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Enea Edge Provides Virtualization and Management for uCPE

Enea Edge combines automation, management, and an operating system to provide a powerful foundation for virtualized branch office networking; software stack is optimized for Intel® Architecture processors.

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Software defined wide area network (SD-WAN) services are providing a branch office networking alternative to legacy multiprotocol label switching (MPLS) connections for enterprises that need encrypted access to both corporate IT systems and cloud services. Communications service providers (CoSPs) can use uCPEs to help customers create a blended and seamless network that includes legacy point-to-point branch office connections to corporate resources combined with broadband internet services to access cloud services.

SD-WANs are a major driver of the move to branch office universal customer premises equipment (uCPE). In a uCPE deployment, multiple virtual network functions (VNFs) run on the same server replacing a collection of single-function network appliances. This provides CoSPs with hardware that both reduces operating expenses and can deliver multiple services.

CoSPs virtualize all branch office networking services, including routing, network security, voice services and others. Beyond networking applications, CoSPs are using uCPE to offer new services, such as video analytics, internet of things sensor connectivity, carrier Wi-Fi and private 5G networks.

Most SD-WAN implementations were deployed using network functions virtualization (NFV), which creates a virtual machine for each application. This approach resulted in monolithic VNFs that were scalable, but not at a very granular level. Containerization is an emerging virtualization technique that offers microservices, a much more granular way to scale services.

The nature of branch office networking requires managing the systems remotely—to not incur the expense of an onsite technician visit. To fill this growing need for managed edge-based services, Enea, an Intel® Network Builders ecosystem partner, offers Enea Edge, an open, software-based managed enterprise edge solution that provides virtualization and management for uCPEs. Enea Edge has a small footprint and works in any edge setting, even in organizations that lack data centers, such as some small business offices.

Enea Edge Offers uCPE Foundation

Enea Edge's architecture provides a complete virtualization environment for the uCPE along with cloud-based automated management. Optimized to provide high performance with a small footprint, Enea Edge offers security features, and its global management enables scalability. It supports a full range of branch office use cases.

Enea brought together three of its solutions to create Enea Edge—Enea Edge Runtime, for deployment on uCPEs, and Enea Edge Management and Enea Edge Automation delivering cloud-based management and control of uCPE servers. In the Enea Edge implementation, each of the component solutions has a distinct role to fill:

Enea Edge Runtime is the uCPE virtualization and operating system. Enea Edge utilizes NETCONF for virtualized network configuration to minimize processing overhead but can also support containers if that is a requirement. Out of the box, Enea Edge Runtime utilizes Linux kernel-based virtual machine (KVM) for virtualization and Docker for container virtualization. Virtual machines and containers can be set up in any combination. The applications communicate over an internal OVS bridge independently of virtualization implementation. Enea Edge Runtime is highly economical in its use of resources—it can run on a single CPU core and needs less than 1 GB of memory and disk space.[1]

Enea Edge Management runs in the cloud and is the heart of the system, providing complete management of the virtual network function (VNF) app catalog, coordinating VNF onboarding and integrating with the customer's orchestration and carrier operations support system (OSS), including providing telemetry to the OSS. Enea Edge Management supports thousands of edge nodes running SD-WAN and any other workloads the enterprise needs to run at the edge. It accomplishes its orchestration/OSS integration through the use of representational state transfer (REST) northbound application programming interfaces (APIs). The solution offers a fast setup with zero-touch provisioning.

Enea Edge Automation automates VNF lifecycle management and platform configuration. It leverages the REST-based northbound API and NETCONF to fit neatly into environments that already use other automation platforms, so that, for example, a customer using Ansible could apply Ansible playbooks to control Enea Edge. Enea Edge Automation speeds time to deployment as well, which enables customers to meet changing market demands quickly.

Some benefits of the Enea Edge include:

- Future-Ready: Replaces any number of existing branch network appliances or can extend existing services with new on-demand applications on already deployed uCPE hardware.

