Network Management and Orchestration Evolution Strategies

SPONSORED BY (intel) ORACLE COMMUNICATIONS

WORKSHOP: NETWORK MANAGEMENT & ORCHESTRATION EVOLUTION STRATEGIES

September 15, 2016

Moderator: Jim Hodges, Senior Analyst, Heavy Reading

Presenters

Todd Spraggins
OSS Strategy
Oracle

Christian Buerger
Technologist, SDND Marketing
Intel

Renuka Prasad
Product Manager - Strategy
Oracle

Frank Schapfel
Manager-NPG SDND,
Telecom Solutions Marketing
Intel

Session Agenda

- **Network Management and Orchestration Evolution Strategies**
- 2:00-3:00 registration
- 3:00-3:15 Session Overview and Background - Jim Hodges, Heavy Reading
  3:15-3:30 Workshop – barrier of entry and technical hurdles
- 3:30-4:00 NFV Business Transformation – Todd Spraggins, Oracle
- 4:00-4:30 VNF Manager Implementation Strategies - Renuka Prasad, Oracle
- 4:30-5:00 Making Sense of MANO - Christian Buerger, Intel
- 5:00-5:30 Wonderful World of VIM - Frank Schapfel, Intel
- 5:30-6:00 Panel – Workshop findings and discovery

Light Reading

HEAVY READING

Session Overview and Background

Jim Hodges, Heavy Reading

Interview Input

- "There are two problems and issues with MANO. The first is just complexity, as it stands there are so many functions and things to consider that it is not easy to deploy a full stack of MANO architecture."

- "Bear in mind, there is no final cloud architecture. That's very important because the cloud will evolve. We're into the next levels of details, we're deep into the details."

Interview Input

- "We're of the view that we want a generic VNF Manager that will handle many types of VNFs."

- "It's not the hardware that worries me so much; it's the MANO software. There are always little differences between vendors that need integration and when you hear the word integration that means a Euro figure with six zeros on the end. That is simply not scalable for our industry."

Interview Input

- "We consider OPNFV important since we need open systems to foster innovation, but we don't think we could launch based on OPNFV as it currently stands. We also need to monitor how OPNFV will continue to develop. To be successful, OPNFV cannot adopt too narrow a scope."

- "We are in favor of open source solutions, and we are currently running open source in our labs but we believe for commercial applications there are still too many risk factors. In addition, open source requires commitment to development and testing, we don't have the time or staff to do this right now."

Workshop – barrier of entry and technical hurdles

- Give us your views to these open question?

- Viability of open source initiative such as OPNFV?
- What is the optimal VNFM strategy?
- How can MANO implementation be simplified?
- What are the key considerations for implementing service? orchestration

Orchestration Interactions with VNFM and VIM
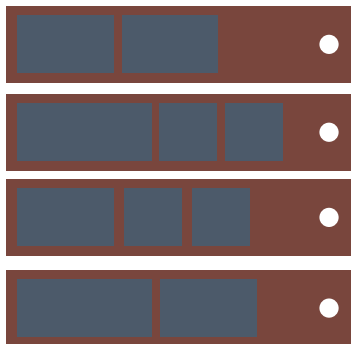
Todd Spraggins, Oracle

Agenda

- **Resource Orchestration**: Telco-cloud Needs
- **Sizing v. Scaling**: Managing the VNFM envelope
- **Dynamic Orchestration**: VNFM & NFV-O Conversations
- **Service Orchestration**: The Forgotten Need
- Oracle **Solution**
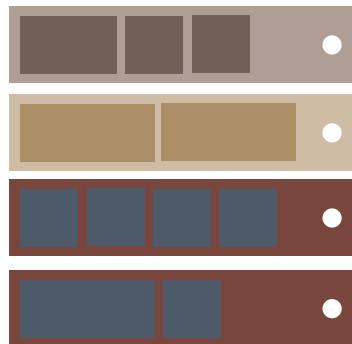
End-to-End Resource Orchestration

Managing Heterogeneous Data Centers

"Web" Cloud

"Telco" Cloud

Optimizing Utilization Across DC

Optimizing Demand by Application

Telco cloud resource requirements:

☐ Media rich, continuous real-time, I/O intensive application require hardware configuration optimized for performance

☐ Meeting application resource requirements imperative for meeting SLA and CX objectives

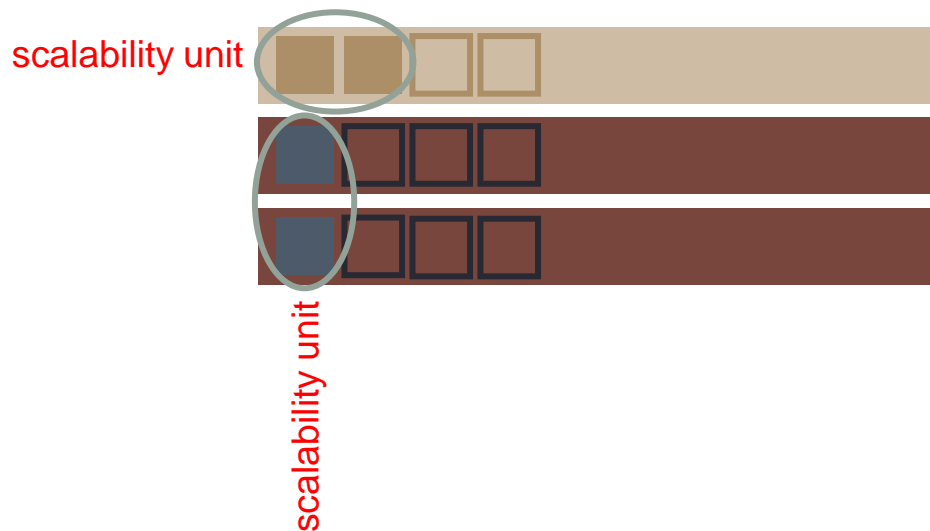**End-to-End Resource Orchestration provides:**

☑ *Optimal matching of application resource needs through enhanced NFVI platform awareness*

☑ *Multi-dimensional optimization*

Sizing Concepts

Initial Request on Instantiation

scalability unit

scalability unit

- AO Calculates based on Criteria
- Colors indicate scalability group
  - HA pairing
  - Affinity/Anti-affinity policy
- Solid indicates minimum
  - Resource reserved for allocation
  - Configuration calculated
- Outline indicates maximum
  - Resource soft reserved
  - No configuration

Light Reading

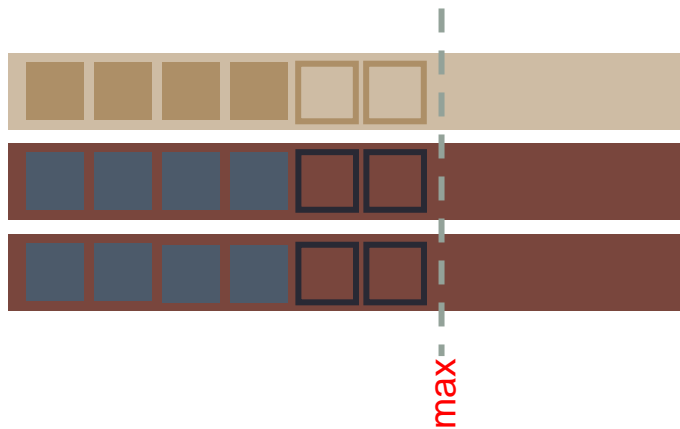HEAVY READING

Sizing Concepts

Elasticity based on KPI

max
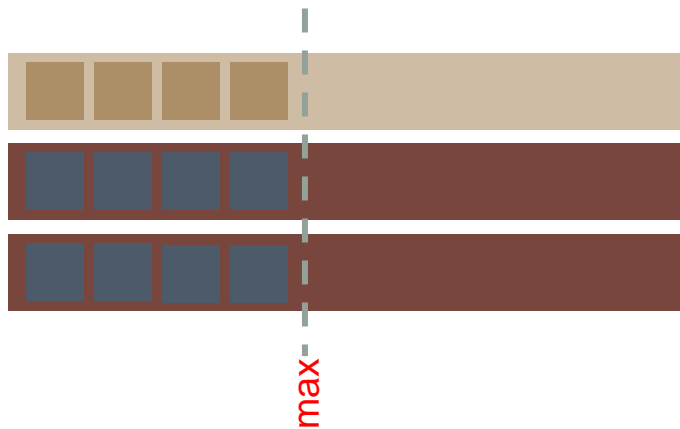
- AO deploys scalability units
  - Resources reserved for allocation
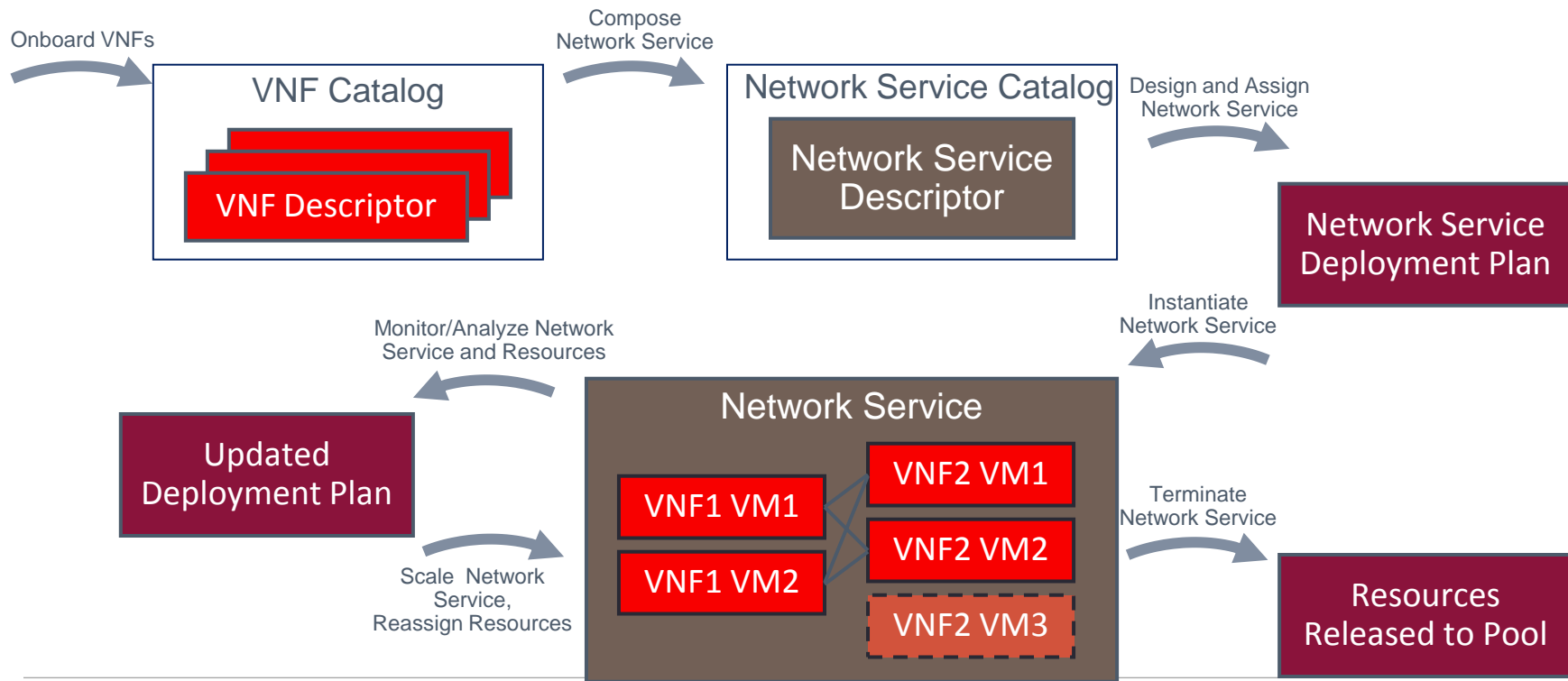 - Configuration calculated
- AO cannot deploy past max

