Networking Fundamentals
Course Outline & Text Materials

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Networking Fundamentals teaches the basic concepts and terminology of networking and is designed to prepare students for the CompTIA Network+ Certification Exam. The text covers media types and standards and how data is encoded and transmitted. Students are also introduced to the terminology and basic concepts of each network operating system. The Open Systems Interconnection (OSI) model is introduced in the first chapter, revisited throughout the textbook, and then examined in detail in Chapter 17, A Closer Look at the OSI Model. A complete chapter is dedicated to TCP/IP and another to subnetting. While this edition was copyrighted in 2005, it remains a solid book for coverage of Networking Fundamentals. When Server 7 is published and marketed by Microsoft, there will be updates available on rmroberts.com until the re-write of the Networking Fundamentals text.

This outline is provided as a basic outline. You may download the outline in PDF format or Word format and adjust it to your needs. Just add days, dates, times and you're in business.

Course Outline (Textbook) Basics Include:

Chapter 1 Definition of a Network

- Definition of a Network
  - Advantages of Networking
  - Disadvantages of Networking
- Network Classifications – LAN, MAN, and WAN
- Network Topologies
  - Bus Topology
  - Star Topology
  - Ring Topology
  - Mesh Topology
  - Wireless Topology
  - Hybrid Topology
- Basic Administration Network Models
  - Client/Server Network
  - Peer-to-Peer Network
- Network Operating Systems (NOS)

- Network Communications
  - How Data is Packaged
  - Network Connectivity
- Protocols
  - NetBIOS
  - NetBEUI
  - TCP/IP
  - FIR
  - IPX/SEX
  - ATM
- Network Media and Devices
  - Media
  - Network Interface Card
  - Repeater
  - Hub
  - Gateway
  - Bridge
  - Brouter
- Standards and Organizations
  - IEEE
  - ISO
  - W3C
  - CERN
  - UL
  - EIA
  - TIA
  - ANSI
- *Laboratory Activity – Identifying a Workstation's IP Configuration Settings*

Chapter 2 Network Media – Copper Core Cable

- Network Media

- Analog and Digital Signals
  - Frequency
  - Attenuation
  - Interference
  - Latency

Fiber-Optic Cable Installation and Troubleshooting
Installing Connectors
Making a Fusion Shape
Using Fiber-Optic Cable Meters
Laboratory Activity – Fiber-Optic Connector Identification

Chapter 4 Wireless Technology

Electromagnetic Waves
Radio and Microwave Transmission
Infrared Transmission
Radio Interference
Antenna Styles
Omni
Dipol
Yagi
Flat Panel
Parabolic
Radio Wave Transmission Techniques and Networking
Radio Waved-Based Transmission Techniques
Radio Wave-Based Networking
The IEEE 802.11 Standard
IEEE 802.11 Access Method
New IEEE Wireless Standards
Bluetooth
Cellular Technology
Microwave Transmission and Networking
Infrared Transmission and Networking
Advantages and Disadvantages of Wireless Technology
Wireless Security
802.1X Authentication
802.1X Encryption
Wi-Fi Protected Access
Laboratory Activity – Installing an Infrastructure Mode Wireless Network

Chapter 5 Digital encoding and Data Transmission

Digital Encoding and Transmission
Data Packaging and Transmission
Parity Checks
Cyclic Redundancy Check (CRC)
Segmentation and encapsulation

Connection-Oriented and Connectionless Communication
Circuit Switching/Packet Switching
Data Codes
ASCII
BCD
EBCDIC
Unicode
HTML
Protocol Frame Structures
UPD Frame Structure
Ethernet Frame Structure
Data Encoding, Transmission, and the OSI Model
Application Layer
Presentation Layer
Session Layer
Transport Layer
Data Link Layer
Physical Layer
Laboratory Activity – Ethereal Protocol Analyzer

Chapter 6 Network Operating Systems and Network Communications
Common Network Operating System Traits
Network Operating Systems and Hardware Protocols
Ethernet
AppleTalk
Token Ring
Token Bus
ARCnet
Network Operating Systems and Networking Protocols
NetBIOS
NetBEUI
IPX/SPX
TCP/IP
Laboratory Activity – Installing Client Service for Netware

Chapter 7 Microsoft Network Operating Systems
A Brief History of Microsoft Network Operating Systems
Common Window Server Administrative Components
User Account
Group Account

Chapter 9 UNIX/Linux Operating Systems

- UNIX
- Linux
  - Linux Advantages
  - Linux Disadvantages
  - Copyright and Copyleft
- UNIX/Linux Basics
  - LILO and GRUB
  - Shells
  - Commands
  - File Systems
  - File Structure
  - Common Files and Directories
  - File and Directory Security
  - Network Authentication
  - File and Print Sharing
  - Remote Access Features
- X Window System
- Interoperability
  - Samba
  - Windows and NFS
- MAX OS X Server
- *Laboratory Activity – Adding a New User in SuSE Linux*

