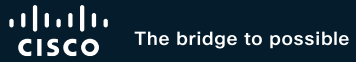


IPv6 – What Do you Mean there isn't a Broadcast?

Fish Fishburne, CCIE #2639, CCDE#2009:14

Cisco Webex App

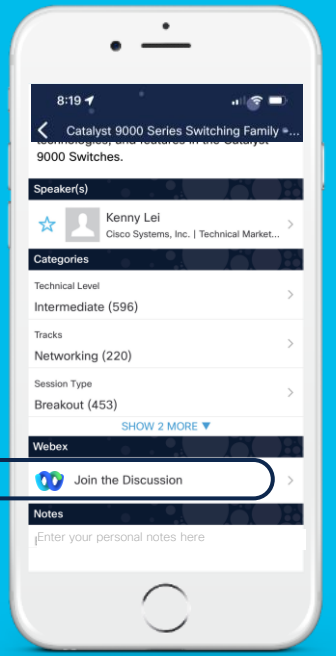
Questions?

Use Cisco Webex App to chat
with the speaker after the session

How

1. Find this session in the Cisco Live Mobile App
2. Click “Join the Discussion”
3. Install the Webex App or go directly to the Webex space
4. Enter messages/questions in the Webex space

Webex spaces will be moderated until February 24, 2023.



IPv6 – My Journey as a Newbie to IPv6

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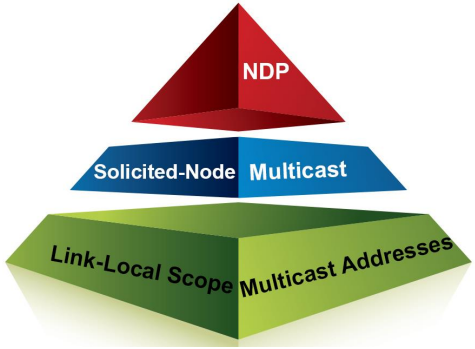
IPv6 – My Journey as a Newbie to IPv6

No.	Source	Destination	Protocol	Length	Info
13	Cisco_0a:a2:80	~~Broadcast~~	ARP	64	Who has 10.10.10.2? Tell 1
14	Cisco_0a:b0:00	Cisco_0a:a2:80	ARP	64	10.10.10.2 is at c4:64:13:0

IPv6 – My Journey as a Newbie to IPv6



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- Part 1 of 7: Understanding IPv6: The Journey Begins
- Part 2 of 7: Understanding IPv6: Link-Local ‘Magic’
- Part 3 of 7: Understanding IPv6: A Sniffer Full Of 3s
- Part 4 of 7: Understanding IPv6: What Is Solicited-Node Multicast?
- Part 5 of 7: Understanding IPv6: Prepping For Solicited-Node Multicast
- Part 6 of 7: Understanding IPv6: The Ping Before Solicited-Node Multicast
- Part 7 of 7: Understanding IPv6: Solicited-Node Multicast In Action

http://www.networkingwithfish.com/ipv6/

Abstract

Super new to IPv6?

Trying to wrap your head around the basics like how this all works without using broadcast and what the heck that "solicited-node multicast" thing is?

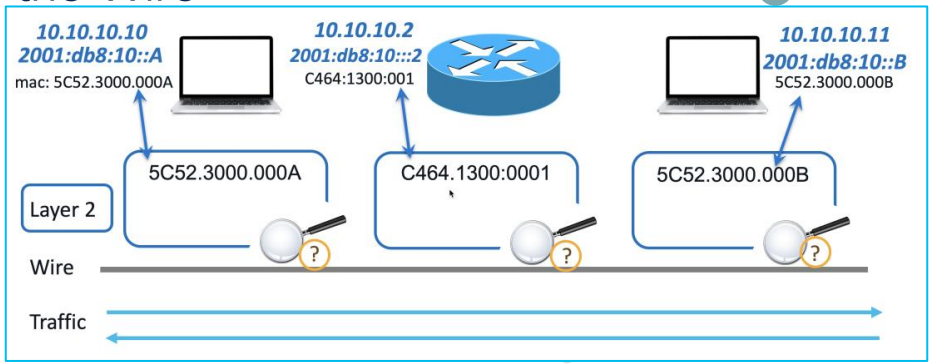
If this describes you and your current knowledge of IPv6 and you want to try to "put the puzzle pieces together" - this session is definitely for you!

This session dives into all this by bringing to life Fish's very popular 7-part blog series "Understanding IPv6".

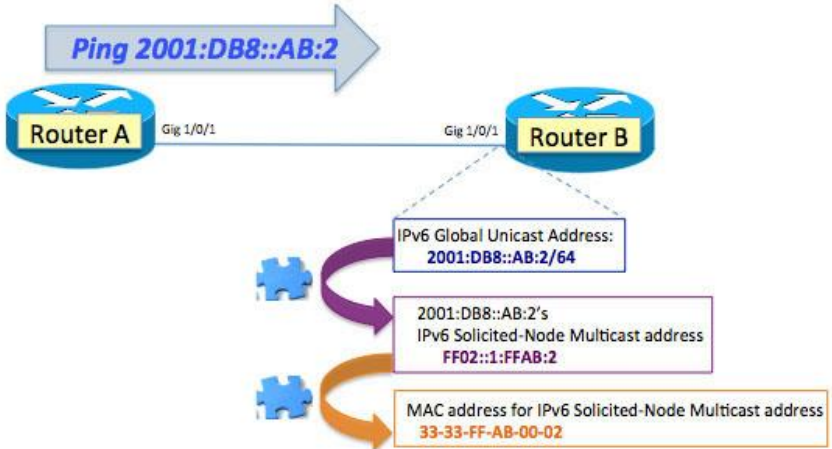
By the end of this session, you will be able to better "see" how the underlying puzzle pieces fit together in order for 2 IPv6 addresses in the same subnet to be able to "talk" with each other without ARP.

Agenda

- Setting the Stage: Picking Things Up off the Wire



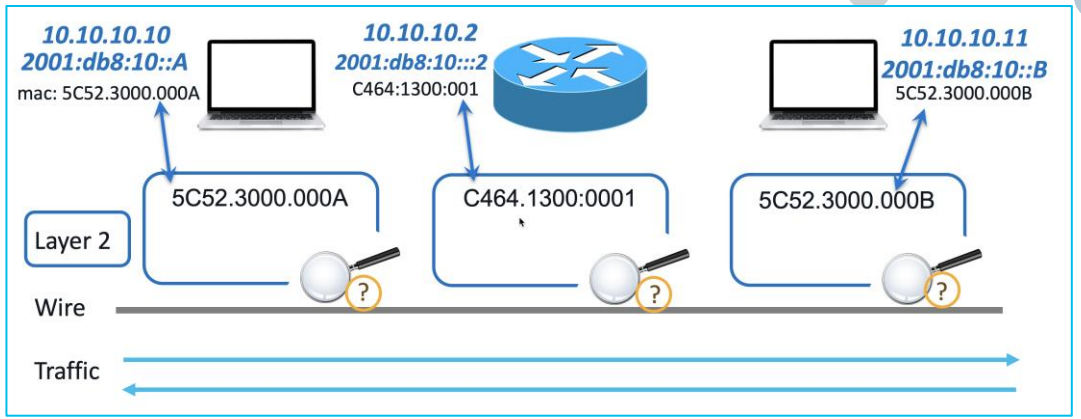
- Show a Magic Trick
- Explain How the Magic Trick works



- Resolving The Destination MAC Address
- Putting the Puzzle Pieces Together

cisco Live!

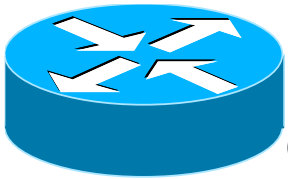
Setting the Stage: Picking Things Up off the Wire



