Cisco Switching Innovations:

Next Generation Performance to enable support for Exponential Data Growth

Rajaseelan Manavalan (seelan@cisco.com)
Product Manager, Enterprise Networking Group
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Agenda

- Enterprise Trends and Cisco Catalyst strategy
- Catalyst product family and positioning for Enterprise Network
- Cisco Innovations to address customer challenges
  - High Availability, Security, Video, Network Virtualization, Smart Operations
- Key Takeaways
The IT Challenge: "Is My Network Ready?"

**CAPACITY**
“Do I have the right performance to scale?”

**COMPLEXITY**
“How do I simplify deployments?”

**COST**
“How can I be operationally efficient?”
Enterprise Megatrends

- Mobility
- Cloud
- Video

Network Foundation

- L4 – 7 Services
- Media Control
- Application Visibility
- Virtualization
- Security
- POE/Energywise
Catalyst Strategy and Direction

INNOVATION

Innovation with Investment Protection

DIFFERENTIATION

The Network Services Platform for Unified Access and Unified Fabric

TRANSITION

Driving Next-Gen Ethernet In the Campus
1G » 10G » 40G » 100G*

LOWER TCO

Price/Performance Virtualization, Energywise, Simplified Operations & Change Management
Campus FEX/Satellite*

* Roadmap
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The New Catalyst 6500
Balancing Innovation with Investment Protection

69xx Series 80Gbps Built-in DFC4
- 8 port 10G
- 4 port 40G* or 16 port 10G

68xx Series 40Gbps
- Built-in DFC4
- 1Gbe Fiber: 24/48 ports
- 10/100/1000: 48 ports
- 10GBASE-T: 16 ports
- 10G Fiber: 16 ports

Service Modules
- WiSM-2
- ASM-SM
- NAM-3
- ACE-30

2 Terabit Supervisor

INNOVATION
The New Catalyst 6500

INVESTMENT PROTECTION
- All E-Series Chassis
- All 61XXPOE/ POE+ Legacy Service Modules
- DFC4 Upgrade option for 67xx Line Cards

*Roadmap
Switch-On "2T": Introducing the New Supervisor 2T

**The Most Scalable Catalyst 6500 Ever**
- 3X System Performance
- 4X Data Plane Scalability
- 4T Virtual Switching System
- 40 Gigabit Ethernet Ready
- Up to 13M NetFlow Entries/system
- 1 million routes and 256K multicast groups
- Large Packet Buffers

**Unparalleled BN/DC Feature Set**
- End to End Network Virtualization—MPLS, EoMPLS, L2VPN/VPLS, VRF-Lite, Easy Virtual Networks (EVN)
- **Security** with TrustSec, MACsec, Atomic ACL’s and ASA-SM
- **Application Visibility** with NAM-3 and Flexible NetFlow
- **Unified Mobility** with WiSM2
- **Comprehensive IPv6** Ready for Transition
- **Future Proof**: 40G Ready, OTV Ready, TRILL Ready, LiSP Ready

Supported with LMS 4.1 & DCNM
Cisco Borderless Networks Access Portfolio

Catalyst 2960 - Competitive feature set at compelling prices
Solid Baseline Switching

Catalyst 4500E - Industry-leading modular access

Catalyst 3750-X 3560-X - Industry-leading fixed switching

Catalyst 2960-S - Competitive feature set at compelling prices

Catalyst Compact Switches - Great for secure, manageable ports ‘at the end of the wire’

Cisco Edge 300* - Open, Lower TCO, All-in-One Access for Connected Rooms
Industrial Automation - Purpose-Built for Industrial Applications

Innovative Services, Lower TCO
Next-Generation Workspace

Solid Baseline Switching
Traditional Workspace

Right Size Without Compromise
All-in-One Access For Connected Rooms

Outside the Wiring Closet

Ruggedized for Industrial Applications

Any Device HD Video VDI

Data Voice

Oil and Gas Retail Manufacturing
Introducing Catalyst 4500-X
Fixed-campus aggregation for space-constrained environments

**INNOVATION**
- Virtual Switching System (VSS)*
- Flexible NetFlow
- Easy Virtual Network (EVN)
- IOS XE Open Application Platform (Wireshark)
- ISSU, NSF, SSO w/ VSS

**OPERATIONAL SIMPLICITY**
- Automation
- Investment protection
- Modular 8-port 10GE uplink
- Hot-swappable dual redundant power supplies & five individual fans
- Limited Lifetime Warranty

800 Gbps System 1.6Tbps w/ VSS
Smallest Size – 1RU 21” Deep
Highest Scalability Richest Services
Industry Leadership
Lower TCO

