

2010 Exam Summer [Network Computing]

Question 1: General Networking Concepts [10 marks]

Each sub-question below is worth 2 marks. Answer either *True* or *False* in each case.

- a) **UDP provides reliable delivery.**
 - False

- b) **HTTP uses TCP as its underlying transport protocol.**
 - True

- c) **A DNS server can map host names to geographic coordinates.**
 - True

- d) **TCP uses the sliding window mechanism to achieve flow control.**
 - True

- e) **Peer to peer is more scalable than client-server for file distribution.**
 - True

Question 2: Networking Fundamentals [20 marks]

a) **What are the five layers of the Internet protocol architecture? List the principal responsibilities of each layer. [10 marks]**

- Applications: supporting network applications: FTP, SMTP, HTTP
- Transport: process-process data transfer: TCP, UDP
- Network: routing of datagram's from source to destination: IP, routing protocols
- Link: data transfer between neighbouring network elements: PPP, Ethernet
- Physical: bits "on the wire"

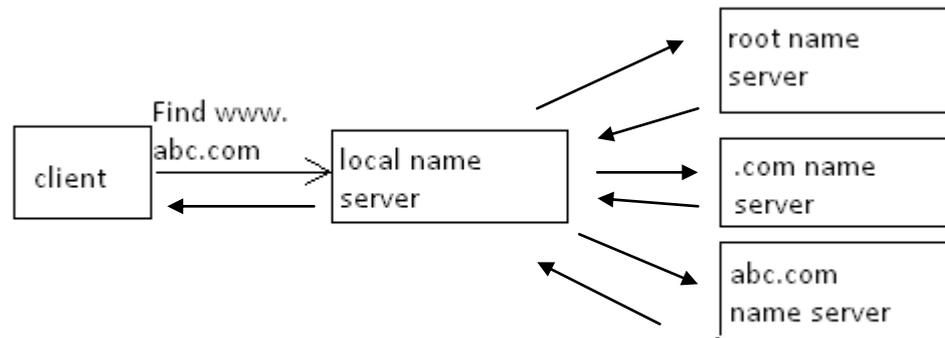
b) **Suppose a 2Mb/s link is being set up between the earth and a new lunar colony. The distance from the moon to the earth is approximately 240,000 miles and data travels over the link at the speed of light – 186,000 miles per second. How long does it take to transfer a 30KByte file from the Moon to the Earth? Assume that in order to request a file from the Moon requires an initial 2*RTT of "handshaking" before the file can be transmitted. [10 marks]**

- $240,000 / 186,000 = 1.290\text{seconds}$
- $\text{RTT} = 2 \times 1.290 = 2.58\text{seconds}$
- $2 \text{ RTT} = 2 \times 2.58 = 5.16\text{seconds}$
- $2\text{mbits/sec link, } 30\text{Kbytes} \times 8 = 240\text{Kbits}$
- $240\text{Kbits}/2\text{MB}(2,000\text{kb/sec}) = 0.12\text{seconds}$
- Time to transfer
 - $5.16(2 \text{ RTT}) + 0.12(\text{Transmission Delay}) + 1.290(\text{Propagation}) = 6.57\text{seconds}$

Question 3: Application Layer [20 marks]

