

# Computer Networks Lab

UE19CS255

Week 9

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Semester: 4      Section: G

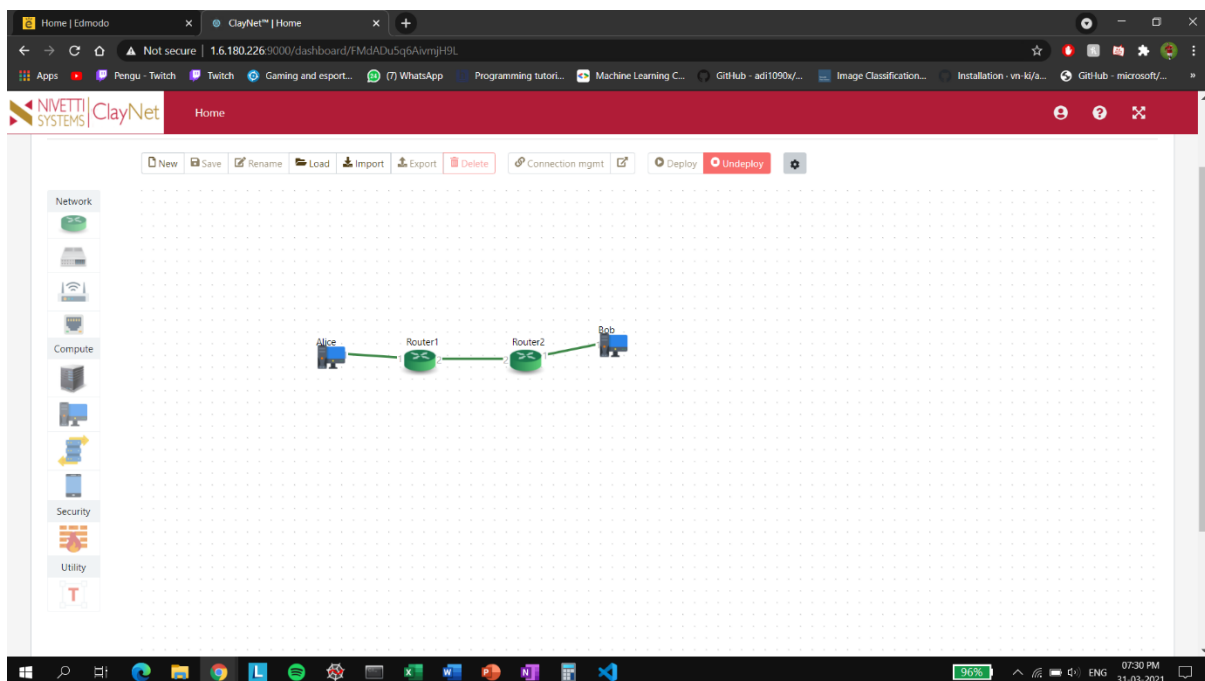
**SRN:** PES2UG19CS406

Date: 06/04/21

## Objectives:

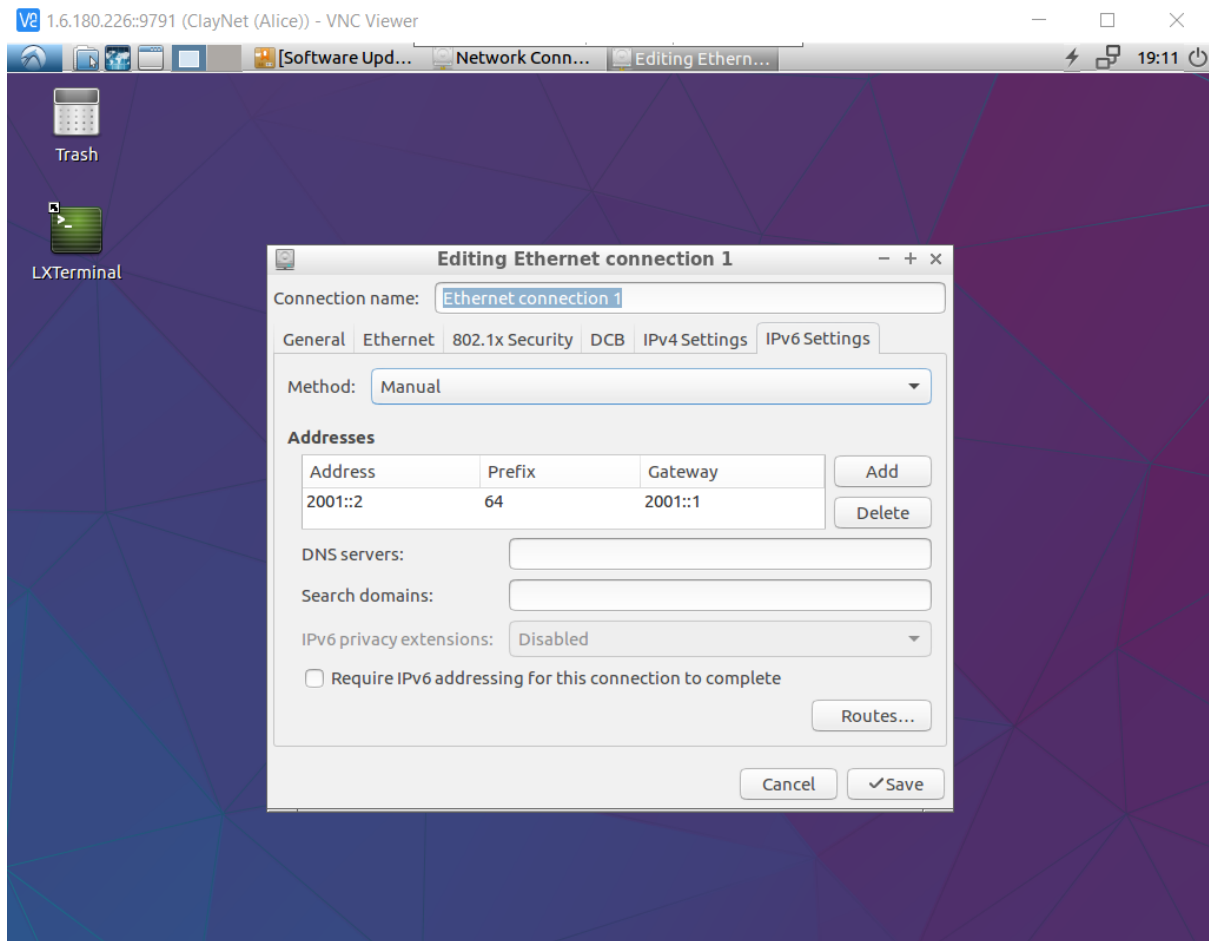
- Perform basic IPv6 configurations on a Desktop and Router.
- Distinguish between IPv4 and IPv6 addresses.
- Configure IPv6 static router in Router.
- Observe traffic flow using IPv6 static routers.
- IPv6 neighbour cache entries.
- Understanding IPv6 Link Local Address.
- Working with ping6 and tracepath6.

