IS-IS Hellos and Circuit IDs

IIHs (IS-IS Hellos)

Hellos are used to establish adjacencies. IS-IS links can be point-to-point or broadcast. In the event that a link is L1L2 over a point-to-point link, the hellos for both levels will be combined into one Hello. If the link were a broadcast, there would be separate hellos for L1 and L2. Of course if the neighbour is L1 only or L2 only, then only L1 or L2 hellos will be sent respectively.

Default hello timer is 10s.
Default Holdtime multiplier is 3.

CSNPs, PSNPs and LSPs and broadcast IIHs are send to the following multicast MAC addresses:
> 0180.c200.0014 for level 1
> 0180.c200.0015 for level 2

IIHs for point-to-point networks use the destination MAC of 0900.2b00.0005

Circuit IDs

Each interface has a Local Circuit ID (1 byte) unless an extended circuit ID is used, in which case it is 4 bytes.

On point-to-point links these are only used in IIHs to a detect change of identity on the other end.

On broadcast links the local-circuit ID is the pseudo-node of the router that is the DIS.

The formats of the IIHs are different for Point-to-point and broadcast networks. Point-to-point uses an state based system (down, init and up) whereas broadcast networks recognise their own MAC addresses in the IIHs of their potential neighbours and then perform a DIS election. Details are on the following pages.

IS-IS
Point-to-Point Networks

Forming Adjacency

ISIS Point-to-Point Adjacency States

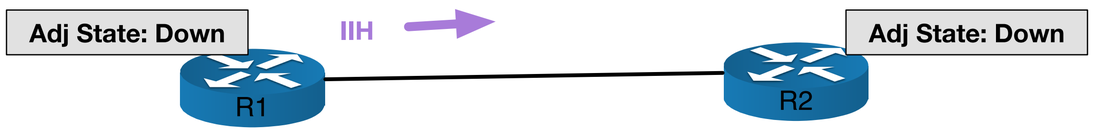
State	Description
Down	No IIHs received from neighbors.
Initializing	IIH received from neighbor but unclear its sent IIHs are being received.
Up	Two way communication has been seen and adjacency is up.

IIH Point-to-Point TLVs

TLV Contents
Adjacency 3-way State
Extended Local Circuit ID
Neighbor System ID
Neighbor Extended Local Circuit ID

TLV Contents	TLV Contents
Adjacency 3-way State	Down
Extended Local Circuit ID	0x1
Neighbor System ID	-
Neighbor Extended Local Circuit ID	-

Initiating router sets Adjacency to Down and local circuit ID to its own value.

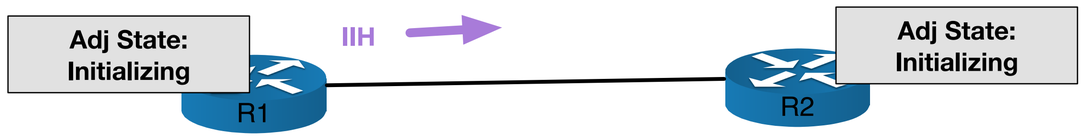


TLV Contents	TLV Contents
Adjacency 3-way State	Initializing
Extended Local Circuit ID	0x2
Neighbor System ID	0000.0000.0001
Neighbor Extended Local Circuit ID	0x1

Receiving router responds but moves to initialising state

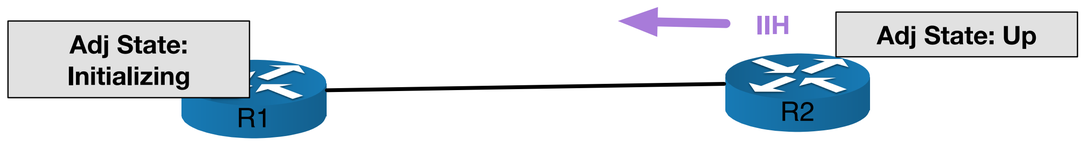
TLV Contents	TLV Contents
Adjacency 3-way State	Initializing
Extended Local Circuit ID	0x1
Neighbor System ID	0000.0000.0002
Neighbor Extended Local Circuit ID	0x2

