了解IPv6本地链路地址

目录

简介

本文档介绍IPv6本地链路地址如何在网络中工作。

先决条件

要求

Cisco 建议您了解以下主题：

- Cisco IOS® IPv6命令参考中的IPv6地址格式

使用的组件

本文档中的信息基于使用Cisco IOS®软件版本12.4(15)T1的Cisco 3700系列路由器。

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您的网络处于活动状态，请确保您了解所有命令的潜在影响。

规则

有关文档规则的详细信息，请参阅 Cisco 技术提示规则。

背景信息

本地链路地址是IPv6单播地址，可在使用本地链路前缀FE80::/10(1111 110 10)和接口标识符的任何接口上使用修改的EUI-64格式自动配置。链路本地地址不一定会绑定到 MAC 地址（配置为 EUI-64 格式）。 本地链路地址也可以使用[ipv6 address link-local]命令以FE80::/10格[式进行手动配]置。

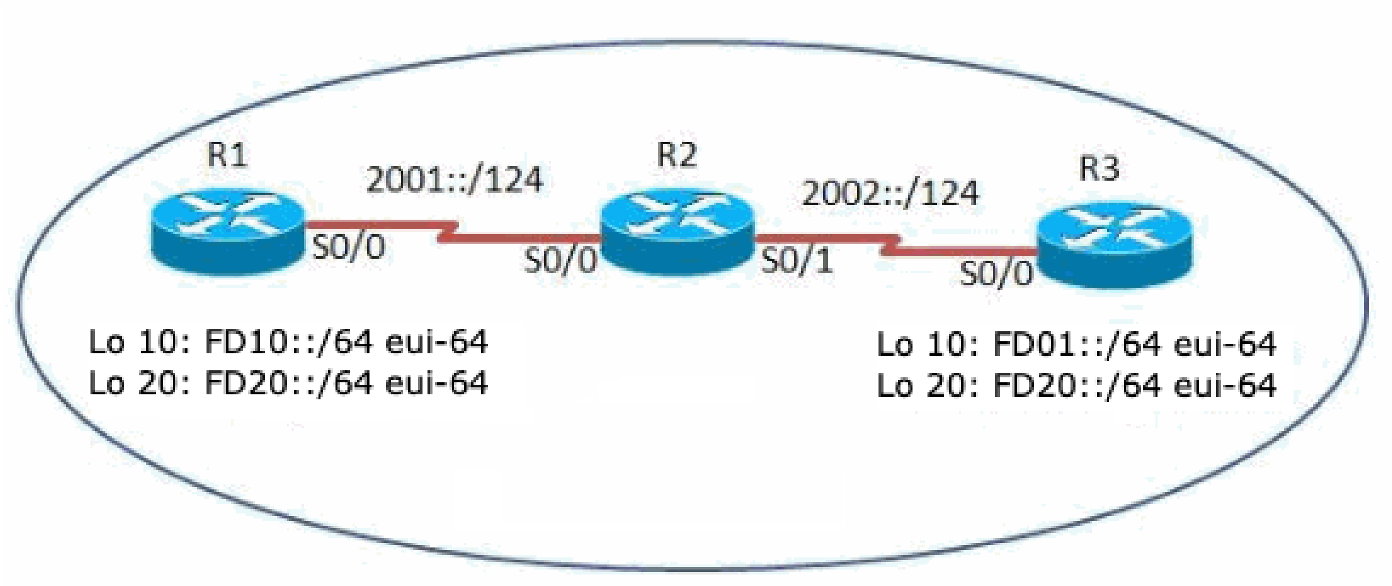
这些地址仅指特定物理链路，用于单个链路上的地址，用于自动地址配置和邻居发现协议等目的。链路本地地址可用于访问连接到同一链路的相邻节点。这些节点不需要具有全局唯一地址进行通信。路由器不会使用本地链路地址转发数据报。IPv6 路由器不得将具有链路本地源地址或目的地址的数据包转发到其他链路。所有支持 IPv6 的接口都具有一个链路本地单播地址。

配置

在本例中，路由器R1、R2和R3通过串行接口连接，并且按照网络图所述配置了IPv6地址。在路由器 R1 和 R3 上配置了环回地址，并且路由器使用 OSPFv3 相互通信。本示例使用**ping**命令演示使用本地链路地址的路由器之间的连通性。路由器R1和R3可以使用IPv6本地单播地址互相ping通，但不能使用其本地链路地址。但是，路由器R2直接连接到R1和R3，因此它可以使用路由器的本地链路地址与这两台路由器通信，因为本地链路地址仅在物理接口专用的本地网络中使用。

网络图

本文档使用以下网络设置：



使用的配置

本文档使用以下配置：

- 路由器 R1
- 路由器 R2
- 路由器 R3

此视频演示Cisco IOS路由器中IPv6本地链路地址和全局单播地址之间的主要区别：

- [了解IPv6本地链路地址]

