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The bridge to possible

Troubleshooting Multicast: The "Usual Suspects"

BRKENT-2264

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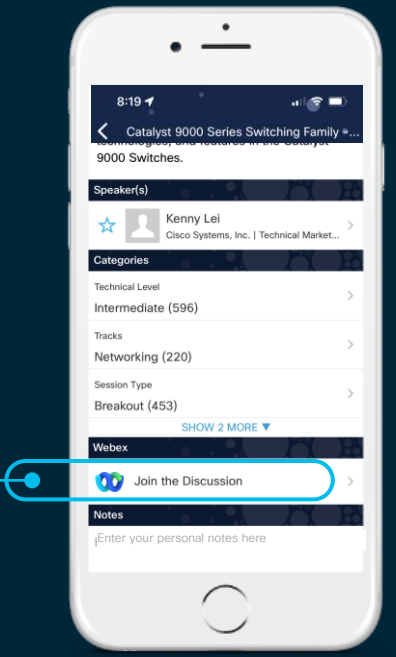

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Agenda

- Super Fast Review
- Building the Plumbing for the Multicast
- Multicast Troubleshooting
- Final Troubleshooting Takeaways

Super Fast Review

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Frequently Used Terms

ASM	Any Source Multicast	**FHR**	First Hop Router
SSM	Source Specific Multicast	**LHR**	Last Hop Router
MDT	Multicast Distribution Tree	**IR**	Intermediate Router
RP	Rendezvous Point	**DR**	Designated Router

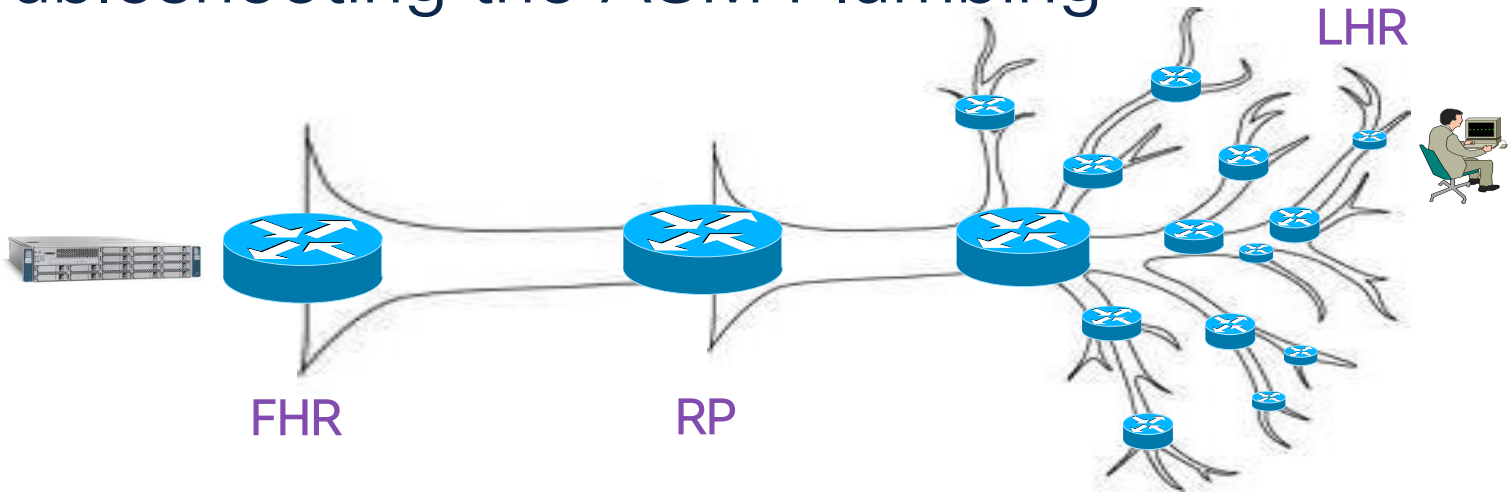
IGMP	Internet Group Management Protocol
PIM	Protocol Independent Multicast

Frequently Used Terms

- Any Source Multicast (**ASM**)
  - Original (Classic) PIM-SM
  - Supports both Shared and Source Trees

- Source Specific Multicast (**SSM**)
  - a.k.a. Single Source Multicast
  - Supports only Source Trees

Troubleshooting the ASM Plumbing

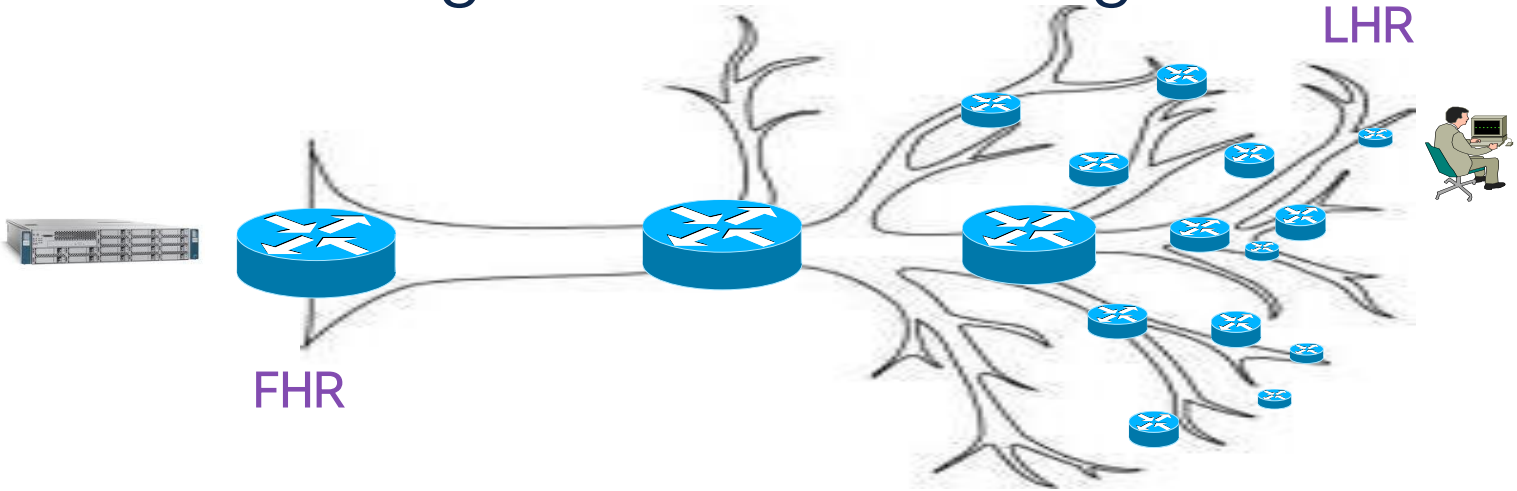


MDTs Built Backwards Towards Root

Traffic

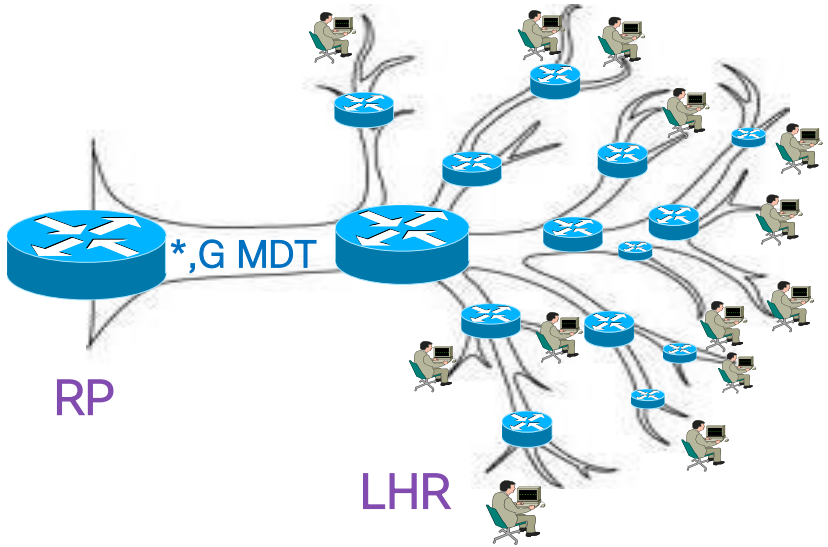
Troubleshooting

Troubleshooting the SSM Plumbing



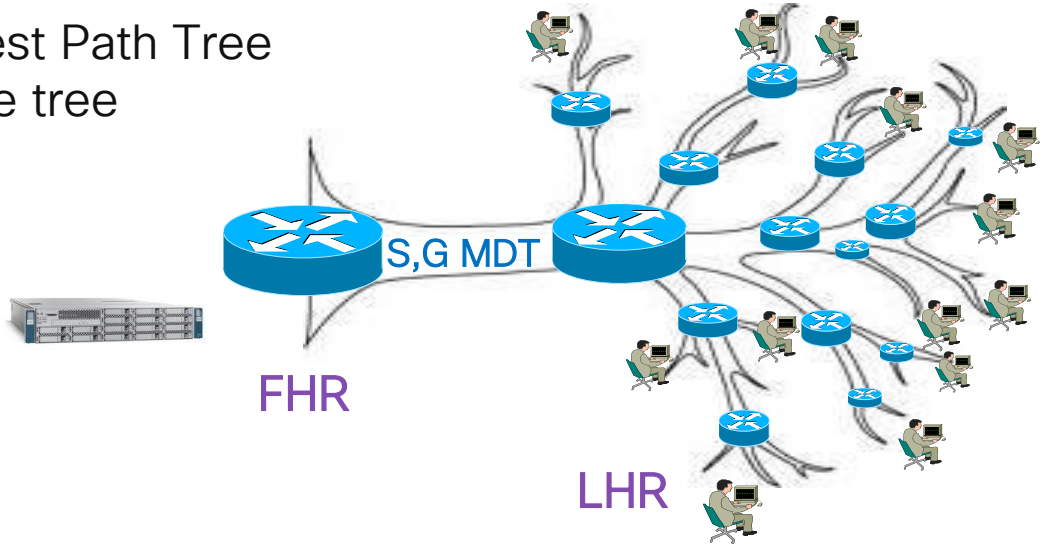
Frequently Used Terms

(*,G) = *,G
= Shared Tree
= RP tree



Frequently Used Terms

(S,G) = S,G
= Shortest Path Tree
= Source tree



Frequently Used Terms

(*,G) = *,G
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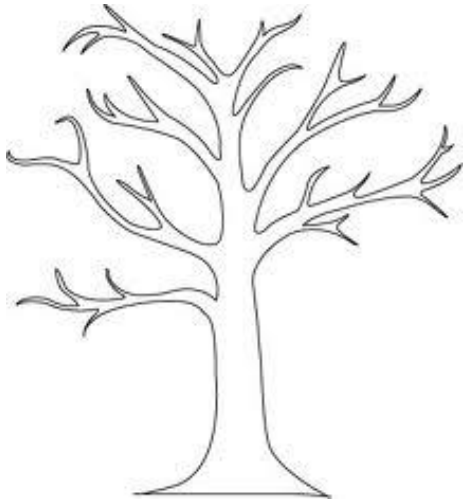
(S,G) = S,G
= Source Tree
= Shortest Path Tree



