Catalyst 4500E Supervisor Engine 7-E: Leading Borderless Network Access and Aggregation Supervisor Engine Data Sheet

Overview

Establishing borderless leadership is now easier than ever to achieve with the new Cisco® Catalyst® 4500E Supervisor Engine 7-E (Figure 1), an enterprise-class Borderless Networks access and aggregation supervisor engine designed to provide 848 Gbps per system with E-Series chassis. Cisco Catalyst 4500E Supervisor Engine 7-E is the first Cisco Catalyst supervisor engine to provide 48 Gbps per slot with Flexible NetFlow (FNF) and Advanced Security combined with reduced total cost of ownership (TCO) and excellent investment protection. With these capabilities; four 10 Gigabit Ethernet uplinks; and 10/100/1000 Power over Ethernet (PoE), PoE Plus (PoEP), and Cisco Universal PoE (UPoE) ports, this supervisor engine is undoubtedly Cisco's leading Borderless Networks access supervisor engine in the Cisco Catalyst Family. Supervisor Engine 7-E is built with price-performance aggregation deployments in mind, providing increased Gigabit Ethernet and 10 Gigabit Ethernet fiber density along with hardware capabilities to support enterprise-class aggregation functions. Supervisor Engine 7-E facilitates user experiences for enterprise, public sector, mid-market, and commercial customer deployment business-critical applications.
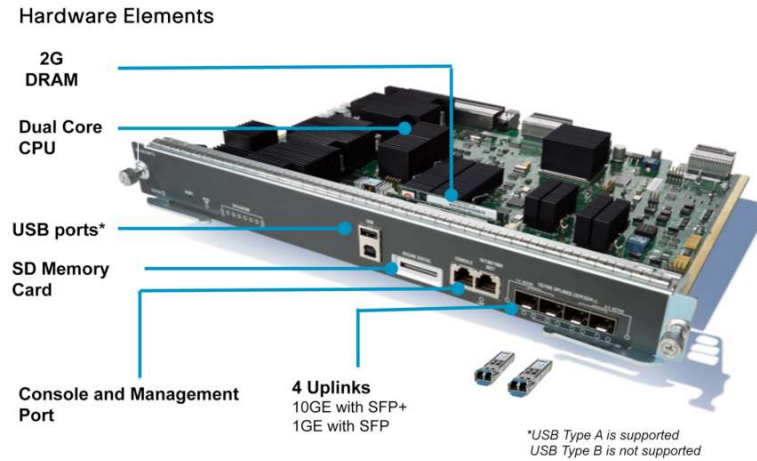
Cisco leadership in Borderless Networks is extended with important features - hardware readiness for Cisco TrustSec® technology, medianet, Flexible NetFlow, Cisco EnergyWise™ technology, Cisco Powered Workspace - and other feature enhancements enabled by the Cisco Catalyst 4500E Supervisor Engine 7-E. Backward and forward compatibility with most existing Cisco Catalyst 4500 and 4500E line cards helps assure deeper customer satisfaction with the industry's best investment protection architecture. Cisco Catalyst Supervisor Engine 7-E is supported in Cisco Catalyst 4500 E-Series chassis only.

The Cisco Catalyst 4500E Supervisor Engine 7-E delivers several new technology breakthroughs and industry firsts, extending the Cisco Catalyst 4500 Series placement from a premium wiring closet solution into next-generation borderless access and aggregation deployments.

