hSenidMobile
CO-CREATING THE FUTURE

Introduction to Network Function Virtualization

About Me

Brayan Perera

BICT(UCSC)

Systems Architect at **hMS**

brayan@hsenidmobile.com

Purpose

- To provide high level understanding on NFV architecture and applications.

Traditional Service to NFV

Wedding @ House

- Venue : Preparation
- Table Arrangements
- Decorations
- Food and Beverages
- Wedding Cakes
- Photographers/Videographers
- Ashtaka and Jayamangalagatha
- Dancers and DJ/Music
- Wedding Ceremony

Wedding @ Event Hall

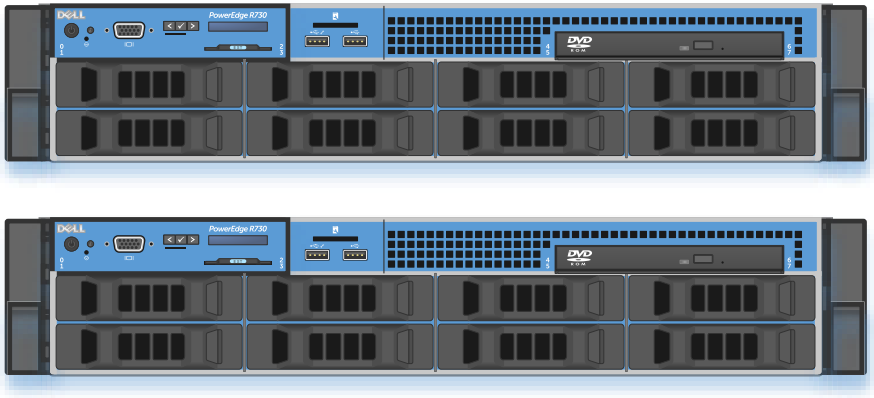
- Venue
- Table Arrangements
- Food and Beverages
- Decorations
- Wedding Cakes
- Photographers/Videographers
- Ashtaka and Jayamangalagatha
- Dancers and DJ/Music
- Wedding Ceremony

Wedding @ Event Hall Orchestrated By An Event Planner

- Venue
- Table Arrangements
- Food and Beverages
- Decorations
- Wedding Cakes
- Photographers/Videographers
- Ashtaka and Jayamangalagatha
- Dancers and DJ/Music
- Wedding Ceremony

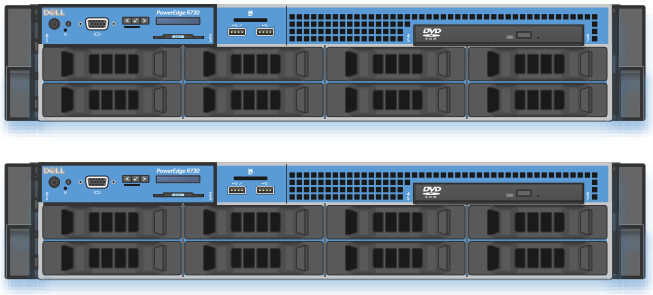
Managed By You

Managed By Vendor



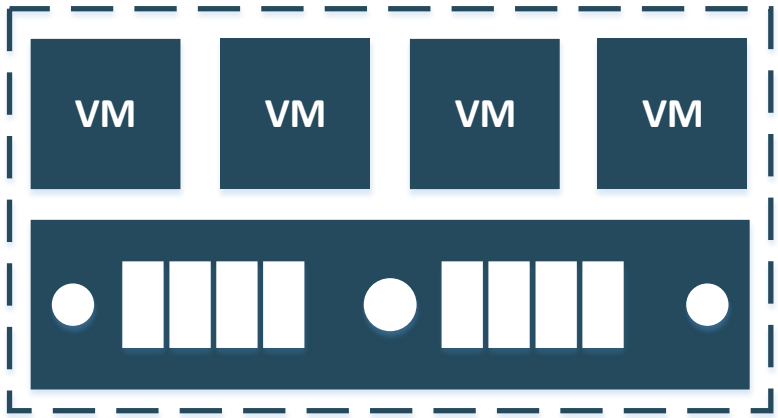
Baremetal Servers

Application runs on Baremetal

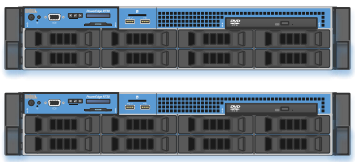


Baremetal Servers

- Under Utilized
- Redundant resources
  - High Availability
- Project/Product based Deployments
- Fragmented deployments
  - Network
  - Hardware

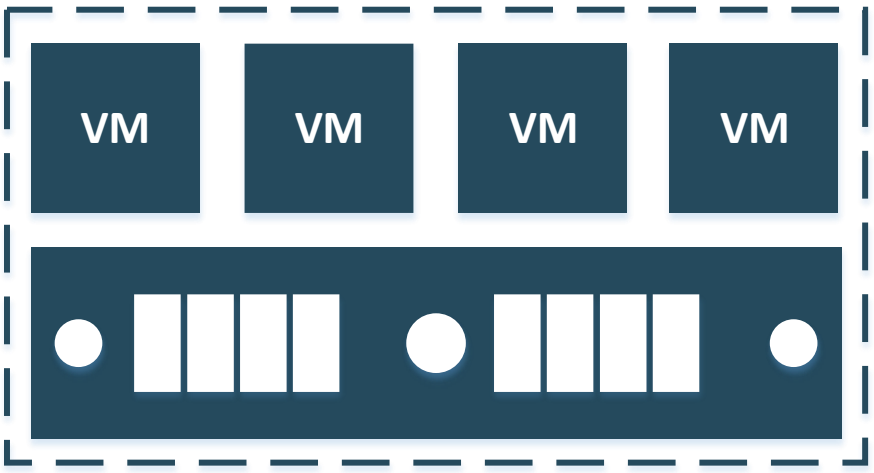


Virtualization Platform

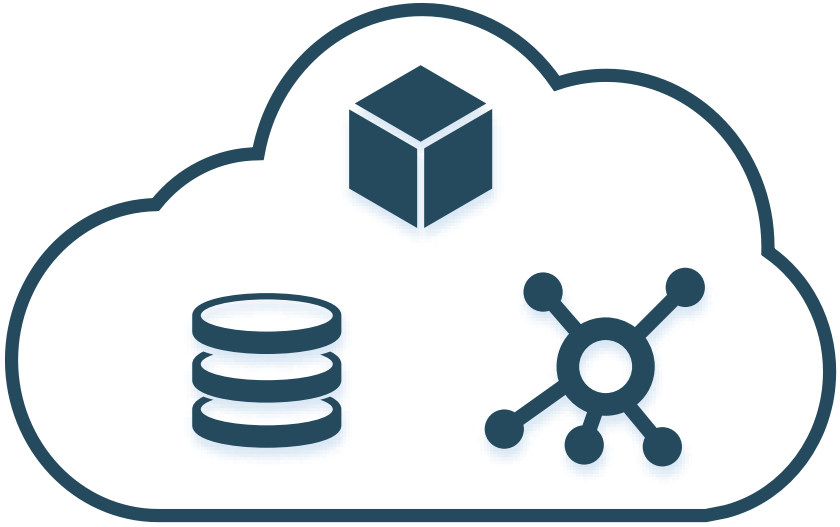


Baremetal Servers

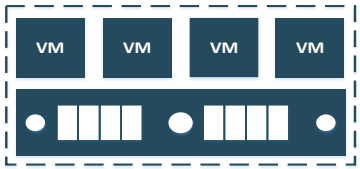
Migrated to Virtualization Platform



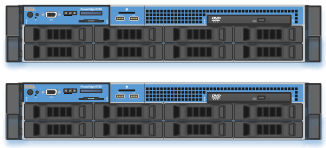
- Small virtual machines to host applications
- No changes on application functionality
- Easy placement and manage of VMs
  - Backup / Restore



