

Computer Networks Laboratory

Week 10

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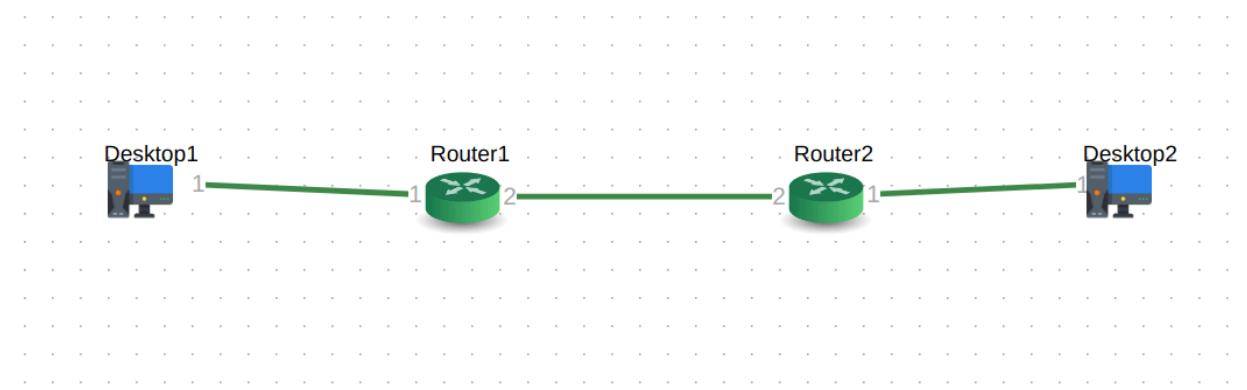
SRN : PES1UG19CS571

