



Dell EMC NFV Ready Bundle for Red Hat

Overview Presentation

January 2018



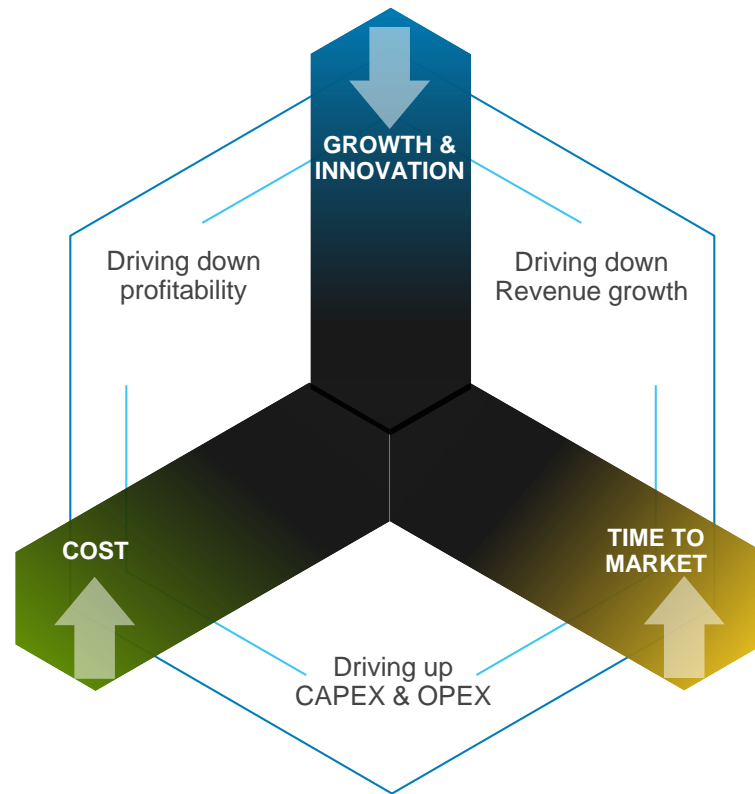
Business challenges for service providers

Growing CAPEX and OPEX for existing network infrastructure

Long time to market for new or updated services delays time to revenue

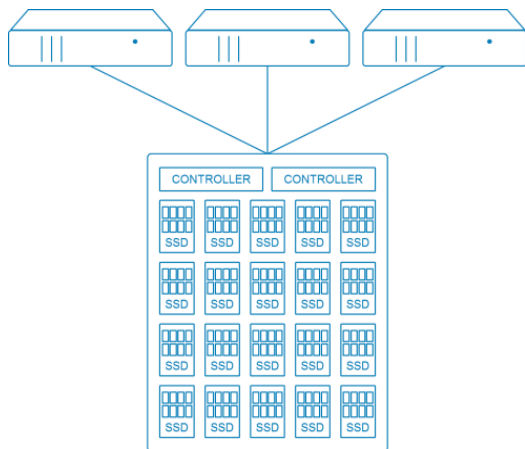
Price and margin erosion in existing businesses models

