
# Troubleshooting IP Multicast



CISCO SYSTEMS



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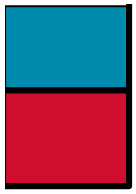


# Agenda

- **Troubleshooting Tools**
- **Basic Troubleshooting**
- **Advanced Troubleshooting**
- **Common Problems**

# Troubleshooter's "Hand" Tools

- *"show ip igmp group" command*
- *"show ip igmp interface" command*
- *"show ip pim neighbor" command*
- *"show ip pim interface" command*
- *"show ip rpf " command*
- *"show ip mroute" commands*

# Troubleshooter's "Hand" Tools

## Special Sparse Mode Tools

- *"show ip pim rp"* **command**
- *"show ip pim rp map"* **command**

# show ip igmp group

- **Shows:**

  **Currently joined multicast groups.**

- **Troubleshooting usage:**

  **Verify that a receiver has actually joined the target group**

  **If not, use *"show ip igmp interface"* to check for proper igmp version, querier, timers, etc.**

  **Use *"debug ip igmp"* to verify that proper igmp host-router exchange is happening**

  **Watch for IGMP v1-v2 interoperability problems**

# show ip igmp group

```
R4#show ip igmp groups
IGMP Connected Group Membership
Group Address    Interface              Uptime    Expires   Last Reporter
224.1.1.1        Ethernet1              3d16h     00:01:59  172.16.7.2
224.0.1.40       Ethernet0              4d15h     never     172.16.6.2
```

# show ip igmp interface

- **Shows:**
  - **Key IGMP timers, status, etc.**
- **Troubleshooting usage:**
  - **Verify that correct IGMP version is running**
  - **Verify that timers are set properly**
  - **Verify that correct router is IGMP Querier**
    - **If not, use *"debug ip igmp"* to determine what's wrong**

# show ip igmp interface

```
R4#show ip igmp interface
Ethernet1 is up, line protocol is up
  Internet address is 172.16.7.1, subnet mask is 255.255.255.0
  IGMP is enabled on interface
  Current IGMP version is 2
  CGMP is disabled on interface
  IGMP query interval is 60 seconds
  IGMP querier timeout is 120 seconds
  IGMP max query response time is 10 seconds
  Inbound IGMP access group is not set
  Multicast routing is enabled on interface
  Multicast TTL threshold is 0
  Multicast designated router (DR) is 172.16.7.1 (this system)
  IGMP querying router is 172.16.7.1 (this system)
  No multicast groups joined
```

# show ip pim neighbor

- **Shows:**

  **PIM Neighbor Adjacencies**

- **Troubleshooting usage:**

  **Verify that all neighbors are up and using proper mode**

  **If not, check router configs and/or interface status**

  **Use *"debug ip pim"* to observe PIM Query msg exchange**

# show ip pim neighbor

```
R6#show ip pim neighbor
PIM Neighbor Table
Neighbor Address  Interface          Uptime    Expires   Mode
172.16.10.2       Serial0            4d15h     00:01:19  Dense
172.16.11.2       Serial1            4d15h     00:01:00  Dense
172.16.9.1        Ethernet0          4d15h     00:01:00  Dense
```

# show ip pim interface

- **Shows:**
  - **PIM Interface information.**
    - **Mode, Neighbor Count, DR**
- **Troubleshooting usage:**
  - **Verify correct PIM mode is configured on interface(s)**
    - **If not, check router configs**
  - **Verify Designated Router is correct**
    - **If not, check router configs**
    - **Especially critical for Sparse Mode!**

# show ip pim interface

```
R6#show ip pim interface
Address          Interface          Mode          Nbr    Query     DR
                                                  Count  Intvl
172.16.10.1      Serial0            Dense         1      30      0.0.0.0
172.16.11.1      Serial1            Dense         1      30      0.0.0.0
172.16.9.2       Ethernet0          Dense         1      30      172.16.9.2
```

# show ip rpf

- **Shows:**
  - **RPF interface information for source**
- **Troubleshooting usage:**
  - **Verify that RPF information is correct**
    - **If not, check unicast routing data for correctness**
    - **Ping or Trace “source” to verify unicast route is working. (Fix any unicast routing problems first!)**
    - **May need to use DVMRP routes or Static Mroutes to fix unicast-multicast incongruency**

# show ip rpf

```
R4#show ip rpf 172.16.8.1
RPF information for Source1 (172.16.8.1)
  RPF interface: Ethernet0
  RPF neighbor: R3 (172.16.6.1)
  RPF route/mask: 172.16.8.0/255.255.255.0
  RPF type: unicast

R4#sh ip rpf 172.16.12.2
RPF information for Source2 (172.16.12.2)
  RPF interface: Tunnel0
  RPF neighbor: R6 (172.16.11.1)
  RPF route/mask: 172.16.12.0/255.255.255.0
  RPF type: DVMRP
```

# show ip mroute commands

- *“show ip mroute sum”*
- *“show ip mroute count”*
- *“show ip mroute active”*
- *“show ip mroute”*

# show ip mroute summary

- **Shows:**
  - **Multicast state at a glance**
    - **Active groups**
    - **Active senders in the group. (If SPT joined)**
- **Troubleshooting usage:**
  - **Verify multicast group(s) are active.**
    - **If not, check for group state at RP. (Sparse mode)**
    - **Work your way from a known source to a receiver or the RP to find where things stop**
  - **Verify senders are active. (If SPT joined)**
    - **If not, check state in 1st-hop router**
    - **Verify sender is really sending**

# show ip mroute summary

```
dallas-gw>show ip mroute summary
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, C - Connected, L - Local, P - Pruned
       R - RP-bit set, F - Register flag, T - SPT-bit set, J - Join SPT
Timers: Uptime/Expires
Interface state: Interface, Next-Hop, State/Mode


(*, 224.0.255.255), 6d23h/00:02:59, RP 171.69.10.13, flags: SJC
  (171.68.37.121/32, 224.0.255.255), 6d23h/00:02:55, flags: CT
  (171.69.58.88/32, 224.0.255.255), 6d23h/00:02:58, flags: CT
  (171.69.60.189/32, 224.0.255.255), 6d23h/00:02:55, flags: CT
  (171.69.128.115/32, 224.0.255.255), 3d01h/00:02:58, flags: CJT
  (171.69.199.49/32, 224.0.255.255), 6d23h/00:02:57, flags: CT
  (171.70.247.82/32, 224.0.255.255), 01:55:33/00:02:58, flags: CJT
...
```

# show ip mroute count

- **Shows:**
  - **Multicast traffic flow rates, drops, etc.**
    - **Group traffic summary**
    - **Sender rates, packet counts, drops, etc.**
- **Troubleshooting usage:**
  - **Verify multicast traffic is being received**
    - **If not, work your way from source to receiver to find where things stop**
  - **Verify multicast traffic is being forwarded**
    - **If not, why? “oif null”, “rpf-failure”**

# show ip mroute count

```
dallas-gw>show ip mroute 224.0.255.255 count
IP Multicast Statistics - Group count: 7, Average sources per group: 3.28
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts: Total received/RPF failed/Other drops(OIF-null, rate-limit etc)

Group: 224.0.255.255, Source count: 6, Group pkt count: 538169
  RP-tree: Forwarding: 0/0/0/0, Other: 0/0/0
  Source: 171.68.37.121/32, Forwarding: 120484/0/94/0, Other: 120535/0/51
  Source: 171.69.58.88/32, Forwarding: 120281/0/84/0, Other: 120283/2/0
  Source: 171.69.60.189/32, Forwarding: 120445/0/95/0, Other: 120447/2/0
  Source: 171.69.128.115/32, Forwarding: 53018/0/93/0, Other: 53018/0/0
  Source: 171.69.199.49/32, Forwarding: 120414/1/92/0, Other: 120415/1/0
  Source: 171.70.247.82/32, Forwarding: 3527/1/78/0, Other: 3527/0/0
```

# show ip mroute active

- **Shows:**
  - **Sources with traffic rates above threshold**
    - **Aggregate RP Tree and (S, G) rates shown**
    - **Rates in Kbps (1 sec, 1 min, 5 min avgs.)**
- **Troubleshooting usage:**
  - **Determine which sources/groups are active**
  - **Determine the traffic rate of each source**
    - **Note: Must have switched to Shortest-Path tree**
  - **Verify "target" group multicast traffic is being received**
    - **If not, work your way from source to receiver**

# show ip mroute active

```
barrnet-gw>show ip mroute active
Active IP Multicast Sources - sending >= 4 kbps

Group: 224.2.156.43, *cisco: Bloomington IPTV Beacon
   Source: 172.17.67.43 (bloom-iptv.cisco.com)
     Rate: 6 pps/63 kbps(1sec), 65 kbps(last 19 secs), 37 kbps(life avg)

Group: 224.2.154.118, Radio Bandit
   Source: 192.36.125.68 (falcon.pilsnet.sunet.se)
     Rate: 11 pps/30 kbps(1sec), 30 kbps(last 33 secs), 23 kbps(life avg)

Group: 224.2.246.13, UO Presents KWAX Classical Radio
   Source: 128.223.83.204 (d83-204.uoregon.edu)
     Rate: 24 pps/69 kbps(1sec), 72 kbps(last 2 secs), 70 kbps(life avg)

Group: 224.2.180.115, ANL TelePresence Microscopy Site
   Source: 146.139.72.5 (aem005.amc.anl.gov)
     Rate: 1 pps/5 kbps(1sec), 9 kbps(last 52 secs), 12 kbps(life avg)
...
```

# show ip mroute

- **Shows:**

  **Detailed multicast state in the router**

- **Troubleshooting usage:**

  **Verify Incoming Interface is correct**

  **If not, check unicast routing table (May need to use DVMRP routes or Static mroutes)**

  **Verify Outgoing Interface(s) are correct**

  **If interface incorrectly "Pruned", check state in downstream router?**

  **May need to "*debug ip pim <group>*" to determine problem**

# show ip mroute

```
barrnet-gw>show ip mroute
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, C - Connected, L - Local, P - Pruned
       R - RP-bit set, F - Register flag, T - SPT-bit set, J - Join
SPT
Timers: Uptime/Expires
Interface state: Interface, Next-Hop, State/Mode
(*, 224.2.130.100), 00:18:53/00:02:59, RP 0.0.0.0, flags: D
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    Fddi1/0, Forward/Dense, 00:09:20/00:02:38
    Hssi3/0, Forward/Dense, 00:18:53/00:00:00
(208.197.169.209/32, 224.2.130.100), 00:18:53/00:02:27, flags: T
  Incoming interface: Hssi3/0, RPF nbr 131.119.26.9
  Outgoing interface list:
    Fddi1/0, Forward/Dense, 00:16:16/00:02:38
(*, 239.100.111.224), 05:35:08/00:02:58, RP 171.69.10.13, flags: DP
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list: Null
```

# show ip pim rp map

- **Shows:**

  **RP assignments by multicast group range**

- **Troubleshooting usage:**

  **Verify that configured (static or Auto-RP) RP's are correct**

  **If not, check local router config and/or network Auto-RP configuration**

# show ip pim rp map

```
dallas-gw>show ip pim rp map
PIM Group-to-RP Mappings

Group(s) 224.0.0.0/4, uptime: 6d21h, expires: 00:02:56
    RP 171.69.10.13 (sj-eng-mbone.cisco.com)
    Info source: 192.31.7.37 (barrnet-gw.cisco.com)
```

# show ip pim rp

- **Shows:**

  **RP's by active group**

- **Troubleshooting usage:**

  **Verify that the RP for the target multicast group is correct**

  **If not, check RP mapping, local router RP config and/or network Auto-RP**

# show ip pim rp

```
dallas-gw>sh ip pim rp
Group: 224.2.127.253, RP: 171.69.10.13, uptime 6d21h, expires 00:01:34
Group: 224.1.127.255, RP: 171.69.10.13, uptime 6d21h, expires 00:01:34
Group: 224.2.127.254, RP: 171.69.10.13, uptime 6d21h, expires 00:01:34
Group: 224.0.255.255, RP: 171.69.10.13, uptime 6d21h, expires 00:01:34
Group: 224.2.0.1, RP: 171.69.10.13, uptime 6d21h, expires 00:01:34
```

# Troubleshooter's "Power" Tools

- "*mtrace*" and "mstat" commands
- "*mrinfo*" command
- "*show ip mpacket*" command

# mtrace and mstat commands

- **Based on Unix *"mtrace"* command**
- **Split into two separate commands**
- **Both use the same mechanism**

  **`draft-ietf-idmr-traceroute-ipm-`*`xx`*`.txt`**

# mtrace

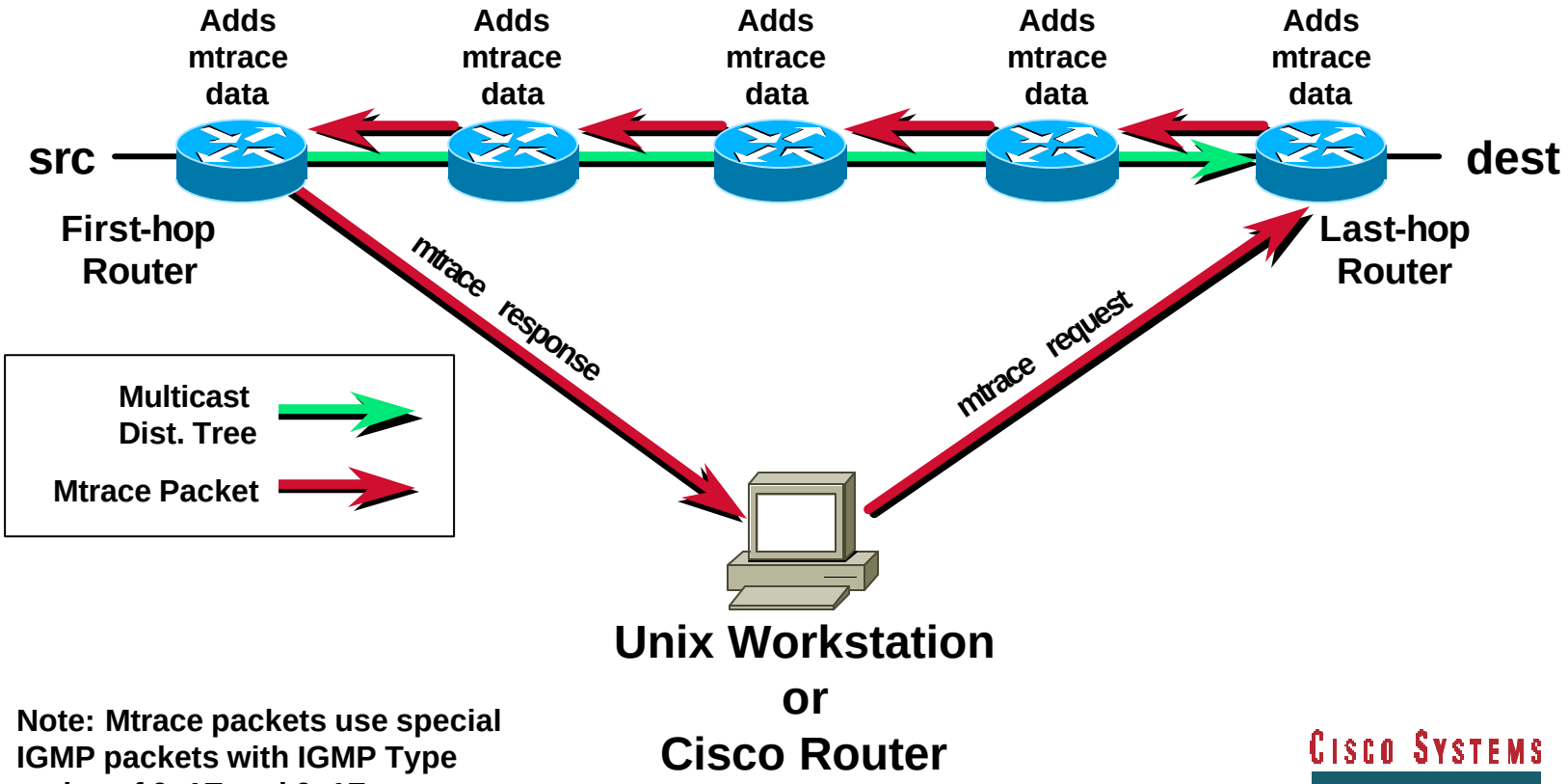
- **Shows:**
  - **Multicast path from source to receiver**
    - **Similar to unicast “trace” command**
    - **Trace path between any two points in network**
    - **TTL Thresholds and Delay shown at each node**
- **Troubleshooting usage:**
  - **Find where multicast traffic flow stops**
    - **Focus on router where flow stops**
  - **Verify path multicast traffic is following**
    - **Identify sub-optimal paths**

# mstat

- **Shows:**
  - **Multicast path in pseudo graphic format**
    - **Trace path between any two points in network**
    - **Drops/Duplicates shown at each node**
    - **TTLs and Delay shown at each node**
- **Troubleshooting usage:**
  - **Locate congestion point in the flow**
    - **Focus on router with high drop/duplicate count**
    - **Duplicates indicated as “negative” drops**

# mtrace/mstat—How it works

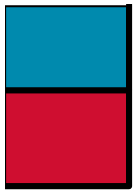
## Mtrace Packet Flow




Note: Mtrace packets use special IGMP packets with IGMP Type codes of 0x1E and 0x1F.

