

COMPUTER NETWORKS LAB

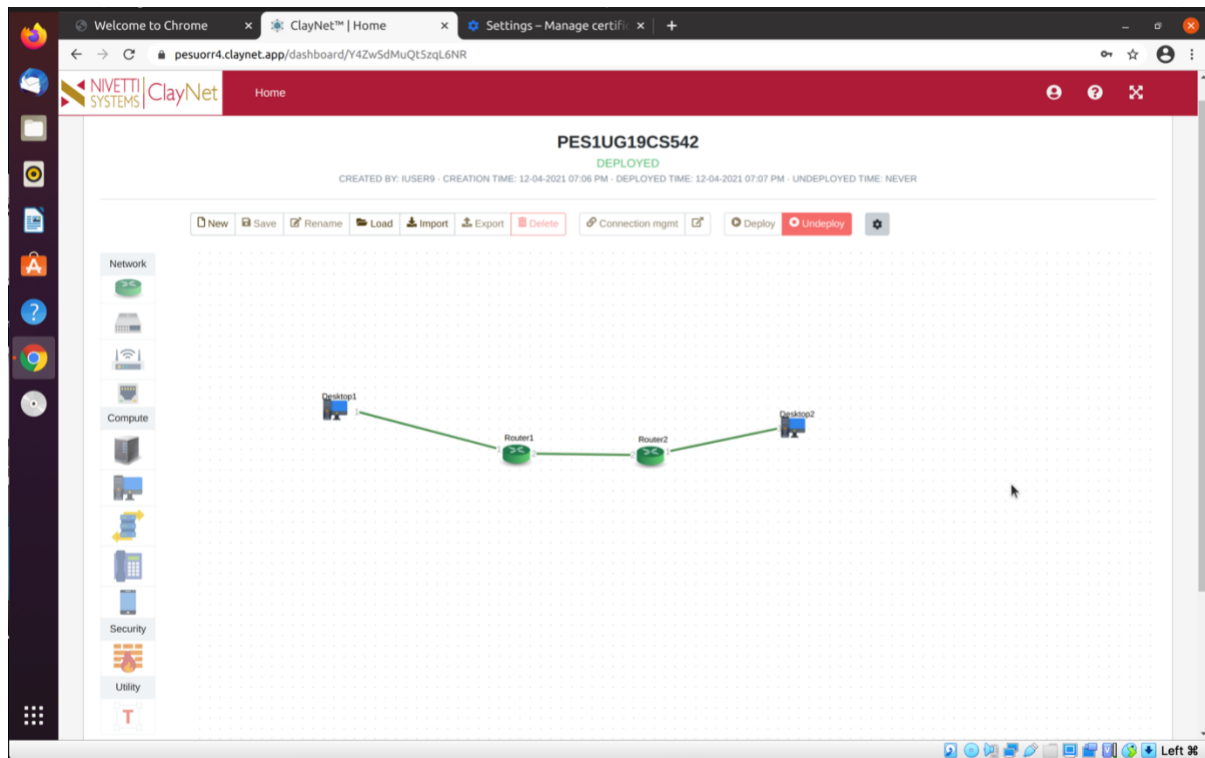
IPV6 ADDRESSING AND STATIC ROUTING

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SECTION : I

1. The following topology was created and deployed :-



2. The end systems were configured as follows :-

END SYSTEM	IP ADDRESS	GATEWAY
Alice	2001::02/24	2001::02
Bob	2003::02/24	2003::01

ROUTER 1 :-

3. IPv6 is enabled in Router1

```

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

```

4. Configured IPv6 interfaces is Router1

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

```

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

Verifying Interface configurations as shown below :-

```
operational> show interface all
```

Interface name	Status	Encaps- ulation	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

Routing table entries that are configured are as follows :-

```
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
```

ROUTER 2:-

IPv6 is enabled 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> exit
```

Configuring IPv6 interfaces in Router 2:-

Configured 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
```

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

```
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
```

Verified interface configurations as follows :-

```
operational> show interface all
```

Interface name	Status	Encaps- ulation	IP address
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

Routing table entries that are configured are as follows :-

```
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
```

Pinging from Alice to Bob :-

```
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 ---
```

Tracepath Command from Alice to Bob :-

```
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
```

Checking IPv6 NDP table on Router-1 :-

```
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
```


Obtaining the link-local address of interface if-port-2 on Router2 :-

```
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 :-

```
operational> ping data:fe80::a026:ff:fe00:710%if-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
```

The ping is successful because the link-local and MAC addresses are consistent with each other.