The Supervisor Engine 7-E offers the following important leading innovations and capabilities:

- More than 10 years of investment protection through backward and forward compatibility
- Cisco Catalyst switch with 48 Gbps per slot (848 Gbps per system)
- Around 5 microseconds of latency to and from any 10 Gigabit Ethernet port
- First Cisco Catalyst switch with campus FNF
- First Cisco Catalyst switch offering Cisco IOS® XE Modular Software services
- First Cisco Catalyst switch with less than 200 msec In-Service Software Upgrade (ISSU) high availability
- First Cisco Catalyst switch for next-generation Cisco Powered Workspace (Energy Efficient Ethernet [EEE] and UPOE)
- First and only modular switch with 8 bidirectional line rate Switched Port Analyzer (SPAN) or Remote SPAN (RSPAN) sessions

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

Hardware Elements

2G DRAM
Dual Core CPU
USB ports*
SD Memory Card
Console and Management Port

4 Uplinks
10GE with SFP+
1GE with SFP

*USB Type A is supported
USB Type B is not supported

Cisco Catalyst 4500E Supervisor Engine 7-E Feature Highlights

The Cisco Catalyst 4500E Supervisor Engine 7-E is the first Cisco Catalyst supervisor engine to provide nonblocking 48-Gbps per-slot bandwidth and FNF for optimized application visibility. In addition, the enterprise-class Cisco Catalyst 4500E Supervisor Engine 7-E offers the following:

- Performance and capability
  - 848 Gbps switching capacity with 250 Mpps of throughput
  - 4 nonblocking 10 Gigabit Ethernet uplinks (Small Form-Factor Pluggable Plus [SFP+])
  - SFP support on uplinks to offer flexibility for up to 4 Gigabit Ethernet ports
  - 384 ports of nonblocking 10/100/1000
  - PoEP (30W) capabilities on all ports in a line card simultaneously
  - UPOE (60W) capabilities on all line-card slots
  - Energy Efficient Ethernet (IEEE 802.3az)
  - 196 ports of nonblocking Gigabit Ethernet SFP
  - 100 ports of 10 Gigabit Ethernet SFP+ (4 uplinks ports + 96 line-card ports)
  - 128,000 FNF entries in hardware
  - External USB and Secure Digital (SD) card support for flexible storage options
  - 256,000 routing entries for high-end campus access and aggregation deployments
  - IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks
  - 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 use 8 queues/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 ISSU support
  - Network virtualization through Multi-Virtual Route Forwarding (VRF) and Easy Virtual Networking (EVN) 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
- Cisco Borderless Networks Services
  - Optimized application performance through deep visibility with FNF supporting rich Layer 2/3/4 information (MAC, VLAN, and TCP Flags) and synthetic traffic monitoring with IP service-level agreement (IP SLA)
  - Medianet capabilities to simplify video QoS, monitoring, and security
  - Energy-efficient design with Cisco EnergyWise technology to manage network, PoEP, and PC
- Investment protection and reduced total cost of ownership (TCO)
  - Full backward compatibility with 6-, 24-, and 48-Gbps slot line cards with no performance degradation

The Cisco Catalyst 4500E Supervisor Engine 7-E is compatible with classic Cisco Catalyst 4500 line cards and power supplies, providing full investment protection. The Supervisor Engine 7-E is not compatible with classic Cisco Catalyst 4500 chassis. When you deploy the Cisco Catalyst 4500E Supervisor Engine 7-E with classic line cards, all of the new features except the 24- and 48-Gbps per-slot switching capacity are inherited.

Predictable Performance and Scalability

The Supervisor Engine 7-E is the first Cisco Catalyst supervisor engine to provide 48-Gbps per-slot switching capacity. Table 1 highlights the performance and scalability enhancements of the Cisco Catalyst 4500E Supervisor Engine 7-E.

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

Feature and Description	Supervisor Engine 7-E
Centralized switching capacity	848 Gbps
Per-slot switching capacity	48 Gbps
Throughput	• 250 Mpps for IPv4 • 125 Mpps for IPv6 • 250 Mpps for L2 Bridging
IPv4 routing entries	256,000
IPv6 routing entries	128,000
Multicast routes	16,000 (available with Cisco IOS XE 3.1.0 SG) 32,000 (Available with Cisco IOS XE 3.2.0 SG or later)
CPU	Dual core; 1.5 GHz
CPU queues	64
Synchronous dynamic RAM (SDRAM)	2 GB upgradable to 4 GB
Nonvolatile RAM (NVRAM)	1 GB
Security and QoS hardware entries	128,000
Cisco Network Admission Control (NAC) and Dynamic Host	12,000

