Dell Networking

校園數據中心與區域網路的安全佈署

Yu Yang 楊尚餘

0932 898 888

yu_yang@dell.com

Nov. 2017

Agenda

Agenda

- 數據中心與區域網路的市場趨勢
- 數據中心網路的安全佈署-Open Networking/SDN
- 有線區域網路的安全佈署-One Tier
- 無線區域網路的安全佈署-Non-Controller connection
- Q&A

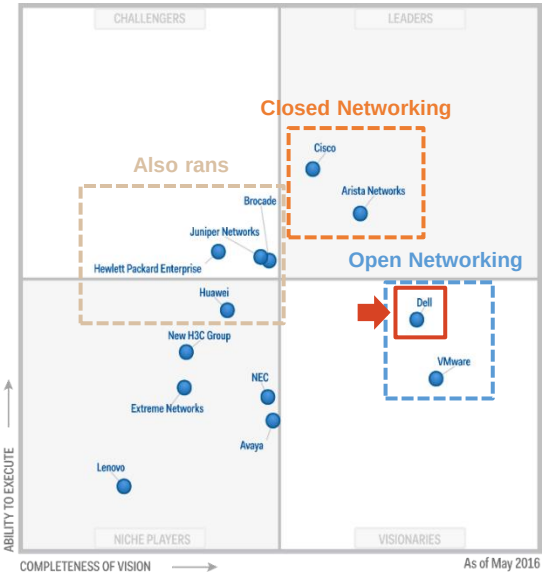
Where we are !?

Gartner MQ Data Center Networking Progress

Recognized for our **vision and execution**

2017 July

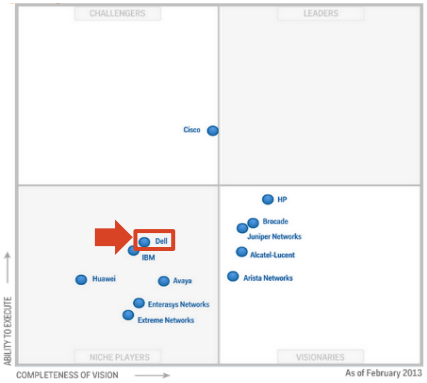
2016



2015

2014

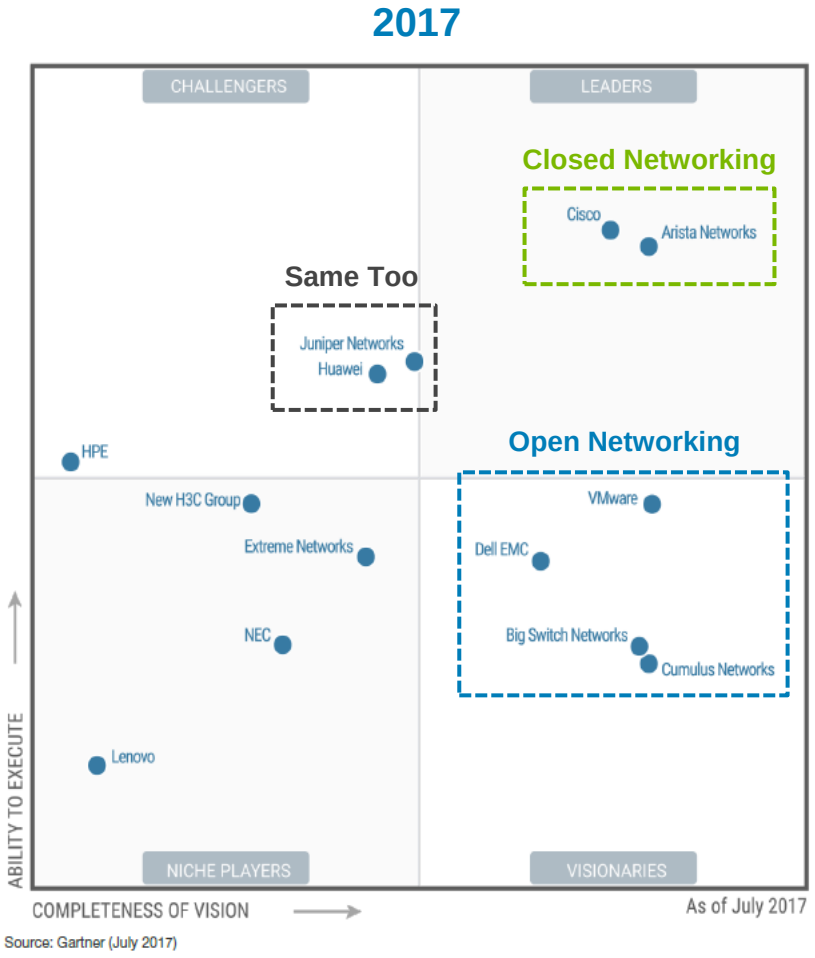
2013



We're recognized for our vision and execution

Gartner Data Center Networking

- 75% of the end users indicated that they expect an increase in relevance of open networking in their purchasing decisions in the next 24 months.
- Interest and adoption of white-/brite-box switching has increased significantly within hyperscale data centers…we expect it to reach 22% of the total data center Ethernet switch market by 2020



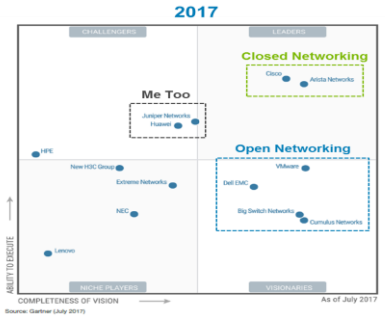
Source: Gartner (July 2017)

What is the difference between White- and Brite-box (Branded white box) switching ?

White-box switching uses original design manufacturer (ODM) switches that have a limited set of features and short refresh cycles.

Brite-box switching joins a trusted vendor to the white box, adding branded software, services and support.

We're recognized for our vision and execution (Cont.)



Gartner Data Center Networking report on Dell EMC

- The vendor's portfolio of hardware and software switching platforms addresses most enterprise data center networking use cases as well as scale-out cloud solutions.
- Based on client deals that Gartner observes, **Dell EMC pricing is very aggressive.**
- Dell EMC has taken a very open approach to data center networking, including support for other vendors' NOSs to run on its hardware, in addition to submitting its own NOS (OS10) to open source.
- Dell EMC also provides compute, storage and integrated system infrastructure, **and we expect increased bundling with networking (including VMware's network software, NSX). This appeals to customers that prefer to purchase their infrastructure from a single vendor.**

Refer to https://www.gartner.com/doc "Magic Quadrant for Data Center Networking" Published: 03 July 2017

Dell
Open
Networking

-ON

Optimization - ON
Networking solution

Dell Open Networking switches simplified

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

Operating System (OS)

ipinfusion

Pluribus NETWORKS

DELL

big switch networks

cumulus networks

ONIE

Open Network Install Environment

Z9100-ON Multi-rate Fabric Switch

S4048/T-ON 10/40GbE Switch

S3048-ON 1/10GbESwitch

S6100-ON Multi-rate Fabric Switch

S6010-ON 40GbE Switch

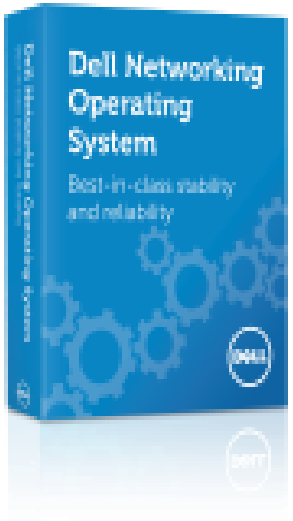
ONIE Bootloader for all OS's for Dell Networking ON switches

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

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

Dell Networking

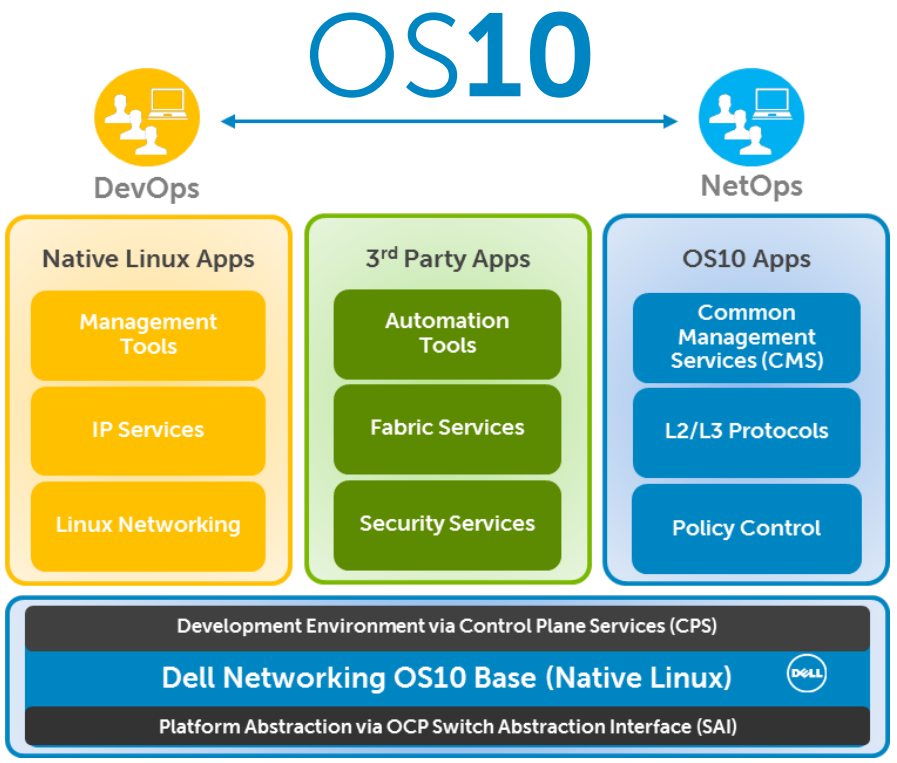
OS10



Modularity and design Operating System (OS)

What really makes OS10 different

- ✓ **Uses an unmodified Linux kernel and distribution**
  - Enables OS standardization across data center infrastructure
- ✓ **Completely disaggregated software architecture**
  - Base system software decoupled from L2/L3 protocol stack and services
  - Unrestricted programmability and portability via CMS, CPS and SAI
- ✓ **Mainline software for Dell Networking portfolio**
  - Not developed for a 'bolt-on' product set, or product sub-set
  - Extensible to campus and wide-area networking environments



Modern software for modern operations

User accounts

OS10 defines two categories of user accounts — use `admin` for both the username and password to log into the CLI, or use `linuxadmin` to log into the Linux shell.

```
Aug 13 19:41:06 OS10 dn_ifm[977]: Node.1-Unit.1:PRI:notice [os10:notify], %Dell EMC (OS1
Aug 13 19:41:07 OS10 dn_ifm[977]: Node.1-Unit.1:PRI:notice [os10:notify], %Dell EMC (OS1
Aug 13 19:41:08 OS10 dn_ifm[977]: Node.1-Unit.1:PRI:notice [os10:notify], %Dell EMC (OS1
Aug 13 19:41:08 OS10 dn_ifm[977]: Node.1-Unit.1:PRI:notice [os10:notify], %Dell EMC (OS1
Aug 13 19:41:08 OS10 dn_l3_core_services[925]: Node.1-Unit.1:PRI:notice [os10:trap], %De
68.10.1/24 added successfully

Debian GNU/Linux 8 OS10 ttyS0

Dell EMC Networking Operating System (OS10)

OS10 login:
Debian GNU/Linux 8 OS10 ttyS0

Dell EMC Networking Operating System (OS10)

OS10 login:
Debian GNU/Linux 8 OS10 ttyS0

Dell EMC Networking Operating System (OS10)

OS10 login:
```

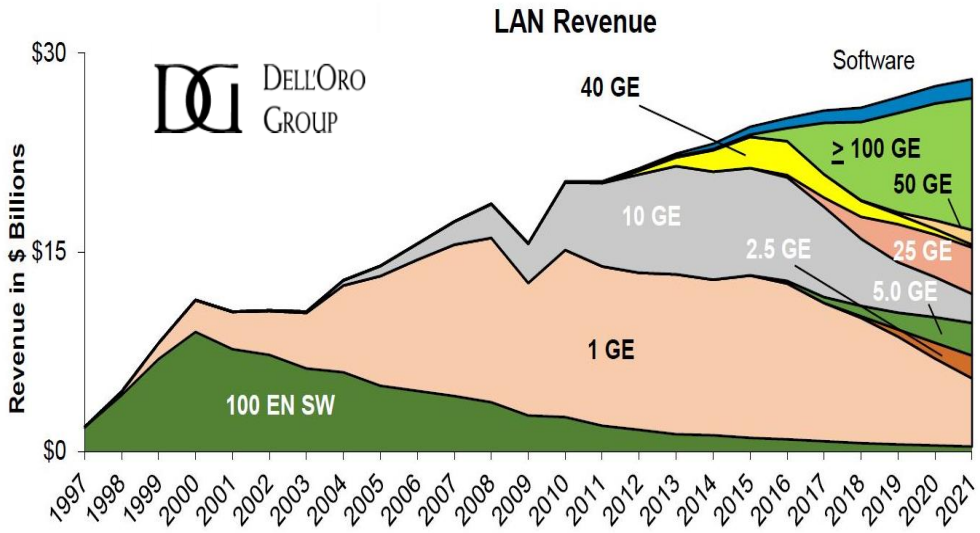
```
OS10 login: admin
Password:
Last login: Sun Aug 13 19:39:31 UTC 2017 on ttyS0
Linux OS10 3.16.39 #1 SMP Debian 3.16.39-1+deb8u2 (2017-06-01) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.


-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-*          Dell EMC  Network Operating System (OS10)            *-
-*                                                                *-
-* Copyright (c) 1999-2017 by Dell Inc. All Rights Reserved.      *-
-*                                                                *-
-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-

This product is protected by U.S. and international copyright and
intellectual property laws. Dell EMC and the Dell EMC logo are
trademarks of Dell Inc. in the United States and/or other
jurisdictions. All other marks and names mentioned herein may be
trademarks of their respective companies.

OS10#
```

```
OS10 login: linuxadmin
Password:
Last login: Sun Aug 13 19:37:07 UTC 2017 on ttyS0
Linux OS10 3.16.39 #1 SMP Debian 3.16.39-1+deb8u2 (2017-06-01) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.


-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-
-*          Dell EMC  Network Operating System (OS10)            *-
-*                                                                *-
-* Copyright (c) 1999-2017 by Dell Inc. All Rights Reserved.      *-
-*                                                                *-
-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-*-

This product is protected by U.S. and international copyright and
intellectual property laws. Dell EMC and the Dell EMC logo are
trademarks of Dell Inc. in the United States and/or other
jurisdictions. All other marks and names mentioned herein may be
trademarks of their respective companies.

linuxadmin@OS10:~$
linuxadmin@OS10:~$
linuxadmin@OS10:~$
```

Ethernet Switch Marketing Forecast

Total L2+L3 Ethernet Switch Revenue Forecast

- Over the five-year forecast period for the Ethernet Switch market, the revenues will increase from $25.1 B in 2016 to $28.0 B in 2021
- The enterprise/campus market has started a mini-upgrade cycle to 2.5/5.0 GE and data center market has started a mega-upgrade cycle to 25/50/100 GE.



The enterprise/campus market will undergo a miniature upgrade cycle to **2.5/5.0 GE in order to support higher-speed 802.11ac Wave 2** access points (APs). As a result, switching will become more of an infrastructure solution and not a direct, end-user connectivity solution. The data center market will move from being enterprise dominated to being Cloud dominated, causing the data center market to make at least two speed migrations by 2021. **The 25 GE SERDES upgrade is occurring now and a 50 GE SERDES upgrade is expected to arrive by 2019.**

Start From.....

Security ?!

Or *proprietary protocol*

.....in your campus networks

Dell Networking Standard Advantages

A. Networking Hardware 3 Years Warranty

B. Only one choice for Layer 3 License (No other option)

C. Free upgrade for Networking OS

D. Free Phone Call Support with Mandarin

E. N/X/PCT Series LLW

Dell Networking product portfolio

Data Center

1GbE: S3048-ON; S3100

10GbE: S4048-ON/ S4048T-ON

100G/40G /10G: S4100-ON

100G/ 8/16/32G FC: S4148U

40GbE: S6010-ON

100GbE: Z9100-ON

100GbE: S6100-ON

One-Tier Chassis

C9010/1048P

Campus

1GbE: X-Series

10GbE: X4012

1GbE: N1100/P

1GbE: N1500/P

1/2.5GbE: N2000/P N2100/P

1/2.5/5GbE: N3000/P N3100/P

10GbE: N4000

Blade Chassis

M1000e

1GbE: M6220; M6348

10GbE: M8024-k

FC: B5424

10/40GbE/FC: MXL

10GbE FX

-ON Open Networking

OS10

Enterprise Open Edition + ecosystem

Pluribus NETWORKS; big switch networks; ipinfusion; cumulus networks

Brocade FC

300: 8, 16, 24

6505: 12, 24

6510: 24, 36, 48

6520: 48, 72, 96

G620

DCX8510

Mellanox

SX6012; SX6025; SX6036

Wireless

AeroHive & HiveManager NG Cloud-Based Management

AP130; AP230; AP250; AP1130室外

W Series- Aruba Guest access and BYOD

W-series ClearPass

intel

H1024; H1048; H9106; H9124

Software OS

Dell Networking Operating System

Active Fabric Manager

OpenManage Network Manager

OS10

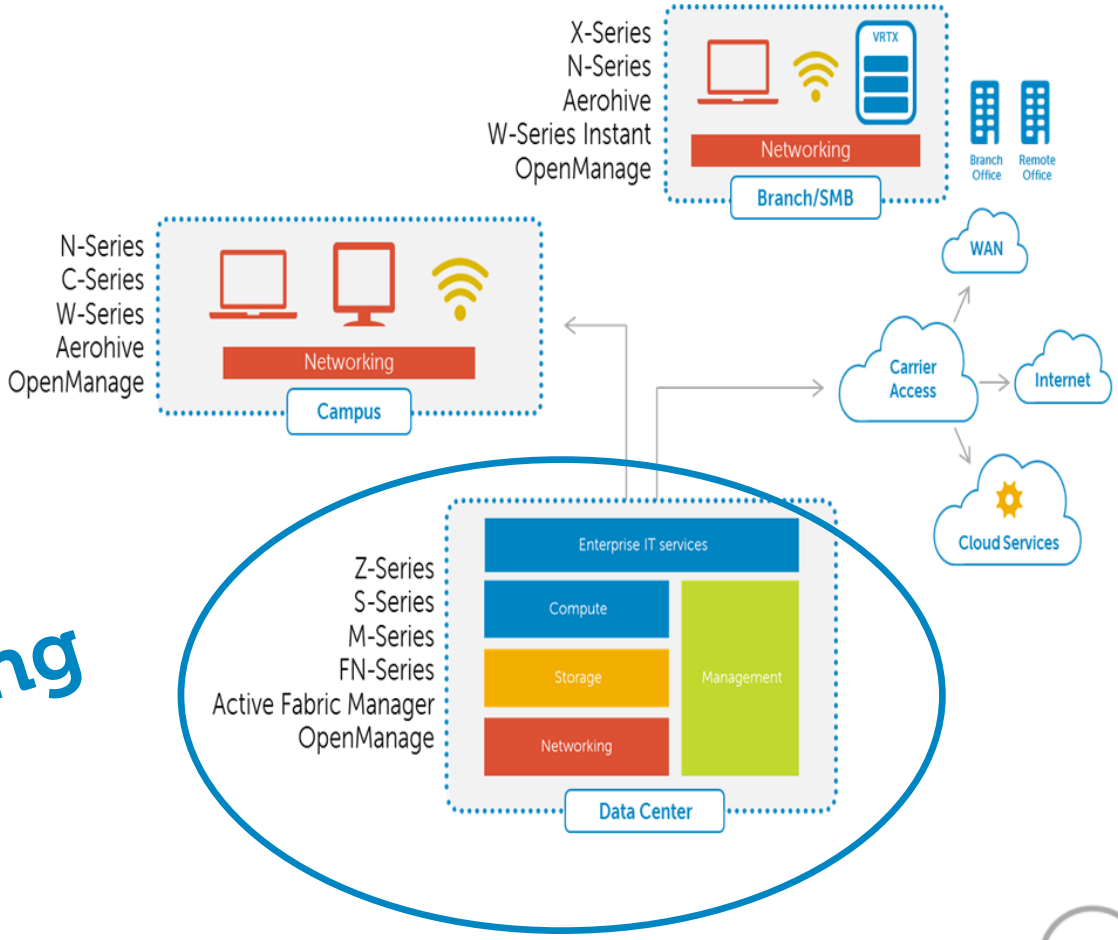
Dell Networking Solution

1. **Data Center**
2. **Campus**
3. **Wireless**

Data Center

SDN

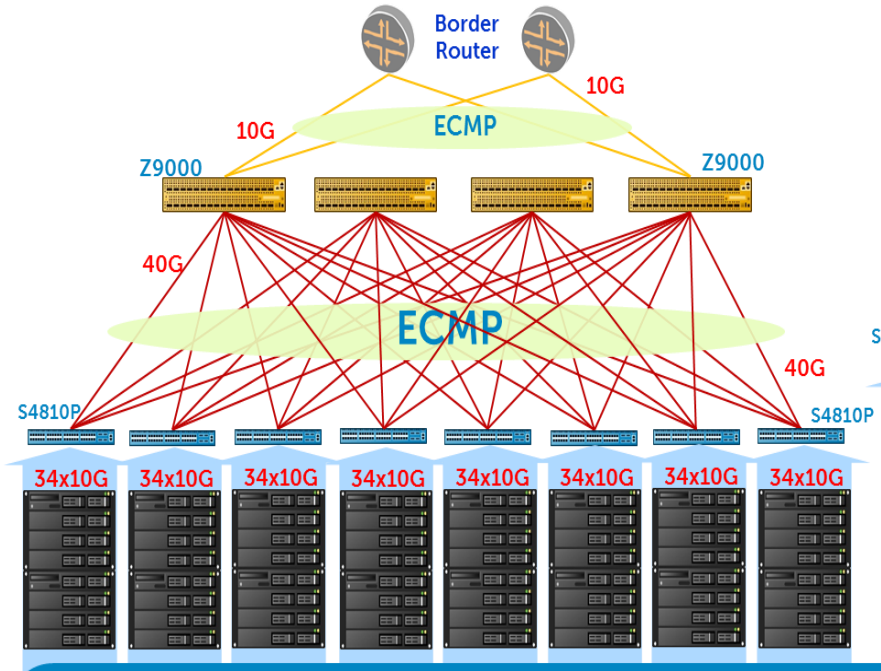
1 Data Center

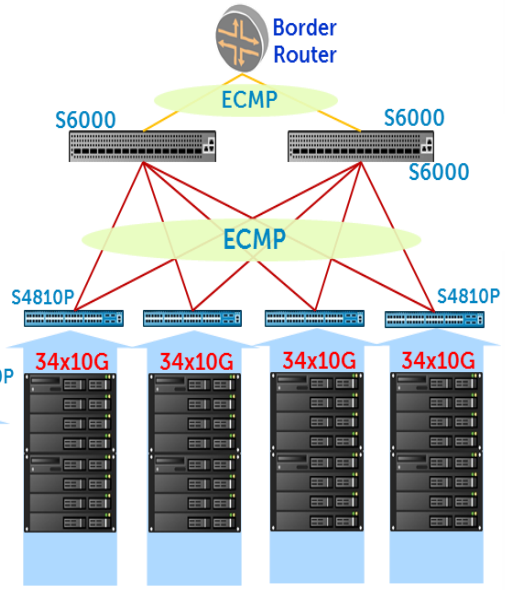


Dell Open Networking -ON

TW Case – Z900/S6000(ECMP)

因傳統式Chassis H.A無法實現Active-active能力，故當H.A其中一台Chassis 故障時，容易造成大量伺服器叢集停止服務。故採用於2011年進行小規模佈署實現Dell Active Fabric架構(Spine-leaf) ，於2012擴充佈署64台以上 Z9000與超過10,000伺服器連接。將國外H.Q實際建置經驗移至台灣。





CY12/CY13 Use Case:

Customer has a large L3 Network Requires 10,000s servers with growth
Need to support smallest O.S possible 1G and 10G servers

Scale:

Build over 64 Z9000 nodes on Spine- Leaf topology
Capable to support 1G to 10G migration.
Start with 10,000 servers growing to 100,000 servers
Expand with little or no hits

CY13/14 Use Case:

Copy US topology to implement in Taiwan site

Scale:

Change Z9000 to S6000
Due to density
S6000 1U

汰換理由:

- 捨棄傳統Chassis的設備耗電 占空間 散熱等問題
- 縮點交換機故障時 影響伺服器服務的時間

競爭對手:

Cisco, Brocade, Juniper

致勝關鍵:

- 分散服務風險 避免傳統Chassis故障導致大量伺服器叢集服務中斷
- **40GbE 專屬Cable management kit 輕鬆佈署**
- 高密度 可依需求擴充
- 耗電量低(<800Watt)
- 低延遲

