PES UNIVERSITY

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WEEK :10

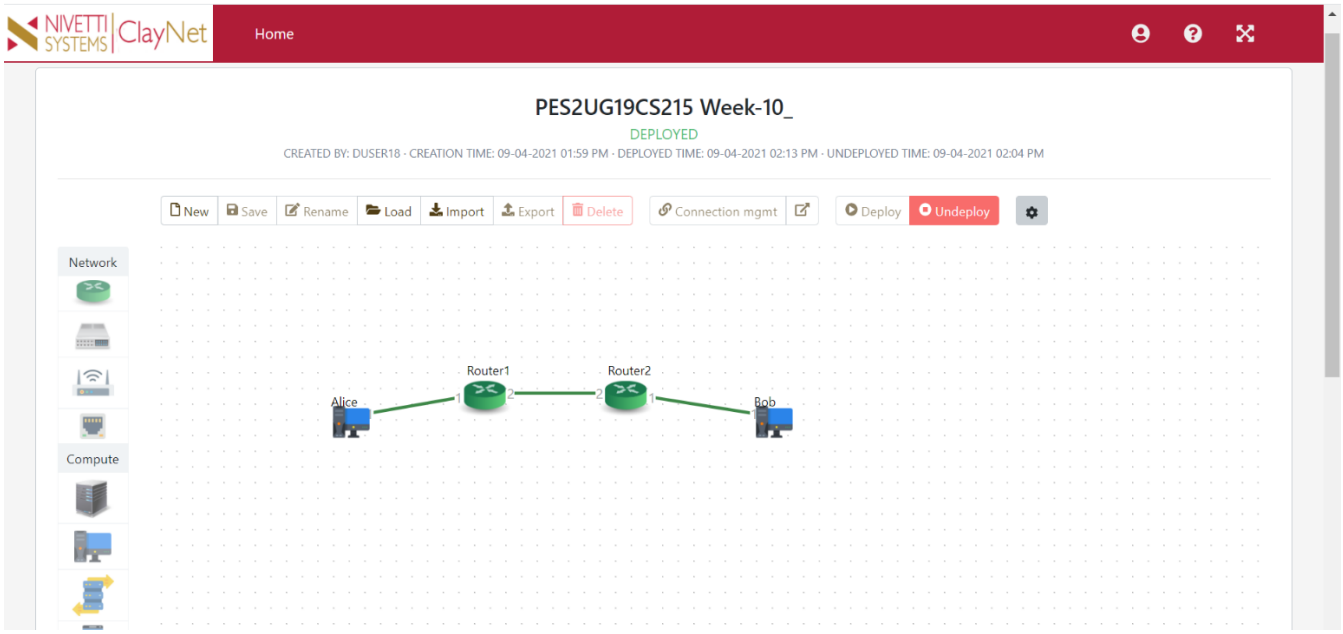
SUBJECT: Computer Network Laboratory

TITLE : IPv6 Configuration and Static Routing

Week 10

IPv6 Configuration and Static Routing

Topology:



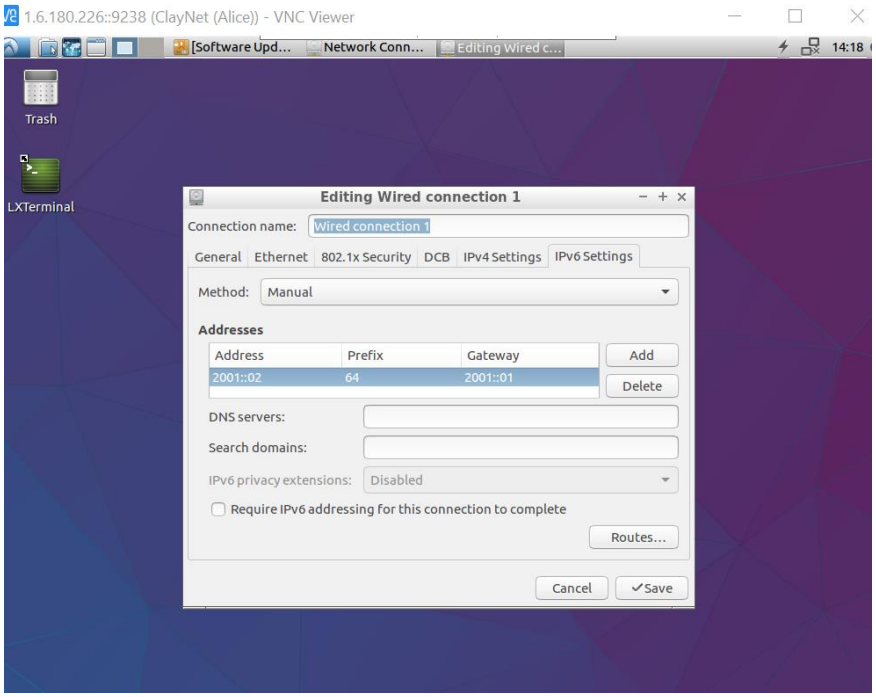
Steps :