## Topology 1:

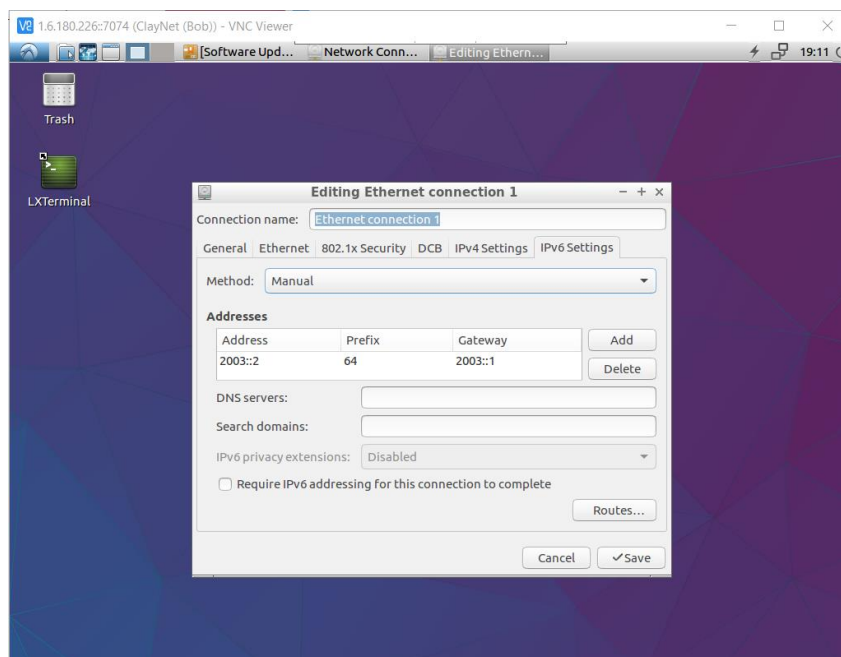


Topology Diagram

## Setting up the IPv6 addresses on Alice and Bob's Systems:



Alice's IP - 2001::02/64

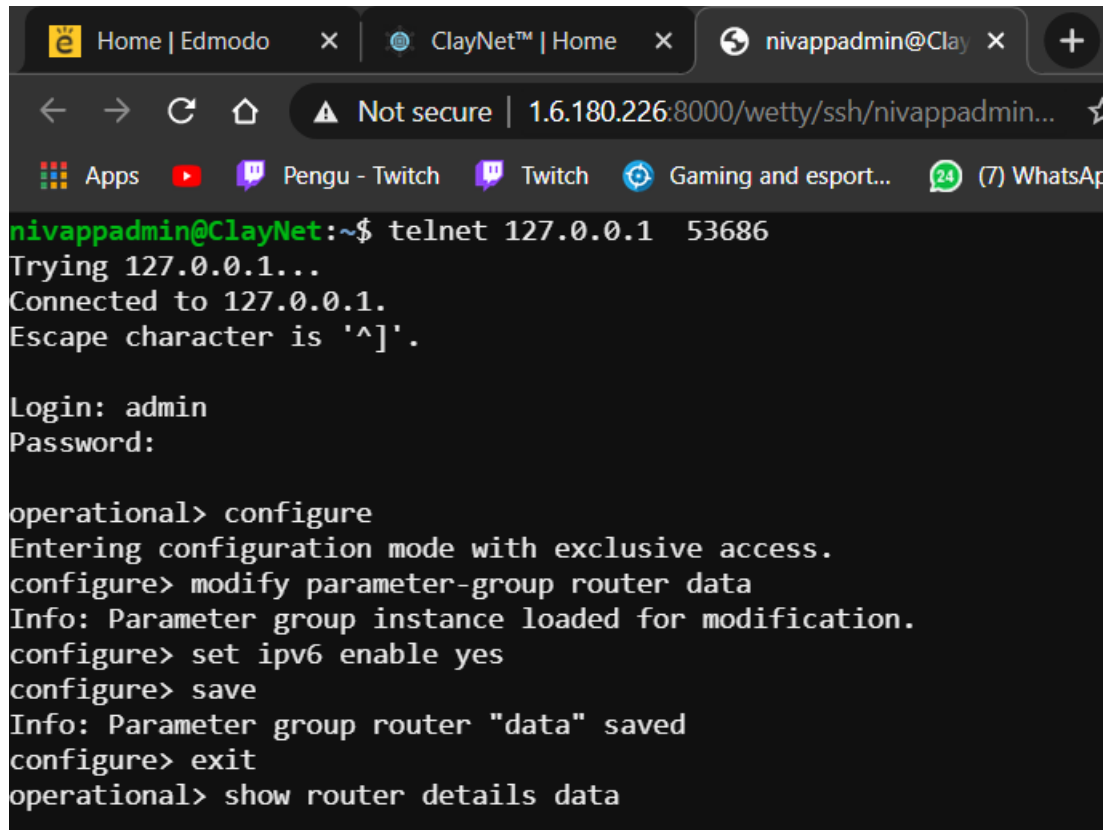


Bob's IP - 2003::02/64

## Router Configuration:

Router 1:

Enabling IPv6:



The screenshot shows a web browser window with three tabs: 'Home | Edmodo', 'ClayNet™ | Home', and 'nivappadmin@Clay'. The address bar shows '1.6.180.226:8000/wetty/ssh/nivappadmin...'. The terminal window displays the following commands and output:

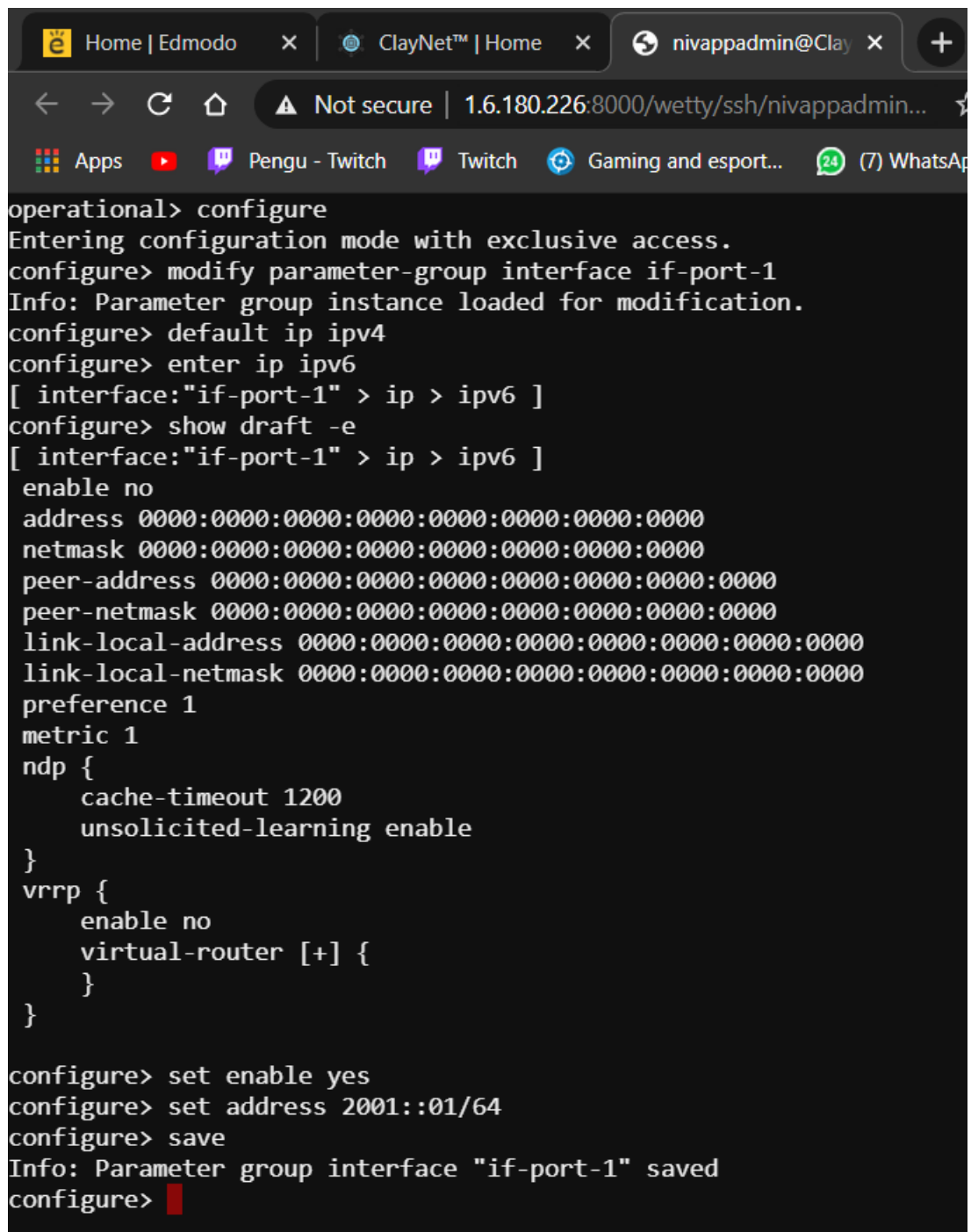
```
nivappadmin@ClayNet:~$ telnet 127.0.0.1 53686
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Login: admin
Password:

operational> configure
Entering configuration mode with exclusive access.
configure> modify parameter-group router data
Info: Parameter group instance loaded for modification.
configure> set ipv6 enable yes
configure> save
Info: Parameter group router "data" saved
configure> exit
operational> show router details data
```