The Root of the (,G) Tree is =* RP

The Root of the (S,G) Tree? = Source

Frequently Used Terms

IIF Incoming Interface

Interface towards the root of the tree

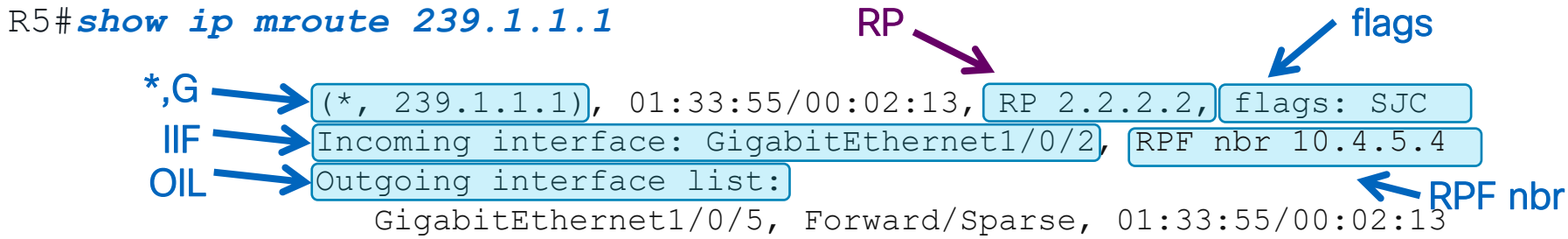
OIL Outgoing Interface List

Interfaces that have received PIM Joins or IGMP membership requests

IIF of the (*,G) Tree point towards RP

IIF of the (S,G) Tree point towards? Source

*,G

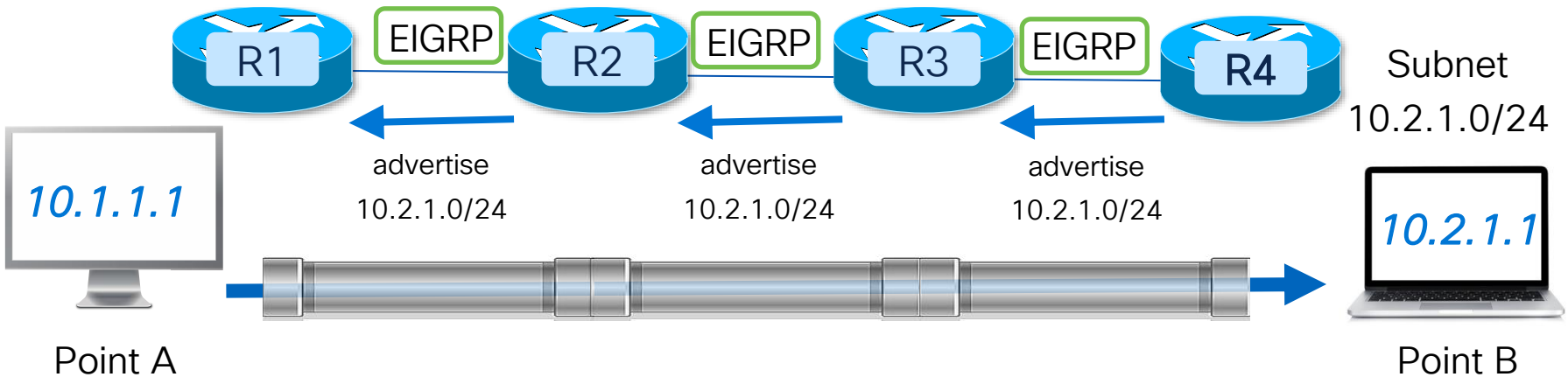


Building the Plumbing

“In solving a problem of this sort, the grand thing is to be able to reason backward. That is a very useful accomplishment, and a very easy one, but people do not practice it much.”

Sherlock Holmes

Building the Plumbing for Unicast Traffic:
Unicast Routing



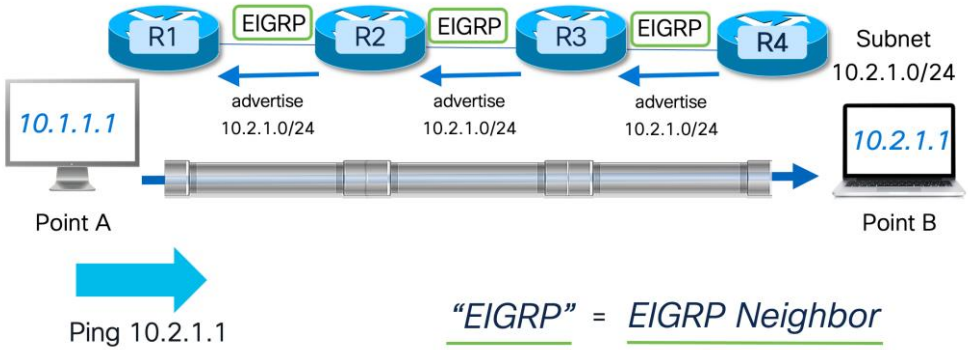
Ping 10.2.1.1

"EIGRP" = *EIGRP Neighbor*

Building the Plumbing for Unicast Traffic:
Unicast Routing

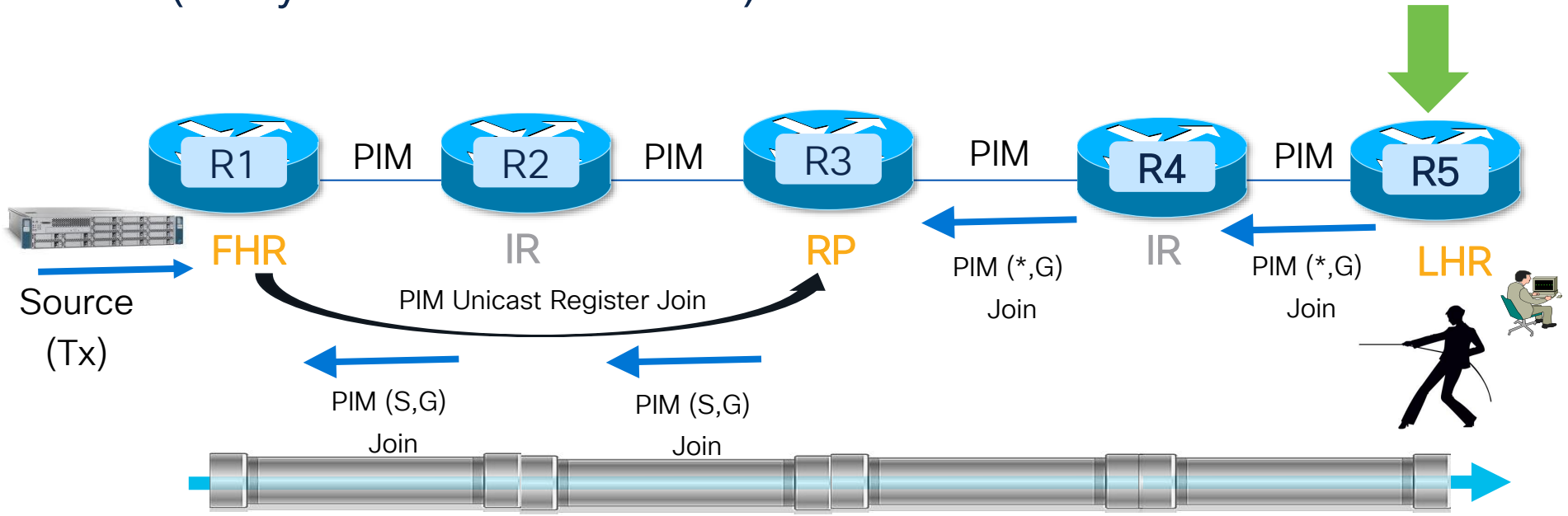
"Usual Suspects"

- Missing piece of plumbing (no EIGRP nbr)
- Subnets on the Interfaces on routers towards the 10.1.1.0/24 and 10.2.1.0/24 not "included" in routing. Not getting advertised
- Lack of knowledge somewhere in plumbing of Where is the Subnet? (RIB) or What is the Next Hop IP address to get to the subnet?

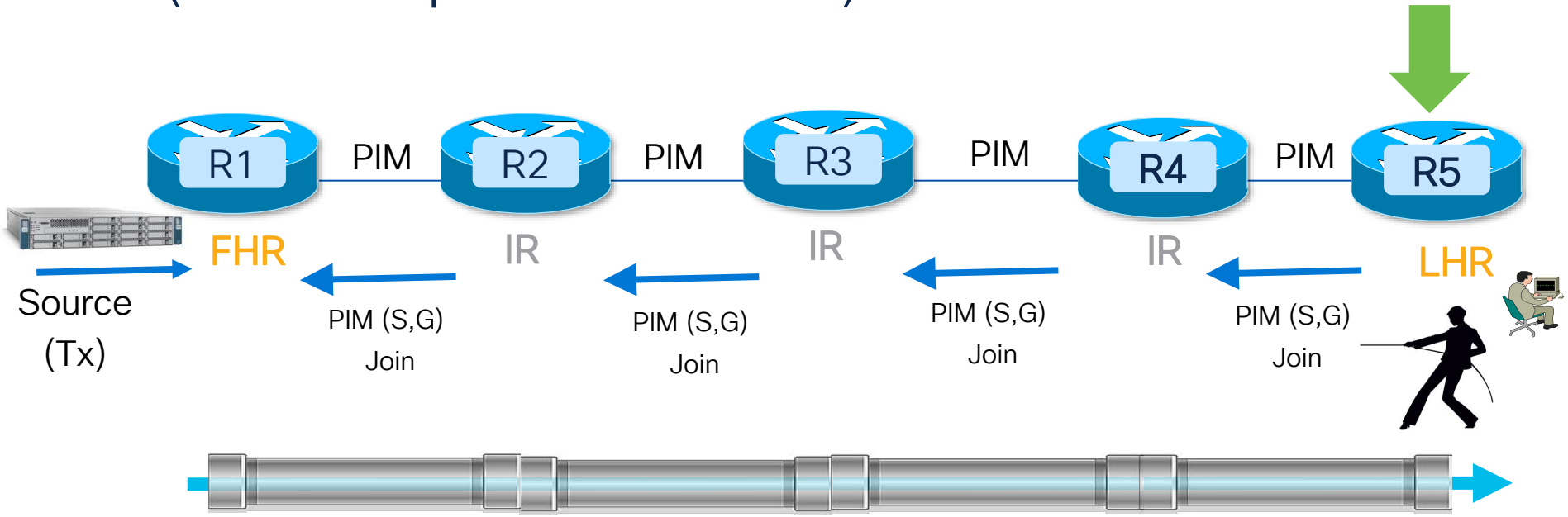


Generic usual Suspects
- Layer 1
- Layer 2
- Access-lists
- Firewalls

Building the Plumbing for Multicast Traffic:
ASM ("Any Source" Multicast)



Building the Plumbing for Multicast Traffic:
SSM ("Source Specific" Multicast)

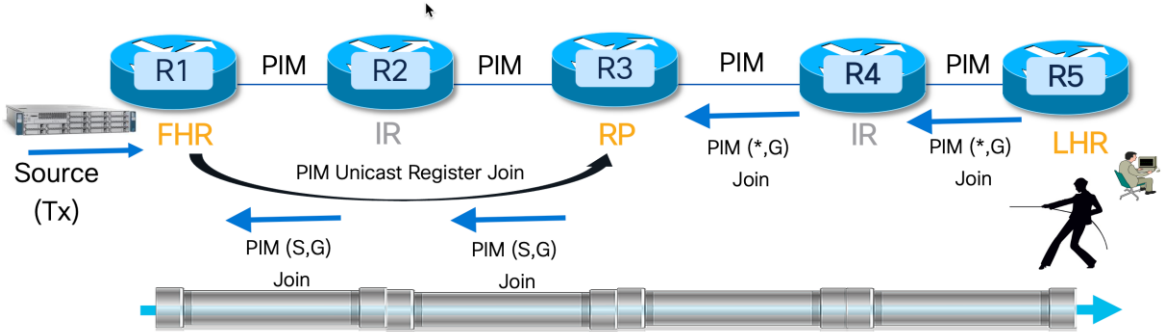


Building the Plumbing for Multicast Traffic:
Multicast Routing

Generic usual Suspects
- Layer 1
- Layer 2
- Access-lists
- Firewalls

"Usual Suspects"