* roadmap

Revolutionizing Fixed 10GE Campus Aggregation Platform
Now Shipping

Next Generation Access Linecard WS-X4748-UPOE+E

**CISCO UNIVERSAL POE (UPOE)**

- 60W PoE with maximum line card budget of 1500W
- Estimate cable loss with intelligent diagnostics
- LLDP enhancement to negotiate beyond 30W
- Power X-Generation applications
  - IP Turrets in financial trading floors
  - Integrated Virtual Desktop Clients

**ENERGY EFFICIENT ETHERNET**

- Compliant with IEEE 802.3az for:
  - 100/1000 Base-T
- Power consumption is based on link utilization
- Green: Save up to 190W per chassis
- Mandatory for Energy Star Compliance*

* Energy Star Requirements for Enterprise Switches Expected to Be Published Mid-2011
Campus Positioning & Design
Performance with Network Services

- **Secure**
- **Robust**
- **Simple**
- **VDI Ready**

**End to End Services**
- Resilient
- Virtualized
- Video Optimized
- Turn Key IPv6

### CORE
- **Cat6k/Sup2T**
  - 4T VSS (with Quad-Sup VSS*)
  - MPLS, VPLS, MPLSoGRE
  - 40G Ready
  - TrustSec L3 SGT Support
  - Sampled Netflow
  - OTV, LISP Ready*

### DISTRIBUTION
- **Cat6k/Sup2T**
  - 4T VSS
  - Integrated L4-7 (WiSM2, ASA, NAM-3, ACE30)
  - Multicast HA
  - Smart Install Director*
  - TrustSec SGACL
  - Flexible Netflow, Egress Netflow

### ACCESS
- **Cat4k/Sup7-E/Cat3K**
  - TrustSec
  - EnergyWise
  - UPoE (60W)
  - Flexible Netflow
  - IPv6 First Hop Security.
Architecture Blueprint for Integrated Services

**6500 as Borderless Services Node (BSN)**

- Provides Service Virtualization, Wired / Wireless Integration and Secure Access
- Catalyst 6500 10GbE Core
- Agg 6k
- Security
- Wireless

**6500 as Data Center Services Node (DSN)**

- Virtualized infrastructure with service tiers to deliver multiple types of SLAs / offerings
- Nexus 7000 10GbE Core
- Security
- Load balancer
- Nexus 7000 2K/5K

**Reduced Total Cost of Ownership**

- Modular Design, Service Virtualization, Reduced power, space, cooling requirements

**Simplified Operations**

- Single point of management and policy enforcement
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Catalyst Value Proposition for Borderless Deployments

- High Availability
- Smart Operations
- Network Virtualization
- Integrated Services
- Data Center Interconnect
- Application Performance
- Video
- Security
- IPv6
- Multicast
- Catalyst

INNOVATE
High Availability
# High Availability on Catalyst

**Best in Class Resiliency**

<table>
<thead>
<tr>
<th>Customer Challenge</th>
<th>Benefits of 6500, 4500 and 3k-X</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Continuity</strong></td>
<td><strong>Non-Stop Communications During Unplanned Outage</strong></td>
</tr>
<tr>
<td>Prevent Loss of Productivity</td>
<td><strong>Minimizes Impact of Planned Downtime</strong></td>
</tr>
</tbody>
</table>

## Non-Stop Communications During Unplanned Outage

- Improved system availability and doubled utilization with 4 Tbps VSS, 4K VSS – (Q3 CY2012)
- Subsec link fault detection
- Subsec network convergence
- Tools to debug and restore network operations

## Minimizes Impact of Planned Downtime

- Network is available during software upgrades
- ‘Hot’ Hardware upgrades reduce service disruption time
- Upgrade Software with Rolling Stack Upgrades
- Max Power Availability with StackPower
Catalyst High Availability Framework

**Upgrades Management**
- Availability during SW upgrades with VSS + EFSU

**Operational Resiliency**
- Tools for Faster Fault Detection and Recovery
  - EEM, Smart Call Home
  - Configuration Rollback
  - GOLD, OBFL
  - Virtual Switching System

**Network Resiliency**
- Sub-second Network Convergence in Standalone (w/ dual Sup) and VSS
  - 16 Way Layer 3 Load Balancing
  - Graceful Restart for IPv4 & IPv6 with various routing protocols
  - V4 and v6 Multicast HA
  - MPLS HA
  - VRRP, HSRP

**Link Resiliency**
- Subsec Failure Detection
  - BFD (Bi-directional Forwarding Detection) for Static Routes*
  - OSPF and EIGRP Clients for BFD
  - BFD Support for logical interfaces*
  - UDLD, Fast UDLD
  - Flexlinks
  - VSS Multi chassis ether channels

