

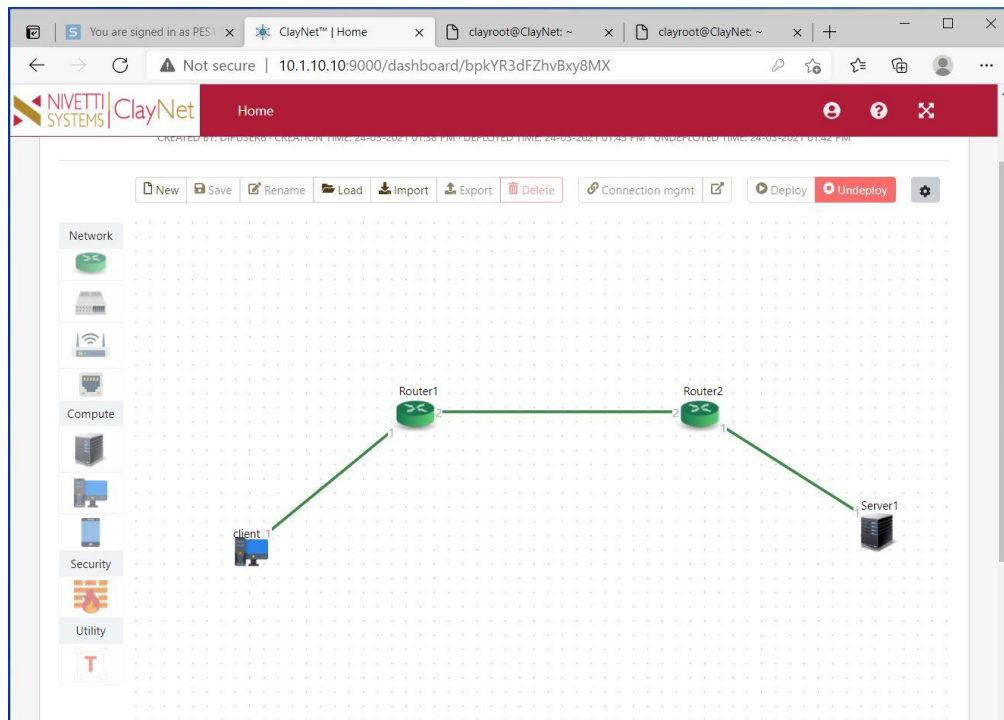
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CN LAB (WEEK 8)

1. IPv4 ADDRESSING AND TOPOLOGY CREATION

- The following topology is created and deployed on ClayNet.



- Configuration of End-System devices is given below:

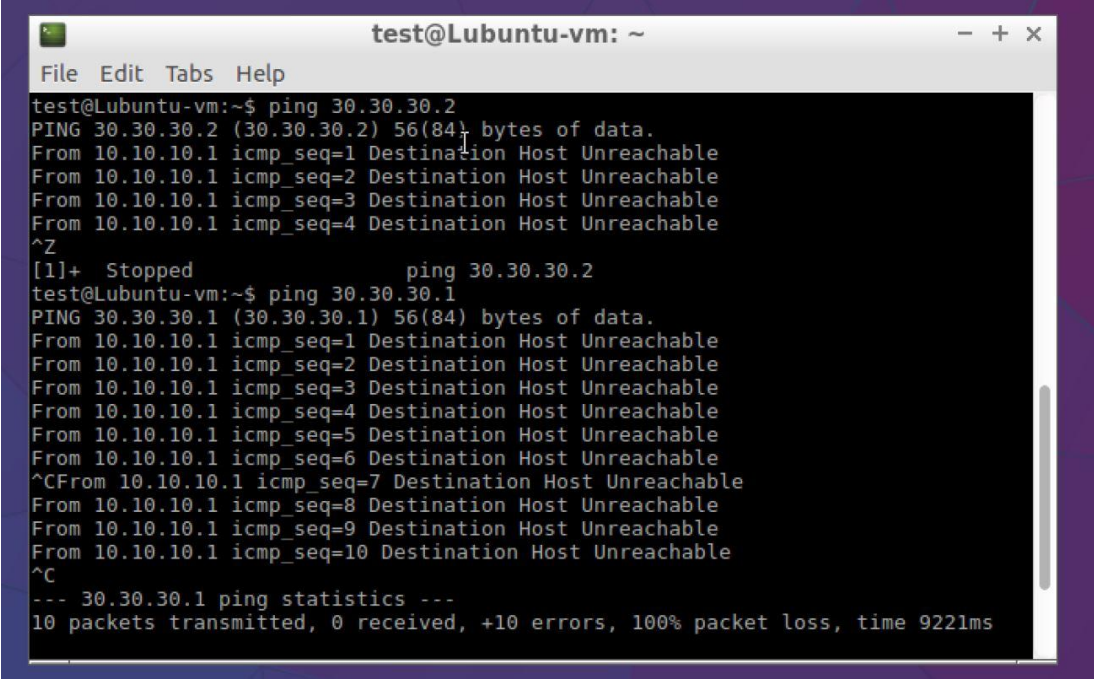
END SYSTEM	IP ADDRESS	GATEWAY
Client 1	10.10.10.2/24	10.10.10.1
Server 1	30.30.30.2/24	30.30.30.1

