Dante Certification

Level 3 - English

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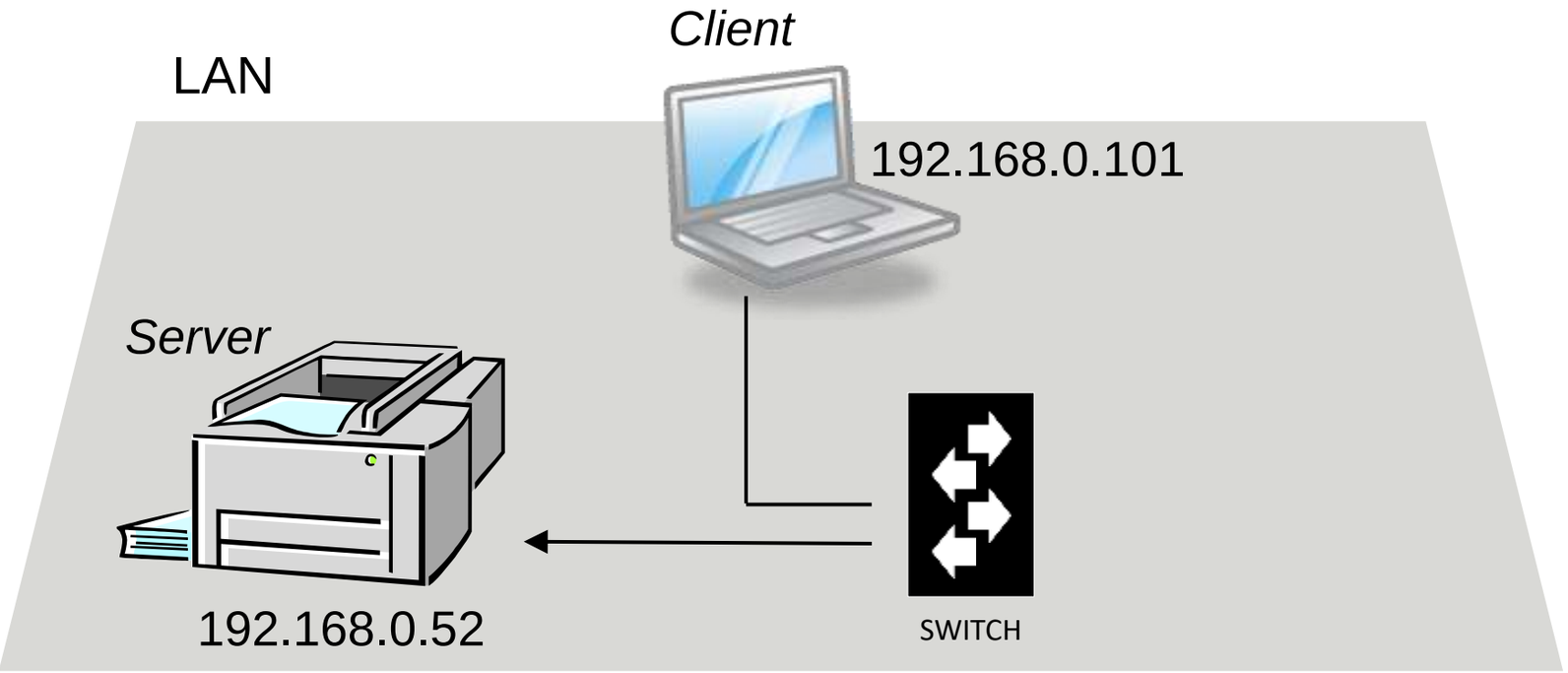
Networking Topics for Today

ENHANCE	**Core IP Settings**	*IP Address, Subnet Mask, Gateway/Router, LAN Range*
	DNS	*Domain Name Service*
	DHCP/Link Local	*Automatic Address Settings*
	TCP/UDP	*Transmission Methods*
	Unicast, Multicast and Broadcast	*Distribution Methods*
	QoS	*Quality of Service – Traffic Prioritization*
	VLAN & Trunk Implications	*VLAN, Trunk, Tagged VLAN, STP, LAG*
NEW	**Network Ports**	*Managing Simultaneous Connections*
	Understanding Clocking	*Precision Time Protocol (PTP)*
	ARP, Layered Network Models	*Gluing IP & MAC Addresses, The OSI Model*
	Segmenting Broadcast Domain	*Managing the “Noise” in a Network*

Core IP Settings: *IP Address, Subnet Mask, Gateway*

Core IP Settings: IP Address

Devices on the Local Area Network (LAN) are contacted directly.



A network connection is also known as a “session”.

A “client” initiates a connection.

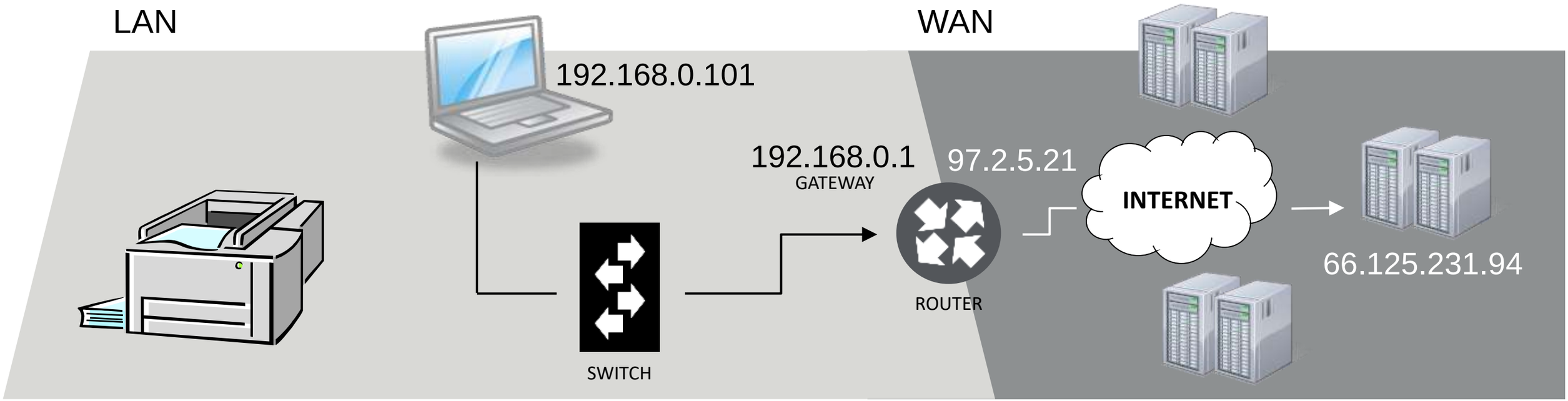
A “server” accepts a connection.

Easy to remember if you consider web client and server.

Core IP Settings: Gateway (Router)

Devices on the Local Area Network (LAN) are contacted directly.

Devices on the Wide Area Network (WAN) are reached through the router.



Core IP Settings

How does a device know to connect on the LAN or through the Gateway?

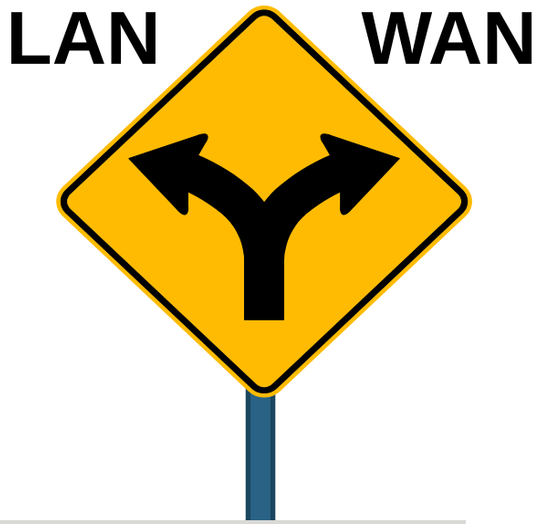
IP Address & Subnet Mask

Core IP Settings: Subnet Mask & Gateway

If the Destination is on the LAN:

Access the devices directly on the local network switches.

The router is not involved in this connection.



Otherwise:

The destination IP address is passed to the Gateway (Router).

Similar to dialing “O” for the operator.

IP Address:	192.168. 10. 11
Subnet Mask:	255.255.255. 0
LAN Range:	192.168. 10. xxx

Quiz: Subnet Mask

IP Address:	192.168. 10. 11
Subnet Mask:	255.255.255. 0
LAN Range:	192.168. 10. xxx

Are these sought on the LAN or through the Gateway?

192.168.10.18	…	LAN
18.231.109.77	…	Gateway (WAN)
192.168.1.113	…	Gateway (WAN)

Core IP Settings: Subnet Mask

IP Address:	192.168. 10. 11
Subnet Mask:	255.255.255. 0
LAN Range:	192.168. 10. xxx

IP Address:	10. 0. 1. 11
Subnet Mask:	255.255.255. 0
LAN Range:	10. 0. 1. xxx

Core IP Settings: Subnet Mask

IP Address:	192.168. 10. 11
Subnet Mask:	255.255.255. 0
LAN Range:	192.168. 10. xxx

IP Address:	192.168. 10. 11
Subnet Mask:	255.255. 0. 0
LAN Range:	192.168. xxx. xxx

Core IP Settings: Subnet Mask

Residential:	255.255.255. 0
Dante Audio Default:	255.255. 0. 0

Internet Service Provider:	255.255.255.248
Corp Network:	255.255.252. 0

Core IP Settings: Subnet Mask

There are 10 types of people in the world:

Binary	Decimal
00	0
01	1
10	2
11	3

those who understand binary, and those who don’t.

Core IP Settings: 32-bit Addresses

We call this “dotted-quad” or “dot-decimal” notation.

192	.	168	.	1	.	12
1100 0000	.	1010 1000	.	0000 0001	.	0000 1100

Dotted Quad Notation: 192.168.1.12

Value Range of Each Field: 0 – 255 (8 bits)

4 fields x 8 bits each: 32-bit address

Core IP Settings: 32-bit Addresses

IP Address and Subnet Mask are 32-bit numbers.
Subnet Mask defines significant binary digits.

192 1100 0000	168 1010 1000	1 0000 0001	12 0000 1100
255 1111 1111	255 1111 1111	255 1111 1111	0 0000 0000
192 1100 0000	168 1010 1000	1 0000 0001	x xxxx xxxx

Core IP Settings: Subnet Mask Length

This LAN range setting is commonly abbreviated:

192.168.1.12 /24

192 1100 0000	.	168 1010 1000	.	1 0000 0001	.	12 0000 1100
255 1111 1111	.	255 1111 1111	.	255 1111 1111	.	0 0000 0000
192 1100 0000	.	168 1010 1000	.	1 0000 0001	.	x xxxx xxxx

Core IP Settings: Subnet Mask Length

You can break the mask “mid-field”:

192.168.0.12 /22

192	168	1	12
1100 0000	1010 1000	0000 0001	0000 1100
255	255	252	0
1111 1111	1111 1111	1111 1100	0000 0000
192	168	0-3	x
1100 0000	1010 1000	0000 00xx	xxxx xxxx

Core IP Settings: Subnet Mask Length

You can break the mask “mid-field”:

192.168.26.12 /22

192	168	26	12
1100 0000	1010 1000	0001 1010	0000 1100
255	255	252	0
1111 1111	1111 1111	1111 1100	0000 0000
192	168	24-27	x
1100 0000	1010 1000	0001 10xx	xxxx xxxx

Core IP Settings: Subnet Mask Length

The Subnet Mask has a Length.

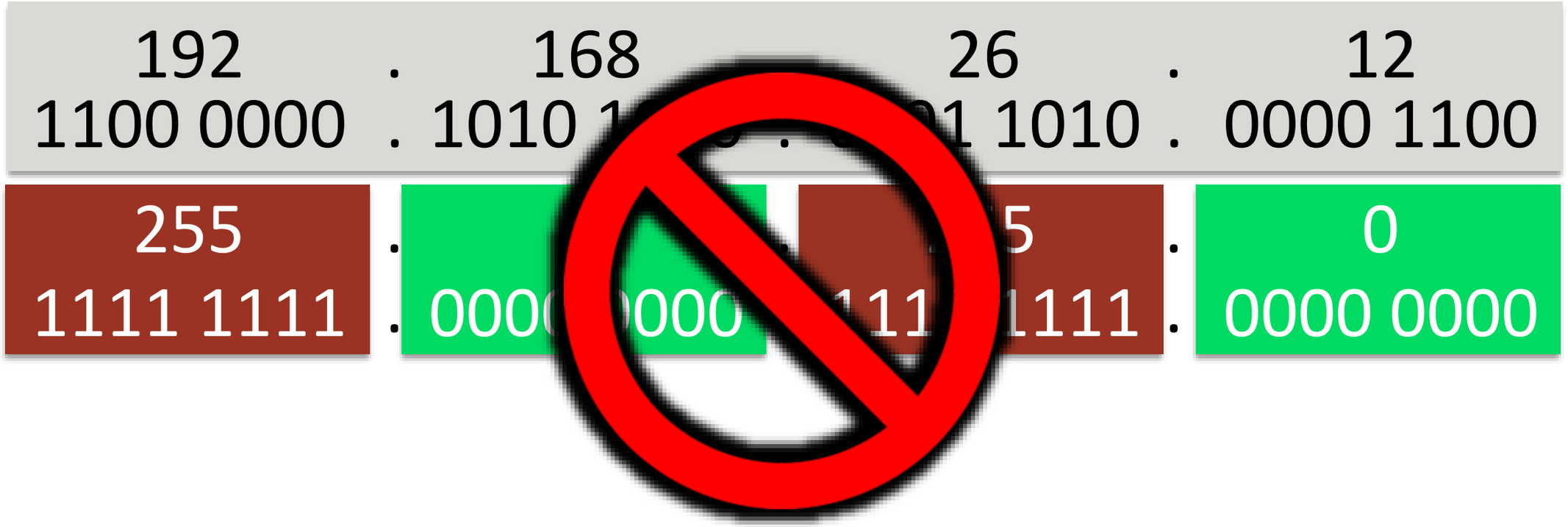
A String of Binary 1's, then Binary 0's.

192	.	168	.	26	.	12
1100 0000	.	1010 1000	.	0001 1010	.	0000 1100
255	.	255	.	255	.	0
1111 1111	.	1111 1111	.	1111 1111	.	0000 0000

Core IP Settings: Subnet Mask Length

The Subnet Mask has a Length.

A String of Binary 1's, then Binary 0's.



Core IP Settings: Subnet Mask Length

The Subnet Mask has a Length.

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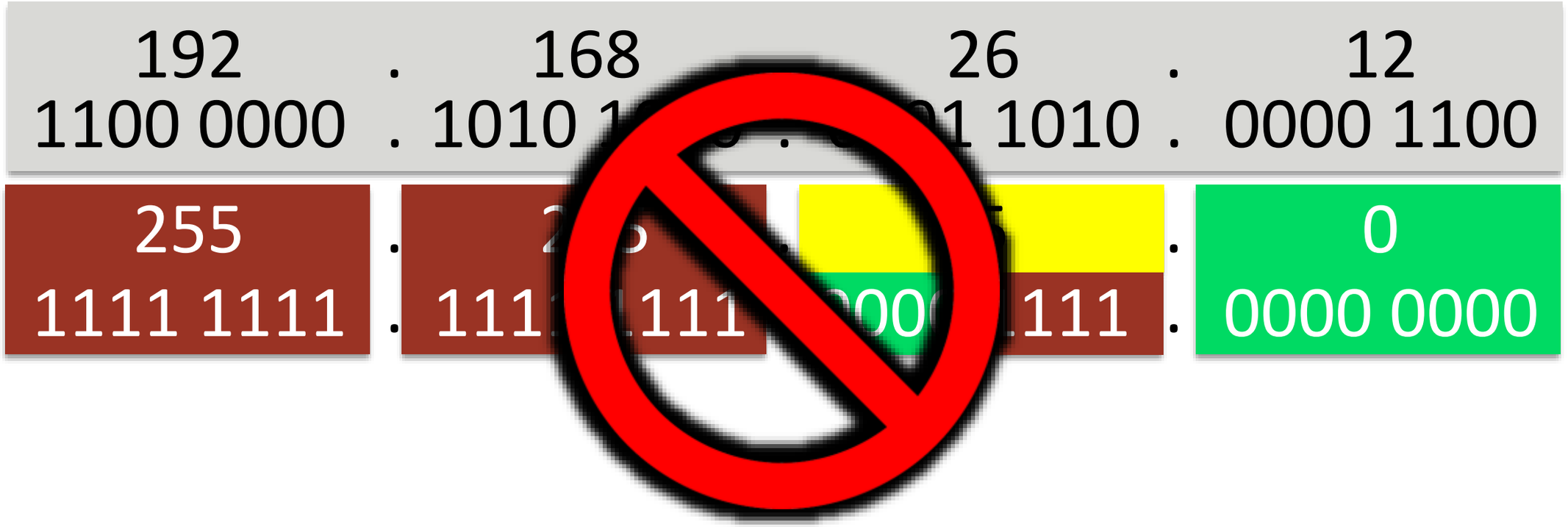


Core IP Settings: Subnet Mask Valid Values

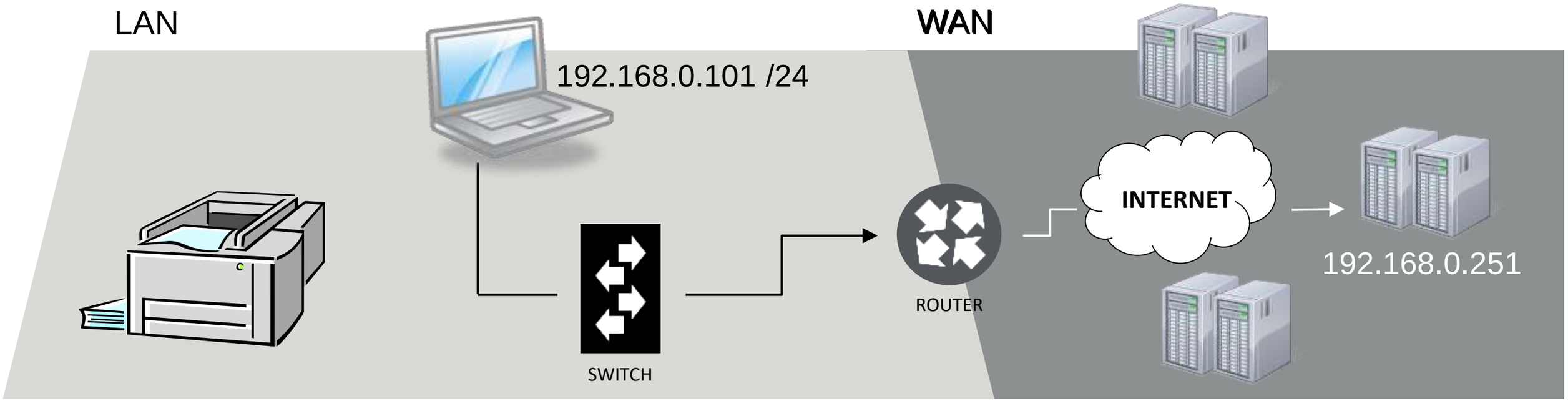
Mask	Binary Value								Answers
255	1	1	1	1	1	1	1	1	1
254	1	1	1	1	1	1	1	0	2
252	1	1	1	1	1	1	0	0	4
248	1	1	1	1	1	0	0	0	8
240	1	1	1	1	0	0	0	0	16
224	1	1	1	0	0	0	0	0	32
192	1	1	0	0	0	0	0	0	64
128	1	0	0	0	0	0	0	0	128
0	0	0	0	0	0	0	0	0	256

Reserved LAN Ranges

Ponder This…

Can this laptop connect to this server?

http://192.168.0.251/



Reserved LAN Ranges

These are reserved for your LAN use.

IP Address Range:	Common Uses
192.168.___.___	
10.___.___.___	
172.16-31.___.___	Dante Secondary (172.31.x.x)
169.254.___.___	Link Local, Dante Primary

Addresses to Avoid

Addresses that often have meaning or a role.

IP Address Range:	Common Uses
___.___.___. 0	Network Identifier
___.___.___. 1	Commonly Used For Router or Network Infrastructure
___.___.___.254	
___.___.___.255	Broadcast Address

Quiz: Valid IP Ranges

Are These Valid LAN Addresses?

192.168. 10. 0 … No: Avoid 0 or 255 in last field.

Quiz: Valid IP Ranges

Are These Valid LAN Addresses?

192.168. 10. 0 … No: Avoid 0 or 255 in last field.

10.255. 0. 15 … Yes.

Quiz: Valid IP Ranges

Are These Valid LAN Addresses?

192.	168.	10.	0	…	No: Avoid 0 or 255 in last field.
10.	255.	0.	15	…	Yes.
172.	26.	0.	1	…	Maybe: Could be Router.

Quiz: Valid IP Ranges

Are These Valid LAN Addresses?

192.	168.	10.	0	…	No: Avoid 0 or 255 in last field.
10.	255.	0.	15	…	Yes.
172.	26.	0.	1	…	Maybe: Could be Router.
192.	169.	150.	11	…	No: Not in a LAN range.

Audinate

DNS (Domain Name Service)

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DNS: Multi Layer Look-Up

If everything is run by IP Addresses, how do I get to a web site?

https://www.audinate.com/certify/

Protocol — Server Domain Name or IP Address — Folder/Request

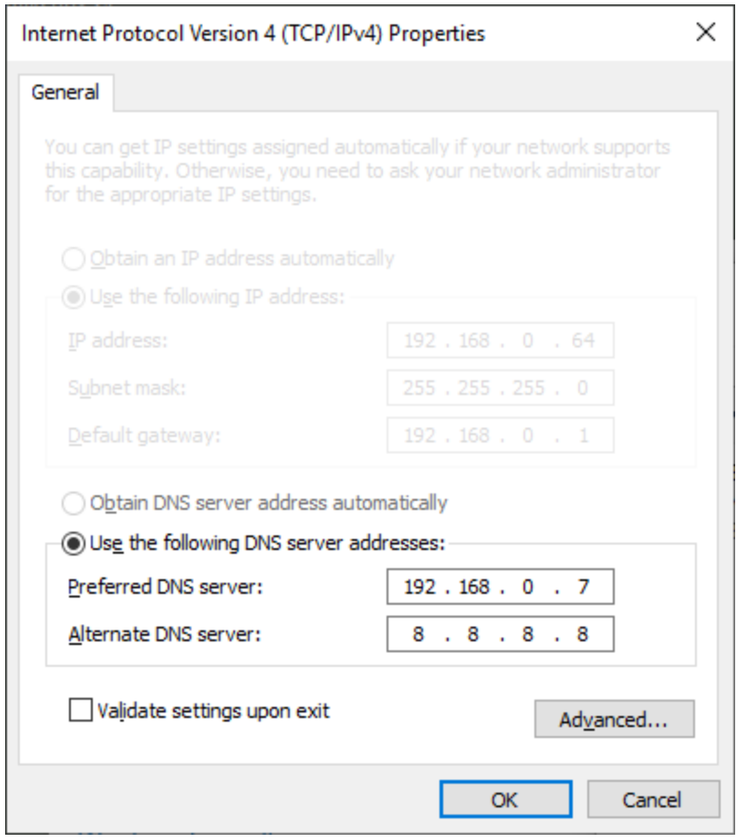
DNS: Multi Layer Look-Up

If everything is run by IP Addresses, how do I get to a web site?

https://www.audinate.com/certify/

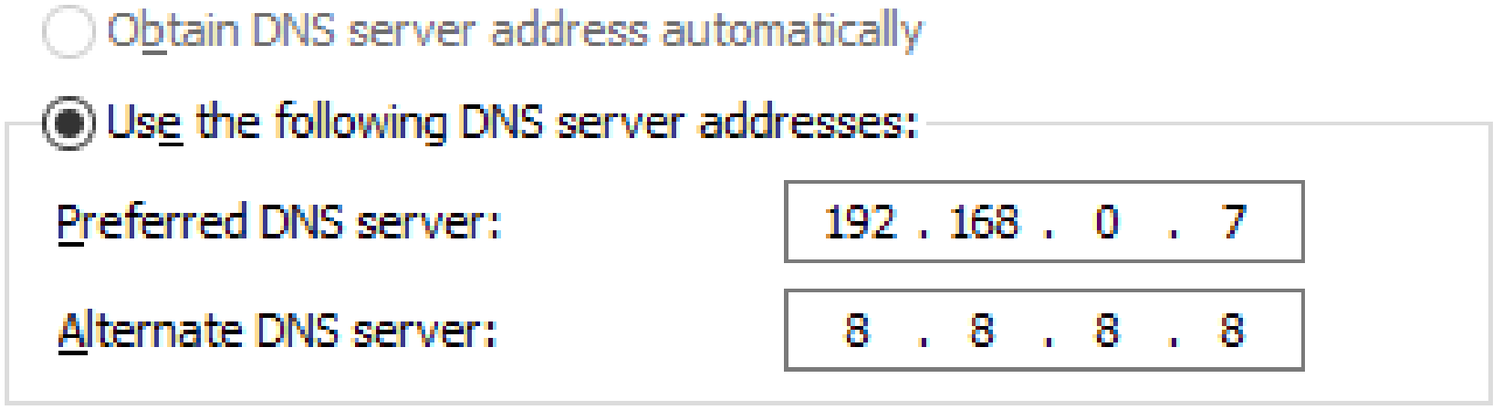
https://45.33.44.50/certify/

DNS: Multi Layer Look-Up

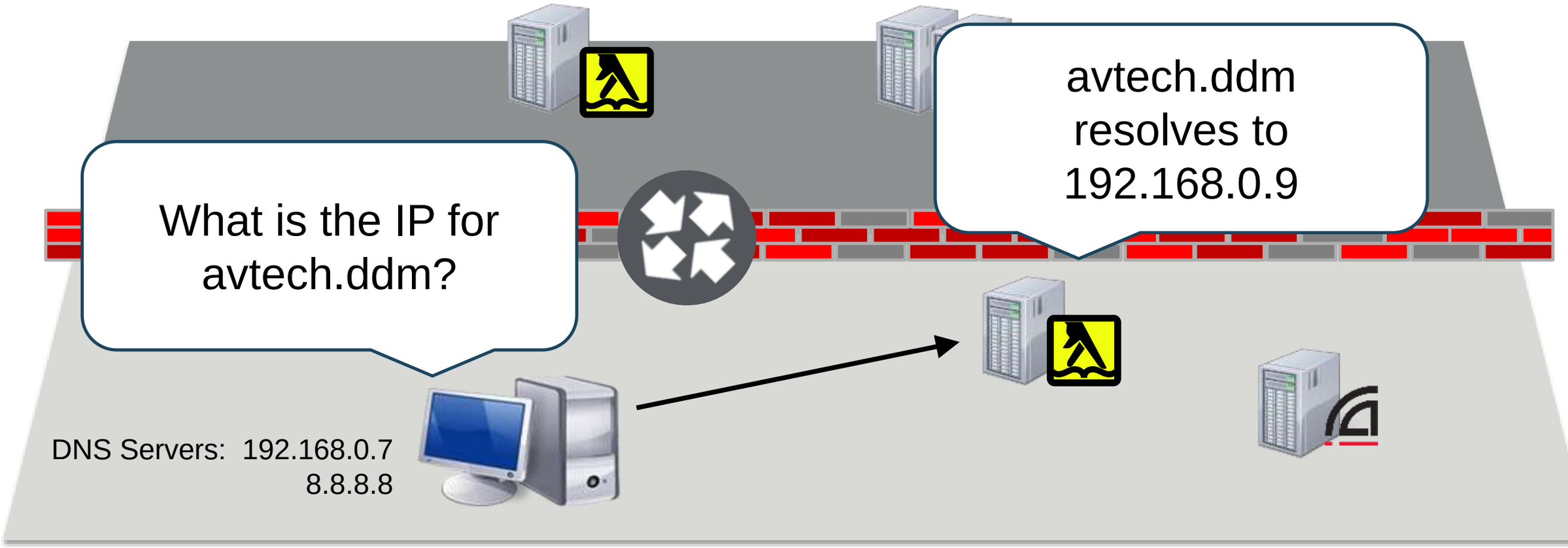


DNS (Domain Name Service)

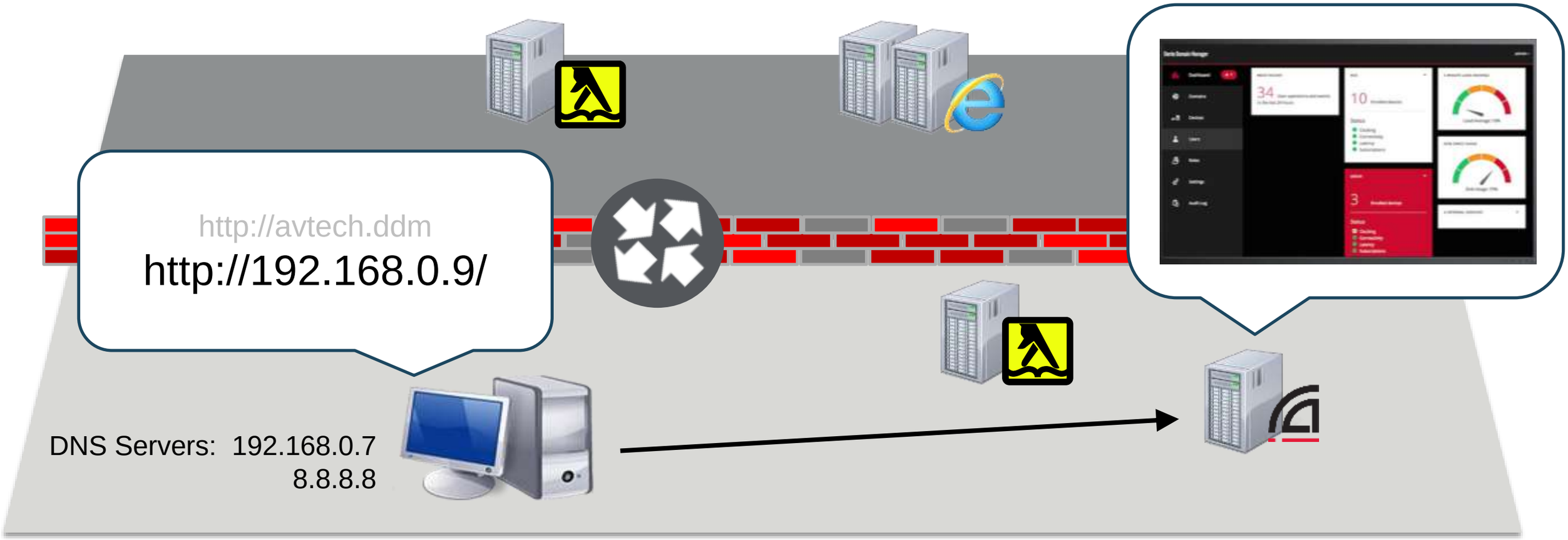
Resolves names to IP Addresses



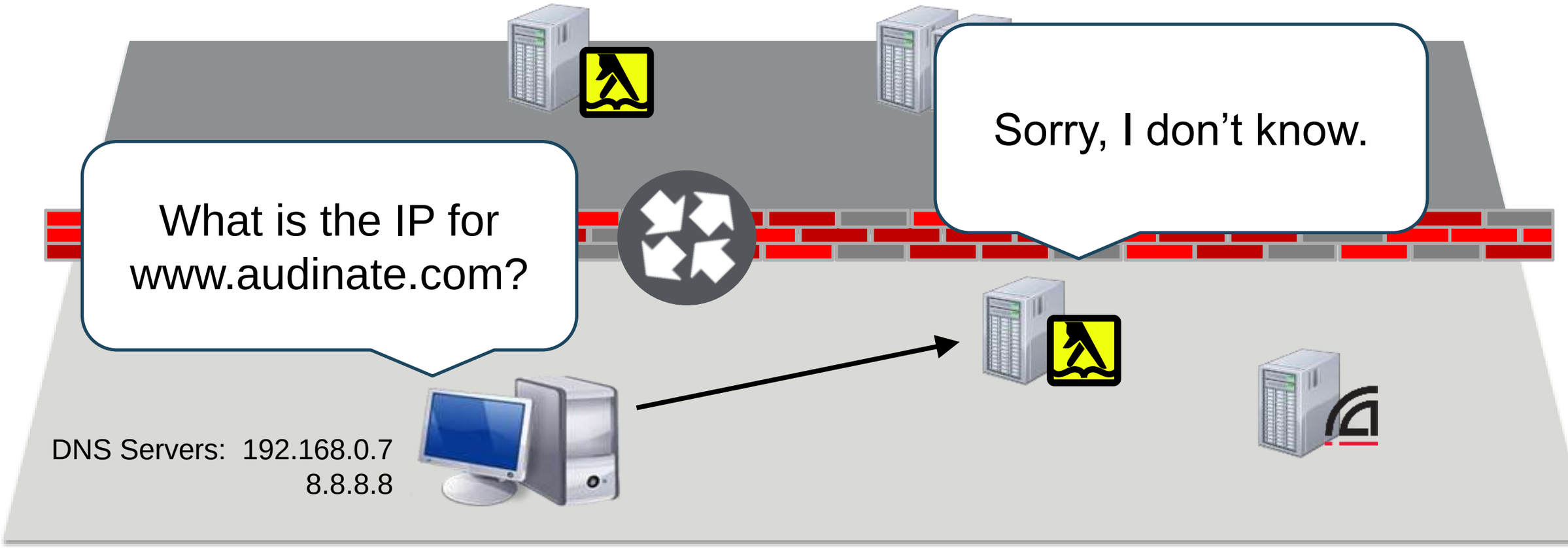
DNS: Multi Layer Look-Up



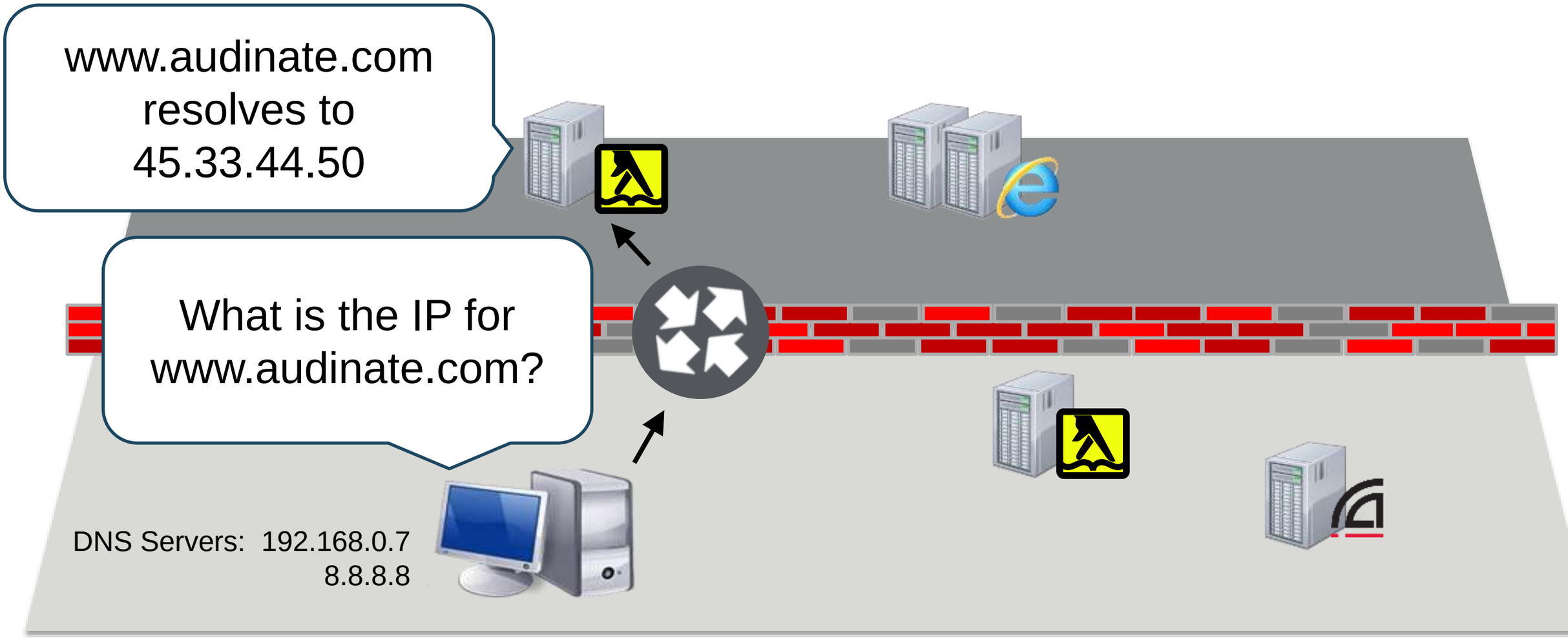
DNS: Multi Layer Look-Up



DNS: Multi Layer Look-Up



DNS: Multi Layer Look-Up



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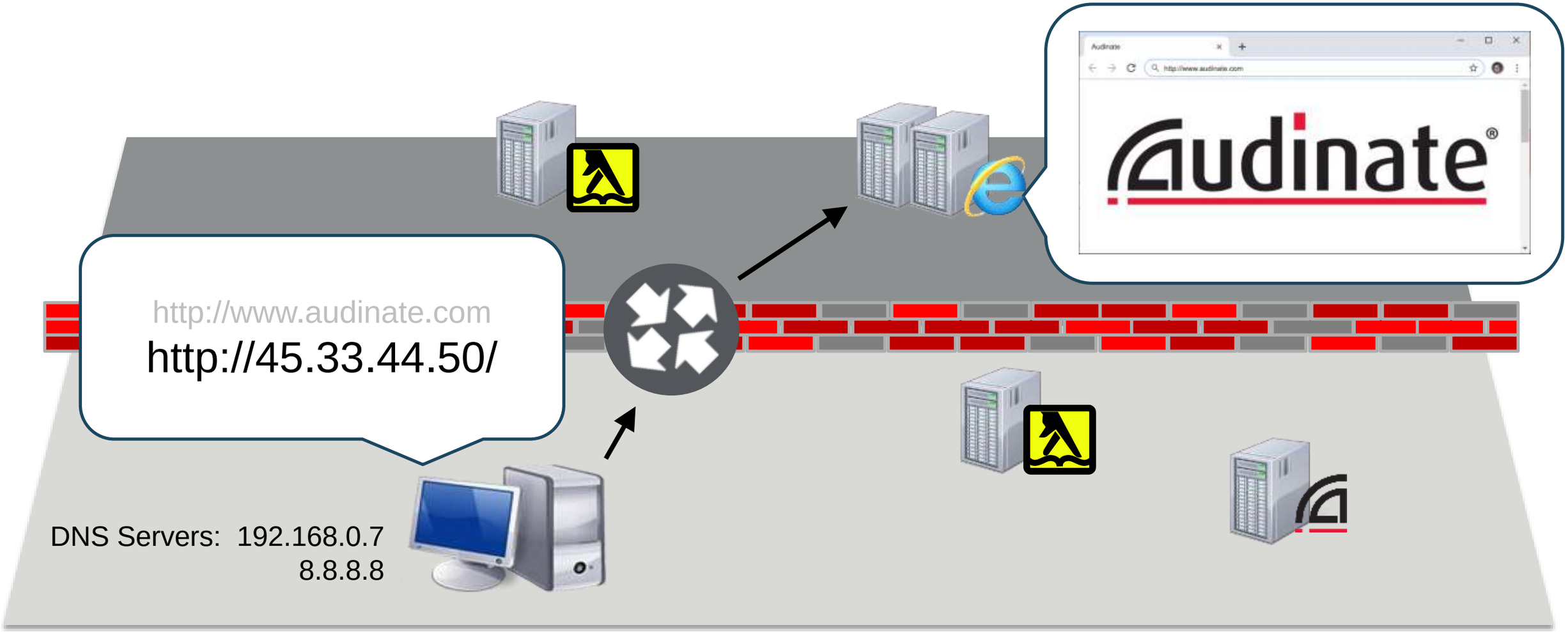
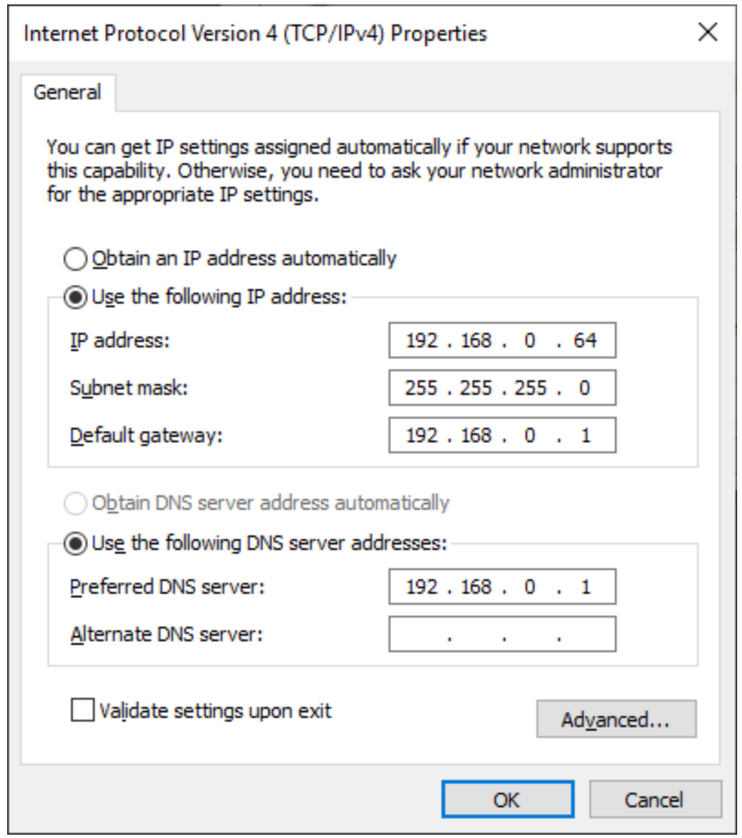
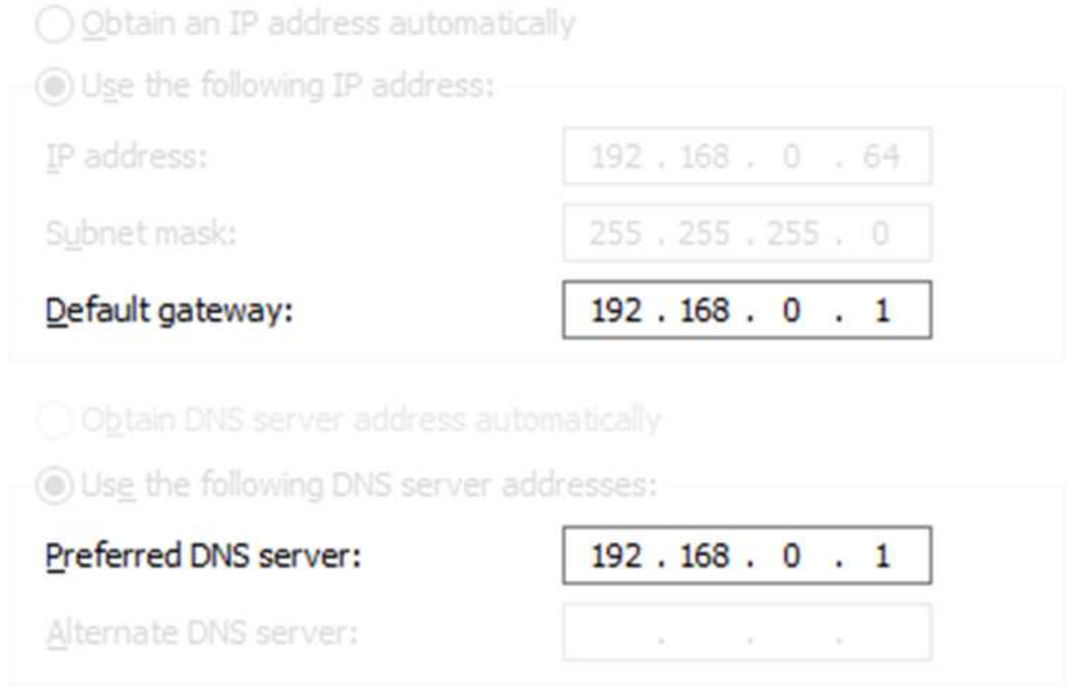


DNS: Multi Layer Look-Up

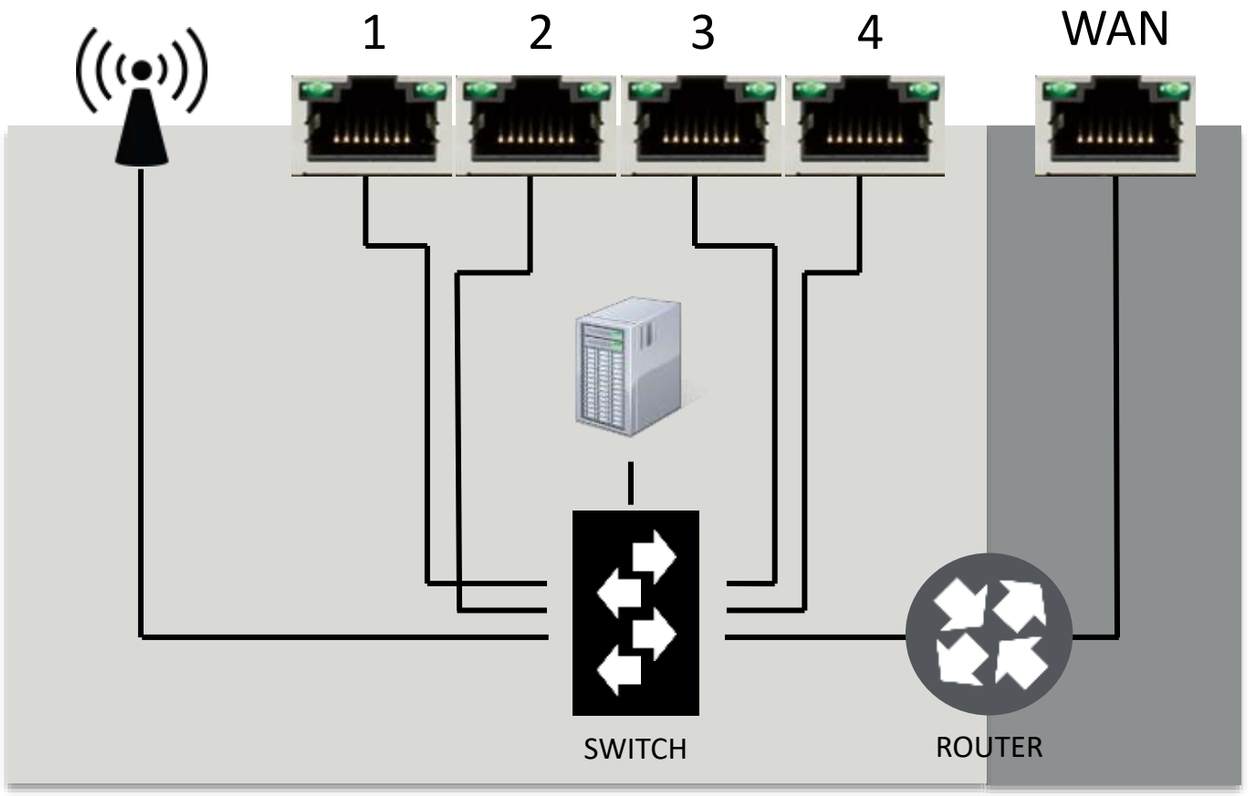


Gateway & DNS Server can be the same address?

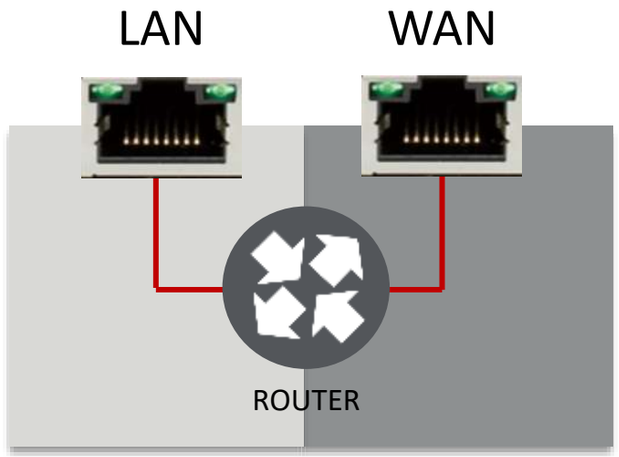


A “Wireless Router” Serves Many Functions

Typical Home Wireless Router:



Router:



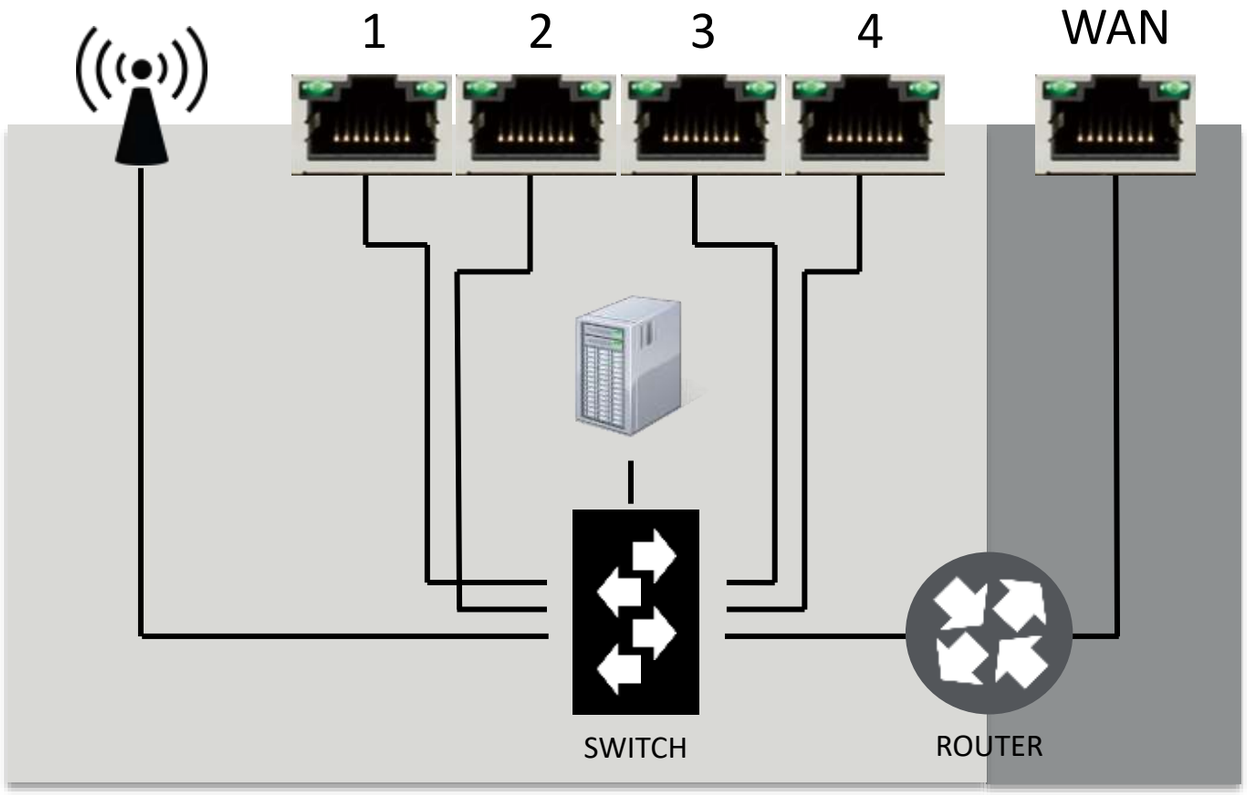
A “Wireless Router” Serves Many Functions

A mixer used to require racks of external gear…

+

DNS Caching

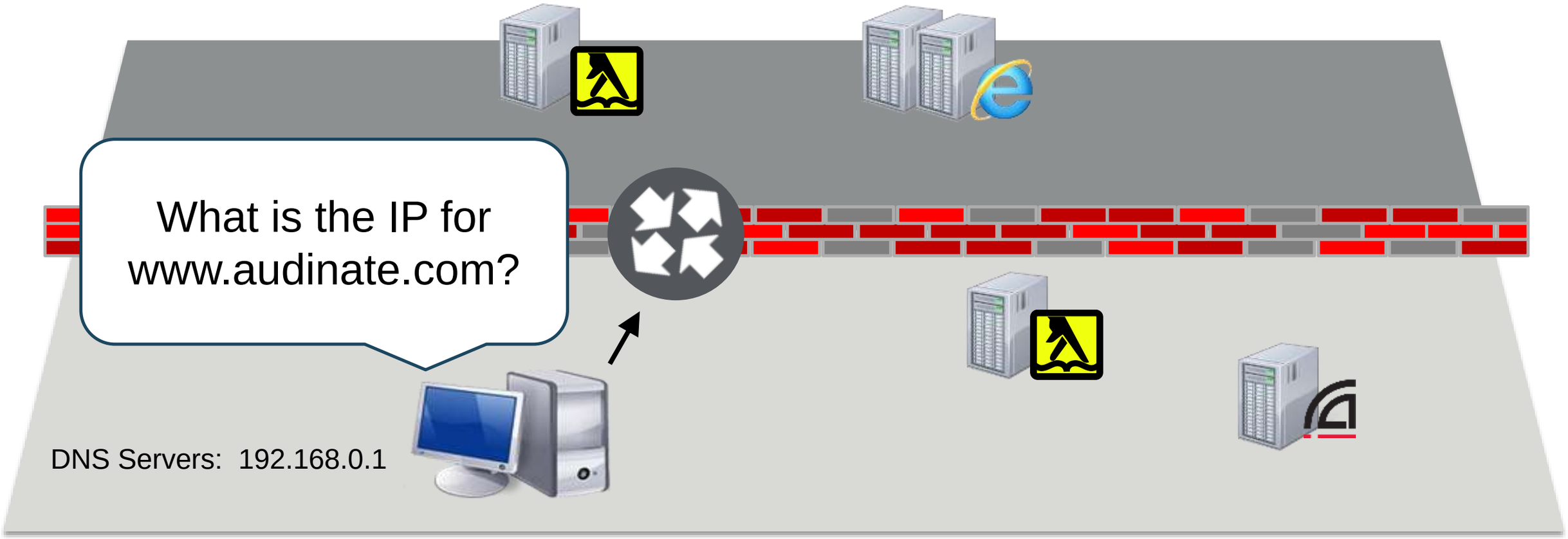
Typical Home Wireless Router:



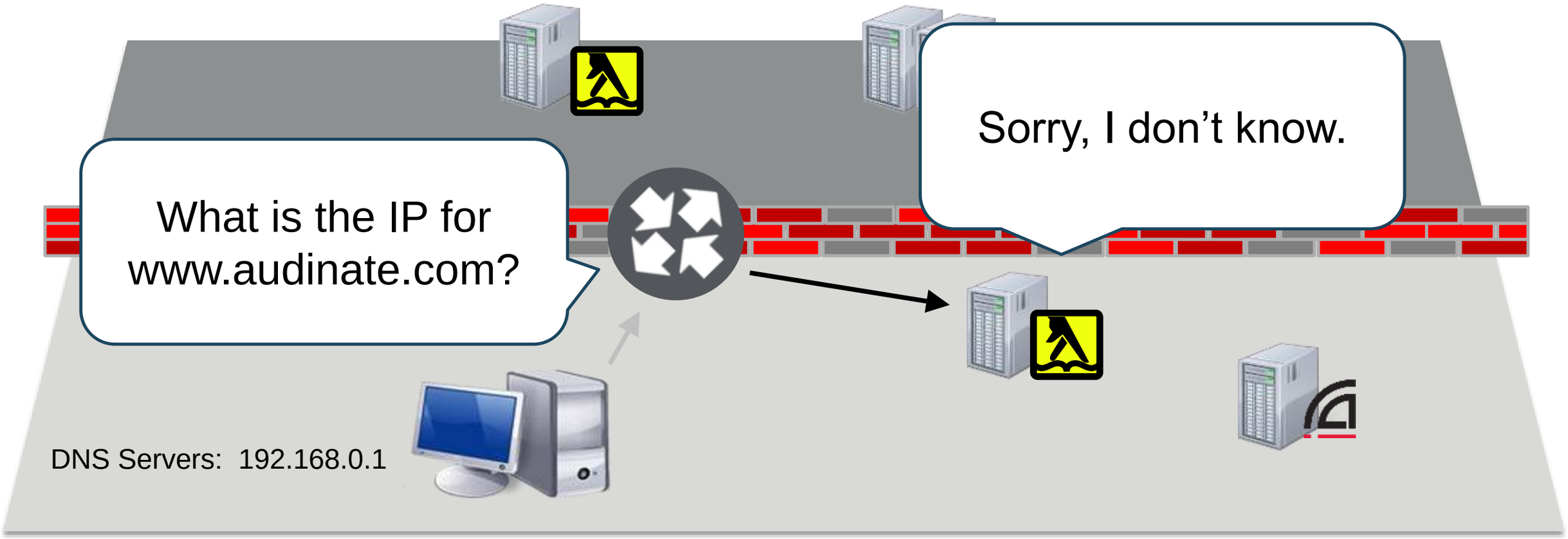
Also Includes:

- DHCP Server
- VPN (Remote Login)
- DNS Resolution & Caching

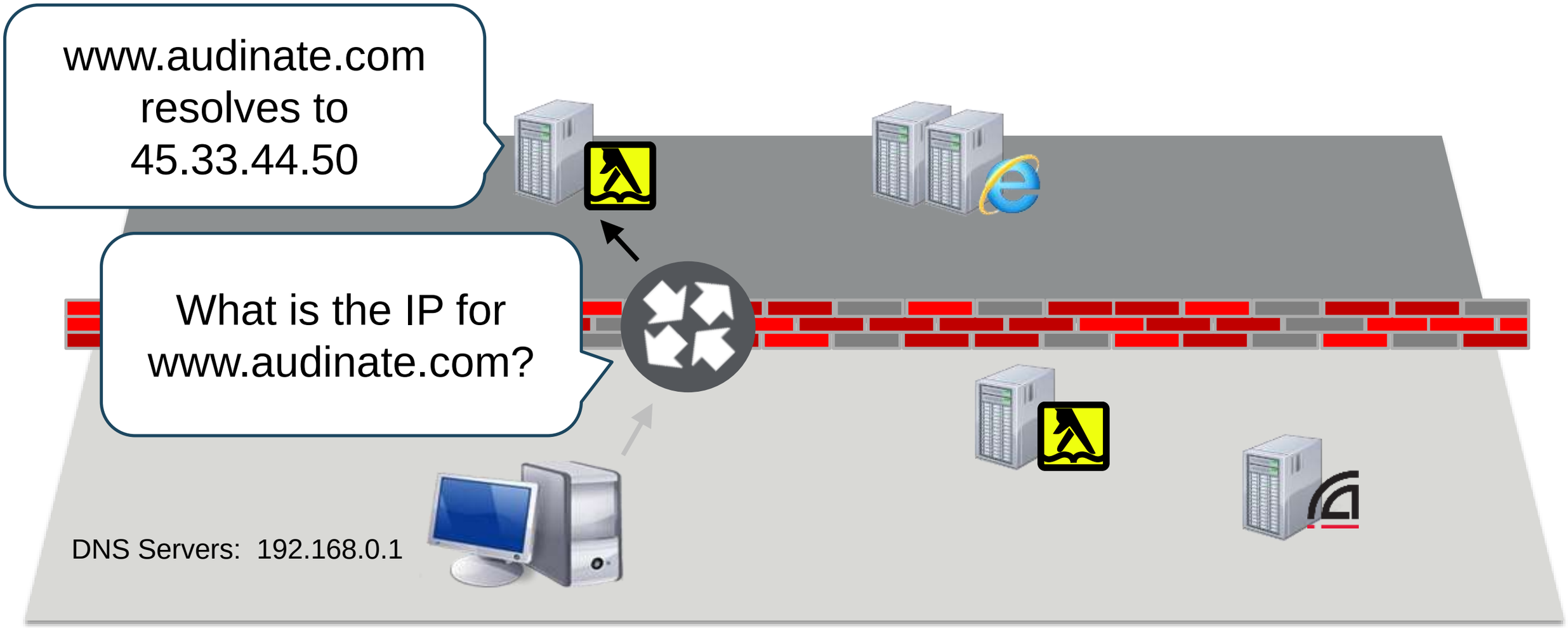
DNS Caching



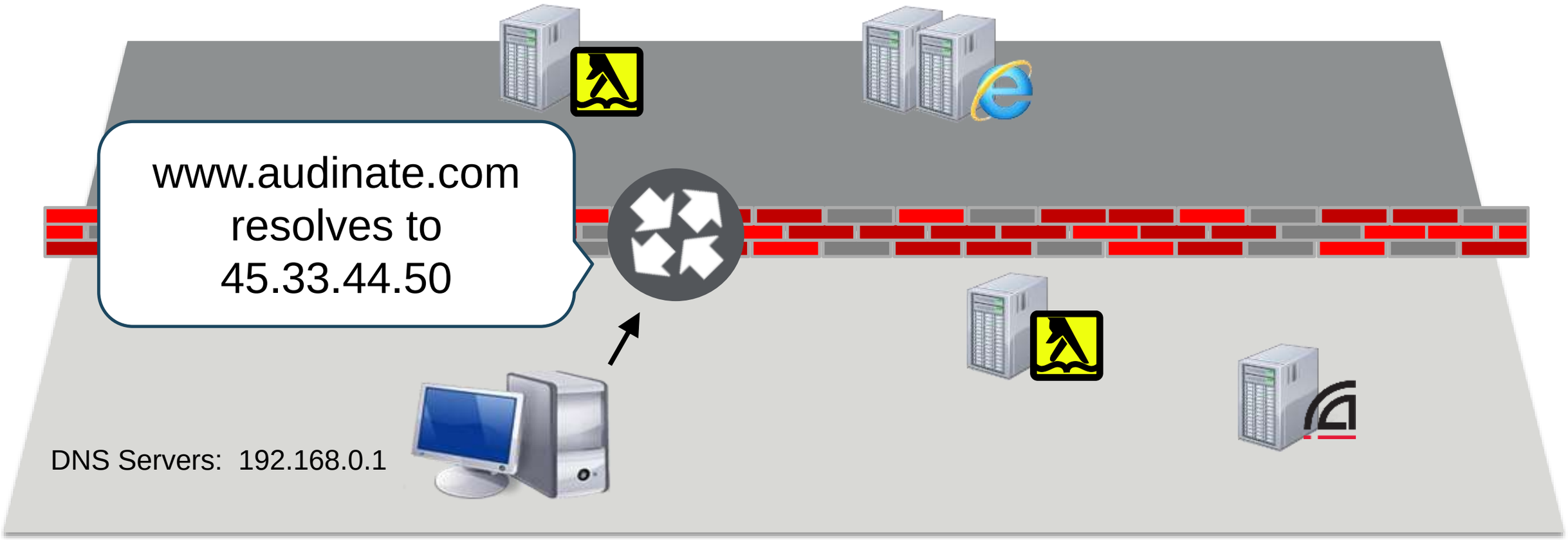
DNS Caching


Sorry, I don’t know.
What is the IP for www.audinate.com?
DNS Servers: 192.168.0.1

