

CIW-Networking Fundamentals

Lesson 1: Introduction to Networking

- 📄 Network: two or more connected computers that share data
- 📄 Internetworking: networking on the Internet
- 📄 Mainframe computing is centralized computing. (e.g. CICS-Customer Information Control System)
- 📄 Two liabilities of mainframe computing:
 - mainframe handles all processing work
 - request and response packets between terminal and mainframe occupy lots of bandwidth
- 📄 Client/server computing is distributed computing:
 - Client: requests a service from another computer
 - Server: provides information or connections to other computers
- 📄 The client/server model contains single database servers and distributed databases.
- 📄 Distributed databases reduce bottlenecks.
- 📄 The most efficient way to translate human readable language into machine-readable code is SQL (Structured Query Language).
- 📄 The key difference between SQL and mainframe retrieval is that the client processes much of the request.
- 📄 Client/server benefits include shared processing and a modular approach to computing.
- 📄 Heterogeneous systems can work together thanks to open standards such as TCP/IP and ODBC.
- 📄 The client/server model gives the ability to adjust to new demands and allow users more control over their own files.
- 📄 Workstation: terminal or PC on a network
- 📄 Web based networking is also called collaborative computing.
- 📄 Web based networking uses mainframes and client/server model.
- 📄 Extranet: network that connects enterprise intranets to the internet
- 📄 Web based networking combines the power of mainframe computing with the scalability of client/server computing.
- 📄 Three basic elements of a network:
 - Protocols: rules of communication for a network
 - Transmission media: method for elements to interconnect
 - Network Services: resources shared with all users
- 📄 Two basic types of network:
 - Peer-to-Peer: does not require dedicated resources
 - Server based: consists of nodes dedicated to providing resources to other nodes or hosts
- 📄 Enterprise network characteristics:
 - systems are capable of translating packets of one architecture to another using gateways
 - systems that support multiple architectures exist on the network
- 📄 Network topologies:
 - Bus: requires that all computers tap into the same cable
 - Star: connect through a central device, usually a hub
 - Ring: no central connection point, a cable connects each node until a ring is formed
 - Hybrid: incorporates bus, star, and ring topologies
- 📄 The backbone is the highest level in the network hierarchy
 - Mesh topologies connect devices with multiple paths so no redundancies occur.
- 📄 A network operating system (NOS) manages all resources on the network.
- 📄 Interoperability is the ability of one computer system to communicate with another.

Lesson 2: Networking Protocols

- 📄 Network protocols are established rules that enable data to flow from one NIC (Network Interface Card) to another
- 📄 Three functions of the OSI/RM (Open Systems Interconnect/Reference Model):
 - 📄 gives developers universal concepts to develop perfect protocols
 - 📄 explains the framework used to connect heterogeneous systems
 - 📄 describes the process of packet creation
- 📄 Seven layers of the OSI/RM:
 - 📄 7 Application: interface to the end user
 - 📄 6 Presentation: provides useful transformations to support standard interface
 - 📄 5 Session: establishes and manages connections
 - 📄 4 Transport: provides transparent transport between end points
 - 📄 3 Network: organizes data into datagrams
 - 📄 2 Data Link: provides data transfer across the physical link
 - LLC (Logical Link Control) Layer: error, flow control and timing; manages link control and defines service access points;
 - MAC (Media Access Control) Layer: framing and physical addressing; places data on the transmission media
 - 📄 1 Physical: responsible for characteristics to establish maintain and deactivate the physical link
- 📄 Packet: fixed piece of information sent across a network
- 📄 Three elements of a packet:
 - 📄 Header
 - 📄 Data
 - 📄 Trailer
- 📄 Cyclical Redundancy Check: mathematical calculation that allows the receiving computer to verify whether a packet is valid
- 📄 Application Layer Protocols:
 - 📄 SMTP (Simple Mail Transfer Protocol): used to send e-mail from host to host
 - 📄 HTTP (Hypertext Transfer Protocol): TCP/IP suite protocol that interconnects Web pages
 - 📄 SMB (Server Message Block): allows files to be shared on a Microsoft network
 - 📄 NCP (Netware Core Protocol): allows files and printers to be shared on a Netware network
 - 📄 NFS (Network File System): allows files and printers to be shared on a UNIX network
- 📄 Transport Layer Protocols:
 - 📄 TCP (Transmission Control Protocol): TCP/IP suite protocol that provides reliable delivery and manages sessions
 - 📄 SPX (Sequenced Packet Exchange Protocol): manages communication sessions
 - 📄 NWLink: Microsoft Implementation of IPX/SPX; operates at Transport and Network layers
 - 📄 NetBEUI: nonroutable protocol that allows different applications on different computers to communicate with one another; operates at Transport and Network layers
- 📄 Network Layer Protocols:
 - 📄 IP (Internet Protocol): TCP/IP suited protocol that is responsible for addressing hosts and routing packets
 - 📄 IPX (Internetwork Packet Exchange): provides addressing for Novell IPX/SPX suite
 - 📄 NWLink (NetWare Link): Microsoft Implementation of IPX/SPX; operates at Transport and Network layers
 - 📄 NetBEUI (Network Basic Input/Output System (NetBIOS) Extended User Interface): nonroutable protocol that allows different applications on different computers to communicate with one another; operates at Transport and Network layers
- 📄 Data Link Layer Protocols:
 - 📄 Ethernet: LAN protocol created by Xerox, Digital Equipment, and Intel; the most popular LAN technology

