Cisco Catalyst 3650 Series Switches

Overview

Q. What are the Cisco® Catalyst® 3650 Series Switches?

A. The Cisco Catalyst 3650 Series is the next generation of enterprise-class standalone and stackable access-layer switches that provide full convergence between wired and wireless on a single platform. Built on the advanced Cisco StackWise®-160 technology and using Cisco's new unified access data plane (UADP) application-specific integrated circuit (ASIC), the Cisco Catalyst 3650 enables uniform wired-wireless policy enforcement, application visibility, flexibility, application optimization, and superior resiliency. The Cisco Catalyst 3650 Series Switches support full IEEE 802.3at Power over Ethernet Plus (PoE+), redundant fans, and new front-end power supplies. The Cisco Catalyst 3650 switches enhance productivity by enabling applications such as IP telephony, wireless, and video for a true borderless network experience.

Q. Can the Cisco Catalyst 3650 act as a wired switch?

A. The Cisco Catalyst 3650 switch can act as a wired switch as well as a converged wired wireless switch.

Q. How do the Cisco Catalyst 3650 switches compare to the Cisco Catalyst 3560-X models?

A. The Cisco Catalyst 3650 switch is revolutionary in terms of both functionality and features. Table 1 shows a comparison with the Cisco Catalyst 3560-X.

Table 1. Comparison of Cisco Catalyst 3560-X and 3650 Switches

Feature	Cisco Catalyst 3560-X	Cisco Catalyst 3650
Optional stacking	No	Yes (160 Gbps)
Native wireless controller support over Cisco IOS® Software	No	Yes
10GE uplinks	2 x 10 GE (field-replaceable unit [FRU])	4 x 10 GE/2 x 10 GE (fixed)
Buffers per 48 port	6 MB	12 MB
Native flexible NetFlow support	No	Yes
Multicore CPU for hosted services	No	Yes
Quality of service (QoS) model and queues per port	MLS, 4 egress queues	MQC, 8 egress queues
Flash/DRAM size	64 MB/256 MB	2 GB/4GB
External power system (XPS-2200)	Yes	No
Converged Access Solution	No	Yes
Operating system	Cisco IOS Software	Cisco IOS-XE Software

Q. How do the Cisco Catalyst 3650 switch features compare to those of Cisco Catalyst 3850?

A. Table 2 shows the feature comparison with Cisco Catalyst 3850.

Table 2. Feature Comparison of Cisco Catalyst 3650 and Cisco Catalyst 3850 Switches

Feature	Cisco Catalyst 3650	Cisco Catalyst 3850
Stacking bandwidth/max members in stack	160G/9	480G/9
Cisco StackPower™	No	Yes

Feature	Cisco Catalyst 3650	Cisco Catalyst 3850
Uplinks	Fixed uplinks	Modular uplinks
Memory/flash	4GB/2GB	4GB/2GB
Wireless	25 access points max as Mobility Controller	50 access points max as Mobility Controller
Stacking module	Optional	Built-in
Power	Dual FRUs	Dual FRUs; Expandable Power System (XPS)*
L3 features	Open Shortest Path First (OSPF), Protocol Independent Multicast (PIM), Border Gateway Protocol (BGP), Enhanced Interior Gateway Routing Protocol (EIGRP), Intermediate System-to-Intermediate System (IS-IS)	OSPF, PIM, BGP, EIGRP, IS-IS
Smart operations	Client, Director	Client, director
Cisco TrustSec®	Secure Group Tagging (SGT), Secure Group Access (SGA), Media Access Control Security (MACsec)*	SGT, SGA, MACsec*
Application visibility and control (AVC)	Flexible NetFlow, Wireshark	Flexible NetFlow, Wireshark
High availability	Stateful Switchover (SSO)	SSO
Power supply	New front-end power supplies: 250WAC, 640WAC, 640WDC, and 1025WAC	Front-end power supplies: 350WAC, 715WAC, 1100WAC, and 440WDC

* On Roadmap.

Q. What feature sets do the Cisco Catalyst 3650 switches support?

A. Table 3 shows the feature set. For more details, refer to the [Cisco Feature Navigator](#).

Table 3. Cisco IOS Software Feature Set Differences

Function	LAN Base	IP Base	IP Services
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 Cisco Catalyst 3000 Layer 2 features, including hot standby protocols	
Layer 3	Static IP routing support Support for Switch Virtual Interface (SVI) IPv6 host support IPv6 port ACLs HTTP(s), SNMP, Syslog over IPv6 IPv6 First Hop Security	Enterprise access Layer 3 Routing Information Protocol (RIP), Protocol-Independent Multicast (PIM), Policy-based routing (PBR) and EIGRP stub OSPF for routed access	Complete access Layer 3 OSPF, EIGRP, BGP, Intermediate System-to-Intermediate System (IS-IS) Protocol VRF-lite (Virtual Routing and Forwarding) and Web Cache Communication Protocol (WCCP)
Mobility	Supports centralized Cisco Unified Wireless Networking mobility architecture	Supports new distributed Cisco Converged Access mobility architecture with Control and Provisioning of Wireless Access Points (CAPWAP) termination at the access	Supports new distributed Cisco Converged Access mobility architecture with CAPWAP termination at the access
Manageability	Basic manageability Support for a wide range of MIBs, IPSLA Responder, and Remote Switched Port Analyzer (RSPAN)	Enterprise access Layer 3, Flexible NetFlow for wired and wireless traffic Embedded Event Manager (EEM), Generic Online Diagnostics (GOLD) Lite, and Smart Install Director	
Security	Enterprise access security Dynamic Host Configuration Protocol (DHCP) snooping, IP Services Gateway (IPSG), Dynamic ARP Inspection (DAI), Port ACLs (PACLs), Cisco Identity 4.0, Network Admission Control (NAC), and 802.1x features	Complete access security Router and virtual LAN (VLAN) access-control lists (ACLs), complete identity and security; Cisco TrustSec SXP and IEEE 802.1AE capable in hardware	
QoS	Enterprise access QoS Ingress policing, Trust Boundary, AutoQoS, and differentiated services code point (DSCP) mapping	Complete access QoS Support for all Cisco Catalyst 2000 and Cisco Catalyst 3000 QoS features, including per-VLAN policies	

Check release notes for latest information on features & packaging.

