IP Routing

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NETWORK ENGINEER

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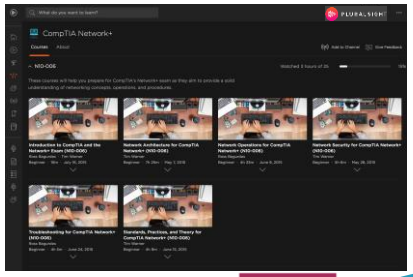
Module Goals

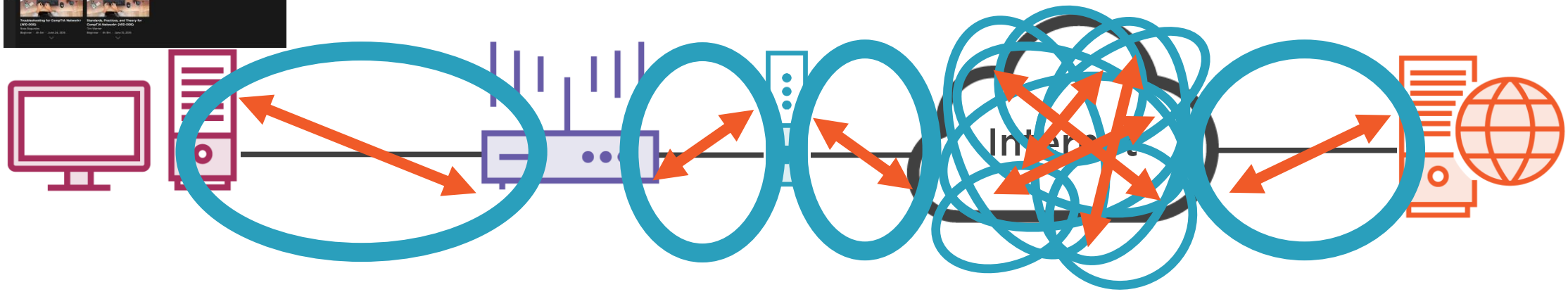
- OSI Model Review
- Introduce Network Layer Communication
- Explain ARP
- Describe the Default Gateway
- Describe IP Routing
- Demonstrate Traceroute

OSI Model

7	Application Layer
6	Presentation Layer
5	Session Layer
4	Transport Layer
3	Network Layer
2	Data Link Layer
1	Physical Layer

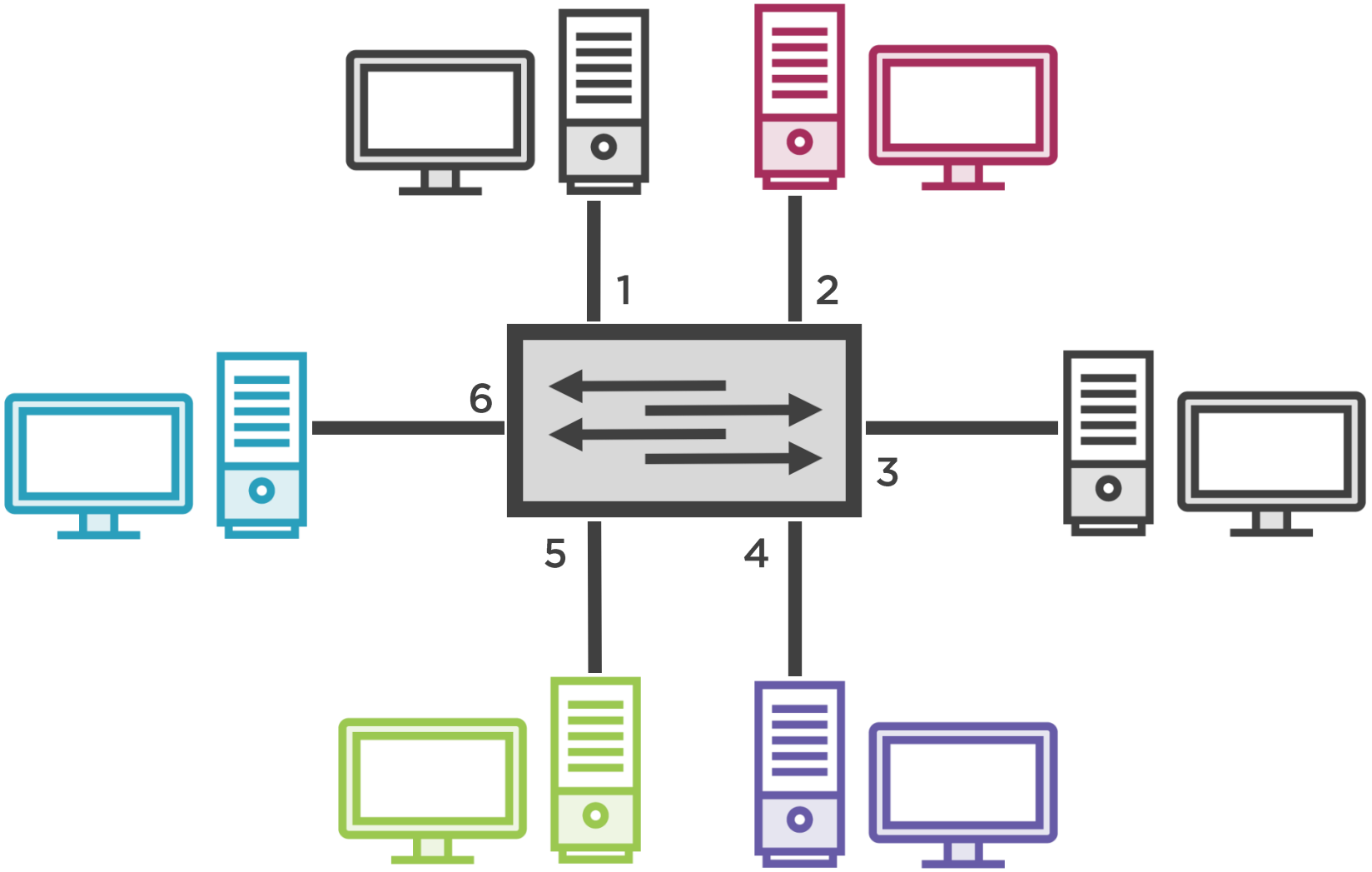
https://www.pluralsight.com/





Data Link Layer

Ethernet Switch



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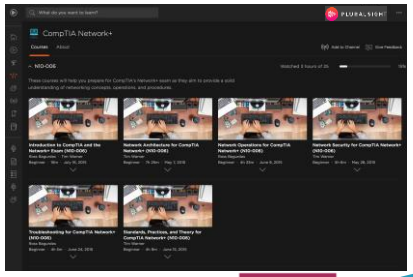

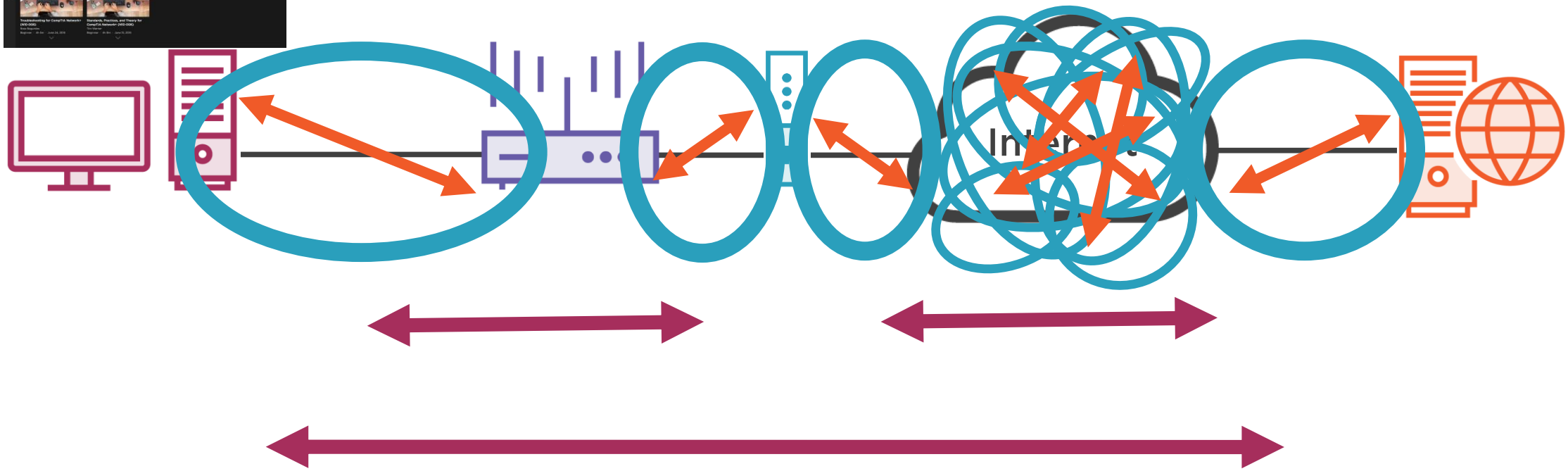

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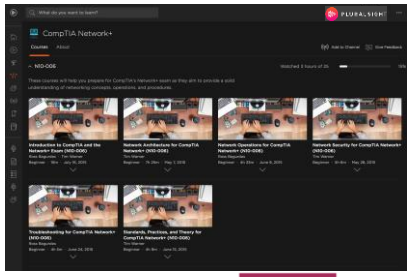
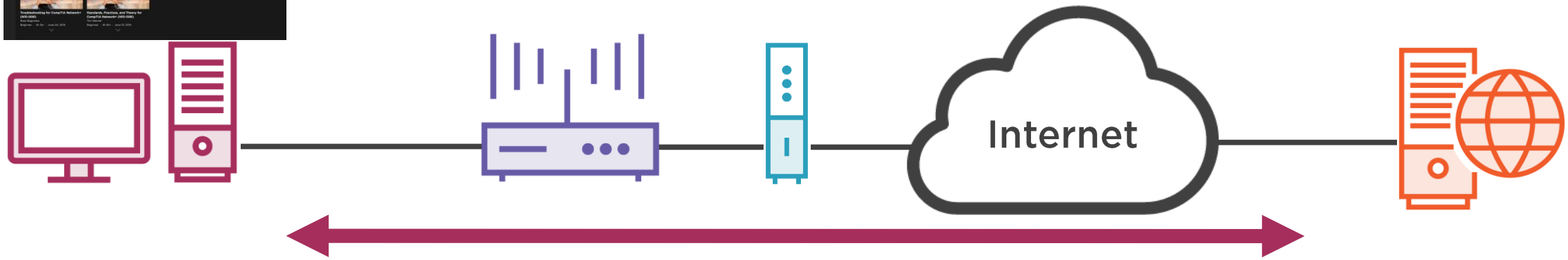
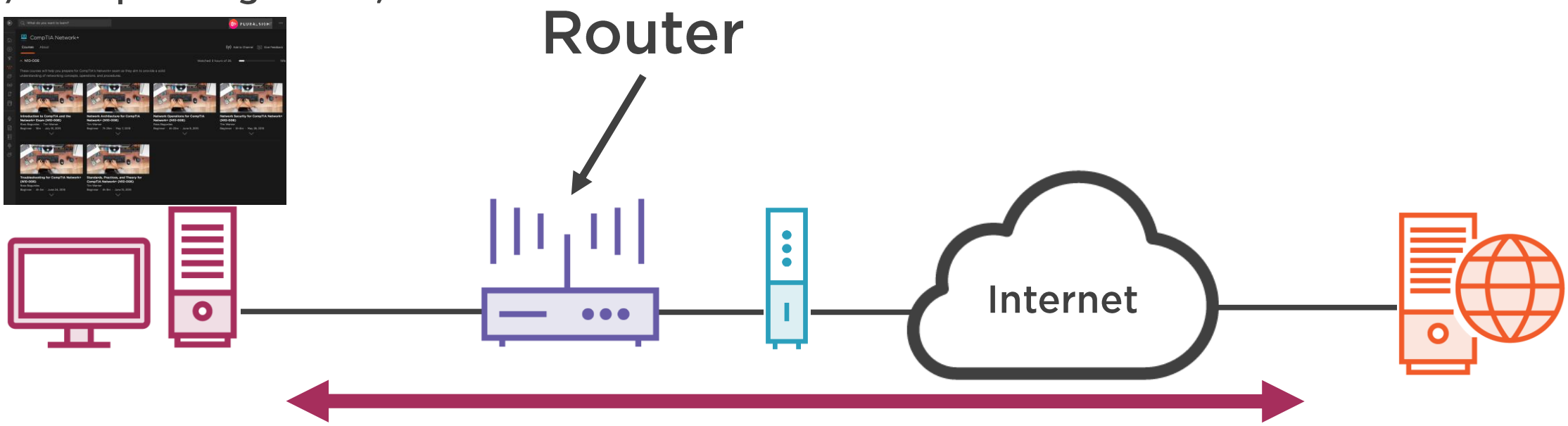




Network Layer

https://www.pluralsight.com/



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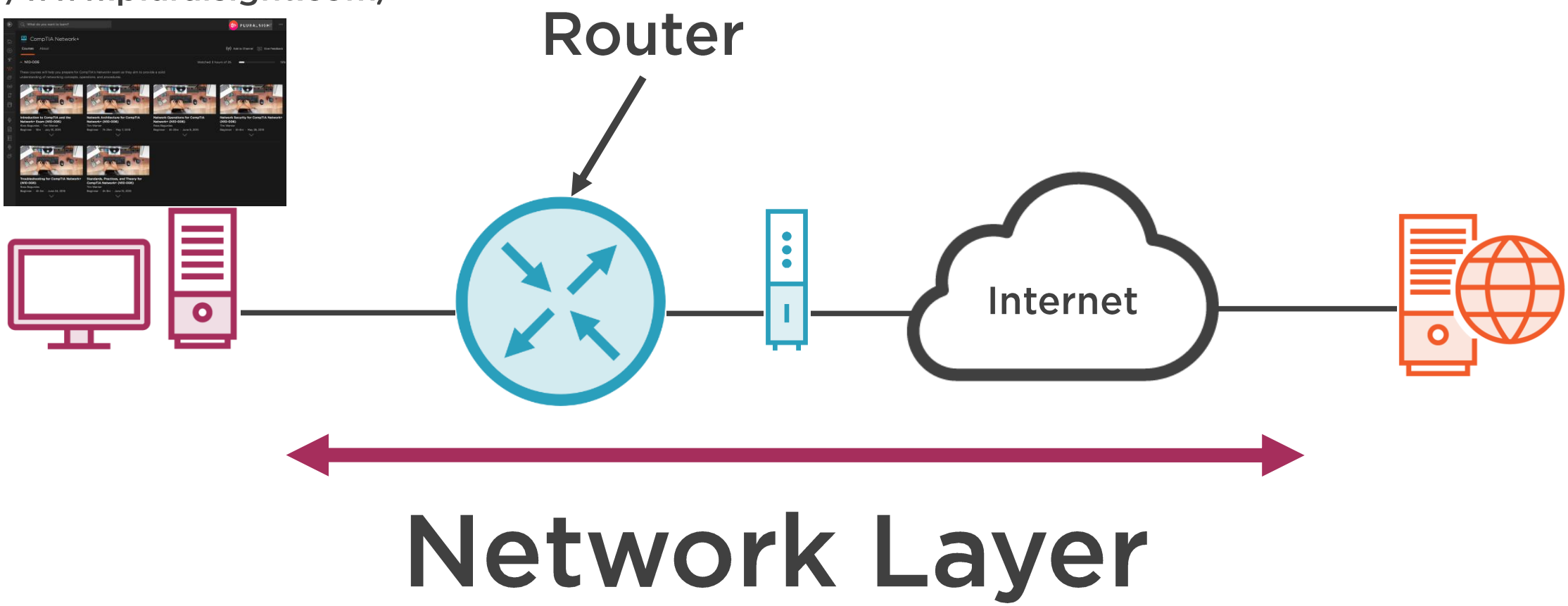

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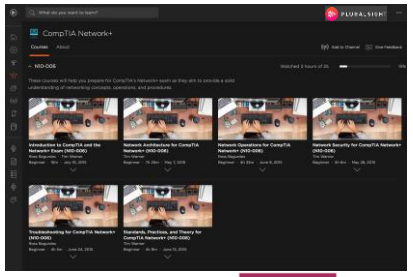
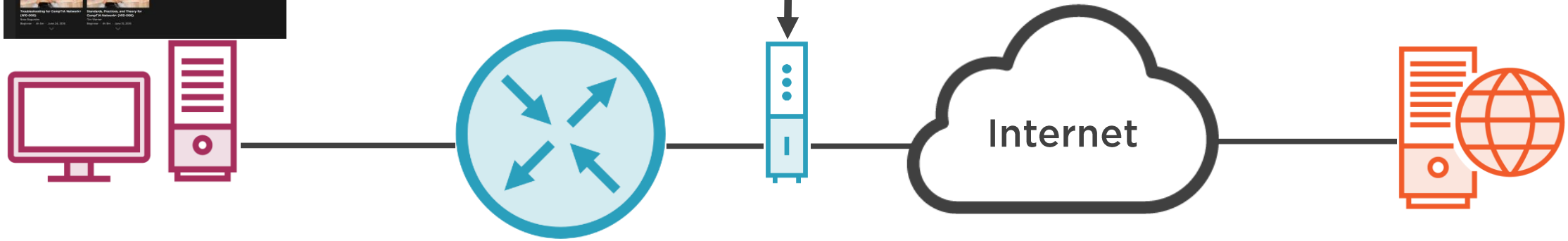


Layer 2 Bridge
Ethernet to DOCSIS



Network Layer

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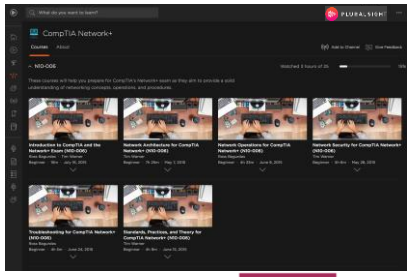

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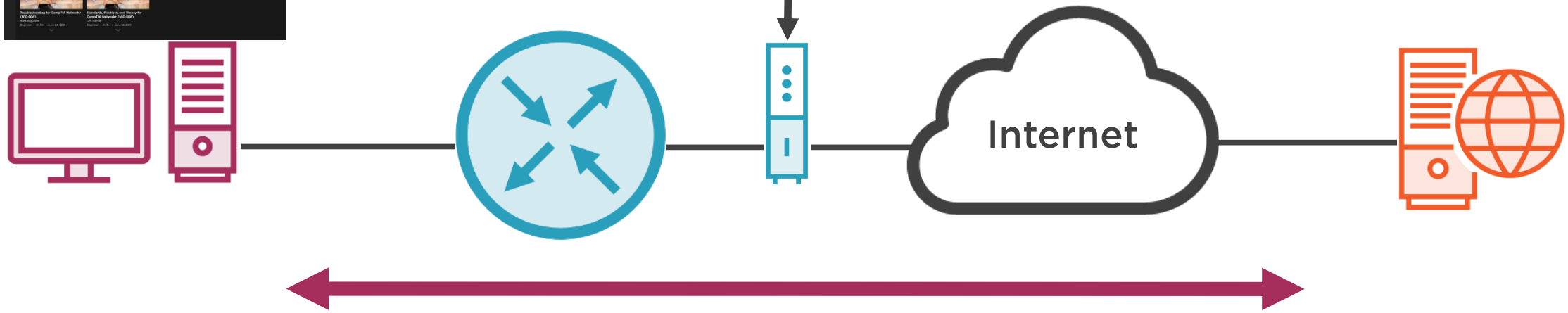

Network Layer

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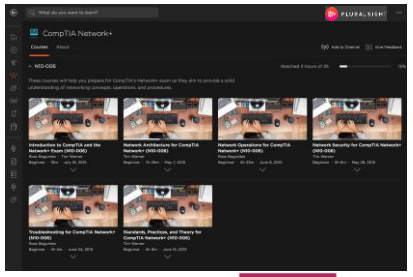

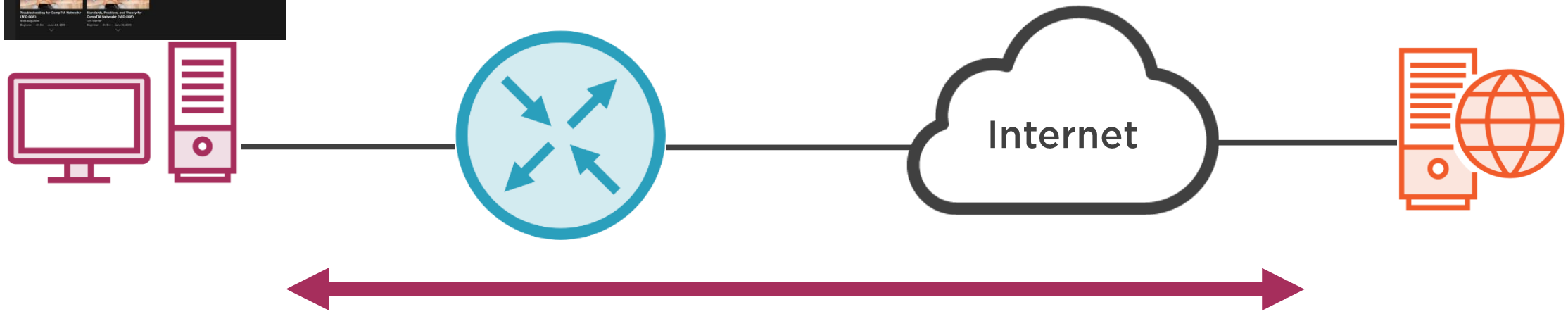

Network Layer

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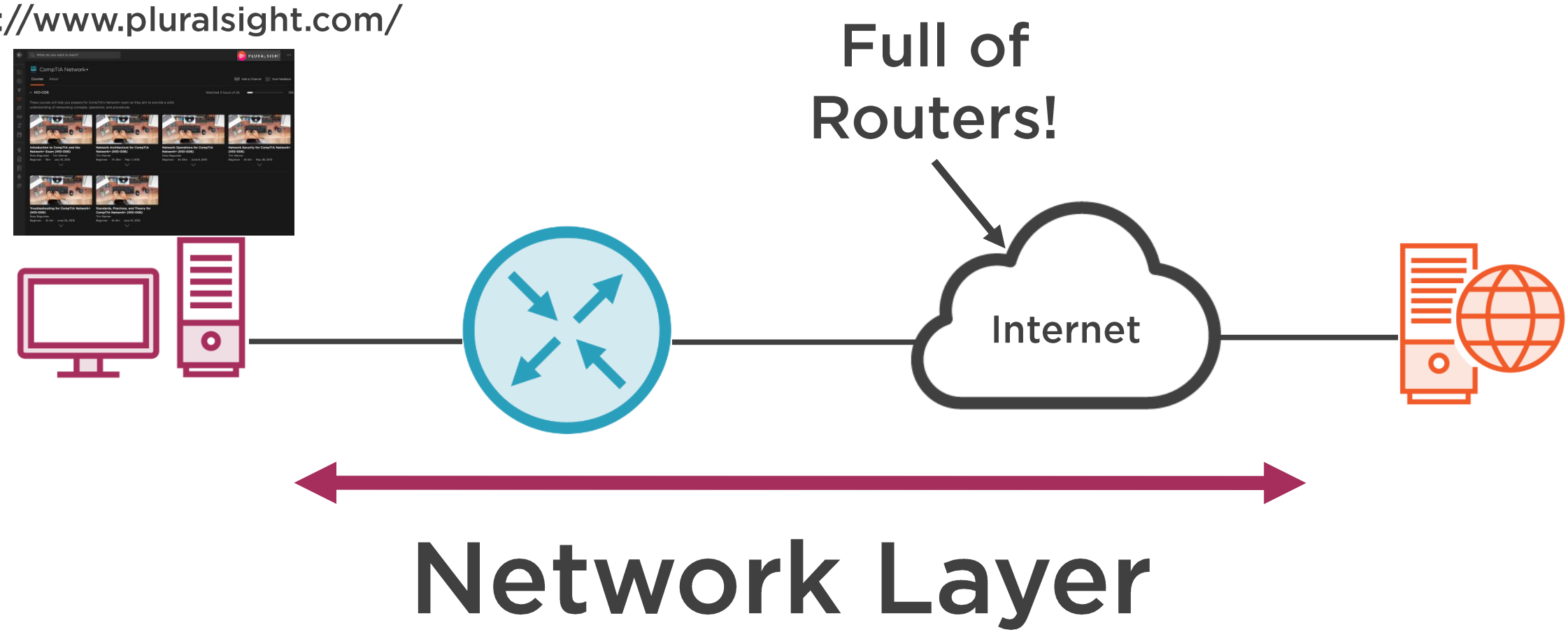
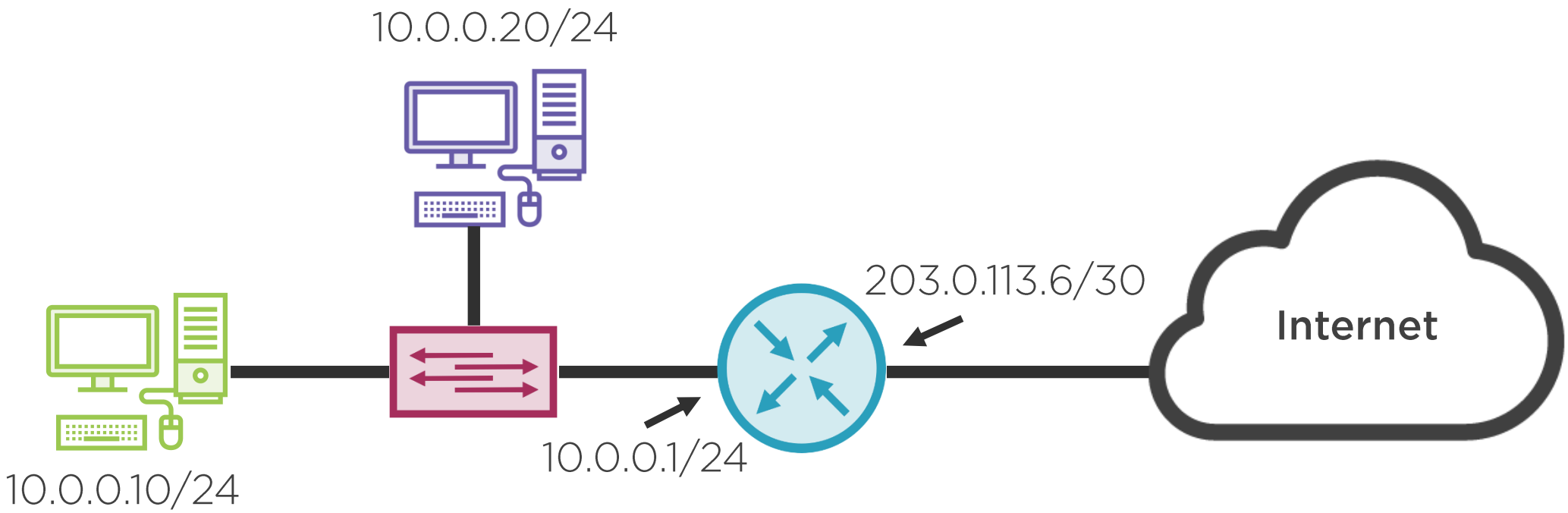