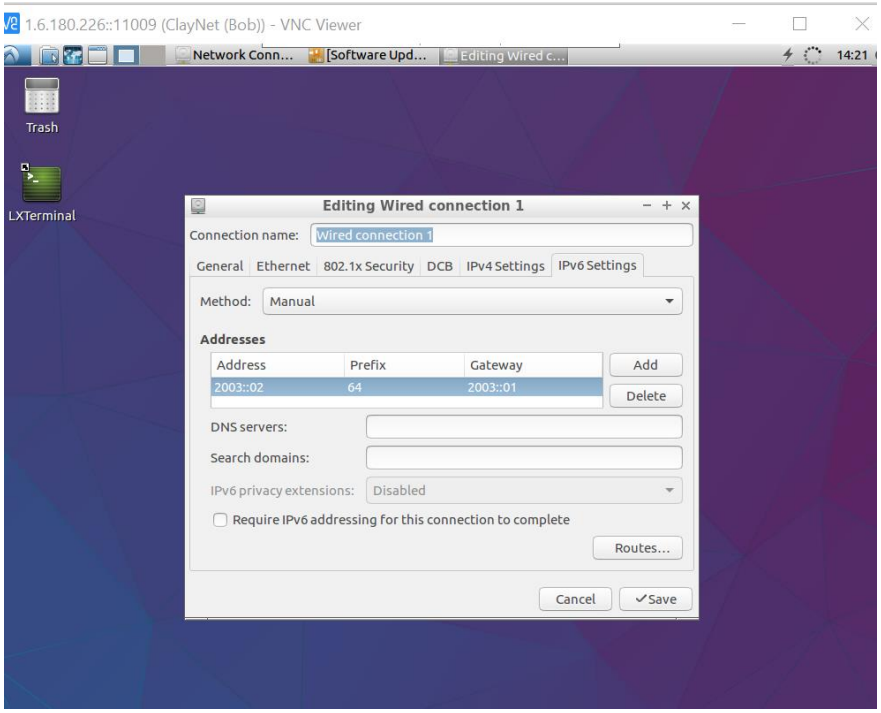
1. Create and deploy the given topology.

2. Configure the PC/Workstation IP address as mentioned in topology.

Alice IPv6 address – 2001::02/64 , Gateway – 2001::01

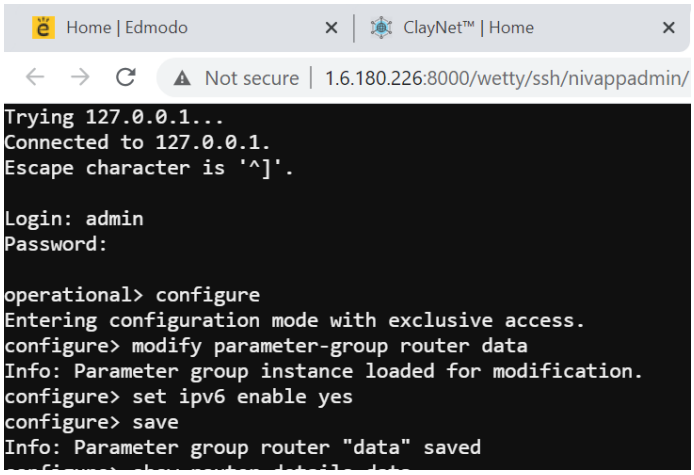
Bob IPv6 address – 2003::02/64 , Gateway – 2003::01





Router Configuration

We first enable the IPv6 mode in both routers.



Router 1

Router 1 is configured by assigning the IPv6 Address 2001::01/64 to the if-port-1 interface as shown below.

```
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
```

Similarly, the IPv6 Address of 2002::01/64 is set for the if-port-2 interface as shown below

```
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> exit
operational>
```

