

VM-Series for Azure



Azure Resource Manager Template

Deployment Guide

How to deploy a two-tiered application environment secured by the VM-Series firewall

<http://www.paloaltonetworks.com>

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Version History

Version number	Comments
1.0	Initial GitHub check-in
1.1	Removed NAT instance
2.0	Expanded guide to include activities

Support Policy

This ARM template 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.

1. About ARM Templates

Azure Resource Manager (ARM) templates are JSON files that can launch nearly all Azure resources including VNets, subnets, security groups, route tables and more.

For more information regarding ARM templates please refer to the Azure documentation here:

<https://azure.microsoft.com/en-us/documentation/articles/resource-group-overview/>

There are also many sample templates available here:

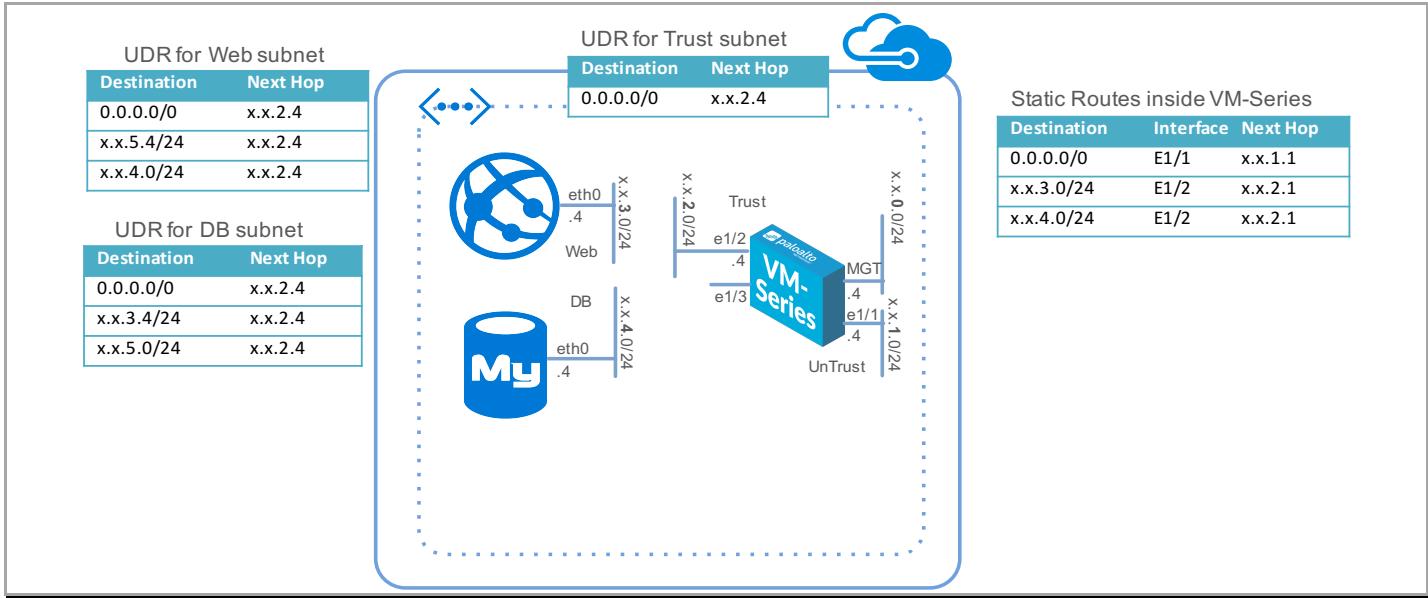
<https://azure.microsoft.com/en-us/documentation/templates/>

This document will explain how to deploy a sample template for a simple, two-tiered application framework including a VM-Series firewall. The template will launch everything that is shown in Figure 1 below. The ARM template includes the following components to help deploy the firewall as a gateway for Internet-facing applications—a VM-Series firewall, and two Linux virtual machines that are configured as a WordPress server and MySQL server respectively (representing a two-tier application environment). The template also includes the functions to create the VNet and subnets within the resource group, and adds the necessary user-defined routes (UDRs) and IP forwarding flags to enable the VM-Series firewall to secure the Azure resource group.

Sample templates provided by Palo Alto Networks including the one this document references can be found here:

<https://github.com/PaloAltoNetworks/azure/>

The template deploys the following virtual machines within a VNET:



For detailed documentation regarding the template and configuration of the VM Series firewall, please refer to the following document:

<https://www.paloaltonetworks.com/documentation/71/virtualization/virtualization/set-up-the-vm-series-firewall-in-azure>

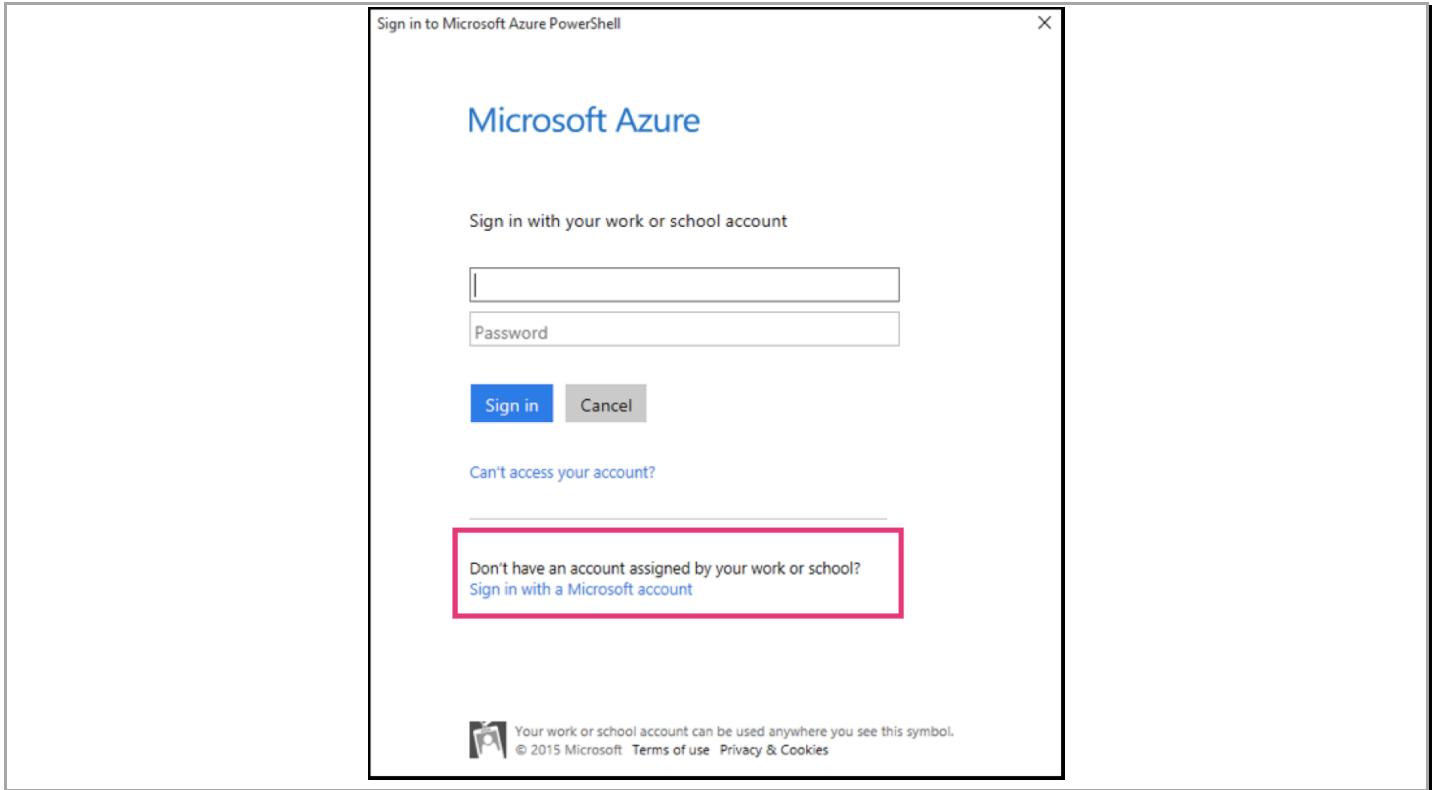
2. Prerequisites

Here are the prerequisites required to successfully launch this template.