Slowing growth & innovation to capture new revenue opportunities

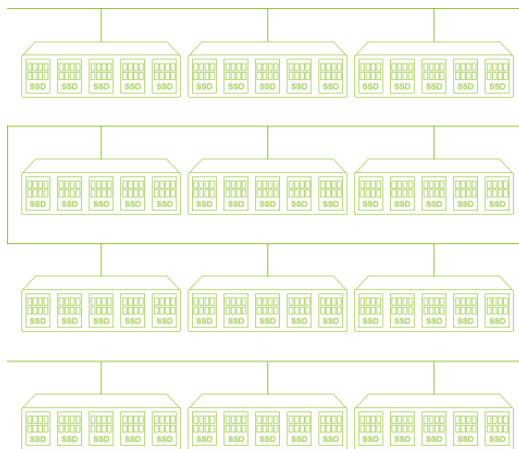


Need for Modern Service Provider Infrastructure

Traditional Data Center Workloads



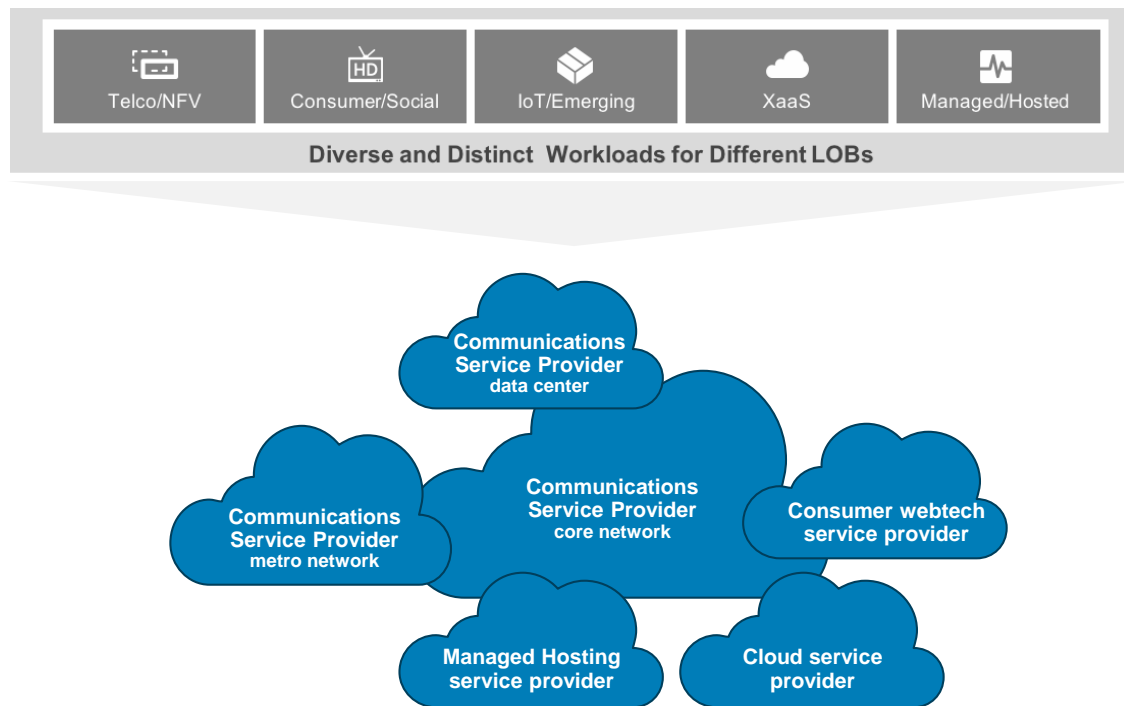
Cloud-Native Workloads



← **Modern Cloud Infrastructure** →

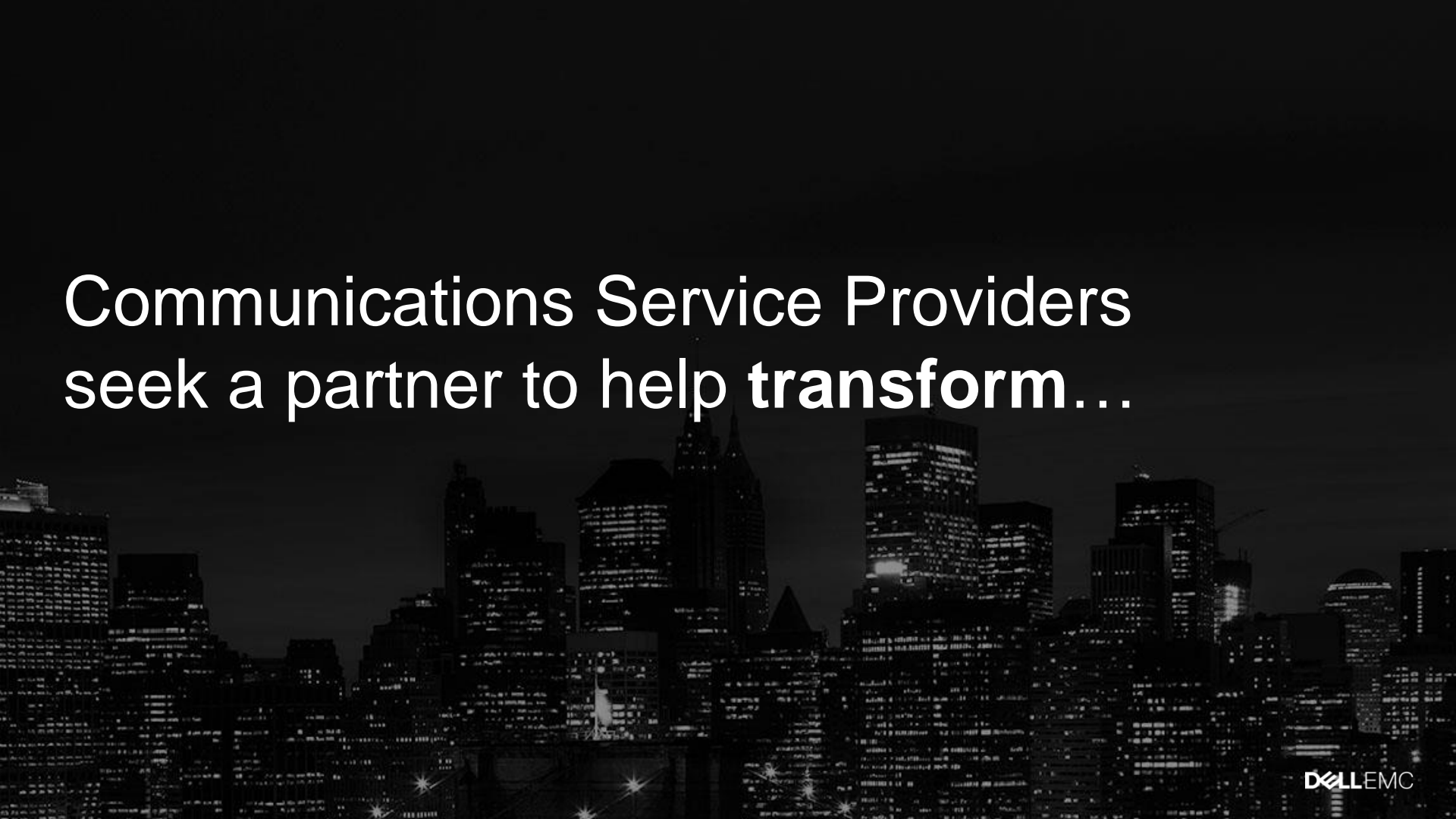
- Compute-centric
- Modular open architecture
- Support both client-server scale-up apps and distributed scale-out apps
- Infrastructure and application resiliency
- Enable both traditional IT operations and DevOps

Profile of the Modern Service Provider



The Modern Service Provider

- Network Functions Virtualization
- Cloud-Native Infrastructure
- Containerization
- Multi-Cloud Management
- Hybrid Cloud Management
- DevOps Management
- Modern Workspace Infrastructure



Communications Service Providers
seek a partner to help **transform...**

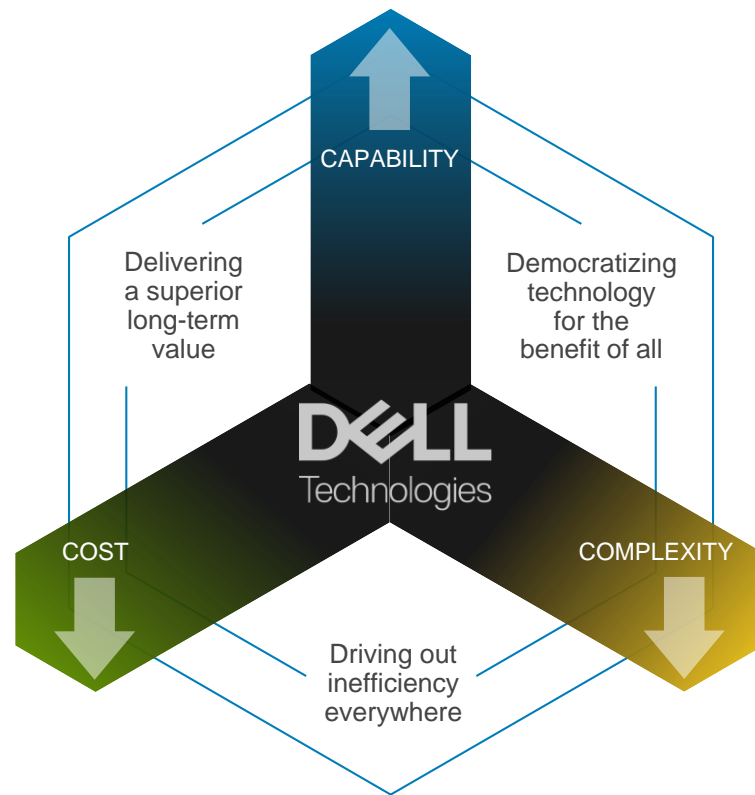
Dell Technologies is that partner



Technology powerhouse combining **industry-leading digital transformation capabilities** and **global expertise**

Solutions designed to work for your business

Delivering
cutting-edge
innovation to
service provider
customers globally



Our design philosophy



Open Architectures

Maximum choice, flexibility and investment protection, without forklift upgrades



Modern Portfolio

Modern systems and technologies no vested interest in legacy systems



Modular Systems

Open building blocks enabling mix-and-match interoperability up and down the stack

