

Network+ 2009

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Network+ 2009

First Edition

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**Network+ 2009
Teacher Manual**

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Introduction



Sample

Using this Workbook

In the *Introduction* section, you will find an outline for each session of training and sample lesson plans. These are included to give you an overview of the training content and to help you structure your lessons. The content, delivered by industry professionals, is the most up-to-date, comprehensive content available.

The exercises included in this workbook are meant to serve as supplementary material for the OnlineExpert courses. The following types of exercises are included for each session of training:

Fill-in-the-Blanks: The student completes a comprehensive fill-in-the-blank exercise while watching each session of the training. Each exercise follows the instructor's lecture and can be used as a review for the Quiz, the Pre-Tests, and the Post-Tests.

Glossary Crossword and Word Search Puzzles: These puzzles, taken directly from the courses' glossary, are intended to help your students become more familiar with the terms found in each session.

Short Answer: The short answer questions facilitate recall of the basic training concepts to further aid in retention of the course topics and information in preparation for the training's Pre-Assessments and Post-Tests.

Matching: The matching exercise provides additional learning reinforcement of terms and concepts found throughout the training in the courses' glossary.

Research Topic: The research topic gives your students the opportunity to research an applicable real-world situation whose answer will require using their understanding of the training as well as outside resources to generate a response.

Projects: The individual and group projects require your students to apply the knowledge gained during the training to complete the assigned task. By using both individual and group projects students receive the added benefit of applying the knowledge they have gained in a situation that mimics life in the workforce.

Quiz: The quizzes will help you gauge your students' progress. They also provide your students additional preparation for the training Pre-Tests and Post-Tests.

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These workbook exercises, used in conjunction with the LearnKey training, give your students the best learning experience possible.

Shoot File Links: The links to shoot files contain any of the actual files (Excel spreadsheets, Flash FLA files, etc.) that are used and demonstrated during the training. The files will typically have a starting file containing all data necessary to begin the demonstrated skill, as well as a completed file that shows the final result.

Keyboard Shortcuts & Tips: The keyboard shortcuts and tips provide a reference of product-specific keyboard shortcuts and helpful hints to make working more efficient.

Objective Mapping: The objective mapping provides a quick reference as to where in the training a specific certification exam objective is covered.

Best Practices Guide: The best practices guide gives you as the instructor the help you will need to effectively incorporate the workbook and training into your classroom experience. This guide comes from teachers like yourself and has been proven time and time again.

Running & Training Time Table: The running and training time tables will help you to better plan your lessons based on the time you have available. The running time is the actual time required to simply watch the training. The training time is an estimated average time that it will take to watch and discuss the concepts presented as well as do any applicable exercises.

Skills Assessment: The skills assessment will help you and your students to gauge their understanding of course topics prior to beginning any coursework. Understanding where your students as a group feel less confident will aid you in planning and getting the most from the training.

Course Introduction

Network+ is an ebecome Network+ certified. Students will gain the knowledge and skills necessary to manage, maintain, troubleshoot, install, operate and configure basic network infrastructure, describe networking technologies, and basic design principles. This course will provide lite training program that completely and a dequately prepares students to students with the ability to effectively learn real-world concepts and skills to help launch or enhance a networking career. This course will prepare you to pass the CompTIA® Network+ certification exam N10-004.

Benefits:

- Certification is ranked as one of the most in-demand networking skills in the IT department
- Achieve industry recognition and respect among colleagues and professionals
- Provides a full library of knowledge that can be referenced time and time again

Course Map

Session 1

Introduction

Understanding The Network+
Network+ Domains

Packets

Network Card
Everything Is Binary
Conceptualizing Packets
Conceptualizing MAC Address
Binary to Hex
IPCONFIG
IFCONFIG

1.0 Network Technologies

1.3 Identify the following address formats; MAC Address

5.0 Network Tools

5.1 Given a scenario, select the appropriate command line interface tool and interpret the output to verify functionally: Ipconfig, Ifconfig.

Topologies

Bus Topology
Ring Topology
Star Topology
Mesh Topology
Point-to-Point
Point-to-Multipoint
Hybrid Topologies

2.0 Network Media and Topologies

2.3 Identify common physical network topologies: Star, Mesh, Bus, Ring, Point to point, Point to multipoint, Hybrid.
2.7 Explain common logical network topologies and their characteristics, Peer to peer, Client/server, VPN, VLAN

Building a Network

OSI History
Physical Layer
Frames
Data Link Layer
Network Layer
Transport Layer
Session Layer
Presentation Layer
Application Layer

3.0 Network Devices

3.1 Install, configure and differentiate between common network devices: Hub, Repeater.

4.0 Network Management

4.1 Explain the function of each layer of the OSI model: Layer 1 – physical, Layer 2 – data link, Layer 3 – network, Layer 4 – transport, Layer 5 – session, Layer 6 – presentation, Layer 7 – application.

Network Cabling

Overview
 Coaxial
 Unshielded Twisted Pair
 CAT Levels
 RJ Connectors
 Cable Fire Ratings
 Shielded Twisted Pair
 Fiber Optic
 Fiber Connectors
 Understanding Fiber

2.0 Network and Media Topologies

2.1 Categorize standard cable types and their properties
 Type: CAT3, CAT5, CAT5e, CAT6, STP, UTP,
 Multimode fiber, single-mode fiber, Coaxial o RG-59 o
 RG-6, Serial, Plenum vs. Non-plenum Properties:
 Transmission Speeds, Distance, Duplex, Frequency

.2 Identify common connector types, RJ-11, RJ-45, BNC,
 SC, ST, LC.2.2 Identify common connector types: RJ-11,
 RJ-45, BNC, SC, ST, LC. 3.1 Install, configure and
 differentiate between common network devices: Hub,
 Repeater, NIC.

Ethernet Basics

Understanding Ethernet
 Ethernet Frame
 Conceptualizing Ethernet
 Sending Ethernet Frames
 Promiscuous Mode
 Receiving Ethernet Frames
 CSMA/CD
 Connecting Hubs
 Crossover Cable
 Daisy Chaining Hubs

2.0 Network Media and Topologies

2.4 Given a scenario, differentiate and implement
 appropriate wiring standards: 568A, 568B, Straight vs.
 cross-over.

2.6 Categorize LAN technology types and properties
 Types: Ethernet, 10BaseT. Properties: CSMA/CD,
 Broadcast, Collision. 3.1 Install, configure and differentiate
 between common network devices: Hub, Repeater, NIC,
 Media converters, Basic switch, Bridge, Wireless access
 point, Basic router, Basic firewall, Basic DHCP server.

4.0 Network Management

4.7 Given a scenario, troubleshoot common connectivity
 issues and select an appropriate solution: Collisions.

10Base/100Base Ethernet

10BaseT
 10BaseFL
 10Base Ethernet
 100BaseT
 100Base Ethernet
 Media Converter
 Link Lights

2.0 Network Media and Topologies

2.4 Given a scenario, differentiate and implement
 appropriate wiring standards: 568A, 568B, Straight vs.
 cross-over.

2.6 Categorize LAN technology types and properties
 Types: Ethernet, 10BaseT. Properties: CSMA/CD,
 Broadcast, Collision. 3.1 Install, configure and differentiate
 between common network devices: Hub, Repeater, NIC,
 Media converters, Basic switch, Bridge, Wireless access
 point, Basic router, Basic firewall, Basic DHCP server.

4.0 Network Management

4.7 Given a scenario, troubleshoot common connectivity
 issues and select an appropriate solution: Collisions.

LearnKey

Session 2

Modern Ethernet

Ethernet Switches
Switching
Spanning Tree Protocol
Gigabit Ethernet
Backbone
10GbE
10GBaseT

2.0 Network Media and Topologies

2.6 Categorize LAN technology types and properties; Types: 1000BaseT, 1000BaseX, 10GBaseSR, 10GBaseLR, 10GBaseER, 10GBaseSW, 10GBaseLW, 10GBaseEW, 10GBaseT. Properties: Speed, Distance.

3.0 Network Devices

3.1 Install, configure and differentiate between common network devices: Basic switch, Bridge.

3.3 Explain the advanced features of a switch: Spanning tree.

Structured Cabling

Structured Cabling Defined
Structured Cabling Terminology
Rack Units
Wiring Distribution
Main Distribution Frame
Patch Panel
Patch Cables
Horizontal Run Demonstration
66 Block
Wiring Schematic
Physical Network Diagram

2.0 Network Media and Topologies

2.8 Install components of wiring distribution: Vertical and horizontal cross connects, path panels, 66 block, MDFs, IDFs, 25 pair, 100 pair, 110 block, Demarc, Demarc extension, Smart jack, Verify wiring installation, Verify wiring termination.

4.0 Network Management

4.2 Identify types of configuration management documentation: Wiring schematics, Physical and logical network diagrams.

4.3 Given a scenario, evaluate the network based on configuration management documentation: Compare wiring schematics, physical and logical network diagrams, baselines, policies and procedures and configurations to network devices and infrastructure. Update wiring schematics, physical and logical network diagrams, configurations and job logs as needed.

