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## 01.2: ARP, Wireshark, Netsim

### ARP #1

Use the IP command to find the IP address and hardware address of the local virtual ethernet card interface.

```
ashfaq@ashfaq-VirtualBox:~$ ifconfig -a
docker0: flags=4099<UP,BROADCAST,MULTICAST> mtu 1500
    inet 172.17.0.1 netmask 255.255.0.0 broadcast 172.17.255.255
    ether 02:42:2c:6d:60:d0 txqueuelen 0 (Ethernet)
    RX packets 0 bytes 0 (0.0 B)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 bytes 0 (0.0 B)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

enp0s3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.0.2.15 netmask 255.255.255.0 broadcast 10.0.2.255
    inet6 fe80::1d25:6172:6704:88b6 prefixlen 64 scopeid 0x20<link>
    ether 08:00:27:f8:ab:4e txqueuelen 1000 (Ethernet)
    RX packets 27883 bytes 41384325 (41.3 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 13767 bytes 885178 (885.1 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 381 bytes 33511 (33.5 KB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 381 bytes 33511 (33.5 KB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Perform a `netstat -rn` to find the default router's IP address

```
ashfaq@ashfaq-VirtualBox:~$ netstat -rn
Kernel IP routing table
Destination      Gateway         Genmask         Flags   MSS Window  irtt Iface
0.0.0.0          10.0.2.2       0.0.0.0         UG        0 0          0 enp0s3
10.0.2.0         0.0.0.0        255.255.255.0   U        0 0          0 enp0s3
169.254.0.0      0.0.0.0        255.255.0.0     U        0 0          0 enp0s3
172.17.0.0       0.0.0.0        255.255.0.0     U        0 0          0 docker0
ashfaq@ashfaq-VirtualBox:~$ ip route
default via 10.0.2.2 dev enp0s3 proto dhcp metric 100
10.0.2.0/24 dev enp0s3 proto kernel scope link src 10.0.2.15 metric 100
169.254.0.0/16 dev enp0s3 scope link metric 1000
172.17.0.0/16 dev docker0 proto kernel scope link src 172.17.0.1 linkdown
ashfaq@ashfaq-VirtualBox:~$
```

Ping the default router and use `arp` to find its hardware address.

```
64 bytes from 10.0.2.2: icmp_seq=84 ttl=64 time=0.094 ms
64 bytes from 10.0.2.2: icmp_seq=85 ttl=64 time=0.096 ms
64 bytes from 10.0.2.2: icmp_seq=86 ttl=64 time=0.100 ms
64 bytes from 10.0.2.2: icmp_seq=87 ttl=64 time=0.097 ms
64 bytes from 10.0.2.2: icmp_seq=88 ttl=64 time=0.120 ms
64 bytes from 10.0.2.2: icmp_seq=89 ttl=64 time=0.130 ms
64 bytes from 10.0.2.2: icmp_seq=90 ttl=64 time=0.113 ms
^Z
[2]+  Stopped                  ping 10.0.2.2
ashfaq@ashfaq-VirtualBox:~$ arp -a
 _gateway (10.0.2.2) at 52:54:00:12:35:02 [ether] on enp0s3
ashfaq@ashfaq-VirtualBox:~$
```

Which hardware manufacturer does the destination hardware address of the packet indicate? (REQUEST) **REALTEK**

The screenshot shows a terminal window with the following commands and output:

