# Testing an IPv6 Network

Testable Setup

- **Hardware**
    - Router: Cisco ISR 7000Series
    - Switch: Switch 1
    - Hosts: Two Virtual PC (PC1 and PC2)
- **Software**
    - GNS3
    - Wireshark
- **Topology**
    - fastEthernet0/0 : Router connected to Switch.
    - Ethernet0/1 : Switch connected to PC1.
    - Ethernet0/2 : Switch connected to PC2.
- **Configuration**
    - Router:
        - Enabled IPv6 routing and IP assigned.
    - PC1 and PC2
        - Configured link-local Address automatically.
        - Assigned global addresses manually.
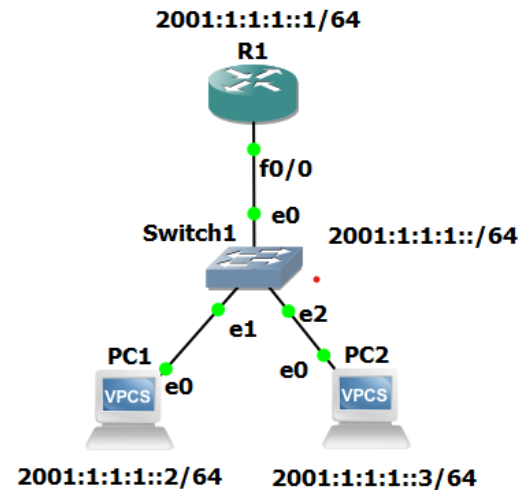
Proof

- Router Addresses
    - link-local: FE80:C801:25FF:FE50:0
    - Global: 2000:1:1:1::1/64
- PC1 Addresses
    - Link-local: fe80::250:79ff:fe66:6800/64
    - Global: 2001:1:1:1::2/64
- PC2 Addresses
    - Link-local: fe80::250:79ff:fe66:6801/64
    - Global: 2001:1:1:1::3/64

Node Communication

- Ping: Used for ICMPv6 Echo.

Proof

- From PC1 to PC2 & Router
- From PC2 to PC1 & Router

```
PC1> show ipv6

NAME                : PC1[1]
LINK-LOCAL SCOPE    : fe80::250:79ff:fe66:6800/64
GLOBAL SCOPE        : 2001:1:1:1::2/64
ROUTER LINK-LAYER   : ca:01:25:50:00:00
MAC                 : 00:50:79:66:68:00
LPORT               : 10008
RHOST:PORT          : 127.0.0.1:10009
MTU:                : 1500

PC1> ping 2001:1:1:1::1/64

2001:1:1:1::1 icmp6_seq=1 ttl=64 time=15.764 ms
2001:1:1:1::1 icmp6_seq=2 ttl=64 time=15.362 ms
2001:1:1:1::1 icmp6_seq=3 ttl=64 time=15.729 ms
2001:1:1:1::1 icmp6_seq=4 ttl=64 time=15.266 ms
2001:1:1:1::1 icmp6_seq=5 ttl=64 time=15.852 ms

PC1> ping 2001:1:1:1::3/64

2001:1:1:1::3 icmp6_seq=1 ttl=63 time=76.831 ms
2001:1:1:1::3 icmp6_seq=2 ttl=63 time=16.923 ms
2001:1:1:1::3 icmp6_seq=3 ttl=63 time=16.401 ms
2001:1:1:1::3 icmp6_seq=4 ttl=63 time=15.344 ms
2001:1:1:1::3 icmp6_seq=5 ttl=63 time=15.368 ms

PC1>
```

```
PC2> show ipv6

NAME                : PC2[1]
LINK-LOCAL SCOPE    : fe80::250:79ff:fe66:6801/64
GLOBAL SCOPE        : 2001:1:1:1::3/64
ROUTER LINK-LAYER   : ca:01:25:50:00:00
MAC                 : 00:50:79:66:68:01
LPORT               : 10010
RHOST:PORT          : 127.0.0.1:10011
MTU:                : 1500

PC2> ping 2001:1:1:1::1/64

2001:1:1:1::1 icmp6_seq=1 ttl=64 time=15.925 ms
2001:1:1:1::1 icmp6_seq=2 ttl=64 time=15.719 ms
2001:1:1:1::1 icmp6_seq=3 ttl=64 time=15.875 ms
2001:1:1:1::1 icmp6_seq=4 ttl=64 time=15.672 ms
2001:1:1:1::1 icmp6_seq=5 ttl=64 time=16.200 ms

PC2> ping 2001:1:1:1::2/64

2001:1:1:1::2 icmp6_seq=1 ttl=63 time=16.280 ms
2001:1:1:1::2 icmp6_seq=2 ttl=63 time=15.475 ms
2001:1:1:1::2 icmp6_seq=3 ttl=63 time=15.599 ms
2001:1:1:1::2 icmp6_seq=4 ttl=63 time=15.051 ms
2001:1:1:1::2 icmp6_seq=5 ttl=63 time=15.873 ms

PC2>
```

