

# IS-IS 网络类型和帧中继接口

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## 简介

在中间系统到中间系统(IS-IS)协议中，有两种网络：点对点和广播。与开放最短路径优先(OSPF)协议不同，IS-IS没有其他网络类型，如非广播和点对多点。对于每种类型的网络，交换不同类型的IS-IS Hello(IIH)数据包以建立邻接关系。在点对点网络上，交换点对点IIH;在广播网络(如LAN)上，交换1级或2级LAN IIH。运行IS-IS的帧中继网络可以配置为属于这些网络类型之一，具体取决于路由器之间通过云可用的连接类型(全网状、部分网状或中心辐射型)。本文档举例说明了这种情况下网络类型配置不匹配的情况，并说明了如何诊断和解决问题。

## 先决条件

### 要求

本文档的读者应掌握以下这些主题的相关知识：

- 配置帧中继
- 配置集成IS-IS

### 使用的组件

本文档不限于特定的软件和硬件版本。

本文档中显示的输出基于以下软件和硬件版本：

- Cisco 2500 系列路由器
- Cisco IOS® 软件版本 12.2(27)

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。

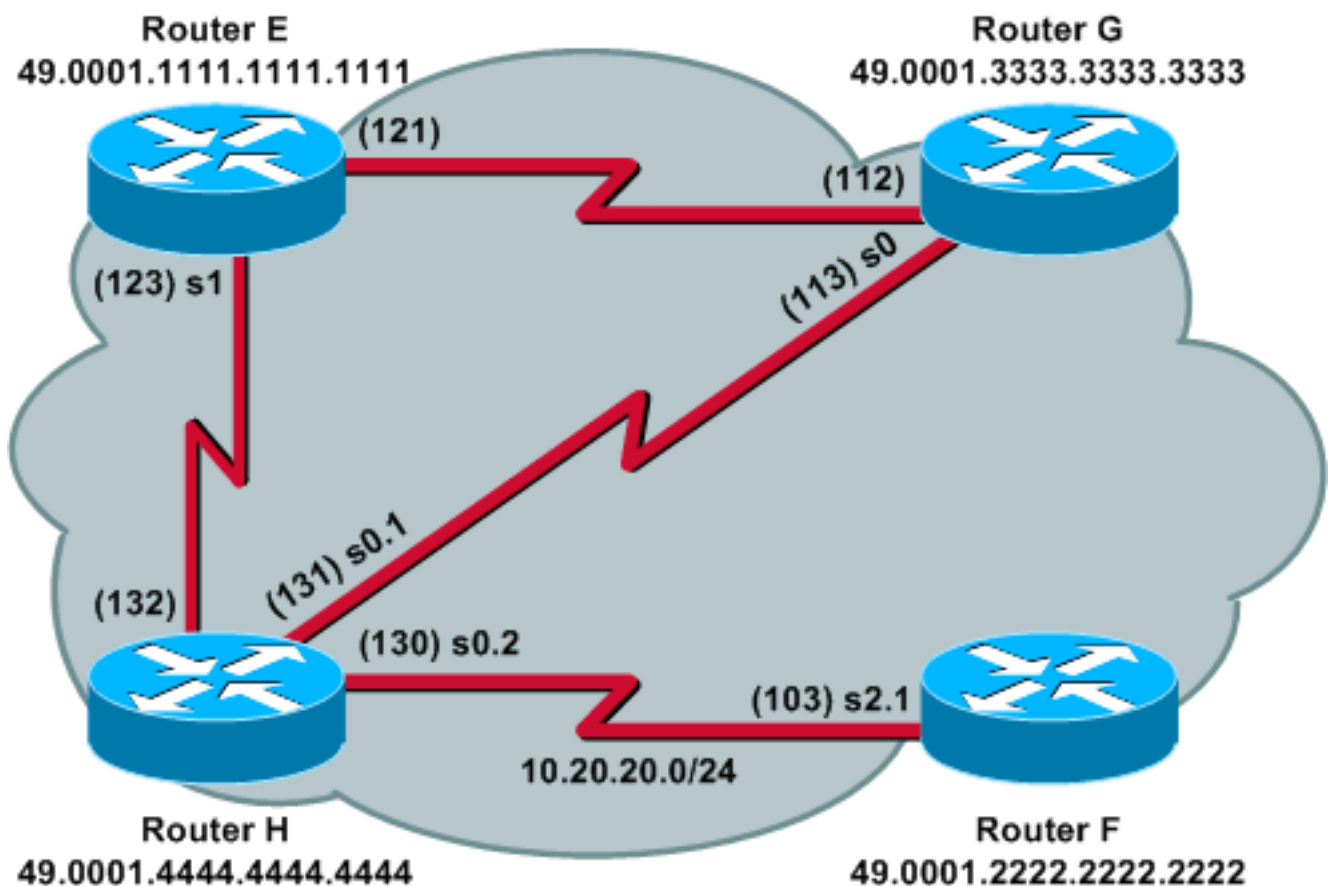
## 规则

有关文件规则的更多信息请参见“Cisco技术提示规则”。

## 正确配置示例

IS-IS处理多点串行接口和子接口的方式与处理广播接口的方式相同，但它处理点对点子接口的方式与处理点对点子接口的方式类似。例如，在本节的网络示例拓扑中，三台全网状路由器之间的WAN多点连接被视为LAN连接。与LAN一样，LAN之间交换1级或2级LAN IIH，并选择指定中间系统(DIS)。

在本示例拓扑中，所有三台路由器都连接到点对多点接口或子接口上的帧中继网云。默认情况下，主接口（如路由器E上的Serial1和路由器G上的Serial0）是多点接口。路由器H和F通过点对点子接口建立点对点连接，并且它们使用点对点IIH。



以下是本示例拓扑中使用的路由器配置：

- [路由器 E](#)
- [路由器 G](#)
- [路由器 H](#)
- [路由器 F](#)

### 路由器 E

```
clsns routing
!  
interface Serial1
```

```
ip address 10.10.10.1 255.255.255.0
ip router isis
encapsulation frame-relay
clns router isis
frame-relay map clns 123 broadcast
frame-relay map clns 121 broadcast
frame-relay map ip 10.10.10.3 121 broadcast
frame-relay map ip 10.10.10.4 123 broadcast
frame-relay lmi-type ansi
!
router isis
net 49.0001.1111.1111.1111.00
is-type level-1
```

## 路由器G

```
clns routing