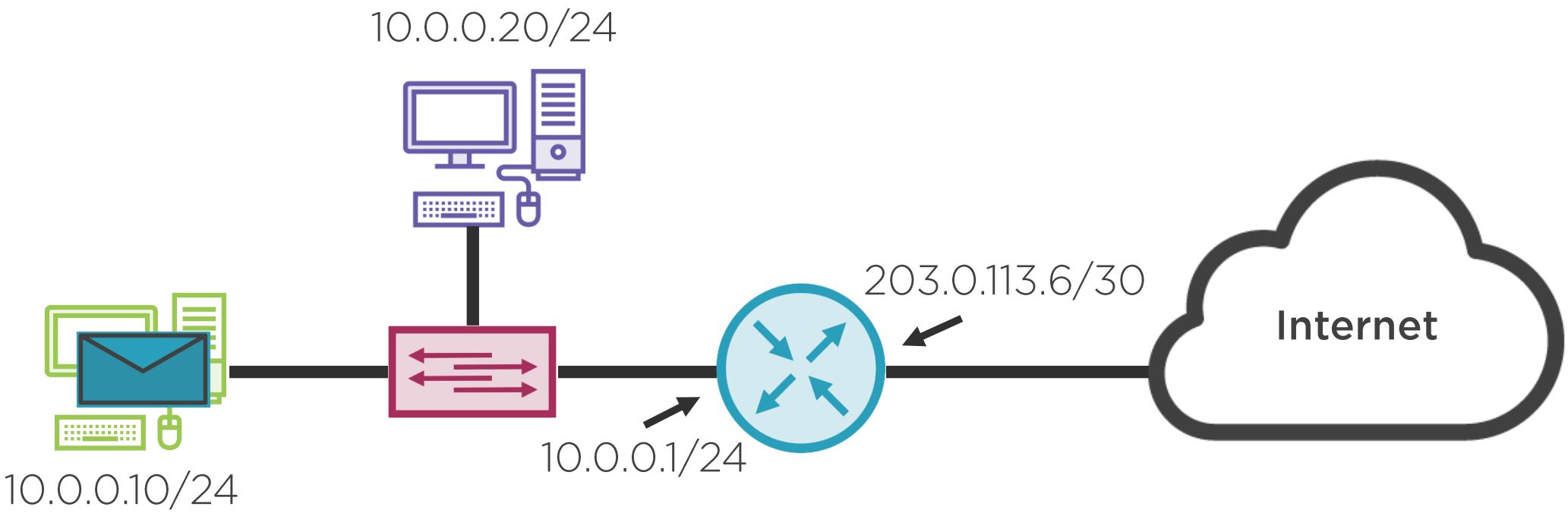
Network Layer

Basic Network

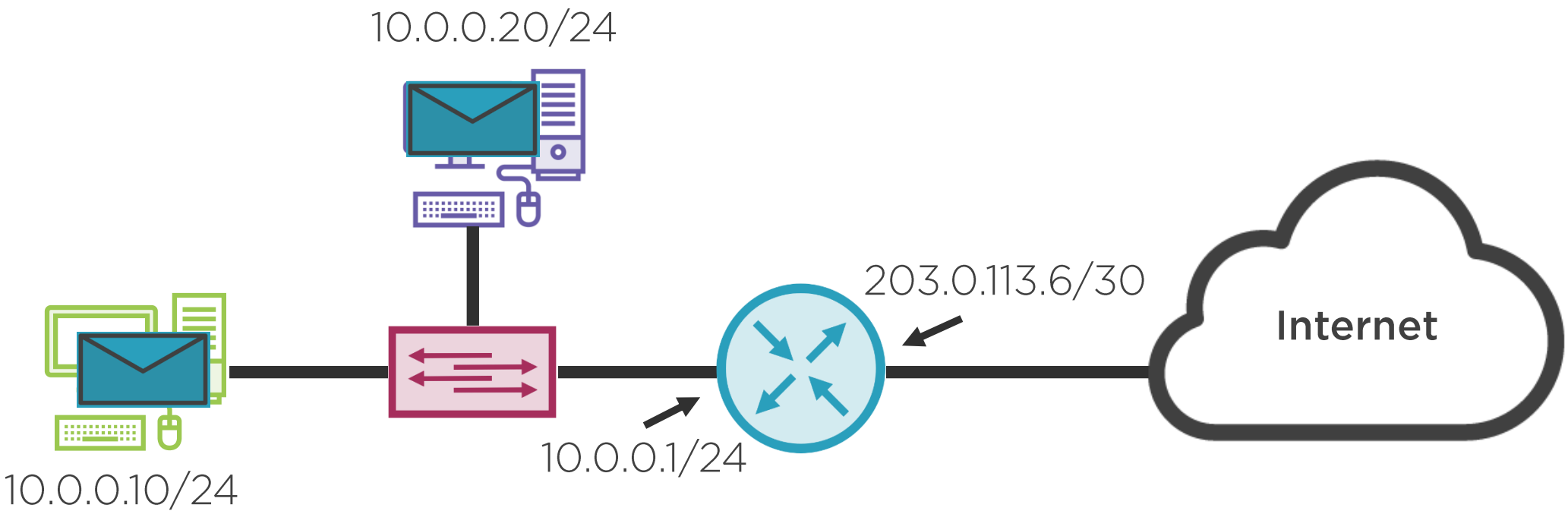
Basic Network



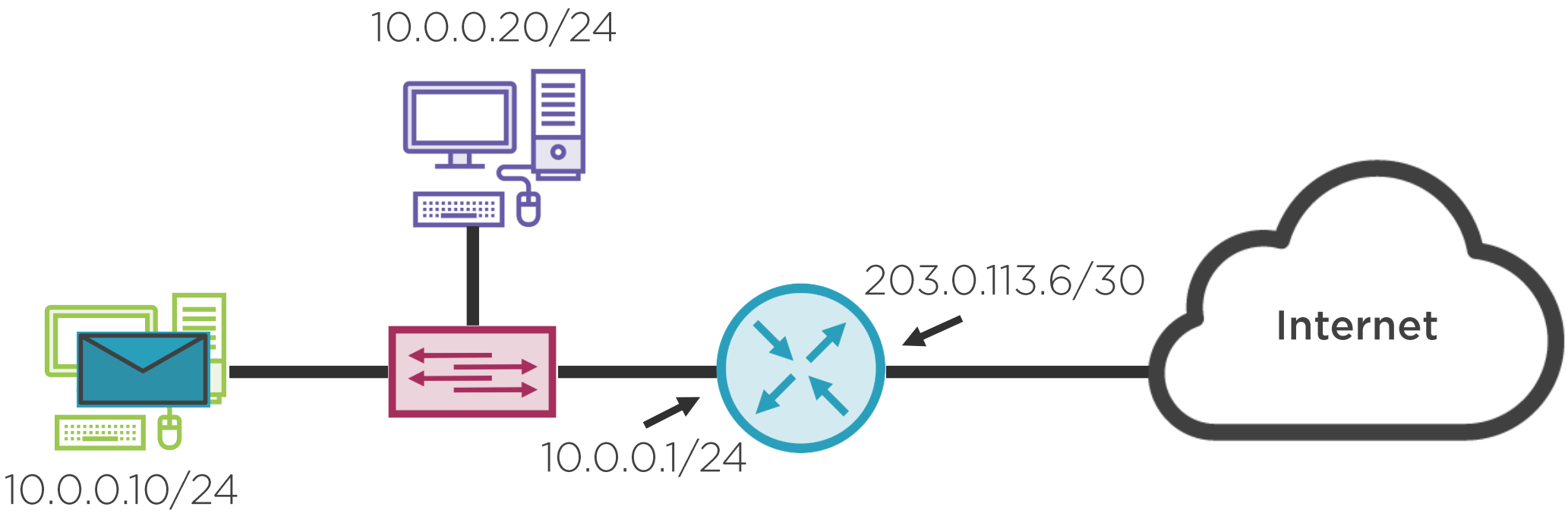
Basic Network



Basic Network



Basic Network



The IP Packet

The IP Packet

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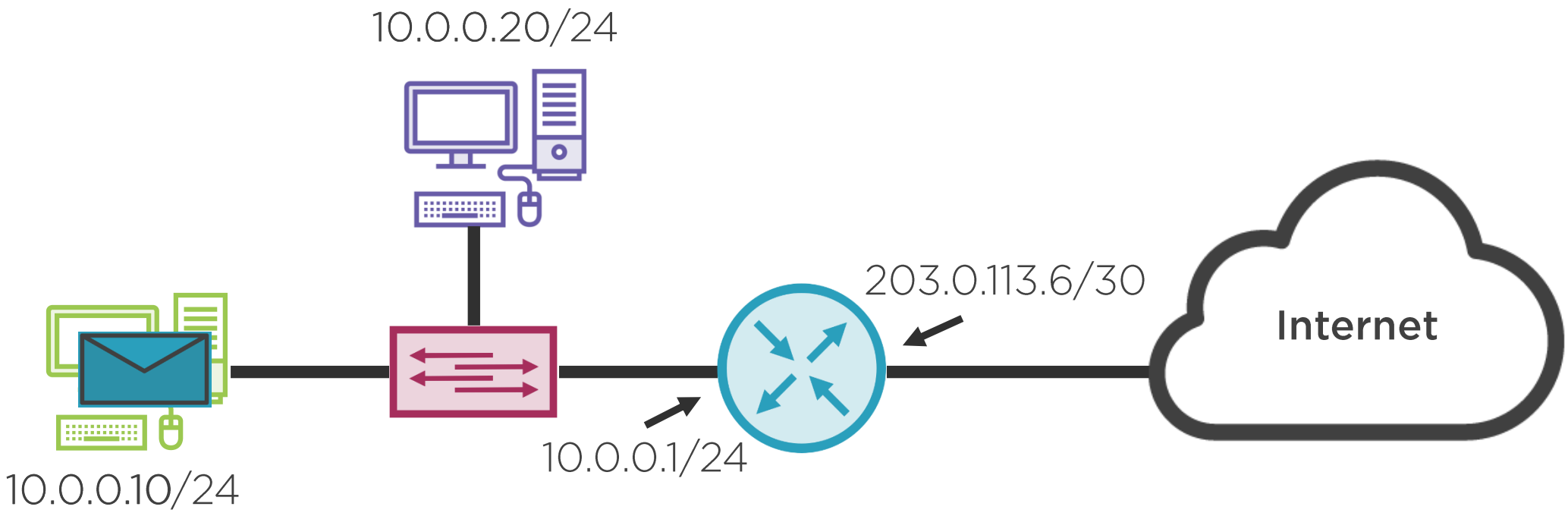
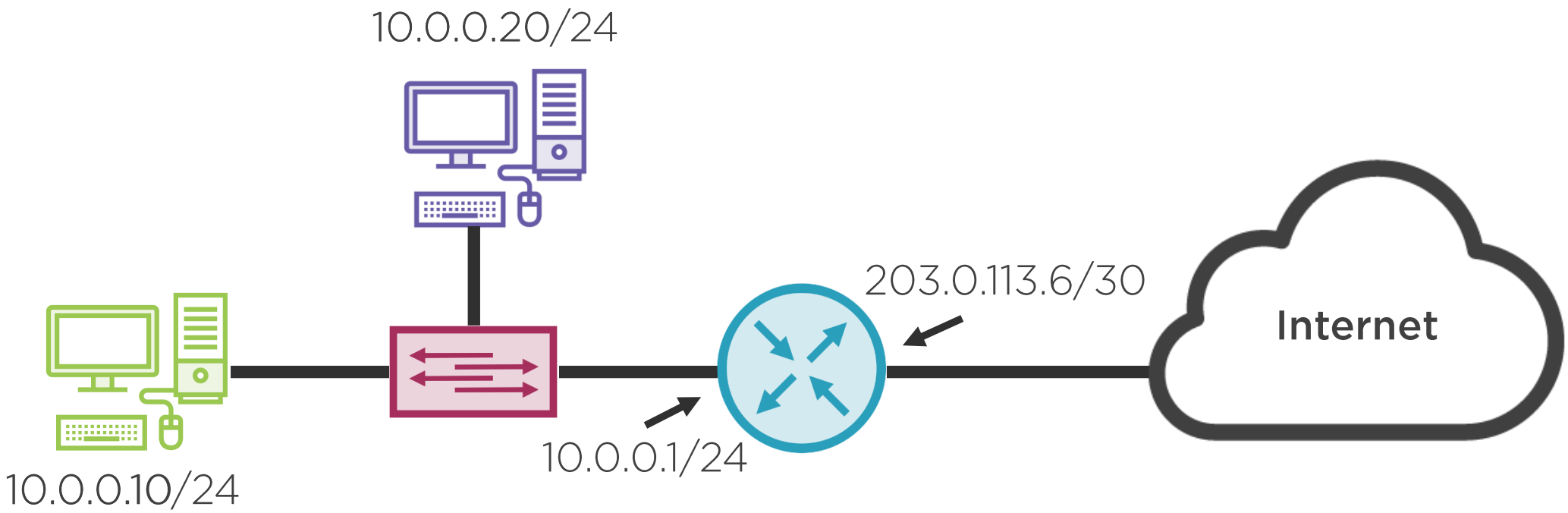
Sending a Ping

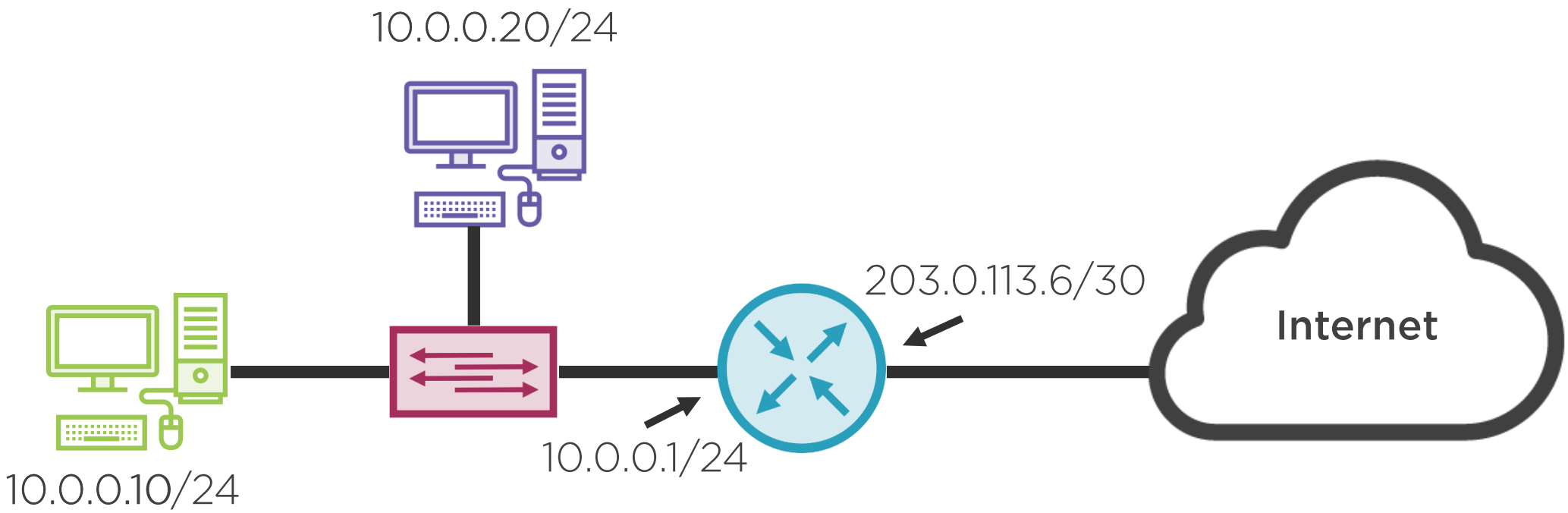


Sending a Ping



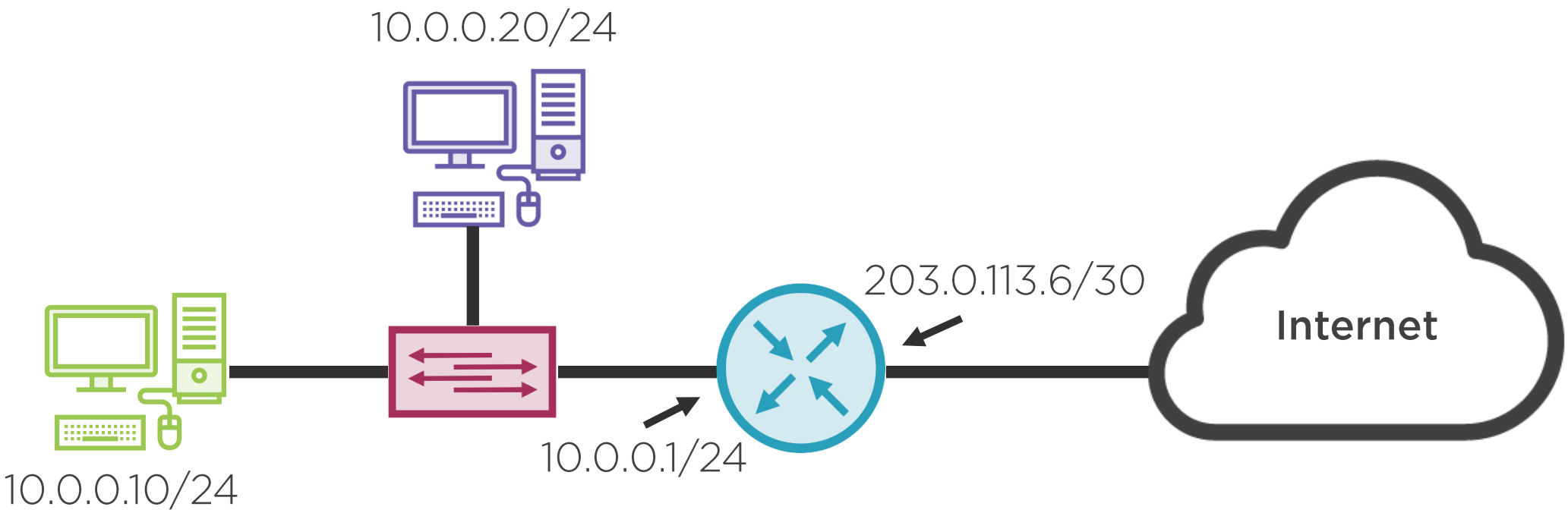
ICMP

Sending a Ping



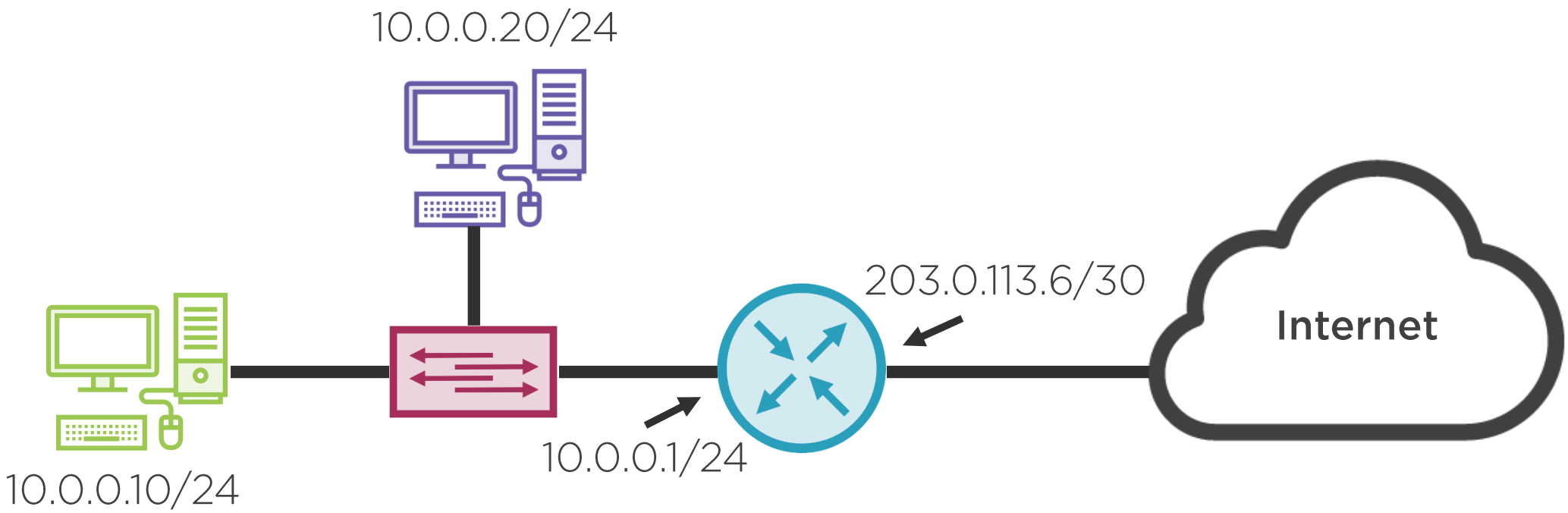
Source IP Address	Destination IP Address	TTL	Other	ICMP

Sending a Ping



10.0.0.10	10.0.0.20	128	Other	ICMP

Sending a Ping



10.0.0.10	10.0.0.20	128	Other	ICMP

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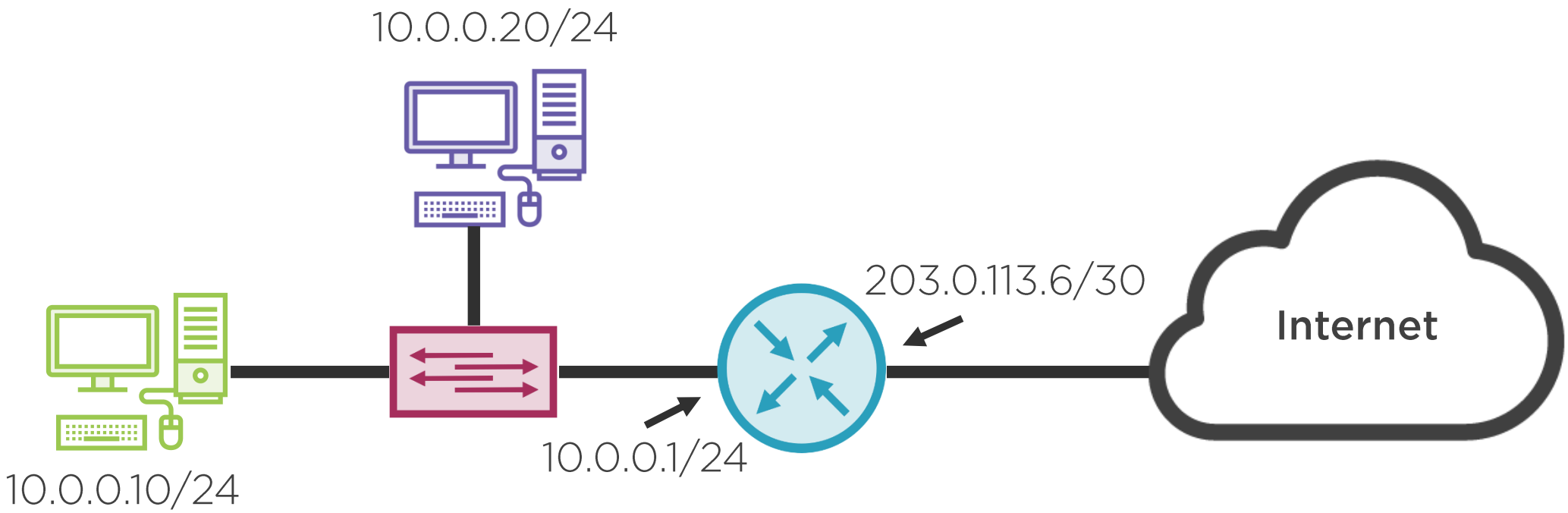