Network Analysis

- Wireshark Captures
    - DAD for Link-Local Addresses: Captured on PC1 and PC2 during initialization.
    - Router Advertisements: Captured on fastEthernet0/0.
    - Neighbor Advertisement: Captured when PC1 tried to communicate with PC2.
    - Neighbor Solicitation: Captured when PC1 tried to communicate with PC2.
    - Packet Flows: Analysed various communication flows.

```
37 171.230808  ca:01:25:50:00:00   ca:01:25:50:00:00   LOOP    60 Reply
38 172.556697  2001:1:1:1::3       ff02::1:ff00:1      ICMPv6  86 Neighbor Solicitation for 2001:1:1:1::1 from 00:50:79:66:68:01
39 172.570696  2001:1:1:1::1       2001:1:1:1::3       ICMPv6  86 Neighbor Advertisement 2001:1:1:1::1 (rtr, sol, ovr) is at ca:01:25:50:00:00
40 173.559586  2001:1:1:1::3       2001:1:1:1::1       ICMPv6  118 Echo (ping) request id=0x0f51, seq=1, hop limit=64 (reply in 41)
41 173.574589  2001:1:1:1::1       2001:1:1:1::3       ICMPv6  118 Echo (ping) reply id=0x0f51, seq=1, hop limit=64 (request in 40)
42 173.590573  2001:1:1:1::3       2001:1:1:1::1       ICMPv6  118 Echo (ping) request id=0x0f51, seq=2, hop limit=64 (reply in 43)
43 173.604557  2001:1:1:1::1       2001:1:1:1::3       ICMPv6  118 Echo (ping) reply id=0x0f51, seq=2, hop limit=64 (request in 42)
44 173.619356  2001:1:1:1::3       2001:1:1:1::1       ICMPv6  118 Echo (ping) request id=0x0f51, seq=3, hop limit=64 (reply in 45)
45 173.634570  2001:1:1:1::1       2001:1:1:1::3       ICMPv6  118 Echo (ping) reply id=0x0f51, seq=3, hop limit=64 (request in 44)
46 173.649801  2001:1:1:1::3       2001:1:1:1::1       ICMPv6  118 Echo (ping) request id=0x0f51, seq=4, hop limit=64 (reply in 47)
47 173.665273  2001:1:1:1::1       2001:1:1:1::3       ICMPv6  118 Echo (ping) reply id=0x0f51, seq=4, hop limit=64 (request in 46)
48 173.680474  2001:1:1:1::3       2001:1:1:1::1       ICMPv6  118 Echo (ping) request id=0x0f51, seq=5, hop limit=64 (reply in 49)
49 173.695472  2001:1:1:1::1       2001:1:1:1::3       ICMPv6  118 Echo (ping) reply id=0x0f51, seq=5, hop limit=64 (request in 48)
50 177.541232  fe80::c801:25ff:fe5…  2001:1:1:1::3     ICMPv6  86 Neighbor Solicitation for 2001:1:1:1::3 from ca:01:25:50:00:00
51 178.515252  fe80::c801:25ff:fe5…  2001:1:1:1::3     ICMPv6  86 Neighbor Solicitation for 2001:1:1:1::3 from ca:01:25:50:00:00
52 179.490705  fe80::c801:25ff:fe5…  2001:1:1:1::3     ICMPv6  86 Neighbor Solicitation for 2001:1:1:1::3 from ca:01:25:50:00:00
53 180.010226  ca:01:25:50:00:00   CDP/VTP/DTP/PAgP/UD…  CDP  397 Device ID: R1  Port ID: FastEthernet0/0
