Cooperation and QoS in Fast Packet Networks: The View from the Edge

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The fundamental architecture of the current generation Internet has changed little over the past two decades. This is a problem when services need to be introduced that require something more than basic point-to-point connectivity, such as needing some form of QOS or multicast capability. Multiple ownership of the Internet is both a strength and a weakness — what incentives do ISPs have to evolve their architectures? At the same time, processing power and intelligence is increasing at the edge of the network, which can be harnessed to create new services. For example, adaptive network-aware applications can react to changing network conditions, while P2P overlay networks can bypass many of the underlay's inherent restrictions.

We give an example of a form of differential QoS using edge-based or end-system control, showing how it possible to construct a "lower than best effort" service, suitable for background transfers. We then discuss how to generalise this to give certain minimal guarantees.

For multicast we describe a P2P filecasting solution that uses network coding and a simple form of cooperation. It is possible to view this scheme as a form of multi-path routing. In general, giving the edge-systems some degree of control over routing has potential performance benefits. For unicast applications, by combining congestion control with a flexible routing scheme, it is possible to halve response times and double the load the network can carry compared with existing approaches. If implemented at the WAN level, this may also change the incentive structure for ISPs.

Finally we discuss issues of incentives and cooperation, and comment on how far it is possible to progress within the current pricing framework and with edge-based solutions *without* requiring fundamental changes to the core of the network.