EECS 489 - Winter 2024

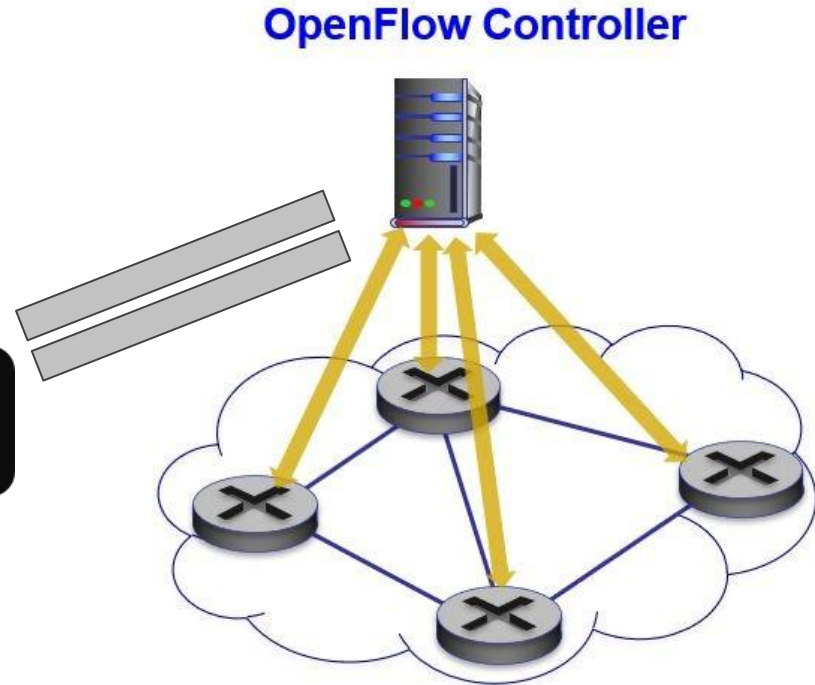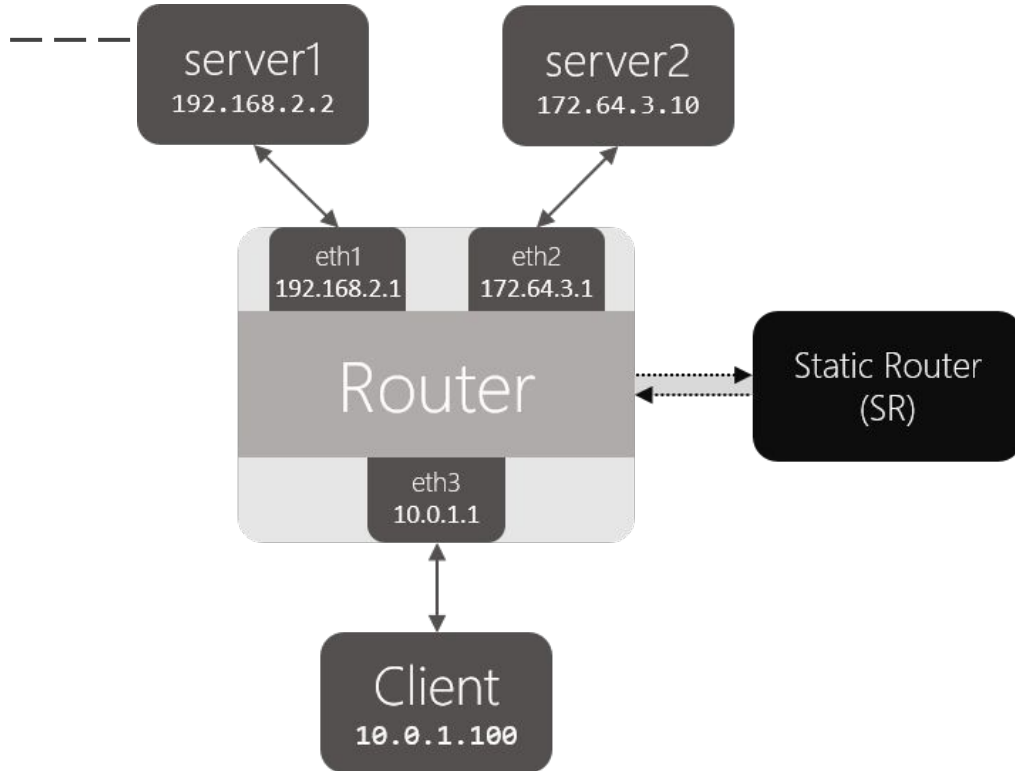Discussion 11

Assignment 4 is out!

