

ثبلا زارط - ي لصلأا ددعتملا ثبلا قفدت ردصم يأل ددعتملا

تايوتحملا

[عمدقملا](#)

[عيساسأ تامولعم](#)

[IGMP ريرقت ةلاس رلسري هناف، اطشن لبقتسملا نوكي امدنع. 1. ةوطخلا](#)

[اطشن ردصملا نوكي امدنع. 2. ةوطخلا](#)

[جذومنلل ةكرتشملا ةرجشلا. 3. ةوطخلا](#)

[FHR يلا لصت يتلا ةمزحلا \(S,G\). 4. ةوطخلا](#)

[ةرجشلا ربع لبقتسملا يلا لوصول، ددعتملا ثبلا ةمزحل لوالا قفدتلا. 5. ةوطخلا](#)

[ةكرتشملا](#)

[ةرجشلا وحن بيذشت ةلاس رلسرتو SPT نم تانايبلا رورم ةكرح LHR يقلتت. 6. ةوطخلا](#)

[ةكرتشملا](#)

عمدقملا

(ASM) ردصم يأل ددعتملا ثبلا جذومنل ةمزحلا قفدت دنتسملا اذه فصي

عيساسأ تامولعم

لي لحتو ي لصلأا ددعتملا ثبلا ةمزح قفدتل لي صافاتلا ةمزح قفدت دنتسملا اذه مدقي
مكحتلا يوتسم ي ف مزحلا قفدتو لي صافاتلا لي لحت جارخا لوح فصي اذهو. اهتاجرخم
هيجوتلا ةداعا يوتسمو.

نأ نكمي هنا ينعى اذه. ل س ر م ل ة فر ع م ل ت س م ل ه ي ف ك ل م ي ا ل ي ذ ل ج ذ م ن ل و ه ASM
ي ت ل د د ع ت م ل ث ب ل ا ة ع و م ج م ب ا ل م ل ت س م ل م ل ع ي ا ل . ر د ص م ي ا ن م ر و ر م ة ك ر ح م ل ت س ي
ة ك ر ح ي ق ل ت ي ف ك ا ر ت ش ا ل ل (IGMP) ت ن ر ت ن ا ل ا ة ع و م ج م ة ر ا د ا ل و ك و ت و ر ب و ل س ر م ل ا ه م د خ ت س ي
ن ا و ن ع ل ا ذ ه ل ة ه ج و م ل ا ت ا ن ا ي ب ل ا ر و ر م .

دنتسملا اذه ي ف اذه لك ةيطغت متي:

1. اطشن لبقتسملا نوكي امدنع ثدحي اذام.

2. اطشن ردصملا نوكي امدنع ثدحي اذام.

3. ءاقتلالا ةطقن دنع لجسلا مالتسا دنع ثدحي ام (RP).

4. ي ل و ا ل ا ة و ط خ ل ا ه ج و م ي ت ح . (ز، س) ا ه ل ي ك ش ت م ت ف ي ك . (FHR).

5. ل و ا ل د د ع ت م ل ث ب ل ا ق ف د ت ه ق ر غ ت س ي ي ذ ل ا ر ا س م ل و ه ا م .

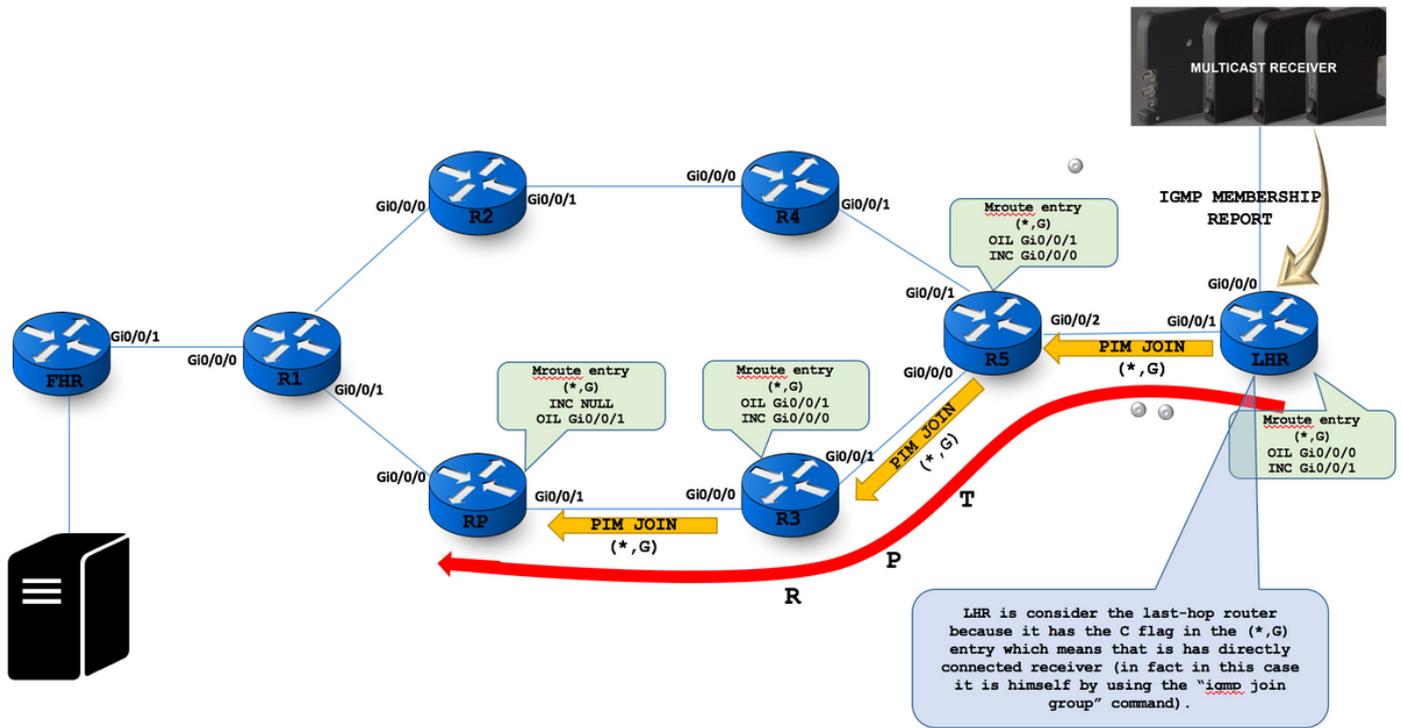
6. (LHR) ةريخألا ةوطخلا هجوم ي ف ناريدم لبقتسمي امدنع ثدحي اذام.