Picking Things Up Off the Wire

10.10.10.10

5C52.3000.000A



10.10.10.2

C464:130A:B000

Layer 2

5C52.3000.000A
FFFF.FFFF.FFFF

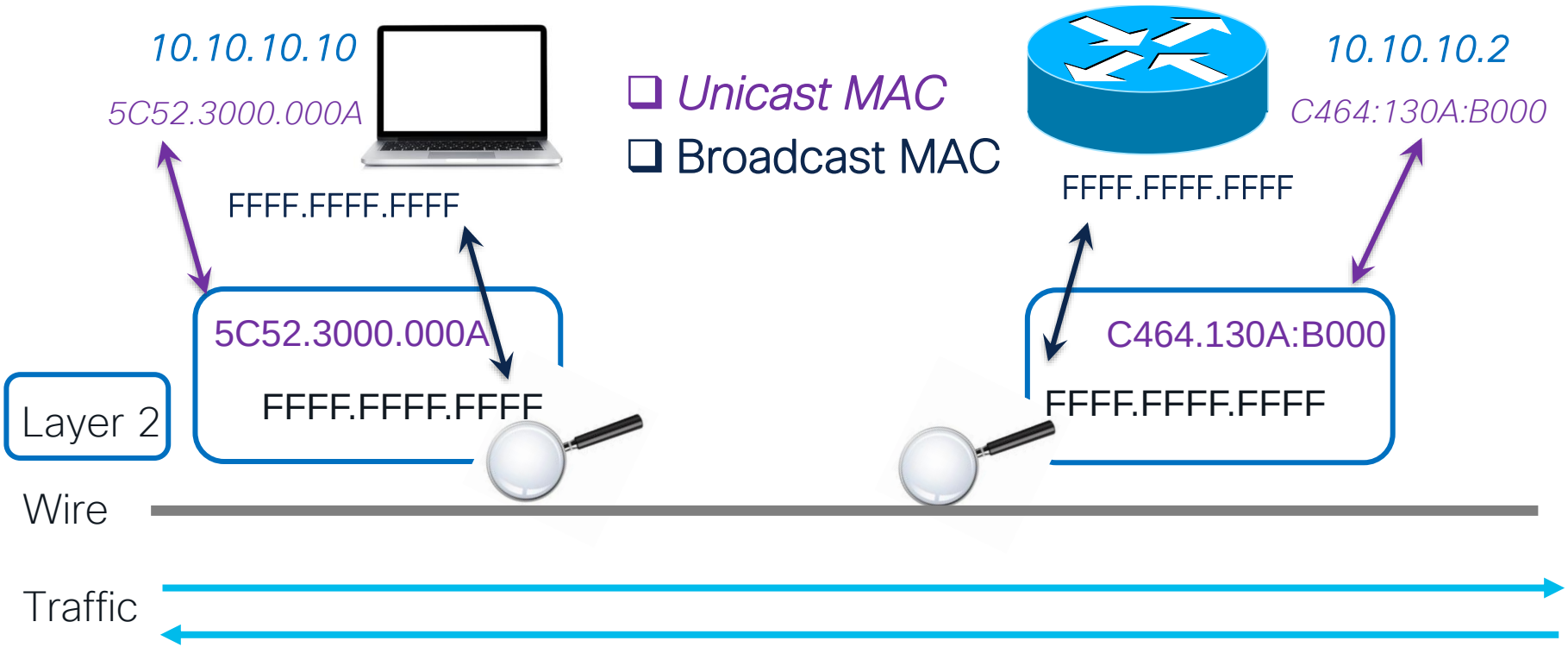
C464.130A:B000
FFFF.FFFF.FFFF

Wire

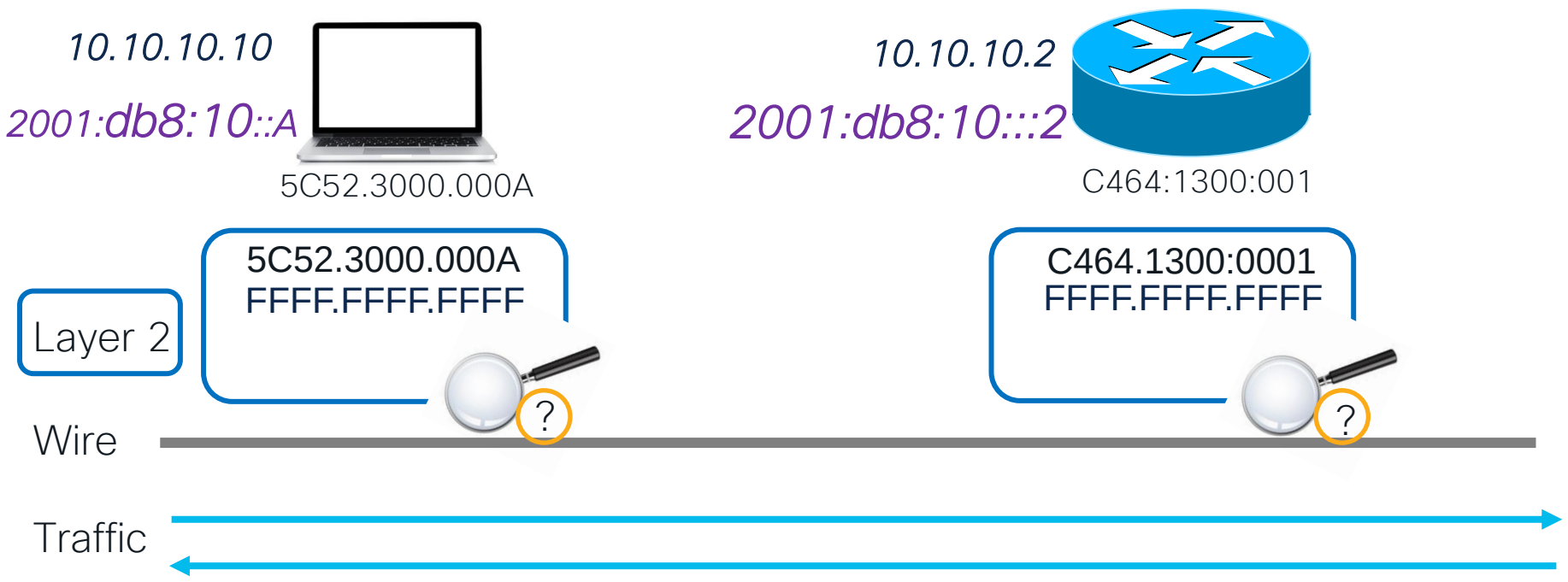
Traffic

No.	Source	Destination	Protocol	Length	Info
13	Cisco_0a:a2:80	Broadcast	ARP	64	Who has 10.10.10.2? Tell 10.10.10.1
14	Cisco_0a:b0:00	Cisco_0a:a2:80	ARP	64	10.10.10.2 is at c4:64:13:0a:b0:00

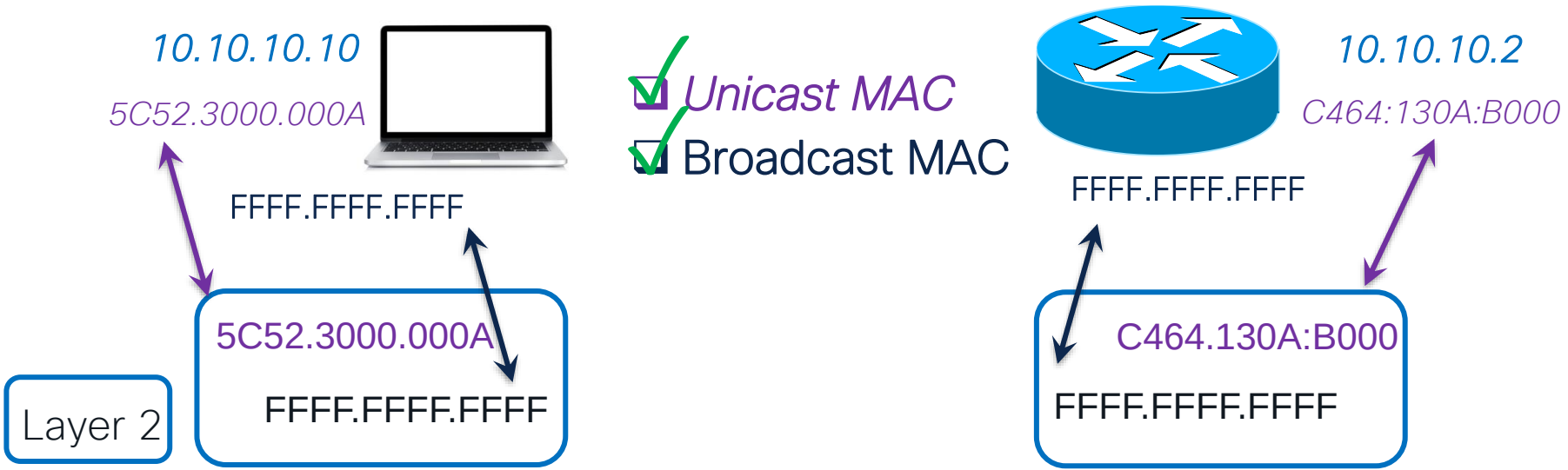
Picking Things Up Off the Wire



Picking Things Up Off the Wire – IPv6



Picking Things Up Off the Wire



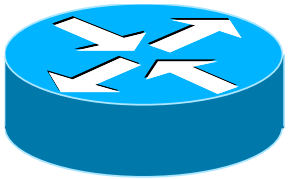
Alzatte la mano se vivetti en Italia

Picking Things Up Off the Wire

❑ Multicast MAC

5C52.3000.000A
FFFF.FFFF.FFFF

? ❑ *Unicast MAC*
? ❑ Broadcast MAC



C464:130A:B000
FFFF.FFFF.FFFF

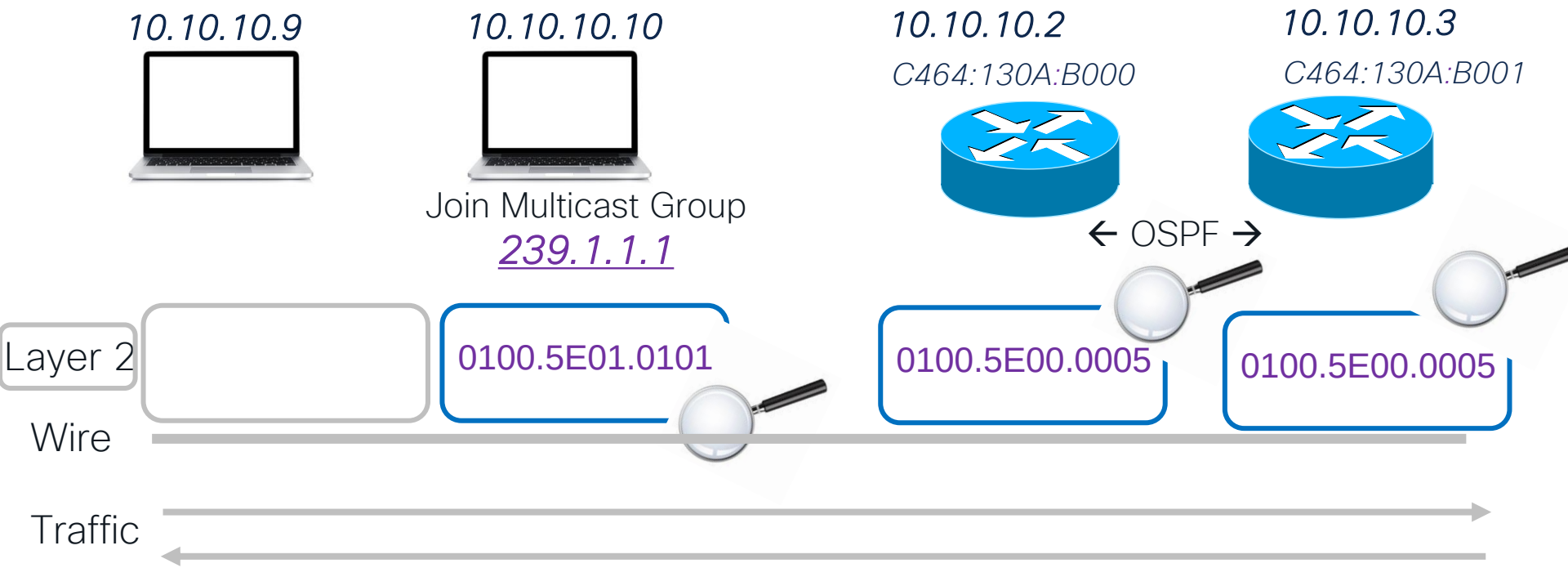
Alzatte la mano se vivetti en Italia

Wire

Traffic

Picking Things Up Off the Wire

❑ Multicast MAC



Picking Things Up Off the Wire

"An IP host group address is mapped to an Ethernet multicast address by placing the low-order 23-bits of the IP address into the low-order 23 bits of the Ethernet multicast address 01-00-5E-00-00-00 (hex). Because there are 28 significant bits in an IP host group address, more than one host group address may map to the same Ethernet multicast address." (RFC 1112)

IP ADDRESS RANGE

224.0.0.0 → 239.255.255.255

MAC ADDRESS RANGE

01-00-5E-*00-00-00* → 01-00-5E-*7F-FF-FF*

Picking Things Up Off the Wire

❑ Multicast MAC

MAC ADDRESS RANGE

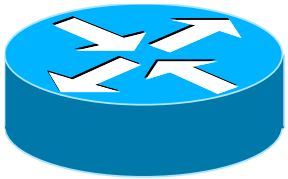
01-00-5E-*00-00-00* → 01-00-5E-*7F-FF-FF*

