



Why Should I Care About 10 Gigabit Ethernet?

Since the 10 gigabit IEEE 802.3ae standard was ratified in mid-2002, 10 Gigabit Ethernet port shipments have grown from hundreds of ports per quarter to tens-of-thousands of ports per quarter. Growth in port deployments is accelerated by growth in desktop gigabit ports, which affect uplink ratios as well as new applications such as IP video and industry-specific applications such as digital imaging. The Cisco® Catalyst® 4500 Supervisor Engine 6-E, Cisco Catalyst 4500 Series Supervisor Engine V-10GE, or Supervisor Engine II-Plus-10GE with two line-rate 10 Gigabit Ethernet uplinks in a modular chassis allow customers to scale their access layer for future applications. In addition, the 6-port 10 Gigabit E-Series line card is a great enabler to scale enterprise distribution or commercial cores. They can start with the gigabit Small Form-Factor Pluggable (SFP) (using TwinGig converter modules on the E-Series) and migrate to the 10 Gigabit Ethernet when needed, without replacing the supervisor engine or line card.

10 Gigabit Ethernet Technology Overview

10 Gigabit Ethernet uses the wealth of Ethernet technologies that have been developed over the years and simplifies the migration to this higher-speed version of a proven technology. 10 Gigabit Ethernet, like gigabit, is full-duplex. Transmission is limited only by the length of the link. There are no packet collisions in a full-duplex link; the link distances are therefore determined by optics and not by the diameter of an Ethernet collision domain, making the technology applicable to enterprise access-layer uplinks, data center, and Metro Ethernet deployments.

Table 1 summarizes the 10 Gigabit Ethernet physical interfaces, available distance supported, and typical deployments.

Table 1. 10 Gigabit Ethernet Interfaces

Part Number	Operating Range Cable	Typical Deployment
X2-10GB-CX4	15m, CX-4 copper	Data center
X2-10GB-SR	Up to 300m, Multimode Fiber	Data center
X2-10GB-LX4	Up to 300m, Multimode Fiber	Campus or data center
X2-10GB-LR	Up to 10 km, Single Mode Fiber	Campus or metro
X2-10GB-ER	Up to 40 km, Single Mode Fiber	Metro

Cisco Catalyst 4500 Series 10 Gigabit Optics

The Cisco Catalyst 4500 E-Series 10 Gigabit Ethernet products make use of smaller X2 transceivers. The X2 transceivers are 100 percent optically compatible with XENPAK and SFP+ optics.

10 Gigabit Ethernet Advantage Versus Multiple Gigabit Links

- **Lower latency:** Latency is a function of wire speed. Aggregated Gigabit Ethernet links have a wire speed of 1 Gbps versus 10 Gigabit Ethernet links with a wire speed of 10 Gbps. 10 Gigabit Ethernet delivers lower latency.
- **Large stream support:** The traffic aggregated over Gigabit Ethernet links is limited to 1-Gbps streams. In some cases the link-aggregation distribution algorithm may map more than one stream to the same link, resulting in congestion and dropped packets. A single 10 Gigabit Ethernet link can support multigigabit streams and does not have link-aggregation distribution algorithm issues.

- **Less fiber usage:** A 10 Gigabit Ethernet link uses fewer fiber strands compared with Gigabit Ethernet aggregation, which uses one fiber strand per Gigabit Ethernet link. This 10 Gigabit Ethernet advantage reduces cabling complexity in data centers and more efficiently uses existing fiber cabling in campus environments, where laying additional fiber could be cost-prohibitive.

Table 2 shows Cisco Catalyst 4500 E-Series 10 Gigabit Ethernet part numbers.

Table 2. Cisco Catalyst 4500 E-Series 10 Gigabit Ethernet Part Numbers

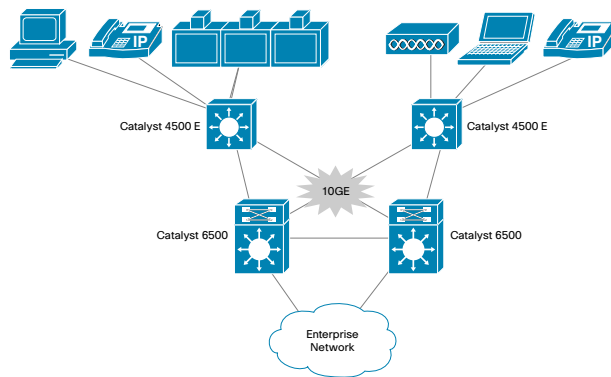
Part Number	Name	Description
WS-X45-SUP6-E	Supervisor Engine 6-E	Cisco Catalyst 4500 E-Series Supervisor Engine with dual 10 Gigabit Ethernet uplinks
WS-X4606-X2-E	6 Port 10 Gigabit Ethernet E-Series line card	E-Series 6-port 10 Gigabit Ethernet, 2.5:1 oversubscribed
WS-X4516-10GE	Supervisor Engine V-10GE	Cisco Catalyst 4500 classic L3 supervisor engine with dual 10 Gigabit Ethernet uplinks
WS-X4013+10GE	Supervisor Engine II-Plus-10GE	Cisco Catalyst 4500 classic L2+supervisor engine with dual 10 Gigabit Ethernet uplinks

10 Gigabit Ethernet Enterprise Access Deployment

Gigabit Ethernet-to-desktop deployments amount to millions of ports per quarter. This broad adoption significantly increased the oversubscription ratios of the rest of the network. 10 Gigabit Ethernet can help bring these oversubscription ratios back in line with network-design best practices. The Supervisor Engine 6-E, Supervisor

Engine V-10GE, and Supervisor Engine II-Plus-10GE provide this capability for high-performance access-layer deployment (Figure 1).

Figure 1. 10 Gigabit Ethernet Enterprise Access Deployment



10 Gigabit Ethernet Enterprise Distribution Deployment

The Cisco Catalyst 4500 E-Series aggregates up to 30 oversubscribed (2.5:1) 10 Gigabit Ethernet connections from access switches for cost-effective distribution layer deployments. Robust, intelligent network services are crucial to successful deployment at the distribution layer. The Cisco Catalyst 4500 E-Series provides centralized, line-rate services such as quality of service (QoS), multicast, and IPv4 and IPv6 routing. QoS imposes prioritization on traffic as it crosses the switch during periods of congestion and guarantees minimum bandwidth to specific applications while controlling jitter and latency. When distribution layer switches aggregate connections from hundreds of access layer devices, reliability is of paramount importance. The Cisco Catalyst 4500 E-Series provides In-Service Software Upgrade (ISSU)* to allow routine

maintenance activities to take place with less than 200 milliseconds of disruption to traffic. With ISSU a complete software upgrade can take place while IP phone calls are crossing the switch.

10 Gigabit Ethernet Commercial Core Deployment

In smaller commercial class deployments, the core and distribution layers of the network are often combined or collapsed into a single layer. In deployments such as these, high-speed connection to other core devices and core services such as Border Gateway Protocol (BGP) are vital. The Cisco Catalyst 4500 E-Series provides wire-speed 10 Gigabit Ethernet ports for transport services required of a core device. Generous ternary content addressable memory (TCAM) resources, up to 256,000 IPv4 routes, help ensure scalability and services.

* Available Q1CY 08