Change your Network, Activate your Business

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Regional Director – Dell Networking

September, 2014

Transform IT with networking innovation
Dell Networking

Grew **3x** the market in **2013**

#3 40GbE networking
#3 blade switching
#3 fixed-port switching [1]

1st layer 3 stackable family

1st of-its-kind intuitive management with **Active Fabric Manager**

1st 40GbE blade for server chassis

64% lower TCO versus **Cisco** [2]

Magic Quadrant

Niche Player— Data Center Network [3]

Challenger— Wired/Wireless LAN [4]

Campus [5]

1/4 the power
1/2 the price
3x more headroom

Data Center

77% less power [6]
59% less CapEx [7]
86% less time to deploy [8]

SVC awards 2013 WINNER

TECHINNOVATOR AWARDS 2013

Best of INTEROP FINALIST 2013 Data Center & Storage

BEST OF CP SHOW AWARD INTEROP 特別賞

[1]Per Dell 'Oro 3QCY13 report
[2]Miercom-produced Lab Testing Report (130301) titled Performance & Interoperability Dell Networking 7000 and 8100 Switch Series (April 2013). For the full report, please visit Del.ly/tco70008100.
[3]Gartner Magic Quadrant for Data Center Network Infrastructure, 2/2013
[4]Gartner Magic Quadrant for the Wired and Wireless LAN Access Infrastructure, 9/2013.
[5]Prices used in this scenario are list prices, including Dell.com and Costcentral.com for Cisco, HP, as of November 2012.
[6]Up to 77% less power using Dell Active Fabric Solutions over comparable Cisco Nexus 7k/5k solutions.
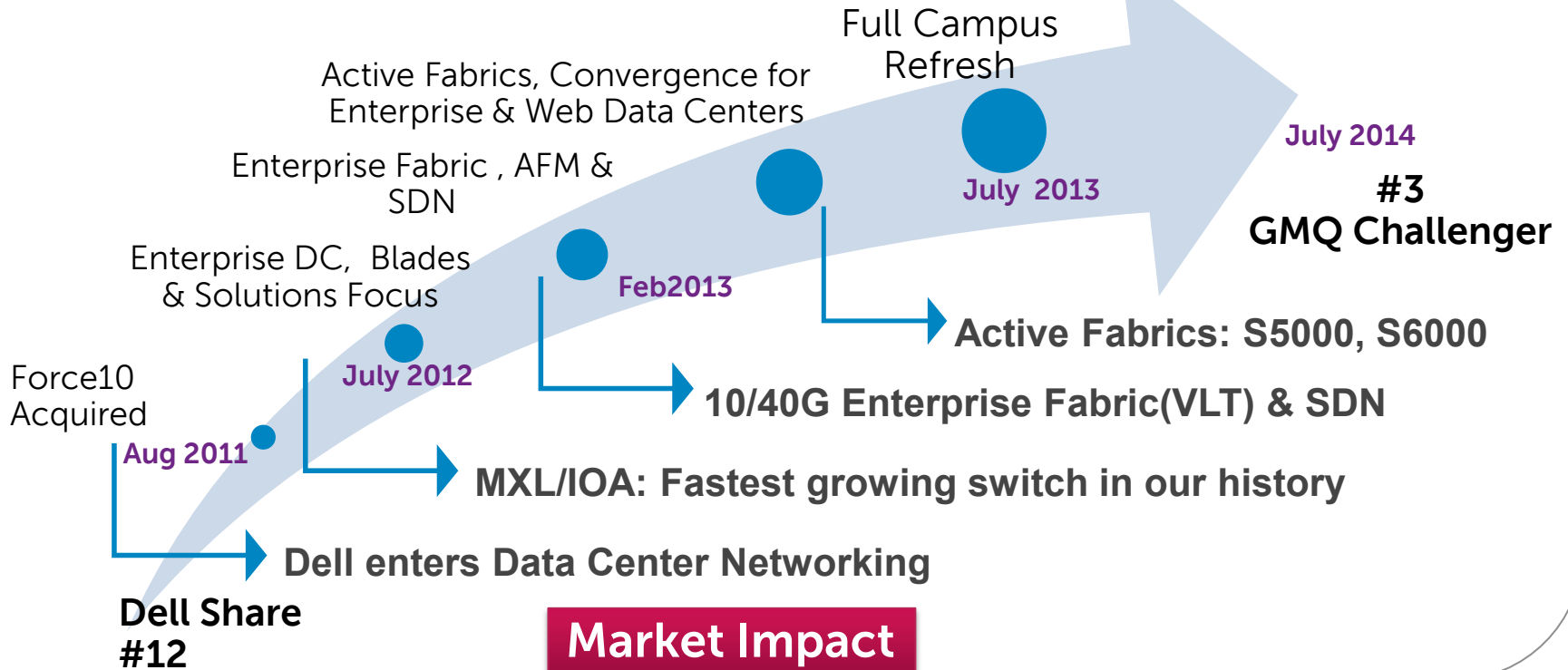[7]Up to 59% average equipment savings using Dell Active Fabric Solutions over comparable Cisco Nexus 7k/5k solutions.
[8]Up to 86% reduction in time required to design and deploy network fabrics with Dell Active Fabric Manager compared to manual processes. Results based on March 2013 internal Dell testing using 2 Spine and 4 Leaf devices.

Dell Networking: Momentum in 2 years

Product Roadmap

Full Campus Refresh

Active Fabrics, Convergence for Enterprise & Web Data Centers

Enterprise Fabric , AFM & SDN

Enterprise DC, Blades & Solutions Focus

Force10 Acquired

July 2014

#3 GMQ Challenger

July 2013

Feb2013

Active Fabrics: S5000, S6000

July 2012

10/40G Enterprise Fabric(VLT) & SDN

Aug 2011

MXL/IOA: Fastest growing switch in our history

Dell enters Data Center Networking

Dell Share #12

Market Impact

Dell Networking Making Headlines

- **April 2013**
  - Active Fabric
    (10/40 GbE, Ethernet + Storage)
  - Active Fabric Manager
    (86% time savings – no CLI req...)
  - New Converged Switch S5000
    Interop in Japan, finalist in Las V...

- **August 2013**
  - Dell Networking S6000 Switch
    (Integration with VMware NSX o...
    leading density, throughput an...

- **April 2013 to now: Social Media M...**
  - 600+ tweets, 48,000+ blog vie...
    over 1.5 million,
  - 30% growth in @DellNetworkin...