———

- **Due: Tuesday, April 23rd @ 11:59 pm EDT**
  - Autograder is up and running, 3 submits per day

Today

———

- Data Link Layer
- Address Resolution Protocol
- Spanning Tree Algorithm
- MAC for Switches and Routers
- Practice Questions
  - Forwarding
  - ARP
  - IP

Assignment 4: Environment (SDN)

Data Link Layer

———

- Protocols
  - Ethernet (IEEE 802.3)
    - CSMA (Carrier-sense multiple access)/CD
      - After collision is detected
  - Wi-Fi (IEEE 802.11)
    - CSMA/CA
      - Avoid collision
  - etc.
- Devices working in this layer use MAC addresses

Address Resolution Protocol
———

- Used to find the MAC address of another device
  - IP address to MAC address
  - ARP requests need to be broadcast
   - `ff:ff:ff:ff:ff:ff` is the broadcast address

Octet offset	0	1
0	Hardware type (HTYPE)	
2	Protocol type (PTYPE)	
4	Hardware address length (HLEN)	Protocol address length (PLEN)
6	Operation (OPER)	
8	Sender hardware address (SHA) (first 2 bytes)	
10	(next 2 bytes)	
12	(last 2 bytes)	
14	Sender protocol address (SPA) (first 2 bytes)	
16	(last 2 bytes)	
18	Target hardware address (THA) (first 2 bytes)	
20	(next 2 bytes)	
22	(last 2 bytes)	
24	Target protocol address (TPA) (first 2 bytes)	
26	(last 2 bytes)	

Spanning Tree Algorithm

———

- Algorithm for avoiding broadcast storm
- Steps:
  - Initially: Each switch proposes itself as the root
  - Switch X announces (X, 0, X) to its neighbors
  - Switches update their view of the root
  - Upon receiving (Y, d, Z) from Z, check Y's id
    - If Y's id <= current root, then set the root = Y
  - Switches compute their distance from root
  - Add 1 to shortest distance received from a neighbor
  - If a root of shortest distance to it changes, then send neighbors an updated message (Y, d + 1, X)

