

Cisco Catalyst 3750-X and 3560-X Series Switches

Q. What are the Cisco Catalyst 3750-X and 3560-X Series Switches?

A. The Cisco® stackable Catalyst® 3750-X and standalone 3560-X Series Switches are enterprise-class wiring closet switches that facilitate the deployment of highly secure converged applications while maximizing investment protection for evolving network and application requirements. Combining 10/100/1000 and Power over Ethernet Plus (PoE+) or GE SFP configurations with four optional uplinks, the Cisco Catalyst 3750-X and 3560-X Series Switches enhance worker productivity by enabling applications such as encryption, IP telephony, wireless, and video.

The Cisco Catalyst 3750-X and 3560-X Series Switches are built on the existing Cisco Catalyst 3750-E and 3560-E Series Switches, using the same port application-specific integrated circuit (ASIC), switch fabric, and Cisco IOS® Software feature sets.

Q. What is new in the Cisco Catalyst 3750-X and 3560-X Series Switches?

A. The Cisco Catalyst X-Series switches build on the E-Series switches and add the following features:

- Cisco StackPower™ technology, available only on the Cisco Catalyst 3750-X, manages power very efficiently by aggregating and sharing power supplies across a stack of switches. It also supports a feature known as Zero-Footprint RPS.
- Four field-replaceable network modules that provide 4 x 1 Gigabit and 2 x 10 Gigabit uplink interfaces for the switch.
- Full 802.3at PoE+ support provides 30W per port on all 48 ports in a single rack unit (RU) switch.
- New LAN Base feature set offers comprehensive Layer 2 functionality.
- Dual redundant power supplies and fans: Four high-efficiency power supply options are available, including a DC power supply for PoE applications. Two redundant, field-replaceable fan modules are also included.
- MACsec provides hardware-based encryption (802.1ae) at line rate on all 48 ports (requires IP Base). Includes MACsec Key Agreement (MKA) (included in Dot1X-rev).
- Open Shortest Path First (OSPF) for routed access in IP Base image.

Q. What Cisco IOS Software feature set do the Cisco Catalyst 3750-X and 3560-X Series Switches support?

A. The Cisco Catalyst 3750-X and 3560-X Series Switches come with a universal image and support the standard IP Base and IP Services feature sets, in addition to the new LAN Base feature set. The GE SFP switch models are available with either IP Base or IP Services feature set.

Q. What is the difference between the Cisco IOS Software feature sets?

A. Table 1 shows the differences between Cisco IOS Software Feature Sets.

Table 1. Cisco IOS Software Feature Set Differences

Functions	LAN Base	IP Base	IP Services
Layer 2+	Enterprise access Layer 2 Wide range of Layer 2 access features for enterprise deployments Supports Cisco StackPower™ technology (Cisco Catalyst 3750-X). Please note that for LAN Base Cisco StackPower is only supported starting 15.0.(2)SE software release and the cables need to be purchased separately	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 SVI	Enterprise access Layer 3 RIP, static and stub PIM, and EIGRP stub OSPF for routed access	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 EEM, Gold-Lite and Smart Install Director	Complete access Layer 3
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, Cisco TrustSec® SXP, and IEEE 802.1AE (Cisco Catalyst 3560-X and Cisco 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 Cisco Catalyst 3000 QoS features, including per-VLAN policies	

Q. What Cisco Catalyst 3750-X and 3560-X Series models are available?

A. Table 2 shows the SKUs that have been created for the LAN Base and IP Base and IP Services models. All switch models are shipped from the factory with the proper feature set license installed.

Table 2. Cisco Catalyst 3750-X and 3560-X Series Models

Switch Type	Feature Set	Models	Port Type and Density	Default Power Supply
Stackable	LAN Base	WS-C3750X-24T-L	24 Ethernet 10/100/1000 ports	350W AC
		WS-C3750X-48T-L	48 Ethernet 10/100/1000 ports	
		WS-C3750X-24P-L	24 Ethernet 10/100/1000 PoE+ ports	715W AC
		WS-C3750X-48P-L	48 Ethernet 10/100/1000 PoE+ ports	
		WS-C3750X-48PF-L	48 Ethernet 10/100/1000 PoE+ ports	1100W AC
		IP Base	WS-C3750X-24T-S	24 Ethernet 10/100/1000 ports
	WS-C3750X-48T-S		48 Ethernet 10/100/1000 ports	
	WS-C3750X-12S-S		12 GE SFP Ethernet ports	
	WS-C3750X-24S-S		24 GE SFP Ethernet ports	
	WS-C3750X-24P-S		24 Ethernet 10/100/1000 PoE+ ports	715W AC
	WS-C3750X-48P-S		48 Ethernet 10/100/1000 PoE+ ports	
	WS-C3750X-48PF-S		48 Ethernet 10/100/1000	
			48 Ethernet 10/100/1000	

Switch Type	Feature Set	Models	Port Type and Density	Default Power Supply
			PoE+ ports	
	IP Services	WS-C3750X-24T-E	24 Ethernet 10/100/1000 ports	350W AC
		WS-C3750X-48T-E	48 Ethernet 10/100/1000 ports	
		WS-C3750X-24P-E	24 Ethernet 10/100/1000 PoE+ ports	715W AC
		WS-C3750X-48P-E	48 Ethernet 10/100/1000 PoE+ ports	
		WS-C3750X-48PF-E	48 Ethernet 10/100/1000 PoE+ ports	1100W AC
		WS-C3750X-12S-E	12 GE SFP Ethernet ports	350W AC
		WS-C3750X-24S-E	24 GE SFP Ethernet	
Standalone	LAN Base	WS-C3560X-24T-L	24 Ethernet 10/100/1000 ports	350W AC
		WS-C3560X-48T-L	48 Ethernet 10/100/1000 ports	
		WS-C3560X-24P-L	24 Ethernet 10/100/1000 PoE+ ports	715W AC
		WS-C3560X-48P-L	48 Ethernet 10/100/1000 PoE+ ports	
		WS-C3560X-48PF-L	48 Ethernet 10/100/1000 PoE+ ports	1100W AC
	IP Base	WS-C3560X-24T-S	24 Ethernet 10/100/1000 ports	350W AC
		WS-C3560X-48T-S	48 Ethernet 10/100/1000 ports	
		WS-C3560X-24P-S	24 Ethernet 10/100/1000 PoE+ ports	715W AC
		WS-C3560X-48P-S	48 Ethernet 10/100/1000 PoE+ ports	
		WS-C3560X-48PF-S	48 Ethernet 10/100/1000 PoE+ ports	1100W AC
	IP Services	WS-C3560X-24T-E	24 Ethernet 10/100/1000 ports	350W AC
		WS-C3560X-48T-E	48 Ethernet 10/100/1000 ports	
		WS-C3560X-24P-E	24 Ethernet 10/100/1000 PoE+ ports	715W AC
		WS-C3560X-48P-E	48 Ethernet 10/100/1000 PoE+ ports	
		WS-C3560X-48PF-E	48 Ethernet 10/100/1000 PoE+ ports	1100W AC

- Q.** What is the difference between the Cisco Catalyst 3750-X and 3560-X Series LAN Base and IP Base models?
- A.** The LAN Base feature set enables comprehensive Layer 2 functionality and supports Cisco StackPower, (available only on the Catalyst 3750-X), while the IP Base feature set provides more advanced features such as MACsec, protocol-independent multicast (PIM) stub, Enhanced Interior Gateway Routing Protocol (EIGRP) stub, and full Open Shortest Path First (OSPF) routing. Please note that for LAN Base Cisco StackPower is only supported starting 15.0.(2)SE software release and the cables need to be purchased separately.

