Cisco Catalyst 3750-X and 3560-X Series

Technical Overview
The Transformation: The World Is Our New Workspace

BORDERLESS NETWORKS
A Next Generation Architecture to Deliver the New Workspace Experience
Driving the Transformation

1.3 Billion New Networked Mobile Devices in Next 3 Years

60% of All Cisco Network Traffic Today Is Video

Sources: IDC; Visual Networking Index; Cisco IT

Blurring the Borders: Consumer ↔ Workforce; Employee ↔ Partner
Borderless Networks

Network Access Challenges

- Operational Complexity and Costs
- Struggling to Keep up With Security
- Network Downtime Is Expensive
- Traffic Volume and Bandwidth Expanding
Your Business Is Borderless

- StackPower StackWise ® Plus
- HA Auto Smartports
- EEM Auto QoS
- L3 Modular uplinks

MACsec
- Location and Resource
- TrustSec
- Location: Wired and Wireless
- Advanced Multicast
- Medianet

Pervasive Services
- Identity Based Policy
- Identity
- Cisco EnergyWise

- PoE+ StackPower
- Temperature
- Phone
- PC
- WLAN
- Lights
- Battery

Ease of Operations
Borderless Security
Borderless Experience
Sustainability

When the Network Knows, You Create a Platform for Your Business
Addressing Business Transformation
NEW Intelligent Secure Access Fixed Switching Solutions

- Entry-Level to Cisco Experience
  - Catalyst 2960-S w/ LAN Lite

- Converged Services
  - Catalyst 2960-S w/ LAN Base

- Intelligent Services
  - Catalyst 3K-X w/ LAN Base

- Evolves With Your Business
  - Catalyst 3K-X w/ IP Base

- Enterprise Services
  - Catalyst 3K-X w/ IP Services

- Borderless Security
- Ease of Operations
- Borderless Experience
- Sustainability

Business Agility
Addressing Business Transformation
NEW Intelligent Secure Access Fixed Switching Solutions

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- Enterprise Services
  - Catalyst 3K-X w/ IP Services

- Threat Intelligence
- Role-based Access, Secure Traffic
- Automated Smart Operations
- Non Stop, Self Preserving
- Reliable Voice, Video
- Scalable Medianet
- Cisco EnergyWise
- Business Agility
Catalyst 3750-X and 3560-X Series

- Catalyst 3750-X Series
  - Next Generation Gigabit Ethernet 24 and 48 port, Data and PoE+ Switches
  - Three IOS feature sets:
    - LAN Base
    - IP Base
    - IP Services
  - Innovative features, StackPower, PoE+, Encryption, Dual redundant PS, Network modules

- Catalyst 3560-X Series
  - Enhanced LLW:
    - Next business day (NBD) advance hardware replacement
    - 90 Day access to Cisco Technical Assistance Center (TAC) support
  - Full Energy-Wise support
Catalyst 3750-X and 3560-X

What’s New

- StackPower – Power aggregation
- Network Modules – Field replaceable uplink
- Full 802.3at PoE+ Support
- Three IOS feature sets
- Dual redundant power supplies and fans
- MACsec – Hardware encryption
## Catalyst 3750-X & 3560-X
### Model comparison

<table>
<thead>
<tr>
<th>IOS</th>
<th>Model</th>
<th>Stackable</th>
<th>StackPower</th>
<th>Full PoE</th>
<th>PoE+</th>
<th>Description</th>
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<tbody>
<tr>
<td></td>
<td>WS-C3750X-24T-L</td>
<td>Yes</td>
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<td>-</td>
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<td>24-port 10/100/1000, 350W AC, LAN Base</td>
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<td>LAN Base</td>
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*IP Base Models can be upgraded to IP services feature set at the time of order*
Management ports with configurable behavior

- RJ45 serial & USB type-B consoles
- Standard 10/100 Ethernet port

Supports SFP+ instead of X2

USB port

- Type A for Storage, All Cisco supported USB flash drives
- Type mini-B as console port in the front

DRAM 256/128 Mbyte, Flash 64Mb

Full support for network based power management – EnergyWise
# Catalyst 3750 Models comparison