# mtrace/mstat—How it Works

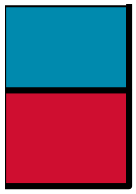
- **Each hop adds data to packet**
  - **Query arrival time**
  - **Incoming Interface**
  - **Outgoing Interface**
  - **Prev. Hop Router address**
  - **Input packet count**
  - **Output packet count**
  - **Total packets for this Source/Group**
  - **Routing Protocol**
  - **TTL Threshold**
  - **Fowarding/Error Code**



# mtrace

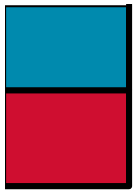
```
dallas-gw>mtrace bloom-iptv-svr bwilliam-ss5 224.2.156.43
Type escape sequence to abort.
Mtrace from 172.17.67.43 to 171.68.37.121 via group 224.2.156.43
From source (?) to destination (bwilliam-ss5.cisco.com)
Querying full reverse path...
 0  bwilliam-ss5 (171.68.37.121)
-1  dallas-gw (171.68.37.1) PIM  thresh^ 0  3 ms
-2  wan-gw4 (171.68.86.193) PIM  thresh^ 0  32 ms
-3  bloomington-mn-gw (171.68.27.2) PIM  thresh^ 0  717 ms
-4  bloom-mnlab (171.68.39.28) PIM  thresh^ 0  730 ms
-5  bloom-iptv-svr (172.17.67.43)
dallas-gw>
```





# mstat

```
dallas-gw>mstat bloom-iptv-svr bwilliam-ss5 224.2.156.43
  Source        Response Dest    Packet Statistics For     Only For Traffic
172.17.67.43    171.68.86.194    All Multicast Traffic     From 172.17.67.43
     |       __/  rtt 547  ms   Lost/Sent = Pct  Rate     To 224.2.156.43
     v      /     hop 547  ms   ---------------------     --------------------
172.17.67.33
171.68.39.28    bloom-mnlab
     |     ^      ttl   0
     v     |      hop -409 ms    -11/168 = --%  16 pps     0/67 = 0%  6 pps
171.68.39.1
171.68.27.2     bloomington-mn-gw
     |     ^      ttl   1
     v     |      hop 379  ms    -9/170 = --%   17 pps    -3/67 = --%  6 pps
171.68.27.1
171.68.86.193   wan-gw4
     |     ^      ttl   2
     v     |      hop 28   ms    -3/195 = --%   19 pps     0/70 = 0%   7 pps
171.68.86.194
171.68.37.1     dallas-gw
     |      \__   ttl   3
     v         \  hop 0    ms        196        19 pps          70    7 pps
171.68.37.121   171.68.86.194
  Receiver      Query Source
```



# mstat

```
dallas-gw>mstat bloom-iptv-svr bwilliam-ss5 224.2.156.43
  Source        Response Dest    Packet Statistics For     Only For Traffic
172.17.67.43    171.68.86.194    All Multicast Traffic     From 172.17.67.43
     |       __/  rtt 399  ms   Lost/Sent = Pct  Rate     To 224.2.156.43
     v      /     hop 399  ms   ---------------------     --------------------
172.17.67.33
171.68.39.28    bloom-mnlab
     |     ^      ttl   0
     v     |      hop 119  ms    77/694 = 11%  69 pps    0/65 = 0%    6 pps
171.68.39.1
171.68.27.2     bloomington-mn-gw
     |     ^      ttl   1
     v     |      hop -150 ms    395/609 = 65% 60 pps    44/65 = 68%  6 pps
171.68.27.1
171.68.86.193   wan-gw4
     |     ^      ttl   2
     v     |      hop 30   ms    -8/39 = --%    3 pps    -1/21 = --%  2 pps
171.68.86.194
171.68.37.1     dallas-gw
     |      \__   ttl   3
     v         \  hop 0    ms        39         3 pps           22    2 pps
171.68.37.121   171.68.86.194
  Receiver      Query Source
```

# mrinfo

- **Shows:**
  - **Multicast neighbor router information**
    - **Indicates router's capabilities and code version**
    - **Multicast interface information**
      - **TTL-Thresholds, Metric, Protocol, Status**
- **Troubleshooting usage:**
  - **Verify multicast neighbors.**
    - **Confirm bi-directional neighbor adjacency exists**
  - **Verify Tunnels are up in both directions**

# mrinfo

```
dallas-gw>mrinfo paloalto-mbone1.bbnplanet.net
Translating " paloalto-mbone1.bbnplanet.net "...domain server (171.68.10.70) [OK]
131.119.0.197 (paloalto-mbone1.bbnplanet.net) [version cisco 11.2] [flags: PMSA]:
  131.119.0.197 -> 131.119.0.201 (paloalto-cr1.bbnplanet.net) [1/0/pim]
  131.119.244.244 -> 0.0.0.0 [1/32/pim/querier]
  131.119.0.197 -> 204.162.119.8 (hydra.precept.com) [1/32/tunnel/querier]
  192.42.110.249 -> 192.9.9.71 (mbone.Sun.COM) [1/32/tunnel]
  192.42.110.249 -> 204.123.13.69 (chocolate.research.digital.com) [1/32/tunnel]
  192.42.110.249 -> 36.253.0.11 (alpo.Stanford.EDU) [1/32/tunnel]
  131.119.0.197 -> 0.0.0.0 [1/64/tunnel/pim/querier/leaf]
  131.119.0.197 -> 0.0.0.0 [1/32/tunnel/pim/querier/leaf]
  192.42.110.249 -> 204.94.211.39 (sgi-too.SGI.COM) [4/64/tunnel/querier]
  192.42.110.249 -> 192.216.174.1 [1/32/tunnel/querier/down/leaf]
  192.42.110.249 -> 198.94.216.2 [1/32/tunnel/querier/down/leaf]
  192.42.110.249 -> 204.161.60.33 (berkeley.faslab.com) [1/32/tunnel/querier]
  131.119.0.197 -> 204.154.181.12 [1/32/tunnel/querier/down/leaf]
...
```

# show ip mpacket

- Used to view multicast packet headers
- Command syntax

  show ip mpacket <source> <group> [detail]

- You can view:

  {source, group} traffic pairs

  IP ident and ttl

  Inter-packet delay

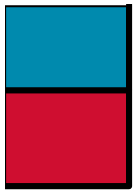
- Configure multicast header capture first

  “ip multicast cache-headers” config cmd

  Captures multicast headers in 1024 entry ring buffer

# show ip mpacket

```
dino-cisco-fr#show ip mpacket 224.2.231.173
IP Multicast Header Cache - entry count: 29, next index: 30
Key: id/ttl timestamp (name) source group

D782/117 206416.908 (all-purpose-gunk.near.net) 199.94.220.184 224.2.231.173
7302/113 206417.172 (speedy.rrz.uni-koeln.de) 134.95.19.23 224.2.231.173
6CB2/114 206417.412 (wayback.uoregon.edu) 128.223.156.117 224.2.231.173
D786/117 206417.868 (all-purpose-gunk.near.net) 199.94.220.184 224.2.231.173
E2E9/123 206418.488 (dino-ss20.cisco.com) 171.69.58.81 224.2.231.173
1CA7/127 206418.544 (dino-ss2.cisco.com) 171.69.129.220 224.2.231.173
1CAA/127 206418.584 (dino-ss2.cisco.com) 171.69.129.220 224.2.231.173
1CAC/127 206418.624 (dino-ss2.cisco.com) 171.69.129.220 224.2.231.173
1CAF/127 206418.664 (dino-ss2.cisco.com) 171.69.129.220 224.2.231.173
1CB0/127 206418.704 (dino-ss2.cisco.com) 171.69.129.220 224.2.231.173
1CB2/127 206418.744 (dino-ss2.cisco.com) 171.69.129.220 224.2.231.173
2BBB/114 206418.840 (crevenia.parc.xerox.com) 13.2.116.11 224.2.231.173
3D1D/123 206419.380 (dalvarez-ss20.cisco.com) 171.69.60.189 224.2.231.173
2BC0/114 206419.672 (crevenia.parc.xerox.com) 13.2.116.11 224.2.231.173
7303/113 206419.888 (speedy.rrz.uni-koeln.de) 134.95.19.23 224.2.231.173
7304/113 206420.140 (speedy.rrz.uni-koeln.de) 134.95.19.23 224.2.231.173
2C7E/123 206420.360 (lwei-ss20.cisco.com) 171.69.58.88 224.2.231.173
```



# Agenda

- Troubleshooting Tools
- **Basic Troubleshooting**
- Advanced Troubleshooting
- Common Problems

# Basic Troubleshooting

## Troubleshooting Table

| | Source | Network | Receivers |
|---|---|---|---|
| State | NA | ? | ? |
| Packet Flow | ? | ? | ? |

**Is each piece working correctly?**

# Check Source Packet Flow

- Check interface counters on source
- Check source TTL > 1

  Verify TTL setting in application

  Confirm on upstream router

  `show ip traffic`

  Increasing "`Invalid hop count`"

# Check Source Packet Flow

- **Check 1st-Hop router for traffic flow**

  **`show ip mroute count`**

  **`show ip mroute active`**

  **`show ip mpacket`**

  ***Don't forget to turn on:***

  **`ip multicast cache-headers`**

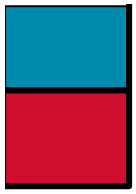
  **`debug ip mpacket`**

  ***Use with caution!!***

  **"`detail`" or ACL for granularity**

# Check Network State

- Most complex piece
- Depends of protocol, mode, etc.
- Check initial state creation
- Check for pruning and timer expiration during session



# Network State

- **`show/debug ip mroute commands`**

  **watch oilist for null entries**

- **`show/debug ip pim commands`**
- **`show/debug ip dvmrp commands`**
- **`show ip rpf`**
- **`mtrace command`**

# PIM SM Troubleshooting

- **`show ip pim rp [<group>]`**
  **indicates RP for the group**
- **`show ip pim rp mapping`**
  **indicates RP for the group**
- **`debug ip pim auto-rp`**

# Check Network Packet Flow

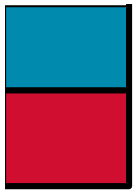
- **`show ip mroute count`**
- **`show ip mroute active`**
- **`show ip mpacket`**
  - **Turn on "`ip multicast cache-headers`" first**
- **`debug ip mpacket`**
  - **Be Careful with this one!**
- **`mstat`**

# Check Receiver State

- `show ip igmp interface`
- `show ip igmp group`
- `debug ip igmp`
- IGMPv1 vs. IGMPv2

# Check Receiver Packet Flow

- Check receiver interface stats
- Is the stack installed and configured properly?
- Is the application installed and configured properly?
- Watch for duplicates
  - Performance implication



# Agenda

- Troubleshooting Tools
- Basic Troubleshooting
- Advanced Troubleshooting
- Common Problems

# Advanced Troubleshooting

- **Troubleshooting Network State**
- **Troubleshooting PIM-DVMRP**
- **Troubleshooting ATM P2MP VCs**

# Troubleshooting Network State

- Use "*show ip mroute <group>*"

  Specify target group to limit output.

  DM: Trace state from source to receiver.

  SM: Trace state from receiver to RP then from source to RP

- Use "*debug ip pim <group>*"

  Be sure to specify target group to limit debug output!

  *Use with caution!!*

- Use "*debug ip mroute <group>*"

  Be sure to specify target group to limit debug output!

  Use with caution!!

# Mroute Flags

- **“S”—Sparse Mode**

  **Appears only on the (*, G) entries**

- **“D”—Dense Mode**

  **Appears only on the (*, G) entries**

- **“P”—Pruned**

  **Sparse mode: oilist is *null***

  **Dense mode: all interfaces in oilist = Pruned**

# Mroute Flags (Cont.)

- **"C"—Connected**

  **A rcvr for this group is directly connected to this router.**

- **"L"—Local**

  **The router itself is a member of this group and is receiving group traffic.**

- **"T"—Shortest-path Tree (SPT) flag**

  **Set on (S,G) entry when packets are being successfully received via the SPT**

# Mroute Flags *(Sparse Mode Only)*

- **"R"—RP bit**
  - **Only appears on (S, G) entries**
  - **(S, G) state is associated with Shared Tree**
  - **RPF interface points up Shared Tree to RP**
  - **Used to prune unwanted (S, G) traffic from the Shared Tree after SPT switchover**
- **"F"—Register Flag**
  - **Appears on (S, G) entries**
  - **Set on (*, G) if any (S, G) "F" flags set**
  - **Router is directly connected to a source**
  - **Register messages must be sent to RP**

# Mroute Flags *(Sparse Mode Only)*

## (*, G) Entry

### "J" —Join SPT

Set once/sec when SPT-Threshold exceeded
Switch to SPT for next (S, G) packet rcvd'd

## (S, G) Entry

### "J" —SPT Joined

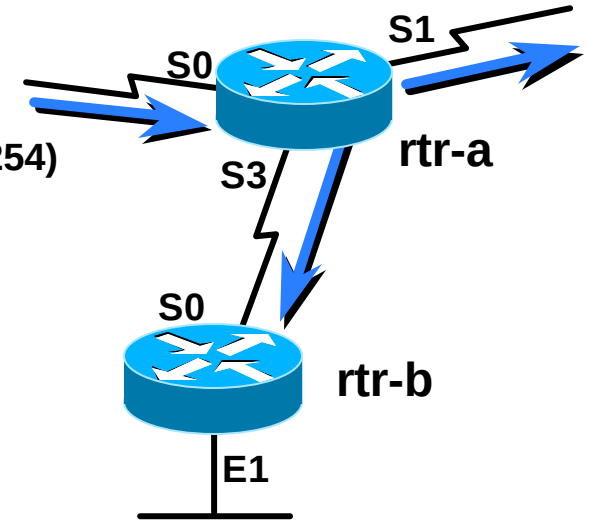
SPT Joined due to SPT-Threshold exceeded.
Switch back to Shared Tree if traffic rate falls below SPT-Threshold. (Checked once/min)

# Network Mroute State Examples

- **PIM DM**
- **PIM SM**
  - **Joining**
  - **Registering**
  - **SPT-Switchover**

# PIM DM

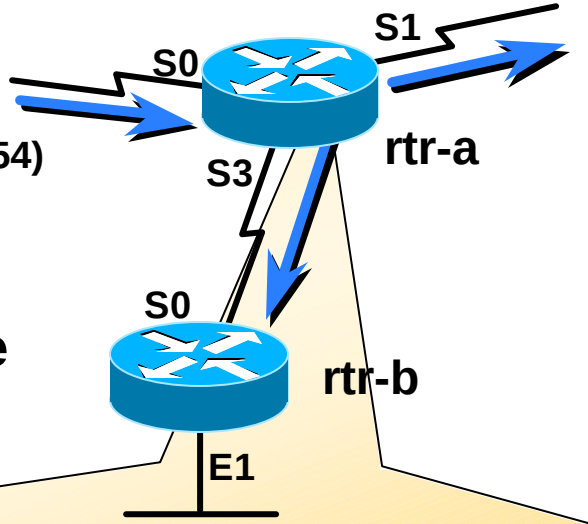
1. Multicast Packets
(128.9.160.43, 224.2.127.254)




1. “rtr-a” initially floods (S, G) traffic out all interfaces in *“oilist”*.

# PIM DM

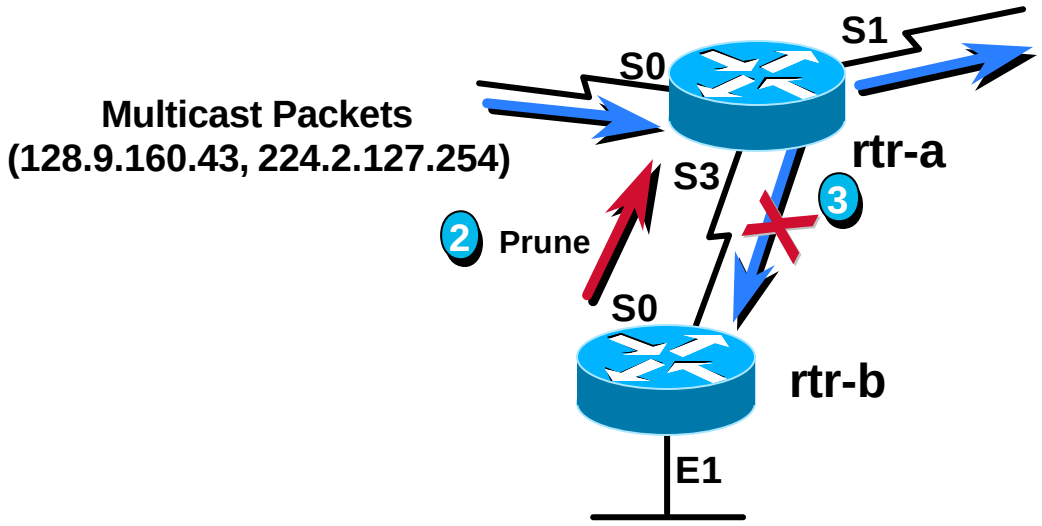
Multicast Packets
(128.9.160.43, 224.2.127.254)




Initial “Flooding” State
in “rtr-a”

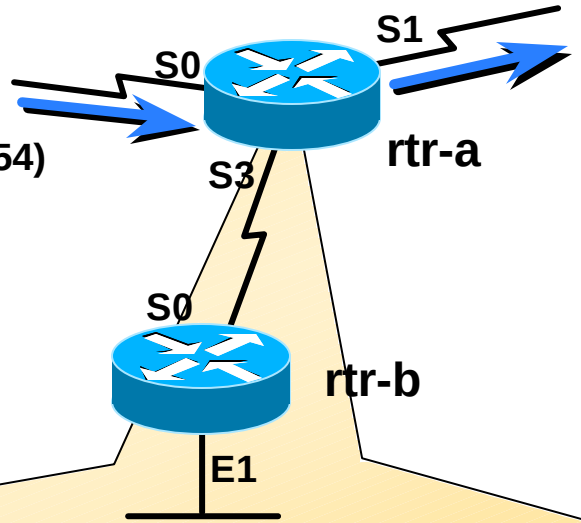
```
(*, 224.2.127.254), 00:00:10/00:00:00, RP 0.0.0.0, flags: D
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    Serial1, Forward/Dense, 00:00:10/00:00:00
    Serial3, Forward/Dense, 00:00:10/00:00:00

(128.9.160.43/32, 224.2.127.254), 00:00:10/00:02:49, flags: T
  Incoming interface: Serial0, RPF nbr 198.92.1.129
  Outgoing interface list:
    Serial1, Forward/Dense, 00:00:10/00:00:00
    Serial3, Forward/Dense, 00:00:10/00:00:00
```

# PIM DM




1. "rtr-a" initially floods (S, G) traffic out all interfaces in *"oilist"*
2. "rtr-b" is a leaf node w/o receivers. Sends Prune for (S,G)
3. "rtr-a" Prunes interface for (S,G)

