The Future of Networking: IPv6 Multicast and MLDv1

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Agenda

New tricks in IPv6 multicast?

Introducing MLDv1

Watching MLD work its magic

Packet Analysis

IPv6 Multicast High-level

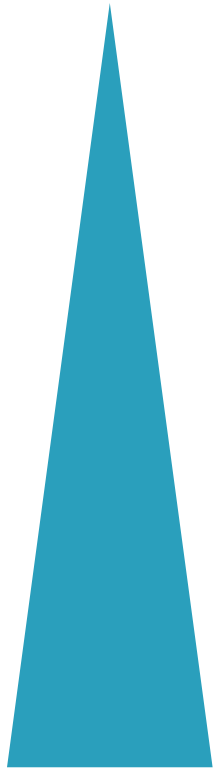
FF00::/8 range

In-band scoping, e.g. FF0x::1

SSM range is FF30::/32

IPv6 Multicast Scope Reference

Narrow Scope



Broad Scope

Scope Value	Scope Description
1	Interface-local scope
2	Link-local scope
3	Realm-local scope
4	Admin-local scope
5	Site-local scope
8	Organization-local scope
E	Global scope

MLD in One Slide

IPv6 host to router communications

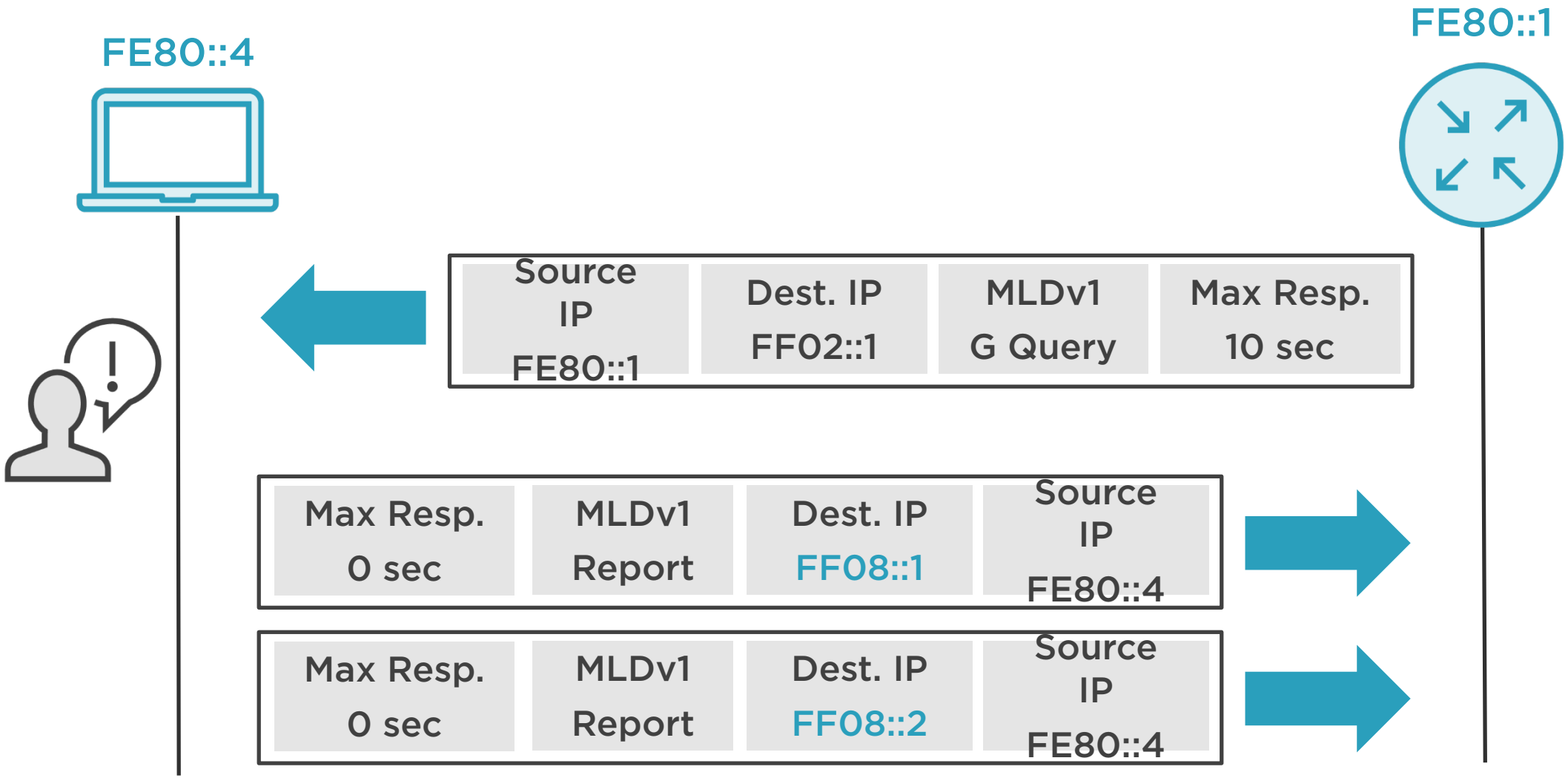
MLDv1 == IGMPv2

MLDv2 == IGMPv3

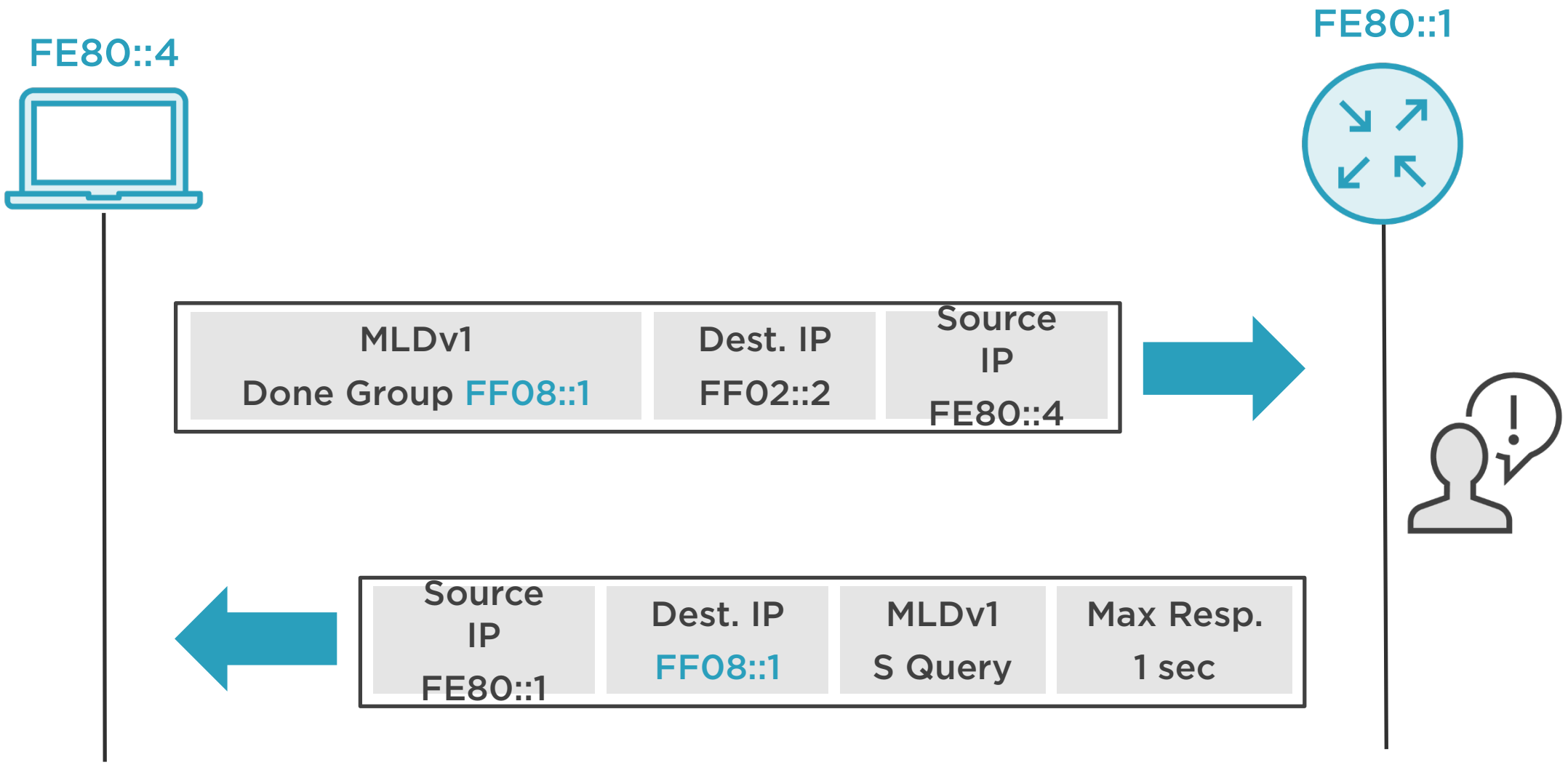
FE80::/10

FF02::/16

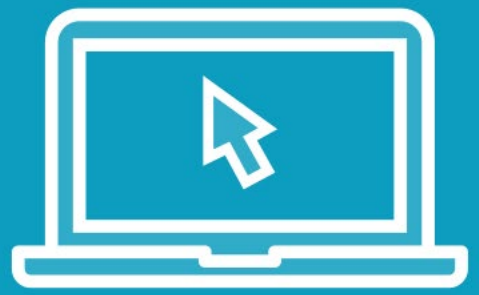
MLDv1 Operations



MLDv1 Done Process



Demo



MLDv1 in Action

MLDv1 General Query

