FIT9137
Introduction to Computer Architecture and Networks

Week 6: Workshop on Backbone Networks & Virtual LANs (VLANs)

Dr. Muhammed Esgin

Today: Week-6 Workshop

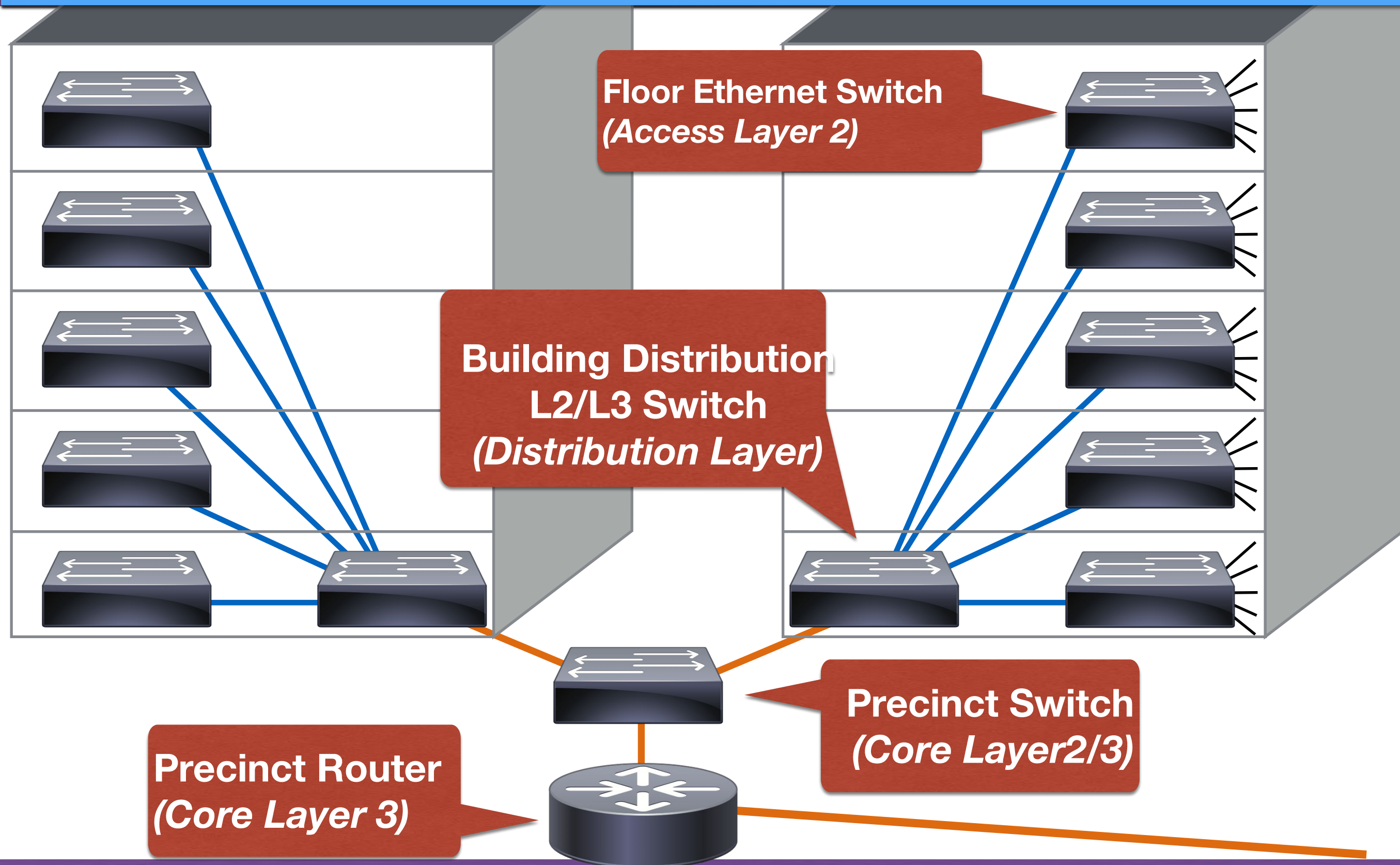| When	What ?	Why ?
15 mins	Backbone networks, VLAN's	Recap from pre-class activities and recorded videos
5 mins	Flux Q&A	Recap
15 mins	• **ACTIVITY A: VLAN Tags**	• VLAN's Tags IEEE802.1Q
10 mins	Take-home message	Conclusion
10 mins	Feed-forward	
40 mins	• **ACTIVITY B: Inter VLAN Communications**	▪ Multiple VLAN's: Inter VLAN communications
10 mins	Take-home message	Conclusion

Backbone Networks

Backbone Networks

High speed links between LANs

- owned and operated by the company

- enables communication between different LANs

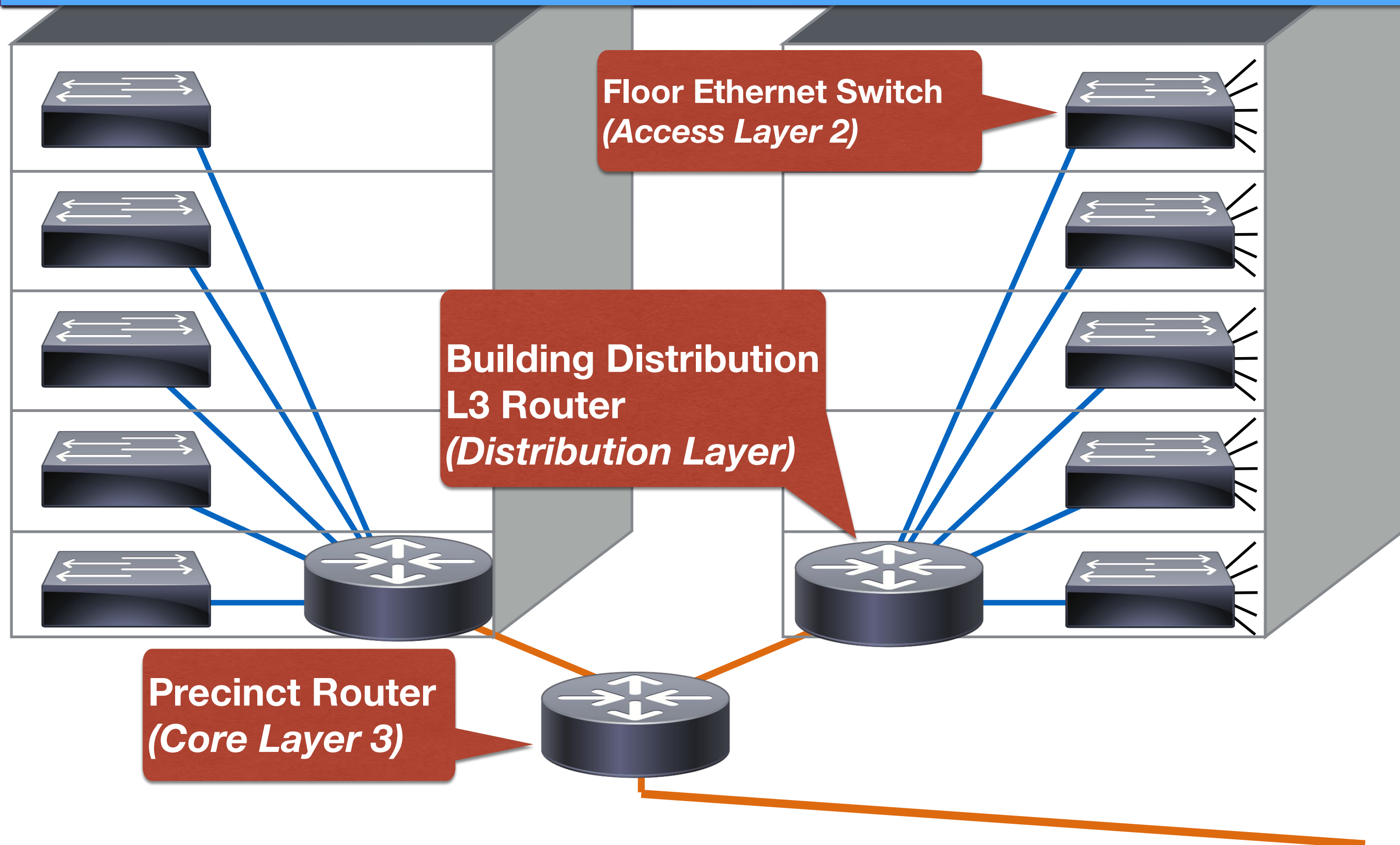- provides connections to other backbones, MANs, WANs, and the Internet