ENTERPRISE Networking PLANET

Dell Activates Network Fabric

Dell Intros New SDN Fabric for Data Center Economics, Architectures

NETWORKWORLD THE CONNECTED ENTERPRISE MIDDLE EAST
AWARDS·2014 WINNER
NETWORKING VENDOR OF THE YEAR

EDGE ...Bet ...Networking

CRN

Dell Makes Big SDN Play with New Fabric Technologies

silicon ANGLE

Dell Goes All-in on Software-Defined Networking at #VMworld

eWEEK

Dell Grows Data Center Fabric with New Switch, Management Tool

Dell Switches Support NSX, Unify Virtual/Physical Networking

IT-TNA IT Trends & Analysis

NETWORKWORLD

Dell Dives Deeper into SDN with New Hardware and Software

Customer success

Web 2.0 & E-commerce	Services & Service Providers	Healthcare & Life Sciences	Education & Government	Business	Manufacturing
affiliatewindow	Telefónica	Blackpool Teaching Hospitals NHS — NHS Foundation Trust	JACOBS UNIVERSITY	CATERHAM	XTREME
i3D.net INTERACTIVE 3D	Innovise	Deutsches Rotes Kreuz	SURF SARA	NAVO	H+H
PIXOMONDO	OptíNet	vitos: Haina	UNIVERSITÀ DI PISA	Iberext	SCHULE DRUCKGUSS
serviceplan gruppe	DSP LIBERO	NHS Avon and Wiltshire Mental Health Partnership NHS Trust	Copeland	VENEZIA TERMINAL PASSEGGERI S.p.A	DANISH CROWN
bluezoo	Sooma loving email	CHOOSE YEOVIL HOSPITAL HEALTH CARE	MARINO KIT	groupe	SCHUBERT VERPACKUNGSMASCHINEN
VIRTALIS	ALTECH KN		janet	res Ecobank	BELLMER
nttx claranet	claranet		Milton Keynes COLLEGE	FPSA BANCA POPOLARE S.ANGELO	Plastic, Packaging, Paper & Print Asia
AMULET HOTKEY	lunacloud			BWT	
	nymgo			Menzies	
				OBI	

Future-Ready IT **building blocks**
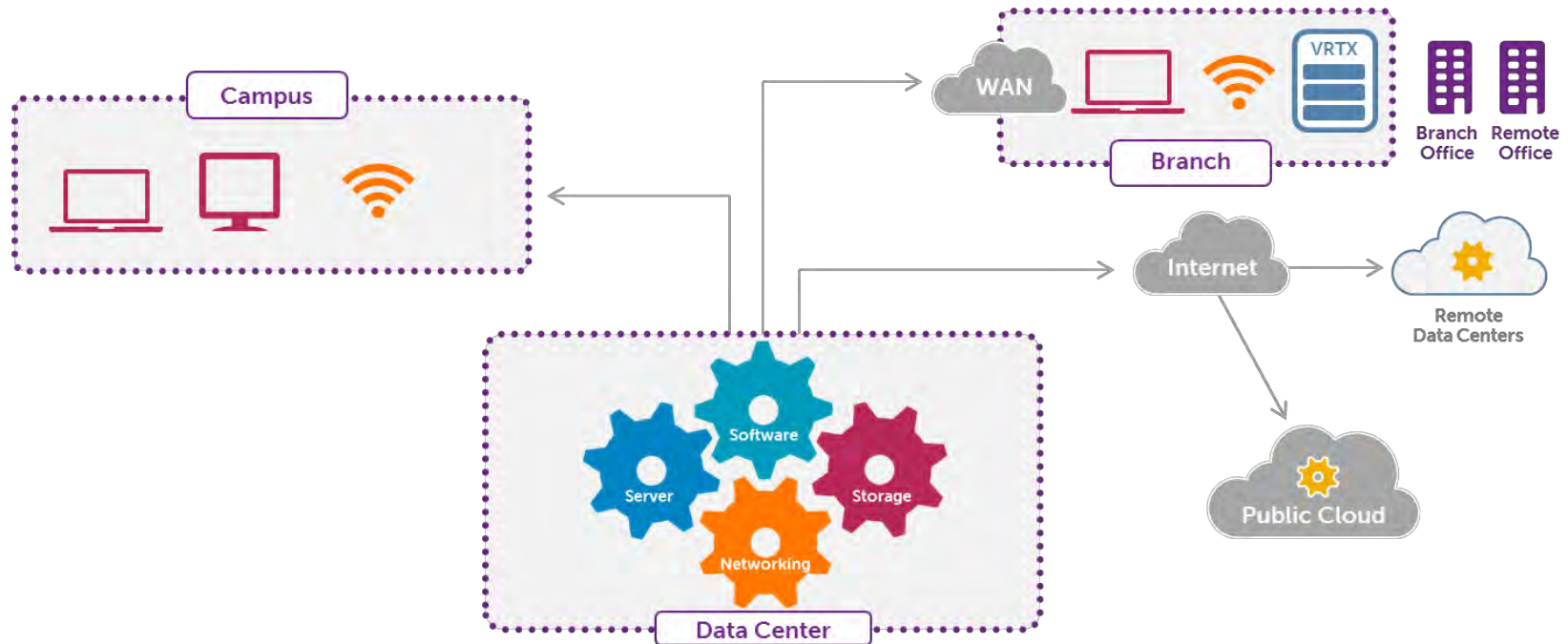
End-to-end solutions for the Enterprise
from Data Center to desktop to mobile device

Networking Industry Trends ...

1. Bandwidth needs continue to grow from data center to desktop to mobile device

2. Virtualization and new workloads changing data center traffic patterns, creating new bottlenecks

3. Explosion of mobile devices and multimedia rewriting the laws of campus networking for good

... creating opportunities for innovation

New solutions for a new era

Modernize & transform on your terms
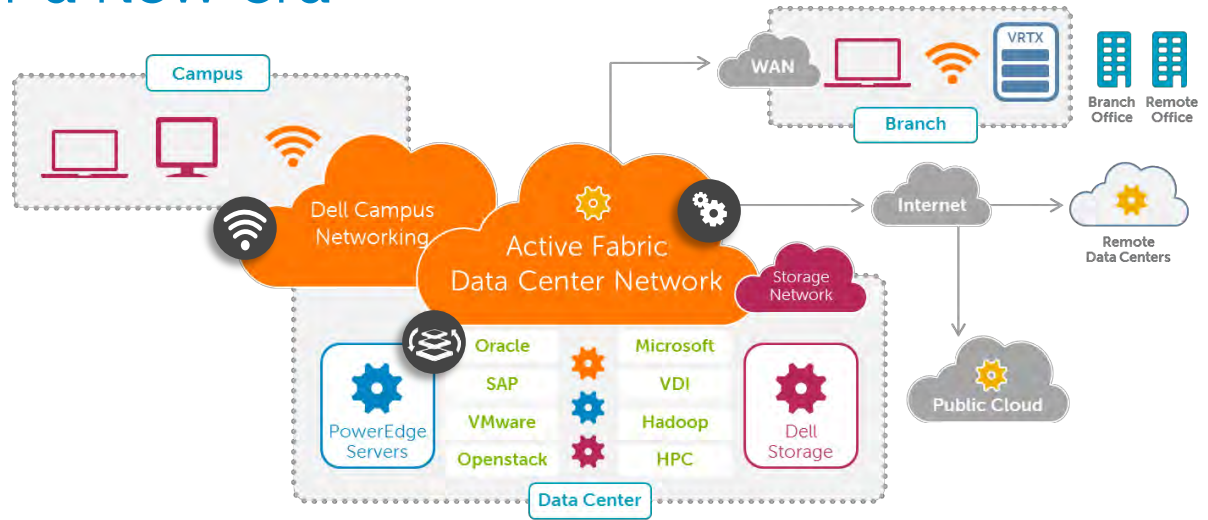
In-rack solutions for the data center	Fabric solutions for the data center	Wired/wireless solutions for the campus
Transform your data center with high performance 10/40GbE Ethernet platforms	Optimize architectures for east-west traffic & SDN initiatives	Enable more devices and multimedia, less presence, and more remote capabilities

Dell Networking

Dell Networking Strategy

1 Harness 10GbE and 40GbE switching technologies to connect, consolidate and converge in-rack server and storage elements

2 Develop high-performance, automated data center fabric solutions to accelerate east-west traffic and lower cost structures

3 Connect end users and end-points with secure wireless and wired solutions optimized for device mobility and multimedia

Superior customer benefit

- **Maximum efficiency—**Save money, conserve space and reduce power consumption

- **Faster results—**Scale up, down and out on your terms easily and economically

