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3-day course: Fundamentals of IP Routing, Switching and Network Access Technologies

Course Objectives	<p>The main objective of this course is to provide foundational knowledge of IP Routing, Switching and Network Access Technologies to Telecom professionals with little or no prior knowledge of IP. This course aims to explain the principles, concepts and common implementations of IP routing, switching and transmission technologies within the context of a telecommunications working environment.</p> <p>At the end of the course, attendees will be able to:</p> <ul style="list-style-type: none">• understand IP data encapsulation concepts, protocol layer interactions of the TCP/IP protocol stack, and related Transmission and Network Layer concepts,• understand and implement IP Address Classes, CIDR and VLSM methods,• understand basic IP QoS, Security and VPN concepts,• understand MPLS concepts, topology and implementation,• understand Network Access protocols, standards and technologies commonly implemented for IP transport, including DWDM, LAN PHY , WAN PHY, SDH and Carrier Ethernet,• demonstrate basic IP technology concepts on a simple network.
Course Benefits	<p>The course will equip Telecom professionals with a solid foundational knowledge of IP routing, switching and transmission technologies and improve staff's ability to perform related tasks within a telecommunications environment.</p>
Target Audience	<ul style="list-style-type: none">• Telecom professionals with little or no prior knowledge of IP.• Non-Telecom professionals who are also keen to learn the Basics of IP technologies.

Proposed Course Outline:

DAY ONE:	Topic	Detail
Introduction to IP	An overview	<ul style="list-style-type: none"> • Very brief history, comparison with other network layer protocols
	IP data encapsulation model concepts	<ul style="list-style-type: none"> • The TCP/IP protocol stack • The IP header (why IP needs a telecoms infrastructure and why telecoms need IP) • IP fragmentation (MTU), TTL, etc
	IP interaction with upper layer protocols	<ul style="list-style-type: none"> • (TCP, UDP, etc) • Application layer protocols (FTP, SMTP, DNS, Telnet)
	IP address classes and CIDR	<ul style="list-style-type: none"> • IP Addressing • Public and Private address classes, NAT • IP ver6
	PRACTICAL EXERCISE	1. IP Subnetting exercises (Addressing a Network Using VLSM) 2. IP Supernetting
	Other Transmission and Network Layer concepts	ARP, ICMP, ping and traceroute, IP loopbacks
	LAB	Use of a packet analyser to examine traffic flows and datagram headers on simple network setup.
	IP QoS overview	<ul style="list-style-type: none"> • loss, jitter, delay, etc • QoS requirements for voice, video and data
		IntServ, DiffServ and Best Effort
	IP VPNs Overview	<ul style="list-style-type: none"> • L2VPN • L3VPN • Tunnelling, Encryption, key management, authentication, IPSec
IP Routing	Topic	Detail
	IP routing concepts	<ul style="list-style-type: none"> • Comparison of Routing and Switching of IP Packets • Main components of Router and their function • Routing metrics • Static vs dynamic routing • Link state vs distance vector routes • Default routes • Interior vs interior routes
	Common IP Routing protocols	<ul style="list-style-type: none"> • Introduction to RIP • Introduction to OSPF (single area and multiple area OSPF) • Introduction to BGP (BGP routing metrics, etc)
	LAB EXERCISE	1. Simple routing configuration with static routes, use ping and show routes to verify 2. Replace static routes with RIP 3. Replace RIP with single area OSPF

DAY TWO:	Topic	Detail
MPLS	Intro	General concepts, benefits, etc
	Basic concepts	<ul style="list-style-type: none"> • Switching • Labels • Label stacking • LER • LSR • LSP • LIB • FEC • LDP • ECMP • VPNs
	MPLS-TE	<ul style="list-style-type: none"> • Components • CBR • Path computation • TE Tunnels • Path Protection • Link Protection
	MPLS-TP	<ul style="list-style-type: none"> • LSP • Pseudo wire • Emulated Service • Scenario for MPLS-TP
	LAB EXERCISE	<i>Simple implementation of MPLS VPN on layer 3 routers.</i>
DAY THREE:	Topic	Detail
Network Access Technologies	Intro and concepts	<ul style="list-style-type: none"> • Access Technologies for IP services and their Comparison for Data Rate and Distance
	LAN PHY, WAN PHY	<ul style="list-style-type: none"> • 10GBase-R, 10G Base-X and 10G Base-W
	DWDM	<ul style="list-style-type: none"> • OF Medium • Optical spectrum • Concept of Lambda/Wavelength • DWDM Components and Network • Capacity of Network
	OTN	<ul style="list-style-type: none"> • OTN/OTH • Variety of Interfaces • OTN Mapping • Coding Gain
	SDH and NG-SDH	<ul style="list-style-type: none"> • (Granularity and Phasing out scenario)
	Carrier Ethernet	<ul style="list-style-type: none"> • Market Drivers • 5 attributes • Service Types • Granularity • Emulation • Economy
	GROUP EXERCISES	<i>Case Studies, Best Practices and Field Application Scenarios</i>