Session #2276: ProLiant BL Switch User Interface Lab

Switch Technology Overview

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Solutions and Technology Conference & Expo

Objectives

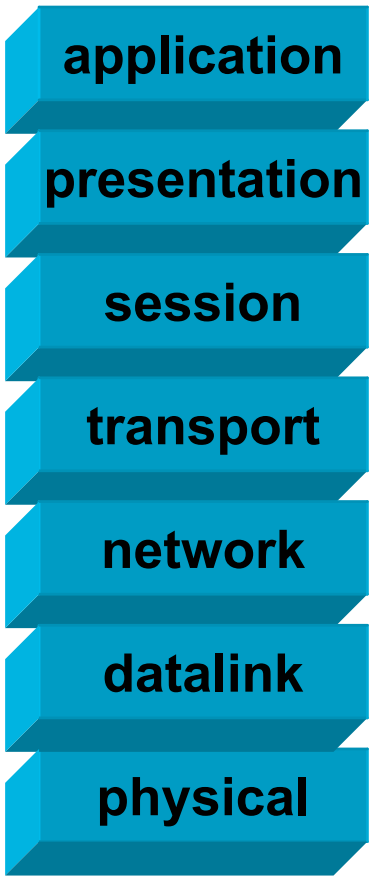
- General networking overview
- Switch technologies for controlling LAN traffic
- Switch Lab (Hands On)

Objectives

- General networking overview
  - OSI model
  - addressing
  - hub vs. switch vs. router
  - LAN vs. WAN

General networking overview

OSI Model



layer 3: packets **(IP addresses)**

layer 2: frames **(MAC addresses)**

layer 1: electrical signals **(bits - 1s & 0s)**

General networking overview

- Addressing
  - MAC (Layer 2)

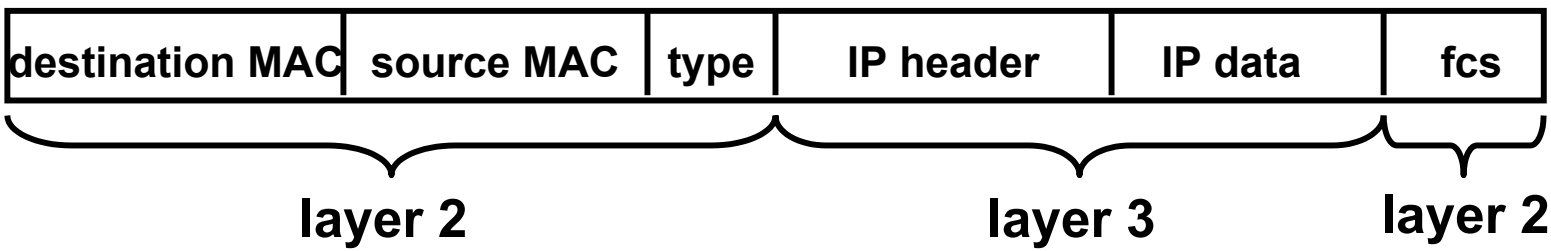
    48 bit address that is assigned to a piece of hardware; typically permanent

    example: 00:02:A5:04:BF:5C or 00-02-A5-04-BF-5C
  - IP (Layer 3)

    32 bit address that is assigned to a computer system; typically temporary

    example: 192.168.1.1

ethernet frame carrying an IP payload



Addressing

- Unicast (one to one)

  A MAC or IP address used by one device to transmit to one device

  - Unicast MAC: 02-A5-00-D0-B5-4E
  - Unicast IP: 192.68.1.1

Addressing

- Broadcast (one to all)

  A MAC or IP address used by one device to transmit to all other devices

  - Broadcast MAC: FF-FF-FF-FF-FF-FF
  - Broadcast IP: 192.168.1.255

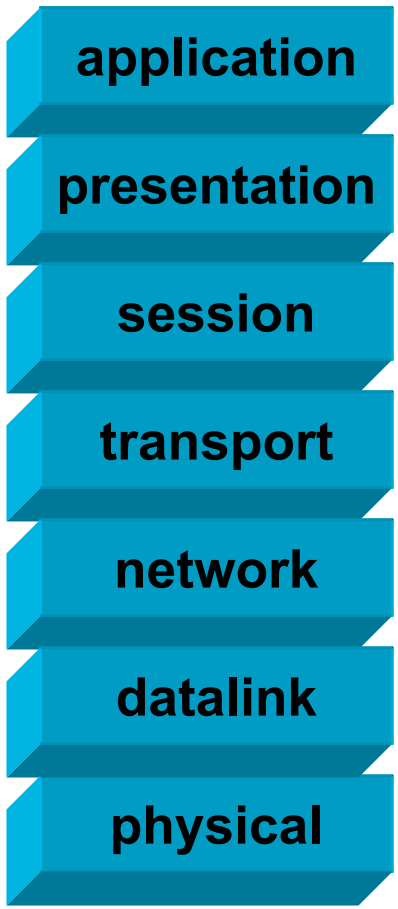
Addressing

- Multicast (one to many)

  A MAC or IP address used by one device to transmit to many other devices

  - Multicast MAC: 01-80-C0-00-00-01
  - Multicast IP : 224.0.0.1

General networking overview – Hub vs. Switch vs. Router



layer 3: router (decision based on IP address)

layer 2: switch (decision based on MAC address)

layer 1: hub/repeater (duplication of electrical signals)

General networking 0verview
Hub vs. Switch vs. Router

- Hubs “repeat” the electrical signal from one port to all other ports
  - No intelligence
  - All hubs connected together belong to the same collision domain
  - Operates at Layer 1 (i.e., repeats electrical signals)
  - Protocol independent

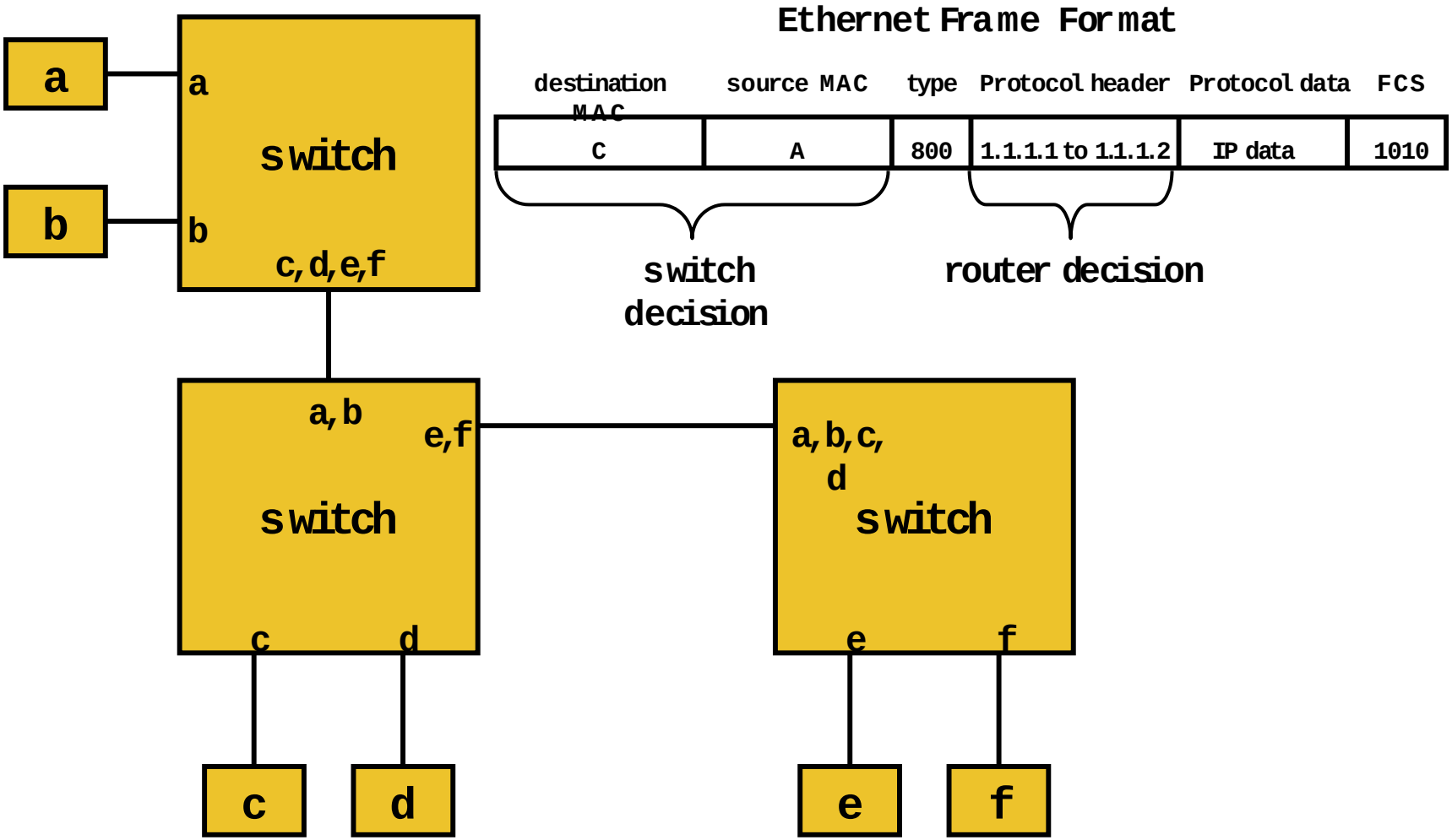
General networking 0verview
Hub vs. Switch vs. Router

- Switches move frames from one port to another
  - Provides intelligence for how frames are moved (switched) between ports
  - Each switch port provides for a separate collision domain
  - All ports on any switch on the same LAN belong to the same broadcast domain (unless using VLANs)
  - Operates at Layer 2 (i.e., makes decisions based on MAC addresses
  - Protocol independent

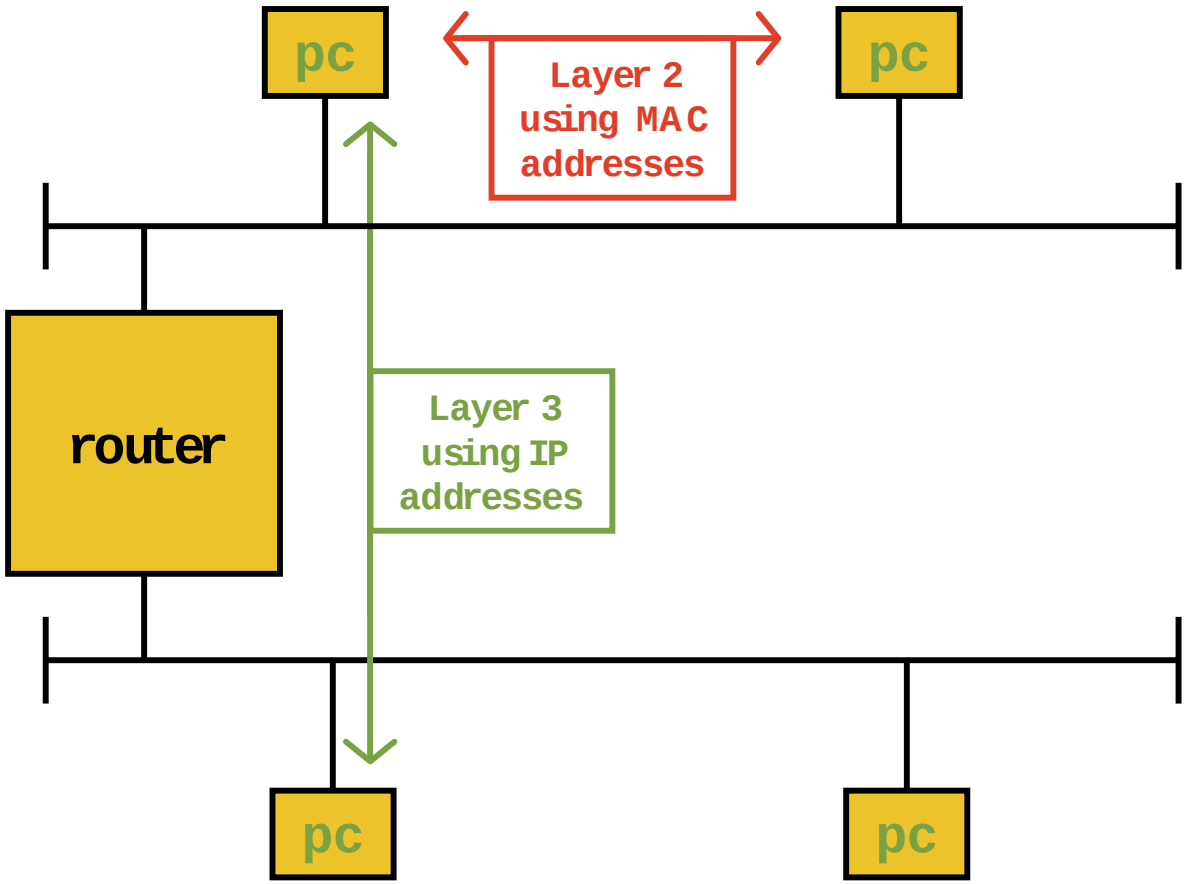
General networking 0verview
Hub vs. Switch vs. Router

- Routers move packets from one network to another
  - Provides intelligence for how packets are moved (routed) between networks
  - Each router port provides for a separate broadcast domain
  - Operates at Layer 3 (i.e., makes decisions based on IP addresses, IPX addresses, etc.)
  - Protocol dependent

General networking overview



General networking overview



Switch technologies for controlling LAN traffic

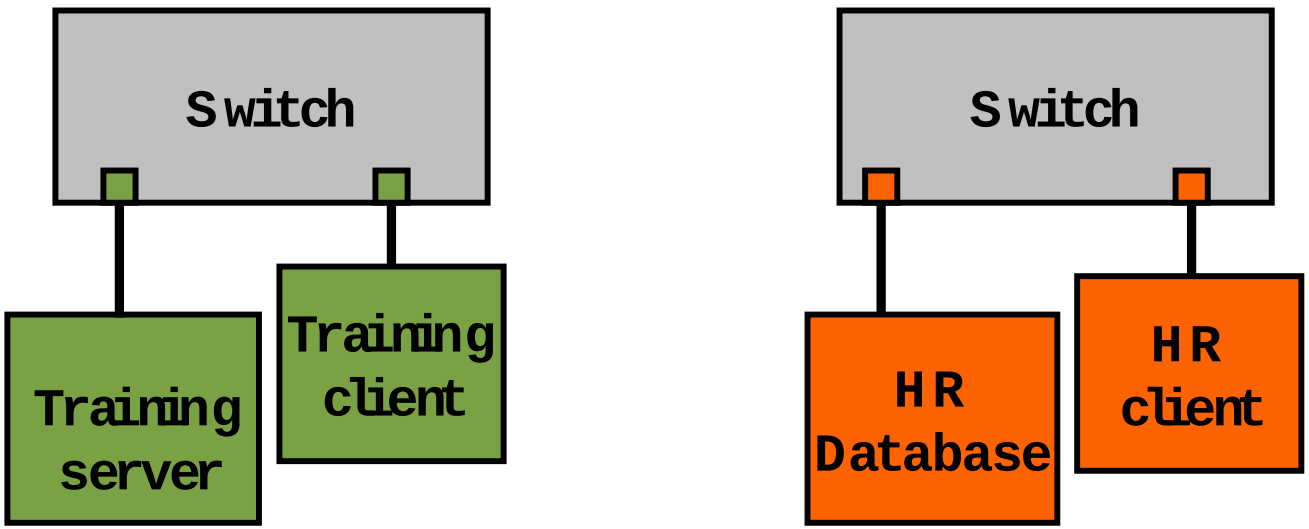
- General networking overview
- Switch technologies for controlling LAN traffic
  - Security
  - Redundancy
  - Bandwidth