Enabling IPv6

## Configuring IPv6 interfaces:



```
operational> configure
Entering configuration mode with exclusive access.
configure> modify parameter-group interface if-port-1
Info: Parameter group instance loaded for modification.
configure> default ip ipv4
configure> enter ip ipv6
[ interface:"if-port-1" > ip > ipv6 ]
configure> show draft -e
[ interface:"if-port-1" > ip > ipv6 ]
enable no
address 0000:0000:0000:0000:0000:0000:0000:0000
netmask 0000:0000:0000:0000:0000:0000:0000:0000
peer-address 0000:0000:0000:0000:0000:0000:0000:0000
peer-netmask 0000:0000:0000:0000:0000:0000:0000:0000
link-local-address 0000:0000:0000:0000:0000:0000:0000:0000
link-local-netmask 0000:0000:0000:0000:0000:0000:0000:0000
preference 1
metric 1
ndp {
    cache-timeout 1200
    unsolicited-learning enable
}
vrrp {
    enable no
    virtual-router [+] {
    }
}
}

configure> set enable yes
configure> set address 2001::01/64
configure> save
Info: Parameter group interface "if-port-1" saved
configure>
```

IP 2001::01/64 to interface if-port-1

```
Home | Edmodo x ClayNet™ | Home x nivappadmin@Clay x
Not secure | 1.6.180.226:8000/wetty/ssh/nivappadmin...
Apps Pengu - Twitch Twitch Gaming and esport... (7) WhatsA

configure> modify parameter-group interface if-port-2
Info: Parameter group instance loaded for modification.
configure> default ip ipv4
configure> set ip ipv6 enable yes
configure> set ip ipv6 address 2002::01/64
configure> save
Info: Parameter group interface "if-port-2" saved
configure> █
```

IP 2002::01/64to interface if-port-2

Verifying configuration:

```
Home | Edmodo x ClayNet™ | Home x nivappadmin@ClayNet: ~ x
Not secure | 1.6.180.226:8000/wetty/ssh/nivappadmin/127.0.0.1/58729
Apps Pengu - Twitch Twitch Gaming and esport... (7) WhatsApp Programming tutori...

operational> show interface all

Interface name      Status    Encaps-  IP address
-----
if-port-1           up        ethernet 2001::1/64
                   fe80::2826:ff:fe00:47e/64
if-port-2           up        ethernet 2002::1/64
                   fe80::2826:ff:fe00:47f/64
if-port-3           down      ethernet -
if-port-4           down      ethernet -
if-port-5           down      ethernet -
if-port-6           down      ethernet -
if-port-7           down      ethernet -
if-port-8           down      ethernet -
management          disabled  ethernet 10.0.0.12/24

Total number of interfaces displayed : 9

operational> █
```

## Routing - IPv6 static Routes:

```
operational> show route summary -F ipv6 data

> IPv6 active routes

>> Destination : ::1/128
   Gateway(s)   : { ^loopback-1
                   ::1 }
   Source        : direct
   Flags         : -

>> Destination : 2001::/64
   Gateway(s)   : { if-port-1
                   :: }
   Source        : direct
   Flags         : -

>> Destination : 2002::/64
   Gateway(s)   : { if-port-2
                   :: }
   Source        : direct
   Flags         : -

>> Destination : 2003::/64
   Gateway(s)   : { if-port-2
                   2002::2 }
   Source        : static
   Flags         : -

>> Destination : fe80::/64
   Gateway(s)   : { if-port-1
                   :: }
   Source        : direct
   Flags         : -

>> Destination : fe80::/64
   Gateway(s)   : { if-port-2
                   :: }
   Source        : direct
   Flags         : -

Total number of IPv6 active routes displayed : 6

No IPv6 backup routes are available

operational>
```

After setting up a route to 2003::/64 via 2002::02

## Router 2:

We follow the same steps as we did with router 1 and setup IPv6 on router 2

```
operational> show interface all
```

Interface name	Status	Encaps- ulation	IP address
if-port-1	up	ethernet	2003::1/64 fe80::2826:ff:fe00:487/64
if-port-2	up	ethernet	2002::2/64 fe80::2826:ff:fe00:488/64
if-port-3	down	ethernet	-
if-port-4	down	ethernet	-
if-port-5	down	ethernet	-
if-port-6	down	ethernet	-
if-port-7	down	ethernet	-
if-port-8	down	ethernet	-
management	disabled	ethernet	10.0.0.12/24