When R1 sees its own Neighbor System ID it too moves to initialising

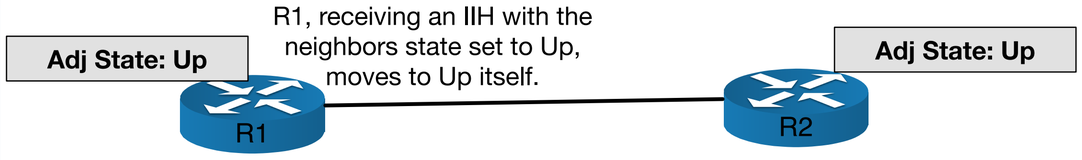


TLV Contents	TLV Contents
Adjacency 3-way State	Up
Extended Local Circuit ID	0x2
Neighbor System ID	0000.0000.0001
Neighbor Extended Local Circuit ID	0x1

Upon receipt of an IIH, and being in an initiliaztion state itself, R2 knows there is full two-way communication so moves to an Up state.



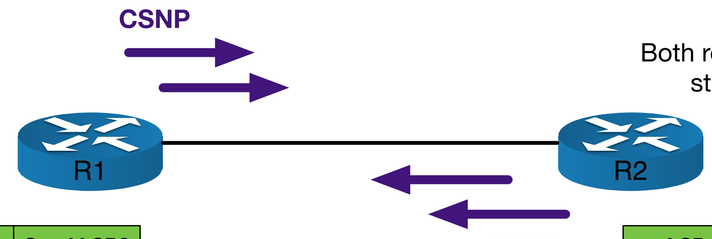
R1, receiving an IIH with the neighbors state set to Up, moves to Up itself.



Older Handshake method

There is an older method of using a 3-way handshake, in which the neighbor information is not included in the TLV. The first router sending an IIH moves straight to initialising before seeing its own neighbor ID in an IIH. The receiving router immediately moves to an Up state before responding. This was abandoned due to potential issues over non-broadcast multi-access networks like *frame relay. Change to this method using* Cisco IOS **`isis three-way-handshake ietf`** interface command.

Synchronisation

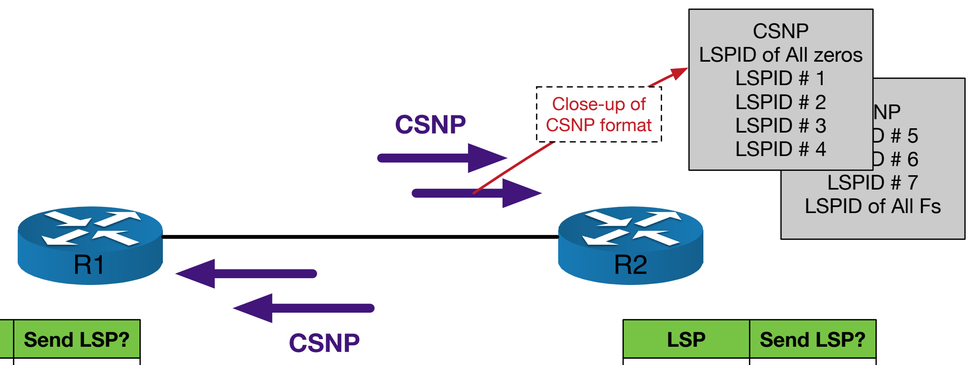


Both routers 3-way state is up

LSP	Send LSP?
#1	YES
#2 (old)	YES
#3	YES
#4	YES
#5	YES

LSP	Send LSP?
#1	YES
#2	YES
#3	YES
#6	YES
#7	YES

Both routers want to send all LSPs, but they exchange CSNPs first to see if it is necessary.

