CLOUD SECURITY FUNDAMENTALS V2

Lab 3: Container Network and Security

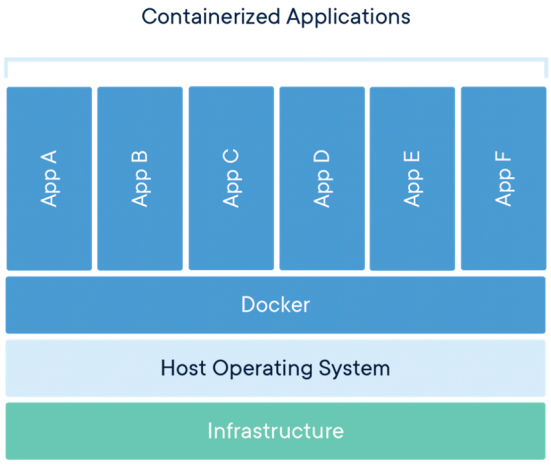
Document Version: 2022-12-22

Contents

Introduction 3
Objective 3
Lab Topology 4
Lab Settings 5
1 Protecting Sensitive Data 6
1.0 Load Lab Configuration 6
1.1 Create a Docker Container Network 11
1.2 Pull a Container Image and Run a Docker Container 15
1.3 Map the Host Port to the Running Web Container and Access the Container using the Web Browser 21

Introduction

In this lab, you will use a Docker Container for Network Security.

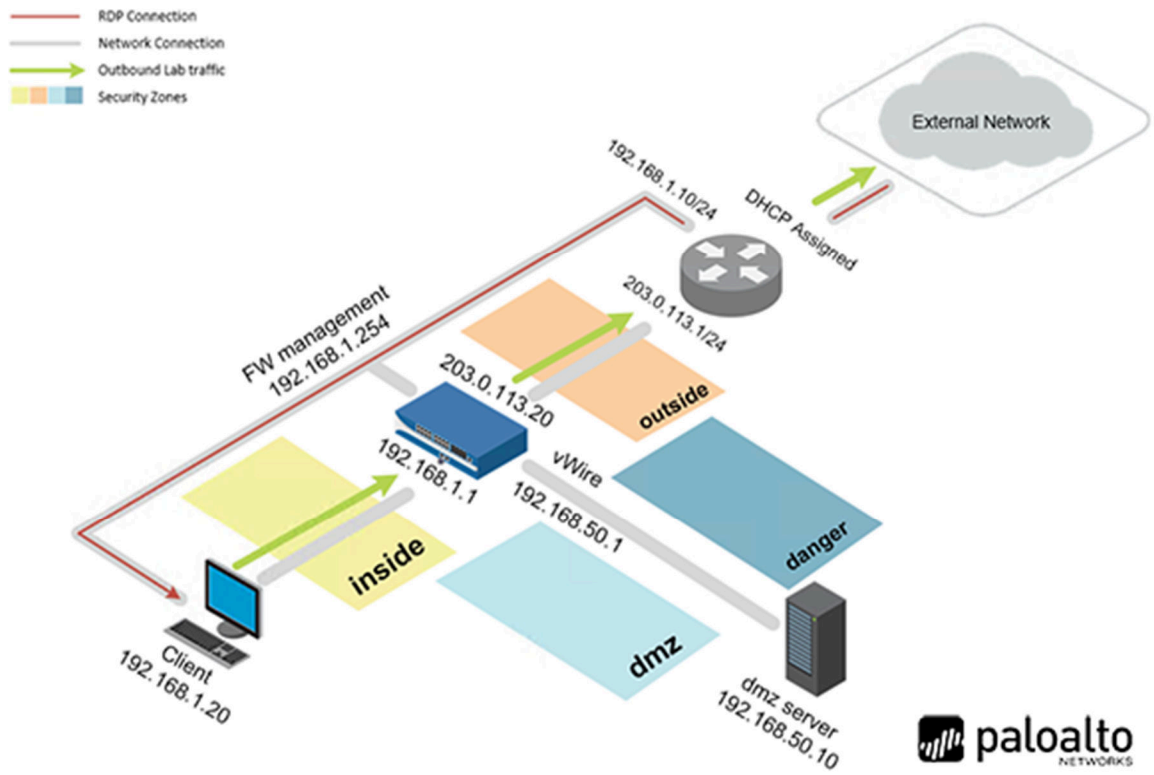


Objective

In this lab, you will perform the following tasks:

- Create a Docker bridge network
- Pull Container images from Docker public repository
- Run containers in detached and interactive mode on created Docker bridge network
- Test container network connectivity
- Run Web nginx Docker container in detached mode and assign host ports to the container
- Test container Web application

Lab Topology



Lab Settings

The information in the table below will be needed in order to complete the lab. The task sections below provide details on the use of this information.

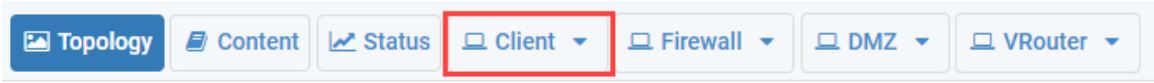
Virtual Machine	IP Address	Account (if needed)	Password (if needed)
Client	192.168.1.20	`lab-user`	`Pal0Alt0!`
DMZ	192.168.50.10	`root`	`Pal0Alt0!`
Firewall	192.168.1.254	`admin`	`Pal0Alt0!`

1 Protecting Sensitive Data

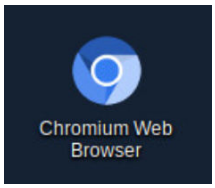
1.0 Load Lab Configuration

In this section, you will load the Firewall configuration file.

1. Click on the **Client** tab to access the Client PC.

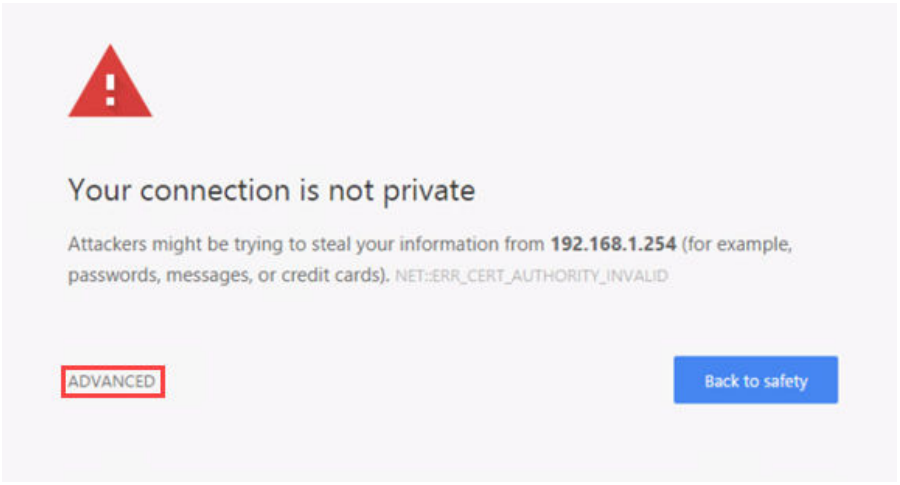


2. Log in to the Client PC as username `lab-user`, password `Pal0Alt0!`.
3. Double-click the **Chromium Web Browser** icon located on the Desktop.



