Abstract

Routers in the Internet are typically required to buffer 250ms worth of data. In high-speed backbone networks, this requirement could translate into the buffering of millions of packets in routers' linecards. This, along with the access time requirement, makes it very challenging to build buffers for backbone routers.

There could be significant advantages in using smaller buffers. Small buffers can fit in fast memory technologies such as on-chip and embedded memories. If very small buffers could be made to work, it might even be possible to use integrated optical buffers in routers. Optical routers, if built, would provide almost unlimited capacity and very low power consumption.

This work is about backbone routers with tiny buffers. Through analysis, simulation, and experiment, we show that when the backbone traffic comes from slow access links (which is the case in a typical network, as the traces collected from backbone links show), then buffers of size 10-50 packets result in over 80% throughput. We address several theoretical and practical issues in implementing tiny buffers in backbone networks—how different network conditions and load parameters affect the required buffer size, how to maintain the traffic pattern of individual flows across a backbone network, and how to build optical buffers with a minimum number of optical switches.