Feature and Description	Supervisor Engine 7-E
Configuration Protocol (DHCP) snooping entries	
MAC addresses	55,000
Active VLANs	4,094
Address Resolution Protocol (ARP) entries	47,000
Spanning Tree Protocol instances	10,000
Switched virtual interfaces (SVIs)	4,094
Switched Port Analyzer (SPAN)	Maximum of 8 sessions: ingress or egress

The Supervisor Engine 7-E is also optimized for multimedia applications with its advanced multicast support offered by features such as Protocol Independent Multicast (PIM) and Source-Specific Multicast (SSM), giving your network additional scalability to support multimedia applications.

Continued Innovations through Infrastructure Services

Modular Open Application Platform, Cisco IOS XE Software

Cisco IOS XE Software is the next-generation operating system for the Cisco Catalyst 4500E Supervisor Engines, beginning with the Supervisor 7-E. Cisco continues to evolve Cisco IOS Software to support next-generation switching hardware and provide increased architectural flexibility to deliver quick adoption of future Cisco Borderless Networks services, while making sure of customer investment protection in Cisco IOS Software.

Cisco IOS XE Software provides the following customer benefits:

- Cisco IOS XE Software provides a modern operating system that can take advantage of the multicore CPU architecture of the next-generation Cisco Catalyst 4500E system with Supervisor 7-E.
- Cisco IOS XE Software makes sure of customer investment protection in the existing Cisco IOS Software. With Cisco IOS XE Software, today's Cisco IOS Software becomes a "Cisco IOS Software package" with a consistent feature set and similar operational user interface allowing a transparent migration experience.
- Cisco IOS XE Software supports service virtualization capability that allows the Cisco Catalyst 4500E to host applications other than Cisco IOS Software, such as customer-written applications or 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 the Cisco Catalyst 4500E to be an open service platform and is a primary anchor to enable future Cisco Borderless Networks innovations.

Best-in-Class Resiliency

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

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 7-E. Facilitating rapid, nondisruptive software upgrade for new line cards, new power supplies, new features, or bug fixes, ISSU offers continuous packet forwarding during the supervisor-engine switchover running different Cisco IOS Software releases.

NSF/SSO offers continuous packet forwarding during supervisor-engine switchover. Information is fully synchronized between supervisor engines to allow the standby supervisor engine to immediately take over in subsecond time if the primary fails.

NSF/SSO and ISSU dramatically improve 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). These features help ensure that VoIP calls are not dropped.

In addition to redundant power supplies, fans, and clock modules, the Cisco Catalyst 4510R+E, 4507R+E, 4510R-E, and 4507R-E chassis models support 1 + 1 supervisor-engine redundancy, using the Supervisor Engine 7-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.

Apart from the features previously mentioned, Supervisor Engine 7-E has resiliency built into its uplinks. Figure 2 shows the uplink options on Supervisor Engine 7-E.

Figure 2. High-Availability and Uplink Options for Supervisor Engine 7-E
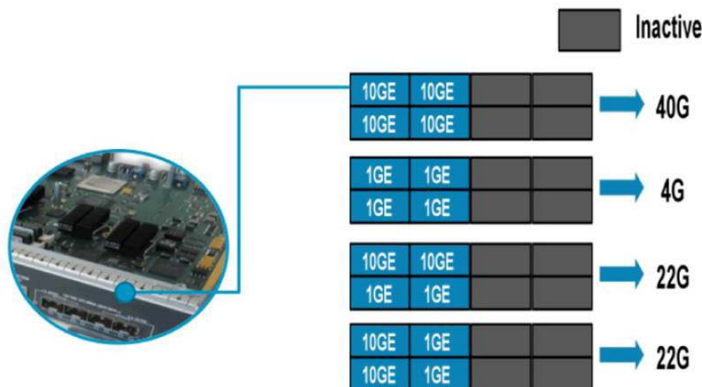
Cisco Virtual Switching Systems (VSS)