Spanning Tree Algorithm

_ _ _

EECS 489 – Lecture 18
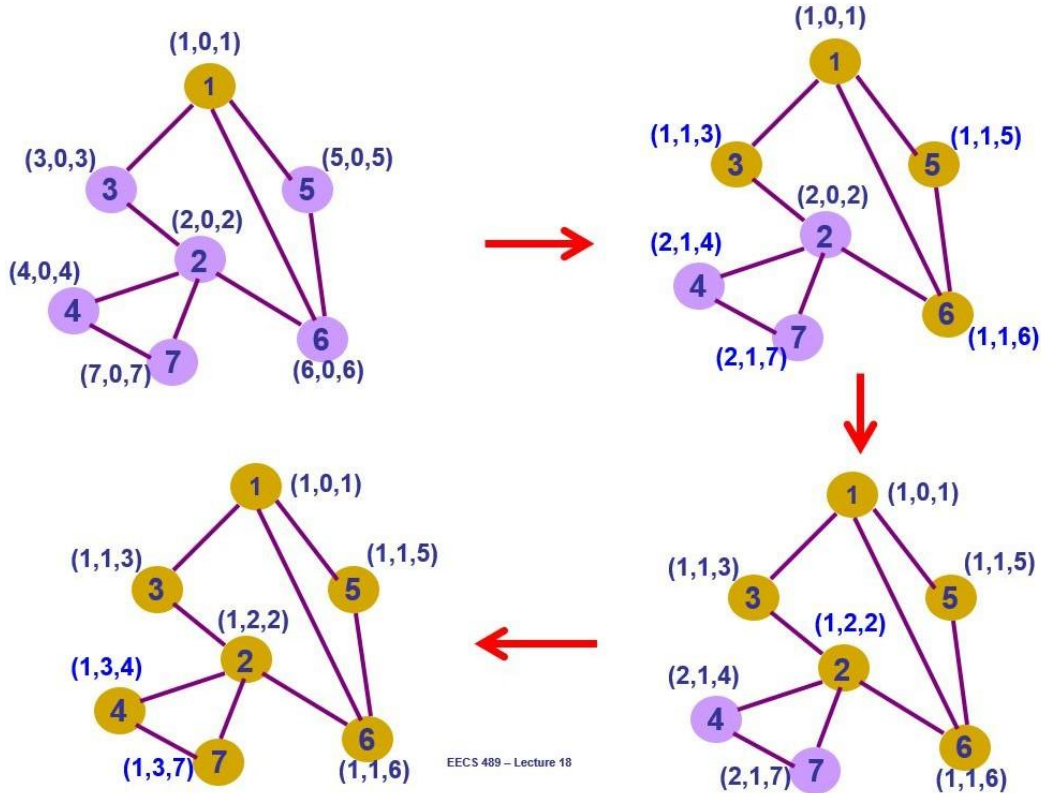
MAC for Switches

———

- Switch: Connects devices within a local area network (LAN)
- Switches use MAC addresses to identify the source and destination of data packets and to determine which port to forward the packet to.
- Each port on a switch has a unique MAC address associated with it, and the switch itself also has a MAC address that is used to identify it on the network.

MAC for Routers

———

- Router: Connects multiple networks together
- Routers use IP addresses to route data packets between networks, rather than MAC addresses.
- However, routers also have MAC addresses associated with each of their interfaces, which are used for functions such as Address Resolution Protocol (ARP) and Neighbor Discovery Protocol (NDP) to map IP addresses to MAC addresses and vice versa.
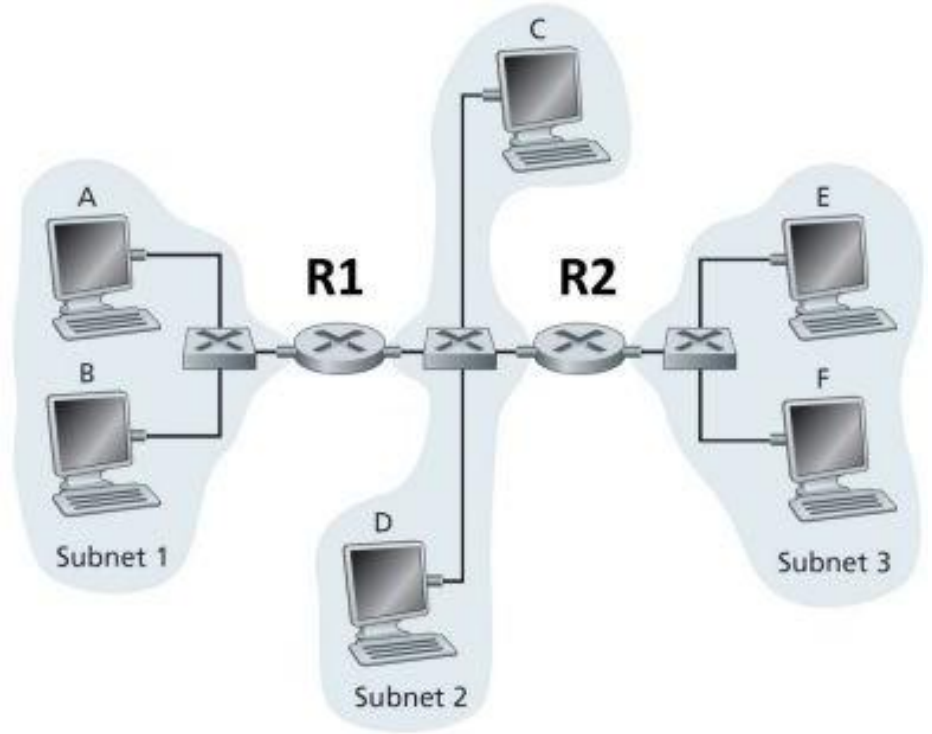
Q1: Forwarding

