

# Protocol Deep Dive: PIM

---

## Basic Multicast Review



**Tim McConaughy**  
Solutions Architect

@juangolbez [carpe-dmvpn.com](http://carpe-dmvpn.com)

# What Should I Know Already?



## Topics:

- IGMP/MLD
- IPv6
- Wireshark

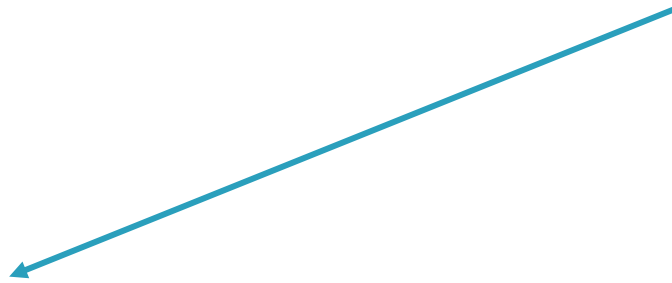
## Pluralsight Courses:

- [Protocol Deep Dive: IGMP and MLD](#)
- [Routing IPv4 and IPv6](#)
- [Getting Started with Wireshark](#)

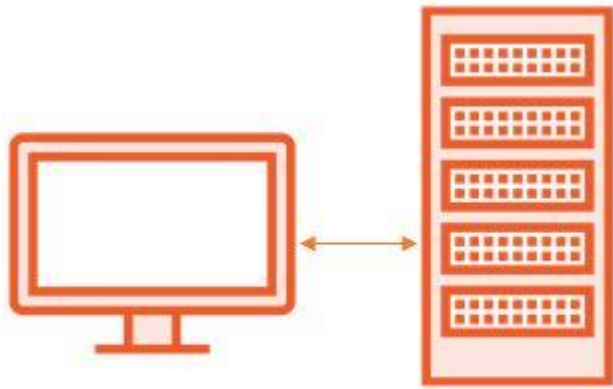




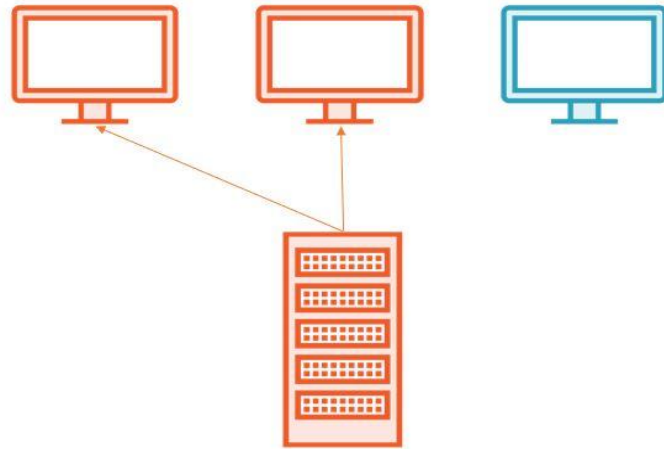




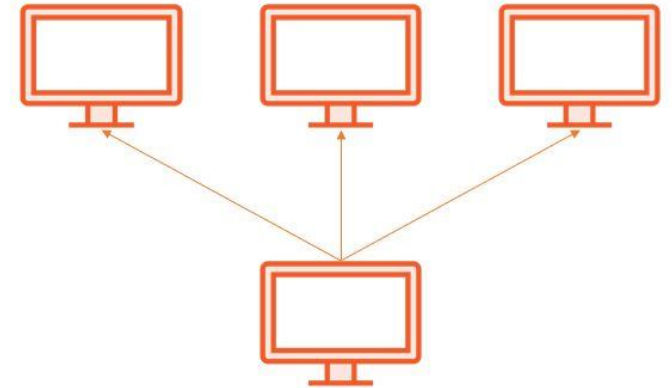
# Optimizing Traffic Flows



**Unicast**  
One to One Flow



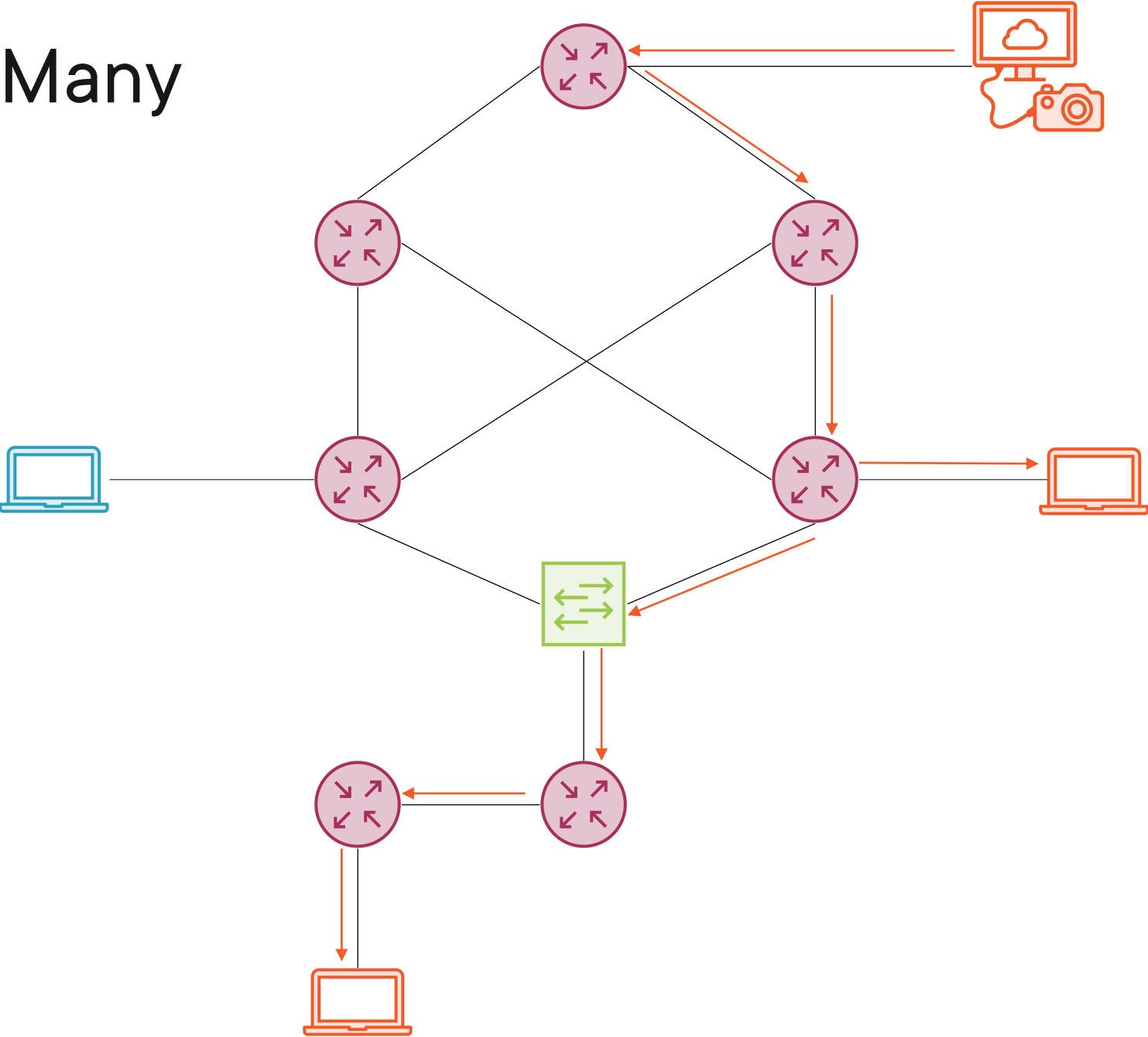
**Multicast**  
One to Many Flow  
Many to Many Flow