Switch technologies for controlling LAN traffic

- Security
  - Virtual Local Area Networks (VLANs)

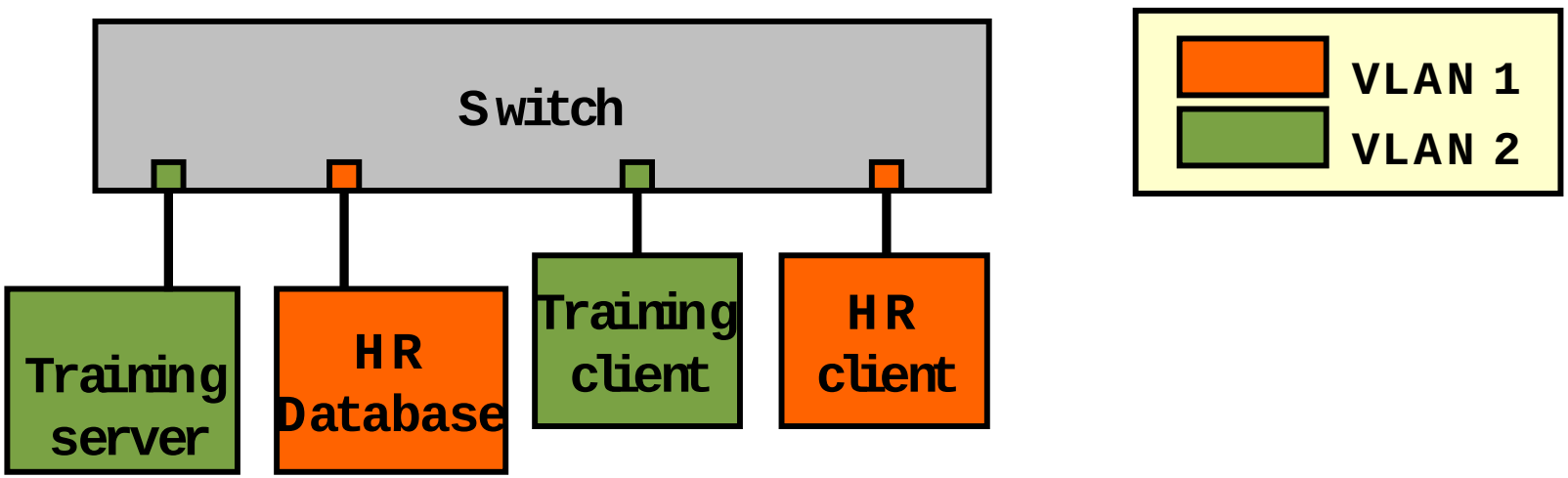
Two physically segregated networks

- HR clients and training clients segregated
- Separate, secure physical networks



Two logically segregated networks using VLANs

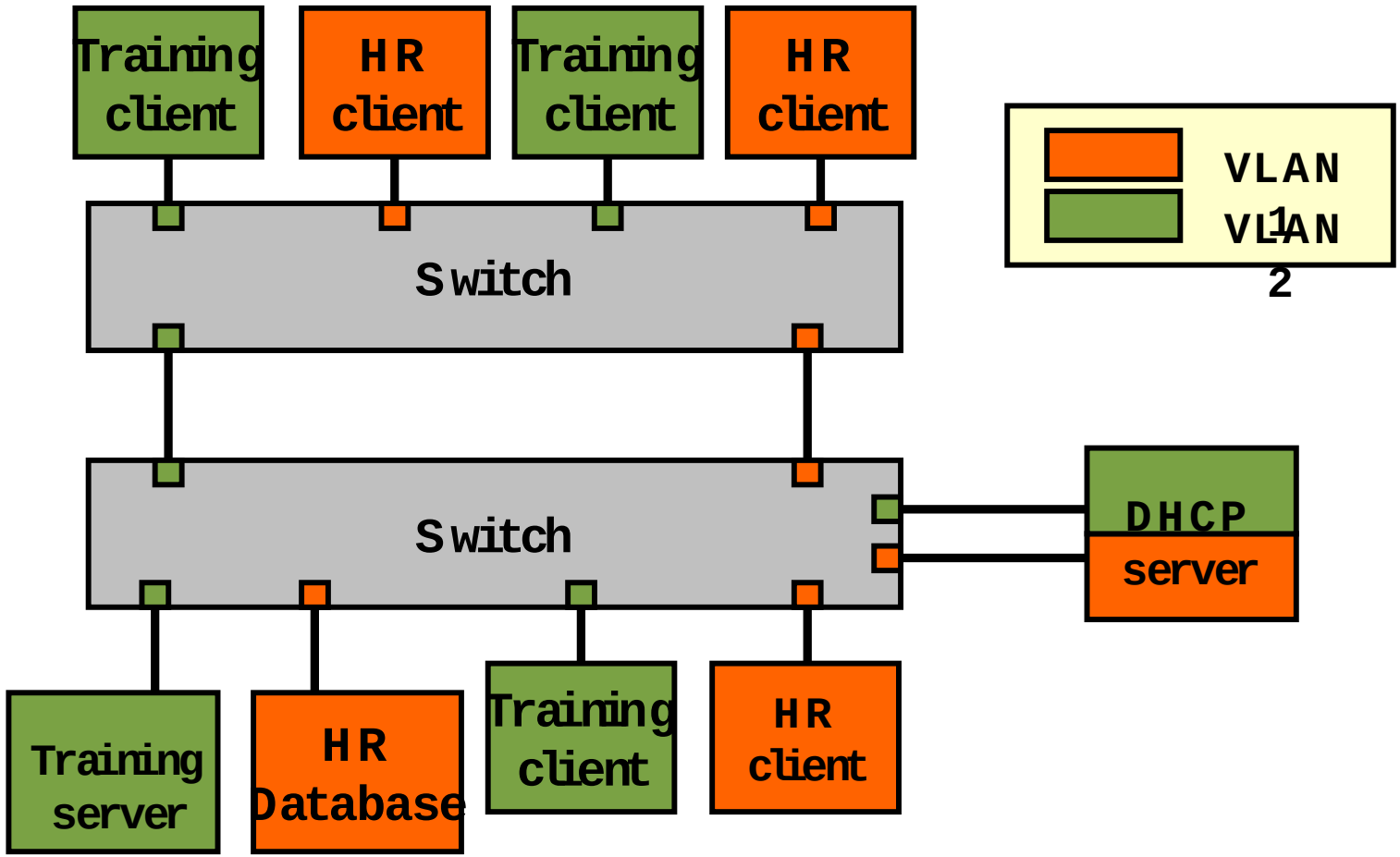
- HR clients and training clients segregated
- Separate, secure logical networks on same physical network



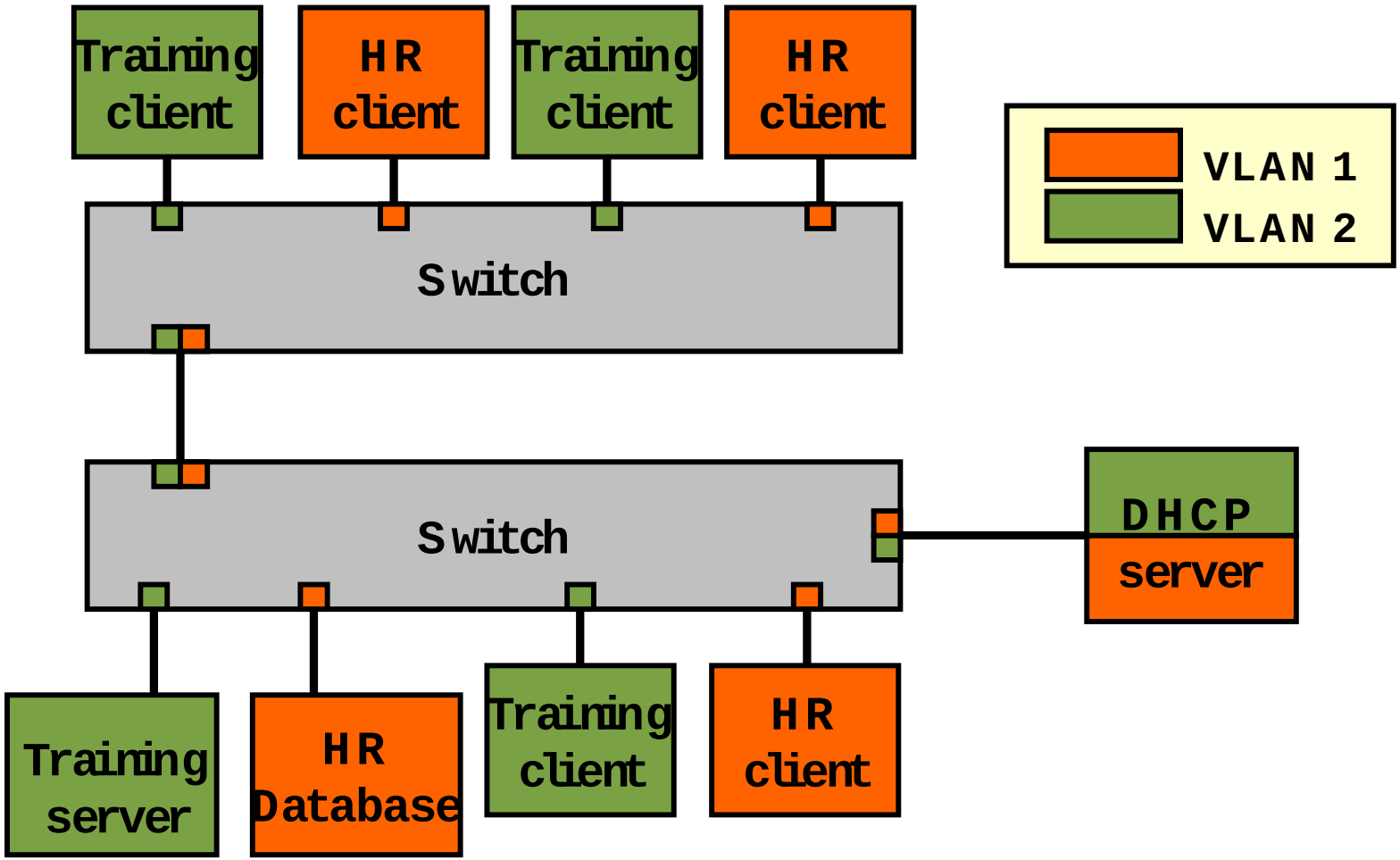
Virtual local area network (VLAN)

- A logical network topology configured in top of a physical network topology
- Logically segments a single Layer 2 network into multiple broadcast domains
- Conserves bandwidth and improves security by limiting traffic to specific groups of devices
- IEEE specification 802.1Q

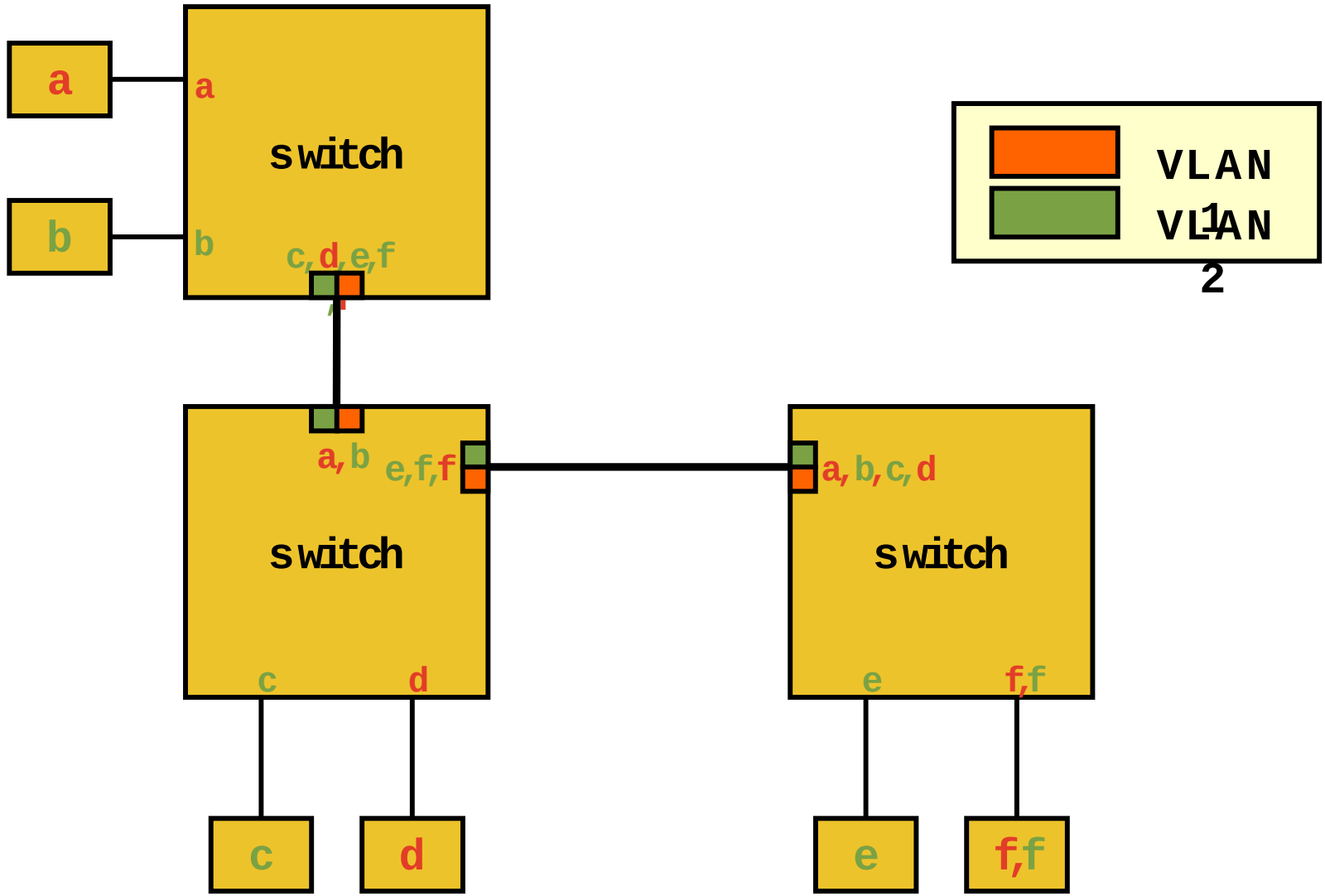
VLANs between two switches



VLANs between two switches using VLAN Tagging

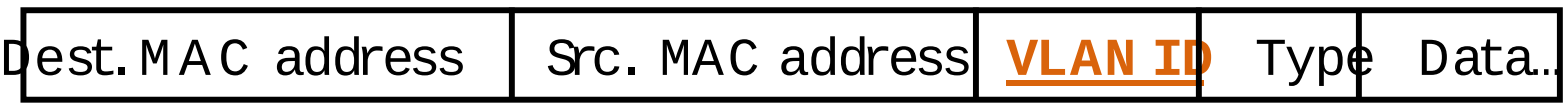


VLANs between three switches



Virtual Local Area Network (VLAN)

- VLAN configuration on switch/server
  - Manual or GVRP (GARP VLAN Registration Protocol)
  - Port can be a member of more than one VLAN (VLAN trunking / VLAN tagging)
- VLAN identification inside each frame
  - VLANs are identified by a number called a VLAN ID
  - 802.1Q VLAN ID added to the Ethernet frame