Sizing Concepts

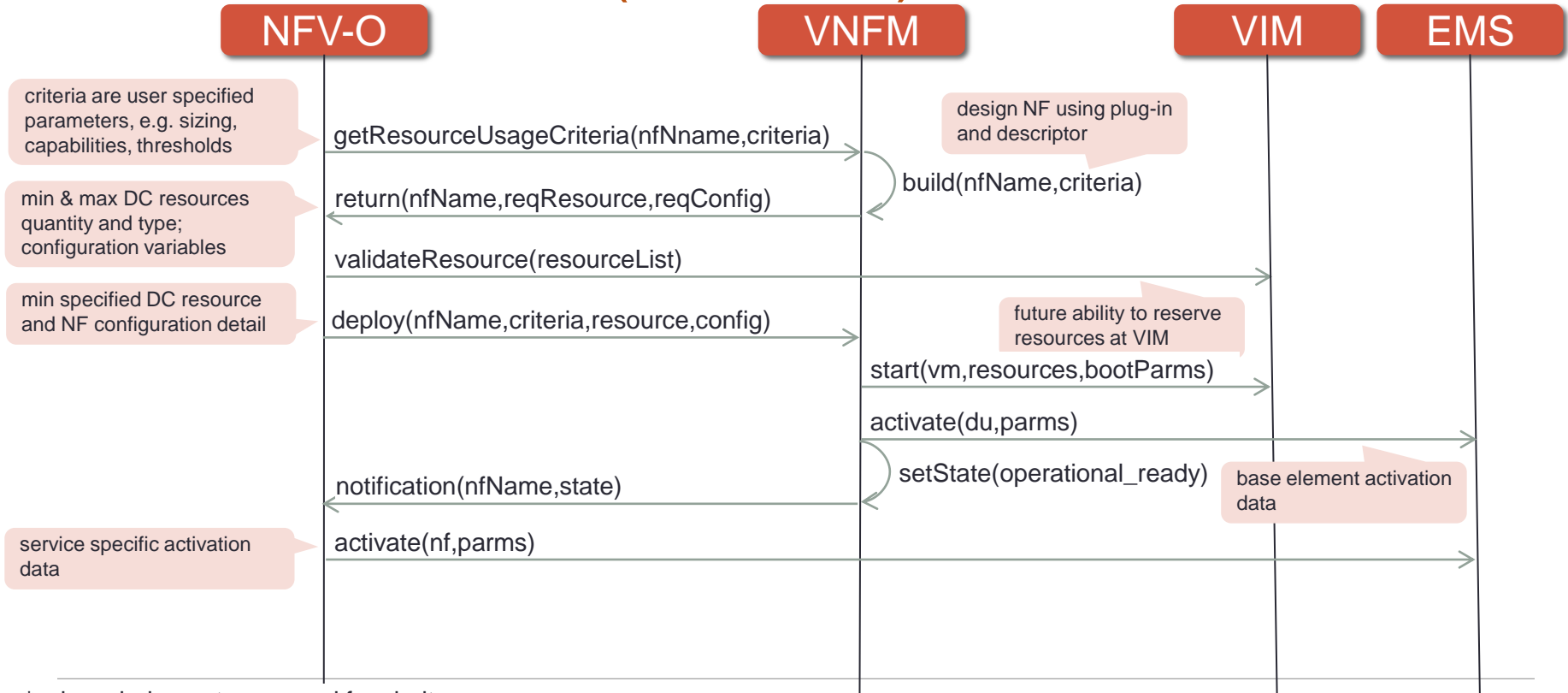**Re-size based on new Criteria**

max

- NSO request new sizing
  - Can shrink or grow
  - Resources soft reserved
- Can trigger elasticity if under capacity stress

Network Service Orchestration Flows

Onboard VNFs

Compose Network Service

VNF Catalog

VNF Descriptor

Network Service Catalog

Network Service Descriptor

Design and Assign Network Service

Network Service Deployment Plan

Instantiate Network Service

Monitor/Analyze Network Service and Resources

Network Service

VNF2 VM1

VNF1 VM1

VNF2 VM2

VNF1 VM2

VNF2 VM3

Updated Deployment Plan

Scale Network Service, Reassign Resources

Terminate Network Service

Resources Released to Pool

Light Reading

HEAVY READING

Instantiate VNF (idealized)

NFV-O   VNFM   VIM   EMS

criteria are user specified parameters, e.g. sizing, capabilities, thresholds

getResourceUsageCriteria(nfNname,criteria)

design NF using plug-in and descriptor

build(nfName,criteria)

min & max DC resources quantity and type; configuration variables

return(nfName,reqResource,reqConfig)

validateResource(resourceList)

min specified DC resource and NF configuration detail

deploy(nfName,criteria,resource,config)

future ability to reserve resources at VIM

start(vm,resources,bootParms)

activate(du,parms)

setState(operational_ready)

base element activation data

notification(nfName,state)

service specific activation data

activate(nf,parms)

*acknowledgments removed for clarity

VNF Elasticity (idealized)

NFV-O   **VNFM**   **VIM**   **EMS**

KPI threshold triggers scaleout with new design

detect(kpi)

build(nfName)

DC resources quantity and type; configuration variables

notification(nfName,scale,reqResource,reqConfig)

validateResource(resourceList)

specified DC resource and NF configuration detail

confirmRequestToScale(nfName, resource,config)

future ability to reserve resources at VIM

start(vm,resources,bootParms)

activate(du,parms)

setState(operational_ready)

notification(nfName,state)

base element activation data

service specific activation data

activate(nf,parms)

*acknowledgments removed for clarity

Light Reading

HEAVY READING

Resize VNF (idealized)

NFV-O   **VNFM**   **VIM**   **EMS**

criteria are user specified parameters, e.g. sizing, capabilities, thresholds

resize(nfNname,criteria)

design NF using new criteria gives new max

build(nfName,criteria)

min & max DC resources quantity and type; configuration variables

return(nfName,reqResource,reqConfig)

*acknowledgments removed for clarity

Light Reading

HEAVY READING

Network Function Virtualization

Illustrating the need for Service Orchestration

Network Service Orchestration

Oversees the entire NFV architecture

- Rapidly introduce new network services for consumer and enterprise customers
- Flexibly deploy and scale network services in response to demand
- Integrate with 3rd party VNF Managers and Virtual Infrastructure Managers using open interfaces
- Seamlessly extend Oracle Communications OSS solutions to support virtual networks

Facilitates dynamic network operations

Enables the transformation of the business, not just the network
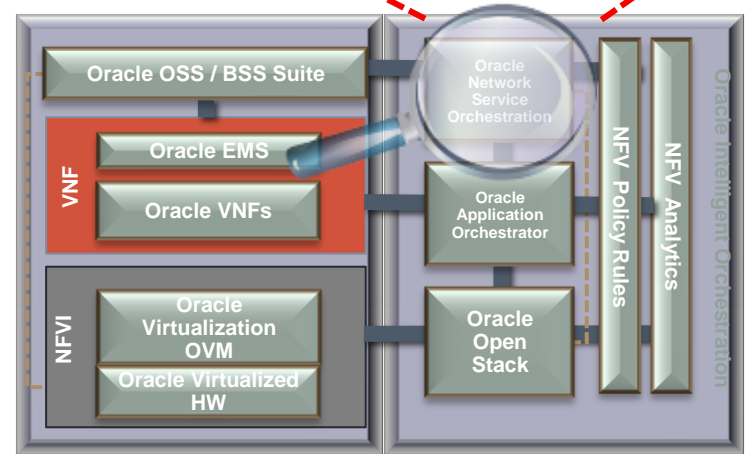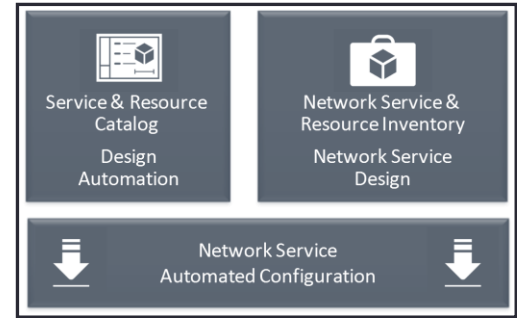
Agenda