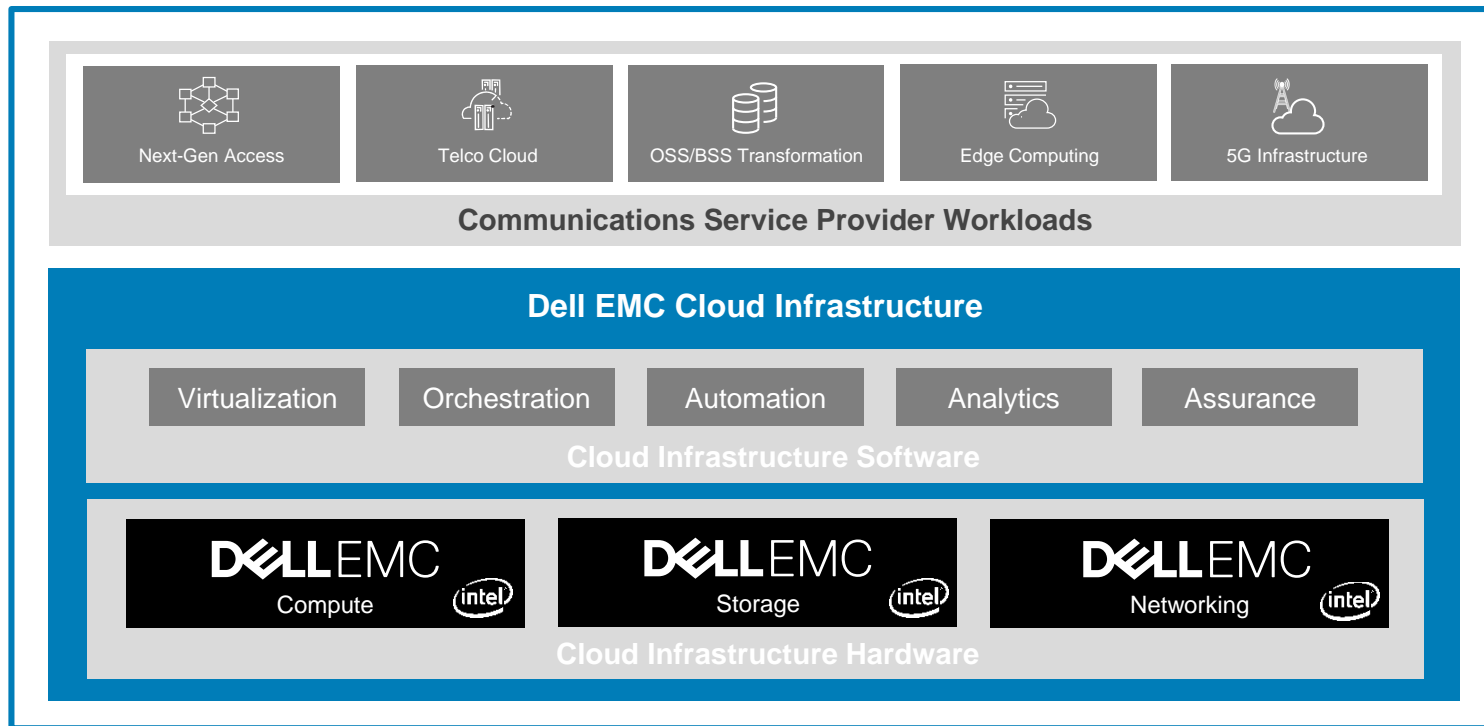


Scalable Solutions

Systems tailored to your workloads and designed to grow with your business

Service Provider Cloud Infrastructure and Use Cases

Dell EMC Cloud Infrastructure for Communications Service Providers



Compute-Centric | Software-Defined | Future-Ready

Dell EMC Priorities For Telecommunications Use Cases

Solutions



Next Generation
Access



Telco Cloud



OSS
Transformation



Network Edge



5G
Networks

SD-WAN,
vCPE/uCPE

NFV, SDN

SAS, Big Data,
Real-Time Visibility

CORD, MEC, MDC

C-RAN, CUPS,
Network Slicing

Dell EMC Ecosystem for Telecommunications Use Cases

Solutions and Ecosystem



Next Generation
Access



Telco Cloud



OSS
Transformation



Network Edge



5G
Networks

SD-WAN,
vCPE/uCPE

NFV, SDN

SAS, Big Data,
Real-Time Visibility

CORD, MEC, MDC

C-RAN, CUPS,
Network Slicing



velocloud



cloudera



Pivotal

ZALONI
THE DATA LAKE COMPANY

Saguna



vmware



WIND

Dell EMC Service Provider Solutions Value

Promise of virtualized architecture



Software based functions running on COTS – no vendor lock



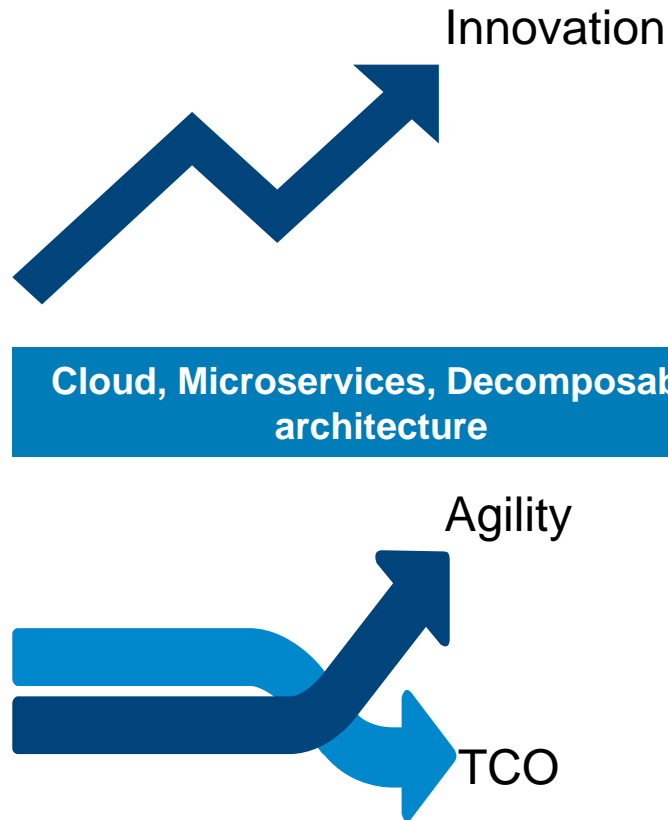
Automation, orchestration & analytics



Software Defined Data Center & Network, Network Function Virtualization

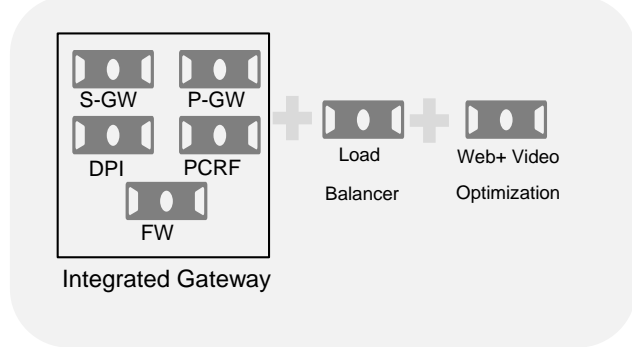


Cloud, Microservices, Decomposable architecture



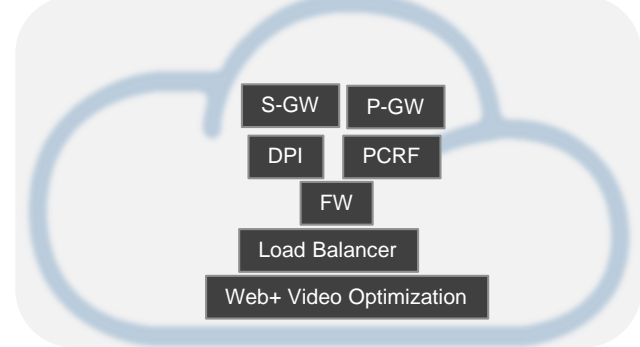
Industry response – paradigm shift

Traditional Architecture



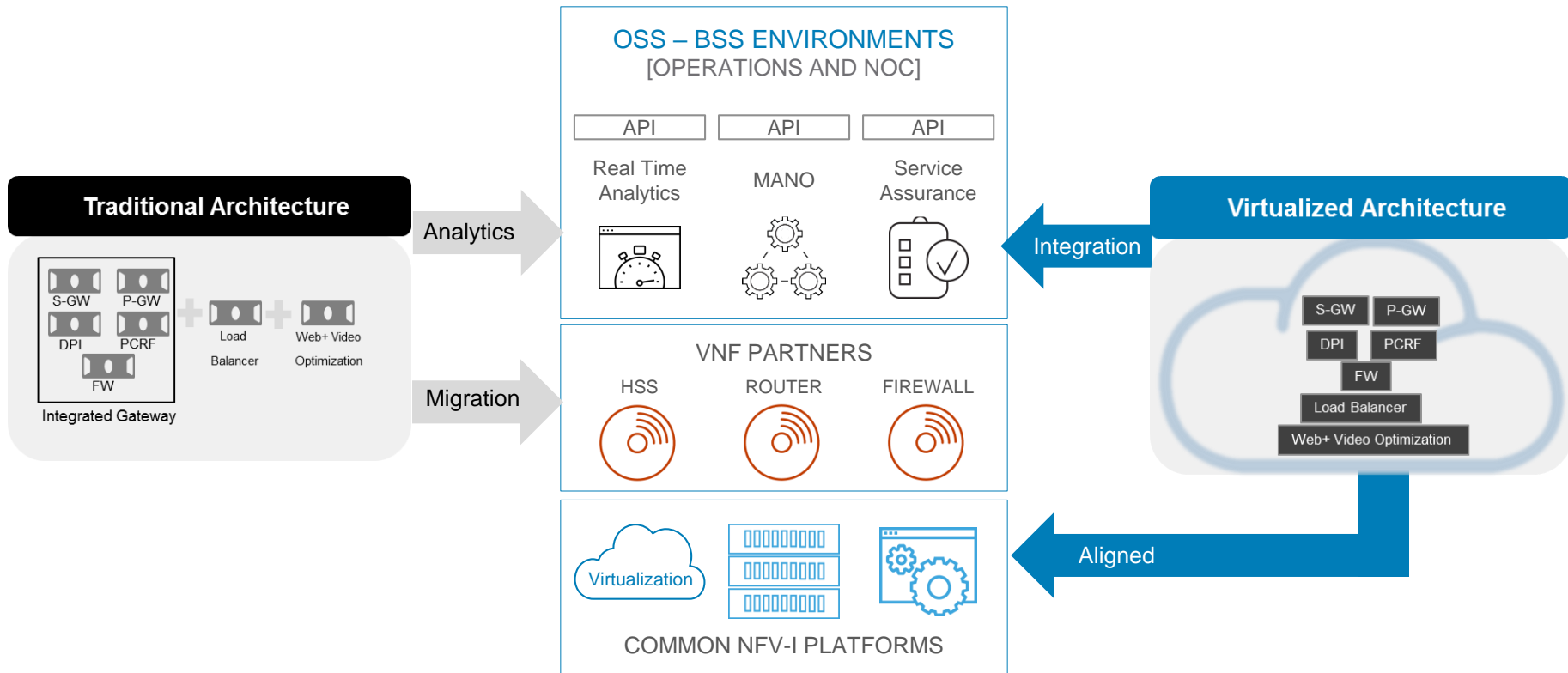
- Proprietary architecture & hardware
- Rigid scalability, over-provisioned
- Dedicated resources, geo dependency
- Restricted redundancy
- Multiple management planes

