

Cisco Catalyst 4500E Supervisor Engine 7L-E: Enhanced Borderless Campus Access and Aggregation Supervisor Engine Data Sheet

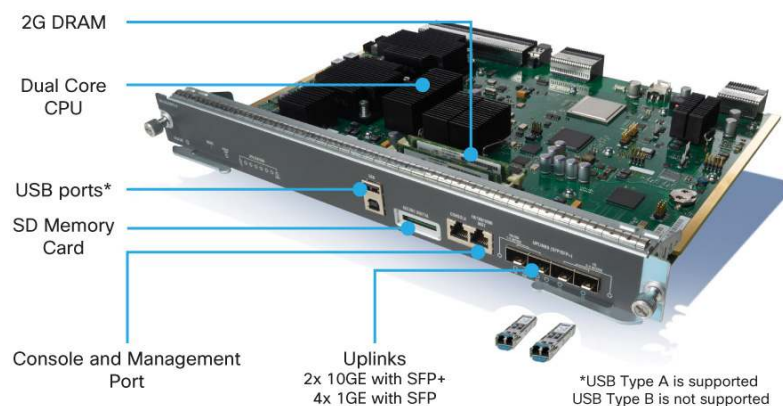
Overview

The Cisco® Catalyst® 4500E Supervisor Engine 7L-E (Figure 1) is an enterprise-class borderless campus access and price/performance aggregation supervisor engine designed to provide 520 Gbps per system with E-Series chassis. The Cisco Catalyst 4500E Supervisor Engine 7L-E builds on the success of its predecessor, the Cisco Catalyst 4500E Supervisor Engine 6L-E, and provides unprecedented performance with borderless services such as Flexible NetFlow (FNF) and hosted third-party applications.

The Supervisor Engine 7L-E offers key innovations including

- Up to 7 to 10 years of investment protection through backward and forward compatibility
- 520-Gbps system performance with 48 Gbps per slot to every line-card slot
- Future-proof investment with dual 10 Gigabit Ethernet uplinks (Small Form-Factor Pluggable Plus [SFP+] optics) or four Gigabit Ethernet uplinks (SFP optics)
- Cisco Universal Power over Ethernet (UPOE) for unprecedented convergence to IP network infrastructure
- Application visibility through FNF
- Cisco IOS® XE Software, which provides the ability to host third-party applications
- Energy efficiency with support for 802.3az Energy-Efficient Ethernet (EEE)-capable line cards
- Industry-leading resiliency through In-Service Software Upgrade (ISSU)
- First and only modular switch with 8 bidirectional line-rate Switched Port Analyzer/Remote SPAN (SPAN/RSPAN) sessions

Figure 1. Cisco Catalyst 4500E Supervisor Engine 7L-E



Cisco Catalyst 4500E Supervisor Engine 7L-E Feature Highlights

The Cisco Catalyst 4500E Supervisor Engine 7L-E builds on the widely deployed line of Cisco Catalyst 4500 supervisor engines and enhances its predecessors to provide nonblocking 48 Gbps per slot bandwidth with Flexible NetFlow for optimized application visibility. In addition, the enterprise-class Cisco Catalyst 4500E Supervisor Engine 7L-E offers the following:

- Performance and scalability:
 - 520-Gbps switching capacity with 225 Mpps of throughput
 - 2 nonblocking 10 Gigabit Ethernet uplinks (SFP+) or 4 nonblocking 1 Gigabit Ethernet uplinks (SFP)
 - Supports 3-, 6-, and 7-slot Cisco Catalyst 4500E chassis
 - Supports a maximum of 240 ports of 10/100/1000 Base-T and 400 ports of 1000Base-X (CSFP) in a 7-slot chassis
 - Supports up to 124 1GE nonblocking fiber ports or 62 10GE fiber ports in a 7-slot chassis
 - Enables next-generation Universal Power Over Ethernet (UPOE, WS-X4748-UPOE+E) in addition to backward compatibility with other PoE standards
 - Enables EEE (IEEE 802.3az)
 - 128,000 Flexible NetFlow entries in hardware
 - External USB and SD card support for flexible storage options
 - 10/100/1000 RJ-45 console and management port
 - 64,000/32,000 IPv4/IPv6 routing entries for campus access and aggregation deployments
 - IPv6 in hardware, providing wire-rate forwarding for IPv6 networks and support for dual stack with innovative resource usage
 - Dynamic hardware forwarding-table allocations for ease of IPv4-to-IPv6 migration
 - Scalable routing (IPv4, IPv6, and multicast) tables, Layer 2 tables, and access-control-list (ACL) and quality-of-service (QoS) entries to make use of 8 queues per port and comprehensive security policies per port
- Infrastructure services:
 - Cisco IOS XE Software, the modular open application platform for virtualized borderless services
 - Maximum resiliency with redundant components, Nonstop Forwarding/Stateful Switchover (NSF/SSO), and In-Service Software Upgrade (ISSU) support
 - Network virtualization through Multi-Virtual Route Forwarding (VRF) technology for Layer 3 segmentation
 - Automation through Embedded Event Manager (EEM), Cisco Smart Call Home, AutoQoS, and Auto SmartPorts for fast provisioning, diagnosis, and reporting