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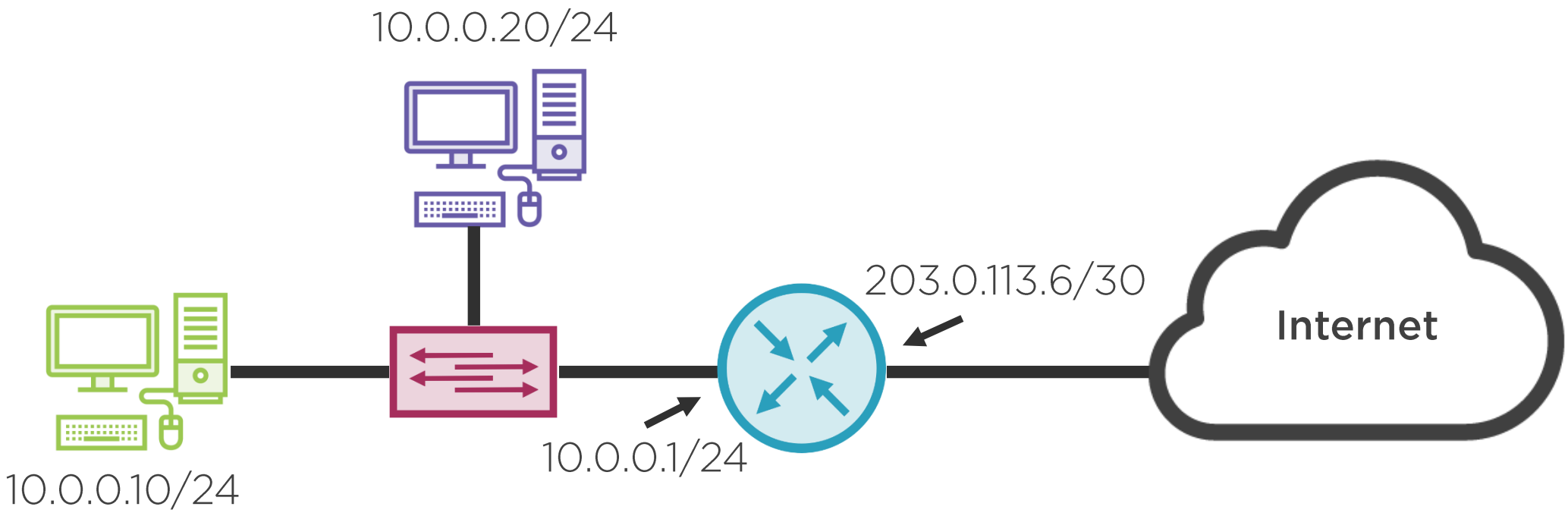
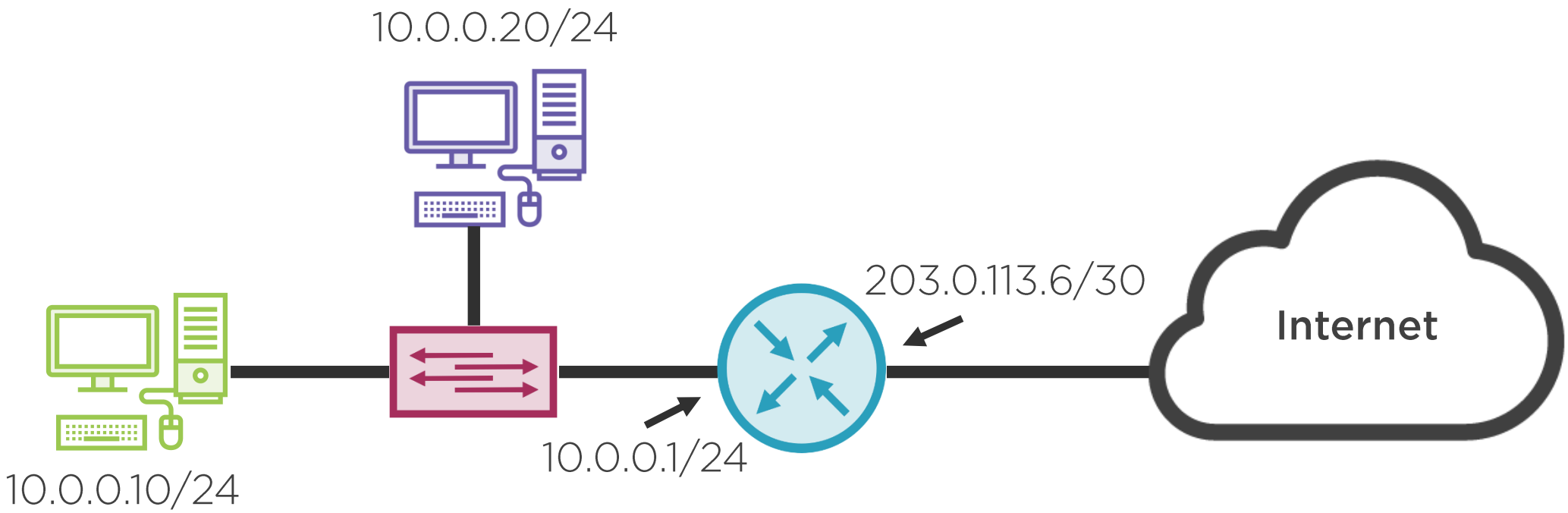
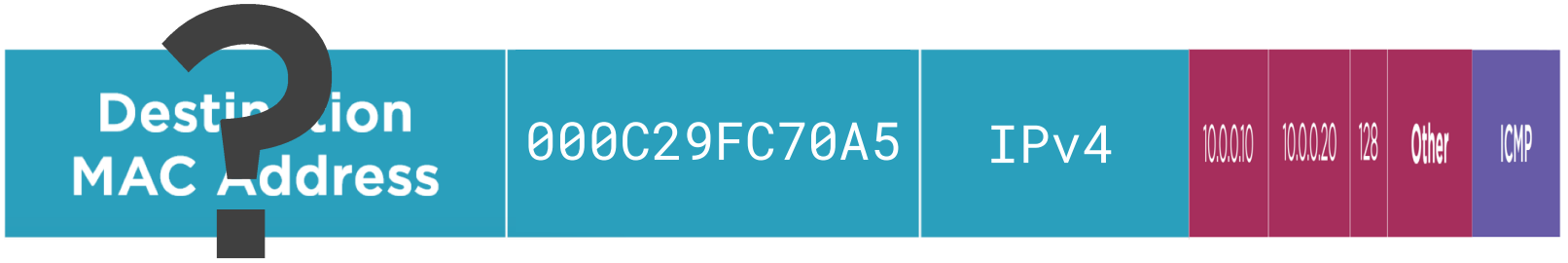


Destination MAC Address	Source MAC Address	Layer 3 Protocol	10.0.0.10	10.0.0.20	128	Other	ICMP

Basic Network

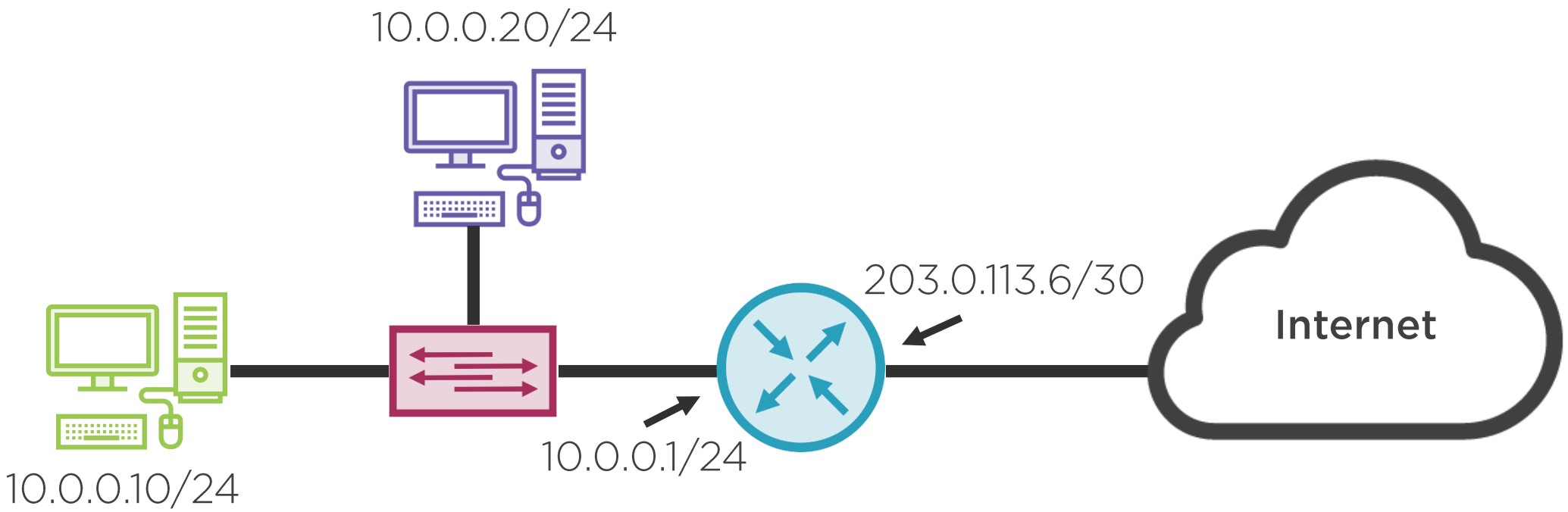




Address Resolution Protocol

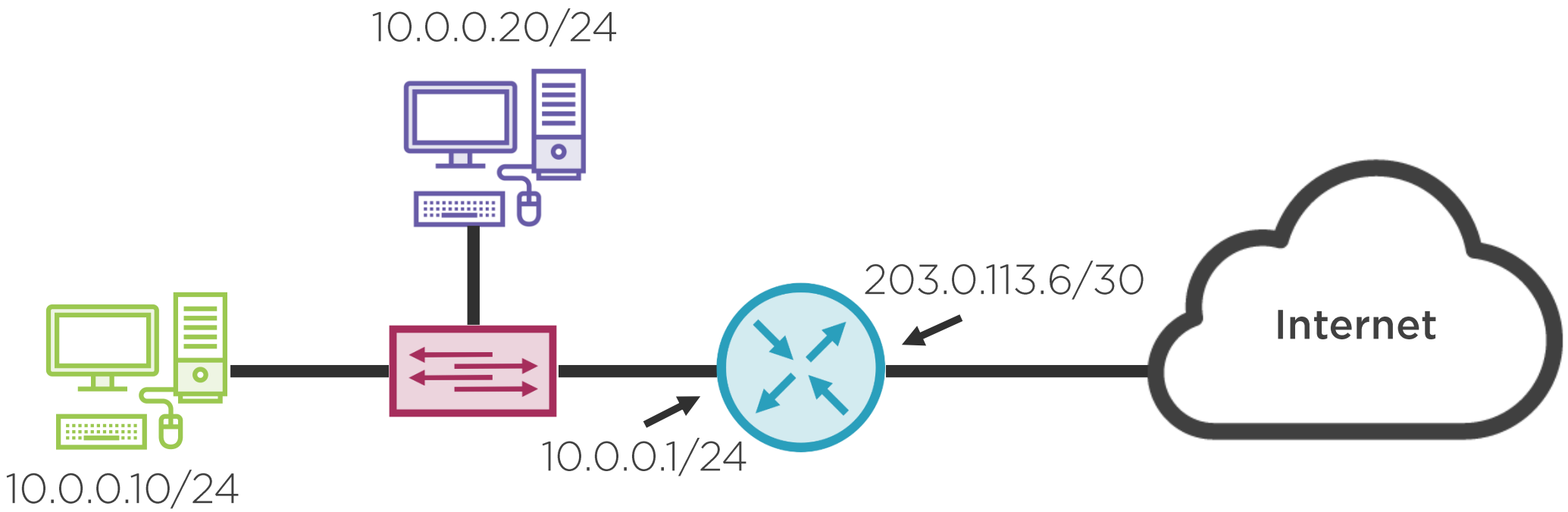
ARP to the rescue!

ARP



Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP

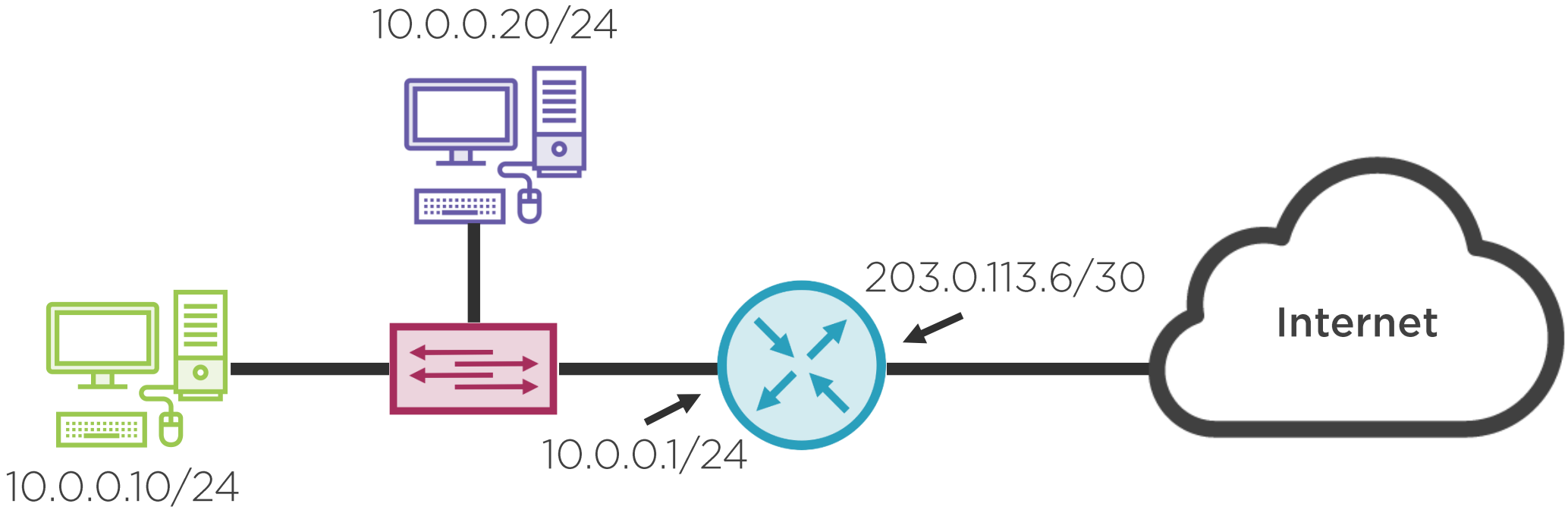
ARP


10.0.0.20/24
203.0.113.6/30
Internet
10.0.0.1/24
10.0.0.10/24

Destination MAC Address
000C29FC70A5
IPv4
10.0.0.10
10.0.0.20
128
Other
ICMP

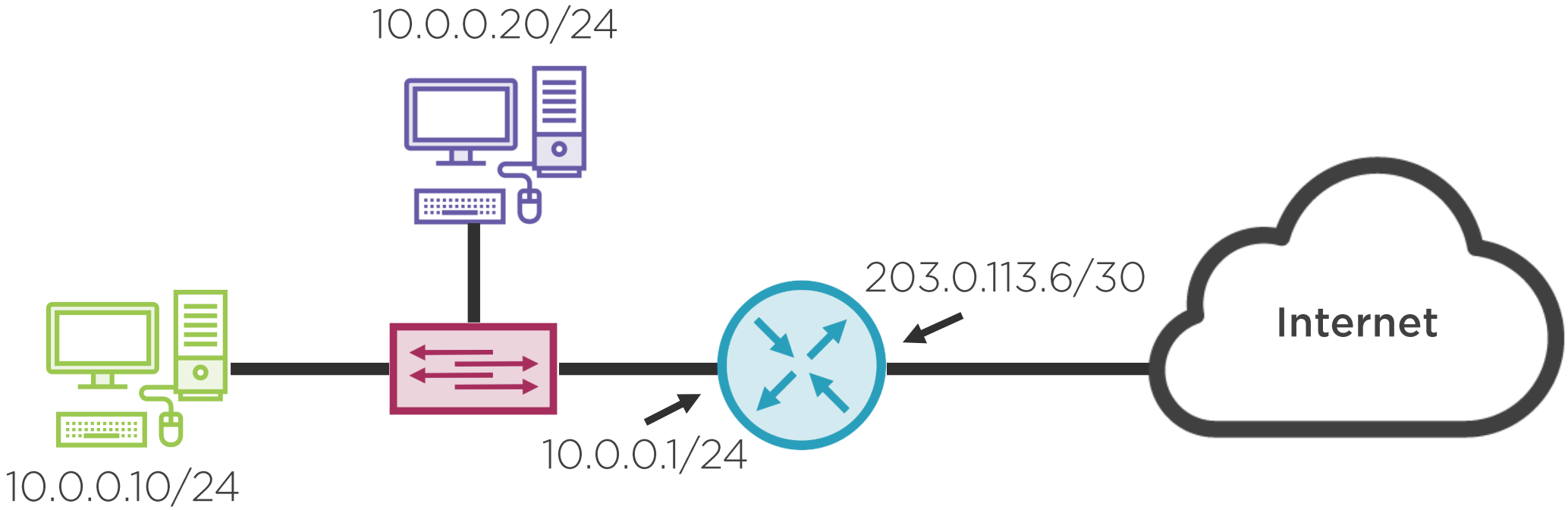
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



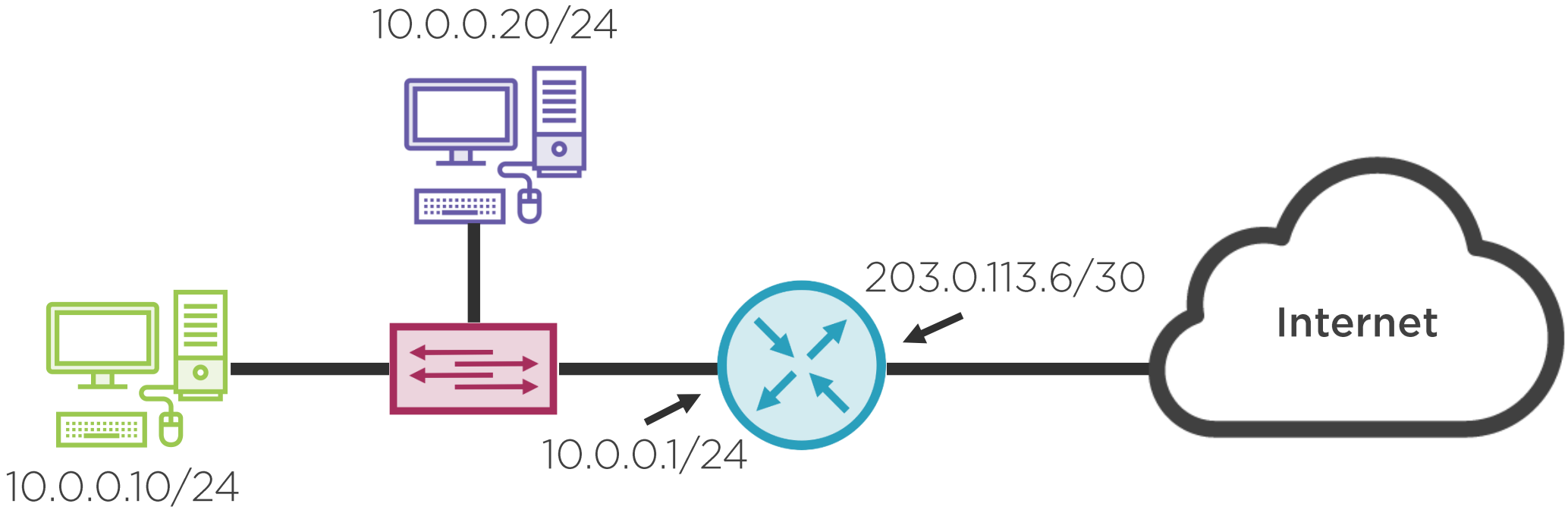
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



ARP

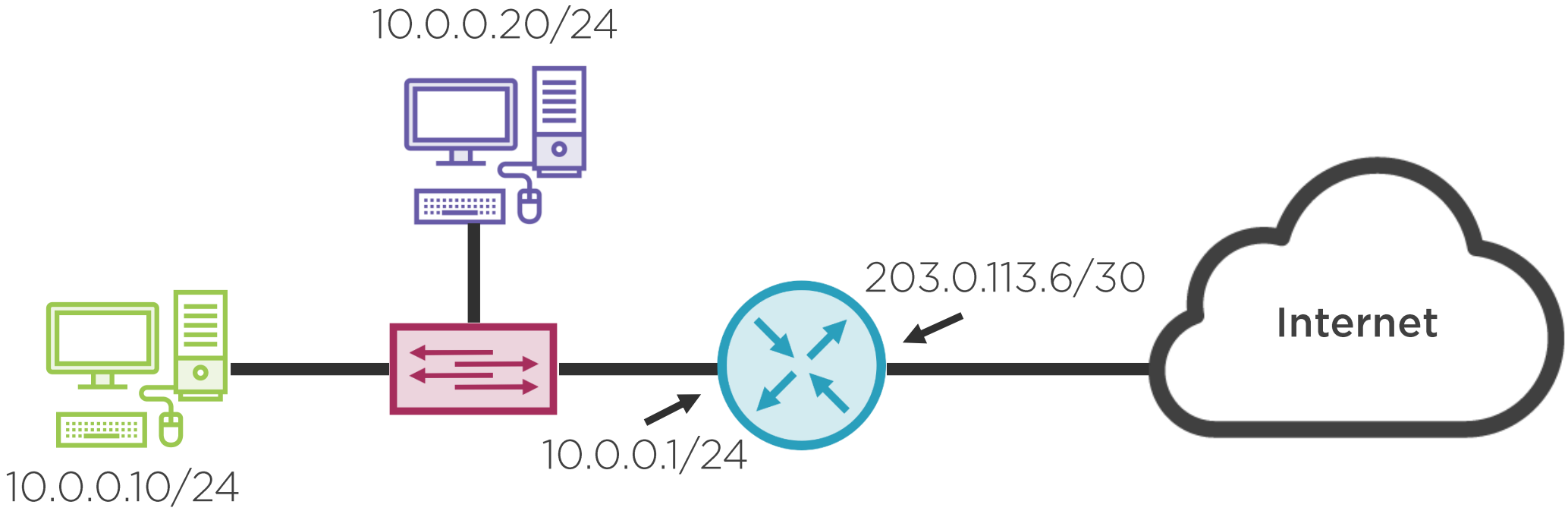
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



Destination MAC Address	Source MAC Address	ARP	Who Has 10.0.0.20?

ARP

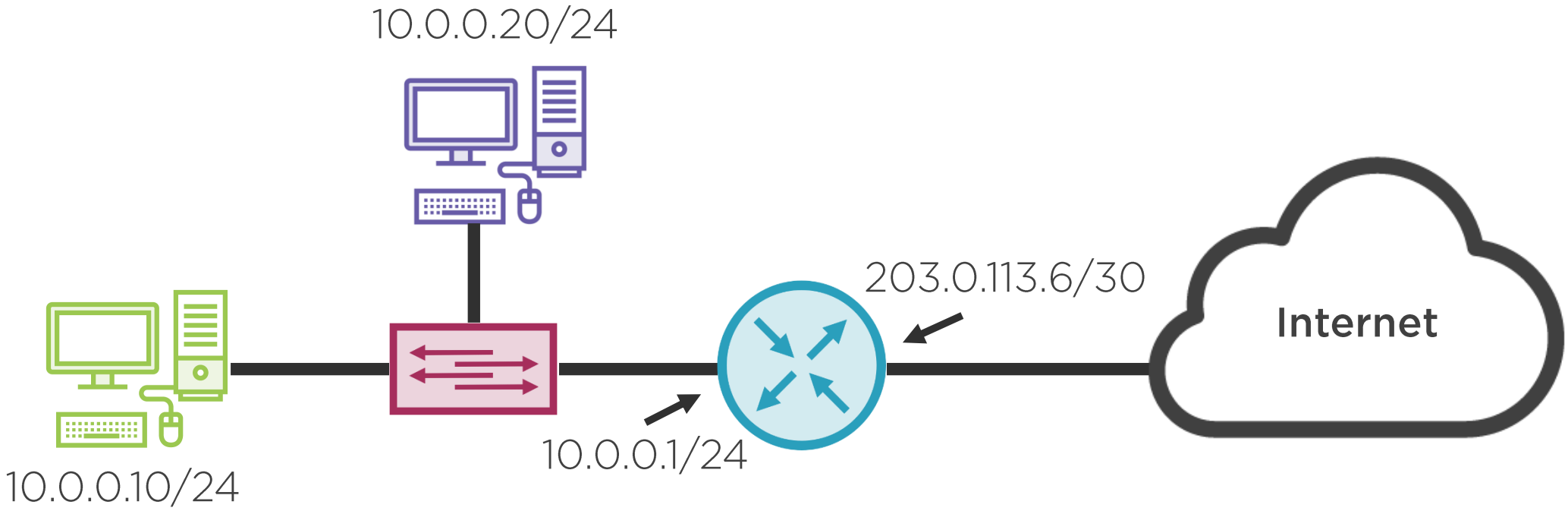
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



Destination MAC Address	000C29FC70A5	ARP	Who Has 10.0.0.20?