Virtualized Architecture



- Open architecture & COTS hardware
- Dynamic scalability, scale-up & scale-out
- Pooled resources, geo independence
- N-Way redundancy & Always-On availability
- Service chaining & orchestration

Overnight transformation is not realistic



Dell EMC Ready Solutions for Service Providers

Introducing Ready Solutions for Service Providers

CSP/Telco Ready Solutions

Telco
Cloud



Next-gen
Access



OSS/BSS
Transformation



Edge
Computing

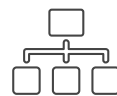


5G
Infrastructure



xSP Ready Solutions

Network
Services



Storage/Data
Protection/Big Data



Cloud
Services



Enterprise
Services

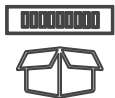


Security
Services



READY Nodes

Not just a bare server



- Hardware & software integrated on single node
- Tested & validated
- Deployment guides
- Sizing guides
- Factory or merge center configuration
- Accelerated quoting

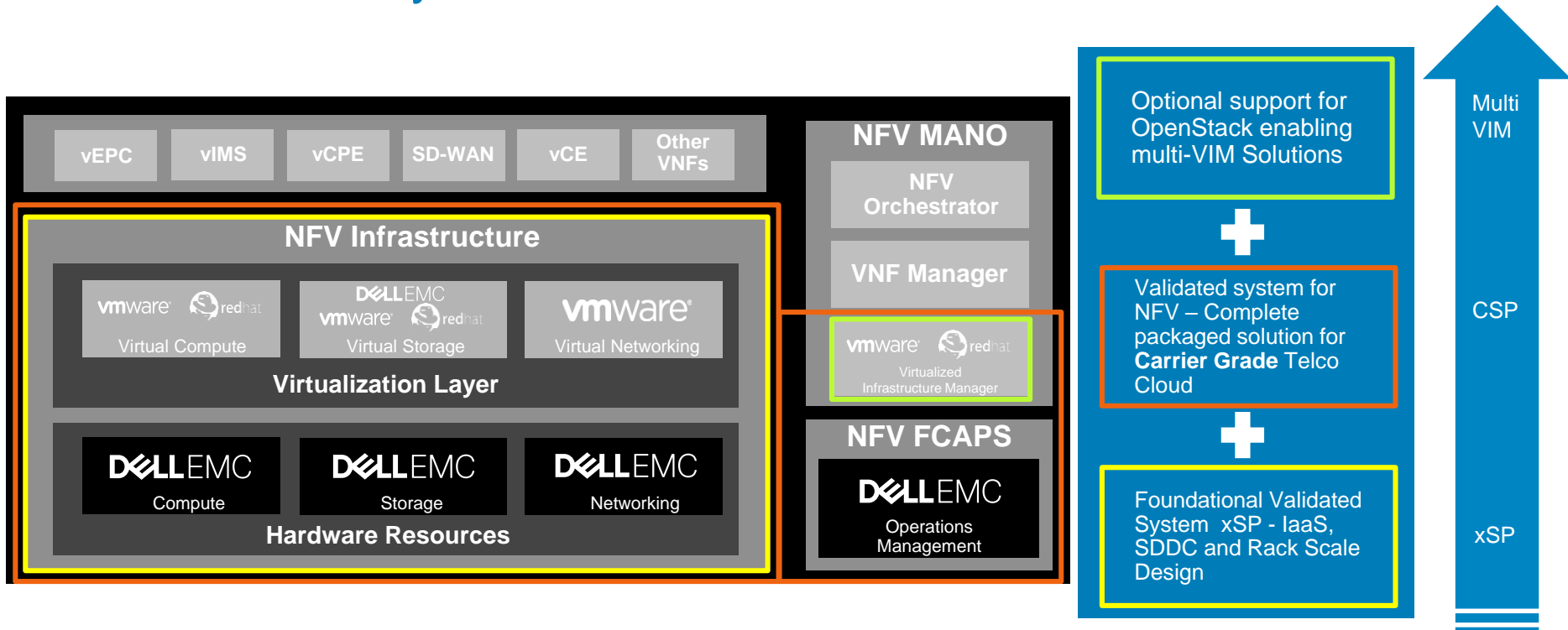
READY Bundles

Not just a bundle



- Hardware & software integrated across multiple nodes
- Tested & validated
- Deployment guides
- Sizing guides
- Deployment services
- Accelerated quoting
- Additional value adds (ie Benchmarking)