7. ثودح ببسو ثدحي ام امامت. ةكرتشم ةرجش ربع (SPT) راسم ةرجش رصقأ نيوكت متي فيك.
لي وحتلا

ثب ل هجوت لوكوتوربك (PIM) لوكوتوربلا نع لقتسمل ددتمال ثبلا مادختسا متي
 مادختسا متي، ASM، ددتمال ثبلا ةرجش عاشنال لبقتسمل او ردصملا ني ب ددتمال
 ثبلا ةومجم ناونع لبقتسمل G لثمي و ردصم ي* لثمي شيح (*،G) ددتمال ثبلا لاخذ
 رورملا ةكرح مالتساب متهي يذلا ددتمال

ةلاسر لسري هناف، اطشن لبقتسمل نوكي ام دنع 1. ةوطخلال ريرقت IGMP

- امامضنا ةلاسر كلذ دعب (DR) نعيمال هجومال لسري، ملتسمل امامتها ريبعت يقلت دنع
 هذه ددتمال ثبلا ةومجم RP لىل PIM
 - ةفاكل G ةومجمال لىل مضنت اهنال "مامضنا" (*،G) مساب هذه امامضنال ةلاسر فرعتو
 ةومجمال هذه لىل رداصل
 - لىل مضنت (*،G) هجوم لك يف G ةومجمال ددتمال ثبلا ةرجش ةلاجل ليثم عاشنال متي
 هلالخ رمت هجوم لك يفو، ةومجمال RP هاجتلا يف اهعطق متي يتلا توطخلال
- هنا ينعى امام (*،G) لاخذ يف C ةمالعل لىل ع يوتحي هنال ةريخالا ةوطخلال هجوم LHR ربتعت
 مادختساب هسفن وه ةلاجل هذه يف عقاولا يف) ةرشابم لصتم لبقتسلا زاهج لىل ع يوتحي
 (IGMP لاصتا ةومجم رما



Step 1 : On receiving the receiver's expression of interest, the DR then sends a PIM Join message towards the RP for that multicast group. This Join message is known as a [*G] Join because it joins group G for all sources to that group. The [*G] Join travels hop-by-hop towards the RP for the group, and in each router it passes through, multicast tree state for group G is instantiated.

```

LDR#6# in igmp groups
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires    Last Reporter  Group Accounted
224.1.1.1          GigabitEthernet1/0  00:37:30  00:02:02  10.0.108.8
224.0.1.40        FastEthernet0/0    01:21:01  00:02:43  10.0.78.8
  
```

```

LDR#6# in routes
(*, 224.1.1.1), 00:00:29/00:02:30, RP 4.4.4.4, Flags: SPC
  Incoming interface: GigabitEthernet1/0/1, RPF nbr 10.0.78.7
  Outgoing interface list:
    GigabitEthernet0/0/0, Forward/Sparse
  
```

C Flag in the [*G] entry which means that it has directly connected receiver.

```

RP #6# in routes
(*, 224.1.1.1), 00:10:39/00:02:30, RP 4.4.4.4, Flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    FastEthernet0/0, Forward/Sparse
  
```

The value of "0.0.0.0" means self, and it appears in the output if the router is the RP itself

E Flag Sparse mode created.

```

(*, 224.0.1.40), 01:56:40/00:02:58, RP 4.4.4.4, Flags: SPMCL
  Incoming interface: FastEthernet0/0, RPF nbr 10.0.78.7
  Outgoing interface list: Null (*, 224.0.1.40), 01:56:40/00:02:58, RP 4.4.4.4, Flags: SPMCL
  Incoming interface: FastEthernet0/0, RPF nbr 10.0.78.7
  Outgoing interface list: Null
  
```

There is a single [*G] entry for the group 224.0.1.40 which is Auto-RP Discovery group address.

NOTE : To prevent a stale PIM-SM forwarding state from getting stuck in the routers, it is given a finite lifetime (5 minutes), after which it is deleted. Routers refresh shared trees by periodically (once a minute) sending [*G] Joins to the upstream neighbor in the direction of the RP.

Actually the PIM register message encapsulates the multicast packet sent by the source into a unicast packet.

```

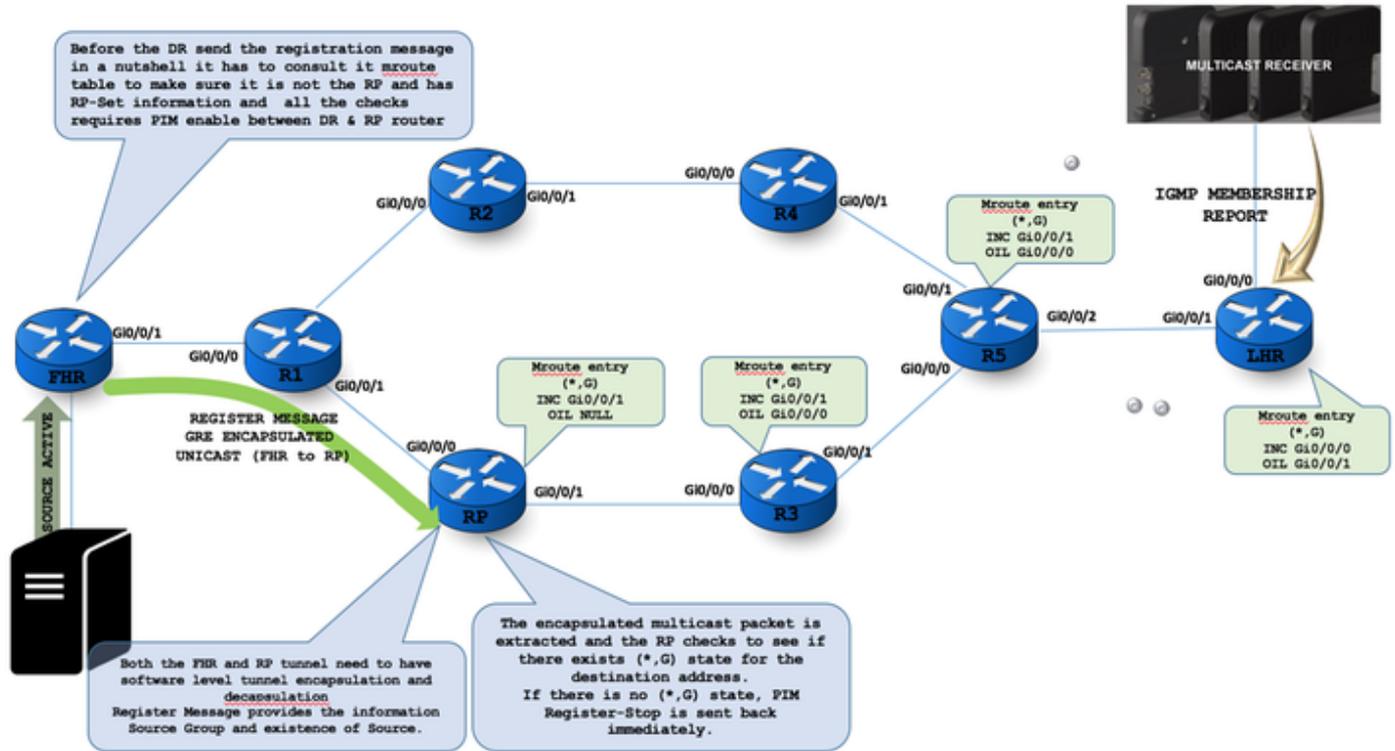
▶ Frame 59: 68 bytes on wire (544 bits), 68 bytes captured (544 bits) on interface 0
▶ Ethernet II, Src: ca:08:fa:92:00:00 (ca:08:fa:92:00:00), Dst: IPv4mcast_0d (01:00:5e:00:00:0d)
▼ Internet Protocol Version 4, Src: 10.0.78.8, Dst: 224.0.0.13
  0100 ... = Version: 4
  ... 0101 = Header Length: 20 bytes
  ▶ Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
  Total Length: 54
  Identification: 0x0b27 (2855)
  ▶ Flags: 0x00
  Fragment offset: 0
  Time to live: 1
  Protocol: PIM (103)
  ▶ Header checksum: 0x7565 [validation disabled]
  Source: 10.0.78.8
  Destination: 224.0.0.13
  [Source GeoIP: Unknown]
  [Destination GeoIP: Unknown]
▼ Protocol Independent Multicast
  0010 ... = Version: 2
  ... 0011 = Type: Join/Prune (3)
  Reserved byte(s): 00
  Checksum: 0x87c7 [correct]
▼ PIM Options
  Upstream-neighbor: 10.0.78.7
  Reserved byte(s): 00
  Num Groups: 1
  Holdtime: 210
  ▼ Group 0: 224.10.10.10/32
    ▶ Num Joins: 1
    Num Prunes: 0
  
