Computer Networks Lab

Week 8

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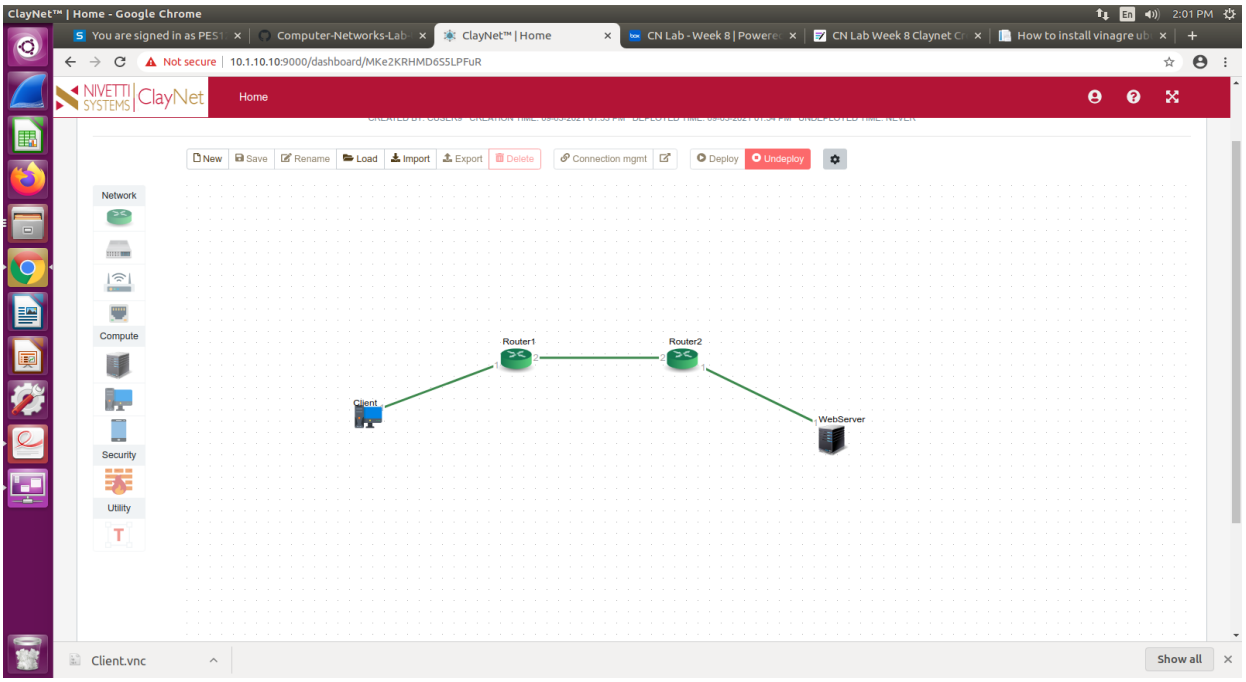
Section : A

Topology -1

1. IPv4 Addressing and Topology Creation

- The following topology is created and deployed on **ClayNet**.



- The configuration of all the end-system devices is shown below.

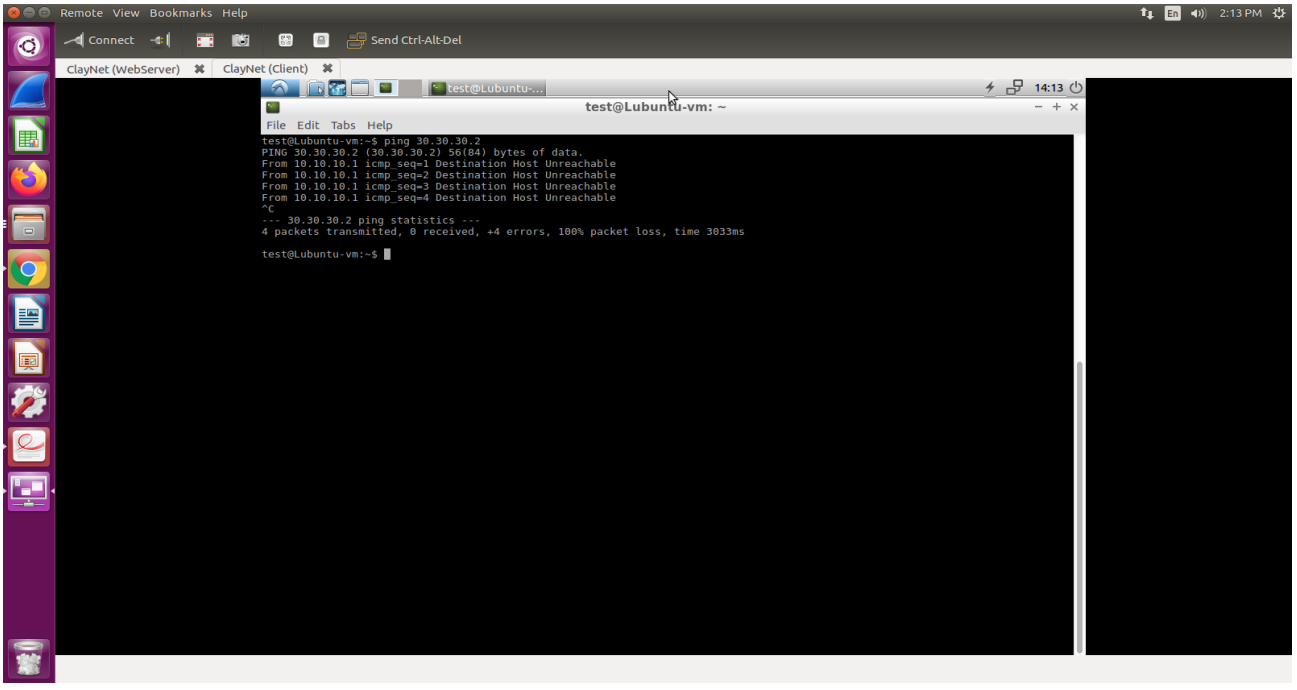
End System	IP Address	Gateway
Client	10.10.10.2/24	10.10.10.1
WebServer	30.30.30.2/24	30.30.30.1

- Similarly, the routers are configured in the same manner.