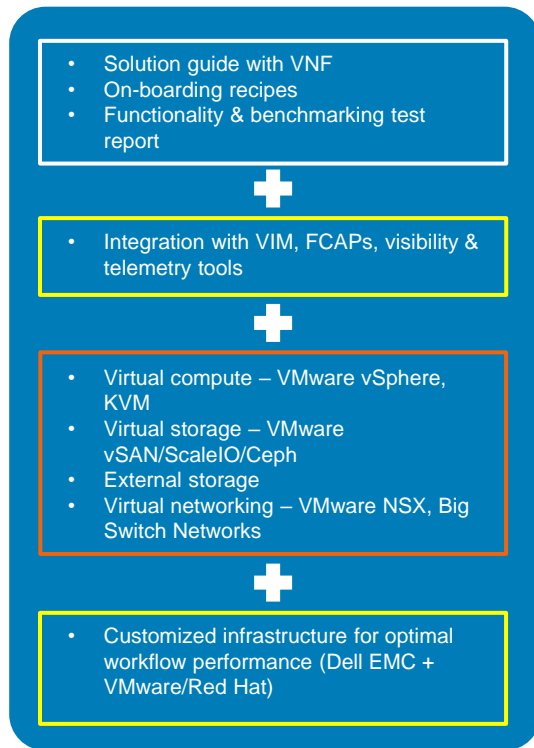
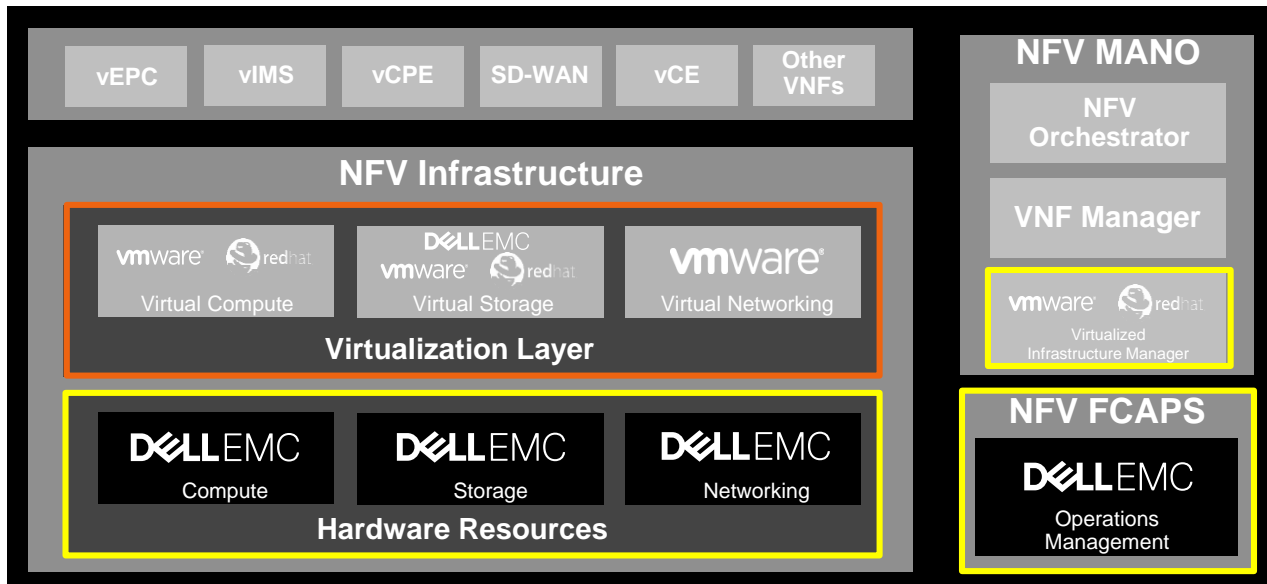
Dell EMC Ready Solutions for Service Providers Overview



Pre-validated system to facilitate adoption & reducing time to service

Ready Solutions for NFV

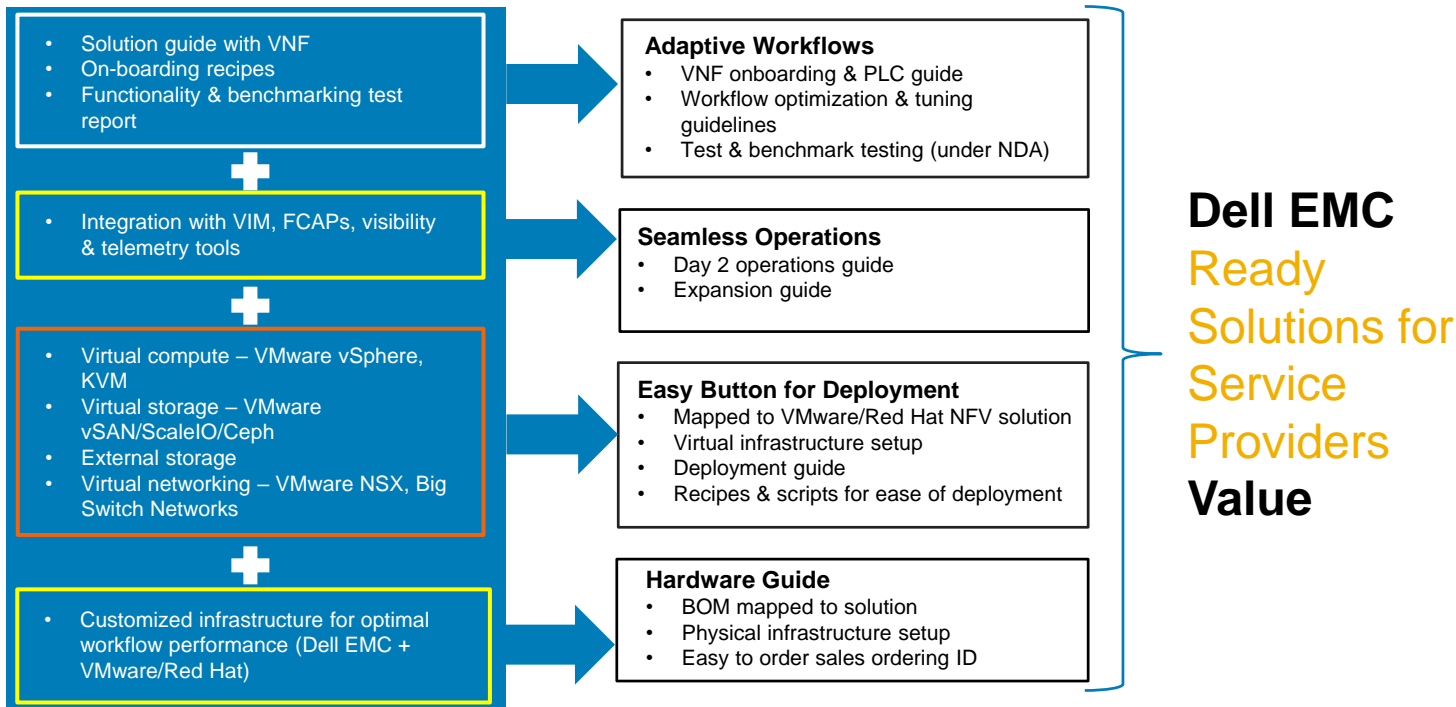
From palette to production with ease



Prescriptive but not restrictive, customizable to meet the needs of any workload

Ready Solutions for NFV

From palette to production with ease



Reduced upfront investment & increased agility enabling faster time to production

Dell EMC NFV Ready Bundle for Red Hat Overview

Dell EMC NFV Ready Bundle for Red Hat Overview

DELL EMC



Turnkey solution optimized to simplify and accelerate production deployments for CSPs

Pre-validated with Dell EMC cloud infrastructure hardware and Red Hat OpenStack Platform software, the Dell EMC NFV Ready Bundle for Red Hat reduces the time it takes to procure, validate, and integrate components.



The Dell EMC NFV Ready Bundle for Red Hat key values:

- Fully integrated and validated
- Enables CSPs to immediately launch their own services
- Reliability to meet SLAs
- Prescriptive yet customizable to meet workload needs of CSPs
- Complete solution orderable from Dell EMC
- Collaborative support for Red Hat products from Dell EMC

