



EC CAMPUS, BANGALORE

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WEEK : 10

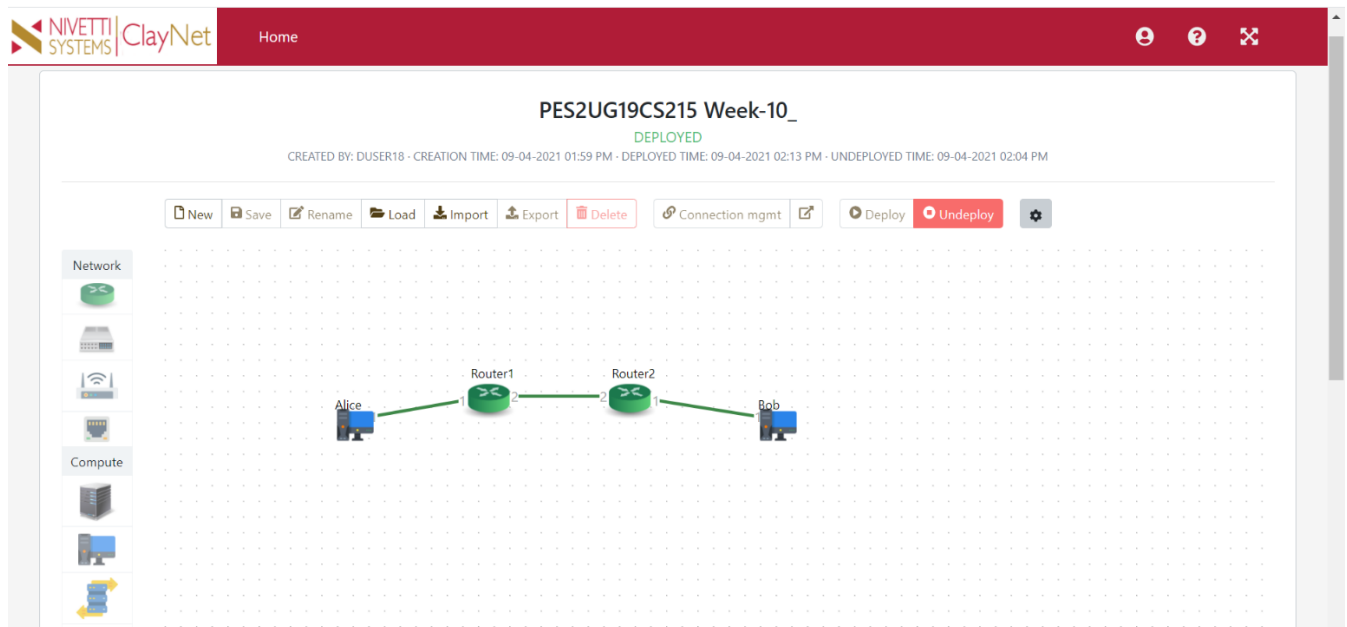
SUBJECT: Computer Network Laboratory

TITLE : IPv6 Configuration and Static Routing

Week 10

IPv6 Configuration and Static Routing

Topology:

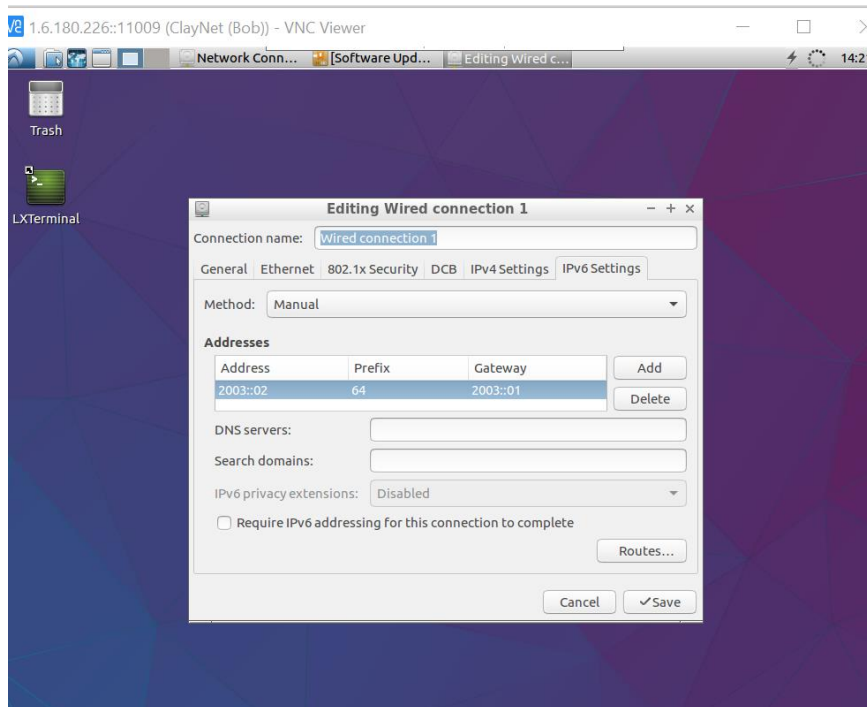
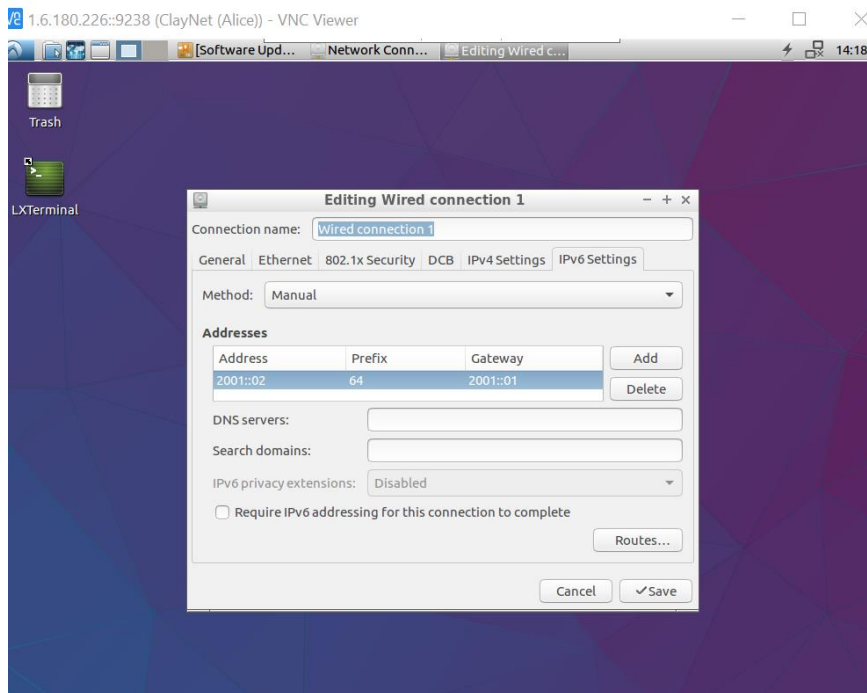