```

TTL is always 1. Which means it's a RP/RE destined packet.

PIM JOIN Message carries the active group address

اطشن ردصم ل نوکي ام دنع 2. ةوطخلال

- هنا نم دكأتل ل راسم ل لودج ةعجارم هيلع ، زاجي اب ، ليجست ل ل ة ل اسر ر DR ل سر ي نأ ل بق بلطت ققحت ل ل تاي لمع عي مج نأ و RP ةعومجم تامولعم يلع يوتحي هنا و RP سيل
- ةلسب ك فوجمارب ل يوتسم يلع قفن ل ل ني مضت ي ل RP و FHR قفن نم لك جاتحي
- ردصم ل دوجو و تامولعم ل ردصم ةعومجم ليجست ل ل ة ل اسر ر رفوت
- ة ل ا ك انه تناك اذا ام ة فرعمل RP ققحتي و فلغم ل لدعت م ل ثب ل ة مزح جارختس ا متي ةه جول ناو نعل
- اروف PIM ليجست فاق ي ل ل اسر ا متي ، (*,G) ة ل ا دوجو مدع ة ل ا ي ف



Once Source is active :

```
FHR #
(1.1.1.1, 224.22.22.44), 00:03:15/00:00:02, flags: PFT
Incoming interface: Loopback0, RPF nbr 0.0.0.0, Registering
Outgoing interface list: Null
```

Register flag (F) is enabled for registration process in the FHR.

F flag: Source is directly connected and the register process must be used to notify the RP to this source.
P flag: Outgoing interface is null as no one has joined the SPT tree yet for this source
T flag: traffic is being received from the source.

PIM must enable between DR & RP router to send and receive the Register message.

- ▶ Frame 442: 142 bytes on wire (1136 bits), 142 bytes captured (1136 bits) on interface 0
- ▶ Ethernet II, Src: ca:01:c1:46:00:1c (ca:01:c1:46:00:1c), Dst: ca:02:c1:6a:00:00 (ca:02:c1:6a:00:00)
- ▶ Internet Protocol Version 4, Src: 10.0.12.1, Dst: 4.4.4.4
- ▼ Protocol Independent Multicast
 - 0010 = Version: 2
 - 0001 = Type: Register (1)
 - Reserved byte(s): 00
 - Checksum: 0xdef [correct]
 - ▼ PIM Options
 - ▶ Flags: 0x00000000
 - 0100 = IP Version: IPv4 (4)
- ▶ Internet Protocol Version 4, Src: 1.1.1.1, Dst: 224.10.10.10
- ▶ Internet Control Message Protocol

If no active receiver present at RP, then RP sends REGISTER STOP DR will be silent for default 60 seconds may result in the so-called "join latency" where a newly Joined listener may have to wait for almost a minute before it can discover a multicast source. This is why in many practical deployments with dynamic listeners you see PIM SSM being used in favor of complicated PIM SM mechanics.

1.1.1.1	224.22.22.44	PIMv2	142 Register
4.4.4.4	10.0.91.1	PIMv2	52 Register-stop

RP #
 (1.1.1.1, 224.22.22.44), 00:00:43/00:02:16, flags: P
 Incoming interface: FastEthernet0/0, RPF nbr 10.0.24.2
 Outgoing interface list: Null

Prune Flag (P) is set as no active receiver (*,G) entry present in RP.

