CS540 - Paper Review V

Hailu Belay Kahsay - 20155624

Title: Fast Switched Backplane for a Gigabit Router

Author: Nick McKeown, Department of Electrical Engineering, Stanford University

Router, a network layer device connected to at least two networks and forwards data packets along networks, has its own architecture. So far many architectures have been designed for routers and these architectures have been selected based on a number of factors, including cost, number of ports, required performance and currently available technology.

In this paper, using Cisco 12000 as an example, the author showed the performance advantages a switched backplane based on a crossbar switch, with a centralized bus, over a conventional router. The author discusses about the need for fast backplanes(switched backplane) and its architecture and length of packets (Variable Vs Fixed) after discussing the architecture of Internet Routers, their key functionalities and their performance issues. The three blocking types: head-of-line (HOL) blocking, input-blocking and output-blocking, that limits the performance of the architecture, and their appropriate mitigation and elimination techniques has also been discussed. i.e.HOL that can significantly reduce the performance of a crossbar switch, wasting nearly half of the switch's bandwidth can be eliminated using virtual output queueing; , input- and output-blocking that increase the delay of individual packets through the system, could also be mitigated using either prioritization or/and speedup mechanism in the crossbar switch.

The paper also takes about iSLIP, the crossbar scheduling algorithm, a rotating priority (round-robin) algorithm used to schedule each active input and output. Performance of the algorithm (in case of Unicast traffic) along with the Key properties of the algorithm: High Throughput, Starvation Free, Fast and Simple to implement has also been discussed in the paper. Switched backplane capability to support multicast traffic, scheduling technique and scheduling algorithm(ESLIP) has also been discussed in the paper.

The paper addresses the key issues well but issues like: Scalability of the architecture to other hardware routers and performance of the router while using single scheduler to schedule both unicast and multicast traffic should be addressed well.

Title: Sizing Router Buffers

Author: Guido Appenzeller, Isaac Keslassy, Nick McKeown, Stanford University

Internet routers are packet switches that forward data packets between computer networks through the networks that constitute the internetwork until a packet reaches its destination node. Routers use buffers to reduce packet loss by absorbing transient bursts of traffic and hold the packets during times of congestion. However, the increasing speed of network interfaces raises a concern on the size of route buffers; under buffered routers lead to packet loss (which affects application performance), and an over buffered router increased latency, complexity and cost. Traditionally, router buffers are sized based on a rule-of-thumb that states each link needs a buffer of size B = RTT × C, where RTT is the average round-trip time of a flow passing across the link, and C is the data rate of the link.

In this paper, the authors argue that the rule-of-thumb is now outdated and incorrect for backbone routers. They suggest that router buffer size needed is equal to the delay bandwidth product divided by the square root of the number of long-lived TCP flows(if there are a large number of long-lived TCP connections flowing through a router). The paper first talks about where the rule-of-thumb comes from and how buffer size influences router design. It then clearly talks about how large the router buffer need to be if all TCP flows are long-lived, what happens when many long TCP flows share a link: Synchronized Vs Desynchronized long flows, and sizing the router buffer for short flows. Simulation and network of real Internet routers has also been done in the paper to validate the models of the authors.

Even though the paper addresses issues related with closed-loop TCP traffic, it does not consider issues related to real-time multimedia applications such as online gaming, audio-video services, IPTV, VoIP etc. Router buffer sizing could also be done: based on per-flow metrics: Average per-flow TCP throughput, Average flow completion time and Fairness issues, and considering congestion control and pacing.