

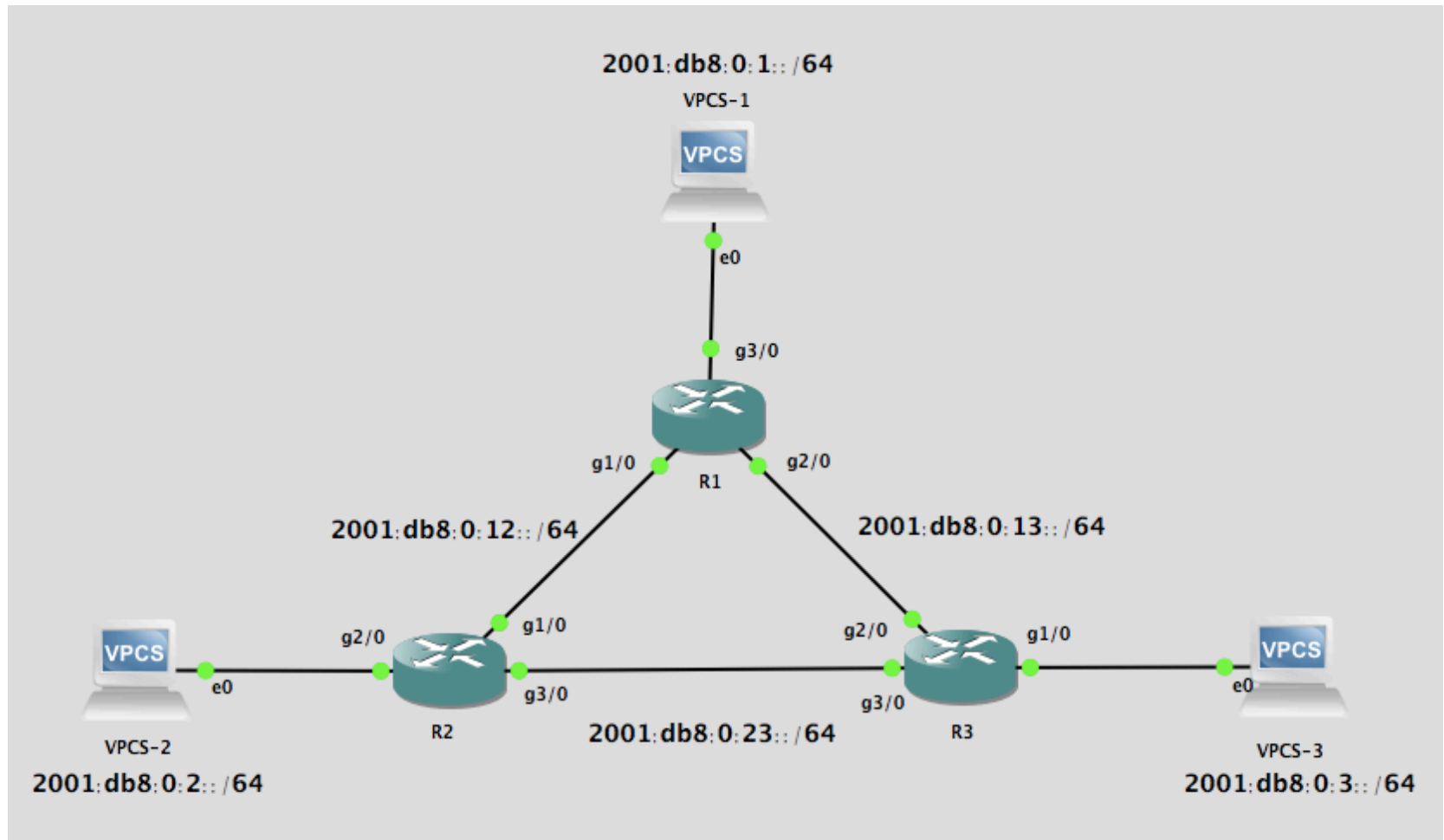
IPv6

Lab Activity



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Topology



Link-Local Address

- Start Wireshark on R1-VPCS1 link
- Turn on VPCS-1
- Check IPv6 Address on VPCS-1: **show ipv6**

Terminal window titled "awal — VPCS-1 — telnet 127.0.0.1 5003 — 51x13" showing the output of the command `VPCS-1> show ipv6`:

```
VPCS-1> show ipv6

NAME                : VPCS-1[1]
LINK-LOCAL SCOPE    : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE        :
DNS                 :
ROUTER LINK-LAYER   :
MAC                 : 00:50:79:66:68:00
LPORT               : 10030
RHOST:PORT          : 127.0.0.1:10031
MTU                 : 1500
```