Router	Interface Number (Port)	IP Address
Router 1	1	10.10.10.1/24
Router 1	2	20.20.20.1/24
Router 2	1	30.30.30.1/24
Router 2	2	20.20.20.2/24

2. Ping Command

- From Client, a ping command is made to WebServer.
- However, this ping command fails because the routing table entries have not been configured yet for Router1 and Router2.
- We obtain a **Destination Host Unreachable** status.



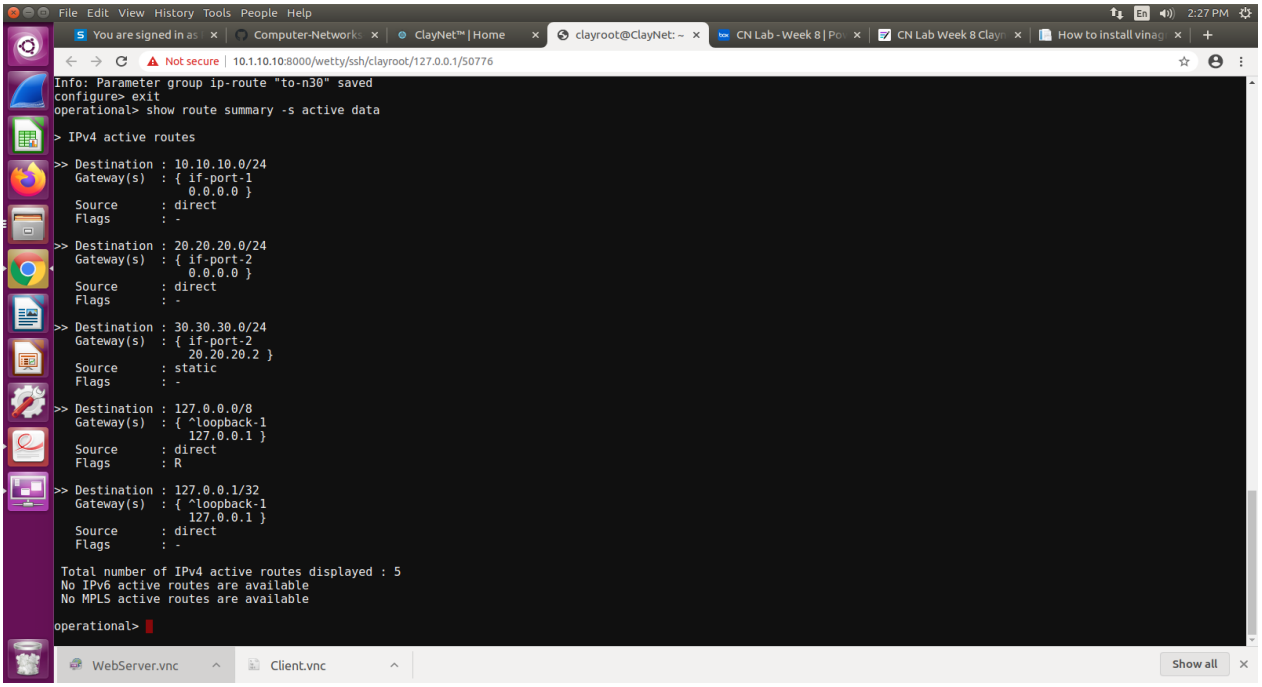
3. Configuration of Routing Table Entries

3.1 Router 1

- The Routing Table entries for Router 1 are configured using the below commands in the console window.

```
configure> create parameter-group ip-route to-n30
Confirm: Modifications not saved. Do you want to discard ? (y/N) y
Info: Parameter group instance created.
configure> set enable yes
configure> set router data
configure> set destination 30.30.30.0/24
configure> set next-hop gateway 20.20.20.2
configure> save
Info: Parameter group ip-route "to-n30" saved
configure> exit
operational>
```

- The resulting Routing Table Entry is shown below.

