Digital Communications II 2004 – Paper 7 Question 2 (JAC)

This material was covered in the Michaelmas term in lectures 5,6 on TCP. It is also extremely well described in the suggested reading books (esp. Stevens).

(*a*) Describe the operation of the TCP congestion control scheme, covering the two phases of *slow start*, *congestion avoidance* and the triggers of *duplicate ack* and *timeout* that set it in train. [10 marks]

Answer need to show the behaviours of cwnd against time in the two stages. cwnd is increemnted once for every ack in "slow start", and once for every cwnd's worth of ack in congestion avoidance phase (implemted as mss/cwmd for each packet). cwnd is halved for every dupack, and timeout, and ssthresh set to cwnd. on timeout, cwnd is set to 1, and slow start ensues until the gap is filled then cwnd is set to ssthresh.

(*b*) A computer is connected to the Internet via a wireless link using the packet service from the mobile phone company. This offers 30kbps data rate, but has a widely varying round trip time across the wireless hop from the computer to the next hop in the bacbone of between 700 milliseconds and 1.1 seconds. It also has an average packet loss rate of 25data packets and acknowledgements, show the impact that this has on the throughput that a typical TCP implementation would get. Assume a 1500 byte MSS. [10 marks]

Answer is qualitative but should use rough numbers to reenforce argument:
So 1500 byte MSS is approx 10k bits - in principle then we could get about 3 packets per round trip time (or more if the back haul network has more capacity*delay), but in practice, we have a 1/4 chance of packets being lost, so the chance of getting out of slow start are quite small - viz
3/4 chance first cwnd *
$3/4 * 3/4$ chance second cwnd *
$3/4^3$ third cwnd
i.e. $(3/4)^6$
which is .18 – i.e. 80% of the time, we will rate half, and half of 3 is 1, so we send 1 packet per round trip time which is only 30% utilisation.