

# **Network Raptors**

## **1. Objective:**

To integrate openvSwitch into docker for communication between multiple containers.

## **2. Technologies:**

Dockers  
OpenDaylight  
OpenvSwitch  
WireShark

### **Why Docker?**

To make it easier to create, deploy, and run applications by using containers that allow a developer to package up an application with all of the parts it needs, such as libraries and other dependencies, and ship it all out as one package.

### **OpenDayLight**

OpenDaylight (ODL) is a modular open platform for customizing and automating networks of any size and scale. In this project, we are going to launch OpenDaylight from Docker.

### **OpenvSwitch**

Open vSwitch is an open-source implementation of a distributed virtual multilayer switch. In this project we are going to implement “Multi-Host Overlay Networking with Open vSwitch using dockers”.

### **WireShark**

Wireshark is a free and open-source packet analyzer. It is used for network troubleshooting, analysis, software and communications protocol development, and education. In this project we are implementing WireShark via docker for analyzing packets.

## **3. Implementation:**

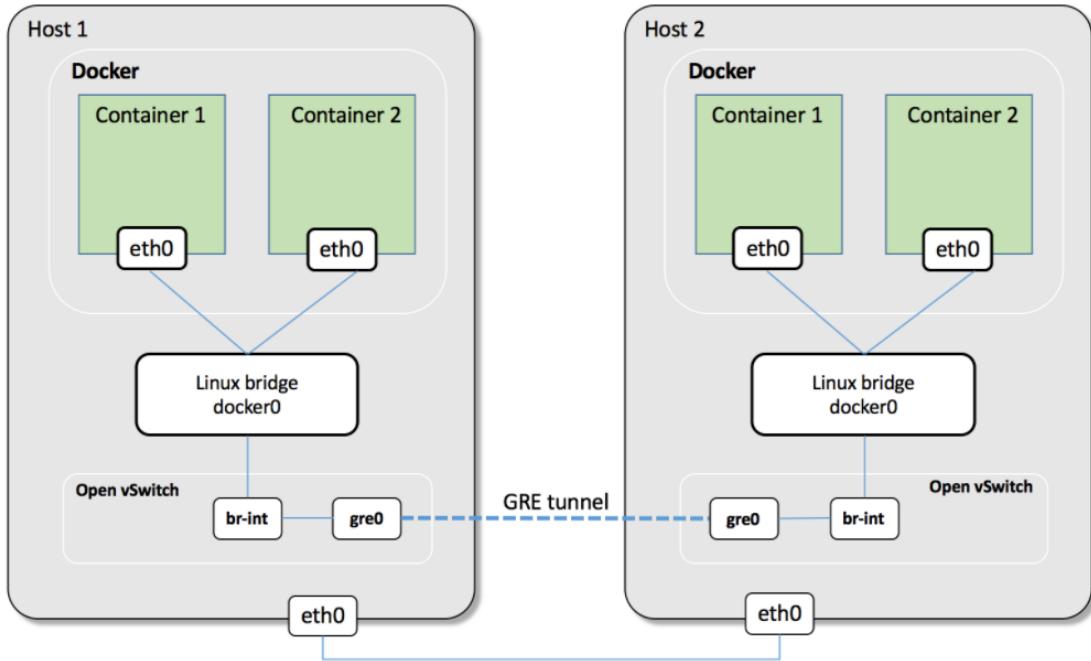
### **a. Docker networking with openvSwitch**

Containers in different hosts (Two Ubuntu Nodes) can communicate with each other by exchanging packets of information. There are two ways to connect containers with open vSwitch.

- a. connect default docker0 with ovs bridge
- b. connect container with ovs bridge directly through veth pair.

We chose the second way, because it's bit complicated as we will need to do more work to connect containers with ovs and it helps us to get a better understanding of the concepts.

## Topology:



## Installation of Docker

## OpenvSwitch Set UP

## Launching Opendaylight via Docker

## Wireshark via Docker for analyzing packets

### Step 1: Connect containers with docker0 bridge

```
gokul@gokul-VirtualBox:~$ sudo /usr/bin/ovs-vsctl add-br br0
[sudo] password for gokul:
gokul@gokul-VirtualBox:~$ sudo /usr/bin/ovs-vsctl add-br br2
gokul@gokul-VirtualBox:~$ sudo /usr/bin/ovs-vsctl add-port br0 tep0 -- set interface tep0 type=internal
gokul@gokul-VirtualBox:~$ sudo /sbin/ifconfig tep0 192.168.0.113 netmask 255.255.255.0
gokul@gokul-VirtualBox:~$
```

```
gokul@gokul-VirtualBox:~$ sudo /usr/bin/ovs-vsctl add-br br0
[sudo] password for gokul:
gokul@gokul-VirtualBox:~$ sudo /usr/bin/ovs-vsctl add-br br2
gokul@gokul-VirtualBox:~$ sudo /usr/bin/ovs-vsctl add-port br0 tep0 -- set interface tep0 type=internal
gokul@gokul-VirtualBox:~$ sudo /sbin/ifconfig tep0 192.168.0.114 netmask 255.255.255.0
gokul@gokul-VirtualBox:~$ sudo /sbin/ifconfig tep0 192.168.200.22 netmask 255.255.255.0
```

### Step 2: OpenvSwitch configuration

#### Install OVS

```
$ sudo apt-get install -y openvswitch-switch openvswitch-common
```

### Host 1:

Create ovs bridge and veth pair and connect veth pair with docker0 and ovs bridge br-int

```
o-upgraded, 0 newly installed, 0 to remove and 119 not upgraded.
gokul@gokul-VirtualBox:~$ sudo ovs-vsctl add-br br-int
[sudo] password for gokul:
gokul@gokul-VirtualBox:~$ sudo ovs-vsctl show
969fad0d-3cd3-4a88-8f59-eb7a9d8dfea2
    Bridge "br0"
        Port "tep0"
            Interface "tep0"
                type: internal
        Port "br0"
            Interface "br0"
                type: internal
    Bridge br-int
        Port br-int
            Interface br-int
                type: internal
    Bridge "br2"
        Port "br2"
            Interface "br2"
                type: internal
        Port "gre0"
            Interface "gre0"
                type: gre
                options: {remote_ip="192.168.200.22"}
        ovs_version: "2.5.4"
gokul@gokul-VirtualBox:~$ sudo ip link add veth0 type veth peer name veth1
gokul@gokul-VirtualBox:~$
```

### Host 2:

Perform similar steps as in step1.

### Step 3: Gre tunnel between host1 and host2

The connection between ovs bridge and docker0 bridge

```
gokul@gokul-VirtualBox:~$ sudo /usr/bin/ovs-vsctl add-port br2 gre0 -- set interface gre0 type=gre options:remote_ip=192.168.200.22
[sudo] password for gokul:
gokul@gokul-VirtualBox:~$ sudo /usr/bin/ovs-vsctl add-port br2 gre0 -- set interface gre0 type=gre options:remote_ip=192.168.200.21
[sudo] password for gokul:
```

### Step 4: Check Tunnel connection

```
gokul@gokul-VirtualBox:~$ ping -c 4 192.168.0.113
PING 192.168.0.113 (192.168.0.113) 56(84) bytes of data.
64 bytes from 192.168.0.113: icmp_seq=1 ttl=64 time=0.343 ms
64 bytes from 192.168.0.113: icmp_seq=2 ttl=64 time=0.271 ms
64 bytes from 192.168.0.113: icmp_seq=3 ttl=64 time=0.289 ms
64 bytes from 192.168.0.113: icmp_seq=4 ttl=64 time=0.266 ms

--- 192.168.0.113 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3067ms
rtt min/avg/max/mdev = 0.266/0.292/0.343/0.032 ms
gokul@gokul-VirtualBox:~$ ping -c 4 192.168.0.114
PING 192.168.0.114 (192.168.0.114) 56(84) bytes of data.
64 bytes from 192.168.0.114: icmp_seq=1 ttl=64 time=0.286 ms
64 bytes from 192.168.0.114: icmp_seq=2 ttl=64 time=0.473 ms
64 bytes from 192.168.0.114: icmp_seq=3 ttl=64 time=0.290 ms
64 bytes from 192.168.0.114: icmp_seq=4 ttl=64 time=0.617 ms

--- 192.168.0.114 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3049ms
rtt min/avg/max/mdev = 0.286/0.416/0.617/0.139 ms
gokul@gokul-VirtualBox:~$
```

### b. Opendaylight on Docker:

1. Installation and configuration of docker.
2. Pull default image from public docker registry.
3. Run the docker image.
4. Start karaf console.
5. Install some features of opendaylight to test it.

#### **4. Challenges faced:**

1. Understanding networking in docker.
2. Installation of opendaylight on docker because of dependency and packages issues.
3. Configuring tunnel connection between two hosts.
4. If container/tunnel creation fails, have to delete the existing container/tunnel and create new tunnel.

#### **5. Conclusion**

1. With the increase in the requirements for a project, dockers will be of paramount important.
2. Based on the the requirements of the organization, we need to use the kind of technique.
3. In this project we tried to implement and launch SDN based controller, switches and analyzers using dockers.
4. Containerization using Dockers will be more useful in a practical team based environment.

#### **Team:**

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#### **Screenshots**

Ubuntu2 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Wed 01:38

ubuntu2@ubuntu2-VirtualBox:~

```
TX packets 244 bytes 18772 (18.7 KB)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

ubuntu2@ubuntu2-VirtualBox:~$ sudo docker run -d --name container1 centos:7 /bin/bash -c "while true; do sleep 3600; done"
[sudo] password for ubuntu2:
Unable to find image 'centos:7' locally
7: Pulling from library/centos
8ba884070f61: Pull complete
Digest: sha256:8d487d68857f5bc9595793279b33d082b03713341ddec91054382641d14db861
Status: Downloaded newer image for centos:7
4335ae5a8422f1e9da54c7f50d2c432e949e1375e367291056c1f626f11447e8
ubuntu2@ubuntu2-VirtualBox:~$ sudo docker run -d --name container2 centos:7 /bin/bash -c "while true; do sleep 3600; done"
aabf5e2cbd2f6fe13e83ebffa4b92742c58de839a4f32f1764138244e61c37a2
ubuntu2@ubuntu2-VirtualBox:~$ sudo docker inspect --format '{{.NetworkSettings.IPAddress}}' container1
172.17.0.2
ubuntu2@ubuntu2-VirtualBox:~$ sudo docker inspect --format '{{.NetworkSettings.IPAddress}}' container2
172.17.0.3
ubuntu2@ubuntu2-VirtualBox:~$ sudo docker stop container1
container1
ubuntu2@ubuntu2-VirtualBox:~$ sudo docker exec -it container2 bash
[root@aabf5e2cbd2f /]# ping 172.17.0.2
PING 172.17.0.2 (172.17.0.2) 56(84) bytes of data.
From 172.17.0.3 icmp_seq=1 Destination Host Unreachable
From 172.17.0.3 icmp_seq=2 Destination Host Unreachable
```

Ubuntu2 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal ▾ Wed 01:39

ubuntu2@ubuntu2-VirtualBox:~\$ sudo docker inspect --format '{{.NetworkSettings.IPAddress}}' container2  
172.17.0.3  
ubuntu2@ubuntu2-VirtualBox:~\$ sudo docker stop container1  
container1  
ubuntu2@ubuntu2-VirtualBox:~\$ sudo docker exec -it container2 bash  
[root@aabf5e2cbd2f /]# ping 172.17.0.2  
PING 172.17.0.2 (172.17.0.2) 56(84) bytes of data.  
From 172.17.0.3 icmp\_seq=1 Destination Host Unreachable  
From 172.17.0.3 icmp\_seq=2 Destination Host Unreachable  
From 172.17.0.3 icmp\_seq=3 Destination Host Unreachable  
From 172.17.0.3 icmp\_seq=4 Destination Host Unreachable  
From 172.17.0.3 icmp\_seq=5 Destination Host Unreachable  
From 172.17.0.3 icmp\_seq=6 Destination Host Unreachable  
From 172.17.0.3 icmp\_seq=7 Destination Host Unreachable  
From 172.17.0.3 icmp\_seq=8 Destination Host Unreachable  
From 172.17.0.3 icmp\_seq=9 Destination Host Unreachable  
^C  
--- 172.17.0.2 ping statistics ---  
10 packets transmitted, 0 received, +9 errors, 100% packet loss, time 9223ms  
pipe 4  
[root@aabf5e2cbd2f /]# ^C  
[root@aabf5e2cbd2f /]# exit  
exit  
ubuntu2@ubuntu2-VirtualBox:~\$ sudo apt-get install -y openvswitch-switch openvswitch-common  
Reading package lists... Done  
Building dependency tree