No.	Time	Source	Destination	Protocol	Info
1	0.000000	fe80::1	ff02::1	ICMPv6	Multicast Listener Query
2	2.042630	fe80::4	ff08::2	ICMPv6	Multicast Listener Report
3	5.293047	fe80::4	ff08::1	ICMPv6	Multicast Listener Report
4	8.292469	fe80::4	ff02::1:ff00:4	ICMPv6	Multicast Listener Report
5	77.248645	fe80::4	ff02::2	ICMPv6	Multicast Listener Done
6	77.249473	fe80::1	ff08::1	ICMPv6	Multicast Listener Query

```
▶ Frame 1: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:01, Dst: 33:33:00:00:00:01
▶ Internet Protocol Version 6, Src: fe80::1, Dst: ff02::1
▼ Internet Control Message Protocol v6
    Type: Multicast Listener Query (130)
    Code: 0
    Checksum: 0x5917 [correct]
    [Checksum Status: Good]
    Maximum Response Delay [ms]: 10000
    Reserved: 0000
    Multicast Address: ::
```

Type 130 means "Query"
Code is always 0

Same behavior as IGMPv2

No specific group means
"General Query"

MLDv1 Report

No.	Time	Source	Destination	Protocol	Info
1	0.000000	fe80::1	ff02::1	ICMPv6	Multicast Listener Query
2	2.042630	fe80::4	ff08::2	ICMPv6	Multicast Listener Report
3	5.293047	fe80::4	ff08::1	ICMPv6	Multicast Listener Report
4	8.292469	fe80::4	ff02::1:ff00:4	ICMPv6	Multicast Listener Report
5	77.248645	fe80::4	ff02::2	ICMPv6	Multicast Listener Done
6	77.249473	fe80::1	ff08::1	ICMPv6	Multicast Listener Query

```
▶ Frame 2: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:04, Dst: 33:33:00:00:00:02
▶ Internet Protocol Version 6, Src: fe80::4, Dst: ff08::2
▼ Internet Control Message Protocol v6
    Type: Multicast Listener Report (131)
    Code: 0
    Checksum: 0x8012 [correct]
    [Checksum Status: Good]
    Maximum Response Delay [ms]: 0
    Reserved: 0000
    Multicast Address: ff08::2
```

Type 131 means "Report"
Code is always 0

Same behavior as IGMPv2

Specific group means
"I want traffic for FF08::2"