Q. What fixed uplink types are available on the Cisco Catalyst 3650?

A. The Cisco Catalyst 3650 comes with the following fixed uplink Small Form-Factor Pluggable/Small Form-Factor Pluggable Plus (SFP/SFP+) port options:

- 4 x Gigabit Ethernet with SFP
- 2 x 10 Gigabit Ethernet with SFP+ or 4 x Gigabit Ethernet with SFP
- 4 x 10 Gigabit Ethernet with SFP+ or 4 x Gigabit Ethernet with SFP (available on 48-port switch only)

Q. Can the SFP and SFP+ module slots on the 2 X 10G/4 X 1G uplink type be used in combination?

A. Yes. It is possible to have a combination of a pair of SFP modules (left two) and a pair of SFP+ modules (right two) on the 2 X 10G/4 X 1G uplink type of the Cisco Catalyst 3650. This combination provides up to 22 Gbps of uplink bandwidth.

Q. Are the uplinks between the Cisco Catalyst 3650 and the 3560-X interchangeable?

A. No, the Cisco Catalyst 3650 has fixed uplinks.

Q. Is a service module available for the Cisco Catalyst 3650?

A. There are no service modules for the Cisco Catalyst 3650. The Cisco Catalyst 3650 natively supports the features supported by the service module in the 3560-X. The Cisco Catalyst 3650 is hardware ready for MACsec, and software support will be added in a future release. Check release notes for availability.

Q. How do you manage the Cisco Catalyst 3650?

A. The Cisco Catalyst 3650 can be managed using the Cisco IOS Software CLI, web GUI, Cisco Prime™ Infrastructure 2.0.1, or the Cisco Network Assistant Software.

Q. Is there a web GUI to manage the Cisco Catalyst 3650?

A. Yes. The Cisco Catalyst 3650 has a web GUI that provides basic manageability for wireless. Support for wired will be added in a future software release. Check release notes for availability.

Q. Does the Cisco Catalyst 3650 support 802.1ae on downlink ports?

A. The Cisco Catalyst 3650 is hardware capable for 802.1ae on all ports on the switch. Software support will be available later. Check release notes for availability.

Q. What management ports are available on the Cisco Catalyst 3650?

A. The Cisco Catalyst 3650 comes with a 10/100/1000 Ethernet dedicated management port on the backside of the switch right below the console port. (See Figure 1.) This port is in a separate VRF called "Mgmt-vrf." This is to segment the management traffic from the global routing table of the switch.

Figure 1. Cisco Catalyst 3650 Switch Rear Panel

Q. Can both console ports be used simultaneously?

A. No. When the USB console is used, the RJ-45 console receives the output of the USB console as well. This design allows the administrator to see when the USB console port is in use. This capability is useful for remote administrators.

Q. Does the switch support auto baud on the console port?

A. No.

Q. Do the Cisco Catalyst 3650 switches support front-to-back airflow?

A. Yes. The Cisco Catalyst 3650 supports front-to-back airflow.

Q. What are the different Cisco Catalyst 3650 model types?

A. Table 4 shows the Cisco Catalyst 3650 model types. Each listed model type is available in LAN Base, IP Base, and IP Services license variants. All PoE PIDs are capable of full PoE and full PoE+.

Table 4. Cisco Catalyst 3650 Model Types (Default Configuration)

PID	Ports	PoE+	4x1GE Uplink	2x10GE/4x1GE Uplink	4x10GE/4x1GE Uplink
WS-C3650-24TS	24		✓		
WS-C3650-24PS	24	✓	✓		
WS-C3650-48TS	48		✓		
WS-C3650-48PS	48	✓	✓		
WS-C3650-24TD	24			✓	
WS-C3650-24PD	24	✓		✓	
WS-C3650-48TD	48			✓	
WS-C3650-48PD	48	✓		✓	
WS-C3650-48TQ	48				✓
WS-C3650-48PQ	48	✓			✓
WS-C3650-48FS	48	✓ (full PoE)	✓		
WS-C3650-48FD	48	✓ (full PoE)		✓	
WS-C3650-48FQ	48	✓ (full PoE)			✓

Q. How many fans does the Cisco Catalyst 3650 have?

A. The Cisco Catalyst 3650 has three FRU fans for thermal management.

Q. What happens if a fan on the Cisco Catalyst 3650 fails?

A. The Cisco Catalyst 3650 can operate for up to four hours with two active fans at ambient temperature of 25℃ without errors. A longer duration might cause errors and reduce reliability of the switch. The failed fan should be replaced within four hours.

Q. Does the Cisco Catalyst 3650 support Energy Efficient Ethernet (802.3az)?

A. Yes.

Q. What mounting options are available on the Cisco Catalyst 3650?

A. The Cisco Catalyst 3650 chassis supports standard 19", 23", and ETSI rack mounting with option for 19" rear mount. For more details on mounting options, refer to the Cisco Catalyst 3650 Hardware Installation Guide.