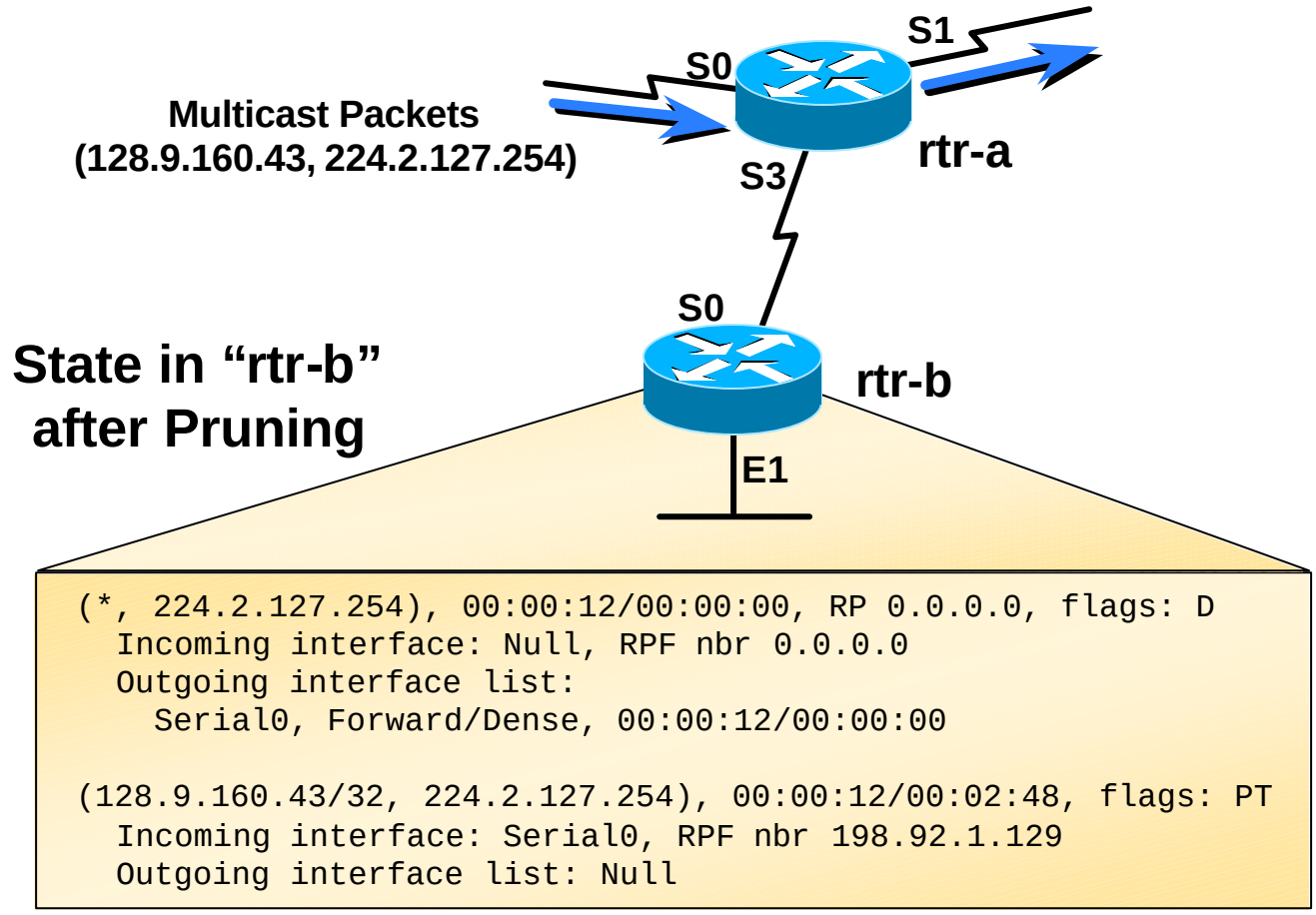
# PIM DM



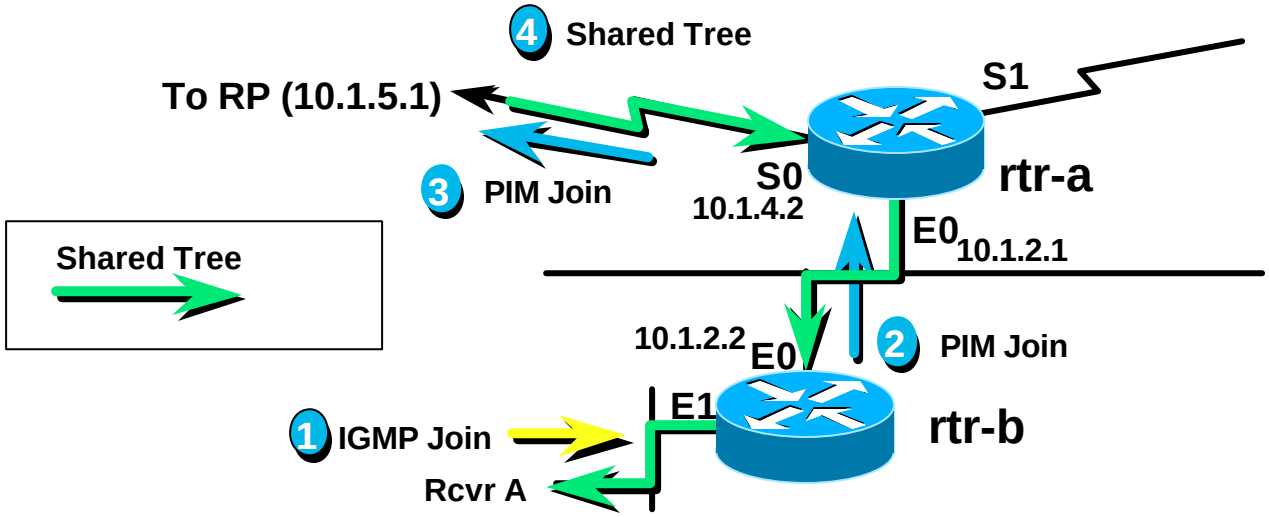

State in “rtr-a” after Pruning

```
(*, 224.2.127.254), 00:00:12/00:00:00, RP 0.0.0.0, flags: D
  Incoming interface: Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    Serial1, Forward/Dense, 00:00:12/00:00:00
    Serial3, Forward/Dense, 00:00:12/00:00:00

(128.9.160.43/32, 224.2.127.254), 00:00:12/00:02:48, flags: T
  Incoming interface: Serial0, RPF nbr 198.92.1.129
  Outgoing interface list:
    Serial1, Forward/Dense, 00:00:12/00:00:00
    Serial3, Prune/Dense, 00:00:04/00:02:56
```

# PIM DM

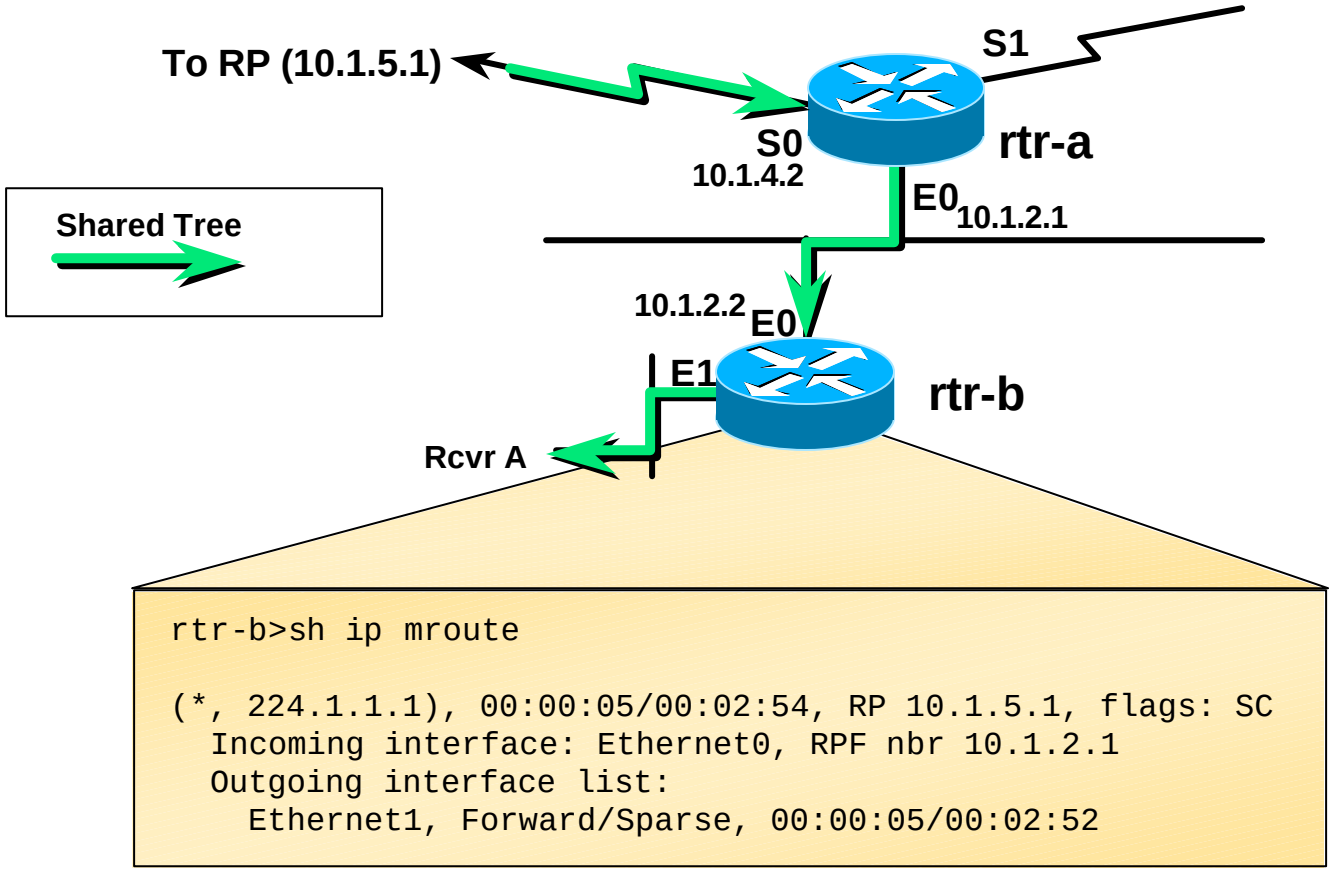

Multicast Packets
(128.9.160.43, 224.2.127.254)
S0
S1
S3
rtr-a
S0
rtr-b
E1
State in “rtr-b”
after Pruning
(*, 224.2.127.254), 00:00:12/00:00:00, RP 0.0.0.0, flags: D
Incoming interface: Null, RPF nbr 0.0.0.0
Outgoing interface list:
Serial0, Forward/Dense, 00:00:12/00:00:00
(128.9.160.43/32, 224.2.127.254), 00:00:12/00:02:48, flags: PT
Incoming interface: Serial0, RPF nbr 198.92.1.129
Outgoing interface list: Null

# PIM SM Joining




1. "Rcvr A" wishes to receive group G traffic. Sends IGMP Join for G
2. "rtr-b" creates (*,G) state; sends (*,G) PIM Join towards RP
3. "rtr-a" creates (*,G) state; sends (*,G) PIM Join towards RP
4. Shared tree is built all the way back to the RP

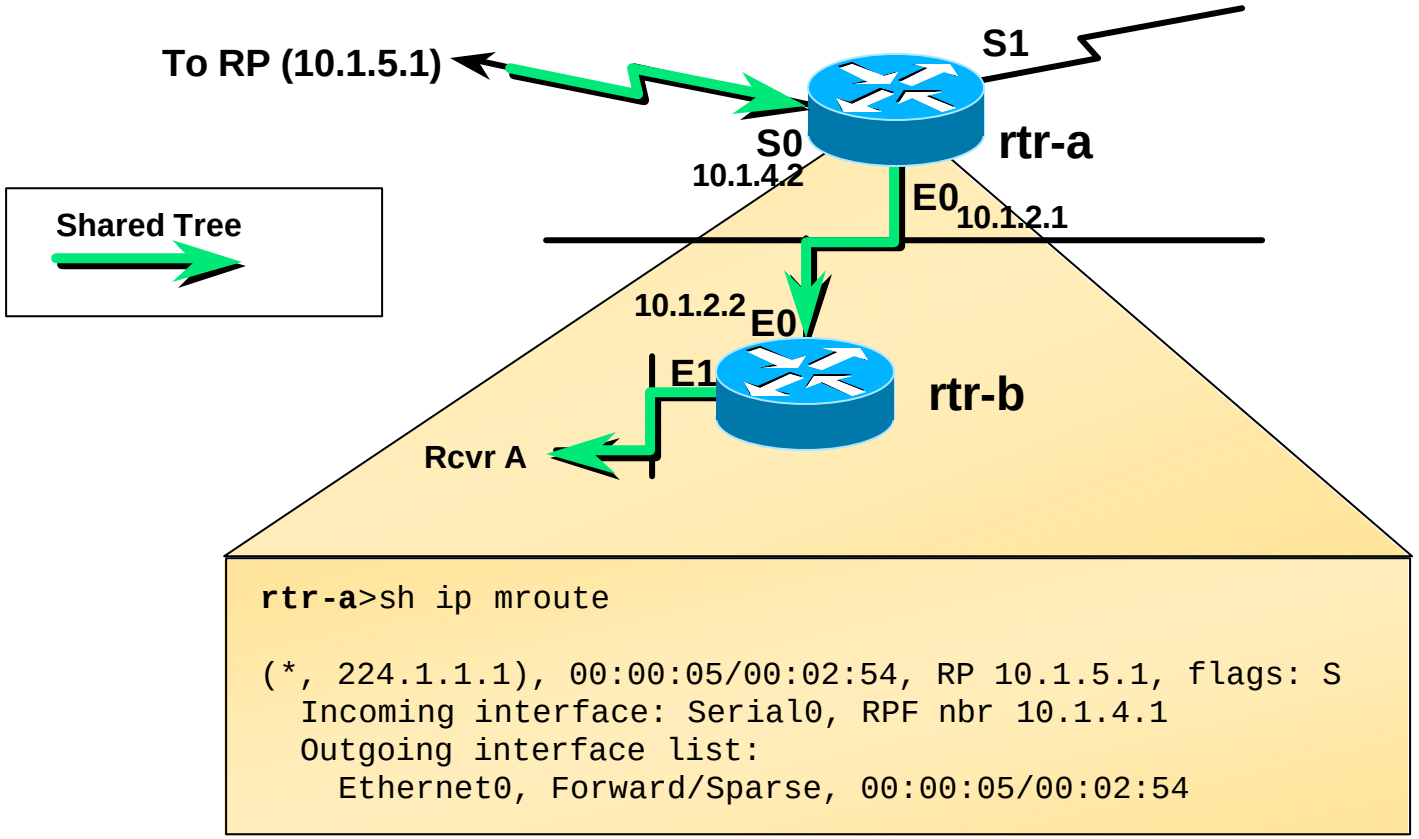
# PIM SM Joining




```
rtr-b>sh ip mroute

(*, 224.1.1.1), 00:00:05/00:02:54, RP 10.1.5.1, flags: SC
  Incoming interface: Ethernet0, RPF nbr 10.1.2.1
  Outgoing interface list:
    Ethernet1, Forward/Sparse, 00:00:05/00:02:52
```

**State in “rtr-b” after Joining (*, 224.1.1.1)**

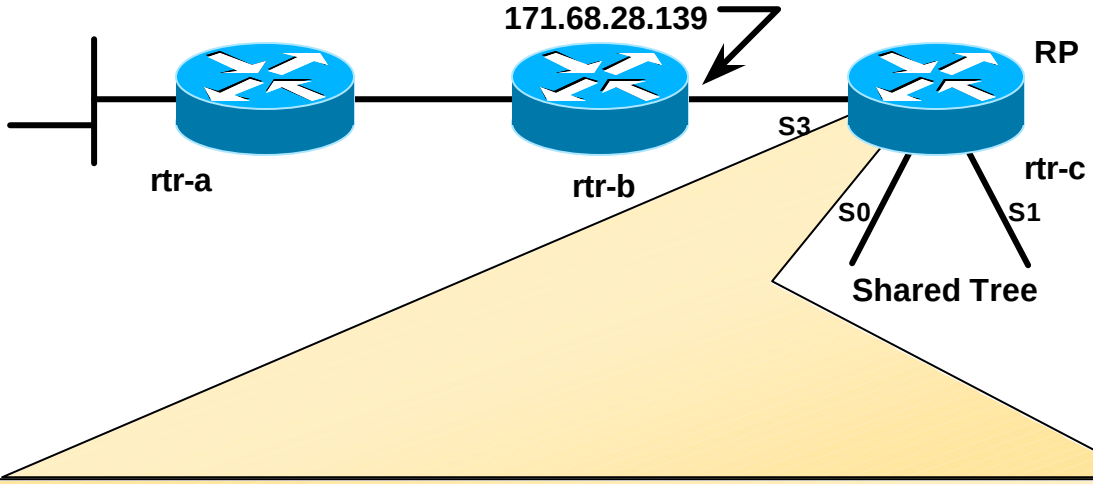
# PIM SM Joining




```
rtr-a>sh ip mroute

(*, 224.1.1.1), 00:00:05/00:02:54, RP 10.1.5.1, flags: S
  Incoming interface: Serial0, RPF nbr 10.1.4.1
  Outgoing interface list:
    Ethernet0, Forward/Sparse, 00:00:05/00:02:54
```

**State in “rtr-a” after Joining (*, 224.1.1.1)**

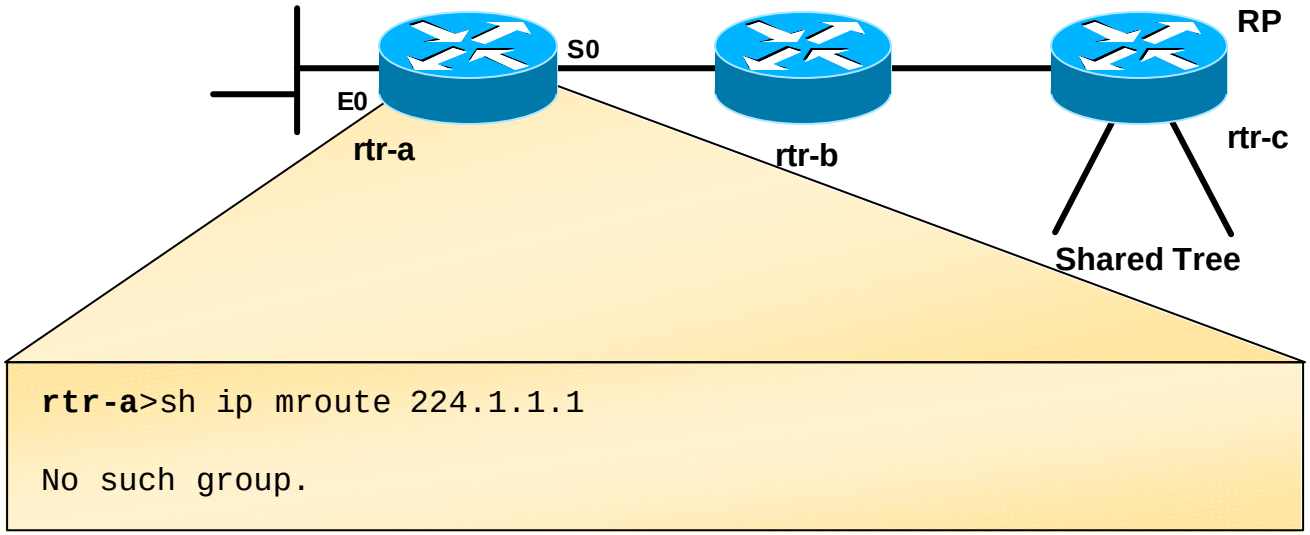
# PIM SM Registering




```
rtr-c>sh ip mroute 224.1.1.1

(*, 224.1.1.1), 00:00:03/00:02:56, RP 171.68.28.140, flags:S
  Incoming interface: Null, RPF nbr 0.0.0.0,
  Outgoing interface list:
    Serial0, Forward/Sparse, 00:03:14/00:02:59
    Serial1, Forward/Sparse, 00:03:14/00:02:59
```

