

Introduction to Data Networks and TCP/IP

Description

The Introduction to Data Networking and TCP/IP course presents the basic theory of network's hardware and software. The course starts from the OSI reference Model and data structure that explains the Ethernet protocol and LAN switching. We continue focusing on TCP/IP, from the basics on IPv4 and IPv6, through TCP and UDP, to application protocols that build the Internet.

Objectives

Upon completion of this course, the student will be able to:

- Understand the concept and the structure of data networks
- Understand Ethernet Local Area Networks (LANs) and LAN switching
- Wwide Area Networks (WAN) protocols and services
- Describe the TCP/IP suite of protocols
- Understand IPv4 operation and addressing
- Understand IPv6 operation and addressing
- Understand UDP and TCP
- Understand routing and routing protocols
- Understand the operation of DNS
- Understand the concept of multicast is IP networks
- Describe the concepts of network security and protocols

Target Audience

R&D, engineering and technical Support, IT and communications managers

Prerequisites

Technical background in computing or parallel areas

Duration

2 Days

Outline

1. Introduction to networking and the OSI reference model

- Introduction to data networks and data communications basics
 - Application types and requirements
 - The OSI-RM functions, and the modular structure of the data network with its Relation the systems
2. Introduction to LAN and the Ethernet Protocol
 - The Ethernet protocols
 - 10M/100M to 10G/100G Ethernet
 - Ethernet media types (Twisted Pairs, cable categories - 5/5e, fiber optical cables and connectors).
 - Frame structure
 - CSMA/CD
 3. LAN Switching
 - LAN switch operation and technology
 - HD/FD and auto-negotiation
 - VLANs (Virtual LANs) technology and VLAN tagging (802.1q)
 - The Spanning Tree protocol (STP/RSTP/MSTP)
 - Priority, QoS and 802.1p
 - LAG (802.3ad) and Cisco Ether-channel
 - Data centre switching (brief)
 4. Wireless LANs
 - The network media and 802.11 standards
 - Connectivity to enterprise networks
 5. Wide Area Networks (WAN) – Protocols and Services
 - The public network architecture
 - MPLS and L3 services
 - Carrier Ethernet and L2 services
 - Cellular networks
 6. Introduction to TCP/IP
 - The TCP/IP model and protocol stack
 - Common Protocols and operation
 - Standards and standardisation
 7. IPv4 – Protocol and Addressing
 - IP characteristics and packet structure
 - ARP – Address Resolution Protocol
 - IP addressing, address classes, VLSM and CIDR
 - DHCP and Relay Agents

- ICMP – Internet Control Message Protocol
8. IP Multicast
- Multicast operation and addressing
 - Internet Group Management Protocol (IGMP)
 - Protocol Independent Multicast (PIM) routing
9. IPv6 – Protocol and Addressing
- Overview
 - Addressing
 - ICMPv6
 - Auto-configuration
10. Layer 4 Protocols – TCP and UDP
- L4 operations
 - Connectivity and reliability
 - Well known ports.
 - UDP Basics and frame structure
 - UDP operation
 - TCP frame structure, The TCP connectivity and reliability, the sliding window mechanism.
 - TCP connection establishment and tear-down, TCP State-machine. Sequence and acknowledge numbers.
 - TCP performance – Flow and congestion control, Ack strategies – Go-Back-N and Selective-repeat. Selective ACK (SACK Options)
 - TCP Performance issues
11. Routers and routing protocols
- Routing principles
 - Routing domains and areas
 - Static and dynamic routing and routing metrics
 - Distance-vector, Link-state and DUAL protocols
 - Routing protocols - RIP and IGRP, OSPF and ISIS, BGP-4
 - Dynamic and static NAT
 - Access Control Lists (ACLs)
12. The Internet structure and applications
- The Internet structure and ISPs tiers
 - DNS – protocols and network structure
 - Mail protocols and applications
 - HTTP1/2 and HTTPs
 - Mail protocols – SMTP, POP and IMAP

- FTP and TFTP
- SSH, Telnet and terminal access protocols

13. VoIP, IPT and Multimedia

- Introduction to VoIP and IP Telephony
- Introduction to SIP
- RTP/RTCP, RTSP and Voice/Video over IP
- Codec's and voice compression

14. Network Security and Security Architectures

- Introduction to network security – threats and ho to protect against them
- FWs and FW network architectures
 - Single and redundant FWs
 - Where and how to install the FW
 - Related servers (Mail relay, access servers and others)
- Security protocols – encryption and authentication
 - Symmetric and Asymmetric encryption, DES, 3DES and AES
 - Authentication methods and protocols
 - IPSec and SSL/TLS
- Tunneling protocols
 - Tunneling principles
 - IP-IP and GRE
 - PPP, PPTP, L2TP