trábajo práctico ipv6

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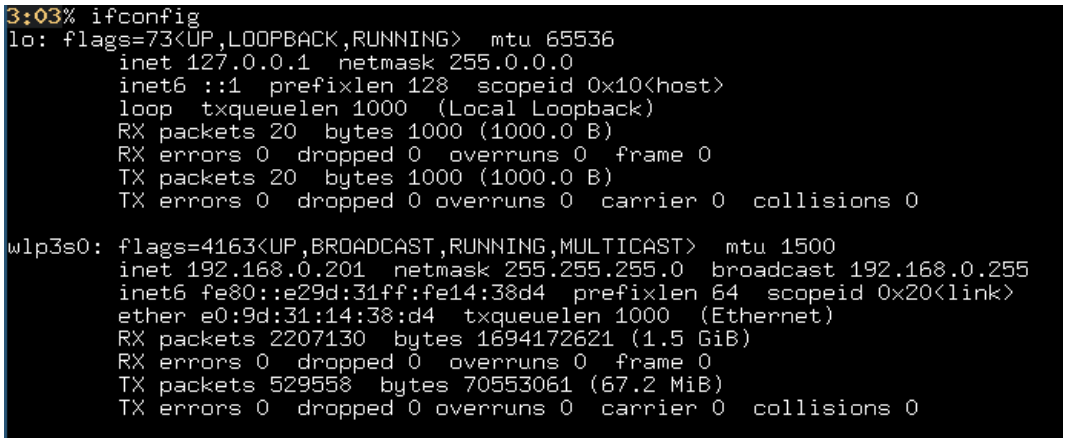
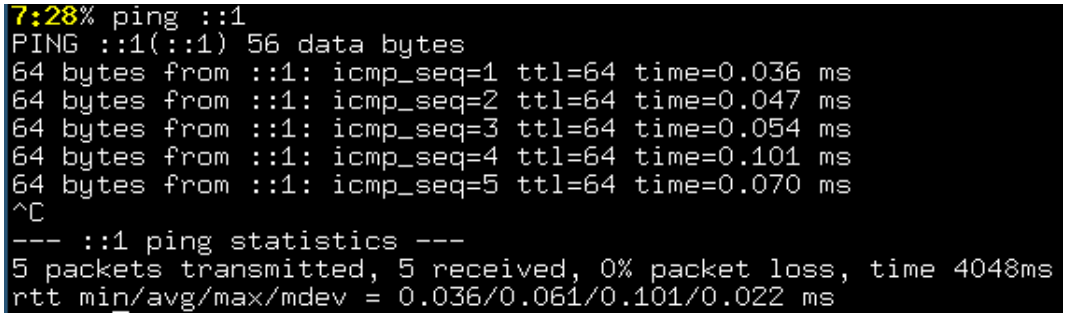
1. c.



Primero se ve la interfaz loopback (lo) con direcciones 127.0.0.1 y ::1 para IPv4 e IPv6.

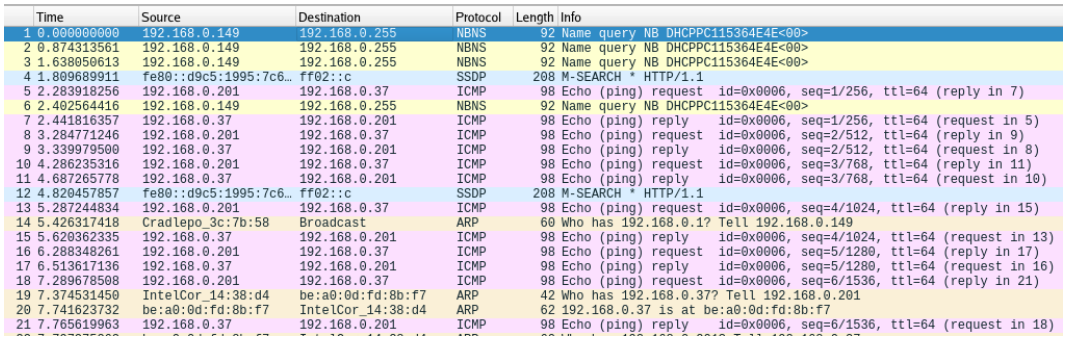
Después se ve otra interfaz wlp3s0, que tiene dirección IPv6 fe80::e29d:31ff:fe14:38d4 con el prefijo fe80 que indica una dirección link local, o sea que es válida sólo para el enlace local. Su dirección MAC es e0:9d:31:14:38:d4.

d.



e. Acá hice un ping con un celular conectado al mismo router que la computadora pero con IPv4.