Section : I 2

IPv6 Configuration and Static Routing

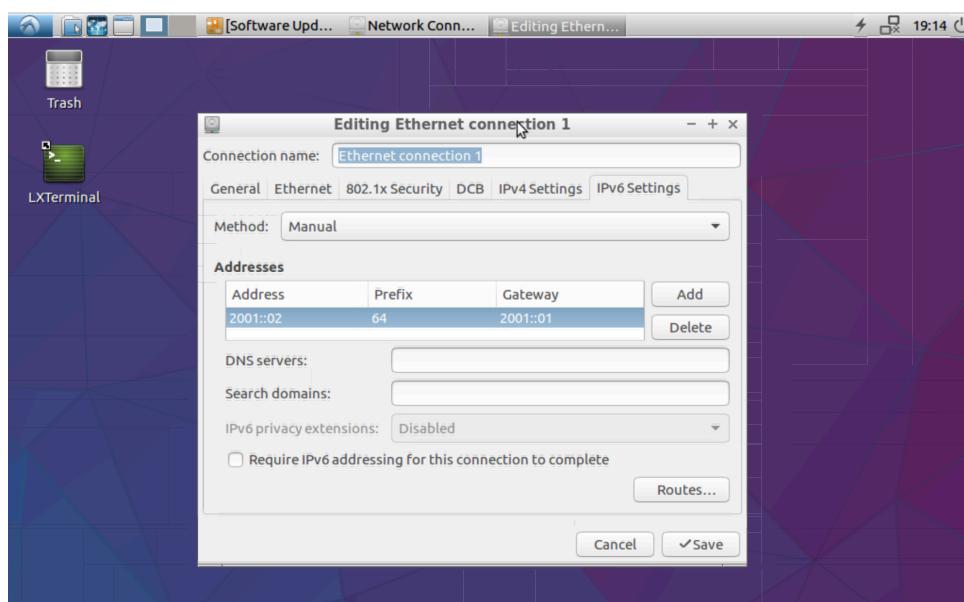
Network Topology

Configure the PC/Workstation IP Addresses

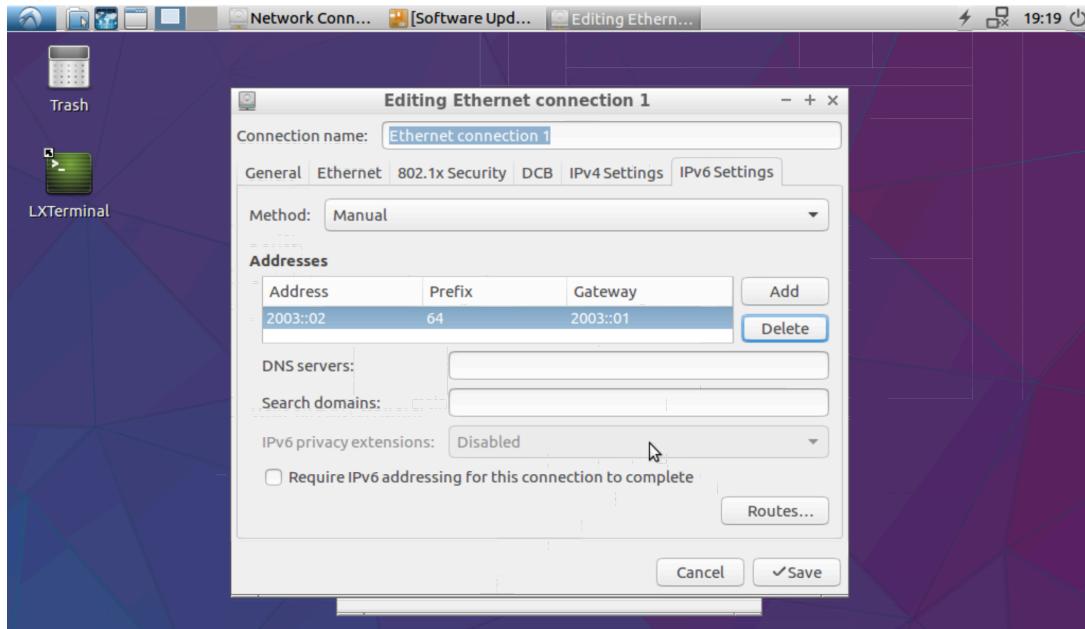


The two PC/Workstations were opened and IP Addresses were added manually.

Alice Workstation



Bob Workstation



Configuring the two Routers

The two routers must now be configured. We can configure them by accessing their console and logging in.

Enabling IPv6 in Router-1

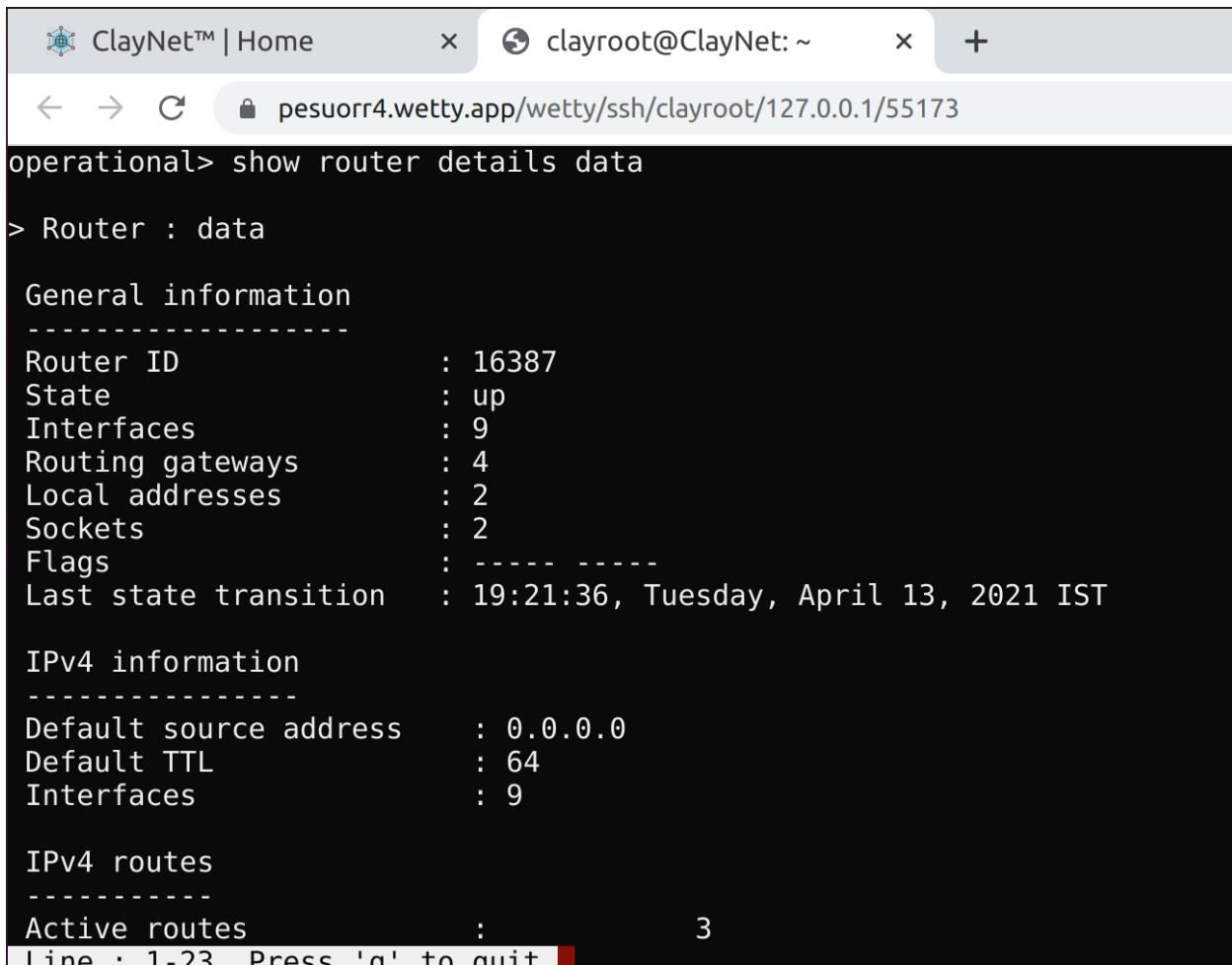
```
ClayNet™ | Home      x      clayroot@ClayNet: ~      x      +
← → ⌂   pesuorr4.wetty.app/wetty/ssh/clayroot/127.0.0.1/55173

clayroot@ClayNet:~$ telnet 127.0.0.1 55173
Trying 127.0.0.1...
Connected to 127.0.0.1.
Escape character is '^]'.

Login: test
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
```

