MPIRICAL
Innovating Telecoms Training

> Knowledgeable presenter who took us through the content in a simple and easy to understand way.

Watch our course intro video.

Packet Transport Networks

Course Description

As TDM transmission networks continue to be replaced by packet based transport solutions, this course seeks to explain the key technologies involved. Initially, the course will explore the concepts of IPv4 and IPv6, before then focusing on the operation of MPLS (including its key capabilities and features). Carrier Ethernet is also considered, exploring its standardized services and transport options. Finally, real life use cases for PTN are examined, in conjunction with a consideration of the new challenges that packet networks bring.

This course has no prerequisites.

2 days (LiveOnsite, LiveOnline)

12 hours learning (OnlineAnytime)

12 CPD Learning Credits

Level: 2 (Intermediate)

This course will contain the following sections:

1. IPv4

Topic areas covered include:

- Protocol Stacks:
  - OSI 7 Layer Model, TCP/IP Model.
  - Encapsulation and Decapsulation.
- IPv4 Header Composition:
  - Key fields and associated functionality.
- IP Addressing:
  - IPv4 address space administration.
  - IPv4 address composition.
    - Dotted Decimal notation.
  - CIDR.
  - Subnetting.
  - Private Addressing.
  - IP Multicasting.
- IPv4 Associated Protocols:
  - DHCP (Dynamic Host Configuration Protocol).
  - DNS (Domain Name System).
  - NAT (Network Address Translation).

2. IPv6

Topic areas covered include:

- The Driving Factors for IPv6.
- Features of IPv6.
- IPv6 Base Header Format.
- IPv6 Address Space.
- IPv6 Address Format:
  - IPv6 Notation (Colon Hexadecimal).

IPv6 (cont.)

- Configuring the IP Address:
  - IPv6 Stateless Auto-configuration.
- IPv6 Specialist Addressing:
  - Unicast Addressing.
  - Multicast Addressing.
  - Anycast Addressing.
- IPv6 Extension Headers:
  - IPv6 Extension Types.
  - Extension Header Example – IPSec.
  - Extension Header Example - Mobile IPv6.
- Migration Strategies:
  - Dual Stack.
  - Translation.
  - Tunnelling.
    - List of current tunnelling techniques for IPv6 migration.

3. Multi Protocol Label Switching

Topic areas covered include:

- Multi Protocol Label Switching.
- MPLS Architecture:
  - Edge Routers and Core Routers (LER and LSR).
- MPLS Key Concepts:
  - MPLS Protocol Stack.
  - Label Format.
    - Label, Traffic Class, Bottom of Stack, TTL.
  - Label Stacking.
  - FEC and Label Binding.

12

CPD Learning Credits

ITP

ITP accredited course

LiveOnsite, LiveOnline, OnlineAnytime

Multi Protocol Label Switching (cont.)

- Label Distribution and Binding:
  - LDP, RSVP-TE, BGP4.
- MPLS Concept of Operation:
  - Packet Forwarding Process.
  - ILM, FTN, NHLFE.
  - Push, Pop and Swap operations.
- Derivatives of MPLS:
  - G-MPLS (Generalized MPLS).
  - MPLS-TP (MPLS Transport Profile).
- MPLS Features:
  - Traffic Engineering.
    - RSVP-TE, CBR.
  - Rapid Circuit Restoration.
    - One to One and Facility FRR (Fast Reroute).
  - Virtual Private Networks.
    - Support for Layer 1, 2 and 3 VPNs.

4. Carrier Ethernet

Topic areas covered include:

- Ethernet Basics:
  - 802.3 Frame Format.
  - Ethernet Switching.
  - 802.1Q VLANs and 802.1p.
  - Ethernet Timeline.
- Carrier Ethernet Key Attributes:
  - E-Line, E-LAN, E-Tree and E-Access services.
  - Carrier Ethernet Use Case – Mobile Backhaul.
- Carrier Ethernet Architecture.
- Carrier Ethernet Transport Technologies.
- Ethernet Based Transport Mechanisms:
  - Provider Bridges (Q-in-Q or 802.1ad).
  - Provider Backbone Bridging (802.1ah).
  - Provider Backbone Bridging - Traffic Engineering (802.1ay).
  - Mapping Ethernet Transport to CE Services.
- MPLS Based Transport Mechanisms:
  - Basic MPLS.
  - MPLS Pseudowires.
  - MPLS VPLS.
  - MPLS Transport Profile.
  - Mapping MPLS Transport to CE Services.

Carrier Ethernet (cont.)

- Optical Based Transport Mechanisms:
  - Optical Transport Network (IPoDWDM).
  - Next Generation SDH.
  - Mapping Optical Transport to CE Services.

5. IP QoS

Topic areas covered include:

- QoS and QoE:
  - Factors Influencing QoS.
  - Factors Influencing QoE.
  - Internet versus Private IP Networks.
  - IP Transport Network QoS Solutions.
- Focus on Differentiated Services:
  - Per Hop Behaviours.
    - EF, BE and AF.
  - Packet Conditioning.
  - DSCP Example Usage.
- Additional QoS Mechanisms:
  - Intserv and RSVP.
  - Bandwidth Solution.
  - DiffServ in MPLS Networks.
  - Diffserv in Ethernet Networks.

6. IP Security

Topic areas covered include:

- The Threat Climate:
  - Protecting the Network.
- Exploring the Threats to Security:
  - The Global Cybercrime Industry.
  - Malicious Software.
  - Botnets.
  - Denial of Service.
  - Physical Insecurity.
- Protecting Network Traffic– IPSec:
  - IPSec Basics.
  - IPSec Modes of Operation.
  - Summary of Operation.
  - Focus on IPSec Encapsulating Security Payload.
  - Internet Key Exchange version 2.
- Public Key Infrastructure (X.509).

IP Security (cont.)

- Protecting Network Traffic – TLS:
  - TLS Operation.
  - TLS Handshake.
- Security Implementation and Management:
  - Security Strategy.
  - Defence in Depth.
  - Disaster Recovery.

7. Timing and Synchronization

Topic areas covered include:

- Timing and Synchronization Basics:
  - Timing and Synchronization in Telecommunications.
  - Timing and Synchronisation in Packet Switched Networks.
  - Hybrid Timing System.
  - Network Time Protocol.
  - Global Positioning System.
- SyncE (Synchronous Ethernet).
- IEEE 1588v2 - Precision Time Protocol.

8. IP Based Services

Topic areas covered include:

- VoIP Basics:
  - Carrier Grade VoIP.
  - VoIP Protocols.
- Soft Switching Concepts:
  - IP Soft Switch Components.
  - Positioning Soft Switches.
  - Focus on Sigtran.
- Session Border Controllers:
  - SBC Capabilities.
  - SBC Architecture.
  - SBC Operation Examples.
- IP Packet Exchange (IPX):
  - IPX Architecture.
  - IPX Connectivity Options.
- VoIP Signalling Considerations:
  - SIP-I.

IP Based Services (cont.)

- GCP/H.248:
  - Overview.
  - Contexts and Terminations.
  - Transactions, Commands and Descriptors.
- Real time Transport Protocol:
  - RTP Header.
  - RTP Payload Formats.
  - RTP Control Protocol.
- Example VoIP Procedure (SIP Bridging).

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