Structured Cabling Tools

Cable Making Tools
Punch Down Tool
Continuity
Continuity Tester
Micro Scanner
TDRs
Attenuation
Crosstalk
Shorts and Interference
Certifiers
Toner Probe

4.0 Network Management

4.7 Given a scenario, troubleshoot common connectivity issues and select an appropriate solution; Physical issues: Cross talk, Nearing crosstalk, Near End crosstalk, Attenuation, Shorts, Interference. Logical issues: Port speed, Port duplex mismatch, Incorrect VLAN, Incorrect IP address, Wrong gateway, Wrong DNS, Wrong subnet mask.

5.0 Network Tools

5.3 Given a scenario, utilize the appropriate hardware tools: Cable testers, Certifiers, TDR, OTDR, Multimeter, Toner probe, Punch down tool, Cable stripper, Snips.

Introducing TCP/IP

Protocoll Suite
 Broadcasting
 NetBIOS/NetBEUI
 Logical Network Addressing
 Routing
 IP Naming Importance
 TCP/UDP/ICMP

1.0 Network Technologies

1.1 Explain the function of networking protocols: TCP, FTP UDP, TCP/IP suite, ICMP.

1.4 Given a scenario, evaluate the proper use of the following addressing technologies and addressing schemes: Broadcast.

Basic IP Addressing

IP Addressing Defined
 Unique Addresses
 Subnet Mask
 Network ID
 Binary vs. Decimal
 Converting Binary to Decimal
 Dotted-Decimal
 Converting Decimal to Binary

1.0 Network Technologies

1.4 Given a scenario, evaluate, the proper use of the following addressing technologies and addressing schemes; Addressing Technologies: Subnetting.

Advanced IP Addressing

Class Licenses
 CIDR
 Configuring IP
 Ping
 Arp
 MAC IP Tools
 Linux IP Tools

1.0 Network Technologies

1.1 Explain the function of common networking protocols: ARP, ICMP.

1.4 Given a scenario, evaluate the proper use of the following addressing technologies and addressing schemes; Addressing schemes: classful vs. classless (e.g. CIDR, Supernetting).

5.0 Network Tools

5.1 Given a scenario, select the appropriate command line interface tool and interpret the output to verify functionality: Ping, Arp Ping, Arp

LearnKey**Session 3****Subnetting**

Understanding Subnetting
 Subnet Setup
 Extending the Subnet
 Calculating Hosts
 Determining IP Addresses
 Defining Network IDs
 Applying Subnetting
 Example Subnetting Scenario

1.0 Network Technologies

1.3 Identify the following address formats: IPv6, IPv4, MAC addressing.

1.4 Given a scenario, evaluate the proper use of the following addressing technologies and addressing schemes. Addressing Technologies; Subnetting.

DHCP

Understanding DHCP
 DHCP Client Side
 DHCP Server
 Administering DHCP Server
 Renewing DHCP lease
 APIPA
 Windows DHCP Server
 Rogue DHCP Server

1.0 Network Technologies

1.1 Explain the function of common networking protocol: DHCP.

1.4 Given a scenario, evaluate the proper use of the following addressing technologies and addressing schemes; Addressing Technologies: DHCP (static, dynamic APIPA).

3.0 Network Devices

3.1 Install, configure and differentiate between common network devices: Basic DHCP server.

5.0 Network Tools

5.1 Given a scenario, select the appropriate command line interface tool and interpret the output to verify functionality: Ipconfig.

Network Naming

Name Resolution
 Host File
 DNS
 DNS Server
 DNS in Action
 Configuring DNS
 Reverse Lookup Zones
 Root Hints
 Forwarder Servers
 Nslookup
 Dig

1.0 Network Technologies

1.1 Explain the function of common networking protocols: DNS

3.0 Network Devices

3.2 Identify the functions of specialized network devices: DNS server.

5.0 Network Tools

5.1 Given a scenario, select the appropriate command line interface tool and interpret the output to verify functionality: Nslookup, Dig.

Windows Name Resolution

WINS
 SMB/CIFS
 NetBIOS Commands

5.0 Network Tools

5.1 Given a scenario, select the appropriate command line interface tool and interpret the output to verify functionality: Hostname, Nbtstat.

Introducing TCP/IP Ports

- Ports Defined
- Netstat
- TCPView
- Wireshark
- Packet Filtering

Static Routing

- Routers
- Router Console Cables
- Routing Table
- Route Print
- Broadcast/Unicast/Multicast
- Netstat -r

- 4.0 Network Management
 - 4.4 Conduct network monitoring to identify performance and connectivity issues using the following: Network monitoring utilities (e.g. packet sniffers, connectivity software, load testing, throughput testers). System logs, history logs, event logs.
- 5.0 Network Tools
 - 5.1 Given a scenario, select the appropriate command line interface tool and interpret the output to verify functionality: Netstat.
 - 5.2 Explain the purpose of network scanners: Packet sniffers, Port scanners.
 - 5.3 Given a scenario, utilize the appropriate hardware tools:
- 1.0 Network Technologies
 - 1.4 Given a scenario, evaluate the proper use of the following addressing technologies and addressing schemes: Addressing schemes: Unicast, Multicast, Broadcast.
 - 1.6 Explain the purpose and properties of routing: Understanding routing tables and how they pertain to path selection.
- 2.0 Network Media and Topologies
 - 2.1 Categorize standard cable types and their properties; Types: Serial.
 - 2.2 Identify common connector types: RS-232
 - 2.4 Given a scenario, differentiate and implement appropriate wiring standards: Rollover, Loopback.
- 3.0 Network Devices
 - 3.1 Install, configure and differentiate between common network devices: Basic router.
- 5.0 Network Tools
 - 5.1 Given a scenario, select the appropriate command line interface tool and interpret the output to verify

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Dynamic Routing

Why Dynamic Routing
 Dynamic Routing Types
 Distance Vector
 RIP
 Autonomous System
 BGP
 OSPF / IS-IS
 Link State in Action
 Hybrid
 Traceroute
 Mtr

1.0 Network Technologies

1.5 Identify common IPv4 and IPv6 routing protocols; Link state: OSPF, IS-IS. Distance vector: RIP, RIPv2, BGP. Hybrid: EIGRP.

1.6 Explain the purpose and properties of routing: IGP vs. EGP, Static vs. dynamic, Next hop, Explain convergence (steady state)

5.0 Network Tools

5.1 Given a scenario, select the appropriate command line interface tool and interpret the output to verify functionality: Traceroute, Mtr.

Firewalls

Private IPs
 NAT
 Static NAT
 Configuring Access Control
 Port Filtering
 Common Firewall Features
 DMZ / Zones
 Intrusion Detection

1.0 Network Technologies

1.4 Given a scenario, evaluate the proper use of the following addressing technologies and addressing schemes; Addressing Technologies: NAT, PAT, SNAT, Public vs. private.

3.0 Network Devices

3.1 Install, configure and differentiate between common network devices: Basic Firewall.

3.2 Identify the functions of specialized network devices: IDS/IPS.

5.0 Network Tools

5.2 Explain the purpose of network scanners: Intrusion detection software, intrusion prevention software.

6.0 Network Security

6.1 Explain the function of hardware and software devices: Network based firewall, Host based firewall, IDS, IPS.

6.2 Explain common features of a firewall: Application layer vs. network layer, Stateful vs. stateless, Content filtering, Zones.

6.3 Explain the methods of network access security; Filtering: ACL-Mac filtering, IP filtering.

Session 4

Internet Applications Part 1

Identifying DHCP Port
Identifying DNS Port
SNMP
Querying SNMP
HTTP / HTTPS
Web Server Admin
Telnet
SSH

1.0 Network Technologies

1.1 Explain the function of common networking protocols: HTTP (S), SSH, Telnet, SNMP2/3.

1.2 Identify commonly used TCP and UDP ports; TCP ports: SSH-33, TELNET-23, DNS-53, HTTP-80, HTTPS-443. UDP ports: DNS-53, BOOTPS/DHCP-67, SNMP-161.

Internet Applications Part 2

FTP
FTP Client
Secure FTP
TFTP
E-Mail
SMTP Server Settings
Network Time Protocol

6.0 Network Security

6.5 Explain issues that affect device security; Secure methods vs. unsecure methods: SSH, HTTPS,SNMPv3,SFTP,SCP. TELENET, HTTP, FTP, RSH, RCP, SNMPv1/2.

1.0 Network Technologies

1.1 Explain the function of common networking protocols: TFTP, SIP (VoIP), RTP (VoIP), POP3, NTP, IMAP4, SMTP, IGMP.

1.2 Identify commonly used TCP and UDP default ports; TCP ports: FTP- 20.21, SMTP-25, POP3-110, NTP-123, IMAP4-143. UDP ports: TFTP-69.

Encryption

Authentication Standards
Point-to-Point Protocol
Kerberos
AAA Tools
EAP
802.1x

6.0 Network Security

6.5 Explain issues that affect device security; Secure methods vs. unsecure methods: SSH, HTTPS,SNMPv3,SFTP,SCP. TELENET, HTTP, FTP, RSH, RCP, SNMPv1/2.

