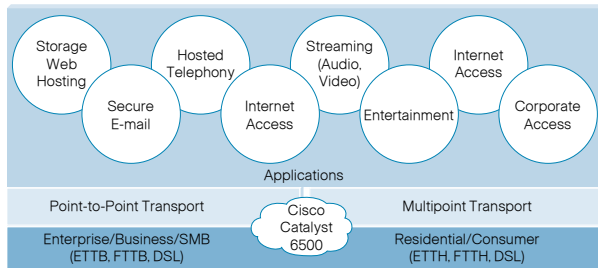


## Carrier Ethernet Requirements

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:

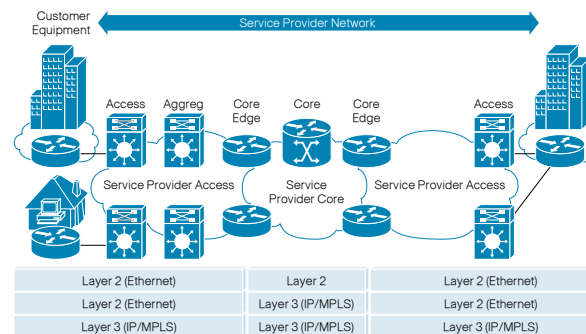
- **Scalability**—Offer high switching performance and bandwidth availability to support bandwidth-intensive applications and enable new services without operational impact.
- **Flexibility**—Offer flexibility of port densities, and various connector types with long-reach optics. Offer the ability to 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.

## Carrier Ethernet Network Architecture

Carrier Ethernet service providers can choose the following three 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

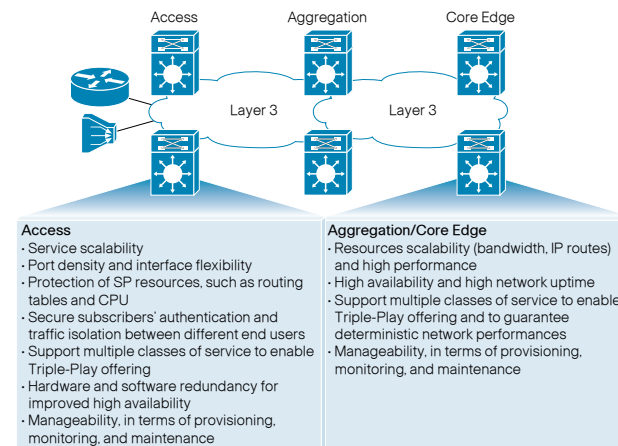
Figure 2. Carrier Ethernet Architecture Options



The focus of this At-a-Glance is the end-to-end Layer 3 architecture.

A Layer 3 Carrier Ethernet network can be segmented into an access and an aggregation or core edge layer with the following 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 and Cisco ME 6524 Series switches form the foundation of Carrier Ethernet architectures by providing leading IP routing, hardware-enabled MPLS, and high performance integrated in a single platform. The Cisco Catalyst 6500 Series is the premier Cisco Layer 3 switching 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** up to 400 IPv4 and 230 IPv6 Mpps switching performance with distributed forwarding
- **High-density Gigabit and 10-Gigabit Ethernet** support
- **High-performance CPU** for Layer 3 protocols convergence and stability
- **High-performing IPv6 forwarding in hardware** (Figure 4):

Figure 4. IPv6 Switching on Supervisor Engine 720

IPv6 Hardware Features on PFC3	IPv6 Software Features
<ul style="list-style-type: none"> <li>• 128K FIB entries</li> <li>• 1Pv6 Load Sharing up to 16 paths</li> <li>• Etherchannel hash across 48 bits</li> <li>• IPv6 Policing/Netflow/Classification</li> <li>• STD and EXT V6 ACLs</li> <li>• IPv6 QoS lookups</li> <li>• IPv6 Multicast</li> <li>• V6 to V4 Tunneling</li> <li>• IPv6 Edge over MPLS (6PE)</li> </ul>	<ul style="list-style-type: none"> <li>• IPv6 Addressing</li> <li>• ICMP for IPv6</li> <li>• DNS for IPv6</li> <li>• V6 MTU Path Discovery</li> <li>• SSH for IPv6</li> <li>• IPv6 Traceroute</li> <li>• dCEF for IPv6</li> <li>• RIP for IPv6</li> <li>• IS-IS for IPv6</li> <li>• OSPF V3 for IPv6</li> <li>• BGP for IPv6</li> </ul>