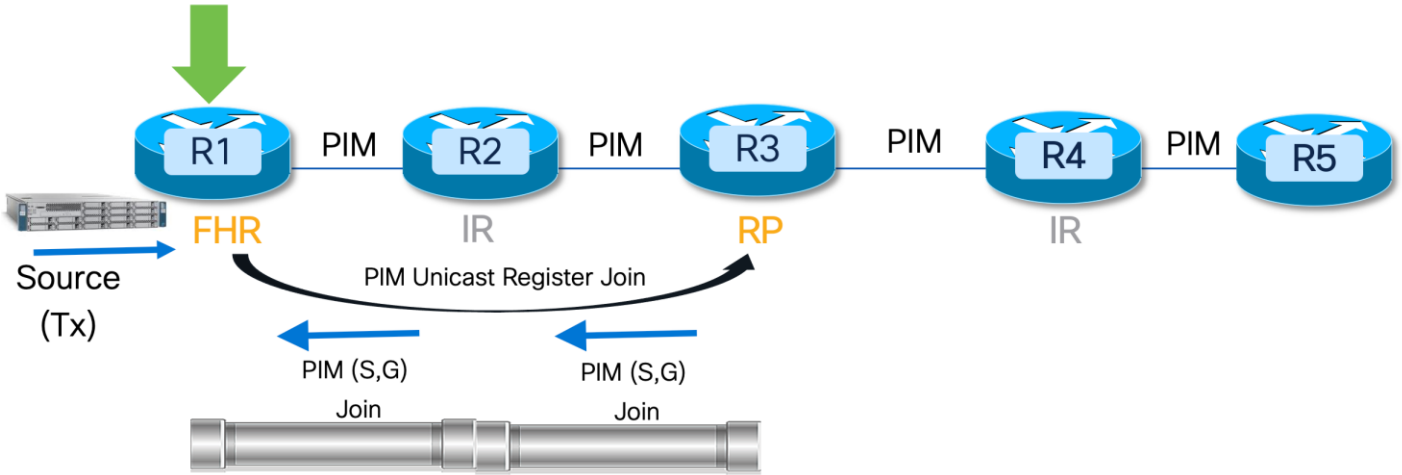
- Missing piece of plumbing (no PIM nbr)
- Missing "pull" from Receiver (no IGMP/MLD request to join a group)
- Interfaces on routers towards the Source or Receiver not "included" in multicast routing. Missing multicast config on interface
- Lack of knowledge somewhere in plumbing of WHO is the Root? Where is the Root? Or "What is the PIM RPF Neighbor toward the root?"



Building the Plumbing for Multicast Traffic:
Multicast Routing

"Usual Suspects"

- Missing "pull" from Receiver (no IGMP/MLD request to join a group)



Multicast Troubleshooting Methodology

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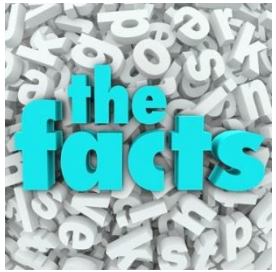
Troubleshooting Toolbox
Facts to Remember



- Multicast Routing must be enabled globally
- PIM must be enabled on the interfaces for PIM neighbors to form
- Multicast Trees get built backwards towards the root
- Multicast traffic in ASM and SSM are triggered via a “pull”

- High on the “food chain” dependent on routing working and PIM working

Troubleshooting Toolbox Questions to Remember

- ❑ Who is the root?
- ❑ Where is the root?
- ❑ What is the PIM RPF neighbor towards the root?

Troubleshooting Toolbox Checklist

- IGMP Membership Report Received by LHR (IPv4)
- MLD Membership Report Received by LHR (IPv6)
- "WHO" is the root?
  - Knowledge of who the RP is for that multicast group
- "WHERE" is the root?
  - Check routing… check routing… check routing
- "WHAT" is the PIM RPF neighbor towards the root?
  - Do you have a PIM neighbor?

Troubleshooting Toolbox "Go To" Commands


```
show ip mroute
show ip mroute count

show ip pim neighbor
show ip pim interface

show ip igmp group

show ip pim rp [group]
show ip pim rp mapping [group]
show ip rpf [address]
```

ASM Troubleshooting

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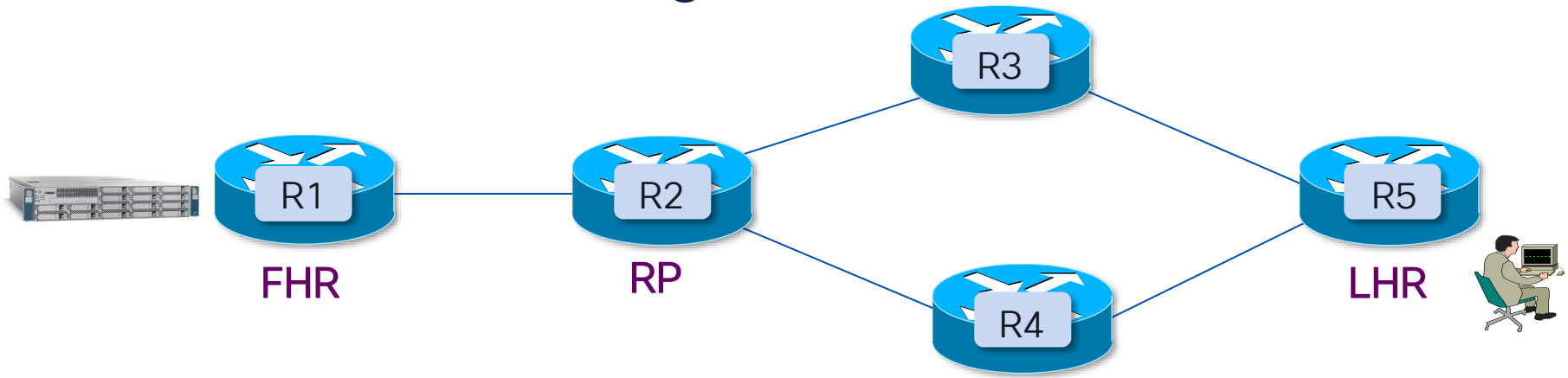
ASM Troubleshooting