———

- Consider sending an IP packet from Host E to Host F. Will Host E ask router R2 to forward the packet? Why?
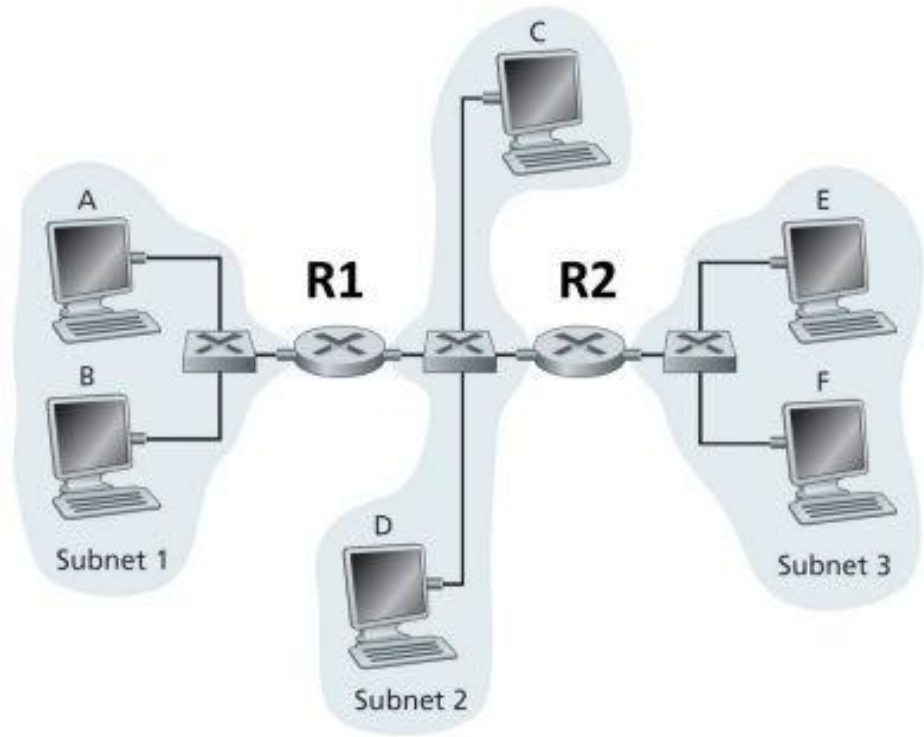
Q1: Forwarding

———
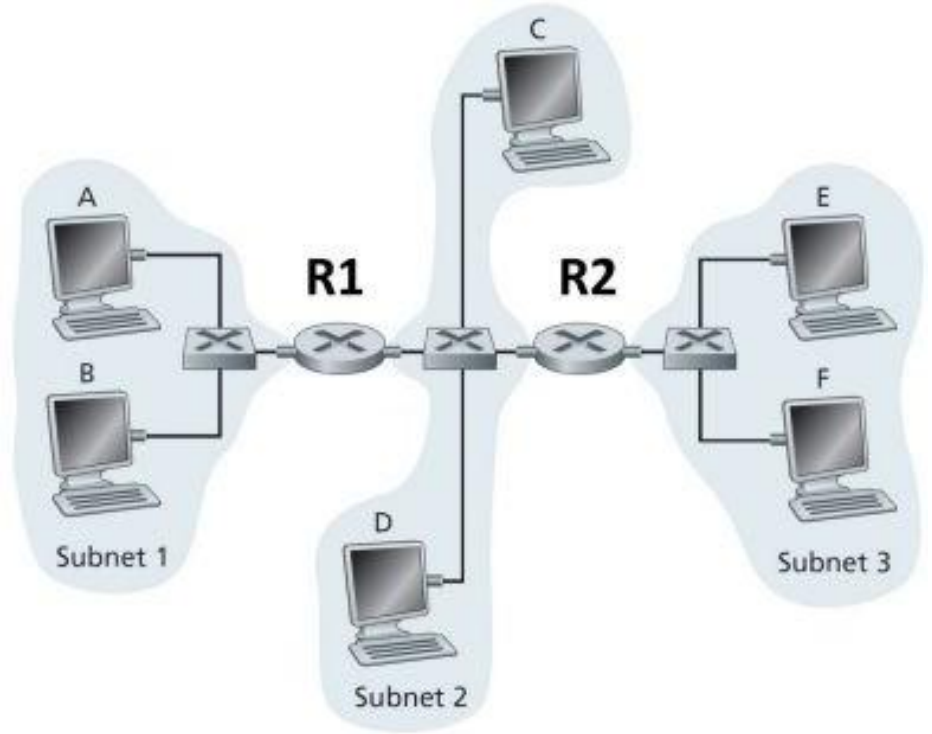
- Consider sending an IP packet from Host E to Host F. Will Host E ask router R2 to forward the packet? Why?
 - No. Host E and Host F are on the same subnet and are connected via switch.

