

Report: Lab 3

Group:

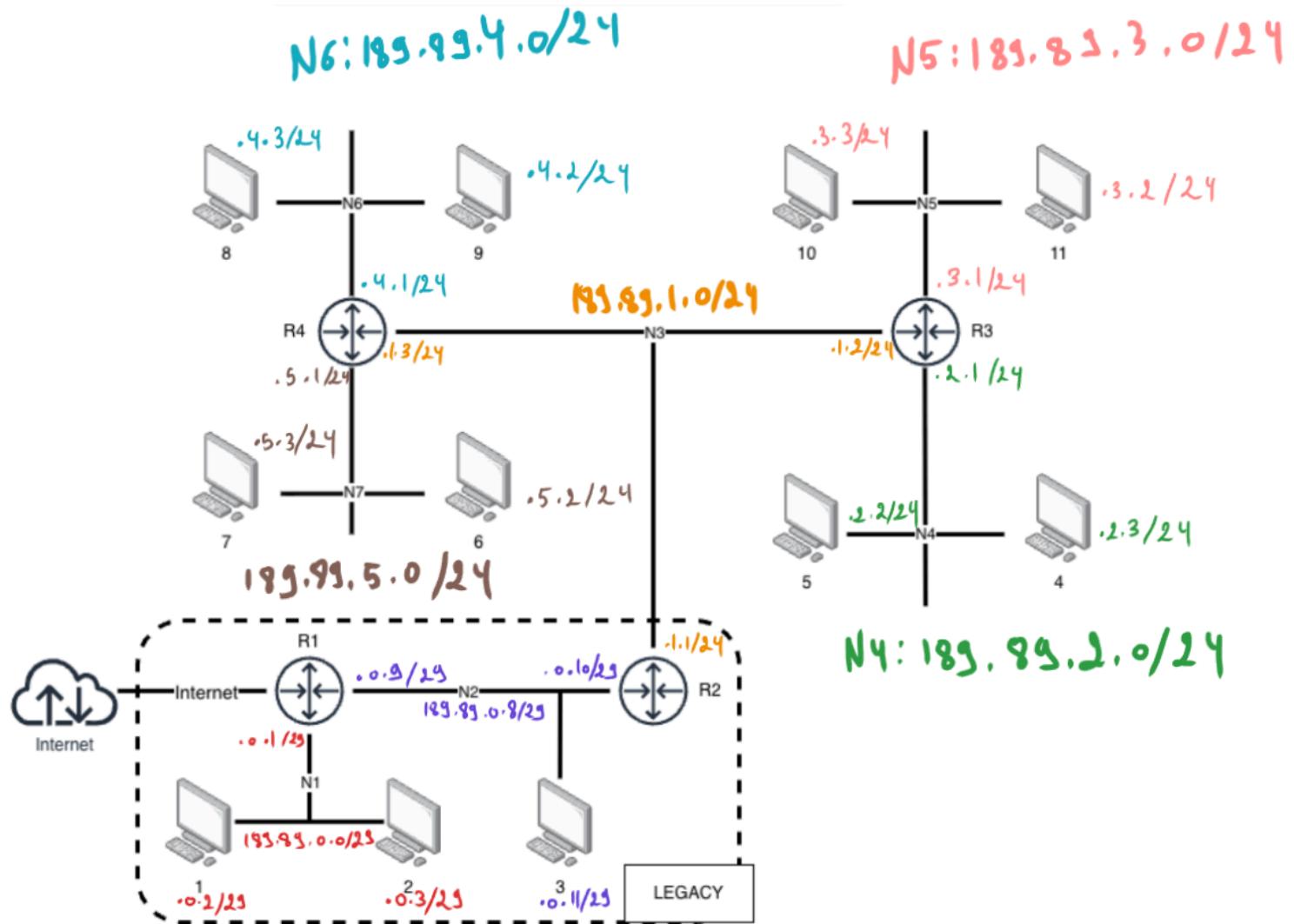
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Load Plan - 1

Topology



We have gone with a plan that uses a variable size subnet masking. Since we already have inside the legacy building a set amount of devices that doesn't change, and an unknown number of devices that are gonna be added outside of the legacy network. And so we won't waste a lot of IP addresses on the legacy network.