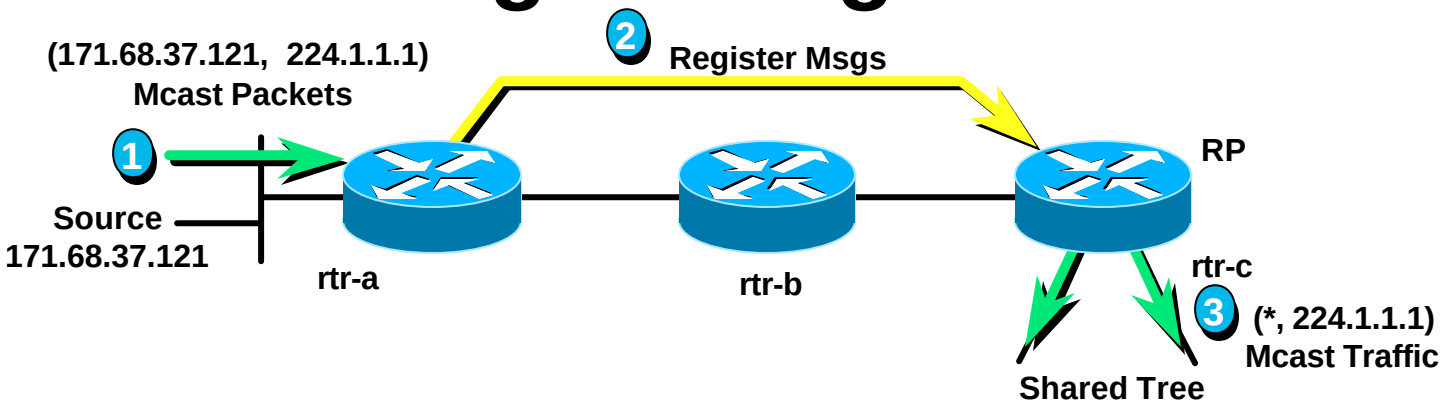
**State in "RP" before Registering**
**(with receivers on Shared Tree)**

# PIM SM Registering



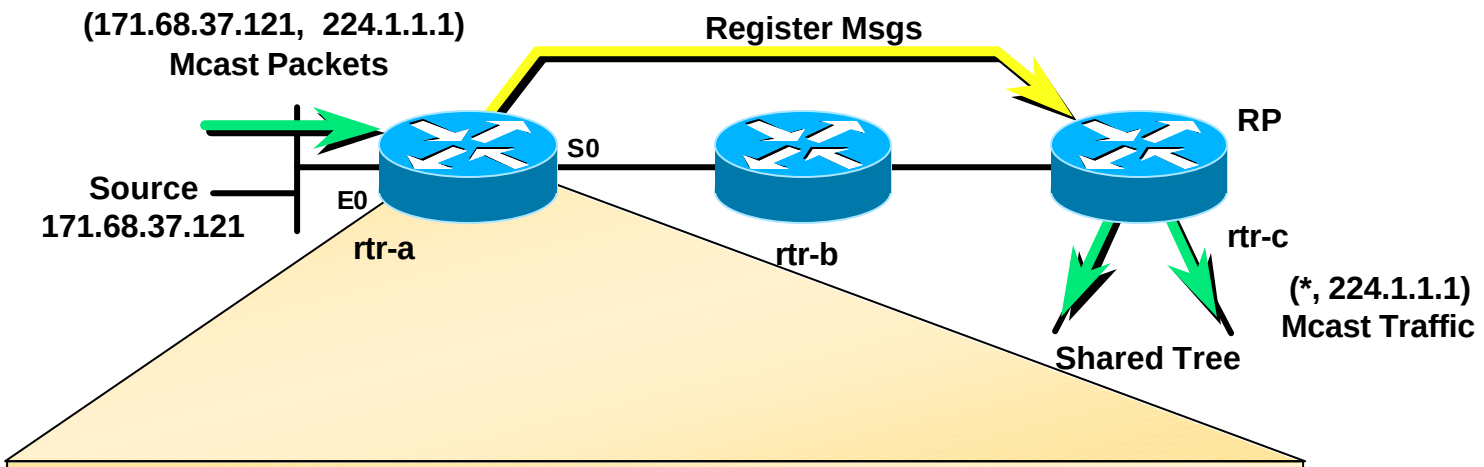

**State in “rtr-a” before Registering**
**(with receivers on Shared Tree)**

# PIM SM Registering




1. "Source" begins sending group G traffic
2. "rtr-a" encapsulates packets in Registers; unicasts to RP
3. "rtr-c" (RP) de-encapsulates packets; forwards down Shared tree

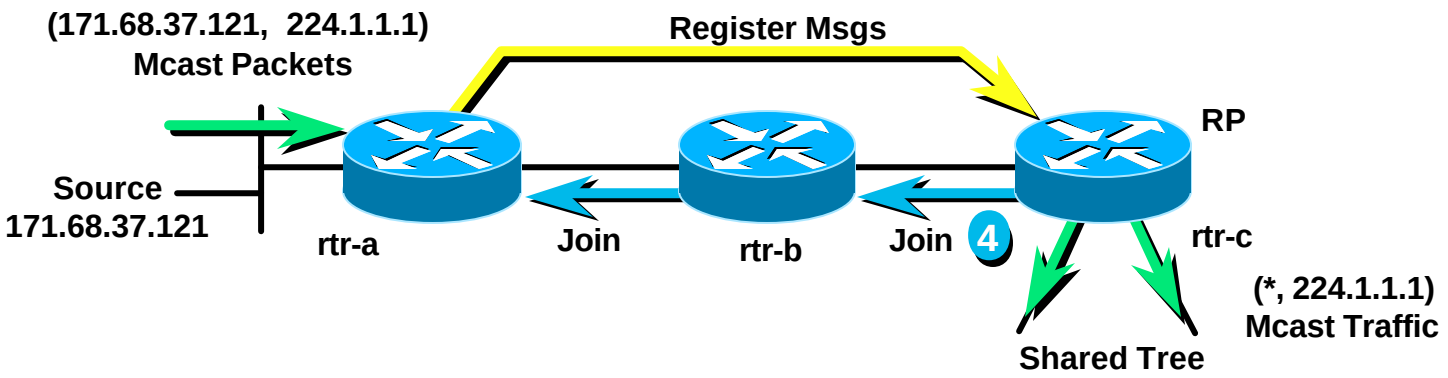
# PIM SM Registering




```
rtr-a>sh ip mroute 224.1.1.1

(*, 224.1.1.1), 00:00:03/00:02:56, RP 171.68.28.140, flags: SP
  Incoming interface: Serial0, RPF nbr 171.68.28.191,
  Outgoing interface list: Null

(171.68.37.121/32, 224.1.1.1), 00:00:03/00:02:56, flags: FPT
  Incoming interface: Ethernet0, RPF nbr 0.0.0.0, Registering
  Outgoing interface list: Null
```

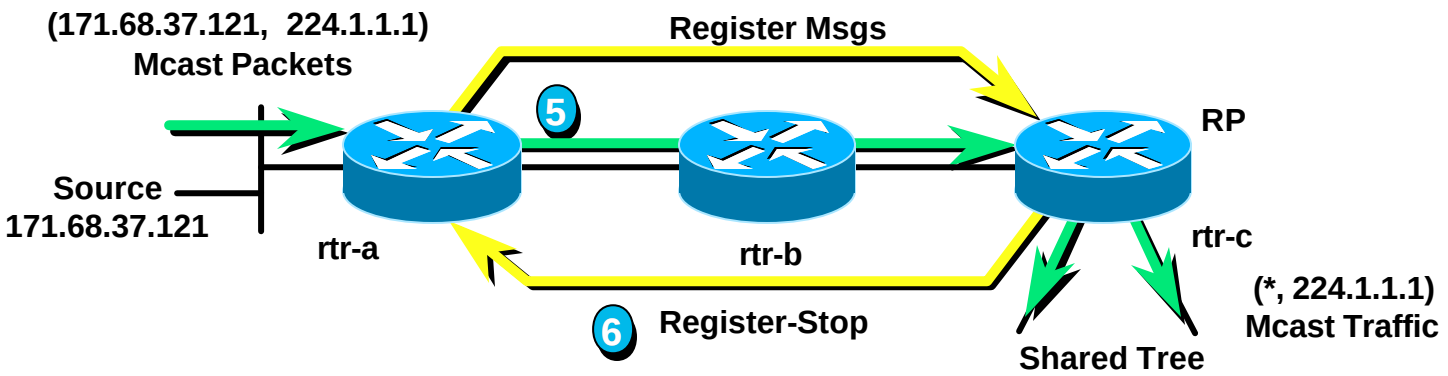
**State in “rtr-a” while Registering**

# PIM SM Registering



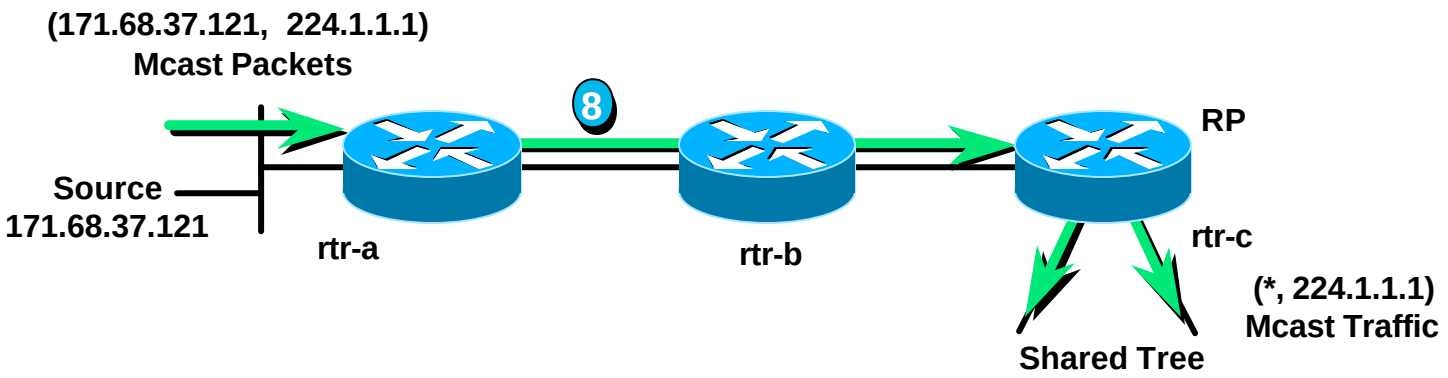

1. "Source" begins sending group G traffic
2. "rtr-a" encapsulates packets in Registers; unicasts to RP
3. RP ("rtr-c") de-encapsulates packets; forwards down Shared tree
4. RP sends (S,G) Join toward Source; builds SPT

# PIM SM Registering



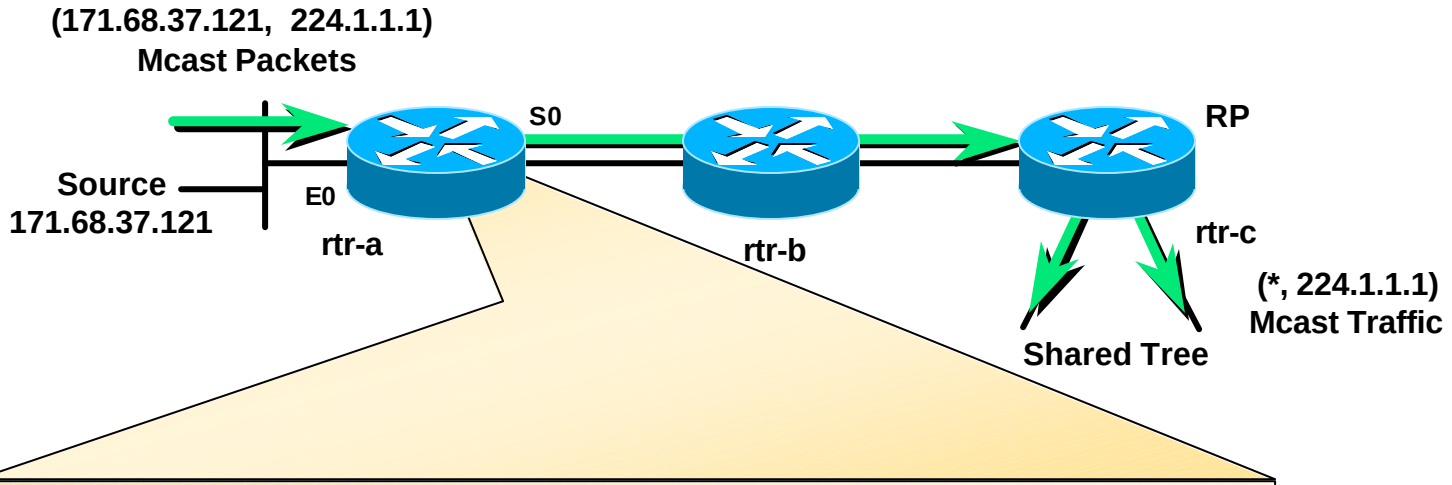

5. RP begins receiving (S,G) traffic down SPT
6. RP sends “Register-Stop” to “rtr-a”

# PIM SM Registering




5. RP begins receiving (S,G) traffic down SPT
6. RP sends “Register-Stop” to “rtr-a”
7. “rtr-a” stops encapsulating traffic in Register Messages
8. (S,G) Traffic now flowing down a single path (SPT) to RP

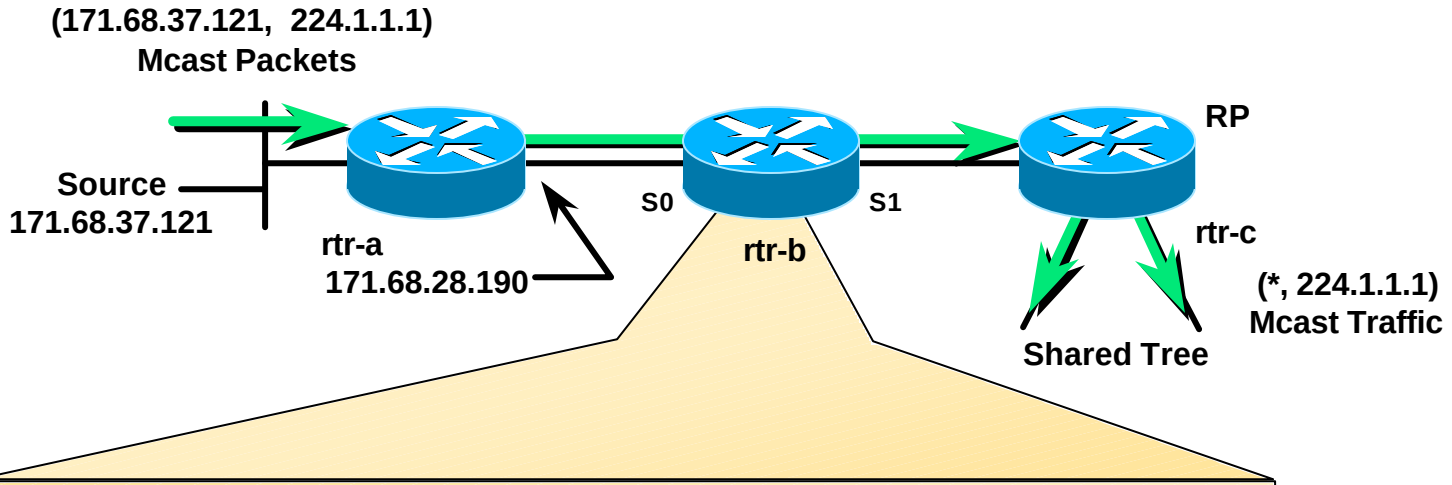
# PIM SM Registering




```
rtr-a>sh ip mroute 224.1.1.1

(*, 224.1.1.1), 00:04:28/00:01:32, RP 171.68.28.140, flags: SP
  Incoming interface: Serial0, RPF nbr 171.68.28.191,
  Outgoing interface list: Null

(171.68.37.121/32, 224.1.1.1), 00:04:28/00:01:32, flags: FT
  Incoming interface: Ethernet0, RPF nbr 0.0.0.0
  Outgoing interface list:
    Serial0, Forward/Sparse, 00:04:28/00:01:32
```