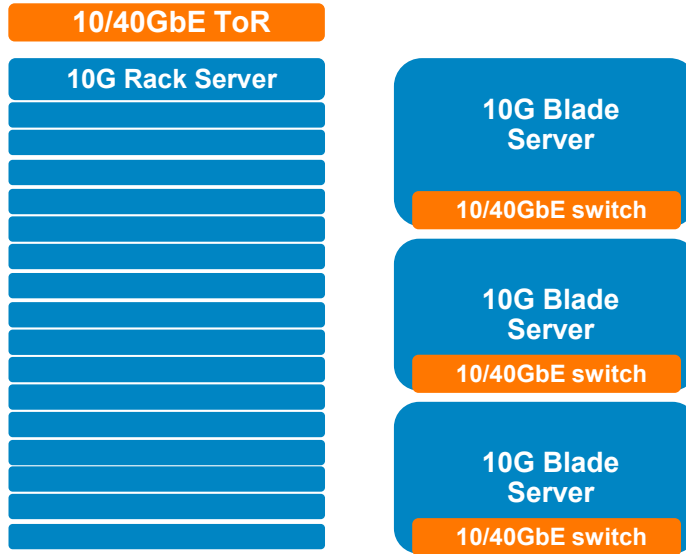- **Reliable operation—**Get results you expect when you expect them

...Modernize and transform your network on your terms

1 Transform the data center with 10/40GbE Ethernet platforms

Harness 10GbE and 40GbE switching technologies to connect, consolidate and converge in-rack server and storage elements
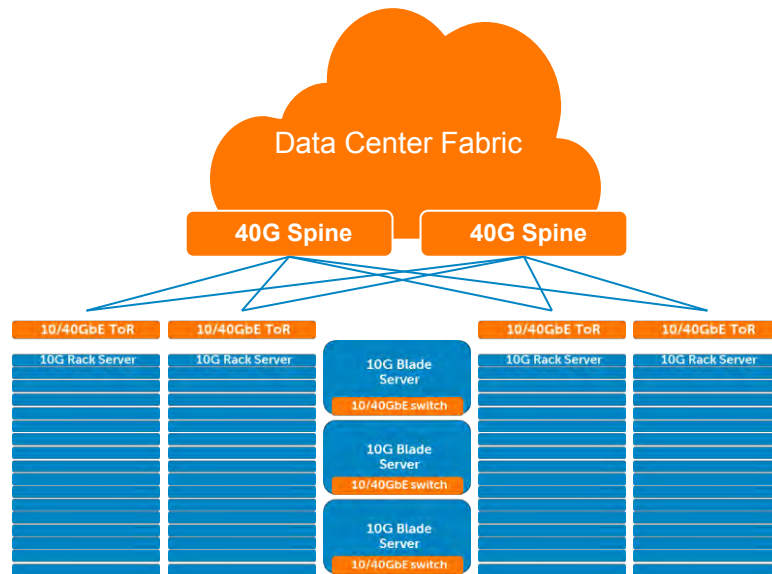
10/40GbE ToR

10G Rack Server

10G Blade Server

10/40GbE switch

10G Blade Server

10/40GbE switch

10G Blade Server

10/40GbE switch

- **Connect** servers and storage at 10GbE to boost performance
- **Consolidate** server I/O, simplify cabling and operations
- **Converge** LAN/ SAN resources with DCB-enabled Ethernet

Develop high-performance, automated data center fabric solutions to accelerate east-west traffic and lower cost structures

2

Optimize data center infrastructure for east-west traffic & SDN initiatives

Data Center Fabric

40G Spine   40G Spine

10/40GbE ToR   10/40GbE ToR   10/40GbE ToR   10/40GbE ToR

10G Rack Server   10G Rack Server   10G Blade Server   10G Rack Server   10G Rack Server

10/40GbE switch

10G Blade Server
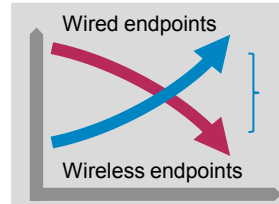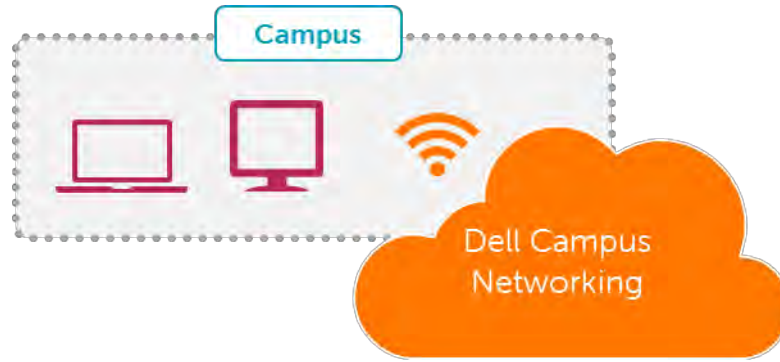
10/40GbE switch

10G Blade Server

10/40GbE switch

- **Scale-out performance** to address growing inter-rack traffic

- **Lower costs** utilizing fixed form-factor fabric switches

- **Simple operation** with software that automates deployments

3 Power the campus with solutions optimized for the mobile workforce

Connect end-users and end-points with secure wireless and wired solutions optimized for device mobility and multimedia

Campus

Dell Campus Networking

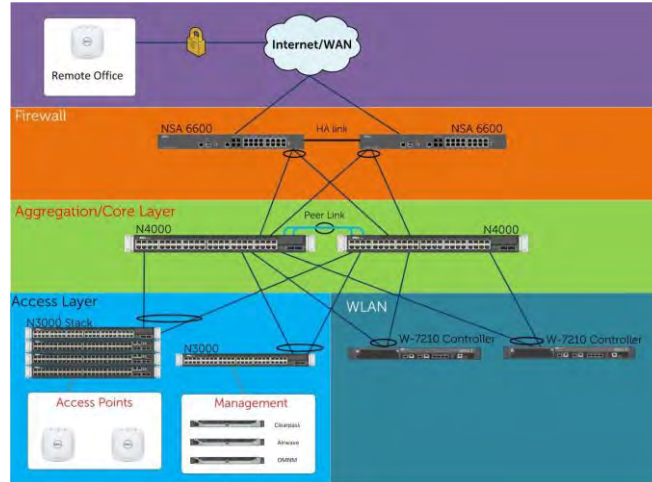Wired endpoints

Wireless endpoints

- **Ultimate mobility** with complete lineup of 802.11ac
- **Ultimate efficiency** with state-of-the-art energy-efficient 1/10GbE switches
- **Ultimate flexibility** with fully-redundant, fully-modular systems

3 Power the campus with solutions optimized for the mobile workforce

Connect end-users and end-points with secure wireless and wired solutions optimized for device mobility and multimedia

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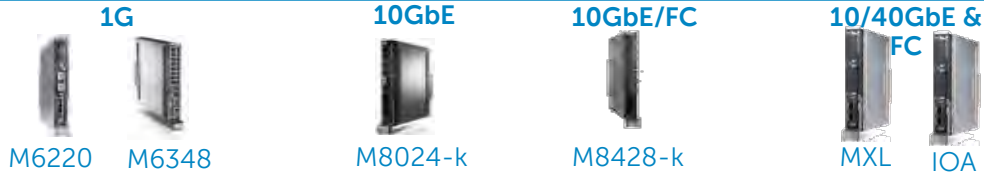# Dell Networking product portfolio

