
Practical

ROUTERS & SWITCHES (INCLUDING TCP/IP & ETHERNET)

for Engineers & Technicians



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



Technology Training that Works

THE PROGRAM

DAY ONE

INTRODUCTION

- Basic concepts, access methods, topologies
- LANs, WANs, VLANs and VPNs
- Open systems, OSI and ARPA models
- TCP/IP Protocol Suite architecture

ETHERNET

- 10MBps 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, 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 acknowledgement numbers
 - Establishing and closing connections
 - Sliding windows
- UDP
 - Principle of operation
 - Header structure

DAY TWO

PROCESS/APPLICATION LAYER PROTOCOLS

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

TCP/IP UTILITIES

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

MECHANICS OF BRIDGING

- Basic operation of (Ethernet) Bridges
- Transparent, translating and speed-buffering Bridges
- Application

MECHANICS OF SWITCHING

- Basic operation of Switches
- Layer 2 vs Layer 3 Switches
- Segment, port and IP switching
- Applications: VLANs, collapsed backbones, 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, parallel backbones

DAY TWO continued

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 (OSPF)

- 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

SUMMARY, OPEN FORUM AND CLOSING

THE WORKSHOP

Routers and switches are key components of most networks and obviously internetworks. Routers are simultaneously the most complex component of networks and the most important. 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.

PRE-REQUISITES

A basic working knowledge of industrial communications and applications is useful.