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 1.6-terabit of aggregate bandwidth with 500Mpps performance. The solution supports up to 768 ports of 1-Gbps and 200 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 7-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 7-E is a validated component of the Cisco TrustSec® 2.1 architecture. This allows the Cisco Catalyst 4500E Supervisor Engine 7-E to be transparently integrated into campus switching environments for a comprehensive security solution based on Cisco TrustSec. The Cisco Catalyst Supervisor Engine 7-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 7-E enables the ability to recognize the devices connected to the switch. This feature also interoperates with the Cisco Identity Services Engine, providing for centralized view of all devices' 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 7-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 undisrupted 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 7-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 7-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 7-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

Optimized Application Visibility with Flexible NetFlow

Cisco IOS Flexible NetFlow is the next generation in flow technology, allowing optimization of the network infrastructure, reducing operation costs, and improving capacity planning and security incident detection with increased flexibility and scalability. The Cisco Catalyst 4500E Supervisor Engine 7-E is the first Cisco Catalyst supervisor engine to provide optimized application visibility with FNF with a capability of 128,000 FNF entries. The Supervisor Engine 7-E, with a custom-built ASIC, delivers next-generation flow technology with unprecedented flexibility and comprehensive visibility extending from Layer 2 (MAC and VLAN) to Layer 4 (TCP, User Datagram Protocol [UDP] flags, and so on).

The flow data collected by FNF can be exported to an external collector for analysis and reporting, or tracked by the EEM. The Cisco Catalyst 4500E Supervisor Engine 7-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 a large IP network.

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 7-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 2 shows the supervisor-engine and line-card slot-assignment options in the Cisco Catalyst 4500E Series chassis.

Table 2. Cisco Catalyst 4500E Chassis Slot-Assignment Options

Chassis	Single Supervisor Engine 7-E Slot Assignments	Redundant Supervisor Engine 7-E 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 4510R+E	Slots 5 or 6	Slots 5 or 6	Slots 1 to 4, and 7 to 10	Slots 1 to 4, and 7 to 10
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 4510R-E	Slots 5 or 6	Slots 5 or 6	Slots 1 to 4, and 7 to 10	Slots 1 to 4, and 7 to 10

Table 3 summarizes the performance capacities of the Supervisor Engine 7-E on a per-chassis basis.

Table 3. Cisco Catalyst 4500 Supervisor Engine 7-E Bandwidth per Slot for Different Chassis

	Cisco Catalyst 4503-E Chassis	Cisco Catalyst 4506-E Chassis	Cisco Catalyst 4507R+E Chassis	Cisco Catalyst 4510R+E Chassis	Cisco Catalyst 4507R-E Chassis	Cisco Catalyst 4510R-E Chassis
Supervisor Engine 7-E (WS-X45-Sup 7-E)	48 Gbps/Slot	48 Gbps/slot	48 Gbps/slot	48 Gbps/slot	24 Gbps/slot	24 Gbps/slot

IPv6 Support

IPv6 is important for the future of IP networking and is critical for the expansion of IP address space in the future. IPv6 capability is required by many companies and is being mandated by governments worldwide. The Cisco Catalyst 4500 Supervisor Engine 7-E supports IPv6 Unicast and Multicast in hardware for full line-rate forwarding performance of up to 125 Mpps. The Supervisor Engine 7-E also dynamically allocates hardware table space between IPv4 and IPv6 routes to maximize table-space usage for optimal IPv4-to-IPv6 migration The Supervisor Engine 7-E supports Multicast Listener Discovery (MLD) Snooping for IPv6, enhancing performance and reducing network traffic by allowing a switch to dynamically add and remove hosts from a multicast group.

Table 4 highlights the IPv6 capabilities of the Supervisor Engine 7-E.

