

Dell Networking: **The OPEN NETWORKING Revolution**

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Mayo 2015



The Dell difference



The forces of cloud, big data, mobile and security are changing the way people live, businesses operate and the world works, just as the PC did. **Now it's time to do what Dell does best—make these innovations simpler, more affordable and more accessible...**

*Michael Dell
September 2013*



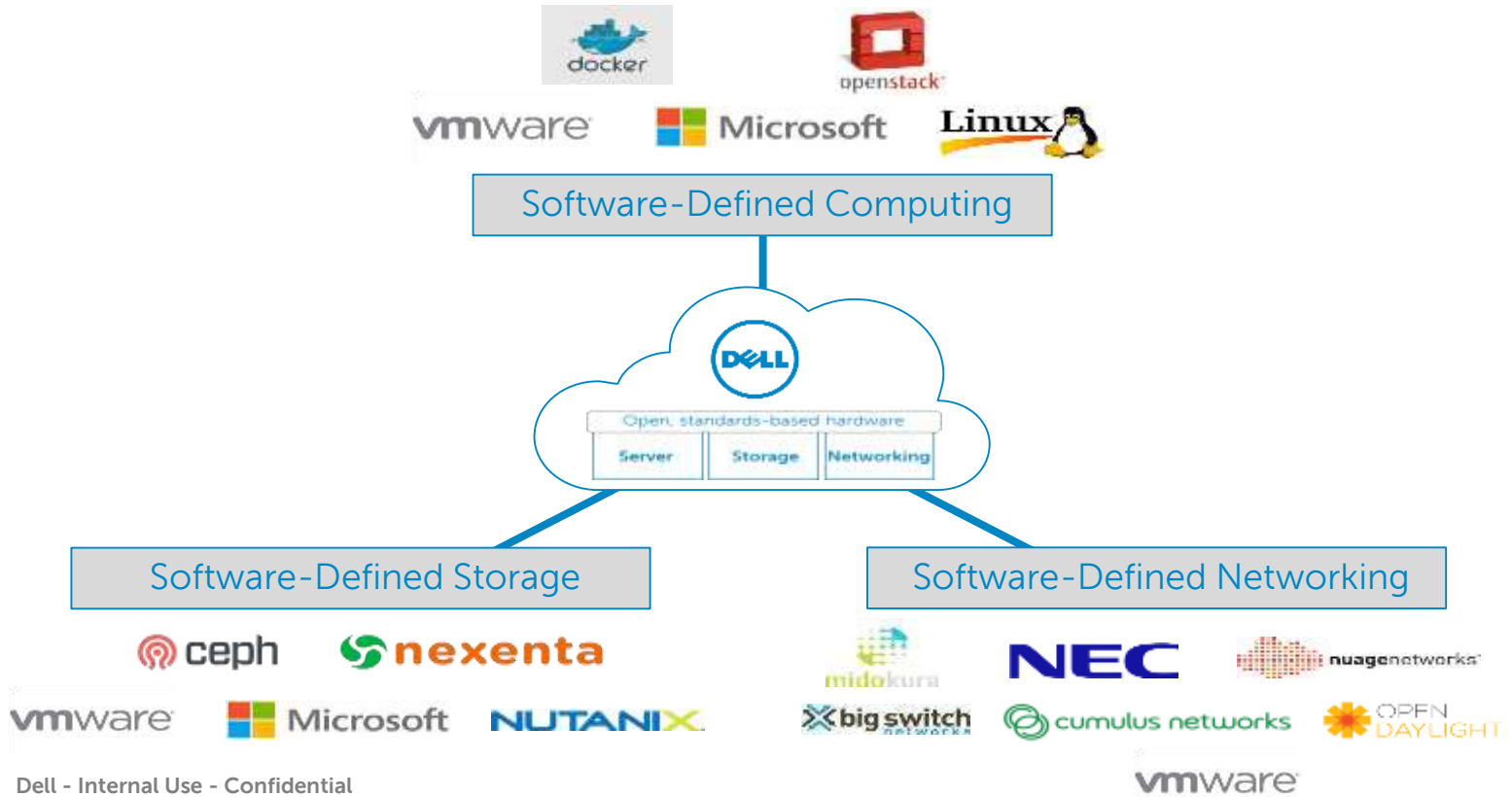
Making technology more accessible

Giving organizations of any size **the power to do more**



Dell enabling the Future Ready Enterprise

Workload ready + virtual infrastructure ready + software-defined & cloud ready



Why SDx - Agility & Economics of Delivering IAAS

Deploy Apps in Minutes



- Enables a level of **agility and flexibility** never before seen in IT
- Enables **policy-driven provisioning** of all infrastructure resources to meet application needs
- **Dynamically allocate** existing HW resources to meet current needs

Change the Economics in IT



- **Reduces OPEX** by dramatically simplifying management and centralizing control
- **Reduces CAPEX** by removing need for expensive specialized HW
- **Increase efficiency** by higher utilization of existing HW resources

Respond to Real- time Business Needs



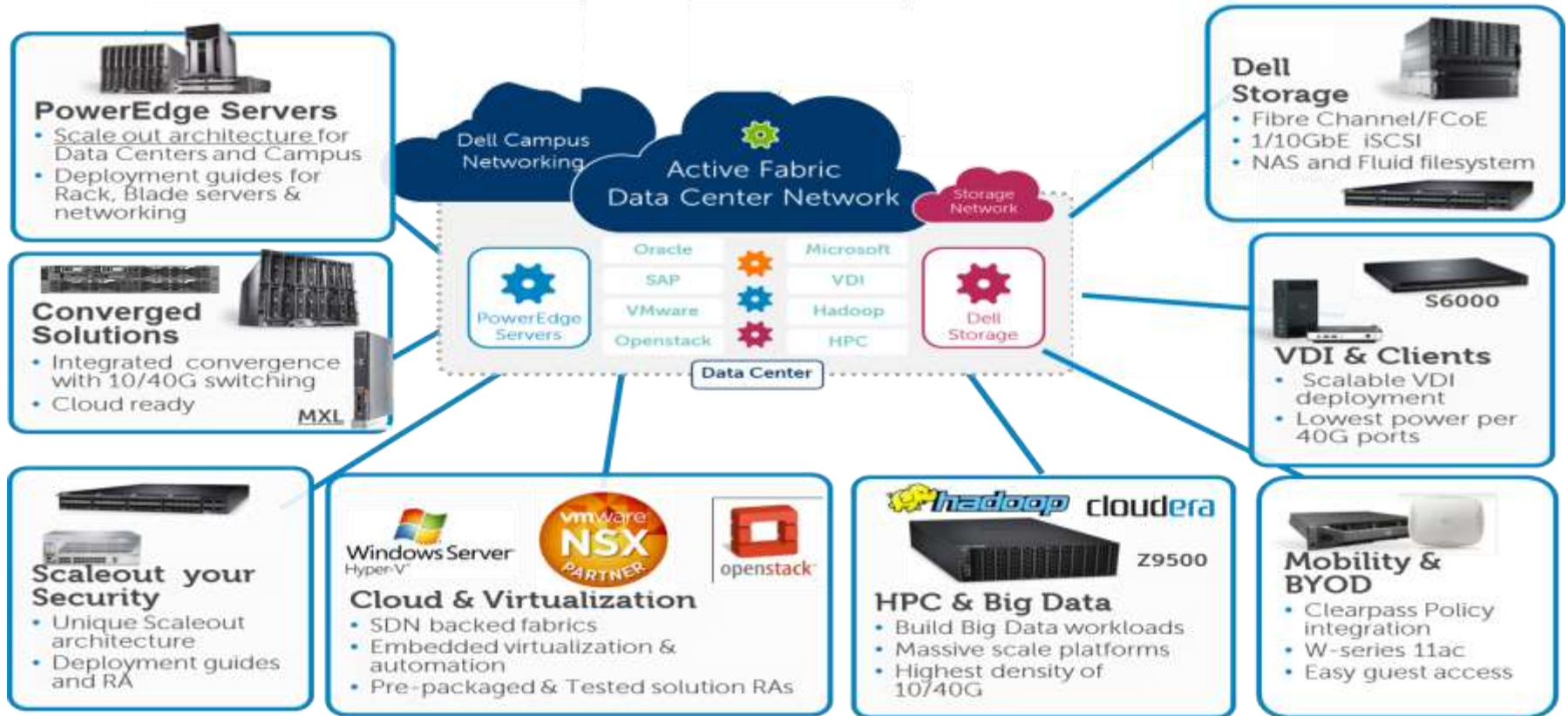
- **Programmable interfaces** makes it easy to control & scale through automation
- **Addresses unpredictable growth** by dynamically repurposing existing HW
- **Auto-scale (up, down or out)** by plugging in more hardware

