

PIM Dense Mode



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Agenda



Topics:

- Basic Operation of PIM-DM

Demos:

- PIM-DM Flood/Prune
- PIM-DM Grafting Multicast Receivers

Packet Analysis:

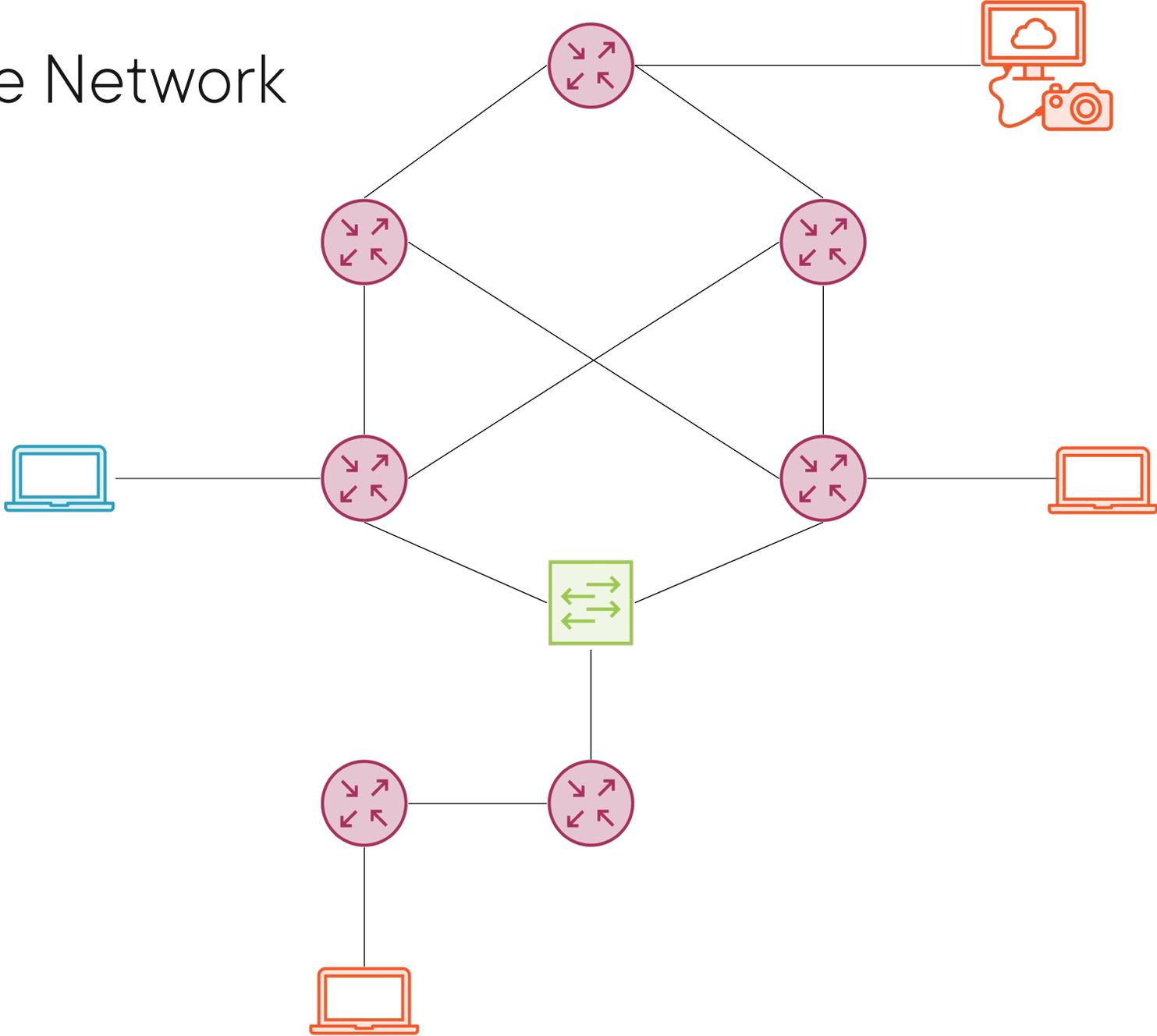
- PIM Join/Prune
- PIM Graft/GraftAck



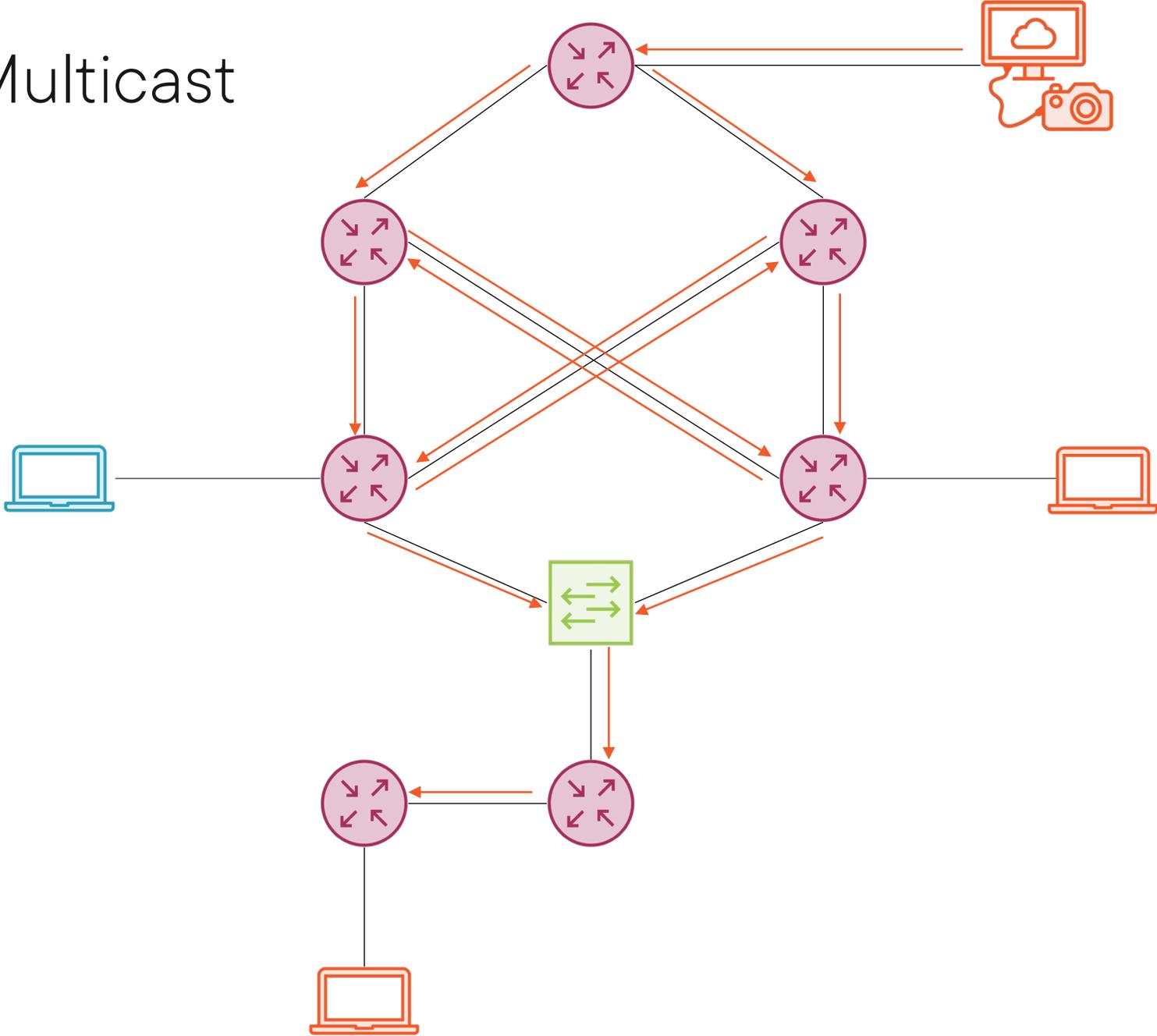
Globomantics Multicast Deployment Continues