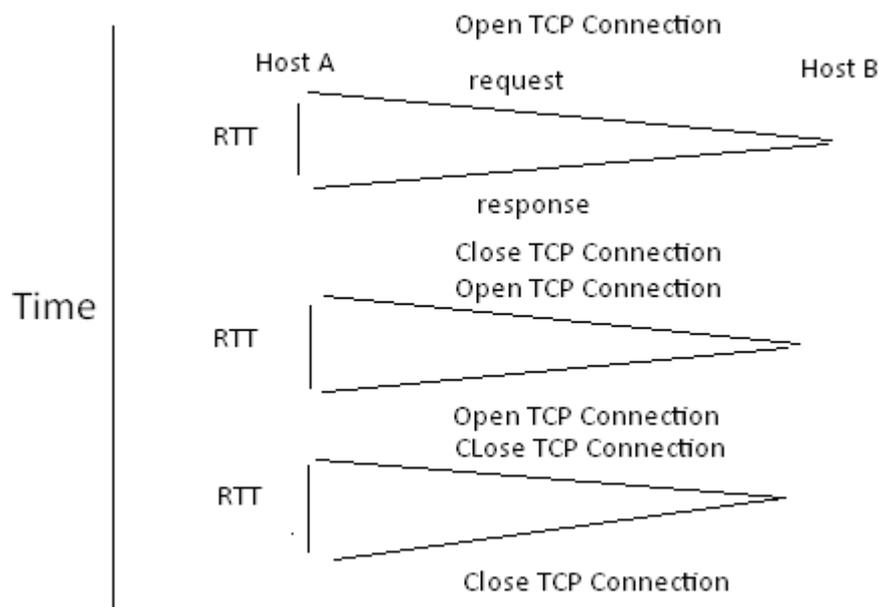
a) Expand the acronym DNS. Copy the following figure into your answer book and use it to explain how the name of host `www.abc.com` is resolved to its corresponding IP address. [10 marks]

- The client makes a request to the DNS. The DNS then makes a request to the root name server looking for the IP of the `.com` name server. The root name server replies and then the DNS contacts the `.com` name server looking for the DNS server of the `abc.com`. The `.com` name server replies with the name server entry of the `abc.com` and the LNS then connects to this and gets the current IP of the `abc.com` host which is then returned to the client.



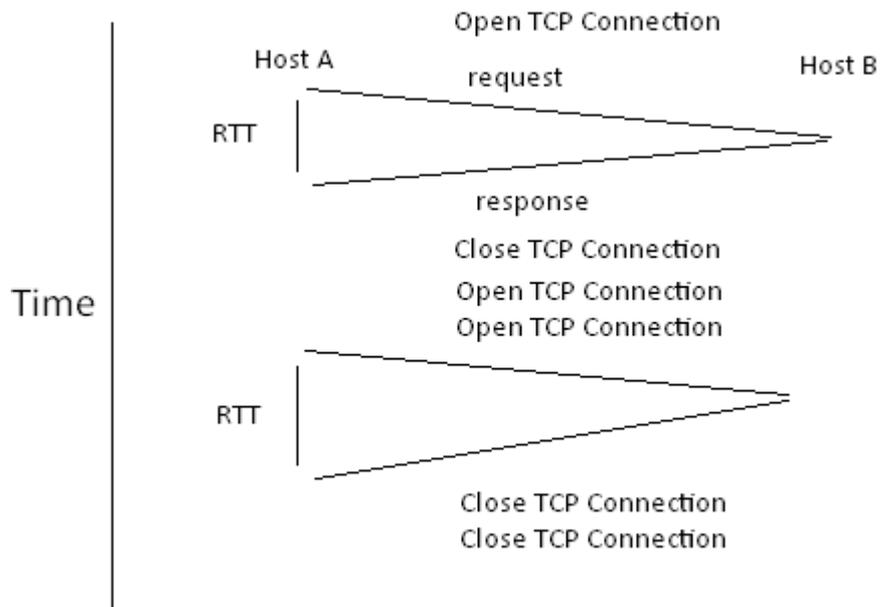
b) Suppose a user clicks on a link using a web browser, resulting in the download of a HTML file. Further suppose that the HTML file includes links for *two* small image files on the same server, and that these two image files are then downloaded by the browser immediately after receiving the initial HTML file. For each of the cases below, calculate *using time sequence diagrams* the number of round trip times (RTTs) that elapse from when the user clicks on the URL to when the download of all *three* files is complete. Only consider delays due to HTTP exchanges, so ignore delays due to TCP. In each case however you are asked to state the total number of TCP connections that are opened. [10 marks]

- i) Nonpersistent HTTP with no parallel TCP connections.