- 📁 Major Networking Protocols:
 - 📁 TCP/IP
 - 📁 IPX/SPX
 - 📁 NetBEUI
 - 📁 AppleTalk
 - 📁 Data Link Control (DLC)
 - 📁 Systems Network Architecture (SNA)
- 📁 Connection-oriented (stateful) protocols are more reliable but require more overhead than connectionless (stateless) protocols.
- 📁 Connectionless protocols rely on a “best effort” technology that sends information in hopes that it reaches the other system. (e.g. IP protocol)
- 📁 Routable protocols include:
 - 📁 TCP/IP
 - 📁 IPX/SPX
- 📁 Nonroutable protocols include:
 - 📁 NetBEUI
 - 📁 NetBIOS
 - 📁 SNA
 - 📁 LAT (Local Area Transport)
 - 📁 DLC
- 📁 To effectively use a nonroutable protocol, add a bridge to encapsulate the nonroutable protocol within a routable protocol. This method is called tunneling.
- 📁 TCP/IP is the official protocol of the Internet.
- 📁 TCP/IP suite protocols:
 - 📁 TCP
 - 📁 UDP (User Datagram Protocol)
 - 📁 ICMP (Internet Control Message Protocol)
 - 📁 ARP (Address Resolution Protocol)
 - 📁 IP
- 📁 Five classes of IP addresses:
 - 📁 A: used for large networks
 - 📁 B: used for medium networks
 - 📁 C: used for small networks
 - 📁 D: used for multicasting
 - 📁 E: experimental
- 📁 TCP/IP allows heterogeneous networks to communicate efficiently.
- 📁 IPX/SPX protocols:
 - 📁 IPX
 - 📁 SPX
- 📁 Microsoft also supports IPX/SPX but has renamed it NWLink (NetWare Link).
- 📁 IBM first developed NetBEUI, but Microsoft has implemented it as a solution for its peer-to-peer networks; it is a nonroutable protocol, which limits its usefulness.
- 📁 NetBIOS was originally designed for use with NetBEUI and is currently declining in popularity and mainly used as a programming interface for applications. NetBIOS resides at the Session layer and can operate over NetBEUI as well as routable protocols such as TCP/IP and IPX/SPX.
- 📁 AppleTalk is used only in Apple networks. It divides groups of computers into zones
- 📁 DLC was developed by IBM to enable client machines to work with mainframes; however, Hewlett-Packard has adopted DLC as a means to connect its laser printers to LANs.
- 📁 IBM introduced SNA in 1974 as a mainframe network architecture. It includes a network topology and a series of protocols.

