Prodapt powering global telecom

Virtual CPE Achieving hardware-based operations through a software-based virtual function

Key design and deployment considerations for a successful vCPE implementation

Credits

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Major drivers for virtual CPE (vCPE) adoption

Legacy devices

Challenges

- Limited by features shipped in the box
- Vendor lock-in & dependence
- Higher integration & operating costs
- Requires specialists to install & operate- one type for each vendor/device class
- Inability to launch new services/add-ons quickly

vCPE enabled white-box devices

Benefits

- **Vendor-agnostic devices**
- **Easy integration & operations**
- **CAPEX reduction**
- **Easy to change policies, features, services etc.**
- **Cost effective maintenance**

Transitioning to virtualized CPE: Disaggregation, virtualization and integration

1 Breaking up devices (Disaggregation)

Off-the-shelf/Commodity hardware
- Use typical DC server, storage

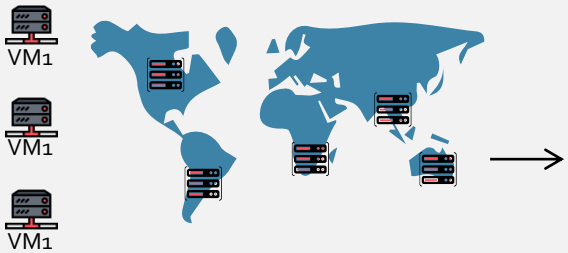
Technology
- FPGA
- DPDK
- SRIOV

Operating system
- Linux
- Specifically developed for n/w or embedded devices
- Built-in basic networking functions routing, switching etc.
- Built-in management UI & protocols

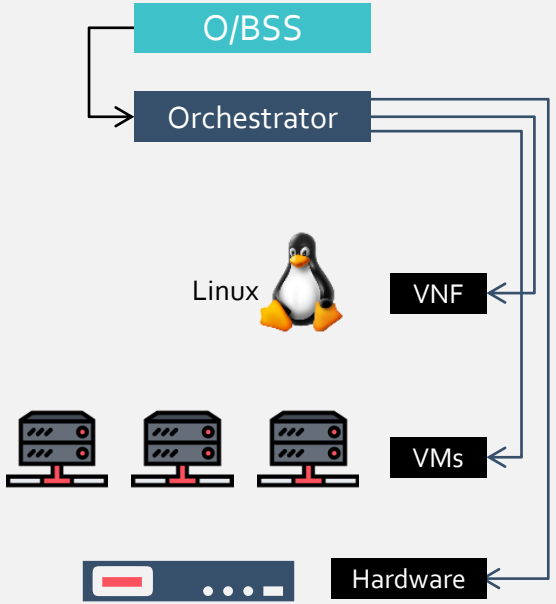
2 Cloud enabling (Virtualization)

Virtual Machines
- Virtualization setup
- Using a hypervisor like KVM/vSphere
- Open source (OpenStack)/vendor (VMWare)

Data Centres
- Servers/VM go into DCs
- Standard space, power, cooling
- DCs can be distributed



3 Implementing in a new environment (Integration)



Key design considerations for effective vCPE deployment

vCPE implementation process should be flexible so that dynamic changes/on-demand service onboarding (value-added service) can be taken care of.

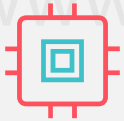
Following are the key areas of design considerations:

1

FUNCTIONALITIES SEGREGATION

ON-PREMISE VS CLOUD: Inefficient distribution of functionalities between on-premise and cloud can affect the vCPE performance

2



CHOOSING RIGHT MIX OF PLATFORMS

Choosing the right mix of platform and data plane accelerators is important in cost and performance optimization

3

LATENCY ISSUES

Distributing the VNFs between edge and cloud in the right way to handle latency issues

4

CHOOSING RIGHT ORCHESTRATOR

It is important to choose correct orchestrator based on the ecosystem & features such as interoperability with legacy, EMS, O/BSS systems

Strategies to address vCPE deployment considerations and achieving service agility

1

Effective segregation of functionalities

Recommended functions for **on-premise**

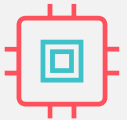
- Termination points
- Enterprise network monitoring
- Layer 2 forwarding
- Access link encryption
- Ethernet access
- WAN load balancing
- WAN optimization
- Caching
- NAT and/or DHCP

Recommended functions for **on-cloud**

- Routing and multicast
- Session border control
- Layer 2 and Layer 3 VPN
- IPSec
- Security (firewall, DPI, DDoS)

2

Right mix of platforms



It is important to have the right mix of physical and virtual platforms when moving CPE to the cloud. Virtual servers such as x86 servers alone may not be enough to handle all vCPE functionalities.