- Borderless network services:
 - Optimized application performance through deep visibility with Flexible NetFlow supporting rich Layer 2/3/4 information (MAC, VLAN, TCP Flags) and synthetic traffic monitoring with IP service-level agreement (SLA)
 - Medianet capabilities to simplify video quality of service, monitoring, and security. In addition, multicast features such as Protocol Independent Multicast (PIM) and Source-Specific Multicast (SSM) that provide enterprise customers the additional scalability to support multimedia applications
 - Energy-efficient design with Cisco EnergyWise™ technology
- Investment protection and reduced total cost of ownership (TCO):
 - Full backward compatibility with 6 G, 24 G, and 48 Gbps slot line cards with no performance degradation

The Cisco Catalyst 4500E Supervisor Engine 7L-E is compatible with classic Cisco Catalyst 4500 line cards and power supplies, providing full investment protection. Supervisor Engine 7L-E is not compatible with classic Cisco Catalyst 4500 chassis.

Table 1 highlights the performance and scalability enhancements of the Cisco Catalyst 4500E Supervisor Engine 7L-E.

Table 1. Cisco Catalyst 4500E Supervisor Engine 7L-E Performance and Scalability Features

Feature and Description	Supervisor Engine 7L-E
Centralized switching capacity	520 Gbps
Per-slot switching capacity	48 Gbps
Throughput	<ul style="list-style-type: none"> • 225 Mpps for IPv4 • 110 Mpps for IPv6 • 225 Mpps for L2 Bridging
IPv4 routing entries	64,000
IPv6 routing entries	32,000
Multicast routes	32,000
CPU	Dual core; 1.5 GHz
CPU queues	64
Synchronous Dynamic RAM (SDRAM)	2 GB
Boot flash	1G
Security and QoS hardware entries	64,000
Dynamic Host Configuration Protocol (DHCP) snooping entries	12,000
Cisco Network Admission Control (NAC)	4,000
MAC addresses	55,000
Active VLANs	4,094
Address Resolution Protocol (ARP) entries	47,000
Spanning Tree Protocol instances	12,000
Switched virtual interfaces (SVIs)	4,094
SPAN	8 bidirectional sessions (ingress and egress)

Continued Innovations through Infrastructure Services

Modular Open Application Platform, Cisco IOS XE Software

Cisco IOS XE Software is the open service platform software operating system for the Cisco Catalyst 4500E Supervisor Engine 7L-E. Cisco continues to evolve Cisco IOS Software to support next-generation switching hardware and provide increased architectural flexibility to deliver Borderless Networks services. Cisco IOS XE Software provides the following customer benefits:

- Cisco IOS XE Software provides an enhanced operating system that can take advantage of the multicore CPU architecture of the Cisco Catalyst 4500E system.
- Cisco IOS XE Software provides customer investment protection in the existing Cisco IOS Software by keeping a consistent feature set and operational look and feel. This allows a transparent migration experience.
- Cisco IOS XE Software supports service virtualization capability that allows the Cisco Catalyst 4500E to host third-party applications in parallel with Cisco IOS Software. The hosted application can communicate with Cisco IOS Software to use its rich feature sets. This benefit allows a customer to quickly adopt new technologies using proven code, while keeping Cisco IOS Software simple and robust. Cisco IOS XE Software enables Cisco Catalyst 4500E to be an open service platform and is a primary anchor for future Cisco Borderless Networks innovations.

Best-in-Class Resiliency

The Cisco Catalyst 4500E Series is designed for excellent nonstop communications with noninterrupted hardware switching. With Cisco IOS XE Software, customers continue to reap the benefits of this best-in-class resiliency in various ways.

In addition to redundant power supplies, fans, and clock modules, the Cisco Catalyst 4507R+E and 4507R-E chassis support 1 + 1 supervisor-engine redundancy, using the Supervisor Engine 7L-E. The primary supervisor engine is active and is responsible for normal system operation. The secondary supervisor engine serves as a standby, monitoring the operation of the primary supervisor engine. The resiliency features of the Cisco Catalyst 4500E prevent network outages that could result in lost business and revenue.

ISSU allows you to upgrade or downgrade complete Cisco IOS Software images with minimal (less than 200 msec) to no disruption to the network when using a redundant Cisco Catalyst 4500E Series system with dual Supervisor Engines 7L-E.

Configuration and other control information between two supervisors is fully synchronized to allow a rapid failover mechanism by the standby supervisor in case of primary supervisor engine failure.

In addition to ease of management, ISSU dramatically improves the network reliability and availability in a Layer 2 or Layer 3 environment. NSF/SSO and ISSU are essential for business-critical applications such as voice over IP (VoIP) and virtual desktop infrastructure (VDI) environments.

Also, Supervisor Engine 7L-E has resiliency built into its uplinks. Table 2 shows the uplink options on Supervisor Engine 7L-E.

