

Understanding IS–IS Pseudonode LSP

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Introduction

Prerequisites

Requirements

Components Used

Conventions

DIS and the Pseudonode

What is the DIS?

Election of the DIS

What is the Pseudonode (PSN)?

Pseudonode LSP

Example

Network Diagram

Configurations

IS–IS Database

Related Information

Introduction

This document describes the link–state packet (LSP) pseudonode. A pseudonode is a logical representation of the LAN which is generated by a Designated Intermediate System (DIS) on a LAN segment. The document also describes the propagation of information to the routers.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

The information in this document is based on the software and hardware versions associated with:

- Cisco IOS® Software Release 12.1(5)T9.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

DIS and the Pseudonode

This section describes DIS and the pseudonode.

What is the DIS?

On broadcast multi-access networks, a single router is elected as the DIS. There is no backup DIS elected. The DIS is the router that creates the pseudonode and acts on behalf of the pseudonode.

Two major tasks are performed by the DIS:

- Creating and updating pseudonode LSP for reporting links to all systems on the broadcast subnetwork. See the Pseudonode LSP section for more information.
- Flooding LSPs over the LAN.

Flooding over the LAN means that the DIS sends periodic complete sequence number protocol data units (CSNPs) (default setting of 10 seconds) summarizing the following information:

- LSP ID
- Sequence Number
- Checksum
- Remaining Lifetime

The DIS is responsible for flooding. It creates and floods a new pseudonode LSP for each routing level in which it is participating (Level 1 or Level 2) and for each LAN to which it is connected. A router can be the DIS for all connected LANs or a subset of connected LANs, depending on the IS-IS priority or the Layer 2 address. The DIS will also create and flood a new pseudonode LSP when a neighbor adjacency is established, torn down, or the refresh interval timer expires. The DIS mechanism reduces the amount of flooding on LANs.

Election of the DIS

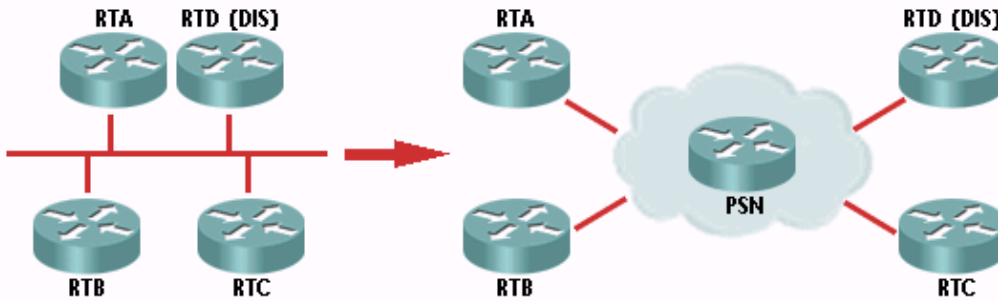
On a LAN, one of the routers elects itself the DIS, based on interface priority (the default is 64). If all interface priorities are the same, the router with the highest subnetwork point of attachment (SNPA) is selected. The SNPA is the MAC address on a LAN, and the local data link connection identifier (DLCI) on a Frame Relay network. If the SNPA is a DLCI and is the same at both sides of a link, the router with the higher system ID becomes the DIS. Every IS-IS router interface is assigned both a L1 priority and a L2 priority in the range from 0 to 127.

The DIS election is preemptive (unlike OSPF). If a new router boots on the LAN with a higher interface priority, the new router becomes the DIS. It purges the old pseudonode LSP and floods a new set of LSPs.

What is the Pseudonode (PSN)?

In order to reduce the number of full mesh adjacencies between nodes on multiaccess links, the multiaccess link itself is modeled as a pseudonode. This is a virtual node, as the name implies. The DIS creates the pseudonode. All routers on the broadcast link, including the DIS, form adjacencies with the pseudonode.

Representation of a Pseudonode:



In IS-IS, a DIS does not synchronize with its neighbors. After the DIS creates the pseudonode for the LAN, it sends hello packets for each Level (1 and 2) every three seconds and CSNPs every ten seconds. The hello packets indicate that it is the DIS on the LAN for that level, and the CSNPs describe the summary of all the LSPs, including the LSP ID, sequence number, checksum, and remaining lifetime. The LSPs are always flooded to the multicast address and the CSNP mechanism only corrects for any lost protocol data units (PDUs). For example, a router can ask the DIS for a missing LSP using a partial sequence number packet (PSNP) or, in turn, give the DIS a new LSP.

CSNPs are used to tell other routers about all the LSPs in one router's database. Similar to an OSPF database descriptor packet, PSNPs are used to request an LSP and acknowledge receipt of an LSP.