Chapter 10 Introduction to the Server

- Server Types and Services
  - Thin Servers
  - Thin Client Servers
  - Server Classification by Number of CPUs
- Major Server Components
  - Case
  - Hot-Swap Components
  - Power Supply
  - Motherboard
  - BIOS
  - Central Processing Unit (CPU)
  - Small Computer Systems Interface (SCSI)
- System Resources
  - Interrupt Request (IRQ)
  - Direct Memory Access (DMA) Channel

- Input/Output (I/O) Port
- Memory Address Assignment

RAID Systems

External Storage Systems

- Network-Attached Storage (NAS)
- Storage Area Network (SAN)

Fibre Channel

- Fibre Channel Point-to-Point Topology
- Fibre Channel Arbitrated Loop Topology
- Fibre Channel Fabric Switched Topology

Laboratory Activity – Using the DiskPart Command Interpreter

Chapter 11 TCP/IP Fundamentals

IP Addressing

- Network Class
- Subnet Mask
- Reserved IP Addresses
- Viewing IP Configuration Settings

Domain Name System (DNS)

- Internet Corporation for Assigned Names and Numbers (ICANN)
- Fully Qualified Domain Name (FQDN)
- DNS Structure and Operation
- Hosts and Lmhosts Text Files

The IP, TCP, and UDP Protocols

- Relationship to the OSI Model
- Frame Formats

Assigning IP Addresses

- Windows Internet Naming Service (WINS)
- Dynamic Host Configuration Protocol (DHCP)
- DHCP Lease
- Automatic Private IP Addressing (APIPA)
- Bootstrap Protocol (BOOTP)

TCP/IP Ports and Sockets

TCP/IP Troubleshooting Utilities

- Netstat
- Nbstat
- Ping
- Tracert or Traceroute
- ARP
- Nslookup

The IPv6 Standard
Loopback Address
IPv6 MAC Address
Laboratory Activity – Configuring a DHCP server

Chapter 12 Subnetting
The Binary Number System
Dotted Decimal Notation
Subnetting
A Closer Look at Subnets
Advantages of Subnetting
Disadvantages of Subnetting
Virtual LAN (VLAN)Preventive Maintenance
Laboratory Activity – Subnet Mask Calculator

Chapter 13 ATM and VoIP
Voice and Audio Signals
Signal Conversion
Latency
Video
Compression
Multimedia Transmission Protocols
X.25
Frame Relay
ATM
VoIP
Laboratory Activity – NetMeeting

Chapter 14 Web Servers and Services
Internet, Intranet, and Extranet
Internet
Intranet
Extranet
Domain Name and URL Resolution
Web Servers
Apache HTTP Server
Internet Information Service (IIS)
Web Browsers

Web Site Communications
- Extensible Markup Language (XML)
- SOAP
- FrontPage Extensions

File Transfer Protocol (FTP)
- Anonymous FTP

E-mail
- SMTP
- Post Office Protocol (POP)
- Internet Message Access Protocol (IMAP)
- HTTP E-Mail
- Multipurpose Internet Mail Extensions (MIME)
- E-mail Address Format
- E-Mail Structure
- Mail Filter
- Mail Gateway

Laboratory Activity – Installing Internet Information Services (IIS)

Chapter 15 Remote Access and Long Distance Communications

Introduction to Telecommunications Systems

Remote Connection Technologies and Media
- Public Switched Telephone Network (PSTN)
- ISDN
- Cable Internet Service
- Satellite
- T-Carrier
- FDDI
- SONET
- X.25
- Frame Relay

Dial-Up Networking
- Dial-In Only
- Dial-Out Only
- Full-Service
- Remote Desktop Protocol
- Remote Access Protocols

Virtual Private Networks (VPN)

Laboratory Activity – Routing and Remote Access Service (RRAS)

Chapter 16 Network Security

- Hackers, Crackers, and Intruders
- Common Network Security Breaches
  - Unprotected Network Shares
  - Social Engineering
  - Open Ports
  - Zero Configuration (Zerocof)
  - Denial of Service (DoS)
  - Man in the Middle (MITM)
  - Spoofing
  - Trojan Horse
  - E-mail Attachments
  - Macro Virus
  - Worm
  - Phishing
  - Administrator Laziness
- Security Methods and Protocols
  - Encryption
  - Secure Sockets Layer (SSL)
  - Secure HTTP
  - IP Security (IPSex)
  - SSH
  - SCP
- Wireless Security
  - Wireless Access Point Authentication
  - Media Access Control (MAC) Filter
  - Wired Equivalency Privacy (WEP)
  - Wi-Fi Protected Access (WPA)
  - Wi-Fi Protected Access 2 (WPA2)
  - 802.11i
  - 802.1x
- Authentication Protocols
  - Password Authentication Protocol (PAP)
  - Challenge Handshake Authentication Protocol (CHAP)
  - Kerberos
- Security Implementations
  - Software Installation Patches
  - Administrator Account
  - User Account Passwords
  - Other Password Security Measures