Table 2. High-Availability and Uplink Options for Supervisor Engine 7L-E in Dual Supervisor Engine Mode

Active	10GE	Inactive	Inactive	Inactive
Standby	10GE	Inactive	Inactive	Inactive
Active	1GE	1GE	Inactive	Inactive
Standby	1GE	1GE	Inactive	Inactive

Cisco Virtual Switching Systems (VSS)

Any two Cisco® Catalyst® 4500E Series Switches with this supervisor engine can be pooled together into a VSS. The two switches are connected with 10/1 Gigabit Ethernet links called Virtual Switch Links (VSLs). These links are enabled through fiber as well as on copper connectivity. After a VSS is created, it acts as a single virtual Cisco Catalyst switch delivers up-to 1-terabit of aggregate bandwidth with 450Mpps performance. The solution supports up to 480 ports of 1-Gbps and 124 ports of 10-Gbps systems deployed with VSS. Cisco VSS on the Cisco Catalyst 4500E provides the following primary benefits:

- Simplified network operations:
 - Providing a single point of management (with single IP address), it allows any updates, policy changes, and configurations to be synchronized between the two switches, eliminating error-prone manual synchronization.
 - Forming Multichassis EtherChannel (MEC) to the logical switch, Cisco VSS provides a loop-free topology, no longer needing to rely on Spanning Tree Protocol.
 - A single routing instance on the virtual switch eliminates the issues of managing, tuning, and troubleshooting first-hop routing protocols such as Hot Standby Router Protocol (HSRP) and Virtual Router Redundancy Protocol (VRRP).
 - Cisco Prime™ 4.2.2 now enables users to centrally manage the pair of switches as a single virtual chassis.
- Resiliency:
 - Stateful failover between the supervisors on the two chassis provides subsecond failover and transparent failover even to delay-sensitive applications such as voice and video.
 - With EtherChannels extended across two physical chassis, it provides for increased resiliency. These links are configured as MEC, minimizing traffic disruption from switch or uplink failure.
- Increased system bandwidth:
 - The active-active MEC extended across two physical chassis provides for dual bandwidth utilization, increasing return on investment (ROI) and reducing additional capital expenditures (CapEx) to add capacity.

Simplified Operations through Automation

As campus switching has grown to support increasing enterprise demands, so has the need to deploy and manage new and evolving technologies. Simplified operations are critical in meeting these challenges and

achieving increased operational efficiency through proactive management and reduction in unplanned network downtime.

The Cisco Catalyst Supervisor Engine 7L-E offers the following rich set of capabilities for simplified operations:

- Auto-Install and AutoQoS for fast deployment
- Config rollback for improved config management
- EEM, Smart Call Home, Generic On-Line Diagnostics (GOLD), and Time Domain Reflectometry (TDR) for simplified operations
- FNF and IP SLA for enhanced visibility
- Cisco EnergyWise technology for simplified power management
- ISSU for simplified change management

Lower Total Cost of Ownership and Ease of Use with Smart Install Director

Smart Install Director simplifies management of images and configurations for enterprise switches in campus and branch networks. The Cisco Catalyst 4500E, now acting as Smart Install Director, provides a single management point for images and configuration of directly or indirectly connected Cisco Catalyst 2960, 3560, 3750, and 3850 Series Switches. It provides for:

- Plug and play in switch deployment
- Zero-touch replacement of switches with the same configuration and image as the switch it is replacing
- Single point of image and configuration management, in which configuration and image management are centralized
- On-demand image and configuration updates across all downstream switches from a single touchpoint

Smart Install Director reduces the customer's TCO and operational expense, while providing ease of use to the user.

For details about Smart Install, go to

http://www.cisco.com/en/US/docs/switches/lan/smart_install/configuration/guide/concepts.html.

Comprehensive Security with Cisco TrustSec

The Cisco Catalyst 4500E Supervisor Engine 7L-E is a validated component of the Cisco TrustSec 2.1 architecture. This allows the Cisco Catalyst 4500E Supervisor Engine 7L-E to be transparently integrated into campus switching environments for a comprehensive security solution based on Cisco TrustSec. The Cisco Catalyst Supervisor Engine 7L-E is a foundational element of the Cisco TrustSec architecture with support for the following functionalities:

- **Device sensor:** The device sensor on the Cisco Catalyst 4500E Supervisor Engine 7L-E enables the ability to recognize the devices connected to the switch. This feature also interoperates with the Cisco Identity Services Engine, providing for a centralized view of all devices that access the network in a scalable manner. When combined with AutoSmartPorts (ASP), it also provides the ability to dynamically apply policies on the switch based on the device type. For more information, visit http://www.cisco.com/en/US/docs/ios-xml/ios/sec_usr_aaa/configuration/15-1sg/sec-dev-sensor.html.
- **Identity-based networking:** The Cisco Catalyst 4500E Supervisor Engine 7L-E has the most rich and robust set of IEEE 802.1X-based identity features to provide the right level of authenticated access to

users. It also simplifies identity deployments with features such as Flexible Authentication, WebAuth and MAC Authentication Bypass (MAB), as well as open mode for uninterrupted operations while providing visibility of network access. The identity features also provide integrated support for IP telephony. It also provides for flexible authorization policies with VLAN assignment and dynamic ACLs. For more information, visit http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/15.1/XE_330SG/configuration/guide/dot1x.html.