Ubuntu2 [Running] - Oracle VM VirtualBox

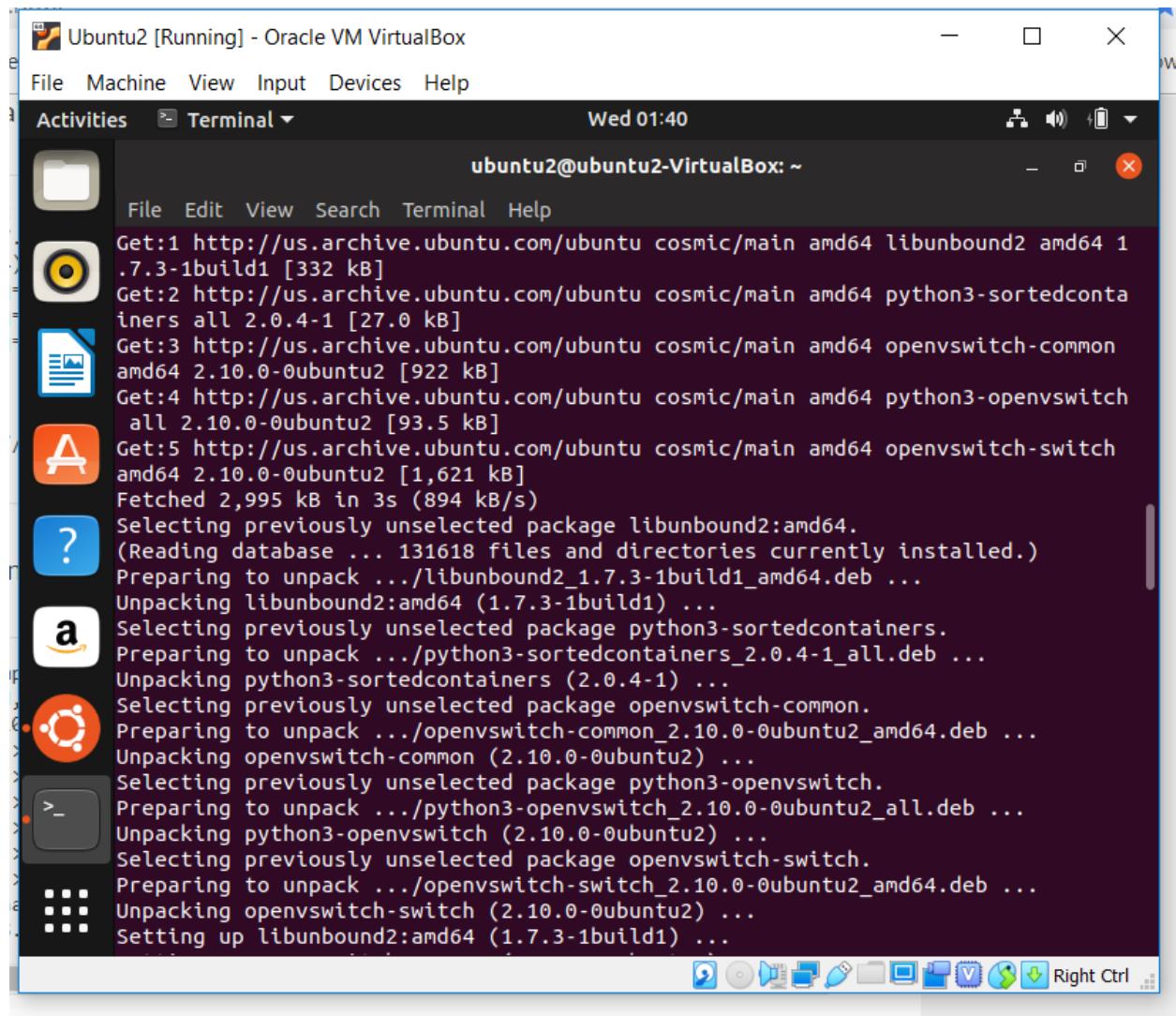
File Machine View Input Devices Help

Activities Terminal ▾ Wed 01:40

ubuntu2@ubuntu2-VirtualBox: ~

```
[root@aabf5e2cbd2f /]# ^C
[root@aabf5e2cbd2f /]# exit
ubuntu2@ubuntu2-VirtualBox:~$ sudo apt-get install -y openvswitch-switch openvswitch-common
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  libunbound2 python3-openvswitch python3-sortedcontainers
Suggested packages:
  ethtool openvswitch-doc python-sortedcontainers-doc
The following NEW packages will be installed:
  libunbound2 openvswitch-common openvswitch-switch python3-openvswitch
  python3-sortedcontainers
0 upgraded, 5 newly installed, 0 to remove and 293 not upgraded.
Need to get 2,995 kB of archives.
After this operation, 13.3 MB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 libunbound2 amd64 1
.7.3-1build1 [332 kB]
Get:2 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 python3-sortedconta
iners all 2.0.4-1 [27.0 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 openvswitch-common
amd64 2.10.0-0ubuntu2 [922 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 python3-openvswitch
all 2.10.0-0ubuntu2 [93.5 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 openvswitch-switch
amd64 2.10.0-0ubuntu2 [1,621 kB]
```

Right Ctrl



Ubuntu2 [Running] - Oracle VM VirtualBox

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Activities Terminal ▾

ubuntu2@ubuntu2-VirtualBox: ~

```
Selecting previously unselected package python3-sortedcontainers.
Preparing to unpack .../python3-sortedcontainers_2.0.4-1_all.deb ...
Unpacking python3-sortedcontainers (2.0.4-1) ...
Selecting previously unselected package openvswitch-common.
Preparing to unpack .../openvswitch-common_2.10.0-0ubuntu2_amd64.deb ...
Unpacking openvswitch-common (2.10.0-0ubuntu2) ...
Selecting previously unselected package python3-openvswitch.
Preparing to unpack .../python3-openvswitch_2.10.0-0ubuntu2_all.deb ...
Unpacking python3-openvswitch (2.10.0-0ubuntu2) ...
Selecting previously unselected package openvswitch-switch.
Preparing to unpack .../openvswitch-switch_2.10.0-0ubuntu2_amd64.deb ...
Unpacking openvswitch-switch (2.10.0-0ubuntu2) ...
Setting up libunbound2:amd64 (1.7.3-1build1) ...
Setting up openvswitch-common (2.10.0-0ubuntu2) ...
Setting up python3-sortedcontainers (2.0.4-1) ...
Processing triggers for libc-bin (2.28-0ubuntu1) ...
Processing triggers for systemd (239-7ubuntu10) ...
Processing triggers for man-db (2.8.4-2) ...
Setting up python3-openvswitch (2.10.0-0ubuntu2) ...
Setting up openvswitch-switch (2.10.0-0ubuntu2) ...
update-alternatives: using /usr/lib/openvswitch-switch/ovs-vswitchd to provide
/usr/sbin/ovs-vswitchd (ovs-vswitchd) in auto mode
Created symlink /etc/systemd/system/multi-user.target.wants/openvswitch-switch.
service → /lib/systemd/system/openvswitch-switch.service.
ovs-vswitchd.service is a disabled or a static unit, not starting it.
ovsdb-server.service is a disabled or a static unit, not starting it.
Processing triggers for systemd (239-7ubuntu10) ...
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl add-br br-int
```

Ubuntu2 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal ▾

ubuntu2@ubuntu2-VirtualBox: ~

```
/usr/sbin/ovs-vswitchd (ovs-vswitchd) in auto mode
Created symlink /etc/systemd/system/multi-user.target.wants/openvswitch-switch.service → /lib/systemd/system/openvswitch-switch.service.
ovs-vswitchd.service is a disabled or a static unit, not starting it.
ovsdb-server.service is a disabled or a static unit, not starting it.
Processing triggers for systemd (239-7ubuntu10) ...
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl add-br br-int
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl show
c50a2e56-0a24-43fd-9667-4f2c1f4cb0a2
    Bridge br-int
        Port br-int
            Interface br-int
                type: internal
                ovs_version: "2.10.0"
ubuntu2@ubuntu2-VirtualBox:~$ sudo ip link add veth0 type veth peer name veth1
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl add-port br-int veth1
ubuntu2@ubuntu2-VirtualBox:~$ sudo brctl addif docker0 veth0
sudo: brctl: command not found
ubuntu2@ubuntu2-VirtualBox:~$ brctl addif docker0 veth0
Command 'brctl' not found, but can be installed with:
sudo apt install bridge-utils

ubuntu2@ubuntu2-VirtualBox:~$ sudo apt install bridge-utils
Reading package lists... Done
Building dependency tree
Reading state information... Done
```

Ubuntu2 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Wed 01:41

ubuntu2@ubuntu2-VirtualBox:~

```
ubuntu2@ubuntu2-VirtualBox:~$ sudo apt install bridge-utils
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
  bridge-utils
0 upgraded, 1 newly installed, 0 to remove and 293 not upgraded.
Need to get 30.0 kB of archives.
After this operation, 102 kB of additional disk space will be used.
Get:1 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 bridge-utils amd64 1.5-16ubuntu1 [30.0 kB]
Fetched 30.0 kB in 0s (119 kB/s)
Selecting previously unselected package bridge-utils.
(Reading database ... 131769 files and directories currently installed.)
Preparing to unpack .../bridge-utils_1.5-16ubuntu1_amd64.deb ...
Unpacking bridge-utils (1.5-16ubuntu1) ...
Setting up bridge-utils (1.5-16ubuntu1) ...
Processing triggers for man-db (2.8.4-2) ...
ubuntu2@ubuntu2-VirtualBox:~$ sudo brctl addif docker0 veth0
ubuntu2@ubuntu2-VirtualBox:~$ sudo ip link set veth1 up
ubuntu2@ubuntu2-VirtualBox:~$ sudo ip link set veth0 up
ubuntu2@ubuntu2-VirtualBox:~$ ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN mode DEFAULT
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP mode DEFAULT group default qlen 1000
    link/ether 08:00:27:9d:f8:b5 brd ff:ff:ff:ff:ff:ff
```

Right Ctrl

Ubuntu2 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Wed 01:42

ubuntu2@ubuntu2-VirtualBox:~

```
File Edit View Terminal Help
ubuntu2@ubuntu2-VirtualBox:~$ sudo brctl addif docker0 veth0
ubuntu2@ubuntu2-VirtualBox:~$ sudo ip link set veth1 up
ubuntu2@ubuntu2-VirtualBox:~$ sudo ip link set veth0 up
ubuntu2@ubuntu2-VirtualBox:~$ ip link
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN mode DEFAULT group default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP mode DEFAULT group default qlen 1000
    link/ether 08:00:27:9d:f8:b5 brd ff:ff:ff:ff:ff:ff
3: docker0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP mode DEFAULT group default
    link/ether 02:42:95:09:7a:5e brd ff:ff:ff:ff:ff:ff
7: veth08367a9@if6: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master docker0 state UP mode DEFAULT group default
    link/ether e2:d8:38:be:8e:51 brd ff:ff:ff:ff:ff:ff link-netnsid 1
8: ovs-system: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN mode DEFAULT group default qlen 1000
    link/ether aa:f0:b1:7f:72:6a brd ff:ff:ff:ff:ff:ff
9: br-int: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN mode DEFAULT group default qlen 1000
    link/ether 2e:0c:7f:56:ed:42 brd ff:ff:ff:ff:ff:ff
10: veth1@veth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master ovs-system state UP mode DEFAULT group default qlen 1000
    link/ether e2:17:18:71:8a:e4 brd ff:ff:ff:ff:ff:ff
11: veth0@veth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master docker0 state UP mode DEFAULT group default qlen 1000
    link/ether 9e:38:5a:bc:90:6b brd ff:ff:ff:ff:ff:ff
```

vs.html

Ubuntu2 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal ▾

ubuntu2@ubuntu2-VirtualBox: ~

```
link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP mode DEFAULT group default qlen 1000
    link/ether 08:00:27:9d:f8:b5 brd ff:ff:ff:ff:ff:ff
3: docker0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP mode DEFAULT group default
    link/ether 02:42:95:09:7a:5e brd ff:ff:ff:ff:ff:ff
7: veth08367a9@if6: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master docker0 state UP mode DEFAULT group default
    link/ether e2:d8:38:be:8e:51 brd ff:ff:ff:ff:ff:ff link-netnsid 1
8: ovs-system: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN mode DEFAULT group default qlen 1000
    link/ether aa:f0:b1:7f:72:6a brd ff:ff:ff:ff:ff:ff
9: br-int: <BROADCAST,MULTICAST> mtu 1500 qdisc noop state DOWN mode DEFAULT group default qlen 1000
    link/ether 2e:0c:7f:56:ed:42 brd ff:ff:ff:ff:ff:ff
10: veth1@veth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master ovs-system state UP mode DEFAULT group default qlen 1000
    link/ether e2:17:18:71:8a:e4 brd ff:ff:ff:ff:ff:ff
11: veth0@veth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master docker0 state UP mode DEFAULT group default qlen 1000
    link/ether 9e:38:5a:bc:90:6b brd ff:ff:ff:ff:ff:ff
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl add-port br-int gre0 -- set interface gre0 type=gre options:remote_ip=192.168.205.11
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl show
c50a2e56-0a24-43fd-9667-4f2c1f4cb0a2
    Bridge br-int
        Port "gre0"
```

