

## Network Computing Question List

---

- a) The Internet Protocol (IP) is an application –layer protocol.
  - b) IPv6 addresses are 64-bits in length.
  - c) UDP provides reliable message delivery.
  - d) HTTP uses TCP as its underlying transport protocol.
  - e) DNS stands for Domain Name System.
  - f) TCP provides flow control.
- a) IPv6 addresses are 128-bits in length.
  - b) UDP does not provide flow control.
  - c) HTTP uses TCP as its underlying transport protocol.
  - d) A DNS server can map host names to geographic coordinates.
  - e) TCP uses the sliding window mechanism to achieve flow control.
- a) TCP provides reliable delivery.
  - b) Congestion is said to occur when queues in routers overflow.
  - c) The software implementing the DNS Domain Name Service is executed on Internet routers.
  - d) HTTP uses binary rather than text to encode its messages.
  - e) The Internet is based on the principle of packet switching.
- a) UDP provides reliable delivery.
  - b) HTTP uses TCP as its underlying transport protocol.
  - c) A DNS server can map host names to geographic coordinates.
  - d) TCP uses the sliding window mechanism to achieve flow control.
  - e) Peer to peer is more scalable than client-server for file distribution.

1. Explain the basic principles of datagram packet switching as used in the Internet.
2. Identify the steps that are taken by an IP router in processing a newly arrived packet. (*Hint: think about all the main fields in the IP header and what they are used for*).
3. The figure below shows the TCP header (without options). For each field briefly explain how its value is determined *and* how it is used.

Source Port

Destination Port

Sequence Number

Acknowledgement

Header Length

Advertised Window

Flags

Checksum

Urgent Pointer

4. List the application-layer protocol, the transport-layer protocol and the network layer protocol that are used by file transfer clients and servers.
5. Draw a diagram showing the sequence of headers in a packet as it would be sent from a file transfer client to a file transfer server.
6. Explain the purpose of the port field in Internet transport protocol headers.
7. 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.
  - i) Nonpersistent HTTP with no parallel TCP connections.
  - ii) Nonpersistent HTTP with parallel TCP connections.
  - iii) Persistent HTTP with no pipelining.

iv) Persistent HTTP with pipelining.

8. Video conferencing applications encode and packetize video and voice for delivery between computers on the Internet. The bandwidth required is relatively high and because users interact in real-time a low latency is desirable. Given the choice of TCP or UDP as transport protocol, which would you recommend for these applications and why? (*Hint*: think about issues such as reliability, latency, congestion).
9. 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. What are the five layers of the Internet protocol architecture? List the principal responsibilities of each layer.
11. Consider a 50Kb/s link to an interplanetary spacecraft. The distance to the spacecraft is approximately 2,232,000 miles and data travels over the link at the speed of light – 186,000 miles per second. The spacecraft takes a photo that is compressed to size 500Kbytes. How long does it take for the photo to be delivered over the link?
12. TCP uses a sliding-window protocol. Consider two hosts, A and B, with an open TCP session. A sends a segment with sequence number 2600 and after some time receives a segment from B with sequence number 22500 and acknowledgment number 3600.
  - i) How many bytes were received and confirmed by host B? [4 marks]
  - ii) Is there a relationship between the values of the two sequence numbers? Explain your answer.
13. 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  $2 \times \text{RTT}$  of "handshaking" before the file can be transmitted.
14. Justify why an application programmer might decide to use UDP rather than TCP? Consider all performance-related factors that impact this decision.

15. 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.
  
16. Explain how you would change your protocol if bit errors can affect packets from sender and receiver.