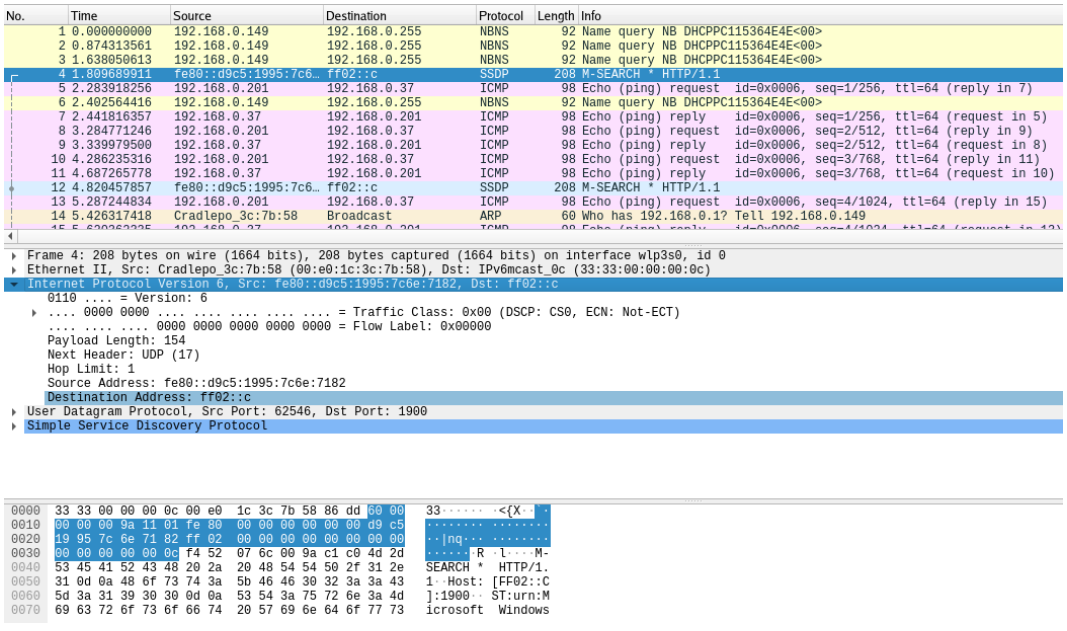
```
7:34% ping 192.168.0.37
PING 192.168.0.37 (192.168.0.37) 56(84) bytes of data.
64 bytes from 192.168.0.37: icmp_seq=1 ttl=64 time=158 ms
64 bytes from 192.168.0.37: icmp_seq=2 ttl=64 time=55.3 ms
64 bytes from 192.168.0.37: icmp_seq=3 ttl=64 time=401 ms
64 bytes from 192.168.0.37: icmp_seq=4 ttl=64 time=333 ms
64 bytes from 192.168.0.37: icmp_seq=5 ttl=64 time=225 ms
64 bytes from 192.168.0.37: icmp_seq=6 ttl=64 time=476 ms
64 bytes from 192.168.0.37: icmp_seq=7 ttl=64 time=496 ms
^C
--- 192.168.0.37 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6007ms
rtt min/avg/max/mdev = 55.275/306.430/496.208/154.066 ms
```



