

## **COMPUTER NETWORKS LABORATORY**

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### **WEEK – 9 - IPv6 Configuration and Static Routing**

**Date: 16/11/2020**

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#### **Learning Objectives:**

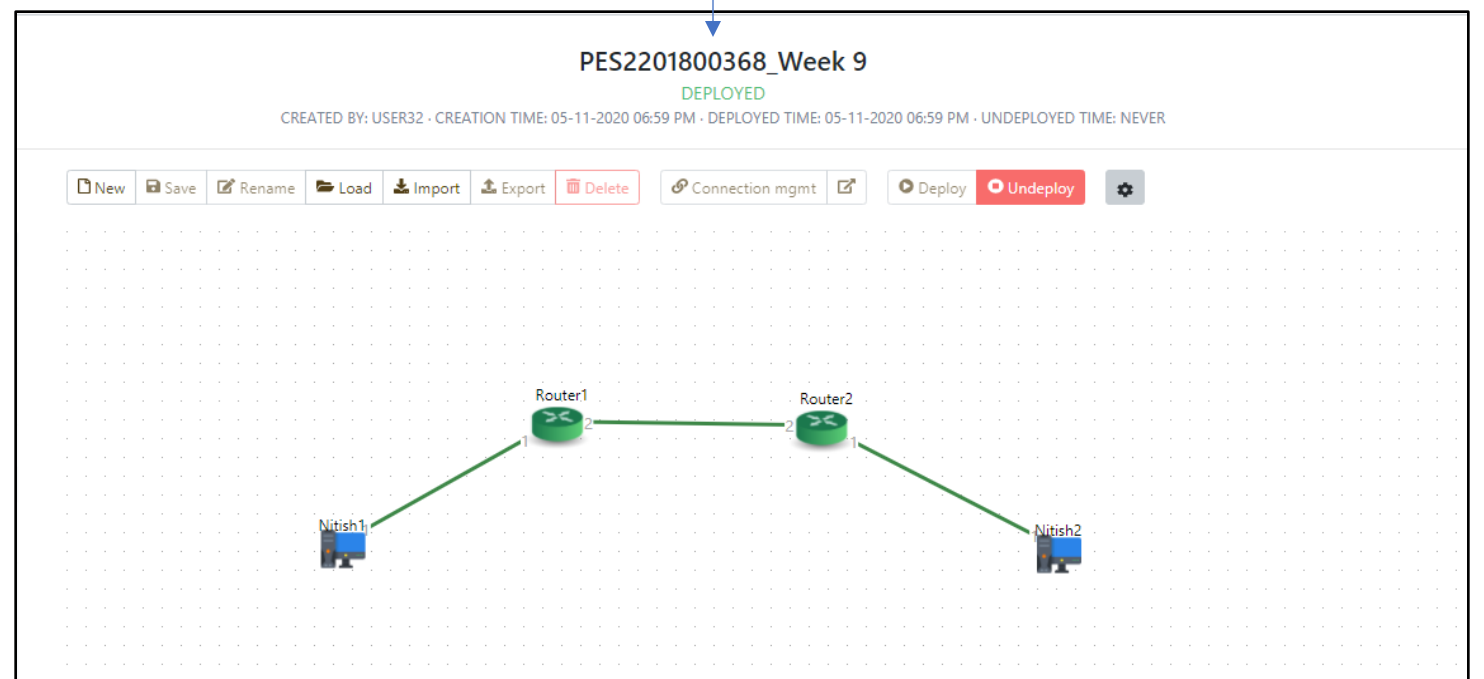
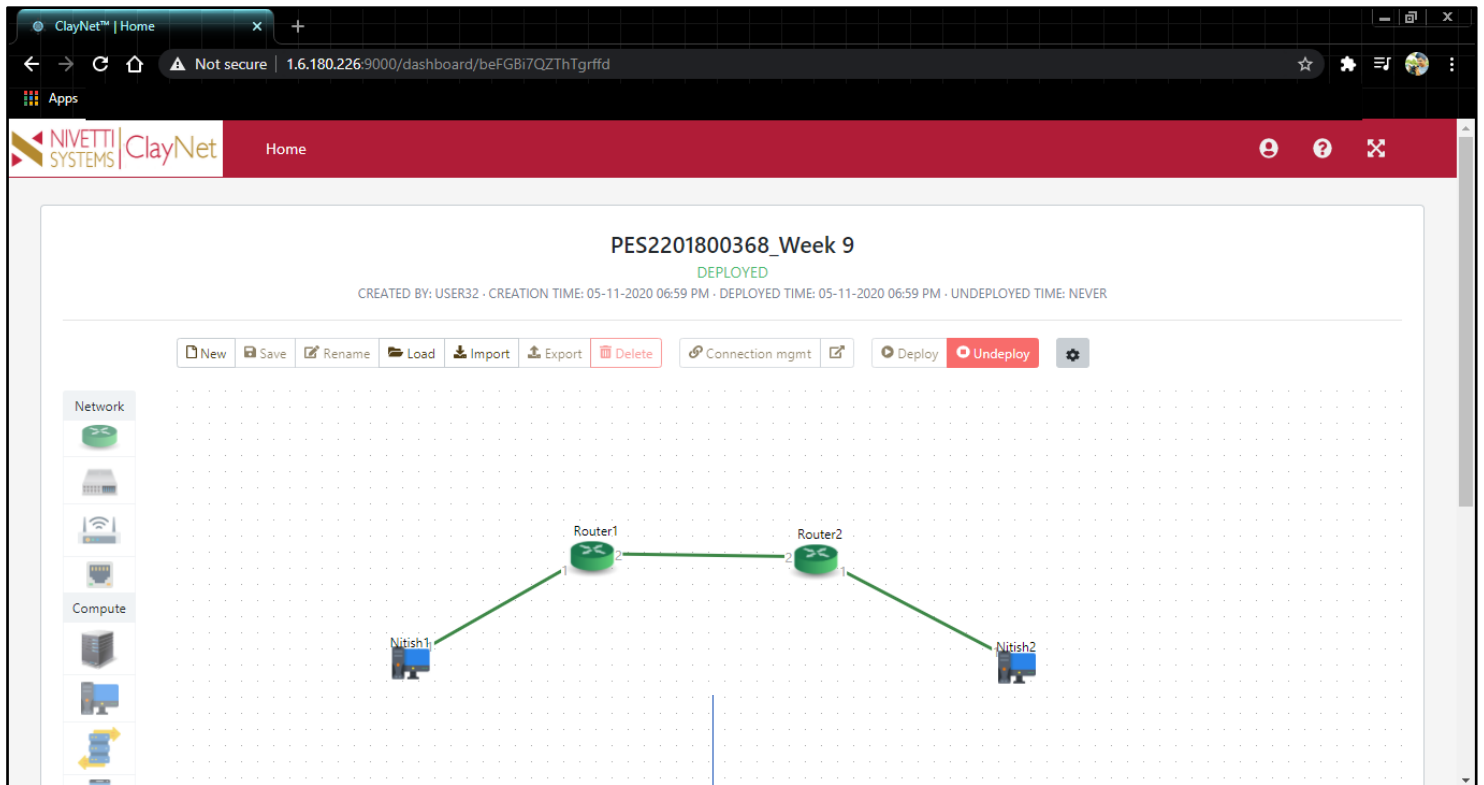
- Perform basic IPv6 configurations on a Desktop and Router.
- Distinguish between IPv4 and IPv6 addresses
- Configure IPv6 static routes in Router
- Observe traffic flow using IPv6 static routes.
- IPv6 neighbor cache entries
- Understanding IPv6 Link Local Address
- Working with ping6 and tracepath6

