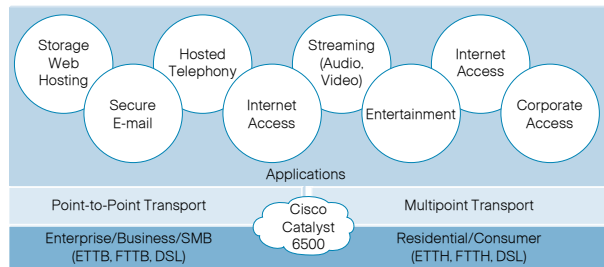


Carrier Ethernet Requirements

Service providers offering Carrier Ethernet target two market segments, *corporate* and *residential* customers (Figure 1).

Figure 1. Carrier Ethernet Market Segments and Applications



The evolving services and network convergence of service providers require a network infrastructure able to fulfill the following requirements:

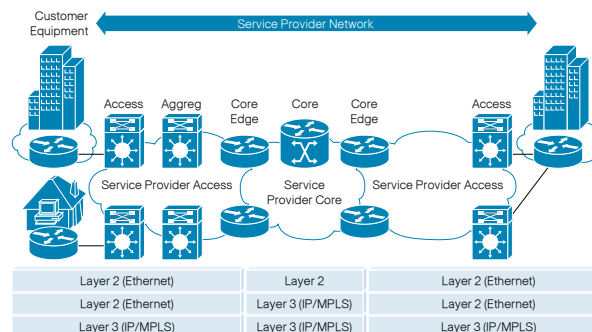
- **Scalability**—Offer high switching performance and bandwidth availability to support bandwidth-intensive applications and enable new services without operational impact.
- **Flexibility**—Offer flexibility of port densities, and various connector types with long-reach optics. Offer the ability to integrate “Triple-Play” and TLS services based on Layer 2, IP, and MPLS technologies.
- **Feature Richness**—Offer differentiators to enable metropolitan services, such as MPLS, IPv6, and Multicast.
- **Security**—Protect service provider resources and guarantee subscribers’ traffic isolation and authentication.
- **High Availability**—Maximize service uptime and reduce MTTR and MTBF, through hardware redundancy, software rapid failover and subsystem In Service Software Upgrade (ISSU) with software modularity.
- **QoS**—Enable voice, video, and data on the same platform, with jitter, latency, and packet loss guarantees.
- **Manageability**—Ease service provisioning, improve operational efficiency, and reduce OpEx costs.

Carrier Ethernet Architectures

Carrier Ethernet service providers can choose the following three different architectures for offering Triple-Play and TLS services to residential and corporate customers (Figure 2):

- End-to-end Layer 2
- Layer 2 in the metropolitan area and IP/MPLS in the core or backbone
- End-to-end Layer 3

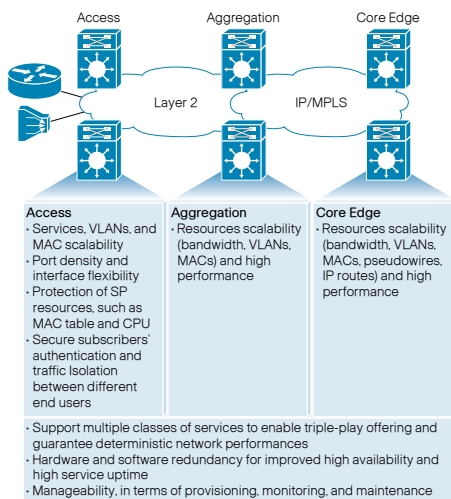
Figure 2. Carrier Ethernet Architecture Options



The focus of this At-a-Glance is the Layer 2 in the metropolitan area and IP/MPLS in the core architecture.

A Layer 2 + IP/MPLS Carrier Ethernet network can be segmented into an access, an aggregation, and a core edge layer, with the following key requirements for enabling services (Figure 3):

Figure 3. Carrier Ethernet Access and Aggregation and Core Edge Requirements



Cisco Catalyst 6500 Series: The Foundation

The Cisco® Catalyst® 6500 Series and Cisco ME 6524 switches form the foundation of Carrier Ethernet architectures by providing leading Layer 2 switching, IP routing, hardware-enabled MPLS, and high performance integrated in a single platform. The Cisco Catalyst 6500 Series is the premier Cisco switching and routing platform for the access, aggregation, and core edge of the service provider network with the following key advantages.

Scalability and Flexibility

- **720-Gbps integrated switch fabric capacity** with Cisco Catalyst 6500 Series Supervisor Engine 720
- **Ability to scale from 15- to 400-Mpps switching performance** with distributed forwarding
- **High-density Gigabit and 10-Gigabit Ethernet support**
- **End-to-end architecture and features consistency** with Cisco ME 6524, Cisco Catalyst 6500 Supervisor Engine 32, and Supervisor Engine 720
- **High-performance CPU** for Layer 2 protocols convergence and stability
- **Optimized switching capabilities** with centralized and distributed forwarding; and scalable IP routing/MPLS functions in hardware without performance impact (Table 1):

Table 1. Cisco Catalyst 6500 Scalability Features

	Up to a Maximum of
IPv4 Routes	1,000,000
IPv6 Routes	500,000
MPLS VPNs	1000
EoMPLS Tunnels	4096
MAC Table Entries	64000
Number of ACLs	4096
Netflow Entries	256,000
QoS TCAM Entries	32,000