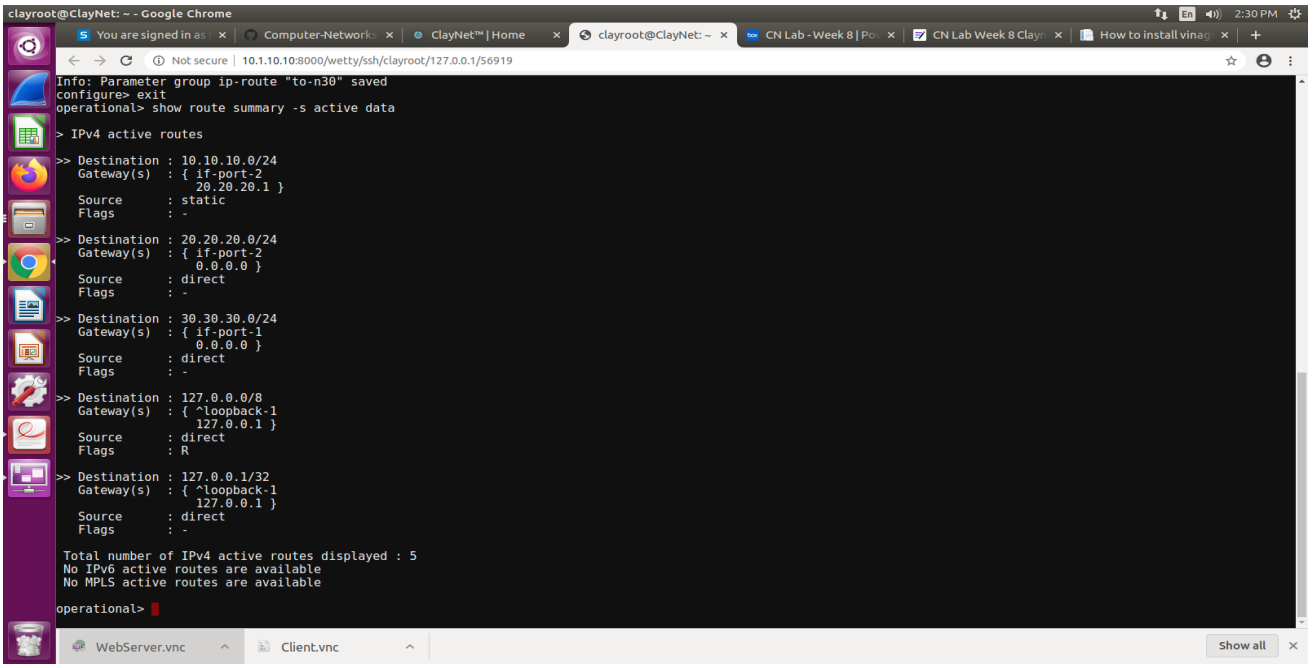


3.2 Router 2

- The Routing Table entries for Router 2 are configured using the below commands in the console window.

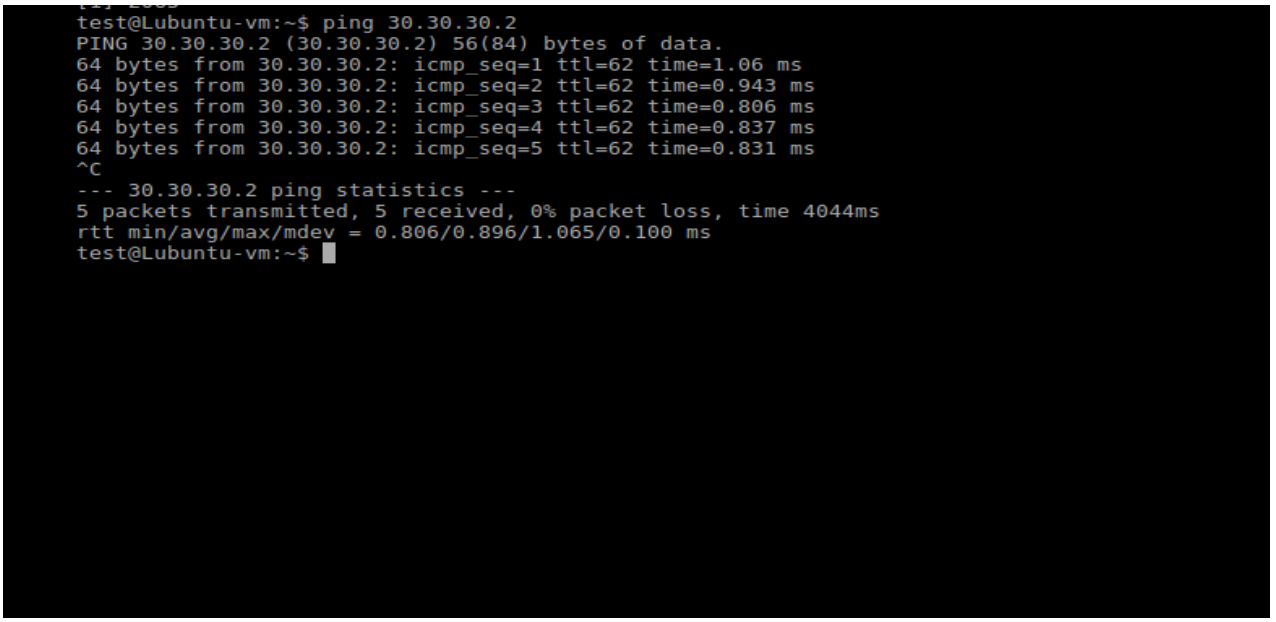
```
operational> configure
Entering configuration mode with exclusive access.
configure> create parameter-group ip-route to-n30
Info: Parameter group instance created.
configure> set enable yes
configure> set router data
configure> set destination 10.10.10.0/24
configure> set next-hop gateway 20.20.20.1
configure> save
Info: Parameter group ip-route "to-n30" saved
configure> exit
operational>
```

- The resulting Routing Table Entry is shown below.

