

Chapter 4

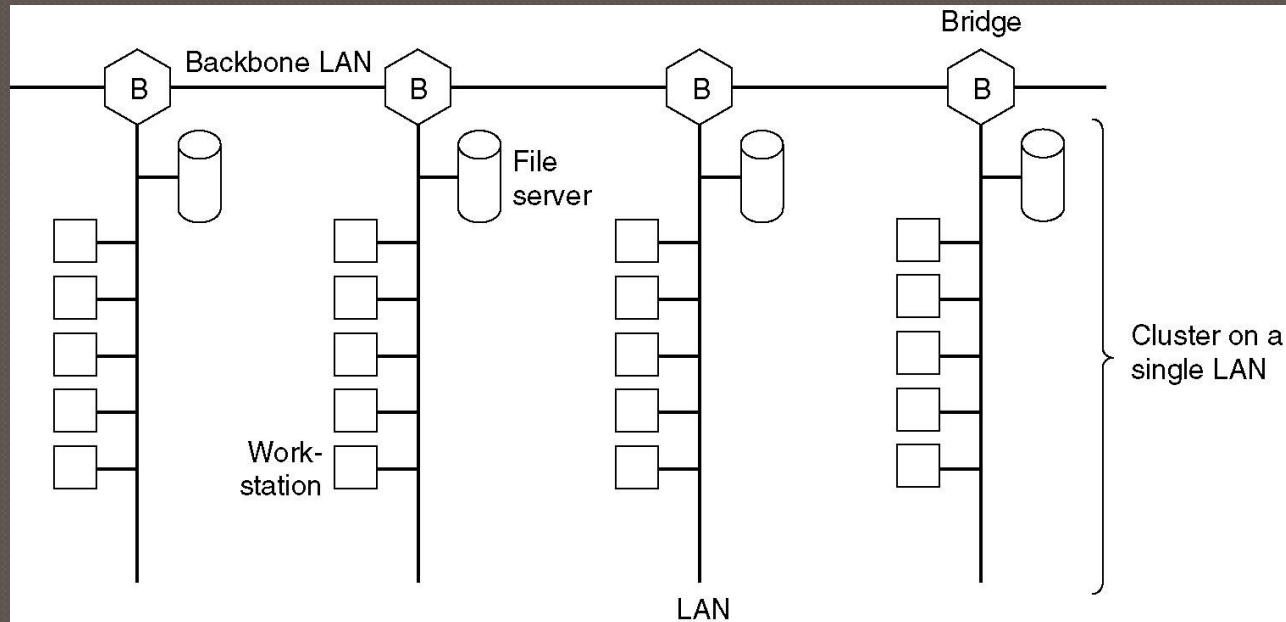
Lesson 13: The Medium Access Control Sublayer

Data Link Layer Switching

- Bridges from 802.x to 802.y
- Local Internetworking
- Spanning Tree Bridges
- Remote Bridges
- Repeaters, Hubs, Bridges, Switches, Routers, Gateways
- Virtual LANs

