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
- Multi-Wavelength, Nanophotonic, Neural Computing System
- 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
- 3D Photonic and Electronic Neuromorphic Artificial Intelligence
- Adapting Existing Computer Networks to a Quantum-Based Internet Future

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