RP SENDS REGISTER STOP WHEN NO ACTIVE RECEIVER FOR THE GROUP AND DISCARD THE MULTICAST PACKET

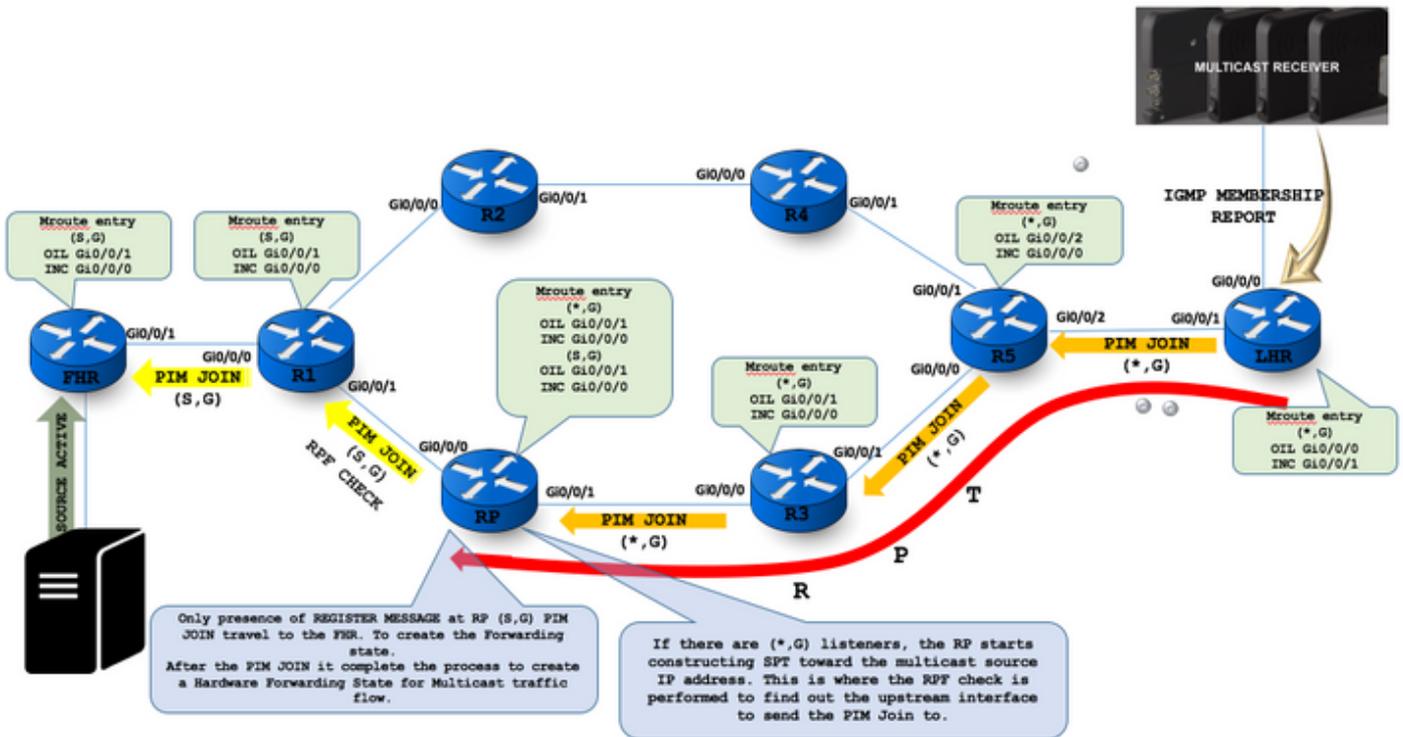
```

▶ Frame 973: 52 bytes on wire (416 bits), 52 bytes captured (416 bits) on interface 0
▶ Ethernet II, Src: ca:02:c1:6a:00:00 (ca:02:c1:6a:00:00), Dst: ca:01:c1:46:00:1c (ca:01:c1:46:00:1c)
▶ Internet Protocol Version 4, Src: 4.4.4.4, Dst: 10.0.91.1
▼ Protocol Independent Multicast
  0010 .... = Version: 2
  .... 0010 = Type: Register-stop (2)
  Reserved byte(s): 00
  Checksum: 0xe39a [correct]
▼ PIM Options
  Group: 224.22.22.44/32
  Source: 1.1.1.1
  
```

جدوم نلل ةكرتشم ل ةرشل ل 3 ةوطخل

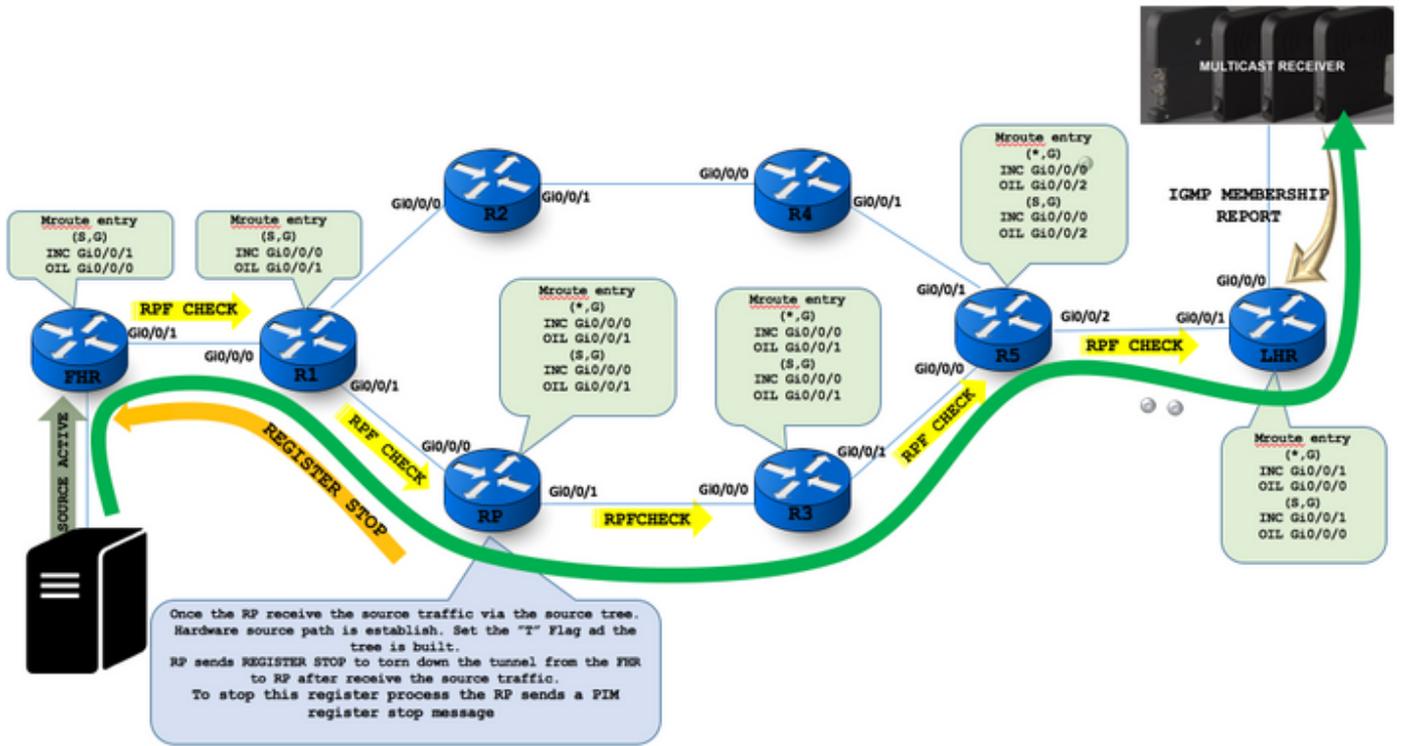
- نأ نم دكأتلل راسم ل لودج ةعجارم هيلع ، زاجياب ، ليجستل ةلاس ر DR لسري نأ لبق بلطت ققحتل تاي لمع عيجم نأو RP ةومجم تامولعم يلع يوتحي ه نأو RP سيل
- ةلسبك فوجماربل يوتسم يلع قفنل ني مضت يل RP و FHR قفن نم لك جاتحي
- ردم ل ناك اذا اهدوجو تامولعمل ردم ةومجم ليجستل ةلاس ر رفوت
- ةلاح لكانه تناك اذا ام ةفرعمل RP ققحتي و فلغم ل ددعت ل ثبل ةمزح جارختس لم تي ةوجل ناونعل
- اروف PIM ليجست فاقيل لاسرا لم تي ، (*،G) ةلاح دوجو مدع ةلاح يف

