

**INVER HILLS COMMUNITY COLLEGE
INVER GROVE HEIGHTS, MINNESOTA**

COURSE OUTLINE

COURSE TITLE: Networking Essentials
COURSE NUMBER: CNT 2510
CREDIT HOURS: 2 hours of lecture weekly
LAB HOURS: 2 hours of lab weekly
DEPARTMENT: Computer Networking and Technology

CATALOG DESCRIPTION

CNT 2510

Networking Essentials

3 credit hours – Two hours of lecture weekly; two hours of lab weekly; one term

Introduces students to the overall technology and design of networks. The course focuses on network terminology and protocols, local-area networks (LANs), wide-area networks (WANs), Open System Interconnection (OSI) models, cabling, cabling tools, routers, router programming, Ethernet, Internet Protocol (IP) addressing, and network standards. Networking Essentials is the first of the four courses leading to the Cisco Certified Network Associate (CCNA) designation. This course is equivalent to CS 1104, and either, but not both courses will apply toward degree requirements at Inver Hills.

Prerequisites: Experience with computer operating system and Internet browser

LEARNING OBJECTIVES

Upon completion of this course, the student will be able to:

- a. Identify and define the 7 layers of the OSI model including TCP/IP Protocols: IP, TCP and UDP
- b. Describe the role and basic functioning of primary networking devices equipment
- c. Define and describe the major variations of network topologies and architectures
- d. Apply LAN cabling standards and techniques.
- e. Design and setup a simple LAN.
- f. Apply essential concepts of networking mathematics to networking tasks such as IP addressing and subnetting
- g. Articulate the differences between various network cabling media and know how to install this cabling
- h. Test cabling for LANs and WANs
- i. Describe essential Ethernet concepts such as 10/100/1000/10 G versions and Ethernet Switching

DIVISION OF SUBJECT MATTER

Main Topic

Time Allocation

1.0 Introduction to Networking	2%
2.0 Networking Fundamentals	5%
3.0 Networking Media	5%
4.0 Cable Testing	5%
5.0 Cabling LANs and WANs	5%
6.0 Ethernet Fundamentals	5%
7.0 Ethernet Technologies	10%
8.0 Ethernet Switching	10%
9.0 TCP/IP Protocol Suite and IP Addressing	30%
10.0 Routing Fundamentals and Subnets	15%
11.0 TCP/IP Transport and Application Layer	8%

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DETAILED COURSE OUTLINE

1.0 Introduction to Networking

1.1. Your Connection to the Internet

- 1.1.1. Requirements for Internet connection
- 1.1.2. PC basics
- 1.1.3. Network interface card
- 1.1.4. NIC and modem installation
- 1.1.5. Overview of high-speed and dialup connectivity
- 1.1.6. TCP/IP description and configuration
- 1.1.7. Testing connectivity with ping
- 1.1.8. Web browser and plug-ins
- 1.1.9. Troubleshooting Internet connection problems

1.2. Networking Math

- 1.2.1. Binary presentation of data
- 1.2.2. Bits and bytes
- 1.2.3. Base 10 number system
- 1.2.4. Base 2 number system
- 1.2.5. Converting decimal numbers to 8-bit binary numbers
- 1.2.6. Converting 8-bit binary numbers to decimal numbers
- 1.2.7. Four-octet dotted decimal representation of 32-bit binary numbers
- 1.2.8. Hexadecimal
- 1.2.9. Boolean or binary logic
- 1.2.10. IP addresses and network masks

Summary

2.0 Networking Fundamentals

2.1. Networking Terminology

- 2.1.1. Data networks
- 2.1.2. Network history
- 2.1.3. Networking devices
- 2.1.4. Network topology; 7 CCNA 1: Networking Basics v3.1 Copyright Ó 2004, Cisco Systems, Inc.
- 2.1.5. Network protocols
- 2.1.6. Local-area networks (LANs)
- 2.1.7. Wide-area networks (WANs)
- 2.1.8. Metropolitan-area networks (MANs)
- 2.1.9. Storage-area networks (SANs)
- 2.1.10. Virtual private network (VPN)
- 2.1.11. Benefits of VPNs
- 2.1.12. Intranets and extranets

2.2. Bandwidth

- 2.2.1. Importance of bandwidth
- 2.2.2. Analogies
- 2.2.3. Measurement
- 2.2.4. Limitations
- 2.2.5. Throughput
- 2.2.6. Data transfer calculation
- 2.2.7. Digital versus analog

2.3. Networking Models

- 2.3.1. Using layers to analyze problems in a flow of materials
- 2.3.2. Using layers to describe data communication
- 2.3.3. OSI model
- 2.3.4. OSI layers

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- 2.3.5. Peer-to-peer communications
- 2.3.6. TCP/IP model
- 2.3.7. Detailed encapsulation process