DNS Caching


www.audinate.com resolves to 45.33.44.50
What is the IP for www.audinate.com?
DNS Servers: 192.168.0.1

DNS Caching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resolves to
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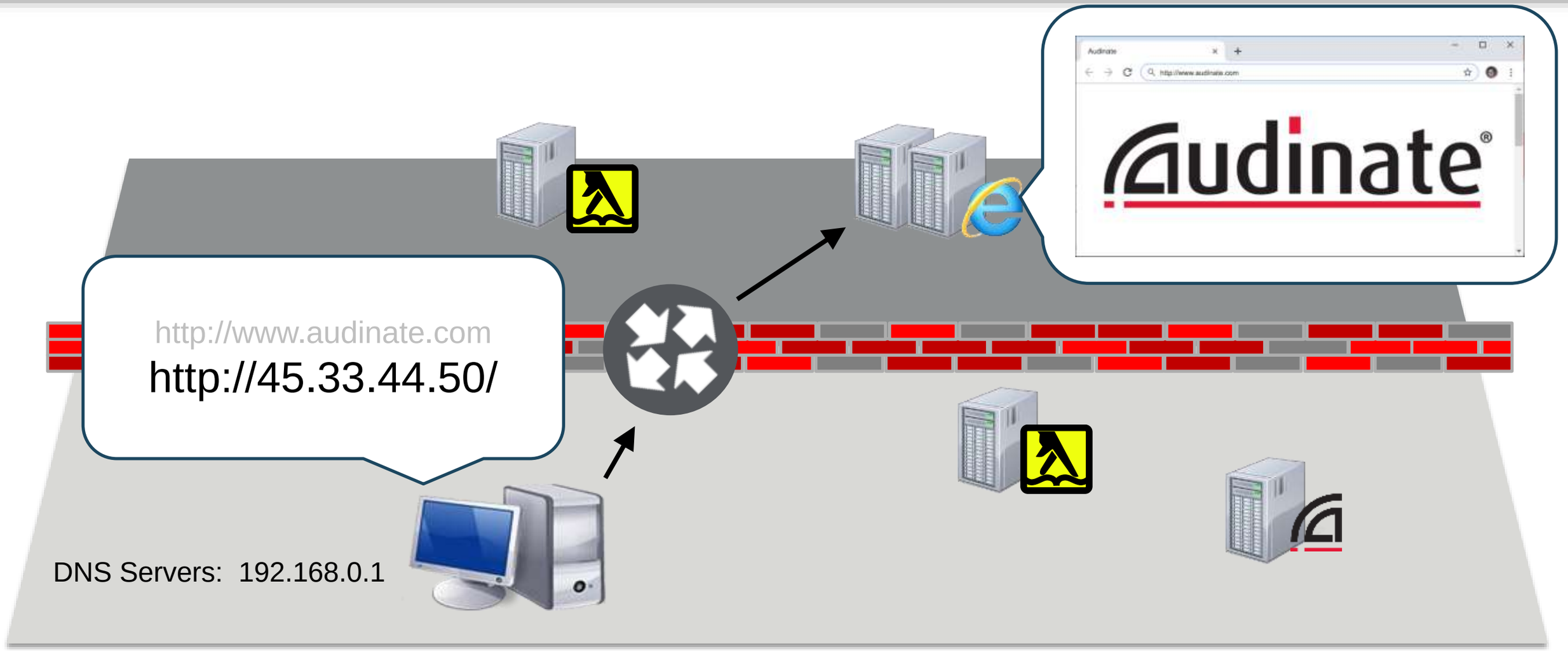
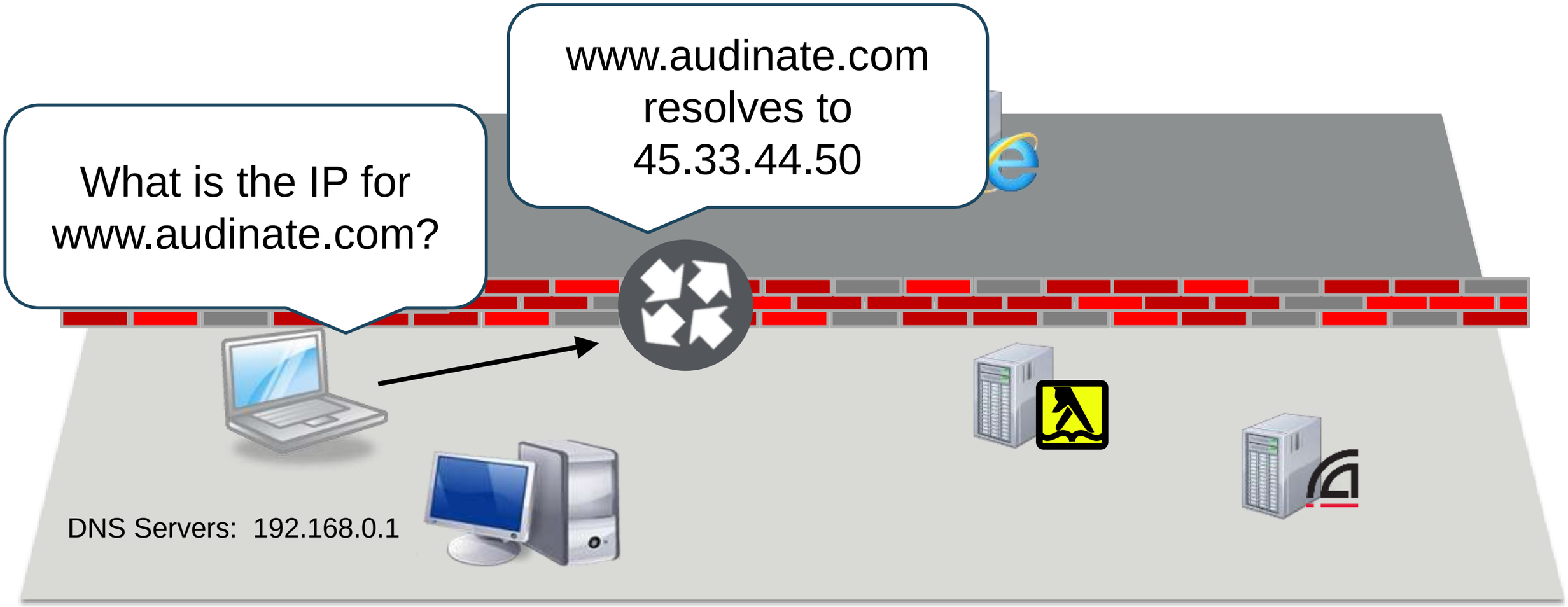
DNS Caching



DNS Caching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www.audinate.com resolves to 45.33.44.50
DNS Servers: 192.168.0.1

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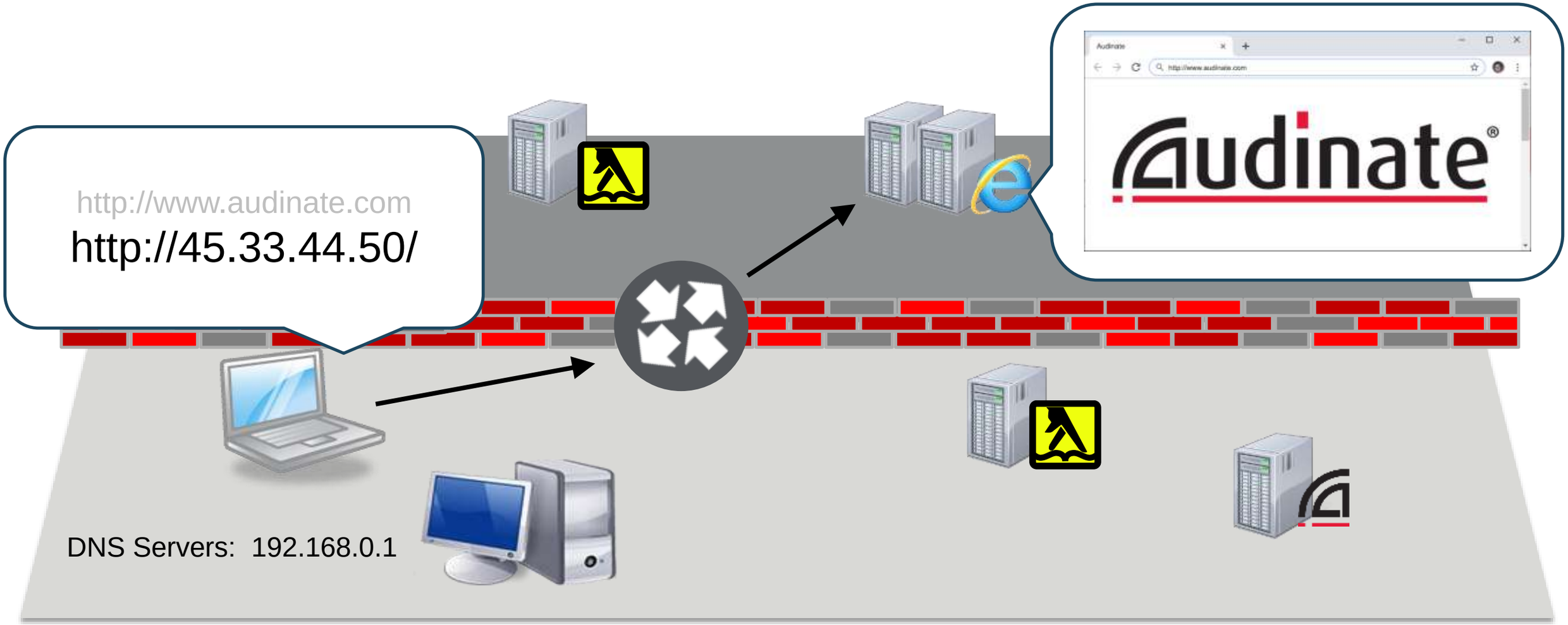
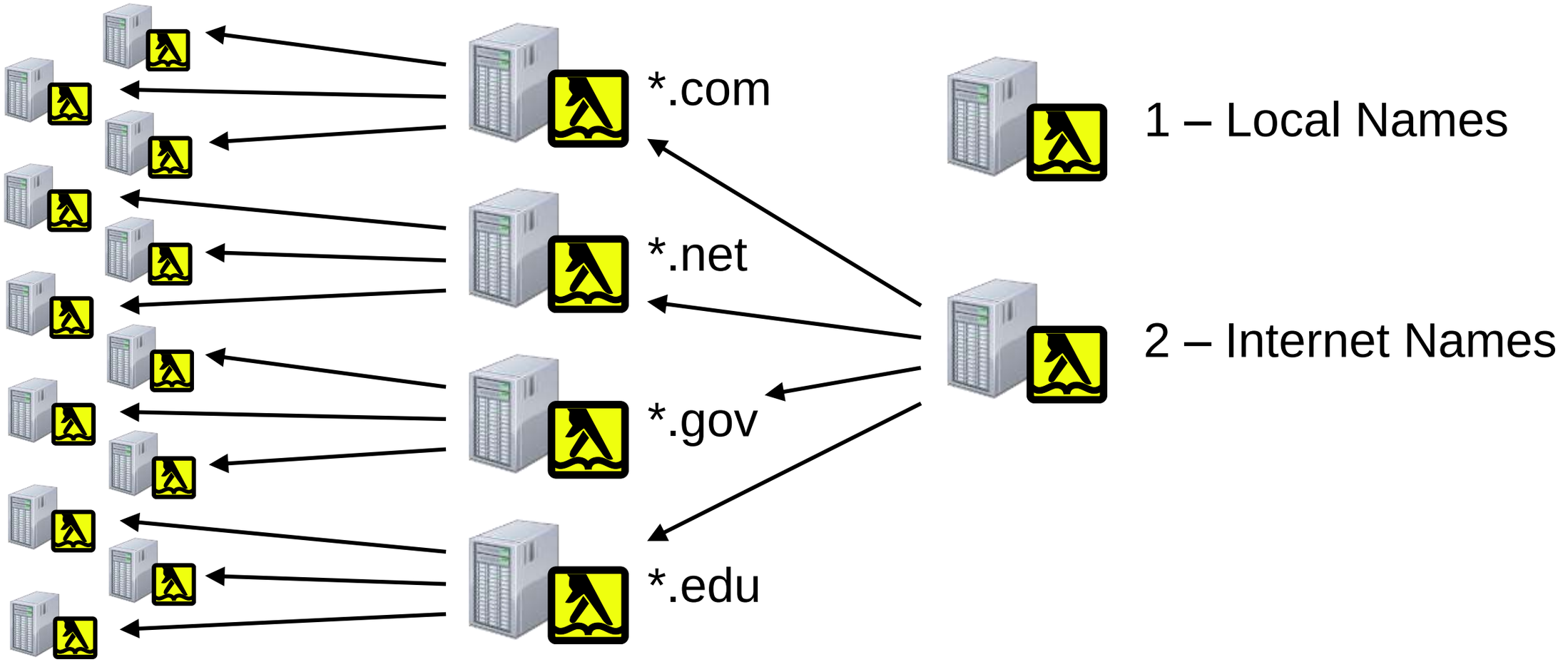

http://www.audinate.com
http://45.33.44.50/
Audinate
http://www.audinate.com
Audinate
DNS Servers: 192.168.0.1

DNS Resolution – Network Is Very Large



DNS Summary

Domain Name Service

- DNS is like a phone book, resolving Domain Names to IP Addresses
- There can be many DNS servers – your system defines them by priority
- The process returns first answer it sees – not a voting system.
- Localized devices cache the names of common sites for speed

DHCP and Link Local

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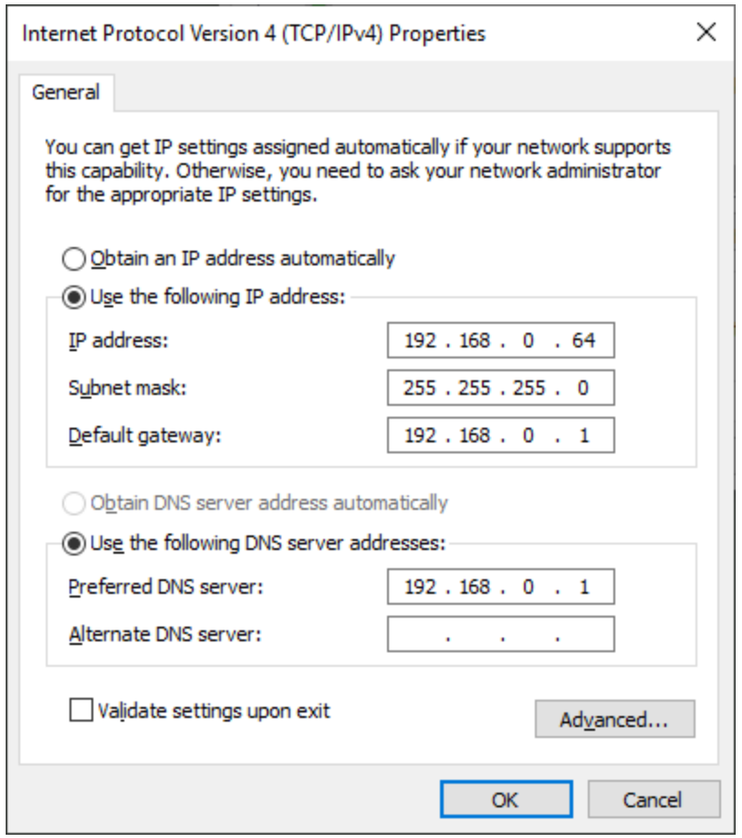
Automatic IP Addressing: DHCP

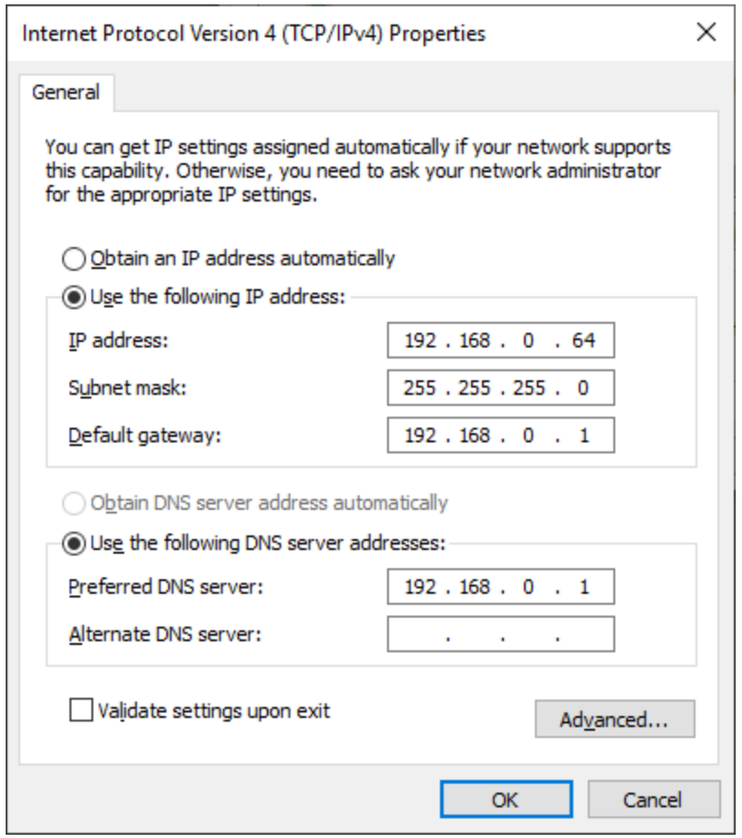


DHCP Automatically Assigns:

- IP Address — Different on each device
- Subnet Mask
- Gateway
- DNS

The same on all devices

Automatic IP Addressing: DHCP



DHCP Settings:

IP Range: IP addresses to hand out:

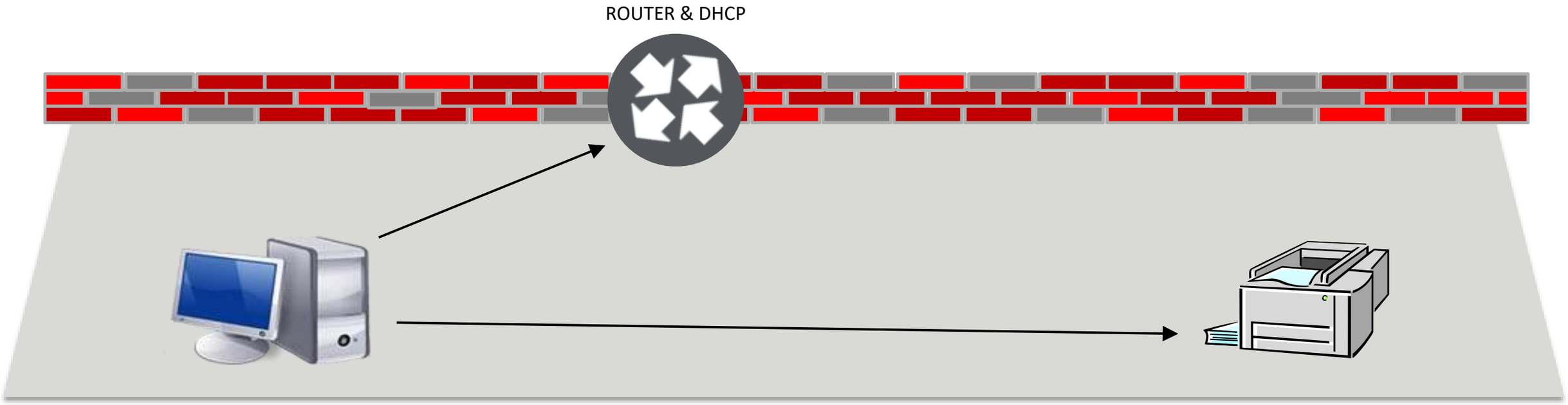
192.168.0. 100 to
192.168.0. 254

DHCP Lease Time: Configuration “Time to Live”:

e.g. – 24 hours

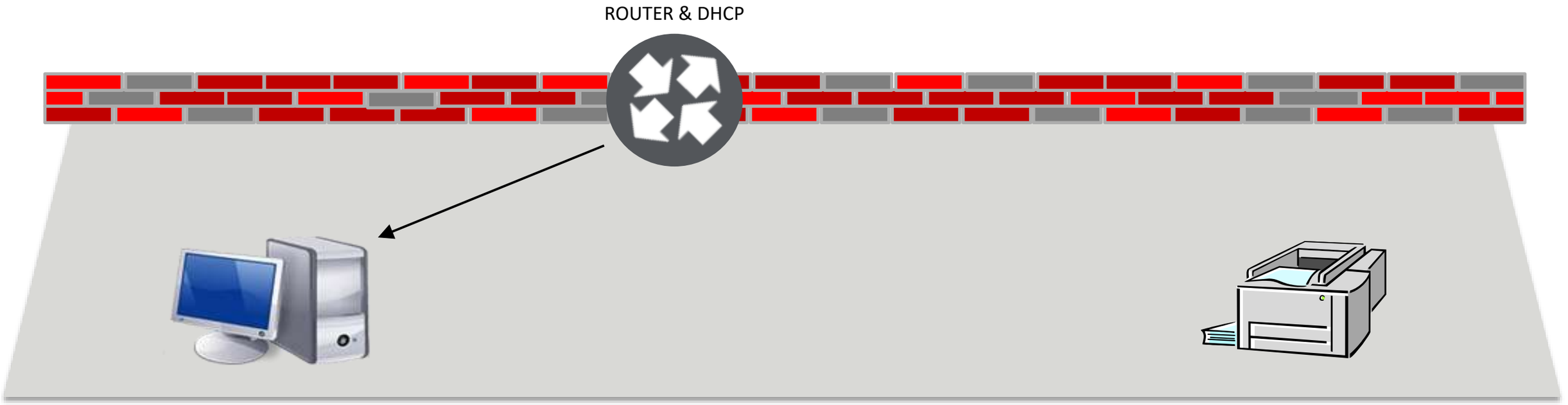
Automatic IP Addressing: DHCP

IP	Expiration	MAC



Automatic IP Addressing: DHCP

IP	Expiration	MAC
.101	2020-06-16 09:30	AA.BB.CC.DD.EE.01

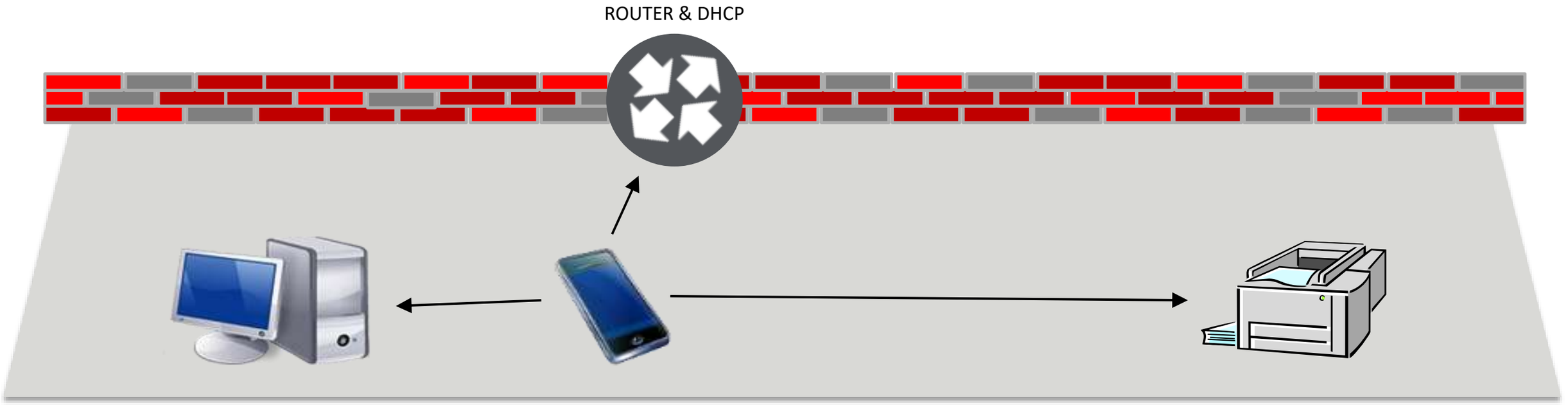


.101 – 9:30am

.51 - Static

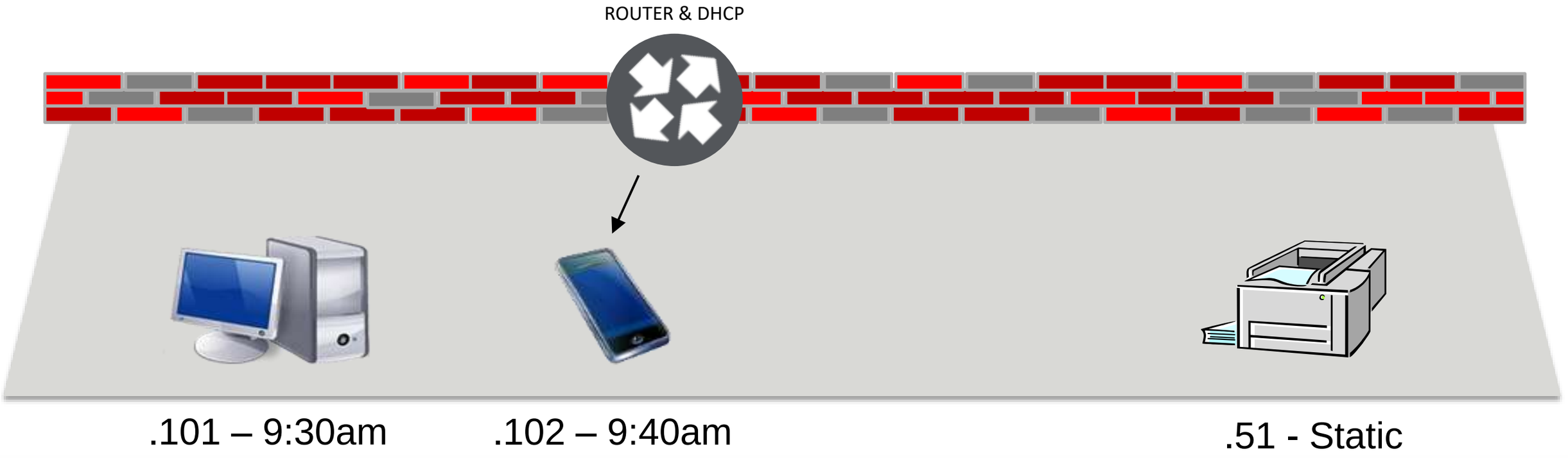
Automatic IP Addressing: DHCP

IP	Expiration	MAC
.101	2020-06-16 09:30	AA.BB.CC.DD.EE.01



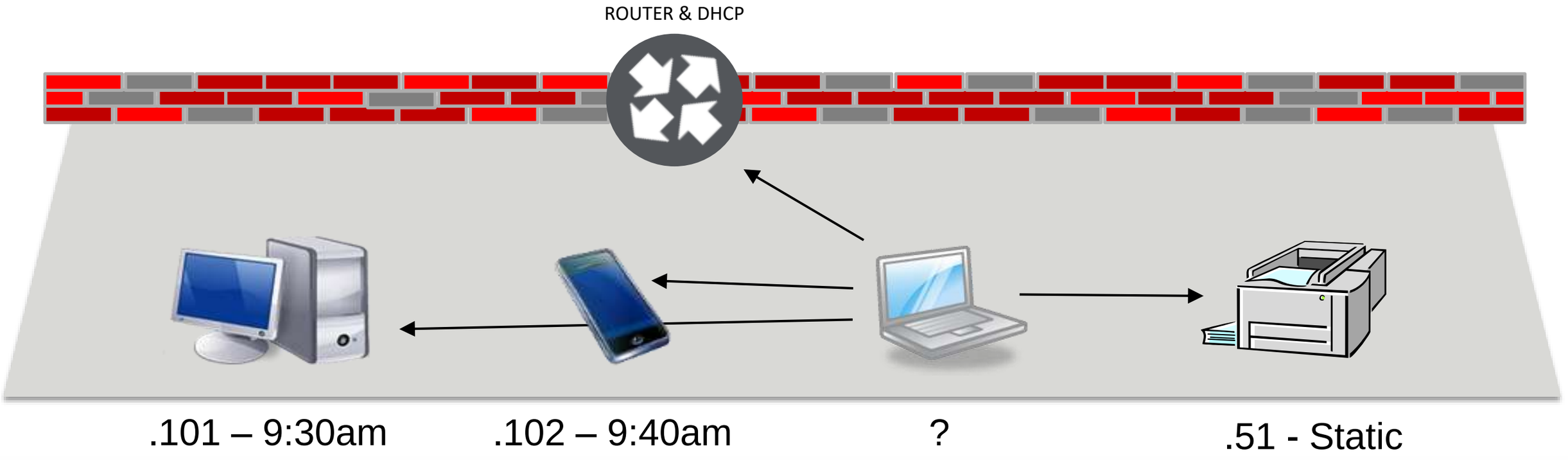
Automatic IP Addressing: DHCP

IP	Expiration	MAC
.101	2020-06-16 09:30	AA.BB.CC.DD.EE.01
.102	2020-06-16 09:40	AA.BB.CC.DD.EE.02



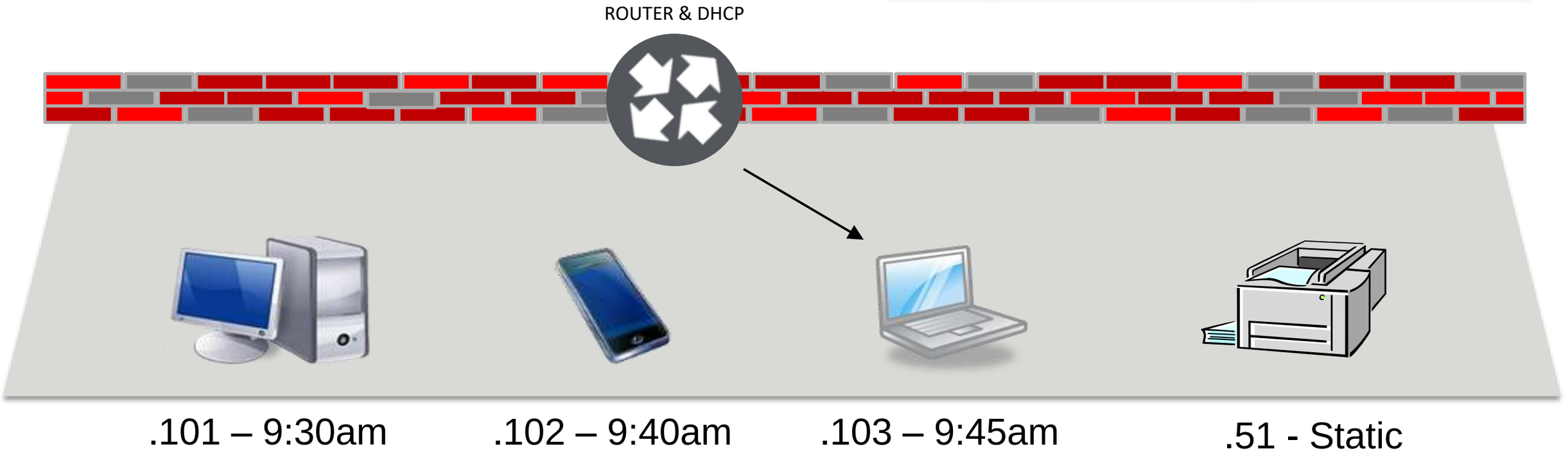
Automatic IP Addressing: DHCP

IP	Expiration	MAC
.101	2020-06-16 09:30	AA.BB.CC.DD.EE.01
.102	2020-06-16 09:40	AA.BB.CC.DD.EE.02



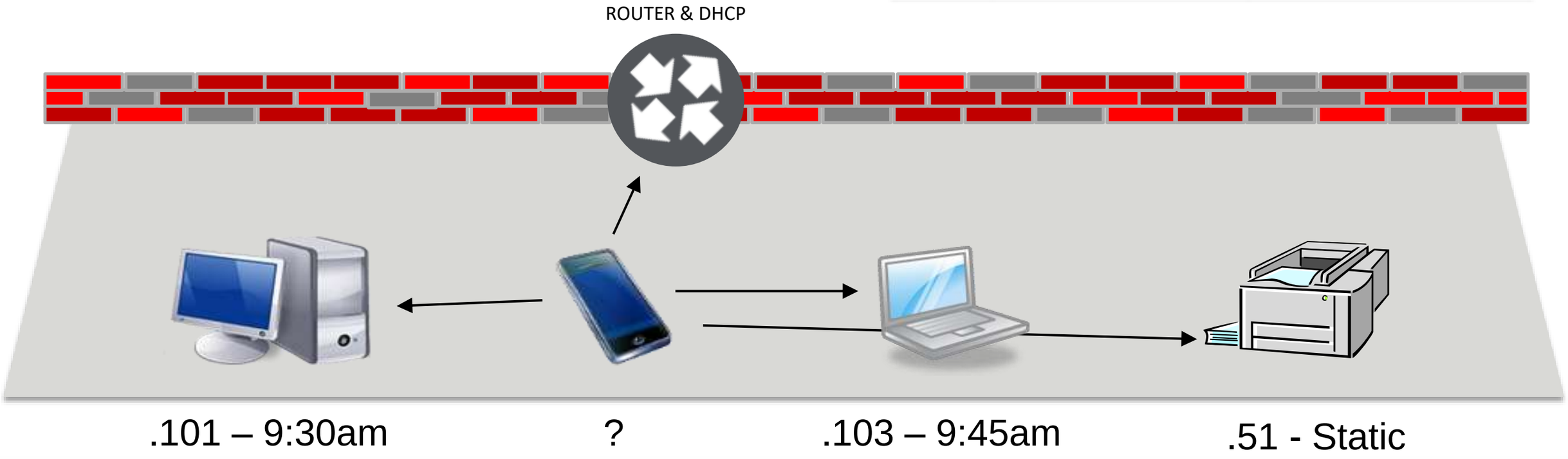
Automatic IP Addressing: DHCP

IP	Expiration	MAC
.101	2020-06-16 09:30	AA.BB.CC.DD.EE.01
.102	2020-06-16 09:40	AA.BB.CC.DD.EE.02
.103	2020-06-16 09:45	AA.BB.CC.DD.EE.03



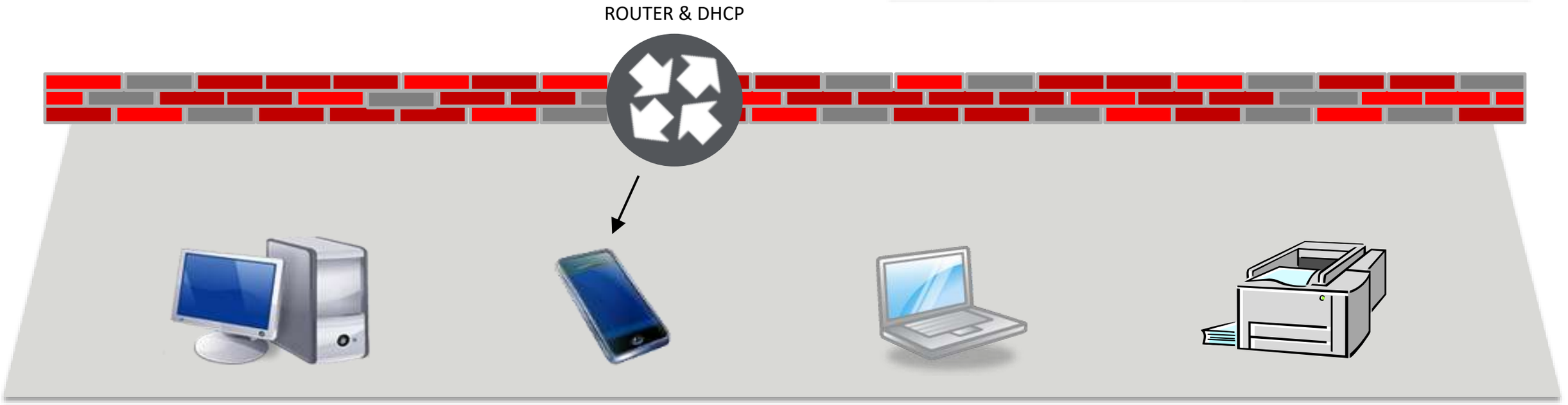
Automatic IP Addressing: DHCP

IP	Expiration	MAC
.101	2020-06-16 09:30	AA.BB.CC.DD.EE.01
.102	2020-06-16 09:40	AA.BB.CC.DD.EE.02
.103	2020-06-16 09:45	AA.BB.CC.DD.EE.03



Automatic IP Addressing: DHCP

IP	Expiration	MAC
.101	2020-06-16 09:30	AA.BB.CC.DD.EE.01
.102	2020-06-16 13:05	AA.BB.CC.DD.EE.02
.103	2020-06-16 09:45	AA.BB.CC.DD.EE.03



.101 – 9:30am .102 – 1:05pm .103 – 9:45am .51 - Static

Automatic IP Addressing: DHCP

IP	Expiration	MAC
.101	2020-06-16 09:30	AA.BB.CC.DD.EE.01
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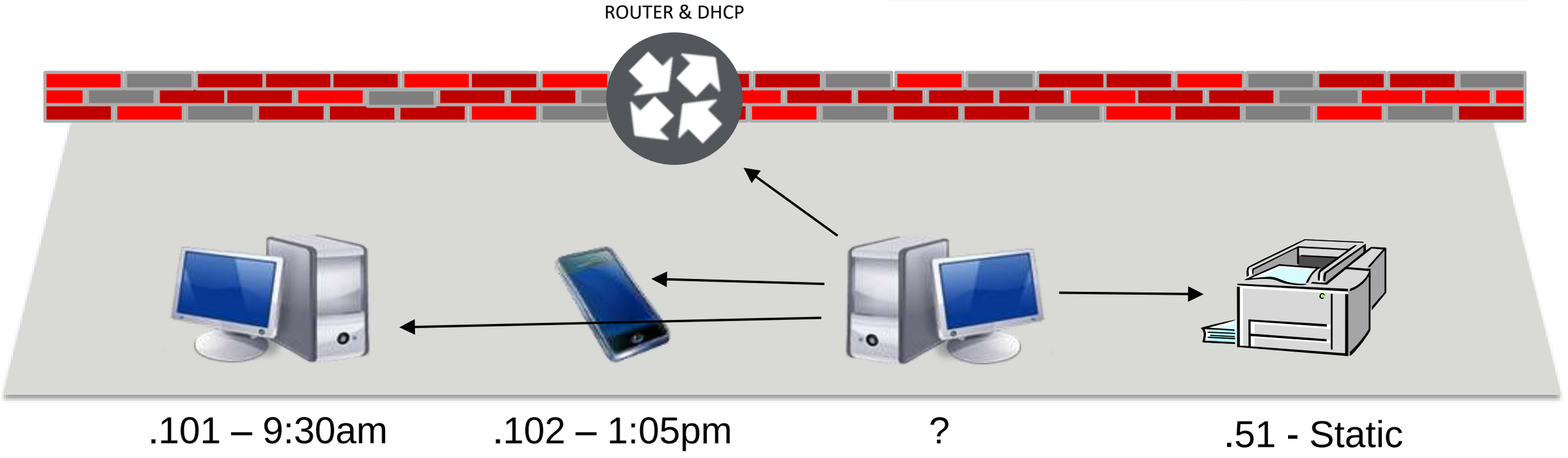

Automatic IP Addressing: DHCP

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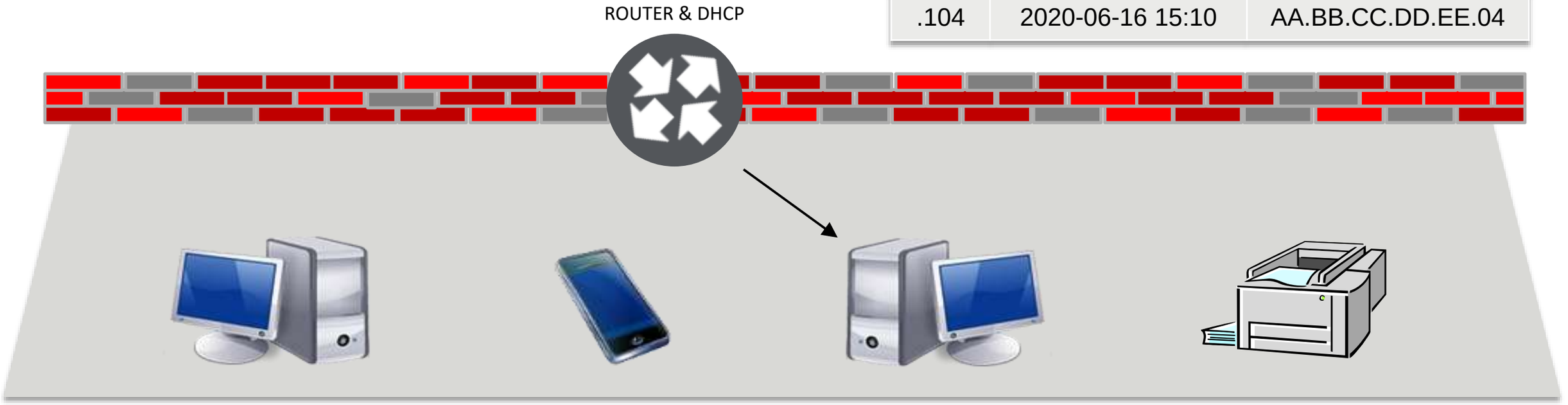
.102	2020-06-16 13:05	AA.BB.CC.DD.EE.02
.103	2020-06-16 09:45	AA.BB.CC.DD.EE.03
.104	2020-06-16 15:10	AA.BB.CC.DD.EE.04



.101 – 9:30am .102 – 1:05pm .104 – 3:10pm .51 - Static

Automatic IP Addressing: DHCP

IP	Expiration	MAC
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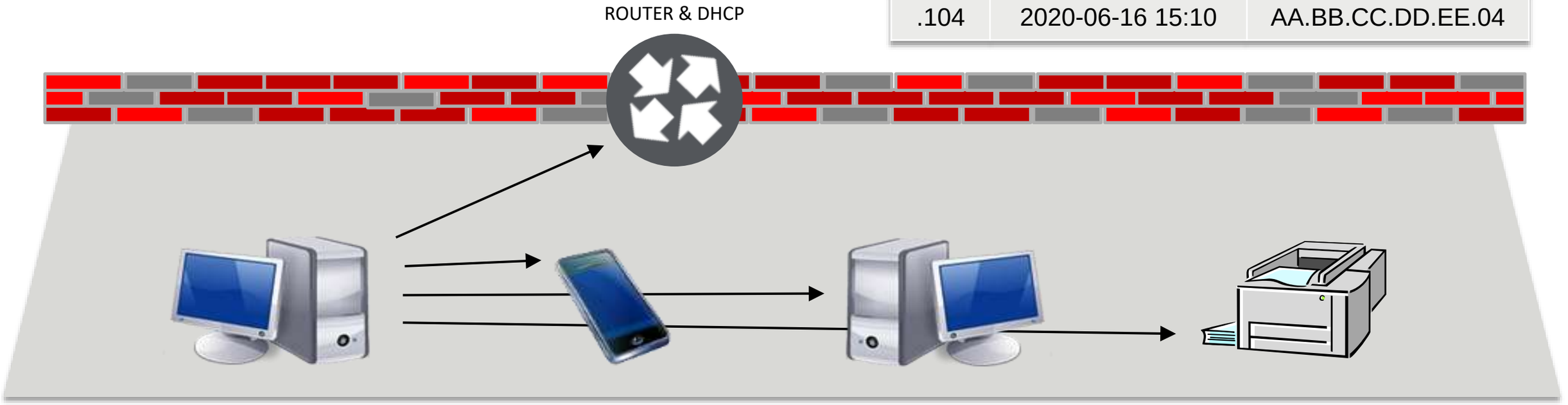

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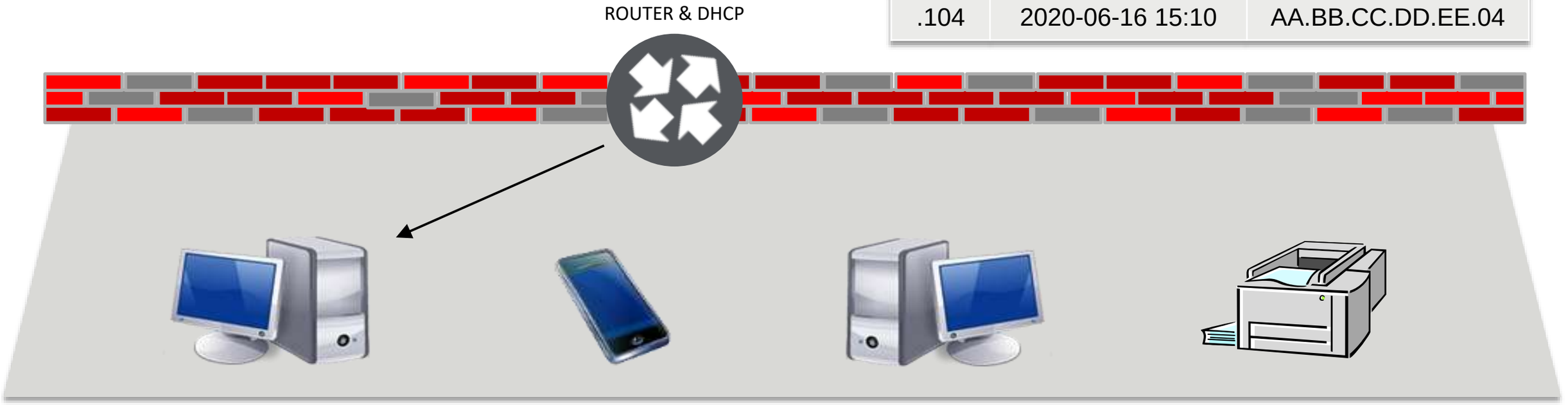


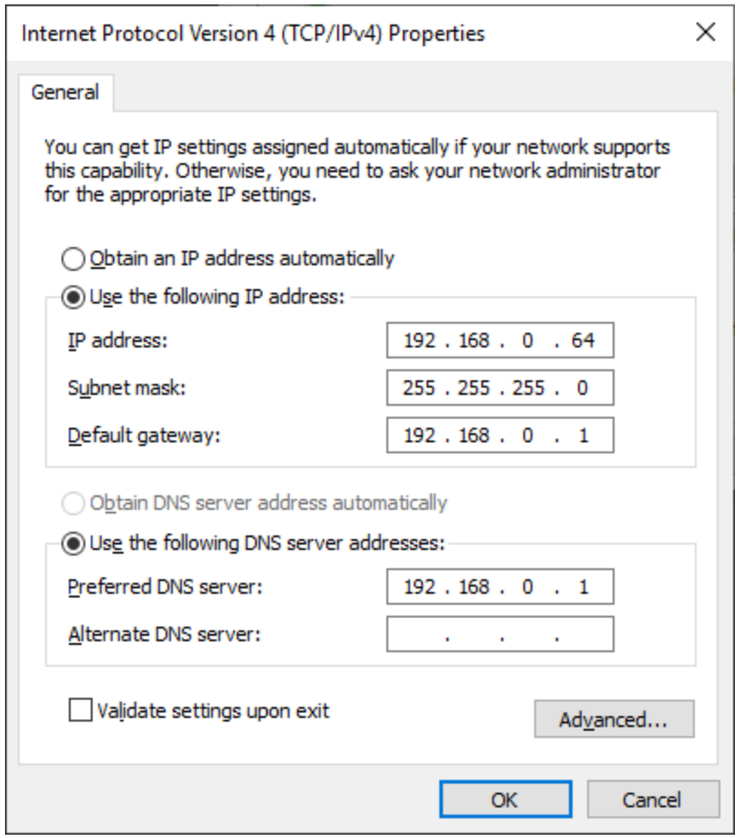
.101 – 9:30am .102 – 1:05pm .104 – 3:10pm .51 - Static

Automatic IP Addressing: DHCP

What if there is no DHCP Server?

Most Devices Revert to “Link Local”

Automatic IP Addressing: Link Local



Link Local Automatically Assigns:

- IP Address
- Subnet Mask

} 169.254.0.0 /16

169.254.__.__
255.255. 0 . 0

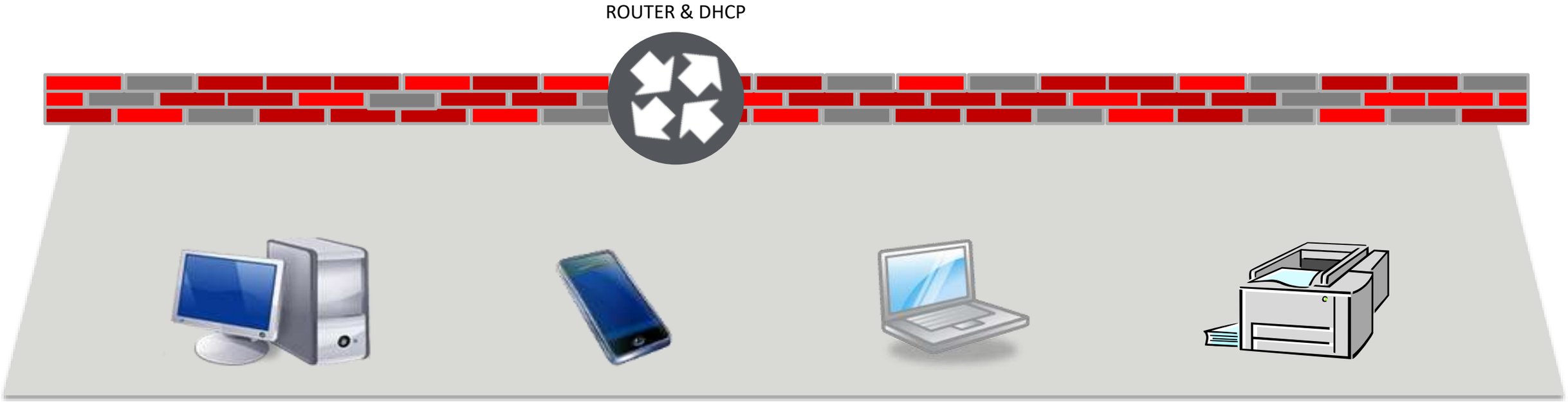
The goal is to allow devices to communicate on a LAN.

Link Local Does Not Deal With:

- Gateway
- DNS

Automatic IP Addressing: DHCP

If DHCP Looks Like This…



Link Local Looks Like This…

ARP “whohas” Request (Broadcast): 169.254.51.137

Automatic IP Addressing: DHCP

Link Local Looks Like This…

ARP Response (Unicast):

Link Local Looks Like This…

ARP “whohas” Request (Broadcast): 169.254.80.12

Automatic IP Addressing: DHCP

Link Local Looks Like This…

"No one responded. Possession is nine-tenths of the law, so I'll use this address."




169.254.51.137 169.254.80.12 169.254.14.81 192.168.0.51

Audinate®

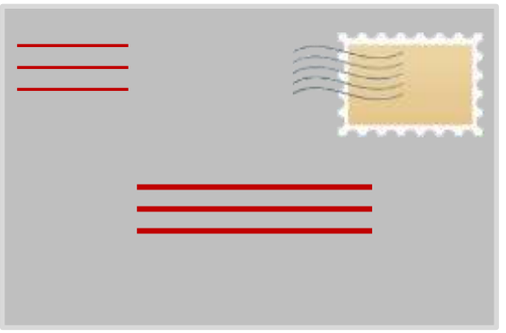
TCP vs UDP

Networking Topics for Today

ENHANCE	**Core IP Settings**	*IP Address, Subnet Mask, Gateway/Router, LAN Range*
	DNS	*Domain Name Service*
	DHCP/Link Local	*Automatic Address Settings*
	TCP/UDP	*Transmission Methods*
	Unicast, Multicast and Broadcast	*Distribution Methods*
	QoS	*Quality of Service – Traffic Prioritization*
	VLAN & Trunk Implications	*VLAN, Trunk, Tagged VLAN, STP, LAG*
NEW	**Network Ports**	*Managing Simultaneous Connections*
	Understanding Clocking	*Precision Time Protocol (PTP)*
	ARP, Layered Network Models	*Gluing IP & MAC Addresses, The OSI Model*
	Segmenting Broadcast Domain	*Managing the “Noise” in a Network*

TCP vs UDP Traffic

- TCP traffic is like “Signature Required” mail
  The sender gets notification that the message was received.
- UDP traffic is like “First Class” mail
  Place envelope in mailbox and trust it gets delivered.



Does that mean UDP is less reliable?

No, it is a different tool for a different job.

TCP vs UDP Traffic

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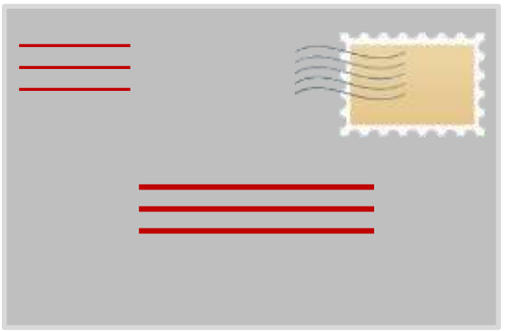


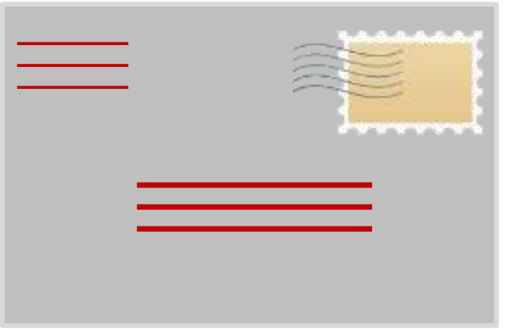
- TCP is appropriate for internet traffic where:
  - Communications are likely to be interrupted (internet),
  - Missing a packet invalidates data (ftp download) or
  - Timely delivery is a convenience, not a necessity.

- Problems with TCP for media:
  - If the packet was dropped, what is the time out on waiting for a confirmation?
  - Creates additional overhead, increasing likelihood of a problem.

TCP vs UDP Traffic

- UDP traffic is like “First Class” mail

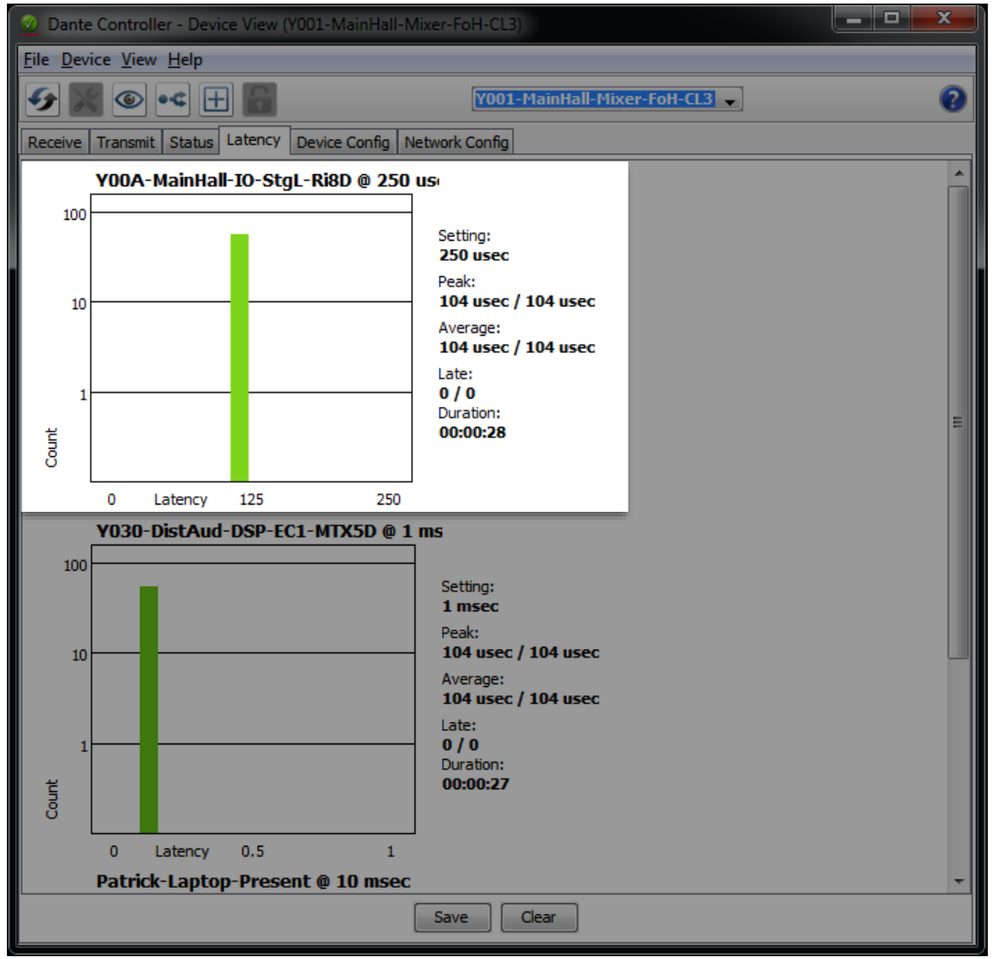
  Place envelope in mailbox and trust it gets delivered.



