

Introduction to Enterprise TCP/IP

Course Summary

Description

This course offers an overview of the primary concepts of TCP/IP (Transmission Control Protocol / Internet Protocol). The class begins with a general introduction to networking, which is discussed in terms of both computers and the Internet. Next, the course progresses through TCP/IP protocols, implementation and management. Hands-on labs with hosts, switches, routers, cabling, and network diagnostic network equipment are used extensively in this course. Finally, TCP/IP internetworking security issues and IPv6 migration will be discussed during the class.

Objectives

By the end of this course, participants will be able to:

- Understand the history of TCP/IP and its evolution as a network protocol
- Relate the binary (base 2) number system and the decimal (base 10) number system
- Conceptually design a network
- Describe the concepts behind routing and the logical flow of data
- Understand security issues, encryption, and use of ethical hacking tools to protect
- Use basic TCP/IP utilities and tools

Topics

- Simple Networking concepts
- Wide Area and Remote Connectivity
- Networking and Data Transmission Standards
- IP Addresses
- Dynamic Host Configuration (DHCP)
- Domain Name System (DNS)
- Routing and Cisco Command-line usage
- Internet Control Message Protocol (ICMP)
- Network security
- Managing a TCP/IP Network
- Implementing IPv6

Audience

This course is intended for those who want to learn about TCP/IP's structure and its implementation. Since TCP/IP is such a widely used protocol, technicians, network managers and almost any person who deals with a TCP/IP network in some way or another can benefit from this class.

Prerequisites

The student should have a basic operational knowledge of computers.

Duration

Three days

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Course Outline

- I. TCP/IP Overview**
 - A. What Is a Computer Network?
 - B. What Is A Protocol?
 - C. TCP/IP Functionality
 - D. Benefits of Using TCP/IP
 - E. Internet vs. Intranet vs. The Internet
 - F. TCP/IP Application Functionality
 - G. Physical Packet Routing
 - H. IP Packet Routing
 - I. Network Physical Layer, IP Layer
 - J. TCP/IP Services
 - K. DNS Domains
 - L. TCP/IP Sockets
 - M. Some Well-known Ports
 - N. TCP/IP Applications
 - O. Voice Over IP Solution
 - P. Managed Power
 - Q. Console Management
 - R. Network Attached Storage (NAS)
 - S. Storage Area Networks
 - T. The Internet: Who's In Charge?
 - U. Internet Standardization Process
 - V. Regional Internet Registries
 - W. IPv4 Problems
 - X. IPv6 Features
 - Y. What Ever Happened to IPv5?
 - Z. IPv6 Migration
 - AA. Brief TCP/IP History
- II. TCP/IP Network Essentials**
 - A. TCP/IP Protocol Suite
 - B. Physical Packet Routing
 - C. IP Packet Routing
 - D. IP - Internet Protocol
 - E. TCP Services
 - F. Address Resolution Protocol
 - G. TCP/IP Protocols and the OSI Model
 - H. IP Addressing
 - I. Class A, B, C IP Classes
 - J. Network Address vs. Host Address
 - K. Reserved IP addresses
 - L. Subnetting
 - M. IP Addresses vs Hostnames
 - N. The etc/hosts File
 - O. DNS Domains
 - P. Resolve: What Does DNS Do
 - Q. Fully Qualified Domain Name
 - R. Traditional Top Level Domains
 - S. New Top Level Domains
 - T. How a name is resolved
 - U. Getting a Datagram From Here to There
- V. Manual vs. Automatic IP Configuration**
- W. DHCP Operation**
- X. DHCP Lease Generation Process**
- Y. DHCP Lease Renewal Process**
- III. Networking Topologies & Hardware**
 - A. Scope of Networks
 - B. Basic Connectivity Components
 - C. Network Adapters
 - D. Common Network Cable Types
 - E. Twisted Pair Cable Types
 - F. Wireless Networking Comparison
 - G. What is Wi-Fi?
 - H. Personal vs. Enterprise Security Model
 - I. Wi-Fi Encryption
 - J. Encryption Key Length Effect on Security
 - K. Network Topologies
 - L. Bus Topology
 - M. Star Topology
 - N. Ring Topology
 - O. Mesh Topology
 - P. Hybrid Topologies
 - Q. Network Mediums
 - R. Protocols
 - S. Contention Protocols
 - T. Deterministic Protocols
 - U. Ethernet
 - V. Token Ring
 - W. Asynchronous Transfer Mode
 - X. Fiber Distributed Data Interface
 - Y. Frame Relay
 - Z. SMDS
 - AA. Expanding the Network
 - BB. Repeaters and Hubs
 - CC. Bridges
 - DD. Switches
 - EE. Routers
 - FF. Gateways
 - GG. Remote IP Implementation
 - HH. Virtual Private Network
 - II. Digital Subscriber Line (DSL)
 - JJ. DSL
 - KK. Cable Modem
 - LL. Data over cable
 - MM. Fixed Wireless Broadband
 - NN. Remote Protocols: SLIP vs PPP
 - OO. Integrated Services Digital Network
 - PP. PSTN
 - QQ. Networking Speed Comparisons