	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	192.168.0.149	192.168.0.255	NBNS	92	Name query NB DHCPPC115364E4E<00>
2	0.874313561	192.168.0.149	192.168.0.255	NBNS	92	Name query NB DHCPPC115364E4E<00>
3	1.638050613	192.168.0.149	192.168.0.255	NBNS	92	Name query NB DHCPPC115364E4E<00>
4	1.809689911	fe80::d9c5:1995:7c6…	ff02::c	SSDP	208	M-SEARCH * HTTP/1.1
5	2.283918256	192.168.0.201	192.168.0.37	ICMP	98	Echo (ping) request id=0x0006, seq=1/256, ttl=64 (reply in 7)
6	2.402564416	192.168.0.149	192.168.0.255	NBNS	92	Name query NB DHCPPC115364E4E<00>
7	2.441816357	192.168.0.37	192.168.0.201	ICMP	98	Echo (ping) reply id=0x0006, seq=1/256, ttl=64 (request in 5)
8	3.284771246	192.168.0.201	192.168.0.37	ICMP	98	Echo (ping) request id=0x0006, seq=2/512, ttl=64 (reply in 9)
9	3.339979500	192.168.0.37	192.168.0.201	ICMP	98	Echo (ping) reply id=0x0006, seq=2/512, ttl=64 (request in 8)
10	4.286235316	192.168.0.201	192.168.0.37	ICMP	98	Echo (ping) request id=0x0006, seq=3/768, ttl=64 (reply in 11)
11	4.687265778	192.168.0.37	192.168.0.201	ICMP	98	Echo (ping) reply id=0x0006, seq=3/768, ttl=64 (request in 10)
12	4.820457857	fe80::d9c5:1995:7c6…	ff02::c	SSDP	208	M-SEARCH * HTTP/1.1
13	5.287244834	192.168.0.201	192.168.0.37	ICMP	98	Echo (ping) request id=0x0006, seq=4/1024, ttl=64 (reply in 15)
14	5.426317418	Cradlepo_3c:7b:58	Broadcast	ARP	60	Who has 192.168.0.1? Tell 192.168.0.149
15	5.620362335	192.168.0.37	192.168.0.201	ICMP	98	Echo (ping) reply id=0x0006, seq=4/1024, ttl=64 (request in 13)
16	6.288348261	192.168.0.201	192.168.0.37	ICMP	98	Echo (ping) request id=0x0006, seq=5/1280, ttl=64 (reply in 17)
17	6.513617136	192.168.0.37	192.168.0.201	ICMP	98	Echo (ping) reply id=0x0006, seq=5/1280, ttl=64 (request in 16)
18	7.289678508	192.168.0.201	192.168.0.37	ICMP	98	Echo (ping) request id=0x0006, seq=6/1536, ttl=64 (reply in 21)
19	7.374531450	IntelCor_14:38:d4	be:a0:0d:fd:8b:f7	ARP	42	Who has 192.168.0.37? Tell 192.168.0.201
20	7.741623732	be:a0:0d:fd:8b:f7	IntelCor_14:38:d4	ARP	62	192.168.0.37 is at be:a0:0d:fd:8b:f7
21	7.765619963	192.168.0.37	192.168.0.201	ICMP	98	Echo (ping) reply id=0x0006, seq=6/1536, ttl=64 (request in 18)

Se pueden ver los paquetes ICMP en rojo de los ping request y reply entre 192.168.0.37 y 192.168.0.201. La información adicional que se muestra es el id del mensaje ping, el número de secuencia y el time to live (ttl).

f.



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13	5.287244834	192.168.0.201	192.168.0.37	ICMP	98	Echo (ping) request id=0x0006, seq=4/1024, ttl=64 (reply in 15)
14	5.426317418	Cradlepo_3c:7b:58	Broadcast	ARP	60	Who has 192.168.0.1? Tell 192.168.0.149

