Review of Congestion Control for High Bandwidth-Delay Product Networks
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Summary

The authors of this paper present eXplicit Control Protocol (XCP), which can be used as an alternative to TCP. XCP separates the fairness controller from the efficiency controller to have better control over the responsiveness of traffic and to decrease oscillation when trying to achieve fairness. It produces an environment that utilizes max-min fairness to distribute bandwidth. It is responsive in as little as one RTT when there is an increase or a decrease in the number of flows, and it is able to quickly reach the desired CWND. It prevents losses by holding packets in queues when the network gets congested and notifies flows of the congestion via a congestion header on each packet. The header tells the sender how congested the network is so that it knows how much to back off without wasting network resources from backing off too much. During each RTT the congestion header is marked so that if more/less bandwidth becomes available it is quickly deallocated/allocated to other flows. The efficiency controller utilizes the MIMD protocol while the fairness controller utilizes the AIMD protocol. With each RTT these values are recalculated so that estimation errors don't cause problems to the system and the end convergence of the system is stable. Overall, they show that XCP out performs TCP in a variety of settings and it can handle flows with long RTT times, which is something that TCP can't do. This makes it more feasible than TCP for use with wireless and satellite links. XCP can also accommodate these flows with long RTT values while still handling short RTT flows in a fair and efficient manner.

Pros

- This algorithm is able to reach the CWND after one RTT.
- It also produces near zero packet drops as long as a flow is responsive.
- Fairness between flows is achieved in a very minimal number of RTTs.
- It significantly out performs TCP in the variety of settings they described for their simulations.
- The protocol can be used for latency sensitive traffic by imposing the differential bandwidth allocation explained in the paper.
- They say that it could be used in conjunction with networks that use TCP today.
- XCP can handle flows with a long RTT without degradation of performance to them.

Cons

To achieve fairness XCP sometimes needs larger queue sizes (than TCP) to accommodate brusty traffic and changes in the number of flows without dropping packets. The protocol specifics how it can determine if a flow is unresponsive after one RTT, but it doesn't specify how it handles it after it's deemed unresponsive. They don't explain the costs of the implementation of XCP very well. They explain the algorithm is fairly simple for the network but they don't explain the effects on the end host.