Reviewing New Multicast Designs with IGMPv3

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Agenda

Why do we need IGMPv3?

New IGMPv3 capabilities
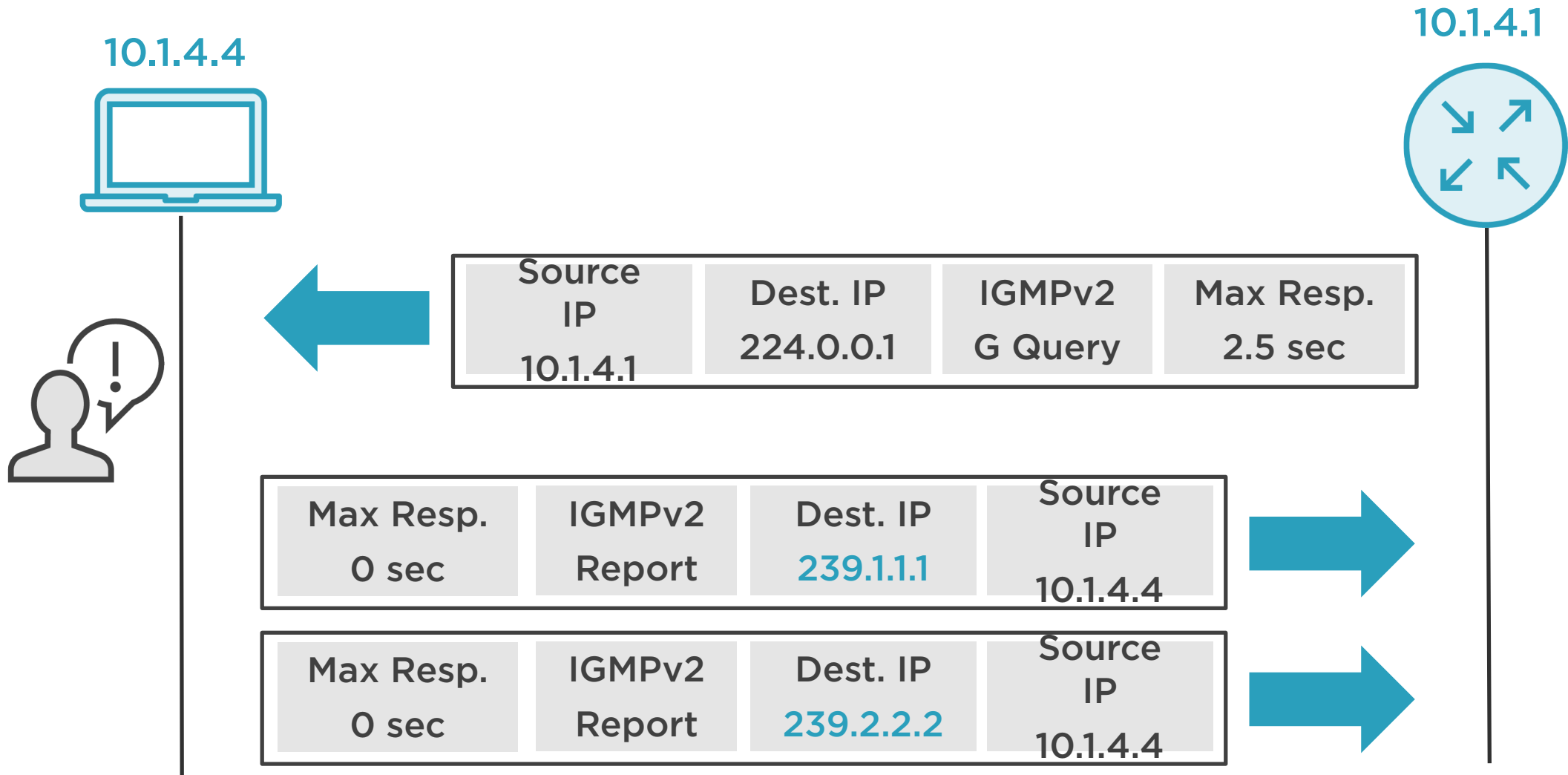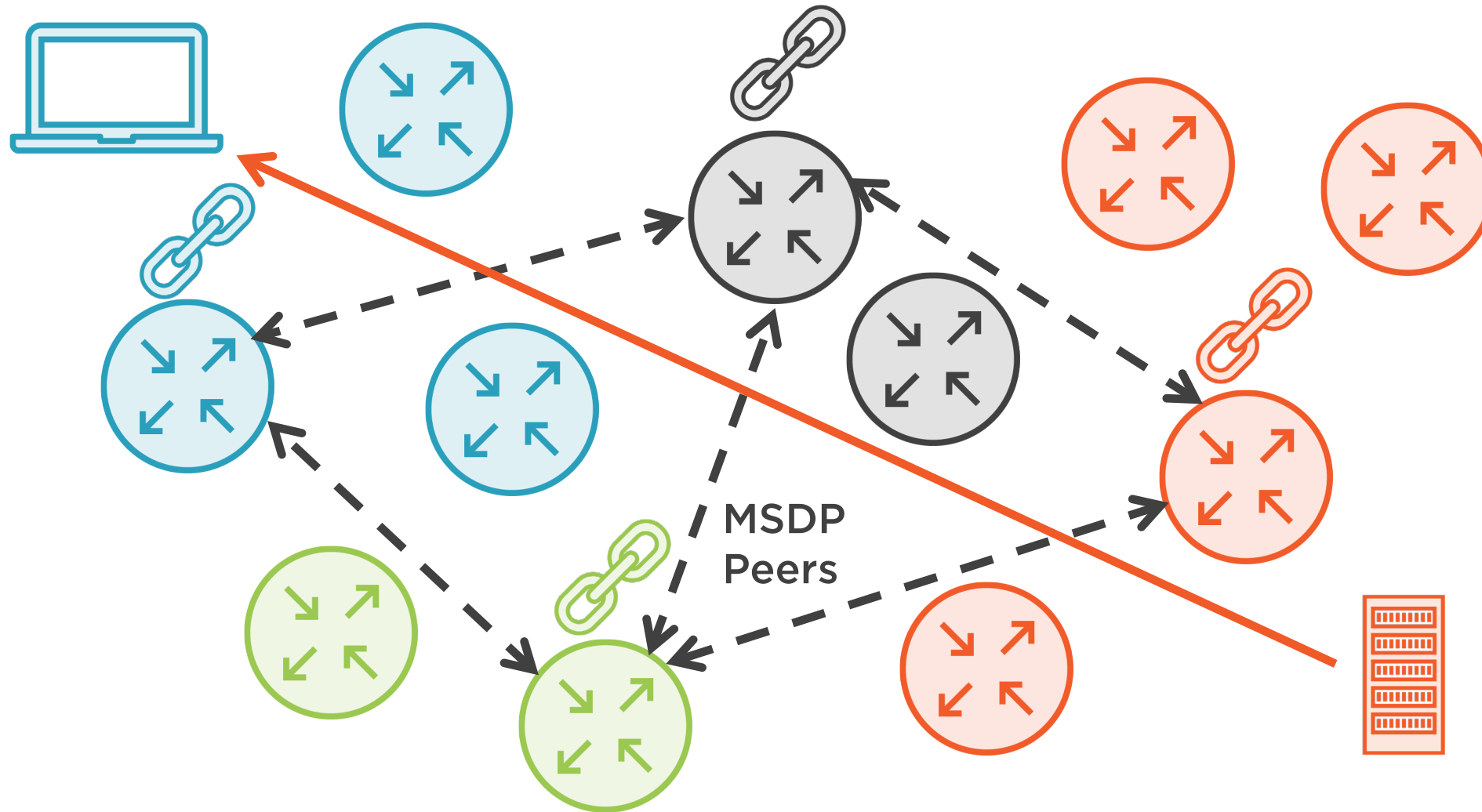
IGMPv3 in action