- **Background**: CSP Network Infrastructure
- **Problem**: Evolving Network Infrastructure
- **Challenges**: Moving in the right direction?
- **Strategies**: Right sizing/selecting a VNFM
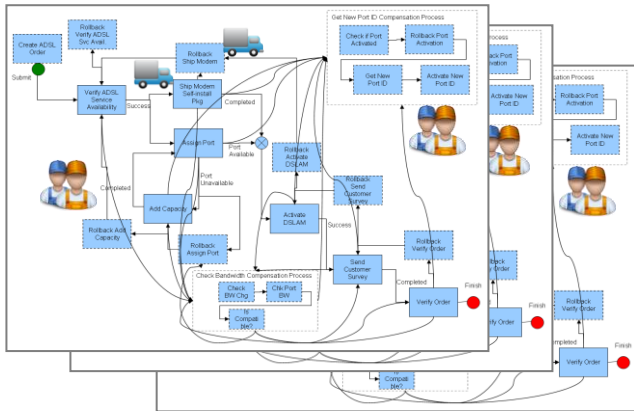- Oracle **Solution**
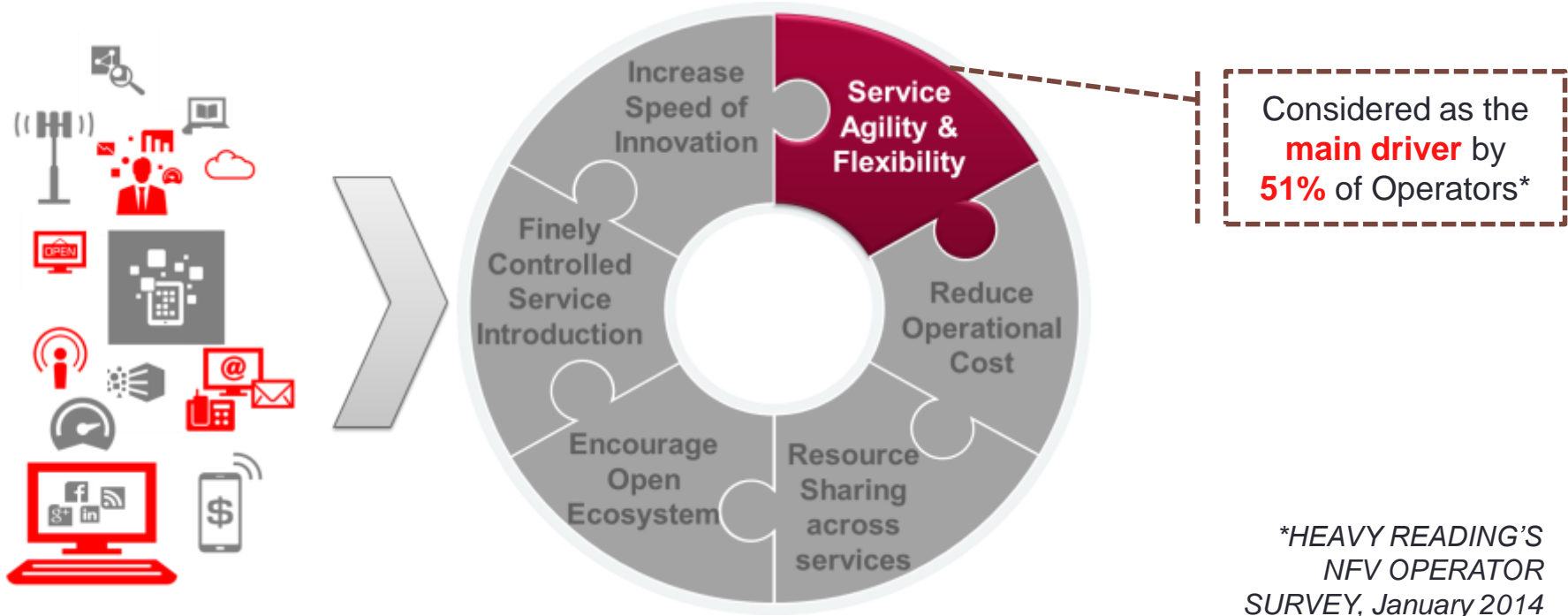- **Recommendation**

Dedicated VNFM

Legacy Environments

- Complex processes

- Highly manual
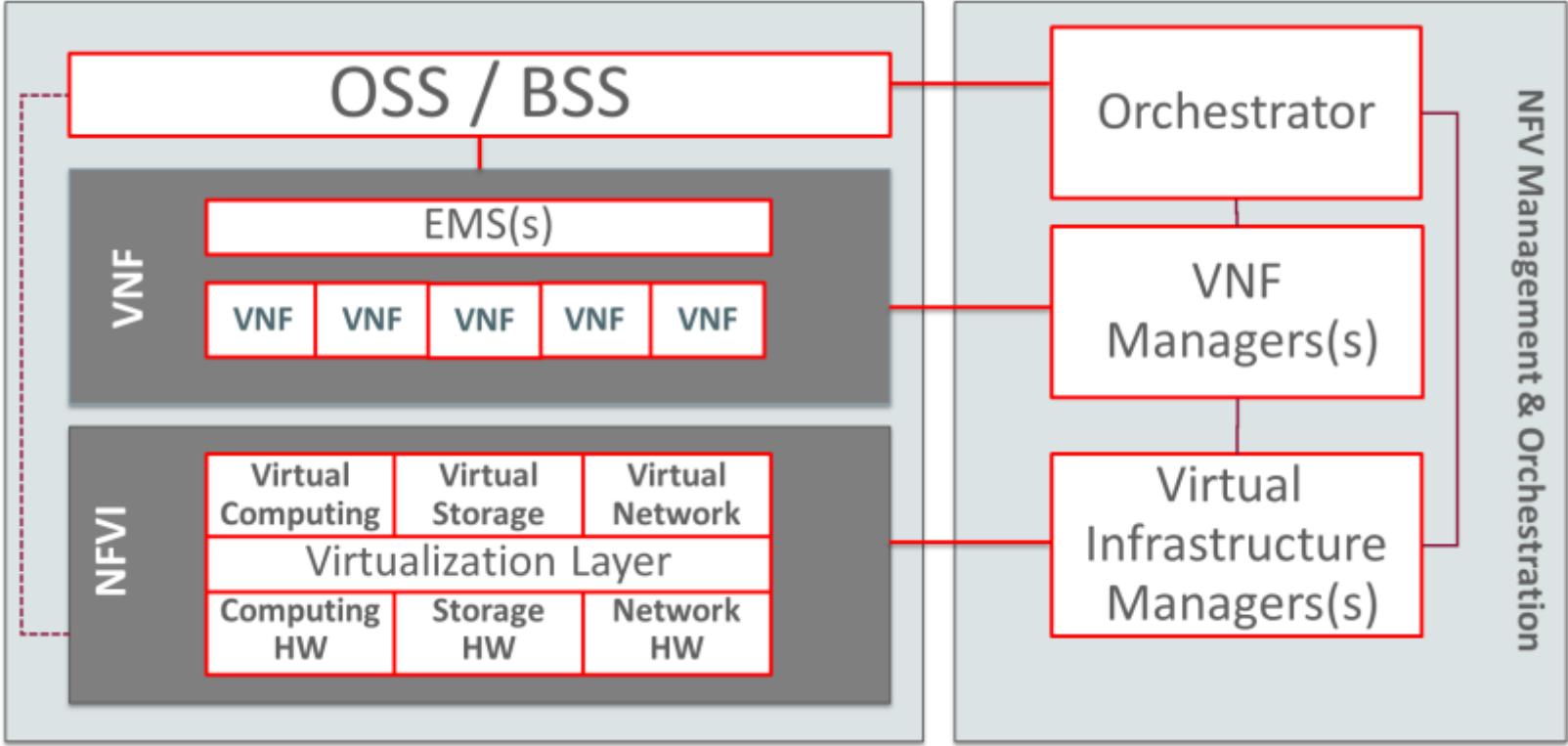
- Hard coded automation

- Physical and static networks

# Network Function Virtualization (NFV)

Increase Speed of Innovation

Service Agility & Flexibility

Finely Controlled Service Introduction

Reduce Operational Cost

Encourage Open Ecosystem

Resource Sharing across services

Considered as the **main driver** by **51%** of Operators*
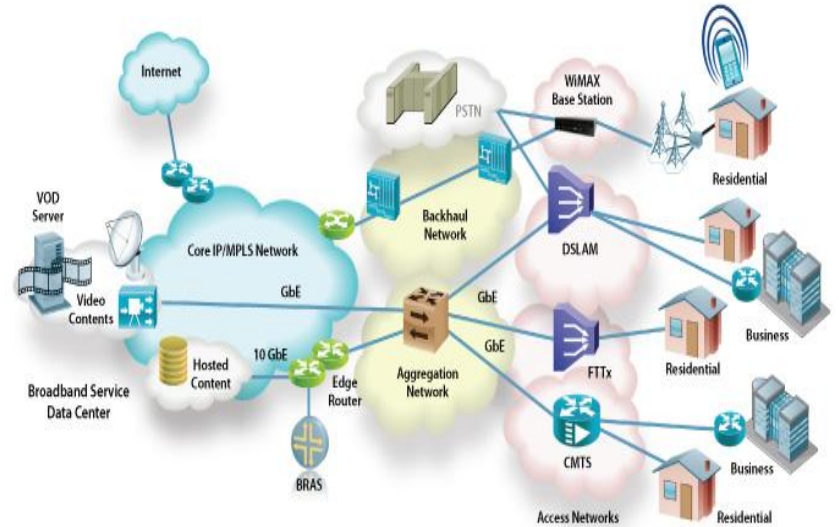
HEAVY READING'S NFV OPERATOR SURVEY, January 2014

ETSI NFV Architecture

VNFM Implementation Options

1

NFVO

VIM

VNFM

EMS

2

NFVO

VNFM

VIM

EMS

3

NFVO

VNFM

VIM

EMS

4

NFVO

VIM
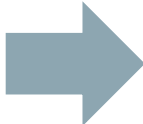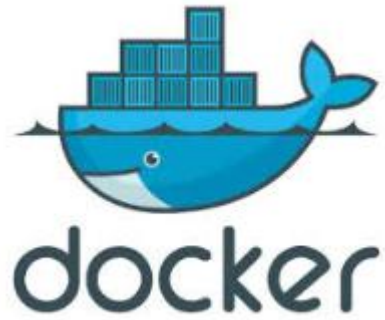
VNFM