Campus & Data Center Chassis Switches

C7004/7008
E600i/E1200i

Core Fabric Switches

Z9000
Z9500

Blade I/O

1G		10GbE	10GbE/FC	10/40GbE & FC
M6220	M6348	M8024-k	M8428-k	MXL IOA

Fabric & Access Switches

	1G	10GbE	10GbE/FC	10/40GbE
S55/S60	N3000	S4810 / 20T	S5000	S6000
	N2000 N4000			

Wireless & BYOD

Controllers & Access Points
Indoor
Outdoor

Instant access Points w/ built-in controller

Guest access and BYOD
W-series ClearPass

Active Fabric Controller
Software-Defined Network and Application Services for Cloud Infrastructure

Active Fabric Manager
Automate the design, deployment and monitoring of fabric installations

OpenManage Network Manager
Simplify and centralize network management

FY15 Key Networking Introductions*

Released

Launched

Fibre Channel Flex IO

Changes your m1000e chassis into a converged server solution, adding FCoE & Fibre Channel services

Open Networking

Dell leads the industry in offering industry standard Linux distribution support for select Dell switches

Z9500 fabric switch

With over 10 Tbps & 132 x 40GbE or 528 x 10GbE, the Z9500 delivers unparalleled scalability & flexibility

Dell Active Fabric™ Manager

Now available with over 100 customizable templates and automated deployment

W-series 802.11ac Access Points

Building out coverage and capacity for wired performance at the wireless edge

X-series

Revolutionary user design & actionable monitoring in a smart-managed family of Ethernet switches

Active Fabric™ controller for OpenStack
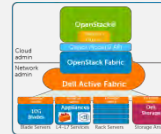
A complete virtualized & zero-touch deployment activated fabric for OpenStack environments
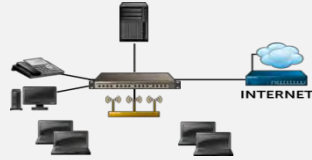
Stay Tuned...

... There is more to come in FY15 from Dell Networking!

Reference architectures for any network

SOHO

End-user networking

10s
End-users

Data center networking

S4810 or Z9000 Spine

SMALL/ MEDIUM

MXL 10/40G Leaf

S5000
S4810
S4820T
S60, S55
Leaf

10s-100s
Server/VMs

ROBO

WLAN: W-Series

Controller

PowerEdge VRTX

INTERNET/ WAN

100-1000s
End-users

LARGE

Spine

Z9000

MXL Leaf

S5000
S4810
S4820T
Leaf

1000s
Server/VMs

CAMPUS

WLAN Controller

W-3x00/W-6000
W-6xx

INTERNET/ WAN
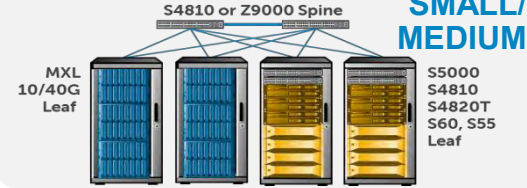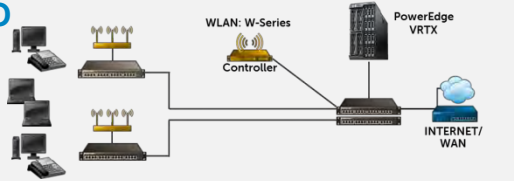
To Data Center

1000s+
End-users

1000s+
Server/VMs

EXTRA LARGE

Spine

Z9000

Leaf

MXL

S5000
S4810
S4820T
S60,S55

DELL
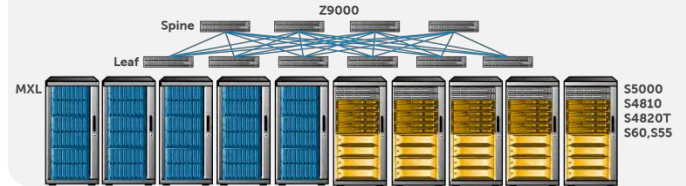
Active Fabric solutions **at any scale**

Fabric scale (vertical axis)

Server/VM density (horizontal axis)

Micro Scale Fabric

Z9500 Spine

10/40GbE

In-Rack/Leaf

<1500 Servers
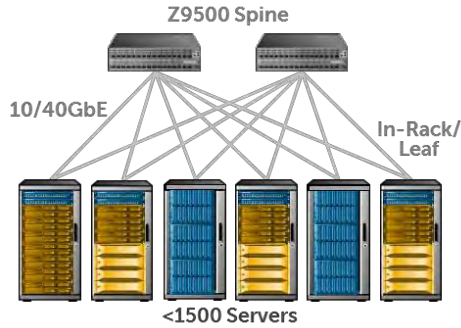
Pay-As-You-Go model for small-scale Data Centers

Macro Scale Fabric

Z9500 Collapsed Spine-Leaf

10/40GbE

No ToR

1500-6000 Servers
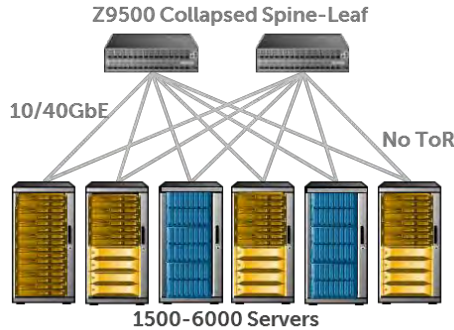
Dense, energy-efficient, low latency solutions

Hyper Scale Fabric

Z9500 Clos-based Spine-Leaf

Z9500 Spine

Z9500 Leaf

>6000 Servers
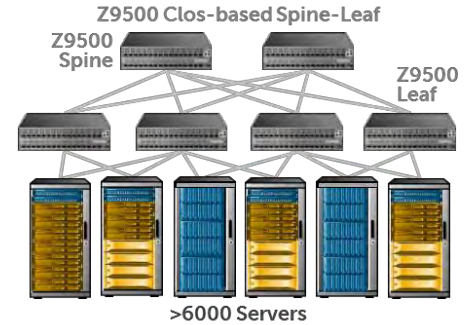
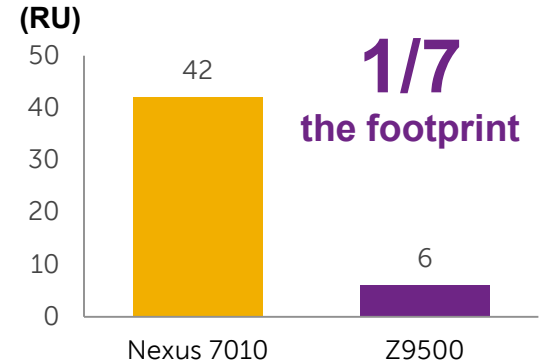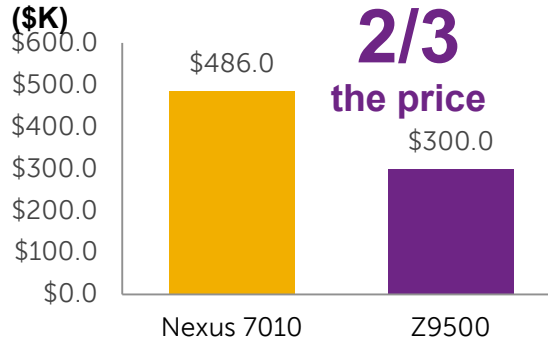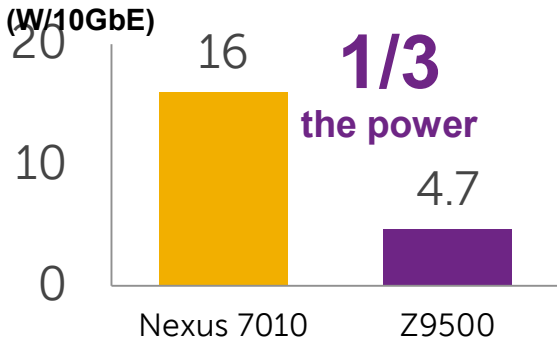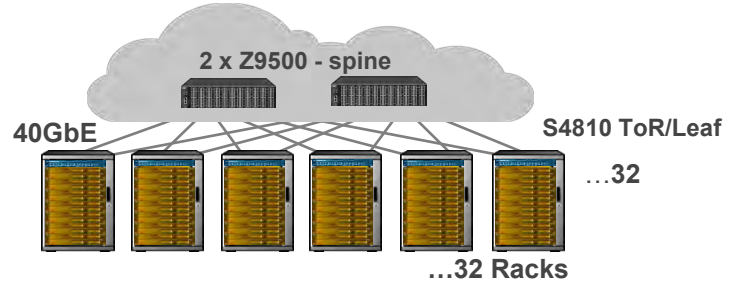Massively scalable with 40GbE interconnects inside fabric

