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# NFV & OPEN NETWORKING

Meetup

January 12th, 2015

# Agenda

- **An introduction to NFV** - 10:00 - 10:15
- **State of the NFV market** - 10:15 - 10:30
- **Open Networking & Red Hat** - 10:30 - 11:00
- **Alcatel-Lucent Journey to the cloud (CloudBand)** - 11:15 - 11:45
- **RHEL OpenStack Platform roadmap** - 11:45 - 12:10
- **Q&A** - 12:10 - 12:30



**Connection** multiplies  
possibility

# An introduction to NFV

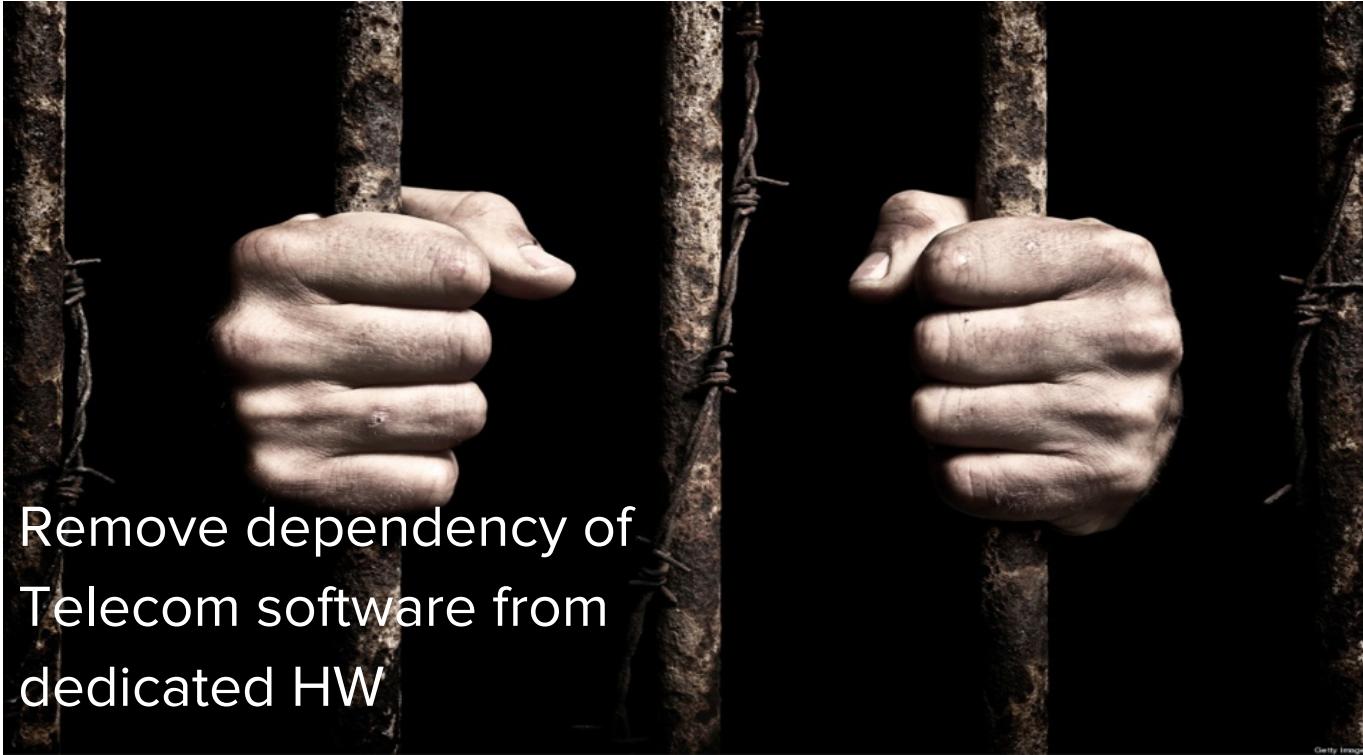
## Sandro Mazziotta - Red Hat

# The Telco challenge from the last 20 years



Reduce costs and  
accelerate new services  
introduction

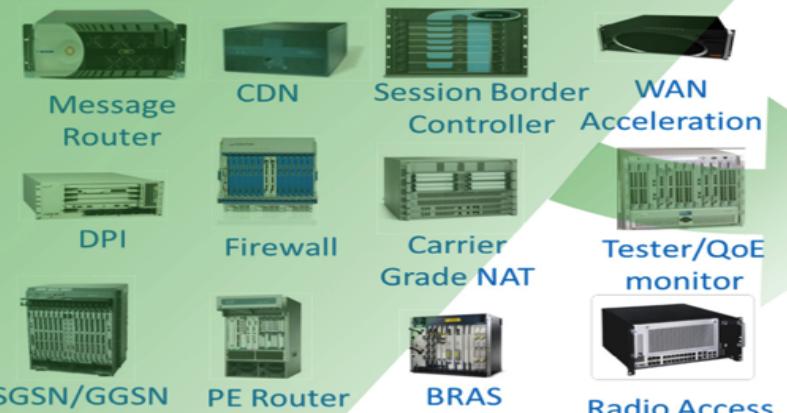
# The main issue



Remove dependency of  
Telecom software from  
dedicated HW

# The road to NFV

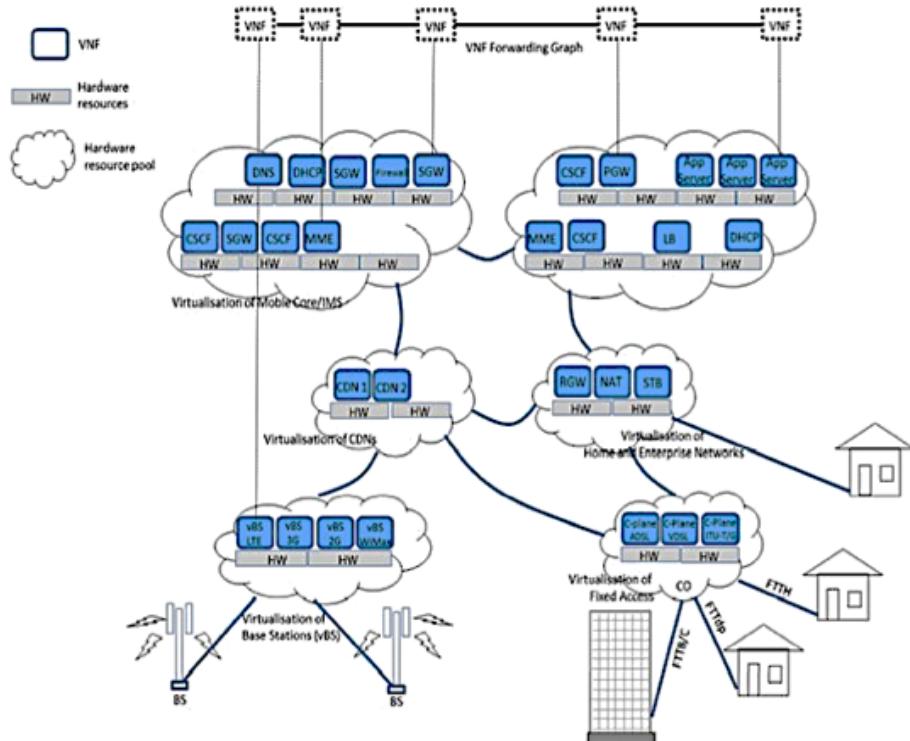
## Classical Network Appliance Approach



- Fragmented non-commodity hardware.
- Physical install per appliance per site.
- Hardware development large barrier to entry for new vendors, constraining innovation & competition.



# NFV Use Cases



- **NFV complexity:**
  - Atomic Network Function - Firewall, DNS, DPI...
  - Composite Network Function - Networking Forwarding Graph
  - Complex Network Functions: EPC, IMS...
- **Use Cases:**
  - Residential/Home/Enterprise: Virtual CPE, Home GW, STB
  - Access Network: C-RAN
  - Core Networks: vEPC, vIMS, ...

# NFV Key Principles

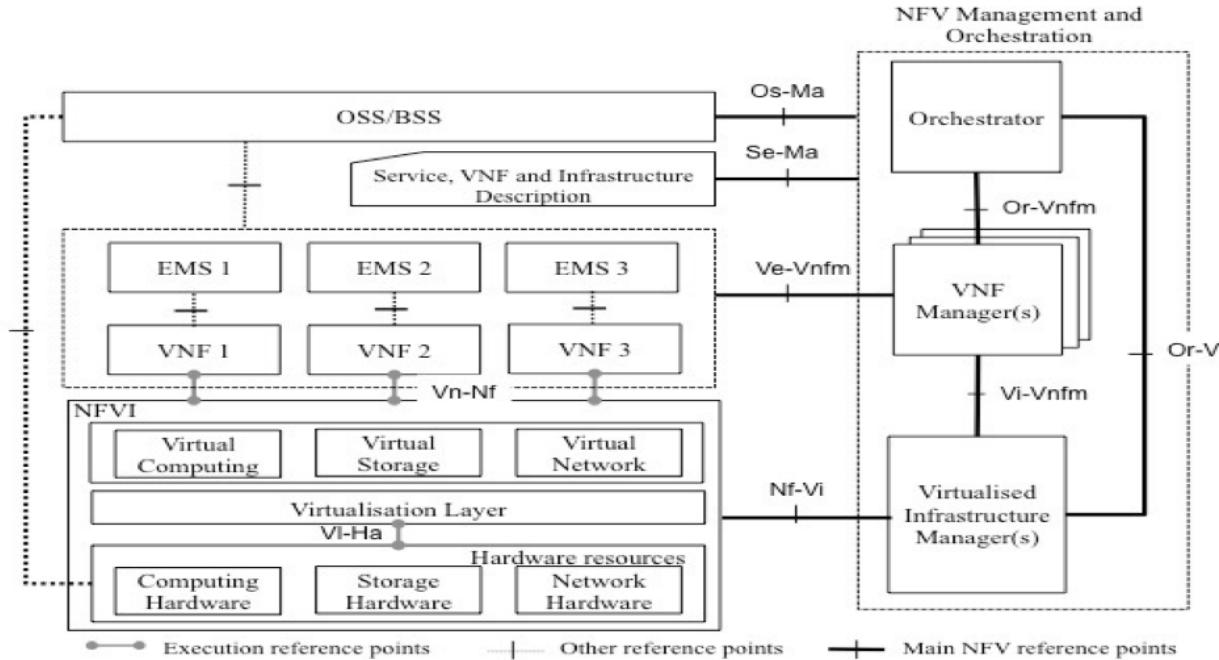
- UNLOCK => OPEN
- Unlock Software from Hardware => Leverage Open Source
- No vertical solution => multi-vendor solution
- Virtualization is not enough... want Cloud

# Collecting Requirements

- ETSI: Official start is Oct 2012. 1st Meeting Jan 2013
  - Phase 1 Jan 2013 – Dec 2014
    - Ref Architecture, White Papers, ... => Not a standard
    - Requirements, Use Cases => No specification
    - Proof of Concepts
  - Phase 2 Jan 2015 – Dec 2016
    - Try to be more formal
    - Defining Interfaces
    - Defining Validation/Certification