- Receiving device (switch, server, router) knows which VLAN a frame belongs to by looking at the VLAN ID in the frame

VLAN trunking methods

VLAN Management	VLAN Tagging Protocol	Vendor Support
VTP	ISL 802.1Q	Cisco
GVRP	802.1Q	Multi-vendor Industry standard

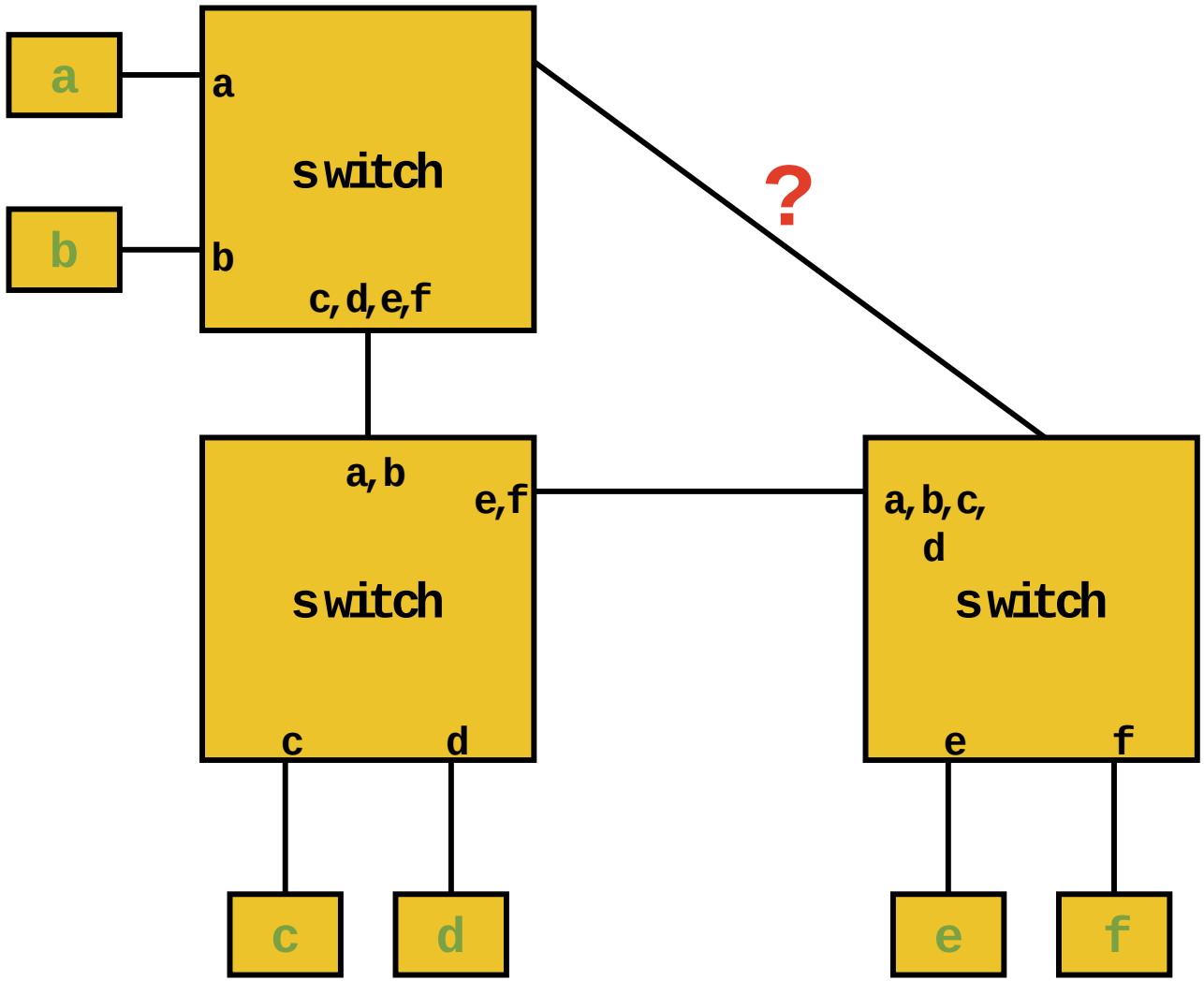
(GVRP = GARP VLAN Registration Protocol, VTP = VLAN Trunking Protocol, ISL = Inter-Switch Link)

- Inter-Switch Link (ISL and 802.1Q VLAN tags are incompatible
- VTP and GVRP are incompatible

Switch technologies for controlling LAN traffic

- Security
  - Virtual Local Area Networks (VLANs)
- Redundancy
  - Spanning Tree Protocol (STP)
  - Port trunking

Switch link redundancy?

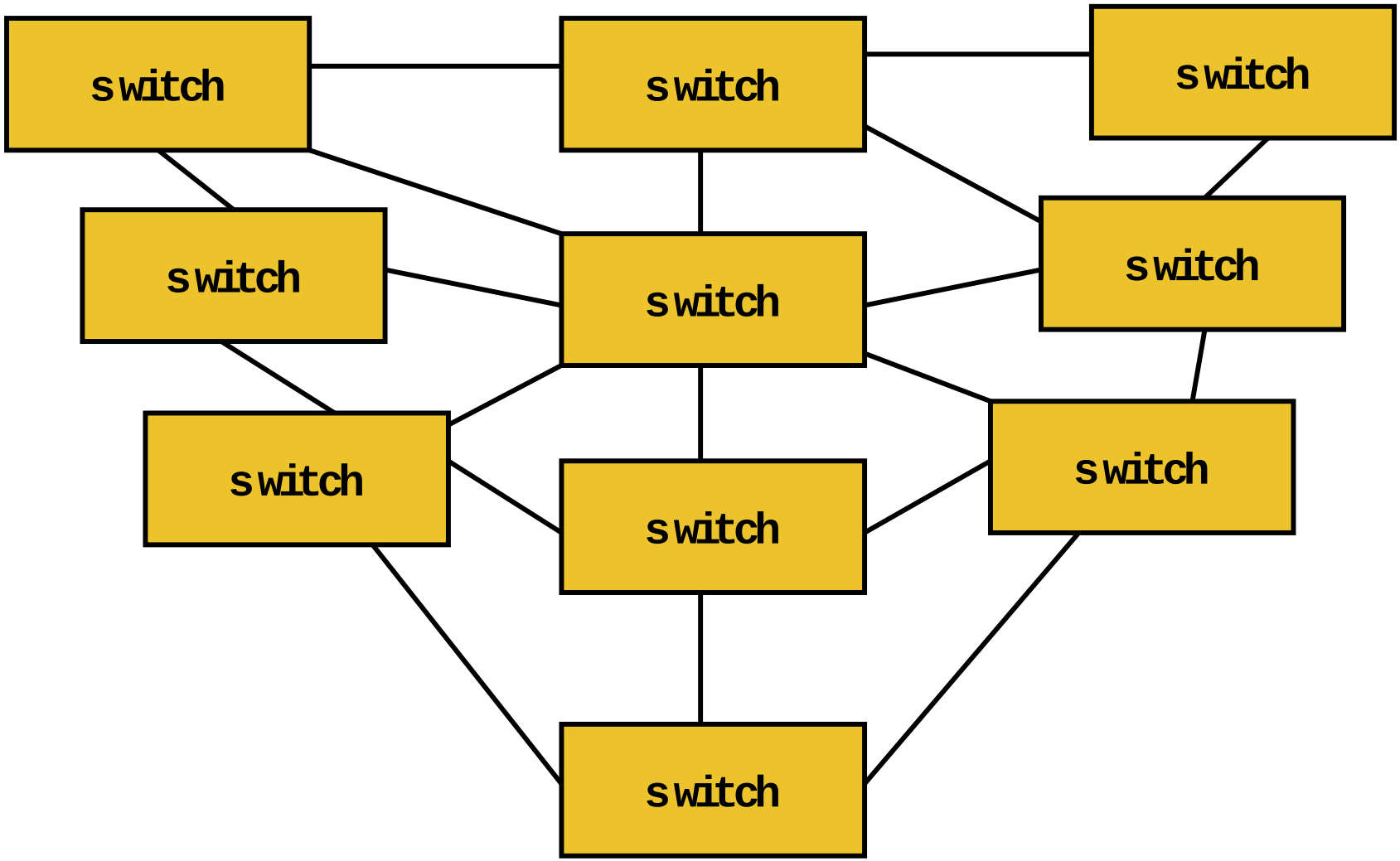


Spanning Tree Protocol (STP)

I think that I shall never see
A graph more lovely than a tree.
A tree whose crucial property
Is loop-free connectivity.
A tree that must be sure to span
So packets can reach every LAN.
First, the root must be selected
By ID, it is elected.
Least cost paths from root are
traced.
In the tree, these paths are placed.
A mesh is made by folks like me,
Then bridges find a spanning tree.

- Radia Perlman
(spanning tree inventor)

Without STP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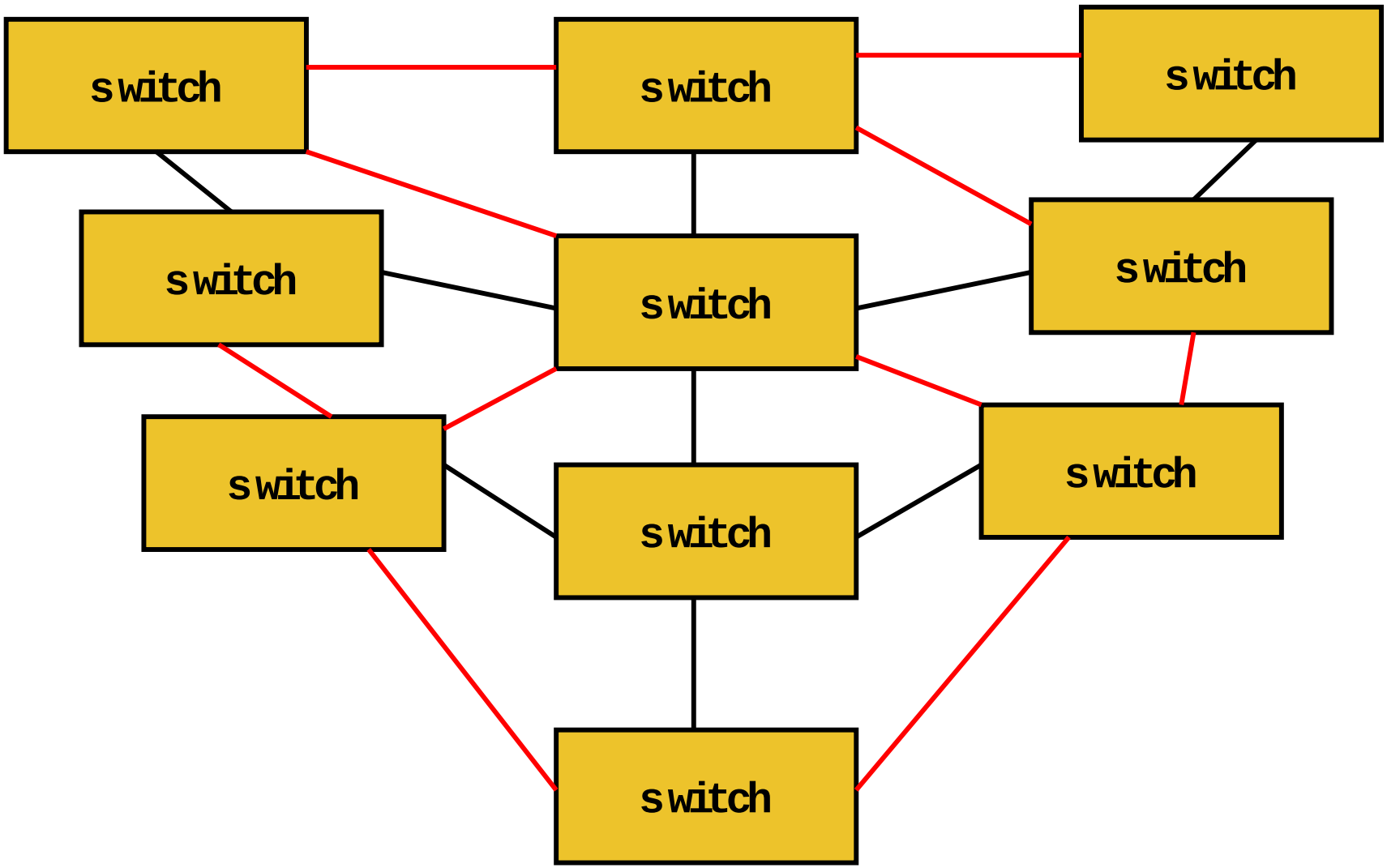
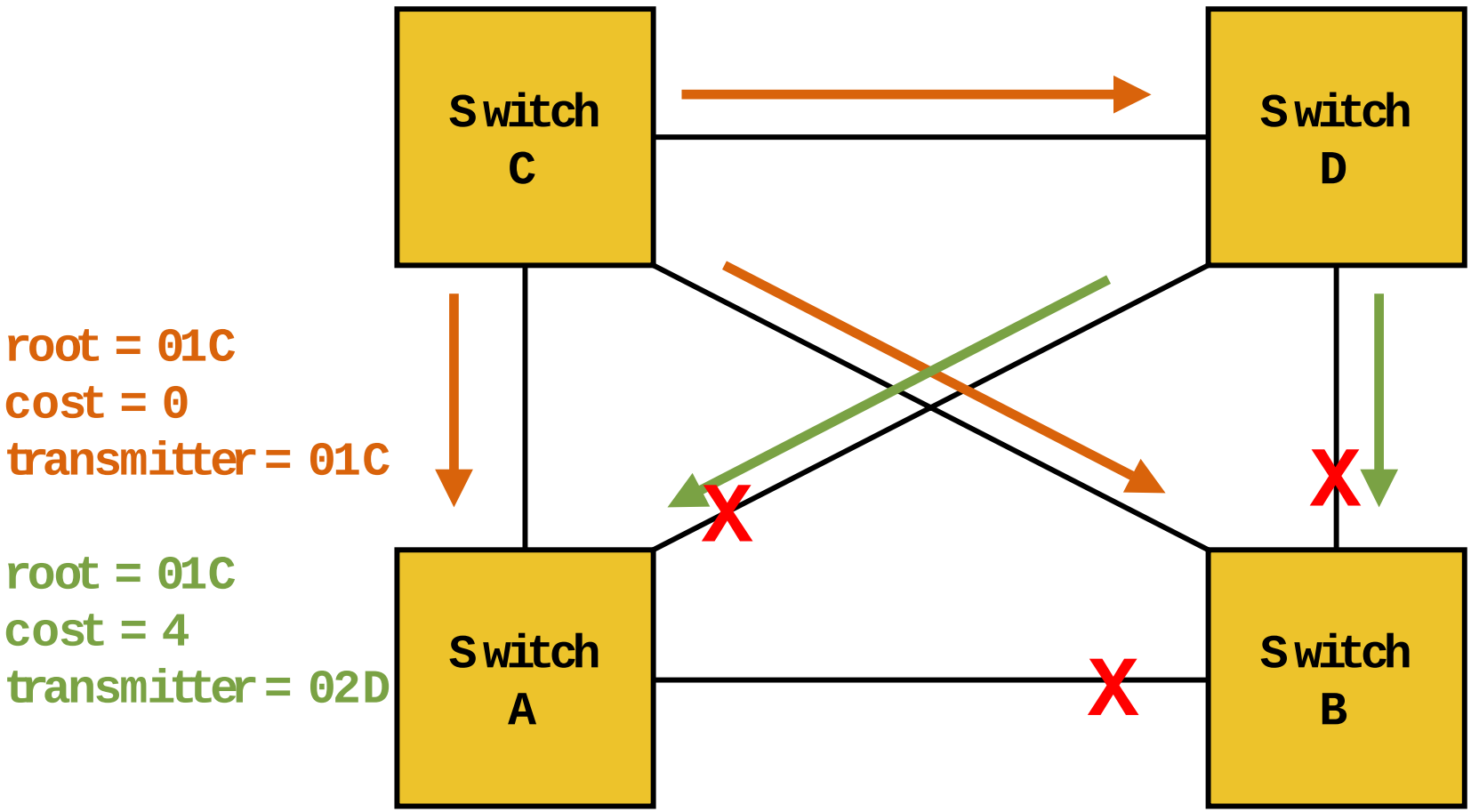
With STP (no loops)