Callouts from the terminal output:

- Link-Local Address autoconfigured using EUI-64 (points to `fe80::250:79ff:fe66:6800/64`)
- No Global Unicast Address generated yet (points to `GLOBAL SCOPE :`)
- MAC Address to be used to generate EUI-64 (points to `MAC : 00:50:79:66:68:00`)

IPv6 Configuration: R1

Enable IPv6 Routing:

```
R1#config terminal
```

```
R1(config)#ipv6 unicast-routing
```

Configure LAN Interfaces:

```
R1(config)#interface gi3/0
```

```
R1(config-if)#no shutdown
```

```
R1(config-if)#ipv6 address 2001:DB8:0:1::1/64
```

```
R1(config-if)#ipv6 enable
```

```
R1(config-if)#exit
```

Global Unicast Address

- Restart VPCS-1
- Check IPv6 Address on VPCS1

```
awal — VPCS-1 — telnet 127.0.0.1 5003 — 56x13
VPCS-1> show ipv6

NAME                : VPCS-1[1]
[LINK-LOCAL SCOPE   : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE        : 2001:db8:0:1:2050:79ff:fe66:6800/64
DNS                 :
ROUTER LINK-LAYER   : ca:01:33:b3:00:54
MAC                 : 00:50:79:66:68:00
LPORT               : 10030
RHOST:PORT          : 127.0.0.1:10031
MTU:                : 1500

VPCS-1> █
```

Global Unicast Address is
now autoconfigured

Wireshark Capture

Standard input — R1 GigabitEthernet3/0 to VPCS-1 Ethernet0

Apply a display filter ... <=>/> Expression...

No.	Time	Source	Destination	Protocol	Info
6	17.196278	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
7	17.196340	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
8	17.207077	::	ff02::1:ff...	ICMPv6	Neighbor Solicitation for fe80::c801:33ff:feb3:54
9	17.903286	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
10	18.291204	::	ff02::16	ICMPv6	Multicast Listener Report Message v2
11	18.613437	fe80::c801:33ff:feb3:54	ff02::16	ICMPv6	Multicast Listener Report Message v2
12	18.613516	fe80::c801:33ff:feb3:54	ff02::16	ICMPv6	Multicast Listener Report Message v2
13	18.613545	fe80::c801:33ff:feb3:54	ff02::1	ICMPv6	Neighbor Advertisement fe80::c801:33ff:feb3:54 (rt...
14	18.613569	fe80::c801:33ff:feb3:54	ff02::1	ICMPv6	Router Advertisement from ca:01:33:b3:00:54
15	19.359428	fe80::c801:33ff:feb3:54	ff02::16	ICMPv6	Multicast Listener Report Message v2
16	19.359566	fe80::c801:33ff:feb3:54	ff02::16	ICMPv6	Multicast Listener Report Message v2
17	29.363116	ca:01:33:b3:00:54	ca:01:33:b3...	LOOP	Reply
18	43.288879	fe80::c801:33ff:feb3:54	ff02::1	ICMPv6	Router Advertisement from ca:01:33:b3:00:54
19	44.358187	ca:01:33:b3:00:54	ca:01:33:b3...	LOOP	Reply
20	58.007356	ca:01:33:b3:00:54	ca:01:33:b3...	LOOP	Reply
21	65.812541	fe80::c801:33ff:feb3:54	ff02::1	ICMPv6	Router Advertisement from ca:01:33:b3:00:54
22	73.395194	ca:01:33:b3:00:54	ca:01:33:b3...	LOOP	Reply
23	82.387397	fe80::c801:33ff:feb3:54	ff02::16	ICMPv6	Multicast Listener Report Message v2
24	82.434601	::	ff02::1:ff...	ICMPv6	Neighbor Solicitation for 2001:db8:0:1::1
25	83.282223	fe80::c801:33ff:feb3:54	ff02::16	ICMPv6	Multicast Listener Report Message v2
26	83.918190	2001:db8:0:1::1	ff02::1	ICMPv6	Neighbor Advertisement 2001:db8:0:1::1 (rtr, ovr)
27	87.021107	ca:01:33:b3:00:54	CDP/VTP/DTP...	CDP	Device ID: R1 Port ID: VPCS-1 Ethernet0
28	88.706093	ca:01:33:b3:00:54	ca:01:33:b3...	LOOP	Reply
29	104.187353	ca:01:33:b3:00:54	ca:01:33:b3...	LOOP	Reply
30	119.522353	ca:01:33:b3:00:54	ca:01:33:b3...	LOOP	Reply
31	125.965199	::	ff02::2	ICMPv6	Router Solicitation
32	125.971087	fe80::c801:33ff:feb3:54	ff02::1	ICMPv6	Router Advertisement from ca:01:33:b3:00:54