# ETSI NFV Reference Architecture



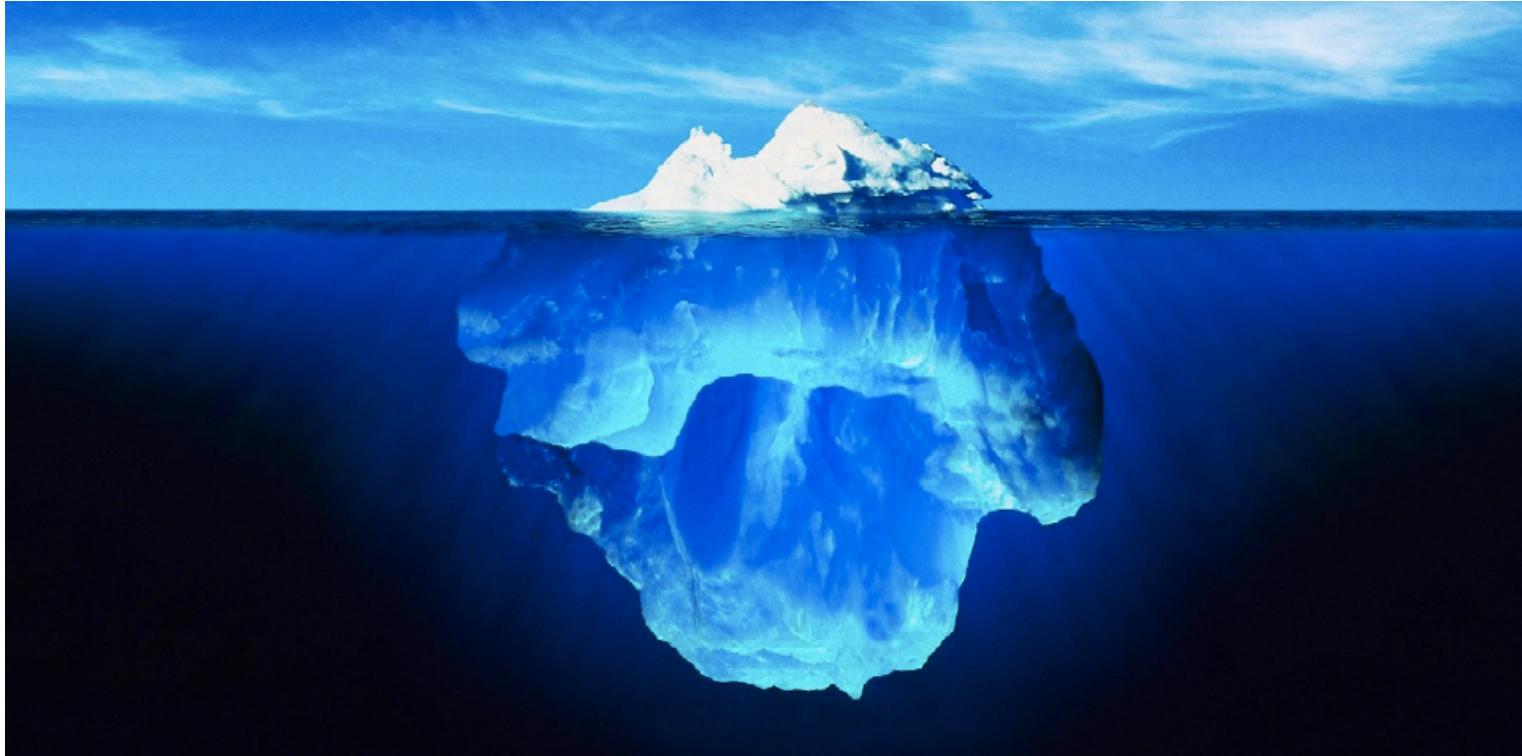


# **State of the NFV market**

**Sandro Mazziotta - Red Hat**

**Disruptive is productive**

# NFV Maturity



# NFV Business Opportunities

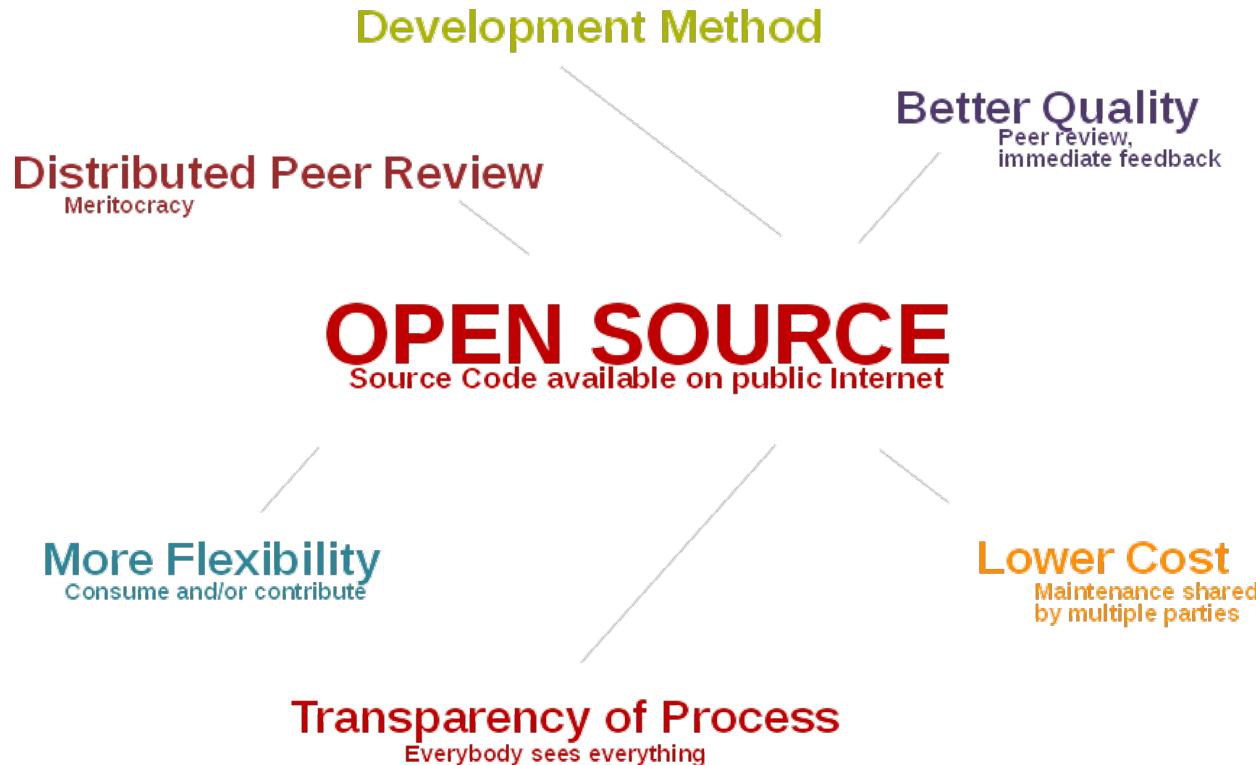
- SNS Estimates market for SDN/NFV is 4B US\$ in 2014 with 60% CAGR for next 6 years
- Early POC & Trials Stage Completed
- Implementing Field Trial / Limited Deployment
- Many RFx in the marketplace
- First commercial deployment in 2015
- Maturity most probably in H2 2016-2017



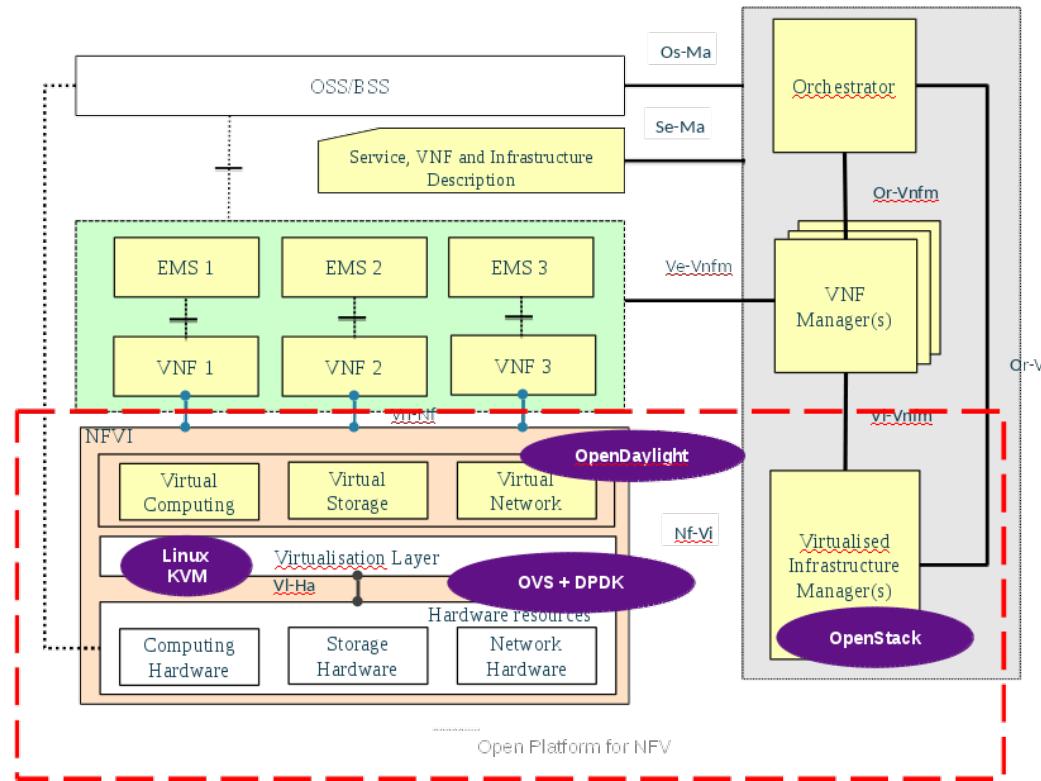
# NFV Business Opportunities

- Latest major disruption in the Telco marketplace since IP introduction
- Create opportunities for service providers:
  - To accelerate development of new services
  - To implement Network and IT convergence
- Force Network Equipment Providers to:
  - To change their business model (transform themselves as Software Providers)
  - To redesign their software

# Implementation of NFV!



# Scope of the project



# OpenStack - The Cloud Management Platform

- 9 out of 10 Service Providers have selected Openstack for the VIM (Virtual Infrastructure Management)
- The remaining is legacy Virtualization environment



# OpenStack related challenges

- Cultural challenges:
  - Introduction of DevOps, Continuous Integration, ...
  - Work with Open Source communities
  - No more standards
  - 80% is good enough...
- Technical R&D challenges:
  - OpenStack is maturing and evolving very fast (major release every 6m)
  - Limited number of skills
  - Redesign of application to become cloud application
- Operational:
  - Need to educate/train people

# NFV is a journey We've Just Started!



# Open Networking & Red Hat

## Nir Yechiel - Red Hat

Disruptive is productive

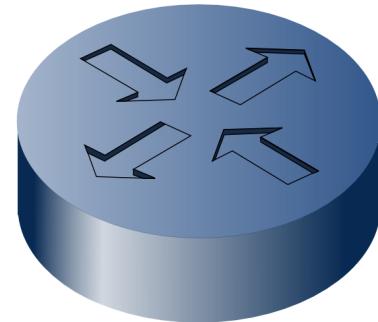


# Virtualization and Cloud

- IaaS pool of resources
- Compute + storage + network = application
  - Compute virtualization
  - Storage virtualization
  - Network status quo

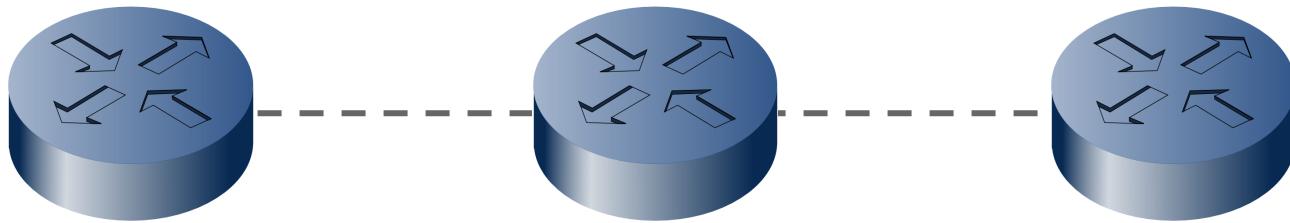
# Network Device

- Control plane
- Forwarding/data plane
- Localized per device
- Costs scale



# Devices Share State

- Distributed across the network
- Convergence can be slow
- Based on local decisions