Lesson 3: LANS and WANS

- 📄 A LAN is a group of computers connected within a confined geographic area.
- 📄 A WAN is a group of computers connected within an expansive geographic area.
- 📄 A NAP (Network Access Point) is a junction between one high-speed network and another.
- 📄 NAP connections are usually made by either a router or a switch.
- 📄 Backbone: the part of a network that carries the majority of network traffic;
- 📄 Segment: part of a larger structure
- 📄 Common Network Components:
 - 🔧 NIC (Network Interface Card): the interface between the computer and the network.
 - NICs operate at the Data Link Layer
 - Most NICs contain a transceiver, a device that transmits and receives analog or digital signals.
 - 🔧 Repeater: low-level device that amplifies the signal on a cable segment
 - Repeaters operate at the Physical Layer.
 - 🔧 Hubs: connect computers in a Star network
 - Hubs operate at the Physical Layer.
 - 🔧 Bridge: filter frames to determine whether it belongs on a local segment or another LAN segment
 - Bridges operate at the Data Link Layer and use hardware addressing.
 - Bridges are independent of all upper layer protocols.
 - 🔧 Router: similar to a bridge, it determines the path along which network traffic should be sent
 - Routers operate at the Network Layer.
 - 🔧 Brouter: incorporates the functionality of bridges and routers
 - Brouters operate at the Data Link and Network Layers.
 - 🔧 Switch: directs the flow of information from one node to another
 - Switches can operate at several layers of the OSI/RM.
 - Switches are faster than other network components.
 - Benefits of switches:
 - ❖ easy to install
 - ❖ higher speeds
 - ❖ more bandwidth
 - 🔧 CSU/DSU (Channel Service Unit/Data Service Unit): terminates physical connections
 - 🔧 Gateway: protocol converter
 - Gateways can operate at any level of the OSI/RM.
 - Gateways are much more complex than that of a router or switch.
 - 🔧 Modem: a device that enables a computer to communicate with other computers over telephone lines
 - 🔧 Patch Panel: a group of sockets that switch data manually between inbound and outbound transmissions
- 📄 Three options for handling increased LAN traffic:
 - 🔧 use a bridge
 - 🔧 use a LAN switch (Layer 2 switch)
 - 🔧 increase network bandwidth
- 📄 Twisted pair cable is the most widely used system in Ethernet networks.
- 📄 Twisted pair segments cannot exceed 100 meters.
- 📄 Two basic types of twisted pair:
 - 🔧 STP (Shielded Twisted Pair): metal sheath wrapped around the wires
 - 🔧 UTP (Unshielded Twisted Pair): less expensive and less secure than STP; prone to electromagnetic interference
- 📄 Two varieties of wire in UTP and STP:
 - 🔧 Stranded: most common; flexible and easy to handle
 - 🔧 Solid: can span longer distances without as much attenuation but it is less flexible

- 📄 Attenuation: the weakening of a signal as it travels farther from its source
- 📄 Seven categories of twisted pair:
 - 📄 CAT 1: used for voice, not for data
 - 📄 CAT 2: 4 Mbps; used for Token Ring
 - 📄 CAT 3: 10 Mbps; used for Ethernet
 - 📄 CAT 4: 16 Mbps; used for Token Ring
 - 📄 CAT 5: 100 Mbps; used for Ethernet and Fast Ethernet
 - 📄 CAT 6: 155 Mbps; used for Fast Ethernet
 - 📄 CAT 7: 1000 Mbps; used for Gigabit Ethernet
- 📄 An RJ 45 connector is larger than RJ-11.
- 📄 Coaxial cable provides higher bandwidth than twisted pair cable.
- 📄 Thick coax (10base5; thicknet) is the Ethernet standard.
- 📄 Thicknet works where electromagnetic interference exists.
- 📄 Thin coax (10base2; thinnet) is used for smaller networks
- 📄 Coaxial cable is connected to NICs with BNCs.
- 📄 Fiber optic cable is much faster than coax and twisted pair.
 - 📄 Fiber optic cable consists of two small glass strands; one sends and one receives
- 📄 Two types of fiber optic cable:
 - 📄 Single mode: uses specific light wavelengths
 - 📄 Multimode: uses a large number of frequencies
- 📄 Synchronous transmission: access device and network device share a clock and a transmission rate (e.g. T1 lines)
- 📄 Asynchronous transmission: access device is not synchronized with the network device (e.g. dial up modem)
- 📄 Three methods of data transmission flow:
 - 📄 Simplex: data travels in only one direction
 - 📄 Half duplex: data travels in two directions but in only one direction at a time
 - 📄 Full duplex: data travels in two directions simultaneously
- 📄 Baseband: uses the entire bandwidth for a single channel; uses time division multiplexing (TDM)
- 📄 Broadband: divides bandwidth into multiple channels; each channel carries a separate signal; used only for analog signals; uses frequency division multiplexing (FDM)
- 📄 Logical topology refers to the signal's path.
- 📄 Physical topology refers to the way devices are connected.
- 📄 Carrier Sense Multiple Access/Collision Detection (CSMA/CD), token, and demand priority LAN technologies are all included in the 802 series of the IEEE LAN standards.
- 📄 IEEE 802.2 divides the OSI/RM Data Link Layer into sublayers:
 - 📄 LLC
 - 📄 MAC
 - MAC addresses are burned onto a NIC by the manufacturer.
 - MAC addresses use twelve hexadecimal digits to form 48-bit addresses (6 bytes).
- 📄 IEEE 802.3 (Ethernet)
 - 📄 Ethernet is a predecessor to IEEE 802.3 standard.
 - 📄 It is a broadcast system for communication between systems.
 - 📄 Ethernet does not totally comply with the 802.2 standard.
 - 📄 All Ethernet/IEEE 802.3 use CSMA/CD.
- 📄 IEEE 802.3u (Fast Ethernet)
 - 📄 100 Mbps; Star topology
- 📄 IEEE 802.3z and 802.3ab (Gigabit Ethernet)
 - 📄 the fastest LAN technology and is primarily used for backbones
 - 📄 802.3z uses copper or fiber optic cabling
 - 📄 802.3ab uses CAT 5 UTP
- 📄 IEEE 802.5 (Token Ring)
 - 📄 uses token passing instead of CSMA/CD
 - 📄 Token Ring networks appear to use Star topology but they actually use an MAU (multistation access unit)