6.0 Network Security

6.3 Explain the methods of network access security; Remote access: PPP.

6.4 Explain methods of user authentication: PKI.

Authentication

WINS
SMB/CIFS
NetBIOS Commands

1.0 Network Technologies

1.7 Compare the characteristics of wireless communication standards; Authentication and encryption: RADIUS.

6.0 Network Security

6.4 Explain methods of user authentication; Kerberos, AAA: RADIUS, TACAS+. Network access control: 802.1x. CHAP, MS-CHAP, EAP.

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Wireless

Understanding 802.11
802.11 Standards
Wireless Settings
ESSID
SSID Broadcast
Joining a Wireless Network

1.0 Network Technologies

1.7 Compare the characteristics of wireless communication standards; Authentication and encryption: RADIUS.

6.0 Network Security

6.4 Explain methods of user authentication; Kerberos, AAA: RADIUS, TACAS+. Network access control: 802.1x. CHAP, MS-CHAP, EAP.

Implementing Wireless

Configuration Considerations
Wireless Access Points
Access Point Antennas
Wireless Issues

.0 Network Devices

3.4 Implement a basic wireless network: Configure appropriate encryptions, Configure channels and frequencies, Set ESSID and beacon, Verify installation.

1.6 Explain the purpose and properties of routing: Understanding routing tables and how they pertain to path selection.

4.0 Network Management

4.7 Given a scenario, troubleshoot common connectivity issues and select an appropriate solution; Wireless Issues: Interference (bleed, environment factors), Standard mismatch (802.11 a/b/g/n), Distance, Bounce, Incorrect antenna placement.

Advanced Networking Devices

Peer-to-Peer
Client Server
Multi-Layer Switch
Content Switch
Bandwidth Shaper
Proxy Server
VLANs
Creating a VLAN
Assigning VLAN Ports
InterVLAN Routing
Trunking
Dynamic VLAN
VPN
Tunneling
Tunneling Protocols
Connecting VPNs

2.0 Network and Media Topologies

2.7 Explain common logical network topologies and their characteristics: Peer to peer, Client/server, VPN, VLAN.

3.0 Network Devices

3.2 Identify the functions of specialized network devices: Multilayer switch, Content switch, Load balancer, Multifunction network devices, Bandwidth shaper, Proxy server.

3.3 Explain the advanced features of a switch: PoE, VLAN, Port authentication.

4.0 Network Management

4.5 Explain different methods and rationales for network performances optimization; Methods: QoS, Traffic shaping, Load balancing, High availability, Caching engines, Fault tolerance. Reasons: latency sensitivity, High bandwidth applications-VoIP-Video Applications, Uptime.

6.0 Network Security

6.1 Explain the function of hardware and software security devices: VPN concentrator.

6.3 Explain the methods of network access security; Tunneling and encryption: SSL VPN, VPN, L2TP, PPTP, IPSEC.

Session 5

IPv6

IPv6 Defined
IPv6 Addresses
Link Local Address
Getting a IPv6 Address

6.0 Network Security

6.3 Explain the methods of network access security; Tunneling and encryption: SSL VPN, VPN, L2TP, PPTP, IPSEC.

Remote Connections

Connectivity History
Analog to Digital
DSO
Digital Cabling
Testing T1s
T-Carriers
SONET
Packet Switching
MPLS

.0 Network Media and Topologies

2.5 Categorize WAN technology types and properties; Type: Frame relay, E1/T1, E3/T3, OC-x, ATM, SONET, MPLS. Properties: Circuit switch, Packet switch, Speed, Transmission media, Distance.

3.0 Network Devices

3.2 Identify the functions of specialized network devices: CSU/ DSU.

5.0 Network Tools

5.3 Given a scenario, utilize the appropriate hardware tools: Butt set.

The Last Mile

POTS
Central Office
Digital to Analog to Digital
ISDN
DSL
DLS Types
PPPoE
Cable Modem
Satellite
Wireless

2.0 Network Media and Topologies

2.5 Categorize WAN technology types and properties; Type: ADSL, SDSL, VDSL, Cable Modem, Satellite, Wireless, ISDN BRI, ISDN PRI, POTS, PSTN. Properties: Circuit switch, Packet switch, Speed, Transmission media, Distance.

3.0 Network Devices

3.1 Install, configure and differentiate between common network devices: Modem.

6.0 Network Security

6.3 Explain the methods of network access security; Remote access: PPPoE.

Remote Access

Overview
Bonding
Traffic Shapping
QoS

4.0 Network Management

4.5 Explain different methods and rationales for network performances optimization; Methods: QoS, Traffic shaping, Load balancing, High availability, Caching engines, Fault tolerance. Reasons: latency sensitivity, High bandwidth applications-VoIP-Video Applications, Uptime.

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Protecting Your Network

Physical Security
Theft
Power
HVAC
Fire
Hardware Failure
Antivirus / Malware
DoS
Man in the Middle
Rogue Access Points
Social Engineering
Protection Checklist
Baselines
Patches / Updates
Configurations
Regulations

4.0 Network Management

4.2 Identify types of configuration management documentation: Baselines, Policies, procedures and configurations, Regulations.

6.0 Network Security

6.5 Explain issues that affect device security: Physical security, Restricting local remote access.

6.6 Identify common security threats and mitigation techniques; Security threats: DoS, Viruses, Worms, Attackers, Man in the Middle, Smurf, Rogue access points, Social engineering (phishing). Mitigation techniques: Policies and procedures User training, Paths and updates.

The Art of Network Support

Nine Step Process

4.0 Network Management

4.6 Given a scenario, implement the following network troubleshooting methodology: Information gathering- identify symptoms and problems, Identify the affected areas of the network, Determine if anything has changed, Establish the most probable cause, Determine if escalation is necessary, Create an action plan and solution identifying potential effects, Implement and test the solution, Identify the results and effects of the solution, Document the solution and the entire process.

Lab 1: LAN Issues

NIC Configuration
Speed / Duplex Issues
Wrong IP Address
Dynamic vs. Static IP / DNS
VLAN Issues
Angry IP Scanner
Port Mirroring
Impedence Mismatch
Logs

4.0 Network Management

4.4 Conduct network monitoring to identify performance and connectivity issues using the following: System logs, history logs, event logs.

4.7 Given a scenario, troubleshoot common connectivity issues and select an appropriate solution; Physical issues: Open impedance mismatch (echo). Logical issues: Port Speed, Port duplex mismatch, Incorrect VLAN, Incorrect IP address, Wrong gateway, Wrong DNS, Wrong subnet mask.

Lab2: WAN Issues

Switching Loops
Routing Loops
Broadcast Storms
Proxy arp
Signature Identification

4.0 Network Management

4.7 Given a scenario, troubleshoot common connectivity issues and select an appropriate solution; Issues that should be identified but escalated: Switching loop, Routing loop, Route problems, Proxy arp, Broadcast storms

Lab3: Wireless Issues

Interference
ESSID Mismatch
Incorrect Encryption
Incorrect Channel
Incorrect Frequency

4.0 Network Management

4.7 Given a scenario, troubleshoot common connectivity issues and select an appropriate solution; Wireless issues: Interference (bleed, environment factors), Incorrect encryption, Incorrect channel, Incorrect frequency, ESSID mismatch.

Session Objectives

Course Objectives: Session 1

1. Understand physical and logical network topology
2. Describe and define the OSI seven layer model
3. Be able to explain what a packet is and how it's built

Course Objectives: Session 2

1. Describe and categorize LAN technology types
2. Given a scenario troubleshoot common connectivity issues
3. Explain the functions of different network protocols and their proper use

Course Objectives: Session 3

1. Describe and implement IP addressing schemes; DHCP, Subnetting, and WINS
2. Gain an understanding of TCP/IP ports
3. Identify the differences between static and dynamic routing

Course Objectives: Session 4

1. Explain the differences among the many encryption protocols
2. Explain the methods of user authentication
3. Implement and troubleshoot a basic wireless network

Course Objectives: Session 5

1. Describe the benefits of IPv6
2. Implement and configure remote access and troubleshoot remote connections
3. Identify common security threats and the steps needed to protect your network

Course Outline

Session 1

Introduction

Understanding the Network+
Network+ Domains

Packets

What is a Network?
Network Card
Everything is Binary
Conceptualizing Packets
Conceptualizing MAC Addresses
Binary to Hex
IPCONFIG
IFCONFIG

Topologies

Bus Topology
Ring Topology
Star Topology
Mesh Topology
Point-to-Point
Point-to-Multipoint
Hybrid Topologies

Building a Network with OSI

OSI History
Physical Layer
Frames
Data-Link Layer
Network Layer
Transport Layer
Session Layer
Presentation Layer
Application Layer

Network Cabling

Network Cabling Overview
Coaxial
Unshielded Twisted Pair
Cat Levels
RJ Connectors
Cable Fire Ratings
Shielded Twisted Pair
Fiber optic
Fiber Connectors
Understanding Fiber

Ethernet Basics

Understanding Ethernet
Ethernet Frame
Conceptualizing Ethernet
Sending Ethernet Frames
Promiscuous Mode
Receiving Ethernet Frames
CSMA/CD
Connecting Hubs
Crossover Cable
Daisy Chaining Hubs

10Base/100Base Ethernet

10Base-T
10Base-FL
10Base Ethernet
100Base-T
100Base Ethernet
Media Converter
Link Lights

