COURSE NUMBER: CE1210

COURSE NAME: Basic Communications Networks I

COURSE DESCRIPTION:

This course introduces learners to the concept of networking using a top-down approach. Throughout this course learners will examine the role and operation of networks including applications, protocols, devices, and media. Learners will also be introduced to wireless networks. This course provides the learner with significant practical experience in networking. Upon completion of this course the learner should have a reasonable understanding of topics such as how Local Area Networks function, the role of IP addressing, and how data is reliably transported between hosts across the Internet. Learners will be expected to construct a simple network and apply appropriate IP addresses and to configure connectivity between a wireless LAN client and a wireless access point.

PREREQUISITES: None

CO-REQUISITES: None

CREDIT VALUE: Four (4)

COURSE HOURS PER WEEK: Three (3)

LAB HOURS PER WEEK: Three (3)

SUGGESTED TEXT:

Cisco Networking Academy. (2014). *Introduction to networks companion guide*. CA: Cisco Press. ISBN-13: 978-1-58713-316-9

LEARNING RESOURCES:

Cisco Networking Academy

MAJOR TOPICS:

1.0 Introduction to Networking
2.0 Network Communications
3.0 Application Layer
4.0 Transport Layer
5.0 Network Layer
6.0 Network Addressing

7.0 Data Link Layer
8.0 Physical Layer
9.0 Ethernet LANs
10.0 Network Planning
11.0 Network Configuration and Testing
12.0 Wireless Networks

LEARNING OBJECTIVES:

The expected learning outcomes are that the learner will be able to:

1.0 Introduction to Networking

1.1 Describe the role of modern networking in society
1.2 Describe the role of networking in applications such as business and education
1.3 Identify the key components of modern networks
1.4 Explain the concept of converged networking including the opportunities and challenges presented by converged networks
1.5 Identify the characteristics of network architectures including fault-tolerance, scalability, Quality of Service, and security

2.0 Network Communications

2.1 Describe the structure of a network including the devices and media required for communications
2.2 Describe the role of protocols in network communications
2.3 Describe the advantages of describing network functionality using layered models
2.4 Define the role of each layer in the OSI and TCP/IP network models
2.5 Explain encapsulation and decapsulation
2.6 Define protocol data unit (PDU)
2.7 Explain the importance of addressing and naming schemes in network communications
2.8 Explain how messages move between hosts, across a network, and across the Internet

3.0 Application Layer

3.1 Explain how the functions of the upper three OSI layers provide network services to end-user applications
3.2 Compare the operation of the TCP/IP application layer to the upper three layers of the OSI model in terms of providing service
3.3 Explain how the application layer allows users to communicate across the network; identify common communications protocols
3.4 Describe the functions of well-known TCP/IP applications such as WWW and e-mail and identify their related services (HTTP, DNS, DHCP, SMTP/POP, and Telnet/SSH

3.5 Explain the operation of peer-to-peer file sharing protocols such as Gnutella
3.6 Explain the operation of protocols including how they ensure that services on one kind of device can communicate with different types of network devices
3.7 Use network analysis tools to examine and explain the operation of common user applications such as FTP and WWW

4.0 Transport Layer

4.1 Explain the need for the transport layer
4.2 Describe the role of the transport layer in end-to-end data transfer between applications
4.3 Distinguish between TCP and UDP
4.4 Explain how the functions of the transport layer including reliability, port addressing, and segmentation work
4.5 Differentiate between TCP and UDP handling of key functions
4.6 Identify situations in which either TCP or UDP should be used and provide examples of applications that require each protocol
4.7 Explain how TCP provides reliability and error recovery

5.0 Network Layer

5.1 Explain how the network layer routes packets from a device on one network to a device on a different network
5.2 Explain how IP works to provide connectionless, best-effort service to upper layer applications
5.3 Distinguish between physical and logical groupings of devices
5.4 Explain how hierarchical device addressing allows communication between networks
5.5 Describe the use of next-hop addresses in path determination
5.6 Explain how routers forward packets
5.7 Differentiate between static and dynamic routing
5.8 Identify common routing protocols

6.0 Network Addressing

6.1 Describe the addressing structure of IPv4 and IPv6
6.2 Perform binary to decimal, and decimal to binary conversions using 8-bit numbers
6.3 Perform hexadecimal to decimal, and decimal to hexadecimal conversions
6.4 Identify the different IPv4 addresses and explain how each is used in a network
6.5 State the limitations of IPv4 addressing
6.6 Explain how IPv6 overcomes the limitations of IPv4 addressing
6.7 Differentiate between the types of IPv6 addresses
6.8 Differentiate between static and dynamic addressing and explain how administrators assign addresses
6.9 Explain the operation of DHCP, including DHCP options such as NTP and parameters such as scope