<table>
<thead>
<tr>
<th>Feature</th>
<th>3750-X</th>
<th>3750-E</th>
<th>3750G</th>
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<tbody>
<tr>
<td>StackPower</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>FRU Network Module</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>FRU Power Supplies</td>
<td>Yes, Dual PS</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Encryption</td>
<td>Yes (Downlink)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>PoE+ 30W/port</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>IOS LAN Base Option</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Management Options</td>
<td>Console RJ45, <strong>USB console</strong>, and Out of band Ethernet</td>
<td>Console RJ45 and Out of Band Ethernet</td>
<td>Console RJ45</td>
</tr>
<tr>
<td>RPS / XPS</td>
<td>XPS</td>
<td>RPS</td>
<td>RPS</td>
</tr>
</tbody>
</table>
Dual Redundant Power supplies & fans

- Four PS options
  - 1100W AC
  - 715W AC
  - 350W AC
  - 440W DC

- Dual, redundant, high efficiency PS

- Redundant fan modules

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<tr>
<th>Models</th>
<th>Default Power Supply</th>
<th>Available PoE Power</th>
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<tbody>
<tr>
<td>24 Port Data Switch</td>
<td>C3KX-PWR-350WAC</td>
<td>–</td>
</tr>
<tr>
<td>48 Port Data Switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 Port PoE Switch</td>
<td>C3KX-PWR-715WAC</td>
<td>370W</td>
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<tr>
<td>48 Port PoE Switch</td>
<td></td>
<td></td>
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<tr>
<td>48 Port Full PoE Switch</td>
<td>C3KX-PWR-1100WAC</td>
<td>740W</td>
</tr>
</tbody>
</table>
PoE+ Support

Main features

- Support for new standard 802.3at
  30W per port Vs. 15.4W per port
- Ability to provide 30W per port on all 48-ports simultaneously
- Ability to assign priorities (high/low) to each port
  Useful for intelligent power shedding!
- Use a 1-event mechanism for classification
  For Type1 (Legacy) or Type2 PD
StackPower

Main features

- Innovative technology, aggregates and shares available input power capacity in a Stack
- Flexible arrangement of power supplies in a stack
  
  Up to 8.8Kw power in a stack
- Supports a “zero-footprint” RPS deployment
- Intelligent power shedding
- Stackpower decouples a PS from its physical location in the stack!
- Up to 4 switches can be part of Stackpower
  
  Independent from Stackwise (Stackwise Plus)
- No need for RPS though an XPS is available!
StackPower Close up

- Console, 10/100 port, and USB type A
- Stackwise Plus 4 Switches
- FRU Dual Redundant Fans
- StackPower Cables
- Redundant, Dual PS, either AC/AC, AC/DC, AC, or DC combinations
StackPower
Capabilities Overview

Power requirements:
246w * 4 + 740 + 1440 = 3,172w
Available Power = 2,130w
Deficit = 1,042w

Options:
Add one 1,100w PS slot B of any switch to cover the deficit. No extra capacity
Add two 1,100w PS to any two switches in slot B to over 1,042w deficit plus 1,100w for redundancy.

Note capability to boot up a switch that doesn’t have a PS and even provide PoE+ on that switch.
Stackpower can provide complementary power as well as Redundant power depending on requirements and configuration.
StackPower Modes
Power share, Redundant, RPS modes

Power Sharing mode

Available Pwr | Allocated Pwr | Unused Pwr
---|---|---
3,300 W | 2,000 W | 1,300 W

Entire available power of 3,300w is available to the system.
Switch and PD requests for more power is granted until all 3,300w are used. No redundancy

Redundant mode

Reserved Power 1,100w

Overall capacity is 3,300w –1,100w is reserved for redundancy.
Available Power to share is 2,200w and there is an extra 200 W available for allocation.
Should a PS fail, then the reserved power is made available for the stack.
Intelligent Load shedding

- Built-in intelligence to detect important PD or switches in a stack
- Stackpower has 27 priority levels
- Default priority per port can be re-programmed
- All ports are Low priority by default
- The amount of load shedding depends on the amount of oversubscribed power
- Intelligent mechanism to shed load during failure scenarios
StackPower modes & Topology

Power Share & Redundant Modes

- Ring & Star topologies
  - Ring is Stackpower & Star is XPS
- On Catalyst 3750-X Power share & Redundant modes supported
  - Includes power sharing across Cat3750X switches
- On Catalyst 3560-X Redundant mode ONLY
- XPS can Not be deployed in a Ring topology
  - The power system can not be part of a Stackpower ring
- In the Star Topology, a XPS must be the hub
- Up to nine switches can be connected to the power system
  - Either Catalyst 3750-X, Catalyst 3560-X or a combination of switches.
  - Can identify Catalyst 3750-X Vs. Catalyst 3560-X to apply defaults
Best Practice

Balance PS across the stack

Total Input Power = 5,400w

Total Output Power = 1,400w

The right half generates only 20A but consumes 80A

Stackpower cables are limited to ~40A

In failure scenario, Stackpower could be oversubscribed; console messages will warn about the condition and Intelligent power shed will occur.