**Infrastructure Resiliency**
- Protection Against Component Failures
  - Dual Power Supply
  - Fan Tray Hotswap
  - Dual Supervisor (NSF/SSO)
  - VSS enables Intra Chassis failover
  - Rolling Stack Upgrade and StackPower
Business Continuity
Issue: STP Loops and Slow Routing Convergence

The Challenge
Complex network design

Typical Deployment Scenario
- Single active uplink per VLAN
- 50% bandwidth utilization only
- Spanning Tree loops
- First Hop Routing Protocol Convergence
- Routing Reconvergence

Productivity Loss
User Downtime (seconds)

Complex Config to Manage
“...There has always been a need for specialized networks inside our institution for research or network services. The Cisco Catalyst 6500 VSS solution makes it much easier for us to support these services...”

“...we’ve achieved approximately a four to fivefold increase in bandwidth and we’re utilizing all the links within VSS. We now can have an Active/Active arrangement on our uplinks ..., so essentially we get what we pay for...”

* Quote provided by AT&T network consulting engineer managing customer network
Business Continuity
Enhanced Availability and Simplified Network Design with VSS

The Solution
4 Tbps Virtual Switching System with 6500
Twice system bandwidth 1696 Gbps with 4K (Q3CY12)

Double Bandwidth Utilization
With Active-Active Multi-Chasis Etherchannel (LACP / PagP)

Simplified Network Design
Spanning Tree and First Hop Redundancy Protocols Elminated

Minimized Traffic Disruption
Subsec Stateful and Graceful Recovery (SSO / NSF)
Prevent Loss of Productivity
Network Always Available Even During Software Upgrades

**The Solution**
VSS + EFSU

**Simplified upgrade process, with four easy steps**

**Increased**
Availability as 50% bandwidth always available if servers/switches are dual homed

**Deterministic**
Recovery, supports Quad-Sup designs as well

With EFSU, a minimum of 50% bandwidth is available throughout the software upgrade process

Aggregate Bandwidth of both VSS chassis

Load  Run  Accept  Commit

LACP or PagP

Access Switch or ToR or Blades

Access Switch or ToR or Blades

VSL

VSS Active
WS-X6708-10G

VSS Active
WS-X6708-10G

Version 2

Version 2

VSS Active
WS-X6708-10G

VSS Active
WS-X6708-10G

LACP
In-Service Software Upgrade (ISSU)
Software Upgrades—Without Service Interruption

• Comprehensive, non-intrusive software upgrade solution
• Transparent to end users—no loss of user sessions
• Upgrades can be scheduled at anytime—even during business hours
StackPower on the Catalyst 3750-X Series
Delivering Unprecedented Power Availability and Flexibility

StackPower

• Adaptable “pool of power” available to all stack members
• Provides “Zero-footprint” RPS i.e. power supply redundancy without an RPS
• Intelligent power shedding—turn off low priority PoE end devices in the event of a power supply failure
Rolling Stack Upgrade (RSU) 
Intelligent s/w Upgrade Mechanism

- Ensures minimal service disruption during an upgrade
- The entire stack will not be taken off line. Stack members taken off-line one at a time
- Redundant uplink always remains active to maintain connectivity
- Connectivity to critical dual-homed servers and wireless clients can be maintained
What Customers Are Saying …

**Chicago Mercantile Exchange**

"The VSS feature will enable us to cut hardware fail-overs from 50 seconds down to two to three seconds, which is the difference between impacting customers and keeping a hardware failure from reaching the end user."

**Université de Montréal**

"There has always been a need for specialized networks inside our institution for research or network services. The Cisco Catalyst 6500 VSS solution makes it much easier for us to support these services…"

**Horizon Blue Cross Blue Shield**

"...we’ve achieved approximately a four to fivefold increase in bandwidth and we’re utilizing all the links within VSS. We now can have an Active/Active arrangement on our uplinks ..., so essentially we get what we pay for..."