Ubuntu2 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal ▾ Wed 01:42

ubuntu2@ubuntu2-VirtualBox: ~

```
link/ether e2:17:18:71:8a:e4 brd ff:ff:ff:ff:ff:ff
11: veth0@veth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue master
    docker0 state UP mode DEFAULT group default qlen 1000
        link/ether 9e:38:5a:bc:90:6b brd ff:ff:ff:ff:ff:ff
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl add-port br-int gre0 -- set interface gre0 type=gre options:remote_ip=192.168.205.11
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl show
c50a2e56-0a24-43fd-9667-4f2c1f4cb0a2
    Bridge br-int
        Port "gre0"
            Interface "gre0"
                type: gre
                options: {remote_ip="192.168.205.11"}
        Port br-int
            Interface br-int
                type: internal
        Port "veth1"
            Interface "veth1"
                ovs_version: "2.10.0"
ubuntu2@ubuntu2-VirtualBox:~$ sudo brctl show
bridge name     bridge id          STP enabled    interfaces
docker0         8000.024295097a5e      no           veth0
                                         veth08367a9
```

Ubuntu2 [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Wed 01:43

ubuntu2@ubuntu2-VirtualBox:~

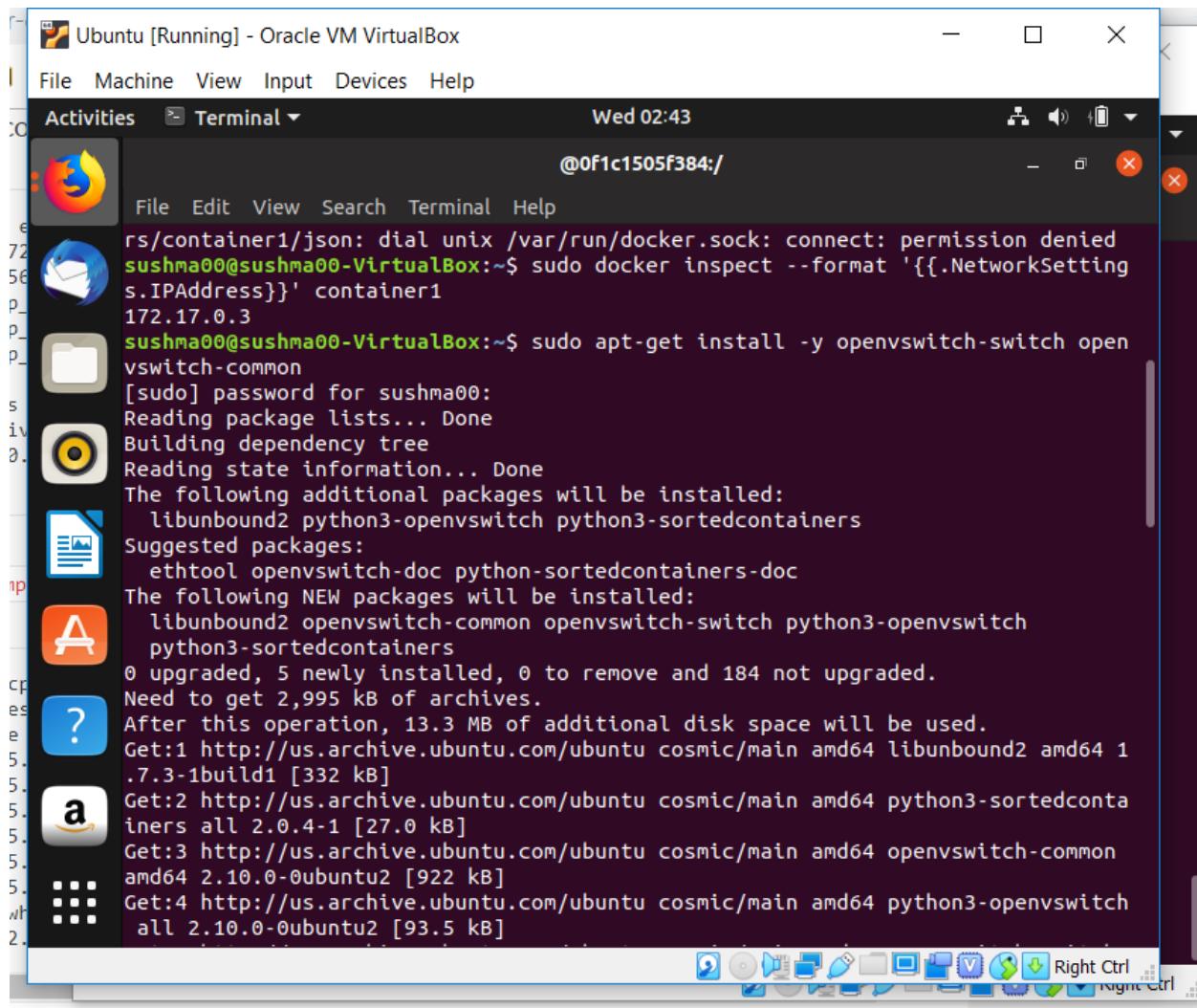
```
ace gre0 type=gre options:remote_ip=192.168.205.11
ubuntu2@ubuntu2-VirtualBox:~$ sudo ovs-vsctl show
c50a2e56-0a24-43fd-9667-4f2c1f4cb0a2
    Bridge br-int
        Port "gre0"
            Interface "gre0"
                type: gre
                options: {remote_ip="192.168.205.11"}
        Port br-int
            Interface br-int
                type: internal
        Port "veth1"
            Interface "veth1"
        ovs_version: "2.10.0"
ubuntu2@ubuntu2-VirtualBox:~$ sudo brctl show
bridge name      bridge id      STP enabled      interfaces
docker0          8000.024295097a5e    no            veth0
                                         veth08367a9
ubuntu2@ubuntu2-VirtualBox:~$ sudo tcpdump -n -i enp0s8 proto gre
tcpdump: enp0s8: No such device exists
(SIOCGIFHWADDR: No such device)
ubuntu2@ubuntu2-VirtualBox:~$ sudo tcpdump -n -i enp0s8 proto gre
tcpdump: enp0s8: You don't have permission to capture on that device
(socket: Operation not permitted)
ubuntu2@ubuntu2-VirtualBox:~$ sudo tcpdump -n -i enp0s8 proto gre
tcpdump: enp0s8: No such device exists
(SIOCGIFHWADDR: No such device)
ubuntu2@ubuntu2-VirtualBox:~$
```

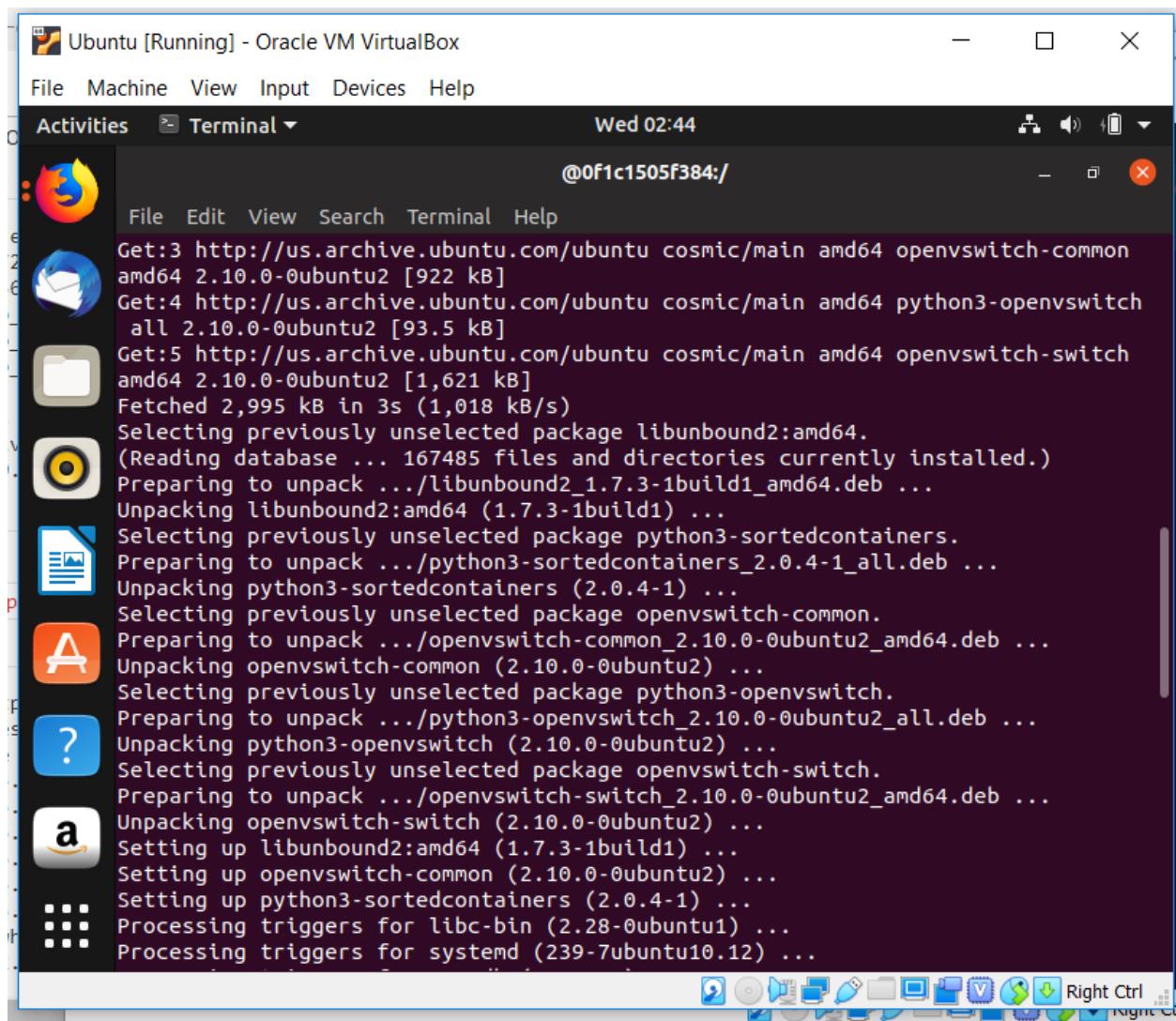
Ubuntu [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Wed 02:43

```
sushma00@sushma00-VirtualBox:~$ docker run -d --name container1 centos:7 /bin/bash -c "while true; do sleep 3600; done"
docker: Got permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Post http://%2Fvar%2Frun%2Fdocker.sock/v1.39/containers/create?name=container1: dial unix /var/run/docker.sock: connect: permission denied.
See 'docker run --help'.
sushma00@sushma00-VirtualBox:~$ sudo docker run -d --name container1 centos:7 /bin/bash -c "while true; do sleep 3600; done"
[sudo] password for sushma00:
Unable to find image 'centos:7' locally
7: Pulling from library/centos
8ba884070f61: Pull complete
Digest: sha256:8d487d68857f5bc9595793279b33d082b03713341ddec91054382641d14db861
Status: Downloaded newer image for centos:7
0f1c1505f384191e4e5e46a79a271957e452c99253fca7494c80835796dd0465
sushma00@sushma00-VirtualBox:~$ docker inspect --format '{{.NetworkSettings.IPAddress}}' container1
Got permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Get http://%2Fvar%2Frun%2Fdocker.sock/v1.39/containers/container1/json: dial unix /var/run/docker.sock: connect: permission denied
sushma00@sushma00-VirtualBox:~$ sudo docker inspect --format '{{.NetworkSettings.IPAddress}}' container1
172.17.0.3
sushma00@sushma00-VirtualBox:~$ sudo apt-get install -y openvswitch-switch openvswitch-common
[sudo] password for sushma00:
```