Cloud Platform

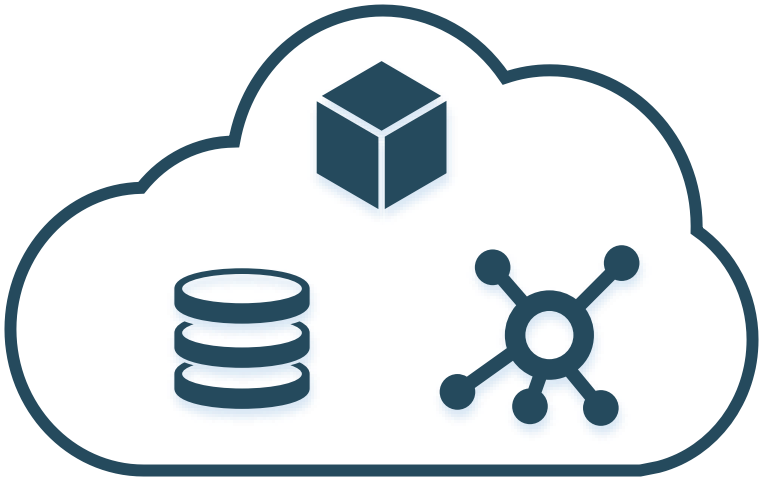


Virtualization Platform



Baremetal Servers

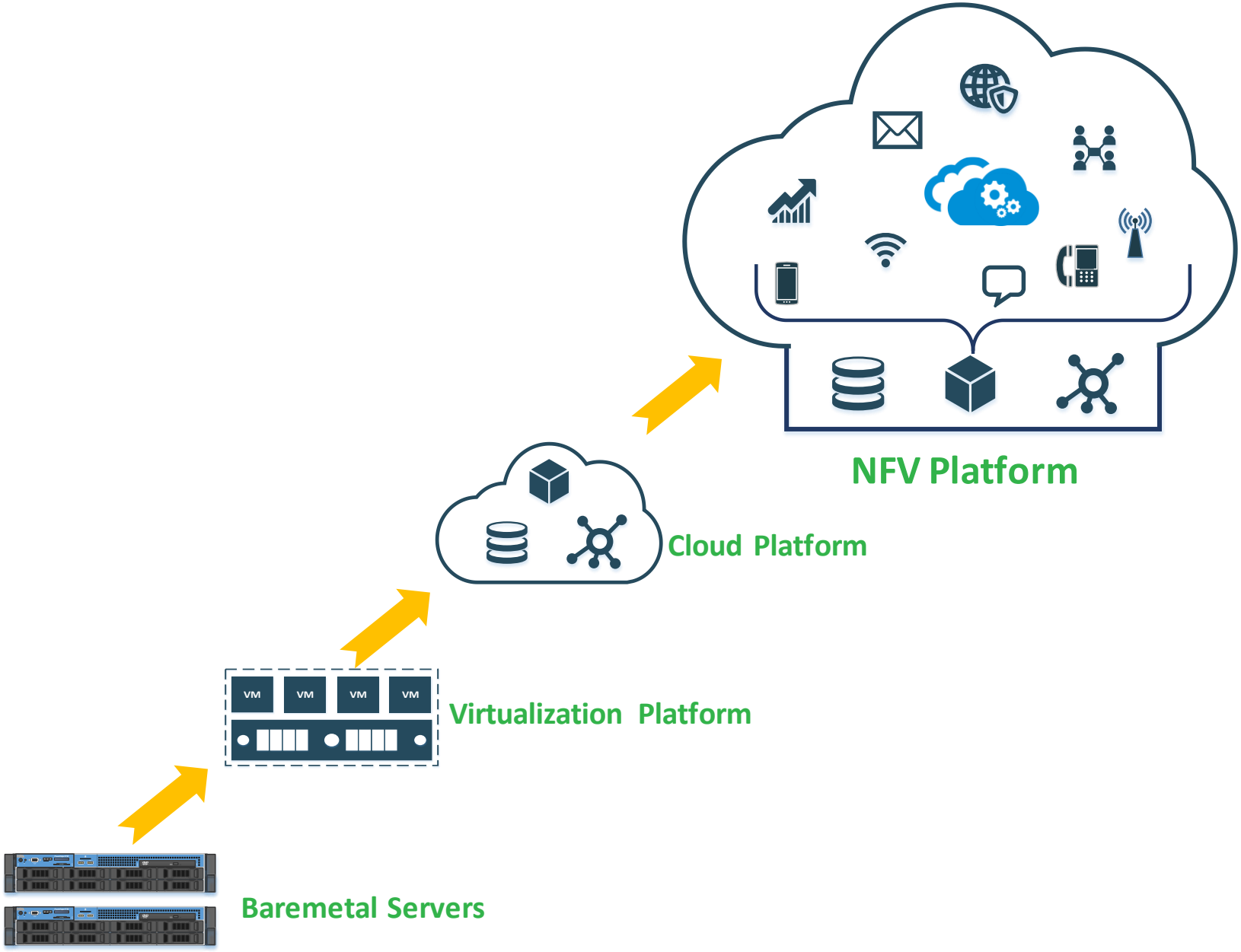
Migrated to Cloud Platform



Cloud Platform

- Application design
  - Cloud Native app
- Orchestration of instances.
  - On demand
  - Time based
  - Metric based

EaaS/XaaS : SaaS PaaS IaaS


NFV Platform
Cloud Platform
VM
VM
VM
VM
Virtualization Platform
Baremetal Servers

Migrated to NFV

NFV Platform

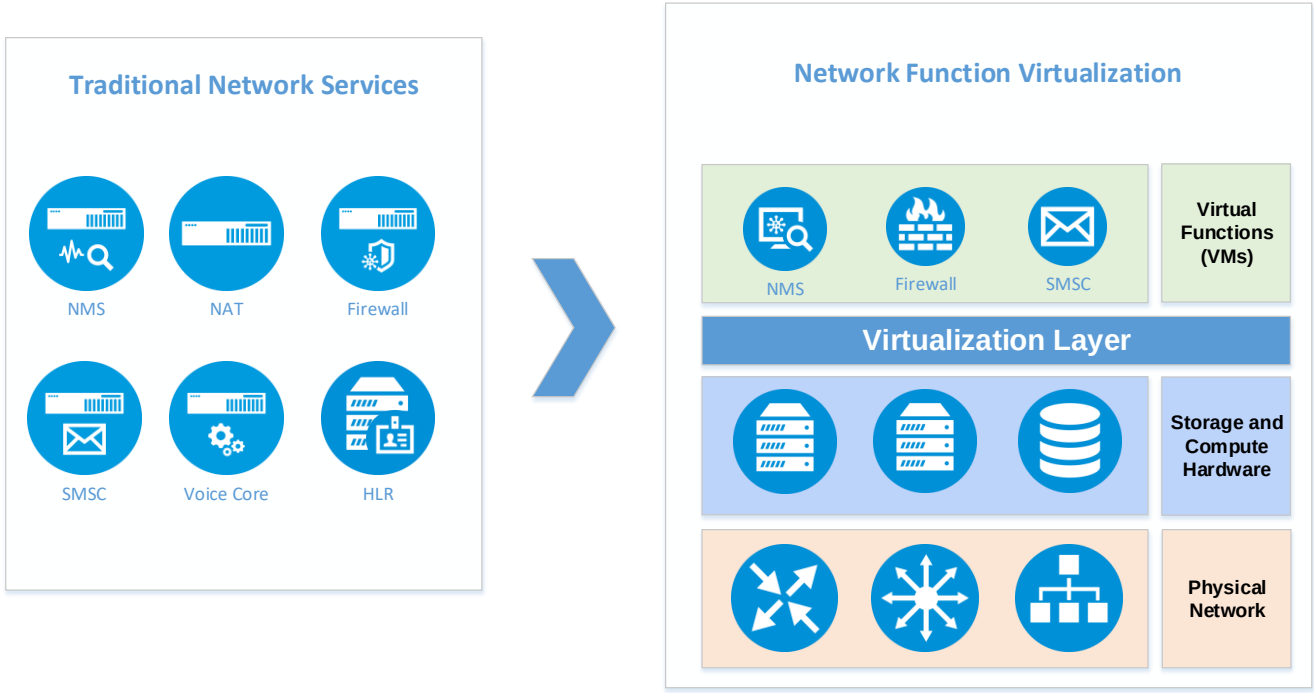
- Optimized for Communication services.
- Workloads considered as Virtual Network Functions
- Horizontal scaling without interruption to workloads.
- Fast time to deployment.
- Better hardware utilization.