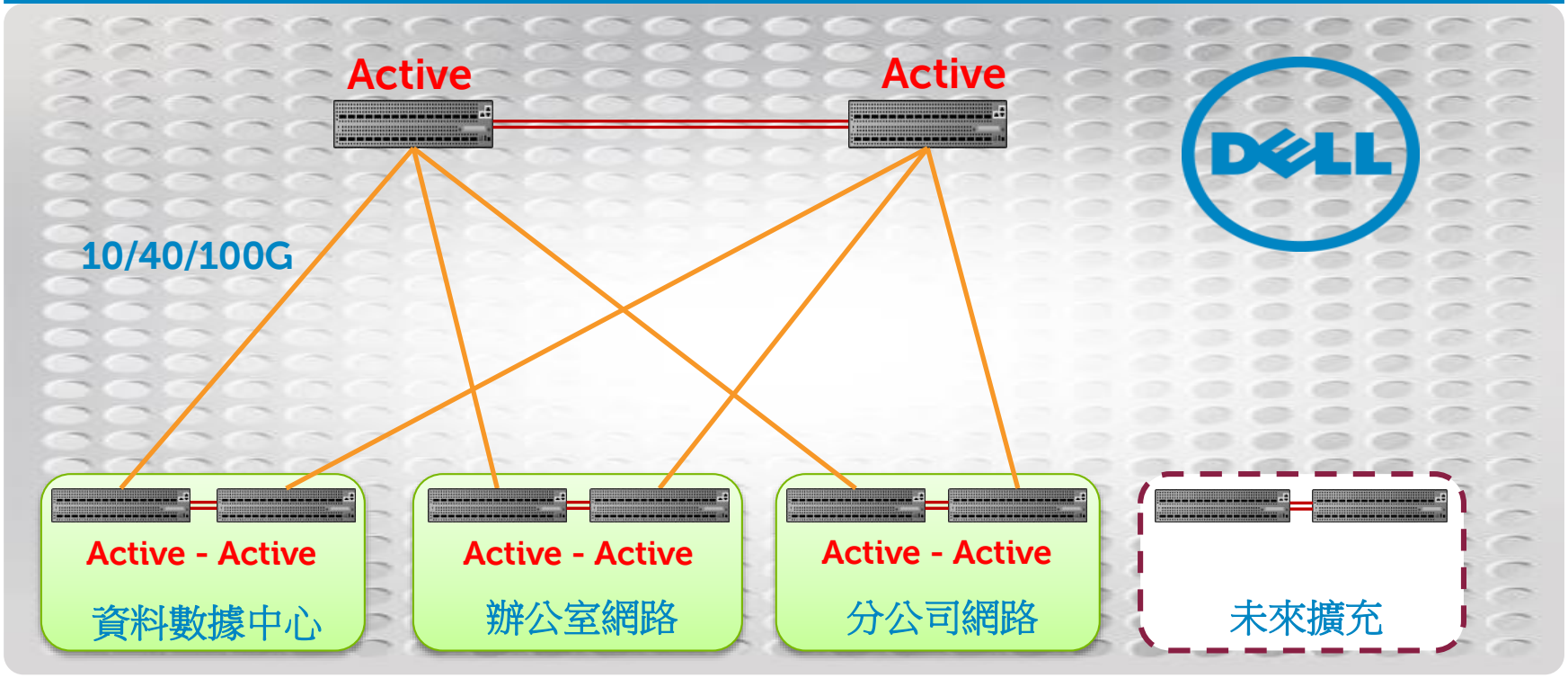
設備部屬:

S6000*2
S4810P*4

Dell 主動式網路架構

- 全球 "統一" 架構佈署
- 架構簡單，佈署容易
- 依營運需求擴容
- 分散式備援，及可預測災難影響範圍
- 縮短災難復原時間。
- 研究與實現 SDx/SDN

Dell Active Fabric Topology



VLT- Virtual Link Trunking

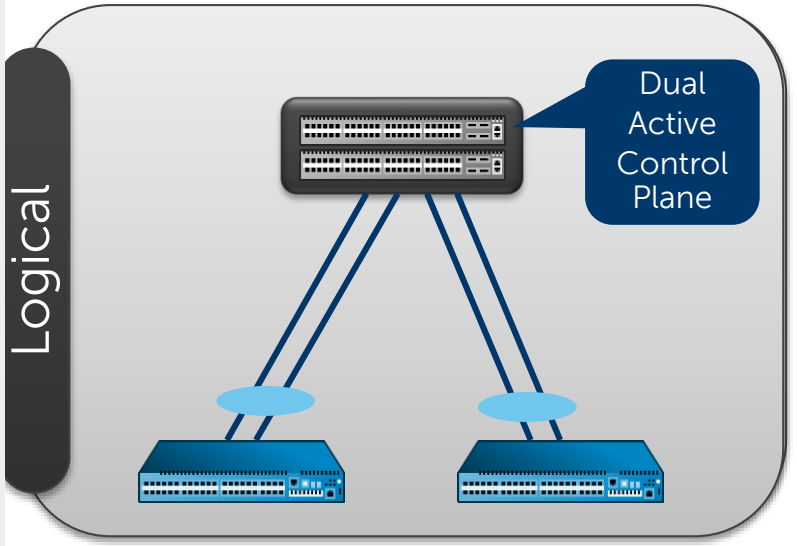
VLT/mVLT: Feature Overview

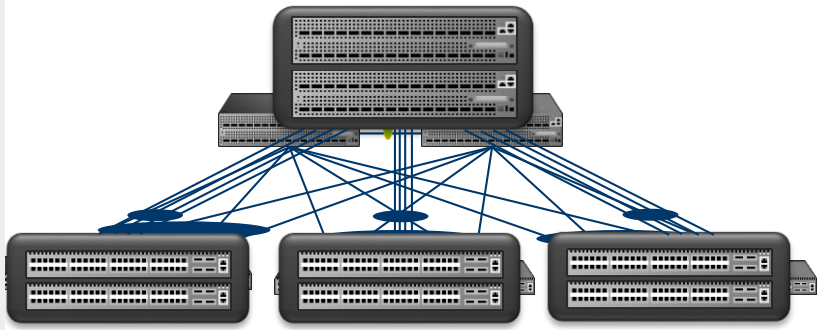
VLT: Multipath LAG

- ✓ VLT is a key ingredient of Active Fabric that enables multiple L2 paths in the fabric.
- ✓ Unlike stacking, VLT is Dual Active Control Plane
- ✓ Works with any standard LACP implementation to form VLT LAG – No Vendor Lockup

mVLT: Interconnecting multi domain

- ✓ Interconnect multiple VLT domains by simple VLT LAGs
- ✓ Create Hierarchical VLT by interconnecting multiple VLT domains
- ✓ Build scale out Clos network with increased port density
- ✓ VLT proxy gateway to stretch L2 VLAN across DC and avoid traffic trombone



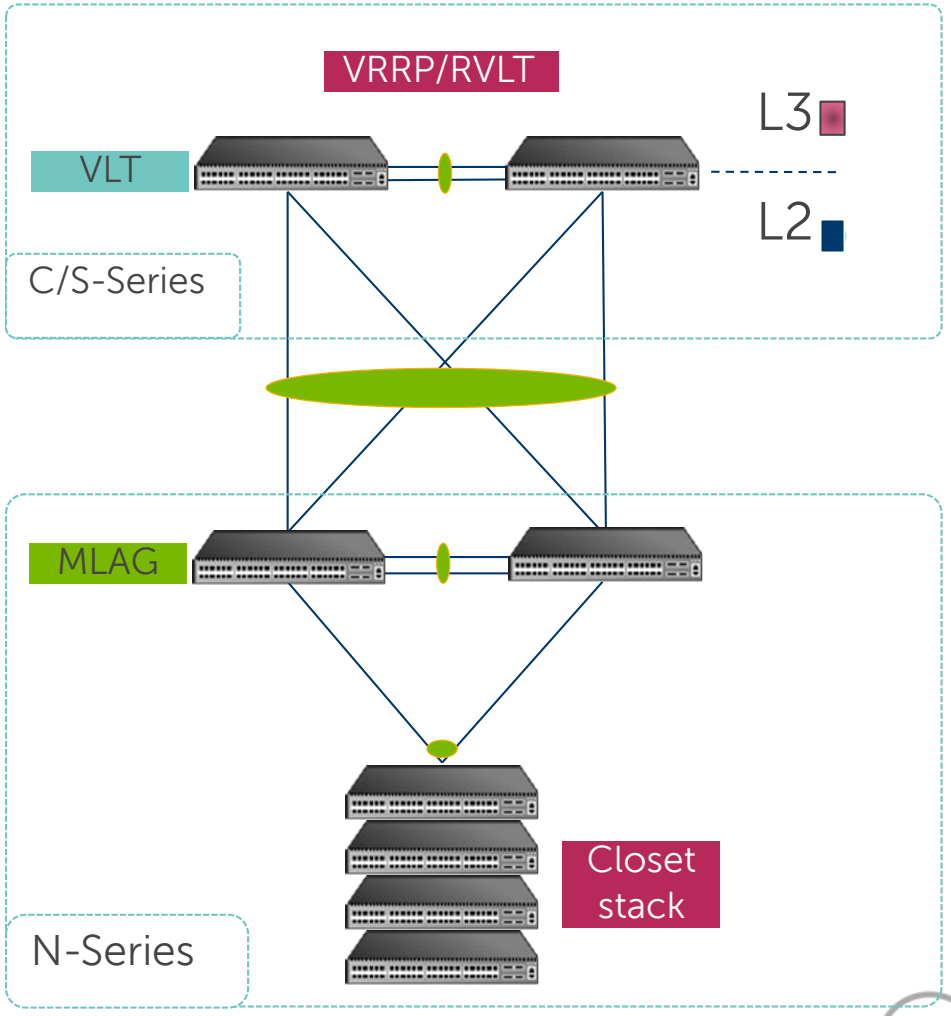


Physical Topology
Logical View

Protocol behavior: **How VLT works**

VLT benefits

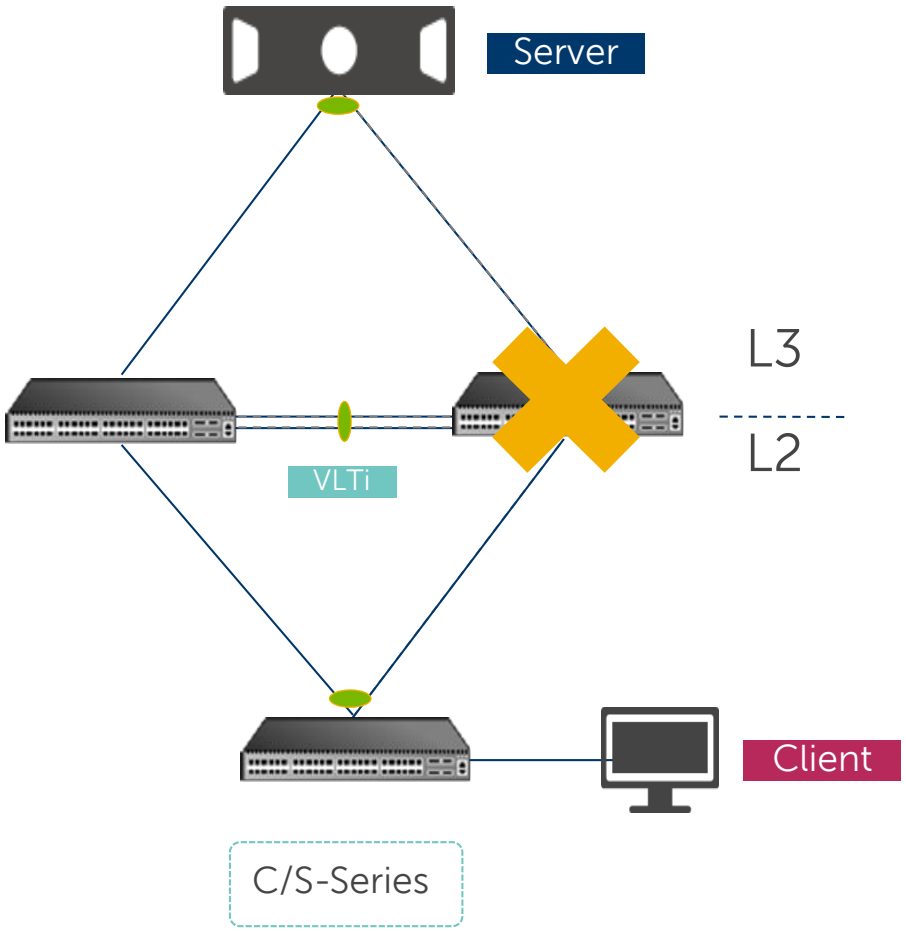
- Supports separate HB
- Peer-link can pass Layer 3 Traffic
- Graceful failover of LACP during reload
- Supports both VRRP or RVLT



VLT: The protocol for high availability

VLT Key Points

- Active / Active is more efficient
- Self Healing without requiring STP
- HA & Redundancy
- Separation of Data & Control Planes

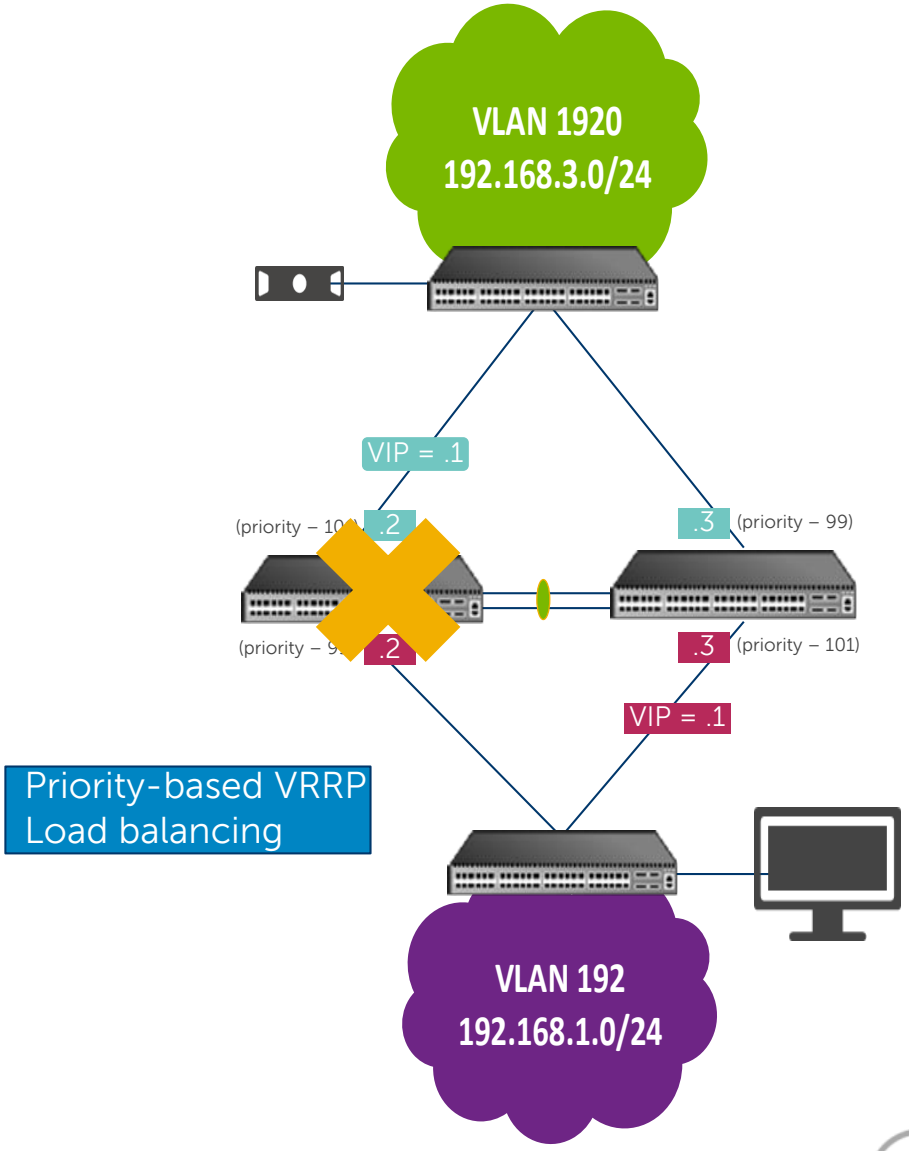


Protocol behavior: **How VRRP works**

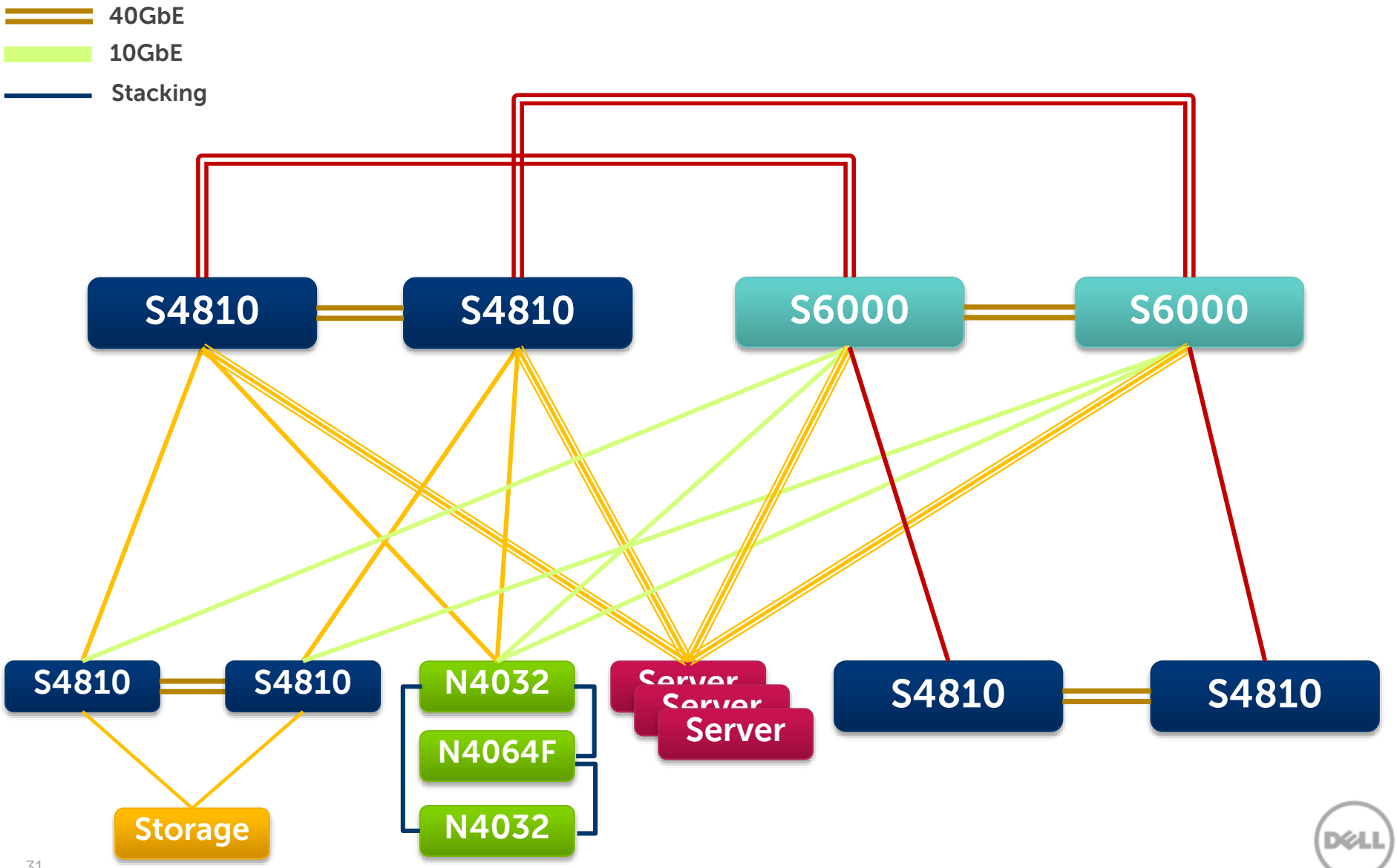
IPv4 or IPv6

VRRP key points

- Master / backup
- Auto-recovery with minor traffic disruption
- **Industry standard**
- **Supports IPv4 or IPv6**
- Path dependent on L2 hashing algorithm

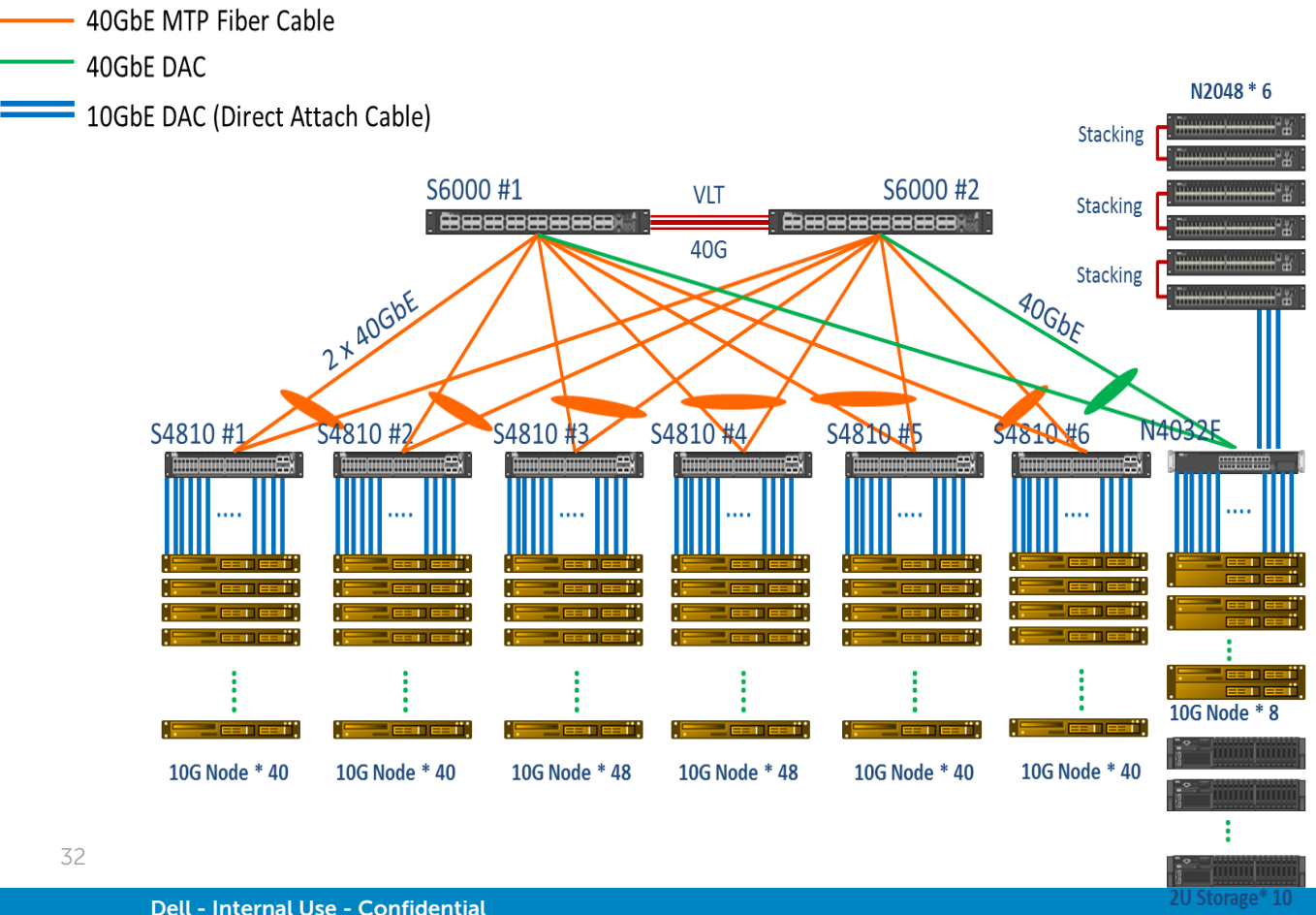


Non-stop service with Core expansion



TW Case- HPCC S6000/S4810P

採用二台DELL S6000實現Active-Active 保護與6台S4810P形成Spine/Leaf 故具備HPCC 所需高密度高容量外，且達到快速擴充需求及Low-Latency能力，故選用直連40/10G Fiber Ports 交換機彼此相互直連。本架構需運行HPCC 高速運算效能外並需具有iSCSI能力完成大量料儲存兼容。



佈建理由:

- 實現HPCC 架構及達到低延遲與快速佈署需求
- 捨棄ECMP應用但需實現D.C所需Active-Active

競爭對手:

Cisco, InfiniBand, HP

致勝關鍵:

- Active-Active主動式備援架構 &ECMP
- Full Ethernet feature
- L2 Spine-Leaf 架構
- mVLT實現消除STP
- 1U 32 40G 高密度佈屬
- Low-Latency (<600ns)

設備部屬:

S6000*2

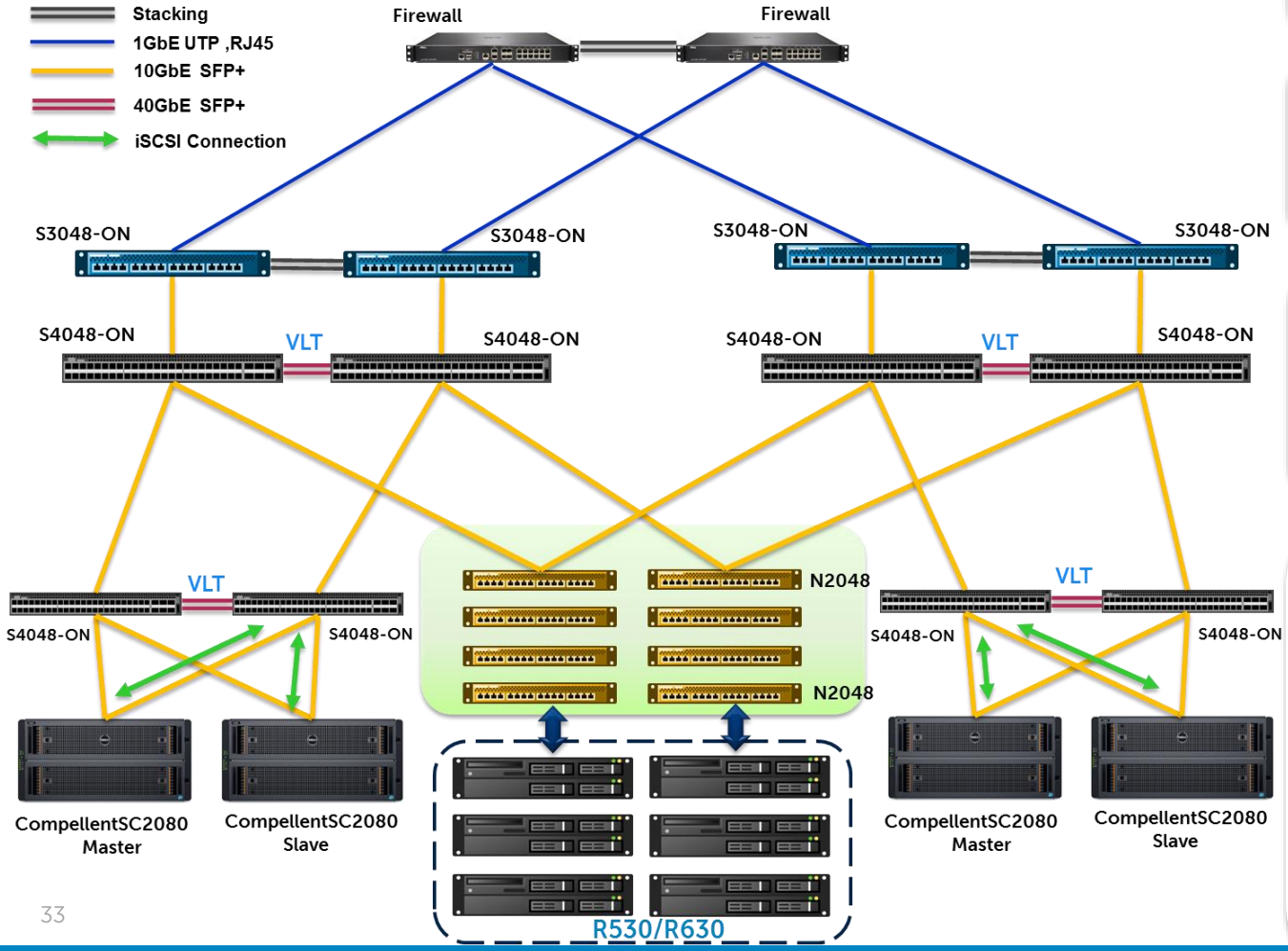
S4810P*6

N4032F*1

N2048*6

TW Case – S4048-ON VLT

透過Active-Active架構解決多層式架構來簡化STP 運算，並可達到快速的橫向擴充(Scale-out) 來實現快速佈署，而利用DELL S4048-ON 低延遲能力可加速Server與Storage資料存取。



佈建理由:

- 需可依需求自由靈活的擴充服務，實現橫向擴充(Scale-out)架構
- 簡化STP達成Active-Active 雙活保護重要服務不中斷

競爭對手:

Cisco, HPE, Brocade, Extreme

致勝關鍵:

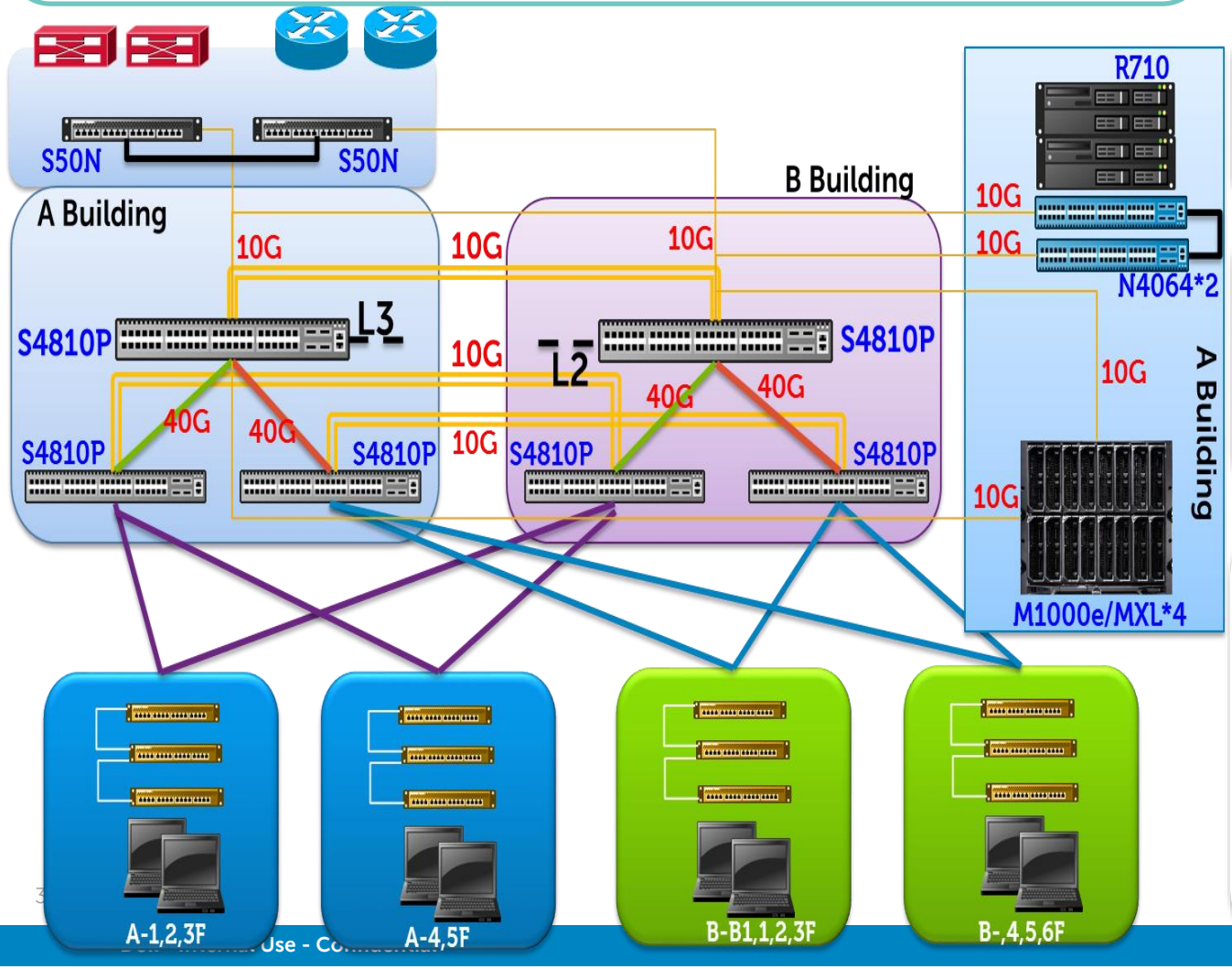
- Scale-out
- Active-Active/ON
- Pro Support Plus Service

設備部屬:

S4048-ON*8
N2048*25
S3048-ON*4
SC2080*4
R530*24
R630*24

TW Case – S4810P mVLT

採用六台DELL S4810P來置換既有兩部Chassis Core - Nortel 8600 ，並坐落於兩棟不同的建物。應用mVLT架構來實現多重Active-active連接下行Edge Switch 於兩棟建物之間。同時雙鏈路接入Data center Server/Storage互連達到雙備援目的。



汰換理由:

- 設備老舊,速率過慢導致延遲久無法即時傳送大資料的影像或數據
- 能跨棟實現異地備援

競爭對手:

Cisco, Extreme ,Juniper, Brocade

致勝關鍵:

- 40GbE骨幹頻寬及10G傳送效能
- 兩層式雙主動備援架構
- 10G RJ-45/SFP+ 共存應用

設備部屬:

S4810P*6
S50N*2
N3048*30
N3048P*10
MXL*4
N4064*2
OMNM*1

Change the mind.....

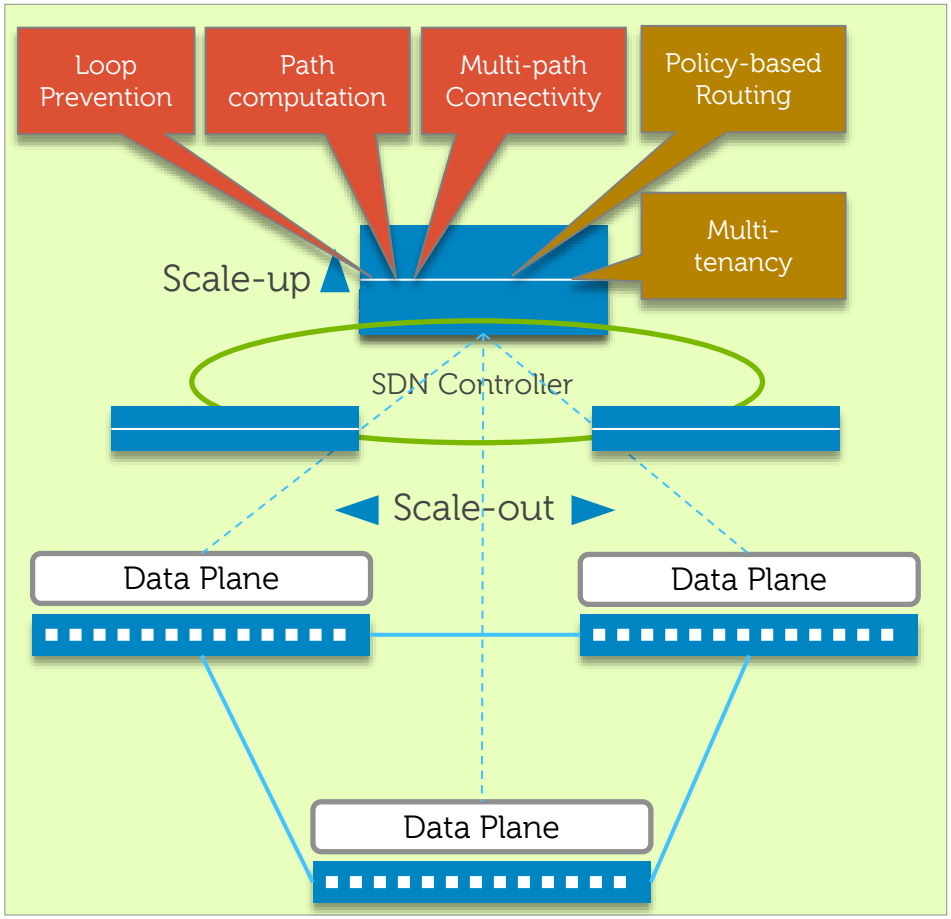
Does SDN has the security ?!

Maybe .....

you can start SDN in your campus networks

Why used SDN in Data Center

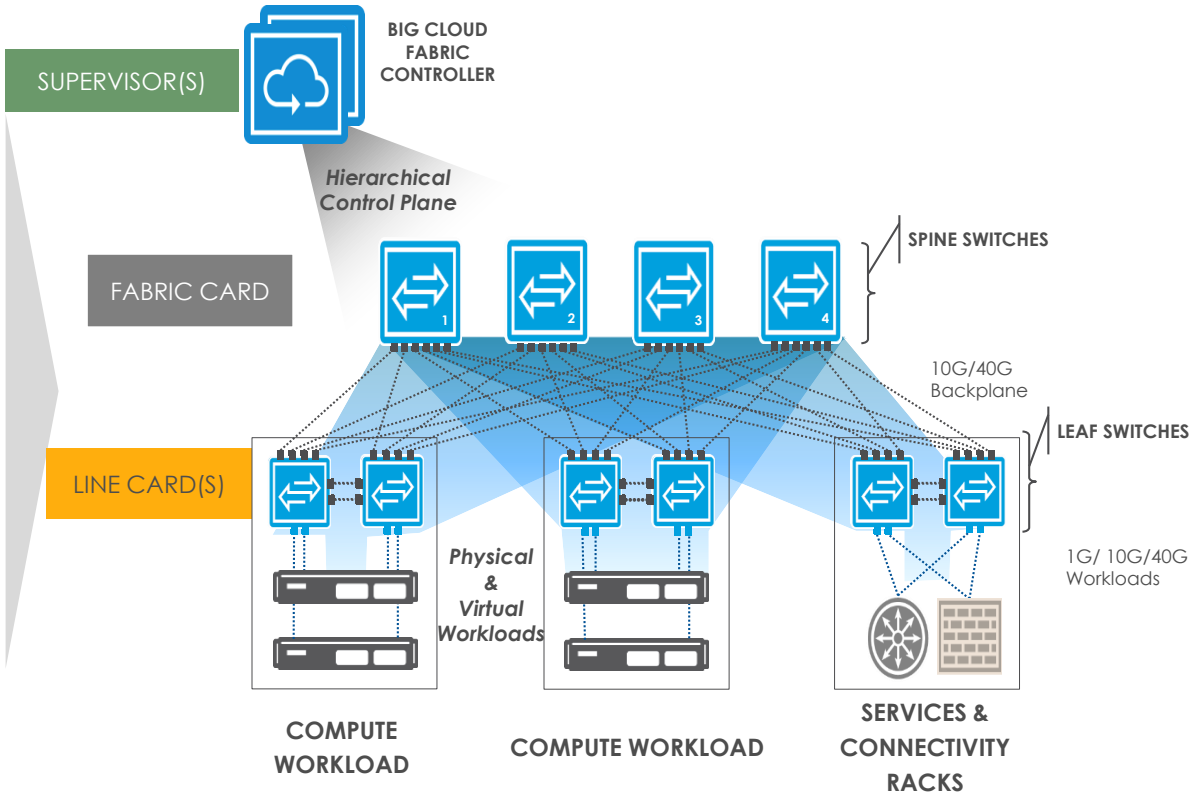
Performance, Scalability, Flexibility, Ease of Operation for Security



- Control plane performance and scalability can be increased independent of CPU and memory limitations of network devices
  - Scale-up
  - Scale-out
- In-line control protocols can be eliminated entirely, and replaced with centralized control logic
- Sophisticated traffic management and network control can be implemented more easily
- Network device operations are made simpler, and easier to manage
- The network devices potentially become less expensive to build

"ONE BIG SWITCH" Architecture

NET
Disaggregation of the "~~Main~~Frame"



- Traditional NET frame design
- Single point of management
- Proprietary, Expensive, Lock-in, Fixed Slots

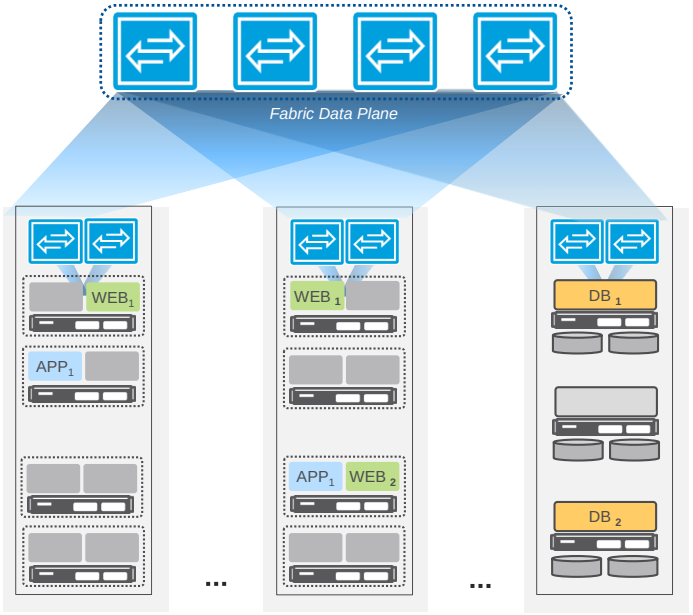
- Disaggregated NET frame – One "Big Switch"
- Open, Simple, Economical, Vendor Choice, Scale-out

SDN & Clos Fabric Necessary for NetFrame Disaggregation

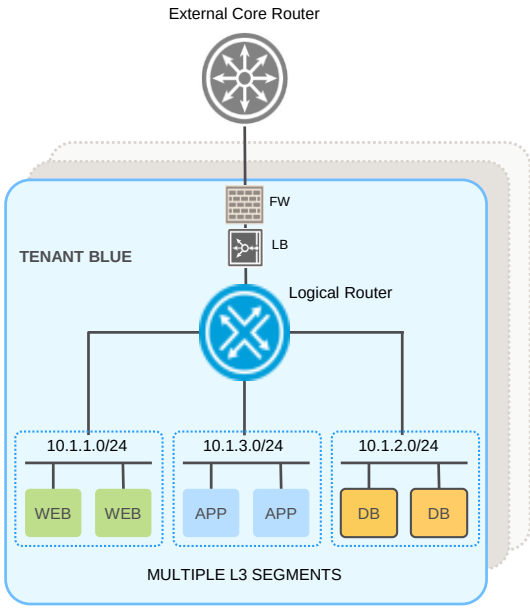
BSN Big Cloud Fabric

- Big Cloud Fabric from Big Switch Networks is the industry's first data center leaf-spine Clos fabric solution built using Dell's open networking switches.
- Uses Big Switch Networks SDN designs inspired by hyperscale data center architectures to provide significant cost savings and operational efficiencies
- Reduces management consoles by over 30:1 with one centralized controller console

BCF Controller configures logical network across various physical fabric nodes



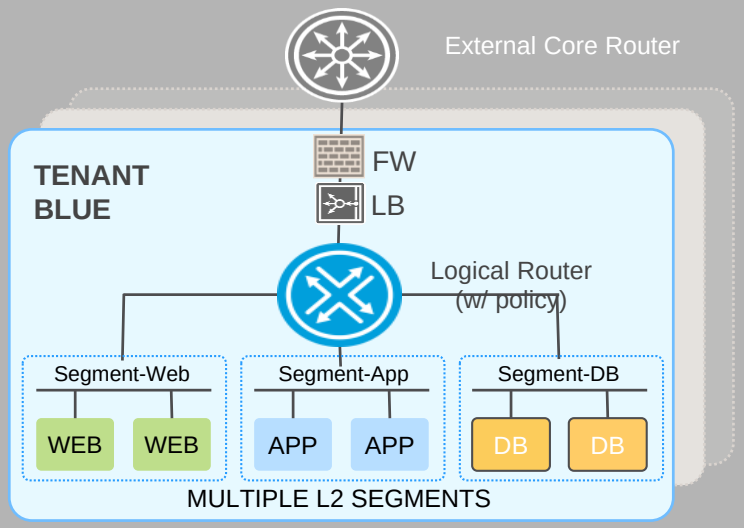
Physical Topology



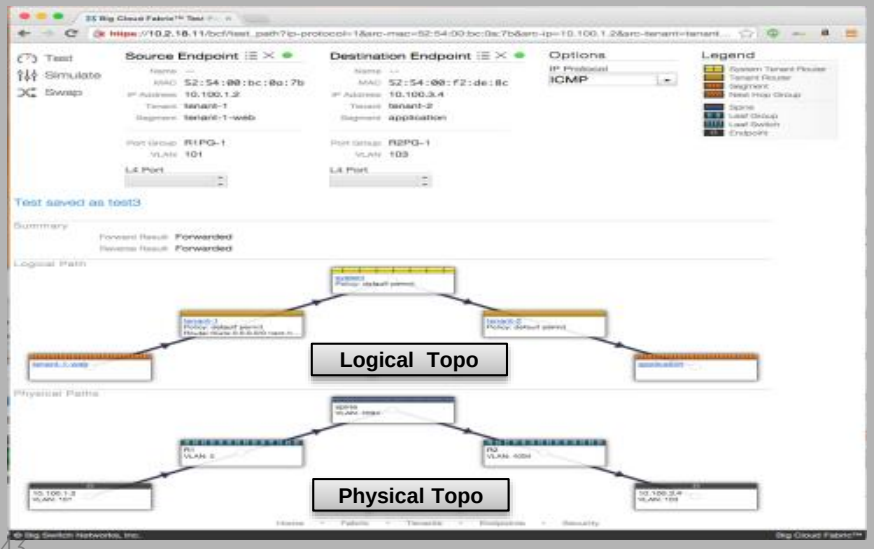
Logical Topology

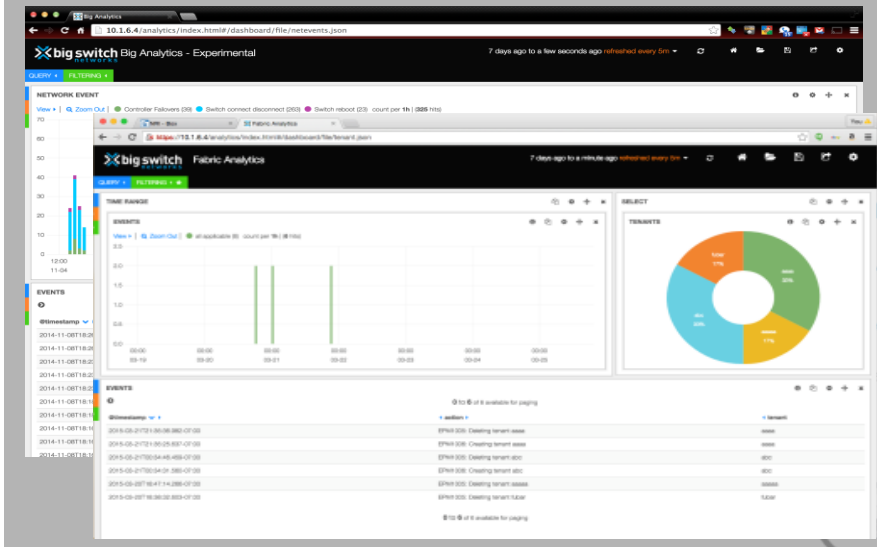
Big Switch UI and visibility

Logical Networking



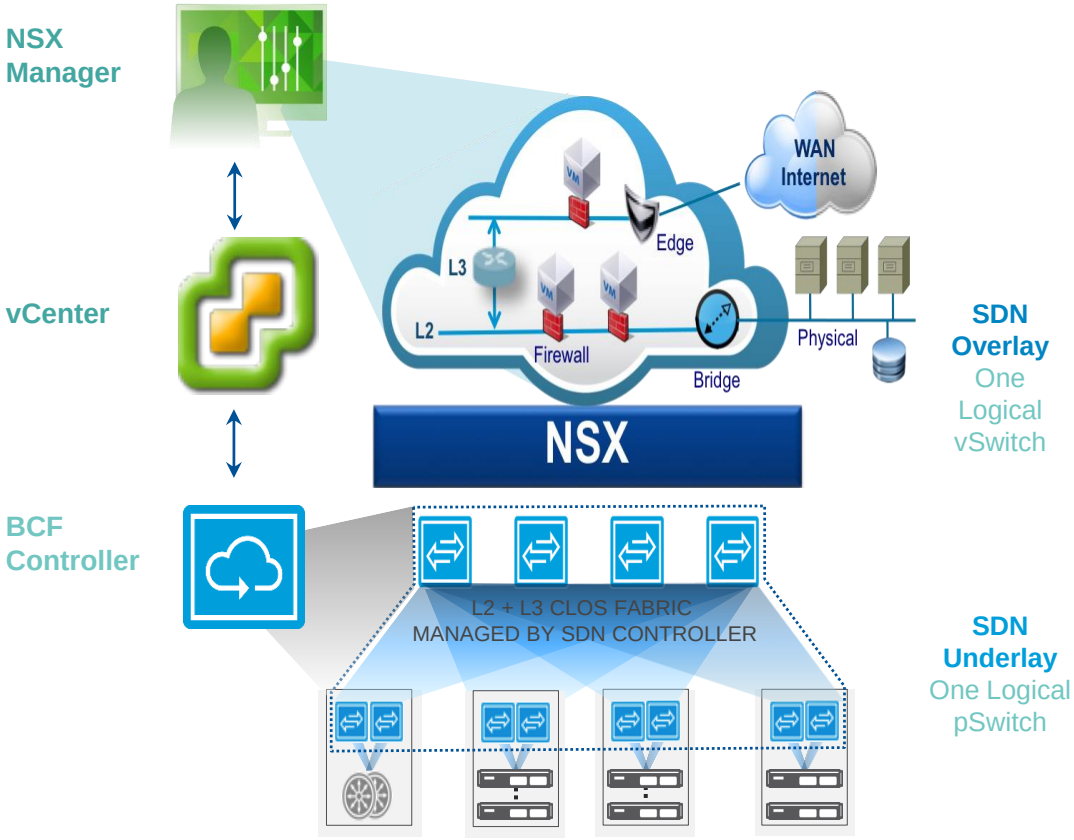
Zero-Touch Fabric





BCF – Ideal underlay for NSX

Optimal SDN Architecture across Overlay and Underlay



SDN Overlay One Logical vSwitch

SDN Underlay One Logical pSwitch

BCF Support for VMware NSX-v

Fabric Automation for NSX-v

- Auto Host Detection & LAG Formation
- Auto L2 Network Creation for VTEP, vMotion, and Storage port groups