17

Redefining fabric economics

For a 1536 10GbE port Data Center design, Dell Z9500 **consumes 1/3 the power**, is **2/3 the price** and requires **1/7 the footprint** compared to Cisco Nexus 7010.
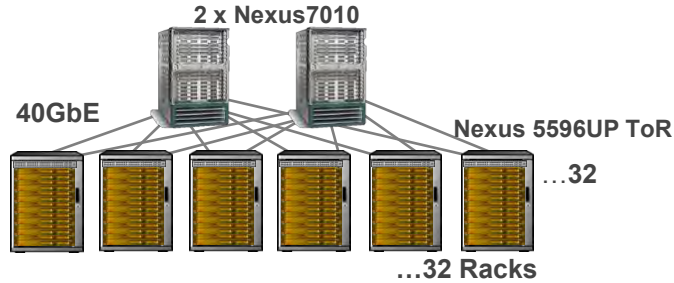
Dell Networking S4810/20T switch

1/10/40GbE top-of-rack switch

Accelerate 1G to 10GbE migration

- **Dell Networking Operating System 9**

  - 48 x 1/10G
  - 4 x 40G fabric uplinks (or 16 x 10G)
- **Built-in** virtualization support (VMware, Citrix)

- **Open Networking** capable on select models

- **DCB support** for SAN/LAN convergence (iSCSI, FCoE)

- Integrated **Open Automation**, scripting and programmatic management

Dell S4810

Dell 4820T

ITPRO INNOVATION AWARD
www.itpro.co.uk

Works with:

vmware®   CITRIX®

Great with   Dell servers & storage

Dell Networking S5000 unified switch

Dell's first fully modular 1RU top-of-rack and fabric switch

- **Pay-as-you-grow,** customizable modular unified switch
    - Up to 64 ports 10GbE; 4x40GbE
    - 2, 4, 8G Fibre Channel
- **Future-ready**, multi-stage design for next-gen I/O without rip & replace
- **Unified storage networking,** with complete support for iSCSI, RoCE, and FCoE with FC fabric services
- **Reduced management complexity,** Integrated automation, scripting and software programmability
- **Easy integration,** strong interoperability with major adapter, switch, & storage solutions

BEST OF SHOW AWARD **INTEROP** TOKYO | 12~14 JUNE, 2013
特別賞

Best of **INTEROP** FINALIST 2013 Data Center & Storage

CRN TECHINNOVATOR AWARDS 2013

Dell Networking S5000

Up to 1.3X
higher port density/RU than Cisco Nexus 5548

Up to 2.6X
higher port density/RU than Brocade VDX 6720-24 or 6730-32

Dell Networking S6000 high-density switch

Purpose-built for the Virtual Era

- **High-throughput low-latency performance** for demanding workloads

- **Built-in virtualization** features to scale virtual machine deployment

- **Integrated** automation, scripting and programmatic management with **Open Automation Framework**

- **Energy-efficient**, low power solution, Fresh Air capable for chiller-less operation

*Winner:
- 2013 Innovative Products & Solutions' award – China Network World
- 2013 Product of the Year' award - It168.com

Dell Networking S6000

- 2.5Tbps throughput

- DCB-enabled & SDN ready

- 32 x 40GbE or 96 x 10GbE + 8 x 40GbE, in breakout mode

- Open Networking-capable on select models

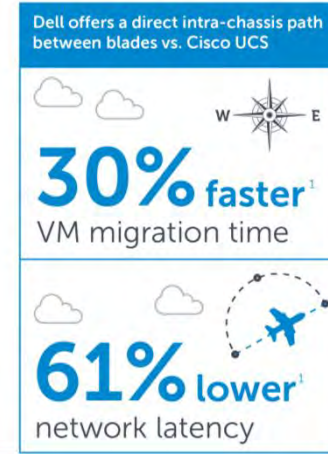- Designed for end-of-row; middle-of-row; top-of-rack; fabric switching
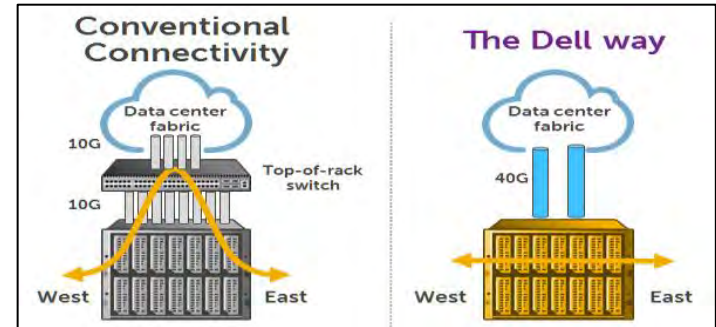
Dell MXL 10/40GbE blade switch

High performance full-featured 1/10/40GbE blade switch

Designed for end-to-end converged networks

- 10/40GbE switching in the chassis

  - 32 x 10Gb internal ports

  - Up to 6 x 40Gb external ports/uplinks

  - FlexIO modules provides flexible "pay as you grow" capability:

    - 1/10G Base-T
    - SFP+
    - 2/4/8 Fibre Channel

- Integrated automation, scripting and programmatic management

Dell offers a direct intra-chassis path between blades vs. Cisco UCS

30% faster[1]
VM migration time

61% lower[1]
network latency

30-40% CapEx savings

Conventional Connectivity — Data center fabric — 10G — 10G — Top-of-rack switch — West — East

The Dell way — Data center fabric — 40G — West — East

Connect to the feature of Networking

SDN- NVO - NFV

Paradigm shift expected in networking
Open Networking model

Networking Today

Proprietary Architectures & Mgmt Tools

Hundreds of Protocols

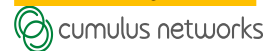Proprietary OS (e.g., Cisco IOS, JunOS)

Proprietary ASICs

Key Benefits

- New model for Open Networking Era—best-of-breed solutions
- Complete & consistent DC solution for servers and networking using widely popular Linux tools
- Independent innovation at every layer