* Quote provided by AT&T network consulting engineer managing customer network

CME Article: http://www.networkworld.com/community/node/21674
Security
Security
Deliver End-to-End Iron-Clad Security

IT Challenges
- Authorized Access
- Regulatory Compliance
- Network Protection and Monitoring

Unique Cisco Benefits
- Discover and profile end devices with IOS Sensor
- Identity-based access control with no impact using Monitor Mode
- Link layer encryption with policy enforcement via MACsec
- Network visibility to security vulnerabilities with Flexible NetFlow
- Attack forensics with Smart Logging and Telemetry

Unified Management and Policy with Identity Services Engine (ISE)
Authorized Access
Manual Device Classification and Policy Enforcement

The Challenge
Device proliferation and identification for policy enforcement

Typical Deployment Scenario
Multitude of devices on the network, wired and wireless
Need to have policy control for each device type
Need assurance that a device conforms with signature
Authorized Access
Device Profiling Automated with IOS Sensor

The Solution
Device Profiling + IOS Sensor

Deployment Scenario with Cisco IOS Sensor

Collection—Switch collects device related data and sends report to ISE

Classification—ISE classifies device, collects flow information and provides device usage report

Authorization—ISE executes policy based on user and device
Authorized Access
Deployment Hurdles with 802.1X

HELP DESK
Productivity Loss
User Downtime

The Challenge
Implement Identity-Based Access Control

Typical Deployment Scenario
Deploy Access Control
Failed Access due to non 802.1X client, supplicant variation etc.

User contacts help desk for assistance
Troubleshooting problem results in loss of productivity

802.1x FAILURE
MAC Address 00:18:F8:46:53:D7

DENIED

CORPORATE RESOURCES

SiSi

SiSi

SiSi

SiSi

SiSi

SiSi

SiSi

SiSi
Authorized Access
Zero Downtime When Implementing 802.1X with Monitor Mode

The Solution
Implement in Monitor Mode

Deployment Scenario—Cisco Access Switch

- **Discovery**—Allows connection regardless of device types
- **Correct**—View failed reports on ACS or ISE; troubleshoot and resolve issues; ensure future authorization
- **Add Authorization**—Block unauthorized access; add policy for restricted resources
Regulatory Compliance
Data Protection with L3/L4 Encryption

The Challenge
Encryption disables visibility for policy enforcement

Typical Deployment Scenario
Encryption at IP or application layers
No visibility into the flows for Security and QoS policy enforcement
Regulatory Compliance
Data Protection with L2 Encryption (MACSec)

The Solution
Data Confidentiality with Visibility

Typical Deployment Scenario
Hop by Hop L2 encryption

Visibility into the flows for Security and QoS policy enforcement

Cipher Data

802.1 AE Encrypted

Flows visible for policy enforcement

Encrypt On Egress Interface

802.1 AE Encrypted

Decrypt On Ingress Interface

Packets in “Clear” Inside the Switch
Network Protection and Monitoring

Example of Inside Attacks: Operation Buckshot Yankee

Once instantiated, malware spreads laterally. These flows do not cross threat boundaries. It took six months to find and completely eradicate the virus.

The Challenge
Protect from attacks originating from inside the network

Attack from an Authenticated Device

USB Key plugged into an authenticated device

Once instantiated, malware spreads laterally

These flows do not cross threat boundaries

It took six months to find and completely eradicate the virus
Network Protection and Monitoring
Network Visibility with Netflow

During attack unusual traffic patterns are created. Knowing the source of the attack down to MAC-address and port number enables quick action.

The Solution
Netflow in the Wiring Closet

Authenticated Device

Remote IT

Authenticated Device

The Solution
Netflow in the Wiring Closet

Network Visibility
Know what applications are running in your network

During attack unusual traffic patterns are created

Known bandwidth distribution
Anomaly pattern of peer-to-peer flows
Drill down to the source and contain the problem

<table>
<thead>
<tr>
<th>Int./Location</th>
<th>Dest. IP</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gi1/0/10 B-3/2</td>
<td>10.1.1.2</td>
<td>AA23AE7B5899Lenovo X41</td>
</tr>
<tr>
<td>Gi1/0/10 B-3/2</td>
<td>10.1.1.19</td>
<td>AA23AE7B5899Lenovo X41</td>
</tr>
</tbody>
</table>
Network Protection and Monitoring
Attacker Visibility with Smart Logging and Telemetry

Smart Probe Monitoring
triggers packet capture

Netflow v9 is used to send the packets to the collector that provide details on the attack

Details of Attacker Source, Destination, and Application Reported

The Solution
Smart Logging and Telemetry

Attacker Visibility
Attacker launches an attack
Smart Probe Monitoring triggers packet capture

Netflow v9 is used to send the packets to the collector that provide details on the attack

Smart Probe Monitoring Triggers for Packet Capture
ACL Logging Violations
DHCP Snooping
Dynamic ARP Inspection
IP Source Guard Logging
Taking Access Control to the Next Level

What’s New with Sup2T?