Packet analysis

Small IGMPv2 Problem

10.1.4.4

10.1.4.1

| Source IP 10.1.4.1 | Dest. IP 224.0.0.1 | IGMPv2 G Query | Max Resp. 2.5 sec |

| Max Resp. 0 sec | IGMPv2 Report | Dest. IP 239.1.1.1 | Source IP 10.1.4.4 |

| Max Resp. 0 sec | IGMPv2 Report | Dest. IP 239.2.2.2 | Source IP 10.1.4.4 |

Big General Multicast Problem

MSDP
Peers

New IGMPv3 Capabilities
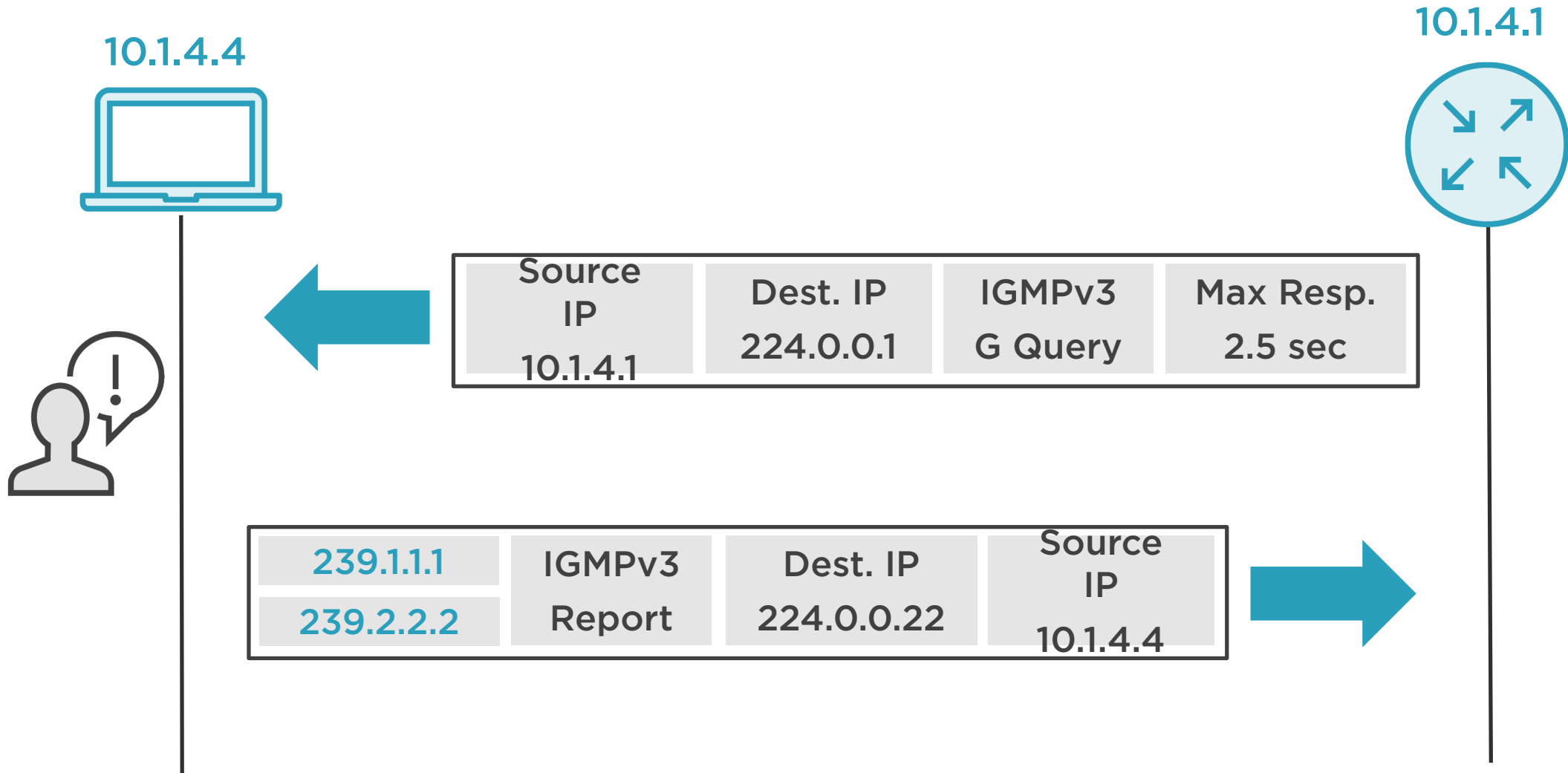
Membership Report Batching

Source-Specific Multicast (SSM) Support

Group "Modes"

IGMPv3 Membership Reports

10.1.4.4

10.1.4.1

| Source IP 10.1.4.1 | Dest. IP 224.0.0.1 | IGMPv3 G Query | Max Resp. 2.5 sec |

| 239.1.1.1 239.2.2.2 | IGMPv3 Report | Dest. IP 224.0.0.22 | Source IP 10.1.4.4 |