2.1 Create an Azure account

If you do not have an Azure account already, go to <https://azure.microsoft.com/en-us/pricing/free-trial/> and create an account. If you already have an Azure account, please proceed to [Section 3](#).

Create the account as a "Microsoft account" (also known as a Live ID or Hotmail account) and not a "for work or school account".



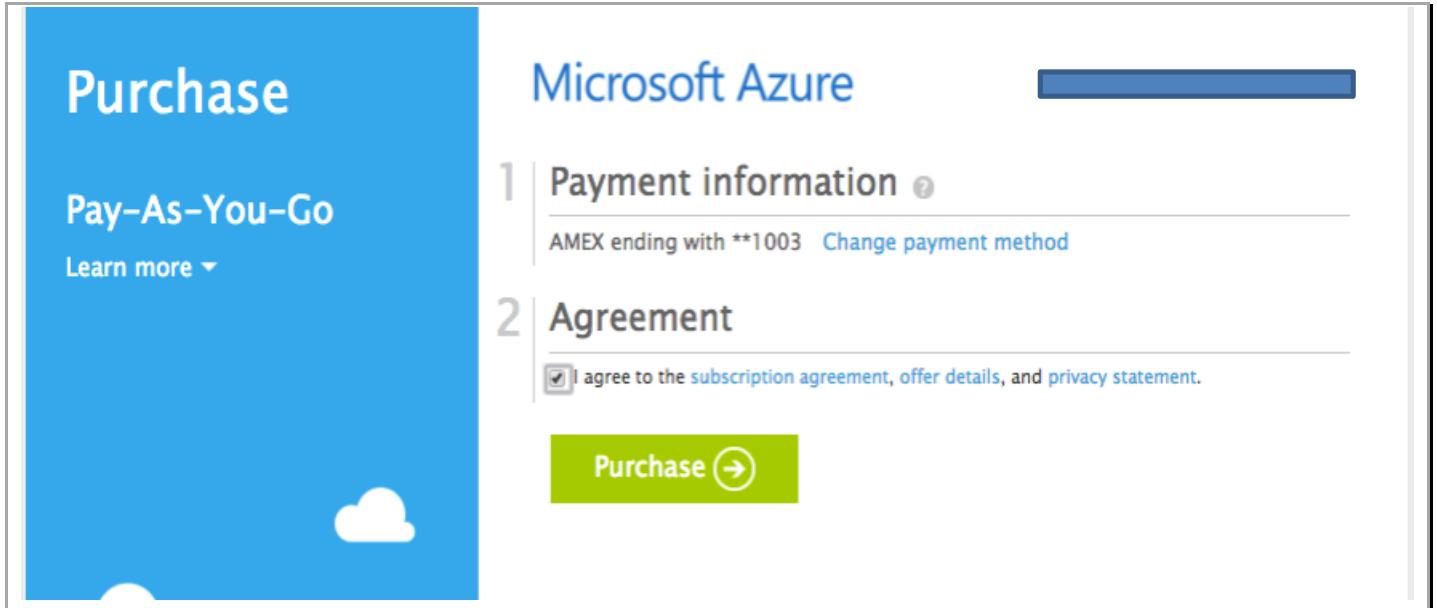
The free trial expires 30 days from account creation date or when \$200 free credits are used up.

2.2 Add a credit card to your Azure account

In order to launch the VM Series firewall (or anything with more than 4 cores) you will need to add a method of payment to your Azure account. For details, see: <https://msdn.microsoft.com/en-us/library/azure/dn736057.aspx>

Once done, request Microsoft to switch to the subscription to use the Pay-As-You-Go subscription (as opposed to the free one). This usually takes 3 to 4 days to complete.

Optionally, you can directly add a new subscription. To do so go to <https://account.windowsazure.com/Subscriptions> and click “**add subscription**” and select “**Pay-As-You-Go**”, Add payment details, check the box to agree to the terms and conditions and click “**Purchase**”



3. Launch the ARM Template

3.1 Deploy from Github

This document covers how to launch the template from the Azure portal. For details on using the Azure command line please refer to following doc

<https://www.paloaltonetworks.com/documentation/71/virtualization/virtualization/set-up-the-vm-series-firewall-in-azure/use-the-arm-template-to-deploy-the-vm-series-firewall>

Navigate to <https://github.com/PaloAltoNetworks/azure/tree/master/two-tier-sample> to access the ARM template.

Note: the current GitHub deployment only works for our Pay as you Go bundles. If you are trying to deploy this architecture as part of a demo environment or customer eval, you will need to replace the azureDeploy.json with an updated version that uses our BYOL offer. There are also additional instructions on activating your license included in this guide (p. 15).

Deploy a two-tiered application environment secured by the VM-Series firewall

This ARM template deploys a VM-Series next generation firewall VM in an Azure resource group along with a web and db server similar to a typical two tier architecture. It also adds the relevant User-Defined Route (UDR) tables to send all traffic through the VM-Series firewall.

Deployment Guide

Support Policy

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 Deploy to Azure

 Visualize

Click “**Visualize**” for a visual representation of the various resources the template launches. Click “**Deploy to Azure**” link. You will be prompted to log in to your Azure account and prompted to specify some template parameters.

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Microsoft Azure New > Custom deployment

Custom deployment

Deploy from a custom template

TEMPLATE

Customized template
20 resources

[Edit](#) [Learn more](#)

BASICS

* Subscription: [Edit](#)

* Resource group Create new Use existing
 [Edit](#)

* Location: [Edit](#)

SETTINGS

* Storage Account Name: [Edit](#)

Firewall Dns Name: [Edit](#)

Web Server Dns Name: [Edit](#)

Firewall Vm Name: [Edit](#)

Firewall Vm Size: [Edit](#)

From Gateway Login: [Edit](#)

Ip Address Prefix: [Edit](#)

TERMS AND CONDITIONS

[Azure Marketplace Terms](#) | [Azure Marketplace](#)

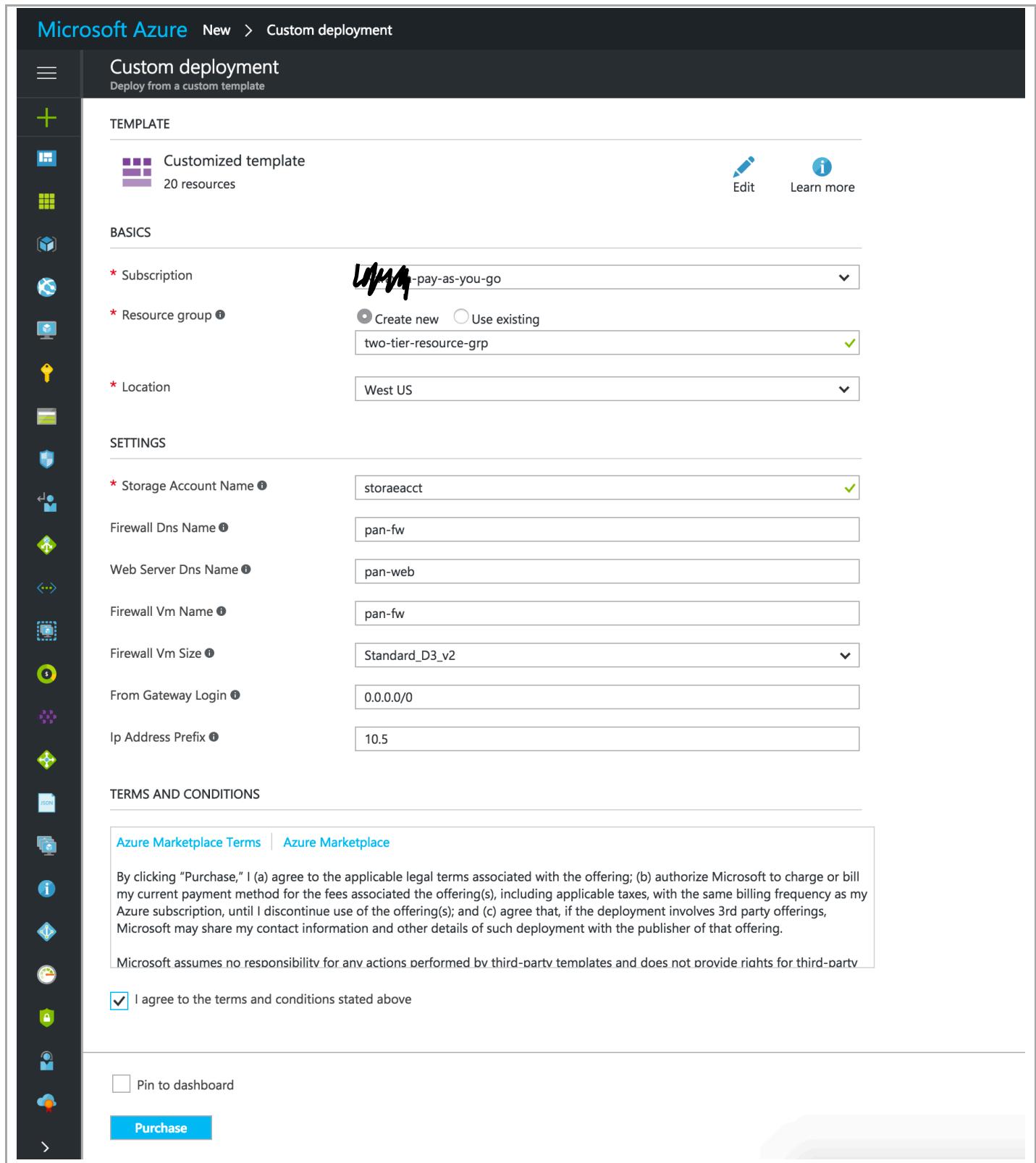
By clicking "Purchase," I (a) agree to the applicable legal terms associated with the offering; (b) authorize Microsoft to charge or bill my current payment method for the fees associated with the offering(s), including applicable taxes, with the same billing frequency as my Azure subscription, until I discontinue use of the offering(s); and (c) agree that, if the deployment involves 3rd party offerings, Microsoft may share my contact information and other details of such deployment with the publisher of that offering.

