Dell Networking momentum continues
Customers, solutions fueling 10 consecutive quarters of growth

Innovation & thought leadership
- New 10/40GbE architectures with Active Fabrics (L2/L3/LAN/SAN)
- Fuelling modular-to-fixed migration
- Enterprise SDN

42% Growth
Gaining market share

New Customers
30K+ FY13

E2E Solutions
+15 Pan Dell
Networking-enabled architectures & attach

Market share
#3/4 overall
#2 in 40GbE

Sources: Dell FY14Q1 earnings presentation; Q12013 Dell’Oro, Revenue market share
Dell Networking Product Portfolio

**Campus & Data Center Chassis Switches**
- C150/300
- E600/E1200i Modular

**Blade I/O**
- 1G: M6220, M6348
- 10G: M8024-k
- 10G/FC: M8428-k
- 10/40G: MXL

**Fabric & Access Switches**
- 1G: S55/S60, S5000
- 10G: S4810 / S4820T, S5000
- 10G/FC: 8100, Z9000, S6000

**Wireless & BYOD**
- **Controllers & Access Points**
  - Indoor
  - Outdoor
- **Instant access Points w/ built-in controller**
- **Guest access and BYOD**
  - W-series ClearPass

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Enterprise solutions enabled by Networking

**PowerEdge Servers**
- Rack servers
- Blade servers
- Tower servers

**Converged Solutions**
- Active System solutions
- M1000e convergence
- Cloud ready

**Dell Storage**
- Fibre Channel/FCoE
- 1/10GbE iSCSI
- NAS

**ClearPass BYOD**
- Policy integration
- User, device, application fingerprinting

**Workloads & Management**
- Big Data workloads
- Cloud platforms
- Management & automation

**Clients**
- Desktops
- Laptops, tablets
- Thin clients

**Security**
- Device recognition
- VPN
- Firewalls

**Virtualization**
- Efficient fabrics
- Automation software
- Pre-packaged solutions

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**Dell Networking**

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DC Product Portfolio & Roadmap
Trend-1: Changing traffic dynamics

1. **North-South**
   - User-Data Center
   - DC to Internet

2. **East-West**
   - Server/VM-Server/VM
   - Server-Storage
Dell Networking Architecture to meet new DC Traffic Patterns

Unifying compute, storage and networking to maximize efficiencies

Legacy Architecture

- Top-of-rack switch required
- East/West traffic switched at ToR
- Extra ports, cables, hassles

Dell Architecture

- No top-of-rack switch required
- East/west traffic switched locally
- 40GbE direct to fabric

Dell Innovation

30-40% CapEx Savings

Active System with 10/40GbE IO Aggregator

30-40% CapEx savings
Trend-2: The changing Data center core

Modular Migration to Fixed Form Factor

Density: Fixed vs. Chassis
40G per RU @ Line Rate (L3)

Source: Dell Oro, 2013
Dell Active Fabric Solutions

**Active Fabric** is a high-performance solution that addresses the emerging trends in the Data Center. The solution delivers end-to-end simplicity of design and management of next generation infrastructure.

- **Dial up and down capacity easily with fixed form-factor switches**
- **Massively Scalable**
- **Template based Provisioning Automation**
- **Unified fabric for LAN and SAN traffic Convergence**

- **10G & 40G L2/L3 fabrics**
- **DCB enabled (iSCSI, FCoE)**
- **OpenFlow enabled**

- **TCL, Perl & Python scripting**
- **Simplified management via northbound interfaces**

1/10GE & 8G FC
Blade Systems
MXL/IOA
1/10GE Rack Servers
S55/S60(1G)
S4810/20T(10G)
10/40GE & 8G FC
Converged LAN/SAN
S5000

40G Active Fabric
10G Active Fabric
Dell Refreshes it’s Top-of-Rack (ToR) Family...

...with several firsts that enable end-to-end data center solutions

Unified Storage Networking Switch Integrated with CI & Storage
- LAN/SAN convergence
- Fixed Modular Design (FC/Ethernet)

First Trident2-based 10/40 switch, Enterprise & Cloud Designs
- 2X TOR Density, 220W power, Fresh Air cooled
- Two Way VMWare Integration for SDN

Dell IP Products

S5000 Modules

Optics & Cables

S5000

Released

S6000

Best of Interop!!

Options & Cables

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Dell Networking S5000 converged LAN/SAN switch

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

- **Pay-as-you-grow**, customizable modularity powered by FTOS
  - 10GbE; 40GbE
  - 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

NEW!