Technology

- high-speed physical layer (often optical fiber)

- switches and/or routers

Switched Backbone

Floor Ethernet Switch
(Access Layer 2)

Building Distribution
L2/L3 Switch
(Distribution Layer)

Precinct Switch
(Core Layer2/3)

Precinct Router
(Core Layer 3)

Routed Backbone

Floor Ethernet Switch
(Access Layer 2)

Building Distribution
L3 Router
(Distribution Layer)
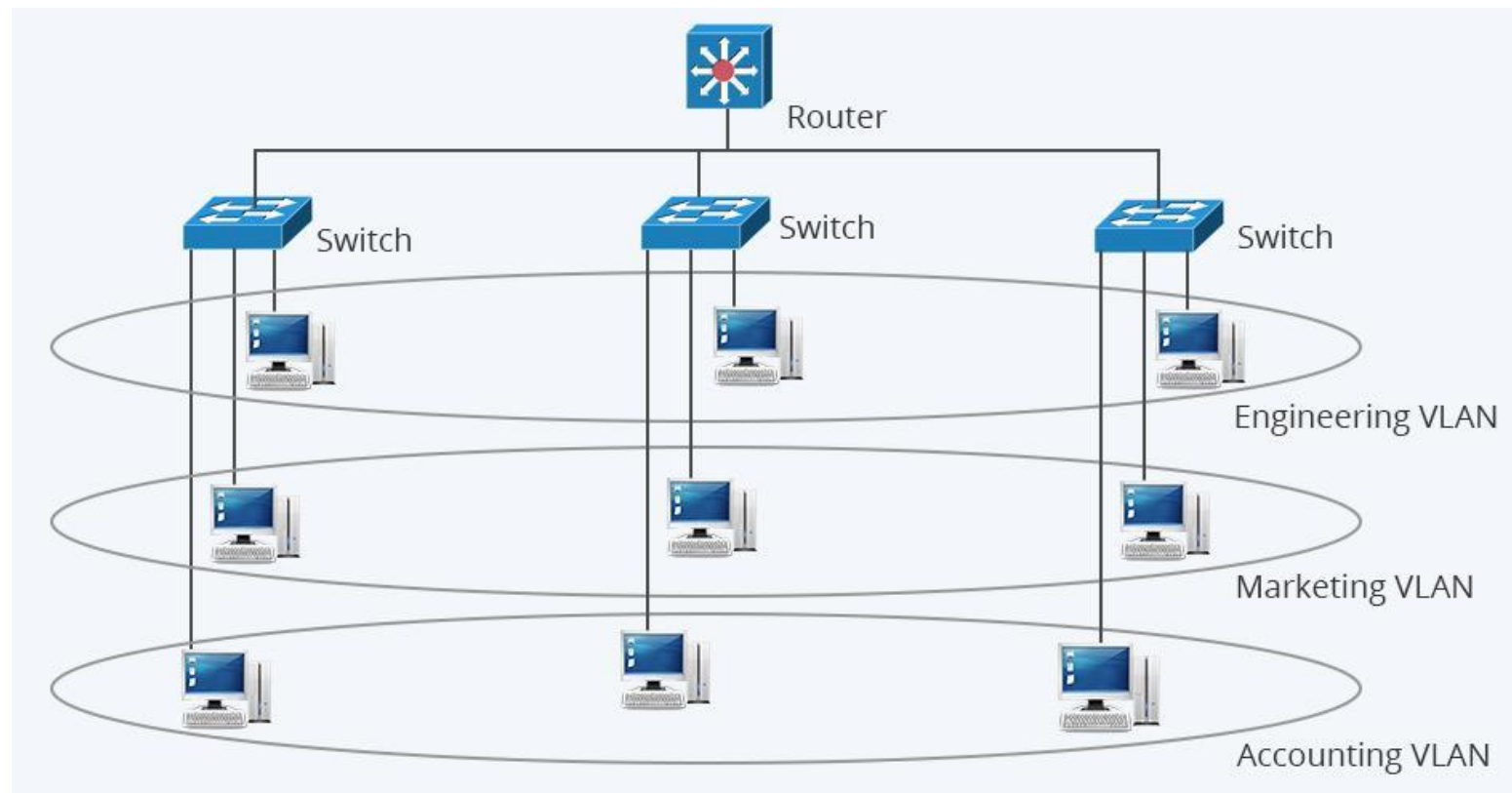
Precinct Router
(Core Layer 3)