ARP

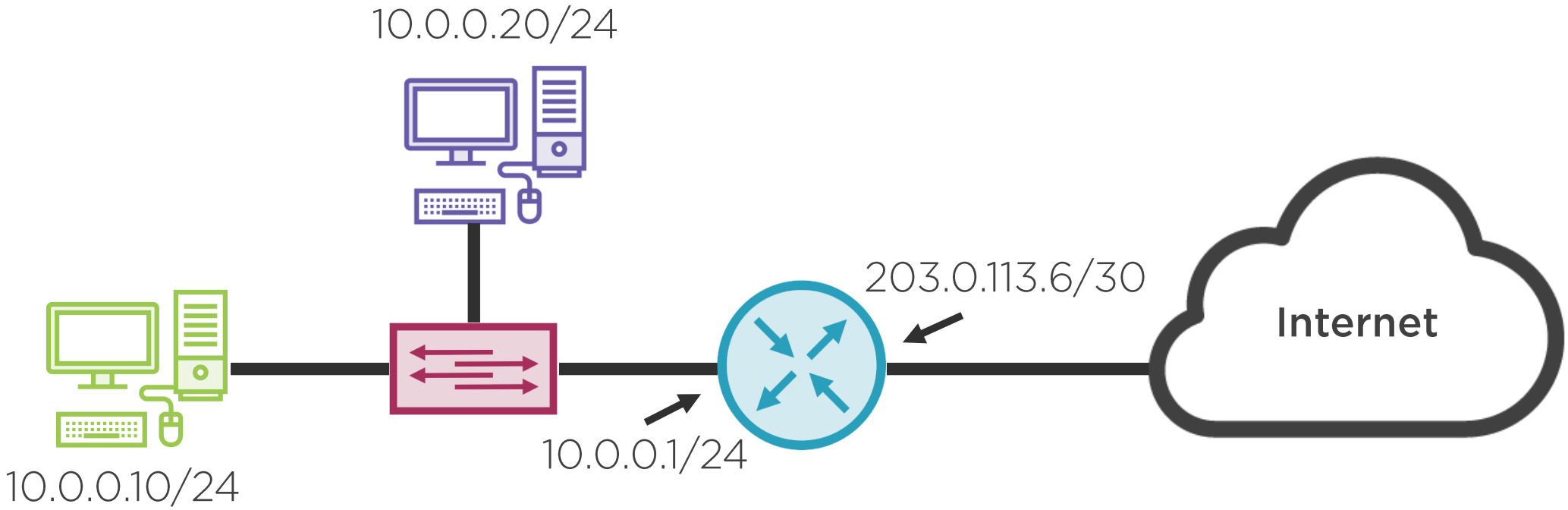
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



Destination MAC Address	000C29FC70A5	ARP	Who Has 10.0.0.20?

ARP

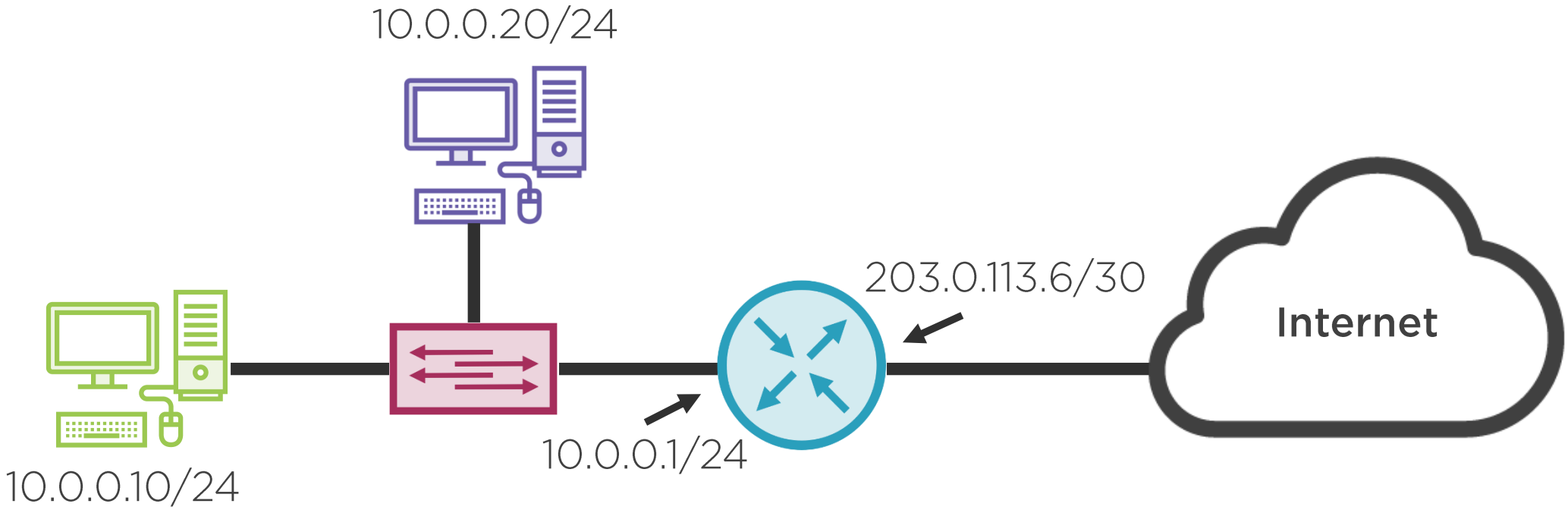
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



FFFFFFFFFFFF	000C29FC70A5	ARP	Who Has 10.0.0.20?

ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



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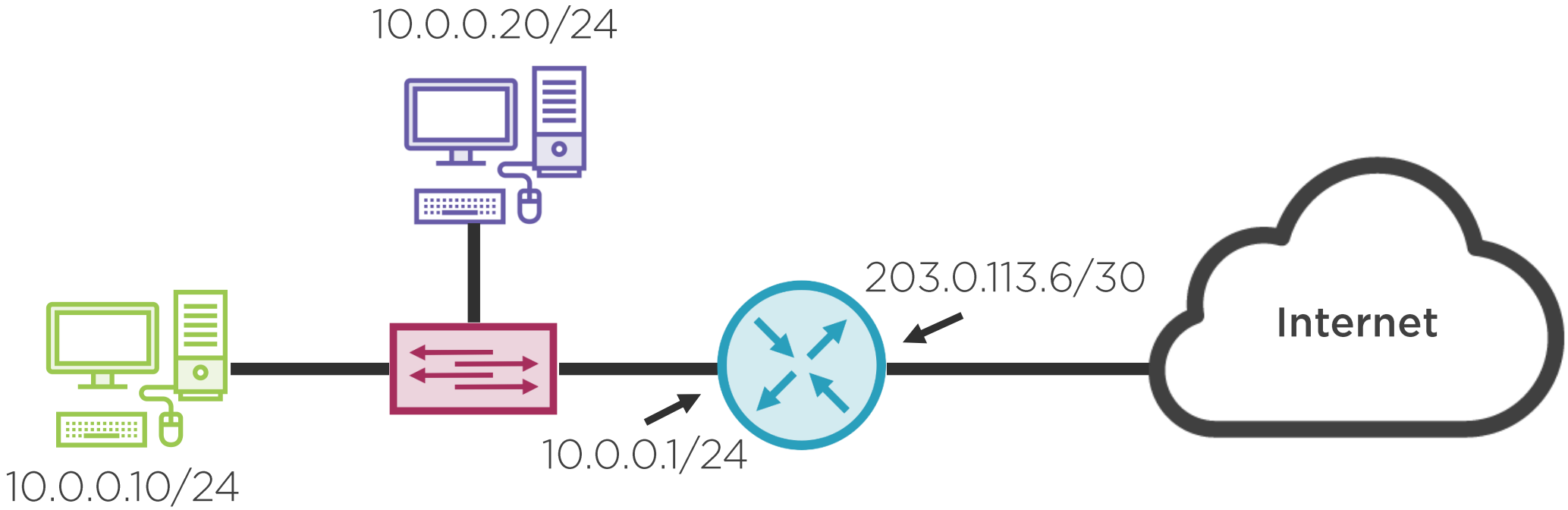
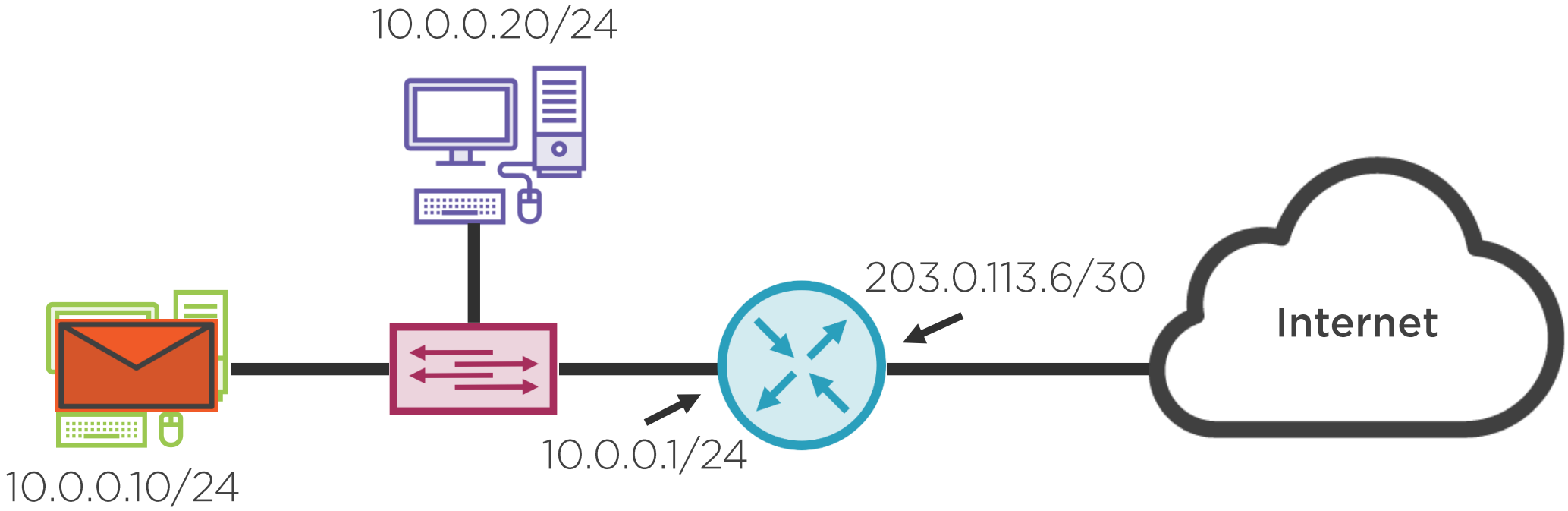


FFFFFFFFFFFF	000C29FC70A5	ARP	Who Has 10.0.0.20?

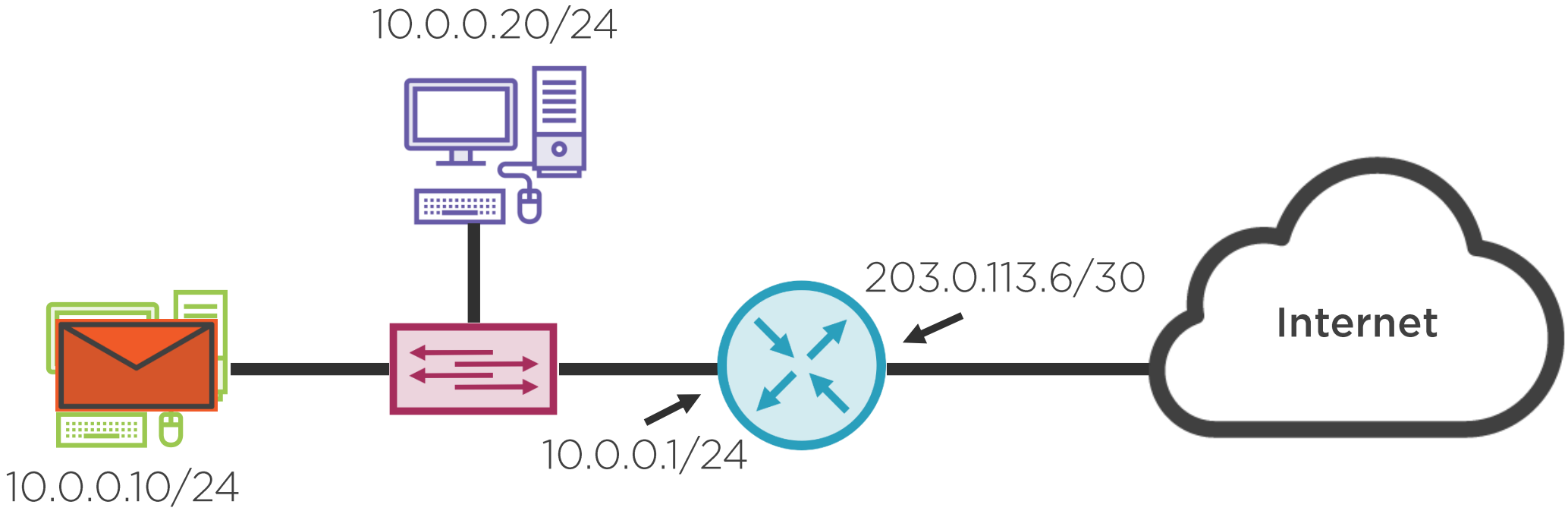
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



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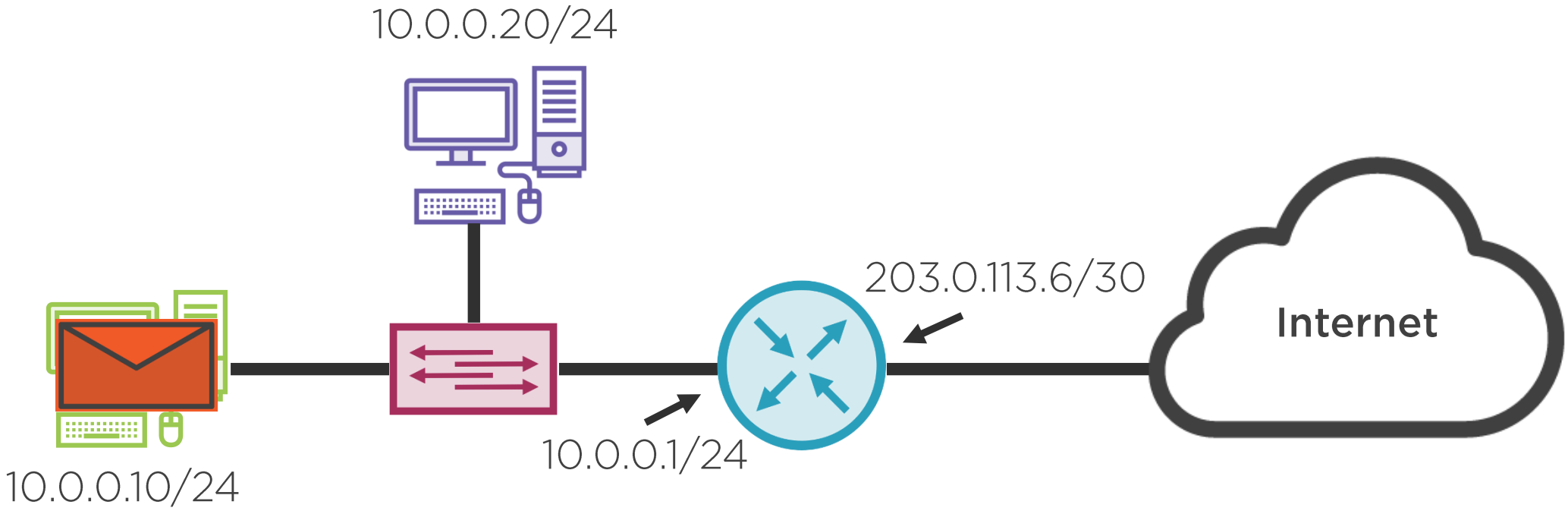
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



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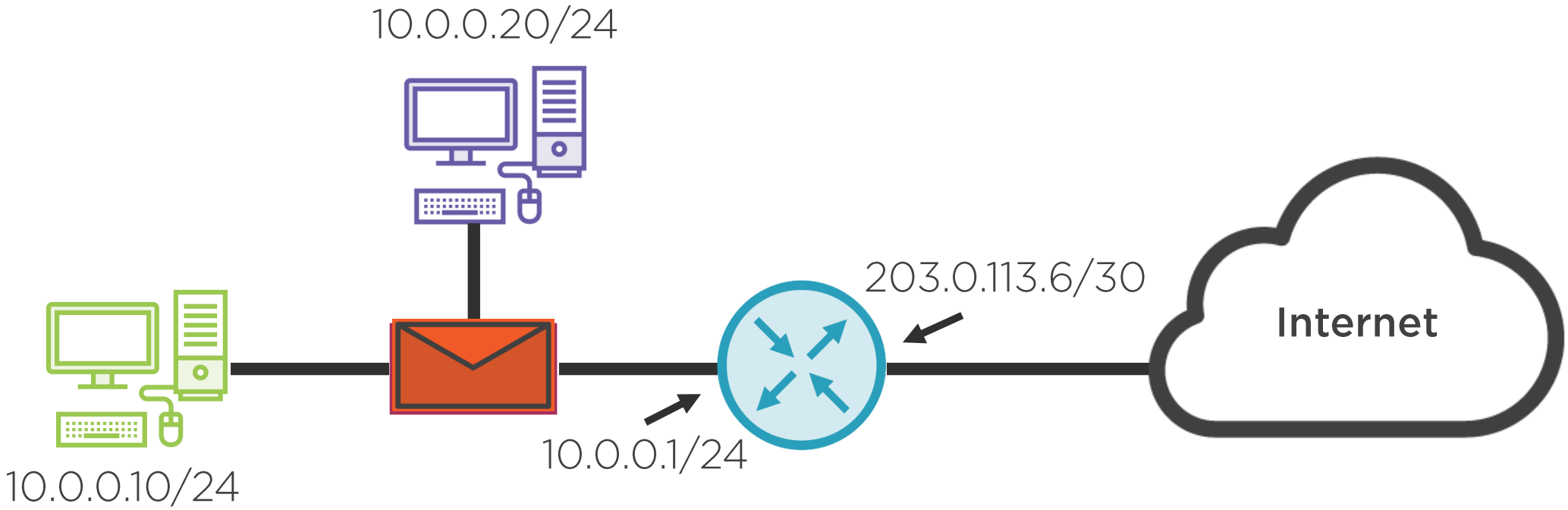

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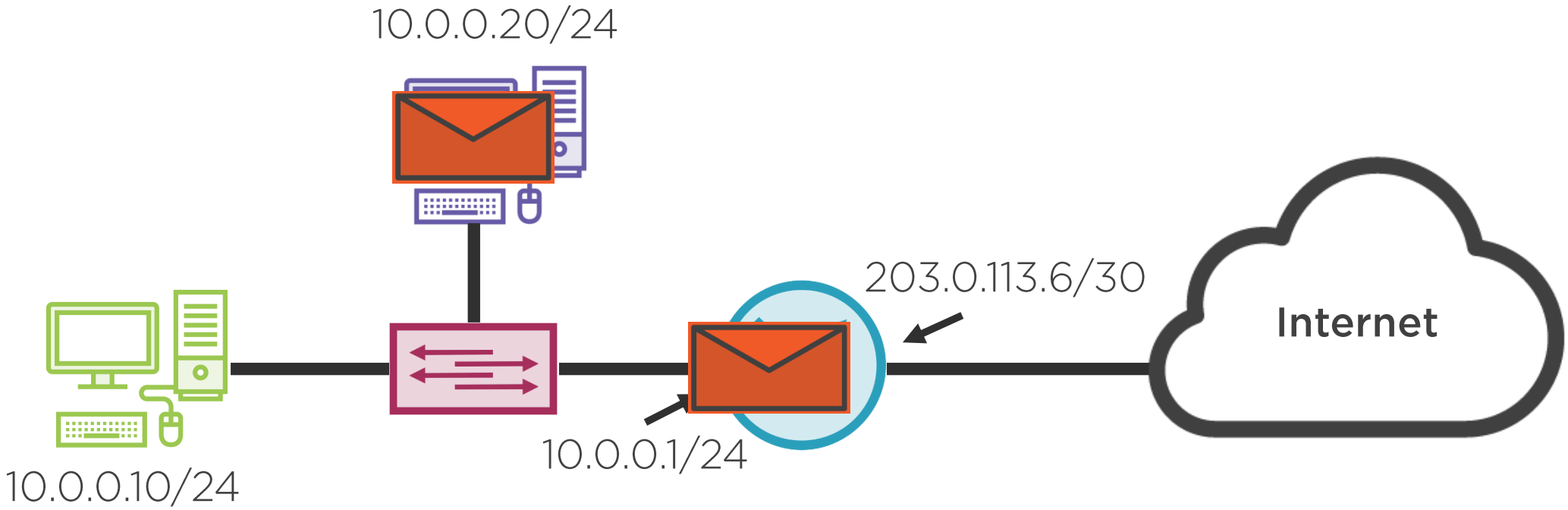
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



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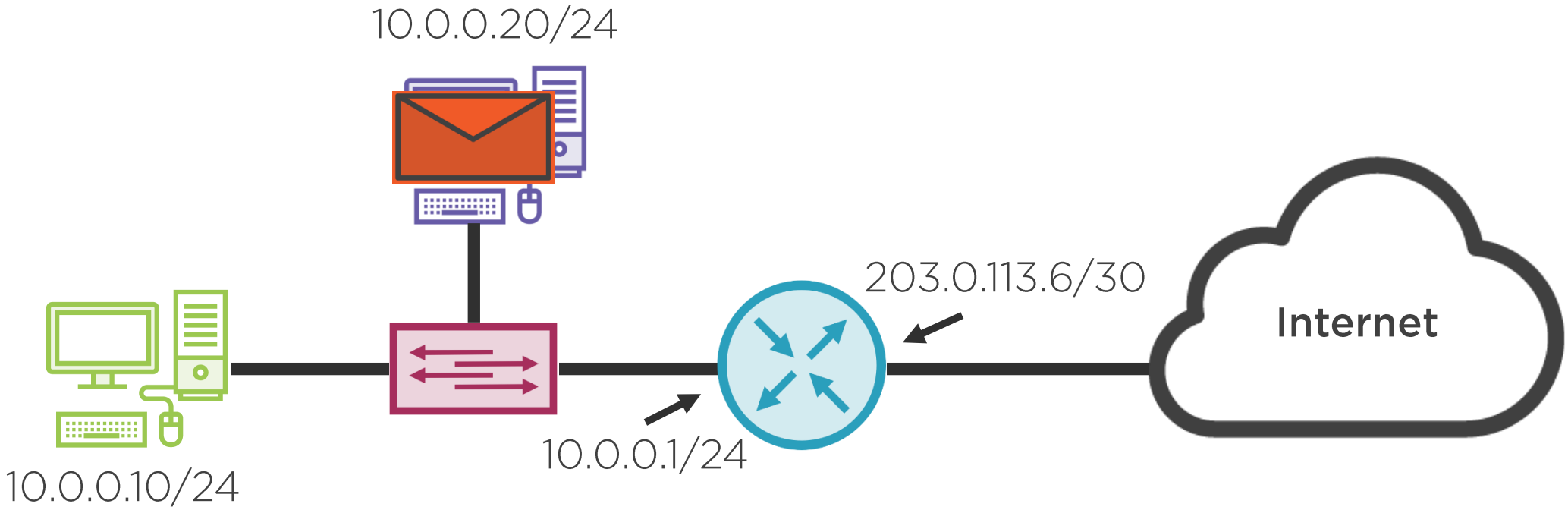
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



