UNIVERSITY COLLEGE DUBLIN

NATIONAL UNIVERSITY OF IRELAND, DUBLIN

An Colaiste Ollscoile Baile Atha Cliath

Ollscoil na hEireann, Baile Atha Cliath

SUMMER EXAMINATIONS 2004

SCHDF0018 - HIGHER DIPLOMA IN COMPUTER SCIENCE EXAMINATION
ARBDF0015 – THIRD YEAR ARTS EXAMINATION

COMPUTER SCIENCE

COMPP303: Networks and Internet Systems
COMP3616: Networks and Internet Systems

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Time: 1 hour and 45 minutes

Answer Question 1 ***(COMPULSORY)*** and ***any two*** of Questions 2–5.

All questions carry equal marks.

Loose Rough Work sheets are not to be distributed or used.

READ EACH QUESTION CAREFULLY.

Question 1 (COMPULSORY)

(1-a) An important architectural principle for computer network software is the concept of ***distributed scripts***. Briefly explain this concept as it applies to layered network architectures.

(1-b) Briefly explain why, for multimedia delivery over IP-based networks, UDP is usually preferred to TCP as the transport protocol.

(1-c) Suppose that a transmitter operating at 10 Mbps (equivalently: 10,000,000 bps) is connected to one end of a 23 km length of coaxial cable. The signal propagation speed in coaxial cable can be taken to be 230,000 km/sec. If packet-switching is used with a packet length of 10,000 bits, how many ***packets*** have been transmitted and are propagating along the cable when the first bit reaches the other end?

(1-d) Briefly describe the principle of ***least-cost routing*** in packet-switched networks, and mention some possible link costs that could be used.

Question 2

(2-a) Consider a Data Link Layer with the following measured parameters:

- frame transmission time at the sender is TRANSF = 400 microseconds
- ACK or NAK transmission time at the receiver is TRANSA = 50 microseconds
- link propagation delay is PROP = 10 microseconds
- frame processing time at sender or receiver is PROC ***(whose value is to be determined)***
- overall round-trip probability of frame error on the link is r = 0.02

Assume that for both the **Stop-and-wait** and **Go-back-n** ARQ schemes, the TIMEOUT at the sender is chosen optimally. The average packet throughput in each scheme is given by:

$$\mathbf{throughput_{SW} = (1-r)/(TRANSF+TIMEOUT)}$$

$$\mathbf{throughput_{GBN} = (1-r)/(TRANSF+(r \acute{} TIMEOUT))}$$

Suppose we want an average packet throughput of at least 2,000 packets/second. Find the maximum possible value of PROC using

(1) Stop-and-wait;
(2) Go-back-n.

(2-b) State and briefly explain the value of the Maximum Medium Access Time, MMAT, of a CSMA/CD scheme (as used in Ethernet, for example).

Question 3

(3-a) State whether the following statements are TRUE or FALSE ***(no explanation required)***:

1. In Ethernet, each node's physical address is guaranteed to be globally unique.

2. The General Parity Check error-handling scheme, in which the receiver takes the closest valid codeword (in Hamming distance) to the received word to be the transmitted codeword, can detect any combination of bit errors.

3. In any flow control scheme, if the receiver cannot handle the sender's current transmission rate it must send an explicit "slow down" signal to the sender.

(3-b) The throughput of an Ethernet can be determined by the formula

$$\mathbf{throughput = 1/(TRANSF + 5.4 \acute{} PROP)}$$

where **PROP** is the one-way channel propagation delay and **TRANSF** is the average frame transmission time. Using this formula, state and explain the effect on Ethernet throughput of the following changes:

1. the length of the channel is increased (everything else held constant);

2. the average frame length is decreased (everything else held constant).

Question 4

(4-a) The two most common types of routing algorithm are ***distance-vector*** and ***link-state***. Briefly describe their operation, mentioning which type is more widely used in practice and why.

(4-b) Briefly describe the operation of a **Gateway** (or Protocol Convertor), and mention some possible adjustments it may have to make to incoming packets before forwarding them.

Question 5

(5-a) An Internet host with IP address 128.96.34.12 and a subnet mask of 255.255.255.192 wants to send an IP packet to another host with IP address 128.96.34.139. Is the destination on the same subnet as the sender or not? Briefly explain your answer ***(a simple "yes" or "no" answer is insufficient).***

(5-b) Briefly describe (with the aid of diagrams) the "hidden" and "exposed" station problems in IEEE 802.11 Wireless LANs.

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