```
ashfaq@ashfaq-VirtualBox:~$ ping www.google.com
PING www.google.com (142.251.33.68) 56(84) bytes of data:
64 bytes from sea09s28-in-f4.1e100.net (142.251.33.68): icmp_seq=1 ttl=113 time=6.87 ms
64 bytes from sea09s28-in-f4.1e100.net (142.251.33.68): icmp_seq=2 ttl=113 time=6.90 ms
64 bytes from sea09s28-in-f4.1e100.net (142.251.33.68): icmp_seq=3 ttl=113 time=6.16 ms
64 bytes from sea09s28-in-f4.1e100.net (142.251.33.68): icmp_seq=4 ttl=113 time=5.40 ms
64 bytes from sea09s28-in-f4.1e100.net (142.251.33.68): icmp_seq=5 ttl=113 time=6.41 ms
64 bytes from sea09s28-in-f4.1e100.net (142.251.33.68): icmp_seq=6 ttl=113 time=6.38 ms
64 bytes from sea09s28-in-f4.1e100.net (142.251.33.68): icmp_seq=7 ttl=113 time=6.19 ms
^Z
[1]+  Stopped                  ping
ashfaq@ashfaq-VirtualBox:~$
```

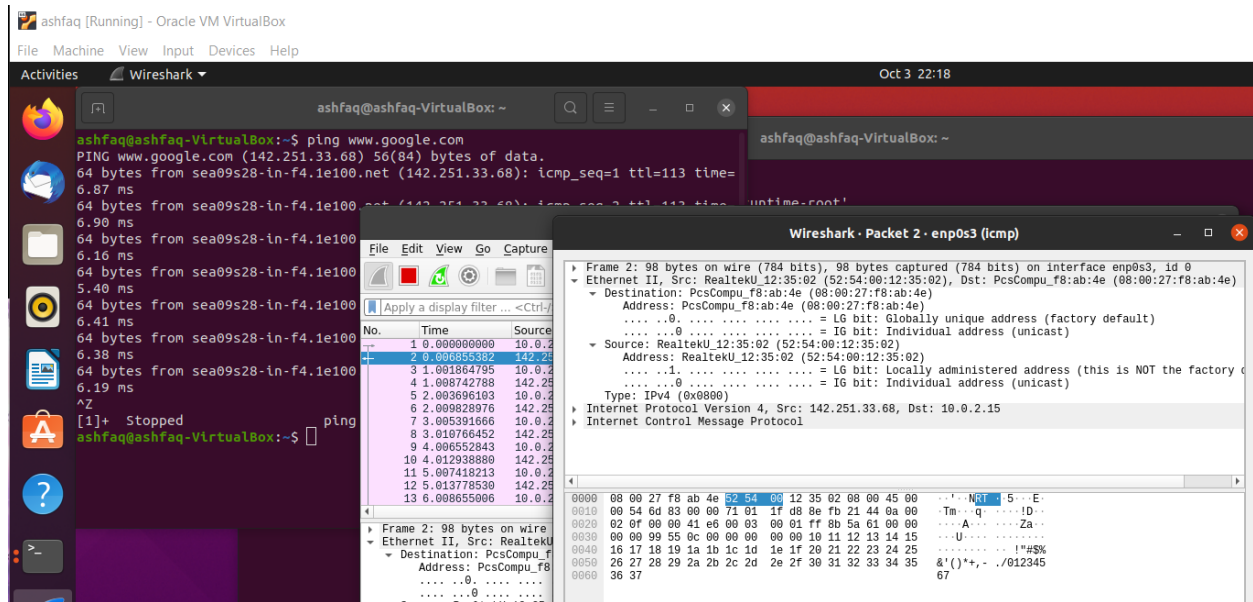
The Wireshark packet capture shows the following details for Packet 1 (enp0s3 (icmp)):

- Frame 1: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface enp0s3, id 0
- Ethernet II, Src: PcsCompu\_f8:ab:4e (08:00:27:f8:ab:4e), Dst: RealtekU\_12:35:02 (52:54:00:12:35:02)
- Destination: RealtekU\_12:35:02 (52:54:00:12:35:02)
- Address: RealtekU\_12:35:02 (52:54:00:12:35:02)
- Type: IG bit: Locally administered address (this is NOT the factory default)
- Type: IG bit: Individual address (unicast)
- Source: PcsCompu\_f8:ab:4e (08:00:27:f8:ab:4e)
- Address: PcsCompu\_f8:ab:4e (08:00:27:f8:ab:4e)
- Type: IG bit: Globally unique address (factory default)
- Type: IG bit: Individual address (unicast)
- Type: IPv4 (0x0800)
- Internet Protocol Version 4, Src: 10.0.2.15, Dst: 142.251.33.68
- Internet Control Message Protocol

The packet details pane shows the following hex data:

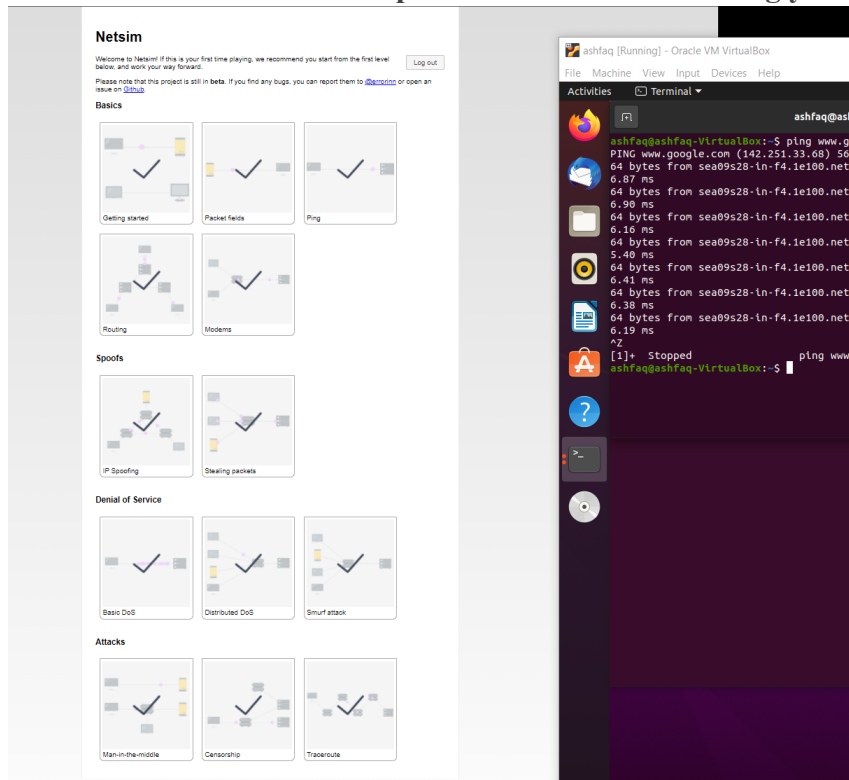
```
0000 52 54 00 12 35 02 00 00 27 f8 ab 4e 00 00 45 00 RT: 5 - N: E
0010 00 64 2a b8 40 00 40 01 53 a3 0a 00 02 0f 8e fb T: 0 - S:
0020 21 44 08 00 39 e6 00 03 00 01 ff 8b 5a 61 00 00 ID: 9 - Z: a
0030 00 00 99 55 0c 00 00 00 00 00 10 11 12 13 14 15 ..U.....
0040 16 17 18 19 1a 1b 1c 1d 1e 1f 20 21 22 23 24 25 .....!#$%
0050 26 27 28 29 2a 2b 2c 2d 2e 2f 30 31 32 33 34 35 8()*+.,/012345
0060 36 37
```

Which hardware manufacturer does the destination hardware address of the packet indicate? (RESPONSE) **PcsCompu\_f8**



## Netsim #2

Take a screenshot of the completed list of levels including your OdinID



## 01.3: Cloud networking

Launch a Compute Engine using the **f1-micro** machine type and place it in **us-west1-b**