Frame 1: 351 bytes on wire (2808 bits), 351 bytes captured (2808 bits) on interface 0

- IEEE 802.3 Ethernet
- Logical-Link Control
- Cisco Discovery Protocol

```

0000  01 00 0c cc cc cc ca 01 33 b3 00 54 01 51 aa aa  .... 3..T.Q..
0010  03 00 00 0c 20 00 02 b4 20 80 00 01 00 06 52 31  ....  ....R1
  
```

wireshark_-_20171213172242_7y7tIZ Packets: 61 · Displayed: 61 (100.0%) Profile: Default

IPv6 Configuration: R1

Configure P2P Interfaces:

```
R1 (config)#interface gi1/0
R1 (config-if)#no shutdown
R1 (config-if)#ipv6 address 2001:DB8:0:12::/127
R1 (config-if)#ipv6 enable
R1 (config-if)#exit
R1 (config)#interface gi2/0
R1 (config-if)#no shutdown
R1 (config-if)#ipv6 address 2001:DB8:0:13::/127
R1 (config-if)#ipv6 enable
```

IPv6 Configuration: R2

Enable IPv6 Routing:

```
R2#config terminal
```

```
R2(config)#ipv6 unicast-routing
```

Configure LAN Interfaces:

```
R2(config)#interface gi2/0
```

```
R2(config-if)#no shutdown
```

```
R2(config-if)#ipv6 address 2001:DB8:0:2::1/64
```

```
R2(config-if)#ipv6 enable
```

```
R2(config-if)#exit
```


IPv6 Configuration: R2

Configure P2P Interfaces:

```
R2 (config)#interface gi1/0
R2 (config-if)#no shutdown
R2 (config-if)#ipv6 address 2001:DB8:0:12::1/127
R2 (config-if)#ipv6 enable
R2 (config-if)#exit
R2 (config)#interface gi3/0
R2 (config-if)#no shutdown
R2 (config-if)#ipv6 address 2001:DB8:0:23::/127
R2 (config-if)#ipv6 enable
```

IPv6 Configuration: R3

Enable IPv6 Routing:

```
R3#config terminal
```

```
R3(config)#ipv6 unicast-routing
```

Configure LAN Interfaces:

```
R3(config)#interface gi1/0
```

```
R3(config-if)#no shutdown
```

```
R3(config-if)#ipv6 address 2001:DB8:0:3::1/64
```

```
R3(config-if)#ipv6 enable
```

```
R3(config-if)#exit
```

IPv6 Configuration: R3

Configure P2P Interfaces:

```
R3(config)#interface gi2/0
R3(config-if)#no shutdown
R3(config-if)#ipv6 address 2001:DB8:0:13::1/127
R3(config-if)#ipv6 enable
R3(config-if)#exit
R3(config)#interface gi3/0
R3(config-if)#no shutdown
R3(config-if)#ipv6 address 2001:DB8:0:23::1/127
R3(config-if)#ipv6 enable
```

Verification: R1

R1#show ipv6 interface brief

```
GigabitEthernet1/0      [up/up]
    FE80::C801:33FF:FEB3:1C
    2001:DB8:0:12::
GigabitEthernet2/0      [up/up]
    FE80::C801:33FF:FEB3:38
    2001:DB8:0:13::
GigabitEthernet3/0      [up/up]
    FE80::C801:33FF:FEB3:54
    2001:DB8:0:1::1
```


Link-Local Address

Global Unicast Address

Verification: R1

R1#show ipv6 interface gi1/0

```
GigabitEthernet1/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::C801:33FF:FEB3:1C
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:0:12::, subnet is 2001:DB8:0:12::/127
  Joined group address(es):
    FF02::1
    FF02::2
    FF02::1:FF00:0
    FF02::1:FFB3:1C
  MTU is 1500 bytes
  ICMP error messages limited to one every 100 milliseconds
  ICMP redirects are enabled
  ICMP unreachables are sent
  ND DAD is enabled, number of DAD attempts: 1
  ND reachable time is 30000 milliseconds (using 30000)
  ND advertised reachable time is 0 (unspecified)
  ND advertised retransmit interval is 0 (unspecified)
  ND router advertisements are sent every 200 seconds
  ND router advertisements live for 1800 seconds
  ND advertised default router preference is Medium
  Hosts use stateless autoconfig for addresses.
```