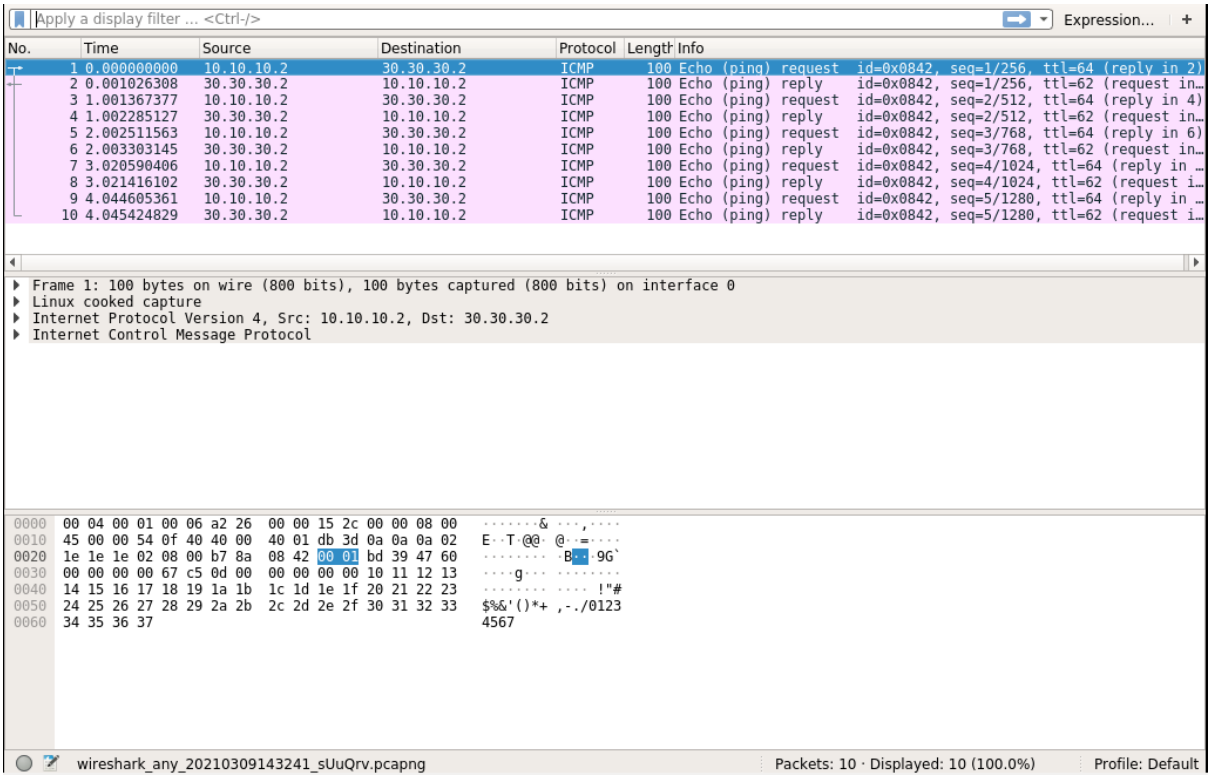


4. Observations

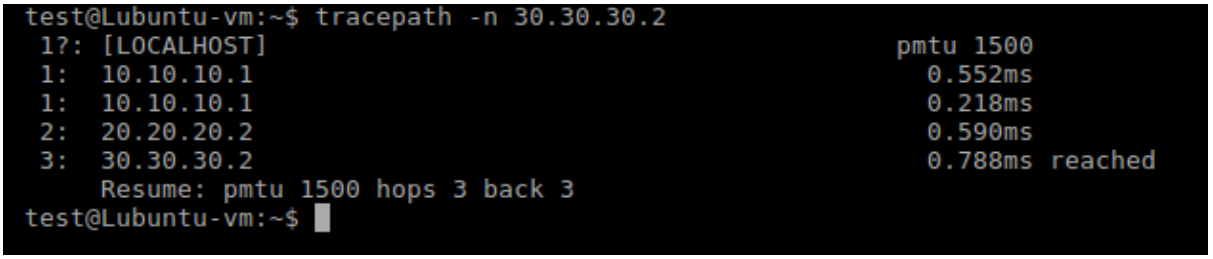
- Client and WebServer are now reachable from each other.
- To verify this, the **ping** command is again used to ICMP request packets to the other.
- Since there are 2 hops between the systems, the TTL value is decremented by 2. Hence the value is decremented from its default value of 64 to 62.



- The following Wireshark Packet Capture shows ICMP request packets being sent from Client to WebServer.



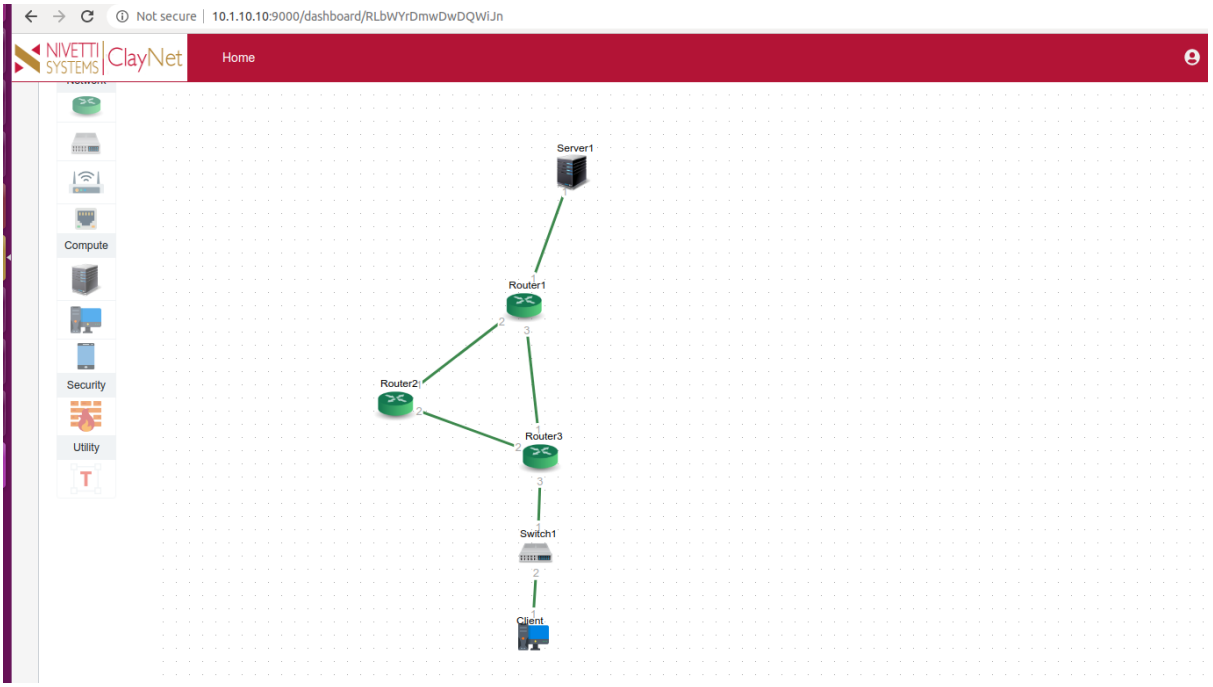
- The following screenshot displays the outcome of the traceroute command from Client to WebServer.



Topology -2

1. IPv4 Addressing and Topology Creation

- The following topology is created and deployed on **ClayNet**.



- The configuration of all the end-system devices is shown below.

