CS5222 Computer Networks and Internets Tutorial 12 (Week 12)

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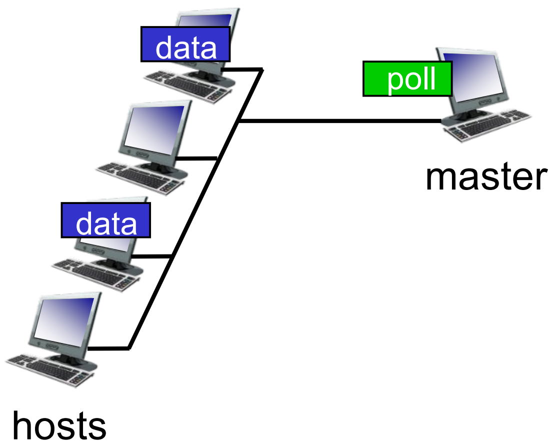
Slides based on book *Computer Networking: A Top-Down Approach.*

“Taking turns” MAC protocols

polling:

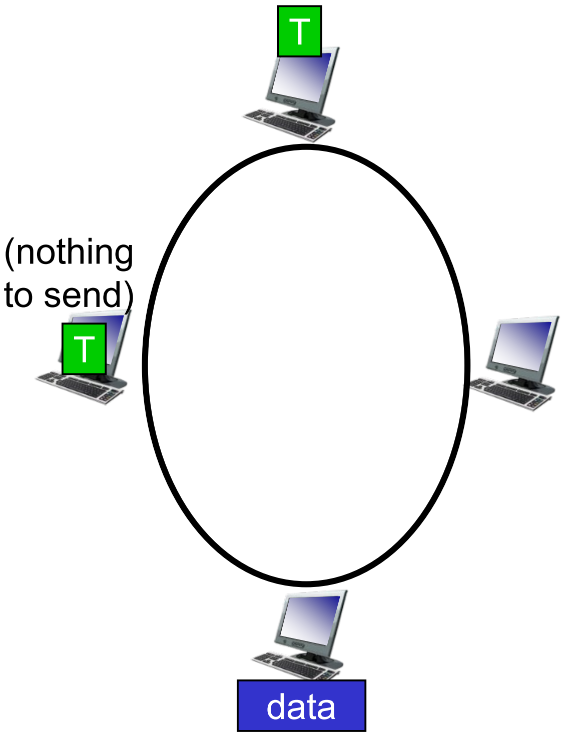
- access is structured into rounds.
- each node gets its turn during a round.
- master node “invites” nodes to transmit (one after the other)
- typically used with “simple” devices
- concerns:
  - polling delay (time d_{poll})
  - single point of failure (master)



“Taking turns” MAC protocols

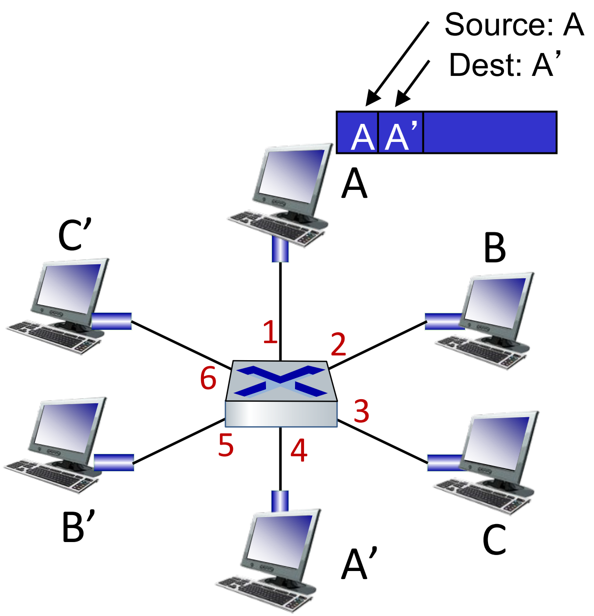
token passing:

- control *token* passed from one node to next sequentially.
- token message
- concerns:
  - token overhead
  - latency
  - single point of failure (token)



Switch: self-learning

- switch *learns* which hosts can be reached through which interfaces
  - when a frame received, switch "learns" the location of its sender: an incoming LAN segment
  - records the sender/location pair in switch table

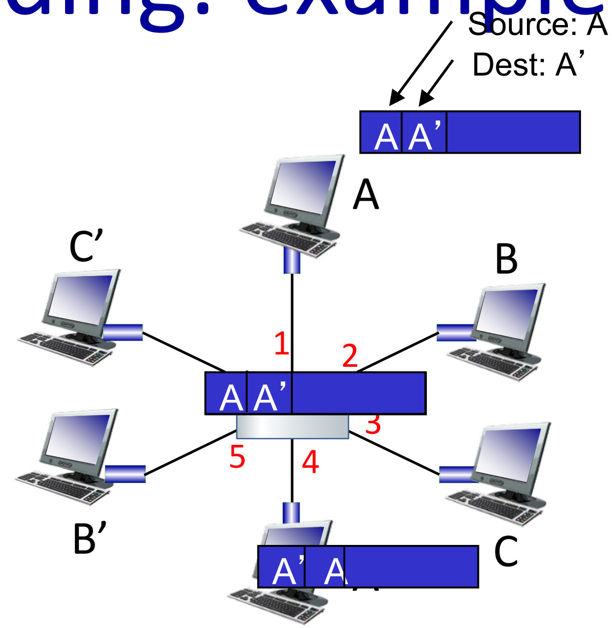


MAC addr	interface	TTL
A	*1*	*60*

Switch table (initially empty)

Self-learning, forwarding: example

- frame destination, A', location unknown: flood
- destination A location known: selectively send on just one link

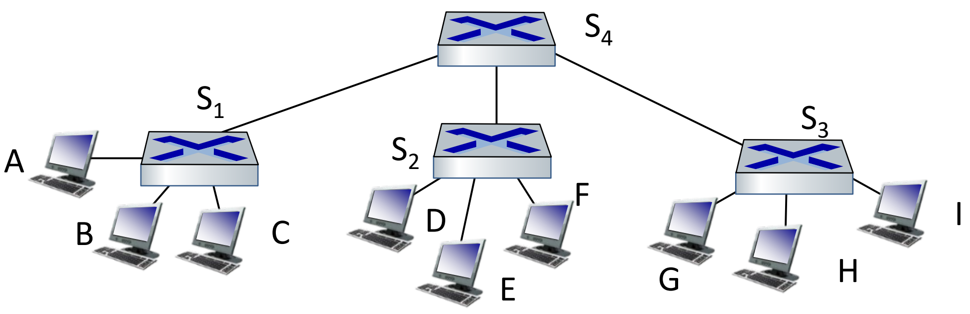


MAC addr	interface	TTL
A	*1*	*60*
A'	*4*	*60*

switch table (initially empty)

Interconnecting switches

self-learning switches can be connected together:

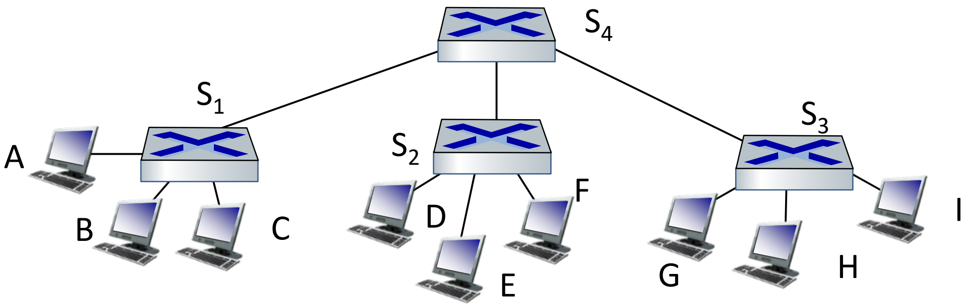


Q: sending from A to G - how does S_1 know to forward frame destined to G via S_4 and S_3?

