# 配置连接位集

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## 简介

本文档介绍中间系统到中间系统(ISIS)连接位的行为。

## 先决条件

### 要求

Cisco 建议您了解以下主题：

- ISIS
- 开放最短路径优先(OSPF)

### 使用的组件

本文档不限于特定的软件和硬件版本。

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。如果您使用的是真实网络，请确保您已经了解所有命令的潜在影响。

## 背景信息

以下是关于ISIS的几件事和附加行为。

1.在ISIS网络中，有3种路由器：1级(L1)路由器、2级(L2)路由器和1级(L1L2)路由器。

2.与OSPF一样，ISIS将L2区域作为主干区域。

3.连接到两个区域（即1级和2级）的路由器称为L1L2路由。

4. OSPF具有多区域的概念，以限制最短路径优先(SPF)计算范围，同样，ISIS中也有不同区域的原因。

5. 1级和2级ISIS路由器分别生成1级和2级链路状态PDU(LSP)。L1L2路由器同时生成LSP（即第1级和第2级）。

6.如果第1级路由器需要到达L2网络，则第1级路由器会将数据包发送到L1L2路由器以到达主干区域。

7.默认情况下，第2级路由器不会由L1L2路由器泄漏到第1级区域，但第1级路由器始终传播到第2级区域。

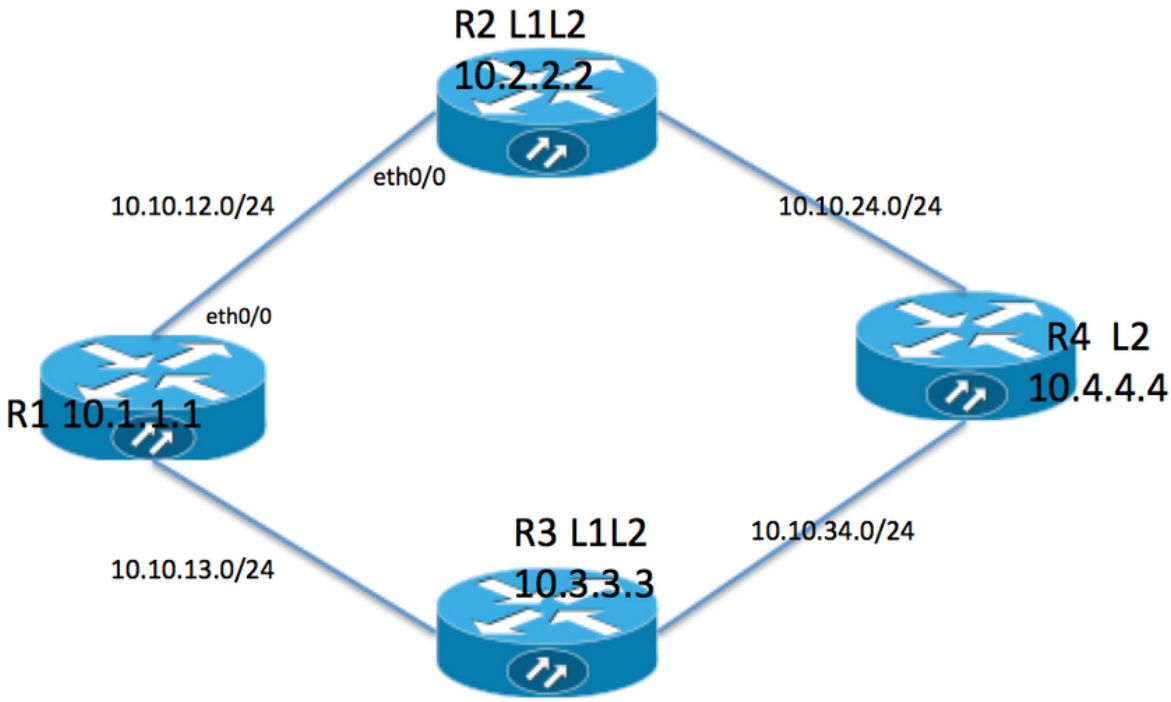
8.为了到达第2级区域，L1L2路由器在第1级LSP中设置Attach位。1级路由器在路由表中安装默认路由，此路由指向L1L2路由器。

9.如果网络有多台L1L2路由器连接同一L1区域，则可能导致次优路由，因为2级路由不会流入1级区域。1级区域仅安装指向L1L2路由器（最近）的默认路由。将2级路由泄漏到1级可以克服这些限制。

# 配置

## 网络图

请考虑此网络拓扑，以了解环路防御技术。




**拓扑信息**

- R1是区域为49.0001的1级路由器
- R2和R3是L1L2路由器，带49.0001
- R4是区域为49.0002的2级路由器
- R1的环回地址为10.1.1.1
- R2环回地址为10.2.2.2
- R3地址为10.3.3.3
- R4环回地址为10.4.4.4