Checking IPv6 information in router details



The screenshot shows a terminal window with the following details:

- Header: ClayNet™ | Home (with a globe icon), clayroot@ClayNet: ~ (with a globe icon), and a plus sign icon.
- Address bar: pesuorr4.wetty.app/wetty/ssh/clayroot/127.0.0.1/55173 (with a lock icon).
- Content:
 - Command: operational> show router details data
 - Response:
 - > Router : data
 - General information
 -
 - Router ID : 16387
 - State : up
 - Interfaces : 9
 - Routing gateways : 4
 - Local addresses : 2
 - Sockets : 2
 - Flags : -----
 - Last state transition : 19:21:36, Tuesday, April 13, 2021 IST
 - IPv4 information
 -
 - Default source address : 0.0.0.0
 - Default TTL : 64
 - Interfaces : 9
 - IPv4 routes
 -
 - Active routes : 3
- Bottom status: Line 1-23 Press 'q' to quit [red bar]

Configuring IPv6 Interfaces in Router-1

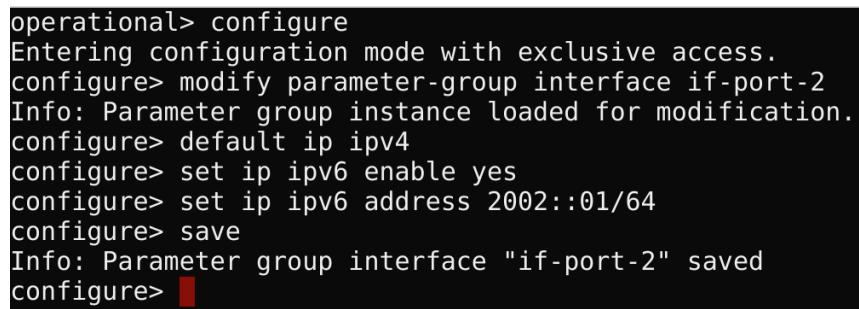
Configure IPv6 global address 2001::01/64 to interface if-port-1



```
ClayNet™ | Home      x   clayroot@ClayNet: ~      x   +
← → ⌂  pesuorr4.wetty.app/wetty/ssh/clayroot/127.0.0.1/55173

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
netmask 0000:0000:0000:0000:0000:0000:0000
peer-address 0000:0000:0000:0000:0000:0000:0000
peer-netmask 0000:0000:0000:0000:0000:0000:0000
link-local-address 0000:0000:0000:0000:0000:0000:0000
link-local-netmask 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>
```

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



```
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::01/64
configure> save
Info: Parameter group interface "if-port-2" saved
configure>
```

Verify Interface configurations

```
operational> show interface all

Interface name          Status   Encaps-    IP address
ulation

-----
if-port-1                up      ethernet  2001::1/64
                           fe80::a026:ff:fe00:211/64
if-port-2                up      ethernet  2002::1/64
                           fe80::a026:ff:fe00:212/64
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> █
```