- *A:* self learning! (works exactly the same as in single-switch case!)

Self-learning multi-switch example

Suppose C sends frame to I, I responds to C



Q: show switch tables and packet forwarding in S_1, S_2, S_3, S_4

Time to work on questions…

1. Suppose that the sender uses CRC with general polynomial $x^4 + x^2 + 1$ for error detection over a link. What is the bit string used as divisor (i.e., the generator) for computing the CRC bits?

Answer:

- Since the polynomial is $1*x^4+0*x^3+1*x^2+0*x^1+1*x^0$, the divisor (i.e. generator) is 10101.

2) Consider the LAN below consisting of 12 computers connected by two self-learning Ethernet switches. At t=0, the switch table entries for both switches are empty. For each of the following frame transmissions (and their replies),

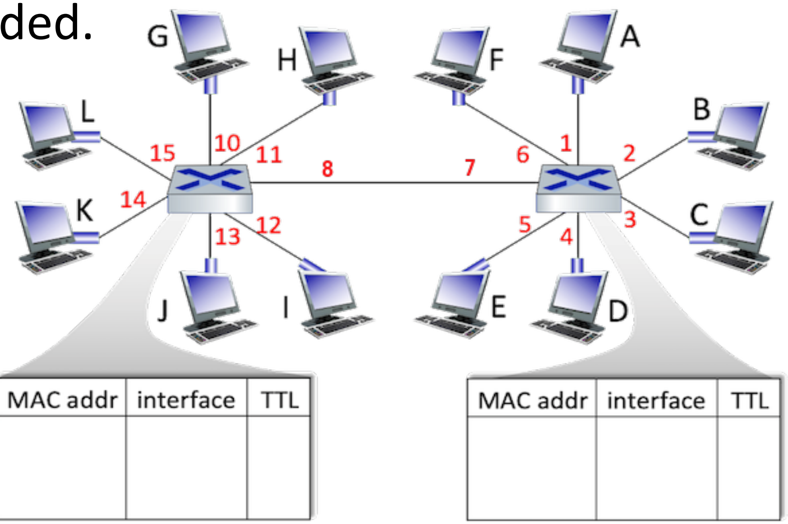
state (1) what information the switches learn, and

(2) to which hosts the frame will be forwarded.

(a) t=1: C -> G, G -> C

(b) t=2: C -> D, D -> C

(c) t=3: B -> G , G -> B



Answer: Let S1 be the left switch and S2 the right switch.

(a): C -> G: S2 learns (C,3), S1 learns (C,8). Frame is sent to everyone.

G -> C: S1 learns (G,10), S2 learns (G,7). Frame is sent only to C.

(b): C -> D: nothing new added to the tables; frame is sent to everyone.

D -> C: S2 learns (D,4). Frame is sent only to C.

(c): B -> G: S2 learns (B,2). S1 learns (B,8). Frame is sent only to G.

G -> B: nothing new added to the tables; frame is sent only to B.

3) Suppose that we are using the polling MAC protocol to control the access of 4 nodes to a broadcast channel. Assume that the channel has a transmission rate of 2 Mbps. There is an additional polling node (which notifies each of the nodes when it can transmit in a round robin fashion), and the polling delay is $d_{poll} = 100$ msec. Each node can transmit 0.25 Mbits in each round. What is the length (in sec) of a polling round?

Answer:

- Recall that the polling delay is the amount of time required to notify a node that it can transmit.
- Each node needs to be invited by the polling node before it can send.
- A round ends once every node has had its turn.
- Thus we need to add the delay d_{poll} four times in a single round.
- The total time for a round is:

  $4 * (d_{poll} + L/R)$
- $= 4 * (0.1 + 0.25 / 2)$
- $= 0.9$ seconds