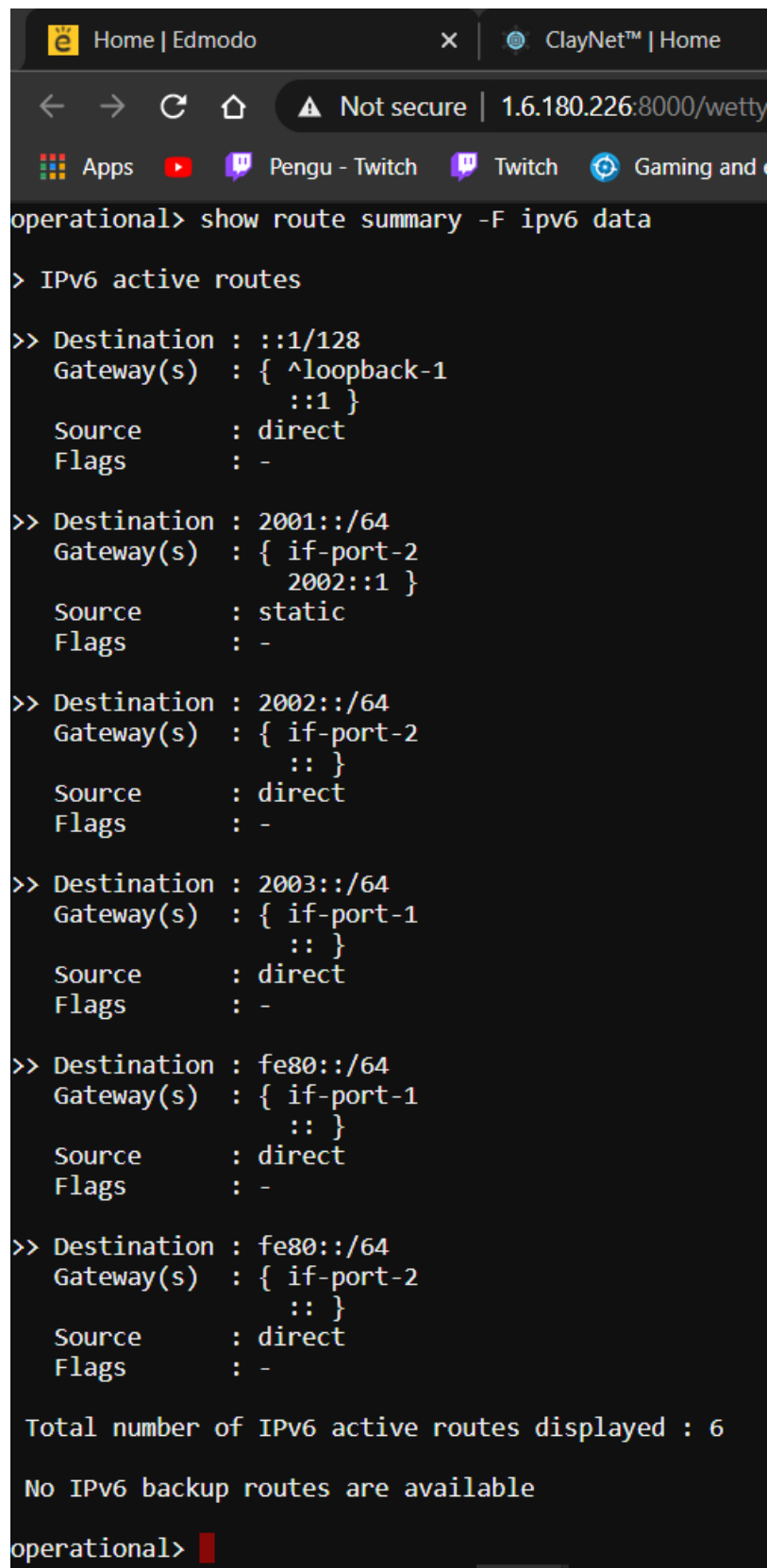
Total number of interfaces displayed : 9

```
operational>
```