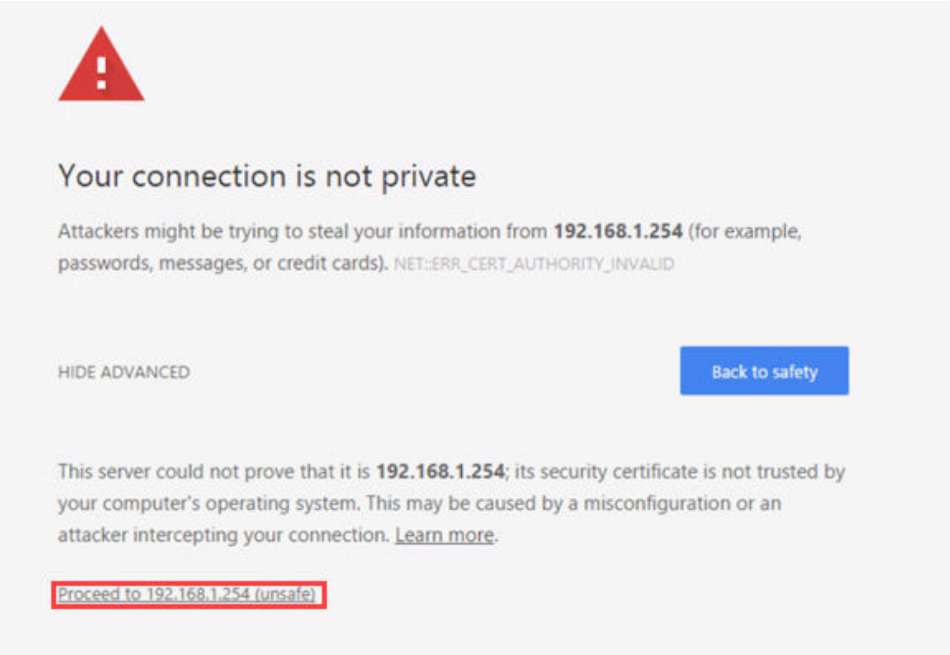
4. In the *Chromium* address field, type `https://192.168.1.254` and press **Enter**.

5. You will see a "*Your connection is not private*" message. Click on the **ADVANCED** link.



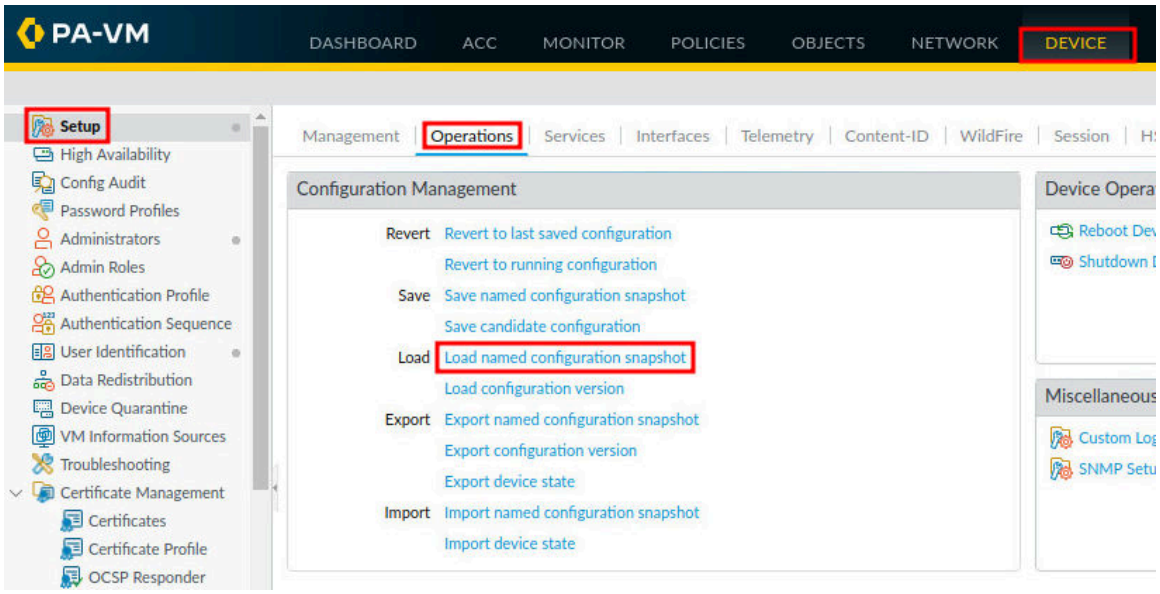
If you experience the "Unable to connect" or "502 Bad Gateway" message while attempting to connect to the specified IP above, please wait an additional 1-3 minutes for the Firewall to fully initialize. Refresh the page to continue.

6. Click on **Proceed to 192.168.1.254 (unsafe)**.

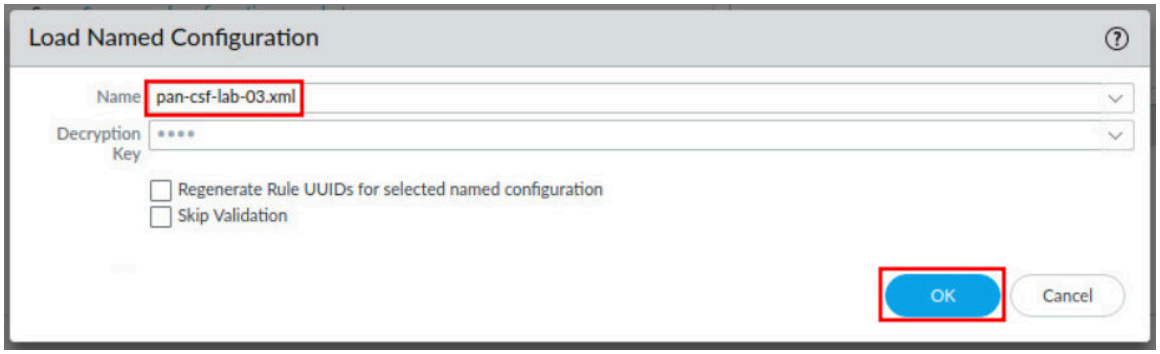


7. Log in to the Firewall web interface as username `admin`, password `Pal0Alt0!.`

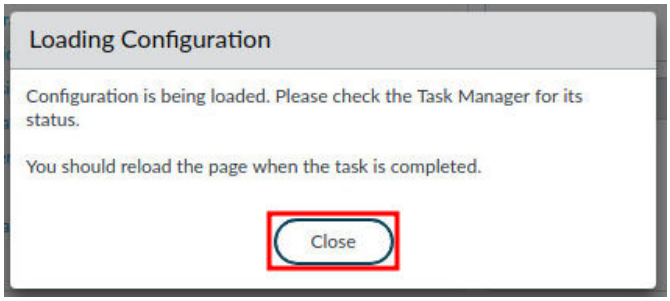
8. In the web interface, navigate to **Device > Setup > Operations** and click on **Load named configuration snapshot** underneath the *Configuration Management* section.



9. In the *Load Named Configuration* window, select **pan-csf-lab-03.xml** from the *Name* dropdown box and click **OK**.