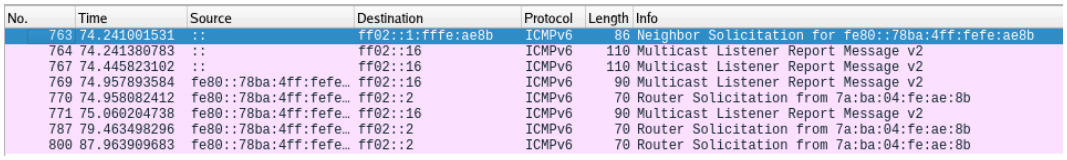
```
▸ Frame 4: 208 bytes on wire (1664 bits), 208 bytes captured (1664 bits) on interface wlp3s0, id 0
▸ Ethernet II, Src: Cradlepo_3c:7b:58 (00:e0:1c:3c:7b:58), Dst: IPv6mcast_0c (33:33:00:00:00:0c)
▾ Internet Protocol Version 6, Src: fe80::d9c5:1995:7c6e:7182, Dst: ff02::c
    0110 .... = Version: 6
  ▸ .... 0000 0000 .... .... .... .... .... = Traffic Class: 0x00 (DSCP: CS0, ECN: Not-ECT)
    .... .... .... 0000 0000 0000 0000 0000 = Flow Label: 0x00000
    Payload Length: 154
    Next Header: UDP (17)
    Hop Limit: 1
    Source Address: fe80::d9c5:1995:7c6e:7182
    Destination Address: ff02::c
▸ User Datagram Protocol, Src Port: 62546, Dst Port: 1900
▸ Simple Service Discovery Protocol
```

```
0000  33 33 00 00 00 0c 00 e0  1c 3c 7b 58 86 dd 60 00   33······ ·<{X··`·
0010  00 00 00 9a 11 01 fe 80  00 00 00 00 00 00 d9 c5   ········ ········
0020  19 95 7c 6e 71 82 ff 02  00 00 00 00 00 00 00 0c   ··|nq··· ········
0030  00 00 00 00 00 0c f4 52  07 6c 00 9a c1 c0 4d 2d   ·······R ·l····M-
0040  53 45 41 52 43 48 20 2a  20 48 54 54 50 2f 31 2e   SEARCH *  HTTP/1.
0050  31 0d 0a 48 6f 73 74 3a  5b 46 46 30 32 3a 3a 43   1··Host: [FF02::C
0060  5d 3a 31 39 30 30 0d 0a  53 54 3a 75 72 6e 3a 4d   ]:1900·· ST:urn:M
0070  69 63 72 6f 73 6f 66 74  20 57 69 6e 64 6f 77 73   icrosoft  Windows
```

Se puede ver que la cabecera del paquete tiene los campos

- versión: 0110 (6)
- trafic class: 0x00
- flow label: 0x00000
- payload length: 154
- next header: 17 (UDP)
- hop limit: 1
- source address
- destination address

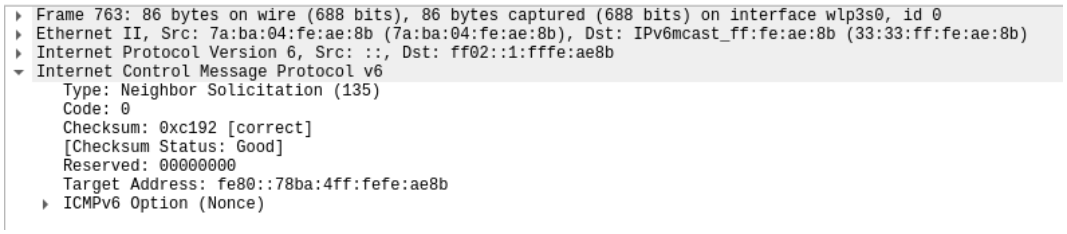
g.



No.	Time	Source	Destination	Protocol	Length	Info
763	74.241001531	::	ff02::1:fffe:ae8b	ICMPv6	86	Neighbor Solicitation for fe80::78ba:4ff:fefe:ae8b
764	74.241380783	::	ff02::16	ICMPv6	110	Multicast Listener Report Message v2
767	74.445823102	::	ff02::16	ICMPv6	110	Multicast Listener Report Message v2
769	74.957893584	fe80::78ba:4ff:fefe…	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
770	74.958082412	fe80::78ba:4ff:fefe…	ff02::2	ICMPv6	70	Router Solicitation from 7a:ba:04:fe:ae:8b
771	75.060204738	fe80::78ba:4ff:fefe…	ff02::16	ICMPv6	90	Multicast Listener Report Message v2
787	79.463498296	fe80::78ba:4ff:fefe…	ff02::2	ICMPv6	70	Router Solicitation from 7a:ba:04:fe:ae:8b
800	87.963909683	fe80::78ba:4ff:fefe…	ff02::2	ICMPv6	70	Router Solicitation from 7a:ba:04:fe:ae:8b

