

CISCO NETWORKING ACADEMY PROGRAM CURRICULUM SCOPE & SEQUENCE

Semester 1 version 2.1

Course Description:

This is the first of four semester courses designed to provide students with classroom and laboratory experience in current and emerging networking technology that will empower them to enter employment or further education and training in the computer networking field. A task analysis of current industry standards and occupational analysis was used to develop the content. Instruction includes, but is not limited to, safety, networking, network terminology and protocols, network standards, 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. Particular emphasis is given to the use of decision-making and problem-solving techniques in applying science, mathematics, communication, and social-studies concepts to solve networking problems. In addition, instruction and training are provided in the proper care, maintenance, and use of networking software, tools, and equipment and all local, state, and federal safety, building, and environmental codes and regulations.

CHAPTER 1

Upon completion of this chapter, students will be able to perform tasks related to:

Basics of Computer Hardware

- Major components of a personal computer
- Information flow in an idealized computer
- The relationship of NICs to PCs
- The installation of a NIC in a PC
- PC components versus laptop components

Basics of Computer Software

- Lab: Configuring network settings required to connect a PC to a network
- Lab: Verify Web browser configuration
- Troubleshooting lab: hardware and software

Binary Numbers

- Binary numbers represent alphanumeric data
- Bits and bytes
- The Base 10 (decimal) number system
- The Base 2 (binary) number system
- Converting decimal numbers to binary numbers
- Converting binary numbers to decimal numbers

Basic Networking Terminology

- Networks and networking
- Data networks
- Data networking solutions
- Local area networks
- Wide area networks

Digital Bandwidth

- Digital bandwidth measurements
- Three analogies to describe digital bandwidth
- Media bandwidth differences
- Data throughput in relation to digital bandwidth
- Data transfer calculation
- The importance of bandwidth

CHAPTER 2

Upon completion of this chapter, students will be able to perform tasks related to:

General Model of Communication

- Using layers to analyze problems in a flow of materials
- Source, destination, and data packets
- Media
- Protocol
- The evolution of ISO networking standards

The OSI Reference Model

- The purpose of the OSI reference model
- The names of the seven layers of the OSI reference model
- Descriptions of the seven layers of the OSI reference model
- Encapsulation
- Names for data at each layer of the OSI model

Comparison of the OSI Model and the TCP/IP Model

- The importance of the TCP/IP reference model
- Names and descriptions of the layers of the TCP/IP reference model
- TCP/IP protocol graph
- Comparison of the OSI model and the TCP/IP model
- Use of the OSI and the TCP/IP models in the curriculum

CHAPTER 3

Upon completion of this chapter, students will be able to perform tasks related to:

Basic LAN Devices

- The teaching topology
- LAN devices in a topology
- NICs
- Media
- Repeaters
- Hubs
- Bridges
- Switches
- Routers
- Clouds
- Network segments

Evolution of Network Devices

- Evolution of network devices
- Milestones in the history of networking
- Evolution of networking devices and the OSI layers
- Basics of Data Flow Through LANs
- Encapsulation and packets review
- Packet flow through Layer 1 devices
- Packet flow through Layer 2 devices
- Packet flow through Layer 3 devices
- Packet flow through clouds and through Layer 1-7 devices
- A data packet's path through all seven layers of a LAN

Building LANs

- Readiness to build a small network
- Lab: Building a simple network

CHAPTER 4

Upon completion of this chapter, students will be able to perform tasks related to:

Basics of Electricity

- A helium atom
- Creating stable atoms
- Static electricity
- Electrical current including insulators, conductors, and semiconductors
- Electrical measurement terms
- Analogy for voltage, resistance, and current
- Graphing AC and DC voltage
- Constructing a simple series electrical current
- Purpose of grounding networking equipment

Basics of Digital Multimeters

- Safe handling and use of the multimeter
- Using a multimeter to make resistance measurements
- Using a multimeter to make voltage measurements
- Measuring simple series circuit
- Constructing a simple electrical communication system

Basics of Signals and Noise in Communications Systems

- Comparing analog and digital signals
- Using digital signals to build analog signals
- Representing one bit on a physical medium
- Network signal propagation
- Network attenuation
- Network reflection
- Noise
- Dispersion, jitter, and latency
- Collision
- Messages in terms of bits

Basics of Encoding Networking Signals

- Historical examples of encoding
- Modulation and encoding

CHAPTER 5

Upon completion of this chapter, students will be able to perform tasks related to:

Most Common LAN Media

- STP
- UTP
- Coaxial cable
- Optical fiber
- Wireless communication

Cable Specification and Termination

- Purpose of LAN media specifications
- TIA/EIA standards
- Explain the details of TIA/TIA-568-A
- Networking media and terminations

Making and Testing Cable

- Testing Ethernet 10Base-T patch cables with a cable tester
- Making and testing Ethernet 10Base-T straight-through patch cable
- Making and testing Ethernet 10Base-T console patch cable

- Making and testing Ethernet 10Base-T crossover cable
- Features of an advanced cable tester
- Cable identification experiments using an advanced cable tester
- Length experiments using an advanced cable tester

Layer 1 Components and Devices

- Ethernet 10Base-T
- Connectors
- Cabling
- Jacks
- Patch panels
- Transceivers
- Repeaters
- Multiport repeaters (hubs)
- OSI Layer 1 components and devices

Collisions and Collision Domains in Shared Layer Environments

- Shared media environment
- Collisions and collision domains
- Signals in a collision
- Collisions as natural functions of shared media environments and collision domains
- Shared access as a collision domain
- Repeaters and collision domains
- Hubs and collision domains
- Hubs and repeaters as causes of collision domains
- The four repeater rule
- Segmenting collision domains

Basic Topologies Used in Networking

- Network topologies
- Linear bus network topology
- Ring network topology
- Dual ring network topology
- Star network topology
- Extended star network topology
- Tree network topology
- Irregular network topology
- Complete (mesh) network topology
- Cellular network topology

CHAPTER 6

Upon completion of this chapter, students will be able to perform tasks related to:

LAN Standards

- Layer 2
- Comparing OSI Layer 1 and 2 with various LAN standards
- Comparing the IEEE model with the OSI model
- Logical Link Control (LLC)
- MAC sublayers
- LLC as one of four concepts of Layer 2

Hexadecimal Numbers

- Hexadecimal numbers as MAC addresses
- Basic hexadecimal (hex) numbering
- Converting decimal numbers to hexadecimal numbers
- Converting hexadecimal numbers to decimal numbers
- Methods for working with hexadecimal and binary numbers
- MAC Addressing

- Data link layer MAC identifiers
- MAC address and NICs
- How the NIC uses MAC addresses
- Layer 2 address encapsulation and decapsulation
- Limitations of MAC addressing

Framing

- Why framing is necessary
- Frame format diagram
- Three analogies for frames
- A generic frame format
- Frame start fields
- Address fields
- Length/type fields
- Data fields
- Frame error problems and solutions
- Stop frame field
- Media Access Control (MAC)
- Definition of MAC
- Three analogies for MAC
- Deterministic MAC protocols
- Non-deterministic MAC protocols
- Three specific technical implementations and their MACs

CHAPTER 7

Upon completion of this chapter, students will be able to perform tasks related to:

Basics of Token Ring

- Overview of Token Ring and its variants
- Token Ring frame format
- Token Ring MAC
- Token Ring signaling
- Token Ring media and physical topologies

Basics of Fiber Distributed Data Interface (FDDI)

- Overview of FDDI and its variants
- FDDI format
- FDDI MAC
- FDDI signaling
- FDDI media

Ethernet and IEEE 802.3

- Comparing Ethernet and IEEE 802.3
- Ethernet family tree
- Ethernet frame format
- Ethernet MAC
- Ethernet signaling
- Ethernet 10Based-T media and topologies

Layer 2 Devices

- NICs
- NIC Layer 2 operations
- Bridges
- Bridge Layer 2 operations
- Switches
- Switch Layer 2 operations

Effects of Layer 2 Devices on Data Flow

- Ethernet LAN segmentation

- Bridge segmentation of a collision domain
- Switch segmentation of a collision domain
- Router segmentation of a collision domain
- Teaching topology segmentation by bridges, switches, and routers

Basic Ethernet 10Base-T Troubleshooting

- Troubleshooting workstations
- Network Inspector discovery lab
- Network Inspector problem log lab
- Network Inspector frame statistics

CHAPTER 8

Upon completion of this chapter, students will be able to perform tasks related to:

Basic Network Design and Documentation

- General design process
- Network design issues
- General network design process
- Network design documents

Planning Structured Cabling: Wiring Closet Specifications

- Overview of wiring closet selection
- Size
- Environmental specifications
- Walls, floors, and ceilings
- Temperature and humidity
- Lighting fixtures and power outlets
- Room and equipment access
- Cable access and support