- ددعتم لثبلا رصم ل IP ناو نع وحن SPT عاشن ا ي ف RP أدبي، (*،g) نوعم تسم كانه ناك اذا ة فرعمل (RPF) يسكعل راسم ل هيجوت ةداع نم ققحتل اارج ه ي ف متي يذلا ناكلما وه اذه PIM. لى مامضنالا لاسرل امداخل ةهجاو



لى لوصولا، ددعتم لثبلا ةمزحل لوألا قفدتلا 5 ةوطخلا ةكرتشملا ةرچشلا ربع لقبقتسملا

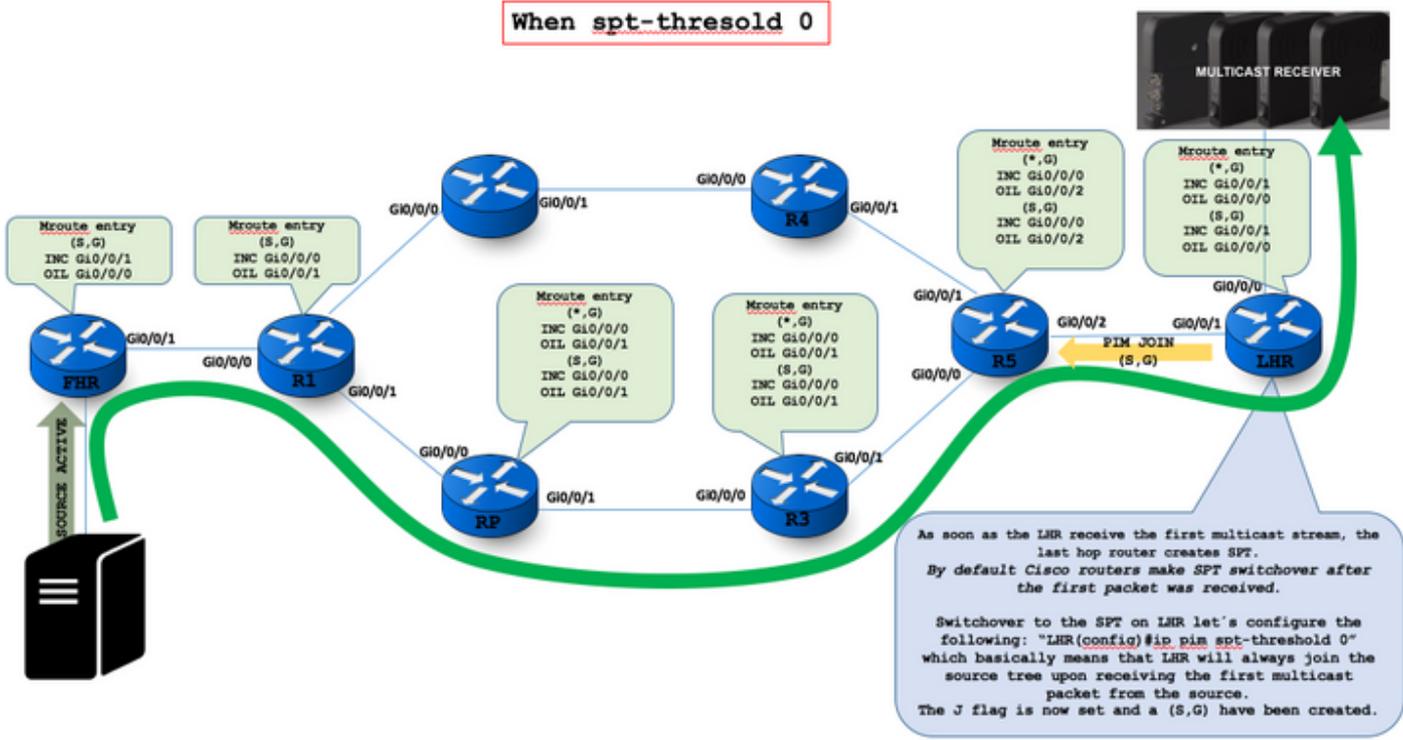
- INC ةهجاو لىل عمالتسا مت اذا طقف ددعتم لثبلا قفدت هيجوت ةداع ا هجومل موقى /RFP.
- يذالال ثبلل RT لقبقم ددعتم لثبلا مزح رصم ناو نع نم ققحتل متي.
- طبرلا لاسرل مت شيح رصم ل اجات ا ي ف ددعتم لثبلل يلاتل هجومل او ةهجاو لدح.
- مزح ني مضت رم تسي سو، S ل رصم ل ا ةرچشلا لىل مامضنالا لىل RP لمعي، RP، لىل يعيبط لكشب لوصولا ي ف اضيا S نم مزحلا أدبت امدنع RP. لىل اتانايال مزحلا هذه نم لك نم نيخسن RP يقلىتسي.
- ةلاسر لسريو، مزحلا هذه نم ةفلغملا ةخسنل ل هجات ي ف RP أدبي، ةطقنل هذه دنع ةرورض نود مزحلا ني مضت نم DR s لىل ارم ةرقت لىل چست