- **Network device authentication:** Cisco TrustSec network device authentication provides for an authenticated network infrastructure, minimizing the risk of rogue access to the network using unauthorized network devices.
- **Data confidentiality and integrity:** The Cisco Catalyst 4500E Supervisor Engine 7L-E supports line-rate 10G MACsec encryption based on IEEE 802.1ae with no additional latency. It supports both switch-to-switch and host-to-switch hardware-based encryption on all uplink ports and all WS-X47XX series line cards. For more information, visit http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/15.1/XE_330SG/configuration/guide/swmacsec.html.
- **Role-based access control:** The Cisco Catalyst 4500E Supervisor Engine 7L-E has hardware support for Cisco TrustSec Secure Group Access (SGA). TrustSec SGA simplifies access control security by defining it in terms of user roles instead of topology-based IP access control lists (ACLs). The Cisco Catalyst 4500E Supervisor Engine 7L-E has hardware support for secure group tagging (SGT) for classifying traffic from users based on roles, as well as secure group access control lists (SGACLs) which are role-based ACLs to apply access control to traffic with the secure group tag. For more information, visit: <http://www.cisco.com/go/trustsec>
<http://www.cisco.com/en/US/docs/switches/lan/trustsec/configuration/guide/config.html>
http://www.cisco.com/en/US/netsol/ns744/networking_solutions_program_home.html

Enhanced Application Visibility with Flexible NetFlow

Cisco IOS Flexible NetFlow is the next generation in flow monitoring technology, allowing optimization of the network infrastructure resources, reducing operation costs, and improving capacity planning and security incident detection with increased flexibility and scalability. The Cisco Catalyst 4500E Supervisor Engine 7L-E provides 128,000 Flexible NetFlow entries. Based on a custom-built application-specific integrated circuit (ASIC), Cisco Catalyst 4500E Supervisor Engine 7L-E delivers unprecedented flexibility and comprehensive flow visibility extending from Layer 2 (MAC and VLAN) to Layer 4 (TCP, UDP flags, and so on).

The flow data collected by Flexible NetFlow can be exported to an external collector for analysis and reporting or tracked by EEM. The Cisco Catalyst 4500E Supervisor Engine 7L-E enables powerful on-box and customizable event correlation and policy actions with EEM, allowing the switches to trigger customized event alarms or policy actions when the predefined condition is met. With no external appliance required, customers are able to use existing infrastructure to perform traffic monitoring, making traffic analysis economical even on large IP networks.

Additional details about Cisco Flexible NetFlow are available at:

http://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6555/ps6601/ps6965/product_data_sheet0900aecd804b590b.html.

Investment Protection with Chassis and Line-Card Support

Already-installed Cisco Catalyst 4500E chassis with classic and E-Series line cards can take advantage of the new features and functions of the Supervisor Engine 7L-E on all ports with a simple supervisor-engine upgrade. However, to take advantage of the increased switching capacity of 48 Gbps per slot, the Cisco Catalyst 4500E Series chassis (including R+E chassis) and the select new E-Series line cards are required. You can mix and match Cisco Catalyst 4500E Series line cards and classic line cards in an E-Series chassis with no performance degradation to either line-card type. Table 3 shows the supervisor-engine and line-card slot-assignment options in the Cisco Catalyst 4500E Series chassis.

Table 3. Cisco Catalyst 4500E Chassis Slot-Assignment Options

Chassis	Single Supervisor Slot Assignments	Redundant Supervisor Slot Assignments	E-Series Line-Card Slot Options	Classic Line-Card Slot Options
Cisco Catalyst 4503-E	Slot 1	-	Slots 2 and 3	Slots 2 and 3
Cisco Catalyst 4506-E	Slot 1	-	Slots 2 through 6	Slots 2 through 6
Cisco Catalyst 4507R+E	Slot 3 or 4	Slots 3 or 4	Slots 1, 2, and 5 to 7	Slots 1, 2, and 5 to 7
Cisco Catalyst 4507R-E	Slot 3 or 4	Slots 3 or 4	Slots 1, 2, and 5 to 7	Slots 1, 2, and 5 to 7

Table 4 summarizes the performance capacities of the Supervisor Engine 7L-E on a per-chassis basis.

Table 4. Cisco Catalyst 4500 Supervisor Engine 7L-E Bandwidth per Slot for Different Chassis

	Cisco Catalyst 4503-E Chassis	Cisco Catalyst 4506-E Chassis	Cisco Catalyst 4507R-E Chassis	Cisco Catalyst 4507R+E Chassis
Supervisor Engine 7L-E (WS-X45-Sup 7L-E)	48 Gbps/slot	48 Gbps/slot	24 Gbps/slot	48 Gbps/slot

IPv6 Support

IPv6 is critical for the expansion of IP address space and is being mandated by governments and enterprises worldwide. The Cisco Catalyst 4500 Supervisor Engine 7L-E supports IPv6 Unicast and Multicast in hardware for full line-rate forwarding performance of up to 110 Mpps. The Supervisor Engine 7L-E efficiently and dynamically allocates hardware table resources between IPv4 and IPv6 routes for optimal IPv4-to-IPv6 migration. The Supervisor Engine 7L-E supports Multicast Listener Discovery (MLD) snooping for IPv6, enhancing performance and reducing network traffic by allowing a switch to dynamically add hosts to and remove hosts from a multicast group.

