

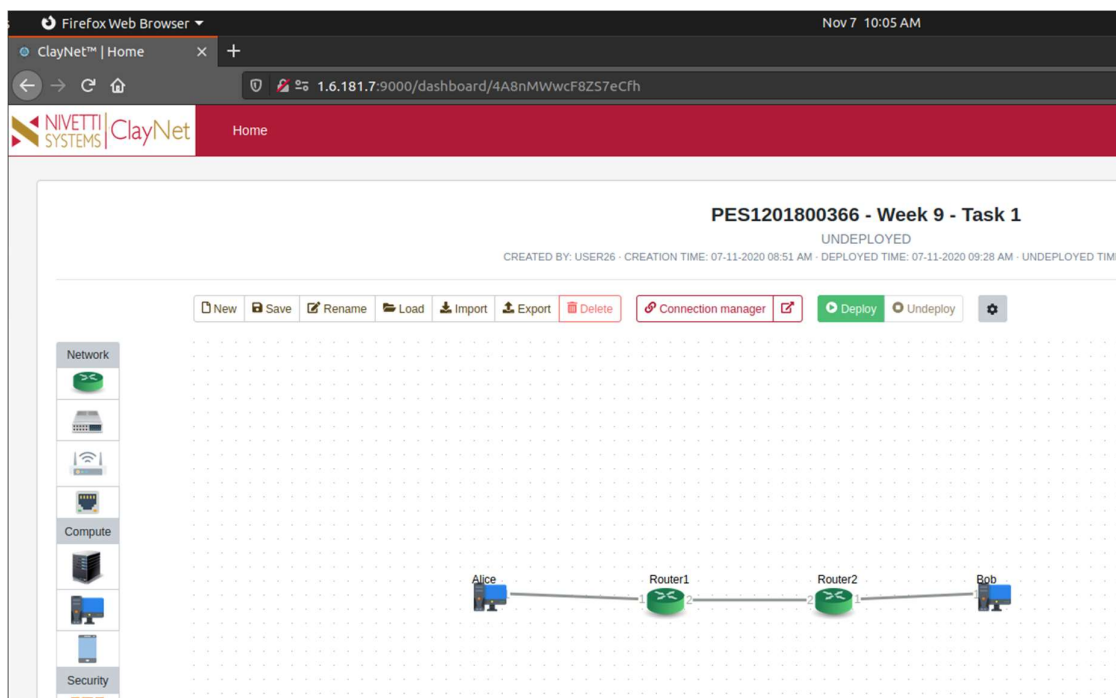
# CN Lab Report – Week 9

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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	2001::02/24	2001::02
Bob	2003::02/24	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
```

## 2.1 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.

```

Login: Login: Login: Login: test
Password:

operational> show interface all

Interface name          Status    Encaps-  IP address
-----
if-port-1               up        ethernet 2001::1/64
                        fe80::a026:ff:fe00:478/64
if-port-2               up        ethernet 2002::1/64
                        fe80::a026:ff:fe00:479/64
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.

```

s Firefox Web Browser
ClayNet™ | Home x clayroot@ClayNet: ~ x Problem loading p
1.6.181.7:8000/wetty/ssh/clayroot/127.0.0.1

TE information
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>

```

## 2.2 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>
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-  IP address
                        ulation
-----
if-port-1                up        ethernet 2003::1/64
                        fe80::a026:ff:fe00:481/64
if-port-2                up        ethernet 2002::2/64
                        fe80::a026:ff:fe00:482/64
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 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