Underlay Troubleshooting

- VTEP-to-VTEP (vSwitch-to-vSwitch) troubleshooting
  - Host – Leaf – Spine – Leaf – Host

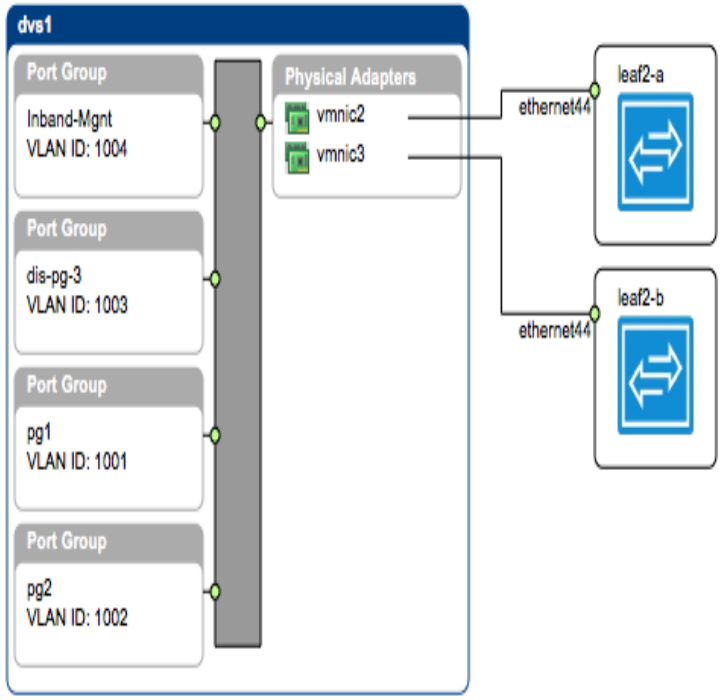
NSX HW VTEP Integration with BCF

BCF Plug-in for vmware vcenter

Powerful Fabric Visibility & Troubleshooting for VM Admin

vCenter

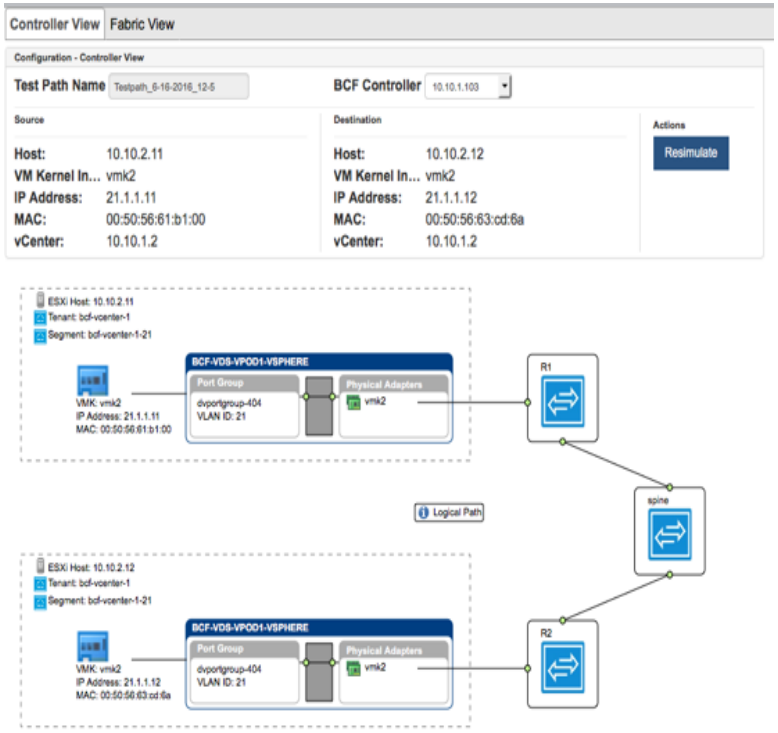
Virtual ←→ Physical
Network Visibility



vCenter

New

VM ←→ VM Path Troubleshooting



Verizon NFV deployment

04.25.2016 News Release

verizon

Verizon launches industry-leading large OpenStack NFV deployment

Verizon collaboration with Big Switch Networks, Dell and Red Hat advances open source knowledge; Companies to discuss project at the OpenStack Summit in Austin

AUSTIN, Texas – Verizon has completed the industry's largest known Network Function Virtualization OpenStack cloud deployment across five of its U.S. data centers.

DELL redhat. big switch networks

Open Architecture Platform

47%
Lower overall TCO over 5 years

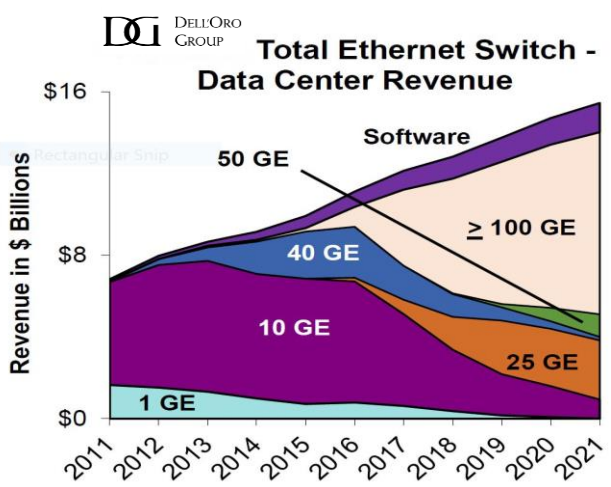
3x
Service agility advantage for new service enablement

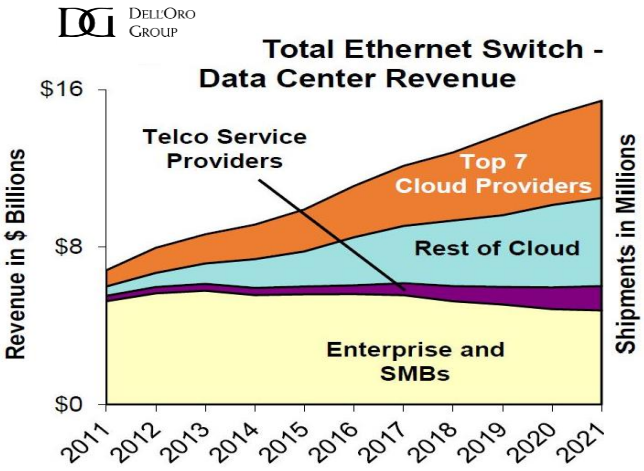
65%
Lower cost to new service enablement

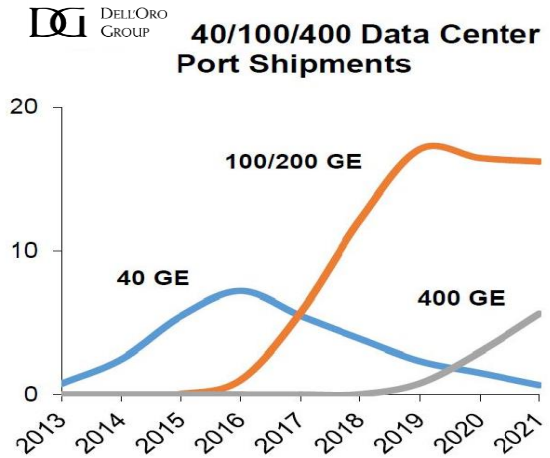
Source: 2017 ACG Research commissioned by Dell EMC & partners.

Are you on the right way?

Data Center Ethernet Switch Revenue Forecast







- The **25 GE/100GE** ramp will be faster than that of **10GE/40GE**, driven by a low-price premium over 10 GE and the opportunity to future-proof at the customer level and consolidate products at the vendor level. **The 100 GE will have strong ramp and a long tail.**
- 100 GE and 25 GE will compose more than 50% of data center switching ports by 2019.
- Speeds higher than 100 GE and based on 50 GE SERDES technology will be short-lived. **They will be adopted only by few large Cloud SPs while the rest of the market will remain on 100 GE.**

Speed Migration on ToR Switch by Market Segment

Market Segment	2014	2016/2017	2018	2019/2020
Top 4 Cloud Data Centers	1/10 GE ->10/40 GE *Only Google and Microsoft moved to 40 GE for server access	10/40 GE ->100 GE with splitter cables to 25/50 GE server port	10/40 GE ->100 GE with splitter cables to 25/50 GE server ports	100 GE ->200/400 GE with splitter cables to 50/100 GE server ports
Rest of Cloud	1 GE ->10 GE *40 GE in the Uplinks/Core	10 GE ->25 GE *100 GE in the Uplinks/Core, may run 40 GE optics	10 GE ->25 GE *100 GE in the Uplinks/Core	25 GE ->50/100 GE * only few SPs will migrate uplinks and core to > 100 GE
High-end entreprises, Private Cloud& Telco SPs	1 GE ->10 GE *40 GE in the Uplinks/Core	10 GE ->25 GE *100 GE in the Uplinks/Core, may run 40 GE optics	10 GE ->25 GE *100 GE in the Uplinks/Core	25 GE ->50 GE *100 GE in the Uplinks/Core
Rest of Entreprises and SMBs	1 GE ->10 GE	1 GE ->10 GE *40 GE in the Uplinks/Core	1 GE ->10 GE *100 GE in the Uplinks/Core, may run 40 GE optics	1 GE ->10 GE *100 GE in the Uplinks/Core

DELL'ORO GROUP
Ethernet_Switch_Data_Center_Forecast_Summary_Jul17

New Launch In Dell Networking

How 25GbE can help optimize your data center

Increase performance

- Stay ahead of growing virtualization, cloud – based and web-scale services
- Take advantage of 25GbE I/O's in servers and storage
- Migrate installed base of 10GbE to 2.5x the throughput with 25GbE

Reduce on-going costs

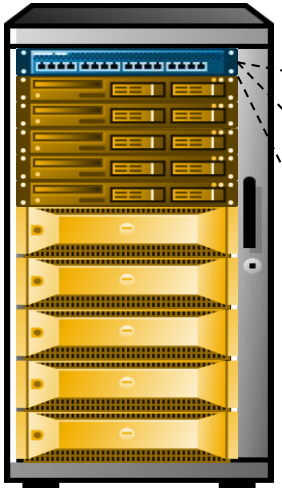
- Leverage cost-effective 25GbE technology
- Achieve cost savings with smaller space, power and cooling requirements
- Take advantage of cost-effective scaling capabilities

Simplify management

- Consolidate I/O's and use fewer ports and cables
- Use one network operating system
- Manage networking devices from a single embedded tool

Dell 25GbE solutions for your data center

25GbE TOR Open Networking Switches



Z9100-ON – 128 ports of 10/25GbE(breakout)

S6100-ON – 128 ports of 10/25GbE(breakout)

NEW!

S5100-ON – 48 ports of 10/25GbE (no breakout)
or 72 ports 10/25GbE (breakout)

Dell's 25GbE switch solutions provide a open, cost-effective and user-friendly path to 25GbE within the rack – delivering **2.5X the throughput** over 10GbE

Multi-rate

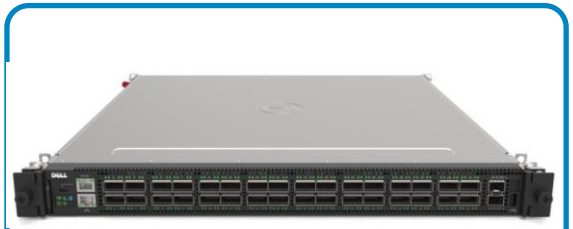
Dell Innovations with Z9100-ON

Multi-Rate 10/25/40/50/ 100GbE

High-Density per RU

Ultra low latency

Network Virtualization



Rich Optical Connectivity

Full DCB / RoCE Support

Choice of OS

SDN Ready

Dell Innovations with S6100-ON

Multi-Rate 10/25/40/50/100GbE

Modular Options for 100G, 40G, 25G

Ultra low latency

Network Virtualization

Rich Optical Connectivity

Full DCB / RoCE Support

Choice of OS

SDN Ready

NEW! S4100 10/100GbE in-rack switches CY17Q3

Latest multi-functional, multi-protocol 10/100GbE in-rack switches

- **S4128F-ON -** 28 x 10G SFP+ and 2 x 100G QFSP28 ports
- **S4128T-ON** – 28 x 10GBaseT ports and 2 x 100G QFSP28 ports
- **S4148F-ON -** 48 x 10G SFP+, 2 x 40G QSFP+ ports and 4 x 100G QSFP28 ports
- **S4148T-ON -** 48 x 10GBaseT ports, 2 x 40G QSFP+ ports and 4 x 100G QSFP28 ports
- **S4148FE** – 48 x 10G SFP+ , 2 x 40G QSFP+ ports and 4 x 100G QSFP28 ports with support for LRM optics
- ★ **S4148U: Industry's first and only 32G FC unified switch** – 24 x SFP+, 24 x unified SFP+/SFP28 ports (1/10GbE or FC8/FC16), 2 x 40G QSFP+ ports and 4 x unified QSFP28 ports (10/25G/40G/50G/100G) or FC8/FC16/FC32)

ONIE

NEW!

OS10

Dell Networking S4100-ON

10/100 GbE
in-rack connectivity

OS10
software environment
Programmable Linux OS

Applications

- 10/100GbE in-rack connectivity for servers and SDS environments
- Converged LAN/SAN environments to FC32

Dell innovation

- Open Networking with support for OS10 & ONIE
- Fully tested and validated with 3rd party operating systems

New! S4148U-ON FC16/32 and 10/100G Switch

CY17Q4

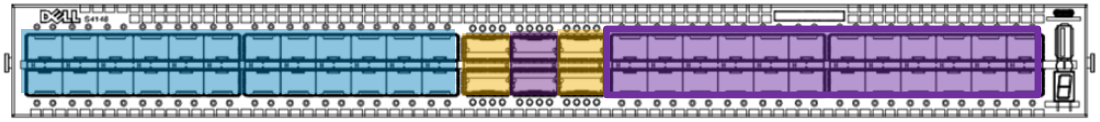
Dell unified port 1RU multi-rate switch for Storage Networking

- **S4148U-ON:** 24 ports of Unified SFP+ and 24 ports of SFP+ and 2 ports of QSFP+ ports / 4 ports of Unified QSFP28 ports
- **Max Ethernet Configuration**
  - 48x10GbE SFP+ ports AND
  - 4x100GbE QSFP28 (or 16x 25GbE/10GbE) ports
- **Max 32G FC Configuration:**
  - 16 x 16/32*Gb FC ports AND
  - 24 x 8/16*Gb FC ports AND
  - 24 x 10GbE SFP+ ports
  - **Max 16G FC Configuration:**
    - 40x16*Gb FC ports AND
    - 24x10GbE SFP+ ports
  - **Max 8G FC Configuration:**
    - 40 x 8Gb FC ports AND
    - 24x10GbE SFP+ ports

ONIE

OS10

NEW!



Dell Networking S4148U-ON

Multi-Protocol 16/32G FC and 25/100GbE Switch

Industry's first and only 32G FC Unified Switch

Dell innovation

* oversubscribed

- **OS10 Open and Enterprise Edition**
- Multi-rate capability with flexible configurations to support 1/10/25/40/50/100GbE and 8G/16G/32G FC

10/40G

Hot Model

S6010-ON 10/40GbE Open Networking switch

10/40GbE in-rack switch

- 32 x 40GbE QSFP+ ports or 96 10GbE SFP+ with breakout cables and 8 x 40GbE QSFP+ ports
- Advanced features VXLAN, larger tables, expanded buffering vs. current generation

Purpose-built for demanding data center environments

- Ideal for high-performance enterprise, mid-market and HPC environments
- Cloud/Web2.0 Open Networking environment
- Complete OS9 feature set including SDN, Open Automation, and virtualization features

Dell innovation

- **Open Networking** (ONIE)
- Fully tested and validated with 3rd party operating systems

ONIE

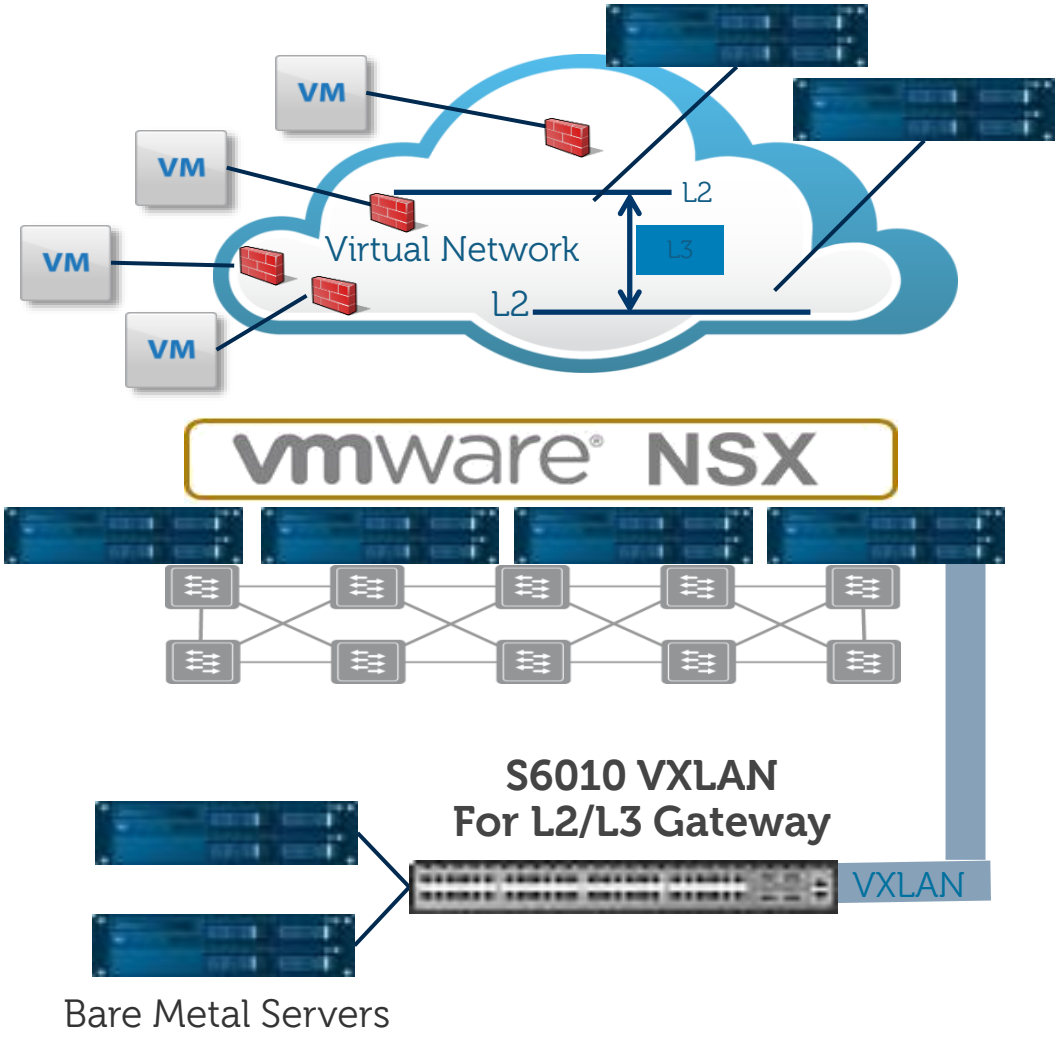
Dell Networking S6010-ON

- New Intel Rangeley 4 Core CPU
- Updated Broadcom T2+ NPU
- Improvement in buffering (16MB)
- 4X improvement in ACLs (16K)
- 4X improvement in ECMP Groups (4K)
- Routing in and out of Tunnels with VXLAN and NVGRE
- Power to support high power optics on all ports

Scale virtual environments

Interworkings with VMware NSX

S6000 VXLAN Gateway Functionality



Deploy large-scale virtualization

- Step up to multi-tenancy and other virtual services to scale beyond the data center

Optimize VM operation

- Deploy VXLAN Gateway to bridge physical and virtual network IT governance and control

Support virtual server networking

- Efficiently connect VMware servers in VSN scenarios

Transform business operations

- Enables seamless connectivity to public, private and hybrid cloud

Dell Networking S4048-ON open networking switch

Next generation switch for the software defined data center

Dell Networking S4048-ON

- ❑ 48 x 10G SFP+ and 6 x 40G QSFP+
- ❑ External Serial ports - one RJ45 type and one micro USB type.
- ❑ One USB-A type for storage
- ❑ One management port support 10M/100M/1G speeds

- Dell's **latest generation** S-Series ultra low-latency 10/40GbE Top-of-Rack (ToR) switch
  - 48x10GbE & 6x40GbE or 72x10GbE ports
  - **Advanced Trident2 silicon features (hardware tables, VXLAN, Buffering)**
- Purpose-built for applications in high-performance data center and computing environments
  - Web/cloud service providers with Linux & OpenSource-heavy environments
  - **Ultra-low-latency 10GbE switching in HPC, high-speed trading or other business-sensitive deployments that require the highest bandwidth and lowest latency**
- Key differentiators
  - Supports Open Networking Install Environment (ONIE)
  - **Fully tested and validated with 3rd party OS and network virtualization solutions from Cumulus Networks, Big Switch Networks, VMware and Midokura**
  - Dell global support and services

Dell Networking S4048T-ON Overview

10GBase-T Open Networking switch

ONIE

Latest 10GBase-T 1RU in-rack switch

- **48 x 10GBase-T & 6 x 40GbE QSFP+ ports or 24 10GbE SFP+ with breakout cables**
- 1.44Tbps Gbps switch fabric capacity
- 1080 Mpps forwarding capacity
- 160K MAC addresses
- 16 MB packet buffer & 4 GB CPU memory
- Advanced features VXLAN, larger tables, expanded buffering vs. current generation

Dell Networking S4048T-ON

Purpose-built for server and storage copper connectivity

- Ideal for high-performance 10GBase-T enterprise, mid-market and HPC environments
- Cloud/Web2.0 Open Networking environment
- Complete OS9 feature set including SDN, Open Automation, and virtualization features

Investment protection
For copper connections in the rack

Open networking
Support of multiple 3rd party OS

Dell innovation

- **Open Networking** (ONIE)
- Fully tested and validated with 3rd party operating systems

Dell networking N4000 10GbE Family

Layer3 10/40G Switch

N4032

- 24x 10GbE ports, optional expansion module

N4032F

- 24x ports SFP+, optional expansion module

N4064

- 48x 10GbE ports, 2x QSFP, optional expansion module

N4064F

- 48x ports SFP+, 2x QSFP, optional expansion module

Dual QSFP

- 2x 40GbE ports, optional breakout cables to deliver 8x 10GbE

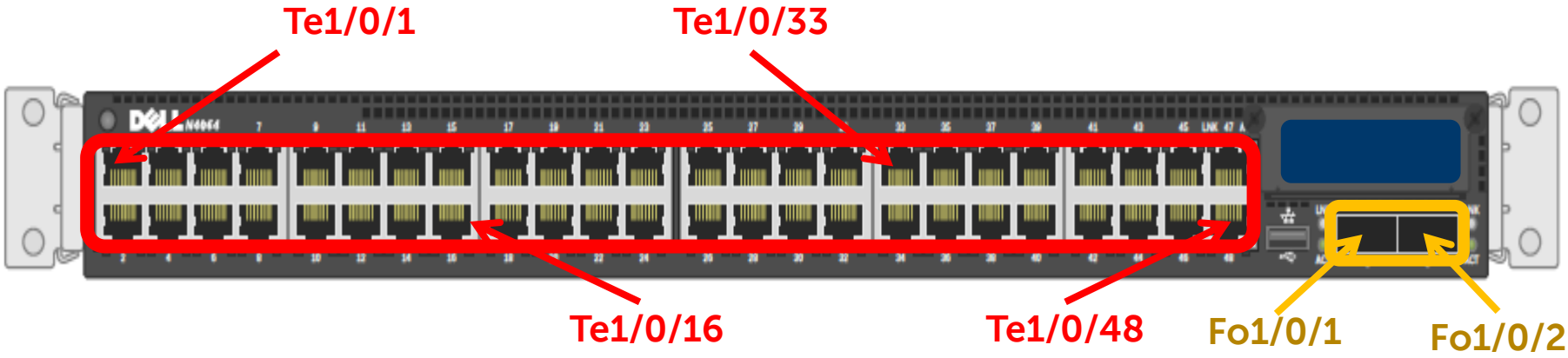
Quad SFP+

- 4x 10Gb SFP+ ports

Quad 10Gb-T

- 4x 10GbE ports

Configure Stacking on Dell networking N4000



Dual QSFP
2 x 40Gb ports

Quad SFP+
4 x 10Gb SFP+ ports

Quad 10Gb-T
4 x 10Gb T-base ports

MTP Fiber Channel Cables
For QSFP+ 40GbE Optic to Optic connectivity

QSFP+ 40GBase-SR4 Optic

QSFP+ MTP Fiber Breakout Cable to 4x SFP+ LC
For QSFP+ 40GbE optic to 4x SFP+ 10GbE optic connectivity

