

# **CSC4200/5200 – COMPUTER NETWORKING**

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**INTERNETWORKING**

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# Midterm! Midterm! Midterm! (Chapter 1 – 4)

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- October 11<sup>th</sup> (In less than a month!)
  - 90 minutes – 1:15PM – 2:30PM
  - **If you have a conflict, let me know NOW!**
  - Location – TBD
- Closed book, no laptop, phone, or calculator!
- One cheat sheet allowed (one letter paper – any note you want)
- Only from the book and lecture notes, no programming questions

# Project groups

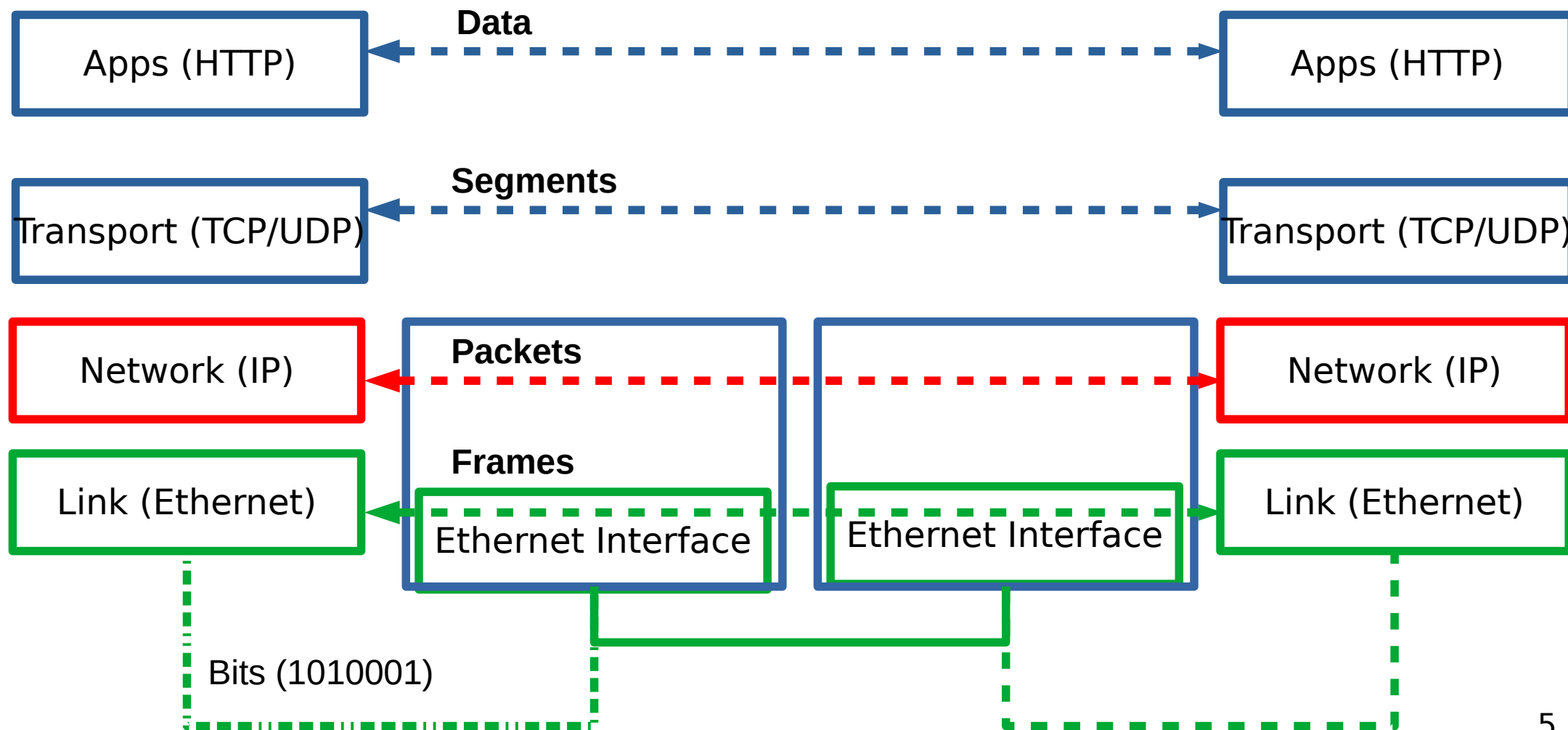
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- Let me know by 09/20, Friday.
- If I don't hear from you by Friday, you will be assigned to a random group!