The plan in short is we subnet our /16 space into a /24 space, so we have 256 new subnets each with 254 hosts. So we assign the following subnets for the network:

- N3: 189.89.1.0/24
- N4: 189.89.2.0/24
- N5: 189.89.3.0/24
- N6: 189.89.4.0/24

- N7: 189.89.5.0/24

Then we subnet the 189.89.0.0/24 space into a /29 space, so we have 8 hosts per subnet. For which we use two:

- N1: 189.89.0.0/29
- N2: 189.89.8.0/29

Routing

As for the routing, you can find the routing table below or in the [routing sim config file](#). But here are the main ideas of the routing done:

1. Each machine has:
 - a. its default gateway as one of the subnet routers
 - b. Points to its own subnet
2. For each router:
 - a. If we follow the routers default gateways, we will reach the internet (e.g. R4 to R3 to R1 to internet)
 - b. We add all the other routers that the current router is connected to directly
 - c. For every other subnet the router is not on, we find one of directly connected gateway that can lead to it and add that as the hop for that subnet

So this way we make the routers handle figuring out the hops instead of storing them on the individual machines, giving us less work to do.

However, we do realize that this task will become monumental if the topology was quite larger, since we could possibly have 254 subnets, and configuring the routing table manually will definitely be prone to human error.

Routing tables for router nodes:

R1

Route	Next Hop	Port
189.89.0.0/29		eth1
189.89.0.8/29		eth2
189.89.1.0/24	R2: 189.89.0.10/29	eth2
189.89.2.0/24	R2: 189.89.0.10/29	eth2
189.89.3.0/24	R2: 189.89.0.10/29	eth2
189.89.4.0/24	R2: 189.89.0.10/29	eth2
189.89.5.0/24	R2: 189.89.0.10/29	eth2
Default Route	internet: 195.85.10.1/24	eth0

R2

Route	Next Hop	Port
189.89.0.8/29		eth0
189.89.1.0/24		eth1
189.89.0.0/29	R1: 189.89.0.9/29	eth0
189.89.2.0/24	R3: 189.89.1.2/24	eth1
189.89.3.0/24	R3: 189.89.1.2/24	eth1
189.89.4.0/24	R4: 189.89.1.3/24	eth1
189.89.5.0/24	R4: 189.89.1.3/24	eth1
Default Route	R1: 189.89.0.9/29	eth0

R3

Route	Next Hop	Port
189.89.1.0/24		eth0
189.89.2.0/24		eth1
189.89.3.0/24		eth2
189.89.0.0/29	R3: 189.89.1.1/24	eth0
189.89.0.9/29	R3: 189.89.1.1/24	eth0
189.89.4.0/24	R4: 189.89.1.3/24	eth0
189.89.5.0/24	R4: 189.89.1.3/24	eth0
Default Route	R3: 189.89.1.1/24	eth0

R4

Route	Next Hop	Port
189.89.1.0/24		eth0
189.89.4.0/24		eth1
189.89.5.0/24		eth2
189.89.0.0/29	R3: 189.89.1.1/24	eth0
189.89.0.9/29	R3: 189.89.1.1/24	eth0
189.89.2.0/24	R4: 189.89.1.2/24	eth0
189.89.3.0/24	R4: 189.89.1.2/24	eth0
Default Route	R3: 189.89.1.1/24	eth0

(I ignored internet here, but you can find it in the [config file](#))

