了解 IPv6 链路本地地址

目录

简介

本文档旨在帮助了解网络中的 IPv6 链路本地地址。链路本地地址是 IPv6 单播地址，可使用链路本地前缀 FE80::/10 (1111 1110 10) 以及采用已修改的 EUI-64 格式的接口标识符，在任意接口上进行自动配置。链路本地地址不一定会绑定到 MAC 地址（配置为 EUI-64 格式）。 也可以使用ipv6 address link-local命令以FE80::/10格式手**动配置本地链路**地址。

这些地址仅指向特定物理链路，并用于在单个链路上寻址，以实现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。路由器将不会使用链路本地地址转发数据报。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。

先决条件

要求

在尝试此配置之前，请确保您了解IPv6地址格式。

使用的组件

本文档不限于特定的软件和硬件版本。

本文所述的配置基于运行 Cisco IOS® 软件版本 12.4(15)T1 的思科 3700 系列路由器。

规则

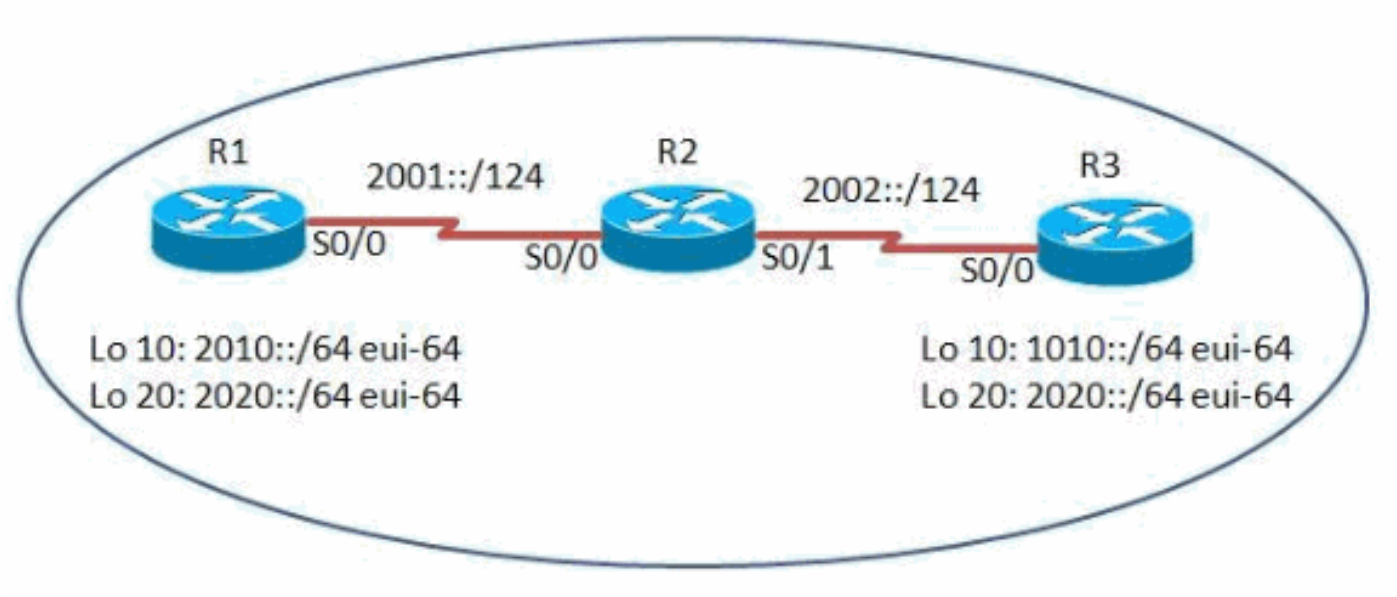
有关文档规则的详细信息，请参阅 Cisco 技术提示规则。

配置

在此示例中，路由器 R1、R2 和 R3 通过串行接口连接，并配置有网络图中所示的 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。此示例使用 **ping 命令演示使用链路本地地址在路由器之间进行连接。**路由器 R1 和 R3 可以使用 IPv6 全局单播地址相互 ping 通，但无法使用其链路本地地址相互 ping 通。但是，直接连接到 R1 和 R3 的路由器 R2 可以使用其链路本地地址与这两台路由器通信，因为链路本地地址仅在特定于物理接口的本地网络中使用。

网络图

本文档使用以下网络设置：



配置

本文档使用以下配置：

- 路由器 R1
- 路由器 R2 和 R3

以下是视频(在思科支持社区上可用)的链接，演示了Cisco IOS路由器中IPv6本地链路地址和全局单播地址之间的关键区别：

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路由器 R1
! hostname R1 ! ipv6 cef ! ipv6 unicast-routing ! interface Loopback10 no ip address ipv6 address 2010::/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 Loopback20 no ip address ipv6 address 2020::/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 1.1.1.1 *!--- Router R1 uses 1.1.1.1 as router id.* log-adjacency-changes ! end