Q. Are the software images for the Cisco Catalyst 3650 and the Cisco Catalyst 3850 the same?

A. The software images are different but support the same software features and services.

Q. What are the hot-swappable elements in the Cisco Catalyst 3650 switch?

A. Online insertion and removal of the following are supported:

- Stack member switches in the stack
- Power supply and fans
- SFP/SFP+ modules
- Stack adapter and cables

License and Warranty

Q. What licensing model does the Cisco Catalyst 3650 use?

A. The Cisco Catalyst 3650 uses a right-to-use (RTU) licensing model.

Q. What is an RTU licensing model?

A. RTU is a trust-based licensing model designed to give customers the flexibility to upgrade, downgrade, or move the license for RMA purpose by using simple EXEC CLI commands.

Q. Do the Cisco Catalyst 3650 switches require a product activation key (PAK) for licensing?

A. No. No PAK is required for software licensing in Cisco Catalyst 3650 switches. Cisco Catalyst 3650 switches use a trust-based RTU licensing model. While placing the order, the customer specifies the license requirement and receives an electronic license or paper license for entitlement purpose only.

Q. What are the different types of licenses in the Cisco Catalyst 3650?

A. There are two main types of Cisco Catalyst 3650 licenses: permanent RTU license and evaluation RTU license. These are available for both image-based licensing (IP Base or IP Services) and access point count licensing.

A permanent RTU license is a paid license, with no expiration date. The universal Cisco IOS-XE Software-based images have all three license levels: LAN Base, IP Base, and IP Services. RTU CLI commands enable the switch license to be moved between different license levels.

An evaluation RTU license allows the customers to evaluate an image-based and/or access point count license for 90 days at no cost.

Q. How is the image-based license enabled?

A. An image-based license can be enabled by executing the following EXEC CLI, which activates the license level and also accepts the end-user license agreement (EULA).

CLI for permanent:

```
license right-to-use activate lanbase | ipbase | ipservices <slot #> acceptEULA
```

CLI for evaluation:

```
license right-to-use activate ipbase | ipservices evaluation <slot #> acceptEULA
```

Q. How is the access point count license enabled?

A. The access point count license can be enabled by executing the following EXEC CLI, which activates the access point count number and also accepts the EULA. A permanent access point count license can be enabled in unit increments up to a maximum of 25. An evaluation license is available only for the maximum access point count (25).

CLI for permanent:

```
license right-to-use activate apcount <1-25> <slot #> acceptEULA
```

CLI for evaluation:

```
license right-to-use activate apcount evaluation <slot#> acceptEULA
```

Q. What happens after 90 days of activating an evaluation RTU license?

A. An evaluation RTU license EULA expects that customers will purchase a permanent license within 90 days. After 90 days the evaluation license will not be valid. Warning syslog messages about the evaluation license expiration are generated 10 and 5 days before the 90-day window ends. Warning syslog messages are generated every day after the 90-day period. The expired evaluation license continues to function with the daily syslog messages until the switch is reloaded. The expired evaluation license cannot be reactivated after the reload.

Q. What are the license requirements for a Cisco Catalyst 3650 switch stack?

A. In a Cisco Catalyst 3650 stack, all switches should be at the same image-based license (IP Services/IP Base/LAN Base) level. The active switch license level is considered as the reference, and the member switch licenses are compared against it. If there is a mismatch, the active switch with the syslog message **"license mismatch error"** indicates that the stacking was unsuccessful.

Q. How is a **"license mismatch error"** fixed in a Cisco Catalyst 3650 stack?

A. The license level of the mismatched stack member switch can be changed with the `license right-to-use activate <license> all acceptEULA` CLI command (entire stack should have the same wired license level) and reloaded from the active switch console. This will enable the member switch to join the stack successfully. The customer has to purchase a license before moving to a specific license level.

Q. How is the access point count license managed across a Cisco Catalyst 3650 stack?

A. The total access point count license of a Cisco Catalyst 3650 stack is equal to the sum of all the individual member access point count licenses, up to a maximum of 25 access points. When new members are added to the stack, the total access point count license of the stack is automatically recalculated. When members are removed from the stack, the access point count license does not decrement until a reload of the stack.

Stack member addition example: A Cisco Catalyst 3650 stack with 3 switches, each with an access point count license of 6 access points, will have support for a total of 18 access points. When a new Cisco Catalyst 3650 (switch 4) is added to the stack with an access point count license of 8 access points, the total access points supported by the stack equals 25, since the total (18+8) 26 exceeds the stack limit.

Stack member remove example: In the preceding example, if switch 4 is removed from the stack, the access point count license stays at 25 access points until the stack is reloaded. After being reloaded, the stack returns to its original value of 18 access points.

Q. How is an RTU license migrated in case of a Cisco Catalyst 3650 hardware swap/RMA?

A. Both image-based and access point count licenses can be deactivated from the old/swapped-out hardware and activated on the new switch. Deactivation is done by the `license right-to-use deactivate` EXEC command and activation by the `license right-to-use activate` EXEC command.

Q. How is the license usage monitored?

A. The license usage is maintained in the Cisco Catalyst 3650 stack for individual switches. The usage information is maintained from the initial boot across reboots, including the status of EULA, in-use condition, and type of license. The usage information is updated daily and can be displayed with the `show license right-to-use usage` EXEC command.