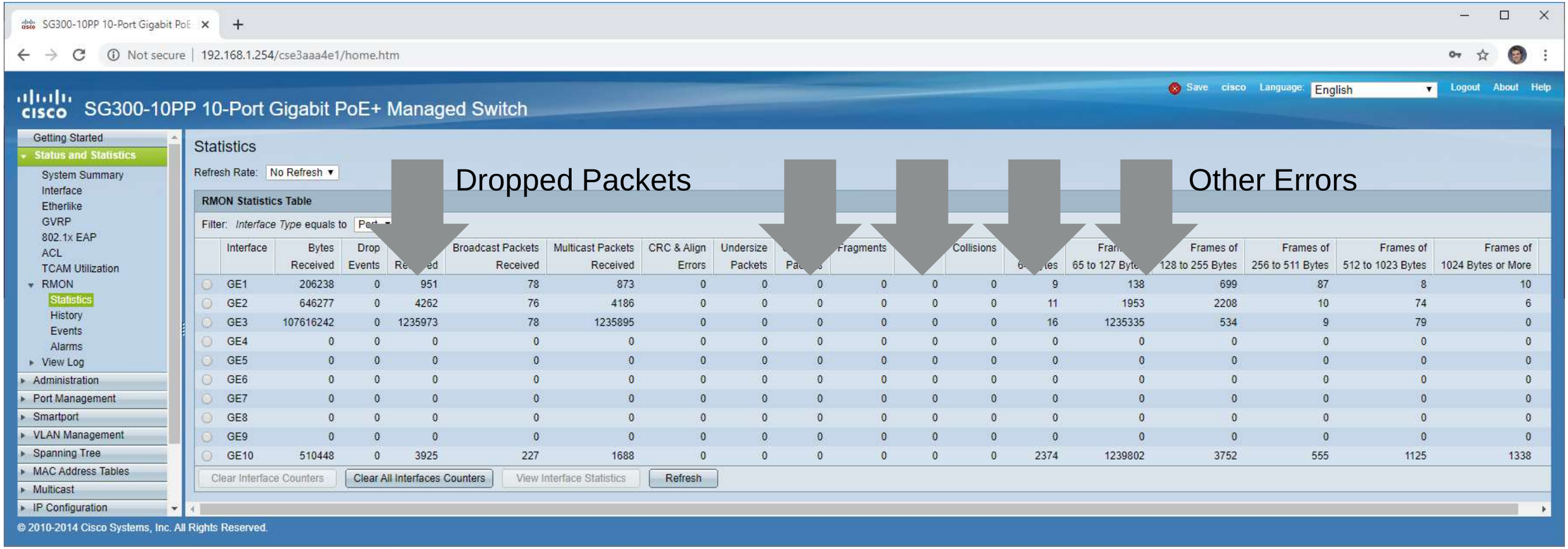
- UDP is appropriate for internet traffic where:
  - Communications are not likely to be interrupted (LAN),
  - Missing a packet in sequences can be overcome (error correction) or
  - Timely delivery or low overhead is key

- Devices can track network performance:
  - Managed switches and endpoints can log unhandled or missing packets

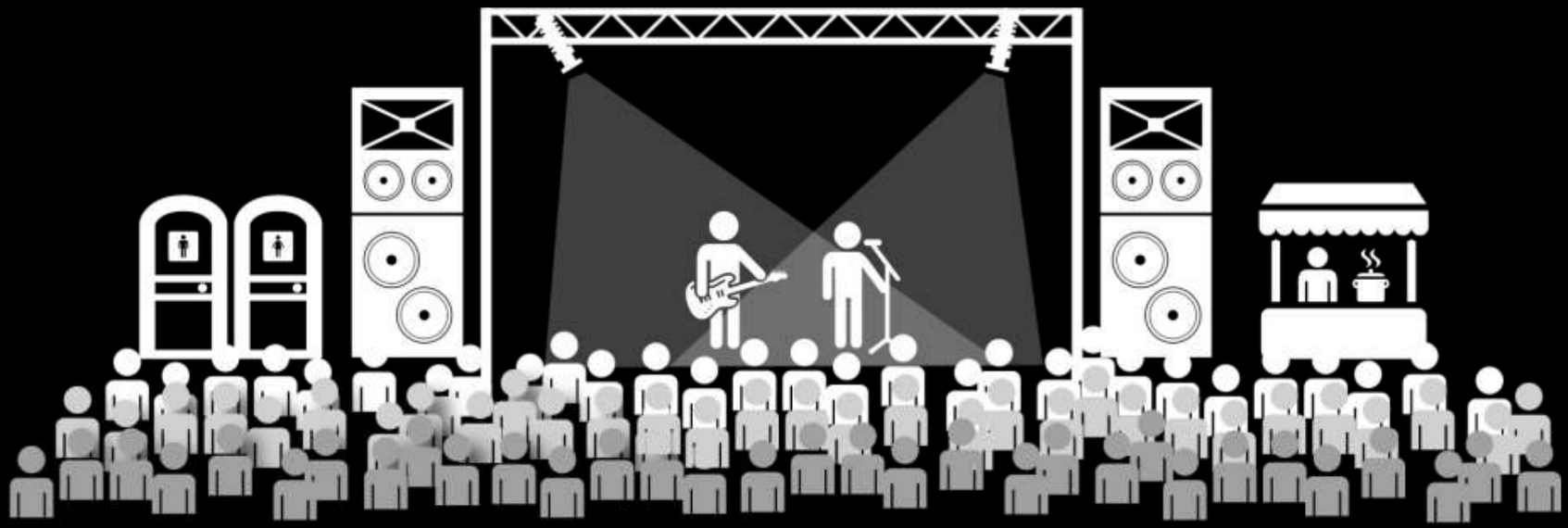
Verifying UDP Delivery



Verifying UDP Delivery



Use Case Scenario:



Music Festival: 48 bands in 3 days…
0 network problems.

Use Case Scenario:

FoH Position
(2) Consoles - Band A & Band B

Monitor Position
(2) Consoles - Band A & Band B

Production Desk
Yamaha CL1 Mixing Consoles
MC Mic, BGM, Quick Routing

Stageboxes
64 Inputs for Band A
64 Inputs for Band B

Main PA
Nexo STM Mains
Yamaha NXAMP Amps

Monitor PA
Nexo 45N12 Wedges
Nexo PS15/LS18 Side Fills
Yamaha NXAMP Amps

Unicast, Multicast and Broadcast

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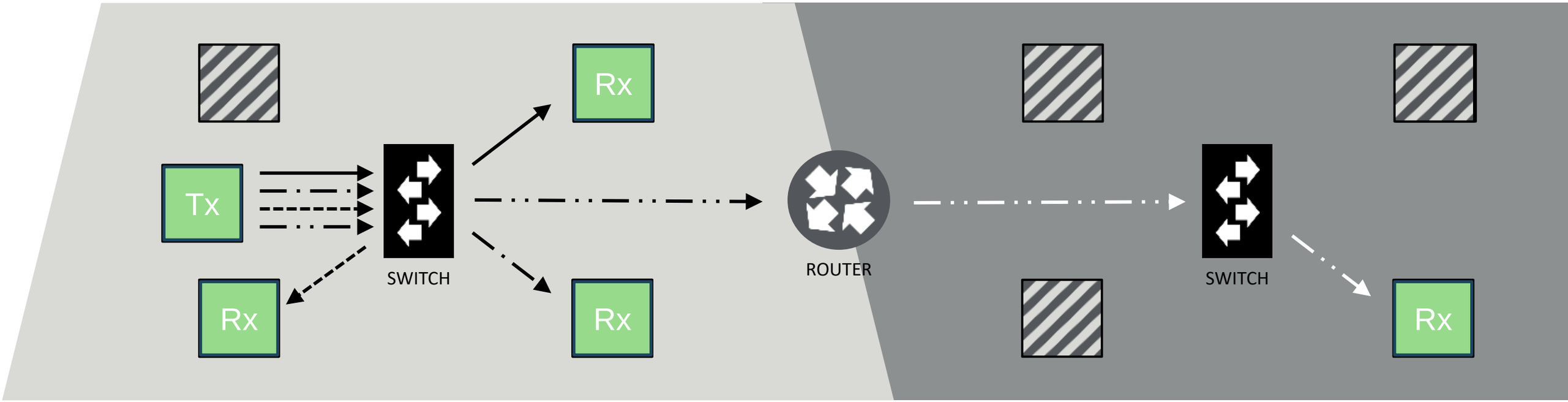
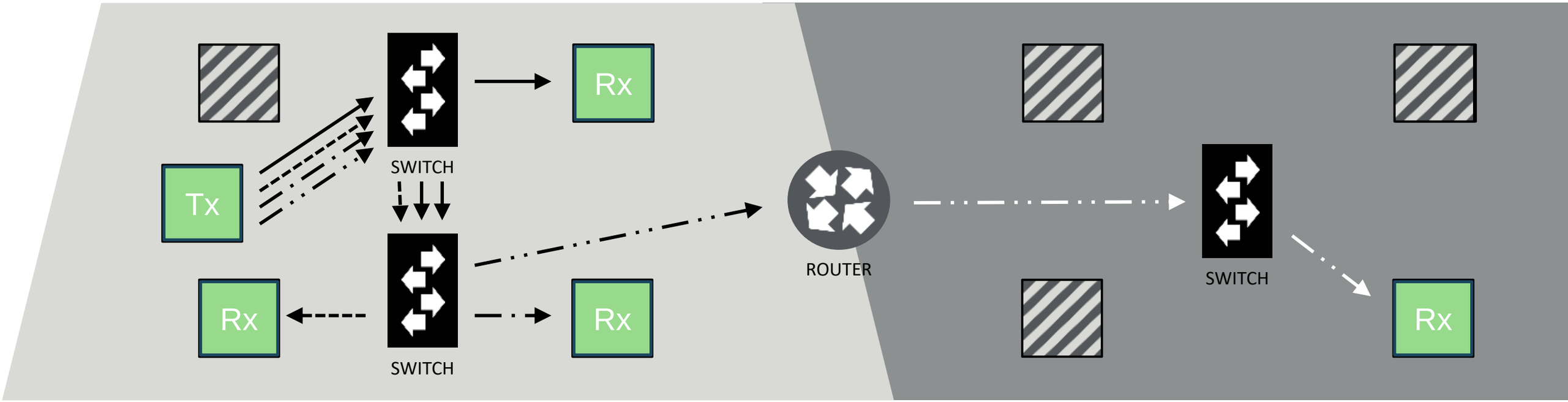
Unicast is like First Class Mail

One-to-One Transmission, Can Be Routed



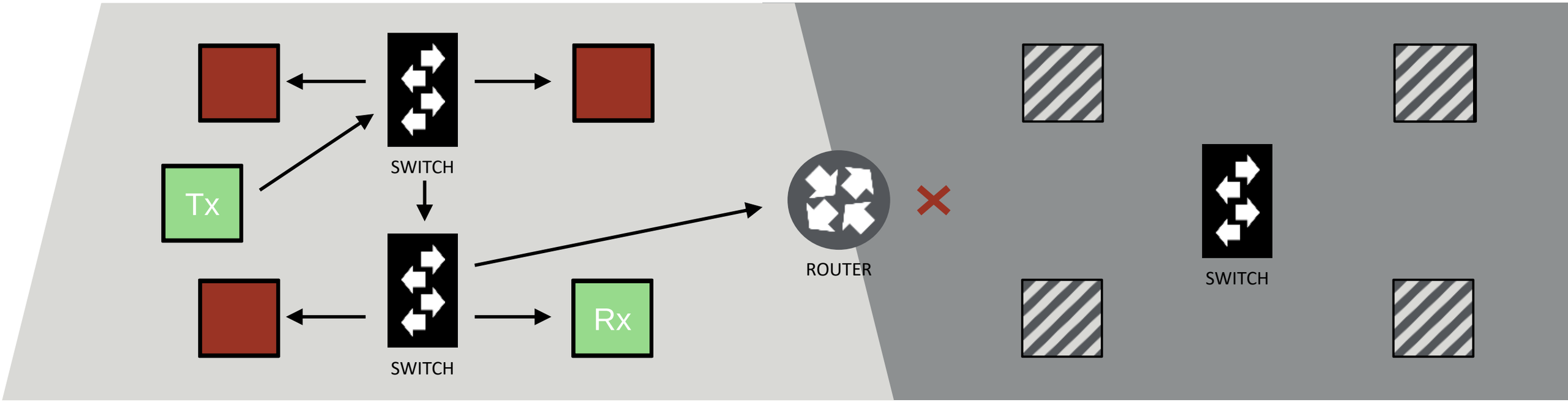
Unicast is like First Class Mail

Unicast Can Create a Burden on Trunk Lines



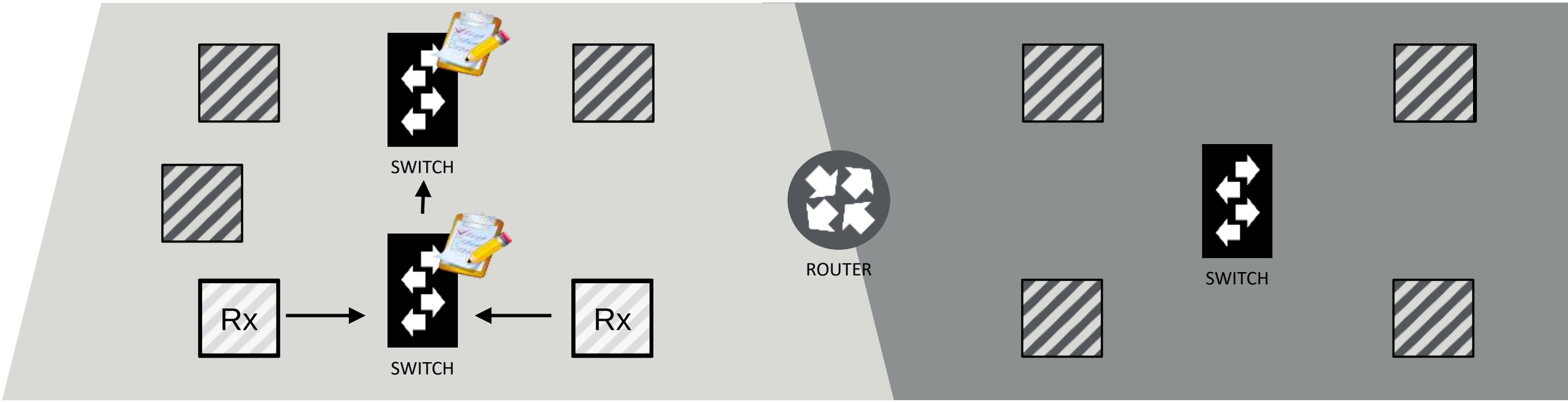
Broadcast is like Junk Mail by Zip Code

One-to-All (In Broadcast Domain) - Does Not Cross a Router



Multicast w/ IGMP is like a Magazine Subscription

One-to-Many Transmission, Does Not Cross Router (By Default)



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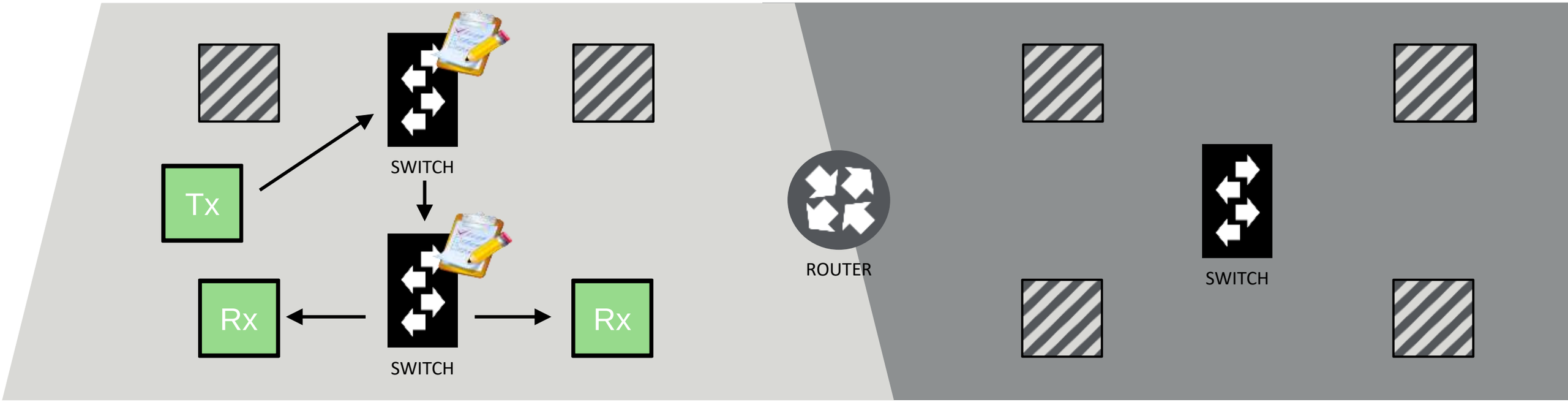

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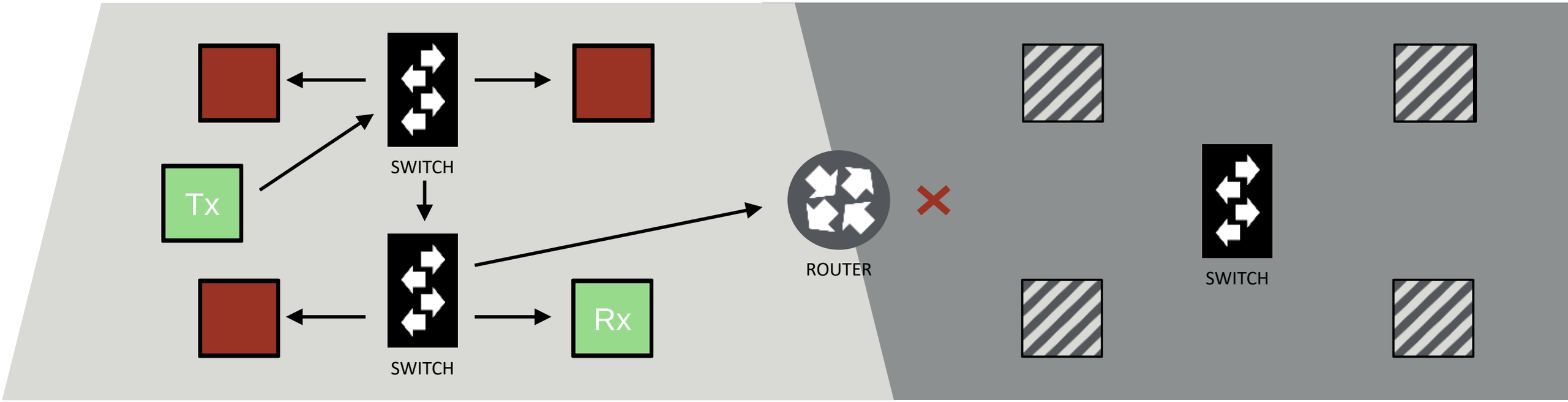


Distribution: Unicast, Multicast and Broadcast

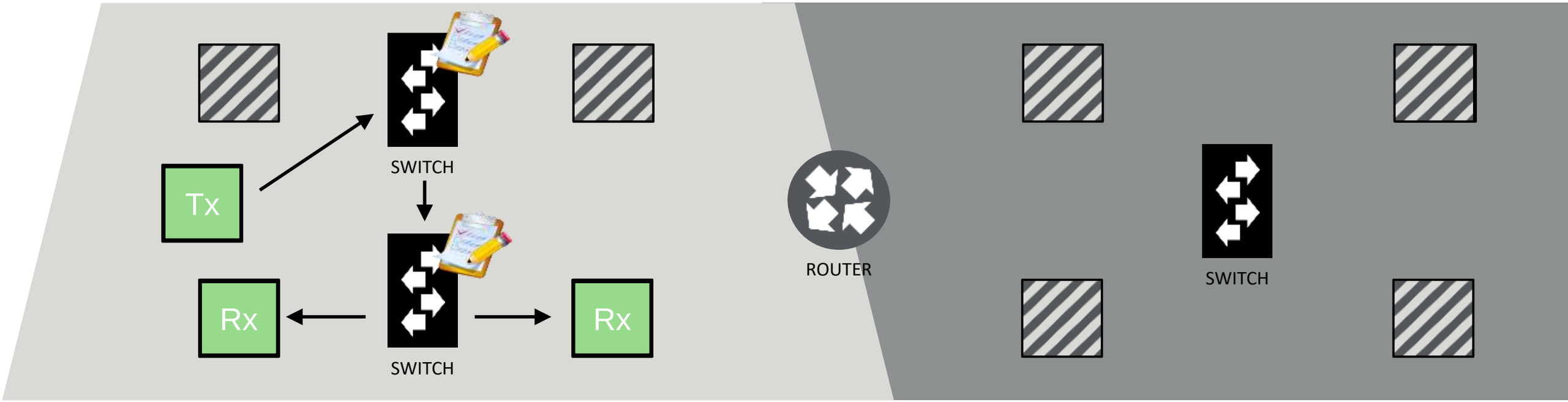
- Subscription is made to a Multicast IP Address
  Range: 224.0.0.0 /4 *(Translates to 224.0.0.0 through 239.255.255.255)*

- IGMP Snooping is the bit that manages the subscriptions:
  - Without IGMP Snooping, Multicast behaves like Broadcast
  - All switches would have IGMP Snooping Engaged
  - There should only be one IGMP Querier on the network

- IGMP Snooping v2 or v3:
  - Dante will work at v2 or v3.
  - Some other systems are still testing with v3 compatibility.

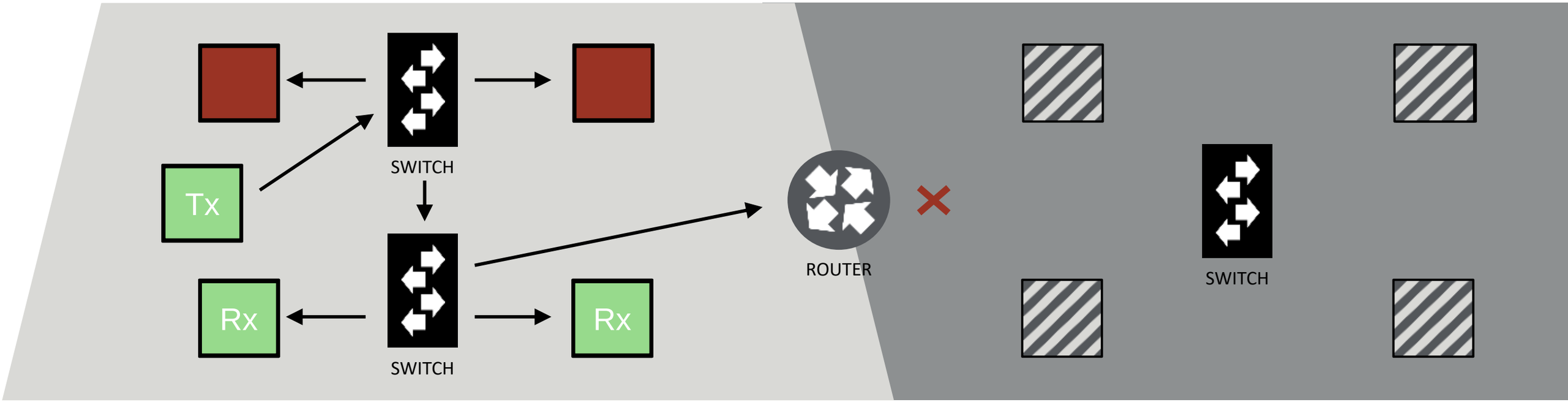
Multicast w/ IGMP Snooping

IGMP Snooping Sends Stream Data to Subscribers Only



Multicast w/o IGMP Snooping

Without Subscription Lists, Data is Sent to All Ports (like Broadcast)

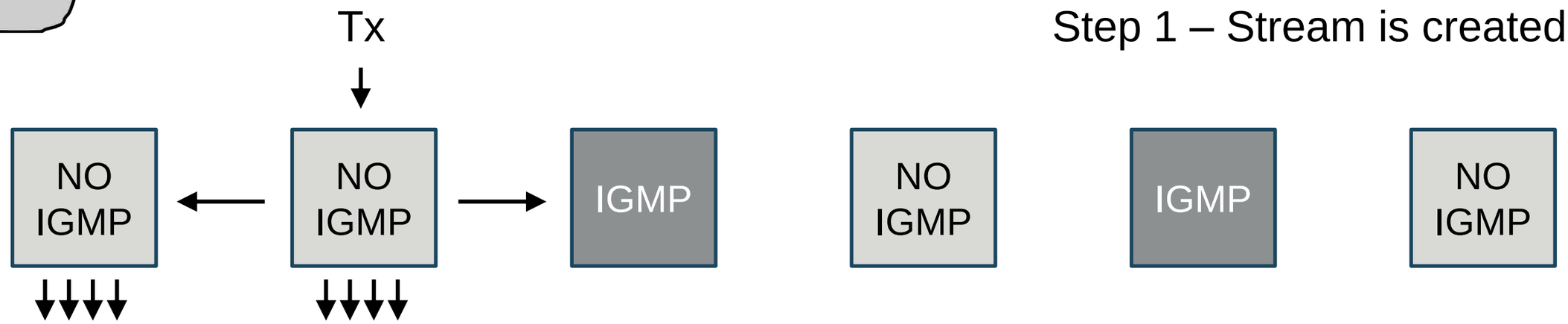


Distribution: Unicast, Multicast and Broadcast

- Can we mix brands of switches with IGMP Snooping?
  You can, but you shouldn't. Sticking with a brand will more likely have the same default values for better compatibility, it might auto-negotiate an IGMP Snooping querier and offer consistent management screens for set-up.
- What if multiple devices transmit to the same IP address?
  Devices subscribing to that stream will receive all contributions. This can be used for good – like with mDNS "Discovery"

Distribution: Unicast, Multicast and Broadcast

- What if a network involves switches with and without IGMP?
  Switches with IGMP Snooping will control Multicast distribution.
  Switches without IGMP Snooping will flood Multicast that enters it.



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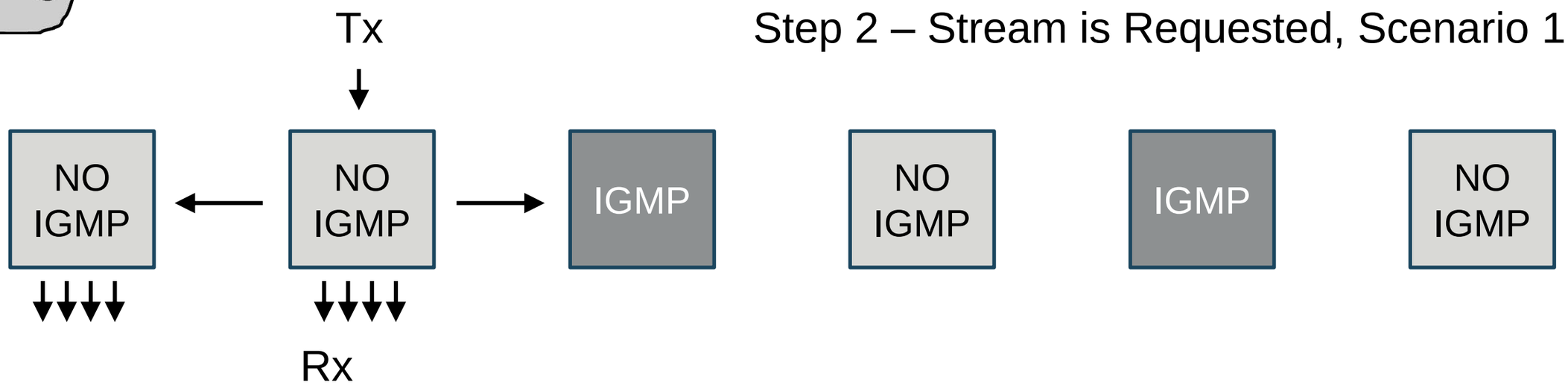

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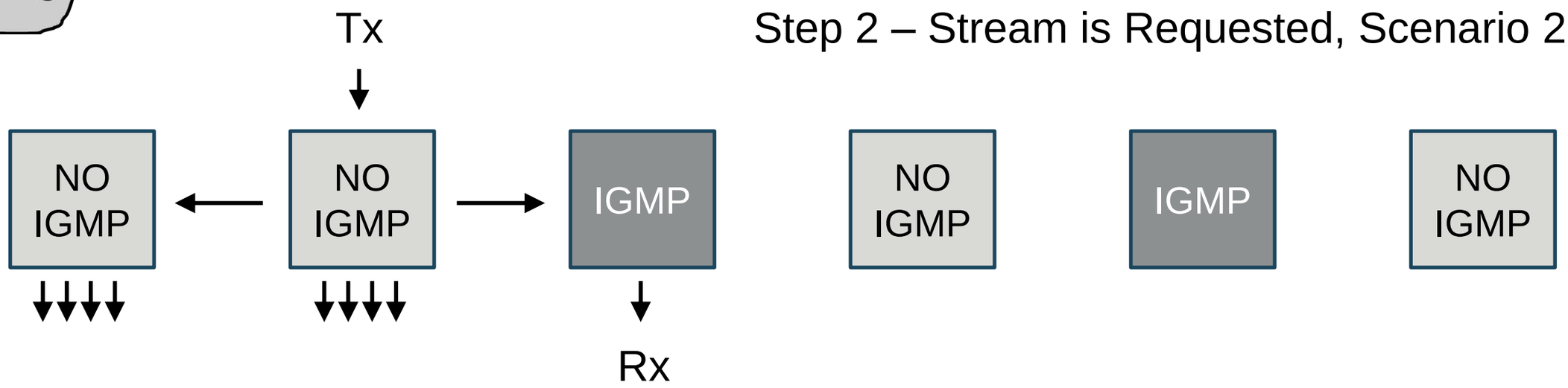

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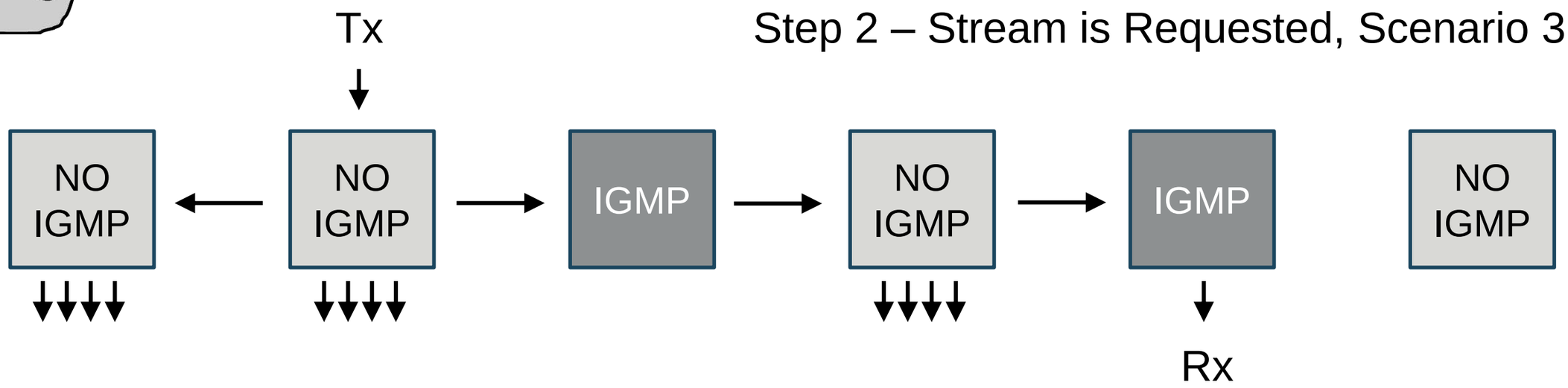

Distribution: Unicast, Multicast and Broadcast

- What if a network involves switches with and without IGMP?
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- Does multicast cross a router?
  By default, no. But where there is a will, there is a way.

- How much multicast can a network handle?
  Watch the CPU load on your switch. But generally, it can move a lot...

Multicast In Use

In 2012, a well-known late-night night talk show's audio production was done 100% Dante.

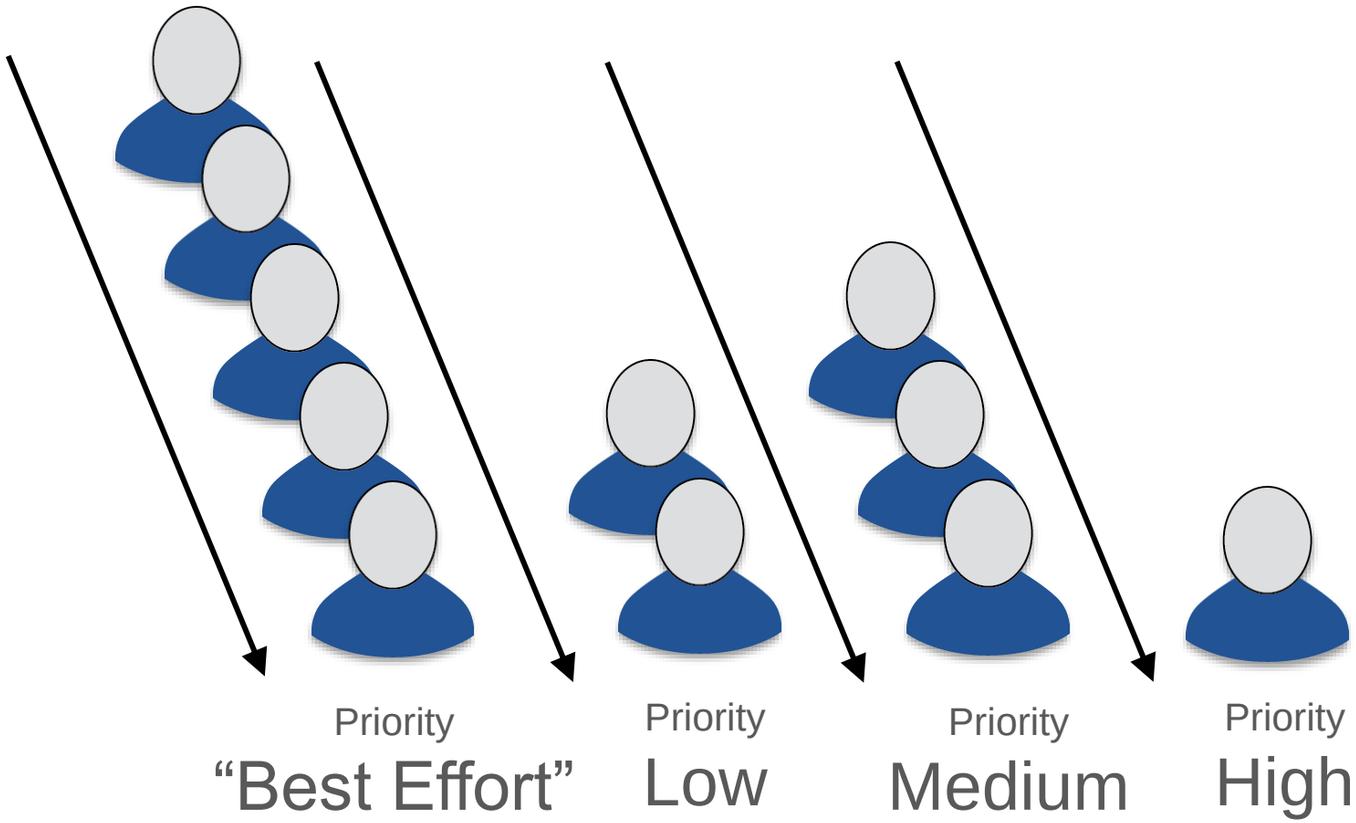
Approx. 150 stage channels were distributed by multicast, reaching up to 9 key destinations.

Cisco SG300 Switch CPU load was approx. 20%

Harvey, S. (2014, 01 01). The Future of TV Workflow: Dante Networking for "The Arsenio Hall Show". https://www.mixonline.com/sfp/future-tv-workflow-dante-networking-arsenio-hall-show-369327

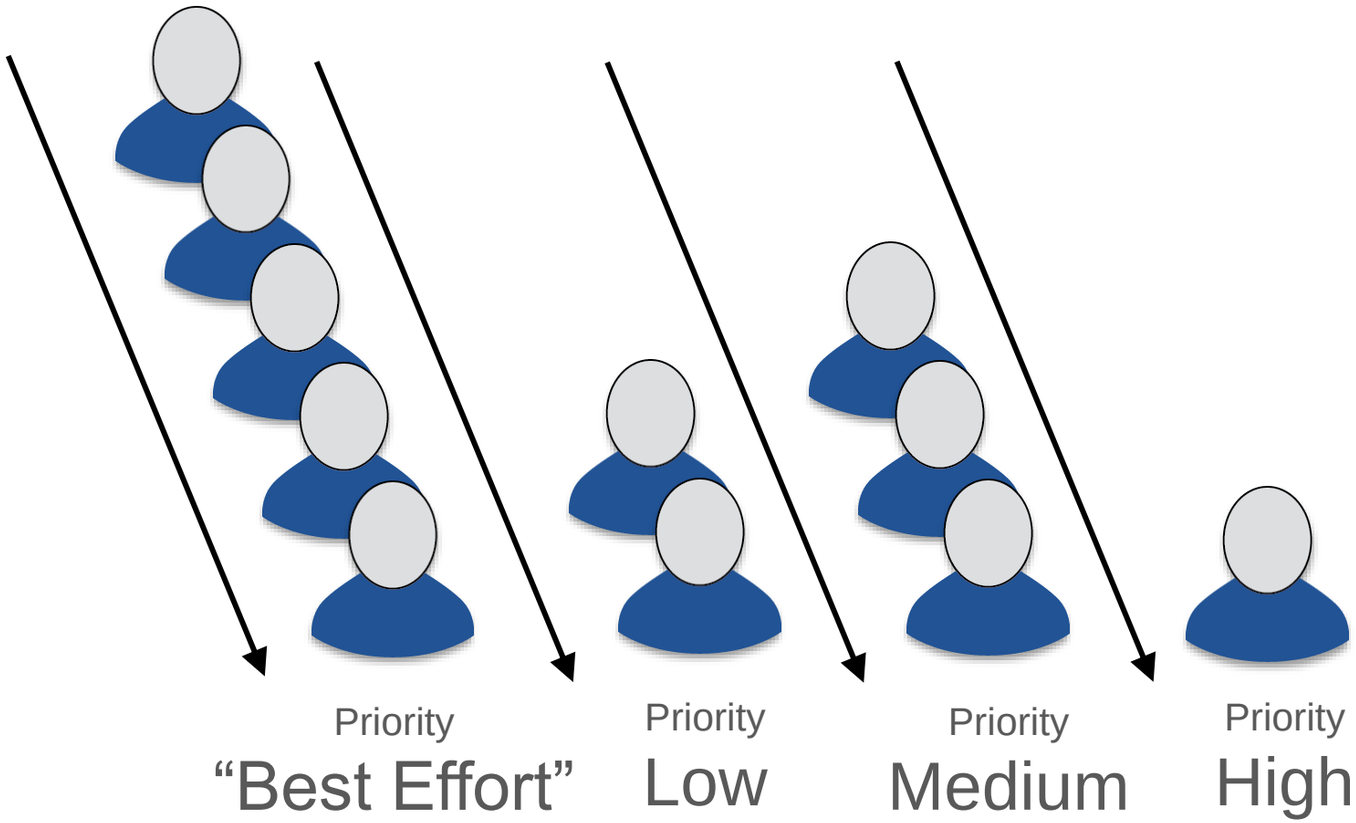
QoS (Quality of Service)

QoS: Quality of Service



- If many data packets need to go out a single port, they queue up.
- QoS allows us to prioritize some packets, similar to priority status on an airline.

QoS: Quality of Service



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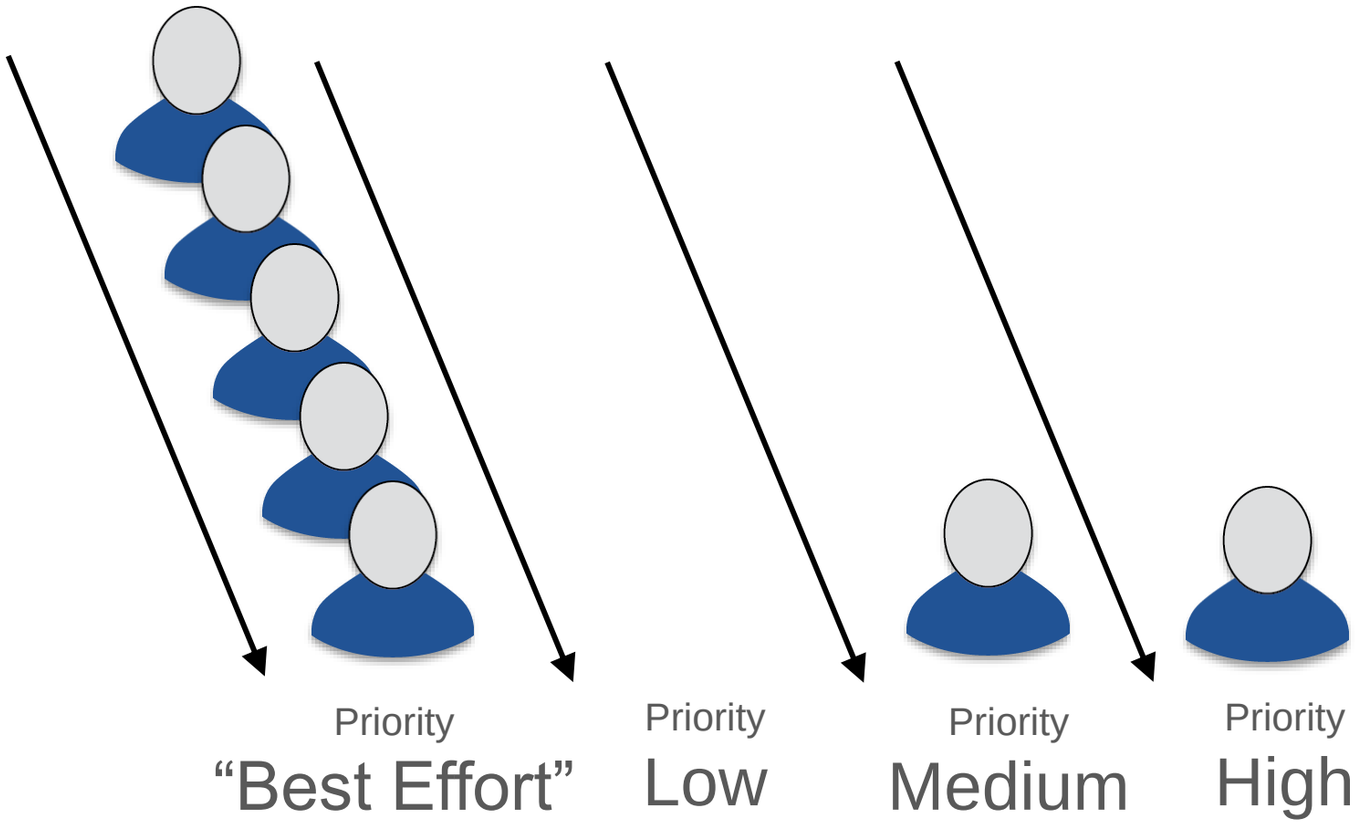

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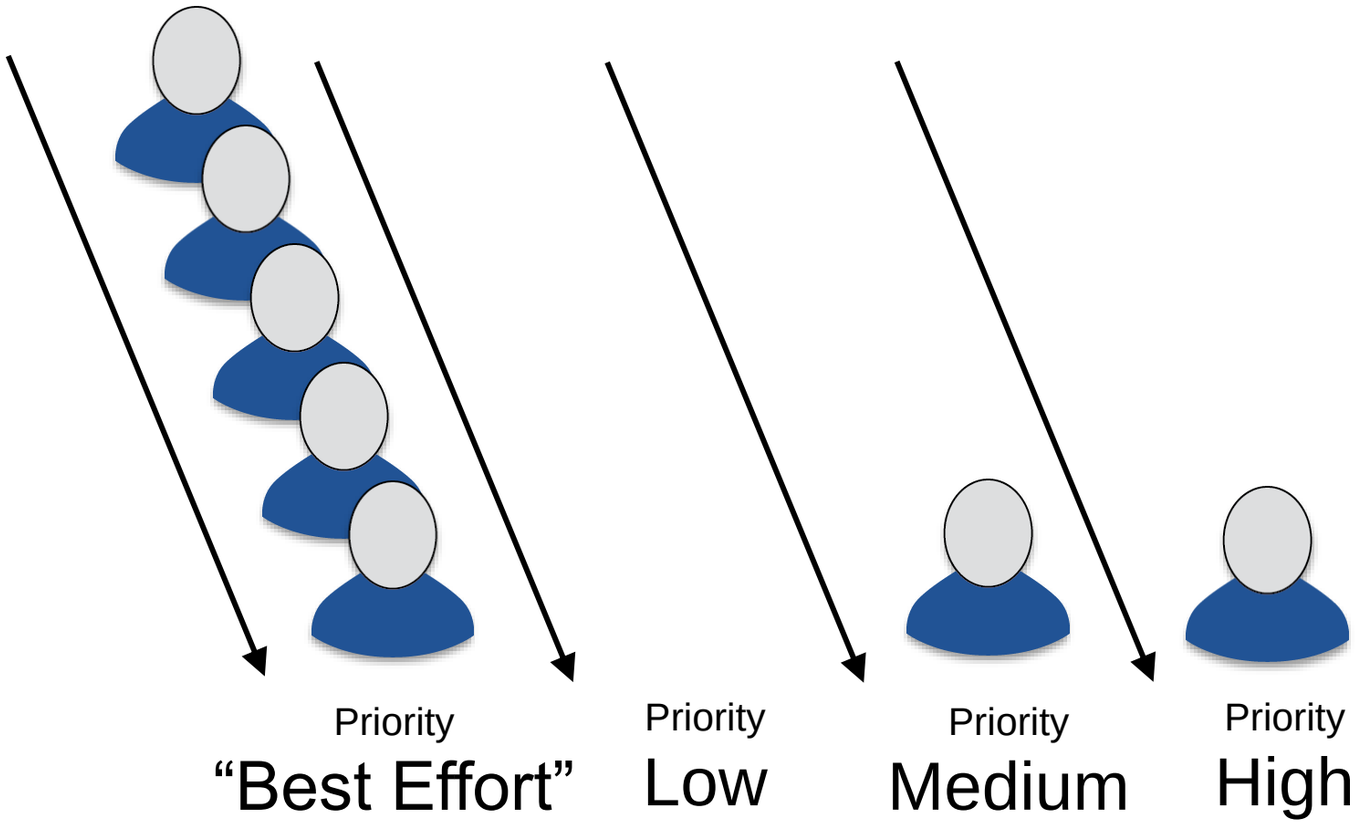


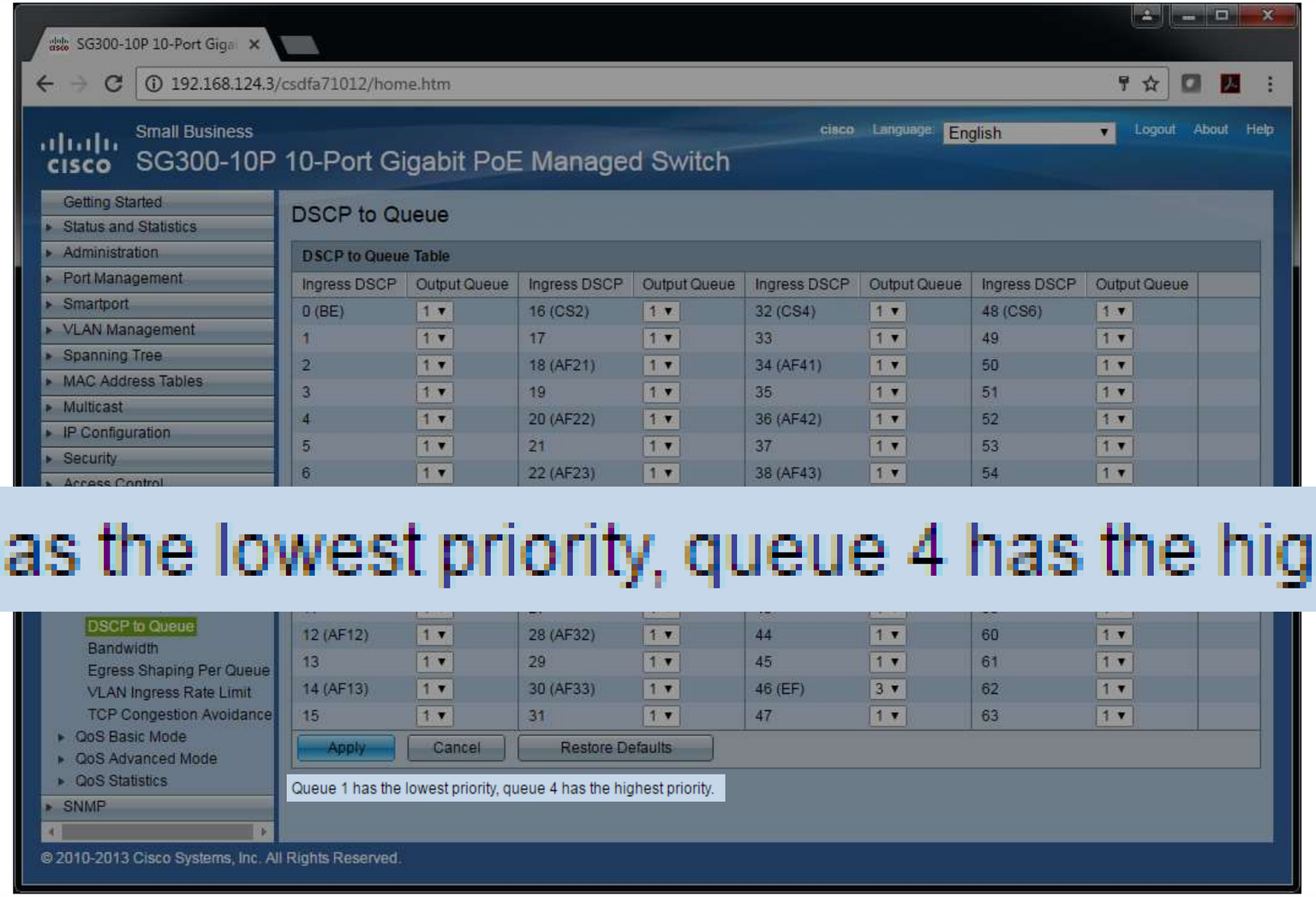
- If many data packets need to go out a single port, they queue up.
- QoS allows us to prioritize some packets, similar to priority status on an airline.
- Prioritizing some means de-prioritizing others.

QoS: Quality of Service

Best Effort	Low	Medium	High
Other	Control 8 (CS1)	Audio 46 (EF)	Clock 56 (CS7)

Dante Uses 3 Priority Queues

QoS: Quality of Service



Queue 1 has the lowest priority, queue 4 has the highest priority.

QoS: Types of QoS

- QoS (e.g. Diffserv) is Class Based
  Specify what is important
  Timing is relative
  Easy to implement – you can mix switches with and without QoS

- Alternative is Reservation Based
  Specify how much, how often – then decide if it is possible
  Timing is absolute
  Complex to implement – reservations must be present the whole way or no link

QoS: Types of QoS

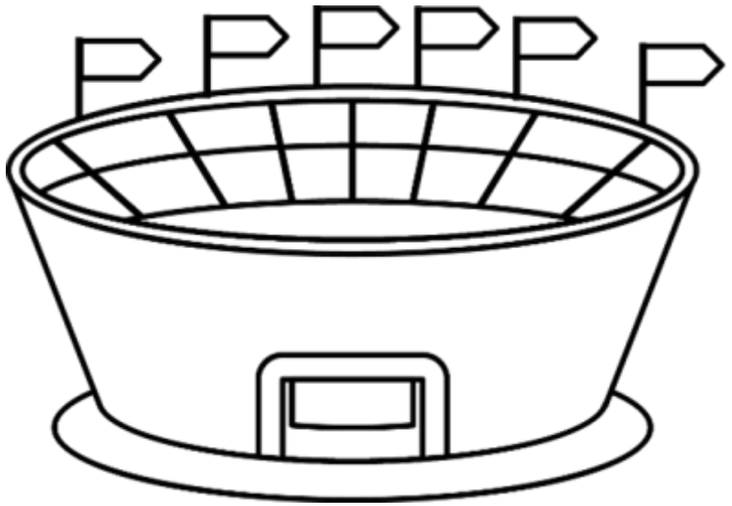
- Neither is magic – they do not generate additional bandwidth
  The best QoS is more bandwidth
  Prioritizing some traffic means de-prioritizing others
  “If everyone is important, then no one is.”

- QoS can help when…
  Running a converged network, protecting against peaks from lower-priority bandwidth.
  Links are approaching 70% saturation or more.
  Using slower (100Mbit) links.

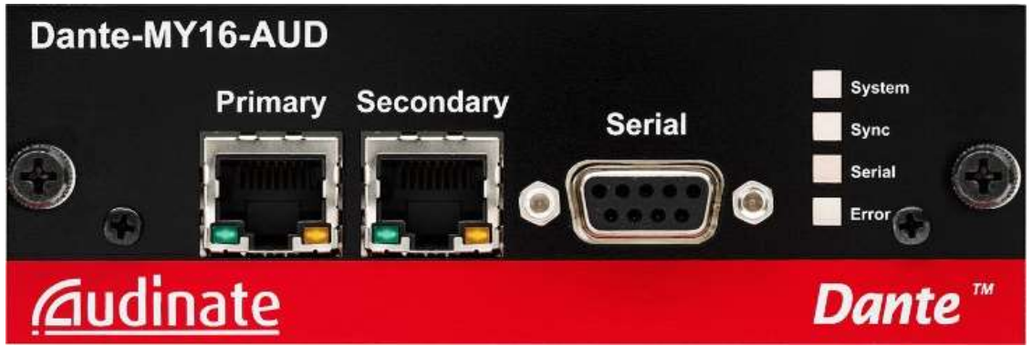
- When using QoS, use “Strict Priority”
  Strict Priority always serves the most important class
  Weighted Round Robin serves queues by weighted averages
  Shaped Round Robin serves by statistical analysis

Use Case Scenario

2008 - CobraNet®



Use Case Scenario

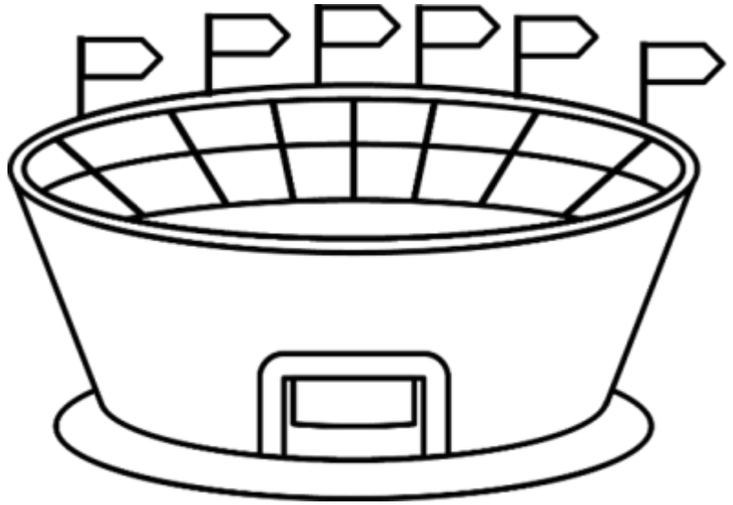


CobraNet®

Dante™

Use Case Scenario

2014 - Dante™



Use Case Scenario

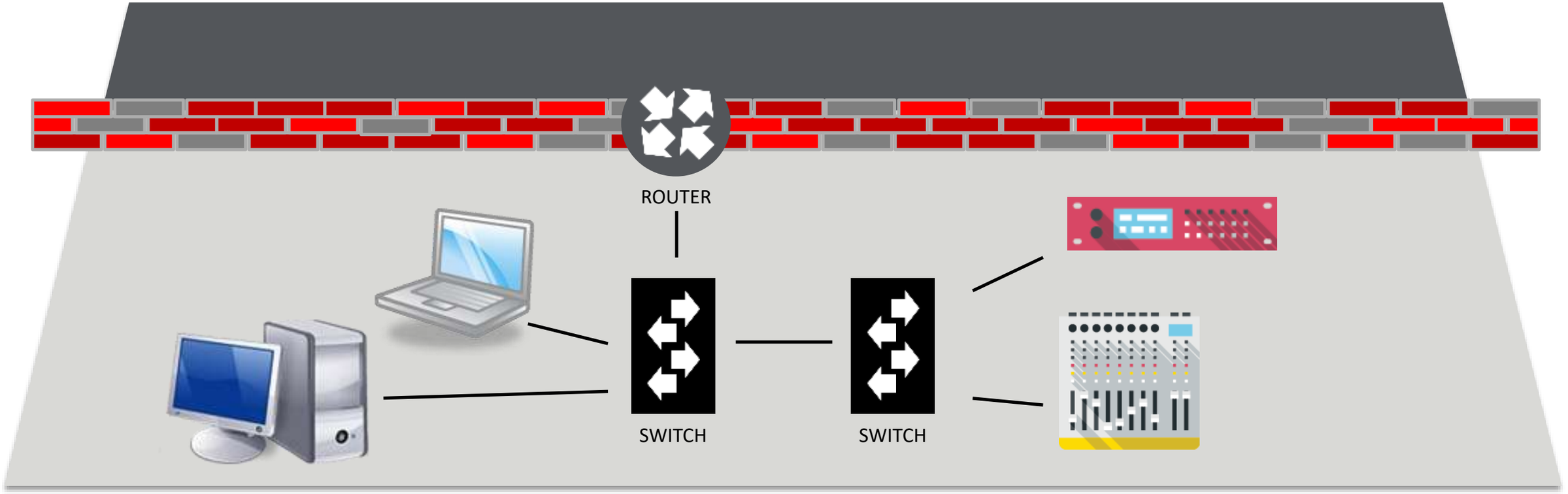
VLANs and Trunk Implications

Networking Topics for Today

ENHANCE	**Core IP Settings**	*IP Address, Subnet Mask, Gateway/Router, LAN Range*
	DNS	*Domain Name Service*
	DHCP/Link Local	*Automatic Address Settings*
	TCP/UDP	*Transmission Methods*
	Unicast, Multicast and Broadcast	*Distribution Methods*
	QoS	*Quality of Service – Traffic Prioritization*
	VLAN & Trunk Implications	*VLAN, Trunk, Tagged VLAN, STP, LAG*
NEW	**Network Ports**	*Managing Simultaneous Connections*
	Understanding Clocking	*Precision Time Protocol (PTP)*
	ARP, Layered Network Models	*Gluing IP & MAC Addresses, The OSI Model*
	Segmenting Broadcast Domain	*Managing the “Noise” in a Network*

What is a LAN?

A LAN is a group of devices that can communicate.



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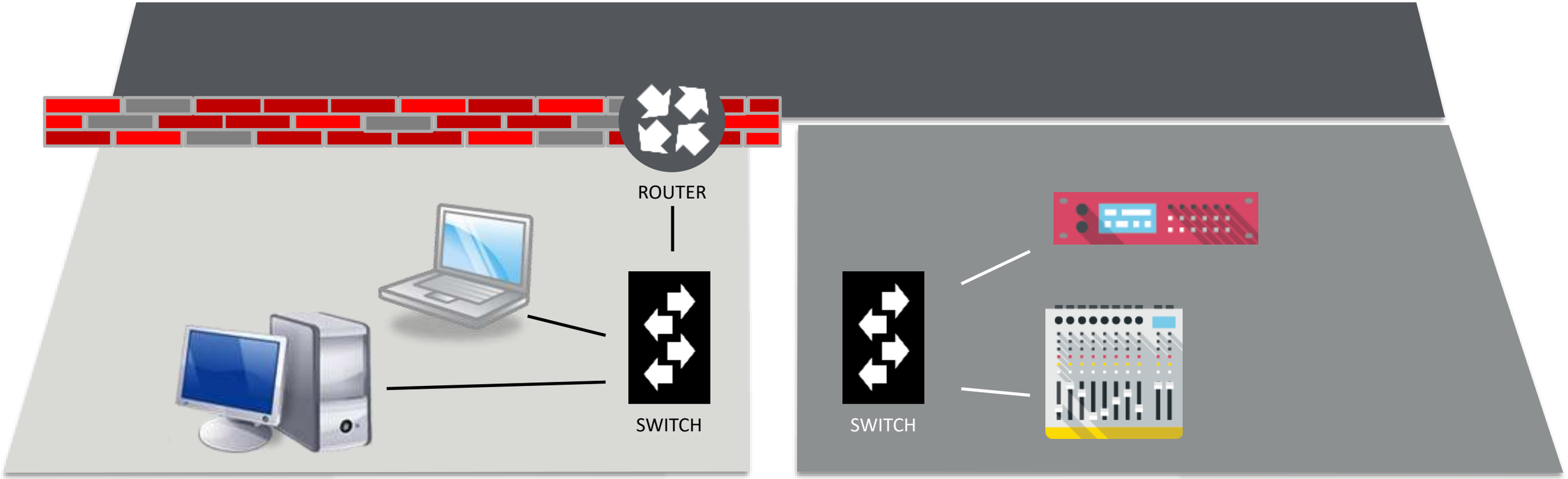
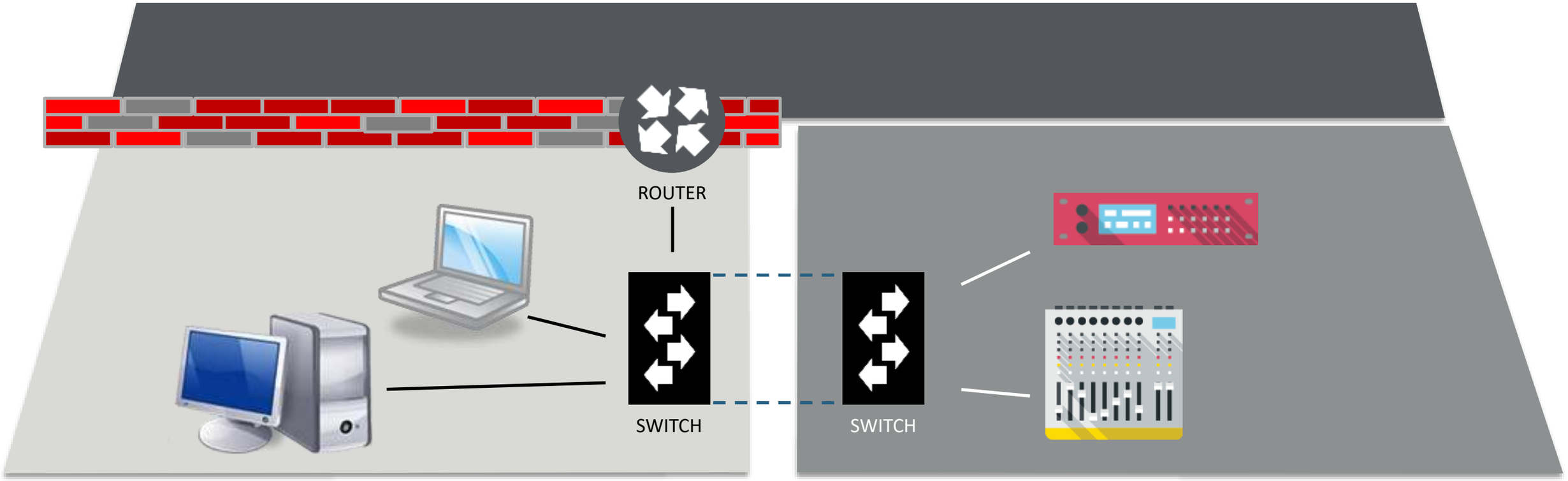


What is a VLAN?

A VLAN simulates isolated networks in one switch

You do not have to offer the same number of ports per VLAN – you can assign the quantity you need.

What is a LAN?



What is “Non-Blocking Architecture”?