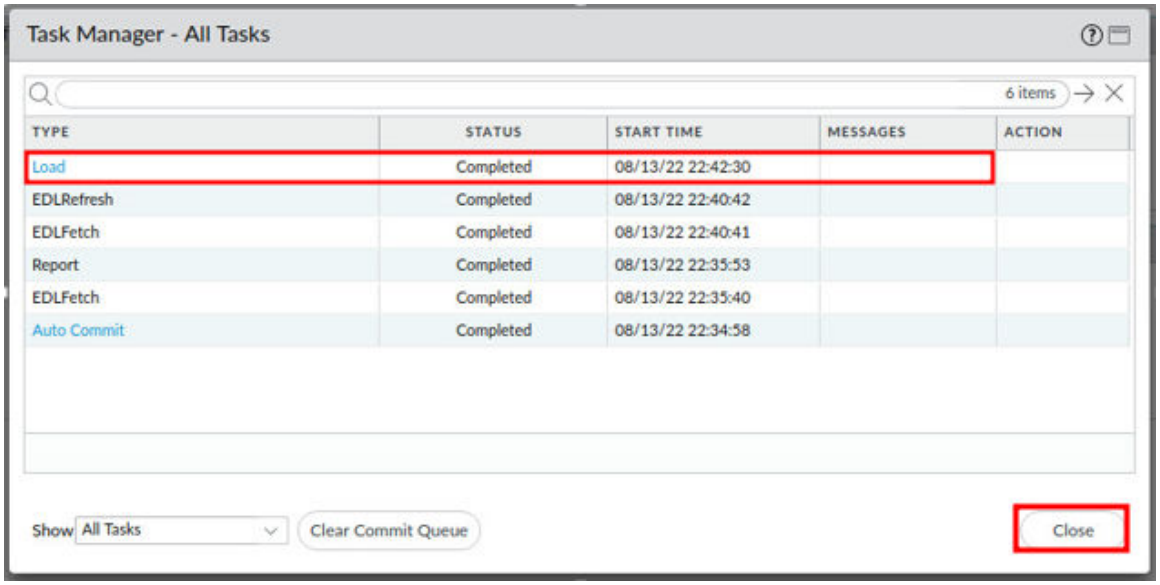


10. In the Loading Configuration window, a message will show *Configuration is being loaded. Please check the Task Manager for its status. You should reload the page when the task is completed.* Click **Close** to continue.

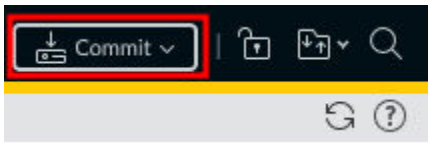


11. Click the **Tasks** icon located at the bottom-right of the web interface.

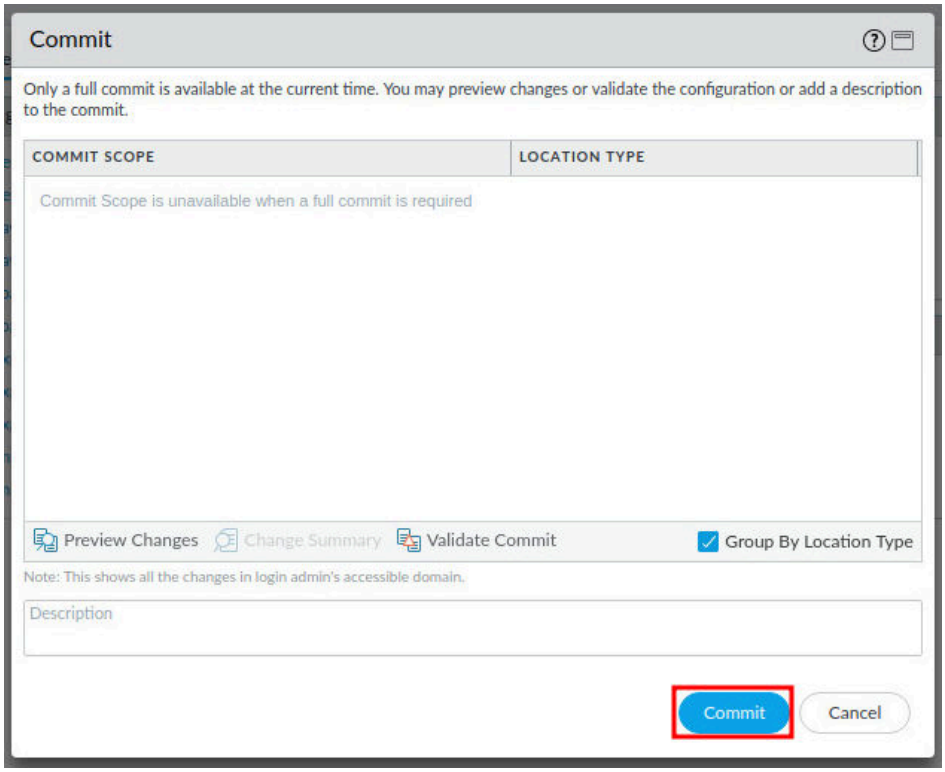
12. In the *Task Manager – All Tasks* window, verify the *Load* type has successfully completed. Click **Close.**



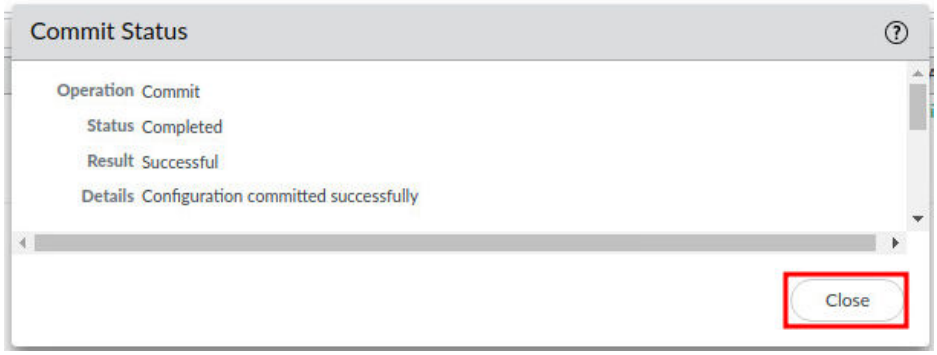
13. Click the **Commit** link located at the top-right of the web interface.



14. In the *Commit* window, click **Commit** to proceed with committing the changes.



15. When the commit operation successfully completes, click **Close** to continue.



The commit process takes changes made to the Firewall and copies them to the running configuration, which will activate all configuration changes since the last commit.

1.1 Create a Docker Container Network

In this section, you will create a docker container network. Docker provides two network drivers, bridge and overlay. Once the Docker Container network has been installed, it will include three networks.

1. Launch **Xfce** Terminal in the lower-left of the student *Desktop*.

2. SSH to the *DMZ* by typing the command below. Use `Pal0Alt0!` for the password. If prompted, enter `yes` to continue connecting. Press **Enter**.

```
C:\home\lab-user> ssh root@192.168.50.10
```

3. Display the default docker daemon networks by typing the command below.

```
[root@pod-dmz ~]# docker network ls
```

The “bridge” is the default docker network that running containers will attach to if a network is not specified when running the container. The host network is the docker network that is attached to the host running the docker daemon.

4. Create a bridge network by typing the command below.

```
[root@pod-dmz ~]# docker network create --driver=bridge \
 --subnet=172.16.3.0/24 csf-br0
```

```
[root@pod-dmz ~]# docker network create --driver=bridge --subnet=172.16.3.0/24 csf-br0
b3bec780149f9c371e2cff4e7b902cd850336874f9d9f070cabe88c256a5fbaa
[root@pod-dmz ~]#
```

The command above is a single line of code that is too long to display, so it is "split" into multiple lines by using the "\" followed by pressing the Enter key. This will proceed to the next line allowing you to type the remaining command.