Picking Things Up Off the Wire

10.10.10.10

5C52.3000.000A

FFFF.FFFF.FFFF



10.10.10.2

C464:130A:B000

FFFF.FFFF.FFFF

☑ *Unicast MAC*

☑ Broadcast MAC

☑ Multicast MAC

Layer 2

5C52.3000.000A
FFFF.FFFF.FFFF

0100.5E01.0101

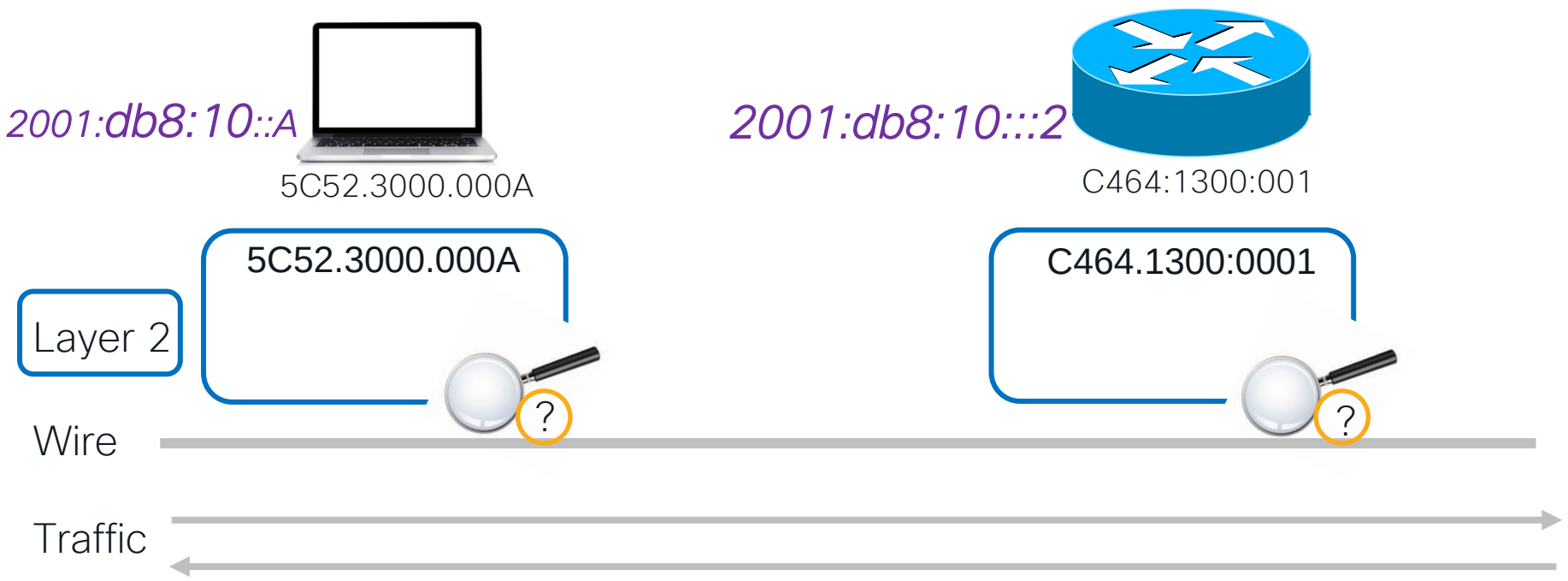
C464.130A:B000
FFFF.FFFF.FFFF

0100.5E00.0005

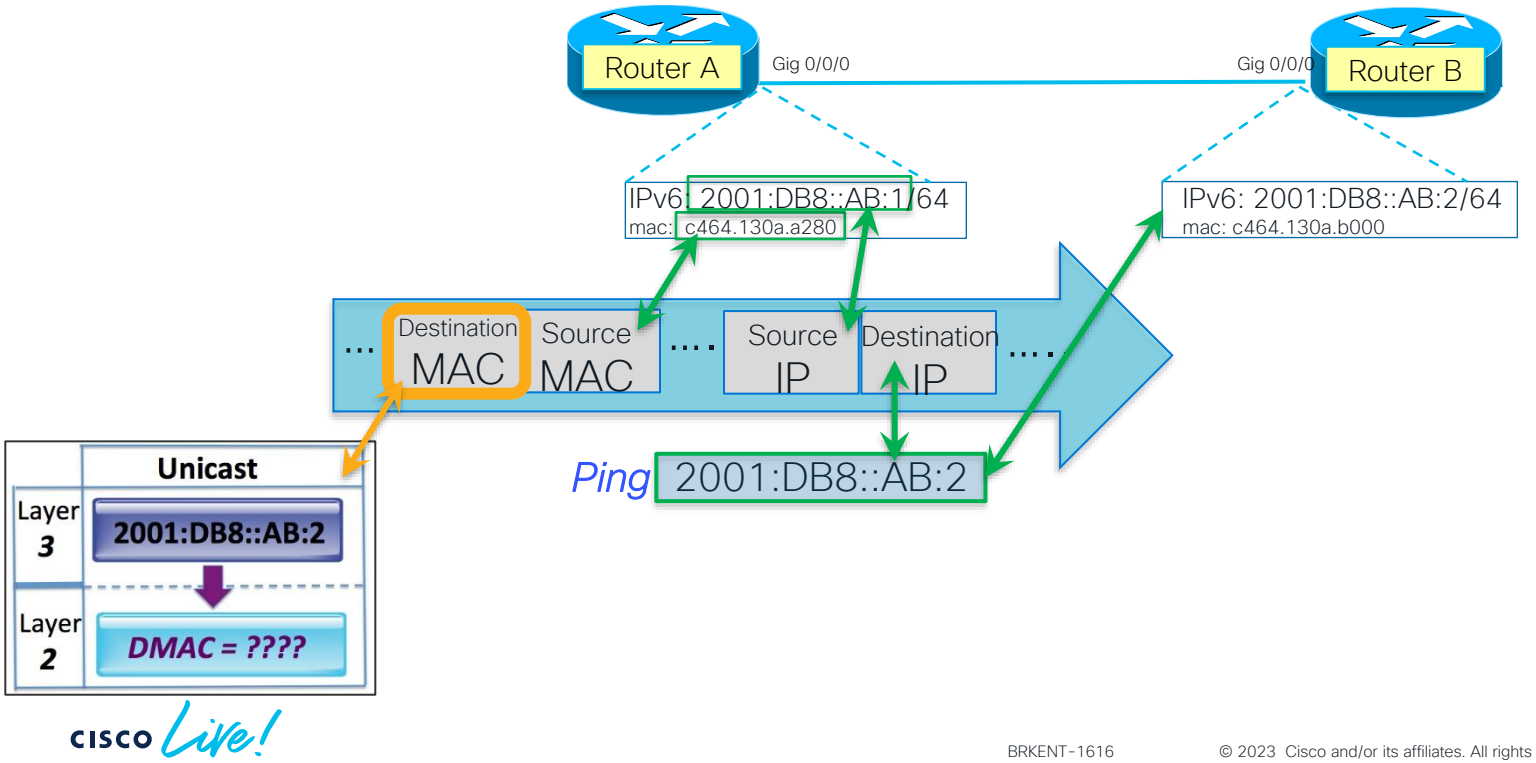
Wire

Traffic

Picking Things Up Off the Wire – IPv6

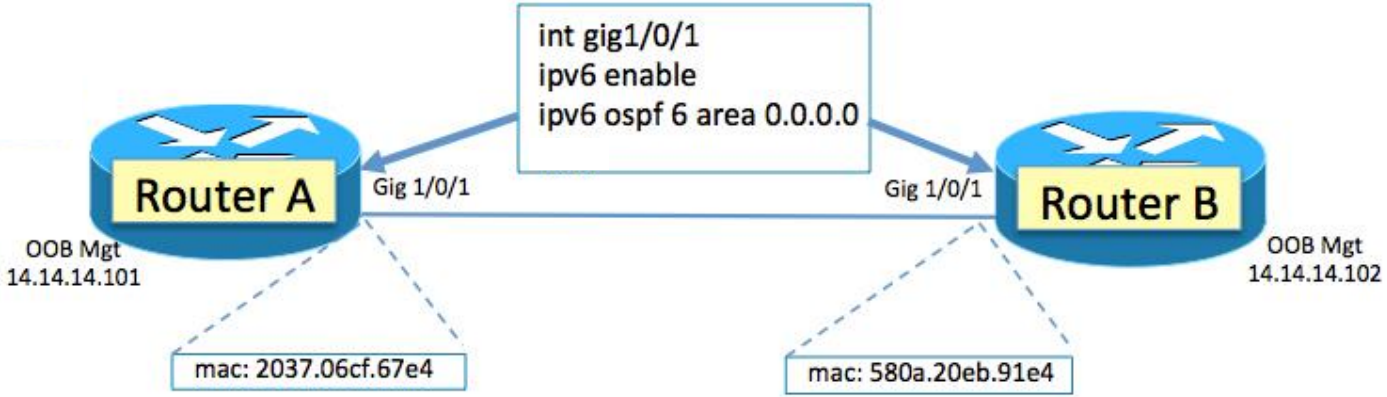


Picking Things Up Off the Wire – IPv6



The Magic Trick

The Magic Trick



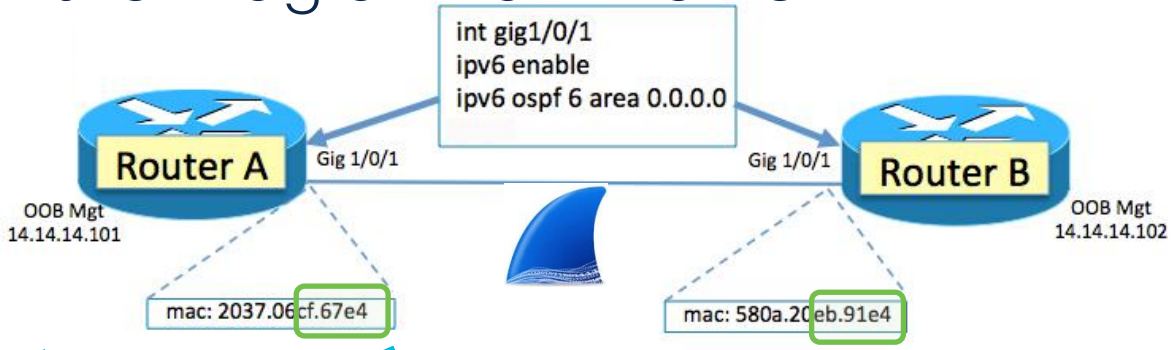
```
RouterA#sh ipv6 ospf neighbor

            OSPFv3 Router with ID (14.14.14.101) (Process ID 6)

Neighbor ID     Pri   State           Dead Time   Interface ID   Interface
14.14.14.102      1   FULL/DR         00:00:38    63             Gig1/0/1
```

How The Magic Trick Works

How the Magic Trick Works



Source IPs

Destination IPs

12	fe80::5a0a:20ff:feeb:91e4	ff02::5	FF02::5	OSPF	Hello Packet
15	fe80::2237:6ff:fecf:67e4	ff02::5		OSPF	Hello Packet
18	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4		OSPF	Hello Packet
19	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	Hello Packet
33	fe80::5a0a:20ff:feeb:91e4	ff02::5		OSPF	Hello Packet
34	fe80::2237:6ff:fecf:67e4	ff02::5		OSPF	Hello Packet
39	fe80::5a0a:20ff:feeb:91e4	ff02::5		OSPF	Hello Packet
40	fe80::2237:6ff:fecf:67e4	ff02::5	FF02::5	OSPF	Hello Packet
43	fe80::5a0a:20ff:feeb:91e4	ff02::5		OSPF	Hello Packet
44	fe80::2237:6ff:fecf:67e4	ff02::5		OSPF	Hello Packet
49	fe80::5a0a:20ff:feeb:91e4	ff02::5		OSPF	Hello Packet
50	fe80::2237:6ff:fecf:67e4	ff02::5		OSPF	Hello Packet
51	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4		OSPF	DB Description
52	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	DB Description
55	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	DB Description
56	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4		OSPF	DB Description
57	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	DB Description
58	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4		OSPF	DB Description
59	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	LS Request

FE80::2237:6ff:fecf:67e4

FE80::5a0a:20ff:feeb:91e4

FF02::5

FE80::2237:6ff:fecf:67e4

FE80::5a0a:20ff:feeb:91e4

How the Magic Trick Works

FF02::5

Exists in IPv4 & IPv6

IPv4	
	Description
224.0.0.2	
224.0.0.3	Unassigned
224.0.0.4	DVMRP Routers
224.0.0.5	OSPFIGP OSPFIGP All Routers
224.0.0.6	OSPFIGP OSPFIGP Designated Routers
224.0.0.7	ST Routers
224.0.0.8	ST Hosts
224.0.0.9	RIP2 Routers
224.0.0.10	IGRP Routers
224.0.0.11	Mobile-Agents
224.0.0.12	DHCP Server / Relay Agent
224.0.0.13	All PIM Routers
224.0.0.14	RSVP-ENCAPSULATION

