

# Multi-Protocol Label Switching in 21st Century Telecommunications Networks



## Course Description

The next generation of telecommunications networks will deliver broadband data and multimedia services to users. The Ethernet interface is becoming the interface of preference for user computers, IP Phones, Digital IP Television and network servers within the network itself. The network infrastructure will deliver these high performance IP services over Switched infrastructures deployed using Multi-Protocol Label Switching (MPLS).

MPLS is a radically new approach to delivering IP services and must be built on an IP routed infrastructure. However by deploying switching hardware it becomes possible to deliver quality of service by bypassing queues in routing functions and switching essentially in OSI layer 2. Once constructed MPLS networks can be used to deliver emulation services to provide customers with more traditional circuits provisioned over interfaces such as E1, Frame Relay, ATM and STM1 which in reality are provided emulated over MPLS running over Gigabit Ethernet infrastructures.

This course provides an understanding of how MPLS works, its advantages and limitations and how it can be deployed to provide effective services over a 21st Century converged network. It will provide a detailed understanding for implementers, designers, managers and infrastructure engineers that need to plan, implement and use the new generation of networks and services.

## Students Will Learn

- **Describe The Basic Function Of MPLS**
- **Select The Appropriate Options And Mechanisms For Label Distribution**
- **Compare The Efficiency Of Routed And MPLS Switched Options For Qos Networks**
- **Build Infrastructures Using MPLS Over Different Physical Infrastructures**
- **Provide Reliability By Deploying The Re-Routing Options In The Event Of Failures**
- **Deliver High Bandwidth MPLS Services For OSPF And BGP4 Routed Networks**
- **Engineer Traffic On MPLS Services**
- **Provide Emulated Services Over MPLS Infrastructures**
- **And More...**

## Target Audience

This course is geared for implementers, designers, managers and infrastructure engineers that need to plan, implement and use the new generation of networks and services.

## Course Outline

### **Module I: Evolution of Multi-Service Telecommunications Networks**

Business environment for 21st Century Networks

Projecting the near future demands for services

Delivering Multimedia Services for Voice, Video and Television

Identifying the Quality of Service (QoS) needs

Analysing the problems with traditional IP routed Services

Adapting Internet Access to 21st Century needs

Solving the Quality of Service Delivery problems for Multi-service Delivery

### **Module II: MPLS Basics**

What exactly is MPLS?

Identifying the characteristics of simple Plain Vanilla MPLS Services

Label Switched Routers

Ingress and Egress Label Edge Routers

Forward Equivalent Classes

Label Switched Paths

Selecting the Label headers appropriate to the technology

Distributing Labels with Label Distribution Protocol (LDP)

Comparing traffic patterns in routed and MPLS switched networks

### **Module III: Stacking Labels for Service Discrimination**

Multi-Service Provisioning

Mechanisms used in ATM networks and their problems

Deploying Label Stacking for identification of Services

Tunnelling VPN services

Delivering Transit Networks Services

### **Module IV: Pseudo Wire Services**

What are Pseudo Wires?

Pseudo Wire Emulation (PWE) Architecture in RFC3916

Suitable Applications for PWE Services Encapsulation and frame ordering

Set-up and Tear-Down of PWE Services

Performance Monitoring

Fault Notification and Management

Quality of Service Needs

### **Module V: Quality of Service Options in MPLS Networks**

Defining the objectives of QoS

QoS Options

Selecting Between Multiple QoS Paths

Deploying QoS using Class of Service and Experimental bits

Explicitly Routed LSP

RSVP for QoS

Constraint Based Label Switched Paths

### **Module VI: Deploying QoS and Differentiated Services**

Delivering QoS using Differentiated Services Code Points within IP

Forwarding Models for Diff-Serv Label Switched Routers

- Tunnelling model

  - Pipe Model

  - Uniform Model

Preconfigured Explicit Label Switched Paths

RSVP Extensions for Diff-Serv support

Intserv Service types

### **Module VII: Delivering Reliability**

Fault Tolerance objectives for MPLS

Establishing a Fault Tolerant Session with LDP

Recovering Failed LDP Sessions

Check-pointing and graceful termination

Fast rerouting Alternatives

Security Considerations

Implementation Issues

### **Module VIII: Delivering Quality In Practice**

Conditions affecting QoS in Practice

Sporadicity

Queue Management Issues

Input and Output queues

Flow Based Queues

Class based Queues

Weighted Fair Queuing

Random Early Determination

### **Revue and Evaluation**

## **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**

3 Days