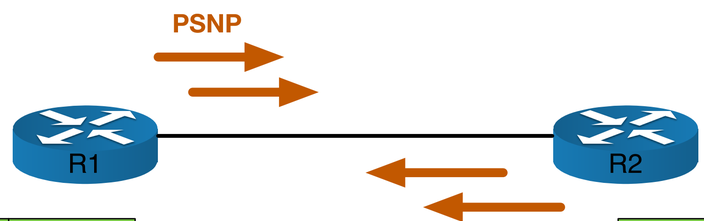


LSP	Send LSP?
#1	NO
#2 (old)	REQUEST
#3	NO
#4	YES
#5	YES
#6	REQUEST
#7	REQUEST

LSP	Send LSP?
#1	NO
#2	REQUEST
#3	NO
#6	YES
#7	YES
#4	REQUEST
#5	REQUEST

Upon receipt of their neighbours CSNPs the each router will discover:

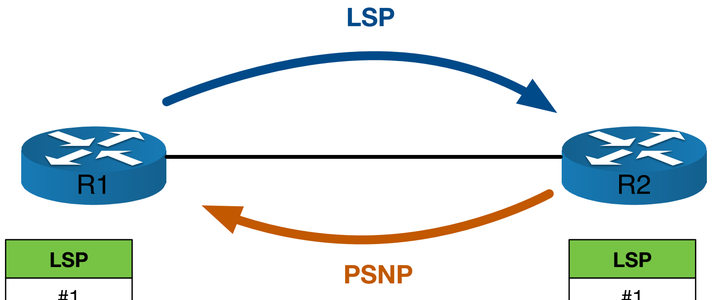
> Which LSPs they both already have.
> Which LSPs the neighbor has but they don't.
> Which LSPs the neighbor has a more up-to-date version of.



LSP	Send LSP?
#1	NO
#2 (old)	REQUEST
#3	NO
#4	YES
#5	YES
#6	REQUEST
#7	REQUEST

LSP	Send LSP?
#1	NO
#2	REQUEST
#3	NO
#6	YES
#7	YES
#4	REQUEST
#5	REQUEST

To optionally increase efficiency each router will request the ones it needs from its neighbor using PSNPs.



LSP
#1
#2
#3
#4
#5
#6
#7

LSP
#1
#2
#3
#4
#5
#6
#7

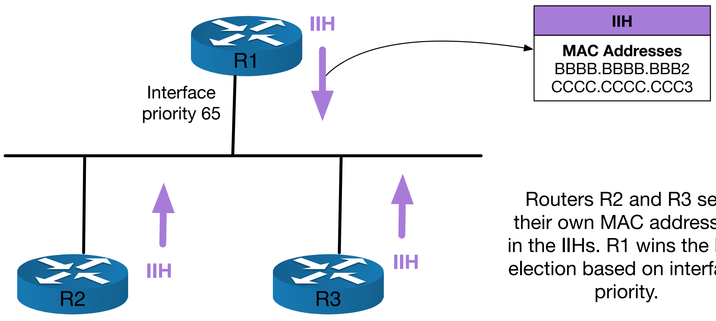
LSPs are exchanged. Each LSP is acknowledged with a PSNP containing the same LSPID. This is because CSNPs are not periodically sent on point-to-point links by default. You can change this behaviour using the Cisco IOS **`isis csnp-interval <sec>`** interface command.

IS-IS
Broadcast Networks
DIS Election

The broadcast network IIHs include the MAC addresses of any potential neighbors that the sending router sees out of its interface. Once routers see their own MAC addresses in the IIHs of its neighbours a DIS election is performed.