- ☐ IEEE 802.12 (100VG AnyLAN)
 - ☐ supports demand priority
 - ☐ hub simultaneously arbitrates when and how systems access the network
- ☐ Apple LocalTalk
 - ☐ uses CSMA/CD
- ☐ FDDI
 - ☐ token based architecture that uses two counter rotating rings
 - ☐ classified as a municipal area network (MAN)
- ☐ X.25 is a WAN standard that operates at 56Kbps or slower.
 - ☐ X.25 operates at the Network Layer
- ☐ Frame Relay is a fast packet switching technology that uses fiber optic and digital cabling
 - ☐ uses Permanent Virtual Circuits (PVCs) and variable length packets
 - ☐ operates at 64Kbps-1.544Mbps
- ☐ ATM (Asynchronous Transfer Mode) is mostly used in Internet backbones
 - ☐ uses cell relay technology and fixed length cells
 - ☐ operates at 155Mbps-622Mbps
- ☐ To connect a T1 line you need:
 - ☐ CSU: diagnoses and prepares signals
 - ☐ DSU: convert LAN signals to T1
- ☐ A router is the interface between LAN and T1
- ☐ T-Carrier system connection speeds:
 - ☐ T1: 1.544 Mbps
 - ☐ E1: 2.048 Mbps
 - ☐ T2: 6.312 Mbps
 - ☐ E2: 8.448 Mbps
 - ☐ E3: 34.368 Mbps
 - ☐ T3: 44.736 Mbps
 - ☐ E4: 139.264 Mbps
 - ☐ T4: 274.176 Mbps
 - ☐ E5: 565.148 Mbps

Lesson 4: TCP/IP and Internet Addressing

- ☐ The Internet architecture consists of four layers
 - ☐ Application: corresponds to the Presentation and Application Layers of the OSI/RM
 - ☐ Transport: corresponds to the Transport and Session Layers of the OSI/RM
 - ☐ Internet: corresponds to the Network Layer of the OSI/RM
 - ☐ Network Access: corresponds to the Physical and Data Link Layers of the OSI/RM
- ☐ The Network Access Layer consists of:
 - ☐ operating system's device driver
 - ☐ interface card
 - ☐ physical connections
- ☐ The Network Access Layer transmits higher layer datagrams over the network, handling all hardware details
- ☐ Protocols used at the Network Layer:
 - ☐ LAN: Ethernet, Token Ring, FDDI, AppleTalk
 - ☐ WAN: Frame Relay, serial lines, ATM
- ☐ The Internet Layer is responsible for addressing and routing packets.
- ☐ Protocols used at the Internet Layer:
 - ☐ IP: basic data transfer method throughout the Internet RFC 791
 - ☐ ICMP: troubleshooting protocol of TCP/IP RFC 792
 - ☐ IGMP (Internet Group Management Protocol): used for multicasting, one source sends messages to a group of subscribers RFC 1112
 - ☐ ARP: translates Internet addresses into Physical addresses RFC 826
 - ☐ RARP (Reverse ARP): translates Physical addresses into Internet addresses RFC 903

