New photonic architecture promises to dramatically change next decade of disaggregated, rack-scale server designs

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Intel Corporation announced a collaboration with Facebook to define the next generation of rack technologies used to power the world's largest data centers. As part of the collaboration, the companies also unveiled a mechanical prototype built by Quanta Computer that includes Intel's new, innovative photonic rack architecture to show the total cost, design and reliability improvement potential of a disaggregated rack environment.

"Intel and Facebook are collaborating on a new disaggregated, rack-scale server architecture that enables independent upgrading of compute, network and storage subsystems that will define the future of mega-datacenter designs for the next decade," said Justin Rattner, Intel's chief technology officer during his keynote address at Open Computer Summit in Santa Clara, Calif. "The disaggregated rack architecture includes Intel's new photonic architecture, based on high-bandwidth, 100Gbps Intel Silicon Photonics Technology, that enables fewer cables, increased bandwidth, farther reach and extreme power efficiency compared to today's copper based interconnects."

Rattner explained that the new architecture is based on more than a decade's worth of research to invent a family of silicon-based photonic devices, including lasers, modulators and detectors using low-cost silicon to fully integrate photonic devices of unprecedented speed and energy efficiency. Silicon photonics is a new approach to using light (photons)

to move huge amounts of data at very high speeds with extremely low power over a thin optical fiber rather than using electrical signals over a copper cable. Intel has spent the past two years proving its silicon photonics technology was production-worthy, and has now produced engineering samples.

Silicon photonics made with inexpensive silicon rather than expensive and exotic optical materials provides a distinct cost advantage over older optical technologies in addition to providing greater speed, reliability and scalability benefits. Businesses with server farms or massive data centers could eliminate performance bottlenecks and ensure long-term upgradability while saving significant operational costs in space and energy.

Silicon photonics and disaggregation efficiencies

Businesses with large data centers can significantly reduce capital expenditure by disaggregating or separating compute and storage resources in a server rack. Rack disaggregation refers to the separation of those resources that currently exist in a rack, including compute, storage, networking and power distribution into discrete modules. Traditionally, a server within a rack would each have its own group of resources. When disaggregated, resource types can be grouped together and distributed throughout the rack, improving upgradability, flexibility and reliability while lowering costs.

"We're excited about the flexibility that these technologies can bring to hardware and how silicon photonics will enable us to interconnect these resources with less concern about their physical placement," said Frank Frankovsky, chairman of the Open Compute Foundation and vice president of hardware design at supply chain at Facebook. "We're confident that developing these technologies in the open and contributing them back to the Open Compute Project will yield an

unprecedented pace of innovation, ultimately enabling the entire industry to close the utilization gap that exists with today's systems designs."

By separating critical components from one another, each computer resource can be upgraded on its own cadence without being coupled to the others. This provides increased lifespan for each resource and enables IT managers to replace just that resource instead of the entire system. This increased serviceability and flexibility drives improved total-cost for infrastructure investments as well as higher levels of resiliency. There are also thermal efficiency opportunities by allowing more optimal component placement within a rack.

The mechanical prototype is a demonstration of Intel's photonic rack architecture for interconnecting the various resources, showing one of the ways compute, network and storage resources can be disaggregated within a rack. Intel will contribute a design for enabling a photonic receptacle to the Open Compute Project (OCP) and will work with Facebook, Corning, and others over time to standardize the design. The mechanical prototype includes distributed input/output (I/O) using Intel Ethernet switch silicon, and will support the Intel Xeon processor and the next generation, 22 nanometer system-on-chip (SoC) Intel Atom processor, code named "Avoton" available this year.

The mechanical prototype shown today is the next evolution of rack disaggregation with separate distributed switching functions.

Provided by Intel