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- Q.** Is static IP routing supported in the LAN Base feature set?
- A.** Yes. LAN Base supports static IP routing.
- Q.** Does the LAN Base feature set support Cisco StackPower technology on the Cisco Catalyst 3750-X Series Switches?
- A.** Yes. Cisco StackPower is supported on LAN Base. Please note that for LAN Base Cisco StackPower is only supported starting 15.0.(2)SE software release and the cables need to be purchased separately.
- Q.** Does the LAN Base feature set support MACsec on the Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** No. IP Base is the minimum required to support MACsec.
- Q.** Are mixed stacks supported?
- A.** It depends. The Cisco StackWise and StackWise Plus solutions are flexible enough to allow you to:
- Stack any Cisco Catalyst 3750 switch in the same stack (hardware mixed stack)
 - Stack any Cisco IOS Software feature set in the same stack (software mixed stack)
- One exception is the new LAN Base models being introduced with the Cisco Catalyst 3750-X Series, which can stack only with other Catalyst 3750-X LAN Base models.
- Q.** Can a Cisco Catalyst 3750-X Series Switch with LAN Base software be used in any Cisco Catalyst 3750 stack?
- A.** No. LAN Base models can stack only with other LAN Base models.
- Q.** Can a Cisco Catalyst 3750-X LAN Base switch be upgraded to IP Base and stacked with any Cisco Catalyst 3000 switch?
- A.** Yes. Once a Cisco Catalyst 3750-X LAN Base switch is upgraded to IP Base or IP Services, it can be stacked with any non-LAN Base switch or stack.
- Q.** Can a Cisco Catalyst 3750-X SFP IP Base switch be upgraded to IP Services?
- A.** Yes. A Cisco Catalyst 3750-X SFP IP Base switch can be upgraded to IP Services.
- Q.** Are X2 modules supported on the Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** No. These new switches support Small Form-Factor Pluggable (SFP) and SFP+ modules only.
- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series Switches support Cisco EnergyWise?
- A.** Yes. EnergyWise is a Cisco solution for power management across an entire enterprise, which enables the network to control, report, and monitor the power use.

The Cisco Catalyst 3750-X and 3560-X Series Switches have instrumentation built in for enhanced EnergyWise support. The power supplies, along with the system board, have the instrumentation to monitor and report detailed power characteristics from the system, such as input/output power, voltage, and current.

- Q.** How do the Cisco Catalyst 3750-X and 3560-X Series Switches compare to the rest of the Cisco Catalyst 3000 switches?
- A.** Table 3 shows a comparison of the various Cisco Catalyst 3750 and 3560 switch models.

Table 3. Comparison of the Cisco Catalyst 3750 and 3560 Switches

Feature	Cisco Catalyst 3750-X and 3560-X	Cisco Catalyst 3750-E and 3560-E	Cisco Catalyst 3750G and 3560G
FRU Network Module	Yes	No	No
Redundant PS	Yes	No	No
FRU Power Supplies	Yes, Dual PS	Yes	No
Encryption	Yes (Downlink)	No	No
PoE+ 30W/port	Yes	No	No
Management Options	Console RJ45, USB console, and Out of band Ethernet	Console RJ45, and Out of band Ethernet	Console RJ45
StackPower	Yes (only on 3750-X)	No	No
RPS/XPS	XPS	RPS	RPS
Zero-Footprint RPS	Yes	No	No
EnergyWise	Monitor, report actual power use System & PoE	Monitor actual power use	Monitor budgeted power

Switch Architecture

This section addresses how the X-Series switches differ from the E-Series switches.

- Q.** What are the differences between the Cisco Catalyst 3750-X and 3560-X and the rest of the Cisco Catalyst 3000 switches?
- A.** The Cisco Catalyst 3750-X and 3560-X are line rate nonblocking switches that are identical to the Cisco Catalyst 3750-E and 3560-E Series with the following added features:
- Cisco StackPower technology: Aggregates and shares power supplies in a stack and supports a zero-footprint redundant power supply. Available only on the Catalyst 3750-X.
 - Network modules: Field-replaceable uplink, 1 Gigabit and 10 Gigabit versions.
 - Full 802.3at PoE+: Supports 30W per port on all 48 ports in a single RU switch.
 - Three software feature sets: LAN Base, IP Base, and IP Services.
 - Dual redundant power supplies and fans: Four power supply options, including a DC power supply for PoE.
 - MACsec: Hardware-based encryption (802.1ae). Includes MACsec Key Agreement (MKA) (included in Dot1X-rev).
- Q.** What management ports are available?
- A.** The Cisco Catalyst 3750-X and 3560-X Series provide two types of console ports and one OOB Ethernet port:
- USB Type B console port
 - Standard RJ-45 serial port
 - 10/100 Ethernet management port
- 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. This was a tradeoff between console speed sensing and the ability to use the USB console.
- Q.** Which management port has priority?
- A.** The RJ-45 console port is always the default management port, but when a PC is connected to the USB console port, the USB console takes over. The RJ-45 port continues to receive the output (a copy) of everything that gets displayed on the USB console port. This capability allows remote administrators to continue monitoring or logging the output showing what is happening at the switch location, sending it to a storage device.
- Q.** When a PC is left unattended on the USB console port, would remote administrators get locked out from the RJ-45 management port?
- A.** The USB console port has a default activity timer that can also be programmed by the user. This activity timer will expire and return control to the RJ-45 management port to avoid locking the remote administrator out.
- Q.** What can I do with the USB Type A port in the back of the Cisco Catalyst 3750-X and 3560-X Series?
- A.** It is additional storage. This USB port can be used to perform software upgrades, store configurations, and even write memory core dumps for troubleshooting purposes. All Cisco USB memory drives can be used (currently up to 1-GB USB drives are available).
- Q.** What USB flash types can be used on the Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** All available Cisco USB flash memory devices can be used. Table 4 lists the available devices.

Table 4. Cisco USB Flash Memory Devices

Product ID	Description
MEMUSB-64FT	64MB USB Flash Token
MEMUSB-128FT	128MB USB Flash Token
MEMUSB-256FT	256MB USB Flash Token
MEMUSB-1024FT	1GV USB Flash Token

- Q.** Can uplink port types be combined in a Cisco Catalyst 3750-X and 3560-X Series Switch or stack?
- A.** Yes. The Cisco Catalyst 3750-X Series and 3560-X Series Switches support four optional network modules for uplink ports. The default switch configuration doesn't include the uplink module.

The four network modules can be used in any of the combinations shown in Table 5.

Table 5. Uplink Ports on the 10 Gigabit Network Module

Network Module	Interface Options	
	10GbE SFP+ Ports	GbE SFP Ports
1GbE	0	4
10GbE Network Module	2	0
	0	4
	1	2
10GB-T	2 (RJ-45)	0
Service Module	2	0
	1	1
	0	2

Either one of these network modules can be installed via online insertion and removal (OIR) in any of these new switches.