Spanning Tree Protocol (STP)

- Allows blocking of links that form loops between switches
- All switches establish a primary link
- Blocks duplicate links (become standby links)
- Will negatively affect switching functions on the network if duplicate links exist between switches
- IEEE specification 802.1D

Spanning Tree Protocol (STP)



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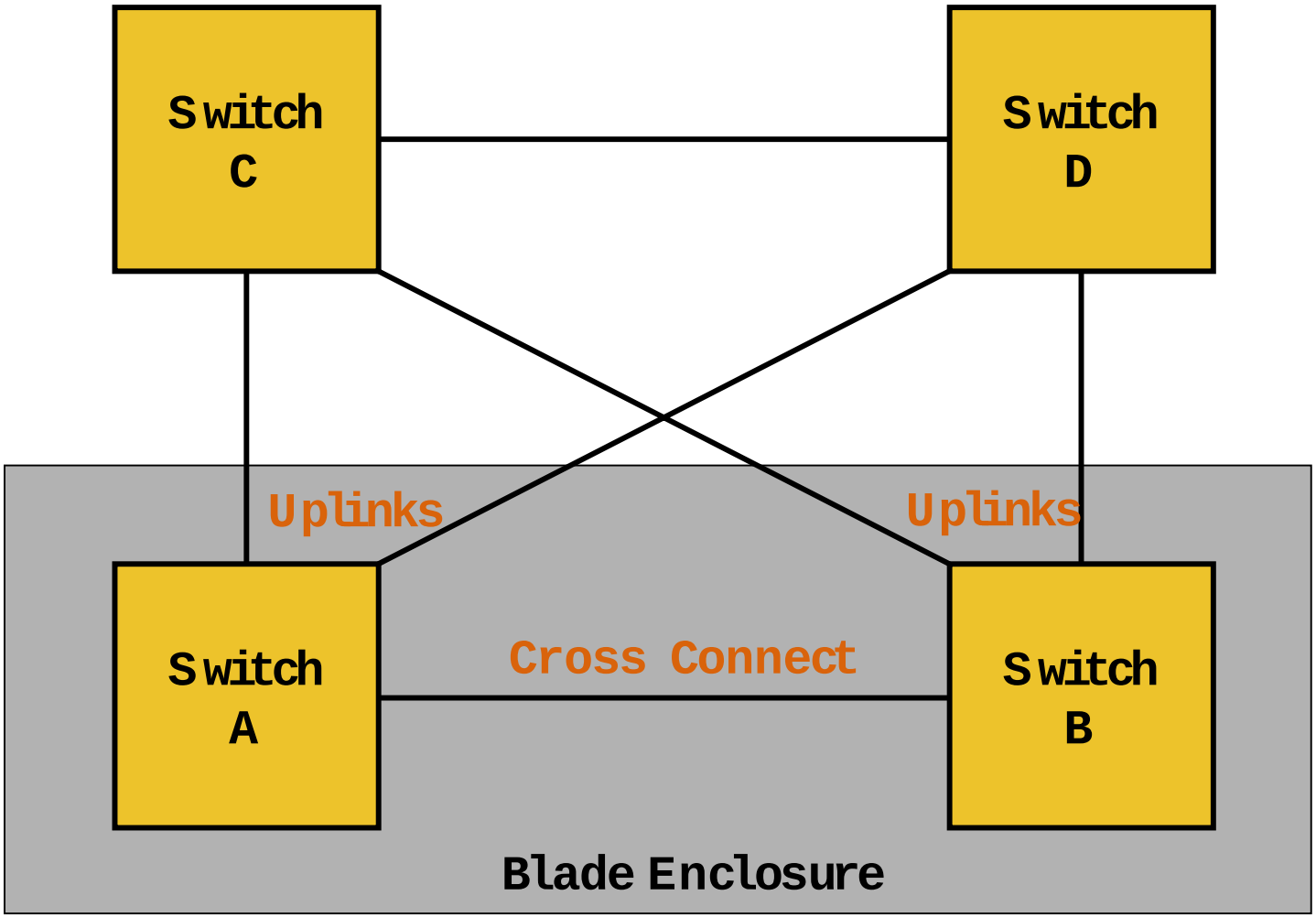

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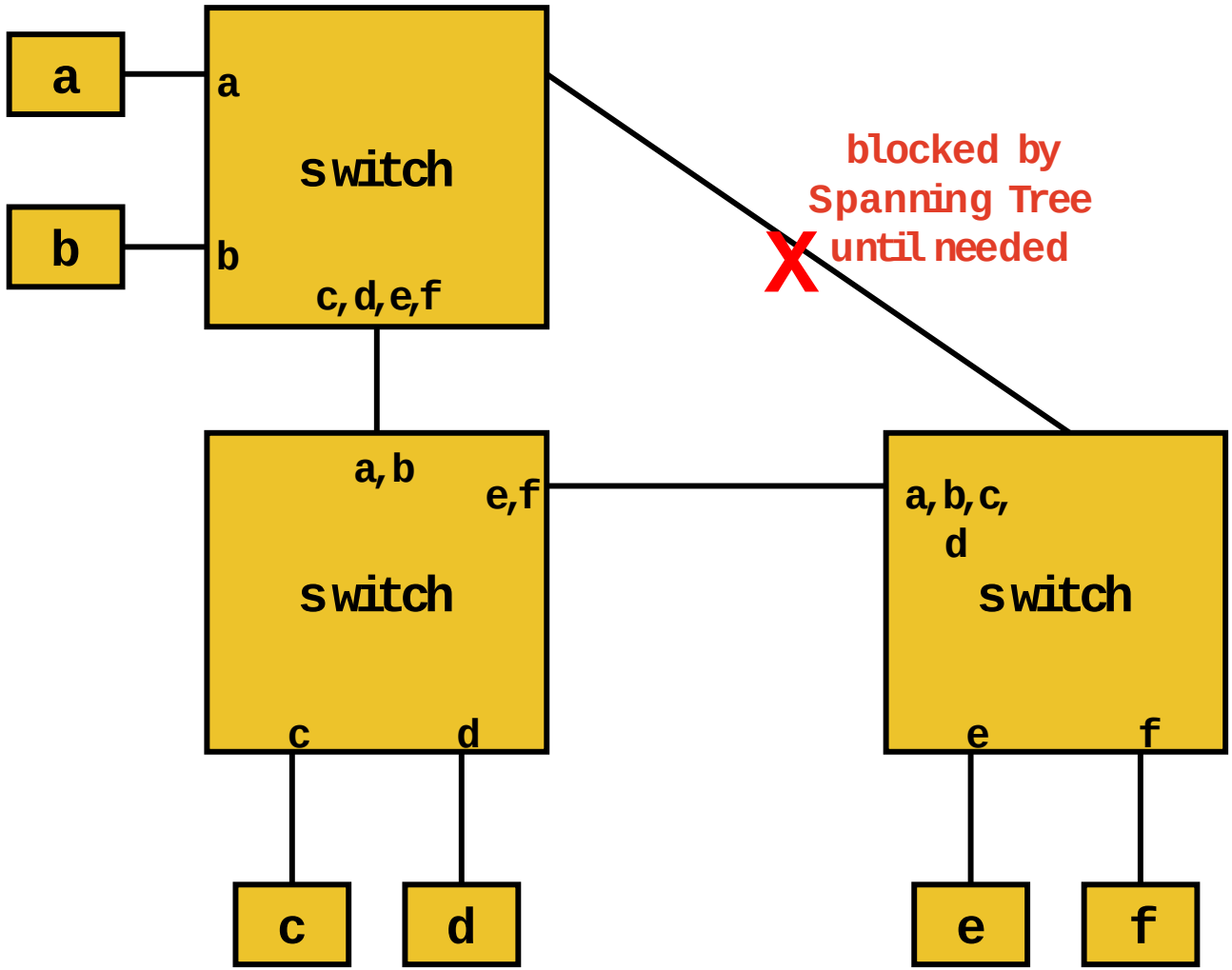
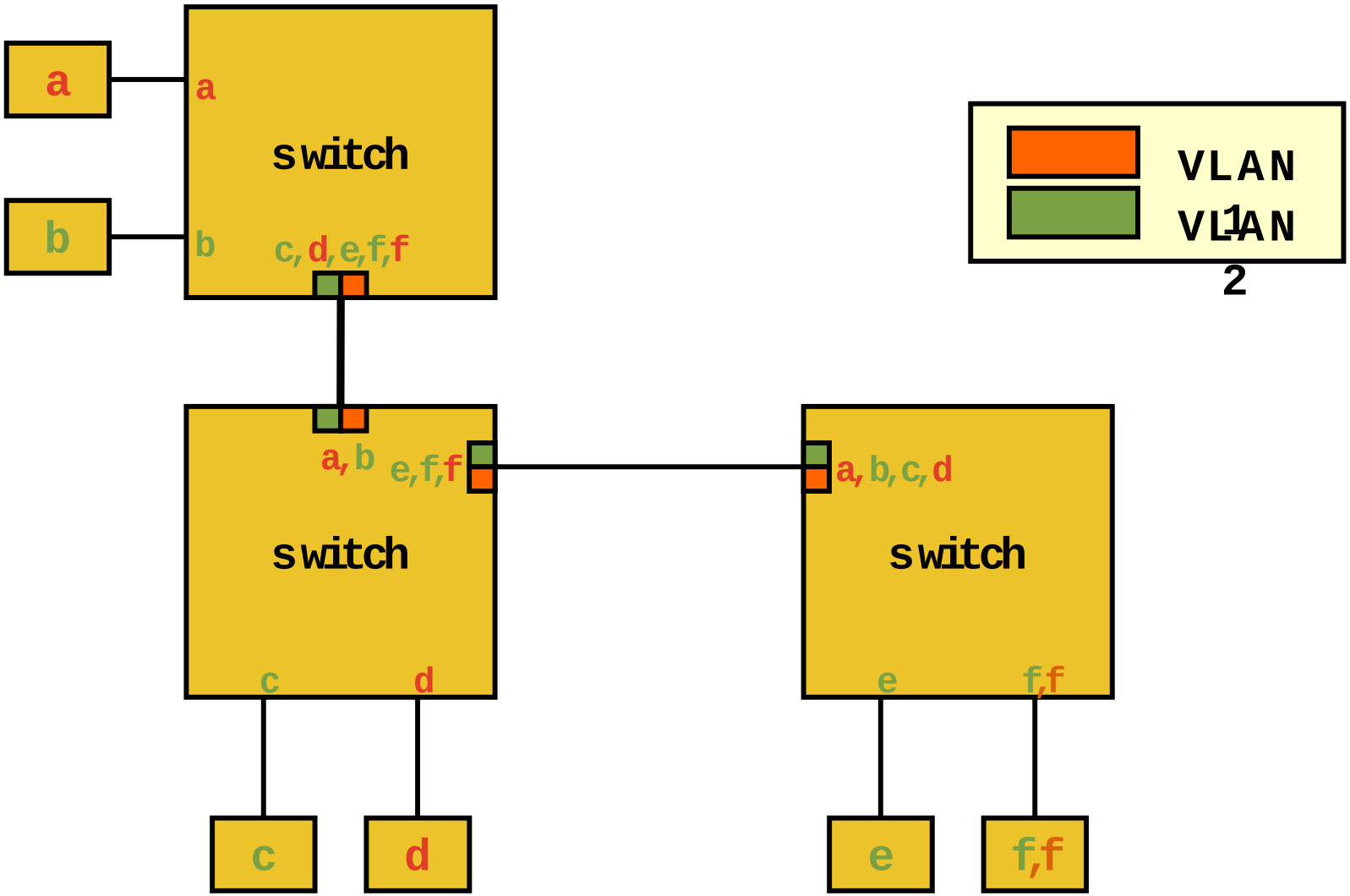
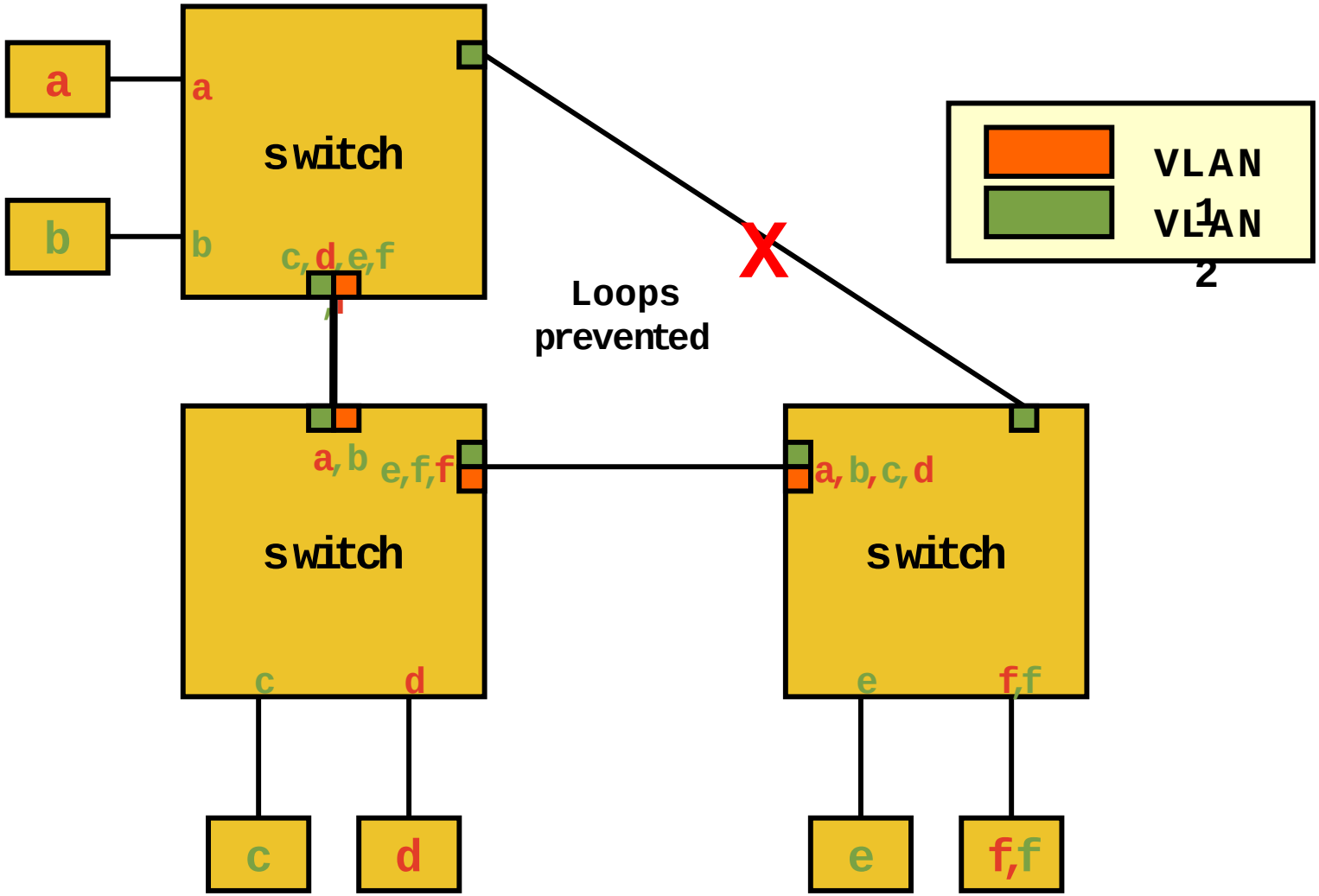


