Chapter 6

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

Solution:

Maximum IP packet is 65,535 bytes, out of which 20 is used for IP headers. So the entire TCP segment must fit in the 65515-byte payload field of an IP packet. Because the TCP header is a minimum of 20 bytes, only 65515-20=65495 bytes are left for TCP data.

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.

Solution:

RTT = α ×RTT + (1-α)R

The value ”0.9” is for “α”

(1) The value “26” is for “R”, and the value “30” is for “RTT”

RTT = 0.9×30 + (1-0.9) ×26 = 29.6

(2) The value “32” is for “R”, and the value “29.6” is for “RTT”

RTT = 0.9×29.6 + (1-0.9) ×32 = 29.84

(3) The value “24” is for “R”, and the value “29.84” is for “RTT”

RTT = 0.9×29.84 + (1-0.9) ×24 = 29.256

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?

Solution:

TPDU with the same sequence number should not be transmitted in the network at the same time. We must ensure that when the sequence number is recycled and reused, the other TPDU with the same sequence number have disappeared from the network. Now the TPDU lifetime is 30 sec, then within 30 sec a sender may not send more than 256 packets, that is, 256×128×8÷30 = 8738 bps

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.

Solution:

The Sequence number (using 64 bits) will wrap around after

$$(2^{64} \times 8) \div (75 \times 10^{12}) = 1.97 \times 10^{6}\,\text{sec} \approx 22.7\ \text{days},$$

so the maximum segment lifetime must be limited to under 22.7 days.