Pseudonode LSP

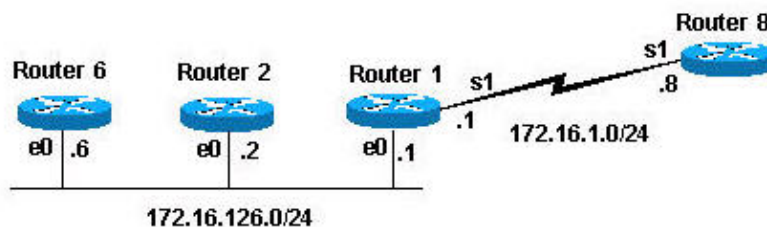
The pseudonode LSP is generated by the DIS. The DIS reports all LAN neighbors (including the DIS) in the pseudonode LSP with a metric of zero. All LAN routers, including the DIS, report connectivity to the pseudonode in their LSPs. This is similar in concept to the network LSA in OSPF.

Example

We'll use the following network diagram to demonstrate how the pseudonode LSP, generated by the DIS, is used to report all LAN neighbors.

Note: In the example below, the dynamic hostname feature is enable. Therefore, the system IDs are automatically mapped to the router hostnames shown in the resulting output of the show commands below.

Network Diagram



Configurations

These configurations were used for the routers shown in the network diagram:

Router ISIS
Router 6

```

interface e0
ip address 172.16.126.6 255.255.255.0
ip router isis
isis priority 127

router isis
net 49.0001.0000.0c4a.4598.00
is-type level-1

```

Router 2

```

interface e0
ip address 172.16.126.2 255.255.255.0
ip router isis

router isis
net 49.0001.0000.0c8d.e6b4.00
is-type level-1

```

Router 1

```

interface e0
ip address 172.16.126.1 255.255.255.0
ip router isis

interface s1
ip address 172.16.1.1 255.255.255.0
ip router isis

router isis
net 49.0001.0000.5c75.d0e9.00
is-type level-1

```

Router 8

```

interface s1
ip address 172.16.1.8 255.255.255.0
ip router isis

router isis
net 49.0001.0000.0c31.c2fd.00
is-type level-1c

```

The following table breaks down the area, MAC address, and network for each of the routers configured above. Notice that all of the routers are in the same area.

Router	Area	MAC Address	NET (Network Entity Title)
6	49.0001	0000.0c4a.4598	49.0001.0000.0c4a.4598.00
2		0000.0c8d.e6b4	49.0001.0000.0c8d.e6b4.00
1		0000.5c75.d0e9	49.0001.0000.5c75.d0e9.00
8		0000.0c31.c2fd	49.0001.0000.0c31.c2fd.00

With the routers configured as described in this section, you can use the **show clns is-neighbor** command to view the IS-IS neighbors:

```

router-6# show clns is-neighbor

```

System Id	Interface	State	Type	Priority	Circuit Id	Format
router-2	Et0	Up	L1	64	router-6.01	Phase V
router-1	Et0	Up	L1	64	router-6.01	Phase V

router-2# **show clns is-neighbor**

System Id	Interface	State	Type	Priority	Circuit Id	Format
router-6	Et0	Up	L1	127	router-6.01	Phase V
router-1	Et0	Up	L1	64	router-6.01	Phase V

router-1# **show clns is-neighbor**

System Id	Interface	State	Type	Priority	Circuit Id	Format
router-6	Et0	Up	L1	127	router-6.01	Phase V
router-2	Et0	Up	L1	64	router-6.01	Phase V
router-8	Sel	Up	L1	0	00	Phase V

router-8# **show clns is-neighbor**

System Id	Interface	State	Type	Priority	Circuit Id	Format
Router-1	Sel	Up	L1	0	00	Phase V

In the preceding neighbor lists, notice the routers connected to the multiaccess network (Ethernet) all have the same circuit ID. The circuit ID is a one-octet number that the router uses to uniquely identify the IS-IS interface. If the interface is attached to a multiaccess network, the circuit ID is concatenated with the system ID of the DIS. This is known as the pseudonode ID. Notice also, that the DIS is Router 6 because of the IS-IS priority configured under its Ethernet interface.

IS-IS Database

This output displays the IS-IS database from each of the routers described in the previous section:

Router-6# **show isis database**

IS-IS Level-1 Link State Database:					
LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL	
router-8.00-00	0x0000006E	0xFF1A	960	0/0/0	
router-6.00-00	* 0x0000006D	0xDD58	648	0/0/0	
router-6.01-00	* 0x00000069	0x6DCB	1188	0/0/0	
router-2.00-00	0x0000006D	0x59DE	589	0/0/0	
router-1.00-00	0x00000074	0xC4B0	759	0/0/0	

router-2# **show isis database**

IS-IS Level-1 Link State Database:					
LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL	
router-8.00-00	0x0000006E	0xFF1A	947	0/0/0	
router-6.00-00	0x0000006D	0xDD58	633	0/0/0	
router-6.01-00	0x00000069	0x6DCB	1172	0/0/0	
router-2.00-00	* 0x0000006D	0x59DE	577	0/0/0	
router-1.00-00	0x00000074	0xC4B0	746	0/0/0	