路由器 R1

```
hostname R1
```

```
!
ipv6 cef
!
ipv6 unicast-routing
!
interface Loopback10
 no ip address
 ipv6 address FD10::/64 eui-64

!--- Assigned a IPv6 unicast address in EUI-64 format.  ipv6 ospf 1 area 1

!--- Enables OSPFv3 on the interface and associates the interface looback10 to area 1. ! interface Loop
no ip address ipv6 address FD20::/64 eui-64
 ipv6 ospf 1 area 2

!--- Associates the Interface loopback20 to area 2. ! interface Serial0/0 no ip address  ipv6 address
2001::1/124
 ipv6 ospf 1 area 0

!--- Associates the Interface serial0/0 to area 0. clock rate 2000000 ! ipv6 router ospf 1 router-id 10
!--- Router R1 uses 10.1.1.1 as router id. log-adjacency-changes ! end
```

路由器 R2

```
hostname R2
!
ipv6 cef
!
ipv6 unicast-routing
!
!
!
interface Serial0/0
 no ip address
 ipv6 address 2001::2/124
 ipv6 ospf 1 area 0
 clock rate 2000000
!
!
interface Serial0/1
 no ip address
 ipv6 address 2002::1/124
 ipv6 ospf 1 area 0
 clock rate 2000000
!
!
!
ipv6 router ospf 1
router-id 10.2.2.2
log-adjacency-changes
!
end
```

路由器 R3

```
hostname R3
!
ipv6 cef
!
ipv6 unicast-routing
!
interface Loopback10
 no ip address
 ipv6 address FD01::/64 eui-64
 ipv6 ospf 1 area 1
!
interface Loopback20
 no ip address
 ipv6 address FD20::/64 eui-64
 ipv6 ospf 1 area 2
!
interface Serial0/0
 no ip address
 ipv6 address FE80::AB8 link-local
 ipv6 address 2002::2/124
 ipv6 ospf 1 area 0
 clock rate 2000000
!
ipv6 router ospf 1
 router-id 10.3.3.3
 log-adjacency-changes
!
end
```

确认

检验OSPF配置

要检验OSPF是否配置正确，请在执行模式下使用 show ipv6 route ospf 命令。

show ipv6 route ospf
路由器 R1

```
R1#show ipv6 route ospf
IPv6 Routing Table - 10 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
       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
OI  FD01::C002:1DFF:FEE0:0/128 [110/128]
     via FE80::C001:1DFF:FEE0:0, Serial0/0
O   2002::/124 [110/128]
     via FE80::C001:1DFF:FEE0:0, Serial0/0
OI  FD20::C002:1DFF:FEE0:0/128 [110/128]
     via FE80::C001:1DFF:FEE0:0, Serial0/0
```

路由器 R3

```
R3#show ipv6 route ospf
IPv6 Routing Table - 10 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
       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
O   2001::/124 [110/128]
     via FE80::C001:1DFF:FEE0:0, Serial0/0
OI  FD10::C000:1DFF:FEE0:0/128 [110/128]
     via FE80::C001:1DFF:FEE0:0, Serial0/0
OI  FD20::C000:1DFF:FEE0:0/128 [110/128]
     via FE80::C001:1DFF:FEE0:0, Serial0/0
```

检验本地链路地址可达性

各路由器可以使用全局单播地址相互 ping 通。如果路由器仅使用本地链路地址，则直连网络可以通信。例如，R1可以使用全局单播地址ping R3，但两台路由器无法与本地链路地址通信。路由器R1和R3中的**ping**和**debug ipv6 icmp**命令显示了这一点。

从远程网络Ping本地链路地址

当路由器R1尝试使用本地链路地址与路由器R3通信时，路由器R1会返回ICMP超时消息，指出本地链路地址是本地特定的，无法与直连网络外的本地链路地址通信。

从路由器R1 ping R3的本地链路地址
在路由器R1中

```
R1#ping FE80::AB8

!--- Pinging Link-Local Address of router R3. Output Interface: serial0/0

!--- To ping LLA, output interface must be entered. Type escape sequence to abort. Sending 5, 100-byte
Echos to FE80::AB8, timeout is 2 seconds: Packet sent with a source address of FE80::C000:1DFF:FEE0:0 .
Success rate is 0 percent (0/5) !--- The ping is unsuccessful and the ICMP packet cannot reach the
destination through serial0/0. !--- This timeout indicates that R1 has not received any replies from th
router R3.
```

从直连网络Ping本地链路地址

对于路由器R2，路由器R1和R3直接相连，当路由器R1和R2与连接到路由器的相关接口通信时，它们可以ping路由器R1和R2的本地链路地址。输出如下所示：

从路由器R2 ping R1的本地链路地址

在路由器R2中

```
R2#ping FE80::C000:1DFF:FEE0:0

!--- Pinging Link-Local Address of router R1. Output Interface: serial0/0

!--- Note that to ping LLA, output interface should be mentioned In our case, R2 connects to R1 via
serial0/0. Type escape sequence to abort. Sending 5, 100-byte ICMP Echos to FE80::C000:1DFF:FEE0:0, tim
is 2 seconds: Packet sent with a source address of FE80::C001:1DFF:FEE0:0 !!!!! Success rate is 100 per
(5/5), round-trip min/avg/max = 0/19/56 ms
```