Ubuntu [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal ▾ Wed 02:44

@0f1c1505f384:/

```
Preparing to unpack .../python3-sortedcontainers_2.0.4-1_all.deb ...
Unpacking python3-sortedcontainers (2.0.4-1) ...
Selecting previously unselected package openvswitch-common.
Preparing to unpack .../openvswitch-common_2.10.0-0ubuntu2_amd64.deb ...
Unpacking openvswitch-common (2.10.0-0ubuntu2) ...
Selecting previously unselected package python3-openvswitch.
Preparing to unpack .../python3-openvswitch_2.10.0-0ubuntu2_all.deb ...
Unpacking python3-openvswitch (2.10.0-0ubuntu2) ...
Selecting previously unselected package openvswitch-switch.
Preparing to unpack .../openvswitch-switch_2.10.0-0ubuntu2_amd64.deb ...
Unpacking openvswitch-switch (2.10.0-0ubuntu2) ...
Setting up libunbound2:amd64 (1.7.3-1build1) ...
Setting up openvswitch-common (2.10.0-0ubuntu2) ...
Setting up python3-sortedcontainers (2.0.4-1) ...
Processing triggers for libc-bin (2.28-0ubuntu1) ...
Processing triggers for systemd (239-7ubuntu10.12) ...
Processing triggers for man-db (2.8.4-2) ...
Setting up python3-openvswitch (2.10.0-0ubuntu2) ...
Setting up openvswitch-switch (2.10.0-0ubuntu2) ...
update-alternatives: using /usr/lib/openvswitch-switch/ovs-vswitchd to provide
/usr/sbin/ovs-vswitchd (ovs-vswitchd) in auto mode
Created symlink /etc/systemd/system/multi-user.target.wants/openvswitch-switch.
service → /lib/systemd/system/openvswitch-switch.service.
ovs-vswitchd.service is a disabled or a static unit, not starting it.
ovsdb-server.service is a disabled or a static unit, not starting it.
Processing triggers for systemd (239-7ubuntu10.12) ...
sushma00@sushma00-VirtualBox:~$ sudo ovs-vsctl add-br br-int
sushma00@sushma00-VirtualBox:~$ sudo ip link add veth0 type veth peer name veth
```

Right Ctrl Right Ctrl

Ubuntu [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Wed 02:44

```
@0f1c1505f384:/
```

File Edit View Search Terminal Help

```
Created symlink /etc/systemd/system/multi-user.target.wants/openvswitch-switch.service → /lib/systemd/system/openvswitch-switch.service.
ovs-vswitchd.service is a disabled or a static unit, not starting it.
ovsdb-server.service is a disabled or a static unit, not starting it.
Processing triggers for systemd (239-7ubuntu10.12) ...
sushma00@sushma00-VirtualBox:~$ sudo ovs-vsctl add-br br-int
sushma00@sushma00-VirtualBox:~$ sudo ip link add veth0 type veth peer name veth1
sushma00@sushma00-VirtualBox:~$ sudo ovs-vsctl add-port br-int veth1
sushma00@sushma00-VirtualBox:~$ sudo brctl addif docker0 veth0
sushma00@sushma00-VirtualBox:~$ sudo ip link set veth1 up
sushma00@sushma00-VirtualBox:~$ sudo ip link set veth0 up
sushma00@sushma00-VirtualBox:~$ sudo ovs-vsctl add-port br-int gre0 -- set interface gre0 type=gre options:remote_ip=192.168.205.10
sushma00@sushma00-VirtualBox:~$ docker exec -it container1 bash
Got permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Get http://<2>var%2Frun%2Fdocker.sock/v1.39/containers/container1/json: dial unix /var/run/docker.sock: connect: permission denied
sushma00@sushma00-VirtualBox:~$ sudo docker exec -it container1 bash
[root@0f1c1505f384 ~]# ping 172.17.0.3
PING 172.17.0.3 (172.17.0.3) 56(84) bytes of data.
64 bytes from 172.17.0.3: icmp_seq=1 ttl=64 time=0.043 ms
64 bytes from 172.17.0.3: icmp_seq=2 ttl=64 time=0.037 ms
64 bytes from 172.17.0.3: icmp_seq=3 ttl=64 time=0.039 ms
64 bytes from 172.17.0.3: icmp_seq=4 ttl=64 time=0.057 ms
64 bytes from 172.17.0.3: icmp_seq=5 ttl=64 time=0.041 ms
64 bytes from 172.17.0.3: icmp_seq=6 ttl=64 time=0.040 ms
64 bytes from 172.17.0.3: icmp_seq=7 ttl=64 time=0.035 ms
```

Ubuntu [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Wed 02:45

```
@0f1c1505f384:/
```

```
sushma00@sushma00-VirtualBox:~$ sudo brctl addif docker0 veth0
sushma00@sushma00-VirtualBox:~$ sudo ip link set veth1 up
sushma00@sushma00-VirtualBox:~$ sudo ip link set veth0 up
sushma00@sushma00-VirtualBox:~$ sudo ovs-vsctl add-port br-int gre0 -- set interface gre0 type=gre options:remote_ip=192.168.205.10
sushma00@sushma00-VirtualBox:~$ docker exec -it container1 bash
Got permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Get http://<2>Fvar%2Frun%2Fdocker.sock/v1.39/containers/container1/json: dial unix /var/run/docker.sock: connect: permission denied
sushma00@sushma00-VirtualBox:~$ sudo docker exec -it container1 bash
[root@0f1c1505f384 ~]# ping 172.17.0.3
PING 172.17.0.3 (172.17.0.3) 56(84) bytes of data.
64 bytes from 172.17.0.3: icmp_seq=1 ttl=64 time=0.043 ms
64 bytes from 172.17.0.3: icmp_seq=2 ttl=64 time=0.037 ms
64 bytes from 172.17.0.3: icmp_seq=3 ttl=64 time=0.039 ms
64 bytes from 172.17.0.3: icmp_seq=4 ttl=64 time=0.057 ms
64 bytes from 172.17.0.3: icmp_seq=5 ttl=64 time=0.041 ms
64 bytes from 172.17.0.3: icmp_seq=6 ttl=64 time=0.040 ms
64 bytes from 172.17.0.3: icmp_seq=7 ttl=64 time=0.035 ms
64 bytes from 172.17.0.3: icmp_seq=8 ttl=64 time=0.032 ms
64 bytes from 172.17.0.3: icmp_seq=9 ttl=64 time=0.061 ms
64 bytes from 172.17.0.3: icmp_seq=10 ttl=64 time=0.053 ms
64 bytes from 172.17.0.3: icmp_seq=11 ttl=64 time=0.103 ms
^C
--- 172.17.0.3 ping statistics ---
11 packets transmitted, 11 received, 0% packet loss, time 10232ms
rtt min/avg/max/mdev = 0.032/0.049/0.103/0.019 ms
[root@0f1c1505f384 ~]#
```

Ubuntu [Running] - Oracle VM VirtualBox

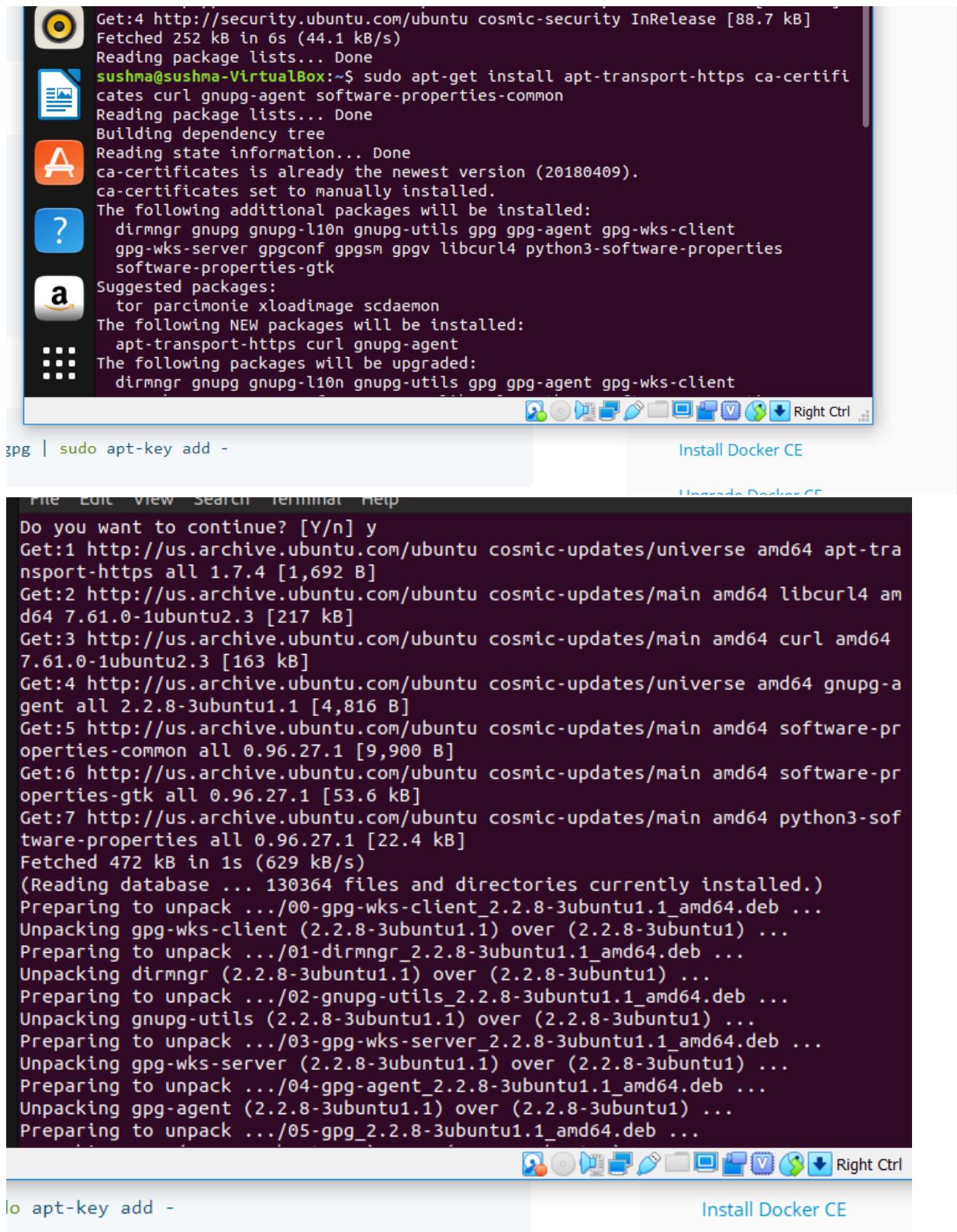
File Machine View Input Devices Help

Activities Terminal Sat 02:58

```
sushma@sushma-VirtualBox:~
```

```
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
```

```
sushma@sushma-VirtualBox:~$ sudo apt-get update
[sudo] password for sushma:
Hit:1 http://us.archive.ubuntu.com/ubuntu cosmic InRelease
Get:2 http://us.archive.ubuntu.com/ubuntu cosmic-updates InRelease [88.7 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu cosmic-backports InRelease [74.6 kB]
Get:4 http://security.ubuntu.com/ubuntu cosmic-security InRelease [88.7 kB]
Fetched 252 kB in 6s (44.1 kB/s)
Reading package lists... Done
sushma@sushma-VirtualBox:~$
```



Get:4 http://security.ubuntu.com/ubuntu cosmic-security InRelease [88.7 kB]  
Fetched 252 kB in 0s (44.1 kB/s)  
Reading package lists... Done  
**sushma@sushma-VirtualBox:~\$ sudo apt-get install apt-transport-https ca-certifi**  
cates curl gnupg-agent software-properties-common  
Reading package lists... Done  
Building dependency tree  
Reading state information... Done  
ca-certificates is already the newest version (20180409).  
ca-certificates set to manually installed.  
The following additional packages will be installed:  
dirmngr gnupg gnupg-l10n gnupg-utils gpg gpg-agent gpg-wks-client  
gpg-wks-server gpgconf gpgsm gpgv libcurl4 python3-software-properties  
software-properties-gtk  
Suggested packages:  
tor parcmimonie xloadimage scdaemon  
The following NEW packages will be installed:  
apt-transport-https curl gnupg-agent  
The following packages will be upgraded:  
dirmngr gnupg gnupg-l10n gnupg-utils gpg gpg-agent gpg-wks-client

gpg | sudo apt-key add -

File Edit View Search Terminal Help

Do you want to continue? [Y/n] y

Get:1 http://us.archive.ubuntu.com/ubuntu cosmic-updates/universe amd64 apt-tra  
nsport-https all 1.7.4 [1,692 B]

Get:2 http://us.archive.ubuntu.com/ubuntu cosmic-updates/main amd64 libcurl4 am  
d64 7.61.0-1ubuntu2.3 [217 kB]

Get:3 http://us.archive.ubuntu.com/ubuntu cosmic-updates/main amd64 curl amd64  
7.61.0-1ubuntu2.3 [163 kB]

Get:4 http://us.archive.ubuntu.com/ubuntu cosmic-updates/universe amd64 gnupg-a  
gent all 2.2.8-3ubuntu1.1 [4,816 B]

Get:5 http://us.archive.ubuntu.com/ubuntu cosmic-updates/main amd64 software-pr  
operties-common all 0.96.27.1 [9,900 B]

Get:6 http://us.archive.ubuntu.com/ubuntu cosmic-updates/main amd64 software-pr  
operties-gtk all 0.96.27.1 [53.6 kB]

Get:7 http://us.archive.ubuntu.com/ubuntu cosmic-updates/main amd64 python3-sof  
tware-properties all 0.96.27.1 [22.4 kB]

Fetched 472 kB in 1s (629 kB/s)

(Reading database ... 130364 files and directories currently installed.)

Preparing to unpack .../00-gpg-wks-client\_2.2.8-3ubuntu1.1\_amd64.deb ...