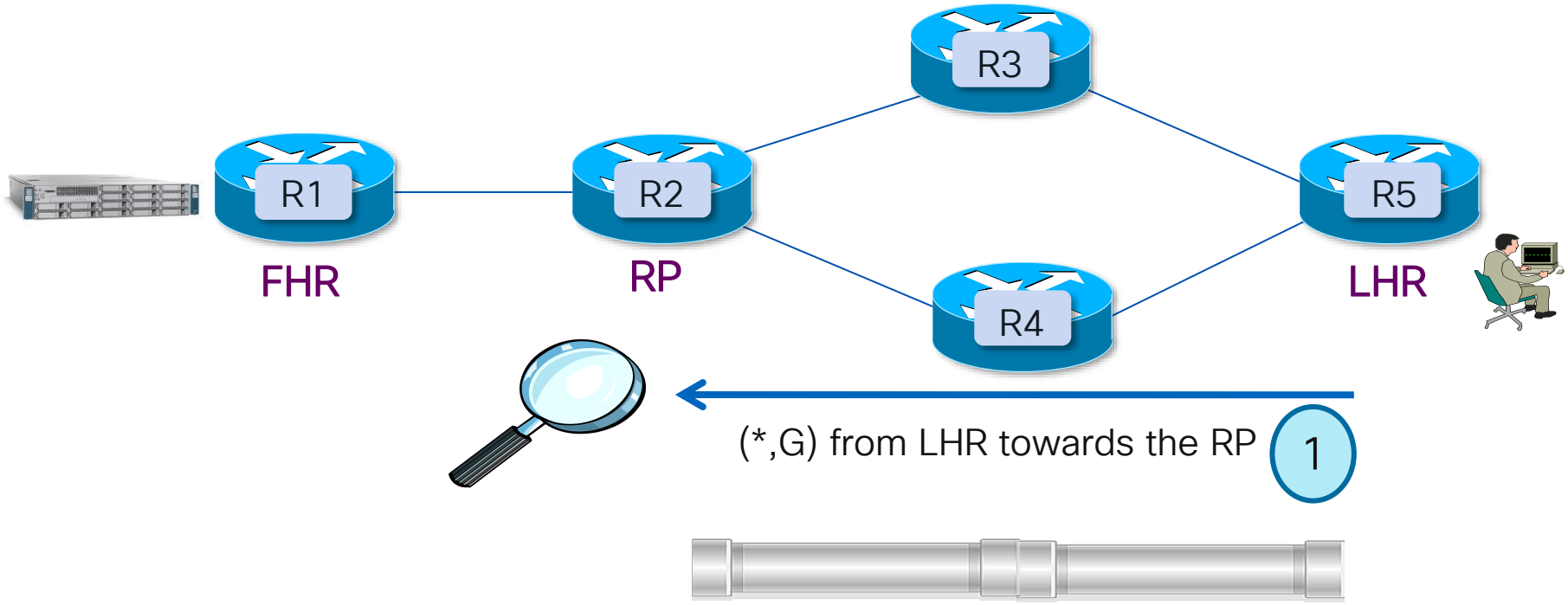
(*,G) from LHR towards the RP 1

2 FHR registers source with RP

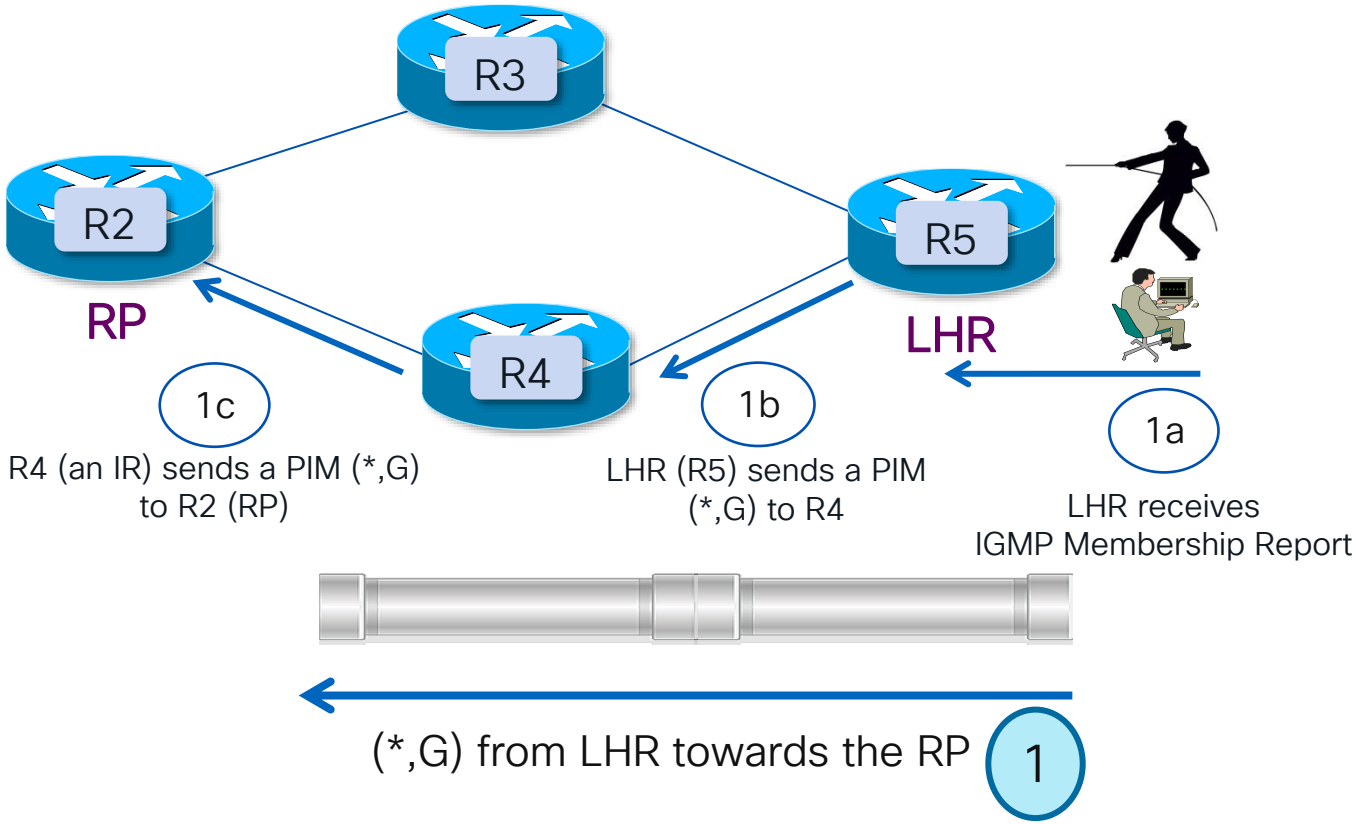
RP sends PIM (S,G) Join Towards Source

LHR Cutting over to SPT (S,G) 3

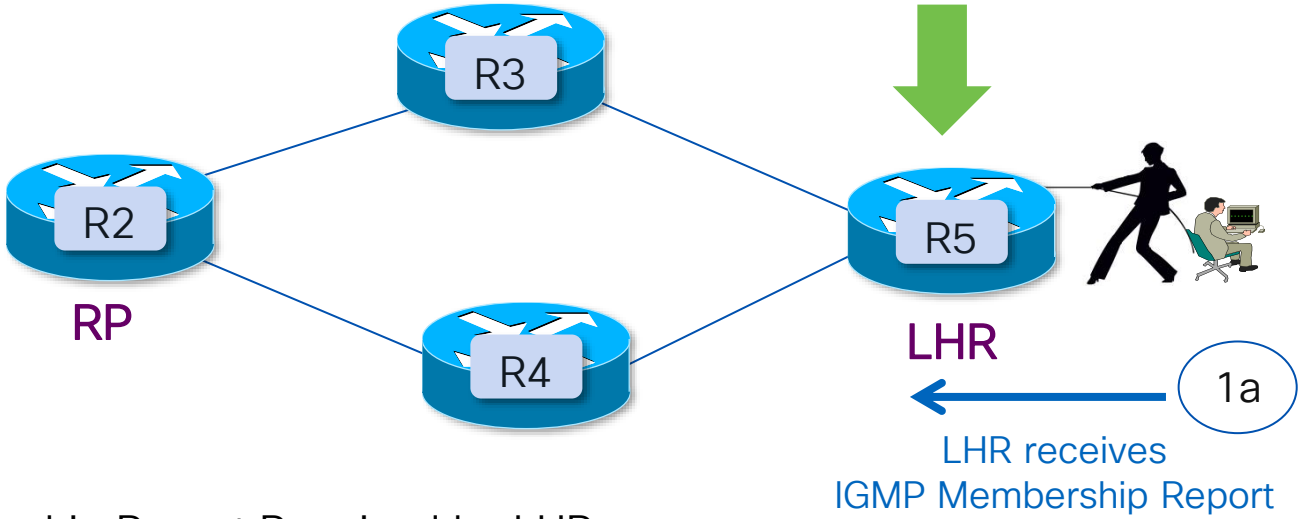
ASM Troubleshooting
Shared Tree



ASM Troubleshooting: Shared Tree



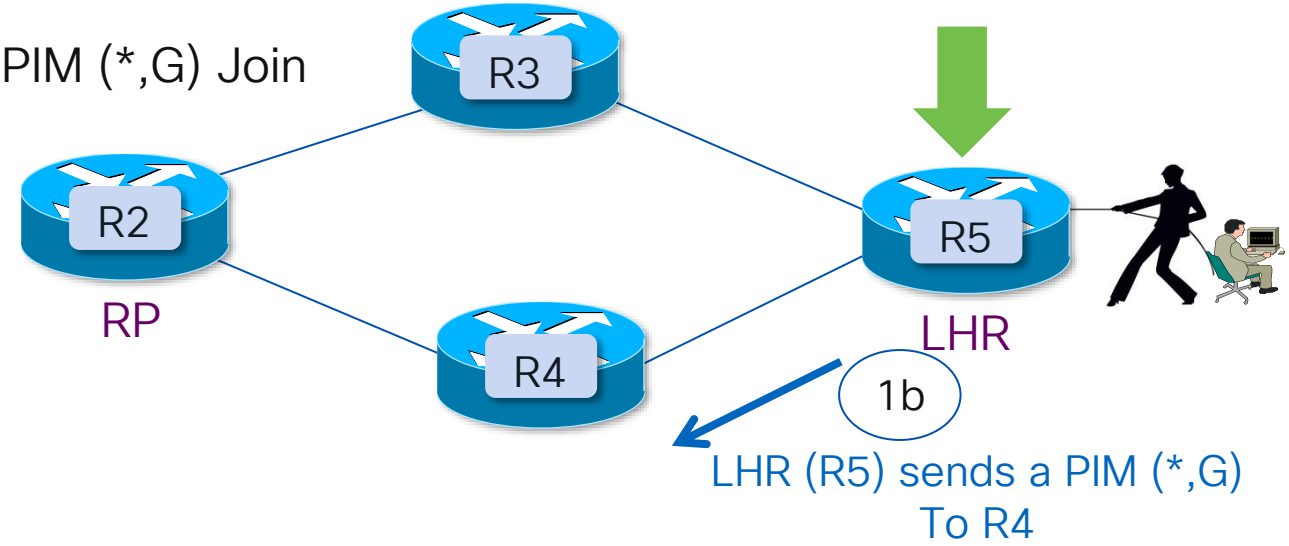
ASM Troubleshooting: Shared Tree



- IGMP Membership Report Received by LHR
- "WHO:" R5 (LHR) knows who the RP is for this group
- "WHERE:" R5 (LHR) knows where (RIB) the RP is
- "WHAT:" R5 (LHR) has a PIM Neighbor to send the PIM (*,G) Join to

ASM Troubleshooting: Shared Tree

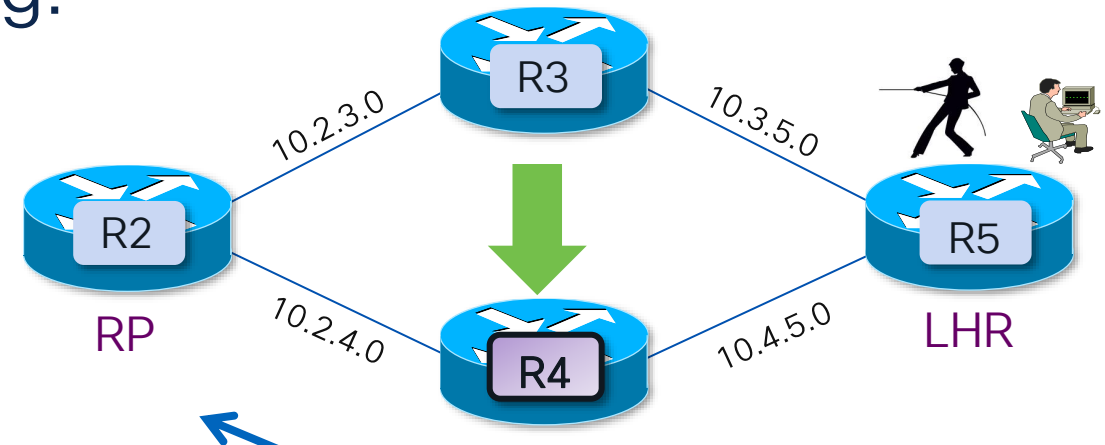
1b LHR Sends PIM (*,G) Join



- "WHO:" R5 (LHR) knows who the RP is for this group
- "WHERE:" R5 (LHR) knows where (RIB) the RP is
- "WHAT:" R5 (LHR) has a PIM Neighbor to send the PIM (*,G) Join to

