

# Pseudo Wire Emulation Edge to Edge (PWE3) and Multi-Protocol Label Switching (MPLS)



## Course Description

Network transport service providers and their users are seeking to rationalize their networks by migrating their existing services and platforms onto IP or MPLS enabled IP packet switched networks (PSN). This migration requires communications services that can emulate the essential properties of traditional communications links over a PSN.

Pseudowire Emulation Edge to Edge (PWE3) will specify the encapsulation, transport, control, management, interworking and security of services emulated over IETF specified PSNs. A pseudowire emulates a point-to-point link, and provides a single service which is perceived by its user as an unshared link or circuit of the chosen service. It is not intended that an emulated service will be indistinguishable from the service that is being emulated. The emulation need only be sufficient for the satisfactory operation of the service. Emulation necessarily involves a degree of cost-performance trade-off. In some cases it may be necessary to design more than one emulation mechanism in order to resolve these design conflicts. All emulated service definitions must include an applicability statement describing the faithfulness of the emulation. Switching, multiplexing, modification or other operation on the traditional service, unless required as part of the emulation, is out of the scope of the PWE3 WG.

PWE3 operates "edge to edge" and will not exert control on the underlying PSN, other than to use any existing QoS or path control mechanism to provide the required connectivity between the two endpoints of the PW.

MPLS is a standards based technology for using label switching and for the implementation of label-switched paths over various packet based link-level technologies, such as Packet-over-Sonet, Frame Relay, ATM, and LAN technologies (e.g. all forms of Ethernet, Token Ring, etc.). This includes procedures and protocols for the distribution of labels between routers and encapsulation.

Next Generation Networks are now being built using these technologies to deliver carrier level services with high levels of QoS and at high speed for deployment of all services over common core networks.

This course provides a fast technical understanding of these new technologies for developers, system designers and managers.

## Students Will Learn

- **Describe How Ethernet, TDM, Frame Relay, ATM, VPN And Other Services Can Be Delivered Over A Single Next Generation Network**
- **Identify How Multi Protocol Label Switching Functions To Deliver A Common Core Transport**
- **Appreciate How Pseudo Wire Emulation Edge To Edge Are Used To Deliver Emulated Customer Services**
- **Use Traffic Engineering Principles In Building Generalized MPLS Services For Future Evolution Of Next Generation Networks**
- **And More...**

## Target Audience

This course is geared for developers, system designers and managers.

## Course Outline

Module I: Next Generations Network Architecture  
Components of Next Generation Networks

Access

Aggregation and concentration

iNode and Services from the Metro

Core Network

QoS requirements

Providing Services to the User

Pre-NGN Services

TDM

SDH

ATM

New Services

QoS Ethernet

VPN

Module II: MPLS: An Introduction

Functions of the core

Routing Approaches

A Faster Solution

Why MPLS

Key Terminology

Label Switched Paths

LSP Based upon Routed Networks

Explicitly Routed LSP

Encapsulations

ATM

Frame Relay

PPP & LAN

Module III: Label Distribution Protocols

Purpose of LDP

Label Distribution Methods

Downstream SPF Tree

On Demand SPF Tree

Distribution Control: Ordered vs Independent

Label Retention Methods

LDP RFC 3036

Constraint Based LSP using LDP RFC 3212

Preemption and Bumping

Setup of LSP on demand using RSVP RFC 3029

OAM for MPLS RFC 4377

Module IV: Pseudo Wire Emulation

Carrier Circuit Services

Edge to Edge Circuits

Pseudo-Wire Standardization

Requirements for PWE3 Pseudo-Wire Edge to Edge: RFC 3916

PWE3 Architecture RFC 3985

Edge-to-Edge Emulation of TDM RFC 4197

Edge-to-Edge Emulation Control Word over MPLS RFC 4385

IANA Allocations RFC 4446

Pseudowire Setup and Maintenance of LDP RFC 4447

Structure Agnostic TDM over Packet RFC 4553

PWE3 Fragmentation and Reassembly RFC 4623

Encapsulation Methods for :

Ethernet Over MPLS RFC 4448

Frame Relay RFC RFC 4619

PPP/HDLC RFC 4618

ATM RFC 4717

ATM Transparent Cell Transport Service RFC 4816

PWE3 Management MIBs

## Module V: **Generalization of MPLS for Carrier Deployment (GMPLS)**

GMPLS Structure

GMPLS Building Blocks

GMPLS Mechanisms

Link Management Protocol

Traffic Engineering

TE Database

Traffic protection

Primary and Secondary LSP

Fault Tolerance for LDP RFC 3479

Virtual private LAN Service (VPLS) RFC 4665 and 4664

VPLS using LDP RFC 4762

**Evaluation and Review**

## **Delivery Method**

Instructor-Led with numerous case-studies and exercises.

## **Equipment Requirements**

**(This apply's to our hands-on courses only)**

BTS always provides equipment to have a very successful Hands-On course. BTS also encourages all attendees to bring their own equipment to the course. This will provide attendees the opportunity to incorporate their own gear into the labs and gain valuable training using their specific equipment.

## **Course Length**

2 Days