Recommendation:

Balance PS across all systems. Or insist on filling up PS slot A on every switch in the stack, before using slot B on any switch!
New eXpandable Power System

Overview

- Work as an RPS or complements StackPower
  Redundant and Power-share modes
- Star topology Only!
  up to 9 switches, stackable or standalone
- Offers full PoE+ redundancy to a 48-port switch
  That is 30W each on all 48 ports
- Works with the X-series switches only; Will not replace the RPS 2300 (which will NOT work with the X-series)
New eXpandable Power System – XPS

- 1RU rack unit Power Shelf
- Holds two PS *
- Two temperature check points
  Front and rear
- Can Protect all 9 Switches in a stack
- It provides additional electrical capacity & redundancy to a switch or stack
- Front panel button for manual operation

*At FCS, only 1.1KW PS are supported
**eXpandable Power System – XPS**

**Benefits**

- Point to point RPS for Standalone switches
  - That is, each PS to one switch!
- One PS can support multiple switches
  - Power share mode for Cat3750X only.
- Redundancy when switches are running full PoE+
  - PoE+ requires two PS
- Increase HA and reliability
- Online PS backup reduces the chances for latent failures during failover.
- Reduced number of outlets required in a wiring closet.
- Larger Stackpower for Cat3750X (9 switches)
## Catalyst 3560-X / 3750-X – Valid Deployments

<table>
<thead>
<tr>
<th>Expandable Power System</th>
<th>StackPower Modes</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>XPS</td>
<td>Power Share Mode</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Redundant Mode</td>
<td></td>
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<tr>
<td>Cat 3750X</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Cat 3560X</td>
<td>X</td>
<td>✓</td>
</tr>
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</table>

- A XPS is required for a Star topology
- The Power shelf can **Not** be part of Ring topology
- XPS Can work in RPS and Power share modes for Cat3750X
  - **ONLY** RPS mode for Cat3560X
- No support for transition from Star to Ring
- Support for a smooth transition from Ring to Star topologies with some caveats
StackPower

Summary

- Better utilization of available power capacity and sharing
- Scalable infrastructure for PoE+
- Improved reliability and efficiency
- PS can be configured as redundant failovers
- Complements PoE+ on switches with smaller PS
- “zero footprint” RPS (Redundant mode)
  
  Except in a fully loaded POE+ stack (Stackpower of 4 w/ all PoE+)
- Increased HA via a resilient Redundant power system
- Pay-as-you-grow architecture – similar to Stackwise
StackPower

Summary (cont.)

- **1+n redundancy Vs. 1:n redundancy**
  
  1+n is better because power is already available online!

- **Efficiency improvements – Green Power feature**
  
  Off-lining supplies when extra capacity is available in the system
  
  Not automatic but customer driven action!

- **Flexible installations – AC outlet requirement is reduced**
  
  four x 250W PS vs. one x 1.1KW PS
  
  “zero footprint” RPS, no need for more outlets and cooling in the closet.
Wire Rate Performance with StackWise Plus

- All models provide wire rate, non-blocking performance as defined in RFC 2544
- 128 Gbps Switch Fabric
- Local switching ensures that local traffic does not traverse the stack

Benefit

- Capable of handling bandwidth-intensive applications like data backup, remote operating system updates, database access, collaborative development, file sharing, scientific modeling, medical imaging, and video production
- Prepares network for next-gen OSs like Microsoft Vista’s remote imaging, data synchronization, and computer-to-computer search
StackWise Plus

- StackWise Plus increases the effective stacking throughput to 64Gbps using spatial reuse
- Same great features as the original StackWise

