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.
- 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 mangers.

**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