Scalable IP routing and MPLS functions in hardware, without performance impact (Table 1):

Table 1. IP and MPLS Scalability Figures

	Up to a Maximum of
IPv4 Routes	1,000,000
IPv6 Routes	500,000
MPLS VPNs	1000
EoMPLS Tunnels	4096

- **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 enabling on regular Ethernet line cards all the MPLS service enablers, such as hardware-based EoMPLS, MPLS VPN, and multicast VPN
- **IETF compliancy** by supporting natively EoMPLS virtual circuit types 4 and 5
- **Support for multipoint connectivity** through VPLS and 10-Gigabit Ethernet VPLS architecture, enabled on CWAN modules (SIPs and SPAs)
- **End-to-end architecture and features consistency** with Cisco ME 6524, Cisco Catalyst 6500 Supervisor Engine 32, and Supervisor Engine 720

### Security

- **Memory protection, fault containment, and improved scalability** through dedicated TCAMs for NetFlow, ACLs, security, and QoS deployments
- **Protection of service provider's network** against DoS attacks, enabling control plane policing and hardware rate limiters
- **Protection of service provider's CPU** through protocol-independent MAC ACLs enabled in hardware
- **Protection from unauthorized end users** through 802.1x, DHCP Snooping, Dynamic ARP Inspection, and IP Source Guard

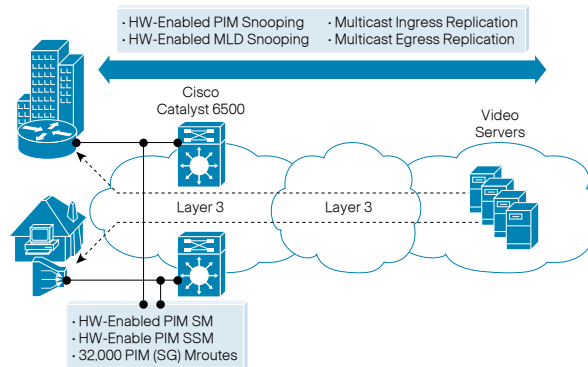
### High Availability

- **Hardware redundancy** for fans, power supplies, fabrics, and clocks for nonstop operation
- **Complete separation of control and data planes** for enhanced resiliency
- **Leadership in high availability and service uptime:** Nonstop forwarding (NSF) and stateful switchover (SSO) help ensure minimal traffic loss and subsecond recovery in IP networks upon primary supervisor failure
- **Increased data path protection** through MPLS Fast Reroute (FRR) and MPLS Traffic Engineering (TE)
- **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, such as per-port policing and DSCP/VLAN-based traffic classification
- **Granular traffic queuing and congestion avoidance** and management mechanisms such as Priority Queuing, WRED, and SRR to guarantee low jitter, low latency, and minimal or null packet loss for sensitive and real-time classes of service
- **Advanced and innovative IP Multicast features** to support Triple-Play services and optimize Video delivery (Figure 5):

Figure 5. Advanced Multicast features to enable TriplePlay



### Manageability

- **Enhanced and scalable network monitoring**, traffic profiling, and capacity planning by enabling hardware-based Netflow, up to a maximum of 256,000 entries with Cisco Catalyst 6500 Series Supervisor Engine 720-3BXL
- **Increased end-to-end service operational efficiency** through management and monitoring features such as MPLS LSP ping and traceroute
- **Flexible and comprehensive network monitoring capabilities** through SNMP MIBs for interface management, traffic monitoring, routing protocol management, and features management

Table 2 gives the key features of the Cisco Catalyst 6500 Carrier Ethernet IP/MPLS solution.

Table 2. Key Carrier Ethernet IP/MPLS Features on Cisco Catalyst 6500

	Access	Aggregation	Core Edge
10 GE	X	X	X
Hardware-enabled IPv6	X	X	X
Hardware-enabled MPLS	X	X	X
Hardware-enabled EoMPLS	X	X	X
802.1x	X		
DHCP Snooping	X		
IP Source Guard	X		
HW-enabled Control Plane Policing	X		
Hardware Rate Limiters	X		
SSO/NSF	X	X	X
MPLS TE and MPLS FRR	X	X	X
Software Modularity	X	X	X
Per Port Policing	X		
HW-enabled PIM Snooping and IGMP Snooping	X	X	X
HW-enabled PIM SM and PIM SSM	X		
MPLS LSP Ping and Traceroute	X	X	X