Check IPv6 information in “show interface details” command output

Configure IPv6 static routes in Router-1

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

```

operational> configure
Entering configuration mode with exclusive access.
configure> create parameter-group ip-route v6-route-2003-nw
Info: Parameter group instance created.
configure> show draft -e
[ ip-route:"v6-route-2003-nw" ]
*name "v6-route-2003-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> set destination 2003::/64
configure> set next-hop gateway 2002::02
configure> save
Info: Parameter group ip-route "v6-route-2003-nw" saved
configure>

```

Display IPv6 routing table in Router-1

```

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
                   :: }
operational>

```

Enable IPv6 in Router-2

```
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 IPv6 interfaces in Router-2

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

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

```
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>
```

Verify Interface configurations

```
operational> show interface all

Interface name          Status   Encaps-    IP address
ulation

-----
if-port-1                up      ethernet  2003::1/64
                           fe80::a026:ff:fe00:21a/64
if-port-2                up      ethernet  2002::2/64
                           fe80::a026:ff:fe00:21b/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> █
```

Check IPv6 information in “show interface details” command output

Configure IPv6 static route in Router-2

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

```
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> 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

configure> █
```

Display IPv6 routing table in Router-2

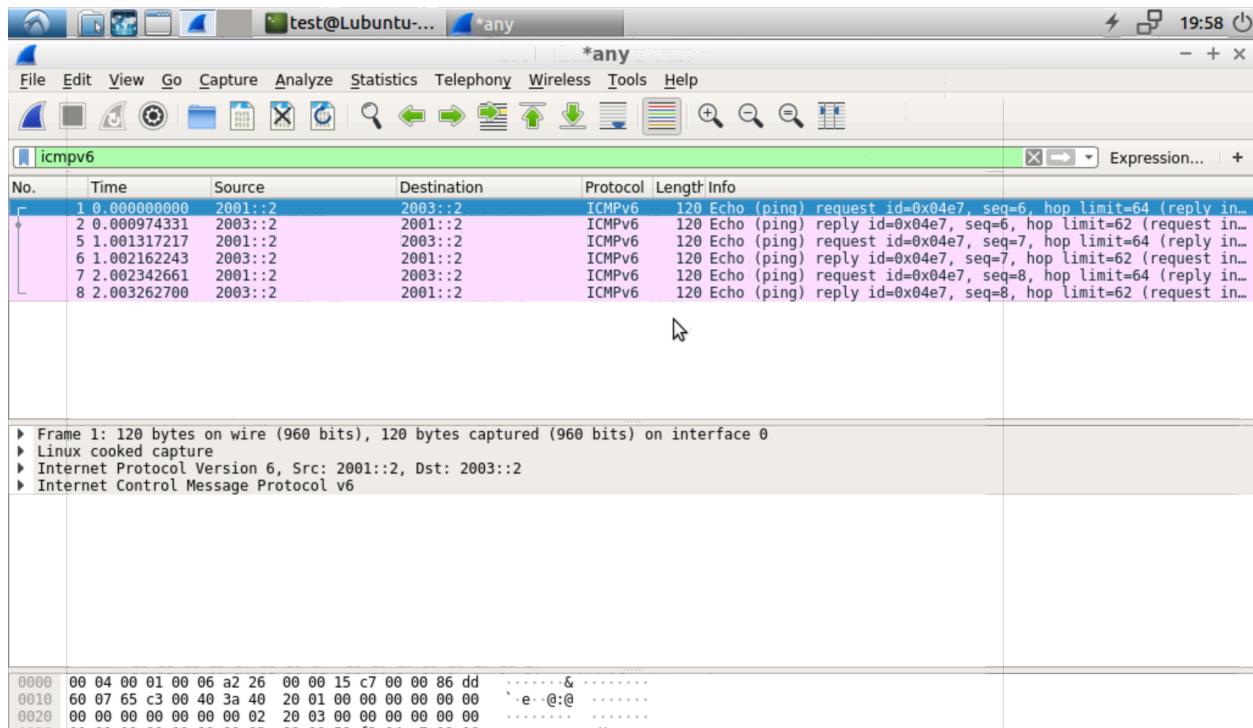
```
operational> show route summary -F ipv6 data
> IPv6 active routes
>> Destination : ::1/128
    Gateway(s) : { ^loopback-16387
                    ::1 }
    Source      : direct
    Flags       : -
>> Destination : 2001::/64
    Gateway(s) : { if-port-2
                    2002::1 }
    Source      : static
    Flags       : -
>> Destination : 2002::/64
    Gateway(s) : { if-port-2
                    :: }
    Source      : direct
    Flags       : -
>> Destination : 2003::/64
    Gateway(s) : { if-port-1
Line : 1-23, Press 'q' to quit.
```

Verify traffic flow between Alice and Bob

We can check if the router configurations we made to the Routers are correct, we will perform a ping test between Alice and Bob.