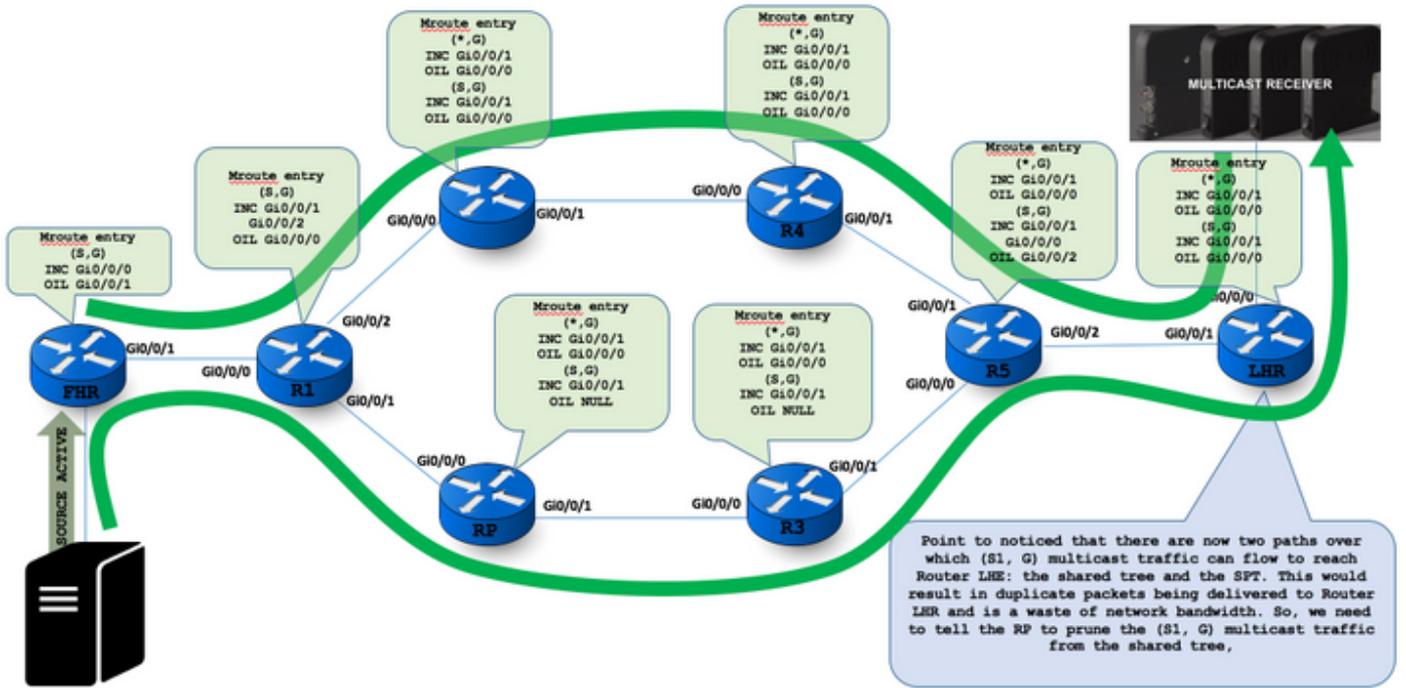


PIM-SM enables a last hop DR (that is, a DR with directly connected hosts that have joined a multicast group) to switch from the shared tree to the SPT for a specific source. This step is usually accomplished by specifying an SPT-Threshold in terms of bandwidth. If this threshold is exceeded, the last-hop DR joins the SPT. (Cisco routers have this threshold set to zero by default, which means that the SPT is joined as soon the first multicast packet from a source has been received via the shared tree.)

- ردصم راسم عاشن! متي . ةرجش ردصم ل رب ع رورم ةكح ردصم ال RP ل ملتسي ن! ام ةرجش ل تينب و "t" ملعل ل عض . ةزهج أا .
- رورم ةكح يقلت دع ب RP ل فHR نم ق فنل ل مي س قتل ل ل ج س ت ل ف قوت RP ل س ري ردصم ل .
- PIM ل ج س ف ا ق ي ل ة ل س ر RP ل س ري . هذ ه ل ل ج س ت ل ل ة ل م ع ف ا ق ي ل

When spt-threshold 0





ل سرتو SPT نم تانا يابل رورم ة كرح LHR ي قلتت .6 ة وطلخا ة كرتشملا ة رجشلا وحن بيذشت ة لاسر

SPT نم رورملا ة كرح ي قلتت ي ف LHR أدبت ، ددعتملا ثبلا رورم ة كرح نم ني قفد مالتسإ دعب ة كرتشملا ة رجشلا وحن بيذشت ة لاسر لسرتو .

ي ف رطل هجوملاب SPT ل يدبت يه ة ني عمل (*,G) ة لاج نأ ل ملع ي نعي .

LHR #

(10.0.12.1, 239.1.1.1), 00:00:38/00:02:21، LJT: تامالعل

ة دراوالة هجاولا: FastEthernet0/0، RPF NBR 10.0.78.7

ة دراوالة ة مئاق:

00:38/00:02:21، قرفتملامال، 1/0، تنرتشي تبا جي ة كبش

ريشت اهنإف - PIM DR هجوم يلع اهؤاشنإ مت ي تلال لودلل "F" ة مالع يلع روثلعل متي ام ة داع ترمتسإ اذإ . RP عم اهليجست مت ي تلال تاقفدتل عم قفاوتت ي تلال هيجوتلا ة داع ا تالاج ي ل PIM ليجست فاق ي لئاسر ي قلتت يلع رداق ريغ كي دل هجوملا نو كي نأ حج رمل نم ف ، "F" ة مالع نم SPT ي ل اهليوت متي مل رداصم كانه ي لاللابو ، RP نم

The J flag means the respective (*,G) state is to be switched the SPT by the leaf router.