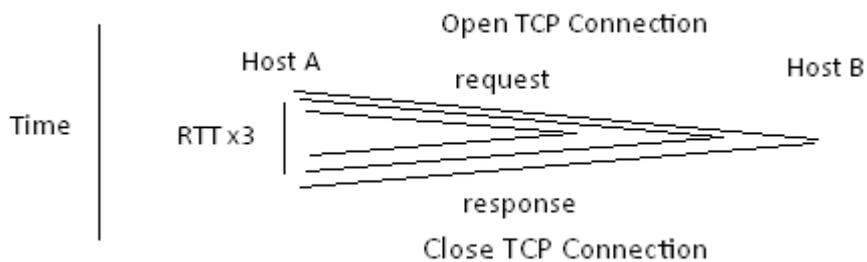
- 3 TCP, 3 RTT

ii) **Nonpersistent HTTP with parallel TCP connections.**



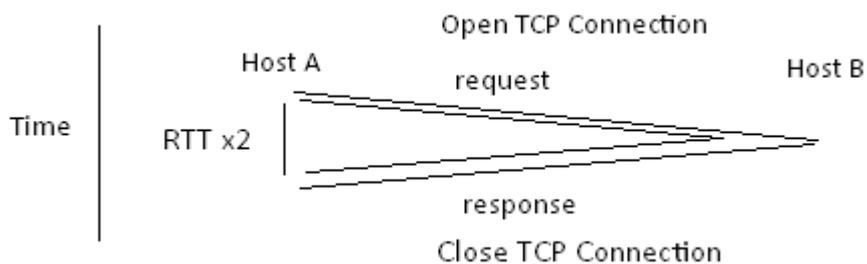
➤ 3 TCP, 2RTT

iii) **Persistent HTTP with no pipelining.**



➤ 1 TCP, 3RTT

iv) **Persistent HTTP with pipelining.**



➤ 1 TCP, 2RTT

Non persistent HTTP means the connection is closed instantly after each TCP request

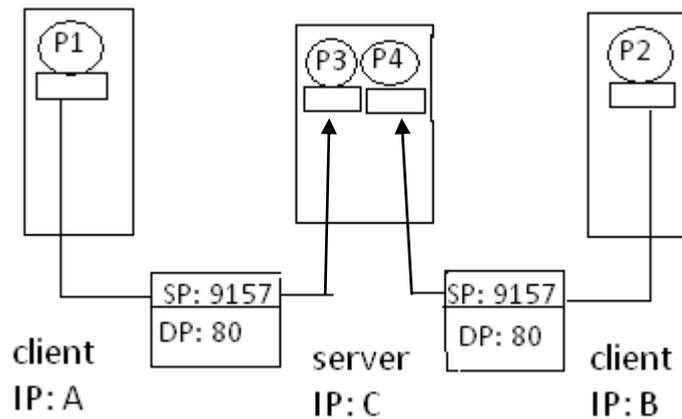
Persistent means everything sent on one TCP

Parallel allows the two images to be requested over the same HTTP connection

Question 4: Transport Layer [20 marks]

- a) Explain the purpose of the *port* field in Internet transport protocol headers. Illustrate using an example. [5 marks]

- The port field in the protocol header is necessary so when the server receives a packet it can forward the packet to the application that is listening on the port that the port field specifies.



Justify why an application programmer might decide to use UDP rather than TCP?

Consider all performance-related factors that impact this decision. [5 marks]

- UDP has less overhead and this reduces network traffic. There are smaller header files in each packet which means you can send more in each packet. TCP flow of control and RTT also reduce the speed of data transfer and the number of packets on the line.

b) You are asked to specify a simple (unidirectional) reliable transport layer protocol that must be able to deal with bit errors but not lost packets. Give the sender and receiver finite state machines for such a protocol. Assume that bit errors only affect packets from the sender. [8 marks]

- As the sender is the only machine affected by the bit error a checksum should be calculated on the sender machine and put in the header of the packet so the receiver can calculate and compare checksums. If the receiver checksums don't match an Ack should be sent so then the packet will be linked.

Explain how you would change your protocol if bit errors can affect packets from sender and receiver. [2 marks]

- If bit errors can affect packets from the sender and receiver I'd make both add checksum to the header and make both compare them on packet received, if they differ they can send an Ack to prompt a resend of the packet.