54 180.271048  2001:1:1:1::3       ff02::1:ff00:2      ICMPv6  86 Neighbor Solicitation for 2001:1:1:1::2 from 00:50:79:66:68:01
55 181.104688  ca:01:25:50:00:00   ca:01:25:50:00:00   LOOP    60 Reply
```

```
> Frame 1: 397 bytes on wire (3176 bits), 397 bytes captured (3176 bits) on interface -, id 0
> IEEE 802.3 Ethernet
> Logical-Link Control
> Cisco Discovery Protocol
```

```
0000  01 00 0c cc cc ca 01  25 50 00 00 01 7f aa aa   ········ %P·····
0010  03 00 00 0c 20 00 02 b4  2b be 00 01 00 06 52 31   ···· ···  +·····R1
0020  00 05 00 fc 43 69 73 63  6f 20 49 4f 53 20 53 6f   ····Cisc o IOS So
0030  66 74 77 61 72 65 2c 20  37 32 30 30 20 53 6f 66   ftware,  7200 Sof
0040  74 77 61 72 65 20 28 43  37 32 30 30 2d 41 44 56   tware (C 7200-ADV
0050  45 4e 54 45 52 50 52 49  53 45 4b 39 2d 4d 29 2c   ENTERPRI SEK9-M),
0060  20 56 65 72 73 69 6f 6e  20 31 32 2e 34 28 32 34    Version  12.4(24
0070  29 54 35 2c 20 52 45 4c  45 41 53 45 20 53 4f 46   )T5, REL EASE SOF
0080  54 57 41 52 45 20 28 66  63 33 29 0a 54 65 63 68   TWARE (f c3)·Tech
0090  6e 69 63 61 6c 20 53 75  70 70 6f 72 74 3a 20 68   nical Su pport: h
00a0  74 74 70 3a 2f 2f 77 77  77 2e 63 69 73 63 6f 2e   ttp://ww w.cisco.
00b0  63 6f 6d 2f 74 65 63 68  73 75 70 70 6f 72 74 0a   com/tech support·
00c0  43 6f 70 79 72 69 67 68  74 20 28 63 29 20 31 39   Copyrigh t (c) 19
00d0  38 36 2d 32 30 31 31 20  62 79 20 43 69 73 63 6f   86-2011  by Cisco
00e0  20 53 79 73 74 65 6d 73  2c 20 49 6e 63 2e 0a 43    Systems , Inc.·C
00f0  6f 6d 70 69 6c 65 64 20  46 72 69 20 30 34 2d 4d   ompiled  Fri 04-M
0100  61 72 2d 31 31 20 30 36  3a 34 39 20 62 79 20 70   ar-11 06 :49 by p
0110  72 6f 64 5f 72 65 6c 5f  74 65 61 6d 00 06 00 11   rod_rel_ team····
0120  43 69 73 63 6f 20 37 32  30 36 56 58 52 00 02 00   Cisco 72 06VXR···
```

Difficulties

- Initially, Router Advertisement was not being sent. It fixed by enabling IPv6 routing on the router.

Findings

- Router Advertisements played a critical role in automatic address configuration on the hosts.
- DAD ensured address uniqueness on the network before assignment.
- IPv6 not more secure than IPv4, not more unsecured than IPv4.

Conclusion

The IPv6 network was successfully tested. All goals were met, illustrating the ability to configure, communicate, and analyse an IPv6 network. IPv6 is the next generation Internet Protocol (IP) address that ensure the availability of IP and eventually replace IPv4, which is running out of potential addresses. The smooth communication viewed between hosts using both Link-Local and Global addresses shows IPv6's stability and flexibility.