Microsoft assumes no responsibility for any actions performed by third-party templates and does not provide rights for third-party

I agree to the terms and conditions stated above

Pin to dashboard

[Purchase](#)



3.2 The Parameters

You must specify the following parameters for your deployment.

1. Basics

Select your subscription, pick a unique resource group name and select a location where the template will deploy resources

BASICS

* Subscription	pay-as-you-go
* Resource group ⓘ	<input checked="" type="radio"/> Create new <input type="radio"/> Use existing two-tier-resource-grp
* Location	West US

You can select an existing resource group into which the resources within the template will be deployed into. But, you will be responsible for cleanup of individual resources if you need to preserve the resource group.

2. Settings

Storage Account Name:

Specify the storage account name to use. This name has to be unique (so use your name or something else as a unique identifier). Also, only lower case letters and number are allowed. The name cannot have spaces, dashes or special characters. You can enter up to 20 characters

* Storage Account Name ⓘ	storageacct
--------------------------	-------------

Note: You must have a unique storage account name, for a successful deployment.

Firewall DNS Name:

This is the DNS name for the VM-Series firewall (for management). It has to be unique name with lower case letters and numbers only. This name is used to address the firewall as opposed to its IP address.

Firewall Dns Name ⓘ	pan-fw
---------------------	--------

Web Server DNS Name:

This is the DNS name for the web server. Part of this name will be incorporated into the web server's URL

Web Server Dns Name ⓘ	pan-web
-----------------------	---------

Firewall VM Name:

The name for the VM-Series firewall in the Azure portal

Firewall Vm Name ⓘ	pan-fw
--------------------	--------

Firewall VM Size:

Select One of the two VM sizes for the firewall. For specifics of the instance sizes please refer to the following <https://azure.microsoft.com/en-us/pricing/details/virtual-machines/linux/>

Firewall Vm Size ⓘ	<input checked="" type="checkbox"/> Standard_D3_v2 <input type="checkbox"/> Standard_D4_v2
--------------------	---

From Gateway Login:

This parameter restricts the IP address from which you can access all of the resources within this VNET. As a best practice, specify an IP address (obtained from checkmyip.org) so the firewall and the NAT VM are not open to the world.

From Gateway Login ⓘ	0.0.0.0/0
----------------------	-----------

3.3 Agree to terms and Launch

Agree to the terms and click “Purchase”

The screenshot shows the "TERMS AND CONDITIONS" section of the Azure Marketplace. It includes links to "Azure Marketplace Terms" and "Azure Marketplace". A detailed legal text describes the user's agreement to terms, authorization of Microsoft to charge, and sharing of contact information. Below the text are two checkboxes: one checked for agreeing to terms and another for pinning to the dashboard. A prominent blue "Purchase" button is at the bottom.

This will deploy the template and create resources.

3.4 Check Deployment Status

If successfully deployed, select **Resource groups** on the portal to view the resource group that was created by the template, and under “**Deployments**” click the “**Deploying**” link to view all the resources that are being created.

The screenshot shows the Azure Resource Groups blade for the "two-tier-resource-grp" resource group. On the left sidebar, "Resource groups" is selected. In the main pane, the "two-tier-resource-grp" resource group is selected. On the right, the "Deployments" blade is open, showing a single deployment labeled "1 Deploying". An arrow points from the "Resource groups" link in the sidebar to the "two-tier-resource-grp" resource group in the list, and another arrow points from the "Deployments" link in the sidebar to the "1 Deploying" entry.

Palo Alto Networks Azure Resource Manager Template Deployment Guide

Add Columns Delete Refresh Move

Essentials ^

Subscription name (change)
[REDACTED] pay-as-you-go

Deployments
1 Deploying

Subscription ID [REDACTED]
Location West US

Filter by name...

18 items

NAME ▼	TYPE ▼	LOCATION ▼	RESOURCE GROUP ▼	...
database-vm	Virtual machine	West US	two-tier-resource-grp	...
DBeth0	Network interface	West US	two-tier-resource-grp	...
DB-to-FW	Route table	West US	two-tier-resource-grp	...
DefaultNSG	Network security group	West US	two-tier-resource-grp	...
FWeth0	Network interface	West US	two-tier-resource-grp	...
FWeth1	Network interface	West US	two-tier-resource-grp	...
FWeth2	Network interface	West US	two-tier-resource-grp	...
fwPublicIP	Public IP address	West US	two-tier-resource-grp	...
fwVNTEcz4	Virtual network	West US	two-tier-resource-grp	...
pan-fw	Virtual machine	West US	two-tier-resource-grp	...
storaecacctecz4	Storage account	West US	two-tier-resource-grp	...
Trust-to-intranetwork	Route table	West US	two-tier-resource-grp	...
Webeth0	Network interface	West US	two-tier-resource-grp	...
WebPublicIP	Public IP address	West US	two-tier-resource-grp	...
webserver-vm	Virtual machine	West US	two-tier-resource-grp	...
Web-to-FW	Route table	West US	two-tier-resource-grp	...

If the ARM template deployment was successful, the deployment state will show as “**3 Succeeded**”

Essentials ^

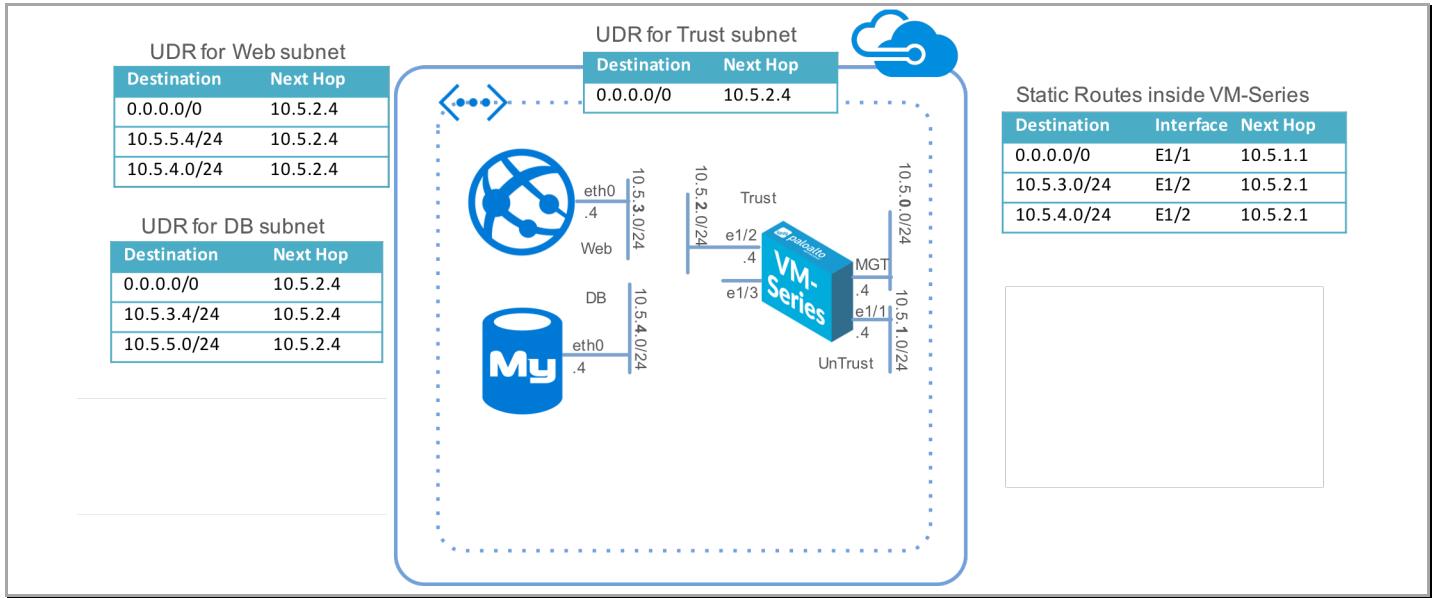
Subscription name (change)
[REDACTED] pay-as-you-go