Session 2

Modern Ethernet

- Ethernet Switches
- Switching
- Spanning Tree Protocol
- Gigabit Ethernet
- Backbone
- 10GbE
- 10GBase-T

Structured Cabling

- Structured Cabling Defined
- Structured Cabling Terminology
- Rack Units
- Wiring Distribution
- Patch Panel
- Patch Cables
- Horizontal Run Demonstration
- 66 Block
- Wiring Schematic
- Physical Network Diagram

Structured Cabling Tools

- Cable Making Tools
- Crimping
- Punch Tools
- Testing Tools
- Continuity
- Continuity Tester
- MicroScanner
- TDRs
- Multimeter
- Attenuation
- Crosstalk
- Shorts
- Interference
- Certifiers
- Toner Probes

Introducing TCP/IP

- Protocol Suite
- Broadcasting
- NetBIOS/NetBEUI
- Logical Network Addressing
- Routing
- IP Naming Importance
- TCP/IP
- TCP/UDP/ICMP

Basic IP Addressing

- IP Addressing Defined
- Unique Addresses
- Subnet Mask
- Network ID
- Binary vs. Decimal
- Converting Binary to Decimal
- Dotted Decimal
- Converting Decimal to Binary

Advanced IP Addressing

- Class Licenses
- CIDR
- Configuring IP
- Ping
- ARP
- Mac IP Tools
- Linux IP Tools

Session 3

Subnetting

- Understanding Subnetting
- Subnet Setup
- Extending the Subnet
- Calculating Hosts
- Determining IP Addresses
- Determining Network IDs
- Applying Subnetting
- Example Subnetting Scenarios

DHCP

- Understanding DHCP
- DHCP Client Side
- DHCP Server
- Administering DHCP Server
- Renewing DHCP Lease
- APIPA
- Windows DHCP Server
- Rogue DHCP Server

Network Naming

- Name Resolution
- Host File
- DNS
- DNS Server
- DNS in Action
- Reverse Lookup Zones
- Root Hints
- Forwarder Servers
- Nslookup
- Dig

Windows Name Resolution

- WINS
- SMB/CIFS
- NetBIOS Commands

Introducing TCP/IP Ports

- Ports Defined
- Netstat
- TCPView
- Wireshark
- Packet Filtering

Static Routing

- Routers
- Router Console Cables
- Routing Tables
- Static Routes
- Route Print
- Broadcast/Unicast/Multicast
- Origin of Routing Tables
- netstat-r

Dynamic Routing

- Why Dynamic Routing
- Dynamic Routing Types
- Distance Vector
- RIP
- Autonomous System
- BGP
- OSPF
- IS-IS
- Link State
- Hybrid
- Trace Route
- MTR

Firewalls

- Private IPs
- NAT
- Overloaded NAT (PAT)
- Static NAT
- Configuring Access Control
- Port Filtering
- Intrusion Detection
- Common Firewall Features

Session 4

Internet Applications Part I

- Identifying DHCP Port
- Identifying DNS Port
- SNMP
- Three Types of SNMP
- Cacti and SNMP
- HTTP and HTTPS
- Web Server Administration
- Telnet
- SSH

Internet Applications Part II

- FTP
- FTP Client
- Secure FTP
- TFTP
- E-mail and SMTP
- Network Time Protocol
- What to Know

Encryption

- Understanding Encryption
- Symmetric Encryption
- Asymmetric Keys
- Certificates/PKI

Authentication

- Authentication Standards
- Point-to-Point Protocol
- PAP and CHAP
- Kerberos
- AAA Tools
- EAP
- 802.1x

Wireless

- Understanding 802.11
- 802.11 Standards
- Wireless Settings
- ESSID
- Joining a Wireless Network
- Wireless Security
- WEP
- 802.11i
- AES Encryption
- WPA
- Recommended Wireless Security

Implementing Wireless

- Wireless Access Points
- Access Point Antennas
- Wireless Issues

Advanced Networking Devices

- Introduction
- Peer-to-Peer
- Multilayer Switch
- Content Switch
- Bandwidth Shaper
- Proxy Server
- VLANs
- Creating a VLAN
- Assigning VLAN Ports
- Route and Trunking
- Dynamic VLAN
- VPNs and Tunnels
- VPN Tunnel Standards
- Connecting VPNs

Session 5

IPv6

- IPv6 Defined
- IPv6 Addresses
- Link Local Address
- Getting an IPv6 Address
- Configuring IPv6
- IPv6 Tunneling
- Using IPv6

Remote Connections

- Connectivity History
- Circuit Switching
- Analog to Digital
- DSO
- Digital Cabling
- Testing T1s
- T-Carriers
- SONET
- Packet Switching
- MPLS

The Last Mile

- The Last Mile
- POTS/PSTN
- Central Office
- Digital to Analog to Digital
- ISDN
- DSL
- DSL Types
- PPPoE
- Cable Modem
- DOCSIS
- Satellite
- Wireless

Remote Access

- Taking Control
- Remote Access Options
- RRAS
- VNC
- Remote Desktop
- Best Practices

Network Optimization

- Network Optimization Overview
- Bonding
- Traffic Shaping
- QoS

Physical Network Protection

- Security Considerations
- Physical Security
- Theft
- Power
- HVAC
- Fire
- Hardware Failure

Maintaining Network Integrity

- Antivirus/Malware
- DoS Attacks
- Man-in-the-Middle
- Rogue Access Points
- Phishing
- Protection Checklist
- Baselines
- Patches/Updates
- Configurations
- Regulations

The Art of Network Support

- Nine Step Process

Session 5

Lab 1: LAN Issues

Misconfigurations
NIC Configurations
Speed/Duplex Issues
IP Address Issues
Dynamic vs. Static IP/DNS
VLAN Issues
Angry IP Scanner
Port Monitoring
Impedance Mismatch
Logs

Lab 2: WAN Issues

Escalatory Problems
Switching Loops
Routing Loops
Broadcast Storms
Proxy ARP
IDS Signature Identification

Lab 3: Wireless Issues

Interface
ESSID Mismatch
Incorrect Encryption
Incorrect Channel
Incorrect Frequency

Sample Lesson Plans

5 Week Plan					
	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Session 1 Pre-Test <u>Introduction</u> <u>Packets</u> <u>Glossary</u> <i>Word Search</i>	<i>Matching</i> <i>Crossword</i> <u>Topologies</u> <u>Building a Network with OSI</u> <i>Research Topic</i>	<u>Network Cabling</u> <u>Ethernet Basics</u> <u>10/100Base Ethernet</u> <i>Group Project</i>	<i>Short Answer</i> <i>Individual Project</i> <i>Labs</i>	Session 1 Post Test
Week 2	Session 2 Pre-Test <i>Read Article: CompTIA Gets Technical</i> <u>Glossary</u> <u>Crossword</u>	<i>Word Search</i> <i>Matching</i> <u>Modern Ethernet</u> <u>Structured Cabling</u> <u>Structured Cabling Tools</u> <i>Group Project</i>	<u>Introducing TCP/IP</u> <u>Basic IP Addressing</u> <u>Advanced IP Addressing</u> <i>Individual Project</i>	<i>Short Answer</i> <i>Labs</i> <i>Research Topic</i>	Session 2 Post Test
Week 3	Session 3 Pre-Test <u>Glossary</u> <i>Word Search</i> <u>Subnetting</u> <u>DHCP</u>	<i>Matching</i> <i>Crossword</i> <u>Network Naming</u> <u>Windows Name Resolution</u> <i>Research Topic</i>	<u>Introducing TCP/IP</u> <u>Ports</u> <u>Static Routing</u> <u>Firewalls</u> <i>Short Answers</i> <i>Group Project</i>	<i>Individual Project</i> <i>Labs</i>	Session 3 Post Test
Week 4	Session 4 Pre-Test <u>Glossary</u> <u>Crossword</u> <u>Internet Applications Part I</u>	<i>Word Search</i> <i>Matching</i> <i>Group Project</i> <u>Internet Applications Part II</u> <u>Encryption</u>	<u>Authentication</u> <u>Wireless</u> <u>Implementing Wireless</u> <i>Individual Project</i>	<u>Advanced Networking</u> <u>Devices</u> <i>Labs</i> <i>Short Answers</i>	Session 4 Post Test
Week 5	Session 5 Pre-Test <u>Glossary</u> <i>Word Search</i> <u>IPv6</u> <u>Remote Connections</u>	<i>Matching</i> <i>Crossword</i> <i>Group Project</i> <u>The Last Mile</u> <u>Remote Access</u>	<i>Individual Project</i> <u>Network Optimization</u> <u>Physical Network</u> <u>Protection</u> <u>Maintaining Network Integrity</u> <u>The Art of Network Support</u>	<u>Lab 1: LAN Issues</u> <u>Lab 2: WAN Issues</u> <u>Lab 3: Wireless Issues</u> <i>Labs</i> <i>Short Answers</i>	Session 5 Post Test

*Complete the corresponding section of the Listing Fill in the Blank Exercise.

LearnKey training segments are underlined. Activities are *italicized*. Tests are **bolded**.