Dell Networking

Modernize & transform your
network



Dell solutions enabled by Dell Networking



Dell Networking

The Open Networking
Revolution



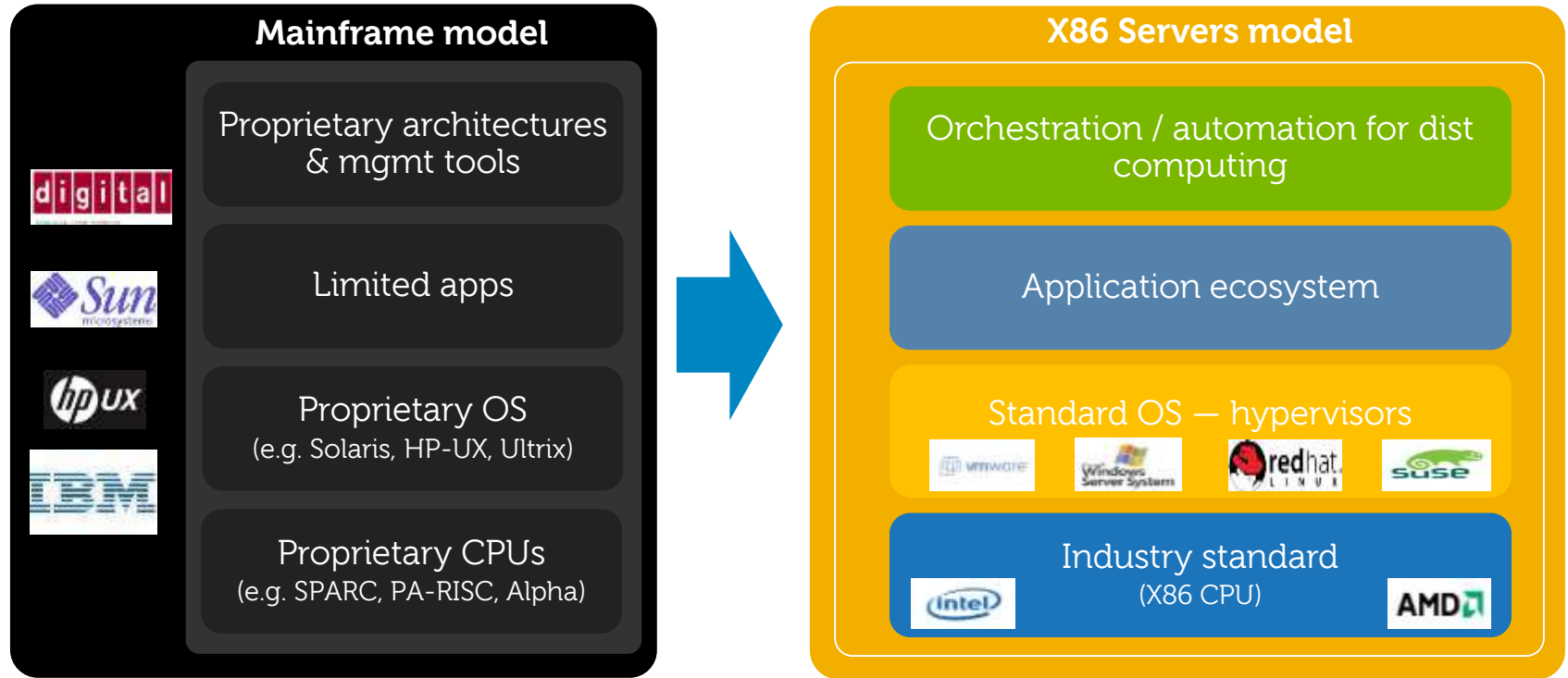
Gartner, Data Center report 2015

"Dell has been the most-innovative and most-disruptive mainstream data center networking vendor in the market over the past 12 months..." Combined with continued advances in the data center portfolio (high-performance, fixed form factor switches and integrated blade switches), Dell now offers a compelling alternative for many data center use cases."



Compute paradigm shift

How the disaggregated server model changed the landscape



Now: Networking paradigm shift

Traditional networking

Proprietary architectures
& mgmt tools

Hundreds of protocols

Proprietary networking
OS
(e.g., Cisco IOS, Juniper OS)