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To access ClayNet, type **http://1.6.180.226:9000/** in browser.

#### **TOPOLOGY: -**

Create a topology in ClayNet, as shown in following figure.



All the configurations and connections to the topology are made by following the instructions given. The configurations to the router and routing table entries are manually provided using commands in the router console.

## CONFIGURATIONS TO THE DESKTOP:-

- **Nitish1**  
IPv6 address –2001::02/64 , Gateway –2001::01
- **Nitish2**  
IPv6 address –2003::02/64 , Gateway –2003::01

## FOR ROUTER1:-

Configure IPv6 global address 2001::01/64 to interface if-port-1.

Configure IPv6 global address 2002::01/64 to interface if-port-2.

Configure a static route to reach 2003:00/64 network (Nitish1) with gateway as 2002::02( Router-2).

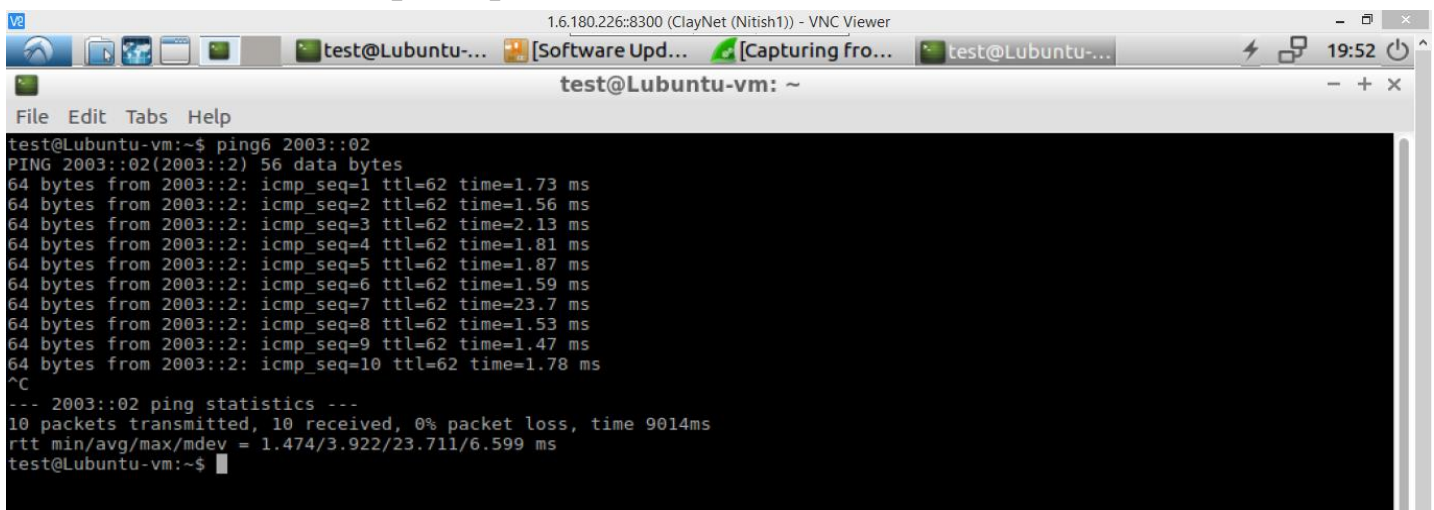
## FOR ROUTER2:-

Configure IPv6 global address 2003::01/64 to interface if-port-1.

Configure IPv6 global address 2002::02/64 to interface if-port-2.

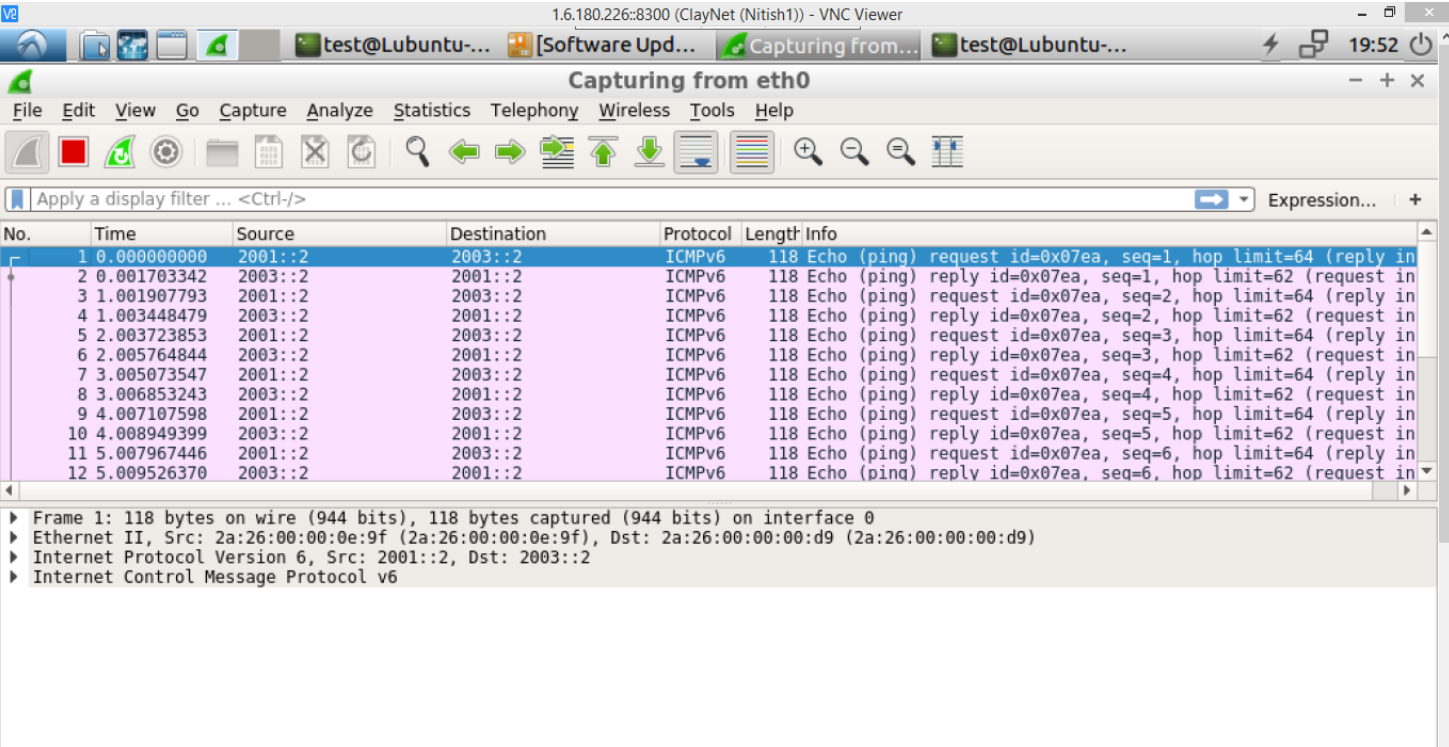
Configure a static route to reach 2001:00/64 network (Nitish2) with gateway as 2002::01( Router-1).