Unpacking gpg-wks-client (2.2.8-3ubuntu1.1) over (2.2.8-3ubuntu1) ...

Preparing to unpack .../01-dirmngr\_2.2.8-3ubuntu1.1\_amd64.deb ...

Unpacking dirmngr (2.2.8-3ubuntu1.1) over (2.2.8-3ubuntu1) ...

Preparing to unpack .../02-gnupg-utils\_2.2.8-3ubuntu1.1\_amd64.deb ...

Unpacking gnupg-utils (2.2.8-3ubuntu1.1) over (2.2.8-3ubuntu1) ...

Preparing to unpack .../03-gpg-wks-server\_2.2.8-3ubuntu1.1\_amd64.deb ...

Unpacking gpg-wks-server (2.2.8-3ubuntu1.1) over (2.2.8-3ubuntu1) ...

Preparing to unpack .../04-gpg-agent\_2.2.8-3ubuntu1.1\_amd64.deb ...

Unpacking gpg-agent (2.2.8-3ubuntu1.1) over (2.2.8-3ubuntu1) ...

Preparing to unpack .../05-gpg\_2.2.8-3ubuntu1.1\_amd64.deb ...

lo apt-key add -

```
Ubuntu [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Activities Terminal Sat 03:00
sushma@sushma-VirtualBox: ~
File Edit View Search Terminal Help
Setting up apt-transport-https (1.7.4) ...
Processing triggers for mime-support (3.60ubuntu1) ...
Processing triggers for desktop-file-utils (0.23-3ubuntu2) ...
Processing triggers for install-info (6.5.0.dfsg.1-4) ...
Setting up gpgconf (2.2.8-3ubuntu1.1) ...
Processing triggers for libglib2.0-0:amd64 (2.58.1-2) ...
Setting up libcurl4:amd64 (7.61.0-1ubuntu2.3) ...
Setting up gpg-agent (2.2.8-3ubuntu1.1) ...
Setting up gnupg-l10n (2.2.8-3ubuntu1.1) ...
Processing triggers for libc-bin (2.28-0ubuntu1) ...
Setting up gpgsm (2.2.8-3ubuntu1.1) ...
Setting up gnupg-utils (2.2.8-3ubuntu1.1) ...
Processing triggers for man-db (2.8.4-2) ...
Processing triggers for shared-mime-info (1.10-1) ...
Processing triggers for gnome-menus (3.13.3-11ubuntu2) ...
Processing triggers for dbus (1.12.10-1ubuntu2) ...
Setting up gpg-agent (2.2.8-3ubuntu1.1) ...
Setting up dirmngr (2.2.8-3ubuntu1.1) ...
Processing triggers for hicolor-icon-theme (0.17-2) ...
Setting up gpg (2.2.8-3ubuntu1.1) ...
Setting up curl (7.61.0-1ubuntu2.3) ...
Setting up gpg-wks-server (2.2.8-3ubuntu1.1) ...
Setting up gpg-wks-client (2.2.8-3ubuntu1.1) ...
Setting up python3-software-properties (0.96.27.1) ...
Setting up software-properties-common (0.96.27.1) ...
Setting up gnupg (2.2.8-3ubuntu1.1) ...
Setting up software-properties-gtk (0.96.27.1) ...
sushma@sushma-VirtualBox:~$
```

```
ntu/gpg | sudo apt-key add -
Install Docker CE
```

```
Processing triggers for hicolor-icon-theme (0.17-2) ...
Setting up gpg (2.2.8-3ubuntu1.1) ...
Setting up curl (7.61.0-1ubuntu2.3) ...
Setting up gpg-wks-server (2.2.8-3ubuntu1.1) ...
Setting up gpg-wks-client (2.2.8-3ubuntu1.1) ...
Setting up python3-software-properties (0.96.27.1) ...
Setting up software-properties-common (0.96.27.1) ...
Setting up gnupg (2.2.8-3ubuntu1.1) ...
Setting up software-properties-gtk (0.96.27.1) ...
sushma@sushma-VirtualBox:~$ sudo curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
OK
sushma@sushma-VirtualBox:~$
```

```
Install Docker CE
```

```
Upgrade Docker CE
```

```
Processing triggers for libc-bin (2.27-3ubuntu1.1) ...
Setting up gpg (2.2.8-3ubuntu1.1) ...
Setting up curl (7.61.0-1ubuntu2.3) ...
Setting up gpg-wks-server (2.2.8-3ubuntu1.1) ...
Setting up gpg-wks-client (2.2.8-3ubuntu1.1) ...
Setting up python3-software-properties (0.96.27.1) ...
Setting up software-properties-common (0.96.27.1) ...
Setting up gnupg (2.2.8-3ubuntu1.1) ...
Setting up software-properties-gtk (0.96.27.1) ...
sushma@sushma-VirtualBox:~$ sudo curl -fsSL https://download.docker.com/linux/u
buntu/gpg | sudo apt-key add -
OK
sushma@sushma-VirtualBox:~$ sudo apt-key fingerprint 0EBFCD88
pub    rsa4096 2017-02-22 [SCEA]
      9DC8 5822 9FC7 DD38 854A  E2D8 8D81 803C 0EBF CD88
uid            [ unknown] Docker Release (CE deb) <docker@docker.com>
sub    rsa4096 2017-02-22 [S]
sushma@sushma-VirtualBox:~$
```

```
To change /etc/apt/sources.list to your parent Ubuntu
sub    rsa4096 2017-02-22 [S]
sushma@sushma-VirtualBox:~$ sudo add-apt-repository "deb [arch=amd64] https://d
ownload.docker.com/linux/ubuntu $(lsb_release -cs) stable"
Get:1 http://security.ubuntu.com/ubuntu cosmic-security InRelease [88.7 kB]
Err:2 https://download.docker.com/linux/ubuntu cosmic InRelease
  Could not resolve 'downoad.docker.com'
Hit:3 http://us.archive.ubuntu.com/ubuntu cosmic InRelease
Get:4 http://us.archive.ubuntu.com/ubuntu cosmic-updates InRelease [88.7 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu cosmic-backports InRelease [74.6 kB]
Fetched 252 kB in 6s (43.2 kB/s)
Reading package lists... Done
W: Failed to fetch https://download.docker.com/linux/ubuntu/dists/cosmic/InRelea
se  Could not resolve 'downoad.docker.com'
W: Some index files failed to download. They have been ignored, or old ones use
d instead.
sushma@sushma-VirtualBox:~$
```

ling or updating without specifying a version in the  
s installs the highest possible version, which may not be

```
sushma@Sushma-VirtualBox:~$ sudo apt-get install docker-ce docker-ce-cli containerd.io
Err:1 https://download.docker.com/linux/ubuntu cosmic InRelease
  Could not resolve 'download.docker.com'
Hit:2 http://us.archive.ubuntu.com/ubuntu cosmic InRelease
Get:3 http://us.archive.ubuntu.com/ubuntu cosmic-updates InRelease [88.7 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu cosmic-backports InRelease [74.6 kB]
Get:5 http://security.ubuntu.com/ubuntu cosmic-security InRelease [88.7 kB]
Fetched 252 kB in 1s (248 kB/s)
Reading package lists... Done
W: Failed to fetch https://download.docker.com/linux/dists/cosmic/InRelease  Could not resolve 'download.docker.com'
W: Some index files failed to download. They have been ignored, or old ones used instead.
sushma@Sushma-VirtualBox:~$ sudo apt-get install docker-ce docker-ce-cli containerd.io
Reading package lists... Done
Building dependency tree
Reading state information... Done
Package docker-ce is not available, but is referred to by another package.
This may mean that the package is missing, has been obsoleted, or
is only available from another source

E: Package 'docker-ce' has no installation candidate
E: Unable to locate package docker-ce-cli
E: Unable to locate package containerd.io
E: Couldn't find any package by glob 'containerd.io'
E: Couldn't find any package by regex 'containerd.io'
sushma@Sushma-VirtualBox:~$ sudo apt-get update
```

```
sushma@Sushma-VirtualBox:~$ sudo apt-cache madison docker-ce
docker-ce | 5:18.09.5~3-0~ubuntu-cosmic | https://download.docker.com/linux/ubuntu cosmic/stable amd64 Packages
docker-ce | 5:18.09.4~3-0~ubuntu-cosmic | https://download.docker.com/linux/ubuntu cosmic/stable amd64 Packages
docker-ce | 5:18.09.3~3-0~ubuntu-cosmic | https://download.docker.com/linux/ubuntu cosmic/stable amd64 Packages
docker-ce | 5:18.09.2~3-0~ubuntu-cosmic | https://download.docker.com/linux/ubuntu cosmic/stable amd64 Packages
docker-ce | 5:18.09.1~3-0~ubuntu-cosmic | https://download.docker.com/linux/ubuntu cosmic/stable amd64 Packages
sushma@Sushma-VirtualBox:~$ s
```

Install using the

Set in the ren

```
untu cosmic/stable amd64 Packages
  docker-ce | 5:18.09.1-3~ubuntu-cosmic | https://download.docker.com/linux/ubuntu
  cosmic/stable amd64 Packages
sushma@sushma-VirtualBox:~$ sudo apt-get install docker-ce=5:18.09.5-3~ubuntu
-cosmic docker-ce-cli=5:18.09.5-3~ubuntu-cosmic
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  aufs-tools cgroupfs-mount containerd.io git git-man liberror-perl pigz
Suggested packages:
  git-daemon-run | git-daemon-sysvinit git-doc git-el git-email git-gui gitk
  gitweb git-cvs git-mediawiki git-svn
The following NEW packages will be installed:
  aufs-tools cgroupfs-mount containerd.io docker-ce docker-ce-cli git git-man
  liberror-perl pigz
0 upgraded, 9 newly installed, 0 to remove and 293 not upgraded.
Need to get 54.9 MB of archives.
After this operation, 275 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu cosmic/universe amd64 pigz amd64 2.4-
1 [57.4 kB]
Get:2 https://download.docker.com/linux/ubuntu cosmic/stable amd64 containerd.i
o amd64 1.2.5-1 [19.9 MB]
Get:3 http://us.archive.ubuntu.com/ubuntu cosmic/universe amd64 aufs-tools amd6
4 1:4.9+20170918-2 [104 kB]
Get:4 http://us.archive.ubuntu.com/ubuntu cosmic/universe amd64 cgroupfs-mount
ttt https://download.docker.com/linux/ubuntu xenial/stable amd64 Package
ttt
```

Install using the repository

Set up the repository

Ubuntu [Running] - Oracle VM VirtualBox

File Machine View Input Devices Help

Activities Terminal Sat 03:14

sushma@sushma:~

```
Selecting previously unselected package git-man.
Preparing to unpack .../7-git-man_1%3a2.19.1-1ubuntu1.1_all.deb ...
Unpacking git-man (1:2.19.1-1ubuntu1.1) ...
Selecting previously unselected package git.
Preparing to unpack .../8-git_1%3a2.19.1-1ubuntu1.1_amd64.deb ...
Unpacking git (1:2.19.1-1ubuntu1.1) ...
Setting up aufs-tools (1:4.9+20170918-2) ...
Setting up git-man (1:2.19.1-1ubuntu1.1) ...
Setting up containerd.io (1.2.5-1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service → /lib/systemd/system/containerd.service.
Setting up liberror-perl (0.17026-1) ...
Setting up cgroupfs-mount (1.4) ...
Processing triggers for libc-bin (2.28-0ubuntu1) ...
Processing triggers for systemd (239-7ubuntu10) ...
Processing triggers for man-db (2.8.4-2) ...
Setting up pigz (2.4-1) ...
Setting up git (1:2.19.1-1ubuntu1.1) ...
Setting up docker-ce (5:18.09.5~3-0ubuntu-cosmic) ...
update-alternatives: using /usr/bin/dockerd-ce to provide /usr/bin/dockerd (dockerd) in auto mode
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /lib/systemd/system/docker.service.
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /lib/systemd/system/docker.socket.
Processing triggers for systemd (239-7ubuntu10) ...
sushma@sushma-VirtualBox:~$
```

ning the `hello-world` image.