Routing tables for the computer machines

N1 and N2

Route	Next Hop	Port
189.89.0.0/29		eth0
Default Route	R1: 189.89.0.1/29	eth0

N3

Route	Next Hop	Port
189.89.0.8/29		eth0
Default Route	R2: 189.89.0.10/29	eth0

N4 and N5

Route	Next Hop	Port
189.89.2.0/24		eth0
Default Route	R3: 189.89.2.1/24	eth0

N6 and N7

Route	Next Hop	Port
189.89.5.0/24		eth0
Default Route	R4: 189.89.5.1/24	eth0

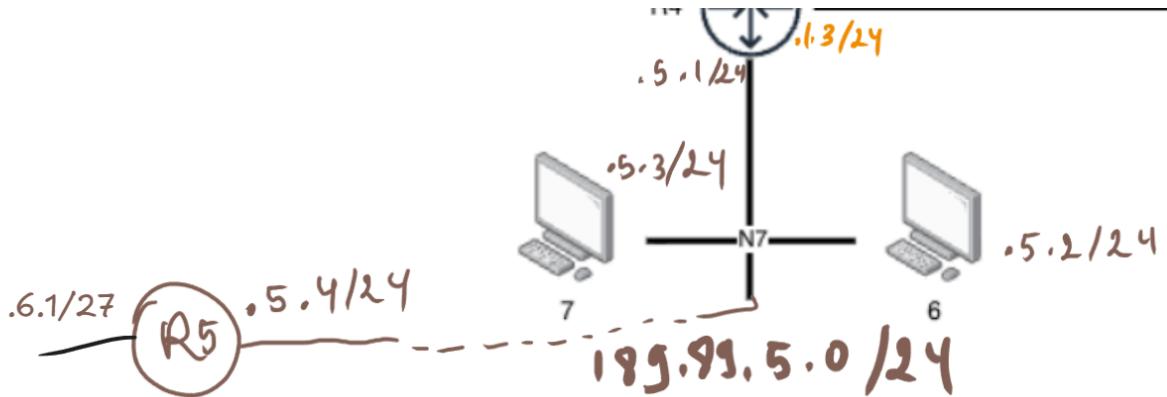
N8 and N9

Route	Next Hop	Port
189.89.4.0/24		eth0
Default Route	R4: 189.89.4.1/24	eth0

N10 and N11

Route	Next Hop	Port
189.89.3.0/24		eth0
Default Route	R3: 189.89.3.1/24	eth0

Load Plan - 2



For this plan since we only added one router to the N7 subnet, we simply gave it an address of 189.89.5.4/24. But for any new subnet to be added on a different interface of this router, or any newly added routers, they must at most have 30 machines connected, then for this could subnet our remaining unused /24 address spaces into /27 spaces.

Finally we have the following subnetting plan:

- 189.89.0.0/29 to 189.89.0.255/29 (of which 2 out of 32 subnets are used)
- 189.89.1.0/24 to 189.89.5.255/29 (all of which are used but hosts can be added to them)
- 189.89.6.0/27 to 178.89.255.255/27

For the routing tables we still apply the same rules in Load Plan 1, we just have to add a new router that points to the already existing 7 subnets, as for the other devices tables, they remain the same since there were no new subnets added. Routing table for R5 can be found below as well as the [RoutingSim files](#)

And yes it would have been helpful to know about R5 and the limitation of 30 hosts beforehand, this way we could have made every subnet to be of mask /27 (and subnetted one of them to /29). But now if the current subnets can support up to 254 hosts of which 30 can be used, thus we could have avoided wasting 1110 hosts ($5 \times 254 - 5 \times 32$). That is unless of course we reconfigured the entire network, but we wanted the least amount of change.

R5

Route	Next Hop	Port
189.89.5.0/24		eth0
(for new subnets) 189.89.6.0/27		eth1
Default Route	R4: 189.89.5.1/24	eth0

RoutingSim.exe Files

NOTE: Resized the text for easier copying and pasting

Load Plan 1

topology.txt

```
install n1 bus1 eth0  
install n2 bus1 eth0
```

```
install n3 bus2 eth0
```

```
install n4 bus4 eth0  
install n5 bus4 eth0
```

```
install n6 bus7 eth0  
install n7 bus7 eth0
```

```
install n8 bus6 eth0  
install n9 bus6 eth0
```

```
install n10 bus5 eth0  
install n11 bus5 eth0
```

```
install r1 bus0 eth0  
install r1 bus1 eth1  
install r1 bus2 eth2
```

```
install r2 bus2 eth0  
install r2 bus3 eth1
```

```
install r3 bus3 eth0  
install r3 bus4 eth1  
install r3 bus5 eth2
```

```
install r4 bus3 eth0  
install r4 bus6 eth1  
install r4 bus7 eth2
```

```
install internet bus0 eth0
```