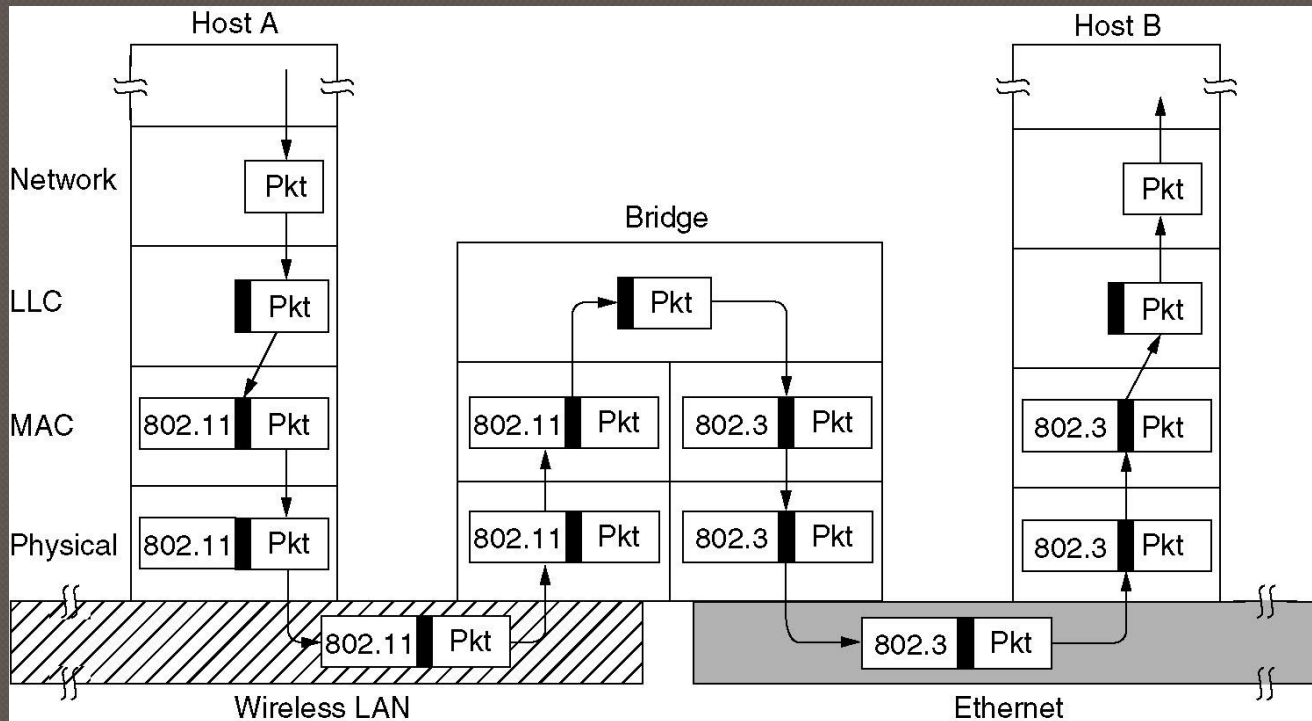
Data Link Layer Switching

Multiple LANs connected by a backbone to handle a total load higher than the capacity of a single LAN.

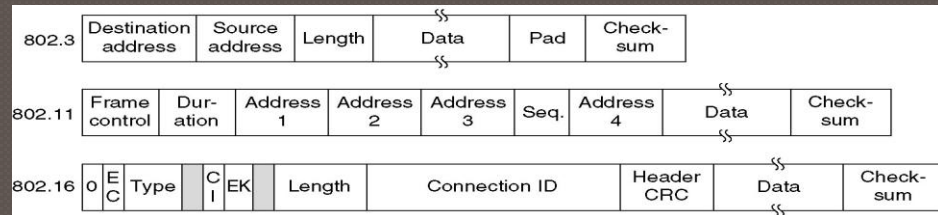


Bridges from 802.11 to 802.3

- The bridge strips off the 802.11 header and replace it with a 802.4 header
 - Actually is not so simple ☹



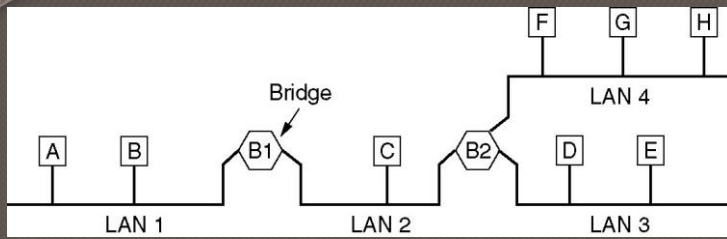
Bridges from 802.x to 802.y



Problems:

1. Different frame format
2. LAN do not run at the same data rate
 - Bridge can flood
3. Different 802 LAN have different maximum frame length
 - A longer frame which cannot be accepted in another LAN cannot be split in this layer
4. Security – Wireless are encrypted, Ethernet is not.
5. Quality of service – Ethernet has no concept of quality of service

- ..and bridges should be completely transparent, invisible to all the HW and SW
 - Just plug in and go