!
interface Serial0
ip address 10.10.10.3 255.255.255.0
ip router isis
encapsulation frame-relay
clns router isis
frame-relay map clns 112 broadcast
frame-relay map clns 113 broadcast
frame-relay map ip 10.10.10.1 112 broadcast
frame-relay map ip 10.10.10.4 113 broadcast
frame-relay lmi-type ansi
!
router isis
net 49.0001.3333.3333.3333.00
is-type level-1
```

## 路由器H

```
clns routing
!
interface Serial0
no ip address
no ip directed-broadcast
no ip mroute-cache
encapsulation frame-relay
frame-relay lmi-type ansi
!
interface Serial0.1 multipoint
ip address 10.10.10.4 255.255.255.0
no ip directed-broadcast
ip router isis
clns router isis
frame-relay map clns 132 broadcast
frame-relay map clns 131 broadcast
frame-relay map ip 10.10.10.1 132 broadcast
frame-relay map ip 10.10.10.3 131 broadcast
!
interface Serial0.2 point-to-point
ip address 10.20.20.4 255.255.255.0
no ip directed-broadcast
ip router isis
clns router isis
frame-relay interface-dlci 130
!
router isis
net 49.0001.4444.4444.4444.00
```

```

is-type level-1

```

---

```

路由器 F

```

```

clns routing
!
interface Serial2
  no ip address
  no ip directed-broadcast
  encapsulation frame-relay
  frame-relay lmi-type ansi
!
interface Serial2.1 point-to-point
  ip address 10.20.20.2 255.255.255.0
  no ip directed-broadcast
  ip router isis
  clns router isis
  frame-relay interface-dlci 103
!
router isis
  net 49.0001.2222.2222.00
  is-type level-1