config.txt

```

n1
ifconfig eth0 189.89.0.2 netmask 255.255.255.248
route add -net 189.89.0.0
route add default gw 189.89.0.1

n2
ifconfig eth0 189.89.0.3 netmask 255.255.255.248
route add -net 189.89.0.0
route add default gw 189.89.0.1

n3
ifconfig eth0 189.89.0.11 netmask 255.255.255.248
route add -net 189.89.0.8
route add default gw 189.89.0.10

n4
ifconfig eth0 189.89.2.3 netmask 255.255.255.0
route add -net 189.89.2.0
route add default gw 189.89.2.1

n5
ifconfig eth0 189.89.2.2 netmask 255.255.255.0
route add -net 189.89.2.0
route add default gw 189.89.2.1

n6
ifconfig eth0 189.89.5.2 netmask 255.255.255.0
route add -net 189.89.5.0
route add default gw 189.89.5.1

n7
ifconfig eth0 189.89.5.3 netmask 255.255.255.0
route add -net 189.89.5.0
route add default gw 189.89.5.1

n8
ifconfig eth0 189.89.4.3 netmask 255.255.255.0
route add -net 189.89.4.0
route add default gw 189.89.4.1

n9
ifconfig eth0 189.89.4.2 netmask 255.255.255.0
route add -net 189.89.4.0
route add default gw 189.89.4.1

n10
ifconfig eth0 189.89.3.3 netmask 255.255.255.0
route add -net 189.89.3.0
route add default gw 189.89.3.1

n11
ifconfig eth0 189.89.3.2 netmask 255.255.255.0
route add -net 189.89.3.0
route add default gw 189.89.3.1

r1
ifconfig eth0 195.85.10.2 netmask 255.255.255.0
ifconfig eth1 189.89.0.1 netmask 255.255.255.248
ifconfig eth2 189.89.0.9 netmask 255.255.255.248
route add -net 189.89.0.0
route add -net 189.89.0.8
route add -net 189.89.1.0 netmask 255.255.255.0 gw 189.89.0.10
route add -net 189.89.2.0 netmask 255.255.255.0 gw 189.89.0.10
route add -net 189.89.3.0 netmask 255.255.255.0 gw 189.89.0.10
route add -net 189.89.5.0 netmask 255.255.255.0 gw 189.89.0.10

route add -net 189.89.6.0 netmask 255.255.255.0 gw 189.89.0.10
#route add default gw 195.85.10.1 # for some reason this breaks the
script if i have other ethernets other than eth0

r2
ifconfig eth0 189.89.0.10 netmask 255.255.255.248
ifconfig eth1 189.89.1.1 netmask 255.255.255.0
route add -net 189.89.0.8
route add -net 189.89.1.0
route add -net 189.89.0.0 netmask 255.255.255.248 gw 189.89.0.9
route add -net 189.89.2.0 netmask 255.255.255.0 gw 189.89.1.2
route add -net 189.89.3.0 netmask 255.255.255.0 gw 189.89.1.2
route add -net 189.89.4.0 netmask 255.255.255.0 gw 189.89.1.3
route add -net 189.89.5.0 netmask 255.255.255.0 gw 189.89.1.3
route add default gw 189.89.0.9

r3
ifconfig eth0 189.89.1.2 netmask 255.255.255.0
ifconfig eth1 189.89.2.1 netmask 255.255.255.0
ifconfig eth2 189.89.3.1 netmask 255.255.255.0
route add -net 189.89.1.0
route add -net 189.89.2.0
route add -net 189.89.3.0
route add -net 189.89.0.0 netmask 255.255.255.248 gw 189.89.1.1
route add -net 189.89.0.9 netmask 255.255.255.248 gw 189.89.1.1
route add -net 189.89.4.0 netmask 255.255.255.0 gw 189.89.1.3
route add -net 189.89.5.0 netmask 255.255.255.0 gw 189.89.1.3
route add default gw 189.89.1.1

r4
ifconfig eth0 189.89.1.3 netmask 255.255.255.0
ifconfig eth1 189.89.4.1 netmask 255.255.255.0
ifconfig eth2 189.89.5.1 netmask 255.255.255.0
route add -net 189.89.1.0
route add -net 189.89.4.0
route add -net 189.89.5.0
route add -net 189.89.0.0 netmask 255.255.255.248 gw 189.89.1.1
route add -net 189.89.0.9 netmask 255.255.255.248 gw 189.89.1.1
route add -net 189.89.2.0 netmask 255.255.255.0 gw 189.89.1.2
route add -net 189.89.3.0 netmask 255.255.255.0 gw 189.89.1.2
route add default gw 189.89.1.1

internet
ifconfig eth0 195.85.10.1 netmask 255.255.255.0