Mixing data plane accelerators such as DPDK and SR-IOV (ethernet adapters) with x86 servers ensure better performance. Anything based on the data path could be offloaded to these accelerators while application logic remains in the x86 servers.

Strategies to address vCPE deployment considerations and achieving service agility

3

Ensuring zero/ minimal latency

VNFs vary according to their functionalities and infrastructure requirement. It is recommended to analyze/classify VNFs based on their network performance criteria and place latency sensitive VNFs (ex-audio/video services) at the network edge while other services such as routing, network address translation (NAT) and firewall can be placed on the cloud infrastructure.

4

Choosing the right orchestration platform

Two most popular open source orchestrators - Tacker and open-source Mano have few benefits and as well as limitations. It is recommended to choose the right orchestrator as per the ecosystem configuration and needs.

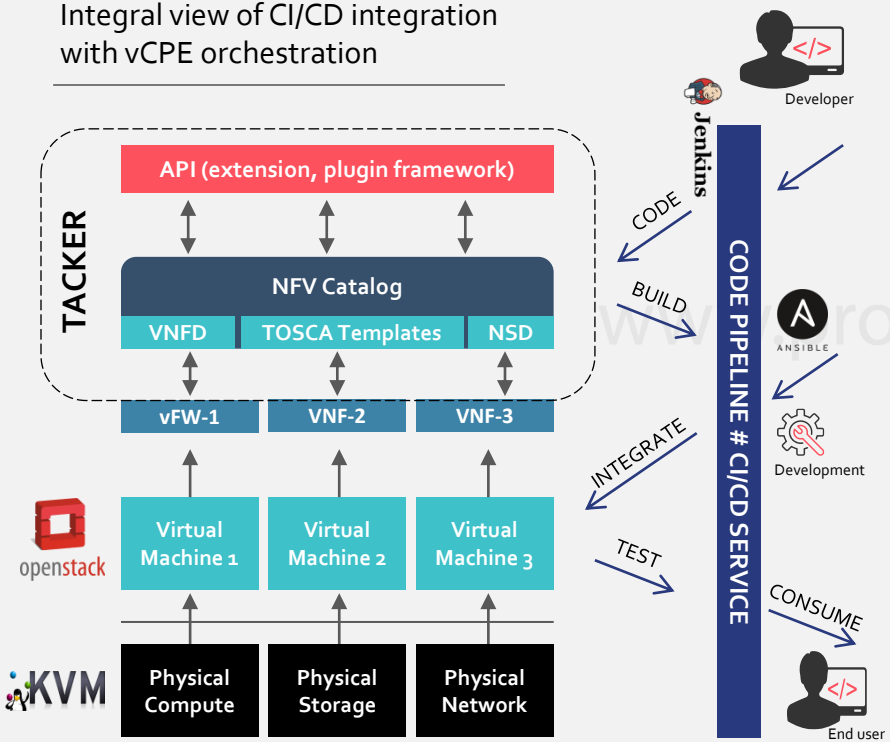
Below are few observations highlighted based on various field experiences.

TACKER	OSM
Tacker is easily integrated with OpenStack	OSM is based on ETSI standard. However, the integration with OpenStack is not very easy.
VNF Update is limited as VNFM is a part of NFVO (tightly coupled)	VNF updates are extensible as OSM supports configuration tools such as Juju/charms using SSH
Does not support VNF forwarding graphs (VNFFG). Due to which auto- scaling is not possible.	VNFFG is supported. Hence, auto-scaling is possible.
Troubleshooting is easy as Tacker converts TOSCA to HOT stack to deploy VNF	Troubleshooting is difficult as API calls are made to OpenStack, so need to rely on OSM logs completely.

