CS530 F23 Week 1 Lab
Prof. Feng

Amelia Miner
9/30/23

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I. Lab 1.2 - ARP, Wireshark, Netsim

1. ARP

- ada's IP address is `131.252.208.103` and its MAC address is `52:54:00:13:a0:c6`.
- `netstat -rn` tells me that the default router's IP address is `131.252.208.1`.
- `arp` tells me that the router's name is `router.seas.pdx.edu` and its MAC/HW address is `00:00:5e:00:01:01`.
- `arp -a | wc -l` tells me there are 45 entries in the ARP table.

2. -

- `arp -a | sort -k 4 | column -t` tells me that:
  `169.254.169.254` and `131.252.208.212` share `30:e4:db:f9:26:37`, and
  `131.252.208.15` and `131.252.208.7` share `cc:aa:77:2e:16:a0`.
- Now we're cooking with unix! I love pipes.
  `arp -a | sort -k 4 | awk '{print $4}' | uniq | wc -l` tells me that there are 43 unique MAC addresses whereas there are 45 unique ARP table entries (IP addresses), so there are 2 fewer MAC addresses than there are IP addresses.
- `arp -an | awk -F '[()]' '{print $2}' > arp_entries` (and then examining the output with `cat`) tells me that most of the IP addresses in Ada's ARP table share the 24-bit prefix `131.252.208`.

3. ARP (Cloud)

- `ip a` tells me the IP address of my cloud VM is `10.138.0.2` and its MAC address is `02:42:5c:60:cb:a9`.
- `netstat -rn` tells me the default router's IP address is `10.138.0.1`.
- `arp` tells me the MAC address of the default router is `42:01:0a:8a:00:01`.

4. Netsim

This was really cute and fun. Screenshot overflows to the next page.

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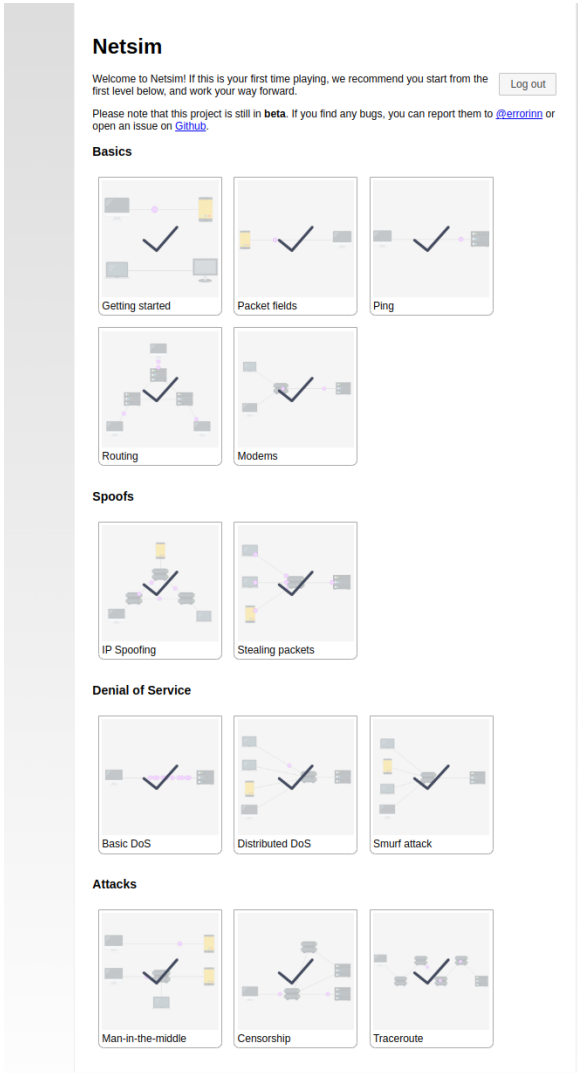