## R1

```
R1#sh run int lo 0
Building configuration...

Current configuration : 82 bytes
!
interface Loopback0
 ip address 10.1.1.1 255.255.255.255
 ip router isis 1
end
```

```
R1#sh run int ethernet 0/0
Building configuration...

Current configuration : 127 bytes
!
interface Ethernet0/0
 ip address 10.10.12.1 255.255.255.0
 ip router isis 1
 isis circuit-type level-1
end

R1#sh run int ethernet 0/1
Building configuration...

Current configuration : 111 bytes
!
interface Ethernet0/1
 ip address 10.10.13.1 255.255.255.0
 ip router isis 1
 isis circuit-type level-1
end
!

router isis 1
 net 49.0001.0000.0000.0001.00  >>>>> Area is 49.0001
 is-type level-1    >>>>>>>>>> Globally this router belongs to Level1
```

## R2

```
R2#sh run int lo 0
Building configuration...

Current configuration : 82 bytes
!
interface Loopback0
 ip address 10.2.2.2 255.255.255.255
 ip router isis 1
end

R2#sh run int eth0/0
Building configuration...

Current configuration : 111 bytes
!
interface Ethernet0/0
 ip address 10.10.12.2 255.255.255.0
 ip router isis 1
 isis circuit-type level-1   >>>>>> Circuit type is L1 towards R1
end

R2#sh run int eth0/1
Building configuration...

Current configuration : 84 bytes
!
interface Ethernet0/1
 ip address 10.10.24.2 255.255.255.0
 ip router isis 1
end
!

router isis 1
```

```
 net 49.0001.0000.0000.0002.00
```

## R3

```
R3#sh run int lo 0
Building configuration...

Current configuration : 82 bytes
!
interface Loopback0
 ip address 10.3.3.3 255.255.255.255
 ip router isis 1
end

R3#sh run int eth0/0
Building configuration...

Current configuration : 84 bytes
!
interface Ethernet0/0
 ip address 10.10.13.3 255.255.255.0
 ip router isis 1
end

R3#sh run int eth0/1
Building configuration...

Current configuration : 84 bytes
!
interface Ethernet0/1
 ip address 10.10.34.3 255.255.255.0
 ip router isis 1
end
!

router isis 1
 net 49.0001.0000.0000.0003.00
```

## R4

```
R4#sh run int lo 0
Building configuration...

Current configuration : 82 bytes
!
interface Loopback0
 ip address 10.4.4.4 255.255.255.255
 ip router isis 1
end

R4#sh run int ethernet 0/0
Building configuration...

Current configuration : 84 bytes
!
interface Ethernet0/0
 ip address 10.10.24.4 255.255.255.0
 ip router isis 1
end

R4#sh run int ethernet 0/1
```

```
Building configuration...

Current configuration : 84 bytes
!
interface Ethernet0/1
 ip address 10.10.34.4 255.255.255.0
 ip router isis 1
end

!

router isis 1
 net 49.0002.0000.0000.0004.00   >>>> Area on R4 is 49.0002.
```

**注意**：两个不同区域之间的路由器始终来自2级邻居关系。在本例中，R4区域为49.0002,R2和R3区域为49.0001。因此，R4必须与R2和R3具有L2邻接关系。

# 验证

使用本部分可确认配置能否正常运行。

```
R1#show clns neighbors
Tag 1:
System Id      Interface   SNPA            State  Holdtime  Type Protocol
R2             Et0/0       aabb.cc01.f600      Up     6         L1   IS-IS
R3             Et0/1       aabb.cc01.f700      Up     9         L1   IS-IS
R1#

R1 neighbor relationship with R2 and R3 is only L1

R2#sh clns neighbors
Tag 1:
System Id      Interface   SNPA            State  Holdtime  Type Protocol
R1             Et0/0       aabb.cc01.f500      Up     24        L1   IS-IS
R4             Et0/1       aabb.cc01.f800      Up     9         L2   IS-IS

R2 neighbor relationship with R1 is L1
R2 neighbor relationship with R4 is L2

So R2 is L1L2 router as it is building both adjanceny i.e. L1 and L2 neighbor

R3#sh clns neighbors
Tag 1:
System Id      Interface   SNPA            State  Holdtime  Type Protocol
R1             Et0/0       aabb.cc01.f510      Up     25        L1   IS-IS
R4             Et0/1       aabb.cc01.f810      Up     7         L2   IS-IS

R3 neighbor relatioship with R1 is L1
R3 neighbor relationship with R4 is L2

So R3 is L1L2 router as it is building both adjanceny i.e. L1 and L2 neighbor

R4#sh clns neighbors
Tag 1:
System Id      Interface   SNPA            State  Holdtime  Type Protocol
R2             Et0/0       aabb.cc01.f610      Up     29        L2   IS-IS
R3             Et0/1       aabb.cc01.f710      Up     23        L2   IS-IS

R4 neighbor relationship with R2 and R3 is L2 only .
```

