Solution Brief

Converged Edge Reference Architecture

Foxconn Offers Converged Access Edge Solutions

Company targets industrial edge computing applications and private wireless base stations with flexible Converged Edge Reference Architecture (CERA) solutions using Intel® Xeon® D processors and Intel Xeon Scalable processors.

Edge computing use cases, including artificial intelligence (AI), wireless, and cloud-native services, have become more cost-effective to deploy as powerful universal customer premises equipment (uCPE) products facilitate advanced workload processing and services delivery. Virtualized infrastructure combined with cloud-native services and edge intelligence layered onto the uCPE provide agile and innovative workload processing and services with reasonable deployment and operational costs.

Cloud-native edge platforms based on Converged Edge Reference Architecture (CERA) offer a new value proposition to enterprise vertical market segments, such as smart city, transportation, industrial, retail, and media, by enabling new video and analytics use cases and delivering improvements in latency, data privacy, and reliability.

To take advantage of this trend, Foxconn Technology Group is developing two high-performance edge computing solutions based on CERA. The architecture combines Intel® architecture processing power with a strong software foundation to advance next-generation edge computing solutions. Foxconn is utilizing this reference architecture to deliver new solutions for industrial edge computing and private wireless applications.

How Edge Computing Is Evolving

Multi-access edge computing (MEC) has given communications service providers (CoSPs) and enterprises a solution for low-latency cloud applications in use cases that include smart cities, smart transportation, retail, industrial, and others.

MEC has also opened the door to new edge-deployed workloads such as edge analytics, inference, virtual radio access networks (vRAN), virtual evolved packet core (vEPC), secure orchestration, and multi-platform connectivity with the same seamless scalability that has been prevalent in the cloud.

But advancements in edge computing come with some challenges. Building, testing, and onboarding new solutions on-premises and at outdoor edge locations is costly and complex. At the same time, many customers see these platforms as opportunities to build or evolve their corporate networks beyond Wi-Fi and Ethernet to include 4G and 5G wireless, which requires an additional investment in wireless software and antenna equipment. CERA platforms provide additional software integration and functionality to overcome these challenges and deliver on the promise of cloud native edge computing.

The CERA platform unifies and converges all of the new edge workloads into a single platform and also enables IoT with 4G/5G wireless infrastructure technology. CERA helps CoSPs to densify their wireless networks and enterprises to build private cellular networks using a cloud native architecture. CERA abstracts network complexity and streamlines the solution get-to-market process, thereby accelerating time to market (TTM) for service providers innovating their services infrastructure on Intel architecture.

Foxconn CERA Solutions

Foxconn is developing two CERA-based solutions, one for industrial MEC services and another that combines MEC capabilities with a cellular base station for private wireless applications. While industrial markets are the initial target for the solutions, by utilizing CERA, these solutions can be deployed in other industries and use cases.

The standalone MEC solution utilizes a server powered by a single-socket Intel Xeon D processor. Intel Xeon D processors are system-on-a-chip processors that support high-density, single-socket network, storage, and edge computing solutions with a range of integrated security, network, and acceleration capabilities. They are designed for applications like MEC that have space and power constraints.

