



Intel Unveils Latest Network Connectivity Innovations

Intel connectivity solutions deliver customers greater levels of intelligence and programmability to enable higher performance networking

October 15, 2020 — Intel Corporation today highlighted its many advancements in the area of network connectivity. Intel's latest product disclosures highlight the valuable role that advanced data center networks play in enabling customers to unleash the performance of compute at scale.

The company introduced two new Field Programmable Gate Array (FPGA)-based Smart NICs, the Intel® FPGA SmartNIC C5000X platform for cloud and the Silicom® FPGA SmartNIC N5010 for networking (code-named Big Springs Canyon and Lightning Creek respectively). These two new FPGA-based SmartNICs will deliver programmable infrastructure acceleration for efficiently moving data center traffic.

Intel also provided an update on its latest Intel® Ethernet 800 Series, which has seen broad adoption from many companies, including SK Telecom, Twitter, and Lightbits Labs. Intel also announced it continues to unleash the power of the programmable Ethernet switch technology acquired through the Barefoot Networks acquisition and will open source the Tofino architecture to ensure programmable packet processors are as open as CPUs.

New FPGA-based Smart NICs

[Intel-based SmartNICs](#) complement Intel's Foundational NICs by providing additional levels of flexibility, functionality and scalability to accelerate select workloads, such as virtual switching, storage and network security applications. Intel's latest additions to its SmartNIC family include the [Intel FPGA SmartNIC C5000X platform for cloud](#) and [Silicom FPGA SmartNIC N5010 for networking](#).

Features and solutions include:

FPGA-based SmartNIC C5000X Platform for Cloud:

- The new Intel FPGA SmartNIC C5000X platform is optimized for use in cloud data centers. It is based on the Intel® Xeon®-D processor and the Intel® Stratix® 10 FPGA, offering a hardware programmable data path.
- This new SmartNIC platform accelerates networking (e.g. vSwitch), storage, and security workloads from the server, freeing up processor resources and simplifying management of the data center infrastructure.
- Inventec is one of the first ecosystem partners to leverage this platform. The Inventec FPGA SmartNIC C5020X offers customers the ability to customize their solution while still delivering greater levels of performance and programmability.

Silicom FPGA SmartNIC N5010 for Networking:

- Intel is partnering with Silicom to deliver the Silicom FPGA SmartNIC N5010, the first hardware-programmable 4x100G FPGA SmartNIC.



- The Silicom FPGA SmartNIC N5010 features an Intel Stratix 10 DX FPGA with integrated high-bandwidth memory (HBM) and Intel Ethernet 800 series adapter.
- This new SmartNIC is optimized for communications service providers, delivering the performance and hardware programmability needed to implement select wireline and wireless infrastructure acceleration of 4G vEPC, 5G UPF, AGF, SrV6, vBNG and other functions for 25G and 100G networks.
- The Silicom FPGA SmartNIC N5010 enables next-generation Intel-based servers to meet the performance needs of the VNFs such as vFW, IPSec, TLS, as well as others.
- The FPGA-based SmartNIC features enhanced packet buffering, traffic flow monitoring, and extended connectivity to 4x100G.

Recent Customer Adoption of Intel SmartNICs

- [Baidu recently deployed](#) Intel Smart NIC innovations based on Intel® SoC FPGAs and Intel® Ethernet 800 Series Network Adapter with Application Device Queues (ADQ) technology to improve their virtualization and workload performance, while accelerating data processing speeds.
- **VMware** announced Project [Monterey](#), a collaboration with Intel and other ecosystem partners. This project is focused on evolving architecture for the data center, cloud and edge to address the changing requirements of next-generation applications including AI, machine learning and 5G applications.
- [Verizon](#) deployed the world's first fully virtualized end-to-end 5G data session in a commercial network using an Intel Xeon Scalable processor, Intel FPGA Programmable Acceleration Card (PAC) N3000 and Intel Ethernet Network Adapter XXV710. The combination helps deliver processing, acceleration and connectivity, as well as Intel's FlexRAN software reference architecture.
- [Nokia](#) AirFrame open edge server uses the Intel FPGA PAC N3000 card to boost server speeds without impacting its fully cloud-based implementation.
- [F5](#) introduced its BIG-IP VE, which uses the Intel PAC N3000 to efficiently help block incoming DDoS attacks and improve overall DDoS mitigation capacity.
- [Supermicro](#) SYS-1019P-FHN2T leverages the Intel PAC N3000 for VRAN server acceleration.

