Exercise 3

Narisu Tao

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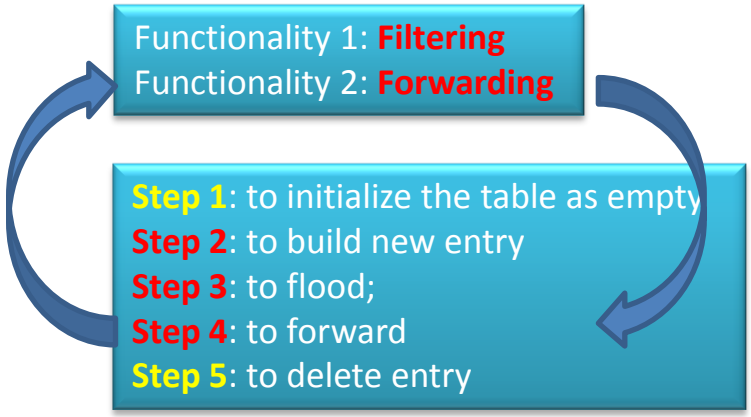
Switch Learning Process

Q1: Please briefly describe the learning process that a switch uses to fill its table.



The steps taken place when a frame received:

Source Addr.	Interface #	TTL
12-34-56-78-9A-BC	1	t1

1. Add a new entry into the table. (**step 2**)
2. **if** Is the entry started with destination address of the frame found in the switch table ?

if Is the interface number of the new found entry the same with the interface number the frame arrived in ?(Or is they from the same sub-network ?)

Drop the frame (**filtering**)

else

Forward the frame on interface indicated (**forwarding / step 4**)

end

else

flood (**step 3**)

end

Hubs, Switches, Routers…

Q2: What are the main purposes of the following devices: hub, switch, and router?

What are the differences between a switch and a router?

	Hub	Switch	Router
Belong to Which layer?	1 physical layer; repeat bits	2 link layer; filter and forward frame	3 network layer; deliver datagram
Can isolate frame collision	No	Yes	Yes
Can be used to connect different Ethernet thenologies	No	Yes	Yes
Multiple access protocol	No	Yes	?
Speed	1	2	3
Plug and play	Yes	Yes	No
Firewall protection	No	No	Yes
Shortest path		No	Yes

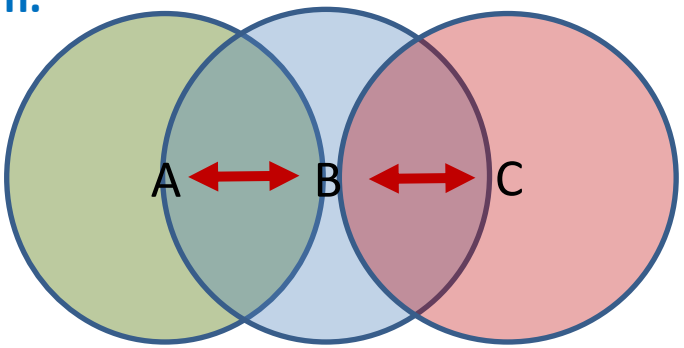
PPP Requirements

Q3: Why does PPP not need to provide error correction/recovery, flow control, etc.?

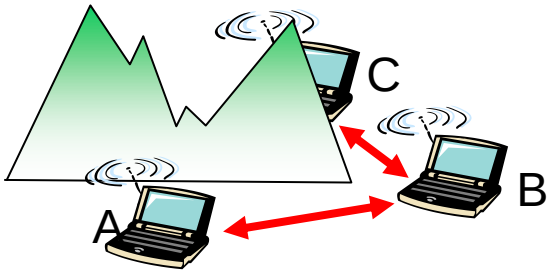
- Concept of Layering:
  - Error correction/recovery, flow control, delivery order are all delegated to the upper layers
- That means: PPP only responsible for
  - Framing of packets arriving from upper layer
  - Detection of data errors
  - Detection of link failure

