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Subject: Computer Network Laboratory

WEEK No: 9

Objective: Understand the building blocks and usage of ClayNet Network Virtualization platform with reference to OSI Layer.

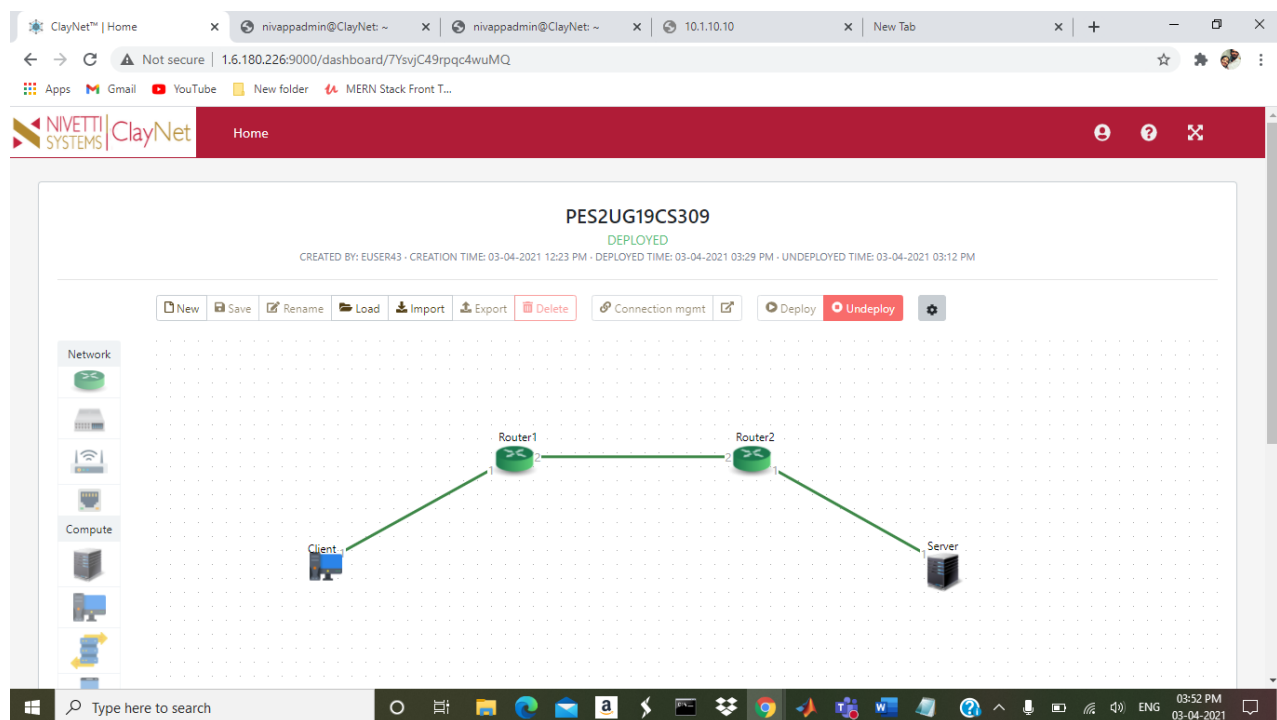
Topology 1: Create a topology in ClayNet, as shown in following figure.



Execution Tasks:

Task 1: Understand the network and compute components available in ClayNet.

Task 2: Drag and drop the necessary components to create the given topology. Provide the names for compute, select OS (Ubuntu 16.04 – Lite or Ubuntu 16.04 – CLI) and RAM (512 MB) as shown below.



Client

Name

Client

OS

Ubuntu 16.04 - Lite

RAM

512 MB

Close

Server

Name

Server

OS

Ubuntu 16.04 - Lite

RAM

1 GB

Close

Task 3: Drag and drop the Routers and set the IP addresses for all the necessary router ports. (You can also set them later by right clicking on the router icon and selecting 'Device Configuration'.)

Router1

NameRouter1

Port	IP Address	Netmask	Port	IP Address	Netmask
1	10.10.10.1	/ 24	5	0.0.0.0	/ 0
2	20.20.20.1	/ 24	6	0.0.0.0	/ 0
3	0.0.0.0	/ 0	7	0.0.0.0	/ 0
4	0.0.0.0	/ 0	8	0.0.0.0	/ 0

Close

Router2

NameRouter2

Port	IP Address	Netmask	Port	IP Address	Netmask
1	30.30.30.1	/ 24	5	0.0.0.0	/ 0
2	20.20.20.2	/ 24	6	0.0.0.0	/ 0
3	0.0.0.0	/ 0	7	0.0.0.0	/ 0
4	0.0.0.0	/ 0	8	0.0.0.0	/ 0