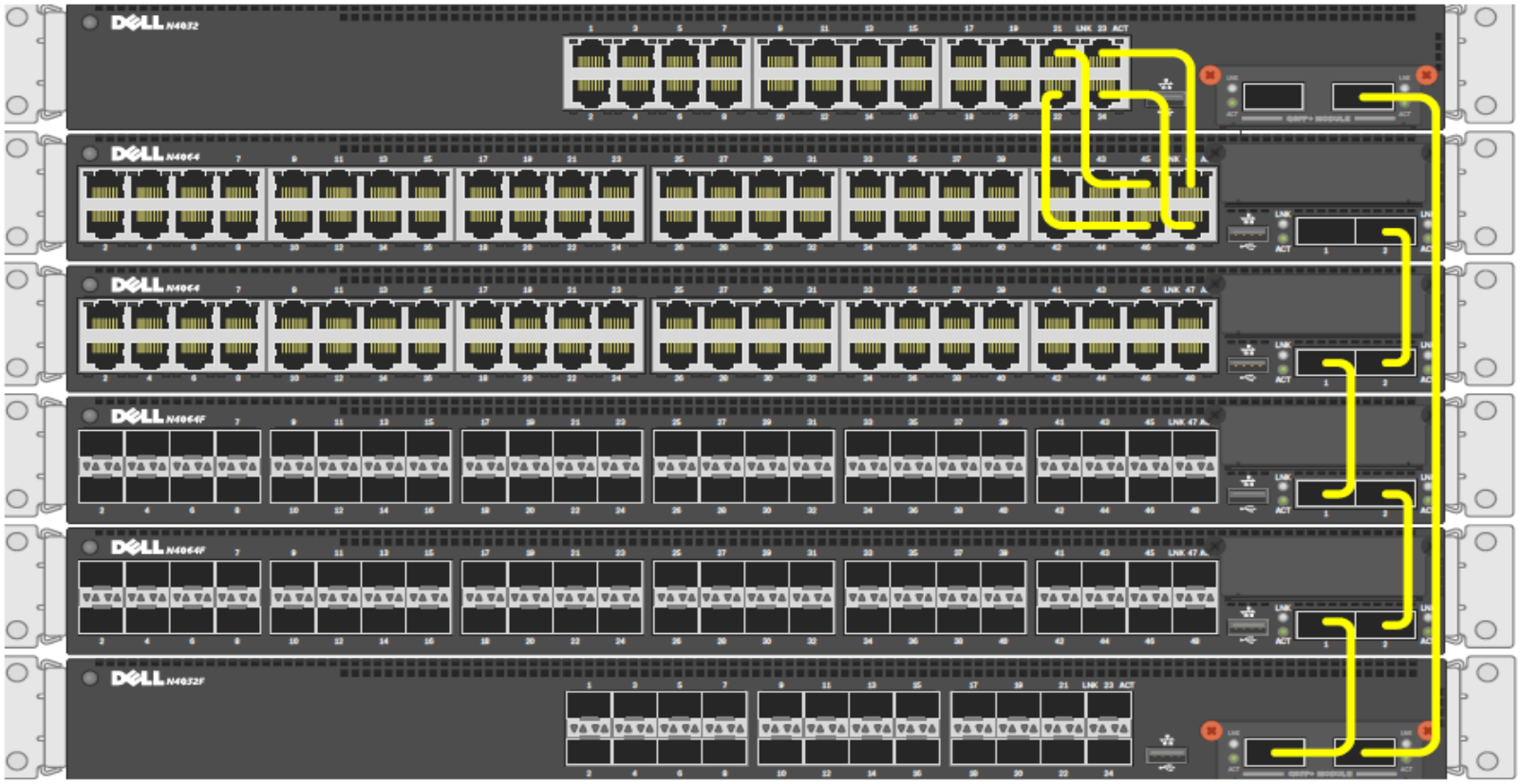
QSFP+ 40GBase-SR4 Optic

QSFP+ Direct Attach Breakout to 4x 10GbE SFP+ Cables
For QSFP+ 40GbE port to 4x SFP+ port connectivity, no optics required.

QSFP+ Passive Copper Twinax / Direct Attach Cables
For QSFP+ 40GbE port to port connectivity, short distances

Dell networking N4000 Series Stacking Overview

using 40G and 10G stack links

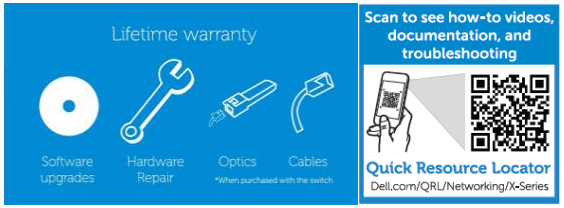


All other Dell Networking Stacking Characteristics remain:

- ~50ms failover times
- Ring topology strongly recommended for HA and prevention of split stacks.
- Single IP Management, Shared Tables, etc.
- Available now: Stacking Whitepaper, and User Guide with additional details

Introducing the Dell Networking X-Series

X-Series is a family of smart managed 1GbE and 10GbE Ethernet switches designed for small and medium businesses who crave enterprise-class network control fused with consumer-like ease.



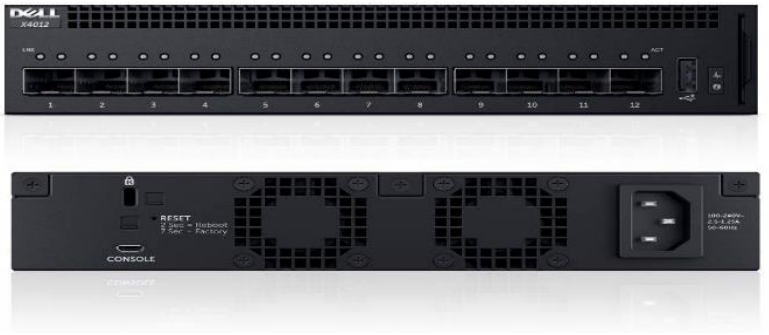
Dell Networking X4012

Smart Web Managed 10 Gigabit Ethernet Layer 2+ Switches

❖ **Only smart web managed 10 GbE all fiber switch in the industry!***

Key features and Innovations

- **12x 10 Gigabit SFP+ full duplex ports for greater bandwidth and distance**
- Asset protecting locking plug
- Micro-USB port and serial cable provided for local switch monitoring & debug access
- Compact 1U half rack width design
- Optional tandem switch tray holds two switches in 1RU
- Redundant variable speed fans



Great For

- Simplifying management of office networks without sacrificing features
- High speed server and storage connections, or network aggregation
- Perfect for bandwidth intensive environments such as virtualization and IP surveillance devices

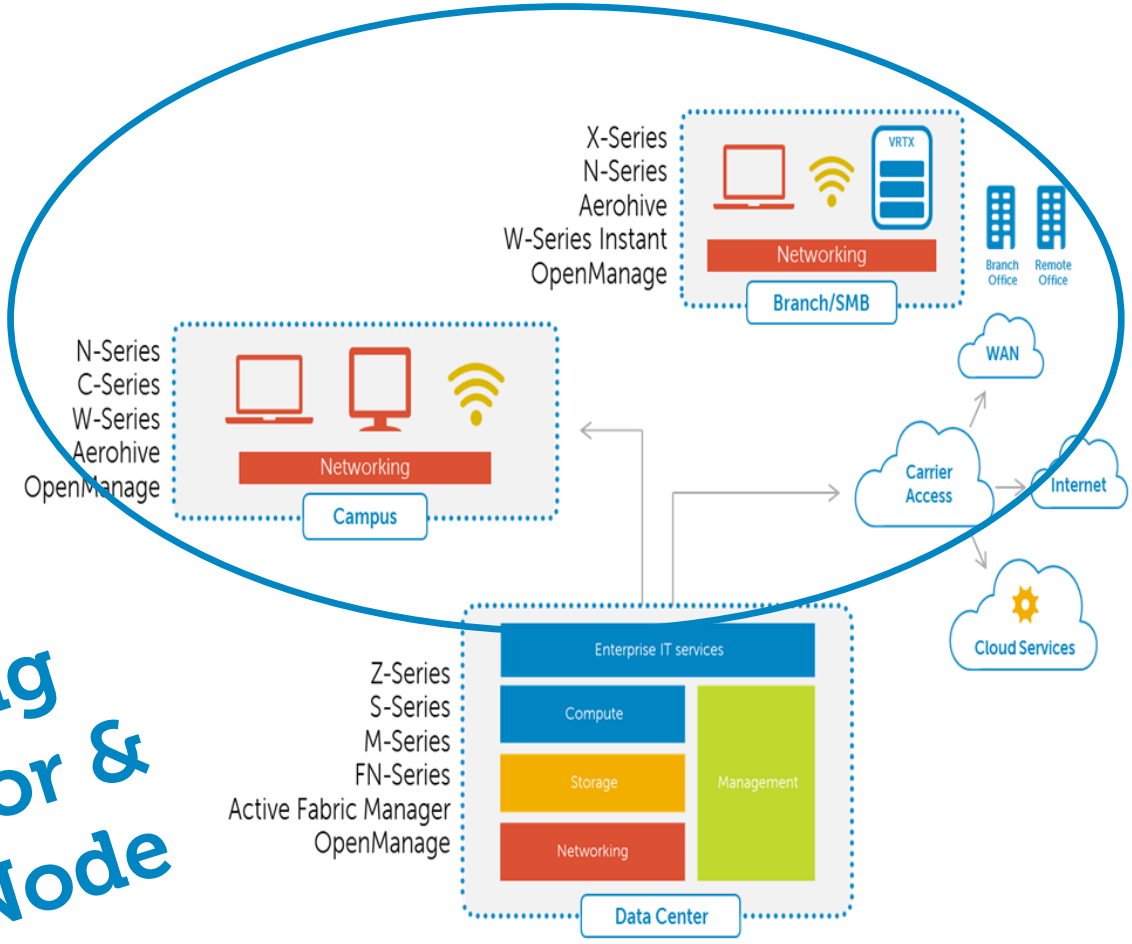
Products

Model	Size (H x W x D)	Port configuration
X4012	1.62 in x 8.23 in x 9.84 in (41.25 mm x 209.0 mm x 250.0 mm) (1RU, half-width)	12x 10Gb SFP+ ports

Campus

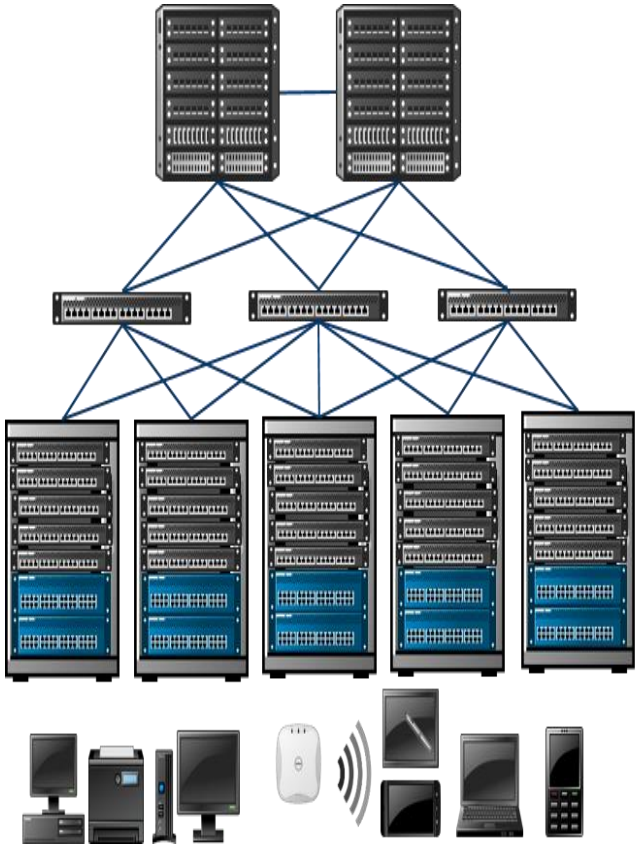
One Tier

2 **Campus**



Dell Networking Network Director & Rapid Access Node

Traditional networks are not optimized for end users, Increases complexity for administrators



Challenges

- Multiple protocols and tiering (both physical & logical)
- Policy enforcement (users, devices, content)
- Complex configurations (multiple devices & types)
- High operating costs/shrinking budgets

Requirements

- Personal device support
- "Seamless" mobility across network locations
- Multi-media usage for video, rich media
- Increased security needs
- Rapid service deployment (new services & applications)

Industry Leading Performance and Scalability

Dell Networking C9010 Network Director

NETWORK computing AWARDS 2016

2016 Communications SOLUTIONS Product Of The Year

Dell Networking C1048P Rapid Access Node

1 Tier

Virtual Ports	Multi-Rate	Stacking	Density
Supports 2,000 Virtual Ports (40 Rapid Access Nodes) at RTS, and 4,000 Virtual Ports (80 Rapid Access Nodes) in a future release	C9010 backplane is designed to support multi-rate for 100GbE/40GbE/10GbE	Supports Rapid Access Node stacking up to 8 units high	Supports up to 248 10GbE ports (SFP+ or 10GBASE-T) Supports up to 60 40GbE ports

Dell Networking C9000 series

10/40GbE Network director& rapid access node

- **Intelligently Designed Chassis**
  - Dense multi-rate ready chassis in a compact 8RU
  - Half-width line cards increase flexibility
  - Tool-less mounting standard plus optional ReadyRails™
  - Up to 248 x 10GbE/ 60 x40GbE ports & 4.8Tbps total throughput
  - Up to 4,000 additional 1GbE POE+ capable virtual ports via the C1048P rapid access node*
- **A New Way to Build Networks**
  - Designed for medium/large enterprise campus networks
  - Collapses traditional network into a single, logical tier through centrally managed architecture
  - Simplified service/configuration changes and software updates
  - Plug & Play Deployment at the Edge
- **Built on open standards with economical scalability**
  - Unique 100Gb ready backplane with tool-less upgrade to full-width line cards*
  - Built-in OpenFlow 1.3 capabilities for SDN
  - Flexible industry standard implementation enables expansion with existing N-series switches*

Dell Networking C9010 & C1048P

C9010 Network Director

- ❑ 8RU
- ❑ 10 half-width card slots (5 full-width)
- ❑ Two 2.56Tbps RPMs (4 SFP+ ports per RPM)
- ❑ Four 2,900W power supplies
- ❑ Three removable fan modules
- ❑ Side-side (right-left) suction cooling

*Future capability; 2,000 virtual port support

Dell's innovative architecture reduces complexity

Single logical tier & operating environment speeds deployment

C9010 Network Director

C1048P Rapid Access Nodes

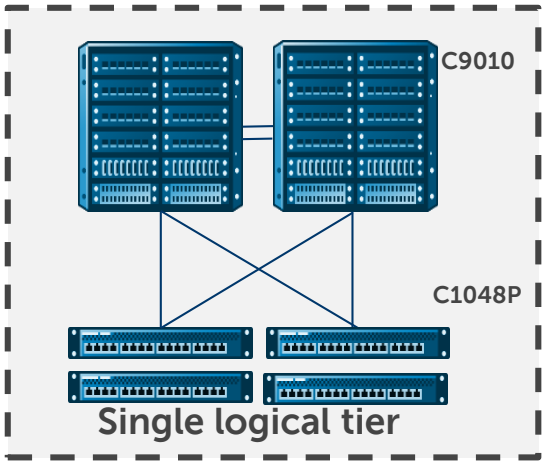
- Simplifies the enterprise network by merging core and access layers
- Administrators build and manage the entire network from a single console providing increased visibility
- Reduced risk of manual errors when deploying or upgrading the network.

Set up network faster

Reduce upgrade time

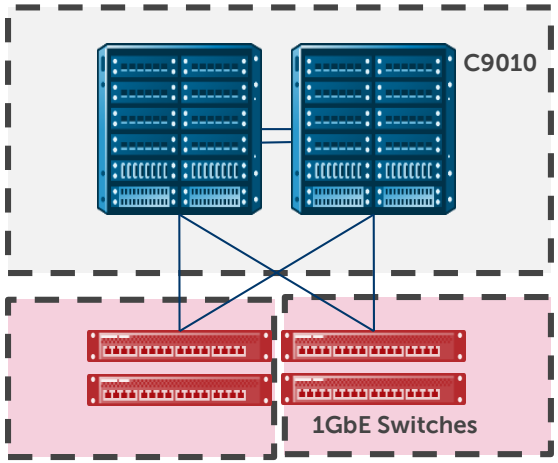
Dell enterprise network today

Flexible configuration of the network via Network Director



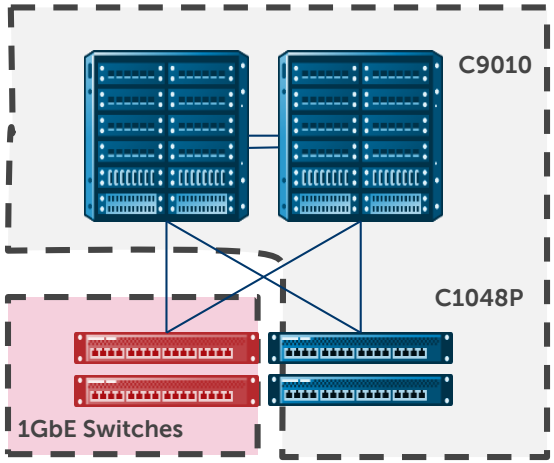
Dell Enterprise Networking

- C9010 connected via VLT for redundancy & scale
- C1048P cabled as a stack & joined to C9010 for power, endpoint access
- All ports configured, viewed & managed centrally from C9010 chassis



Traditional Networking

- C9010 connected via VLT
- Fixed-port switches stacked & managed by stack
- Ports are configured, viewed & managed traditionally

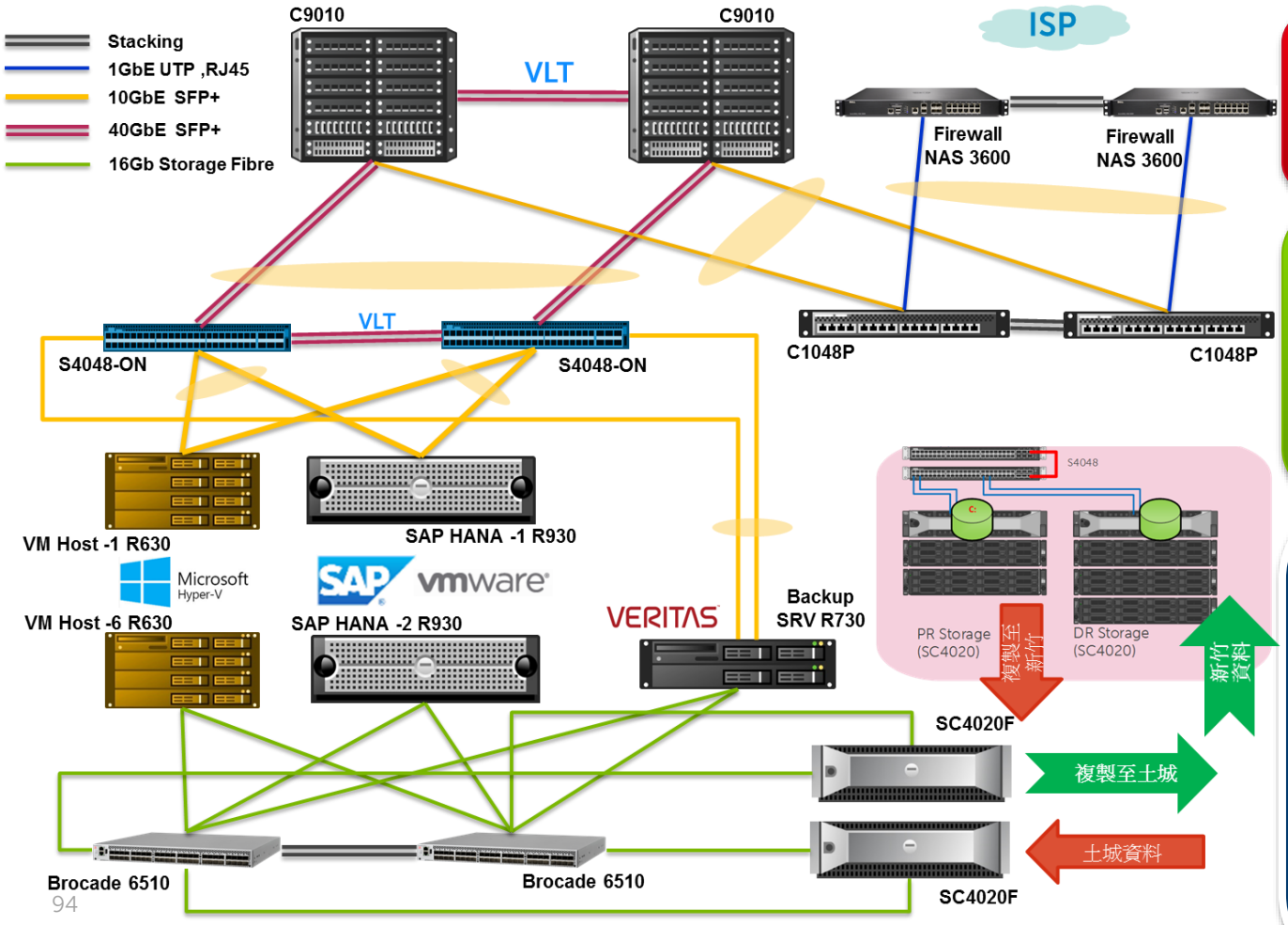


Hybrid Mode

- Fixed-port switches stacked & managed by stack
- C1048P cabled as a stack & joined to C9010 for power, endpoint access
- C-series ports managed via C9010

TW Case – C9010 One-Tier

採用兩台DELL C9010來實現雲端 SAP HANA高效能資料運算與SAP應用程式系統平台。應用C9010 One-Tier架構來簡化整體網路規畫並可提供未來IoT運用接入。實現一層式因而也實現低延遲與高效能異地備援，同時也VDI輕鬆佈署。



佈建理由:

- 實現SAP HANA 架構及模組式達到快速佈署並節省機房空間與電力
- 簡化架構反應快速資料備援於異地之間

競爭對手:

Cisco, HPE, Juniper

致勝關鍵:

- One-Tier 消除STP
- 模組式輕鬆擴充
- Pro Support Plus Service

設備部屬:

C9010*2
C1048P*2
S4048-ON*2
Brocade6510*2
SC4020F*2
R630*6
R730*1
R930*1

Dell Networking

N Series- N3/N2/N15

1G Model

Dell Networking S3048-ON open networking switch

Next generation switch for the software defined data center

Dell Networking S3048-ON

Feature	S3048-ON
Line-rate performance	Yes
Up-link	4 x 10G-SFP ports included
Full OS9 Feature Set	Yes
MAC Address Table	64k
PHY-less	Yes
Stacking	supported on included 10GbE Ports

- Dell's **latest generation**

S-Series ultra-efficient 1/10GbE Top-of-Rack (ToR) switch

  - 48x1GBase-T & 4x10G-SFP ports
  - Built with the latest-generation merchant silicon for superior efficiency & performance

- Purpose-built for applications in high-performance data center and computing environments
  - Web/cloud service providers with Linux & OpenSource-heavy environments
  - Complete OS9 feature set including VLT, OpenFlow, Open Automation, Cloud Stack Integration (OpenStack/Microsoft/VMware/Docker) & more

Key differentiators

- Supports Open Networking Install Environment (ONIE)
- Full support for with 3rd party OS and network virtualization solutions from Cumulus Networks, Microsoft, VMware and Midokura
- Dell global support and services

S3100 – Features View

Feature parity with OS9.8	POE+	Dedicated Stacking Interface
VRF-Lite		VLT
BMP / Smart Scripts */ SNMP	QOS	SDN Ready

Dell Networking N3000 Series

1 Gigabit Ethernet with advanced Layer 3 capabilities

Key features and innovations

- Up to 260 Gbps switch fabric capacity
- Supports up to 48 line-rate 1GbE ports per switch and up to 624 1GbE ports in a twelve-unit stack
- Hot swap expansion module supporting dual SFP+ and dual 10GBaseT
- Standard N-Series stacking cables and built-in ports for cost-effective high-performance stacking at up to 84 Gbps.
- Up to 48 ports of PoE+ without external power supply
- Advanced Layer 3 functionality included
- Plug-and-Play configuration with Dell EqualLogic™
- Dual 80PLUS-certified hot swappable power supplies
- Energy Efficient Ethernet and lower power PHYs reduce power to inactive ports and idle links
- Tool-less rails significantly reduce rack installation time
- USB Rapid deployment expedites switch configuration

Power efficient density for campus or small-scale data center deployments

A power efficient and resilient 1/10 Gigabit Ethernet switching solution for advanced Layer 3 distribution and dense PoE+. Dual hot-swappable 80Plus-certified power supplies add resiliency and the capacity to provide up to 48 ports of PoE+ (up to 30.8 watts) in a 1RU footprint. Plug-and-Play configuration with Dell EqualLogic™.