Summary

3.0 Networking Media

3.1. Copper Media

- 3.1.1. Atoms and electrons
- 3.1.2. Voltage
- 3.1.3. Resistance and impedance
- 3.1.4. Current
- 3.1.5. Circuits
- 3.1.6. Cable specification and termination; 8 CCNA 1: Networking Basics v3.1 Copyright Ó 2004, Cisco systems, Inc.
- 3.1.7. Coaxial cable
- 3.1.8. STP cable
- 3.1.9. UTP cable

3.2. Optical Media

- 3.2.1. The electromagnetic spectrum
- 3.2.2. Ray model of light
- 3.2.3. Reflection
- 3.2.4. Refraction
- 3.2.5. Total internal reflection
- 3.2.6. Multimode fiber
- 3.2.7. Single-mode fiber
- 3.2.8. Other optical components
- 3.2.9. Signals and noise in optical fibers
- 3.2.10. Installation, care, and testing of optical fiber

3.3. Wireless Media

- 3.3.1. Wireless LAN organizations and standards
- 3.3.2. Wireless devices and topologies
- 3.3.3. How wireless LANs communicate
- 3.3.4. Authentication and association
- 3.3.5. The radio wave and microwave spectrums
- 3.3.6. Signals and noise on a WLAN
- 3.3.7. Wireless security

Summary

4.0 Cable Testing

4.1. Background for Studying Frequency-Based Cable Testing

- 4.1.1. Waves
- 4.1.2. Sine waves and square waves
- 4.1.3. Exponents and logarithms
- 4.1.4. Decibels
- 4.1.5. Time and frequency signals
- 4.1.6. Analog and digital signals in time and frequency
- 4.1.7. Noise in time and frequency
- 4.1.8. Bandwidth; 9 CCNA 1: Networking Basics v3.1 Copyright Ó 2004, Cisco Systems, Inc.

4.2. Signals and Noise

- 4.2.1. Signaling over copper and fiber optic cabling
- 4.2.2. Attenuation and insertion loss on copper media
- 4.2.3. Sources of noise on copper media
- 4.2.4. Types of crosstalk
- 4.2.5. Cable testing standards

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- 4.2.6. Other test parameters
- 4.2.7. Time-based parameters
- 4.2.8. Testing optical fiber
- 4.2.9. A new standard

Summary

5.0 Cabling LANs and WANs

5.1. Cabling the LAN

- 5.1.1. LAN physical layer
- 5.1.2. Ethernet in the campus
- 5.1.3. Ethernet media and connector requirements
- 5.1.4. Connection media
- 5.1.5. UTP implementation
- 5.1.6. Repeaters
- 5.1.7. Hubs
- 5.1.8. Wireless
- 5.1.9. Bridges
- 5.1.10. Switches
- 5.1.11. Host connectivity
- 5.1.12. Peer-to-peer
- 5.1.13. Client-server

5.2. Cabling the WANs

- 5.2.1. WAN physical layer
- 5.2.2. WAN serial connections
- 5.2.3. Routers and serial connections
- 5.2.4. Routers and ISDN BRI connections
- 5.2.5. Routers and DSL connections
- 5.2.6. Routers and cable connections; 10 CCNA 1: Networking Basics v3.1 Copyright Ó 2004, Cisco Systems, Inc.
- 5.2.7. Setting up console connections

Summary

6.0 Ethernet Fundamentals

6.1. Ethernet Fundamentals

- 6.1.1. Introduction to Ethernet
- 6.1.2. IEEE Ethernet naming rules
- 6.1.3. Ethernet and the OSI model
- 6.1.4. Naming
- 6.1.5. Layer 2 framing
- 6.1.6. Ethernet frame structure
- 6.1.7. Ethernet frame fields

6.2. Ethernet Operation

- 6.2.1. MAC
- 6.2.2. MAC rules and collision detection/backoff
- 6.2.3. Ethernet timing
- 6.2.4. Interframe spacing and backoff
- 6.2.5. Error handling
- 6.2.6. Types of collisions
- 6.2.7. Ethernet errors
- 6.2.8. FCS and beyond
- 6.2.9. Ethernet auto-negotiation
- 6.2.10. Link establishment and full/half duplex

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7.0 Ethernet Technologies

7.1. 10 Mbps and 100 Mbps Ethernet

- 7.1.1. 10 Mbps Ethernet
- 7.1.2. 10BASE5
- 7.1.3. 10BASE2
- 7.1.4. 10BASE-T
- 7.1.5. 10BASE-T wiring and architecture
- 7.1.6. 100-Mbps Ethernet; 11CCNA 1: Networking Basics v3.1 Copyright Ó 2004, Cisco Systems, Inc.
- 7.1.7. 100BASE-TX
- 7.1.8. 100BASE-FX
- 7.1.9. Fast Ethernet architecture