- Automated: Built in features to automate deployment and management using Zero Touch Provisioning, Ansible automation, and integration with third-party orchestration software

- Scales from small networks to large networks: Enea Edge scales from high-end Intel® Xeon® Scalable processor-based servers down to Intel Atom® processor-powered servers with only two cores and 2 GB RAM. Scalability offers a cost-effective solution for all the needs of a large enterprise with one software system to learn.

- Security Features: Uses encryption feature of NETCONF for all management communications, offers secure boot and role-based access control

- Centralized uCPE management: Enea Edge offers centralized application onboarding, networking management, and application lifecycle management.

- Ecosystem: Enea has developed a significant ecosystem of verified uCPE servers, VNF and CNF applications, and network orchestrators.

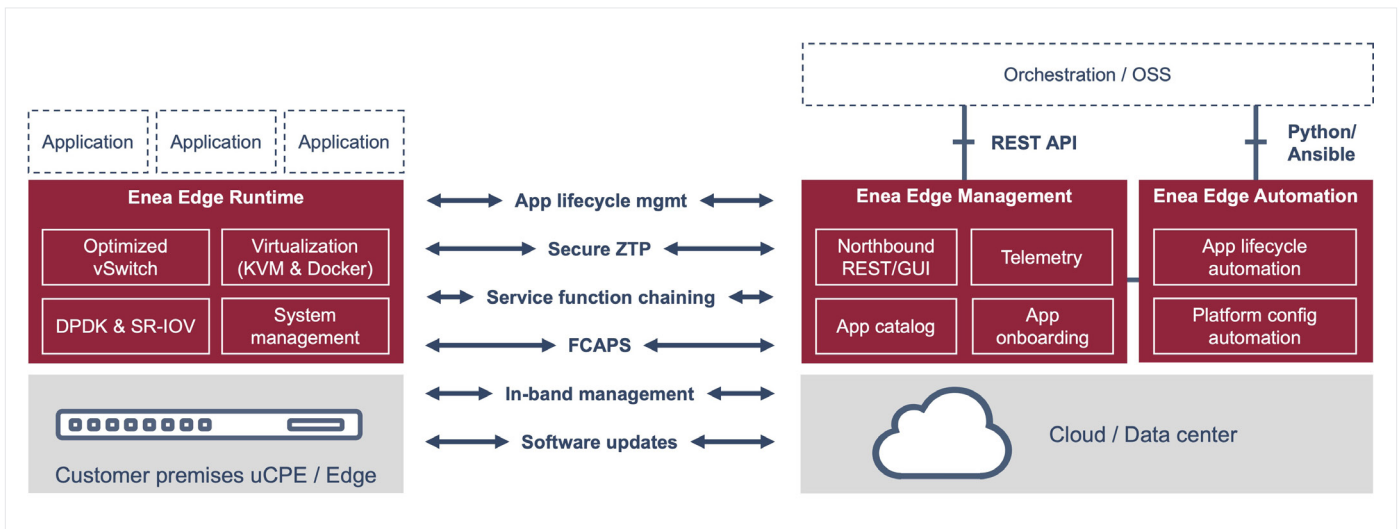Figure 1 shows the relationship of the components of Enea Edge.

Figure 1. A schematic view of Enea Edge in a typical deployment.

Low Overhead Virtualization

With virtualization quickly replacing branch office single-function appliances and bare-metal servers, the software virtualization platform is the linchpin for controlling hardware costs. Enea Edge minimizes resource overhead while providing a feature set geared toward automation and management of large-scale deployments, making it an ideal option at the customer premises. Enea Edge provides this, and also reduces RAM and CPU demands so that customers can use more cost-effective hardware. Figure 2 shows the low resource demands of Enea Edge.