- Firewall
- Packet Filter
- Application Gateway
- Circuit-Level Gateways
- Proxy Server
- Securing Remote Access
- Physical Security

Security Tools

- Netstat Utility
- Audit Tools
- Self-Hack Tools
- Protocol Analyzer
- Packet Sniffer
- System Backups

Laboratory Activity – Security Even Monitoring

Chapter 17 A closer Look at the OSI Model

History and Purpose of the OSI Model

The OSI Layers

- Application Layer
- Presentation Layer
- Session Layer
- Transport layer
- Network Layer
- Data Link Layer
- Physical Layer

The Encapsulation Process

The OSI Model and the Major Protocol Suites

- TCP/IP Protocols
- Novell IPX/SPX Protocols
- AppleTalk
- AppleShare IP

Request For Comments (RFC)

Laboratory Activity – Ethereal OSI Model Exploration

Chapter 18 Maintaining the Network

Monitoring the Server and Network

- Establishing a Baseline
- Monitoring Tools

Maintaining System Software
- Patches
- Service Packs
- Upgrades
- Software Installations

Maintaining System Hardware
- Scheduling Downtime
- Major Network Hardware Upgrades

Maintaining System Integrity
- Fault Tolerant RAID Systems
- Backup Data Methods
- Hot and Cold Spares
- Hot, Cold and Warm Sites

Maintaining Stable Electrical Power
- Electrical Surges and Spikes
- Brownouts and Blackouts
- Uninterruptible Power Supply (UPS)
- Isolation Transformers
- Generators

Protecting from Malware
- Establishing Network System User Policies
- Antivirus Software
- Malware
- Merging Networks
- *Laboratory Activity – LANguard Network Security Scanner*

Chapter 19 Fundamentals of Troubleshooting the Network

Troubleshooting Procedures
1. Establish the Symptoms and Potential Causes
2. Identify the Affected Area
3. Establish What Has Changed
4. Select the Most Probable Cause
5. Implement and Action Plan and Solution Including Potential Benefits
6. Test the Result
7. Indentify the Results and Effect of the Solution
8. Document the Solution and Process

Troubleshooting the Network Infrastructure
- The Windows 98 Boot Process
- The Windows NT Family Boot Process

- Dual Boot Systems
- Troubleshooting Windows NT-Based Operating Systems

Troubleshooting the Network Infrastructure

- Windows XP Network Diagnostic Utility
- Network Cable Tester
- Tone Generator and Tracer
- Fiber-Optic Cables
- NIC Loopback Test
- Indicator Lights
- Network Analyzers
- Protocol Analyzer
- Wireless Network Tester/Analyzer

Troubleshooting the Server

Troubleshooting the Most Common Network Problems

- The User Cannot Log On to the Network/Computer
- Loose Connections
- The User Cannot Access a Share
- The user Cannot Print to the Network Printer
- The Printer is Printing Gibberish
- The User Cannot Access the Internet
- The User's Computer Has a Virus or Worm

Troubleshooting with Event Viewer and System Monitor

Troubleshooting with TCP/IP Utilities

- Ping
- Tracert
- Netstat
- Nbstat
- ARP
- Ipconfig
- Nslookup

Laboratory Activity – Network Diagnostics

Chapter 20 Designing and Installing a New Network

Needs Assessment and Design

- Physical Network Structure
- Security
- Application
- Organizational Structure
- Fault Tolerance and Data Integrity
- Network Design Tools

Developing a Timeline
Installation
Implementation
Documentation
Training
Specifications for Network Design
    Architectural Design Elements
    Standards Organizations
    ANSI/TIA/EIA Standards
    Network and Computer Electrical Requirements
BICSI
Laboratory Activity – Designing a Small Network

Chapter 21 Network + Certification Exam Preparation

The Network+ Certification Exam
Preparation Strategy
1. Review and Analyze the Exam Objectives
2. Match Exam Objective to Resource Material
3. Identify and Practice laboratory Activities that Match the Exam Objectives
4. Take Practice Exams
5. Review Problem Areas
6. Retake Practice Exams
7. Schedule and Take the Network + Certification Exam

Network + Certification Practice Exam
    Domain 1 – Media and Topologies
    Domain 2 – Protocols and Standards
    Domain 3 – Network Implementation
    Domain 4 – Network Support
    Scoring the Exam

Chapter 22 Employment in the Field of Networking Technology

Information Technology Industry Careers
    Network Support Specialist
    Network Administrator
    Systems Analyst
    Consultant
    Technical Salesperson
    Web Administrator
    Programmer

Recommended Textbook, Student Workbook, Instructor Manual, and Complete Classroom and Reference Materials (http://www.g-w.com)

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