Dell Networking S5000
Dell Networking S6000 purpose-built for the virtual era

- Fully-featured, high-density 1RU data center switch
  - 2.56Tbps throughput powered by FTOS software, DCB-enabled, VLT
  - 32 x 40GbE or 96 x 10GbE + 8 x 40GbE, in breakout mode
  - Designed for end-of-row; middle-of-row; top-of-rack; fabric switching

- 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
Trend-4: Simplifying the complex in today’s data centers

Ultra scalable, reliable Dell FTOS
Dell Simplifies fabric design, deployment & monitoring with Active Fabric Manager

**Design**
- Network topology
- Wiring diagram
- Fabric documentation
- Bill of materials

**Build**
- Config generation
- Provisioning
- Error detection

**Run**
- Monitoring
- Troubleshooting
- Maintenance

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**Dell Enterprise Forum Australia**

Manual
- Costly consultants
- Multiple tools
- "Best-guess" approach

Automated
- Any user
- Single intuitive tool
- Validated—no guesswork

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Automated configuration
- Rapid wiring & error detection

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**Manual**
- Expensive network admins
- Manual provisioning & configuration
- Error-prone, hard to troubleshoot

**Automated**
- Most information privy to certain admins
- Multiple CLI commands to execute per switch
- Manual tasks for each step

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Trend-5: Convergence

Compute + storage + networking + management
IO & Fabric Convergence and Use Cases
LAN & SAN Convergence

BEFORE
Ethernet and Fibre Channel traffic carried on separate infrastructure

AFTER
Ethernet and Fibre Channel converged and switched by S5000
Dell Networking + Dell iSCSI Storage
Certified together with Equallogic

Fabrics Optimized for new workload and storage

Certified Storage solutions with reference designs

Optimized software (Auto-detect, Config..)

Dell Networking

PowerVault EqualLogic
Compellent Storage

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Trend-6: Software Defined Networking

Dell Networking provides a **completely unbiased** approach

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**Applications & Hypervisors**

- NVO Gateway for VMware & Microsoft

**Dell Software Defined Networking**

- Legacy Interoperability
- Open Automation
- OpenFlow & Controller Interoperability

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**Legacy Environments**

**Greenfield & Cloud Environments**
Unified command line configurations

**Dell and VMware promotes team collaboration**

*With Two-way integration with VMware*

### VMware vDS visibility and Management from AFM 2.0
- Enables common command line interface (CLI) for physical and virtual fabric switches
- Provide industry-standard familiar CLI interface to manage virtual switches

### NSX Automation with S6000 VXLAN gateway
- Network virtualization extends to physical servers and non-VXLAN components in the DC
- Offers automation, scale and performance to customers

### Benefit to Users
- Increases productivity and collaboration for both server and network admins

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**Key Components**

- VCenter Mgmt
- CMS – Cloud Mgmt Suite (VCD or Openstack)
- NSX
- OVS
- S6000 VXLAN gateway
- Active Fabric CLI for VDS
- Visibility & Mgmt
Dell SDN OpenFlow Solution

SDN Controller
- Any OpenFlow 1.0 controller ex. NEC

Third Party App Ecosystem
- Orchestration
- L4-L7 Service integration

SDN Enabled Switch
- Implements OpenFlow 1.0+
- Platforms supported: S4810, Z9000, MXL, S4820T

Orchestration / Apps Services
- Orchestration
- Control Plane
- Forwarding Plane

For 2HCY13
- Beta OF1.0 N2000 & N3000 and PCT 8100

For 1HCY14
- Openflow 1.0+ support on s5000
- Openflow 1.0 with s6000
- RTS OF1.0 N2000 & N3000 and PCT 8100

For 2HCY14
- Support Openflow 1.3

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Campus Product Portfolio & Roadmap
Today’s Campus networks are expensive & complex

Explosive North-South Traffic Growth

Active Fabric

Increasing Complexity & Shrinking Budgets

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Trend 1: Performance - 10GE in the Campus Agg
New Dell Networking 8100 Series Agg Switch

• **Switching Capacity**
  - 10GE wire speed on all ports
  - 40GE uplinks to fabric
  - Fast Recovery, High Availability 160Gb Stacking
  - 1.2 Tbps switch fabric capacity

• **Edge Port Capacity**
  - 8132 - supports 9,216 edge ports (24 wiring closets)
  - 8164 - supports 18,432 edge ports (48 wiring closets)

• **Reliability**
  - Active – Active Agg designs (MLAG) \(^1\)
  - Internal, hot swappable, redundant power

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1. OS 6.0 feature scheduled for Q1 2014.
Trend 1: Performance - 10GE in the Campus Agg
Dell Networking C-Series chassis upgrades

**C300**

- **Switching Capacity**
  - 10GE wire speed on all ports (SFP+ and Base-T)
  - 40GE uplinks to fabric
  - 3.8Tbps local switch capacity

- **Edge Port Capacity**
  - C150 - supports 4,608 edge ports (12 wiring closets)
  - C300 - supports 10,752 edge ports (28 wiring closets)