```

在网状网中的任何路由器上发出**show clns neighbors**、**show isis database**和**show isis database details**命令，以观察IS-IS配置对多点WAN连接的影响。以下是所有路由器上**show clns neighbors**命令的输出：

Router\_E# **show clns neighbors**

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
Router_G	Se1	DLCI 121	Up	29	L1	IS-IS
Router_H	Se1	DLCI 123	Up	7	L1	IS-IS

Router\_G# **show clns neighbors**

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
Router_E	Se0	DLCI 112	Up	27	L1	IS-IS
Router_H	Se0	DLCI 113	Up	7	L1	IS-IS

Router\_H# **show clns neighbors**

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
Router_E	Se0.1	DLCI 132	Up	23	L1	IS-IS
Router_F	Se0.2	DLCI 130	Up	25	L1	IS-IS
Router_G	Se0.1	DLCI 131	Up	28	L1	IS-IS

Router\_F# **show clns neighbors**

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
Router_H	Se2.1	DLCI 103	Up	24	L1	IS-IS

**show isis database**的输出显示，根据源节点的链路状态数据包(LSP)ID，路由器H是DIS:

Router\_E# **show isis database**

```

IS-IS Level-1 Link State Database

```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
Router_E.00-00	* 0x00000EA6	0xA415	54	10/0/0
Router_F.00-00	0x00000DD7	0xD76E	46	0/0/0
Router_G.00-00	0x00000DE7	0x780B	40	0/0/0

```
Router_H.00-00      0x00000DF0      0x4346      37      0/0/0
Router_H.01-00      0x00000DD5      0xFD1F      46      0/0/0
```

```
Router_G# show isis database
```

```
IS-IS Level-1 Link State Database
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
Router_E.00-00	0x00000E8F	0xD2FD	46	10/0/0
Router_F.00-00	0x00000DC0	0x0657	45	0/0/0
Router_G.00-00	* 0x00000DD0	0xA6F3	41	0/0/0
Router_H.00-00	0x00000DDA	0x6F30	42	0/0/0
<b>Router_H.01-00</b>	<b>0x00000DBE</b>	<b>0x2C08</b>	<b>50</b>	<b>0/0/0</b>

```
Router_H# show isis database
```

```
IS-IS Level-1 Link State Database
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
Router_E.00-00	0x000001EC	0x1D12	44	10/0/0
Router_F.00-00	0x00000124	0x63A2	54	0/0/0
Router_G.00-00	0x00000130	0x0C3B	33	0/0/0
Router_H.00-00	* 0x0000012F	0xEA6C	42	0/0/0
<b>Router_H.01-00</b>	<b>* 0x00000123</b>	<b>0xBA21</b>	<b>43</b>	<b>0/0/0</b>

您还可以检查DIS生成的子节点的LSP的详细信息。在此输出中，伪节点LSP Router\_H.01-00代表全网状WAN，它显示连接到网状网的所有路由器（就像LAN上的伪节点LSP一样）：

```
Router_E# show isis database detail Router_H.01-00
```

```
IS-IS Level-1 LSP Router_H.01-00
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
Router_H.01-00	0x00000DD6	0xFB20	42	0/0/0
Metric: 0 IS Router_H.00				
Metric: 0 IS Router_E.00				
Metric: 0 IS Router_G.00				

```
Router_G# show isis database detail Router_H.01-00
```

```
IS-IS Level-1 LSP Router_H.01-00
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
Router_H.01-00	0x00000DBE	0x2C08	35	0/0/0
Metric: 0 IS Router_H.00				
Metric: 0 IS Router_E.00				
Metric: 0 IS Router_G.00				

```
Router_H# show isis database detail Router_H.01-00
```

```
IS-IS Level-1 LSP Router_H.01-00
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
Router_H.01-00	* 0x00000126	0xB424	55	0/0/0
Metric: 0 IS Router_H.00				
Metric: 0 IS Router_G.00				
Metric: 0 IS Router_E.00				

## 配置不匹配问题

本部分检查由配置不匹配引起的问题。路由器F的Serial2.1子接口从点对点变为多点，从而在路由器F和H之间引入了问题。如下面的输出所示，当路由器H仍通过点对点子接口连接到路由器F时，路由器F的配置已更改。

- [路由器H](#)

- [路由器 F](#)

### 路由器H

