Reliable Transport Protocols for Heterogeneous Inter-networks

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We depart from the experimental TCP-Probing [1] and propose an enhanced transport protocol that achieves energy and throughput performance gains in mixed wired and wireless environments. Our approach decouples error recovery from contention estimation and focuses on how these two mechanisms can (i) feed the probing decision process and (ii) implement the protocol strategy by shaping traffic, according to detected conditions. We use a validation mechanism, which uncovers previous possibly wrong estimations. Our analysis matches well our simulation results, which are very promising.

We observe that in heterogeneous networks:
- Timeout should be growing, only in association with contention. More precisely a transient, random error does not call for either timeout or congestion window adjustment.
- An "early"' attempt to estimate contention can lead to a more effective error classification strategy. When a packet is lost in a low contention-environment, then a wireless error is clearly indicated.
- A false "early" contention estimation can be filtered by a second-level contention estimation mechanism, which is deployed between packet-drop detection and error-recovery.
- During a dense error or a handoff, a probing mechanism can significantly reduce unnecessary retransmission overhead.

Our enhanced protocol incorporates mechanisms, which are designed based on the aforementioned observations. We present a set of simulations under varying error conditions, network topologies and link capacities; we show that the new design occasionally yields very significant throughput improvements and energy-savings without damaging the balance between system efficiency and fairness.

References

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