In a stack of Cisco Catalyst 3750-X switches, each switch in the stack can deploy any of the network modules or no network module at all.

- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series Switches have feature parity with the existing Cisco Catalyst 3000 switches?
- A.** Yes. The Cisco Catalyst 3750-X and 3560-X Series have all the features of the Cisco Catalyst 3750-E and 3560-E series respectively, and will have feature parity with existing respective Cisco Catalyst 3000 switches. All Cisco Catalyst 3000 switches run the same Cisco IOS Software train, which provides maximum compatibility.
- Q.** What is the performance of the Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** The Cisco Catalyst 3750-X and 3560-X Series have a nonblocking switching architecture capable of forwarding traffic for all 48 1 Gigabit ports plus 2 10 Gigabit ports at line rate. See the datasheet for the MPPS information for each model.
- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series Switches consume less power than the Cisco Catalyst E-Series switches?
- A.** The Cisco Catalyst 3750-X and 3560-X Series are based on the same building blocks as the E-Series switches, in terms of port ASIC, switch fabric, and most components. However, these switches have a new thermal design, new highly efficient power supplies, and new efficient fans, which use less power. At the same time, newer components have added new capabilities that require additional power; therefore, the savings in power consumption were used to power the new capabilities. The Cisco Catalyst 3750-X and 3560-X Series consume the same power as the Cisco Catalyst 3750-E and 3560-E Series and provide more functionality.
- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series Switches support front to back airflow?
- A.** The airflow on the Cisco Catalyst 3750-X and 3560-X Series is "front and sides" to back airflow.
- Q.** Is the airflow reversible in the Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** No. The airflow is not reversible.
- Q.** Can the Cisco Catalyst 3750-X and 3560-X Series Switches run with only one fan module?
- A.** Yes. The Cisco Catalyst 3750-X and 3560-X Series have two fan modules that are serviceable from the back of the switch. The switches' thermal design requires the air volume of three fans (each fan module has two fans inside) for the worst case scenario; hence, removing one fan module puts the switch at risk of overheating. Nonetheless, the fan module can be serviced provided that the switch does not run for long periods of time under extreme conditions with a single fan module.
- Q.** Do I need two power supplies to run a Cisco Catalyst 3750-X or 3560-X Series Switch?
- A.** No. The Cisco Catalyst 3750-X and 3560-X Series Switches support two field-replaceable power supplies to provide redundancy. The second power supply might be required in cases in which deployment of full PoE+ on all 48 ports is needed. Four power supply options are available for use in the Cisco Catalyst 3750-X and 3560-X Series, as shown in Table 6.

Table 6. Power Supply Options for the Cisco Catalyst 3750-X and 3560-X Series Switches

Product ID	Description
C3KX-PWR-350WAC	350W AC power supply
C3KX-PWR-715WAC	715W AC power supply
C3KX-PWR-1100WAC	1100W AC power supply
C3KX-PWR-440WDC	440W DC power supply

Q. What SFP+ transceivers are supported?

A. Table 7 shows the SFP+ transceivers supported by Cisco Catalyst 3750-X and 3560-X Series Switches.

Table 7. Supported SFP+ Transceivers for Cisco Catalyst 3750-X and 3560-X Series Switches

SFP+ Transceivers for Cisco Catalyst 3750-X and 3560-X Series	
Product ID	Description
SFP-10G-LR=	10GBASE-LR SFP+ module
SFP-10G-SR=	10GBASE-SR SFP+ module
SFP-10G-LRM=	10GBASE-LRM SFP+ module
SFP-H10GB-CU1M=	10GBASE-CX1 SFP module
SFP-H10GB-CU3M=	10GBASE-CX3 SFP module
SFP-H10GB-CU5M=	10GBASE-CX5 SFP module

Q. What SFP transceivers are supported?

A. See datasheet for full list. Table 8 shows the SFP transceivers supported by Cisco Catalyst 3750-X and 3560-X Series Switches. Please refer to the following URL for a full list of supported SFP:

http://www.cisco.com/en/US/products/hw/modules/ps5455/products_device_support_tables_list.html

Table 8. Supported SFP Transceivers for Cisco Catalyst 3750-X and 3560-X Series Switches

SFP Transceivers for Cisco Catalyst 3750-X and 3560-X Series	
Product ID	Description
GLC-GE-100FX=	100BASE-FX SFP on Gigabit Ethernet SFP ports for LAN switches1
GLC-LH-SM=	Gigabit Ethernet SFP, LC connector LX/LH transceiver
GLC-SX-MM=	Gigabit Ethernet SFP, LC connector SX transceiver
GLC-T=	1000BASE-T SFP transceiver module for copper connections
GLC-ZX-SM=	1000BASE-ZX SFP
GLC-BX-D=	1000BASE-BX SFP, 1490 nm
GLC-BX-U=	1000BASE-BX SFP, 1310 nm
CWDM-SFP-1470=	Coarse wavelength-division multiplexing (CWDM) 1470 nm SFP Gigabit Ethernet and 1G/2G Fibre Channel (FC)
CWDM-SFP-1490=	CWDM 1490 nm SFP Gigabit Ethernet and 1G/2G FC
CWDM-SFP-1510=	CWDM 1510 nm SFP Gigabit Ethernet and 1G/2G FC
CWDM-SFP-1530=	CWDM 1530 nm SFP Gigabit Ethernet and 1G/2G FC
CWDM-SFP-1550=	CWDM 1550 nm SFP Gigabit Ethernet and 1G/2G FC
CWDM-SFP-1570=	CWDM 1570 nm SFP Gigabit Ethernet and 1G/2G FC
CWDM-SFP-1590=	CWDM 1590 nm SFP Gigabit Ethernet and 1G/2G FC
CWDM-SFP-1610=	CWDM 1610 nm SFP Gigabit Ethernet and 1G/2G FC
SFP-GE-S=	1000BASE-SX SFP module for MMF, 850 nm (DOM)2
SFP-GE-L=	1000BASE-LX/LH SFP module for SMF, 1300 nm (DOM)2