6.10 Define the role of ISPs including different types of ISPs and address assignment
6.11 Define the role of the subnet mask and identify the network portion of a host address for a given subnet mask
6.12 Differentiate between Classful and Classless IP addressing
6.13 Divide a network address according to specified criteria
6.14 Explain how IP depletion is slowed using VLSM, private IP addresses, and NAT
6.15 Identify the private IP address ranges, including loopback and educator network addresses
6.16 Use common utilities to test and troubleshoot connectivity and the operational status of IP
6.17 Devise a network addressing scheme according to supplied criteria for device addressing

7.0 Data Link Layer

7.1 Explain the role of data link layer protocols in data transmission
7.2 Explain how the data link layer prepares data for transmission across the network media
7.3 Define Media Access Control
7.4 Identify different types of MAC and explain the operation of each
7.5 Identify common logical topologies
7.6 Explain how the MAC method for a network is determined by the logical topology
7.7 Explain why packets are encapsulated into frames and how this facilitates media access
7.8 Identify the fields of a Layer 2 PDU and explain the purpose of each
7.9 Describe the generic Layer 2 PDU structure

8.0 Physical Layer

8.1 Describe how physical layer protocols and services support communications across data networks
8.2 Explain the purpose of physical layer signaling and encoding
8.3 Describe common physical layer signaling and encoding schemes
8.4 Explain how frames are represented as signals for transport across the physical media
8.5 Identify the characteristics of common network media including copper, fiber, and wireless
8.6 Identify common implementations of copper, fiber, and wireless media in modern networks
8.7 Differentiate between different transmitter types used with fiber cable
8.8 Discuss common issues with copper media such as crosstalk, noise, and interference
8.9 Explain how shielding mitigates noise and interference issues in copper media
8.10 Discuss factors such as scattering and reflection that can interfere with signal transmission in fiber cable

8.11 Explain how twisted-pair cable uses cancellation to mitigate crosstalk
8.12 Discuss the potential electrical hazards when working with copper media
8.13 Explain how grounding and bonding mitigates potential electrical hazards with copper media
8.14 Connect network devices using physical media
8.15 Identify the correct media for a given application
8.16 Demonstrate the proper procedure for testing copper and fiber media
8.17 Differentiate between the three types of cable testing: verification, qualification, and certification
8.18 Discuss the relevant ANSI/TIA standards governing structured cabling systems using copper and fiber media
8.19 Demonstrate the proper method of terminating copper and fiber cables for a given application

9.0 Ethernet LANs

9.1 Briefly outline the evolution of Ethernet
9.2 Differentiate between Ethernet and IEEE 802.3 (and associated versions)
9.3 Identify the fields of an Ethernet frame and explain the purpose of each
9.4 Differentiate between Ethernet frames and IEEE 802.3 frames
9.5 Explain the purpose of IEEE 802.2
9.6 Explain CSMA/CD and CSMA/CA
9.7 Identify the functions and characteristics of the MAC method used by Ethernet
9.8 Describe the Layer 1 and Layer 2 features of Ethernet
9.9 Differentiate between Ethernet hubs and Ethernet switches
9.10 Describe the operation of ARP and explain its purpose
9.11 Identify the common varieties of compatible CSMA/CD (Ethernet) technologies
9.12 Briefly discuss the future of Ethernet in terms of multi-gigabit speeds

10.0 Network Planning

10.1 Identify the network media required to make a LAN connection
10.2 Identify the connection types for intermediate and end-device LAN connectivity
10.3 Specify the correct pinout sequence for straight-through and crossover cables according to ANSI/TIA standards
10.4 Identify the connector types, port type, and cable type for various WAN connections
10.5 Explain the role of device connections management when using network equipment such as routers and switches
10.6 Design an address scheme for an internetwork and assign ranges for hosts, network devices, and router connections
10.7 Explain the importance of sound network design

11.0 Network Configuration and Testing

11.1 Explain the purpose of a network device operating system such as the Cisco IOS

11.2 Explain the purpose of a configuration file on a network device
11.3 Identify the classes of network devices that have an embedded operating system
11.4 Explain the factors that contribute to the set of commands and features available on a network device operating system
11.5 Identify the different modes of operation for a specified network device operating system such as the Cisco IOS
11.6 Identify and use basic router and switch configuration commands
11.7 Identify the router and switch commands that are used to view status information and perform basic troubleshooting
11.8 Explain the purpose of establishing a network performance baseline
11.9 Program a router or switch to support network communications
11.10 Configure basic security on a router or switch

12.0 Wireless Networks

12.1 Identify current wireless networking standards
12.2 Explain wireless network operation including beaconing, bssid, and essid
12.3 Differentiate between association and authentication with wireless networks
12.4 Configure a wireless access point for connectivity
12.5 Configure a network client for wireless connectivity
12.6 Troubleshoot common connectivity issues

EVALUATION:

Laboratories:	10%
Quizzes:	10%
Practical Examination:	40%
Final Examination:	40%

DATE DEVELOPED: January 2011 **DATE REVIEWED:** March 2012

REVISION NUMBER: 2 **DATE REVISED:** June 2014

Note to instructor: Check PIRS to ensure this outline is the most current version