ASM Troubleshooting: Shared Tree

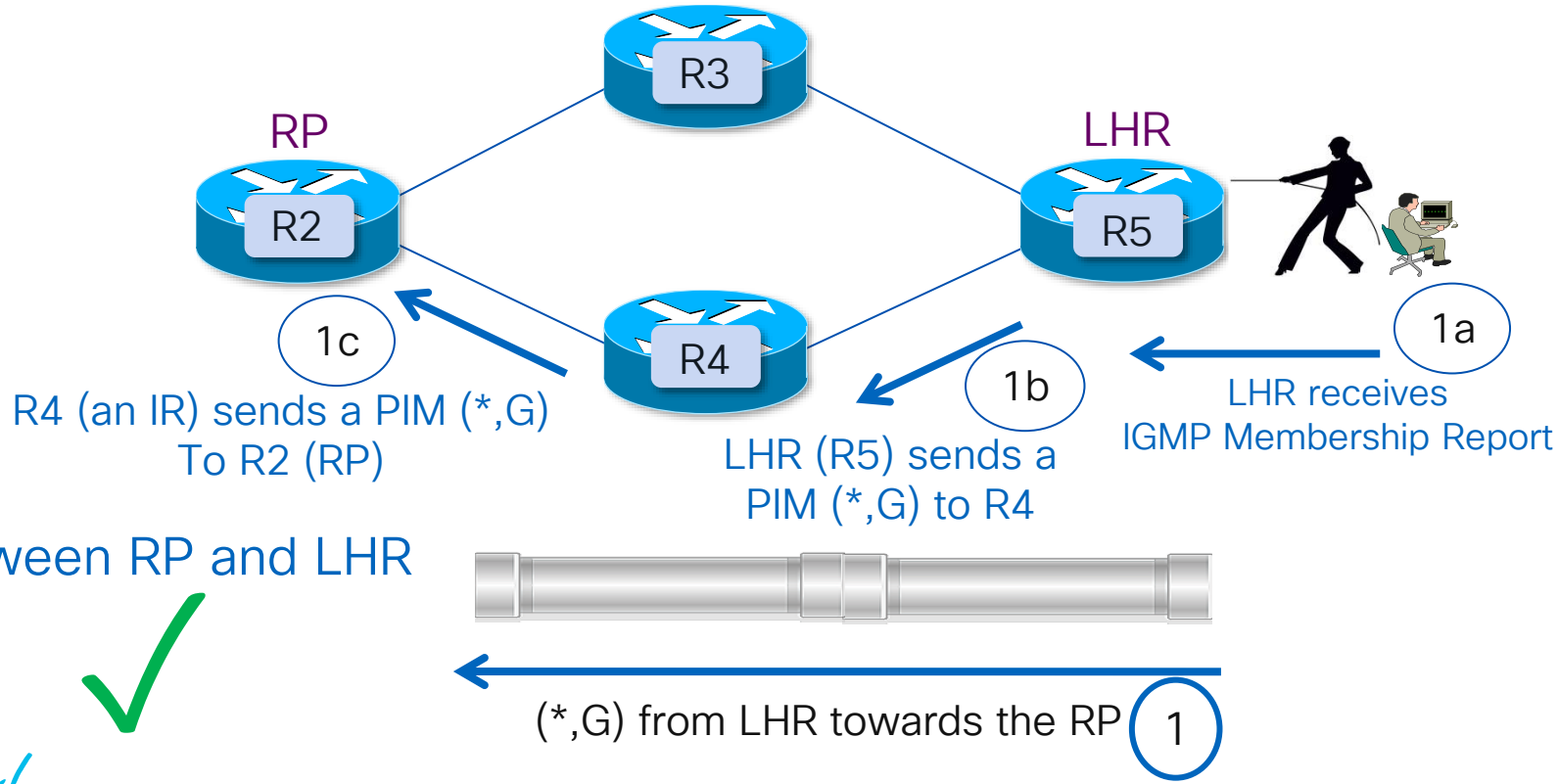
1c IR Sends PIM (*,G) Join



R4 (an IR) sends a PIM (*,G) To R2 (RP) 1c

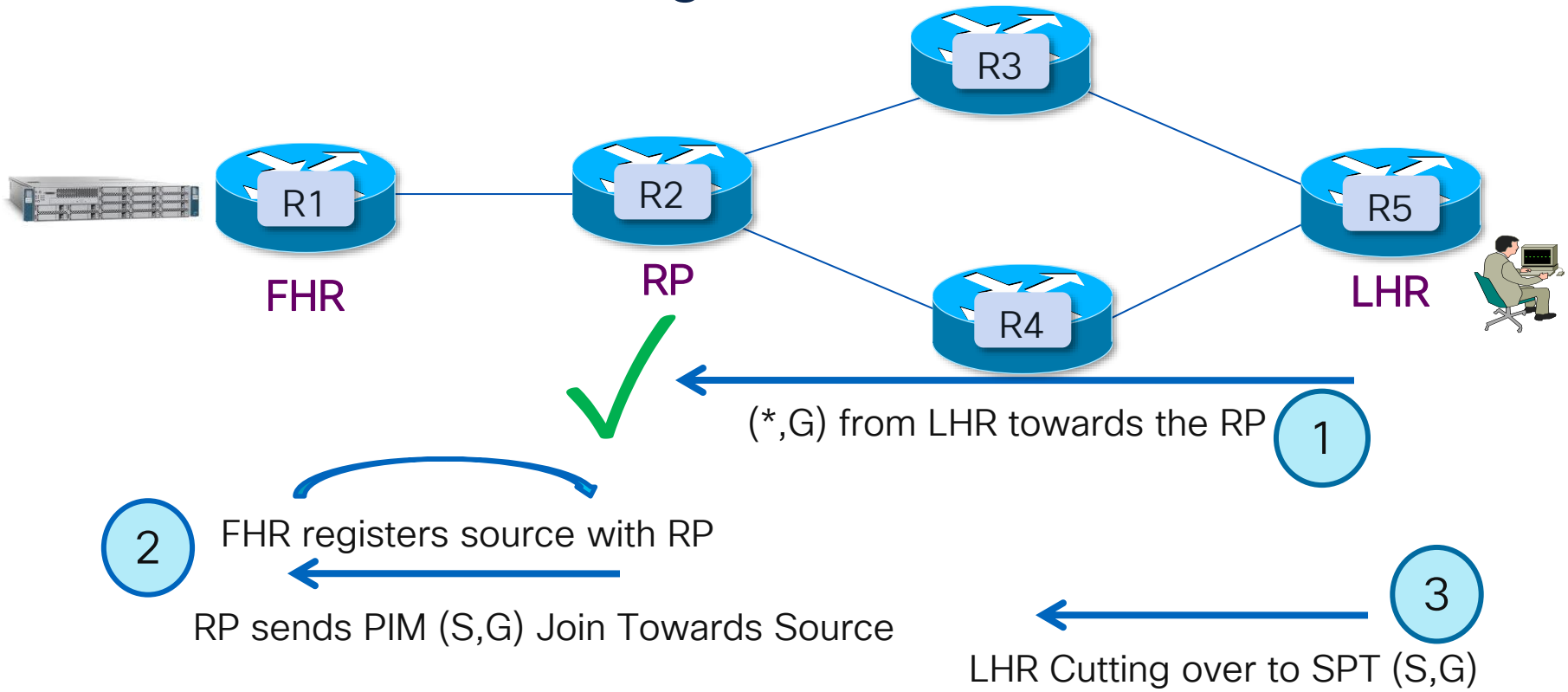
- ❑ “WHO:” R4 (IR) knows who the RP is for this group
- ❑ “WHERE:” R4 (IR) knows where (RIB) the RP is
- ❑ “WHAT:” R4 (IR) has a PIM Neighbor to send the PIM (*,G) Join to

ASM Troubleshooting: Shared Tree

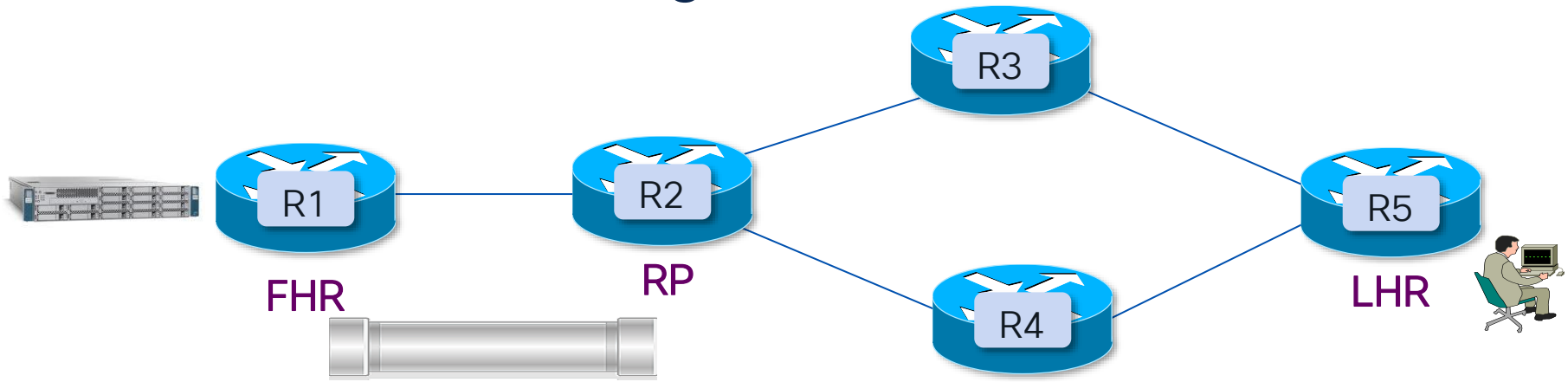


(*,G) Between RP and LHR

ASM Troubleshooting



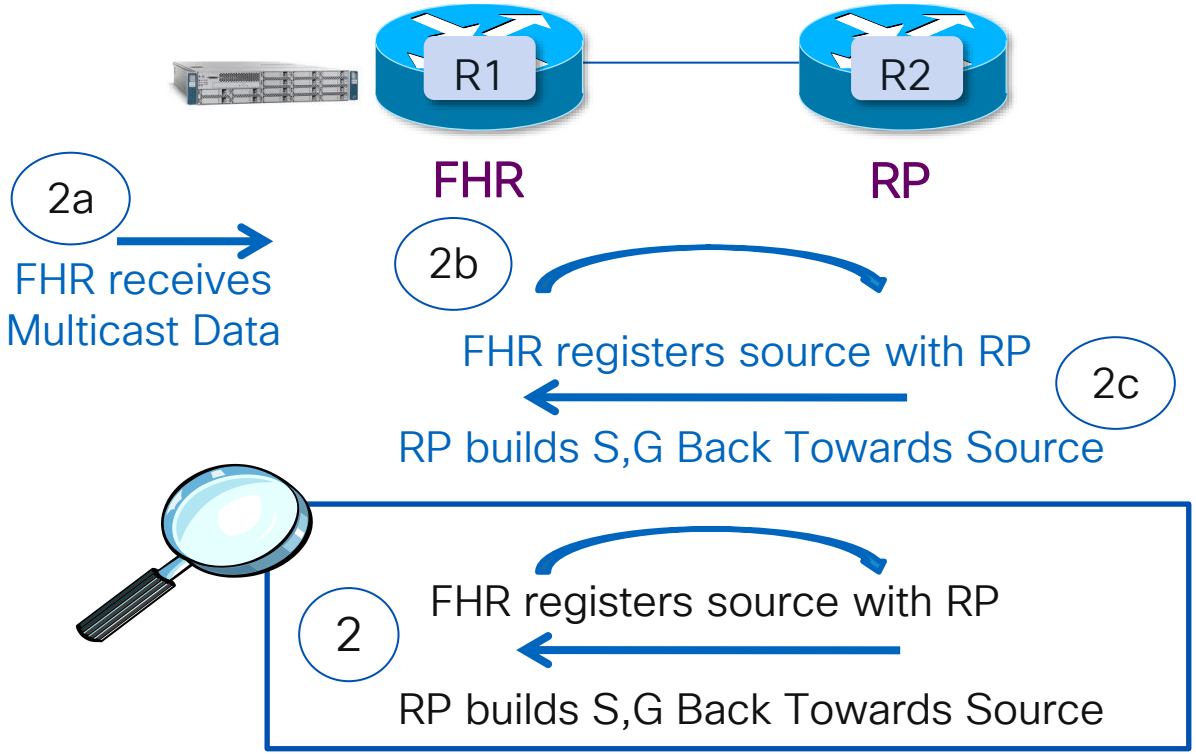
ASM Troubleshooting



2 FHR registers source with RP

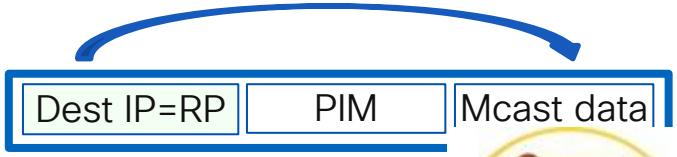
RP sends PIM (S,G) Join Towards Source

ASM Troubleshooting: Source Tree



Registering a Source***

Mcast Data



Mcast packet is encapsulated into unicast PIM packet:
Destination IP is the RP.
PIM header type is Register

gig0 added to the OIL for (S,G)

P sends PIM (S,G) Join Back Towards Source if there is an active shared tree for that G

Mcast Data

Mcast packets now get sent out twice:
1. With Register
2. Out (S,G)

Mcast Data

Once the RP sees the packets come in on the (S,G),
.... it sends a unicast Register Stop

Register Stop to the FHR

Mcast Data

Mcast Data

Mcast packets now only out the (S,G) tree

ASM Troubleshooting: Source Tree

R1

R2

Who is RP?

FHR

RP

Who is Source?
Where is Source?
What is PIM RPF to source?