**State in “rtr-a” after Registering**

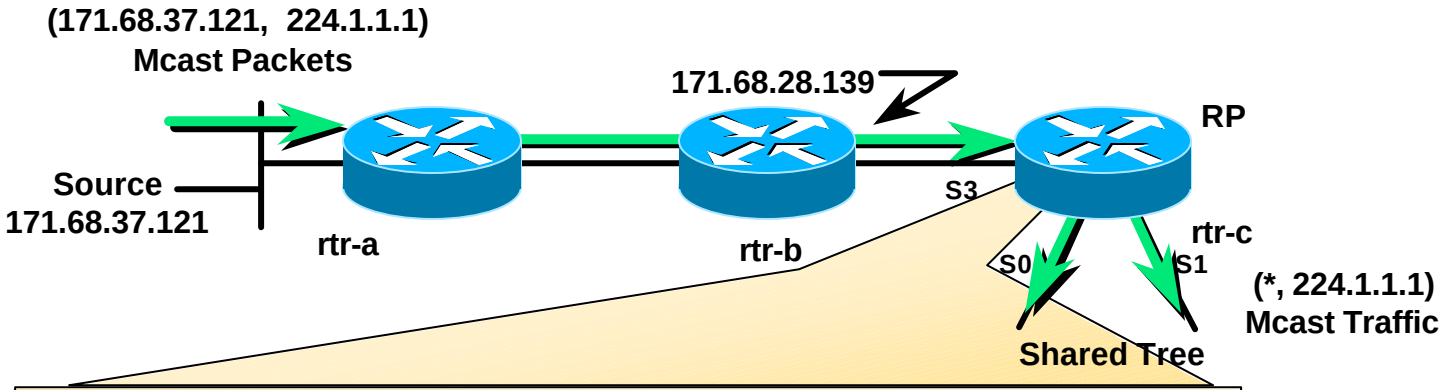
# PIM SM Registering




```
rtr-b>sh ip mroute 224.1.1.1

(*, 224.1.1.1), 00:04:28/00:01:32, RP 171.68.28.140, flags: SP
  Incoming interface: Serial1, RPF nbr 171.68.28.140,
  Outgoing interface list: Null

(171.68.37.121/32, 224.1.1.1), 00:04:28/00:01:32, flags: T
  Incoming interface: Serial0, RPF nbr 171.68.28.190
  Outgoing interface list:
    Serial1, Forward/Sparse, 00:04:28/00:01:32
```

**State in “rtr-b” after “rtr-a” Registers**
**(with receivers on Shared Tree)**

# PIM SM Registering




```
rtr-c>sh ip mroute 224.1.1.1

(*, 224.1.1.1), 00:09:21/00:02:38, RP 171.68.28.140, flags: S
  Incoming interface: Null, RPF nbr 0.0.0.0,
  Outgoing interface list:
    Serial0, Forward/Sparse, 00:09:21/00:02:38
    Serial1, Forward/Sparse, 00:03:14/00:02:46

(171.68.37.121, 224.1.1.1, 00:01:15/00:02:46, flags: T
  Incoming interface: Serial3, RPF nbr 171.68.28.139,
  Outgoing interface list:
    Serial0, Forward/Sparse, 00:00:49/00:02:11
    Serial1, Forward/Sparse, 00:00:49/00:02:11
```

**State in "RP" after "rtr-a" Registers**
**(with receivers on Shared Tree)**

# PIM SM SPT-Switchover Review

## SPT-Switchover Mechanism

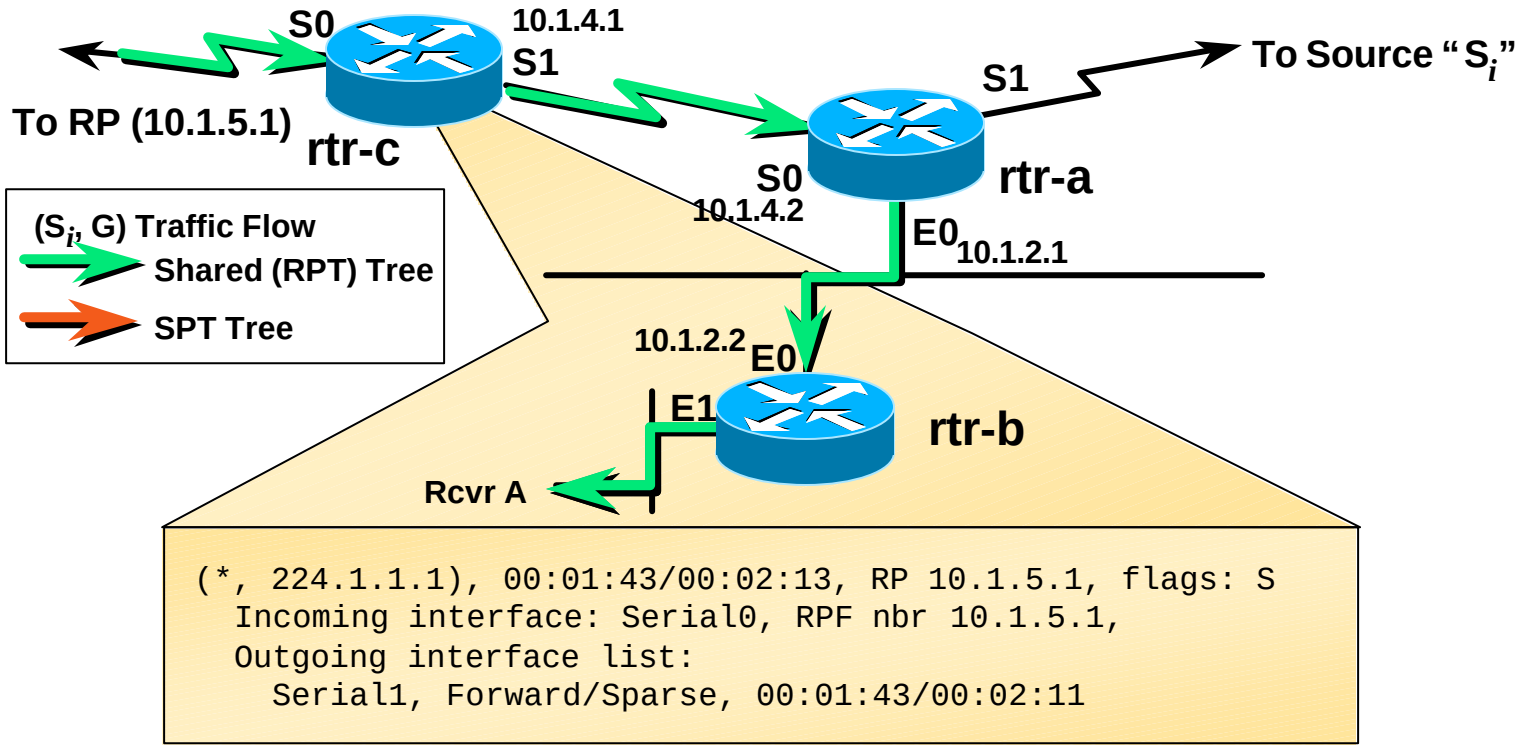
**Once each second**

- **Compute new (*, G) traffic rate**
- **If threshold exceeded, set "J" flag in (*, G)**

**For each ($S_i$ , G) packet received:**

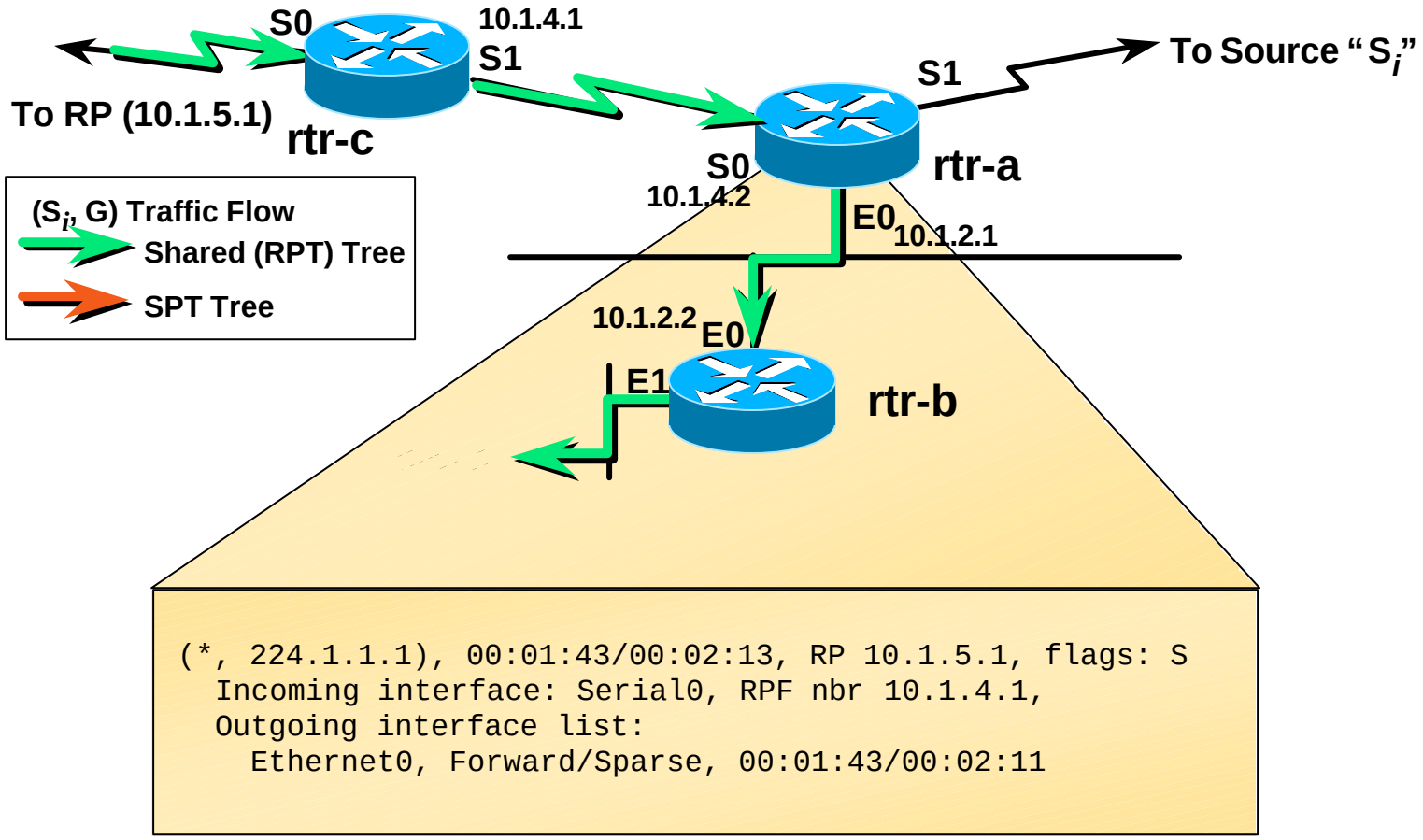
- **If "J" flag set in (*, G)**
  - **Clear "J" flag in (*,G)**
  - **Join SPT for ($S_i$ , G)**
  - **Mark ($S_i$ , G) entry with "J" flag**

# PIM SM SPT-Switchover



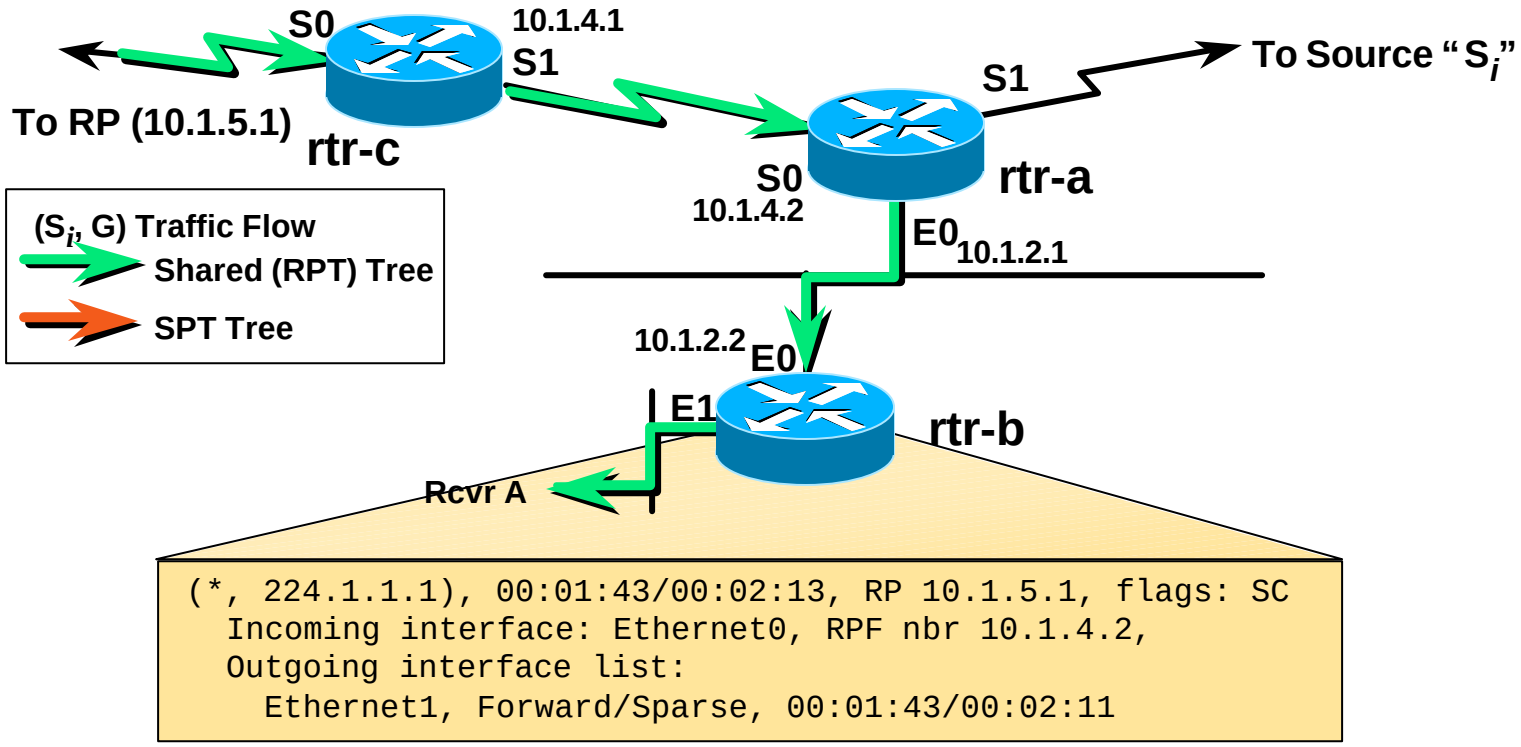

**State in "rtr-c" before switch**

# PIM SM SPT-Switchover




**State in "rtr-a" before switch**

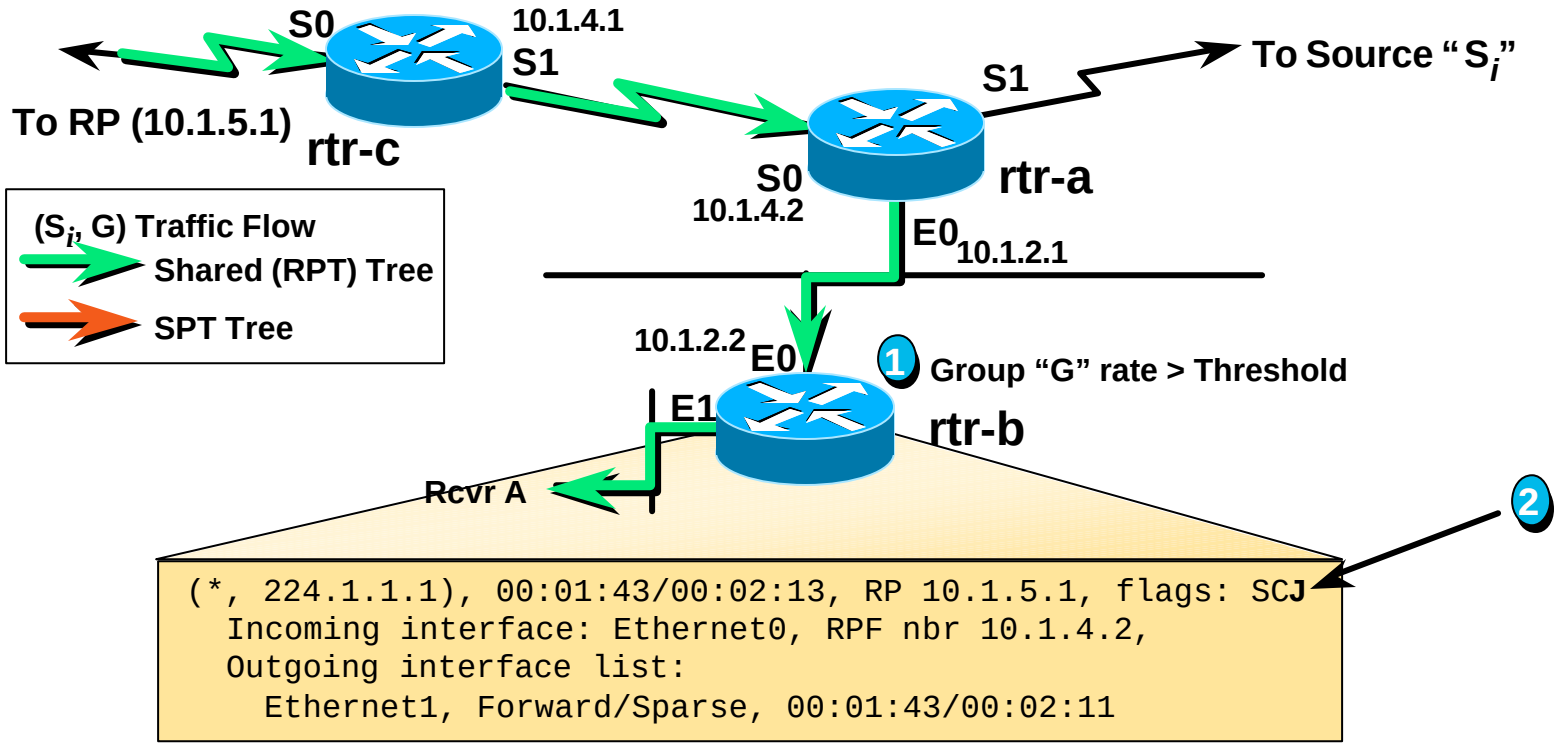
# PIM SM SPT-Switchover




```
(*, 224.1.1.1), 00:01:43/00:02:13, RP 10.1.5.1, flags: SC
  Incoming interface: Ethernet0, RPF nbr 10.1.4.2,
  Outgoing interface list:
    Ethernet1, Forward/Sparse, 00:01:43/00:02:11
```