# Midterm! Midterm! Midterm! (Chapter 1 – 4)

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- What do I study?
  - Think about the fundamentals
    - Why this protocols are designed this way?
      - **Why not use bit correction on Ethernet frames?**
      - **Why use CSMA/CA for wireless and not CSMA/CD?**
    - What will happen if I change this aspect of the protocol?
      - **What will happen if we make the sliding window infinite?**
    - Simple calculations
      - **Calculate the total delay of a link**
  - **Study the homeworks!**

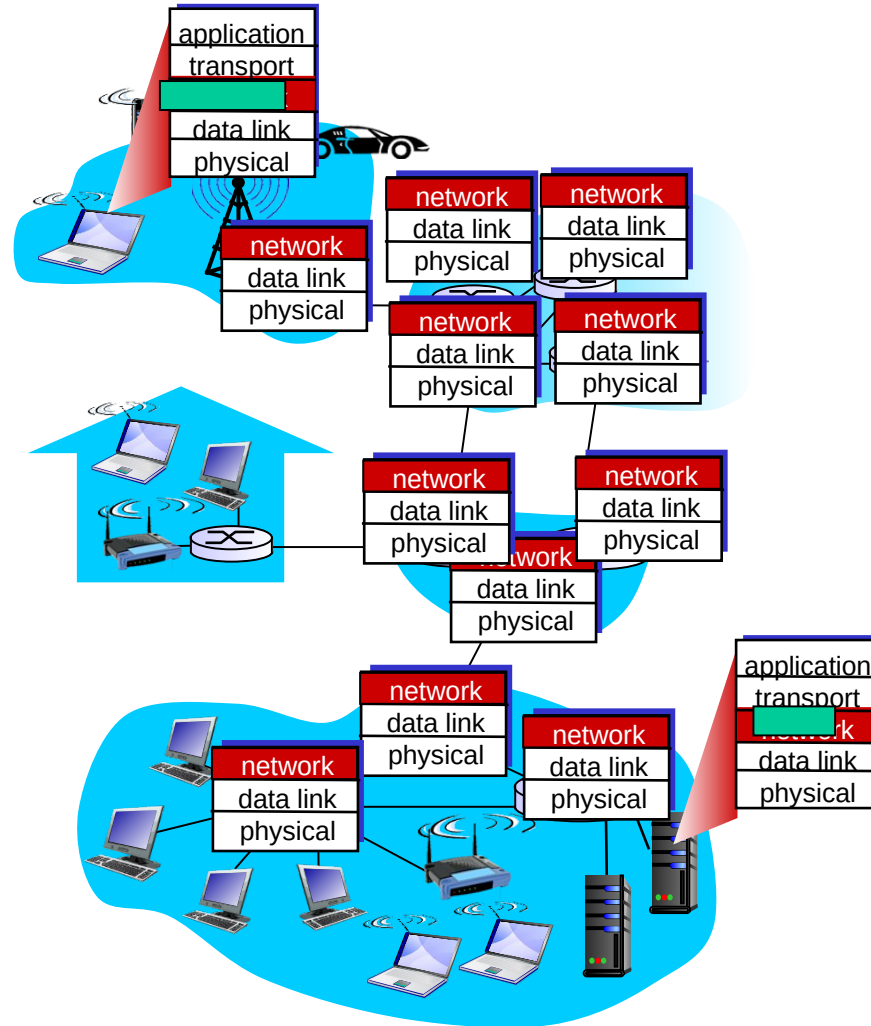


# So far...

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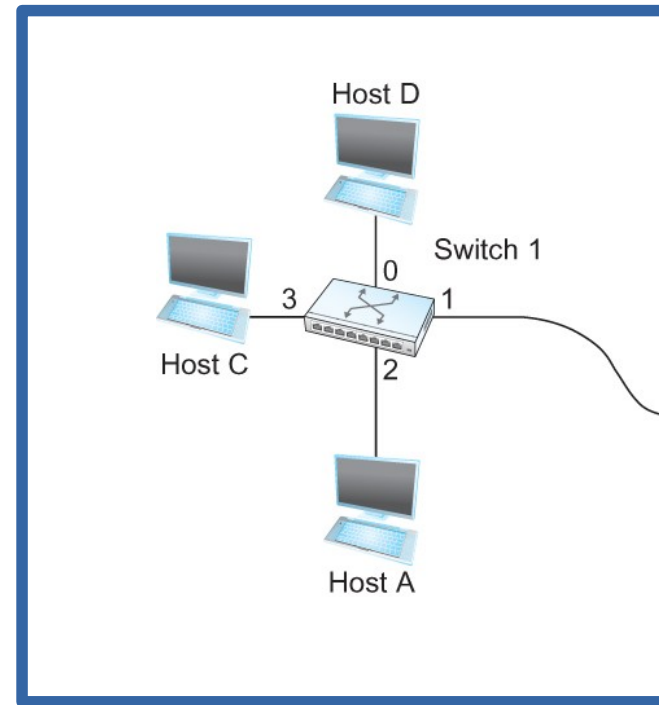
- we saw how to build a local network
- How do we interconnect different types of networks to build a large global network?

