AWS Console.

▼ Version

PAN-OS 8.1.0, released 03/13/2018 ▼

[Usage Instructions](#)

Palo Alto Networks Panorama

1-Click Launch

Review, modify and launch

Manual Launch

With EC2 Console, API or CLI

Service Catalog

Copy to SC and Launch

Click "Accept Software Terms & Launch with 1-Click" to launch this software with the settings below

Once you accept the terms, you will have access to launch any version of this software in any supported region. For future launches, you can return to this page or launch directly from the EC2 console, APIs or CLI.

► Version

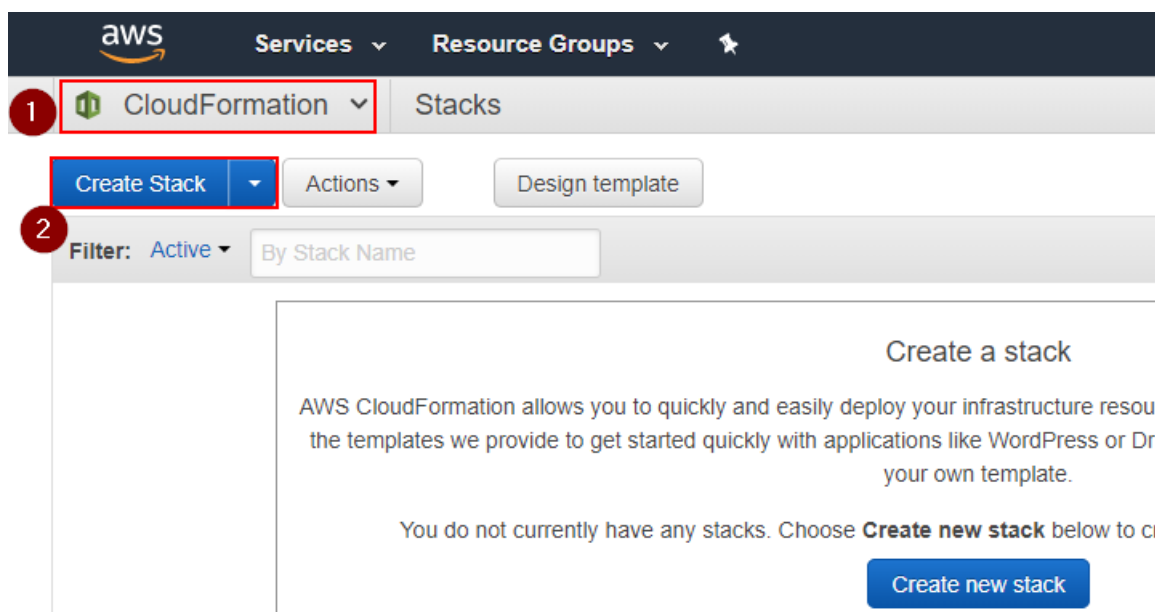
Panorama 8.1.0, released 03/13/2018

Deploy the CloudFormation Template

You can now deploy the AWS CloudFormation Template (CFT) to create the lab environment. Before starting, make sure that you have 5 Elastic IPs (EIPs) available in the region you want to deploy the CFT (by default AWS limits EIPs to 5 per region per account).

Proceed with the following steps:

1. Navigate to "AWS CloudFormation" and select "Create Stack":



2. Select "Upload a template to Amazon S3", and upload the template JSON file provided by Palo Alto Networks (appframework-lab.json in the example), then click on Next:

Select Template

Select the template that describes the stack that you want to create. A stack is a group of related resources that you manage as a single unit.

Design a template Use AWS CloudFormation Designer to create or modify an existing template. [Learn more.](#)

Design template

Choose a template A template is a JSON/YAML-formatted text file that describes your stack's resources and their properties. [Learn more.](#)

☐ Select a sample template

1 ☒ Upload a template to Amazon S3

2 Choose File appframework-lab.json

☐ Specify an Amazon S3 template URL

3
Cancel

Next

3. Insert the required parameters:

- **Stack name:** an arbitrary name for this deployment (i.e. PartnerLab1)
- **Admin Password:** an arbitrary password that will be used for the following systems:
 - NGFW admin user
 - Panorama admin user
 - API Explorer VM ec2-user user (SSH login with password will be enabled)
 - API Explorer application admin user
 - Ubuntu Web Server ubuntu user (SSH login with password will be enabled)
 - Kali Linux ec2-user
 - Windows Domain Controller admin (the default username is "paloalto", but can be changed in the advanced parameters below)
 - Windows Domain Users (user1, user2, user3)
- **Environment Config Bucket Name:** the name of the S3 miscellaneous lab configuration bucket that you previously created. In the example, **appframework-conf** was used.
- **Bootstrap Bucket Name:** the name of the S3 NGFW configuration bucket that you previously created. In the example, **appframework-ngfw** was used.
- **Bootstrap Bucket Region:** select the AWS region where the Bootstrap Bucket was created (**us-east-1** in the example)
- **Private Key File:** the relative path in the configuration bucket of the NGFW/Panorama private key file. In the example the file is named **paloalto.pem** and you uploaded it in the **keys** subfolder of the environment configuration bucket. Hence, the parameter would be **"keys/paloalto.pem"**. If you named the file differently, provide the right name.
- **EC2 VMs Key Name:** from the drop down menu, select the KeyPair that you want to use for the non-Palo Alto Networks VMs (Kali Linux, API Explorer VM, Ubuntu VM). It can be the KeyPair that you previously created in EC2, or a different one of your choice.
- **Panorama and NGFW Key Name:** from the drop down menu, select the KeyPair that you want to use for the Palo Alto Networks VMs (Panorama and NGFW). This **must** be the KeyPair that you have previously created (named "paloalto" in the example), whose private key was uploaded to the miscellaneous lab configuration S3 bucket.
- **Panorama Serial:** Insert the Panorama Serial number that was provided by Palo Alto Networks
- **DNS Domain Name:** Insert the domain name zone that you have configured on Route53. If you don't have it, add a domain name and select "false" under both the "Configure Route53" AND the "Create API Explorer LetsEncrypt Cert" fields in the Advanced Configuration section. In the example we use the **hhq.cloud** domain.
- **LetsEncrypt Email:** Insert your (valid) email address that will be used to request a Let's Encrypt SSL certificate for the API Explorer.

Leave the other parameters to the default values unless you are a power user and you know what you're doing.

The following screenshot shows an example configuration:

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

Basic Configuration - REQUIRED

Admin Password	<input type="password" value="*****"/>	Password for API Explorer, NGFW/Panorama admin, VMs ec2-user/ubuntu users (SSH password auth enabled), Windows DC admin and users. Must be at least 8 characters containing letters, numbers and symbols
Environment Config S3 Bucket Name	<input type="text" value="appframework-conf"/>	Bucket name for non-Firewall configuration (i.e. myappframeworkbucket-conf)
Bootstrap S3 Bucket Name	<input type="text" value="appframework-ngfw"/>	S3 Bucket name for FW bootstrap configuration (i.e. myappframeworkbucket-conf)
Bootstrap S3 Bucket Region	<input type="text" value="us-east-1"/>	S3 Region where the FW bootstrap bucket is located
Private Key File	<input type="text" value="keys/paloalto.pem"/>	Private Key File with Path in the Environment Configuration S3 Bucket (i.e. keys/paloalto.pem)
EC2 VMs Key Name	<input type="text" value="paloalto"/>	Name of an existing EC2 KeyPair to enable SSH access to VMs. Except NGFW and Panorama
Panorama and NGFW Key Name	<input type="text" value="paloalto"/>	Name of an existing EC2 KeyPair to enable SSH access to NGFW and Panorama
Panorama Serial	<input type="text" value="00000000000"/>	Panorama Serial Number (provided by Palo Alto Networks)
DNS Domain Name	<input type="text" value="hhq.cloud"/>	DNS Domain Name or Route53 Hosted Zone Name (i.e. panwlab.mycompany.com)
LetsEncrypt Email	<input type="text" value="devrel@paloaltonetworks.com"/>	Email address to provide to Letsencrypt for API Explorer SSL certificate generation (i.e. user@mycompany.com)

- Click on "Next" twice.
- In the Review page, at the bottom, under "Capabilities", check the "I acknowledge that AWS CloudFormation might create IAM resources with custom names" box, and click on "Create":

Capabilities

The following resource(s) require capabilities: [AWS::IAM::Role, AWS::CloudFormation::Stack]
This template contains Identity and Access Management (IAM) resources. Check that you want to create each of these resources and that they have the minimum required permissions. In addition, they have custom names. Check that the custom names are unique within your AWS account. [Learn more.](#)

☒ I acknowledge that AWS CloudFormation might create IAM resources with custom names.