“Non-Blocking Architecture” means the *switch* is not the bandwidth bottleneck – the *port/cable* is.

---

20 ports x 1 Gbit x 2 Directions = 40 Gbit Backplane

What is “Non-Blocking Architecture”?

Cisco SG350X-24P

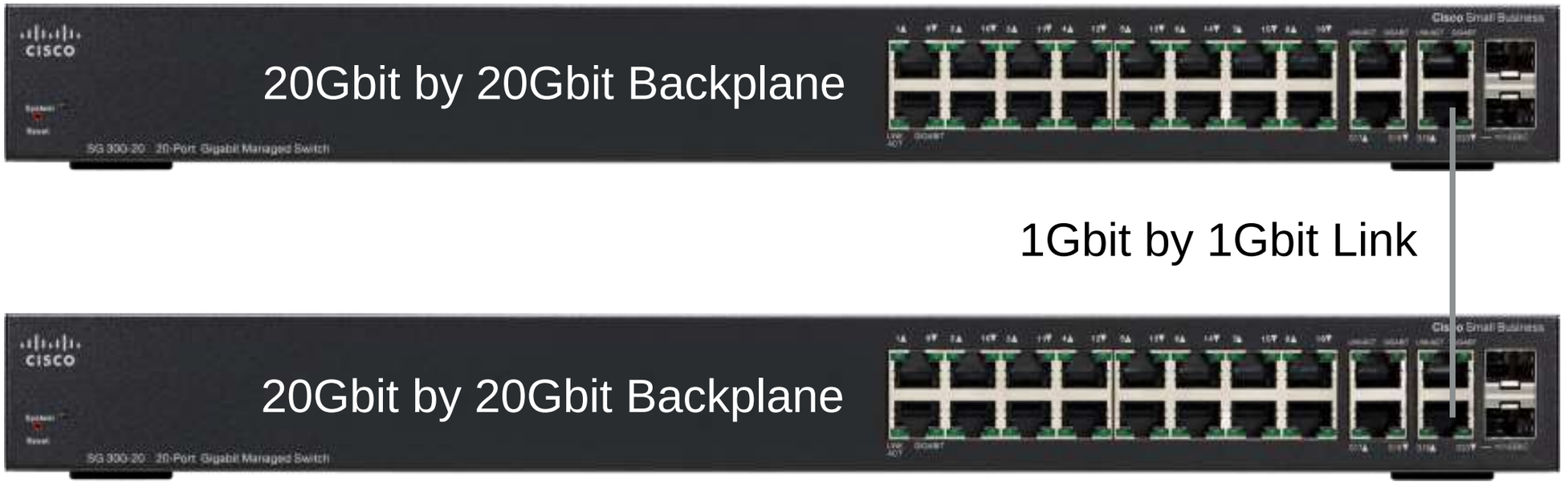
26x 1Gbit Ports

2x 10Gbit Ports

26 ports	x	1 Gbit	x	2 Directions	=	52 Gbit
2 ports	x	10 Gbit	x	2 Directions	=	40 Gbit
						92 Gbit backplane

What is a Trunk?

A Trunk Line is a link Between Switches



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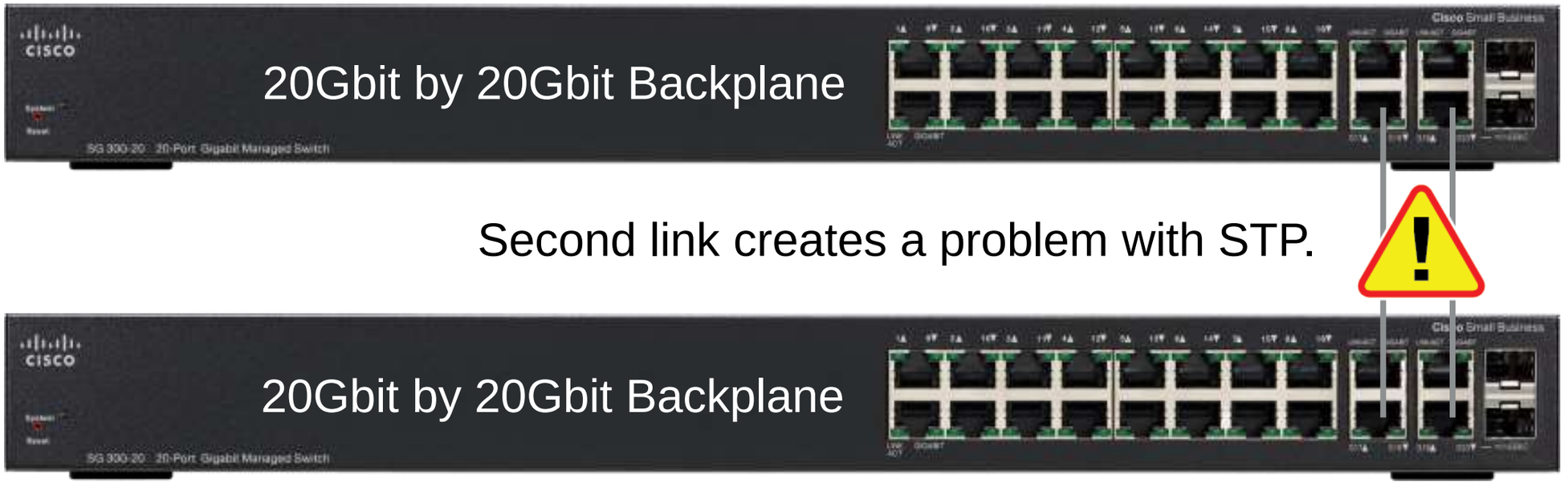
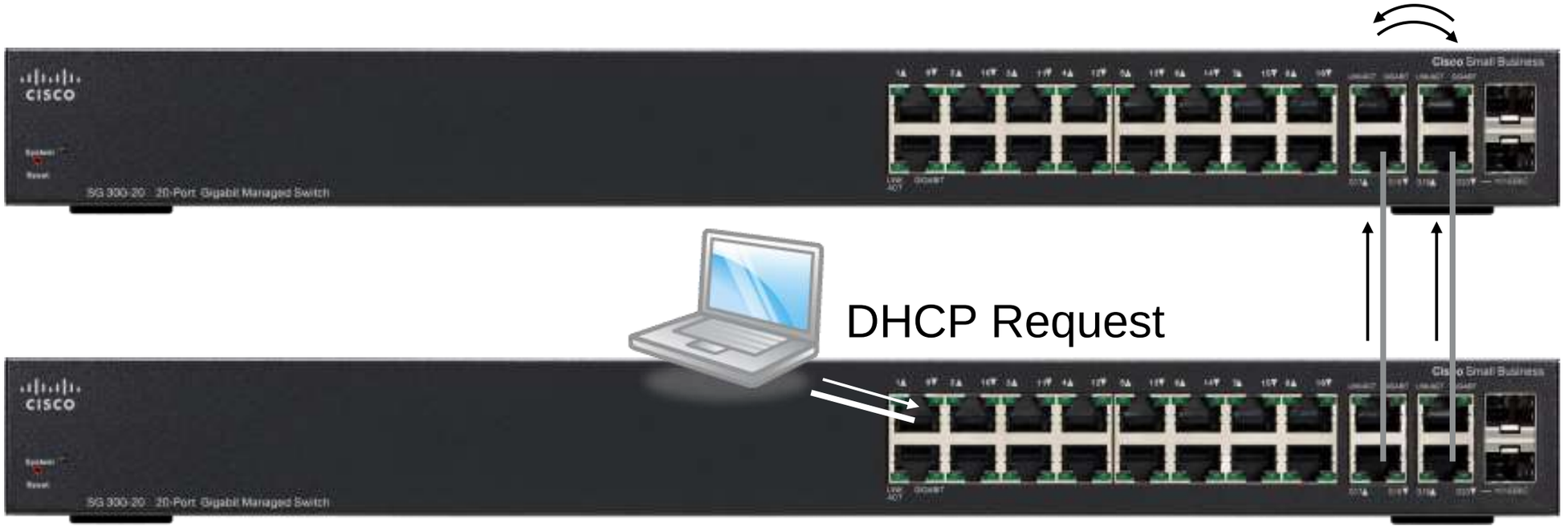


STP Prevents “Loops” in the Network



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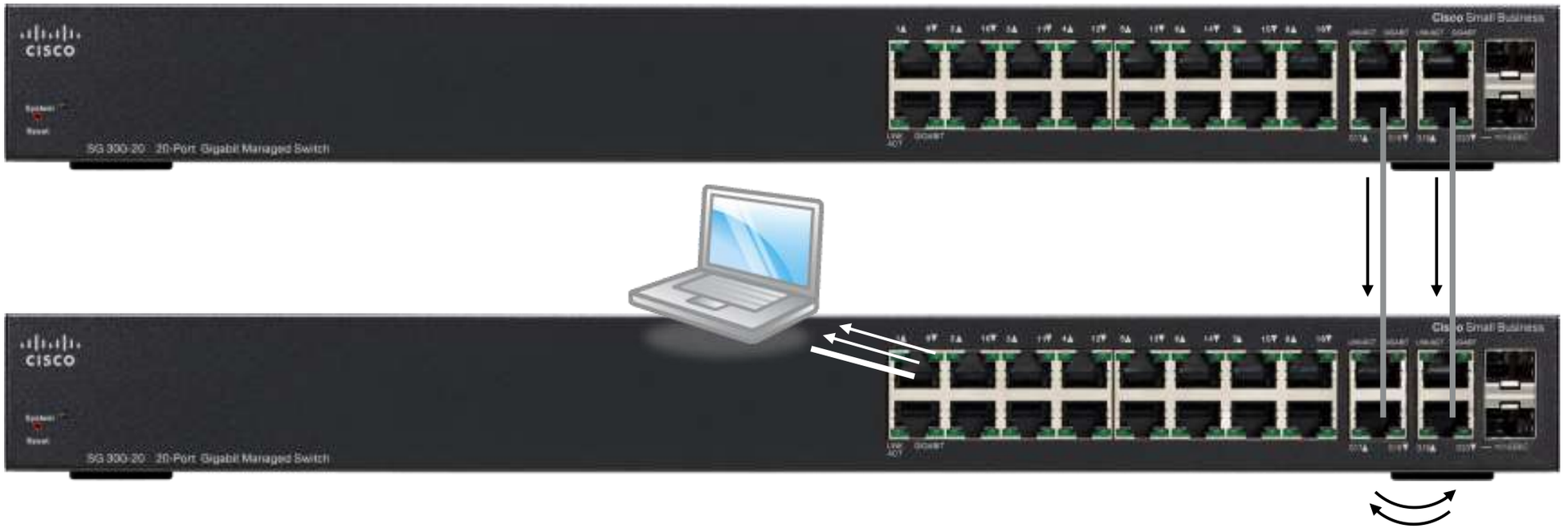

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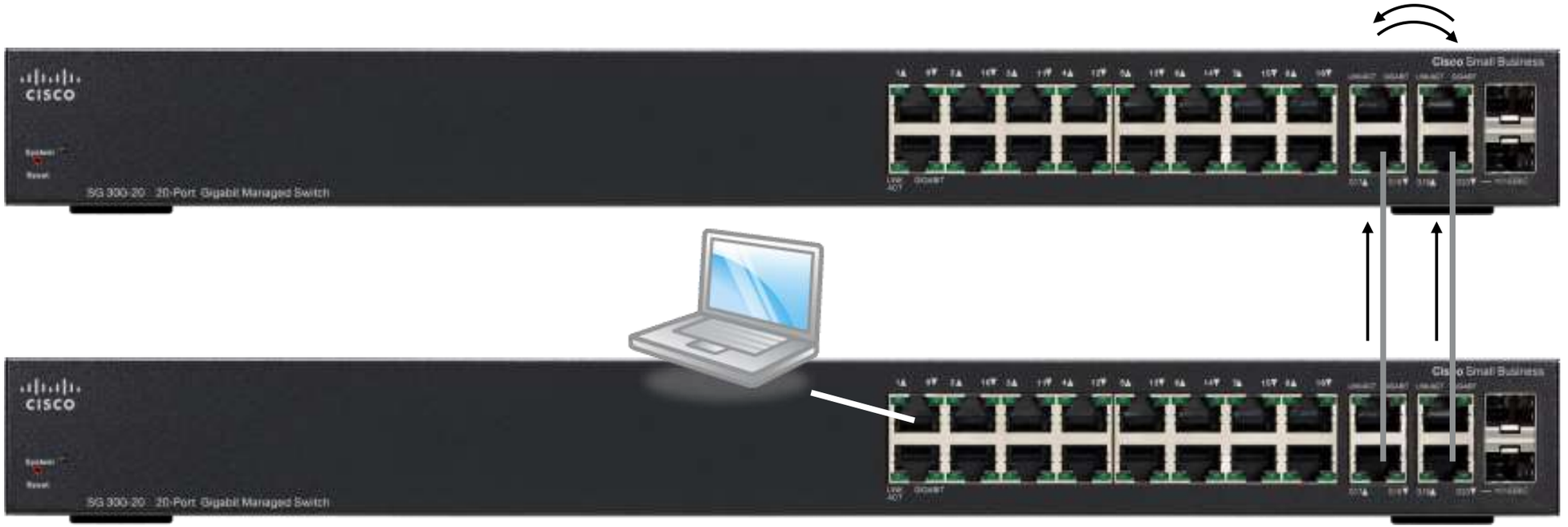

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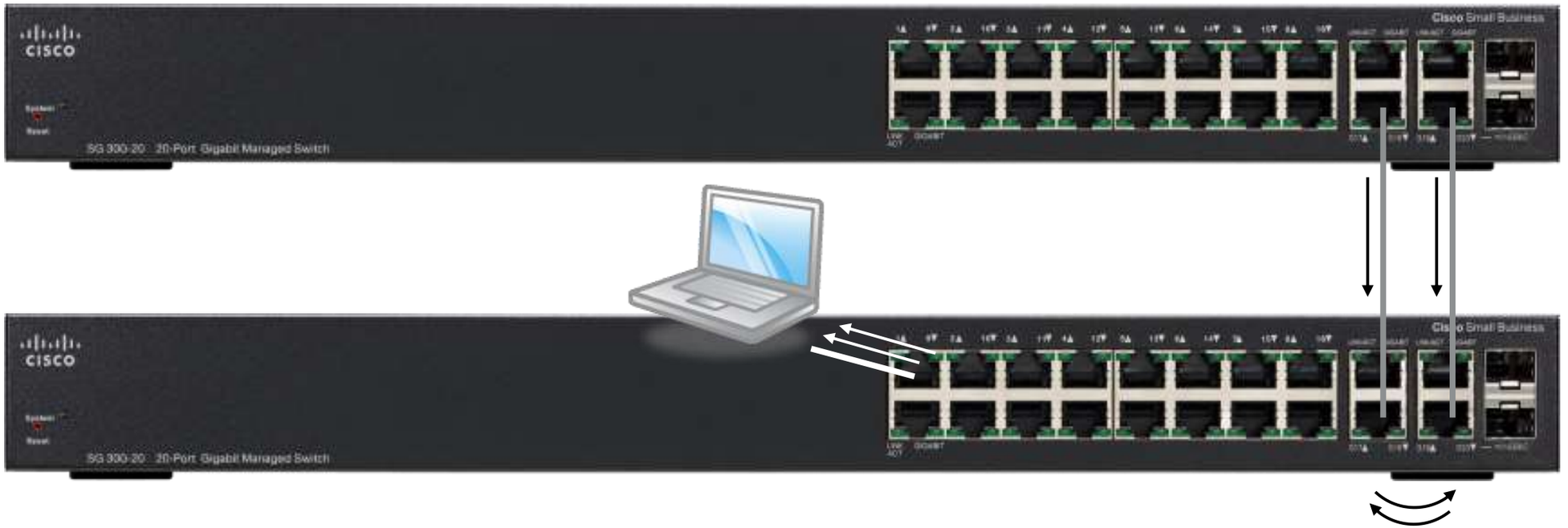
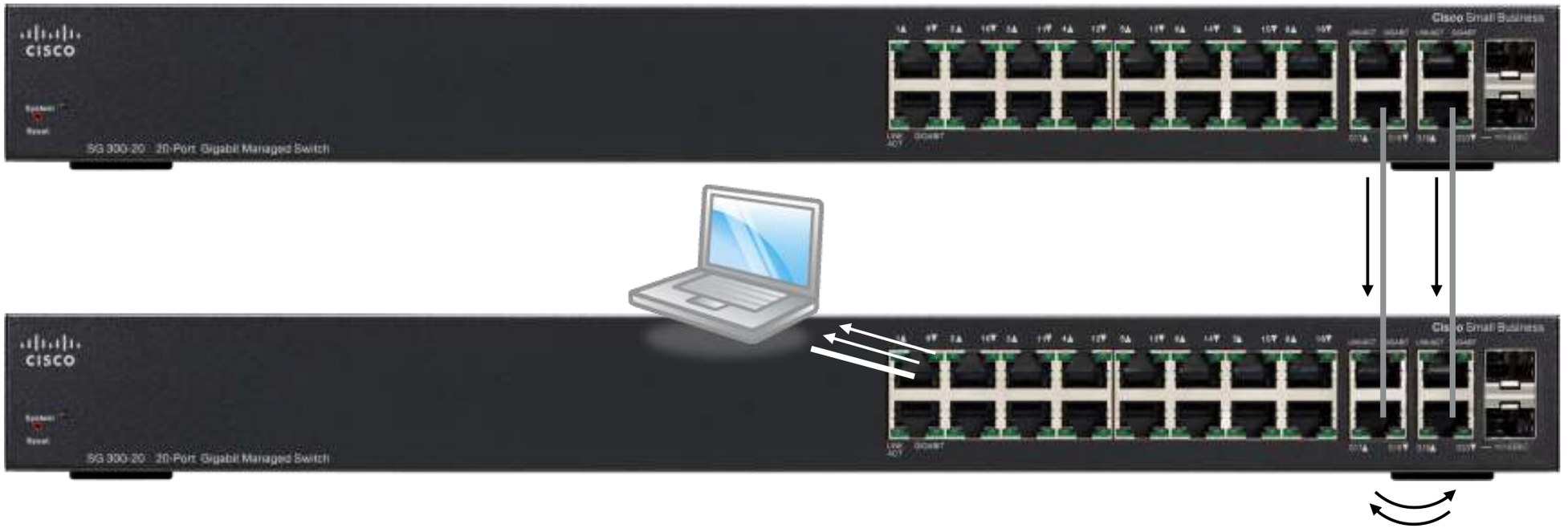
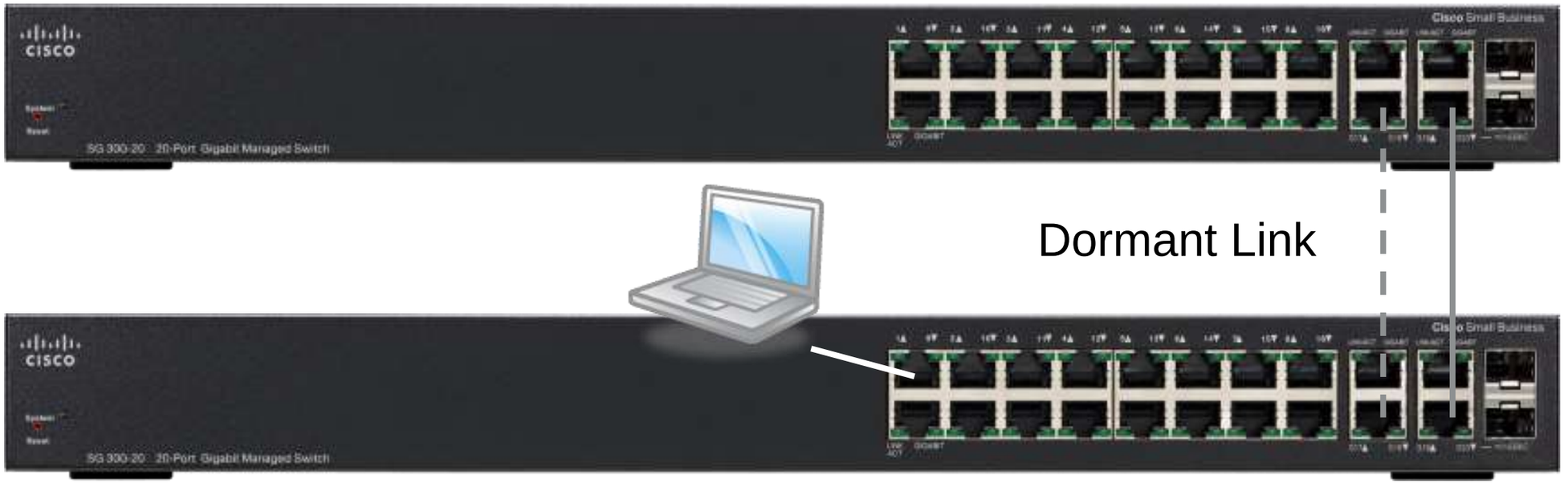


Spanning Tree Protocol (STP)

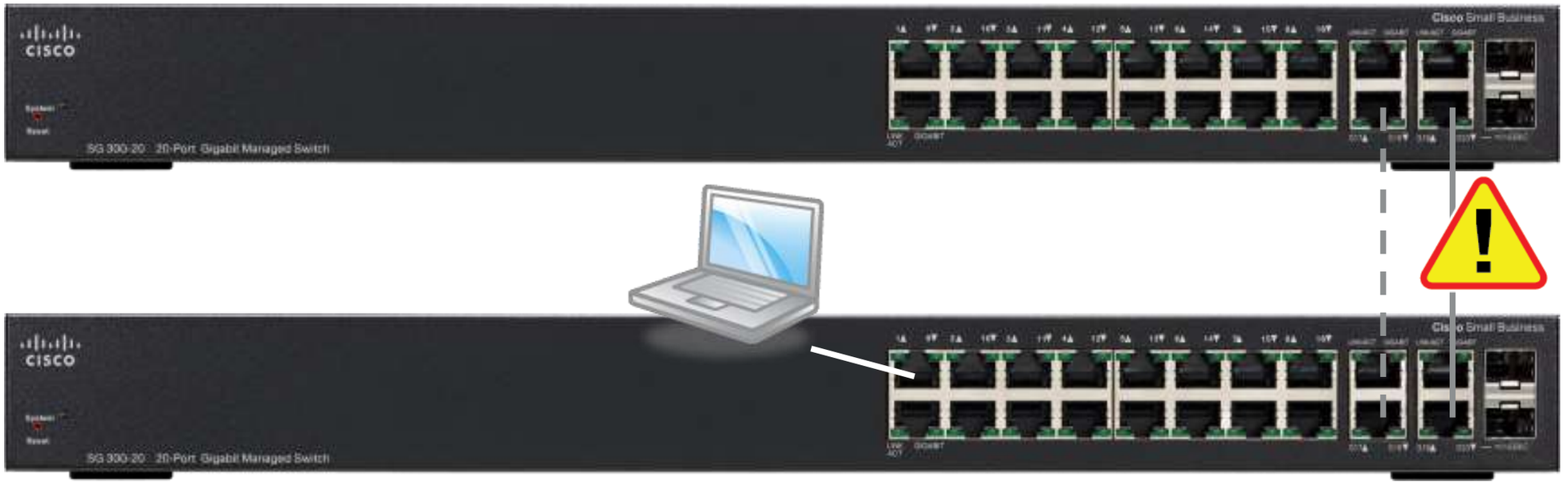
This Endless Loop is Called a “Broadcast Storm”



STP Creates a “Dormant Link”



STP Can Be a Form of Redundancy



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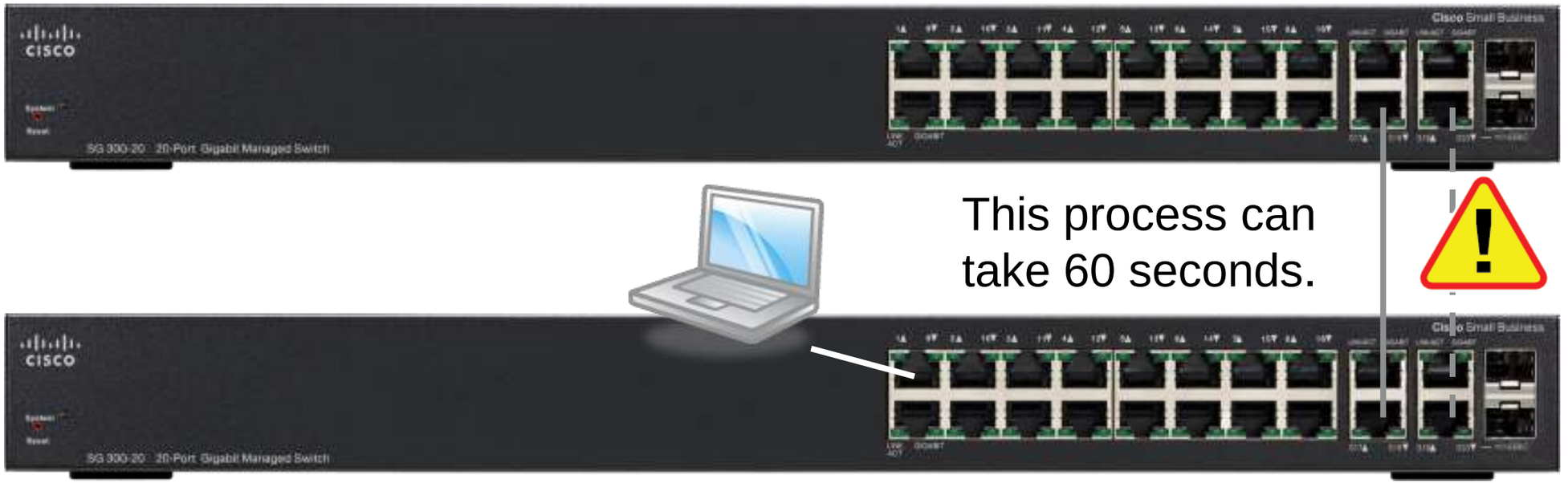
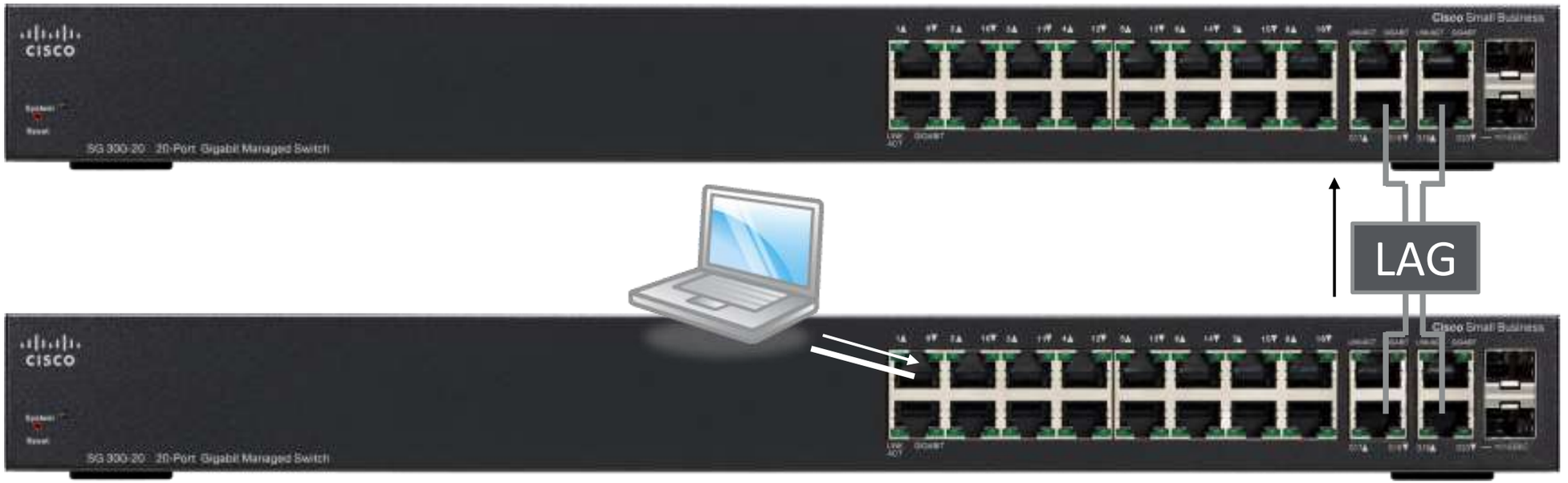
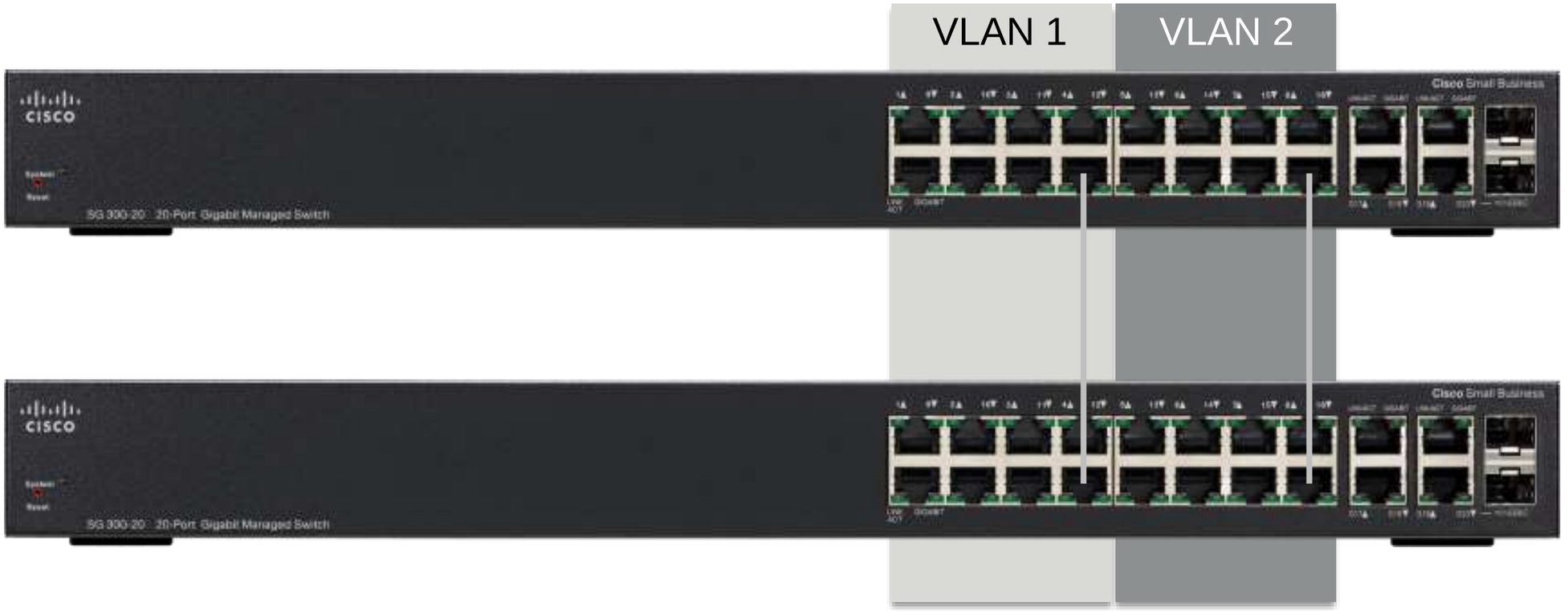


Link Aggregation Group Solves the Loop Problem



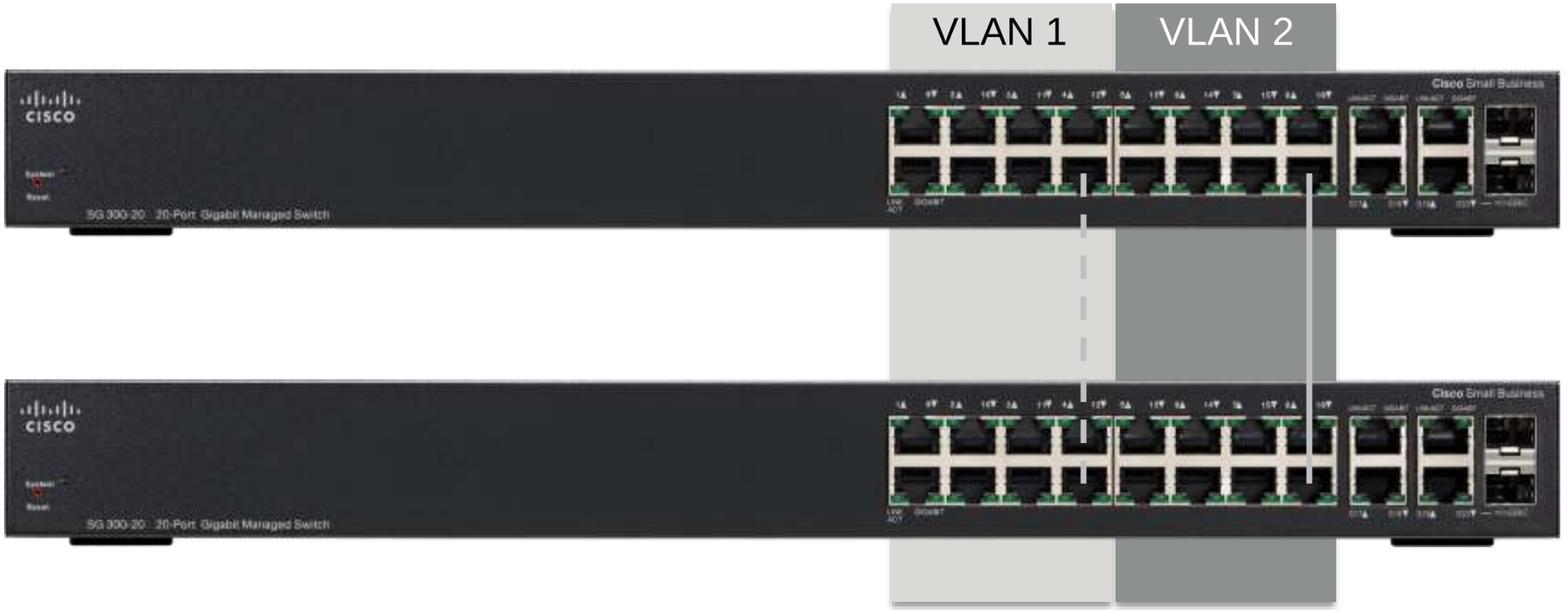
Multiple VLANs on a Trunk

Can we do this?



Multiple VLANs on a Trunk

No – STP is not “VLAN aware”.



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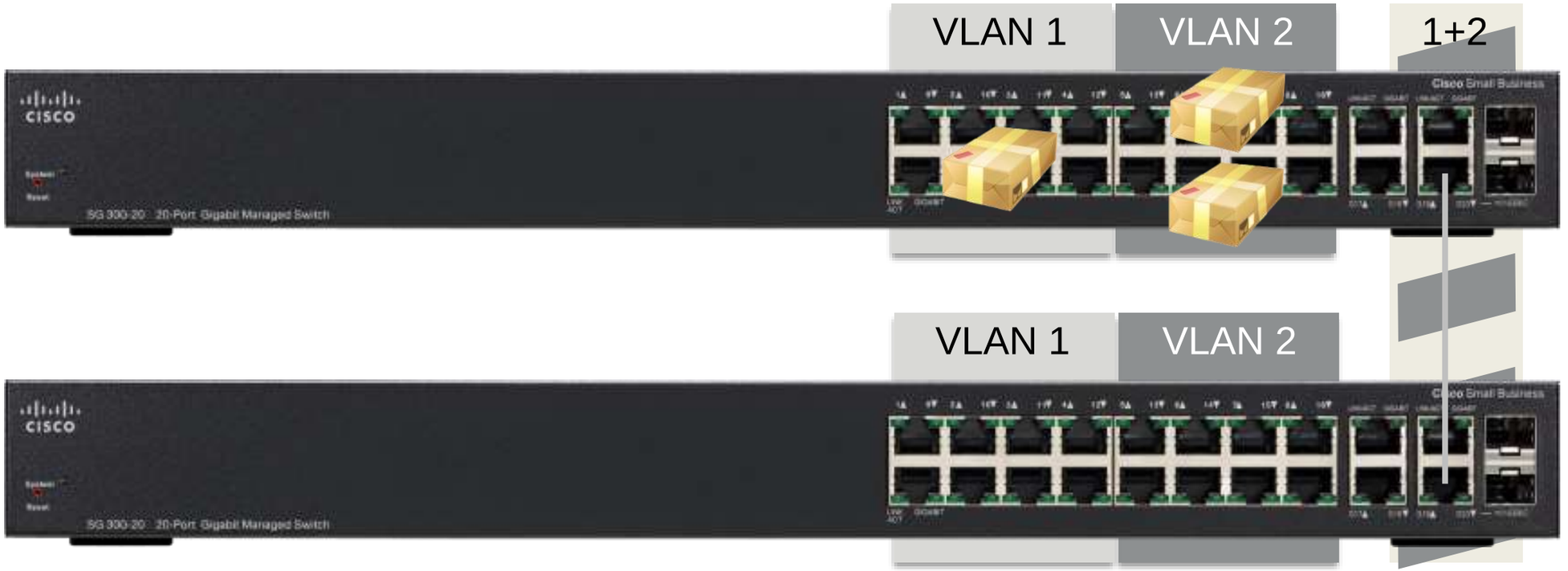
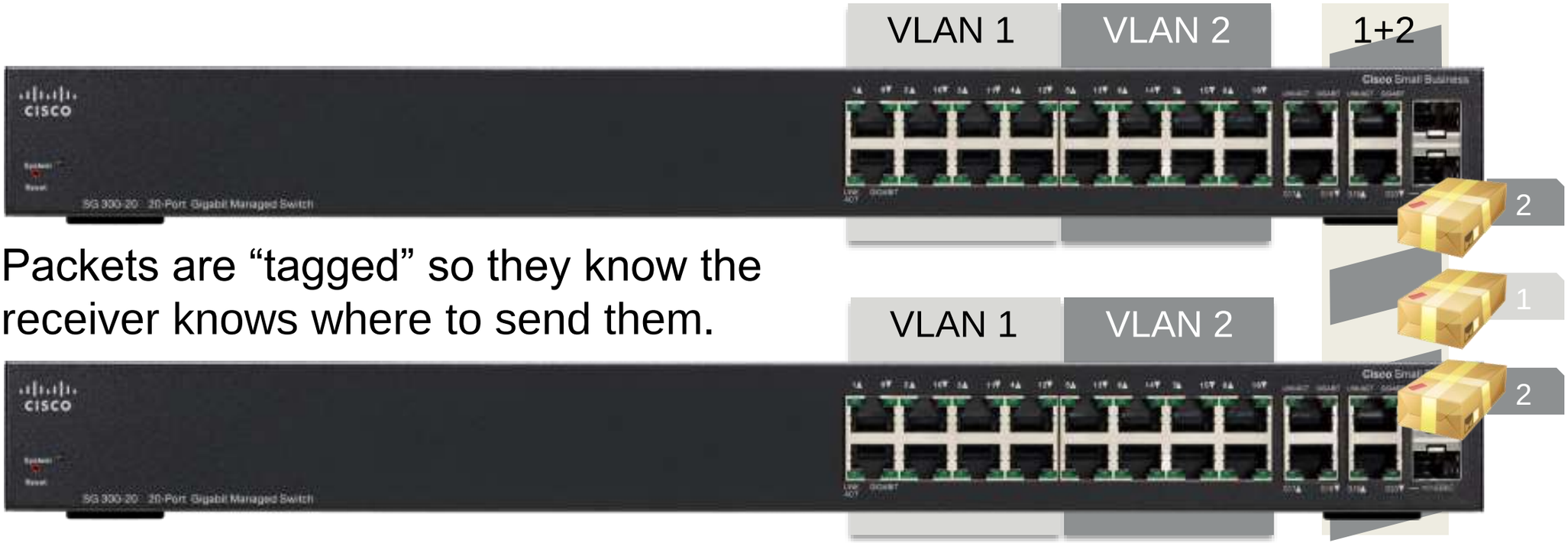


Multiple VLANs on a Trunk

Create a Trunk with Tagged VLANs



Packets are “tagged” so they know the receiver knows where to send them.

Multiple VLANs on a Trunk

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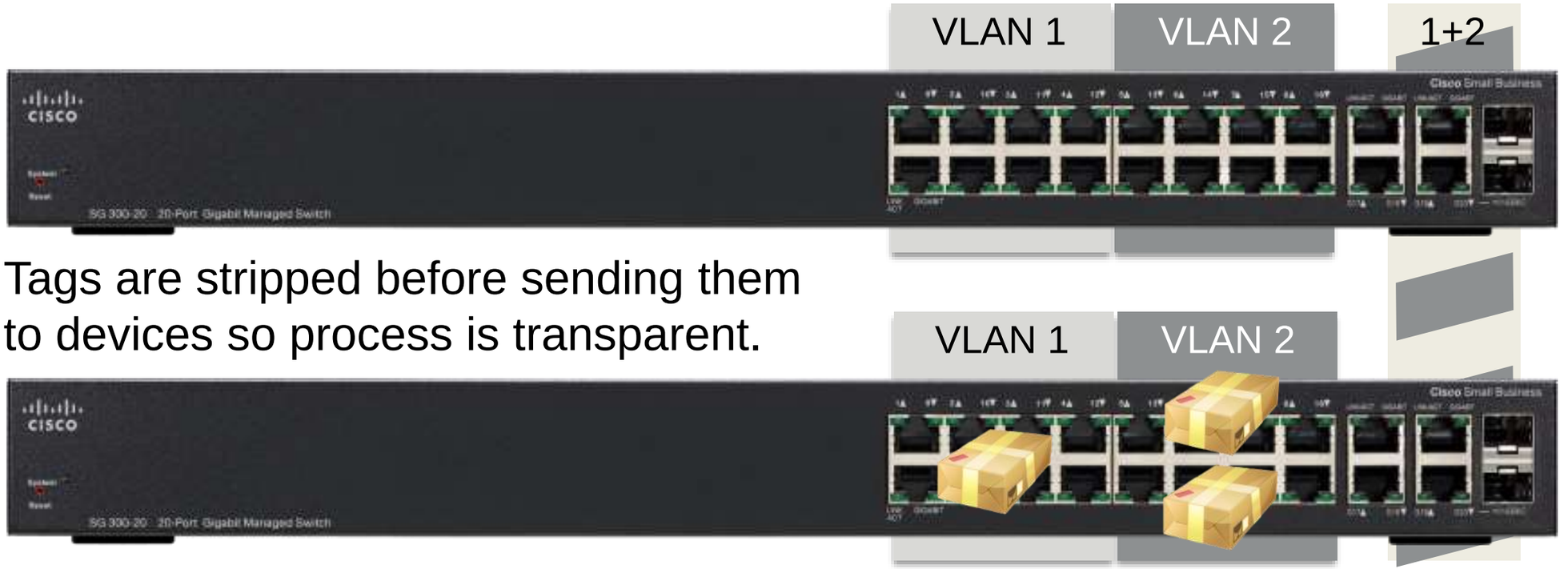
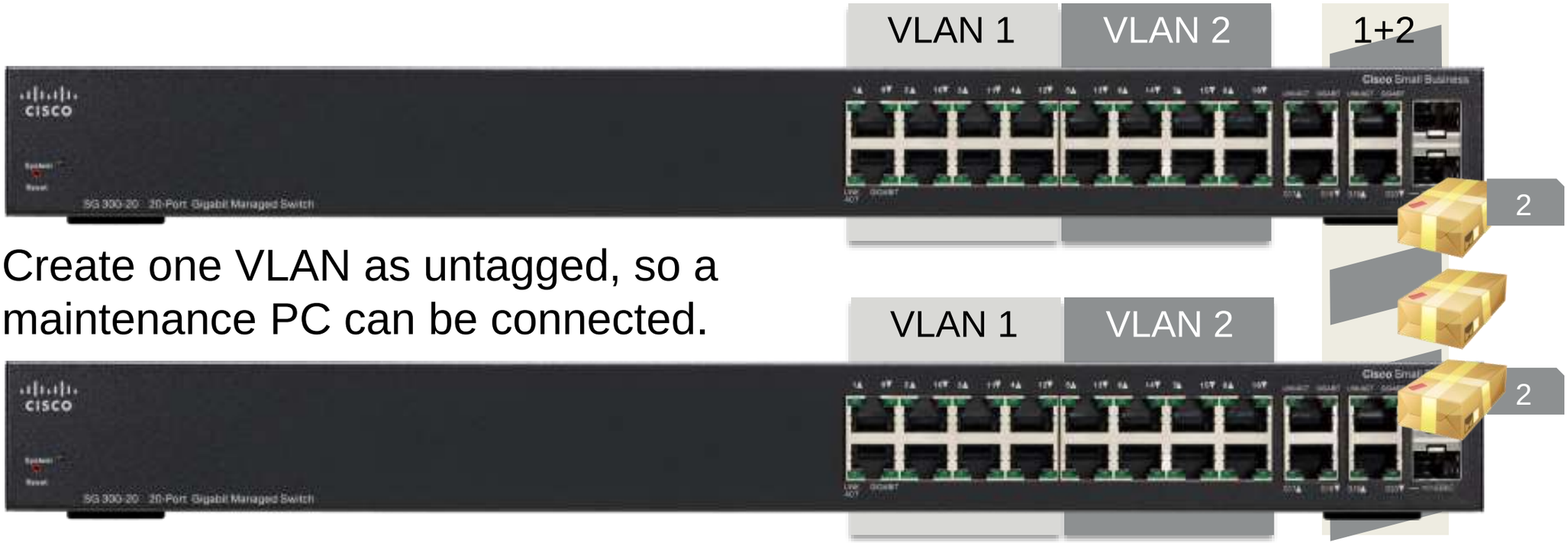


Tags are stripped before sending them to devices so process is transparent.

Multiple VLANs on a Trunk

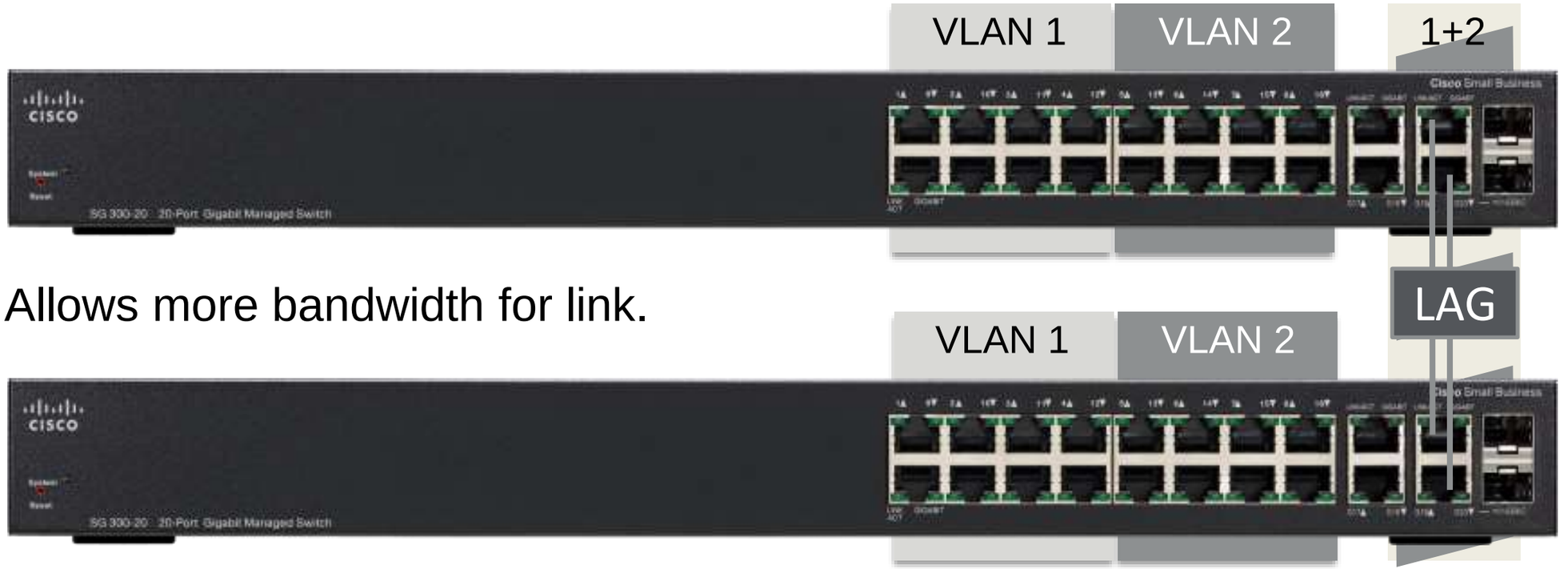
The “Untagged” VLAN on a Trunk



Create one VLAN as untagged, so a maintenance PC can be connected.

Multiple VLANs on a Trunk

Combine Ideas – a LAG of Trunk Lines



Allows more bandwidth for link.

Network Ports: *https://www.audinate.com:443*

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HOW DO WE MANAGE SO MANY CONNECTIONS AT ONCE?

APPLICATION ADDRESSES

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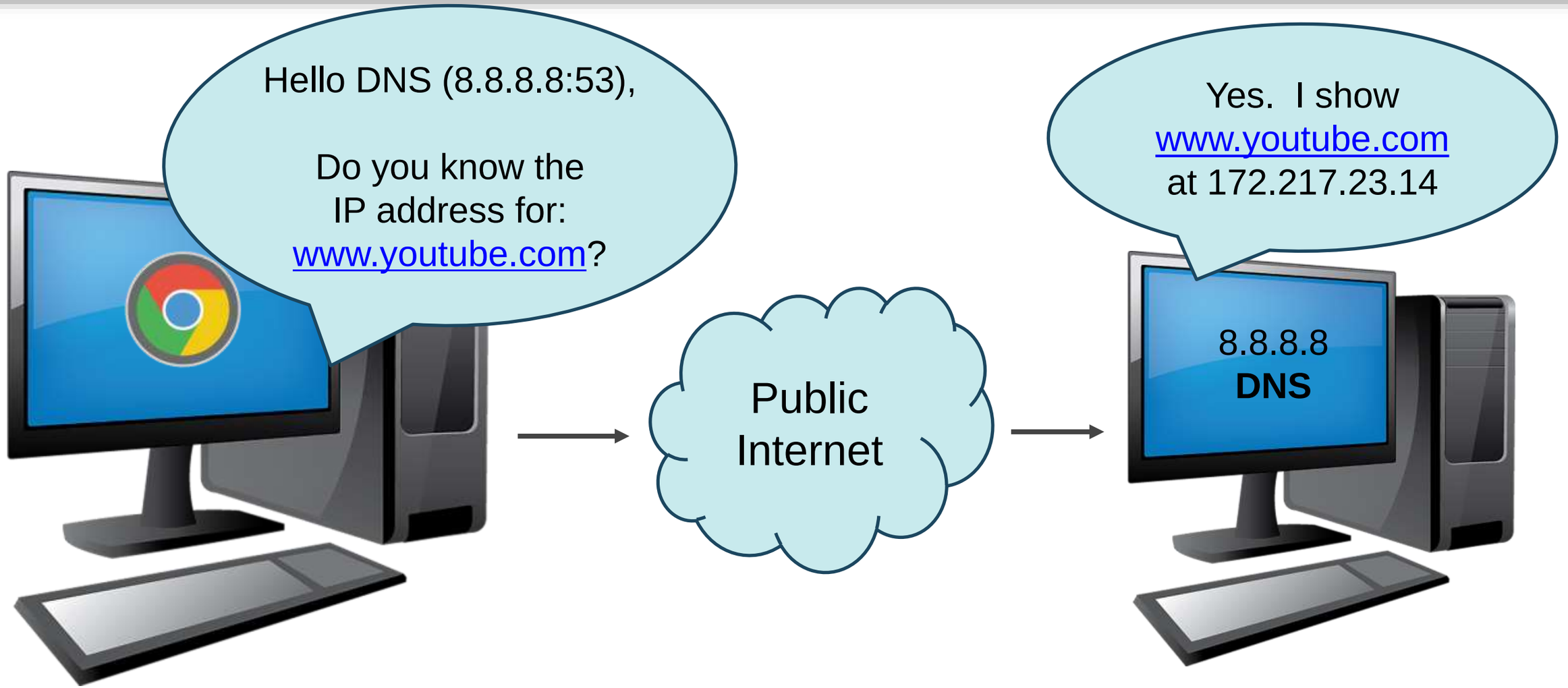

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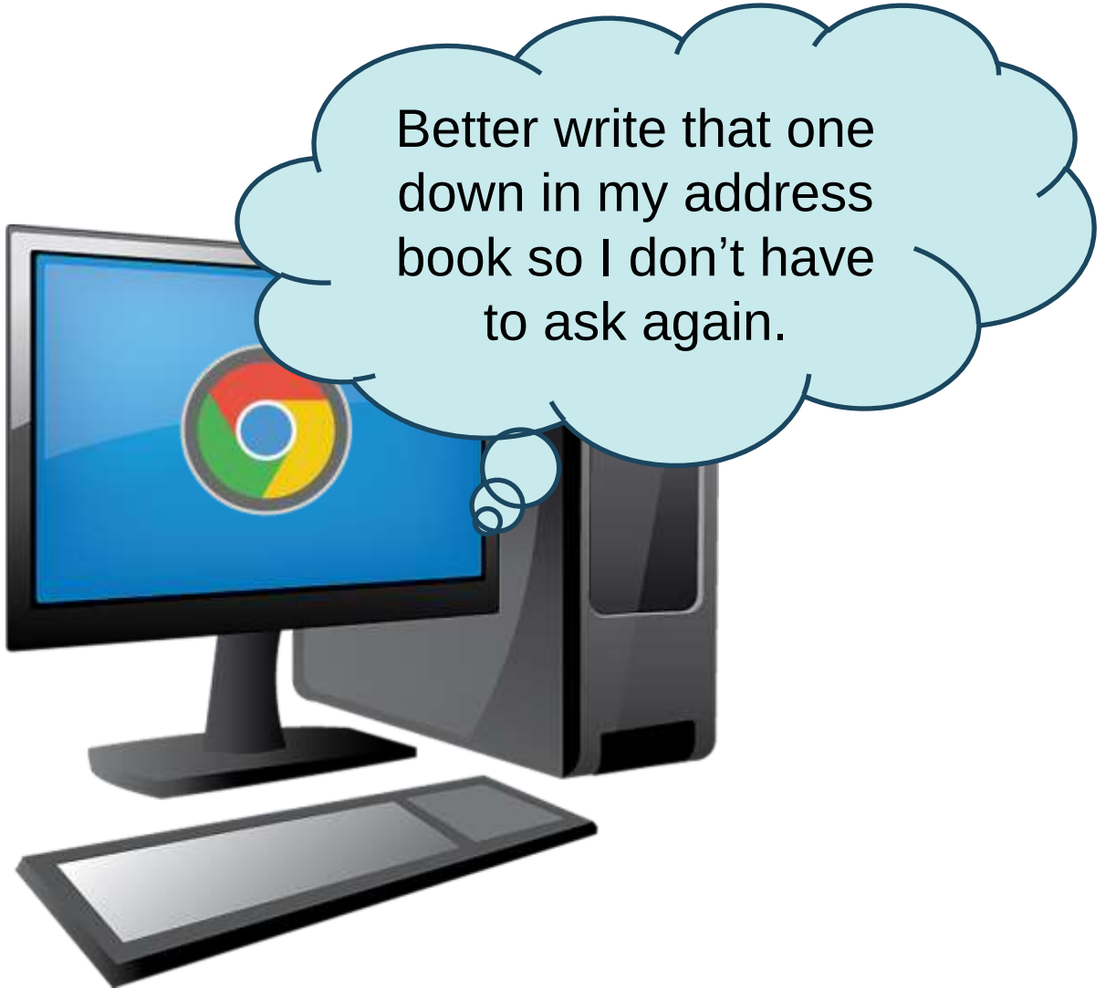

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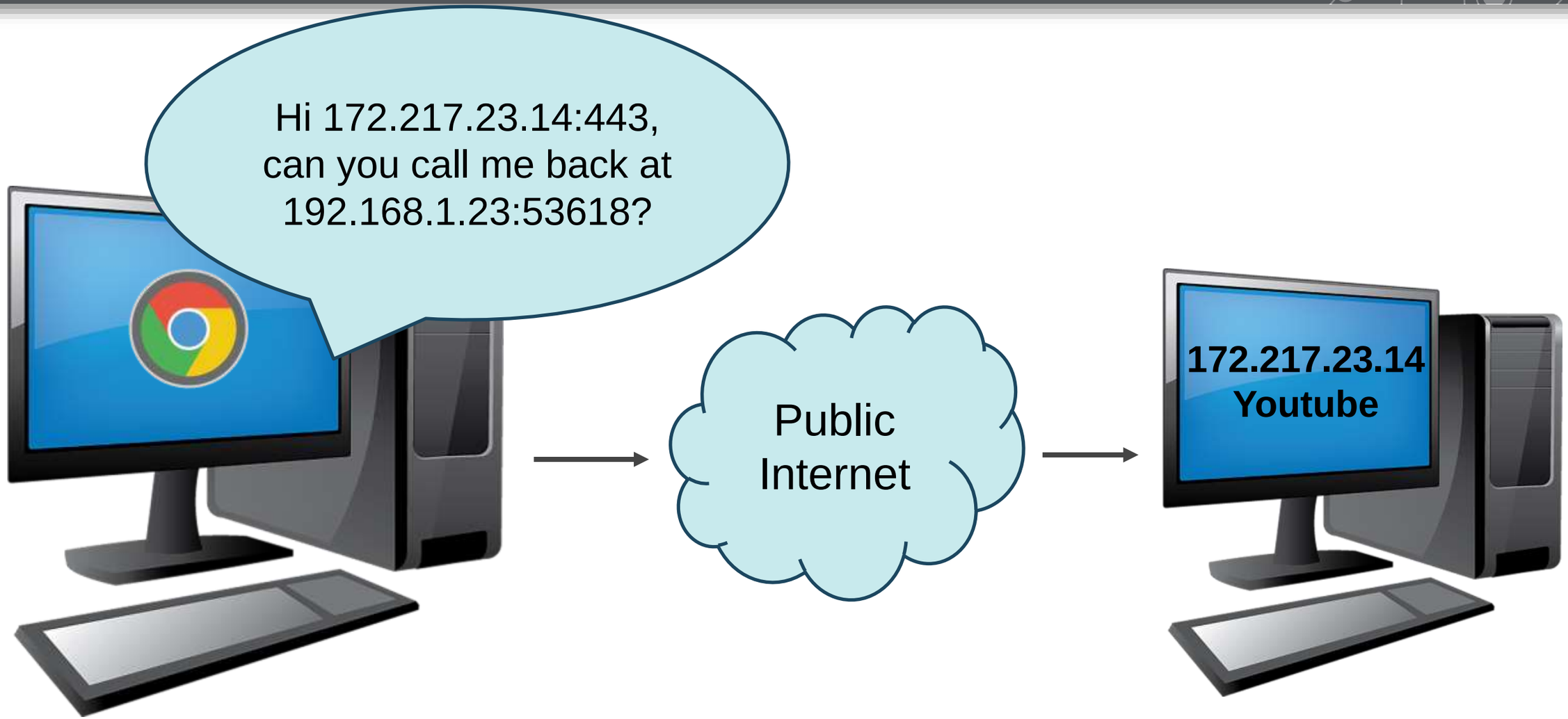

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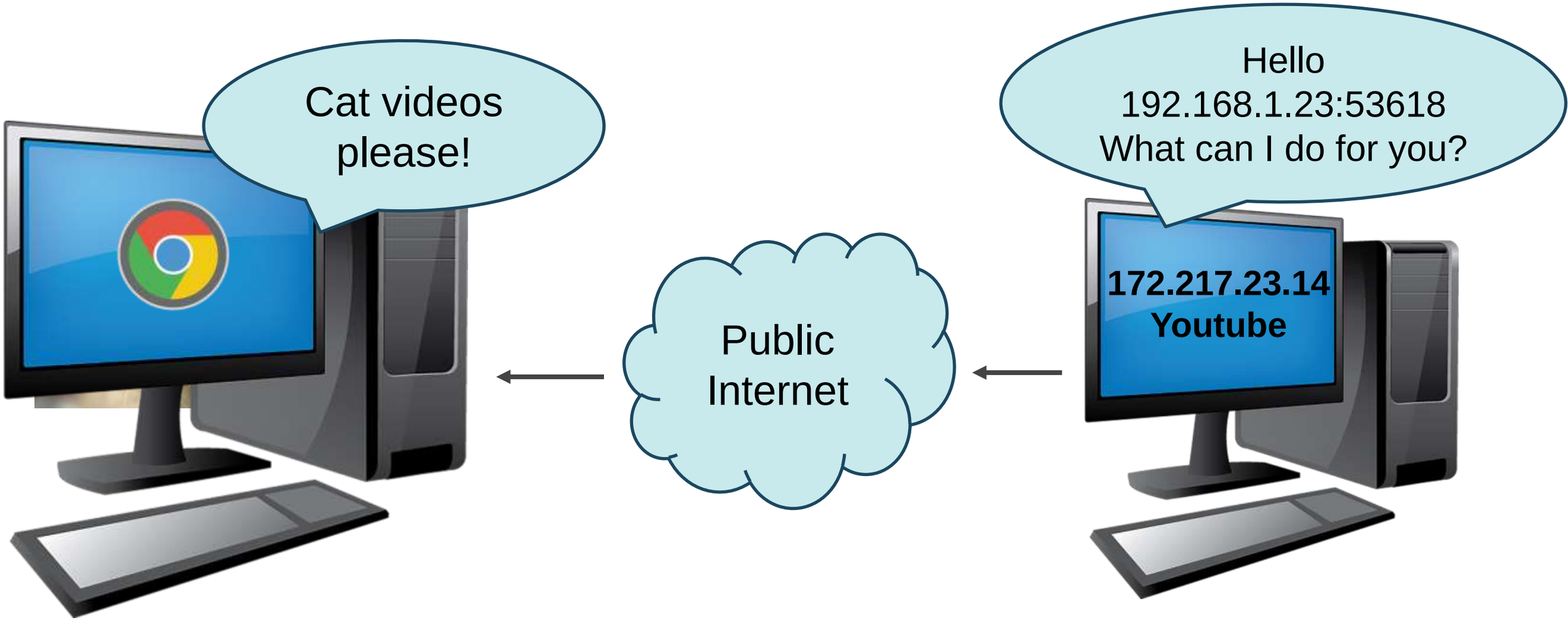

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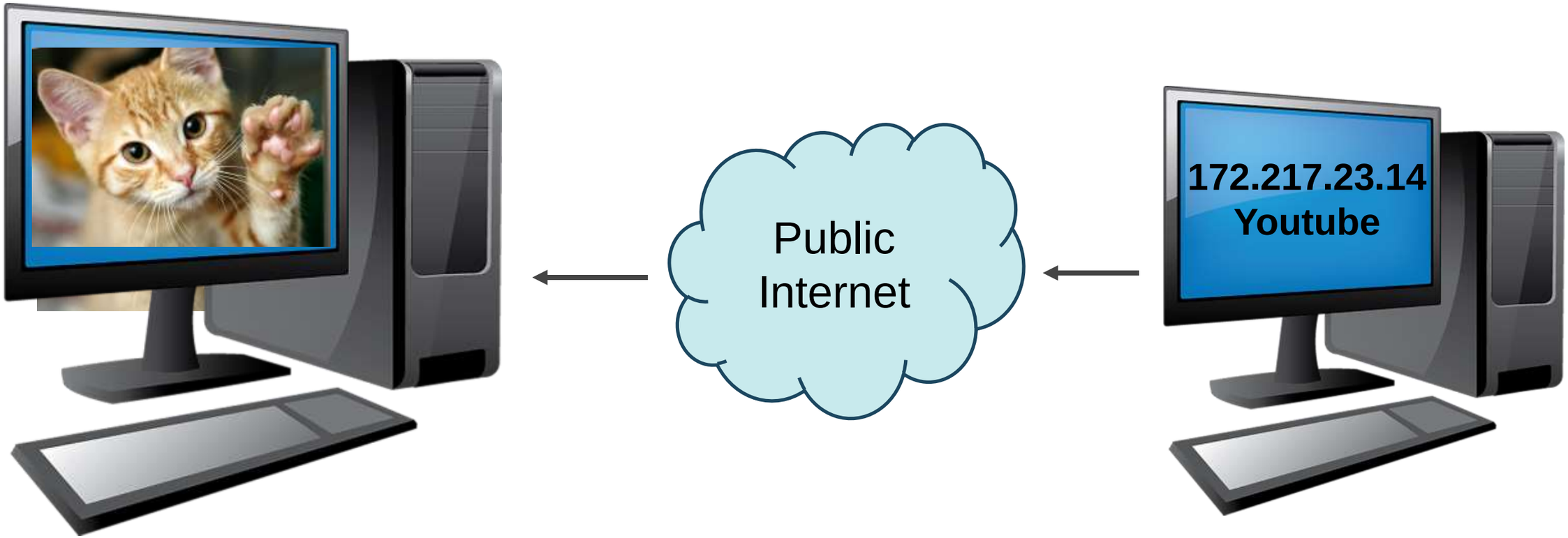


APPLICATION ADDRESSES

- The same process repeats for every application
- Each application has its own unique Internal (port) address

Application	Local Port	Remote IP	Remote Port
Youtube	TCP 53618	172.217.23.14	TCP 443
Facebook	TCP 53653	31.13.92.36	TCP 443
Outlook	TCP 67123	105.40.225.204	TCP 389
Spotify	TCP 57453	194.132.198.198	TCP 443

APPLICATION ADDRESSES

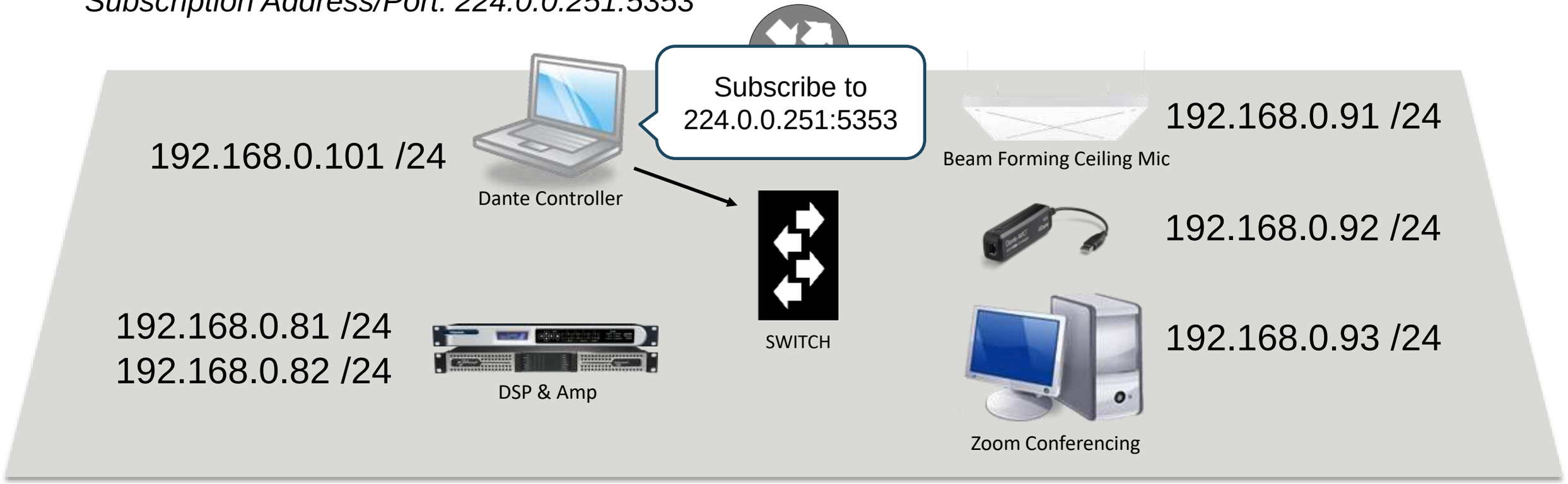
- The same process repeats for every application
- Each application has its own unique Internal (port) address
- Dante networks do this as well.

