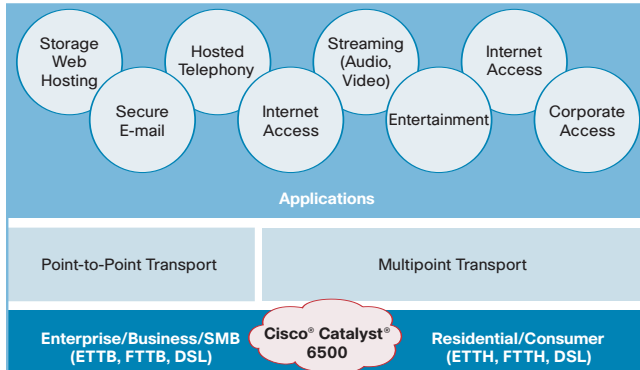


## Intelligent Network Architecture for Metro Ethernet and Broadband Solutions

### Metro Ethernet Requirements

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

**Figure 1.** Metro Ethernet Market Segments and Applications



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

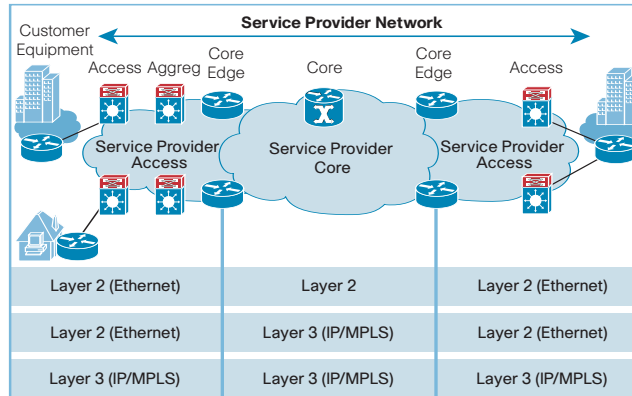
- **Scalability**—Offer high switching performance and bandwidth availability to support bandwidth-intensive applications and enable new services without operational impact.
- **Flexibility**—Offer flexibility of port densities, and various connector types with long-reach optics. Offer the ability to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

### Metro Ethernet Architectures

Metro 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

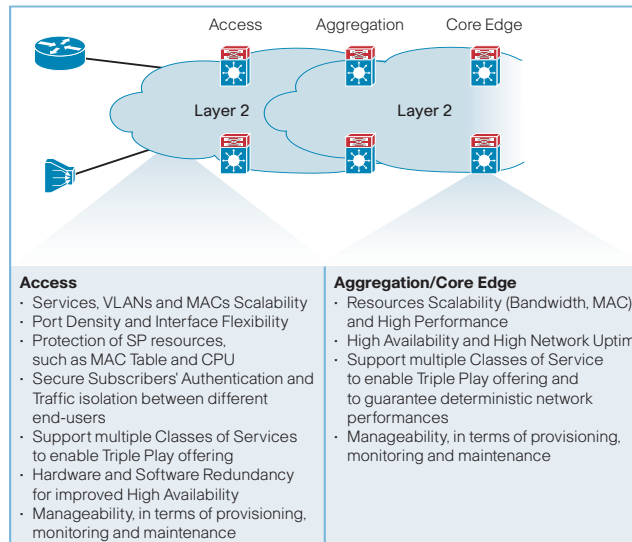
**Figure 2.** Metro Ethernet Architecture Options



The focus of this At-a-Glance is the end-to-end Layer 2 architecture.

A Layer 2 Metro 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.** Metro Ethernet Access and Aggregation and Core Edge Requirements



### Cisco Catalyst 6500 Series: The Foundation

The Cisco® Catalyst® 6500 Series switches form the foundation of Layer 2 Metro Ethernet architectures by providing leading Layer 2 switching and high performance. The Cisco Catalyst 6500 Series is the premier Cisco Systems® switching platform for the access, aggregation, and core edge of the service provider network with the following key advantages.