Steps :

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.

```
Home | Edmodo x ClayNet™ | Home x
← → ↻ ⚠ Not secure | 1.6.180.226:8000/wetty/ssh/nivappadmin/
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> show router details data
```

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
-----
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.

```
Home | Edmodo x | ClayNet™ | Home
← → ↻ Not secure | 1.6.180.226:8000/wetty/ssh/n
configure> exit
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-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
```

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- ulation	IP address
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

```
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=2.60 ms  
64 bytes from 2003::2: icmp_seq=2 ttl=62 time=1.33 ms  
64 bytes from 2003::2: icmp_seq=3 ttl=62 time=1.20 ms  
64 bytes from 2003::2: icmp_seq=4 ttl=62 time=1.51 ms  
64 bytes from 2003::2: icmp_seq=5 ttl=62 time=1.13 ms  
64 bytes from 2003::2: icmp_seq=6 ttl=62 time=1.41 ms  
64 bytes from 2003::2: icmp_seq=7 ttl=62 time=1.84 ms  
64 bytes from 2003::2: icmp_seq=8 ttl=62 time=1.20 ms  
64 bytes from 2003::2: icmp_seq=9 ttl=62 time=1.16 ms  
64 bytes from 2003::2: icmp_seq=10 ttl=62 time=1.13 ms  
64 bytes from 2003::2: icmp_seq=11 ttl=62 time=0.962 ms  
64 bytes from 2003::2: icmp_seq=12 ttl=62 time=1.14 ms  
^C
```

Wireshark capture:

The Wireshark capture shows a series of ICMPv6 Echo (ping) requests and replies between source 2003::2 and destination 2001::2. The capture is filtered by 'eth0'. The packet list shows 27 packets, with the first 12 being requests and the remaining 15 being replies. The packet details pane shows the structure of the first packet: Frame 1: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0. Ethernet II, Src: 2a:26:00:00:0f:7d (2a:26:00:00:0f:7d), Dst: IPv6mcast ff:00:00:01 (33:33:ff:00:00:01). Internet Protocol Version 6, Src: fe80::682a:21d9:a366:32f6, Dst: ff02::1:ff00:1. Internet Control Message Protocol v6.

No.	Time	Source	Destination	Protocol	Length	Info
10	1.003250039	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=1, hop limit=62 (repl
11	2.003434752	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=1, hop limit=62 (repl
12	2.004591649	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=2, hop limit=62 (repl
13	3.004761107	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=2, hop limit=62 (repl
14	3.006239811	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=3, hop limit=62 (repl
15	4.006385209	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=3, hop limit=62 (repl
16	4.007493096	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=4, hop limit=62 (repl
17	5.007695485	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=4, hop limit=62 (repl
18	5.009072684	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=5, hop limit=62 (repl
19	6.009157150	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=5, hop limit=62 (repl
20	6.010964649	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=6, hop limit=62 (repl
21	7.011170279	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=6, hop limit=62 (repl
22	7.012338164	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=7, hop limit=62 (repl
23	8.012488603	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=7, hop limit=62 (repl
24	8.013615001	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=8, hop limit=62 (repl
25	9.013865859	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=8, hop limit=62 (repl
26	9.014962736	2003::2	2001::2	ICMPv6	118	Echo (ping) request id=0x0763, seq=9, hop limit=62 (repl
27	10.015163258	2001::2	2003::2	ICMPv6	118	Echo (ping) reply id=0x0763, seq=9, hop limit=62 (repl

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 name of outgoing 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
```