
2. Problem 5.42. Ans: The effective interarrival time now would be $T - I$, so the peak rate now is $1/(T - I) = 125,000$ cells/sec.

3. Problem 5.43. Ans: 12 cells. Just plug in the formula $N = 1 + L/(T - \delta)$ with $\delta = (53 \times 8)/155.52Mbps = 2.73\mu$sec, $L = 25\mu$sec and $T = 1/PCR = 1/200,000 = 5\mu$sec.

4. Problem 6.4 Ans: (a) 3216.8 sec (b) 5361.3 sec. The clock takes 32,768 ticks, i.e., 3276.8 sec to cycle around. The worst case happens when the sender has zero generation rate, for which the sender would enter the forbidden zone at 3276.8 - 60 = 3216.8 sec.

5. Problem 6.7 Ans: the sender should retransmit in state $S_1$; the receiver’s order does not matter, i.e., either AW or WA would do. When the AW or WA time is small, the event AC(W) and WC(A) are unlike events. Therefore we can ignore the first and the last columns of Figure 6.18 on page 509 and choose the best combination of client and server strategies that would yield only OK’s.

6. Problem 6.14 Ans: No. A connection is identified only by its sockets. Thus (1,p) - (2, q) is the only possible connection between these two ports.

7. Problem 6.15 Ans: Because the maximum IP packet length is 65,535 bytes but the minimum TCP header is 20 bytes and the minimum IP header is also 20 bytes.

8. Problem 6.16 Ans: One way is to start with a LISTEN. If a SYN is received, the protocol enters the SYN RECD state. Another way is when a process tries to do an active open and sends a SYN. If the other side was opening at the same time and a SYN is received, the SYN RECD is also entered.

9. Problem 6.18 Ans: 40 msec. The first bursts contain 2KB, 4KB, 8KB, and 16KB, respectively. The next one is 24KB which will occur after 40 msec.

10. Problem 6.21 Ans: Maximum achievable data rate = 3.277MBps or 26.21Mbps; maximum achievable line efficiency is 2.62%. One window can be sent every 20 msec (round-trip time). This gives 50 windows/sec, for a maximum data rate of $50 \times 65,535B \times 8b/B$ per second.

11. Problem 6.22 Ans: 8.704Kbps. A sender may not send more than 255 TPDUs in 30 second to avoid using the same sequence number within the maximum TPDU lifetime, so the maximum date rate is $(255 \times 128 \times 8)/30$.

13. Problem 6.29 Ans: 80.5% for AAL 3/4 and 87.8% for AAL 5. For AAL 3/4, the number of cells needed to carry 1024 bytes of user data = \((1024+8)/44\), i.e., 24 cells, so the efficiency is \(1024/(24 \times 53) = 80.5\%\). For AAL 5, the number of cells needed is only \((1024+8)/48\), i.e., 22 cells, so the efficiency is \(1024/(22 \times 53) = 87.8\%\).

14. Problem 6.30 Ans: about two per week. The cell rate is \(600\text{Mbps}/(53 \times 8) = 1.425\) million cells per second, so the bad cell rate is 14,150 bad cells per second. Assume that each message carries one cell. With a 32-bit CRC, it means that 1 bad cell in every \(2^{32}\) bad cells will be undetected. Therefore the amount of time taken for a bad cell to go undetected is \(2^{32}/14,150 = 303,531\) seconds. This means that \((7 \times 24 \times 60 \times 60)/303,531 \approx 2\) bad cells will go undetected in a week of time.

15. Problem 6.32 Ans: For the 1Gbps line, the response time is 0.5 msec (1-way propagation delay obtained by dividing the distance by the propagation speed) + 0.5 msec + 1.024 \(\mu\) sec (transmission time for 128 bytes on a 1Gbps line); for the 1Mbps line, the response time is 0.5 msec + 0.5 msec + 1.024 msec. Therefore, the conclusion is that the response time is basically limited by the speed of light or the round-trip propagation delay. In this case, improving the line speed by a factor of 1000 only wins a factor of two in performance, so unless the Gbps line is cheap it is probably not worth it.