Products

Model	Port configuration
N3024	24x RJ45 10/100/1000 Mb ports, 2x SFP+ ports, 2 combo media ports, 2x stacking ports, 1x hot swap expansion module bay
N3024F	24x SFP 1000 Mb ports, 2x SFP+ ports, 2x combo media ports, 2x stacking ports, 1x hot swap expansion module bay
N3024P	24x RJ45 10/100/1000 Mb PoE+ ports, 2x SFP+ ports, 2x combo media ports, 2x stacking ports, 1x hot swap expansion module bay
N3048	48x RJ45 10/100/1000 Mb ports, 2x SFP+ ports, 2x combo media ports, 2x stacking ports, 1x hot swap expansion module bay
N3048P	48x RJ45 10/100/1000 Mb PoE+ ports, 2x SFP+ ports, 2x combo media ports, 2x stacking ports, 1x hot swap expansion module bay

Dell Networking N2000 Series

1 Gigabit Ethernet with Layer 2+ capabilities

Key features and innovations

- Up to 220 Gbps switch fabric capacity.
- Supports up to 48 line-rate 1GbE ports per switch and up to 600 1GbE ports in a twelve-unit stack
- Standard N-Series stacking cables and built-in ports for cost-effective high-performance stacking at up to 84 Gbps
- Up to 48 ports of PoE+
- Up to 4,094 VLANs supported
- Advanced Layer 2+ functionality with up to 256 static routes and Routing Information Protocol (RIP) included supporting up to 256 interfaces
- Advanced network security including highly configurable ACLs
- USB Rapid deployment expedites switch configuration
- Energy Efficient Ethernet (EEE) and lower power PHYs reduce power to inactive ports and idle links
- Fresh Air® compliant for high operating temperature environments

Products	
Model	**Port configuration**
N2024	24x RJ45 10/100/1000 Mb ports, 2x SFP+ ports, 2 stacking ports
N2024P	24x RJ45 10/100/1000 Mb PoE+ ports, 2x SFP+ ports, 2x stacking ports
N2048	48x RJ45 10/100/1000 Mb ports, 2x SFP+ ports, 2 stacking ports
N2048P	48x RJ45 10/100/1000 Mb PoE+ ports, 2x SFP+ ports, 2x stacking ports

Energy efficient and cost effective

A powerful and economical 1/10 Gigabit Ethernet switching solution for efficient Layer 2+ access for end user devices, entry-level servers, and network devices. Up to twelve switches can be stacked and managed with a single IP address to deliver reliable network performance.

Dell Networking N1500 Series

1 Gigabit Ethernet with Layer 2+ capabilities

Key features and innovations

- Up to 176 Gbps switch fabric capacity
- Supports up to 50 1GbE ports per switch and up to 200 1GbE ports in a four-unit stack
- Standard 10GbE SFP+ transceivers and cables for cost-effective high-performance stacking at up to 40 Gbps
- Up to 48 ports of PoE+
- Up to 512 VLANs supported
- Advanced Layer 2+ functionality with up to 256 static routes
- Advanced network security including highly configurable ACLs
- USB Rapid deployment expedites switch configuration
- Energy Efficient Ethernet (EEE) and lower power PHYs reduce
  power to inactive ports and idle links

Products	
SKUs	**Port configuration**
N1524	24x RJ45 10/100/1000 Mb ports, 4x SFP+ ports for uplinks & stacking
N1524P	24x RJ45 10/100/1000 Mb PoE+ ports, 4x SFP+ ports for uplinks & stacking
N1548	48x RJ45 10/100/1000 Mb ports, 4x SFP+ ports for uplinks & stacking
N1548P	48x RJ45 10/100/1000 Mb PoE+ ports, 4x SFP+ ports for uplinks & stacking

Right Sized for your needs

A Gigabit Ethernet switching solution with N-series functionality, providing a cost effective migration path from aging 10/100 access switches. Switches can be stacked and managed with a single IP address to deliver reliable network performance.

NEW! N3100 & N2100 Multi-Gig switches

Industry's first Open Networking switches for the Campus

CY17Q3

Dell Networking N3132PX-ON

- 24 RJ45 10/100/1000Mb PoE 60W ports
- Eight RJ45 10/100/1000/2500/5000Mb PoE 60W ports
- Four integrated 10GbE SFP+ ports
- One hot-swap expansion module bay for either 2 port 40GbE QSFP+ or 2 port stacking modules
- One hot-swap power supply (1100W AC)
- Dual hot-swap power supply bays (optional power supply available)

Dell Networking N2128PX-ON

- 24 RJ45 10/100/1000Mb PoE+ auto-sensing ports (optional external power supply needed to provide power to all ports at 30.8 watts)
- Four RJ45 10/100/1000/2500Mb PoE 60W auto-sensing ports
- Two integrated 10GbE SFP+ ports
- Two dedicated rear stacking ports
- One integrated power supply (1000W AC)

NEW!

ONIE

Dell Networking N3132PX-ON

ONIE

Dell Networking N2128PX-ON

Products	
Model	**Port configuration**
N3132PX-ON	24x RJ45 10/100/1000Mb PoE 60W, 8x 2.5/5G, 32x PoE 60W, 4x SFP+, 2x stacking ports, 2x hot swap expansion module bays
N2128PX-ON	24x RJ45 10/100/1000 Mb PoE+, 2x SFP+, 4x 2.5G PoE 60W, 2x stacking ports

NEW! N1100-ON Managed L2 Switches

Cost-effective Open Networking switches for campus access

CY17Q3

❑N1108T-ON/N1108P-ON –

- Half-width, 8 x 10/100/1000Mbps RJ45 ports and 2 x GbE RJ45 and 2 x GbE SFP interfaces, 4 x PoE/PoE+ ports

❑N1124T-ON/N1124P-ON –

- Full-width, 24 x 10/100/1000Mbps RJ45 ports and 4 x SFP/SFP+ 1/10GbE ports, 12 x PoE/PoE+ ports

❑N1148T-ON/N1148P-ON –

- Full-width, 48 x 10/100/1000Mbps RJ45 ports and 4 x SFP/SFP+ 1/10GbE ports, 12 x PoE/PoE+ ports

ONIE

NEW!

Dell Networking N1100-ON

Applications

- Cost effective migration for aging 10/100 Mbps access switches with full-featured N-series functionality

Dell Innovation

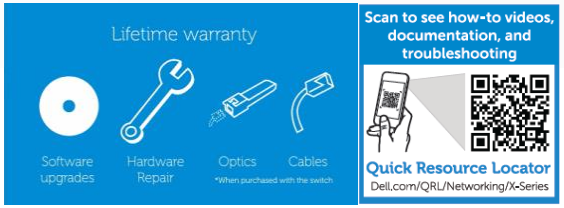
- Open Networking with support for ONIE
- USB rapid deployment to expedite switch configuration
- **Fanless design for ultra-quiet operation**
- Energy-efficient Ethernet plus lower power PHYs to reduce power to inactive ports and idle links

Full & half width form factors

PoE and non-PoE in a range of port configurations

Introducing the Dell Networking X-Series

X-Series is a family of smart managed 1GbE and 10GbE Ethernet switches designed for small and medium businesses who crave enterprise-class network control fused with consumer-like ease.

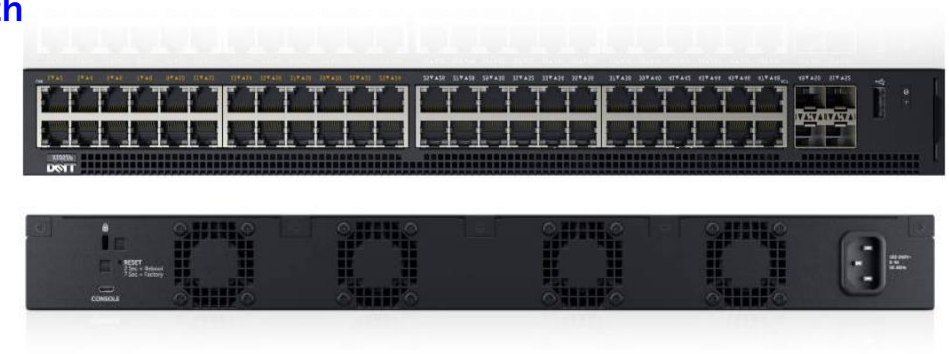


Dell Networking X1052 / X1052P

Smart Web Managed 1/10 Gigabit Ethernet Layer 2+ Switches

Key features and Innovations

- **48x 10/100/1000Mbps RJ45 Ethernet ports with PoE/PoE+ (X1052P)**
- **4x 10 dedicated Gigabit SFP+ ports for greater performance / bandwidth and distance**
- Half/full duplex 10/100 as well as 1000Mbps full duplex ports
- Asset protecting locking plug
- Micro-USB port and serial cable provided for local switch monitoring & debug access
- Standard 1U design with ready rail kit for fast and easy rack installation
- Redundant variable speed fans (X1052)



Great For

- Simplifying management of office networks without sacrificing features
- High density of connections in a limited space
- Powering phones, cameras, compact switches and other network devices directly from the network with PoE/PoE+ (X1052P)

Products

Model	Size (H x W x D)	Port configuration
X1052	1.71 in x 17.1 in x 10.63 in (43.5 mm x 434.0 mm x 270.0 mm) (1RU)	48x RJ45 10/100/1000 Mb ports, 4x SFP+ ports
X1052P	1.71 in x 17.1 in x 16.0 in (43.5 mm x 434.0 mm x 407.0 mm) (1RU)	24x RJ45 10/100/1000Mb ports, 24x RJ45 10/100/1000Mb PoE/PoE+ ports**, 4x SFP+ ports

**** Can be any combination of PoE (15W) and PoE+ (30W) up to a total of 360W**

Dell Networking X1026 / X1026P

Smart Web Managed Gigabit Ethernet Layer 2+ Switches

Key features and Innovations

- **24x 10/100/1000Mbps RJ45 Ethernet ports with PoE/PoE+ (X1026P)**
- **2x dedicated Gigabit SFP ports** for greater bandwidth and distance
- Half/full duplex 10/100 as well as 1000Mbps full duplex ports
- Push button toggle for unmanaged and Smart Web Managed operation
- Fanless design delivers low power consumption, increased reliability, and silent operation (X1026)
- Asset protecting locking plug
- Micro-USB port and serial cable provided for local switch monitoring & debug access
- Compact 1U half rack width design
- Optional tandem switch tray holds two switches in 1RU
- Redundant variable speed fans (X1026P)

Great For

- Simplifying management of office networks without sacrificing features
- Powering phones, cameras, compact switches and other network devices directly from the network with PoE/PoE+ (X1026P)

Products

Model	Size (H x W x D)	Port configuration
X1026	1.62 in x 8.23 in x 9.84 in (41.25 mm x 209.0 mm x 250.0 mm) (1RU, half-width)	24x RJ45 10/100/1000 Mb ports, 2x SFP ports
X1026P	1.62 in x 8.23 in x 17.72 in (41.25 mm x 209.0 mm x 450.0 mm) (1RU, half-width)	24x RJ45 10/100/1000Mbps PoE/PoE+ ports**, 2x SFP ports

**** Can be any combination of PoE (15W) and PoE+ (30W) up to a total of 369W**

Dell Networking X1008 / X1008P

Smart Web Managed Gigabit Ethernet Layer 2+ Switches

reddot award 2015 winner

Key features and Innovations

- **8x 10/100/1000Mbps Ethernet ports with PoE (X1008P)**
- Choice of AC power or power from a PoE switch port (X1008)
- Half/full duplex 10/100 as well as 1000Mbps full duplex ports
- Push button toggle for unmanaged and Smart Web Managed operation
- Fanless design delivers low power consumption, increased reliability, and silent operation
- Asset protecting locking plug
- Micro-USB port and serial cable provided for local switch monitoring & debug access
- Compact design for flexible placement – surface top, wall, or ceiling

❖ **Smallest PoE capable switch on the market!***

Great For

- Simplifying management of office networks without sacrificing features
- Powering phones, cameras, compact switches and other network devices directly from the network with PoE (X1008P)

Products

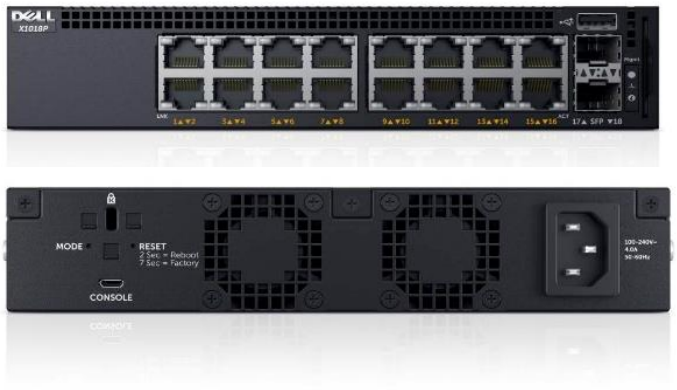
Model	Size (H x W x D)	Port configuration
X1008	1.67 in x 5.95 in x 5.95 in (42.5 mm x 151.13 mm x 151.13 mm)	8x RJ45 10/100/1000 Mb ports
X1008P	1.67 in x 5.95 in x 5.95 in (42.5 mm x 151.13 mm x 151.13 mm)	8x RJ45 10/100/1000Mbps PoE ports (up to 123W total)

Dell Networking X1018 / X1018P

Smart Web Managed Gigabit Ethernet Layer 2+ Switches

Key features and Innovations

- **16x 10/100/1000Mbps RJ45 Ethernet ports with PoE (X1018P)**
- **2x dedicated Gigabit SFP ports** for greater bandwidth and distance
- Half/full duplex 10/100 as well as 1000Mbps full duplex ports
- Push button toggle for unmanaged and Smart Web Managed operation
- Fanless design delivers low power consumption, increased reliability, and silent operation (X1018)
- Asset protecting locking plug
- Micro-USB port and serial cable provided for local switch monitoring & debug access
- Compact 1U half rack width design
- Optional tandem switch tray holds two switches in 1RU
- Redundant variable speed fans (X1018P)



Great For

- Simplifying management of office networks without sacrificing features
- Powering phones, cameras, compact switches and other network devices directly from the network with PoE (X1018P)

Products

Model	Size (H x W x D)	Port configuration
X1018	1.62 in x 8.23 in x 9.84 in (41.25 mm x 209.0 mm x 250.0 mm) (1RU, half-width)	16x RJ45 10/100/1000 Mb ports, 2x SFP ports
X1018P	1.62 in x 8.23 in x 17.72 in (41.25 mm x 209.0 mm x 450.0 mm) (1RU, half-width)	16x RJ45 10/100/1000Mbps PoE ports (up to 246W total), 2x SFP ports

Dell Networking & 3SVisoin 成功案例

位置：桃園縣 新建廠房監控專案

為了確保該企業加工品處一個安全的狀態，並且可以從產品，存儲，運輸和環境方面獲得問題瞬間的狀態，該加工業必須檢測產品區域和包裝區域，原材料區域，倉庫和物流方面。同時，該企業廠區有很多分支，總部和分工廠需要影像實時監控和回放。為了實現領導遠程監控，新廠房採納了3S Pocket Net IP監控方案和3S VMS/CMS軟件的電子地圖功能。

3S Pocket Net 提供了一個全面的監控方案：通過100支百萬像素網路攝影機和影像服務器，監控每一個區域；通過中心的3S VMS/CMS集中管理影像影像，並且安排最好的存儲系統進行百萬像素影像的存儲，因此，重要影像的再現可以很容易地實現。

3S服務
- 現場調查和評估
- 監控系統的諮詢和規劃
- 通過Internet 24小時技術支持
- 提供合適的產品
- 技術規劃和系統培訓
- 3S VMS和CMS軟件

Dell Networking 服務
- Product certificate by 3S
- 3Y Warranty
- 3Y Pro Support
- LLW

3S相關產品：

3路N1011槍式網路攝影機
2路N5012高速球網路攝影機
6路N9033紅外半球網路攝影機
56路N6078紅外槍型網路攝影機
33路N6035槍型網路攝影機

Dell Networking 相關產品：

N3024F 1 Unit
X1052P 22 Units
X1026P 24 Units
X1026 9 Units
PCT 2824 9 Units

N1011

N5012

N9033

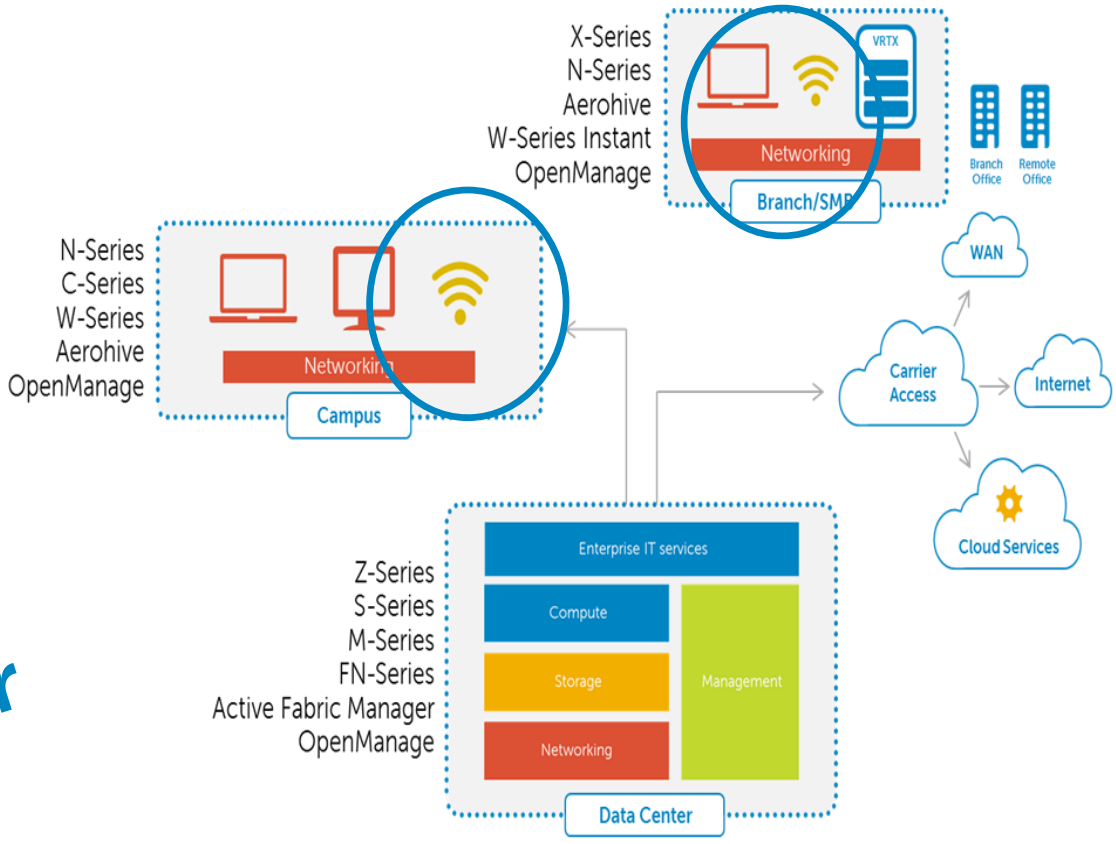
N6078

N6075

Campus

One Tier

3 Wireless



No Controller

Dell
Networking

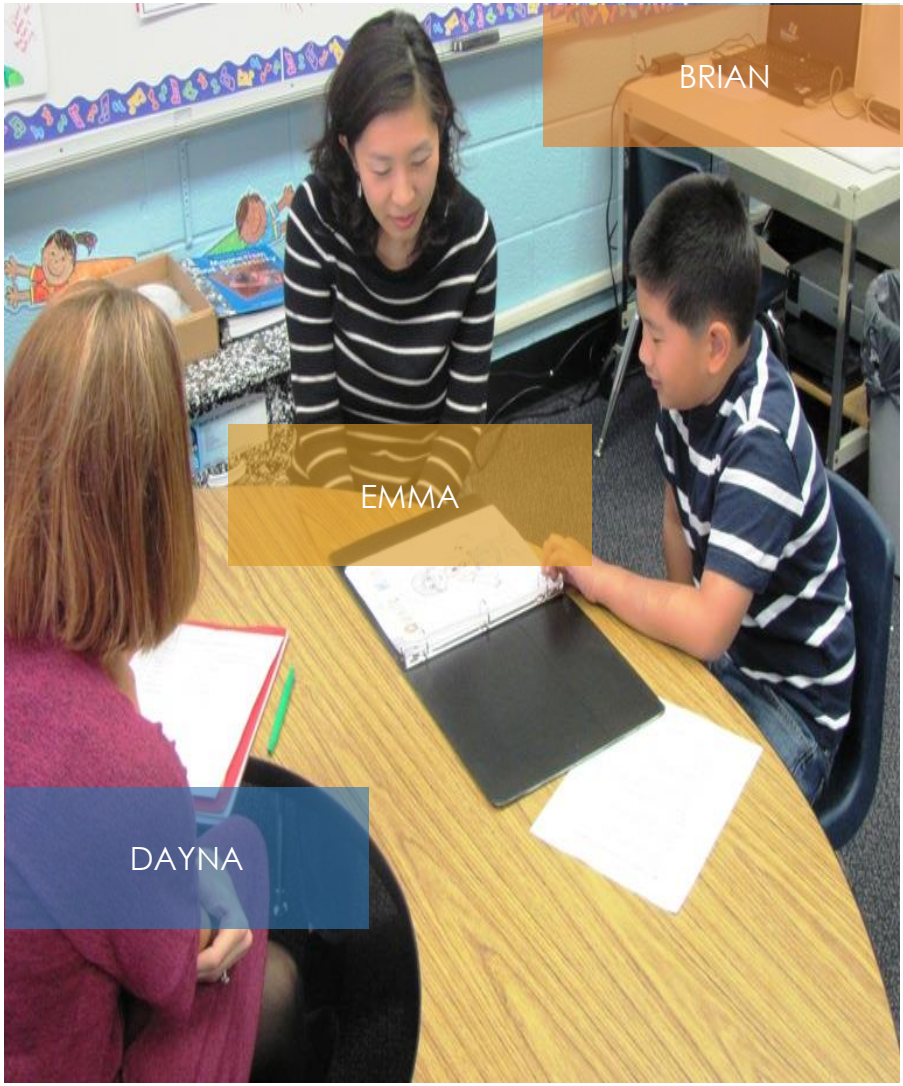
AeroHive
- Cloud WiFi

802.11ac

2013年底,
移動裝置的數量

已經比地球上
的人**更多**

Connected Users



Connected Devices

Connected Apps

Connected Everything

Wi-Fi 預測

以前**從未**連接過的用戶端設備的數量預計會成倍增長，
並且已**超過**現有設備的數量

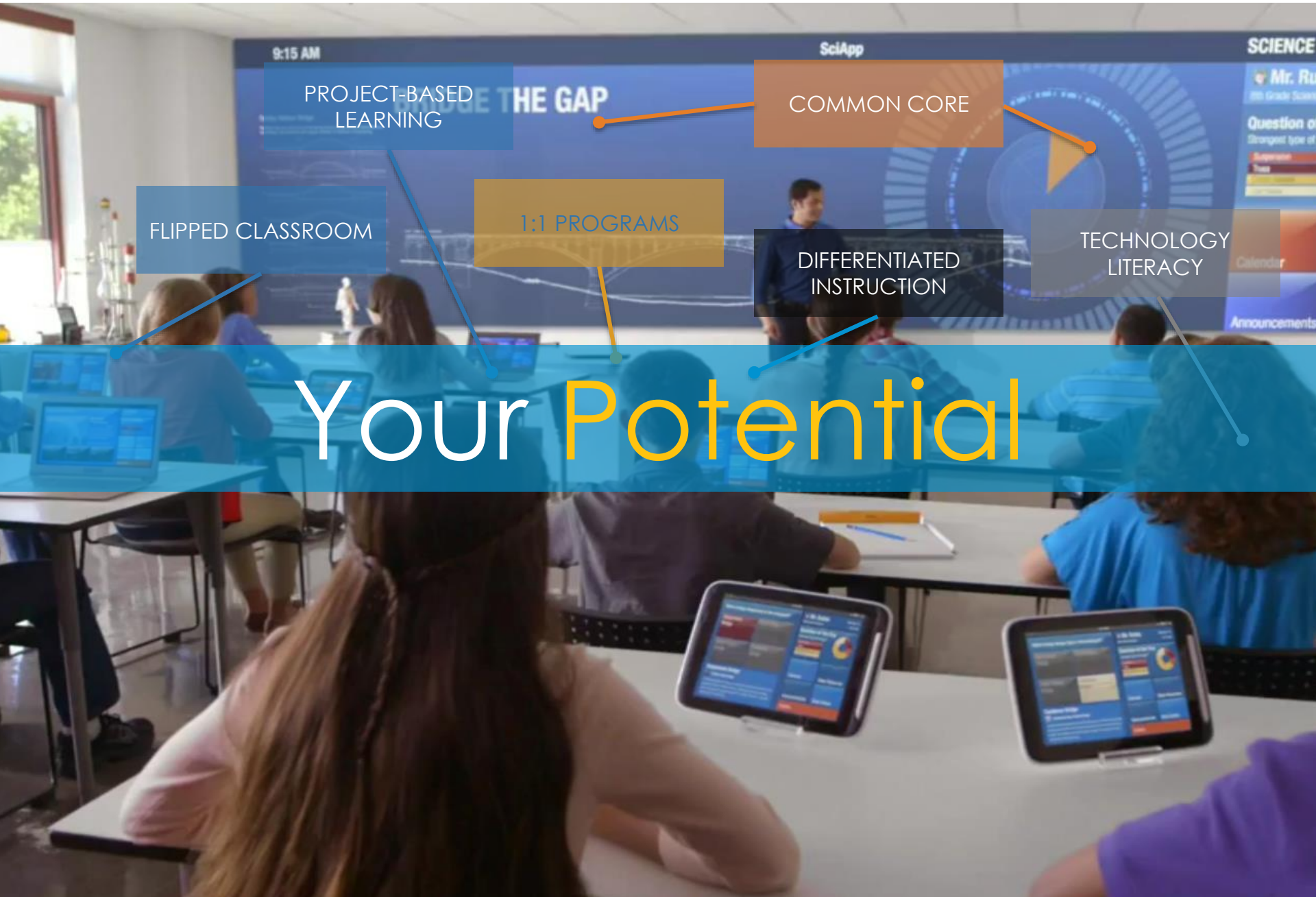
Aerohive NETWORKS

Aerohive NETWORKS

Engage. Inspire. Connect


怎樣才能改變
課堂上的教育體驗？
Aerohive
NETWORKS

Your Past...and possibly present


PROJECT-BASED LEARNING
COMMON CORE
FLIPPED CLASSROOM
1:1 PROGRAMS
DIFFERENTIATED INSTRUCTION
TECHNOLOGY LITERACY
Your Potential

Aerohive
NETWORKS

如何提升無線通訊網絡的服務容量?