Close

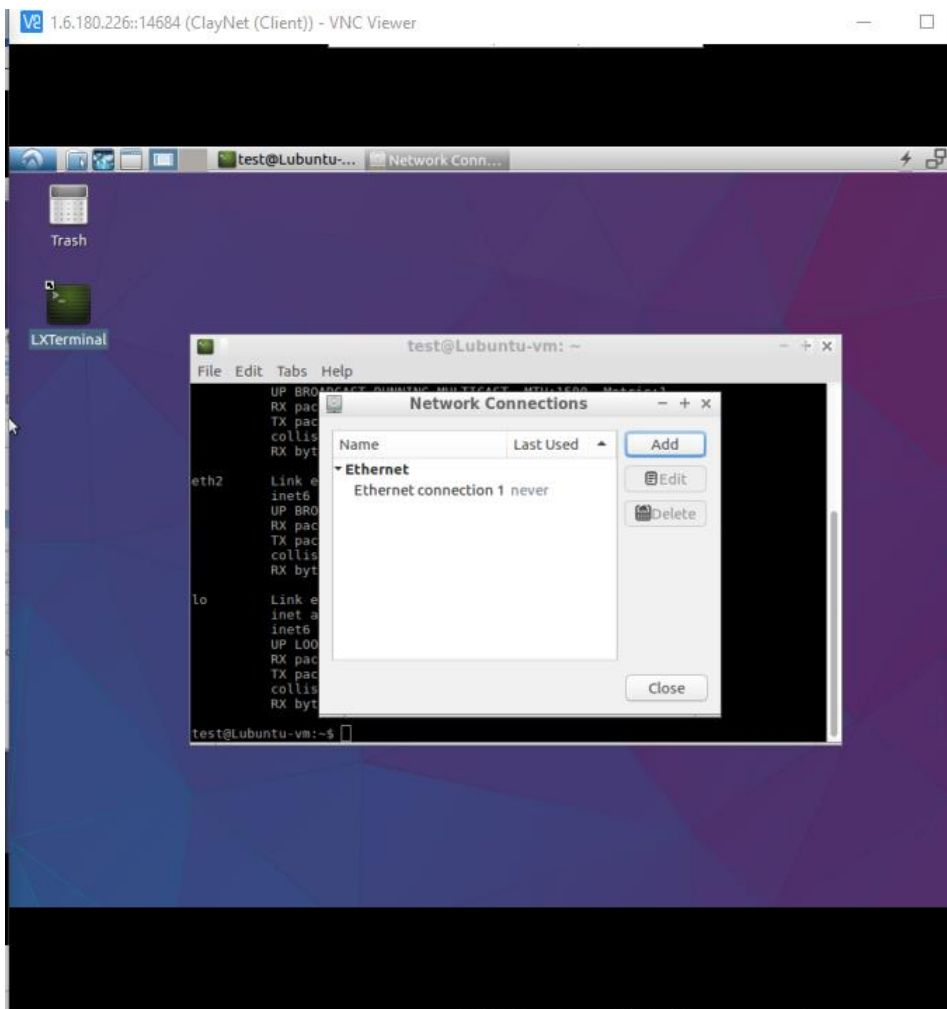
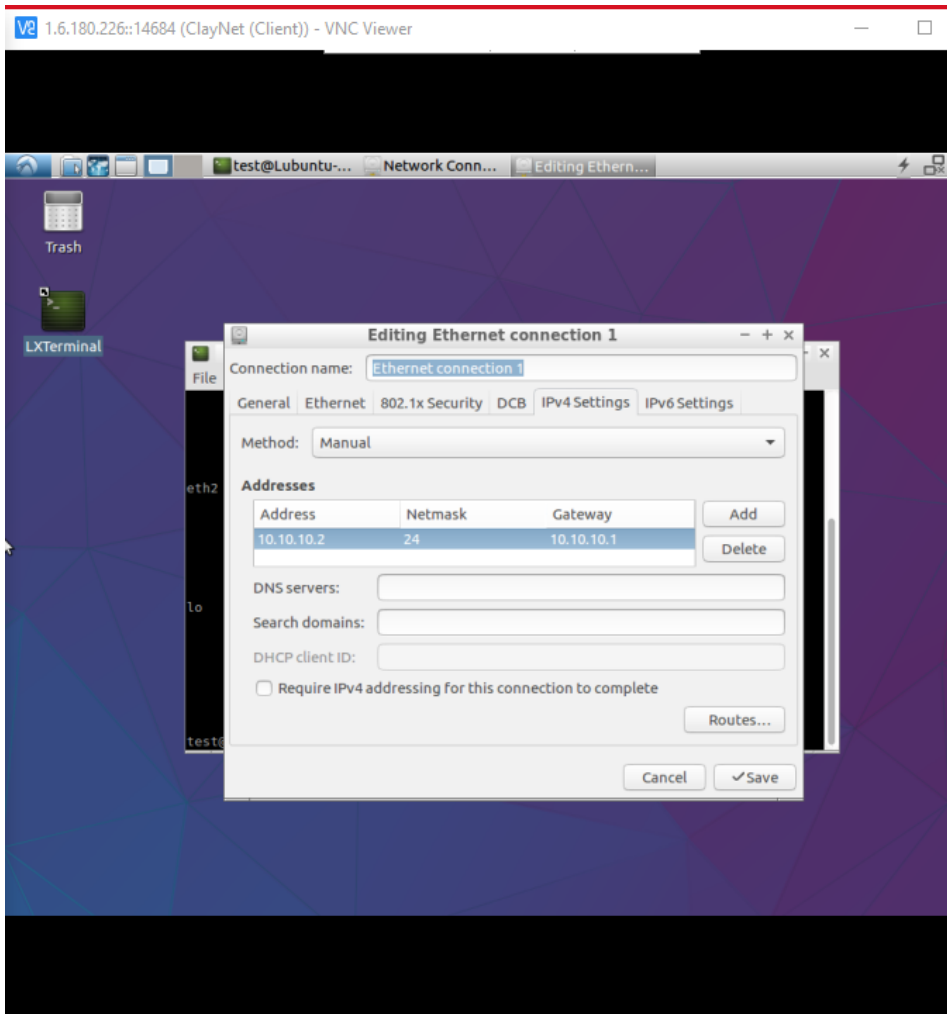
Task 4: Go to connection manager and select appropriate Source, Source ports, Target and Target ports and save the connection.