- 📄 The Transport Layer accepts Application Layer data, divides it into packets, and provides flow of information between hosts.
- 📄 Protocols used at the Transport Layer:
 - 📄 TCP: provides session management between source and destination
 - 📄 UDP: simple datagram form of communication
- 📄 The Application Layer interacts with the Transport Layer to send and receive data
- 📄 Protocols used at the Application Layer:
 - 📄 HTTP: transports HTML documents across the Internet RFC 1945 and RFC 2616
 - 📄 FTP: (File Transfer Protocol): system for transferring files between TCP/IP computers RFC 959
 - 📄 Telnet: terminal emulation protocol; allows users at a site to log on and run programs from a remote system RFC 854
 - 📄 NNTP (News Network Transfer Protocol): allows Internet sites to exchange UseNET articles RFC 977
 - 📄 Gopher: menu based program used to find resources on the Internet RFC 1436
 - 📄 SMTP: Internet standard protocol for e-mail transfer RFC 821
 - 📄 SNMP (Simple Network Management Protocol): used to manage TCP/IP networks RFC 1157
 - 📄 DNS (Domain Name Server): used to translate host names into IP addresses RFC 1034 and RFC 1035
 - 📄 BOOTP (BOOTstrap Protocol): an alternative to RARP RFC 951
 - 📄 DHCP (Dynamic Host Configuration Protocol): based on BOOTP; assigns Internet addresses to nodes on a TCP/IP network during initialization
- 📄 Port Numbers
 - 📄 FTP: 21
 - 📄 SMTP: 25
 - 📄 DNS: 53
 - 📄 HTTP: 80
- 📄 RFC (Request for Comments): published documents of interest to the Internet community.
- 📄 Protocol states:
 - 📄 Experimental: only used in laboratory situations
 - 📄 Proposed: may be considered for future standardization
 - 📄 Draft: being seriously considered to become Internet standards
 - 📄 Standard: determined by IESG to be an official standard protocol on the Internet
 - 📄 Historic: protocols that have been replaced by recent ones
 - 📄 Informational: developed outside of IETF/IESG
- 📄 Demultiplexing is the method a destination computer uses to process incoming packets.
- 📄 The Internet Layer performs the routing of protocols:
 - 📄 Routing is the process that determines the path that packets travel across a network.
 - one of the most important IP functions
- 📄 Routing has two classifications:
 - 📄 Direct: two computers on the same network
 - 📄 Indirect: two computers on separate networks
- 📄 Routing involves two key elements:
 - 📄 host must know which router to use for given destination
 - 📄 router must know where to send the packet
- 📄 A routing information table is a database maintained by a router; the table contains the location of all networks
- 📄 Hop: link between two network devices
- 📄 Static routers contain information that must be built and updated manually.
- 📄 Dynamic routers communicate with other dynamic routers using protocol such as RIP and OSPF
- 📄 Routing protocols determine how routers share information and report routing tables.
- 📄 Interior routing protocols are used within an organization's network. (e.g. RIP, OSPF)
- 📄 Exterior routing protocols are used outside an organization's network. (e.g. EGP, BGP)