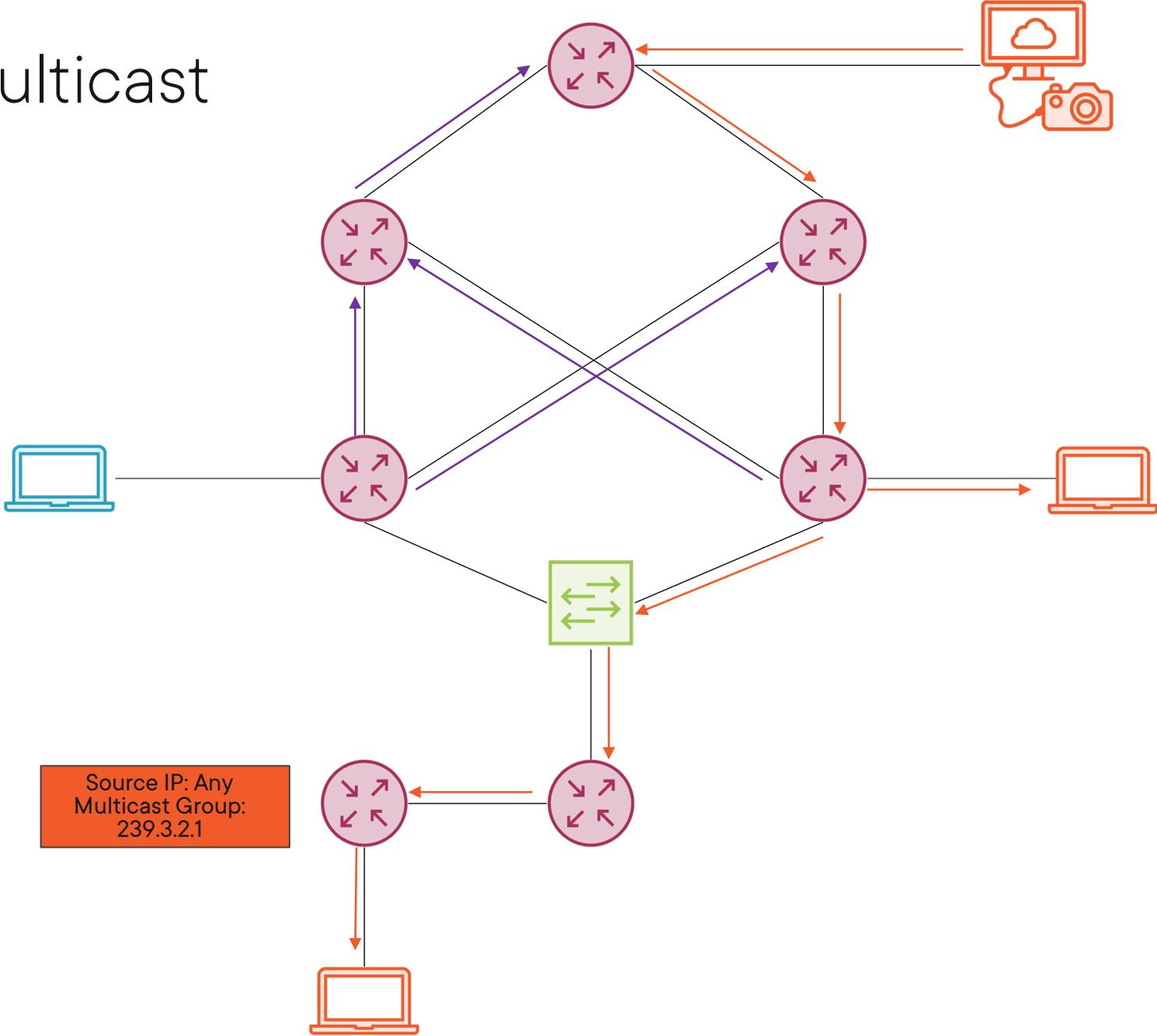
Warehouse Network



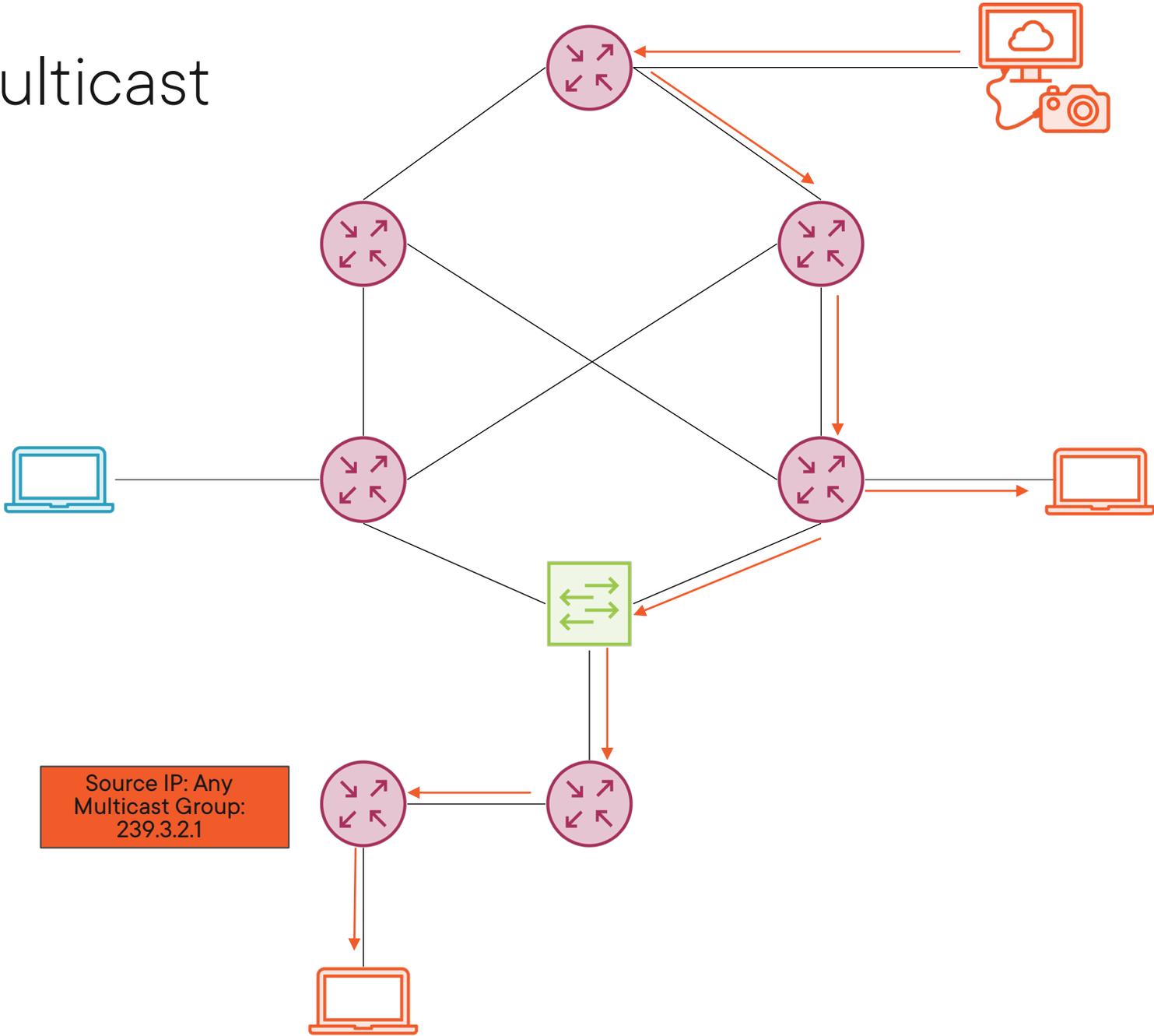
Flooding Multicast



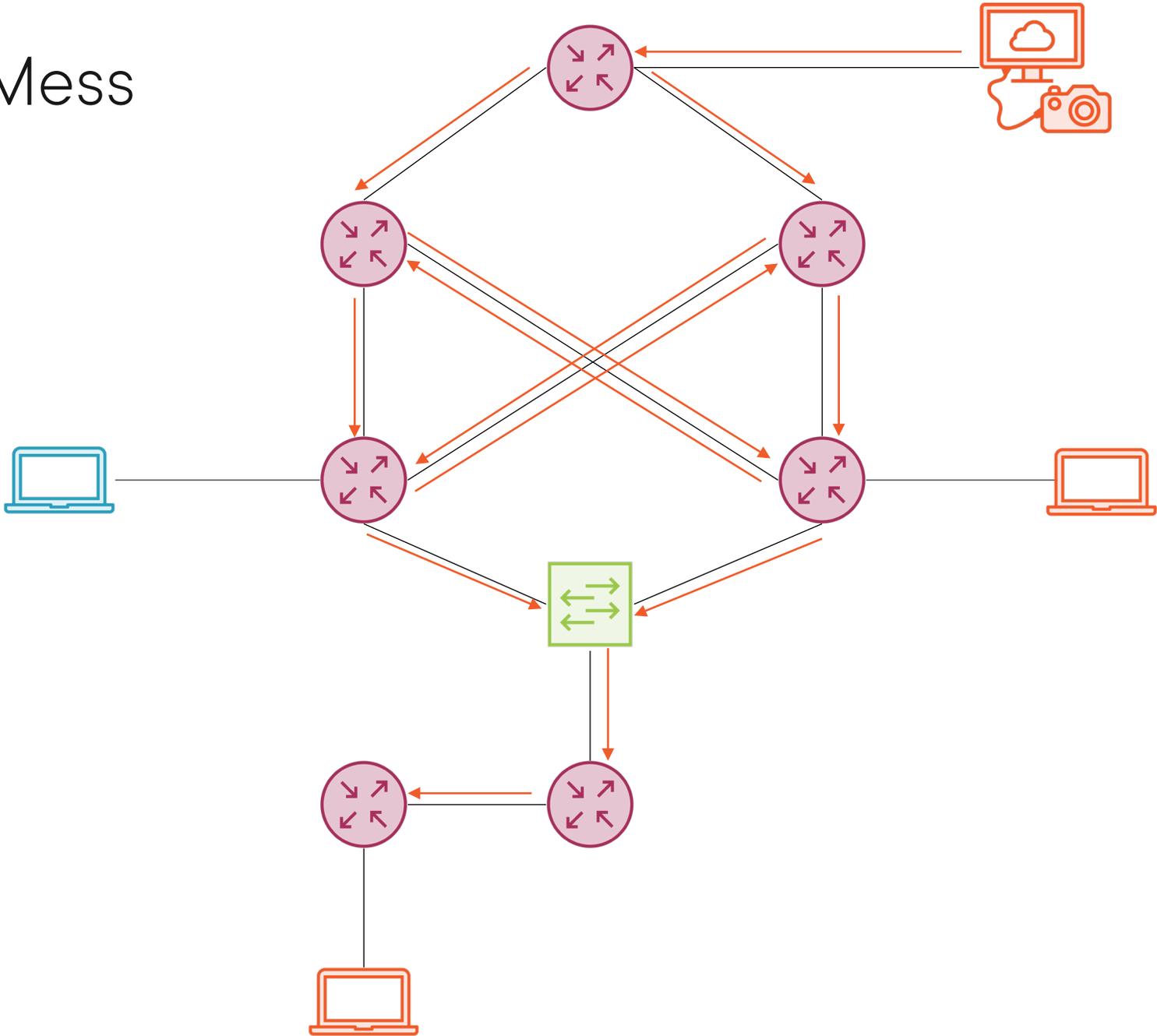
Pruning Multicast



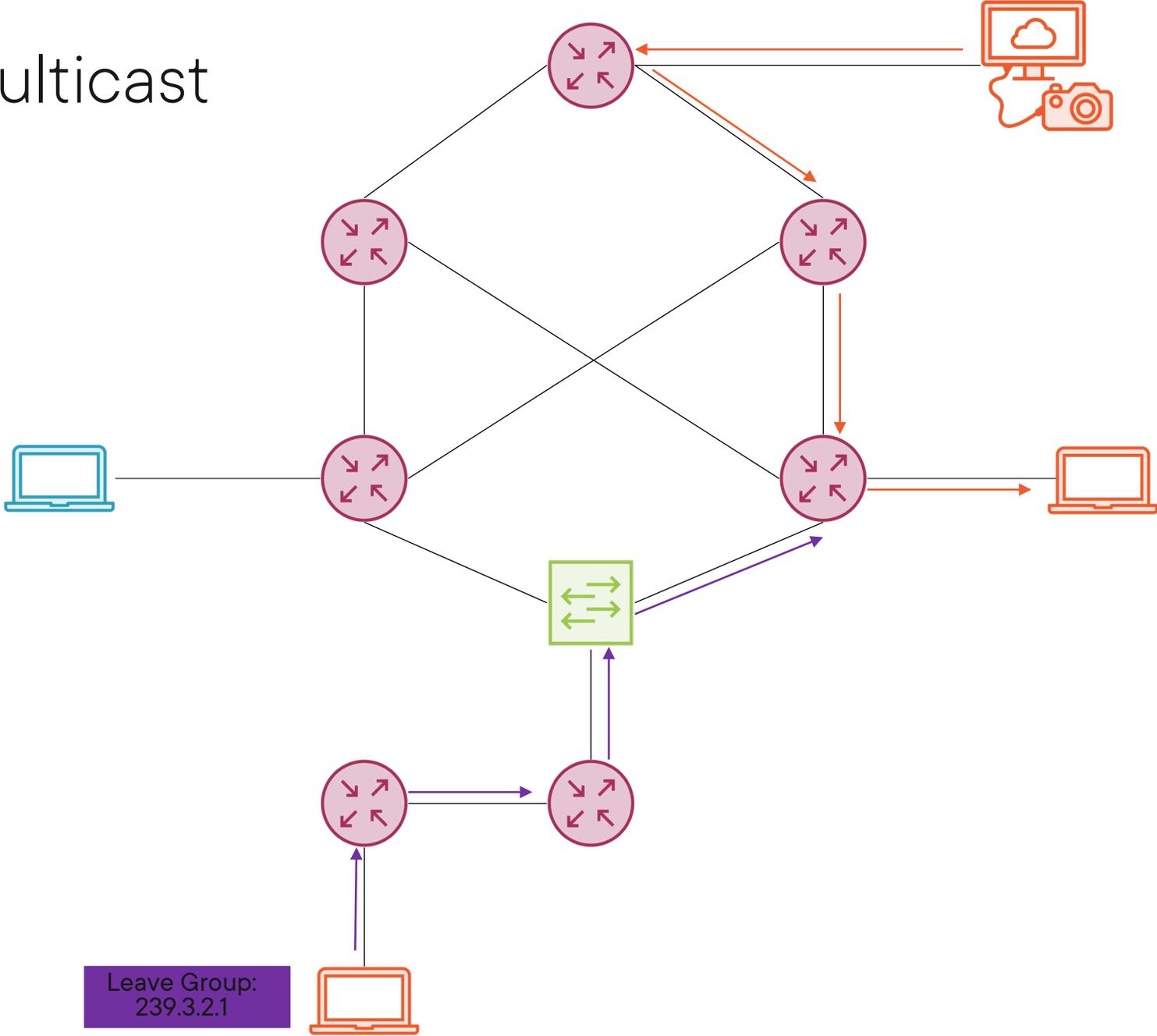
Optimal Multicast



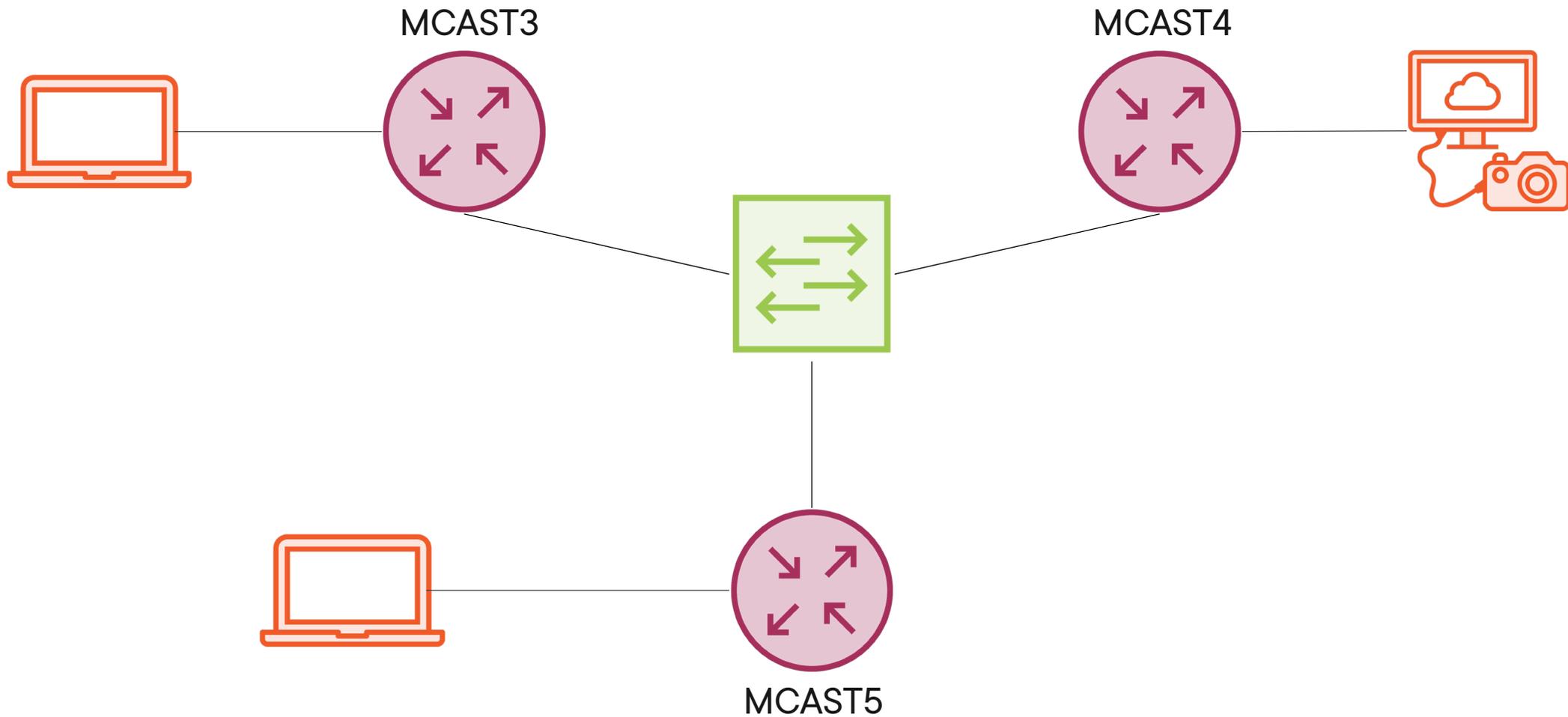
Multicast Mess



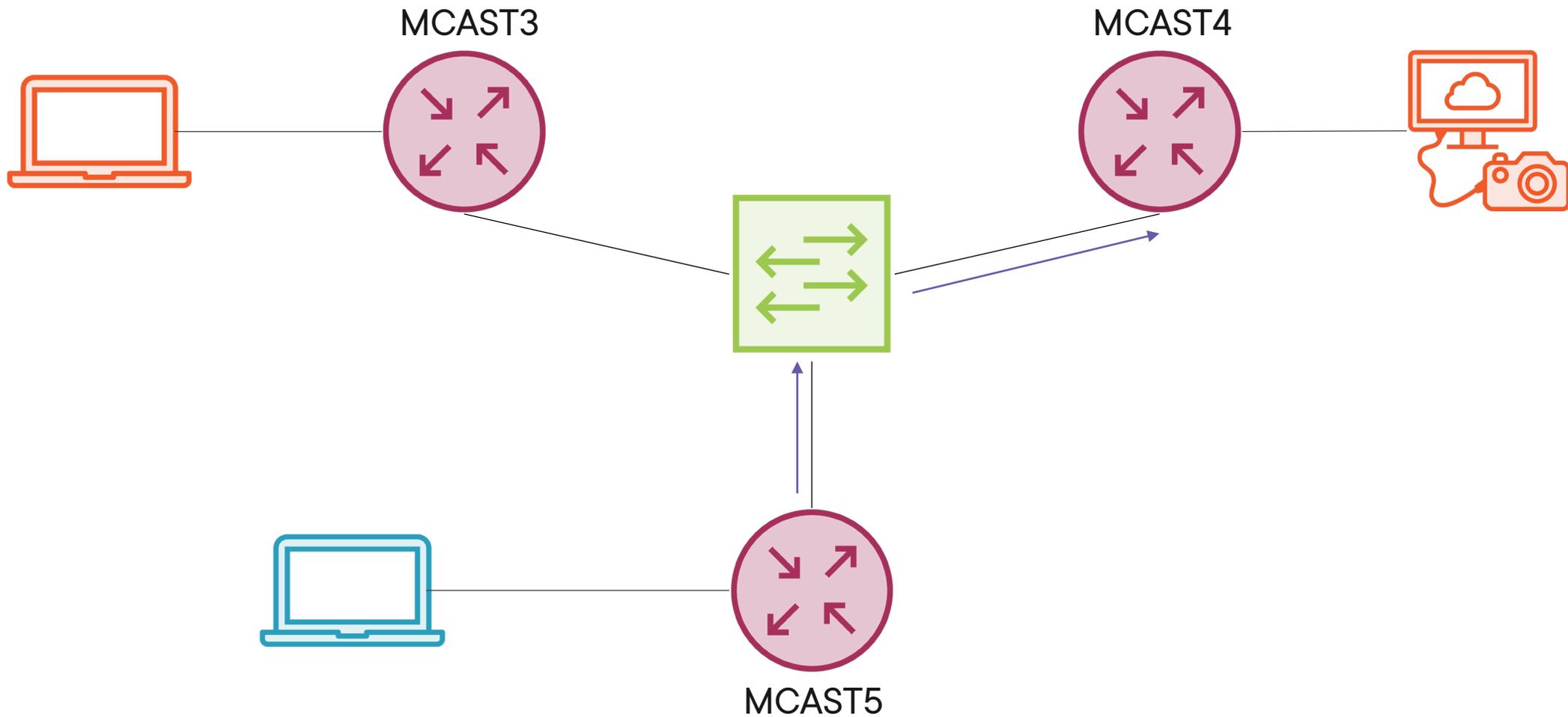
Leaving Multicast



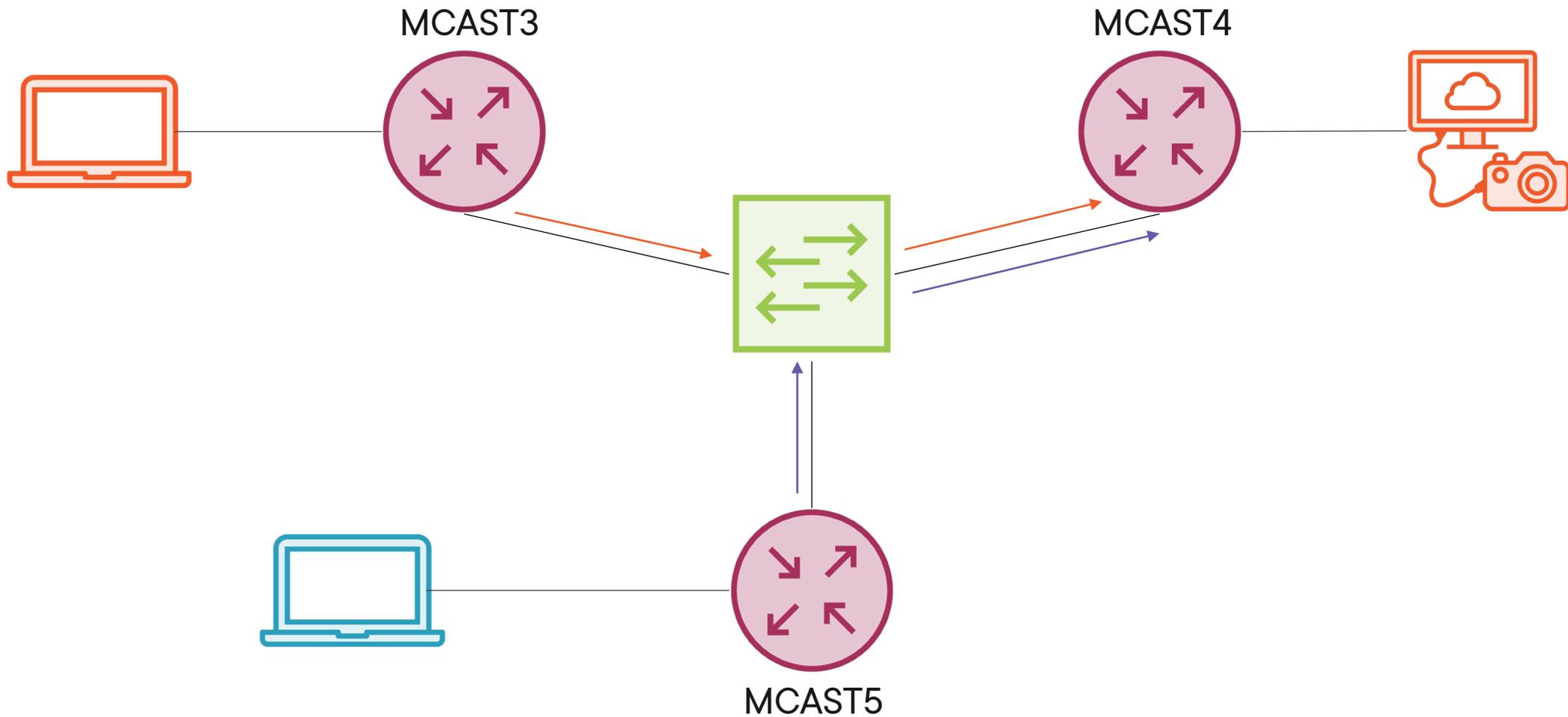
PIM Join in PIM-DM



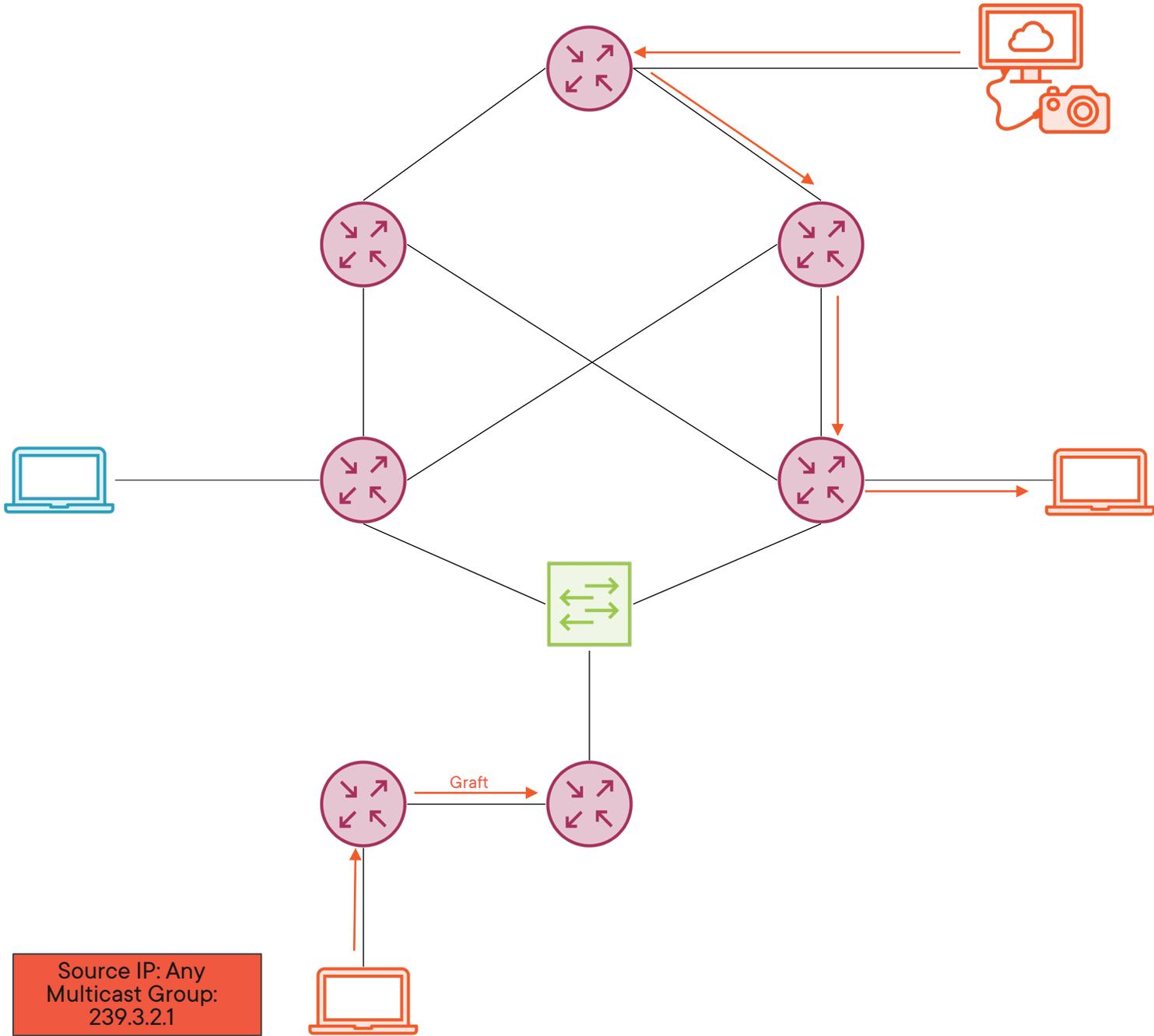
PIM Join in PIM-DM



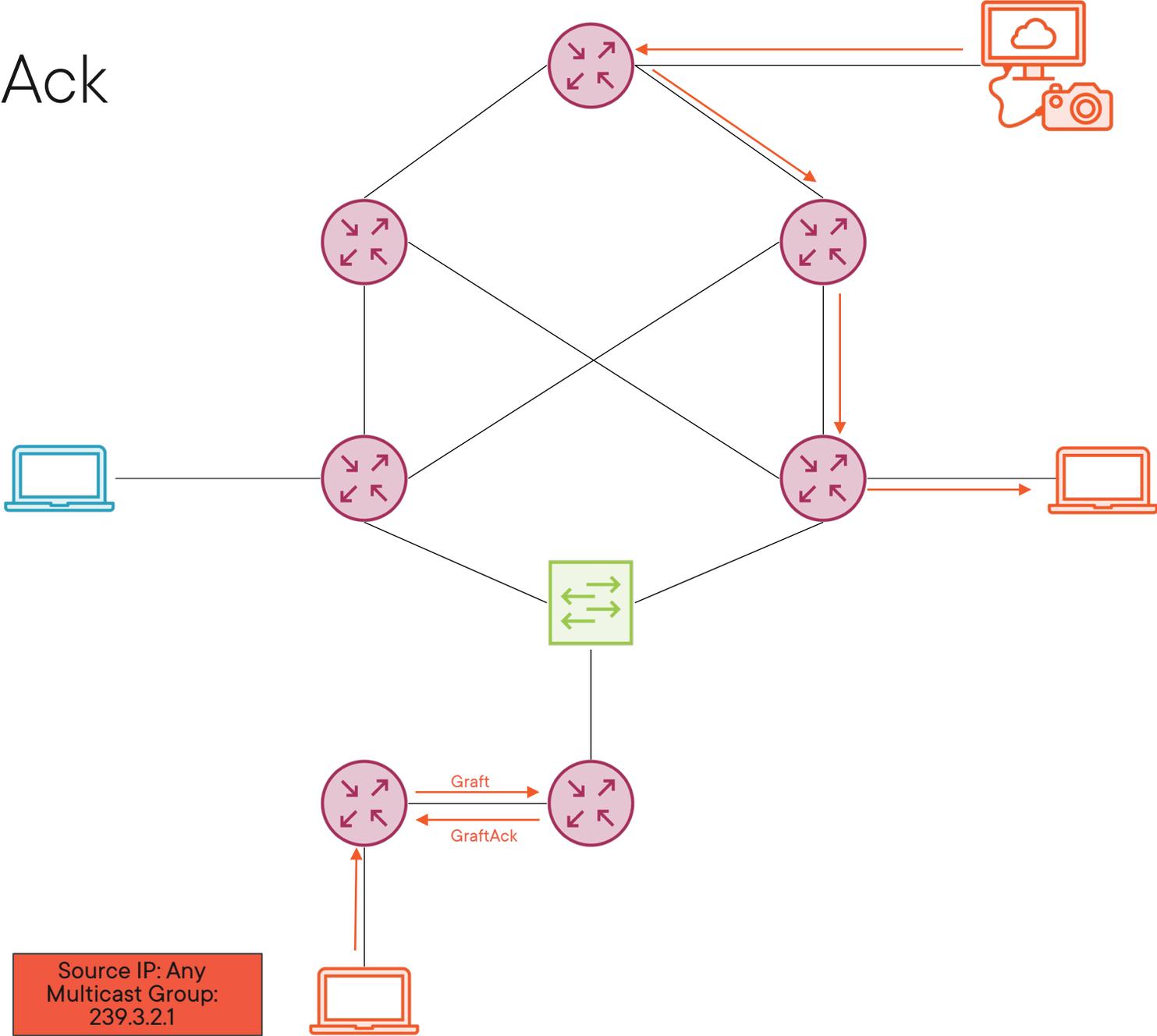
PIM Join in PIM-DM



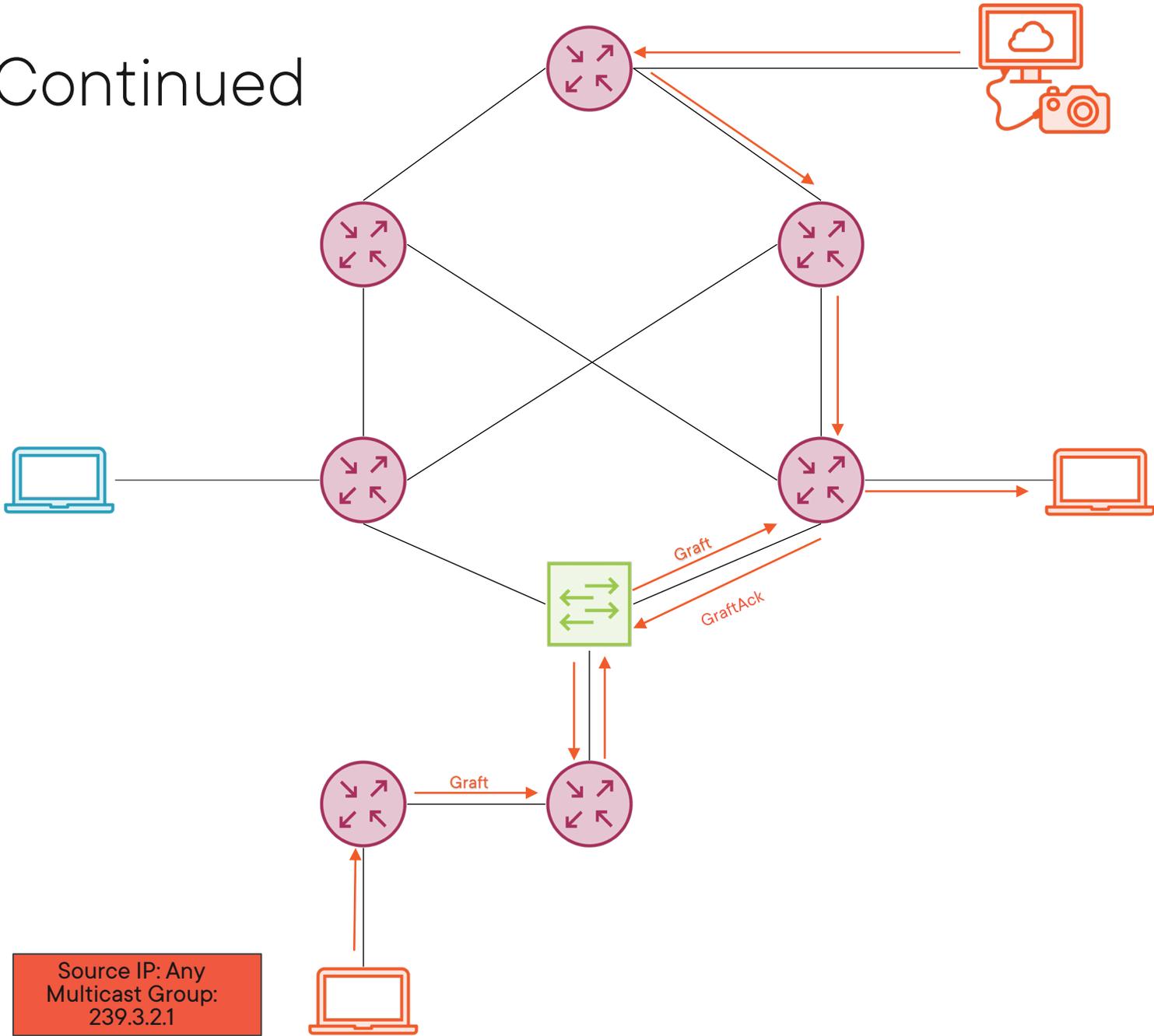