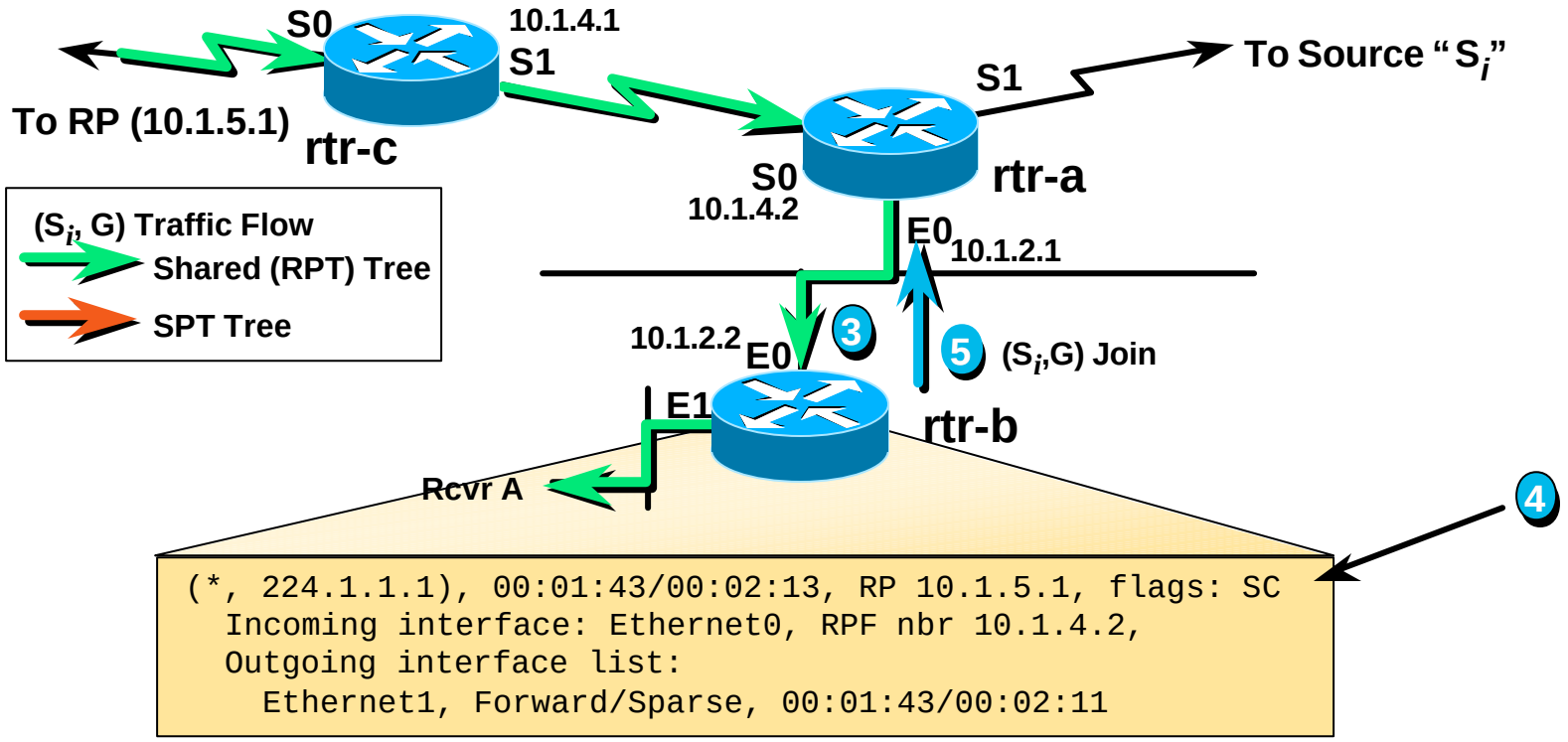
**State in "rtr-b" before switch**

# PIM SM SPT-Switchover



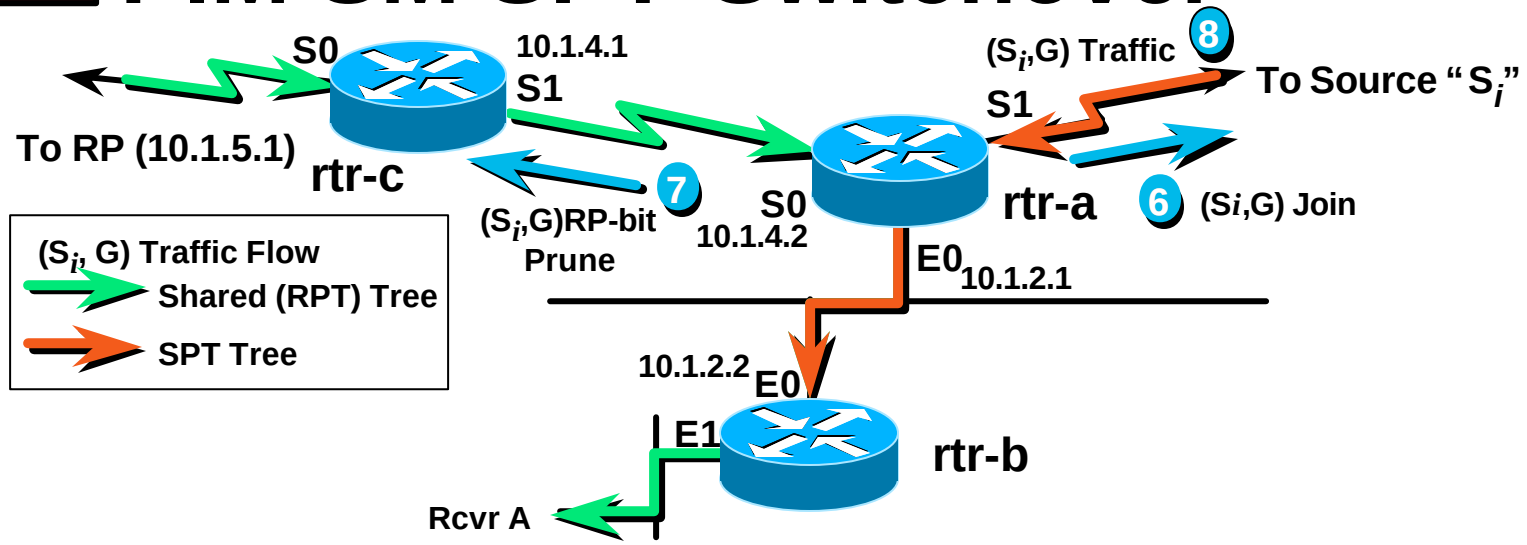

1. Group "G" rate exceeds SPT Threshold at "rtr-b";
2. Set J Flag in (*, G) and wait for next ($S_i$,G) packet

# PIM SM SPT-Switchover



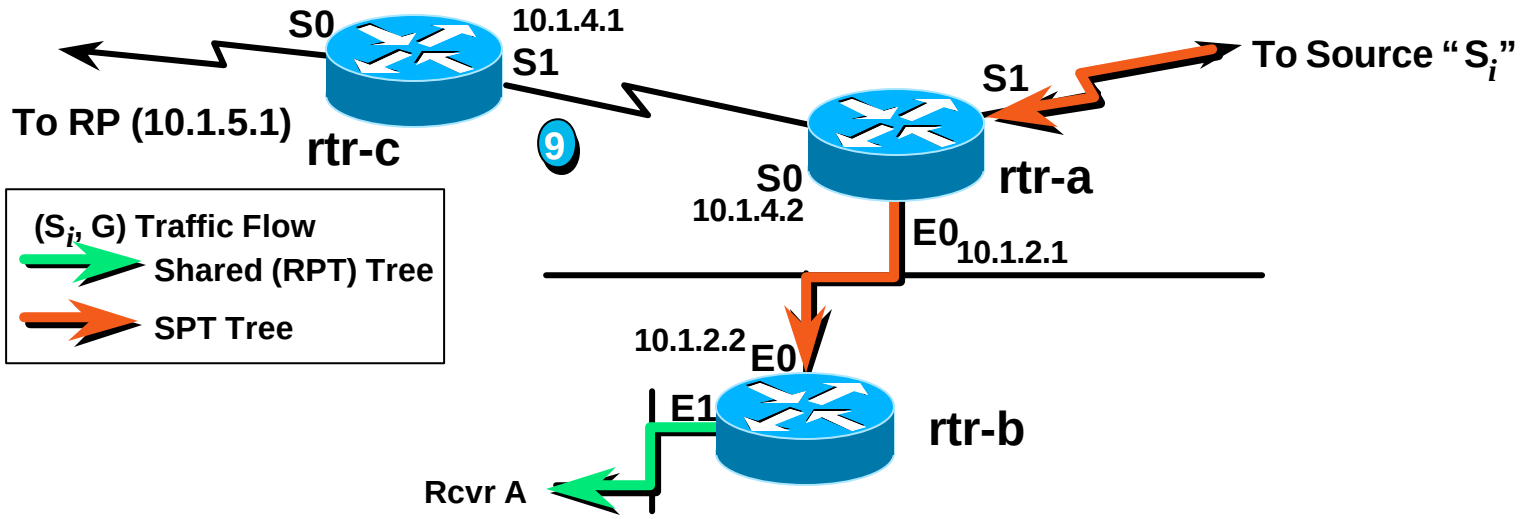

1. Group "G" rate exceeds SPT Threshold at "rtr-b";
2. Set J Flag in (*, G) and wait for next ($S_i$,G) packet.
3. ($S_i$,G) packet arrives down Shared tree.
4. Clear J Flag in (*,G) and
5. Send ($S_i$,G) Join towards $S_i$ .

# PIM SM SPT-Switchover



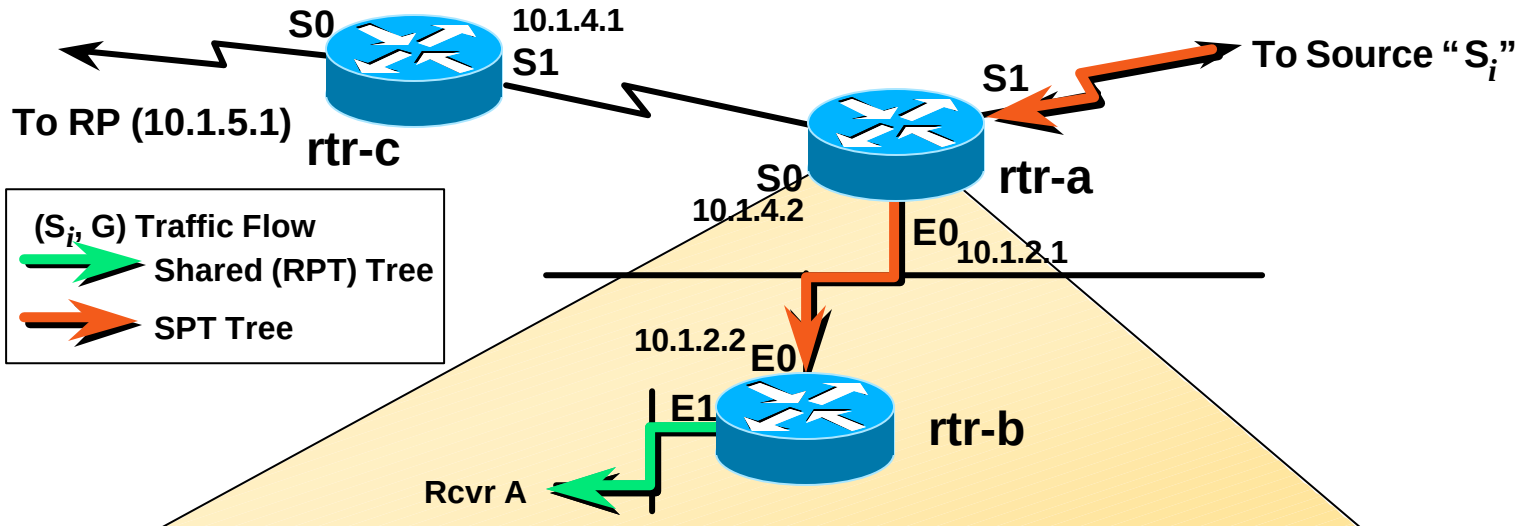

6. SPT & RPT diverge; "rtr-a" forwards ($S_i$,G) Join toward $S_i$
7. "rtr-a" triggers ($S_i$,G)RP-bit Prune toward RP
8. ($S_i$, G) traffic begins flowing down SPT tree

# PIM SM SPT-Switchover




6. SPT & RPT diverge; "rtr-a" forwards ($S_i$,G) Join toward $S_i$
7. "rtr-a" triggers ($S_i$,G)RP-bit Prune toward RP
8. ($S_i$, G) traffic begins flowing down SPT tree
9. ($S_i$, G) traffic ceases flowing down Shared tree

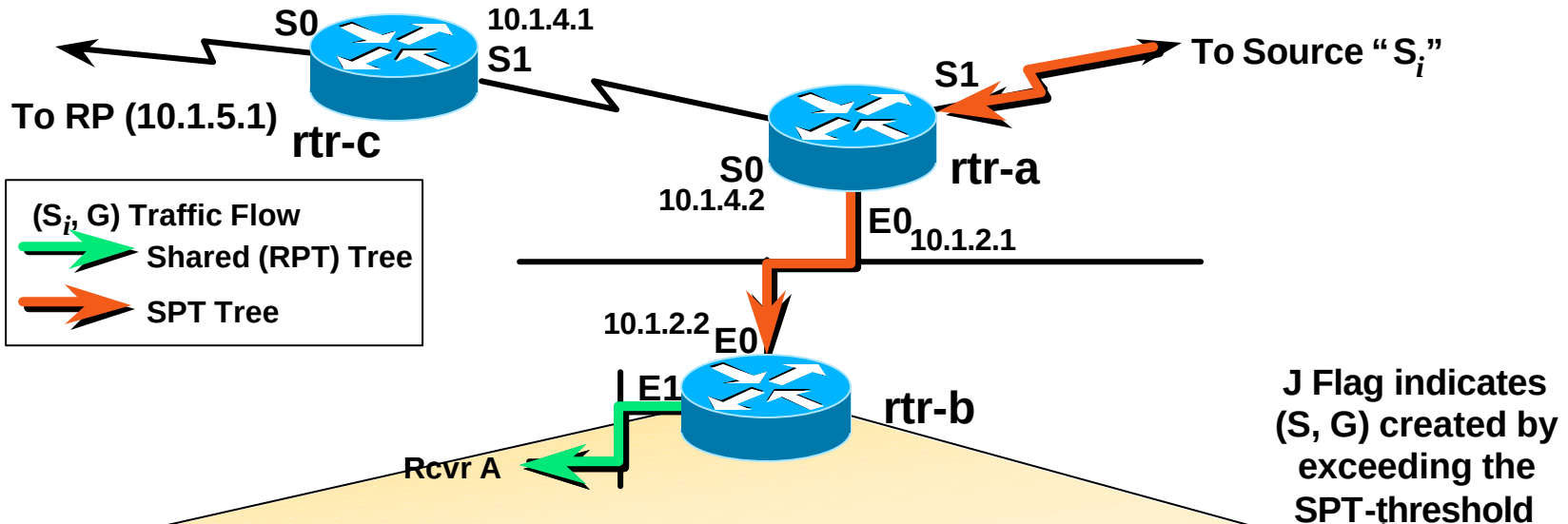
# PIM SM SPT-Switchover




```
(*, 224.1.1.1), 00:01:43/00:02:13, RP 10.1.5.1, flags: S
  Incoming interface: Serial0, RPF nbr 10.1.4.1,
  Outgoing interface list:
    Ethernet0, Forward/Sparse, 00:01:43/00:02:11

(171.68.37.121/32, 224.1.1.1), 00:13:28/00:02:53, flags: T
  Incoming interface: Serial1, RPF nbr 10.1.9.2
  Outgoing interface list:
    Ethernet0, Forward/Sparse, 00:13:25/00:02:30
```

**State in "rtr-a" after switch**

# PIM SM SPT-Switchover

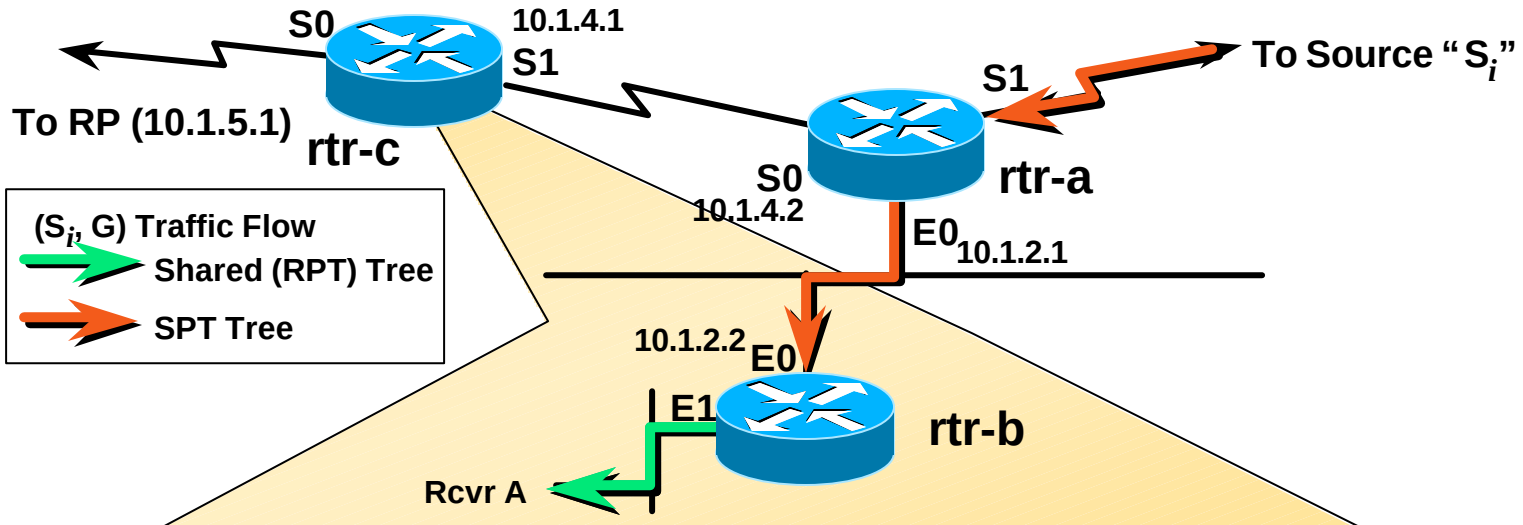



J Flag indicates (S, G) created by exceeding the SPT-threshold

```
(*, 224.1.1.1), 00:01:43/00:02:13, RP 10.1.5.1, flags: SC
  Incoming interface: Ethernet0, RPF nbr 10.1.2.1,
  Outgoing interface list:
    Ethernet1, Forward/Sparse, 00:01:43/00:02:11

(171.68.37.121/32, 224.1.1.1), 00:13:28/00:02:53, flags: CJT
  Incoming interface: Ethernet0, RPF nbr 10.1.2.1
  Outgoing interface list:
    Ethernet1, Forward/Sparse, 00:13:28/00:02:53
```