6 Week Plan					
	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Session 1 Pre-Test <u>Introduction</u> <u>Packets</u>	<i>Glossary</i> <i>Word Search</i> <i>Matching</i> <i>Crossword</i> <u>Topologies</u>	<u>Building a Network with OSI</u> <i>Research Topic</i> <u>Network Cabling</u>	<u>Ethernet Basics</u> <u>10/100Base Ethernet</u> <i>Group Project</i>	<i>Short Answer</i> <i>Individual Project</i> <i>Labs</i>
Week 2	Session 1 Post Test	Session 2 Pre-Test <i>Read Article: CompTIA Gets Technical</i> <i>Glossary</i>	<i>Crossword</i> <i>Word Search</i> <i>Matching</i> <u>Modern Ethernet</u>	<u>Structured Cabling</u> <u>Structured Cabling Tools</u> <i>Group Project</i>	<u>Introducing TCP/IP</u> <u>Basic IP Addressing</u> <u>Advanced IP Addressing</u> <i>Individual Project</i>
Week 3	<i>Short Answer</i> <i>Labs</i> <i>Research Topic</i>	Session 2 Post Test	Session 3 Pre-Test <i>Glossary</i> <i>Word Search</i> <u>Subnetting</u>	<u>DHCP</u> <i>Matching</i> <i>Crossword</i> <u>Network Naming</u> <u>Windows Name Resolution</u>	<i>Research Topic</i> <u>Introducing TCP/IP</u> <u>Ports</u> <i>Short Answers</i>
Week 4	<u>Static Routing</u> <u>Firewalls</u> <i>Group Project</i> <i>Individual Project</i> <i>Labs</i>	Session 3 Post Test	Session 4 Pre-Test <i>Glossary</i> <i>Crossword</i> <u>Internet Applications</u> <u>Part I</u>	<i>Word Search</i> <i>Matching</i> <i>Group Project</i>	<u>Internet Applications</u> <u>Part II</u> <u>Encryption</u> <u>Authentication</u> <u>Wireless</u>
Week 5	<i>Individual Project</i> <u>Implementing Wireless</u>	<u>Advanced Networking</u> <u>Devices</u> <i>Labs</i> <i>Short Answers</i>	Session 4 Post Test	Session 5 Pre-Test <i>Glossary</i> <i>Word Search</i>	<u>IPv6</u> <u>Remote Connections</u> <i>Matching</i> <i>Crossword</i> <i>Group Project</i>
Week 6	<u>The Last Mile</u> <u>Remote Access</u> <i>Individual Project</i> <u>Network Optimization</u>	<u>Physical Network</u> <u>Protection</u> <u>Maintaining Network</u> <u>Integrity</u> <u>The Art of Network</u> <u>Support</u>	<u>Lab 1: LAN Issues</u> <u>Lab 2: WAN Issues</u> <u>Lab 3: Wireless Issues</u>	<i>Labs</i> <i>Short Answers</i>	Session 5 Post Test

LearnKey

7 Week Plan					
	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Session 1 Pre-Test <u>Introduction</u> <u>Packets</u> <u>Glossary</u> <u>Word Search</u>	<u>Matching</u> <u>Crossword</u> <u>Topologies</u> <u>Building a Network with OSI</u> <u>Research Topic</u>	<u>Network Cabling</u> <u>Ethernet Basics</u> <u>10/100Base Ethernet</u> <u>Group Project</u>	<u>Individual Project</u>	<u>Short Answer</u> <u>Labs</u>
Week 2	Session 1 Post Test	Session 2 Pre-Test	<u>Read Article::</u> <u>ComPTIA Gets Technical</u> <u>Glossary</u> <u>Crossword</u>	<u>Word Search</u> <u>Matching</u> <u>Modern Ethernet</u>	<u>Group Project</u>
Week 3	<u>Structured Cabling</u> <u>Structured Cabling Tools</u> <u>Individual Project</u>	<u>Introducing TCP/IP</u> <u>Basic IP Addressing</u> <u>Advanced IP Addressing</u> <u>Research Topic</u>	<u>Short Answer</u> <u>Labs</u>	Session 2 Post Test	Session 3 Pre-Test <u>Subnetting</u> <u>DHCP</u>
Week 4	<u>Glossary</u> <u>Word Search</u> <u>Matching</u> <u>Crossword</u>	<u>Network Naming</u> <u>Windows Name Resolution</u> <u>Research Topic</u>	<u>Introducing TCP/IP</u> <u>Ports</u> <u>Static Routing</u> <u>Firewalls</u>	<u>Short Answers</u> <u>Group Project</u> <u>Individual Project</u> <u>Labs</u>	Session 3 Post Test
Week 5	Session 4 Pre-Test <u>Internet Applications Part I</u>	<u>Glossary</u> <u>Crossword</u> <u>Word Search</u> <u>Matching</u>	<u>Group Project</u>	<u>Internet Applications Part II</u> <u>Encryption</u>	<u>Authentication</u> <u>Wireless</u> <u>Individual Project</u>
Week 6	<u>Implementing Wireless</u> <u>Advanced Networking Devices</u>	<u>Labs</u> <u>Short Answers</u>	Session 4 Post Test	Session 5 Pre-Test <u>Glossary</u> <u>Word Search</u> <u>IPv6</u> <u>Remote Connections</u>	<u>Matching</u> <u>Crossword</u> <u>Group Project</u> <u>The Last Mile</u> <u>Remote Access</u>
Week 7	<u>Individual Project</u> <u>Network Optimization</u>	<u>Physical Network Protection</u> <u>Maintaining Network Integrity</u> <u>The Art of Network Support</u>	<u>Lab 1: LAN Issues</u> <u>Lab 2: WAN Issues</u> <u>Lab 3: Wireless Issues</u>	<u>Labs</u> <u>Short Answers</u>	Session 5 Post Test

8 Week Plan					
	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Session 1 Pre-Test <u>Introduction</u> <u>Packets</u> <u>Glossary</u> <u>Word Search</u>	<u>Matching</u> <u>Crossword</u> <u>Topologies</u> <u>Building a Network with OSI</u> <u>Research Topic</u>	<u>Network Cabling</u> <u>Ethernet Basics</u> <u>10/100Base Ethernet</u>	<u>Group Project</u>	<u>Individual Project</u> <u>Short Answer</u> <u>Labs</u>
Week 2	Session 1 Post Test	Session 2 Pre-Test <u>Read Article::</u> <u>CompTIA Gets Technical</u> <u>Glossary</u> <u>Crossword</u>	<u>Word Search</u> <u>Matching</u> <u>Modern Ethernet</u>	<u>Structured Cabling</u> <u>Structured Cabling Tools</u>	<u>Group Project</u>
Week 3	<u>Introducing TCP/IP</u> <u>Basic IP Addressing</u> <u>Advanced IP Addressing</u>	<u>Individual Project</u> <u>Short Answer</u> <u>Labs</u>	<u>Research Topic</u>	Session 2 Post Test	Session 3 Pre-Test <u>Glossary</u> <u>Subnetting</u> <u>DHCP</u>
Week 4	<u>Word Search</u> <u>Matching</u> <u>Crossword</u>	<u>Network Naming</u> <u>Windows Name Resolution</u> <u>Research Topic</u>	<u>Introducing TCP/IP</u> <u>Ports</u> <u>Static Routing</u> <u>Firewalls</u>	<u>Short Answers</u> <u>Group Project</u>	<u>Individual Project</u> <u>Labs</u>
Week 5	Session 3 Post Test	Session 4 Pre-Test	<u>Glossary</u> <u>Internet Applications</u> <u>Part I</u>	<u>Crossword</u> <u>Word Search</u> <u>Matching</u>	<u>Group Project</u>
Week 6	<u>Internet Applications Part II</u> <u>Encryption</u>	<u>Authentication</u> <u>Wireless</u> <u>Implementing Wireless</u>	<u>Individual Project</u>	<u>Advanced Networking Devices</u>	<u>Labs</u> <u>Short Answers</u>
Week 7	Session 4 Post Test	Session 5 Pre-Test <u>Glossary</u>	<u>Word Search</u> <u>IPv6</u> <u>Remote Connections</u>	<u>Matching</u> <u>Crossword</u>	<u>Group Project</u> <u>The Last Mile</u> <u>Remote Access</u>
Week 8	<u>Individual Project</u> <u>Network Optimization</u> <u>Physical Network Protection</u>	<u>Maintaining Network Integrity</u> <u>The Art of Network Support</u>	<u>Lab 1: LAN Issues</u> <u>Lab 2: WAN Issues</u> <u>Lab 3: Wireless Issues</u>	<u>Labs</u> <u>Short Answers</u>	Session 5 Post Test

Skills

Assessment



Instructions: Rate your skills with the following tasks on a level from 1-5.

Skills	Poor		Excellent		
	1	2	3	4	5
Finding the MAC Address					
Finding the MAC on a Windows System					
Point-to-Multipoint					
RJ Connectors					
Duplex LC Connector					
Configuring IP Settings					
Ping Command					
Using MAC Command Programs					
Accessing Root Hints List					
Services					
View DHCP Port					
Filtering Wireshark Results					
Starting SNMP					

Skills	Poor			Excellent	
	1	2	3	4	5
Accessing Telnet via PuTTY					
Using SSH on PuTTY					
Connecting to FTP					
Connecting to Wireless Networks					
Creating a VLAN					
Modify VLAN Ports					
Quality of Service					
Configuring IPv4					
IP Address Scan					

Sample

Best Practices Using LearnKey's Online Training

LearnKey offers video-based training solutions which are flexible enough to accommodate the private student, as well as educational facilities and organizations.