# Why another layer?

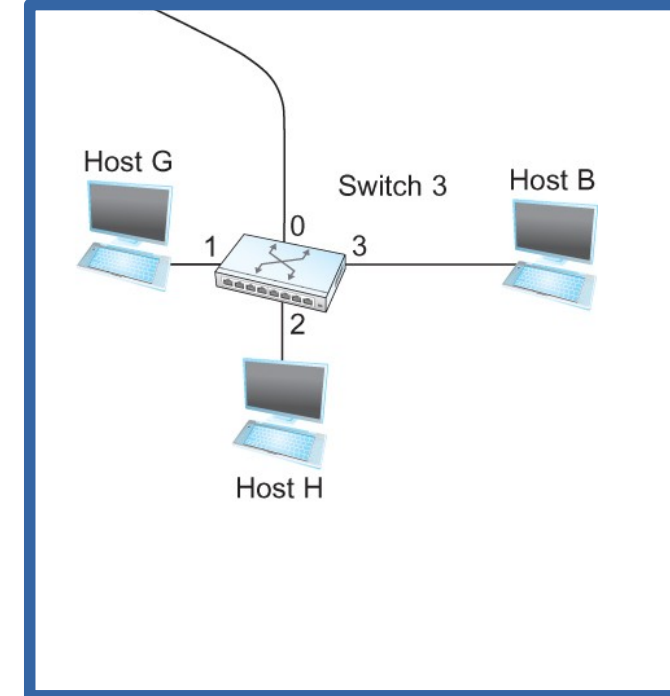
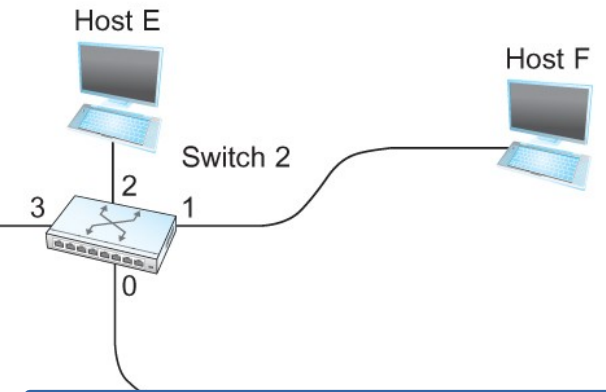


# Switching

- Switch
  - A mechanism to interconnect links to form a large network
- Forward **frames**
- Separate the collision domains
- Filter packets between LANs
- Connects two or more LAN segments - **Bridging**