From the remote Desktop in ‘Nitish1’, we ping the Desktop ‘Nitish2’ using the IP address. If all the connections and routing table entries are correct, we can capture packets transferred to and received from Nitish2.



```
1.6.180.226:8300 (ClayNet (Nitish1)) - VNC Viewer
test@Lubuntu-vm: ~
File Edit Tabs Help
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=1.73 ms
64 bytes from 2003::2: icmp_seq=2 ttl=62 time=1.56 ms
64 bytes from 2003::2: icmp_seq=3 ttl=62 time=2.13 ms
64 bytes from 2003::2: icmp_seq=4 ttl=62 time=1.81 ms
64 bytes from 2003::2: icmp_seq=5 ttl=62 time=1.87 ms
64 bytes from 2003::2: icmp_seq=6 ttl=62 time=1.59 ms
64 bytes from 2003::2: icmp_seq=7 ttl=62 time=23.7 ms
64 bytes from 2003::2: icmp_seq=8 ttl=62 time=1.53 ms
64 bytes from 2003::2: icmp_seq=9 ttl=62 time=1.47 ms
64 bytes from 2003::2: icmp_seq=10 ttl=62 time=1.78 ms
^C
--- 2003::02 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9014ms
rtt min/avg/max/mdev = 1.474/3.922/23.711/6.599 ms
test@Lubuntu-vm:~$
```