```
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=2.01 ms
64 bytes from 2003::2: icmp_seq=2 ttl=62 time=0.979 ms
64 bytes from 2003::2: icmp_seq=3 ttl=62 time=0.896 ms
64 bytes from 2003::2: icmp_seq=4 ttl=62 time=0.735 ms
64 bytes from 2003::2: icmp_seq=5 ttl=62 time=0.843 ms
64 bytes from 2003::2: icmp_seq=6 ttl=62 time=1.00 ms
64 bytes from 2003::2: icmp_seq=7 ttl=62 time=1.15 ms
64 bytes from 2003::2: icmp_seq=8 ttl=62 time=1.09 ms
64 bytes from 2003::2: icmp_seq=9 ttl=62 time=1.03 ms
64 bytes from 2003::2: icmp_seq=10 ttl=62 time=0.985 ms
^C
--- 2003::02 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 9077ms
rtt min/avg/max/mdev = 0.735/1.074/2.015/0.335 ms
test@Lubuntu-vm:~$
```

Wireshark Packet Capture during Ping Operation



Performing Tracepath on Alice's PC to Bob's IP address

```
test@Lubuntu-vm:~$ tracepath6 -n 2003::02
 1?: [LOCALHOST]                                0.024ms pmtu 1500
 1: 2001::1                                     0.431ms
 1: 2001::1                                     0.258ms
 2: 2002::2                                     0.646ms
 3: 2003::2                                     1.144ms reached
Resume: pmtu 1500 hops 3 back 3
test@Lubuntu-vm:~$
```

Check IPv6 NDP table on Router-1

```
operational> show ipv6 neighbour summary data

Host address                MAC address      Interface
-----                      -----
2001::2                     a2:26:00:00:15:c7 if-port-1
2002::2                     a2:26:00:00:02:1b if-port-2
fe80::4976:2a6f:78bd:8306   a2:26:00:00:15:c7 if-port-1
fe80::a026:ff:fe00:21b     a2:26:00:00:02:1b if-port-2

Total number of NDP entries displayed : 4

operational>
```

Verify auto-configured Link Local Address on IPv6 interfaces

```
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   : a2:26:00:00:02:11
POST          : passed
Media         : copper
Loop back mode: no-loopback
State         : up
Duplex mode   : half-duplex
Speed         : ten-mbps
Work flags    : ---- ----

operational> █
```

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

```
operational> ping data:fe80:0:1ff:b:a026:ff:fe00:12b%if-port-2
PING fe80:0:1ff:3:a026:ff:fe00:134 --> fe80:0:1ff:b:a026:ff:fe00:12b%33488899
16 bytes from fe80::a026:ff:fe00:12b%33488899: icmp_seq=0 hoplimit=64 time=0.373 ms
16 bytes from fe80::a026:ff:fe00:12b%33488899: icmp_seq=1 hoplimit=64 time=0.361 ms
16 bytes from fe80::a026:ff:fe00:12b%33488899: icmp_seq=2 hoplimit=64 time=0.418 ms
16 bytes from fe80::a026:ff:fe00:12b%33488899: icmp_seq=3 hoplimit=64 time=0.445 ms
16 bytes from fe80::a026:ff:fe00:12b%33488899: icmp_seq=4 hoplimit=64 time=0.360 ms
16 bytes from fe80::a026:ff:fe00:12b%33488899: icmp_seq=5 hoplimit=64 time=0.337 ms
16 bytes from fe80::a026:ff:fe00:12b%33488899: icmp_seq=6 hoplimit=64 time=0.374 ms
^C
---- PING Statistics----
7 packets transmitted, 7 packets received, 0.0% packet loss
round-trip min/avg/max/std-dev = 0.000/0.381/0.445/0.035 ms
```

```
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:2:a026:ff:fe00:211 --> fe80::226:f7ff:fe00:77%33488898
^C
---- PING Statistics----
17 packets transmitted, 0 packets received, 100.0% packet loss
operational> █
```