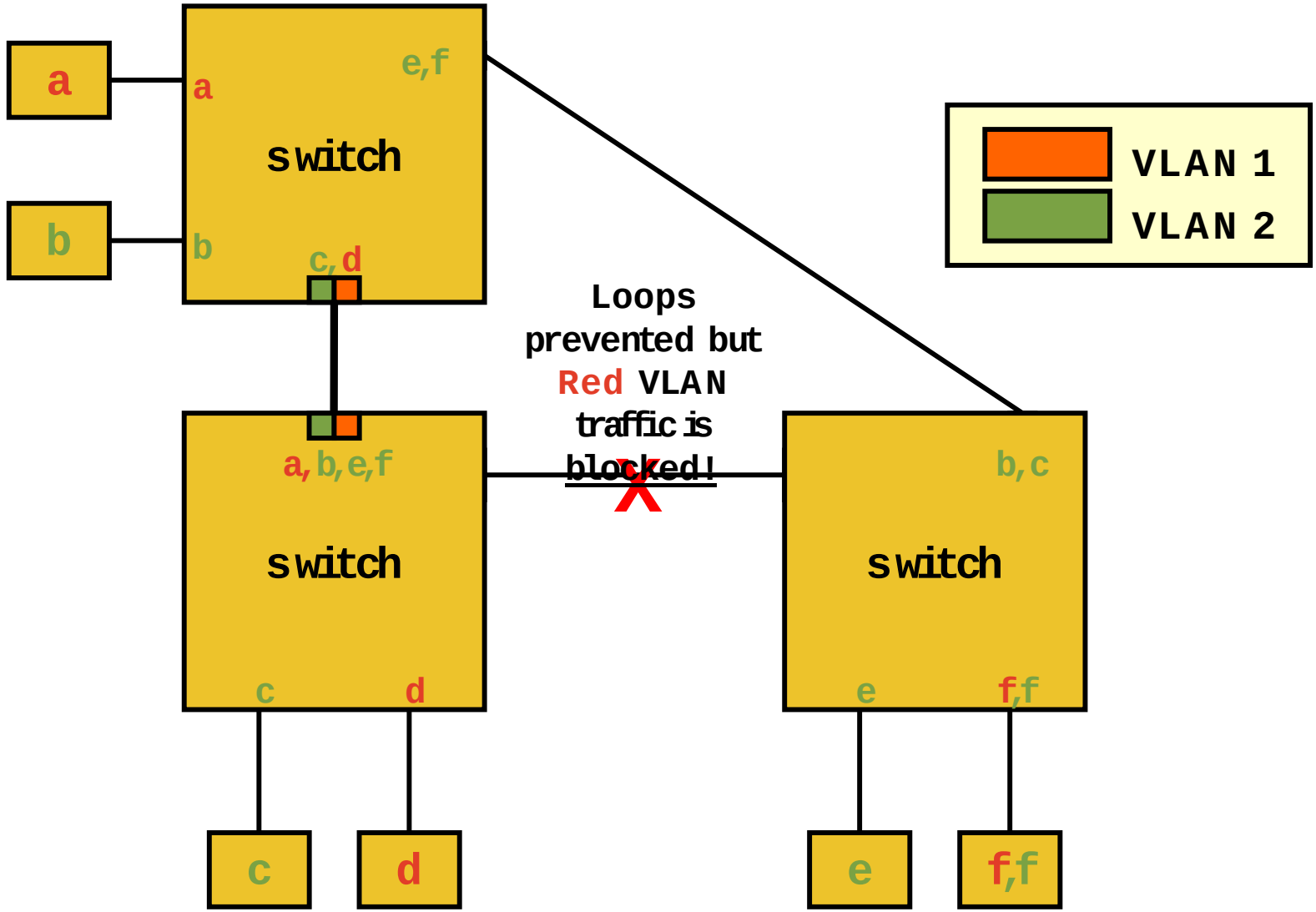
VLANs between three switches (review)



VLANs and STP combined…



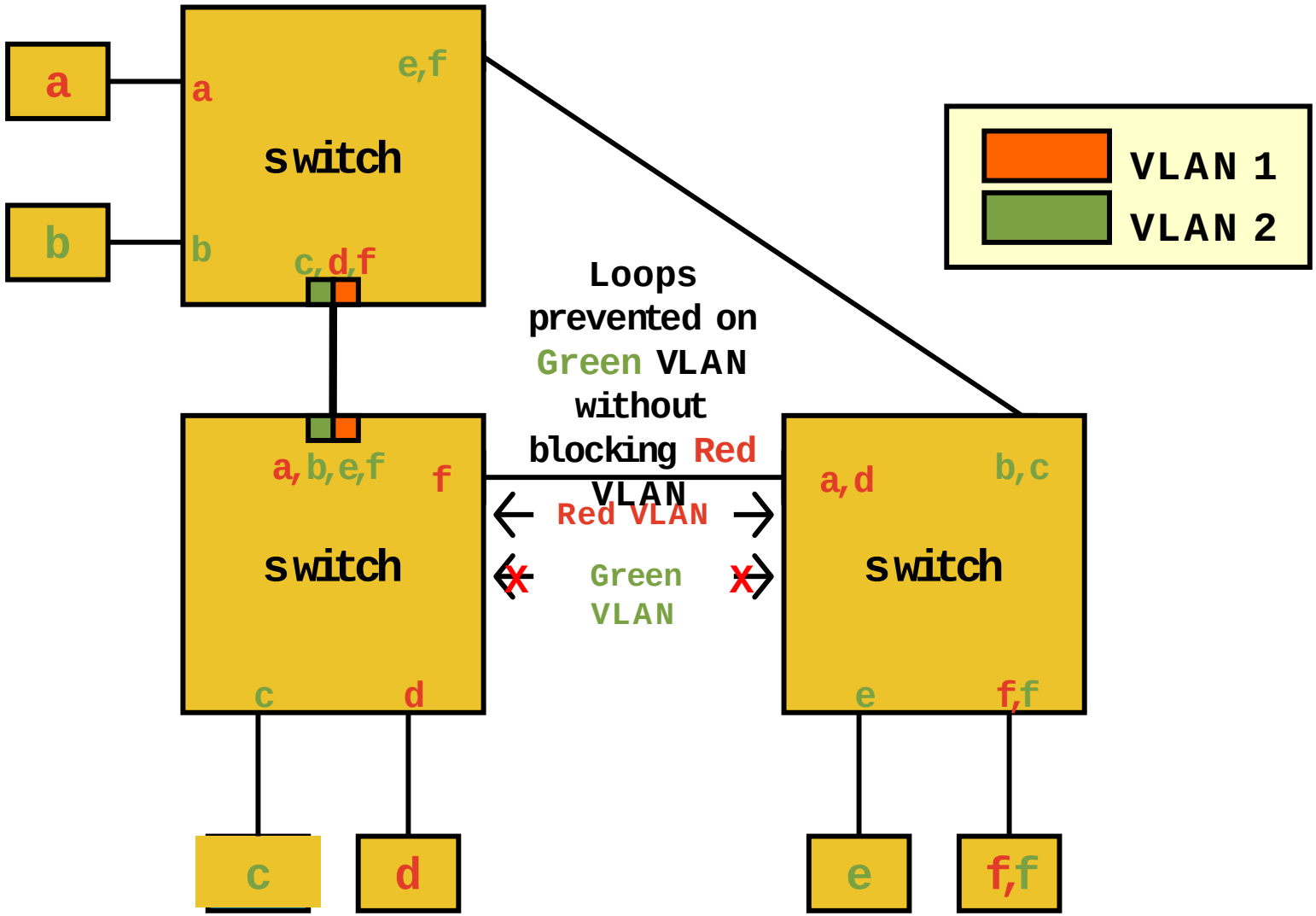
VLANs and STP… (STP unaware of VLANs)



Multiple Spanning Trees (i.e. per-VLAN STP)

- Blocks loops at the VLAN level instead of the port level
- Allows for a separate spanning tree per VLAN
- IEEE specification is 802.1S (extension to 802.1D)
- Cisco methods include PVST, PVST+, MISTP, and MST.

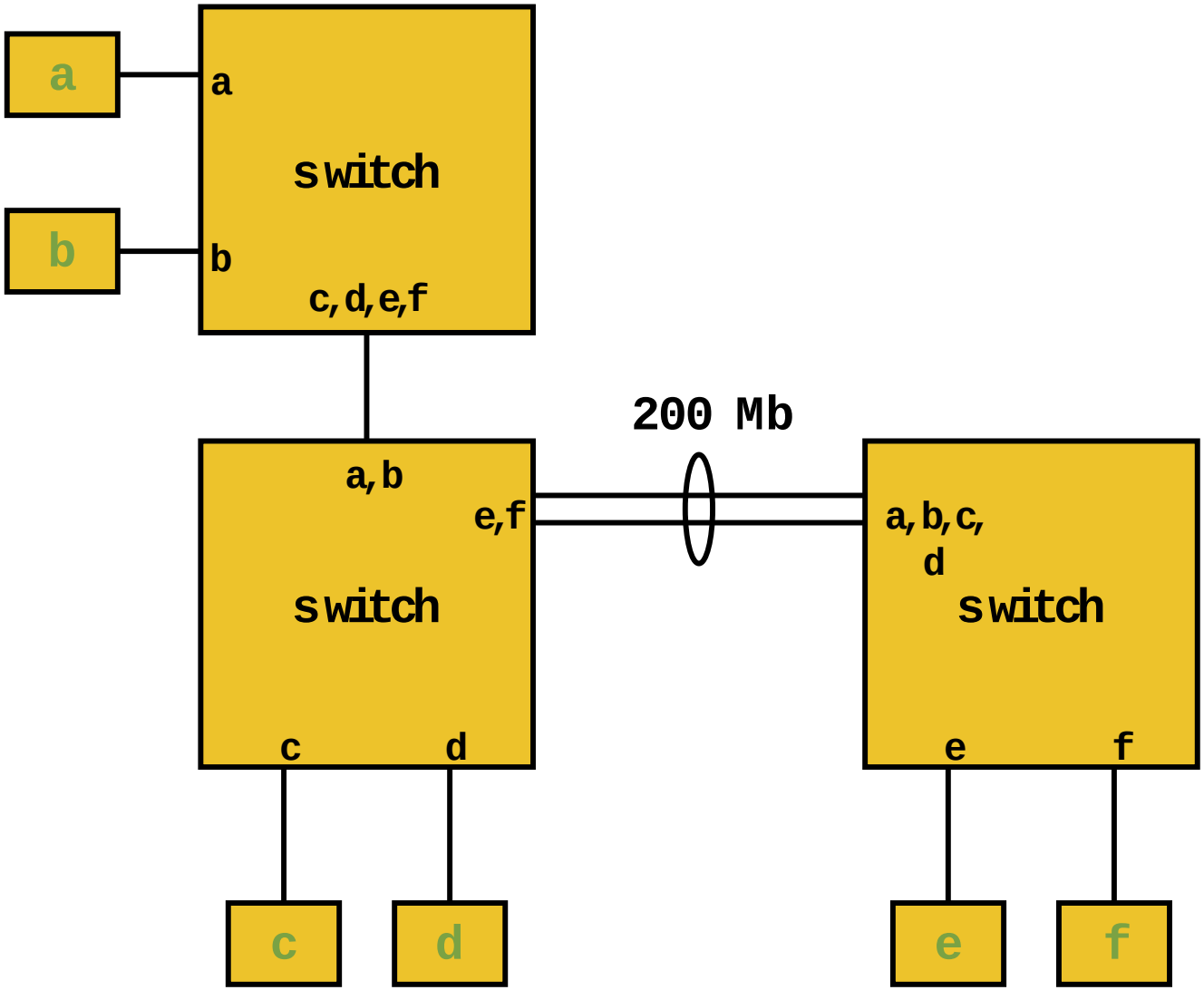
802.1s and VLANs combined…



Switch technologies for controlling LAN traffic

- Security
  - Virtual Local Area Networks (VLANs)
- Redundancy
  - STP
  - Port Trunking

Port trunking for redundancy



Port trunking

- Creates a single virtual port out of many physical ports
- Treated as a single port by the network (i.e. STP)
- Special algorithms are used to load balance traffic across each port in the port trunk
- Frames are not modified in any way for port trunking (unlike VLAN trunking)
- IEEE specification is 802.3ad
- Switch vendors use proprietary names for port trunking:
  - Called EtherChannel by Cisco
  - Called MLT (MultiLink Trunking) by Nortel