- **Reliability**
  - Active – Active Agg designs (VLT)
  - Internal, hot swappable, redundant power

Existing Line Cards

- 8 x 10GE SFP+
- 48 x 1GE PoE+
- 16 x 10GE Base-T*
- 6 x 40GE QSFP+*

* Coming in April CY2014.
Trend 2: Performance - scale effects on the Edge

New Dell Networking N-Series 1GE Edge Switches

**Hardware**
- Market Leading Performance and Efficiency
- Common Features across Edge/Agg

**OS Versions**
- Single OS 6.x
  - L2/L3 Edge
  - Edge & Agg

**OS Features**
- Common CLI & GUI
- Common Feature Sets
- Faster Development Velocity

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**N-Series**

**N3000 Series**
- N3048P
- N3048
- N3024P
- N3024F
- N3024

**N2000 Series**
- N2048P
- N2048
- N2024P
- N2024

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**8100 Series**

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**First Floor**

**Second Floor**

**Third Floor**

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Trend 3: Performance - Wireless goes Gig
New Dell Networking 802.11ac access points

New technology introduction – 802.11ac Gigabit Wi-Fi

W-Series 802.11ac Access Point – GIGABIT WIRELESS

- In first wave of 802.11ac Enterprise Access Points on the market
- 3x3 MIMO for 11ac – Delivering up to 1.3 Gbps
- Models with Internal and External antenna support
- Instant or Standard AP modes
- Dual-Ethernet ports to the wired network available
- Powered by 802.3at (PoE+)
Trend 3: Performance - Wireless goes Gig
New Dell Networking 7000 Series WiFi Controllers

- RF coverage for The Pentagon or 3 Empire State Buildings
- Capacity for students of UPenn to watch NetFlix HD Movies

Platform for Tomorrow
- Optimized for 802.11ac
- Up to 2048 APs / 32K devices / 40Gbps encryption
- 2 million firewall sessions
- Integrated security & app intelligence

Front View
- Expansion Slot
- dual personality ports (RJ-45 or SFP)
- I/O, HA, MGMT
- 4x 10GBaseX (SFP+) Ports
- Console RJ-45 or usb

Rear View
- Hot-Swappable, Load-Sharing, Redundant Power Supplies
- Field-Replaceable Fan Tray
Trend 4: Simplifying the complex in Campus Reference Architectures - Switching and Wireless LAN Deployments

- Bring Your Own Device (BYOD)
- Guest Access
- Virtual Desktop Infrastructure (VDI)
- Unified Communications & Collaboration (UC&C)
- Reference Architectures

Management Solutions

Campus Foundations and Tenets

- Performance
- Reliability
- Disruptive Economics
- Simple Bring-Up
- Simple Serviceability

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Trend 4: Simplifying the complex in Campus Reference Architectures - Switching and Wireless LAN Deployments

**Products & Features**

**Access Layer** - Best Practices & Features
- Access, trunk and general Switchport modes
- PVID and native VLAN
- LACP and LAGs (link aggregation groups)
- STP (spanning tree protocol)
- Stacking
- QoS

**Core and Aggregation Layer** - Best Practices & Features
- VLAN’s and VLAN Routing
- Multiple Spanning Tree
- VRRP

**Architecture Overview**

**Physical Configurations**

**Deployment Examples**

**Product & Feature Configs**

```plaintext
ip vrrp
interface vlan 200
vrrp 20
vrrp 20 mode
vrrp 20 description master
vrrp 20 ip 20.20.20.1
exit
interface vlan 201
vrrp 21
vrrp 21 mode
vrrp 21 description master
vrrp 21 ip 21.21.21.1
exit
interface vlan 300
vrrp 30
vrrp 30 mode
vrrp 30 description backup
vrrp 30 ip 30.30.30.1
exit
interface vlan 301
vrrp 31
vrrp 31 mode
vrrp 31 description backup
vrrp 31 ip 31.31.31.1
```
Trend 5: Transformation in ROBO (Remote Office/Branch)

- LCD Display Panel
- KVM Ports
- Shared Storage 25 2.5” or 12 3.5” (expandable)
- Internal low latency, fast storage
- 8 External PCIe Slots
- Hot Plug Redundant Blowers & PSUs
- 8 External RJ45 ports
- Remote Management Ports
- Locking Front Cover
- Shared DVD
- Up to 4 PowerEdge M-Series Servers Running Microsoft Windows or VMware ESXi
Key take-away’s for Campus Networking

1. 24 Month Full Campus Refresh
   - 10/40G Agg – 8100 Series and C-Series Chassis
   - WLAN – 802.11ac AP’s, 7000 Controllers, ClearPass
   - 1G Edge – N2000 & N3000

2. Campus Solutions
   - Campus Reference Architectures 1.0 and 2.0
   - Security integration
   - Guest Access/BYOD, MS Lync, and VDI
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