- In the same way the Router are configured:

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 1, a ping command is made to Server1
- 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

A screenshot of a terminal window titled 'test@Lubuntu-vm: ~'. The terminal shows two ping commands being executed. The first command is 'ping 30.30.30.2', which results in four 'Destination Host Unreachable' messages. The second command is 'ping 30.30.30.1', which results in ten 'Destination Host Unreachable' messages. After the second ping, the user enters '^C' to stop the command, followed by '^C' again. The terminal then displays ping statistics for 30.30.30.1, showing 10 packets transmitted, 0 received, and 100% packet loss.

```
test@Lubuntu-vm:~$ ping 30.30.30.2
PING 30.30.30.2 (30.30.30.2) 56(84) bytes of data.
From 10.10.10.1 icmp_seq=1 Destination Host Unreachable
From 10.10.10.1 icmp_seq=2 Destination Host Unreachable
From 10.10.10.1 icmp_seq=3 Destination Host Unreachable
From 10.10.10.1 icmp_seq=4 Destination Host Unreachable
^Z
[1]+  Stopped                  ping 30.30.30.2
test@Lubuntu-vm:~$ ping 30.30.30.1
PING 30.30.30.1 (30.30.30.1) 56(84) bytes of data.
From 10.10.10.1 icmp_seq=1 Destination Host Unreachable
From 10.10.10.1 icmp_seq=2 Destination Host Unreachable
From 10.10.10.1 icmp_seq=3 Destination Host Unreachable
From 10.10.10.1 icmp_seq=4 Destination Host Unreachable
From 10.10.10.1 icmp_seq=5 Destination Host Unreachable
From 10.10.10.1 icmp_seq=6 Destination Host Unreachable
^CFrom 10.10.10.1 icmp_seq=7 Destination Host Unreachable
From 10.10.10.1 icmp_seq=8 Destination Host Unreachable
From 10.10.10.1 icmp_seq=9 Destination Host Unreachable
From 10.10.10.1 icmp_seq=10 Destination Host Unreachable
^C
--- 30.30.30.1 ping statistics ---
10 packets transmitted, 0 received, +10 errors, 100% packet loss, time 9221ms
```

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

```
clayroot@ClayNet:~$ telnet 127.0.0.1 50673
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Login: test
Password:

operational> show route summary -s active data

> IPv4 active routes

>> 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-1
                  0.0.0.0 }
  Source       : direct
  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        : -

Total number of IPv4 active routes displayed : 4
No IPv6 active routes are available
No MPLS active routes are available
```