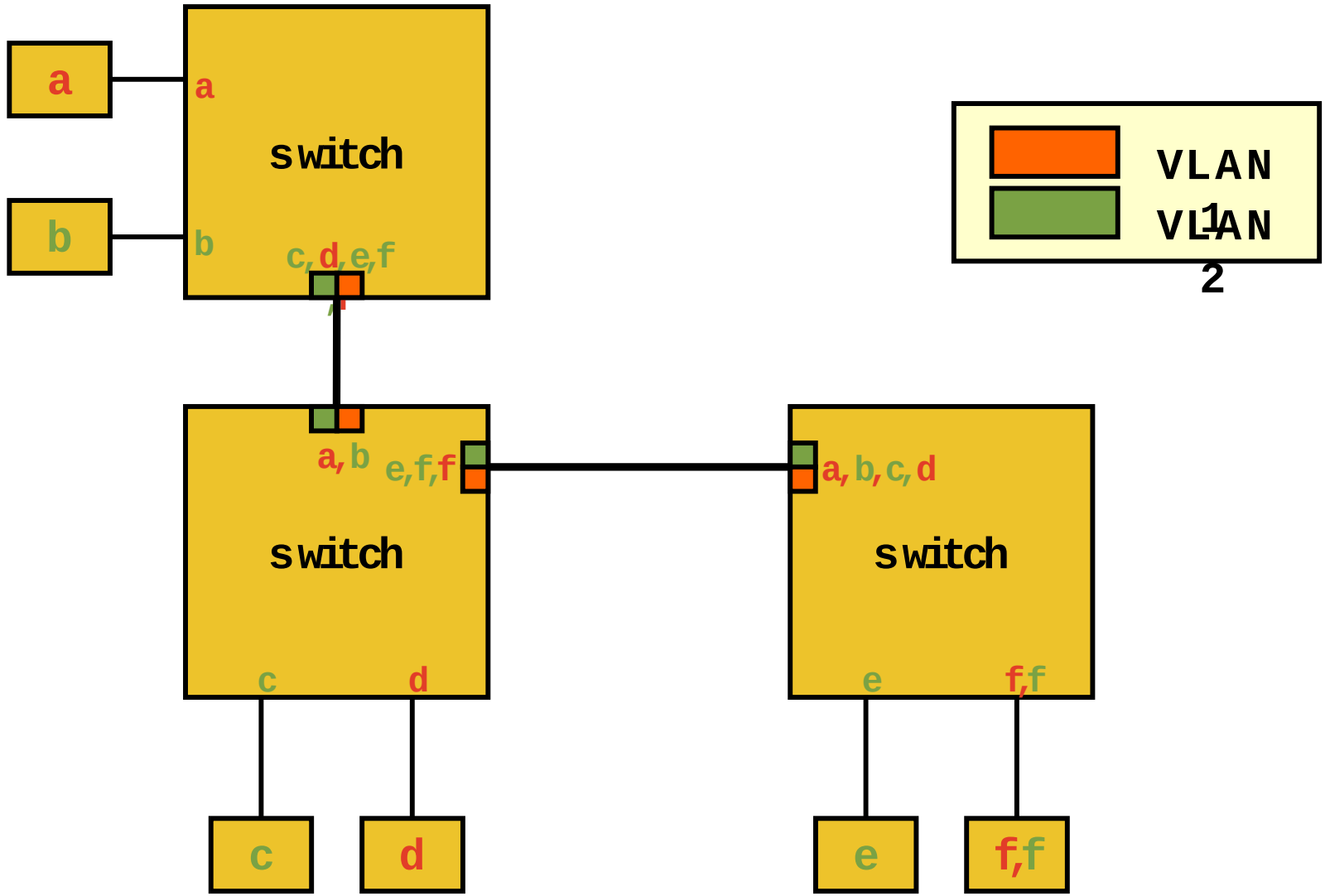
Trunking Terminology

Cisco	Multi-Vendor
Trunking	VLAN trunking
Channeling	Port trunking

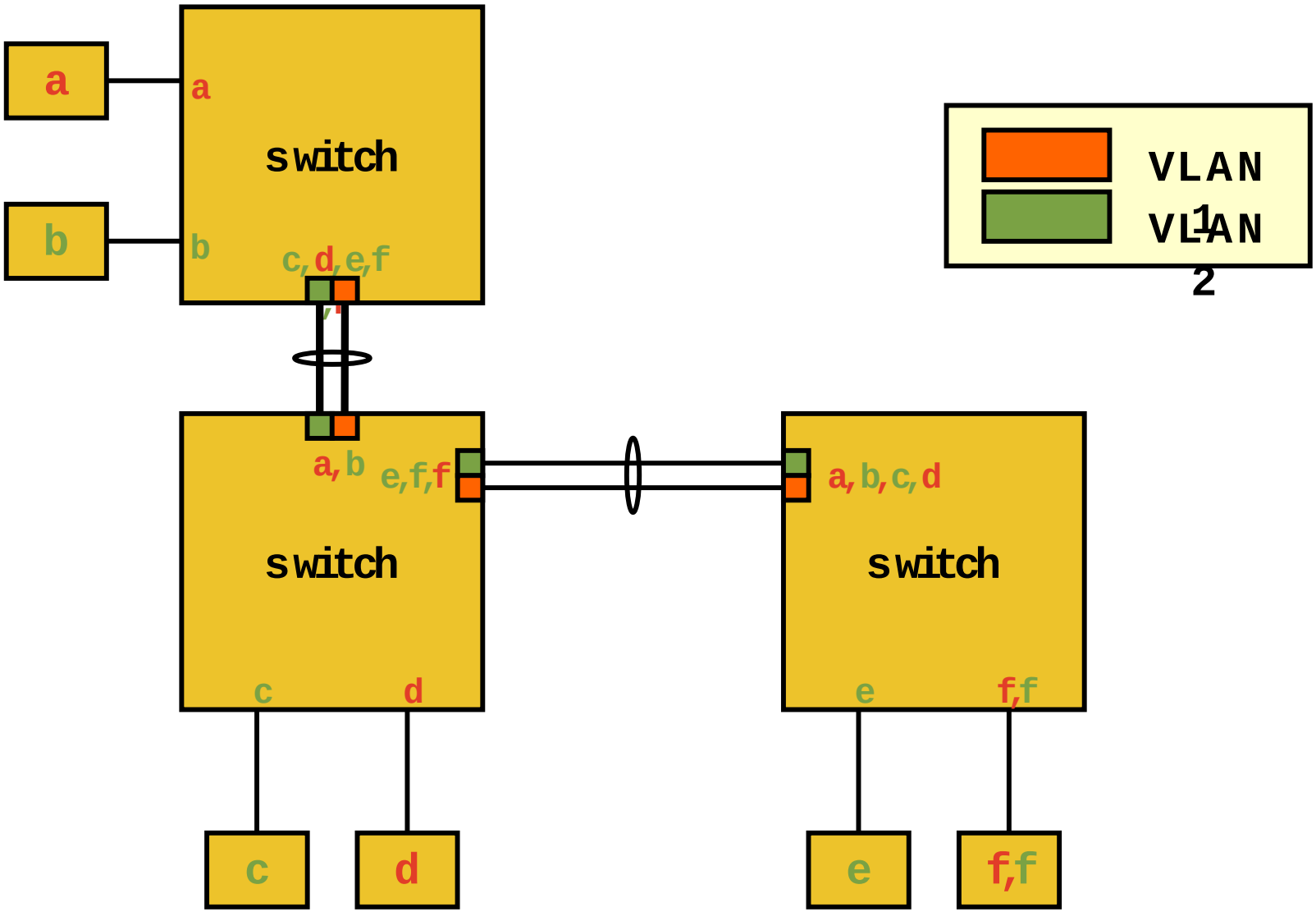
2 physical links configured as 1 virtual link

1 link (virtual or physical) configured to carry multiple VLANs

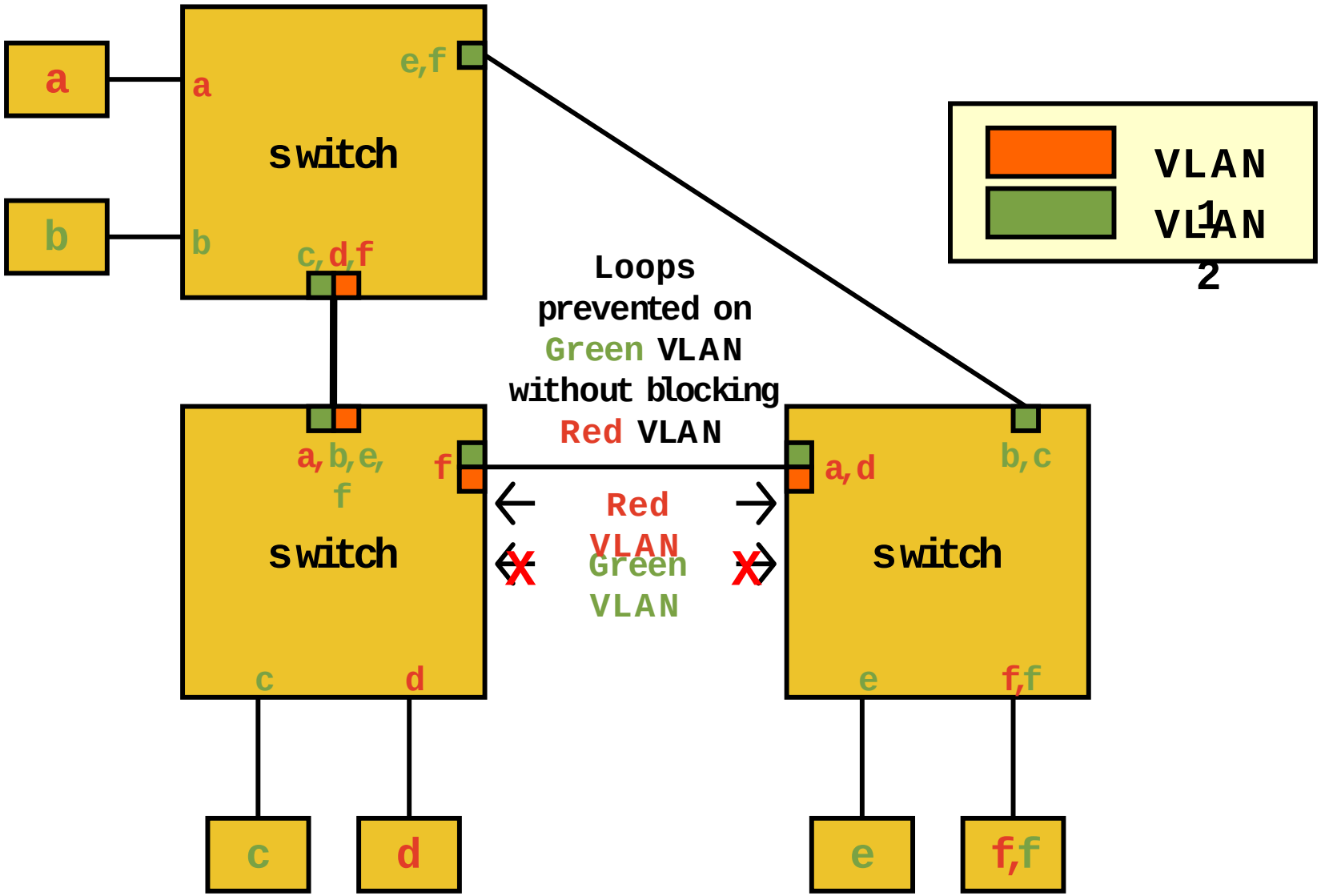
VLANs between three switches (review)



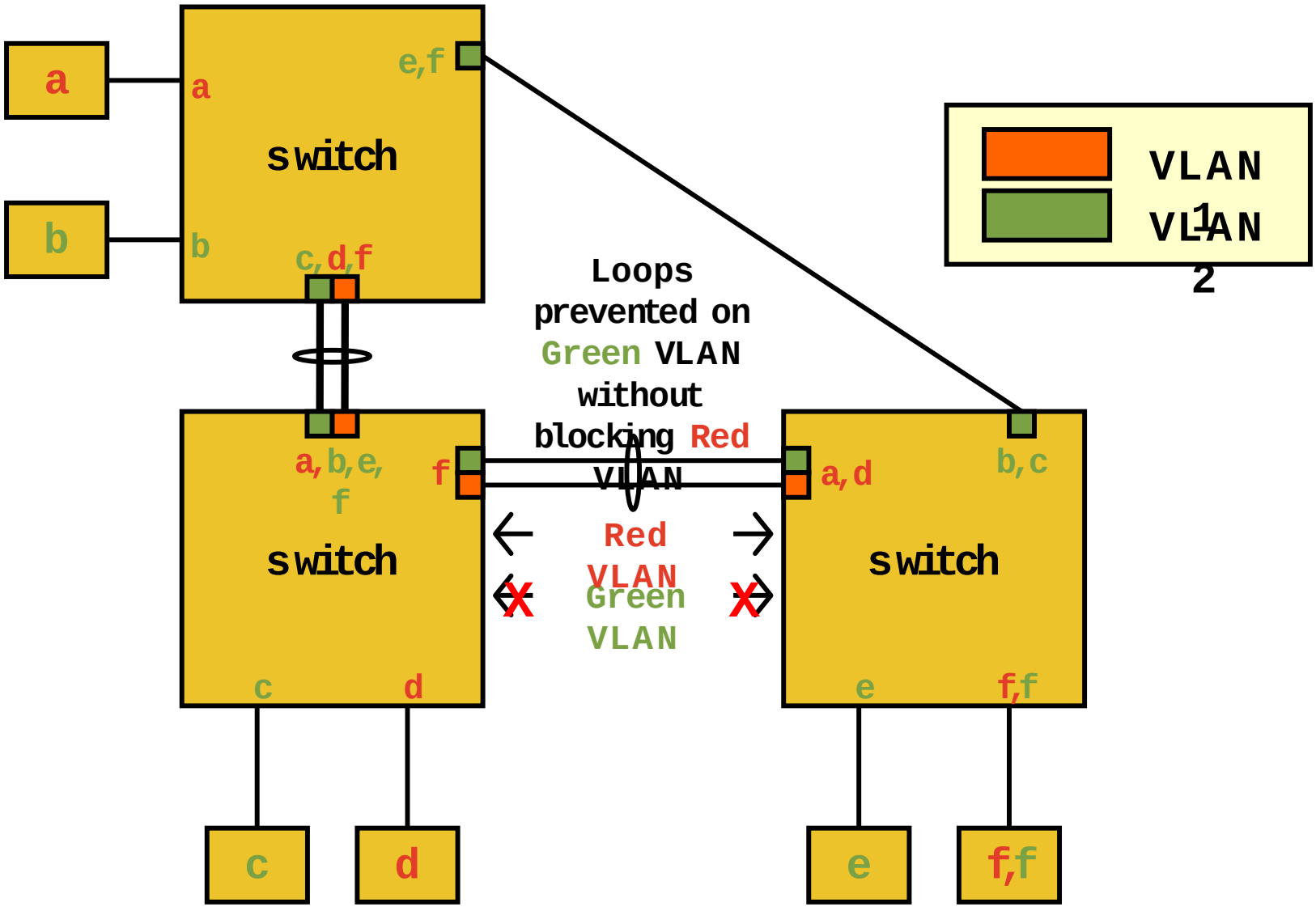
VLAN trunking and port trunking combined...



802.1s and VLANs combined… (review)



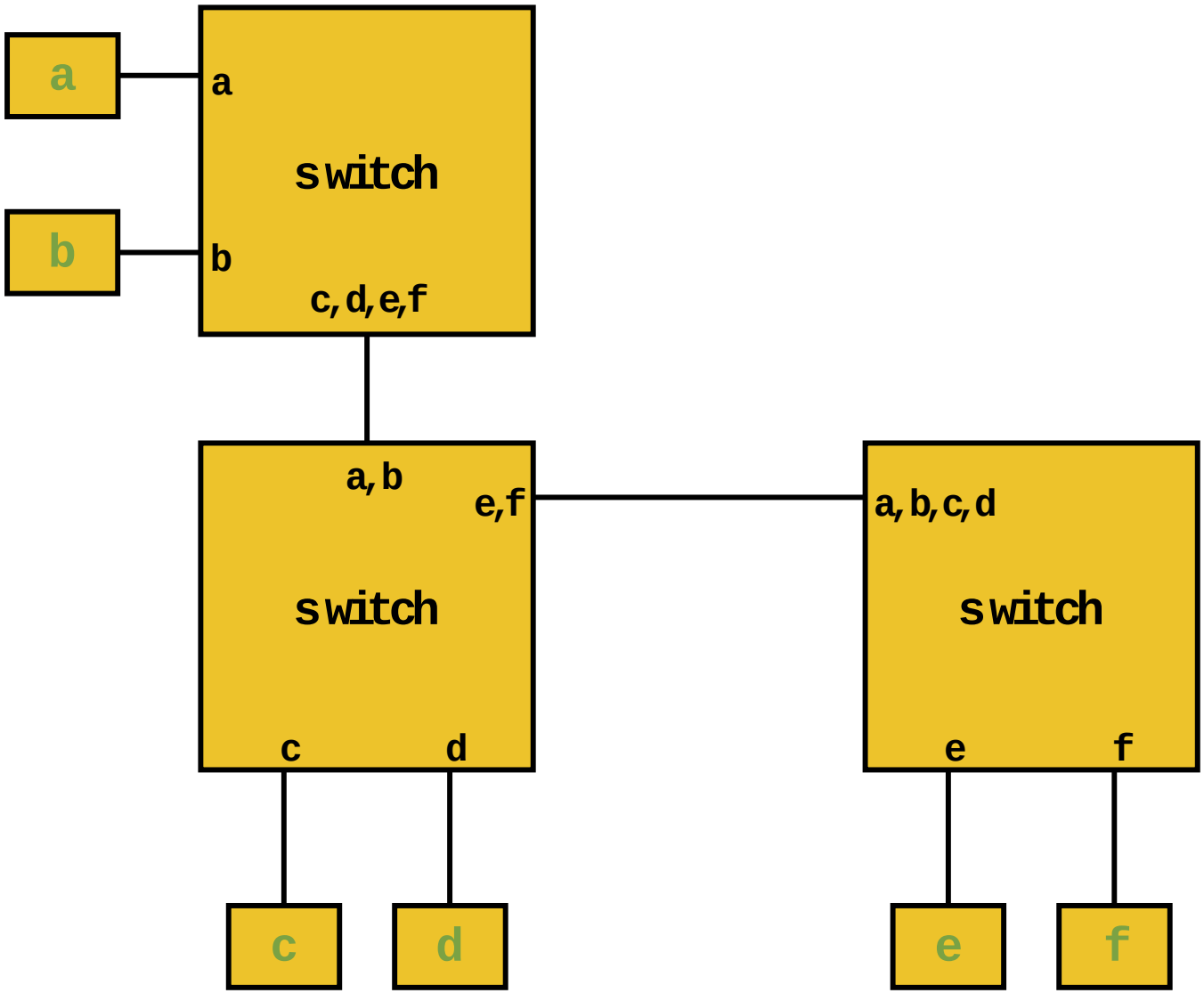
VLAN trunking, port trunking, and STP combined…



