Reading Report #10
Paper: Congestion Control for High Bandwidth-Delay Product Networks
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XCP is designed to improve traditionally TCP congestion control methods, the goal is still the same: to maximum network bandwidth utilization while ensuring the fairness among flows. The design is still focused on network itself. If we take a look at the metrics it used for measuring the effectiveness of XCP: *average link utilization*, *average queue size* and *number of packet drops* for efficiency and *average throughput per flow* for fairness, we will notice that these metrics are all network-centric. But how about the end-user experience? Do they really feel like they get good services when XCP is in use?

All the benefits XCP brought in also came with a prices. Because of the ignore of the end-user experience, XCP does not perform well in any cases. For example, for long-lived flows, XCP performs very well, being able to achieve high bandwidth utilization, small queue size, low packet drops and fair bandwidth share among flows. However, the Internet is a dynamic environment, therefore we always see flows with different length. Especially, as the long-tail distribution suggested: there are more short-lived flows and fewer long-lived flows. Under such condition, will all the performance benefits envisioned by XCP still hold?

With a mix of flows of different length, XCP does not perform well for short flows. In XCP, when there are available bandwidths, its fairness controller will divide it evenly among flows. This seems not fair to those short-lived flows because it is possible that they could have finished within one or few RTTs, but because of the way XCP's fairness controller works, they still get very little bandwidth increase for each round trip. This could stretch their duration to many RTTs, which is definitely not desirable. From end-user point of view, they might experience relative long service delay than they should. Things get worse when several long-lived flows keep the link occupied, when new short flows come in, they will get very little share of bandwidth, though they will gain bandwidth gradually, since they are short flows, they may have finished before they enter fair-share state. Thus XCP leads to long flow duration for those short flows, this will negatively impact end-user experience of services through the Internet.

The way XCP controls fairness may be a bit over conservative. The use of AIMD leads to slow converge to fair-share state of flows. Ignorance of different flow sizes leads to long duration for short flows. For new arriving flows, XCP will gradually decrease the window sizes of existing flows to allocate bandwidth for new flows, thus it takes time for new flows to get their fair-share of bandwidth. All these contribute to the unfairness of XCP. A better congestion control mechanism should be able adjust to short flows to let them finish early as they should, and be able to allocate bandwidth to new flows more aggressively then XCP.