- ACL “Dry Run”—test if the ACL will fit in the TCAM before applying it
  
  Protect your control plane from unanticipated disruption due to ACL programming

- ACL Atomic “Hitless” update
  
  No traffic disruption when applying complex ACL

- Role-based ACL with SGACL
  
  Identity aware ACL

- 1:1 ACL masking to maximize TCAM usage

- New match criteria—DSCP, IP Prec, TTL, length, Q-Q inner and outer CoS and Vlan

- IPv4/IPv6 parity in ACL features

- Increased Scalability

---

**ACL Labels**

- PFC3: 0 - 4
- PFC4: x4

**Security ACEs**

- PFC3: 0 - 4
- PFC4: x6

**Port ACLs**

- PFC3: 0 - 4
- PFC4: x4
Catalyst Enables End to End Security in Campus

Security Group Tagging and Forwarding

<table>
<thead>
<tr>
<th>IP Address</th>
<th>SGT</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.1.1.1</td>
<td>100</td>
</tr>
<tr>
<td>10.1.1.2</td>
<td>110</td>
</tr>
<tr>
<td>10.1.1.3</td>
<td>120</td>
</tr>
</tbody>
</table>

Network Device Authentication

Cisco TrustSec Domain

SGACL Enforcement

c $ts role-based permissions from 100 to 3200
  permit tcp dst eq 443
  permit tcp dst eq 80
  permit tcp dst eq 22
  permit tcp dst eq 3389
  permit tcp dst eq 135
  permit tcp dst eq 136
  permit tcp dst eq 138
  permit tcp dst eq 139
  deny ip

Identity Services with SXP for SGT Mapping

Identity Service Engine

1x, MAB, Web Auth
What Customers Are Saying ...

Cisco Identity-based Networking Services on the Cisco Catalyst 4500 Series Switches “helps faculty and researchers work more effectively as it lets users easily switch from one network environment to the other”

“NetFlow [on the Catalyst 3750-X] helps understand what applications are running on the network, identify undesired behavior, detect security anomalies, enforce remediation policies, and analyze traffic patterns for capacity planning.”
Smart Operations
Cisco Catalyst Smart Operations
Intelligence—Health Assessment, Best Practice

Cost Savings: $15,000 (or 230 Hours) per 100 Switches*

Smart Install
Zero Touch Deployments and Maintenance

Auto Smart Ports
Plug and Play for End Devices

New Switch is Connected
VSS Unified Control Plane removes STP and FHRP

New Device Attached
Port Configuration: Applied
QoS Policy: Enforced
Security Policy: Enforced

Anomaly Detected
Proactive diagnostics
Alert created in real-time
Web-based reports
Routed to correct TAC team
Remediation initiated

6500 VSS or ISR or 3K (“Director”)
Greater Network Visibility with Flexible NetFlow in the Network

Know Your Network
Identify Applications Running over the Network, Top Talkers, Changes in Network Performance Throughout the Day—All the Way Down to the Interface

Perform Capacity Planning
Multicast Visibility with Egress Netflow
Simplify Network Operations

Flexible NetFlow on Sup2T
- Highly Scalable Full Visibility Solution with Flexible NetFlow in hardware
- Multicast traffic visibility and simpler deployment with egress NetFlow
- Full NetFlow as well as sampled NetFlow in hardware to scale beyond 13 million flows
IOS XE Application
“Wireshark” Running on SUP7-E

Simplified Troubleshooting

- Wireshark provides a built-in packet sniffer and decoder to enable remote troubleshooting
- Wireshark removes the need to travel onsite for packet captures and also need for external equipment to be connected on the path
- Wireshark: Real-time capture and decode on Sup7E (Lightweight Text version “T-Shark”)
- Capture and Display Filters to capture packets and/or decode and display packets
- Captured packets can be stored on SD card or USB
- Ability to display packets in brief, detailed or hexadecimal dump mode

Mini Protocol Analyzer on SUP2T provides similar functionality
**EnergyWise Lowers IT Operational Costs**

Across 5,000 Employees Working 9 Hours a Day, 5 Days a Week...

<table>
<thead>
<tr>
<th>PC: Desktop</th>
<th>Laptop</th>
<th>PC Monitors</th>
<th>APs using POE</th>
<th>IP Phones</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$95</strong></td>
<td><strong>$35</strong></td>
<td><strong>$30</strong></td>
<td><strong>$10</strong></td>
<td><strong>$5</strong></td>
</tr>
<tr>
<td>10–35%</td>
<td>10–15%</td>
<td>10–15%</td>
<td>40–65%</td>
<td>30–50%</td>
</tr>
<tr>
<td><strong>$50,000 – 175,000</strong></td>
<td><strong>$20,000 – 30,000</strong></td>
<td><strong>$15,000 – 25,000</strong></td>
<td><strong>$20,000 – 35,000</strong></td>
<td><strong>$10,000 – 15,000</strong></td>
</tr>
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</table>