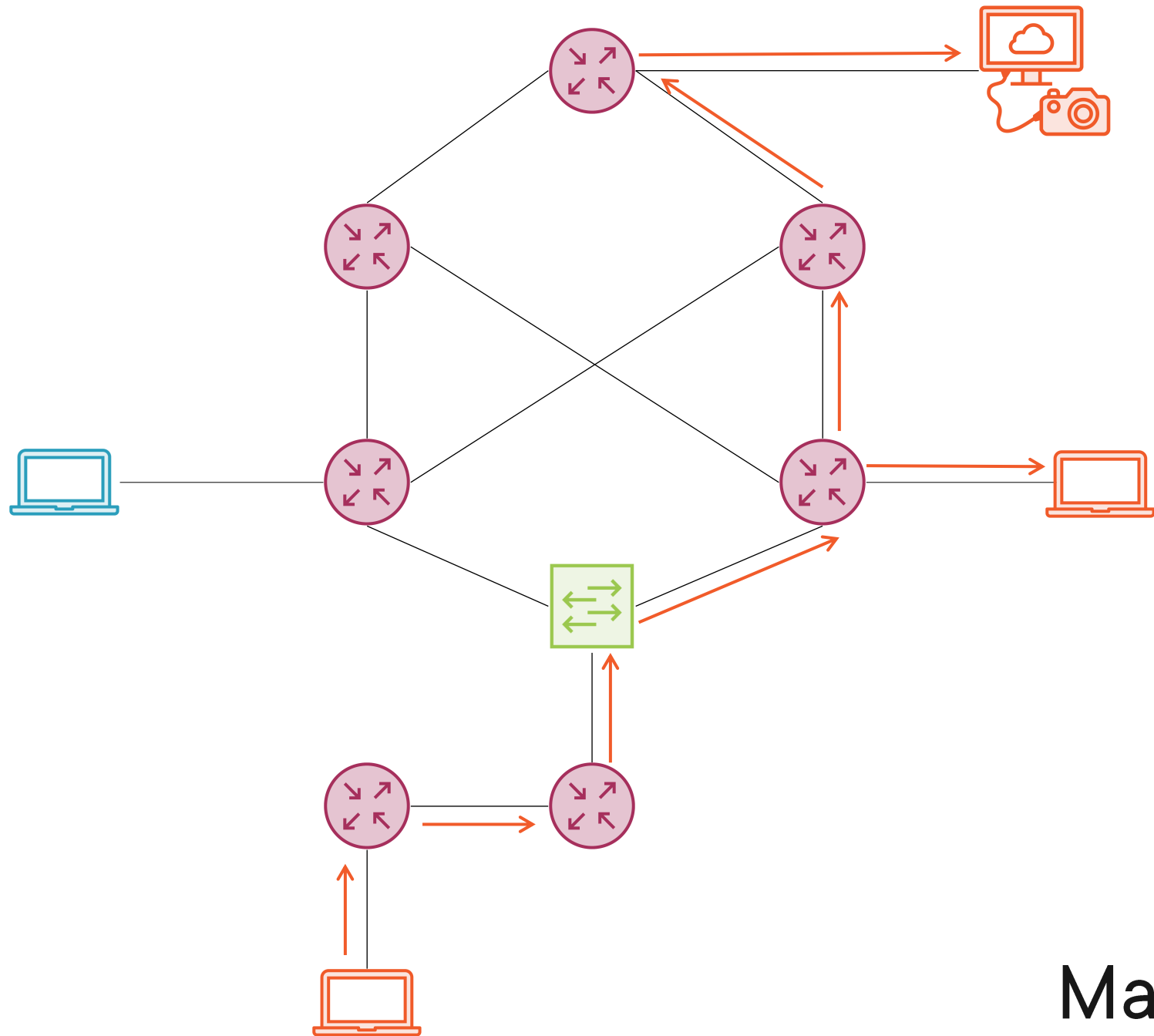


**Broadcast**  
One to All Flow



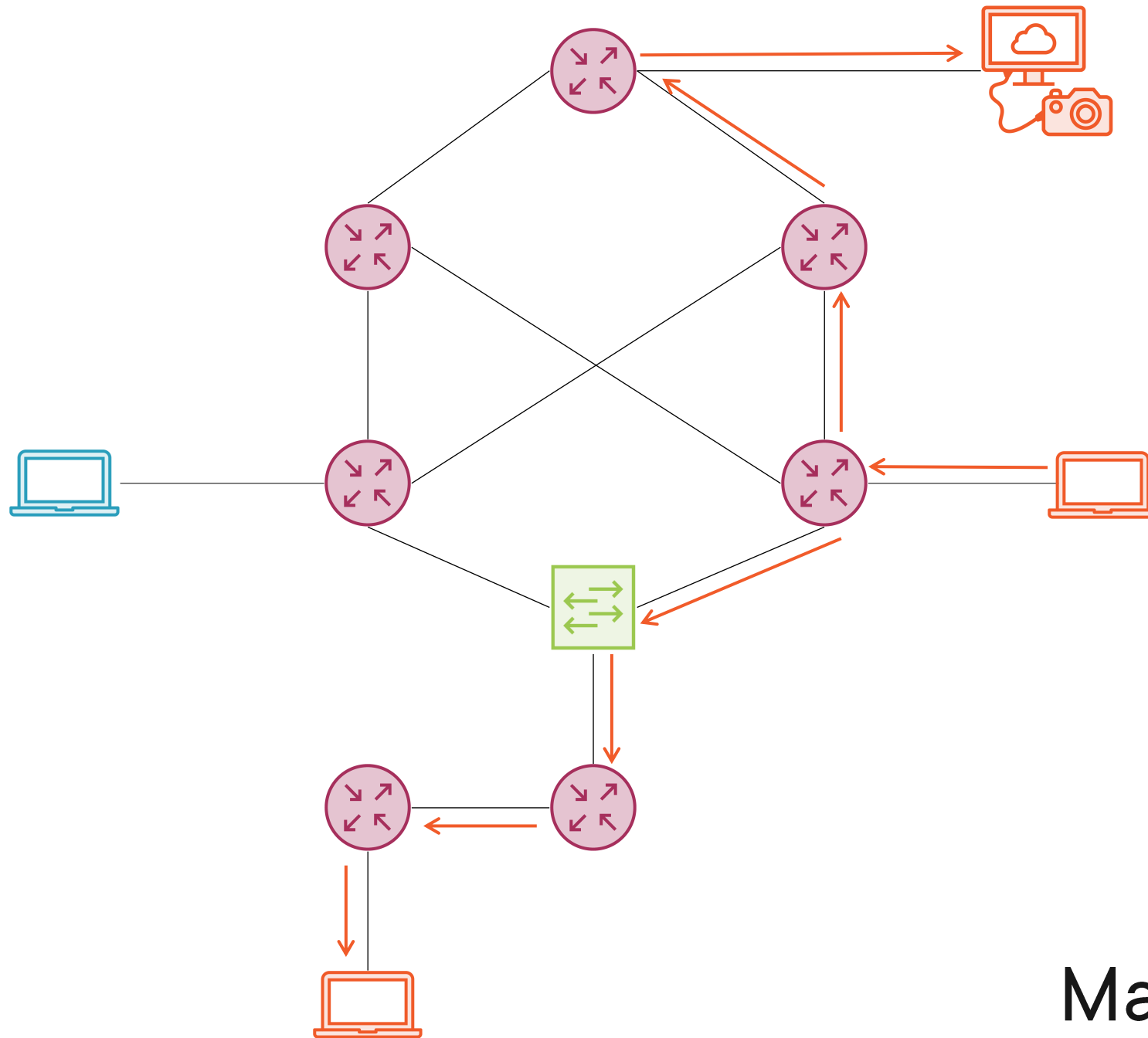
# One to Many





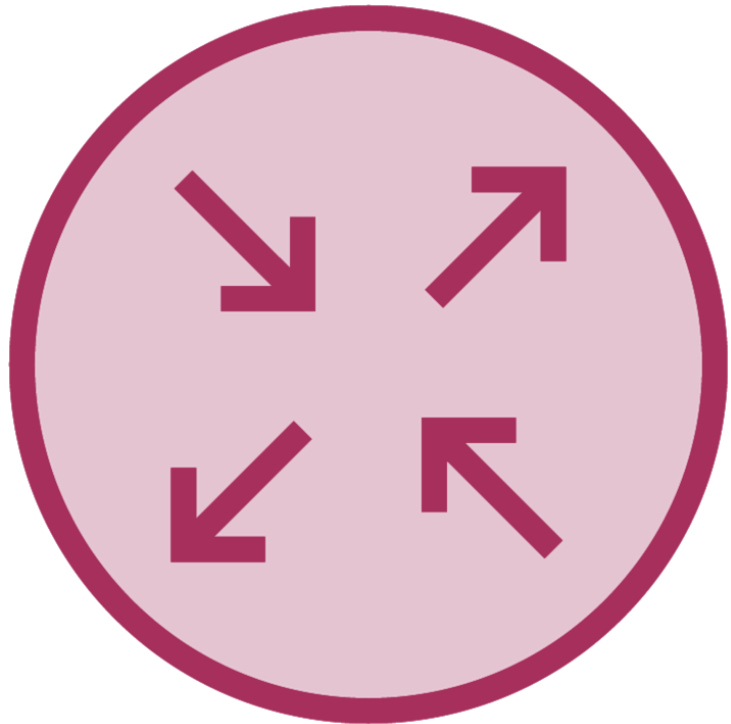
Many to Many 





Many to Many 

# Multicast Immutable Truths



**Multicast Applications are NOT transactional**

**Multicast Applications are UDP-Based**

**Multicast Traffic Flows One Way**



# GloboTicket Takes Off!

The screenshot shows the top navigation bar with the 'GLOBOTICKET' logo and 'A Globomania Company' tagline. A shopping cart icon indicates '0 TICKETS'. Below the navigation, there are filter buttons for 'ALL' and 'FILTER'. A table lists three concerts:

DATE	NAME	ARTIST	PRICE	
1/11/2021 4:22 PM	Alexander Lemtov Live	Alexander Lemtov	\$65	<a href="#">PURCHASE DETAILS</a>
3/11/2021 4:22 PM	To the Moon and Back	Santiago Martinez	\$135	<a href="#">PURCHASE DETAILS</a>
4/11/2021 4:22 PM	The State of Affairs: Mariam Live!	Mariam Johnson	\$85	<a href="#">PURCHASE DETAILS</a>

List Concerts

The screenshot shows the concert details for 'Alexander Lemtov Live'. It includes a photo of the artist, the event name, artist name, date (1/21/2020), and a description: 'Join Alexander for his global tour. Alexander really needs no introduction since he has already mesmerized the world with his electronic ambient sound.' The price is listed as '\$65 PER TICKET'. At the bottom, there is a 'QUANTITY' dropdown set to '2' and a 'PLACE ORDER' button.

Select an Artist

The screenshot shows the checkout page for the 'Alexander Lemtov Live' concert. It features a table with columns for 'EVENT NAME', 'DATE', 'PRICE PER TICKET', 'QUANTITY', and 'TOTAL'. The table shows 2 tickets at \$65 each, totaling \$130. There is an 'UPDATE' button next to the quantity and a 'Back to event catalog' link at the bottom.

EVENT NAME	DATE	PRICE PER TICKET	QUANTITY	TOTAL
Alexander Lemtov Live	1/11/2021	\$65	2	\$130

Buy a Ticket!



# The Multicast Source



**Video Recording Server**



**Concert Feed**



---

**Sends to radio frequency**

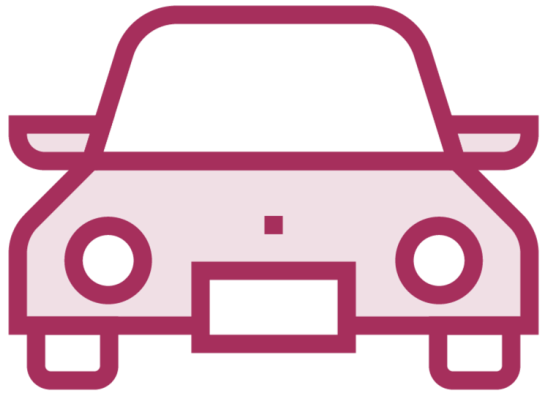
**Source is radio station**

**Destination is airwaves**

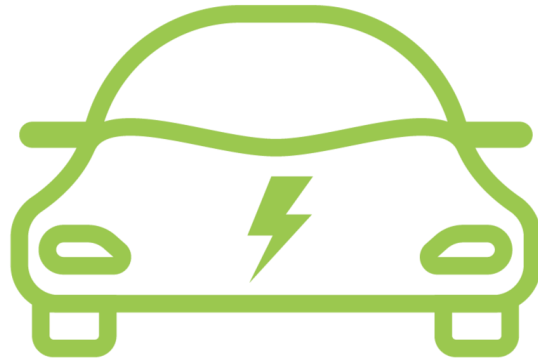
**Radio Station has no  
visibility on Listeners**



