ITS323 – Quiz 1

Introduction to Data Communications, Semester 1, 2011

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Question 1 [4 marks]

Consider the TCP/IP protocol architecture.

(a) Windows Live Messenger, used for instant messaging or online chat, uses the MSN Messenger protocol. What layer is it implemented at? *Application*

(b) Which layer are IP addresses part of? *Network*

(c) Which layer includes the task of reliable delivery of data between application processes? *Transport*

(d) What type of network is used for communications inside a campus or office building? *Local Area Network*

(e) Which layer includes the task of reliable delivery of data across a single link? *Data Link*

(f) TCP and UDP are protocols in which layer? *Transport*

(g) Which layer deals with transmitting light signals across an optical fibre? *Physical*

(h) What type of network is used for communications between campuses or between cities? *Wide Area Network*

(i) One task in the Internet is for protocols to select the best path across a network. Which layer are these routing protocols most often a part of? *Network*

(j) Which layer deals with transmitting light signals across an optical fibre? *Physical*

(k) Timeliness is important for real-time Internet applications, whereas ____________ is more important for traditional data-based Internet applications? *Accuracy*

(l) In Thailand, local ____________ are connected together via about 5 or 6 National Internet Exchanges. *ISPs*

(m) Ethernet, used for wired LANs, includes a protocol for determining when a computer is allowed to send across a link or LAN, and fixing bit errors if any. Which layer is this protocol part of? *Data Link*

(n) Apache is the name of commonly used web server software. The protocols used by Apache are in which layer? *Application*

(o) A hardware address identifies a network interface card on a computer, whereas a ____________ identifies an application on the computer. *port number*

(p) An internet is comprised of LANs and ____________ connected together by routers. *WANs*

Question 2 [3 marks]

You have paid for a [6Mb/s | 500kb/s | |] link from your office to the ISP. When transferring a large file to one of the servers in the ISP's network your application reports a download rate of [4Mb/s | 250kb/s | |]. The application segmented the file into segments of 800B each.

(a) How many bits are transmitted by the server for each segment? Assume no errors or other non-data packets are needed. [2 marks]

Answer. *The efficiency is 4/6, which is 2/3. For every 800B of real data, there is another 400B of header. Hence 1200B or 9600b are transmitted for each segment. With the variant with 500kb/s, the efficiency is 1/2, hence 1600B or 12800b are transmitted.*

(b) Assuming you cannot change the amount of overhead per packet, and you cannot afford to get a higher speed link, what could be done to increase the efficiency? [1 mark]

Answer. *Increase the segment size sent by the application.*

Question 3 [2 marks]

Consider a protocol architecture that introduces [| | 200B | 500B] of header for each 1,000B of data. Two computers using the protocol architecture communicate across a [| | 60Mb/s | 600kb/s] link. What is the throughput? Assume no errors or other non-data packets are need.

Answer. *For every 1,000B of real data delivered, 1,200B of actual information must be sent. That is an efficiency of 5/6. With a link data rate of 60Mb/s, the throughput will be 50Mb/s. With the variant with 500B header, the efficiency is 2/3, and hence throughput is 400kb/s.*

Question 4 [3 marks]

Computer A is connected to computer B via a [3km | 12km | |], [1Mb/s | 100kb/s | |] link. Computer B is also connected to computer C via a 6km, [1Mb/s | 100kb/s | |] link. The processing delay for a packet at each computer is 100μs. There is no queuing delay. Every packet transmitted contains 125B.

(a) What is the propagation delay across the link from A to B? [1 mark]

Answer.

$$\begin{aligned} d_{propA} &= \frac{distance}{speed} \\ &= \frac{3000m}{300000000m/s} \\ &= 10\mu s \end{aligned}$$

For the variant, the propagation delay is 40μs.

(b) What is the transmission delay across the link from B to C? [1 mark]

Answer.

$$\begin{aligned} d_{transB} &= \frac{datasize}{datarate} \\ &= \frac{125B}{1Mb/s} \\ &= 1,000\mu s \end{aligned}$$

For the variant, the transmission delay is 10,000μs.

(c) What is the total delay to send a packet from A to C? [1 mark]

Answer. *The transmission delay across link 1 is the same as for link 2. However the propagation delay for link 2 is two times that for link 1. The total delay is the summation of both link transmission/propagation delays and the processing times:*

$$1000 + 1000 + 10 + 20 + 100 + 100 + 100 = 2330\mu s$$

For the variant, the total delay is 20,360μs.

Question 5 [4 marks]

You are web browsing on a lab PC in Bangkadi, visiting the Registration web site hosted on a server in Rangsit. The two campuses are connected via a [| | 12km | 120km], [| | 8Mb/s | 800kb/s] wireless link. The delay of a single packet (of any size) inside Bangkadi campus, from laptop to wireless transmitter, is 0.2ms. It is also 0.2ms within the Rangsit campus. You click on a link. The HTTP GET Request is 100B. The web page requested is 1000B. Ignore any processing and queuing times, and the time to use DNS.

(a) What is the propagation delay of the wireless link? [1 mark]

(b) How long does it take to transmit the web page across the wireless link? [1 mark]

(c) After you click on the link, how long do you have to wait for the web page to be received by your browser? [2 marks]

Answer. *We need to calculate the delay across the wireless link. Firstly, the transmission delay of the request:*

$$\begin{aligned} d_{wt\_req} &= \frac{datasize}{datarate} \\ &= \frac{100B}{8Mb/s} \\ &= 0.1ms \end{aligned}$$

Note that the response is 10 times larger and therefore will have a transmission delay 10 times larger. That is, $d_{wt\_resp} = 1ms$.

Now we need to calculate the propagation delay across the wireless link:

$$\begin{aligned} d_{wp} &= \frac{distance}{speed} \\ &= \frac{12km}{3 \times 10^8 m/s} \\ &= 0.04ms \end{aligned}$$

The propagation delay is the same in both directions.

So now we can calculate the response time as the sum of the times to deliver the request and to receive the response:

$$\begin{aligned} d_{response} &= d_{BKD} + d_{wt\_req} + d_{wp} + d_{RS} + d_{RS} + d_{wt\_resp} + d_{wp} + d_{BKD} \\ &= 0.2 + 0.1 + 0.04 + 0.2 + 0.2 + 1.0 + 0.04 + 0.2 \\ &= 1.98ms \end{aligned}$$

With the variant with 120km link at 800kb/s, the propagation delay is 0.4ms and the transmission delay for the request is 1.0ms. Therefore the total response time is 12.6ms.