Dell EMC NFV Ready Bundle for Red Hat Components

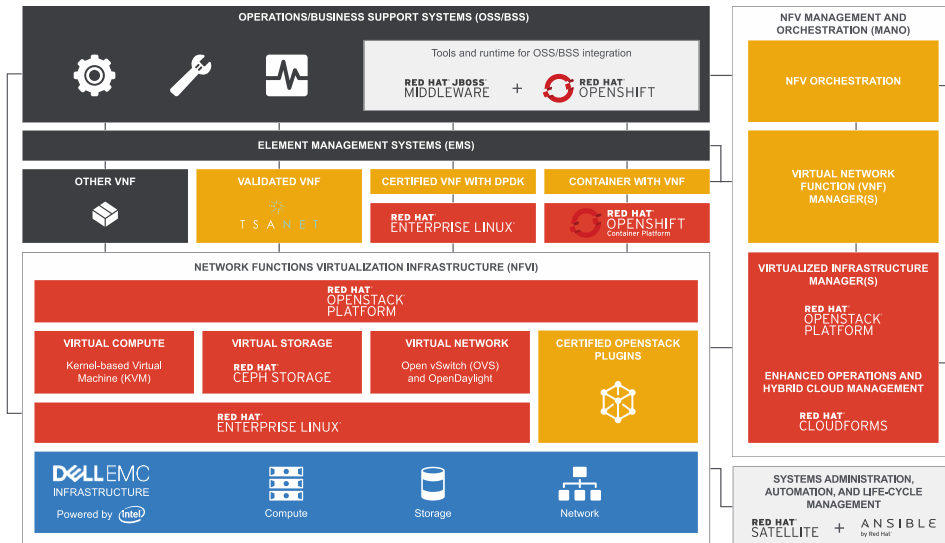


Red Hat OpenStack Platform

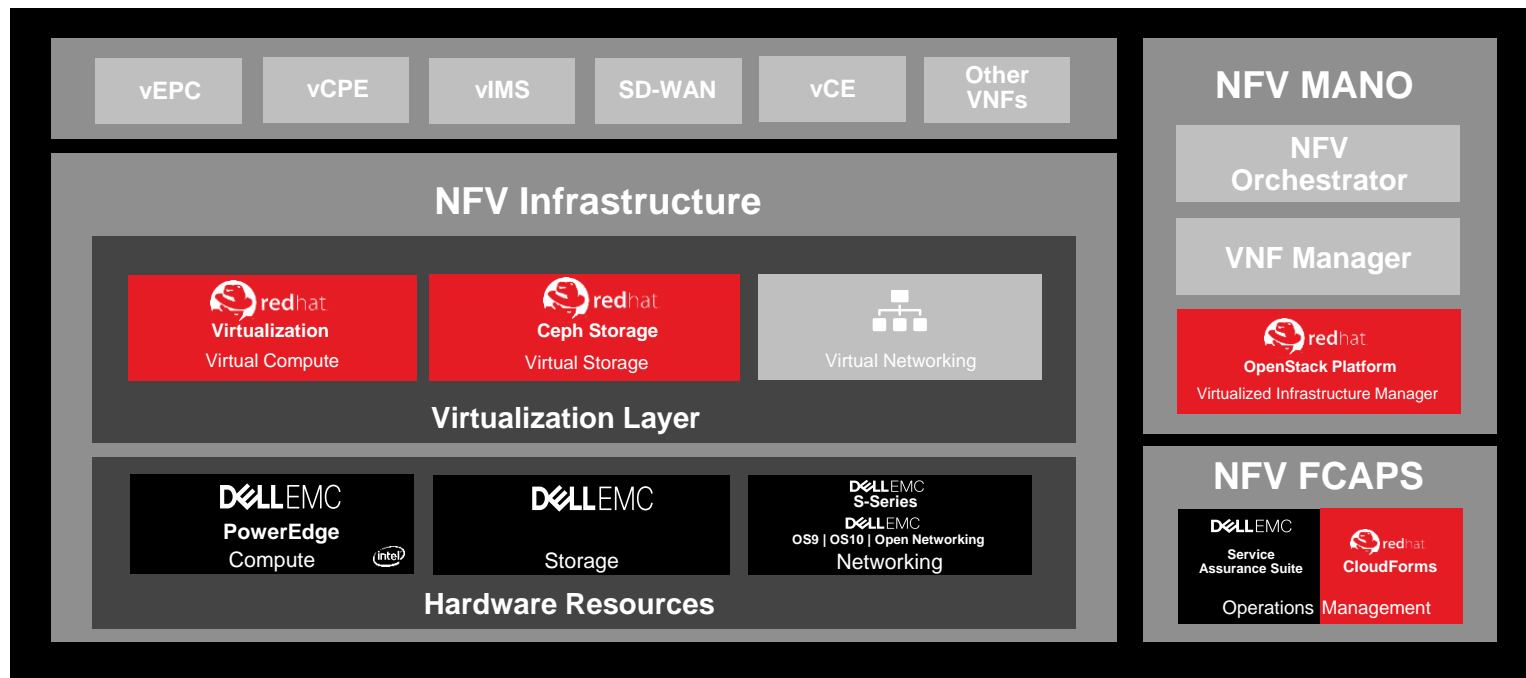
- Kernel-based Virtual Machine
- Red Hat Ceph Storage
- Open vSwitch and Neutron plugins
- Red Hat Enterprise Linux

Dell EMC infrastructure

- Dell EMC Networking
 - 4 x S6010-ON
 - 1 x S4048T-ON
- PowerEdge Rack Servers
 - 7 x R630/R730
 - 3 x R730XD



Dell EMC NFV Ready Bundle for Red Hat Shown in ETSI diagram



A proven, optimized NFV infrastructure solution for CSPs to deploy rapidly

Dell EMC NFV Ready Bundle for Red Hat Advantages



Ready-to-use solution

- Fully validated and tested by Dell EMC
- Decreases your deployment risk
- Enables faster deployment time



Ease of ordering

- Full bundle orderable from Dell EMC
- No need to buy software separately
- Eliminates hassle of ordering from two different vendors



Long lifecycle support

- Long-life Intel® Xeon® processors
- Reduces your investment risk
- Protects your investment for the long-haul



Collaborative support

- Dell EMC - Single point of contact for any Red Hat issues
- Provides peace of mind



World-class professional services

- Dell EMC and Red Hat professional services included
- Consulting, deployment, and design support
- Guides your deployment needs



Customizable solution

- Prescriptive solution yet not restrictive
- Customize to address your unique VNF workload requirements

Delivers exceptional scalability and agility in an integrated, optimized, and cost-effective package

Value of Dell EMC Service Provider Solutions



Software based functions running on COTS – no vendor lock
Open, standards based, carrier grade, modular
infrastructure – prescriptive to NFV workloads



Automation, orchestration & analytics

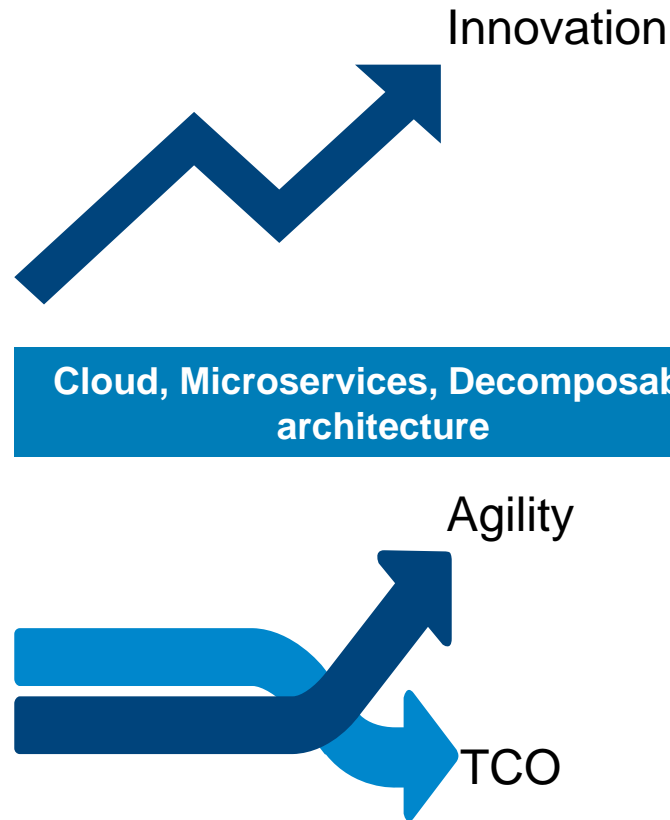
Multi-VIM orchestration with 360 visibility from
applications to infrastructure & everything in-between



Software Defined Data Center & Network, Network Function Virtualization



SDDC with NFV optimizations customized to Telco
workloads with complete solution support reducing
Time to Service



Dell EMC NFV Ready Bundle for Red Hat - Technical Details

Dell EMC NFV Ready Bundle for Red Hat Details

- Built on top of Jetstream – OpenStack Ready Bundle
- Optimized for Communication Service Providers use cases.
- 40Gbps switches
- Additional deployment-time capabilities
- Additional scripts-based EPA feature lifecycle management
 - HugePages
 - NUMA awareness and CPU pinning
 - SR-IOV enablement with active-active and active-standby HA
 - Validated SELinux policies for OpenStack components
 - NUMA for NICs
- Ease-of-use when configuring 10s or 100s of VNF projects
- Support for optional enablement of OVS-DPDK at deployment time
- Automated deployment of the solution with JetPack automation framework