The Magic in Local Internetworking

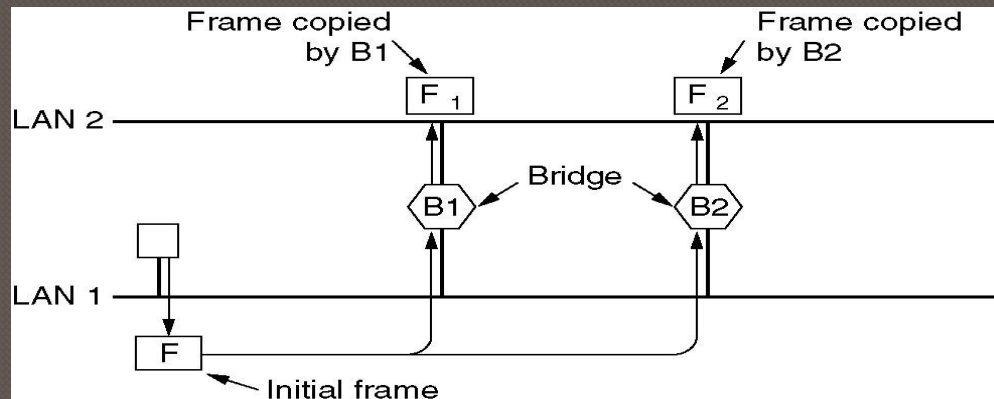
- If destination and source LAN are the same, discard the frame, otherwise forward it
- If destination LAN is unknown, use flooding
- Backward learning
 - keep a table of each possible destination and in which LAN it is
 - Table is empty at plug in time
 - Table is filled when a frame is received