Application	Local Port	Remote IP	Remote Port
PTP	UDP 53618	224.0.1.129	UDP 319
Audio Flow	UDP 14340	192.168.1.56	UDP 14390
Audio Flow	UDP 14350	192.168.1.60	UDP 14367
Gain control	UDP 50135	192.168.1.56	UDP 50231

Dante Discovery

Dante Discovery

- Dante uses mDNS to discover devices on the network.
  The “m” stands for multicast.
  Subscription Address/Port: 224.0.0.251:5353



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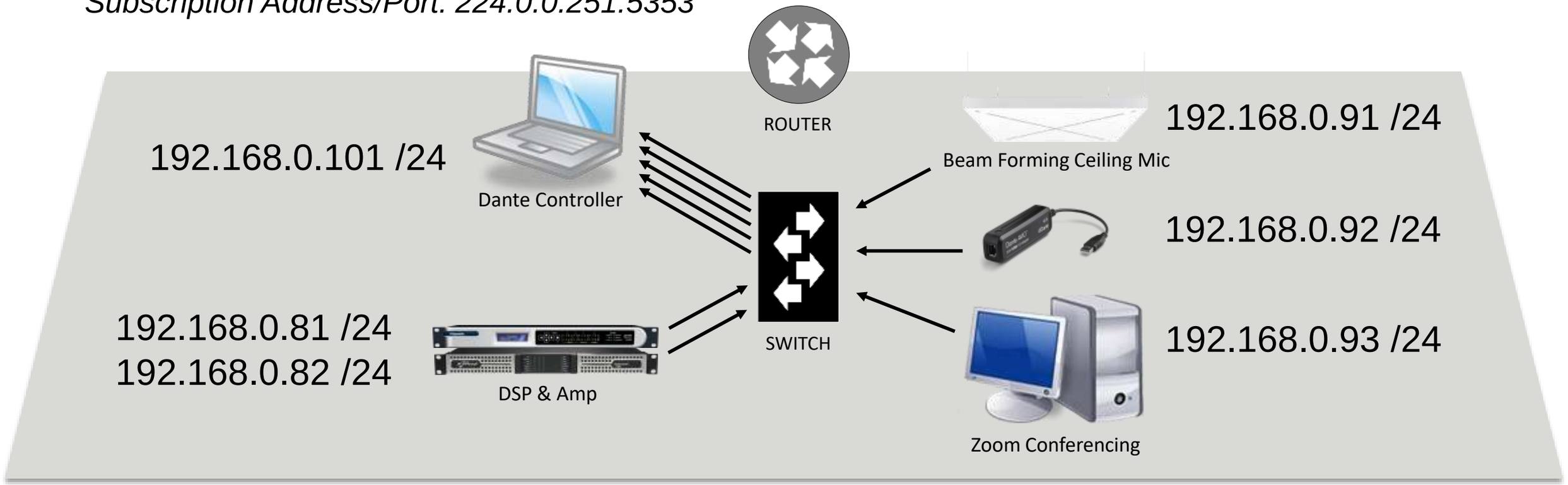

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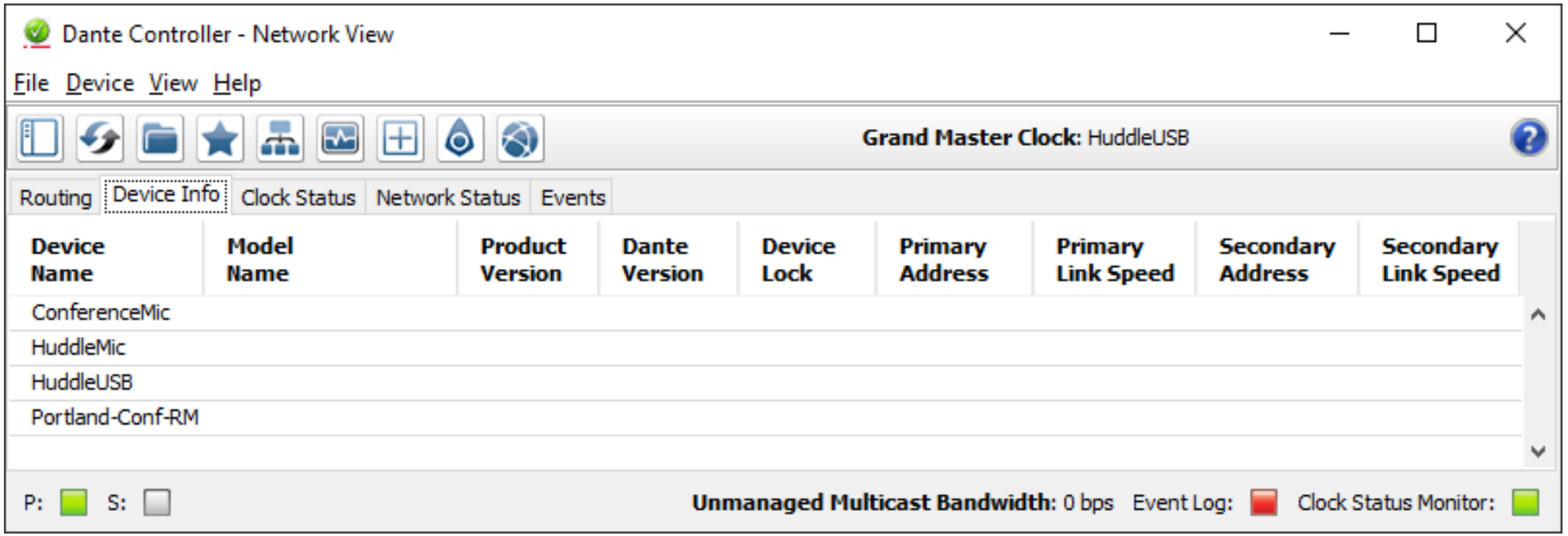
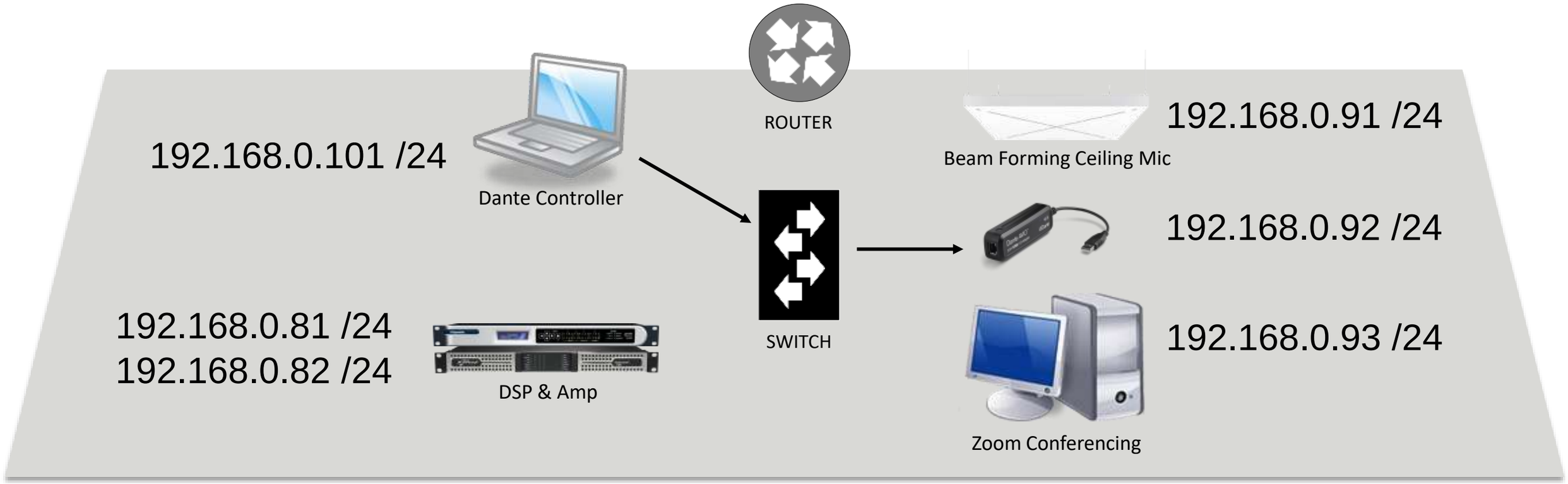


Dante Discovery

- Dante API then takes over, getting more details.
  Further queries are unicast.



Dante Controller uses unicast Dante API to learn more.

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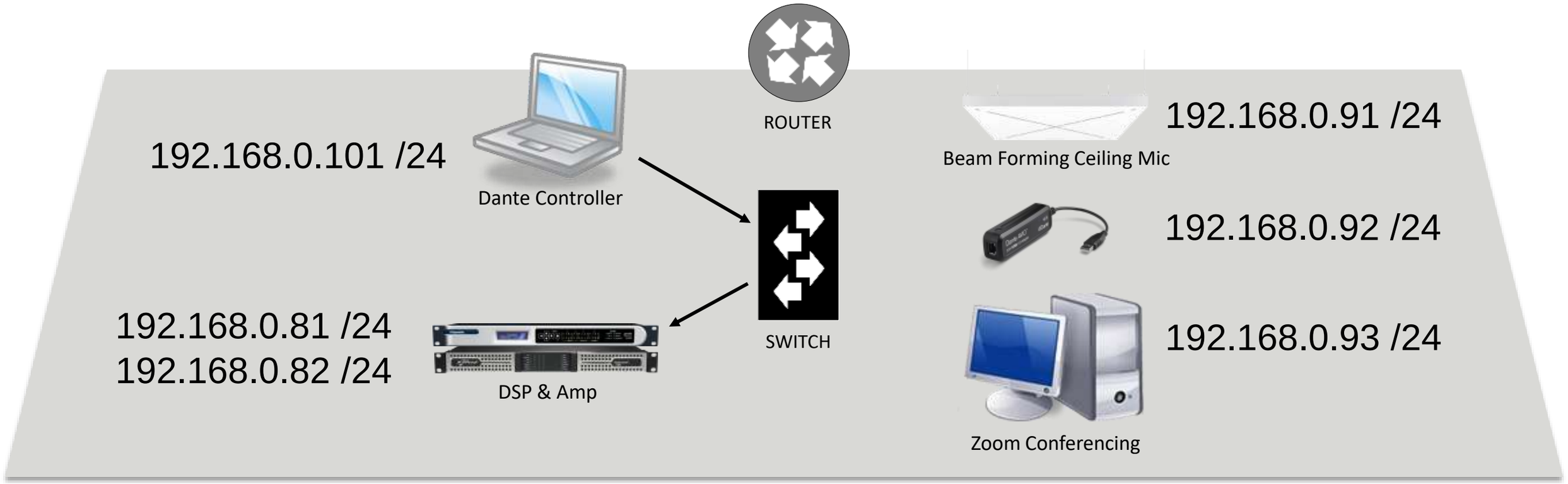

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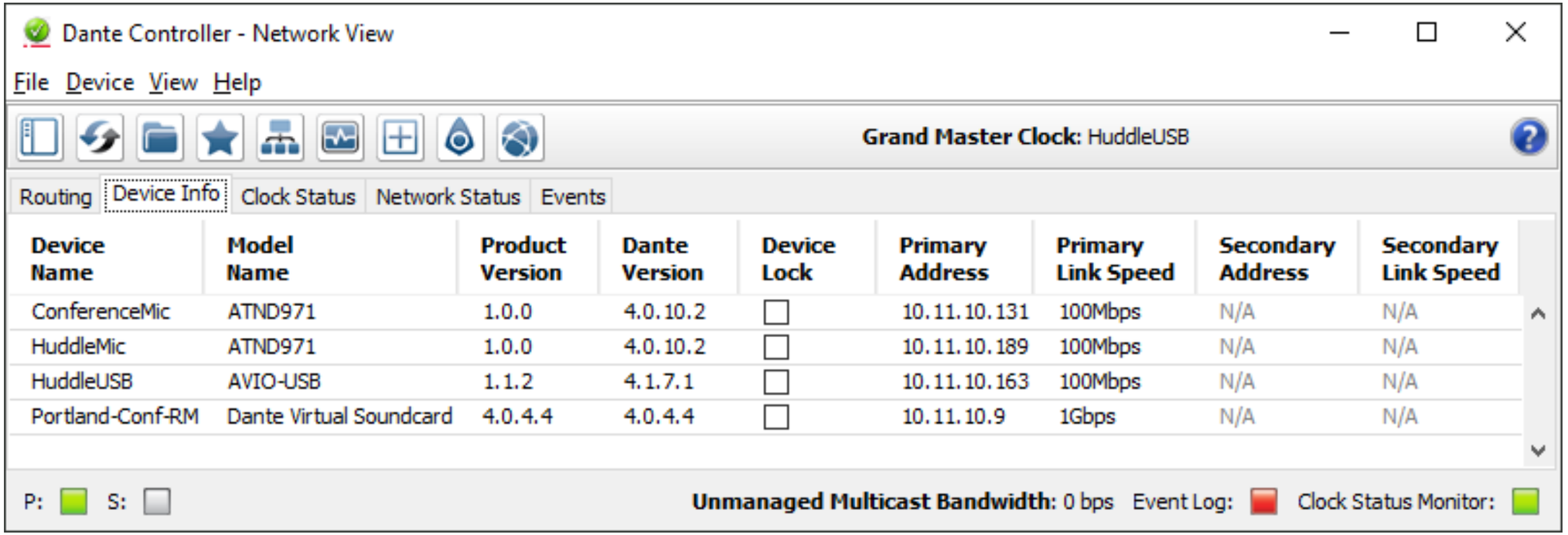
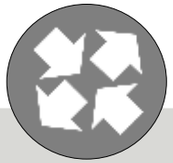


Dante Discovery - Troubleshooting

What happens if some devices are mistakenly out of the LAN range?

192.168.0.101 /24

Dante Controller

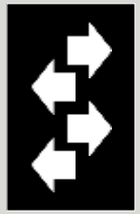


ROUTER

192.168.0.91 /24

Beam Forming Ceiling Mic

192.168.0.92 /24



SWITCH

10.0.15.81 /24
10.0.15.82 /24

DSP & Amp

192.168.0.93 /24

Zoom Conferencing

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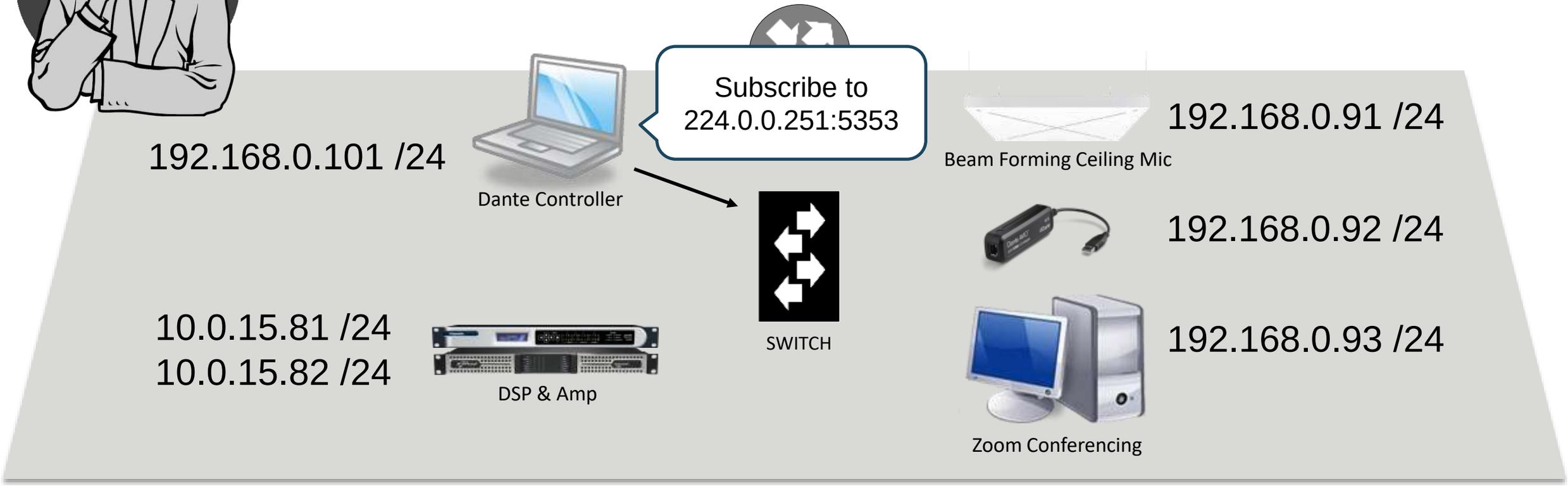

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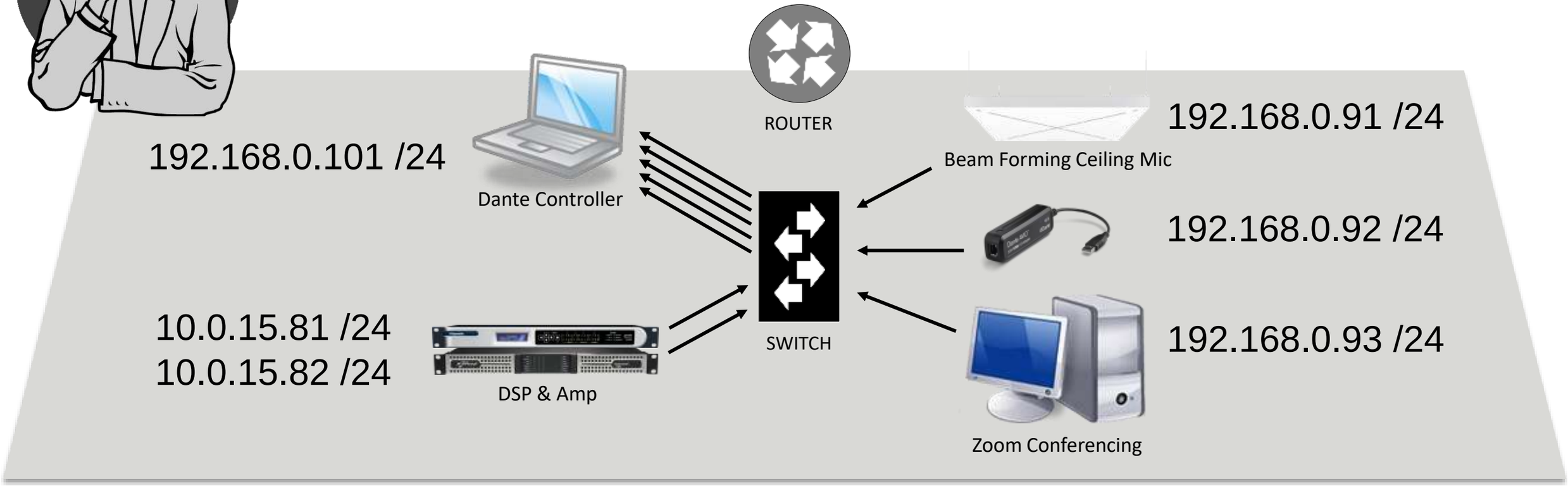

mDNS discovery still populates core device info – multicast is not dependent on LAN range.

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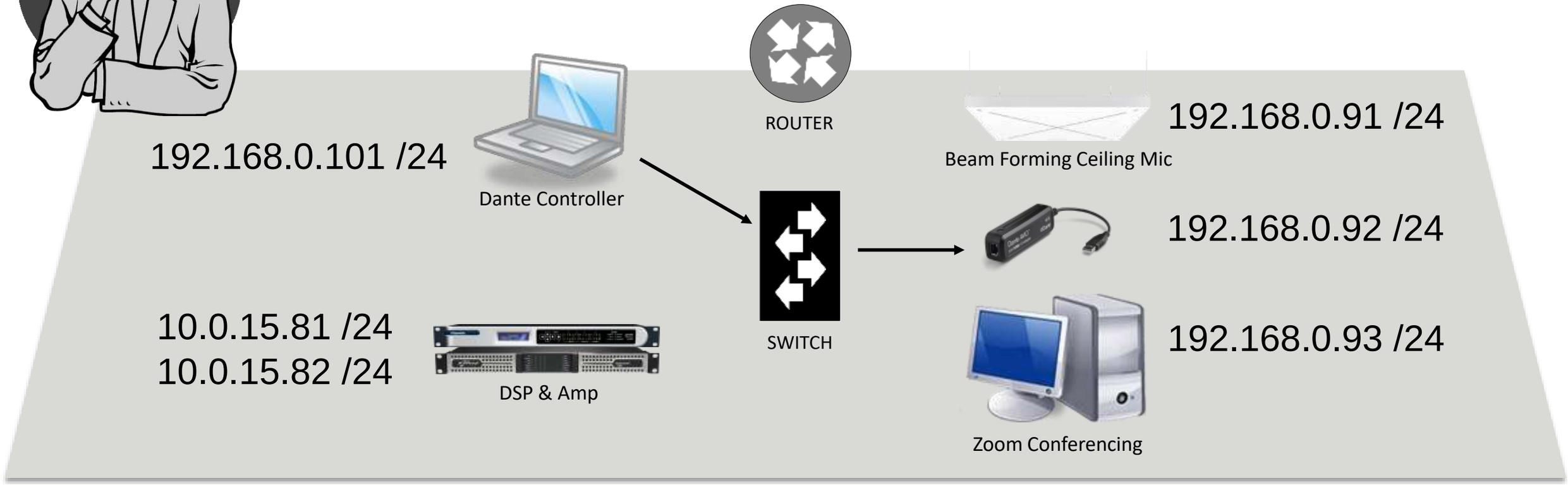

The unicast Dante API will gather information about devices in the proper LAN range.

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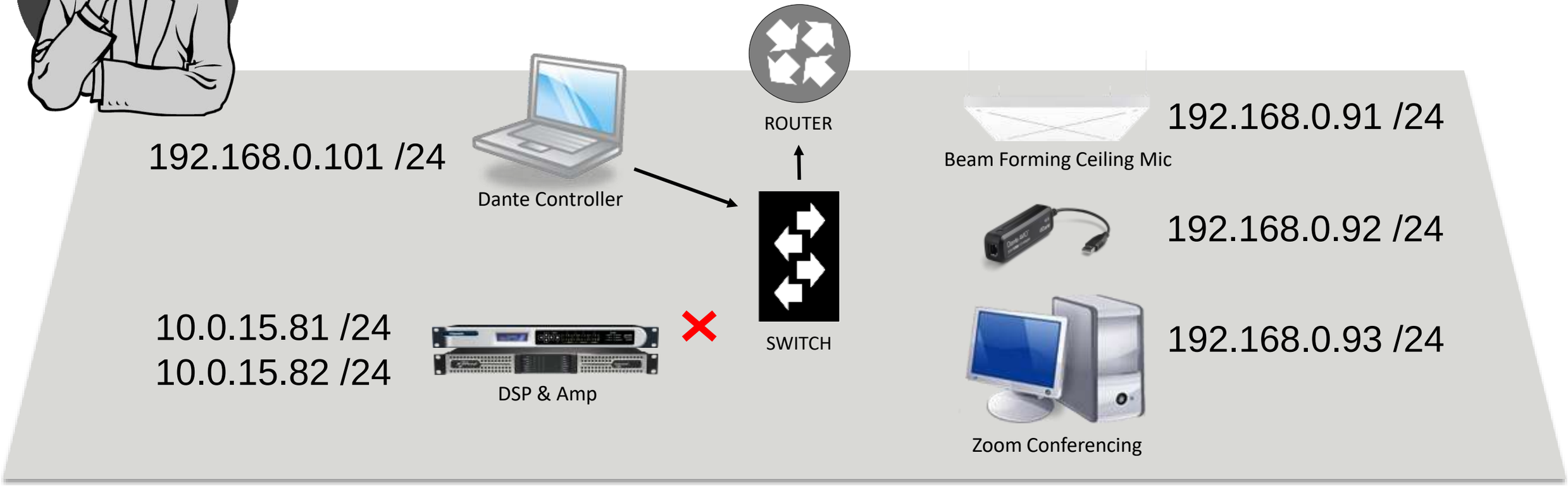


But the unicast transmission will see addresses outside our LAN and go to the router.

Dante Discovery - Troubleshooting

What happens if some devices are mistakenly out of the LAN range?

te Controller - Network View

File Device View Help

Grand Master Clock: HuddleUSB

Routing | Device Info | Clock Status | Network Status | Events

Device Name	Model Name	Product Version	Dante Version	Device Lock	Primary Address	Primary Link Speed	Secondary Address	Secondary Link Speed
ConferenceMic	ATND971	1.0.0	4.0.10.2	☐	10.11.10.131	100Mbps	N/A	N/A
HuddleMic	ATND971	1.0.0	4.0.10.2	☐	10.11.10.189	100Mbps	N/A	N/A
HuddleUSB								
Portland-Conf-RM	Dante Virtual Soundcard	4.0.4.4	4.0.4.4	☐	10.11.10.9	1Gbps	N/A	N/A

P: S: Unmanaged Multicast Bandwidth: 0 bps Event Log: Clock Status Monitor:

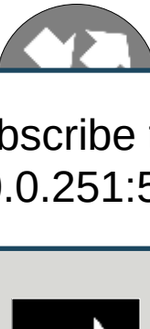
Dante Discovery - Troubleshooting

What happens if Dante Controller is mistakenly out of the LAN range?

10.0.15.101 /24

Dante Controller

Subscribe to
224.0.0.251:5353



SWITCH

Beam Forming Ceiling Mic

192.168.0.91 /24

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DSP & Amp

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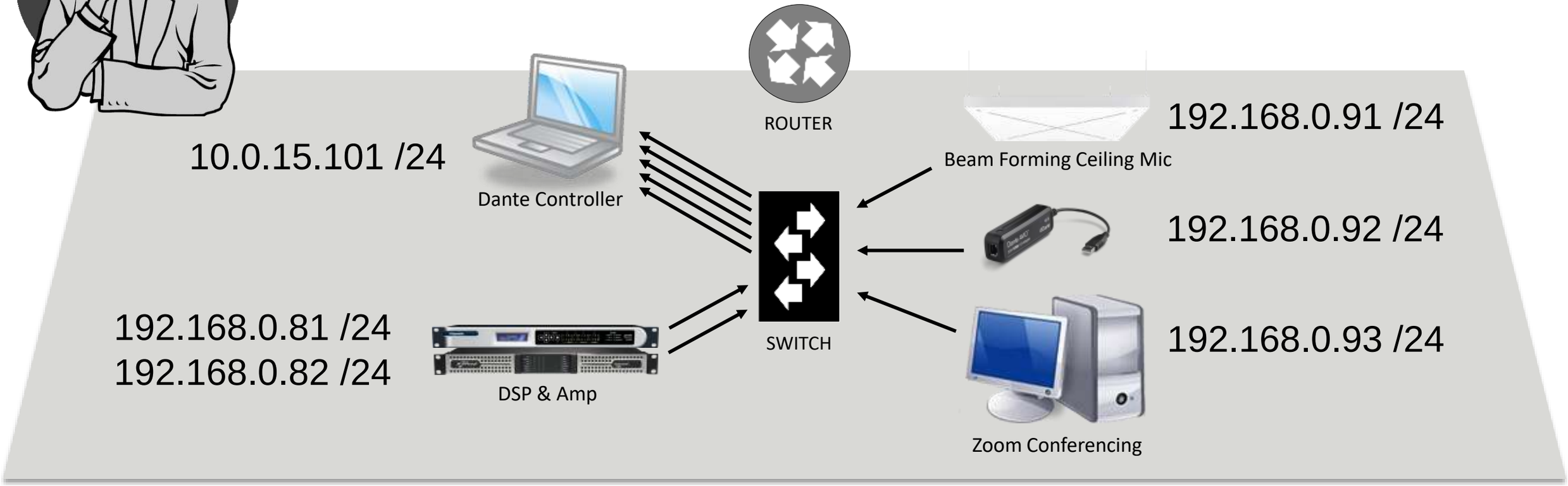

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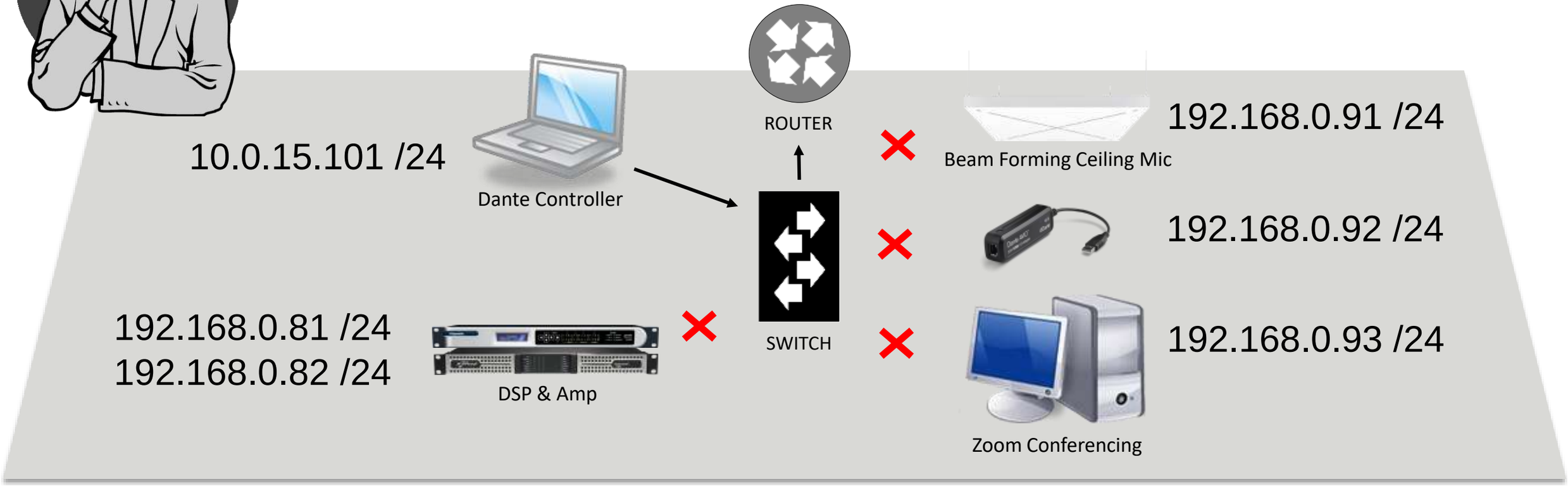

But the unicast Dante API will think these addresses are on another LAN, not inside our network.

Dante Discovery - Troubleshooting

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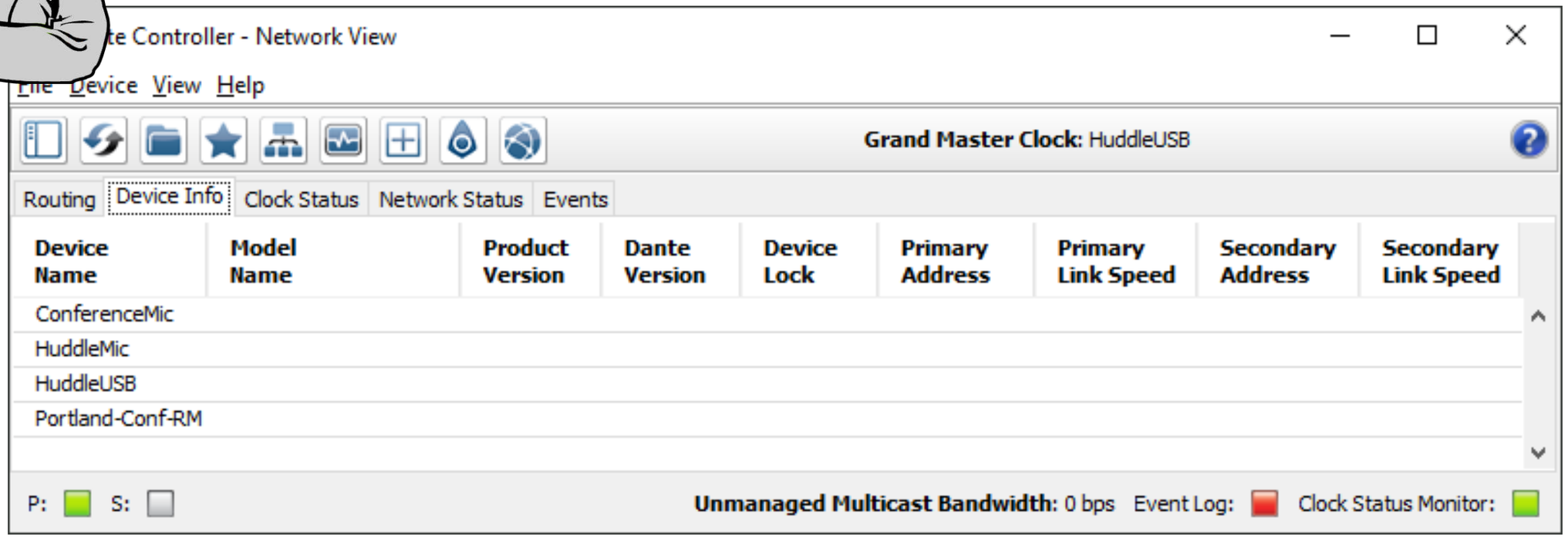
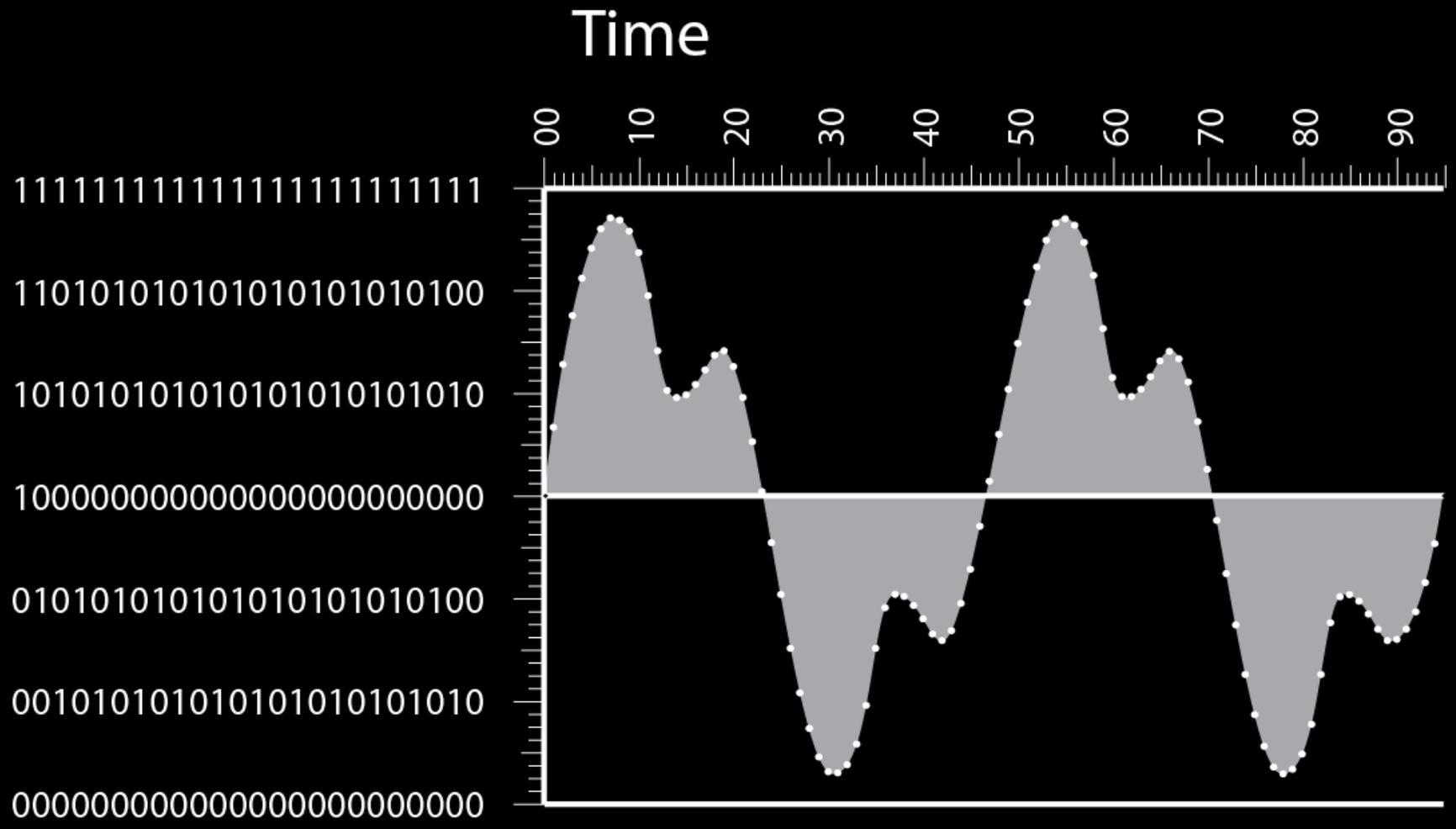


Dante Discovery – Troubleshooting

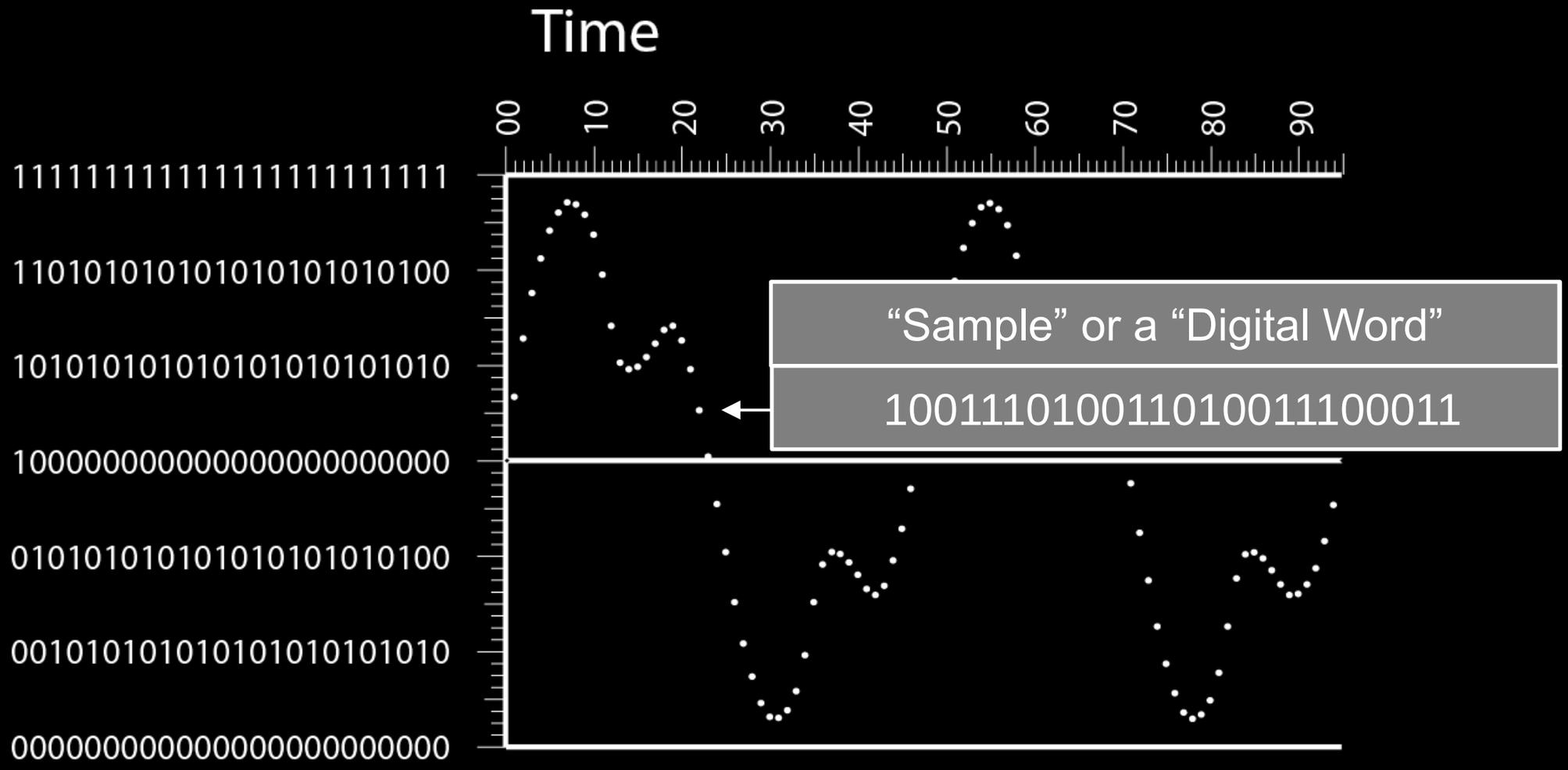
- Partial discovery can be interrupted by simple LAN range problems
  Dante Controller may be able to tell you the LAN range the device is in.
  If everything is empty, check if your computer is out of the LAN range.
  Also check if Dante Controller is using the right network interface (NIC)

Advanced Clocking, Layer 2

Basics of Sample Rate & Clock



Basics of Sample Rate & Clock



Why Do We Cover Clocking?

Dante means your whole system is connected digitally.

This is often the first time people work with a digitally-connected system.

Troubleshooting: Fear and lack of knowledge cause people to blame clock quickly.

Digital Audio Chain

Capture

#1

Digital Audio Chain

Capture

#2

Transmit

#1

Digital Audio Chain

Capture

#3

Transmit

#2

Process

#1

Digital Audio Chain

Capture

#4

Transmit

#3

Process

#2

Transmit

#1

48KHz Internal

Digital Audio Chain

Capture

#4

48,000.1 Hz

Transmit

#3

Process

#2

48,000.3 Hz

Transmit

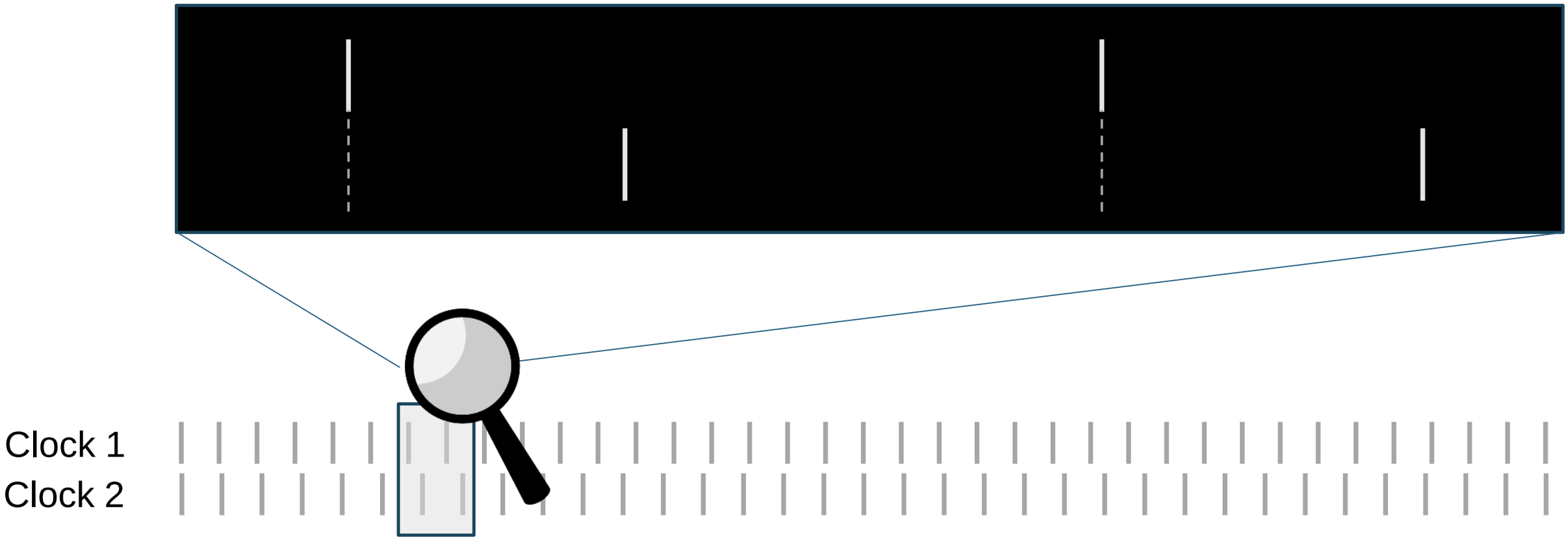
#1

Clock 1

Clock 2

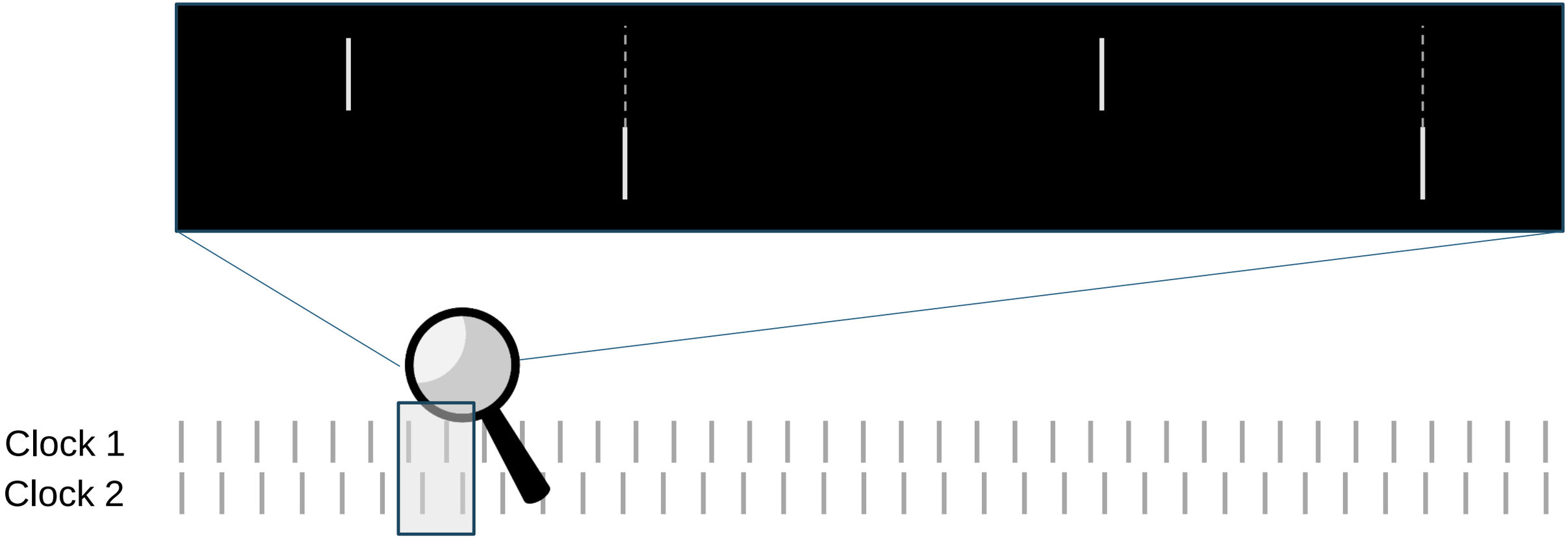
Clock: In Sync vs In Phase

OK: In Sync, Out of Phase



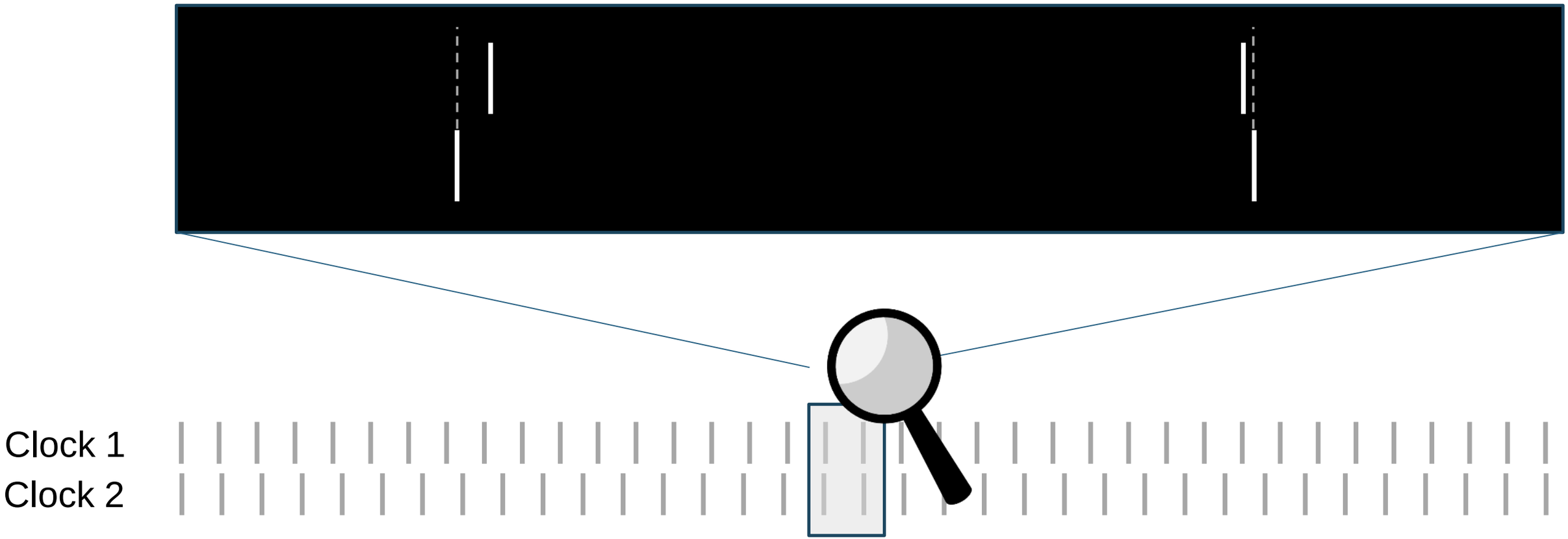
Clock: In Sync vs In Phase

OK: In Sync, Out of Phase



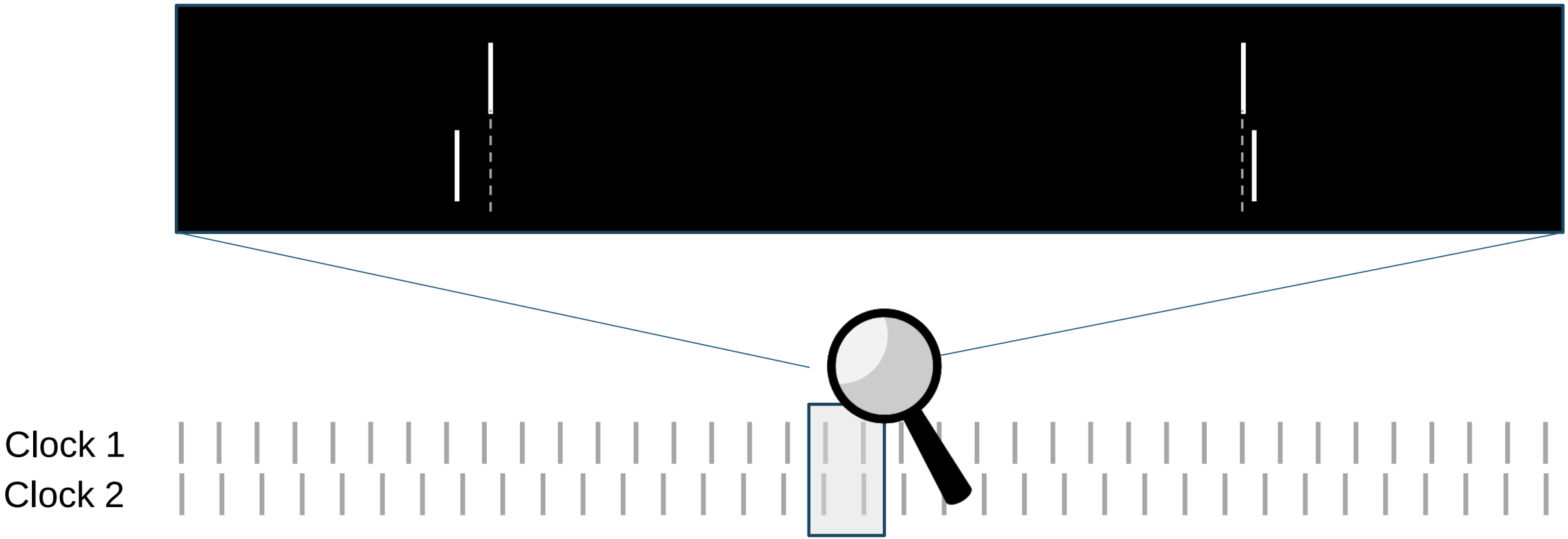
Clock: In Sync vs In Phase

Problem: No Sync – Buffer Overrun/Underrun



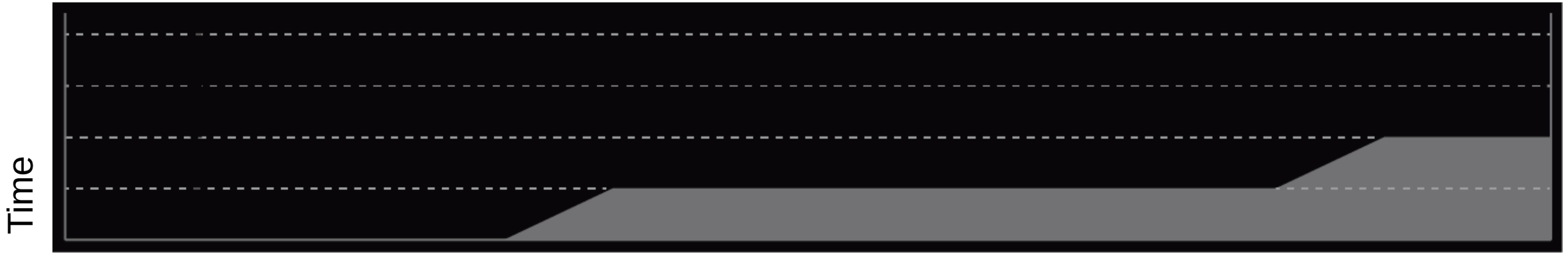
Clock: In Sync vs In Phase

Problem: No Sync – Buffer Overrun/Underrun



Clock: Propagation Delay

Word Clock Variance (Propagation Delay)