Deployments
3 Succeeded

Subscription ID [REDACTED]
Location West US

3. Review the Provisioned Resources

Verify that the resources match this topology. If you customized the template, the subnets may be different.



Here is a high level break down:

DB server, VM-Series firewall and web server respectively.

database-vm	Virtual machine	West US
pan-fw	Virtual machine	West US
webserver-vm	Virtual machine	West US

Activate the licenses on the VM-Series firewall.

(instructions are at: <https://www.paloaltonetworks.com/documentation/80/virtualization/virtualization/set-up-the-vm-series-firewall-on-azure/deploy-the-vm-series-firewall-on-azure-solution-template>)

For the BYOL version

Create a Support Account .

1. Go to <https://www.paloaltonetworks.com/support/tabs/overview.html> .
2. Click the Register link (bottom of the page), and enter the corporate email address to associate with the support account.
3. Click Register device using Serial Number or Authorization Code.
4. Register the VM-Series Firewall (with auth code) .

The rest of the setup will be done via the VM Series Firewall interface

5. On the firewall web interface, select DeviceLicenses and select Activate feature using authentication code.
6. Enter the capacity auth-code that you registered on the support portal. The firewall will connect to the update server (updates.paloaltonetworks.com), and download the license and reboot automatically.
7. Log back in to the web interface and confirm the following on the Dashboard:
 - A valid serial number displays in Serial#.
 - If the term Unknown displays, it means the device is not licensed. To view traffic logs on the firewall, you must install a valid capacity license.
 - The VM Mode displays as Microsoft Azure.

Network interfaces

For the firewall: FWeth0 is the management interface, FWeth1 is in the untrust zone and FWeth2 is in the trust zone.

 DBeth0	Network interface	West US
 FWeth0	Network interface	West US
 FWeth1	Network interface	West US
 FWeth2	Network interface	West US
 Webeth0	Network interface	West US

The DefaultNSG (network security group)

This security group applies to the Azure Resource Group as a whole. The network security group specifies rules that allow or deny access to the resources within the resource group and provides a very rudimentary port/protocol based firewall.

 DefaultNSG	Network secur...	azuretestnarayanrg	West US	 pay-as-you... 
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Inbound and outbound rules for the DefaultNSG

The screenshot displays two Azure portal windows side-by-side, both titled "DefaultNSG - [Rule Type] security rules".

Inbound security rules (Left Window):

PRIORITY	NAME	SOURCE	DESTINATI...	SERVICE	ACTION
100	Allow-Outside-From-IP	0.0.0.0/0	Any	Custom (Any/Any)	Allow
101	Allow-Intra	10.5.0.0/16	Any	Custom (Any/Any)	Allow
200	Default-Deny	Any	Any	Custom (Any/Any)	Deny
65000	AllowVnetInBound	VirtualNetwork	VirtualN...	Custom (Any/Any)	Allow
65001	AllowAzureLoadBalancerInBound	AzureLoadBalancer	Any	Custom (Any/Any)	Allow
65500	DenyAllInBound	Any	Any	Custom (Any/Any)	Deny

Outbound security rules (Right Window):

PRIORITY	NAME	SOURCE	DESTINATION	SERVICE	ACTION
65000	AllowVnetOutBound	VirtualNetwork	VirtualNetwork	Custom (Any/Any)	Allow
65001	AllowInternetOutBound	Any	Internet	Custom (Any/Any)	Allow
65500	DenyAllOutBound	Any	Any	Custom (Any/Any)	Deny

User defined Routes (UDRs)

 DB-to-FW	Route table	West US
 Trust-to-intranetwork	Route table	West US
 Web-to-FW	Route table	West US

The above UDRs enable the VM-Series firewall to secure the Azure resource group. For the four subnets—Trust, Untrust, Web, and DB—included in the template, you have three route tables, one for routing traffic from the web to the FW, the DB to the FW and the Trust to the intra-network. Each UDR ensures that the traffic flows through the VM-Series firewall.

Public IPs

 fwPublicIP	Public IP address	West US
 WebPublicIP	Public IP address	West US

Custom Scripts/Linux Extensions

The template deploys Linux extensions to configure the firewall, web server (with Apache and WordPress) and database server (MySQL). Linux extensions are resources that can be used to configure Linux VMs. Each custom script downloads and runs a specific script (found in the Github repo) that configures a specific VM. The web-vm-customscript configures the firewall and the web server. The db-vm-custom script configures the database server

Note: The entire template should take about 10 minutes to deploy and be fully functional

The next sections will guide you through the PAN-OS WebUI and show you how to safely enable applications

4. Activity 1 – Review PAN-OS WebUI

In this activity, you will:

- Login to the VM-Series firewall
- Review key portions of the firewall configurations

Task 1 – Login and Dashboard summary

To access the firewall login page, access the URL from the azure portal template deployment summary page. You should be able to log into the **VMSeriesURL** using the username/password: paloalto/Pal0Alt0@123

The screenshot shows the Azure portal interface. On the left, there's a navigation pane with 'Add', 'Columns', 'Delete', and 'Refresh' buttons. Below that, it says 'Essentials ^' and 'Subscription name (Changed) Narayan-palo-alts-you-do'. A red box highlights the 'Deployments' section, which shows '3 Succeeded'. The main area lists three deployments:

- Microsoft.Template** (highlighted with a blue box), deployed on 3/27/2017, 8:58:47 PM.
- WeblinkedTemplate**, deployed on 3/27/2017, 8:58:42 PM.
- DBlinkedTemplate**, deployed on 3/27/2017, 8:58:23 PM.