# Vendor Centric

- Vertical integration
- Proprietary protocols
- Minimal automation

# Collaboration Through SDO

- Slow
- Political
- Interoperability

# Software Defined Networking

- Separation of control plane and forwarding plane
- Open standard protocols
- Well-known, stable API
- Programmability
- Agility

# Software Defined Networking

- OpenFlow != SDN



# Network Functions Virtualization

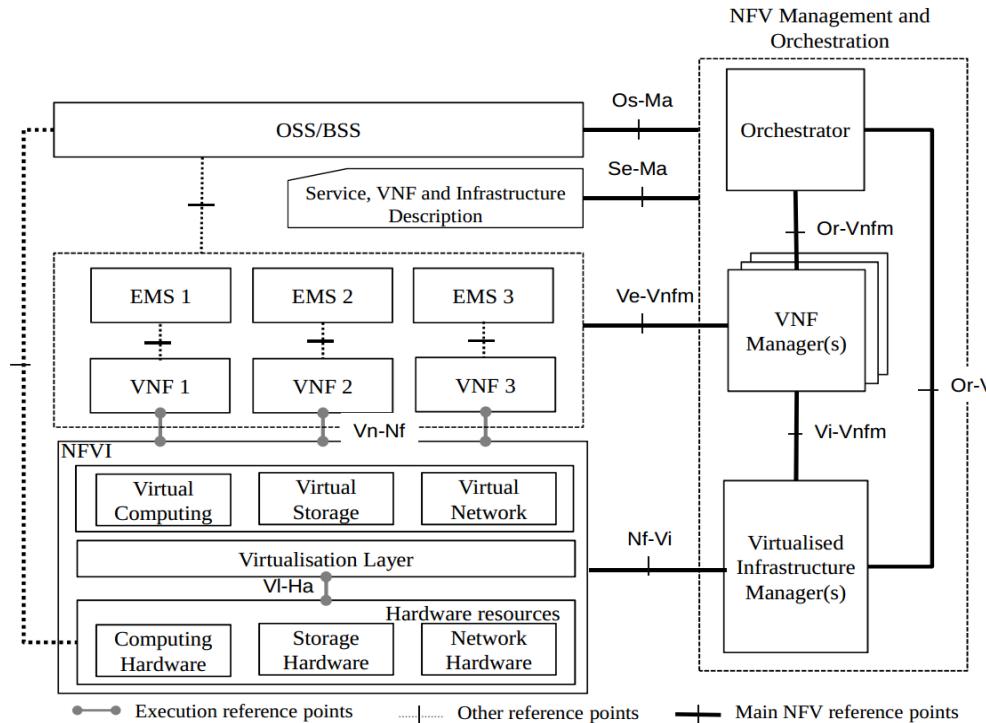
- Network functions are tapped in hardware
- Middle boxes are expensive
- Service rollout is slow



# Network Functions Virtualization

- vPE (Provider Edge)
- vCPE (Customer Premises Equipment)
- vADC (Application Delivery Controller)
- vFirewall
- vEPC (Evolved Packet Core)
- vRAN (Radio Access Networks)
- ...

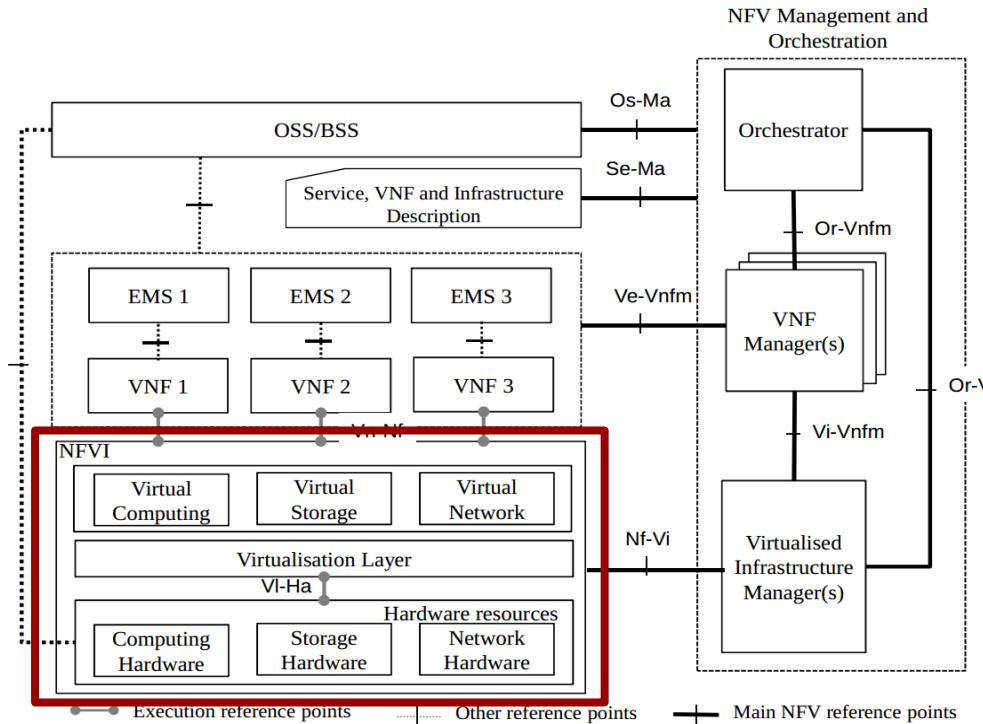
# Network Functions Virtualization



Source: NFV ISG

# Network Functions Virtualization

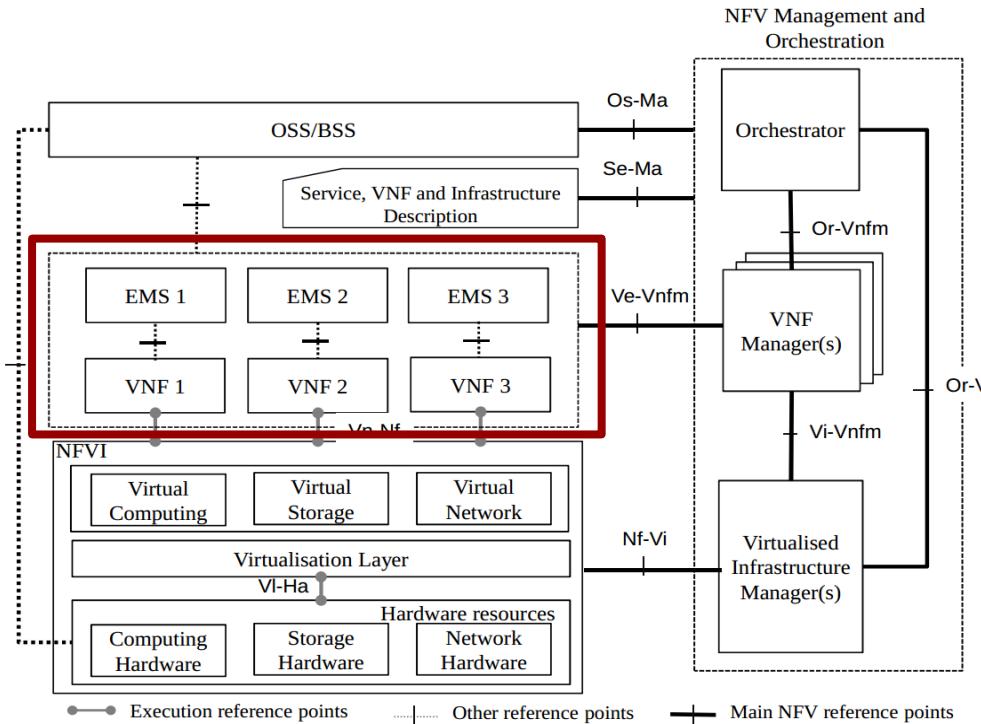
NFVI



Source: NFV ISG

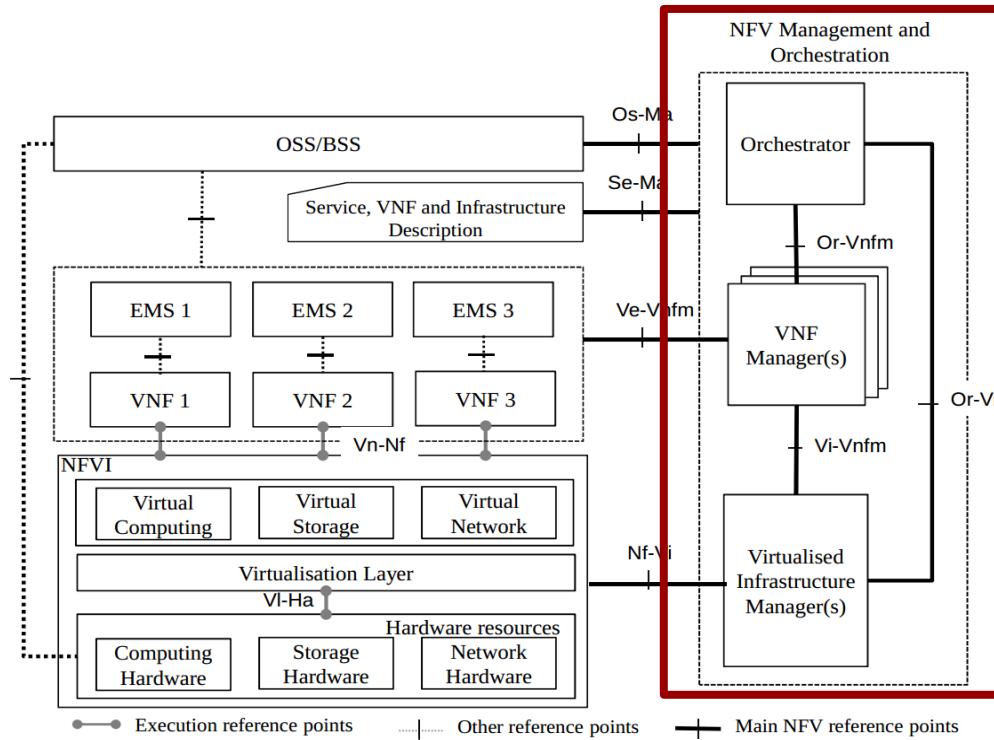
# Network Functions Virtualization

VNF



Source: NFV ISG

# Network Functions Virtualization



**MANO**

Source: NFV ISG

# Network Functions Virtualization

- Virtualize network functions
- Distribute on a cloud
- Steer with SDN

# What about the Data Plane?

- Disaggregation
- Software packet processing

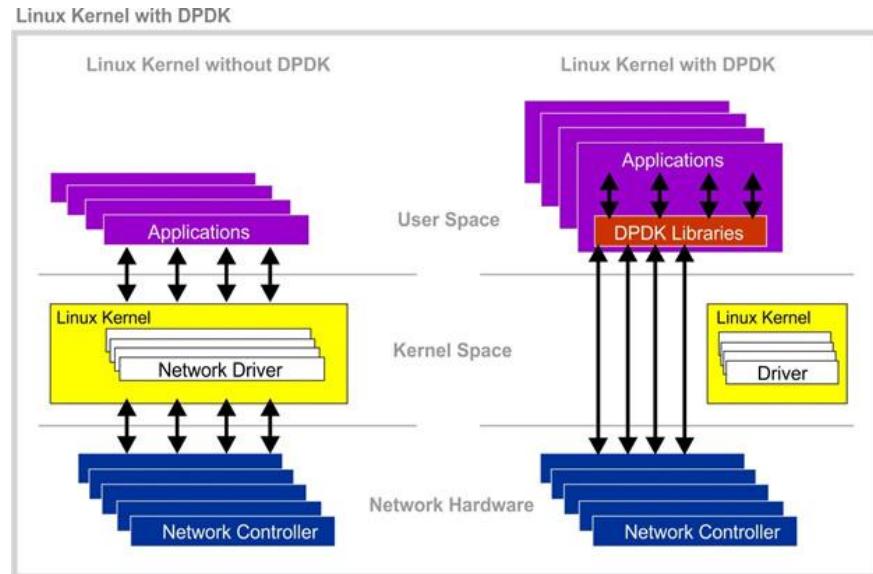
# Disaggregation

- Separate hardware from software
- Linux is the network OS



# Software Packet Processing

- Open vSwitch
- DPDK
- OpenDataPlane



Source: <http://www.accton.com/Newspage.asp?sno=87>

# Red Hat in Open Networking

- OpenStack
- OpenDaylight
- Open Platform for NFV (OPNFV)
- Data plane
  - Open vSwitch
  - DPDK
  - SR-IOV

