Eastern University, Sri Lanka

Department of Mathematics

Special Degree Examination in Science - (2013/2014) (March/April, 2016)

CS10 ADVANCED NETWORKING TECHNOLOGIES

Answer All Questions

This paper has 6 questions in a total of 6 pages

allowed: **Three Hours**

(a) List the five layers in the `Internet protocol` stack and describe their principal responsibilities. [20%]

(b) Suppose two hosts `Host A` and `Host B` are connected to each other by two packet switches, and a message of length 7.5×10^6 bits is sent from `Host A` to `Host B`. Also suppose that each link between `Host A` and the first packet switch, between the first packet switch and the second packet switch, between the second packet switch and `Host B` has a transmission rate of 1.5 Mbps. Ignore propagation and processing delays.

i. Consider sending the whole message without message segmentation. Find out how long it would take to move the message from `Host A` to the first packet switch. By assuming that each switch uses the store-and-forward packet switching, estimate the total time taken to move the message from `Host A` to `Host B`. [20%]

ii. Now suppose that the message is segmented in to `5,000 packets`, with each packet being `1,500 bits` long. Estimate how long it would take to move the first packet from `Host A` to the first switch. [20%]

iii. When the first packet is being sent from the first switch to the second switch, the second packet is being sent from `Host A` to the first switch. Estimate how long it would take to move the whole file from `Host A` to `Host B` when segmentation is used. [20%]

iv. Compare your results for parts i and iii, and comment on the values obtained. [20%]

2. (a) Describe the type of services provided by each of `User Datagram Protoc` and `Transmission Control Protocol (TCP)`.

   (b) Assume that the SendBase for a `TCP` sender is currently `4000`. The `TCP` se sent four `TCP` segments with sequence numbers `4000, 4500, 5500` an The sender then receives a segment with an acknowledgement number 7 a receive window `6000`. The congestion window, `CongWin`, is set to 100 after this `ACK` is processed. Answer the following questions by assuming `ACK` is processed and no further `ACK`s are received:

      i. Determine the value of `SendBase`.

      ii. Estimate the total number of bytes sent in the `four TCP` segments

      iii. Determine the last byte (number) that the `TCP` sender can send with that the receiver's buffer will not overflow.

   (c) An intelligent group of super speedy ants decide to set up a point-to- between two ant holes, denoted by `Hole A` and `Hole B`. Suppose width of this link is `1000 bps`, or bread crumbs per second (you ine that each ant holds a bread crumb, and they leave `Hole A` at `1000 ants per second`). The distance from `Hole A` to `Hole B` is 10 and the ants walk at a speed of `1 m/s`.

      i. Calculate the `Round Trip Time(RTT)` for the link between the t

      ii. Using the delay as half the `RTT` (i.e. just going from `Hole A` to going back), calculate the *delay* $\times$ *bandwidth* product for the li crumbs.

[Question 2 continues on next page]

iii. Suppose the queen ant in HoleA sends a messenger ant to HoleB to request 10,000 bread crumbs (remember each ant holds exactly one bread crumb). Assume that 10,000 ants are ready to leave when the messenger arrive. What is the duration of time that will elapse between when the messenger departed the queen and all 10,000 ants have arrived at HoleA. [10%

(a) With the aid of a diagram describe the series of actions that take place when a client requests a web page over HTTP from a server, which runs a web server program and waits for client requests. [10%

(b) Describe how web caching can reduce the delay in receiving a requested web page. Will web caching reduce the delay for all objects requested by a user or only for some of the objects? Justify your answer with reasons. [20%

(c) Describe two functions provided by *Domain Name System* (DNS) in a Client-Server paradigm. [15%

(d) Suppose within your Web browser you click on a link to obtain a Web page. The IP address for the associated URL is not cached in your local host, so a DNS lookup is necessary to obtain the IP address. Suppose that there are n DNS servers are visited before your host receives the IP address from DNS; the successive visits incur an Round Trip Time RTT of RTT1,..., RTTn. Further suppose that the Web page associated with the link contains exactly one object, consisting of a small amount of HTML text. Let RTT0 denote the RTT between the local host and the server containing the object. Assuming zero transmission time of the object, estimate the time elapsed from when the client clicks on the link until the client receives the object. [20%

e) The text below shows the reply sent from the server in response to the HTTP GET message in the question above. Answer the following questions, indicating where in the message below you find the answer:

HTTP/1.1 200 OK<cr><lf>Date: Tue, 07 Mar 2008 12:39:45GMT<cr><lf>

[Question 3 continues on next page]

Server: Apache/2.0.52 (Fedora)<cr><lf>Last-Modified: Sat, 10 Dec200
18:27:46 GMT<cr><lf>ETag: "526c3-f22-a88a4c80"<cr><lf>Accept-Ra
bytes<cr><lf>Content-Length: 3874<cr><lf> Keep-Alive:
timeout=max=100<cr><lf>Connection:Keep-Alive<cr><lf>Content-T
text/html; charset=ISO-8859-1<cr><lf><cr><lf><!doctype html publi
"-//w3c//dtd html 4.0 transitional//en"><lf><html><lf><head><lf>
http-equiv="Content-Type" content="text/html; charset=iso-8859-">
<meta name="GENERATO" content="Mozilla/4.79 [en] (Windows N
U) Netscape]"><lf> <title>CMPSCI 453 / 591 /NTU-ST550A Spri
homepage</title><lf></head><lf><much more document text follo
(not shown)>

i. Was the server able to successfully find the document or not? D
the time at which the document reply provided.

ii. Determine the time when the document was last modified.

iii. Find out the number of bytes that are there in the document th
returned.

iv. Write down the first 5 bytes of the document being returned. Did
agree to a persistent connection?

4. (a) Sheldon Cooper is designing a **Network Address Translator (NAT)**
use at home so that multiple computers share a single global IP addr

i. In his first attempt Sheldon designs a **NAT**, which maps an outg
ip, source port, destination ip, destination port tuple to nat ip
destination ip, destination port. To his surprise, he finds that n
Internet drop every packet sent by his **NAT**. What is missing in Sh
design?

ii. Now assume that Sheldon has corrected the above problem. F
that he can successfully browse the Web through the **NAT**, but h
FTP. Why? Explain your answer with justification.

[Question 4 continues on next page]

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