调试R1的输出

```
R1#
*Mar  1 03:59:53.367: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.371: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.423: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.427: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.463: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.463: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.467: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.467: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.471: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 03:59:53.471: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0

!--- The debug output shows that the router R2 can ping router R1's link-local address.
```

从路由器R2 ping R3本地链路地址

在路由器R2中

```
R2#ping FE80::AB8

!--- Pinging Link-Local Address of router R3. Output Interface: serial0/1

!--- Note that,to ping LLA,output interface should be mentioned. In our case, R2 connects to R3 through
serial0/1. Type escape sequence to abort. Sending 5, 100-byte ICMP Echos to FE80::AB8, timeout is 2 sec
Packet sent with a source address of FE80::C001:1DFF:FEE0:0 !!!!! Success rate is 100 percent (5/5), ro
trip min/avg/max = 0/18/60 ms
```

调试R3的输出

```
R3#
*Mar  1 04:12:11.518: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.522: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.594: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.598: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.618: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.618: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.622: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.622: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.626: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 04:12:11.630: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0

!--- The debug output shows that the router R2 can ping router R3's link-local address.
```

本地链路地址仅特定于本地网络。路由器可以拥有相同的本地链路地址，而且直连网络可以彼此通信，而不会发生冲突。对于全局单播地址，情况并非如此。可路由的全局单播地址在网络中必须唯一。show ipv6 interface brief命令显示有关接口上的本地链路地址的信息。

show ipv6 interface brief

在路由器R1中

```
R1#show ipv6 interface brief
Serial0/0                   [up/up]
    FE80::AB8
    2001::1
Loopback10                  [up/up]
    FE80::C000:1DFF:FEE0:0
```

```
    FD10::C000:1DFF:FEE0:0
Loopback20                  [up/up]
    FE80::C000:1DFF:FEE0:0
    FD20::C000:1DFF:FEE0:0
```

在路由器R3中

```
R3#show ipv6 interface brief

Serial0/0                   [up/up]
    FE80::AB8
    2002::2
Loopback10                  [up/up]
    FE80::C002:1DFF:FEE0:0
    FD01::C002:1DFF:FEE0:0
Loopback20                  [up/up]
    FE80::C002:1DFF:FEE0:0
    FD20::C002:1DFF:FEE0:0

!--- Shows that R1 and R3's serial interface has same link-local address FE80::AB8.
```

在本例中，R1和R3分配了相同的本地链路地址，并且R2在指定相关输出接口时仍然可以到达两台路由器。

从R2 ping R1和R3的本地链路地址

从R2 ping R1的本地链路地址

```
R2#ping FE80::AB8
Output Interface: serial0/0

!--- R2 is connected to R1 through serial0/0. Type escape sequence to abort. Sending 5, 100-byte ICMP E
to FE80::AB8, timeout is 2 seconds: Packet sent with a source address of FE80::C001:1DFF:FEE0:0 !!!!! S
rate is 100 percent (5/5), round-trip min/avg/max = 0/26/92 ms
```

调试R1的输出

```
R1#
*Mar  1 19:51:31.855: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.859: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.915: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.919: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.947: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.947: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.955: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.955: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.955: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:51:31.955: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
```

从R2 Ping R3本地链路地址

```
R2#ping FE80::AB8
Output Interface: serial0/1

!--- R2 is connected to R1 through serial0/1. Type escape sequence to abort. Sending 5, 100-byte ICMP E
to FE80::AB8, timeout is 2 seconds: Packet sent with a source address of FE80::C001:1DFF:FEE0:0 !!!!! S
rate is 100 percent (5/5), round-trip min/avg/max = 4/28/76 ms
```

调试R3的输出

```
R3#
*Mar  1 19:53:38.815: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.819: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.911: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.915: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.923: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.927: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.955: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.955: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.963: ICMPv6: Received echo request from FE80::C001:1DFF:FEE0:0
*Mar  1 19:53:38.963: ICMPv6: Sending echo reply to FE80::C001:1DFF:FEE0:0
```

注意：R2 只能 ping 通 R1 和 R3 的链路本地地址，因为它们是直接连接的。R2 无法 ping 通路由器 R1 和 R3 中的环回接口的链路本地地址，因为它们不是直接连接的。仅在直连网络中可以 ping 通链路本地地址。

注意：对于本地链路地址，traceroute不起作用，它返回% No *valid source address for destination*错误消息。这是因为 IPv6 路由器不得将具有链路本地源或目的地址的数据包转发到其他链路。

相关信息

- **IPv6 寻址架构 - RFC 4291**
- **IPv6 技术支持**
- **技术支持和文档 - Cisco Systems**