

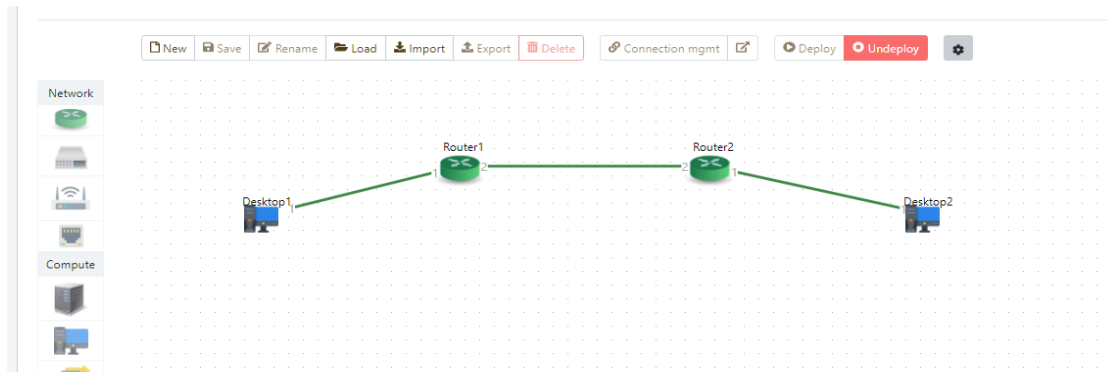
**CN LAB WEEK 10**

**PES1UG20CS806**

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## 1. IPv6 Address and Topology Creation

- The following topology was created and deployed on ClayNet.
- The two workstations are labelled as Alice and Bob for this experiment.



- The end-systems are configured initially as follows

End System Name	IP Address	Gateway
Alice (Desktop1)	2001::02/64	2001::02
Bob (Desktop)	2003::02/64	2003::01

## 2. Router Configuration

- IPv6 Addresses must be set for each router using the console.
- We first enable the IPv6 mode in both routers.

```
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
```

### 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
configure>

```

- 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

```

- The full interface configuration for Router 1 is shown below.

```

operational> show interface all

```

Interface name	Status	Encaps-ulation	IP address
if-port-1	up	ethernet	2001::1/64 fe80::2826:ff:fe00:40c/64
if-port-2	up	ethernet	2002::1/64 fe80::2826:ff:fe00:40d/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>

```

- The routing table entries are now configured. After configuration, the routing table for Router1 can be seen below.

```
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 : 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 : 5
```

## 2.2 Router 2

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

```
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.
zz
Error: Command not available
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> 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> █
```

```
operational> show interface all
```

Interface name	Status	Encaps- ulation	IP address
-----			
if-port-1	up	ethernet	2003::1/64 fe80::2826:ff:fe00:427/64
if-port-2	up	ethernet	2002::2/64 fe80::2826:ff:fe00:428/64
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       : -
```

### 3. Observations

#### 3.1 Ping Command

- Successful ping requests can be sent from Alice to Bob workstations as shown below.
- Since there are 2 hops between the workstations, the TTL value is reduced by 2 from its default value of 64 to 62.

```
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=1.80 ms  
64 bytes from 2003::2: icmp_seq=2 ttl=62 time=1.16 ms  
64 bytes from 2003::2: icmp_seq=3 ttl=62 time=0.833 ms  
64 bytes from 2003::2: icmp_seq=4 ttl=62 time=1.04 ms  
64 bytes from 2003::2: icmp_seq=5 ttl=62 time=1.17 ms  
64 bytes from 2003::2: icmp_seq=6 ttl=62 time=1.09 ms  
64 bytes from 2003::2: icmp_seq=7 ttl=62 time=1.06 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=1.08 ms  
64 bytes from 2003::2: icmp_seq=10 ttl=62 time=0.891 ms  
64 bytes from 2003::2: icmp_seq=11 ttl=62 time=0.889 ms  
64 bytes from 2003::2: icmp_seq=12 ttl=62 time=0.945 ms  
64 bytes from 2003::2: icmp_seq=13 ttl=62 time=0.933 ms  
^C  
--- 2003::02 ping statistics ---  
13 packets transmitted, 13 received, 0% packet loss, time 12038ms  
rtt min/avg/max/mdev = 0.833/1.111/1.802/0.265 ms  
test@Lubuntu-vm:~$
```

### 3.2 Tracepath Command

- A similar tracepath command can be issues from Alice to Bob as shown below.

```
test@Lubuntu-vm: ~  
File Edit Tabs Help  
test@Lubuntu-vm:~$ tracepath6 -n 2003::02  
1?: [LOCALHOST] 0.051ms pmtu 1500  
1: 2001::1 0.382ms  
1: 2001::1 0.202ms  
2: 2002::2 0.581ms  
3: 2003::2 0.699ms reached  
Resume: pmtu 1500 hops 3 back 3  
test@Lubuntu-vm:~$
```

### 3.3 Neighbour Table

We can view the neighbour table for Router1 using the following command.

```
operational> show ipv6 neighbour summary data  


| Host address              | MAC address       | Interface |
|---------------------------|-------------------|-----------|
| 2001::2                   | a2:26:00:00:16:3f | if-port-1 |
| 2002::2                   | a2:26:00:00:04:82 | if-port-2 |
| fe80::a026:ff:fe00:482    | a2:26:00:00:04:82 | if-port-2 |
| fe80::f31e:b00c:bc4c:7352 | a2:26:00:00:16:3f | if-port-1 |

  
Total number of NDP entries displayed : 4  
operational>
```

We can also obtain the link-local address of interface if-port-2 on Router2 using the following command



```

operational> show interface details if-port-2

> Interface : if-port-2

General Information
-----
ID                : 3
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 : 21:39:06, Thursday, April 08, 2021 IST
Work flags         : -- -- -- -- --

Ethernet information
-----
VLAN tagging       : disabled

IP information
-----
Router             : data

```

```

IPv6 information
-----
Address           : 2002::2
Netmask           : ffff:ffff:ffff:ffff::
Link local Address : fe80::2826:ff:fe00:428
Link local Netmask : ffff:ffff:ffff:ffff::
Scope Zone        : 33488899
Preference        : 1
Metric            : 1

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

```

```

operational> ping data:fe80::2826:ff:fe00:428%if-port-2
PING ::1 --> fe80::2826:ff:fe00:428%33488899
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=0 hoplimit=64 time=0.115 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=1 hoplimit=64 time=0.033 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=2 hoplimit=64 time=0.045 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=3 hoplimit=64 time=0.052 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=4 hoplimit=64 time=0.041 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=5 hoplimit=64 time=0.032 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=6 hoplimit=64 time=0.043 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=7 hoplimit=64 time=0.052 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=8 hoplimit=64 time=0.081 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=9 hoplimit=64 time=0.035 ms
16 bytes from fe80::2826:ff:fe00:428: icmp_seq=10 hoplimit=64 time=0.073 ms
^C
---- PING Statistics----
11 packets transmitted, 11 packets received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.000/0.055/0.115/0.024 ms
operational>

```