[Quick Create Stack](#) (Create stacks similar to this one, with most details auto-populated)

[Cancel](#) [Previous](#) [Create](#)

Note: the CFT will create two IAM roles to allow some of the VMs to Read the files from the two S3 buckets that you've previously created.

6. Sit down and relax, the whole process will take 30-35 minutes to complete:

CloudFormation ▾ Stacks				
Create Stack ▾ Actions ▾ Design template C ⚙				
Filter: Active ▾ By Stack Name Showing 2 stacks				
	Stack Name	Created Time	Status	Description
<input type="checkbox"/>	PartnerLab1-DomainControll... <small>NESTED</small>	2018-03-22 21:13:19 UTC-0700	CREATE_IN_PROGRE...	This template creates 1 Active Directory Domain Controller in a private subnet. The d...
<input checked="" type="checkbox"/>	PartnerLab1	2018-03-22 21:12:13 UTC-0700	CREATE_IN_PROGRE...	Palo Alto Networks AppFramework PlayGround with API Explorer

7. The deployment will show **CREATE_COMPLETE** once everything is done:

CloudFormation ▾ Stacks				
Create Stack ▾ Actions ▾ Design template C ⚙				
Filter: Active ▾ By Stack Name Showing 2 stacks				
	Stack Name	Created Time	Status	Description
<input type="checkbox"/>	PartnerLab1-DomainControll... <small>NESTED</small>	2018-03-22 21:13:19 UTC-0700	CREATE_COMPLETE	This template creates 1 Active Directory Domain Controller in a private subnet. The d...
<input checked="" type="checkbox"/>	PartnerLab1	2018-03-22 21:12:13 UTC-0700	CREATE_COMPLETE	Palo Alto Networks AppFramework PlayGround with API Explorer

Note: if you run in an error, make sure you added the right licenses and Auth-Codes, check the FAQ document and reach out to your Palo Alto Networks contact for support.

8. Select the template and click on the **Outputs** tab of the to view the deployment information (IP addresses and FQDNs) of the lab:

Filter: Active ▾ By Stack Name Showing 2 stacks				
	Stack Name	Created Time	Status	Description
<input type="checkbox"/>	PartnerLab1-DomainControll... <small>NESTED</small>	2018-03-28 15:05:46 UTC-0700	CREATE_COMPLETE	This template creates 1 Active Directory Domain Controller in a private subnet. The default Domain Administrator password will be the one retrieved from the instance. Additional users (user1, user2, us...
<input checked="" type="checkbox"/>	PartnerLab1	2018-03-28 15:04:40 UTC-0700	CREATE_COMPLETE	Palo Alto Networks AppFramework PlayGround with API Explorer

1

2

Overview Outputs Resources Events Template Parameters Tags Stack Policy Change Sets Rollback Triggers ⌵ ⌶ ⌷				
Key	Value	Description	Export Name	
APIExplorerAppURL	https://apiexplorer.lab.hhq.cloud	API Explorer URL		
KaliLinuxIP	52.15.80.97	Kali Linux Public IP		
PanoramaURL	https://panorama.lab.hhq.cloud	Panorama URL		
FirewallManagementURL	https://mgfw.lab.hhq.cloud	VM-Series management interface URL		
PublicIPAddress	18.218.130.35	Public IP Address		

9. You can also see all the DNS records added to Route53 records for easier access:

Dashboard
Hosted zones
Health checks
Traffic flow
Traffic policies
Policy records
Domains
Registered domains
Pending requests

Back to Hosted Zones
Create Record Set
Import Zone File
Delete f

☐ Aliases Only
☐ Weighted On

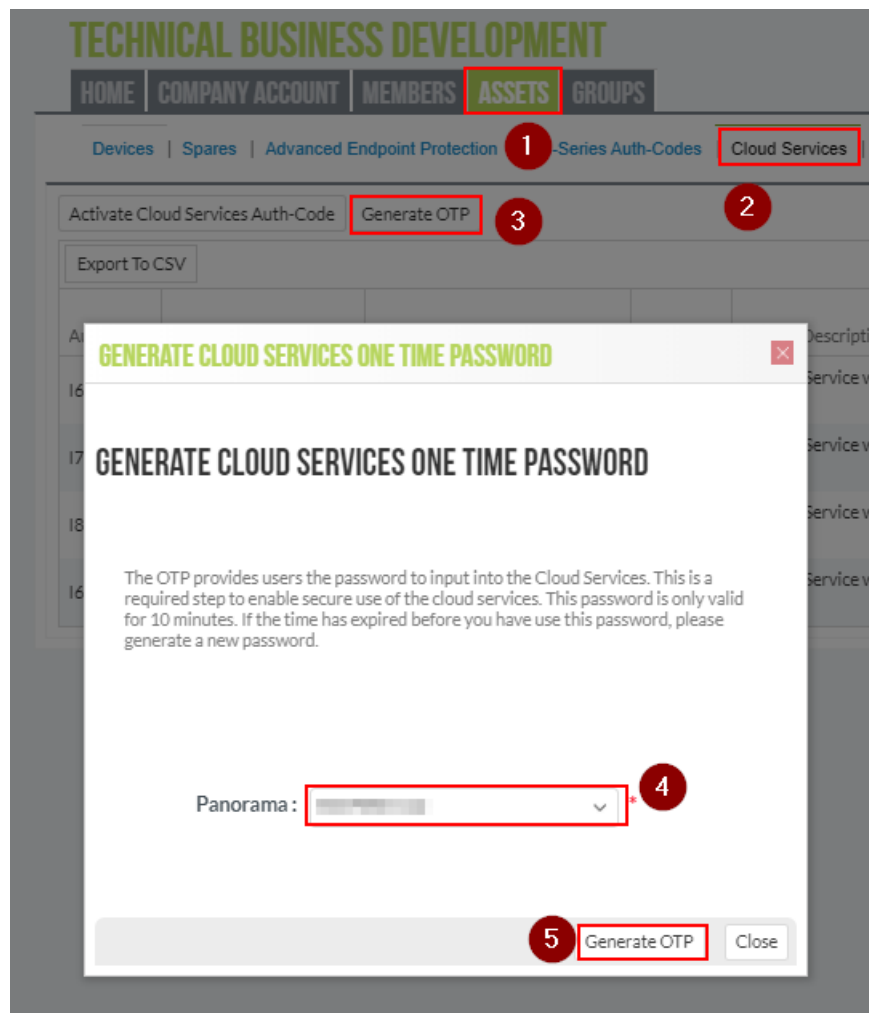
<input type="checkbox"/>	Name	Type	Value
<input type="checkbox"/>	lab.hhq.cloud.	NS	ns-829.awsdns-39.net. ns-1192.awsdns-21.org. ns-2012.awsdns-59.co.uk. ns-36.awsdns-04.com.
<input type="checkbox"/>	lab.hhq.cloud.	SOA	ns-36.awsdns-04.com. awsdns-hostmaster.amazon.
<input type="checkbox"/>	apiexplorer.lab.hhq.cloud.	A	18.217.43.119
<input type="checkbox"/>	kali.lab.hhq.cloud.	A	52.15.80.97
<input type="checkbox"/>	ngfw.lab.hhq.cloud.	A	18.188.91.210
<input type="checkbox"/>	panorama.lab.hhq.cloud.	A	18.221.237.136
<input type="checkbox"/>	public.lab.hhq.cloud.	A	18.218.130.35

####AT THIS STAGE YOU SHOULD STOP. A MANUAL CONFIGURATION STEP TO POINT THE FIREWALL AND PANORAMA TO THE DEVELOPER INSTANCES IS REQUIRED, PLEASE REACH OUT TO YOUR PALO ALTO NETWORKS TECHNICAL CONTACT FOR THIS.