## WIRESHARK CAPTURE:-

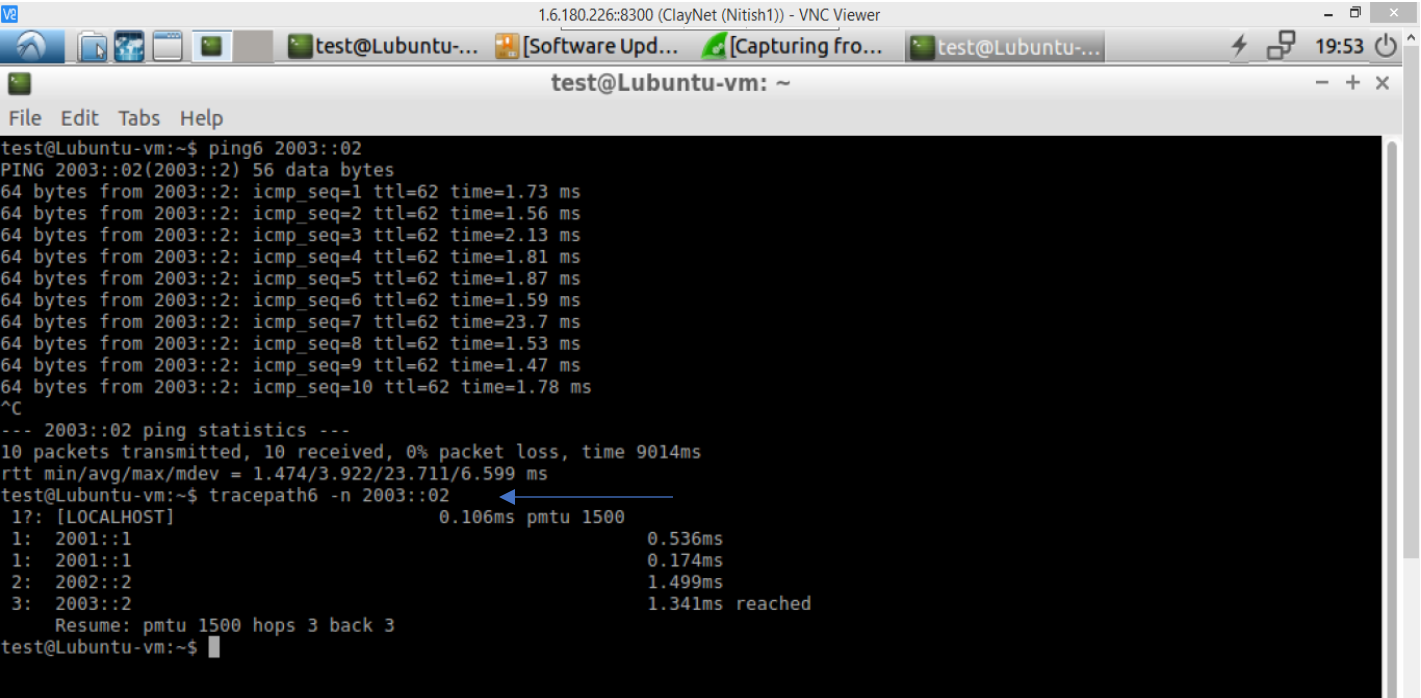


The screenshot shows the Wireshark interface with a capture on interface eth0. The packet list displays 12 ICMPv6 Echo (ping) packets. The first packet is a request from 2001::2 to 2003::2 with sequence 1. The subsequent packets are replies from 2003::2 to 2001::2 with sequence 1, followed by requests and replies for sequences 2 through 6.

| No. | Time        | Source  | Destination | Protocol | Length | Info   |
|-----|-------------|---------|-------------|----------|--------|--|
| 1   | 0.000000000 | 2001::2 | 2003::2     | ICMPv6   | 118    | Echo (ping) request id=0x07ea, seq=1, hop limit=64 (reply in |
| 2   | 0.001703342 | 2003::2 | 2001::2     | ICMPv6   | 118    | Echo (ping) reply id=0x07ea, seq=1, hop limit=62 (request in |
| 3   | 1.001907793 | 2001::2 | 2003::2     | ICMPv6   | 118    | Echo (ping) request id=0x07ea, seq=2, hop limit=64 (reply in |
| 4   | 1.003448479 | 2003::2 | 2001::2     | ICMPv6   | 118    | Echo (ping) reply id=0x07ea, seq=2, hop limit=62 (request in |
| 5   | 2.003723853 | 2001::2 | 2003::2     | ICMPv6   | 118    | Echo (ping) request id=0x07ea, seq=3, hop limit=64 (reply in |
| 6   | 2.005764844 | 2003::2 | 2001::2     | ICMPv6   | 118    | Echo (ping) reply id=0x07ea, seq=3, hop limit=62 (request in |
| 7   | 3.005073547 | 2001::2 | 2003::2     | ICMPv6   | 118    | Echo (ping) request id=0x07ea, seq=4, hop limit=64 (reply in |
| 8   | 3.006853243 | 2003::2 | 2001::2     | ICMPv6   | 118    | Echo (ping) reply id=0x07ea, seq=4, hop limit=62 (request in |
| 9   | 4.007107598 | 2001::2 | 2003::2     | ICMPv6   | 118    | Echo (ping) request id=0x07ea, seq=5, hop limit=64 (reply in |
| 10  | 4.008949399 | 2003::2 | 2001::2     | ICMPv6   | 118    | Echo (ping) reply id=0x07ea, seq=5, hop limit=62 (request in |
| 11  | 5.007967446 | 2001::2 | 2003::2     | ICMPv6   | 118    | Echo (ping) request id=0x07ea, seq=6, hop limit=64 (reply in |
| 12  | 5.009526370 | 2003::2 | 2001::2     | ICMPv6   | 118    | Echo (ping) reply id=0x07ea, seq=6, hop limit=62 (request in |