SFP Transceivers for Cisco Catalyst 3750-X and 3560-X Series	
DWDM-SFP-3033=	Dense wavelength-division multiplexing (DWDM) SFP 1530.33 nm SFP (100 GHz ITU grid)
DWDM-SFP-3112=	DWDM SFP 1531.12 nm SFP (100 GHz ITU grid)
DWDM-SFP-3190=	DWDM SFP 1531.90 nm SFP (100 GHz ITU grid)
DWDM-SFP-3268=	DWDM SFP 1532.68 nm SFP (100 GHz ITU grid)
DWDM-SFP-3346=	DWDM SFP 1533.47 nm SFP (100 GHz ITU grid)
DWDM-SFP-3425=	DWDM SFP 1534.25 nm SFP (100 GHz ITU grid)
DWDM-SFP-3504=	DWDM SFP 1535.04 nm SFP (100 GHz ITU grid)
DWDM-SFP-3582=	DWDM SFP 1535.82 nm SFP (100 GHz ITU grid)
DWDM-SFP-3661=	DWDM SFP 1536.61 nm SFP (100 GHz ITU grid)
DWDM-SFP-3739=	DWDM SFP 1537.40 nm SFP (100 GHz ITU grid)
DWDM-SFP-3819=	DWDM SFP 1538.19 nm SFP (100 GHz ITU grid)
DWDM-SFP-3898=	DWDM SFP 1538.98 nm SFP (100 GHz ITU grid)
DWDM-SFP-3977=	DWDM SFP 1539.77 nm SFP (100 GHz ITU grid)
DWDM-SFP-4056=	DWDM SFP 1540.56 nm SFP (100 GHz ITU grid)
DWDM-SFP-4134=	DWDM SFP 1541.35 nm SFP (100 GHz ITU grid)
DWDM-SFP-4214=	DWDM SFP 1542.14 nm SFP (100 GHz ITU grid)
DWDM-SFP-4294=	DWDM SFP 1542.94 nm SFP (100 GHz ITU grid)
DWDM-SFP-4373=	DWDM SFP 1543.73 nm SFP (100 GHz ITU grid)
DWDM-SFP-4453=	DWDM SFP 1544.53 nm SFP (100 GHz ITU grid)
DWDM-SFP-4532=	DWDM SFP 1545.32 nm SFP (100 GHz ITU grid)
DWDM-SFP-4612=	DWDM SFP 1546.12 nm SFP (100 GHz ITU grid)
DWDM-SFP-4692=	DWDM SFP 1546.92 nm SFP (100 GHz ITU grid)
DWDM-SFP-4772=	DWDM SFP 1547.72 nm SFP (100 GHz ITU grid)
DWDM-SFP-4851=	DWDM SFP 1548.51 nm SFP (100 GHz ITU grid)
DWDM-SFP-4931=	DWDM SFP 1549.32 nm SFP (100 GHz ITU grid)
DWDM-SFP-5012=	DWDM SFP 1550.12 nm SFP (100 GHz ITU grid)
DWDM-SFP-5092=	DWDM SFP 1550.92 nm SFP (100 GHz ITU grid)
DWDM-SFP-5172=	DWDM SFP 1551.72 nm SFP (100 GHz ITU grid)
DWDM-SFP-5252=	DWDM SFP 1552.52 nm SFP (100 GHz ITU grid)
DWDM-SFP-5332=	DWDM SFP 1553.33 nm SFP (100 GHz ITU grid)
DWDM-SFP-5413=	DWDM SFP 1554.13 nm SFP (100 GHz ITU grid)
DWDM-SFP-5494=	DWDM SFP 1554.94 nm SFP (100 GHz ITU grid)
DWDM-SFP-5575=	DWDM SFP 1555.75 nm SFP (100 GHz ITU grid)
DWDM-SFP-5655=	DWDM SFP 1556.55 nm SFP (100 GHz ITU grid)
DWDM-SFP-5736=	DWDM SFP 1557.36 nm SFP (100 GHz ITU grid)
DWDM-SFP-5817=	DWDM SFP 1558.17 nm SFP (100 GHz ITU grid)
DWDM-SFP-5898=	DWDM SFP 1558.98 nm SFP (100 GHz ITU grid)
DWDM-SFP-5979=	DWDM SFP 1559.79 nm SFP (100 GHz ITU grid)
DWDM-SFP-6061=	DWDM SFP 1560.61 nm SFP (100 GHz ITU grid)
DWDM-SFP-6141=	DWDM SFP 1561.42 nm SFP (100 GHz ITU grid)

- Q.** Is local switching supported on the Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** Yes, local switching is performed only on the Cisco Catalyst 3750-X and 3560-X Series and E-Series switches. Even if there is a mixed hardware stack of X-Series and E-Series switches with classic Cisco Catalyst 3750 switches, the X-Series switches can still support local switching.

Cisco StackPower and StackWise Plus

This section explains the workings of the Cisco StackPower and StackWise Plus technologies. In addition, it compares StackWise and StackWise Plus. The Cisco Catalyst 3750-X and 3750-E Series Switches run StackWise Plus, while the Cisco Catalyst 3750v2 and 3750G switches run StackWise. None of the Cisco Catalyst 3560 switches support the Cisco StackPower, StackWise, nor StackWise Plus technologies.

- Q.** What is the Cisco StackWise technology?
- A.** Cisco StackWise is a technology that provides an innovative method for collectively using and extending the resources of a stack of Cisco Catalyst 3750 and 3750-X Series Switches. To the rest of the network, the stack appears to operate as a single switch. StackWise technology is optimized for Gigabit Ethernet deployment, bringing customers new levels of performance through the high-speed interconnect, resiliency through advanced failover mechanisms, and ease of use through automated configuration and a single management interface.

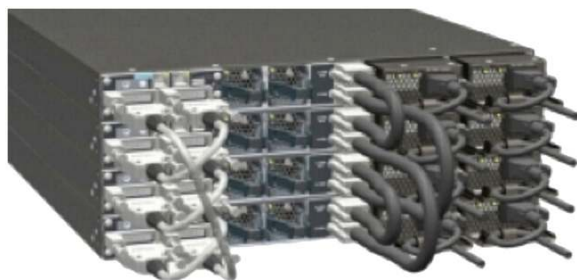
- Q.** What is the Cisco StackWise Plus technology?
- A.** The Cisco StackWise Plus technology is built on the highly successful StackWise technology. StackWise Plus provides an enhanced forwarding mechanism, provides a local switching capability, and adds destination stripping of unicast packets (unlike StackWise, which uses source stripping for all packets). StackWise Plus technology can support up to 468 Gigabit Ethernet ports in a stack or up to 18 10 Gigabit Ethernet ports in a stack.

- Q.** What is the maximum number of Cisco Catalyst 3750-X Series Switches that can make up one stack?
- A.** Up to nine Cisco Catalyst 3750-X switches can be stacked together.

- Q.** What is the Cisco StackPower technology?
- A.** Cisco StackPower is a new technology developed by Cisco to allow efficient use of available power in a stack. Cisco StackPower aggregates available power in a stack and shares the power where needed.

- Q.** How many Cisco Catalyst 3750-X Series Switches can make up a Cisco StackPower stack?
- A.** Up to four switches can become part of the same Cisco StackPower stack in a ring topology (Figure 1).

Figure 1. Cisco StackPower



By using an eXpandable Power System (XPS), you can build a larger Cisco StackPower stack consisting of nine Cisco Catalyst 3750-X Series Switches, using a star topology.

Q. Why is Cisco StackPower restricted to four switches?

A. It is limited by cable gauge and maximum current draw allowed.

Q. How many Cisco StackPower stacks can be built within one data stack?

A. In theory, one switch is a stack on its own in terms of Cisco StackWise. In terms of Cisco StackPower, one switch constitutes a StackPower stack of one switch.

The recommendation is to have Cisco StackPower stacks of four switch members to maximize the effect of power aggregation and redundancy.

Another option is to build three Cisco StackPower stacks of three each, for a total of nine switches, matching the maximum number of switch members in a Cisco StackWise stack (also known as a data stack).