PIM Graft



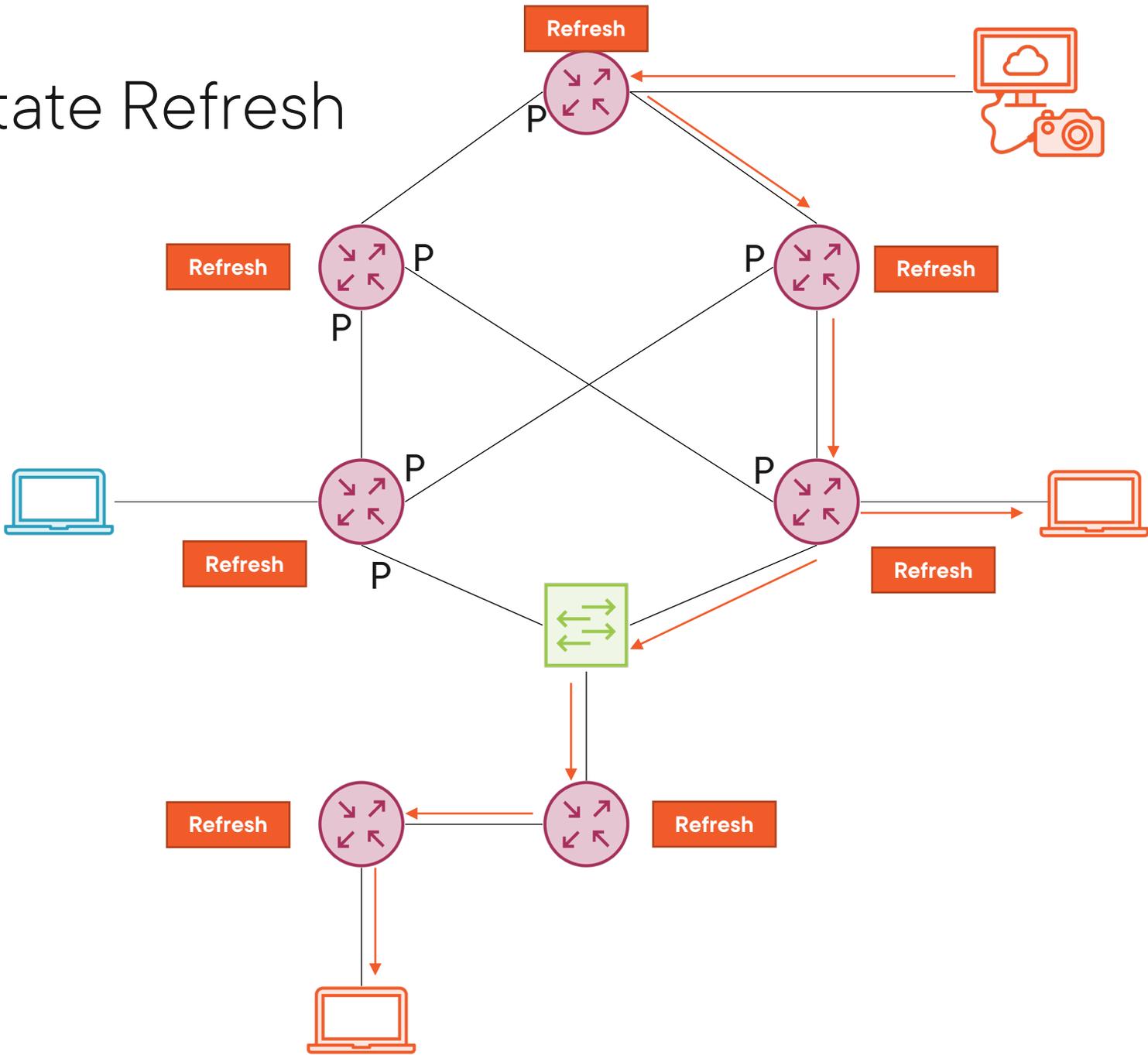
PIM Graft-Ack



PIM Graft Continued



PIM-DM State Refresh



PIM Hello Packet Dissected

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.10.255.1	224.0.0.13	PIMv2	72	Hello
2	10.690125199	10.10.255.2	224.0.0.13	PIMv2	72	Hello

> Frame 1: 72 bytes on wire (576 bits), 72 bytes captured (576 bits) on interface eth0, id 0

▼ Ethernet II, Src: 50:00:00:06:00:01 (50:00:00:06:00:01), Dst: IPv4mcast_0d (01:00:5e:00:00:0d)

- > Destination: IPv4mcast_0d (01:00:5e:00:00:0d)
- > Source: 50:00:00:06:00:01 (50:00:00:06:00:01)