Frame 1: 118 bytes on wire (944 bits), 118 bytes captured (944 bits) on interface 0  
Ethernet II, Src: 2a:26:00:00:0e:9f (2a:26:00:00:0e:9f), Dst: 2a:26:00:00:00:d9 (2a:26:00:00:00:d9)  
Internet Protocol Version 6, Src: 2001::2, Dst: 2003::2  
Internet Control Message Protocol v6

From Nitish1 workstation run tracepath to Nitish2's IP. Observe the intermediate hops



```
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=1.73 ms
64 bytes from 2003::2: icmp_seq=2 ttl=62 time=1.56 ms
64 bytes from 2003::2: icmp_seq=3 ttl=62 time=2.13 ms
64 bytes from 2003::2: icmp_seq=4 ttl=62 time=1.81 ms
64 bytes from 2003::2: icmp_seq=5 ttl=62 time=1.87 ms
64 bytes from 2003::2: icmp_seq=6 ttl=62 time=1.59 ms
64 bytes from 2003::2: icmp_seq=7 ttl=62 time=23.7 ms
64 bytes from 2003::2: icmp_seq=8 ttl=62 time=1.53 ms
64 bytes from 2003::2: icmp_seq=9 ttl=62 time=1.47 ms
64 bytes from 2003::2: icmp_seq=10 ttl=62 time=1.78 ms
^C
--- 2003::02 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9014ms
rtt min/avg/max/mdev = 1.474/3.922/23.711/6.599 ms
test@Lubuntu-vm:~$ tracepath6 -n 2003::02
  1?: [LOCALHOST]           0.106ms pmtu 1500
    1: 2001::1               0.536ms
    1: 2001::1               0.174ms
    2: 2002::2              1.499ms
    3: 2003::2              1.341ms reached
      Resume: pmtu 1500 hops 3 back 3
test@Lubuntu-vm:~$
```

## Check IPv6 NDP table on Router-1:-

```
ClayNet™ | Home x nivappadmin@ClayNet: ~ x nivappadmin@ClayNet: ~ x +
Not secure | 1.6.180.226:8000/wetty/ssh/nivappadmin/127.0.0.1/51553
Apps
>> Destination : 2002::/64
Gateway(s) : { if-port-2
:: }
Source : direct
Flags : -

>> Destination : 2003::/64
Gateway(s) : { if-port-2
operational>
Terminating CLI session due to inactivity

Login: admin
Password:

operational> show ipv6 neighbour summary data ←

Host address      MAC address      Interface
-----
2001::2           2a:26:00:00:0e:9f if-port-1
2002::2           2a:26:00:00:00:e3 if-port-2
fe80::2826:ff:fe00:e3 2a:26:00:00:00:e3 if-port-2
fe80::42ad:d938:cce2:9171 2a:26:00:00:0e:9f if-port-1

Total number of NDP entries displayed : 4
```