5. Confirm the newly created bridge network has been created by typing the command below.

```
[root@pod-dmz ~]# docker network ls
```

```
[root@pod-dmz ~]# docker network ls
NETWORK ID          NAME                DRIVER              SCOPE
7b784bc3206f        bridge              bridge              local
4ffda97343ab        host                host                local
709d1e0f4031        none                null                local
[root@pod-dmz ~]# docker network create --driver=bridge --subnet=172.16.3.0/24 csf-br0
b3bec780149f9c371e2cff4e7b902cd850336874f9d9f070cabe88c256a5fbaa
[root@pod-dmz ~]# docker network ls
NETWORK ID          NAME                DRIVER              SCOPE
7b784bc3206f        bridge              bridge              local
b3bec780149f        csf-br0             bridge              local
4ffda97343ab        host                host                local
709d1e0f4031        none                null                local
[root@pod-dmz ~]#
```

Default docker networks

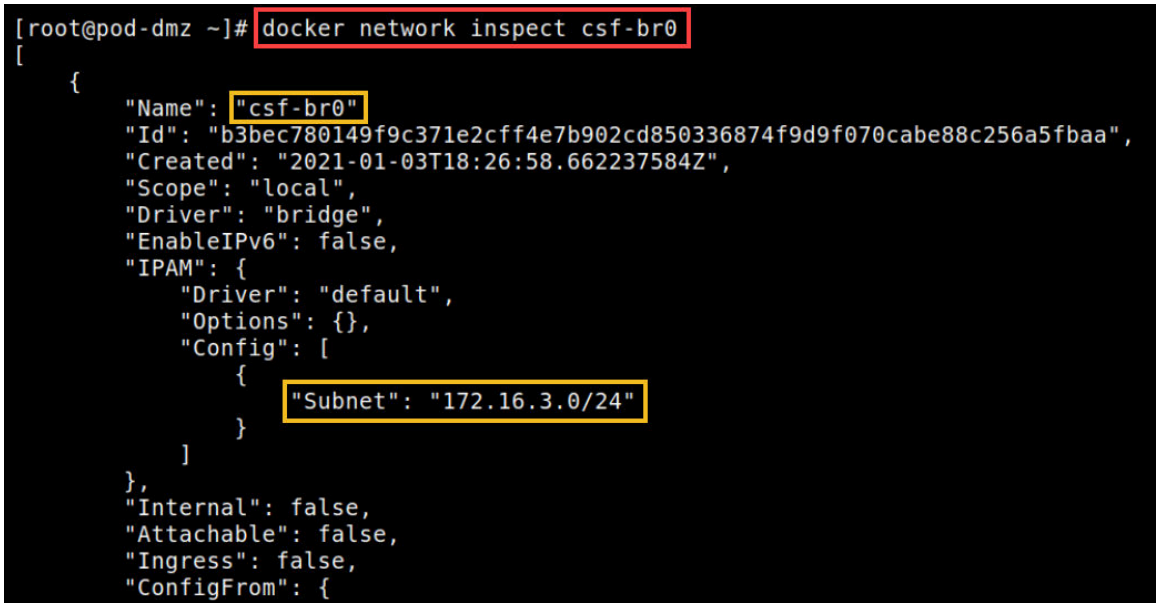
Newly created bridge network

Please Note

As you can see from the CLI output, you have created a docker bridge network named csf-br0. You will use this network to attach your running containers.

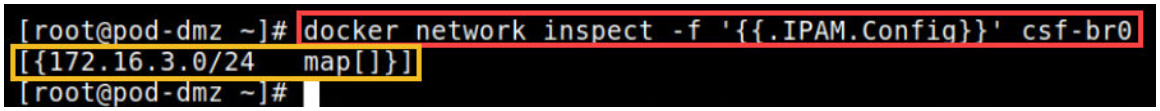
6. View the details about the **csf-br0** network by typing the command below. The CLI output will be in json file format, and you will be able to view all the details about the bridge network to include its assigned subnet.

```
[root@pod-dmz ~]# docker network inspect csf-br0
```

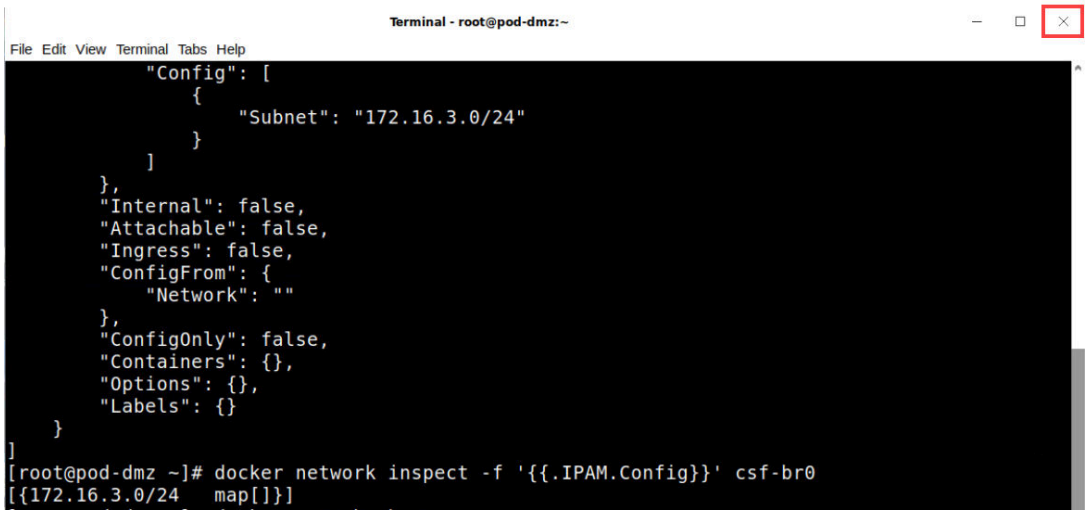


7. Parse the json file to describe your bridge network and display its subnet address by typing the command below.

```
[root@pod-dmz ~]# docker network inspect -f '{{.IPAM.Config}}' csf-br0
```



8. Close the *Terminal* window.



9. If a *Warning* window appears, click **Close Window**. Continue to the next task.

1.2 Pull a Container Image and Run a Docker Container

In this section, you will pull a container image from the docker public repository and run a docker container.

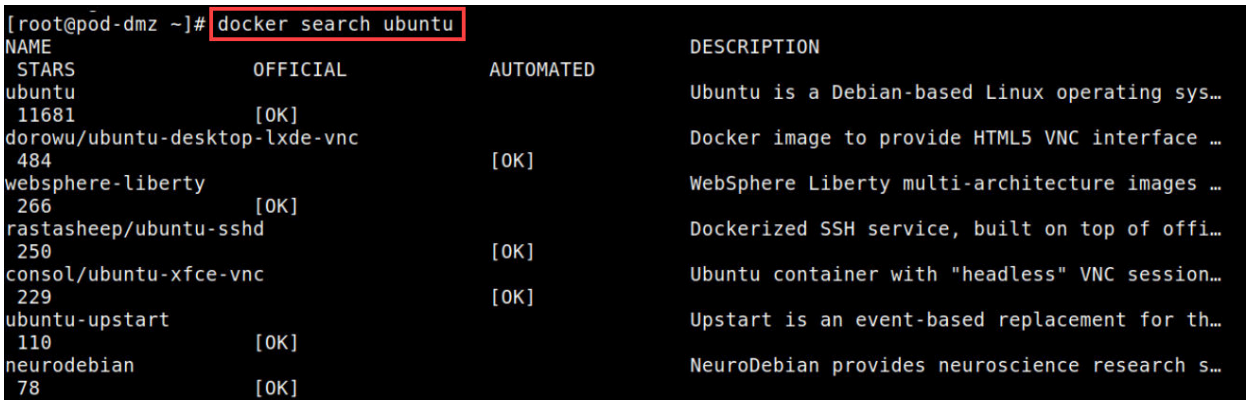
1. Launch **Xfce** Terminal in the lower-left of the student *Desktop.*