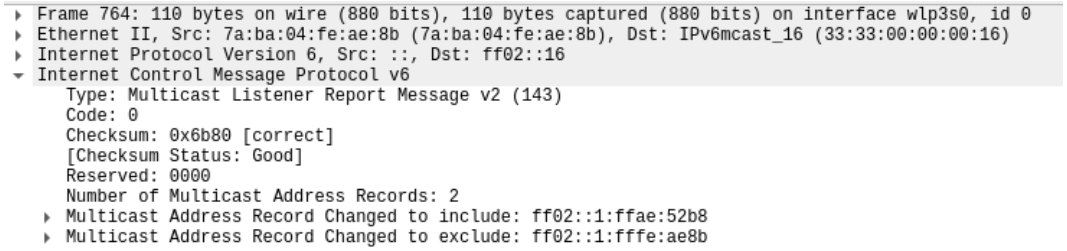
Cuando se conecta un nodo nuevo se intercambian mensajes de descubrimiento de vecinos. Los mensajes son:

- **Neighbor Solicitation:** tipo 135. Se usa para determinar direcciones MAC de los vecinos.



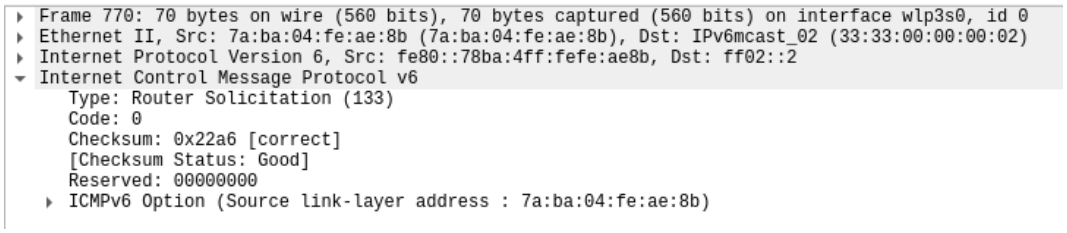
```
▸ Frame 763: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface wlp3s0, id 0
▸ Ethernet II, Src: 7a:ba:04:fe:ae:8b (7a:ba:04:fe:ae:8b), Dst: IPv6mcast_ff:fe:ae:8b (33:33:ff:fe:ae:8b)
▸ Internet Protocol Version 6, Src: ::, Dst: ff02::1:fffe:ae8b
▾ Internet Control Message Protocol v6
    Type: Neighbor Solicitation (135)
    Code: 0
    Checksum: 0xc192 [correct]
    [Checksum Status: Good]
    Reserved: 00000000
    Target Address: fe80::78ba:4ff:fefe:ae8b
  ▸ ICMPv6 Option (Nonce)
```

- **Multicast Listener Report Message:** tipo 143. Es para descubrir nodos que deseen recibir paquetes multicast.



```
▸ Frame 764: 110 bytes on wire (880 bits), 110 bytes captured (880 bits) on interface wlp3s0, id 0
▸ Ethernet II, Src: 7a:ba:04:fe:ae:8b (7a:ba:04:fe:ae:8b), Dst: IPv6mcast_16 (33:33:00:00:00:16)
▸ Internet Protocol Version 6, Src: ::, Dst: ff02::16
▾ Internet Control Message Protocol v6
    Type: Multicast Listener Report Message v2 (143)
    Code: 0
    Checksum: 0x6b80 [correct]
    [Checksum Status: Good]
    Reserved: 0000
    Number of Multicast Address Records: 2
  ▸ Multicast Address Record Changed to include: ff02::1:ffae:52b8
  ▸ Multicast Address Record Changed to exclude: ff02::1:fffe:ae8b
```

- **Router Solicitation:** tipo 133. Cuando un nodo nuevo se conecta pide al router que se anuncie para informar a los nodos.



2. Tarea 2.

   b.