Planning Structured Cabling: Identifying Potential Wiring Closets

- Topology as floor plan
- Selecting potential locations
- Determining number of wiring closets
- Identification practice

Planning Structured Cabling: Selection Practice

- Building description
- Closet A
- Closet B
- Closet C
- Closet D
- Closet E
- Closet F
- Closet G
- Closet H
- Closet I
- Closet J

Planning Structured Cabling: Horizontal and Backbone Cabling

- Catchment area problems
- MDF location in multi-story building
- Example of where you would use multiple wiring closets
- Cabling for MDF and IDF connections
- Backbone cabling media
- TIA/EIA 568-A requirements for backbone cabling
- Maximum distance for backbone cabling

Planning Structured Cabling: Electricity and Grounding

- Differences between AC and DC
- AC line noise
- Electrostatic discharge
- Grounding electrical current in computer equipment
- Purpose of grounding computer equipment
- Safety ground connections
- Safety ground connection problems

Planning Structured Cabling: Cabling and Grounding

- Causes of ground potential problems
- Networking devices and dangerous circuits
- Faulty ground wiring problems
- Avoiding potentially dangerous circuits between buildings
- How fiber optic cable can prevent electrical shocks
- Reasons for using UTP for backbone cabling between buildings

Design Practice No. 1: Wiring Plan for Ethernet Star Topology LAN

- Overview
- Main building: first floor
- Main building: second floor
- East building: first floor
- East building: second floor
- West building: first floor
- West building: second floor

Design Practice No. 2: Multiple Earth Ground Problems

- Overview
- Company A: MDF location
- Company A: backbone media
- Company A: IDFs and ICCs
- Company A: HCC locations
- Company A: drawing horizontal cabling runs
- Company B: MDF location
- Company B: backbone media
- Company B: HCC or ICC determination
- Company B: drawing horizontal cabling runs

Network Power Supply Issues: Power Line Problems

- Power problem classifications
- Normal mode and common mode
- Typical power line problems
- Sources of surges and spikes
- Surge and spike damage
- Surge and spike solutions
- Sag and brownout solutions
- Oscillation solution

Network Power Supply Issues: Surge Suppressors and Uninterruptible Power Supply (UPS) Functions

- Surge suppressors: networking device locations
- Surge suppressors: for power panel locations
- UPS: for certain LAN devices
- UPS: for certain electrical problems
- UPS: components
- UPS: differences in UPS features
- UPS: description and operation

CHAPTER 9

Upon completion of this chapter, students will be able to perform tasks related to:

Project Planning

- Network installation safety procedures
- Network documentation
- Network installation teams
- Work flow
- Scheduling materials flow

RJ-45 Jack and Outlet Installation

- TIA/EIA-568-aA standards
- RJ-45 jack
- Two methods for mounting an RJ-45 jack
- Surface-mounting an RJ-45 jack
- Advantages of surface-mounting an RJ-45 jack
- Factors to consider before flush-mounting an RJ-45 jack
- Preparing a drywall surface for a flush-mounted jack
- Preparing a plaster surface for a flush-mounted jack
- Preparing a wood surface for a flush-mounted jack
- Flush mounting a jack in a wall
- Procedure for placing the copper wires into a jack
- Procedure for punching wires down into a jack
- Installing RJ-45 jack and outlet

Basics of Cable Installation

- Basics of installing UTP cable
- Documenting cable runs
- TIA/EIA-606 specifications for labeling cable
- Types of labels
- Preparing cable for routing and labeling
- Labeling cable ends

Structured Cable Run Installation

- Easiest procedure for routing cable
- Mounting cable in raceway
- Running cable through existing raceway
- Personal safety precautions before installing cable
- Building safety
- Supporting horizontal cabling
- Stringing cable in an attic, or room with a dropped ceiling
- Fishing cable from above a wall
- Fishing cable from below a wall
- Stringing, Running, and Mounting Cable
- Installation tasks

Basics of Wiring Closets and Patch Panels

Wiring closet

- Reason for MDFs and IDFs
- Patch panel
- Structure of a patch panel
- Laying wires in a patch panel
- Punch tools
- Mounting a patch panel

Range of Equipment for Testing Structured Cabling Projects

- Procedures for testing cable already installed
- Network operation testing
- Cable testing equipment
- Tests performed by cable testers
- Cable testers and distance measurements
- TDRs (time domain reflectometers)
- Wire maps

