Dept. Computer Science **Computer Networks**
Vrije Universiteit **25.08.2003**

Always explain your answers concisely and be sure to be to-the-point.

1a Explain the difference between a connection-oriented messaging service and a connectionless messaging service. *5pt*

A connection-oriented service requires that a peer first sets up a connection to the target peer before data can be exchanged. In a connectionless service, messages are sent directly to a peer, requiring that the address is part of each message.

1b Describe which packets in which order would be transmitted in a simple request-reply protocol that is implemented on top of a connection-oriented service. *5pt*

See Fig. 1-18.

1c Is it possible to have two entirely different network-layer protocols be simultaneously supported by a single data-link layer? Explain your answer. *5pt*

Yes. The point is that the data-link frames really don't care what data they are carrying. What's important however, is that the data link layer can pass its frames to the appropriate network-layer module, which is identified by means of an ID field in the frame header.

2a What is the difference between a 2400-baud line, and a line that supports a trsnmission speed of 2400 bits per second? *5pt*

A 2400-baud line can support a sampling frequency of 2400 symbols per second. More than two symbols can be used, effectively enabling a higher transmission speed. A transmission speed of 2400 bps, means that only 2400 bits per second can be transmitted.

2b What is the purpose of modulation? *5pt*

Directly trying to transmit a digital signal across a wire may lead to such distortions that it becomes impossible to properly receive it. Modulation encodes a digital signal into an analog one, which is subsequently transmitted. By detecting the amplitude, frequency, or phase of such a signal, the receiver will interpret the signal to the proper digital value (e.g., 0 or 1).

3a Satellite links often exhibit high propagation times and low transmission speed. What does this mean? *5pt*

It means that it can take a long time for the start of a signal that represents a bit to reach the sender, and that the number of bits that can be transmitted per time unit is low.

3b What is the effect of having a small window size in the case of satellite communication? *5pt*

The connection is heavily underutilized as no frames can be sent while acks are being returned while at the same time the sender's window is full.

4a What is the difference between pure ALOHA and slotted ALOHA? *5pt*

In slotted ALOHA, a frame can be sent only at fixed times, whereas in pure ALOHA, you can send any time.

4b Data-link protocols usally do not support frame fragmentation, but 802.11 does. Why? *5pt*

If you can send shorter frames, the chance that a frame is damaged during transmission is smaller. Fragmentation allows the protocol to fragment frames in order to increase transmission reliability, without letting the network layer be aware of this. With 802.3 frame loss due to noise is rare; with 802.11 it is common.

5a Does it make sense to apply reverse path forwarding in a network using shortest path routing? *5pt*

No. In shortest path routing, routers build a spanning tree to all other routers. That tree can be used for broadcasting as well, which is the goal of reverse path forwarding.

5b Peer-to-peer routing is generally efficient in terms of the number of hops, but not in terms of the distance that is travelled in the underlying network. What is meant by this statement? *5pt*

P2P routing takes place between nodes that can be placed at entirely different locations in the Internet. In other words, two neighbors in a P2P network may actually lay in completely different parts of the Internet, effectively requiring long-distance Internet communication.

5c What is the purpose of the finger tables in the Chord peer-to-peer network and what would be effect of removing them? *5pt*

The finger tables allow to forward a request to a node that is really much closer to the request's target. Without them, Chord could only forward request to a neighbor on the logical ring of current nodes, leading to a very low performance.

6a Explain how TCP's slow start works. *5pt*

See book.

6b Running TCP across wireless networks may lead to performance problems. Why? *5pt*

The problem is that the underlying network may drop packets due to bad transmission conditions. However, TCP assumes that packet loss is caused by congestion and as a consequence starts to decrease the congestion window size, in turn leading to sending off smaller segments. What it should have done is adopt a more aggressive form of retransmission (perhaps with smaller segments) instead of just merely lowering the segment size.

6c When a TCP implementation passes bytes to the receiving application, the TCP specification permits the receiving TCP entity to wait with informing the sender that more data can be sent. What purpose does this waiting have? *5pt*

By waiting, we can avoid that the sender is allowed to send only a single byte of data, which will always need to be accompanied by 40 byte header info, which is highly inefficient in terms of consumed bandwidth.

7a What is the difference between a DNS domain and a DNS zone? *5pt*

A DNS domain is a subtree in the DNS name space. A zone is a part of the tree that is managed by a single name server.

7b Assume that all root servers in DNS are successfully attacked and are brought down. What effect will this have on the use of the Internet? *5pt*

Initially, the effect will not be visible as the data stored by the root servers is replicated by the many servers for the top-level domains. However, as time passes, these data become obsolete or are removed by which time name resolution will become a problem. Note that resolving nonexisting names becomes impossible from the start.

8 Give a simple authentication protocol based on public-key cryptography. *5pt*

See book.

***Grading:** The final grade is calculated by accumulating the scores per question (maximum: 90 points), and adding 10 bonus points. The maximum total is therefore 100 points.*