# Chapter 6

1．The maximum payload of a TCP segment is 65495 bytes. Why was such a strange number chosen?

The maximum length of an IP datagram is 65535 bytes, comprising a minimum of 20 bytes for the fixed header and the IP payload. Therefore, the maximum size available for the IP payload itself is **65535 - 20 = 65515 bytes**.

For a TCP segment to be transmitted within an IP packet, it must fit within this 65515 byte payload field. Since the TCP header consumes a minimum of 20 bytes, the maximum payload size for a TCP segment becomes **65515 - 20 = 65495 bytes**.

2．If the TCP round-trip time RTT is currently 30 msec and the following acknowledgements come in after 26, 32 and 24 msec, respectively, what is the new RTT estimate using the Jacobson algorithm? Use a = 0.9.



3．In a network that has a maximum TPDU size of 128 bytes, a maximum TPDU lifetime of 30 sec, and an 8-bit sequence number, what is the maximum data rate per connection?

A sender may not send more than 255 TPDUs, i.e., 255\*128 \*8 bits, in 30 sec.

The data rate is thus no more than **8.704 kbps.**

4．To get around the problem of sequence number wrapping around while old packets still exist, one could use 64-bit sequence number. However, theoretically, an optical fiber can run at 75 Tbps. What maximum packet lifetime is required to make sure that future 75 Tbps networks do not have wraparound problems even with 64-bit sequence numbers? Assume that each byte has its own sequence number, as TCP does.

The size of the sequence space is bytes, which is about bytes. 75 Tbps= bps.

# Chapter 7

1. Can a machine with a single DNS name have multiple IP addresses? How could this occur?

Yes, an IP address is composed of both a network number and a host number. When a machine is equipped with two Ethernet cards, it has the capability to be part of two distinct networks. In such a scenario, the machine requires two separate IP addresses.

1. A binary file is 3072 bytes long. How long will it be if encoded using base64 encoding, with a CR+LF pair inserted after every 80 bytes sent **and** at the end?
2. From an ISP's point of view, POP3 and IMAP differ in an important way. POP3 users generally empty their mailboxes every day. IMAP users keep their mail on the server indefinitely. Imagine that you were called in to advise an ISP on which protocol it should support. What considerations would you bring up?

In order to make an informed decision regarding email protocols, several factors need to be considered. Firstly, it's essential to discuss the expected volume of incoming mail, as this will impact storage requirements, especially when using IMAP. POP3, on the other hand, is a more suitable choice for servers with limited storage space because it downloads all emails to the user's local disk. However, if local storage is also limited, POP3 may not be the best option.

Another critical consideration is the predominant usage pattern among subscribers. IMAP offers the advantage of allowing users to sync their emails and search for specific content within emails before downloading them. In contrast, POP3 lacks this capability.

Additionally, it's crucial to determine whether subscribers access their mail from multiple devices or just one. With POP3, email access is limited to a single device at a time, whereas IMAP allows messages to be accessed across multiple devices simultaneously. These considerations are vital when choosing the most suitable email protocol for your specific server setup.

1. The standard http URL assumes that the Web server is listening on port 80. However, it is possible for a Web server to listen to some other port. Devise a reasonable syntax for a URL accessing a file on a nonstandard port

The official RFC 1738 way to do this is **http://dns-name:port/file**

1. Imagine that someone in the CS Department at Stanford has just written a new program that he wants to distribute by FTP. He puts the program in the FTP directory ftp/pub/freebies/newprog.c. What is the URL for this program likely to be?

The URL is probably **ftp://www.cs.stanford.edu/ftp/pub/freebies/newprog.c**