

## Enea NFV Access: Lightweight and optimized uCPE without OpenStack

Optimized hardware cost at the customer premise through minimal hardware resource utilization, no need for OpenStack, and leveraging NETCONF to drive native Linux virtualization infrastructure.

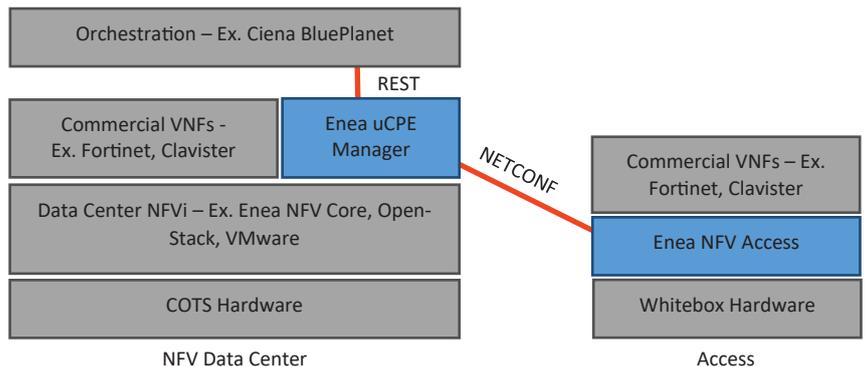
### Benefits

- ▶ **Minimal footprint:** Designed for high compute density on edge devices and standard servers. OpenStack is not required in the standard setup
- ▶ **High networking performance:** 10Gbps throughput
- ▶ **Container and VM support:** Supports virtualization with virtual machines and/or containers
- ▶ **Scalable:** From 2-core ARM edge device with single NIC to high-end x86 servers
- ▶ **Fast boot:** Boot speed optimization for best-in-class availability
- ▶ **Multiple orchestration interfaces:** VNF lifecycle management and service function chaining from orchestrator or central office/point-of-presence control node VIM
- ▶ **Device management framework** supporting FCAPS functionality in the platform
- ▶ **Zero lock-in:** Open APIs and standards for portability and whitebox deployment

Enea NFV Access optimizes hardware cost at the customer premise through minimal hardware resource utilization, by not requiring OpenStack, and by using NETCONF to drive the native Linux virtualization infrastructure. Minimizing hardware cost at the customer premise is crucial to ensure good margins, due to the scale of deployment. A cost-efficient uCPE requires low RAM footprint, minimal CPU overhead and optimized virtualized networking performance. OpenStack is intended for data center deployment; however, customer premise equipment's hardware constraints makes OpenStack a suboptimal solution, since low hardware cost is a key criteria for business success.

Enea NFV Access is a lightweight and extensible virtualization platform for Universal Customer Premise Equipment (uCPE) and NFV Edge Devices. The design has been architected from the bottom up with the goal of providing a software infrastructure platform that is truly independent of hardware, VNF and Orchestration, and optimal for edge use cases.

Enea NFV Access includes the software virtualization platform and the Enea uCPE Manager, packaged as a VNF, a delocalized Virtual Infrastructure Manager (VIM) provided to manage the uCPE and the VNF's lifecycle using NETCONF protocol. Enea uCPE Manager is a VIM and VNF Manager that integrates with orchestration using REST API's. Enea uCPE Manager can be integrated with Multi-VIM orchestrators for OpenStack or VMware integration.



Based on architectural and design choices, specific platform level characteristics are provided. Enea NFV Access provides platform characteristics that allow uCPE vendors to minimize hardware cost through:

- Multi-processor architectures: x86 and ARM
- Minimized RAM footprint
- Minimized Disk footprint
- Minimized CPU utilization
- Optimized virtualized networking performance
- Optimizations for white-box hardware specifications

The table to the right compares selected Enea NFV Access characteristics to common uCPE solutions in the market.

Characteristics	Enea NFV Access	Common uCPE solutions
Platform RAM Footprint	Sub 1 GB	4-12 GB
Platform Disk Footprint	Sub 1 GB	4-12 GB
Platform CPU Utilization	Down to single core	2-4 cores
Platform Boot Speed	Sub 3 seconds	10-30 seconds
Virtualized Network Throughput over vSwitch	10 Gb IMIX Line Rate	1 Gb IMIX Line Rate
Virtualized Network Latency over vSwitch	Average 10-15 $\mu$ s	Average 25-75 $\mu$ s

Enea NFV Access main characteristics and features are based on specific architectural and design choices. The table below compares these choices with common uCPE solutions seen in the market

	Enea NFV Access	Common uCPE solutions	Comment
<b>Platform foundation</b>	Bottom up approach with optimizations and footprint reduction in every layer of the platform based on Open Source software	Top down, adapting either Common Linux Distributions such as Centos or Ubuntu Preexisting CPE or Data Center platforms	Enea NFV Access is optimized for small CPU, RAM and Disk footprint and fast boot speed. to drastically reduce the hardware BOM
<b>Feature set</b>	Minimal extensible feature set	Large feature set induced by OpenStack services presence	Start with a small feature set and grow it according to needs for minimized platform footprint and optimal uCPE characteristics
<b>VIM architecture</b>	Delocalized VIM using NETCONF for management protocols  - Alternatively -  Containerized OpenStack for solution requiring OpenStack compatibility at Customer Premise	Localized VIM using OpenStack with OpenStack internal management protocols	Delocalized VIM reduces uCPE CPU utilization, RAM and Disk footprint  Containerizing OpenStack allows OpenStack to be an optional platform component
<b>Data plane</b>	Optimized DPDK and OVS-DPDK and SR-IOV Networking for physical and virtualized network functions	DPDK, optimized OVS and SR-IOV for virtualized network functions	Enea NFV Access outperforms competition with data plane optimizations in combination with small RAM footprint
<b>Virtualization</b>	Optimized KVM/QEMU and Docker Containers	Optimized KVM/QEMU	Docker Containers for minimized footprint
<b>Platform Feature Extensibility</b>	Platform SDK enabling : Building custom kernel modules in host and VMs Building custom kernel configuration in host and VMs Native platform extensions VM and containers platform extensions	Professional Services for custom configurations and extensions and VM-based extensions	Extend the platform to adapt specifically to specific customer use cases
<b>Management Extensibility</b>	SDK for NETCONF and YANG modelling support, for FCAPS and for customized Platform Management	NETCONF protocol support for FCAPS	Use NETCONF for standardized and extendible platform management beyond FCAPS
<b>VIM Feature Extensibility</b>	Enea uCPE Manager is customizable and model-based VIM with REST northbound and NETCONF southbound APIs	Not Available	Customizing OpenStack is hard, complex and costly. Enea uCPE manager is designed to be extensible

Find out more on the Enea website!



Enea develops the software foundation for the connected society with a special emphasis on reducing cost and complexity at the network edge. We supply open-source based NFVI software platforms, embedded DPI software, Linux and Real-Time Operating Systems, and professional services. Solution vendors, Systems Integrators, and Service Providers use Enea to create new networking products and services faster, better and at a lower cost. More than 3 billion people around the globe already rely on Enea technologies in their daily lives. For more information: [www.enea.com](http://www.enea.com)