Product Assessment:	**Cisco - Catalyst 4500-E Series**
Report Date:	December 07, 2011
Analyst:	Spanbauer, Mike
Service:	Hot Topics , Business Technology and Software
Market:	Data Center , Enterprise Networking
Class:	Modular Switching
Current Perspective:	★★★★☆

Summary

Buying Criteria

Current Perspective   ★★★★☆

The Catalyst 4500E series is threatening to competing products because of its solid performance, port diversity and strong investment protection brought about by Cisco's constant product improvements for the Catalyst 4500 family. On top of that, Cisco's immense mind share in the enterprise switching market serves to bring customers for the Catalyst 4500 family. The Catalyst 4500E chassis offers more capacity for inline power, and brings fabric-level fault tolerance to the platform in the form of the Catalyst 4507R+E and 4510R+E. With support for up to 384 line-rate Gigabit Ethernet ports, as well as PoE and PoE+ in Gigabit Ethernet, the Catalyst 4500E series is a dense solution that delivers bandwidth and packet forwarding performance tailored for the wiring closet. With the addition of the Supervisor 7-E in 2010, Cisco added 4x10GbE line rate uplink capabilities on the supervisor card as well as doubling the performance of the line cards from 24Gb to 48Gb per slot. This performance increase offers customers line-rate GbE for applications that demand it. The Supervisor 7-E uplinks provide the flexibility of supporting both 1GE and 10GE providing smooth migration to 10GE from 1GE between their wiring closet and aggregation switches. Supervisor 7-E enables Application Visibility and Control by enabling Flexible Netflow and the ability to host third-party applications, including a built-in packet analyzer (Wireshark). As a 1 GbE solution, the Catalyst 4500E is Cisco's lead platform for the modular wiring closet in configurations from 96 to 384 ports. However it does compete with its other Catalyst brethren, the popular 3750 fixed switch family and the more robust Catalyst 6500. In 10GbE deployments, the Supervisor 7-E supports up to 96 ports in a 4510R+E chassis with a 2.5:1 oversubscription. Despite the increased performance per line card the Catalyst 4500E still exists in the shadows of the Catalyst 6500-E, and many customers opt for the 6500-E over the 4500E, citing the advanced features of the 6500-E such as on module switching for the acceptable price premium.

The Catalyst 4500E can be provisioned with a choice of four Supervisor engines: supervisor 6L-E is the entry level supervisor which provide higher 24G/slot performance and IPv6 in hardware in addition to the PoE+ capabilities on certain line cards. The Supervisor 7-E is the leading services rich supervisor, providing a fully populated line rate GbE configuration (384 ports) in addition to up to 96 10GE ports. All Supervisors support the IP Base (for layer 2 and routed access deployments) and Enterprise Services (for layer 3 aggregation and virtualized deployments) Cisco IOS Software feature sets.

Strengths and Weaknesses

Strengths

• All modern Supervisor engines for the Catalyst 4500E series support full multi-layer switching and packet classification. The Supervisor Engine 7 also introduces support for the Energy Efficient Ethernet (EEE) compliant line cards and brings full In Service Software Updates (ISSU) to the 4500 family.

• The Catalyst 4507R+E and 4510R+E offer competitive 10/100/1000/10G densities available in a wiring closet

Weaknesses

• While the Catalyst 4500 offers power supply and fan redundancy in all the chassis types, the supervisor switching engine redundancy is however available only on the "R" series chassis – 4507R+E and 4510R+E. This makes the other models of the Catalyst 4500E optimized for traditional data only deployments and the R-series chassis optimized for VoIP and video installations.

• There are hidden costs involved in deploying the Catalyst

form factor today. The Catalyst 4500E family offers a large variety of line cards, providing considerable flexibility for the customer. The addition of the Supervisor 7-E to the family offers customers dense PoE(+) options as well as line rate GbE.

• The Supervisor 7-E brings dense 10G as an option to the 4500E family with support for up to 100 ports (four on sup, 96 line card ports) at a 2.5:1 oversubscription ratio (48Gb/slot across 12 ports).