[Install using the rep](#)

[Set up the reposi](#)

```
Setting up git (1:2.19.1-1ubuntu1.1) ...
Setting up docker-ce (5:18.09.5~3-0~ubuntu-cosmic) ...
update-alternatives: using /usr/bin/dockerd-ce to provide /usr/bin/dockerd (dock
kerd) in auto mode
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /l
ib/systemd/system/docker.service.
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /lib/s
ystemd/system/docker.socket.
Processing triggers for systemd (239-7ubuntu10) ...
sushma@sushma-VirtualBox:~$ sudo docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
1b930d010525: Pull complete
Digest: sha256:92695bc579f31df7a63da6922075d0666e565ceccad16b59c3374d2cf4e8e50e
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

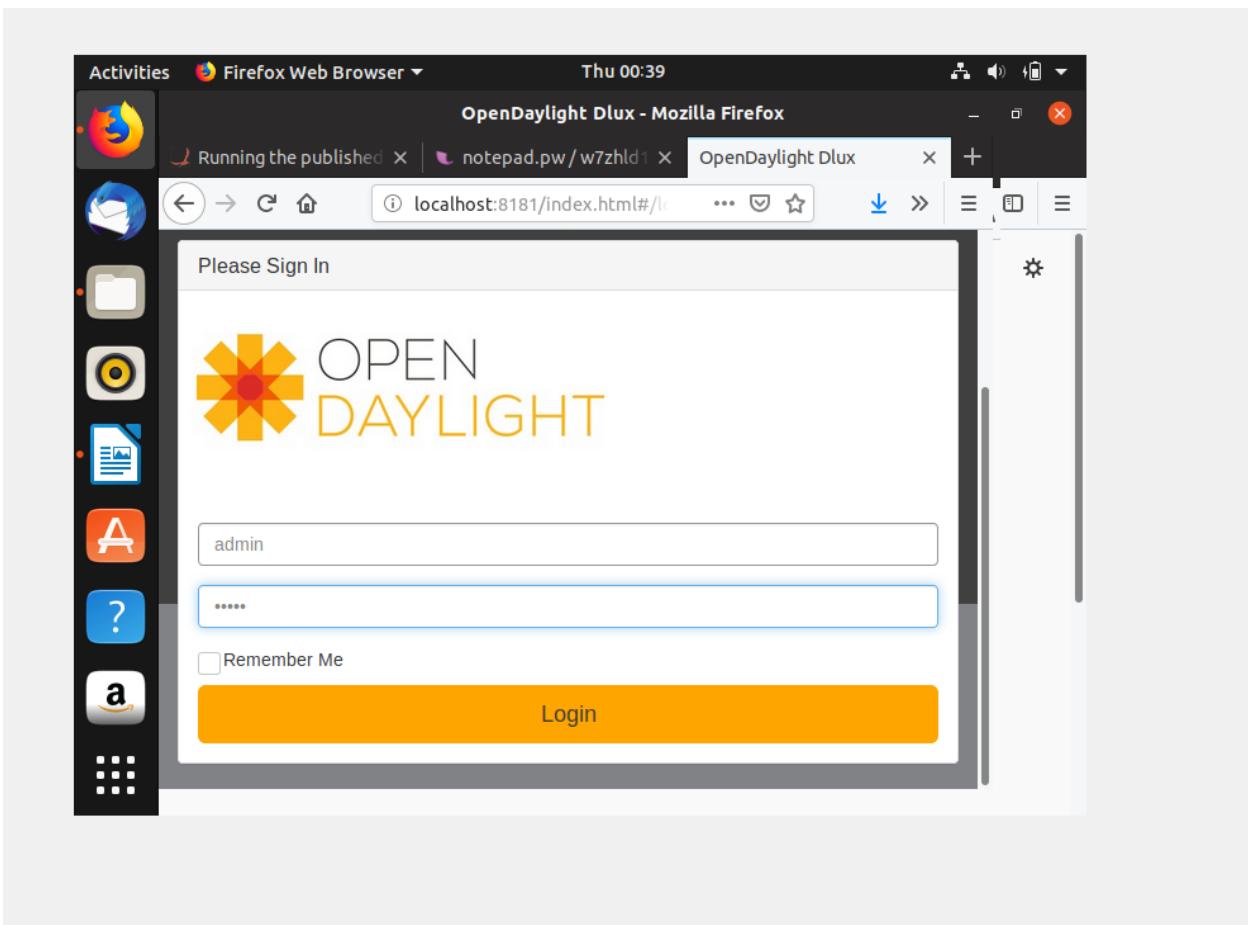
To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
```

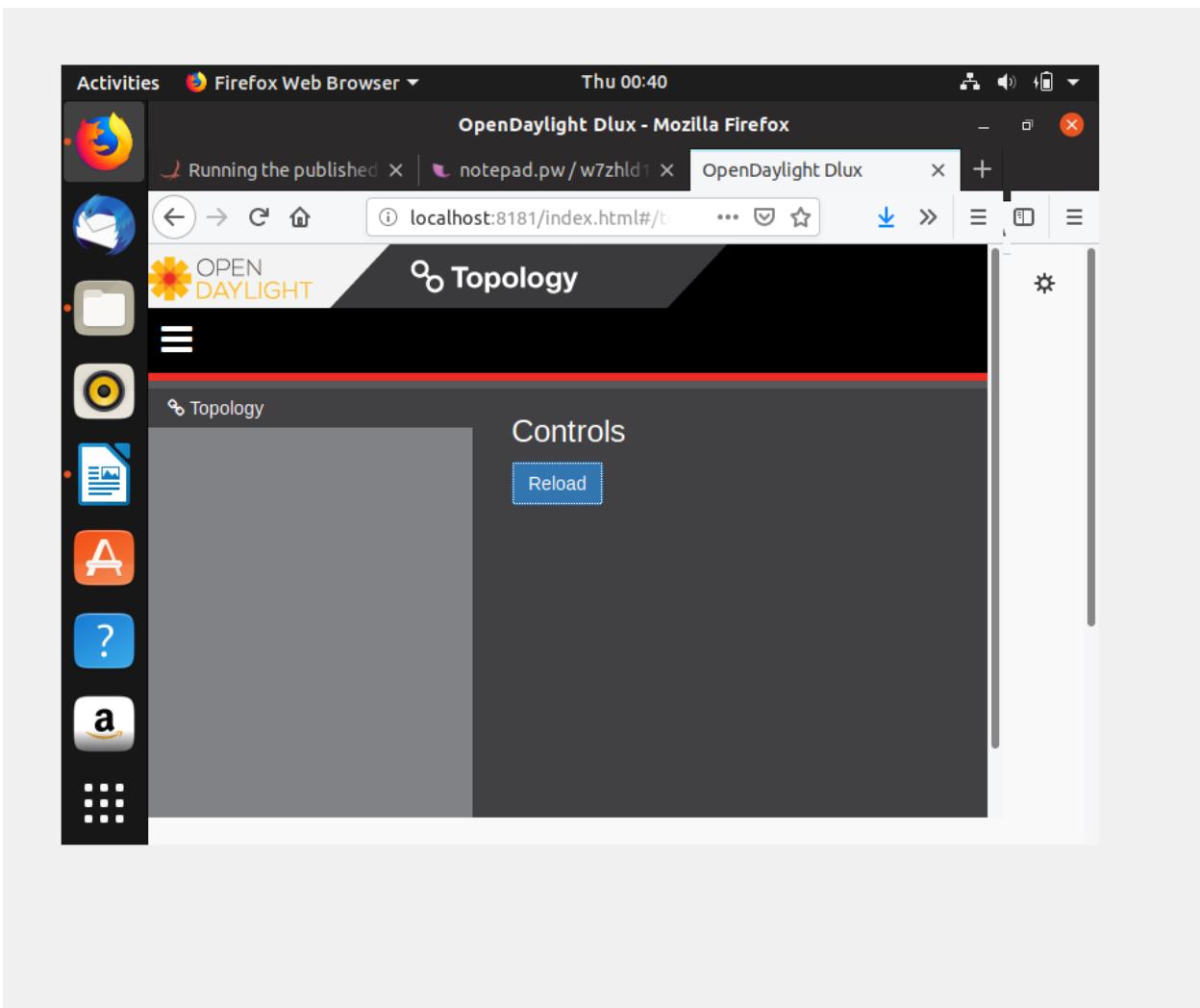
; it in a container. When the container runs, it prints an informational

[Install using the repository](#)

[Set up the repository](#)

[Install Docker CE](#)





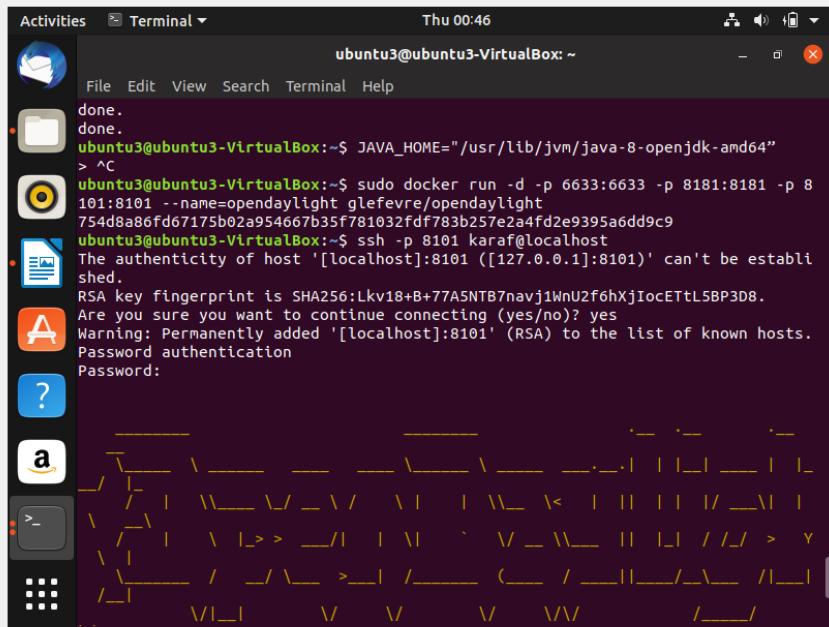
```
Activities Terminal Thu 00:44
ubuntu3@ubuntu3-VirtualBox: ~
File Edit View Search Terminal Help
./createCluster: line 7: `<!DOCTYPE html>'  
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker pull glefevre/opendaylight
[sudo] password for ubuntu3:
Using default tag: latest
latest: Pulling from glefevre/opendaylight
169185f82c45: Pull complete
ae8bc0cc0ce1: Pull complete
3b7cff9ed821: Pull complete
16a0e28f9dec: Pull complete
Digest: sha256:74a5938a83f9b1c9b74211c4f203d75d93b3a2ace4c17460fa7734c6c2d0ca24
Status: Downloaded newer image for glefevre/opendaylight:latest
ubuntu3@ubuntu3-VirtualBox:~$ sudo apt-get update
Get: http://security.ubuntu.com/ubuntu cosmic-security InRelease [88.7 kB]
Hit:2 https://download.docker.com/linux/ubuntu cosmic InRelease
Hit:3 http://us.archive.ubuntu.com/ubuntu cosmic InRelease
Get:4 http://us.archive.ubuntu.com/ubuntu cosmic-updates InRelease [88.7 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu cosmic-backports InRelease [74.6 kB]
Get:6 http://us.archive.ubuntu.com/ubuntu cosmic-updates/main i386 Packages [26
2 kB]
Get:7 http://us.archive.ubuntu.com/ubuntu cosmic-updates/main amd64 Packages [2
99 kB]
Get:8 http://us.archive.ubuntu.com/ubuntu cosmic-updates/universe amd64 Package
s [350 kB]
Get:9 http://us.archive.ubuntu.com/ubuntu cosmic-updates/universe i386 Packages
[346 kB]
Fetched 1,508 kB in 12s (126 kB/s)
Reading package lists... Done
ubuntu3@ubuntu3-VirtualBox:~$ sudo apt-get install default-jdk
```

```
Activities Terminal Thu 00:45
ubuntu3@ubuntu3-VirtualBox: ~
File Edit View Search Terminal Help
ubuntu3@ubuntu3-VirtualBox:~$ sudo apt-get install default-jdk
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  ca-certificates-java default-jdk-headless default-jre default-jre-headless
  fonts-dejavu-extra java-common libatk-wrapper-java libatk-wrapper-java-jni
  libgif7 libice-dev libpthread-stubs0-dev libsm-dev libx11-dev libxau-dev
  libxcb1-dev libxdmcp-dev libxt-dev openjdk-11-jdk openjdk-11-jdk-headless
  openjdk-11-jre openjdk-11-jre-headless x11proto-core-dev x11proto-dev
  xorg-sgml-doctools xtrans-dev
Suggested packages:
  libice-doc libsm-doc libx11-doc libxcb-doc libxt-doc openjdk-11-demo
  openjdk-11-source visualvm fonts-ipafont-gothic fonts-ipafont-mincho
  fonts-wqy-microhei | fonts-wqy-zenhei
The following NEW packages will be installed:
  ca-certificates-java default-jdk default-jdk-headless default-jre
  default-jre-headless fonts-dejavu-extra java-common libatk-wrapper-java
  libatk-wrapper-java-jni libgif7 libice-dev libpthread-stubs0-dev libsm-dev
  libx11-dev libxau-dev libxcb1-dev libxdmcp-dev libxt-dev openjdk-11-jdk
  openjdk-11-jdk-headless openjdk-11-jre openjdk-11-jre-headless
  x11proto-core-dev x11proto-dev xorg-sgml-doctools xtrans-dev
0 upgraded, 26 newly installed, 0 to remove and 302 not upgraded.
Need to get 259 MB of archives.
After this operation, 413 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://us.archive.ubuntu.com/ubuntu cosmic/main amd64 java-common all 0.6
8ubuntu1 [6,988 B]
```