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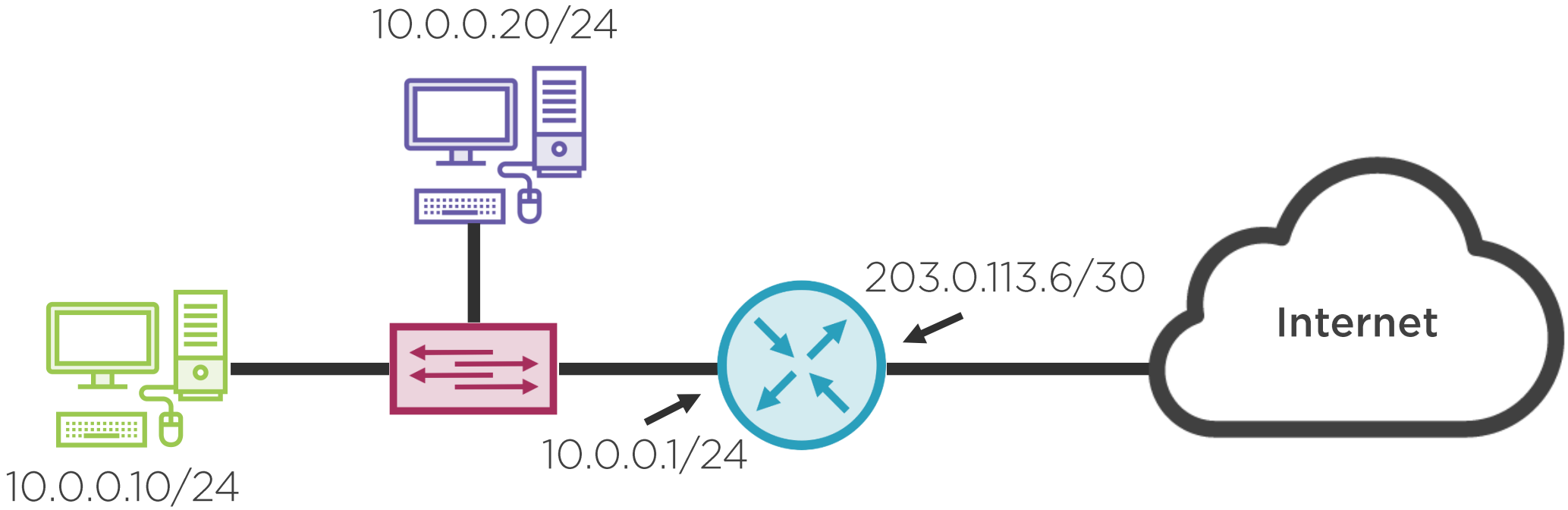
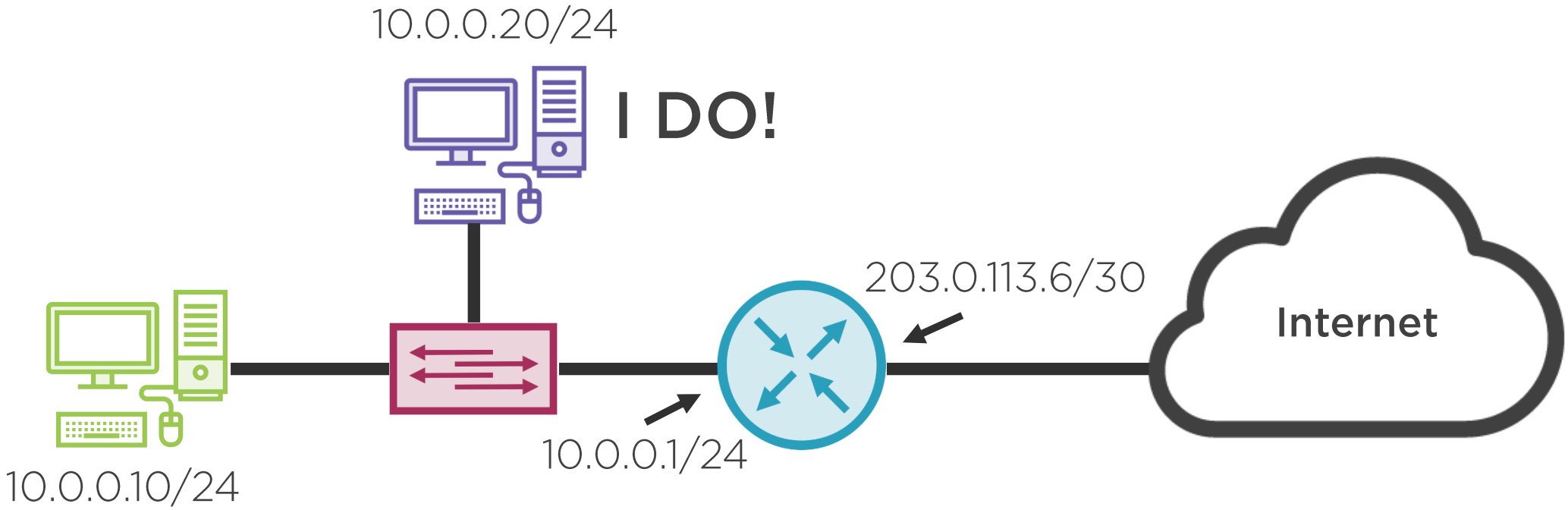
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



FFFFFFFFFFFF	000C29FC70A5	ARP	Who Has 10.0.0.20?

ARP

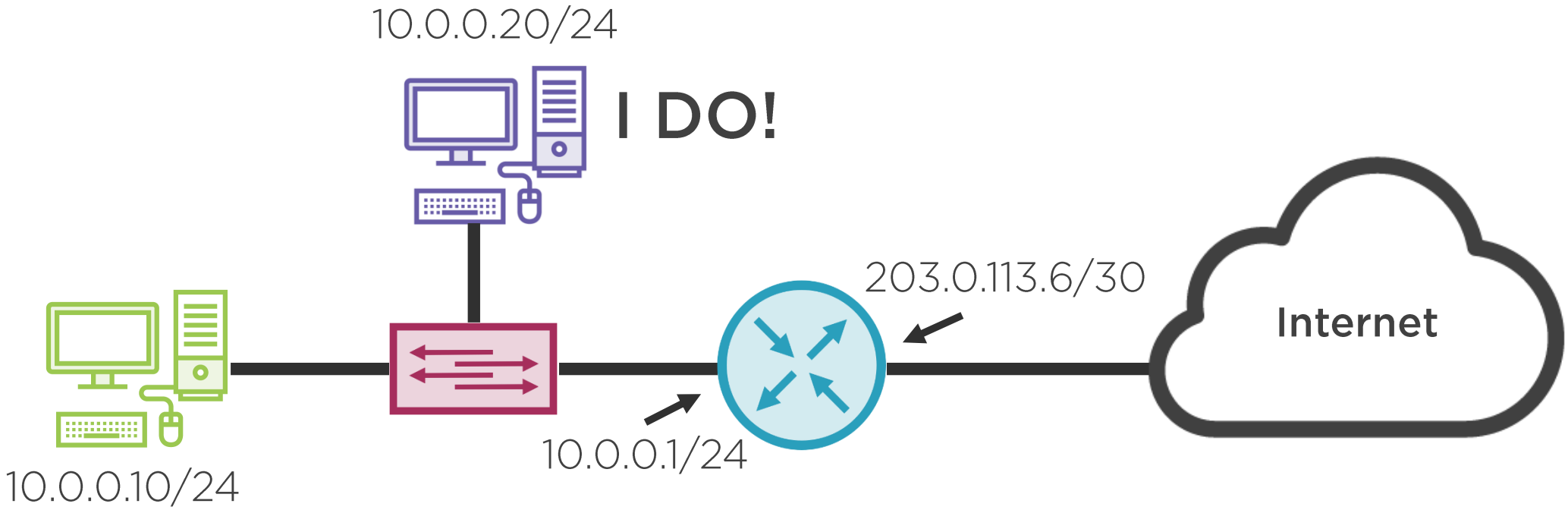
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



FFFFFFFFFFFF	000C29FC70A5	ARP	Who Has 10.0.0.20?

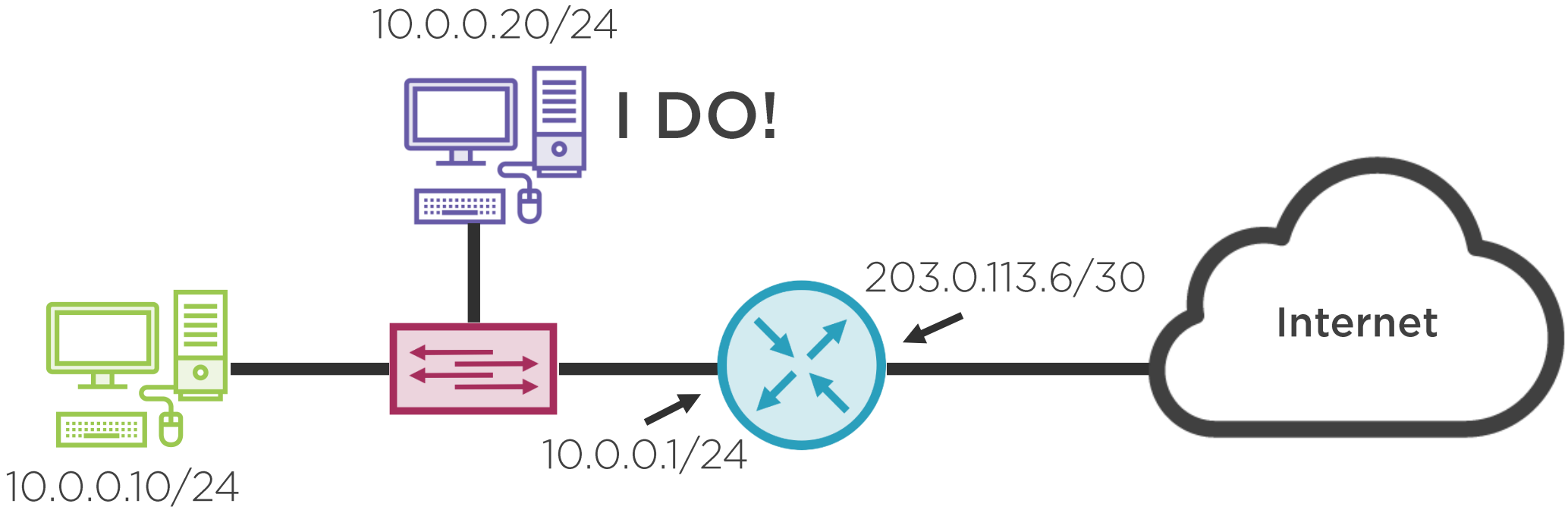
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



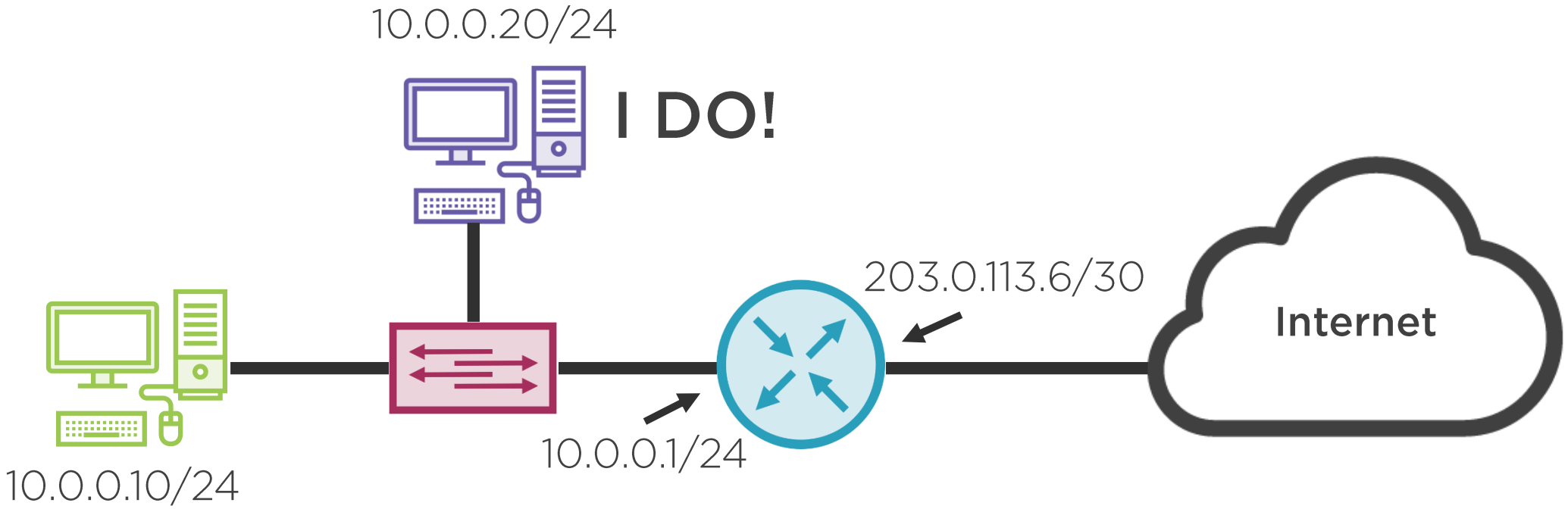
ARP

Destination MAC Address
000C29FC70A5
IPv4
10.0.0.10
10.0.0.20
128
Other
ICMP


10.0.0.20/24
I DO!
203.0.113.6/30
Internet
10.0.0.1/24
10.0.0.10/24

Destination MAC Address
Source MAC Address
ARP

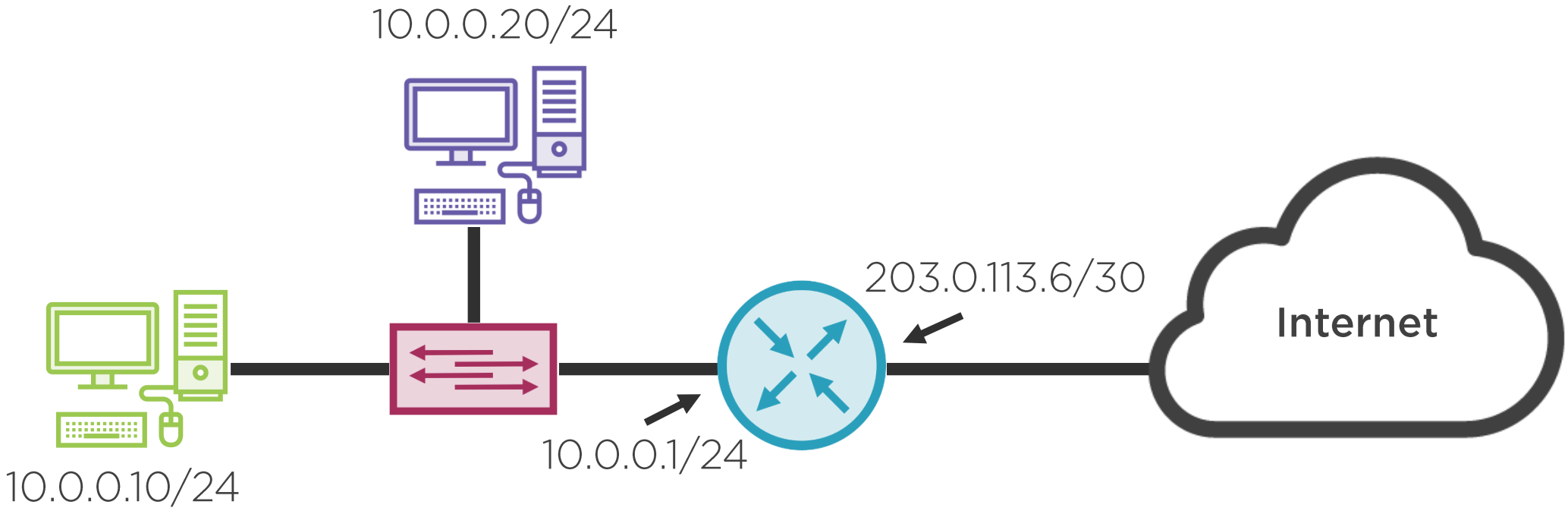
ARP



Destination MAC Address	Source MAC Address	ARP	000C29C78B22

ARP

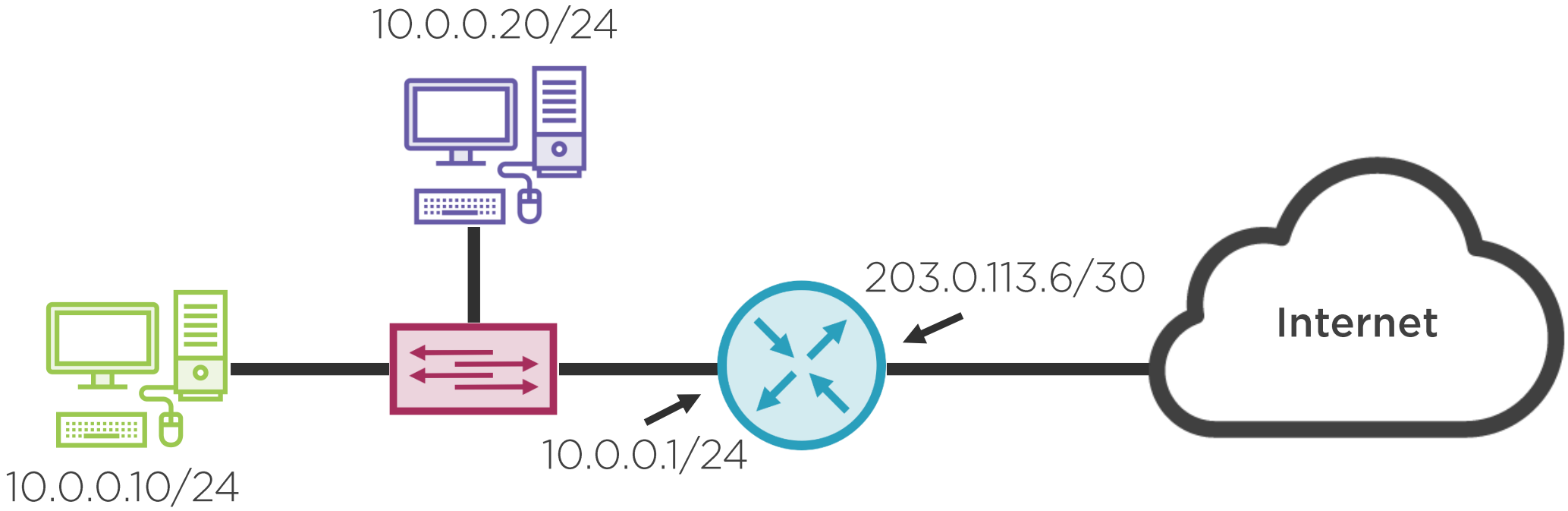
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



Destination MAC Address	Source MAC Address	ARP	000C29C78B22

ARP

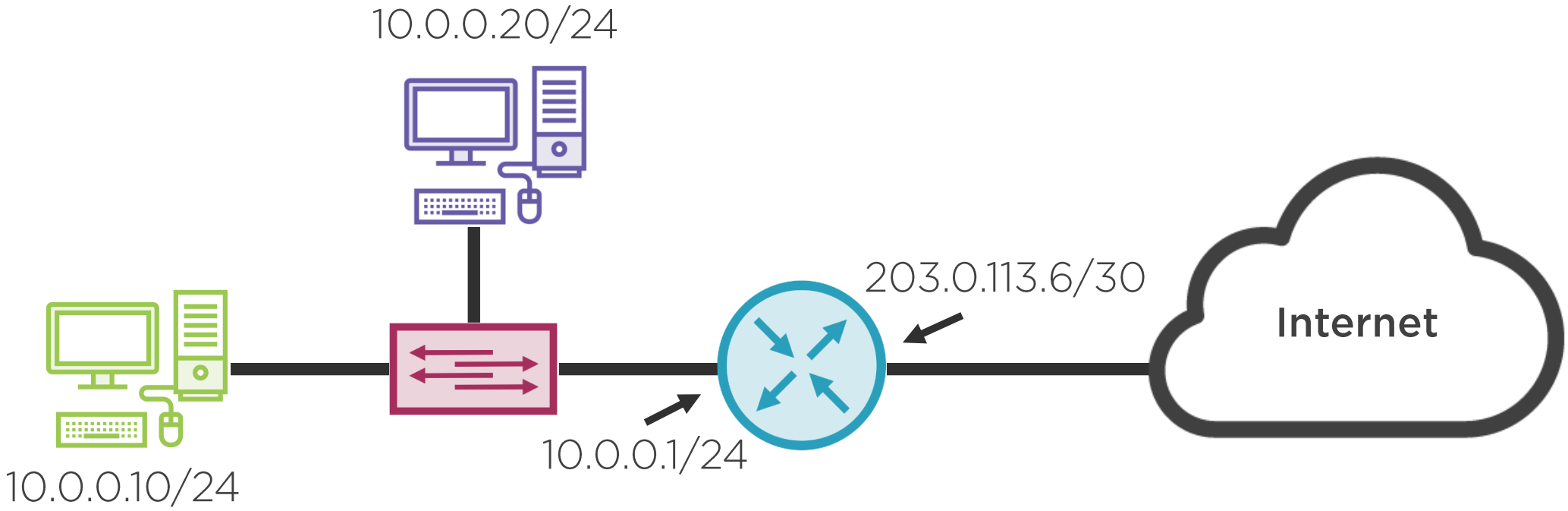
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



Destination MAC Address	000C29C78B22	ARP	000C29C78B22

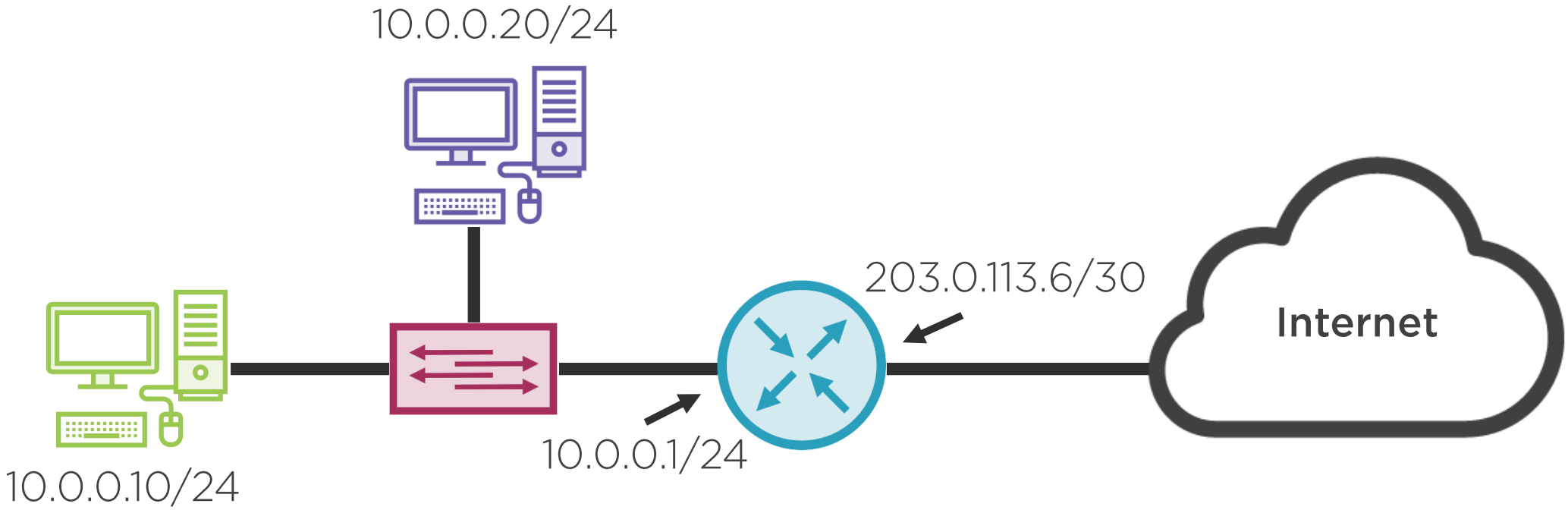
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