LAN 1  
Collision domain 1

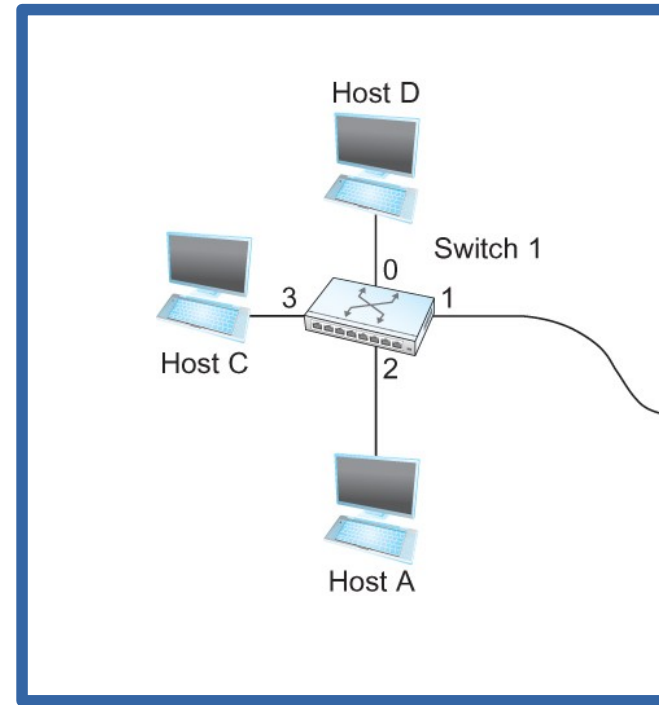


LAN 2  
Collision domain 2

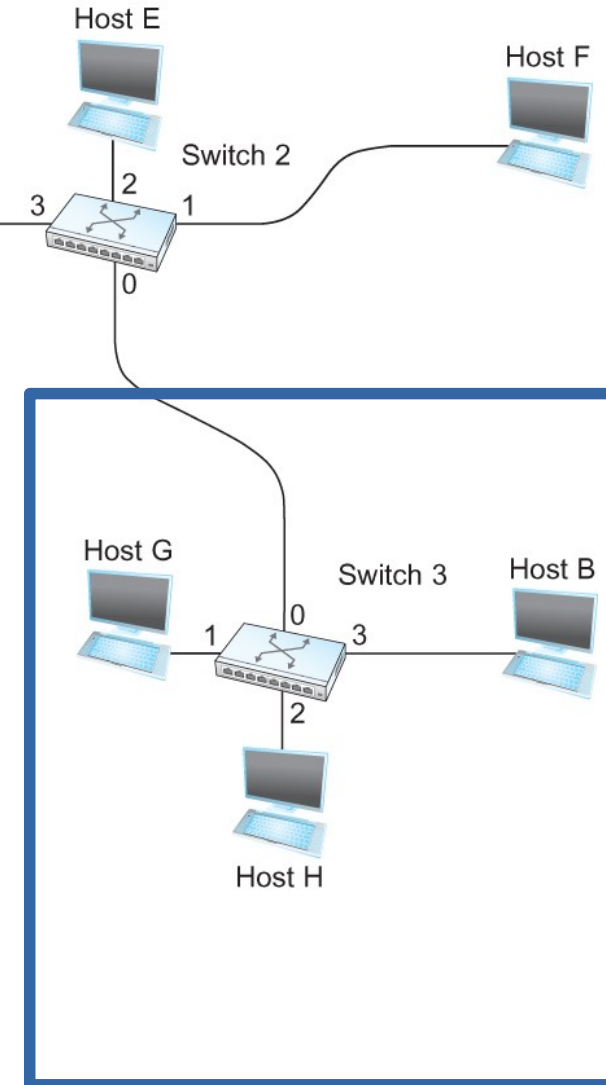


# Switches are Self learning!

- No configuration needed
- Send frames to needed segment
- **How do they construct such a table?**



LAN 1  
Collision domain 1



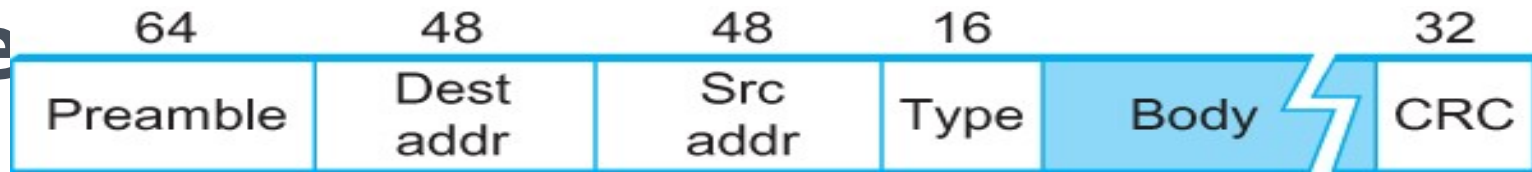
LAN 2  
Collision domain 2

# Switches are self learning!

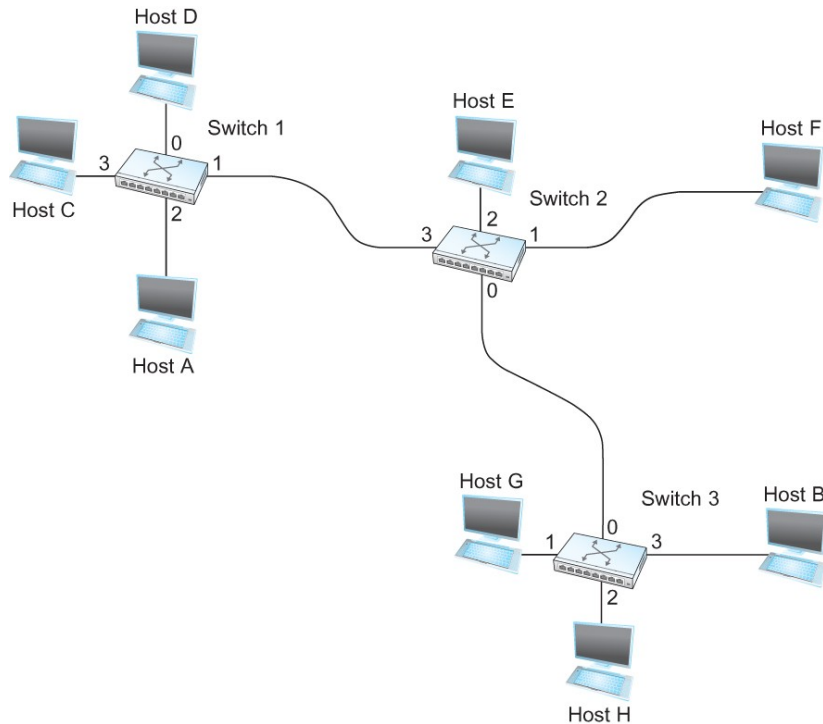
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- Inspect the source MAC address
  - **What is a mac address?**
- Associate mac address and incoming interface
- Store this association for later use, (for some time)
  - aging-timer

