Cisco Catalyst 3850 and 3650 switches

René Andersen & Mikkel Brodersen
Cisco SE DK
Introduction to Catalyst 3850 & 3650
3K Product Portfolio

Stand-Alone 3K Switches

**Catalyst 3560 v2**
- Data/PoE
- Fixed 1G Uplinks
- Single PS

**Catalyst 3560-X**
- Data/PoE(+)/UPoE
- Mod 1G/10G Uplinks
- Dual PS

Fast Ethernet | Gigabit Ethernet

Optionally Stackable

**Catalyst 3650**
- Data/PoE(+)/UPoE
- Fixed 1G/10G Uplinks
- Dual PS

Gigabit Ethernet

Stackable 3K Switches

**Catalyst 3750 v2**
- Data/PoE
- StackWise
- Fixed 1G Uplinks
- Single PS

**Catalyst 3750-X**
- Data/PoE(+)/UPoE
- StackWise+
- StackPower
- Mod Uplinks 1G/10G
- Dual PS

**Catalyst 3850**
- Data/PoE(+)/UPoE
- Stackwise-480
- StackPower
- Mod Uplinks 1G/10G
- Dual PS

Fast Ethernet | Gigabit Ethernet | Gigabit Ethernet

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LAN Base | IP Base | IP Services
Introduction to Catalyst 3850 & 3650

- EEE
- Stackable
- FRUable Fans & PS
- Integrated Wireless Controller
- 40 Gbps Uplink BW
- Full PoE+
- Granular QoS, Flexible Netflow
- Line Rate on All-Ports
- Built on Cisco’s Innovative “UADP” ASIC
Uplink Options

4 x 1Gig
- 4 x 1G
- SFP
- Supported on 24 and 48 Port version

2 x 1Gig, 2 x 10 Gig
- 4 x 1G OR 2 x 10G OR 2 x 1G + 2 x 10G
- SFP & SFP+
- Supported on 24 and 48 Port version

4x 10 Gig
- Auto-sensing – All Combinations
- SFP & SFP+
- Supported on 48 Port version only
Power Supplies

Catalyst 3850

- Same as 3750-X – Interchangeable
- New PIDs

350WAC  440WDC  715WAC  1100WAC

Catalyst 3650

- Wider than 3850/3750-X PSs
- Different Watts capacity

250WAC  640WAC  640WDC  1025WAC
Stack - Cable & Components

Catalyst 3850

- 3 lengths of cable, 0.5 1 and 3 Meters
- 3 rings vs 1 ring in 3650

Catalyst 3650
• Modern IOS to enable multi-core CPU
• Easy customer migration
• While maintaining IOS functionality and look and feel
• Allow hosted applications like Wireshark
## Fixed-Access Switches Feature Matrix

<table>
<thead>
<tr>
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<tr>
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<td>No</td>
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*On 3850 roadmap
Catalyst 3850/3650 Wireless – Converged Access
One Network with Converged Access

Converged Access Mode
- Integrated wireless controller
- Distributed wired/wireless data plane (CAPWAP termination on switch)

One Network
Catalyst 3x50
Cisco Access Point
Cisco Wireless LAN Controller
Cisco Firewall
Corporate Network
Internet

Cisco Firewall
Access Control Server
ISE
NAC Profiler
Cisco Public
One Policy
One Management
Prime
Catalyst Switch
One Network

Cisco Wireless LAN Controller
Internal Resources

Corporate Network

One Policy
ISE
NAC Profiler
Cisco Public

One Management
Prime

Converged Access
Mode

Integrated wireless controller
Distributed wired/wireless data plane (CAPWAP termination on switch)
Converged Wired/Wireless Access – Benefits

**Single platform** for wired and wireless
Common IOS, same administration point, one release

**Network wide visibility** for faster troubleshooting
Wired and wireless traffic visible at every hop

**Consistent security and quality of service control**
Hierarchical bandwidth management and distributed policy enforcement

**Maximum resiliency** with fast stateful recovery
Layered network high availability design with stateful switchover

**Scale** with distributed wired and wireless data plane
160G stack bandwidth; 40G wireless/switch; efficient multicast

Unified Access - One Policy | One Management | One Network
Understanding Current Deployment Model

The Wireless LAN Controller

Known Deployment Model

- Wireless is an Overlay Network
- Software components within the WLC today:
  - **Mobility Agent (MA) is responsible for:**
    - AP CAPWAP termination
    - Maintaining client database
    - Policy enforcement
  - **Mobility Controller (MC) is responsible for:**
    - Client Mobility
    - Radio Resource Management (RRM)
    - WiPS, Spectrum Management