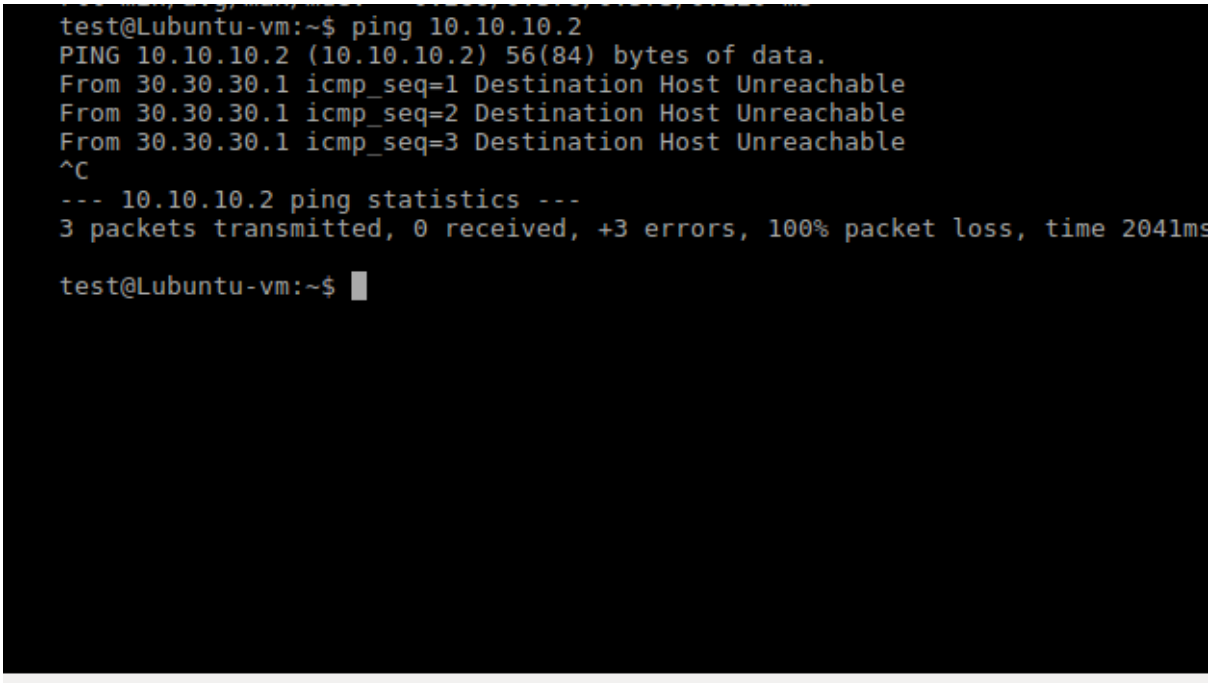
End System	IP Address	Gateway
Client	50.50.50.2	50.50.50.1
Server	10.10.10.2	10.10.10.1

- Similarly, the routers are configured in the same manner.

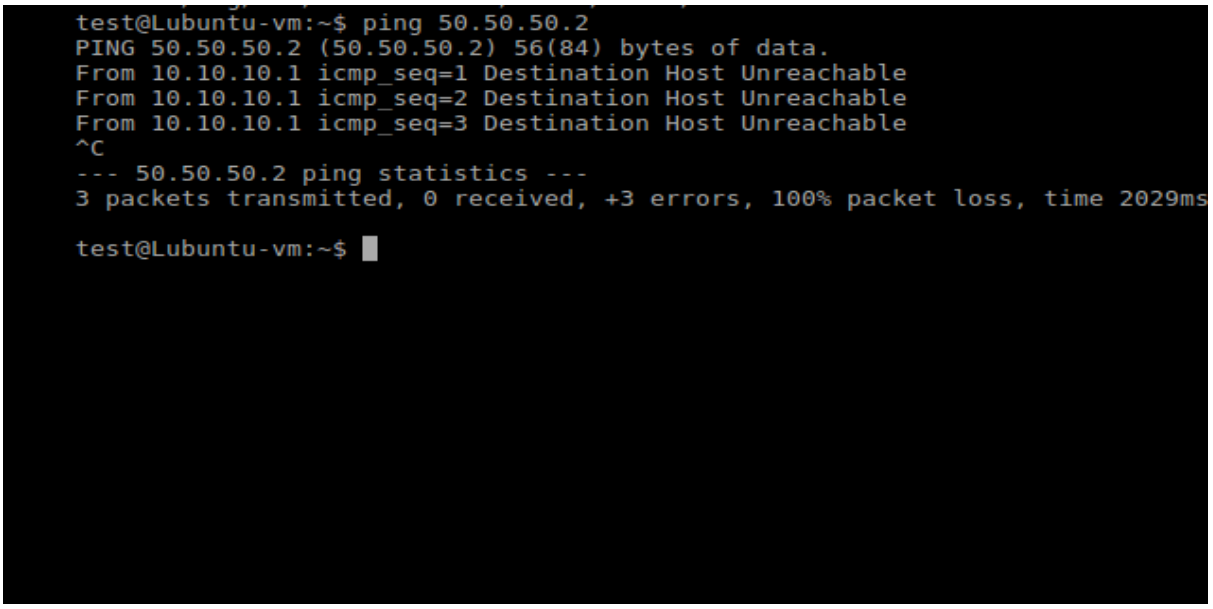
Router	Interface Number (Port)	IP Address
Router 1	1	10.10.10.1/24
Router 1	2	20.20.20.1/24
Router 1	3	30.30.30.1/24
Router 2	1	20.20.20.2/24
Router 2	2	40.40.40.1/24
Router 3	1	30.30.30.2/24
Router 3	2	40.40.40.2/24
Router 3	3	50.50.50.1/24

2. Ping Command

- From the Client, a ping command is made to Server1.
- However, this ping command fails because the routing table entries have not been configured for Router 1 , Router 2, Router 3.
- We obtain a **Destination Host Unreachable** status.



