Analysis and Simulation of a Fair Queuing Algorithm

This paper presents a fair queuing algorithm which is based on a previous work done by Nagle. The aim here is to provide some fairness in bandwidth and delays observed by flows and to provide protection from ill-behaved sources.

The basic idea behind the algorithm proposed in this paper is to closely simulate a bit-by-bit round robin scheduling algorithm for packet switching. The algorithm differs from Nagle's proposal in that they take into account the packet lengths as well. The authors also take into account the allocation of bandwidth, buffer space and delay and also separate delay allocation from the other two.

For analyzing the algorithm, the authors assume two arrival streams- FTP like sources and a telnet-like interactive source. With this interaction, they show that (1) FQ provides lower delay to lower throughput sources independent of flow control at end points and (2) No conversation gets more than its fair share; queuing delay diverges with throughput relative to fair share approaching 1.

The authors also provide a variety of simulation results in which they measure throughput, RTT, number of retransmissions and dropped packets with different simplistic topologies and with different combinations of flow control algorithms at end hosts. They simulate an underloaded gateway, overloaded gateway, ill-behaved source, mixed protocols, multihop path and complicated network. Overall the results show that FQ delivers satisfactory congestion control in all scenarios.

In my opinion, while the proposal is very significant, its effectiveness hasn't been fully explored or proven in the paper. The simulations are done on simplified topologies, typically to illuminate the features of the algorithm and a detailed measurement study on the Internet would be more satisfying. Another thing to note is that the simulations use only FTP and Telnet traffic, whereas more recent Internet is seeing a lot of streaming traffic and mostly HTTP web traffic. A good study of these types of traffic in the present scenario will also be useful.

To conclude, though one might say that incorporating intelligence in the routers might be a violation of the end-to-end principle, but I agree to the notion that in a diverse and potentially distrustful environment such as the Internet, fairness can only be achieved at the aggregation points of flows i.e. the routers themselves.