Standard Orchestration & Automation tools
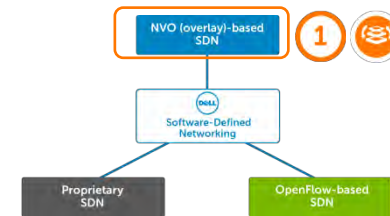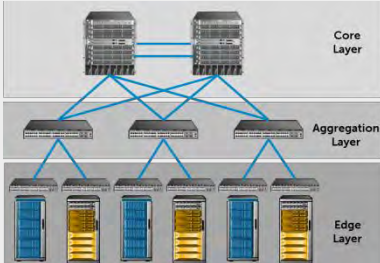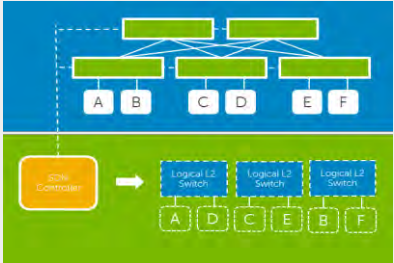
Optional 3rd party SDN / NVO Controller

3rd party OS   cumulus networks   **FTOS**

Open Standard HW

Merchant Silicon   BROADCOM

DELL
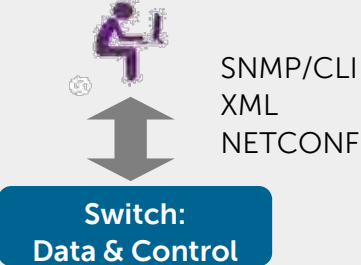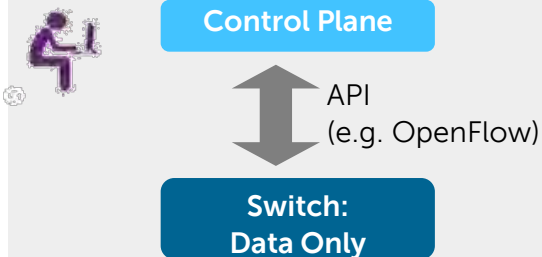
AFC benefits compared to traditional

Topology	**Traditional**	**SDN**
Network Slicing & Virtualization	• Manual Planning and Node-by-Node Configuration	• Centralized Programmable Fabric Virtualization Services • Robust Multi-tenancy for carrier grade isolation
Network Administration	• Cumbersome & inefficient	• Designed to support highly dynamic cloud applications & infrastructure
Software & Control Plane Maintenance	• Closed/Legacy Network OS • Outages during switch upgrades	• Linux/x86 Control Plane • Controller ISSU/Non-Stop Forwarding • Flow steering for hitless switch upgrades

AFC benefits compared to traditional

	Traditional	**SDN**
Control plane separation	SNMP/CLI XML NETCONF Switch: Data & Control	Control Plane API (e.g. OpenFlow) Switch: Data Only
Topology	• Fixed architectures: • STP based, VLT/MLAG, Leaf-Spine	• Flexible topology support with Auto-Discovery • No STP Blocked Links
Configuration & Provisioning	• Per-device & Per-port Manual Configuration & Provisioning	• Zero-touch Provisioning • Automated Configuration • Single Config for entire Fabric
Application & Cloud Orchestrator Integration	• Per-Device • Fragmented • Non-Scalable	• Centralized API for Fabric-Wide Control • Native Integration with OpenStack • Neutron API support + Extensions

Dell SDN: Maximize choice, complete unbiased approach

Cost-effective fabrics for virtualized and cloud data centers of any size

Network Functions Virtualisation 15G (NFV)
ETSI World Class Standards
CloudNFV™ Taking NFV to the Cloud

Hybrid, Public Clouds, Service Providers

Overlay Solutions

NVO Gateway for VMware & Microsoft
NFV – | Network Function Virtualization

VxLAN NVGRE

Active Fabric

Software Defined Networks

RESTful API
GET PUT POST DELETE

THE Open GROUP
puppet
Chef
OPSCODE

Open Automation
TCL, Perl & Python scripting
REST-API, XML, OMI, Puppet, Chef

Programmable Solutions

Private Clouds, Web 2.0 Providers

OPENDAYLIGHT

SDI, SDN, Open SDN Controllers,
Open Standards: OMG
Open Protocol: Open Flow

OMG
ONF OPEN NETWORKING FOUNDATION

Purist SDN with Open Flow

Greenfield Deployments

Dell **Open Networking** Approach

Offers open, innovative and best of breed solutions for open data center

Standard orchestration and automation tools

Optional 3rd Party SDN / NVO controller

Any OS

Open Networking switch

Merchant silicon

Big Switch Big Tap & Cumulus OS are complementary & unique solutions

Networking for Unified mgmt of servers & switches for Linux savvy customers

For Monitoring fabrics – capture growing market driven by Cyber attacks & application performance

Dell's rich, full-featured OS architected for performance, resiliency and portability across switch platforms

S4810-ON 1/10/40 GbE switch
S6000-ON 10/40 GbE switch

Dell's **Commitment** to OpenStack

"Dell … was one of the first of the hardware vendors to grasp the fact that cloud is about provisioning services, **not about the hardware**."

Maxwell Cooter, Cloud Pro

Proven solutions

Proven components

- **First OpenStack cloud solution provider**

- **Pioneering OpenStack partner**
  Only tier 1 day 1 hardware provider

- **Deep partner ecosystem**
  with single point of service and support

- ONLY company with automated software for **multi-node OpenStack provisioning: Crowbar**

- **Dell OpenStack experts** continually invest in the community

- **Gold Foundation Member** with 2 board positions

Save on licensing fees

Innovate aggressively
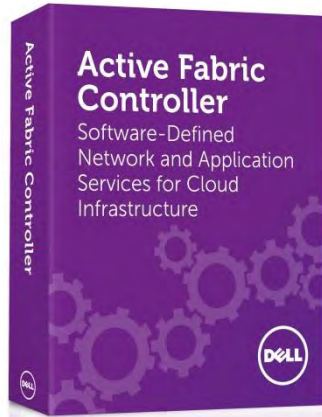
Scale operations efficiently

OpenStack

Can **deliver** the **promise**

of the **Cloud**

BUT

It is missing one thing …

Introducing
Active Fabric Controller

Active Fabric Controller

Active Fabric Controller
Software-Defined Network and Application Services for Cloud Infrastructure

DELL

Zero Touch
Deployment & Operation

Built-In
Topology Discovery & Optimization

Transform & Modernize IT Operations with a Network Designed for the Cloud

AFC Delivers on-demand virtualized network services for OpenStack with fully automated, whole-lifecycle management of the physical infrastructure