Multicast Groups this link participates with

Verification: R1

R1#sh ipv6 route

IPv6 Routing Table - default - 7 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, H - NHRP, I1 - ISIS L1

I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP

EX - EIGRP external, ND - ND Default, NDp - ND Prefix, DCE - Destination

NDr - Redirect, O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1

OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, 1 - LISP

```
C 2001:DB8:0:1::/64 [0/0]
    via GigabitEthernet3/0, directly connected
L 2001:DB8:0:1::1/128 [0/0]
    via GigabitEthernet3/0, receive
C 2001:DB8:0:12::/127 [0/0]
    via GigabitEthernet1/0, directly connected
L 2001:DB8:0:12::/128 [0/0]
    via GigabitEthernet1/0, receive
C 2001:DB8:0:13::/127 [0/0]
    via GigabitEthernet2/0, directly connected
L 2001:DB8:0:13::/128 [0/0]
    via GigabitEthernet2/0, receive
L FF00::/8 [0/0]
    via Null0, receive
```

Only the local and connected routes are available. No routes from other routers

Verification

- Ping VPCS-2 from VPCS-1: Failed 😞

```
awal — VPCS-1 — telnet 127.0.0.1 5003 — 98x7
[VPCS-1> ping 2001:db8:0:3:2050:79ff:fe66:6802/64

*2001:db8:0:1::1 icmp6_seq=1 ttl=64 time=8.347 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:0:1::1 icmp6_seq=2 ttl=64 time=6.699 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:0:1::1 icmp6_seq=3 ttl=64 time=9.584 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:0:1::1 icmp6_seq=4 ttl=64 time=1.437 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:0:1::1 icmp6_seq=5 ttl=64 time=10.297 ms (ICMP type:1, code:0, No route to destination)
```

- Ping VPCS-3 from VPCS-1: Failed 😞

```
awal — VPCS-1 — telnet 127.0.0.1 5003 — 98x7
[VPCS-1> ping 2001:db8:0:2:2050:79ff:fe66:6801/64

*2001:db8:0:1::1 icmp6_seq=1 ttl=64 time=24.055 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:0:1::1 icmp6_seq=2 ttl=64 time=2.558 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:0:1::1 icmp6_seq=3 ttl=64 time=2.645 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:0:1::1 icmp6_seq=4 ttl=64 time=6.478 ms (ICMP type:1, code:0, No route to destination)
*2001:db8:0:1::1 icmp6_seq=5 ttl=64 time=6.613 ms (ICMP type:1, code:0, No route to destination)
```

OSPF Configuration: R1

Configure Router-ID:

```
R1(config)#router ospfv3 1
R1(config-router)#router-id 1.1.1.1
R1(config-router)#exit
```

Enable OSPFv3 on the Interfaces:

```
R1(config)#interface gi1/0
R1(config-if)#ipv6 ospf 1 area 0
R1(config-if)#exit
R1(config)#interface gi2/0
R1(config-if)#ipv6 ospf 1 area 0
R1(config-if)#exit
R1(config)#interface gi3/0
R1(config-if)#ipv6 ospf 1 area 0
R1(config-if)#exit
```


OSPF Configuration: R2

Configure Router-ID:

```
R2(config)#router ospfv3 1
R2(config-router)#router-id 2.2.2.2
R2(config-router)#exit
```

Enable OSPFv3 on the Interfaces:

```
R2(config)#interface gi1/0
R2(config-if)#ipv6 ospf 1 area 0
R2(config-if)#exit
R2(config)#interface gi2/0
R2(config-if)#ipv6 ospf 1 area 0
R2(config-if)#exit
R2(config)#interface gi3/0
R2(config-if)#ipv6 ospf 1 area 0
R2(config-if)#exit
```

OSPF Configuration: R3

Configure Router-ID:

```
R3(config)#router ospfv3 1
R3(config-router)#router-id 3.3.3.3
R3(config-router)#exit
```

Enable OSPFv3 on the Interfaces:

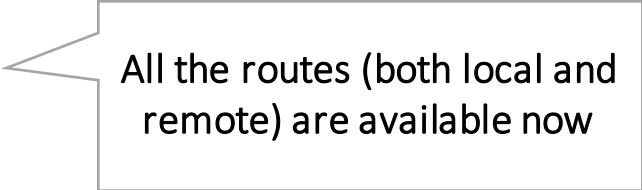
```
R3(config)#interface gi1/0
R3(config-if)#ipv6 ospf 1 area 0
R3(config-if)#exit
R3(config)#interface gi2/0
R3(config-if)#ipv6 ospf 1 area 0
R3(config-if)#exit
R3(config)#interface gi3/0
R3(config-if)#ipv6 ospf 1 area 0
R3(config-if)#exit
```

Verification: R1

R1#show ipv6 route

IPv6 Routing Table - default - 10 entries

```
C 2001:DB8:0:1::/64 [0/0]
   via GigabitEthernet3/0, directly connected
L 2001:DB8:0:1::1/128 [0/0]
   via GigabitEthernet3/0, receive
O 2001:DB8:0:2::/64 [110/2]
   via FE80::C802:33FF:FEB4:1C, GigabitEthernet1/0
O 2001:DB8:0:3::/64 [110/2]
   via FE80::C803:33FF:FEB5:38, GigabitEthernet2/0
C 2001:DB8:0:12::/127 [0/0]
   via GigabitEthernet1/0, directly connected
L 2001:DB8:0:12::/128 [0/0]
   via GigabitEthernet1/0, receive
C 2001:DB8:0:13::/127 [0/0]
   via GigabitEthernet2/0, directly connected
L 2001:DB8:0:13::/128 [0/0]
   via GigabitEthernet2/0, receive
O 2001:DB8:0:23::/127 [110/2]
   via FE80::C802:33FF:FEB4:1C, GigabitEthernet1/0
   via FE80::C803:33FF:FEB5:38, GigabitEthernet2/0
L FF00::/8 [0/0]
   via Null0, receive
```



All the routes (both local and remote) are available now

Verification: R1

IPv6 Routing Table - default - 10 entries

Codes: C - Connected, L - Local, S - Static, U - Per-user Static route

B - BGP, R - RIP, H - NHRP, I1 - ISIS L1

I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP

EX - EIGRP external, ND - ND Default, NDp - ND Prefix, DCE -

Destination

NDr - Redirect, O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1

OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2, 1

- LISP

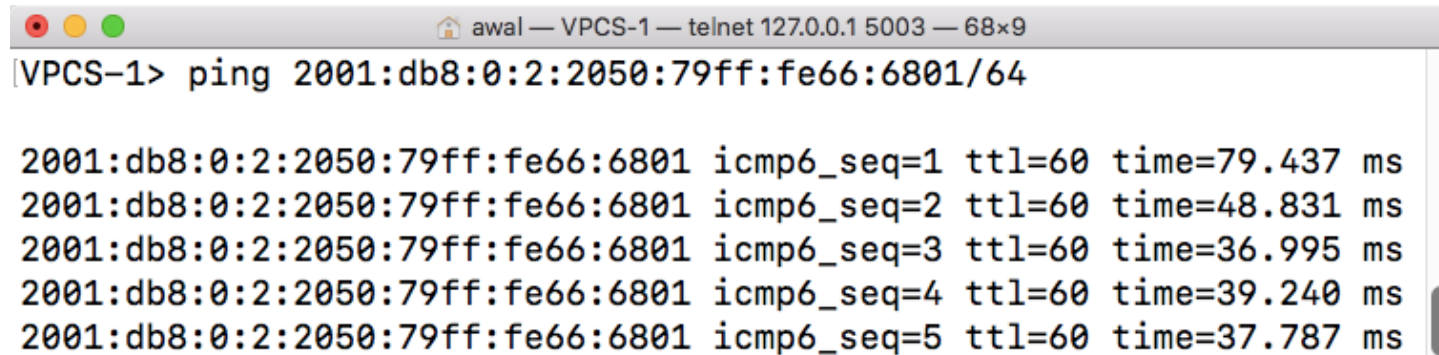
```
O    2001:DB8:0:2::/64 [110/2]
      via FE80::C802:33FF:FEB4:1C, GigabitEthernet1/0
O    2001:DB8:0:3::/64 [110/2]
      via FE80::C803:33FF:FEB5:38, GigabitEthernet2/0
O    2001:DB8:0:23::/127 [110/2]
      via FE80::C802:33FF:FEB4:1C, GigabitEthernet1/0
      via FE80::C803:33FF:FEB5:38, GigabitEthernet2/0
```