000C29FC70A5	000C29C78B22	ARP	000C29C78B22

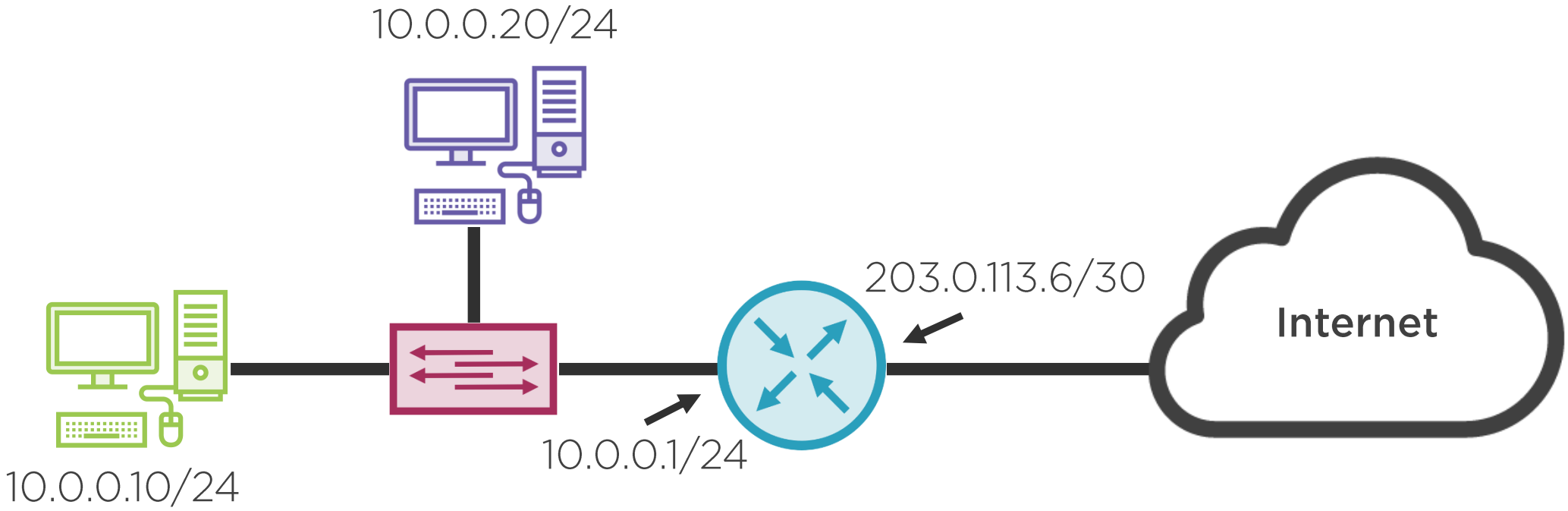
ARP



000C29FC70A5	000C29C78B22	ARP	000C29C78B22

ARP

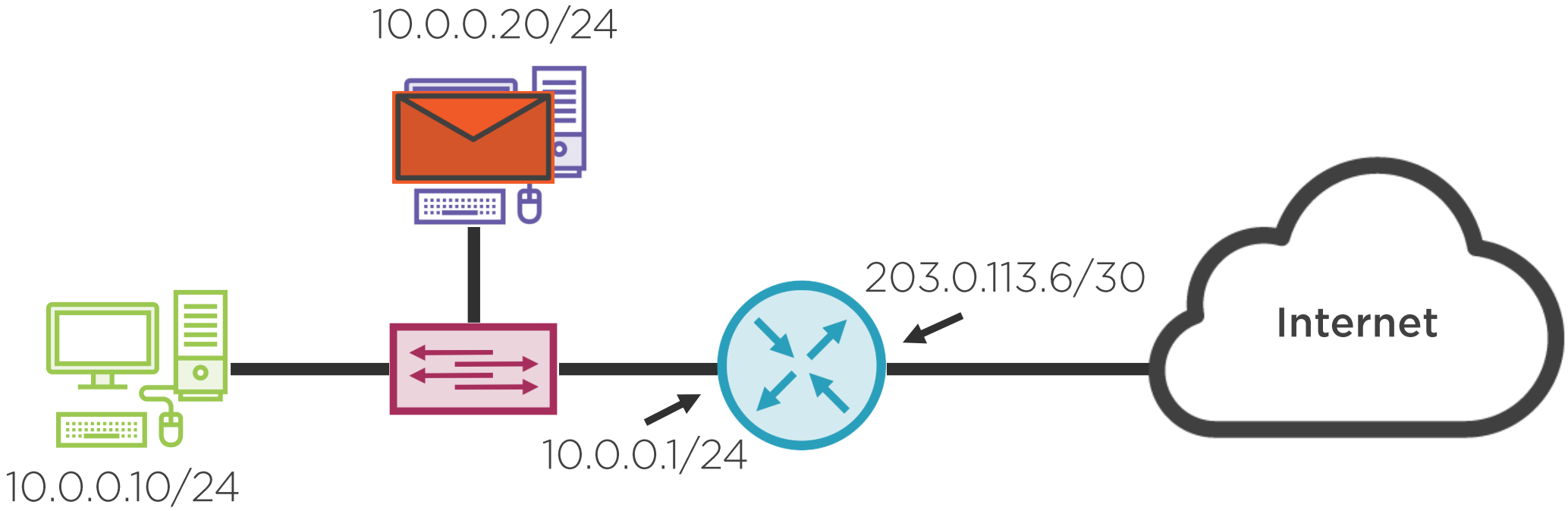
Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



000C29FC70A5	000C29C78B22	ARP	000C29C78B22

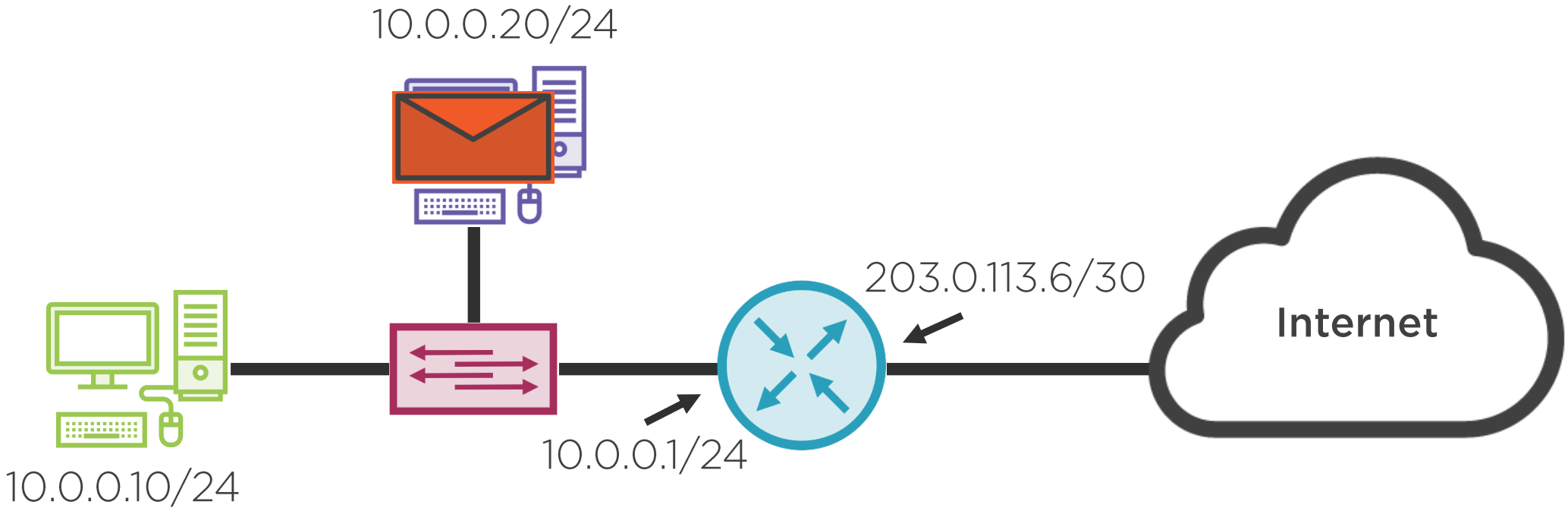
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



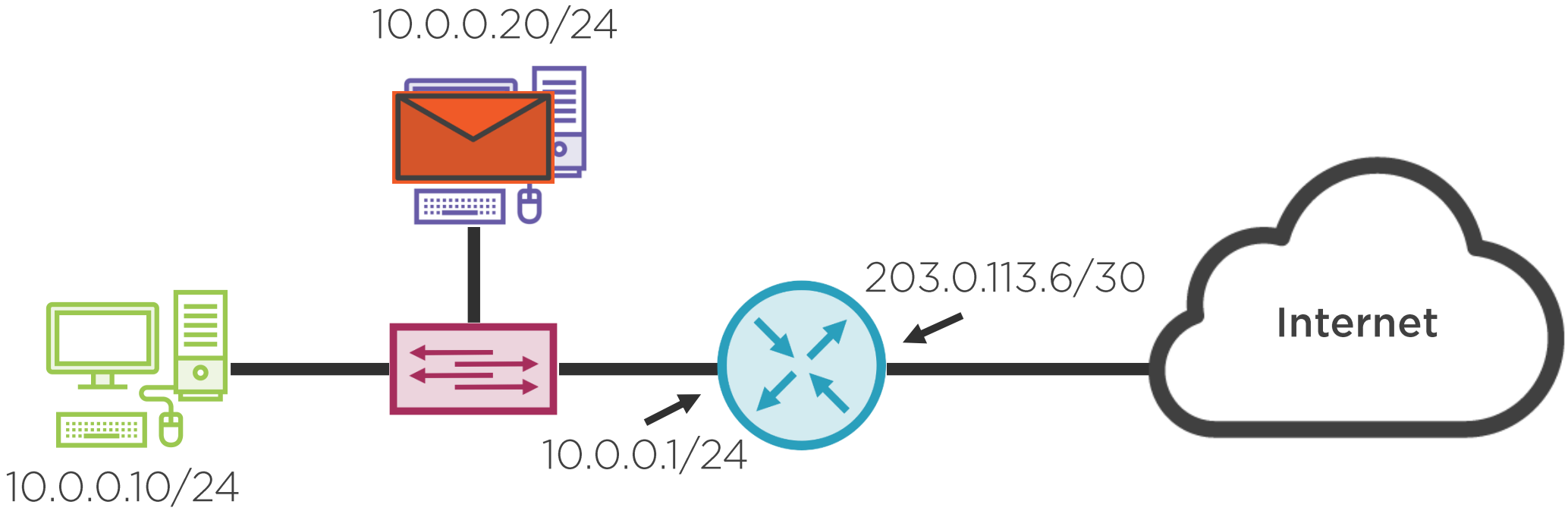
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



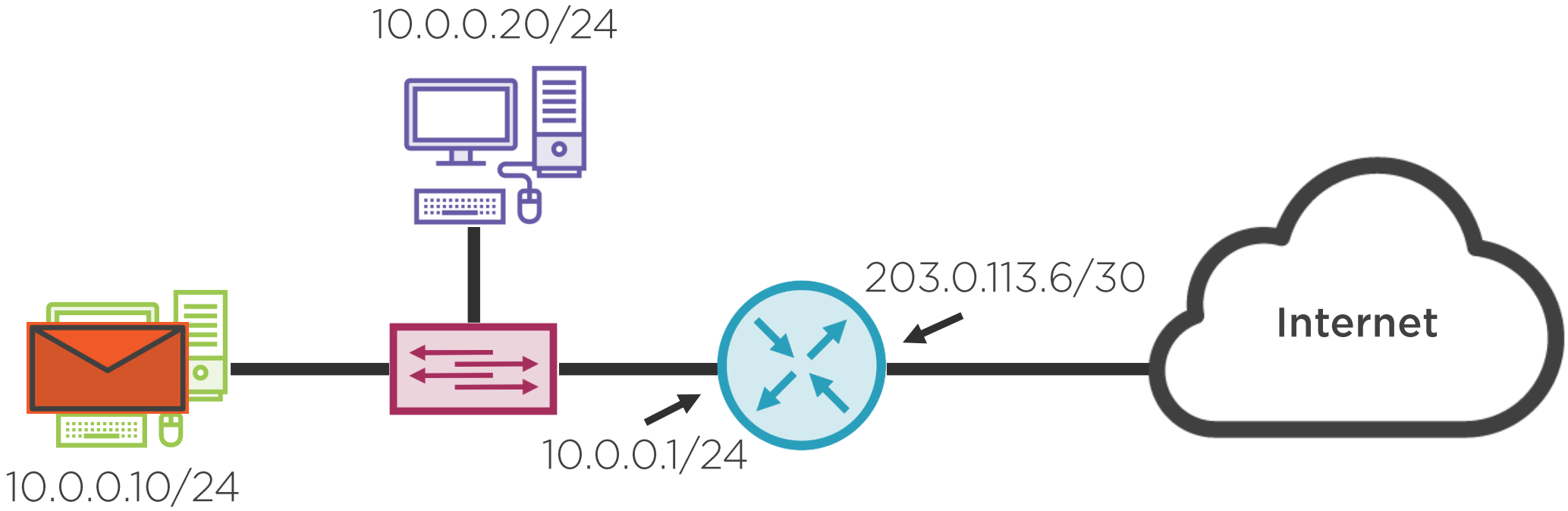
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



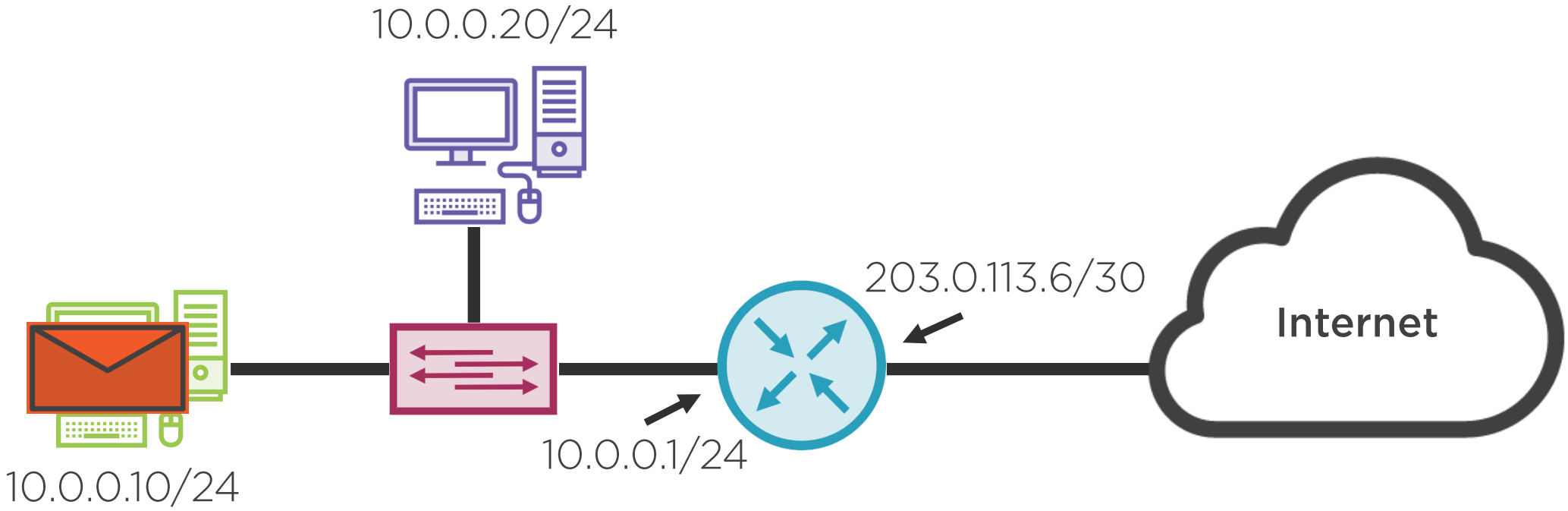
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