2. SSH to the *DMZ* by typing the command below. Use `Pal0Alt0!` for the password. If prompted, enter `yes` to continue connecting. Press **Enter.**

```
C:\home\lab-user> ssh root@192.168.50.10
```

3. In the Terminal window, display the ubuntu container images by typing the command below.

```
[root@pod-dmz ~]# docker search ubuntu
```



4. Pull the 20.04 "Focal Fossa" container image of ubuntu from the docker public repository by typing the command below.

```
[root@pod-dmz ~]# docker image pull ubuntu:focal
```

```
[root@pod-dmz ~]# docker image pull ubuntu:focal
focal: Pulling from library/ubuntu
3b65ec22a9e9: Pull complete
Digest: sha256:af5efa9c28de78b754777af9b4d850112cad01899a5d37d2617bb94dc63a49aa
Status: Downloaded newer image for ubuntu:focal
docker.io/library/ubuntu:focal
[root@pod-dmz ~]#
```

5. Display all the docker images stored on the DMZ by typing the command below.

```
[root@pod-dmz ~]# docker image ls
```

```
[root@pod-dmz ~]# docker image ls
REPOSITORY                  TAG                 IMAGE ID            CREATED             SIZE
ubuntu                      focal               3bc6e9f30f51        3 weeks ago         72.8MB
icarossio/metasploitable2   latest              7a129e1a0be3        2 years ago         1.51GB
vulnerables/web-dvwa        latest              ab0d83586b6e        3 years ago         712MB
[root@pod-dmz ~]#
```

6. Run the docker container named **csf-ubuntu1** by typing the command below. This command will also attach the container to the **csf-br0** network.

```
[root@pod-dmz ~]# docker run -i -d --name csf-ubuntu1 --network=csf-br0 \
 ubuntu:focal
```

```
[root@pod-dmz ~]# docker run -i -d --name csf-ubuntu1 --network=csf-br0 \
> ubuntu:focal
5aff54739090b4aa45254e72ea751ee4bb920fe8778264c4ded5402a4866226c
[root@pod-dmz ~]#
```

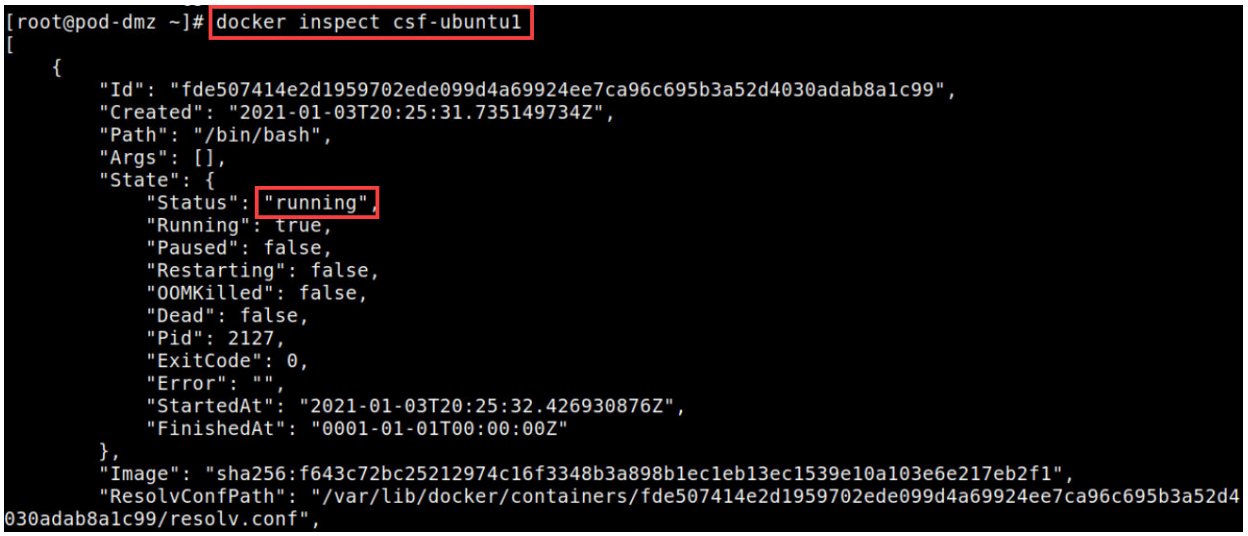
7. View the running containers by typing the command below.

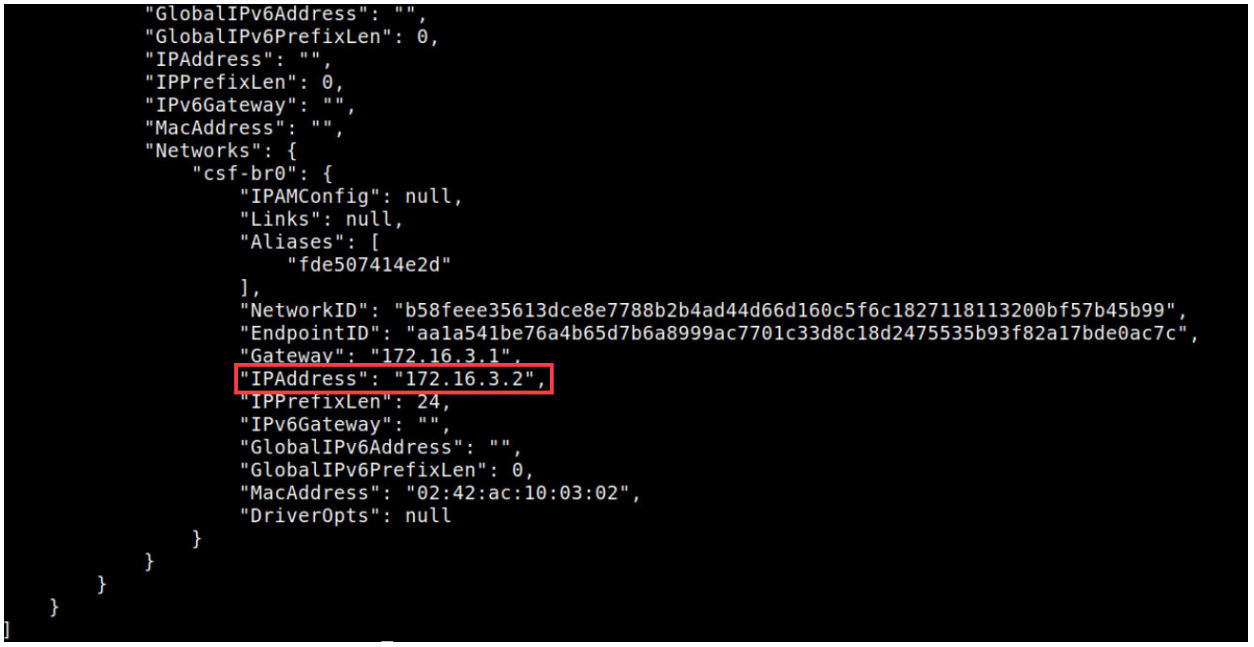
```
[root@pod-dmz ~]# docker ps -a
```

```
[root@pod-dmz ~]# docker ps -a
CONTAINER ID        IMAGE               COMMAND             CREATED
STATUS              PORTS               NAMES
a6beb7299947        ubuntu:focal        "bash"              11 seconds ago
Up 9 seconds                            csf-ubuntu1
[root@pod-dmz ~]#
```


8. View the details of the running container in json format by typing the command below. Record the IP Address of **172.16.3.2** as you will need this in a later step.

```
[root@pod-dmz ~]# docker inspect csf-ubuntu1
```