• Cisco based the Supervisor engines for the Catalyst 4500E series on its IOS for Catalyst switching software, which has a long history of product development and support for virtually all networking protocols and standards. The Supervisor 7-E supports Cisco IOS XE, which provides all the benefits of IOS with the added advantage of an open application platform on a Linux kernel allowing the integration of third-party applications.

• The Catalyst 4500E series is convergence-ready, providing integrated multi-layer classification, control plane protection, a four-queue QoS architecture and PoE+ technology. All available Supervisor Engines support < 200 msec failover via stateful switchover (SSO) for VoIP applications, and support true In Service Software Upgrades (ISSU).

• IEEE 802.3af PoE and IEEE 802.3at (PoE+) is available in several switching modules for the Catalyst 4500E chassis. This allows customers to add only the number of PoE ports that are required.

4500E in a Layer 3 aggregation environment. The software that delivers advanced routing support, including support for OSPF, requires an additional $10,000 license per chassis. EIGRP-stub and OSPF support up to 200 routes for routed layer 3 access designs, which are supported in the default IP Base image.

• The Catalyst 4500E uses a centralized switching architecture, which is somewhat undesirable in some environments. Competitors have all gone to on-card switching and the Catalyst 4500E is behind in this respect, even though its centralized switching lowers the per-port cost of line cards considerably. Though some may argue that the feature is unnecessary in most wiring closet use cases, it is a feature that the 4500E lacks compared to its peers.

Point and Counterpoint

Point

• The Catalyst 4500E Series is often considered "second fiddle" to Cisco's flagship Catalyst 6500 switch products and often doesn't get the best features or attention from development.

Counterpoint

• Cisco has made considerable effort over the years to provide the same industry-leading long term value that the Catalyst 6500 offers. The Catalyst 4500E is aimed lower in the market for aggregation than the Catalyst 6500 and has correspondingly different features, rather than suffering from a lack of attention. The Catalyst 4500E is now positioned as Cisco's lead platform for campus access and has a market share position demonstrating customer confidence. Considerable, continued investment in the platform demonstrates support and commitment to the platform by Cisco.

Point

• In the wiring closet market, the 90-day warranty Cisco provides is particularly poor in comparison to competitors' lifetime warranties and free software upgrades.

Counterpoint

• Cisco now offers a Limited Lifetime Warranty on the Catalyst 4500E. In addition, Cisco offers service contracts that will deal with any servicing issues on the next business day.

Point

• Cisco seems to be putting a heavy cost burden on existing customers to move their Catalyst 4500s up to 10 Gigabit Ethernet functionality. This flies in the face of Cisco's supposed strong investment protection.

Counterpoint

• Customers that need 10 Gigabit Ethernet also require capacity improvements. Certainly there is cost involved in increasing the capacity and port speed of a switch, but because customers do not need to forklift the entire switch – only the sheet metal and supervisor plus 10G ports, the overall costs, including installation and downtime, will be much lower on the Catalyst 4500E.

Point

• Customers that have purchased the 4510R+E may be upset that they have to upgrade to a new Supervisor card to take advantage of the advanced failover features.

Counterpoint

• By providing a new Supervisor card with advanced features, Cisco is providing significant investment protection in the Catalyst 4500E chassis, and customers will see that value. True customer disappointment comes in a platform that cannot be upgraded.

Buying/Selecting Criteria

Management/Ease of Use

★★★★☆

• Cisco based the Catalyst 4500E on its IOS for Catalyst, meaning it supports as many configurations as the customer chooses to save to flash memory. This allows administrators to roll back code versions and safeguard against potential network outages.

• Cisco's Cisco Discovery Protocol (CDP) enables more detailed network device discovery for Cisco devices and extends power management technology by enabling Cisco to query the powered device to determine exact power requirements. Cisco also now supports the standards-based LLDP protocol.

• Catalyst 4500E can support "Zero Touch" installation through automation tools like the Embedded Event Manager (EEM). In addition to EEM, the switching platform also offers Cisco Smart Call Home for automated diagnostics and notification, significantly reducing downtime.