Table 4.   Summary of Supervisor Engine 7-E IPv6 Capabilities

Feature and Description	Supervisor Engine 7-E
IPv6 support	Unicast and Multicast forwarding done in hardware
IPv6 performance	125 Mpps
IPv6 Routing entries	128,000
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 3.   Simplified Campus Network Virtualization with Cisco EVN
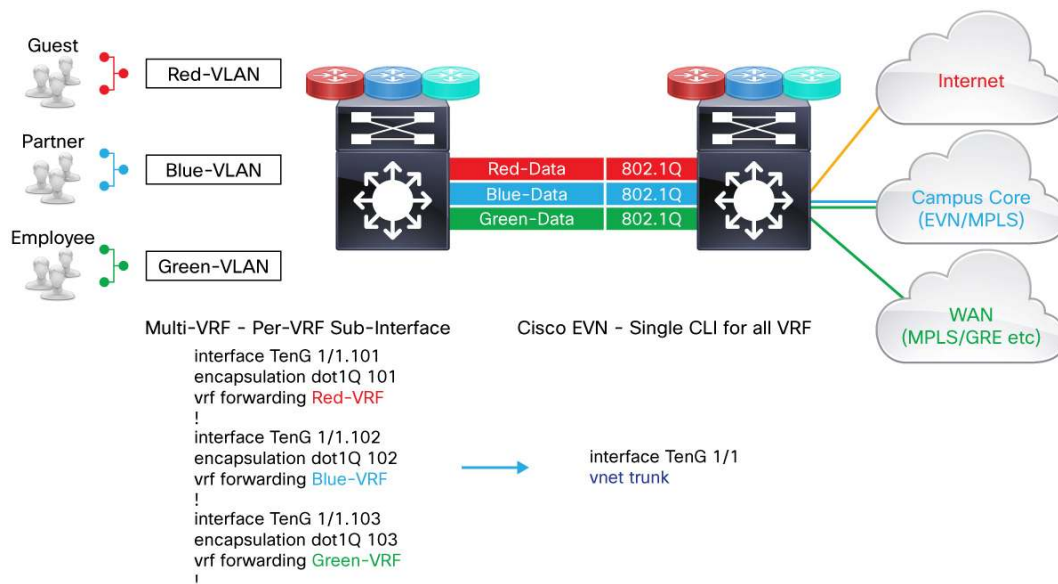
Cisco EVN is a successor solution that offers numerous advantages over traditional Multi-VRF technology:

- 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 feature set on the Supervisor 7-E-based bundles provides Layer 2 features for access.

Cisco IOS XE Software IP Base: This feature set 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 feature set is upgradable with a SAL; it supports full Layer 3 protocols and advanced features such as complete routing scalability (256,000), 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 these three images, refer to the Cisco IOS XE 3.1.0 SG Release Notes at: http://www.cisco.com/en/US/docs/switches/lan/catalyst4500/release/note/OL_23474.html.

Industry Standards

- 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 802.3af PoE, 802.3at PoEP, and UPoE 10/100/1000
- WS-X4748-RJ45-E: Cisco Catalyst 4500E Series, 48-port 10/100/1000 (RJ-45)
- WS-X4748-RJ45V+E: Cisco Catalyst 4500E Series, 48-port PoE 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 Premium 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 Ethernet 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)
- CVR-X2-SFP: Twin gigabit converter module

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+: 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 7-E is supported only in Cisco IOS Software and is not supported in the Cisco Catalyst Operating System Software. The minimum software version is as follows:

- Supervisor Engine 7-E, Cisco IOS XE Software Release 3.1.0 SG

Environmental Conditions

- Operating temperature: 32 to 104ºF (0 to 40ºC)

- Storage temperature: -40 to 167ºF (-40 to 75ºC)

- Relative humidity: 10 to 90 percent, noncondensing

- Operating altitude: -60 to 3000m

Power and MTBF Information

Active supervisor power = 280W

Standby supervisor power = 224W

This result is not indicative of the actual power draw during operation. It is the absolute maximum value recommended for facility power and cooling capacity planning. Typical power draw is about 20 percent lower than the maximum value shown.