Network Function Virtualization

What is NFV ?

Definition :-

Network architecture concept that propose to virtualize traditional network services to network node functions, which will be building blocks that may be connected or chained together to create a communication service.



Importance of NFV

- Openness
  - Reduce vendor lock-in
- Multi Tenancy
  - Multiple vendors in same physical environment.
- Service Velocity
  - Reduce time-to-market of new network services.
- Operational Efficiency
  - Elasticity, Standardizing the operational environment.
  - Common operational and management tools.
- Improved Network economics
  - Optimize network resources

Importance of NFV ….

- Telcos moving to 5G
  - NFV is a key enabler of 5G
    - Decouple Software and Hardware
    - On-demand automated network service deployment
    - Network Services on Distributed Cloud
    - Enhanced Network Slicing with SDN.

NFV Use Cases

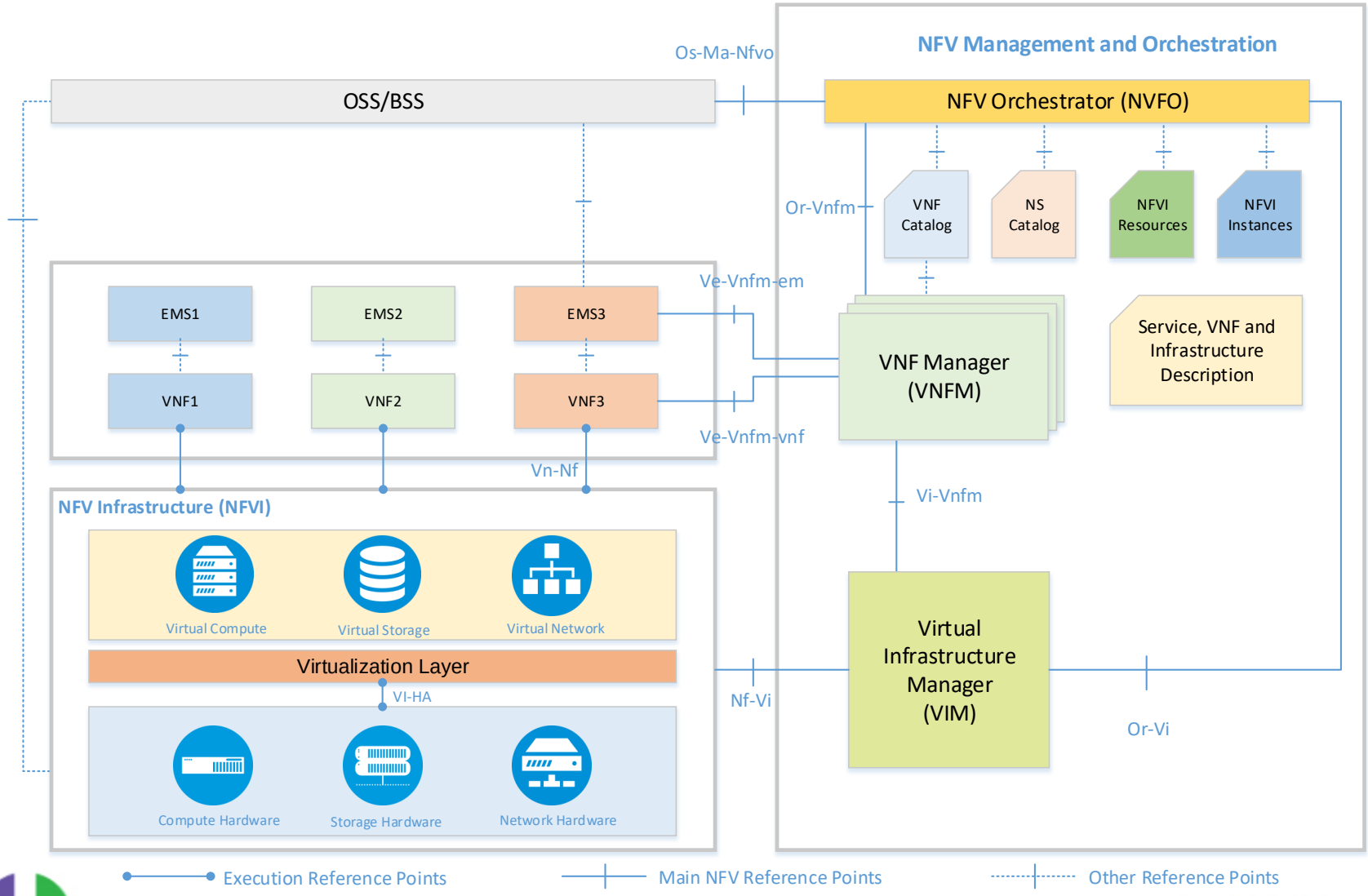
- PCRF (Policy and Charging Rules Function) Systems
- Load Balancers
- CDN (Content Delivery Network) Platforms
- Firewalls
- Signaling Plane Applications
  - STP (Signal Transfer Point)
  - SMSC
- IP telephony
- Voice Core
- IDS – Intrusion Detection Systems

Challenges on migrating to NFV ….

- Some Services are not cloud optimized.
  - Updates, Scaling, load-balancing
- Addressing all ‘Application’ requirements from common hardware.
  - Each vendor specifies different requirements than others.
- Licensing of VNF
  - Differ than hardware-equivalent
  - Scale out/in, dynamic workloads
- Learning curve.

ETSI NFV Architecture

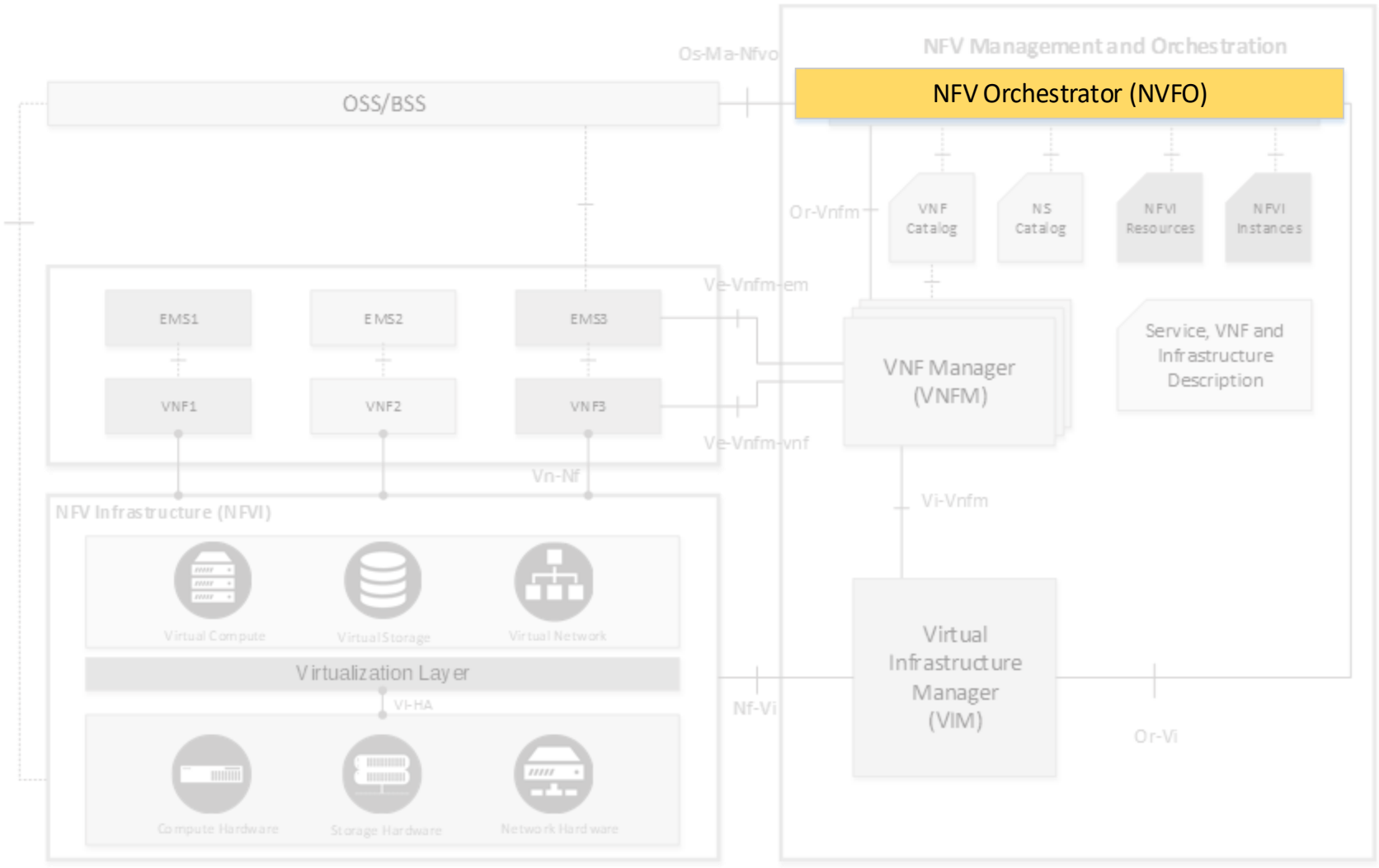
ETSI NFV Architecture



NFV MANO

- NFV MANO – Management and Orchestration
  - Comprises three functional blocks
    - NFV Orchestrator (NFVO)
    - VNF Manager (VNFM)
    - Virtualized Infrastructure Manager (VIM)

ETSI NFV Architecture

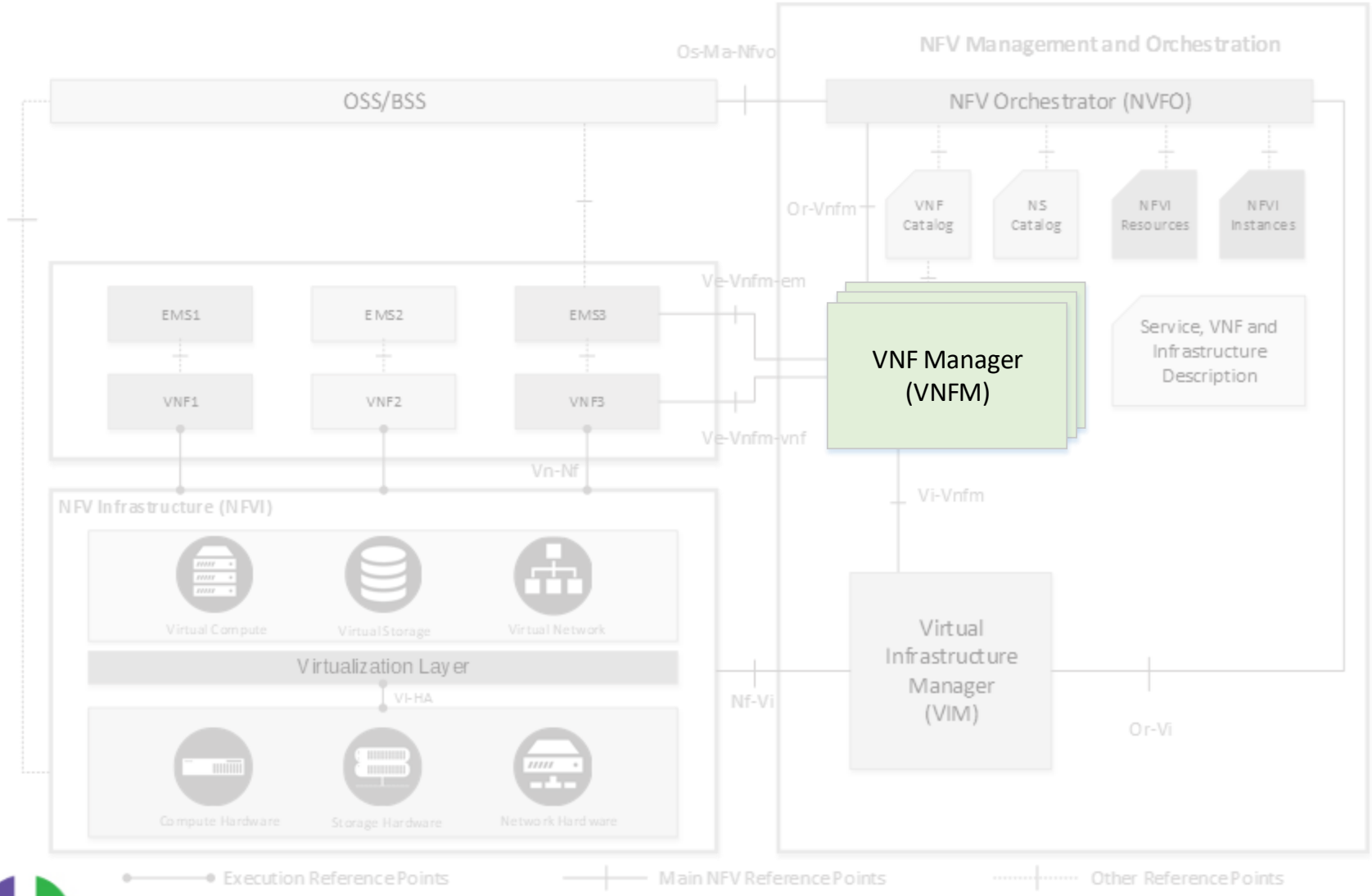


NFV MANO

NFV Orchestrator (NFVO)

- On-boarding of new Network Service (NS) and VNF Packages
- NS lifecycle management
- Resource management
- Policy management for NS instances