Table 5 highlights the IPv6 capabilities of the Supervisor Engine 7L-E.

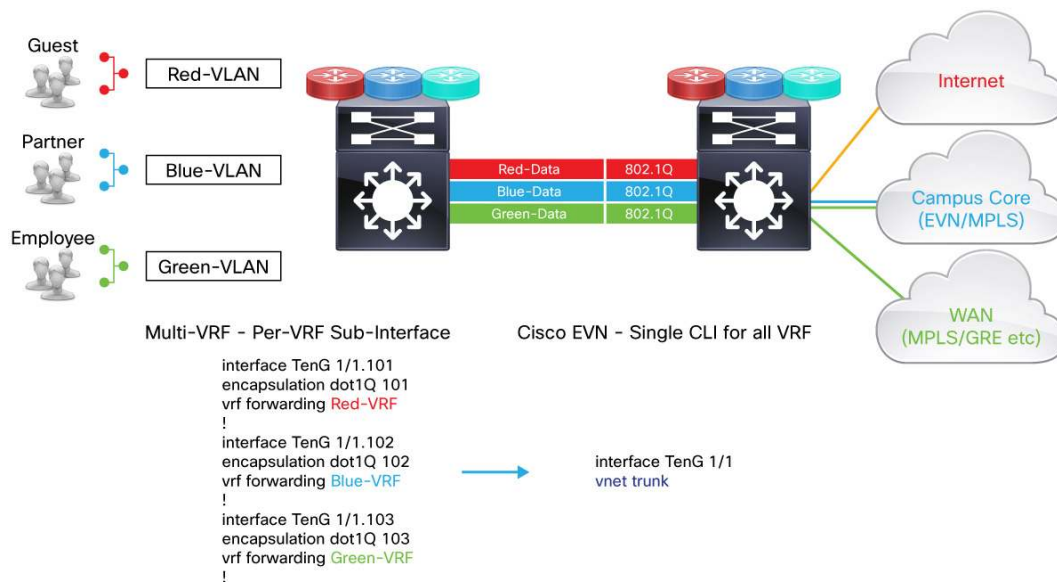
Table 5. Summary of Supervisor Engine 7L-E IPv6 Capabilities

Feature and Description	Supervisor Engine 7L-E
IPv6 support	Unicast and Multicast forwarding done in hardware
IPv6 performance	110 Mpps
IPv6 routing entries	32,000
Dynamic Hardware Route Table allocations	Yes
MLD snooping for IPv6	Yes, in hardware
Unicast Reverse Path Forwarding Version 6 (URPFv6): Strict Mode	Yes, in hardware

Simplified and Scalable Network Virtualization with Easy Virtual Network (EVN)

Enterprise networks use single foundational infrastructure to build multiple logical overlay networks for diversified closed usergroups, regulatory, secure IT applications, etc. On campuses the traditional Multi-VRF solution is widely adopted and deployed to solve such network segmentation challenges. The Cisco Catalyst 4500E Series platform simplifies virtual network operation and maximizes scalability with the Cisco campus end-to-end Easy Virtual Network (EVN) technology (Figure 2).

Figure 2. Simplified Campus Network Virtualization with Cisco EVN



Cisco EVN is a successor solution that offers numerous advantages over traditional Multi-VRF technology:

- **Simplified:** To simplify campus virtual-network solutions, the Cisco EVN is designed with following three major components:
 - **Virtual network (VNET) trunk:** The Cisco EVN solution reduces 98 to 99 percent of configuration complexities.
 - **Route replication:** A simplified unicast and multicast route-leaking capability enables shared network and application services to virtual-network users. It replaces traditional Border Gateway Protocol (BGP)-based route-leaking mechanics.
 - **Routing context:** Simplified and optimized virtual-network operation and troubleshooting are supported on a per-VRF basis.
- **Scalable:** Cisco EVN enables flexibility to scale up to 32 virtual network solutions - operationally 4x virtual-network scalability capacity over Multi-VRF technology.
- **Interoperable:** Cisco EVN provides network topology isolation based on an RFC-defined control plane; for example, Enhanced IGRP (EIGRP), Open Shortest Path First (OSPF), Multicast etc. The data-plane security and protection are maintained through industry-standard IEEE 802.1Q. In addition, the Cisco EVN-supported system interoperates with peer Cisco EVN, Multi-VRF, and MPLS systems.