**Remote routes are
carried by OSPFv3**

Verification

- Ping VPCS-2 from VPCS-1: Successful 😊

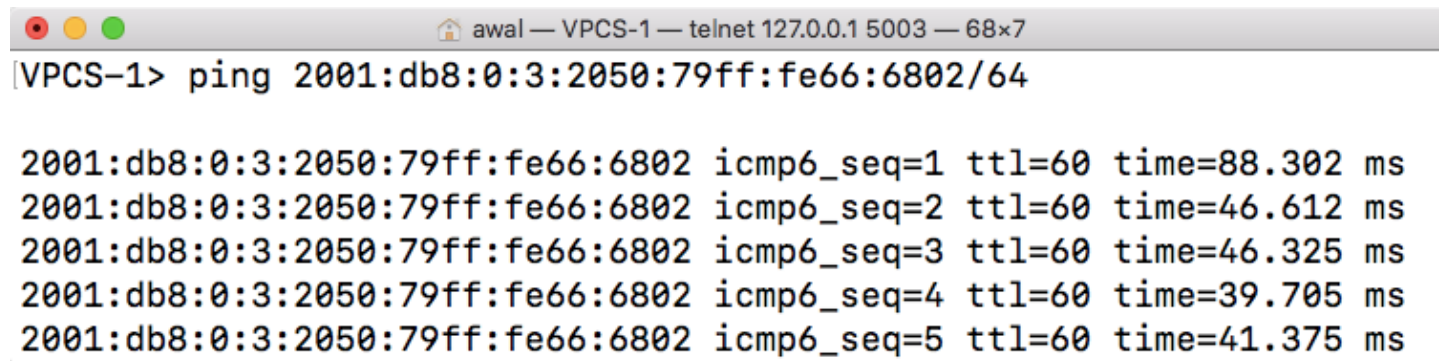


The screenshot shows a terminal window titled 'awal — VPCS-1 — telnet 127.0.0.1 5003 — 68x9'. The user enters the command 'ping 2001:db8:0:2:2050:79ff:fe66:6801/64'. The output shows five successful ping responses with varying times: 79.437 ms, 48.831 ms, 36.995 ms, 39.240 ms, and 37.787 ms. Each response includes the destination IP and ICMP sequence number.

```
awal — VPCS-1 — telnet 127.0.0.1 5003 — 68x9
[VPCS-1> ping 2001:db8:0:2:2050:79ff:fe66:6801/64

2001:db8:0:2:2050:79ff:fe66:6801 icmp6_seq=1 ttl=60 time=79.437 ms
2001:db8:0:2:2050:79ff:fe66:6801 icmp6_seq=2 ttl=60 time=48.831 ms
2001:db8:0:2:2050:79ff:fe66:6801 icmp6_seq=3 ttl=60 time=36.995 ms
2001:db8:0:2:2050:79ff:fe66:6801 icmp6_seq=4 ttl=60 time=39.240 ms
2001:db8:0:2:2050:79ff:fe66:6801 icmp6_seq=5 ttl=60 time=37.787 ms
```

- Ping VPCS-3 from VPCS-1: Successful 😊



The screenshot shows a terminal window titled 'awal — VPCS-1 — telnet 127.0.0.1 5003 — 68x7'. The user enters the command 'ping 2001:db8:0:3:2050:79ff:fe66:6802/64'. The output shows five successful ping responses with varying times: 88.302 ms, 46.612 ms, 46.325 ms, 39.705 ms, and 41.375 ms. Each response includes the destination IP and ICMP sequence number.

```
awal — VPCS-1 — telnet 127.0.0.1 5003 — 68x7
[VPCS-1> ping 2001:db8:0:3:2050:79ff:fe66:6802/64

2001:db8:0:3:2050:79ff:fe66:6802 icmp6_seq=1 ttl=60 time=88.302 ms
2001:db8:0:3:2050:79ff:fe66:6802 icmp6_seq=2 ttl=60 time=46.612 ms
2001:db8:0:3:2050:79ff:fe66:6802 icmp6_seq=3 ttl=60 time=46.325 ms
2001:db8:0:3:2050:79ff:fe66:6802 icmp6_seq=4 ttl=60 time=39.705 ms
2001:db8:0:3:2050:79ff:fe66:6802 icmp6_seq=5 ttl=60 time=41.375 ms
```

Questions?