Switch technologies for controlling LAN traffic

- Security
  - Virtual Local Area Networks (VLANs)
- Redundancy
  - STP
  - Port Trunking
- Bandwidth
  - Controlling traffic
    - IGMP
    - QoS/CoS

Unknown Unicast , Multicast, and Broadcast control



Switch technologies for controlling LAN traffic

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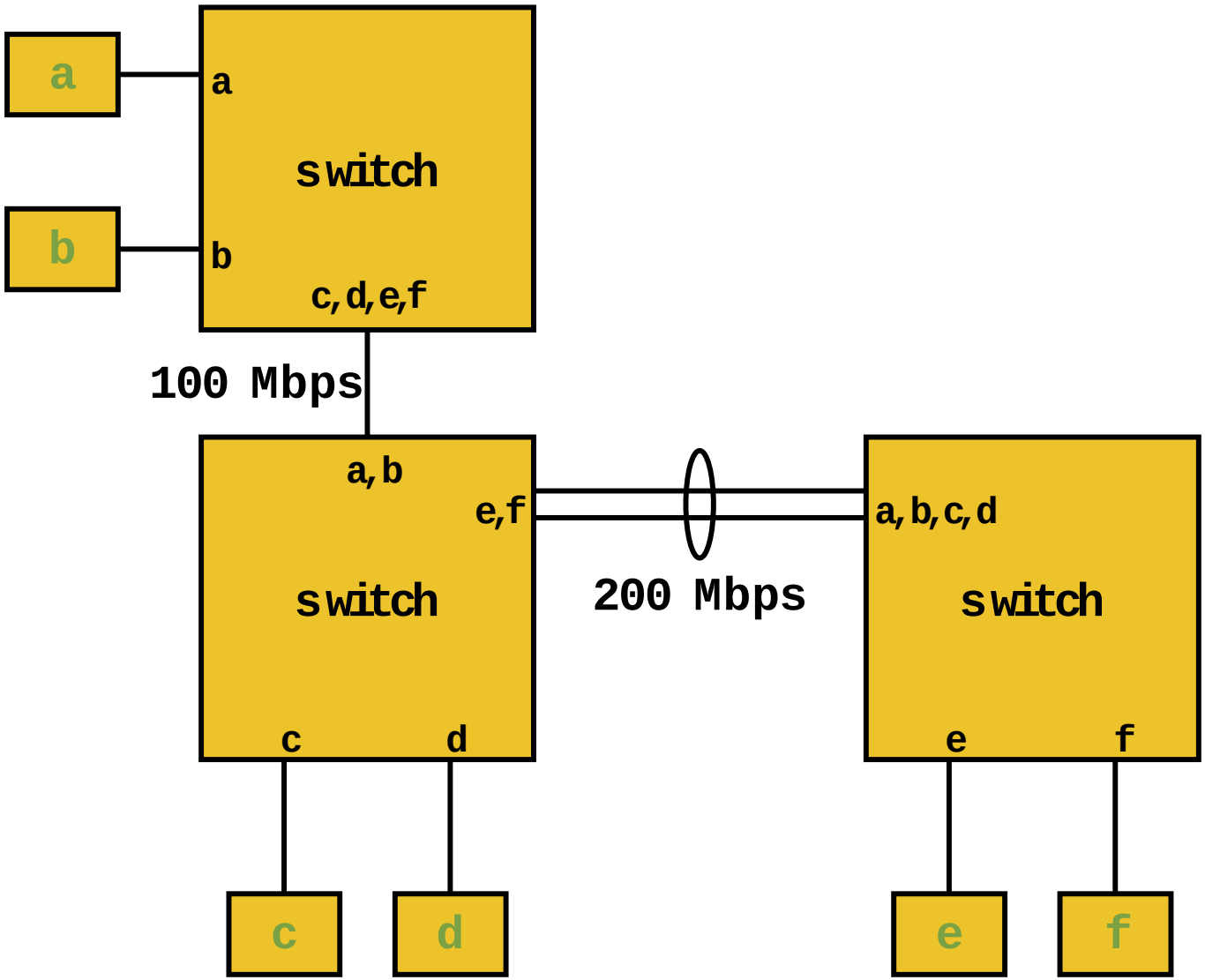
    - IGMP
    - QoS/CoS
  - Upgrade options
    - Port Trunking

Port trunking for increased bandwidth



switch technologies for controlling LAN traffic

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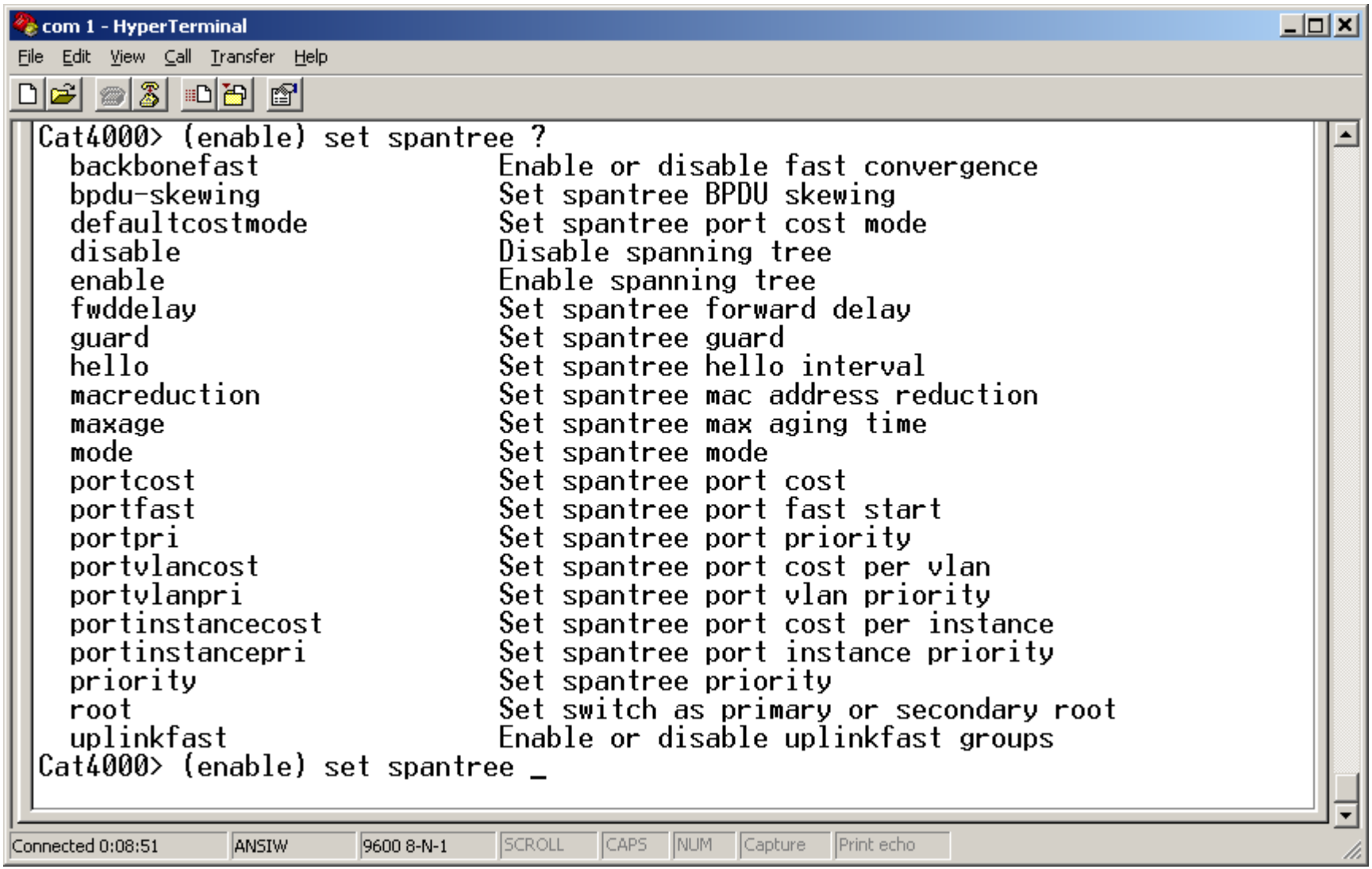
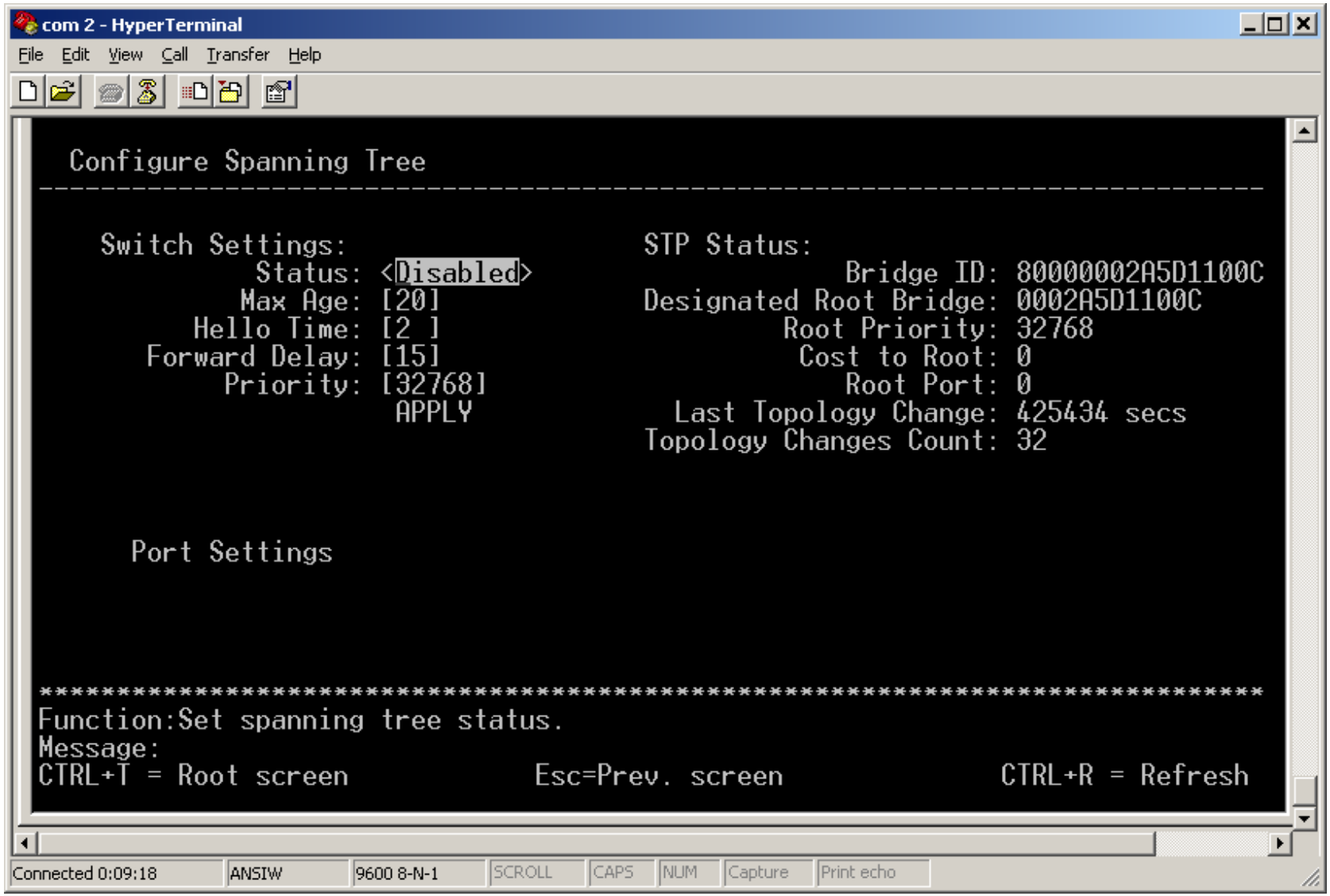
  - Controlling traffic
    - Unknown unicast / multicast / broadcast control
    - IGMP
    - QoS/CoS
  - Upgrade options
    - Port Trunking
- Management
  - Port mirroring
  - Switch Management Interfaces (CLI, Menu, BBI/Web, SNMP)