Q2: ARP

- Consider E sending an IP packet to B. Assume E's ARP cache is empty.
  - Will E make an ARP request to find B's MAC address?
 - Will E make an ARP request? If yes, to whom?

Q2: ARP
———

- Consider E sending an IP packet to B. Assume E's ARP cache is empty.
  - Will E make an ARP request to find B's MAC address?
    - No. Host B and Host E are on the different subnets.
  - Will E make an ARP request? If yes, to whom?
   - Yes. It will be to R2 (next hop to B)
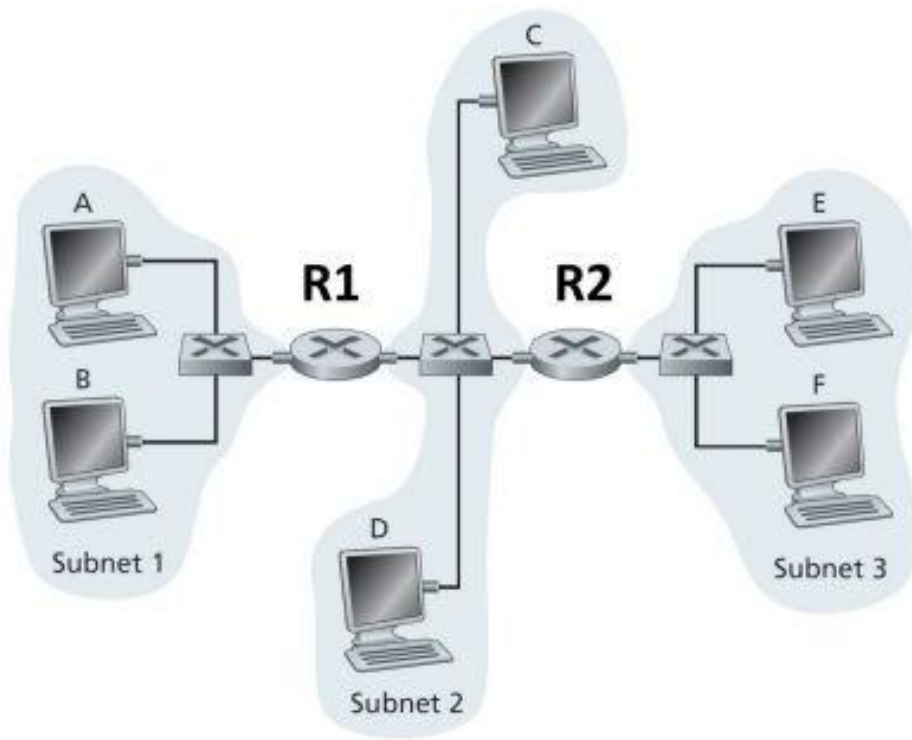
Q3: ARP and IP

___

- Consider E sending an IP packet to B.
- In the Ethernet frame of the IP packet going to B that is delivered to **router R1**, what are the source and destination IP and MAC addresses?