Intel® Ethernet 800 Series Improves Network Performance

Intel is recognized as a leader and innovator of Ethernet products with controllers and adapters that deliver unique capabilities to address customer needs. The [Ethernet 800 Series](#) improves application efficiency and network performance with innovative and versatile capabilities that optimize high-performance server workloads such as network function virtualization (NFV), storage, HPC-AI and hybrid cloud. Intel delivers customer value by offering unique advanced capabilities that improve workload performance and packet-processing efficiency.

Key features and solutions include:

- Application Device Queues ([ADQ](#)), an advanced traffic-steering technology that improves application response time predictability and scalability.



- Dynamic Device Personalization ([DDP](#)) reduces latency and improves packet processing performance and efficiency for cloud, communication and network edge workloads.
- Increased throughput and lower latency with Remote Direct Memory Access (RDMA). Support for both iWARP and RoCE v2.
- Ethernet Port Configuration Tool ([EPCT](#)), which provides the flexibility to support different link modes and speeds.
- [Intel Select Solutions](#) for Networking, specifically, NFVI Red Hat and NFVI Forwarding Platform, which supports the Intel Ethernet 800 Series Network Adapter leveraging DDP and EPCT.
- Up to 310Gbps vBNG performance consuming 50W less wall power compared with the previous generation⁽²⁾ in the Intel® Select Solution for NFVI Forwarding Platform.
- Maximum throughput of 100Gbps with flexible port configurations.
- Intel-branded PCIe and OCP NIC 3.0 Adapters that support all major 10, 25, 50 and 100 GbE Ethernet port configurations.

Broad Customer Adoption of Intel Ethernet 800 Series

- **Supermicro** leverages the Intel Ethernet 800 Series in its AOC-S100G-i2C networking cards. Michael McNerney, vice president of marketing at Supermicro stated, “Our enterprise and cloud customers will benefit with up to 50% reduced latency⁽¹⁾ with our new AOC-S100GC-i2C dual 100G networking card based on the new Intel Ethernet 800 Series with ADQ.”
- **Inspur:** “Intel’s new 800 series 100G Ethernet solution brings significant features expected by the market, including fully programmable pipeline benefiting existing customers on 700 series to implement DDP profile, application device queue (ADQ) significantly reducing application latency as well as RDMA implementation in both iWARP and RoCE v2. Inspur expects to work with Intel to bring excellent networking solution for the end users.” Mr. William Chen, Deputy GM of Inspur Server Product Group.
- **Advantech:** “Advantech’s 1U SKY-8101D NUMA balanced dual socket server based on 2nd Generation Intel Xeon Scalable processor will integrate Intel Ethernet 800 Series 100GbE Adapters to support increasing 5G user-plane virtual functions traffic load.”
- **Lanner Electronics:** “We are excited to collaborate with Intel to build up the 100G-ready network appliance NCA-6210 powered by Intel Ethernet 800 Series” “The new Intel 800-Series Ethernet controllers empower Lanner network appliances to accelerate packet processing while reducing application latency with improved response predictability. Terence Chou, VP and GM of Lanner Electronics Network Computing BU, Product: NCA-6210, Lanner Electronics
- **NEXCOM:** “We are delighted to boost NEXCOM’s product portfolio with the addition of the 100G NIC, based on Intel’s E8100 solution,” said Allan Chiu, VP of NEXCOM’s Network and Communication Solutions Group.
- **CASwell:** “CASwell is excited to include the Intel Ethernet 800 Series products into our solutions, particularly for SD-WAN, load balancing and network security applications. The next generation of our own network modules now based on the Intel Ethernet 800 Series is almost ready to be released and will surely be well received by our customers.” Reaforl Hung, President of CASwell Inc.



- **AIC:** “Our end customers of media and broadcasting sector will be benefiting from our performance-optimized storage servers featuring the new Intel® Ethernet 800 Series products,” David Huang, VP of Sales and Marketing, AIC Inc.
- **Axiomtek:** “The Intel Ethernet 800 Series products will be delivering outstanding performance for our network solutions in the networking/5G segment of IOT world” said William Wu, VP of Axiomtek IOT DFG.
- **iBASE:** “The Intel® Ethernet 800 Series comes with speeds of up to 100GbE and features many new innovative capabilities,” said Wilson Lin, Director of IBASE Product Planning Department. “Powered by Intel Ethernet Controller E810-CAM2, IBASE IBN-C200 is a 100GbE dual-port fiber NIC module delivering 2 x 100Gb/s Ethernet connectivity, with up to 100Gb/s throughput packet and almost zero latency performance, making it a good optimized load-balancing solution for network applications such as network security, firewall, UTM and cloud-based workloads.”