**State in "rtr-b" after switch**

# PIM SM SPT-Switchover




```
(*, 224.1.1.1), 00:01:43/00:02:13, RP 10.1.5.1, flags: S
  Incoming interface: Serial0, RPF nbr 10.1.5.1,
  Outgoing interface list:
    Serial1, Forward/Sparse, 00:01:43/00:02:11

(171.68.37.121/32, 224.1.1.1), 00:13:28/00:02:53, flags: PR
  Incoming interface: Serial0, RPF nbr 10.1.5.1
  Outgoing interface list: Null
```

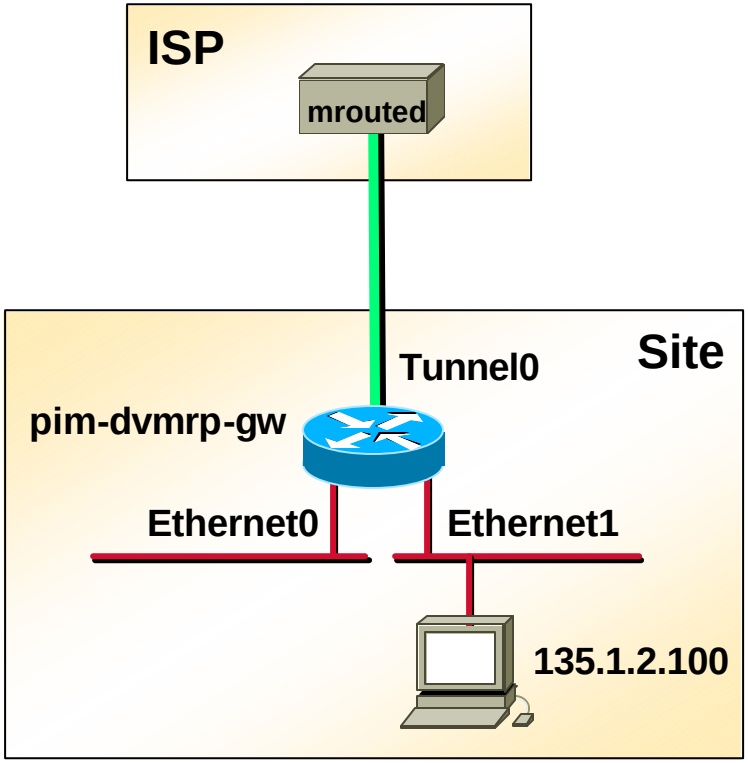
**State in "rtr-c" after switch**

# Advanced Troubleshooting

- Troubleshooting Network State
- Troubleshooting PIM-DVMRP
- Troubleshooting ATM P2MP VCs

# PIM-DVMRP Troubleshooting

## Example Network




**pim-dvmrp-gw:**

```
interface tunnel0
ip unnumbered ethernet0
ip pim dense-mode
tunnel mode dvmrp
tunnel source ethernet0
tunnel destination 135.1.22.98

interface ethernet0
ip addr 135.1.3.102 255.255.255.0
ip pim dense-mode

interface ethernet1
ip addr 135.1.2.102 255.255.255.0
ip pim dense-mode
```

# PIM-DVMRP Troubleshooting

- **Verifying the DVMRP tunnel**
- **Verifying DVMRP route exchange**

# Verifying the DVMRP Tunnel

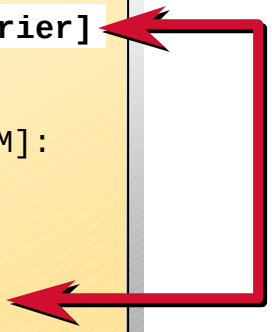
## Using the “show interface” Command

```
pim-dvmrp-gw> show int tunnel 0
Tunnel0 is up, line protocol is up
  Hardware is Tunnel
  Interface is unnumbered.  Using address of Ethernet0 (135.1.3.102)
  MTU 1500 bytes, BW 9 Kbit, DLY 500000 usec, rely 255/255, load 1/255
  Encapsulation TUNNEL, loopback not set, keepalive set (10 sec)
  Tunnel source 135.1.3.102 (Ethernet0), destination 135.1.22.98
  Tunnel protocol/transport IP/IP (DVMRP), key disabled, sequencing disabled
  Checksumming of packets disabled,  fast tunneling enabled
  Last input 00:00:05, output 00:00:08, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
        .
        .
        .
```

# Verifying the DVMRP Tunnel

## Using the “mrinfo” Command

```
pim-dvmrp-gw>mrinfo
135.1.3.102 [version cisco 11.2] [flags: PMA]:
  135.1.3.102 -> 0.0.0.0 [1/0/pim/querier/leaf]
  135.1.2.102 -> 135.1.2.2 [1/0/pim/querier]
  135.1.2.102 -> 135.1.2.3 [1/0/pim/querier]
  135.1.3.102 -> 135.1.22.98 [1/0/tunnel/querier]

pim-dvmrp-gw>mrinfo 135.1.22.98
135.1.22.98 [version mrouted 3.8] [flags: GPM]:
  172.21.32.98 -> 172.21.32.191 [1/1]
  172.21.32.98 -> 172.21.32.1 [1/1]
  135.1.22.98 -> 135.1.22.102 [1/1/querier]
  135.1.22.98 -> 135.1.3.102 [1/1/tunnel]
```



**Both Ends See Each Other**

# PIM-DVMRP Troubleshooting

- Verifying the DVMRP tunnel
- Verifying DVMRP route exchange

# Verifying DVMRP Route Exchange

## Using “show ip dvmrp route”

```
pim-dvmrp-gw# show ip dvmrp route
DVMRP Routing Table - 8 entries
130.1.0.0/16 [0/3] uptime 00:19:03, expires 00:02:13
    via 135.1.22.98, Tunnel0, [version mrouted 3.8] [flags: GPM]
135.1.0.0/16 [0/3] uptime 00:19:03, expires 00:02:13
    via 135.1.22.98, Tunnel0, [version mrouted 3.8] [flags: GPM]
135.1.22.0/24 [0/2] uptime 00:19:03, expires 00:02:13
    via 135.1.22.98, Tunnel0, [version mrouted 3.8] [flags: GPM]
171.69.0.0/16 [0/3] uptime 00:19:03, expires 00:02:13
    via 135.1.22.98, Tunnel0, [version mrouted 3.8] [flags: GPM]
172.21.27.0/24 [0/3] uptime 00:19:04, expires 00:02:12
    via 135.1.22.98, Tunnel0, [version mrouted 3.8] [flags: GPM]
172.21.32.0/24 [0/2] uptime 00:19:04, expires 00:02:12
    via 135.1.22.98, Tunnel0, [version mrouted 3.8] [flags: GPM]
172.21.33.0/24 [0/3] uptime 00:19:04, expires 00:02:12
    via 135.1.22.98, Tunnel0, [version mrouted 3.8] [flags: GPM]
172.21.120.0/24 [0/3] uptime 00:19:04, expires 00:02:12
    via 135.1.22.98, Tunnel0, [version mrouted 3.8] [flags: GPM]
```

# Verifying DVMRP Route Exchange

## Using “debug ip dvmrp”

```
pim-dvmrp-gw# debug ip dvmrp
DVMRP debugging is on
pim-dvmrp-gw#
Mar 20 11:39:36.335: DVMRP: Aging routes, 0 entries expired
Mar 20 11:39:41.271: DVMRP: Received Probe on Tunnel0 from 135.1.22.98
Mar 20 11:39:45.335: DVMRP: Building Report for Tunnel0 224.0.0.4
Mar 20 11:39:45.335: DVMRP: Send Report on Tunnel0 to 135.1.22.98
Mar 20 11:39:45.335: DVMRP: 2 unicast, 8 DVMRP routes advertised
Mar 20 11:39:47.335: DVMRP: Aging routes, 0 entries expired
Mar 20 11:39:51.371: DVMRP: Received Probe on Tunnel0 from 135.1.22.98
Mar 20 11:39:52.379: DVMRP: Received Report on Tunnel0 from 135.1.22.98
```

# Verifying DVMRP Route Exchange

## Checking DVMRP Routes Being Advertised

```
pim-dvmrp-gw# debug ip dvmrp detail
DVMRP debugging is on
Mar 20 11:42:45.337: DVMRP: Building Report for Tunnel0 224.0.0.4
Mar 20 11:42:45.337: DVMRP: Report 130.1.0.0/16, metric 35, from DVMRP table
Mar 20 11:42:45.337: DVMRP: Report 135.1.0.0/16, metric 35, from DVMRP table
Mar 20 11:42:45.337: DVMRP: Report 135.1.22.0/24, metric 34, from DVMRP table
Mar 20 11:42:45.337: DVMRP: Report 171.69.0.0/16, metric 35, from DVMRP table
Mar 20 11:42:45.337: DVMRP: Report 172.21.27.0/24, metric 35, from DVMRP table
Mar 20 11:42:45.337: DVMRP: Report 172.21.32.0/24, metric 34, from DVMRP table
Mar 20 11:42:45.337: DVMRP: Report 172.21.33.0/24, metric 35, from DVMRP table
Mar 20 11:42:45.337: DVMRP: Report 172.21.120.0/24, metric 35, from DVMRP table
Mar 20 11:42:45.337: DVMRP: Report 135.1.2.0/24, metric 1
Mar 20 11:42:45.337: DVMRP: Report 135.1.3.0/24, metric 1
Mar 20 11:42:45.337: DVMRP: Send Report on Tunnel0 to 135.1.22.98
Mar 20 11:42:45.337: DVMRP: 2 unicast, 8 DVMRP routes advertised
```

# Verifying DVMRP Route Exchange

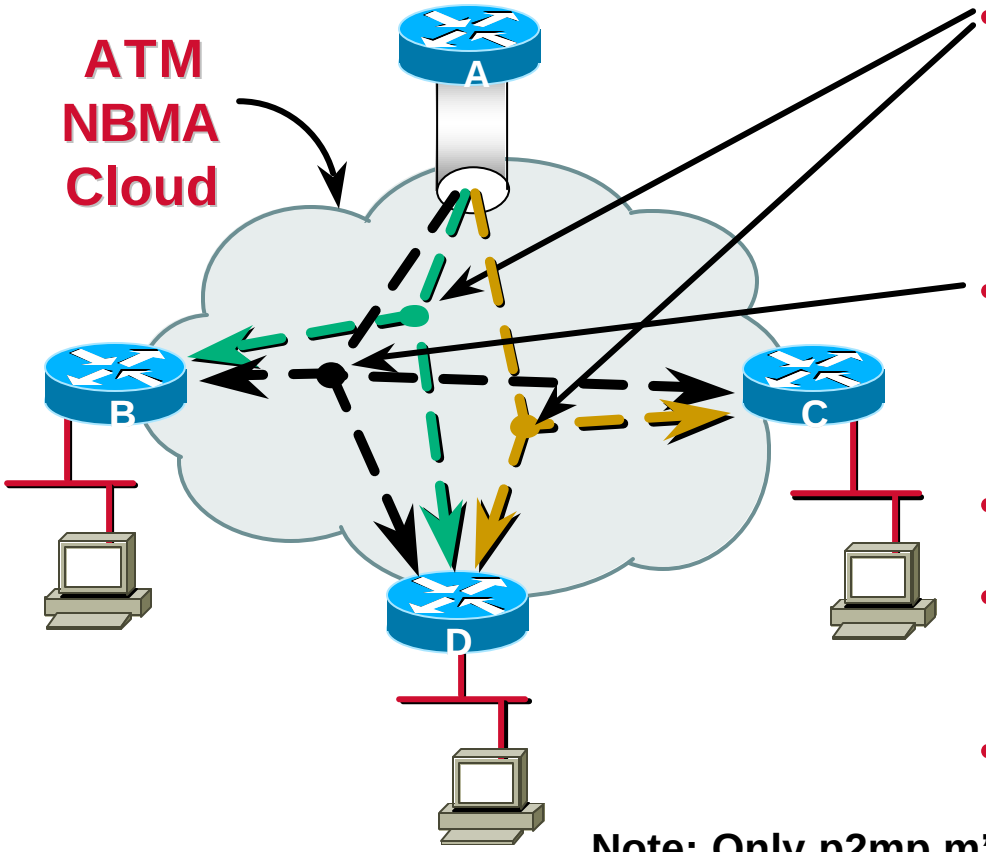
## Checking DVMRP Routes Being Received

```
pim-dvmrp-gw# debug ip dvmrp detail
DVMRP debugging is on
... : DVMRP: Received Report on Tunnel0 from 135.1.22.98
... : DVMRP: Origin 130.1.0.0/16, metric 2, metric-offset 1, distance 0
... : DVMRP: Origin 135.1.0.0/16, metric 2, metric-offset 1, distance 0
... : DVMRP: Origin 171.69.0.0/16, metric 2, metric-offset 1, distance 0
... : DVMRP: Origin 135.1.2.0/24, metric 34, metric-offset 1, infinity
... : DVMRP: Origin 135.1.3.0/24, metric 34, metric-offset 1, infinity
... : DVMRP: Origin 135.1.22.0/24, metric 1, metric-offset 1, distance 0
... : DVMRP: Origin 172.21.27.0/24, metric 2, metric-offset 1, distance 0
... : DVMRP: Origin 172.21.32.0/24, metric 1, metric-offset 1, distance 0
... : DVMRP: Origin 172.21.33.0/24, metric 2, metric-offset 1, distance 0
... : DVMRP: Origin 172.21.120.0/24, metric 2, metric-offset 1, distance 0
```

# Advanced Troubleshooting

- Troubleshooting Network State
- Troubleshooting PIM-DVMRP
- Troubleshooting ATM P2MP VCs

# Multicast over ATM P2MP VCs




- One p2mp VC/group performs multicast replication instead of the router
- B'cast p2mp VC used when # Groups > max p2mp VC count
- Use PIM Sparse mode
- p2mp VCs map group membership
- Fast Switched!!

Note: Only p2mp m'cast VCs for Router A shown for clarity.

# M’cast P2MP VC Troubleshooting

```
rtr-a> show ip pim vc
       IP Multicast ATM VC Status
       ATM0/0 VC count is 5, max is 5
       Group              VCD   Interface    Leaf Count  Rate
       224.0.1.40         21    ATM0/0       2           0 pps
       224.2.2.2          26    ATM0/0       1           0 pps
       224.1.1.1          28    ATM0/0       1           0 pps
       224.4.4.4          32    ATM0/0       2           0 pps
       224.5.5.5          35    ATM0/0       1           0 pps
```

# M’cast P2MP VC Troubleshooting

Root P2MP VC with 3 Leaf Routers

```
rtr-a> show atm vc

                                         AAL /              Peak   Avg.  Burst
Interface     VCD   VPI   VCI Type     Encapsulation      Kbps   Kbps  Cells
Status
ATM0/0          1     0     5  PVC     AAL5-SAAL      155000 155000     96 ACT
ATM0/0          2     0    16  PVC     AAL5-ILMI      155000 155000     96 ACT
ATM0/0          3     0   124  MSVC-3  AAL5-SNAP      155000 155000     96 ACT
ATM0/0          4     0   125  MSVC    AAL5-SNAP      155000 155000     96 ACT
ATM0/0          5     0   126  MSVC    AAL5-SNAP      155000 155000     96 ACT
ATM0/0          6     0   127  MSVC    AAL5-SNAP      155000 155000     96 ACT
ATM0/0          9     0   130  SVC     AAL5-SNAP      155000 155000     96 ACT
ATM0/0         10     0   131  SVC     AAL5-SNAP      155000 155000     96 ACT
ATM0/0         11     0   132  MSVC-3  AAL5-SNAP      155000 155000     96 ACT
ATM0/0         12     0   133  MSVC-1  AAL5-SNAP      155000 155000     96 ACT
ATM0/0         13     0   134  SVC     AAL5-SNAP      155000 155000     96 ACT
ATM0/0         14     0   135  MSVC-2  AAL5-SNAP      155000 155000     96 ACT
ATM0/0         15     0   136  MSVC-2  AAL5-SNAP      155000 155000     96 ACT
```

P2MP VC for which we are a Leaf

# M’cast P2MP VC Troubleshooting

```
show ip mroute 224.1.1.1

     IP Multicast Routing Table
     Flags: D - Dense, S - Sparse, C - Connected, L - Local, P - Pruned
            R - RP-bit set, F - Register flag, T - SPT-bit set, J - Join SPT
     Timers: Uptime/Expires
     Interface state: Interface, Next-Hop or VCD, State/Mode

     (*, 224.1.1.1), 00:03:57/00:02:54, RP 130.4.101.1, flags: SJ
       Incoming interface: Null, RPF nbr 0.0.0.0
       Outgoing interface list:
         ATM0/0, VCD 3, Forward/Sparse, 00:03:57/00:02:53
```