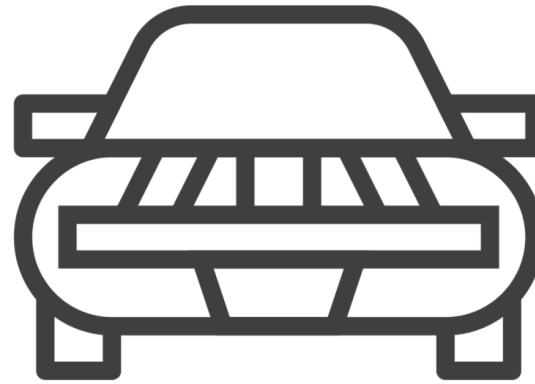
# Multicast is Like Local Radio



88.3 FM



97.5 FM



101.6 FM



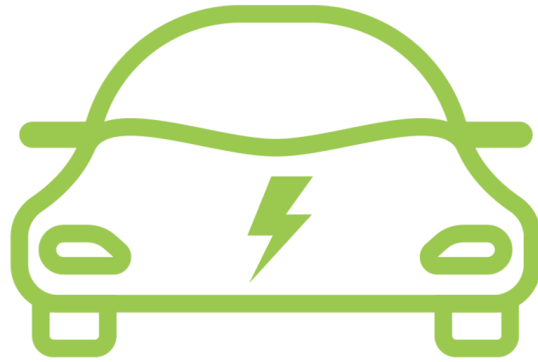
97.5 FM



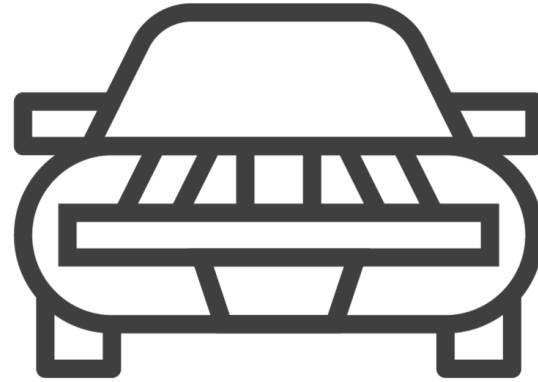
# Multicast is Like Local Radio



97.5 FM



97.5 FM



101.6 FM



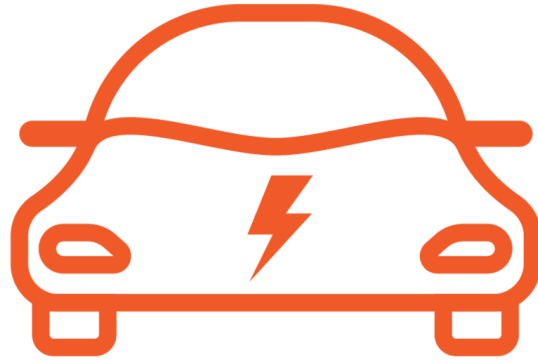
97.5 FM



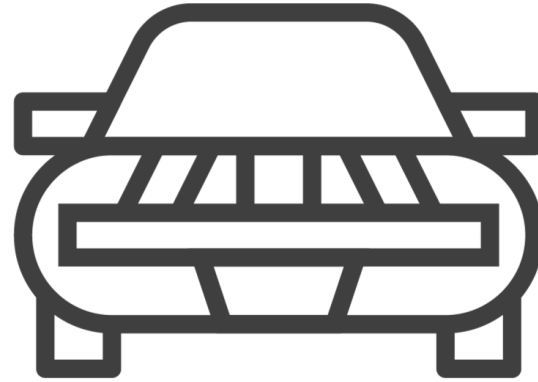
# Multicast is Like Local Radio



97.5 FM



Turned Off



101.6 FM



97.5 FM





**Sends to network**

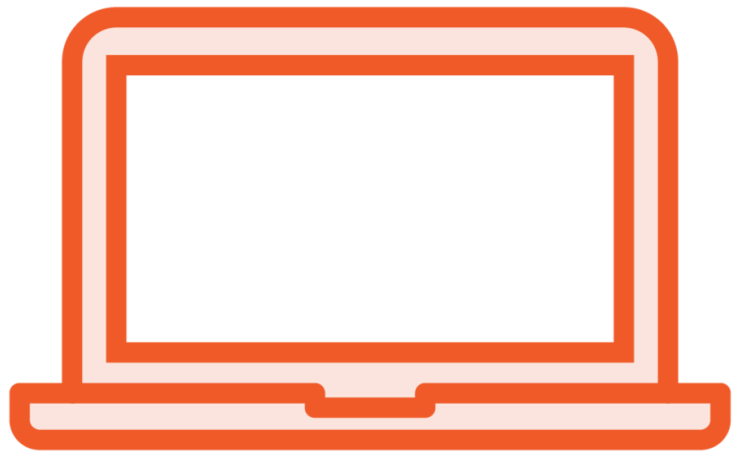
**Source is fixed IP**

**Destination is multicast  
group address IP**

**Source has no visibility  
on receivers**



# Multicast Receivers



**Similar to radio tuner**

**Signals interest in multicast group**

**Depending on protocol version:**

- Can request any source sending to group
- Can request specific source sending to group