2a

FHR receives Multicast Data

2b

FHR registers source with RP

2c

RP builds S,G Back Towards Source

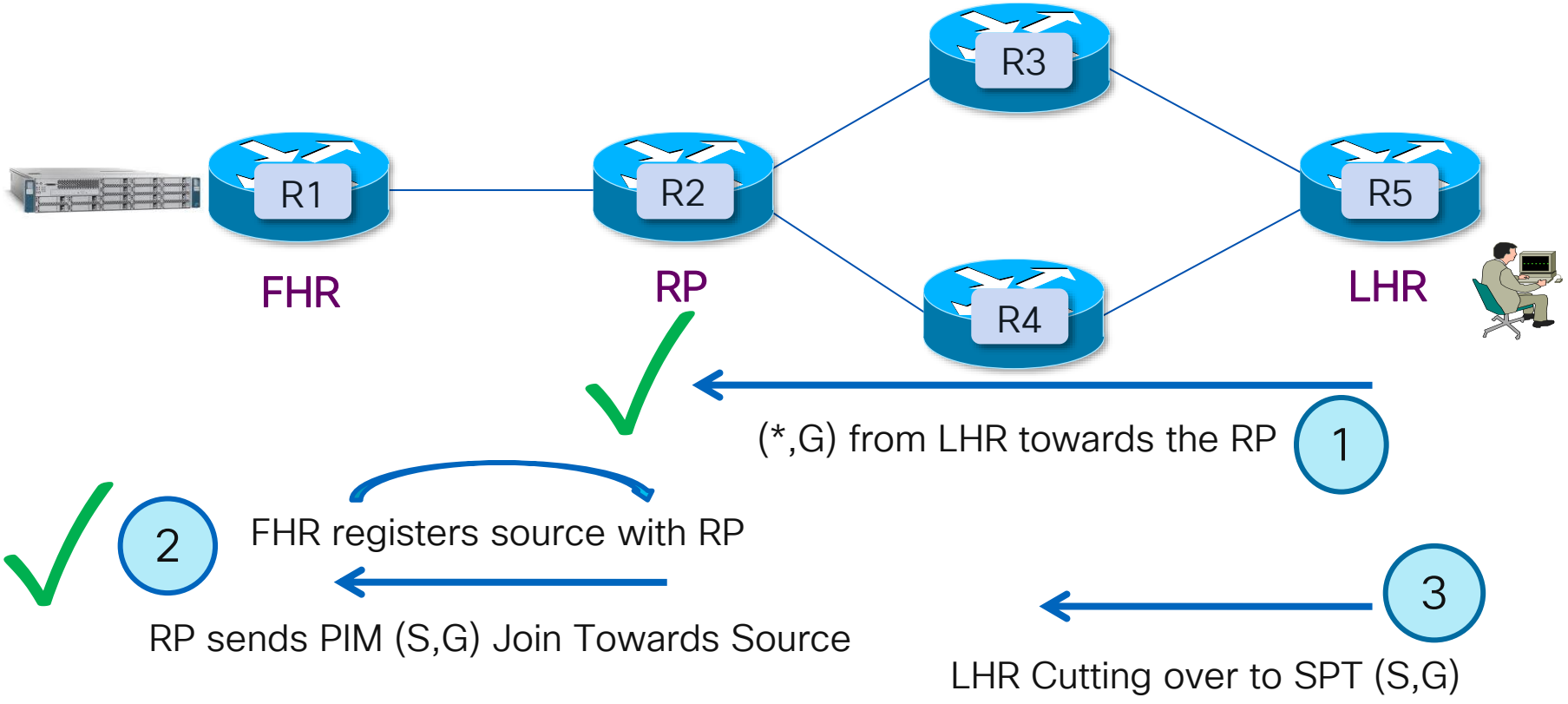
R1 has PIM enabled on interface towards Source

2

FHR registers source with RP

RP builds S,G Back Towards Source

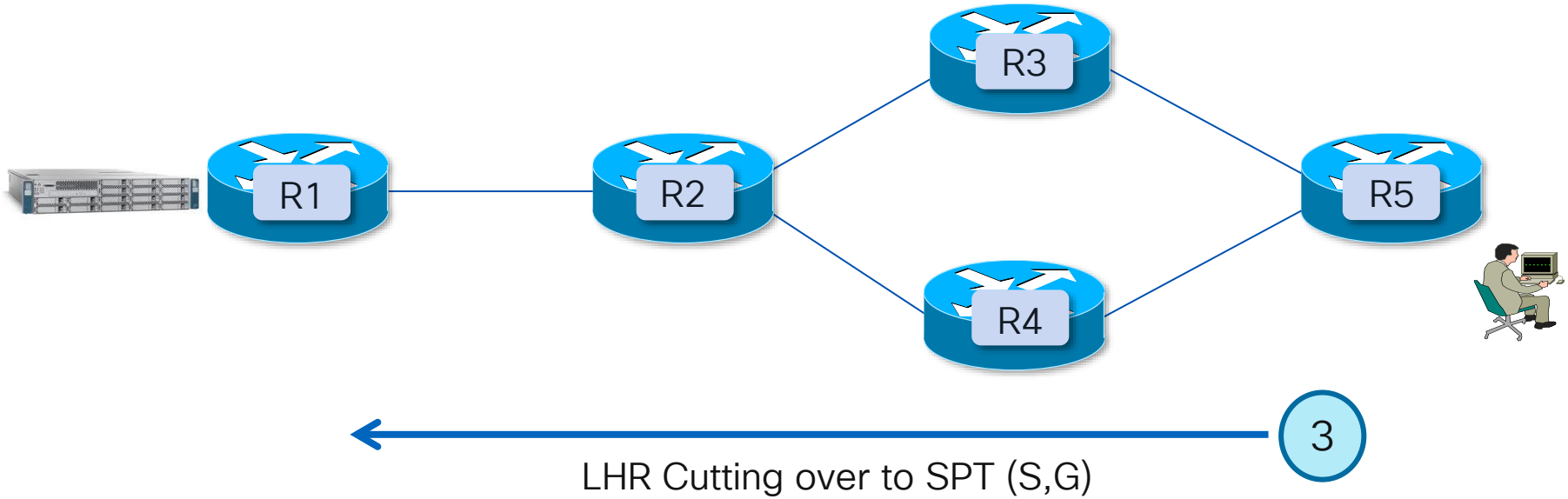
ASM Troubleshooting



The default behavior of PIM-SM is that routers with directly connected members will join the shortest path tree as soon as they detect a new multicast source.”

PIM-SM Frequently Forgotten Fact

ASM Troubleshooting
Joining the SPT

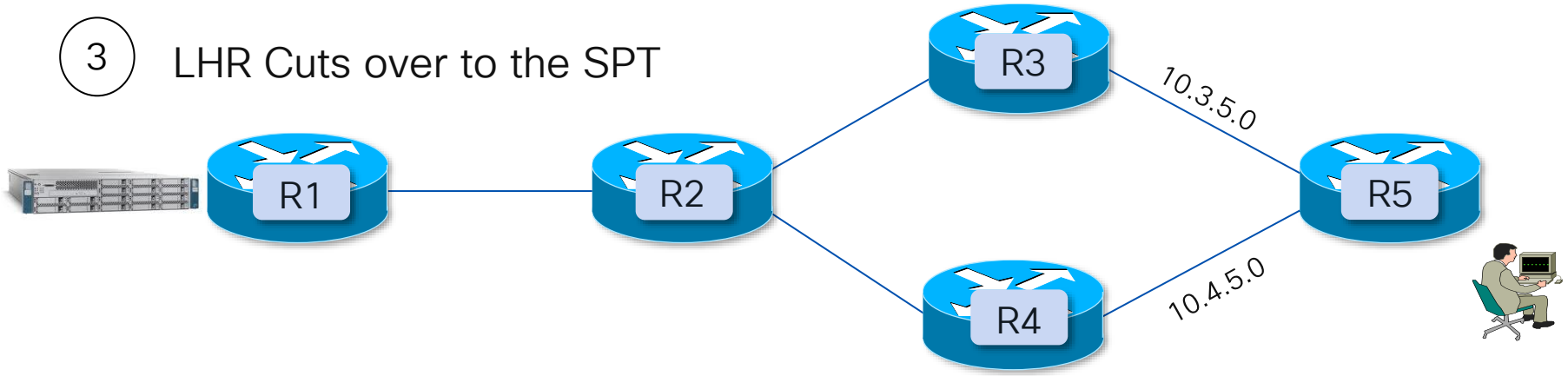


--If SPT Threshold is not infinity (default 0) when the mcast stream comes down the shared tree and into the LHR,

--then the LHR will try to cutover to the shortest path tree

ASM Troubleshooting
Joining the SPT

3 LHR Cuts over to the SPT

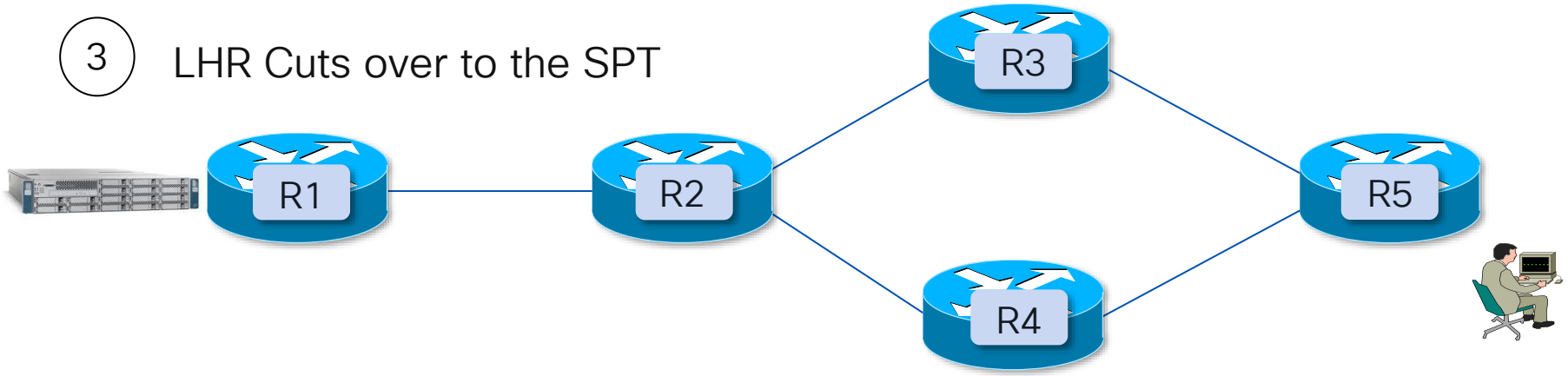


LHR Now must answer 3 questions before sending PIM (S,G) Join

Source
- ❑Who?
- ❑Where?
- ❑RPF Nbr?