Virtual LANs

Virtual LANs (VLANs)
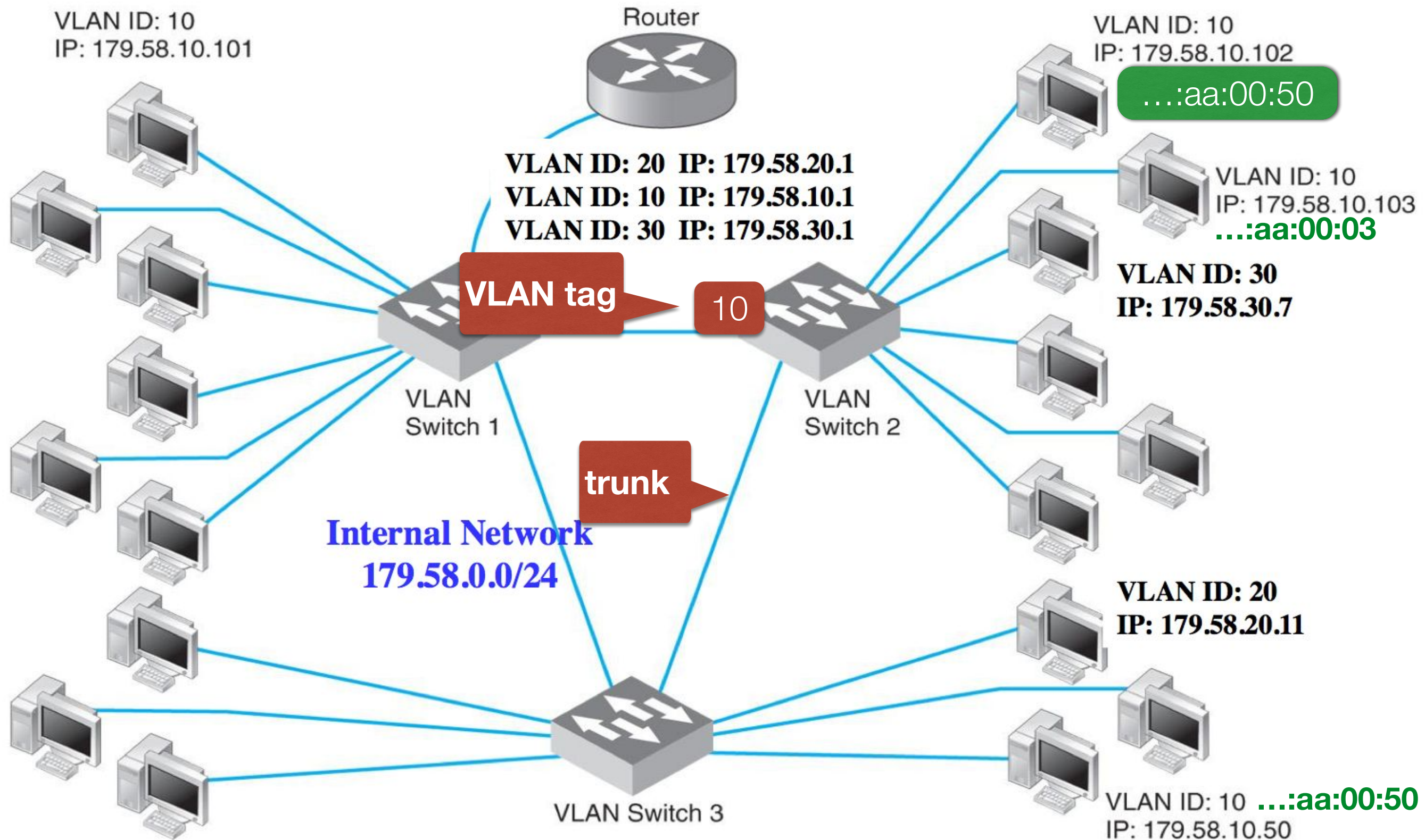
One switch - *multiple* **subnets / VLANs**
- subnets configured in software (switch OS)
- each port (network port) can be assigned to a particular subnet
- hundreds of computers connected to a single switch

