



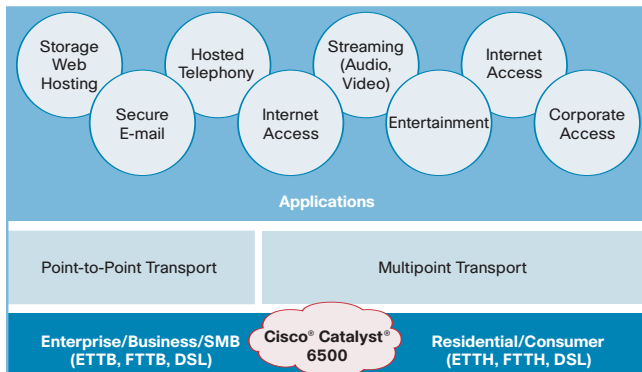
# Cisco Catalyst 6500 Series in Layer 2 and Layer 3 Metro Ethernet Architecture

## 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:

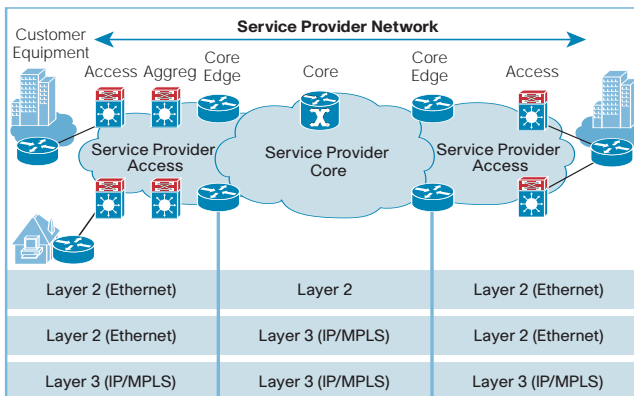
- **Scalability**—Offer high switching performance and bandwidth availability to support bandwidth-intensive applications and enable new services without operational impact.
- **Flexibility**—Offer flexibility of port densities, and various connector types with long-reach optics. Offer the ability to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

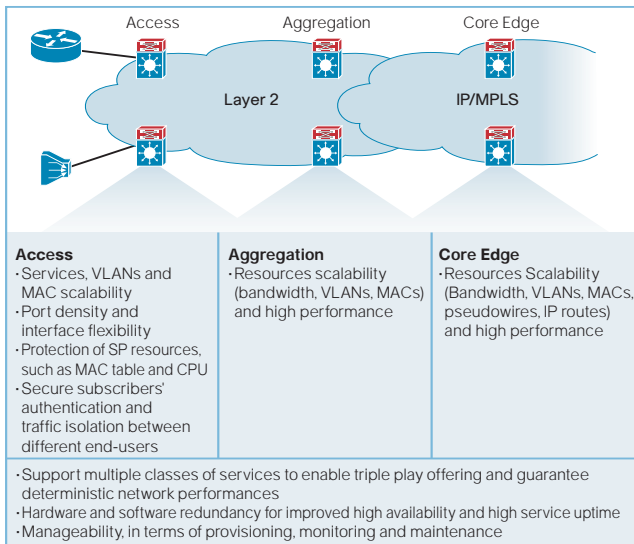
Figure 2. Metro Ethernet Architecture Options



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

A Layer 2 + IP/MPLS Metro 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. Metro Ethernet Access, Aggregation, and Core Edge Requirements



### Cisco Catalyst 6500 Series: The Foundation

The *Cisco Catalyst 6500 Series switches* form the foundation of Metro 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 Systems® 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 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 Figures

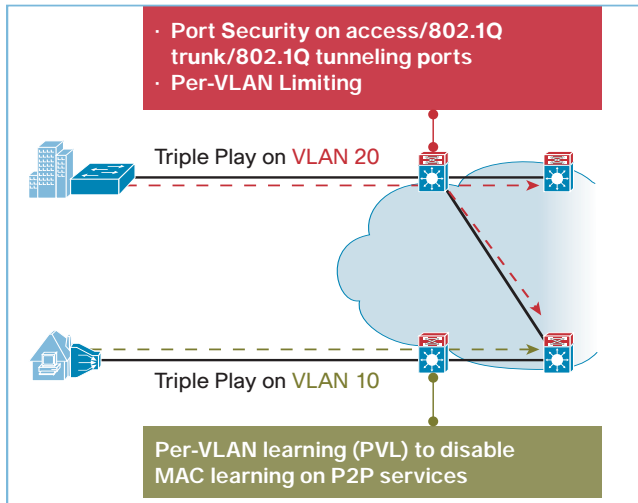
	Up to a Maximum of
IPv4 Routes	1,000,000
IPv6 Routes	500,000
MPLS VPNs	1000
EoMPLS Tunnels	4,096
MAC Table Entries	64,000
Number of ACLs	4,096
Netflow Entries	256,000
QoS TCAM Entries	32,000

- **Innovative mechanism to scale the number of service instances and MACs in a Layer 2 network** 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 and 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 (OSMs, 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

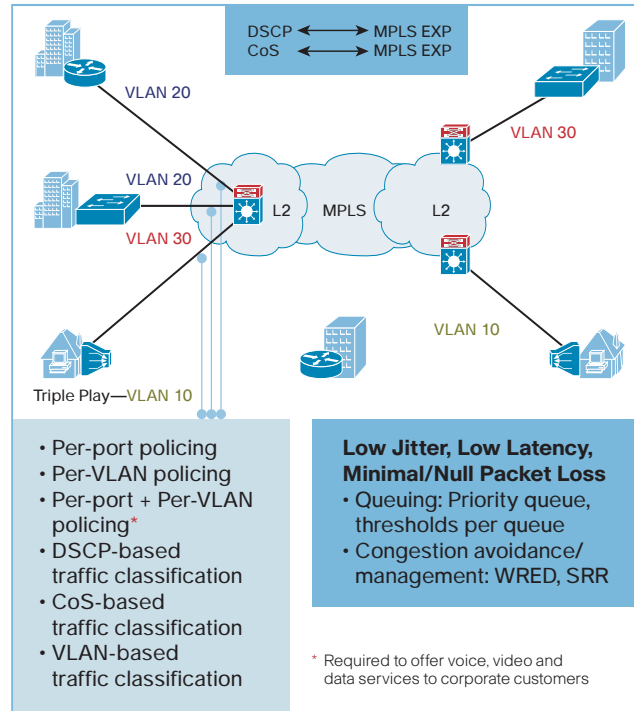
### High Availability

- **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-LMI and E-OAM
- **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 Metro Ethernet Layer 2 IP MPLS features.

**Table 2.** Metro Ethernet Layer 2 IP MPLS 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
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/NSF	X	X	X
Software Modularity	X	X	X
HW-enabled PIM Snooping and IGMP Snooping	X	X	
E-LMI	X	X	
E-OAM	X	X	
MPLS LSP Ping and Traceroute			X