Strategies to address vCPE deployment considerations

Integrating CI/CD framework into the orchestration layer brings agility, innovation and quicker vCPE rollouts

Integral view of CI/CD integration with vCPE orchestration



It is important to have a robust CI/CD framework integrated with vCPE implementation to realize the full benefits of vCPE implementation

- Brings cloud native approach into the network delivery
- Easy rollout and rollback of new features
- Realizing full self-care, self-provisioning functionalities

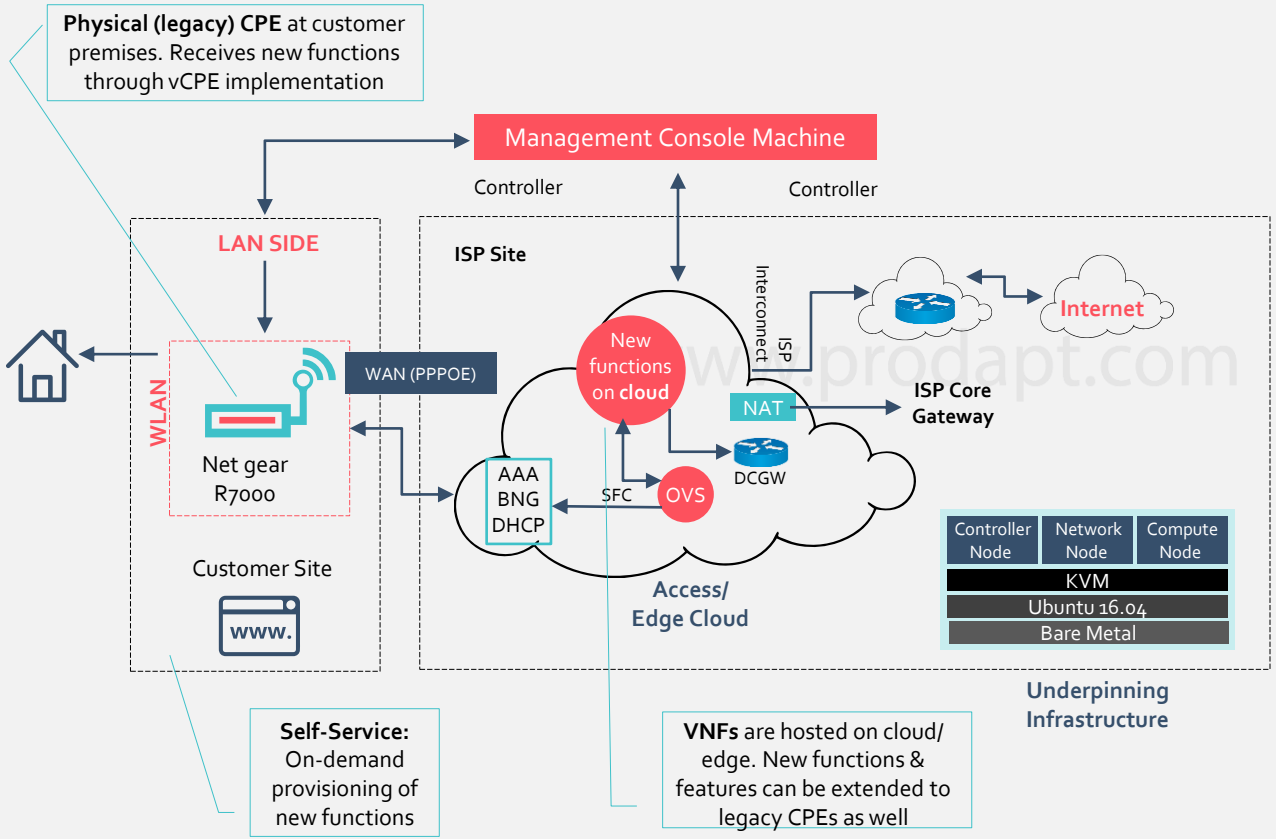
Automation through DevOps tools such as Jenkins and Ansible help in achieving better control over deployment

Use robot framework to track changes better

Adopt container-based vCPE deployment, leveraging tools such as Kubernetes and Docker for dynamic changes

A leading DSP adopted vCPE to overlay innovative functions on legacy CPEs

Protect investments on legacy CPEs and offer new customers with low cost white box



Benefits

- The DSP had several thousands of physical/hardware CPEs at customer premises and faced limitations with new feature rollouts
- Adopted vCPE implementation strategy
- Introduced new innovative features and functionalities (not supported by legacy CPEs) on the cloud/edge
- Extended those new features (e.g. parental control, throttling, etc.) to subscribers' legacy CPEs
- For new customers (without legacy CPE), the DSP directly offered the light weight/low cost white box (vCPE)

Key takeaways

Efficient vCPE implementation reduces cost of device replacement as legacy devices can also be used for new functionalities

Efficient distribution of functionalities between on-premise and cloud helps in achieving zero/ minimal latency, thus improving customer experience

Using open-source Mano (OSM) orchestrator with CICDCT tools makes it easier to update functionalities and onboard new value-added services

Right mix of platforms, servers with VNFs along with data plane accelerators help in improving vCPE performance.

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THANK YOU!