# Multicast Receiver Request Options

## **Any-Source Multicast**

**Request specifies only multicast group address**

**Every source sending to the group address will be delivered**

## **Source-Specific Multicast**

**Request specifies multicast group address and specific source IP address**

**Only the stream from the requested source will be delivered**



# Multicast Receiver Signaling Protocols

## IGMP

IPv4 Only

Three Versions

Supports ASM in Version 1/2/3

Supports SSM in Version 3

## MLD

IPv6 Only

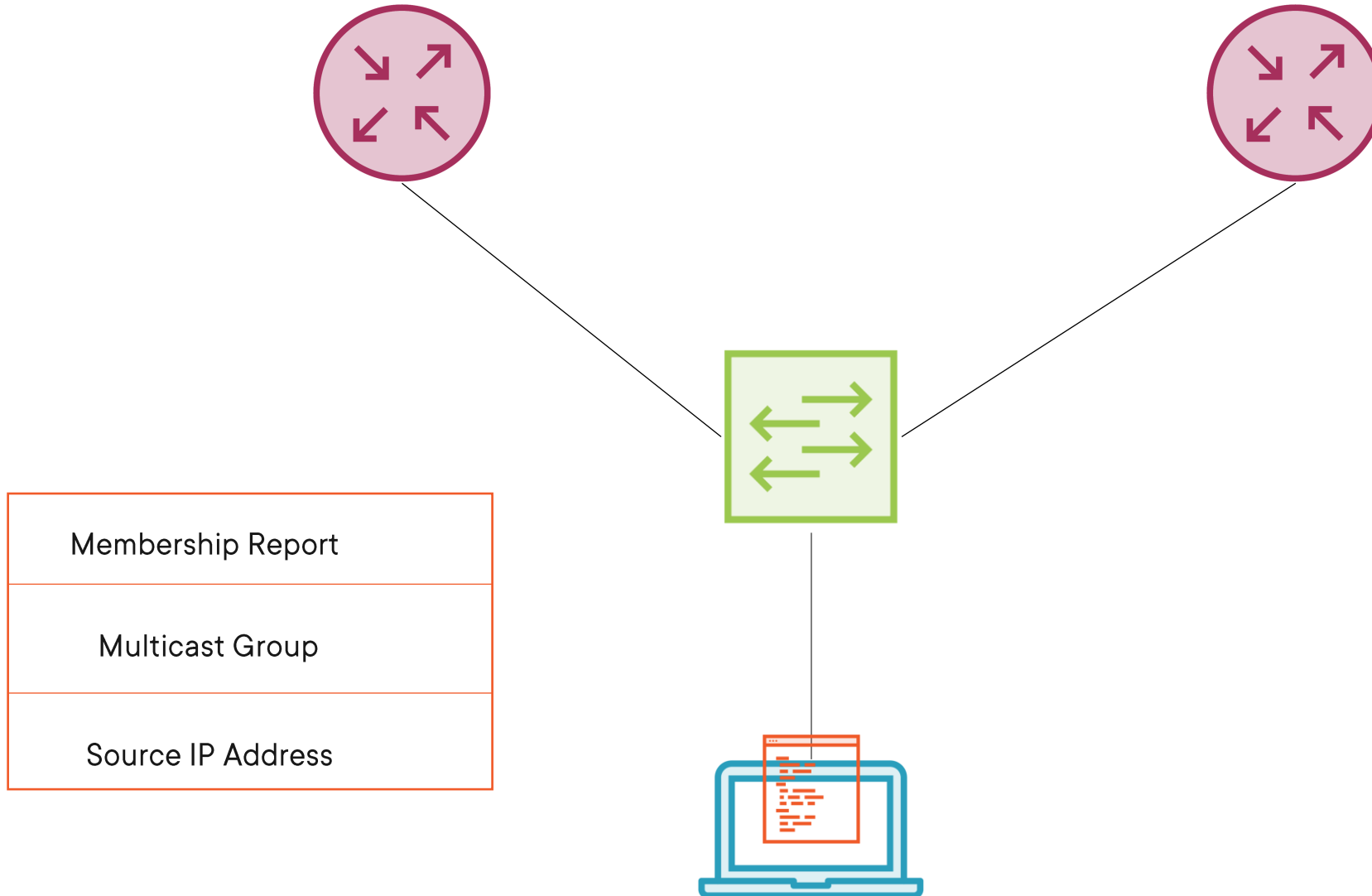
Two Versions

Supports ASM in Version 1/2

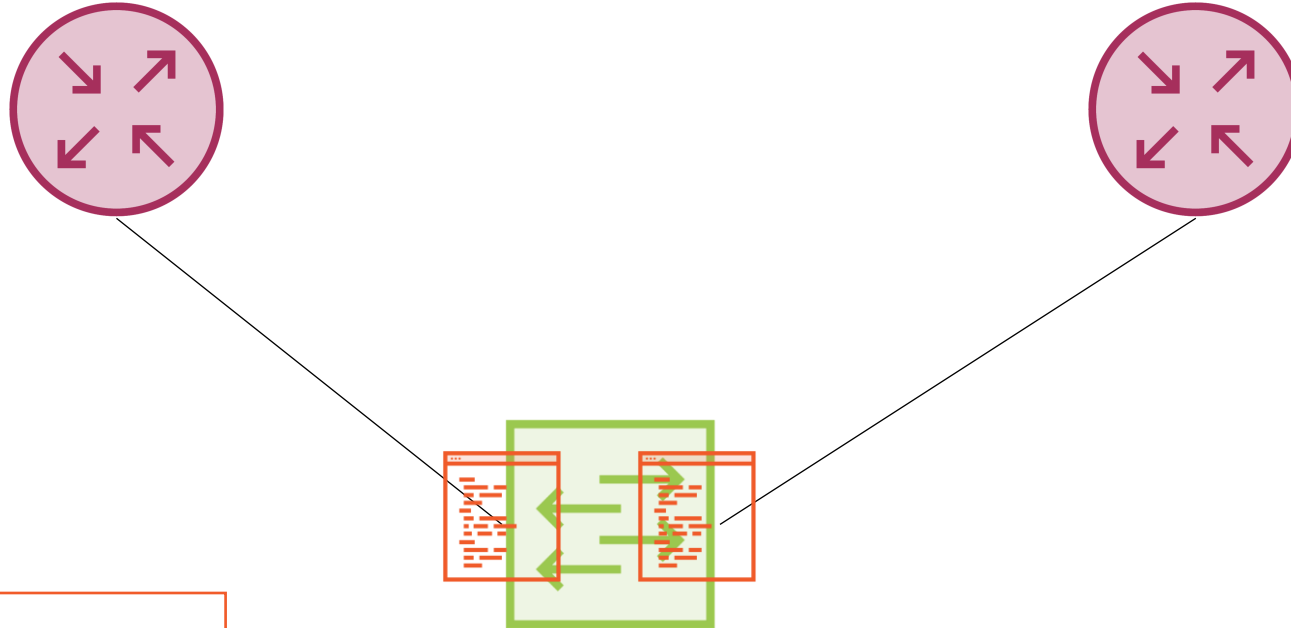
Supports SSM in Version 2



# Membership Reports



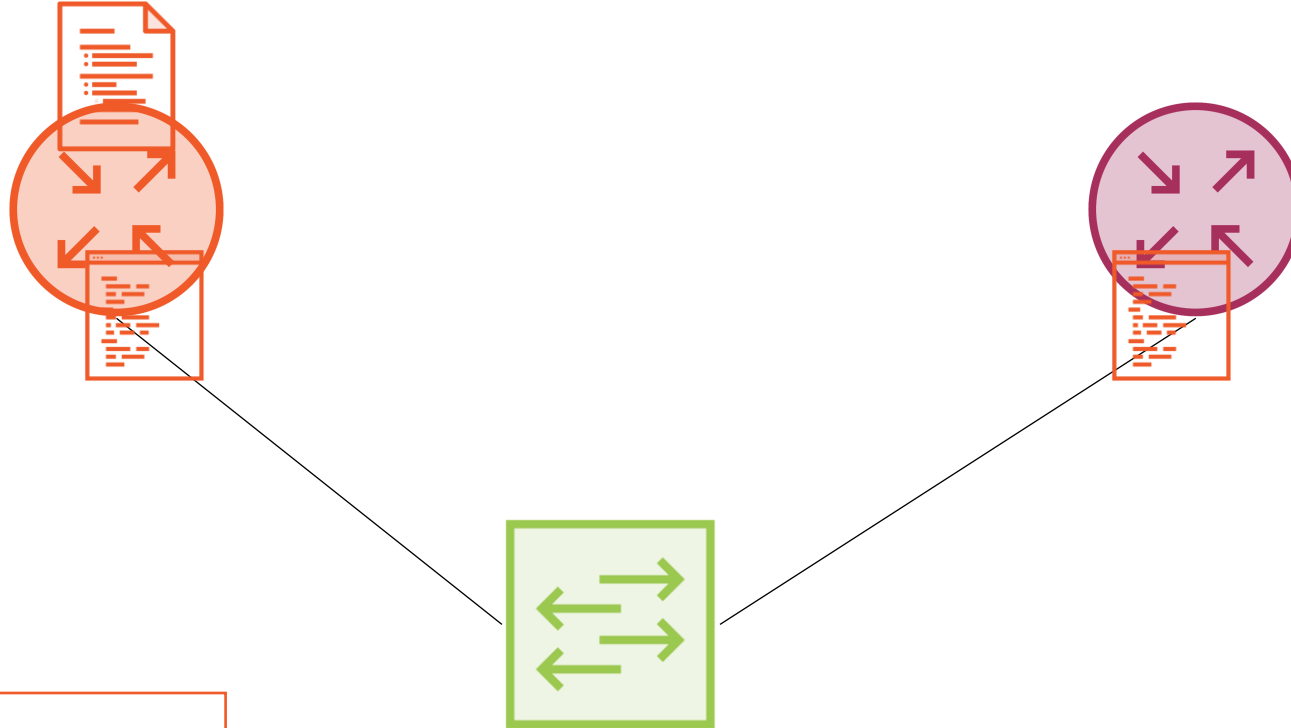