Proprietary ASICs



Future of networking

Standard orchestration & automation tools

Optional 3rd party SDN/NVO controller

Any networking OS

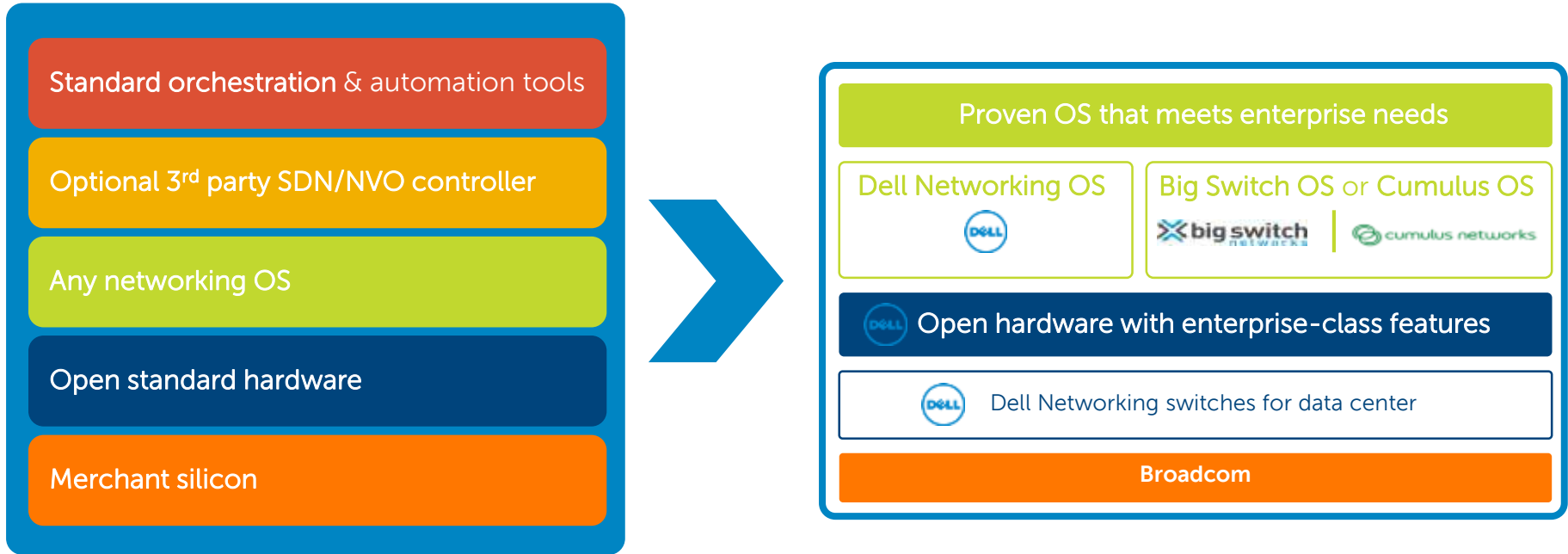
Open standard hardware

Merchant silicon

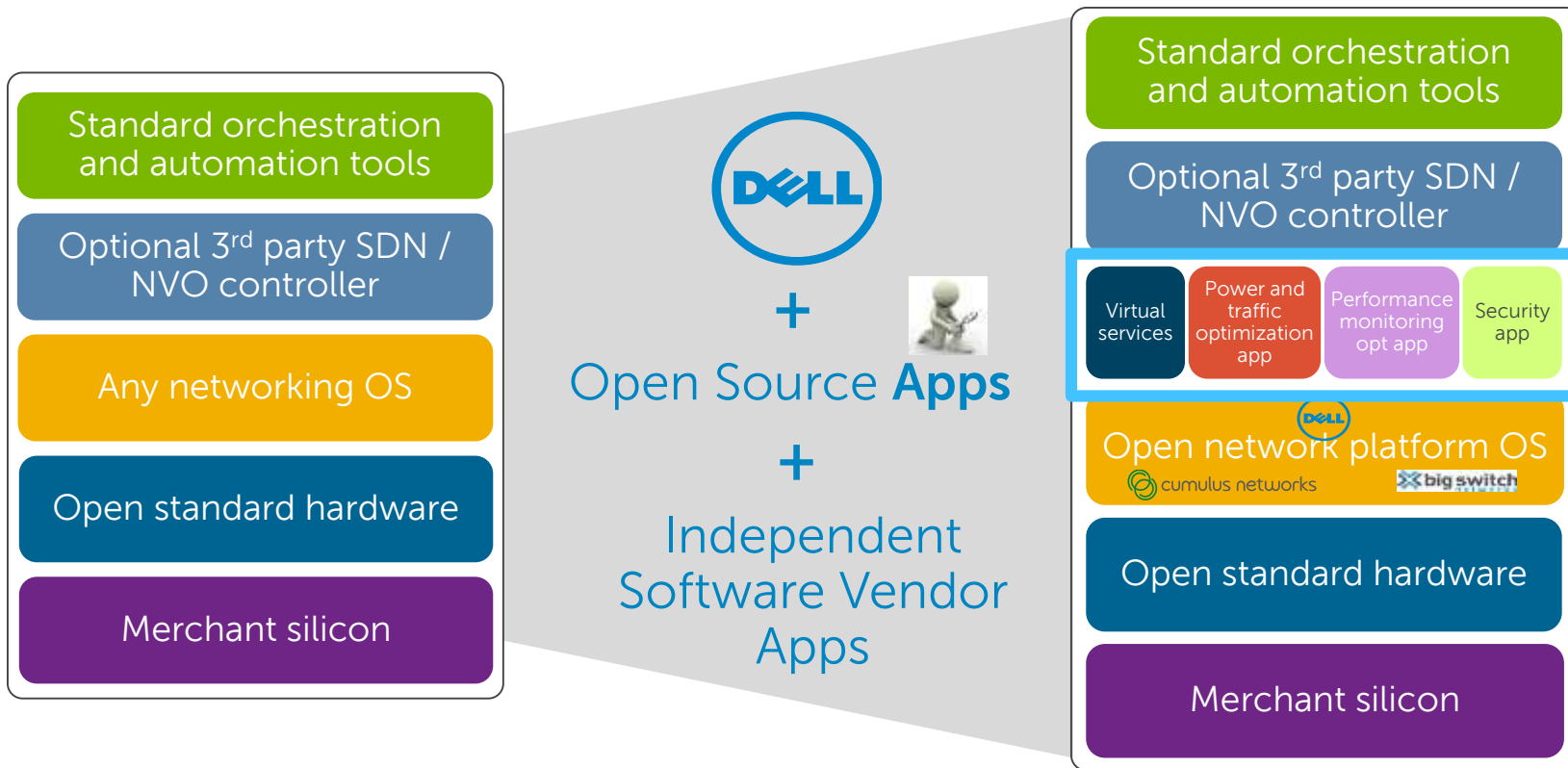


Making the **open networking shift** work for you

Leverage open, innovative and best-of-breed solutions for the data center

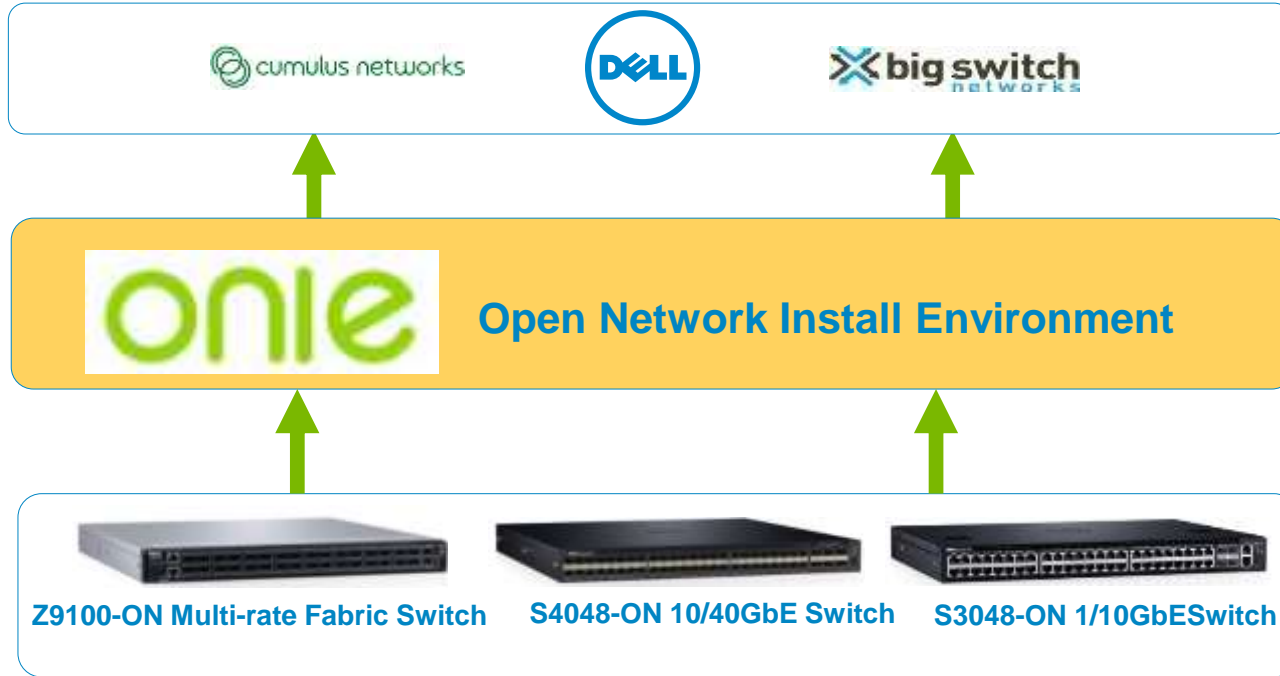


Imagine - "Androidification" of networking



Dell Open Networking switches simplified

100% ONIE loading for all OS's on new ON switches



ONIE Bootloader for all OS's for Dell Networking ON switches

Zero-touch install of all pre-qualified 3rd party operating systems

ONIE also used for loading **Dell Networking OS9**

Dell's Open Networking vision

Dell is driving a new open ecosystem to speed innovation by offering best of breed, standards based network equipment, network operating systems and network applications to serve customers unique business needs

Helping customers to:

- Embrace the open networking era with best-of-breed solutions
- Simplify network management, orchestration and automation
- Leverage open source standards-based tools & expertise



Why Open Networking

- Enable Choice
- Multiple Operating Systems to Bring Out the Best of the Same Box
- Select the Software for your Needs Instead of Replacing Systems
- End to End Common Hardware
- Unlock New & Broader Capabilities of Network Hardware
- Drive Down the Economics with Standardized Hardware
- Capture Fast Moving Merchant Silicon Innovation
- Simplify Support, Sparing, Logistics and Re-use
- Shortened Time to Market of New Capabilities



Leading the **Open Networking** revolution



*"Dell wins this month's Network Innovation Award from SearchNetworking for its partnership with Cumulus Networks, in which Dell became the first mainstream switch vendor to permit third-party OSEs to run on its switches." - **TechTarget***

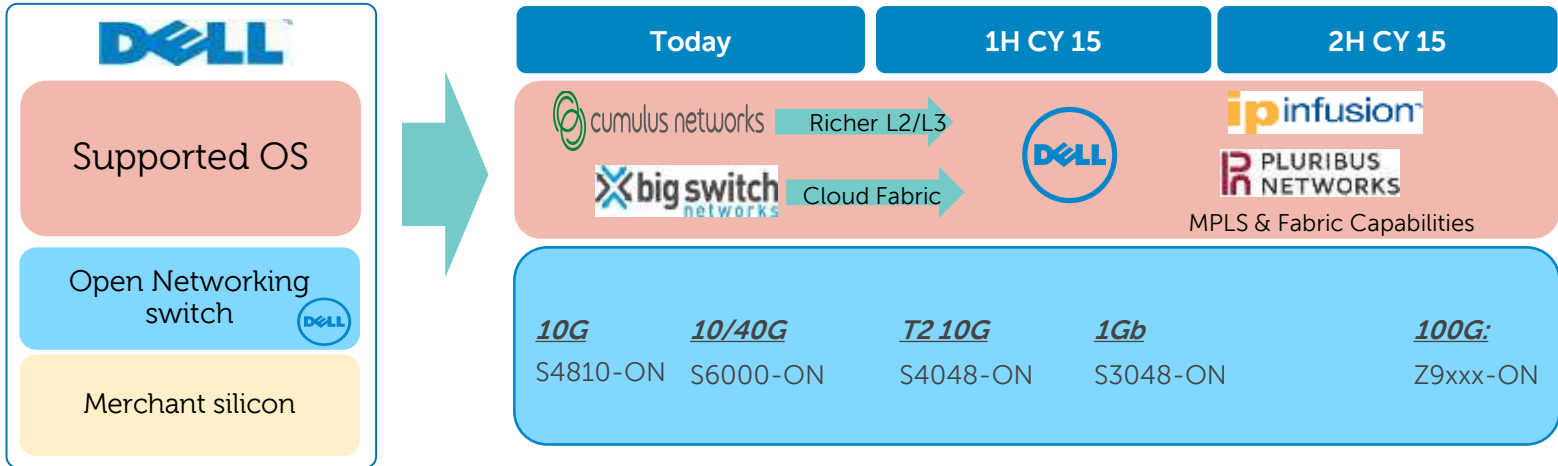
*"Dell was the first mainstream vendor to support this approach via support for non-Dell networking OS software from Cumulus or Big Switch on its ToR hardware . Dell will load and test the software in its switches and deliver a complete product, including presales and post sales support." - **Gartner***

*"Dell is shaking up the networking market, a stable market that loathes change and optimizes keeping customers from having choice... Dell is clearly firing the first shot over the bows of its competitors, companies like Arista, Cisco Systems, and Hewlett-Packard." - **Patrick Moorhead***



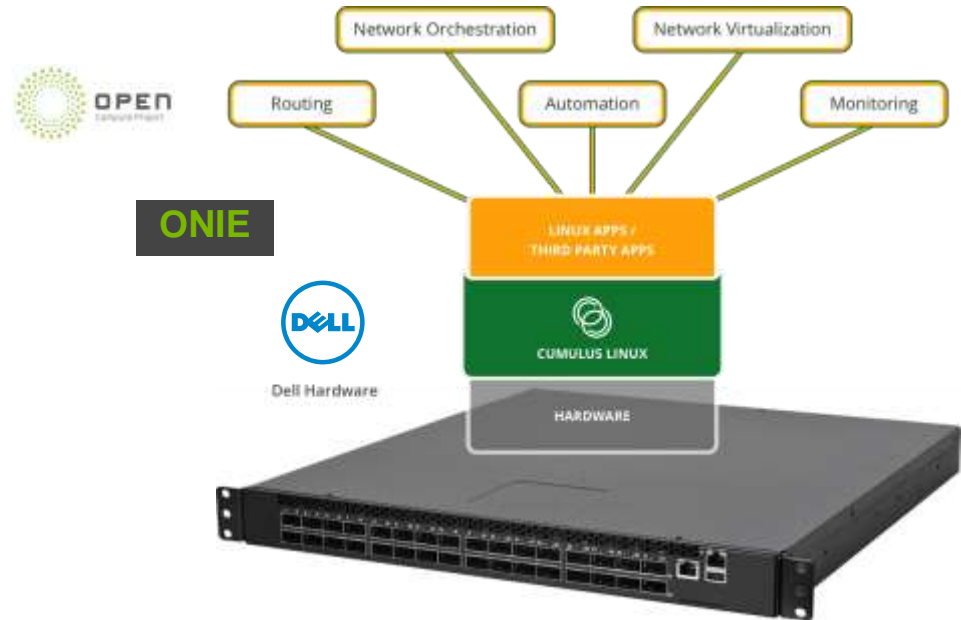
Dell "Disaggregated OS" Momentum Continues