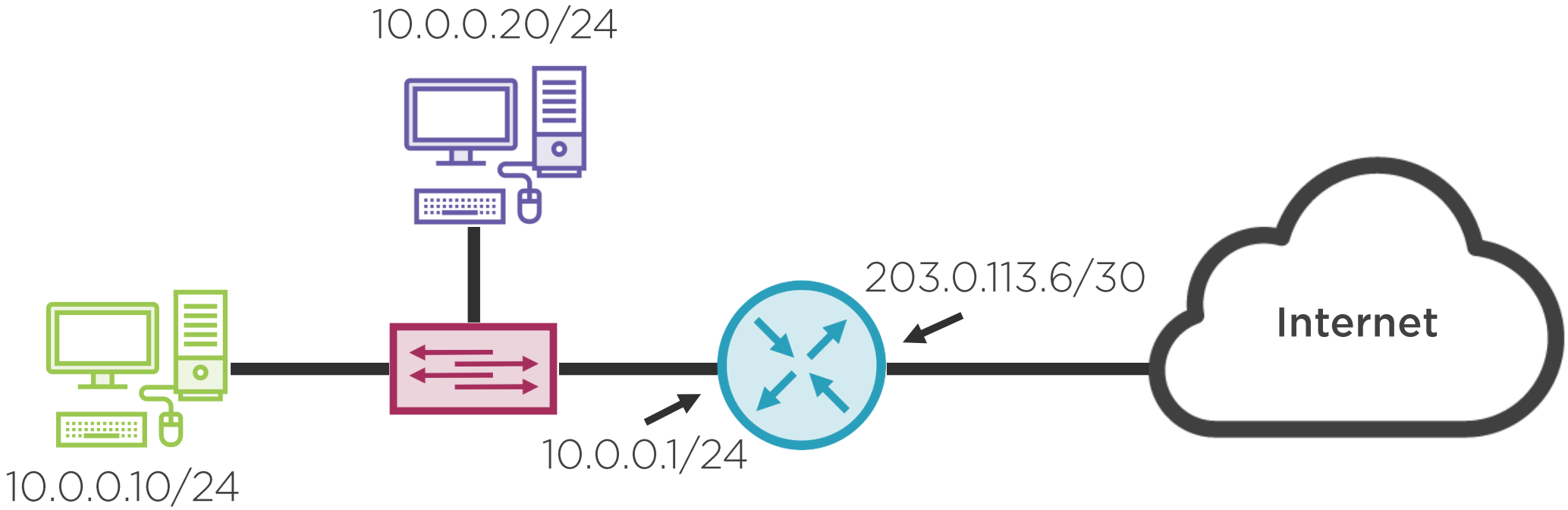
ARP

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP



000C29FC70A5	000C29C78B22	ARP	000C29C78B22

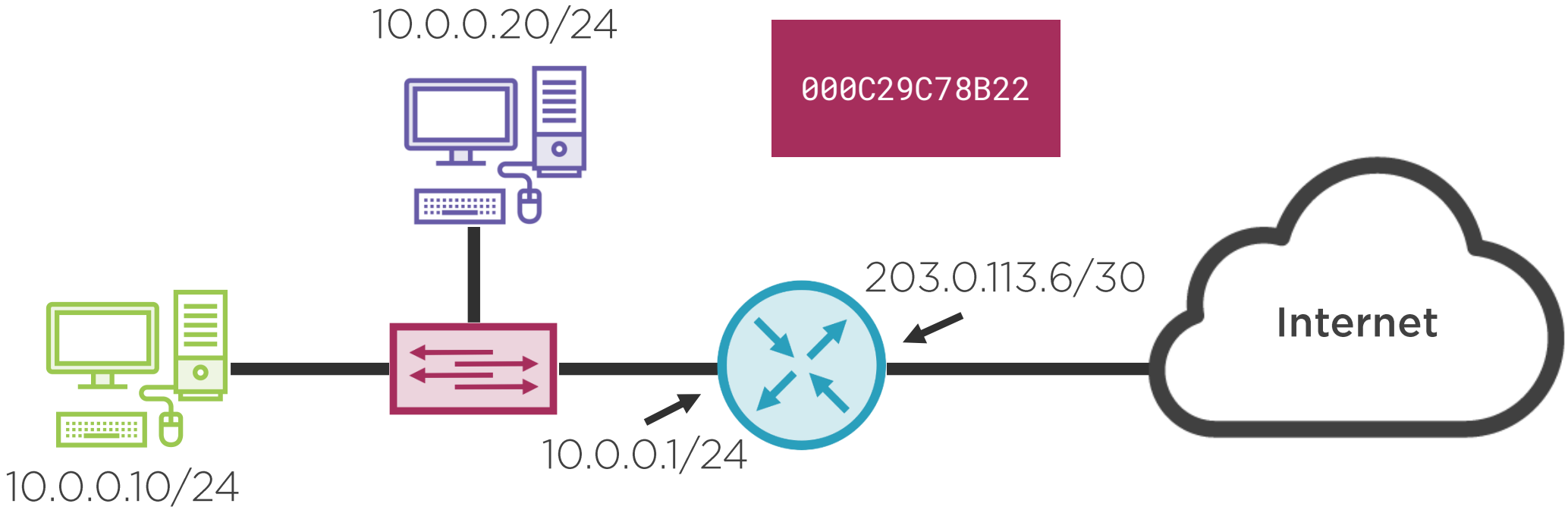
ARP



000C29FC70A5	000C29C78B22	ARP	000C29C78B22

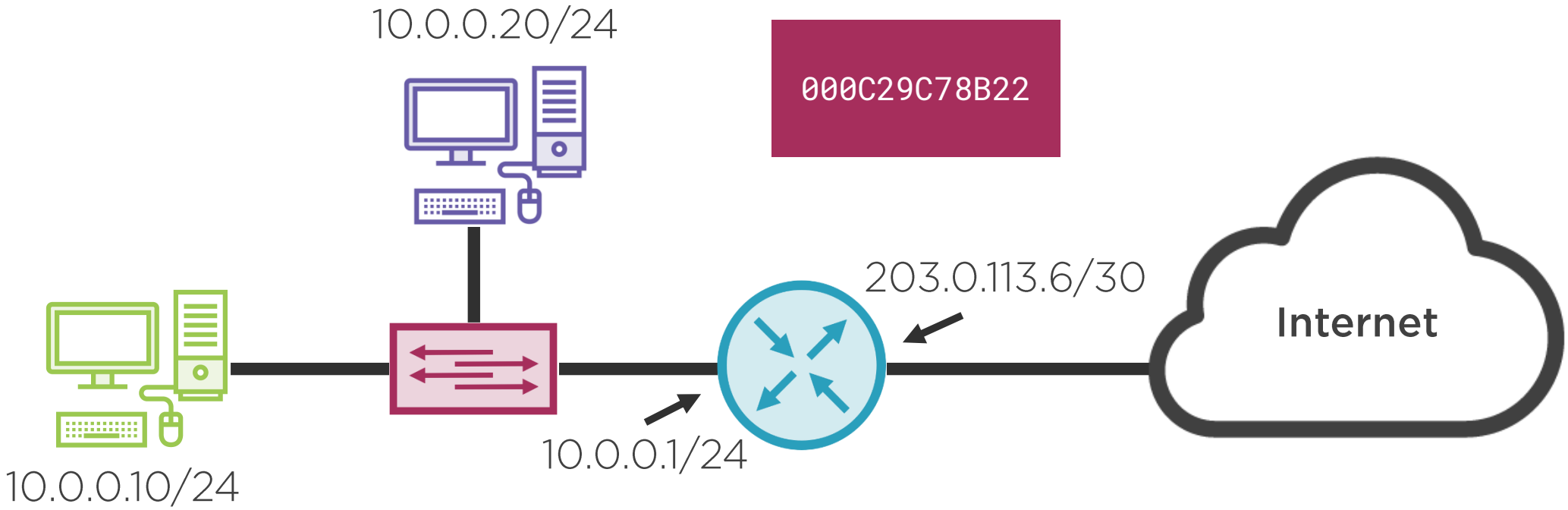
Send a Ping

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP

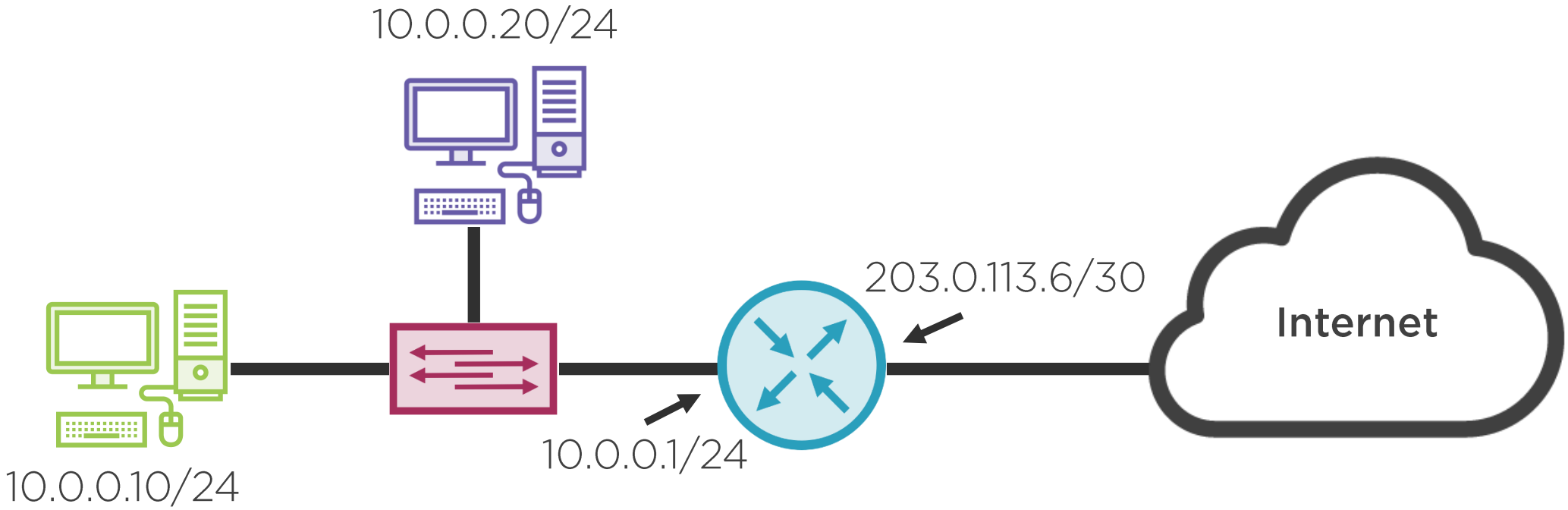


Send a Ping

Destination MAC Address	000C29FC70A5	IPv4	10.0.0.10	10.0.0.20	128	Other	ICMP

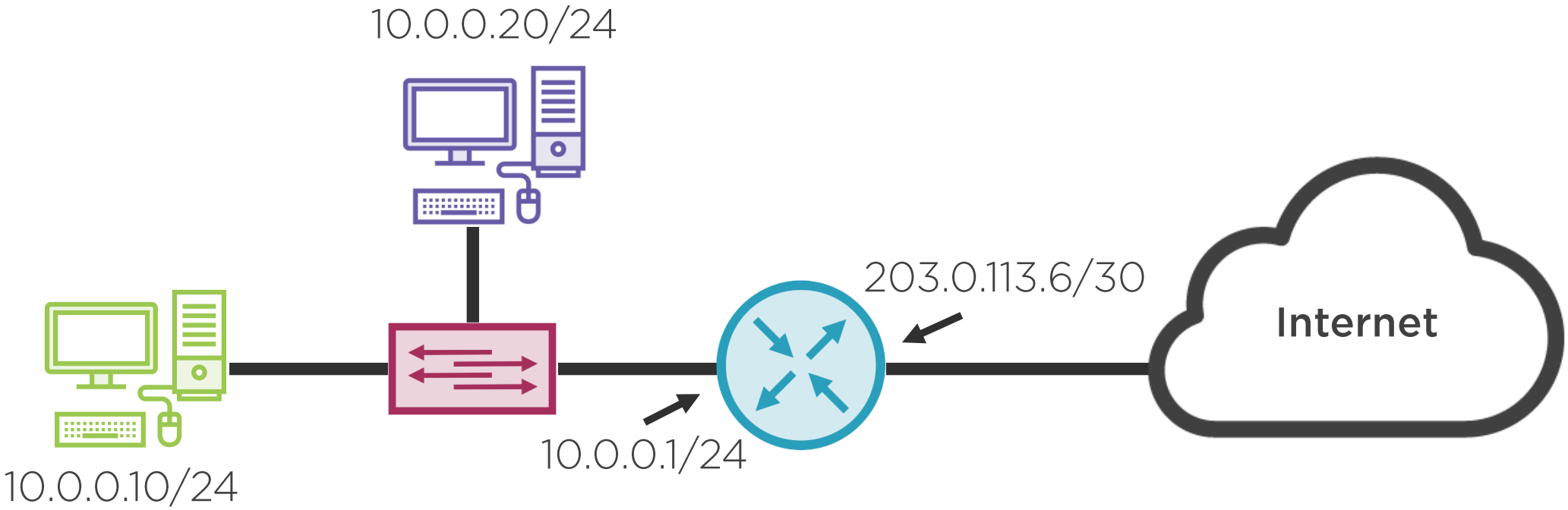


Send a Ping


10.0.0.20/24
203.0.113.6/30
Internet
10.0.0.1/24
10.0.0.10/24

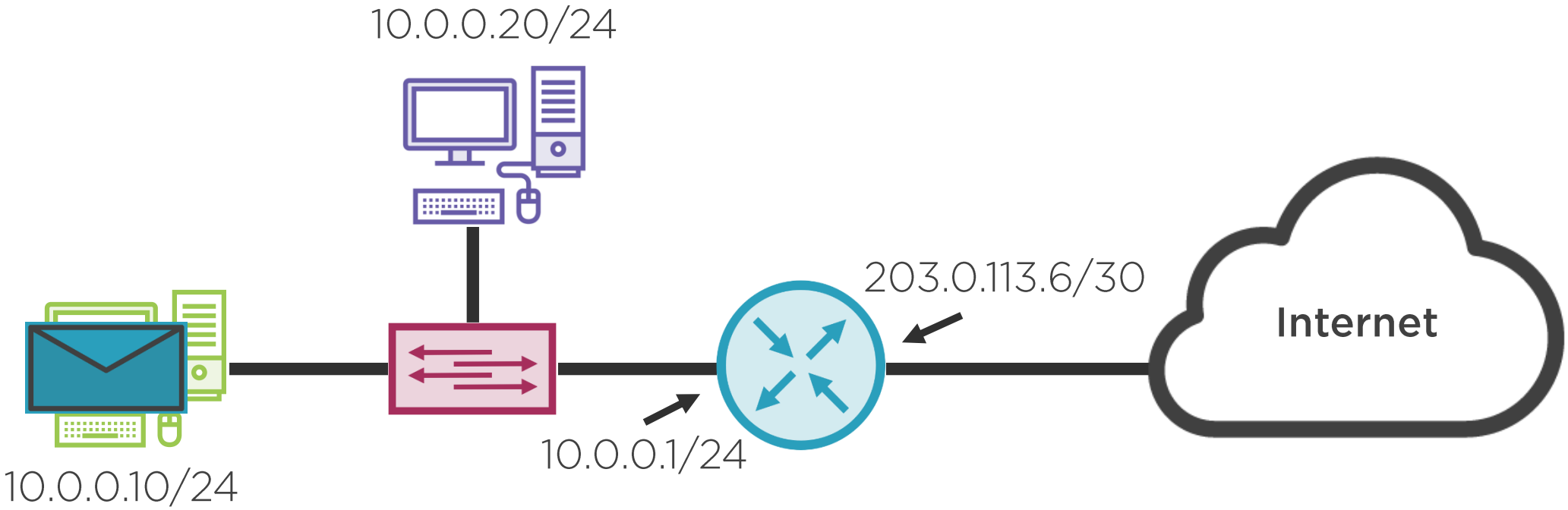
000C29C78B22
000C29FC70A5
IPv4
10.0.0.10
10.0.0.20
128
Other
ICMP

Send a Ping


10.0.0.20/24
203.0.113.6/30
Internet
10.0.0.1/24
10.0.0.10/24

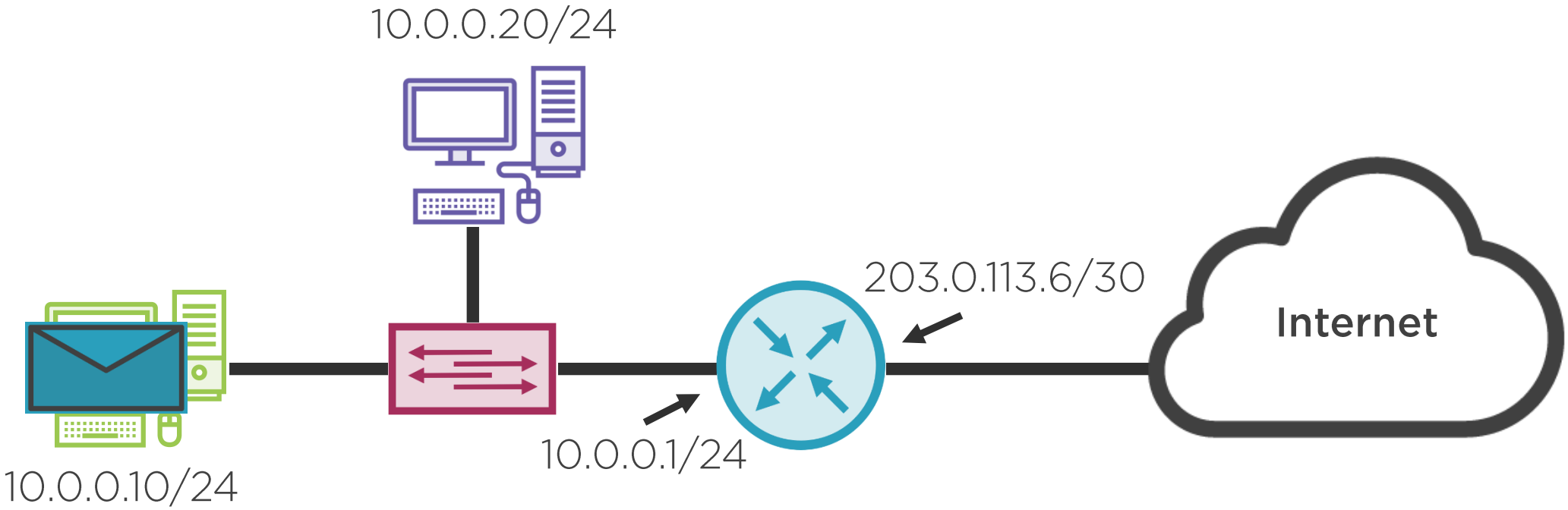
000C29C78B22
000C29FC70A5
IPv4
10.0.0.10
10.0.0.20
128
Other
ICMP

Send a Ping

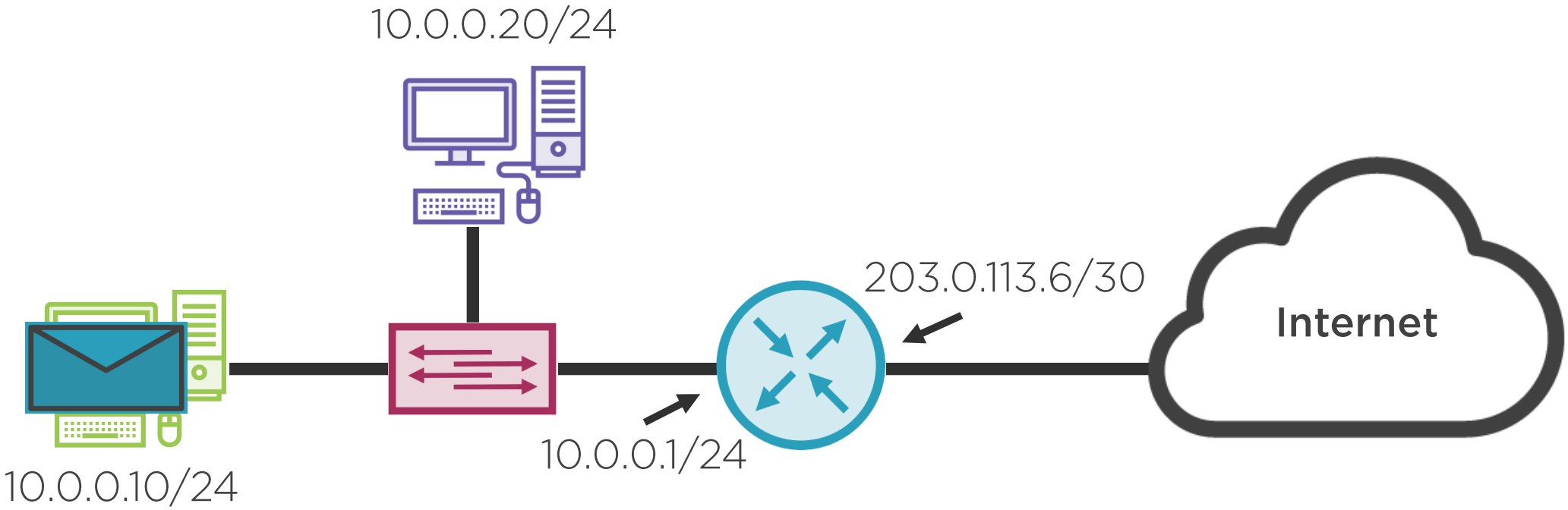

10.0.0.20/24
203.0.113.6/30
Internet
10.0.0.1/24
10.0.0.10/24

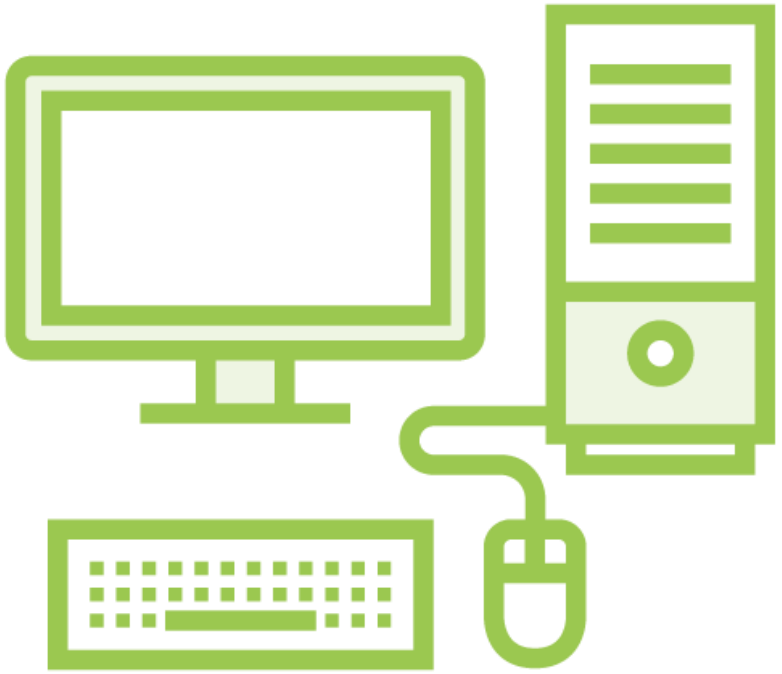
000C29C78B22
000C29FC70A5
IPv4
10.0.0.10
10.0.0.20
128
Other
ICMP

Send a Ping



Send a Ping





ARP

Devices maintain an ARP Cache (Table)