EMS
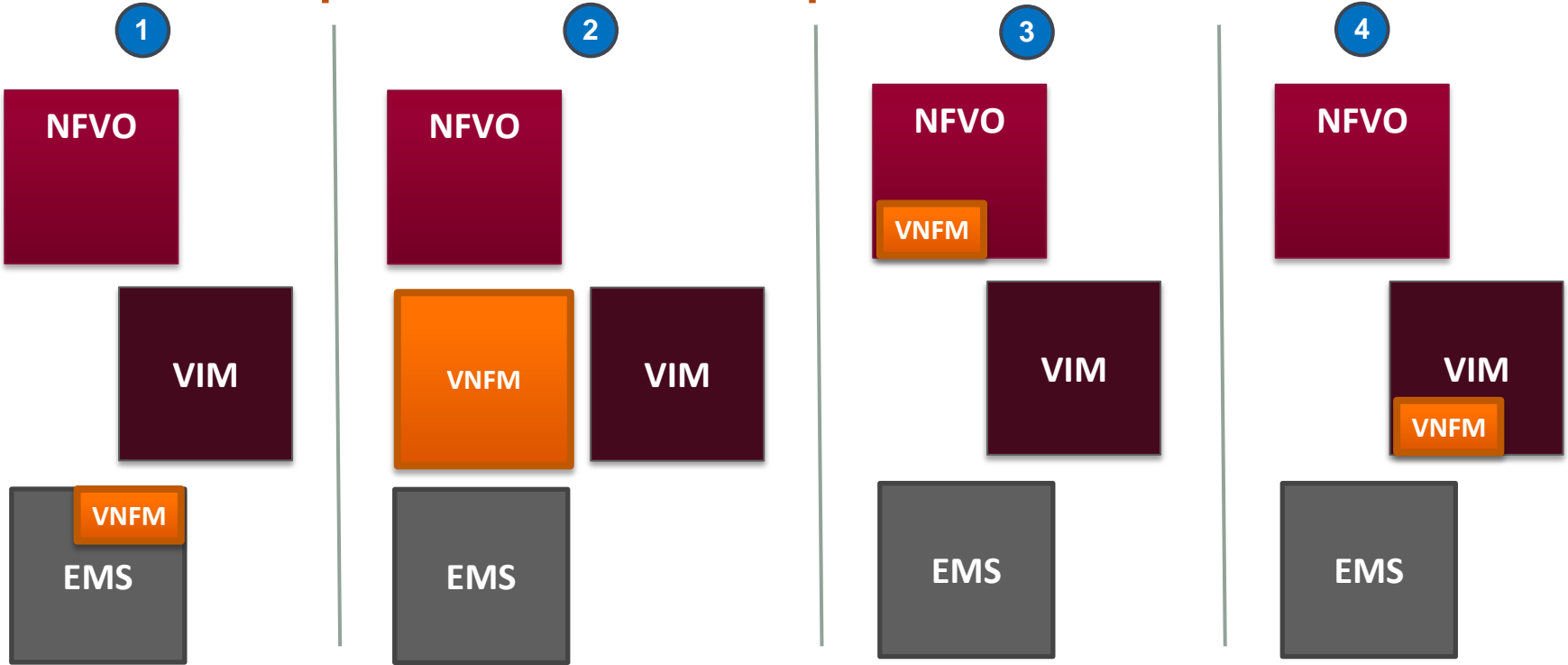
Evolving Network Infrastructure

- Diverse physical footprint
- Many Virtualization choices
- Multiple VIMs
- Evolving VNF structures

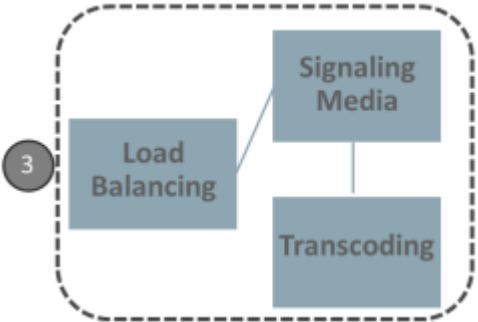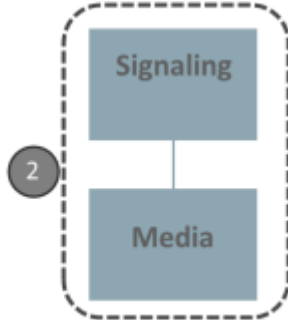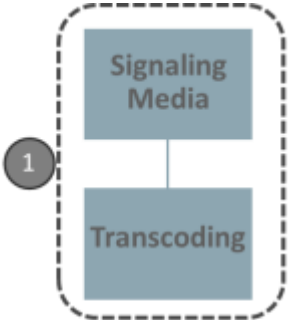# Diverse Physical Footprint

Appliances

COTS
(NEP specified)

Oracle Virtual Networking

COTS
(Commodity)

COTS
(Commodity with Advance HW)

Many Virtualization Choices

New VNF Structures

Challenges: Moving in the Right Direction?

- How to orchestrate in a diverse hardware footprint
- How to simplify management & orchestration of decomposed structures
- How to orchestrate a heterogeneous infrastructure (multi-vendor NF)
- How to avoid VNFM sprawl
- How to obtain at least same Service Level guarantees as traditional infrastructure
- How to leverage existing infrastructure assets
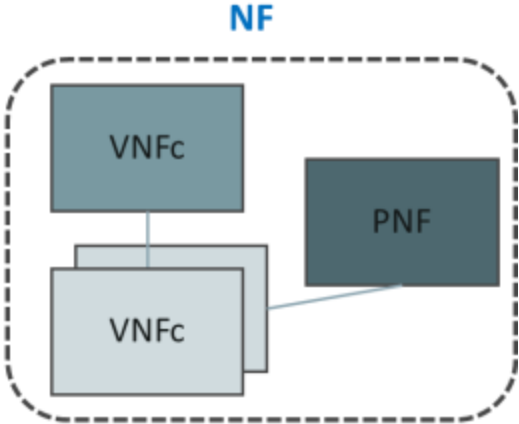
NF Complexity

NF

VNFc
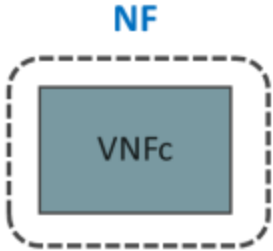
Low complexity

Examples: Firewall, NAT, VPN

NF

VNFc

VNFc
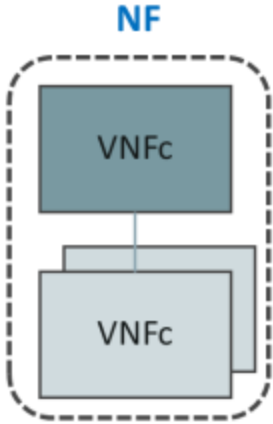
Moderate complexity

Examples: ENUM

NF

VNFc

VNFc

PNF

High complexity

Examples: SBC, CSCF, App Server, MRF, DSR, PCRF

Strategies: Right sizing/selecting a VNFM
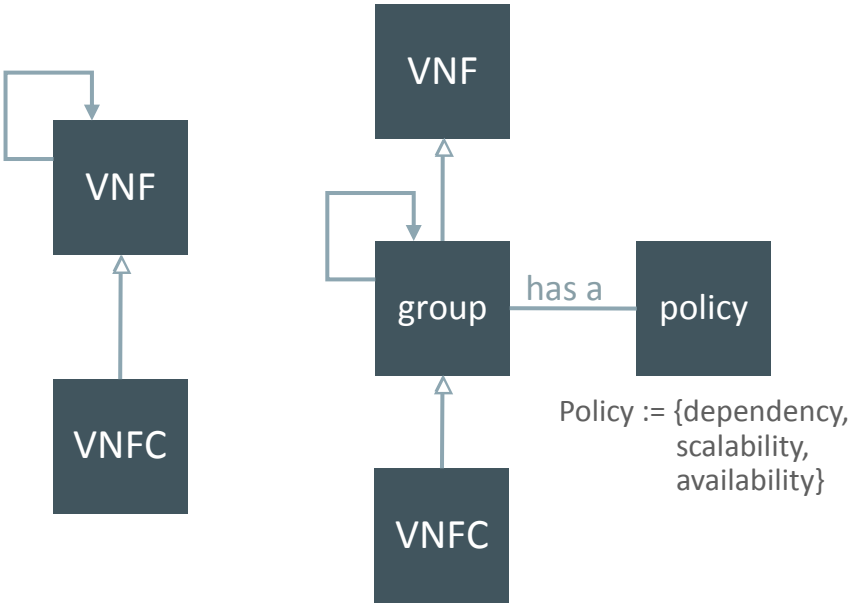
- Hybrid NF support
- Seamless integration with NFVO, VIMs
- Simplified orchestration via localized aggregation
- Minimize ecosystem evolution impact
- VNFM synergy with EMS
- Multi-vendor extensibility

Oracle Solution

- Hybrid NF orchestration & management
- Composite NF
- VNF Manager extensibility
  - single VNFM for vendor's portfolio,
  - extensible for other VNFs