Our course content is presented by top experts in their respective fields, and provides clear and comprehensive information. The full line of LearnKey products have been extensively reviewed to meet superior standards of quality. The content in our courses has also been endorsed by organizations such as Certiport, CompTIA®, Cisco, and Microsoft. However, it is the testimonials given by countless satisfied customers that truly set us apart as leaders in the information training world.

LearnKey experts are highly qualified professionals who offer years of job and project experience in their subjects. Each expert has been certified in the highest level available for their field of expertise. This provides the student with the knowledge necessary to also obtain top level certifications in the field of their choice.

Our accomplished instructors have a rich understanding of the content they present. Effective teaching encompasses not only presenting the basic principles of a subject, but understanding and appreciating organization, real-world application, and links to other related disciplines. Each instructor represents the collective wisdom of their field and within our industry.

Our Instructional Technology

Each course is independently created, based on standard objectives provided by the manufacturer for which the course was developed.

We ensure that the subject matter is up-to-date and relevant. We examine the needs of each student and create training that is both interesting and effective. LearnKey training provides auditory, visual, and Kinesthetic learning materials to fit diverse learning styles. The following are three levels of implementation:

Standard Training Model

The standard training model allows students to proceed through basic training, building upon primary knowledge and concepts to more advanced application and implementation. In this method students will use the following toolset:

- *Pre-assessment:* The pre-assessment is used to determine the student's prior knowledge of the subject matter. It will also identify a student's strengths and weaknesses, allowing the student to focus on the specific subject matter he/she needs to improve most. Students should not necessarily expect a passing score on the pre-assessment as it is a test of prior knowledge.

- *Video training session:* Each course of training is divided into sessions that are approximately two hours in length. Each session is divided into topics and subtopics.
- *Post test:* The post test is used to determine the student's knowledge gained from interacting with the training. In taking the post test, students should not consult the training or any other materials. A passing score is 80 percent or higher. If the individual does not pass the post test the first time it is taken LearnKey would recommend the incorporation of external resources such as the workbook and additional customized instructional material.

Intermediate Training Model

The intermediate training model offers students additional training materials and activities which allows for better retention, review, and interaction. This model includes not only the standard model material, but also includes the following toolset:

- *Study guides:* Study guides are a list of questions missed which can help students recognize areas of weakness and necessary focus. They can be accessed from either the pre-assessment or post test.
- *Labs:* Labs are interactive activities that simulate situations presented in the training. Step-by-step instructions and live demonstrations are provided.
- *Workbooks:* Workbooks have a variety of activities, such as glossary puzzles, short answer questions, practice exams, research topics, and group and individual projects, which allow the student to study and apply concepts presented in the training.

Master Training Model

The master training model offers the student an additional opportunity to prepare for certification by further examining his/her knowledge. This model includes the materials used in the standard and intermediate models, as well as the MasterExam.

- *Master Exam:* The MasterExam draws from a large pool of questions to provide a unique testing experience each time it is taken. LearnKey recommends a student take and pass the exam, with a score of 80 percent or higher, four times in order to prepare for certification testing. Study guides can also be accessed for the MasterExam.

Sample

Session **1**



Sample

Session 1 Time Tables

Session 1	
Introduction	00:07:18
Packets	00:15:23
Topologies	00:09:45
Building a Network with OSI	00:15:01
Network Cabling	00:17:02
Ethernet Basics	00:20:35
10Base/100Base Ethernet	00:11:34
Actual Time	01:36:38

Session 1	
Introduction	00:10:00
Packets	00:15:04
Topologies	00:14:30
Building a Network with OSI	00:22:30
Network Cabling	00:25:33
Ethernet Basics	00:30:52
10Base/100Base Ethernet	00:17:21
Training Time	02:24:54

Fill-in-the-Blanks



Instructions: While watching Session 1, fill in the missing words according to the information presented by the instructor.

[References where answers are found are in brackets.]

Introduction

1. Network devices is the objective which covers topics such as switches, routers and wireless access points. [Network+ Domains]

Packets

1. The hexadecimal equivalent to the binary group 1010 is Ah. [Binary to Hex]
2. The MAC address is burned into the Network Card at the factory which it was made. [IPconfig]
3. The OUI is represented in the first 24 bits of a MAC Address. [IPconfig]
4. The last 24 bits of the MAC address are called the host identifier or unique identifier. [IPconfig]

Topologies

1. Topology is the term used to describe methods of physically wiring computers together. [Bus Topology]
2. Ring topologies move packets in one direction. [Ring Topology]
3. Mesh topology physically connects every computer to every other computer. [Mesh Topology]
4. The formula $n(n-1)/2$ is used to determine the number of connections needed to create a fully meshed network. [Mesh Topology]

Building a Network with OSI

1. **Cabling**, hubs, creating, and repeating copies of a frame are elements of the physical layer of the OSI model. [**Physical Layer**]
2. A **broadcast domain** is a term used to describe an array of computers linked by a hub, in which one computer sends a piece of information and every other computer receives it. [**Frames**]
3. Layer **two** of the OSI model is called the data link layer. [**Data-link layer**]
4. A **router** works on the network layer to interconnect multiple local area networks using logical addresses. [**Network Layer**]
5. The terms **assemble** and **disassemble** are associated with the transport layer of the OSI model. [**Transport Layer**]
6. **PDF files** and PostScript are examples of the presentation layer. [**Presentation Layer**]
7. The application layer is layer **seven** of the OSI model. [**Application Layer**]

Network Cabling

1. A Coaxial Cable has two wires with a **shared** axis. [**Coaxial**]
2. UTP, or Unshielded Twisted Pair is a very common cable consisting of **twisted pairs** of cable wrapped in a plastic sheath. [**Unshielded Twisted Pair**]
3. **Bandwidth** is defined by Cat levels. [**Cat levels**]
4. Cat 4 has a capacity of **20** BPS. [**Cat levels**]
5. **RJ-45** cable connectors are the most common type of 4 pair connectors. [**RJ Connectors**]
6. RJ-11 connectors are designed to handle **two** pairs of wire. [**RJ Connectors**]
7. **PVC** rated cable has a very low fire rating and is not readily used as a network cable. [**Cable Fire Ratings**]
8. **Single Mode** fiber optic cable uses lasers instead of regular light. [**Fiber optic**]
9. There is one **glass** fiber in a fiber optic cable used for sending and receiving information. [**Fiber optic**]
10. **ST connectors** are commonly used with fiber optic cable. [**Fiber Connectors**]

Ethernet Basics

1. **Full-duplex** allow two parties to communicate simultaneously. [**Fiber Connectors**]
2. **CRC**, data, **type**, Source MAC, and Destination MAC are all elements included in the Ethernet. [**Ethernet Frame**]
3. Data which is less than **46 bytes** requires a pad. [**Ethernet Frame**]
4. A **repeater** is another name for a hub. [**Conceptualizing Ethernet/Sending Ethernet Frames**]
5. Promiscuous mode allows a user to keep a **copy** of every packet sent including ones intended for a different MAC address. [**Promiscuous Mode**]
6. The **source** MAC address from a frame is stored after the frame is received. [**Receiving Ethernet Frames**]
7. The **CSMA/CD** is the process that allows multiple Ethernet devices to share the same line. [**CSMA/CD**]
8. Star bus topology is a hybrid topology used in a **10Base-T** standard Ethernet. [**Connecting Hubs**]
9. EIA/TIA 568 A and **EIA/TIA 568 B** are cabling methodologies used on RJ-45 connectors. [**Connecting Hubs**]

10Base/100Base Ethernet

1. The **RJ-45** is the type of connector is used by 10Base-T Ethernet. [**10Base Ethernet**]
2. **Multimode fiber optic** cabling is used by 10Base-FL Ethernet. [**10Base Ethernet**]
3. The maximum length of cabling for 100Base-FX Ethernet is **400 meters**. [**100Base Ethernet**]
4. **Speed**, **activity**, and **connection** are types of link lights used by network cards and hubs. [**Link Lights**]

Glossary Crossword

Instructions: Use the terms and clues below to complete the crossword puzzle.