ETSI NFV Architecture

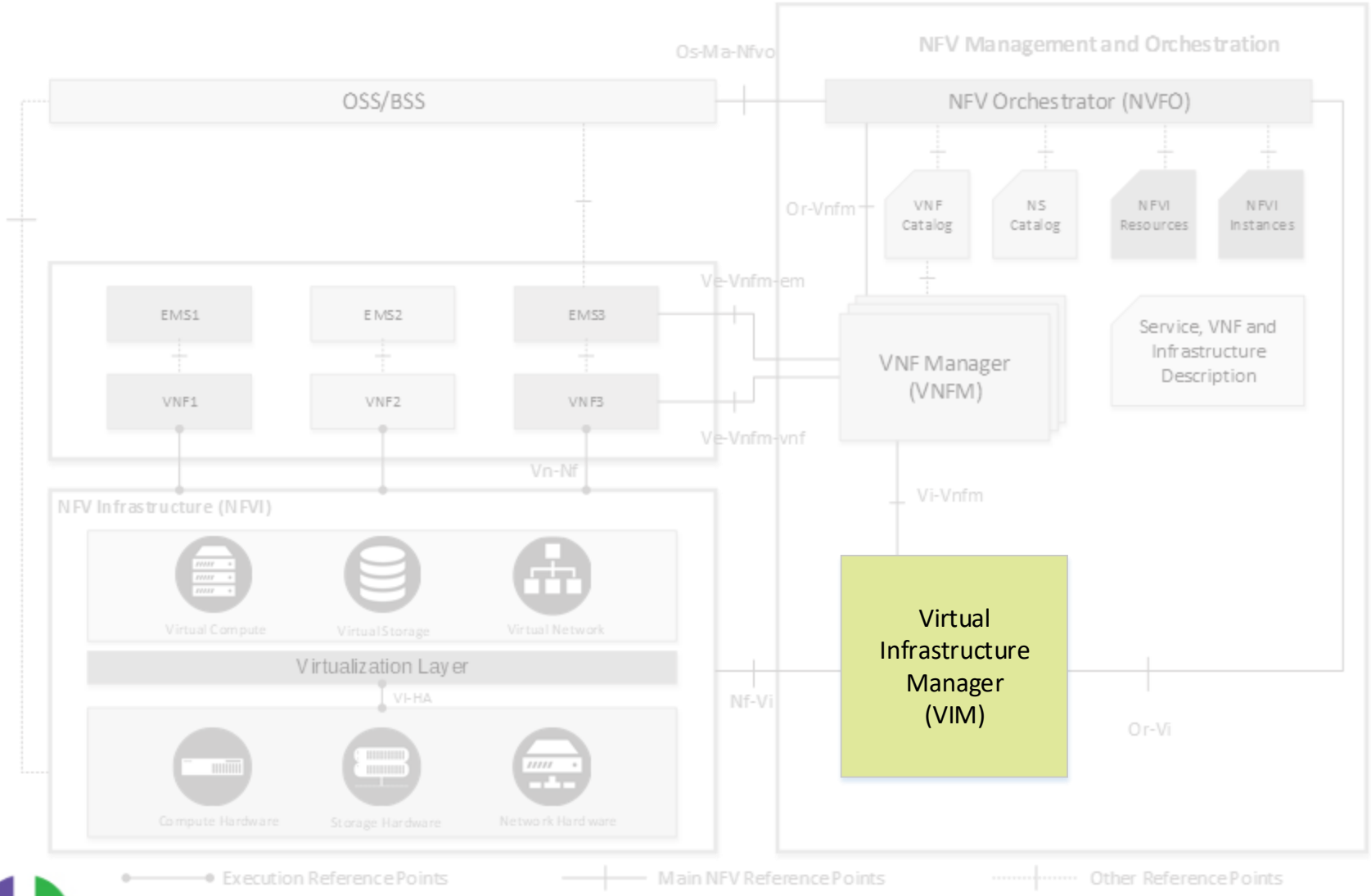


NFV MANO

VNF Manager (VNFM)

- Lifecycle management of VNF instances
- Coordination of configuration and event reporting between NFVI and the E/NMS

ETSI NFV Architecture



NFV MANO

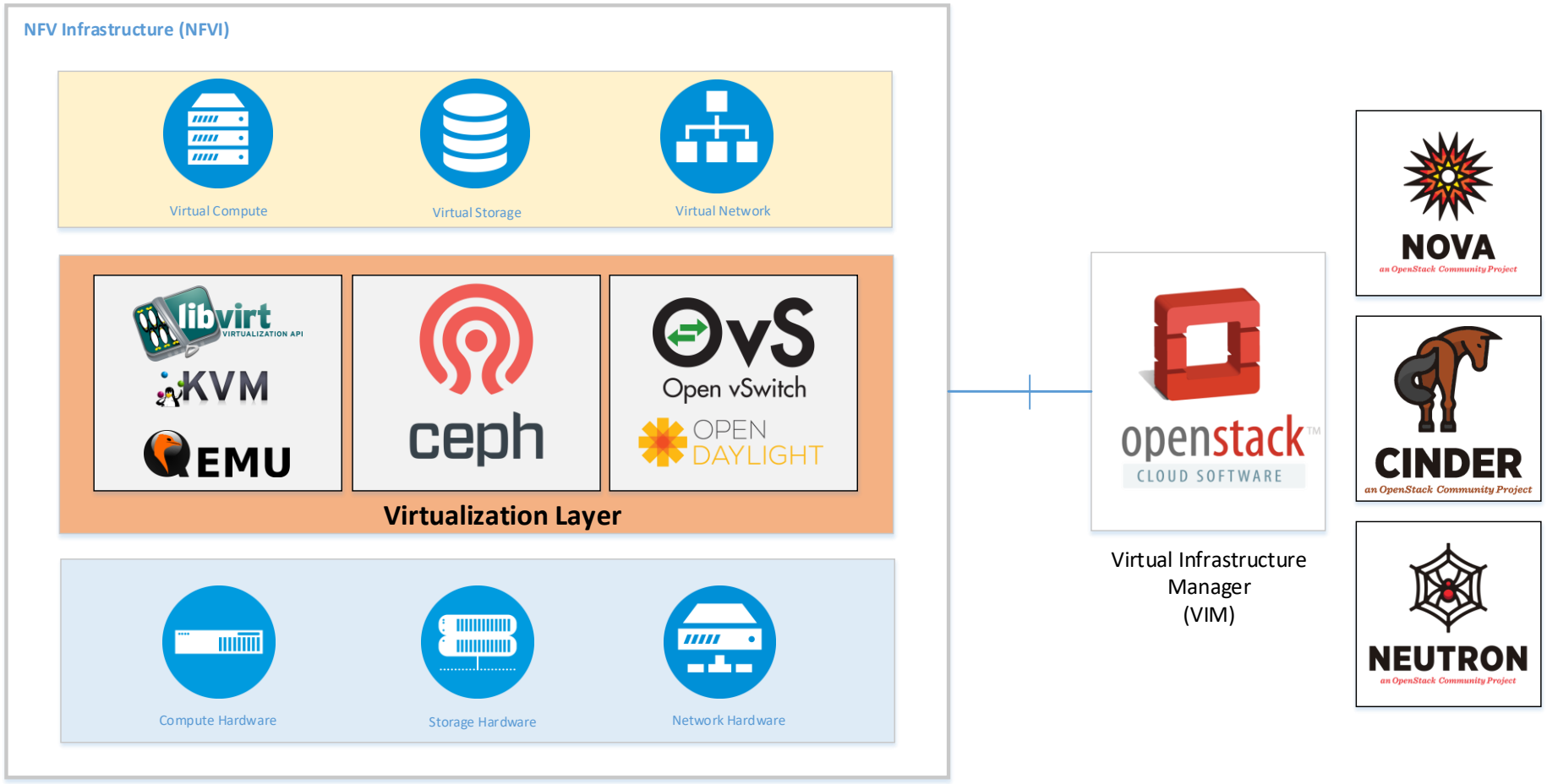
Virtualized Infrastructure Manager (VIM)

- Controlling and managing the NFVI compute, storage and network resources
- Collection and forwarding of performance measurements and events

