

Invited paper

Power consumption in optical packet switches

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Abstract

We discuss architectures, systems, and technologies of optical packet switches designed for power-efficient IP networks. In contrast to conventional electronic routers based on the store-and-forward paradigm, optical packet switches can exploit wavelengths and optical parallelism to reduce power consumption.

Extended Abstract

We will compare the power consumption and performance of future networks based on electronic routers vs. optical packet switches. While electronic routers benefit from the rich functionality of readily-available random access memory, they traditionally rely on the store-and-forward architecture where each bit needs to be processed at the line rate. Typical power consumption of such an electronic router is currently at 20 nJ/bit (~1 MW at 46 Tb/s). Optical packet switches assuming the same type of store-and-forward architecture can consume even higher power than the electronic counterpart. On the other hand, a pipelined optical packet switching system exploiting optical-labels and all-optical contention resolution in the wavelength, time, and space domains can achieve significantly lower power consumption at ~10 pJ/bit (~500 W at 46 Tb/s). By exploiting the optical parallelism and the wavelength domain statistical multiplexing, the optical label switching routers can support high-throughput and low power optical IP networks. Finally, we will include discussions of future photonic-electronic integrated networking systems and their impacts on agile and high-performance future networks.

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S. J. Ben Yoo (S'82–M'84–SM'97–F'07) is Professor of Electrical Engineering at University of California at Davis (UC Davis) and Director of UC Davis CITRIS (Center for Information Technology Research in the Interest of Society). His research at UC Davis includes power-efficient and high-performance optical networking and computing systems. Prior to joining UC Davis in 1999, he was a Senior Research Scientist at Bell Communications Research (Bellcore: 1991-1999), and conducted research at Stanford University, Bell Laboratories, and IBM Research Laboratories. Prof. Yoo is a Fellow of IEEE Lasers & Electro-Optics Society (LEOS), a Fellow of the Optical Society of America (OSA), and a Member of Tau Beta Pi. He is a recipient of the DARPA Award for Sustained Excellence in 1997, the Bellcore CEO Award in 1998, and the Mid-Career Research Faculty Award (UC Davis) in 2004.