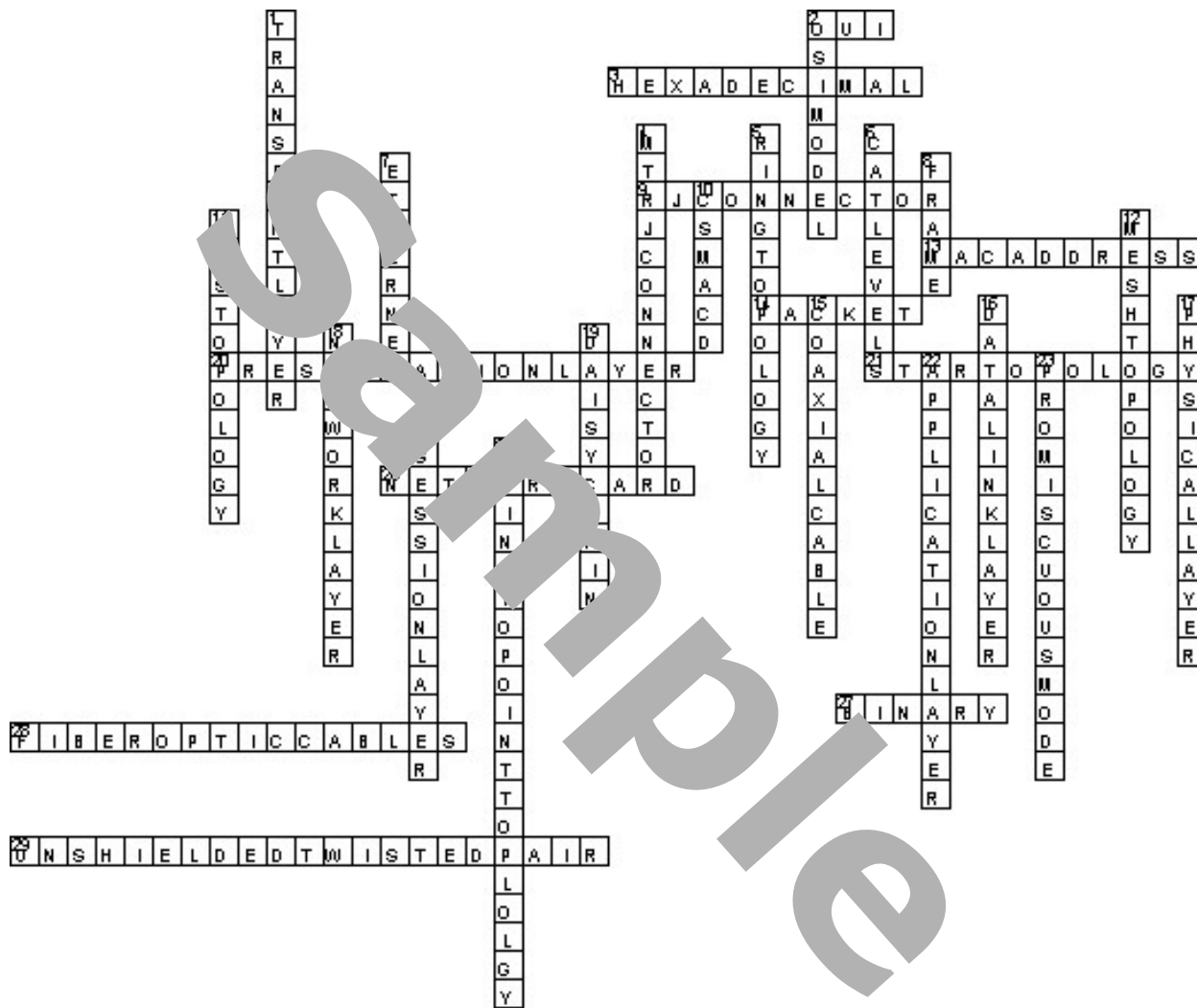
application layer	ethernet	network layer	ring topology
binary	fiberoptic cables	OSI model	RJ connector
bus topology	frame	OUI	session layer
cat levels	hexadecimal	packet	star topology
coaxial cable	MAC address	physical layer	transport layer
CSMA/CD	mesh topology	point-to-point topology	unshielded twisted pair
daisy chain	MTRJ connector	presentation layer	
data link layer	network card	promiscuous mode	

Across

2. The first bits of a MAC address
3. 16-digit notation system used to convert 4-digit segments of binary
9. A standard interface connector for phone and internet
13. Unique 48-bit hexadecimal number burned into a network card connected
14. Small bundle of information sent over the network
20. Sixth layer of the OSI model
21. A type of physical network configurations connected through a central hub
26. Provides communication between computer and network
27. Primary language of computers consisting of only two digits
28. Glass or plastic fiber which transmits information through light or laser pulses
29. Type of cable with one or more twisted copper wires in a plastic sheath

Down

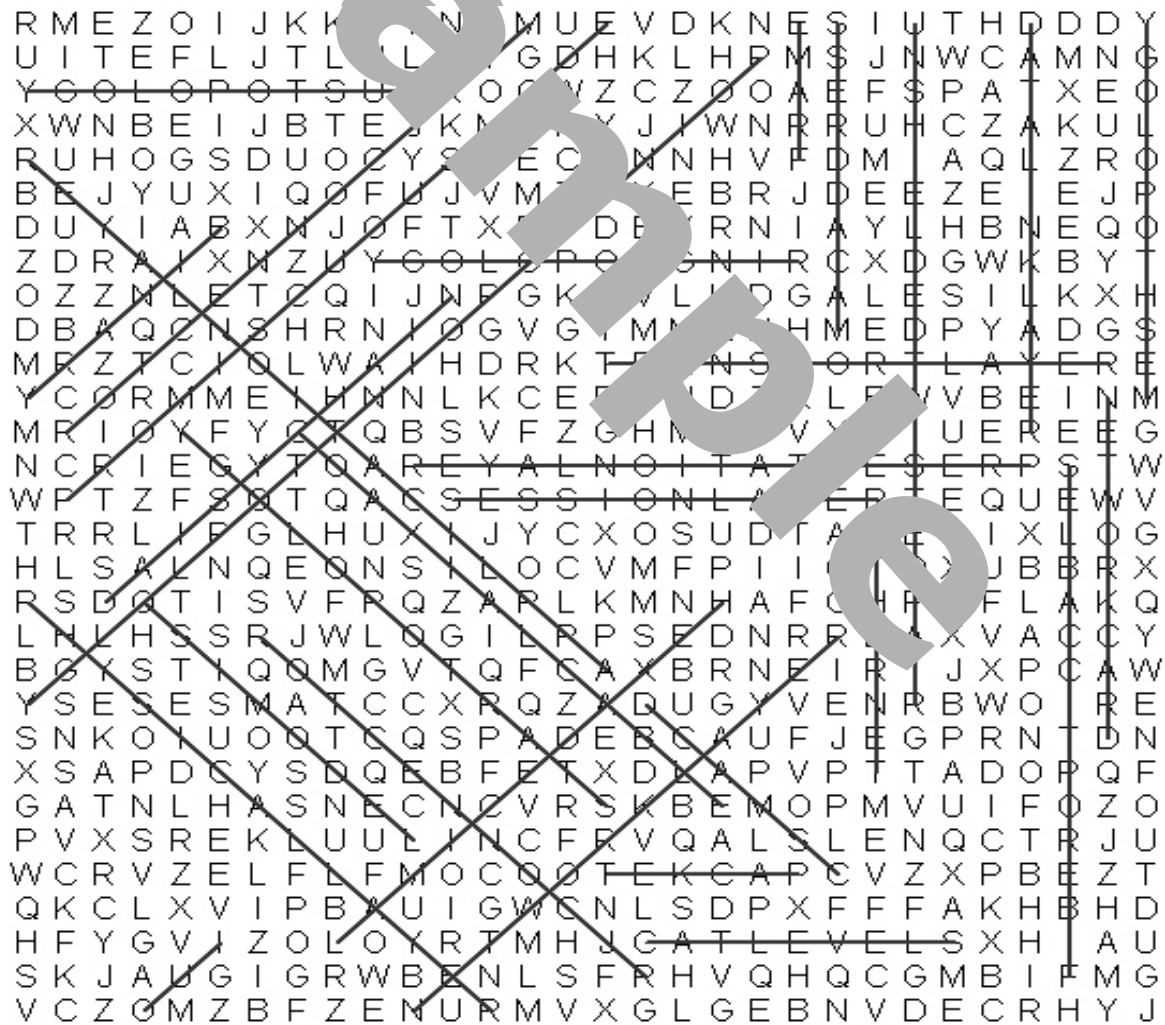
1. Fourth layer of the OSI model
2. A seven layer model used to define various operation levels
4. A connector used to connect pairs of optical fibers
5. A unidirectional circular physical network configuration
6. A cable rating system which defines the speed of bandwidth
7. Type of network for local area network
8. A data packet encoded at the data link layer
10. A network protocol used to send data over a segment of an Ethernet network
11. Type of physical network configuration where all nodes connect to a common pathway
12. Type of physical network configuration where each node is directly connected
15. An electrical transmission medium with a single copper conductor and a plastic insulation layer
16. Second layer of OSI model
17. First layer of the OSI model
18. Third Layer of OSI model
19. A wiring scheme used in linking two or more HGs in a local area network
22. Seventh layer of the OSI model
23. A network card configuration that allows Ethernet interface to read all information on the network card
24. Fifth layer of OSI model
25. Type of physical network configuration where only two nodes directly connect



Glos- sary Word Search

Instructions: Use the clues below to complete the word search.

- layer
- binary
- bus
- topology
- cat levels
- coaxial cable
- CSMA/CD
- daisy chain
- data link layer
- ethernet
- fiberoptic cables
- frame
- hexadecimal
- MAC address
- mesh topology
- MTRJ connector
- network card
- network layer
- OSI model
- application



Short Answer

Instructions: Use the information learned while watching Session 1 to answer the questions.