IP 2003::1/64 on if-port-1 and  
IP 2002::2/64 on if-port-2 of Router 2



## Routing:

A screenshot of a web browser window. The address bar shows '1.6.180.226:8000/wetty'. The browser has several tabs: 'Home | Edmodo', 'ClayNet™ | Home', and others. Below the address bar, there are icons for 'Apps', 'YouTube', 'Pengu - Twitch', 'Twitch', and 'Gaming and...'. The main content area is a terminal window with a black background and white text. The terminal shows the command 'operational> show route summary -F ipv6 data' and its output, which lists IPv6 active routes. The routes include destinations like '::1/128', '2001::/64', '2002::/64', '2003::/64', and 'fe80::/64', along with their gateways, sources, and flags. The terminal also shows 'Total number of IPv6 active routes displayed : 6' and 'No IPv6 backup routes are available'.

```
operational> show route summary -F ipv6 data

> IPv6 active routes

>> Destination : ::1/128
    Gateway(s)  : { ^loopback-1
                   ::1 }
    Source      : direct
    Flags       : -

>> Destination : 2001::/64
    Gateway(s)  : { if-port-2
                   2002::1 }
    Source      : static
    Flags       : -

>> Destination : 2002::/64
    Gateway(s)  : { if-port-2
                   :: }
    Source      : direct
    Flags       : -

>> Destination : 2003::/64
    Gateway(s)  : { if-port-1
                   :: }
    Source      : direct
    Flags       : -

>> Destination : fe80::/64
    Gateway(s)  : { if-port-1
                   :: }
    Source      : direct
    Flags       : -

>> Destination : fe80::/64
    Gateway(s)  : { if-port-2
                   :: }
    Source      : direct
    Flags       : -

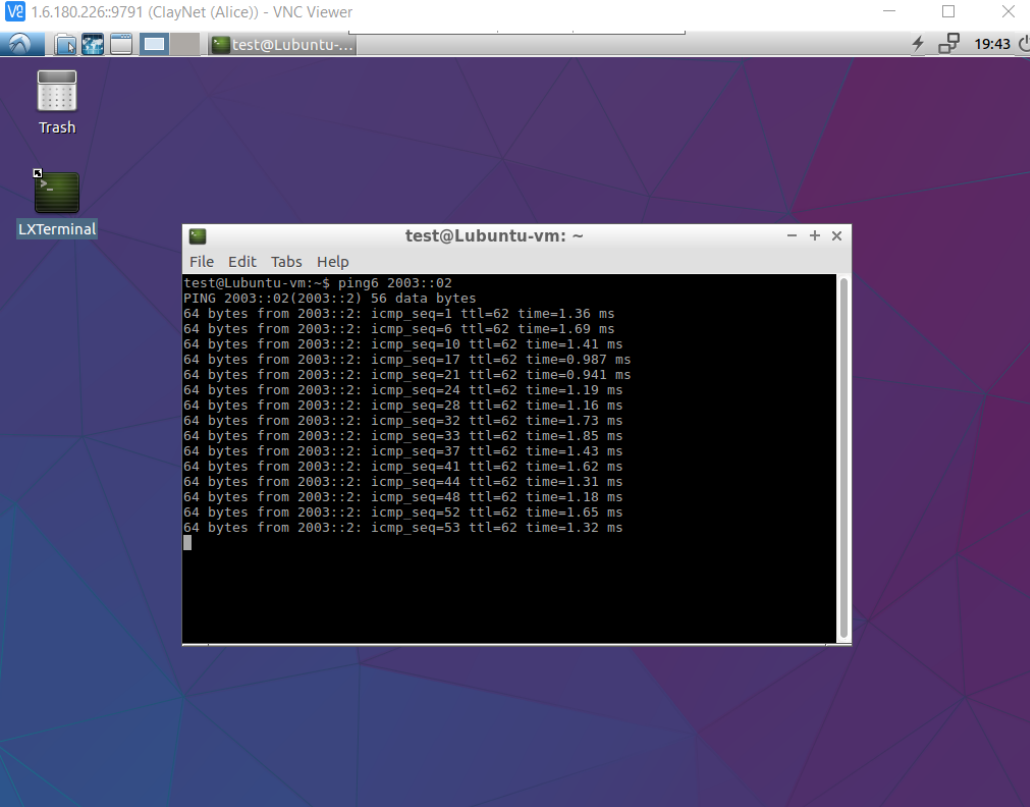
Total number of IPv6 active routes displayed : 6

No IPv6 backup routes are available

operational>
```

After setting up a route to 2001::/64 via 2002::1

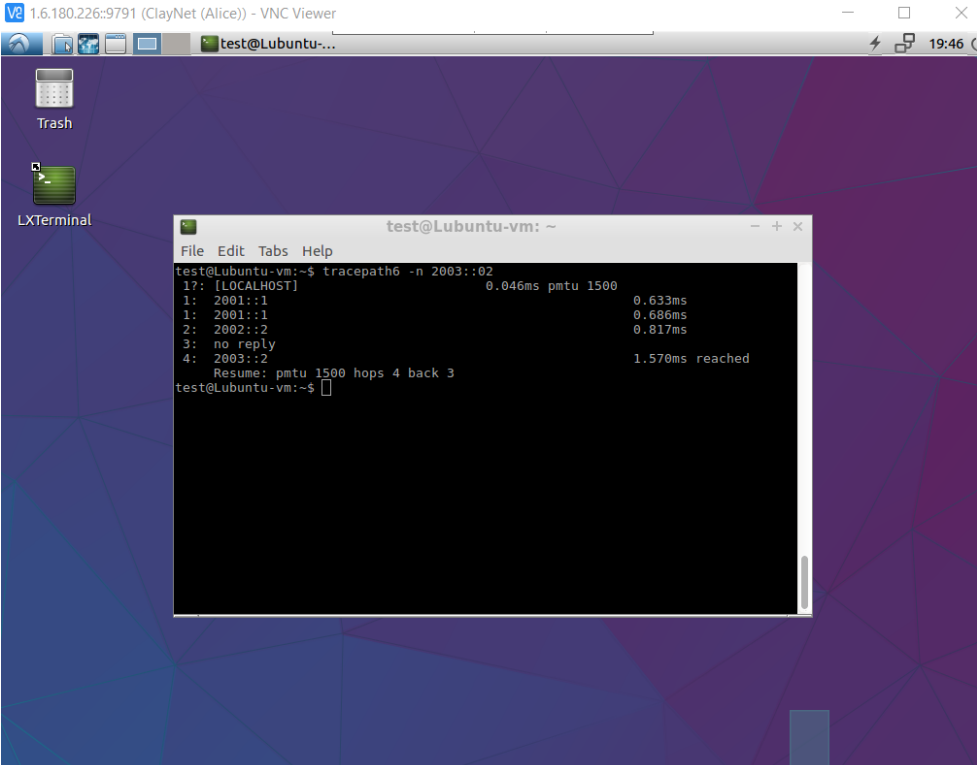
## Verifying Traffic Flow between Alice and Bob:



The screenshot shows a VNC viewer window titled "1.6.180.226:9791 (ClayNet (Alice)) - VNC Viewer". Inside the viewer is a desktop environment with a purple background, a "Trash" icon, and an "LXTerminal" icon. The terminal window, titled "test@Lubuntu-vm: ~", displays the output of a `ping6 2003::02` command. The output shows 15 successful ping requests, each receiving 64 bytes from the destination with various round-trip times.

```
test@Lubuntu-vm:~$ ping6 2003::02
PING 2003::02(2003::2): 56 data bytes
64 bytes from 2003::2: icmp_seq=1 ttl=62 time=1.36 ms
64 bytes from 2003::2: icmp_seq=6 ttl=62 time=1.69 ms
64 bytes from 2003::2: icmp_seq=10 ttl=62 time=1.41 ms
64 bytes from 2003::2: icmp_seq=17 ttl=62 time=0.987 ms
64 bytes from 2003::2: icmp_seq=21 ttl=62 time=0.941 ms
64 bytes from 2003::2: icmp_seq=24 ttl=62 time=1.19 ms
64 bytes from 2003::2: icmp_seq=28 ttl=62 time=1.16 ms
64 bytes from 2003::2: icmp_seq=32 ttl=62 time=1.73 ms
64 bytes from 2003::2: icmp_seq=33 ttl=62 time=1.85 ms
64 bytes from 2003::2: icmp_seq=37 ttl=62 time=1.43 ms
64 bytes from 2003::2: icmp_seq=41 ttl=62 time=1.62 ms
64 bytes from 2003::2: icmp_seq=44 ttl=62 time=1.31 ms
64 bytes from 2003::2: icmp_seq=48 ttl=62 time=1.18 ms
64 bytes from 2003::2: icmp_seq=52 ttl=62 time=1.65 ms
64 bytes from 2003::2: icmp_seq=53 ttl=62 time=1.32 ms
```

## Pinging Bob's system from Alice using Ping6



The screenshot shows the same VNC viewer window. The terminal window now displays the output of a `tracepath6 -n 2003::02` command. The output shows the path from the local host to the destination, including hop times and the final destination reached.

```
test@Lubuntu-vm:~$ tracepath6 -n 2003::02
17: [LOCALHOST] 0.046ms pmtu 1500
1: 2001::1 0.633ms
1: 2001::1 0.686ms
2: 2002::2 0.817ms
3: no reply 1.570ms reached
4: 2003::2
Resume: pmtu 1500 hops 4 back 3
test@Lubuntu-vm:~$
```

## Using tracepath6 from Alice's system to Bob's

## Checking IPv6 NDP table on Router-1



The screenshot shows a web browser window with three tabs: 'Home | Edmodo', 'ClayNet™ | Home', and 'nivappadm'. The address bar shows a 'Not secure' warning and the URL '1.6.180.226:8000/wetty/ssh/nivappadmin/127.0.0.1/'. Below the address bar is a taskbar with icons for 'Apps', 'YouTube', 'Pengu - Twitch', 'Twitch', 'Gaming and esport...', and 'WhatsApp (7)'. The main content area is a terminal window with a black background and white text. It shows the command 'operational> show ipv6 neighbour summary data' being executed. The output is a table with three columns: 'Host address', 'MAC address', and 'Interface'. There are four entries in the table. Below the table, it says 'Total number of NDP entries displayed : 4'. The prompt 'operational>' is followed by a red cursor.

```
operational> show ipv6 neighbour summary data
```

Host address	MAC address	Interface
2001::2	2a:26:00:00:0f:32	if-port-1
2002::2	2a:26:00:00:04:88	if-port-2
fe80::2826:ff:fe00:488	2a:26:00:00:04:88	if-port-2
fe80::843d:ad7f:83fe:e9b5	2a:26:00:00:0f:32	if-port-1