StackWise Plus

3. Packet travels along the ring, then it reaches the destination switch and is copied by the destination switch

2. Packet stripped from back to destination. Acknowledgement stripped back to source
<table>
<thead>
<tr>
<th>Feature</th>
<th>2960-S Stacking Ease of Use</th>
<th>3750-X StackWise Plus Ease of Use and High Availability</th>
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</thead>
<tbody>
<tr>
<td><strong>Device Limit</strong></td>
<td>4 units</td>
<td>9 units</td>
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<tr>
<td><strong>Stack Bandwidth</strong></td>
<td>10G / 20G</td>
<td>32G / 64G</td>
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<tr>
<td><strong>Architecture</strong></td>
<td>HW Drop Table</td>
<td>Ring (Destination stripping)</td>
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<tr>
<td><strong>Dynamic Ring Load Balancing</strong></td>
<td>No</td>
<td>Yes</td>
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<tr>
<td><strong>Stack Convergence</strong></td>
<td>1-2 seconds</td>
<td>Few milliseconds</td>
</tr>
<tr>
<td><strong>Stack QoS</strong></td>
<td>Applied hop by hop</td>
<td>Applied on ingress</td>
</tr>
<tr>
<td><strong>Management</strong></td>
<td>Single IP address, SNMP, SYSLOG</td>
<td>Single IP address, SNMP, SYSLOG</td>
</tr>
<tr>
<td><strong>Configuration</strong></td>
<td>Single config and CLI, auto image and config update</td>
<td>Single config and CLI, auto image and config update</td>
</tr>
<tr>
<td><strong>Show and Debug Commands</strong></td>
<td>Unified</td>
<td>Unified</td>
</tr>
<tr>
<td><strong>Single Forwarding and Control Plane</strong></td>
<td>Synchronize ARP, MAC Address, IGMP, VLAN tables</td>
<td>Synchronize ARP, MAC Address, IGMP, VLAN, Routing tables</td>
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<tr>
<td><strong>Cross-Stack Features</strong></td>
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<td>Yes</td>
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<tr>
<td><strong>Single Bridge-ID</strong></td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Preprovision members</strong></td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td><strong>Redundancy</strong></td>
<td>Stack master 1:N redundancy</td>
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<tr>
<td><strong>Easy member replacement</strong></td>
<td>Yes</td>
<td>Yes</td>
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Optional Network Module

Main features

- FRU Network module supports OIR
- Provides flexibility with two options at FCS:
  - Four 1G ports (SFP)
  - Two 10Gig port (SFP+) or Two 1G ports (SFP)
- Port numbering changed
  - Interface Gig 1/1/1 – 1/1/4
  - Interface TenGig 1/1/1 – 1/1/2

<table>
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<th>Network Modules for the Catalyst 3750-X and 3560-X Series</th>
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<tbody>
<tr>
<td>C3KX-NM-1G=</td>
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<tr>
<td>C3KX-NM-10G=</td>
</tr>
<tr>
<td>C3KX-NM-BLANK=</td>
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</table>
MACsec (Crypto)
Main features

- Standards based encryption (802.1AE) on all user ports
- Line rate performance
- Standards based key exchange protocol, MKA, included in 802.1X-Rev
- Tested with current Intel NIC cards
- Some newer Intel’s LOM chip set supports MACsec
Catalyst 3750-X and 3560-X Key Innovations

- StackPower - Innovative technology that increases HA
  Reduces operating costs with efficient power use
  “Green Power supplies” High efficiency 80% efficiency @ 10% loads
  Capability to boot up switches without PS – Resiliency
  Zero-footprint RPS – less PS, outlets, and rack space required
- FRU Network modules help to protect customers’ investment
- Standards based HW encryption – Closely integrated w/ Intel NIC
- Increased flexibility:
  PoE+ support via AC & DC power supplies
  Power source options, combination of PS, AC/DC, and XPS
  Flexible uplink options via Network modules
  OIR Network modules & FRU components (PS & Fans)
- HW Instrumentation to integrate with EnergyWise
## Cisco IOS Software Feature Set Capabilities