Type: IPv4 (0x0800)

▼ Internet Protocol Version 4, Src: 10.10.255.1, Dst: 224.0.0.13

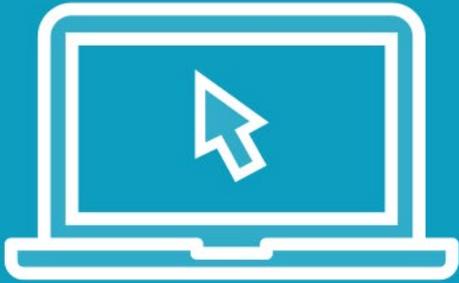
- 0100 = Version: 4
- 0101 = Header Length: 20 bytes (5)
- > Differentiated Services Field: 0xc0 (DSCP: CS6, ECN: Not-ECT)
Total Length: 58
Identification: 0x099b (2459)
- > Flags: 0x00
Fragment Offset: 0
Time to Live: 1
Protocol: PIM (103)
Header Checksum: 0xc5e9 [validation disabled]
[Header checksum status: Unverified]
Source Address: 10.10.255.1
Destination Address: 224.0.0.13

▼ Protocol Independent Multicast

- 0010 = Version: 2
- 0000 = Type: Hello (0)
- Reserved byte(s): 00
- Checksum: 0xd438 [correct]
[Checksum Status: Good]
- ▼ PIM Options: 5
 - > Option 1: Hold Time: 105
 - > Option 20: Generation ID: 4067957164
 - > Option 19: DR Priority: 1
 - > Option 21: State-Refresh: Version = 1, Interval = 0s
 - > Option 65004: RPF Proxy Vector (Cisco proprietary)



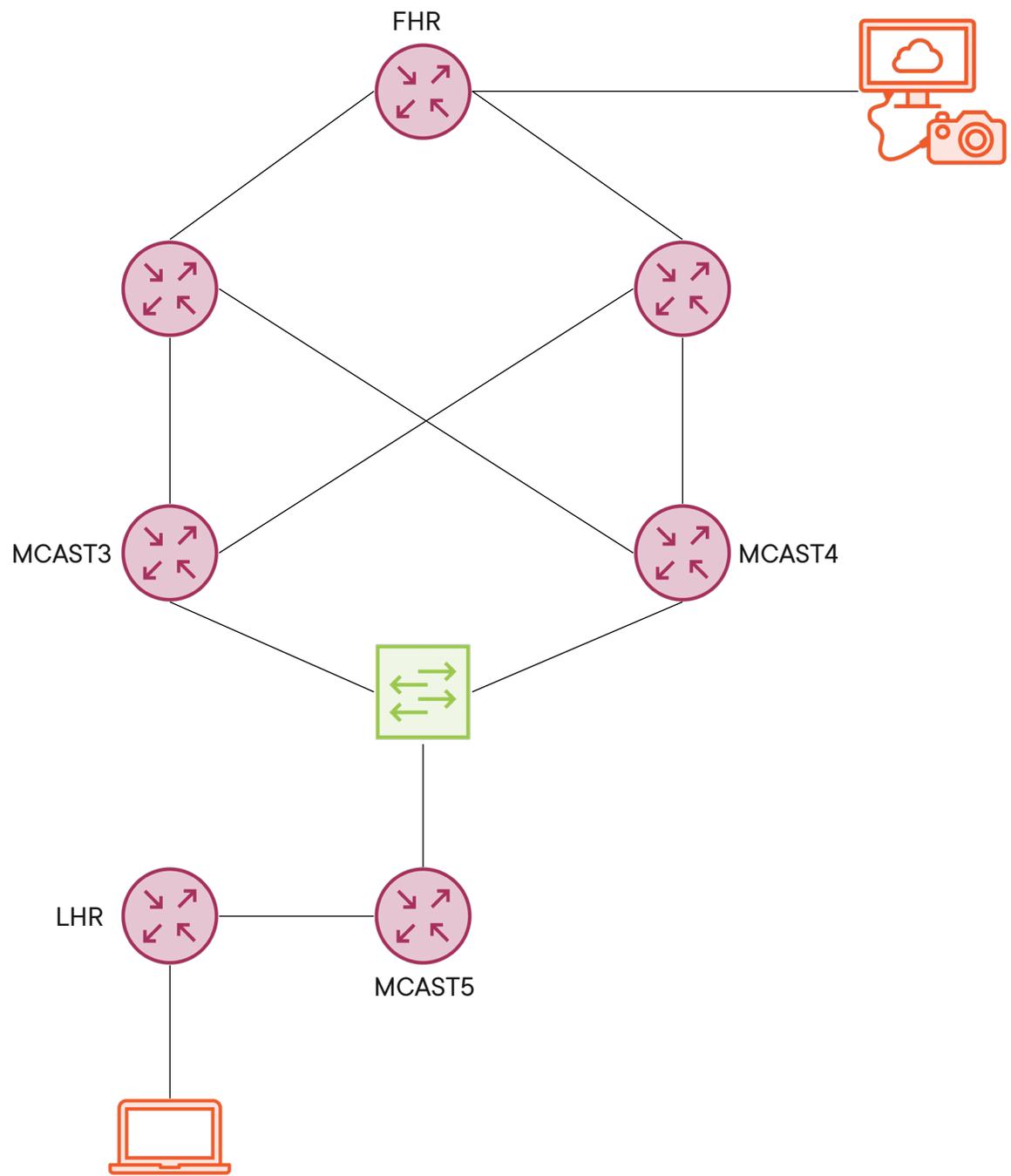
Demo



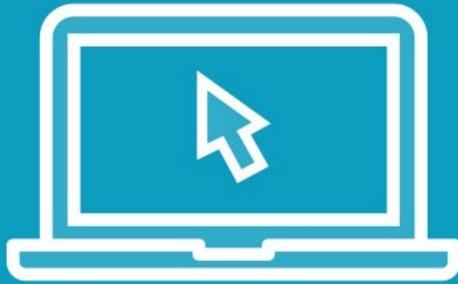
PIM-DM Multicast Flood/Prune

- How flooding makes routers aware of sources
- How multicast routers stop unwanted flows
- How downstream routers keep the traffic flowing