7.2. Gigabit and 10-Gigabit Ethernet

- 7.2.1. 1000-Mbps Ethernet
- 7.2.2. 1000BASE-T
- 7.2.3. 1000BASE-SX and LX
- 7.2.4. Gigabit Ethernet architecture
- 7.2.5. 10-Gigabit Ethernet
- 7.2.6. 10-Gigabit Ethernet architectures
- 7.2.7. Future of Ethernet

Summary

8.0 Ethernet Switching

8.1. Ethernet Switching

- 8.1.1. Layer 2 bridging
- 8.1.2. Layer 2 switching
- 8.1.3. Switch operation
- 8.1.4. Latency
- 8.1.5. Switch modes
- 8.1.6. Spanning-Tree protocol

8.2. Collision Domains and Broadcast Domains

- 8.2.1. Shared media environments
- 8.2.2. Collision domains
- 8.2.3. Segmentation
- 8.2.4. Layer 2 broadcasts
- 8.2.5. Broadcast domains
- 8.2.6. Introduction to data flow
- 8.2.7. What is a network segment?

Summary

9.0 TCP/IP Protocol Suite and IP Addressing

9.1. Introduction to TCP/IP; 12 CCNA 1: Networking Basics v3.1 Copyright Ó 2004, Cisco Systems, Inc.

- 9.1.1. History and future of TCP/IP
- 9.1.2. Application layer
- 9.1.3. Transport layer
- 9.1.4. Internet layer
- 9.1.5. Network access layer
- 9.1.6. The OSI model and the TCP/IP model
- 9.1.7. Internet architecture

9.2. Internet Addresses

- 9.2.1. IP addressing
- 9.2.2. Decimal and binary conversion
- 9.2.3. IPv4 addressing
- 9.2.4. Class A, B, C, D, and E IP addresses
- 9.2.5. Reserved IP addresses

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- 9.2.6. Public and private IP addresses
- 9.2.7. Introduction to subnetting
- 9.2.8. IPv4 versus IPv6
- 9.3. Obtaining an IP Address
 - 9.3.1. Obtaining an Internet address
 - 9.3.2. Static assignment of an IP address
 - 9.3.3. RARP IP address assignment
 - 9.3.4. BOOTP IP address assignment
 - 9.3.5. DHCP IP address management
 - 9.3.6. Problems in address resolution
 - 9.3.7. Address Resolution Protocol (ARP)

Summary

10.0 Routing Fundamentals and Subnets

10.1. Routed Protocol

- 10.1.1. Routable and routed protocols
- 10.1.2. IP as a routed protocol
- 10.1.3. Packet propagation and switching with a router
- 10.1.4. Connectionless and connection-oriented delivery
- 10.1.5. Anatomy of an IP packet

10.2. IP Routing Protocols; 13 CCNA 1: Networking Basics v3.1 Copyright Ó 2004, Cisco Systems, Inc.

- 10.2.1. Routing overview
- 10.2.2. Routing versus switching
- 10.2.3. Routed versus routing
- 10.2.4. Path determination
- 10.2.5. Routing tables
- 10.2.6. Routing algorithms and metrics
- 10.2.7. IGP and EGP
- 10.2.8. Link state and distance vector
- 10.2.9. Routing protocols

10.3. The Mechanics of Subnetting

- 10.3.1. Classes of network IP addresses
- 10.3.2. Introduction to and reason for subnetting
- 10.3.3. Establishing the subnet mask address
- 10.3.4. Applying the subnet mask
- 10.3.5. Subnetting Class A and B networks
- 10.3.6. Calculating the resident subnetwork through ANDing

Summary

11.0 TCP/IP Transport and Application Layer

11.1. TCP/IP Transport Layer

- 11.1.1. Introduction to transport layer
- 11.1.2. Flow control
- 11.1.3. Session establishment, maintenance, and termination overview
- 11.1.4. Three-way handshake
- 11.1.5. Windowing
- 11.1.6. Acknowledgement
- 11.1.7. TCP
- 11.1.8. UDP
- 11.1.9. TCP and UDP port numbers

11.2. The Application Layer

- 11.2.1. Introduction to the TCP/IP application layer
- 11.2.2. DNS
- 11.2.3. FTP and TFTP

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- 11.2.4. HTTP; 14 CCNA 1: Networking Basics v3.1 Copyright Ó 2004, Cisco Systems, Inc.
- 11.2.5. SMTP
- 11.2.6. SNMP
- 11.2.7. Telnet

Summary

Case Study: Structured Cabling

TEXTBOOKS

TITLE: CCNA 1 and 2 Companion Guide and Journal Pack
AUTHOR: Inc. Academic Business Consultants Inc. Cisco Systems
PUBLISHER: Cisco Systems
ISBN: 1587131501

TITLE: CCNA 1 and 2 Lab Companion
AUTHOR: Inc. Academic Business Consultants Inc. Cisco Systems
PUBLISHER: Cisco Systems
ISBN: 1587131110