Offers open, innovative and best of breed solutions along with our Ecosystem



Cumulus Linux OS

- Cumulus Linux OS is the industry's first, full-featured Linux operating system for networking hardware
 - Resilient Linux modular operating system
 - Broad set of Layer 2 and layer 3 features
 - Support for network virtualization
- Enables users to take full advantage of the latest industry standard networking hardware while enabling the latest Linux applications and automation tools
- Provides a consistent experience between the network and the compute environments helping customers to realize the full extent of a software defined data center



The Cumulus Linux Differentiators

Independence

Choice of hardware, choice of applications, no vendor lock-in

It's Linux

Familiarity, community, open source, rapid & simple application integration, customization

Business Model

Subscription, pricing transparency, software only

Operational Efficiencies

Automated deployment & provisioning

Workflow Orchestration

Simple configuration management, workflow orchestration,, application centricity

High Capacity Fabrics

Modern DC designs, simple integration with overlay, high capacity fabric,



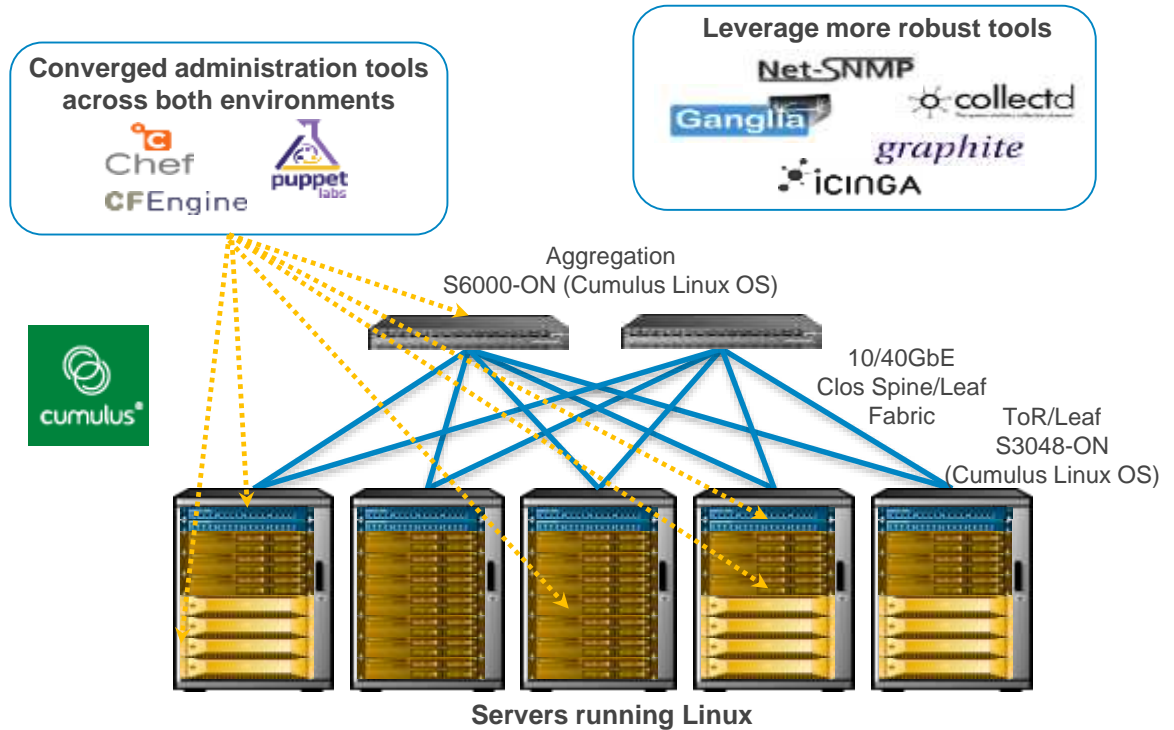
Early adopter Linux-savvy open networking environments

Components

- Dell S4040-ON/S6000-ON with Open Network Install Environment (ONIE)
- Cumulus Linux OS

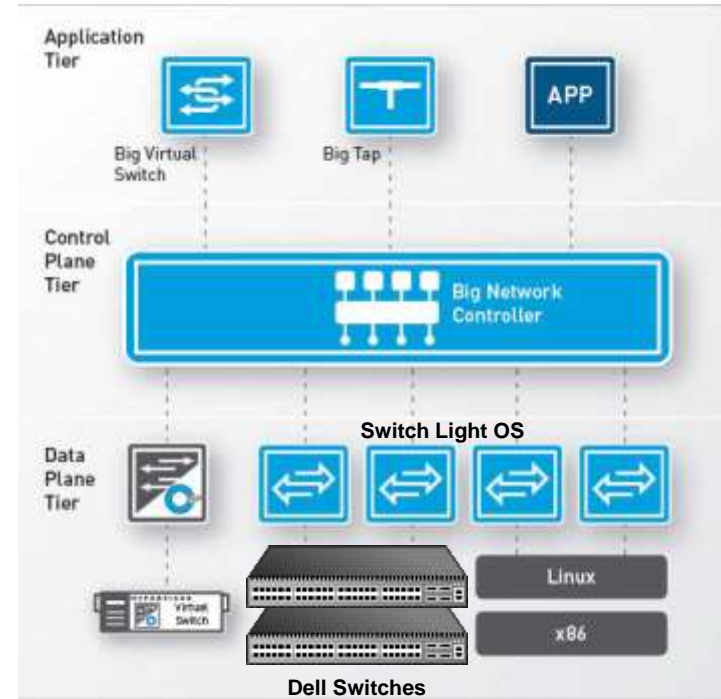
Benefits

- Enter the open networking era with best-of-breed solutions
- Gain a consistent view across compute and network resources
- Leverage Linux and open source standards-based tools and expertise



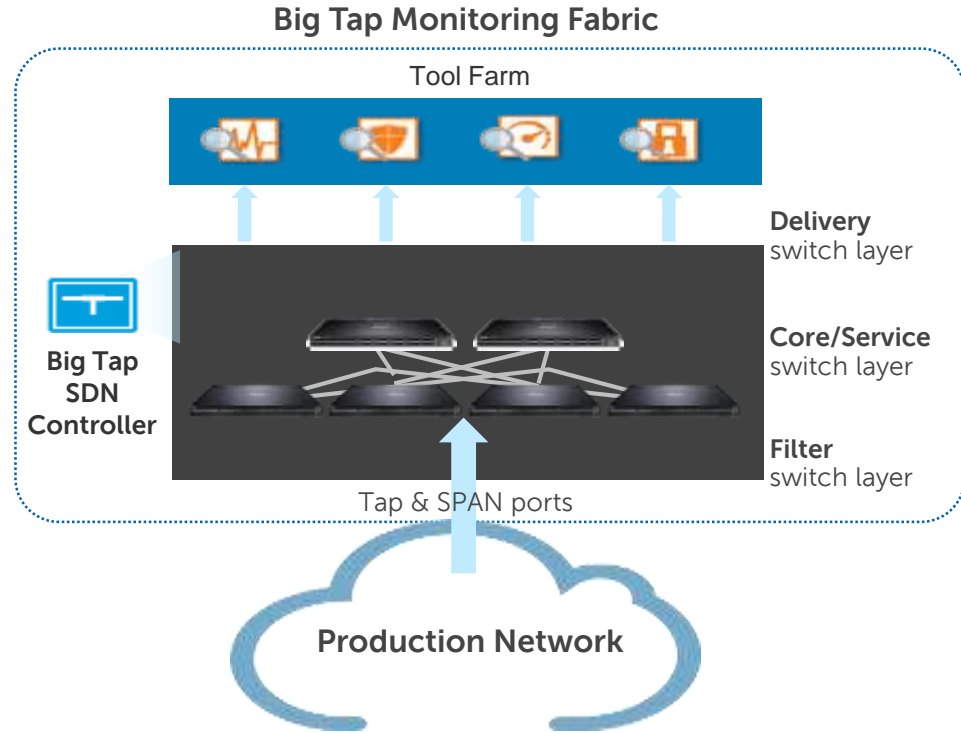
BSN Switch Light™ OS

- Switch Light from Big Switch Networks is an open source, OpenFlow-based thin switching platform for Open Software-Defined Networking (Open SDN)
- Enables a common, OpenFlow-based thin switching feature set that can be centrally provisioned and which automates policy configuration across your entire network fabric
- Enables dramatic reductions in the cost of your network operations and eliminates time consuming, manual procedures
- Operates in coordination with an OpenFlow controller, which provides centralized switch programming and forwarding



BSN Big Tap™ Monitoring Fabric

- Big Tap Monitoring Fabric leverages open standard switches and SDN design principles to monitor traffic everywhere in your network and selectively delivers traffic to your security and monitoring appliances
 - Has a layer of Ethernet switches labeled as “filter” switches - wired to passive optical taps or switch/router/firewall SPAN ports in the production network and are configured as “filter interfaces” in the Big Tap controller software
 - A layer labeled as “delivery” switches. - wired to tools and are configured as “delivery interfaces”
- At the core of the Big Tap monitoring network is the centralized Big Tap Controller software