SSM High-level View

232.0.0.0/8
SSM range
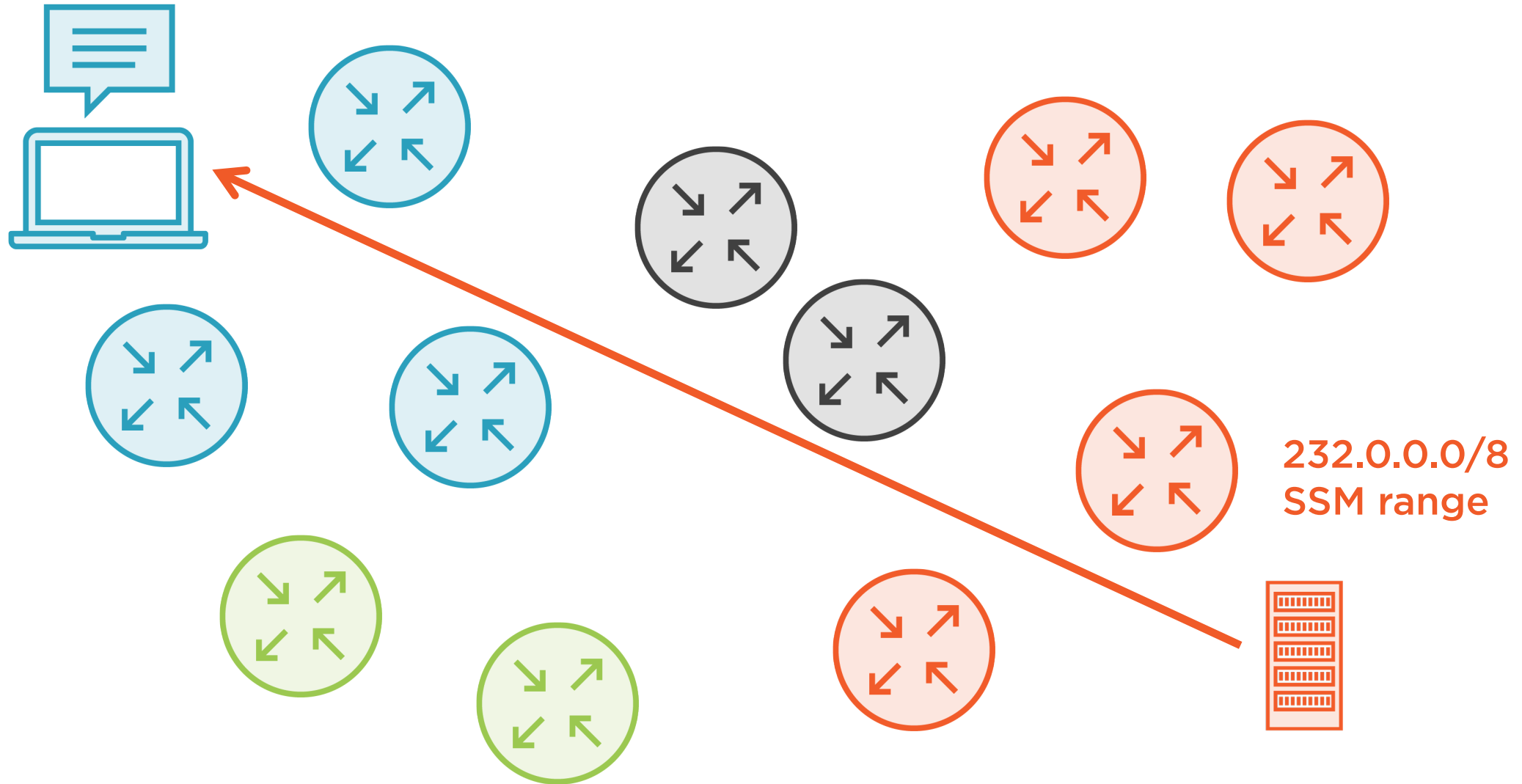
Demo
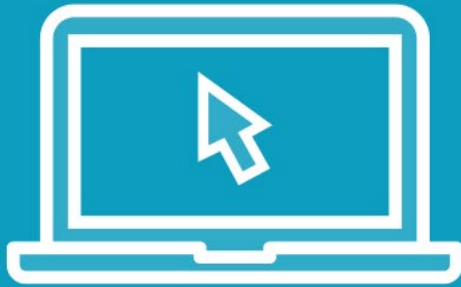
IGMPv3 in Action

IGMPv3 General Query

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.1.4.1	224.0.0.1	IGMPv3	Membership Query, general
2	2.512753	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Join group 239.2.2.2 for any sources / …
3	35.777267	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Leave group 239.1.1.1
4	35.777478	10.1.4.1	239.1.1.1	IGMPv3	Membership Query, specific for group 239.1.1.1
5	47.026504	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Group 232.3.3.3, block source {10.2.5.5}
6	47.026811	10.1.4.1	232.3.3.3	IGMPv3	Membership Query, specific for group 232.3.3.3, source {10.…