Features at a Glance

- Cisco IOS XE Software LAN Base: This image provides Layer 2 features for campus access.
- Cisco IOS XE Software IP Base: this image is upgradable with a software activation license (SAL). It includes all Layer 2 features and some basic Layer 3 features. ISSU/SSO is supported in this package.
- Cisco IOS XE Software Enterprise Services: This image is upgradable with a SAL; it supports full Layer 3 protocols and advanced features such as complete routing scalability, BGP, VRF, Policy-Based Routing, and so on.

These features can be enabled using the software-licensing mechanism. For details about software licensing, refer to the “Licensing” section later in this document or visit <http://www.cisco.com/go/sa>.

For details about the supported features in each feature set, refer to the Cisco IOS XE 3.2.0XO Release Notes at http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/release/note/OL_25346.html.

Industry Standards Supported

- Ethernet: IEEE 802.3
- 10 Gigabit Ethernet: IEEE 802.3ae
- IEEE 802.1D Spanning Tree Protocol
- IEEE 802.1w Rapid Reconfiguration of Spanning Tree
- IEEE 802.1s Multiple VLAN Instances of Spanning Tree
- IEEE 802.3ad LACP
- IEEE 802.1p CoS Prioritization
- IEEE 802.1Q VLAN
- IEEE 802.1X User Authentication
- RMON I and II standards

Supported Cisco Catalyst 4500E Series Line Cards and Modules

- WS-X4748-UPOE+E: Cisco Catalyst 4500E Series 48-port 10/100/1000 RJ-45 with 802.3af PoE, 802.3at PoEP, and UPoE
- WS-X4748-RJ45-E: Cisco Catalyst 4500E Series, 48-port 10/100/1000 (RJ-45)
- WS-X4748-RJ45V+E: Cisco Catalyst 4500E 48-Port with 802.3af PoE and 802.3at 10/100/1000 (RJ-45)
- WS-X4712-SFP+E: Cisco Catalyst 4500E Series 12-port 10 Gigabit Ethernet (SFP+)
- WS-X4648-RJ45V-E: Cisco Catalyst 4500E Series, 48-port 802.3af PoE 10/100/1000 (RJ-45)
- WS-X4648-RJ45V+E: Cisco Catalyst 4500E Series, 48-port 802.3af and 802.3at PoE 10/100/1000 (RJ-45)
- WS-X4648-RJ45-E: Cisco Catalyst 4500E Series, 48-port 10/100/1000 (RJ-45)
- WS-X4640-CSFP-E: Cisco catalyst 4500E Series, 40- and 80 port SFP/CSFP Gigabit line card
- WS-X4606-X2-E: Cisco Catalyst 4500E Series, 6-port 10 Gigabit Ethernet (X2)
- WS-X4624-SFP-E: Cisco Catalyst 4500E Series 24-port Gigabit Ethernet (SFP)
- WS-X4612-SFP-E: Cisco Catalyst 4500E Series 12-port Gigabit Ethernet (SFP)

Supported Cisco Catalyst 4500 Classic Line Cards and Modules

- WS-X4148-FE-BD-LC: Cisco Catalyst 4500 Fast Ethernet Switching Module, 48-port 100BASE-BX-D SMF (LC)
- WS-X4124-FX-MT: Cisco Catalyst 4000 Fast Ethernet Switching Module, 24-port 100BASE-FX (MT-RJ)
- WS-X4148-FX-MT: Cisco Catalyst 4500 Fast Ethernet Switching Module, 48-port 100BASE-FX multimode fiber (MMF)
- WS-X4124-RJ45: Cisco Catalyst 4500 10/100 Module, 24 ports (RJ-45)
- WS-X4148-RJ: Cisco Catalyst 4500 10/100 Module, 48 ports (RJ-45)
- WS-X4148-RJ21: Cisco Catalyst 4500 10/100 Module, 48-port telco (4 x RJ-21)
- WS-X4248-RJ21V: Cisco Catalyst 4500 PoE 802.3af 10/100, 48 ports (RJ-21)
- WS-X4224-RJ45V: Cisco Catalyst 4500 PoE 803.3af 10/100, 24 ports (RJ-45)
- WS-X4248-RJ45V: Cisco Catalyst 4500 PoE 802.3af 10/100, 48 ports (RJ-45)
- WS-X4248-FE-SFP: Cisco Catalyst 4500 Fast Ethernet Switching Module, 48-port 100BASE-X (SFP)
- WS-X4232-GB-RJ: Cisco Catalyst 4500 32-Port 10/100 (RJ-45), 2 Gigabit Ethernet (GBIC) modules
- WS-X4302-GB: Cisco Catalyst 4500 Gigabit Ethernet Module, 2 ports (GBIC)
- WS-X4306-GB: Cisco Catalyst 4500 Gigabit Ethernet Module, 6 ports (GBIC)
- WS-X4506-GB-T: Cisco Catalyst 4500 Gigabit Ethernet Module, 6 ports 10/100/1000 802.3af PoE or 1000BASE-X (SFP)
- WS-X4418-GB: Cisco Catalyst 4500 Gigabit Ethernet Module, server switching 18 ports (GBIC)
- WS-X4448-GB-SFP: Cisco Catalyst 4500 Gigabit Ethernet Module, 48 ports 1000BASE-X (optional SFPs)
- WS-X4424-GB-RJ45: Cisco Catalyst 4500 24-Port 10/100/1000 Module (RJ-45)
- WS-X4448-GB-RJ45: Cisco Catalyst 4500 48-Port 10/100/1000 Module (RJ-45)
- WS-X4548-GB-RJ45: Cisco Catalyst 4500 Enhanced 48-Port 10/100/1000 Module (RJ-45)
- WS-X4524-GB-RJ45V: Cisco Catalyst 4500 PoE 802.3af 10/100/1000, 24 ports (RJ-45)
- WS-X4548-GB-RJ45V: Cisco Catalyst 4500 PoE 802.3af 10/100/1000, 48 ports (RJ-45)
- WS-X4548-RJ45V+: Cisco Catalyst 4500 PoE+ Ready 10/100/1000, 48 ports (RJ-45)