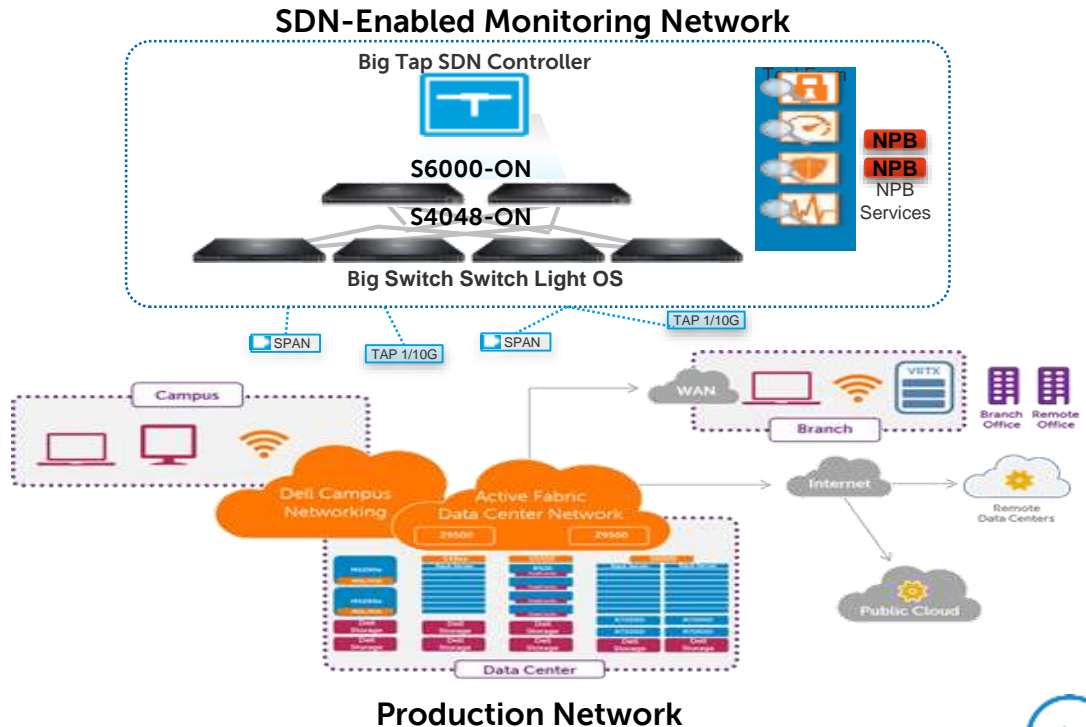
Early adopter SDN-based open networking environments

Components

- Dell S4048-ON/S6000-ON with Open Network Install Environment (ONIE)
- Big Switch Networks Switch Light™ OS
- Big Switch Networks Big Tap™ Monitoring Fabric

Benefits

- Embrace the power of choice with best-of-breed solutions
- Start the transition to SDN with a practical network monitoring solution
- Manage all monitoring fabric components from a central place



Big Switch Cloud Fabric



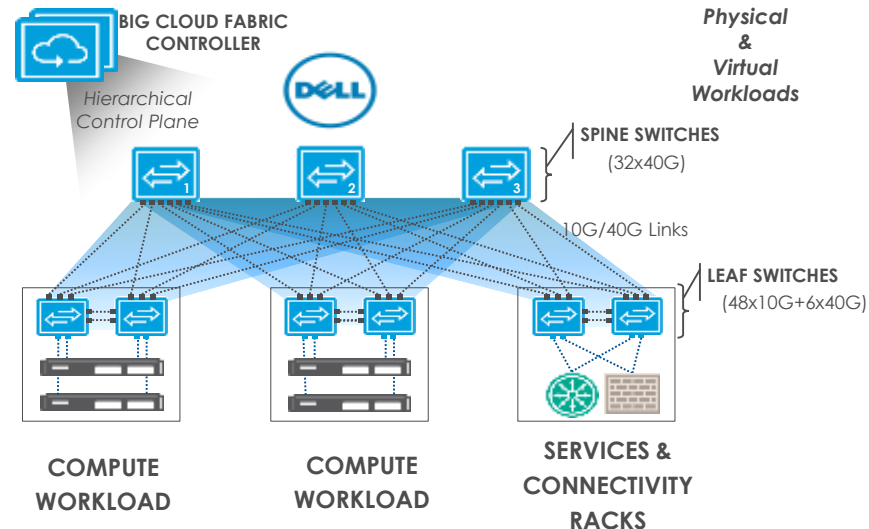
- ✓ High Performance: Dense 10G/40G
- ✓ Latest Merchant Silicon HW: Trident II
- ✓ Scalable: Max scale of Trident II
- ✓ Resilient: Headless Mode Operations
- ✓ L4-7 Service Insertion & Chaining
- ✓ Hypervisor: ESX, Hyper-V, KVM, Xen
- ✓ Orchestration: OpenStack, CloudStack

Private/Public
Clouds

Big Data
Analytics

VDI

...



Value-prop = Single "Logical" Switch (Zero-touch fabric, Dramatic TCO reduction)



New S-Series open networking models

Dell's first disaggregated open networking switches

- Designed for flexibility, performance and support of 3rd party OS
- 1RU high-density 10/40Gbps TOR switches
 - **S4810-ON** with 48 ports 10GbE and 4 ports 40GbE
Cumulus Linux 2.0.2 GA released on April 18, 2014
 - **S6000-ON** with 32 ports of 40GbE or 96 ports of 10GbE + 8 ports of 40GbE
Cumulus Linux 2.1.0 GA planned for June 12, 2014
- Supports the open source **Open Network Install Environment (ONIE)**



Dell S4810-ON



Dell S6000-ON



Other vendors doing Open Networking?

Branded Switching + White-Box Switching = Brite-Box Switching

Gartner: We feel this is an important and disruptive trend in the networking space that can bring a **ton of value** to organizations. Our forecasts indicate that by 2018, non-traditional switching will account for **more than 10%** of global data center port shipments, up from under 4% in 2013. Further, we anticipate that additional mainstream networking vendors will be entering this space

Brite Box vs. White Box

- BRITE BOX
 - Fully Supported solution by networking vendor, both HW & SW
 - Quality Service Level Agreements guaranteed by vendor
 - Global Supply Chain
 - One stop shop
 - Make it simple, affordable and accesible
- White box
 - Only HW support
 - No solution support
 - Complex model



Dell Networking

The Software Defined
Networking Vision



Why SDN?



Shared & Virtualized Infrastructure

Attribute	Servers	Networking
Provisioning time	Minutes	Days / Weeks
Cost	Cost-effective	Expensive
Open & Choice	Yes	Near Monopoly
Management	Easy/Simple	Complex/Hard
HW Abstraction	Yes (e.g. VMware ESX)	Very primitive

Key Customer Benefits from SDN/Open Networking

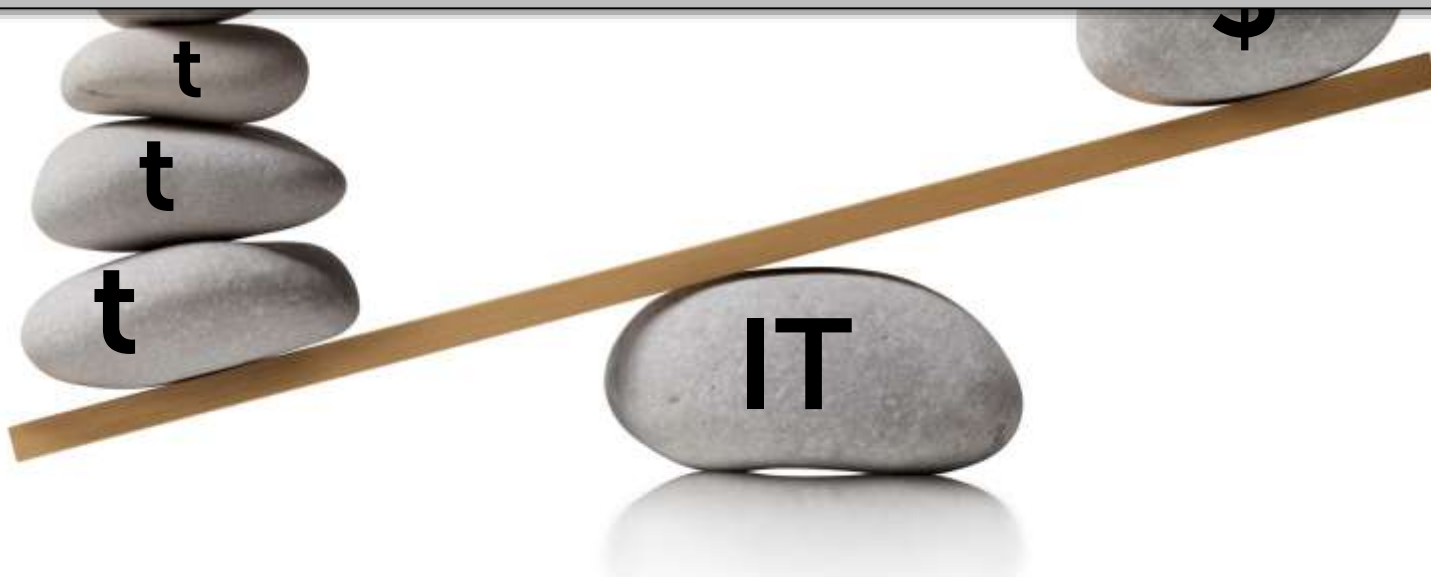
<i>Programmability & Automation</i>	<i>Network as a Service</i>
<i>Open Standards & interoperability</i>	<i>Simpler management & control</i>



More Time = Less Money

We need to be able to deliver a VM in less than one hour. Otherwise, we will lost thousand euros per month.