VNFM Modeling Concepts

Deriving AO model from General Concepts

VNF

VNFC

MANO

VNF

group — has a — policy

VNFC

Policy := {dependency, scalability, availability}

Generalized

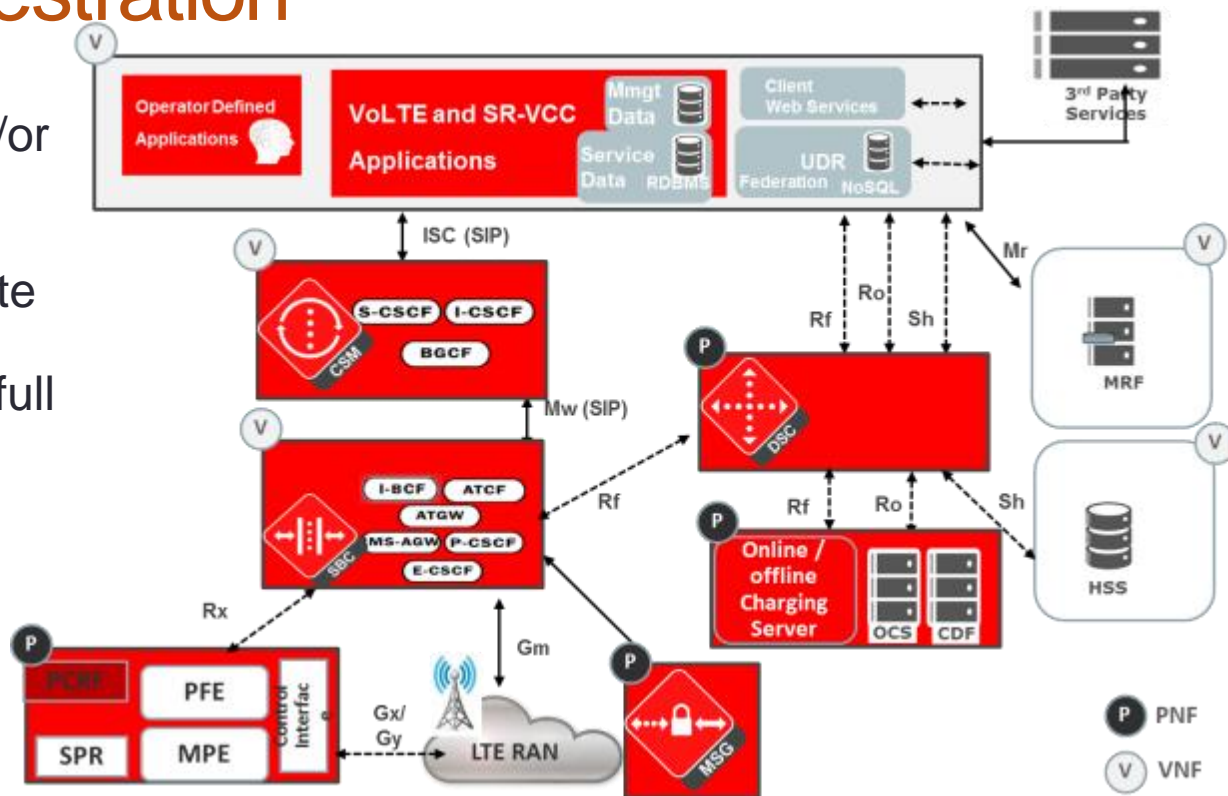AO Generalized Model

NF
    Group {dependency}
                ⋮
        Group {scaling}
            Group {geo-availability}
                Group {local-availability}
                    VNFC

Hybrid NF Orchestration

- Orchestrate virtual and/or physical network functions
- Atomic and/or composite NFs
- Seamless transition to full virtual
- Leverage existing investment in physical NFs

Hybrid NF Deployment

- Diagram shows a singe VNF that consists of physical and virtual network function components.
- Total of 7 instances distributed across 3 data centers.
- Virtual instances can be scaled in and out

Composite Network Function (CNF)

VNFM Extensibility - Plugin Framework

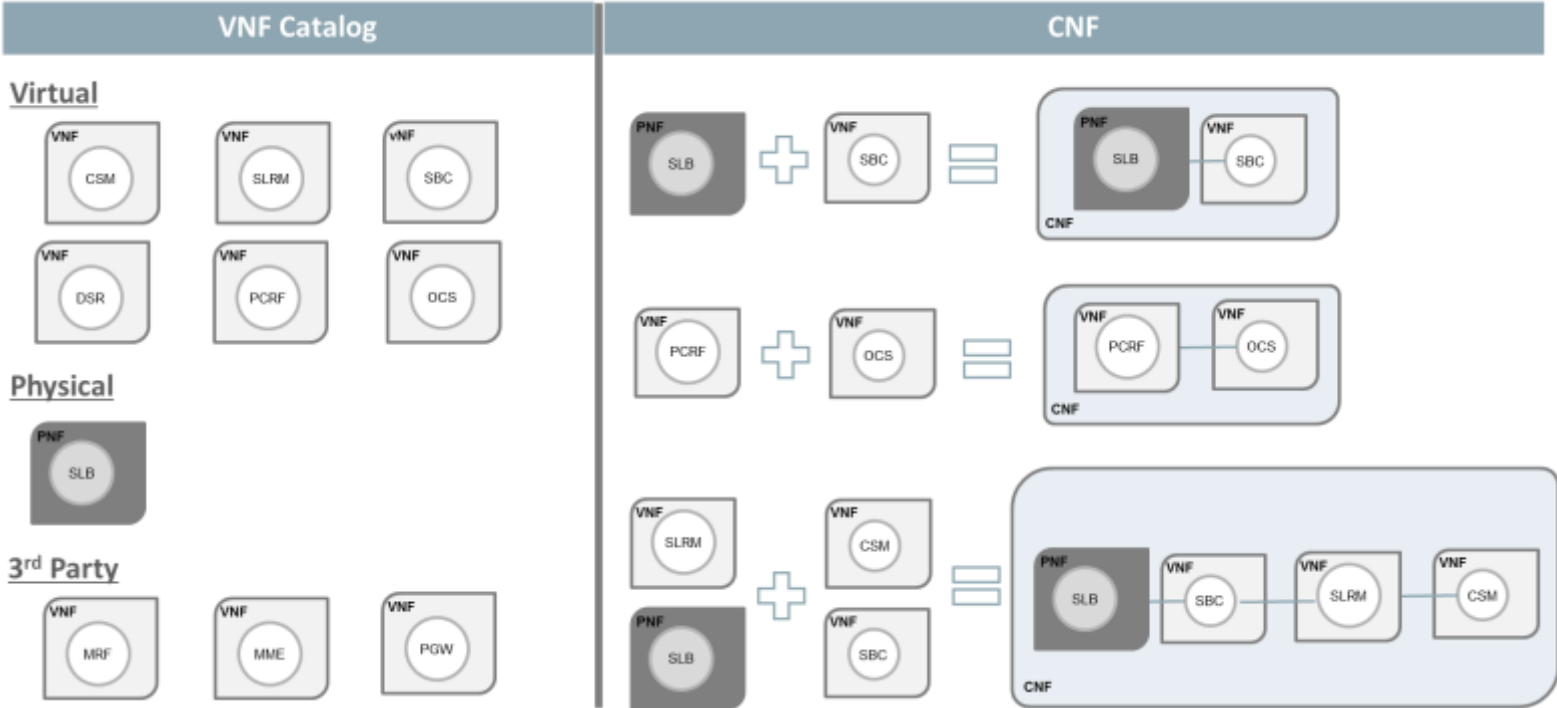- Provides plugin development kit, onboarding and, plugin lifecycle services
- Open ecosystem (Anyone can develop a plugin)
- Multi-vendor, multi-domain Oracle and 3rd Party VNF orchestration

REST API

Core functions, infrastructure, etc.

Open Plugin framework

SBC plugin

PCRF plugin

3rd party plugin

Plugin Development Kit (PDK)

Oracle Communications

Third-party
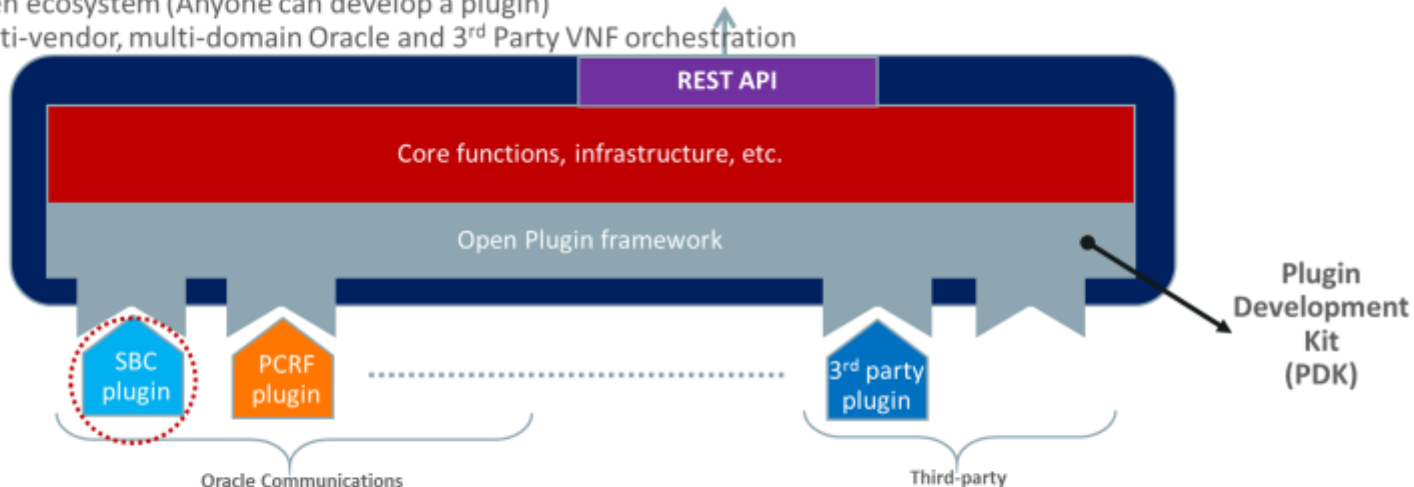
Plugin framework
- Defines interface, specification, etc
- Provides libraries
- Pre-built UI for VNF specific customization

Plugin (captures)
- Model, Topology
- Policies/rules
- Workflows
- Management (EMS/EMF)

Light Reading

HEAVY READING

Conclusion/Recommendation

- Fine balance of dedicated & generic VNF management
  - Choose dedicated VNFM for moderate to high complexity VNFs
  - Choose generic or dedicated VNFM for low complexity VNFs