```
Get:2 http://us-west1.gce.archive.ubuntu.com/ubuntu bionic/main amd64
Get:3 http://us-west1.gce.archive.ubuntu.com/ubuntu bionic-updates/main
4.1 [115 kB]
Get:4 http://us-west1.gce.archive.ubuntu.com/ubuntu bionic/main amd64
Fetched 5467 kB in 0s (29.0 MB/s)
Selecting previously unselected package libblas3:amd64.
(Reading database ... 65612 files and directories currently installed.)
Preparing to unpack .../libblas3_3.7.1-4ubuntu1_amd64.deb ...
Unpacking libblas3:amd64 (3.7.1-4ubuntu1) ...
Selecting previously unselected package liblinear3:amd64.
Preparing to unpack .../liblinear3_2.1.0+dfsg-2_amd64.deb ...
Unpacking liblinear3:amd64 (2.1.0+dfsg-2) ...
Selecting previously unselected package liblua5.3-0:amd64.
Preparing to unpack .../liblua5.3-0_5.3.3-1ubuntu0.18.04.1_amd64.deb ...
Unpacking liblua5.3-0:amd64 (5.3.3-1ubuntu0.18.04.1) ...
Selecting previously unselected package nmap.
Preparing to unpack .../nmap_7.60-1ubuntu5_amd64.deb ...
Unpacking nmap (7.60-1ubuntu5) ...
Setting up libblas3:amd64 (3.7.1-4ubuntu1) ...
update-alternatives: using /usr/lib/x86_64-linux-gnu/blas/libblas.so.3
.so.3 (libblas.so.3-x86_64-linux-gnu) in auto mode
Setting up liblinear3:amd64 (2.1.0+dfsg-2) ...
Setting up liblua5.3-0:amd64 (5.3.3-1ubuntu0.18.04.1) ...
Setting up nmap (7.60-1ubuntu5) ...
Processing triggers for man-db (2.8.3-2ubuntu0.1) ...
Processing triggers for libc-bin (2.27-3ubuntu1.4) ...
ashfaq@instance-1:~$
```

## Launch targets

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<input type="checkbox"/>	Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Connect
<input type="checkbox"/>	✓	drupal-1-vm	us-west1-b			10.138.0.5 (nic0)	34.145.54.64	SSH ⌵ ⋮
<input type="checkbox"/>	✓	instance-1	us-west1-b			10.138.0.2 (nic0)	35.230.54.65	SSH ⌵ ⋮
<input type="checkbox"/>	✓	magento-1-vm	us-west1-b			10.138.0.4 (nic0)	34.82.54.142	SSH ⌵ ⋮
<input type="checkbox"/>	✓	wordpress-1-vm	us-west1-b			10.138.0.3 (nic0)	34.83.86.226	SSH ⌵ ⋮

Related actions

## Scan targets for services