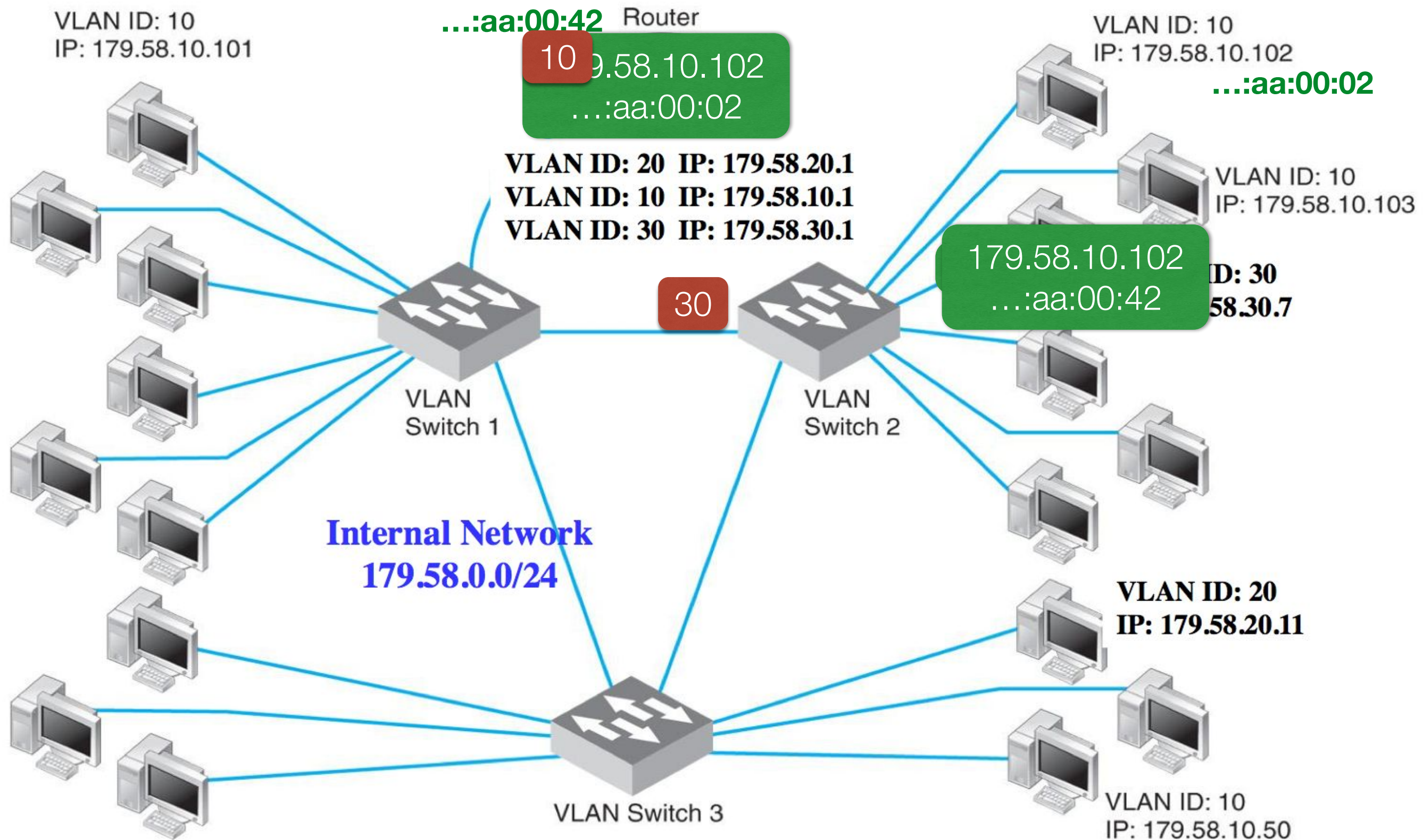**Multiple switches - multiple subnets / VLANs**
- switches connected with each other
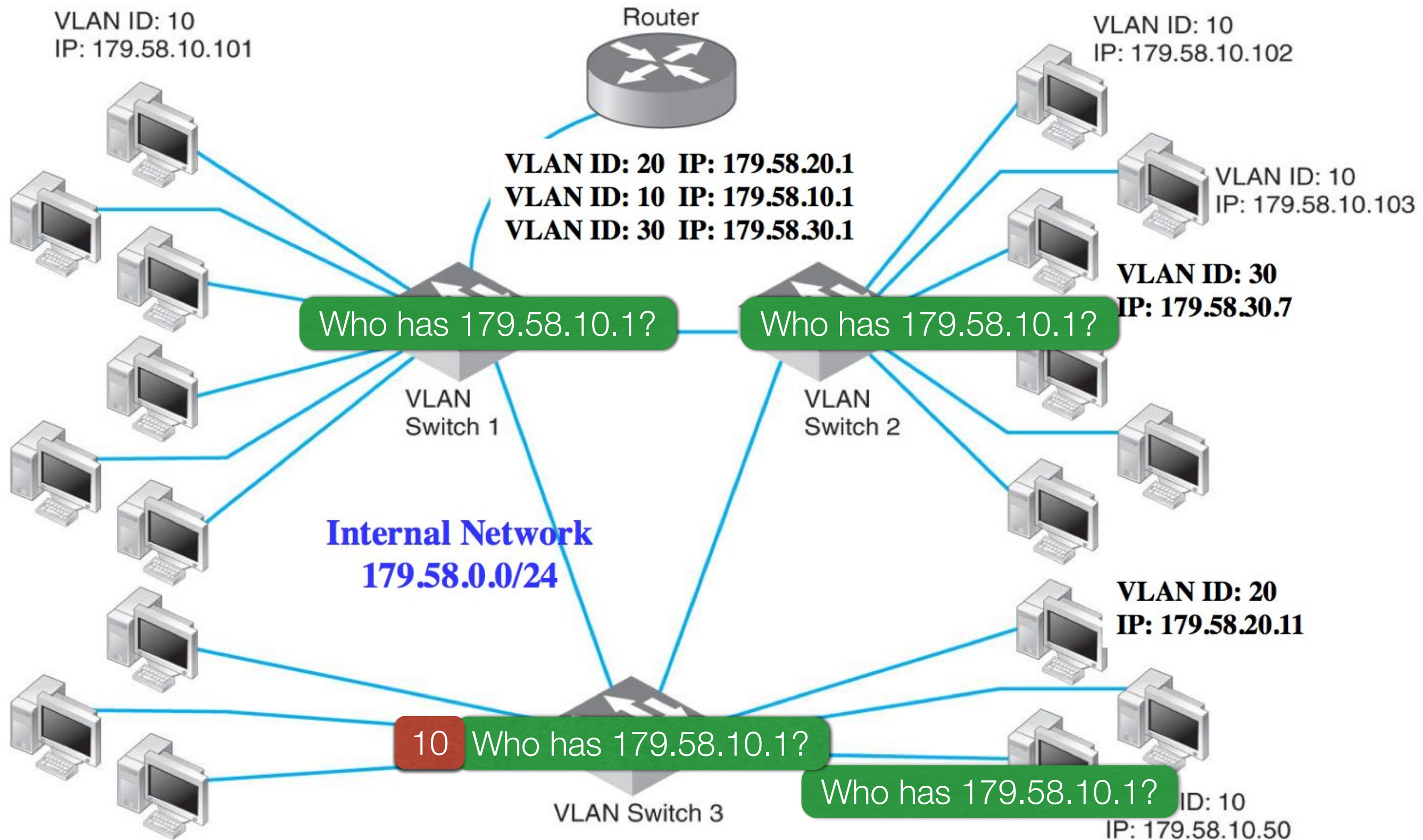- move packets between VLANs

Multi-switch VLANs

VLAN ID: 10
IP: 179.58.10.101

Router

VLAN ID: 20 IP: 179.58.20.1
VLAN ID: 10 IP: 179.58.10.1
VLAN ID: 30 IP: 179.58.30.1

VLAN ID: 10
IP: 179.58.10.102

VLAN ID: 10
IP: 179.58.10.103

VLAN ID: 30
IP: 179.58.30.7

Who has 179.58.10.1?

Who has 179.58.10.1?

VLAN
Switch 1

VLAN
Switch 2

Internal Network
179.58.0.0/24

VLAN ID: 20
IP: 179.58.20.11

10   Who has 179.58.10.1?

Who has 179.58.10.1?

VLAN Switch 3

ID: 10
IP: 179.58.10.50

VLAN advantages

Subnets organized by function

- servers can be placed in LANs even if they are in a different building

- when people move office, they can keep their IP addresses (just reconfigure the switch)

Limited broadcasting

- compared to switch-only backbones

- broadcasts are only sent to the same subnet

Efficient

- faster, cheaper, easier to configure than routing

FLUX Question: Large Subnets

What is the **disadvantage** of large **switched backbones**?

A.   Since Ethernet uses a **shared medium**, all frames are delivered to all devices, increasing traffic.

B.   **Broadcasts** (such as ARP) have to be transmitted through the whole network, increasing traffic.

C.   **Servers** are placed in the same subnet as clients, which should never be done (remember last week).

D.   It's a **security risk**, because everyone is part of the same network.

To participate, go to

flux.qa/JSBJLK

https://flux.qa/JSBJLK

What is the valid range of VLAN Ids?