Inter--Controller EoIP/CAPWAP tunnel
AP-Controller CAPWAP tunnel
Better Scale and Bandwidth with Converged Access
Separation of MA and MC

- Traditional Controllers continue to play MA and MC
- Catalyst 3850/3650 can play the role of both MA and MC
  - Valid for Branch and small-medium campus type deployments
- Moving the MA only to the Catalyst 3850/3650 (typically in large campus) helps with:
  - Improved Scalability – larger mobility domains
  - Increased wireless bandwidth
  - Uniform wired/wireless policy enforcement

ISE  
Prime  
5508 or WISM2 with SW Upgrade or new 5760

New Catalyst 3850

MA

MC

Catalyst 3750

Access Points

AP Capwap Tunnels

Mobility Tunnels
Branch Deployment with Converged Access

**Scale:**
- 3850/3650: Up to 16k clients and 250 APs

**Migration:**
- Access Layer Switch – Refresh using Catalyst 3850
- Guest access tunneled to DMZ
- Alternate guest segmentation with separate SSID

**Benefits of Converged wired/wireless:**
- Integrated Controller – Catalyst 3850
- WAN dependency removed
- All WLAN features available locally
- WAN optimization, NetFlow, optimized multicast, Videostream, granular QoS
- Increased resiliency via next-generation stacking
Delivering Converged Access – Green Field

Catalyst 3x50:
- Integrated wireless controller
- Distributed wired/wireless data plane (CAPWAP termination on switch)

WLC 5760:
- First IOS Based Wireless LAN Controller

Benefits of Converged Access:
- Single Platform for wired and wireless
- Network wide visibility for faster troubleshooting
- Consistent security and QoS control
- Maximum resiliency with stateful recovery
- Scale with distributed wired and wireless data plane

ISE Prime
Access Points

New WLC 5760 or
WLC 5508 or WISM2
New Catalyst 3850
Delivering Converged Access – Brown Field

Scale:
- Deployments greater than 16k wireless clients and 250 APs
- Up to 72k APs, 864k clients within a Mobility Domain.

Migration:
- Software Update on existing 5508 or Wism2 to release 7.3
- Access Switch Refresh – Catalyst 3850/3650
- Wireless Controller Replacement

Benefits:
- Investment Protection with existing WLC code update
- Works seamlessly with Cisco’s Campus Deployment Best Practices
- Phased Adoption: Interoperable with existing deployment
Better Network Utilization with Unicast Optimization Achieved via Converged Access

Unicast with Traditional Deployments
- All wired-wireless (and vice-versa) conversion happens at the controller.
- Leads to hair-pinning
- Entire network traversed even for peer-to-peer traffic (wired-wireless or wireless-wireless) on the same switch

Unicast Optimization with Converged Access
- Wired-wireless conversion (and vice versa) happens at the 3x50 switch
- Reduces the number of streams in the network and avoids hair-pinning - Optimized
Scalable Multicast Deployments Achieved via Converged Access

Multicast with Traditional Deployments (Multicast-Multicast mode)
- Wired Multicast Replication happens at the switch
- Wireless Multicast Replication happens at the Controller

Multicast Optimization with Converged Access
- Wired and Wireless Multicast Replication happens at the 3x50 switch
- Reduces the number of streams for the same traffic type in the network
Platform Architecture
Catalyst 3850: Under the Covers…

- Cavium CPU
- Downlink Phys (x12)
- PoE+ Controllers (x2)
- UADP ASICs
- FRU Uplink Module
- Ethernet And Console Port
- Fan FRU (x3)
- Back Stack Conn (x2)
- Power Stack Conn (x2)
- Ampere / Stack Power Controller
- Redundant Power Supplies
UADP ASIC Enables Convergence

Built on UADP

• Unified Access Data Plane
• Unique and powerful Cisco innovation
  • Hardware performance with software flexibility
• Optimized Performance
  • CAPWAP encapsulation/de-capsulation, Flexible Netflow, QoS happens in ASIC for line rate performance
• Future Proofed and Programmable
  • Flexparser enables new software features (like SDN) over the product lifetime
• UADP is used across multiple platforms – Catalyst 3650, 3850, Sup 8E, WLC5760
WS-C3850-48 Layout

480G STACK INTERFACE

Packet Buffer
Forwarding Controller
Ingress FIFO
Egress FIFO
Network Interface
Octal PHY MACSec
Octal PHY MACSec
Octal PHY MACSec
24 Port PoE+
24 x 1G 10/100/1000

