

18-345

Introduction to Telecommunication Networks

Homework 1

September 3, 2008

Due: September 10, 2008

1. Discuss the advantages and disadvantages of packet switched networks over circuit switched networks. Name some of the applications for which a packet switched network would be preferred over a circuit switched network.
2. Suppose transmission channels become virtually error-free. Is the data link layer still needed?
3. Harry Bovik decides to do away with DNS. Instead he stores the mapping between domain names and IP addresses in a local file that is stored on his computer. He argues that this approach is better since it resolves domain names much faster. What is the problem with this approach?
4. What protocol (between *UDP* and *TCP*) do the following protocols use? Give reasons accordingly.
 - a) FTP
 - b) HTTP
 - c) DNS
5. Suppose you want to build a new application that requires inorder service but can afford losses. In other words, you don't require all the features of TCP but want more than the simple datagram delivery service provided by UDP. Is it possible to build such an application? Justify your answer.
6. Suppose an application layer entity wants to send an L byte message to its peer process, using an existing TCP connection. The TCP segment consists of the message plus 20 bytes of header. The segment is encapsulated into an IP packet that has an additional 20 bytes of header. The IP packet in turn goes inside an Ethernet frame that has 18 bytes of header and trailer. What percentage of the transmitted bits ("efficiency") in the physical layer correspond to message information, if $L = 100$ bytes, 500 bytes, 1000 bytes?
7. Suppose the population of the world is 6 billion, and that there is an average of 1000 communicating devices per person. How many bits are required to assign a unique host address to each communicating device? Suppose that each device attaches to a single network and that each network on average has 10000 devices. How many bits are required to provide unique network ids to each network?

8. You are required to reduce the delay for a certain application. The options under consideration are listed below. For each option, explain whether the decision will increase or decrease the packet delay. Moreover, which component of the delay (transmission or propagation) will be affected?
- i) Increasing the packet size
 - ii) Increasing the bit rate of the transmission system from R bits/second to $2R$ bits/second
 - iii) Moving the two endpoints physically closer (for example, Pittsburgh to New York rather than Pittsburgh to San Francisco)
9. Suppose regularly spaced PING packets are sent to a remote host. What can you conclude from the following results?
- i) No replies arrive back
 - ii) Some replies are lost
 - iii) All replies arrive but with variable delays
10. Assume an analog signal in a system has a bandwidth of 10 kHz. If we want to send the signal in digital format, what should be the minimum sampling rate required?