A. 0 – 4095

B. 1 – 4094

C. 0 – 2047

D. 1 – 2046

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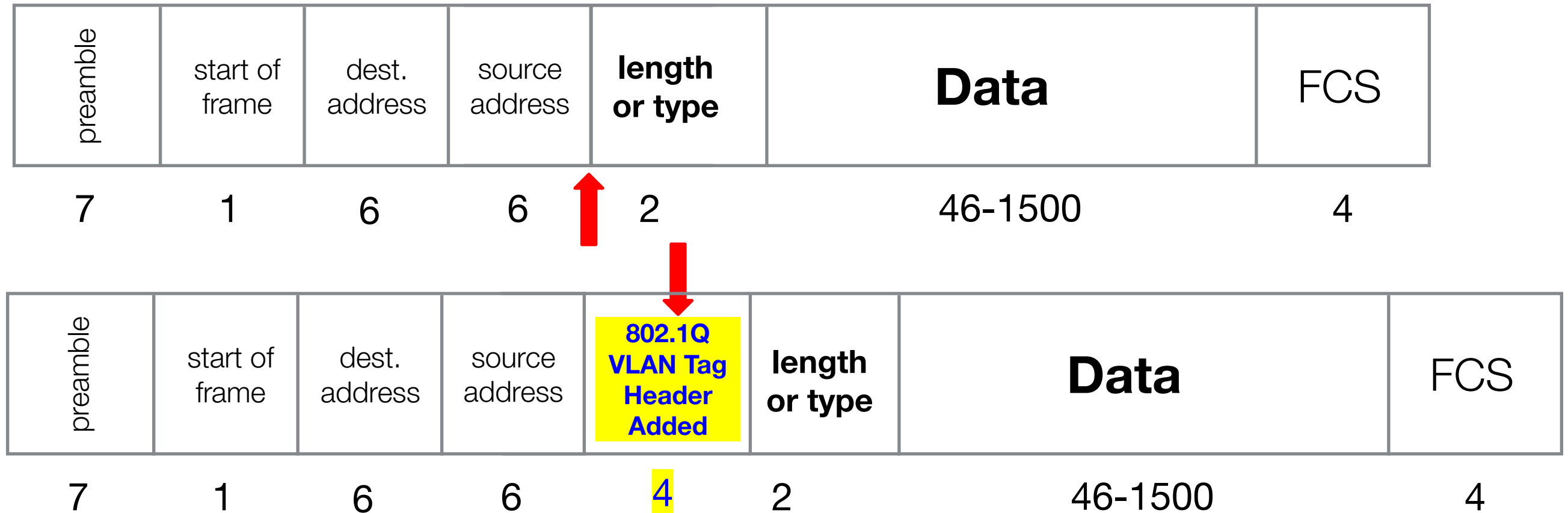**https://flux.qa/JSBJLK**

ACTIVITY A

How does it work?

Switches insert IEEE802.1Q VLAN Tag

preamble	start of frame	dest. address	source address	length or type	Data	FCS
7	1	6	6	2	46-1500	4

preamble	start of frame	dest. address	source address	802.1Q VLAN Tag Header Added	length or type	Data	FCS
7	1	6	6	4	2	46-1500	4

- tag contains 4 Bytes = 16-bit TagProtocolID, 3-bit PCP, 1-bit DEI, 12-bit VLAN ID
- VLAN ID is 12 bits (4096 VLANs)

Switch configuration

- network admin defines which VLANs span which switches, and how switches are connected (trunks)
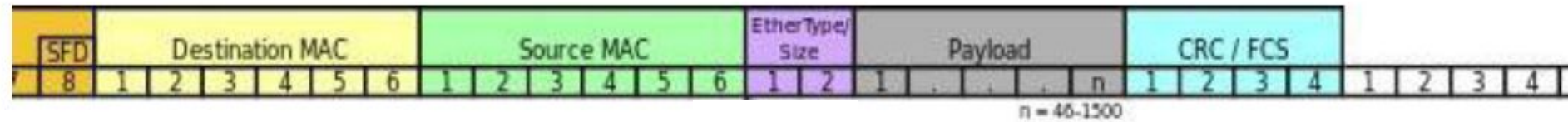
Topics

- Virtual LANs (VLANs)

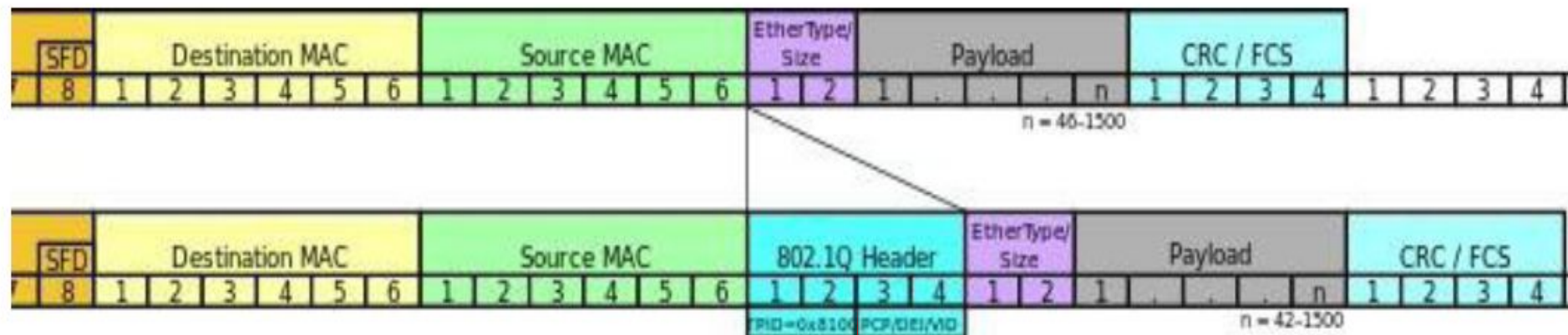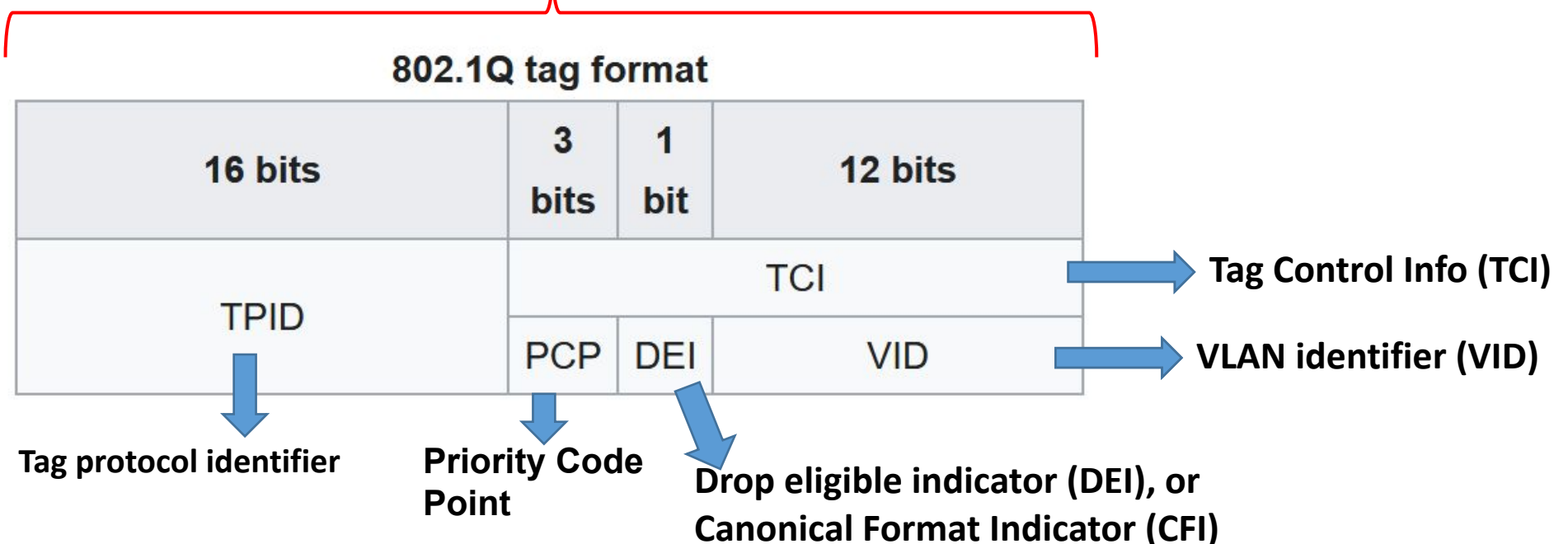**Figure 1: 802.3 Standard Header in Ethernet Frame**