1. What are some of the objectives covered in the Network+ 2009 Certification exam?
Network Tools; Network Devices; Network Security; Network Technologies; Network Management; Network Media and Topologies.
2. Define Point-to-Multipoint topology.
A type of network configuration in which only two nodes are directly connected.
3. Define the OSI model.
OSI, or Open Systems Interconnection, model is a seven-layer model used to define the various operation levels of network connections.
4. List (in order) the seven layers of the OSI model.
Physical; Data-link; Network; Transport; Session; Presentation; Application
5. What is a UTP, and how is it recognized?
UTP, or Unshielded Twisted Pair is a type of common cable that is consisting of twisted pairs of cable wrapped in a plastic sheath.
6. Define the function of Cat Levels.
Cat Levels are a rating system for cabling systems which defines the speed of bandwidth.
7. If a cable has a PVC rating, what does that mean?
A PVC rated cable has a very low fire rating and is not readily used as a network cable.
8. Define Ethernet.
A type of network technology for local area networks in which cables carry radio frequency signals between computers at a rate of either 10 or 100 megabits per second.
9. Describe the elements found in an Ethernet frame.
CRC, Data, Type, Source MAC, and Destination MAC are all elements included in an Ethernet frame.
10. What is the Promiscuous mode?
The Promiscuous mode allows a user to keep a copy of every packet sent, including ones intended for a different MAC address.

LearnKey

11. Describe the function of a CSMA/CD.
The CSMA/CD, or Carrier Sense Multiple Access with Collision Detection, is a network protocol for computers to send data over a segment of an Ethernet network.
12. Describe the function of an MT-RJ connector.
An MT-RJ, or mechanical transfer registered jack, connector is used to connect pairs of optical fibers.
13. What is the function of Fiberoptic Cables?
Fiberoptic Cables are a glass or plastic fiber which transmits information in one direction through light or sometimes laser pulses.
14. What is the purpose of a Daisy Chain?
A Daisy Chain is a wiring scheme used in linking two or more hubs together in a local area network.
15. List the types of link lights that are used by network cards and hubs.
Speed, Activity, and Connection are types of link lights used by network cards and hubs.

Glossary Matching

Instructions: Match the glossary term described in Session 1 to its definition.

- | | | |
|----------------------|----------------------------|-----------------------------|
| a. MAC address | k. binary | u. star topology |
| b. ring topology | l. data link layer | v. RJ connector |
| c. packet | m. promiscuous mode | w. transport layer |
| d. bus topology | n. daisy chain | x. OUI |
| e. network layer | o. point-to-point topology | y. physical layer |
| f. fiberoptic cables | p. ethernet | z. MTRJ connector |
| g. hexadecimal | q. coaxial cable | aa. frame |
| h. cat levels | r. network card | bb. session layer |
| i. application layer | s. mesh topology | cc. presentation layer |
| j. CSMA/CD | t. OSI model | dd. unshielded twisted pair |

1. p A type of protocol for local area networks.
2. m A network card configuration that allows an Ethernet interface to read all information on the network card.
3. k Primary language of computers consisting of only two digits.
4. u A type of physical network configuration connected through a central hub.
5. s A type of physical network configuration where each node is directly connected.
6. c A small bundle of information sent over a network.
7. aa A data packet encoded at the data link layer.
8. a A unique 48-bit hexadecimal number burned into a network card.
9. g A 16-digit notation system used to convert 4-digit segments of binary.
10. x The first 3 bits of a MAC address in the OSI model.
11. l The second layer of the OSI model.
12. e The third layer of the OSI model.
13. cc The sixth layer of the OSI model.
14. i The seventh layer of the OSI model.

LearnKey

15. q An electrical transmission medium with a single copper conductor and a plastic insulation layer.
16. dd A type of cable with one or more twisted copper wires in a plastic sheath.
17. d A type of physical network configuration where all nodes connect to a common pathway.
18. w The fourth layer of the OSI model.
19. bb The fifth layer of the OSI model.
20. b A unidirectional circular physical network configuration.
21. o A type of physical network configuration where only two nodes are directly connected.
22. t A seven-layer model used to define various operation levels.
23. y The first layer of the OSI model.
24. h A cable rating system which defines the speed of bandwidth.
25. v A standard interface connector for phone and internet.
26. r Provides communication between a computer and a network.
27. z A connector used to connect pairs of optical fibers.
28. f Glass or plastic fiber which transmits info through light or laser pulses.
29. j A network protocol used to send data over a segment of an Ethernet network.
30. n A wiring scheme used in linking two or more components together.

Research Topic



Instructions: Research the topic below using the Internet and then write a few paragraphs reporting your findings. Be sure to research thoroughly and site your resources. This page may be used to take notes.

Research the different types of topologies. Write a short essay describing each of the seven types, bus topology, ring topology, star topology, mesh topology, Point-to-Point, Point-to-Multipoint, and hybrid topology. Be sure to include the advantages and disadvantages of each type, as well as the environments that each would be best utilized.

Individual Project



Instructions: Assign each student the following subjects to research. Each student should prepare a short 5-10 minute class presentation of the information researched.

Everything that comes in and out of the network card is binary data. In order for this data to be received properly, the binary code must be converted to a hexadecimal value known as a MAC address. This is an identification number burned into every network card at the factory where it was manufactured. On the Network+ Exam, you will be asked to convert not only binary to hexadecimal, but hexadecimal to binary.

Using the formula in Session 1, convert the following hexadecimal MAC address back into binary code:

12-34-46-78-9A-BC

Group Projects



Instructions: Divide into groups and assign each group one of the following subjects to research. Each group should prepare a short 5-10 minute class presentation of the information researched.

1. Within a network there are a number of different methods used to connect individual systems. These methods are called Topologies. These topologies are crucial to the proper delivery of data, effective communication, and security measures within a company/organization.

As a group determine what kind of organization is using the network, what the network will be used for, and whether all systems involved are in the same location.

Divide the class into four groups and assign each group a computer. Each group must:

1. Identify the Physical (MAC) address
2. Identify the OUI and its manufacturer
3. Find the Host Identifier
4. Decide which Topography best serves the organization and its needs.

2. The OSI Seven Layer Model defines seven functions that all networks need in order to act as a network and provide for interoperability. The Network+ Exam fixates on this model, knowing each layer and its function is crucial.

Divide the class into seven groups and assign each group/student one of the seven layers.

Each group/student will then gather specific data and document the uses of the layer and its relation to the other layers of the model. These must be specific and thorough using illustrations, diagrams, definitions, and descriptions of processes and functions.

Allow each group to share their finding with the other groups.

Discuss as a group the importance of each layer and the role it plays within the network.

Session 1 Quiz



Instructions: Circle the letter of the option that BEST answers the question.

1. ____ topology physically connects every computer to every other computer.
A. Ring
B. Layer
C. Joint
D. Mesh
E. Link
2. The terms "assemble" and "disassemble" are associated with the Presentation layer of the OSI.
A. True
B. False
3. What formula is used to determine the number of connections needed to create a fully meshed network?
A. $[n(n-1)/2]$
B. $[n/5-4]$
C. $[3(n-3)n]$
4. A _____ Domain is a term used to describe an array of computers linked by a hub, in which one computer sends a piece of information and every other computer receives it.
A. Cabling
B. Broadcast
C. Network
D. Identifier
E. Transport
5. The last 24 bits of the MAC Address are called the Host Identifier.
A. True
B. False
6. The RJ-45 is the type of connector used by 10Base-T Internet.
A. True
B. False
7. Which types of link lights are used by the network cards and hubs?
A. Speed
B. Connection
C. Activity

8. Bandwidth is defined by _____ levels.
- A. Sky
 - B. Wide
 - C. Set
 - D. Cat**
 - E. Sound
9. What is the name of layer seven of the OSI model?
- A. Physical layer
 - B. Presentation layer
 - C. Application layer**
 - D. Data Link layer
10. Binary is a 16-digit-based numeric notation system.
- A. True
 - B. False**
11. The OSI model is a seven-layer model used to define the various operation levels of network connections.
- A. True**
 - B. False
12. The fourth layer of the OSI model, which is responsible for routing data across one or more networks:
- A. Network
 - B. Presentation
 - C. Transport**
 - D. Data-link
 - E. Application
13. Which are found on the presentation layer of the OSI model.
- A. SMTP
 - B. PDF files**
 - C. PostScript**
 - D. TCP
14. CRC, Data, Type, Source MAC, and Destination MAC are all elements included in the Internet.
- A. True
 - B. False**
15. What is another name for a Hub?
- A. Gopher
 - B. RILO
 - C. Router
 - D. Repeater**


Slides & Notes

Network+ Domains

- 1.0 Network Technologies - 20%
- 2.0 Network Media and Topologies - 20%
- 3.0 Network Devices - 17%
- 4.0 Network Management - 20%
- 5.0 Network Tools - 12%
- 6.0 Network Security - 11%

Notes:


Conceptualizing MAC Addresses



- MAC (Media Access Control)
- A number burned into every network card, no exceptions

Notes:

OSI History



OSI Seven Layer Model

Defined seven functions that all networks needed to do in order to act as a network

Notes:
