

Stanford EE Computer Systems Colloquium

October 19, 2022

This lecture will be presented live on Campus and live streamed with possible participation using Zoom. Eventually the video will be posted to the EE380 archive on YouTube.

Optimizing the Internet

Alan Huang

Optimize the Internet by:

- selecting a mathematically optimal $\sqrt{N} \times \lceil \log_{\sqrt{N}} N \rceil$ network, such as a Banyan, Butterfly, or Perfect Shuffle;
- increasing the redundancy and decreasing the fabric blocking of this network by adding an extra row;
- decreasing the average number of “hops” of this network by converting this network into a toroid;
- decreasing the average “hops” per packet of the network by assigning cities with the greatest mutual packet traffic to neighboring nodes;
- stretching the links of this network so that the location of each node corresponds to the geographic location of the associated city;
- implementing these links with wavelength division multiplexed (WDM) optical fibers; • allowing Border Gateway Protocol (BGP) to divert traffic on to this network; and • cannibalize the under-utilized links and using them to enhance the optimized network.

Whereby, reducing the average number of hops per packet in a network reduces the latency, power consumption, and cost of the network.



A toroidal, fault tolerant, perfect shuffle based network capable to connecting any two of twelve cities with an average of 1.5 hops.

Speaker Alan Huang is an expert in packet switching and optics. While at Bell Labs, he worked on high performance packet switches for voice and video. He co-invented the Batcher / Banyan switching network and helped design AT&T's first ATM switch. He also managed the development of an optical pipelined processor, a photonic switching network, vertical cavity surface emitting lasers (VCSEL), planar optics, and ultrafast (> 1Tbs) all-optical logic. After Bell Labs he helped start Terabit Corporation. While at Terabit, he worked on calable, fault tolerant routers, DARPA's Next Generation Internet (NGI) project, and ultrafast optical networks. He has a BS and MS in EE from Cornell and a Ph.D. in EE from Stanford. He has over 20 technical publications and 30 US patents.

Live presentation: 4:00-5:30 PM in 320-220 on the Stanford campus. This is a video classroom, which means that recording is always on. [MAP](#)

Zoom live presentation. Join [URL](#).