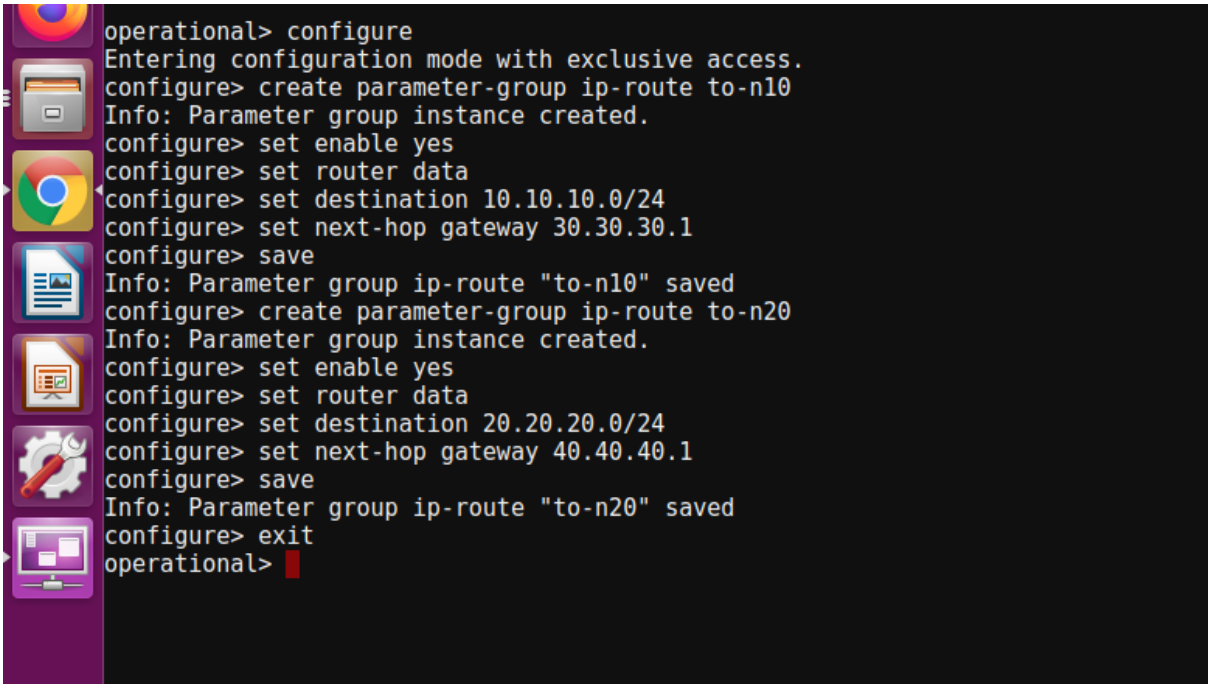
- From the Server1, a ping command is made to Client
- However, this ping command fails because the routing table entries have not been configured for Router 1 , Router 2, Router 3.
- We obtain a **Destination Host Unreachable** status.



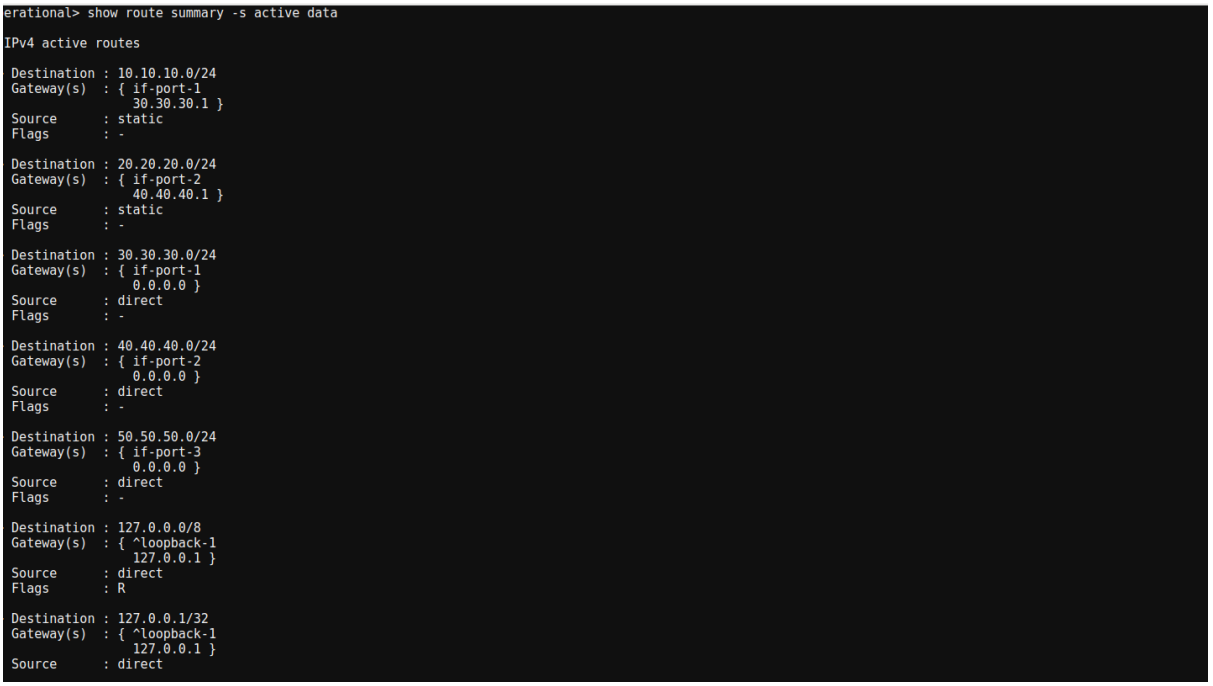
3. Configuration of Routing Table Entries

3.1 Router 3

- The Routing Table entries for Router 3 are configured using the below commands in the console window.



- The resulting Routing Table Entry is shown below.