Task 5: To deploy the topology, save the topology first and deploy it by clicking 'Deploy' button available on the top. (Note: It will take few seconds or even minutes to deploy the topology for the first time).

Task 6: Go to 'Remote Desktop' by right clicking on client and server icons and set the IP addresses accordingly. Also add the gateway address. (Login: user - test, password - test)

Client:

IP Address ---> 10.10.10.2 Gateway ---> 10.10.10.1



```
test@Lubuntu-vm: ~  
File Edit Tabs Help  
test@Lubuntu-vm:~$ ping 10.10.10.1  
PING 10.10.10.1 (10.10.10.1) 56(84) bytes of data.  
64 bytes from 10.10.10.1: icmp_seq=1 ttl=64 time=0.712 ms  
64 bytes from 10.10.10.1: icmp_seq=2 ttl=64 time=0.304 ms  
64 bytes from 10.10.10.1: icmp_seq=3 ttl=64 time=0.572 ms  
64 bytes from 10.10.10.1: icmp_seq=4 ttl=64 time=0.568 ms  
64 bytes from 10.10.10.1: icmp_seq=5 ttl=64 time=0.340 ms  
64 bytes from 10.10.10.1: icmp_seq=6 ttl=64 time=0.480 ms  
64 bytes from 10.10.10.1: icmp_seq=7 ttl=64 time=0.359 ms  
64 bytes from 10.10.10.1: icmp_seq=8 ttl=64 time=0.347 ms  
64 bytes from 10.10.10.1: icmp_seq=9 ttl=64 time=0.537 ms  
64 bytes from 10.10.10.1: icmp_seq=10 ttl=64 time=0.281 ms  
64 bytes from 10.10.10.1: icmp_seq=11 ttl=64 time=0.299 ms  
64 bytes from 10.10.10.1: icmp_seq=12 ttl=64 time=0.427 ms  
64 bytes from 10.10.10.1: icmp_seq=13 ttl=64 time=0.477 ms  
64 bytes from 10.10.10.1: icmp_seq=14 ttl=64 time=0.556 ms
```

Server:

IP Address ---> 30.30.30.2 Gateway ---> 30.30.30.1

Task 6: From client, ping to server 30.30.30.2.

```
test@Lubuntu-vm: ~  
File Edit Tabs Help  
test@Lubuntu-vm:~$ ping 30.30.30.1  
PING 30.30.30.1 (30.30.30.1) 56(84) bytes of data.  
64 bytes from 30.30.30.1: icmp_seq=1 ttl=64 time=0.596 ms  
64 bytes from 30.30.30.1: icmp_seq=2 ttl=64 time=0.405 ms  
64 bytes from 30.30.30.1: icmp_seq=3 ttl=64 time=0.481 ms  
64 bytes from 30.30.30.1: icmp_seq=4 ttl=64 time=0.565 ms  
64 bytes from 30.30.30.1: icmp_seq=5 ttl=64 time=0.243 ms  
64 bytes from 30.30.30.1: icmp_seq=6 ttl=64 time=0.391 ms  
64 bytes from 30.30.30.1: icmp_seq=7 ttl=64 time=0.429 ms  
64 bytes from 30.30.30.1: icmp_seq=8 ttl=64 time=0.366 ms  
64 bytes from 30.30.30.1: icmp_seq=9 ttl=64 time=0.294 ms  
64 bytes from 30.30.30.1: icmp_seq=10 ttl=64 time=0.518 ms  
64 bytes from 30.30.30.1: icmp_seq=11 ttl=64 time=0.488 ms  
64 bytes from 30.30.30.1: icmp_seq=12 ttl=64 time=0.521 ms  
64 bytes from 30.30.30.1: icmp_seq=13 ttl=64 time=0.340 ms  
64 bytes from 30.30.30.1: icmp_seq=14 ttl=64 time=0.428 ms  
64 bytes from 30.30.30.1: icmp_seq=15 ttl=64 time=0.308 ms
```

Task 7: Set up the following routing table entries for Routers 1 & 2.

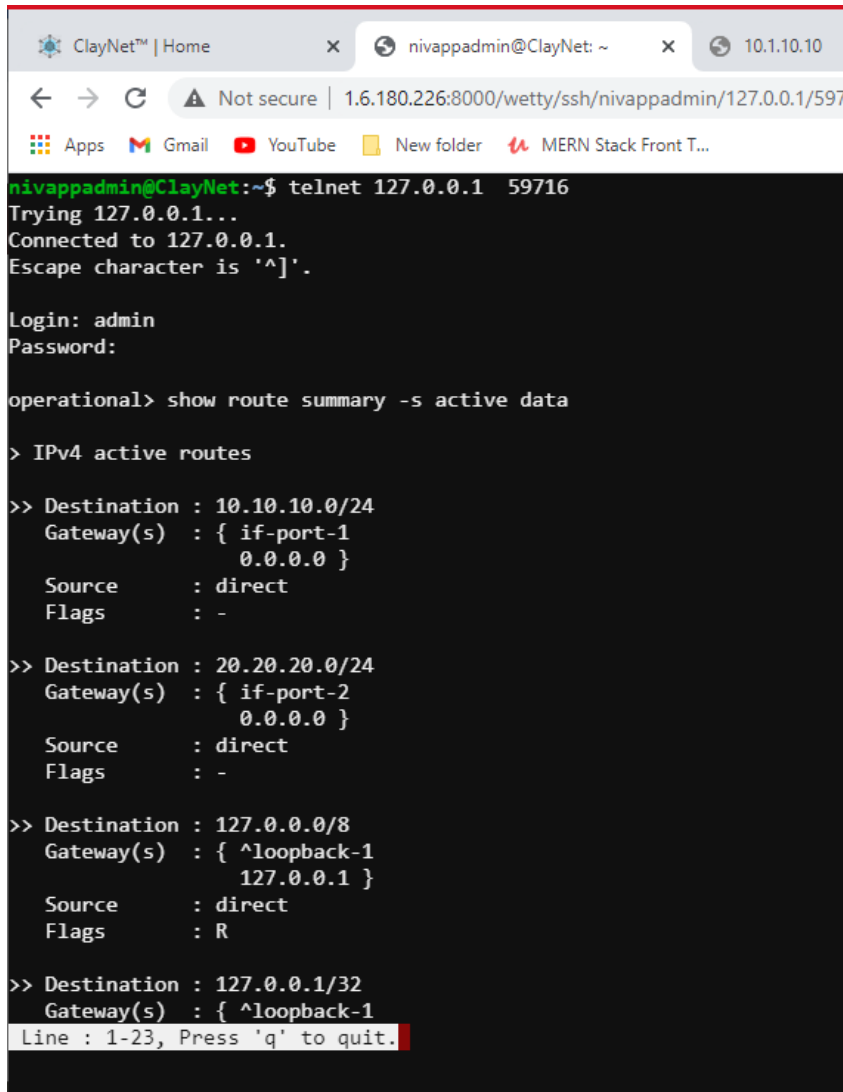
Routers	Destination	Next hop gateway	Via
Router 1	30.30.30.0	20.20.20.2	Direct
Router 2	10.10.10.0	20.20.20.1	Direct

Steps to add the routing table entries:

Step 1: Login to Router1 by right clicking on Router icon and selecting 'Console Access'. (Type 'Enter' key once to get into Login screen. Username - test, Password- test@12345)

Step 2: Display the routing table to view all static routes using the command.

show route summary -s active data



```
nivappadmin@ClayNet:~$ telnet 127.0.0.1 59716
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Login: admin
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        : -

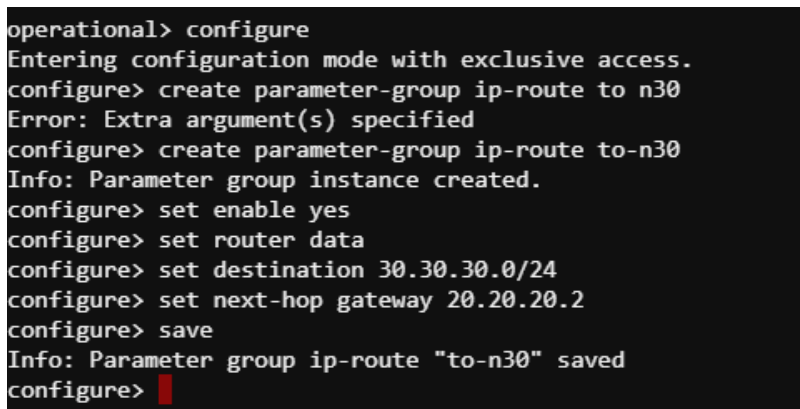
>> Destination : 20.20.20.0/24
  Gateway(s)   : { if-port-2
                  0.0.0.0 }
  Source       : direct
  Flags        : -

>> 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
Line : 1-23, Press 'q' to quit.
```

Note in routing table of Router1 that there is no route to reach the destination network 30.30.30.0/24. Go to configure mode and start configuring the router for all the possible routes.

Step 3: Configure a static route in Router1 for destination 30.30.30.0/24 with next-hop gateway as 20.20.20.2, which is the IP address of Router2.



```
operational> configure
Entering configuration mode with exclusive access.
configure> create parameter-group ip-route to n30
Error: Extra argument(s) specified
configure> create parameter-group ip-route to-n30
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>
```

Step 4: Check routing table again and verify that the route is added.

```
configure> create parameter-group ip-route to-n30
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> 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
Line : 1-23, Press 'q' to quit.
```

Step 5: Repeat the steps 3 & 4 to configure a static route in Router2 for destination 10.10.10.0/24 with next-hop gateway as 20.20.20.1, which is the IP address of Router1.

```
ClayNet nive x nivapp 10.1.10 Download New Tab +
Not secure | 1.6.180.226:8000/wetty/ssh/nivappadmin/127....
Apps Gmail YouTube New folder MERN Stack Front T...

nivappadmin@ClayNet:~$ telnet 127.0.0.1 55323
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

login: admin
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
Line : 1-23, Press 'q' to quit.

configure> create parameter-group ip-route to-n10
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-n10" 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
Line : 1-23, Press 'q' to quit.
```


Task 8: Now Ping will be successful as all the required routers are now configured. Observe the TTL getting decremented by 2 because two hops/routers are in between. Also keep the Wireshark ready for observation.

.6.180.226::14684 (ClayNet (Client)) - VNC Viewer

The screenshot shows a VNC viewer window titled ".6.180.226::14684 (ClayNet (Client)) - VNC Viewer". Inside the viewer, there are two windows. The top window is a terminal window titled "test@Lubuntu-vm: ~" showing the output of a ping command: `test@Lubuntu-vm:~$ ping 30.30.30.2`. The output shows 7 successful pings with a TTL of 62 and various response times. The bottom window is a Wireshark packet capture window titled "*eth0". It shows a list of captured packets, including ICMP Echo (ping) replies and requests, and an OSPF Hello Packet. The packet list is filtered by "Internet Protocol Version 4".

Task 9: Also observe the output of `tracert -n 30.30.30.2` command on Client

The screenshot shows a terminal window titled "test@Lubuntu-vm: ~". It displays the output of the `ping 30.30.30.2` command, which shows 7 successful pings with a TTL of 62 and various response times. Below the ping output, the `tracert -n 30.30.30.2` command is executed, showing the path from the local host to the destination IP address. The output of the tracert command is as follows:

```
17: [LOCALHOST] pmtu 1500
1: 10.10.10.1 0.440ms
1: 10.10.10.1 0.186ms
2: 20.20.20.2 0.425ms
3: 30.30.30.2 0.904ms reached
Resume: pmtu 1500 hops 3 back 3
test@Lubuntu-vm:~$
```