33	fe80::5a0a:20ff:feeb:91e4	ff02::5	OSPF	Hello Packet
34	fe80::2237:6ff:fecf:67e4	ff02::5	OSPF	Hello Packet
39	fe80::5a0a:20ff:feeb:91e4	ff02::5	OSPF	Hello Packet
40	fe80::2237:6ff:fecf:67e4	ff02::5	OSPF	Hello Packet
43	fe80::5a0a:20ff:feeb:91e4	ff02::5	OSPF	Hello Packet
44	fe80::2237:6ff:fecf:67e4	ff02::5	OSPF	Hello Packet
49	fe80::5a0a:20ff:feeb:91e4	ff02::5	OSPF	Hello Packet

FF02::5

How the Magic Trick Works

IPv6	
Address(s)	**Description**
FF02:0:0:0:0:0:0:1	All Nodes Address
FF02:0:0:0:0:0:0:2	All Routers Address
FF02:0:0:0:0:0:0:3	Unassigned
FF02:0:0:0:0:0:0:4	DVMRP Routers
FF02:0:0:0:0:0:0:5	OSPFIGP
FF02:0:0:0:0:0:0:6	OSPFIGP Designated Routers
FF02:0:0:0:0:0:0:7	ST Routers
FF02:0:0:0:0:0:0:8	ST Hosts
FF02:0:0:0:0:0:0:9	RIP Routers
FF02:0:0:0:0:0:0:A	EIGRP Routers
FF02:0:0:0:0:0:0:B	Mobile-Agents
FF02:0:0:0:0:0:0:C	SSDP
FF02:0:0:0:0:0:0:D	All PIM Routers
FF02:0:0:0:0:0:0:E	RSVP-ENCAPSULATION

RFC4291, Section 2.4

2.4. Address Type Identification

The type of an IPv6 address is identified by the high-order bits of the address, as follows:

Address type	Binary prefix	IPv6 notation	Section
Unspecified	00...0 (128 bits)	::/128	2.5.2
Loopback	00...1 (128 bits)	::1/128	2.5.3
Multicast	11111111	FF00::/8	2.7
Link-Local unicast	1111111010	FE80::/10	2.5.6
Global Unicast	(everything else)		

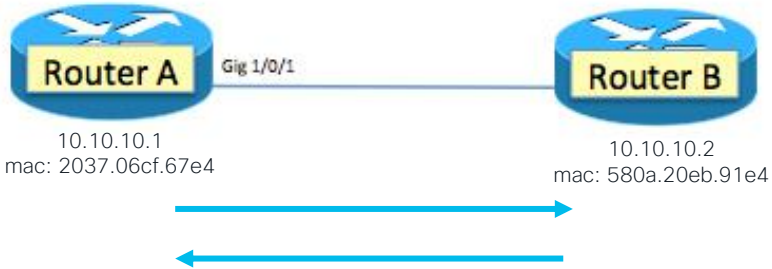
How the Magic Trick Works

"Link Local" Multicast Exists in IPv4 & IPv6

IPv6		IPv4	
Address(s)	**Description**	**Address(es)**	**Description**
		224.0.0.0	Base Address (Reserved)
FF02:0:0:0:0:0:0:1	All Nodes Address	224.0.0.1	All Systems on this Subnet
FF02:0:0:0:0:0:0:2	All Routers Address	224.0.0.2	All Routers on this Subnet
FF02:0:0:0:0:0:0:3	Unassigned	224.0.0.3	Unassigned
FF02:0:0:0:0:0:0:4	DVMRP Routers	224.0.0.4	DVMRP Routers
FF02:0:0:0:0:0:0:5	OSPFIGP	224.0.0.5	OSPFIGP OSPFIGP All Routers
FF02:0:0:0:0:0:0:6	OSPFIGP Designated Routers	224.0.0.6	OSPFIGP OSPFIGP Designated Routers
FF02:0:0:0:0:0:0:7	ST Routers	224.0.0.7	ST Routers
FF02:0:0:0:0:0:0:8	ST Hosts	224.0.0.8	ST Hosts
FF02:0:0:0:0:0:0:9	RIP Routers	224.0.0.9	RIP2 Routers
FF02:0:0:0:0:0:0:A	EIGRP Routers	224.0.0.10	IGRP Routers
FF02:0:0:0:0:0:0:B	Mobile-Agents	224.0.0.11	Mobile-Agents
FF02:0:0:0:0:0:0:C	SSDP	224.0.0.12	DHCP Server / Relay Agent
FF02:0:0:0:0:0:0:D	All PIM Routers	224.0.0.13	All PIM Routers
FF02:0:0:0:0:0:0:E	RSVP-ENCAPSULATION	224.0.0.14	RSVP-ENCAPSULATION

- Multicast
- Local: They are local to the wire they are on.
- Common interest:
  If a router wants to participate in EIGRP, it already knows the local multicast address (IPv4/IPv6) to start to listen to and the corresponding MAC address.
- Join:
  "Join" just by just deciding to listen to a local multicast address and then, by extension, to the corresponding MAC address for that multicast IP address.

Link-Local Scope Multicast Address

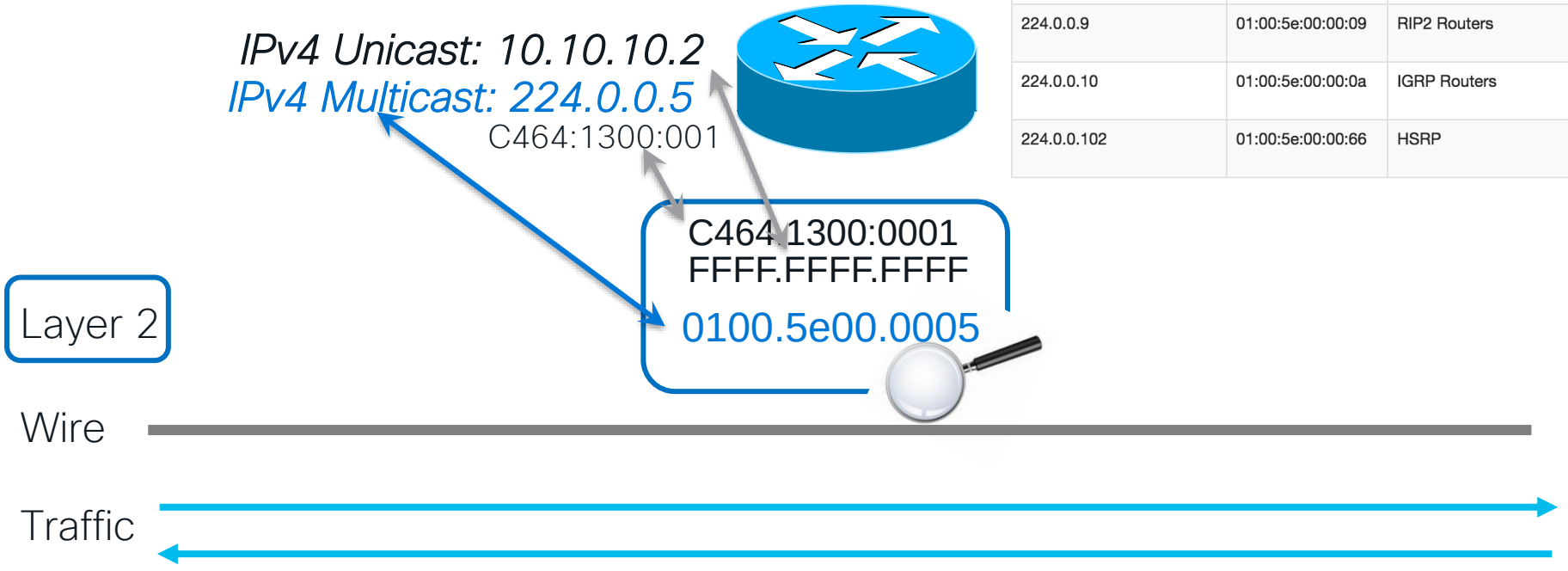


Multicast IPv4 Address	*Ethernet Address*	*Description*
224.0.0.5		OSPFIGP All Routers
224.0.0.6		OSPFIGP Designated Routers
224.0.0.9		RIP2 Routers
224.0.0.10		IGRP Routers
224.0.0.102		HSRP

No.	Src IP	Src MAC	Dest IP	Dest MAC
5	10.10.10.1	20:37:06:cf:67:e4	224.0.0.5	
8	10.10.10.2	58:0a:20:eb:91:e4	224.0.0.5	
26	10.10.10.1	20:37:06:cf:67:e4	224.0.0.5	
27	10.10.10.2	58:0a:20:eb:91:e4	10.10.10.1	
28	10.10.10.2	58:0a:20:eb:91:e4	224.0.0.5	
31	10.10.10.2	58:0a:20:eb:91:e4	224.0.0.5	
32	10.10.10.1	20:37:06:cf:67:e4	224.0.0.5	
35	10.10.10.2	58:0a:20:eb:91:e4	224.0.0.5	
36	10.10.10.1	20:37:06:cf:67:e4	224.0.0.5	
39	10.10.10.2	58:0a:20:eb:91:e4	224.0.0.5	

Picking Things Up Off the Wire

Multicast IPv4 Address	Ethernet Address	Description
224.0.0.5	01:00:5e:00:00:05	OSPFIGP All Routers
224.0.0.6	01:00:5e:00:00:06	OSPFIGP Designated Routers
224.0.0.9	01:00:5e:00:00:09	RIP2 Routers
224.0.0.10	01:00:5e:00:00:0a	IGRP Routers
224.0.0.102	01:00:5e:00:00:66	HSRP



Link-Local Scope Multicast Address

IPv6 Multicast MAC ADDRESS RANGE

33-33-00-00-00-00 through *33-33-FF-FF-FF-FF*

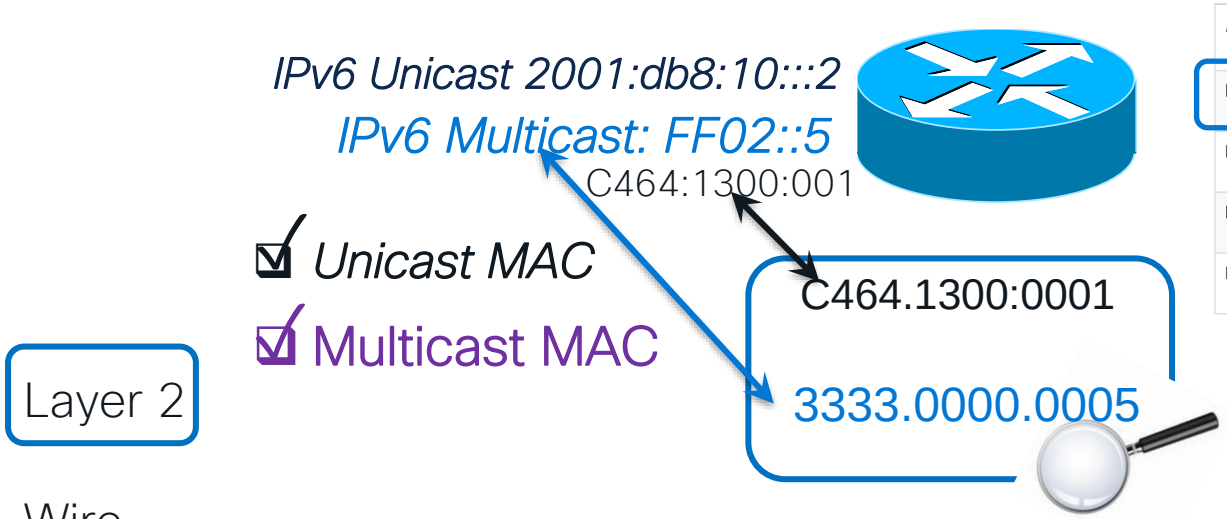
Multicast IPv6 Address	*Ethernet Address*	*Description*
FF02:0:0:0:0:0:0:5		OSPFIGP All Routers
FF02:0:0:0:0:0:0:6		OSPFIGP Designated Routers
FF02:0:0:0:0:0:0:9		RIP2 Routers
FF02:0:0:0:0:0:0:A		EIGRP Routers

"The low 32 bits an Ethernet address for IPv6 multicast traffic are the low 32 bits of the multicast IPv6 address used.
For example, IPv6 multicast traffic using the address *ff02::d* uses the MAC address *33-33-00-00-00-0D*,
and traffic to
ff05::1:3 goes to the MAC address *33-33-00-01-00-03*."