router-1# **show isis database**

IS-IS Level-1 Link State Database:					
LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL	
router-8.00-00	0x0000006E	0xFF1A	934	0/0/0	
router-6.00-00	0x0000006D	0xDD58	619	0/0/0	

```

router-6.01-00      0x00000069   0x6DCB      1158         0/0/0
router-2.00-00      0x0000006D   0x59DE      561          0/0/0
router-1.00-00      * 0x00000074  0xC4B0      734          0/0/0
router-1#

router-8# show isis database
IS-IS Level-1 Link State Database
LSPID                LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
router-8.00-00*      0x0000006E   0xFF1A       927           0/0/0
router-6.00-00       0x0000006D   0xDD58       607           0/0/0
router-6.01-00       0x00000069   0x6DCB       1147          0/0/0
router-2.00-00       0x0000006D   0x59DE       550           0/0/0
router-1.00-00       0x00000074   0xC4B0       723           0/0/0
router-8#

```

As the preceding output indicates, the **show isis database** command displays a list of LSPs in the database. In this case, all routers are Level 1 routers in the same area, so they all have the same LSPs in their IS-IS database. Notice that each of the routers generates an LSP. The DIS generates an LSP for itself, and it also generates an LSP on behalf of the pseudonode. The pseudonode LSP in this example is 0000.0C4A.4598.01-00.

We mentioned that the routers on the LAN only send advertisements to the pseudonode of the LAN. The pseudonode reports all LAN neighbors, in the pseudonode LSP, with a metric of zero as shown in these **show isis database lsp detail** command output examples:

- Router 6 LSP (as seen from Router 8)

Notice that router 6 advertises that it can only reach its directly-connected network and the pseudonode. In this case, the pseudonode has a metric of 10. As we mentioned, routers on the LAN will advertise that they can be reached to the pseudonode of the LAN only.

```

router-8# show isis database router-6.00-00 detail
IS-IS Level-1 LSP router-6.00-00
LSPID                LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
router-6.00-00       0x00000071   0xD55C       456           0/0/0
  Area Address: 49.0001
  NLPID:             0xCC
  Code:              137 Length: 8
  IP Address:        172.16.126.6
  Metric: 10 IP 172.16.126.0 255.255.255.0
  Metric: 10 IS router-6.01
router-8#

```

- Pseudonode LSP (as seen from Router 8)

The pseudonode LSP advertises all the LAN neighbors with a metric of zero. The pseudonode LSP is generated by the DIS, Router 6 in this case, on behalf of the pseudonode.

```

Router-8# show isis database router-6.01-00 detail
IS-IS Level-1 LSP router-6.01-00
LSPID                LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
router-6.01-00       0x0000006D   0x65CF       759           0/0/0
  Metric: 0 IS router-6.00
  Metric: 0 IS router-2.00
  Metric: 0 IS router-1.00
router-8#

```

- Router 2 LSP (as seen from Router 8)

Again, the Router 2 LSP contains information as to whether it can reach its directly-connected network and the pseudonode only.

```

Router-8# show isis database router-2.00-00 detail
IS-IS Level-1 LSP router-2.00-00
LSPID                LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
router-2.00-00       0x00000072   0x4FE3        791            0/0/0
  Area Address: 49.0001
  NLPID:          0xCC
  Code:          137 Length: 8
  IP Address:    172.16.126.2
  Metric: 10 IP 172.16.126.0 255.255.255.0
  Metric: 10 IS router-6.01
router-8#

```

- Router 1 LSP (as seen from Router 8)

The only information the Router 1 LSP contains for the LAN network is the network itself and whether it can reach the pseudonode. Since Router 1 is also connected to another network, the serial network, this directly-connected network is also advertised.

```

Router-8# show isis database router-1.00-00 detail
IS-IS Level-1 LSP router-1.00-00
LSPID                LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
router-1.00-00       0x00000079   0xBAB5        822            0/0/0
  Area Address: 49.0001
  NLPID:          0xCC
  Code:          137 Length: 8
  IP Address:    172.16.1.1
  Metric: 10 IP 172.16.126.0 255.255.255.0
  Metric: 10 IP 172.16.1.0 255.255.255.0
  Metric: 10 IS router-6.01
  Metric: 10 IS router-8.00
router-8#

```

- Router 8 LSP

In this case, Router 8 is not connected to the LAN, so it does not advertise to the pseudonode that it can be reached. It does, however, advertise (that it can be reached) to itself, router 1, and to the directly-connected network.

```

Router-8# show isis database router-8.00-00 detail
IS-IS Level-1 LSP router-8.00-00
LSPID                LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
router-8.00-00*      0x00000072   0xF71E        554            0/0/0
  Area Address: 49.0001
  NLPID:          0xCC
  IP Address:    172.16.1.8
  Metric: 10 IP 172.16.1.0 255.255.255.0
  Metric: 10 IS router-1.00
  Metric: 0  ES router-8
router-8#

```

Related Information

- [IP Routing Support Page](#)
 - [IS-IS Support Page](#)
 - [Technical Support – Cisco Systems](#)
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