Making Sense of MANO

Christian Buerger, Intel

Wonderful World of VIM

Frank Schapfel, Intel

From ETSI NFV to Open Network Platform

- ETSI NFV history

- Open Network Platform

- Intel ONP Server use cases

In the beginning… there was the ETSI NFV Industry Study Group
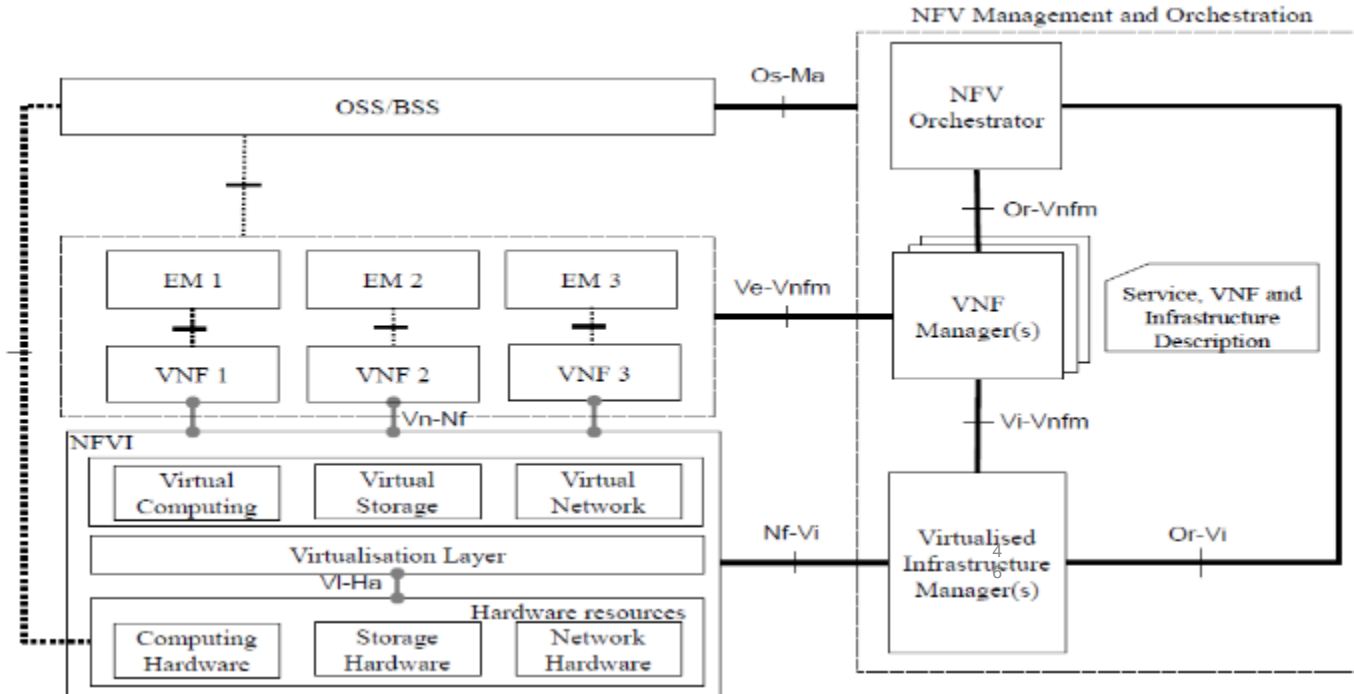
ETSI NFV Framework to Intel Open Network Platform Reference Architecture
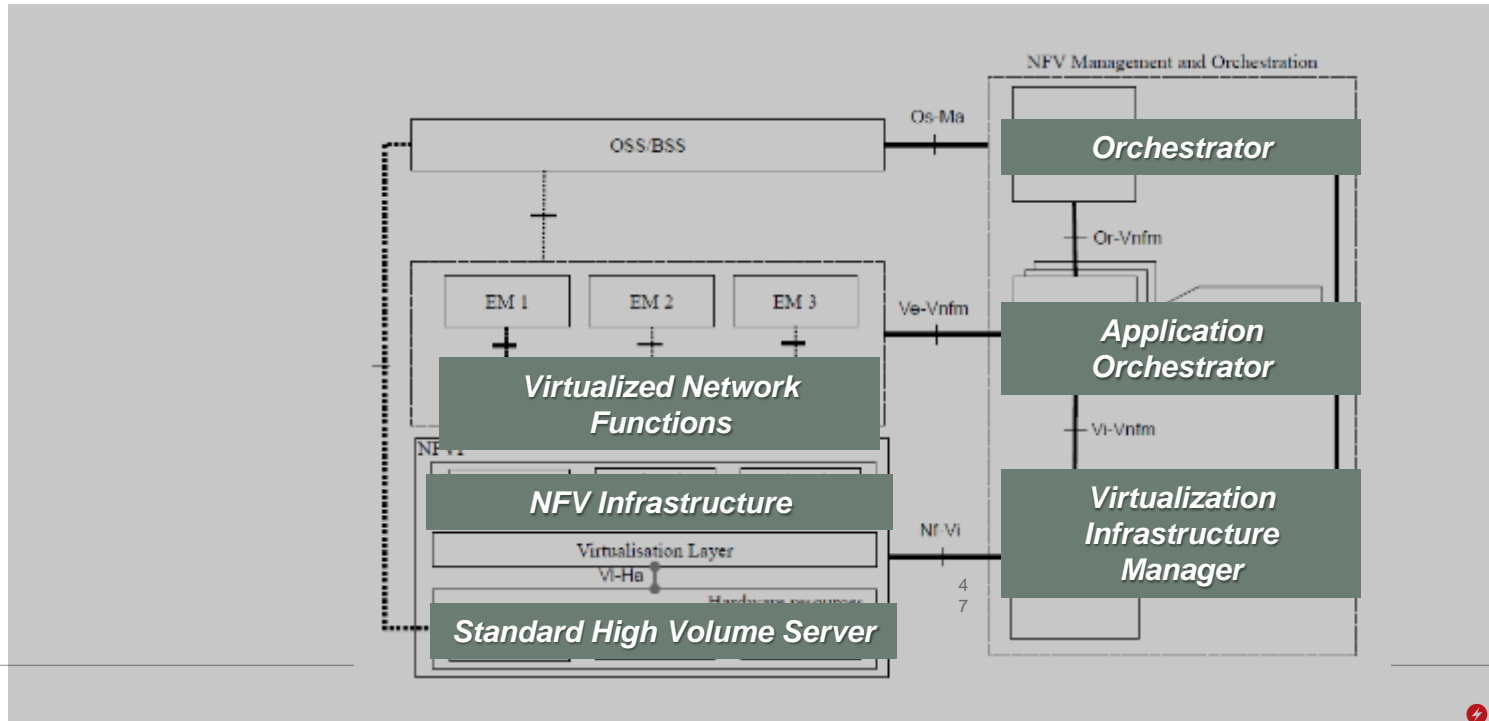
Advance Open Source and Standards

Deliver Open Reference Designs

Enable Open Ecosystem on IA

Collaborate on Trials and Deployments

Accelerating
SDN/NFV Adoption
with
Reference Designs

Deliver
Open Reference
Designs

Intel® ONP Server
Intel® ONP Switch

Industry
Consortia

Intel® Network Builders

Telecom
Cloud
Enterprise

Light
Reading

HEAVY
READING

* Other names and brands may be claimed as the property of others.

Enabling Network Transformation

openstack™

OPEN DAYLIGHT

OPEN VSWITCH
An Open Virtual Switch

DPDK

Orchestration

Network Apps

Controller ○○○ Controller

Node | Node | Node | Node | Node

Firewall | Cloud Server | E-CPE | EPC | BNG
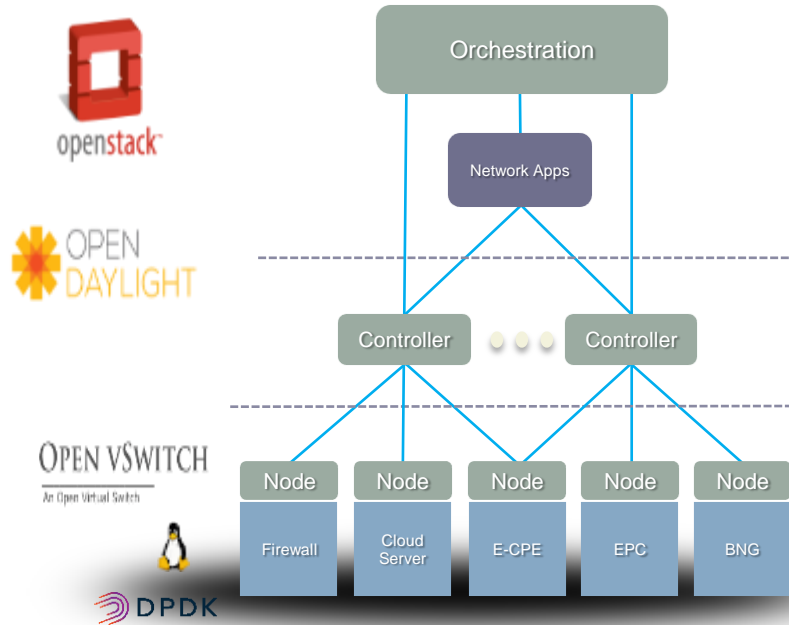
Promote and contribute improvements to open source projects for all three network layers

Enable industry leading manageability by exposing health, state and resource availability

Enable TEM/OEM to deliver optimized solutions based on IA

Light Reading

HEAVY READING

Intel® ONP Server Definition

A Server Reference Architecture Optimized for SDN/NFV

> Software Stack based on Open Source and Open Standards

> Industry Standard Server based on Intel Architecture

VM | VIRTUAL SWITCH HW OFFLOAD | DPDK | LINUX/ KVM
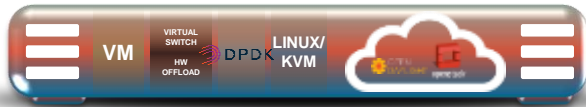
What it is?