Characteristics	Enea Edge
Platform RAM Footprint	< 1 GB
Platform Disk Footprint	< 1 GB
Platform CPU Footprint	1 core
Platform Boot Speed (excl. BIOS)	< 3 s
Network Throughput over vSwitch	10 Gb IMIX Line Rate
Network Latency over vSwitch	10-15 µs Average

Figure 2. Enea Edge demands lower overhead than typical alternatives.[2]

Enea Edge uses NETCONF and YANG instead of OpenStack to provide management communications with a minimal footprint at the network edge, and with no sacrifice of performance or functionality. While NETCONF automates and manages network devices and VNFs, YANG defines the data hierarchy that informs NETCONF operations. YANG provides a complete description of all the data exchanged via NETCONF.

NETCONF connects uCPEs running Enea Edge Runtime with Enea Edge Management for configuration, deployment and management of infrastructure and application lifecycles. NETCONF provides the connection to third-party orchestration solutions using standard REST APIs. It is extensible and adaptable to brownfield deployments, features extensions and complex integrations and deployments. Enea Edge is optimized for servers based on Intel architecture CPUs, including Intel Xeon Scalable, Intel Xeon D and Intel Atom processors.

The solution supports VNFs from other vendors and running on the Intel architecture white box hardware of the customer's choice. It utilizes the Data Plane Development Kit (DPDK) to accelerate packet throughput, and single-root I/O virtualization (SRIOV) to further maximize hardware performance.

Enea Edge Simplifies SD-WAN Service Deployment for Expereo

Expereo is a network independent service provider in the Netherlands that selected Enea Edge for its "intelligent edge" uCPE infrastructure. It used this infrastructure to deploy SD-WAN services with the option to add security functionality and other services.

A certain amount of future-readiness is expected from these intelligent edge uCPE servers to allow new services to roll out when the customers need them. This capability can be seen in Figure 3, which shows the various layers of the Expereo intelligent edge solution. Enea Edge and Intel architecture hardware forms the foundational layer of the solution with the various network functions shown as the service layer. Expereo adds its Expereo Services Network Automation Platform (ESNAP) for automated management and configuration of service deployments and operations.

Enea Edge Optimized for Intel® Architecture

Enea Edge excels on servers powered by Intel® Xeon® Scalable, Intel® Xeon® D and Intel Atom® processors. Intel Xeon Scalable processors are built with the performance needed to deliver flexible and highly scalable workload-optimized performance in an NFV environment. Intel Xeon Scalable processors are optimal for applications requiring high performance and power efficiency, such as distributed orchestration, high-throughput encryption and firewall processing.

Intel Xeon D system on a chip (SoC) processors are designed with the same core processor capabilities as the Intel Xeon Scalable processors, with integrated Ethernet and Intel® QuickAssist technology.

Intel Atom systems on chips (SoCs) are designed for uCPE and other low-power, high-density workloads. Intel Atom SoCs can run the same software and instruction sets as Intel Xeon Scalable CPUs and are designed with power and performance levels for network and edge applications.

Enea supports other Intel technology including Intel® QuickAssist Technology (Intel® QAT) for acceleration of cryptographic workloads. Enea also supports Vector Packet Processing (VPP), which utilizes the Data Plane Development Kit (DPDK) for higher packet throughput. Enea also utilizes Intel single-root input/output virtualization (SR-IOV) in order to provide direct connections between virtual network elements and network controllers.