Deliver Customized Policy that Provisions & Scales Seamlessly
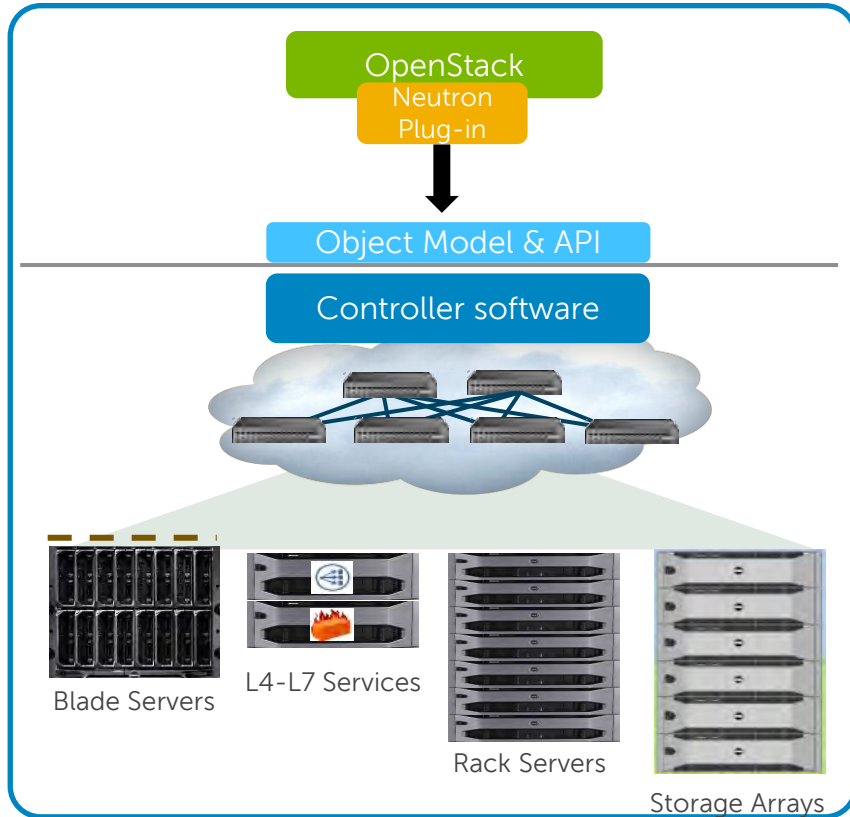
Provides real-time workload visibility and dynamically scalable policy - delivering adaptive security to make your Data Center untouchable

Experience Ultimate Efficiency with Elastic, Auto-Adapting Fabric Services

Automated topology discovery & forwarding optimization enables simple, seamless scalability - Programmable QoS & DCB enables convergence & higher-density operations

DELL

Active Fabric **controller** for Open Stack

OpenStack
Neutron Plug-in

Object Model & API

Controller software

Blade Servers

L4-L7 Services
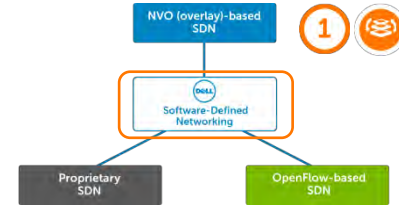
Rack Servers

Storage Arrays

Simple
- Zero-touch provisioning
- Centralized control plane
- Built-in support for L4-L7

Flexible
- Ready for DC and Cloud solutions
- Hypervisor agnostic
- Blades, rack servers, and VMs

Programmable
- Single interface for fabric-wide mgmt & control
- Language-agnostic APIs (REST)
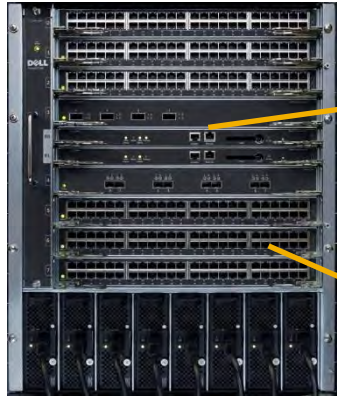- Simple/Extensible object model

How Active Fabric SDN Controller Works
Core Concepts
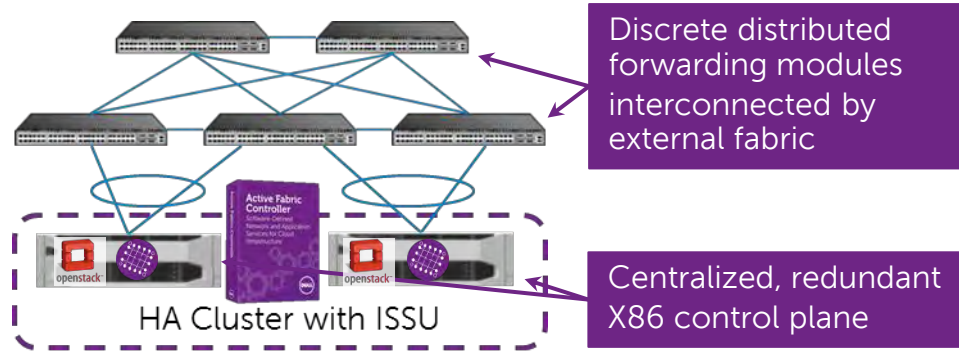
Traditional Modular Chassis

Centralized, redundant x86 control plane

Discrete distributed forwarding modules interconnected by internal fabric

- System of discrete components with centralized, x86-based control plane connected via an internal fabric
- One logical switch

Active Fabric Controller

Discrete distributed forwarding modules interconnected by external fabric

HA Cluster with ISSU

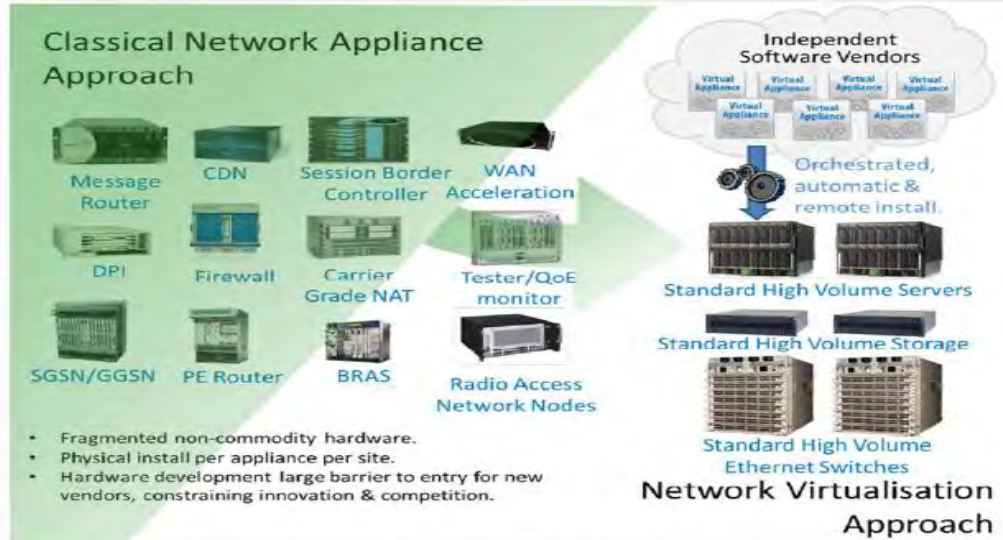Centralized, redundant X86 control plane

- System of discrete components with centralized, x86-based control plane connected via an external fabric
- One logical switch

NFV – What & Why

Today

Specialized / Dedicated

Static / Rigid

Closed

Manual

Classical Network Appliance Approach

Message Router | CDN | Session Border Controller | WAN Acceleration

DPI | Firewall | Carrier Grade NAT | Tester/QoE monitor

SGSN/GGSN | PE Router | BRAS | Radio Access Network Nodes

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

Independent Software Vendors

Virtual Appliance

Orchestrated, automatic & remote install.

