

Ultrahigh-Bandwidth Low-Latency Reconfigurable Memory Interconnects by Wavelength Routing

Tech ID: 33805 / UC Case 2021-901-0

ABSTRACT

Researchers at the University of California, Davis, have developed a memory system that uses optical interconnects.

FULL DESCRIPTION

The technology encompasses low latency memory systems and a novel silicon photonics (SiPh) architecture using Wavelength Division Multiplexing based optical interconnects. The silicon photonic interconnects enable optical parallelism and wavelength routing to reduce contention in the entire path from a processor to a memory subarray. The low latency architecture can include three pieces: a contention-less optical data plane, a low-bandwidth electrical control plane, and fine-grained memory banks with integrated photonics. In the data plane, the arrayed wavelength grating router (AWGR)-based optical interconnect can provide a dedicated data path from every requester to every memory bank, with no intermediate buffering, to reduce the queuing and interconnect latency. In the control plane, a low-bandwidth electrical or optical interconnect can communicate the addresses and commands between processors and memory and coordinate the time that a processor sends or receives data. The fine-grained memory banks (also referred to as microbanks) can be directly accessed by the memory controller to allow for massive amounts of parallelism.

APPLICATIONS

- ▶ Low Latency Memory System Architecture
- ▶ Silicon Photonics (SiPh) with space saving scalability
- ▶ Processor and Memory Interconnect Solution
- ▶ Suitable for processor, memory, and system designers and manufacturers

FEATURES/BENEFITS

- ▶ High parallelism data communication in memory systems
- ▶ Fast throughput and low energy data communication
- ▶ Replaces conventional electrical interconnects

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	12,386,512	08/12/2025	2021-901

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OTHER INFORMATION

KEYWORDS

low-latency memory,
 memory, optical
 interconnects, Silicon
 Photonics (SiPh)

CATEGORIZED AS

- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Computer**
 - ▶ Hardware
 - ▶ Other
- ▶ **Nanotechnology**
 - ▶ Electronics
 - ▶ Other
- ▶ **Semiconductors**
 - ▶ Design and Fabrication

▶ Other

RELATED CASES

2021-901-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Higher-Speed and More Energy-Efficient Signal Processing Platform for Neural Networks
- ▶ Crystal Orientation Optimized Optical Frequency Shifter
- ▶ Hyperspectral Compressive Imaging
- ▶ Athermal Nanophotonic Lasers
- ▶ Ultra-High Resolution Multi-Platform Heterodyne Optical Imaging
- ▶ Multi-Wavelength, Laser Array
- ▶ Optical Interposers for Embedded Photonics Integration
- ▶ Development of a CMOS-Compatible, Nano-photonic, Laser
- ▶ Energy Efficient and Scalable Reconfigurable All-to-All Switching Architecture
- ▶ Compressive High-Speed Optical Transceiver
- ▶ All-Optical Regenerators
- ▶ Tensorized Optical Neural Network Architecture
- ▶ Silicon Based Chirped Grating Emitter for Uniform Power Emission
- ▶ Energy-Efficient All-Optical Nanophotonic Computing
- ▶ All-To-All Interconnection With Wavelength Routing Devices
- ▶ 3D Photonic and Electronic Neuromorphic Artificial Intelligence
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