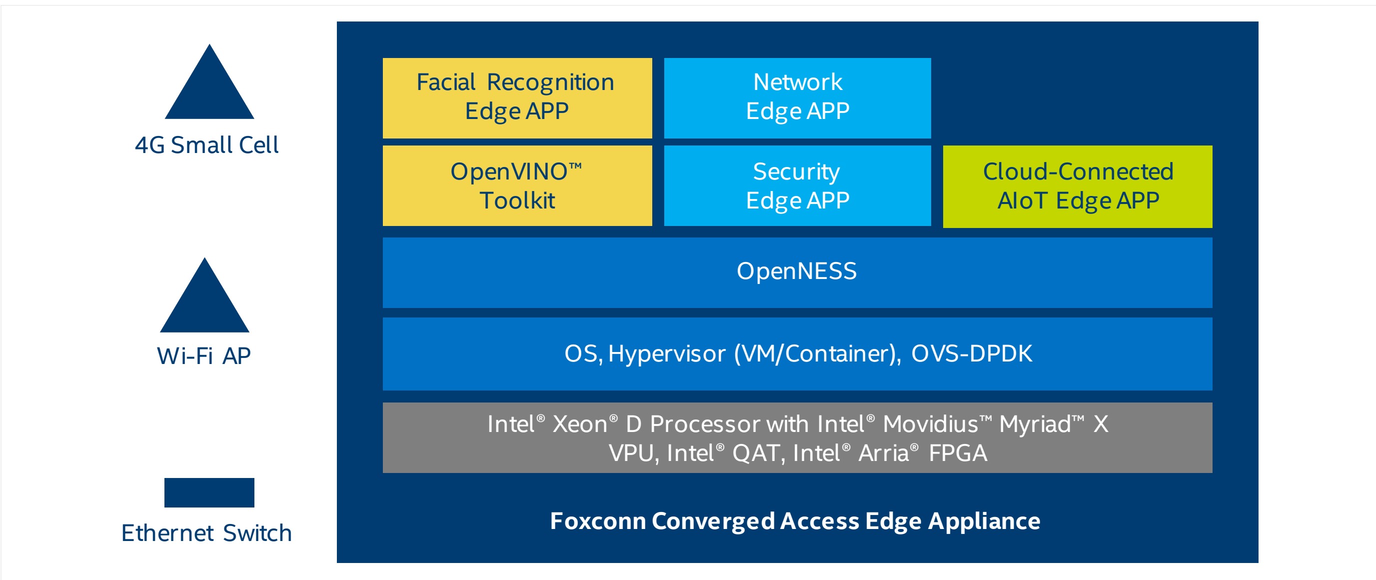


Figure 1. Block diagram of Foxconn MEC server solution (CERA-based portion of solution at right).

The MEC/private wireless solution supports 4G/LTE and 5G New Radio (NR) networks and is based on a dual-socket Intel Xeon Scalable processor-based server. The system is configured so one socket of an Intel Xeon processor can deliver LTE base station services, including virtual radio access network (vRAN), virtual evolved packet core (vEPC), and 5G NR centralized unit (CU) services, while the other CPU is utilized for MEC services.