9. Parse the json file with just the containers IP Address by typing the command below.

```
[root@pod-dmz ~]# docker inspect \
 --format='{{range.NetworkSettings.Networks}}{{.IPAddress}}{{end}}' \
 csf-ubuntu1
```

```
[root@pod-dmz ~]# docker inspect \
> --format='{{range.NetworkSettings.Networks}}{{.IPAddress}}{{end}}' \
> csf-ubuntu1
172.16.3.2
[root@pod-dmz ~]#
```

10. Run another container called **cfs-ubuntu2** and attach the container to the **csf-br0** network bridge by typing the command below.

```
[root@pod-dmz ~]# docker run -i -d --name csf-ubuntu2 --network=csf-br0 \
 ubuntu:focal
```

```
[root@pod-dmz ~]# docker run -i -d --name csf-ubuntu2 --network=csf-br0 \
> ubuntu:focal
44ffcd5293a160b33f449368017017c01a71003e1246881f723693d2ae6b464d
[root@pod-dmz ~]#
```

11. Interact with the docker container bash shell to run commands by typing the command below.

```
[root@pod-dmz ~]# docker exec -it csf-ubuntu2 /bin/bash
```

```
[root@pod-dmz ~]# docker exec -it csf-ubuntu2 /bin/bash
root@27b737a1a215:/#
```

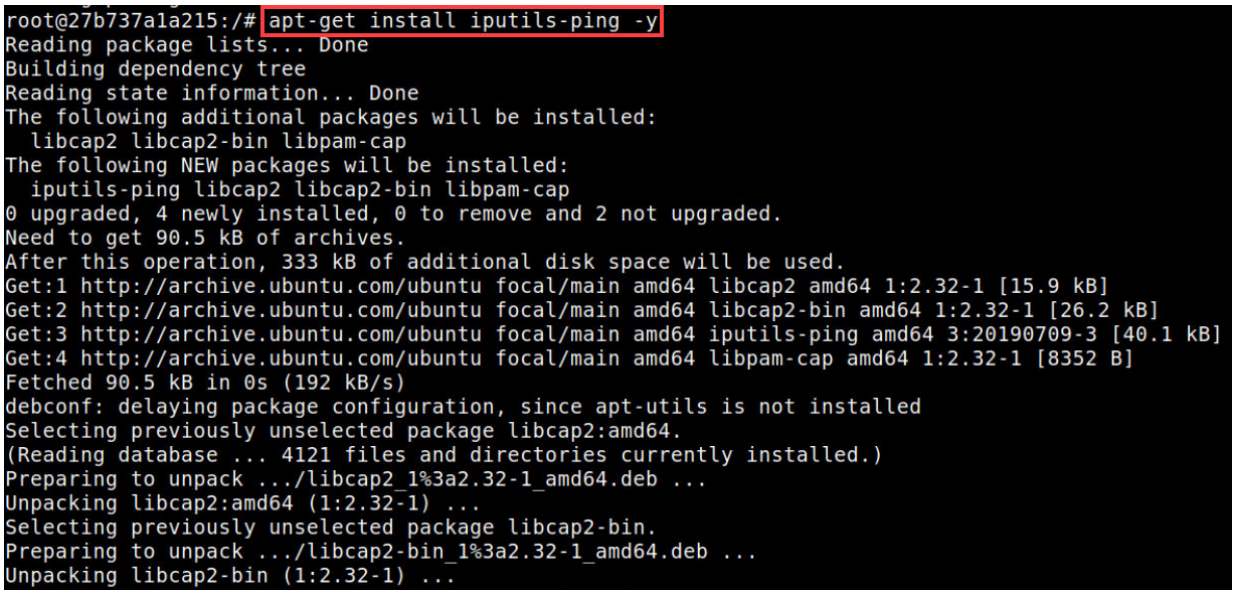
12. After the container's bash shell appears, type the command below to update the container repository to the newest version of packages and their dependencies.

```
root@27b737a1a215:/# apt-get update
```

```
root@27b737a1a215:/# apt-get update
Get:1 http://security.ubuntu.com/ubuntu focal-security InRelease [109 kB]
Get:2 http://archive.ubuntu.com/ubuntu focal InRelease [265 kB]
Get:3 http://archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security/restricted amd64 Packages [103 kB]
Get:5 http://archive.ubuntu.com/ubuntu focal-backports InRelease [101 kB]
Get:6 http://security.ubuntu.com/ubuntu focal-security/multiverse amd64 Packages [1167 B]
Get:7 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [495 kB]
Get:8 http://archive.ubuntu.com/ubuntu focal/multiverse amd64 Packages [177 kB]
Get:9 http://archive.ubuntu.com/ubuntu focal/restricted amd64 Packages [33.4 kB]
Get:10 http://archive.ubuntu.com/ubuntu focal/main amd64 Packages [1275 kB]
Get:11 http://security.ubuntu.com/ubuntu focal-security/universe amd64 Packages [645 kB]
Get:12 http://archive.ubuntu.com/ubuntu focal/universe amd64 Packages [11.3 MB]
Get:13 http://archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 Packages [30.4 kB]
Get:14 http://archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [136 kB]
Get:15 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [885 kB]
Get:16 http://archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages [885 kB]
Get:17 http://archive.ubuntu.com/ubuntu focal-backports/universe amd64 Packages [4250 B]
Fetched 16.6 MB in 3s (6587 kB/s)
Reading package lists... Done
root@27b737a1a215:/#
```

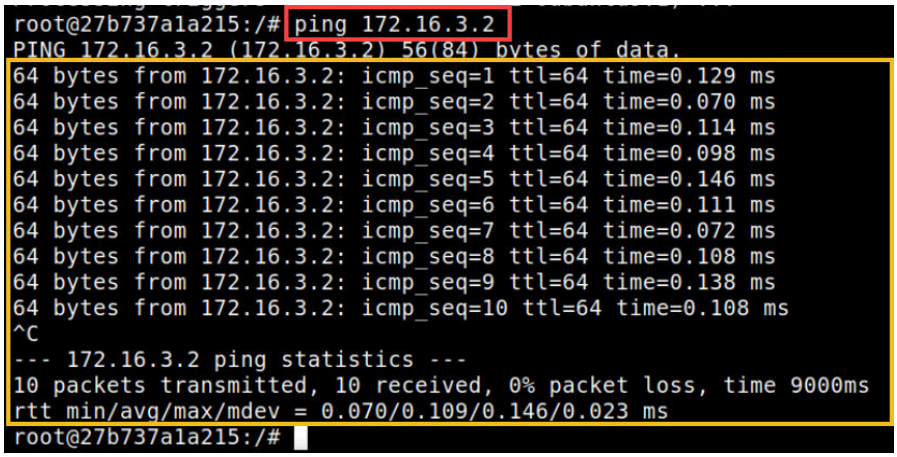

13. Install the ping utility by typing the command below.

```
root@27b737a1a215:/# apt-get install iputils-ping -y
```

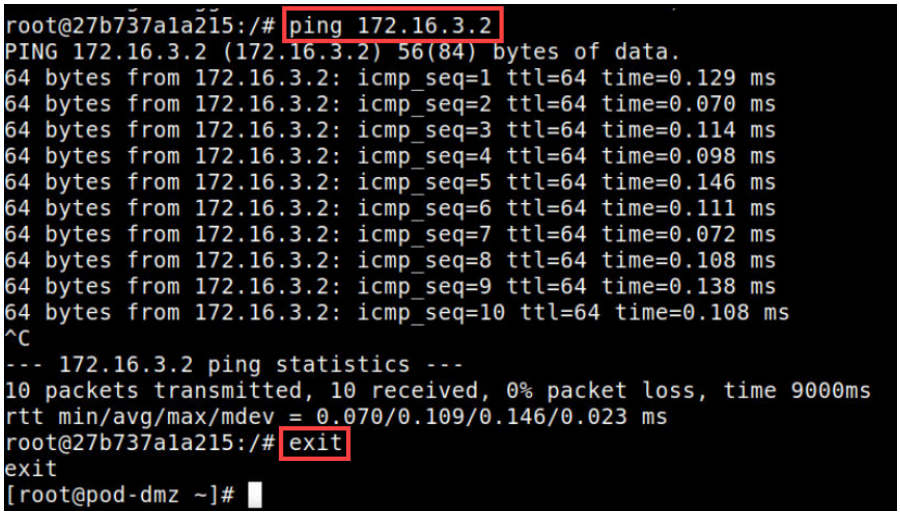


14. Ping the newly created container by typing the command below. Notice the pings are successful.

```
root@27b737a1a215:/# ping 172.16.3.2
```



15. Enter **Ctrl+C** to stop the pings and exit the container's bash shell. Type **Exit** to return to the **DMZ** server's bash shell.