- The resulting Routing Table Entry is shown below

```
operational> configure
Entering configuration mode with exclusive access.
configure> create parameter-group ip-route n-10
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 "n-10" saved
configure> exit
operational> show route summary -s active data

> IPv4 active routes

>> Destination : 10.10.10.0/24
  Gateway(s)   : { if-port-2
                  20.20.20.1 }
  Source       : static
  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-1
                  0.0.0.0 }
  Source       : direct
  Flags        : -

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

3.2 Router 2

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

```
clayroot@ClayNet:~$ telnet 127.0.0.1 56466
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Login: test
Password:
Login incorrect
Login: test
Password:

operational> show route summary -s active data

> 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 : 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       : -
```

- The resulting Routing Table Entry is shown below.

```
operational> configure
Entering configuration mode with exclusive access.
configure> create parameter-group ip-route n-30
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 "n-30" saved
configure> exit
operational> show route summary -s active data

> IPv4 active routes

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

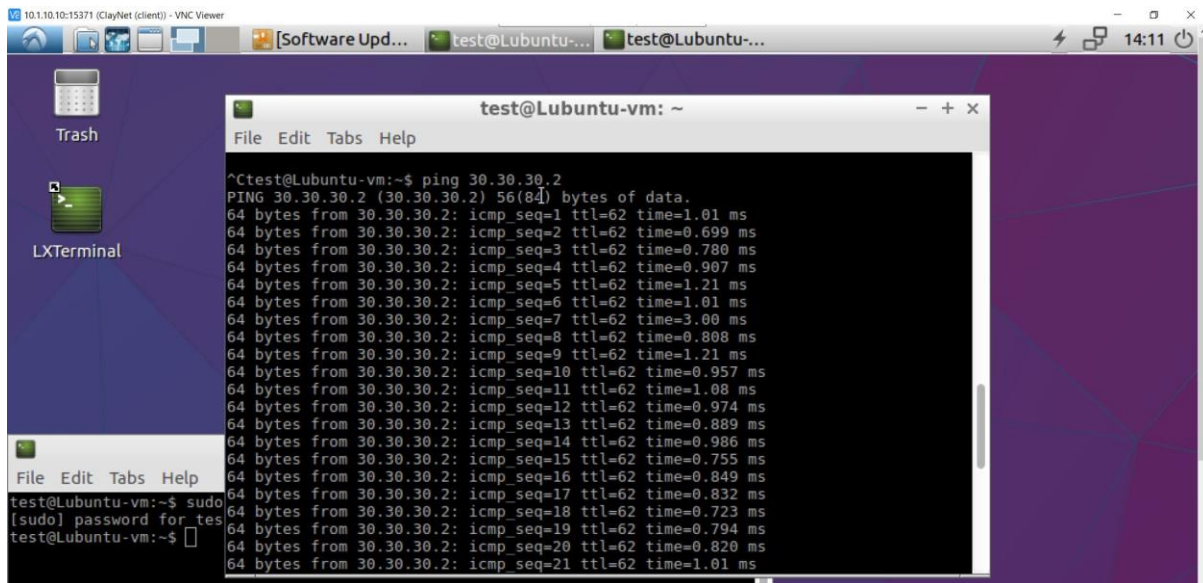
>> Destination : 20.20.20.0/24
Gateway(s) : { if-port-2
              0.0.0.0 }
Source      : direct
Flags       : -

>> Destination : 30.30.30.0/24
Gateway(s) : { if-port-2
              20.20.20.2 }
Source      : static
Flags       : -