Figure 1: 802.3 Ethernet Frame with 802.1Q VLAN Tag in Protocol Header in Ethernet Frame

802.1Q tag format

16 bits	3 bits	1 bit	12 bits	
TPID	TCI			→ Tag Control Info (TCI)
	PCP	DEI	VID	→ VLAN identifier (VID)

Tag protocol identifier

Priority Code Point

Drop eligible indicator (DEI), or
Canonical Format Indicator (CFI)

FEED-FORWARD

BIG THANK YOU TO EVERYONE FOR YOUR INPUT!

About "Feed-Forward"

- Some (contrary) requests
  - "Cover more theory/concepts" and "Do more practise"
  - "More reading activities" and "more videos" and "Less pre-class activities"
  - "more group activities" and "less of group activities"

About "Feed-Forward"

- Some (contrary) requests
  - "Cover more theory/concepts" and "Do more practise"
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- (relatively) common requests:
  - "extend Applied", "speak slowly/loudly"
    Action for us: in discussion with CE and Faculty
  - "provide more reading"
    Reminder: (extended) reading materials available under "Additional Weekly Resources"
  - "more consultation", "more tutors in class"
    Action for you: Provide feedback to the Faculty

ACTIVITY B

FLUX Question: Switch port

Which of the following switch port can carry only **single** VLAN traffic?

A. access port

B. trunk port

C. both access & trunk ports

D. None of them

To participate, go to

flux.qa/JSBJLK

https://flux.qa/JSBJLK

FLUX Question: Switch port

Which of the following types of VLAN connections are supported by Switch?

A. Access Link

B. Trunk Link

C. Both of Access & Trunk Links

D. None of these options

To participate, go to

flux.qa/JSBJLK

https://flux.qa/JSBJLK

FLUX Question: Switch port

How switches identify which frames belong to which VLANs ?

A. Frame filtering.

B. Mac filtering.

C. Frame tagging.

D. None of the above.

To participate, go to

flux.qa/JSBJLK

https://flux.qa/JSBJLK

1.1 Inter-VLAN Communication

A network configuration is as shown in Figure-2

1.

✔ Explain why having a *layer 2 loop in a network will be problematic ?*

✔ Explain *why layer 2 loops are used and how the problem is resolve ?*
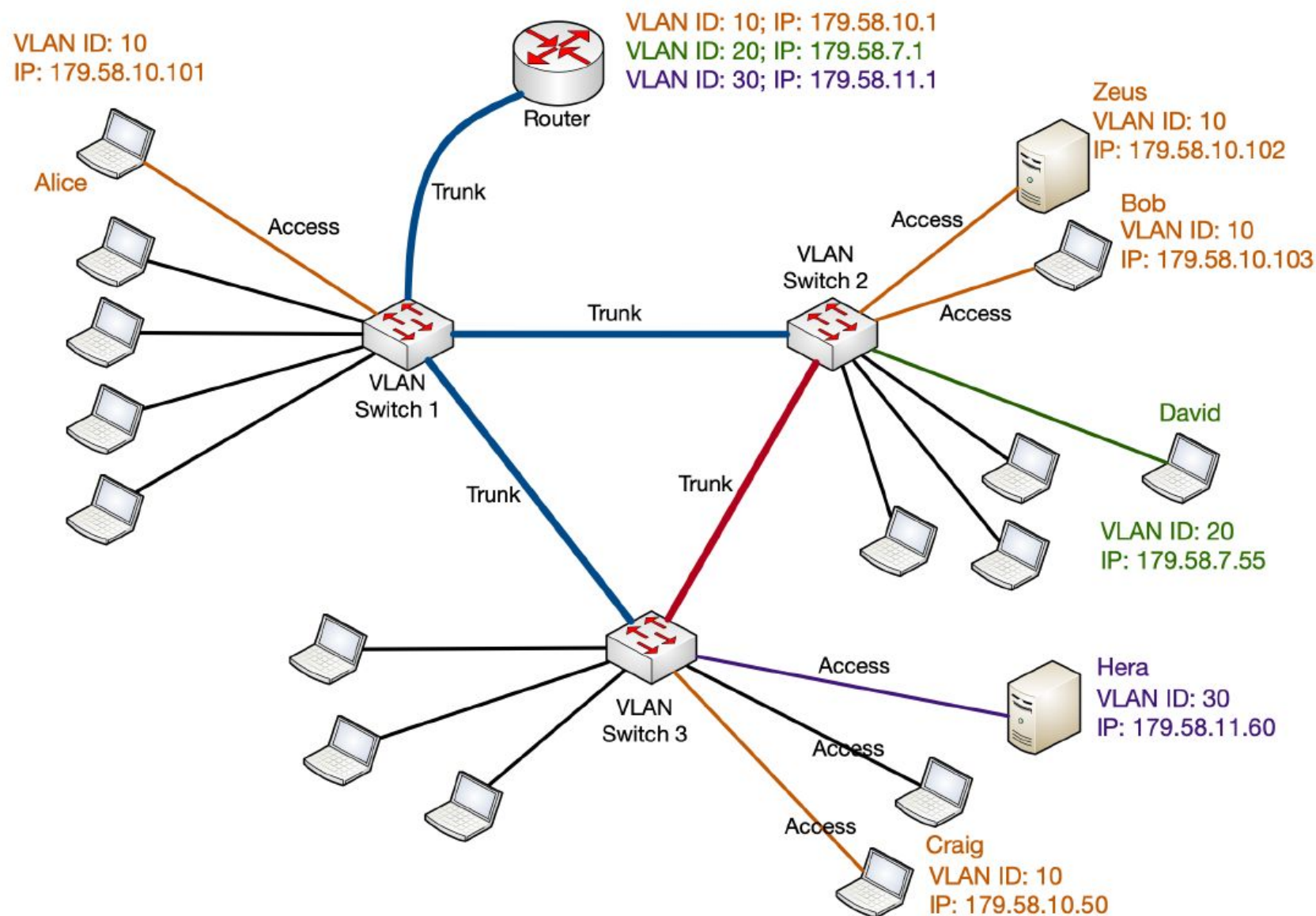

Figure 2: Network Configuration of Talos Corp.