A Reference Architecture that brings together hardware and open source software ingredients

An optimized server architecture for SDN/NFV in Telco, Enterprise & Cloud markets

A vehicle to drive development and to showcase server solutions for SDN/NFV based on IA

It is not a commercial product

Light Reading

HEAVY READING

Intel® ONP Server Software Stack

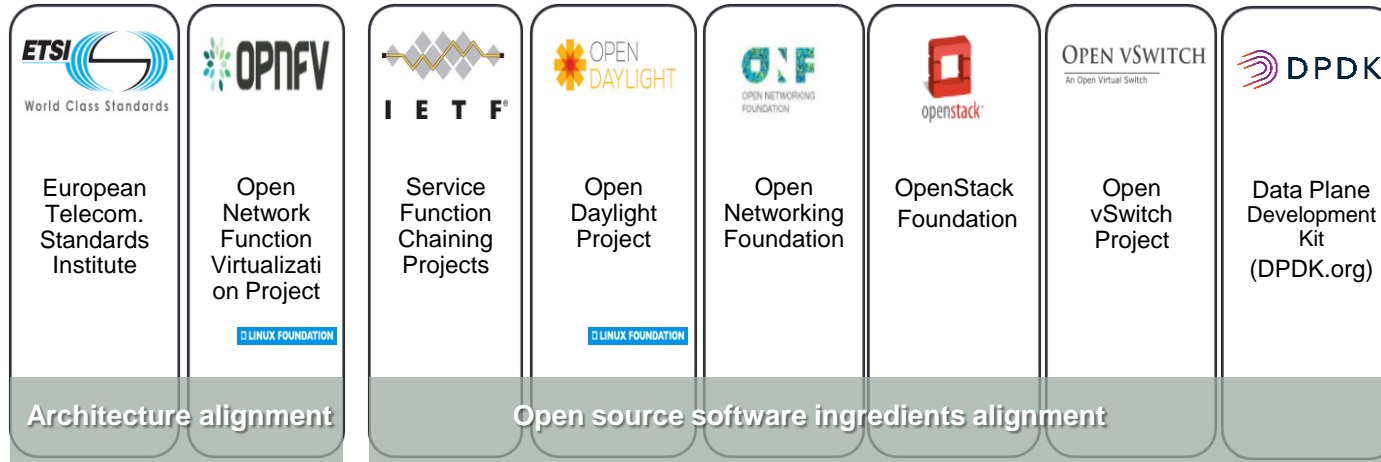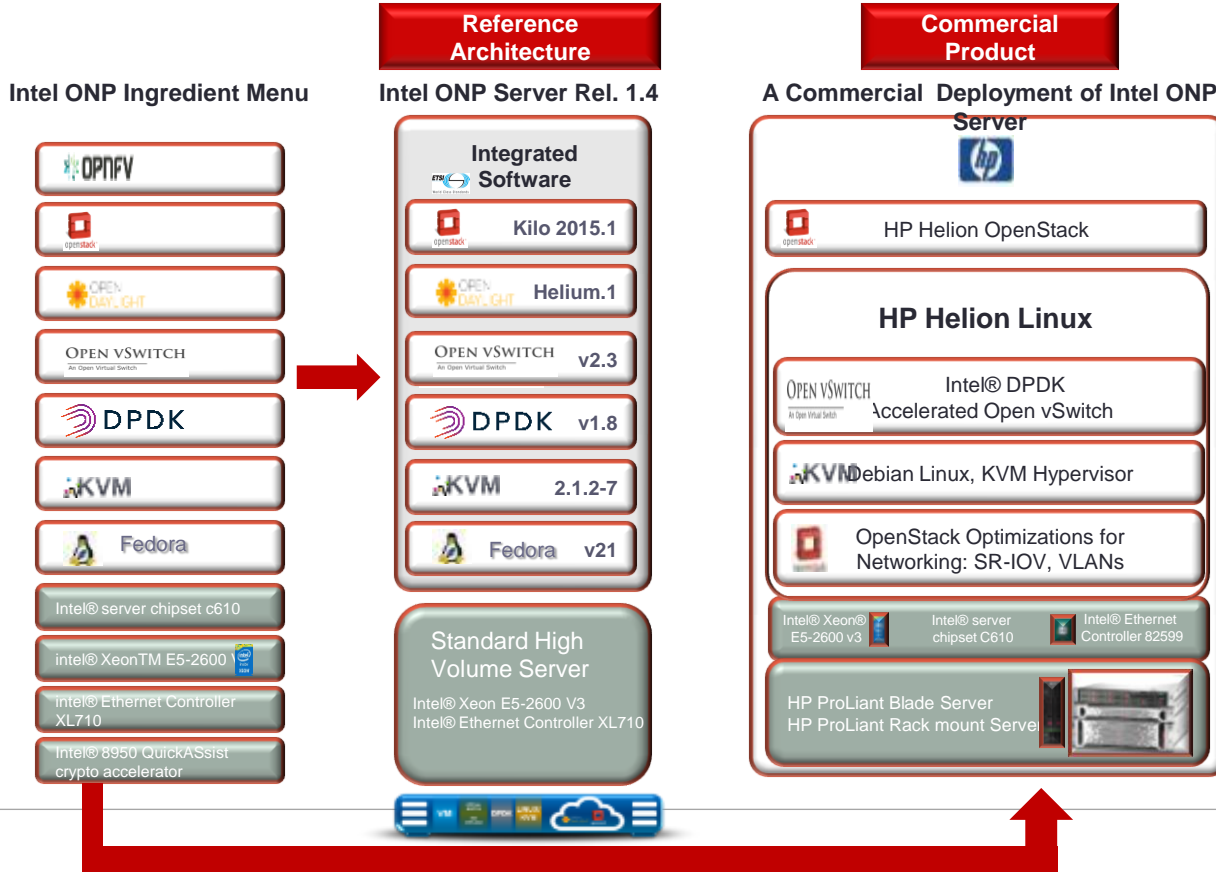|							
European Telecom. Standards Institute	Open Network Function Virtualization Project	Service Function Chaining Projects	Open Daylight Project	Open Networking Foundation	OpenStack Foundation	Open vSwitch Project	Data Plane Development Kit (DPDK.org)
Architecture alignment		**Open source software ingredients alignment**					

In Planning
ONP Switch Software
Linux Driver
□ LINUX FOUNDATION

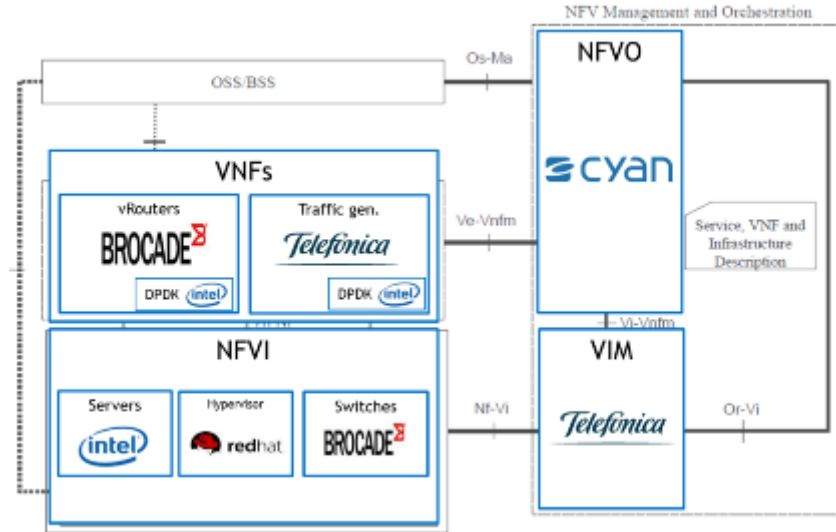**Innovation through integration of open source software deployed with any SHVS**

Intel® ONP Server Enabling SDN/NFV Solutions

Intel ONP Ingredient Menu

- OPNFV
- openstack
- OPEN DAYLIGHT
- OPEN VSWITCH — An Open Virtual Switch
- DPDK
- KVM
- Fedora
- Intel® server chipset c610
- intel® XeonTM E5-2600 v3
- intel® Ethernet Controller XL710
- Intel® 8950 QuickASsist crypto accelerator

Reference Architecture

Intel ONP Server Rel. 1.4

Integrated Software (ETSI)

openstack	**Kilo 2015.1**
OPEN DAYLIGHT	**Helium.1**
OPEN VSWITCH	**v2.3**
DPDK	**v1.8**
KVM	**2.1.2-7**
Fedora	**v21**

Standard High Volume Server

Intel® Xeon E5-2600 V3
Intel® Ethernet Controller XL710

Commercial Product

A Commercial Deployment of Intel ONP Server

HP

openstack	HP Helion OpenStack

HP Helion Linux

- OPEN VSWITCH — An Open Virtual Switch: Intel® DPDK Accelerated Open vSwitch
- KVM: Debian Linux, KVM Hypervisor
- openstack: OpenStack Optimizations for Networking: SR-IOV, VLANs

Intel® Xeon® E5-2600 v3	Intel® server chipset C610	Intel® Ethernet Controller 82599

HP ProLiant Blade Server
HP ProLiant Rack mount Server

* Other names and brands may be claimed as the property of others.