路由器 R2	路由器 R3
hostname R2 ! ipv6 cef !	! hostname R3 ! 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 2.2.2.2
log-adjacency-changes
!
end
```

```
!
ipv6 unicast-routing
!
interface Loopback10
 no ip address

 ipv6 address 1010::/64 eui-64
 ipv6 ospf 1 area 1
!
interface Loopback20
 no ip address

 ipv6 address 2020::/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 3.3.3.3
 log-adjacency-changes
!
end
```

验证

检验 OSPF 的配置

使用本部分可确认配置能否正常运行。

要验证OSPF是否配置正确，请在路由器R1和R3中使用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  1010::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  2020::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  2010::C000:1DFF:FEE0:0/128 [110/128]
     via FE80::C001:1DFF:FEE0:0, Serial0/0
OI  2020::C000:1DFF:FEE0:0/128 [110/128]
     via FE80::C001:1DFF:FEE0:0, Serial0/0
```

验证链路本地地址可访问性

各路由器可以使用全局单播地址相互 ping 通。但是，使用链路本地地址时，只有直连网络可以通信。例如，R1 可以使用全局单播地址 ping 通 R3，但这两台路由器无法使用链路本地地址进行通信。这在路由器R1和R3中使用**ping**和**debug ipv6 icmp**命令来显示。本部分提供了一些场景，以更好地了解本地链路地址。

从远程网络对链路本地地址执行 Ping 操作

当路由器 R1 尝试使用链路本地地址与路由器 R3 通信时，路由器 R1 返回一条 ICMP 超时消息，指示链路本地地址是专用于本地的地址，无法与直连网络之外的链路本地地址通信。

从路由器 R1 对 R3 的链路本地地址执行 ping 操作

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 ICMP 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 the router R3.
```

从直连网络对链路本地地址执行 Ping 操作

对于路由器 R2，路由器 R1 和 R3 是直连路由器，可以通过指定已连接到路由器的相应接口来 ping 通路由器 R1 和 R2 的链路本地地址。输出如下所示：

从路由器 R2 对 R1 的链路本地地址执行 ping 操作

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, timeout is 2 seconds: Packet
sent with a source address of FE80::C001:1DFF:FEE0:0
!!!!! Success rate is 100 percent (5/5), round-trip
min/avg/max = 0/19/56 ms
```

R1 的调试输出

```
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
R1#
*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 对 R3 的链路本地地址执行 ping 操作

在路由器R2中

```
R2#pingFE80::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 throught serial0/1. Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to FE80::AB8, timeout is
2 seconds: Packet sent with a source address of
FE80::C001:1DFF:FEE0:0 !!!!! Success rate is 100 percent
(5/5), round-trip min/avg/max = 0/18/60 ms
```

R3 的调试输出

```
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
R3#
```

```
*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.
```

顾名思义，链路本地地址仅可用于相应本地网络。即，各路由器可以具有相同的链路本地地址，并且直连网络仍然可以相互通信，而不会发生任何冲突。如果使用全局单播地址，则情况就会不一样。可路由的全局单播地址在网络中应是唯一的。show ipv6 interface brief命令显示有关接口上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
    2010::C000:1DFF:FEE0:0
Loopback20                 [up/up]
    FE80::C000:1DFF:FEE0:0
    2020::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
    1010::C002:1DFF:FEE0:0
Loopback20                 [up/up]
    FE80::C002:1DFF:FEE0:0
    2020::C002:1DFF:FEE0:0
!--- Shows that R1 and R3's serial interface has same
link-local address FE80::AB8.
```

在此示例中，为 R1 和 R3 分配了相同的链路本地地址，R2 仍可以通过指定相应输出接口来访问这两台路由器。

从 R2 对 R1 和 R3 的链路本地地址执行 ping 操作

从 R2 对 R1 的链路本地地址执行 ping 操作

```
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 Echos
to FE80::AB8, timeout is 2 seconds: Packet sent with a
source address of FE80::C001:1DFF:FEE0:0 !!!!! Success
rate is 100 percent (5/5), round-trip min/avg/max =
0/26/92 ms
```

R1 的调试输出

```
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
R1#
*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 对 R3 的链路本地地址执行 ping 操作

```
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 Echos
to FE80::AB8, timeout is 2 seconds: Packet sent with a
source address of FE80::C001:1DFF:FEE0:0 !!!!! Success
rate is 100 percent (5/5), round-trip min/avg/max =
4/28/76 ms
```

R3 的调试输出

```
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
R3#
*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的本地链路地址，因为它们是直连的。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，返回的目标地址为*% No valid source address*。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 配置指南，Cisco IOS 版本 15.2M&T
- 实现 IPv6 编址和基本连通性
- IPv6 知识库门户网站
- IPv6 技术支持
- 技术支持和文档 - Cisco Systems