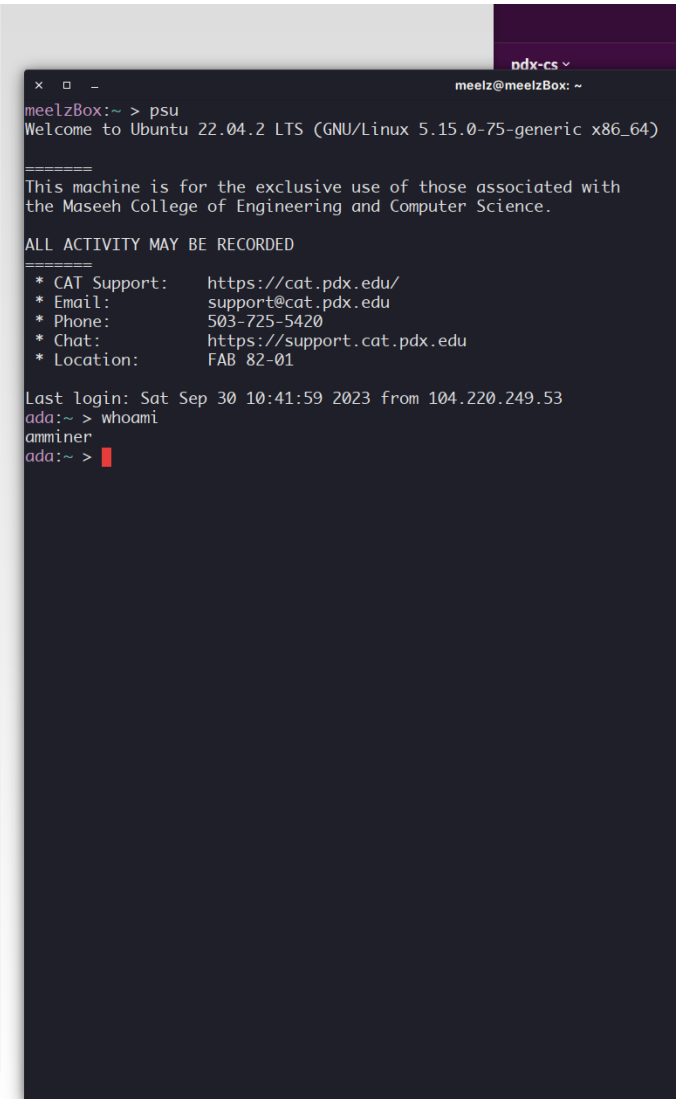

II. Lab 1.3 - Cloud Networking

1. Network Scanning (nmap) #1

- Done.

2. Launch targets

- Done:
  (screenshot on next page)