Q. How is the license information stored and protected?

A. The license information is stored in two hidden flash partitions: active and backup. They are not customer accessible, and write erase will not erase the license files. If the license file in the primary partition is corrupted or tampered with, the license file from secondary/backup partition is used. If both the partitions are corrupted, Cisco will recreate the license files.

Q. What are the hardware warranty and return policy on the Cisco Catalyst 3650 switches?

A. Cisco Catalyst 3650 switches come with an enhanced limited lifetime hardware warranty (ELLW). It provides 90-day TAC support and next business day delivery for hardware replacement.

Q. What is the software update policy for Cisco Catalyst 3650 switches?

A. The software update can be viewed at http://www.cisco.com/en/US/prod/collateral/switches/ps5718/ps4324/product_bulletin_c25-696974_ps13133_Products_Bulletin.html.

Stacking and High Availability

Q. How is stacking done in the Cisco Catalyst 3650?

A. The Cisco Catalyst 3650 is built with the advanced Cisco StackWise-160. It offers a stacking bandwidth of 160 Gbps nonblocking and supports Cisco IOS Software SSO technology. The Cisco Catalyst 3650 requires a stacking kit that includes two data stack adapters and one stacking cable per switch to enable stacking. Data stack adapters are installed from the back of chassis, two adapters per switch. (See Figures 2 and 3.)

Figure 2. Cisco StackWise-160 Cabling with Cisco Catalyst 3650

Figure 3. New StackWise-160 Modular Adapters and Stacking Cable

Q. Is stacking enabled by default on the Cisco Catalyst 3650 switch?

A. Stacking is optional and not enabled by default on the Cisco Catalyst 3650 switch.

Q. Does the stacking kit have to be ordered separately?

A. The stacking kit can be added at the time of switch purchase or can be purchased separately at a later time. Stacking is enabled after the stacking kit is installed on the Cisco Catalyst 3650. Refer to Cisco Catalyst 3650 data sheet for ordering information.

Q. Does the Cisco Catalyst 3650 need to be switched off in order to install the stacking kit?

A. No. Online insertion and removal of stack adapters and cables are supported.

Q. Is the Cisco Catalyst 3650 switch stack operation interrupted when a new stack member is added?

A. Stack operation is not interrupted if the new stack member is powered on after its physical addition (stack cable connections) to the stack is completed. Connecting powered-on switches (merging) to the stack causes all switches to reload and elect a new active switch from among them.

Q. Is a license required to enable StackWise-160?

A. There is no separate license required to enable StackWise-160. All stack member switches should be at the same image-based license (IP Services/IP Base/LAN Base) level.

Q. What is SSO technology?

A. The Cisco Stateful Switchover (SSO) technology synchronizes the Layer 2 and Layer 3 unicast routing protocols and wireless tunnel state machines in real time from active to standby Cisco Catalyst 3650 stack switch. During active switch switchover, the standby switch performs graceful recovery with neighbors without disrupting network topology.

Q. What is Nonstop Forwarding (NSF) technology?

A. The complementary NSF technology enables business continuity by delivering nonstop forwarding communication across stack-member switches, while the standby switch is transitioning in the active role.

Q. How many Cisco Catalyst 3650 switches can stack into a single logical entity?

A. Up to nine Cisco Catalyst 3650 switches can be stacked together to build single logical StackWise-160 switch.

Q. Does the Cisco Catalyst 3650 support Cisco StackPower technology?

A. The Cisco Catalyst 3650 does not support Cisco StackPower technology.

Q. Can a Cisco Catalyst 3650 stack with any other Cisco Catalyst switch type?

A. No.

Q. Are StackWise-160 cables backward compatible with StackWise and StackWise Plus?

A. No. The cable and connector type used in StackWise-160 are different from the StackWise and StackWise Plus cables. Hence the newly redesigned hardware architecture of the StackWise-160 is incompatible with traditional StackWise Plus technology.

Q. Are the stacking cables for the Cisco Catalyst 3650 different from those for the Cisco Catalyst 3850?

A. Yes. The Cisco Catalyst 3850 stacking cables cannot be used for Cisco Catalyst 3650 stacking.

Q. What StackWise-160 cable lengths are supported?

A. The Cisco Catalyst 3650 stack cables are 50 cm, 1m, and 3m in length.

Q. What is the StackWise-160 stack cable bend radius?

A. The copper stack cable bend radius can be up to 4".

Q. What is the primary difference between StackWise Plus and StackWise-160 technology?

A. The primary differences are as follows:

- **Bandwidth:** Each Cisco Catalyst 3650 switch in StackWise-160 mode supports a stacking bandwidth of 160 Gbps as compared to 64 Gbps on StackWise Plus.
- **Cable and connectors:** These have been revamped with StackWise-160 for ease of insertion and removal.
- **Stacking technology:** StackWise-160 is built on Cisco IOS Software SSO, which provides better state synchronization between the various members.
- **Stacking terminology:** StackWise-160 identifies active and standby members in the stack per the Cisco IOS Software SSO technology. All control-plane activities are centralized and synchronized between the active and standby. StackWise Plus identifies a single master in the stack and distributes some control-plane activities.

Q. Which stack switch in StackWise-160 manages the control and management planes?

A. The active stack switch centrally manages all the control and management communication. The network control data traffic is transparently switched from standby and other member switches to active for centralized processing.

Q. How does distributed forwarding work in the Cisco Catalyst 3650 stack architecture?

A. The active stack switch builds the network adjacencies and forwarding tables. For hardware-accelerated distributed forwarding, the active switch programs the forwarding information to standby and member switches.