對速度的需求

802.11 的發展

Aerohive NETWORKS

是什麼使802.11ac 的速度更快？

- Wider Channels
- More Spatial Streams
- 256 QAM
- MU-MIMO

Aerohive NETWORKS

802.11ac 的變化

WAVE 1	WAVE 2
80 MHz Channels	*160MHz Channels*
3 Spatial Streams	*4 Spatial Streams*
256 QAM	*MU-MIMO*

這都意味著什麼？

WAVE 1

1.3

Gbps

WAVE 2

3.5

Gbps

Aerohive NETWORKS

Transmit Beamforming & MU-MIMO

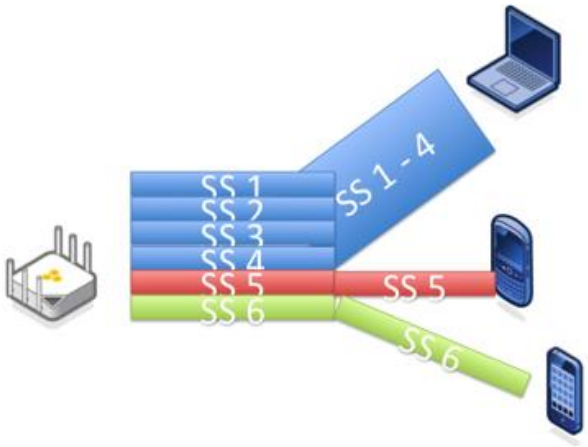


Figure from *802.11ac: A Survival Guide* by Matthew Gast

SU-MIMO directs energy to a single device

MU-MIMO transmits independent streams to multiple devices

Beamforming steers an individual stream to one receiver

Why AeroHive ?

客戶必須選擇Aerohive的原因

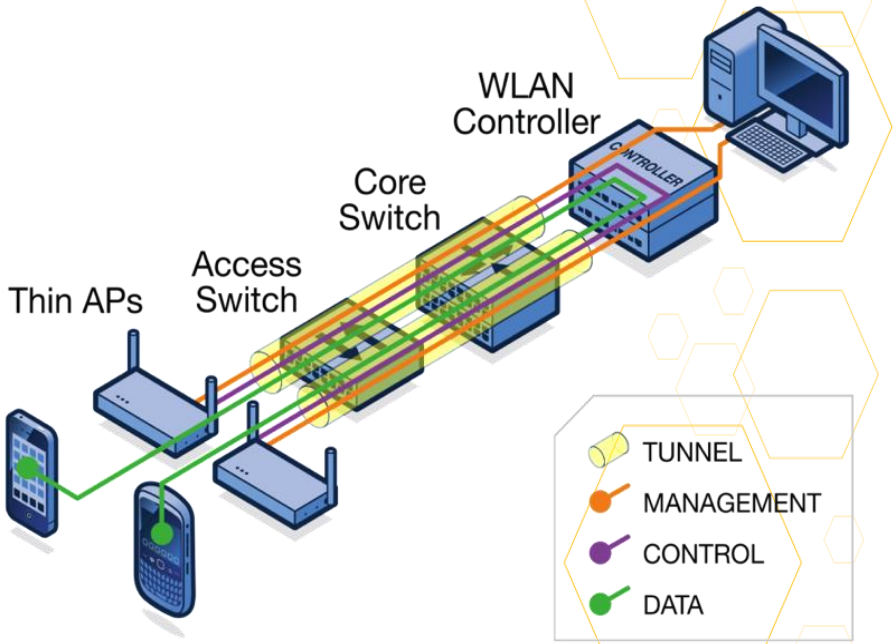
Connected  Intelligence

雲端管理帶來企業網絡變革

- 主要優勢
  - Gartner 評為排名最前的WLAN 廠商遠見者（Visionary）
  - 分散式不受控制器架構
  - 集中於雲端服務的管理
  - 極速佈署 - 零接觸設備配置
  - 豐富企業級功能
  - 應用開發 - API 平台

中央控制

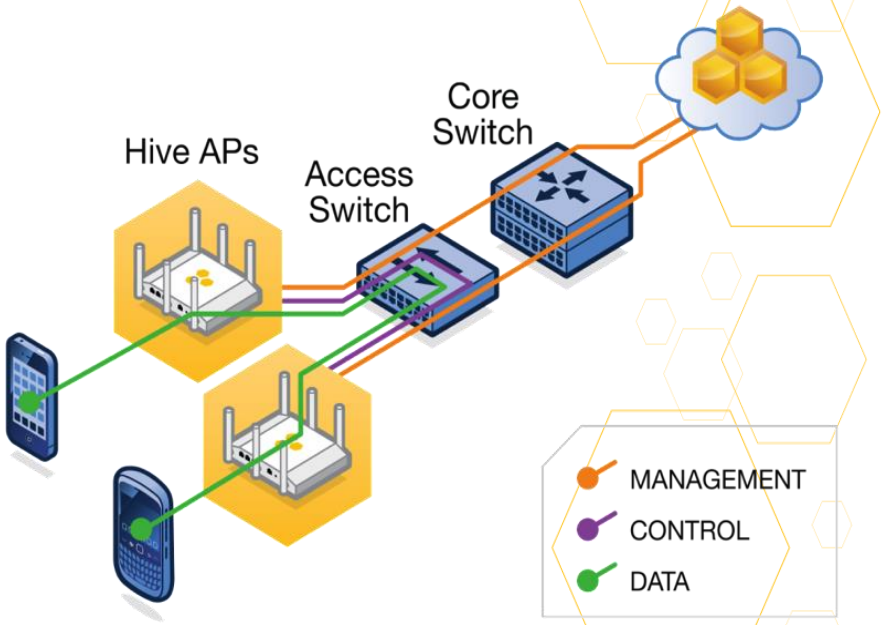
架構



Aerohive NETWORKS

協同控制

智能



Aerohive NETWORKS

Cloud Networking
雲端網絡技術和架構的科技趨勢

為什麼 雲服務?

傳統

複雜
更長的開發/測試週期
客戶維繫

雲服務

部署簡單、支援快速
快速創新
更新及時、可靠性高

Aerohive NETWORKS

Aerohive NETWORKS

提高網絡的能見度和策略控制

Network Visibility & Control

TOP APPLICATION GROUPS

File Transfer

Usage	37.78%
Users	73.33%

10	Applications	Top App: ICLOUD
99	Users	Top User: apatel

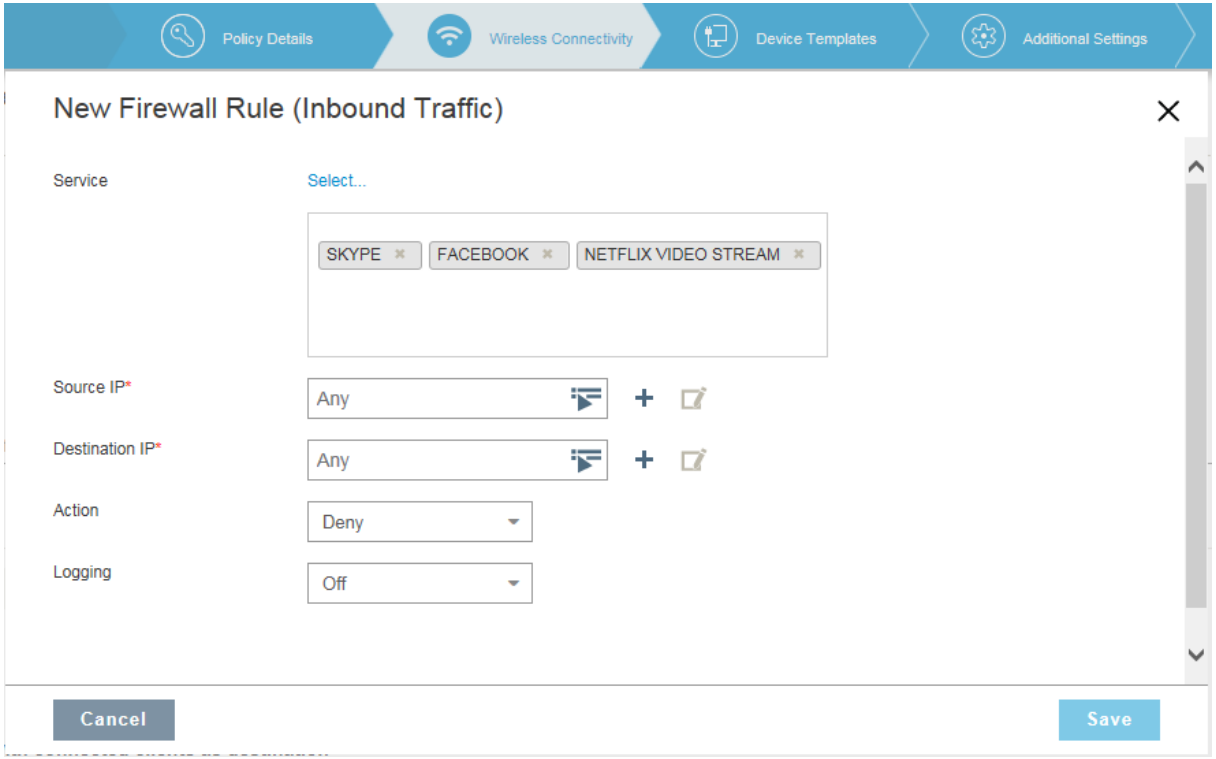
TOP APPLICATIONS

TOP 20 | TOP 100

Applications	Data Usage		# Clients	# Users
ICLOUD	4.62 GB	20.53%	32	29
Aerohi...	4.35 GB	19.34%	35	35
CIFS	2.4 GB	10.65%	68	68
MAPI	1.81 GB	8.05%	43	43
SSL	1.57 GB	6.98%	118	108
BITS	1.44 GB	6.38%	12	12

Aerohive NETWORKS

Network Visibility & Control

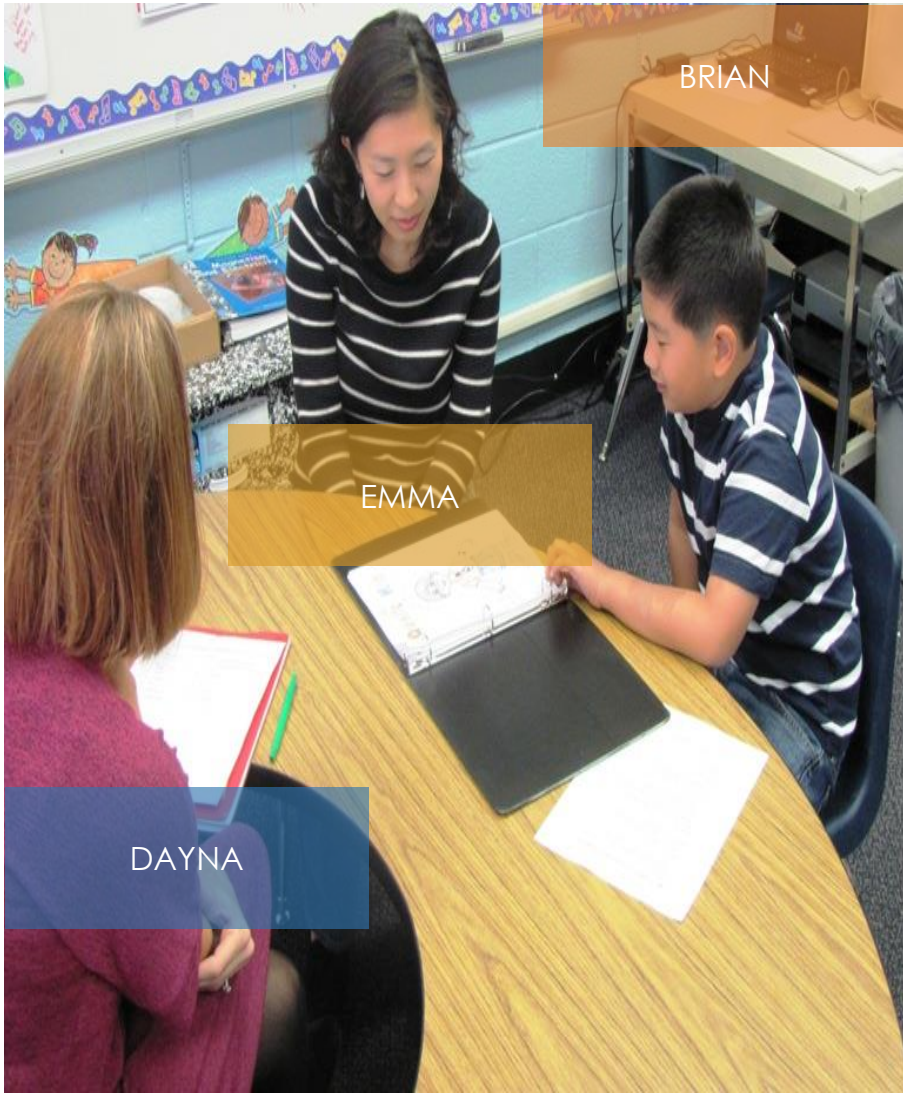


Aerohive NETWORKS

Network Visibility & Control

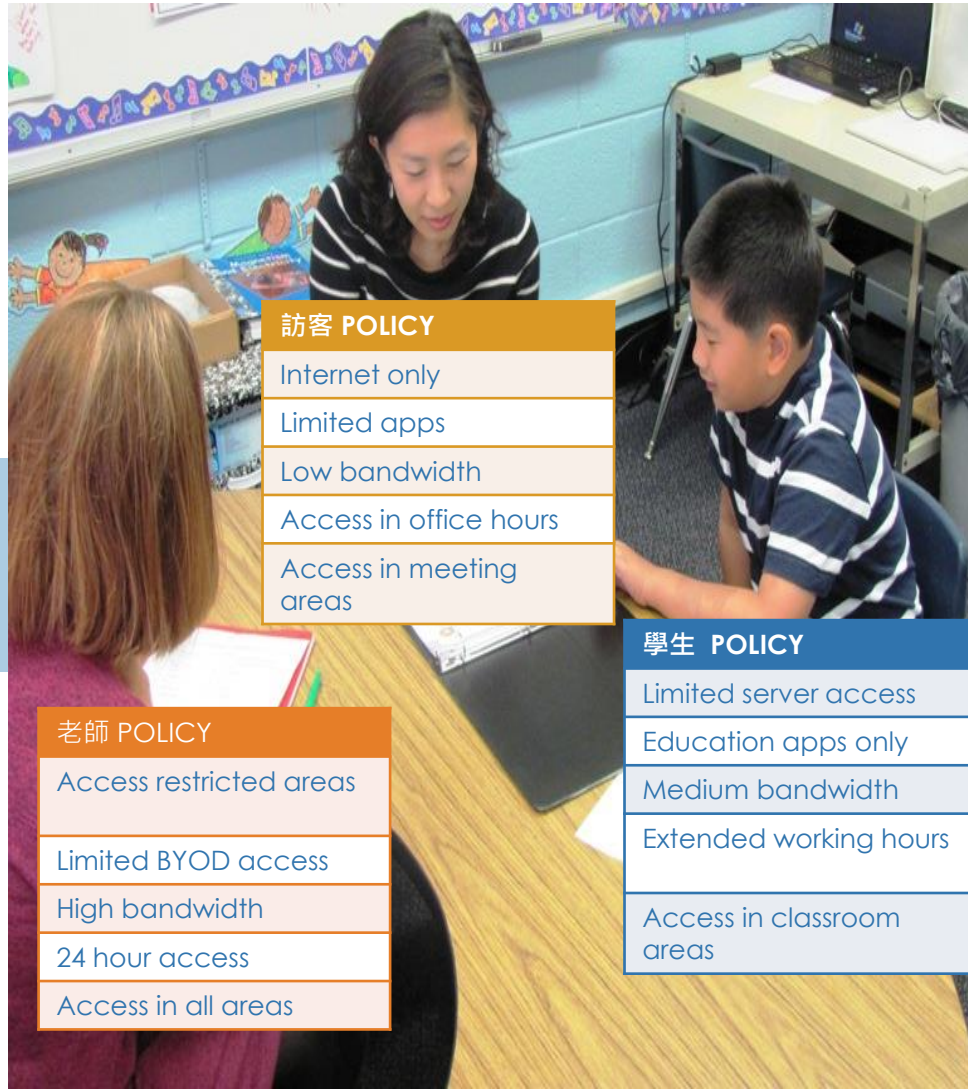
Who?	Students/Teachers		Guests
What ?	Evernote, ~~BitTorrent~~, ~~YouTube~~	YouTube, Facebook	YouTube, Facebook, 1 Mbps
When ?	8AM – 3PM	After 3PM	8AM – 5PM
Where ?		Cafeteria	

Connected Users

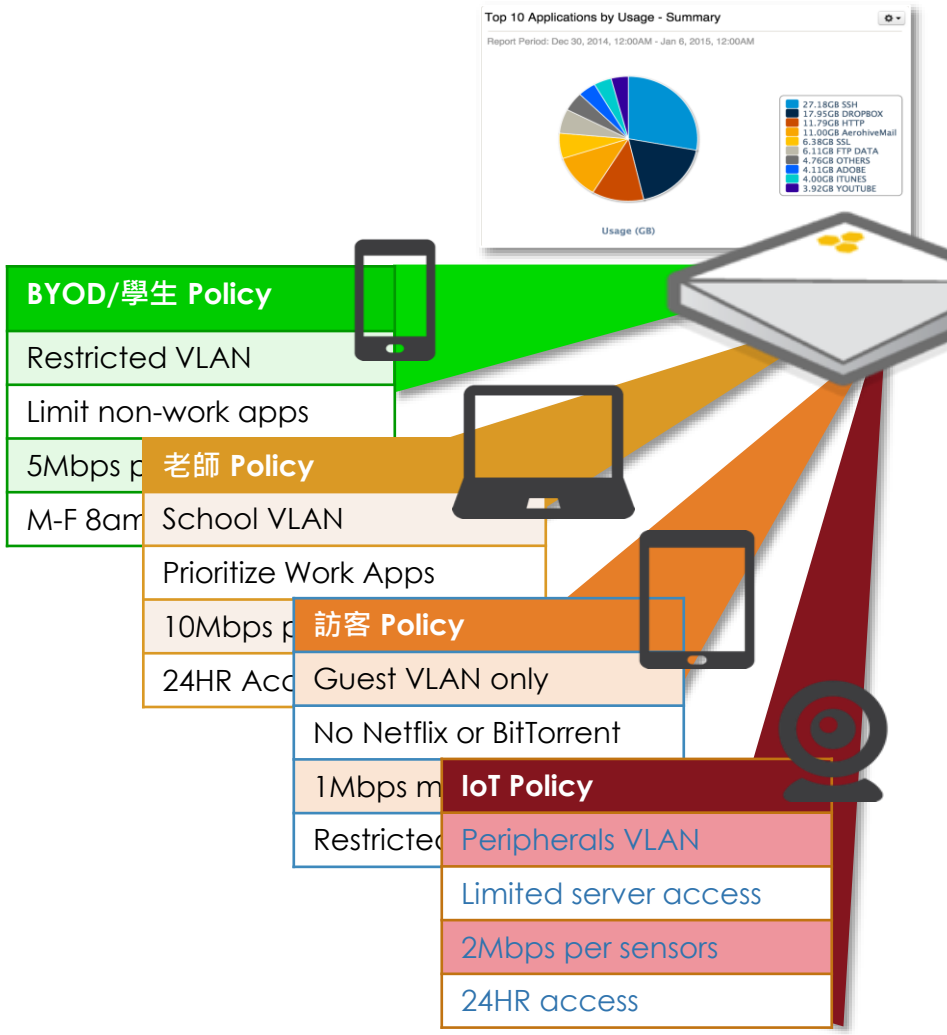


Connected Users

Connected Users



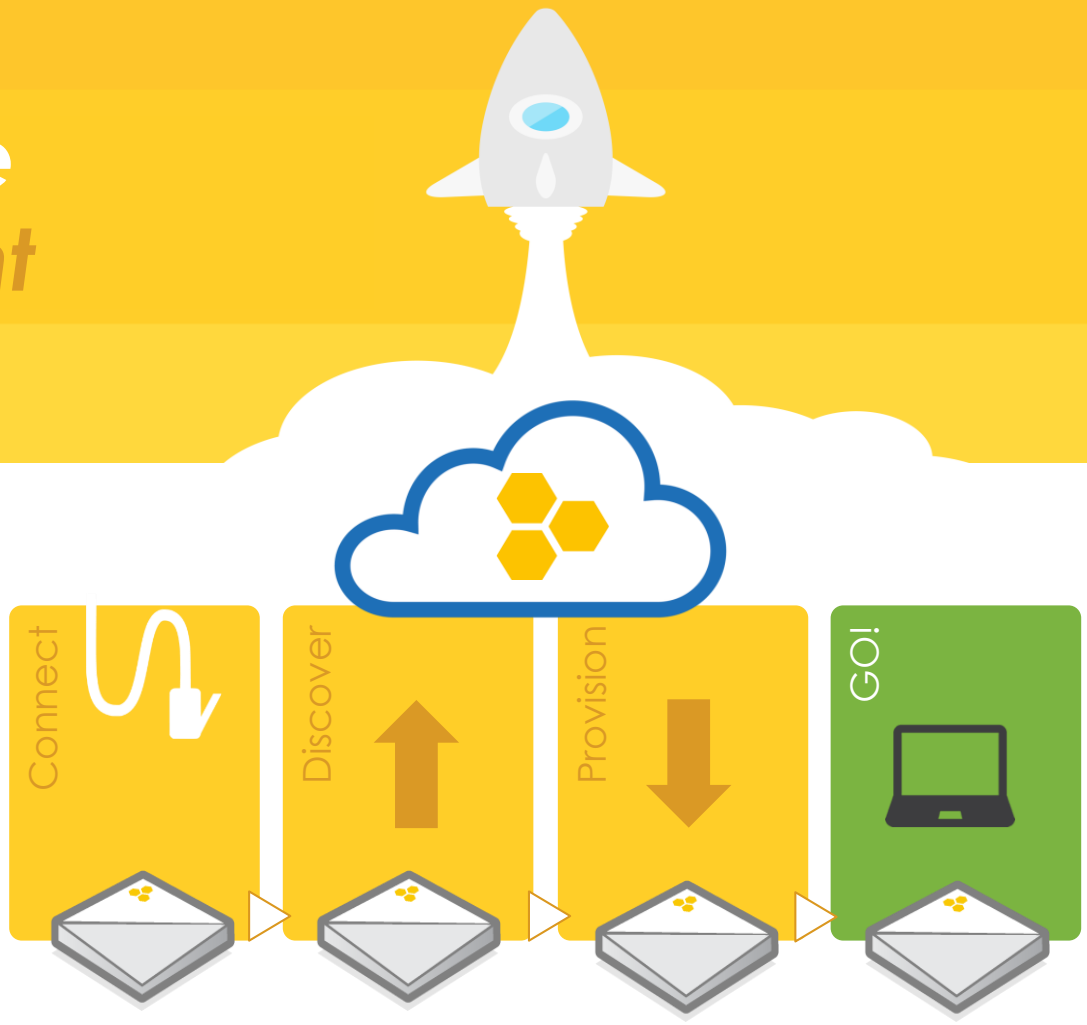
Context Focused



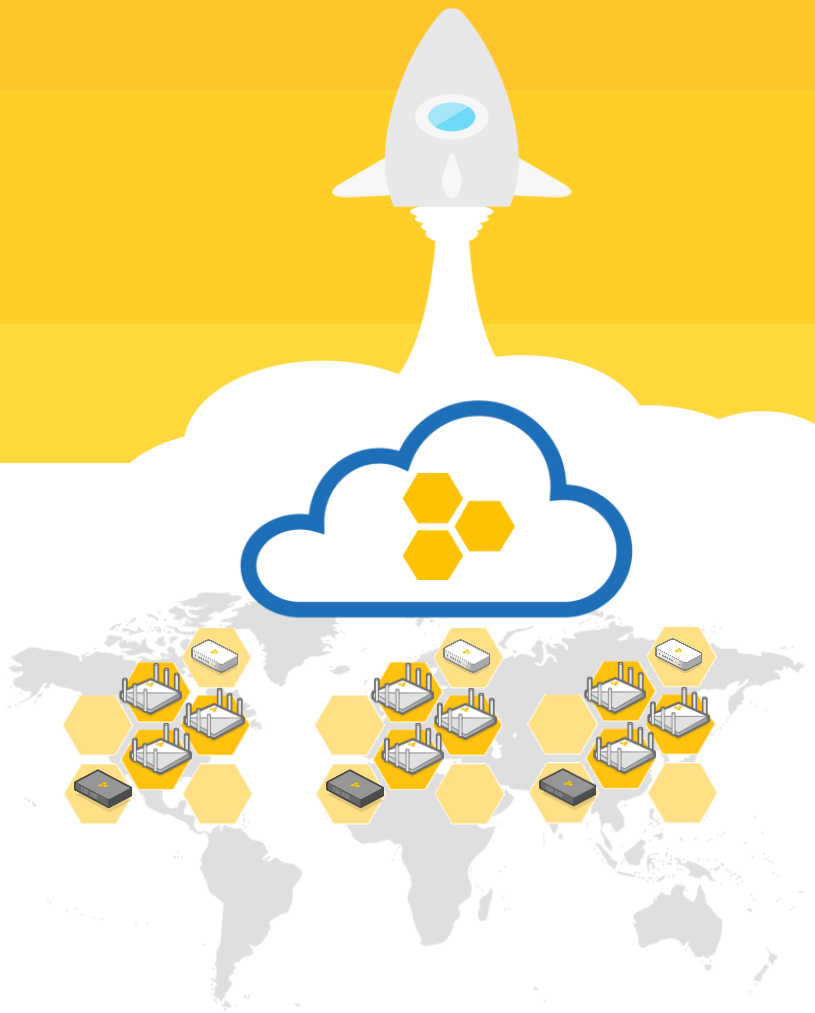
企業Wi-Fi雲網路管理平臺

Accelerate Deployment

您需要多長的時間去部署新的無線網絡?