Dell Customer



Dell Software-Defined Networking

Powered by Open Networking – Choice + Capability

Dell Software-Defined Networking

Operating System Solutions

Disaggregating operating system software from hardware



Network Overlay Solutions

Disaggregating virtual networking from physical networking



Control Plane Solutions

Disaggregating network control from forwarding plane

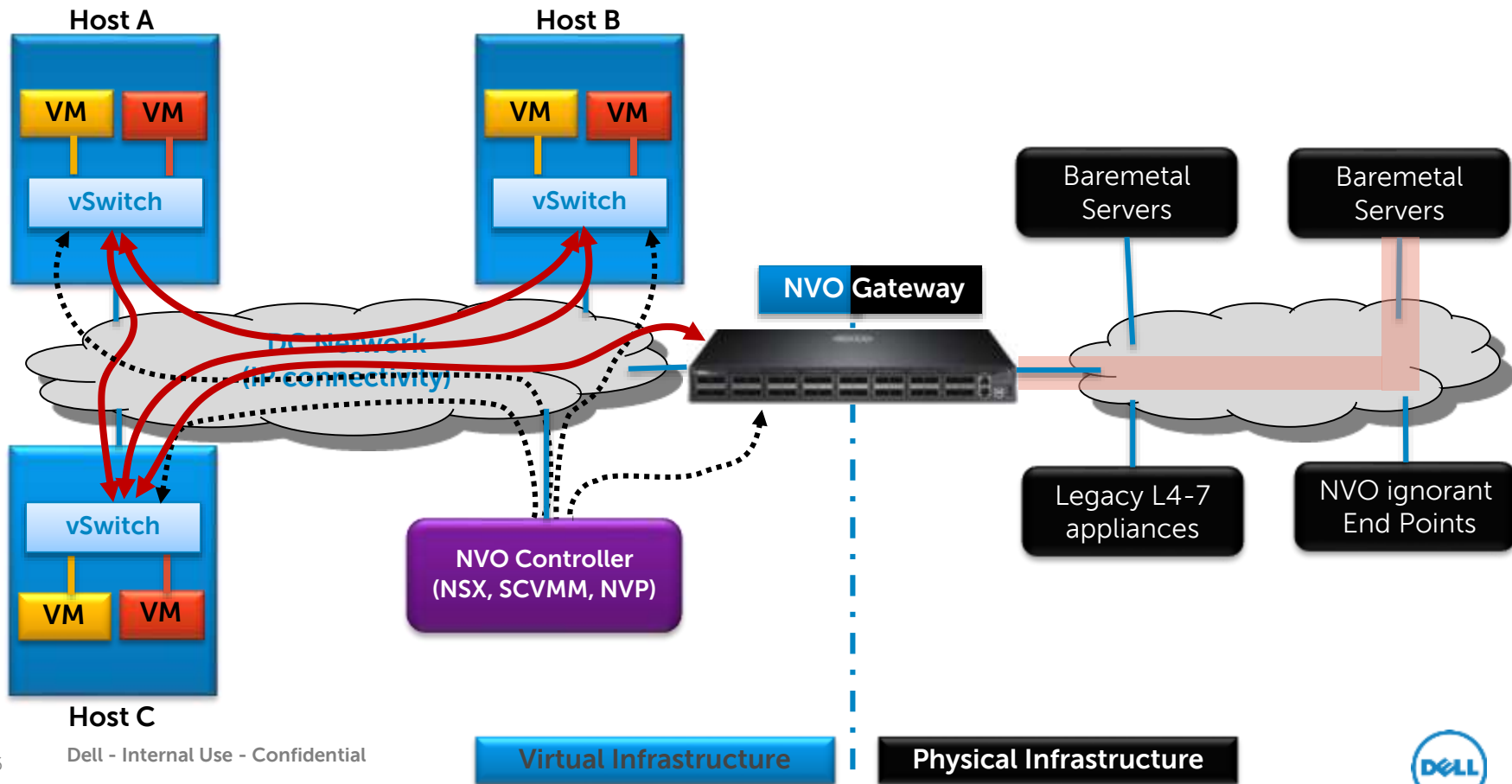


Dell Open Networking

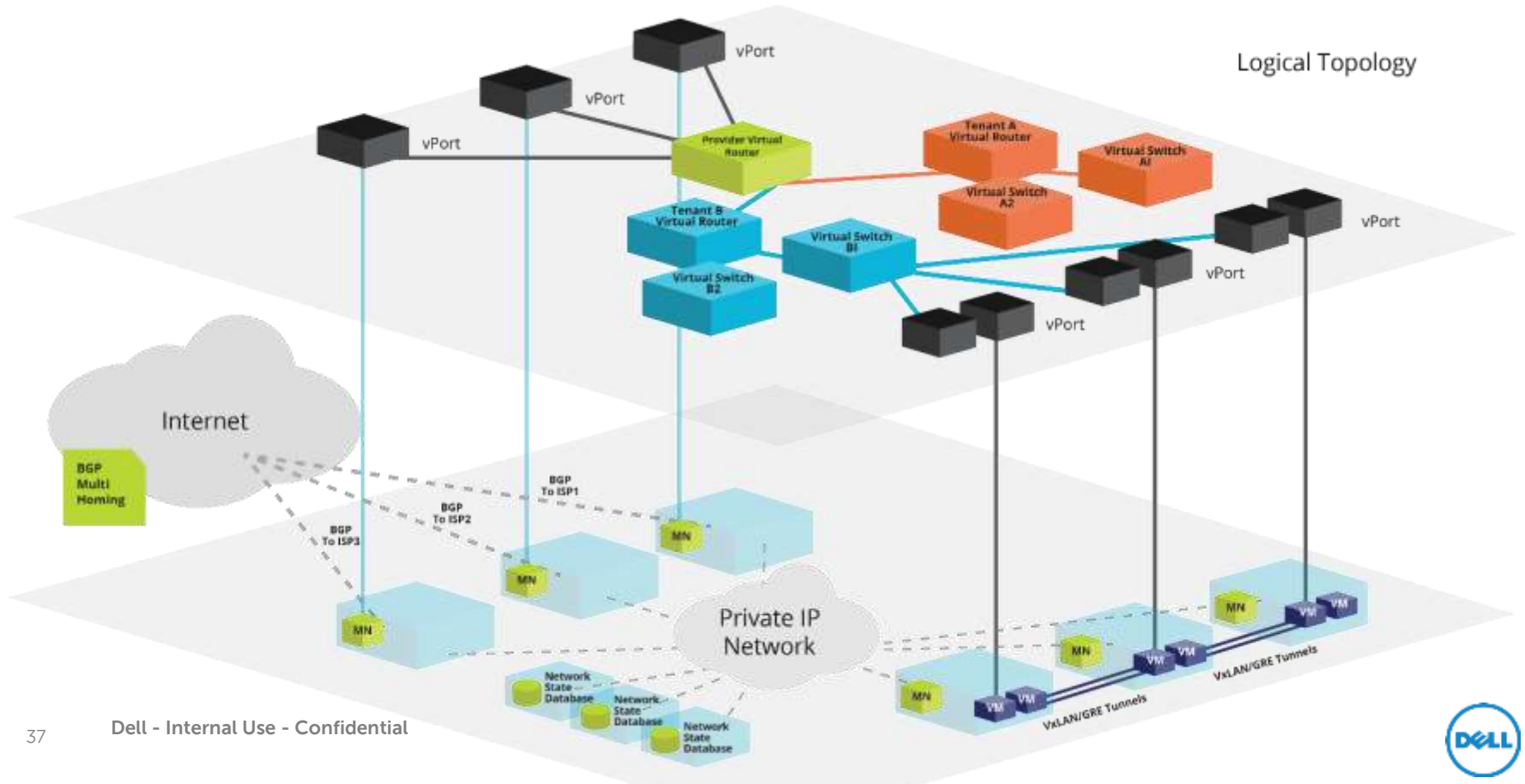
Disaggregating networking technologies to maximize capability and choice



How NVO work?



Logical Topology – Overlay Networks

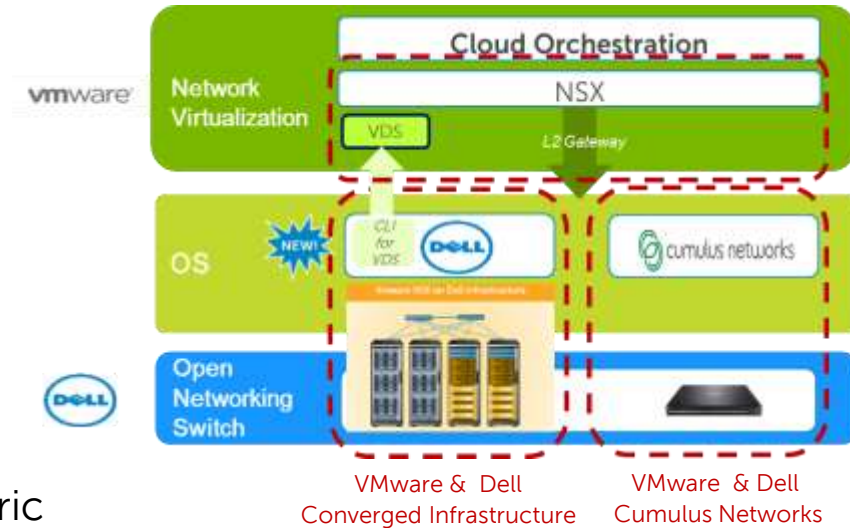


VMWare NSX +Dell

Compelling alternative to Cisco HDDC

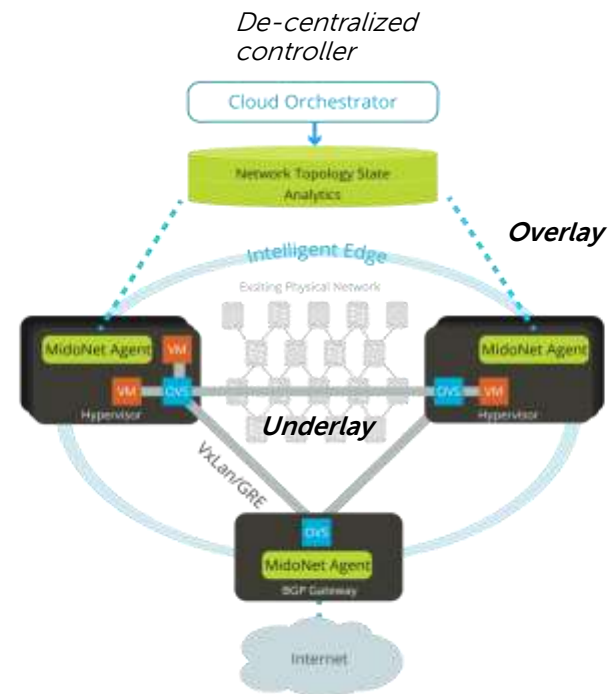


- ✓ VMware for NVO solutions
- ✓ Distributed Controller Logical Switching, Distributed Logical Routing, L4 Load Balancing
- ✓ Distributed virtual firewall, Kernel Integrated
- ✓ NSX for vSphere (NSX 6.x) –
- ✓ NSX for MH (mixed hypervisor) (NSX 4.x)
- ✓ Dell Networking OS set up with AFM.
- ✓ Cumulus Linux on Dell switches for server centric management