Panorama Pairing with Logging Service

The last step of the process requires to pair your Panorama Instance with Logging Service:

1. Navigate back to <https://support.paloaltonetworks.com> and login with your CSP credentials
2. Go to "Assets", "Cloud Services" and click "Generate OTP". Select the Panorama instance you've created (corresponding to the Panorama Serial Number) and click on "Generate OTP":



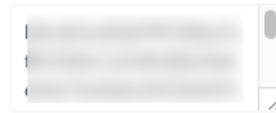
3. Copy the generated One Time Password in your browser clipboard by clicking on **'Copy to Clipboard'** (6):



GENERATE CLOUD SERVICES ONE TIME PASSWORD

The OTP provides users the password to input into the Cloud Services. This is a required step to enable secure use of the cloud services. This password is only valid for 10 minutes. If the time has expired before you have use this password, please generate a new password.

Panorama : *



Password :

Expires On : 3/26/2018 1:07:56 PM

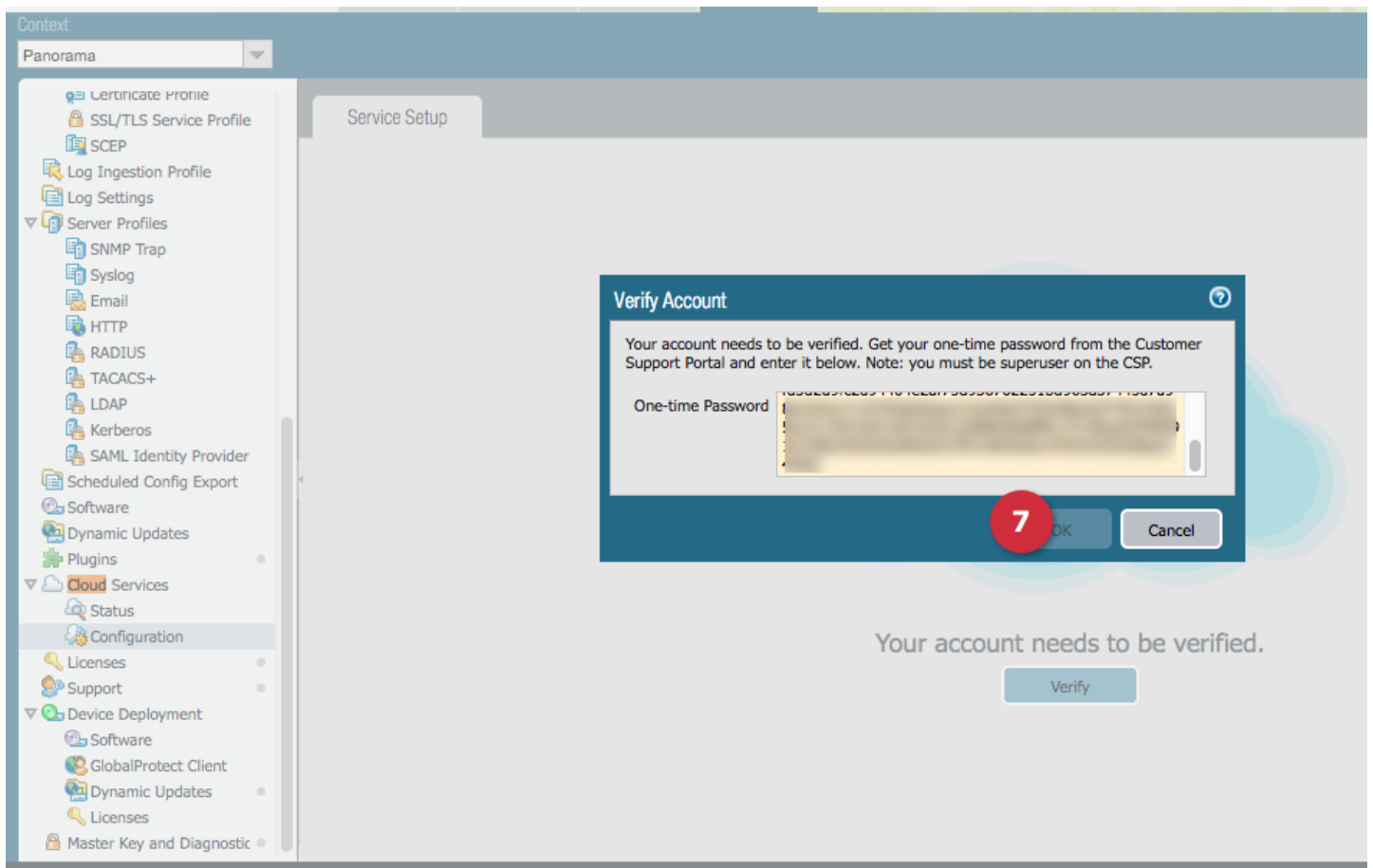
6

Copy to Clipboard

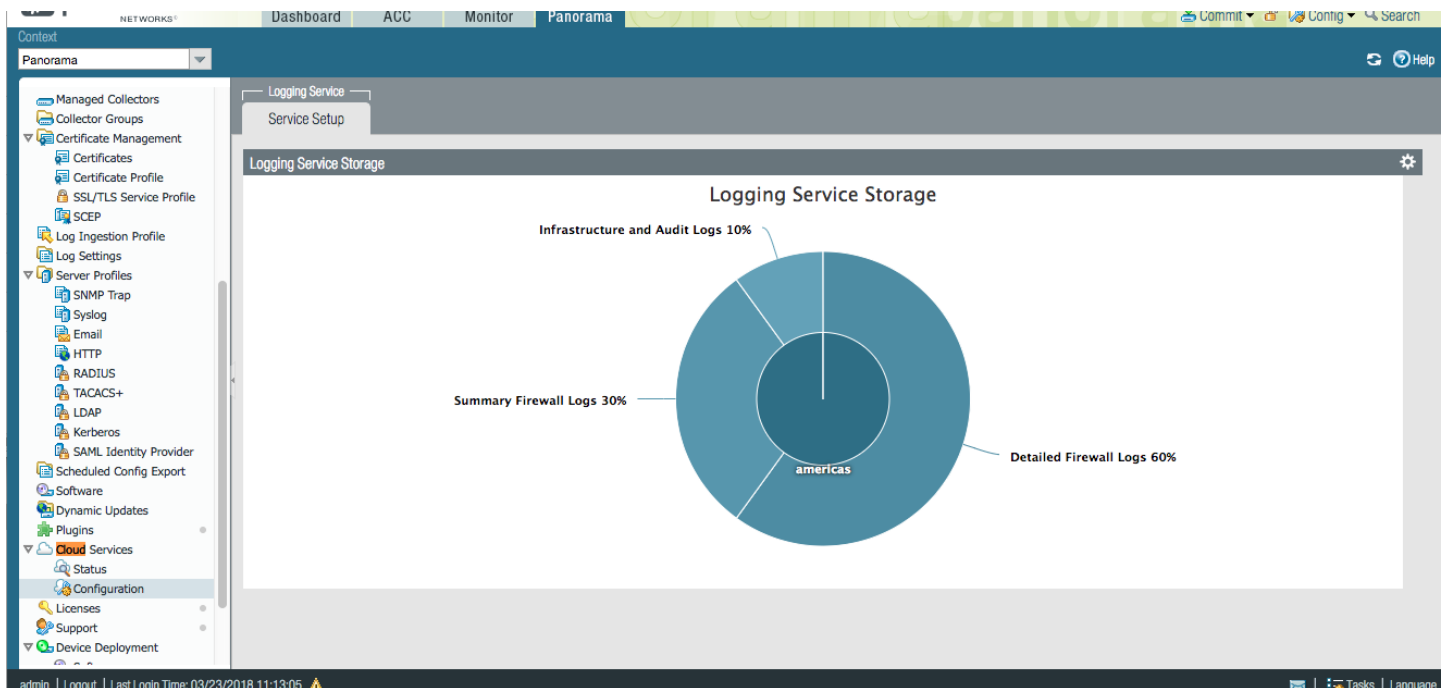
Generate OTP

Close

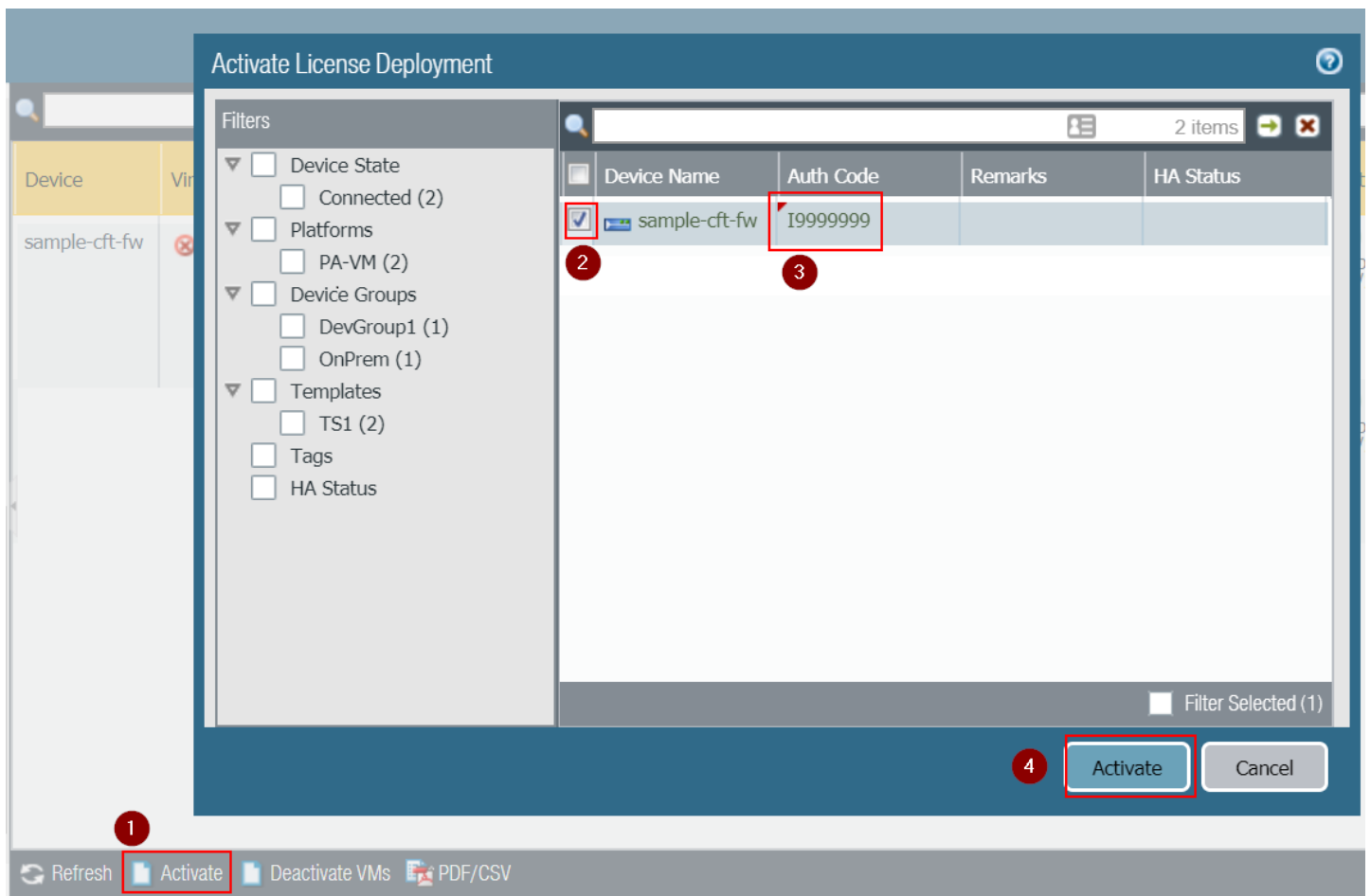
4. Login to Panorama via the web UI, navigating to <https://panorama.lab.yourdomain.com> (assuming that Route53 has used to automatically create the FQDN, otherwise look at the EIP of the Panorama instance). Use the "admin" user and the password you have configured in the template.
5. On the Panorama UI, navigate to **Panorama**, **Cloud Services**, **Configuration**.
6. Insert the previously copied One Time Password (OTP) to complete the pairing and click on **OK** (7):



After the pairing is complete, in the "Configuration" page under "Cloud Services", you should see a dashboard similar to the following:



7. On the Panorama UI, navigate to **Panorama**, **"Device Deployment"**, **"Licenses"** and click on **"Activate"**.
8. Select the firewall (**sample-cft-fw** in the example), insert the Services Bundle Auth-Code (the one that corresponds to the **PAN-VM-100-BND-NFR4** SKU) and click on **"Activate"**:



9. On the Panorama UI, navigate to **Panorama**, **Device Deployment**, **Licenses** and click on **Refresh**.

10. Select the firewall (**sample-cft-fw** in the example) and click on **Refresh** to refresh the licenses:

paloalto NETWORKS®

Dashboard ACC Monitor Policies Objects Network Device **Panorama** 1

Context
Panorama

Access Domain
Authentication Profile
Authentication Sequence
User Identification
Managed Devices
Summary
Health
Templates
Device Groups
Managed Collectors
Collector Groups
Certificate Management
Certificates
Certificate Profile
SSL/TLS Service Profile
SCEP
Log Ingestion Profile
Log Settings
Server Profiles
SNMP Trap
Syslog
Email
HTTP
RADIUS
TACACS+
LDAP
Kerberos
SAML Identity Provider
Scheduled Config Export
Software
Dynamic Updates
Plugins
Cloud Services
Status
Configuration
Licenses 2
Support
Device Deployment 3
Software
GlobalProtect Client
Dynamic Updates
Licenses 3
Master Key and Diagnostics

Refresh License Deployment

Filters

- ☐ Device State
 - ☐ Connected (2)
- ☐ Platforms
 - ☐ PA-VM (2)
- ☐ Device Groups
 - ☐ DevGroup1 (1)
 - ☐ GW (1)
- ☐ Templates
 - ☐ TS1 (2)
- ☐ Tags
- ☐ HA Status

2 items

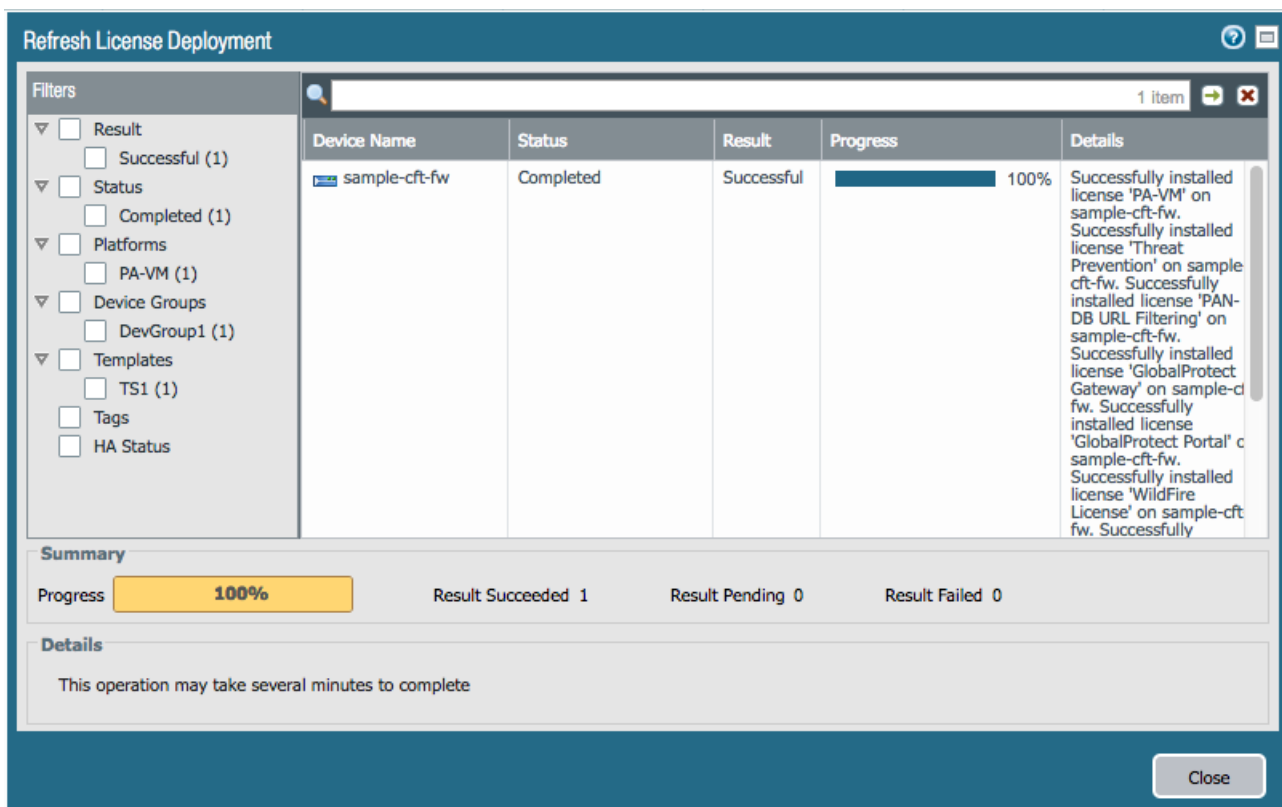
Device Name	Remarks	HA Status
<input checked="" type="checkbox"/> sample-cft-fw 5		

Filter Selected (1)

6 Refresh Cancel

4 Refresh Activate Deactivate VMs PDF/CSV

The refresh process will take a few seconds. Wait until it completes:



After the license refresh is complete, wait a few minutes.