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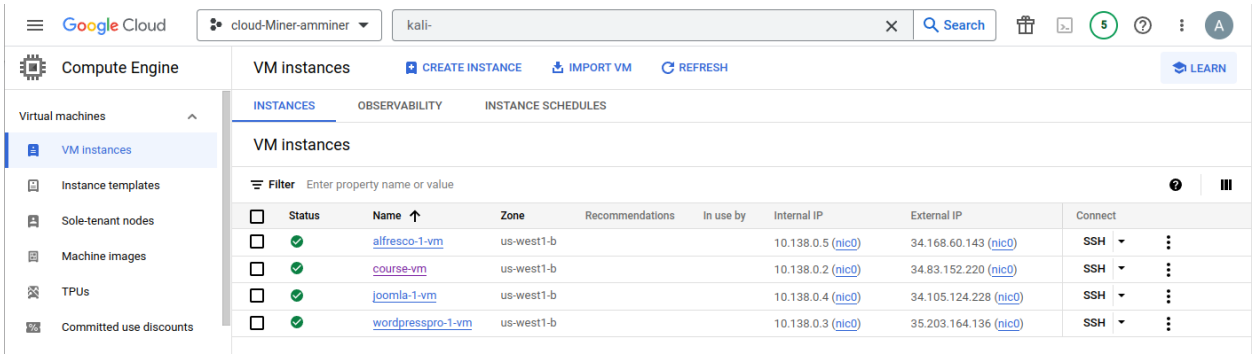
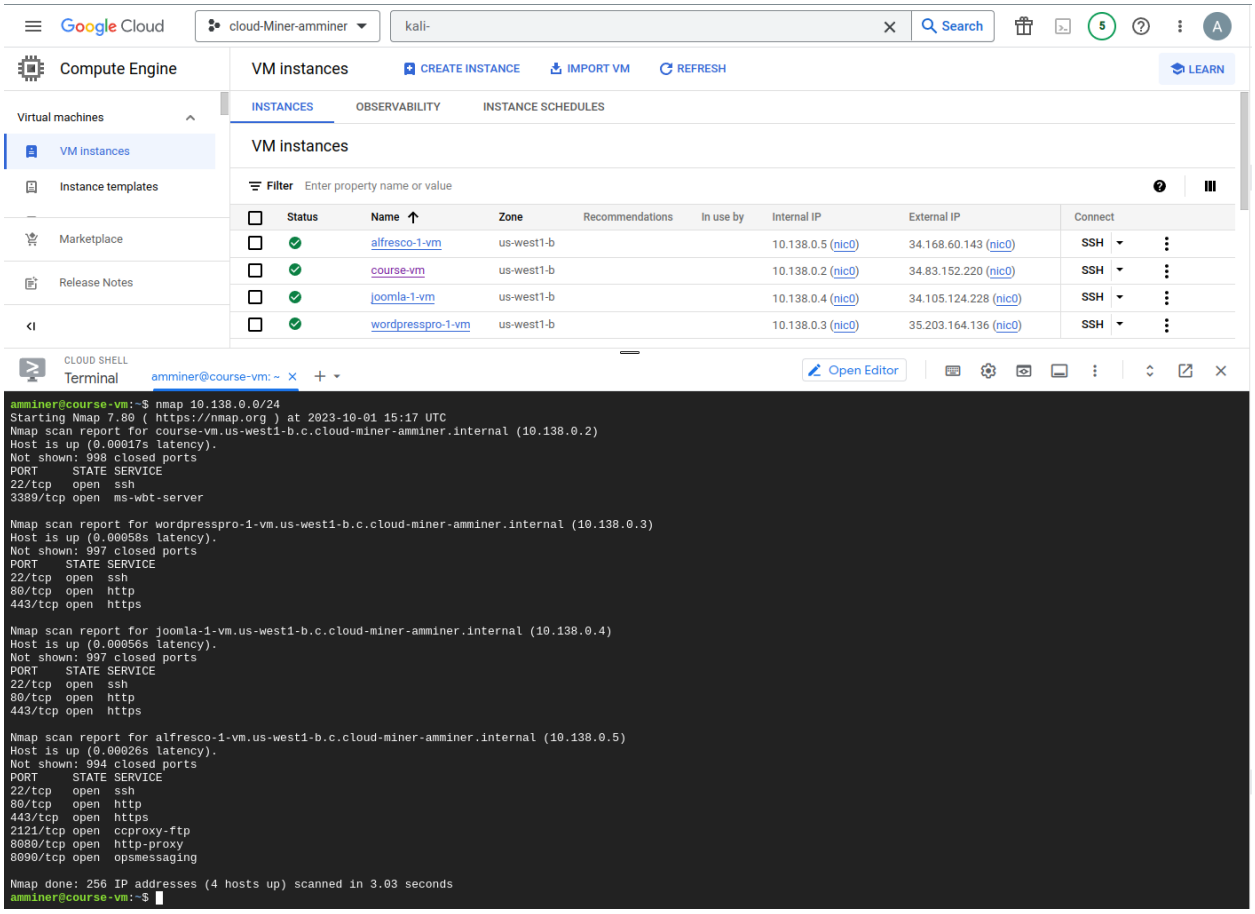


3. Scan targets for services

- Done:



4. CIDR and Subnets #2

- Done.

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5. Navigating Default Networks

- gcloud compute networks subnets list | grep "NETWORK: default" | wc -l tells me there are 40 subnets in the default network.
- gcloud compute networks subnets list | grep "REGION:" | uniq | wc -l tells me there are 40 unique regions to which these subnets correspond.
- Every subnet has a CIDR network mask of /20, so 20 bits are reserved for the network and 12 remain for hosts. 2**12 = 4096. so each subnet has enough address space for 4096 host devices.
- Instances created:

```
amminer@cloudshell:~ (cloud-miner-amminer)$ gcloud compute instances list
NAME: course-vm
ZONE: us-west1-b
MACHINE_TYPE: e2-medium
PREEMPTIBLE:
INTERNAL_IP: 10.138.0.2
EXTERNAL_IP: 34.83.152.220
STATUS: RUNNING

NAME: instance-1
ZONE: us-east1-b
MACHINE_TYPE: n1-standard-1
PREEMPTIBLE:
INTERNAL_IP: 10.142.0.2
EXTERNAL_IP: 34.138.188.25
STATUS: RUNNING

NAME: instance-2
ZONE: us-west3-b
MACHINE_TYPE: n1-standard-1
PREEMPTIBLE:
INTERNAL_IP: 10.180.0.2
EXTERNAL_IP: 34.106.78.24
STATUS: RUNNING
amminer@cloudshell:~ (cloud-miner-amminer)$
```