Clock: Propagation Delay

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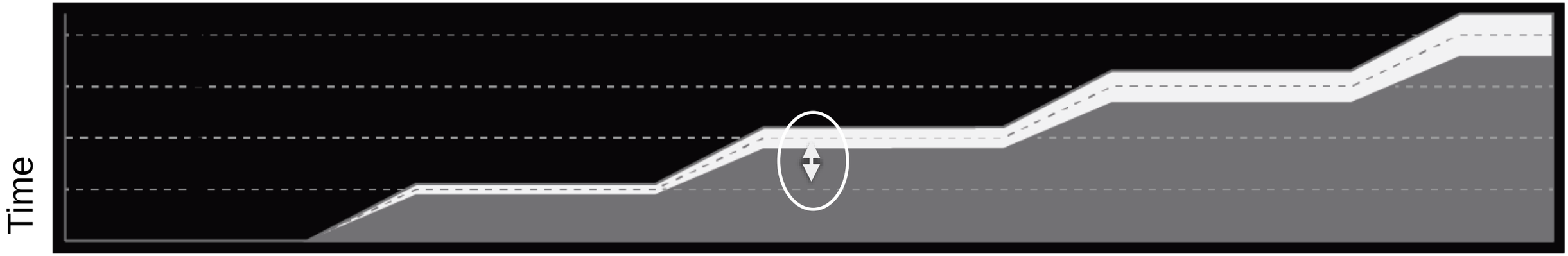
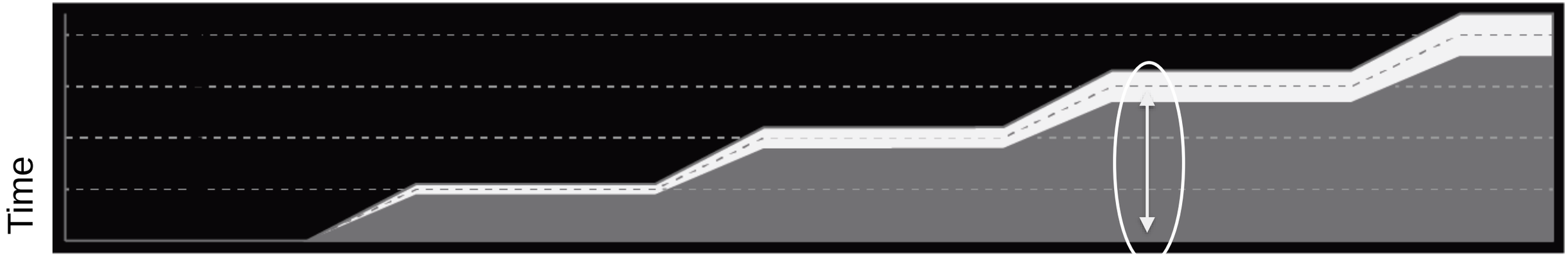
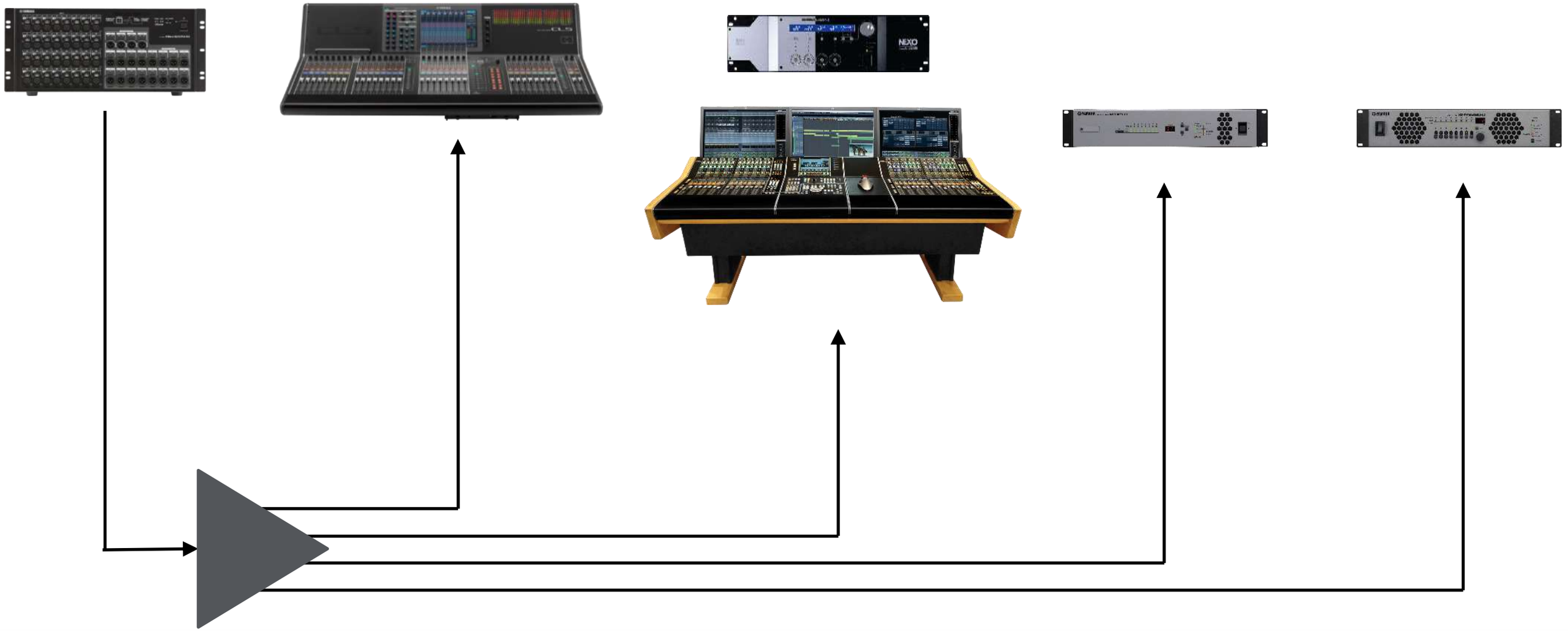


Clock: Propagation Delay

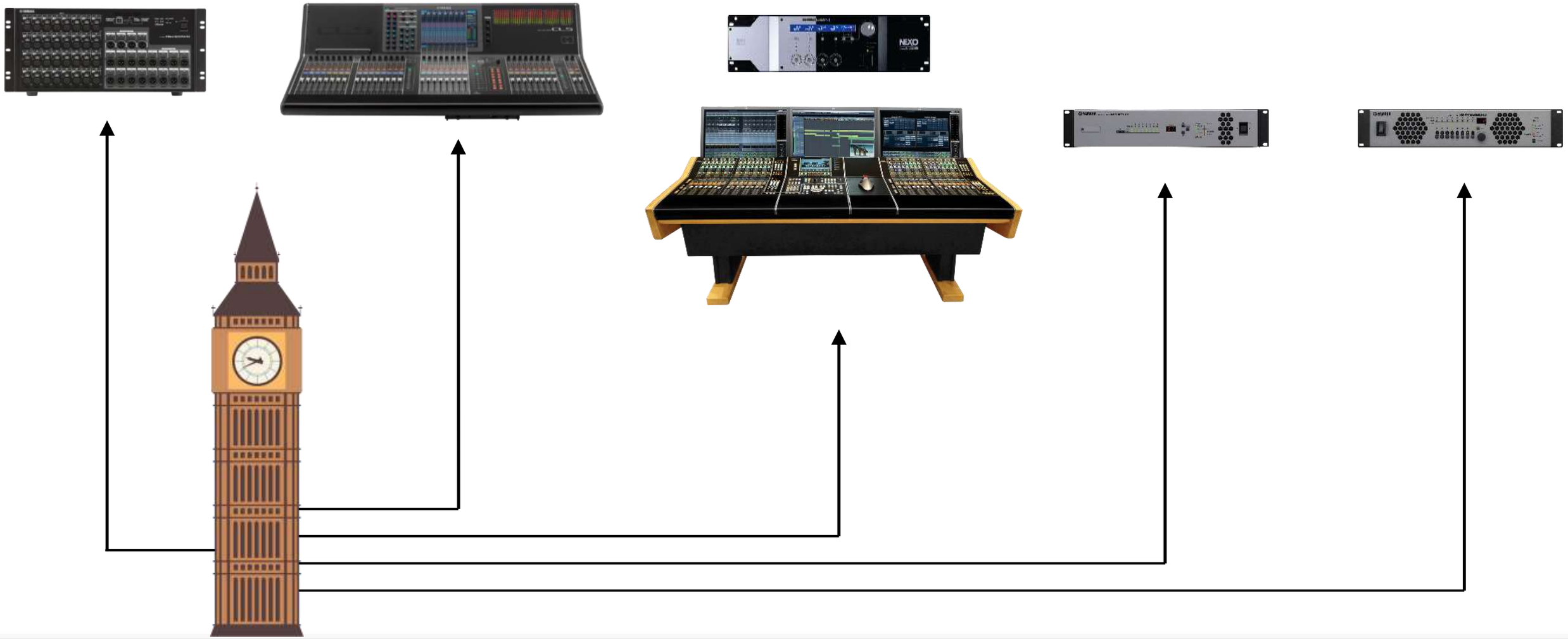
Word Clock Variance (Propagation Delay)



Clock: Buffered Distribution



Clock: Central Clock

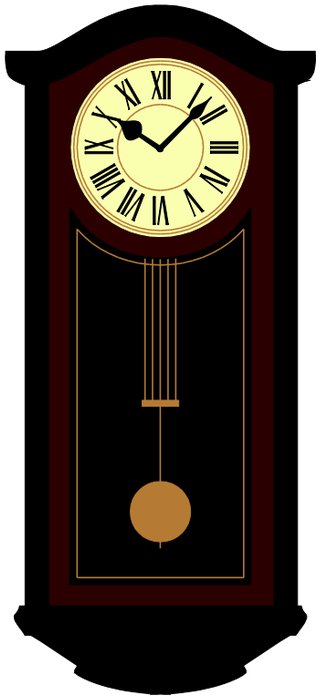


Clock: Cyclical Reference vs Positional Pointer

Is word clock like SMPTE time code?

SMPTE time code →
(face of the clock)

Word Clock →
(pendulum)



Word Clock and SMPTE Time Code must be "resolved", meaning they are related and align, but they are not describing the same thing.

Dante Word Clock

Dante Simplifies Configuration.

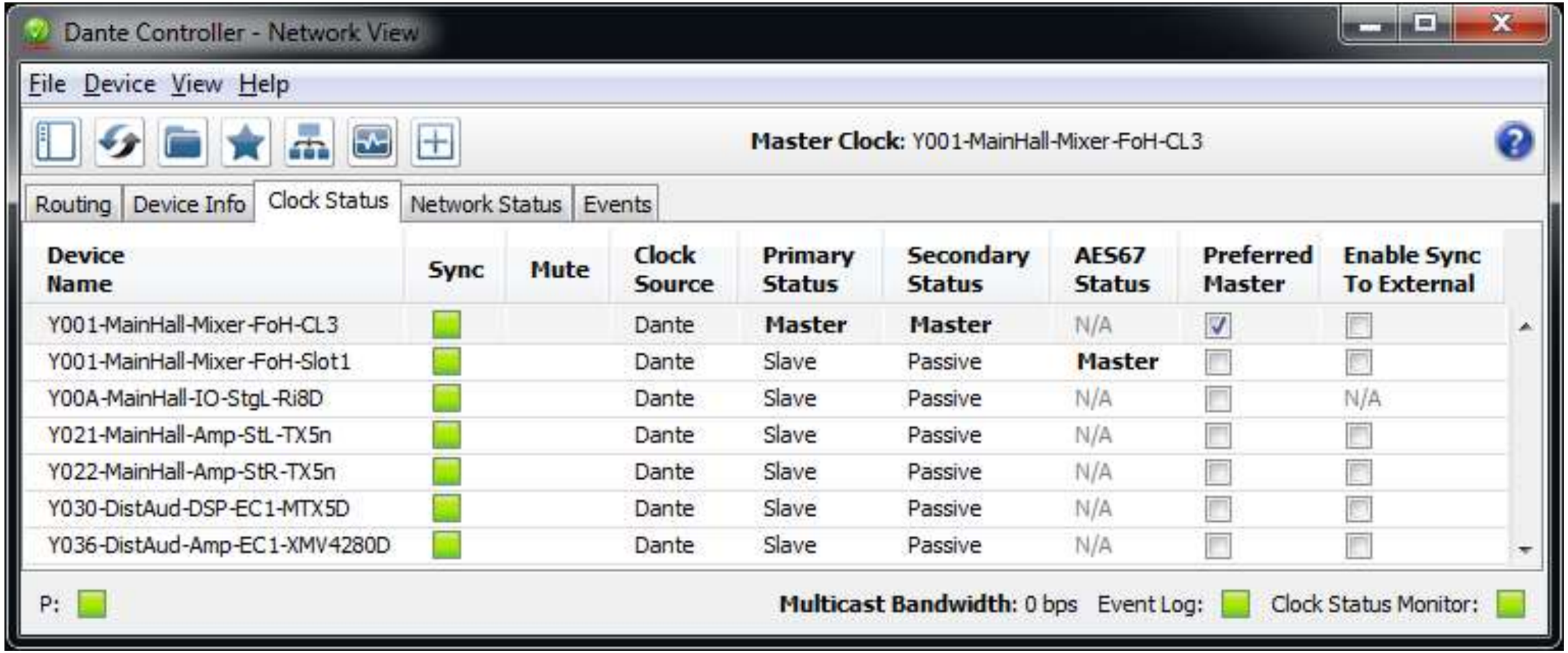
Not Just In Sync, but In Phase.

Dante Word Clock Master Election

- Automated Election Criteria:

Preferred Master	
Chasing External Clock	User Intervention
Best Master Clock Algorithm	Automatic Process

Dante Word Clock Master Election



Dante Word Clock Master Election

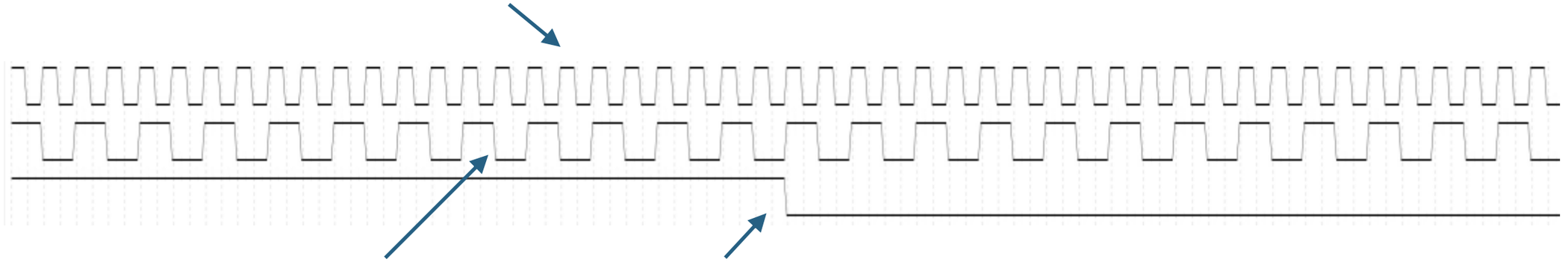
- Automated Election Criteria:

Preferred Master	
Chasing External Clock	User Intervention
Best Master Clock Algorithm	Automatic Process

- Synchronize “Time of Day” to sub-microsecond accuracy.
- Derive the desired audio sample rate or video frame rate.

Derrive Clocks from a Higher Resolution PTP Sync

If we have a higher resolution clock like PTP…

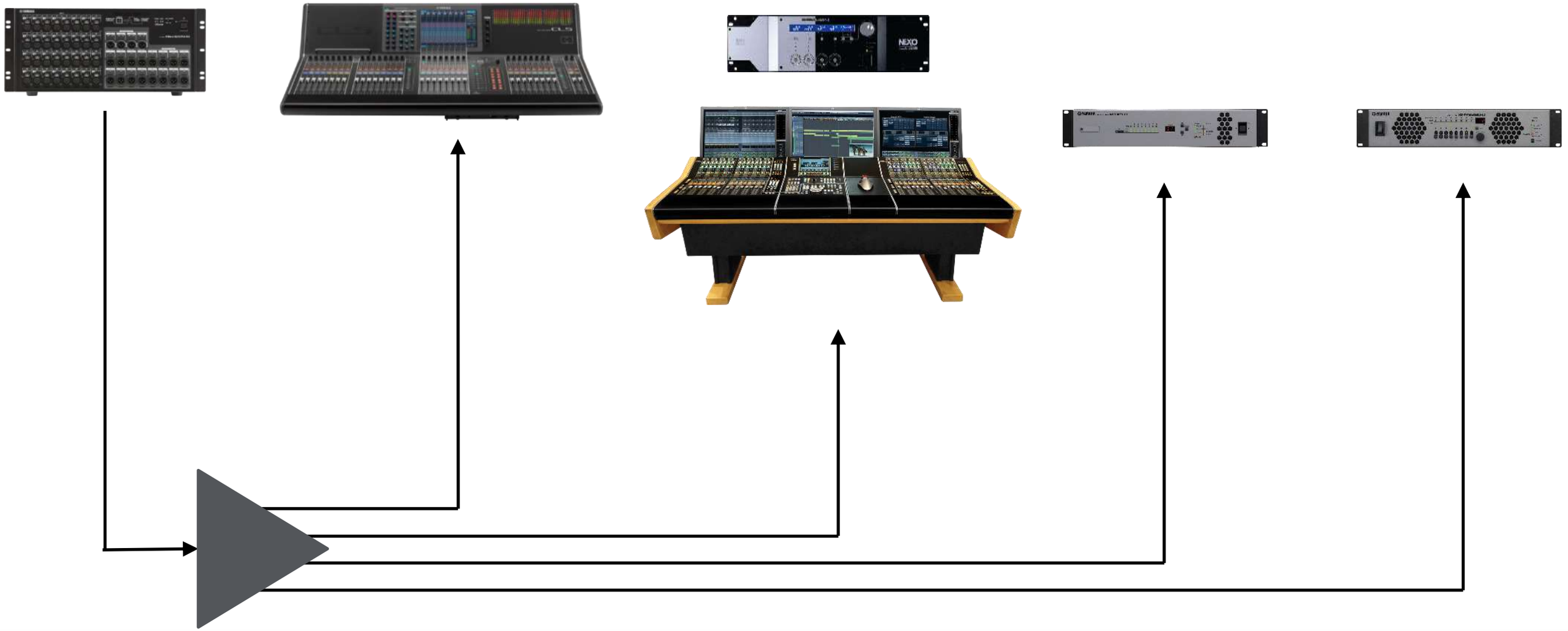


We can derive lower frequency clocks from it.
192kHz, 96kHz, 48kHz, 44.1kHz, 60fps, 50fps, 30fps, 25fps, 24fps, etc.

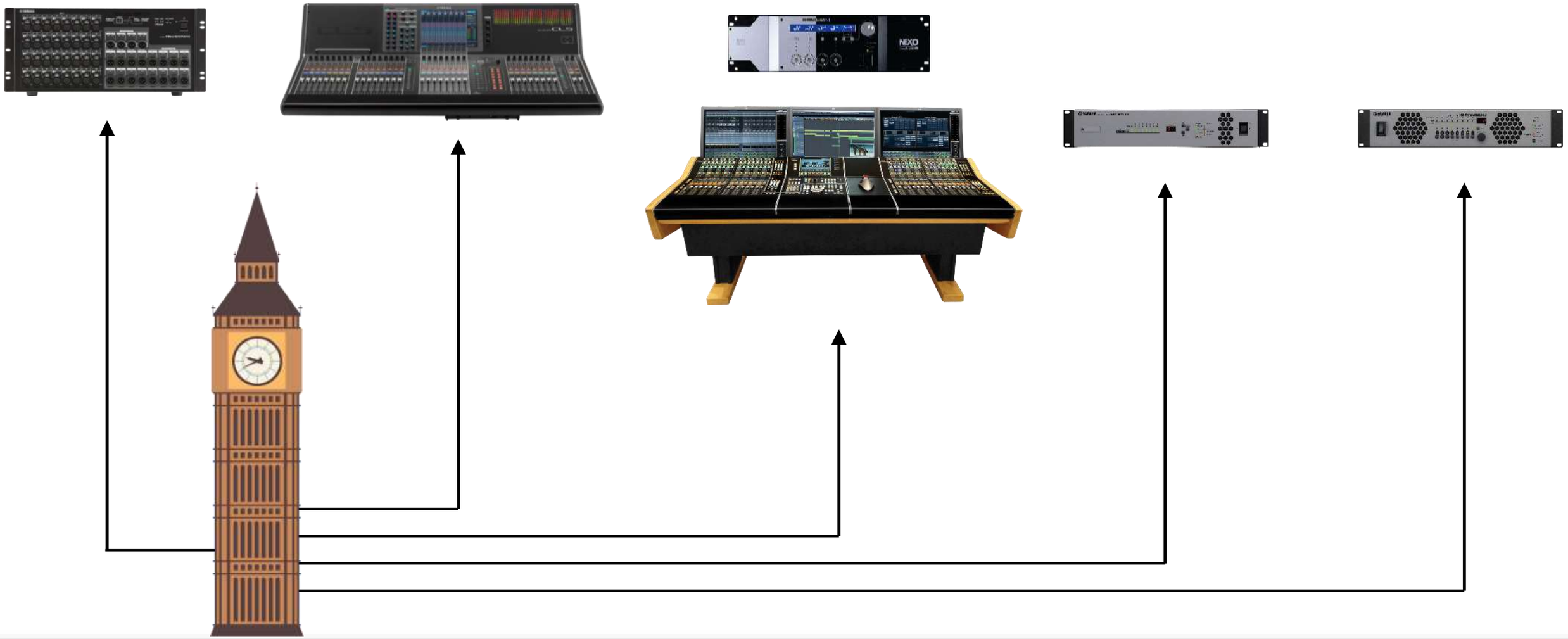
So with PTP, we have one clock master for the network – not one per sample rate, frame rate, etc. Everything automatically derives from (and thus is resolved to) this common PTP clock.

PTP resolution far exceeds sample rates or frame rates – the chart above simplifies the drawing so it'll fit in the resolution of the screen.

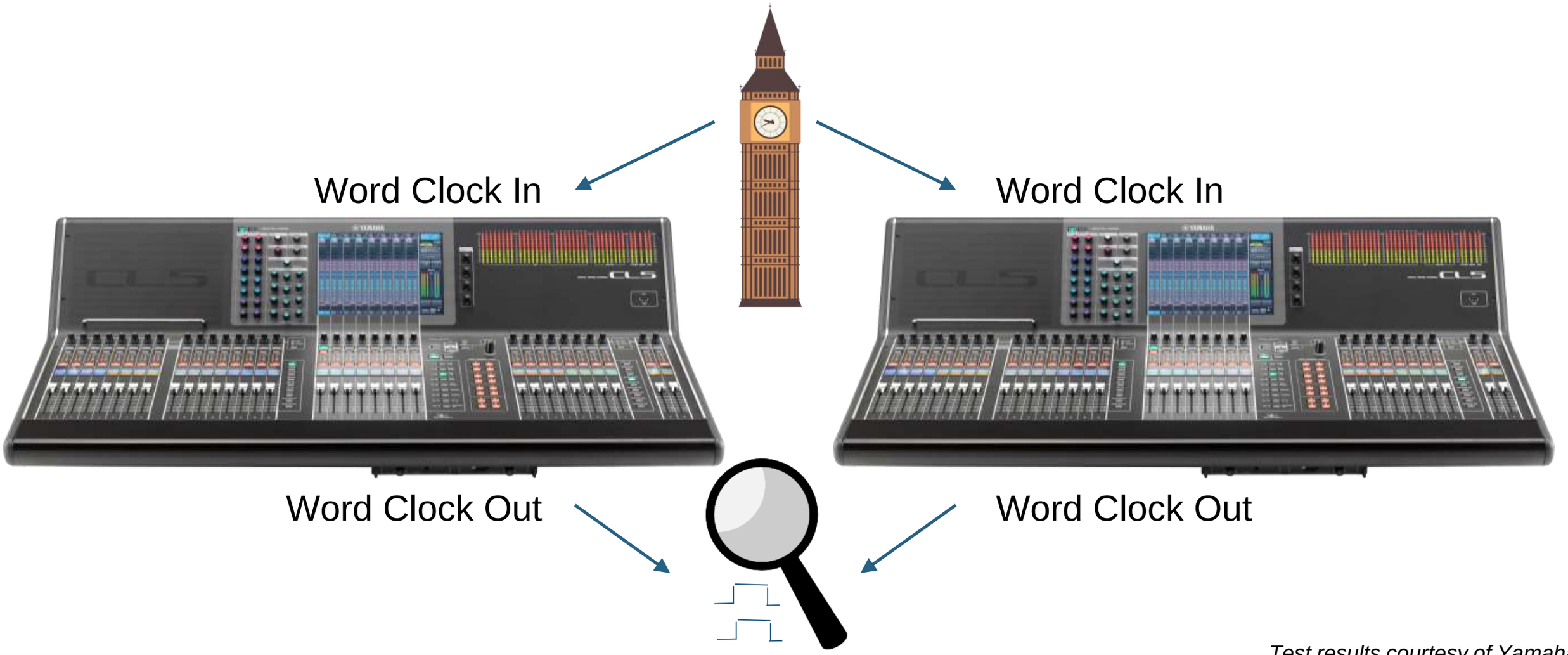
Clock: Buffered Distribution



Clock: Central Clock

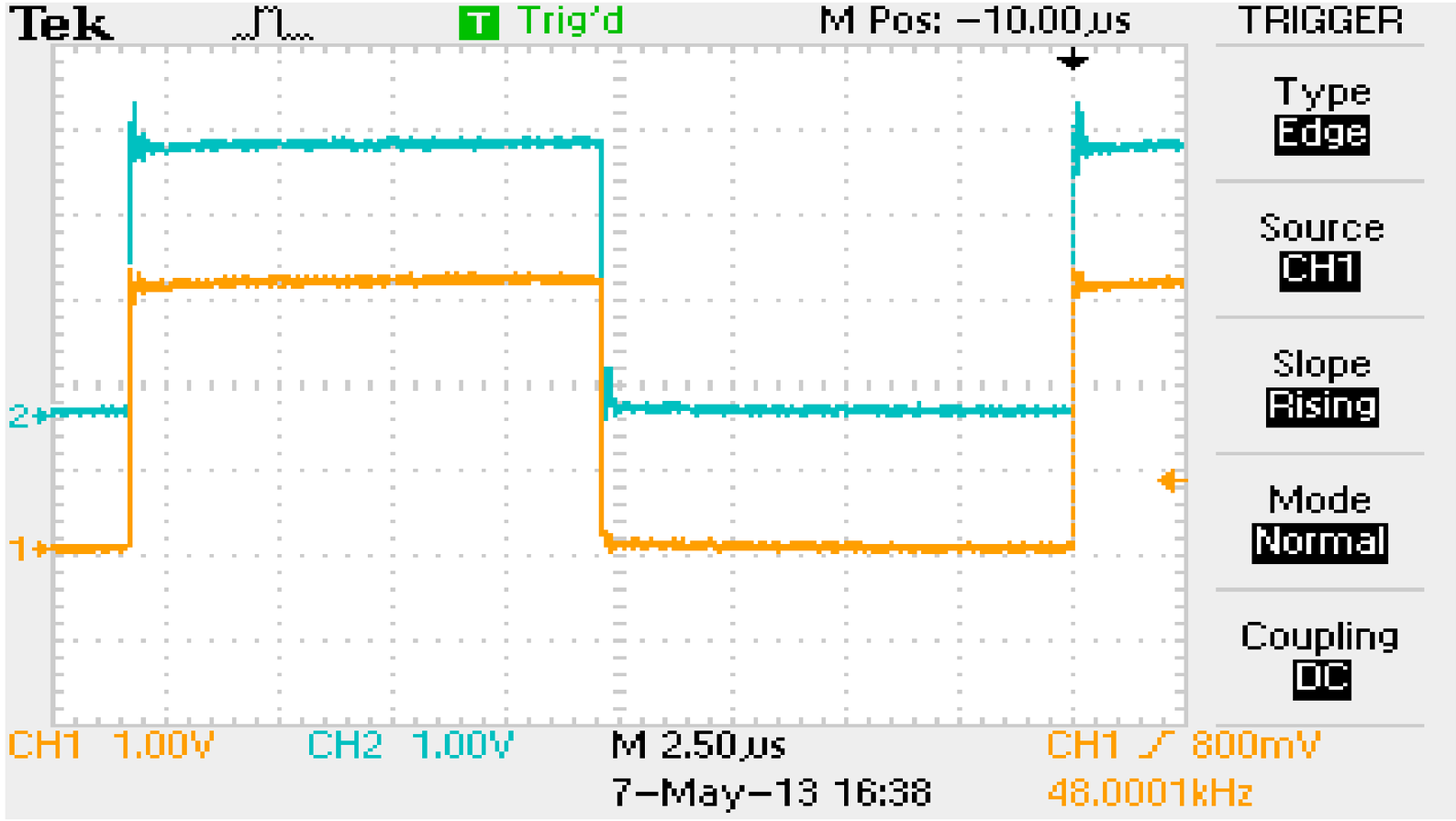


Clock: Testing Accuracy – Central Clock



Test results courtesy of Yamaha

Clock: Testing Accuracy – Central Clock

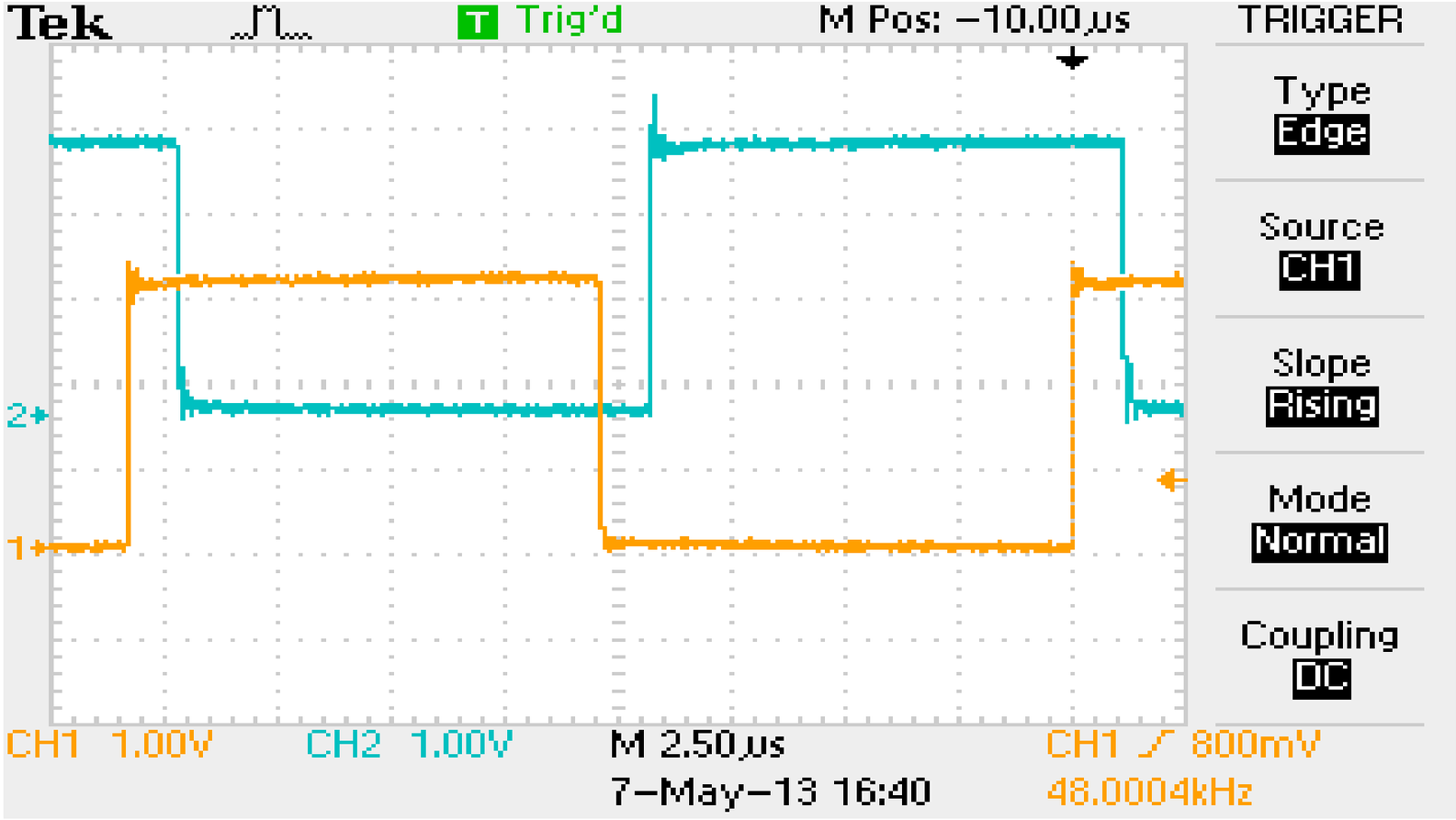


Test results courtesy of Yamaha

Clock: Testing Accuracy – AES3

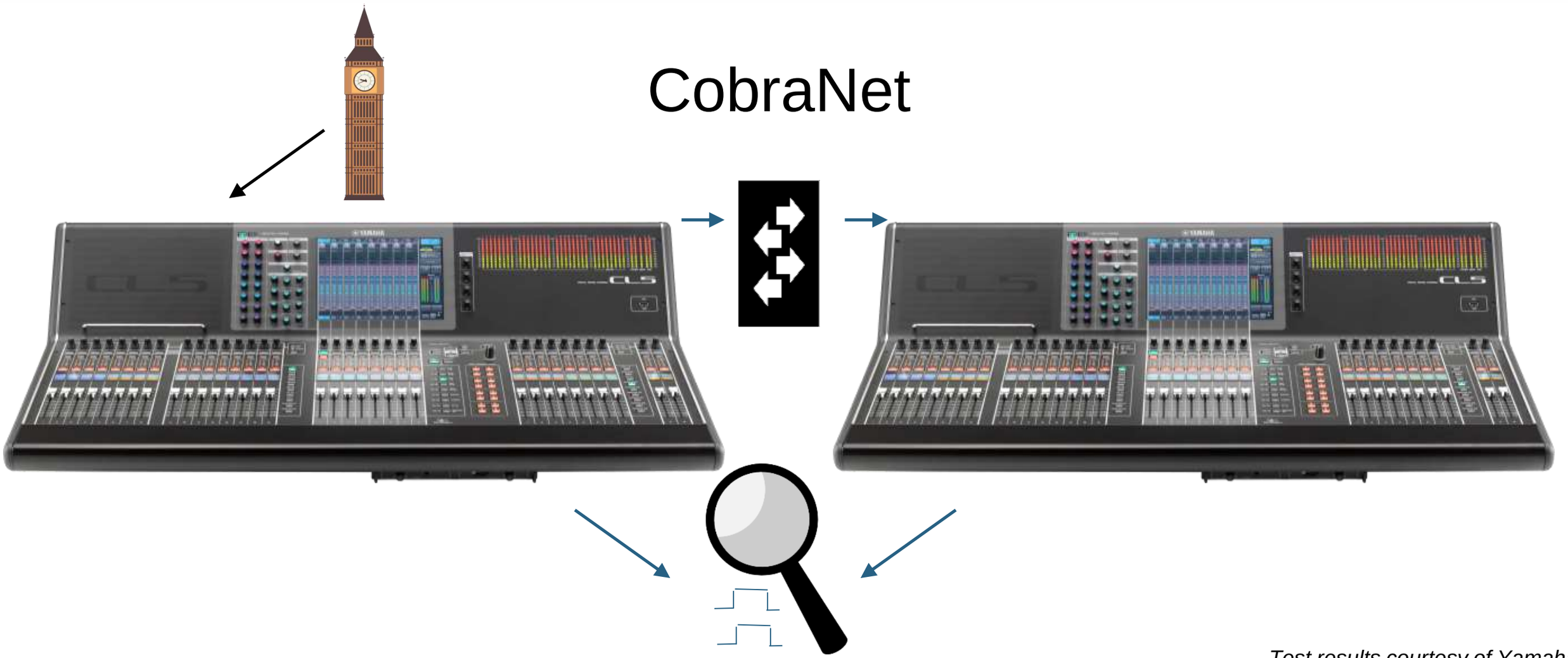
Test results courtesy of Yamaha

Clock: Testing Accuracy – AES3



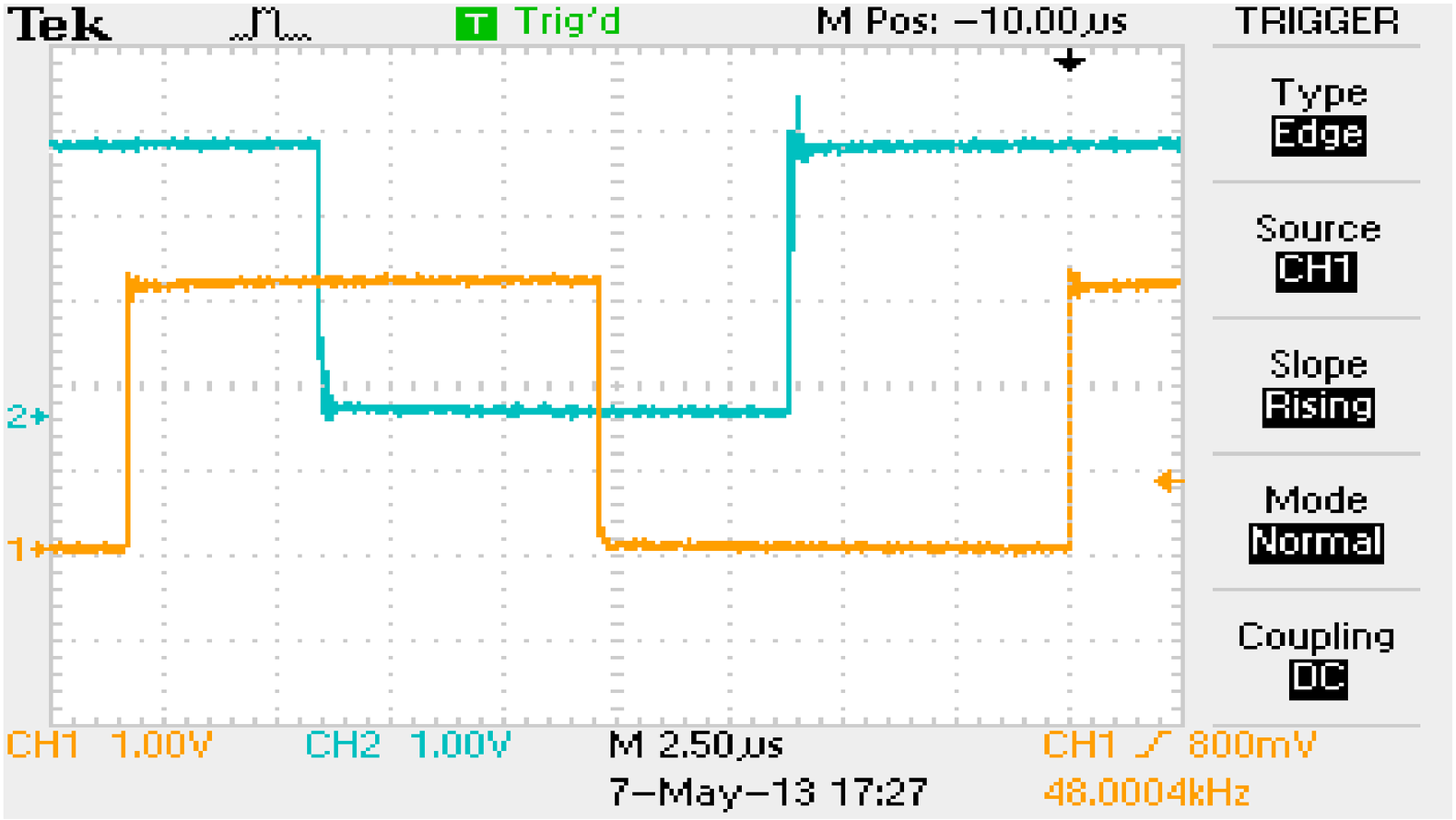
Test results courtesy of Yamaha

Clock: Testing Accuracy – CobraNet



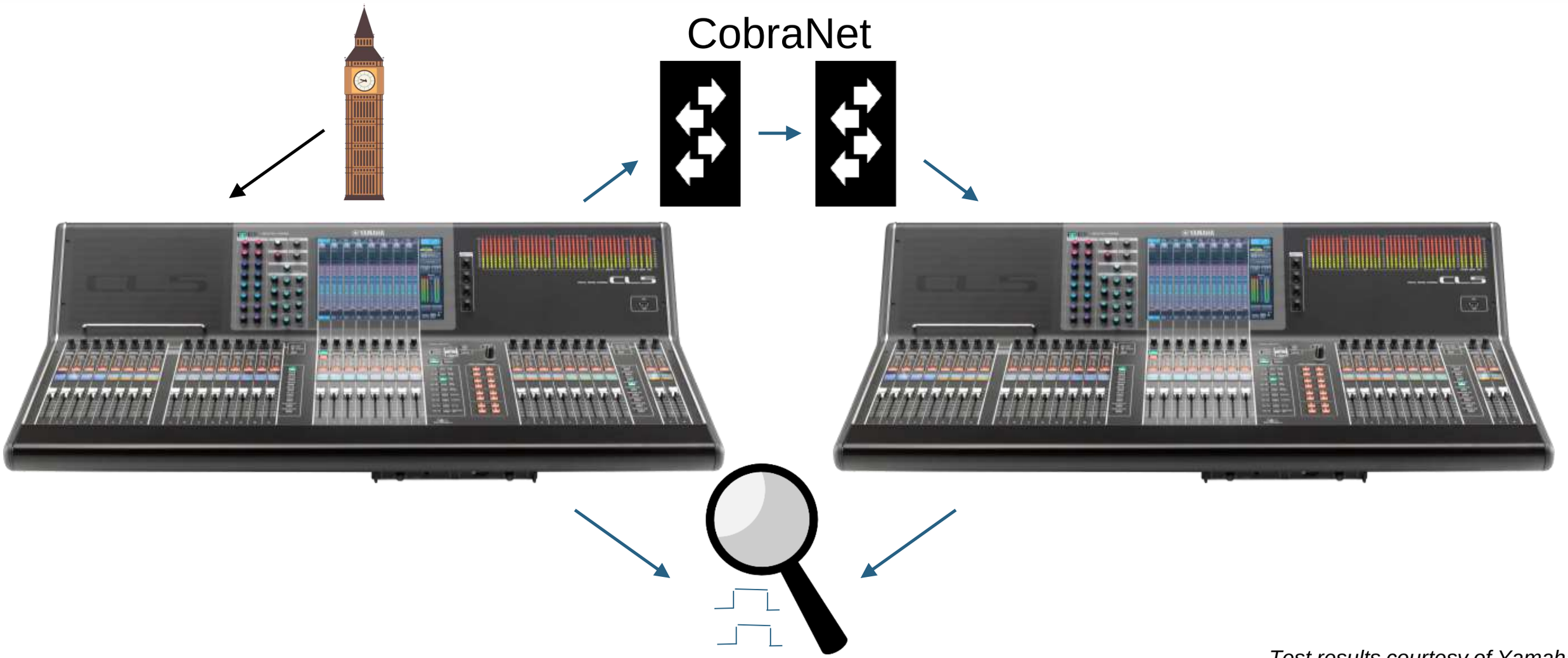
Test results courtesy of Yamaha

Clock: Testing Accuracy – CobraNet



Test results courtesy of Yamaha

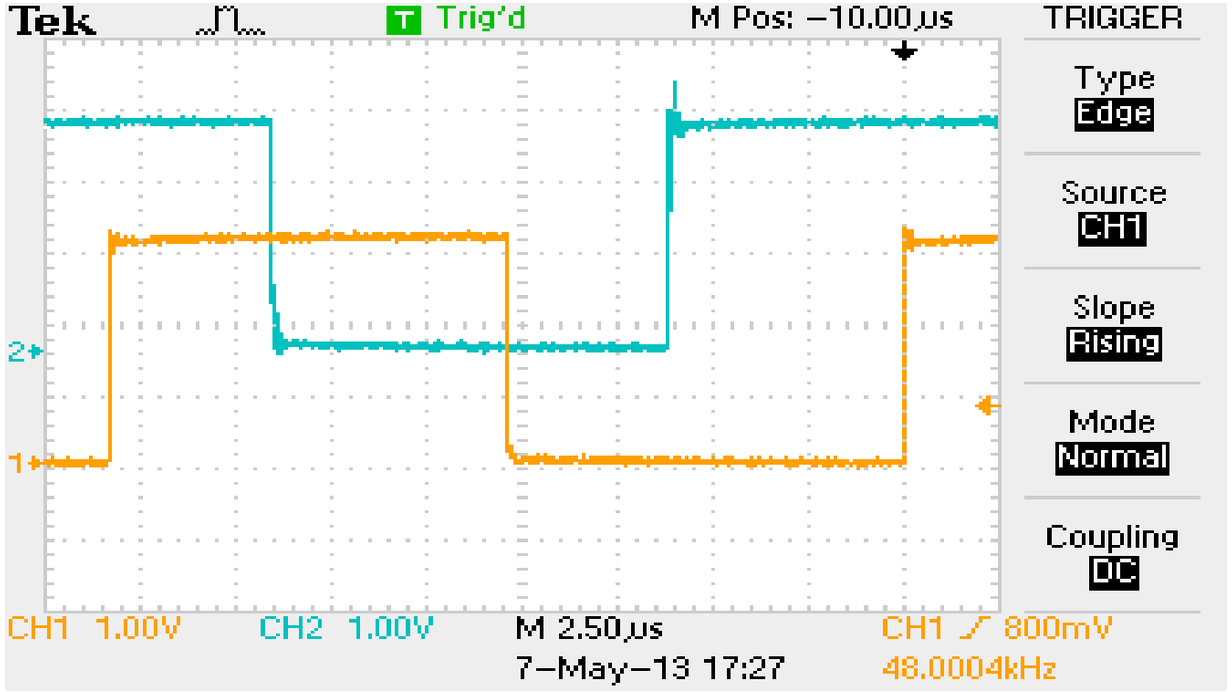
Clock: Testing Accuracy – CobraNet



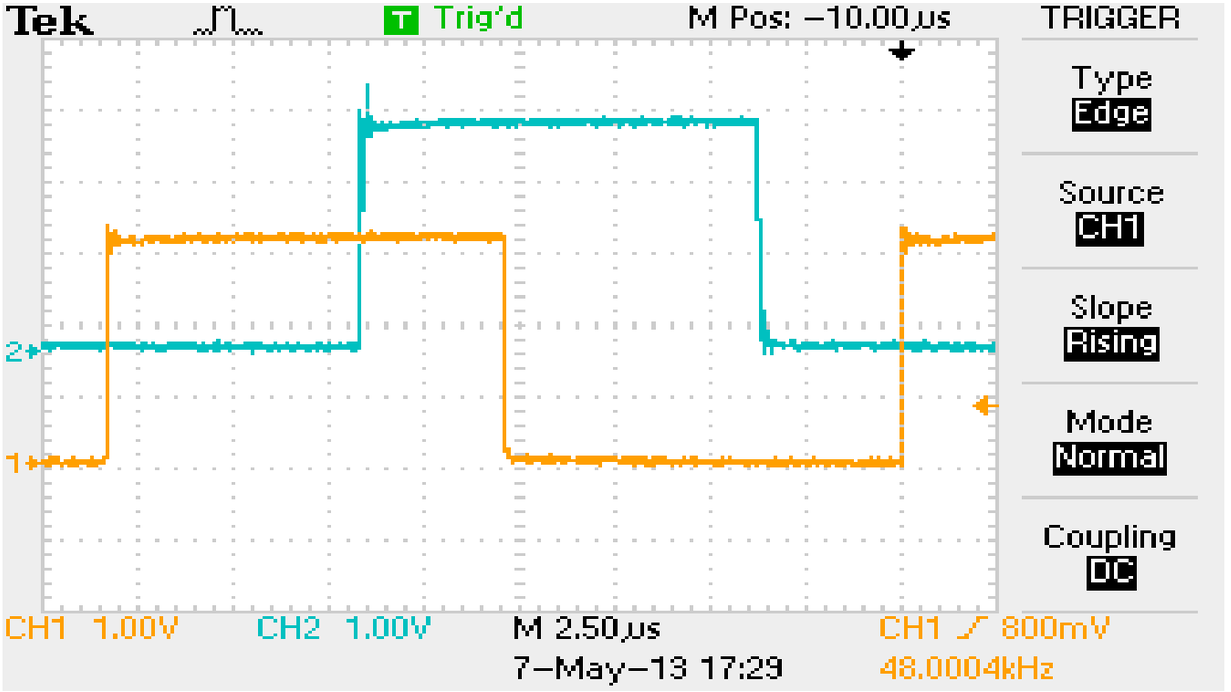
Test results courtesy of Yamaha

Clock: Testing Accuracy – CobraNet

One Switch

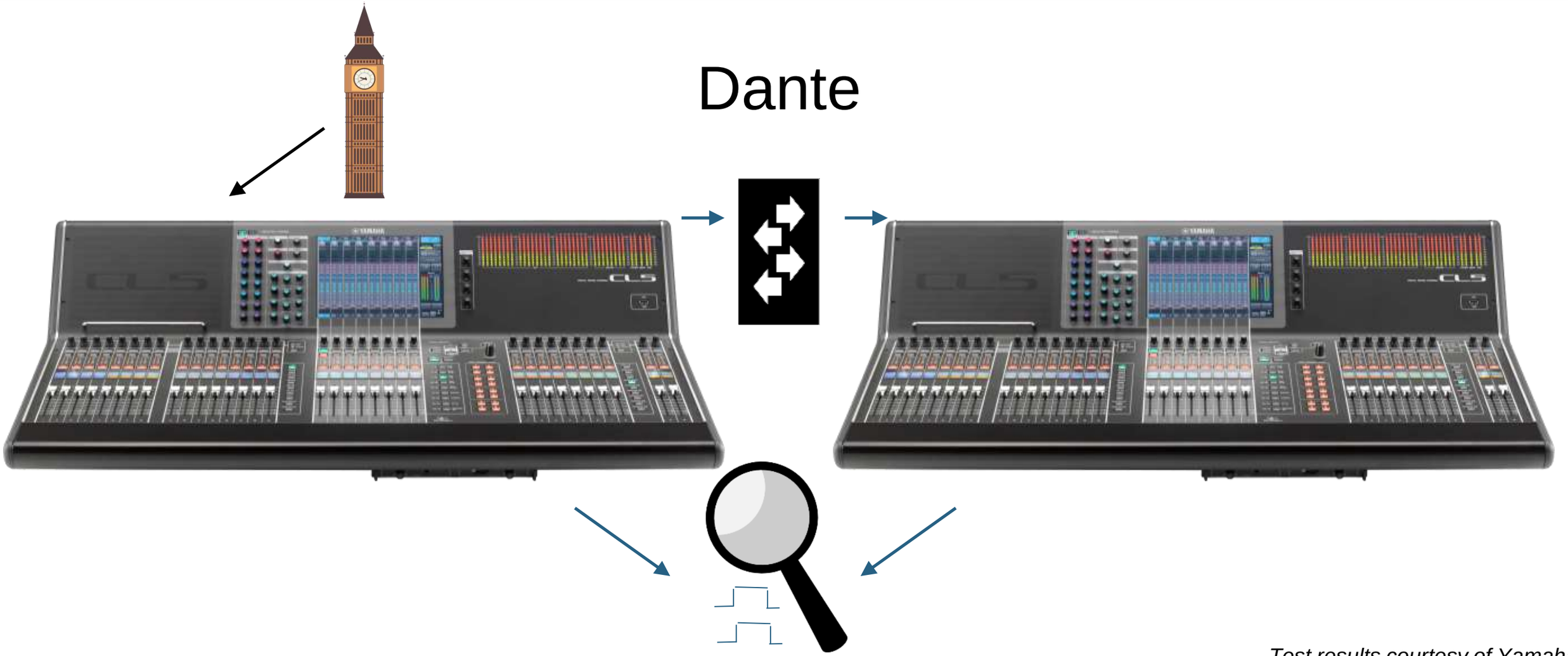


Two Switches



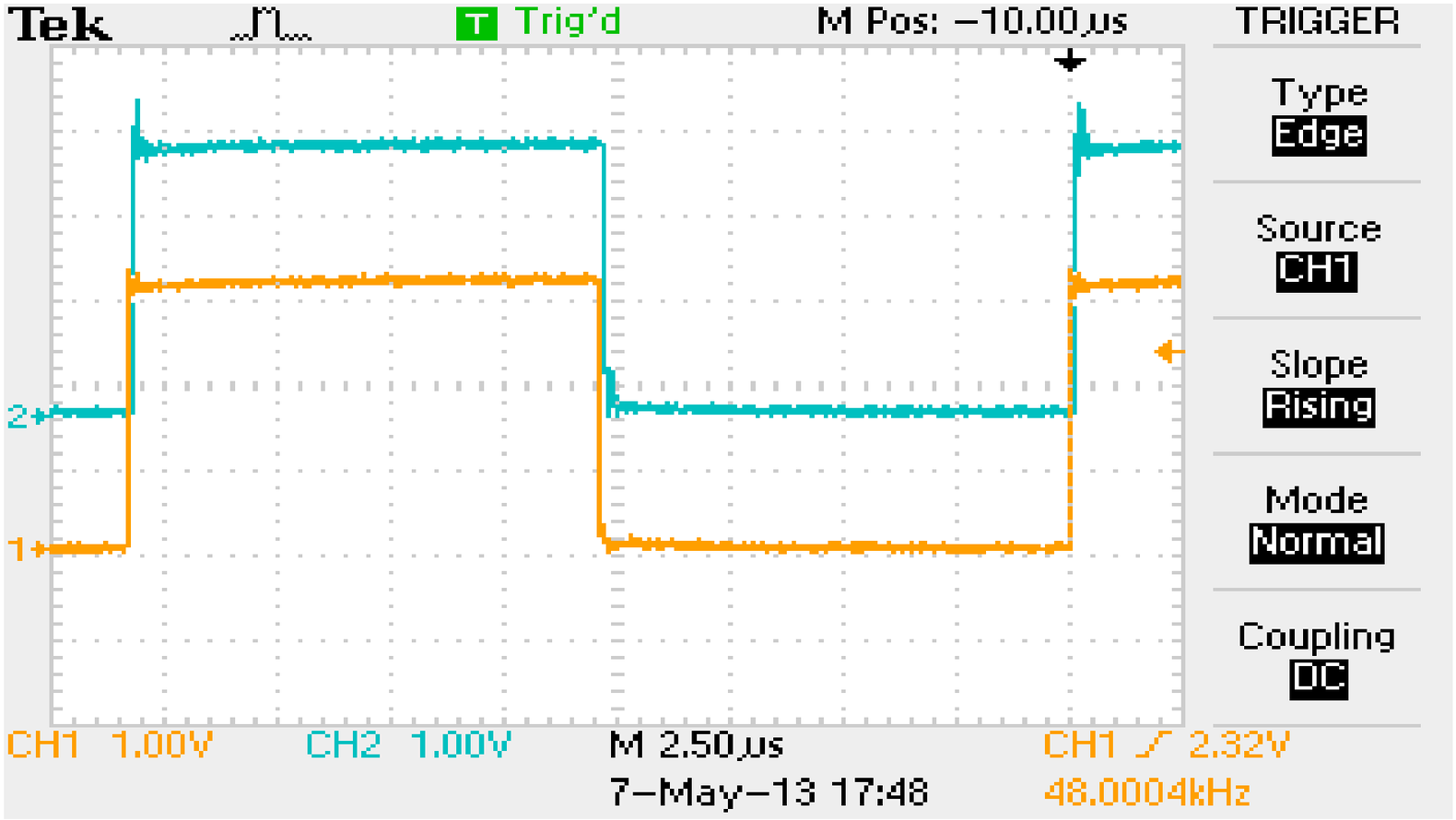
Test results courtesy of Yamaha

Clock: Testing Accuracy – Dante



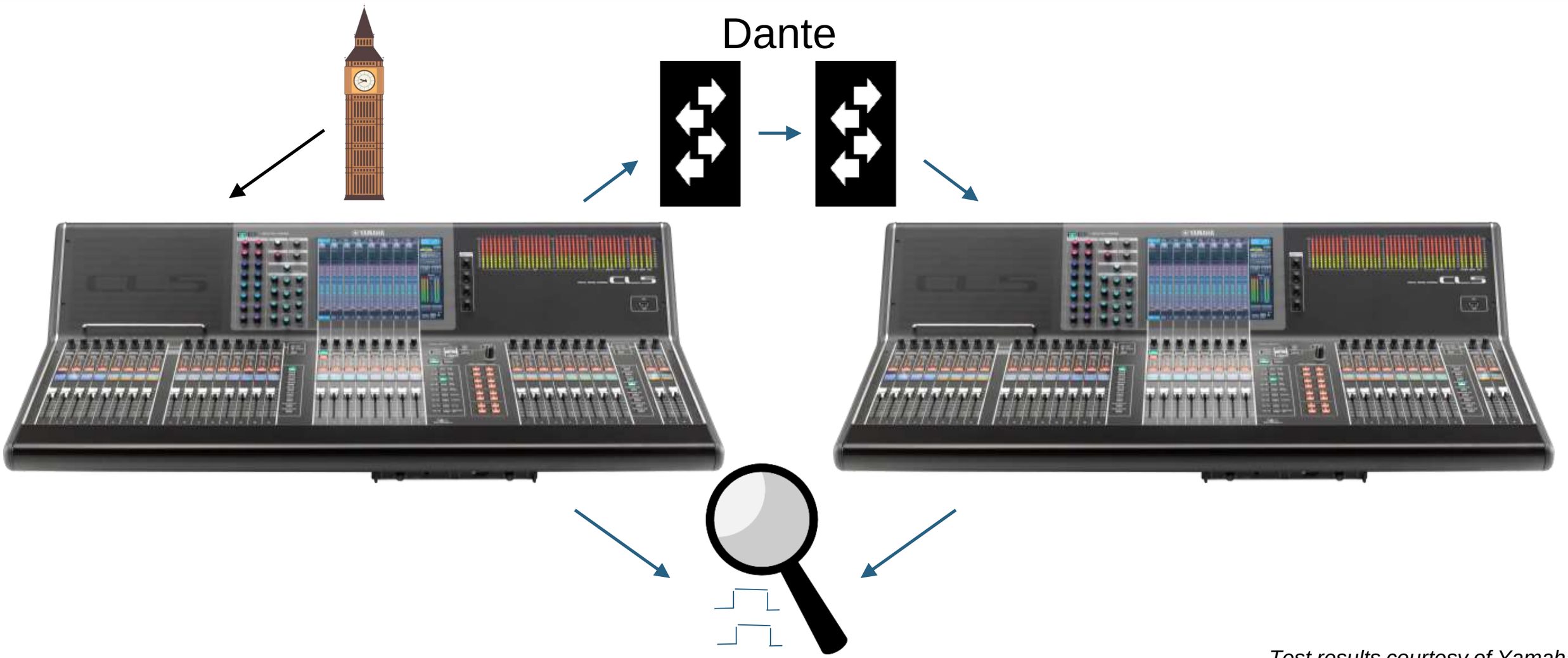
Test results courtesy of Yamaha

Clock: Testing Accuracy – Dante



Test results courtesy of Yamaha

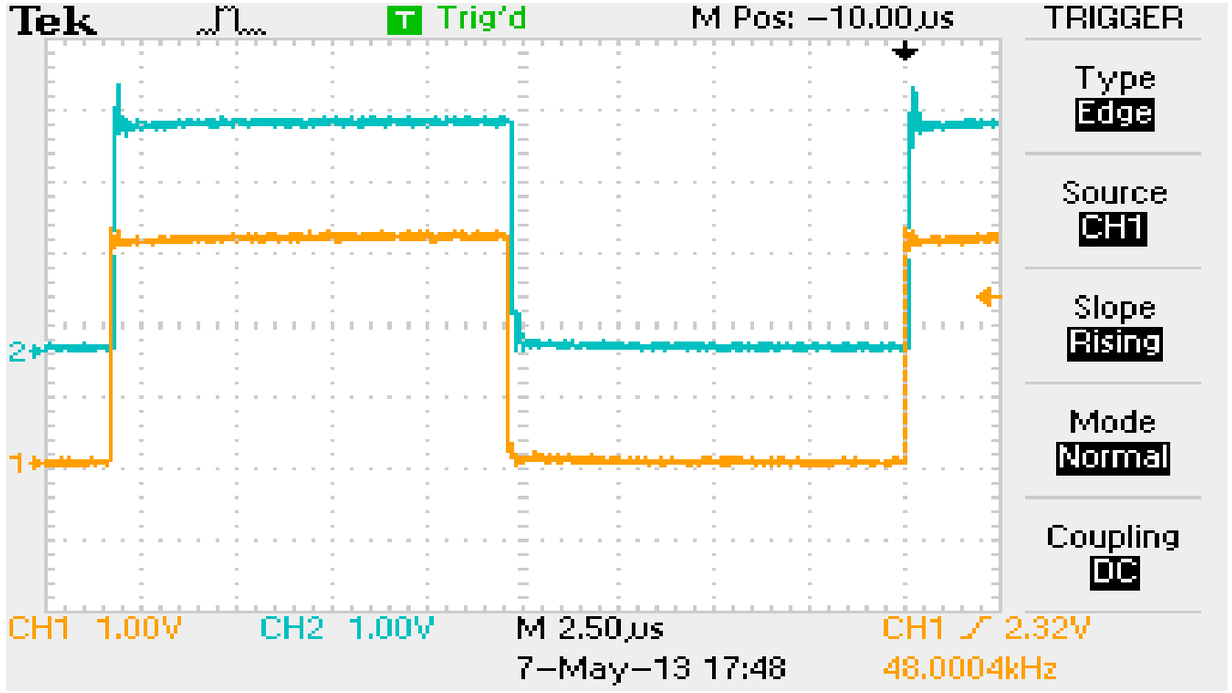
Clock: Testing Accuracy – Dante



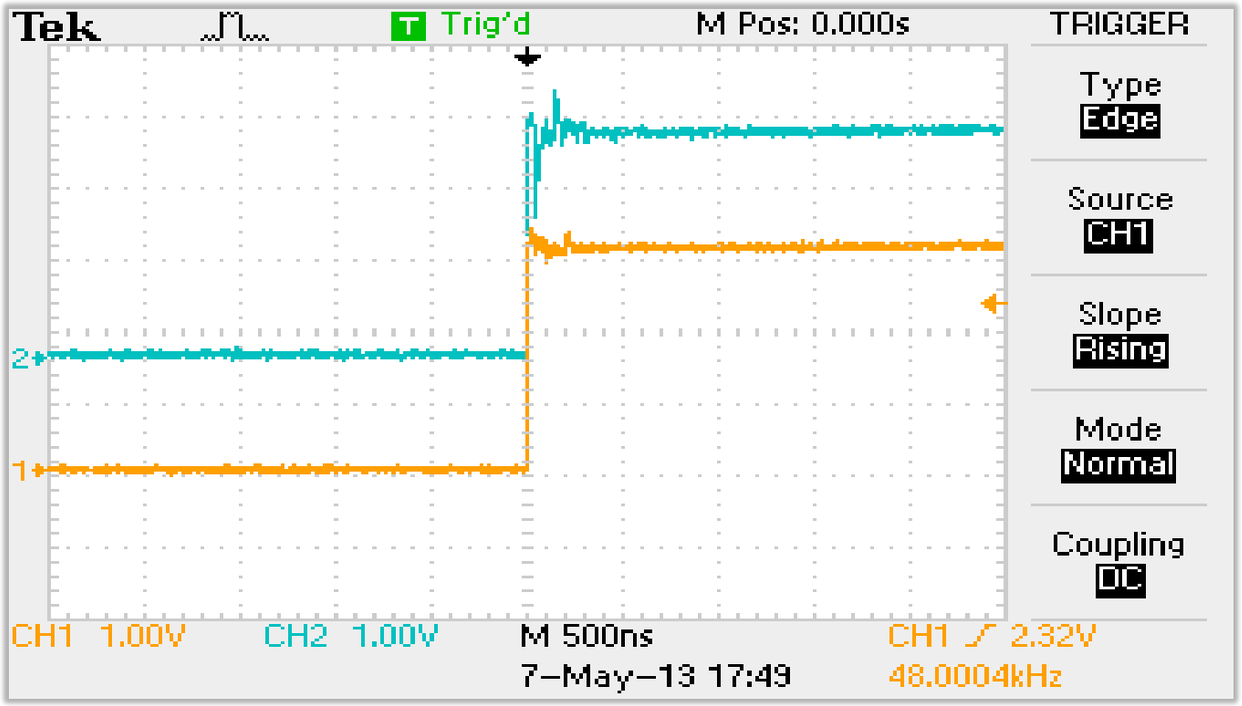
Test results courtesy of Yamaha

Clock: Testing Accuracy – Dante

One Switch



Two Switches

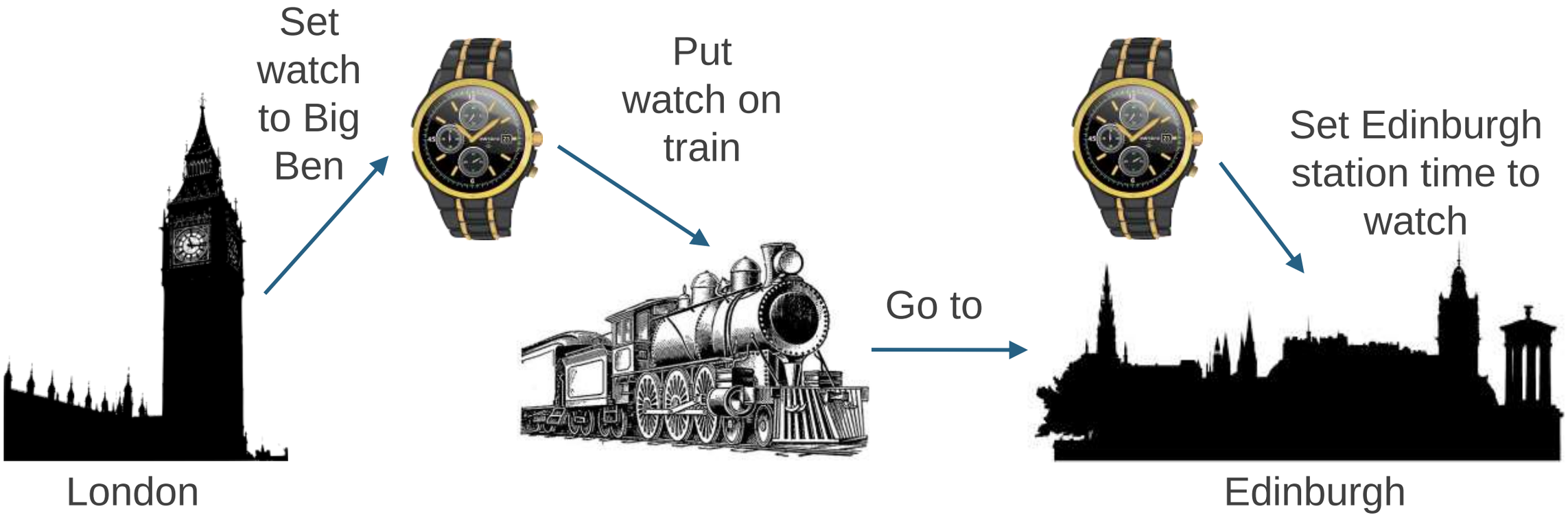


Test results courtesy of Yamaha

PTP: Synchronizing Time

- The idea of distributing time over a network started with British Railways
- Trains had a schedule – arrive/departure times.
- Stations on the route needed to agree on what time it was, so trains would be “on time”.