# Switching Table



- To decide how to forward a packet, a switch consults a *forwarding table*



Destination, Port

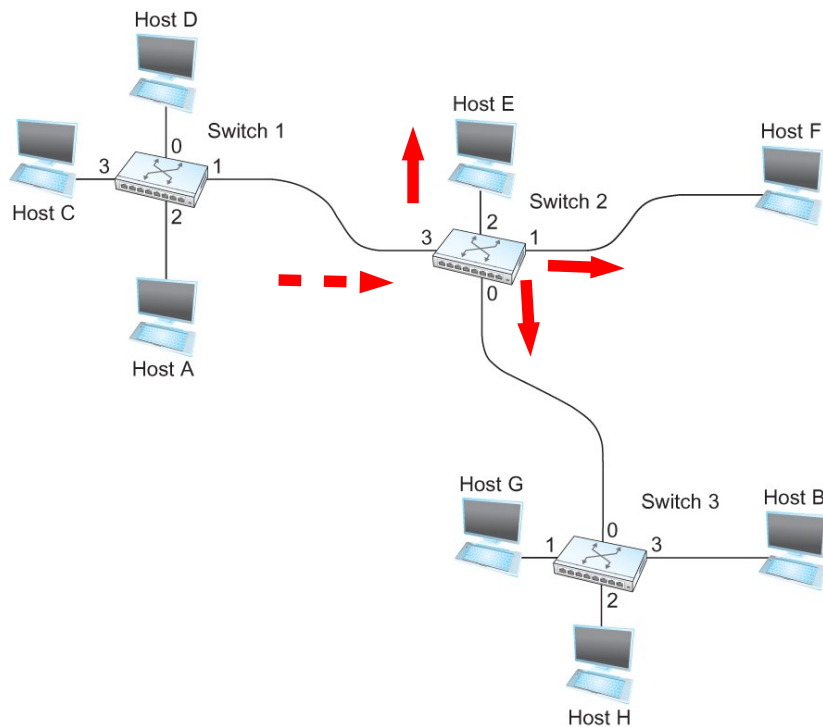
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A 3  
B 0  
C 3  
D 3  
E 2  
F 1  
G 0  
H 0

**Forwarding Table for  
Switch 2**

# Switching Table

- Unknown destination → send out on all Interfaces (**flooding**)