# Membership Reports



Membership Report
Multicast Group
Source IP Address



# PIM Join Conversion



Membership Report
Multicast Group
Source IP Address



# Group Membership Timers

```
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires      Last Report
239.3.2.1         GigabitEthernet1 00:01:52  00:02:13    10.10.1.100
```

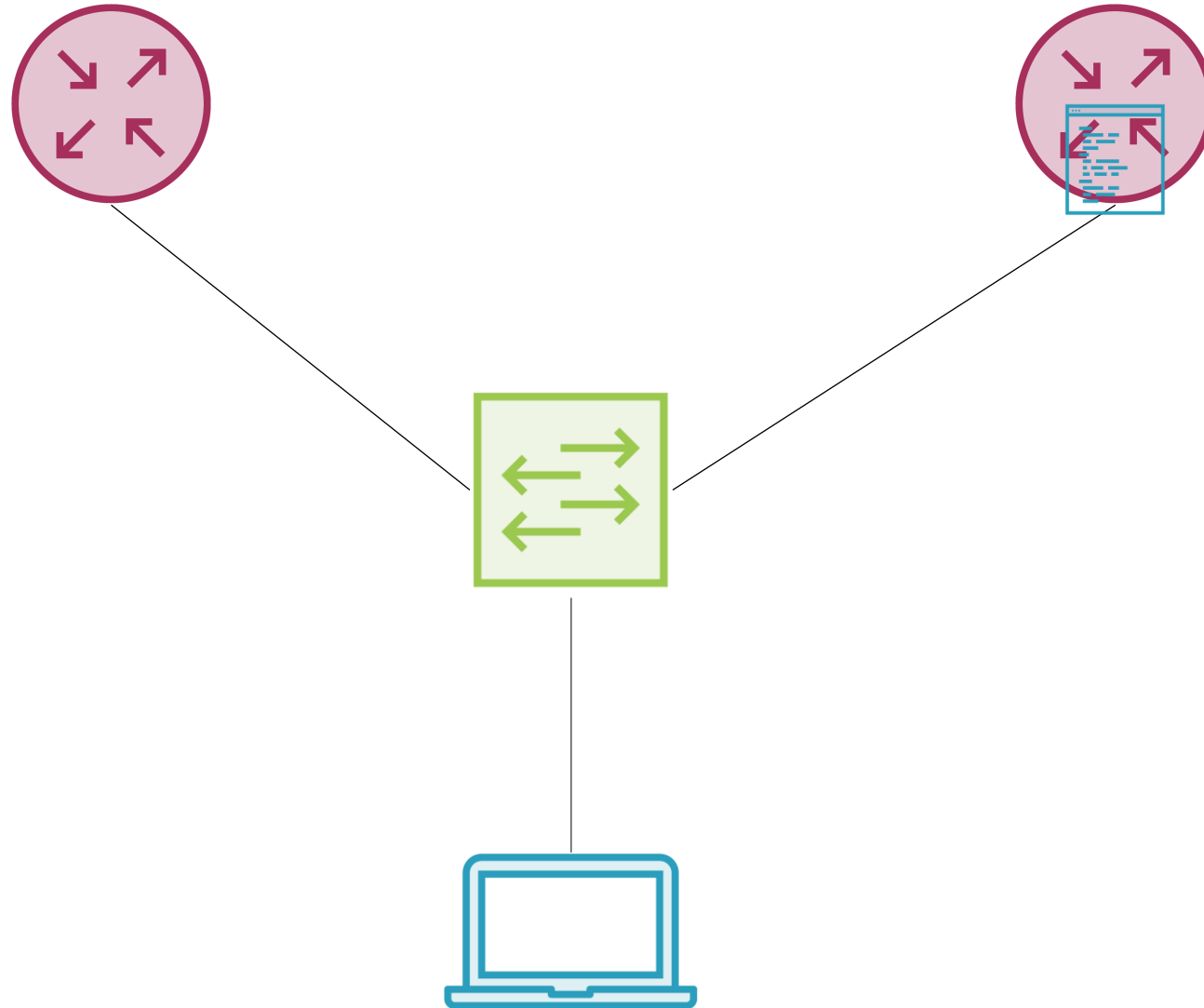
```
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires      Last Report
239.3.2.1         GigabitEthernet1 00:07:35  00:02:24    10.10.1.100
```

```
IGMP Connected Group Membership
Group Address      Interface          Uptime    Expires      Last Report
239.3.2.1         GigabitEthernet1 00:11:02  00:01:55    10.10.1.100
```

