Explicit Control Protocol (XCP)

The Explicit Control Protocol (XCP) is a new congestion control protocol developed by Dina Katabi from MIT Computer Science & Artificial Intelligence Lab. It extracts information about congestion from routers along the path between endpoints. It is more complicated to implement than other proposed Internet congestion control protocols.

XCP-capable routers make a fair per-flow bandwidth allocation without carrying per-flow congestion state in packets. In order to request for the desired throughput, the sender sends a congestion header (XCP packet) located between the IP and transport headers. It enables the sender to learn about the bottleneck on the path from the sender to the receiver in a single round trip.

In order to increase congestion window size for TCP connection, the sender require feedback from the network, informing about the maximum, available throughput along the path for injecting data into the network. The routers update such information in the congestion header as it moves from the sender to the receiver. The main task for the receiver is to copy the network feedback into outgoing packets belonging to the same bidirectional flow.

The congestion header consists of four fields as follows:

- Round-Trip Time (RTT): The current round-trip time for the flow.
- Throughput: The throughput used currently by the sender.
- Delta_Throughput: The value by which the sender would like to change its throughput. This field is updated by the routers along the path. If one of the router sets a negative value, it means that the sender must slow down.
- Reverse_Feedback: This is the value, which is copied from the Delta_Throughput field and returned by the receiver to the sender, it contains a maximum feedback allocation from the network.

A router that implements XCP maintains two control algorithms, executed periodically. The first of them, implemented in the congestion controller, is responsible for specifying maximum use of the outbound port. The fairness controller is responsible for fair distribution of throughput to flows sharing the link.

Benefits of XCP

- it achieves fairness and rapidly converges to fairness,
- it achieves maximum link utilization (better bottleneck link utilization),
- it learns about the bottleneck much more rapidly,
- it is potentially applicable to any transport protocol,
- is more stable at long-distance connections with larger RTT.

Deployment issues and issues with XCP

- has to be tested in real network environments,
- it should describe solutions for tunneling protocols,
- has to be supported by routers along the path,
- the work load for the routers is higher.

References

- XCP@ISI - Web site about XCP at the Information Sciences Institute - http://www.isi.edu/isi-xcp/

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