Exercise 3

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Switch Learning Process

- Observation of traffic
  - When receiving a frame, location of sender is learned
    - Record that information as sender/location pair in **switch table**
- Forwarding Table: Mapping MAC addresses to ports
  - If it does not know where to forward to, it broadcasts the packet on all ports
    - If it gets an answer on one port, it updates the forwarding table (as when receiving a frame)

MAC address	Interface	TTL
12-34-56-78-9A-BC	1	60
AB-CD-EF-12-34-56	3	40

Hubs, Switches, Routers…

- Hub:
  - Sort of dump (e.g., no collision analysis)
  - operates as broadcaster

- Switch: Layer 2 device
  - Connects hosts inside one broadcasting domain
  - uses CSMA/CD for collision detection
  - learning process via switch tables (see slide before)

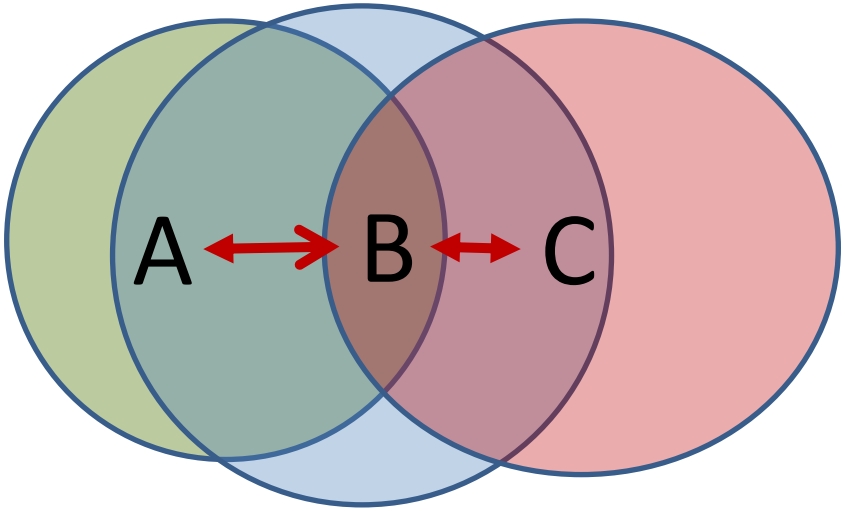
- Router: Layer 3 device
  - connects different broadcast domains (ARP only works within 1 domain)
  - routing tables

PPP Requirements

- Concept of Layering:
  - Error correction/recovery, flow control, delivery order are all delegated to the upper layers
- That means: PPP only responsible for
  - Framing of packets arriving from upper layer
  - Detection of data errors
  - Detection of link failure

Hidden Terminal Problem

- Appears in wireless networks
  - Two nodes that are not visible to each other (A,C) try to communicate to a node (e.g., an AP) visible to both (B) at the same time -> interference



- Need a solution that limits collisions
  - RTS/CTS in CSMA/CA

- Somewhat Contrary Effect: Exposed Station Problem
  - If you‘re interested, google it (not part of the lecture)

CSMA/CA Collision Avoidance

- Sender:
  - Sense channel
    - If idle for a certain amount of time (802.11: DIFS, ~50 µs) transmit entire frame
    - If busy, start exponential backoff (see last weeks exercise)
- Receiver:
  - If frame received OK, return ACK after waiting a certain amount of time (802.11: SIFS, ~10 µs)
    - Hidden terminal problem

CSMA/CA RTS/CTS

- Goal: Avoid collsions of large data frames
- Idea:
  - Use reservation of channel instead of random access
  - Allow collisions of reservation packets (small!)
  - Only reservation packets collide, no data frames!
- Solution: Sender transmits Request-To-Send (RTS) to BS, BS broadcasts Clear-To-Send (CTS) as answer (notifies other nodes in range that channel is busy)