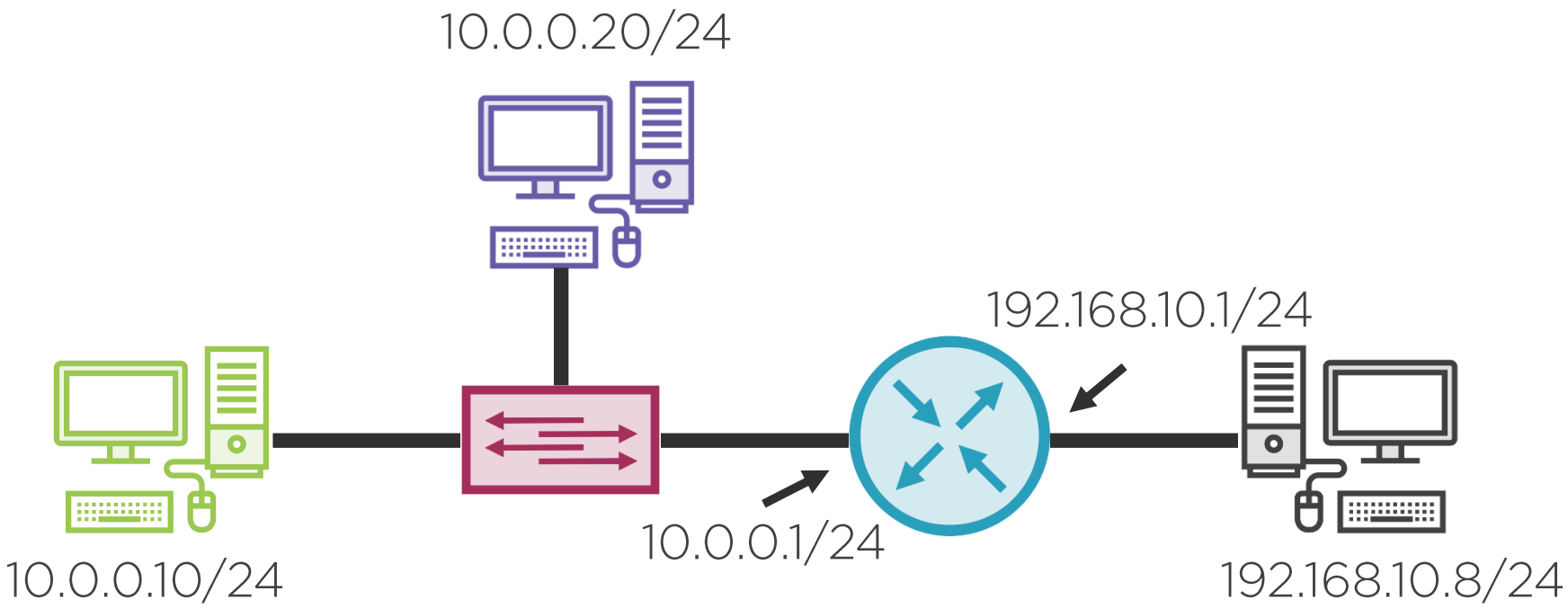
ARP Cache will age out entries

The ARP table is NOT the MAC Address Table

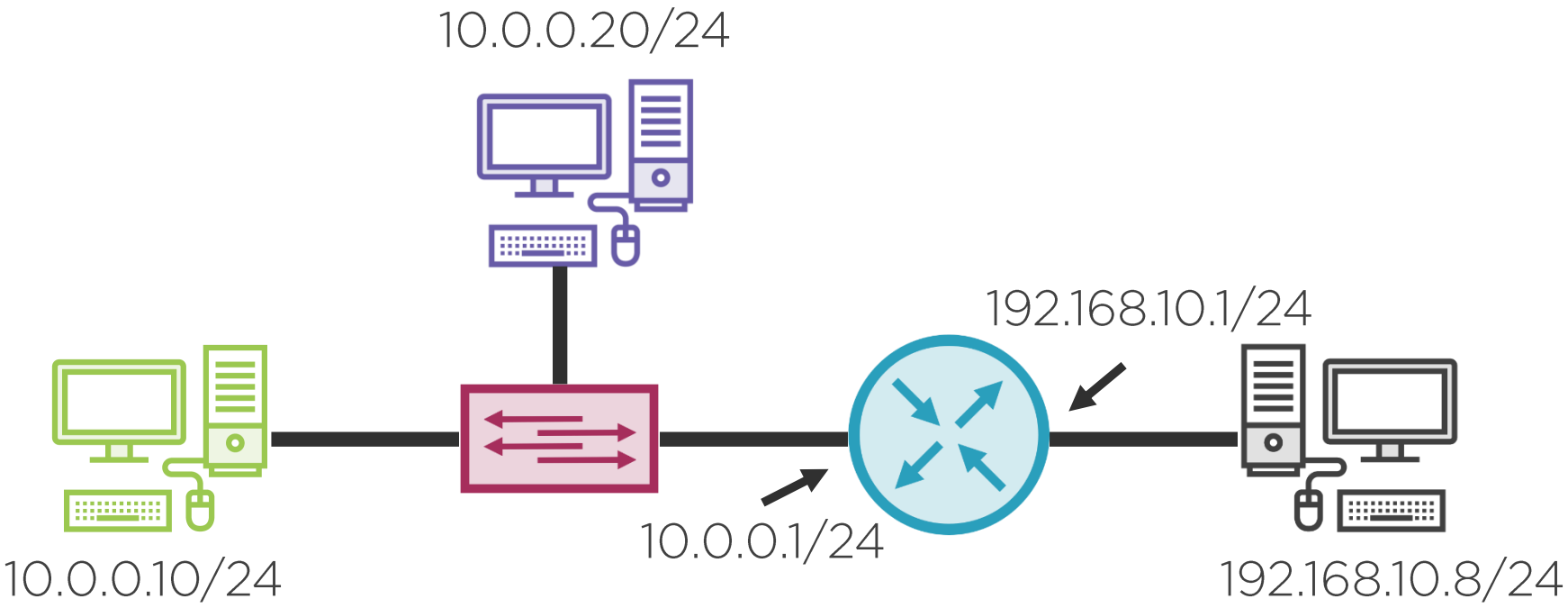
Demo

Examine ARP Table

The Default Gateway

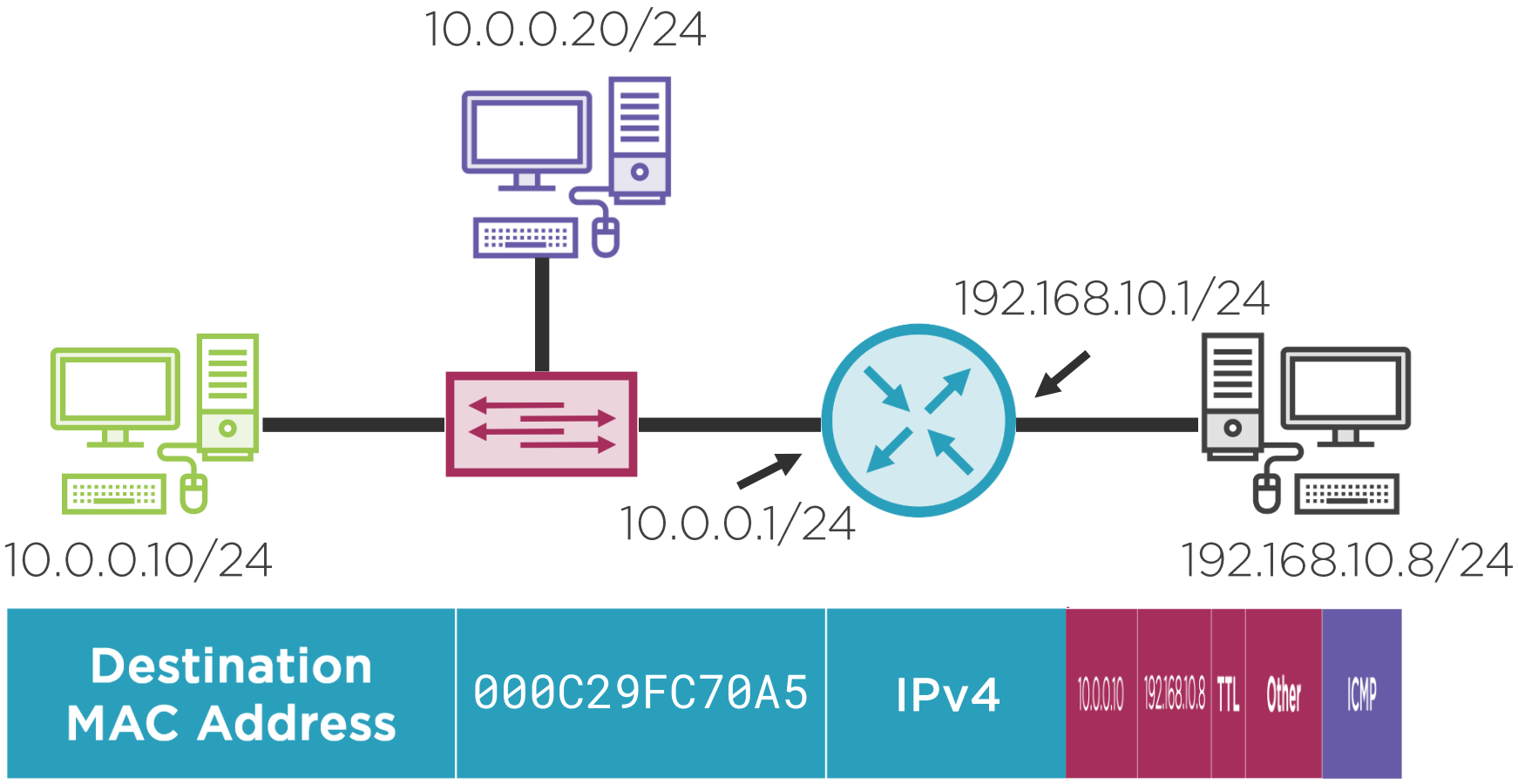


The Default Gateway

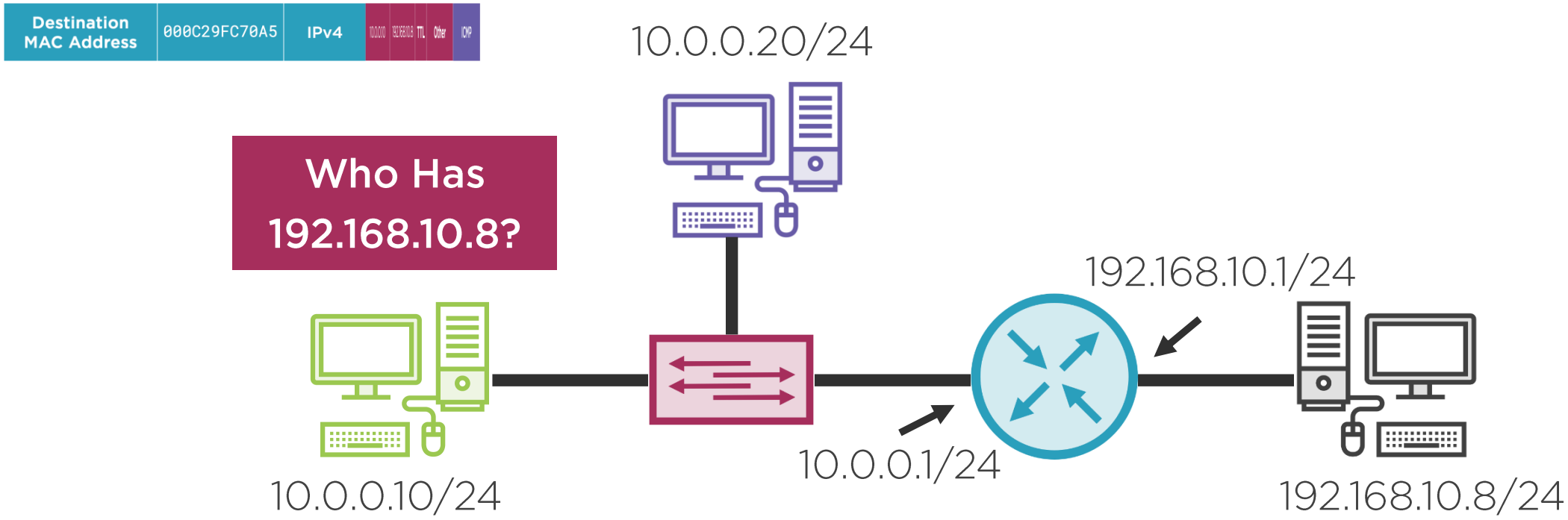


10.0.0.10	192.168.10.8	128	Other	ICMP

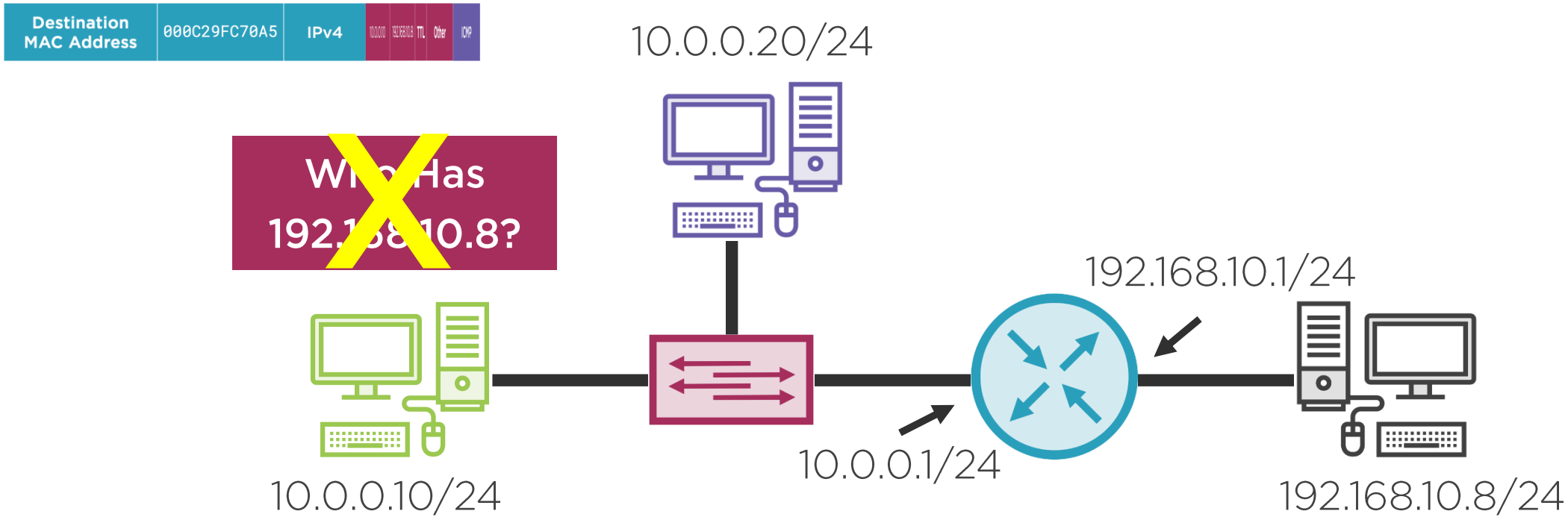
The Default Gateway



The Default Gateway



The Default Gateway



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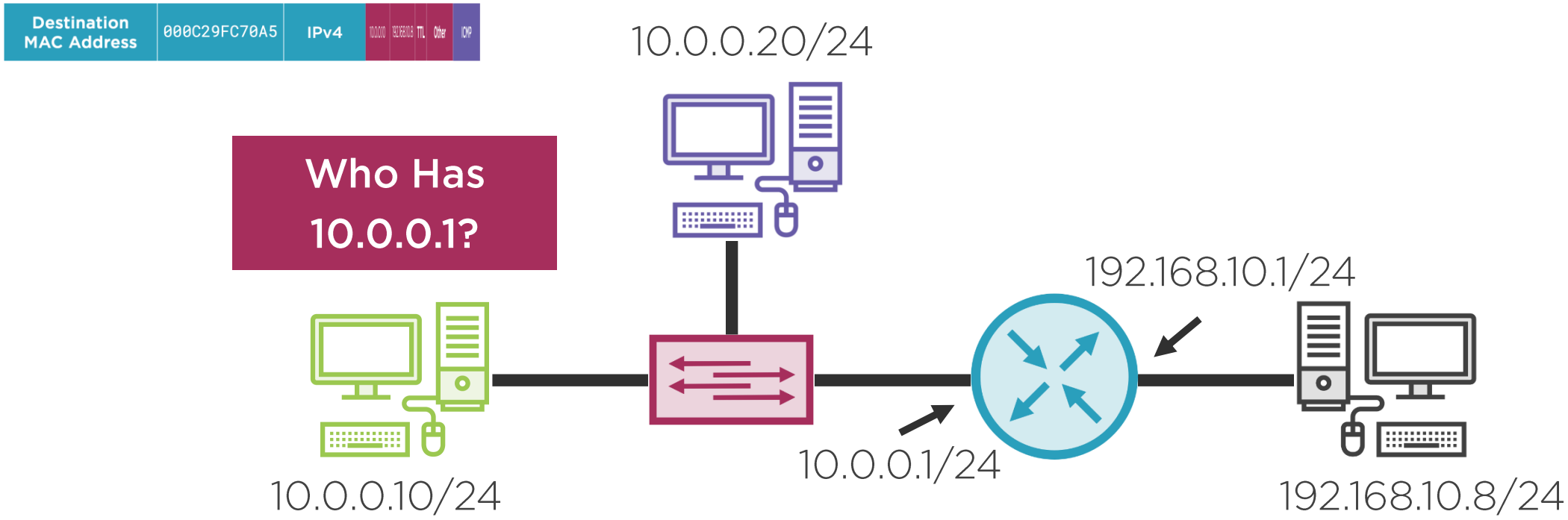
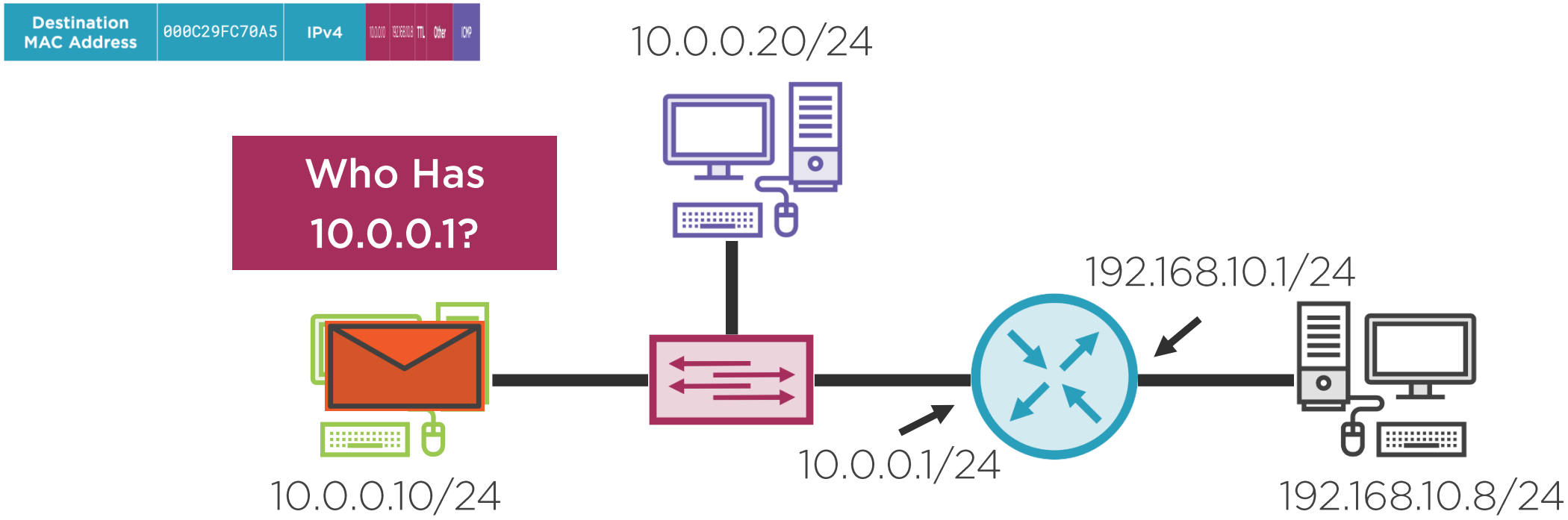


The Default Gateway



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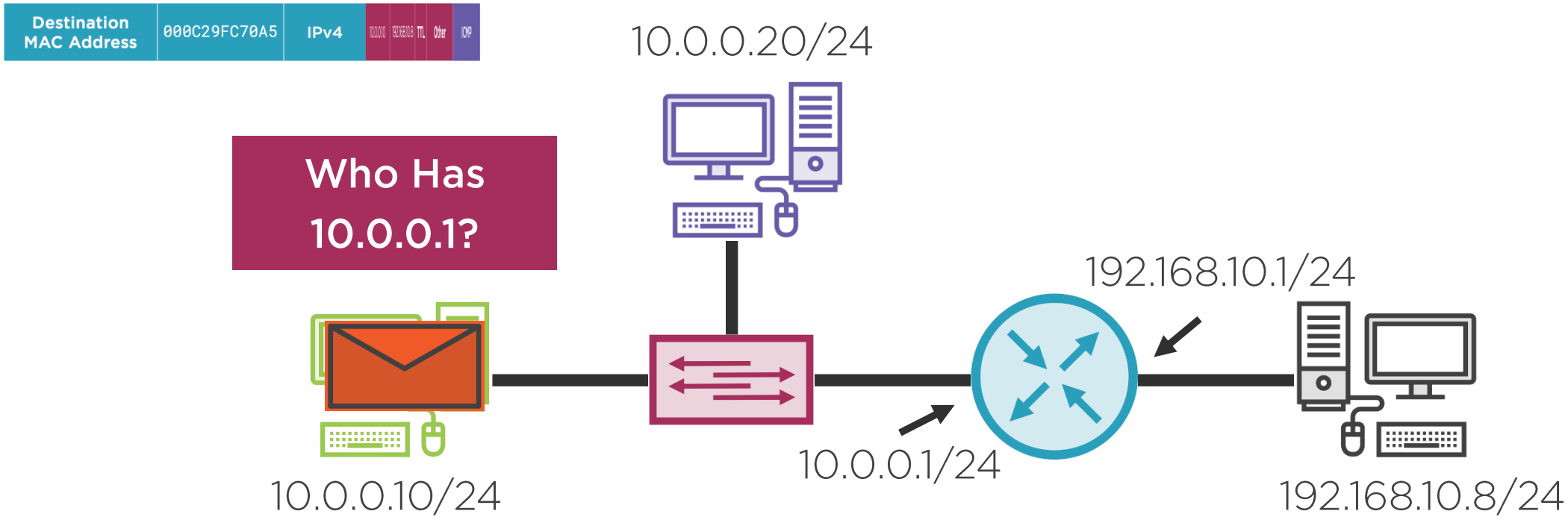
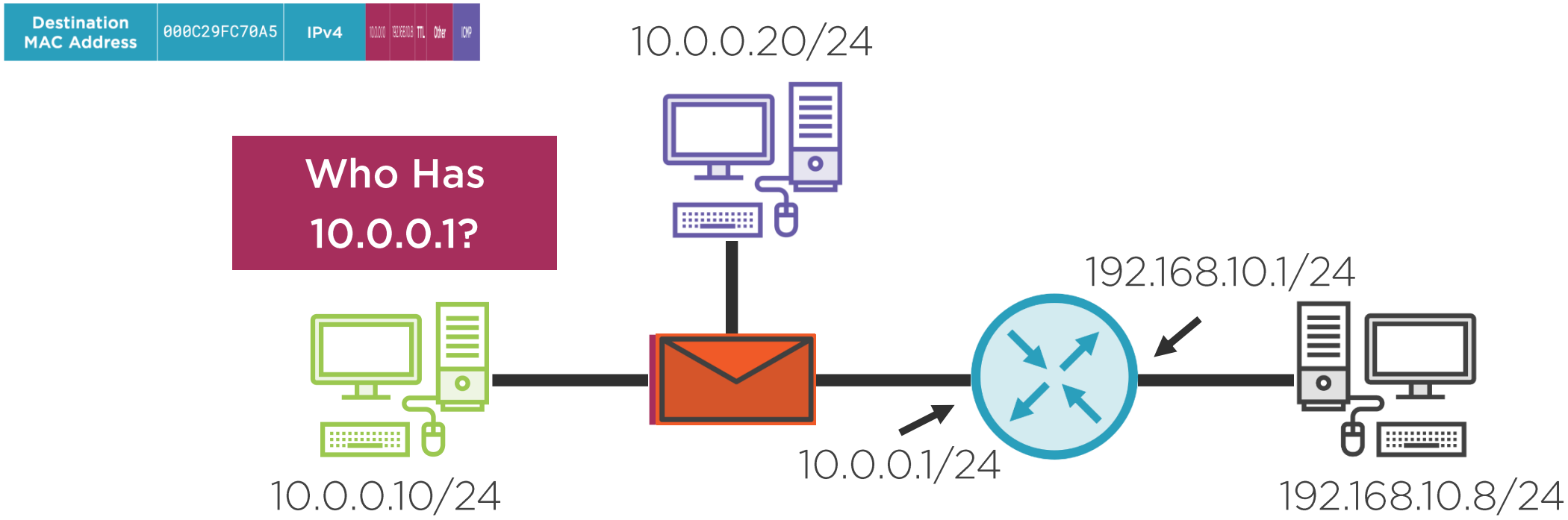
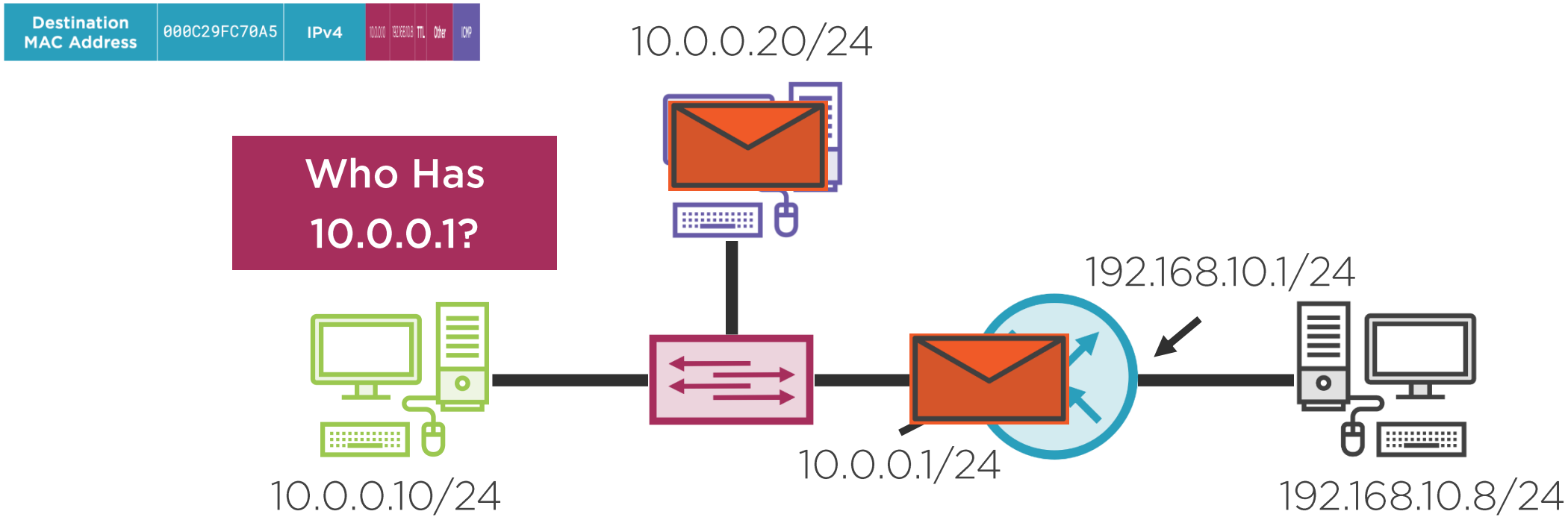


The Default Gateway



The Default Gateway



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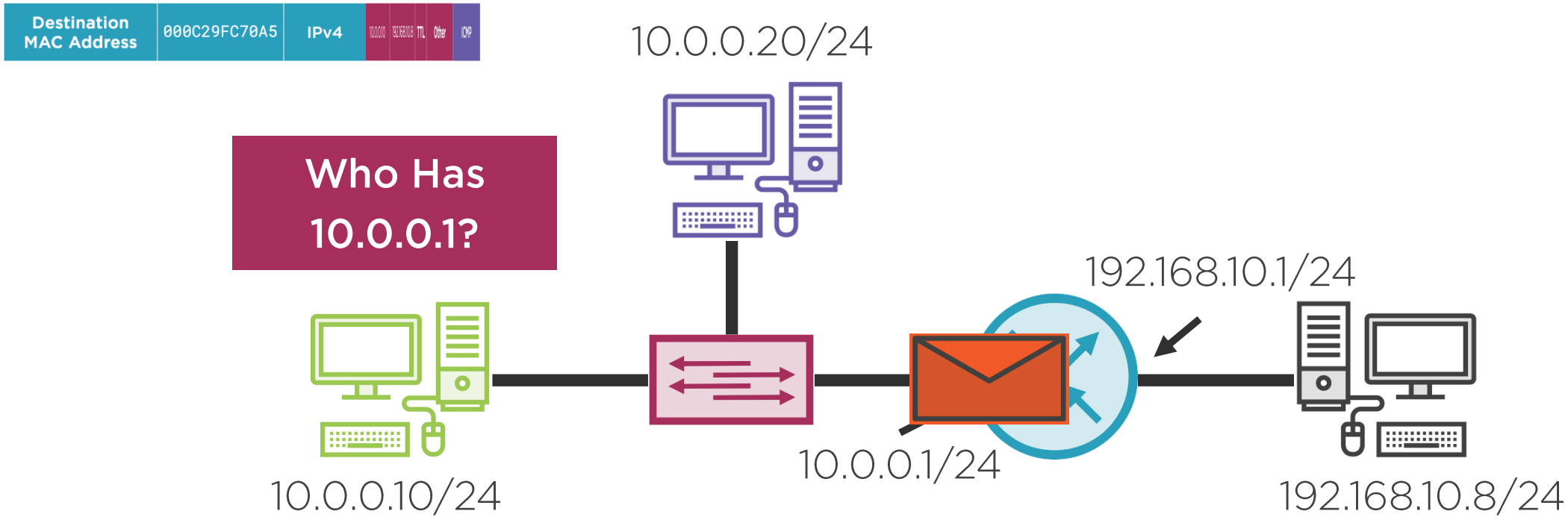
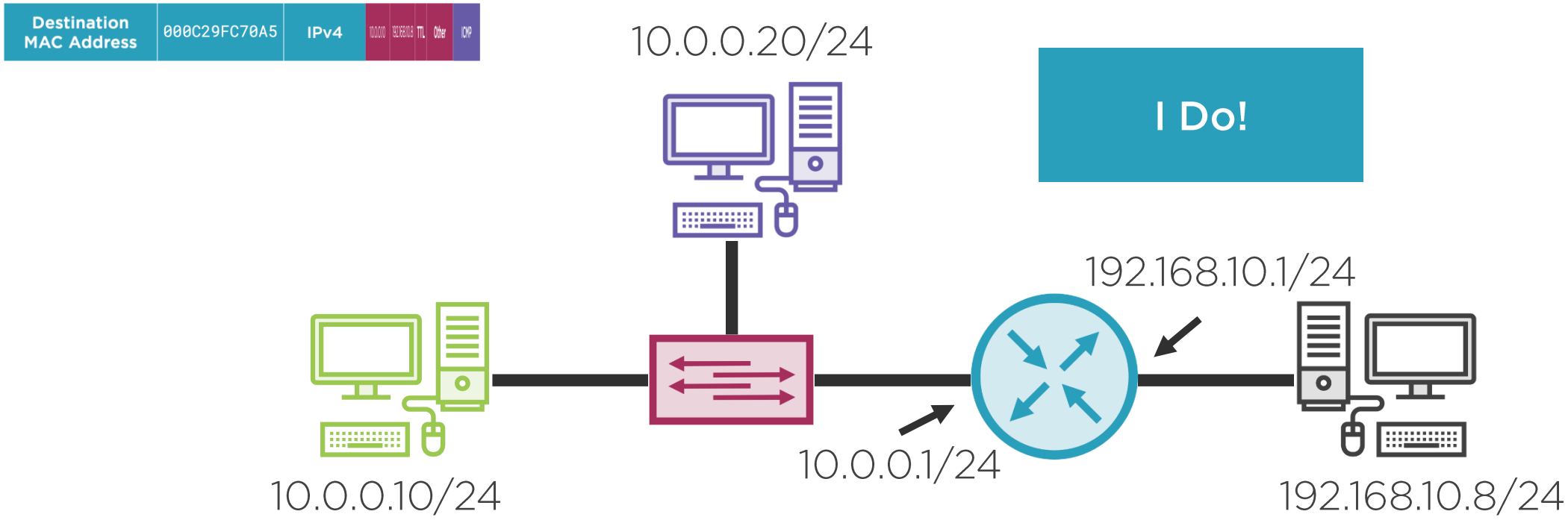
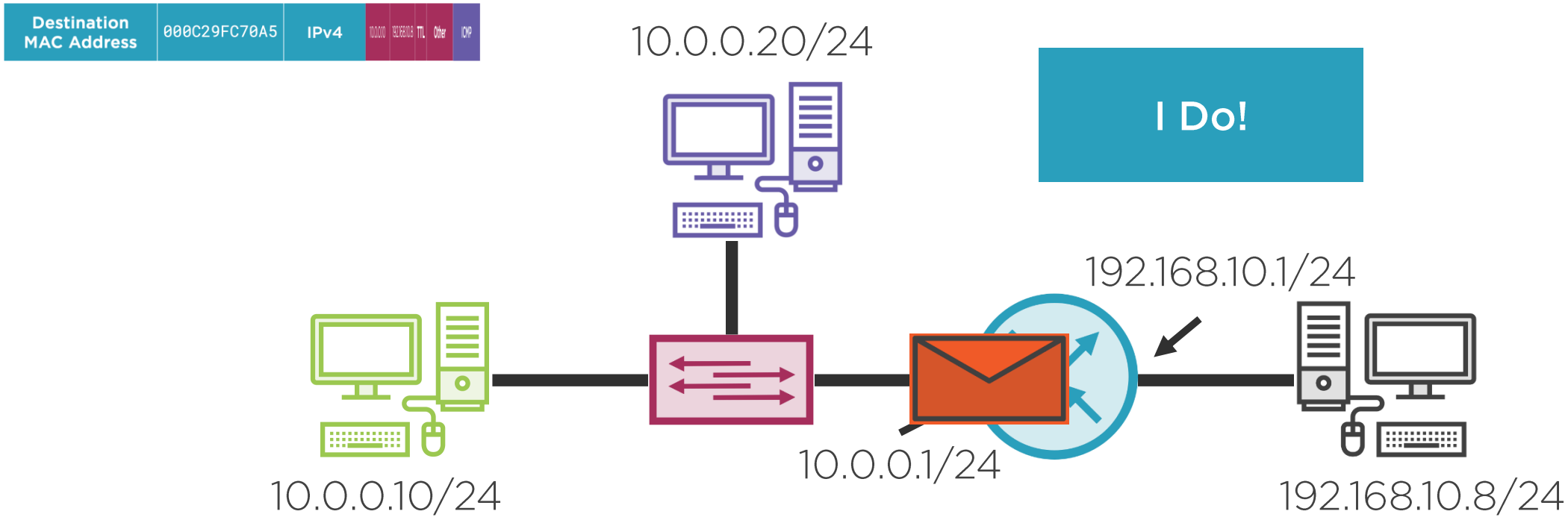
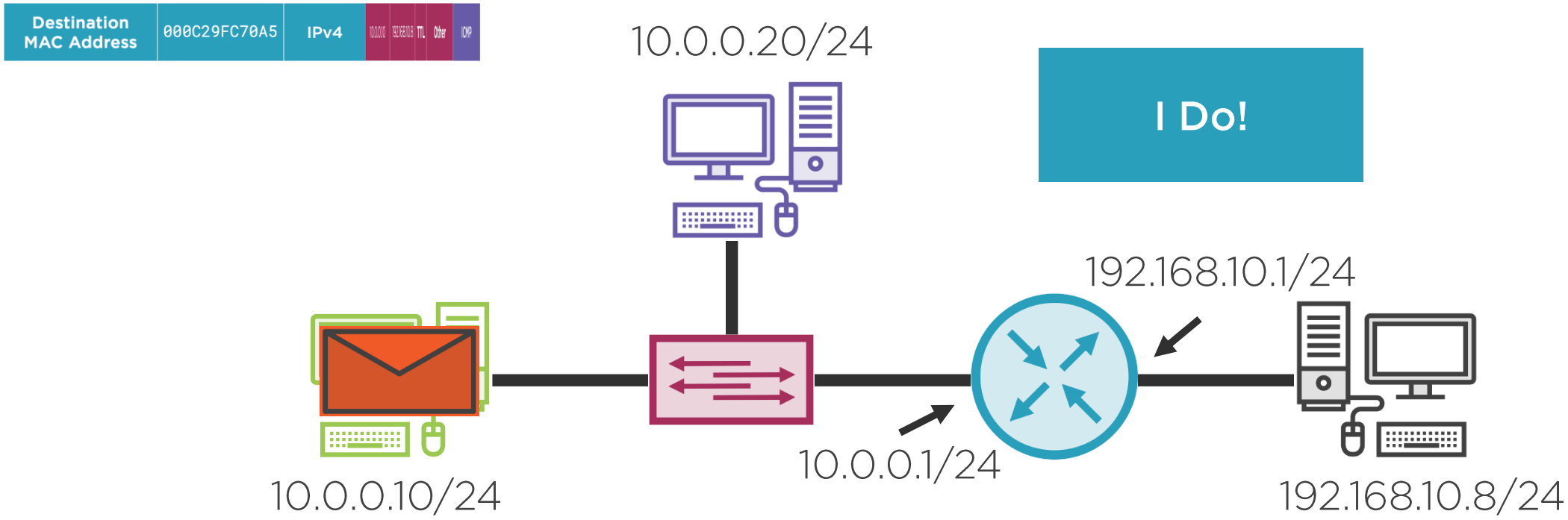


The Default Gateway



The Default Gateway



The Default Gateway