Q. Does StackWise-160 support same spatial-reuse technology as StackWise Plus?

A. Yes. The spatial-reuse technology enables multipath parallel switching across each stack ring to double the throughput.

Q. What are the primary StackWise-160 benefits over standalone Cisco Catalyst 3650?

A. The Cisco Catalyst 3650 Series deployed in StackWise-160 mode provides the following set of benefits:

- **Simplified:** Single unified system to manage and operate up to 432 ports. StackWise-160 also simplifies network design and topologies in converged access.
- **Scalable**: No performance compromise. Each Cisco Catalyst 3650 switch deployed in StackWise-160 mode boosts wiring-closet performance with nonblocking 160-Gbps backplane and 40 Gbps on uplink ports.
- **Resilient**: The Cisco Catalyst 3650 deployed in StackWise-160 mode enables the Cisco IOS Software SSO high-availability framework to deliver nonstop communication during fault conditions.

Q. Can switch priorities be configured in a Cisco Catalyst 3650 stack?

A. Yes. For deterministic control-plane operation within a StackWise-160 ring network, it is recommended to adjust switch priorities from default value.

Q. How can switch priorities and switch numbers be configured in a Cisco Catalyst 3650 stack?

A. In the new Cisco Catalyst 3650 software design, the switch priority and switch number CLI are available using EXEC mode. These switch parameters are dynamically saved based on user input. This is different from the Cisco Catalyst 3750 Series, where it was configured using global configuration mode.

Assigning a stack member number:	Example:
switch *current-stack-member-number* **renumber** *new-stack-member-number*	**Switch# switch 3 renumber 5**

Setting the stack member priority: **switch** *stack-member-number* **priority** *new-priority-number*	Example: **Switch# switch 5 priority 2**

Q. What is the active and standby switch election process during bootup?

A. The active and standby switch role selection during bootup is based on switch MAC address or user-defined switch priorities. The active switch is elected or reelected based on one of these factors and in the order listed:

1. The switch that is currently the active switch
2. The switch with the highest stack member priority value
3. The switch with the shortest startup time
4. The switch with the lowest MAC address

Q. What happens during an active switchover?

A. The original standby switch gracefully transitions into new active role upon rapidly detecting active switch failure. The new active switch elects its own standby and synchronizes with it to be SSO ready again. This role switchover remains deterministic and independent of switch priority set across other switches in a stack ring.

Q. How will the Cisco Catalyst 3650 support NSF/SSO differently than Cisco modular switches?

A. Both the Cisco Catalyst 3650 and modular switches in fully operational state enable 1+1 control-plane redundancy. The Cisco Catalyst 3650 uniquely enables 1:N system-level resiliency across stack design.

Q. What network protocols are NSF/SSO capable?

A. The Cisco Catalyst 3650 Series Switches support the following Layer 2 and Layer 3 network protocols:

- Layer 2 protocols: Cisco Discovery Protocol, Spanning Tree Protocol, VLAN Trunking Protocol (VTP), Link Aggregation Control Protocol (LACP), Port Aggregation Protocol Plus (PAgP+), Dynamic Trunking Protocol (DTP), Unidirectional Link Detection Protocol (UDLD)
- Layer 3 protocols: EIGRP, OSPF, IS-IS, BGP
- VRF-aware Layer 3 protocols: EIGRP, OSPF, IS-IS, BGP
- Mobility: Access Point management, CAPWAP data tunnel, CAPWAP mobility tunnel, CAPWAP multicast tunnels

Q. What types of EtherChannel capability are supported on Cisco Catalyst 3650 Series Switches?

A. The Cisco Catalyst 3650 Series is supported on two different modes:

- Single-chassis EtherChannel: In this EtherChannel configuration mode, all the member links of given EtherChannel on single stack-switch system.
- Cross-stack EtherChannel: In this EtherChannel configuration mode, the member links are diversified between stack switches regardless of their roles.

Q. What cross-stack EtherChannel link bundling protocols are supported?

A. The Cisco Catalyst 3650 supports Cisco Enhanced Port Aggregation Protocol (ePAgP) and industry-standard IEEE 802.3ad LACP. Other 3750 Series Switches support only LACP for cross-stack EtherChannel.

Q. Can Cisco Catalyst 3650 deployed in StackWise-160 be used for VSS dual active detection?

A. Yes. Cisco Catalyst 3650 cross-EtherChannel can be Enhanced PAgP trusted for VSS dual active detection.

Q. How many links can be bundled into a single EtherChannel?

A. Each Layer 2 or Layer 3 EtherChannel can support up to 8 member links.

Q. How many EtherChannels are supported on Cisco Catalyst 3650 Series Switches?

A. The Cisco Catalyst 3650 Series Switch can support up to 128 EtherChannels.

Q. What wireless network redundancy can StackWise-160 provide?

A. The StackWise-160 enables wireless mobility tunnel SSO capability in the system. The active switch establishes various types of CAPWAP tunnels with different devices and synchronizes the tunnel state machines to the standby switch.

Q. What type of mobility function does the Cisco Catalyst 3650 stack handle?

A. The active switch provides the same centralized wireless controller function as standalone mode. It terminates the CAPWAP data tunnel from all locally attached Cisco WAP across stack member switches and forms CAPWAP tunnels with peer mobility systems and client communications.

Q. What is the WCM and CAPWAP tunnel state on the standby switch?

A. The integrated WCM and all CAPWAP tunnels remain in hot standby mode on a standby Cisco Catalyst 3650 stack switch.

Q. Does the active stack switch centrally process the wireless data-plane traffic?

A. The high-speed data-plane switching between wired (802.3) and wireless (802.11) network is fully distributed in StackWise-160 design.