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Course Outline (con't)

IV. IP Addressing

- A. Mathematical Foundations
- B. Number System Review
- C. More Binary Math
- D. Logic/Truth Tables
- E. Typical Addressing
- F. Internet Protocol
- G. IP Addresses - The Basics
- H. IP Classes (aaa.bbb.ccc.ddd)
- I. Anatomy of an IP Address
- J. Class A, B, C IP Classes
- K. Network Address vs. Host Address
- L. IP Address Class Characteristics
- M. Network Design Review
- N. Network Design Exercise
- O. Problem With Internet
- P. Split the Network Into Segments
- Q. Subnetting in Binary #s
- R. Network Address Translation (NAT)
- S. N:1 Network Address Translation
- T. NAT Issues
- U. TCP/IP Sockets with Port Numbers
- V. Well Known UDP & TCP Ports
- W. TCP/IP Services
- X. DNS Domains

V. TCP/IP Standards & Protocols

- A. OSI Model
- B. Standards and Networking
- C. Documentation: RFCs
- D. OSI Reference Model
- E. Analogy: Sending a Physical Package
- F. Layer Independence
- G. Physical Layer 1
- H. Data Link Layer 2
- I. Network Layer 3
- J. Transport Layer 4
- K. Session Layer 5
- L. Presentation Layer 6
- M. Application Layer 7
- N. TCP/IP 4 Layer Model vs. OSI
- O. TCP/IP Network Access Layer
- P. TCP/IP Internet Layer
- Q. TCP/IP Host-to-Host Layer
- R. Headers
- S. User Datagram Protocol (UDP)
- T. UDP Datagram Format
- U. UDP Application Interface
- V. Transmission Control Protocol
- W. Logical Connections
- X. TCP Overview
- Y. Windowing

- Z. TCP Windows
- AA. Window Example
- BB. TCP Segment Format
- CC. Acknowledgements & Retransmissions
- DD. Establishing a TCP Connection
- EE. TCP Application Programming Interface
- FF. TCP Congestion Control Algorithms
- GG. Slow Start
- HH. Congestion Avoidance
- II. Fast Retransmit
- JJ. Fast Recovery

VI. Dynamic Host Configuration Protocol

- A. Overview of DHCP
- B. Manual vs. Automatic Configuration
- C. DHCP Operation
- D. DHCP Lease Generation Process
- E. DHCP Lease Renewal Process
- F. DHCP Servers
- G. Authorizing the DHCP Service
- H. Creating and Configuring a Scope
- I. Overview of Scopes
- J. Using the Scope Wizard
- K. Configuring a Scope with Options
- L. Customizing Scope Options
- M. Reserving IP Addresses
- N. Customizing DHCP Functionality
- O. Using Option Classes
- P. Combining Scopes via Superscopes
- Q. Issuing Multicast Addresses
- R. Using DHCP in a Routed Network
- S. Routed Network Configuration Options
- T. Using a DHCP Relay Agent
- U. Supporting DHCP
- V. Monitoring DHCP Server Service
- W. Troubleshooting DHCP Problems
- X. Removing a DHCP Server

VII. Introduction to the

- A. Domain Name System
- B. Resolve: What Does DNS Do
- C. DNS, and Alternatives
- D. DNS Components
- E. Domain Name Service
- F. DNS Structure
- G. DNS Domains
- H. Fully Qualified Domain Name
- I. DNS Name Space
- J. Traditional Top Level Domains
- K. New Top Level Domains
- L. Types of Name Servers
- M. DNS Request

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Course Outline (con't)