Packet Buffer
Forwarding Controller
Ingress FIFO
Egress FIFO
Network Interface
Octal PHY MACSec
Octal PHY MACSec
Octal PHY MACSec
24 Port PoE+
24 x 1G 10/100/1000

800 MHz Quad-Core CPU
UADP ASIC

Flash 2GB
SDRAM 4GB
USB

2 x 10G, 2 x 1G / 4 x 10G / 4 x 1G

Ingress FIFO
Egress FIFO
Packet Buffer
Forwarding Controller
Network Interface
Octal PHY MACSec* Dual PHY MACSec
Octal PHY MACSec* Dual PHY MACSec
Octal PHY MACSec* Dual PHY MACSec

Lightweight Services (WS) - C3850 - 48 Layout

BRKARC-3438
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Stacking Architecture
The Stack Ring

- 6 rings in total
- 3 rings go East
- 3 rings go West
- Each ring is 40Gbps
- 240Gbps uni-direction
- Spatial Reuse= 480Gbps

Assuming 4 x 24-port 3850 Switches
Resiliency – StackWise-160

- Modular Stacking (Optional)
  - New stack adapters
  - New connectors and copper cables
- Stack Bandwidth
  - 80 Gbps bi-directional
  - 160 Gbps with spatial reuse
- Stateful Switch Over (SSO)
  - Faster Convergence (vs 3750-X)
  - Active-Standby model
  - Improved Central synchronization on Active Switch for Wired+Wireless
- Tunnel SSO ensures AP, MA-MC connectivity during failover

Assuming 4 x 24-port 3650 Switches
Unicast Packet Path on the Stack Ring

Assuming 4 x 24-port 3850 Switches

- Packet segmented into 256 bytes
- Packet travels half the ring for unicast traffic
- Segments reordered at destination stack port
- Destination strips the packet off the stack ring
Stack Ring Spatial Reuse

Assuming
4 x 24-port
3850 Switches

- Credit based system on the Stack Ring
- Multiple stack ports grab the ring that is free and they have credits on to transmit
- Increases the stack ring bandwidth to 480Gbps
High Availability
Catalyst 3850 Stack vs Catalyst 6500

- Active and Standby Members run IOSd, WCM, etc.
- Synchronize information
- Active controls Data plane programing for all members
- Member switches act as Line cards—connected via the Stack Cable

- Active and Standby Supervisors
- Run IOS on Supervisors
- Synchronize information
- Active programs all DFCs
- DFCs run a subset of IOS for LCs
9 Member Stack

- Both 3850 & 3650
- StackPower stays at 4
- No XPS2200 Support yet
- 9 Member Limit implemented in Software
Wireshark

Catalyst 3850 Switch

- Freeware
- Bundled with Operating System
- Software Process
- Quick & Easy Remote Analysis
- Does NOT replace SPAN
POD1# sh monitor capture MY_CAP

Status Information for Capture MY_CAP

Target Type: 
  Interface: Vlan,
  Ingress:

Status: Inactive

Filter Details:
  IPv4
  Source IP: any
  Destination IP: any
  Protocol: any

Buffer Details:
  Buffer Type: LINEAR (default)

File Details:
  Associated file name: flash:test.pcap

Limit Details:
  Number of Packets to capture: 0 (no limit)
  Packet Capture duration: 10
  Packet Size to capture: 0 (no limit)
  Packets per second: 0 (no limit)
  Packet sampling rate: 0 (no sampling)

POD1#

POD1# sh monitor capture file flash:test.pcap

1  0.000000 00:00:00:00:00:00 -> 54:78:1a:be:c1:10 IEEE
802.11 Probe Request, SN=0, FN=0, Flags=........

2  3.000000 00:00:00:00:00:00 -> 54:78:1a:be:c1:10 IEEE
802.11 Probe Request, SN=0, FN=0, Flags=........

3  6.000000 00:00:00:00:00:00 -> 54:78:1a:be:c1:10 IEEE
802.11 Probe Request, SN=0, FN=0, Flags=........

4  6.495961 11.1.1.101 -> 11.1.1.1  DTLSv1.0
  Application Data

5  6.496968 11.1.1.101 -> 11.1.1.1  CAPWAP CAPWAP-
  Control - WTP Event Request

6  6.499974 00:00:00:00:00:00 -> 54:78:1a:be:c1:10 IEEE
802.11 Probe Request, SN=0, FN=0, Flags=........