Spanning Tree Bridges

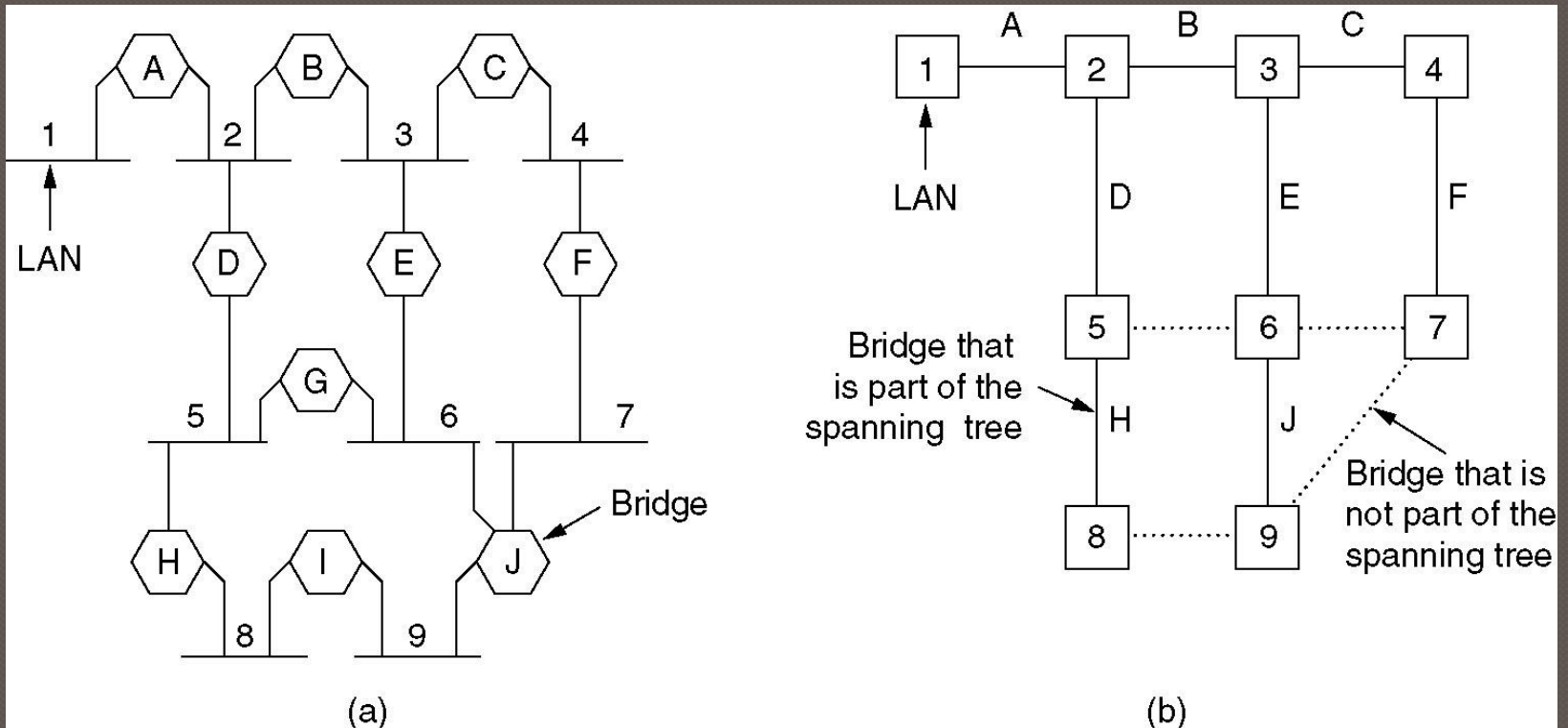
Loops must be avoided in topology

Cycle Example

- B1 and B2 see F – they do not know F's destination - they floods and make a copy (F₁ and F₂) to LAN2
- B2 sees F₂ - it doesn't know F₂'s destination - it floods and makes a copy (F₃) to LAN1
- B1 sees F₁ - it doesn't know F₁'s destination - it floods and makes a copy (F₄) to LAN1
- This cycle goes forever



Spanning Tree Bridges (2)

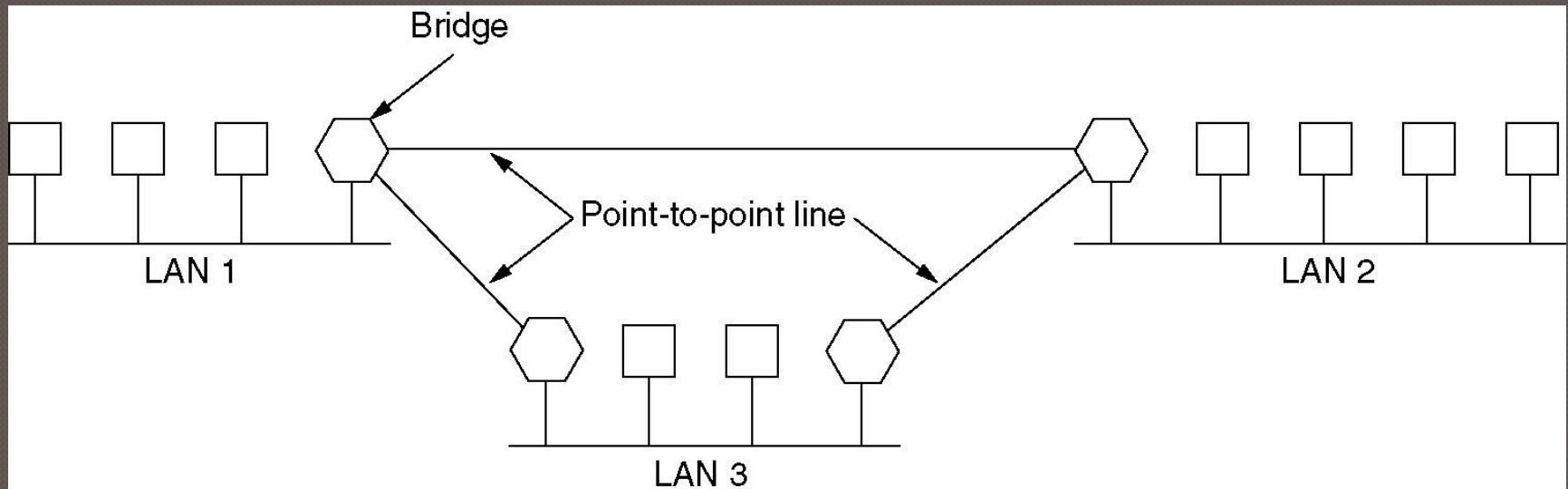


(a) Interconnected LANs. **(b)** A spanning tree covering the LANs. The dotted lines are not part of the spanning tree.