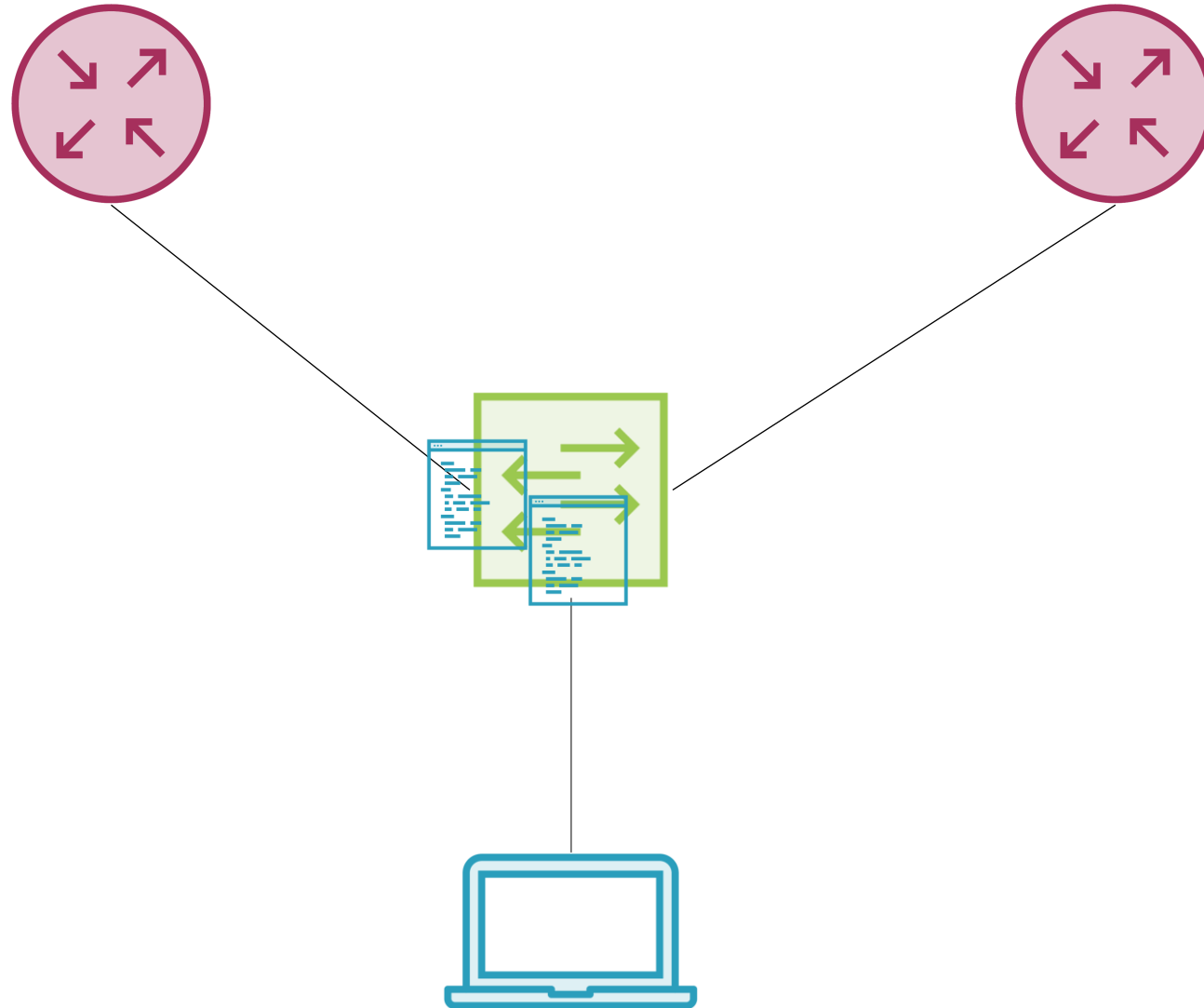




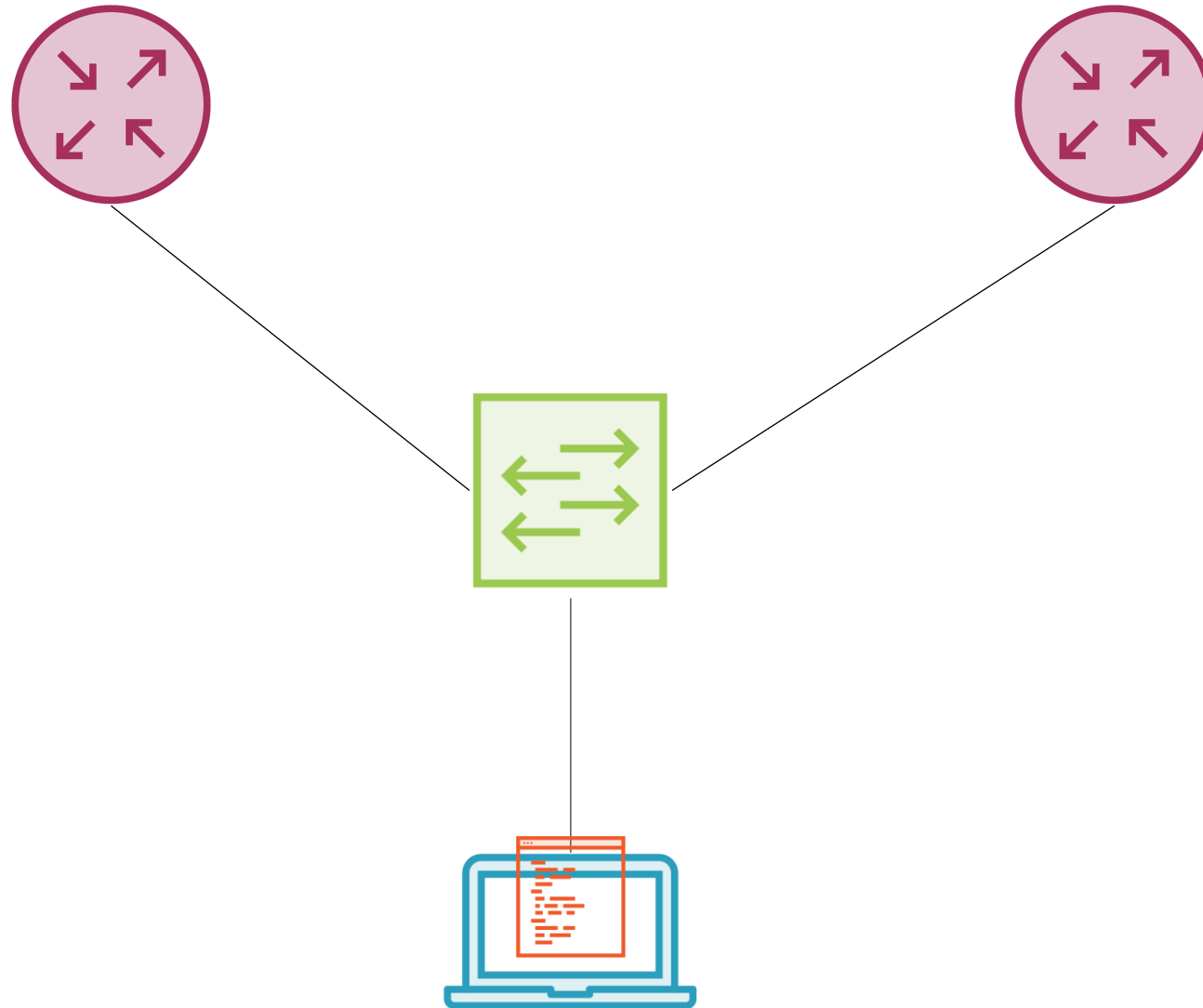
# Multicast Querier



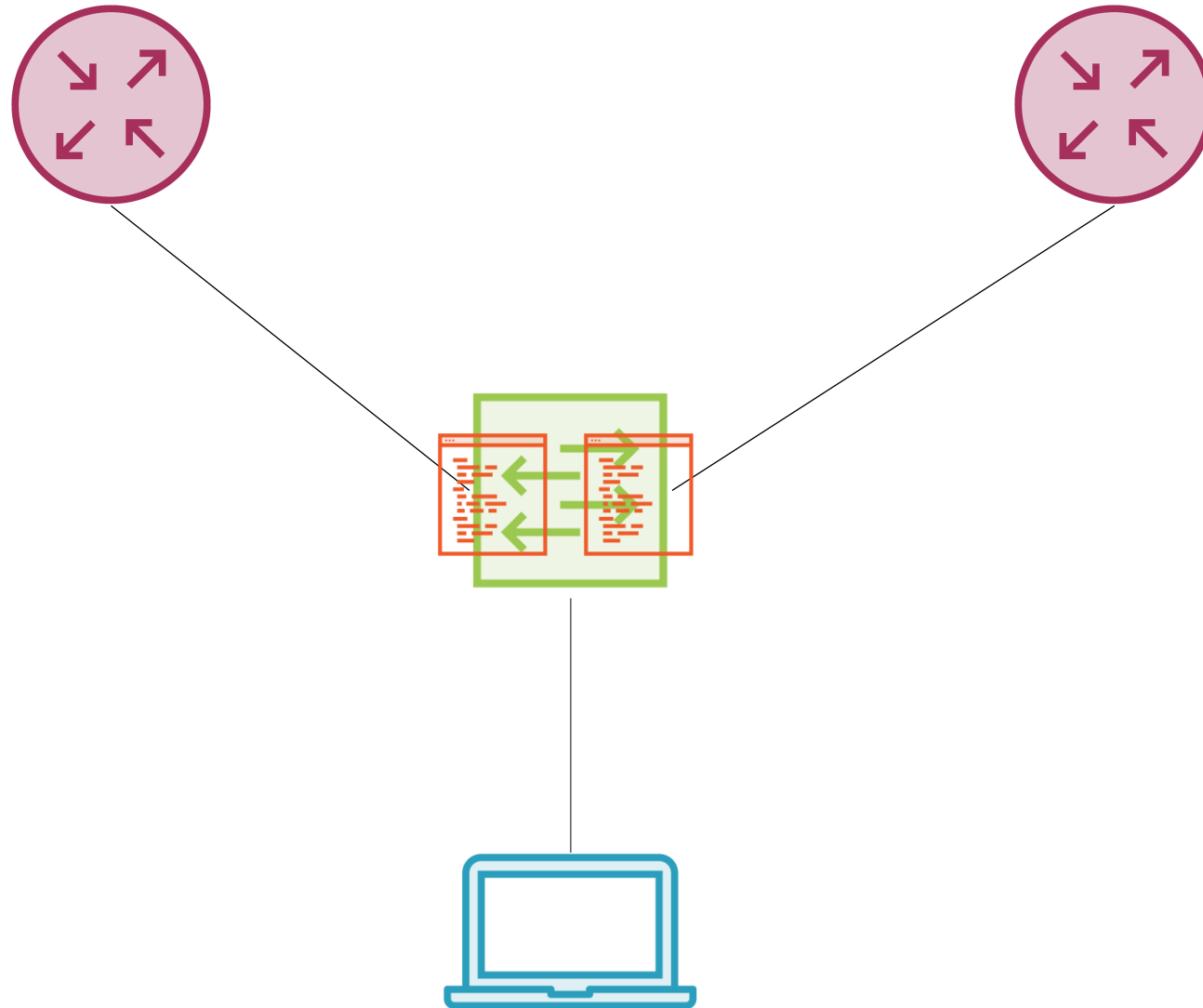
# Multicast Querier



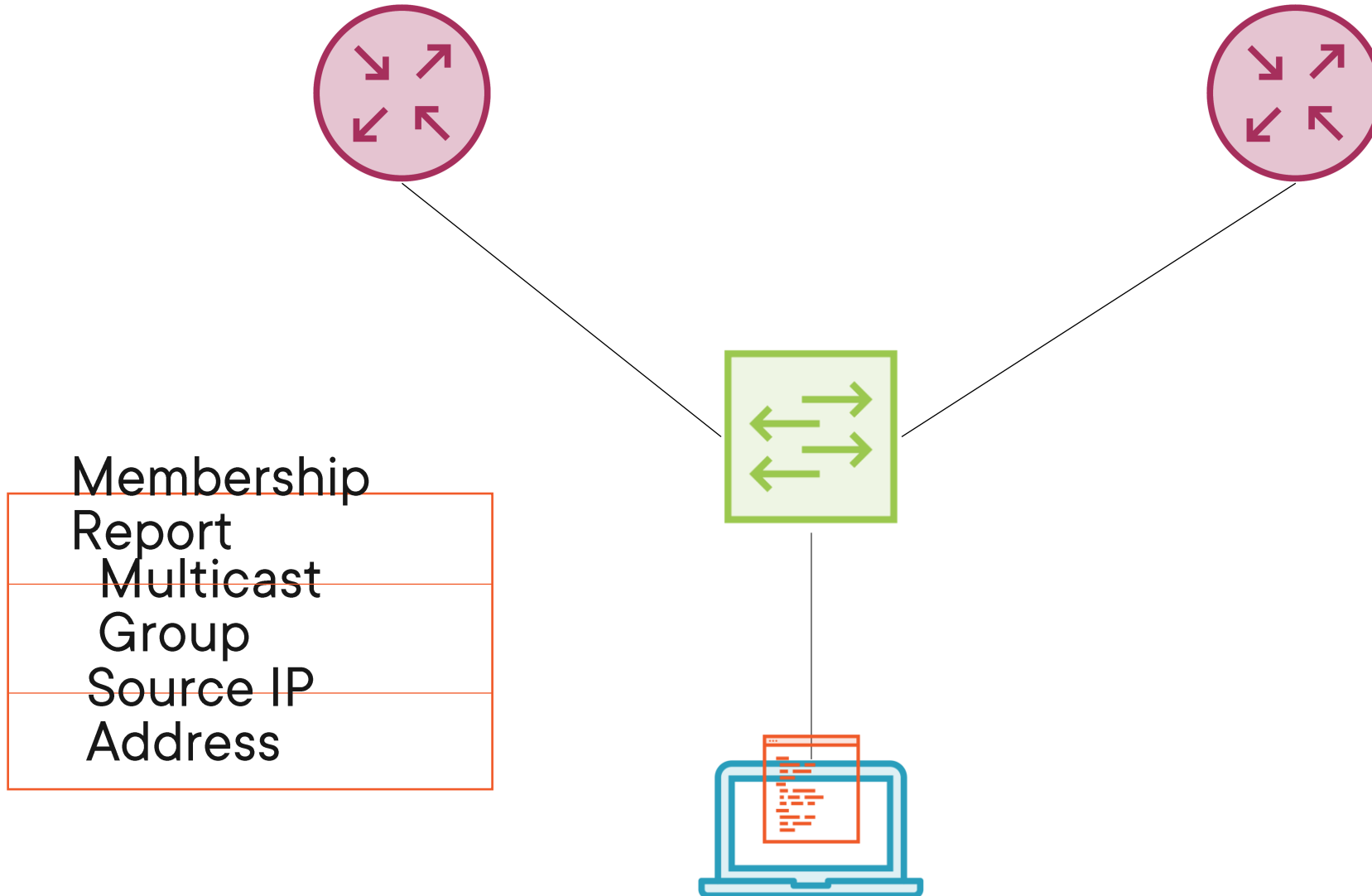
# Triggered Report



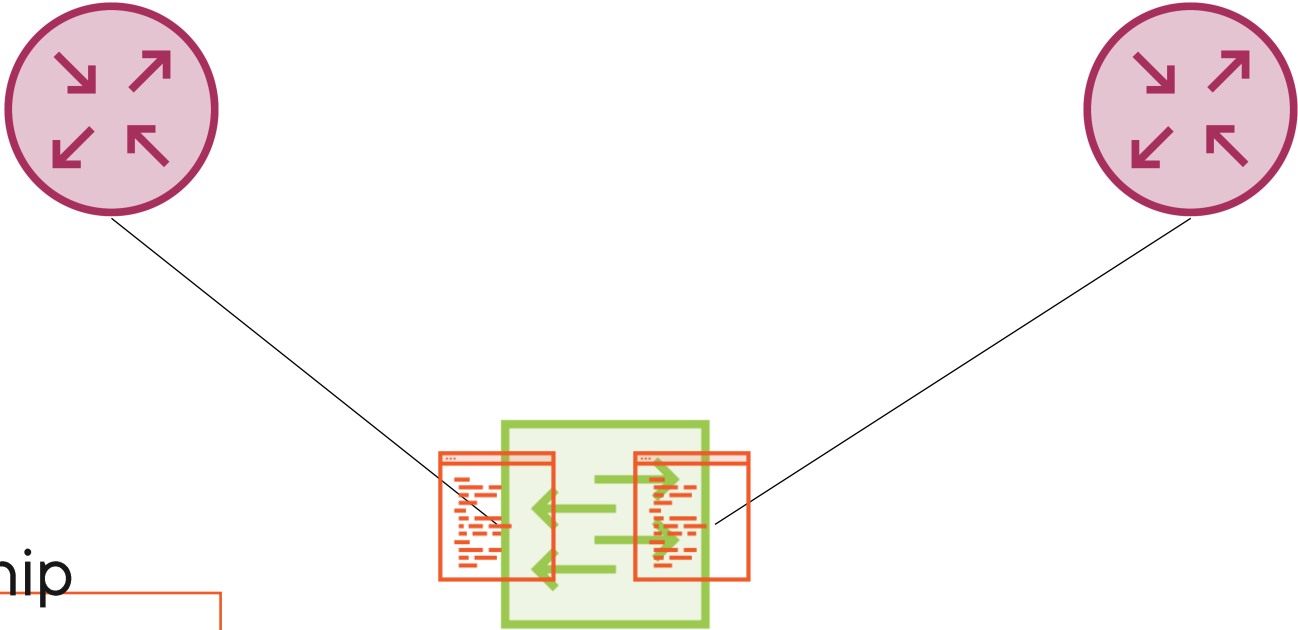
# Triggered Report



# Leaving a Multicast Group



# Leaving a Multicast Group



Membership
Report
Multicast
Group
Source IP
Address





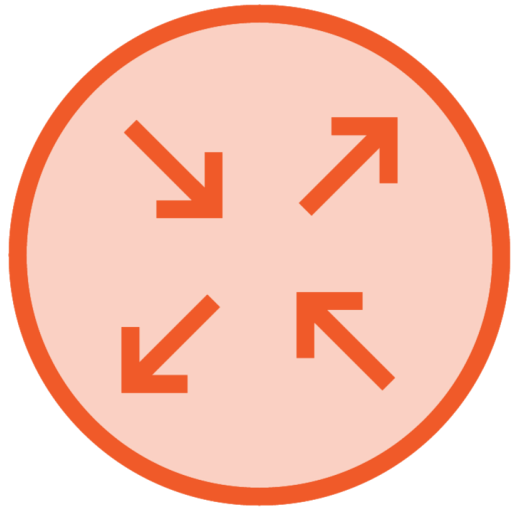
## More Information

[Protocol Deep Dive: IGMP and MLD](#)

Nick Russo



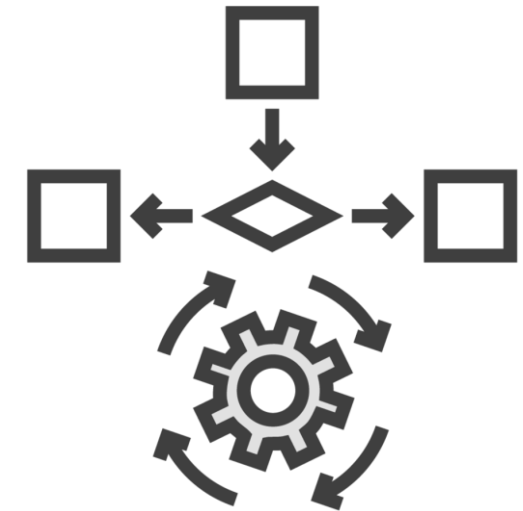
# Introducing PIM



**Router-to-Router  
Protocol**



**Avoid Multicast  
Forwarding Loops**



**Optimize Multicast  
Traffic Flow**