Midokura Network Virtualization

- ✓ Alternative to VMware for NVO solutions
- ✓ More **cost-effective** compared to VMware NSX
- ✓ Any customer seeking open-source/ KVM/Openstack
- ✓ For DNOS and Cumulus Linux deployments (HW GW)
- ✓ Distributed Controller with centralized database
- ✓ Logical Switching, Distributed Logical Routing, L4 Load Balancing
- ✓ Distributed virtual firewall, Kernel Integrated
- ✓ Integration with CloudStack, VMware and OpenStack



Dell Software-Defined Networking

Powered by Open Networking – Choice + Capability

Dell Software-Defined Networking

Operating System Solutions

Disaggregating operating system software from hardware



Network Overlay Solutions

Disaggregating virtual networking from physical networking



Control Plane Solutions

Disaggregating network control from forwarding plane



Dell Open Networking

Disaggregating networking technologies to maximize capability and choice



Big Switch Cloud Fabric



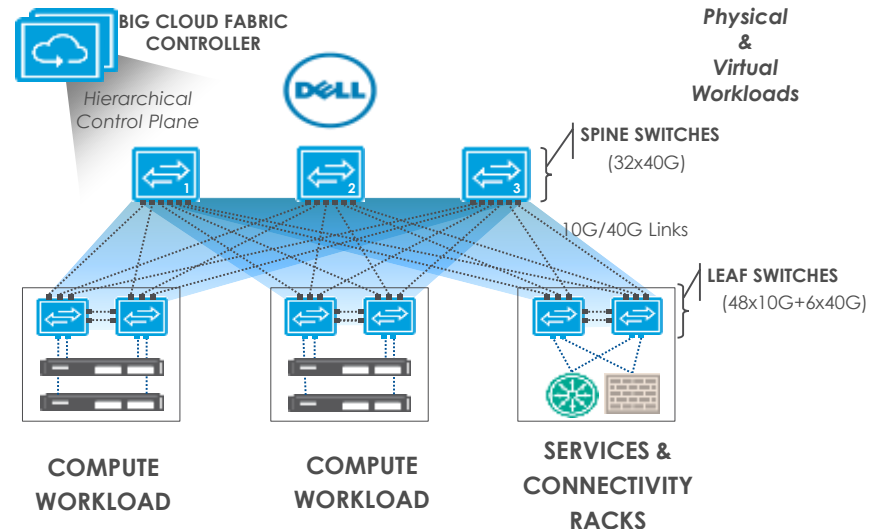
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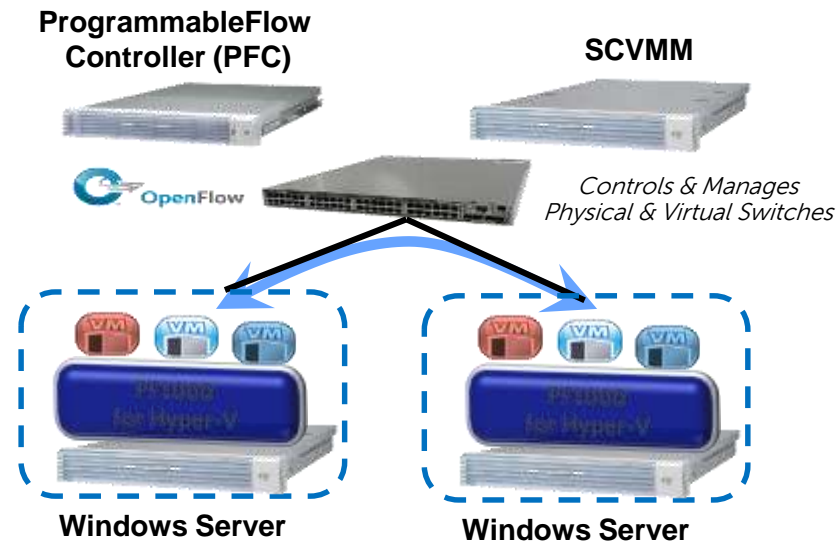
Value-prop = Single "Logical" Switch (Zero-touch fabric, Dramatic TCO reduction)



NEC Solution Overview



- ✓ Offers a commercial OpenFlow solution
- ✓ NEC is a pioneer in SDN controller based solution
- ✓ Multi-Tenant network and VM provisioning
- ✓ TAP solution with OpenFlow
- ✓ OpenFlow network aggregates all packets. Operators can set flow filters within controller
- ✓ Integration with Dell networking: OS 9.4 and beyond; OF 1.0 + extensions to Dell



Any customer who wants an OpenFlow solution
Microsoft Hyper-V customers who want P+V solution





Last **F**rontier?

Dell Networking

NFV – The Next Frontier

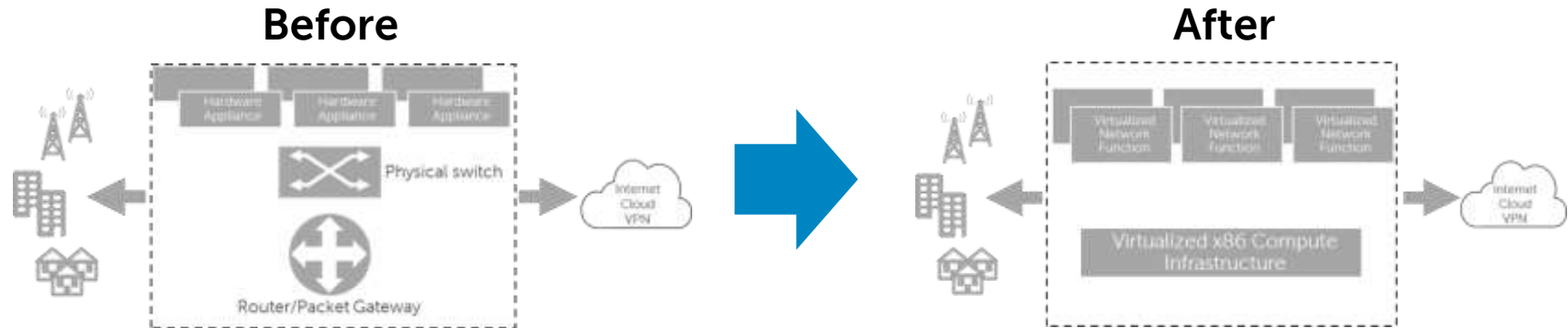


What is NFV

Network Functions Virtualization

The virtualization of a wide range of different hardware-based telecom service functions

Executed as virtual network functions on software-defined x86 infrastructure

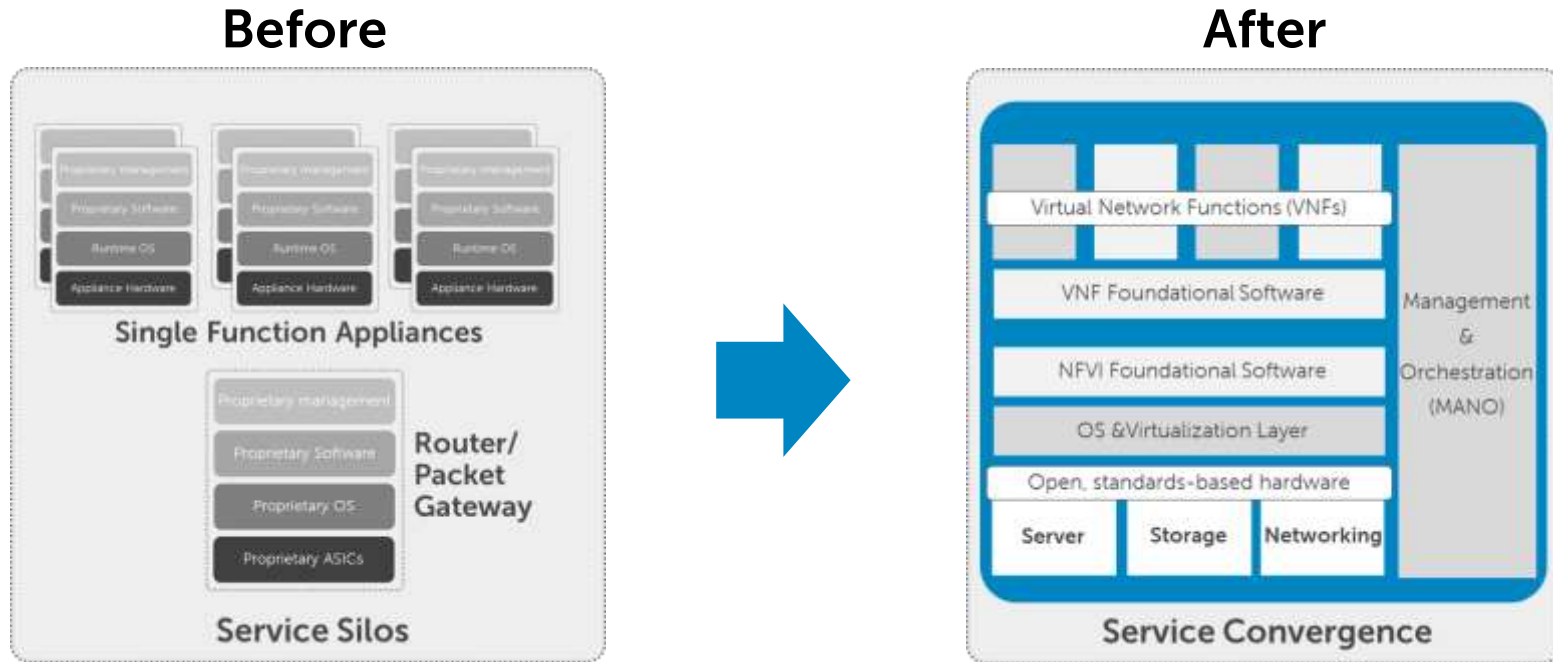


- Benefits** {
- Improve service delivery cost structures
 - Accelerate service innovation and creation