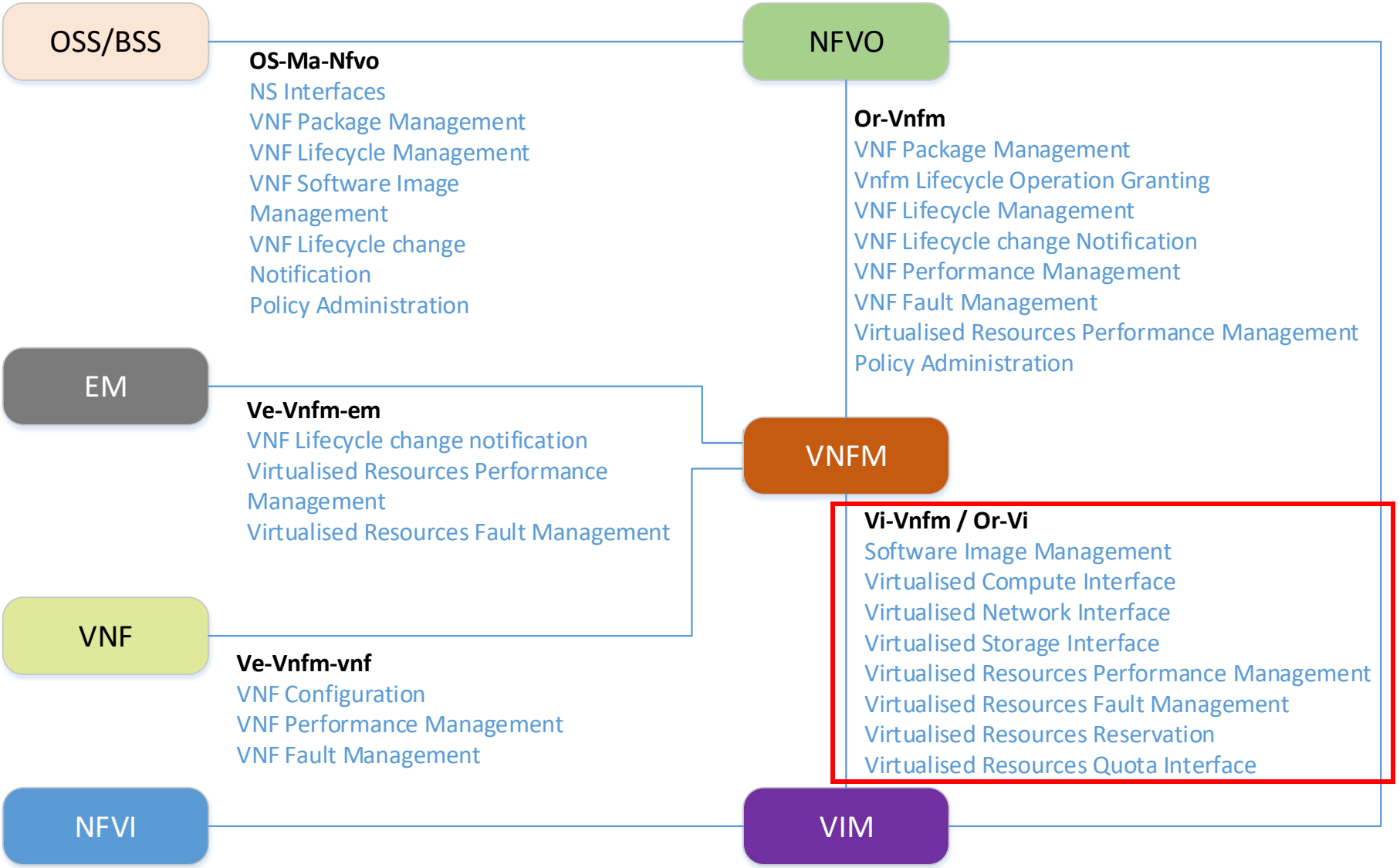
NFV MANO - NFVO

- NFV Orchestrator (NFVO)
  - Resource Orchestration
    - Manage and orchestrate resources from one or more NFVI-PoPs
    - Keep track of VNF instances mapped to different VIMs, VNFMs and NFVIs.
    - Policy management and enforcement.
  - Network Service Orchestration
    - Management of VNFs and Network Service Deployment templates.
    - Instantiation and lifecycle management of Network Services.

VIM / NFVI – Openstack as VIM



NFV MANO – API Interfaces



Virtual Network function

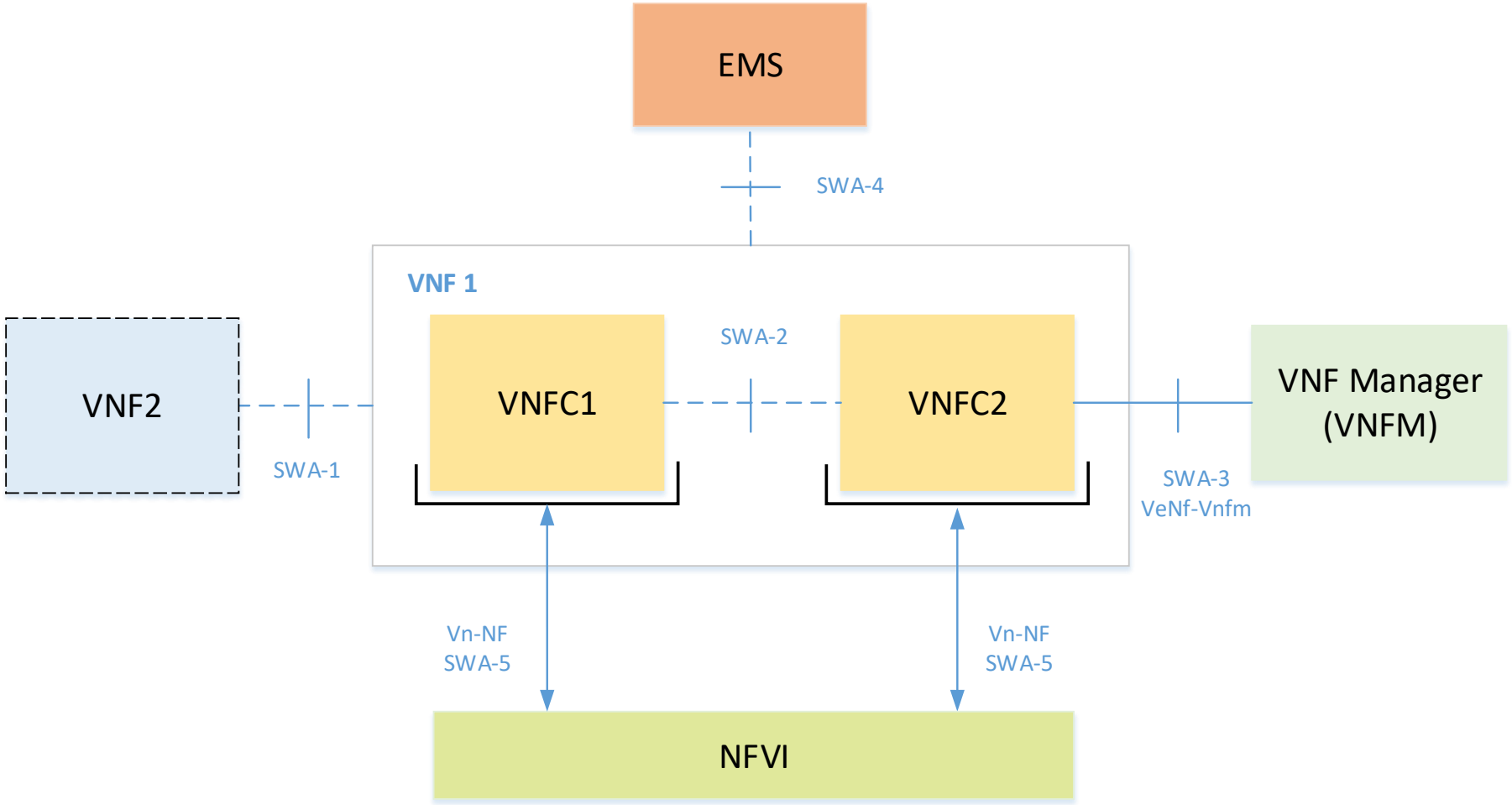
Virtual Network function

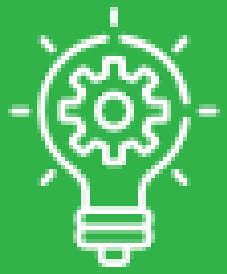
- VNF Overview
- VNF Architecture
- VNF Design
- VNF Lifecycle Management

VNF Overview

- VNF is responsible for handling specific network function that runs on one or more virtual machines that runs on NFVI.
  - Multiple VMs or Single VM can act as VNF.
  - Component view of VNF is called VNFC
- VNF will be a part of Network Service, which will be instantiate by the NFVO.
  - Can be single VNF or multiple connected or combined VNFs
- VNF will be on boarded via VNFD (VNF Descriptor), which define the VNF and its scope.