Under the Monitor tab in Panorama you should be able to view Logs (see Appendix C)

Congratulations, the setup is complete!

You can work with your Palo Alto Networks contact to register the API Explorer application in the Application Portal, and then activate it (see the next section of this document for details)

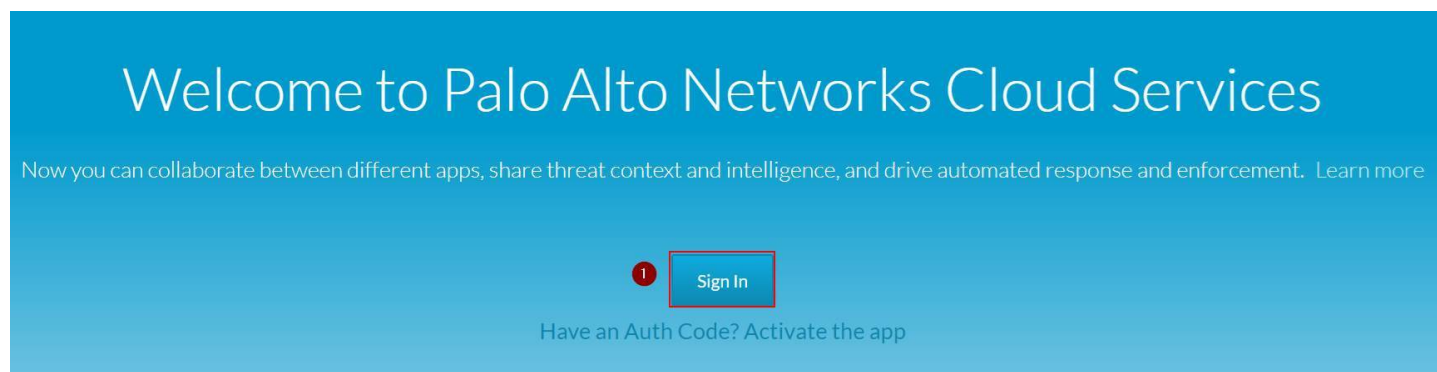
API Explorer App Activation Process

This section describes how to Activate the API Explorer application and start interacting with the APIs.

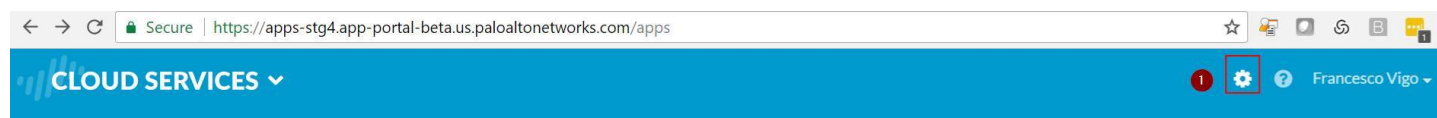
Note: this section requires the manifest file activation part to be already configured, otherwise you will not see your API Explorer application in the App Portal. You will also be provided a **Client ID** and a **Client Secret** by your Palo Alto Networks contact.

To activate the API Explorer, follow this process:

1. Navigate to the App Portal beta environment: <https://apps-stg4.app-portal-beta.us.paloaltonetworks.com> and Sign in with your Customer Support Portal credentials:



2. Click on the Settings icon in the top right corner:



3. Make sure that you have a Logging Service instance, and a Directory Sync instance. If the latter is missing, just create one (click on **Add Instance**) :

Settings

Configure details and shared services for your app instances.

Directory Sync				Add Instance
INSTANCE	STATUS	LICENSE EXPIRES	REGION	
Directory Sync - 4819565333594693803	!	Never	unknown	
DirSyncInstance1	✓	Never	Americas	


Logging Service			
INSTANCE	STATUS	LICENSE EXPIRES	REGION
Logging Service - 01790001351	✓	03-29-2019	Americas
Logging Service - 01790001348	✓	03-28-2019	Americas

Note: You don't need to actually register an Active Directory agent to it if you don't need to interact with AD data to build your integration. Or you can deploy the Directory Sync Agent on the windows Domain Controller, by following the Getting Started Guide, not covered by this manual

- Navigate to the bottom of the Application Portal page, under **Partner Apps on the Application Framework**. Select the application (i.e. YourCompany - API Explorer) and click on the "Activate" icon:




Partner Apps on the Application Framework




apollodev
This is app description

Activate Learn More →




API Explorer
Take the Application Framework for a test drive!

1 Activate Learn More →



demoapp
This is app description

Activate Learn More →



Hello Mars
This is app description

Activate Learn More →

Note: if you don't see your API Explorer App, reach out to your Palo Alto Networks technical contact for support.

- Enter the required parameters, then select "Agree and Submit":

Activate API Explorer



License Type: `api_explorer`

* Company Name: Technical Business Development 1

* Instance Name: 2

Description:

* Region: 3

* Logging Service: 4

If not all Logging Service instances appear, you may need to [activate purchased licenses](#).

* Directory Sync: 5

* Developer Name:

* Email Address:

* Company:

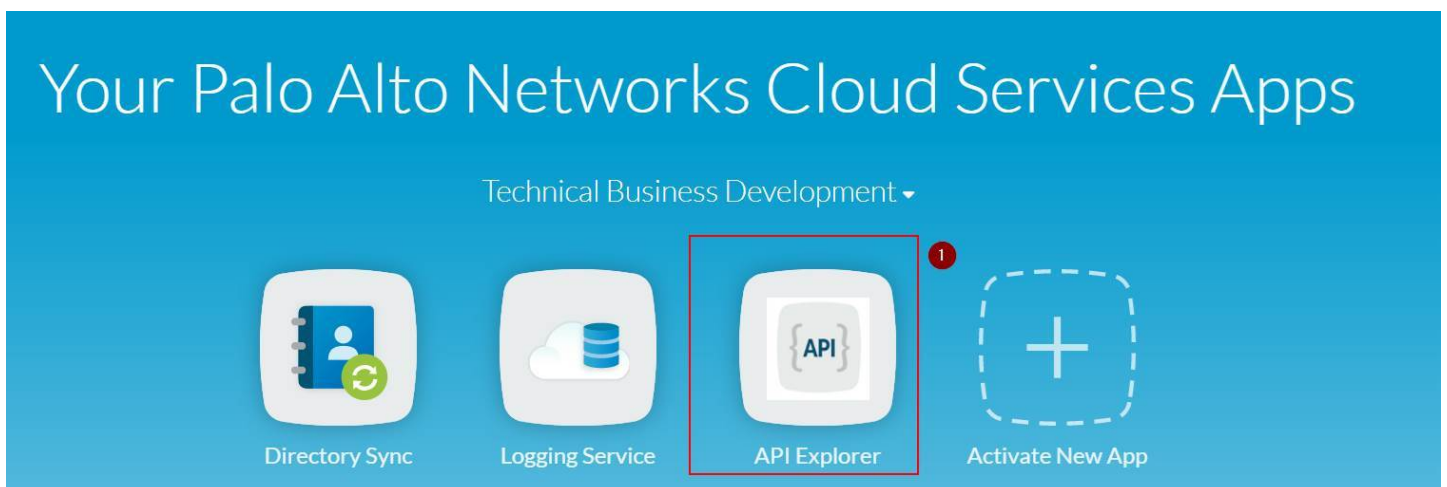
* Department:

* Company URL:

EULA: By clicking "Agree and Activate", you accept the terms of the [End User License Agreement](#).