Q3: ARP and IP

———
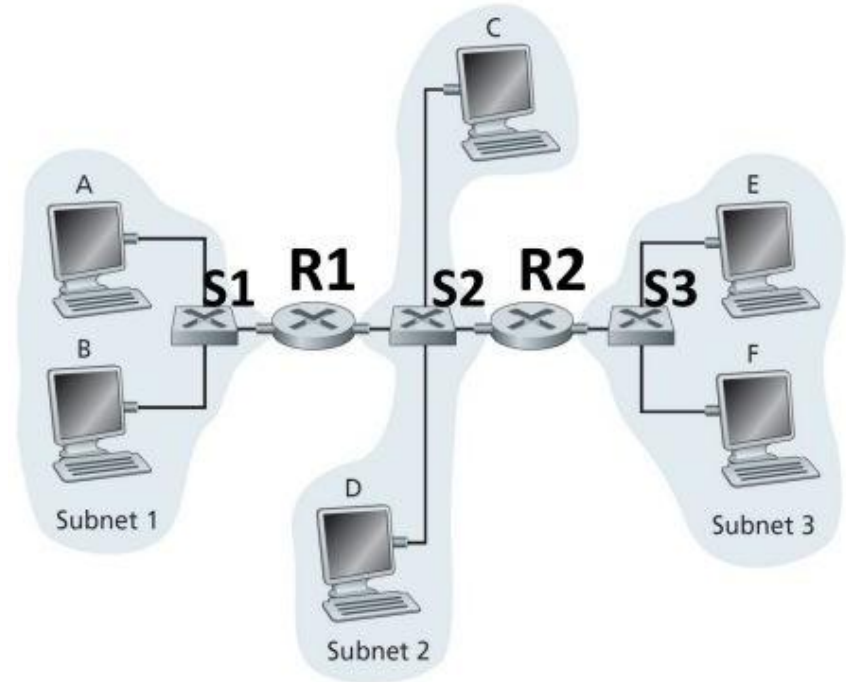
- Consider E sending an IP packet to B.
- In the Ethernet frame of the IP packet going to B that is delivered to **router R1**, what are the source and destination IP and MAC addresses?
  - srcIP: IP-E, dstIP: IP-B
  - srcMAC: MAC-R2, dstMAC: MAC-R1
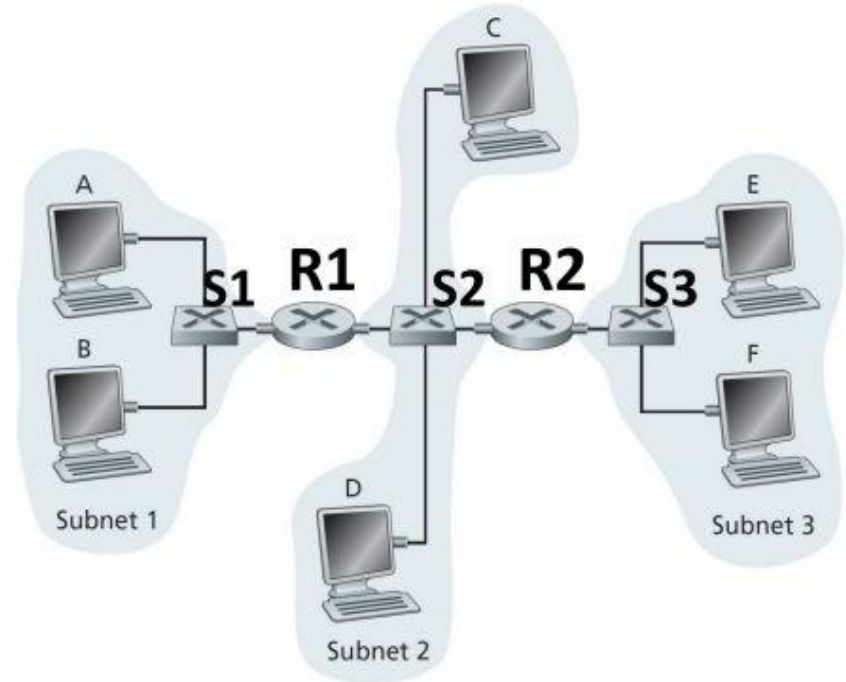
Wrap-Up

———

- Thanks for coming!
- Start Assignment 4 if you have not already!
- Start thinking about the Final Exam (Tuesday, April 30th, 1:30 pm – 3:30 pm, more details to be out soon)