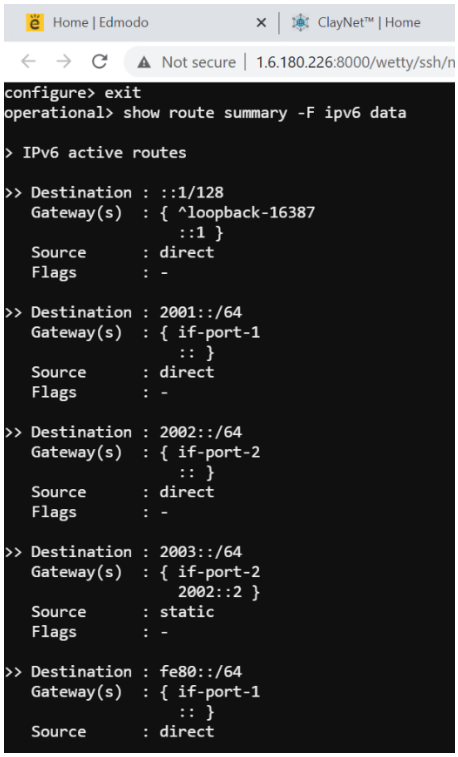
The full interface configuration for Router 1 is shown below.

```
operational> show interface all

 Interface name                  Status    Encaps-   IP address
                                           ulation
 ------------------------------------------------------------------------------
 if-port-1                       up        ethernet  2001::1/64
                                                     fe80::2826:ff:fe00:89a/64
 if-port-2                       up        ethernet  2002::1/64
                                                     fe80::2826:ff:fe00:89b/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>
```

```
operational> show interface details if-port-1 if-port-2

> 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 : 14:29:24, Friday, April 09, 2021 IST
 Work flags            : -- -- ----- -----

 Ethernet information
 --------------------
 VLAN tagging          : disabled

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

```
> Interface : if-port-2

 General Information
 -------------------
 ID                    : 20
 Encapsulation         : ethernet
 MTU                   : 1500
 Base port type        : fast-ethernet
 Base port location    : { shelf-1 { active-controller base-slot } port-2 }

 State Information
 -----------------
 State                 : up
 Last state transition : 14:31:34, Friday, April 09, 2021 IST
 Work flags            : -- -- ----- -----

 Ethernet information
 --------------------
 VLAN tagging          : disabled

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

After configuration, the routing table for Router1 can be seen below.



Router 2:

The IPv6 Addresses for the interfaces if-port-1 and if-port-2 are set similarly.

```
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> set ip ipv6 enable yes
configure> set ip ipv6 address 2003::01/64
configure> save
Info: Parameter group interface "if-port-1" saved
configure> exit
operational> configure
Entering configuration mode with exclusive access.
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::02/64
configure> save
Info: Parameter group interface "if-port-2" saved
configure> exit
```

Configure IPv6 static route in Router-2

```
operational> configure
Entering configuration mode with exclusive access.
configure> create parameter-group ip-route v6-route-2001-nw
Info: Parameter group instance created.
configure> show draft -e
[ ip-route:"v6-route-2001-nw" ]
*name "v6-route-2001-nw"
 enable no
 router ""
 destination 0.0.0.0
 netmask 0.0.0.0
 next-hop {
     router ""
     gateway 0.0.0.0
     label-switched-path ""
 }
 preference 30
 metric 2
```

```
configure> set enable yes
configure> set router data
configure>
configure> set destination 2001::/64
configure> set next-hop gateway 2002::01
configure> save
Info: Parameter group ip-route "v6-route-2001-nw" saved
configure>  show draft -e
[ ip-route:"v6-route-2001-nw" ]
*name "v6-route-2001-nw"
 enable yes
 router "data"
 destination 2001:0000:0000:0000:0000:0000:0000:0000
 netmask ffff:ffff:ffff:ffff:0000:0000:0000:0000
 next-hop {
     router ""
     gateway 2002:0000:0000:0000:0000:0000:0000:0001
     label-switched-path ""
 }
 preference 30
 metric 2
```

Show all the interfaces.

```
operational> show interface all

 Interface name                  Status    Encaps-   IP address
                                           ulation
 ------------------------------------------------------------------------------
 if-port-1                       up        ethernet  2001::1/64
                                                     fe80::2826:ff:fe00:66c/64
 if-port-2                       up        ethernet  2002::1/64
                                                     fe80::2826:ff:fe00:66d/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
```

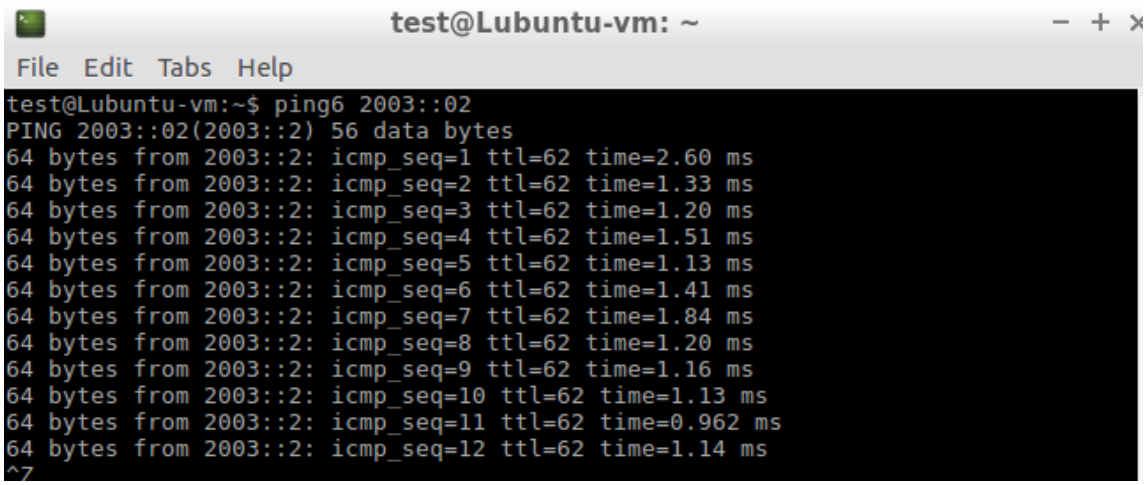
The routing table entries are configured as well and are shown below