Supported Pluggables

For details about the different optical modules and the minimum Cisco IOS Software release required for each of the supported optical modules, visit

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

Software Requirements

The Cisco Catalyst 4500E Series Supervisor Engine 7L-E is supported only in Cisco IOS Software and is not supported in the Cisco Catalyst Operating System Software. The minimum software version is Cisco IOS XE Software Release 3.2.0XO.

Environmental Conditions

- Operating temperature: 32 to 104°F (0 to 40°C)
- Storage temperature: -40 to 167°F (-40 to 75°C)
- Relative humidity: 10 to 90 percent, noncondensing
- Operating altitude: -60 to 3000m

Power and MTBF Information

Active supervisor power = 263W

Standby supervisor power = 224W

These results are not indicative of the actual power draw during operation but rather are the absolute maximum values recommended for facility power and cooling capacity planning. Typical power draw is about 20 percent lower than the maximum value shown.

MTBF = 183,341 hours

Regulatory Standards Compliance

Table 6 shows regulatory standards compliance information, and Table 7 provides ordering information.

Table 6. Cisco Catalyst 4500 Supervisor Engine 7L-E Regulatory Standards Compliance

Specification	Standard
Regulatory compliance	<ul style="list-style-type: none"> • CE marking
Safety	<ul style="list-style-type: none"> • UL 60950-1 • CAN/CSA-C22.2 No. 60950-1 • EN 60950-1 • IEC 60950-1 • AS/NZS 60950-1
EMC	<ul style="list-style-type: none"> • 47CFR Part 15 Class A • AS/NZS CISPR22 Class A • CISPR22 Class A • EN55022 Class A • ICES003 Class A • VCCI Class A • EN61000-3-2 • EN61000-3-3 • EN61000-6-1 • EN55024 • CISPR24 • EN300386 • KN22 Class A • KN24
Industry EMC, safety, and environmental standards	<ul style="list-style-type: none"> • SR-3580 NEBS level 3 GR-63-CORE, issue 3; GR-1089 CORE, issue 4 • ETS 300 019-2-1, Class 1.2 Storage • ETS 300 019-2-2, Class 2.3 Transportation • ETS 300 019-2-3, Class 3.2 Stationary Use
ROHS compliance	<ul style="list-style-type: none"> • ROHS5

Table 7. Ordering Information

Product Number	Description
WS-X45-SUP7L-E	Cisco Catalyst 4500E Series Supervisor Engine, 520 Gbps
S45U-32-1502XO	Cisco Catalyst 4500 Supervisor Engine 7L-E Cisco IOS Software XE release 3.2.0 XO noncrypto universal image
S45UK9-32-1502XO	Cisco Catalyst 4500 Supervisor Engine 7L-E Cisco IOS Software XE release 3.2.0 XO crypto universal
C4500E-LB	LAN BASE software license
C4500E-IPB	IP BASE software license
C4500E-LIC=	Base product ID for paper delivered software upgrade licenses
C4500E-LB-IPB	LAN BASE to IP BASE upgrade license (paper delivery)
C4500E-LB-ES	LAN BASE to Enterprise Services upgrade license (paper delivery)
C4500E-IP-ES	IP BASE to Enterprise Services upgrade license (paper delivery)
C4500E-LIC-PAK	Base product ID for paper delivered software licenses for spare Supervisor Engine 7L-E
C4500E-IP-ES-S	IP BASE to Enterprise Services upgrade license for spare Supervisor Engine 7L-E (paper delivery)
C4500E-IPB-S	IP BASE software license for spare Supervisor Engine 7L-E (paper delivery)
L-C4500-LIC=	Base product ID for electronically delivered software upgrade licenses
L-C4500E-LB-IP	LAN BASE to IP BASE upgrade license (electronically delivered)
L-C4500E-IP-ES	IP BASE to Enterprise Services upgrade license (electronically delivered)
L-C4500E-LB-ES	LAN BASE to Enterprise Services upgrade license (electronically delivered)
SD-X45-2GB-E	Cisco Catalyst 4500 2GB DRAM Memory for Sup 7L-E
USB-X45-4GB-E	Cisco Catalyst 4500 4GB USB device for Sup 7L-E

Licensing

Software Activation Licensing

The Cisco Catalyst 4500E platform with Supervisor Engine 7L-E enables software activation licensing. Each Supervisor Engine 7L-E ships with a universal image containing all feature sets, LAN Base, IP Base, and Enterprise Services. The level of functions is determined by the license applied.