Q. Can Cisco StackPower expand over two data stacks?

A. Technically yes, but this is not recommended.

One Cisco StackPower stack can expand across two data stacks, but doing so is neither recommended nor encouraged due to the complexity created in terms of managing power budgets that are monitored by one or both of the data stacks masters. Power budget and allocation information is passed to the data stack master, and when a Cisco StackPower stack spreads over two data stacks, both stack masters will receive information about power that is not consumed in their own stacks, creating confusion and unexpected power-shedding scenarios that would be difficult to troubleshoot.

Q. Is there a way to share power across all nine switches?

A. An XPS can connect up to nine switches and becomes the Cisco StackPower master by default; hence, it does not matter if all nine switches are part of one data stack or form many data stacks sharing the same StackPower stack. The power budget and allocation information is passed to the XPS as the StackPower master, and thus there is no chance of confusion among data stacks.

Q. What are the possible Cisco StackPower topologies?

A. The Cisco StackPower solution can be deployed in two ways. One is by connecting one switch to another in sequence, forming a closed physical ring of up to four switches; another is to attach up to nine switches to an XPS in a hub-and-spoke fashion.

Both topologies have advantages. The ring topology allows for more creative deployments, such as the Zero-Footprint RPS, which is a way to provide redundant power without adding another device to the rack, thus reducing the number of AC outlets required in a wiring closet.

Using an XPS has advantages as well. Up to nine switches can be protected with one power shelf, which reduces the number of power supplies as well as the number of outlets required in the wiring closet. This deployment can either support Cisco StackPower for up to nine Cisco Catalyst 3750-X Series Switches or provide redundant power for up to nine Cisco Catalyst 3560-X switches.

The Cisco StackPower solution can be used with stackable switches only and RPS functionality can be used with standalone switches only.

Q. What modes does the Cisco StackPower solution support?

A. The Cisco StackPower solution has the flexibility to support various deployments:

- Power-sharing mode
- Redundant mode
- RPS mode (with XPS only)

Power-sharing mode allows the stack to aggregate and share the entire amount of power available among all the switches in the stack. If needed, all power gets allocated until the entire power budget is depleted.

Redundant mode allows a customer to plan for potential power supply failures. When this mode is configured, Cisco StackPower sets aside an amount of power equal to the capacity of the largest power supply in the system, in case a power supply fails or the power source of that power supply fails. This mechanism is considered better than the mechanism of a traditional redundant power supply because there is no chance for a latent failure to occur during the power switch-over to the redundant power supply, since the redundant power is already online as part of the power available in the system. This is known as 1+N as opposed to 1:N redundancy.

RPS mode allows a customer to configure a one-to-one redundancy; that is, one specific power supply is designated to back up one specific system and nothing else. This mode is available only on the XPS.

Q. Is the Cisco StackPower solution supported on the Cisco Catalyst 3560-X Series Switches?

A. No. Although StackPower can be deployed in a ring or star topology using an XPS, it can be deployed only with Cisco Catalyst 3750-X Series Switches. The XPS can work only in RPS mode when deployed with Cisco Catalyst 3560-X switches.

Q. Can I build a Cisco StackPower stack with Cisco Catalyst 3560-X Series Switches?

A. No. The standalone switches do not have the capability to form a ring topology and share power. Cisco StackPower and StackWise Plus are features of the stackable switches.

Q. Can I share power on my Cisco Catalyst 3560-X Series Switches by using an XPS?

A. No. The Cisco Catalyst 3560-X switches do not have the capabilities to share power with the XPS or with another switch.

Q. What happens when a power supply fails in a power stack configured in Redundant mode?

A. The entire amount of reserved power is made available upon a power supply failure, without regard to which type or size of power supply failed.

Q. What is the "reserved" power?

A. When the Cisco StackPower solution is configured in redundant mode, it aggregates all of the power available in the stack (from all power supplies in the stack) and then subtracts an amount of power that it keeps in reserve. The amount of reserved power is determined by the size of the largest power supply in the stack. The remaining power is used to power up all of the switches and PoE devices similar.

This mechanism allows the stack to be resilient and withstand a single power supply failure, regardless of the type of power supply that fails. That is, the failed power supply could be 350W, 715W, 440W DC, or 1100W, and the system can protect against that failure because the "reserved" power is sized for the worse case.

Notice that no mechanism allows the stack to be resilient and withstand a single power supply failure, regardless of the type of power supply that fails. That is, the failed power supply could be 350W, 715W, 440W DC, or 1100W, and the system can protect against power supply is singled out or placed in reserved mode. All power supplies are online, and the StackPower solution works with the overall budget.

- Q.** Is the Cisco RPS 2300 compatible with the Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** No. Customers cannot use the older Cisco RPS 2300 with the new Cisco Catalyst 3750-X and 3560-X Series switches because the power supplies and the system design are not compatible.

With the Cisco Catalyst 3750-X and 3560-X Series, customers have the options to provide redundancy with dual power supplies, with the flexible features of Cisco StackPower, and with an XPS.

Cisco StackPower and all of the new power train enhancements require a new redundancy system that provides capabilities similar to those of Cisco StackPower in an XPS and a new set of high-efficiency power supplies. These new power supplies are different and provide different voltages; therefore, the existing Cisco RPS 2300 is not compatible with the requirements of the Cisco Catalyst 3750-X and 3560-X Series Switches or with the newer power supplies.

- Q.** Do I need to populate all of the power supply slots in my switch?
- A.** No. The Cisco Catalyst 3750-X and 3560-X Series 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. In that case, the power requirement is about 1700W, which is more than the 1100W provided by the largest available power supply. If the switch is deployed within a Cisco StackPower stack, a second power supply may not be needed if the stack has extra power to meet the requirements of this switch, though the power supply slot must be covered to maintain proper airflow.
- 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 if the switch is to remain in a standalone deployment. If the switch is deployed in a Cisco StackPower stack, it is recommended that you fill in slot A first on every switch in the stack before using any slot B in any switch of the stack.
- Q.** Do I need special cables for the Cisco StackPower solution?
- A.** Yes. Cisco StackPower has special keyed cables to be used to build the power stack.

Two cables are available, one for the XPS, which connects to a Cisco Catalyst 3750-X or 3560-X. The second cable is used to stack Cisco Catalyst 3750-X switches and build a StackPower stack ring. Notice that these cables are keyed so that they can fit only in their intended scenarios.

- Q.** What is the length of the Cisco StackPower cables?
- A.** There are two types of cables, StackPower cables and XPS cables. The StackPower cables come in two lengths, 30 cm and 150 cm. The XPS cables come in two lengths also, 58 cm and 150 cm. Table 9 gives the product IDs for these cables.

The reason for the cable length limitation is the amount of current that can be carried. Longer cables would have to be thicker, which would affect their flexibility. There is no plan for longer cables.