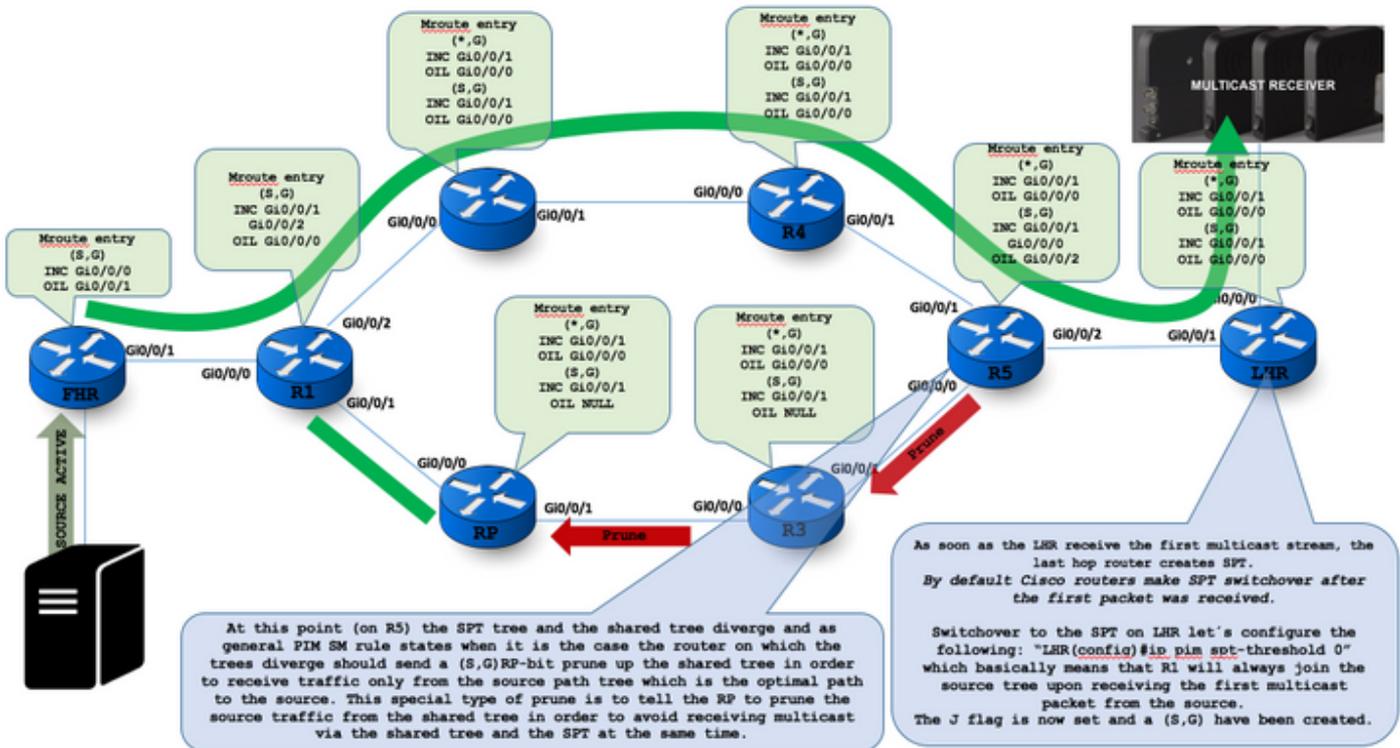
```
LHR #
(10.0.12.1, 239.1.1.1), 00:00:38/00:02:21, flags: LJT
Incoming interface: FastEthernet0/0, RPF nbr 10.0.78.7
Outgoing interface list:
GigabitEthernet1/0, Forward/Sparse, 00:00:38/00:02:21
```

The "F" flag is typically found for the states created at the PIM DR router - it signals the forwarding states that correspond to the flows being registered with the RP. If the "F" flag persists, then your router is most likely not receiving the PIM Register-Stop messages back from the RP, and thus there are sources that has not switched to the SPT tree.

```
FHR #
(*, 239.1.1.1), 00:09:01/stopped, RP 4.4.4.4, flags: SPF
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list: Null

(1.1.1.1, 239.1.1.1), 00:03:02/00:00:15, flags: PFT
Incoming interface: Loopback0, RPF nbr 0.0.0.0, Registering
Outgoing interface list: Null
```

There is an (S,G) entry in this table, which has the flag "T" meaning it's a shortest-path and not a shared tree construct. The incoming interface is set to Loopback0 and RPF neighbor to "0.0.0.0" which means the local router is the traffic source.



The receiver (or a router upstream of the receiver) will be receiving two copies of the data: one from the SPT and one from the RPT. When the first traffic starts to arrive from the SPT, the DR or upstream router starts to drop the packets for G from S that arrive via the RP tree. In addition, it sends an (S,G) Prune message towards the RP. This is known as an (S,G,rpt) Prune. The Prune message travels hop-by-hop, instantiating state along the path towards the RP indicating that traffic from S for G should NOT be forwarded in this direction. The prune is propagated until it reaches the RP or a router that still needs the traffic from S for other receivers.

At this point (on R5) the SPT tree and the shared tree diverge and as general PIM SM rule states when it is the case the router on which the trees diverge should send a (S,G)RP-bit prune up the shared tree in order to receive traffic only from the source path tree which is the optimal path to the source. This special type of prune is to tell the RP to prune the source traffic from the shared tree in order to avoid receiving multicast via the shared tree and the SPT at the same time.

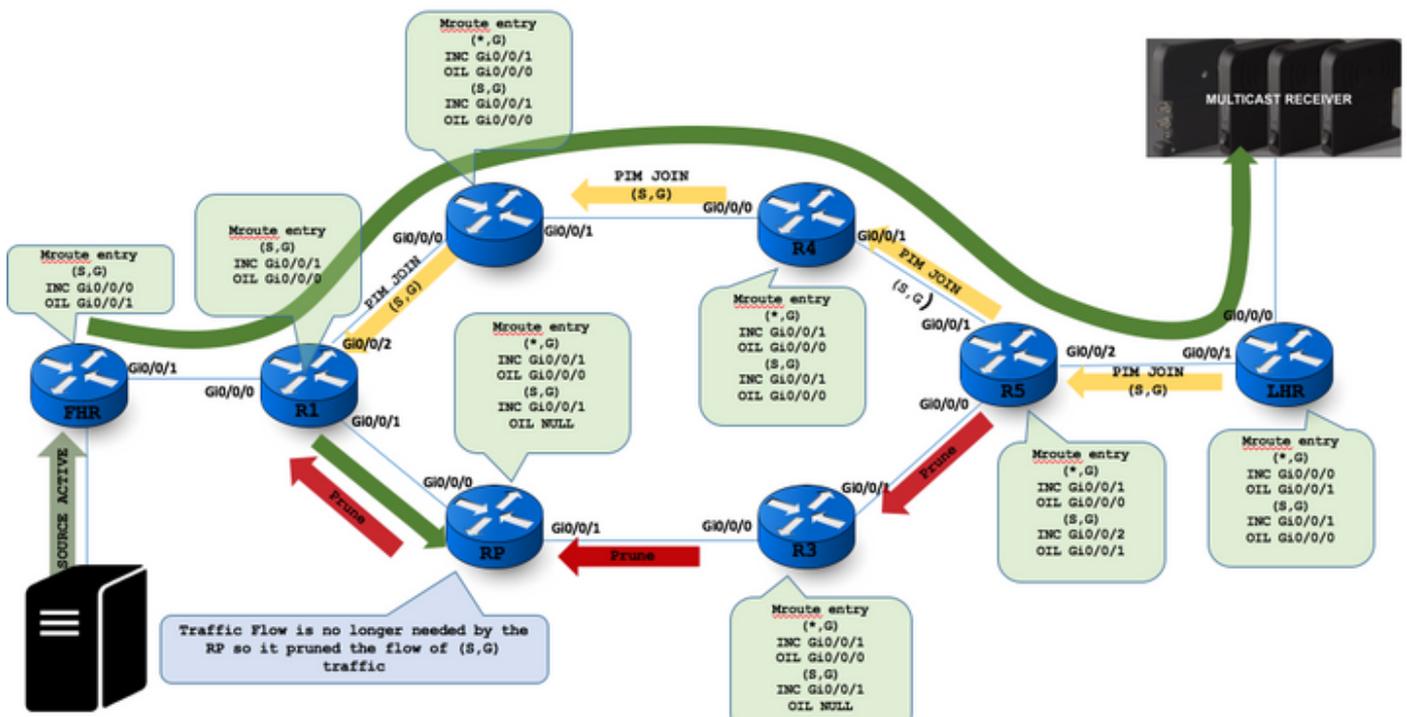
RP #
 (10.0.12.1, 224.1.1.1), 00:00:10/00:02:53, flags: PTX
 Incoming interface: FastEthernet0/0, RPF nbr 10.0.24.2
 Outgoing interface list: Null