- Split pairs
- Signal attenuation
- Causes of near-end crosstalk
- Problem detected by a noise level test
- Using a cable tester to locate sources of outside interference
- Cable testing procedures

CHAPTER 10

Upon completion of this chapter, students will be able to perform tasks related to:

Importance of a Network Layer

- Identifiers
- Segmentation and autonomous systems
- Communication between separate networks
- Layer 3 network devices

Path Determination

- Path determination
- Network layer addressing
- Layer 3 and computer mobility
- Comparing flat and hierarchical addressing

IP Address within the IP Header

- Network layer datagrams
- Network layer fields
- IP header source and destination fields
- IP address as a 32-bit binary number
- IP address component fields

IP Address Classes

- IP address classes
- IP address as decimal numbers
- Binary and decimal conversion review
- Converting decimal IP addresses to binary equivalents
- Converting binary IP addresses to decimal equivalents

Reserved Address Space

- Reserved Address Space
- Purposes for network IDs and broadcast addresses
- Network ID
- Network ID analogy
- Broadcast address analogy
- Hosts for classes of IP addresses

Basics of Subnetting

- Classical IP addressing
- Subnetwork
- Purpose for subnetting
- Subnet mask
- Boolean operation: AND, OR, and NOT
- Performing the AND function

Creating a Subnet

- Range of bits needed to create subnets
- Determining subnet mask size
- Computing subnet mask and IP address
- Computing hosts per subnetwork
- Boolean AND operation
- IP configuration on a network diagram

- Host/subnet schemes
- Private addresses

CHAPTER 11

Upon completion of this chapter, students will be able to perform tasks related to:

Layer 3 Devices

- Routers
- Layer 3 addresses
- Unique network numbers
- Router interface/port

Network-to-Network Communications

- Methods for assigning an IP address
- DHCP initialization sequence
- Function of the address resolution protocol (ARP)
- ARP operation within a subnet
- Default gateway

Advanced ARP Concepts

- Problems with sending data to nodes on different subnets
- Names and descriptions of the layers of the TCP/IP reference model
- How ARP sends data to remote networks
- Proxy ARP
- Four Layer 3 flowcharts

Routable Protocols

- Routed protocols
- Other routed protocols
- Routable and non-routable protocols
- Characteristics of a routable protocol

Routing Protocols

- Examples of routing protocols
- Definition of routing protocol
- Routing encapsulation sequence
- Multi-protocol routing

Other Network Layer Services

- Connectionless network services
- Connection-oriented network services
- Comparing connectionless and connection-oriented network processes
- IP and transport layer

ARP Tables

- Internetworking devices that have ARP tables
- Comparing router ARP tables with ARP tables kept by other networking devices
- Other router table addresses
- ARP requests and ARP replies
- Proxy ARP
- Indirect routing

Interior Gateway Protocols (IGP) and Exterior Gateway Protocol (EGP)

- Routed protocols and routing protocols
- IGPs and EGPs
- RIP
- IGRP and EIGRP
- OSPF
- How routers recognize networks

- Examples of static routing
- Example of dynamic routing
- How routers use RIP to route data through a network

Protocol Analyzer Software

- Using protocol analyzer software for ARPs and broadcasts

CHAPTER 12

Upon completion of this chapter, students will be able to perform tasks related to:

The Transport Layer

- Purpose of the transport layer
- Layer 4 protocols
- Comparing TCP and IP

TCP and UDP

- TCP
- UDP segment format

TCP Connection Methods

- Port numbers
- Three-way handshake/open connection

CHAPTER 13

Upon completion of this chapter, students will be able to perform tasks related to:

The Session Layer

- The session layer overview
- The session layer in terms of analogies
- Dialogue control
- Dialogue separation
- Layer 5 protocols

CHAPTER 14

Upon completion of this chapter, students will be able to perform tasks related to:

The Presentation Layer

- The presentation layer functions and standards
- File formats
- Data encryption and compression

CHAPTER 15

Upon completion of this chapter, students will be able to perform tasks related to:

Basics of the Application Layer

- Application processes
- Direct network applications
- Indirect network support
- Making and breaking a connection

Domain Name System

- Problems with using IP addresses
- The domain name server

Network Applications

- Internet applications
- E-mail message
- DNS function

Application Layer Examples

- Telnet
- File transfer protocol
- Hypertext transfer protocol