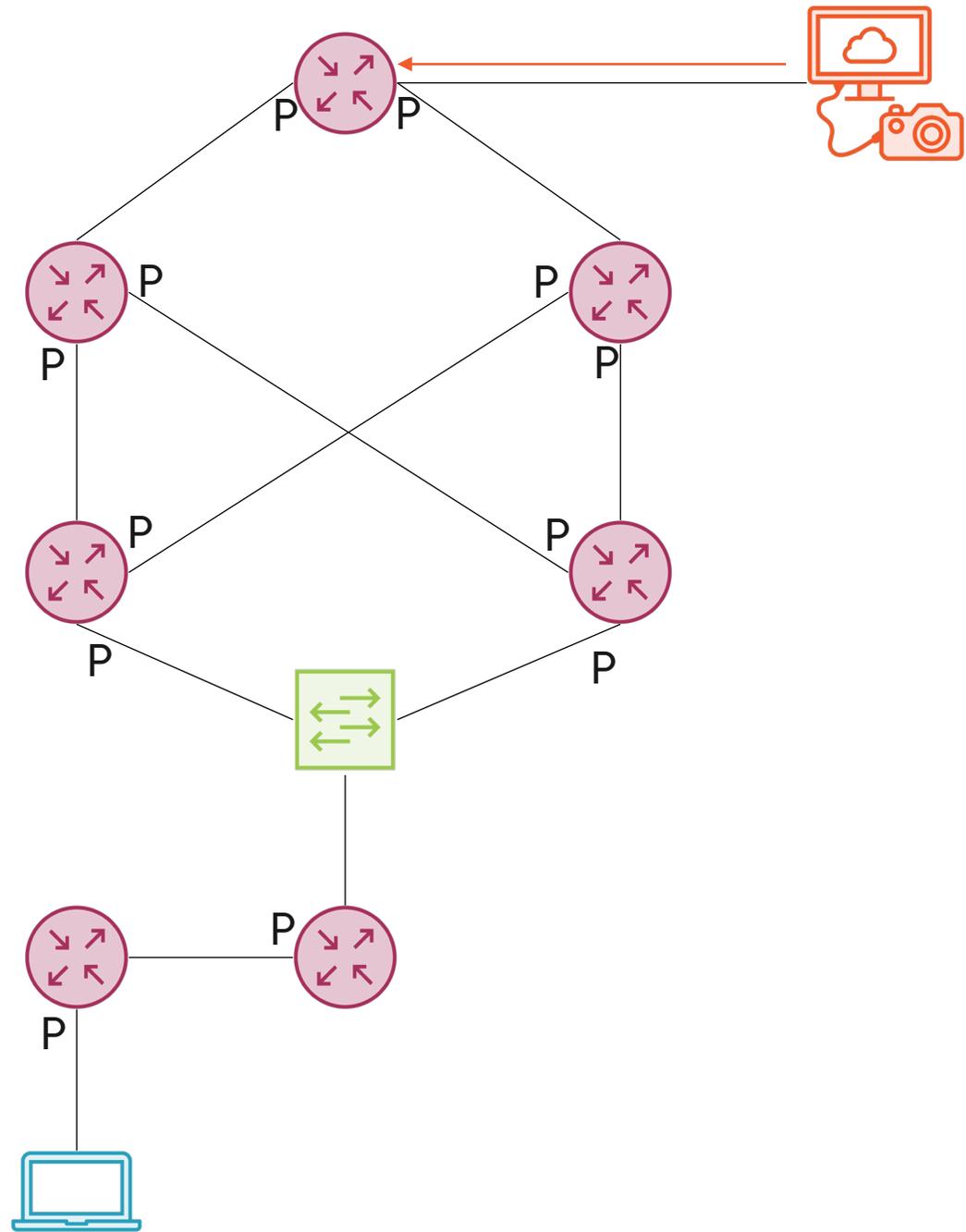
Demo



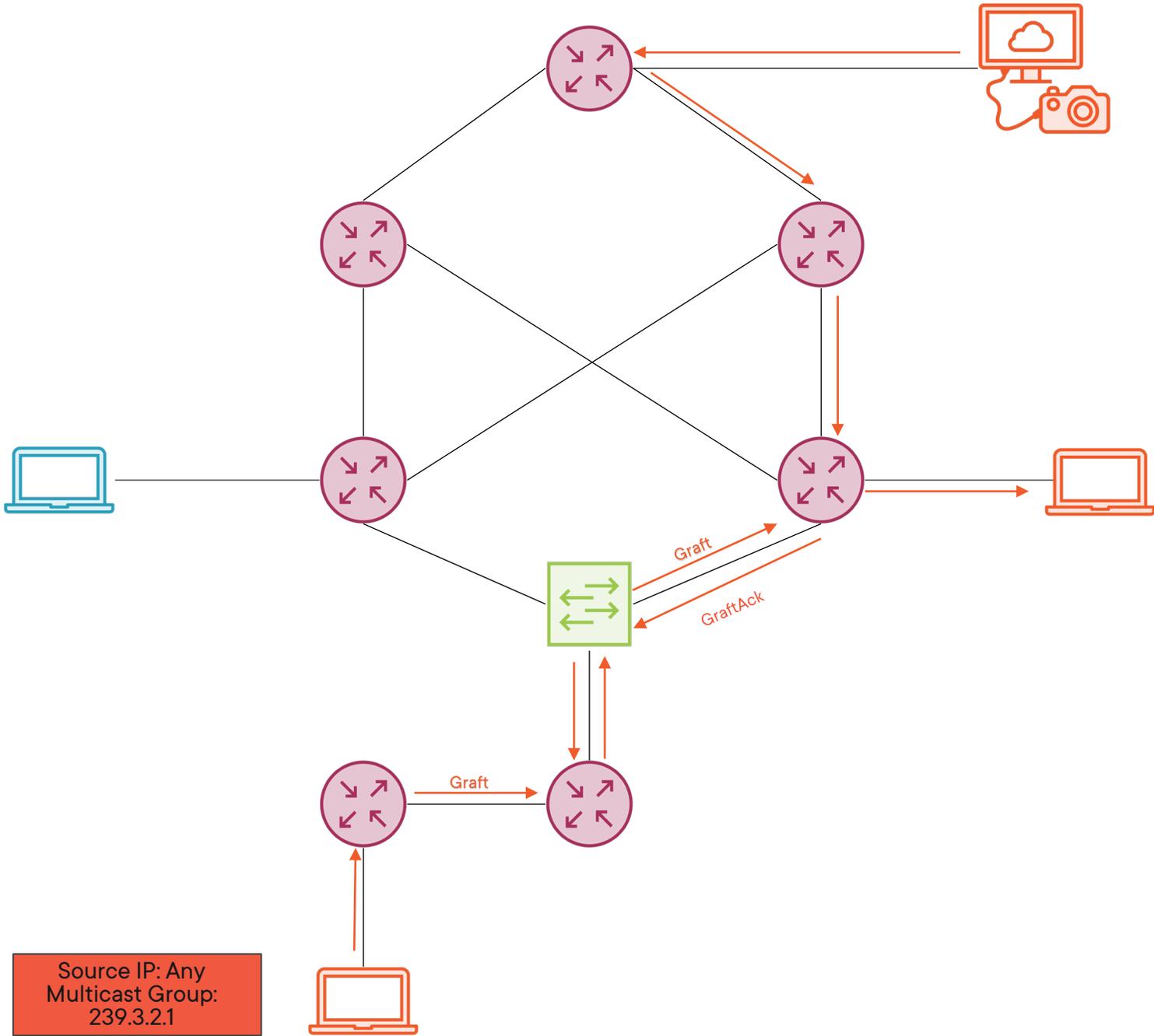
PIM-DM Graft/Graft-Ack

- How we add new receivers to previously pruned interfaces
- How upstream routers acknowledge the request and restart traffic delivery

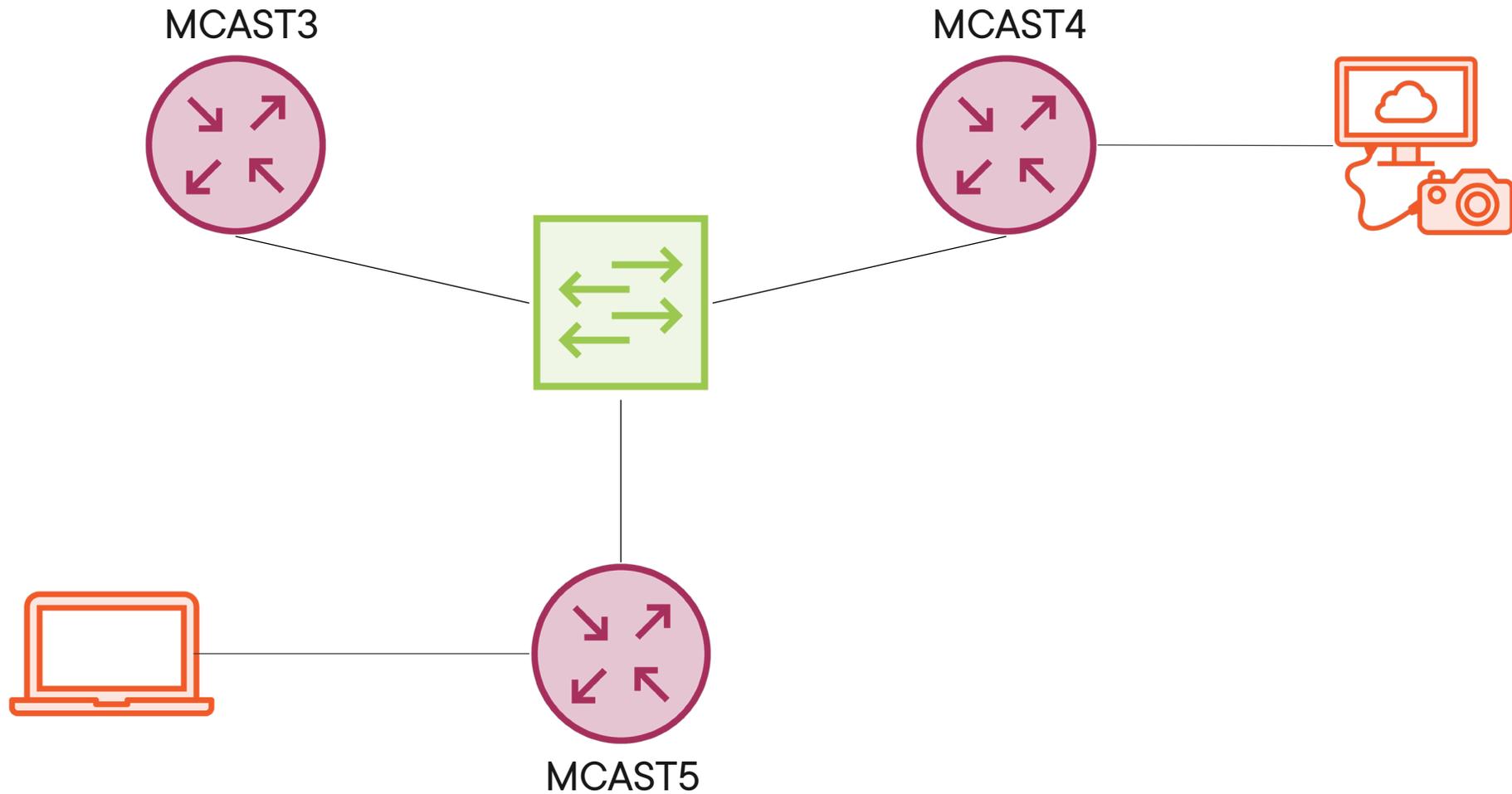




PIM Graft



PIM Shared Segment



PIM Prune

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.255.254.3	224.0.0.13	PIMv2	68	Join/Prune
2	0.000834843	10.255.254.4	224.0.0.13	PIMv2	68	Join/Prune
3	0.343112403	10.255.254.5	224.0.0.13	PIMv2	68	Join/Prune

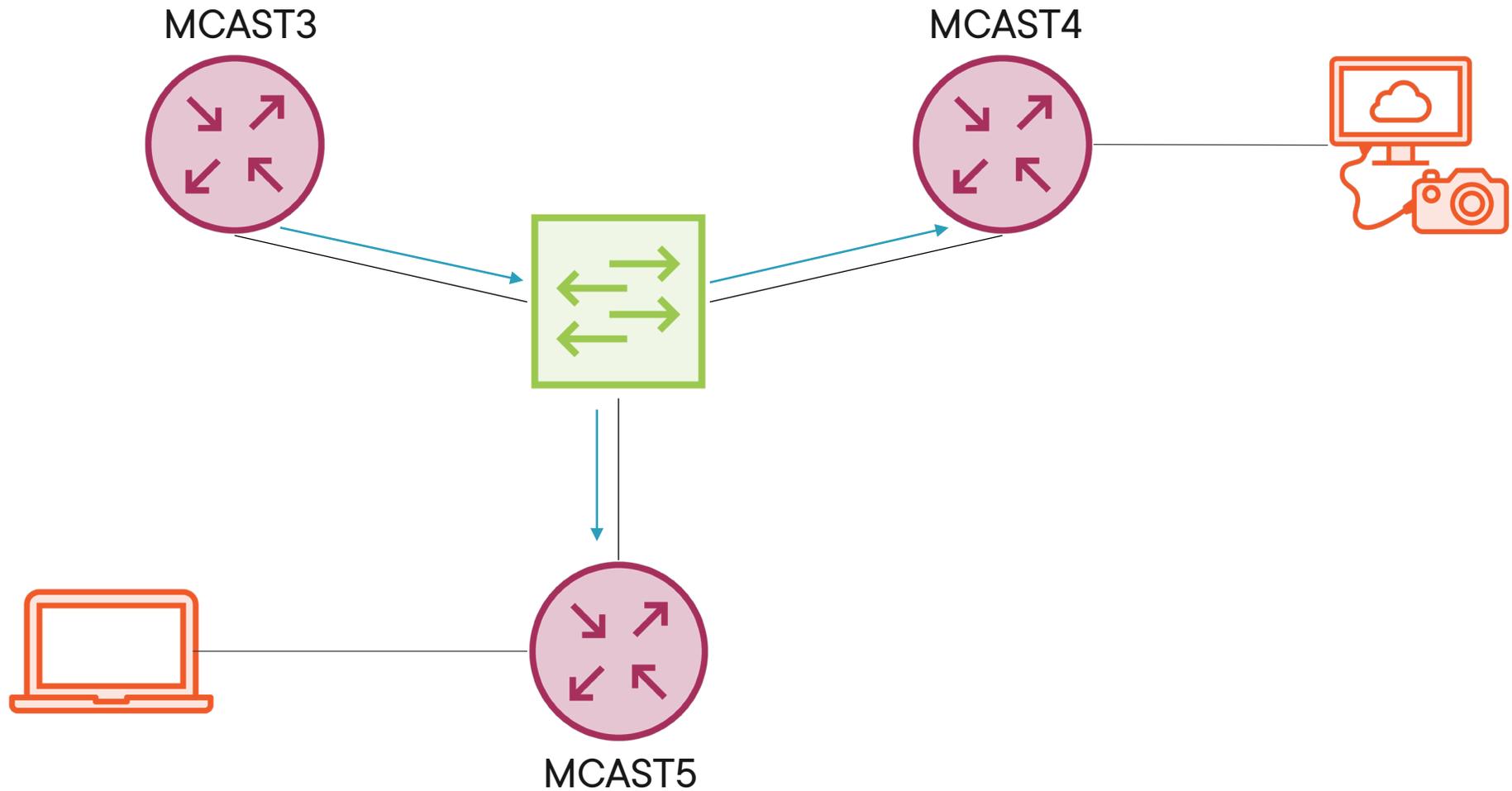
> Frame 1: 68 bytes on wire (544 bits), 68 bytes captured (544 bits) on interface eth0, id 0
> Ethernet II, Src: 50:00:00:01:00:00 (50:00:00:01:00:00), Dst: IPv4mcast_0d (01:00:5e:00:00:0d)
> Internet Protocol Version 4, Src: 10.255.254.3, Dst: 224.0.0.13