Table 9. Cisco StackPower and XPS Cables

Product ID	Description
CAB-SPWR-30CM	30-cm StackPower cable
CAB-SPWR-150CM	150-cm StackPower cable
CAB-XPS-58CM	Short XPS cable
CAB-XPS-150CM	Long XPS cable

- Q.** Can Cisco StackPower take power supplies offline automatically?
- A.** No. This feature is planned for the future. The command-line interface (CLI) to control the state of a power supply currently exists, but the switch would not automatically make that decision for a customer; more intelligence needs to be developed. Either EnergyWise or Cisco IOS Embedded Event Manager (EEM) are available to implement a policy to turn off redundant power supplies during off-hours.
- Q.** Can you mix power supplies in Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** Yes. You can mix the power supply types either in a standalone switch or in a stack. That is, you can combine a 350W AC power supply (the default for a data-only switch) with a 1100W AC power supply (the default in a full PoE switch) or with a 440W DC power supply.
- Q.** Why would you mix a DC power supply with an AC power supply?
- A.** You can power up the AC power supply via the standard AC power source available and then power up the DC power supply via an uninterruptible power supply (UPS) system in the lab or data center.
- Q.** Will there be a Cisco StackPower MIB?
- A.** Yes. The Cisco StackPower MIB objects are included in the StackWise MIB.
- Q.** Can you give priority to an important switch in the stack?
- A.** The Cisco StackPower solution assigns a default priority to the switches in a stack as well as to the ports (high or low) of every switch. The administrator has the ability to change and program these priorities.
- Q.** Is there a way to know the power-shedding priority of my stack?
- A.** Yes. A CLI is available to display the current set of priorities for the entire stack. See the command reference for "show stackpower".
- Q.** Can the Cisco StackPower solution boot up a switch that does not have a power supply?
- A.** Yes. By using the extra power capacity available in the stack, StackPower allows the system to supply power to a switch that does not have a power supply or that has a failed power supply.
- Q.** Can I power up a Cisco Catalyst 3560-X Series Switch through the Cisco StackPower solution?
- A.** No. Although the Cisco Catalyst 3560-X switches have connectors similar to the connectors on the Cisco Catalyst 3750-X switches, they do not support Cisco StackPower and cannot share power.
- Q.** What happens when I oversubscribe the power budget in my stack?
- A.** The Cisco Catalyst 3750-X and 3560-X Series Switches have an intelligent mechanism to shed power when the system goes into a negative power budget. This scenario can occur after a power failure or the offlining of a power supply in a stack. The stack will shed power starting with the lowest-priority powered devices (PDs) in the entire system, then the high-priority PDs, then the low-priority switches, and finally the high-priority switches until a balance is reached.

Once a power budget goes negative, Cisco IOS Software will send warning messages about the situation and the potential outage that a negative budget represents. Power shedding will initiate immediately if strict mode has been configured.

PoE Support (IEEE 802.3af, IEEE 802.3at and UPOE)

The following section discusses the PoE features available in the Cisco Catalyst 3750-X and 3560-X Series Switches, which include support for standard PoE and the new PoE+ standard.

- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series PoE switches support the IEEE 802.3af or 802.3at standards?
- A.** Both standards are supported; that is, the Cisco Catalyst 3750-X and 3560-X Series PoE switches can detect and support 802.3af and 802.3at PDs. Up to 30W per port on all 48 ports is possible. Full PoE+ (802.3at) requires 1.45kW of PoE power; therefore, more than one power supply is needed in a standalone switch. In the case of stackable switches, the Cisco StackPower solution allows the system to draw power from the stack and provide the power needed to support full PoE+ on all 48 ports. Additionally, the UPOE-capable 3750-X and 3560-X models can support up to 60 watts per port. UPOE-enabled ports can be used to deliver power for all current PoE/PoE+ solutions in addition to UPOE devices, including VDI clients, IP turrets for financial trading, personal Cisco TelePresence® systems, and more.
- Q.** Can the Cisco Catalyst 3750-X and 3560-X Series PoE switches detect Type 1 and Type 2 PDs?
- A.** The Cisco Catalyst 3750-X and 3560-X Series support both the PoE and PoE+ standards and can classify a PD as either Type 1 or 2 with a one-event classification. A Type 2 PD supports Class 4 in order to obtain more power than is supported by the legacy power levels (30W). A Type 1 PD can support only up to Class 3, or 15.4W.
- Q.** Can the Cisco Catalyst 3750-X and 3560-X Series PoE switches support two-event classification?
- A.** No. Two-event classification is specific to mid-spans that work a (Power supplying equipment) PSE. The Cisco Catalyst 3750-X and 3560-X Series support only one-event classification.
- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series PoE switches support power classification?
- A.** Yes, the Cisco Catalyst 3750-X and 3560-X Series Switches can optionally detect the PD power classification signature and budget the appropriate power. This reduces the maximum power that must be budgeted by the switch and provisioned in the wiring closet.
- Q.** What is the maximum power per port that the Cisco Catalyst 3750-X and 3560-X Series PoE switches can supply?
- A.** The Cisco Catalyst 3750-X and 3560-X Series support both PoE standards, 802.3af and 802.3at, which define the maximum power that can be supplied to a port. The switches can provide up to 30W per port. On the UPOE-capable 3750-X and 3560-X models, the switch can support up to 60W per port.
- Q.** Do I need two power supplies on the Cisco Catalyst 3750-X and 3560-X Series PoE switches to deploy PoE+ (802.3at)/UPOE?
- A.** The requirement for PoE+ is 1440W for a 48-port switch or 720W for a 24-port switch, in addition to the system power requirements, which include the reserved power needed to power up the Cisco StackPower stack during formation. This requirement already exceeds the rating of any available power supply; therefore, a second power supply would be needed unless the switch is part of a Cisco StackPower stack and the system can provide the remaining power required. In case of the UPOE-capable 3750-X and 3560-X models, the maximum POE budget available is 1800W, which can power all 24 UPOE ports on 24-port models and up

to 30 UPOE ports on the 48-port models. In order to realize the 1800W UPOE budget, the switch must use 2 x 1100W AC power supplies.

- Q.** What pair set is used to support DC power in the Cisco Catalyst 3750-X and 3560-X Series PoE switches?
- A.** The pairs 2 and 3 (pins 1, 2, 3, and 6) of the four pairs in Category 3 and 5 cables are used for both the Ethernet data signals and the DC power at the same time. The PD must accept either polarity of power from either pair set. This allows the use of both crossover and straight cables. Only straight cables should be used with the prestandard Cisco PDs.
- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series Switches have a DC-to-DC converter to support PoE with the DC power supply?
- A.** Yes. The Cisco Catalyst 3750-X and 3560-X Series have a DC-to-DC converter and support PoE even with the 440W DC power supply. This is made possible by the use of a single power output from the power supplies to the system, allowing the power supplies to output the same voltage and moving the complexity of the power supply design to the switch itself, where the power is properly adjusted to the power levels needed. Hence, it does not matter how the power is generated; the switch sees one voltage level and works with it.
- Q.** Can I still use the Cisco Power Calculator to help me determine power consumption for my new Cisco Catalyst 3750-X or 3560-X Series Switch?
- A.** Yes. The Power Calculator tool has been updated to cover the Cisco Catalyst 3750-X and 3560-X Series in terms of power consumption for the system and for the PD. Remember that PoE power is dissipated at the PD and not at the switch. Top