6

6. At this point you should see the instance of your "API Explorer" App in the "Your Palo Alto Networks Cloud Services Apps" section of the App Portal:



7. Click on your API Explorer App icon and you will be redirected to your API Explorer instance (the FQDN of your AWS API Explorer instance). Login as **admin** (the password is the one you set as part of the CloudFormation Template parameters, same as Firewall and Panorama):



Note: Make sure that you login on the API explorer App for the first time through link on the Cloud Services Portal. Do not login on the API Explorer by navigating to the FQDN directly with your browser, as some required tokens must be passed to the API Explorer by the Cloud Services Portal through the link.

- At the first Login, the API explorer app will ask you to perform the Activation. Click on the **Activate** button:

FURTHER ACTIVATION STEPS REQUIRED

NOTICE: Some features of your API EXPLORER will have limited functionality until the activation steps are completed.

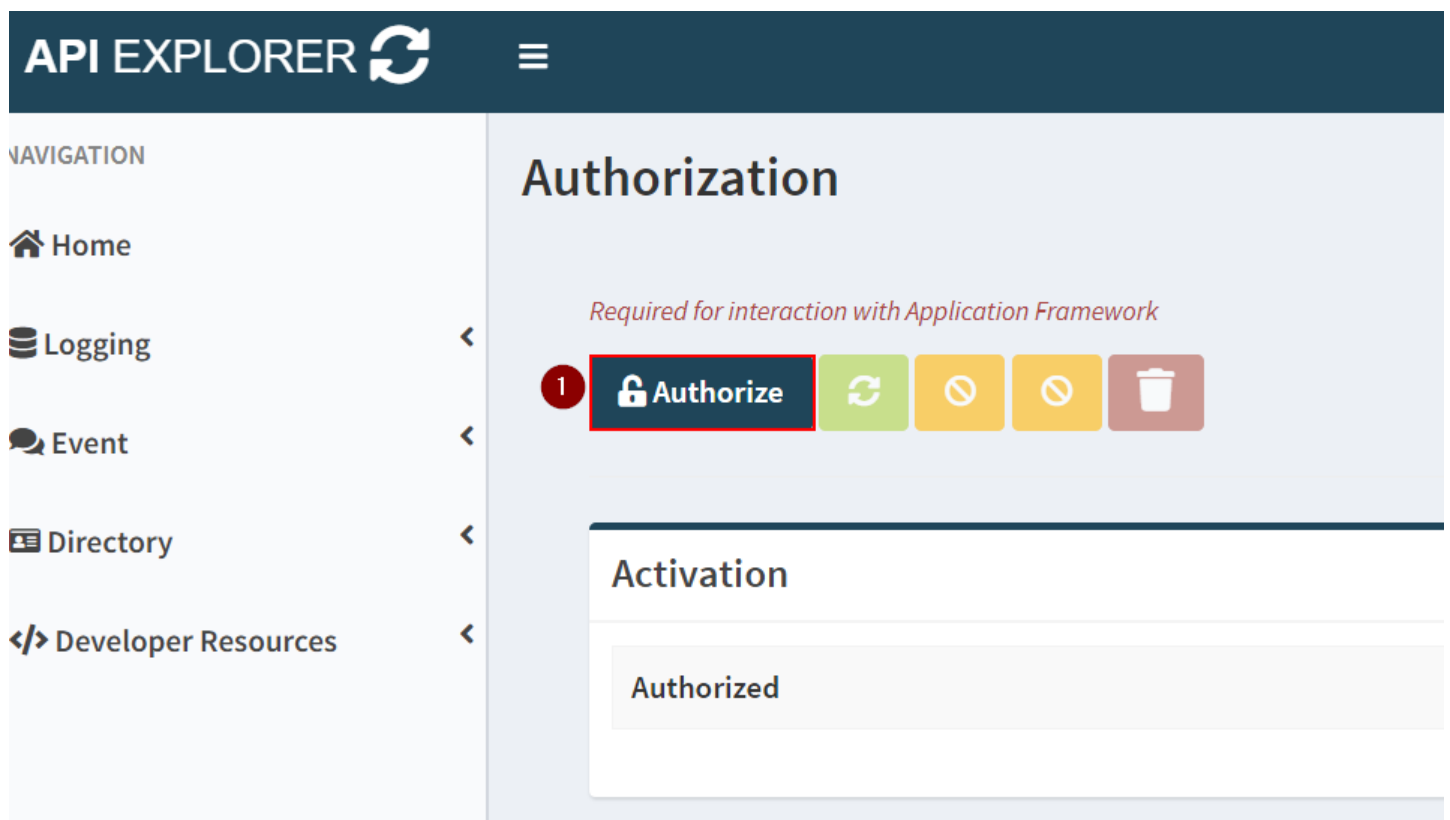
Activation Steps:

1. Click **Activate** button.
2. Click the **Authorize** button and provide the following to begin authorization:
 - Client ID
 - Client Secret
 - Redirect URI
 - Scope
3. When prompted, authenticate using your CSP credentials.
4. Complete and submit the "Request for Approval" form.

Note: If successful, your API EXPLORER will receive tokens necessary for interacting with your Logging, Event and Directory-Sync instances.



9. In the Authorization page, click on "Authorize":



10. Insert the required parameters:

a. **Client ID** and **Client Secret** that you obtained from your

Palo Alto Networks technical contact

b. Redirect URI should be correspond to your API Explorer instance

with the /auth-callback route (i.e.
<https://apiexplorer.lab.yourcompany.com/auth-callback> --
https://apiexplorer-stg4.lab.hhq.cloud/auth-callback in this
example)

c. Scope must be "logging-service:read" , "event-service:read"

and "***directory-sync-service:read***" . Do not select **write** scopes
at the moment.

11. Click on **"Authorize"**:

API EXPLORER Authorization

Contact your Developer Relations representative if you are missing any of the required fields.

Client ID *

api_explorer_fv2

1



Client Secret *

.....

2



Redirect URI * /auth-callback

https://apiexplorer-stg4.lab.hhq.cloud/auth-callback

3



Scope * (select one or more)