# OpenStack

# OpenStack

- Modular architecture
- Designed to scale out
- Based on a growing set of services



# NFV OpenStack Challenges

- Performance
- Determinism
- Reliability
- New features

# Deterministic Performance

- NUMA aware CPU, memory and I/O scheduling
- VM memory backend by hugepages
- Enhanced packet processing
- Resource aware scheduling

# Reliability

- All infrastructure deployed with HA
- VM HA (non-cloud aware application)
- Rich monitoring requirements
  - Fault detection, resource consumption
- Ability to monitor Key Performance Indicators (KPIs)

# NFV Features (Incomplete List)

- Service VM, service insertion, and service chain APIs
- IPv6 support
- VLAN trunk to VM
- vNIC without address
- Network QoS

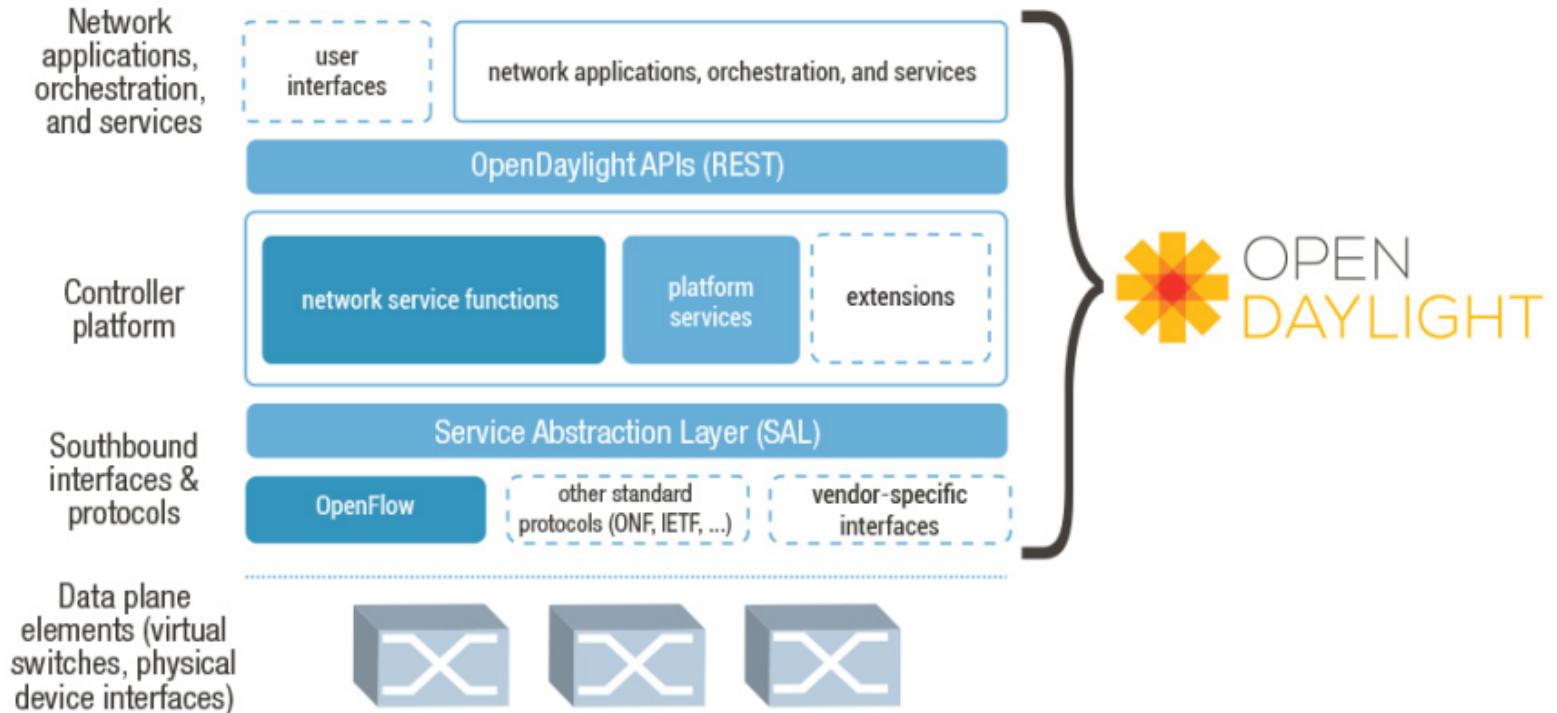
# Making NFV OpenStack Real

- Created upstream sub-team to focus on NFV
  - <https://wiki.openstack.org/wiki/Teams/NFV>

# OpenDaylight



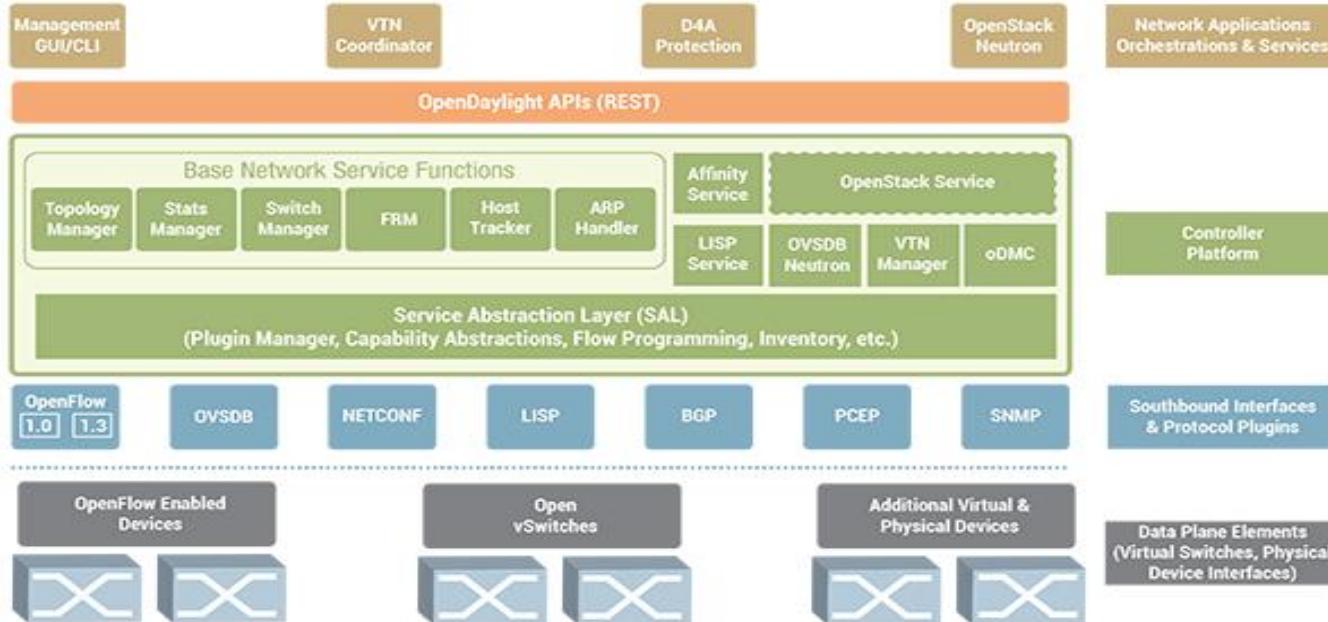
# OpenDaylight





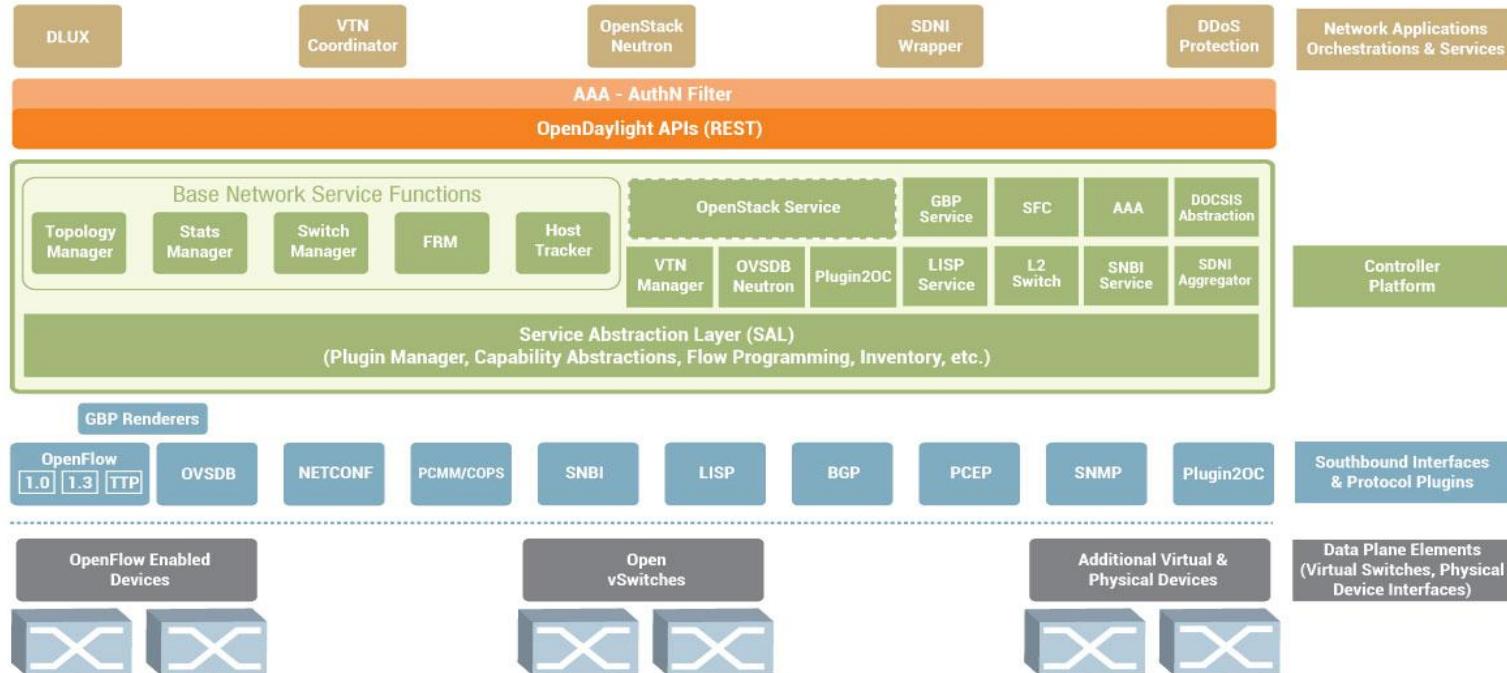
# OPEN DAYLIGHT “HYDROGEN”