▼ Protocol Independent Multicast

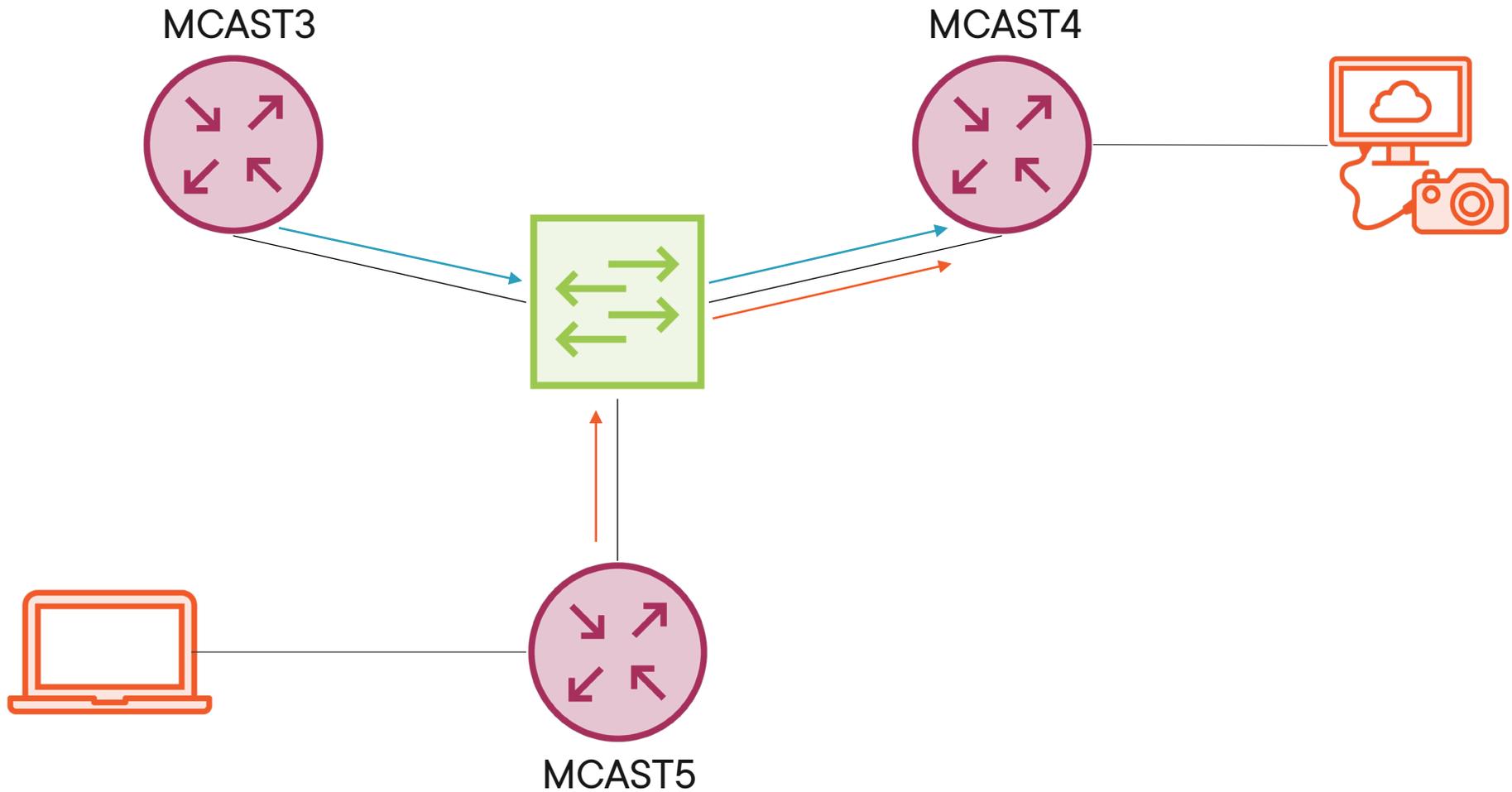
- 0010 = Version: 2
- 0011 = Type: Join/Prune (3)
- Reserved byte(s): 00
- Checksum: 0xd31b [correct]
- [Checksum Status: Good]
- ▼ PIM Options
 - > Upstream-neighbor: 10.255.254.4
 - Reserved byte(s): 00
 - Num Groups: 1
 - Holdtime: 210
 - ▼ Group 0
 - ▼ Group 0: 239.3.2.1/32
 - Address Family: IPv4 (1)
 - Encoding Type: Native (0)
 - > Flags: 0x00
 - Masklen: 32
 - Group: 239.3.2.1
 - Num Joins: 0
 - ▼ Num Prunes: 1
 - ▼ IP address: 10.99.1.100/32
 - Address Family: IPv4 (1)
 - Encoding Type: Native (0)
 - > Flags: 0x00
 - Masklen: 32
 - Source: 10.99.1.100



PIM Prune From MCAST3



PIM Join From MCAST5



PIM Join

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.255.254.3	224.0.0.13	PIMv2	68	Join/Prune
2	0.000834843	10.255.254.4	224.0.0.13	PIMv2	68	Join/Prune
3	0.343112403	10.255.254.5	224.0.0.13	PIMv2	68	Join/Prune

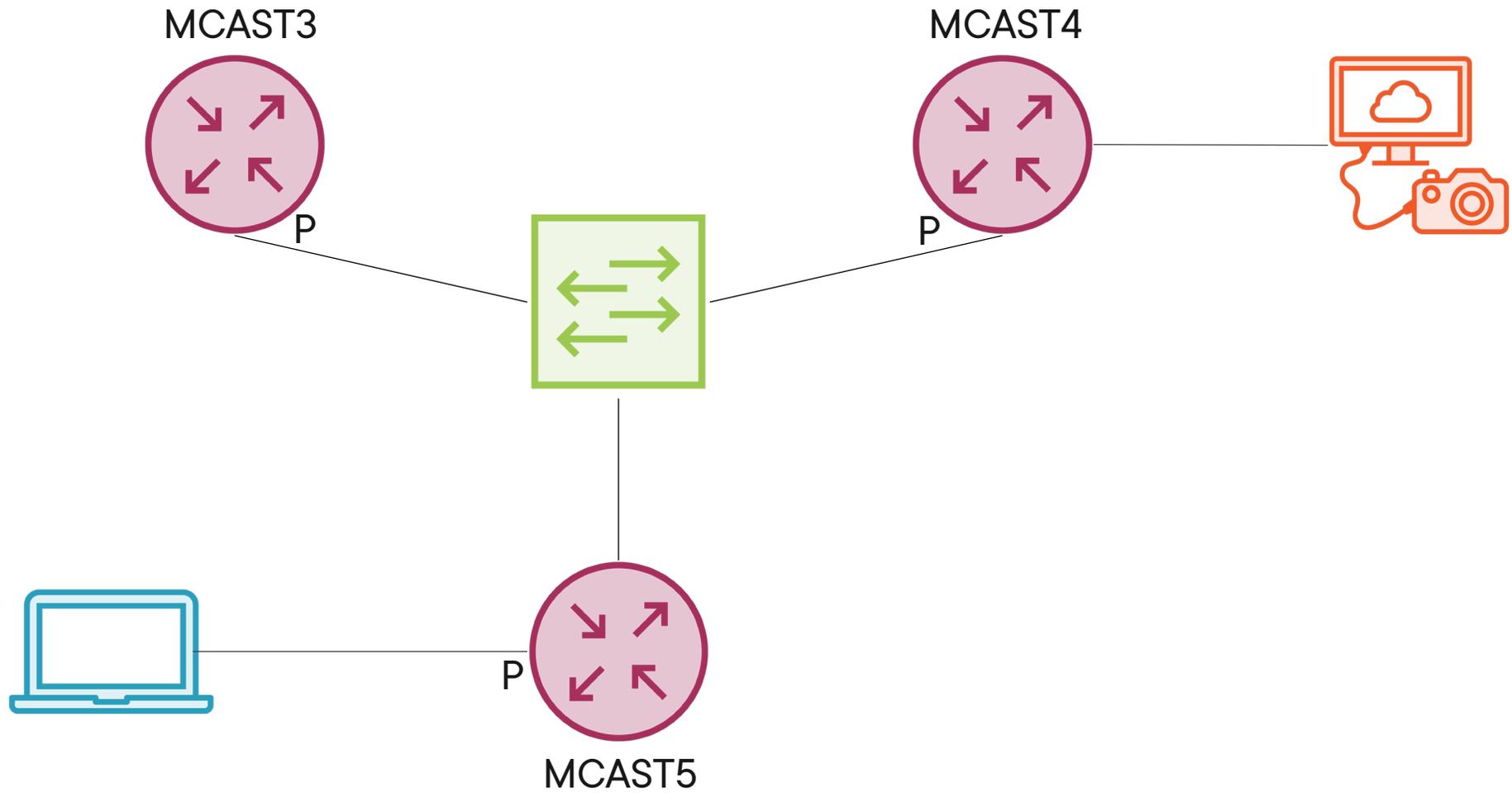
> Frame 3: 68 bytes on wire (544 bits), 68 bytes captured (544 bits) on interface eth0, id 0
> Ethernet II, Src: 50:00:00:06:00:00 (50:00:00:06:00:00), Dst: IPv4mcast_0d (01:00:5e:00:00:0d)
> Internet Protocol Version 4, Src: 10.255.254.5, Dst: 224.0.0.13