Saves up to $65 per Switch Port**

*Estimates 65% desktops, 35% laptops, 1 AP for every 20 employees, everyone has an IP Phone
Results vary based on what, if any, energy management solution is previously in place; Assumes $0.12 per kWh (kilowatt-hour).
** Assumes ROI across 5 years; modeled on a 250 employee campus

Up to 30% Savings in IT!
Cisco EnergyWise Product Portfolio

- Catalyst 2960-S
- Catalyst 2960
- Catalyst 4500 & 4900
- Catalyst 6500
- Catalyst 3750 and 3560-G/E/V2 Series
- Catalyst 3750-X and 3560-X
- Catalyst 2960-C and 3560-C Compact
- Cisco Prime LMS
- Cisco IP Phones
- VDI Phone Backpack and Tower
- Integrated Services Routers (ISR i.e. 1900/2900/3900) G2
Reducing TCO—Smart Operations

WILLIAMS-SONOMA

- 600 Stores Nationwide
- Using ISR 2811 as the Director
- Store access switches include 2960 and 2960-C
- Ship directly to Store
- Using Smart Install for zero touch installation
- Simplify switch replacement process
- Simplify code upgrades

Using Smart Install we were able to stage and deploy the switches in our stores quickly and with zero touch.

Roland Law – Manager, Network Engineering  Williams Sonoma
Virtualization
# Network Virtualization

Catalyst 6500 The Network Virtualization Platform

<table>
<thead>
<tr>
<th>Customer Challenge</th>
<th>Benefits of Sup2T</th>
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<tbody>
<tr>
<td>Compliance &amp; Regulations</td>
<td>Group Segregation for Regulation Compliance</td>
</tr>
<tr>
<td></td>
<td>Cost-effective way to group and manage users by traffic, service, bandwidth and security</td>
</tr>
<tr>
<td>Mergers &amp; Acquisitions</td>
<td>Run Multiple Virtual Networks Over One Physical Network</td>
</tr>
<tr>
<td></td>
<td>Network Virtualization solutions allow integration of disparate networks while sharing common resources</td>
</tr>
<tr>
<td>Partner &amp; Supplier Integration</td>
<td>Quick and Secure Access to New Business Partners</td>
</tr>
<tr>
<td></td>
<td>Virtualized Firewalls allow integrated policy enforcement over Wired and Wireless</td>
</tr>
</tbody>
</table>
Network Virtualization Case Study

Zurich Airport Case Study

Airline A
- VRF A
- 10GE

Airline B
- VRF B
- 10GE

Backup and Restore
- VRF C
- 10GE

Video Surveillance
- VRF D
- 10GE

Air Traffic Control
- VRF E
- 10GE

Retail Shops
- VRF F
- 10GE
Network Virtualization Case Study
Zurich Airport Case Study

Simplified network design via MPLS, VPLS, VRF-Lite, and GRE

Enhanced Security, group segregation and shared services via Virtualized Firewalls

Better Monitoring and Operations with VRF aware services
End to End Campus Network Virtualization

**ACCESS CONTROL**
- Branch – Campus

**PATH ISOLATION**
- WAN – MAN – Campus
- GRE
- MPLS
- VRFs

**SERVICES EDGE**
- Data Center – Internet Edge – Campus

**VRF-Lite or EVN**
- L3 Only
- Builds on existing campus protocols
- Limited scalability
- Medium complexity

**Layer 2 and Layer 3 MPLS VPNs**
- High scalability
- High initial learning curve
- Requires BGP for L3, LDP

**ACLs / PBR**
- Widely deployed
- Seamless services integration
- Limited scalability
- High complexity

**MPLS over GRE**
- Builds on existing campus protocols
- Limited scalability
- Medium complexity
Supervisor 2T VPLS on Any Port
Data Center Interconnect

Native VPLS support
CapEx Savings: No need for SIP Based linecards
True Scalable 10 Gigabit Data Center Interconnect
Application VM mobility
- Redistribute compute workloads
- No Service Disruption
- Capacity management
- Disaster avoidance
- Data center upgrades
Easy Virtual Networks (EVN)
Supervisor 2T and Catalyst 4500

ACCESS CONTROL
- Branch—Campus

PATH ISOLATION
- WAN—MAN—Campus
- GRE
- MPLS
- VRFs

SERVICES EDGE
- Data Center—Internet Edge—Campus

Easy Virtual Networks (EVN)
- Enterprise Scalability
- Simplified configuration and management
- Works with existing campus routing protocols
- Routing Contexts for ease of operations in a VRF
- Better Monitoring and Troubleshooting
- Shared Services between groups
Easy Virtual Networks - EVN
Reduce Complexity for Network Virtualization