### Catalyst 2960-S, Catalyst 3750-X and 3560-X

#### Positioning Guidelines

<table>
<thead>
<tr>
<th>Layer 2</th>
<th>Layer 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LAN Lite</strong> Entry Level Layer 2</td>
<td><strong>IP Base</strong> Enterprise Access Layer 3</td>
</tr>
<tr>
<td>Cisco® Catalyst® 2960 and 2960-S</td>
<td>Cisco Catalyst 3560-X &amp; 3750-X</td>
</tr>
<tr>
<td><strong>LAN Base</strong> Enterprise Access Layer 2</td>
<td><strong>IP Services</strong> Enterprise Advanced Layer 3</td>
</tr>
<tr>
<td>Cisco Catalyst 2960 and 2960-S, 3560-X and 3750-X</td>
<td>Cisco Catalyst 3560-X &amp; 3750-X</td>
</tr>
<tr>
<td>Functions</td>
<td>LAN Base</td>
</tr>
<tr>
<td>-----------</td>
<td>----------</td>
</tr>
</tbody>
</table>
| **Layer 2+** | • Enterprise access Layer 2  
Wide range of Layer 2 access features for enterprise deployments | • Complete Access Layer 2  
Supports all Cisco Catalyst 2000 and Catalyst 3000 Layer 2 features, including hot standby protocols; supports Cisco StackPower™ technology (Cisco Catalyst 3750-X) |  |
| **Layer 3** | • No routing support  
Support for SVI with no IP routing support | • Enterprise access Layer 3  
RIP, static and stub PIM, and EIGRP | • Complete access Layer 3  
OSPF, EIGRP, BGP, IS-IS VRF-lite, WCCP, and PBR |
| **Manageability** | • Basic manageability  
Support for a wide range of MIBs, IPSLA Responder, and RSPAN | • Enterprise access Layer 3  
Gold-Lite and Smart Install Director | • Complete access Layer 3  
EEM and IPSLA Initiator |
| **Security** | • Enterprise access security  
DHCP Snooping, IPSG, DAI, PACLS, Cisco Identity 4.0, NAC and 802.1x features | • Complete access security  
Router and VLAN ACLs, private VLANs, complete identity and security, TrustSec SXP, and IEEE 802.1AE (Cisco Catalyst 3560-X and Catalyst 3750-X) |  |
| **QoS** | • Enterprise access QoS  
Ingress policing, Trust Boundary, AutoQoS, and DSCP mapping | • Complete access QoS  
Support for all Cisco Catalyst 2000 and Catalyst 3000 QoS features, including per-VLAN policies |  |

Note: IP Services feature set includes all IP Base features. IP Base feature set includes all LAN Base features.
Cisco EnergyWise

Technology Leadership Continues

- Cisco EnergyWise Orchestrator – PC Power Management client/server
  Sustainability Dashboard for PoE devices and PC power usage and control
- Developer Toolkit – CDN, API/SDK for 3rd party developers and technology partners
  Available through Cisco Developer Program
- New platform support – Cisco ISR G2 and Catalyst 6500
### TrustSec Identity: Benefit / Feature

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Smart Install, Auto Smart Ports, CISF

- **Smart Install**
  Automated plug and play switch deployment
  Reduced operational expense for switches

- **Auto Smart Ports**
  Ease of management utilizing automatic configuration
  Automatically execute Smart Port macro's based upon device type
  Support for Catalyst 2960/3560/3750/3560E/3750E

- **Threat Defense – Layer 2 security features**
  Dynamic ARP Inspection
  DHCP Snooping
  IP Source Guard
  Port Security
Catalyst 3750-X and 3560-X Summary

- Introduce significant new value proposition unmatched by the competition
- New Enhanced LLW
- Overall Increased HA & Resiliency
  - Increased “up time” via Stackpower
  - Dual PS resiliency
  - FRU components, Fans, PS, Network modules
  - OIR Network modules
- Full PoE+ 802.3at
- HW encryption 802.1ae
- SFP+
Cisco Catalyst 2960-S Series
Technical Overview
Introducing Catalyst 2960-S

- 24/48 10/100/1000 ports with fixed uplinks
- Fixed Uplink Options: 4x1G or 2x10G SFP+
- FlexStack Technology
  Brings stackable ease-of-use features to the 2960 family, features 20G stacking links
- Power over Ethernet
  Full standards-based PoE on every port
  PoE+ support for next-generation high-power devices
- Sustainability - GREEN
  Very low power for Gigabit Ethernet Switch
  New EnergyWise functionality to control PHY power
  Half the power of Catalyst 2960G
  - E-LLW, NBD and 90 day TAC support
- LAN Lite and LAN Base Software Options
- LAN Lite option provides entry-level Gig-E platform
Catalyst 2960-S Characteristics