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

operational> show interface details if-port-1

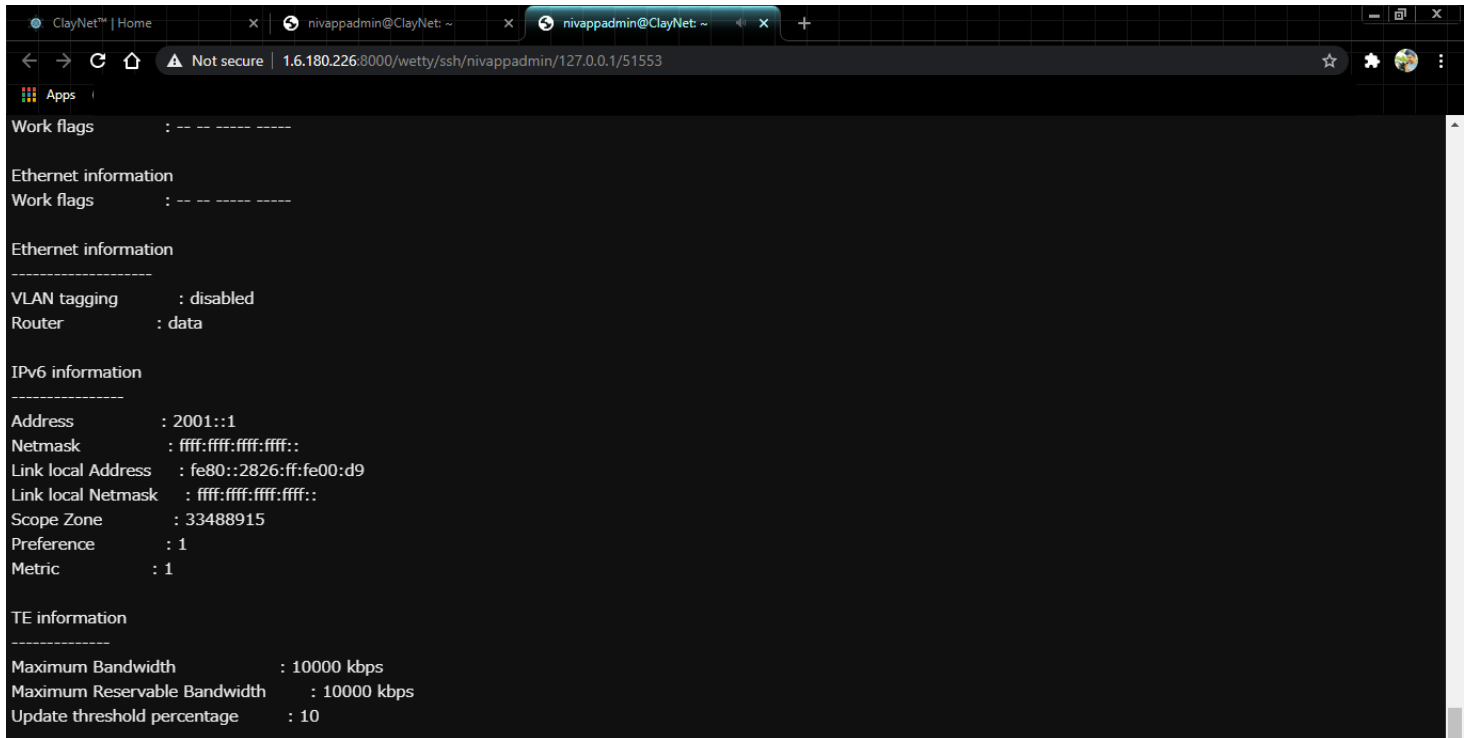
```
ClayNet™ | Home x nivappadmin@ClayNet: ~ x nivappadmin@ClayNet: ~ x +
Not secure | 1.6.180.226:8000/wetty/ssh/nivappadmin/127.0.0.1/51553
Apps
> Interface : if-port-1

General Information
-----
ID : 19
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 : 19:15:09, Thursday, November 05, 2020 IST
Work flags : -- -- -- --

Ethernet information
Work flags : -- -- -- --

Ethernet information
-----
VLAN tagging : disabled
Line : 1-23, Press 'q' to quit
```



**operational> show fast-ethernet details { shelf-1 { active-controller base-slot } port-1 }**

```
operational> show fast-ethernet details { shelf-1 { active-controller base-slot } port-1 }
```

```
> Port : { shelf-1 { active-controller base-slot } port-1 }
```

