

## METRO & WIDE AREA ETHERNET: TECHNOLOGY, PROTOCOLS AND DESIGN ©

**A**ppplied Learning Solutions' Metro and Wide Area Ethernet: Technology, Protocols and Design course includes all three of these important elements in a narrowly-focused two day format tailored for the Engineering Education audience. Applied Learning Solutions' Metro & Wide Area Ethernet course combines lecture with hands-on individual and group learning exercises. Students will go beyond the topics themselves and discover how to apply what they learn when they return to their jobs.

They will have a new understanding of the perspectives and facets of metropolitan and wide area Ethernet. They will learn that Metro and Wide Area Ethernet share a name with LAN Ethernet but go way beyond LAN Ethernet in its impact on the network landscape.

### *Objectives:*

At the end of this course the attendee will be able to:

- Understand the similarities and differences between traditional LAN Ethernet and emerging Metro and Wide Area Network technologies, protocols and services
- Describe Ethernet switching technologies and industry trends
- Demonstrate an understanding of Carrier inter-connect to ILEC provided Ethernet services, Ethernet to IP and relationship to convergence
- Be able to work with Metro and WAN protocols
- Be knowledgeable in Metro and WAN Ethernet interoperability issues

### *Audience:*

This course is designed specifically for students who have an intermediate to advanced understanding of communications technologies.

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### MODULE OUTLINE

#### 1. Ethernet History, State-of-the-Art and Future Trends

- Who is Bob Metcalfe? Why do we care?
- LAN Ethernet
- Wireless Ethernet
- Optical Ethernet
- Metro & Wide Area Ethernet
- Ethernet Interconnection
- Ethernet Switching and MPLS
- Metro Ethernet vs SONET/SDH

#### 2. Metro & WAN Ethernet Requirements & Services

- Resiliency
- Reliability
- Redundancy
- Interoperability
  - Quality of Service/SLA Support
  - Security
  - Multicast Support
  - Services
    - a. VPN Services
    - b. TDM/CES Support
    - c. Triple Play Services
  - Service Management

► *Individual Exercise: Ethernet Services SLAs*

#### 3. Metro & WAN Ethernet Carrier/Service Provider Business Case

- Metro Ethernet Forum Case Study
- Ethernet vs “Legacy” Services

#### 4. Metro Ethernet In Depth

- Metro Ethernet Specifications & Standards
- Participants
  - Metropolitan Ethernet Forum (MEF)
  - IEEE
  - IETF
- Scalability
  - MEF UNI Type I, IA and II
  - MEF Ethernet Aggregation
  - IEEE 802.1
- Protection
  - MEF 2 Ethernet Protection
  - MEF 4 Architecture Framework
  - IETF MPLS Fast Reroute
- “Hard” QoS
  - MEF 6 Service Definition
  - MEF 10 Service Attributes
- TDM Support
  - MEF 3 Circuit Emulation Service (CES) Framework
  - MEF 8 CES Implementation

- Service Management
  - MEF 7 EMS and NMS Info Model
  - MEF OAM Framework & Requirements
  - MEF Performance Monitoring
  - MEF IIE Management Requirements
  - IEEE 802.1 ITU

#### 5. Metro & WAN Ethernet Bandwidth Profiles & QoS

- Service Frame “Color”
- Bandwidth Profile Parameters
  - CIR (Committed Information Rate)
  - CBS (Committed Burst Size)
  - EIR (Excess Information Rate)
  - EBS (Excess Burst Size)
  - CM (Color Mode)
- Bandwidth Profile Rate Enforcement
- Color Blind/Color Unaware UNIs
- Bandwidth Profile Service Attribute

► *Paired Exercise: Ethernet Bandwidth Profiles & QoS*

#### 6. Metro & WAN Ethernet Protocols

- Header Type
- Jumbo Frames
- Gbic/Ethernet
- Ethernet Payload
- VLAN Transparency
- 802.1q Tag
- Activating VLAN on the Switch
- Inter-VLAN Bridging / L2VPN Interworking
- AToM/QnQ
- L2TPv3

► *Individual Exercise: Ethernet Protocol LAB*

#### 7. Metro & WAN Ethernet Design

- Configurations
- Network Configurations
- Attaching to an EMS with Switches
- Attaching to an EMS with Routers
- Simple ERS with Routers
- Large-Scale ERS with Routers
- Hybrid EMS- ERS Configuration
- Attaching to an EWS with Switches and Routers
- Security Configurations
- Network Element Level Security
- VLAN and Other Layer 2 Security

► *Group Exercise: Metro/WAN Ethernet Design*

#### 8. Conclusion