3.2 Router 1

- The Routing Table entries for Router 1 are configured using the below commands in the console window.

```
configure> create parameter-group ip-route to-n31
Confirm: Modifications not saved. Do you want to discard ? (y/N) y
Info: Parameter group instance created.
configure> set enable yes
configure> set router data
configure> set destination 40.40.40.0/24
configure> set next-hop gateway 20.20.20.2
configure> save
Info: Parameter group ip-route "to-n31" saved
configure> exit
```

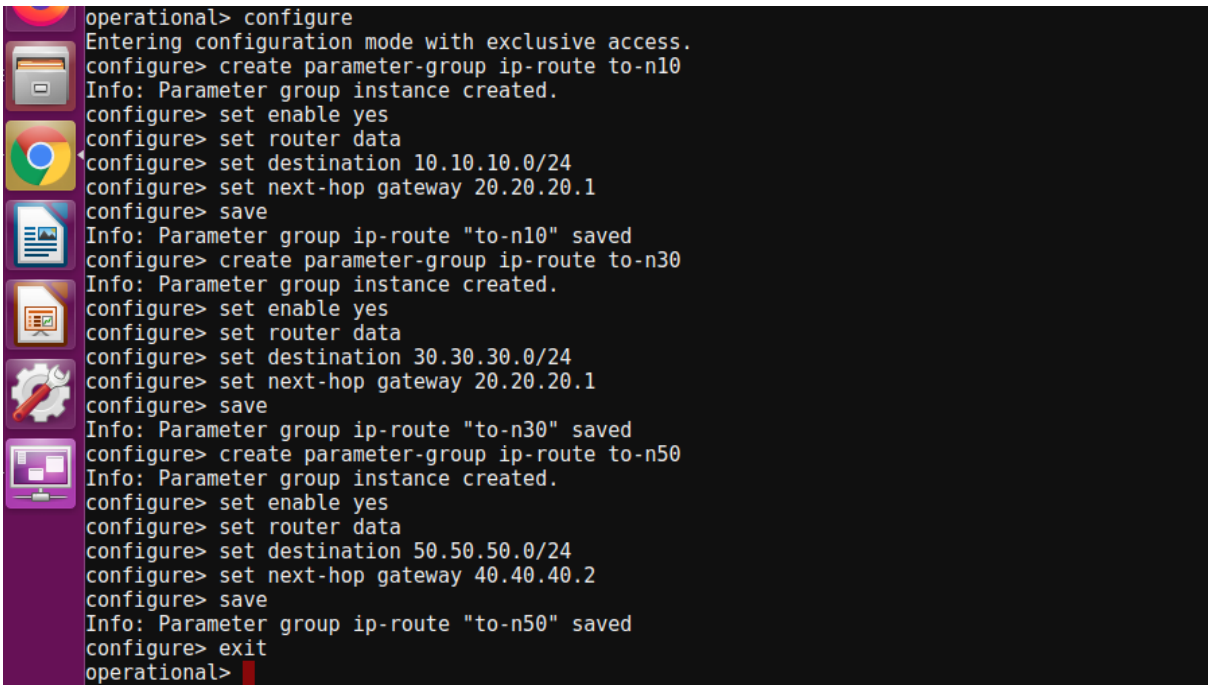
```
operational> configure
Entering configuration mode with exclusive access.
configure> create parameter-group ip-route to-n30
Info: Parameter group instance created.
configure> set enable yes
configure> set router data
configure> set destination 50.50.50.0/24
configure> set next-hop gateway 30.30.30.2
configure> save
Info: Parameter group ip-route "to-n30" saved
```

- The resulting Routing Table Entry is shown below.

```
> IPv4 active routes

>> Destination : 10.10.10.0/24
   Gateway(s)  : { if-port-1
                   0.0.0.0 }
   Source      : direct
   Flags       : -

>> Destination : 20.20.20.0/24
   Gateway(s)  : { if-port-2
                   0.0.0.0 }
   Source      : direct
   Flags       : -

>> Destination : 30.30.30.0/24
   Gateway(s)  : { if-port-3
                   0.0.0.0 }
   Source      : direct
   Flags       : -

>> Destination : 40.40.40.0/24
   Gateway(s)  : { if-port-2
                   20.20.20.2 }
   Source      : static
   Flags       : -

>> Destination : 50.50.50.0/24
   Gateway(s)  : { if-port-3
                   30.30.30.2 }
   Source      : static
   Flags       : -

>> Destination : 127.0.0.0/8
   Gateway(s)  : { ^loopback-1
                   127.0.0.1 }
   Source      : direct
   Flags       : R

>> Destination : 127.0.0.1/32
   Gateway(s)  : { ^loopback-1
                   127.0.0.1 }
   Source      : direct
   Flags       : -
```