Q. How is roaming traffic handled in StackWise-160-based network design?

A. In StackWise-160 design, the active stack switch provides a centralized "plumbing" service between a roaming CAPWAP mobility tunnel to a foreign switch and a local CAPWAP data tunnel to a Cisco access point. The active stack switch provides centralized data switching service between two different tunnel types.

Q. What is the effect on the end user when a Cisco Catalyst 3650 switch stack is deployed in mobility agent or mobility controller mode and the active stack switch fails?

A. The WLAN client information will require rebuilding on the new active switch. The local WLAN clients will be required to authenticate and use DHCP again to update the database. The roamed WLAN clients will go through the same process and become local to the new active switch.

Q. What is the effect on the end user when a Cisco Catalyst 3650 switch stack is deployed in mobility agent mode and active stack switch and the connected Cisco WAP fails?

A. The WLAN client immediately initiates fast roam to another Cisco access point that is possibly connected to another stack switch in the same StackWise-160 ring.

Q. What is the effect to users and connectivity to mobility agents when a Cisco Catalyst 3650 switch stack is deployed in mobility controller mode and the active member fails?

A. The CAPWAP mobility tunnel with mobility agents remains in operational state. No effect occurs to local and roamed users between mobility agents in the same switch peer group. The user roamed between switch peer groups will become local and require reauthentication and rerun DHCP for connectivity.

Q. What is the effect to users and connectivity to mobility agents when a Cisco Catalyst 3650 switch stack is deployed in mobility controller mode and complete stack failure occurs?

A. In such a catastrophic failure event, the intra-switch peer group (SPG) communication between mobility agents remains intact. The centralized mobility controller services such as guest access, RRM, and so on will remain down until the mobility controller is restored. The inter-SPG roamed client will need to reauthenticate and rerun DHCP because pairwise master key (PMK) cache information cannot be distributed.

Power Supplies and PoE Support

Q. What is the power supply configuration on the Cisco Catalyst 3650?

A. The Cisco Catalyst 3650 supports dual front-end AC/DC power supplies with load sharing and redundancy.

Q. Are Cisco Catalyst 3650 power supplies field replaceable?

A. Yes, all power supplies units on the Cisco Catalyst 3650 are FRUs.

Q. Does the Cisco Catalyst 3650 have XPS support?

A. No, the Cisco Catalyst 3650 does not support XPS. For power redundancy, a secondary power supply should be used.

Q. What different power supply capacity options are available for the Cisco Catalyst 3650?

A. Four power supply options are available for use in the Cisco Catalyst 3650, as shown in Table 5. Refer to Cisco Catalyst 3650 data sheet for details.

Table 5. Power Supply Options for Cisco Catalyst 3650

Part Number	Description
PWR-C2-250WAC	FRU power supply for all non-PoE Cisco Catalyst 3650 switches, provides 250W AC of power
PWR-C2-640WAC	FRU power supply for all 390W PoE+ Cisco Catalyst 3650 switches, provides 640W AC of power
PWR-C2-640WDC	FRU power supply for all 390W PoE+ Cisco Catalyst 3650 switches, provides 640W DC of power
PWR-C2-1025WAC	FRU power supply for all 775W PoE+ Cisco Catalyst 3650 switches, provides 1025W AC of power

Q. Does the Cisco Catalyst 3650 switch need two power supplies to run?

A. No. The Cisco Catalyst 3650 switches support two field-replaceable power supplies to provide redundancy. The power supplies are in shared mode.

Q. Are Cisco Catalyst 3850 power supplies swappable with the Cisco Catalyst 3650?

A. No. Because of differences in form factor and power capacities, the Cisco Catalyst 3850 power supplies cannot be used on Cisco Catalyst 3650 switches.

Q. In Cisco Catalyst 3650 switches, are the power supplies in shared mode or standby mode?

A. When both the power supplies are present in Cisco Catalyst 3650 switches, the power supplies work in shared mode. Power is drawn from both the power supplies.

Q. Can the power supplies in Cisco Catalyst 3650 switches be mixed?

A. The two power supplies in a Cisco Catalyst 3650 switch can be a mix and match of AC/DC power supplies and can be of different capacities. For example, you can combine a 250W AC power supply (the default for a data-only switch) with a 640W or 1025W AC power supply (the default in a full PoE switch) or with a 640W DC power supply.

Q. What are the default power supplies (shipped with the unit) for the different Cisco Catalyst 3650 switch models?

A. Table 6 shows the default power supplies for the different Cisco Catalyst 3650 switch models.

Table 6. Default Power Supplies with Cisco Catalyst 3650 Models

Models	Default Power Supply	Available PoE Power
24-port data switch	PWR-C2-250WAC	-
48-port data switch		

Models	Default Power Supply	Available PoE Power
24-port PoE switch	PWR-C2-640WAC	390W
48-port PoE switch		
48-port full PoE switch	PWR-C2-1025WAC	775W

Q. Why would you mix a DC power supply with an AC power supply?

A. You can power up the AC power supply using the standard AC power source available and then power up the DC power supply using an uninterruptible power supply (UPS) system in the lab or data center.

Q. Can a non-PoE Cisco Catalyst 3650 switch support PoE by replacing its power supply with a PoE-capable power supply?

A. No. A non-PoE Cisco Catalyst 3650 switch will not support PoE by using a PoE-capable power supply.

Q. Can the PoE budget of Cisco Catalyst 3650 switch be increased by replacing its power supply with a high-capacity power supply?