Hidden Terminal Problem

Q4: Please explain the 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



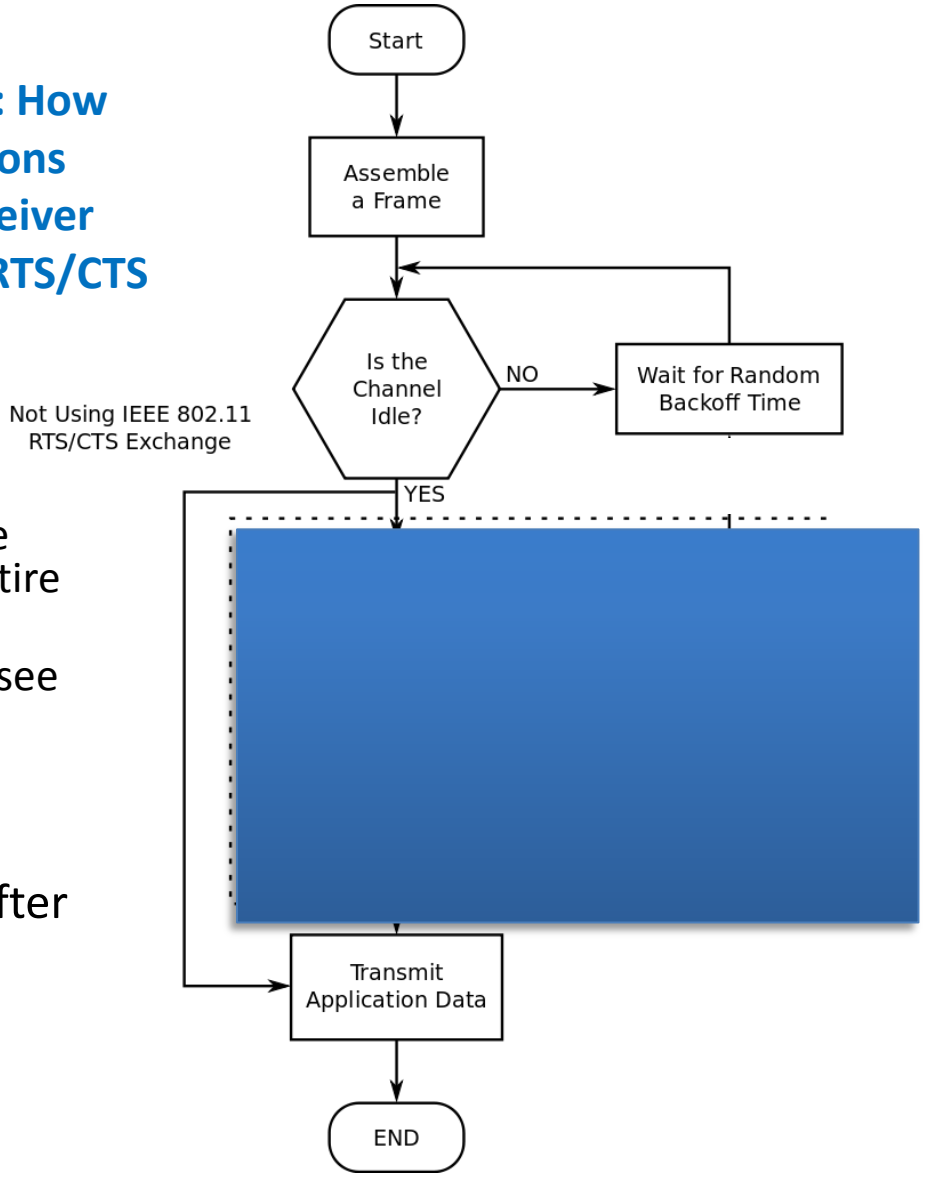
- Need a solution that limits collisions
  - RTS/CTS in CSMA/CA

- Contrary Effect: Exposed Station Problem
  - Imagine B sending to A, C wants to send to D (out of range of B)
  - C waits for A,B finishing their communication (-> unnecessary)

CSMA/CA Collision Avoidance

Q5: Consider the IEEE 802.11 MAC Protocol: How does CSMA/CA tackle the problem of collisions (what steps are taken at the sender and receiver respectively)? What is the idea behind the RTS/CTS concept?

- 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)