```
ashfaq@instance-1: ~ - Google Chrome
ssh.cloud.google.com/projects/cloud-f21-mazin-ashfaq-ashfaq/zones/us-west1-b/instances/instance-1?authuser=4&hl=en_US&project...
ashfaq@instance-1:~$ nmap 10.183.0.3/24

Starting Nmap 7.60 ( https://nmap.org ) at 2021-10-04 07:03 UTC
Nmap done: 256 IP addresses (0 hosts up) scanned in 104.23 seconds
ashfaq@instance-1:~$
```

## CIDR and subnets #2

### How many subnetworks are created initially on the default network?

56

Given the CIDR prefix associated with each subnetwork, how many hosts does each subnetwork support?

$$/20 \text{ Hosts} = 2^{32-20} - 2 = 4,094$$

```
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CLOUD SHELL Terminal (cloud-f21-mazin-ashfaq-ashfaq) x +
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:

NAME: default
REGION: europe-central2
NETWORK: default
RANGE: 10.186.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:

NAME: default
REGION: northamerica-northeast2
NETWORK: default
RANGE: 10.188.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:

NAME: default
REGION: asia-south2
NETWORK: default
RANGE: 10.190.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:

NAME: default
REGION: australia-southeast2
NETWORK: default
RANGE: 10.192.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:
ashfaq@cloudshell:~ (cloud-f21-mazin-ashfaq-ashfaq) $ grep default | wc -l
^Z
[2]+  Stopped                  grep --color=auto default | wc -l
ashfaq@cloudshell:~ (cloud-f21-mazin-ashfaq-ashfaq) $ gcloud compute networks subnets list | grep default | wc -l
56
ashfaq@cloudshell:~ (cloud-f21-mazin-ashfaq-ashfaq) $
```

Navigating default networks

**Which CIDR subnetworks are these instances brought up in? Do they correspond to the appropriate region based on the prior commands?**

10.150.0.2 for the east and 10.182.0.2 for the west. They correspond to the previous command.

**From the figure in the previous step. What facilitates this connectivity: the virtual switch or the VPN Gateway?**

The virtual switch facilitates.