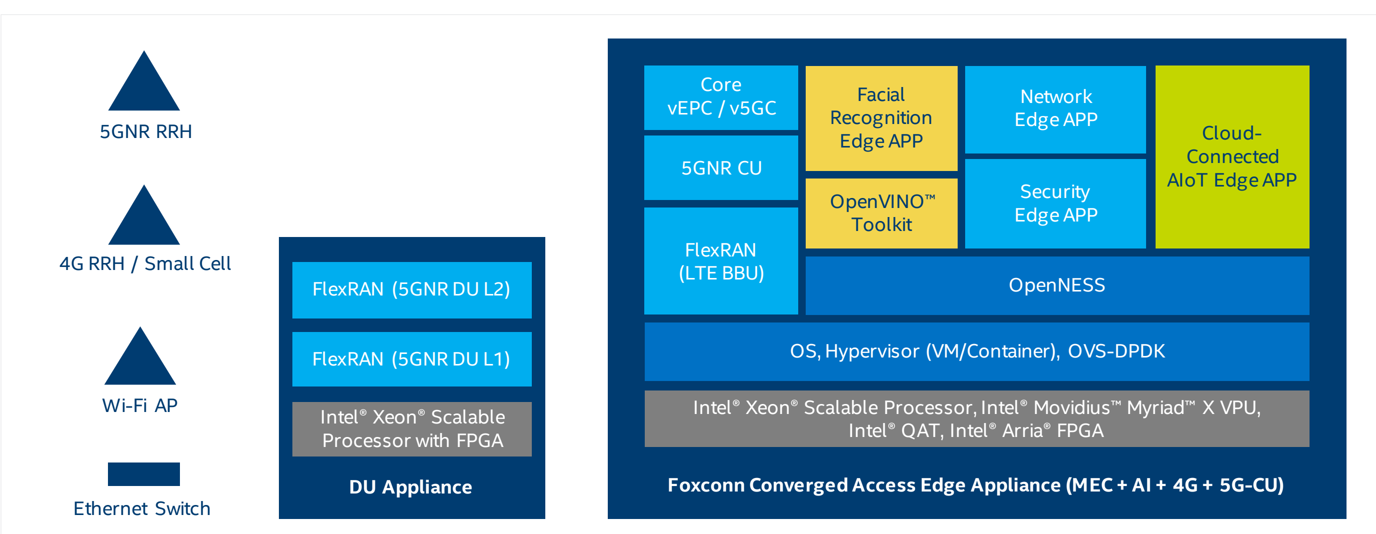


Figure 2. Block diagram of Foxconn MEC and private wireless solution (CERA-based portion of solution at right).

For the MEC servers, Foxconn has identified facial recognition for authorization and authentication as a critical first use case and application. The server specification is designed to support video streams up to 10 IP cameras streaming 1080p high-definition video with decoding done on the CPU. The MEC server platform is flexible to upgrade and support additional use cases and applications for industrial and other enterprise segments.

Foxconn's MEC solutions can also be used in 5G private wireless networks by hosting central unit (CU) functionality that links radio traffic to the DU server for processing.

In large 5G private cellular applications, an Intel® FPGA Programmable Acceleration Card (Intel® FPGA PAC) N3000 is suitable to accelerate the high physical layer forward error correction (FEC) functions such as low-density parity-check (LDPC) applications in 5G. The Intel FPGA PAC N3000 is equipped with Intel® Arria® 10 FPGA, which contains a set of embedded peripherals, hardened floating-point variable-precision DSP blocks, high-speed transceivers, and protocol intellectual property (IP) controllers—all in a single highly integrated package. The Intel FPGA PAC N3000 also provides two on-board Intel® Ethernet Controller X710 ports, enabling network fronthaul transmission and connectivity functions in addition to the FEC accelerator.

The MEC servers support hardware acceleration for applications that use artificial intelligence (AI) and machine learning (ML). Intel Arria 10 FPGA and Intel® Movidius™ Myriad™ X Vision Processing Unit (VPU) can be added to either server to provide a dedicated neural compute engine for accelerating deep learning inferencing at the edge. To take advantage of the performance of the neural compute engine, Intel has developed the high-density deep learning (HDDL) inference engine plugin for inference of neural networks.

For heavy encryption and decryption needs, the MEC servers can also support Intel® QuickAssist Technology (Intel® QAT). Intel QAT is a hardware encryption and decryption engine that accelerates cryptography requests, providing additional performance and reducing the compute load on the CPU.

Software

Both the solutions operate with the CERA network functions virtualization infrastructure (NFVI) software that includes the following open source software:

- Linux operating system
- KVM hypervisor
- Data Plane Development Kit (DPDK) for enhanced packet throughput
- Open vSwitch for virtual switching