ASM Troubleshooting
Joining the SPT

3 LHR Cuts over to the SPT

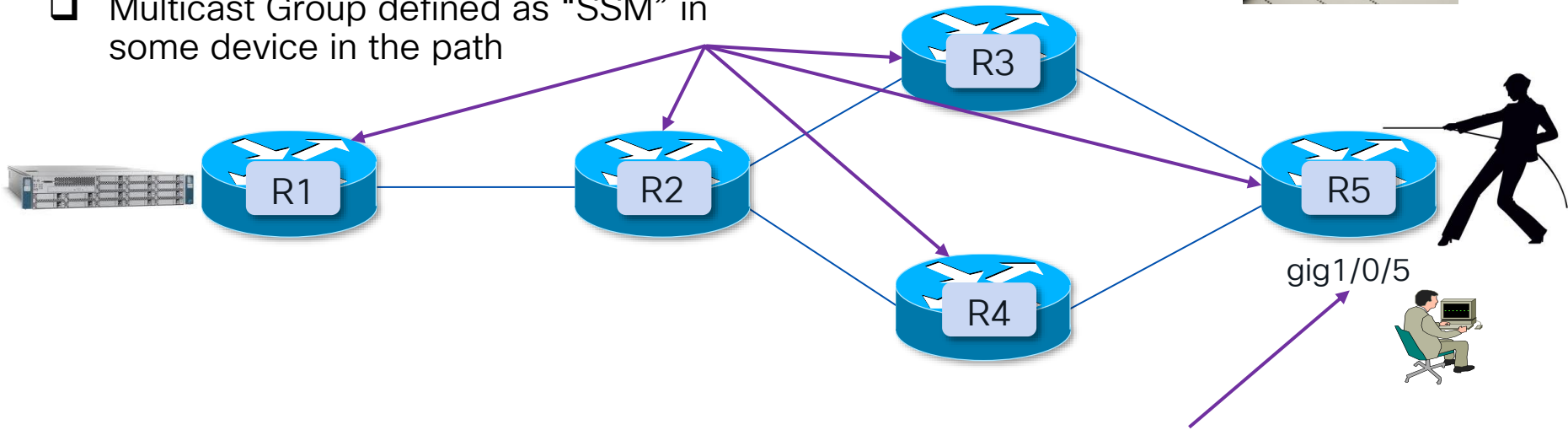


(S,G) Between LHR and FHR

SSM Specific Troubleshooting

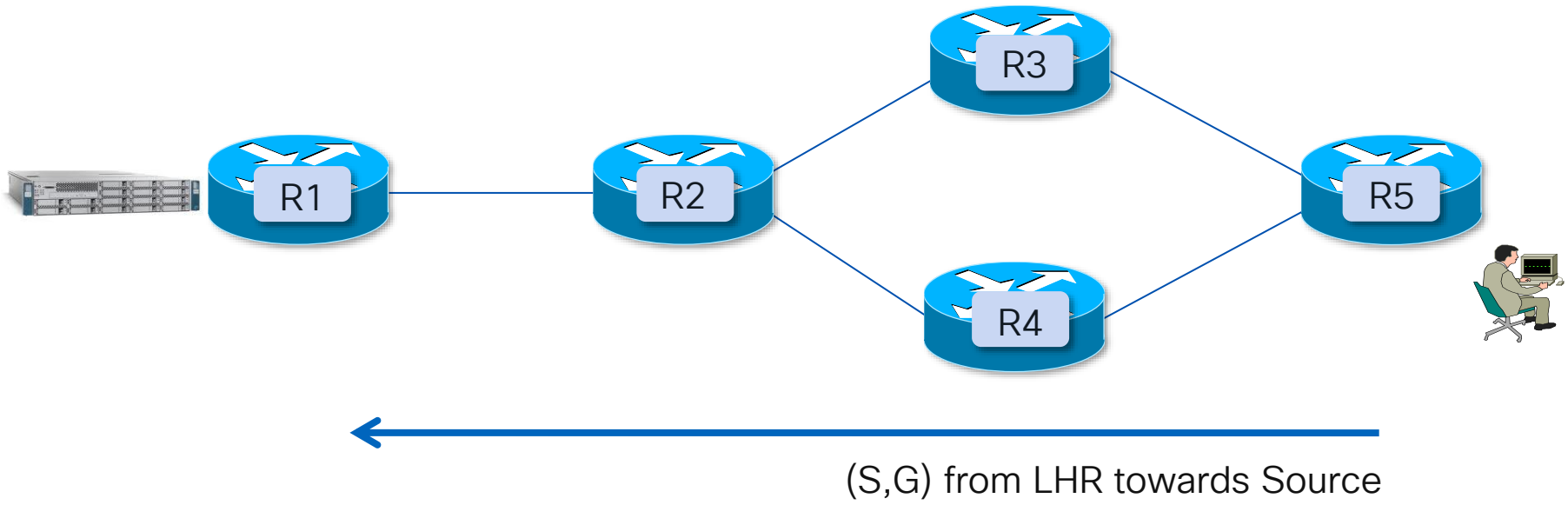
SSM Specific Troubleshooting Checklist

- Multicast Group defined as “SSM” in some device in the path

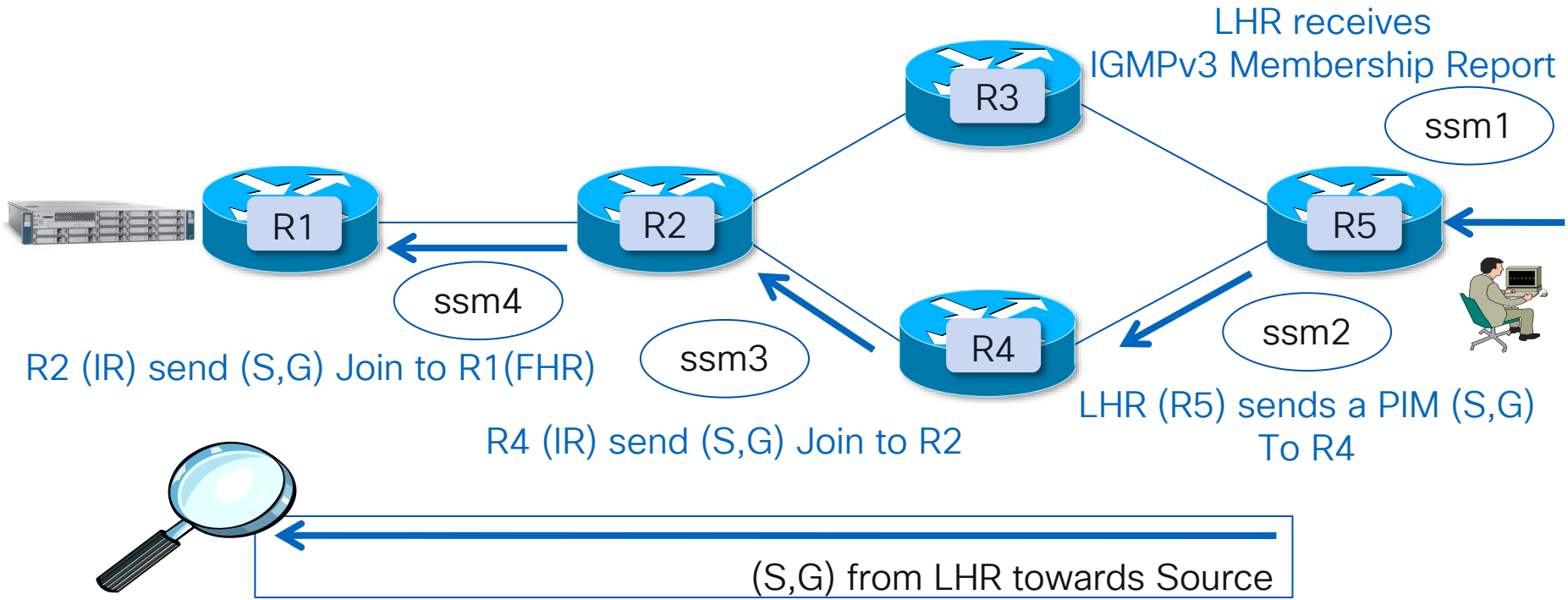


- IGMP Version 3 enabled (IPv4)
- MLD Version 2 enabled (IPv6)

SSM Specific Troubleshooting



SSM Specific Troubleshooting



Troubleshooting Tips with Fish

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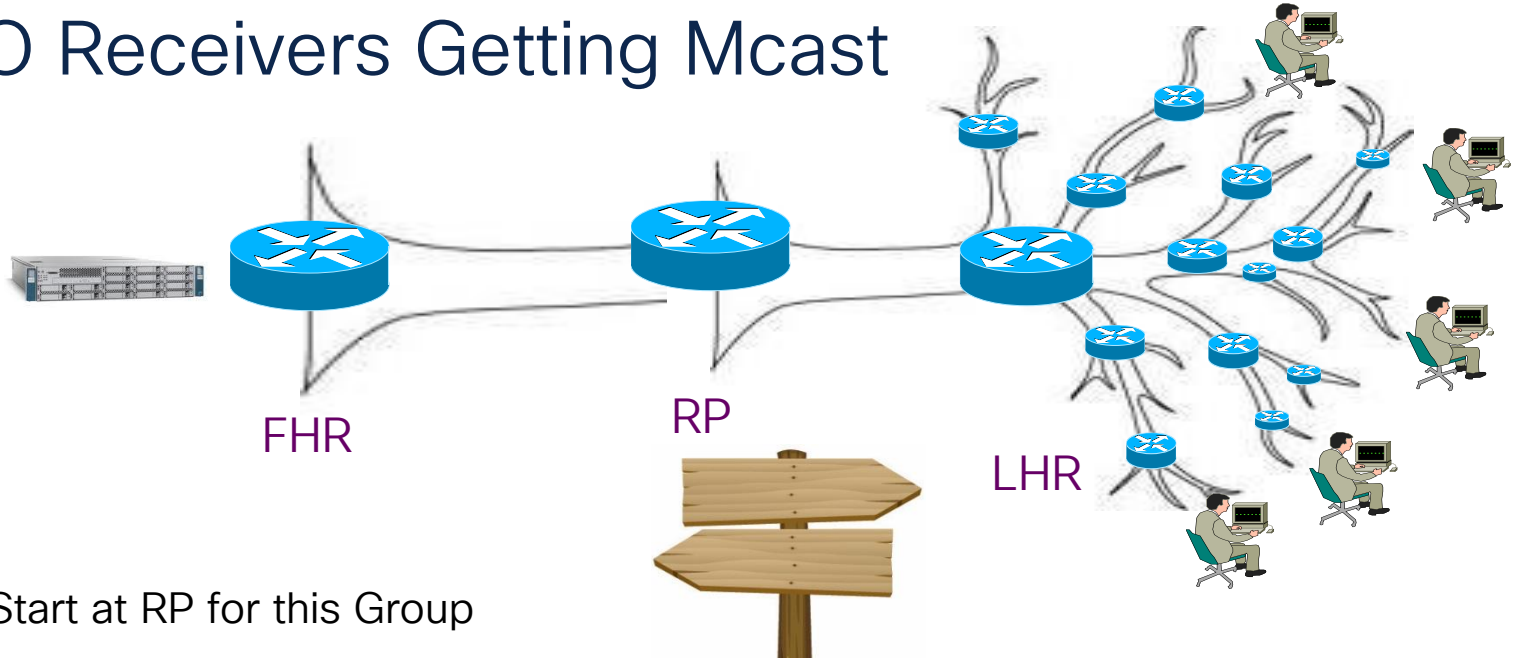
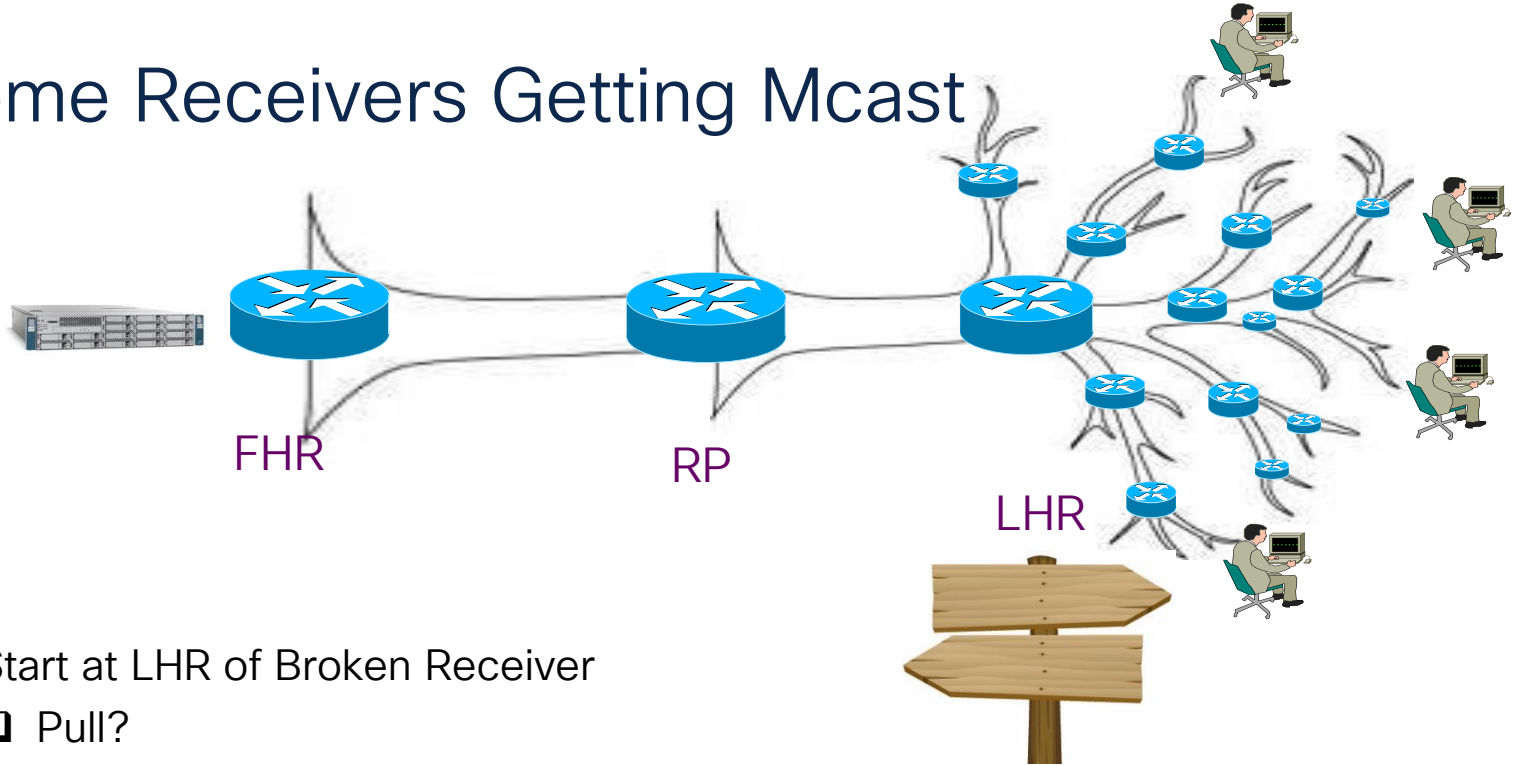
NO Receivers Getting Mcast