# Introducing PIM

**PIM Dense Mode (PIM-DM)**

**RFC 3973**

**PIM Sparse Mode (PIM-SM)**

**RFC 7761**

**Source-Specific Multicast  
(PIM-SSM)**

**RFC 4607**

**BiDirectional PIM (BIDIR-PIM)**

**RFC 5015**



# Default Link-Local Multicast Groups (IPv4)

**224.0.0.1**

**All Systems**

**224.0.0.2**

**All Routers**



# Default Link-Local Multicast Groups (IPv6)

**FF02::1**

**All Nodes**

**FF02::2**

**All Routers**



# All PIM Routers Group (IPv4 and IPv6)

**IPv4**

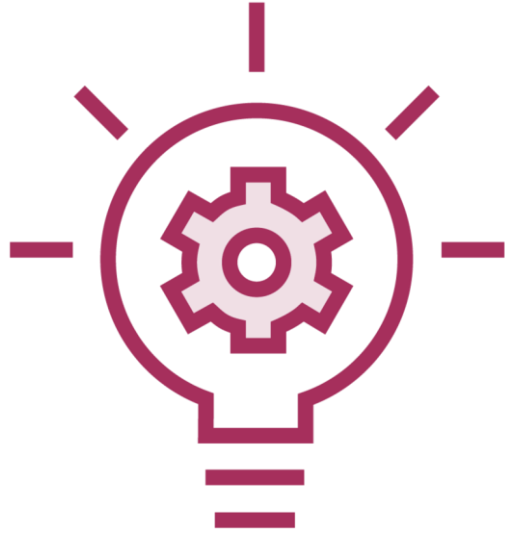
**224.0.0.13**

**IPv6**

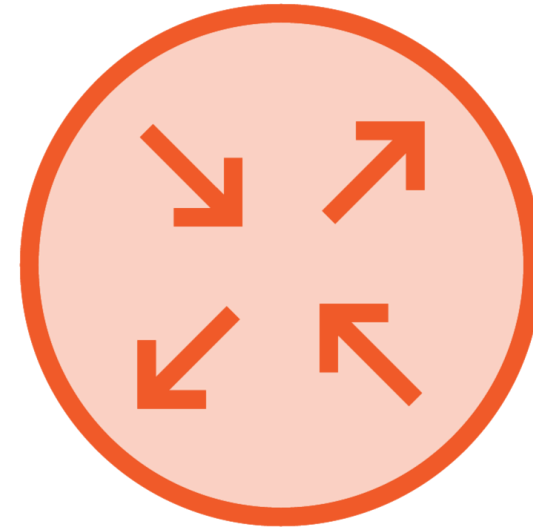
**FF02::D**



# Multicast Forwarding is a Feature



**Activate the Feature On Each  
Multicast Interface**



**Don't Assume Neighbors Can  
Forward Multicast Traffic**



# Dynamic Neighbor Discovery



# Dynamic Neighbor Discovery



# Multicast State Tracking With PIM

## LHR Output

IP Multicast Routing Table

Timers: Uptime/Expires

Interface state: Interface, Next-Hop or VCD,  
State/Mode

(\*, 239.3.2.1), 20:40:12/00:02:56, RP 0.0.0.0, flags:  
DC

Incoming interface: Null, RPF nbr 0.0.0.0

Outgoing interface list:

GigabitEthernet1, Forward/Dense, 20:40:12/stopped

GigabitEthernet2, Forward/Dense, 20:40:12/stopped

(10.99.1.100, 239.3.2.1), 00:00:08/00:02:51, flags: T

Incoming interface: GigabitEthernet2, RPF nbr  
10.10.255.1

Outgoing interface list:

GigabitEthernet1, Forward/Dense, 00:00:08/stopped



Don't forget to turn on  
multicast routing!