在此拓扑中，R2和R3是L1L2路由器，因此它们必须设置连接位，因此R1必须具有两条默认路由。

```
R1#show isis database

Tag 1:
IS-IS Level-1 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R1.00-00            * 0x0000002B   0x4269        576               0/0/0
R2.00-00              0x00000033   0xB1CA        997               1/0/0
R2.01-00              0x0000001F   0x42F0        1018              0/0/0
R3.00-00              0x0000002B   0xCA5E        857               1/0/0
R3.01-00              0x0000001B   0x50E4        964               0/0/0

ATT ( which is marked in Bold ) represents attach bit and is set to 1 for both R2 and R3
router in Level 1 LSP . ATT bit is only set in Level1 LSP .

R1#sh ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override

Gateway of last resort is 10.10.13.3 to network 0.0.0.0

i*L1  0.0.0.0/0 [115/10] via 10.10.13.3, 00:00:26, Ethernet0/1
                [115/10] via 10.10.12.2, 00:00:26, Ethernet0/0
      10.0.0.0/8 is variably subnetted, 9 subnets, 2 masks
C        10.1.1.1/32 is directly connected, Loopback0
i L1     10.2.2.2/32 [115/20] via 10.10.12.2, 00:00:26, Ethernet0/0
i L1     10.3.3.3/32 [115/20] via 10.10.13.3, 00:46:55, Ethernet0/1
C        10.10.12.0/24 is directly connected, Ethernet0/0
L        10.10.12.1/32 is directly connected, Ethernet0/0
C        10.10.13.0/24 is directly connected, Ethernet0/1
L        10.10.13.1/32 is directly connected, Ethernet0/1
i L1     10.10.24.0/24 [115/20] via 10.10.12.2, 00:00:26, Ethernet0/0
i L1     10.10.34.0/24 [115/20] via 10.10.13.3, 00:46:55, Ethernet0/1


In route table R1 is installing default route towards R2 and R3 .
```

此处的路由表没有任何R4的特定路由，因为默认情况下，2级路由不会泄漏到1级区域。它依靠默认表来转发流量，这可能导致次优路由。在上述情况下，由于两个默认路由的度量相同，因此都安装了。如果R1和R2之间的度量增加，则路由器必须只安装指向R2的默认路由。

```
R1(config)#int eth0/0
R1(config-if)#isis metric 20 >>>>> Metric is increased by 20

R1#sh ip route 0.0.0.0
Routing entry for 0.0.0.0/0, supernet
 Known via "isis", distance 115, metric 10, candidate default path, type level-1
 Redistributing via isis 1
 Last update from 10.10.13.3 on Ethernet0/1, 00:00:05 ago
 Routing Descriptor Blocks:
 * 10.10.13.3, from 10.3.3.3, 00:00:05 ago, via Ethernet0/1
     Route metric is 10, traffic share count is 1
```

```
Now only 1 default route in routing table i.e. towards R3 .
```

在上述情况下，R4的所有流量都将转发到R3，并且不使用指向R2的链路。为了利用指向R2的链路，需要在R2上执行重分发。为了描述这一点，R4上的loopback 0通过重分发泄漏到R2中。

```
R4#sh run int lo 1
Building configuration...

Current configuration : 85 bytes
!
interface Loopback1
 ip address 10.44.44.44 255.255.255.255
 ip router isis 1
end
```

```
R2#

router isis 1
 net 49.0001.0000.0000.0002.00
 redistribute isis ip level-2 into level-1 route-map LEVEL2_into_Level1

R2#show route-map
route-map LEVEL2_into_Level1, permit, sequence 10
 Match clauses:
   ip address (access-lists): 10
 Set clauses:
 Policy routing matches: 0 packets, 0 bytes
!
R2#sh access-lists 10
Standard IP access list 10
   10 permit 10.4.4.4 (22 matches)
```

重分发后R1数据库和路由表：

```
R1#show isis database R2.00-00 detail

Tag 1:

IS-IS Level-1 LSP R2.00-00
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R2.00-00              0x00000036   0xABCD        859               1/0/0
 Area Address: 49.0001
 NLPID:        0xCC
 Hostname: R2
 IP Address:   10.2.2.2
 Metric: 10         IP 10.10.12.0 255.255.255.0
 Metric: 10         IP 10.2.2.2 255.255.255.255
 Metric: 10         IP 10.10.24.0 255.255.255.0
 Metric: 10         IS R2.01
  Metric: 148        IP-Interarea 10.4.4.4 255.255.255.255


After redistribution 10.4.4.4/32 route is being seen into R1 database .


R1#sh ip route 10.4.4.4
Routing entry for 10.4.4.4/32
 Known via "isis", distance 115, metric 168, type inter area
 Redistributing via isis 1
 Last update from 10.10.12.2 on Ethernet0/0, 00:06:32 ago
```

```
 Routing Descriptor Blocks:
 * 10.10.12.2, from 10.2.2.2, 00:06:32 ago, via Ethernet0/0
     Route metric is 168, traffic share count is 1

After redistribution 10.4.4.4/32 is also present in routing table as well .
```

**注意**：在这种情况下，R2在路由表中通告特定路由，但不通告默认路由。R1在1级LSP中看到连接位，并在路由表中安装默认路由。

# 故障排除

目前没有针对此配置的故障排除信息。