Activities Terminal Thu 00:46

ubuntu3@ubuntu3-VirtualBox:~

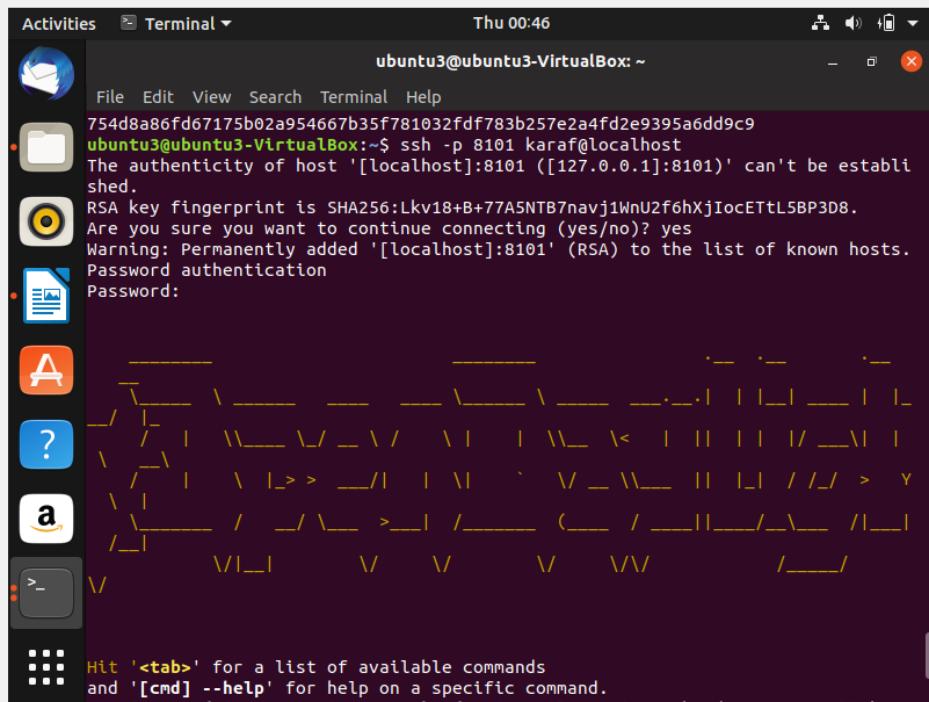
```
done.
done.
> ^C
ubuntu3@ubuntu3-VirtualBox:~$ JAVA_HOME="/usr/lib/jvm/java-8-openjdk-amd64"
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -d -p 6633:6633 -p 8181:8181 -p 8
101:8101 --name=opendaylight glefevre/opendaylight
754d8a86fd67175b02a954667b35f781032fdf783b257e2a4fd2e9395a6dd9c9
ubuntu3@ubuntu3-VirtualBox:~$ ssh -p 8101 karaf@localhost
The authenticity of host '[localhost]:8101' ([127.0.0.1]:8101) can't be established.
RSA key fingerprint is SHA256:Lkv18+B+77A5NTB7navj1WnU2f6hXjIocETtL5BP3D8.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '[localhost]:8101' (RSA) to the list of known hosts.
Password authentication
Password:
```



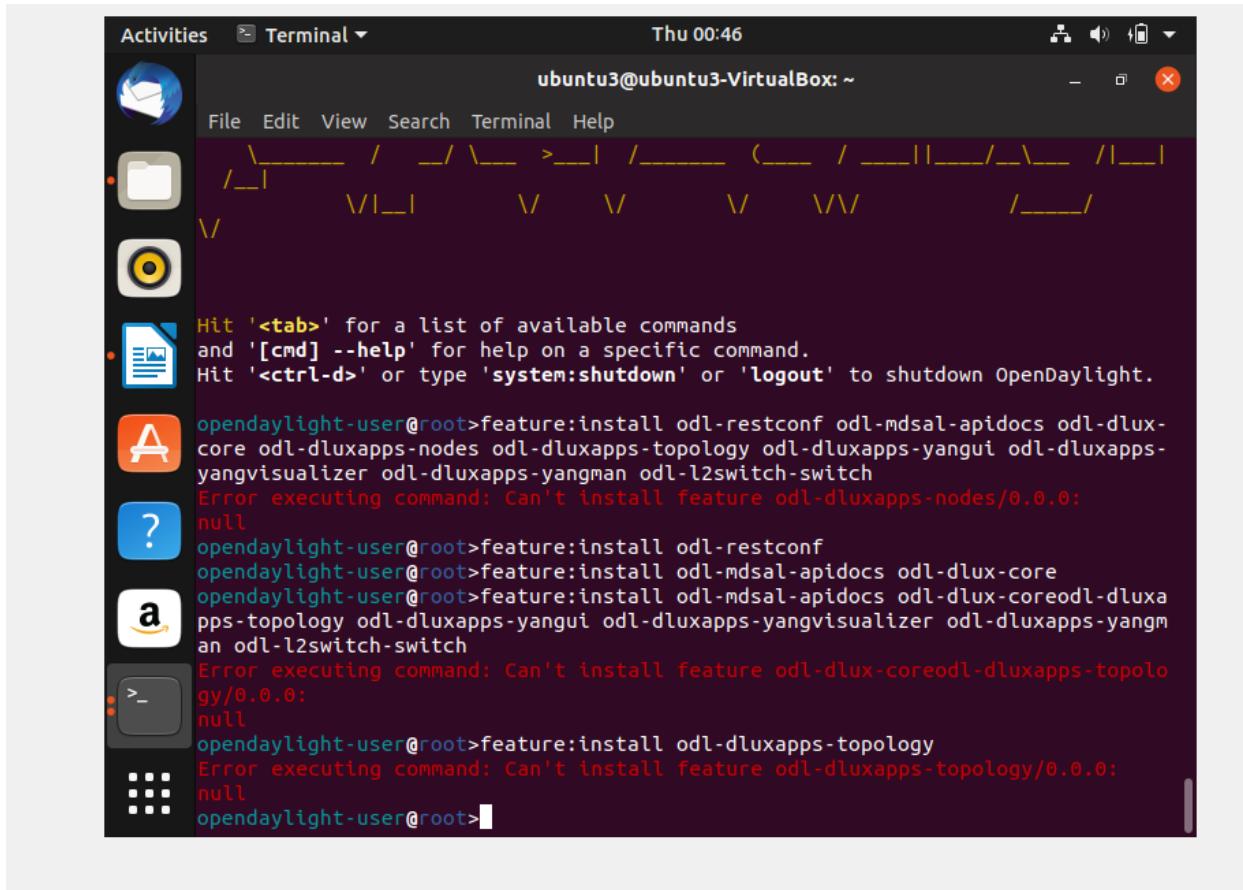
Activities Terminal Thu 00:46

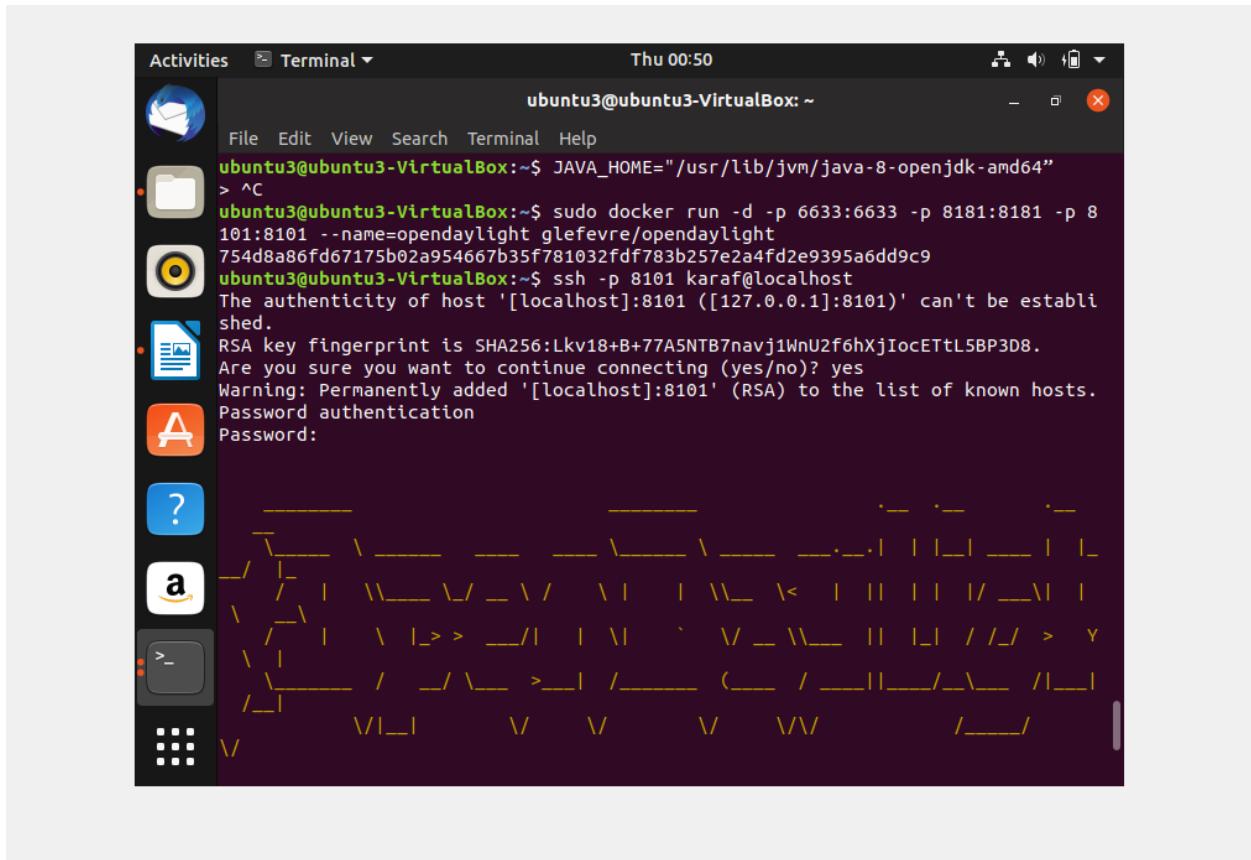
ubuntu3@ubuntu3-VirtualBox:~

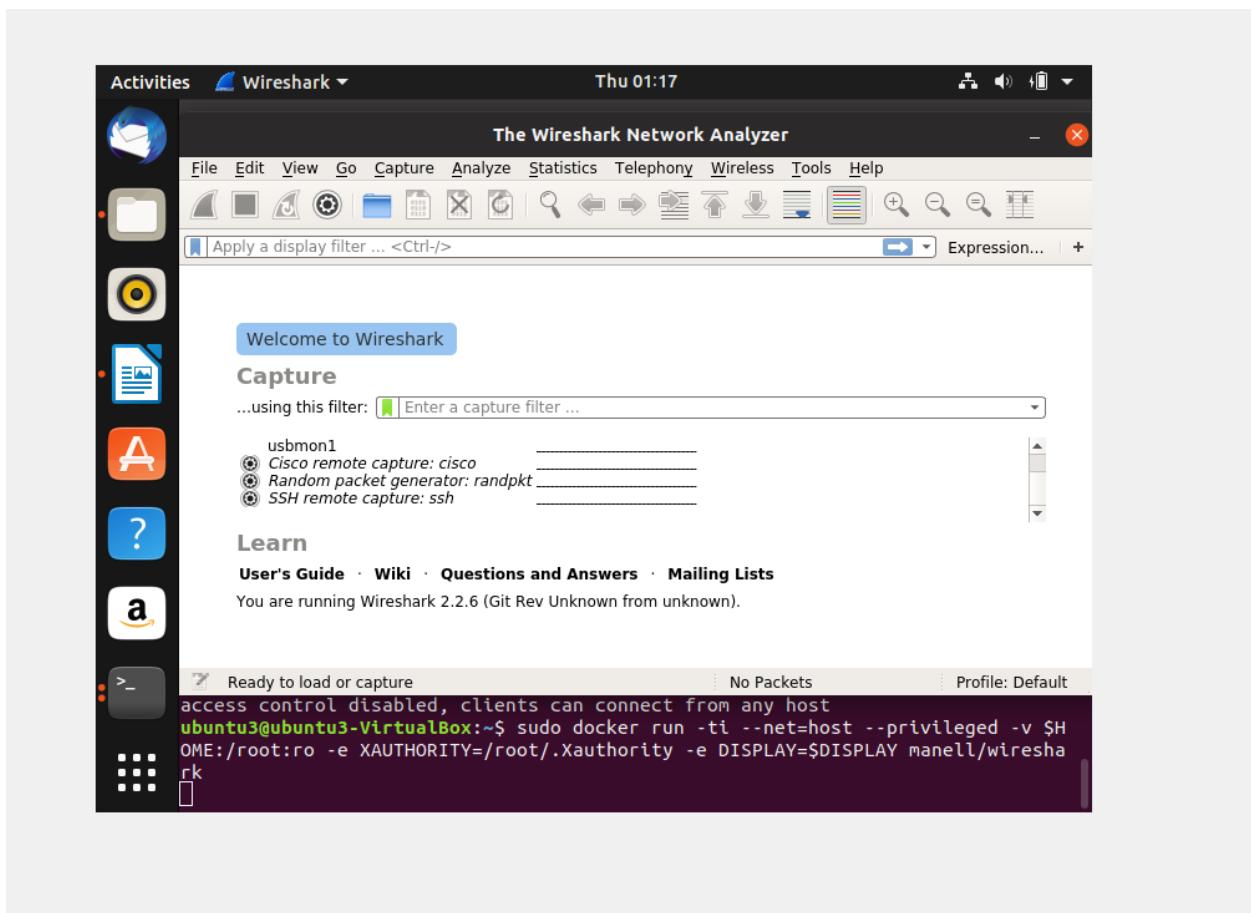
```
754d8a86fd67175b02a954667b35f781032fdf783b257e2a4fd2e9395a6dd9c9
ubuntu3@ubuntu3-VirtualBox:~$ ssh -p 8101 karaf@localhost
The authenticity of host '[localhost]:8101' ([127.0.0.1]:8101) can't be established.
RSA key fingerprint is SHA256:Lkv18+B+77A5NTB7navj1WnU2f6hXjIocETtL5BP3D8.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '[localhost]:8101' (RSA) to the list of known hosts.
Password authentication
Password:
```



Hit '<tab>' for a list of available commands  
and '[cmd] --help' for help on a specific command.







Activities Terminal Thu 01:17

```
ubuntu3@ubuntu3-VirtualBox: ~
File Edit View Search Terminal Help
opendaylight-user@root>feature:install odl-dluxapps-topology
Error executing command: Can't install feature odl-dluxapps-topology/0.0.0:
null
opendaylight-user@root>exit
opendaylight-user@root>logout

Connection to localhost closed.
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker pull manell/wireshark
[sudo] password for ubuntu3:
Using default tag: latest
latest: Pulling from manell/wireshark
d3938036b19c: Pull complete
a9b30c108bda: Pull complete
67de21feec18: Pull complete
817da545be2b: Pull complete
d967c497ce23: Pull complete
a8c836392158: Pull complete
266183ba57c5: Pull complete
Digest: sha256:5ca01277b780c0403de99143c513e3022bac10ab7d8fc7f6b66bda9d7f461aaa
Status: Downloaded newer image for manell/wireshark:latest
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -ti --net=host --privileged -v $HOME:/root:ro -e XAUTHORITY=/root/.Xauthority -e DISPLAY=$DISPLAY manell/wireshark
No protocol specified
QXcbConnection: Could not connect to display :0
ubuntu3@ubuntu3-VirtualBox:~$ ssh -X user@host
ssh: Could not resolve hostname host: Temporary failure in name resolution
ubuntu3@ubuntu3-VirtualBox:~$ ssh -X ubuntu3@host
```

Activities Terminal ▾

Thu 01:18

ubuntu3@ubuntu3-VirtualBox: ~

```
OME:/root:ro -e XAUTHORITY=/root/.Xauthority -e DISPLAY=$DISPLAY manell/wireshark
No protocol specified
QXcbConnection: Could not connect to display :0
ubuntu3@ubuntu3-VirtualBox:~$ ssh -X user@host
ssh: Could not resolve hostname host: Temporary failure in name resolution
ubuntu3@ubuntu3-VirtualBox:~$ ssh -X ubuntu3@host
ssh: Could not resolve hostname host: Temporary failure in name resolution
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -ti --net=host --privileged -v $HOME:/root:ro -e XAUTHORITY=/root/.Xauthority -e DISPLAY=$DISPLAY manell/wireshark
flag needs an argument: 'e' in -e
See 'docker run --help'.
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -ti --net=host --privileged -v $HOME:/root:ro -e XAUTHORITY=/root/.Xauthority -e DISPLAY=$DISPLAY manell/wireshark
No protocol specified
QXcbConnection: Could not connect to display :0
ubuntu3@ubuntu3-VirtualBox:~$ sudo ssh -X user@host
ssh: Could not resolve hostname host: Temporary failure in name resolution
ubuntu3@ubuntu3-VirtualBox:~$ sudo ssh -X user@ubuntu3
ssh: Could not resolve hostname ubuntu3: Temporary failure in name resolution
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
NAMES
754d8a86fd67      glefeuvre/opendaylight   "/bin/sh -c ./distri..."   36 minutes ago   Up 36 minutes   0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8101/tcp, 0.0.0.0:8181->8181/tcp   opendaylight
```

Activities Terminal Thu 01:19

```
ubuntu3@ubuntu3-VirtualBox:~
```

File Edit View Search Terminal Help

```
ago      Up 37 minutes      0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8101/tcp, 0.0.0.0:8181->8181/tcp      opendaylight
cdc418ff69ab      onosproject/onos      "./bin/onos-service ..."    5 hours ago
o          Exited (1) 5 hours ago      onos3
6c359e9cbf94      onosproject/onos      "./bin/onos-service ..."    5 hours ago
o          Exited (255) 4 hours ago      6640/tcp, 6653/tcp, 8101/tcp, 8181/tcp, 9876/tcp      onos2
9e6228050d90      onosproject/onos      "./bin/onos-service ..."    5 hours ago
o          Exited (255) 4 hours ago      6640/tcp, 6653/tcp, 8101/tcp, 8181/tcp, 9876/tcp      onos1
891b8cbad9f7      hello-world      "/hello"          10 hours ago
go          Exited (0) 10 hours ago      keen_minsky
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -d manell/wireshark
ce79138b8d8307b3ef6bd5b29c5ddc5e0f86e7ea534361d626d80d155f0bd487
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
NAMES
ce79138b8d83        manell/wireshark     "wireshark"         20 seconds ago      Up 9 seconds
ago          pedantic_hamilton
754d8a86fd67        glefevre/opendaylight   "/bin/sh -c ./distri..."   41 minutes ago      Up 41 minutes      0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8101/tcp, 0.0.0.0:8181->8181/tcp      opendaylight
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -ti --net=host --privileged -v $HOME:/root:ro -e XAUTHORITY=/root/.Xauthority -e DISPLAY=$DISPLAY manell/wiresha
```

Activities Terminal Thu 01:18

```
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker ps --all
CONTAINER ID        IMAGE               COMMAND                  CREATED             STATUS              PORTS                 NAMES
1dd2d27a0053        manell/wireshark    "wireshark"            8 minutes ago      Exited (139) 8 minutes ago
be6bfa64d36c        manell/wireshark    "wireshark"            12 minutes ago     Exited (139) 11 minutes ago
754d8a86fd67        glefevre/opendaylight "/bin/sh -c ./distri..."   38 minutes ago     Up 37 minutes      0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8101/tcp, 0.0.0.0:8181->8181/tcp
cdc418ff69ab        onosproject/onos      "./bin/onos-service ..."   5 hours ago       Exited (1) 5 hours ago
6c359e9cbf94        onosproject/onos      "./bin/onos-service ..."   5 hours ago       Exited (255) 4 hours ago
9e6228050d90        onosproject/onos      "./bin/onos-service ..."   5 hours ago       Exited (255) 4 hours ago
891b8cbad9f7        hello-world          "/hello"                10 hours ago      Exited (0) 10 hours ago
```

Activities Terminal ▾ Thu 01:19

```
File Edit View Search Terminal Help
go      Exited (0) 10 hours ago
keen_minsky
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -d manell/wireshark
ce79138b8d8307b3ef6bd5b29c5dc5e0f86e7ea534361d626d80d155f0bd487
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
NAMES
ce79138b8d83        manell/wireshark    "wireshark"        20 seconds ago   Up 9 seconds
ago                Up 9 seconds
pedantic_hamilton
754d8a86fd67        glefevre/opendaylight "/bin/sh -c ./distri..."  41 minutes ago   Up 41 minutes   0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8101/tcp, 0.0.0.0:8181->8181/tcp   opendaylight
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -ti --net=host --privileged -v $HOME:/root:ro -e XAUTHORITY=/root/.Xauthority -e DISPLAY=$DISPLAY manell/wireshark
No protocol specified
QXcbConnection: Could not connect to display :0
ubuntu3@ubuntu3-VirtualBox:~$ adding -display :0.0
adding: command not found
ubuntu3@ubuntu3-VirtualBox:~$
ubuntu3@ubuntu3-VirtualBox:~$ display :0.0
display-im6.q16: unable to open image `:0.0': No such file or directory @ error
/blob.c/OpenBlob/2871.
display-im6.q16: no decode delegate for this image format `0' @ error/constitut
```

Activities Terminal Thu 01:19  
ubuntu3@ubuntu3-VirtualBox:~

```
File Edit View Search Terminal Help
ago Up 9 seconds
754d8a86fd67 pedantic_hamilton
ago Up 41 minutes 0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8101/tcp, 0
.0.0.0:8181->8181/tcp opendaylight
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -ti --net=host --privileged -v $H
OME:/root:ro -e XAUTHORITY=/root/.Xauthority -e DISPLAY=$DISPLAY manell/wiresha
rk
No protocol specified
QXcbConnection: Could not connect to display :0
ubuntu3@ubuntu3-VirtualBox:~$ adding -display :0.0
adding: command not found
ubuntu3@ubuntu3-VirtualBox:~$ ubuntu3@ubuntu3-VirtualBox:~$ display :0.0
display-im6.q16: unable to open image `:0.0': No such file or directory @ error
/blob.c/OpenBlob/2871.
display-im6.q16: no decode delegate for this image format `0' @ error/constitut
e.c/ReadImage/504.
ubuntu3@ubuntu3-VirtualBox:~$ env |grep DISPLAY
DISPLAY=:0
ubuntu3@ubuntu3-VirtualBox:~$ xhost +
access control disabled, clients can connect from any host
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -ti --net=host --privileged -v SH
OME:/root:ro -e XAUTHORITY=/root/.Xauthority -e DISPLAY=$DISPLAY manell/wiresha
rk
```

Activities Terminal Thu 01:19  
ubuntu3@ubuntu3-VirtualBox:~

```
File Edit View Search Terminal Help
No protocol specified
QXcbConnection: Could not connect to display :0
ubuntu3@ubuntu3-VirtualBox:~$ sudo ssh -X user@host
ssh: Could not resolve hostname host: Temporary failure in name resolution
ubuntu3@ubuntu3-VirtualBox:~$ sudo ssh -X user@ubuntu3
ssh: Could not resolve hostname ubuntu3: Temporary failure in name resolution
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
NAMES
754d8a86fd67      glefevre/opendaylight   "/bin/sh -c ./distri..."   36 minutes ago      Up 36 minutes   0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8101/tcp, 0
.0.0.0:8181->8181/tcp opendaylight
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker ps --all
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
NAMES
1dd2d27a0053      manell/wireshark       "wireshark"          8 minutes ago     Exited (139) 8 minutes ago
be6bfa64d36c      manell/wireshark       "wireshark"          12 minutes ago    Exited (139) 11 minutes ago
754d8a86fd67      glefevre/opendaylight   "/bin/sh -c ./distri..."   38 minutes ago      Up 37 minutes   0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8
101/tcp, 0.0.0.0:8181->8181/tcp opendaylight
cdc418ff69ab      onosproject/onos        "./bin/onos-service ..."   5 hours ago      Exited (1)
```

Activities Terminal Thu 01:23

```
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker ps --all
CONTAINER ID        IMAGE               COMMAND                  CREATED             STATUS              PORTS
NAMES
1dd2d27a0053        manell/wireshark    "wireshark"            8 minutes ago      Exited (139) 8 minutes ago
ago
be6bfa64d36c        manell/wireshark    "wireshark"            12 minutes ago     Exited (139) 11 minutes ago
ago
754d8a86fd67        glefevre/opendaylight "/bin/sh -c ./distri..."   38 minutes ago     Up 37 minutes      0.0.0.0:6633->6633/tcp, 0.0.0.0:8101->8101/tcp, 0.0.0.0:8181->8181/tcp
opendaylight
cdc418ff69ab        onosproject/onos      "./bin/onos-service ..."  5 hours ago       Exited (1) 5 hours ago
o
onos3
6c359e9cbf94        onosproject/onos      "./bin/onos-service ..."  5 hours ago       Exited (255) 4 hours ago
o
onos2
9e6228050d90        onosproject/onos      "./bin/onos-service ..."  5 hours ago       Exited (255) 4 hours ago
o
onos1
891b8cbad9f7        hello-world          "/hello"                10 hours ago      Exited (0) 10 hours ago
go
keen_minsky
ubuntu3@ubuntu3-VirtualBox:~$ sudo docker run -d manell/wireshark
ce79138b8d8307b3ef6bd5b29c5ddc5e0f86e7ea534361d626d80d155f0bd487
```