- 10/100 Ethernet for Out Of Band (OOB) network mgmt new for C2960-S series
- USB Flash - type A, external Flash storage
- USB console (type B) and RJ45 console supported
- DRAM: 128MB
- On board Flash: 64MB
- Low Latency
- RPS support: CAB-E type cable. (CAB-RPS2300-E=)
Catalyst 2960-S Enhancements

- GOLD – OnLine Hardware Diagnostics
- Crypto images (K9) – shipped from Mfg
- Single SDM Template – Fixed TCAM Resources
  More security ACL resources than Catalyst 2960
  IPv6 functionality built-in to TCAM Resources
  No modification and reboot required
- 9198 Bytes max MTU
  9000 bytes max for Catalyst 2960
- OBFL – HW failure logging capability
# Catalyst 2960-S Model comparison

<table>
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<tr>
<th>Model</th>
<th>Cisco FlexStack Stacking</th>
<th>10G SFP+ Ports</th>
<th>1G SFP Ports</th>
<th>10/100/1000 Ports</th>
<th>Full PoE (15.4W) ports</th>
<th>PoE Budget</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-C2960S-48FPD-L</td>
<td>✓</td>
<td>2</td>
<td>48</td>
<td>48</td>
<td></td>
<td>740W (PoE+)</td>
</tr>
<tr>
<td>WS-C2960S-48LPD-L</td>
<td>✓</td>
<td>2</td>
<td>48</td>
<td>24</td>
<td></td>
<td>370W (PoE+)</td>
</tr>
<tr>
<td>WS-C2960S-48TD-L</td>
<td>✓</td>
<td>2</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-C2960S-24PD-L</td>
<td>✓</td>
<td>2</td>
<td>24</td>
<td>24</td>
<td></td>
<td>370W (PoE+)</td>
</tr>
<tr>
<td>WS-C2960S-24TD-L</td>
<td>✓</td>
<td>2</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>1G Uplink Ports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-C2960S-48FPS-L</td>
<td>✓</td>
<td>4</td>
<td>48</td>
<td>48</td>
<td></td>
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<td>✓</td>
<td>4</td>
<td>48</td>
<td>24</td>
<td></td>
<td>370W (PoE+)</td>
</tr>
<tr>
<td>WS-C2960S-48TS-L</td>
<td>✓</td>
<td>4</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-C2960S-24PS-L</td>
<td>✓</td>
<td>4</td>
<td>24</td>
<td>24</td>
<td></td>
<td>370W (PoE+)</td>
</tr>
<tr>
<td>WS-C2960S-24TS-L</td>
<td>✓</td>
<td>4</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>LAN Lite 1G Uplink Ports</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-2960S-48TS-S</td>
<td></td>
<td>2</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WS-2960S-24TS-S</td>
<td></td>
<td>2</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Catalyst 2960-S FlexStack

- FlexStack available with optional Module
  Hot Swappable with two wire-speed 10G ports
- Up to 4 switches in a stack
- Unified management, control, and data plane (similar look and feel as StackWise)
- 3 FlexStack Cable lengths supported
  0.5 meters, 1.0 meter, 3.0 meter
Cross-stack EtherChannel, SPAN, and FlexLink supported

EtherChannel physical links across stack members

Pre-Provisioning of stack members supported

Easy member addition and replacement

Configurable Stack Master

Following same Master election rules as StackWise Plus

Support same CISCO-STACKWISE-MIB

Single Spanning tree node: No spanning-tree across stack

Stack link topology change is handled in SW, not HW

Data flow recovery needs SW involvement
FlexStack Architecture Overview

- **Not a Ring Architecture!**
  - Packets traverse stack members hop by hop
  - Local switching of unicast packets
- **Both Stack Links active and Fwd**
- **HW Drop Table to stop Broadcasts**
  - Shortest path algorithm used to determine drops
  - Drop table uses ingress member to determine drop
  - All members see the Bcast & Mcast packets