MLDv1 Link-local Report

No.	Time	Source	Destination	Protocol	Info
1	0.000000	fe80::1	ff02::1	ICMPv6	Multicast Listener Query
2	2.042630	fe80::4	ff08::2	ICMPv6	Multicast Listener Report
3	5.293047	fe80::4	ff08::1	ICMPv6	Multicast Listener Report
4	8.292469	fe80::4	ff02::1:ff00:4	ICMPv6	Multicast Listener Report
5	77.248645	fe80::4	ff02::2	ICMPv6	Multicast Listener Done
6	77.249473	fe80::1	ff08::1	ICMPv6	Multicast Listener Query

```
▶ Frame 4: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:04, Dst: 33:33:ff:00:00:04
▶ Internet Protocol Version 6, Src: fe80::4, Dst: ff02::1:ff00:4
▼ Internet Control Message Protocol v6
    Type: Multicast Listener Report (131)
    Code: 0
    Checksum: 0x8216 [correct]
    [Checksum Status: Good]
    Maximum Response Delay [ms]: 0
    Reserved: 0000
    Multicast Address: ff02::1:ff00:4
```

This group means
"I want traffic for my own
solicited node address"

MLDv1 Done

No.	Time	Source	Destination	Protocol	Info
1	0.000000	fe80::1	ff02::1	ICMPv6	Multicast Listener Query
2	2.042630	fe80::4	ff08::2	ICMPv6	Multicast Listener Report
3	5.293047	fe80::4	ff08::1	ICMPv6	Multicast Listener Report
4	8.292469	fe80::4	ff02::1:ff00:4	ICMPv6	Multicast Listener Report
5	77.248645	fe80::4	ff02::2	ICMPv6	Multicast Listener Done
6	77.249473	fe80::1	ff08::1	ICMPv6	Multicast Listener Query

```
▶ Frame 5: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:04, Dst: 33:33:00:00:00:02
▶ Internet Protocol Version 6, Src: fe80::4, Dst: ff02::2
▼ Internet Control Message Protocol v6
    Type: Multicast Listener Done (132)
    Code: 0
    Checksum: 0x7f19 [correct]
    [Checksum Status: Good]
    Maximum Response Delay [ms]: 0
    Reserved: 0000
    Multicast Address: ff08::1
```

Type 132 means "Done"
Code is always 0

Same behavior as IGMPv2

Specific group means
"I no longer want traffic for FF08::1"

MLDv1 Group-specific Query

No.	Time	Source	Destination	Protocol	Info
1	0.000000	fe80::1	ff02::1	ICMPv6	Multicast Listener Query
2	2.042630	fe80::4	ff08::2	ICMPv6	Multicast Listener Report
3	5.293047	fe80::4	ff08::1	ICMPv6	Multicast Listener Report
4	8.292469	fe80::4	ff02::1:ff00:4	ICMPv6	Multicast Listener Report
5	77.248645	fe80::4	ff02::2	ICMPv6	Multicast Listener Done
6	77.249473	fe80::1	ff08::1	ICMPv6	Multicast Listener Query

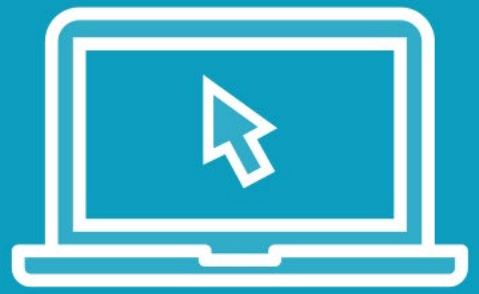
```
▶ Frame 6: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
▶ Ethernet II, Src: 00:00:a6:16:00:01, Dst: 33:33:00:00:00:01
▶ Internet Protocol Version 6, Src: fe80::1, Dst: ff08::1
▼ Internet Control Message Protocol v6
    Type: Multicast Listener Query (130)
    Code: 0
    Checksum: 0x7d2f [correct]
    [Checksum Status: Good]
    Maximum Response Delay [ms]: 1000
    Reserved: 0000
    Multicast Address: ff08::1
```

Type 130 means "Query"
Code is always 0

Faster max resp. time

Specific group means
"Who wants traffic for FF08::1?"

Demo



Basic IPv6 Multicast Flow

MLDv1 in Review

IPv6 multicast has built-in scoping

MLD is equivalent to IGMP

Done vs. Leave message