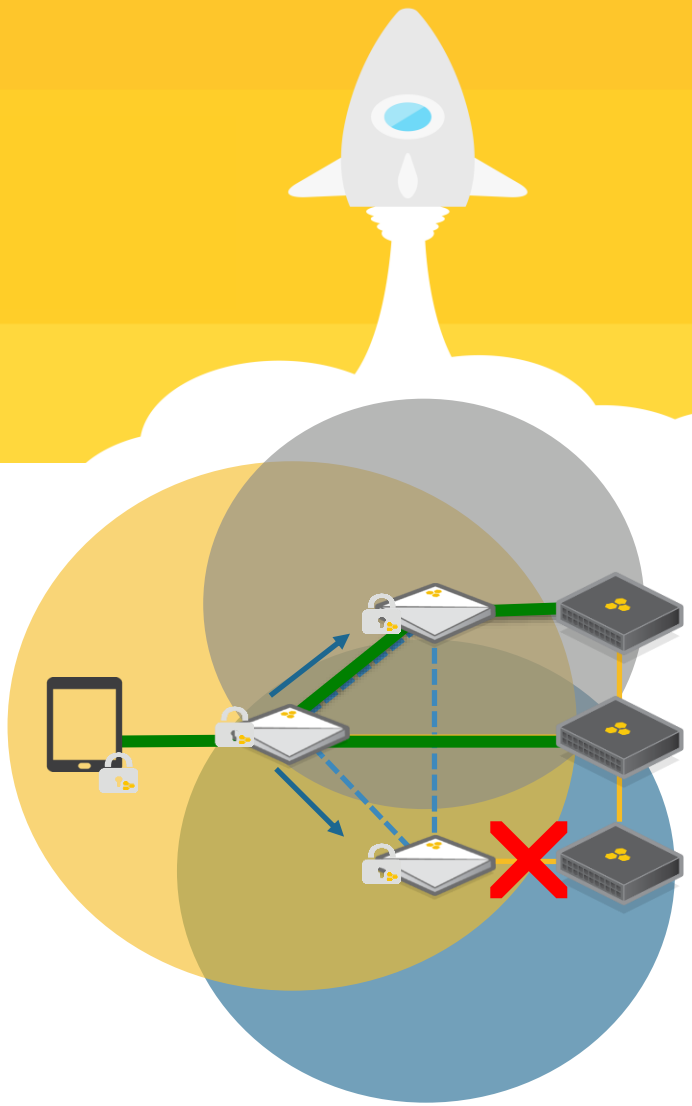


Accelerate Growth



您的無線方案可以有效的拓展嗎?

Accelerate Recovery



您的無線網絡可靠穩定嗎?

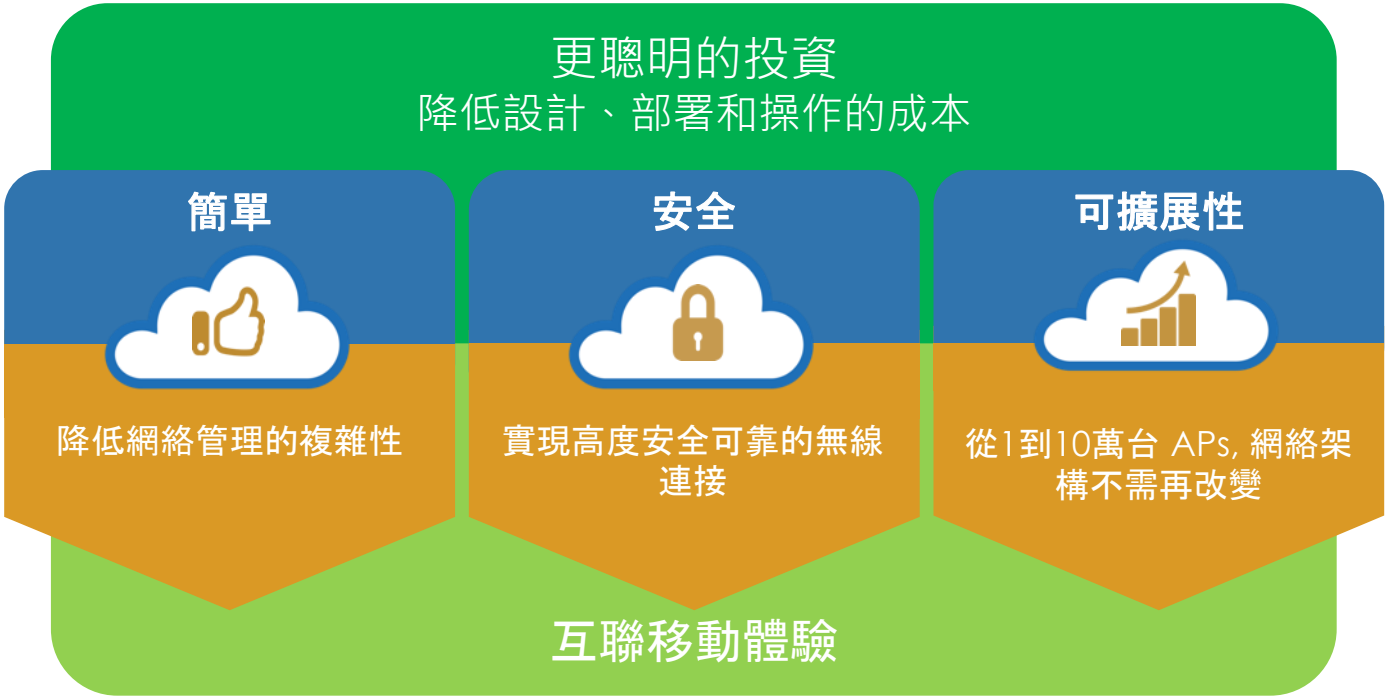
Accelerate Support

您的無線方案可以檢查和協助你排錯嗎?

Aerohive Networks

新一代的互聯移動體驗

互聯移動體驗

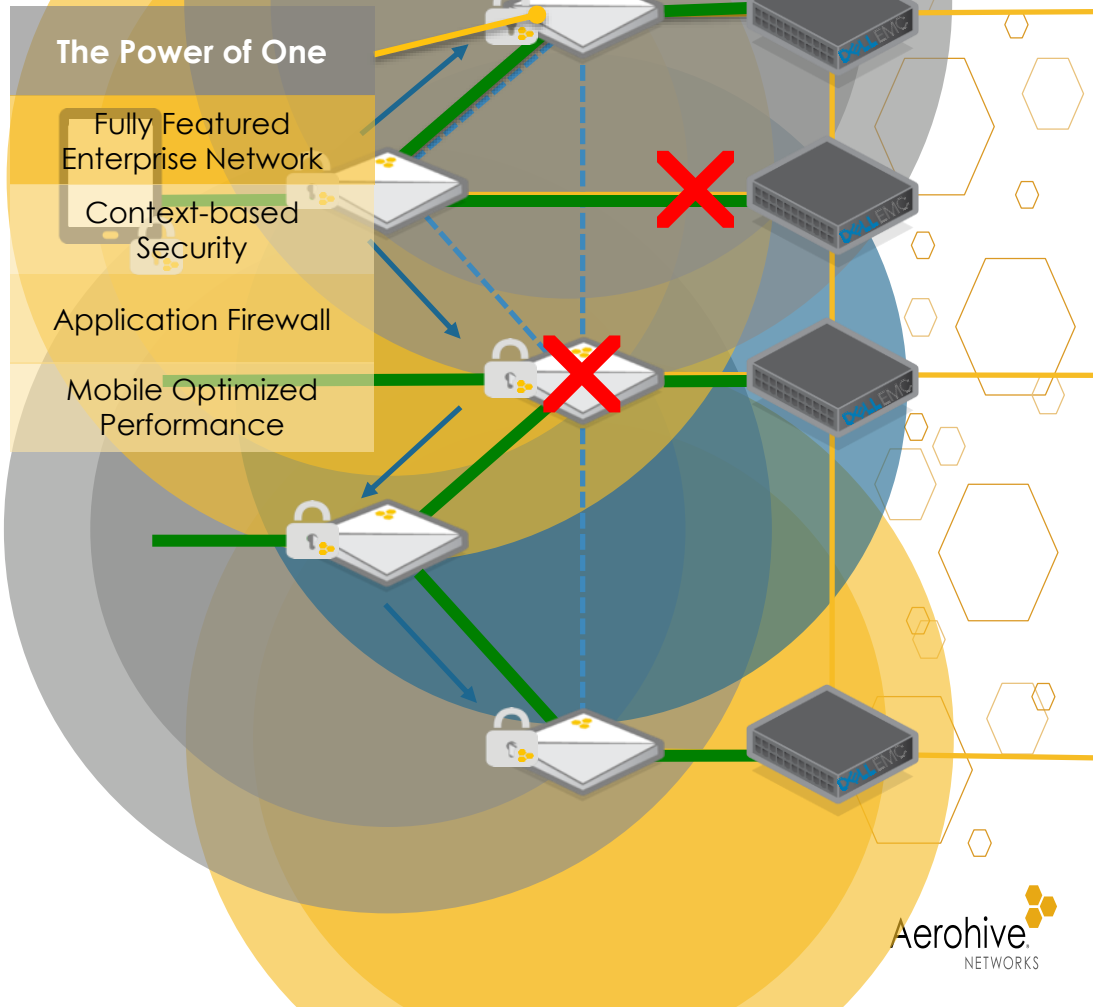


Aerohive NETWORKS

使用協同控制來分佈智慧

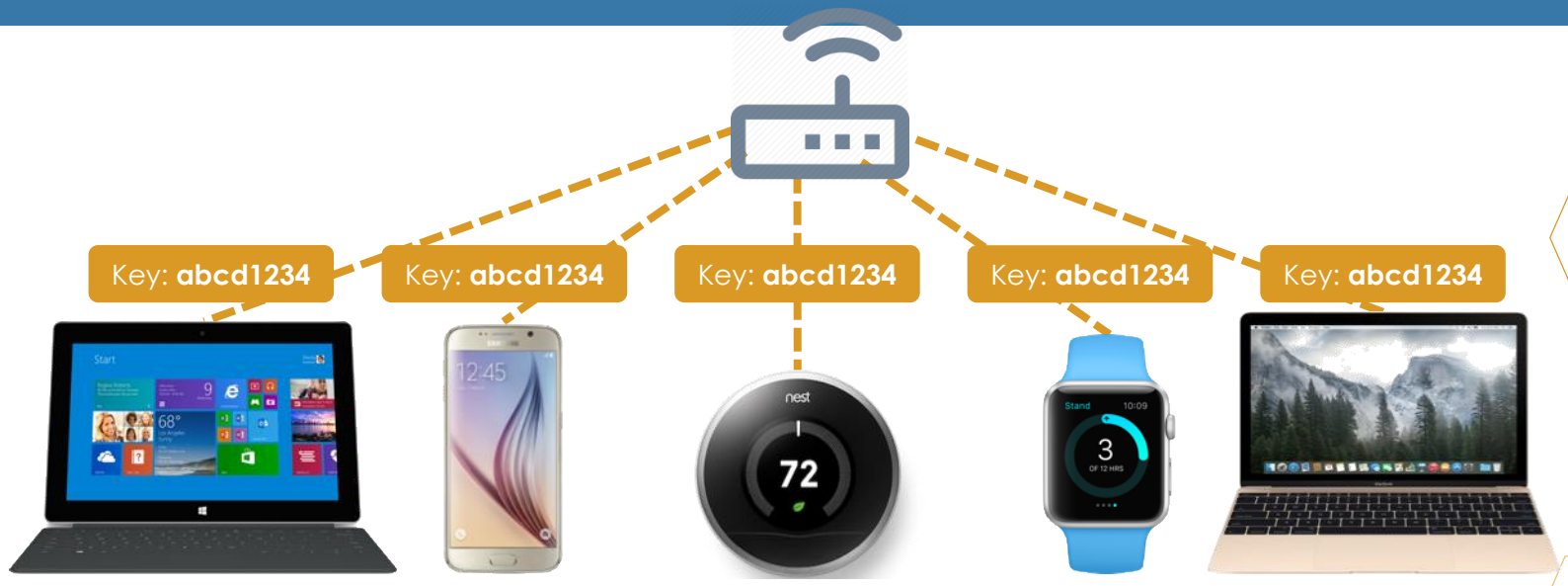
智能的接入层

- 提升了整體網路性能並實現優質的服務品質
- 不再需要中央控制器



Aerohive NETWORKS

傳統 WPA2-PSK 的基本連接



SAME Key **SAME** Identity **SAME** Policy **for** Corporate, BYOD, Guest, IoT Devices

Same VLAN

Same Firewall and Application Policy

Same Bandwidth Policy

Same Time Of Day & Location Access

Aerohive NETWORKS

物聯網IoT的安全考驗

Unique Identity

Certificate Authentication

Personalized Policy

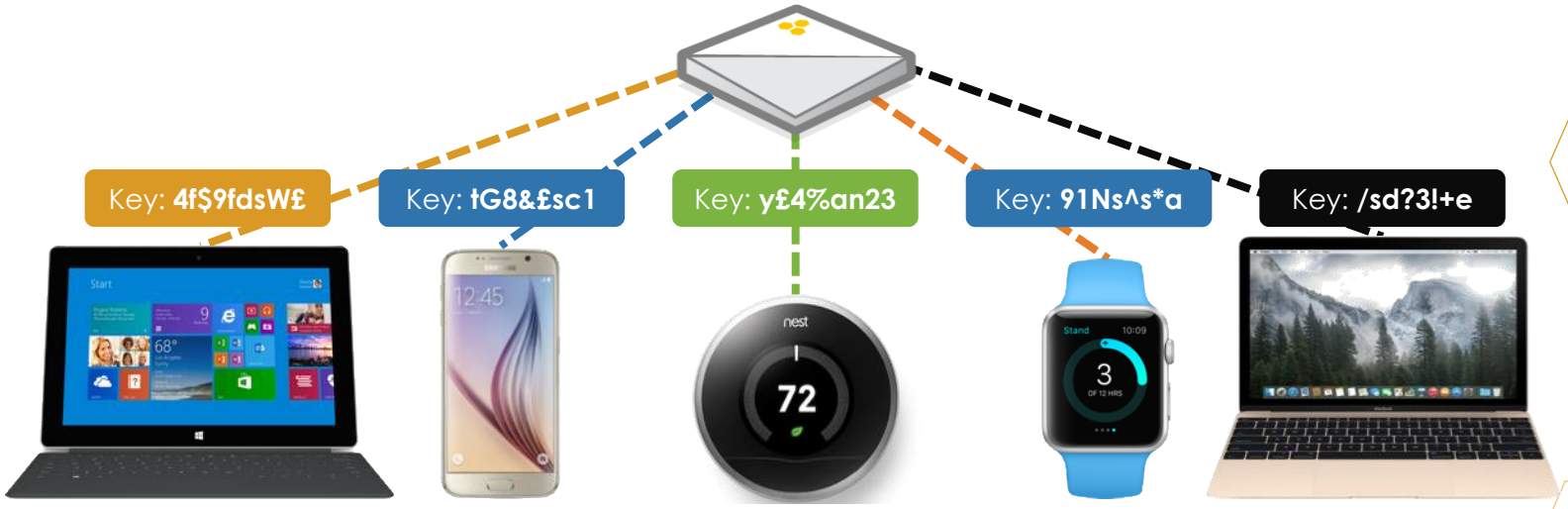
CORP Policy
Corp VLAN
Application Firewall
20Mbps per user
24HR Access

實現安全的網路訪問

私有預共用金鑰PPSK為每台關聯的設備發佈唯一的密碼以便用於身份驗證以及加密秘鑰的創建。但仍然可以實現 PSK 的易用性和網路的簡便性。

Aerohive NETWORKS

不需要複雜配置的安全網路訪問



UNIQUE Key **UNIQUE** Identity **UNIQUE** Policy **for** Corporate, BYOD, Guest, IoT Devices

Corporate	Guest	IoT	Personal BYOD	Corp BYOD
Role-based firewall and VLAN. Access to most Apps with highest bandwidth	Isolated in DMZ with limited app access, restricted to meeting areas during office hours	Service specific VLAN, with firewall only permitting access to IoT device server	VIP guest access, but Torrents and malicious Apps denied	Semi-restrictive access based on MDM enrollment

Aerohive NETWORKS

每一個客戶或專案
從一個AP存取點開始

最新 802.11ac Access Point

AP122	AP130	AP230	AP245X	AP250	AP550	AP1130
Indoor						Outdoor
Dual Radio 802.11ac Wave 1			Dual Radio 802.11ac Wave 2			Dual Radio 802.11ac Wave 1
2x2:2 867 Mbps		3x3:3 1.3 Gbps	3x3:3:3 1.3 Gbps	3x3:3:3 1.3 Gbps Software Selectable	4x4:4:3 1.7 Gbps Software Selectable	2x2:2 867 Mbps
TPM Security Chip						
1 x GigE		2 x GigE				1 x GigE
802.3af		802.3af + 802.3at (for full functionality)			802.3at	802.3at
Non-plenum	Plenum rated					Waterproof (IP 67)
0 to 40°C			0 to 50°C	0 to 40°C		-40 to 55°C
USB and BLE	None	USB	USB and BLE			None

Dell & Aerohive Cloud-based wireless solutions

Unified wired/wireless infrastructure

- Switches, APs, licenses and support provided from a single vendor
- Lowers operating costs through simplified management
- Wide range of indoor and outdoor APs, 802.11n/ac, up to two radio (3x3) three stream MIMO to address low to high capacity environments

Cloud-based management

- Services and updates delivered via public or private cloud
- Flexible, anytime/anywhere control and troubleshooting
- Centrally manage one site or many
- Simple plug-and-play operation makes it easy for administrators to deploy hundreds or even thousands of remote/branch offices

Wired + Wireless + Cloud Convergence

HiveManager NG 統一邊緣網路管理平臺

彈性的網路管理

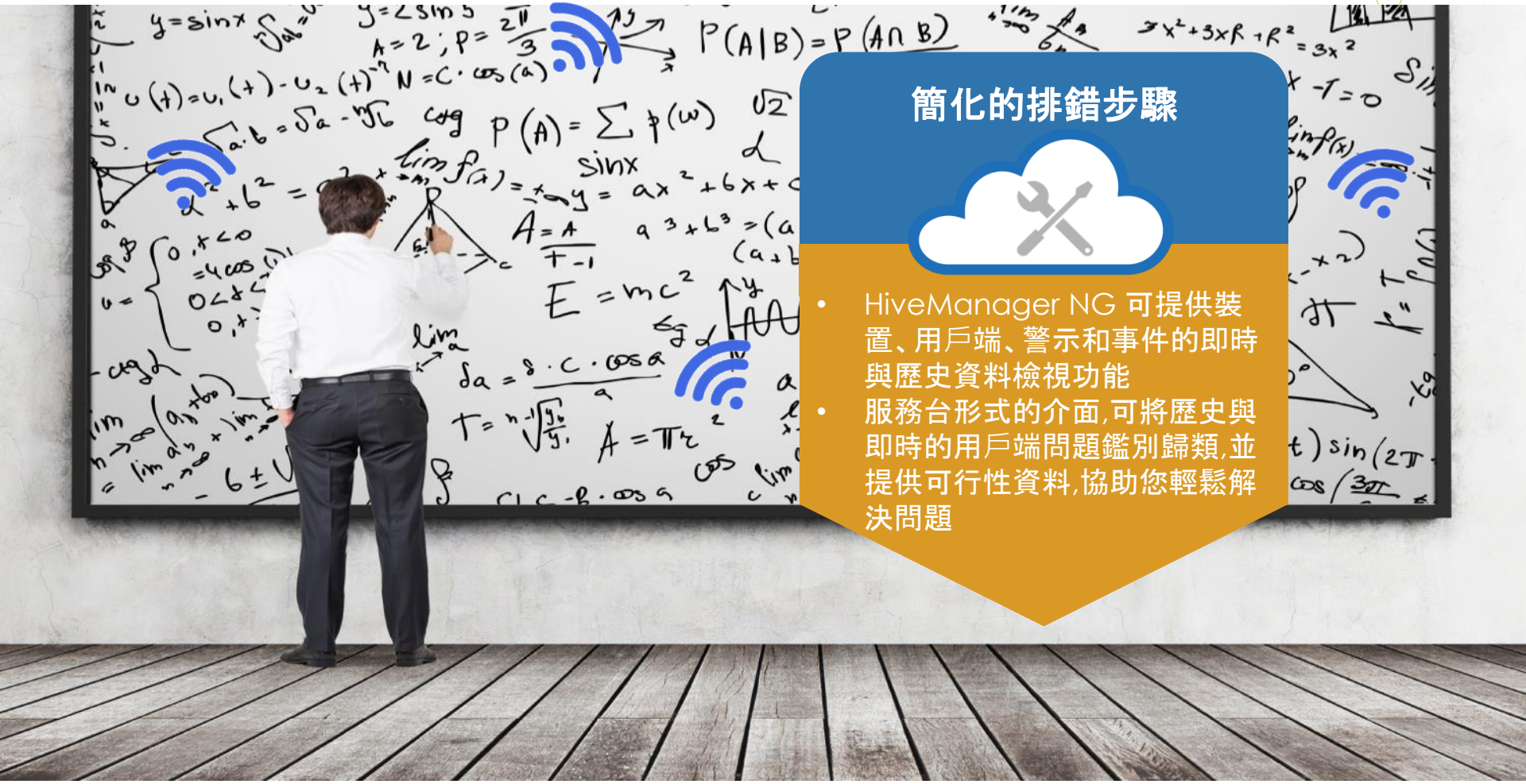
通過一個介面實現所有邊緣網路基礎設施的監控和配置,這也將進一步降低企業運維的壓力和成本。

簡化的消費者體驗
精細且具彈性的控管能力，

360 度全方位檢視	簡化的部署作業	全功能解決方案
存取點、用戶端裝置、消費者或應用程式	導覽式工作流程	完整的功能性

Aerohive NETWORKS

故障診斷功能
使您的團隊變成Wi-Fi專家



簡化的排錯步驟

- HiveManager NG 可提供裝置、用戶端、警示和事件的即時與歷史資料檢視功能
- 服務台形式的介面,可將歷史與即時的用戶端問題鑑別歸類,並提供可行性資料,協助您輕鬆解決問題

Thank you

The Power to Do More

Yu Yang 楊尚餘
Yu_Yang@Dell.com