National University of Singapore
School of Computing

CS2105 **Tutorial 9** Answer paper

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1. **[KR, Chapter 5, R6]** In CSMA/CD, after the fifth collision, what is the probability that a node chooses $K = 4$? The result $K = 4$ corresponds to a delay of how many microseconds on a 10 Mbps Ethernet?

   After 5th collision, NIC will choose K at random from {0, 1, 2, …, 2^5-1}. The chance to choose $K = 4$ is 1/32.

   NIC will wait for 4 * 512 / 10^7 = 204.8 microseconds.

2. **[Modified from KR, Chapter 5, P26]** Let's consider the operation of a learning switch in the context of a network in which 4 nodes, labeled A through D, are star connected into an Ethernet switch (refer to the diagram on Lecture 10 notes page 32).

   Suppose that the following events happened in sequence,

   i. B sends a frame to D

   ii. D replies with a frame to B

   iii. D sends a frame to A

   The switch table is initially empty. Show the state of the switch table after each of the above events (ignore TTL field). For each event, identify the link(s) on which the transmitted frame will be forwarded, and briefly justify your answers.

Event	Switch table after event	Link(s) a frame is forwarded to
B sends a frame to D	**(B, 4)**	**1, 2, 3**
D replies with a frame to B	**(B, 4) , (D, 3)**	**4**
D sends a frame to A	**(B, 4) , (D, 3)**	**1, 2, 4**

3. Refer to the diagram on Lecture 10 notes page 11. Suppose nodes A, B and R are star connected into a switch S. A, B and R are aware of the IP addresses of each other.

   a) Consider sending an IP datagram from Host A to Host B. Suppose all of the ARP tables and switch table are up to date. Enumerate all the steps the host and switch take to move the packet from A to B.

      1) A creates a frame with destination MAC address CC-49-DE-D0-AB-7D (B's address is found in ARP table).

      2) This frame travels to switch S and is forwarded towards B (interface to B is found in switch table).

   b) Repeat the problem in a), assuming that ARP table in the sending host is empty, but all other tables are up to date.

      1) A broadcasts an ARP query packet, with destination MAC address FF-FF-FF-FF-FF-FF.

      2) Switch S forwards this ARP query packet to both B and R since destination MAC address is a broadcast address.

      3) R will ignore this ARP query packet but B will reply to A. Switch S forwards the reply frame towards A (interface to A is found in switch table).

      4) Subsequently A can send IP datagram to B as in part a).

   c) Repeat the problem in a), assuming that all tables in all nodes are empty.

      1) A needs to issue an ARP query to know the MAC address of B.

      2) The query packet travels to switch S and is forwarded to both B and R. Switch S learns A is reachable via the interface query packet arrives at.

      3) R will ignore this ARP query packet but B will reply to A. Switch S forwards the reply frame towards A (interface to A is found in switch table). Switch S learns B is reachable via the interface reply frame arrives at.

      4) Subsequently A can send IP datagram to B as in part a).

   d) Suppose A sends an IP datagram to a host in another subnet. All of the ARP tables and switch table are up to date. Enumerate all the steps the host, switch and router take to move the packet to another subnet.

      1) A creates a frame with destination MAC address E6-E9-00-17-BB-4B (R's address is found in ARP table).

2) **This frame travels to switch S and is forwarded towards R (interface to R is found in switch table).**

3) **R checks the destination IP of the datagram and decides to forward it towards external network. It encapsulates the IP datagram in a new frame with source MAC address 1A-23-F9-CD-06-9B (dest MAC address not mentioned in question) and sends it through the interface towards external network.**

4. Wireshark: Ethernet

Do the following:

1. Make sure your browser's cache is empty. To do this, Clear Recent History.
2. Start up the Wireshark packet sniffer.
3. Enter the following URL into your browser http://gaia.cs.umass.edu/wireshark-labs/HTTP-ethereal-lab-file3.html.
4. Stop Wireshark packet capture.

Answer the following questions:

1. Based on the contents of the Ethernet frame containing the HTTP GET message:
    a. What is the 48-bit Ethernet address of your computer?

    Ans: select HTTP GET message and explore the 'mac-src' header field in the ethernet frame used to carry this HTTP GET message.

    b. What is the 48-bit destination address in the Ethernet frame? Is this the Ethernet address of gaia.cs.umass.edu? What device has this as its Ethernet address?

    Ans: destination address: select HTTP GET message and explore the 'mac-dst' header field in the ethernet frame used to carry this HTTP GET message.

    No.

    Gateway.

2. Based on the contents of the Ethernet frame containing the first byte of the HTTP response message:
    a. What is the value of the Ethernet source address? Is this the address of your computer, or of gaia.cs.umass.edu. What device has this as its Ethernet address?

Ans: select HTTP response message and explore the 'mac-src' header field in the ethernet frame used to carry this HTTP response message.

Neither my computer nor gaia.cs.umass.edu.

Gateway.

b. What is the destination address in the Ethernet frame? Is this the Ethernet address of your computer?

Ans: select HTTP response message and explore the 'mac-dst' header field in the ethernet frame used to carry this HTTP response message. Yes.