A. Yes, the available PoE budget of a Cisco Catalyst 3650 PoE switch can be increased by either replacing its power supply with a higher capacity one or adding a second PoE power supply model (640W or 1025W).

Q. Do the PoE power supplies (640W and 1025W) contribute their full capacity to the switches' PoE budget?

A. No. Only a part of the rated capacity of these power supplies contributes to the PoE budget. For example, the addition of 1025W as the secondary supply on a Cisco Catalyst 3650 PoE switch will result in an overall PoE budget increase of 775W. The remaining 250W of power is still reserved for the system even in the case of redundant power supply units. This is notably different from Cisco Catalyst 3850 switches.

Q. What is the available PoE budget with the different power supply combinations?

A. Table 7 shows the available PoE budget with different power supply combinations.

Table 7.   PoE Budgets for Cisco Catalyst 3650

Power Supply Combination	Available PoE Budget	Cisco Catalyst 3650
640W supply	390W	24 ports PoE
1025W supply	775W	48 ports PoE
640W and 640W supply or 1025W supply	780W	24 ports PoE+
1025W and 1025W supply	1550W	48 ports PoE+
640W and 1025W supply	1165W	24 ports PoE+

Q. Can the 250W front-end power supply be used to increase the PoE budget of a Cisco Catalyst 3650 PoE switch?

A. A 250W power supply unit cannot be used to increase the PoE budget of the switch, because it does not provide any PoE power. It is intended to be used in a data-only switch (non-PoE switch). This behavior will change in the future.

Q. What happens when the 250W power supply is added to a Cisco Catalyst 3650 PoE switch?

A. The Cisco Catalyst 3650 PoE switch software will log an error message indicating that the 250W FEP is incompatible and will disable the 250W FEP unit. This restriction will be removed in a future release.

Q. Does the Cisco Catalyst 3650 require a reboot upon change or addition of a power supply unit?

A. In the Cisco Catalyst 3650 dual power supply system, one power supply can be removed and replaced without rebooting the switch.

Q. What happens when a power supply fails on the Cisco Catalyst 3650?

A. The power supplies support A + B load sharing, meaning that total available power equals supply A power + supply B power. When a power supply fails, full power redundancy is supported when total used power is equal to or less than the smaller power supply. Otherwise, hardware will automatically shed PoE power on low-priority ports when total used PoE power exceeds the supply capability.

Q. Why are high-priority ports needed?

A. Configuring some ports on the Cisco Catalyst 3650 switch with high priority makes sure of continuity in the PoE provided to devices on these ports in the event of PoE power shed triggered by power supply failure or removal in a dual supply configuration.

Q. How many ports on the Cisco Catalyst 3650 switch can be configured with high priority?

A. A maximum of 12 ports can be configured with high priority on a Cisco Catalyst 3650 PoE switch.

Q. Do I need to populate all of the power supply slots in my switch?

A. No. The Cisco Catalyst 3650 switches provide two slots for the use of redundant power supplies, but only one supply is needed to run a single switch unless full PoE+ is deployed on a 48-port switch.

Q. Does it matter which power supply slot is used in a single power supply deployment?

A. No. It does not matter which slot is used in a single power supply deployment.

Q. Can the switch operate with one power supply module slot empty?

A. It is not recommended to operate the Cisco Catalyst 3650 with one power module slot empty. For proper chassis cooling, both power supply module slots must be populated, with either a power supply or a blank cover.

Q. Do the Cisco Catalyst 3650 power supplies have field-replaceable fans?

A. No. Cisco Catalyst 3650 power supplies have integrated fans that are not field-replaceable.

Cisco IOS-XE Software

Q. What is the base software architecture of the Cisco Catalyst 3650 switch?

A. The Cisco Catalyst 3650 Series Switches are developed based on advanced and next-generation Cisco IOS-XE Software. The Cisco IOS-XE Software is installed as a hosted core software service over Linux kernel infrastructure.

Q. What are the primary cost benefits of Cisco IOS-XE Software?

A. The next-generation Cisco IOS-XE Software helps lower the total cost of ownership of many Cisco solutions by offering enhanced services integration for enhanced functionality within the network.

Q. What are the primary technical benefits of Cisco IOS-XE Software?

A. Cisco IOS-XE Software increases scalability and performance by using Linux capabilities by utilizing system resources such as multiple CPU cores, control-plane and data-plane separation, and hardware-layer abstraction.

Q. What type of integrated application is supported on Cisco Catalyst 3650 Series Switches?

A. The Cisco Catalyst 3650 powered with Cisco IOS-XE Software is designed to deliver converged wired and wireless network infrastructure. The WCM is a hosted application over a Linux kernel that enables coexistence and giving a single operational user experience with single Cisco IOS Software to manage wired and wireless infrastructure in a single system.

Q. How is the Cisco IOS-XE Software architecture structured?

A. The framework of next-generation Cisco IOS-XE Software is internally distributed into major subcomponents. To design a scalable software architecture, each Cisco IOS-XE Software subcomponent handles unique tasks such as core applications (Cisco IOSd Software), integrated applications (WCM, Wireshark, and so on), Common Management Interface (syslog, HTTP, and so on), distributed forwarding manager, and so on.

Q. Does an integrated WCM needs its own Cisco IOSd Software service instance?

A. No. The Cisco IOSd Software is a centralized core application that delivers rich technologies and provides shared services to hosted applications such as WCM and to other infrastructure such as Common Management Interface.

Q. What are the high-availability (HA) states of Cisco IOSd Software running on the different switches in a stack?

A. The state of Cisco IOSd Software on each system is unique:

- **Active:** This Cisco IOSd Software is fully operational on the active switch. All management planes, Layer 2/3 control planes, and integrated WCMs function from this system.