Start at RP for this Group

- ❑ *,G w/ OIL?
  - NO? Go to LHR and start there
- ❑ S,G
  - NO? Go to any FHR

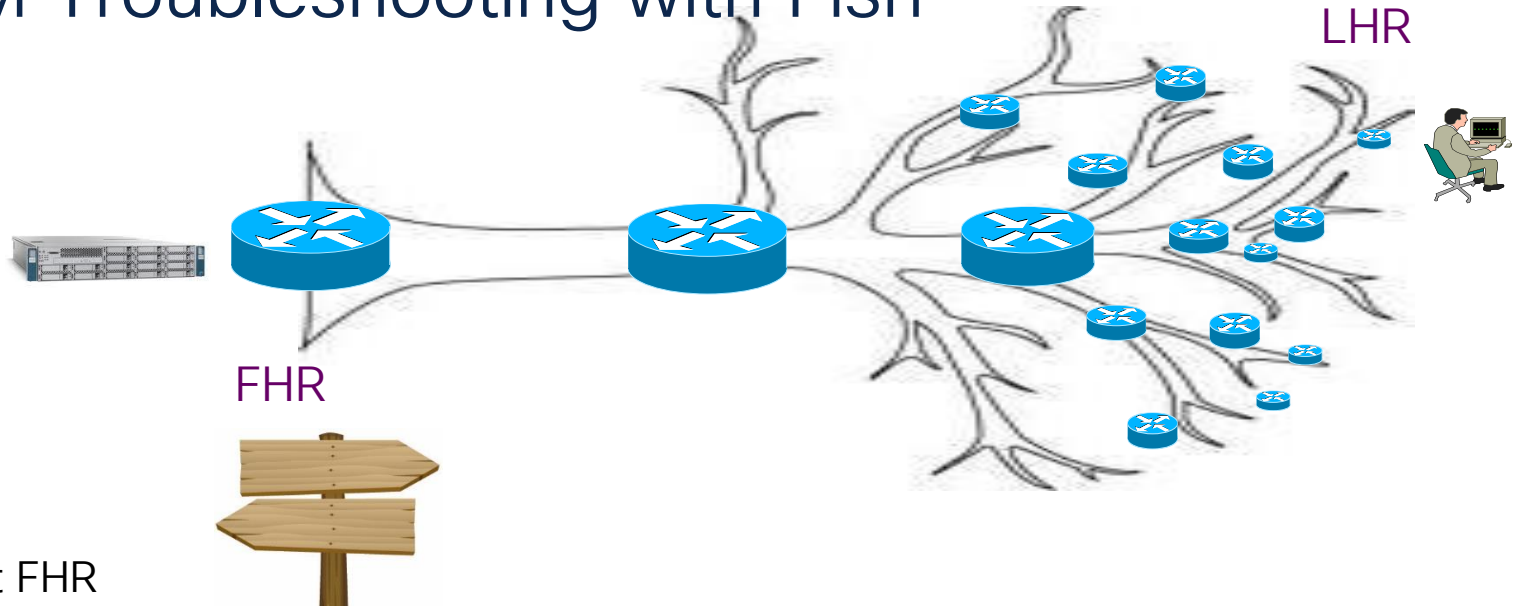
Some Receivers Getting Mcast



Start at LHR of Broken Receiver

- ❑ Pull?
- ❑ Who, Where, What

SSM Troubleshooting with Fish

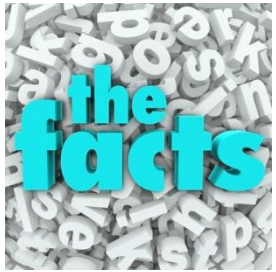


Start at FHR

- ❑ S,G w/ OIL?
  - NO? Pick 1 LHR and start there
  - YES? Check to see if traffic coming in from Source

Key Takeaways

Troubleshooting Toolbox
Facts to Remember



- Multicast Trees get built backwards towards the root
- Multicast traffic in ASM and SSM are triggered via a “pull”
- High on the “food chain” dependent on routing working and PIM working

Troubleshooting Toolbox Questions to Remember

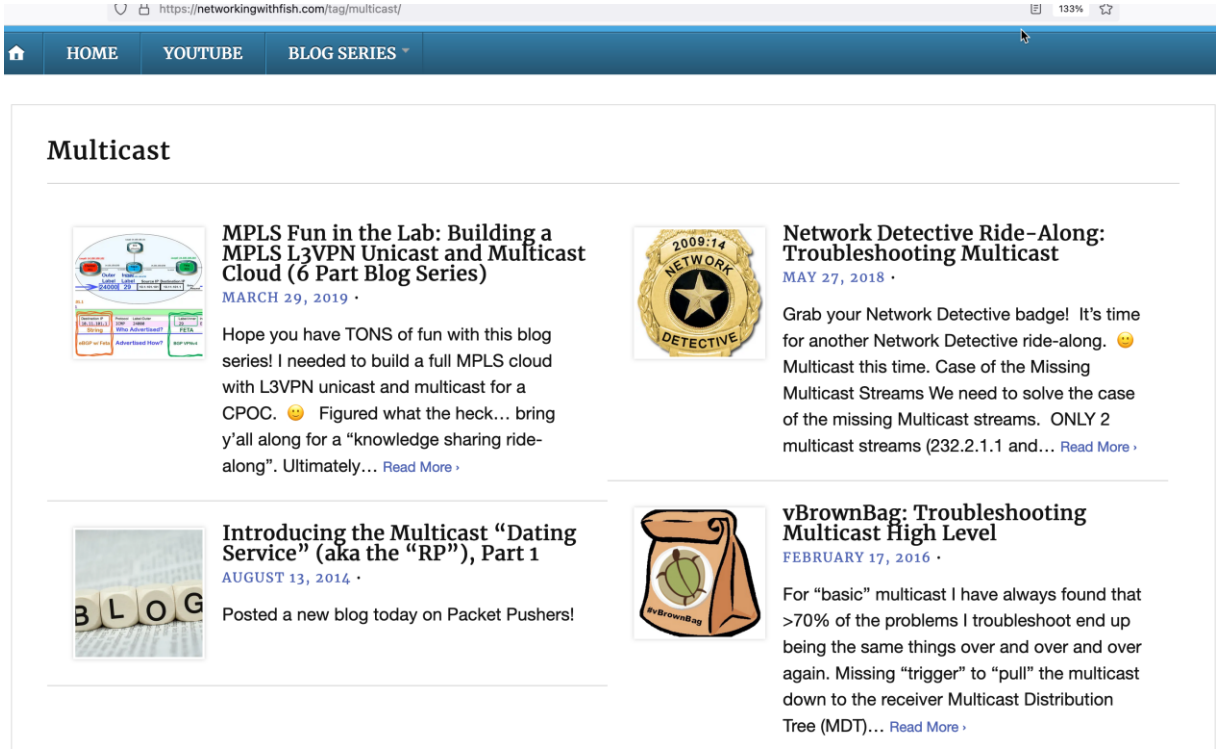
- Who is the root?
- Where is the root?
- What is the PIM RPF neighbor towards the root?

Troubleshooting Toolbox Checklist

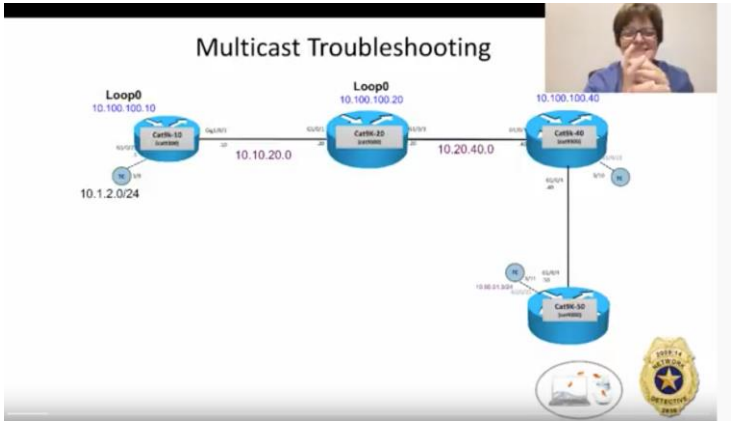
- IGMP Membership Report Received by LHR
- “WHO:” is the root?
- “WHERE” is the root?
- “WHAT” is the PIM RPF neighbor towards the root?

NetworkingWithFish.Com Multicast Fun

https://networkingwithfish.com/tag/multicast/



YouTube Multicast Troubleshooting Fun



Symptom: ONLY 2 multicast streams (232.2.1.1 and 239.2.1.1) are getting thru to the hosts who requested them. The other 4 streams the same hosts requested are NOT getting thru.

Start of Video - 2:30: The Facts and the Symptom
2:31-4:40: Overview of How I Plan on Troubleshooting This PLUS What I will Find
4:41 til End: Off to the CLI and playing Network Detective. :)

https://youtu.be/KXC7Q-l3wDc

CiscoLive BRKIPM-2264:
In Depth Mcast Troubleshooting

Multicast Troubleshooting - BRKIPM-2264

Fish Fishburne, Solution Architect, Cisco Systems, Inc. - **Distinguished Speaker**

You built it. Now how do you maintain it? Multicast networks present unique challenges to network managers. This session presents a look at basic multicast troubleshooting and troubleshooting methodologies. This session will also present many examples of common, and not so common, multicast networks problems and show what commands to use and how to solve them.

Event: 2019 San Diego
Technical Level: Intermediate
Technology: Routing
Session Type: Breakout
Tracks: Enterprise Technologies
Featured: Sessions with Video

Session Presentation
Session Video

https://www.ciscolive.com/on-demand/on-demand-library.html?zid=pp&search=BRKIPM-2264#/session/1636059916369001 78q9

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