• With In-service software upgrade of the platform now possible, customers possess the means to upgrade their 4500s without interrupting service. In the increasingly mobile enterprise and with more and more services being highly network dependent (i.e., virtual desktop) the less downtime required for the network, the better.

• The Catalyst 4500E, Supervisor Engine 7-E offers Flexible Netflow, which enables application visibility and control with a tight integration with EEM enabling the network administrators to have more proactive control on their network through automated syslogs, SNMP traps in case of an event, significantly reducing the time it takes to troubleshoot and isolate network related issues.

• The Supervisor 7-E also offers IOS-XE, which enables the ability to host third-party applications like a built-in packet analyzer that can debug packets directly on the supervisor.

• The Catalyst 4500E also supports up to eight bi-directional SPAN/RSPAN sessions to collect traffic from every port and be sent to an external traffic analytical engine for advanced troubleshooting and capacity planning.

• Embedded location services support provides a central view of location for all wired and wireless devices helping with inventory management.

• Cisco's AutoQoS feature and Smartports technology further simplify the configuration of QoS and other port-specific parameters, but they are still no substitute for the policy-managed solutions of some competitors.

Performance

★★★☆☆

• The introduction of the Catalyst 4500E Supervisor 7-E improved platform performance to a fabric bandwidth of 848 Gbps with throughput of 250 Mpps.

• Cisco has increased the available bandwidth and throughput considerably with the E series switches and recent supervisors, making the product more competitive with other modular mid-market solutions.

• The Catalyst 4500E models with the Supervisor 7-E have a 2.5:1 oversubscription rate on the 10GbE line cards, which is a bit behind the average in this price / class of device today (such as the HP E5400/E8200 or Brocade SX).

• The Catalyst 4500E offers one of the lowest modular switching latencies at ~5 microseconds.

Port Diversity

★★★★★

• The Catalyst 4500E supports full IEEE 802.3af PoE for 10/100 and 10/100/1000 links on all ports. It also supports the new PoE+ standard for 30 watts per port on certain Gigabit Ethernet line cards.

• The Catalyst 4500E has the best port diversity among modular wiring closet offerings. Cisco offers a wide selection of fiber and copper options as well as some specialty telco interfaces for the Catalyst 4500E.

• The Catalyst 4500E with Supervisor Engine 7-E supports up to four ports of SFP+ uplinks, which can be mixed and matched for 1GE or 10GE support simply with a change of optics.

• Since Cisco offers so many line cards for the Catalyst 4500E, customers can customize the product to exactly their needs. However, because there are so many line cards available, it is often difficult to sort through them all at purchasing time, although Cisco has been reducing the total number of cards available for the product line to simplify purchasing.

• Cisco has competitive 1G and 10G options in terms of connectors and density in this class of switches with any other vendor in the space, exceeding most.

Scalability

★★★★☆

• High-density PoE can be enabled with the 6000W AC power support and no longer require external power shelves on the Catalyst 4500E, simplifying deployments and taking up less rack space. With power supplies in "redundant" mode, about 280 ports can receive full 15 Watts of full power redundancy.

• The Catalyst 4500E is a high-density chassis. Even though the 4507R+E has only five slots available for line cards, the very high-density 48-port line cards combine to deliver 240 ports per chassis. With the 4510R+E, this number increases to 384. This density ranks the Catalyst 4500E competitive with most rival products for density in a wiring closet product.

• The Catalyst 4500E is a convergence-ready switch, with eight QoS queues per port, including a strict priority queue for VoIP traffic. Many

competitors have moved to eight QoS ports in their offerings.

• The Catalyst 4500E supports up to 55,000 MAC address, 256,000 routing protocols, 32,000 multicast routes, 128,000 Netflow entries and 16,000 aggregate policers – ideal for both campus wiring closet and distribution deployments.

Total Cost of Ownership

⭐⭐⭐⭐☆

• The initial acquisition costs of the 4500E vary greatly. The up-front costs for the Catalyst 4500E are slightly higher than competitors' costs; however the system is able to reach extremely competitive price points due to its system and port density.