- 📄 RIP (Routing Information Protocol): maintains only the best route to a destination.
 - 📄 RIPv1 RFC 1058
 - 📄 RIPv2 RFC 2453
- 📄 OSPF (Open Shortest Path First): gateway that maintains protocols; overcomes RIPv1 shortcomings. RFC 2328
- 📄 OSPF features:
 - 📄 various types of service routing
 - 📄 load balancing
 - 📄 network areas
 - 📄 authenticated exchanges
 - 📄 defined route support
- 📄 Ports 1-1023: well known port numbers
- 📄 Ports 1024-65535 : registered port numbers
- 📄 Ports 1-1023 are controlled by ICANN.
- 📄 No process can bind to well known ports unless user id=0.
- 📄 Registered port numbers are non-privileged, which means any process can use them.
- 📄 Internet addresses are broken into a Network portion and a Host portion.
- 📄 Each dotted quad has one byte of data and there are four fields. (0-255)
- 📄 Internet Address Classes:
 - 📄 A: 0.0.0.0-127.255.255.255
 - 📄 B: 128.0.0.0-191.255.255.255
 - 📄 C: 192.0.0.0-223.255.255.255
 - 📄 D: 224.0.0.0-239.255.255.255
 - 📄 E: 240.0.0.0-247.255.255.255
- 📄 A: first byte is network, last three bytes are host
- 📄 B: first two bytes are network, last two bytes are host
- 📄 C: first three bytes are network, last byte is host
- 📄 D: multicasting, all bytes are network
- 📄 E: reserved for future use
- 📄 Loopback address: 127.0.0.1; used to ping network
- 📄 Broadcast address: 255; send messages to all hosts:
 - 📄 Limited broadcast: 255.255.255.255
 - 📄 Net-directed broadcast: netid.255.255.255.255
 - 📄 Subnet-directed: 255.255.255.255 within a subnet
 - 📄 All subnets-directed: not used anymore
- 📄 Three reserved blocks of IP addresses:
 - 📄 10.0.0.0-10.255.255.255
 - 📄 172.16.0.0-172.31.255.255
 - 📄 192.168.0.0-192.168.255.255
- 📄 Subnet mask: 32-bit number with one-to-one correspondence between each of the 32 bits in the Internet address
- 📄 Subnet masks two main purposes:
 - 📄 distinguish network and host portions of IP address
 - 📄 specify whether destination address is local or remote
- 📄 Default subnet masks:
 - 📄 Class A: 255.0.0.0
 - 📄 Class B: 255.255.0.0
 - 📄 Class C: 255.255.255.0
- 📄 Ipv6 uses 128 bit addresses instead of 32 bits.
- 📄 Normal TCP/IP desktop configurations:
 - 📄 IP address: 32 bit address unique to the workstation
 - 📄 Subnet mask: 32 bit number used to distinguish network and host portion of IP address
 - 📄 Default Gateway: local IP address if destination address is remote
 - 📄 DHCP Client: alternative to entering static IP address

- 📁 Name resolution configurations:
 - 📁 Host name
 - 📁 Domain name
 - 📁 DNS server
 - 📁 NetBIOS name
 - 📁 WINS server
- 📁 Diagnostic tools for Internet troubleshooting
 - 📁 ping: tests connectivity between source and destination systems
 - 📁 tracert: determine the path between source and destination
 - 📁 netstat: displays contents of various network related data
 - 📁 ipconfig: displays Windows NT/2000 configuration
 - 📁 winipconfig: determine network card's IP configuration and Ethernet address
 - 📁 arp: resolves software addresses to hardware addresses
- 📁 Network analyzers allow administrators to analyze data traversing a network:
 - 📁 monitor network traffic
 - 📁 identify problems and send alert messages
 - 📁 identify specific problems
 - 📁 test network connections, devices, and cables

Lesson 5: Internetworking Servers

- 📁 Network services have become more decentralized.
- 📁 Common servers found on the Internet:
 - 📁 File and Print servers:
 - File servers store data files and programs.
 - Print servers allow multiple users to print to the same printer.
 - ❖ LPR/LPD is a printing protocol used by NT/2000 and UNIX.
 - 📁 Web server has access to set of documents that it may return to a client in response to a request.
 - HTTP server can download any type of file.
 - Multipurpose Internet Mail Extensions (MIME) allows HTTP and email attachments to identify the files they must use.
 - S/MIME is used for secure transactions.
 - The MIME type identifies the contents of a file.
 - Common Web Servers:
 - ❖ Apache
 - ❖ Microsoft IIS
 - ❖ Netscape Enterprise
 - 📁 Proxy servers provide enhanced security, manage TCP/IP addresses and speed access to the Internet by caching server functions for frequently used documents.
 - Additional services of a Proxy server:
 - ❖ caching web documents
 - ❖ corporate firewall access
 - ❖ filtering client transactions
 - ❖ transaction logging
 - ❖ securing the host
 - ❖ enhanced administration
 - 📁 Caching servers speed data access by storing retrieved data then presenting it to users who later request it.