1.1 Inter-VLAN Communication

A network configuration is as shown in Figure-2

2.
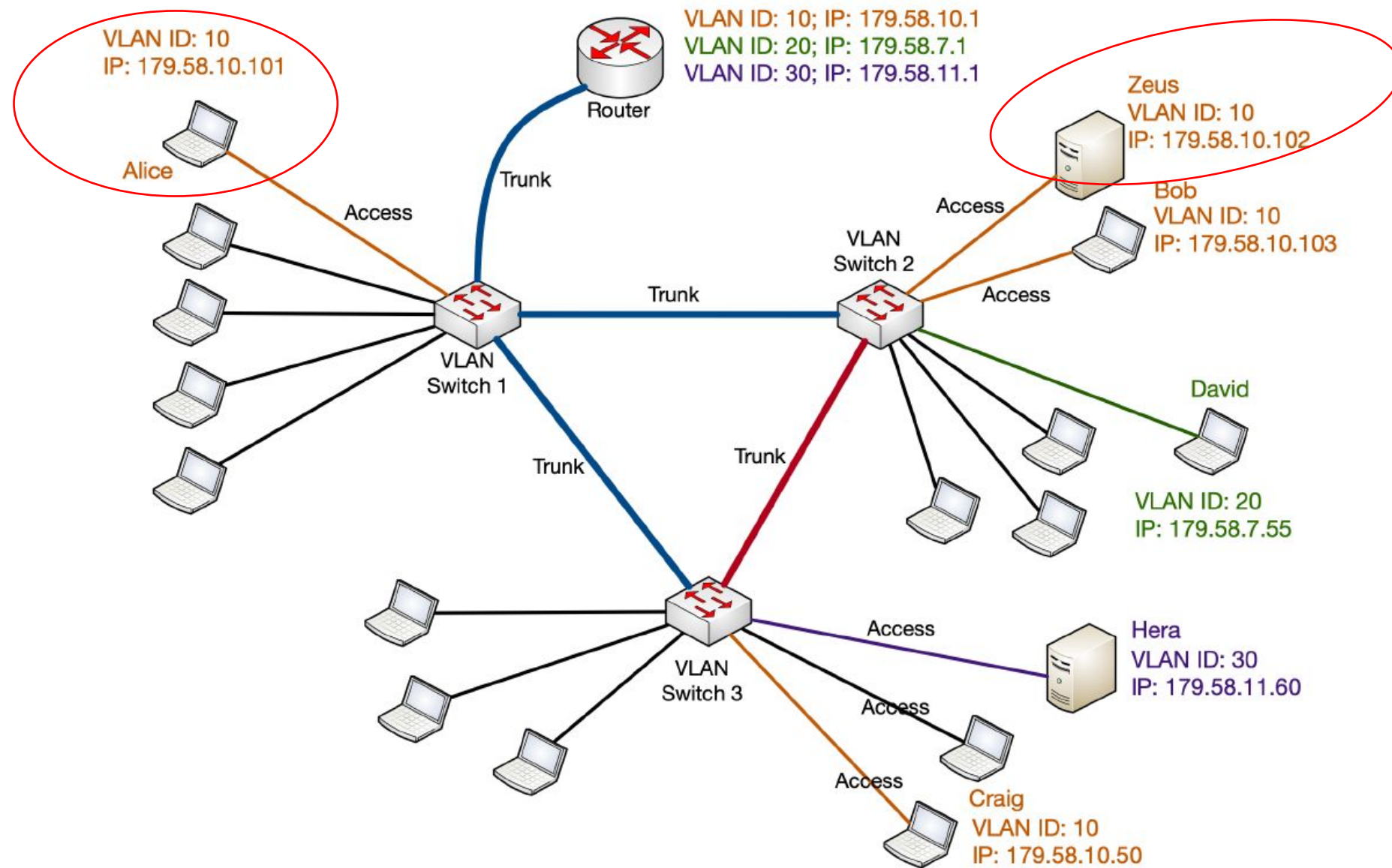✔ Explain the process when *Alice accesses a service on Zeus server*?

Figure 2: Network Configuration of Talos Corp.

1.1 Inter-VLAN Communication

A network configuration is as shown in Figure-2

3.

✔ Explain the process when *Alice accesses a service on Hera server*?

VLAN ID: 10
IP: 179.58.10.101

Alice

VLAN ID: 10; IP: 179.58.10.1
VLAN ID: 20; IP: 179.58.7.1
VLAN ID: 30; IP: 179.58.11.1

Router

Trunk

Access

VLAN Switch 1

Trunk

Trunk

Zeus
VLAN ID: 10
IP: 179.58.10.102

Access

Bob
VLAN ID: 10
IP: 179.58.10.103

VLAN Switch 2

Access

David

VLAN ID: 20
IP: 179.58.7.55

Trunk

Trunk

VLAN Switch 3

Access

Access

Hera
VLAN ID: 30
IP: 179.58.11.60

Access

Craig
VLAN ID: 10
IP: 179.58.10.50

Figure 2: Network Configuration of Talos Corp.

1.1 Inter-VLAN Communication

A network configuration is as shown in Figure-2

3.