- N. Resolver Query Types
 - O. Recursive/Iterative
 - P. Resolve: Who is asked?
 - Q. Root Name Servers
 - R. DNS Caching
 - S. The Internet: Who's In Charge?
 - T. Regional Internet Registries
 - U. Root Name Servers
 - V. Root Hints in Windows DNS Server
 - W. DNS Record Types
 - X. More DNS Record Types
 - Y. Zone File Example
 - Z. DNS with BIND
 - AA. Zone Transfer Process
 - BB. DNS Setup for Windows Clients
 - CC. Overview of Dynamic Registration
 - DD. DHCP Registration of DNS Records
 - EE. DNS Review
 - FF. Recommended Texts
- VIII. Routing**
- A. ARP
 - B. ARP Illustration
 - C. Reverse ARP (RARP)
 - D. Routing With IP
 - E. Types of Routing
 - F. Direct Routing
 - G. Static Routing Table
 - H. Dynamic Routing Table
 - I. Routing and Subnets
 - J. Layers Again
- IX. Internet Control Message Protocol (ICMP)**
- A. ICMP Error Messages
 - B. When Not to Send ICMP Messages
 - C. Path MTU Discovery
 - D. ICMP Query Messages
 - E. Viewing ICMP Activities
 - F. Router Discovery
 - G. Dead Router Detection
- X. Network Security**
- A. Security Layers
 - B. Physical Access is ALL!
 - C. Network Access
 - D. Media Access
 - E. Social Engineering
 - F. Planning
 - G. Password Guidelines
 - H. Other Implementation Precautions
 - I. Security Monitoring
 - J. What Is SSL/TLS?
- K. Security Problems Solved by Cryptography
 - L. TLS Technical Details
 - M. Example SSLLABS Scan Results
 - N. TLS Protocol Stack
 - O. Asymmetric Encryption
 - P. Authentication with Certificates
 - Q. PKI: Public Key Infrastructure
 - R. Certificate Authorities
 - S. Rogue Certificate Authorities
 - T. Viewing CAs Trusted by your Browser
 - U. Firewalls
 - V. Other Types of Protection
 - W. Protection Methods
- XI. Hacking**
- A. Nessus: Security Vulnerability Scanner
 - B. nmap – Ultimate UNIX-based scanning tool
 - C. nmap TCP Sweep method
 - D. nmap Stealth scan using SYN method
 - E. nmap – Operating System Identification
 - F. nmap ident scanning of UNIX systems
 - G. Wireless Attack Tools
 - H. Windows Hacking - RestrictAnonymous
 - I. Hacking Exposed
 - J. Hacking Linux Exposed
 - K. Incident Response: Investigating Computer Crime
 - L. Metasploit: Penetration Tester's Guide
 - M. Network Warrior
 - N. Nmap Network Scanning
- XII. TCP/IP Network Management**
- A. Network Health
 - B. Network Health Care
 - C. Network Troubleshooting
 - D. Ping
 - E. Traceroute
 - F. More Tools
 - G. SNMP Management Components
 - H. Management Information Base (MIB)
 - I. MIB Browser
 - J. Basic SNMP Concepts
 - K. SNMP Products
 - L. HP OpenView Network Node Manager
 - M. SNMP Services
 - N. Object Identifier
 - O. Example of snmpwalk
 - P. SNMP Traps
 - Q. Default UDP Ports for SNMP

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- R. TCP/IP Applications
- S. FTP (File Transfer Protocol)
- T. FTP: Pros and Cons
- U. Telnet
- V. Electronic Mail and TCP/IP
- W. SMTP Address Format
- X. DNS Again!
- Y. The Post Office Protocol
- Z. Basic File Sharing Operations
- AA. CIFS/SMB
- BB. Network File System
- CC. NFS Exporting
- DD. The Network Daemon
- EE. Other Internet Applications
- FF. What is HTTP?
- GG. Basic Operation
- HH. Example HTTP Communication
- II. HTTP Request
- JJ. URLs and URIs
- KK. HTTP Response
- LL. HTTP Headers
- MM. Non-static content
- NN. Common Gateway Interface
- OO. Notes on URL-Encoding
- PP. CGI POST

XIII. IPv6:

- A. Introducing IPv6
- B. IPv4 vs IPv6 Packet Header
- C. Sample IPv6 Header
- D. IPv4 / IPv6 Coexistence: Dual Stack
- E. IPv4 / IPv6 Coexistence: Tunnelling
- F. IPv4 / IPv6 Coexistence: Translation
- G. IPv6 Address Representation
- H. IPv6 Rule 1- Omitting Leading 0s
- I. IPv6 Rule 2 - Omitting All 0 Segments
- J. IPv6 Prefix Length
- K. IPv6 Address Types
- L. IPv6 Unicast Address Types
- M. IPv6 Link-Local Unicast Addresses
- N. IPv6 Global Unicast Address Structure
- O. Static Configuration of Global Unicast Address
- P. Stateless Address Autoconfiguration (SLAAC)
- Q. EUI-64 Process vs Random
- R. EUI-64 Verification at the Router
- S. Dynamic Link-local Addresses
- T. Static Link-local Address
- U. Verifying IPv6 Routing Table
- V. Sample IPv6 Host Routing Table
- W. IPv6 Multicast Addresses
- X. All-nodes multicast group
- Y. Solicited Node IPv6 Multicast Address
- Z. ICMPv4 and ICMPv6 Messages
- AA. Router Solicitation and Router Advertisement
- BB. Neighbor Solicitation and Neighbor Advertisement
- CC. Windows CMD Example: IPCONFIG
- DD. IPv6 Test and Advocacy Sites
- EE. Windows CMD Example: Route Table
- FF. Windows CMD Example: IPv6 Traffic
- GG. Windows CMD Example: Ping, Tracert