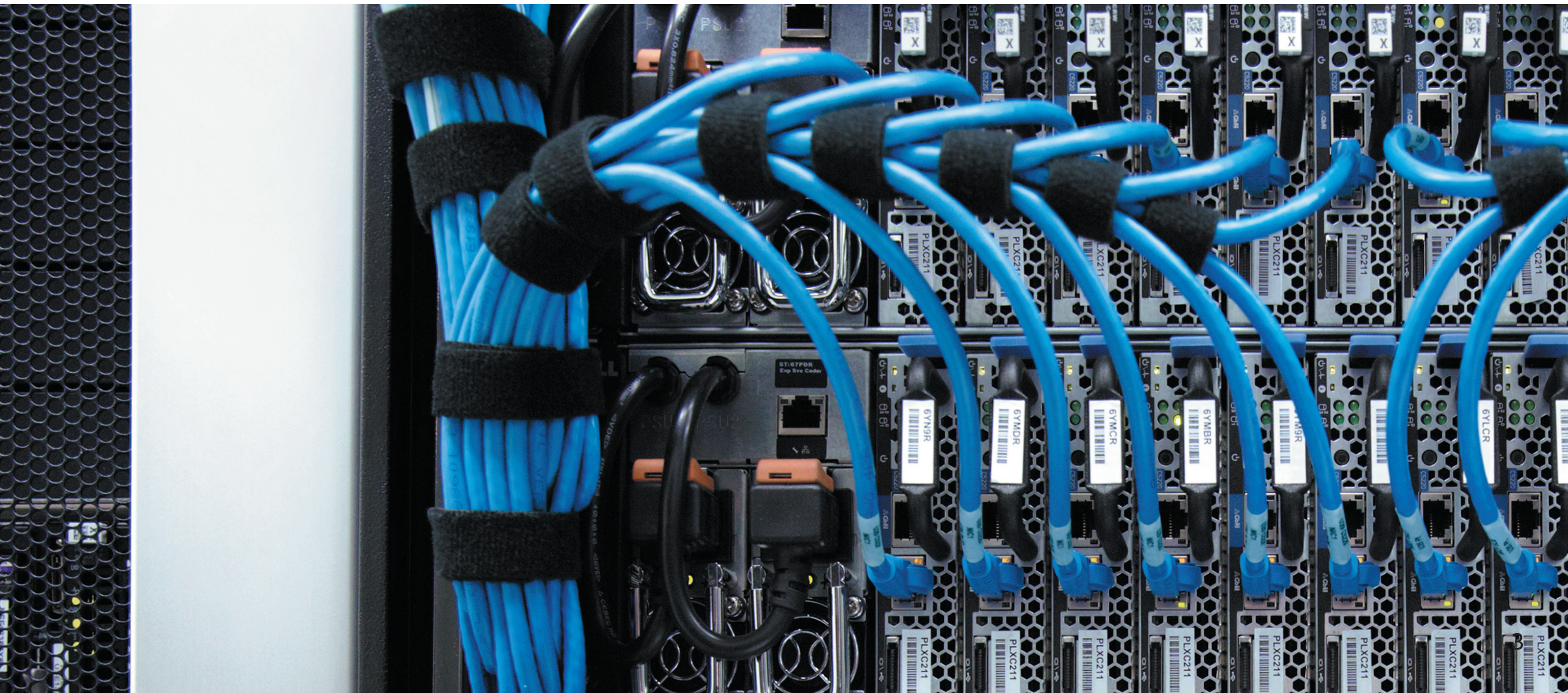
VNFs

The use of open source software for the NFVI facilitates compatibility with an incredibly wide range of virtual network functions (VNFs). CERA system developers can integrate their own VNFs and also choose from VNFs offered by members of the Intel® Network Builders ecosystem and other third-party software companies.

The CERA NFVI has been tested with several VNFs that help facilitate 5G radio access network functionality (RAN) for private wireless networks. In its private wireless solution, Foxconn utilizes FlexRAN software-based radio reference architecture to enable cloud RAN in a variety of flexible configurations (for both macro and small cell for both indoor and outdoor). The FlexRAN includes SDK Modules, which are optimized signal processing libraries for Intel architecture CPUs and the FlexRAN Task Controller facilitates scaling across multiple CPUs.

Software Tool Kits

Foxconn has built in Open Network Edge Services Software (OpenNESS), an open source software toolkit to enable easy onboarding, deployment, and management of edge services across diverse network platform and access technologies in multi-cloud environments. Developed by Intel, OpenNESS uses standards-based APIs and a micro services architecture to onboard, develop, and manage applications at the network edge.



OpenNESS features include more secure on-boarding and management of applications with an intuitive web-based GUI. Additional functionality includes access termination, traffic steering, multi-tenancy for services, service registry, service authentication, telemetry, application frameworks, appliance discovery, and control. This functionality makes it easy for cloud and IoT developers to engage with a worldwide ecosystem of hardware, software, and solutions integrators to develop new 5G and edge use cases and services.

To enable facial recognition applications along with other deep learning and AI applications, Foxconn's CERA-enabled systems support the Intel® Distribution of OpenVINO™ toolkit. The toolkit enables deep learning inference and easy heterogeneous execution across multiple Intel® platforms—providing implementations across cloud architectures to edge devices.

Learn More

Foxconn is a member of the Intel® Network Builders ecosystem:

http://networkbuilders.intel.com

https://software.intel.com/en-us/openvino-toolkit