- Software activation licensing enables customers to:
 - Speed deployment and roll out new Cisco software activation feature sets across customers' global networks.
 - Centrally and more accurately manage and track software and license compliance.
 - Easily conduct software compliance audits to meet regulations without affecting network operations.
- Simplify operations:
 - Simplified upgrades and license transfers save time and improve productivity; you can add new capabilities simply by using a license file.
 - You can easily track software assets, licenses, and feature set status.
 - A single software image improves service delivery.
- Order easily:
 - “Try and buy” lets you use a temporary license to try and evaluate new Cisco IOS Software functions before purchasing.
 - Pay-as-you-grow software key enables new features incrementally without service calls.

For more information about Cisco software licensing, visit <http://www.cisco.com/go/sa>.

Cisco Limited Lifetime Hardware Warranty

The Cisco limited lifetime hardware warranty (LLW) includes 10-day advance hardware replacement for as long as the original end user owns the product. Table 8 describes the Cisco limited lifetime hardware warranty.

The formal warranty statement, including the warranty applicable to Cisco software, appears in the Cisco information packet that accompanies your Cisco product. We encourage you to review carefully the warranty statement shipped with your specific product before use.

For additional information on warranty terms, visit <http://www.cisco.com/go/warranty>.

Table 8. Limited Lifetime Hardware Warranty

	Cisco Limited Lifetime Hardware Warranty ¹
Warranty duration	As long as the original customer owns the product.
End-of-life policy	In the event of discontinuance of product manufacture, Cisco warranty support is limited to 5 years from the announcement of discontinuance
Hardware replacement	Cisco or its service center will use commercially reasonable efforts to ship a replacement part within 10 business days after receipt of the RMA request and confirmation that a replacement part is the appropriate response. Actual delivery times may vary depending on customer location
Effective date	Hardware warranty commences from the date of shipment to the customer (and in case of resale by a Cisco reseller, not more than 90 days after original shipment by Cisco)
Cisco Technical Assistance Center (TAC) support	None
Cisco.com access	Warranty allows guest access only to Cisco.com

¹ Cisco reserves the right to refund the purchase price as its exclusive warranty remedy.

Adding a Cisco technical services contract to your device coverage provides benefits not available with warranty, including access to the Cisco TAC, a variety of hardware replacement options to meet critical business needs, updates for licensed Cisco IOS Software, and registered access to the extensive Cisco.com knowledge base and support tools. Choose from a flexible suite of support services designed to meet your business needs and help you maintain high-quality network performance while controlling operational costs. Table 9 describes the benefits and features of Cisco Technical Services.

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

Table 9. Cisco Technical Services for Cisco Catalyst 4500-E Series Switches

Technical Services
<p>Cisco SMARTnet[®] Service</p> <ul style="list-style-type: none"> • Around-the-clock, global access to the Cisco TAC • Unrestricted access to the extensive Cisco.com resources, communities, and tools • Next-business-day, 8 x 5 x 4, 24 x 7 x 4, and 24 x 7 x 2 advance hardware replacement² and onsite parts replacement and installation available • Ongoing operating system software updates within the licensed feature set¹ • Proactive diagnostics and real-time alerts on Smart Call Home-enabled devices
<p>Cisco Smart Foundation Service</p> <ul style="list-style-type: none"> • Next business day (NBD) advance hardware replacement as available • Business-hours access to TAC for small and medium-sized businesses (SMBs) (access levels vary by region) • Access to Cisco.com SMB knowledge base • Online technical resources through Smart Foundation Portal • Operating system software bug fixes and patches

Technical Services

Cisco Focused Technical Support Services

Three levels of premium, high-touch services are available:

- Cisco High-Touch Operations Management Service
- Cisco High-Touch Technical Support Service
- Cisco High-Touch Engineering Service

Valid Cisco SMARTnet or SP Base contracts on all network equipment are required.

Footnotes:

¹. Cisco operating system updates include the following: maintenance releases, minor updates, and major updates within the licensed feature set.

². Advance hardware replacement is available in various service-level combinations. For example, 8 x 5 x NBD indicates that shipment will be initiated during the standard 8-hour business day, 5 days a week (the generally accepted business days within the relevant region), with NBD delivery. Where NBD is not available, same-day shipment is provided. Restrictions apply; please review the appropriate service descriptions for details.

Cisco and Partner Services

Enable the innovative, secure, intelligent edge in the Borderless Network Architecture using personalized services from Cisco and our partners. Through a discovery process that begins with understanding your business objectives, we help you integrate the next-generation Cisco Catalyst 4500-E Series Switches into your architecture and incorporate network services onto that platform. Sharing knowledge and leading practices, we support your success every step of the way as you deploy, absorb, manage, and scale new technology.

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



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