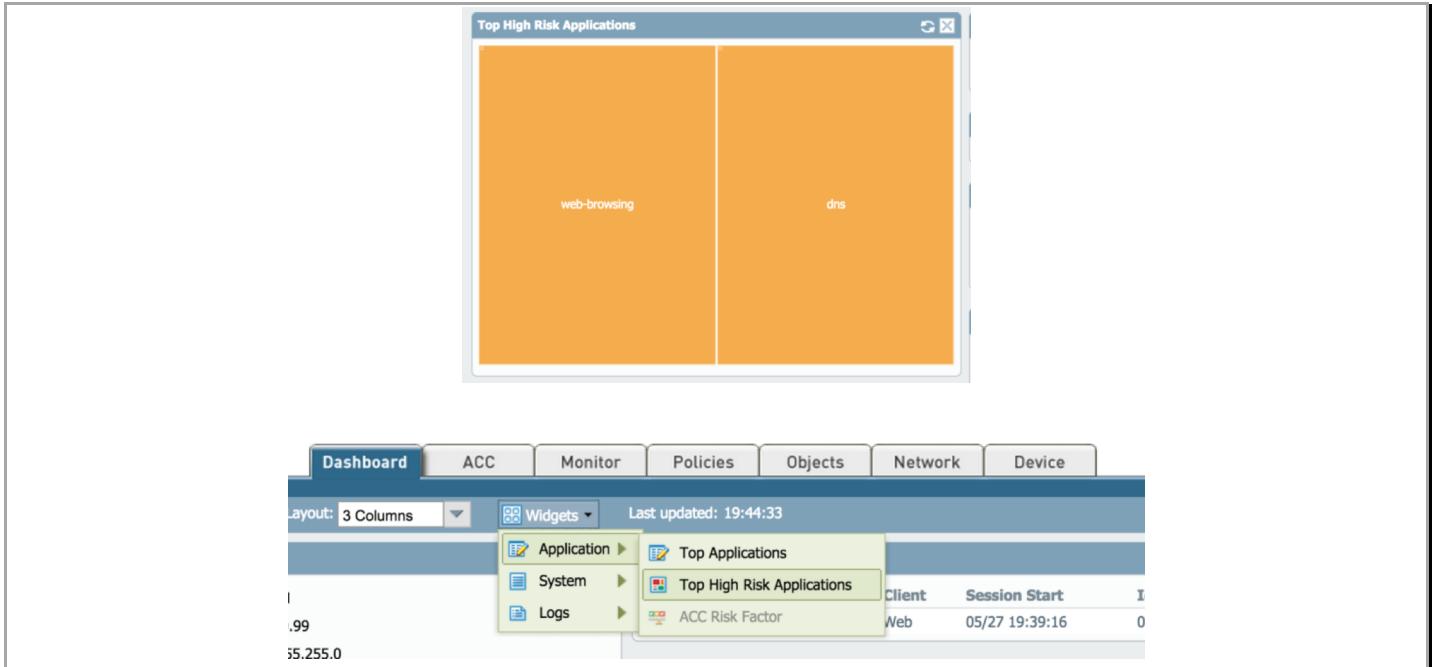
On the right, a detailed view of the 'Microsoft.Template' deployment is shown. It includes:

- Summary**: DEPLOYMENT DATE: 3/27/2017, 8:58:47 PM; STATUS: Succeeded; DURATION: 8 minutes 15 seconds; RESOURCE GROUP: two-tier-resource-grp; RELATED: Events.
- Outputs**: VMSERIESURL: https://pan-fwecz4.westus.cloudapp.azure.com; WEBSERVERURL: http://pan-webecz4.westus.cloudapp.azure.com.
- Inputs**: (empty)

Note: Your browser will give you a certificate warning, you can safely acknowledge it and proceed.

Upon login, you will see the dashboard for the VM-Series. The dashboard provides a visual summary of the device status. It is widget-based and can be customized to fulfill your specific requirements. In the **General Information** widget, you can see this VM is a **Microsoft Azure** instance under the **VM Mode**.

Note: Since this firewall is brand new, it likely doesn't have any traffic yet and your screen won't match the screenshot below. You can return to the dashboard at the end of the lab to see real data.



Task 2 – Application Command Center (ACC)

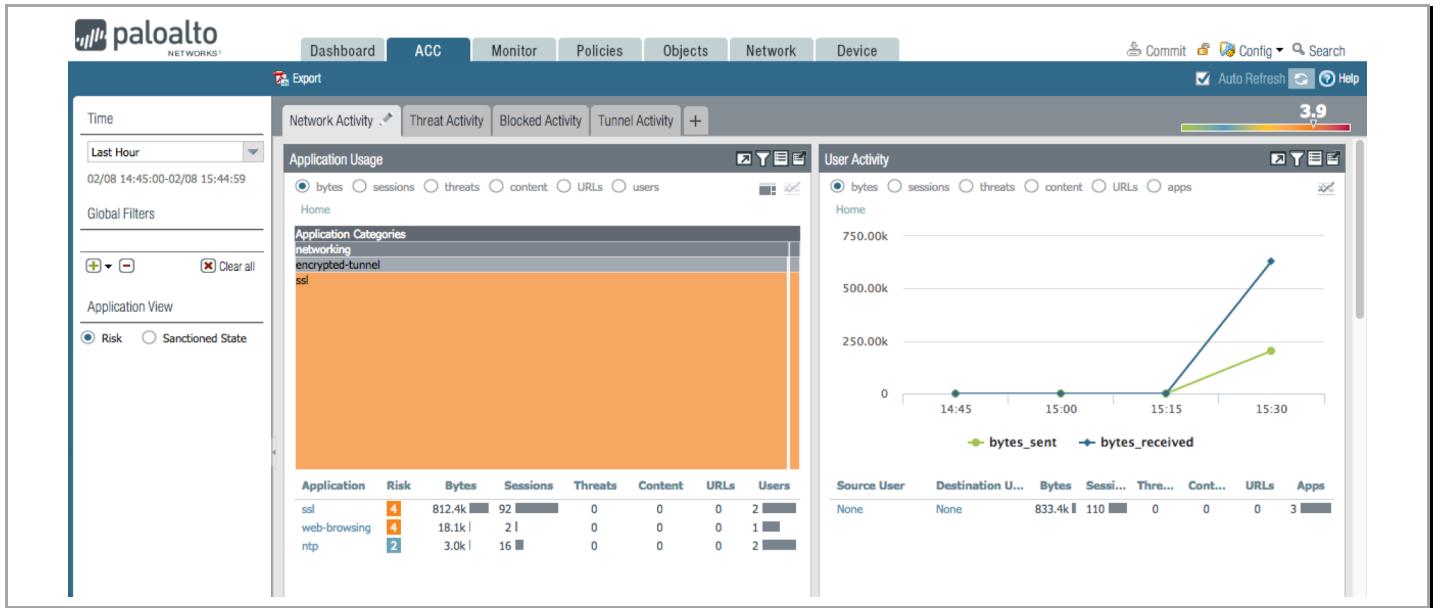
The ACC provides you with a widget-based summary of the applications, the content within, and who the user is over a given time period [default is 1 hour]. With the ACC, you can see the contextual linkage between the application and the content, which allows you to make more informed security decisions.

Select the **ACC** Tab:

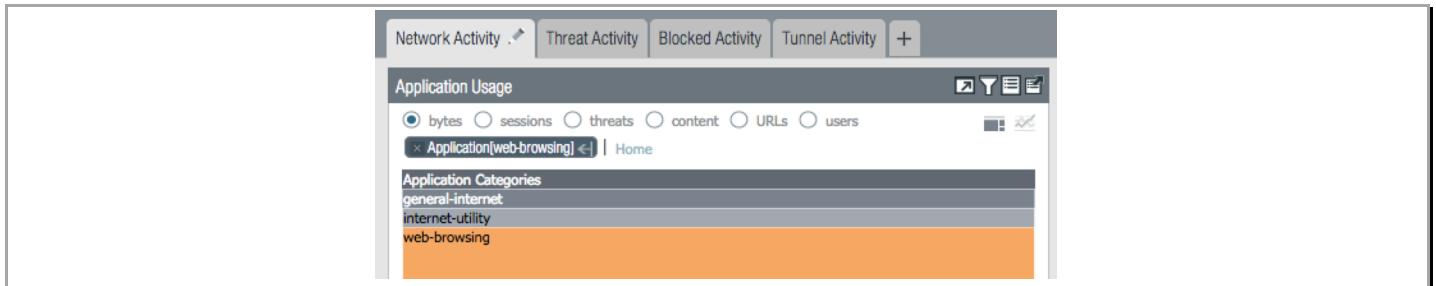


The default ACC view will show you the network, threat, blocked and tunnel activity in four separate tabs for the past hour. As shown in the image below, the time frame and each tab can be customized to display the relevant application, threat, and user activity depending upon the user role. Additional tabs can be added via the + sign on the right side of the Blocked Activity tab.

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Within each of the widgets, you can select the relevant data point to learn more about what it is and what it means, and you can “Promote” that data point as a filter by clicking on the arrow to the right of the filter, which in turn will force all other widgets to be updated based on that context. Because you are viewing a brand-new firewall, there won’t be much data in this view yet.



Task 3 – The Object, Network and Device Tabs

The Objects, and Device tabs provide you with the various management capabilities.

The Objects tab allows you to manage the building blocks for creating policies such as address objects, custom applications, and security profiles.