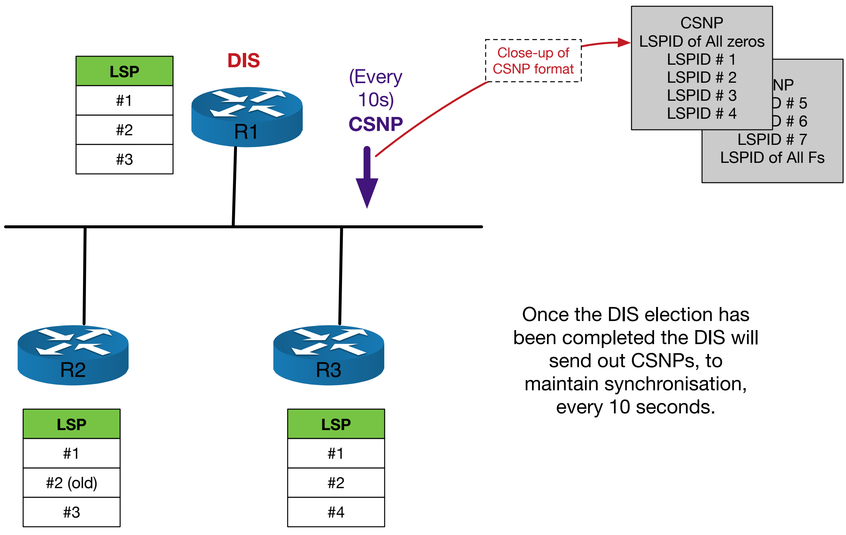
DIS Election

1. Highest interface priority (range 0-127, default 64)
2. Highest SNPA (MAC)
3. Highest System ID

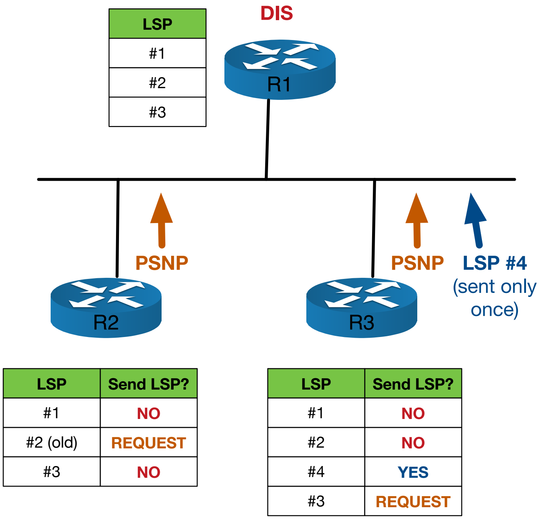


Routers R2 and R3 see their own MAC addresses in the IIHs. R1 wins the DIS election based on interface priority.

Synchronization



Once the DIS election has been completed the DIS will send out CSNPs, to maintain synchronisation, every 10 seconds.

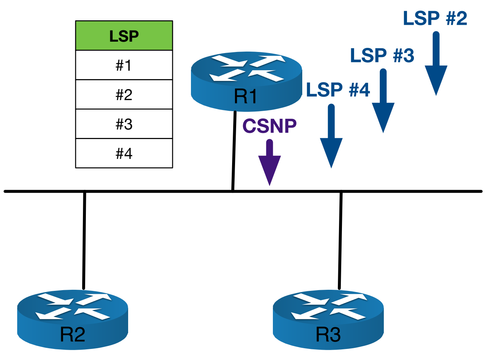


LSP	Send LSP?
#1	NO
#2 (old)	REQUEST
#3	NO

LSP	Send LSP?
#1	NO
#2	NO
#4	YES
#3	REQUEST

Non-DIS routers request missing or outdated LSPs using PSNPs.

If the DIS has a missing or outdated LSPs the non-DIS routers will send updates to inform the DIS.



The DIS will respond to requests by sending LSPs. It will also send periodic updates.

LSP
#1
#2 (old)
#3

LSP
#1
#2
#4
#3

Though not shown here, once R2 and R3 receive the LSPs, all LSDBs will be synchronised.