Remote Bridges

Remote bridges can be used to
interconnect distant LANs.

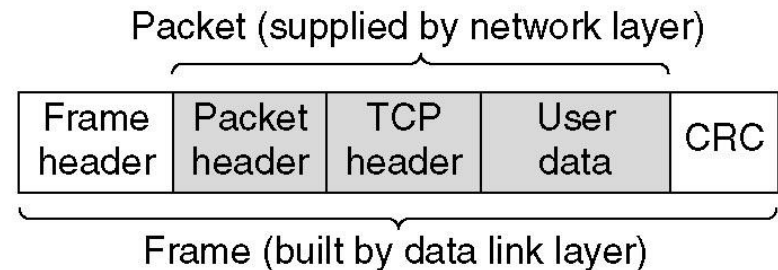
(connected via leased lines from a telephone company)



Repeaters, Hubs, Bridges, Switches, Routers and Gateways

Application layer	Application gateway
Transport layer	Transport gateway
Network layer	Router
Data link layer	Bridge, switch
Physical layer	Repeater, hub

(a)

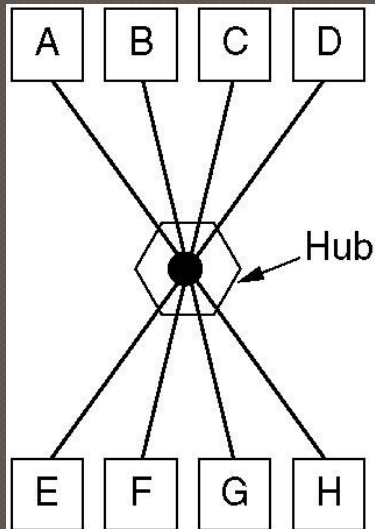


(b)

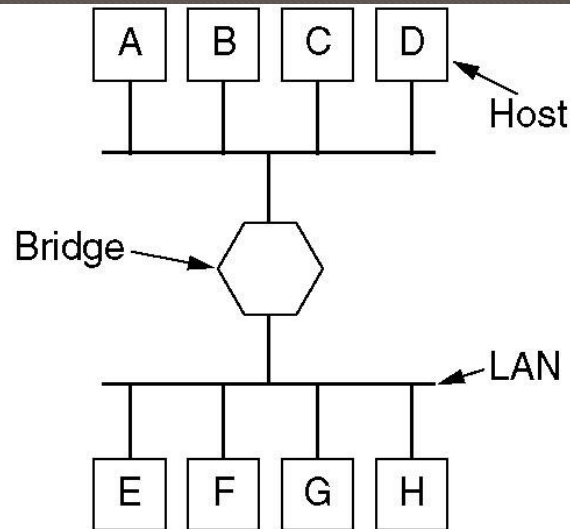
- (a) Which device is in which layer.
- (b) Frames, packets, and headers.

Repeaters, Hubs, Bridges, Switches, Routers and Gateways (2)

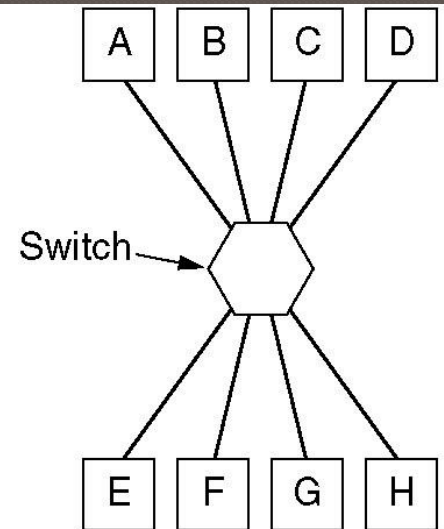
(a) A hub. (b) A bridge. (c) a switch.