Create and manage all objects

Manage network connectivity

Manage the device

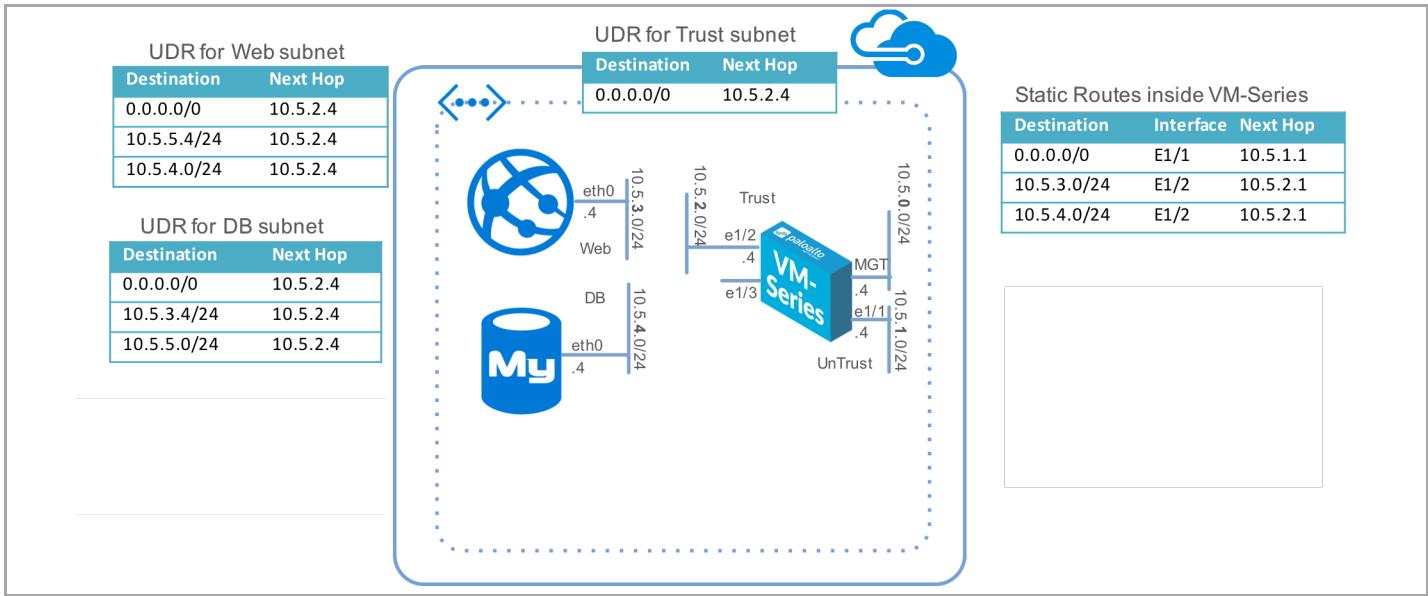
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The network tab allows you to create and manage interfaces, security zones, VLANs and other elements that enable connectivity. Click the *Network* tab:

The screenshot shows the Palo Alto Networks Network tab interface. On the left is a navigation sidebar with various icons and sections like Interfaces, Zones, Virtual Routers, etc. The main area has tabs for Ethernet, Loopback, and Tunnel, with Ethernet selected. Below is a table of network interfaces:

Interface	Interface Type	Management Profile	Link State	IP Address	Virtual Router	Tag	VLAN / Virtual-Wire	Security Zone	Features	Comment
ethernet1/1	Layer3		Up	Dynamic-DHCP Client	default	Untagged	none	Untrust		
ethernet1/2	Layer3		Up	Dynamic-DHCP Client	default	Untagged	none	Trust		
ethernet1/3			Up	none	none	Untagged	none	none		
ethernet1/4			Up	none	none	Untagged	none	none		

The network configuration should align with the following topology



The interface (Ethernet 1/1) in the *Unturst* zone is the interface that is exposed to the outside world. All traffic enters through this interface.

The interface in the *Trust* zone (Ethernet 2/2) is the interface where the assets that need to be protected reside (in this case the web and database servers).

The Device tab is where configuration items like DNS, service routes, etc. are managed. The device tab also allows you to manage high availability, users, software and content updates.

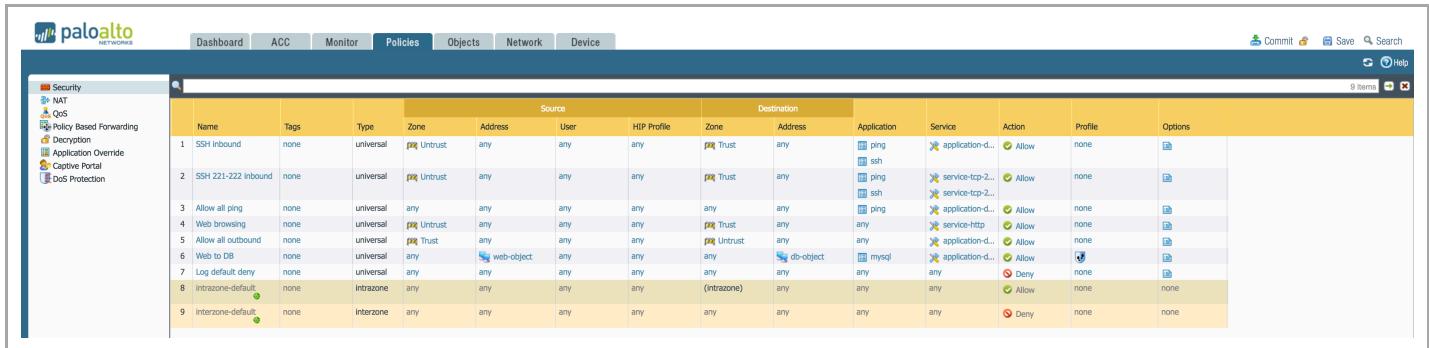
Task 3 - Security Policies

The Policies tab is where you will define all of your policies. The default view will be your security policies, all of which can be based on the application, the content within, and the user. As shown

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along the left side of the image, additional policies can be defined for actions such as NAT, Decryption, and DoS.

Select the *Policies* tab:



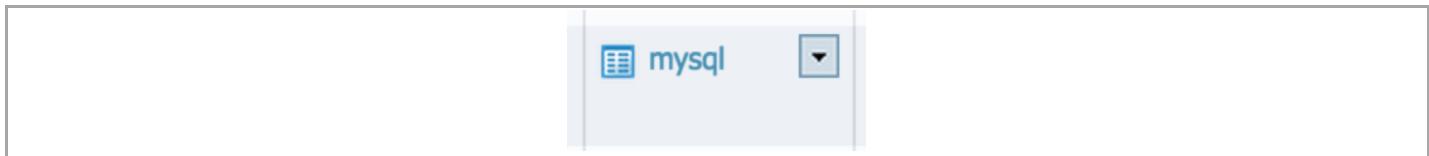
The screenshot shows the Palo Alto Networks Policy tab interface. On the left, there's a sidebar with icons for Security, NAT, QoS, Policy Based Forwarding, Decryption, Application Override, Captive Portal, and DoS Protection. The main area displays a table of 9 security policies:

Name	Tags	Type	Source				Destination				Action	Profile	Options
			Zone	Address	User	HIP Profile	Zone	Address	Application	Service			
SSH inbound	none	universal	Untrust	any	any	any	Trust	any	ping	application-d...	Allow	none	
SSH 221-222 inbound	none	universal	Untrust	any	any	any	Trust	any	ping	service-tcp-2...	Allow	none	
Allow all ping	none	universal	any	any	any	any	any	any	ssh	service-tcp-2...	Allow	none	
Web browsing	none	universal	Untrust	any	any	any	Trust	any	ping	application-d...	Allow	none	
Allow all outbound	none	universal	Trust	any	any	any	Untrust	any	ssh	service-http	Allow	none	
Web to DB	none	universal	any	web-object	any	any	any	any	db-object	mysql	application-d...	Allow	
Log default deny	none	universal	any	any	any	any	any	any	any	any	Deny	none	
Intrazone-default	none	intrazone	any	any	any	any	(Intrazone)	any	any	any	Allow	none	none
Interzone-default	none	interzone	any	any	any	any	any	any	any	any	Deny	none	none

These policies are defined to allow ssh access on ports 221 and 222 to the web and db server respectively (for troubleshooting purposes), secures N/S traffic and E/W traffic between zones.

And the NAT policies allow for ssh access to the web and db servers as well as directing web traffic to the web server only.

