Fundamentals of Communication Networks

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1. **Exercise (6 pts)**:
   Two hosts A and B are connected to a host C. Assuming that:
   - Host A produces twice the traffic than host B.
   - Host A transmits packets of 1000 bits
   - Host B transmits packets of 500 bits.
   - The bit error rate on the link from A to C is 10^{-3}
   - The bit error rate on the link from B to C is 10^{-4}
   - A packet is marked as corrupted at C if at least one of its bits is corrupted

   Compute:
   (a) The probability of receiving a corrupted packet at C.
   (b) The probability that a corrupted packet received at C was transmitted from A.
2. **Exercise (6 pts)**
   In the network illustrated in Figure 1, the output queue of host A is composed by packets with the following destinations: B B C B. Each packet is composed by a 15 byte header and a 135 byte payload (for a total of 150 bytes).
   (a) Compute the time each packet reaches its destination assuming R1 operates in store and forward mode and no ARQ mechanism is implemented on A.
   (b) Repeat the computation in (a) assuming that R1 operates in cut-through mode.

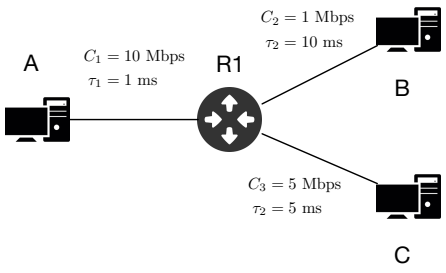

Figure 1: Network topology

3. **Exercise (6 pts)**

An organization has the network topology illustrated in Figure 2 and is given the following IP addressing space: 131.175.0.0/20. Define an addressing plan for the network and indicate for each subnet: IP address, netmask, direct broadcast address and maximum number of hosts.

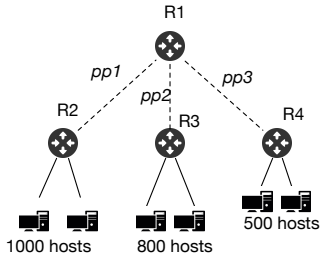

Figure 2: The network topology

4. **Exercise (4 pts)**

Given the network graph illustrated in Figure 3, compute the shortest path between R1 and all other nodes using Dijkstra algorithm.

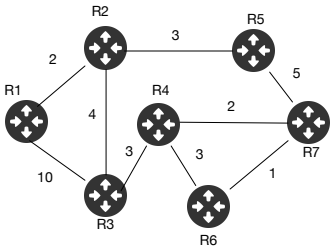

Figure 3: Network graph

5. **Question (6 pts)**
A router has the following interface configuration and routing table:

Eth0	145.170.123.76/25
Eth1	145.174.124.169/25

Network	Mask	Next Hop
145.170.122.128	255.255.255.128	145.174.124.254
145.170.122.0	255.255.254.0	145.170.123.1
145.174.124.0	255.255.255.128	145.170.123.2
145.174.122.0	255.255.254.0	145.170.123.3
0.0.0.0	0.0.0.0	145.174.124.253

Indicate how packets with the following destination are handled (indicate if direct or indirect forwarding is used and what is the next hop).

(a) 145.170.123.134

(b) 145.170.122.134

(c) 145.174.123.12

(d) 145.174.124.136

(e) 140.170.124.6

6. **Questions (4 pts - each answer can be either TRUE or FALSE)**
In case the answer is FALSE, briefly explain why.

- [T] [F] Cut-through is a more efficient choice than store-and-forward
- [T] [F] The Spanning Tree Protocol solves the problem of loops among routers.
- [T] [F] The codes $c_1 = \{1,1,1,1\}$ and $c_2 = \{-1,-1,1,1\}$ cannot be used in Code Division Multiplexing
- [T] [F] DNS requests are transported in an unreliable way.