- us-east1 has RANGE: 10.142.0.0/20 and us-west3 has RANGE: 10.180.0.0/20, so the instances are brought up in subnetworks corresponding to their region based on prior commands.
- Pinged instance-2 from instance-1 (screenshot on next page):

```
amminer@cloudshell:~ (cloud-miner-amminer)$ gcloud compute ssh instance-1
Did you mean zone [us-west1-a] for instance: [instance-1] (Y/n)?  n

No zone specified. Using zone [us-east1-b] for instance: [instance-1].
Linux instance-1 5.10.0-25-cloud-amd64 #1 SMP Debian 5.10.191-1 (2023-08-16) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Mon Oct  2 15:14:14 2023 from 35.227.157.249
amminer@instance-1:~$ ping 10.180.0.2
PING 10.180.0.2 (10.180.0.2) 56(84) bytes of data.
64 bytes from 10.180.0.2: icmp_seq=1 ttl=64 time=55.0 ms
64 bytes from 10.180.0.2: icmp_seq=2 ttl=64 time=53.2 ms
64 bytes from 10.180.0.2: icmp_seq=3 ttl=64 time=53.2 ms
^C
--- 10.180.0.2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2002ms
rtt min/avg/max/mdev = 53.235/53.822/54.987/0.823 ms
amminer@instance-1:~$
```

- This connection is facilitated by the virtual switch.

6. Creating Custom Networks

- custom-network1 created & listed:

```
amminer@cloudshell:~ (cloud-miner-amminer)$ gcloud compute networks list
NAME: custom-network1
SUBNET_MODE: CUSTOM
BGP_ROUTING_MODE: REGIONAL
IPV4_RANGE:
GATEWAY_IPV4:

NAME: default
SUBNET_MODE: AUTO
BGP_ROUTING_MODE: REGIONAL
IPV4_RANGE:
GATEWAY_IPV4:
amminer@cloudshell:~ (cloud-miner-amminer)$
```

- 192.x.x.x subnets created & listed:

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```
amminer@cloudshell:~ (cloud-miner-amminer)$ gcloud compute networks subnets list | grep -e 'us-central1$' -e 'europe-west1$' -C 5
NAME: default
REGION: us-central1
NETWORK: default
RANGE: 10.128.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
INTERNAL_IPV6_PREFIX:
EXTERNAL_IPV6_PREFIX:

NAME: subnet-us-central-192
REGION: us-central1
NETWORK: custom-network1
RANGE: 192.168.1.0/24
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
INTERNAL_IPV6_PREFIX:
EXTERNAL_IPV6_PREFIX:

NAME: default
REGION: europe-west1
NETWORK: default
RANGE: 10.132.0.0/20
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
INTERNAL_IPV6_PREFIX:
EXTERNAL_IPV6_PREFIX:

NAME: subnet-europe-west-192
REGION: europe-west1
NETWORK: custom-network1
RANGE: 192.168.5.0/24
STACK_TYPE: IPV4_ONLY
IPV6_ACCESS_TYPE:
INTERNAL_IPV6_PREFIX:
amminer@cloudshell:~ (cloud-miner-amminer)$
```

- Instances created; instance-3 has internal IP 192.168.1.2, instance-4 has 192.168.5.2.
- Pinged the internal addresses of instances 3 and 4 from instance-1; the packets do not reach their destination because these instances are not on the same internal network as instance-1, whereas instance-1 and instance-2 are on different subnets within the same broader network, connected by a virtual switch.
- All 4 instances in the UI with their networks and my ODIN ID:

Status	Name	Zone	Recommendations	Internal IP	External IP	Network
✓	instance-4	europe-west1-d		192.168.5.2 (nic0)	35.233.27.33 (nic0)	custom-network1
✓	instance-3	us-central1-a		192.168.1.2 (nic0)	34.41.183.224 (nic0)	custom-network1
✓	instance-2	us-west3-b		10.180.0.2 (nic0)	34.106.78.24 (nic0)	default
✓	instance-1	us-east1-b		10.142.0.2 (nic0)	34.138.188.25 (nic0)	default

mminer × + Open Editor

r-amminer)$

- custom-network1 subnets:

Subnets ADD SUBNET FLOW LOGS

Filter Enter property name or value

Name	Region	Stack Type	Internal IP ranges	External IP ranges	Secondary IPv4 ranges	Gateway
subnet-europe-west-192	europe-west1	IPv4	192.168.5.0/24	None	None	192.168.5.1
subnet-us-central-192	us-central1	IPv4	192.168.1.0/24	None	None	192.168.1.1

mminer × + Open

r-amminer)$

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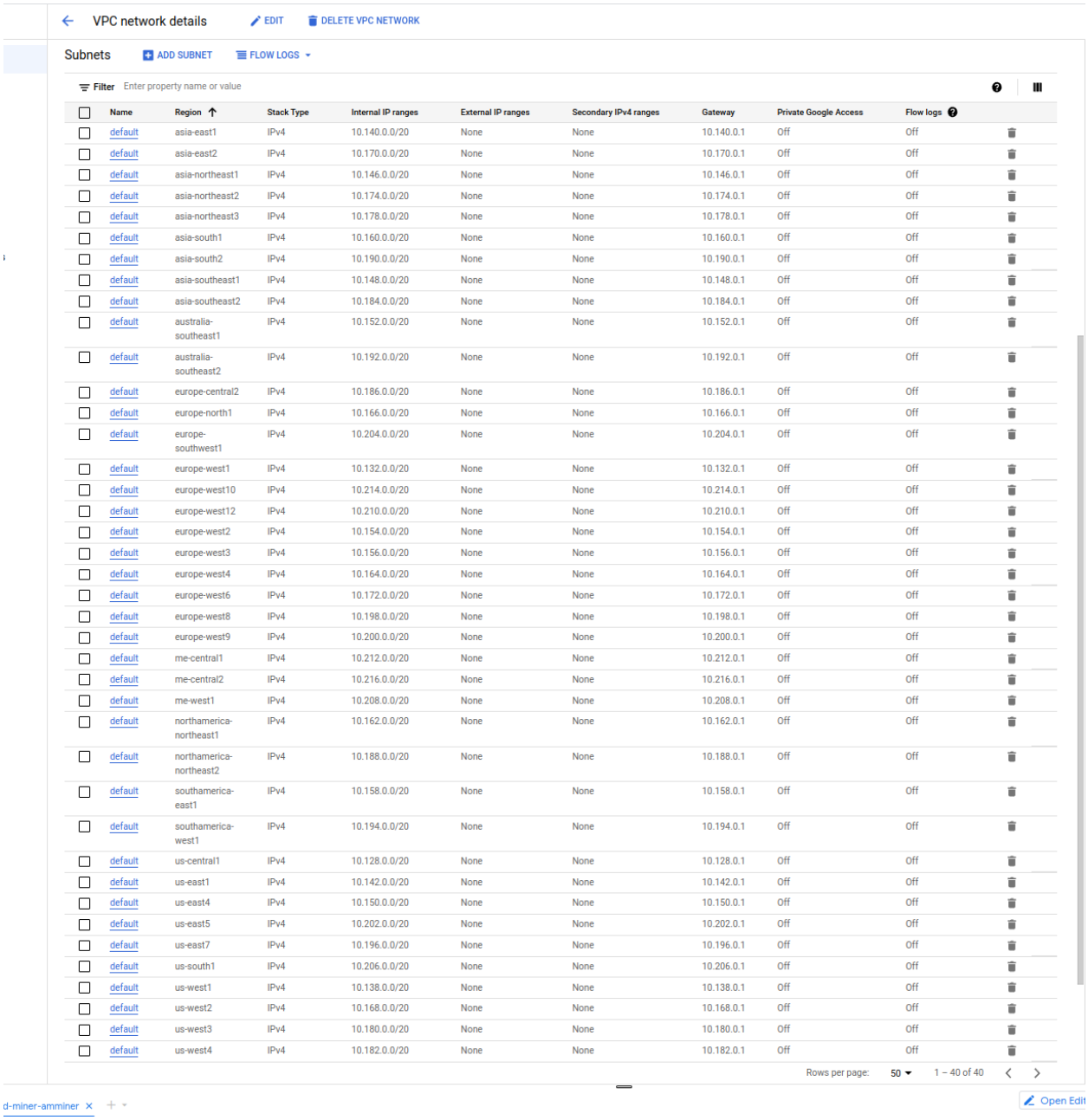
- default network subnets:



VPC network details EDIT DELETE VPC NETWORK

Subnets ADD SUBNET FLOW LOGS

Filter Enter property name or value

Name	Region	Stack Type	Internal IP ranges	External IP ranges	Secondary IPv4 ranges	Gateway	Private Google Access	Flow logs
default	asia-east1	IPv4	10.140.0.0/20	None	None	10.140.0.1	Off	Off
default	asia-east2	IPv4	10.170.0.0/20	None	None	10.170.0.1	Off	Off
default	asia-northeast1	IPv4	10.146.0.0/20	None	None	10.146.0.1	Off	Off
default	asia-northeast2	IPv4	10.174.0.0/20	None	None	10.174.0.1	Off	Off
default	asia-northeast3	IPv4	10.178.0.0/20	None	None	10.178.0.1	Off	Off
default	asia-south1	IPv4	10.160.0.0/20	None	None	10.160.0.1	Off	Off
default	asia-south2	IPv4	10.190.0.0/20	None	None	10.190.0.1	Off	Off
