Solution notes

Digital Communication II 2005 – Paper 9 Question 3 (JAC)

Outline the interaction between the end-to-end flow of packets, and the following four buffering/queueing schemes: FIFO; RED; RED with ECN; Fair Queueing. [20 marks]

Hopefully, they will form a framework (diagram?) of TCP flows and a set of routers to discuss 4 schemes.

1. First in first out – as load varies, mean queue length varies. Has no isolation properties at all, but is really simple to implement. basically, statistical multiplex will tend to increase burstiness. Is work conserving. Still majority of routers do this.

2. Random Early Detect – need some estimation of queue occupancy over time (EWMA was discussed), and a cheap way to choose a packet at random to drop, increasing as the queue builds. Intention is that TCP then adapts sooner, and mean queue lengths are shorter.

3. Explicit Congestion Notification signals source with a bit that is reflected by receiver. Entails no loss (but does take 1 (actually 2) bits per packet for every packet. Might not be obvious what to do with UDP (or multicast).

4. Fair queue – visit flows round robin – gives isolation/protection. Flow state must be kept somehow (e.g. inferred, or signalled via RSVP).

Any reasonable discussion of these points (or relevant other ones) – Was in lectures 10/11.