VRF-lite (Manual)

- Backwards compatible with VRF-lite
- Interoperable with all WAN solutions: MPLS-VPN
- VN trunk, Route Replication and Routing context

With VRF-Lite
Must configure 40 subinterfaces

With EVN
Configure 4 interfaces

<table>
<thead>
<tr>
<th>Virtual Networks</th>
<th>6500 Neighbors</th>
<th>VRF Subinterfaces</th>
<th>EVN Trunks</th>
</tr>
</thead>
<tbody>
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<td>20</td>
<td>4</td>
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</tr>
<tr>
<td>30</td>
<td>4</td>
<td>120</td>
<td>4</td>
</tr>
</tbody>
</table>

EVN Simplifies Configuration By a Factor of 10x+
What Customers Are Saying ...

**Marilyn Hay** Manager of Network Planning, University of British Columbia

"...tremendous synergies between the network virtualization... Faculty and departments maintain the control... securing information better than before, while expanding their ability to use campus resources. The University can manage campus-wide resources more efficiently and cost-effectively."

**Frank Hoonhout** Senior Network Engineer State of Oregon

“With network virtualization technology, we have eliminated the siloed and overlapping agency networks. We have one statewide network that is divided into logical, secure sub-networks for each agency, even the smaller authorities.”

**Clarence Leonard** Manager of Network & Voice, GTAA

“Moving tenants around the campus is so much simpler with our unified network,” says Leonard. “Instead of taking days or even weeks to move someone, we can respond in less than a day. That translates to cost savings and more productive operations for our tenants.”

**Video: Oregon State Government Increases Efficiency**
Video
Video
Your Network Is Your Business

IT Challenges

- Assessing network readiness
- Monitoring and troubleshooting
- Ensuring quality of user experience

Unique Cisco Benefits

- Calibrate and assess the network with Built-In Traffic Simulator
- Simplify hop-by-hop troubleshooting with Mediatrace
- Reduced Latency with Hardware SSM and IGMPv3
- Improve network visibility with Flexible Netflow
- Differentiate traffic flows with Medianet Services Proxy

Enabled via Cisco Prime with Workflows to Deploy, Monitor, and Troubleshoot Video
Video Deployments Today
Manual Network Readiness Assessment

The Challenge

Network Readiness

Typical Deployment Scenario — Traditional Switch

Need to purchase extra traffic generation appliances

IT employee must travel to set up appliances

Time consuming to implement and control
Video Deployments with Medianet
Built-in Traffic Simulator to Automate Network Readiness

The Solution
Automate Network Readiness

Deployment Scenario—Cisco Catalyst Switches
Traffic simulator built into switch; no extra appliance needed
IT can monitor and test remotely
Includes a scheduler to run periodic test over extended durations

Scheduler (Traffic Simulator based on IPSLA)
Monitoring and Troubleshooting Today
Manual, Time Consuming, Expensive and Business Critical

The Challenge
Monitoring and Troubleshooting

Typical Deployment Scenario
Manual troubleshooting at location and device; and manual simulation
Hop by hop logging into each network node is needed
Huge time consumption to troubleshoot and simulate problems
Monitoring and Troubleshooting with Medianet
Automation Results in Time and Resource Savings

The Solution
Automate Monitoring and Troubleshooting

Deployment Scenario—Cisco Catalyst Switches
- Mediatrace automatically traces the mediapath
- Hop by hop statistics collected to find the problem node; enabled remotely
- Allows easy recreation of problems with built-in traffic simulator, yielding time and resource savings
Quality of Experience Issues Today
Increase Bandwidth to Ensure Quality

The Challenge
Quality of experience

Typical Deployment Scenario—Traditional Switch
Multiple kinds of Video and Non-Video Applications using the same protocol wrapper
IT employee must increase bandwidth to avoid congestion
Time consuming and does not guarantee differential treatment
Deterministic Quality of Experience with Medianet
Differential Traffic Treatment Ensures Quality of Experience While Optimizing Bandwidth

The Solution
Optimize quality of experience

Deployment Scenario—Cisco Catalyst Switches
Various Detection techniques in the switch to identify devices and applications
Switch passes device/application info and requests services from the network
Differential treatment guaranteed throughout the network Optimized bandwidth requirements
End-to-end Catalyst video deployment

Access

Services in Access
- Hardware IGMPv3
- GOLD for Medianet
- AutoQoS
- Medianet 2.2
  ✓ Video Monitoring
  ✓ Mediatrace
  ✓ Metadata*