Dell EMC NFV Ready
Bundle for Red Hat

10.0.1 Delivered Items

Hardware Support OS: Red Hat Enterprise Linux

- ✓ **Server:** (R630, R730, R730xd)
- ✓ **Networking:** (S6010, S4048T, Z9100)
- ✓ **NICs:** Intel X520,
- ✓ **Storage:** SDS w/ RH Ceph Storage (v2.4)

NFVI Features

- ✓ NFV Scripts integration to Jetpack
- ✓ Creation of Custom Role (Dell-NFV-Compute)
- ✓ Extension of “Ease of Use” for Security Group configuration
- ✓ OVS-DPDK (Stretch) - *Implemented*
- ✓ DPDK v2.6 (Stretch) - *Implemented*

Knowledge Mgmt Documentation

- ✓ DE NFV RB Solution Spec Sheet
- ✓ DE NFV RB Sales Ordering Guide
- ✓ DE NFV RB 411 Document

Validated Software

- ✓ Red Hat OSP 10 (*Jetstream 10.0.1*)
- ✓ Red Hat Enterprise Linux (v7.3)

Service Deliverables

- ✓ Knowledge Transfer Support of 10.0.1 Features
- ✓ Update to NFV Service documentation (*if needed*)

Technical Documentation

- ✓ DE NFV RB 10.0.1 Hardware Deployment Guide
- ✓ DE NFV RB NFV 10.0.1 OSPD Deployment Guide
- ✓ DE NFV RB 10.0.1 Reference Architecture
- ✓ DE NFV RB Release Notes
- ✓ DE NFV RB Ease of Use Guide
- ✓ DE NFV RB SR-IOV Guide

Same Names for these guides. IE –No Ready Bundle Changes.

Note: *Ease of Use & SR-IOV Guides updated based on completion of Stretch Goals features.*

Dell EMC NFV Ready Bundle for Red Hat Solution 10.0

- Hardware Specs:
 - Top-of-Rack Switch: S4048T
 - Leaf/spine Switches : Z9100, S6010
 - Solution Admin Host Node : R630/R730
 - Min RAM : 32 GB; Min Cores : 16
 - Controller Nodes : R630/R730
 - Min # of nodes : 3
 - Min RAM : 128GB; Min Cores : 20
 - Compute Nodes : R630/R730
 - Min # of nodes : 3
 - Min RAM : 128GB; Min Cores : 20
 - Storage Nodes : R730 XD
 - Min # of nodes : 3
 - Min RAM : 48GB; Min Cores : 20
- NFVi Software
 - Openstack (RHEL OSP 8.0)
 - Linux (RHEL 7.4), KVM, OVS
 - Dell EMC JetPack
 - Optional NFVi Enablement scripts

S4048T ToR



Z9100 Leaf(s)



VIM Node



Solution Admin Host



Controller nodes 1, 2, 3



Compute nodes 1, 2, 3



Storage nodes 1, 2, 3



Switches

Admin Nodes

Controller
Nodes

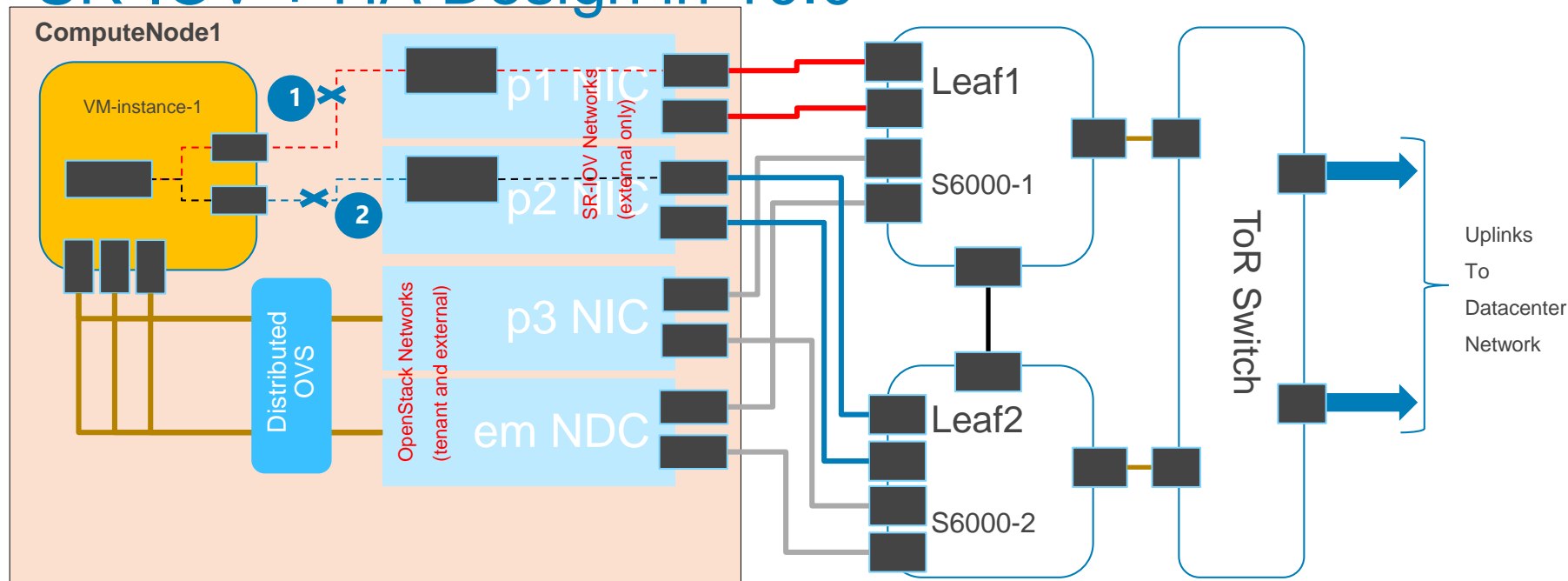
Compute
Nodes

Storage
Nodes

SR-IOV

- Each physical port (“PF” – physical function) can be “sliced” 64 ways (max)
- Each virtual slice is called a “VF” – virtual function
- B/W can be allocated per-VF, and guaranteed
- An unshared VF is then connected to a VM
- Without SR-IOV
 - All VMs share the PF, and
 - One VM might take all available b/w
- **SR-IOV Benefits**
 - **Each VM gets the b/w allocated to that VF**
 - **Distribution guarantees fairness across the pool of VMs and VFs**

SR-IOV + HA Design in 10.0



Withstands:

Physical port failure,
NIC failure,
Link failure,
Leaf switch failure

Linux VM HugePages

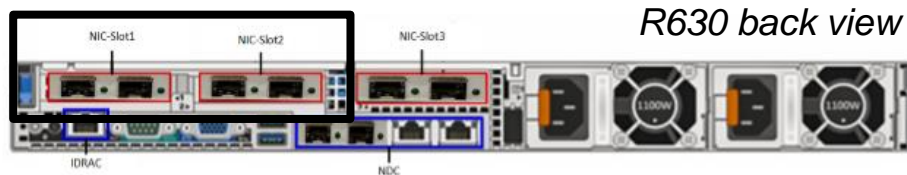
Huge pages can significantly increase performance, particularly for large memory and memory-intensive workloads.