- **Hot standby:** The Cisco IOSd Software is in hot standby state on the standby switch. To enable 1+1 stateful redundancy, the active switch synchronizes the network protocol state machines, wireless CAPWAP tunnel states, and so on in real time.

- **Cold:** All primary software components remain in cold state on member or line-card stack switches. The Cisco IOSd Software, management, and hosted applications remain in active state and are fully programmed for wire-speed distributed switching performance.

Q. What is the software code version on a Cisco Catalyst 3650 switch?

A. The software code version on a Cisco Catalyst 3650 is Cisco IOS-XE Software 3.3.0SE.

Q. What are the primary features introduced with the new Cisco IOS-XE Software 3.3.0SE on the Cisco Catalyst 3650 switch?

A. Refer to release notes for Cisco IOS-XE Software 3.3.0SE. For more details, refer to the Cisco Feature Navigator.

Q. Can the Cisco Catalyst 3650 be upgraded with only the controller software?

A. The Cisco Catalyst 3650 has a single Cisco IOS Software image that has wired and wireless capabilities built in. The wireless controller software cannot be upgraded separately.

Q. Is there a separate wireless configuration wizard on the Cisco Catalyst 3650?

A. Yes, there is a separate wireless configuration wizard on the Cisco Catalyst 3650. The configuration wizard is accessed using the Configuration -> Wizard option on the web user interface. It allows you to configure user details, management interface, and so on.

Q. Which models of access points can a Cisco Catalyst 3650 switch support?

A. The following models of access points are supported: LAP1040, LAP1142, LAP1260, CAP3500, CAP3600, CAP2600, and AP1600. This changes over time as new access point models are added. Review the release notes for 3650 Cisco IOS Software releases to determine support for new access point models.

Q. In what modes can an access point operate when connected to a Cisco Catalyst 3650?

A. The following access point modes are supported on the Cisco Catalyst 3650:

- Local mode

- SE connect mode

- Monitor mode

- Sniffer mode

Flex mode and indoor mesh access points are not supported.

Q. Does the Cisco Catalyst 3650 support indirectly connected access points?

A. No. The Cisco Catalyst 3650 switch will always terminate the CAPWAP tunnel locally. Pass-through mode or indirectly connected access point is not supported at this time.

Q. In what wireless modes can the Cisco Catalyst 3650 operate?

A. The Cisco Catalyst 3650 Series Switch supports two modes of operation. It can be operated as a mobility agent or mobility controller.

Mobility

Q. What is a mobility agent?

A. A mobility agent is an access switch such as a Cisco Catalyst 3650 with a wireless module running on it. A mobility agent terminates CAPWAP tunnels of directly connected access points and maintains the client mobility state machine. The mobility agent functionality requires an IP Base- or IP Services-capable image license.

Q. What is a mobility controller?

A. A mobility controller is a switch providing mobility management services for group roaming events. The mobility controller provides a central point of contact for management and policy-based control protocols. In mobility controller mode, the mobility agent capabilities are inherited. The mobility controller functionality requires an IP Base or IP Services image license with necessary access point count licenses.

Q. What is a switch peer group (SPG)?

A. A switch peer group is the list of statically configured neighboring mobility agent switches. They are logical constructs that can be formed across Layer 2 or Layer 3 boundaries. SPGs are designed to constrain roaming traffic to a smaller area and optimize roaming capabilities and performance. Roamed traffic within an SPG moves directly between the mobility agents in that SPG. Roamed traffic between SPGs moves using the mobility controllers servicing those SPGs.

Q. What is a mobility group?

A. A mobility group is the grouping of a mobility controller and related devices to enable fast roaming, radio frequency management, and so on.

Q. What is a mobility domain?

A. A mobility domain is the entire set of wireless devices across which roaming is supported.

Q. What are the scalability numbers for new converged access architecture?

A. Table 8 provides scalability information.

Table 8. Scalability Numbers with Cisco 3650 as Mobility Controller

Scalability	3650 as MC	3850 as MC	5760	5508	WiSM2
Max number of mobility controllers in mobility domain	8	8	72	72	72
Max number of mobility controllers in mobility group	8	8	24	24	24
Max number of mobility agents in subdomain (per mobility controller)	16	16	350	350	350
Max number of SPGs in subdomain (per mobility controller)	8	8	24	24	24
Max number of MAs in an SPG	16	16	64	64	64

Q. How is Layer 3 roaming enabled in a distributed architecture?

A. The data is tunneled back to the switch where the IP address lives (the anchor switch).

Q. Are 5508 and WiSM2 supported as part of the converged access deployment mode?

A. Yes. The 5508 and WiSM2 with 7.3MR1 or 7.5 (and higher) can operate as mobility controllers with the Cisco Catalyst 3650.

Q. What type of HA functionality is supported by the Cisco Catalyst 3650 switch stack?

A. The Cisco Catalyst 3650 switch stack supports transparent access point failover with access point SSO functionality. Client SSO will be added at a later time.

Q. What is the difference between the new Cisco Catalyst 3650 and legacy Cisco Catalyst 3750G-WS Series Switch with integrated controller?

A. The 3750G-WS has separate control and data planes for wired and wireless functionality. The Cisco IOS-XE architecture enables converged wired and wireless in the next-generation Cisco Catalyst 3650 switch. The new converged access delivers a single OS, system operation, and management for wired and wireless users. Both wired and wireless features can be configured and monitored using a single console.