• Although the initial investment cost on the 4500E is 10-20% higher, prices for individual line cards are generally more aggressive than competitors' prices. This is mainly due to the centralized switching done on the product, where the line cards are not much more than physical connectivity with no local switching.

• While Cisco has made improvements on the management front through features such as AutoQoS and the Smartports technology, the overall network management aspect of Cisco's wiring closet solution is still significantly weaker than the strong, policy-driven network management solutions of several competitors such as Enterasys and Alcatel-Lucent.

• Cisco has demonstrated the Catalyst 4500E series chassis' power of investment protection by delivering new Supervisor modules and advanced line cards that have increased performance and expanded functionality, without requiring a forklift upgrade from customers.

• Cisco licenses advanced features (e.g., full routing and virtualization) separately, raising TCO for customers requiring those features.

• Catalyst 4500E now offers Limited Lifetime Warranty similar to the Catalyst 2k/3k product families and one of the few modular products on the market to do so.

Metrics

Physical Characteristics

Device Class	Layer 3
Primary Target Market	Wiring Closet

QoS Features

Total Number of Transmit Queues Per Port	8
Total Number of Receive Queues Per Port	Not applicable;shared memory
Rate Limiting Granularity	32k

Protocol Support

802.3ad Trunking	Yes
IP Routing	Yes
IP Routing Protocols	RIP, (E)IGRP, OSPF, IS-IS, BGP

Interface Support

10/100/1000Base-T	48 per line card
10/100/1000Base-T with 802.3af	48 per line card
1000Base-X (GBIC or SFP)	2,6,18,24 Metro,24 Standard, 48
10G - Fixed Optics	Not applicable
10G - Modular	6-Port (E-Series), 12-Port (E-Series), 2-Port (on Supervisor Engine V-10GE, 6L-E & 6-E), 4-Port (On Supervisor Engine 7-E)
Other (Specify Type and Port Count)	100BaseLX10, 100BaseBX-D
Special Modules (Non-line Cards)	None

Chassis-Specific Characteristics

Total Number of Slots in Chassis	3, 6, 7, or 10
Reserved Slots	5,6 on 7R+E and 6,7 on 10R+E chassis

Fabric Module

Fabric Type	Shared memory switching fabric
Fabric Location	Co-located with management module
Fabric Redundancy	4503E & 4506E: single dedicated fabric integrated in chassis; 4507R+E, 4510R+E: single fabric required for switch operation; dual fabrics provide redundancy but no additional performance

High Availability

Hot-Swap Fan Trays	Yes
Hot-Swap Line Cards	Yes
Hot-Swap Management Module	Yes
Hot-Swap Fabric Module	Yes
Hot-Swap Power Supplies	Yes
Hot-Swap Other	Yes
Minimum Number of Power Supplies	1
Maximum Number of Power Supplies	2
Power Supply Load Distribution	Redundant - power supplies equally share the load; any one power supply can fully power the system
Non-Stop Code Upgrade	Yes – ISSU available on Supervisor 6 and 7 series

Performance

Backplane Size	SE V-10GE: 136Gbps, Supervisor Engine 6-E 320Gbps, Supervisor Engine 6L-E 280Gbps, Supervisor 7-E 848Gbps
Forwarding Rate	SE V10GE: 102Mpps, SE 6-E 250Mpps, SE 6L-E 225Mpps, SE 7-E 250Mpps
Switch Forwarding Latency	< 10 us

Pricing

Bare Chassis Configuration	4503-E: Chassis = $995, 4506-E: Chassis = $4995, 4507R+E: Chassis = $6995, 4510R+E $9,995, Should list Power supply offering and price from $995 to $3995
10/100Base-T Line Card Price (non-PoE)	(note, this is the only 1G module for line rate GbE) 48Gbps 48-port 10/100/1000 PoEP =$8,995, 24Gbps 48 port 10/100/1000 PoEP = $7495
10/100Base-T Line Card Price (PoE)	24 Gbps 48-port 10/100/1000=$5,495

Support

Standard Warranty	Limited Lifetime - fan and power supply = 5 years, 5 years End-of-sale
Enterprise Maintenance Contract	Smartnet options vary based on model and software license – ranging from 3% of product price on up

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