× logging-service:read

× event-service:read

× directory-sync-service:read

4

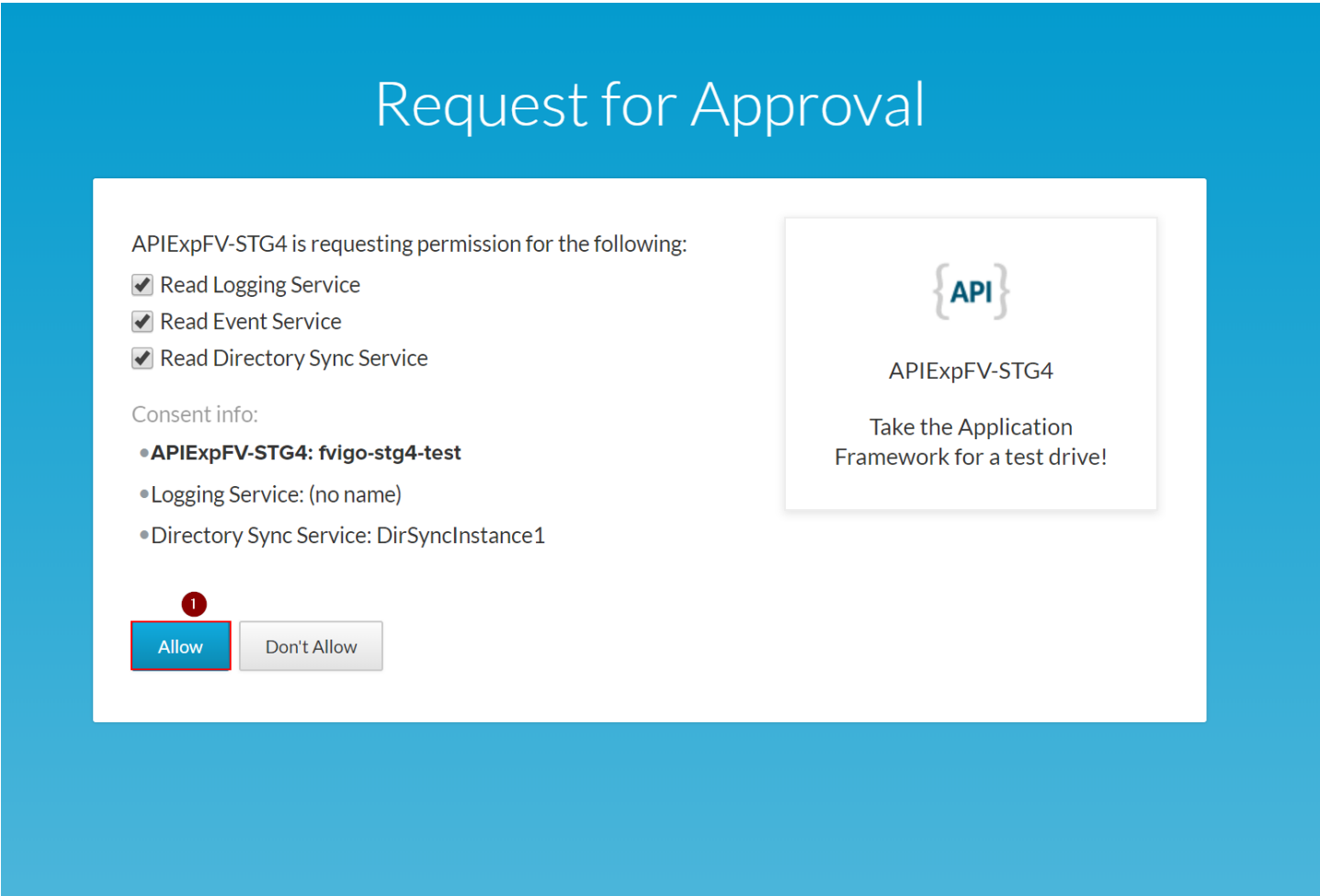
Authorize

5

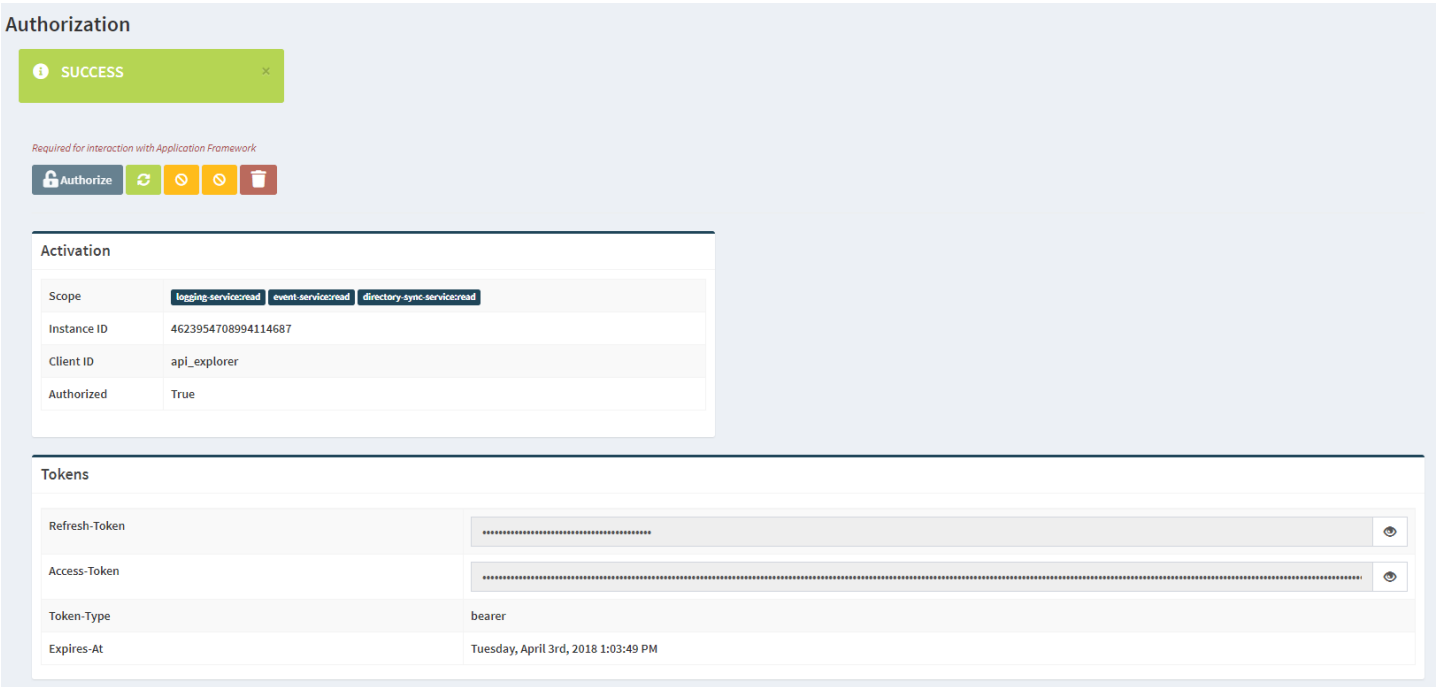
Note: If successful, API EXPLORER will receive tokens necessary for interacting with your Logging, Event and Directory-Sync instances.

Cancel

12. The "Request for Approval" page on the Identity Provider will show up. Click on **"Allow"**:



13. If the authorization is successful, you should see the Tokens in the Authorization page, and the application should work:



Congratulations: You can now use the functions of the API Explorer. For example, the "Query Explorer" from the left menu.

Appendix A: Explanation of the CFT services and usage

Kali Linux VM

Used to generate exploits to trigger Threat events on NGFW

Access server directly with SSH private key with the **ec2-user** user:

```
# ssh -i paloalto.pem **ec2-user**@kali.lab.yourcompany.com
```

Run threats against web server:

```
# sudo uniscan -u http://10.0.0.100 -esqdw
```

API Explorer VM

Runs the API Explorer application

Access the WebUI: <https://apiexplorer.lab.yourcompany.com>

You can also access directly with SSH private key with the **ec2-user** user:

```
# ssh -i paloalto.pem **ec2-user**@apiexplorer.lab.yourcompany.com
```

Public IP

Public IP of the NGFW eth1 interface :

- Use port 221 to access WEB VM through SSH (username is **ubuntu**)
- Use port 3389 to access Windows Domain controller through RDP

Next-Generation Firewall (NGFW)

Palo Alto Networks Next-Generation Firewall

Access directly with SSH private key with the **admin** user:

```
# ssh -i paloalto.pem **admin**@ngfw.lab.yourcompany.com
```

Or via the WebUI: <https://ngfw.lab.yourcompany.com>

Panorama

Palo Alto Networks Panorama

Access directly with SSH private key with the **admin** user:

```
# ssh -i paloalto.pem **admin**@panorama.lab.yourcompany.com
```

Or via the WebUI:

<https://panorama.lab.yourcompany.com>

Ubuntu Web Server

Traffic generation VM and Web Server

Internal address that can be reached through NGFW public interface (see above)

A web crawler runs on it (for URL and traffic logs, etc)

Access server with SSH private key through firewall mapped port 221 with the **ubuntu** user:

```
# ssh -i paloalto.pem **ubuntu**@public.lab.yourcompany.com -p 221
```

Useful commands:

- `# crontab -l` (shows the command in the crontab to register IP-to-User mapping with the NGFW API every 15 minutes)
- `# /home/ubuntu/web-traffic-generator` (web traffic generator. It's started during the first boot but won't restart at VM reboot). Configuration is in config.py
- Restart the Web traffic Generator with the following command:

```
REQUESTS_CA_BUNDLE=/etc/ssl/certs/ca-certificates.crt nohup python /home/ubuntu/web-traffic-generator/gen.py 1>>/tmp/webgen.stdout 2>>/tmp/webgen.stderr &
```

Domain Controller:

Windows 2012R2 Domain Controller

Internal IP that can be reached via RDP through NGFW public interface (see above)

Login as yourdomain\youruser (default **PANWDOMAIN\paloalto**), or as user1, user2 or user3

The password is the one you configured in the CFT.

