LIGHTELLIGENCE

HUMMINGBIRD

Optical Network-on-Chip Accelerator

Ultra-Low Latency Performance

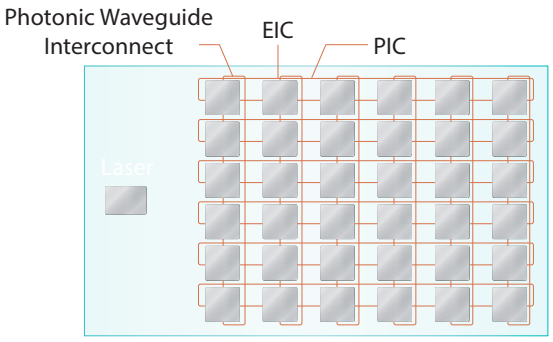
As the demand for compute power grows exponentially while the ability to scale performance according to Moore's Law declines, chip designers are integrating multiple chiplets on a single die to increase compute power. However, performance is bottlenecked by data movement between cores, which degrades linearly with distance.

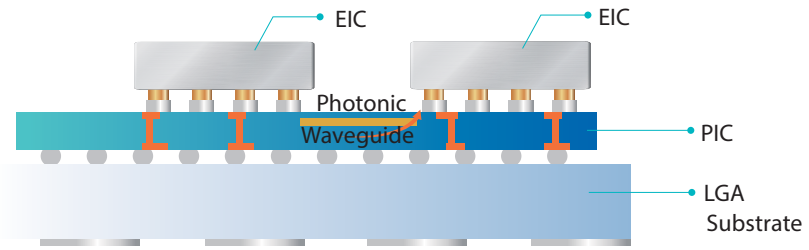
Hummingbird™ is the first in a family of products that utilize Lightelligence's oNOC platform, which breaks through this scalability wall using the natural properties of photonics. Its waveguides propagate signals at the speed of light and utilize an all-to-all data broadcast network to each core on a 64-core domain-specific AI processor chip, giving Hummingbird significant advantages in latency and power reduction over traditional digital interconnect solutions.

Hummingbird's electronic and photonic ICs are co-packaged and integrated into a PCIe form factor ready for installation in industry-standard servers. Coupled with the Lightelligence Software Development Kit (SDK), machine learning and AI workloads can be optimized to take full advantage of the oNOC. oNOC and Hummingbird IP can also be customized for other unique workloads and applications.

Specification	Value
Compute Cores	64
Precision	INT8
On-Chip Memory	38 MiB SRAM
ECC	SECDED
Photonic Transmitters	64
Photonic Receivers	512
System Interface	X4 PCIe Gen3
System Memory	2 GB DDR4 SDRAM
Form Factor	Full Length, Dual Slot PCIe
Thermal Solution	Passive
Compute API	LT-SDK

Key Technology: Optical Network On Chip(oNOC)





Hummingbird is the first accelerator to leverage Optical Network-on-Chip (oNOC) technology. In an oNOC system, two electronic chips are stacked on the same photonic chip, and the data communication between electronic chips is performed by waveguide based optical links on the photonic chip. Since optical interconnect is not sensitive to distance, the on-chip optical network can enable many long-distance channels. As shown in the figure, the photonic chip can be extended to the entire wafer, thereby realizing a wafer-level oNOC system, which can support tens of electronic chips, thereby achieving 2D torus or other types of isotropic interconnect network topology. To learn more about oNOC, visit: https://www.lightelligence.ai

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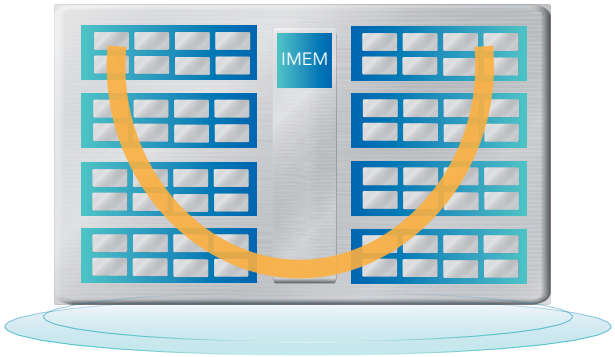
All-to-All Data Broadcast Network

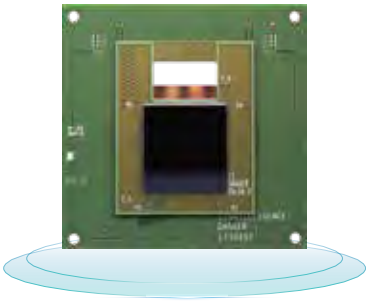


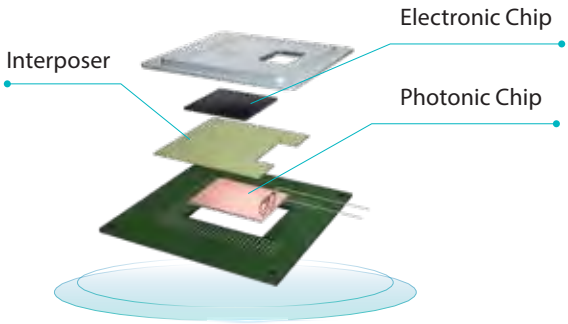
Powered by Lightelligence Optical Network-on-Chip technology, data is transferred optically across the Photonic Integrated Circuit in a U-Shaped pattern, enabling All-to-All connectivity without waveguide crossings. The EIC has a single instruction, multiple detect (SIMD) architecture and custom ISA, with its central instruction unit issuing to each of the 64 cores in parallel.

Photonic Broadcast Network

Compute Cluster

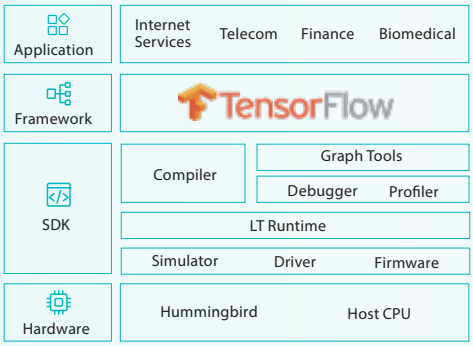
Advanced 3-D Packaging





The Hummingbird System-in-Package (SiP) is the product of advanced 3D packaging of photonics, electronics and a high-density organic interposer, with 64 distributed compute cores, each able to transmit to every core in the system, creating an all-to-all broadcast network.

Full Lightelligence Software Stack



Adaptable with your existing TensorFlow models

- Provides a heterogenous computing platform
- Natively supports nearly all TensorFlow operators
- Accelerates targeted graphs and dedicated operators

The Platform SDK enables Hummingbird with CPU to support most popular workloads in TensorFlow format it targets to and optimize them for highest performance of such heterogenous system by fully utilizing the novel ONOC.

It supports a rich set of TensorFlow operators and features multi-card data-parallel inference, built-in functional and performance simulation and necessary observability of profiling and debugging.

FOR MORE INFORMATION

Visit www.lightelligence.ai and social media to stay up to date on our latest news

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