- **Skip the incoming interface**



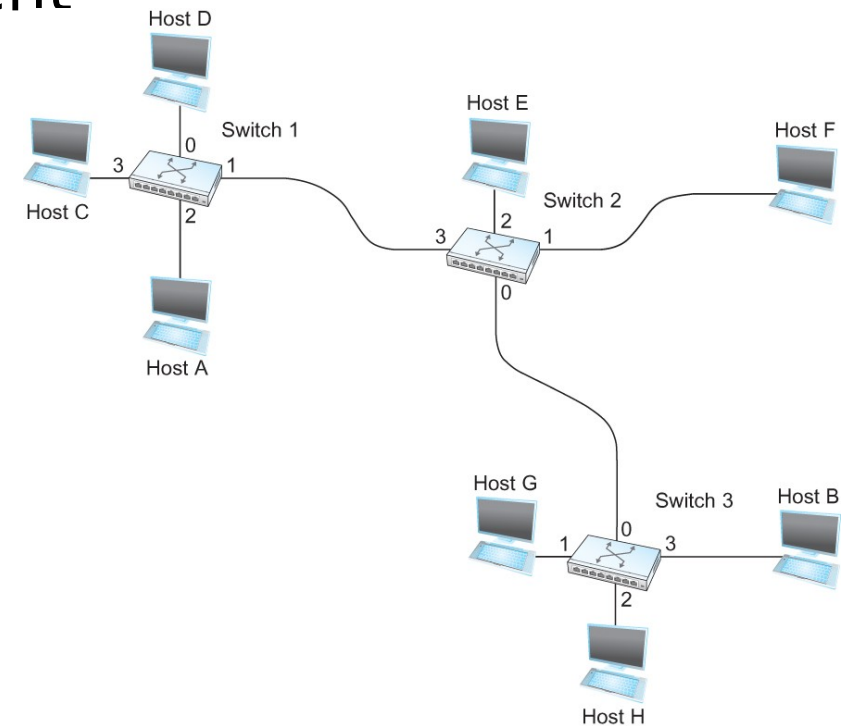
Destination, Port

--  
A 3  
B 0  
C 3  
D 3  
E 2  
F 1  
G 0  
H 0

**Forwarding Table for  
Switch 2**

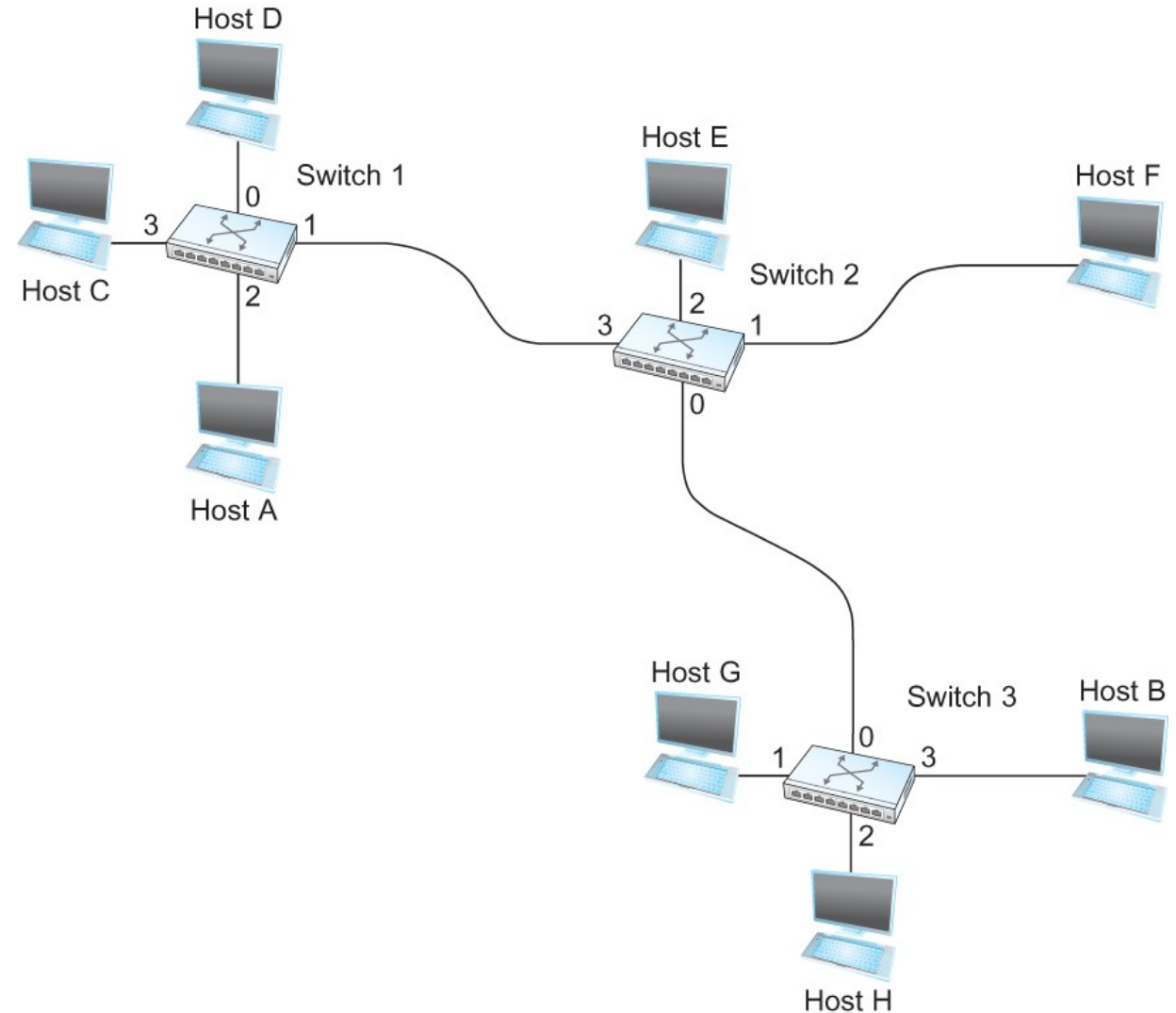
# Switching Table Algorithm

- Create the table first!
  - **For each packet**
    - If destination address in arriving segment
      - Drop
    - If destination is in another segment
      - Forward
    - If destination unknown
      - Flood!

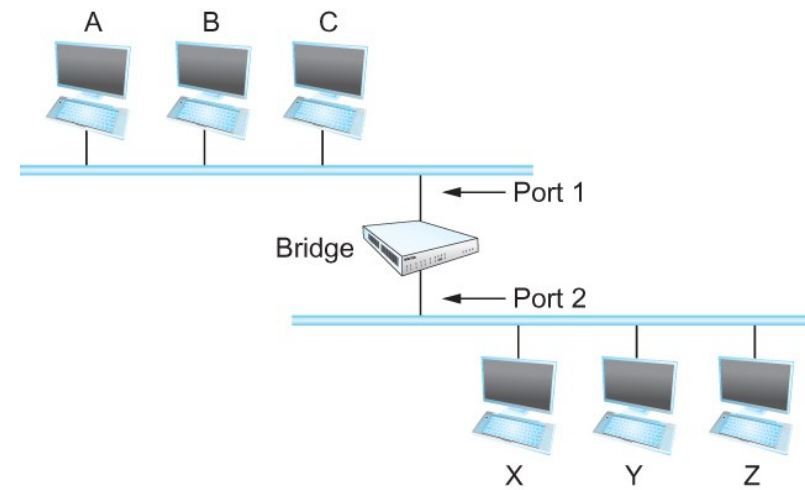


# Switching Table Algorithm

- **Send frame from C to F**
- Switch 1 →
  - Notes C is on Interface 3
  - Floods
- Switch 2 →
  - Notes C is on Interface 3
  - Floods
- Host F replies
  - Switch 2 notes F is on Interface 1
  - Sends back over Interface 3
- Switch 1 notes F is on Interface 1
  - Sends back over Interface 3
  - Host c receives frame