▼ Protocol Independent Multicast

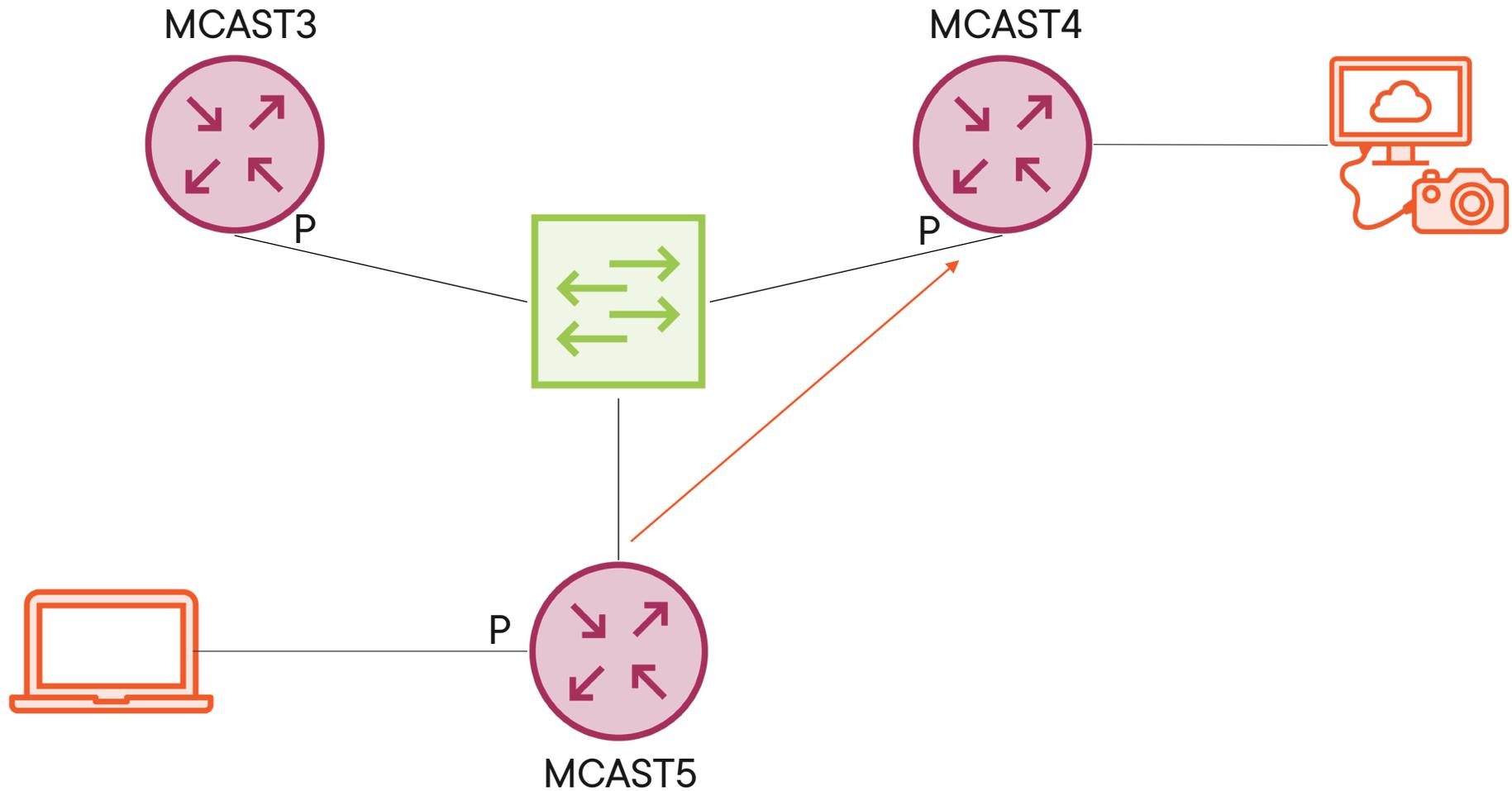
- 0010 = Version: 2
- 0011 = Type: Join/Prune (3)
- Reserved byte(s): 00
- Checksum: 0xd31b [correct]
- [Checksum Status: Good]
- ▼ PIM Options
 - ▼ Upstream-neighbor: 10.255.254.4
 - Address Family: IPv4 (1)
 - Encoding Type: Native (0)
 - Unicast: 10.255.254.4
 - Reserved byte(s): 00
 - Num Groups: 1
 - Holdtime: 210
 - ▼ Group 0
 - ▼ Group 0: 239.3.2.1/32
 - Address Family: IPv4 (1)
 - Encoding Type: Native (0)
 - > Flags: 0x00
 - Masklen: 32
 - Group: 239.3.2.1
 - ▼ Num Joins: 1
 - ▼ IP address: 10.99.1.100/32
 - Address Family: IPv4 (1)
 - Encoding Type: Native (0)
 - > Flags: 0x00
 - Masklen: 32
 - Source: 10.99.1.100
 - Num Prunes: 0



PIM Shared Segment



PIM Shared Segment



PIM Graft

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.255.254.5	10.255.254.4	PIMv2	68	Graft
2	0.007312577	10.255.254.4	10.255.254.5	PIMv2	68	Graft-Ack

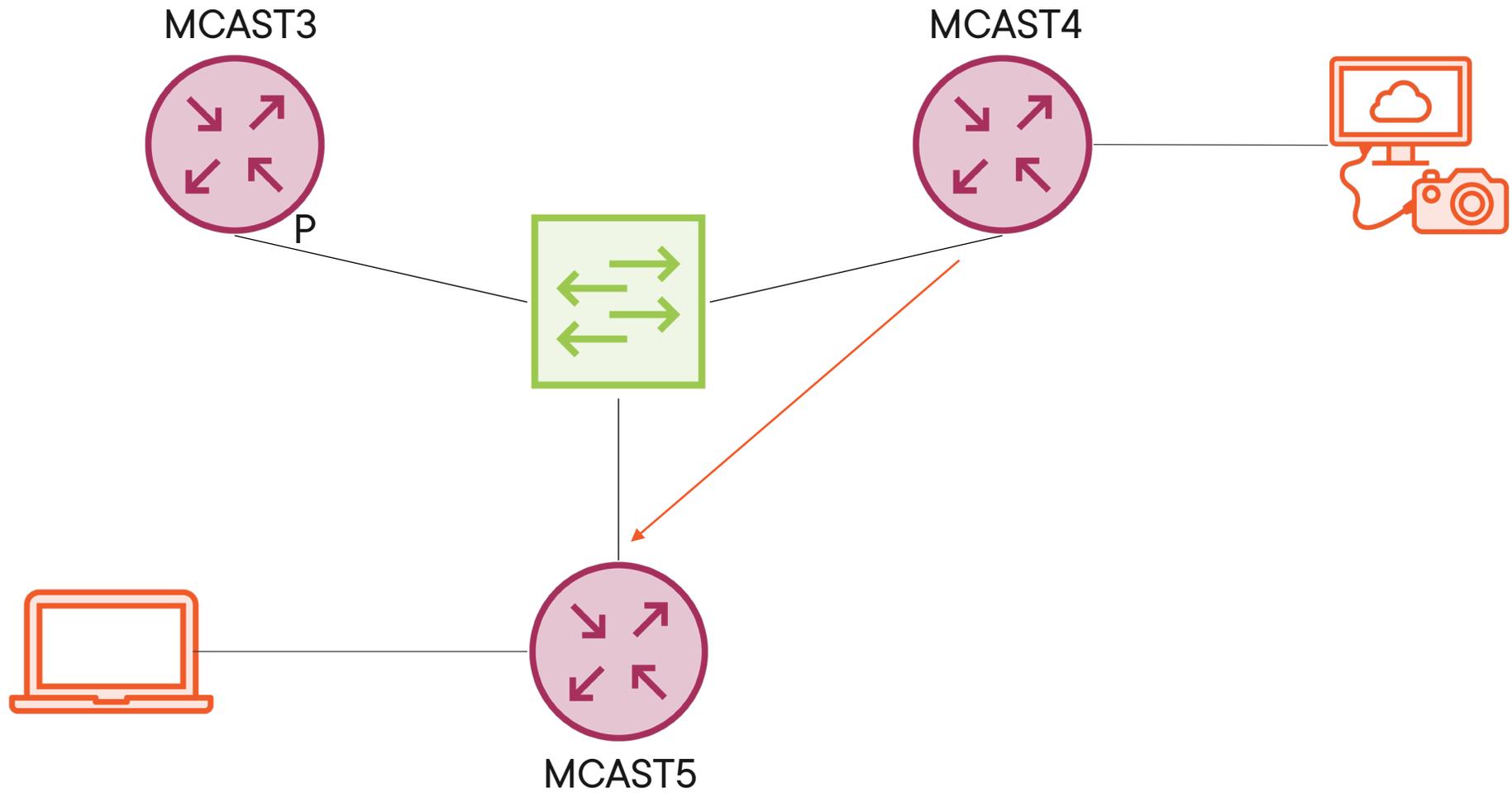
> Frame 1: 68 bytes on wire (544 bits), 68 bytes captured (544 bits) on interface eth0, id 0
> Ethernet II, Src: 50:00:00:06:00:00 (50:00:00:06:00:00), Dst: 50:00:00:02:00:00 (50:00:00:02:00:00)
> Internet Protocol Version 4, Src: 10.255.254.5, Dst: 10.255.254.4

▼ Protocol Independent Multicast

- 0010 = Version: 2
- ... 0110 = Type: Graft (6)
- Reserved byte(s): 00
- Checksum: 0xd01b [correct]
- [Checksum Status: Good]
- ▼ PIM Options
 - ▼ Upstream-neighbor: 10.255.254.4
 - Address Family: IPv4 (1)
 - Encoding Type: Native (0)
 - Unicast: 10.255.254.4
 - Reserved byte(s): 00
 - Num Groups: 1
 - Holdtime: 210
 - ▼ Group 0
 - ▼ Group 0: 239.3.2.1/32
 - Address Family: IPv4 (1)
 - Encoding Type: Native (0)
 - > Flags: 0x00
 - Masklen: 32
 - Group: 239.3.2.1
 - ▼ Num Joins: 1
 - ▼ IP address: 10.99.1.100/32
 - Address Family: IPv4 (1)
 - Encoding Type: Native (0)
 - > Flags: 0x00
 - Masklen: 32
 - Source: 10.99.1.100
 - Num Prunes: 0



PIM Shared Segment



PIM Graft-Ack

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	10.255.254.5	10.255.254.4	PIMv2	68	Graft
2	0.007312577	10.255.254.4	10.255.254.5	PIMv2	68	Graft-Ack


```
> Frame 2: 68 bytes on wire (544 bits), 68 bytes captured (544 bits) on interface eth0, id 0
> Ethernet II, Src: 50:00:00:02:00:00 (50:00:00:02:00:00), Dst: 50:00:00:06:00:00 (50:00:00:06:00:00)
> Internet Protocol Version 4, Src: 10.255.254.4, Dst: 10.255.254.5
v Protocol Independent Multicast
  0010 .... = Version: 2
  .... 0111 = Type: Graft-Ack (7)
  Reserved byte(s): 00
  Checksum: 0xcfa [correct]
  [Checksum Status: Good]
v PIM Options
  v Upstream-neighbor: 10.255.254.5
    Address Family: IPv4 (1)
    Encoding Type: Native (0)
    Unicast: 10.255.254.5
    Reserved byte(s): 00
    Num Groups: 1
    Holdtime: 210
  v Group 0
    v Group 0: 239.3.2.1/32
      Address Family: IPv4 (1)
      Encoding Type: Native (0)
      > Flags: 0x00
      Masklen: 32
      Group: 239.3.2.1
    v Num Joins: 1
      v IP address: 10.99.1.100/32
        Address Family: IPv4 (1)
        Encoding Type: Native (0)
        > Flags: 0x00
        Masklen: 32
        Source: 10.99.1.100
      Num Prunes: 0
```



Summary



Topics:

- Basic Operation of PIM-DM

Demos:

- PIM-DM Flood/Prune
- PIM-DM Grafting Multicast Receivers

Packet Analysis:

- PIM Join/Prune
- PIM Graft/GraftAck

