1.1. Why FTP uses two ports?

1.2. What do you mean by iterative and recursive DNS query?

1.3. How DDoS attack affect DNS services?

1.4. List at least four different applications that are naturally suitable for P2P architectures.

1.5. Suppose you want to do a transaction from a remote client to a server as fast as possible. Would you use UDP or TCP? Why?

1.6. The Internet was originally intended for robust transfer of computer-to-computer data over long distances. Briefly explain why connectionless packet-switching was preferred to circuit-switching in the IP layer.

1.7. The text below shows the reply sent from the server in response to the HTTP GET message. 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*>Server: Apache/2.0.52 (Fedora) <cr><lf>Last-Modified: Sat, 10 Dec2005 18:27:46 GMT<*cr*><*lf*>ETag: "526c3-f228a4c80"<*cr*><*lf*>Accept-Ranges: bytes<*cr*><*lf*>Content-Length: 3874<*cr*><*lf*>Keep-Alive: timeout=max=100<*cr*><*lf*>Connection: Keep-Alive<*cr*><*lf*>Content-Type: text/html; charset=ISO-8859-1<*cr*><*lf*><*cr*><*lf*><!doctype html public "-//w3c//dtd html 4.0 transitional//en"><*lf*><html><*lf*><head><*lf*> <meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1"><*lf*> <metaname="GENERATOR" content="Mozilla/4.79 [en] (Windows NT5.0; U) Netscape]"><*lf*> <title>CMPSCI 453 / 591 / NTU-ST550A Spring 2005 homepage</title><*lf*></head><*lf*><*much more document text following here (not shown)*>

a) **Was the server able to successfully find the document or not? What time was the document reply provided?**
b) **When the document was last modified?**
c) **How many bytes are there in the document being returned?**
d) **What are the first 5 bytes of the document being returned? Did the server agree to a persistent connection?**

Section 2: Problems

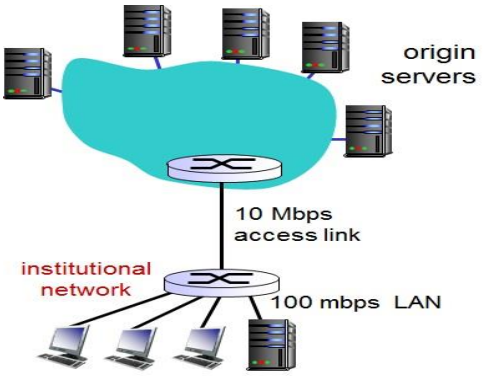
2.1. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links with transmission rates *R*1 = 250 kbps, *R*2 = 1 Mbps, and *R*3 = 500 Kbps.

a) **Assuming no other traffic in the network, what is the throughput for the file transfer? (3 points)**
b) **Suppose the size of the file is 8 million bytes. How long will it take to transfer the file from Host A to Host B? (3 points)**
c) **Repeat (a) and (b), when the transmission rate of *R*2 is reduced to 200 kbps. (4 points)**

2.2. Consider a packet of length 1500 bytes that needs to be transmitted over a link of 3100 km with a transmission rate 3 Mbps and a propagation speed 2.5 x 10^8 m/s.

a) **How long does a packet take to propagate over a link ? (4 points)**
b) **More generally, how long does it take for a packet of length *L* to propagate over a link of distance *d*, propagation speed *s*, and transmission rate *R* bps? (4 points)**
c) **Does this delay depends on the packet length? Does this delay depends on transmission rate? (2 points)**

2.3. Consider the following network topology where an institutional network of 100 Mbps capacity is connected to the Internet with an Access Link of 10 Mbps. Lets assume the browsers in the institutional network request objects of an average size of 600 Kbits at a rate of 20 requests/second. Find the:



4.

a. **Average data rate to browsers over the access link. (1 points)**
b. **LAN utilization. (2 points)**
c. **Access link utilization. (2 points)**

Now suppose that you have installed a web cache in the institutional network to reduce the load on the access network. With the addition of web cache 33% of the requests are satisfied locally and 67% of the requests are forwarded to the origin servers. Find the:

d. **Average data rate to browsers over access link. (1 points)**
e. **LAN utilization. (2 points)**
f. **Access link utilization. (2 points)**