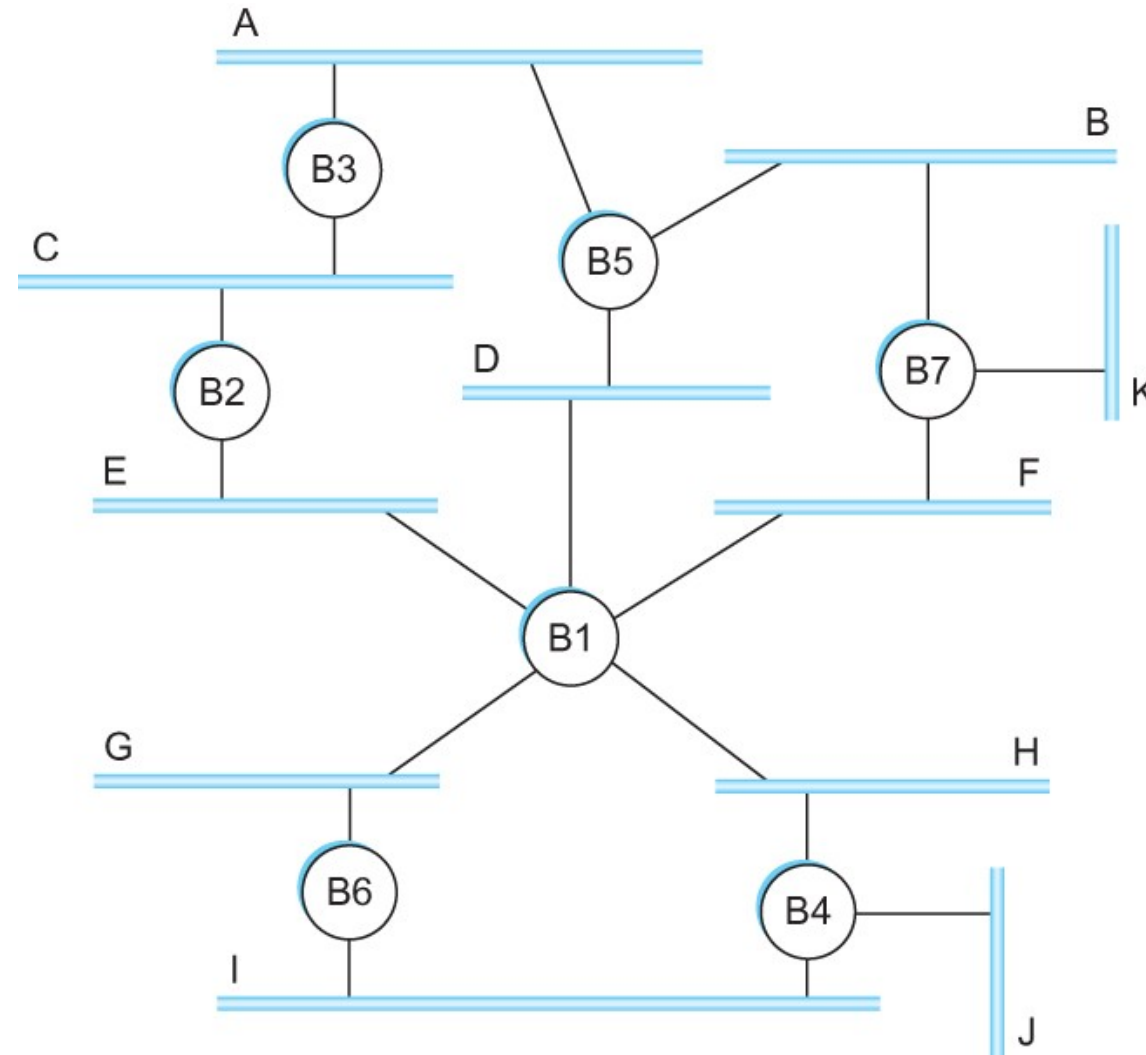


# Bridges



- Bridges and LAN Switches
  - Class of switches that is used to forward packets between shared-media LANs such as Ethernets
  - Known as LAN switches
  - Referred to as Bridges
- Suppose you have a pair of Ethernets that you want to interconnect
  - One approach is put a repeater in between them, physical limitations
- An alternative would be to put a node between the two Ethernets and have the node forward frames from one Ethernet to the other
  - This node is called a **Bridge**
  - A collection of LANs connected by one or more bridges is usually said to form an **Extended LAN**