16. Close the Terminal window and continue to the next task. If a *Warning* window appears, click **Close Window.**

1.3 Map the Host Port to the Running Web Container and Access the Container using the Web Browser.

In this section, you will map the host port and run the container in detached mode. Mapping the host port will allow access to the container's nginx default web page using your client's browser.

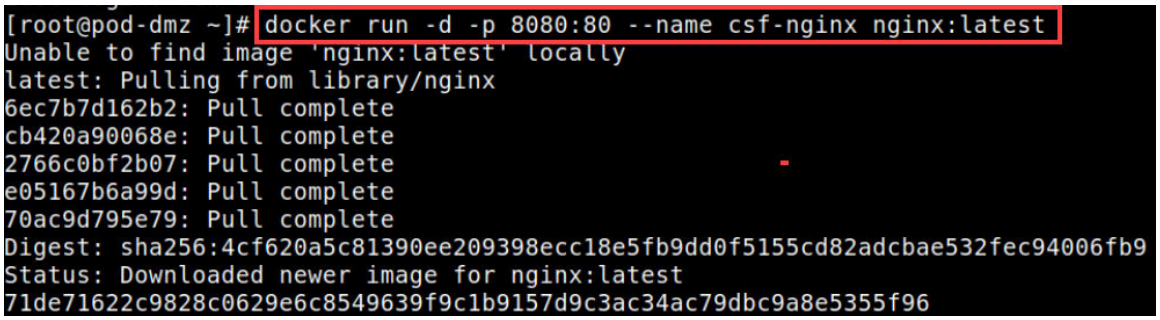
1. Launch **Xfce** Terminal in the lower-left of the student Desktop.

2. SSH to the *DMZ* by typing the command below. Use `Pal0Alt0!` for the password. If prompted, enter `yes` to continue connecting. Press **Enter**.

```
C:\home\lab-user> ssh root@192.168.50.10
```

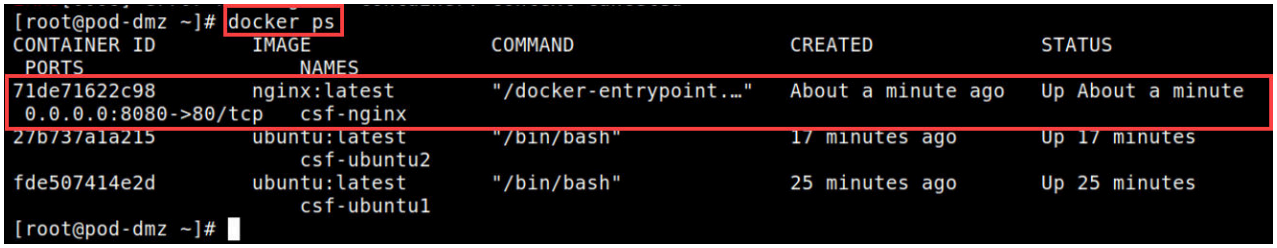
3. Pull the nginx:latest container image and run the container in detached mode and then use this image to run a container in detached mode. The command will map the host port 8080 to your container's port 80. Type the command below.

```
[root@pod-dmz ~]# docker run -d -p 8080:80 --name csf-nginx nginx:latest
```