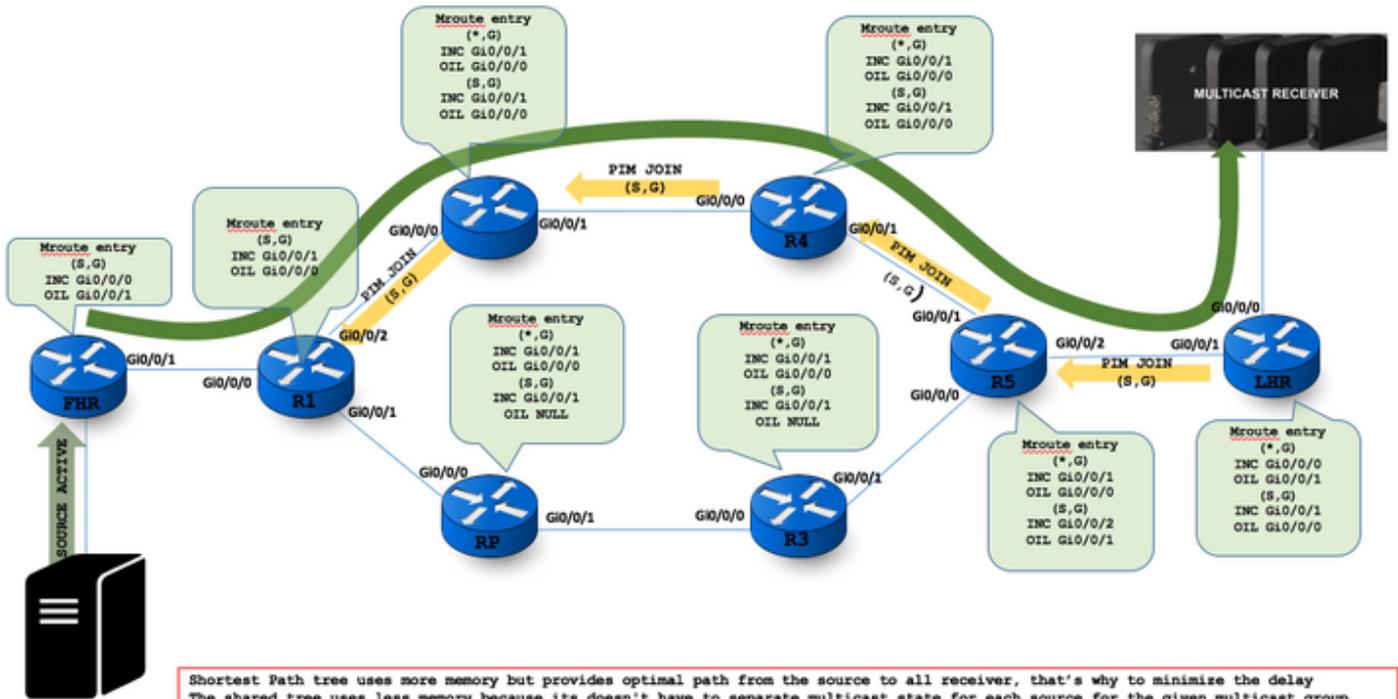
P Bit (Prune Flag) received from the diverge point.

LHR #
 (10.0.12.1, 224.1.1.1), 00:01:59/00:01:00, flags: LJT
 Incoming interface: FastEthernet0/0, RPF nbr 10.0.78.7
 Outgoing interface list:
 GigabitEthernet1/0, Forward/Sparse, 00:01:59/00:02:57

J Flag Join the SPT// T Flag Tree formed

"PIM Join/Prune Messages" the RP flag (also referred to as the RP-bit) indicates that this message is applicable to the shared tree and should be forwarded up the shared tree toward the RP. Setting this flag/bit in an (S1, G) Prune and sending it up the shared tree tells the routers along the shared tree to prune Source S1 multicast traffic from the shared tree.





Shortest Path tree uses more memory but provides optimal path from the source to all receiver, that's why to minimize the delay. The shared tree uses less memory because it doesn't have to separate multicast state for each source for the given multicast group. But may create a suboptimal routing for some receiver. Shared tree also introduced extra delay.

"Incoming interface" is set to Null, which means there is no incoming traffic for this group. If any physical interface the traffic is their.

"C" means there is a group-member directly connected

R5#sh ip mroute

```
(*, 239.1.1.1), 00:27:32/00:02:08, RP 4.4.4.4, flags: SJCL
Incoming interface: FastEthernet0/0, RPF nbr 10.0.78.7
Outgoing interface list:
GigabitEthernet1/0, Forward/Sparse, 00:27:32/00:02:08
```

"L" means the router itself joined the group.

possibly the next-hop router

Expire times (How soon the group will expired if no refreshed)

Uptime (How long this state has been created)

Incoming interface: Null, RPF nbr 155.29.0.5

If the incoming interface is null and the RPF neighbor is IP address, then there is a RPF failure. Mtrace will confirm the issue.

ةمچرتل هذه لوج

ةللأل تاي نقتل نمة ومة مادختساب دن تسمل اذة Cisco تمةرت
ملاعلاء انء مء مء نء مء دختسمل معد وء مء مء دقتل ةر شبل او
امك ةق قء نوك ت نل ةللأل ةمچرت لصف أن ةظءالم ءرء. ةصاءل مء ءب
Cisco ءلءت. فرءم مچرت مءم دقء ءلءل ةء فارءءال ةمچرتل عم لاعل او
ءل ءمءءءء ءوچرلاب ءصوء وءءامچرتل هذه ةقء نء ءءل وءءس م
Systems (رفوتم طبارل) ءلصل ءل ءلءءءلءل دن تسمل