Total number of NDP entries displayed : 4

```
operational>
```

## Verifying auto-configured Link Local Address on IPv6 interfaces:

```
operational> show interface details if-port-1

> Interface : if-port-1

General Information
-----
ID : 2
Encapsulation : ethernet
MTU : 1500
Base port type : fast-ethernet
Base port location : { shelf-1 { active-controller base-slot } port-1 }

State Information
-----
State : up
Last state transition : 19:37:40, Wednesday, March 31, 2021 IST
Work flags : -- -- -- -- --

Ethernet information
-----
VLAN tagging : disabled

IP information
-----
Router : data

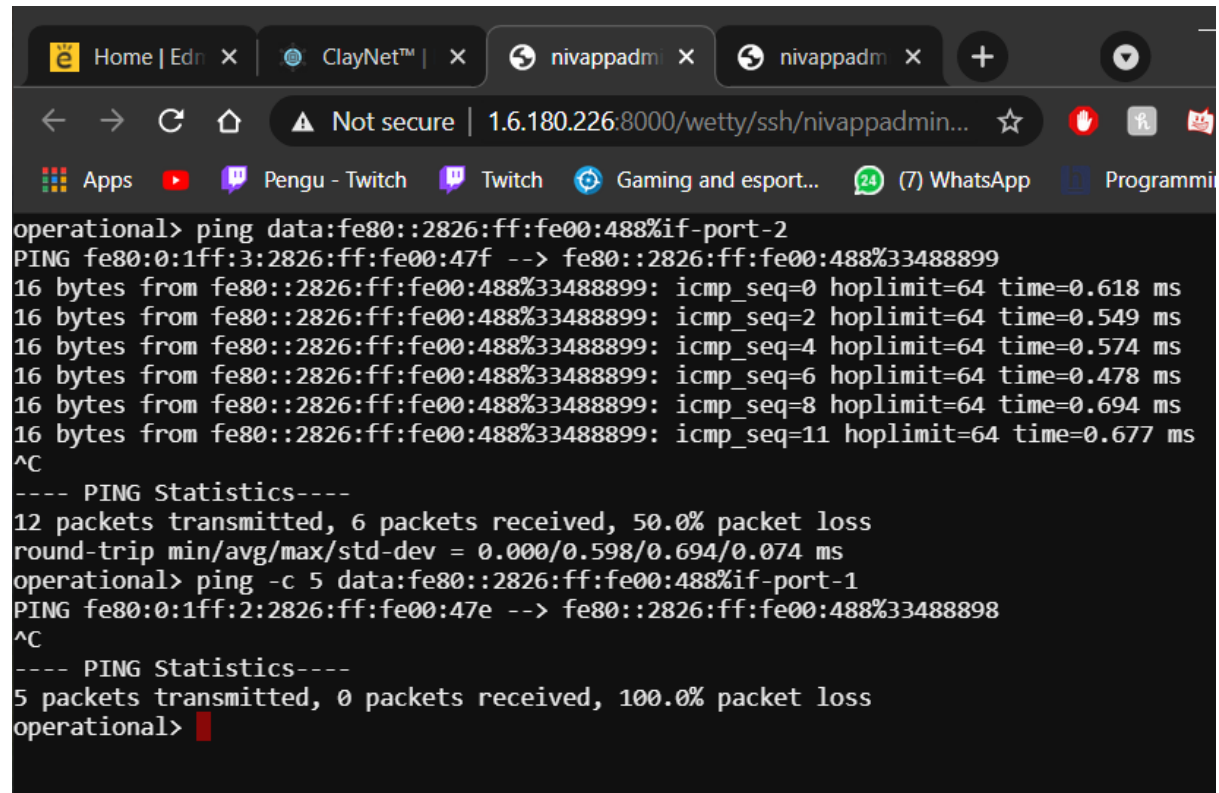
IPv6 information
-----
Address : 2001::1
Netmask : ffff:ffff:ffff:ffff::
Link local Address : fe80::2826:ff:fe00:47e
Link local Netmask : ffff:ffff:ffff:ffff::
Scope Zone : 33488898
Preference : 1
Metric : 1

TE information
-----
Maximum Bandwidth : 10000 kbps
Maximum Reservable Bandwidth : 10000 kbps
Update threshold percentage : 10

operational> █
```

Checking Connectivity between Router's 1 and 2 using Link Local Address:

After obtaining the Link Local Address of Router 2, use that address to ping it from Router 1.



```
operational> ping data:fe80::2826:ff:fe00:488%if-port-2
PING fe80:0:1ff:3:2826:ff:fe00:47f --> fe80::2826:ff:fe00:488%33488899
16 bytes from fe80::2826:ff:fe00:488%33488899: icmp_seq=0 hoplimit=64 time=0.618 ms
16 bytes from fe80::2826:ff:fe00:488%33488899: icmp_seq=2 hoplimit=64 time=0.549 ms
16 bytes from fe80::2826:ff:fe00:488%33488899: icmp_seq=4 hoplimit=64 time=0.574 ms
16 bytes from fe80::2826:ff:fe00:488%33488899: icmp_seq=6 hoplimit=64 time=0.478 ms
16 bytes from fe80::2826:ff:fe00:488%33488899: icmp_seq=8 hoplimit=64 time=0.694 ms
16 bytes from fe80::2826:ff:fe00:488%33488899: icmp_seq=11 hoplimit=64 time=0.677 ms
^C
---- PING Statistics----
12 packets transmitted, 6 packets received, 50.0% packet loss
round-trip min/avg/max/std-dev = 0.000/0.598/0.694/0.074 ms
operational> ping -c 5 data:fe80::2826:ff:fe00:488%if-port-1
PING fe80:0:1ff:2:2826:ff:fe00:47e --> fe80::2826:ff:fe00:488%33488898
^C
---- PING Statistics----
5 packets transmitted, 0 packets received, 100.0% packet loss
operational>
```