▶ Frame 1: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:01, Dst: 01:00:5e:00:00:01
▶ Internet Protocol Version 4, Src: 10.1.4.1, Dst: 224.0.0.1
▼ Internet Group Management Protocol
    [IGMP Version: 3]
    Type: Membership Query (0x11)
    Max Resp Time: 2.5 sec (0x19)
    Checksum: 0xecaa [correct]
    [Checksum Status: Good]
    Multicast Address: 0.0.0.0
    .... 0... = S: Do not suppress router side processing
    .... .010 = QRV: 2
    QQIC: 60
    Num Src: 0

Type 0x11 (17) means "Query"
Non-zero max resp. means "not IGMPv1"

No specific group means "General Query"

Suppress Bit
Querier Robustness Variable
Querier's Query Interval Code

Always 0 in general queries

IGMPv3 Membership Report

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.1.4.1	224.0.0.1	IGMPv3	Membership Query, general
2	2.512753	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Join group 239.2.2.2 for any sources / …
3	35.777267	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Leave group 239.1.1.1
4	35.777478	10.1.4.1	239.1.1.1	IGMPv3	Membership Query, specific for group 239.1.1.1
5	47.026504	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Group 232.3.3.3, block source {10.2.5.5}
6	47.026811	10.1.4.1	232.3.3.3	IGMPv3	Membership Query, specific for group 232.3.3.3, source {10.…

▶ Frame 2: 78 bytes on wire (624 bits), 78 bytes captured (624 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:04, Dst: 01:00:5e:00:00:16
▶ Internet Protocol Version 4, Src: 10.1.4.4, Dst: 224.0.0.22
▼ Internet Group Management Protocol
   [IGMP Version: 3]
   Type: Membership Report (0x22)
   Reserved: 00
   Checksum: 0xeedc [correct]
   [Checksum Status: Good]
   Reserved: 0000
   Num Group Records: 3
  ▼ Group Record : 239.2.2.2 Mode Is Exclude
    Record Type: Mode Is Exclude (2)
    Aux Data Len: 0
    Num Src: 0
    Multicast Address: 239.2.2.2
  ▼ Group Record : 232.3.3.3 Mode Is Include
    Record Type: Mode Is Include (1)
    Aux Data Len: 0
    Num Src: 2
    Multicast Address: 232.3.3.3
    Source Address: 10.2.5.5
    Source Address: 10.2.5.6
  ▶ Group Record : 239.1.1.1 Mode Is Exclude

Type 0x22 (34) means "IGMPv3 Join"
Max resp. no longer used

Record says "I want multicast on 239.2.2.2 from any source"

Record says "I want multicast on 232.3.3.3 from sources 10.2.5.5 and 10.2.5.6 only"

IGMPv3 "Leave" Mechanism

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.1.4.1	224.0.0.1	IGMPv3	Membership Query, general
2	2.512753	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Join group 239.2.2.2 for any sources / …
3	35.777267	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Leave group 239.1.1.1
4	35.777478	10.1.4.1	239.1.1.1	IGMPv3	Membership Query, specific for group 239.1.1.1
5	47.026504	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Group 232.3.3.3, block source {10.2.5.5}
6	47.026811	10.1.4.1	232.3.3.3	IGMPv3	Membership Query, specific for group 232.3.3.3, source {10.…

▶ Frame 3: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:04, Dst: 01:00:5e:00:00:16
▶ Internet Protocol Version 4, Src: 10.1.4.4, Dst: 224.0.0.22
▼ Internet Group Management Protocol
    [IGMP Version: 3]
    Type: Membership Report (0x22)
    Reserved: 00
    Checksum: 0xeafb [correct]
    [Checksum Status: Good]
    Reserved: 0000
    Num Group Records: 1
  ▼ Group Record : 239.1.1.1 Change To Include Mode
      Record Type: Change To Include Mode (3)
      Aux Data Len: 0
      Num Src: 0
      Multicast Address: 239.1.1.1

Type 0x22 (34) means "IGMPv3 Join"
Max resp. no longer used

Record means "I no longer want traffic on 239.1.1.1"

