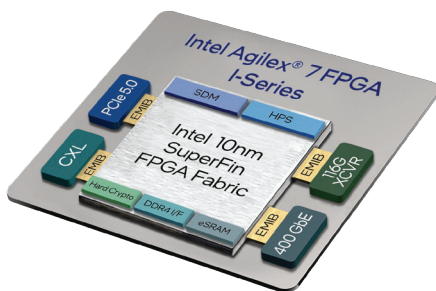


Intel Agilex® 7 FPGAs and SoCs I-Series AGI 041 Device for IPU-Enhanced Solution

Intel expands the Intel Agilex® 7 FPGAs and SoCs I-Series product offering with the AGI 041 device that delivers the right balance of capacity, power efficiency, and performance for 400G IPU and networking solutions.



Executive Summary

In the data center and networking realm, we are seeing a vast increase in data traffic speeds and a variety of services while service providers and enterprises are investing to increase compute efficiencies and make the most of their network capabilities. Infrastructure processing units (IPUs) offload infrastructure overhead and stacks from host CPUs, free up cores for performance scaling, and adding additional applications and services, and help improve revenue from infrastructure investment. Data center infrastructure interconnect speeds are increasing to 400 Gbps and PCI Express (PCIe) 5.0. For disaggregated or local storage, multiple hosts may connect to one IPU where each operates independently without interference from the others. Along with the performance increase of known applications or services, new use cases, features and functions continue to emerge. Fully programmable IPU solutions are needed to enable high-speed, low latency, and secure networking infrastructure in modern data centers, communications, and enterprise networks.

Intel Agilex® 7 FPGAs and SoCs I-Series AGI 041 combines high fabric densities, 800G of hardened crypto blocks, PCIe 5.0 with multi-host enhancement, Compute Express Link (CXL) 2.0 support and 400GbE high-performance networking tiles with hardened MAC/PCS/FEC providing the right balance of capacity, power efficiency, and performance for 400G infrastructure acceleration workloads. These features make the AGI 041 device optimal for IPU solutions and applications such as high-performance virtual switching (OVS), accelerated storage (NVMe-oF, RoCE, RDMA), and accelerated security (TLS, IPsec, ACL/Firewall).

Cloud

Public cloud service providers (CSP) constantly improve the efficiency of infrastructure investments to support a variety of use cases, increase performance, and deliver quality services at a competitive price. High-performance programmable devices are required for data center infrastructure processing and acceleration in virtualized and bare metal environments. Intel has introduced generations of IPU architectures to enable and accelerate infrastructure services that address CSP needs. Take a deep dive into an [IPU architecture](#) that uses a programmable device with or without external SoC (Intel SoC or customer owned) to offload, customize and deploy desired infrastructure functions. The IPU is transitioning from 200 Gbps to 400 Gbps performance, leading CSPs to roll out 400G platforms starting in 2023. The Intel Agilex 7 FPGA AGI 041 provides existing customers with a smooth transition path to the 400G generation, while leveraging their investment in IP and software, as well as providing new customers with future-proof protection.

Authors

Harrison Zou

Product Line Manager
Intel Corporation

Darren Van Wageningen

Business Development Manager
Intel Corporation

Nicolas Tausanovitch

Business Development Manager
Intel Corporation

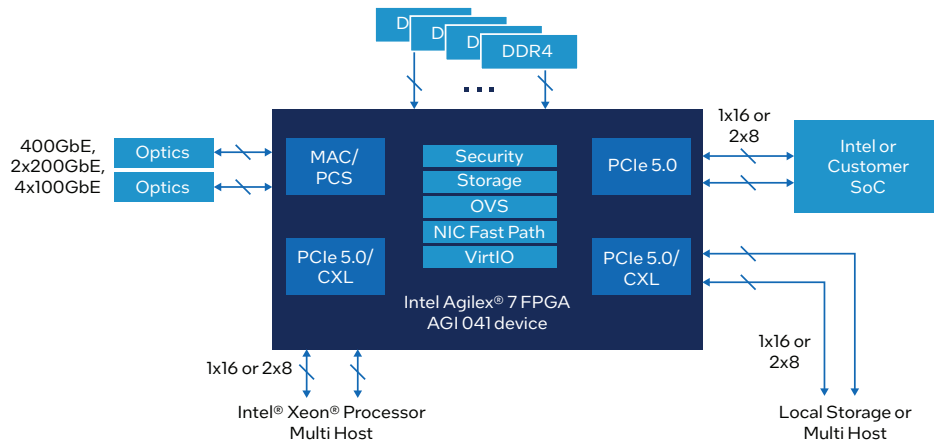


Figure 1. Block diagram (example) of 400G IPU implemented using Intel Agilex® 7 FPGA AGI 041 device

The AGI 041 device is enhanced to deliver 400G IPU solutions that meet CSP timelines. Figure 1 shows an example of how the AGI 041 device can be deployed on a PCIe form factor card or OCP 3.0 mezzanine card, as well as customized platforms. Multiple hosts connect through PCIe 5.0 interfaces with x16 or x8 lanes with independent clock and reset signals allowing each host to operate independently.