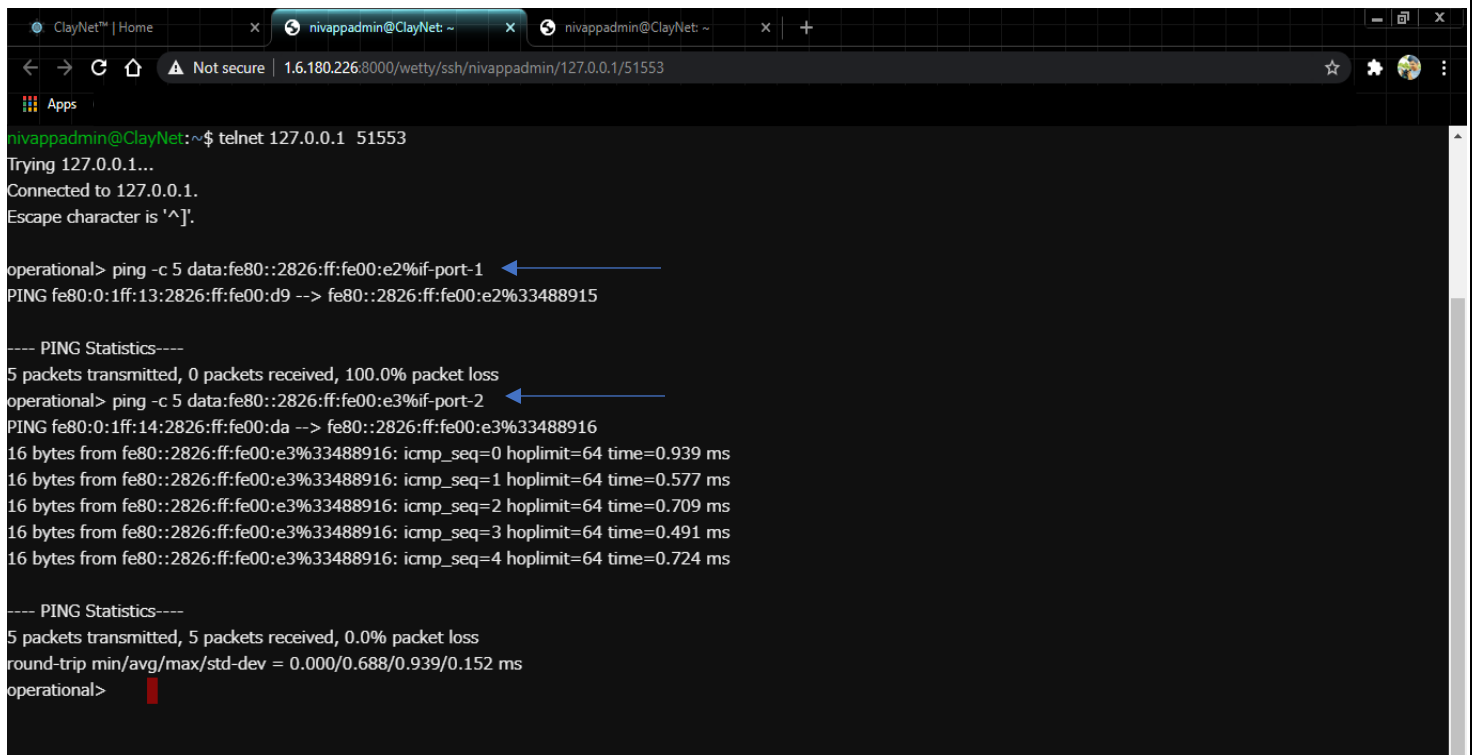
Port details

```
Name :
MAC address : 2a:26:00:00:00:d9
POST : passed
Media : copper
Loop back mode : no-loopback
State : up
Duplex mode : half-duplex
Speed : ten-mbps
Work flags : ----
```

## Check the connectivity between Router-1 and Router-2 using Link Local Address

### Login to Router-2 and get the link-local address of interface connected to Router-1.

Now, Login to Router-1 and ping the link-local address on Router-2 and observe the response. When pinging link-local address, the the name if out-going interface should be specified in the command. If no interface or wrong interface name is specified, ping will result in error or unsuccessful.



```
ClayNet™ | Home x nivappadmin@ClayNet: ~ x nivappadmin@ClayNet: ~ x +
Not secure 16.180.226:8000/wetty/ssh/nivappadmin/127.0.0.1/51553
Apps
nivappadmin@ClayNet:~$ telnet 127.0.0.1 51553
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

operational> ping -c 5 data:fe80::2826:ff:fe00:e2%if-port-1
PING fe80:0:1ff:13:2826:ff:fe00:d9 -> fe80::2826:ff:fe00:e2%33488915

---- PING Statistics----
5 packets transmitted, 0 packets received, 100.0% packet loss
operational> ping -c 5 data:fe80::2826:ff:fe00:e3%if-port-2
PING fe80:0:1ff:14:2826:ff:fe00:da -> fe80::2826:ff:fe00:e3%33488916
16 bytes from fe80::2826:ff:fe00:e3%33488916: icmp_seq=0 hoplimit=64 time=0.939 ms
16 bytes from fe80::2826:ff:fe00:e3%33488916: icmp_seq=1 hoplimit=64 time=0.577 ms
16 bytes from fe80::2826:ff:fe00:e3%33488916: icmp_seq=2 hoplimit=64 time=0.709 ms
16 bytes from fe80::2826:ff:fe00:e3%33488916: icmp_seq=3 hoplimit=64 time=0.491 ms
16 bytes from fe80::2826:ff:fe00:e3%33488916: icmp_seq=4 hoplimit=64 time=0.724 ms

---- PING Statistics----
5 packets transmitted, 5 packets received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.000/0.688/0.939/0.152 ms
operational>
```