   Las 4 interfaces tienen IPv6 habilitado

Dispositivo		**Dirección IP local**	**Dirección IP global**
Router0	**Fa0/0**	FE80::202:4AFF:FE35:6301	2001:DB8:1:0:202:4AFF:FE35:6301
	Fa0/1	FE80::202:4AFF:FE35:6302	2001:DB8:2:0:202:4AFF:FE35:6302
Router1	**Fa0/0**	FE80::2D0:BCFF:FE88:ED01	2001:DB8:3:0:2D0:BCFF:FE88:ED01
	Fa0/1	FE80::2D0:BCFF:FE88:ED02	2001:DB8:2:0:2D0:BCFF:FE88:ED02

   Router0:

```
FastEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::202:4AFF:FE35:6301
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:1:0:202:4AFF:FE35:6301, subnet is 2001:DB8:1::/64 [EUI]
FastEthernet0/1 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::202:4AFF:FE35:6302
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:2:0:202:4AFF:FE35:6302, subnet is 2001:DB8:2::/64 [EUI]
```

   Router1:

```
FastEthernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::2D0:BCFF:FE88:ED01
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:3:0:2D0:BCFF:FE88:ED01, subnet is 2001:DB8:3::/64 [EUI]
FastEthernet0/1 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::2D0:BCFF:FE88:ED02
  No Virtual link-local address(es):
  Global unicast address(es):
    2001:DB8:2:0:2D0:BCFF:FE88:ED02, subnet is 2001:DB8:2::/64 [EUI]
```

(a) Una dirección IPv6 tiene 128 bits.

(b) El prefijo es 2001:DB8:1::/64 y la ID de la interface es 202:4AFF:FE35:6301

(c) La MAC es 0002.4A35.6301. El ID de la interface se forma dividiendo la MAC en dos partes de 24 bits y agregando en el medio FFFE. Éste es el formato EUI-64.

c.

Router0:

```
Router>show ipv6 route
IPv6 Routing Table - 6 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       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
       D - EIGRP, EX - EIGRP external
C   2001:DB8:1::/64 [0/0]
     via ::, FastEthernet0/0
L   2001:DB8:1:0:202:4AFF:FE35:6301/128 [0/0]
     via ::, FastEthernet0/0
C   2001:DB8:2::/64 [0/0]
     via ::, FastEthernet0/1
L   2001:DB8:2:0:202:4AFF:FE35:6302/128 [0/0]
     via ::, FastEthernet0/1
R   2001:DB8:3::/64 [120/2]
     via FE80::2D0:BCFF:FE88:ED02, FastEthernet0/1
L   FF00::/8 [0/0]
     via ::, Null0
```

Router1:

```
Router>show ipv6 route
IPv6 Routing Table - 6 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       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
       D - EIGRP, EX - EIGRP external
R   2001:DB8:1::/64 [120/2]
     via FE80::202:4AFF:FE35:6302, FastEthernet0/1
C    2001:DB8:2::/64 [0/0]
     via ::, FastEthernet0/1
L   2001:DB8:2:0:2D0:BCFF:FE88:ED02/128 [0/0]
     via ::, FastEthernet0/1
C    2001:DB8:3::/64 [0/0]
     via ::, FastEthernet0/0
L   2001:DB8:3:0:2D0:BCFF:FE88:ED01/128 [0/0]
     via ::, FastEthernet0/0
L   FF00::/8 [0/0]
     via ::, Null0
```

d.

```
Packet Tracer PC Command Line 1.0
C:\>ping 2001:DB8:3:0:20C:CFFF:FE97:7944

Pinging 2001:DB8:3:0:20C:CFFF:FE97:7944 with 32 bytes of data:

Reply from 2001:DB8:3:0:20C:CFFF:FE97:7944: bytes=32 time<1ms TTL=126
Reply from 2001:DB8:3:0:20C:CFFF:FE97:7944: bytes=32 time<1ms TTL=126
Reply from 2001:DB8:3:0:20C:CFFF:FE97:7944: bytes=32 time<1ms TTL=126
Reply from 2001:DB8:3:0:20C:CFFF:FE97:7944: bytes=32 time<1ms TTL=126

Ping statistics for 2001:DB8:3:0:20C:CFFF:FE97:7944:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```