**VTN:** Virtual Tenant Network  
**oDMC:** Open Dove Management Console  
**D4A:** Defense4All Protection  
**LISP:** Locator/Identifier Separation Protocol  
**OVSDB:** Open vSwitch DataBase Protocol  
**BGP:** Border Gateway Protocol  
**PCEP:** Path Computation Element Communication Protocol  
**SNMP:** Simple Network Management Protocol  
**FRM:** Forwarding Rules Manager  
**ARP:** Address Resolution Protocol





LEGEND	
<b>AAA:</b> Authentication, Authorization & Accounting	<b>OVSDB:</b> Open vSwitch DataBase Protocol
<b>AuthN:</b> Authentication	<b>PCEP:</b> Path Computation Element Communication Protocol
<b>BGP:</b> Border Gateway Protocol	<b>PCMM:</b> Packet Cable MultiMedia
<b>COPS:</b> Common Open Policy Service	<b>Plugin2OC:</b> Plugin To OpenContrail
<b>DLUX:</b> OpenDaylight User Experience	<b>SDNI:</b> SDN Interface (Cross-Controller Federation)
<b>DDoS:</b> Distributed Denial Of Service	<b>SFC:</b> Service Function Chaining
<b>DOCSIS:</b> Data Over Cable Service Interface Specification	<b>SNBI:</b> Secure Network Bootstrapping Infrastructure
<b>FRM:</b> Forwarding Rules Manager	<b>SNMP:</b> Simple Network Management Protocol
<b>GBP:</b> Group Based Policy	<b>TTP:</b> Table Type Patterns
<b>LISP:</b> Locator/Identifier Separation Protocol	<b>VTN:</b> Virtual Tenant Network



# Red Hat OpenDaylight Focus

- Integration with OpenStack
  - ML2 ODL driver + L3-L7 extensions
- Overlay networks
  - Add OVSDDB HW\_VTEP schema support
- SAL
- AAA
- SFC (Service Function Chaining)

# OPNFV

# NFV

OpenDaylight

OpenStack

libvirt

DPDK

Open vSwitch

KVM

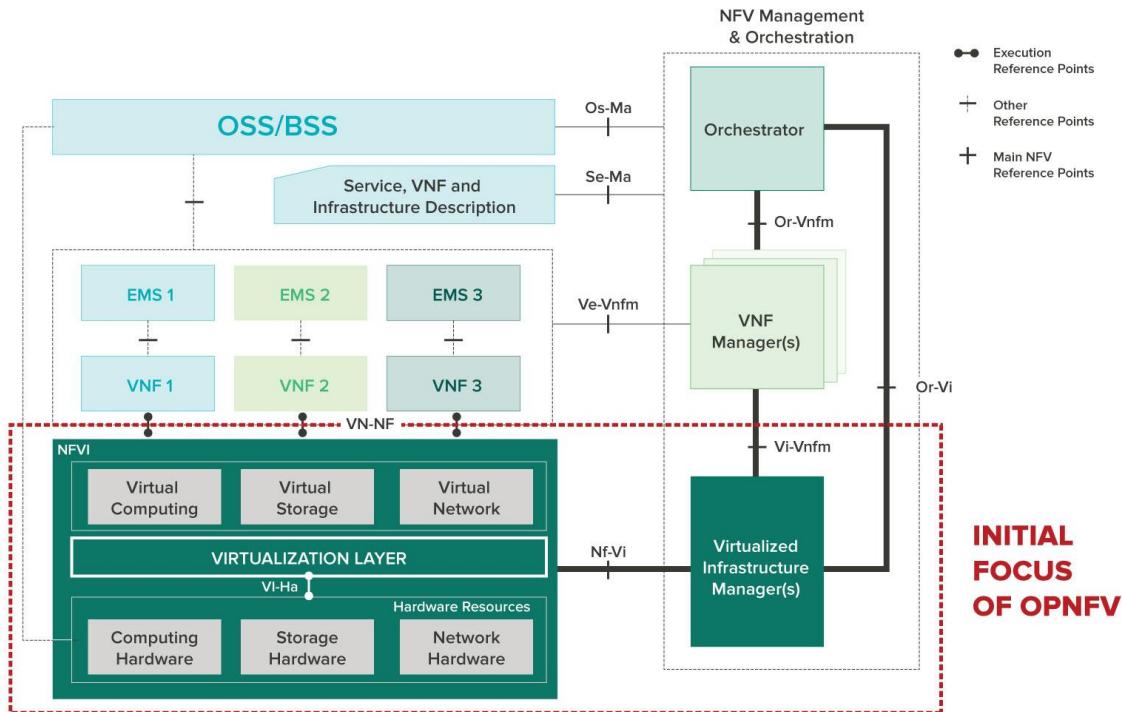
Linux

# OPNFV

- Open source NFV reference implementation
  - Open, transparent
  - Upstream first
  - Integrate and validate
- Move from SDO to Open Source
- Red Hat is a Platinum Founding member



# OPNFV



Source: <http://www.opnfv.org>

# OPNFV Projects

- Fault Management (Doctor)
- Continuous Integration (Octopus)
- Bootstrap/Get-started
- Virtualized Infrastructure Deployment Policies (Copper)
- Resource Management (Promise)
- High availability for VNFs
- IPv6-enabled OPNFV
- Characterize vSwitch Performance for Telco NFV Use Cases
- Software Fastpath Service Quality Metrics

# Making NFV OpenStack Real

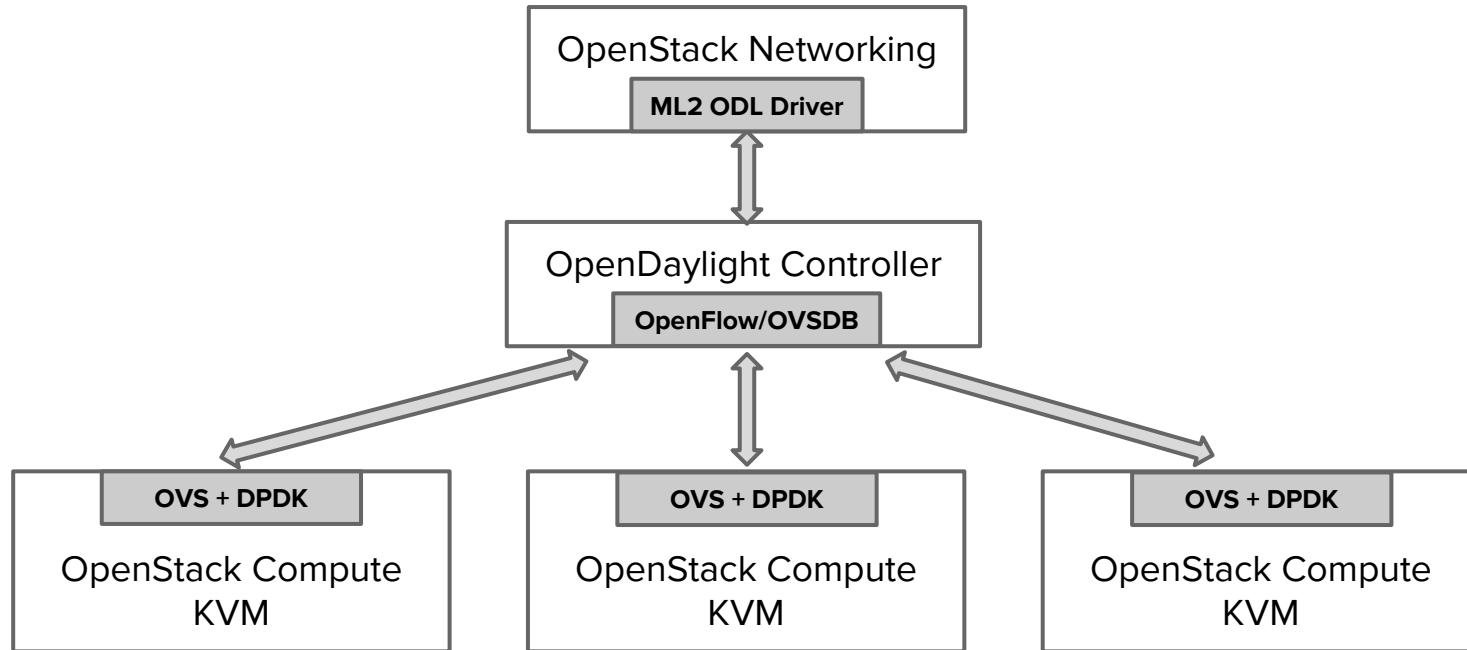
- OPNFV brings additional resources to focus on NFV requirements in OpenStack
  - <http://opnfv.org>

# Data Plane

# Red Hat Data Plane Focus

- Open vSwitch
  - Performance
  - OpenStack integration
- DPDK
  - API/ABI compatibility, difficult to package in distribution
  - Compile time rather than runtime optimizations
  - OVS integration disables kernel features
- SR-IOV
  - SR-IOV Neutron ML2 driver (OpenStack Juno)