In the **Web to DB** rule (rule 6) and under the **Application** column, click on the small arrow next to **mysql**.



Then click on **value** to see the details for the mysql AppID. You will see details about the application including the standard ports

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The screenshot shows the Palo Alto Networks Policy Editor interface. A context menu is open over a MySQL service object named "mysql". The menu options are: Edit..., Filter, Remove, Value (which is highlighted), and Global Find.

any	any	any	any	web-object	mysql
any	any	any	any	any	any
any	any	(intrazone)	any	any	any

Application

Name: mysql
 Description: MySQL is a multithreaded, multi-user, SQL Database Management System (DBMS) with more than six million installations
 Category: business-systems
 Subcategory: database
 Technology: client-server
 Risk: 2
 Standard Ports: tcp/3306
 Characteristic: Vulnerability
 Widely used

Note: The VM-Series is a next generation firewall. It does not simply assume all traffic on TCP port 3306 is MySQL. It inspects the traffic and ensures that it truly is MySQL.

On the left-hand side, under *NAT* you can also inspect that translation rules that allow the web and db servers to be accessed from the outside world via SSH. A NAT rule that allows http access to the web server and a default outbound NAT rule to allow the web and db servers to access external resources.

The screenshot shows the NAT configuration table in the Palo Alto Networks UI. The table lists four entries:

Name	Tags	Original Packet						Translated Packet		
		Source Zone	Destination Zone	Destination Interface	Source Address	Destination Address	Service	Source Translation	Destination Translation	
1 Web SSH	none	Untrust	Untrust	any	any	10.5.1.4	dynamic-ip-and-port ethernet1/2	address: 10.5.3.5 port: 22		
2 DB SSH	none	Untrust	Untrust	any	any	10.5.1.4	dynamic-ip-and-port ethernet1/2	address: 10.5.4.5 port: 22		
3 WordPress NAT	none	Untrust	Untrust	any	any	10.5.1.4	dynamic-ip-and-port ethernet1/2	address: 10.5.3.5 port: 80		
4 Outbound nat	none	any	Untrust	any	any	any	dynamic-ip-and-port ethernet1/1	none		

Task 4 – The Monitor tab

The Monitor tab is where you can perform log analysis and generate reports on all of the traffic flowing through the VM-Series. Logs are stored on box and can also be forwarded to either Panorama, our centralized management solution, or forwarded to a syslog server for analysis and reporting by 3rd party offerings



Navigate through the various log viewers, click Reports to see the various pre-defined reports you can use.

Note: Your firewall is new and doesn't have any data yet so any reports you create at this point will likely be blank. You can return to this step at the end of the lab and create new reports.

The screenshot shows the Palo Alto Networks Firewall interface with the 'Monitor' tab selected. On the left, there's a navigation sidebar with various monitoring and reporting options like Traffic, Threat, Log, and Reports. The main area displays a log viewer with columns for Receive Time, Severity, Type, Name, Ingress IP, From Zone, To Zone, Attacker, Attacker Name, Victim, To Port, Application, and Action. Three specific features are highlighted with red boxes and callouts:

- View and analyze logs**: Points to the log viewer table where several entries are listed, such as 'ZeroAccess.Gen Command and Control Traffic' and 'FTP: login Brute-force attempt'.
- Compare activity over time**: Points to the same log viewer table, emphasizing the temporal nature of the data.
- Fully customizable reporting**: Points to the 'Reports' section in the sidebar, which includes options like 'Manage PDF Summary', 'User Activity Report', 'Report Groups', 'Email Scheduler', and 'Manage Custom Reports'.

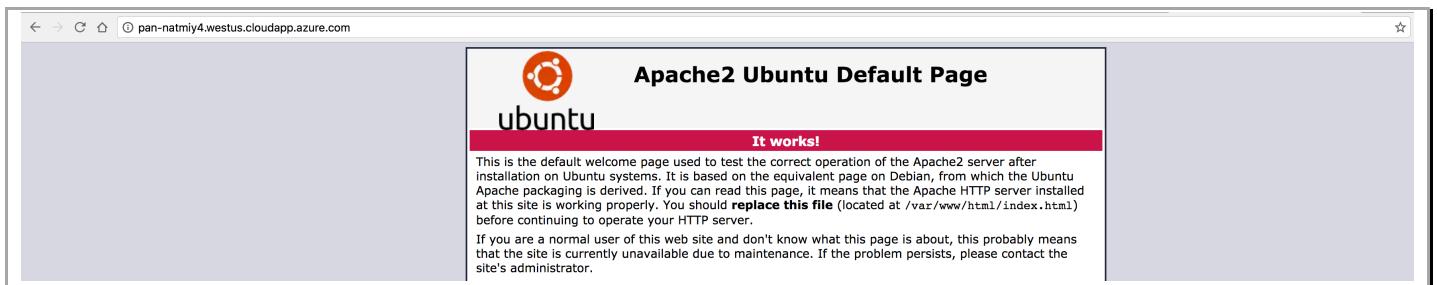
5. Activity 2 – Safely Enable Applications

In this activity, you will:

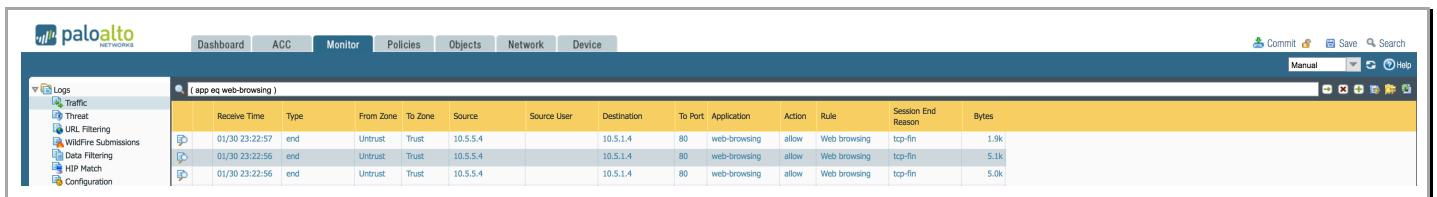
- Generate traffic on the firewall and review the traffic log
- Edit the security policy to allow inter-tier application traffic

Task 1 – Verify Static Content on Web Server

Using the second URL (WebserverURL) in the output section of the deployment summary access the static content of the webserver and you should see:



Check firewall logs to verify that the traffic is passing through the firewall:



Task 2 – Verify Dynamic Content on Web Server

In this task, you will generate a WordPress content request from your web browser that will trigger a database query to the MySQL server. Like many web-based applications, WordPress uses a backend database to create, store, and retrieve dynamic content. You will use the WordPress application to show exactly this type of behavior and demonstrate how the VM-Series firewall will secure this traffic.

In the browser, head to the WordPress server (<http://webserverURL/wordpress>) this should be the second link in the output section of the deployment tab

Palo Alto Networks Azure Resource Manager Template Deployment Guide

The screenshot shows the Azure portal interface. On the left, there's a navigation pane with 'Add', 'Columns', 'Delete', and 'Refresh' buttons. Below that, it says 'Essentials ^' and 'Subscription name (Changed) Narayan-pay-as-you-go'. It lists 'Deployments' with '3 Succeeded': 'Microsoft.Template' (3/27/2017, 8:58:47 PM), 'WeblinkedTemplate' (3/27/2017, 8:58:42 PM), and 'DBlinkedTemplate' (3/27/2017, 8:58:23 PM). A search bar 'Filter by name...' and a dropdown 'NAME' are also present. On the right, a detailed view of the 'Microsoft.Template' deployment is shown. It includes a 'Summary' section with 'DEPLOYMENT DATE' (3/27/2017, 8:58:47 PM), 'STATUS' (Succeeded), 'DURATION' (8 minutes 15 seconds), and 'RESOURCE GROUP' (two-tier-resource-grp). An 'Events' link is also provided. Under 'Outputs', two outputs are listed: 'VMSERIESURL' (https://pan-fwecz4.westus.cloudapp.azure.com) and 'WEBSERVERURL' (http://pan-webecz4.westus.cloudapp.azure.com). These last two outputs are highlighted with a red box.

And you should see the WordPress welcome page.

Note: You don't need to actually configure the new WordPress server. In its initial, un-configured state, it will generate the traffic we need to test the VM-Series firewall.

