Application Note

Cost-efficient uCPE: NETCONF-based NFVI Management without OpenStack

NFV use cases at the customer premise are very sensitive to hardware costs because of the volume of deployed devices. OpenStack, a high consumer of customer premise hardware resources, is therefore a poor fit for uCPE. NETCONF provides an excellent alternative for a low footprint management solution. For this reason, Enea NFV Access and Enea uCPE Manager use NETCONF and YANG to create a highly cost-effective NFVI platform, optimized for uCPEs.

Minimizing hardware costs at the customer premise is crucial to reducing expenditure and ensuring good margins for service providers, due to the sheer scale of deployment. A cost-efficient uCPE requires low RAM footprint, minimal CPU overhead and optimized virtualized networking performance. Universal Customer Premise Equipment (uCPE) is how enterprises will leverage Network Functions Virtualization (NFV) to reduce costs and add agility for use cases such as SD-WAN and UTM.

This makes the resource hungry OpenStack a poor fit for the customer premise. OpenStack was designed and built for data center deployment on data center hardware solutions. Where OpenStack is big, feature-rich and complex, a typical uCPE needs a virtualization infrastructure that is streamlined and manageable, providing the needed functionality and performance using minimal resources. Cost driven hardware constraints in the uCPE therefore make OpenStack a suboptimal solution.

Native Linux virtualization using KVM or Docker can provide a slimmed down runtime for VNFs, but needs management and integration with orchestration and OSS/BSS. Enea NFV Access uses a solution based on the NETCONF protocol to provide the management interface between the runtime and its controller component, the Enea uCPE Manager, significantly reducing utilization of hardware resources compared to OpenStack and minimizing costs at the customer premise.

NETCONF is a modern network management protocol that brings a standardized, unified way to configure and manage uCPEs and VNFs. It provides mechanisms for installing, manipulating, and deleting configurations for VNFs and the NFVI using transaction management, and enables key attributes for efficient uCPE management like zero-touch provisioning (ZTP) and automation. All communication is secured using Secure Shell (SSH).

Since Enea uCPE Manager is not based on OpenStack and uses NETCONF, it can provide a complete feature set for uCPE management including full FCAPS, but with a significantly reduced footprint in terms of RAM consumption and CPU utilization.

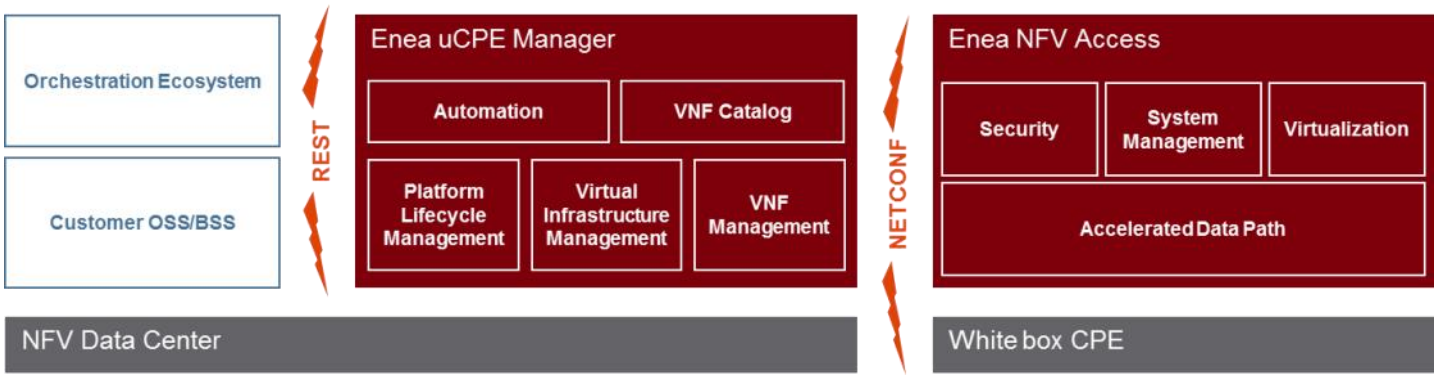
Characteristics	Enea NFV Access	Alternatives
Platform RAM Footprint	< 1 GB	4-12 GB
Platform Disk Footprint	< 1 GB	4-12 GB
Platform CPU Footprint	1 core	2-4 cores
Platform Boot Speed	< 3 s	10-30 s
Network Throughput over vSwitch	10 Gb IMIX Line Rate	1 Gb IMIX Line Rate
Network Latency over vSwitch	10-15 µs Average	25-75 µs verage

Enea NFV Access

Enea NFV Access is a virtualization platform for universal Customer Premise Equipment (uCPE). It has been developed from the bottom up with the goal of providing a software infrastructure platform that is truly independent of hardware, virtual network functions (VNFs) and orchestration, with optimal characteristics for the customer premise.

Enea NFV Access includes Enea uCPE Manager, a virtualized infrastructure manager (VIM) and VNF manager that manage the uCPE and the VNF's lifecycle using NETCONF/ YANG.

Enea uCPE Manager integrates with orchestration using REST API's. Enea uCPE Manager can be integrated with Multi -VIM orchestrators for OpenStack or VMware integration.



Virtualization Platform Comparison

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

Design Choice	Enea NFV Access	Typical uCPE Software Platforms	Comment
Platform Foundation	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 and 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.
Feature Set	Streamlined and extensible feature set.	Large feature set through the presence of OpenStack services.	Start with a small feature set and extend it according to needs to ensure minimal platform footprint and optimal uCPE characteristics.
VIM Architecture	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.
Data Plane	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.
Virtualization	Optimized KVM/QEMU and Docker Containers.	Optimized KVM/QEMU	Docker Containers for minimized footprint.
Platform Feature Extensibility	Platform SDK enabling : ▪ Development of custom kernel modules in host and VMs ▪ Development of custom kernel configuration in host and VMs ▪ Native platform extensions ▪ VM and container platform extensions.	Professional Services for custom configurations and extensions and VM -based extensions.	Extend the platform to adapt to specific customer use cases.
Management Extensibility	SDK for NETCONF and YANG modelling support, for FCAPS and for customized Platform Management.	NETCONF protocol support for FCAPS.	Use NETCONF for standardized and extendable platform management beyond FCAPS.
VIM Feature Extensibility	Enea uCPE Manager is a 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!

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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