PTP: Synchronizing Time



PTP: Sync (Time) and Follow-ups (Speed)

Sync (Set Time) - Multicast
Ref 1435: 2019 June 12 09:00:01.000325364

→ Follower Sets Clock

Follow-Up (Set Speed) - Multicast
“Ref 1435: 2019 June 12 09:00:01.000326789”

→ Follower Adjusts Speed:

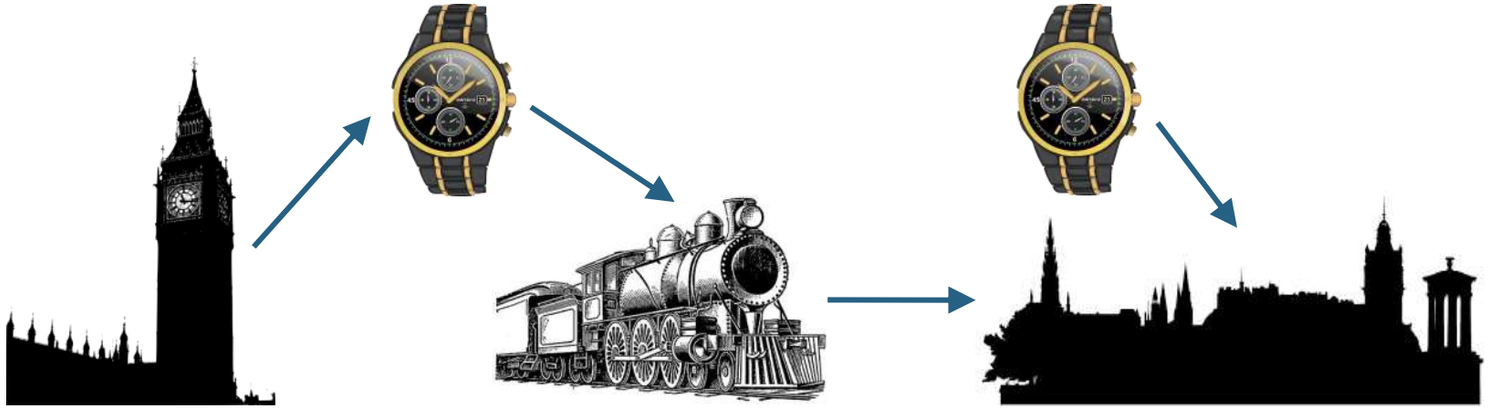
Compare elapsed time from master and local clock, then slow or speed up to match.

PTP: Sync (Time) and Follow-ups (Speed)

PTP: Sync (Time) and Follow-ups (Speed)

What about propagation delay?

The watch on the train continued keeping time in transit. Network packets don't.



PTP: Sync and Follow-ups are Multicast

Clock followers send delay requests to the clock master, to which the clock master responds.

Delay Request – Multicast

Delay Req 1066:
09:00:02.00567283

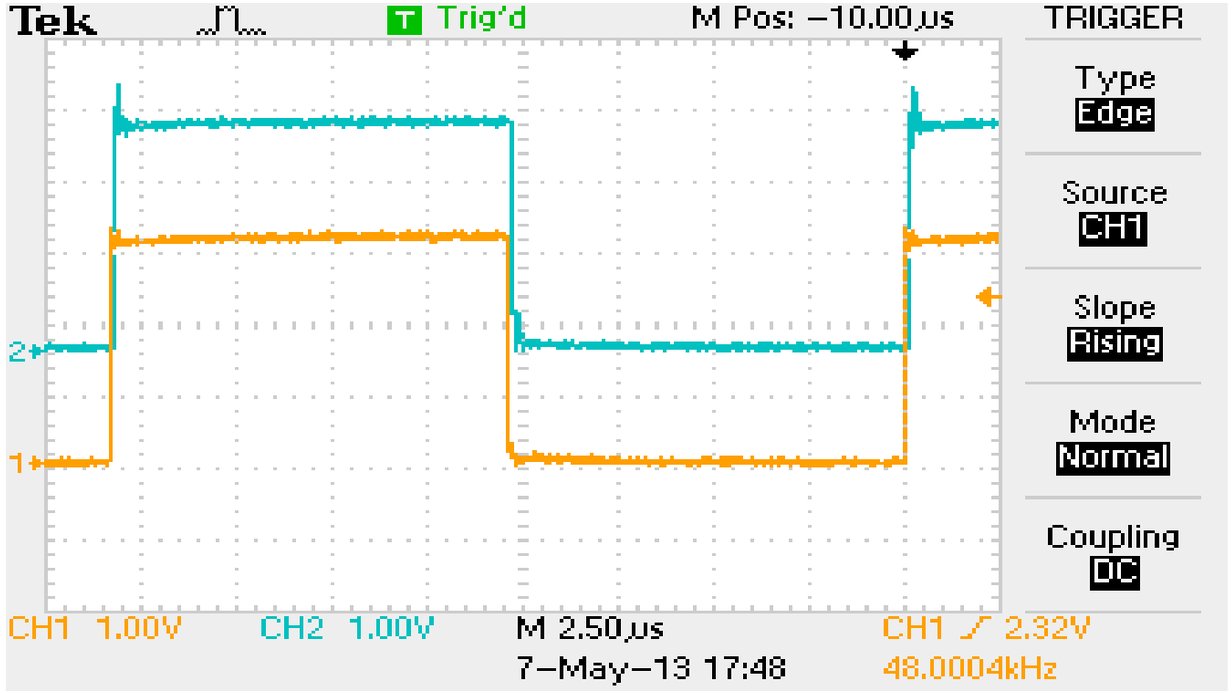
Delay Response - Multicast

Delay Response 1066:
Received: 09:00:02.001325745
Responded: 09:00:02.008564367

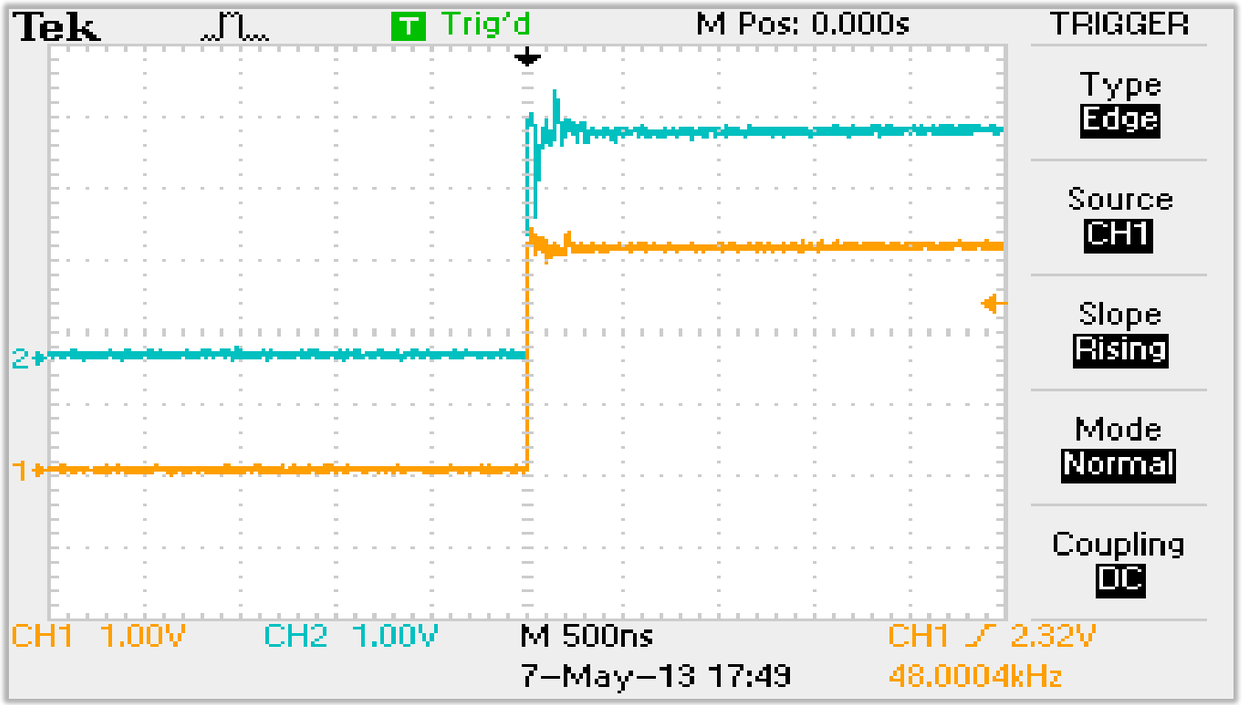
Clock follower knows Tx & Rx timestamps of request & response, mathematically averages to pinpoint network traversal times.

Clock: Testing Accuracy – Dante

One Switch



Two Switches



No More BNC Clock Distribution

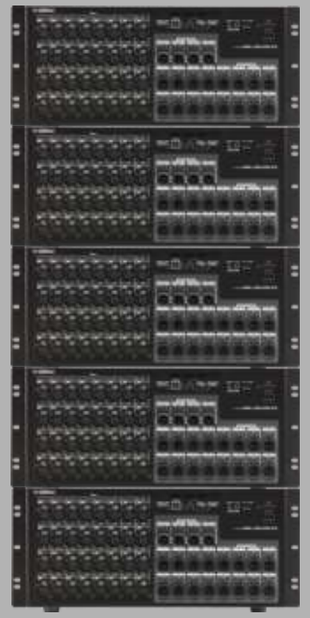
In 2015, another well-known late-night night talk show's audio production was done 100% Dante.

Approx. 225 stage channels were distributed by multicast, reaching up to 7 key destinations.

Cisco SG300 Switch CPU load was approx. 30%

Use Case Scenario

Studio



House Band

FOH

Monitors

Guest Band

Sound FX

160 Mic Ins (Studio)
64 Mic/Line Ins (Remote)
32 Guest Band "Tracks"
64 Monitor Mixes (32 stereo)
32 Stems
16 Communication Lines

256 Multicast Streams
112 Unicast Streams

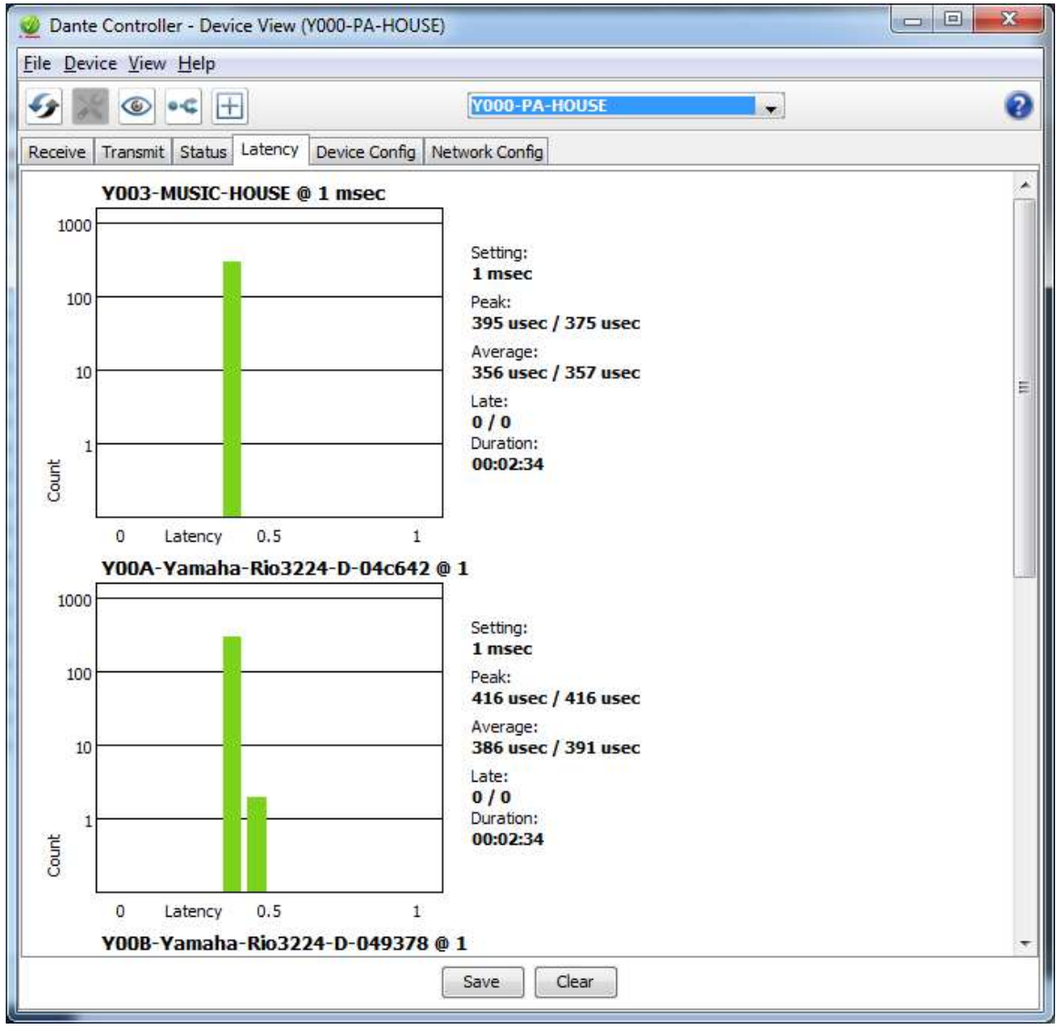
500-1000 Patches

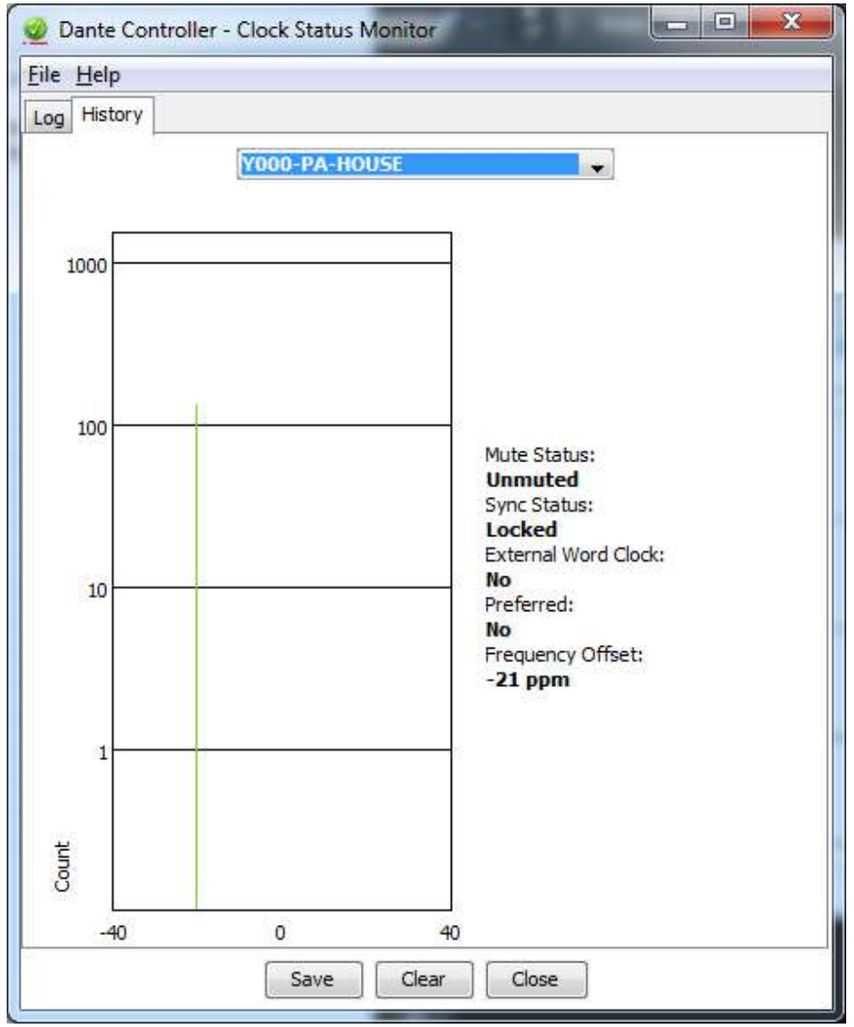
Remote Feed

FOH

Monitors

Use Case Scenario





ARP – Address Resolution Protocol

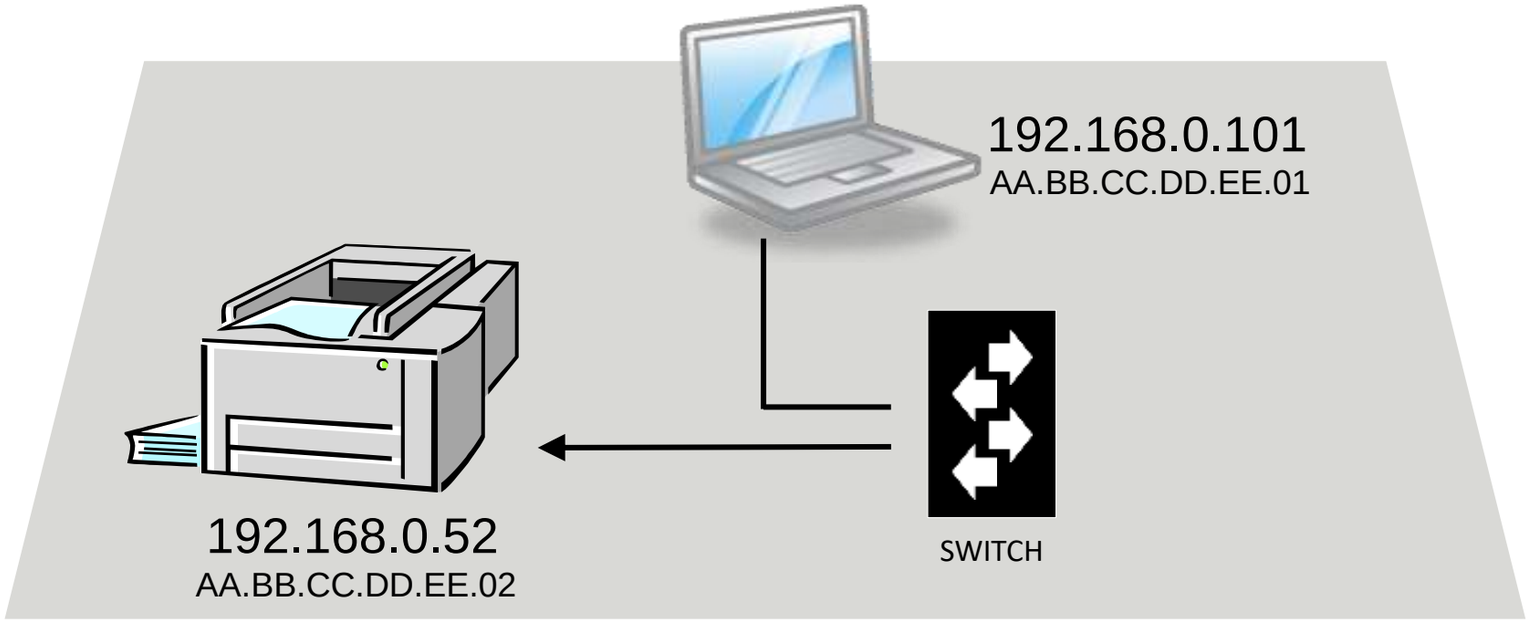
Networking Topics for Today

ENHANCE	**Core IP Settings**	*IP Address, Subnet Mask, Gateway/Router, LAN Range*
	DNS	*Domain Name Service*
	DHCP/Link Local	*Automatic Address Settings*
	TCP/UDP	*Transmission Methods*
	Unicast, Multicast and Broadcast	*Distribution Methods*
	QoS	*Quality of Service – Traffic Prioritization*
	VLAN & Trunk Implications	*VLAN, Trunk, Tagged VLAN, STP, LAG*
NEW	**Network Ports**	*Managing Simultaneous Connections*
	Understanding Clocking	*Precision Time Protocol (PTP)*
	ARP, Layered Network Models	*Gluing IP & MAC Addresses, The OSI Model*
	Segmenting Broadcast Domain	*Managing the “Noise” in a Network*

Switching Happens by MAC Address

Remember when we said this switches by IP?

Time to look a layer deeper…

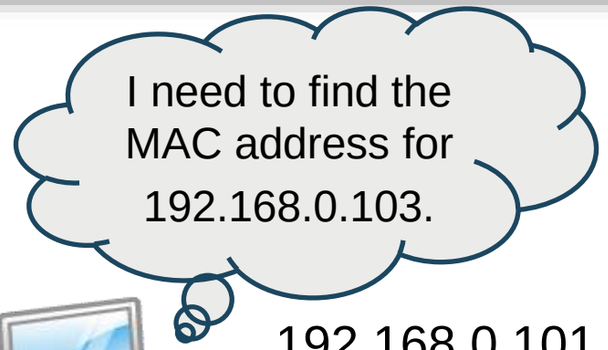


DNS → *Domain Name*

IP Address

ARP → *MAC Address*

ARP Correlates IP Addresses to MAC Addresses



IP	MAC
.103	

192.168.0.101
AA:BB:CC:DD:EE:01

IP	MAC

192.168.0.102
AA:BB:CC:DD:EE:02

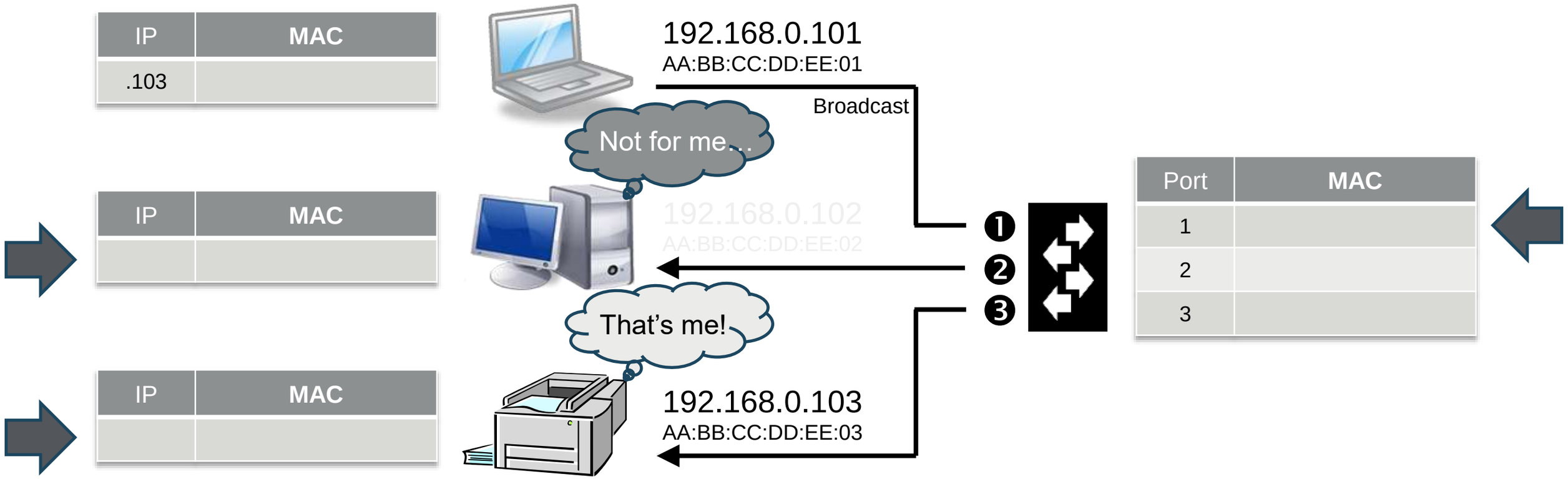
IP	MAC

192.168.0.103
AA:BB:CC:DD:EE:03

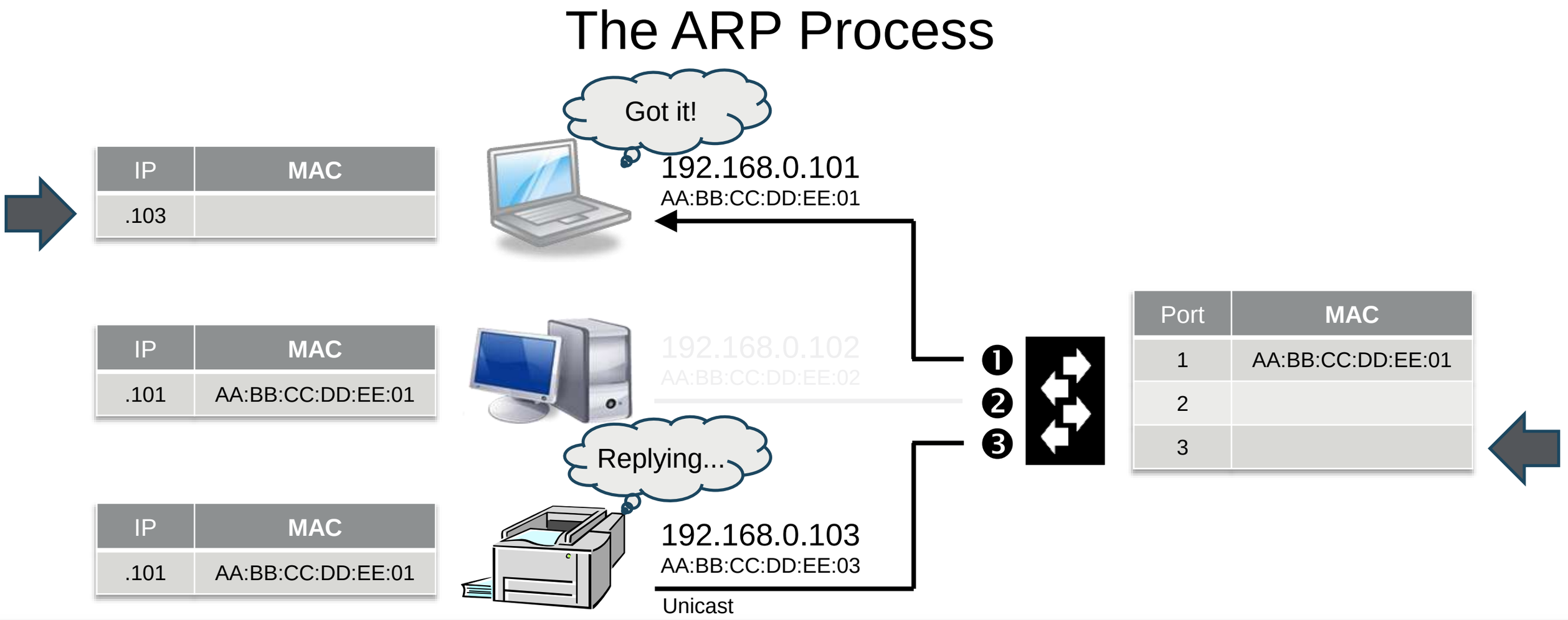
Port	MAC
1	
2	
3	

ARP Correlates IP Addresses to MAC Addresses

The ARP Process



ARP Correlates IP Addresses to MAC Addresses



ARP Review:

ARP finds the MAC Address for a requested IP Address. They “glue” the two together.

Switches and Devices alike passively gather information from ARP requests as they pass through the network.

ARP messages are part of the “Link Local Protocol”

Layered Network Models & Encapsulation

Networking Topics for Today

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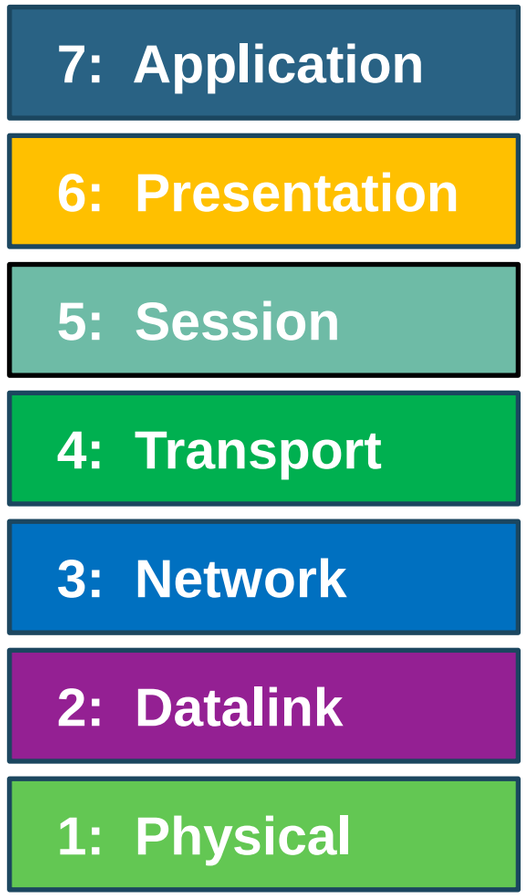
	Segmenting Broadcast Domain	*Managing the “Noise” in a Network*

LAYERED MODELS

OSI Model



Layered Models are:

- Conceptual, not concrete
  Concepts tend to last longer than concrete models.
  Hardware independent, doesn't always reflect real life.
- Helpful in designing or troubleshooting
  An unplugged cable is a "Layer 1" problem.
  I'm looking for a "Layer 3" network switch.
- Not required skill to set up a simple Dante network
  But it is on the Dante Level 3 Certification test.

LAYERED MODELS

OSI Model

- 7: Application
- 6: Presentation
- 5: Session
- 4: Transport
- 3: Network
- 2: Datalink
- 1: Physical

I write a letter…
(data)

That is put in an envelope…
(datagram)

With to/from addresses…
(both in MAC and IP Address)

That goes to the postal service
(CAT6 or fiber cable)

LAYERED MODELS

OSI Model

7: Application

6: Presentation

5: Session

4: Transport

3: Network

2: Datalink

1: Physical

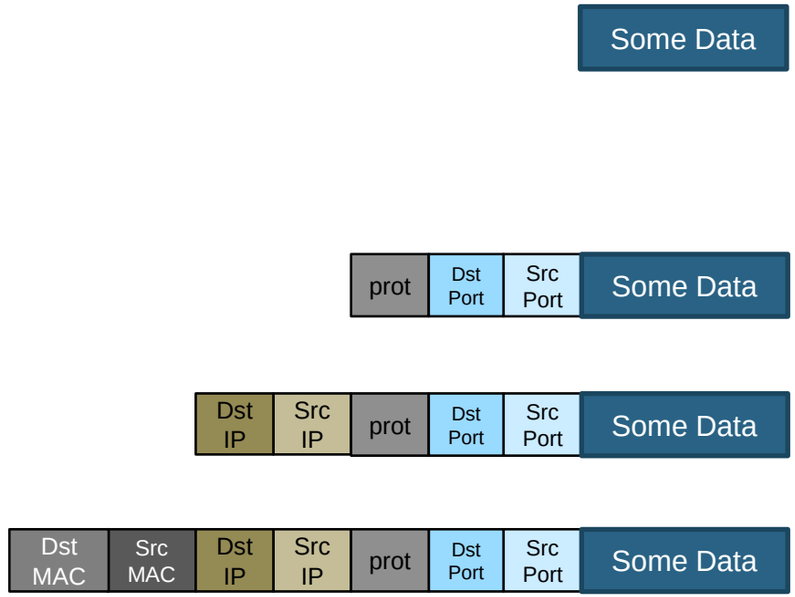
Data for the network

gets put in a datagram…

to/from IP Addresses…

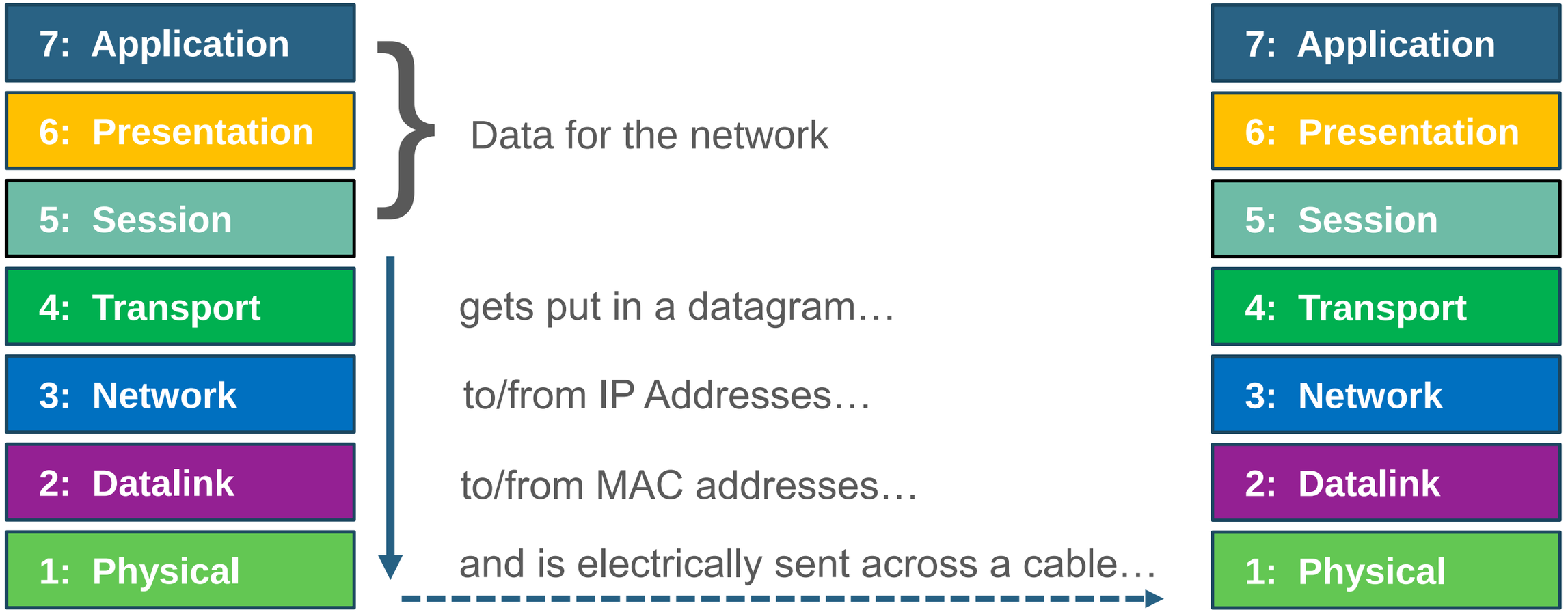
to/from MAC addresses…

Encapsulation



LAYERED MODELS

OSI Model



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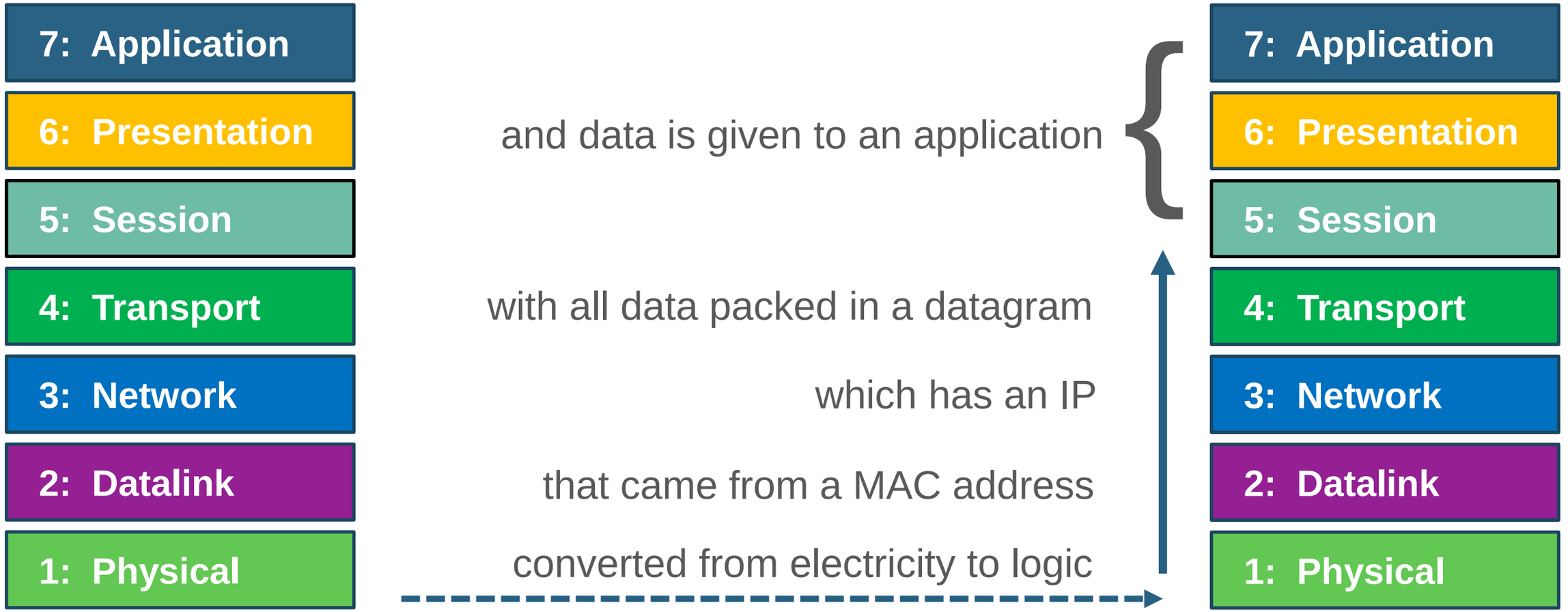
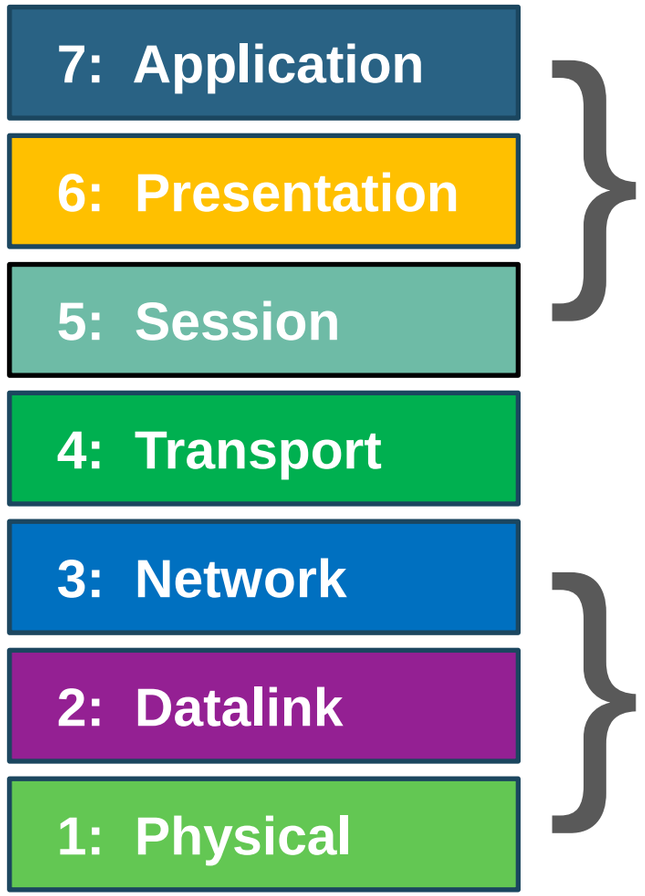


LAYERED MODELS

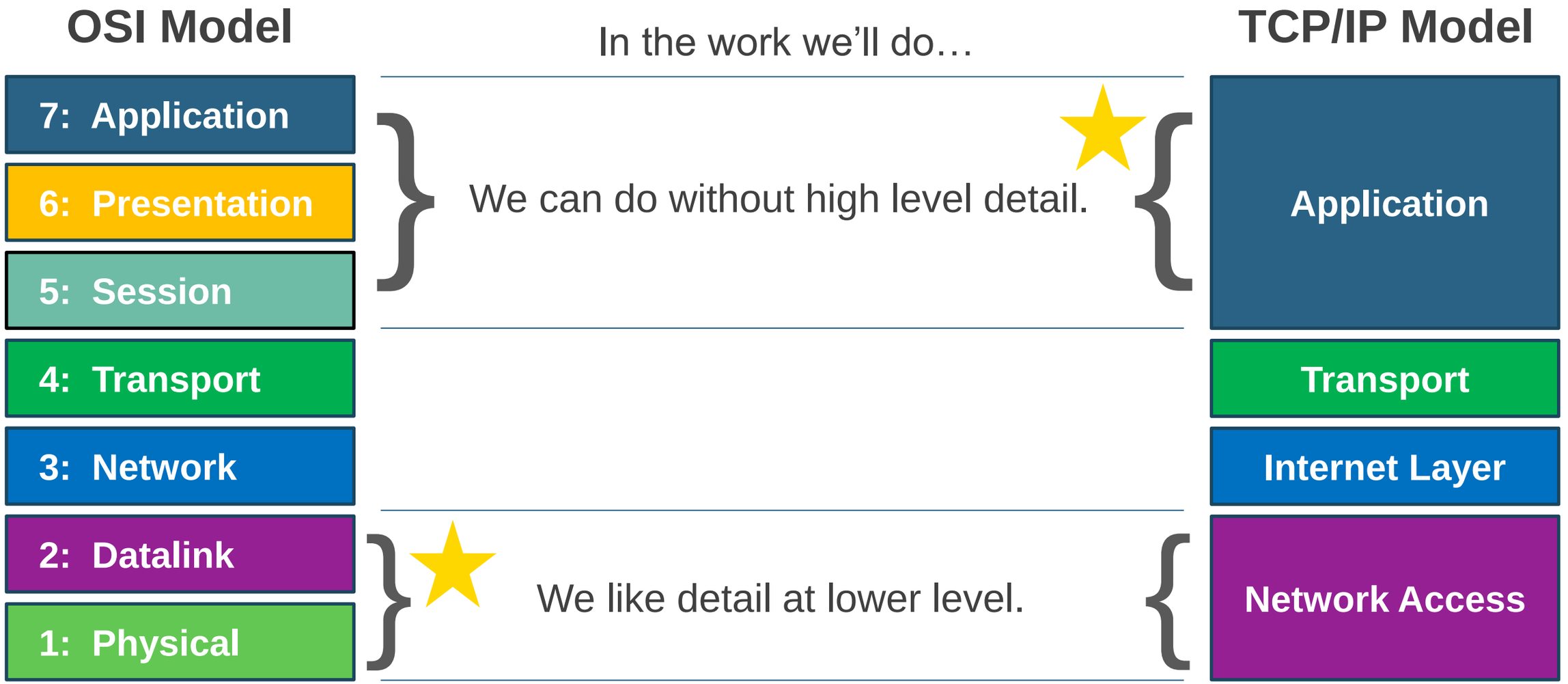
OSI Model



If you are a designing a computer application, you probably care about the higher levels of the model.

If you are a network engineer, you probably care more about the lower levels of the model.

LAYERED MODELS



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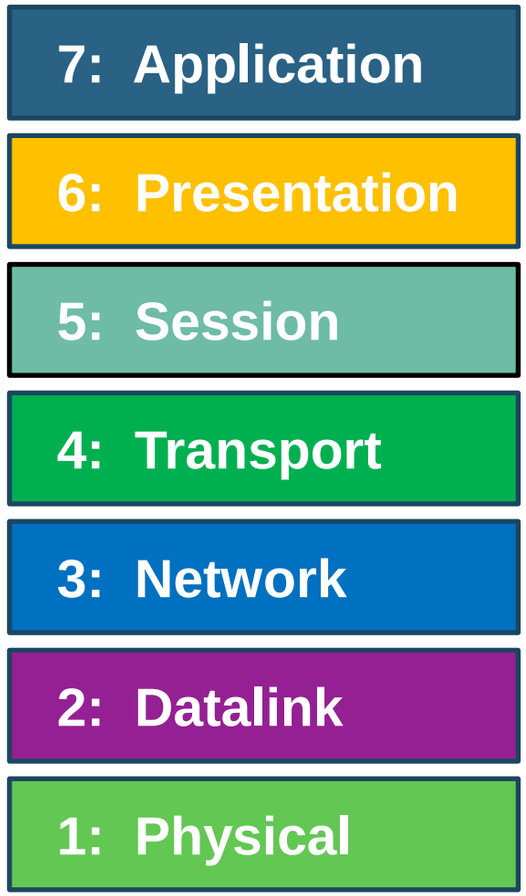
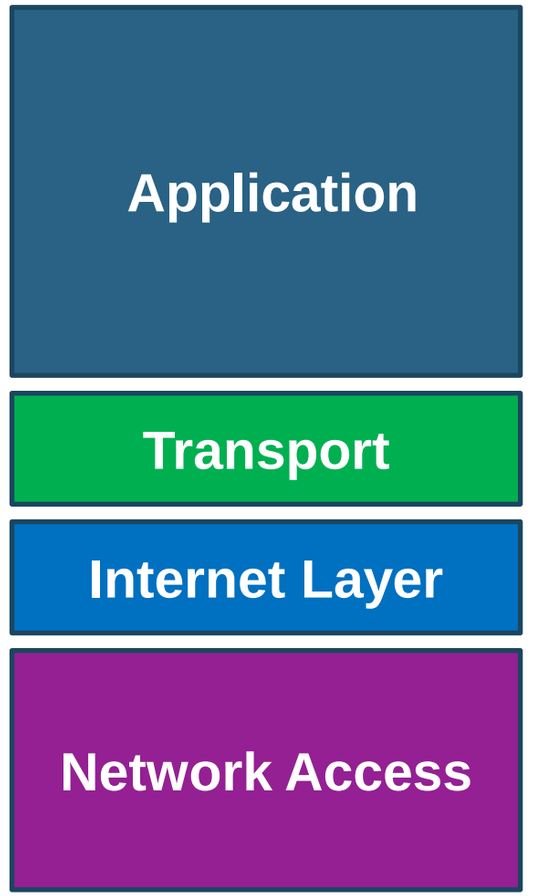


Neither model is perfect. But if we focus on the bottom three layers of the OSI model, we'll get what we need.

TCP/IP Model



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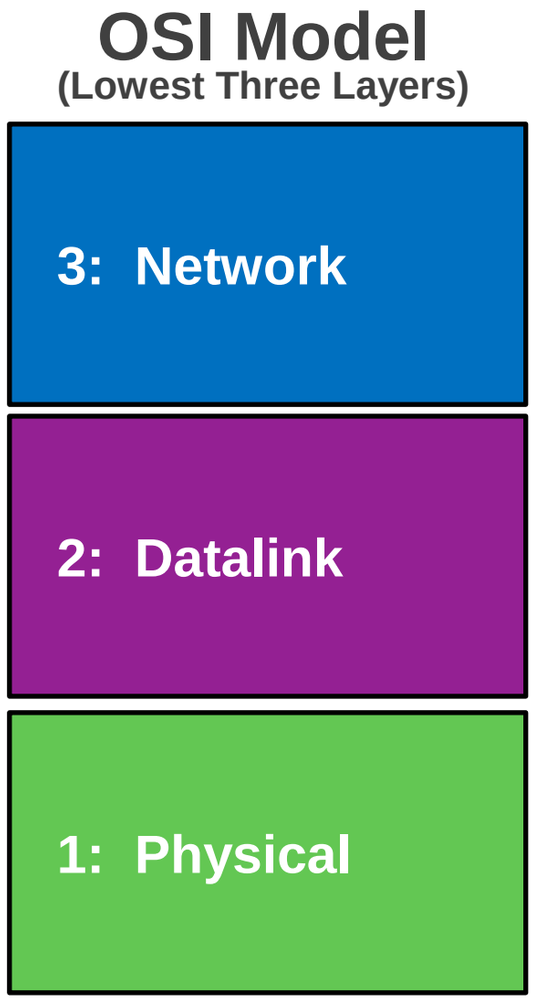
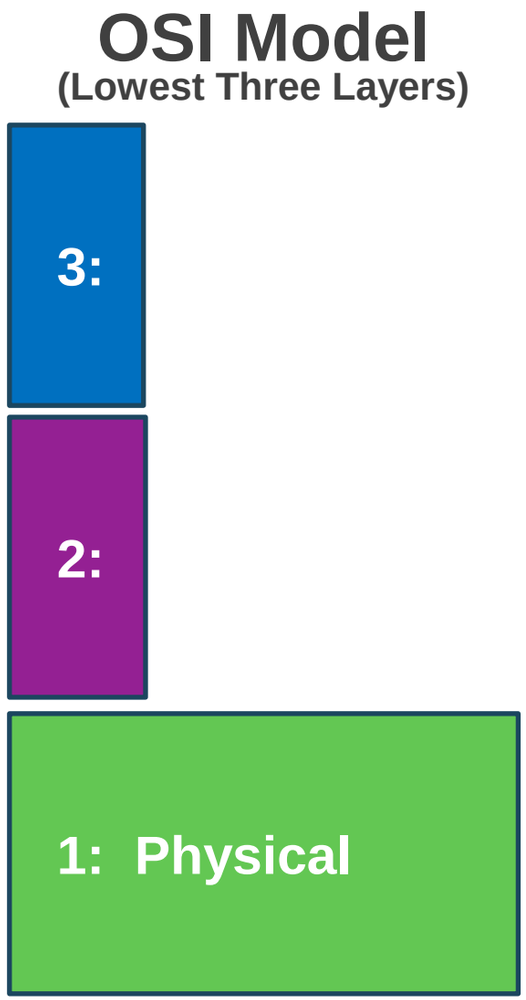


Layer 1 refers to the cable and the electrical signal on it.

- Is it plugged in?
- Is the cable broken, problem with impedance, etc?
- Is there electro-magnetic interference on copper?
- Is there light or dirty ends on the fiber optic cable?



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LAYERED MODELS

OSI Model
(Lowest Three Layers)

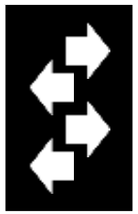
3: Network

2: Datalink

1:

ROUTER

Managed by IP Address



SWITCH

Managed by MAC Address

Segmenting the Broadcast Domain

LAYERED MODELS

OSI Model
(Lowest Three Layers)

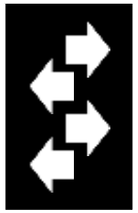
3: Network

2: Datalink

ROUTER

Layer 3 = Router
Passing data from one LAN to another

Unicast only
No Multicast passes (there are workarounds)
No Broadcast passes



SWITCH

Layer 2 = Switch
Passing data within a LAN

Unicast, Multicast, Broadcast allowed

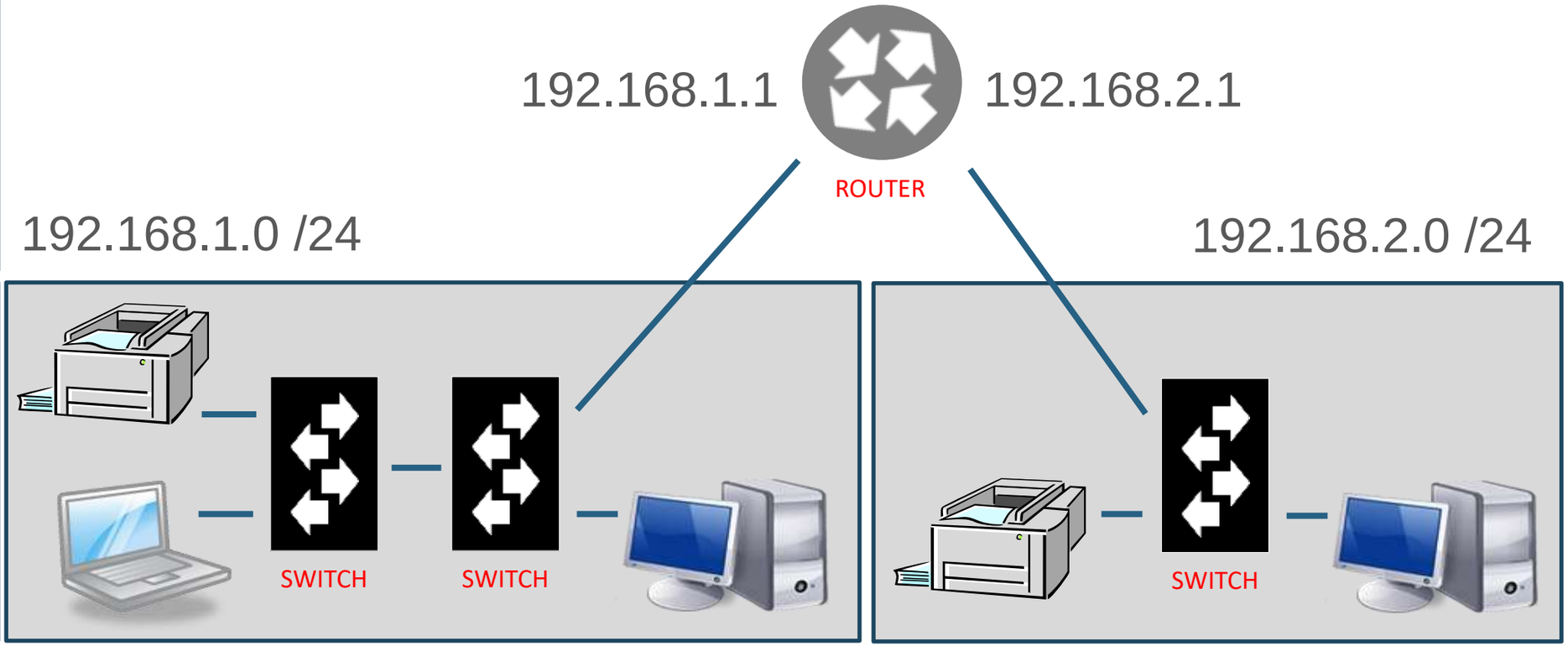
LAYERED MODELS

OSI Model
(Lowest Three Layers)

3: Network

2: Datalink

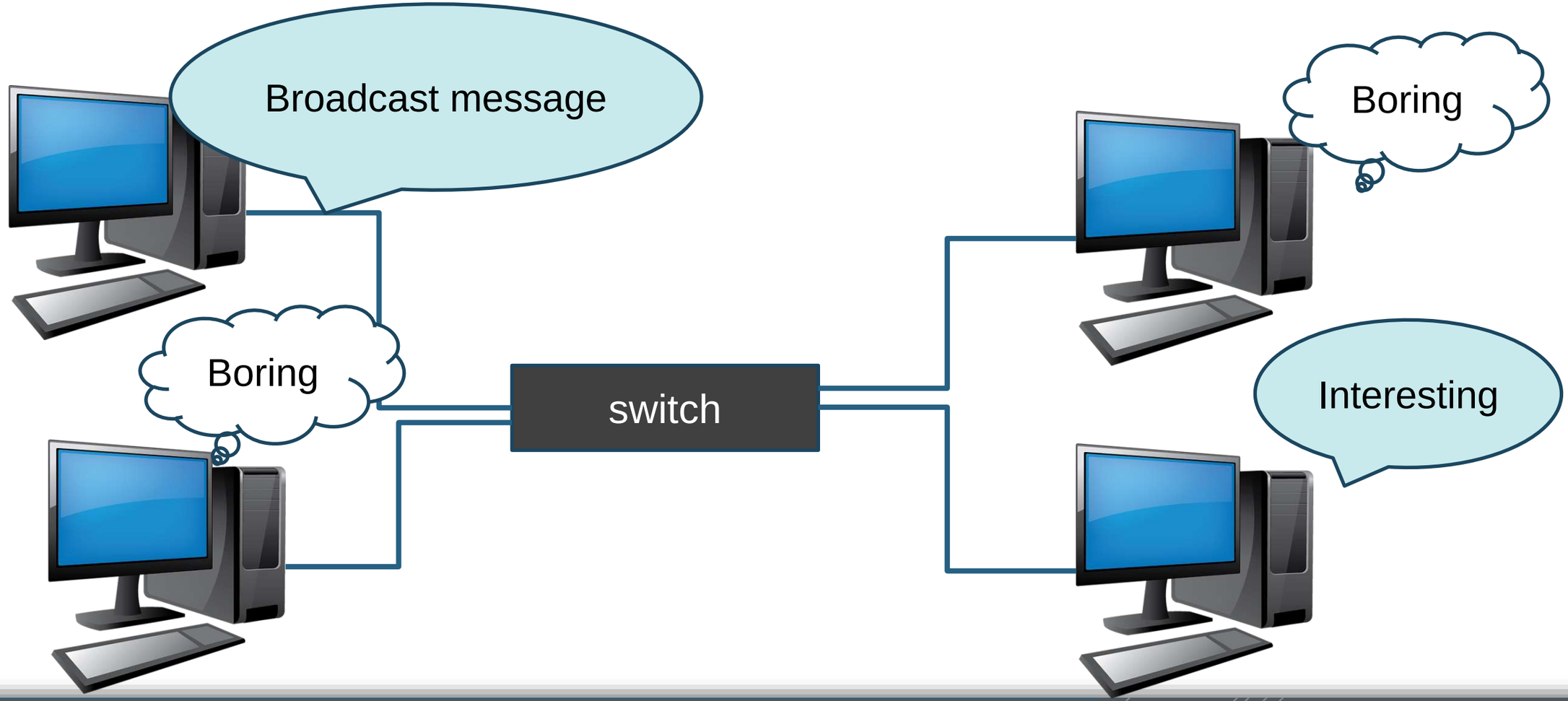
Each VLAN should have a designated IP Subnet.