– https://en.wikipedia.org/wiki/Multicast_address

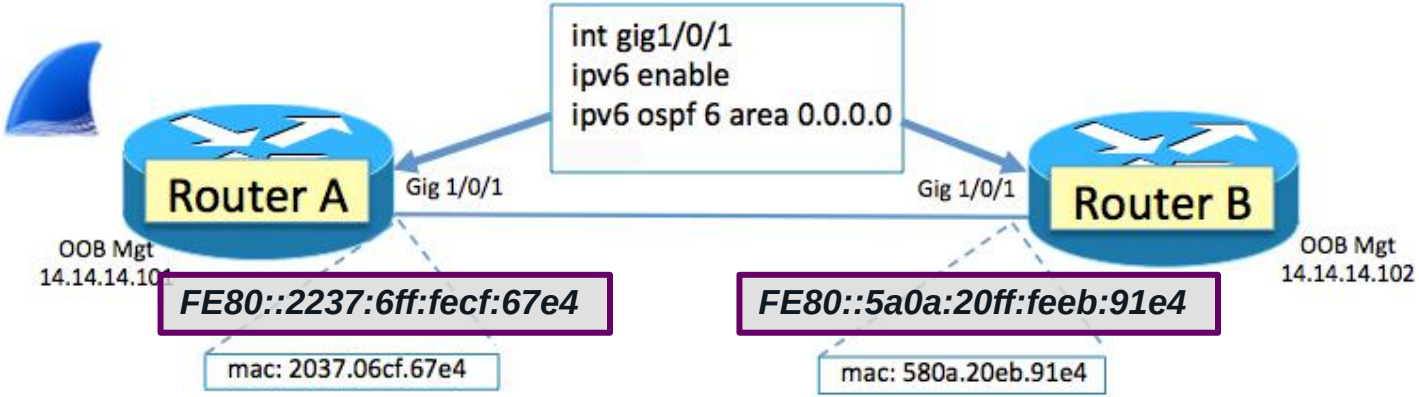
Dest IP	Dest MAC
fe80::2	
ff02::6	
ff02::5	
fe80::2	
ff02::6	
ff02::5	

Picking Things Up Off the Wire



Multicast IPv6 Address	*Ethernet Address*	*Description*
FF02:0:0:0:0:0:0:5	33:33:00:00:00:05	OSPFIGP All Routers
FF02:0:0:0:0:0:0:6	33:33:00:00:00:06	OSPFIGP Designated Routers
FF02:0:0:0:0:0:0:9	33:33:00:00:00:09	RIP2 Routers
FF02:0:0:0:0:0:0:A	33:33:00:00:00:0A	EIGRP Routers

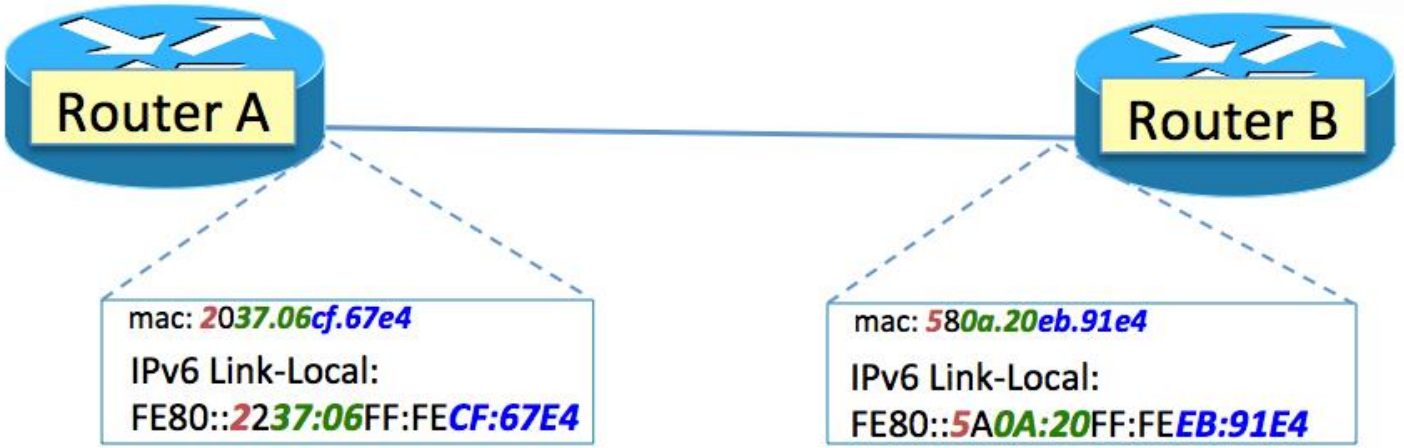
How the Magic Trick Works



51	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4	OSPF	DB Description
52	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4	OSPF	DB Description
55	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4	OSPF	DB Description
56	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4	OSPF	DB Description
57	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4	OSPF	DB Description
58	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4	OSPF	DB Description
59	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4	OSPF	LS Request

How the Magic Trick Works

FE80::



51	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4	OSPF	DB Description
52	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4	OSPF	DB Description
55	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4	OSPF	DB Description
56	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4	OSPF	DB Description
57	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4	OSPF	DB Description
58	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4	OSPF	DB Description
59	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4	OSPF	LS Request

How the Magic Trick Works

FE80::

FE80::2237:6ff:fecf:67e4

FE80::5a0a:20ff:feeb:91e4

FE80::

"Link Local" Unicast

RFC4291, Section 2.4

2.4. Address Type Identification

The type of an IPv6 address is identified by the high-order bits of the address, as follows:

Address type	Binary prefix	IPv6 notation	Section
Unspecified	00...0 (128 bits)	::/128	2.5.2
Loopback	00...1 (128 bits)	::1/128	2.5.3
Multicast	11111111	FF00::/8	2.7
Link-Local unicast	1111111010	FE80::/10	2.5.6
Global Unicast	(everything else)		

How the Magic Trick Works

*A host is **REQUIRED** to have*
a link-local address for each interface

FE80::

RFC4291, Section 2.4

FE80::2237:6ff:fecf:67e4

FE80::5a0a:20ff:feeb:91e4

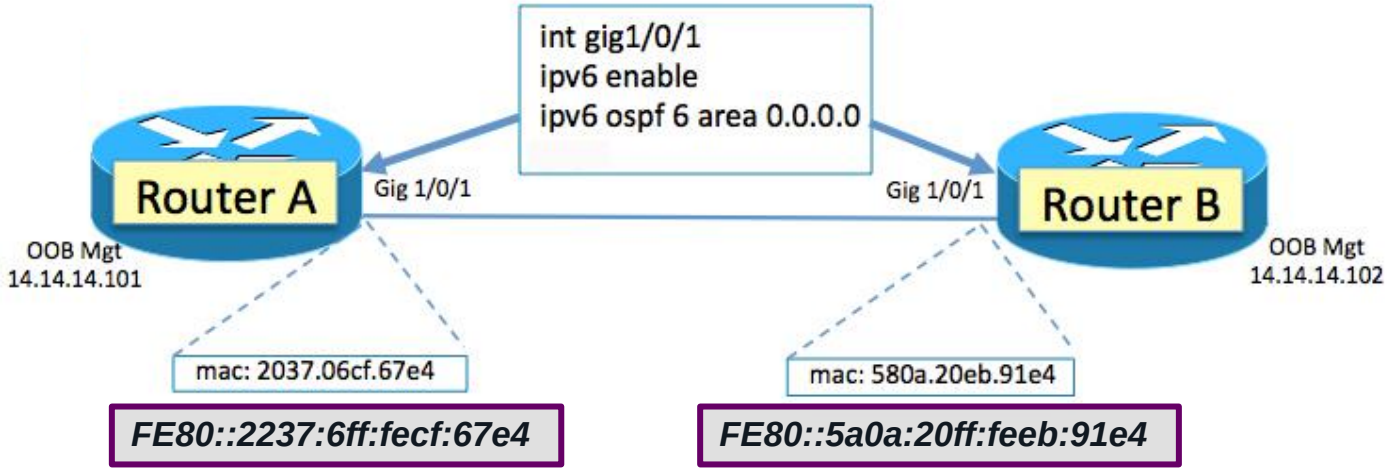
2.8. A Node's Required Addresses

A host is required to recognize the following addresses as identifying itself:

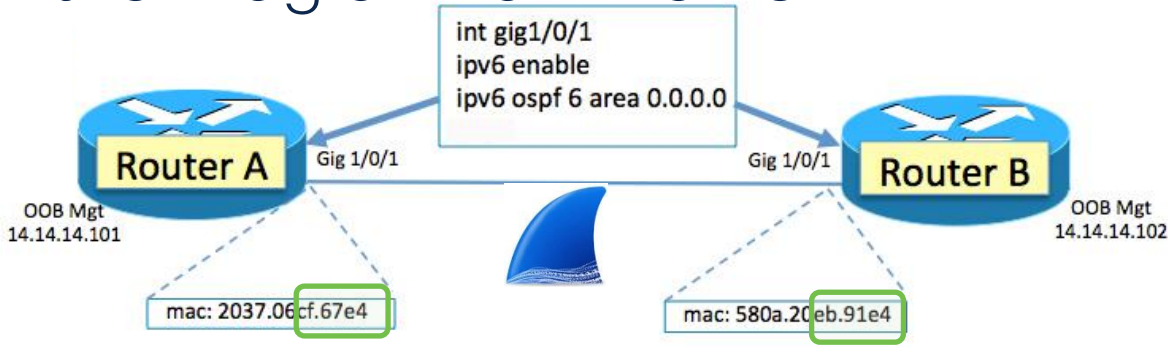
o Its required Link-Local address for each interface.