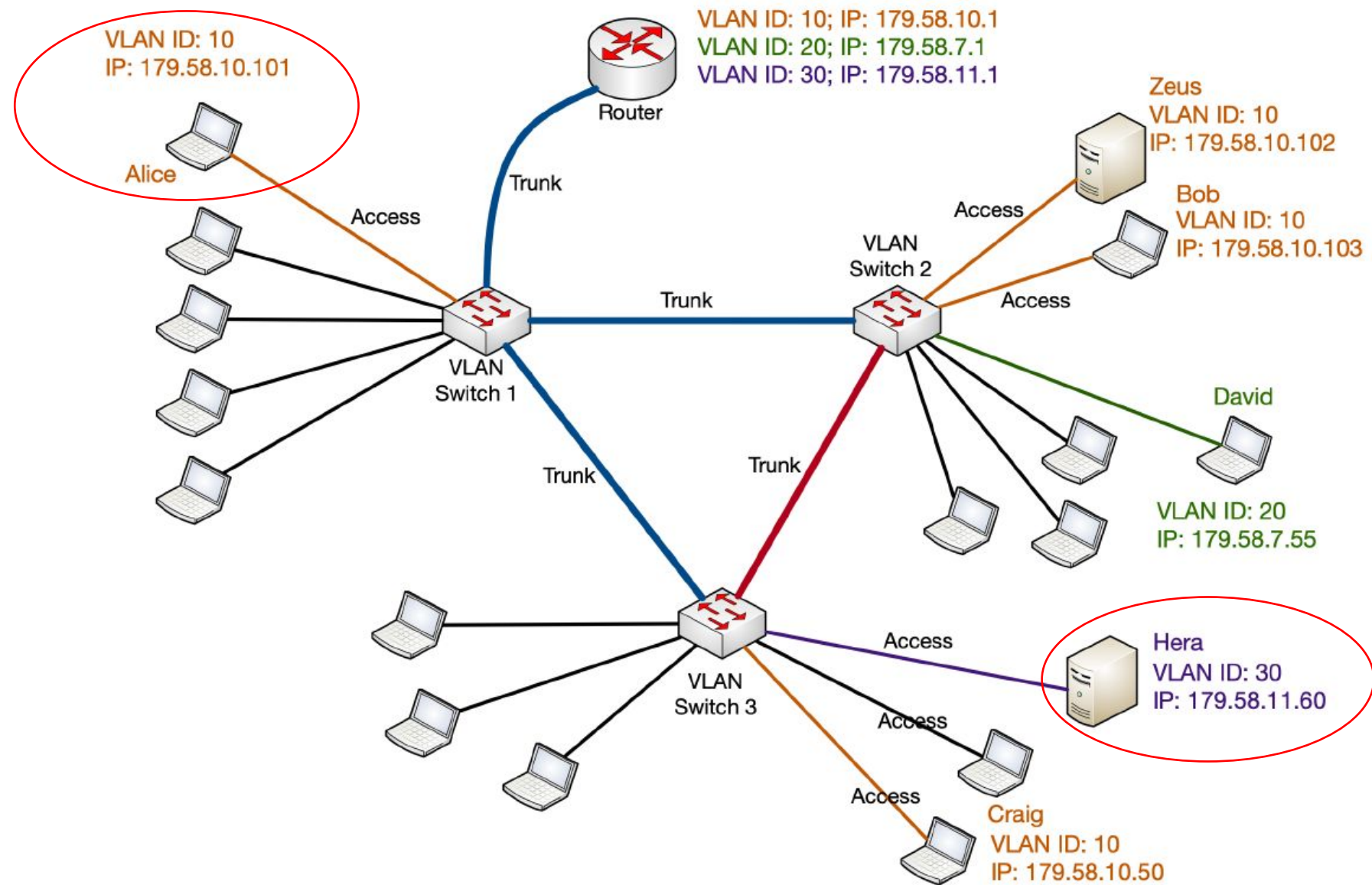✔ Explain the process when **Alice accesses a service on Hera server**?

- Alice sends frame with *Hera's destination IP with MAC address of the Router in VLAN 10*.

- **Switch1 on access port in VLAN-10 finds the Routers MAC address** and outgoing port being trunk tags the frame with VLAN 10 and sends to Router.

- *Router opens-up the frame routes it to **VLAN 30** and the port being **trunk tags** it with VLAN 30 and sends out the frame*.

- **switch1 finds the MAC address of Hera in its MAC address table (or flood it if not found) and sends it out the trunk port to switch3**. switch3 finds the MAC address of **Hera** in its MAC address table and the port being an access port removes the tag and send out the frame to Hera.
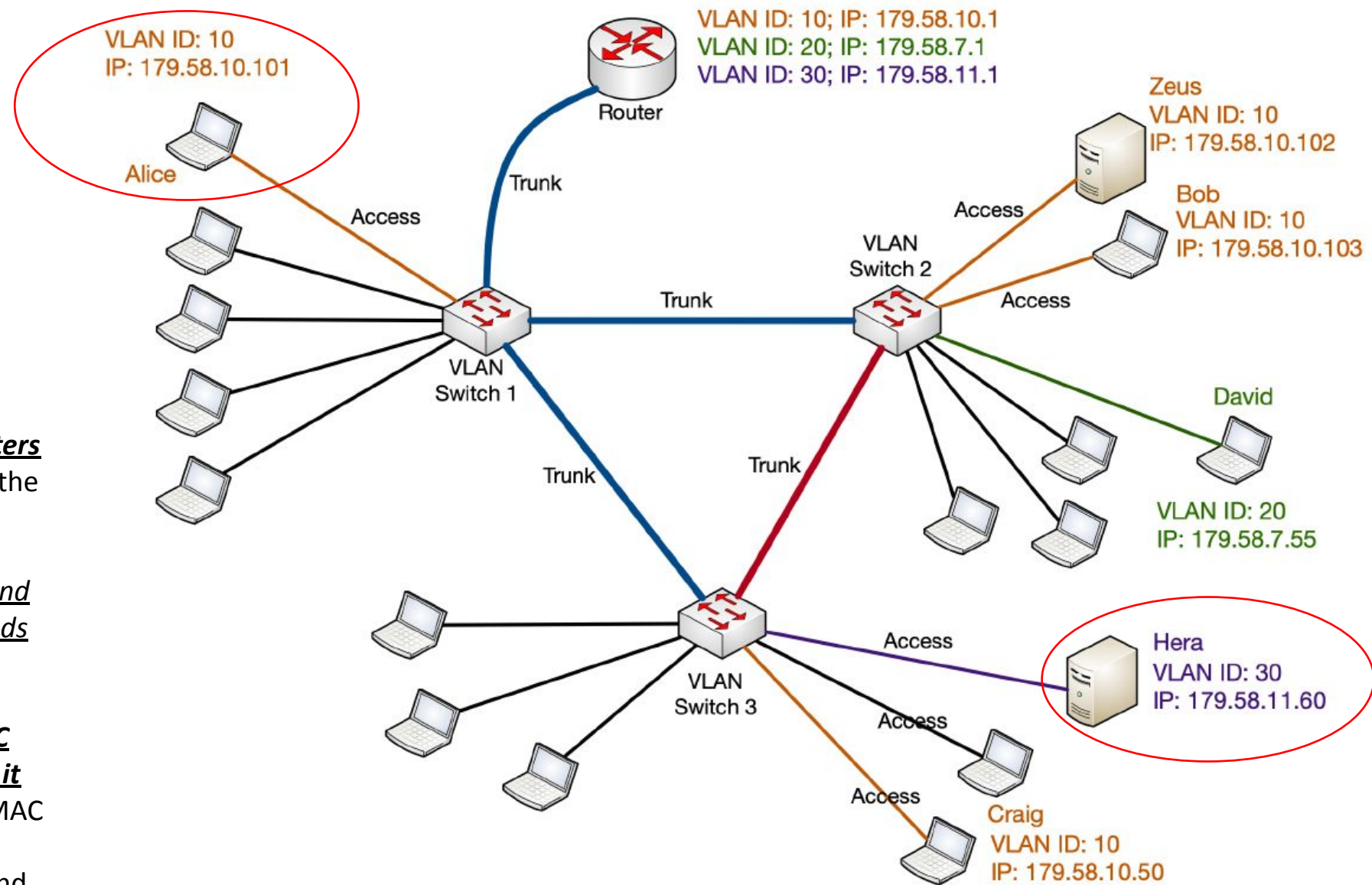

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