Distribution/Edge

Services in Distribution/Edge
- Hardware Multicast Replication
- 10G/40G ready
- 256K multicast groups
- Large buffers
- Hardware IGMPv3
- GOLD for Medianet
- Medianet 2.2
  ✓ Video Monitoring
  ✓ Mediatrace
  ✓ Metadata*

Core

Services in WAN/Core
- 2 Terabit Fabric Bandwidth
- 10G/40G ready
- Hardware Multicast Replication
- Hardware SSM
- RSVP CAC
- 256K multicast groups
- Medianet 2.2
  ✓ Video Monitoring
  ✓ Mediatrace
  ✓ Metadata*

MediaTrace

Resource Control/CAC

Metadata*

*Available in MA2
Brunel University

4000 IT Man-Hour Savings/Year with a Borderless Network Architecture

Background
- 3500 staff; 14,500 students
- World class university in West London

Key Challenges
- Manage influx of student devices. Simplify device registration, maintain identity, eliminate rogue devices
- Green initiatives

Why Cisco
Standardize on a single architecture to meet all their wired, wireless and security needs while simplifying deployment of solutions and supporting initiatives such as Green and Mobility

Cisco Borderless Network Services Deployed
- Voice/Video
- Green
- Security
- Mobility

OpEx Savings
Reduction in IT man hours by ~4000/year

Green
Pilot program yielding £20-30,000 annual energy savings

Rapid ROI
Payback (EnergyWise) on investment in less than 12 months

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Agenda

- Enterprise Trends and Cisco Catalyst strategy
- Catalyst product family and positioning for Enterprise Network
- Cisco Innovations to address customer challenges
  - High Availability, Security, Video, Network Virtualization, Smart Operations
- Key Takeaways
Summary and Key Takeways

INNOVATION
Catalyst Innovations address key Enterprise trend enabling you to build the Next Gen Campus with Investment protection

TRANSITION
Catalyst optimizes performance while maximizing services for Campus. Catalyst also provides transition path to 10G/40G and 100GE readiness

UNIFIED SERVICES
Catalyst portfolio delivers IOS & integrated services for Borderless and Data Center deployments

LOWER TCO
Catalyst portfolio provides price/performance improvement with lowering TCO with Borderless Network Enhancements
Additional Resources
Catalyst Switches VODs

- **Intelligent Switches Come Out of the Closet**
  - Learn how the innovative new Cisco Catalyst compact switches enable you to extend network services far from the wiring closet over a single cable.

- **Advancing the Catalyst 6500 with the Supervisor 2T**
  - Find out how the new Cisco Catalyst 6500 Supervisor 2T and new line cards and services modules deliver capabilities and performance critical to the Enterprise Next Generation Network.

- **Technical Deep Dive: The Big Cat – 6500**
  - A deep dive into the newest innovations of the Catalyst 6500, the industry’s most successful networking platform since 1999.

- **Cisco Catalyst Switches: Innovations in Networking**
  - Enhance your network with the most successful networking platform since 1999. Discover the latest innovations of Cisco Catalyst switches that will deliver improved seamless services and lower IT costs.

- **Enhance Your Power Options with Cisco UPOE**
  - This episode covers everything from the physical challenge of putting 60 watts of power on small cable, to the equipment, the management, and the real-world benefits UPOE can bring to your operation.

- **Technical Deep Dive: Cisco Universal Power Over Ethernet Cisco Catalyst 4500E Switches**
  - Dive into what UPOE is and is not. Go though the CDP and LLDP TLV's to see how power is delivered and look at various design innovations the 60W enables on the network. Ready to get rid of all those cables on your users desktops?
Additional Resources

The New Catalyst 6500

Switching Page
http://www.cisco.com/go/switching

Borderless Networks
http://www.cisco.com/go/borderless
Thank you.
What Customers Are Saying...

“Cisco’s new Catalyst 4500E with Sup7-E delivers on our need for maximum uptime for IP telephony infrastructure with unmatched In-Service Software Upgrade capabilities....”

“We have developer groups in China, India and the UK.... so if access goes down, our core development work comes to a standstill. Our comprehensive Cisco environment (Cat 3K-X) helps drive our success by keeping our teams collaborating w/o interruption”

“Instead of having to prepare for two weeks for a planned outage... [with ISSU] we no longer have any downtime at all.”
What Customers Are Saying …

Cisco Identity-based Networking Services on the Cisco Catalyst 4500 Series Switches “helps faculty and researchers work more effectively as it lets users easily switch from one network environment to the other.”

“NetFlow [on the Catalyst 3750-X] helps understand what applications are running on the network, identify undesired behavior, detect security anomalies, enforce remediation policies, and analyze traffic patterns for capacity planning.”