```
clns routing
!
interface Serial0
  no ip address
  no ip directed-broadcast
  no ip mroute-cache
  encapsulation frame-relay
  frame-relay lmi-type ansi
!
interface Serial0.1 multipoint
  ip address 10.10.10.4 255.255.255.0
  no ip directed-broadcast
  ip router isis
  clns router isis
  frame-relay map clns 132 broadcast
  frame-relay map clns 131 broadcast
  frame-relay map ip 10.10.10.1 132 broadcast
  frame-relay map ip 10.10.10.3 131 broadcast
!
interface Serial0.2 point-to-point
  ip address 10.20.20.4 255.255.255.0
  no ip directed-broadcast
  ip router isis
  clns router isis
  frame-relay interface-dlci 130
!
router isis
  passive-interface Ethernet0
  net 49.0001.4444.4444.4444.00
  is-type level-1
```

### 路由器 F

```
clns routing
!
interface Serial2
  no ip address
  no ip directed-broadcast
  encapsulation frame-relay
  frame-relay lmi-type ansi
!
interface Serial2.1 multipoint
  ip address 10.20.20.2 255.255.255.0
  no ip directed-broadcast
  ip router isis
  clns router isis
  frame-relay interface-dlci 103
!
router isis
  net 49.0001.2222.2222.2222.00
  is-type level-1
```

现在，路由器H不再将路由器F视为IS-IS邻居。

Router\_H# **show clns neighbors**

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
Router_E	Se0.1	DLCI 132	Up	23	L1	IS-IS
Router_G	Se0.1	DLCI 131	Up	22	L1	IS-IS

路由器F将路由器H视为邻居；但邻接类型是IS而不是L1，协议是终端系统到中间系统(ES-IS)而不是IS-IS。这意味着路由器F存在邻接问题。

```
Router_F# show clns neighbors
```

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
Router_H	Se2.1	DLCI 103	Up	272	IS	ES-IS

## 问题原因

问题的根源在于路由器F在其多点子接口上发送LAN IIH，而路由器H在其点对点子接口上发送串行IIH。在路由器H上激活**debug isis adj packets**时，您可以看到它通过Serial0.2发送串行IIH。但是，您看不到任何IIH通过Serial0.2发送，尽管路由器F在Serial2.1上发送LAN IIH。

```
Router_H# debug isis adj-packets
```

```
IS-IS Adjacency related packets debugging is on
*Mar 2 01:11:10.065: ISIS-Adj: Rec L1 IIH from DLCI 131 (Serial0.1),
cir type L1, cir id4444.01, length 1500
*Mar 2 01:11:11.421: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 01:11:11.961: ISIS-Adj: Rec L1 IIH from DLCI 132 (Serial0.1),
cir type L1, cir id4444.01, length 1500
*Mar 2 01:11:14.657: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 01:11:15.205: ISIS-Adj: Sending serial IIH on Serial0.2, length 1499
*Mar 2 01:11:17.237: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 01:11:18.765: ISIS-Adj: Rec L1 IIH from DLCI 131 (Serial0.1),
cir type L1, cir id4444.01, length 1500
*Mar 2 01:11:20.181: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 01:11:21.861: ISIS-Adj: Rec L1 IIH from DLCI 132 (Serial0.1),
cir type L1, cir id4444.01, length 1500
*Mar 2 01:11:22.717: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 01:11:24.073: ISIS-Adj: Sending serial IIH on Serial0.2, length 1499
*Mar 2 01:11:25.845: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 01:11:27.289: ISIS-Adj: Rec L1 IIH from DLCI 131 (Serial0.1),
cir type L1, cir id4444.01, length 1500
*Mar 2 01:11:28.637: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 01:11:31.853: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 01:11:31.865: ISIS-Adj: Rec L1 IIH from DLCI 132 (Serial0.1),
cir type L1, cir id4444.01, length 1500
*Mar 2 01:11:33.181: ISIS-Adj: Sending serial IIH on Serial0.2, length 1499
*Mar 2 01:11:35.165: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
```

在路由器F上激活相同的调试时，您可以看到路由器F在其Serial2.1接口上从路由器H接收串行IIH，但它忽略了Hello。路由器F尝试发送的LAN IIH会因封装失败而丢弃。