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

> IPv6 active routes

>> Destination : ::1/128
   Gateway(s)  : { ^loopback-16387
                   ::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
```

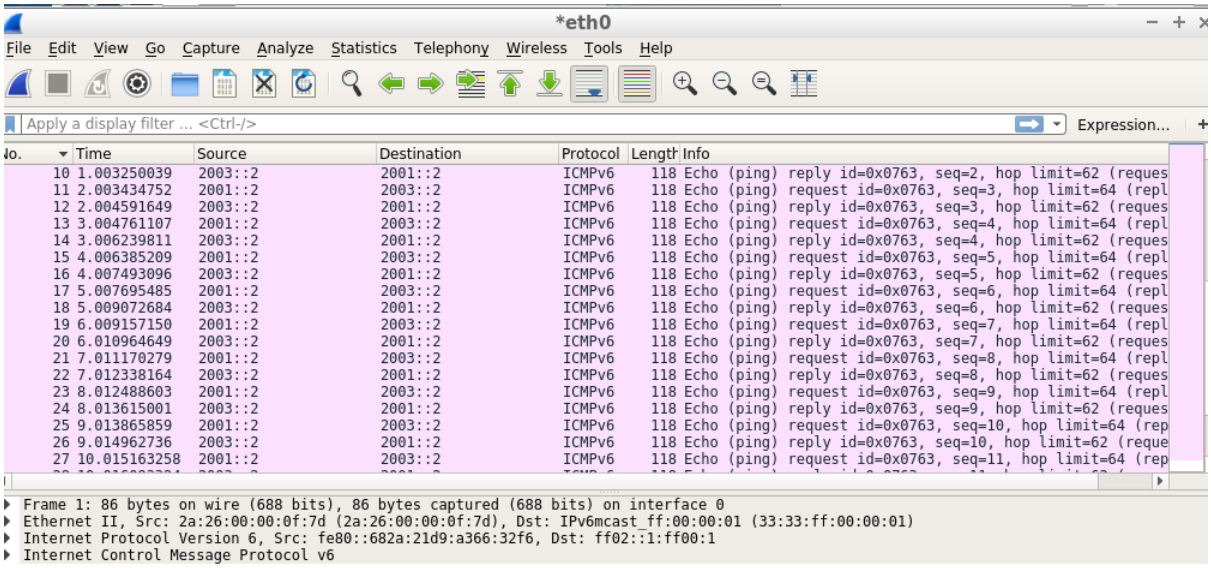
Observations

Ping Command

Successful ping requests can be sent from Alice to Bob workstations as shown below



Wireshark capture:



Check IPv6 NDP table on Router-1

This is similar to ARP Table in IPv4.

```
operational> show ipv6 neighbour summary data

 Host address                              MAC address       Interface
 ------------------------------------------------------------------------------
 2001::2                                   2a:26:00:00:0f:7d if-port-1
 2002::2                                   2a:26:00:00:05:c6 if-port-2
 fe80::2826:ff:fe00:5c6                    2a:26:00:00:05:c6 if-port-2
 fe80::682a:21d9:a366:32f6                 2a:26:00:00:0f:7d if-port-1

 Total number of NDP entries displayed : 4
```

Login to Router-1 and check the auto-configured link local address.

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

> 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   : 17:23:37, Wednesday, April 07, 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:fe00:5bc
 Link local Netmask      : ffff:ffff:ffff:ffff::
 Scope Zone              : 33488915
 Preference              : 1
 Metric                  : 1

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

```
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:26:00:00:05:bc
 POST                : passed
 Media               : copper
 Loop back mode      : no-loopback
 State               : up
 Duplex mode         : half-duplex
 Speed               : ten-mbps
```

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.Page 10/10

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.

```
operational> ping -c 5 data:fe80::226:f7ff:fe00:77


Error: No source address found for this destination


operational> ping data:fe80::226:f7ff:fe00:77%if-port-1
PING fe80:0:1ff:13:2826:ff:fe00:5bc --> fe80::226:f7ff:fe00:77%33488915
^C
---- PING Statistics----
19 packets transmitted, 0 packets received, 100.0% packet loss
```