default	asia-southeast1	IPv4	10.148.0.0/20	None	None	10.148.0.1	Off	Off
default	asia-southeast2	IPv4	10.184.0.0/20	None	None	10.184.0.1	Off	Off
default	australia-southeast1	IPv4	10.152.0.0/20	None	None	10.152.0.1	Off	Off
default	australia-southeast2	IPv4	10.192.0.0/20	None	None	10.192.0.1	Off	Off
default	europe-central2	IPv4	10.186.0.0/20	None	None	10.186.0.1	Off	Off
default	europe-north1	IPv4	10.166.0.0/20	None	None	10.166.0.1	Off	Off
default	europe-southwest1	IPv4	10.204.0.0/20	None	None	10.204.0.1	Off	Off
default	europe-west1	IPv4	10.132.0.0/20	None	None	10.132.0.1	Off	Off
default	europe-west10	IPv4	10.214.0.0/20	None	None	10.214.0.1	Off	Off
default	europe-west12	IPv4	10.210.0.0/20	None	None	10.210.0.1	Off	Off
default	europe-west2	IPv4	10.154.0.0/20	None	None	10.154.0.1	Off	Off
default	europe-west3	IPv4	10.156.0.0/20	None	None	10.156.0.1	Off	Off
default	europe-west4	IPv4	10.164.0.0/20	None	None	10.164.0.1	Off	Off
default	europe-west6	IPv4	10.172.0.0/20	None	None	10.172.0.1	Off	Off
default	europe-west8	IPv4	10.198.0.0/20	None	None	10.198.0.1	Off	Off
default	europe-west9	IPv4	10.200.0.0/20	None	None	10.200.0.1	Off	Off
default	me-central1	IPv4	10.212.0.0/20	None	None	10.212.0.1	Off	Off
default	me-central2	IPv4	10.216.0.0/20	None	None	10.216.0.1	Off	Off
default	me-west1	IPv4	10.208.0.0/20	None	None	10.208.0.1	Off	Off
default	northamerica-northeast1	IPv4	10.162.0.0/20	None	None	10.162.0.1	Off	Off
default	northamerica-northeast2	IPv4	10.188.0.0/20	None	None	10.188.0.1	Off	Off
default	southamerica-east1	IPv4	10.158.0.0/20	None	None	10.158.0.1	Off	Off
default	southamerica-west1	IPv4	10.194.0.0/20	None	None	10.194.0.1	Off	Off
default	us-central1	IPv4	10.128.0.0/20	None	None	10.128.0.1	Off	Off
default	us-east1	IPv4	10.142.0.0/20	None	None	10.142.0.1	Off	Off
default	us-east4	IPv4	10.150.0.0/20	None	None	10.150.0.1	Off	Off
default	us-east5	IPv4	10.202.0.0/20	None	None	10.202.0.1	Off	Off
default	us-east7	IPv4	10.196.0.0/20	None	None	10.196.0.1	Off	Off
default	us-south1	IPv4	10.206.0.0/20	None	None	10.206.0.1	Off	Off
default	us-west1	IPv4	10.138.0.0/20	None	None	10.138.0.1	Off	Off
default	us-west2	IPv4	10.168.0.0/20	None	None	10.168.0.1	Off	Off
default	us-west3	IPv4	10.180.0.0/20	None	None	10.180.0.1	Off	Off
default	us-west4	IPv4	10.182.0.0/20	None	None	10.182.0.1	Off	Off

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7. Clean Up

- Done!