Optical switches for high performance on-chip communication in multi-core processors architecture

Technology #m08-035

Computing processes in computers, cell phones and other electronics are carried out by microprocessors on integrated circuits. Increasingly, multiple processors are being utilized on a single chip to improve device performance. Communication delays and power dissipation issues, however, increase with additional processors. This technology utilizes a photonic network-on-chip system to achieve low power, high-speed communication within a chip. Further, this technology integrates with existing CMOS architectures and achieves high bandwidth, allowing increasingly more processors to be added onto a single chip while maintaining high data speeds and high bandwidth at low power consumption.

Optical communication for high data speeds, high bandwidth, and low power consumption on CMOS compatible architectures

This technology utilizes optical resonators in place of electronic switches for optical data communication. In traditional electronic network-on-chips, data is often rerouted, buffered and regenerated several times before reaching its destination. With optical communication, data can be transmitted end to end without any rerouting or disturbances, as there are no photonic storage elements. As such, high communication speeds between processors are achievable with this technology. Power consumption in this photonic architecture is lower because unlike electronic switches, photonic switches turn on/off after every message, not every transmitted bit. Additionally, power dissipation is independent of transmission distance in the optical waveguides.

A prototype of the technology has been simulated and been shown to deliver high speed communication within chip multiprocessor architectures while expending low power.

Lead Inventor:

Keren Bergman, Ph.D.
Applications:

• Optical switches
• Multicore processors
• Optical data networks

Advantages:

• Dissipates low power
• Spans high bandwidth
• Works at high speeds

Patent Information:

Patent Issued (US 8,340,517)

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Related Publications:

• Shacham, A., Bergman, K., & Carloni, L. P. "On the design of a photonic network-on-chip" Proceedings of the First International Symposium on Networks-on-Chip. 2007 May; 53-64.

Inventors

Keren Bergman