Standard High Volume Servers

Standard High Volume Storage

Standard High Volume Ethernet Switches

Network Virtualisation Approach

Source: "Network Functions Virtualization: An Introduction, Enablers, Benefits, Challenges, & Call for Action", ETSI NFV ISG

Future

- **Shared Infrastructure**

- **Dynamic / Elastic**

- **Open**

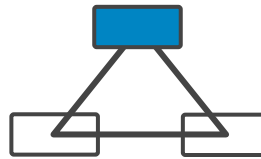- **Automated**

Network Virtualization Overlay

NVO Solution based on Hypervisors

vmware

vCloud Suite
- vCloud Automation Center
- vFabric Application Director
- vCenter Operations Management Suite
- vCenter Site Recovery Manager
- vCloud Networking and Security
- vCloud Director / vCloud Connector
- vSphere Enterprise+

Network Virtualization

Physical Infrastructure

Policy based automation of logical networks & services

- *Abstract*
- *Pool*
- *Automate*

- *Scalability (L2/L3 Active Fabric)*
- *Resilient & Non-blocking*
- *Optimized for new workloads*

Active Fabric

10/40G Fabric S4810, Z9000

Blade Switch MXL/IOA

Active Infrastructure
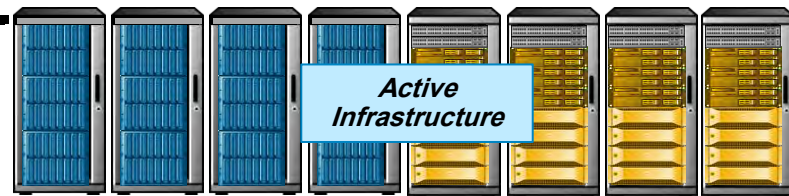
Top of Rack Switch S4810/S4820T, S60,S55
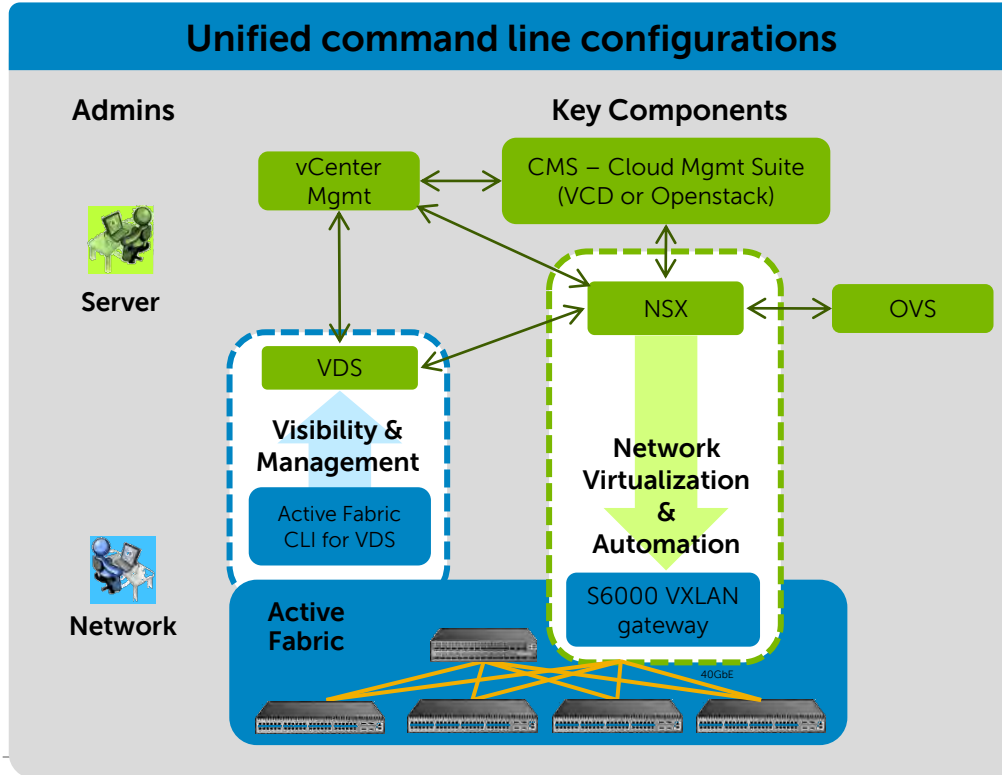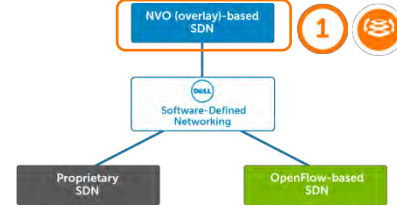
Note: Similar NVO solution for Microsoft exists – that requires Microsoft software stack

Dell + VMware **two-way integration**

Active Fabric Manager 2.0 support for VMware vDS

Unified command line configurations

Admins

Key Components

Server

Network

vCenter Mgmt

CMS – Cloud Mgmt Suite (VCD or Openstack)

NSX

OVS

VDS

Visibility & Management

Active Fabric CLI for VDS

Network Virtualization & Automation

S6000 VXLAN gateway

Active Fabric

40GbE

VMware vDS support in AFM 2.0

- Enables common design templates Provide familiar CLI interface to manage virtual switches

Common management

- Provide a single view
- Simplify operations

Common practices

- Leverage industry-standard command
- Establish common procedures, save time
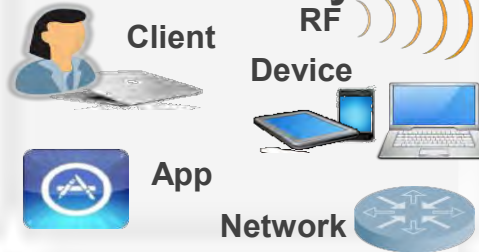
AirWave: Manage Network Operations
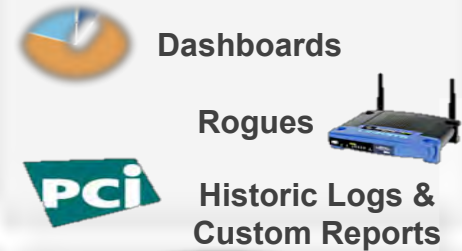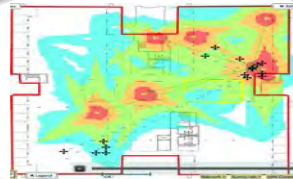
BYOD infrastructure for any business

Integrate seamlessly into the network

Applications

Data

Active Directory

Internet

Remote Access & VPN

3. **user**, **device** and **application** access authorized via policy integration

Dell Active Fabric

Dell SonicWALL Firewall & Remote Access

ClearPass™ GuestConnect & BYOD

2. ClearPass fingerprints **device, user and context**

1. Employees connect to network wirelessly

Individually owned devices self-register via login screen

Dell Networking

4. Employee receive **QOS access** to apps, network & data based on pre-set policies

Dell Networking N-Series Lifetime Warranty

Asset protection with upgradeable support options

	Lifetime Warranty	ProSupport
Technical support access		24x7
Parts and labor response	NBD Parts only	NBD or Mission Critical parts & labor
Software and firmware updates	✓	✓
TechDirect online cases and dispatch	✓	✓
SupportAssist remote monitoring	✓	✓
Dispatch monitoring and crisis management		✓
Escalation management		✓
Hypervisor and OS support		✓
Collaborative 3rd party assistance		✓
SupportAssist automated support		✓
Cost	included	$

Summary

Protect your investments	Open standards-based platforms designed for interoperability allow you to add new capabilities as needed without costly rip-and-replace
Drive new economics	Innovative data center and campus solutions are optimized for modern workloads and applications
Increase flexibility	"Pay as you grow" foundation based on modular, stackable, attractively priced interoperable switches gives you freedom to evolve at your own pace
Scale up, down and out	High-performance, economical 10/40GE fabrics provide greater agility as you respond to changing enterprise dynamics
Simplify management	Open automation tools and inherent support for virtualization help you achieve results quickly and easily

Commercial Marketing