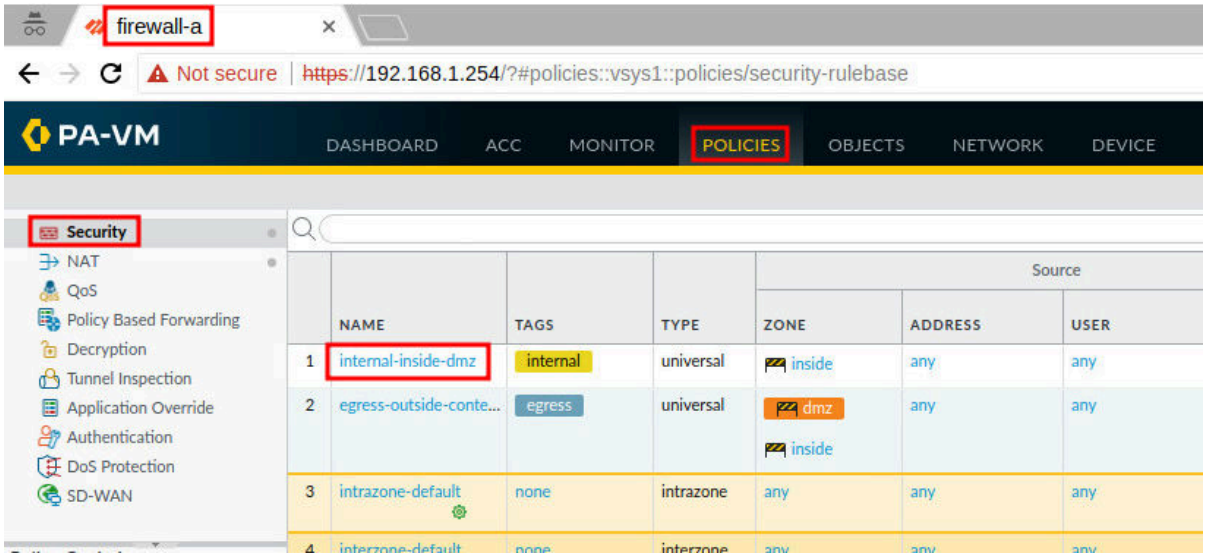


4. View your newly created nginx container by typing the command below.

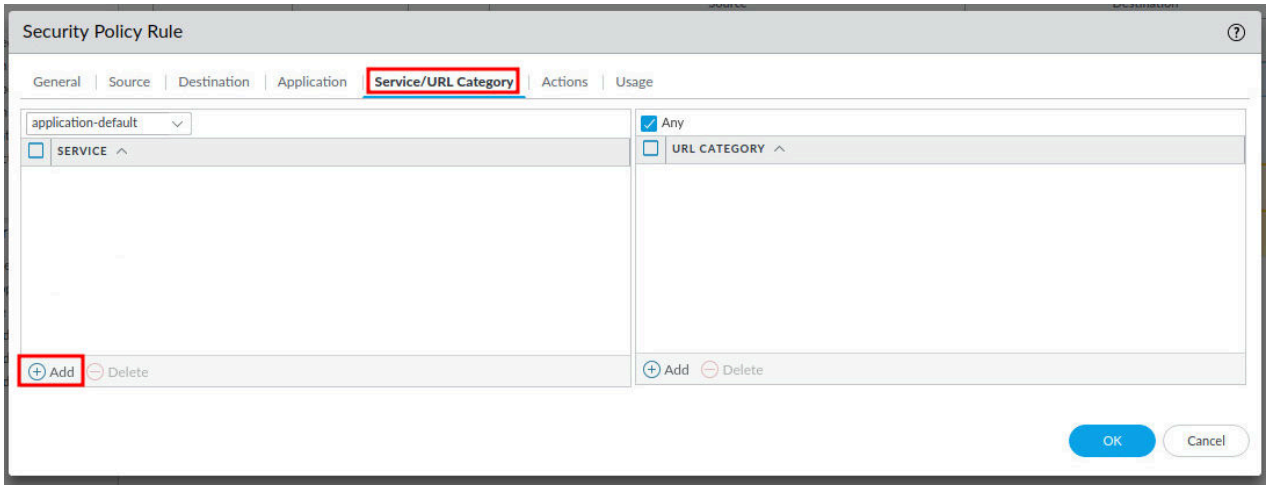
```
[root@pod-dmz ~]# docker ps
```



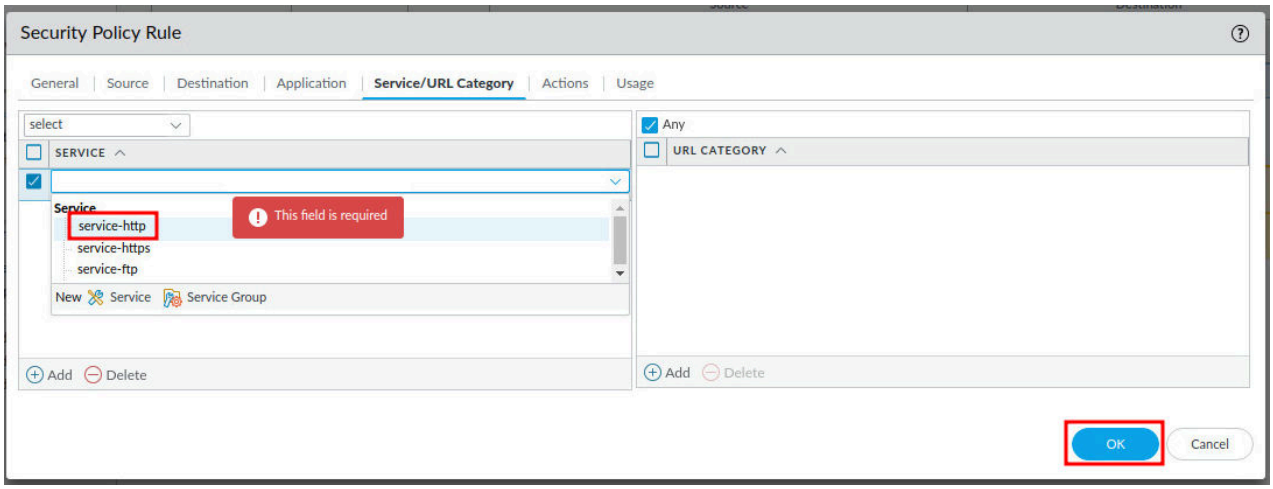
5. Ensure that you are in the *firewall-a* interface. Navigate to **Polices > Security**. Click the **internal-inside-dmz** security policy.

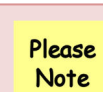


6. In the *Security Policy Rule* window, select **Service/URL Category**. Click **Add** in the *Service* pane.



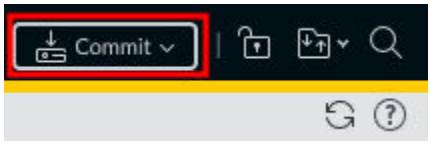
7. In the dropdown menu, select **service-http** and click **OK**.



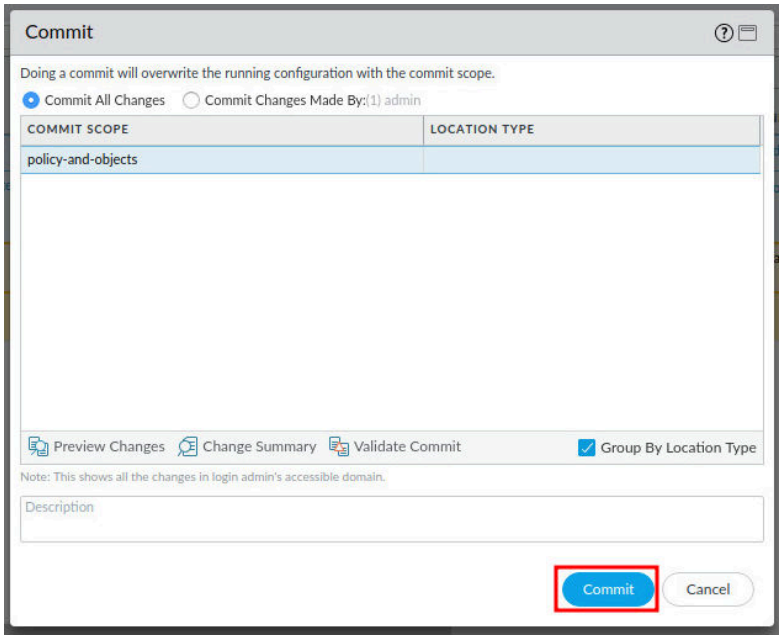


Because you are doing this over port 80, you will change it to port 8080 / service-http so it will not be blocked.

8. Click the **Commit** link located at the top-right of the web interface.



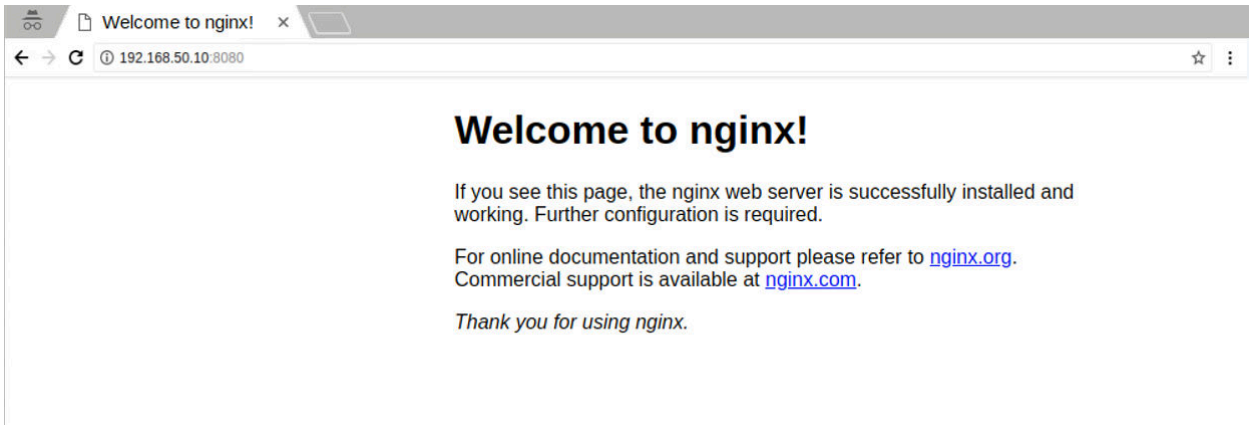
9. In the *Commit* window, click **Commit** to proceed with committing the changes.



10. When the commit operation successfully completes, click **Close** to continue.

11. Launch a new *Chromium Web Browser* by clicking the **Chromium** icon on the lower-left of the student *Desktop.*

12. Access the *nginx* container's default web page by typing the `http://192.168.50.10:8080` in the *Chromium* browser address bar.



13. The lab is now complete; you may end your reservation.