How the Magic Trick Works

A host is ***required*** to ***have and recognize*** its ***link local unicast*** address



How the Magic Trick Works



Source IPs

Destination IPs

12	fe80::5a0a:20ff:feeb:91e4	ff02::5	FF02::5	OSPF	Hello Packet
15	fe80::2237:6ff:fecf:67e4	ff02::5		OSPF	Hello Packet
18	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4		OSPF	Hello Packet
19	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	Hello Packet
33	fe80::5a0a:20ff:feeb:91e4	ff02::5		OSPF	Hello Packet
	FE80::2237:6ff:fecf:67e4	ff02::5		OSPF	Hello Packet
	feeb:91e4	ff02::5		OSPF	Hello Packet
40	fe80::2237:6ff:fecf:67e4	ff02::5	FF02::5	OSPF	Hello Packet
43	fe80::5a0a:20ff:feeb:91e4	ff02::5		OSPF	Hello Packet
44	fe80::2237:6ff:fecf:67e4	ff02::5		OSPF	Hello Packet
49	fe80::5a0a:20ff:feeb:91e4	ff02::5		OSPF	Hello Packet
50	fe80::2237:6ff:fecf:67e4	ff02::5		OSPF	Hello Packet
51	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4		OSPF	DB Description
	ecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	DB Description
	ecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	DB Description
56	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4		OSPF	DB Description
57	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	DB Description
58	fe80::5a0a:20ff:feeb:91e4	fe80::2237:6ff:fecf:67e4		OSPF	DB Description
59	fe80::2237:6ff:fecf:67e4	fe80::5a0a:20ff:feeb:91e4		OSPF	LS Request

FE80::5a0a:20ff:feeb:91e4

✓ FF02::5

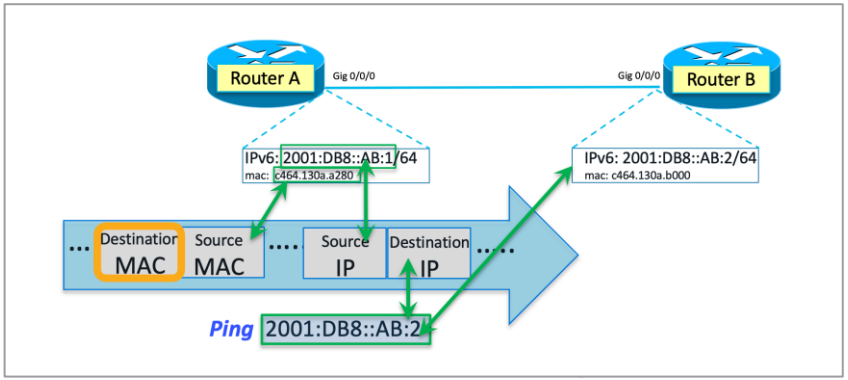
✓ FE80::

FF02::5

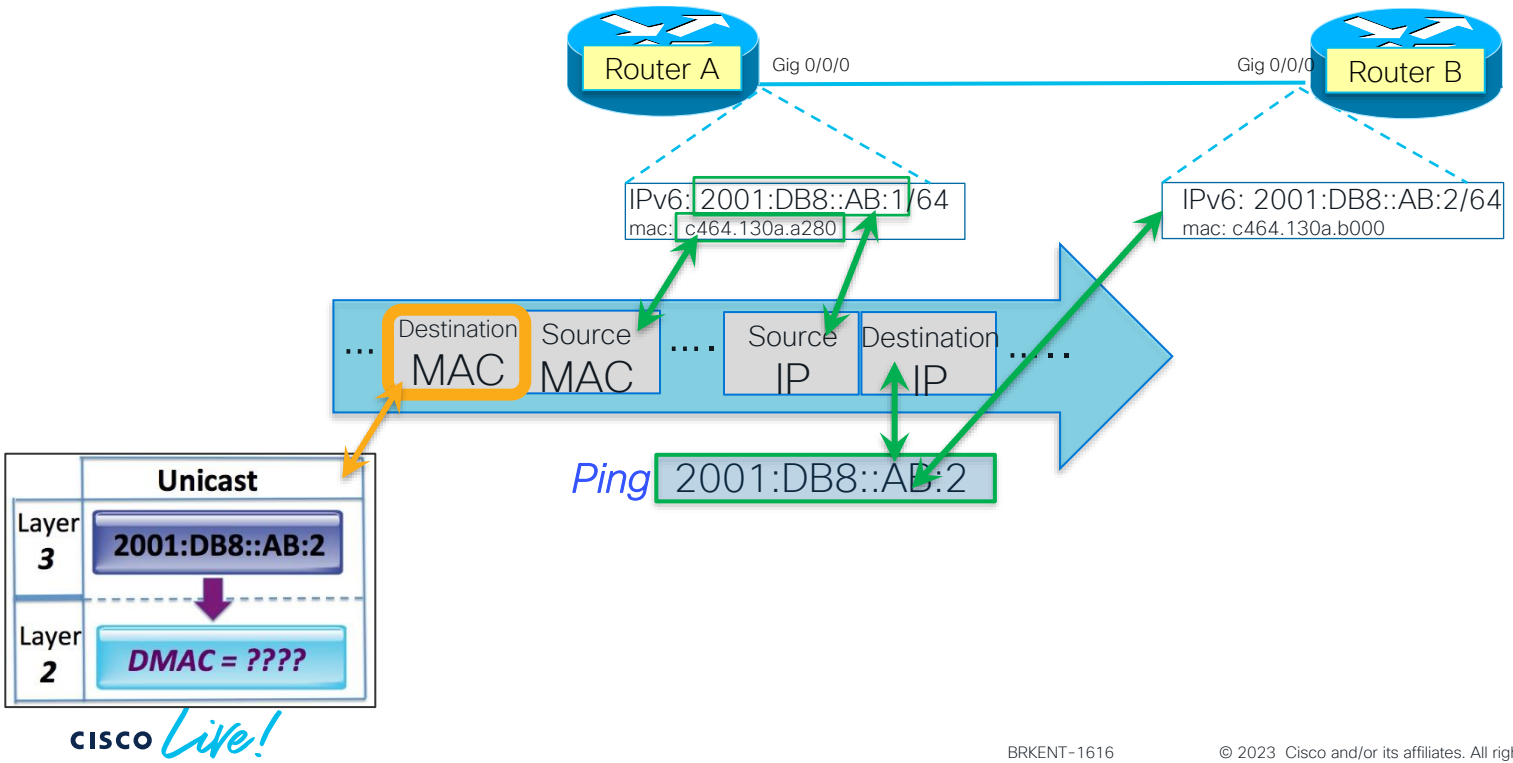
FE80::2237:6ff:fecf:67e4

FE80::5a0a:20ff:feeb:91e4

Resolving the Destination MAC Address



Resolving the Destination MAC Address



Solicited-Node Multicast

Snippets from RFC4291 section 2.7

- *A node is required to compute and join (on the appropriate interface) the associated solicited-node multicast addresses for all unicast and anycast addresses that have been configured for the node's interfaces (manually or automatically).*

- A Solicited-Node multicast address
  - is formed by taking the low-order 24 bits of an address (unicast or anycast) and
  - appending those bits to the prefix FF02:0:0:0:0:1:FF00::/104
  - resulting in a multicast address in the range FF02:0:0:0:0:1:FF00:0000 to FF02:0:0:0:0:1:FFFF:FFFF

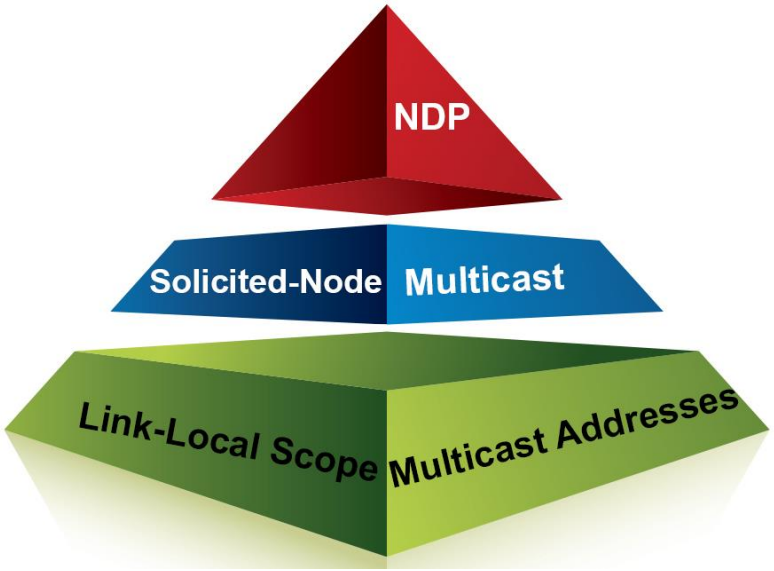
Solicited-Node Multicast

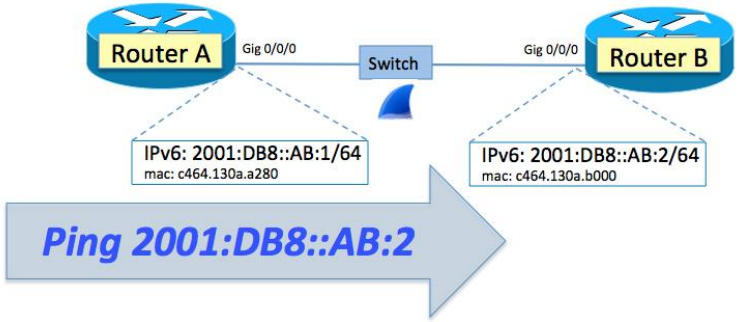
Low-order 24 bits of an address (unicast or anycast) and append those bits to the prefix FF02:0:0:0:0:1:FF00::/104

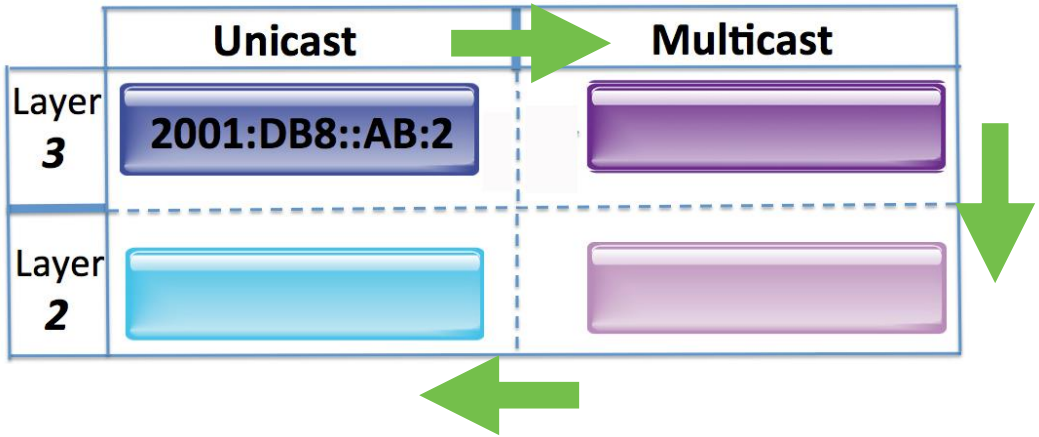
- *IPv6 address 4037::01:800:200E:8C6C*
  - *MUST listen for the multicast address FF02::1:FF0E:8C6C.*

- *IPv6 address 2001:DB8::AB:2*
  - *MUST listen for the multicast address FF02:0:0:0:0:1:FFAB:000*

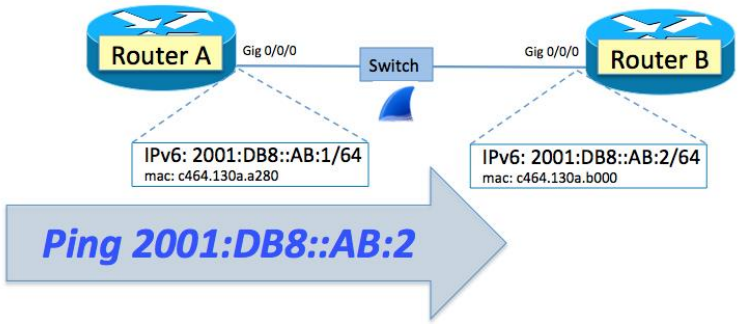
Resolving the Destination MAC Address



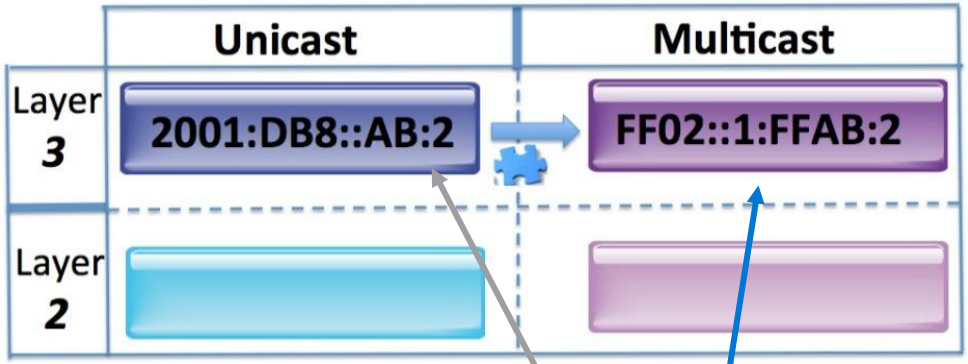




Resolving the Destination MAC Address



- A node is required to compute and join the associated solicited-node multicast address for all unicast addresses



