

9025- TCP/IP Networking

History and Standards

- ARPA
- NCP
- TCP, IP, ARPANET
- PARC
- Collaborative Network Requirements
- One Protocol?
- Peer-to-Peer Protocols
- Documentation and RFCs
- RFC Categories
- Where to Find Documentation

Review of Numbering Systems

- Binary
- Decimal
- Hexadecimal
- Conversion from Binary or Hex to Decimal
- Conversion from Decimal to Binary or Hex
- Exercises
- Converting from Hex to and from Binary
- Counting
- Which Base, Where

Local Signaling

- Local Signaling
- Ethernet Addressing
- Unicast
- Multicast
- Broadcast
- The Ethernet Header
- Protocol Type
- Size Limits

IP Addressing

- A Logical Address
- IP Address Structure
- Dotted Decimal Notation
- Classful Addressing

- Reserved Addresses
- Private Addressing
- Masking
- Comparing Addresses
- CIDR
- Prefix Notation
- Address Assignment

IP Subnets

- Why Subnet
- Required Information
- Multiple Subnets and VLSM
- Determining the Mask
- Laying out the Subnets and their Addresses
- Planning for Growth
- Adding More Subnets

Address Resolution Protocol

- Address Mapping
- ARP Cache
- ARP Restrictions
- ARP Types
- LAN Fill
- Gratuitous ARP
- ARP Commands

Internet Protocol

- IP On Everything
- IP Header
- IP Header Layout
- Differentiated Services
- Total IP Length
- Datagram ID Number
- Fragmentation
- TTL
- Protocol Field
- IP Header Checksum
- IP Address
- Source IP Address
- Target IP Address
- IP Option Fields
- IP Sample Data Exchanges

IP Routing

- Routing Function
- The IP Routing Algorithm
- The Routing Table
- Routing Table Basics
- Automatic Table Maintenance
- Exterior or Interior Protocol
- Routing Information Protocol
- RIP Routing Information Basics
- RIP Route Loops
- OSPF vs. RIP 1 vs. RIP 2 vs. IGRP vs. EIGRP
- Layer 3 Switching
- BGP

Simple Sessions with User Datagram Protocol

- Host-to-Host Layer Categories
- Connectionless Protocol
- Connection-Oriented Protocol
- Low Overhead vs. Reliability
- Port Origins and Basics
- Well-Known Ports
- Registered Ports
- Dynamic Ports versus Random Ports
- Ports and Sockets
- UDP Header
- Applications
- UDP Sample Data Exchanges

Multicast

- Overview
- Applications
- Advantages
- Disadvantages
- Addressing
- IGMP
- PIM and MOSPF

Robust Sessions with TCP

- The TCP Choice
- Reliable Transport Services
- TCP Functions and Facilities
- TCP Headers

- TCP Source and Target Ports
- Source Sequence Number
- Acknowledgment Sequence Number
- TCP Header Length
- Session Bit Flags
- Sender Window Size
- TCP Checksum
- Urgent Data Size
- Option Fields
- Maximum Segment and Window Size
- TCP Three-Step Handshake
- Normal Data Flow
- Recovering Lost Segments
- TCP Sliding Window Process
- Four Step Session Shutdown
- Normal End
- Reset Session
- TCP Sample Session

Auto Configuration

- IP Address Assignment
- IP Auto Configuration
- DHCP Characteristics
- DHCP Messages
- DHCP in a Routed Network
- Multiple DHCP Servers

DNS: Names Instead of Numbers

- What Does DNS Do?
- A Distributed Service
- The DNS Tree
- TLDs
- Country Domains
- Servers
- Resource Records
- The Lookup Process
- Recursive vs. Non-recursive Queries
- Local Lookup
- Looking at the Root
- Reversing the Process
- Dynamic DNS
- DHCP Lease Expiration

Diagnostics and Error Reports via ICMP

- ICMP Basics
- ICMP Message Destinations
- ICMP Messages
- ICMP Echo Request (Type 8) and Response (Type 0)
- Destination Unreachable (Type 3)
- Redirecting Traffic with an ICMP Message (Type 5)
- ICMP Time Exceeded Message (Type 11)
- ICMP Parameter Problem Message (Type 12)
- ICMP Samples

TCP Applications

- ❖ Telnet
 - Telnet Option Negotiations Sample Session
- ❖ FTP
 - Multiple Sessions
 - Stateful and Stateless Sessions
 - PASV
 - FTP Sample Session
- ❖ Email
 - SMTP Sample Session
 - POP3
 - POP3 Sample Session
 - IMAP4
- ❖ World Wide Web
 - URL
 - HTTP Requests and Responses

UDP Applications

- ❖ TFTP
 - TFTP Client and Server Ports
 - TFTP Transfer Process
 - TFTP Operations
 - TFTP Sample Session
- ❖ SNMP Basics
 - An SNMP Model
 - The Network Management Station
 - The SNMP Agent
 - The Structure of Management Information
 - Management Information Base
 - Private MIBs
 - Remote Network Monitoring

VoIP

- Overview
- Uses
- Voice Packets
- Compression
- Quality of Service
- Traffic Engineering

Instant Messaging

- Overview
- Integrated Communications
- Server Location(s)
- Security Issues
- Standards
- SOX

Security

- Protocol Limitations
- Issues
- Threats
- Solutions
- Port Numbers
- Authentication
- VPN

IPv6

- Overview
- Addressing
- Header
- ICMPv6
- IPv6 DNS operation
- Routing Services and Protocols
- Internet2

Course Review

- Standards
- Numbering Systems
- Local Signaling
- IP Addressing
- IP Subnets

- Address Resolution Protocol
- Internet Protocol
- Routing
- UDP
- Multicast
- TCP
- DHCP
- DNS
- ICMP
- TCP Applications
- UDP Applications
- VoIP
- Instant Messaging
- Security
- IPv6