The screenshot shows a web browser window with the URL 'pan-natmiy4.westus.cloudapp.azure.com/wordpress/wp-admin/install.php'. The page features the classic WordPress 'W' logo at the top. Below it, a 'Welcome' message says: 'Welcome to the famous five-minute WordPress installation process! Just fill in the information below and you'll be on your way to using the most extendable and powerful personal publishing platform in the world.' A 'Information needed' section follows, asking for 'Site Title', 'Username', 'Password', 'Your Email', and 'Search Engine Visibility'. The 'Password' field contains 'Ojolt3RbCUndQa^rti' with a green 'Strong' indicator. A note below says: 'Important: You will need this password to log in. Please store it in a secure location.' At the bottom is a large 'Install WordPress' button.

Now, head back to the firewall and verify that the traffic did indeed go through the firewall from web to db:

The screenshot shows the Palo Alto Networks Firewall's "Logs" section. A search filter "(app eq mysql)" is applied. The log table displays four entries:

	Receive Time	Type	From Zone	To Zone	Source	Source User	Destination	To Port	Application	Action	Rule	Session End Reason	Bytes
1	01/30 23:26:59	end	Trust	Trust	10.5.3.5		10.5.4.5	3306	mysql	allow	Web to DB	tcp-fin	20.7k
2	01/30 23:26:58	end	Trust	Trust	10.5.3.5		10.5.4.5	3306	mysql	allow	Web to DB	tcp-fin	5.1k
3	01/30 23:26:44	start	Trust	Trust	10.5.3.5		10.5.4.5	3306	mysql	allow	Web to DB	n/a	375
4	01/30 23:26:44	start	Trust	Trust	10.5.3.5		10.5.4.5	3306	mysql	allow	Web to DB	n/a	375

6. Activity 3 – Safe Application Enablement

In this activity, you will:

- Generate two simulated east/west (web tier to database tier) attacks
- Monitor the firewall logs to see the results of the attacks

Task 1 – Attempt to SSH from the web server to the DB server

This task will simulate a compromised web server that is being used to attack the database. This is a common attack strategy of getting a foothold on the web front-end server and then expanding to the other application tiers with the ultimate goal of accessing all data in the database.

Go to (<http://WebserverURL/sql-attack.html>) and simulate a web to db ssh attempt by clicking on the **LAUNCH WEB TO DB SSH ATTEMPT**.

LAUNCH WEB TO DB SSH ATTEMPT

This launches a CGI script that attempts to ssh as root to the db server from the web server. Now return to the firewall's monitor tab to note the failed traffic:

The screenshot shows the Palo Alto Networks Firewall's "Logs" section. A search filter "(port.dst eq 22)" is applied. The log table displays five entries, all showing failed attempts (denied) from the web server to the database server:

	Receive Time	Type	From Zone	To Zone	Source	Source User	Destination	To Port	Application	Action	Rule	Session End Reason	Bytes
1	01/30 23:36:23	drop	Trust	Trust	10.5.3.5		10.5.4.5	22	not-applicable	deny	Log default deny	policy-deny	74
2	01/30 23:36:22	drop	Trust	Trust	10.5.3.5		10.5.4.5	22	not-applicable	deny	Log default deny	policy-deny	74
3	01/30 23:34:07	drop	Untrust	Untrust	10.5.5.4		10.5.1.4	22	not-applicable	deny	Log default deny	policy-deny	54
4	01/30 23:20:13	drop	Untrust	Untrust	10.5.5.4		10.5.1.4	22	not-applicable	deny	Log default deny	policy-deny	54
5	01/30 22:58:14	drop	Untrust	Untrust	10.5.5.4		10.5.1.4	22	not-applicable	deny	Log default deny	policy-deny	54

Task 2 – Trigger the SQL brute force attack and review logs

On the firewall's security policies tab, under Security, Rule 6, you will notice that the web to db traffic is protected further by a vulnerability profile:

	Name	Tags	Type	Zone	Address	User	HTTP Profile	Zone	Address	Application	Service	Action	Profile	Options
1	SSH inbound	none	universal	Untrust	any	any	any	Trust	any	ping	application-d...	Allow	none	
2	SSH 22-222 Inbound	none	universal	Untrust	any	any	any	Trust	any	ssh	service-tcp-...	Allow	none	
3	Allow all ping	none	universal	any	any	any	any	any	any	ping	application-d...	Allow	none	
4	Web browsing	none	universal	Untrust	any	any	any	Trust	any	http	service-tcp-...	Allow	none	
5	Allow all outbound	none	universal	Trust	any	any	any	Untrust	any	db-object	application-d...	Allow	none	
6	Web to DB	none	universal	any	any	any	any	any	any	mysql	application-d...	Allow	none	
7	Log default deny	none	universal	any	any	any	any	any	any	any	any	Deny	none	
8	Intrazone-default	none	intrazone	any	any	any	any	(intrazone)	any	any	any	Allow	none	none
9	Interzone-default	none	interzone	any	any	any	any	any	any	any	any	Deny	none	none

Now click on the icon in the Profile column and you will see all the threat protection profiles

Profile Type	Profiles
Antivirus	None
Vulnerability Protection	Test Drive
Anti-Spyware	None
URL Filtering	None
File Blocking	None
Data Filtering	None
WildFire Analysis	None

Note the Vulnerability Protection profile. This is a custom profile created just for this lab. It is part of the default vulnerability protection profile but is called out separately for the purpose of this demo environment.

Let's finally trigger the attack. Head back to the sql-attack.html page at (<http://WebserverURL/sql-attack.html>)

Click on Launch Brute Force Attack to start a script that will generate multiple failed MySQL authentication attempts.

LAUNCH BRUTE FORCE SQL ROOT PASSWORD GUESSING

This will launch some scripted attacks on the SQL server and use the pre-configured threat protection to show and block those attacks on the VM-Series firewall. Now return to the firewall and click the Monitor tab and then click on Threats in the left-hand pane under Logs and notice the new vulnerability log message regarding the failed MySQL events:

The screenshot shows the Palo Alto Networks Firewall's "Logs" section under the "Monitor" tab. A single log entry is displayed in the main pane:

Receive Time	Type	Name	From Zone	To Zone	Attacker	Attacker Name	Victim	To Port	Application	Action	Severity	URL
01/30 23:40:42	vulnerability	MySQL Login Authentication Failed	Trust	Trust	10.5.3.5		10.5.4.5	3306	mysql	reset-client	informational	

The log entry details a failed MySQL login attempt from an attacker at 10.5.3.5 to a victim at 10.5.4.5 on port 3306, which was reset by the firewall.

The CGI script you launched above attempted to login to the MySQL database multiple times with an incorrect password. The VM-Series firewall saw this activity and using the vulnerability profile, reset the connection and logged the activity.

7. Cleanup

If done, delete the resource group in order to cleanup and remove all the resources created.

The screenshot shows the Azure portal's "Resource Groups" blade. A red box highlights the "Delete" button in the top toolbar. A red arrow points from this button to a confirmation dialog box on the right. The dialog box contains the following text:

Are you sure you want to delete "two-tier-resource-grp"?

Warning! Deleting the "two-tier-resource-grp" resource group is irreversible. The action you're about to take can't be undone. Going further will delete this resource group and all the resources in it permanently.

TYPE THE RESOURCE GROUP NAME: two-tier-resource-grp

Affected resources: There are 18 resources in this resource group that will be deleted.

NAME	KIND	LOCATION	TYPE
database-vm	Virtual machine	West US	Virtual machine
db-vm	Microsoft.Compute/virtualmachines	West US	Virtual machine
pan-fw	Virtual machine	West US	Virtual machine
webserver-vm	Virtual machine	West US	Virtual machine
web-vm	Microsoft.Compute/virtualmachines	West US	Virtual machine
fwPublicIP	Public IP address	West US	Public IP address
fwVNETcz4	Network interface card	West US	Network interface card
pan-fw	Network interface card	West US	Network interface card
storageaccz4	Storage account	West US	Storage account
Trust-to-intranetwork	Route table	West US	Route table
Webeth0	Network interface card	West US	Network interface card
WebPublicIP	Public IP address	West US	Public IP address
webserver-vm	Virtual machine	West US	Virtual machine
Web-to-FW	Route table	West US	Route table

At the bottom of the dialog box, there are "Delete" and "Cancel" buttons, with "Delete" highlighted by a red box.