Confidentiality

- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series Switches support the Cisco TrustSec solution?
- A.** Cisco TrustSec is an end-to-end solution, and the Cisco Catalyst 3750-X and 3560-X Series include support for it. At first customer shipment, encryption will be supported only on the user ports, along with support for Security Group Tag (SGT) Exchange Protocol (SXP). No hardware tagging is supported at this time.
- Q.** What hardware encryption is included in the Cisco Catalyst 3750-X and 3560-X Series Switches?
- A.** The Cisco Catalyst 3750-X and 3560-X Series support 802.1ae encryption at line rate. This hardware encryption is done between the switch port and the client's network interface card (NIC). Some Intel NIC and LAN on Motherboard (LoM) components already support 802.1ae. Some PC and laptop manufacturers may have not implemented the encryption feature, although the capability is already available.
- Q.** The NICs in my installed client base do not have encryption capability. Will I be able to deploy Cisco Catalyst 3750-X and 3560-X Series Switches in my network?
- A.** Cisco will offer a software-based application that can provide encryption for legacy PCs and laptops. In these cases, the software client will handle encryption. This client will also provide for key negotiation as described by MACsec Key Agreement (MKA).
- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series Switches have encryption on all ports, including the uplinks?
- A.** No. Hardware encryption is provided only on the user ports (downlinks).
- Q.** What is the competition doing in terms of hardware encryption?
- A.** IEEE 802.1ae is a standard; hence any competitor has the same opportunity to build products that support encryption. The strength of the Cisco Catalyst 3750-X and 3560-X Series Switches is that encryption is just one piece of the whole Cisco TrustSec solution, and competitors can offer only point products or features. Top

Licensing and Warranty

Q. Why should I purchase a Cisco Technical Services contract for these switches when they include a limited lifetime warranty (LLW)?

A. Cisco service and support has received numerous industry recognitions and awards for excellence.

Adding a Cisco Technical Services contract to warranty coverage provides access to the Cisco Technical Assistance Center (TAC) beyond the 90-day period allowed by the LLW. It also can provide a variety of hardware replacement options to meet critical business needs, as well as updates for licensed premium Cisco IOS Software and registered access to the extensive Cisco.com knowledge base and support tools.

For information about Cisco Technical Services, visit <http://www.cisco.com/go/ts>.

For information about the Cisco LLW, visit <http://www.cisco.com/go/warranty>.

Q. Do the Cisco Catalyst 3750-X and 3560-X Series Switches comes with a limited lifetime warranty?

A. Yes. The new Cisco Catalyst 3750-X and 3560-X Series come with the LLW:

Enhanced limited lifetime warranty (LLW) with next business day (NBD) advance hardware replacement and 90 day access to Cisco Technical Assistance Center (TAC) support.

Q. What are the service options?

A. Table 10 shows the service options for the Cisco Catalyst 3750-X and 3560-X Series Switches.

Table 10. Service and Warranty Information for Cisco Catalyst 3750-X and 3560-X Series Switches

Service Element	Warranty	Cisco® Smart Foundation	Cisco SMARTnet Service
Duration of Coverage	As long as the original customer owns the product	Renewable 1-, 3-, and 5-year contracts	Renewable 1 year and multi-year contracts depending on product family
Cisco Technical Assistance Center (TAC) Support	LLW: Not included E-LLW: Business hours access for 90 days	Business hours access to SMB TAC (access levels vary by region)	24x7 coverage
Online Support/Web Access	Unregistered access only	Available through Smart Foundation Portal	Direct 24x7 registered access
Advance Hardware Replacement	LLW: 10 business days* E-LLW: Next business day**	Next business day as available, otherwise same day ship	Next business day, 8x5x4, 24x7x4, 24x7x2 delivery options as available
On-site Support	No	No	Cisco SMARTnet® Onsite service options available

* Cisco or its service center will use commercially reasonable efforts to ship a replacement part within ten (10) working days after receipt of the RMA request. Actual delivery times might vary depending on reseller and customer location. Taxes, duties, and import fees may apply.

** Cisco or its service center will use commercially reasonable efforts to ship a replacement for next business day delivery, where available. Otherwise, a replacement will be shipped within ten (10) working days after receipt of the RMA request. Actual delivery times might vary depending on reseller and customer location. Taxes, duties, and import fees may apply.

Q. How do I request a return materials authorization (RMA) for an IP Services switch?

A. RMAs are done like-for-like by SKU for the Cisco Catalyst 3750-X and 3560-X Series models. Currently, there are only LAN Base and IP Base SKUs; therefore, LAN Base and IP Base switches can be replaced, and IP Services switches will have to be rehosted on site by customers.

Remember that you still have the option to run the temporary license in your switch in case of an emergency requiring a higher license level. Check the configuration guide for more details.

- Q.** Do the Cisco Catalyst 3750-X and 3560-X Series Switches require licensing to enable Cisco IOS Software feature sets?
- A.** Yes. The Cisco Catalyst 3750-X and 3560-X Series Switches run the Universal image, which means that a license is required to enable the Cisco IOS Software feature sets: LAN Base, IP Base, and IP Services. Note that the proper license comes already installed in the switch from manufacturing as ordered.
- Q.** Do I need to load a license file into my switch?
- A.** When you order a new switch, it will arrive with the proper feature set license already loaded. The only time you need to install a license file into your switch is when you do a feature set upgrade.

Service Module

General

- Q.** What SFPs are supported on the Service Module?
- A.** Service module supports the same SFPs that are supported by the C3KX-NM-1G and C3kX-NM-10G. Please refer to the Cisco Catalyst 3750X datasheet for more details.
- Q.** I have a Cisco Catalyst 3750X/3560X switch with LAN Base license on it. Can I use the Service Module to configure MACSec and Netflow?
- A.** No. In order to use the Netflow and MACSec features, the switch must be running IP Base or IP Services license levels.
- Q.** In future, when I update my switch Cisco IOS Software version, (for example from 12.2(55) SE to 12.2(58) SE), do I have to upgrade the software on the Service Module as well?
- A.** Yes. The software image for the Service Module must be upgraded every time the switch Cisco IOS Software version is upgraded. The software for the Service Module can be found on the same page as the Cisco IOS Software download for the Cisco Catalyst 3750X and 3560X.
- Q.** What will happen if I update my switch Cisco IOS Software (for example from 12.2(55) SE to 12.2(58) SE) and not the software on the Service Module?
- A.** If you are upgrading a switch with the Service Module inserted, you are forced to upgrade the Service Module software as well (using the archive download-sw CLI). If you are plugging in a Service Module to a switch running a new version of Cisco IOS Software code, the Service Module will behave in pass-through mode till you upgrade the software on the module. Netflow and MACSec can be configured after the software upgrade is complete.
- Q.** Can I do Flexible Netflow monitoring and MACSec at the same time?
- A.** Yes. You can do both at line-rate without compromising on switch performance.
- Q.** Is my Service Module ready to use when I plug it into my Cisco Catalyst 3750x/3560X switch?
- A.** Service Module is ready for use if the Hardware Board Revision number of the switch is 0x03. Hardware Board Revision Number can be obtained from executing the "show version" CLI on the switch console.

Snippet from the CLI output:

```
512K bytes of flash-simulated non-volatile configuration memory.
Base ethernet MAC Address          : F8:66:F2:2B:62:00
Motherboard assembly number       : 73-12557-04
```

```
Motherboard serial number      : FDO14290JB6
Model revision number          : A0
Motherboard revision number    : A0
Model number                   : WS-C3560X-48P-S
Daughterboard assembly number  : 800-32786-01
Daughterboard serial number    : FDO1429068M
System serial number           : FDO1429K02V
Top Assembly Part Number      : 800-31328-01
Top Assembly Revision Number   : A0
Version ID                    : V01
CLEI Code Number              : COMJP00ARA
Hardware Board Revision Number : 0x03
```

If the Hardware Board Revision number is not 0x03, the Service Module can only be used as a regular uplink module. Netflow and MACSec cannot be used. In order to upgrade your switch to Hardware Board Revision number 0x03, please refer to the field notice on Cisco.com.