3.3 Router 2

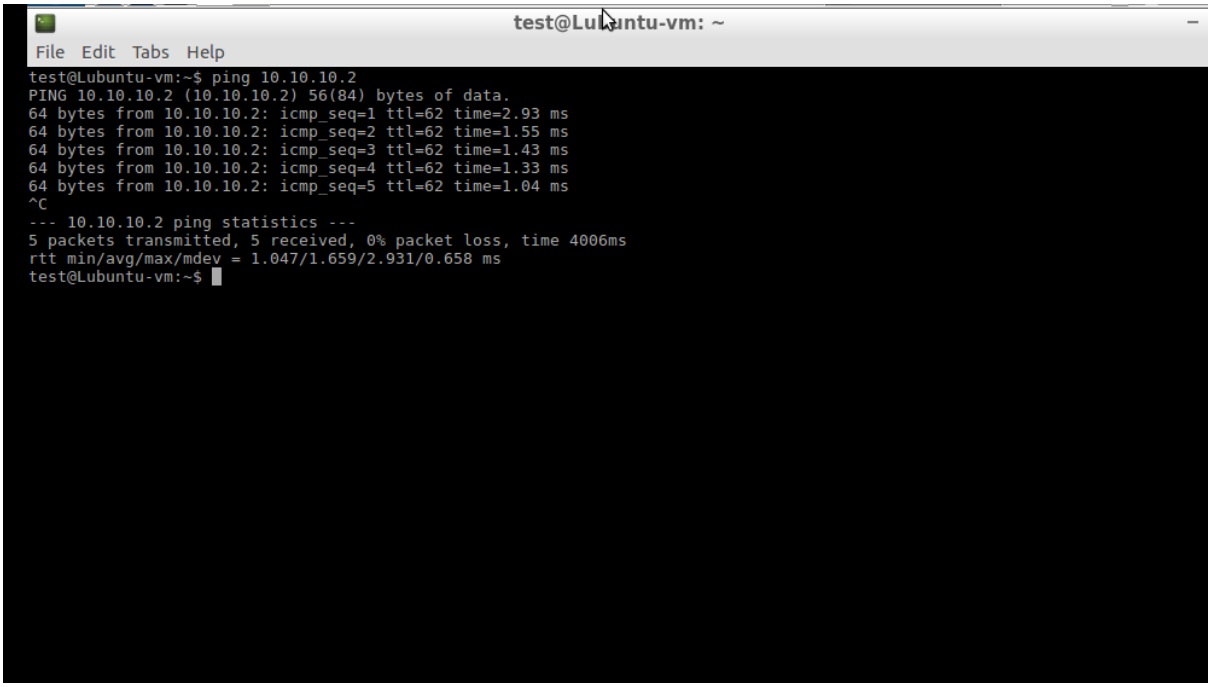
- The Routing Table entries for Router 2 are configured using the below commands in the console window.



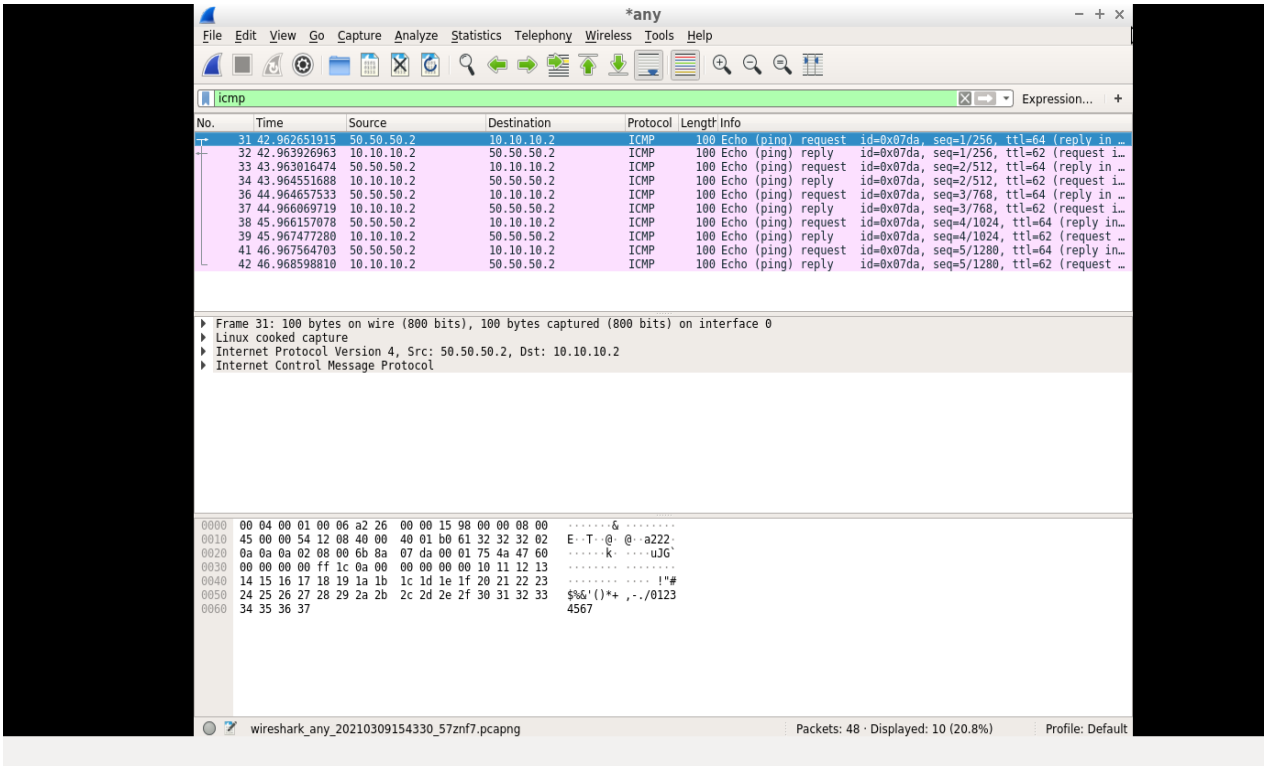
- The resulting Routing Table Entry is shown below.

4. Observations

- Client and Server1 are now reachable from each other.
- To verify this, the **ping** command is again used to ICMP request packets to the other.



- The following Wireshark Packet Capture shows ICMP request packets being sent from Client to Server1.



5. Questions

Q1 . How many hops will the client take to reach the Server?

Answer. 3 hops (maximum) for longest path and 2 hops (minimum)for shortest path

Q2. Observe the RTT and justify your observation.

Answer. Initially, the TTL will be high because the sender does an ARP request to find the MAC address of the Router. This is additional work and takes some time. The second packet RTT is faster because the ARP data is cached on the device. After that, it appears to be within the margin of error. The times are so close to each other and they are in milliseconds that it is hard to say the reduction is significant.

Q3. While Pinging, cut the link between Router 1 and Router 3. What will happen now ?

Answer. When Router 1 and Router 3 link is cut, the only path left for packets to travel is between Router 3 and Router 1 via Router 2, so there will be 3 hops between the client and the server.