```
Router_F# debug isis adj-packets
```

```
IS-IS Adjacency related packets debugging is on
*Mar 2 01:19:15.113: ISIS-Adj: Rec serial IIH from DLCI 103 (Serial2.1),
cir type L1, cir id 00, length 1499
*Mar 2 01:19:15.117: ISIS-Adj: Point-to-point IIH received
on multi-point interface: ignored IIH
*Mar 2 01:19:17.177: ISIS-Adj: Encapsulation failed for L1 LAN IIH on Serial2.1
*Mar 2 01:19:20.305: ISIS-Adj: Encapsulation failed for L1 LAN IIH on Serial2.1
*Mar 2 01:19:22.813: ISIS-Adj: Rec serial IIH from DLCI 103 (Serial2.1),
```

```

cir type L1, cir id 00, length 1499
*Mar 2 01:19:22.817: ISIS-Adj: Point-to-point IIH received
on multi-point interface: ignored IIH
*Mar 2 01:19:23.229: ISIS-Adj: Encapsulation failed for L1 LAN IIH on Serial2.1
*Mar 2 01:19:26.157: ISIS-Adj: Encapsulation failed for L1 LAN IIH on Serial2.1
*Mar 2 01:19:28.825: ISIS-Adj: Encapsulation failed for L1 LAN IIH on Serial2.1
*Mar 2 01:19:30.833: ISIS-Adj: Rec serial IIH from DLCI 103 (Serial2.1),
cir type L1, cir id 00, length 1499
*Mar 2 01:19:30.837: ISIS-Adj: Point-to-point IIH received
on multi-point interface: ignored IIH
*Mar 2 01:19:31.849: ISIS-Adj: Encapsulation failed for L1 LAN IIH on Serial2.1
*Mar 2 01:19:34.929: ISIS-Adj: Encapsulation failed for L1 LAN IIH on Serial2.1
*Mar 2 01:19:38.029: ISIS-Adj: Encapsulation failed for L1 LAN IIH on Serial2.1

```

这是对当链路类型不匹配时路由器F和H之间发生的情况的分析：

- LAN邻接使用握手，这会导致三种可能的状态之一：DOWN、INIT或UP。
- 1级IIH在Serial2.1子接口上从路由器F出站时存在封装故障，因为它在多点子接口下没有[frame-relay map clns](#)命令转发IS-IS PDU。
- 路由器H没有收到来自路由器F的任何LAN IIH，因为路由器F在发送LAN IIH时有封装故障。
- 路由器F确实看到来自路由器H的串行IIH，但它忽略Hello，因为它在多点子接口上接收点对点Hello。路由器F确实检测到路由器H的IIH中缺失或出错，因此路由器F创建LAN邻接关系，但认为它是通过ES-IS而不是通过与IS-IS的L1类邻接关系获知的。

## 解决方案

解决方案是确保链路的两端均为点对点或多点。在这种情况下，将路由器F的Serial2.1子接口改回点对点接口，以匹配路由器H的Serial0.2接口上配置的子接口。更改后，摆动接口。

下一个调试输出显示更改后发生的情况，路由器F的Serial2接口已断开。现在，路由器F能够在其Serial2.1接口上发送和接收串行IIH。