Barefoot Networks Open Tofino Architecture

[Barefoot Networks](#) was a pioneer in bringing programmable switching to the market with its Tofino series of P4-programmable switches. Since acquiring Barefoot Networks in 2019, Intel has been committed to carrying out Barefoot Networks' mission to make Tofino the first open, programmable Ethernet switch ASIC.

- Today, we announced that Intel is openly publishing the data plane and control plane code for Tofino. Intel helped create one of the biggest software ecosystems in the computing industry and is approaching the networking industry in a similar way. Intel believes Ethernet switch ASICs should have a software ecosystem that is as open and easy to participate in as CPUs. In taking this step, Intel is:
 - Accelerating innovation in the networking industry
 - Enabling network owners and operators to customize and build new applications for their network infrastructures.
 - Encouraging collaboration among developers and researchers to foster the growth of the P4 ecosystem.
 - For further detail, view the [‘Open-Tofino’ repository](#) on Github
 - Examples of researchers taking advantage of Open Tofino:
 - [AES-tofino](#): AES encryption on Tofino switch
 - [BeauCoup](#): Run multiple distinct-counting queries on Tofino
 - [Cheetah](#): Use Tofino to accelerate Spark queries
 - [Chipmunk](#): Use program synthesis to generate P4 code
 - [ConQuest-tofino](#): ConQuest queue analysis on Tofino switch
 - [Mantis](#): Generates reactive P4 program and C++ agent
 - [MicroP4](#): Modularized data-plane programming
 - [NetLock](#): Using P4 switch for lock management
 - [ONTAS](#): Traffic anonymization on BMV2 / Tofino
 - [PRECISION-tofino](#): The PRECISION heavy-hitter algorithm on Tofino switch
 - [RTT-tofino](#): TCP Round-Trip Time measurement on Tofino switch



- Today, we announced we are bringing together Intel Tofino switch silicon and Intel Stratix 10 FPGA to deliver scalable performance for demanding applications at the edge. The combined programmable switch and functionalities of an Intel FPGA offer comprehensive capabilities for packet processing that can be used by cloud service providers, communications service providers or at the network edge.
- Kaloom, a provider of programmable data center networking software, uses P4-programmable Intel Tofino switches, Intel Stratix 10 FPGAs and Intel Xeon processors in a fully virtualized manner in its programmable networking fabrics. The Kaloom solution enables communications service providers, data center operators and cloud service providers the ability to accelerate performance and monetization of millions of subscribers at the network edge.

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The Small Print

⁽¹⁾ [Lightbits Whitepaper](#): Scalable, Low-Latency Storage Using NVMe Over TCP

⁽²⁾ Performance results are based on testing by Intel as of 09/02/2020 and may not reflect all publicly available updates. See configuration disclosure for details. No product or component can be absolutely secure. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit www.intel.com/benchmarks. Testing conducted by Intel on Sept. 2, 2020, with the following hardware and software configurations: 1 Node, 2x Intel Xeon Gold 6252N processor; Intel C628 series chipset; Total Memory 384 GB, 24 slots/16 GB/2666 MT/s DDR4 RDIMM; Intel Hyper-Threading Technology (Intel HT Technology): Enable; Intel Turbo Boost Technology: Disable; C-State:1; Storage (boot): 2X 480 GB Intel SATA SSD; Storage (capacity): 4x 2 TB Intel SSD DC P4510 Series PCIe NVMe; Network devices: 2x 25GbE Dual Port Intel Ethernet Controller XXV710; 2x 100GbE Dual Port Intel Ethernet Controller E810 CAM2; Network speed: 25 GbE; 100GbE. ucode: 0x5002f01; OS/Software: Red Hat Enterprise Linux 7.6 (Kernel : RHEL8.2-kernel- 4.18.0-193.el8.x86_64).

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About Intel

Intel (Nasdaq: INTC) is an industry leader, creating world-changing technology that enables global progress and enriches lives. Inspired by Moore's Law, we continuously work to advance the design and manufacturing of semiconductors to help address our customers' greatest challenges. By embedding intelligence in the cloud, network, edge and every kind of computing device, we unleash the potential of data to transform business and society for the better. To learn more about Intel's innovations, go to newsroom.intel.com and intel.com.

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