```

Load Plan 2

topology.txt

install n1 bus1 eth0
install n2 bus1 eth0

install n3 bus2 eth0

install n4 bus4 eth0
install n5 bus4 eth0

install n6 bus7 eth0
install n7 bus7 eth0

install n8 bus6 eth0
install n9 bus6 eth0

install n10 bus5 eth0
install n11 bus5 eth0

install r1 bus0 eth0
install r1 bus1 eth1
install r1 bus2 eth2

install r2 bus2 eth0
install r2 bus3 eth1

install r3 bus3 eth0
install r3 bus4 eth1
install r3 bus5 eth2

install r4 bus3 eth0
install r4 bus6 eth1
install r4 bus7 eth2

install r5 bus7 eth0

install internet bus0 eth0

config.txt

```

n1
ifconfig eth0 189.89.0.2 netmask 255.255.255.248
route add -net 189.89.0.0
route add default gw 189.89.0.1

n2
ifconfig eth0 189.89.0.3 netmask 255.255.255.248
route add -net 189.89.0.0
route add default gw 189.89.0.1

n3
ifconfig eth0 189.89.0.11 netmask 255.255.255.248
route add -net 189.89.0.8
route add default gw 189.89.0.10

n4
ifconfig eth0 189.89.2.3 netmask 255.255.255.0
route add -net 189.89.2.0
route add default gw 189.89.2.1

n5
ifconfig eth0 189.89.2.2 netmask 255.255.255.0
route add -net 189.89.2.0
route add default gw 189.89.2.1

n6
ifconfig eth0 189.89.5.2 netmask 255.255.255.0
route add -net 189.89.5.0
route add default gw 189.89.5.1

n7
ifconfig eth0 189.89.5.3 netmask 255.255.255.0
route add -net 189.89.5.0
route add default gw 189.89.5.1

n8
ifconfig eth0 189.89.4.3 netmask 255.255.255.0
route add -net 189.89.4.0
route add default gw 189.89.4.1

n9
ifconfig eth0 189.89.4.2 netmask 255.255.255.0
route add -net 189.89.4.0
route add default gw 189.89.4.1

n10
ifconfig eth0 189.89.3.3 netmask 255.255.255.0
route add -net 189.89.3.0
route add default gw 189.89.3.1

n11
ifconfig eth0 189.89.3.2 netmask 255.255.255.0
route add -net 189.89.3.0
route add default gw 189.89.3.1

r1

```

```

ifconfig eth0 195.85.10.2 netmask 255.255.255.0
ifconfig eth1 189.89.0.1 netmask 255.255.255.248
ifconfig eth2 189.89.0.9 netmask 255.255.255.248
route add -net 189.89.0.0
route add -net 189.89.0.8
route add -net 189.89.1.0 netmask 255.255.255.0 gw 189.89.0.10
route add -net 189.89.2.0 netmask 255.255.255.0 gw 189.89.0.10
route add -net 189.89.3.0 netmask 255.255.255.0 gw 189.89.0.10
route add -net 189.89.5.0 netmask 255.255.255.0 gw 189.89.0.10
route add -net 189.89.6.0 netmask 255.255.255.0 gw 189.89.0.10
#route add default gw 195.85.10.1 # for some reason this breaks the
script if i have other ethernets other than eht0

r2
ifconfig eth0 189.89.0.10 netmask 255.255.255.248
ifconfig eth1 189.89.1.1 netmask 255.255.255.0
route add -net 189.89.0.8
route add -net 189.89.1.0
route add -net 189.89.0.0 netmask 255.255.255.248 gw 189.89.0.9
route add -net 189.89.2.0 netmask 255.255.255.0 gw 189.89.1.2
route add -net 189.89.3.0 netmask 255.255.255.0 gw 189.89.1.2
route add -net 189.89.4.0 netmask 255.255.255.0 gw 189.89.1.3
route add -net 189.89.5.0 netmask 255.255.255.0 gw 189.89.1.3
route add default gw 189.89.0.9

r3
ifconfig eth0 189.89.1.2 netmask 255.255.255.0
ifconfig eth1 189.89.2.1 netmask 255.255.255.0
ifconfig eth2 189.89.3.1 netmask 255.255.255.0
route add -net 189.89.1.0
route add -net 189.89.2.0
route add -net 189.89.3.0
route add -net 189.89.0.0 netmask 255.255.255.248 gw 189.89.1.1
route add -net 189.89.0.9 netmask 255.255.255.248 gw 189.89.1.1
route add -net 189.89.4.0 netmask 255.255.255.0 gw 189.89.1.3
route add -net 189.89.5.0 netmask 255.255.255.0 gw 189.89.1.3
route add default gw 189.89.1.1

r4
ifconfig eth0 189.89.1.3 netmask 255.255.255.0
ifconfig eth1 189.89.4.1 netmask 255.255.255.0
ifconfig eth2 189.89.5.1 netmask 255.255.255.0
route add -net 189.89.1.0
route add -net 189.89.4.0
route add -net 189.89.5.0
route add -net 189.89.0.0 netmask 255.255.255.248 gw 189.89.1.1
route add -net 189.89.0.9 netmask 255.255.255.248 gw 189.89.1.1
route add -net 189.89.2.0 netmask 255.255.255.0 gw 189.89.1.2
route add -net 189.89.3.0 netmask 255.255.255.0 gw 189.89.1.2
route add default gw 189.89.1.1

r5
ifconfig eth0 189.89.5.4 netmask 255.255.255.0
route add -net 189.89.5.0
route add default gw 189.89.5.1

internet
ifconfig eth0 195.85.10.1 netmask 255.255.255.0

```