Netflow

Q. Why do I need Netflow in the access layer switch?

A. Enabling Netflow at the access switch makes sure that the traffic from the user ports are monitored. The access switch is the most logical place in the network for collecting statistics and monitoring flows as it is able to use the location base of the endpoint on MAC address and interface port number provided by the access switch. Access switch has a variety of identity mechanisms for user authentication, and adding user awareness is the natural progression that can be developed. Access switches are an order of magnitude greater than distribution and core, which makes them scale well for Netflow and make sure there are no performance effects of oversubscription at aggregation and core.

Q. Does the Service Module support Flexible Netflow?

A. Yes. Flexible Netflow is supported and the exporting format is version 9 per RFC 3954.

Q. Are there any performance issues if I turn on Netflow at line rate?

A. No. There is dedicated custom hardware for NetFlow monitoring, which does all the Netflow operations. Therefore there is no effect on packet forwarding performance and latency.

Q. How many simultaneous flows are supported?

A. 32000.

Q. How many simultaneous monitors are supported?

A. 128.

Q. What is the number of exporters per monitor?

A. 10 exporters per monitor are supported when attaching the monitor to the interface. After this, the user is free to add as many exporters as they want.

Q. What are the key fields that can be used to define the flow?

A. The supported key fields are as follows:

Layer 2

- Source and destination MAC addresses
- Source and destination VLAN IDs
- Dot1q fields
- Ether-type

Layer 3: IPv4

- Source and destination IP address
- Header length
- TTL
- Protocol
- Fragmentation fields
- Version
- TOS
- Length fields

Layer 3: IPv6

- Source and destination IP address
- Hop limit
- Next header
- Protocol
- Fragmentation fields
- Traffic class
- Version
- Length fields

Layer 4

- Destination ports
- Source ports
- ICMP fields
- IGMP fields
- UDP fields
- TCP fields

Q. What is the difference between key and nonkey fields?

A. Key fields are the match parameters that you define for a given flow. Nonkey is miscellaneous data related to the flow: for example, first time stamp, last time stamp, packets, counters, and so on, which can be seen either using switch CLI or on the Collector software.

-
- Q.** Where are the flows stored?
- A.** Flows are stored in the custom hardware dedicated for Netflow operation.
- Q.** Can I monitor every flow in my switch using the Service Module?
- A.** All flows that pass the uplink ports are supported. Flows that do not traverse the uplinks like the flows between two access ports on the same switch or switch stack are not supported at FCS.
- Q.** Is Netflow better than sFlow? Why?
- A.** A. Yes. Netflow accounts for all the packets for a given flow. Also Netflow monitors the interface for incoming flows at all times. Sflow on the other hand uses sampling for collecting the traffic, and the sampled traffic may not indicate the traffic type and volume as accurately as Netflow.
- Q.** Where can I find more information on Flexible Netflow?
- A.** More information is available at http://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6555/ps6601/ps6965/prod_qas0900aecd804be091.html.
- Q.** What is MACsec?
- A.** MACsec is IEEE 802.1ae industry standard for L2 hop-by-hop encryption.
- Q.** Do I need a service module for encrypting user access ports connecting to PCs, IP phone, and so on?
- A.** No. Cisco Catalyst 3750x/3560x supports MACsec on downlink ports connecting to user access devices such as PCs and IP phones without requiring a service module.
- Q.** What MACsec use cases require a service module?
- Switch to switch encryption in campus: wiring closet access to distribution or core
 - Encryption using fiber ports
 - Encryption over 10G
- Q.** What can I expect in terms of MACsec performance? Is there any degradation in switch performance?
- A.** No. MACsec is supported at line rate (over 1G and 10G), and the encryption is done in hardware, making sure that there is no performance degradation.
- Q.** Can I connect a Cisco Catalyst 3750x/3560x service module to another Cisco Catalyst 3750x/3560x service module and encrypt Ethernet link between them?
- A.** Yes. MACsec can be enabled between Cisco Catalyst 3750x/3560x switches with service module. Service module ports have to be configured with Cisco Security Association Protocol (SAP) for management of MACsec keys.
- Q.** Are there any other Cisco network devices to which the service module can connect over a MACsec encrypted link?
- A.** Yes. Cisco switches including Cisco Catalyst 3750x/3560x, Cat 6k with Supervisor 2T and Cisco Nexus® 7k use the same key management protocol (SAP) and interoperate with each other. Service module ports have to be configured Cisco SAP for key management.
- Q.** Can I use MKA key management for encrypting switch-to-switch links?
- A.** No. MKA is only supported for end user access ports such as PC, phone, and other user access devices. Typically downlink ports connect to end user access ports and need to be configured with MKAny time a switch-to-switch link needs to be encrypted, both ends of the link have to be configured with Cisco SAP for key management.

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- Q.** Could I connect two Cisco Catalyst 3750x/3560x copper ports and encrypt the link between them using MACsec?
- A.** This is not a common use case, due to distance limitations of copper. But this is a supported scenario and does not require the service module. Any time a switch-to-switch link needs to be encrypted, both ends of the link have to be configured with Cisco SAP for key management.
- Q.** If a 3560C compact switch is connected to a Cisco Catalyst 3750x/3560x on the downlink port, how do I set up MACsec between them?
- A.** Any time a switch-to-switch link needs to be encrypted, both ends of the link have to be configured with Cisco SAP for key management. Compact switch support for switch-to-switch encryption is planned for a future release. With this future release, link between Cisco Catalyst 3750x/3560x and 3k-C compact switch can be encrypted with Cisco SAP.
- Q.** Is there a requirement for a specific client for user access port encryption?
- A.** Yes. Cisco AnyConnect 3.0 client is required for MACsec encryption on a client.
- Q.** Could I use MACsec and NEAT (CISP) together on a port?
- A.** No. MACsec and NEAT are mutually exclusive. MACsec provides L2 hop-by-hop encryption, which makes NEAT redundant.
- Q.** Could I just use MACsec for switch-to-switch authentication (Cisco Network Device Admission Control [NDAC]) without encryption of traffic?
- A.** Yes.
- Q.** Does switch-to-switch encryption require Cisco NDAC?
- A.** Yes, encryption is performed after successful switch-to-switch authentication (NDAC).
- Q.** What infrastructure do you need for setting up switch-to-switch encryption with the service module?
- A.** In order to successfully set up switch to switch MACsec encryption, the following are needed:
- a) Cisco Catalyst 3750x with the service module one end.
 - b) Cisco Catalyst 3750x with the service module OR Cisco Catalyst 6k Sup 2T OR Cisco Nexus 7k on the other end.
 - c) ACS server ver 5.2 or higher for initial SAP key.
- Q.** I don't have an ACS Server. Can I still enable encryption between the switches?
- A.** Yes. Using statically configured keys on both switches, encryption can be enabled without the ACS server.



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