```

Router_F# debug isis adj-packets
*Mar 2 04:32:37.276: %LINK-5-CHANGED: Interface Serial2,
changed state to administratively down
*Mar 2 04:32:38.316: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2,
changed state to down
*Mar 2 04:32:45.868: %LINK-3-UPDOWN: Interface Serial2, changed state to up
*Mar 2 04:32:46.868: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2,
changed state to up
*Mar 2 04:33:05.896: ISIS-Adj: Sending serial IIH on Serial2.1, length 1499
*Mar 2 04:33:13.312: ISIS-Adj: Rec serial IIH from DLCI 103 (Serial2.1),
cir type L1, cir id 00, length 1499
*Mar 2 04:33:13.316: ISIS-Adj: rcvd state DOWN, old state DOWN, new state INIT
*Mar 2 04:33:13.316: ISIS-Adj: Action = GOING UP, new type = L1
*Mar 2 04:33:13.320: ISIS-Adj: New serial adjacency
*Mar 2 04:33:13.324: ISIS-Adj: Sending serial IIH on Serial2.1, length 1499
*Mar 2 04:33:14.196: ISIS-Adj: Rec serial IIH from DLCI 103 (Serial2.1),
cir type L1, cir id 00, length 1499
*Mar 2 04:33:14.204: ISIS-Adj: rcvd state INIT, old state INIT, new state UP
*Mar 2 04:33:14.204: ISIS-Adj: Action = GOING UP, new type = L1
*Mar 2 04:33:14.208: ISIS-Adj: L1 adj count 1
*Mar 2 04:33:14.212: ISIS-Adj: Sending serial IIH on Serial2.1, length 1499
*Mar 2 04:33:15.100: ISIS-Adj: Rec serial IIH from DLCI 103 (Serial2.1),
cir type L1, cir id 00, length 1499
*Mar 2 04:33:15.100: ISIS-Adj: rcvd state UP, old state UP, new state UP
*Mar 2 04:33:15.104: ISIS-Adj: Action = ACCEPT

```



```
*Mar 2 04:33:22.924: ISIS-Adj: Rec serial IIH from DLCI 103 (Serial2.1),
cir type L1, cir id 00, length 1499
*Mar 2 04:33:22.928: ISIS-Adj: rcvd state UP, old state UP, new state UP
*Mar 2 04:33:22.932: ISIS-Adj: Action = ACCEPT
```

从路由器H的角度来看，配置恢复正常：

```
Router_H# show clns neighbors
```

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
Router_E	Se0.1	DLCI 132	Up	28	L1	IS-IS
<b>Router_F</b>	<b>Se0.2</b>	<b>DLCI 130</b>	<b>Up</b>	<b>21</b>	<b>L1</b>	<b>IS-IS</b>
Router_G	Se0.1	DLCI 131	Up	28	L1	IS-IS

debug isis adj packets命令输出也恢复正常：

```
Router_H# debug isis adj-packets
```

```
*Mar 2 04:40:19.376: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 04:40:21.944: ISIS-Adj: Rec L1 IIH from DLCI 132 (Serial0.1),
cir type L1, cir id 4444.4444.01, length 1500
*Mar 2 04:40:22.020: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 04:40:22.428: ISIS-Adj: Rec L1 IIH from DLCI 131 (Serial0.1),
cir type L1, cir id 4444.4444.01, length 1500
*Mar 2 04:40:24.740: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 04:40:24.780: ISIS-Adj: Rec serial IIH from DLCI 130 (Serial0.2),
cir type L1, cir id 0ngth 1499
*Mar 2 04:40:24.784: ISIS-Adj: rcvd state UP, old state UP, new state UP
*Mar 2 04:40:24.784: ISIS-Adj: Action = ACCEPT
*Mar 2 04:40:26.068: ISIS-Adj: Sending serial IIH on Serial0.2, length 1499
*Mar 2 04:40:27.516: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 04:40:30.432: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 04:40:31.152: ISIS-Adj: Rec L1 IIH from DLCI 132 (Serial0.1),
cir type L1, cir id 4444.4444.01, length 1500
*Mar 2 04:40:31.540: ISIS-Adj: Rec L1 IIH from DLCI 131 (Serial0.1),
cir type L1, cir id 4444.4444.01, length 1500
*Mar 2 04:40:33.292: ISIS-Adj: Rec serial IIH from DLCI 130 (Serial0.2),
cir type L1, cir id 0ngth 1499
*Mar 2 04:40:33.296: ISIS-Adj: rcvd state UP, old state UP, new state UP
*Mar 2 04:40:33.296: ISIS-Adj: Action = ACCEPT
*Mar 2 04:40:33.664: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
*Mar 2 04:40:34.420: ISIS-Adj: Sending serial IIH on Serial0.2, length 1499
*Mar 2 04:40:36.328: ISIS-Adj: Sending L1 LAN IIH on Serial0.1, length 1500
```

## [相关信息](#)

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