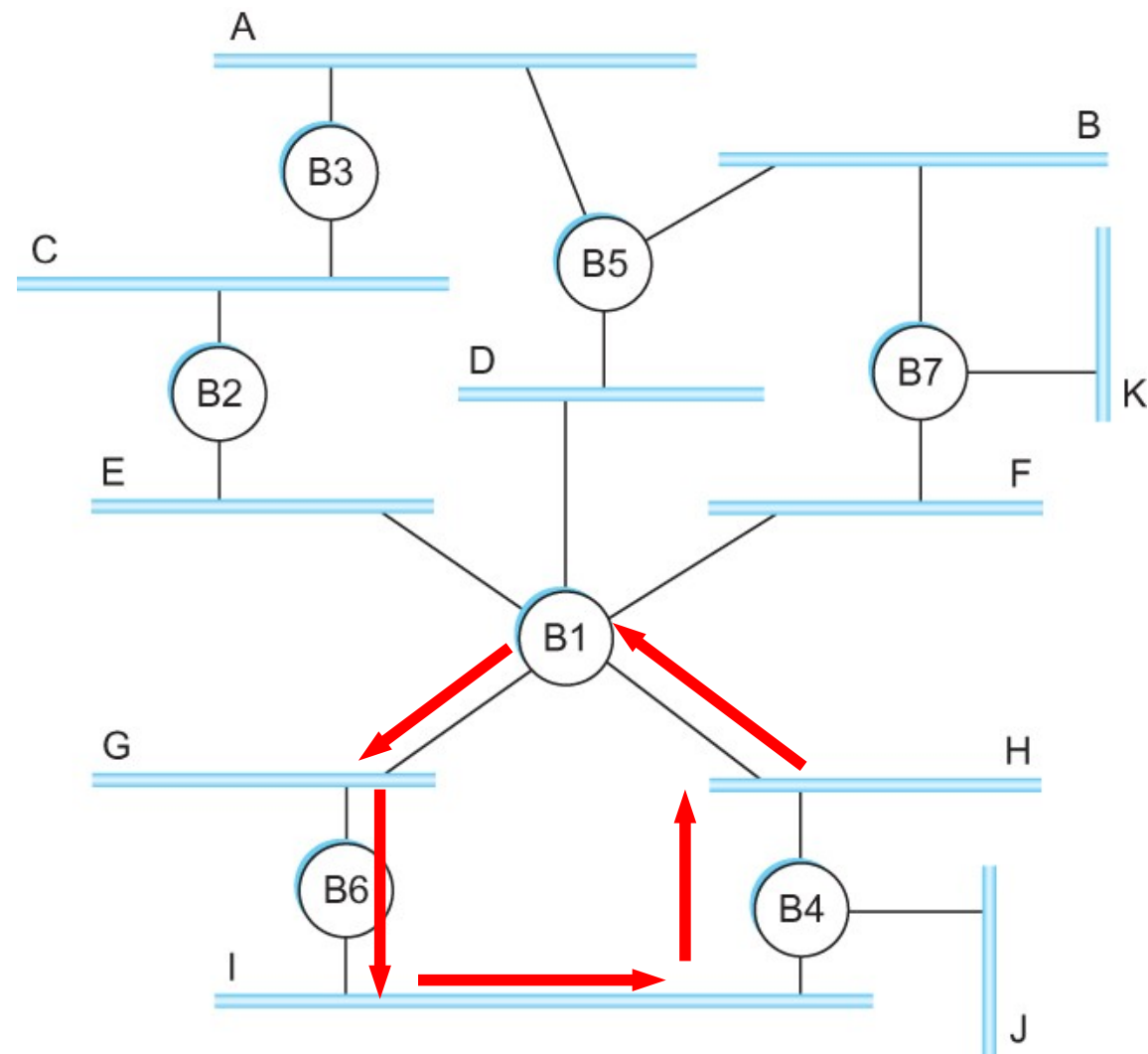
# Flooding over bridges causes forwarding loops



**Spot the loop**  
**Why?**



# Loop

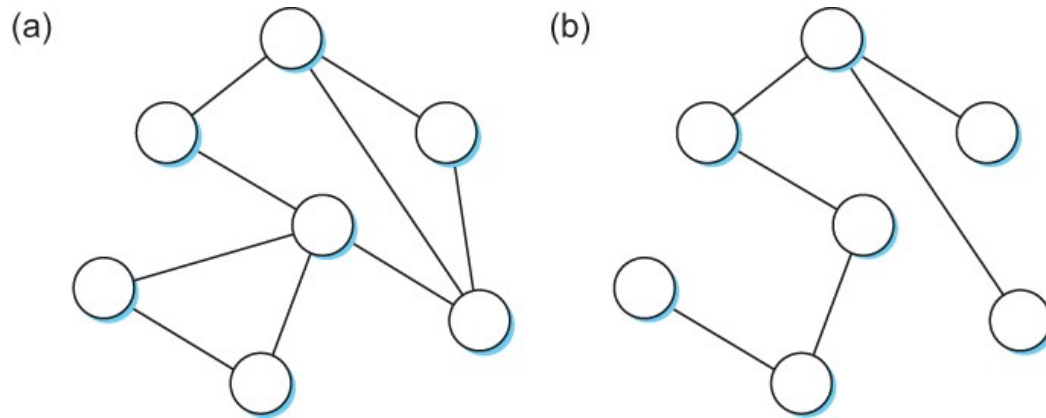


**Spot the loop**  
**Why?**

# Solution? Spanning Tree

Think of the extended LAN as being represented by a graph that possibly has loops (cycles)

- A spanning tree is a sub-graph of this graph that covers all the vertices but contains no cycles
- Spanning tree keeps all the vertices of the original graph but throws out some of the edges



Example of (a) a cyclic graph; (b) a corresponding spanning tree.

# Next Steps

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How to construct a spanning tree!

Virtual LANs

IP



# Link Layer Recap – All this for a cat picture