VNF Architecture



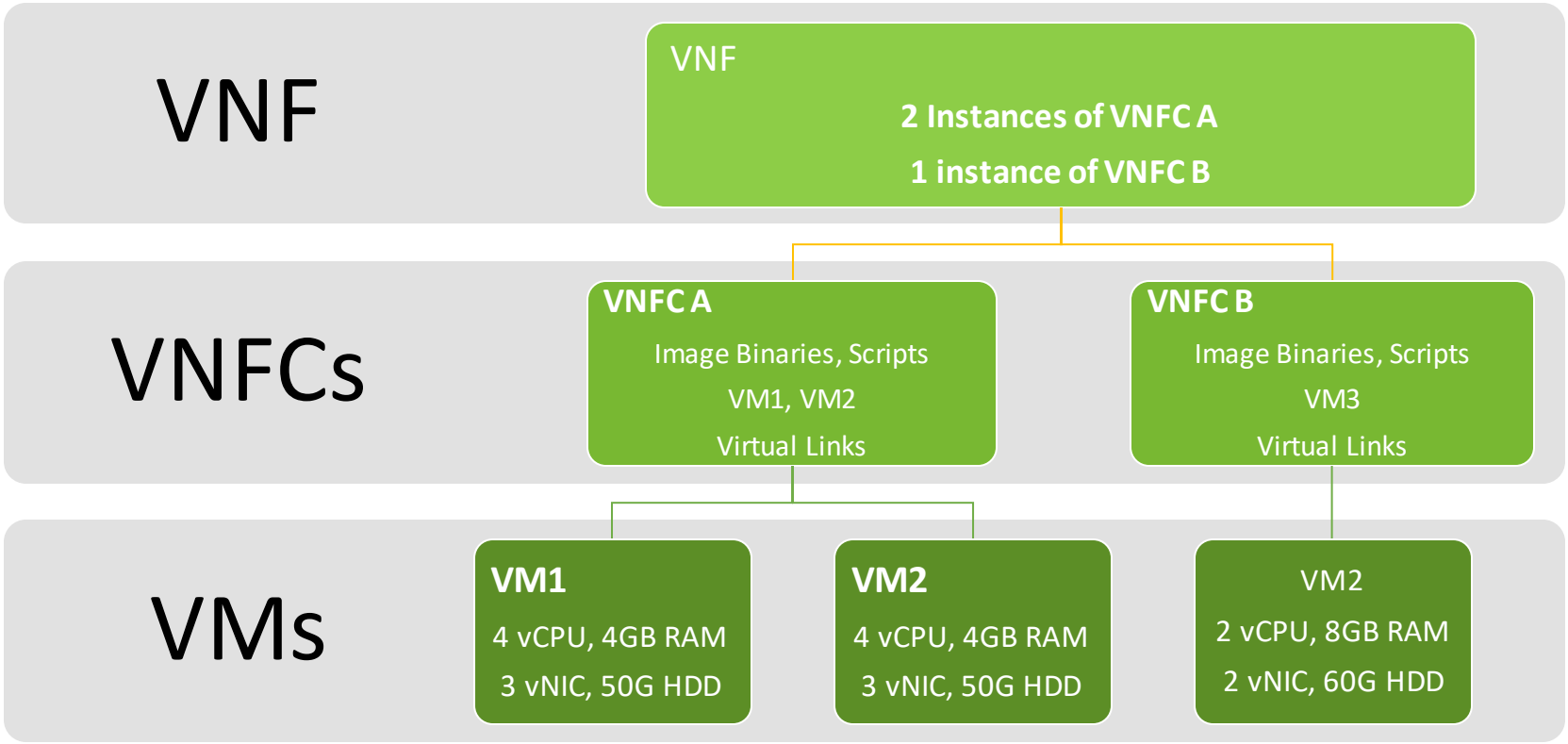


VNF Design

VNF Design

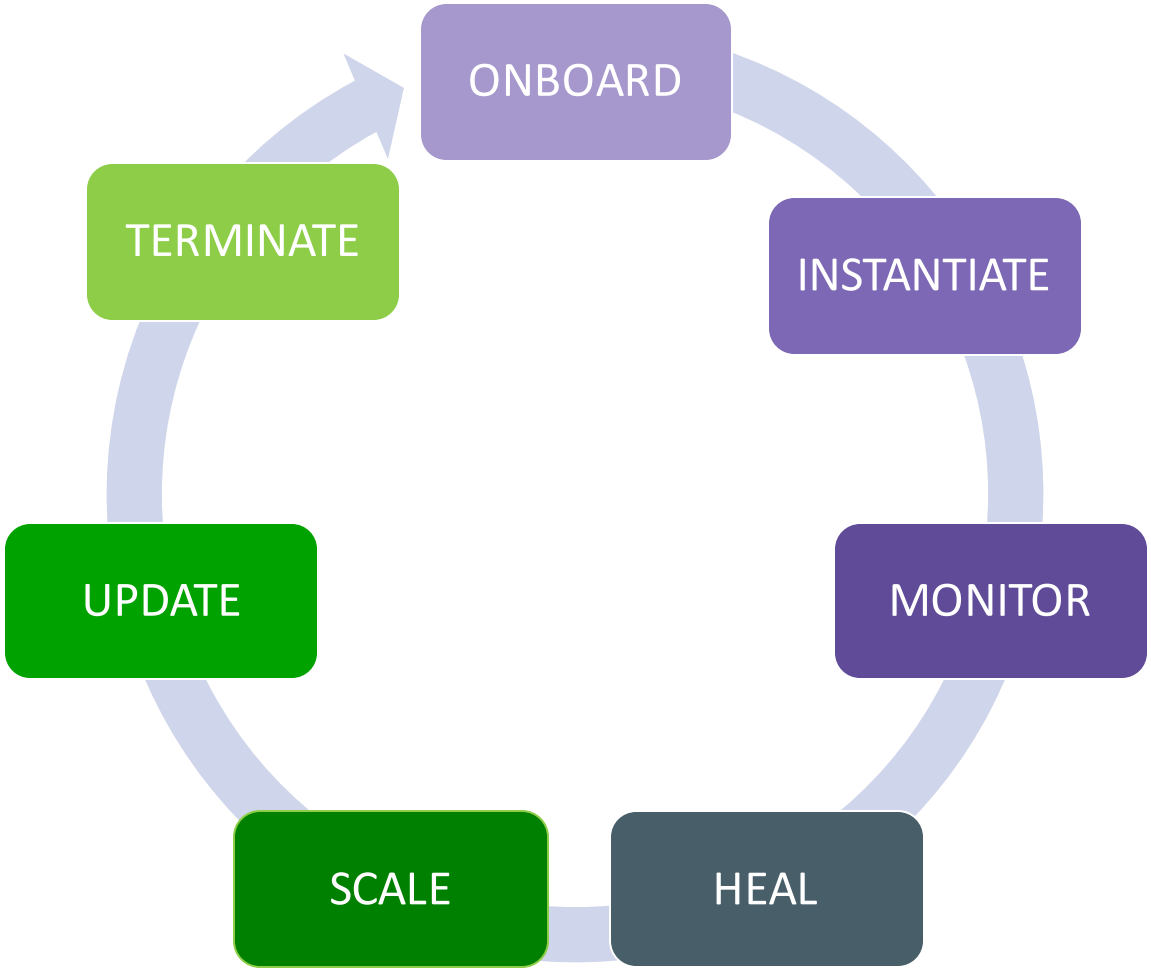
- Components / Decision points of the VNF design
  - VNF Internal Structure
  - Load balancing mechanism
  - VNF Scaling
  - VNF Upgrade/Updates
  - VNF Properties
  - VNF Descriptor Design
  - VNF Security