(a)



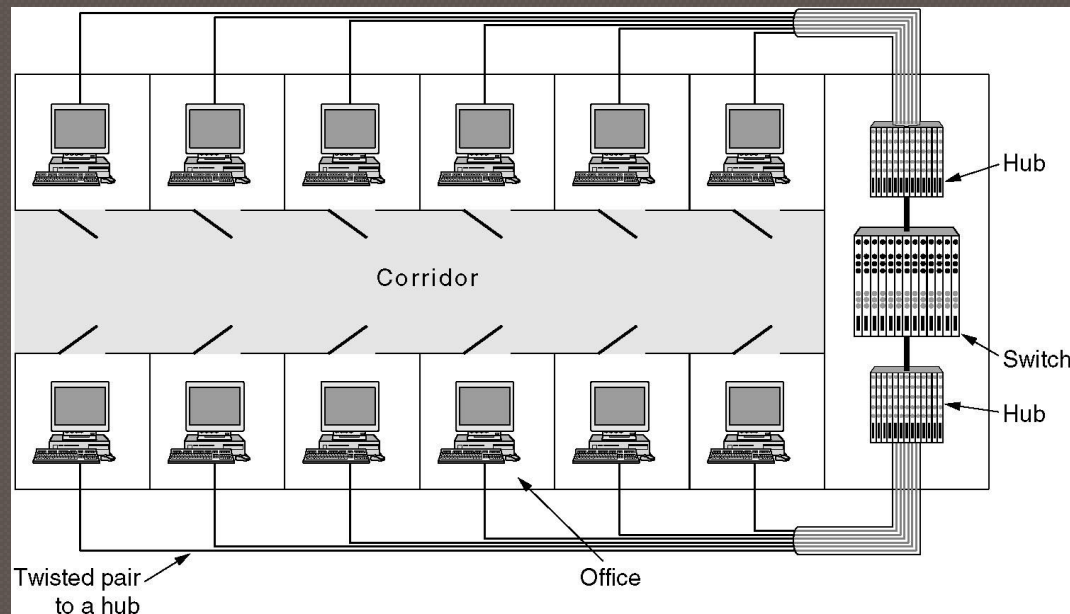
(b)



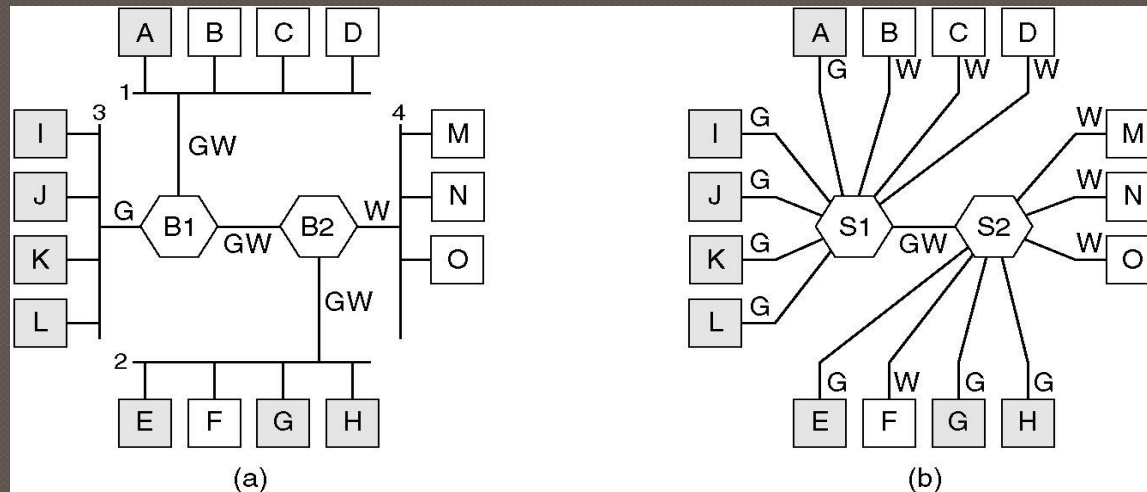
(c)

