

Problem 1.

For the TCP protocol, every byte of data is numbered and the TCP SEQ field is 32 bits long. So, at most 2^{32} bytes can be sent in 120 sec (approximately, 35,791,394 payload bytes/sec). This is 23,860 1500-byte frames/sec. The TCP overhead is 20 bytes. The IP overhead is 20 bytes. The Ethernet overhead is 26 bytes. This means that for 1500 bytes of payload, 1566 bytes must be sent. If we are to send 23,860 frames of 1566 bytes every second, we need a line of $23860 \times 1566 \times 8 \text{ bps} = 298918080 \text{ bps} \approx 299 \text{ Mbps}$. With anything faster than this we run the risk of two different TCP segments having the same sequence number at the same time.