VNF Descriptor and Instantiation

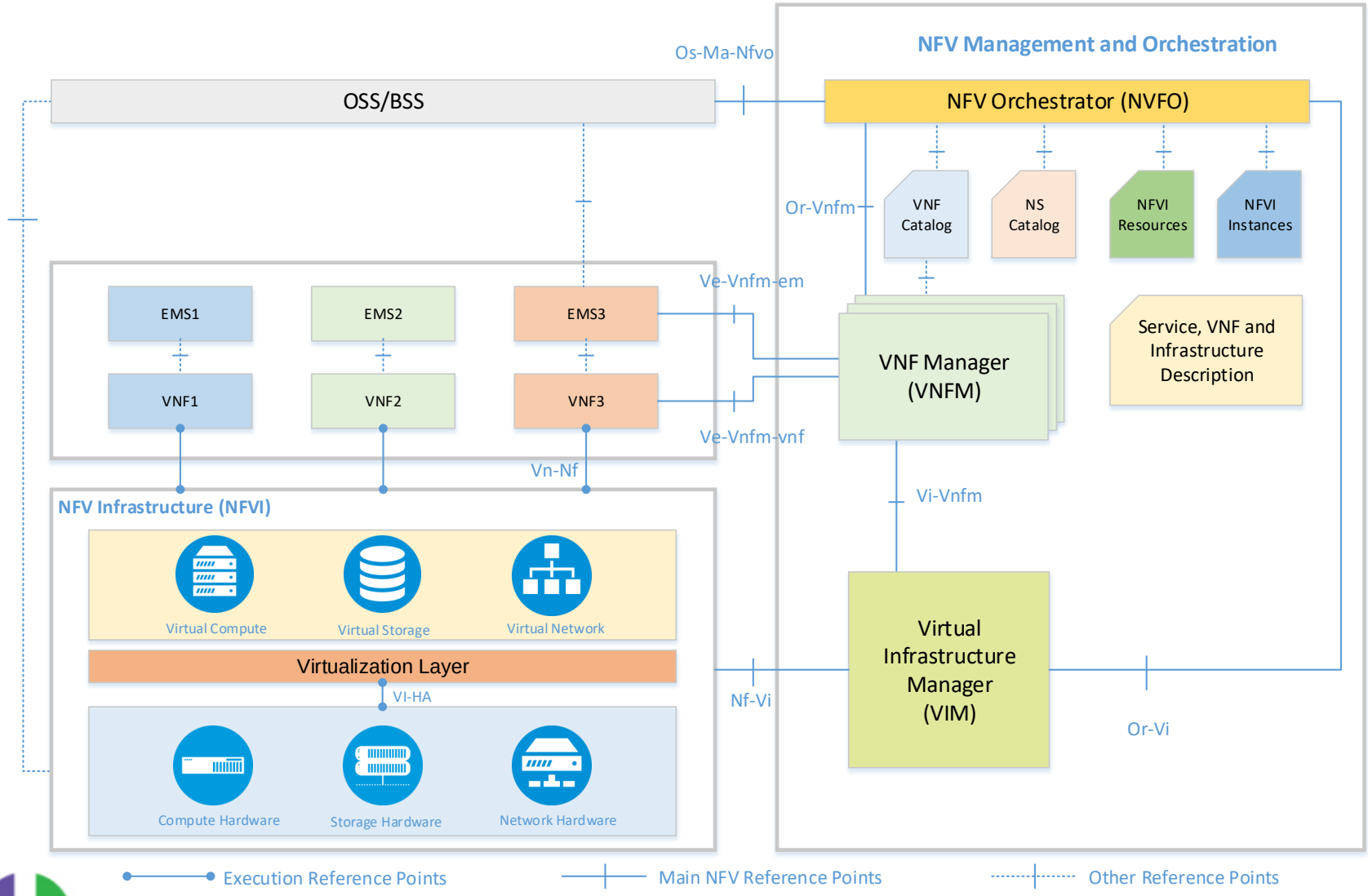


Lifecycle Management

VNF Lifecycle Management



ETSI NFV Architecture



NFV Products

MANO Offerings in Industry

- Most of the MANO Solutions provide both NFVO and VNFM.
  - VIM offerings
    - Openstack
    - VMWare vCloud Director
    - OpenVIM
    - AWS
  - Open source MANO offerings
    - Tacker – Openstack Project
    - OSM
    - OpenMANO
    - OpenBaton

MANO Offerings in Industry

Commercial MANO products

NOKIA **Nokia CloudBand-** -CloudBand Network Director (NFVO) -CloudBand Application Manager (VNFM) -CloudBand Infrastructure Software (NFVI,VIM)	ERICSSON **Ericsson Cloud Manager** (NFVO, VNFM)	HUAWEI **Huawei CloudOpera Orchestrator** (NFVO, VNFM)	Hewlett Packard Enterprise **HPE NFV Director** (NFVO, VNFM)
	ZTE **ZTE vManager** (NFVO, VNFM)	RIFT.io **Rift.IO Rift.Ware MANO** (NFVO, VNFM)	CLOUDIFY **Cloudify Manager** (NFVO, VNFM)

VIM Offerings in Industry

- Openstack
  - Red Hat, Mirantis, Oracle and VMWare
- Cisco VIM
- Ericsson Cloud Execution Environment
- VMWare vSphere
- OpenVIM
- Amazon Public Cloud

VNF Offerings in Industry

- Many Commercial products
  - Ericsson, Nokia, MetaSwitch, CISCO, Juniper, F5 etc …
- Sample Open Source VNFs
  - Clear Water IMS
  - OpenSIPS

NFV Opportunities

NFV Opportunities

- As NFV MANO Vendor - Developer / DevOps
- As VNF Vendor - Developer / DevOps
- As Telco User – Operations / Planning and Management
- Key Skills to gather
  - Networking and OS administration
  - Service Oriented application development
  - DevOps technologies including automation
  - Virtual Infrastructure technologies
  - PaaS technologies
  - Private and Public cloud technologies
  - SDN and SDS

Activity

Question 1

- Which of the following type of virtualization is also characteristic of cloud computing?

A. Storage
B. Application
C. CPU
D. All of the mentioned

Question 2

- The technology used to distribute service requests to resources referred to as ?

A. Load performing
B. Load scheduling
C. Load balancing
D. All of the mentioned

Question 3

- Name two cloud service types and a one example for each type.

I. ……

II. ……

Question 4

- Telco service provider uses cloud software in their Datacentres to provide virtual machines to the application vendors.
- This deployment can be categorized as?

A. Virtualization Platform
B. Public Cloud Platform
C. Hybrid Cloud Platform
D. Private Cloud Platform

Question 5

- Name two VIM (Virtual Infrastructure Manager) solutions in industry.

I. ……

II. ……

Q&A

Further Readings

- https://www.telcocloudbridge.com/blog/a-beginners-guide-to-nfv-management-orchestration-mano/
- https://www.telcocloudbridge.com/blog/a-cheat-sheet-for-understanding-nfv-architecture/
- https://osm.etsi.org/images/OSM-Whitepaper-TechContent-ReleaseFOUR-FINAL.pdf
- https://nfvwiki.etsi.org/index.php?title=API_specifications
- https://www.ietf.org/proceedings/88/slides/slides-88-opsawg-6.pdf

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