
PRACTICAL ROUTERS AND SWITCHES (INCLUDING TCP/IP AND ETHERNET) FOR ENGINEERS AND TECHNICIANS



YOU WILL LEARN HOW TO:

- Configure, maintain and manage your routers
- Understand TCP/IP and how to apply it
- Design, install and manage routes internetworks
- Segment networks with bridges, routers and switches
- Analyse internetwork protocols
- Troubleshoot and fix router and switch problems
- Improve the performance of both networks and internetworks
- Construct a secure robust Local Area Network (LAN)
- Plan and design your networks more effectively
- Analyse and construct a typical firewall
- Effectively troubleshoot TCP/IP and LANs
- Optimise you company's connectivity with LANs/Intranets and the Internet
- Construct a basic intranet
- Apply the appropriate network management tools to routers and Internetworks

WHO SHOULD ATTEND:

Anyone who will be designing, installing and commissioning, maintaining or troubleshooting TCP/IP and Intra/Internet sites will benefit, including:

- Instrumentation Engineers and Technicians
- Network Engineers
- Engineering Managers
- Design Engineers
- Electrical Engineers
- Network System Administrators

The Program

INTRODUCTION

- Basic concepts, assess methods and topologies
- LANs, WANs, VLANs, VPNs
- Open systems, OSI and ARPA models
- TCP/IP protocol suite architecture

ETHERNET

- 100Mbps Ethernet systems
 - Media access control CSMA/CD; Layer 1 versions (10Base5/2/T/F); Layer 2 addressing (MAC addresses)
- Fast Ethernet
 - Media access control: full duplex; Layer 1 versions (100BaseTX/FX); Full duplex, deterministic and dual redundant Ethernet

INTERNET LAYER PROTOCOLS

- IPv4
 - Address classes; Subnet masking; Classless addressing; Subnetting and VLSM; Supernetting and CIDR; Fragmentation; Header structure; Deploying IP addresses; Public and private IP addresses; Allocating addresses with DHCP; Multicasting; Multicast address management: NAT and PIM; Network address translation: NAT and NAPT; Layer 2 vs Layer 3 address mapping; Address resolution: ARP; Reverse address resolution: RARP; Control messages: ICMP
- IPv6
 - Addressing modes; Header structure; Extension headers

HOST TO HOST PROTOCOLS

- TCP
 - Principle of operation; Header structure; Ports and sockets; Sequence and acknowledgment numbers; Establishing and closing connections; Sliding windows
- UDP
 - Principle of operation; Header structure

PROCESS/APPLICATION LAYER PROTOCOLS

- Boot Protocol (BootP)
- Dynamic Host Configuration Protocol (DHCP)
- TELNET
- File Transfer Protocol (FTP)
- Trivial File Transfer Protocol (TFTP)
- Network File Systems (NFS)
- Simple Mail Transfer Protocol (SMTP)
- Post Office Protocol 3 (POP3)
- HyperText Transfer Protocol (HTTP)
- Simple Network Management Protocol (SNMP)
- Domain Name System

TCP/IP UTILITIES

- Ping; Arp; Tracert; Netstat; Ipconfig; Winipcfg; Hosts file

MECHANICS OF BRIDGING

- Basic operation of Ethernet bridges
- Transparent, translating and speedbuffering bridges
- Application

MECHANICS OF SWITCHING

- Basic operation of switches
- Layer 2 vs Layer 3 switches
- Segment, port and IP switching
- Applications: VLANs, collapsed backbones and dual redundant rings
- Troubleshooting switches

MECHANICS OF ROUTING

- Basic operation of routers
- Router functions
- Static vs dynamic routing
- Routing tables
- Routing metrics
- Route advertisement
- Routing protocols
- Convergence
- Route calculation: distance vector vs link state
- Autonomous systems
- Interior vs exterior gateway protocols
- Border routers
- Applications: WAN routers, collapsed backbones and parallel backbones

ROUTING INFORMATION PROTOCOL (RIP)

- Origins & specifications
- Packet format
- Routing tables
- Operation
- Vector calculation
- Dealing with topology changes
- Limitations

ROUTING INFORMATION PROTOCOL VERSION 2 (RIPv2)

- Origins & specifications
- Additional features
- Limitations

INTERIOR GATEWAY ROUTING PROTOCOL (IGRP)

- Origins & specifications
- Packet Format
- Routing tables
- Operation
- Vector calculation
- Dealing with topology changes
- Limitations
- Multipath routing

ENHANCED INTERIOR GATEWAY ROUTING PROTOCOL (EIGRP)

- Origins
- Improvements over IGRP
- EIGRP data structures
- Convergence

OPEN SHORTEST PATH FIRST

- Origins & specifications
- Operation
- OSPF data structures
- Calculation of routes

ADVANCED ROUTING CONCEPTS

- Multi Protocol Label Switching (MPLS)
- IP Security (IPSec)
- Access Control Lists (ACLs)

CONSTRUCTION OF ROUTER BASED INTERNETWORKS

- Basic rules to be followed
- Topologies of simple internetworks
- Topologies for larger networks
- Design issues
- Maintenance issues
- Dealing with dissimilar protocols
- Redundancy issues

TYING IT ALL TOGETHER

- Current and future trends in routers
- Critical areas of focus

The Workshop

Routers and switches are key components of most networks and internetworks. Routers are simultaneously the most complex and the most important component of networks. This workshop goes through the basics of routers, routed and routing protocols and the basic rules to follow in building internetworks. If you are using any form of communication system or are applying modern PLCs/SCADA systems, this workshop will give you the essential tools in working with your networks. It is not an advanced workshop - but a hands-on one.

Practical Sessions

This is a practical, hands on workshop enabling you to work through practical exercises which reinforce the concepts discussed.

Practical sessions include:

- Connect simple networks together
- Construct a simple local area network using 10/100BaseT
- Configure network parameters
- Configure IP addresses and subnet masks
- Communicate over network
- Use ping utility and observe ARP operation

- Analysis of ARP/ICMP/IP/UDP/TCP
- Tracert and route commands
- Set up and analyse FTP sessions
- Quick analysis of packets using protocol analyser
- Web based view of network
- Configuration of switches
- Analysis of internetwork protocols
- Troubleshooting a router and switch
- Routers and switches - configuration issues
- Firewall configuration