3 Member Broadcast Packet Example

- Packet enters stack on member 1
- Packet FWDed on both stack links
- Packet dropped between 2 & 3
<table>
<thead>
<tr>
<th></th>
<th>2960-S Stacking Ease of Use</th>
<th>3750-X StackWise Plus Ease of Use and High Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device Limit</td>
<td>4 units</td>
<td>9 units</td>
</tr>
<tr>
<td>Stack Bandwidth</td>
<td>10G / 20G</td>
<td>32G / 64G</td>
</tr>
<tr>
<td>Architecture</td>
<td>HW Drop Table</td>
<td>Ring (Destination stripping)</td>
</tr>
<tr>
<td>Dynamic Ring Load Balancing</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Stack Convergence</td>
<td>1-2 seconds</td>
<td>Few milliseconds</td>
</tr>
<tr>
<td>Stack QoS</td>
<td>Applied hop by hop</td>
<td>Applied on ingress</td>
</tr>
<tr>
<td>Management</td>
<td>Single IP address, SNMP, SYSLOG</td>
<td>Single IP address, SNMP, SYSLOG</td>
</tr>
<tr>
<td>Configuration</td>
<td>Single config and CLI, auto image and config update</td>
<td>Single config and CLI, auto image and config update</td>
</tr>
<tr>
<td>Show and Debug Commands</td>
<td>Unified</td>
<td>Unified</td>
</tr>
<tr>
<td>Single Forwarding and Control Plane</td>
<td>Synchronize ARP, MAC Address, IGMP, VLAN tables</td>
<td>Synchronize ARP, MAC Address, IGMP, VLAN, Routing tables</td>
</tr>
<tr>
<td>Cross-Stack Features</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Single Bridge-ID</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Preprovision members</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Stack master 1:N redundancy</td>
<td>Stack master 1:N redundancy</td>
</tr>
<tr>
<td>Easy member replacement</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Catalyst 2960-S PoE+

- 802.3at (30W) PoE+ Plus compliant
  - 802.3af (15.4 W) compliant – maintain backward compatibility

- Full PoE Functionality
  - 48 Ports of full 15.4W per switch
  - 24 Port of 30W per switch
  - No External RPS needed

- 2 PoE Power Models Available
  - 740W PoE available power budget
  - 370W PoE available power budget

- Capable of supporting 802.3at and 802.3af PDs simultaneously
Catalyst 2960-S Sustainability Green
Cisco Technology Innovation

- Lowest Power Consumption in Industry
  Improving Gigabit Ethernet switching power efficiency
  Cisco low power consumption ASICs
  Uses 50% power of equivalent Ethernet switches in the market

- Additional Power savings
  Interfaces power down when interface not in connected to reduce power

- EnergyWise Capable
### Power Savings with Cisco
(Based on Internal Power Testing Results)

<table>
<thead>
<tr>
<th></th>
<th>Catalyst 2960S-48TS-L</th>
<th>Industry</th>
<th>Save $</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Wattage</strong></td>
<td>38 W</td>
<td>87 W</td>
<td>71 W</td>
</tr>
<tr>
<td><strong>Cost per day (Cost per kWh = $0.125)</strong></td>
<td>$ 0.11</td>
<td>$ 0.26</td>
<td>$ 0.15</td>
</tr>
<tr>
<td><strong>Power Cost 1 year (1 switch)</strong></td>
<td>$41</td>
<td>$ 95</td>
<td>$54</td>
</tr>
<tr>
<td><strong>Power Cost 1 year (100 switches)</strong></td>
<td>$4,161</td>
<td>$9,526</td>
<td>$5365</td>
</tr>
<tr>
<td><strong>Power Cost 5 years (100 switches)</strong></td>
<td>$20,805</td>
<td>$47,632</td>
<td>$26827</td>
</tr>
<tr>
<td><strong>Heat dissipated (1W=3.41 BTU)</strong></td>
<td>177 BTU</td>
<td>419 BTU</td>
<td>242</td>
</tr>
<tr>
<td><strong>Power Consumed for Cooling (1 BTU=.105W)</strong></td>
<td>19 W</td>
<td>44 W</td>
<td>25 W</td>
</tr>
<tr>
<td><strong>Cost to Cool 5 years (1 switch)</strong></td>
<td>$74</td>
<td>$170</td>
<td>$96</td>
</tr>
<tr>
<td><strong>Savings for 100 Switches 5 years</strong></td>
<td></td>
<td></td>
<td>$26,923</td>
</tr>
</tbody>
</table>
Cisco increases power supply efficiency with C2960-S series switches.