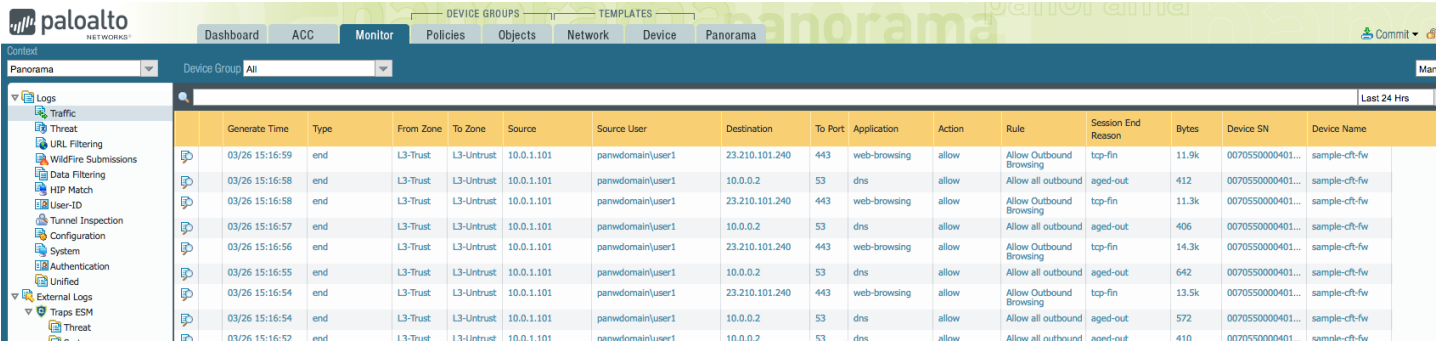
You can install the Directory Sync Service agent on this VM if you want to use it.

Appendix B: Default hostname to IP and VM Mapping

Public Hostname	Internal IP	EIP assigned?	VM
kali	10.0.0.88	Y	Kali Linux VM
apiexplorer	10.0.0.55	Y	API Explorer VM
public	10.0.0.100	Y	NGFW Public Interface
ngfw	10.0.0.99	Y	NGFW Management Interface
panorama	10.0.0.20	Y	Panorama Management Interface
N/A	10.0.1.101	N	Ubuntu Web Server VM
N/A	10.0.1.20	N	Windows Domain Controller VM

Appendix C: Sample log outputs in the monitor tab

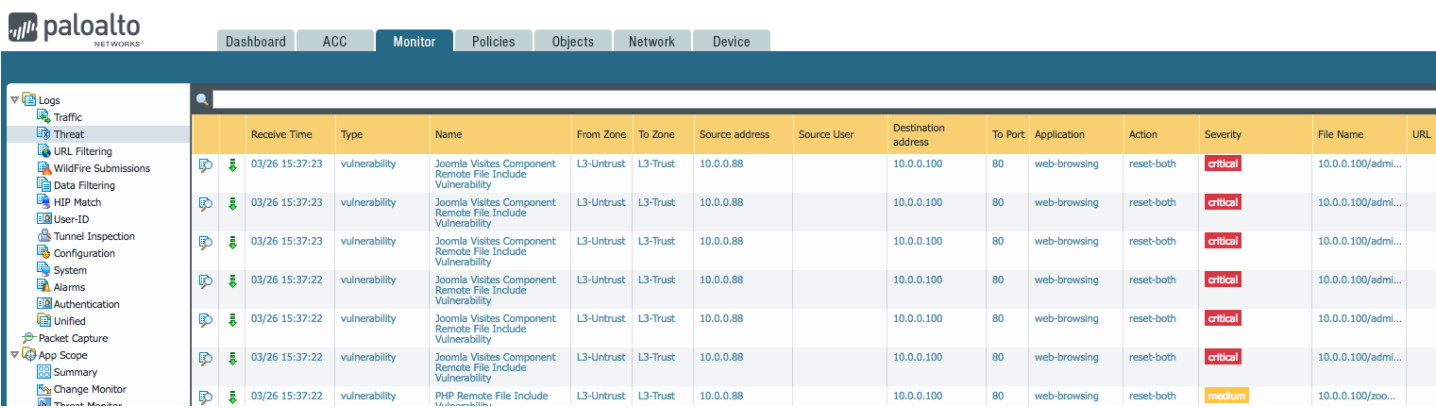
Traffic



The screenshot shows the Palo Alto Networks Panorama interface. The 'Monitor' tab is selected, and the 'Traffic' log is displayed. The table shows logs for various traffic events, including web browsing, DNS, and tunnel inspection. The columns include Generate Time, Type, From Zone, To Zone, Source, Source User, Destination, To Port, Application, Action, Rule, Session End Reason, Bytes, Device SN, and Device Name.

Generate Time	Type	From Zone	To Zone	Source	Source User	Destination	To Port	Application	Action	Rule	Session End Reason	Bytes	Device SN	Device Name
03/26 15:16:59	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	23.210.101.240	443	web-browsing	allow	Allow Outbound Browsing	tcp-fin	11.9k	0070550000401...	sample-ct-fw
03/26 15:16:58	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	10.0.0.2	53	dns	allow	Allow all outbound	aged-out	412	0070550000401...	sample-ct-fw
03/26 15:16:58	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	23.210.101.240	443	web-browsing	allow	Allow Outbound Browsing	tcp-fin	11.3k	0070550000401...	sample-ct-fw
03/26 15:16:57	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	10.0.0.2	53	dns	allow	Allow all outbound	aged-out	406	0070550000401...	sample-ct-fw
03/26 15:16:56	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	23.210.101.240	443	web-browsing	allow	Allow Outbound Browsing	tcp-fin	14.3k	0070550000401...	sample-ct-fw
03/26 15:16:55	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	10.0.0.2	53	dns	allow	Allow all outbound	aged-out	642	0070550000401...	sample-ct-fw
03/26 15:16:54	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	23.210.101.240	443	web-browsing	allow	Allow Outbound Browsing	tcp-fin	13.5k	0070550000401...	sample-ct-fw
03/26 15:16:54	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	10.0.0.2	53	dns	allow	Allow all outbound	aged-out	572	0070550000401...	sample-ct-fw
03/26 15:16:52	end	L3-Trust	L3-Untrust	10.0.1.101	panwdomain\user1	10.0.0.2	53	dns	allow	Allow all outbound	aged-out	410	0070550000401...	sample-ct-fw

Threat



The screenshot shows the Palo Alto Networks Panorama interface. The 'Monitor' tab is selected, and the 'Threat' log is displayed. The table shows logs for various threat events, including Joomla Visites Component Remote File Include Vulnerability and PHP Remote File Include. The columns include Receive Time, Type, Name, From Zone, To Zone, Source address, Source User, Destination address, To Port, Application, Action, Severity, File Name, and URL.

Receive Time	Type	Name	From Zone	To Zone	Source address	Source User	Destination address	To Port	Application	Action	Severity	File Name	URL
03/26 15:37:23	vulnerability	Joomla Visites Component Remote File Include Vulnerability	L3-Untrust	L3-Trust	10.0.0.88		10.0.0.100	80	web-browsing	reset-both	critical	10.0.0.100/admi...	
03/26 15:37:23	vulnerability	Joomla Visites Component Remote File Include Vulnerability	L3-Untrust	L3-Trust	10.0.0.88		10.0.0.100	80	web-browsing	reset-both	critical	10.0.0.100/admi...	
03/26 15:37:23	vulnerability	Joomla Visites Component Remote File Include Vulnerability	L3-Untrust	L3-Trust	10.0.0.88		10.0.0.100	80	web-browsing	reset-both	critical	10.0.0.100/admi...	
03/26 15:37:22	vulnerability	Joomla Visites Component Remote File Include Vulnerability	L3-Untrust	L3-Trust	10.0.0.88		10.0.0.100	80	web-browsing	reset-both	critical	10.0.0.100/admi...	
03/26 15:37:22	vulnerability	Joomla Visites Component Remote File Include Vulnerability	L3-Untrust	L3-Trust	10.0.0.88		10.0.0.100	80	web-browsing	reset-both	critical	10.0.0.100/admi...	
03/26 15:37:22	vulnerability	Joomla Visites Component Remote File Include Vulnerability	L3-Untrust	L3-Trust	10.0.0.88		10.0.0.100	80	web-browsing	reset-both	critical	10.0.0.100/admi...	
03/26 15:37:22	vulnerability	PHP Remote File Include	L3-Untrust	L3-Trust	10.0.0.88		10.0.0.100	80	web-browsing	reset-both	medium	10.0.0.100/zoo...	

Note: to see these you should generate some threats with Kali Linux, as explained in Appendix A.

URL Filtering