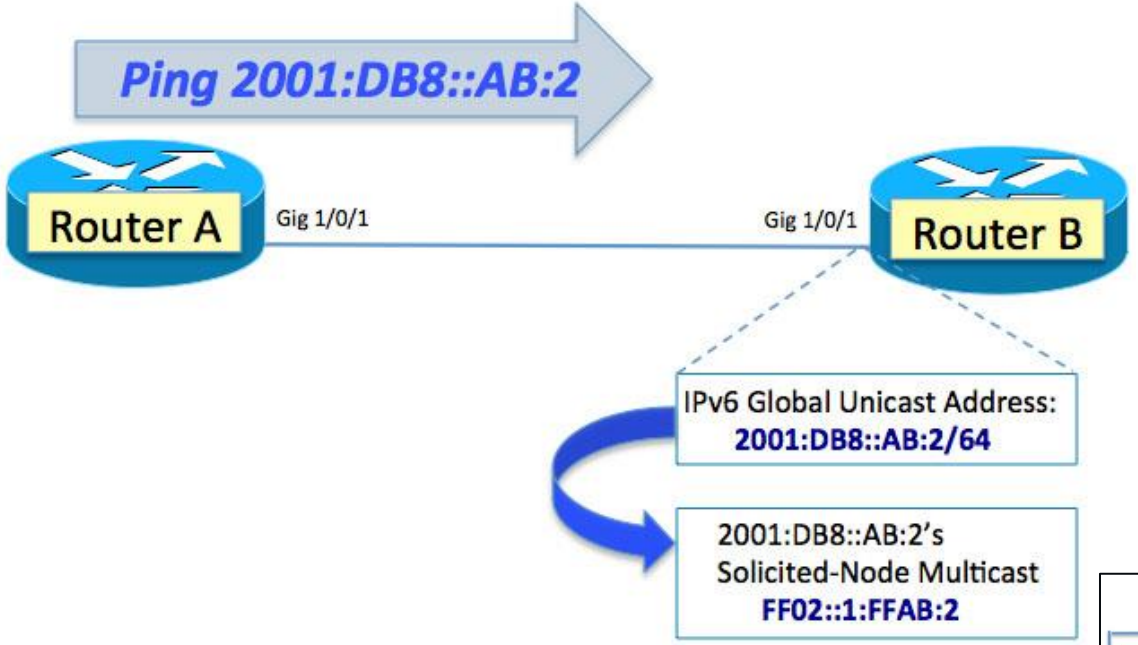
IPv6 Unicast Address: *2001:DB8::AB:2*

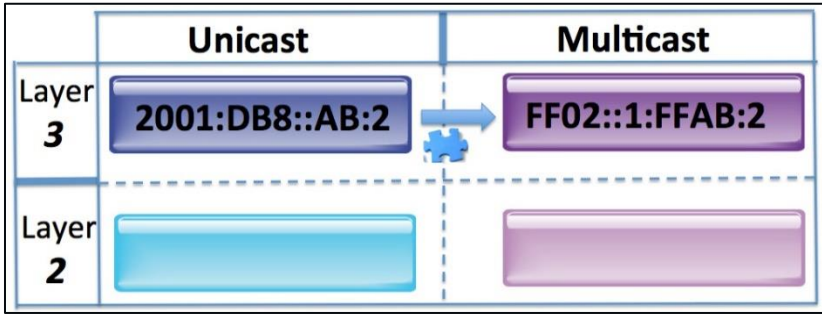
= ***2001:DB8:0:0:0:0:00AB:0002***

Compute Associated solicited–node multicast:

FF02:0:0:0:0:1:FF***AB***:0002

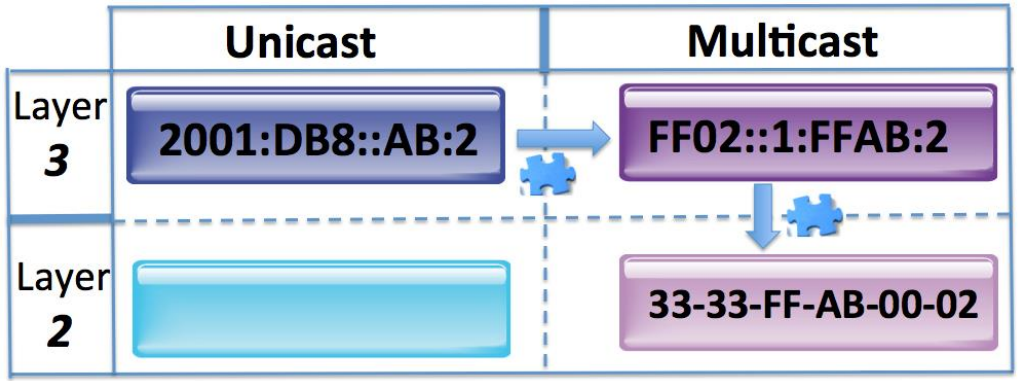
Resolving the Destination MAC Address



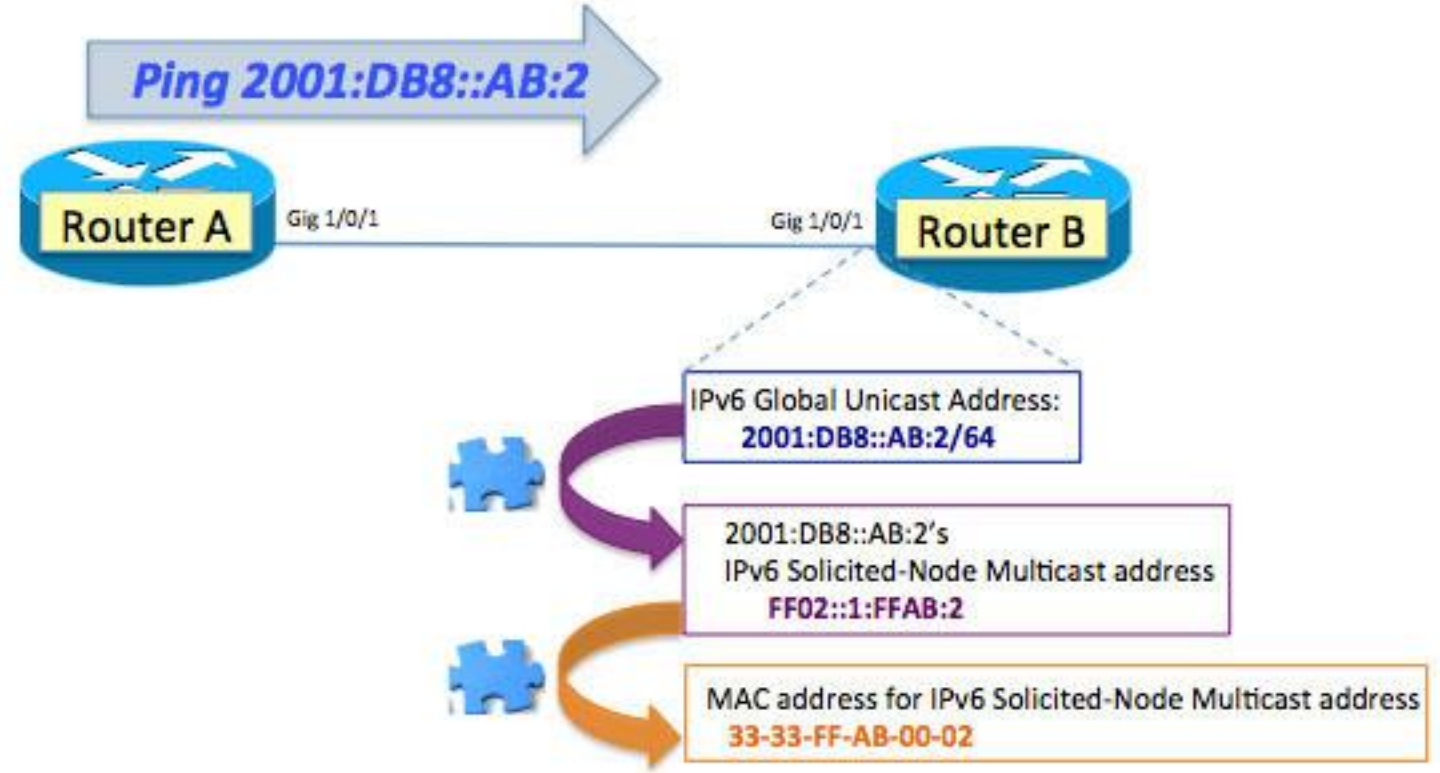


Resolving the Destination MAC Address

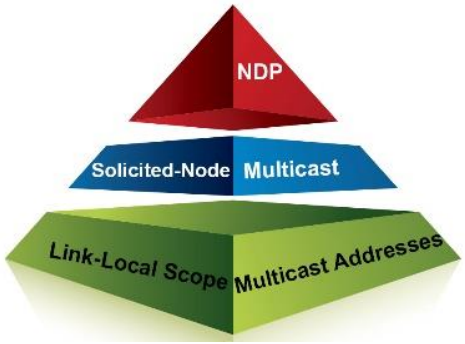
Multicast IPv6 Address	*Ethernet Address*	*Description*
FF02:0:0:0:0:0:0:5	33:33:00:00:00:05	OSPFIGP All Routers
FF02:0:0:0:0:0:0:6	33:33:00:00:00:06	OSPFIGP Designated Routers
FF02:0:0:0:0:0:0:9	33:33:00:00:00:09	RIP2 Routers
FF02:0:0:0:0:0:0:A	33:33:00:00:00:0A	EIGRP Routers

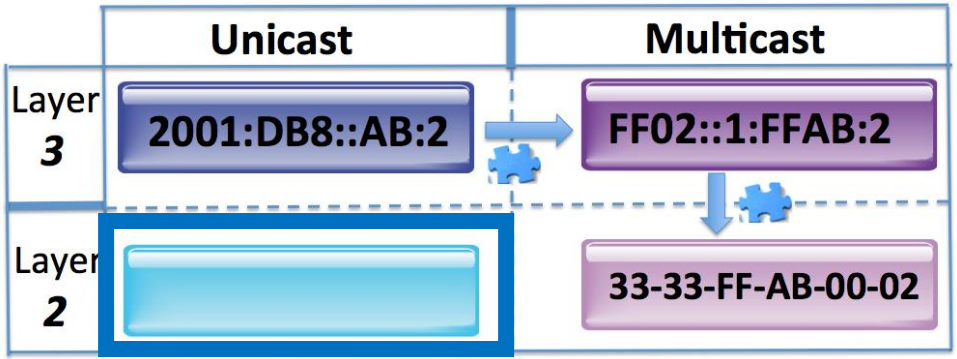


Resolving the Destination MAC Address



The Final Piece



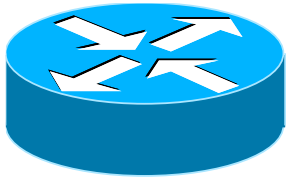


The Final Piece

IPv6 Unicast 2001:db8::AB:2

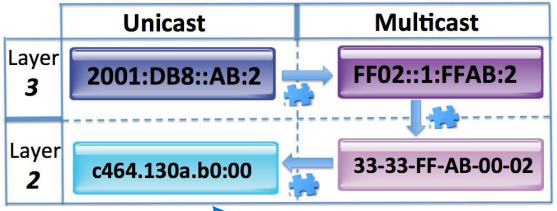
Solicited Node Multicast: FF02::1:FFAB:2