# Putting It All Together





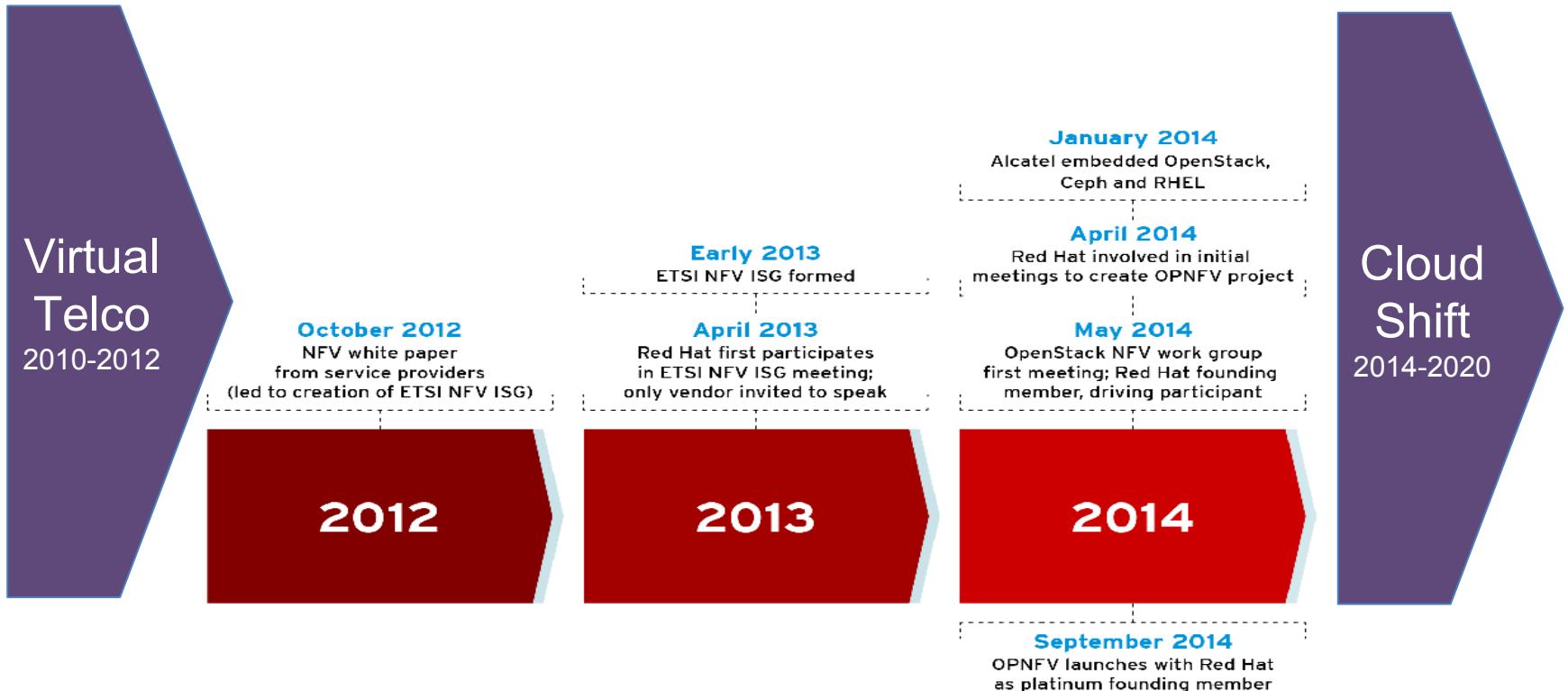
**Connection** multiplies  
possibility

# Alcatel-Lucent Journey to NFV - lessons learned

Idan Mor, Yuki Arbel

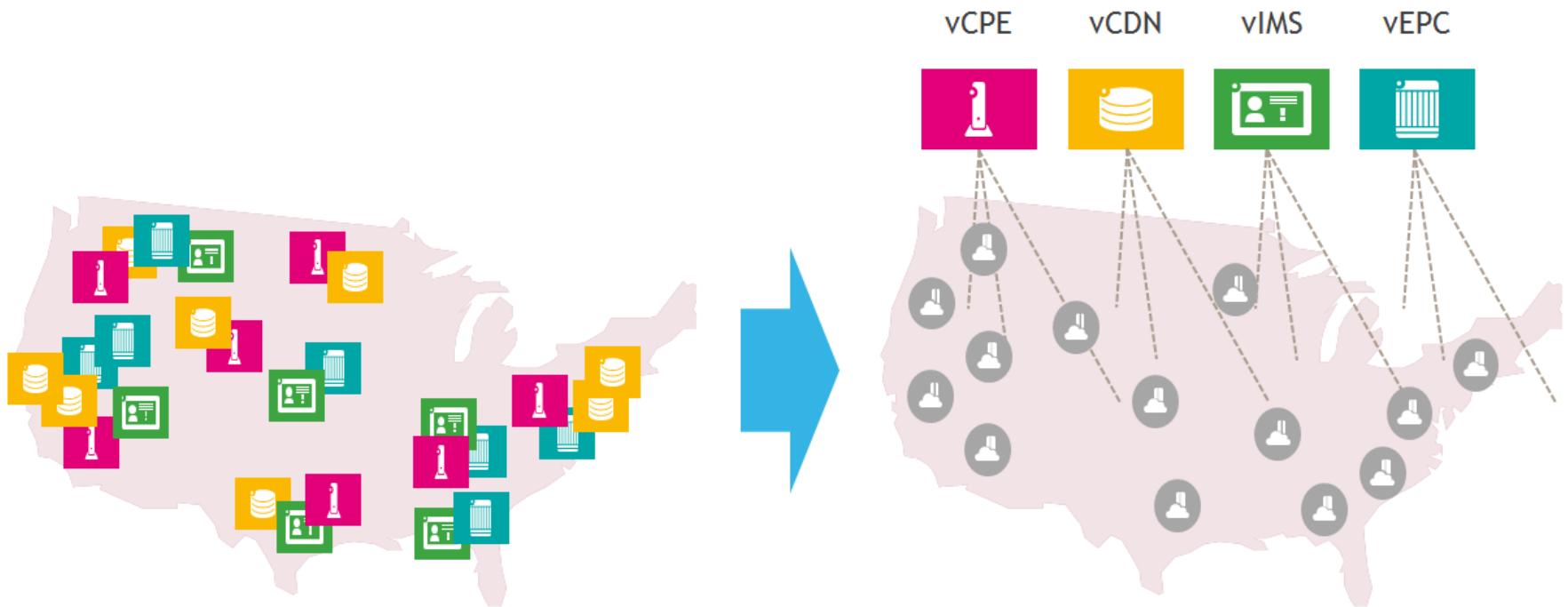


# Red Hat and ALU engagement in NFV



# NFV: What Is It All About?

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# NFV Requirements

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# What Makes CloudBand Unique?

1



AUTOMATED CLOUD  
INFRASTRUCTURE  
(CLOUD NODES)

2



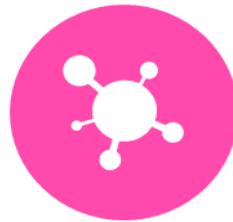
ORCHESTRATE  
DISTRIBUTED  
CLOUDS

3



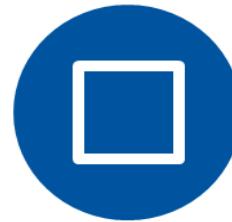
CARRIER PaaS

4



LEVERAGE THE  
NETWORK

5



BE OPEN AND  
MULTI-VENDOR

- PLUG AND PLAY
- COMMODITY HW AND  
OPENSOURCE

- ONE CLOUD
- POLICY DRIVEN PLACEMENT
- ANALYTICS

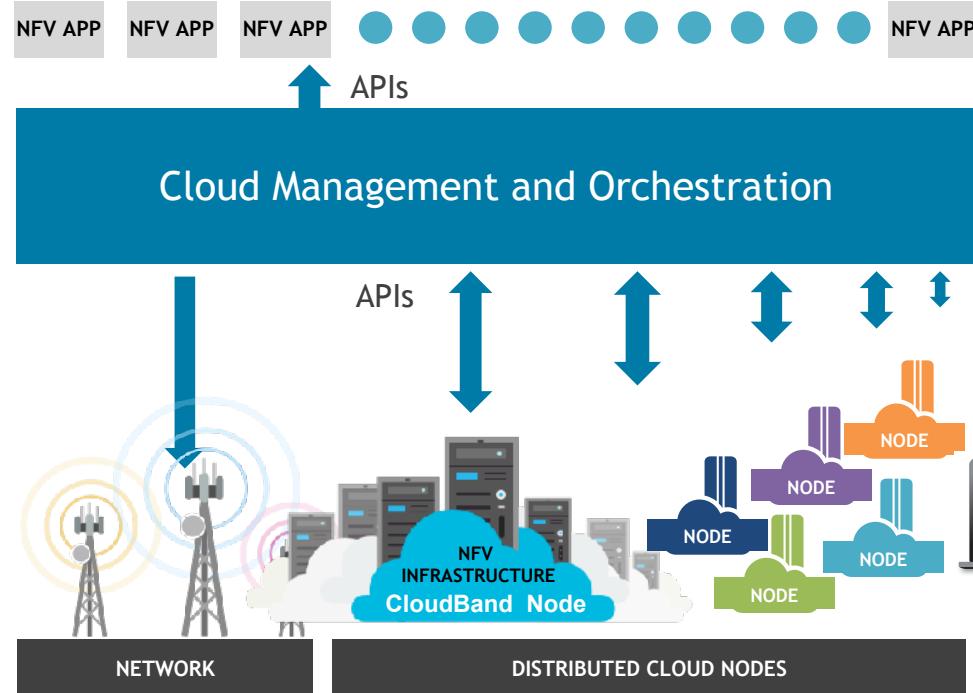
- LIFECYCLE MANAGEMENT
- DEPLOYMENT,  
SCALABILITY, HEALING,  
UPGRADES

- AUTOMATION
- CUSTOM TOPOLOGY
- LEVERAGE SDN

- SIMPLIFY INTEGRATION
- OPEN APIs
- COMMUNITY SPEED

## CLOUDBAND BRINGS IT ALL TOGETHER

# CloudBand NFV Platform



CLOUDBAND™ IS THE FIRST  
NFV PLATFORM  
INHERENTLY DESIGNED FOR CARRIER  
APPS

“Alcatel-Lucent’s CloudBand is the only full-scale NFV implementation that’s both public and has specific credibility with operators in my surveys.”