MTBF = 155,241 hours

Regulatory Standards Compliance

Table 5 shows regulatory standards compliance information, and Table 6 provides ordering information.

Table 5.   Cisco Catalyst 4500 Supervisor Engine 7-E Regulatory Standards Compliance

Specification	Standard
Regulatory compliance	• CE marking
Safety	• UL 60950CAN/CSA-C22.2 No. 60950 • EN 60950 • IEC 60950 • TS 001 • AS/NZS 3260

Specification	Standard
EMC	• FCC Part 15 (CFR 47) Class A • ICES-003 Class A • EN55022 Class A • CISPR22 Class A • AS/NZS 3548 Class A • VCCI Class A • ETS 300 386 • EN 55022 • EN 55024 • EN 61000-6-1 • EN 50082-1 • EN 61000-3-2 • EN 61000-3-3
Industry EMC, safety, and environmental standards	• GR-63-Core Network Equipment Building Standards (NEBS) Level 3 • GR-1089-Core Level 3 • ETS 300 019 Storage Class 1.1 • ETS 300 019 Transportation Class 2.3 (pending) • ETS 300 019 Stationary Use Class 3.1 • ETS 300 386 • EN 50121-4
ROHS compliance	• ROHS5

Table 6.   Ordering Information

Product Number	Description
WS-X45-SUP7-E	Cisco Catalyst 4500E Series Supervisor, 848 Gbps
WS-C4510RE-S7+96V+	4510R+E Chassis, Two WS-X4748-RJ-45V+E, Sup7-E
S45U-31-01XO	Cisco Catalyst 4500 Supervisor Engine 7-E Cisco IOS Software XE release 3.1.0 SG non-crypto universal image
S45ULK9-31-01XO	Cisco Catalyst 4500 Supervisor Engine 7-E Cisco IOS Software XE release 3.1.0 SG 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 7-E
C4500E-IP-ES-S	IP BASE to Enterprise Services upgrade license for spare Supervisor Engine7-E (paper delivery)
C4500E-IPB-S	IP BASE software license for spare Supervisor Engine 7-E (paper delivery)
L-C4500E-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 SD Memory Card for Sup 7-E
USB-X45-4GB-E	Cisco Catalyst 4500 4GB USB device for Sup 7-E

Licensing

Software Activation Licensing

The Cisco Catalyst 4500E platform with Supervisor 7-E enables software activation licensing. Each Supervisor 7-E will ship 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

Operational simplicity:

- 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

Ease of ordering:

- "Try and buy" lets you use a temporary license to try and evaluate new Cisco IOS Software functions before purchasing them
- A 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 7 describes the limited lifetime hardware warranty.

Your 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 about warranty terms, visit http://www.cisco.com/go/warranty.

Adding a Cisco technical services contract to your device coverage provides benefits not available with warranty, including access to the Cisco Technical Assistance Center (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. Table 7 describes the benefits and features of Cisco technical services.

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

Table 7. 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 our 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 TAC support	None
Cisco.com access	The warranty allows guest access only to Cisco.com

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

Cisco and Partner Services

Enable the innovative, secure, intelligent edge in the Cisco Borderless Networks 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. 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 8 shows the Cisco technical services available for Cisco Catalyst 4500-E Series Switches.

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

Table 8. Cisco Technical Services for Cisco Catalyst 4500-E Series Switches

Technical Services
Cisco SMARTnet Service • 24-hour global access to the Cisco TAC • Unrestricted access to the extensive Cisco.com resources, communities, and tools • Next-business-day (NBD), 8 x 5 x 4, 24 x 7 x 4, and 24 x 7 x 2 advance hardware replacement[2] and onsite parts replacement and installation available • Ongoing operating system software updates within the licensed feature set[1] • Proactive diagnostics and real-time alerts on Smart Call Home-enabled devices
Cisco Smart Foundation Service • Next business day 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
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.

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