Virtual LANs

- A building with centralized wiring using hubs and a switch.
 - Dependent on the geography
 - People in different Depts will be on the same LAN



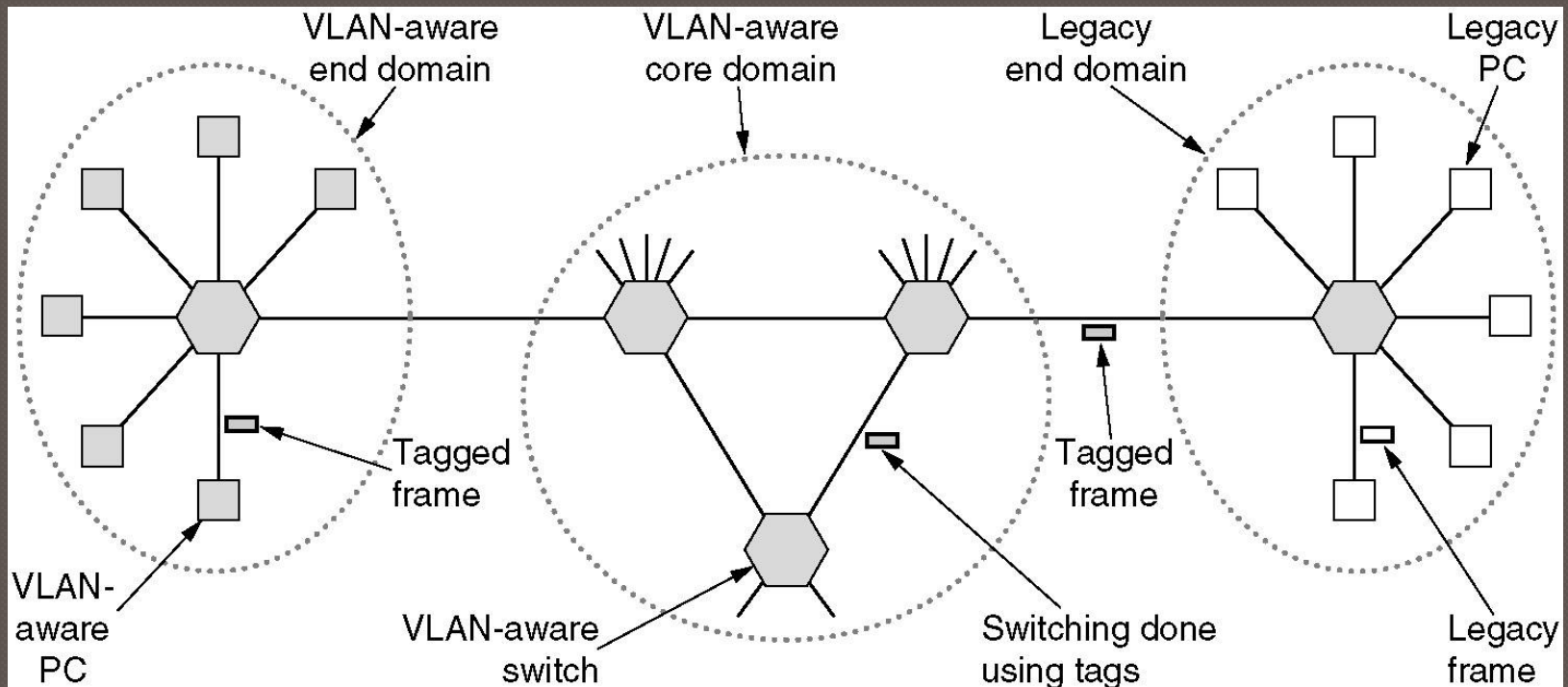
Virtual LANs (2)



- (a) Four physical LANs organized into two VLANs, gray and white, by two bridges.
- (b) The same 15 machines organized into two VLANs by switches.
- Each LAN is colored and if a machine is moved from a LAN to another only the color must be changed in the configuration table.