*Tom Nolle, CIMIcorp*

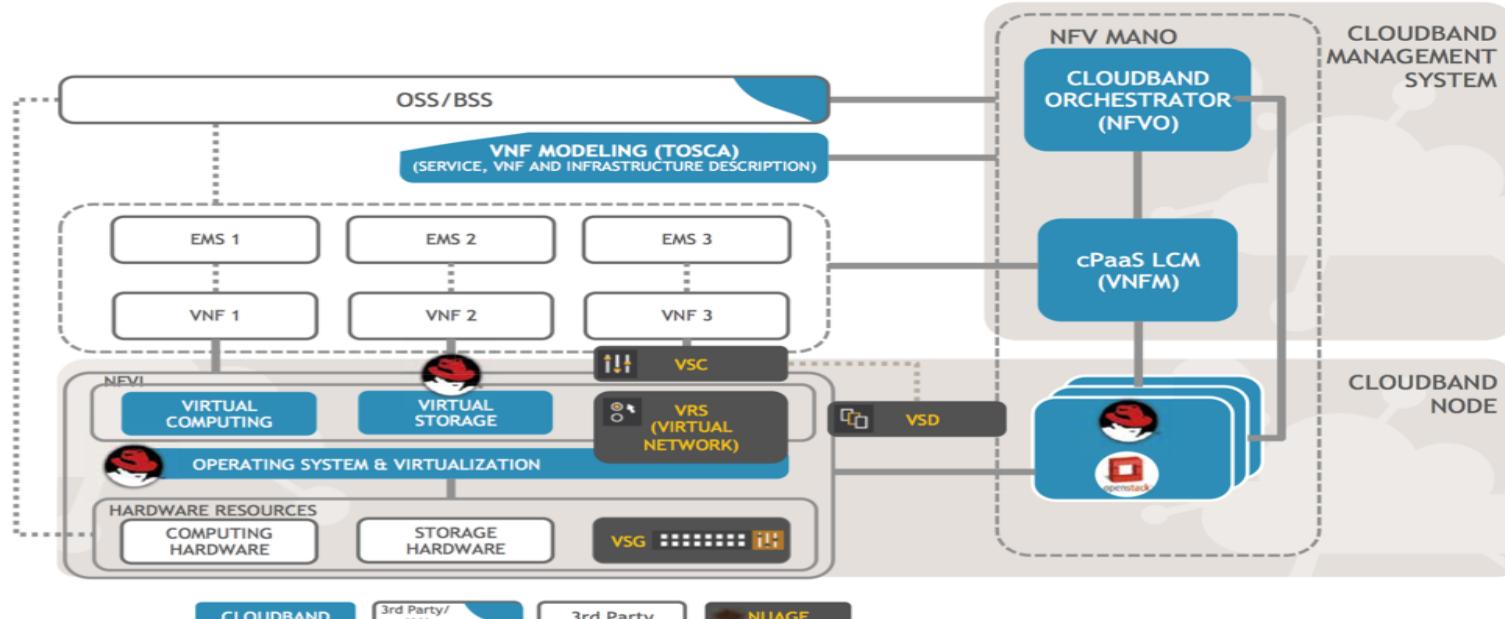
## CLOUDBAND MANAGEMENT SYSTEM

Orchestrates, automates and optimizes vNFs across distributed clouds and network

## CLOUDBAND NODE

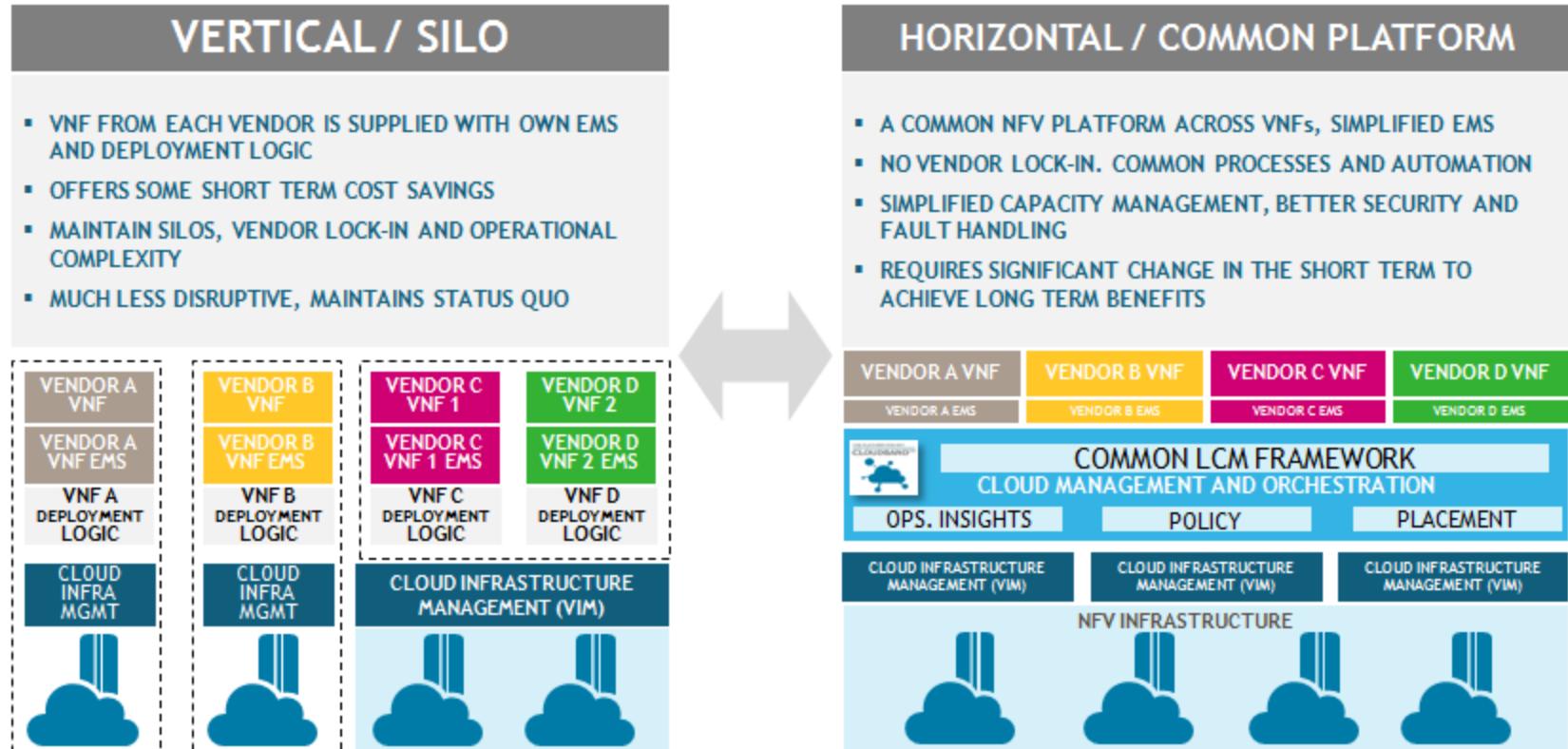
Pre-configured turnkey node that includes compute, storage and networking with software designed for remote operation

# Openness by Design



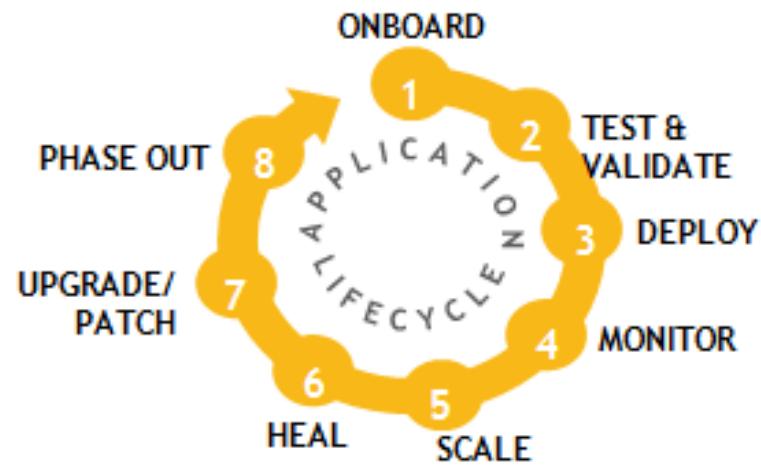
Cloudband with OpenStack as NFV Platform  
Joint White paper by Alcatel-Lucent & Red Hat

# Why an NFV Platform



# Virtual Network Function Life Cycle Management

- Using TOSCA and HOT
- Deployment, Scaling, Healing, Upgrade
- Abstract Business policies
- Distribution Awareness



# Infrastructure Orchestration in Action: Deploy

Example:

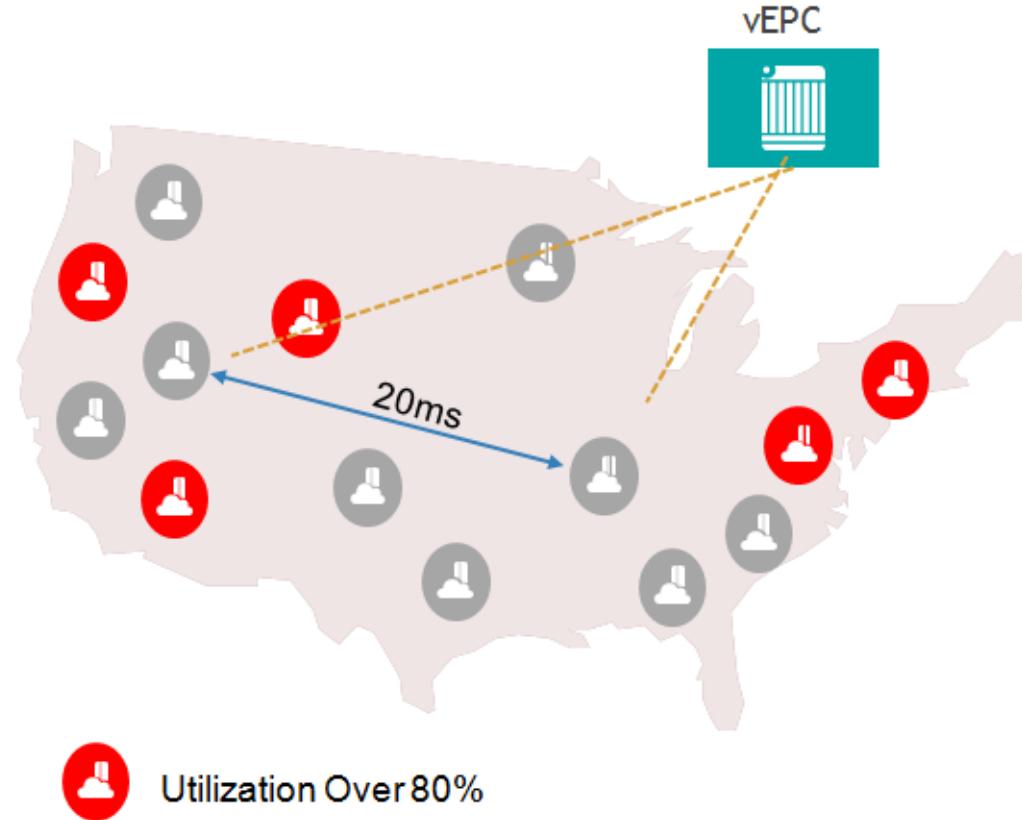
Deployment of an EPC Application

Policy:

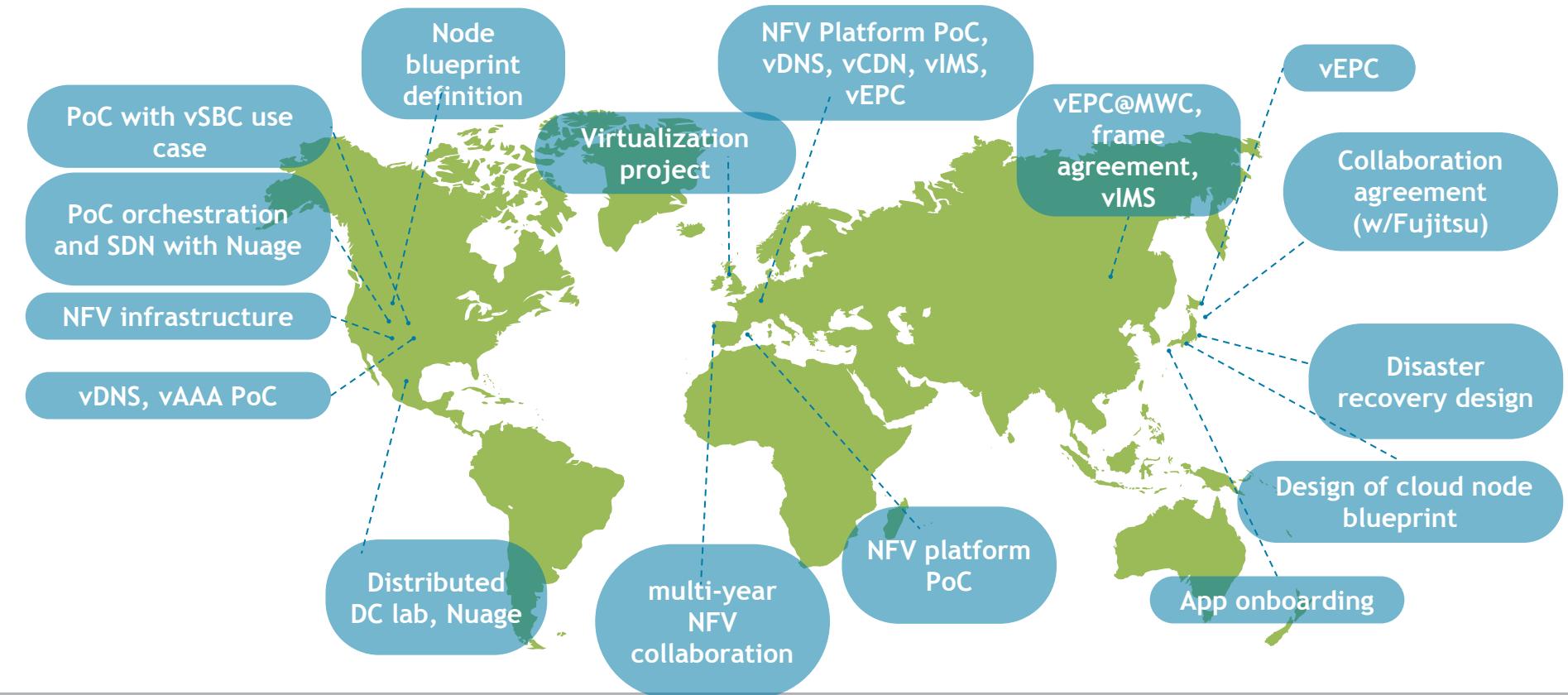
Geo redundant deployment

Geo Latency not to exceed 25ms

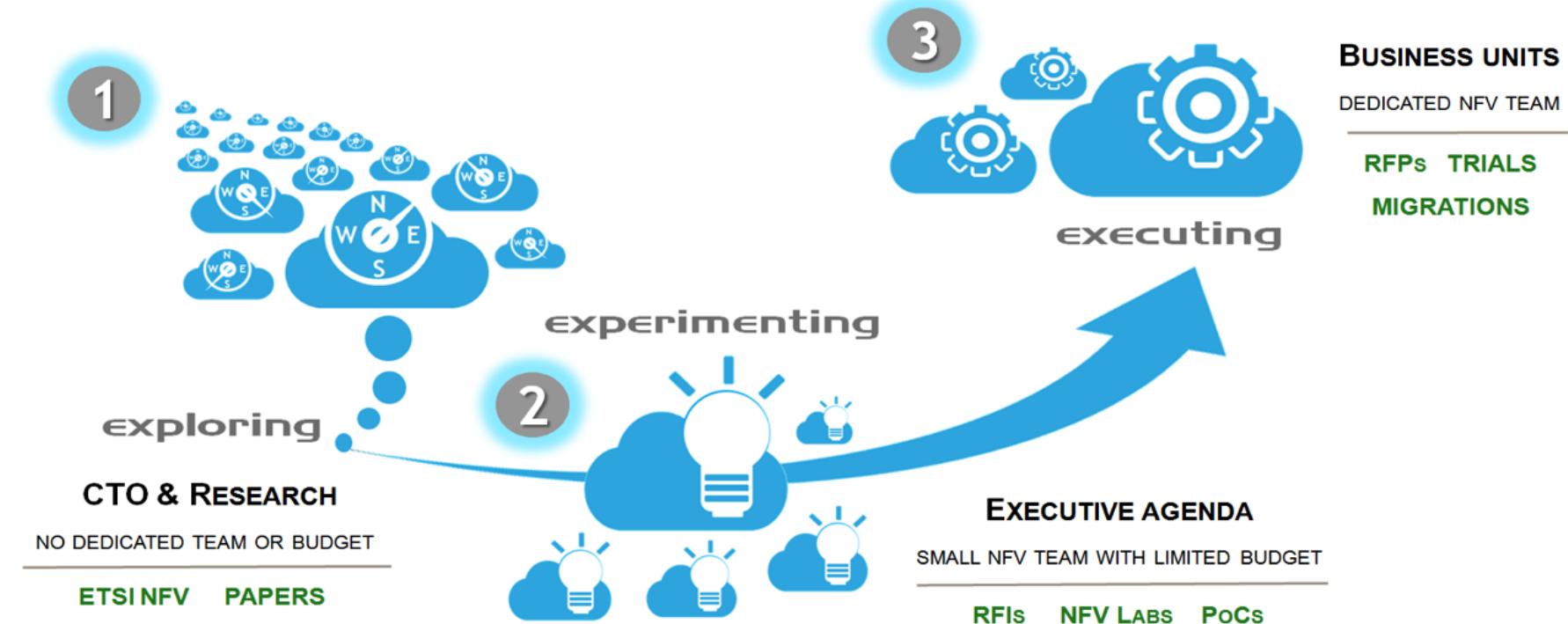
Infra utilization not to exceed 85%



# CloudBand WW Engagements



# NFV is in Motion



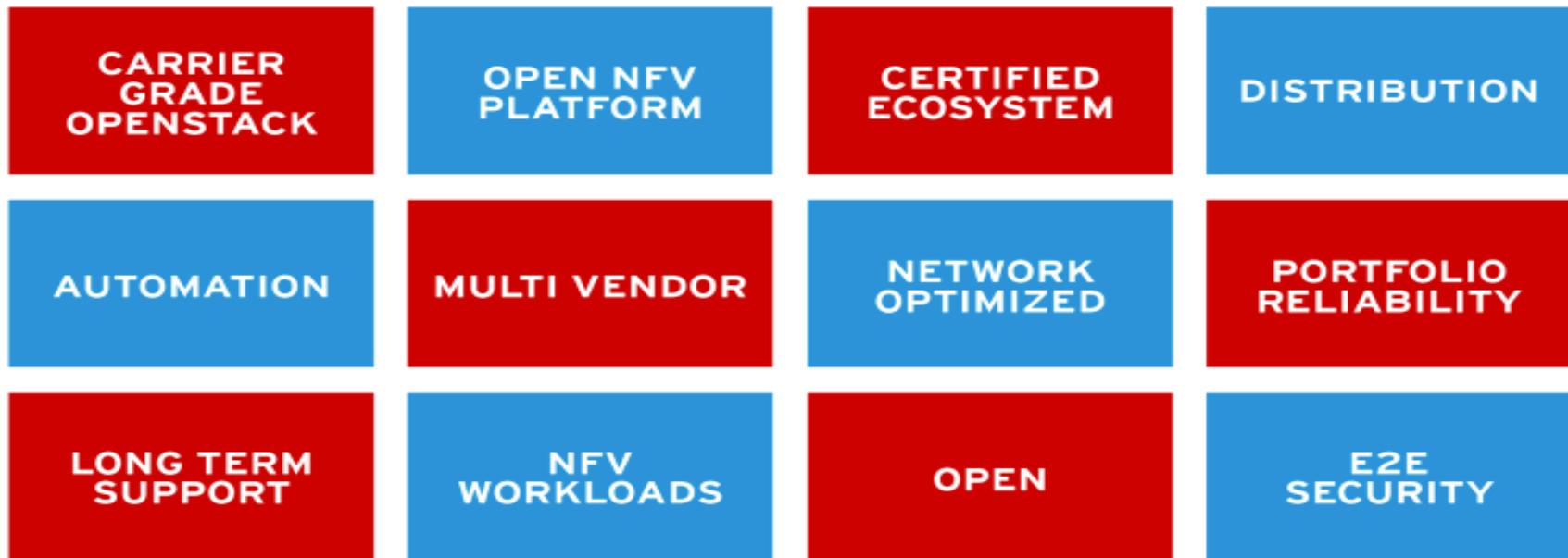
# Better Together: Leading NFV



redhat.



Alcatel-Lucent



# Red Hat Enterprise Linux OpenStack Platform - Roadmap

Nir Yechiel - Red Hat

Disruptive is productive



# Disclaimer

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This information is provided for discussion purposes only and is subject to change for any or no reason.

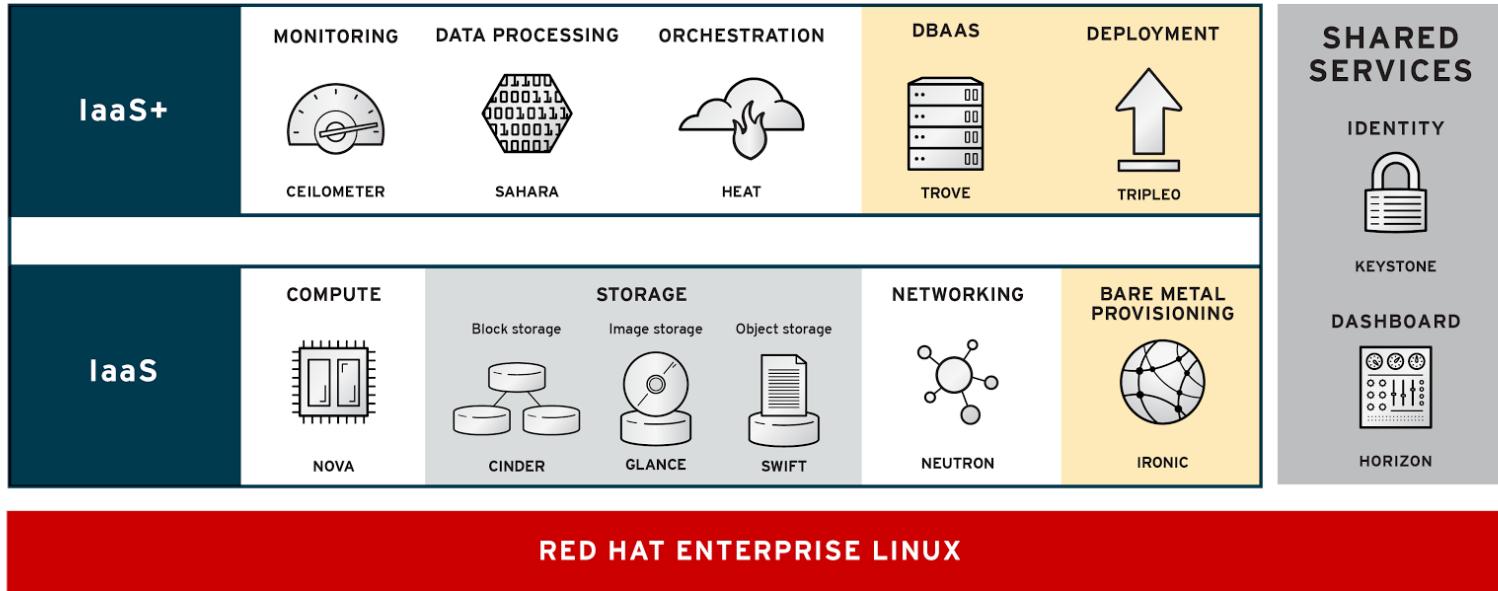
# RHEL OpenStack Platform Roadmap

- RHEL OSP 6 update
- A look into RHEL OSP 7
- Focus here is on Networking, Compute and other NFV-related features

# RHEL OSP 6 - New Services

- Based on OpenStack Juno
- Data processing (Sahara) fully supported
- Technology Preview of deployment projects
  - TripleO
  - Ironic
- Technology Preview of Database service (Trove)

# RHEL OpenStack Platform 6



= Tech preview

RHELOSP0012-C

# RHEL OSP 6 - Networking

- High Availability for Neutron routers via VRRP
  - Keeps the existing deployment layout with dedicated Network Nodes
  - Each logical router is translated into a VRRP group
  - Active routers are scheduled randomly between nodes
  - Built for ML2/Open vSwitch and supported with VLANs or overlay

# RHEL OSP 6 - Networking

- Distributed Virtual Routing (Tech Preview)
  - L3 routing and 1:1 NAT distributed to Compute nodes
  - Fundamentally changes the deployment architecture
  - Network Nodes are still required (L4-L7 services, SNAT)
  - Limited to ML2/Open vSwitch and overlays with I2-pop enabled

# RHEL OSP 6 - Networking

- IPv6 for tenant and provider networks
  - Provider network - SLAAC from upstream (physical) device
  - SLAAC and stateless/stateful DHCPv6 for tenant networks
    - Dnsmasq on DHCP namespace
    - radvd on router namespace

# RHEL OSP 6 - Networking

- SR-IOV ML2 driver
  - Allows a PCIe device to appear to be multiple separate devices
  - NIC vendor manually defined through vendor\_id:product\_id
  - Supported NICs inherited from RHEL

# RHEL OSP 6 - Compute

- Guest vCPU topology configuration
  - Defined in image properties and/or flavor
  - nodes/sockets/cores/threads
- Multiple instance vNICs on the same subnet
- Evacuation to a scheduled host
- Baremetal (Ironic) Technology Preview

# RHEL OSP 6 - Other

- Support for hardware-oriented monitoring
  - Monitoring of IPMI sensors via Ironic or standalone agent
- Improved Telemetry scalability
  - Horizontally scaled agent with alarm partitioning
- Improved SNMP handling
  - Batching of queries for related SNMP metrics
  - Simpler extending of existing metrics

# RHEL OSP 7 / Kilo - Networking

- VLAN trunking into a VM
- Permit unaddressed interfaces
- SR-IOV improvements
- DPDK enablement
- IPv6 infrastructure

# RHEL OSP 7 / Kilo - Compute

- Continuation of NUMA awareness work:
  - vCPU pinning
  - NUMA memory layout (including hugepages)
  - I/O device locality
- VIF driver for userspace vhost
- VirtIO multiqueue optimization



**Connection** multiplies  
possibility

**Learn more...**



GROW

# Resources

- Are you ready for OpenStack?
  - [redhat.com/openstack](http://redhat.com/openstack)
- Learn more about Red Hat Telco solutions
  - [redhat.com/technologies/industries/telecommunications](http://redhat.com/technologies/industries/telecommunications)
- ETSI NFV ISG
  - <http://www.etsi.org/technologies-clusters/technologies/nfv>
- OPNFV
  - <http://opnfv.org>

# Q&A