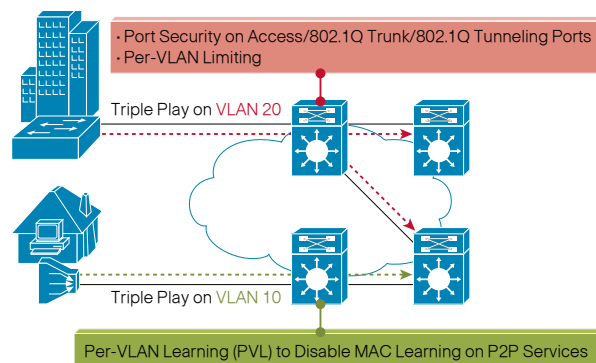
- **Innovative mechanism to scale the number of service instances and MACs in a Layer 2 network**
- **Support for a broad range of connectivity options** by offering 10/100, 100BASE-X SFP, 10/100/1000, Gigabit Ethernet SFP, and 10-Gigabit Ethernet line cards

- **Enhanced service richness in the same platform** by supporting Layer 2, Layer 3, and MPLS service enablers, such as access ports, 802.1Q trunk ports, hardware-enabled 802.1Q Tunneling and VLAN Translation, Layer 2 Protocol Tunneling, hardware-enabled MPLS VPNs, and EoMPLS
- **Support for H-VPLS**, with 802.1Q in the access and VPLS enabled on CWAN cards (SIPs and SPAs)
- **Support for next-generation Layer 2 networks** through pre-standard IEEE 802.1ad implementation

Security

- **Memory protection, fault containment, and improved scalability** through dedicated TCAMs for NetFlow, ACLs, security, and QoS deployments
- **Protection of the service provider's network** against DoS attacks, through Control Plane Policing and hardware rate limiters
- **Flexible mechanisms to safeguard service provider's MAC table** and optimize MAC learning (Figure 4):

Figure 4. Security Mechanisms to Protect Service Provider MAC Table



- **Protection of service provider's CPU** through port-, VLAN-, and MAC-based ACLs enabled in hardware
- **Protection from unauthorized end users** through 802.1x, DHCP Snooping, and Dynamic ARP Inspection
- **Subscriber protection and traffic isolation** through Private VLANs and Private Hosts

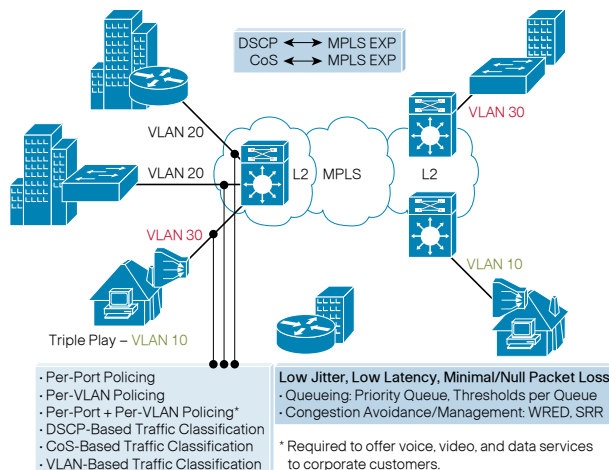
High Availability

- **Hardware redundancy** for fans, power supplies, fabrics, and clocks for nonstop operation
- **Complete separation of control and data planes** for enhanced resiliency
- Improved Layer 2 fast convergence over hub-and-spoke topologies **by enabling Flexlink to obviate the need for Spanning Tree**
- **Leadership in high availability and service uptime:** stateful switchover (SSO) to help ensure minimal traffic loss and sub-second recovery in Layer 2 networks upon primary supervisor failure
- **Cisco IOS® Software modularity** to deliver fault containment, memory protection, process restartability, and In Service Software Upgrade (ISSU) for patch fixes

QoS and Multicast

- **Advanced quality-of-service mechanism** to enable Triple-Play and TLS services on the same infrastructure (Figure 5):

Figure 5. Flexible QoS Mechanism to Enable Voice, Video, and Data



- **Triple-Play services support** by enabling Cisco innovative technologies such as hardware-enabled PIM and IGMP snooping, and hardware-based Layer 2 Multicast

Manageability

- **Increased end-to-end service operational efficiency** through management and monitoring features such as E-OAM protocols
- **Enhanced and scalable network monitoring, traffic profiling, and capacity planning** by enabling hardware-based NetFlow, up to a maximum of 256,000 entries
- **Increased end-to-end service operational efficiency** through management and monitoring features such as MPLS LSP ping and traceroute

Table 2 lists the key Cisco Catalyst 6500 Carrier Ethernet Layer 2 IP MPLS features.

Table 2. Key Carrier Ethernet Layer 2 Features on Cisco Catalyst 6500

	Access	Aggregation	Core Edge
10 GE	X	X	X
Hardware-enabled IPv6			X
Hardware-enabled MPLS			X
Hardware-enabled EoMPLS			X
Per VLAN Learning	X	X	
802.1x	X		
DHCP Snooping	X		
Private VLAN	X		
Private Hosts	X		
Hardware-enabled Control Plane Policing	X		
Hardware Rate Limiters	X		
SSO/NSF	X	X	X
Software Modularity	X	X	X
Hardware-enabled PIM Snooping and IGMP Snooping	X	X	
E-OAM, IEEE 802.1ag	X	X	
E-OAM, IEEE 802.3ah	X		
MPLS LSP Ping and Traceroute			X