53

Light Reading

HEAVY READING

Intel® ONP Server End to End NFV Demo

- End to End NFV Scenario Instantiation in a multi-vendor environment

- Classic cloud cannot provide carrier-grade performance since it does not have proper view of Data Plane effecting hardware resources

- Enhanced Platform Awareness at NFV-O and VIM level enables an intelligent allocation of resources

Intel® ONP Server Roadmap

	Feb. 2015 1.3	May. 2015 1.4	Q3'15 Rel. 1.5	Q1'16 Rel. 2.0
01 Intel ONP Server				
Workload	vBNG	vCPE	vE-CPE	OPNFV
OPNFV				Arno
openstack	Juno 2014 2.2	Kilo 2015.1	Kilo2015.1.1	Liberty
OPEN DAYLIGHT	Helium.1	Helium SR3	Lithium SR1	Lithium/Beryllium
OPEN vSWITCH	2.3.1	2.3.2	2.4	2.6
DPDK	1.7.1	1.8	2.0	2.2
Linux OS	Fedora 21	Fedora 21	Fedora 21	Fedora 21
QuickAssist Technology	1.6	1.6	1.6	1.7
Xeon	Grantley Intel® Xeon E5-2600 V3 4X10G QuickAssist chipset	Grantley Intel® Xeon E5-2600 V3 4x10GbE QuickAssist chipset	Grantley Intel® Xeon E5-2600 V3 2X40GbE QuickAssist Chipset	Grantley Intel® Xeon E5-2600 V3 2x40GbE 100GbE QuickAssist Chipset

Released

Dev. Focus

Planning

Light Reading   HEAVY READING

Open Network Platform - Summary

- **Open Reference Architecture**

- **Quarterly releases**

- **Integration of multiple open community projects**

- **Broad ecosystem to test NFV configurations**

- **Path to commercially available solutions**

Intel® ONP Server Roadmap

01 Intel ONP Server	**Feb. 2015 Re. 1.3 - minor**	**May. 2015 Rel. 1.4 - major**	**Q3'15 Rel. 1.5 - minor**	**Q4'15 Rel. 1.6 - major**
Release Theme	Community Leadership OPNFV	Performance OVS	Performance: SFC	Scalable Security
Workload	vBNG	vCPE	vPE	IDC
OPNFV		1.0	2.0	2.0
openstack	Juno 2014 2.2	Kilo	Kilo2015.x	"L"
OPEN DAYLIGHT	Helium.1	Helium.2	Lithium.1	Lithium/Beryllium
OPEN vSWITCH	2.3.1	2.4	2.5	2.6
DPDK	1.7.1	1.8	2.1	2.2
Linux OS	Fedora 21	Fedora 21	Fedora 21	Fedora 21
QuickAssist Technology	1.6	1.6	1.6	1.7
Xeon	Grantley Intel® Xeon E5-2600 V3 Fortville (4X10G) 8950 Coleto Creek	Grantley Intel® Xeon E5-2600 V3 Fortville(1X40G) 8950 Coleto Creek	Grantley Intel® Xeon E5-2600 V3 Fortville(1X40G) 8950 Coleto Creek	Grantley Intel® Xeon E5-2600 V3 Fortville (1X40G) RRC 8950 Coleto Creek

Done

Dev. Focus

Planning

SAA ------------------- -- Broadwell-DE

* Other names and brands may be claimed as the property of others Note: Roadmap subject to change without prior notice.

Light Reading

HEAVY READING

Intel® ONP Server Release 1.3 - WW9 2015

Intel ONP Server	Dec. 2014 Re. 1.2	Feb. 2015 Rel. 1.3
OPNFV		Align w/ OPNFV bootstrap project
openstack	Juno 2014.2	Juno 2014.2.2
OPEN DAYLIGHT	Helium.1	Helium.1
OPEN VSWITCH	2.3	2.3.9
DPDK	1.7.1	1.7.1
Linux OS	Fedora 20	Fedora 21
QuickAssist Technology	1.5	1.6
Xeon		

Intel ONP Server Release 1.3 is a minor release (WW92015)
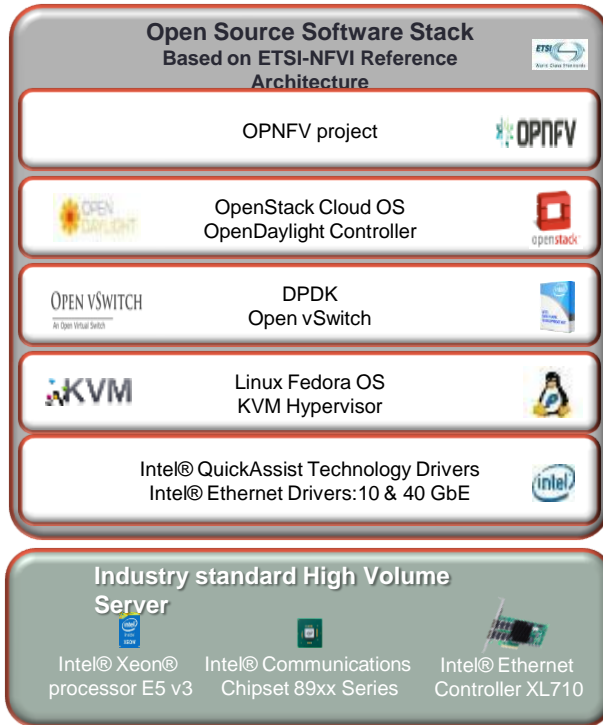
Release Theme: Align ONP Server with OPNFV

Main Deliverables :

1. **SRT 1.3 script on 01.org to include:**
    - Integrate latest core ingredients
    - Fedora 21 for server
    - Integrate Linux real-time kernel, per Telco requirements
    - Support FTXL710-AM2 4x10GbE (code-name Fortville)

2. **Reference Architecture Document**

3. **Benchmark Test Report**

Done

Light Reading

HEAVY READING

Summary - Intel® Open Network Server

Open Source Software Stack
Based on ETSI-NFVI Reference Architecture

OPNFV project

OpenStack Cloud OS
OpenDaylight Controller

DPDK
Open vSwitch

Linux Fedora OS
KVM Hypervisor

Intel® QuickAssist Technology Drivers
Intel® Ethernet Drivers:10 & 40 GbE

Industry standard High Volume Server

Intel® Xeon® processor E5 v3

Intel® Communications Chipset 89xx Series

Intel® Ethernet Controller XL710

What is it?

Server software reference architecture integrating Intel HW optimizations for Open Source and Open Standard ingredients used in SDN/NFV

Not a commercial product

Who is it targeted at?

Telco, Enterprise, Cloud

TEMs, OEMs, ODMs, ISVs, OSVs

Telecom SPs, Cloud SPs, IT End Users

Where can you get it?

Released on Intel's 01.org on quarterly basis

What is delivered?

Intel ONP Server free open source software (script

Intel ONP Server Reference Architecture Document

Intel ONP Server Benchmark Test Report

Release Notes and marketing collateral

Application Demo (Planned Q2 2015)

* Other names and brands may be claimed as the property of others.

Light Reading

HEAVY READING
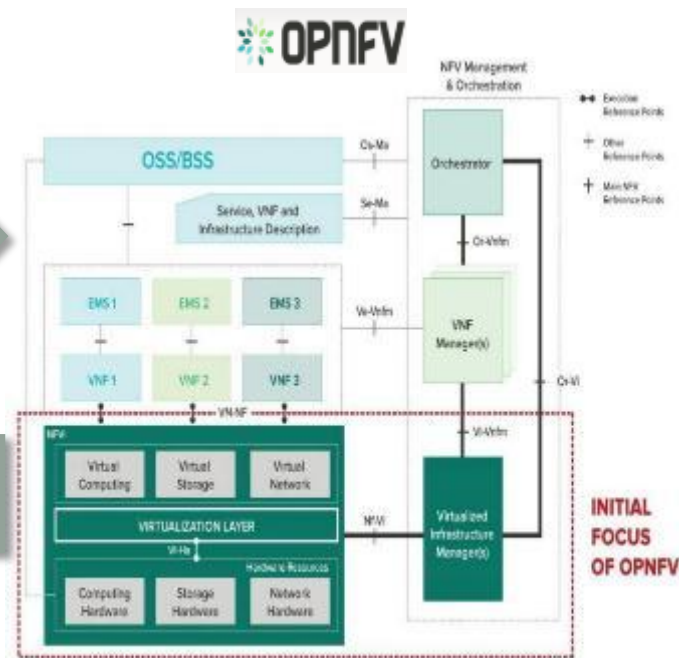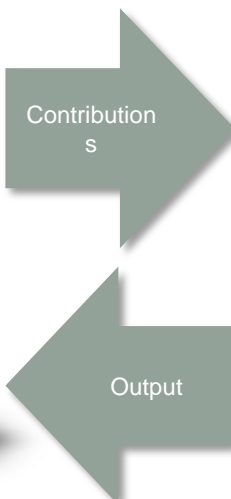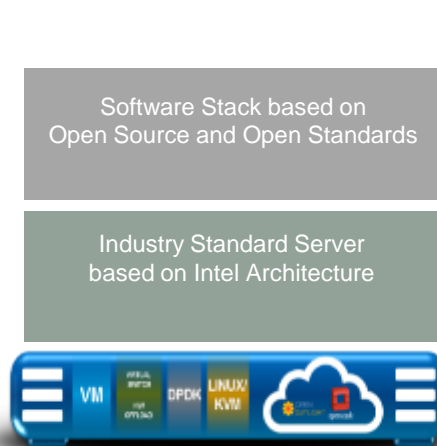
59

Legal Disclaimers

- INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

- A "Mission Critical Application" is any application in which failure of the Intel Product could result, directly or indirectly, in personal injury or death. SHOULD YOU PURCHASE OR USE INTEL'S PRODUCTS FOR ANY SUCH MISSION CRITICAL APPLICATION, YOU SHALL INDEMNIFY AND HOLD INTEL AND ITS SUBSIDIARIES, SUBCONTRACTORS AND AFFILIATES, AND THE DIRECTORS, OFFICERS, AND EMPLOYEES OF EACH, HARMLESS AGAINST ALL CLAIMS COSTS, DAMAGES, AND EXPENSES AND REASONABLE ATTORNEYS' FEES ARISING OUT OF, DIRECTLY OR INDIRECTLY, ANY CLAIM OF PRODUCT LIABILITY, PERSONAL INJURY, OR DEATH ARISING IN ANY WAY OUT OF SUCH MISSION CRITICAL APPLICATION, WHETHER OR NOT INTEL OR ITS SUBCONTRACTOR WAS NEGLIGENT IN THE DESIGN, MANUFACTURE, OR WARNING OF THE INTEL PRODUCT OR ANY OF ITS PARTS.

- Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined". Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

- The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

- Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

- Copies of documents which have an order number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725, or go to: http://www.intel.com/design/literature.htm

- Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families: Go to: Learn About Intel® Processor Numbers

- Intel, the Intel logo, Itanium, Intel Atom, Intel Xeon Phi, Intel AppUp, and Xeon are trademarks of Intel Corporation in the U.S. and/or other countries.

- *Other names and brands may be claimed as the property of others.

Thank You

Intel® ONP Server is Aligned to OPNFV

Intel® ONP server

Software Stack based on Open Source and Open Standards

Industry Standard Server based on Intel Architecture

Contributions

Output

Intel® ONP Server contributes to and consumes OPNFV output to create an industry-standard open source platform optimized on IA

Panel – Workshop findings and discovery