7  6.502964 11.1.1.101 -> 11.1.1.1  DTLSv1.0
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8  6.502964 11.1.1.101 -> 11.1.1.1  CAPWAP CAPWAP-
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POD1#
Deployment Tips & Considerations
Cisco Catalyst 3x50 provides… A Single Platform

Wired/Wireless Convergence

Consistent Feature Application

Scalability with Resiliency
Single Platform for Wired and Wireless

20+ Years of IOS Richness – Now on Wireless

**Features:**
- 802.11n
- CleanAir
- VideoStream
- Radio Resource Management (RRM)
- Wireless Intrusion Prevention System (WiPS)
- 802.11ac Ready
- AP SSO

**Benefits**
- Built on **UADP ASIC** – Cisco’s Innovative Flexparser ASIC technology
- Eliminates operational complexity
- Single Operating System for wired and wireless

**Features:**
- Stacking
- Flexible Netflow
- Granular QoS
- Trustsec*/Identity
- AVC/Medianet*
- Smart Operations*
- EnergyWise*
- HSRP
- Wireshark
- Service Discovery Gateway

Note: All features may not be available on new platforms at introduction but are expected to be added within 12-18 months.
Flexible NetFlow for Converged Access

Complete Visibility into Wired + Wireless Traffic at the Access

- FNF for the first time on Wireless
- Consistent Configuration for Wired+Wireless
  - Single flow monitor can be applied to wired ports and SSID
- Natively available in the UADP ASIC
  - No additional hardware required
- Can monitor East-West (peer-to-peer) and North-South flows
  - 48k flows on the 48 port model.
- 0$ Collector SKUs available at FCS
  - Actively working with PAM and 3rd party collector vendors for supporting key and non-key fields

Understand Bandwidth consumption by various devices and applications

Detect Anomaly in Traffic flows
Granular QoS for Converged Access

**MQC based CLI**
- Alignment with 4500E series
- Class-based Queuing, Policing, Shaping, Marking

**New QOS features**
- Hierarchical Bandwidth Management (HBM) – Per AP-Radio-SSID-Client upstream and downstream
- Approximate Fair Drop (AFD) – Fair sharing of bandwidth
- Per-user-per-application-level policing and marking in SW roadmap

**QOS by the numbers**
- Queues/port for Wired traffic : 8 (Up to 2P6Q3T queuing capabilities)
- Queues/port for Wireless traffic : 4
- Buffers - 12 MB/48 port model
- 2000 Aggregate & 48k Microflow Policers
Hierarchical Bandwidth Management and Fair Sharing

**Converged Access**
- Deterministic SSID bandwidth
  - 10% min BW
    - Guest
  - 90% min BW
    - Enterprise

**Usage based fair bandwidth allocation**
- Fair BW allocation
  - Heavy Hitter (BW hog)

**Fair Sharing**
- Deterministic SSID bandwidth
  - 10% min BW
    - Guest
  - 90% min BW
    - Enterprise

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The New vs. Old Branch Office

Converged Network Branch Office Advantages

Advanced and Simple Mobility Solution
- Single platform for wired and wireless
- Better network auditing for applications
- Single point of configuration for both Wired and Wireless
- Consistent policies for service control including AVC
- Improved network control (Fair Sharing)
- Higher network bandwidth at the edge (802.11ac and 40G)
- Scalable as needed

Optimal TCO
- Business Continuity with or without WAN
- Less devices to manage and service
- Smart & optimal use of WAN bandwidth
- Faster Troubleshooting
## Fixed-Access Switches Feature Matrix

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<th>Cisco Enhanced Limited Lifetime Warranty (E-LLW)</th>
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<td><strong>Software Policy</strong></td>
<td>Unlimited free IOS updates in the same license (only on LAN Base and IP Base images) IP Services requires a SmartNet service contract</td>
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<tr>
<td><strong>SmartNet</strong></td>
<td>Available. SmartNet required for IP Services</td>
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<tr>
<td></td>
<td>Catalyst 2960-X/XR</td>
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<td>--------------------</td>
</tr>
<tr>
<td>LAN Lite</td>
<td>Yes / No</td>
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<td>LAN Base</td>
<td>Yes / No</td>
</tr>
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<td>IP Base</td>
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<td>IP Services/Ent Services</td>
<td>No</td>
</tr>
<tr>
<td>RTU Based Licensing</td>
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Be aware:

Switch Depth Comparison

Catalyst 2960S  
Catalyst 2960X  
Catalyst 3560X  
Catalyst 36/3850  
Catalyst 4500E
**Catalyst 4500E, Supervisor 8-E**

**Reach New Heights**

**Scalability**
- 8 x 10G Uplinks
- 384 10/100/1000 ports
- 3, 6, 7 and 10 slot chassis
- 96 SFP+ LC ports
- 256K Routes

**Platform Innovations**
- 48G/slot
- Flexible NetFlow
- NBAR2 Lite*
- UPOE (60w)
- Hosted Applications (Wireshark)
- VRF-Lite, EVN
- In Service Software Upgrade
- VSS*
- Smart Install Director*
- Cisco TrustSec (SGA*, MACSec)