The AGI 041 device connects hosts to a 400 Gbps link. Infrastructure processing workloads (e.g., NIC fast path, OVS, storage, security) run in the fabric pairing with control plane and management software on an external SoC device (e.g., Intel® Xeon®-D processor or client processor) connected through a PCIe interface.

With high-performance fabric and densities, the AGI 041 device can implement and support multiple workloads simultaneously at 400 Gbps line rate. The AGI 041 device is a programmable device at the speed of software that not only allows intellectual property (IP) and software reuse but also makes hardware platforms fully reprogrammable, deploying new protocols, customized mechanisms, and algorithms that benefit the services to cloud customers.

The AGI 041 device-based IPU platforms support disaggregated storage and/or local storage. Local storage NVMe flash devices can connect through PCIe interfaces and CXL 2.0 attached storage using AGI 041 device CXL technology and IP portfolio.

Multiple levels of security are required and critical to keep infrastructure, tenant applications, and assets secure and protected from attacks and threats. Built on advanced Intel Agilex FPGA security architecture, the AGI 041 device delivers the highest security capabilities. Integrated 800G hardened crypto blocks add a sophisticated encryption layer protecting data through the networks and connected devices. The programmability adds an extra layer of security and protection, enabling adaptive protocols and algorithms against future unknown threats.

Communications and Enterprises

With more broadly deployed 5G networks, Communications Service Providers (CoSPs) and Enterprise Service Providers require rapidly increasing data rates in edge and core networks while adding new services and subscriptions. Like CSPs, CoSPs are also investing to secure the network at 400 Gbps in their regional and core networks and telco cloud infrastructure.

AGI 041 device-based solutions provide Telco NFV/SDN infrastructure processing, segment routing, load balancing, Routing/Switching, QoS/NAT/ACL, IPsec, MACsec, Next Gen Firewall (NGFW), Deep Packet Extraction and Inspection (DPI), and inline networking data analysis. Communications networks that are sensitive to latency will benefit from large on-chip memory integrated in the AGI 041 device, plus hardened DDR4 memory controllers seamlessly working with off-chip DDR4 memory devices and high-speed fabric to deliver low-latency packet processing at 400 Gbps line rate.

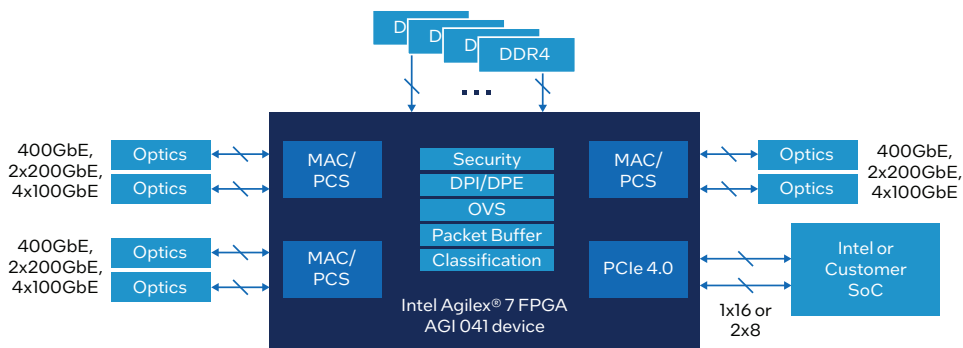


Figure 2. Block diagram (example) of 3x 400G networking appliance implemented using Intel Agilex 7 FPGA AGI 041 device

CoSPs networking infrastructure connects the world through wired and wireless networks connecting end consumers, homes, Internet of Things (IoT), machines, enterprise buildings, branch offices, campuses, and data centers. Networking protocols, types of services and use cases, QoS, SLAs are broadly different and dynamic. These technologies continue to evolve and improve, while many legacy protocols and services require continuous support by CoSPs infrastructure. The AGI 041 device programmability enables telco infrastructure supports legacy and new protocols and services based on customers need, and their geographic regions.

Conclusion

The increasing network speeds and processing complexity create a demand for devices capable of delivering 400 Gbps infrastructure processing capabilities for cloud and communications service providers. The Intel Agilex 7 FPGA AGI 041 device is enhanced to deliver a competitive solution that offers a variety of features to address performance, power efficiency, and programmability. This device helps lower the total cost of ownership (TCO), improves the efficiency from infrastructure investment, and provides smooth migration to 400G. With integrated high-performance fabric and densities, PCIe 5.0 multi host enhancement, CXL 2.0, 800G hardened crypto blocks, 400GbE, and 116G transceivers, the AGI 041 device is the optimal solution for new generation 400G IPU platforms and next generation networking or enterprise solutions.

Learn More

- [Read the Intel IPU White Paper](#)
- [Explore Intel Agilex 7 FPGA I-Series](#)



Intel technologies may require enabled hardware, software or service activation.

No product or component can be absolutely secure.

Your costs and results may vary.

Performance varies by use, configuration and other factors. Learn more at www.Intel.com/PerformanceIndex.

© Intel Corporation. Intel, the Intel logo, and other Intel marks are trademarks of Intel Corporation or its subsidiaries. Other names and brands may be claimed as the property of others.