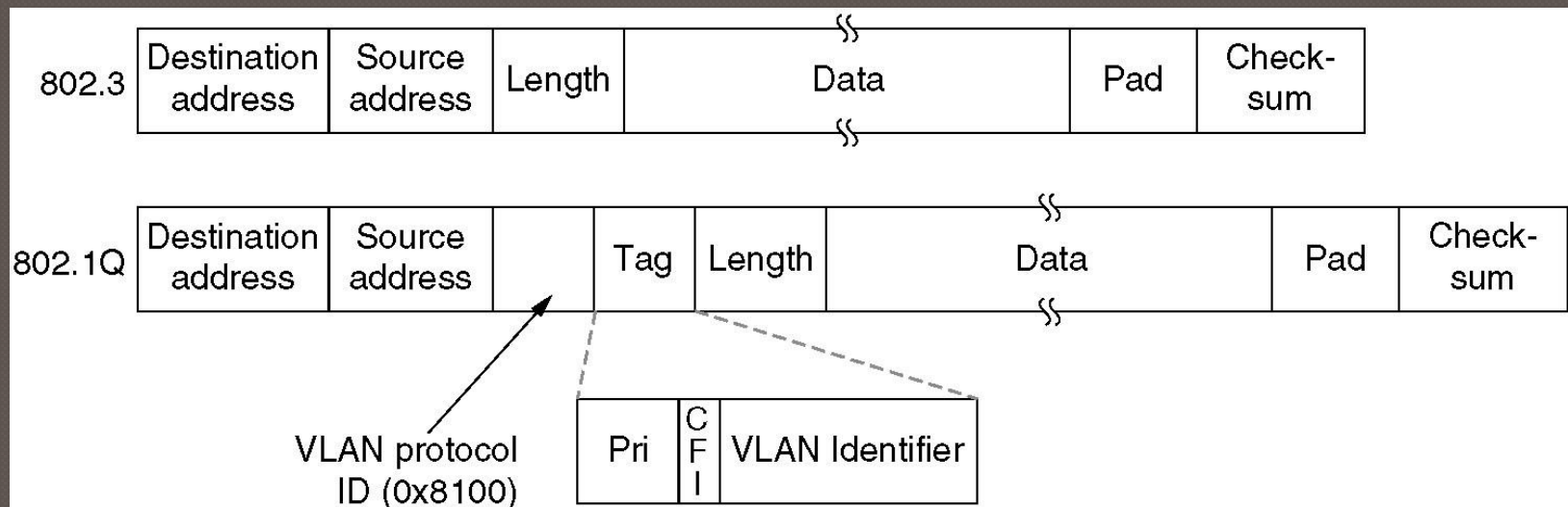
The IEEE 802.1Q Standard

Transition from legacy Ethernet to VLAN-aware Ethernet. The shaded symbols are VLAN aware. The empty ones are not.



The IEEE 802.1Q Standard (2)

The 802.3 (legacy) and 802.1Q Ethernet frame formats.



Summary

Method	Description
FDM	Dedicate a frequency band to each station
WDM	A dynamic FDM scheme for fiber
TDM	Dedicate a time slot to each station
Pure ALOHA	Unsynchronized transmission at any instant
Slotted ALOHA	Random transmission in well-defined time slots
1-persistent CSMA	Standard carrier sense multiple access
Nonpersistent CSMA	Random delay when channel is sensed busy
P-persistent CSMA	CSMA, but with a probability of p of persisting
CSMA/CD	CSMA, but abort on detecting a collision
Bit map	Round robin scheduling using a bit map
Binary countdown	Highest numbered ready station goes next
Tree walk	Reduced contention by selective enabling
MACA, MACAW	Wireless LAN protocols
Ethernet	CSMA/CD with binary exponential backoff
FHSS	Frequency hopping spread spectrum
DSSS	Direct sequence spread spectrum
CSMA/CA	Carrier sense multiple access with collision avoidance

Channel allocation methods and systems for a common channel.