Enea Edge delivers OS-level Intel integration through the use of Enea Linux, Enea's own Yocto-based Linux distribution. This is optimized with a high-performance, multi-core real-time OS (RTOS) for telecom (e.g. radio base stations). Enea software also features open source optimizations which improves combines expertise selecting and configuring the right packages in the optimal way for the purpose and Intel architecture CPUs.
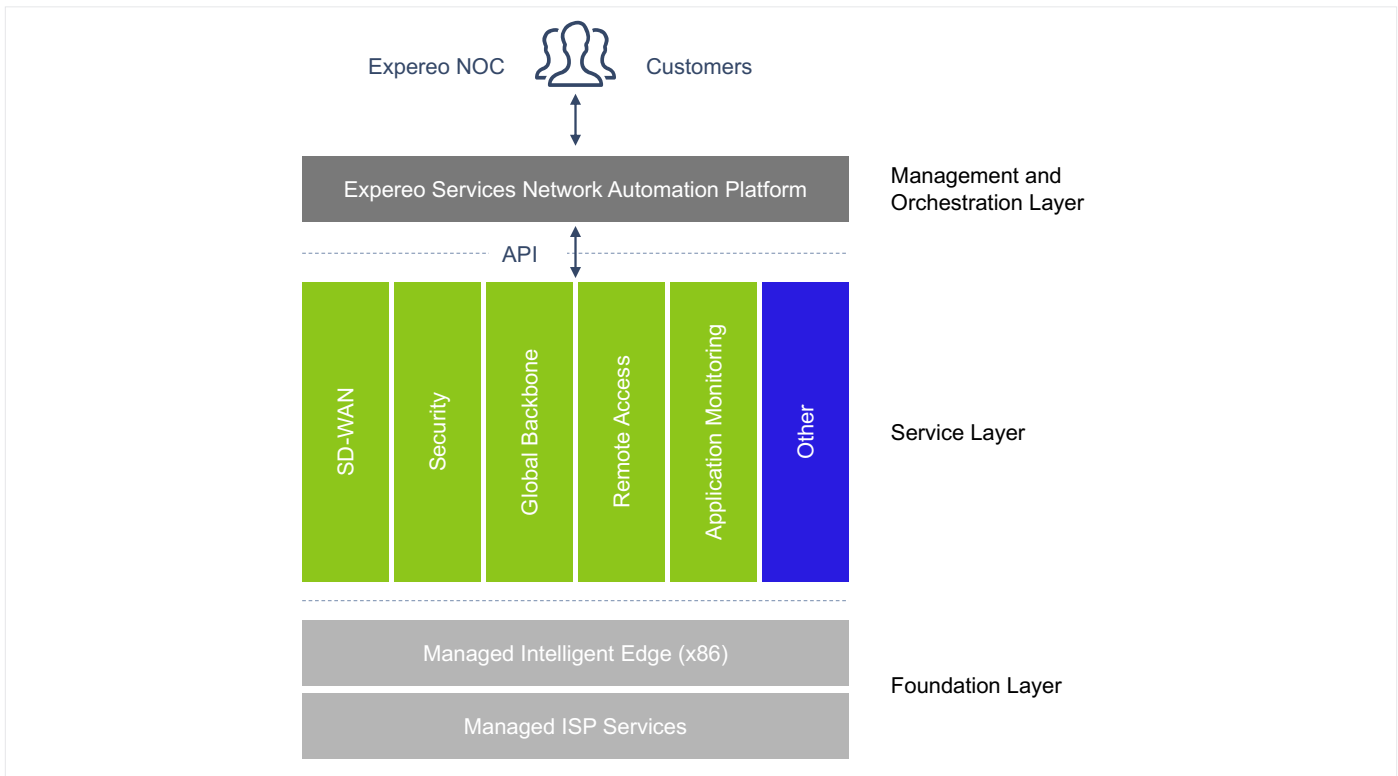
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Figure 3. Architecture of Expereo's intelligent edge uCPE server.

Enea Edge provides the uCPE virtualization platform to deliver an easy-to-deploy SD-WAN service with the capability to add other services. The combined solution is future proof and a cost-effective system that allows Expereo to offer a solution it can scale, cost effectively.

allowing the use of both VNFs and CNFs. Enea Edge runs on a wide range of Intel servers providing scalability from entry-level to high-end deployments. Enea Edge provides attractive features for CoSPs that want to fully embrace the growing market for edge computing.

Conclusion

Driven by the success of SD-WAN solutions, branch office networking is a common and critical uCPE use case, with computing demands spread across multiple locations. SD-WAN services allow CoSPs to fulfil customer demand for broadband access to cloud services while also supporting existing MPLS services. Enea Edge offers the right architectural combination of OS and virtualization on the uCPE with management and automation in the cloud to give CoSPs the performance they need with a very low footprint. It offers virtualization flexibility

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