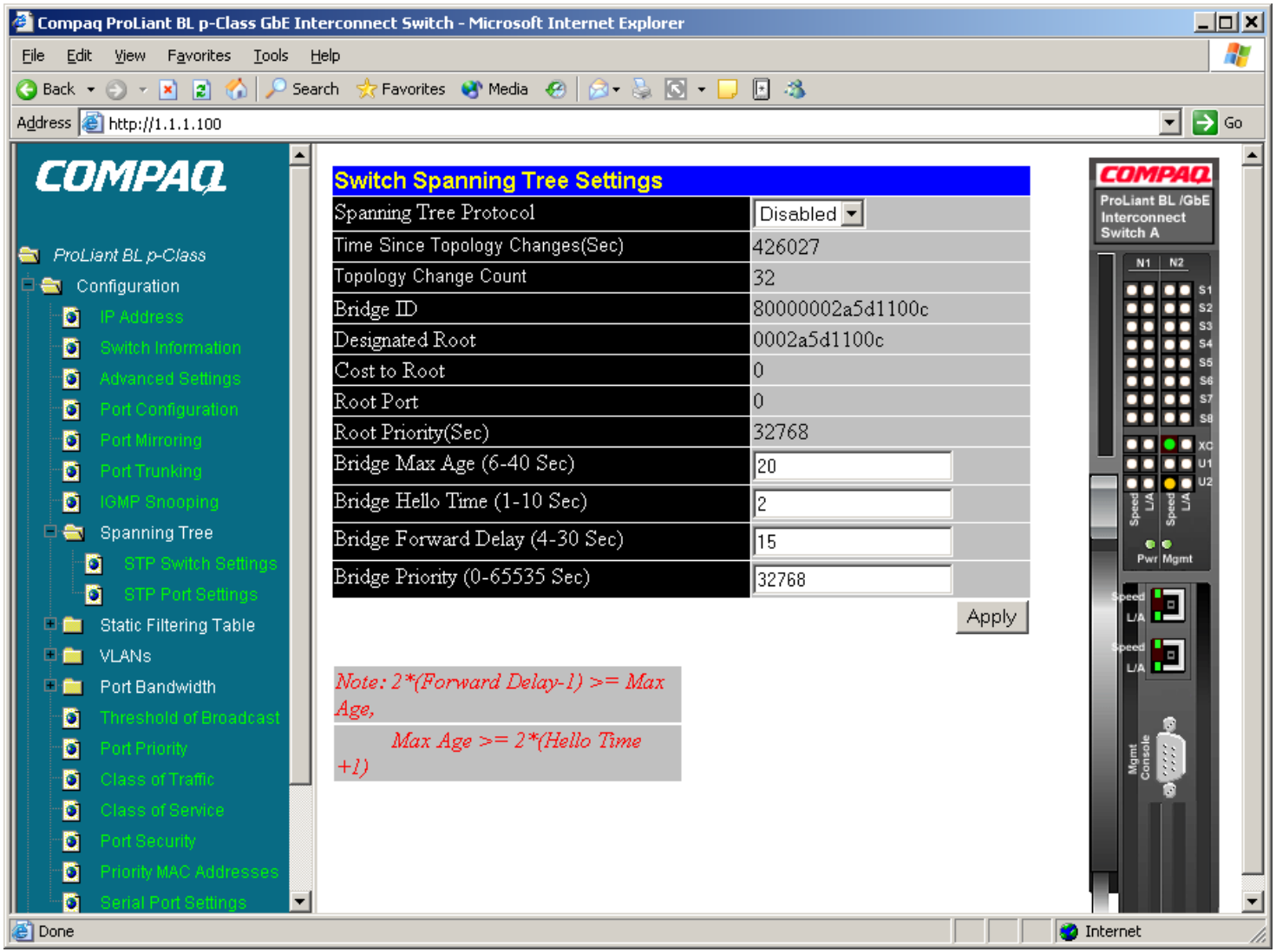
Switch management: CLI interface



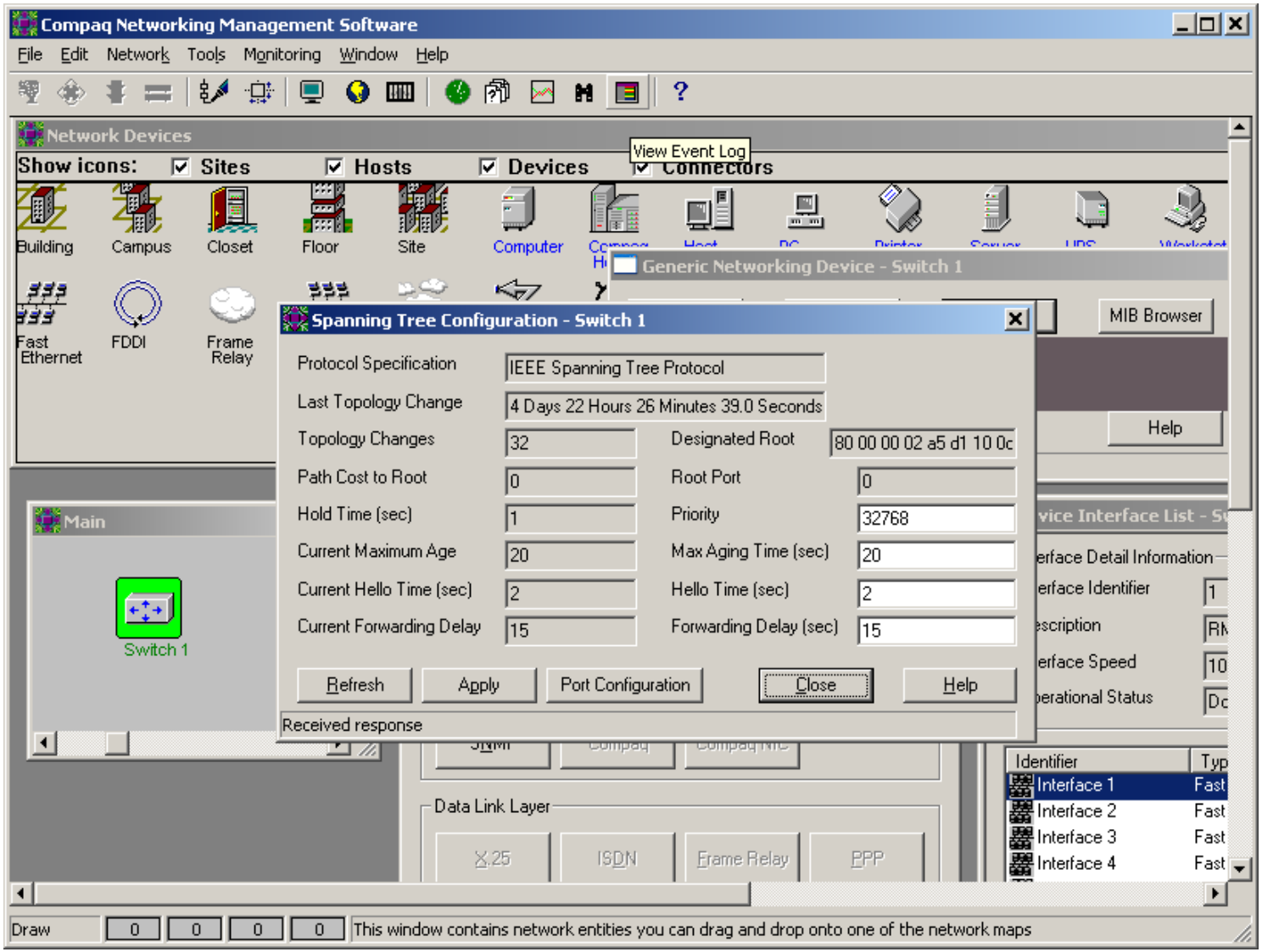
Switch management: menu interface



Switch management: Web/BBI interface



Switch management: SNMP



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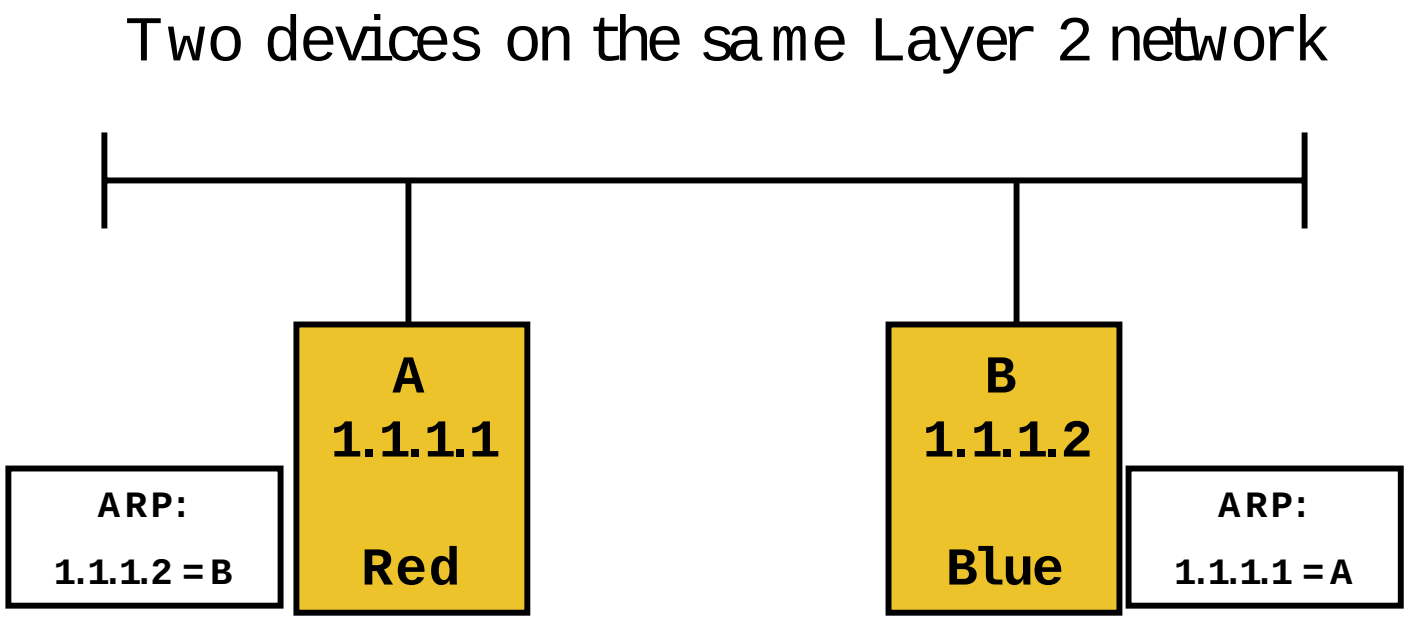
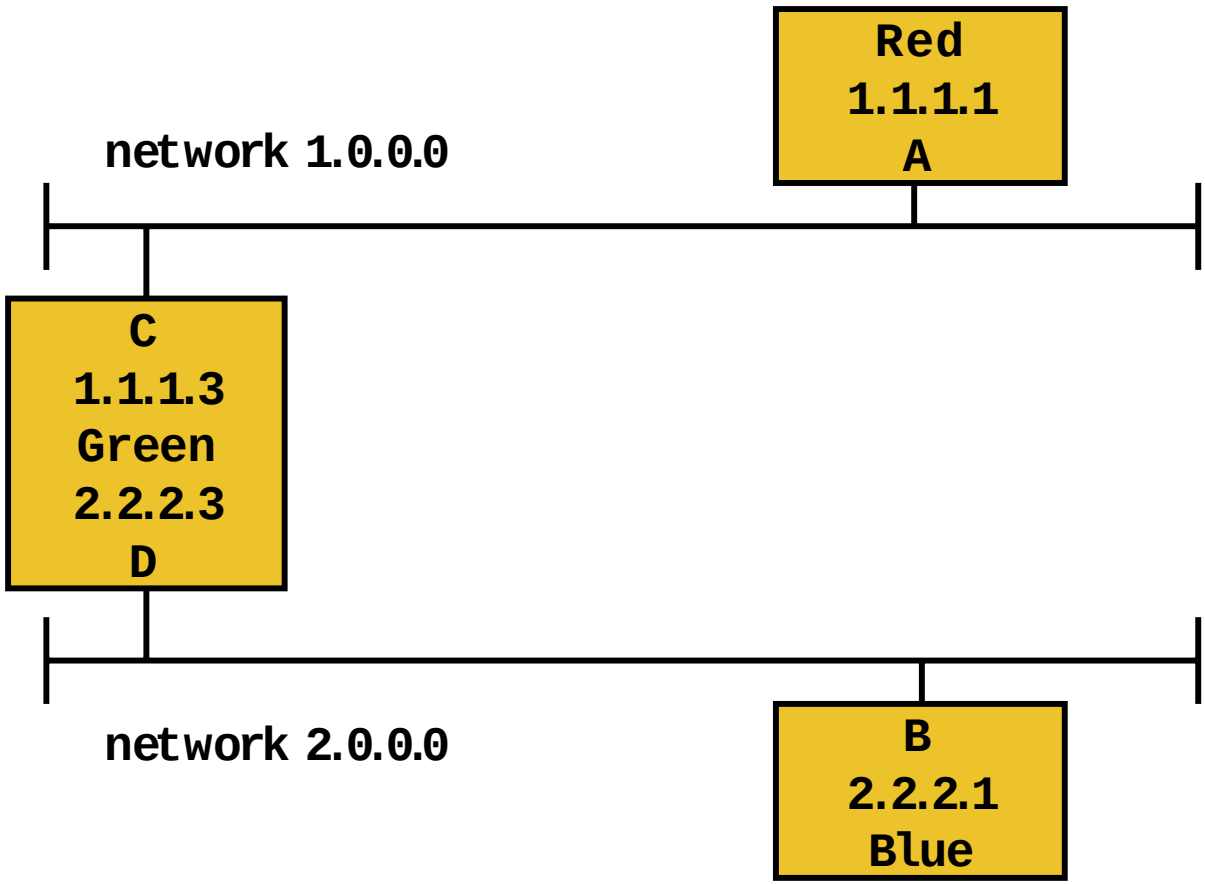
Backup Slides

Communication process



Communication process

Two devices on different Layer 2 networks



Communication process

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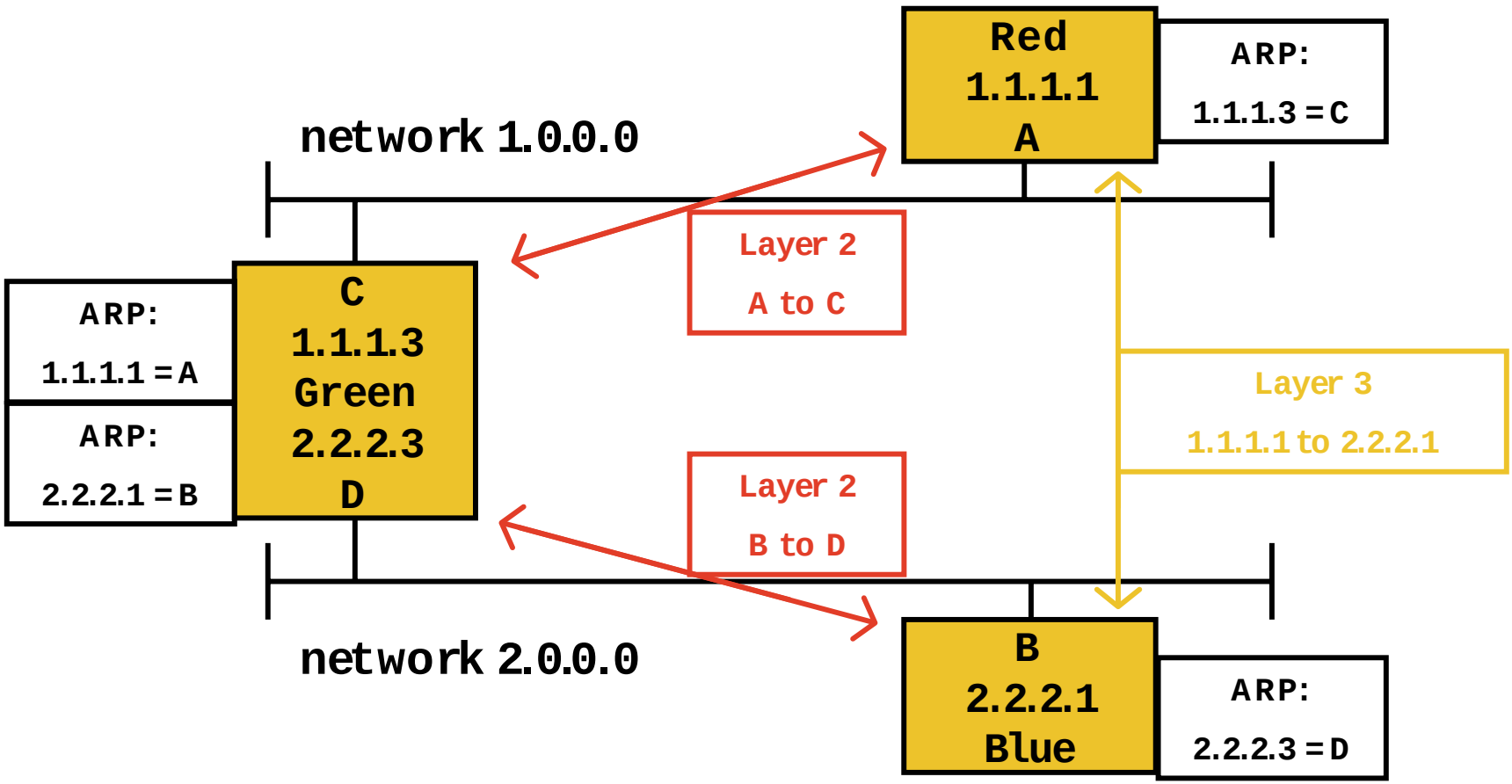

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