IGMPv3 Group-specific Query

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.1.4.1	224.0.0.1	IGMPv3	Membership Query, general
2	2.512753	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Join group 239.2.2.2 for any sources / …
3	35.777267	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Leave group 239.1.1.1
4	35.777478	10.1.4.1	239.1.1.1	IGMPv3	Membership Query, specific for group 239.1.1.1
5	47.026504	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Group 232.3.3.3, block source {10.2.5.5}
6	47.026811	10.1.4.1	232.3.3.3	IGMPv3	Membership Query, specific for group 232.3.3.3, source {10.…

▶ Frame 4: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:01, Dst: 01:00:5e:01:01:01
▶ Internet Protocol Version 4, Src: 10.1.4.1, Dst: 239.1.1.1
▼ Internet Group Management Protocol
    [IGMP Version: 3]
    Type: Membership Query (0x11)   ← **Type 0x11 (17) means "Query"**
    Max Resp Time: 1.0 sec (0x0a)   **Faster max resp. time**
    Checksum: 0xfcb6 [correct]
    [Checksum Status: Good]   **Specific group means**
    Multicast Address: 239.1.1.1   ← **"Who wants traffic for 239.1.1.1?"**
    .... 0... = S: Do not suppress router side processing
    .... .010 = QRV: 2
    QQIC: 60
    Num Src: 0   ← **ASM group-specific query**

IGMPv3 Specific "Leave" Mechanism

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.1.4.1	224.0.0.1	IGMPv3	Membership Query, general
2	2.512753	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Join group 239.2.2.2 for any sources / …
3	35.777267	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Leave group 239.1.1.1
4	35.777478	10.1.4.1	239.1.1.1	IGMPv3	Membership Query, specific for group 239.1.1.1
5	47.026504	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Group 232.3.3.3, block source {10.2.5.5}
6	47.026811	10.1.4.1	232.3.3.3	IGMPv3	Membership Query, specific for group 232.3.3.3, source {10.…

▶ Frame 5: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:04, Dst: 01:00:5e:00:00:16
▶ Internet Protocol Version 4, Src: 10.1.4.4, Dst: 224.0.0.22
▼ Internet Group Management Protocol
    [IGMP Version: 3]
    Type: Membership Report (0x22)
    Reserved: 00
    Checksum: 0xddef [correct]
    [Checksum Status: Good]
    Reserved: 0000
    Num Group Records: 1
  ▼ Group Record : 232.3.3.3 Block Old Sources
      Record Type: Block Old Sources (6)
      Aux Data Len: 0
      Num Src: 1
      Multicast Address: 232.3.3.3
      Source Address: 10.2.5.5

Type 0x22 (34) means "IGMPv3 Join"
Max resp. no longer used

Specific source-group pair means
"I no longer want traffic for 232.3.3.3
specifically from 10.2.5.5"

IGMPv3 Source/Group-specific Query

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.1.4.1	224.0.0.1	IGMPv3	Membership Query, general
2	2.512753	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Join group 239.2.2.2 for any sources / …
3	35.777267	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Leave group 239.1.1.1
4	35.777478	10.1.4.1	239.1.1.1	IGMPv3	Membership Query, specific for group 239.1.1.1
5	47.026504	10.1.4.4	224.0.0.22	IGMPv3	Membership Report / Group 232.3.3.3, block source {10.2.5.5}
6	47.026811	10.1.4.1	232.3.3.3	IGMPv3	Membership Query, specific for group 232.3.3.3, source {10.…

▶ Frame 6: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:01, Dst: 01:00:5e:03:03:03
▶ Internet Protocol Version 4, Src: 10.1.4.1, Dst: 232.3.3.3
▼ Internet Group Management Protocol
　　[IGMP Version: 3]
　　Type: Membership Query (0x11)
　　Max Resp Time: 1.0 sec (0x0a)
　　Checksum: 0xf2aa [correct]
　　[Checksum Status: Good]
　　Multicast Address: 232.3.3.3
　　.... 0... = S: Do not suppress router side processing
　　.... .010 = QRV: 2
　　QQIC: 60
　　Num Src: 1
　　Source Address: 10.2.5.5

Type 0x11 (17) means "Query"
Faster max resp. time

Specific group means
"Who wants traffic for 232.3.3.3?"

Source/group-specific query
for 10.2.5.5

Comparing IGMPv2 and IGMPv3

IGMPv2	IGMPv3
RFC 2236	RFC 3376
One report per group	Multiple group records per report
ASM only	ASM and SSM
Explicit leave message	Implicit leaves via group mode logic