**UNIFIED ACCESS INNOVATION**
- Integrated Wireless Controller
- Upto 20G Wireless capacity (50 APs, 2K clients)
- Converged Security Policy for Wired And Wireless
- Converged Flexible NetFlow
- Granular, Hierarchical BW management (SSID, AP, Radio, Client)
- Quad-Core and faster 2 GHz CPU for 3rd party application
Catalyst 4500E Campus Portfolio

Four Chassis Options
7 and 10 Slot with Sup Redundancy

Supervisors
Wireless Convergence vs Traditional
928G Wired, 20G Wireless

Port Scale:
Access and Collapse Agg
384 10/100/1000 POE/UPOE,
96 SFP+, 192 SFP

Power Supply
Maximize UPOE/POE+/POE delivery
Fully Loaded 10-Slot with POE
Cisco UPOE on Catalyst 3850

Same Price as Full PoE+

A Historical Perspective

- 2000: 7W Inline Power
  - Industry Standard: IEEE 802.3af (15W PoE)

- 2003: 15W (PoE)
  - Cisco

- 2007: 30W (PoE+)
  - Cisco

- 2009: 60W UPOE
  - Cisco

- 2011: 60W UPOE
  - Cisco

Rapidly Growing UPOE Ecosystem

- Virtual Desktop
- Trading Floor (IP telephony)
- Campus, Retail, Hospitality
- Building Management
- Healthcare (Nurse Call Systems)
- DEP Lighting
- Clinical Video Monitoring
- Telepresence
- Compact Switches

Catalyst 3850 UPOE

- NEW $0 premium over 3850-48F-L/S/E model (48 Port Full POE Switch)

Benefits of Cisco UPOE

- Wider Choice of End Points
- Efficient Power Delivery
- High Availability
- Universal RJ45
- Lower CapEx/OpEx

Same Price as Full PoE+

Industry Standard:
- IEEE 802.3af (15W PoE)
- IEEE 802.3at (30W PoE+)
One Policy
ISE 1.2/1.3

One Management
Prime 2.1, WEBGUI, MSE8.0

One Network
New APs- AP2700, AP700I, AP700W, AP1530
Optics: Active/Passive SFPs CX1,

Policy

Manageability

Infrastructure

BYOD & Mobility
Service Discovery Gateway Ph 2, Device Profiling for Wired/Wireless

Application Experience
AVC Wireless on AP Ph II (QoS tie-in with Policy), Medianet on 3850/3650 (Wired)

IT Simplicity
Plug & Play (PnP), Interface Template, Auto-conf

Complete Govt. Certification, One Combined Release, Extended Maintenance

IOS-XE3.6.0E/15.2(2)E (Amur) Software Release
C4K(SUP8,7,6,4500-X,49xx), C3K(3850,3650,X,C), C2K(2960S,FE,X,XR,C), WLC5760

Target CCO July, 2014
The NEW Catalyst 3850 Fiber Switches

Key Benefits

• 12 and 24 port 1G Fiber SKUs
• 2x10G or 4x1G Uplinks
• Built on UADP ASIC
• Integrated Mobility Controller
• StackPower
• Stackable with 3850 Access switches

Licensing Options: IP Base and IP Services

Converged Access Portfolio strengthened with the New 3850 Fiber switches
Zero Touch Deployments and Maintenance 
NG Plug n Play & Smart Install
- Software image & Configuration downloaded
- Consistent for Devices & PIN
- On-going Image Update and Configuration Back-up

Plug and Play for End Devices
Auto Smart Ports, Auto Conf & Interface Templates
- Port Configuration: Applied
- QoS Policy: Enforced
- Security Policy: Enforced

Monitor & Troubleshoot
Smart Call Home
IPSLA, WireShark
- Packet Capture for Wired and Wireless
- Proactive diagnostics
- Real time Alerts
- Web-based reports
- Routed to TAC team

Control Your Network
EEM, XML Programmability
- Ability to take custom actions based on syslogs/triggers
- Enhanced Flexibility and control

Reduced Energy Consumption
Energywise and EEE
- EEE ready
- Energywise – Time of the day policy based on/off of access devices
- 0 $ SKUs for energy management

Please refer to the Software Roadmap for the list of features supported at FCS and upcoming releases
Reference Links for 3850 Deployment

Catalyst 3850 Q&A

Catalyst 3850 Deployment Guide –

Catalyst 3850 Services Guide –