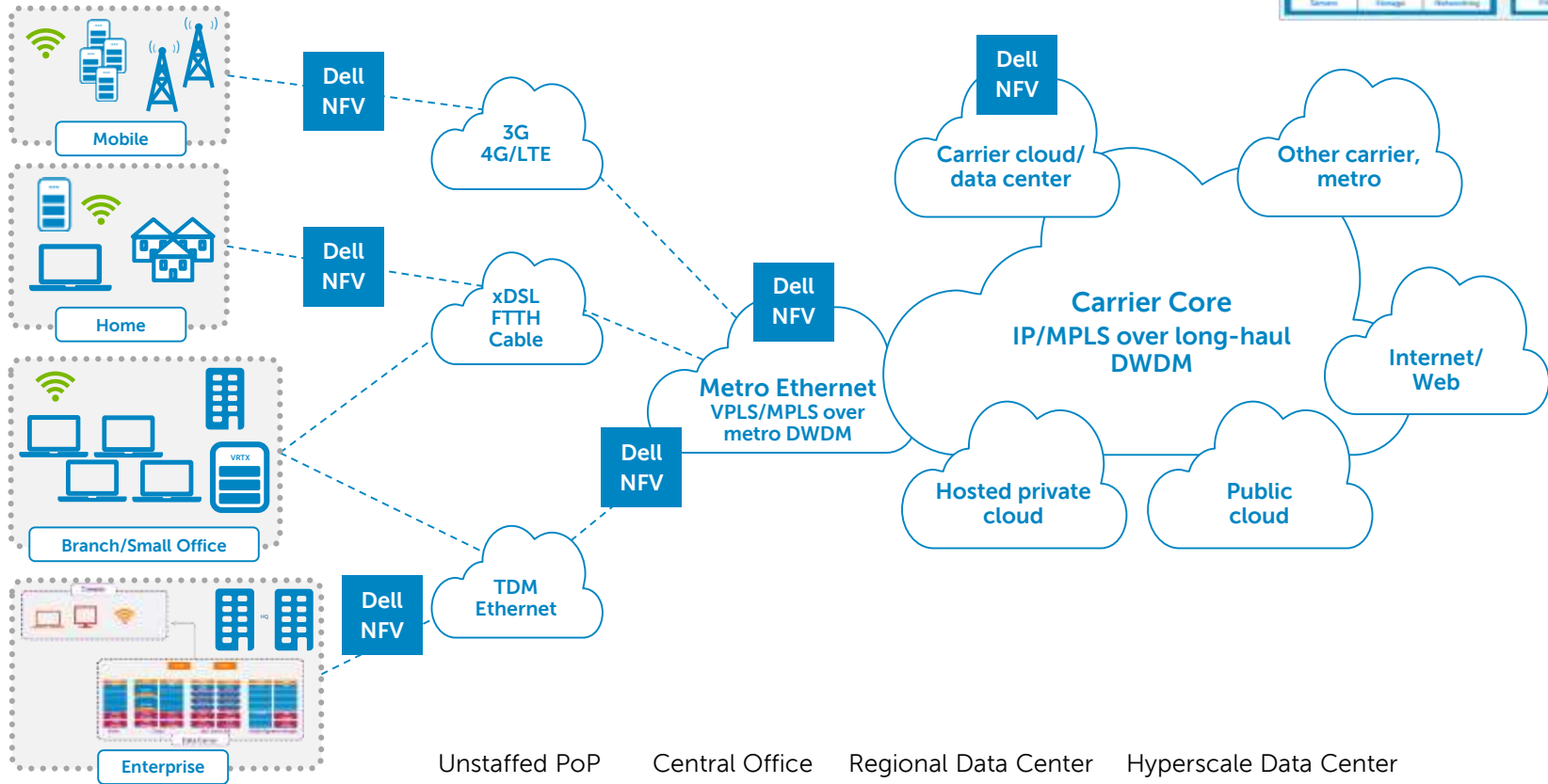


Functional comparison

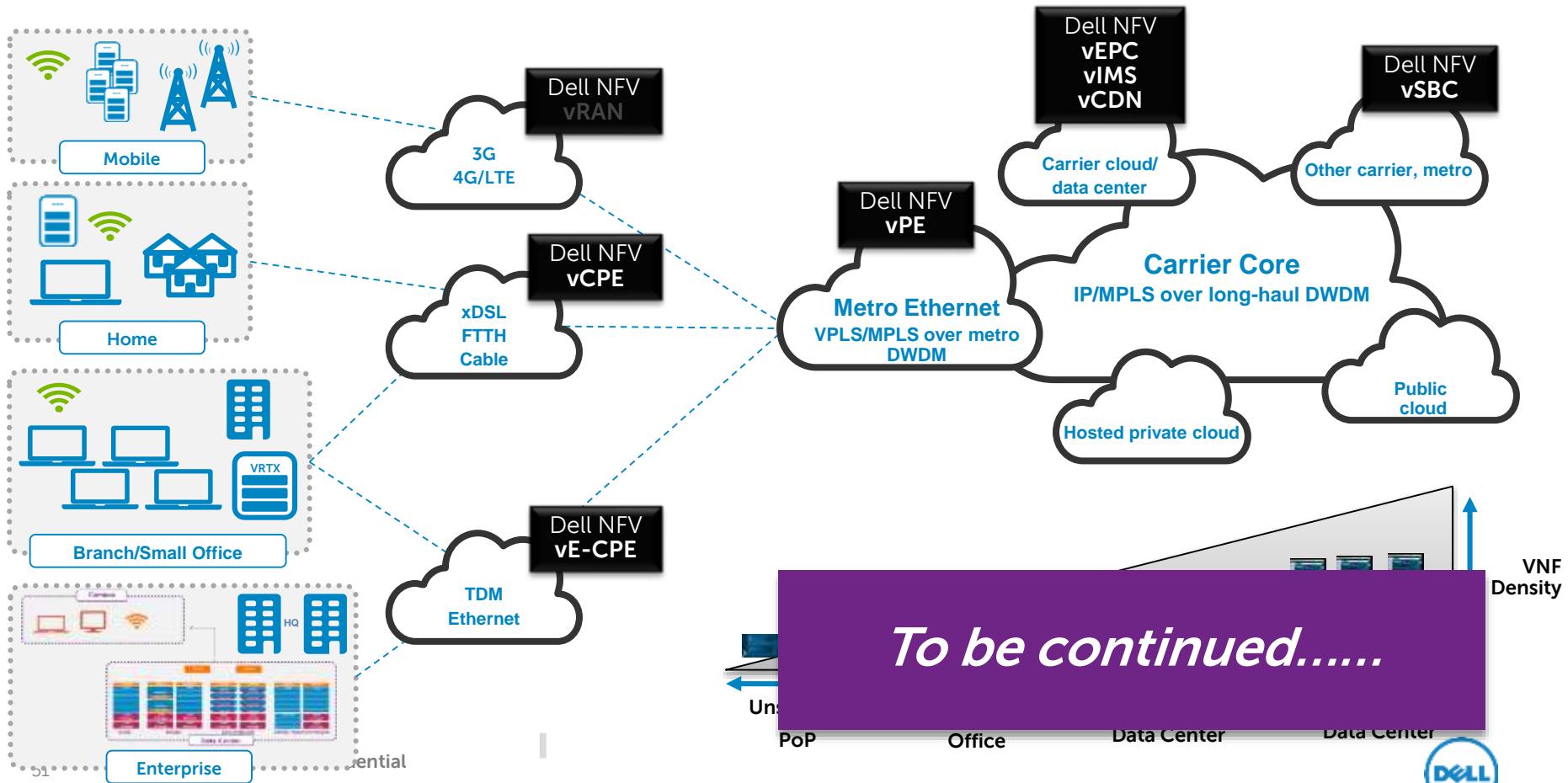
Legacy service deployment vs. NFV service deployment



Dell NfV deployment options



Dell NFV Solution for Telco



Bold indicates active use cases

Summary



Why Dell Networking – Open and Innovative

1

Open Networking

First vendor to offer disaggregated networking model and leading the industry disruption in software defined compute, storage and networking

2

Leading Edge Innovation

Rapid execution model with rich product pipeline and industry first in delivering networking systems with state of art technology

3

End-to-End Solutions

Leading end-to-end solutions encompassing best in class servers, storage and networking products with global services and reach



The Power To Do More



¡Muchas gracias por
su atención!