5% over previous generation Catalyst 2960-G

The more efficient the power supply, the cheaper to operate.
Catalyst 2960-S  SFP+ 10Gig

- SFP+ supported in 10Gig Models
  - SFP / SFP+ interchangeable
  - *100MB SFPs not supported in 10Gig models
- Additional SFP+ models support as released.

<table>
<thead>
<tr>
<th>SFP+ Module</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFP-H10GB-CU1M=</td>
<td>Copper 10Gig SFP+ modules 1-m, 3-m, 5-m 10G SFP+ Twinax cable assembly</td>
</tr>
<tr>
<td>SFP-H10GB-CU3M=</td>
<td></td>
</tr>
<tr>
<td>SFP-H10GB-CU5M=</td>
<td></td>
</tr>
<tr>
<td>SFP-10G-SR=</td>
<td>Optical 10Gig SFP+ modules 10GBASE-SR SFP+ transceiver module for MMF</td>
</tr>
<tr>
<td>SFP-10G-LR=</td>
<td>10GBASE-LR SFP+ transceiver module for MMF</td>
</tr>
<tr>
<td>SFP-10G-LRM=</td>
<td>10GBASE-LRM SFP+ transceiver module for MMF</td>
</tr>
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Cisco IOS Software Feature Set Capabilities
Catalyst 2960-S, Catalyst 3750-X and 3560-X

Positioning Guidelines

**Layer 2**
- LAN Lite
  - Entry Level Layer 2
  - Cisco® Catalyst® 2960 and 2960-S
- LAN Base
  - Enterprise Access Layer 2
  - Cisco Catalyst 2960 and 2960-S, 3560-X and 3750-X

**Layer 3**
- IP Base
  - Enterprise Access Layer 3
  - Cisco Catalyst 3560-X & 3750-X
- IP Services
  - Enterprise Advanced Layer 3
  - Cisco Catalyst 3560-X & 3750-X
# LAN Lite vs. LAN Base Highlights

## Functions

<table>
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<tr>
<th>Layer 2</th>
<th>LAN Lite</th>
<th>LAN Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Entry-level access Layer 2</td>
<td>Basic Layer 2 access features, including 802.1Q trunking, (M)STP, STP extensions, Cisco Discovery Protocol, DTP, UDLD, VTPv2, PAGP/LACP, LLDP, and storm control</td>
<td>• Enterprise Access Layer 2 Wide range of Layer 2 access features for enterprise deployments, including FlexLinks, VTPv3, and LLDP MED</td>
</tr>
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<tr>
<th>Layer 3</th>
<th>LAN Lite</th>
<th>LAN Base</th>
</tr>
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<tbody>
<tr>
<td>• No routing support</td>
<td>Support for Layer 3 management interface</td>
<td>• Static Routing Support (Future)</td>
</tr>
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</table>

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<tr>
<th>Manageability</th>
<th>LAN Lite</th>
<th>LAN Base</th>
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<td>• Entry-level manageability</td>
<td>Express setup, Cisco Device Manager, SNMPv3 (with cryptography), RMON, SPAN, TDR, Auto Smart Ports, and Smart Install client</td>
<td>• Basic manageability Support for a wider range of MIBs, IPSLA Responder, and RSPAN</td>
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<td>• Entry-level access security</td>
<td>SSH v2 server, SSL, HTTPS, SCP, TACACS+, RADIUS, port security, 802.1x (with guest VLAN), MAB, private VLAN edge, and NAC</td>
<td>• Enterprise access security DHCP snooping, IPSG, DAI, PACLs, Cisco Identity 4.0, and 802.1x features</td>
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<td>• Entry-level access QoS</td>
<td>Ingress and egress queuing, scheduling, Priority Queuing, and SRR</td>
<td>• Enterprise access QoS Ingress policing, Trust Boundary, AutoQoS, and DSCP mapping, service policy</td>
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Note: LAN Base feature set includes all LAN Lite features.
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Catalyst 2960-S Key Differentiations

- Catalyst 2960-S – Gigabit Ethernet Switch
  - LAN Base & LAN Lite models available
- Stacking with FlexStack technology
- 10 Gigabit UpLinks with SFP+ form factor
- 802.3at POE+; Full POE power with 740W or 370W budgets
- Low power consumption – Lowest in industry (Fixed Gig Switches)
- Very Low Latency
- Line rate all interfaces
- Enhanced LLW