- Red Hat Linux 7.3 has built in support for 4KB, 2MB, and 1GB pages
- Must be enabled at boot time of the Compute Node Host OS (i.e. in the Hypervisor)
- HugePages are allocated “transparently” – when a process requests large chunks of virtual memory, the OS automatically uses HugePages if they have been enabled
- Objectives
 - Simplicity: single script, all Compute Nodes covered
 - Single script used for both enablement & removal of HugePages setting
 - Graceful exit upon failure
- Steps:
 - › Controller node gathers information on Compute nodes
 - › Controller node runs a parameterized script to enable HugePages
 - › All Compute Nodes are reset to the same HugePages setting
 - › All Compute Nodes are rebooted after the setting
 - › An OpenStack Nova ‘flavor’ for VMs is created with HugePages setting
 - › If a failure occurs, all changes are reverted (option to remove flavor also provided)

NUMA / CPU Pinning – features

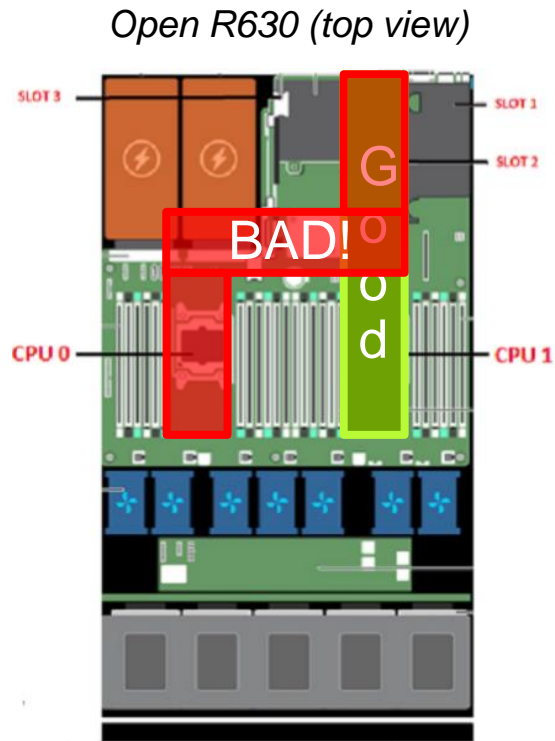
- **CPU pinning is the ability to run a specific virtual machine's virtual CPU on a specific physical CPU, in a specific host. With this setup, virtual machine instances are pinned to dedicated CPU cores, which enables smarter scheduling and therefore improves guest performance.**
- The KVM Hypervisor can be programmed to use knowledge of affinity
- Must be enabled at boot time of the Compute Node Host OS (i.e. in the Hypervisor)
- Once a VM is spawned, it will be restricted to a socket and attached resources
- Objectives
 - Simplicity: single script, all Compute Nodes covered
 - Single script used for both enablement & removal of NUMA / CPU pinning
 - Graceful exit upon failure
- Steps:
 - › Controller node gathers information on Compute nodes
 - › Controller node runs a parameterized script to enable NUMA / CPU Pinning
 - › All Compute Nodes are reset to the same NUMA / CPU Pinning parameters
 - › All Compute Nodes are rebooted after the setting
 - › An OpenStack Nova 'flavor' for VMs is created with NUMA / CPU Pinning parameters
 - › If a failure occurs, all changes are reverted (option to remove flavor also provided)

NIC Alignment feature



R630 back view

- A VM Instance *pinned down* in CPU 1, and assigned networks from Slot 1 or Slot 2 NICs is **GOOD!**
- A VM Instance *pinned down* in CPU 0, and assigned networks from Slot 1 or Slot 2 NICs is **BAD!**
 - Adds approximately 80 CPU cycle latency *per packet!*
- 10.0 SR-IOV networks are only available from NIC Slots 1 & 2
- The NIC Alignment feature is made available using *extended enable_numa* and *enable_sriov* capabilities



Open R630 (top view)

Figure 10: Dell EMC R630 motherboard

IPv6 addressing for Tenant Networks

Background

- The world has run out of IPv4 address space
- No. of devices that need IP addressing is ever-increasing
 - 6B+ already here
 - IoT (“Internet of Things”) will lead the next explosion of devices
- Everything will be a server and a client
- **Need:** Dell NFV clients & partners need to start using IPv6 in their VNF PoC

IPv6 Addressing in NFV Ready Bundle:

- Tenant VMs are on connected by a VLAN, together implement one or more VNF “service function” chains
- This features enabled the VMs on a VLAN to communicate using IPv6 addressing
- Wave support – deployment guide and validated support

SELinux - Features

- SELinux = Security-Enhanced Linux
- Was developed by the NSA, and donated to the community. Now under open-source community manages and maintains it.
- Implements “role-based access control” (RBAC) model of security
- Elements of SELinux
 - Linux kernel enhancements
 - File system enhancements
 - User and process roles
 - Execution contexts
 - Policies: rules of the type “**who** can access/write/execute **what**, and **when**”
- Policies are built into the kernel – no way to bypass once **enforcement** is turned on

SELinux in Dell NFV 6.0 Solution

- Protect OpenStack Components from each other
- Carefully **restrict** the actions that a component can take – exclude everything that is unnecessary for the normal functioning of a component

Why? A hacker cannot “make” a component do things that it’s not supposed to do

(Validation test 1)

- Further, **enforce** the restrictions even if a component is replaced by a **malicious plant**

Thus, a malicious replacement of a valid component is still futile

(Validation test 2)

- SELinux is enabled by default in NFV 5.0; No special action needed.
- OpenStack components protected: Glance, HAProxy, KeepAlive, Keystone, MongoDB, MySQL, Neutron, Nova, OVS, RabbitMQ, Redis, Swift

Detailed Tech Guide Library

All technical documents are maintained on Dell TechCenter:
http://en.community.dell.com/techcenter/service_provider_solutions/w/wiki/12377.dell-emc-nfv-ready-bundle-for-red-hat

Extensive, validated documentation covering:

- Pre-designed architectures
- Deployment methodologies and automation for hardware and software
- Software upgrade and update methodologies and automation
- Scaling out, i.e. adding/removing compute and storage nodes
- Value-added features and extensions, including enablement of SR-IOV, Huge Pages, NUMA, NIC Alignment, etc.

Dell EMC NFV Ready Bundle for Red Hat

SERVICE PROVIDER SOLUTIONS - WWK

The Dell EMC NFV Ready Bundle for Red Hat is a turnkey solution optimized to simplify and accelerate production deployments. With this solution, Dell EMC has built a fully integrated and validated solution that enables service providers to immediately launch their own services on top of this Network Function Virtualization (NFV) platform, minimizing, if not eliminating, the need to apply engineering resources to develop their own infrastructure.

The Dell EMC NFV Ready Bundle for Red Hat combines hardware, software, and Dell EMC engineering and is designed to create a more flexible, scalable, and agile platform for CSPs. It includes open standards-based Dell EMC cloud infrastructure hardware (compute, networking) and Red Hat OpenStack Platform.

Solutions Brief

[Dell EMC NFV Ready Bundle for Red Hat Solution Brief](#)

[Solution Brief for NEXT GENERATION ACCESS SOLUTION WITH DELL EMC, REDHAT AND VERSA NETWORKS](#)

Spec Sheet

[Dell EMC NFV Ready Bundle for Red Hat Spec Sheet](#)

[Dell EMC NFV Ready Bundle for Red Hat Release 10.0](#)

[Dell EMC Red Hat NFV Solution OSP Guide](#)

[Dell EMC Red Hat NFV Solution Auto-Deploy Guide](#)

[Dell EMC Red Hat NFV Solution Ease of Use User Guide](#)

[Dell EMC Red Hat NFV Solution Hardware Deployment Guide](#)

[Dell EMC Red Hat NFV Solution RA](#)

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[Dell EMC NFV Ready Bundle for VMware](#)

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Let us be your partner for the **future...**



Take the next steps – with Dell EMC

Foundation for the Modern Service Provider

**Start
today**

Engage with our executives & engineers
Request a workshop and technical deep-dive
Customize your own proof-of concept

DELL EMC