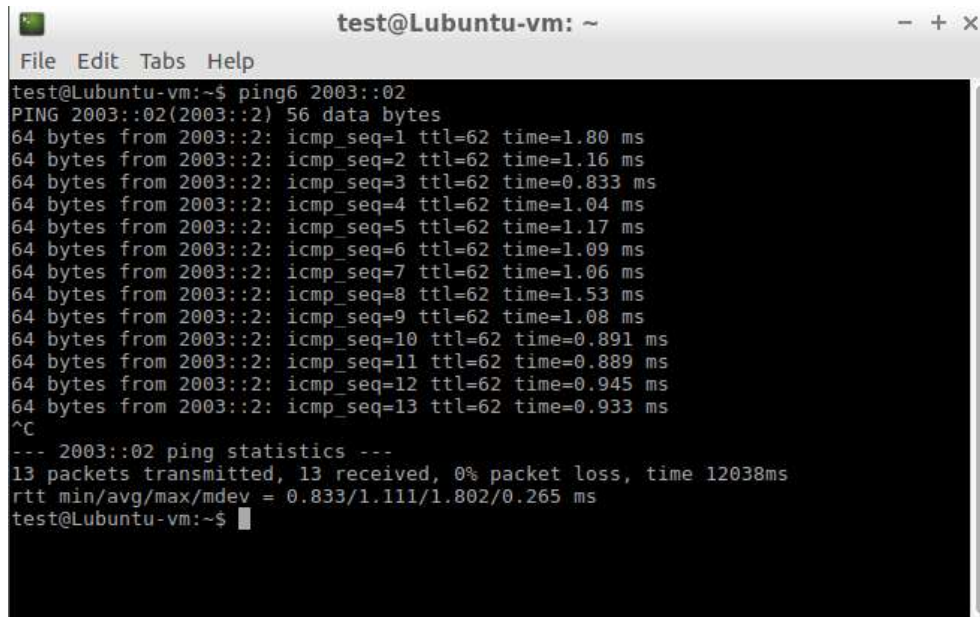
No IPv6 backup routes are available

operational>
```

### 3. Observations

#### 3.1 Ping Command

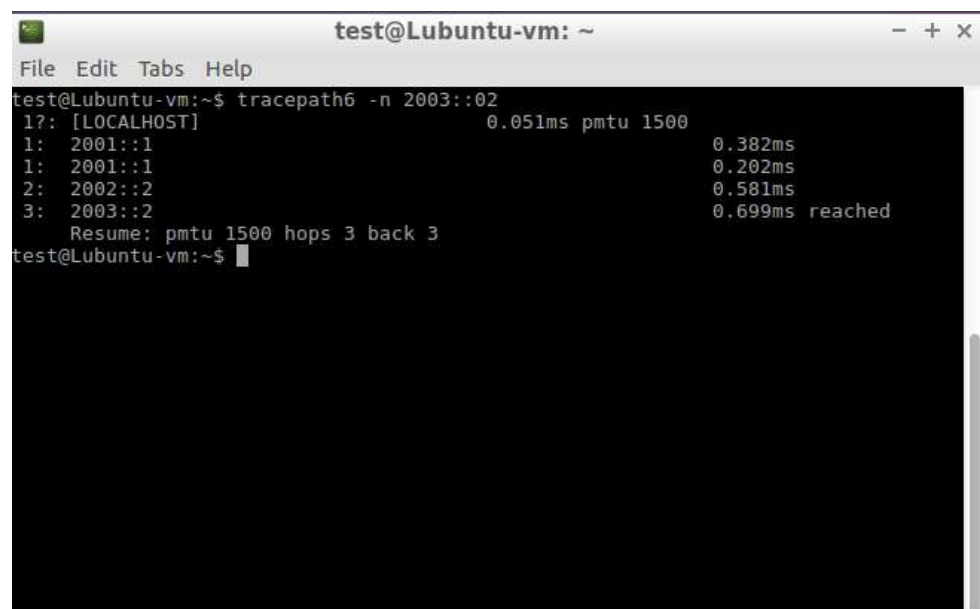
- Successful ping requests can be sent from Alice to Bob workstations as shown below.
- Since there are 2 hops between the workstations, the TTL value is reduced by 2 from its default value of 64 to 62.



```
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 : 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 : 13:00:21, Saturday, November 07, 2020 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::a026:ff:fe00:710
Link local Netmask : ffff:ffff:ffff:ffff::
Scope Zone : 33488916
Preference : 1
Metric : 1
```

TE information

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

- The link-local address that was retrieved from Router2 is now used to ping the router from Router1. As shown below, there is a successful ping request made from one router to another, hence showing that the link-local and MAC addresses are consistent with each other.

```
operational> ping data:fe80::a026:ff:fe00:710if-port-2
PING fe80:0:1ff:14:a026:ff:fe00:707 -> fe80::a026:ff:fe00:710%33488916
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=0 hoplimit=64 time=0.656 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=1 hoplimit=64 time=0.490 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=2 hoplimit=64 time=0.446 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=3 hoplimit=64 time=0.345 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=4 hoplimit=64 time=0.346 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=5 hoplimit=64 time=0.332 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=6 hoplimit=64 time=0.322 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=7 hoplimit=64 time=0.335 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=8 hoplimit=64 time=0.340 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=9 hoplimit=64 time=0.333 ms
16 bytes from fe80::a026:ff:fe00:710%33488916: icmp_seq=10 hoplimit=64 time=0.324 ms
^C
---- PING Statistics----
11 packets transmitted, 11 packets received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.000/0.388/0.656/0.100 ms
operational>
```