ATM P2MP VC information for Group

# M’cast P2MP VC Troubleshooting

P2MP VC Opened by Group 224.1.1.1

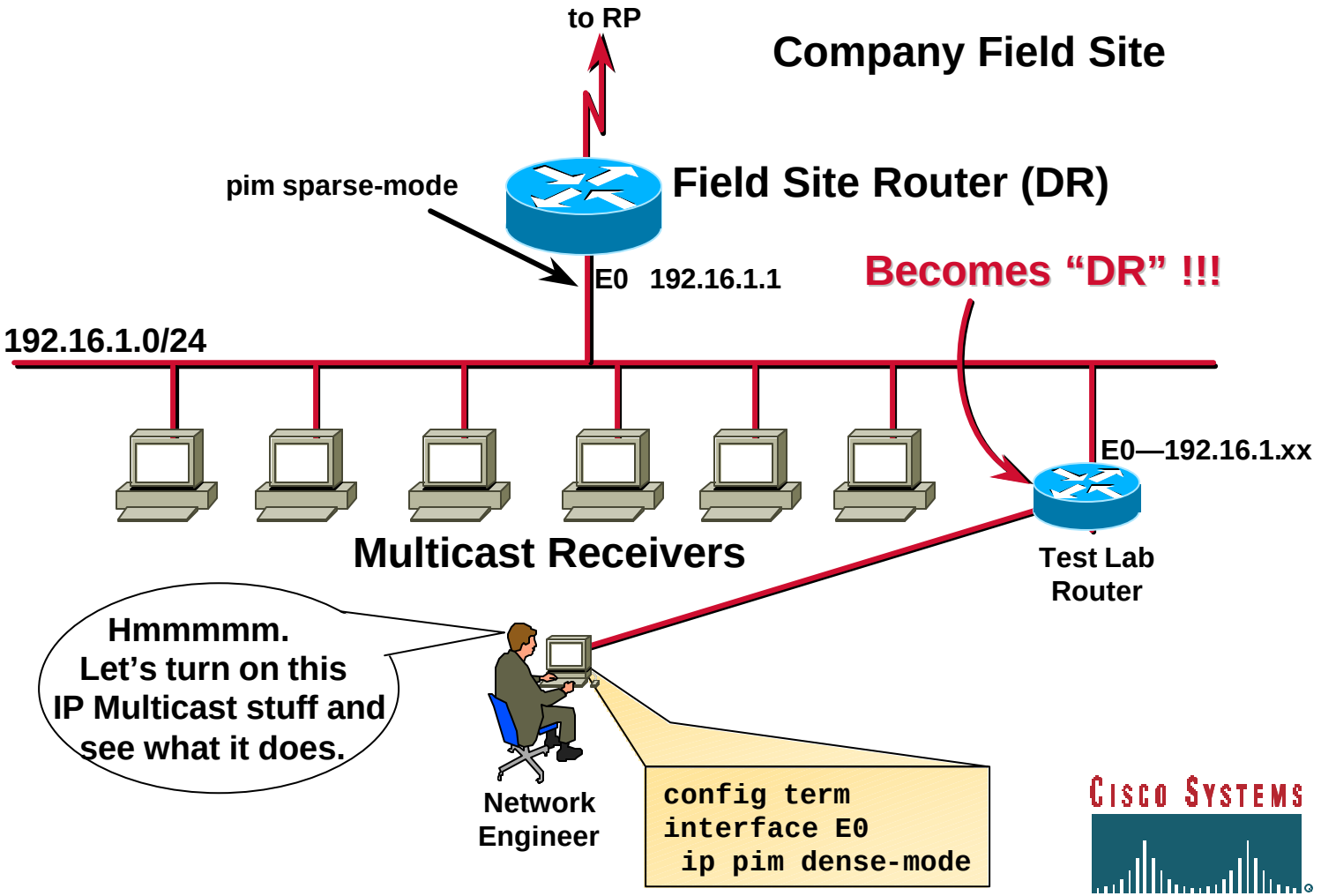
```
 rtr-a> show atm vc 3

ATM0/0: VCD:  3, VPI: 0, VCI: 124, etype:0x0, AAL5 - LLC/SNAP, Flags: 0x650
PeakRate: 155000, Average Rate: 155000, Burst Cells: 96, VCmode: 0xE000
OAM DISABLED, InARP DISABLED
InPkts: 0, OutPkts: 12, InBytes: 0, OutBytes: 496
InPRoc: 0, OutPRoc: 0, Broadcasts: 12
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
OAM F5 cells sent: 0, OAM cells received: 0
Status: ACTIVE, TTL: 2, VC owner: IP Multicast (224.1.1.1)
interface =  ATM0/0, call locally initiated, call reference = 2
vcnum = 11, vpi = 0, vci = 132, state = Active
 aal5snap vc, multipoint call
Retry count: Current = 0, Max = 10
timer currently inactive, timer value = 00:00:00
Leaf Atm Nsap address: 47.0091810000000002BA08E101.444444444444.02
Leaf Atm Nsap address: 47.0091810000000002BA08E101.333333333333.02
Leaf Atm Nsap address: 47.0091810000000002BA08E101.222222222222.02
```

NSAP Addresses of Leaf Nodes

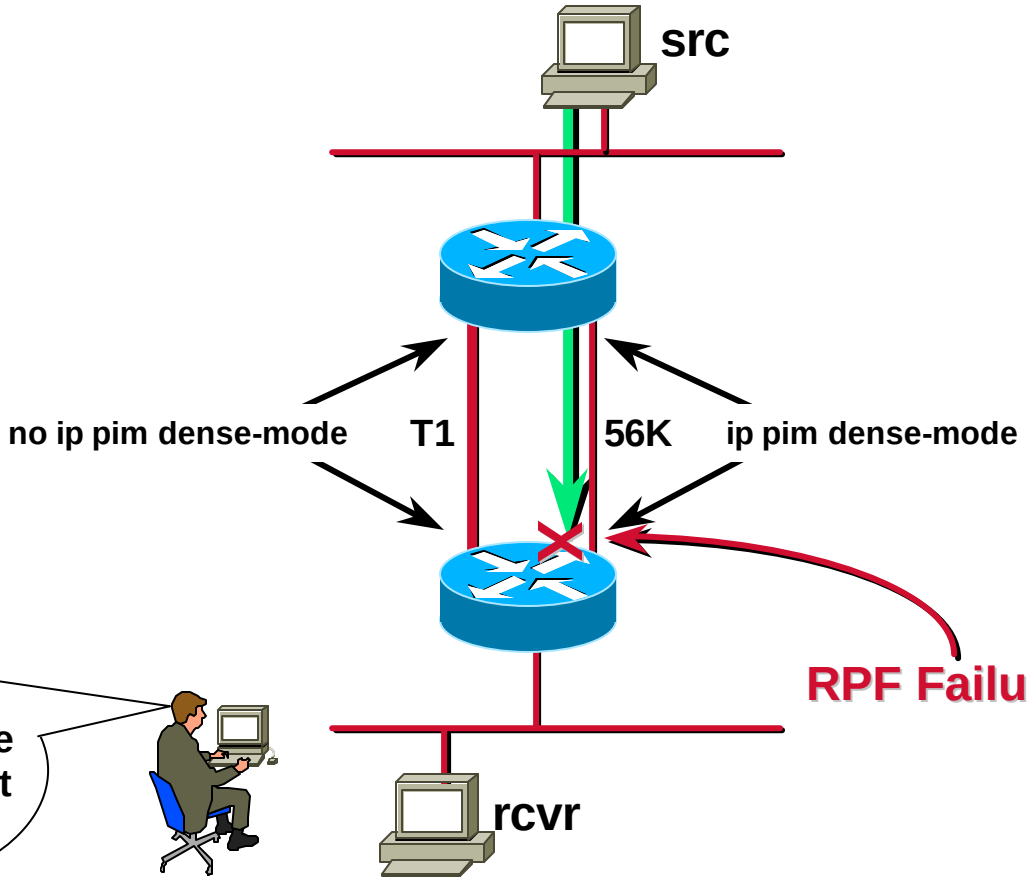
# Agenda

- Troubleshooting Tools
- Basic Troubleshooting
- Advanced Troubleshooting
- Common Problems

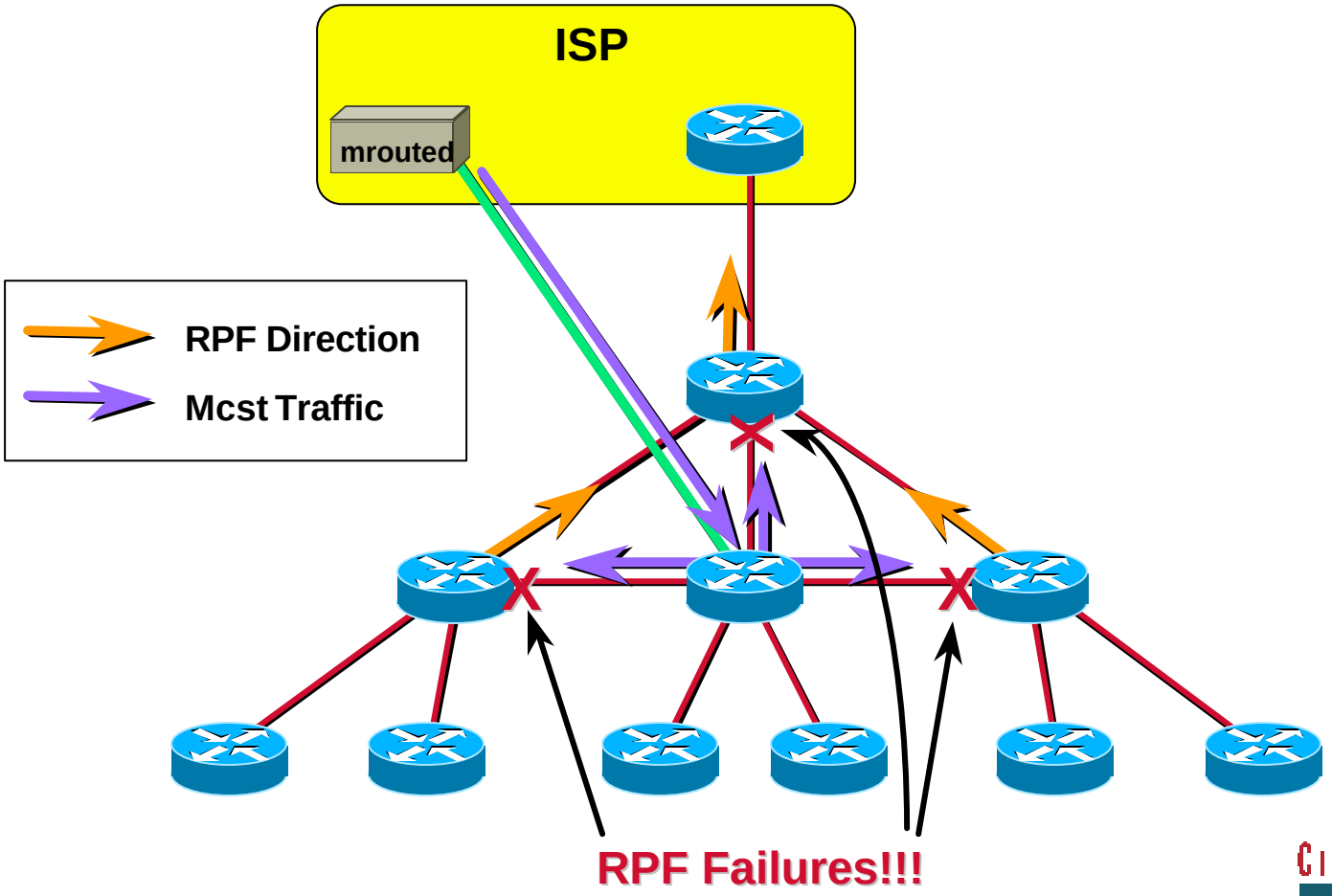
# “Bogus” Designated Router



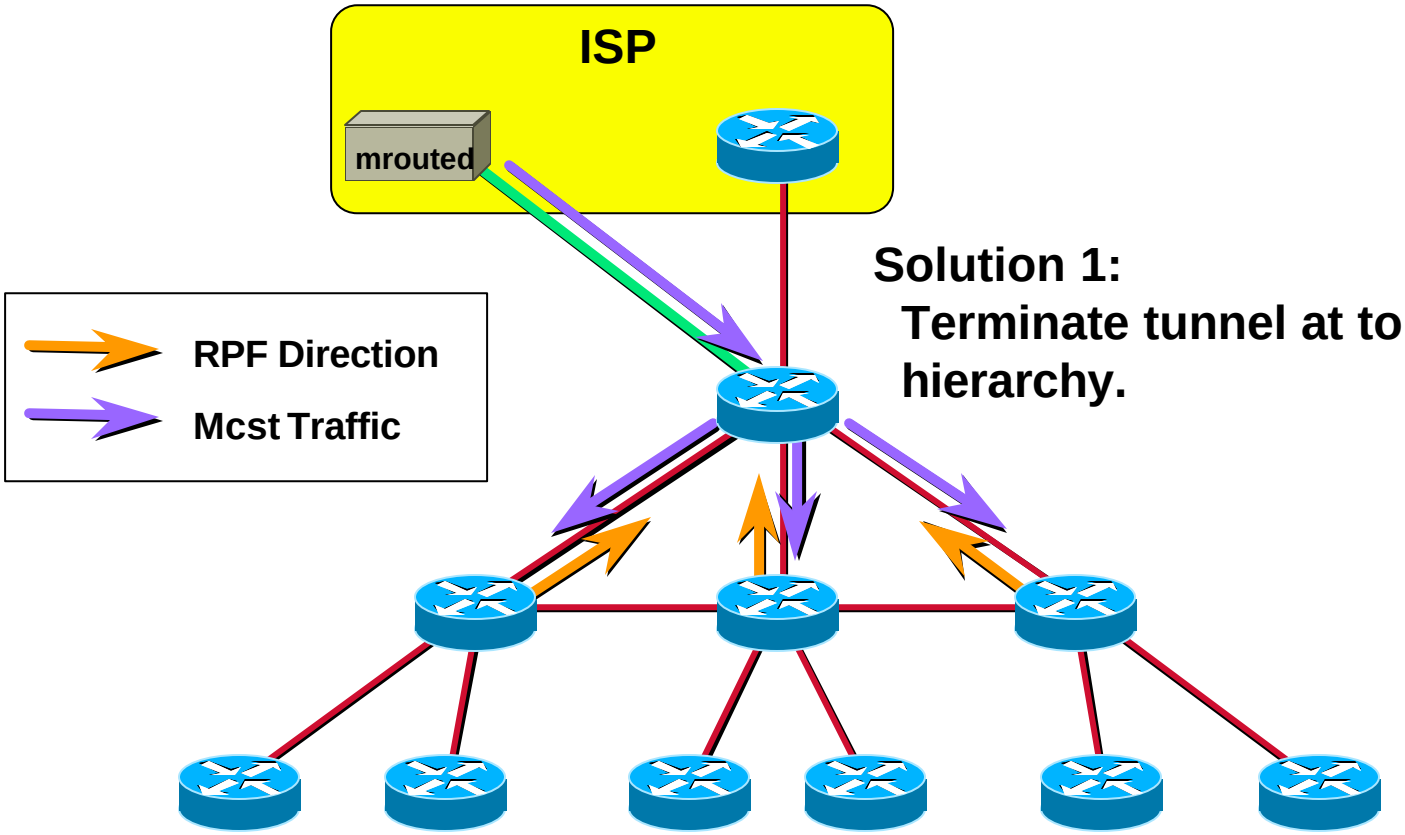
# Partial Multicast Cloud



# DVMRP Tunneling Problem

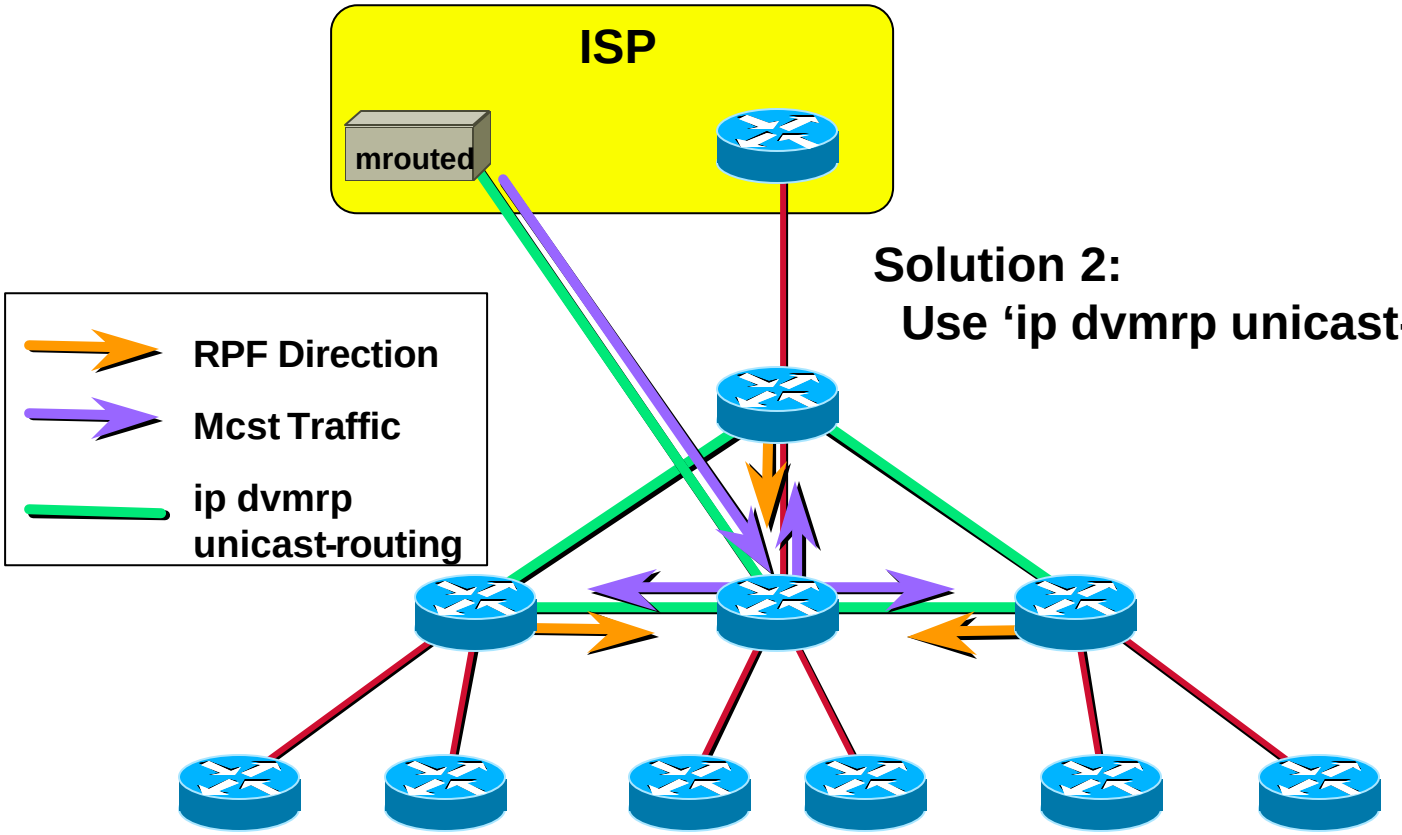


# DVMRP Tunneling Problem




**Solution 1:**
**Terminate tunnel at top of hierarchy.**

# DVMRP Tunneling Problem




**Solution 2:**
**Use ‘ip dvmrp unicast-routing’**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