- ❏ Mail servers store and forward e-mail messages.
 - SMTP, POP, and IMAP all reside at the Application Layer of the OSI/RM.
 - Two ways to store and access e-mail:
 - ❖ POP3
 - ❖ IMAP
 - MIME is used to transmit files with e-mail.
 - UU Coding was used to transmit non-text files with e-mail.
 - BinHex: Apple
- ❏ Mailing List servers are SMTP servers that forward email to members on a distribution list.
- ❏ Media servers offer streaming audio and video
 - Buffer: cache of memory used to store frequently used data
- ❏ DNS Servers contain the application that supports name-to-address translation.
 - DNS is a decentralized system.
 - HOSTS file is a text file referenced by applications and commands for name-to-address resolution.
 - DNS is hierarchical and distributed.
 - DNS consists of three levels:
 - ❖ root-level domain: contains entries for each top-level domain
 - ❖ top-level domain: consists of categories at the end of domain names
 - ◆ divides domains into organizations, businesses, and other categories
 - ❖ second-level domain: include the businesses and institutions that register their domains with top-level domains
 - ◆ can be divided into sub-domains
 - DNS components:
 - ❖ name server: supports name-to-address translation and runs the DNS service
 - ❖ name resolver: software that uses services of one or more name servers to resolve unknown requests
 - DNS server types:
 - ❖ root server: all top level domains on the Internet
 - ❖ primary server: the authority for a domain and maintains DNS databases for its domain
 - ❖ secondary server: receives authority and database from primary server
 - DNS records provide additional routing and resolution information.
 - ❖ name server (NS): identifies DNS servers for the DNS domain
 - ❖ start of authority (SOA): identifies the DNS server that is best source for information
 - ❖ address (A): most commonly used; associates to IP addresses
 - ❖ canonical name (CNAME): creates alias for specified host
 - ❖ mail exchanger (MX): identifies server used to process and deliver e-mail
- ❏ FTP servers allow file transfers between servers in real time and allow for larger files to be sent over the Internet:
- ❏ News servers use NNTP to access Usenet databases.
 - SSL (Secure Sockets Layer) provides security in a newsgroup.
- ❏ Certificate servers validate keys, which are strings of ciphertext generated from a series of algorithms to allow secure communications.
- ❏ Directory servers identify all resources on a network.
 - Two protocols serve as a basis for most directory services:
 - ❖ X.500: OSI protocol used to manage user and resource directories; offers scalability, synchronization, and replication
 - ❖ Lightweight Directory Access Protocol (LDAP): developed from X.500 but easier to implement because it is based on TCP/IP
- ❏ Catalog servers provide a single point of access that allows users to search for information across a network.
 - Robots are catalog servers that automate indexing with the use of algorithms.

- Transaction servers guarantee that all databases are updated when a transaction takes place.
 - replacements for CICS mainframe servers
 - The Internet Daemon: inetd
 - inetd is a UNIX service that starts other Internet services.
 - Services typically launched by inetd:
 - ❖ smtpd
 - ❖ tftd
 - ❖ telnetd
 - inetd can present security problems because it has a root permission.
- Mirrored servers provide data redundancy to protect data.