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

4. Observation

- The resulting Routing Table Entry is shown below.
- 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 screenshot shows a VNC viewer window titled "10.1.10.10:15371 (ClayNet (client)) - VNC Viewer". The desktop background is purple with icons for "Trash", "LXTerminal", and "Software Upd...". A terminal window titled "test@Lubuntu-vm: ~" is open, displaying the output of a ping command. The terminal shows 21 successful ping requests to 30.30.30.2, each with a TTL of 62 and a response time between 0.699 ms and 1.01 ms. The terminal also shows the user running the command "sudo" and entering the password "test".

```
test@Lubuntu-vm:~$ ping 30.30.30.2
PING 30.30.30.2 (30.30.30.2) 56(84) bytes of data:
64 bytes from 30.30.30.2: icmp_seq=1 ttl=62 time=1.01 ms
64 bytes from 30.30.30.2: icmp_seq=2 ttl=62 time=0.699 ms
64 bytes from 30.30.30.2: icmp_seq=3 ttl=62 time=0.780 ms
64 bytes from 30.30.30.2: icmp_seq=4 ttl=62 time=0.907 ms
64 bytes from 30.30.30.2: icmp_seq=5 ttl=62 time=1.21 ms
64 bytes from 30.30.30.2: icmp_seq=6 ttl=62 time=1.01 ms
64 bytes from 30.30.30.2: icmp_seq=7 ttl=62 time=3.00 ms
64 bytes from 30.30.30.2: icmp_seq=8 ttl=62 time=0.808 ms
64 bytes from 30.30.30.2: icmp_seq=9 ttl=62 time=1.21 ms
64 bytes from 30.30.30.2: icmp_seq=10 ttl=62 time=0.957 ms
64 bytes from 30.30.30.2: icmp_seq=11 ttl=62 time=1.08 ms
64 bytes from 30.30.30.2: icmp_seq=12 ttl=62 time=0.974 ms
64 bytes from 30.30.30.2: icmp_seq=13 ttl=62 time=0.889 ms
64 bytes from 30.30.30.2: icmp_seq=14 ttl=62 time=0.986 ms
64 bytes from 30.30.30.2: icmp_seq=15 ttl=62 time=0.755 ms
64 bytes from 30.30.30.2: icmp_seq=16 ttl=62 time=0.849 ms
64 bytes from 30.30.30.2: icmp_seq=17 ttl=62 time=0.832 ms
64 bytes from 30.30.30.2: icmp_seq=18 ttl=62 time=0.723 ms
64 bytes from 30.30.30.2: icmp_seq=19 ttl=62 time=0.794 ms
64 bytes from 30.30.30.2: icmp_seq=20 ttl=62 time=0.820 ms
64 bytes from 30.30.30.2: icmp_seq=21 ttl=62 time=1.01 ms
```

- The following Wireshark Packet Capture shows ICMP request packets being sent from Desktop1 to Server1.

The image shows a Wireshark packet capture analysis of an ICMP Echo (ping) request and reply. The packet list on the left shows 52 packets. The packet details pane on the right shows the selected packet (No. 30) and its details: Ethernet II, Internet Protocol Version 4, and Internet Control Message Protocol (ICMP). The packet bytes pane at the bottom shows the raw data of the selected packet.

No.	Time	Source	Destination	Protocol	Length	Info
30	29.796080525	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
31	29.797046123	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
33	30.796613083	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
34	30.797348053	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
35	31.812075876	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
36	31.812904980	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
37	32.836083888	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
38	32.836896109	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
39	33.860087318	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
40	33.860790862	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
41	34.884085562	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
42	34.884860186	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
43	35.908080910	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
44	35.908878050	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
45	36.932195939	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
46	36.933140584	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
47	37.933256648	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
48	37.934079948	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
49	38.948084256	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
50	38.949067628	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...
51	39.949085417	10.10.10.2	30.30.30.2	ICMP	98	Echo (ping) request ...
52	39.949943437	30.30.30.2	10.10.10.2	ICMP	98	Echo (ping) reply ...

Frame 3: 98 bytes on wire (784 bits), 98 bytes captured (784 bits) on interface 0
 Ethernet II, Src: a2:26:00:00:16:83 (a2:26:00:00:16:83), Dst: a2:26:00:00:07:e6 (a2:26:00:00:07:e6)
 Internet Protocol Version 4, Src: 10.10.10.2, Dst: 30.30.30.2
 Internet Control Message Protocol