C464:130a:b000



C464.1300:0001

3333.FFAB.0002

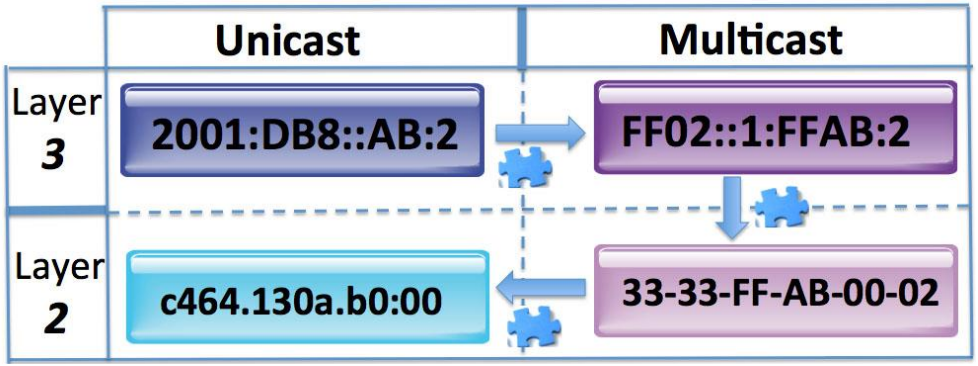


Layer 2

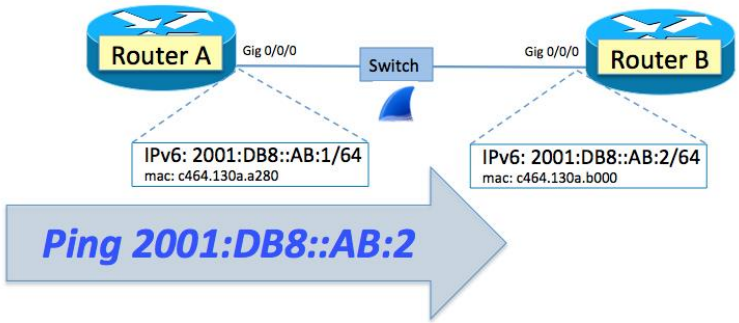
Wire

No.	Source	Destination	Protocol	Length	Info
5	2001:db8::ab:1	ff02::1:ffab:2	ICMPv6	90	Neighbor Solicitation for 2001:db8::ab:2 from c464.130a.a280
6	2001:db8::ab:2	2001:db8::ab:1	ICMPv6	90	Neighbor Advertisement 2001:db8::ab:2 (sol, ovr) is at c464.130a.b000
7	2001:db8::ab:1	2001:db8::ab:2	ICMPv6	118	Echo (ping) request id=0x24ff, seq=0, hop limit=64 (reply in 8)
8	2001:db8::ab:2	2001:db8::ab:1	ICMPv6	118	Echo (ping) reply id=0x24ff, seq=0, hop limit=64 (request in 7)
9	2001:db8::ab:1	2001:db8::ab:2	ICMPv6	118	Echo (ping) request id=0x24ff, seq=1, hop limit=64 (reply in 10)
10	2001:db8::ab:2	2001:db8::ab:1	ICMPv6	118	Echo (ping) reply id=0x24ff, seq=1, hop limit=64 (request in 9)

Putting the Puzzle Pieces Together

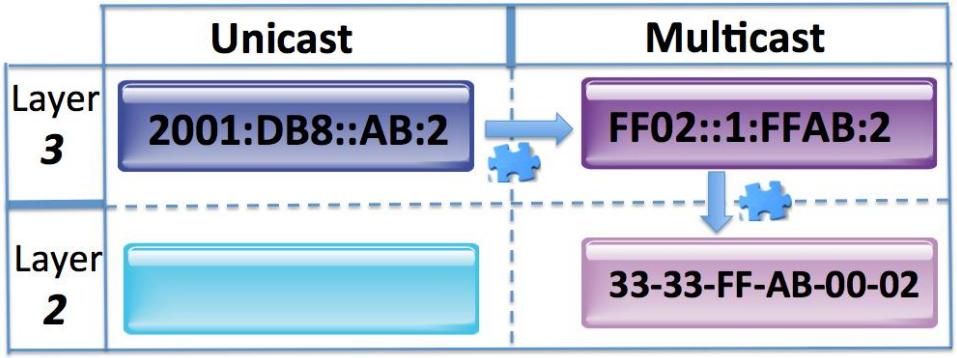


Putting the Puzzle Pieces Together

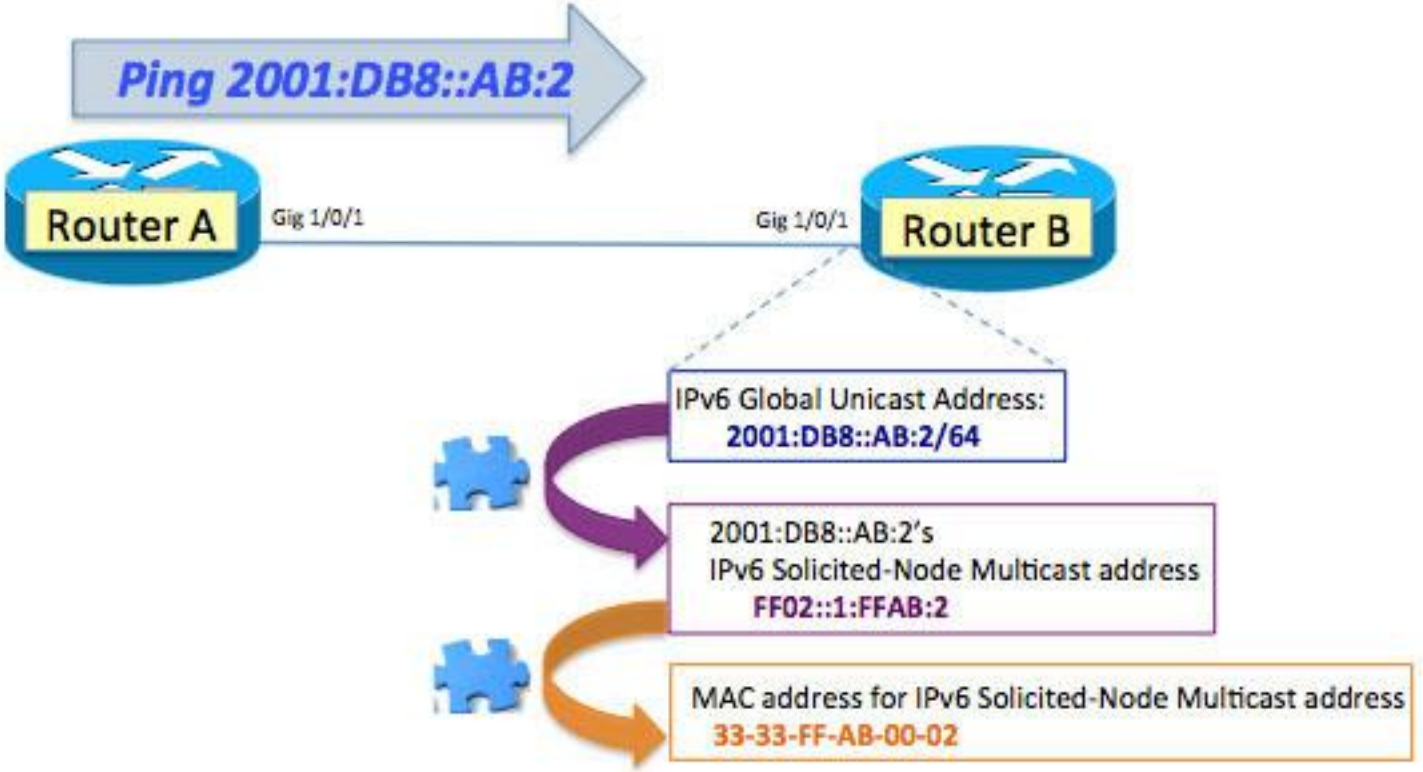


A node is

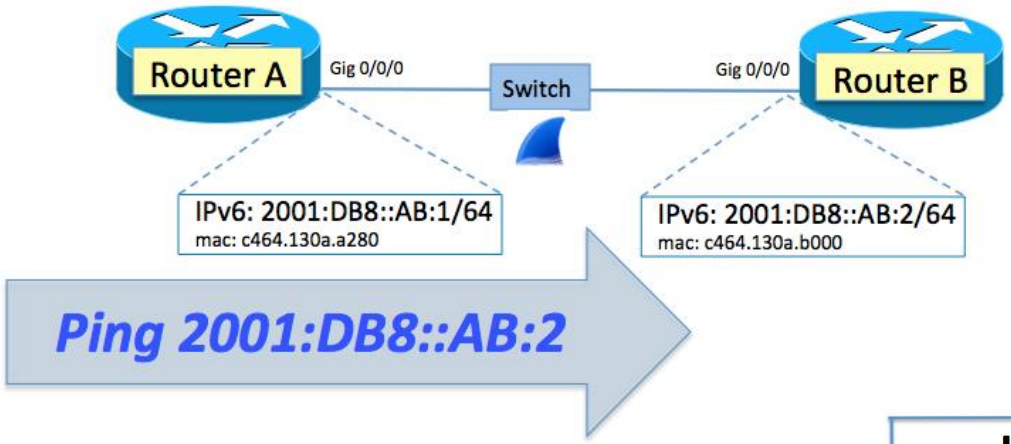
- ***required*** to compute and join the associated
- ***Solicited-Node Multicast*** address for all unicast addresses

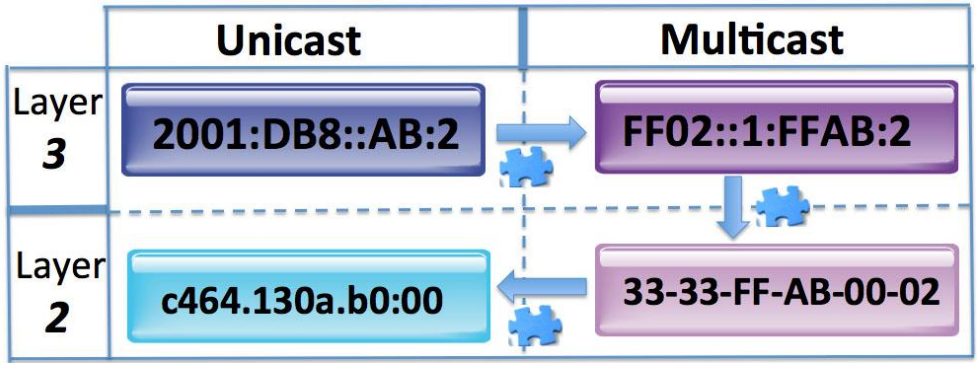


Putting the Puzzle Pieces Together



Putting the Puzzle Pieces Together





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