### Scalability and Flexibility

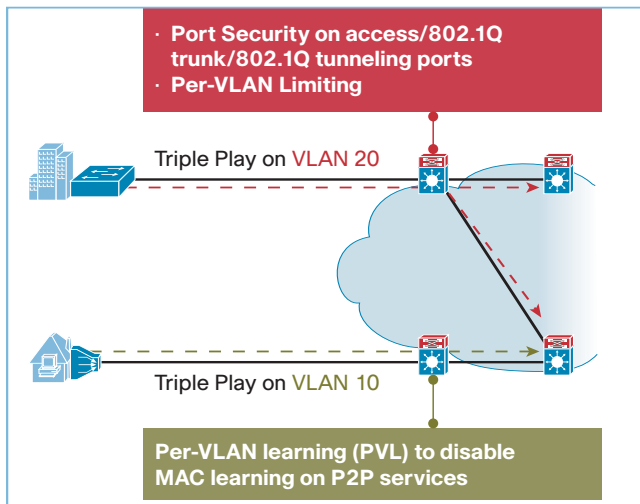
- 720 Gbps integrated switch fabric capacity with Cisco Catalyst 6500 Series Supervisor Engine 720
- Ability to scale from 15 to 400 Mpps switching performance with distributed forwarding
- High-density Gigabit and 10-Gigabit Ethernet support
- End-to-end architecture and features consistency with Cisco 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 MAC learning in hardware
- Optimized performance with jumbo frame support, deep packet buffers to handle bursty traffic, and low latency to minimize response times of real-time applications
- Innovative mechanism to scale the number of service instances and MACs in a Layer 2 network by driving IEEE 802.1ah definition and developing MAC Tunneling Protocol (MTP) line card
- 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 service enablers such as access and 802.1Q trunk ports, hardware-enabled 802.1Q tunnels, VLAN translation, and Layer 2 Protocol Tunneling
- Full IEEE compliancy and third-party interoperability through IEEE 802.3ad, 802.1w, and 802.1s
- Support for next-generation Layer 2 networks through pre-standard IEEE 802.1ad implementation

## Intelligent Network Architecture for Metro Ethernet and Broadband Solutions

### Security

- Memory protection, fault containment, and improved scalability through dedicated TCAMs for ACLs, security, and QoS deployments
- Protection of the service provider's network against DoS attacks, enabling 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
- Subscribers' protection and traffic isolation through Private VLANs and Private Hosts

### High Availability

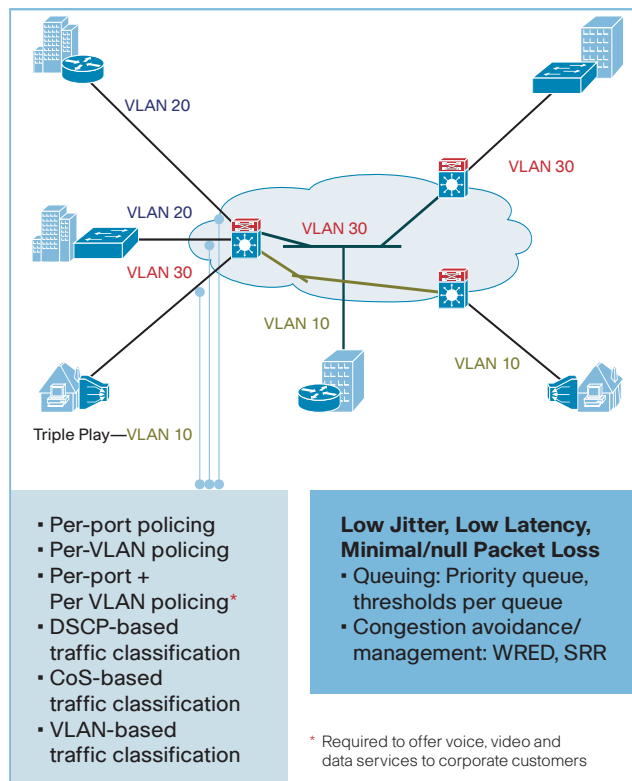
- Hardware redundancy for fans, power supplies, fabrics, and clocks for nonstop operation
- Complete separation of control and data planes for enhanced resiliency
- Optimized Layer 2 fast convergence by enabling IEEE 802.1w (RSTP) and IEEE 802.1s (MSTP)
- Improved Layer 2 fast convergence over hub-and-spoke 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-SM and PIM-SSM 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-LMI and E-OAM
- Flexible and comprehensive network monitoring capabilities through SNMP MIBs for interface management, traffic monitoring, switching protocol management, and features management

Table 1 gives Metro Ethernet Layer features of the Cisco Catalyst 6500.

**Table 1.** Key Metro Ethernet Layer 2 Features on Cisco Catalyst 6500

	Access	Aggregation/ Core Edge
10 GE	X	X
Pre-Standard 802.1ah (MTP)	X	X
Per VLAN Learning	X	X
802.1x	X	
DHCP Snooping	X	
Private VLAN	X	
Private Hosts	X	
HW-enabled Control Plane Policing	X	
Hardware Rate Limiters	X	
SSO	X	X
Software Modularity	X	X
Per Port/Per VLAN/Per Port + Per VLAN Policing	X	
HW-enabled PIM Snooping and IGMP Snooping	X	X
E-LMI	X	
E-OAM	X	X