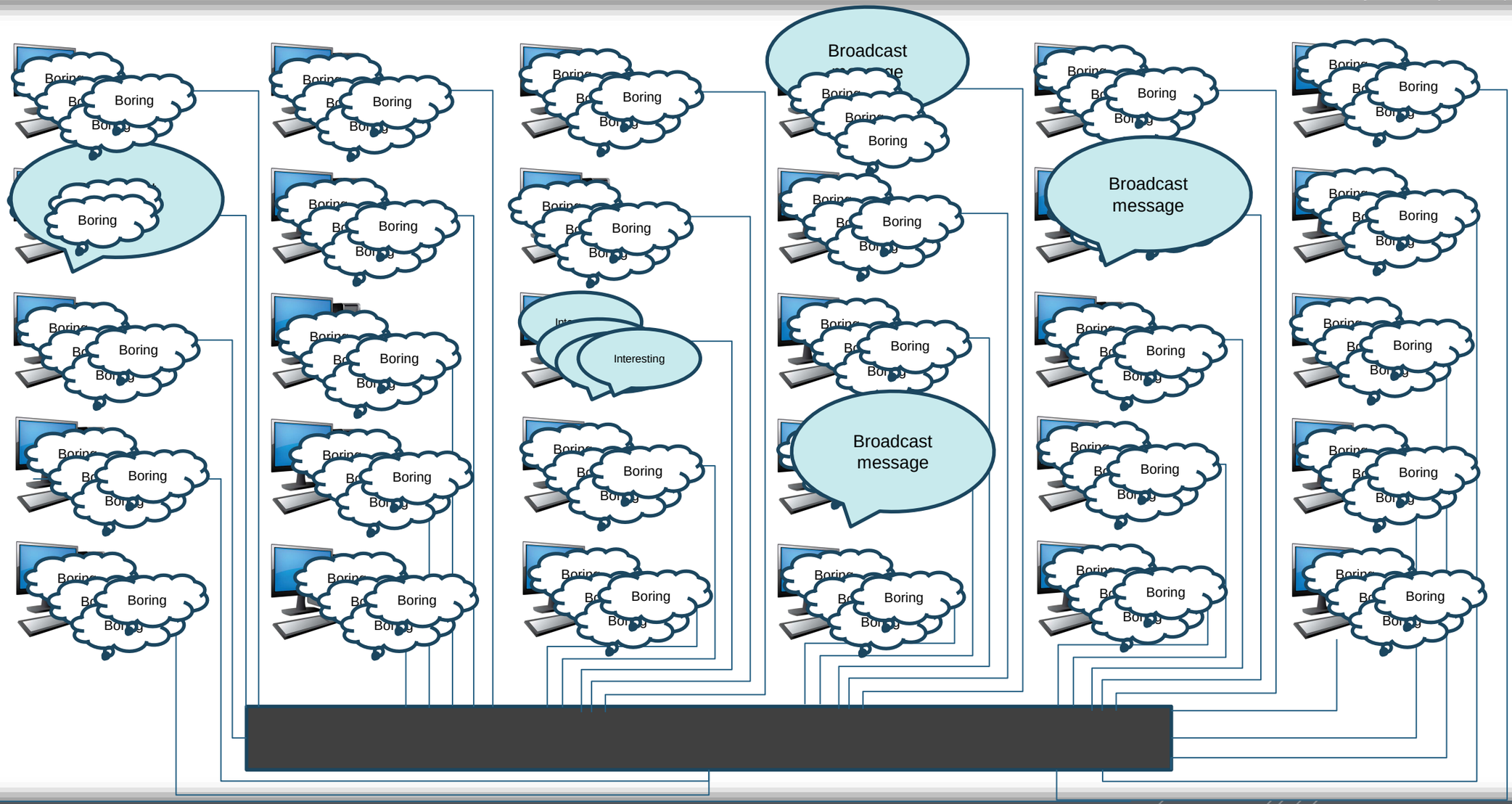
A Meeting Space w/ Airwalls is analogous to VLANs in a Network…

BROADCAST TRANSMISSION

Broadcast Messages are one to all Messages

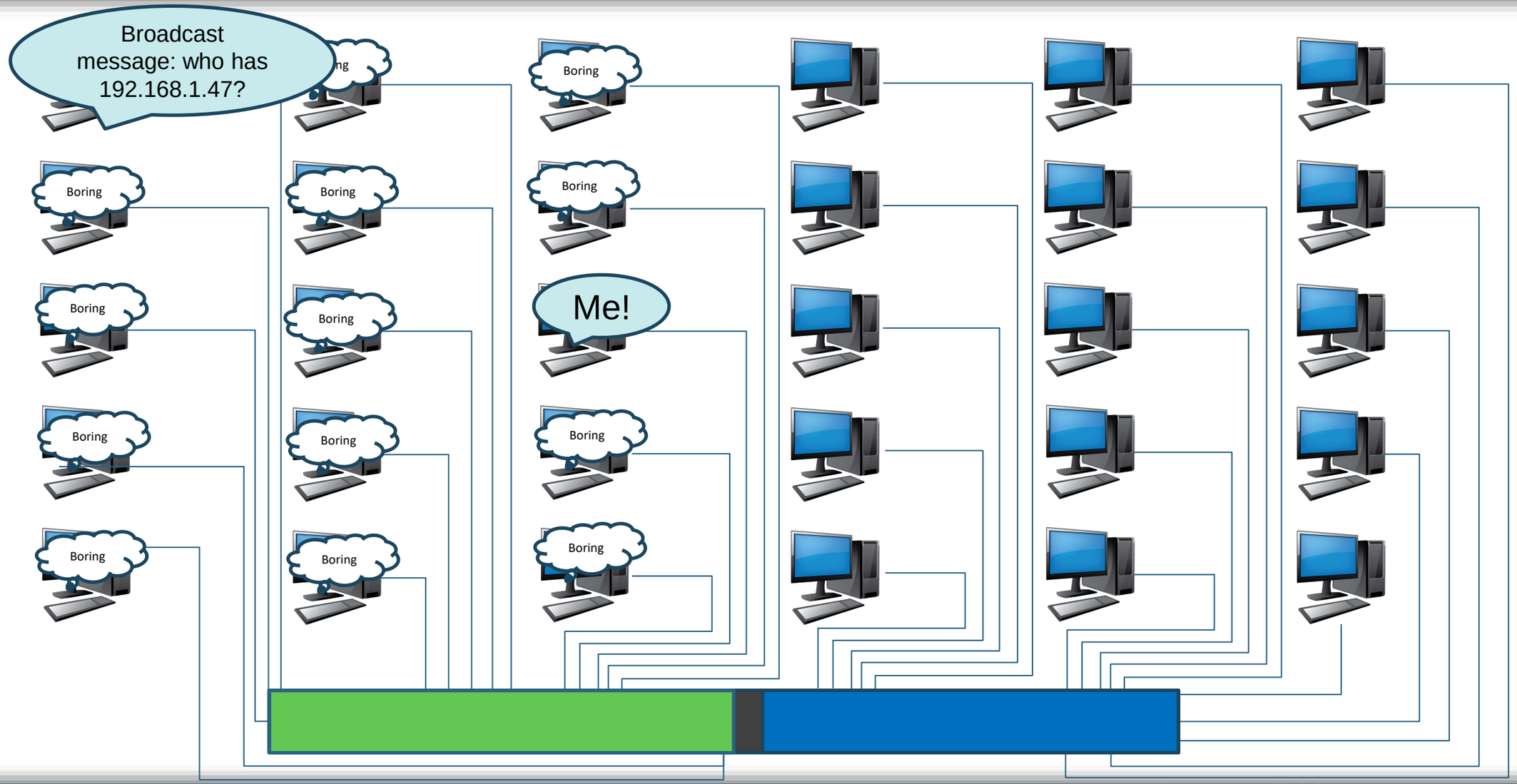


BROADCAST TRAFFIC



Surely there is a better way to deal with this?

SEGMENTING BROADCAST DOMAINS – GOOD PRACTICE



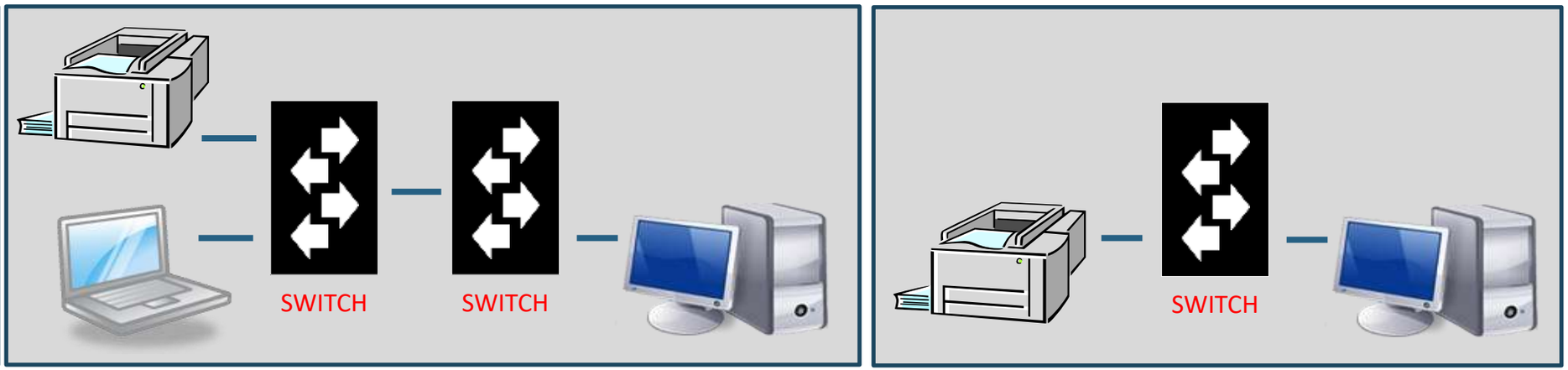
Quick Review:

OSI Model
(Lowest Three Layers)

3: Network

2: Datalink

VLANs segment broadcast domains (Layer 2).



Quick Review:

OSI Model
(Lowest Three Layers)

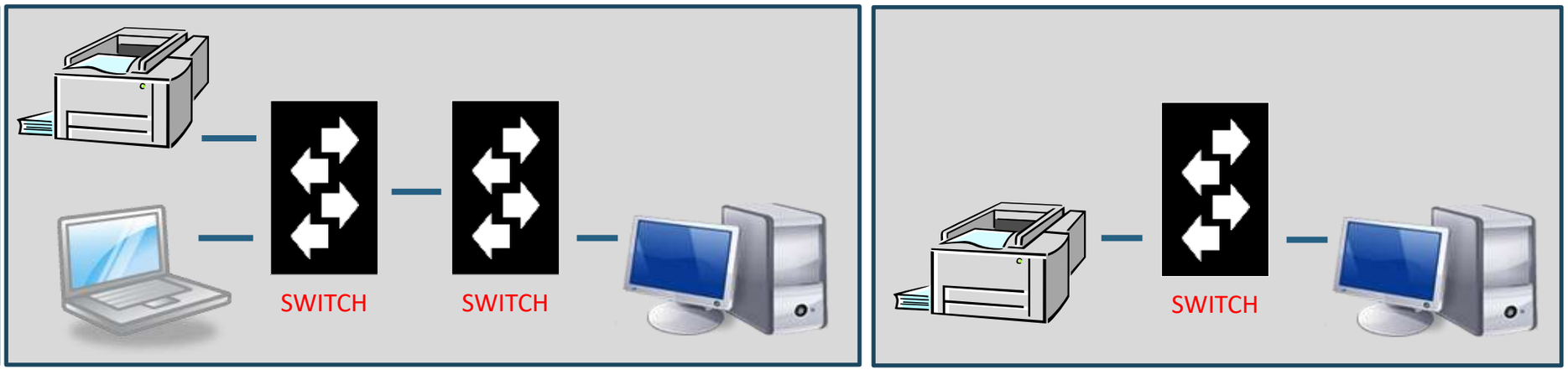
3: Network

Separate IP subnets are designated to each VLAN.

192.168.1.0 /24

192.168.2.0 /24

2: Datalink



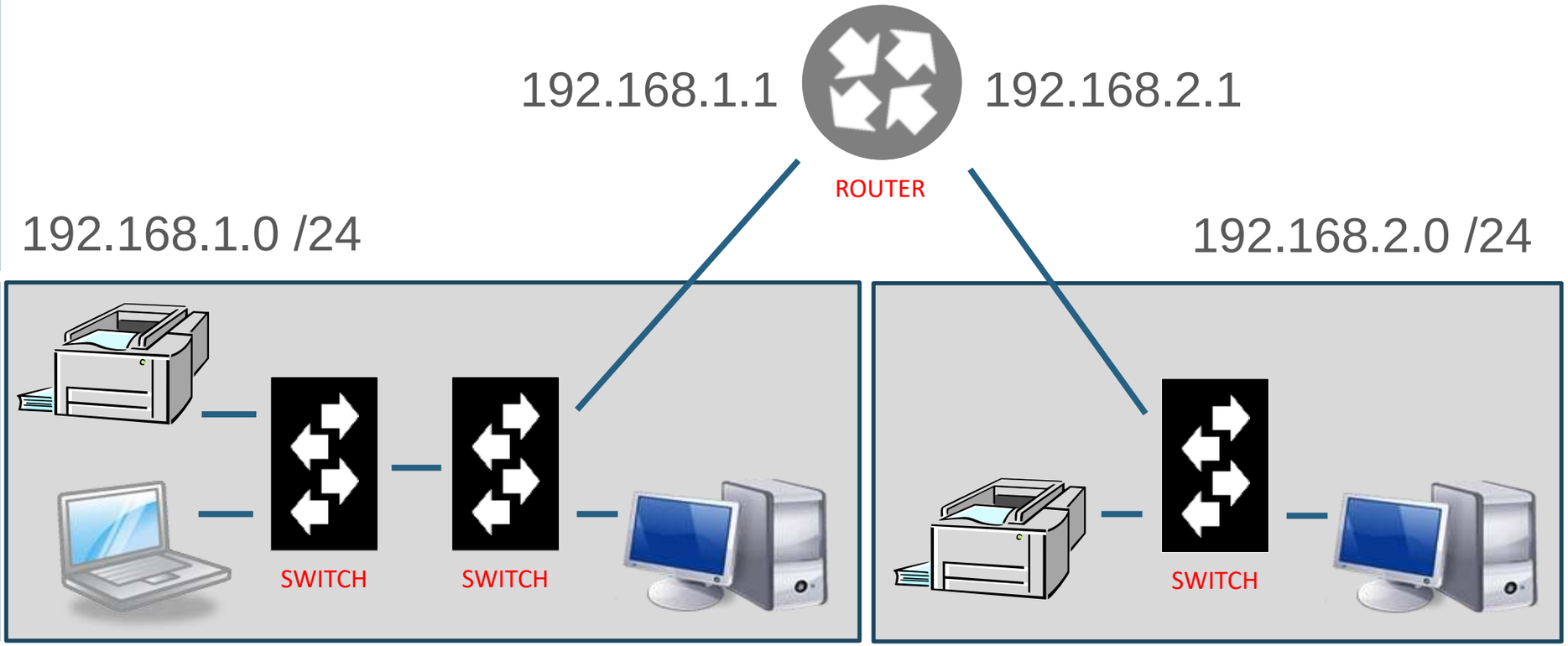
Quick Review:

OSI Model
(Lowest Three Layers)

3: Network

2: Datalink

A router can then link devices between broadcast domains (VLANs).



What is a Layer 3 Switch?

OSI Model
(Lowest Three Layers)

3: Network
Routers

2: Datalink
Switches

If switching traffic occurs at Layer 2, the what exactly is a “Layer 3 Switch”?

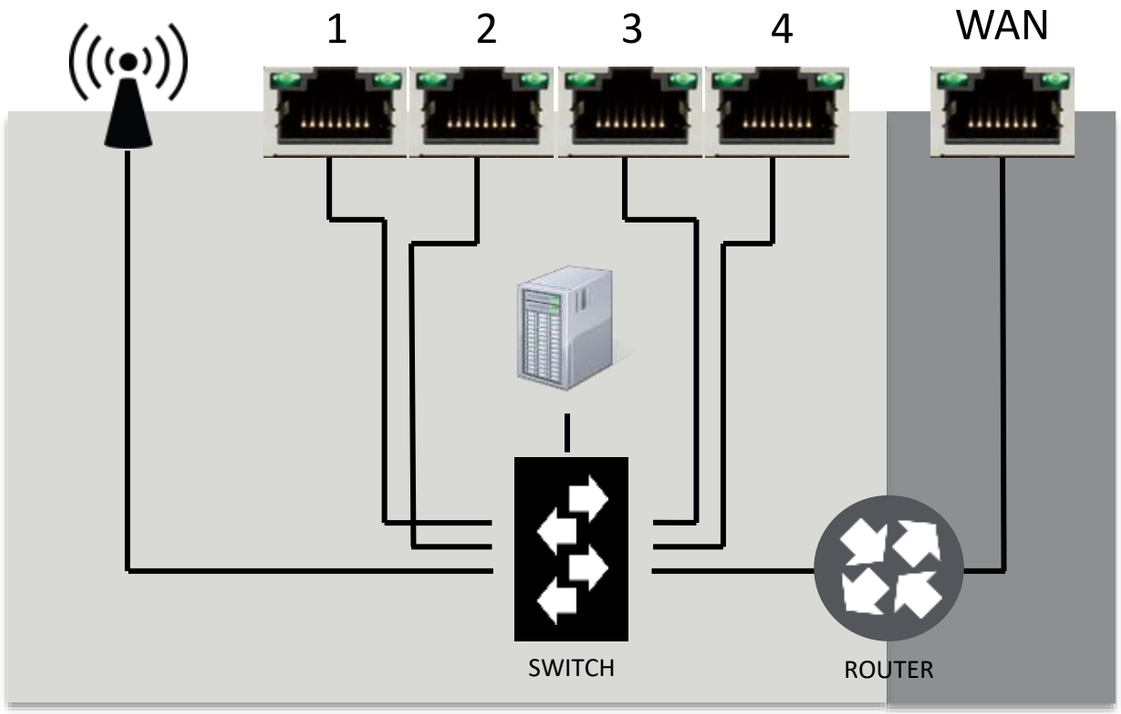
What is a Layer 3 Switch?

Recall when we talked about gear consolidating?

+

What is a Layer 3 Switch?

Recall when we talked about gear consolidating?



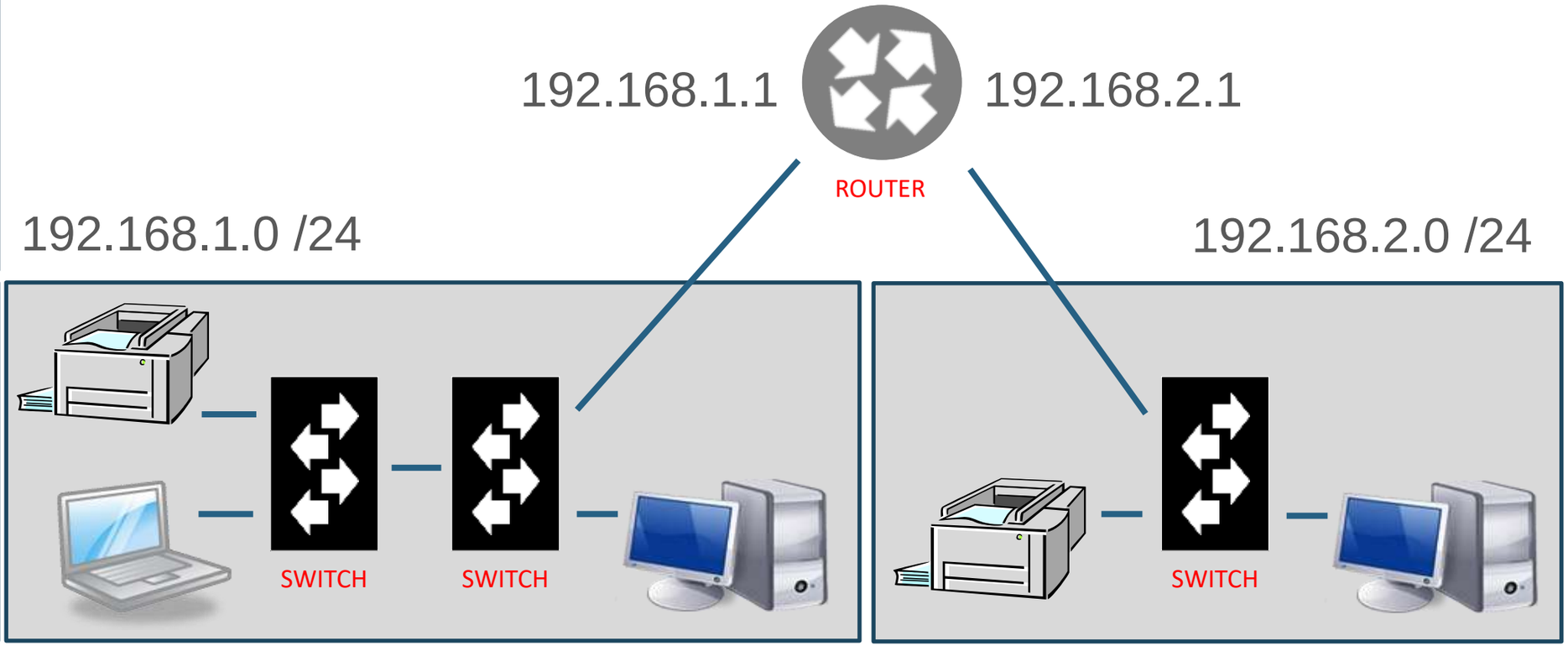
What is a Layer 3 Switch?

OSI Model
(Lowest Three Layers)

3: Network
Routers

2: Datalink
Switches

A “Layer 3 Switch” has routers inside.



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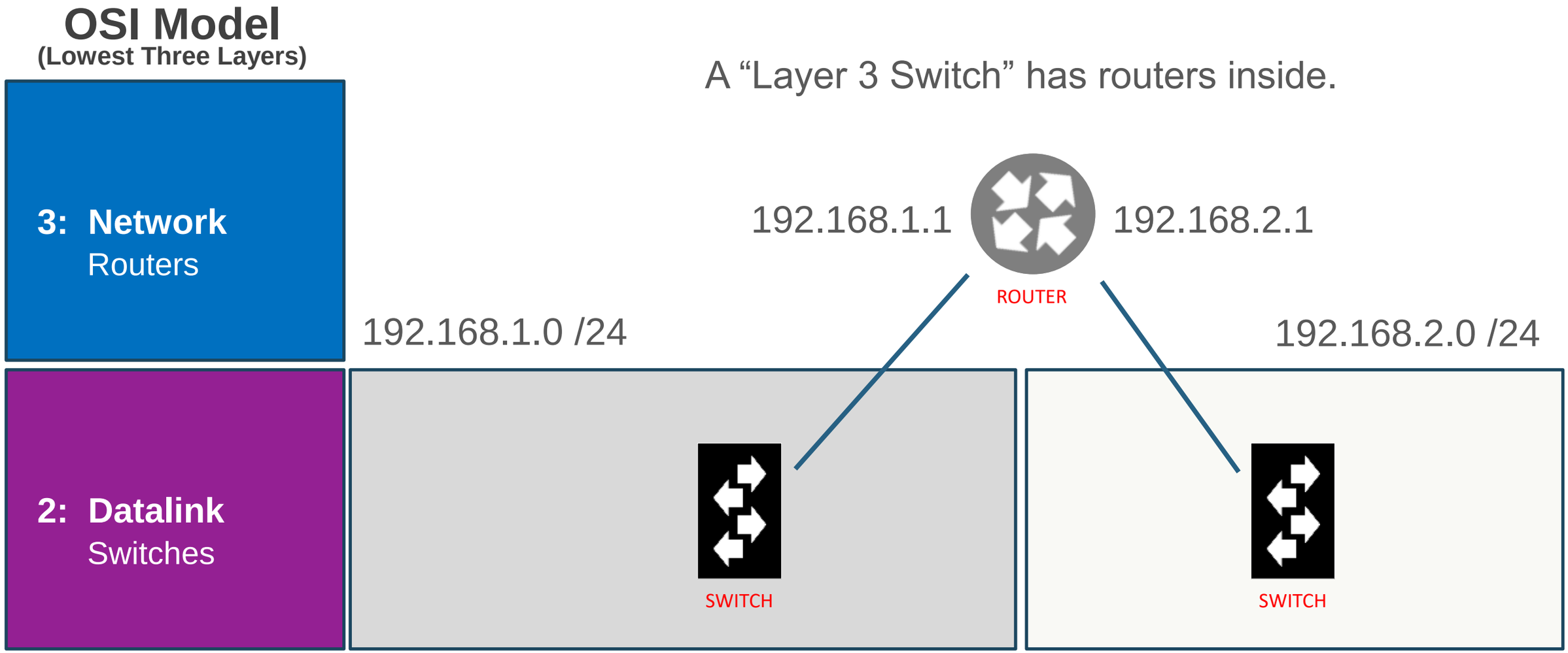

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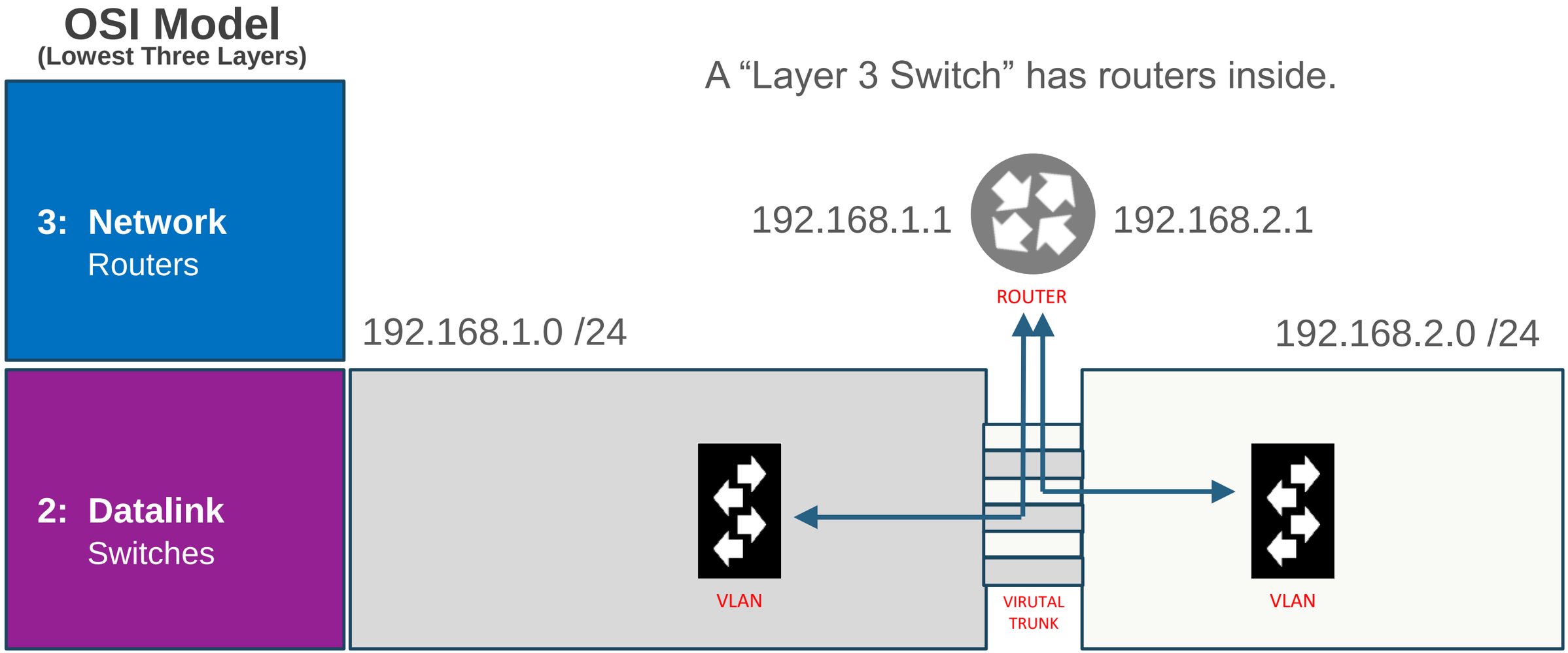


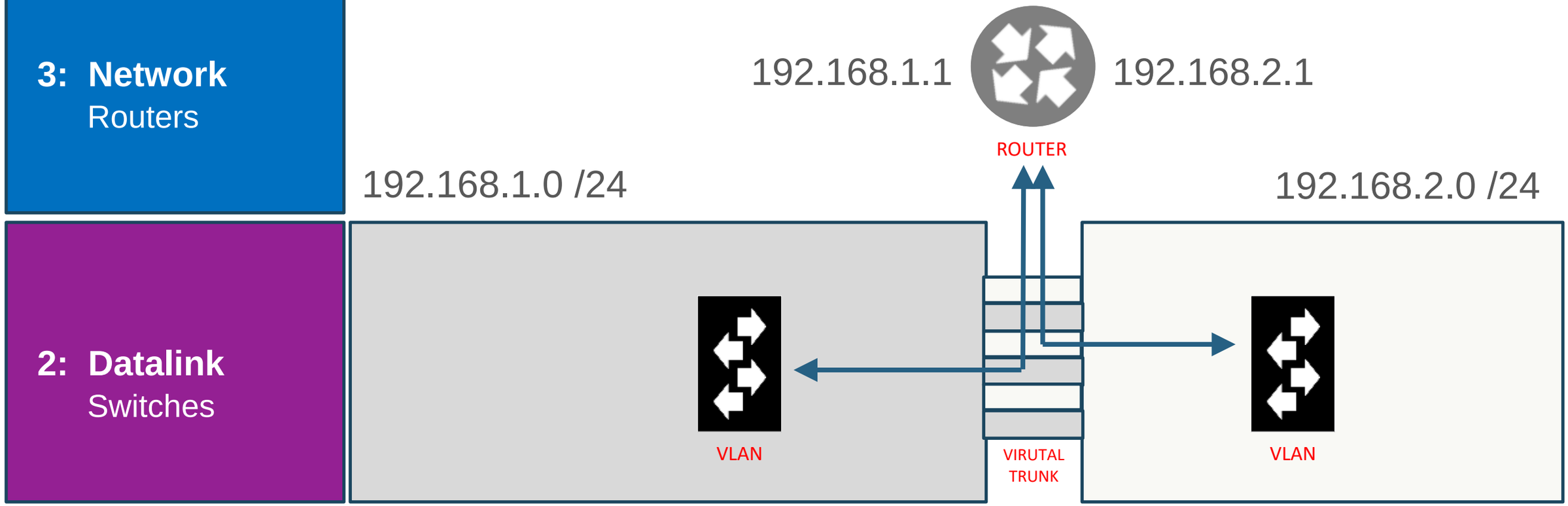
What is a Layer 3 Switch?

OSI Model
(Lowest Three Layers)

3: Network
Routers

2: Datalink
Switches

This is often referred to as a “Router on a Stick”.



Advanced Clocking, Layer 3

Some Clocking Challenges:

Studio Technologies 5401 “Dante Master Clock”

This is a Brooklyn II with a Sync input that can accept Video or Word Clock input. This was designed to allow large networks of Ultimo devices to work together.

Can the Master Clock sync all devices?

Dante Interface	Maximum Channels	Flows	Redundant	Clock Master
Ultimo	0x4 2x2 4x0	2		✓ ≤20
Broadway	16x16	16	✓	✓
Brooklyn II	64x64	32	✓	✓ ≤250
PCIe Card	128x128	32	✓	✓
HC	512x512	128	✓	✓
Dante AV	V: 1x0 or 0x1 A: 8x8	V: 1 A: 4		✓
DVS	64x64	16		
Dante Via	16x16/pgm 32x32 total	8		✓

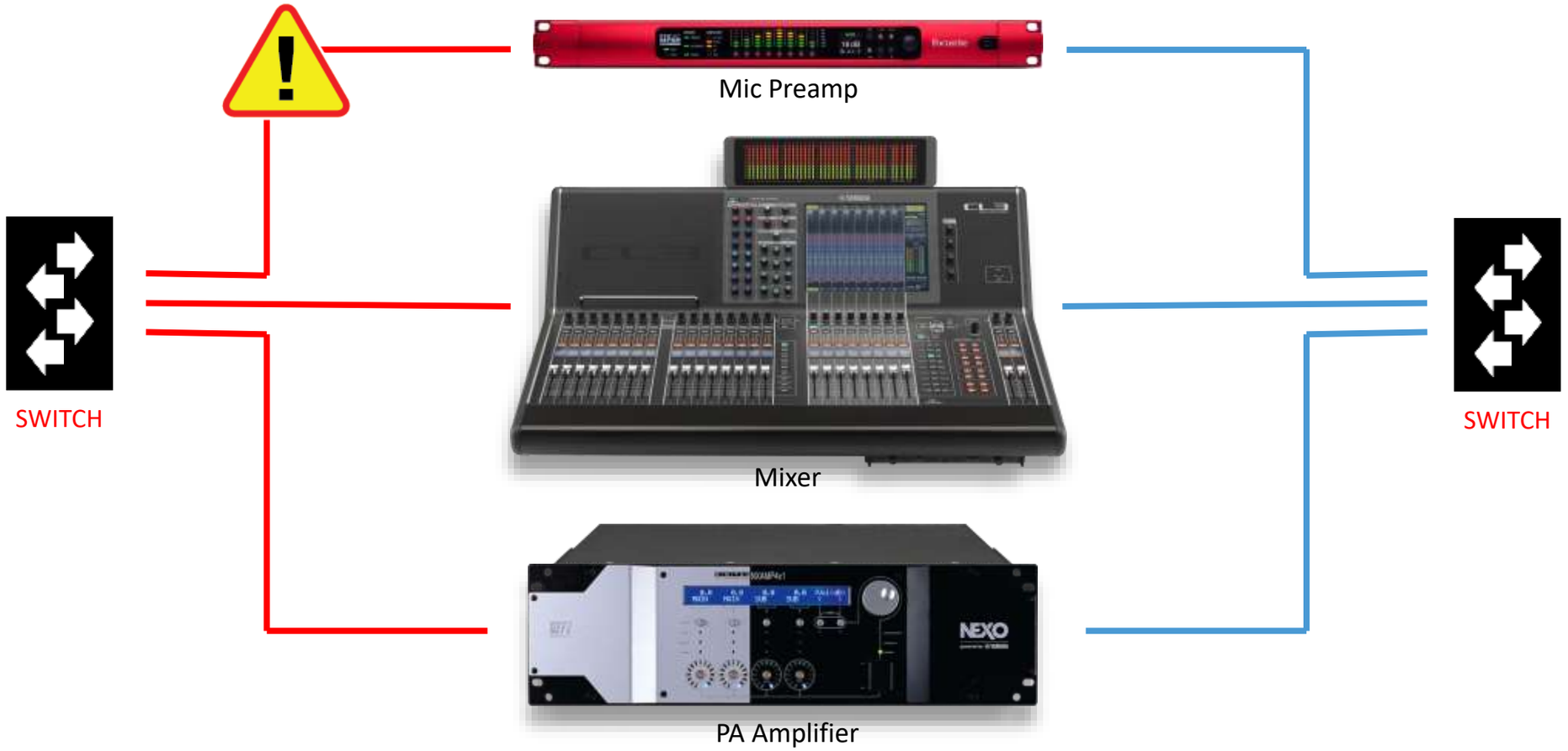
Dante Domain Manager can arrange clocking trees to support over a thousand Dante devices, so one device does not have to synchronize all others directly.

Redundant Networks

Redundant Networks

- Redundant Networks Are Both Full Time
  Dante does not “fail-over” – it naturally has two opportunities to get the data through.
  This is why we have seamless recovery if a network fails.
  This is a consideration for bandwidth, especially if trunked together.

Redundant Networks – Both Run Full-Time



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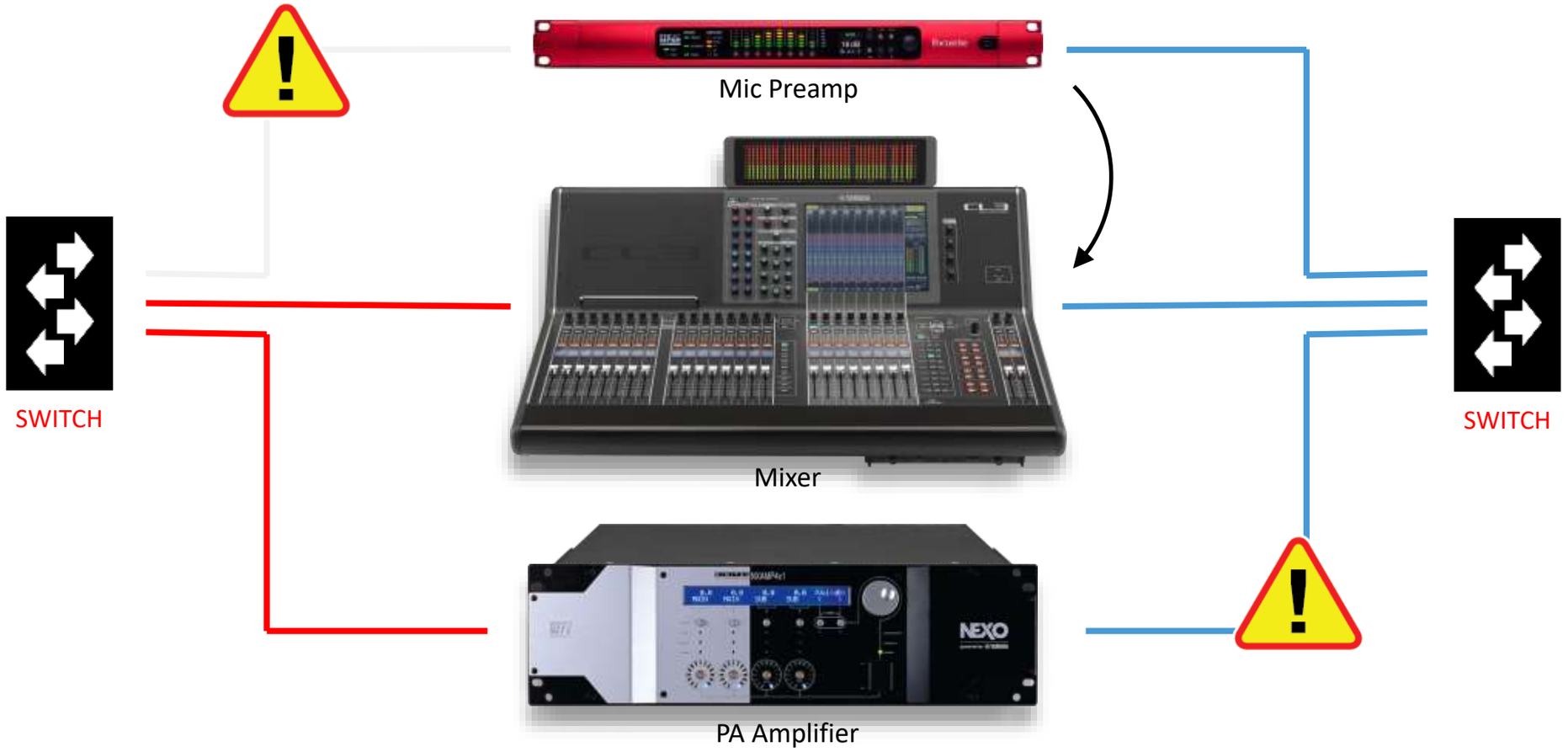

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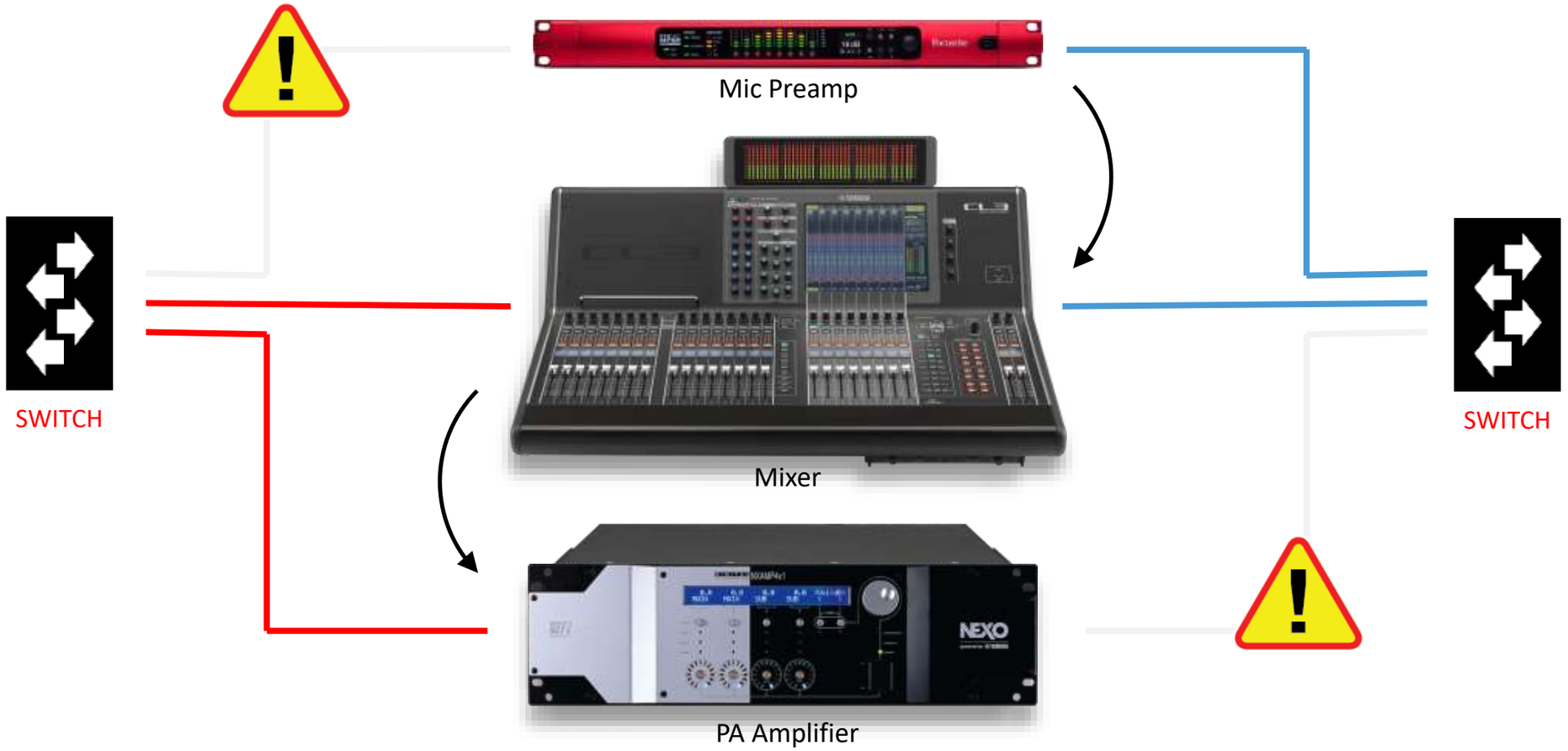

Redundant Networks

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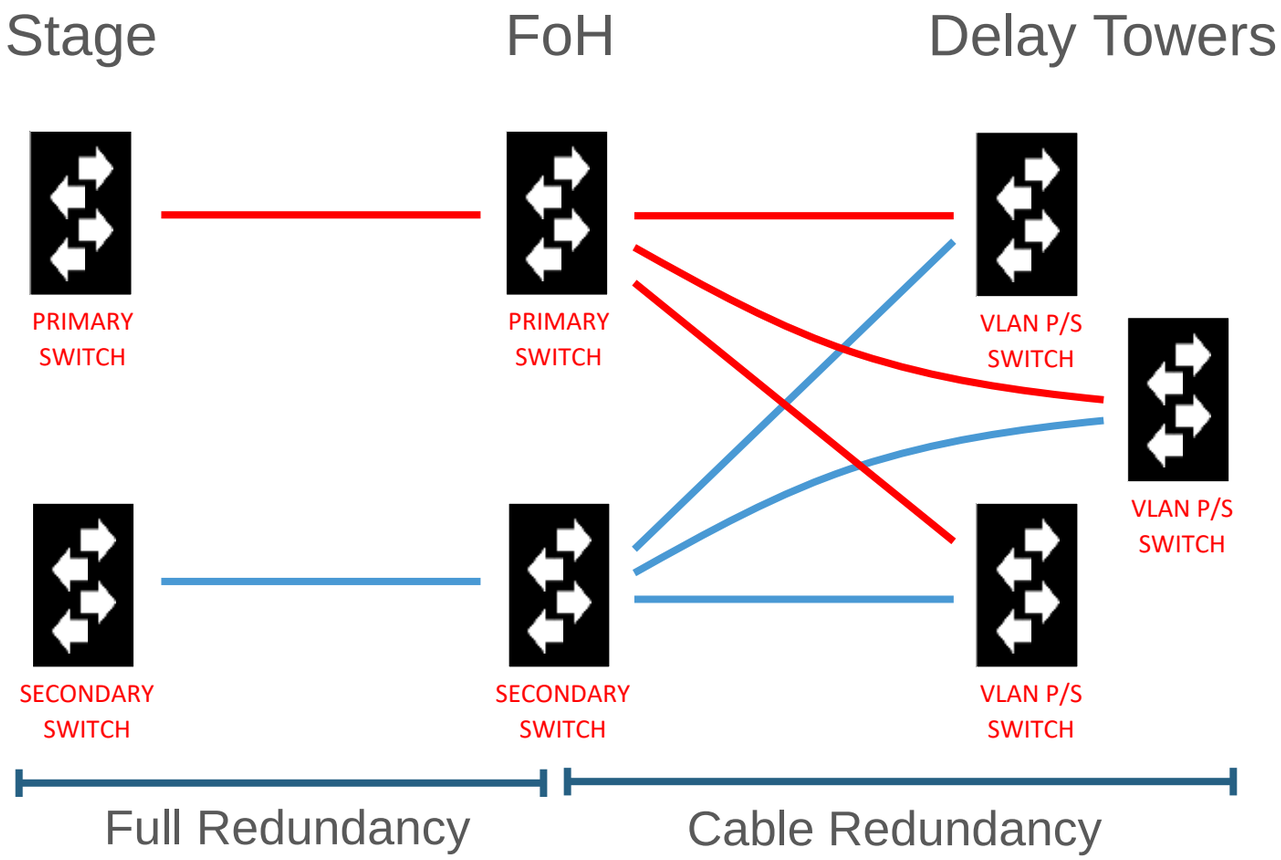
  Dante does not “fail-over” – it naturally has two opportunities to get the data through.
  This is why we have seamless recovery if a network fails.
  This is a consideration for bandwidth, especially if trunked together.

- Redundant Networks Must be Isolated (Broadcast Domain)
  Both networks use PTP for Clocking in the same IP range.
  To achieve redundant clocks on each network, each network must be isolated from each other.

- Common Failure – Connected Redundant, Configured Switched
  To avoid this problem, bring up one network at a time.
  Check that all devices are in redundant, and all expected connections can be made.
  Then bring up both networks, and simulate failures on devices.

Redundant Networks – How Much Redundancy?



Design & Troubleshooting

OS-X Running Virtual Soundcards

Problem:

Dante Virtual Soundcard cannot get clock.

Symptoms:

DVS Shows “Listening” in Dante Controller.
Network is using IGMP Snooping.

Multicast subscriptions have a Time-To-Live (TTL). OS-X is not properly extending subscriptions to multicast stream for clocking.

OS-X Running Virtual Soundcards

Problem:

Dante Virtual Soundcard cannot get clock.

Solution:

Either turn off IGMP Snooping, manually forward PTP or “Forward All Multicast”.

PTP uses 224.0.1.129-224.0.1.132 on ports 319/320.
“Forward All” effectively overrides IGMP Snooping on a port.
The port is often 1Gbit, so there is likely bandwidth to spare.

Troubleshooting: Oddball Issues To Know

iMac, Mac Mini, MacBook, etc.

Problem:

Built-in Ethernet may not be serviced often enough for Virtual Soundcards (DVS, Via, etc.)

Symptoms:

Other network devices perform normally.
Only Virtual Soundcard Latency is inconsistent.

Not a network issue - the computer isn't transmitting in time. The CPU often services the NIC, which induces network jitter.

iMac, Mac Mini, MacBook, etc.

Problem:

Built-in Ethernet may not be serviced often enough for Virtual Soundcards (DVS, Via, etc.)

Solution:

Use a Thunderbolt to Ethernet Adapter.

This moves the NIC port maintenance off the CPU and on to the adapter, smoothing network jitter issues.

Troubleshooting: Gathering Information

Troubleshooting: Defining the Problem

In order to solve a problem,
you must first define it.

"It doesn't work," doesn't help.

What doesn't work?

Troubleshooting: Defining the Problem

Connectivity

Is it online and responding?

Clocking

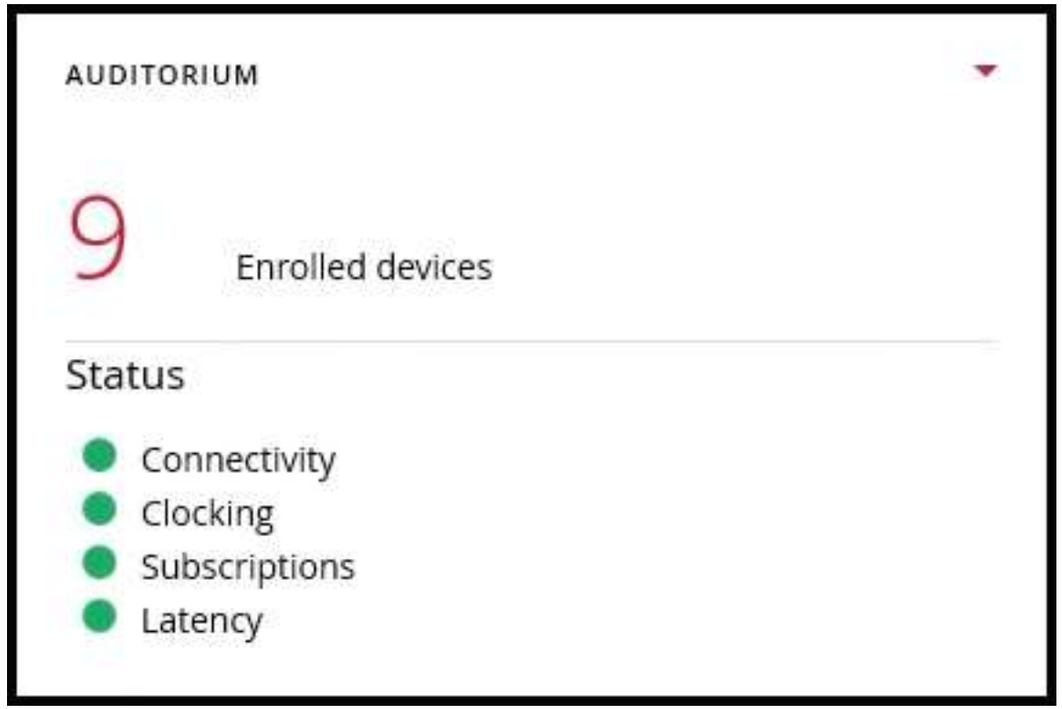
Is it synchronized and stable?

Subscriptions

Is it receiving the channels it is expecting?

Latency

Are all channels arriving in a timely manner?



Troubleshooting: Solving the Issue

Connectivity

Is it online and responding?

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Powered on, plugged in and ports lighting up?

Try new cables *including trunk lines*. Reboot switch.

Plug directly into device or use another switch.

Most switch config problems won't span switches. A multicast flood would cross if IGMP Snooping absent.

Duplicate IP Address or Dante Name

If the device is off and the IP responds to a ping or the name shows in Dante Controller, this is your issue.

Validate path for discovery/communication.

Broken trunk lines, failed routers, frozen switches.

Ping device to confirm it's presence, subnet & VLAN

mDNS discovery open? (Multicast 224.0.0.251:5353.)

If link is Layer 3, ensure DNS-SD is working.

Troubleshooting: Solving the Issue

Connectivity
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Are all channels arriving in a timely manner?

Changing Clock Masters:

New clock elections take place when devices appear on or leave the network. This may be normal behavior, especially when systems boot up.

Evaluate Dante Controller Clock Histogram & Follow Dante Domain Manager Clock Tree:

“Blades of Grass” could just be clock master change. Clear history and watch performance going forward.

Look for trends of stable devices. A common path for instability indicates a network optimization issue.

Follow unicast and multicast “tree”, determine if a particular path is challenged, past which links are not establishing a stable clock.

Troubleshooting: Solving the Issue

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Virtual Interfaces (e.g. - DVS, Dante Via)

Computer Issues, not Network Issues.

Is CPU servicing virtual interface often enough?

Quit other programs, just run Dante-related programs.

OS-X w/ built-in network port?

iMac, Mac Mini and MacBook (not Pro) Ethernet ports are often managed by CPU directly. Using an external Ethernet adapter (i.e. Thunderbolt) helps.

OS-X and switch w/ IGMP snooping?

Known problem with OS-X and most switch makers where multicast subscriptions are not maintained. See our switch configuration guide for solutions.

Troubleshooting: Solving the Issue

Connectivity

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Is QoS Set Correctly?

Dante PTP uses DSCP tag “CS7” (decimal value 56).

In QoS, the highest value is the highest priority. So, queue 4 is higher priority than queue 1. Those new to switch configuration may set this backwards.

Are Device or Trunk Links Saturated?

We recommend keeping links under 80% saturation for best performance, and QoS may be required over 60% or when 100Mbit devices are added.

Other Traffic Skewing Clock

AVB traffic does not integrate with QoS – it simply supercedes it. Keep AVB on separate hardware.

As if “jumbo packets” are being used by other systems on the network. If so, ensure QoS prioritize PTP.

Troubleshooting: Solving the Issue

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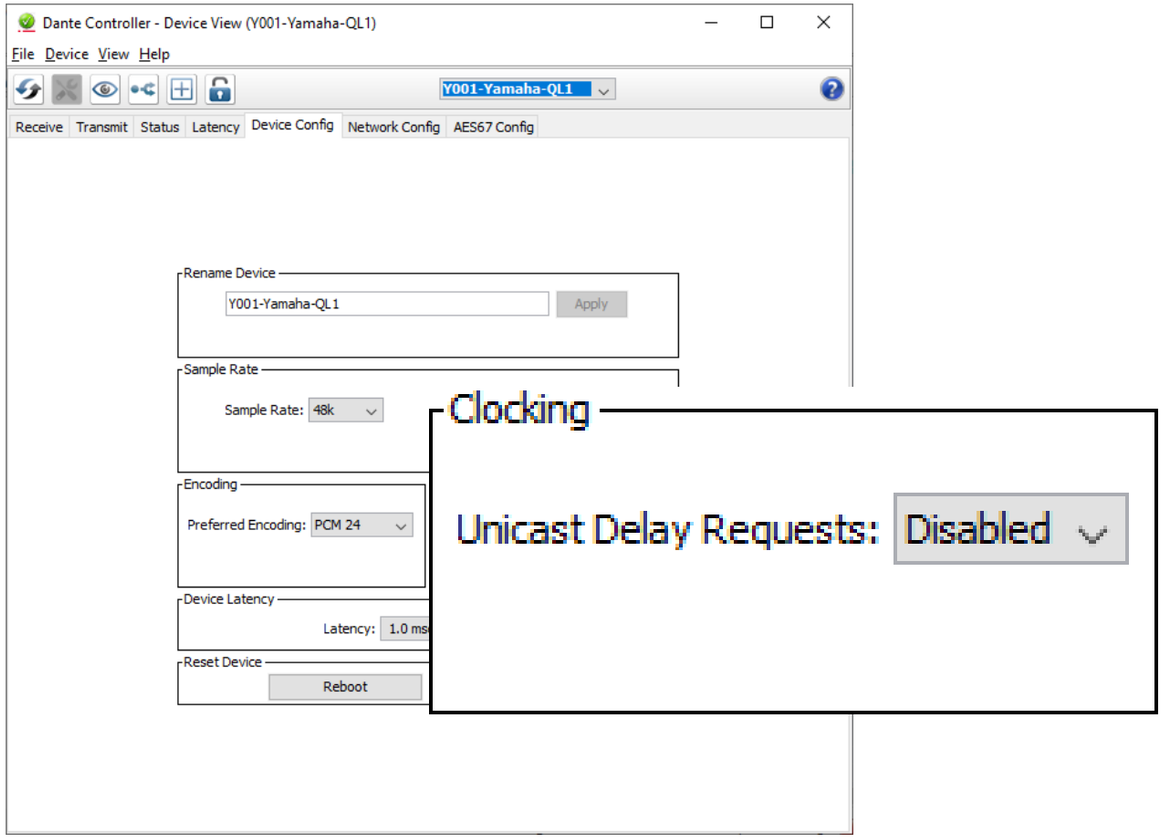

Troubleshooting: Solving the Issue

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Are all channels arriving in a timely manner?

Dante Controller Shows the Nature of the Problem

More detail is available in the "Tool Tip" roll-over.

Working Subscription

Cannot Locate Transmitter on Network

Receiver cannot locate transmitter/channel.
Dante device or channel name changed

Something is wrong with the Stream

Wrong Sample Rate (One device changed)
Out of flows (switch to multicast)
No audio (silence or audio packets not received)

Troubleshooting: Solving the Issue

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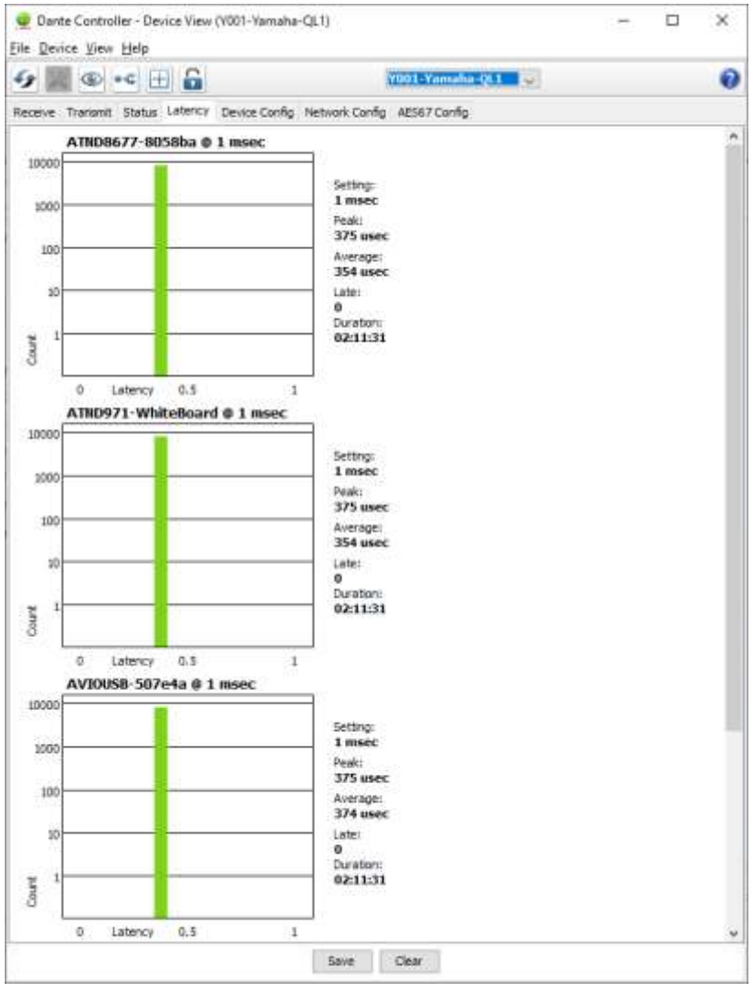

Next Steps

TAKE THE LEVEL 3 TEST

http://www.audinate.com/certify

- Create an Audinate account if you don’t have one
- Login to your account
- Take Level 3 test
- Certificate is automatically generated

Thank You

Augusto “Gus” Marcondes

Technical Training Manager EMEA

augusto.marcondes@audinate.com