```
ashfaq@instance-1:~$ ping 10.182.0.2
PING 10.182.0.2 (10.182.0.2) 56(84) bytes of data.
```

**Take a screenshot of the new subnets created in custom-network1 alongside the default subnetworks in those regions assigned to the default network.**

```
ashfaq@cloudshell:~ (cloud-f21-mazin-ashfaq-ashfaq)$ gcloud compute networks subnets list
NAME: default
REGION: us-central1
NETWORK: default
RANGE: 10.128.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:

NAME: subnet-us-central-192
REGION: us-central1
NETWORK: custom-network1
RANGE: 192.168.1.0/24
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:

NAME: default
REGION: europe-west1
NETWORK: default
RANGE: 10.132.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:

NAME: subnet-europe-west-192
REGION: europe-west1
NETWORK: custom-network1
RANGE: 192.168.5.0/24
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
IPV6_CIDR_RANGE:
EXTERNAL_IPV6_CIDR_RANGE:
```



Creating custom networks

```
ashfaq@cloudshell:~ (cloud-f21-mazin-ashfaq-ashfaq)$ gcloud compute networks create custom-network1 --subnet-mode custom
Created [https://www.googleapis.com/compute/v1/projects/cloud-f21-mazin-ashfaq-ashfaq/global/networks/custom-network1].
NAME: custom-network1
SUBNET_MODE: CUSTOM
BGP_ROUTING_MODE: REGIONAL
IPV4_RANGE:
GATEWAY_IPV4:

Instances on this network will not be reachable until firewall rules
are created. As an example, you can allow all internal traffic between
instances as well as SSH, RDP, and ICMP by running:

$ gcloud compute firewall-rules create <FIREWALL_NAME> --network custom-network1 --allow tcp,udp,icmp --source-ranges <IP_RANGE>
$ gcloud compute firewall-rules create <FIREWALL_NAME> --network custom-network1 --allow tcp:22,tcp:3389,icmp

ashfaq@cloudshell:~ (cloud-f21-mazin-ashfaq-ashfaq)$
```

Explain why the result is different from instance-2.

Instance 1 is not able to get into the other VPC.

Take screenshots of all 4 instances in the UI including the network they belong to.

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	Status	Name ↑	Zone	Recommendations	In use by	Internal IP	External IP	Network	Connect	
<input type="checkbox"/>		drupal-1-vm	us-west1-b			10.138.0.5 (nic0)	None	default	SSH ▾	⋮
<input type="checkbox"/>		instance-1	us-east4-b			10.150.0.2 (nic0)	35.188.229.121	default	SSH ▾	⋮
<input type="checkbox"/>		instance-2	us-west4-b			10.182.0.2 (nic0)	34.125.88.131	default	SSH ▾	⋮
<input type="checkbox"/>		instance-3	us-central1-a			192.168.1.2 (nic0)	34.132.75.146	custom-network1	SSH ▾	⋮
<input type="checkbox"/>		instance-4	europa-west1-d			192.168.5.2 (nic0)	35.195.145.193	custom-network1	SSH ▾	⋮

Then visit "VPC Network" and take a screenshot of the subnetworks created.

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Q vpc network


X

^

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Name ↑	Region	Subnets	MTU ⓘ	Mode	IP address ranges	Gateways	Firewall Rules	Global dynamic routing	Flow logs
▼ custom-network1		2	1460	Custom			0	Off	
	us-central1	subnet-us-central-192			192.168.1.0/24	192.168.1.1			Off
	europe-west1	subnet-europe-west-192			192.168.5.0/24	192.168.5.1			Off
▼ default		28	1460	Auto			7	Off	
	us-central1	default			10.128.0.0/20	10.128.0.1			Off
	europe-west1	default			10.132.0.0/20	10.132.0.1			Off