Lesson 6: Server-side Scripting and Database Connectivity

- Server-side scripting is a piece of code that activates programs on the server.
- Client-side scripting is embedded into HTML files freeing the load on the server.
- HTTP Gateway is the script or mini-application that allows HTTP servers to pass data to a program or database and return the output.
- Application Program Interface: method that allows programmers to make requests of an OS or application
- Guidelines for combining server-side and client-side scripting:
 - access to data on the client should use client-side scripting
 - access to any other data should use server-side scripting
 - changes to HTML layout and properties should use client-side scripting
- HTML Forms and Form Processing:
 - METHOD: sets method by which browser sends form data
 - GET: data is appended to the URL that points to the location where the form is submitted
 - POST: data is sent separately from the call to the script using standard input
 - ACTION: specifies gateway path used to process form
- Common Gateway Interface (CGI) is the most simple and universal gateway.
- CGI scripts are typically located in a folder named CGI-BIN.
- CGI is not platform specific.
- Each CGI script runs as a separate process.
- CGI Alternatives: *Server Programming Alternatives*
 - ISAPI: Microsoft proprietary HTTP server extension that allows the server to execute programs and scripts without CGI; favors VBScript
 - NSAPI: supports different languages and has a slightly different environment than ISAPI; favors JavaScript
- CGI Alternatives: *Scripting Technologies*
 - JavaServer Pages (JSP): uses Java servlets and is not proprietary
 - Personal Home Page (PHP): can be embedded into HTML
 - Active Server Pages (ASP): Microsoft proprietary
 - Server-side JavaScript (SSJS): Netscape proprietary
- CGI Alternatives: *Java servlets*
 - complement the HTTP server
 - less platform-specific
- Three types of databases:
 - non-relational (DBMS):
 - hierarchical: only one user at a time can access
 - network: many users can access
 - relational (RDBMS): uses tables that index the data
 - object-oriented (ODBMS): attempt to mimic real world data relationships

- 📄 Two types of database connectivity:
 - 📌 ODBC (Open Database Connectivity): Microsoft standard API for SQL to access relational databases
 - 📌 JDBC (JavaScript Database Connectivity): allows Java to process SQL statement within Java programs.

Lesson 7: Network Security Essentials

- 📄 Security is defined as a means to reduce vulnerability of data and resources.
- 📄 Assets: data, applications, and resources on any computer
- 📄 Network assets:
 - 📌 local resources: workstations
 - 📌 network resources: communications media
 - 📌 server resources: Web, e-mail, and FTP servers
 - 📌 database and information resources: how a company organizes and disseminates information
- 📄 Types of attacks by hackers:
 - 📌 Spoofing attacks occur when a hacker assumes the identity of a legitimate network device.
 - 📌 Man-in-the-middle attacks occur when a hacker captures packets being sent from one host to another.
 - 📌 Denial-of-service attacks occur when the host or system cannot perform properly because another program is using all of its resources.
 - 📌 Insider attacks are eavesdropping on messages between applications and compromising existing mechanisms.
 - 📌 Brute force attacks occur when a hacker attempts to gain access as a legitimate user.
 - 📌 Trapdoor attacks occur when hackers establish certain commands that open unauthorized access.
 - 📌 Replay attacks occur after a hacker captures and alters a key part of a message.
 - 📌 Trojan horse attacks are a variation of Trapdoor attacks that involve hiding an unauthorized command within a commonly used function to cause a breach.
 - 📌 Social engineering attacks occur when a hacker attempts to obtain information about a network through simple tricks.
- 📄 A virus is a malicious program designed to damage network equipment, including stand-alone computers.
- 📄 Viruses affect programs at the Application Layer.
- 📄 Types of viruses:
 - 📌 macros: small programs written in macro code for word processing or spreadsheet applications
 - 📌 executables: viruses that attach themselves to executables and are activated when the user launches the program
 - 📌 boot sector: viruses that copy themselves to the boot sector of hard drives allowing themselves to be loaded into memory each time the system is booted up.
 - 📌 stealth: attempts to avoid detection by redirecting hard drive read requests from the scanning software
 - 📌 polymorphic: has programming code enabling it to execute differently each time it is activated
- 📄 The hacker process:
 - 📌 Stage 1 Discovery: hacker gains information about the target system
 - 📌 Stage 2 Penetration: hacker chooses a target
 - 📌 Stage 3 Control: hacker attempts to control the system

- 📄 Defeating attacks:
 - 📄 Authentication provides unique identity upon presentation.
 - 📄 Access control grants various levels of file or directory permissions.
 - 📄 Data confidentiality provides protection of data from unauthorized access.
 - 📄 Data integrity provides protection against active threats that attempt to alter messages before they are sent or received.
- 📄 Auditing is the process of examining your systems and procedures to determine their efficiency.
 - 📄 status quo analysis: current level of security
 - 📄 risk analysis: determines which networks are vulnerable
 - 📄 threat analysis: determines probable attacks
- 📄 Intrusion-detection software (IDS) monitors traffic and shuts down any unsafe activity
- 📄 Authentication is the ability to determine a user's true identity.
- 📄 Three methods of authentication:
 - 📄 What you know (login, password)
 - 📄 What you have (key, smart card)
 - 📄 Who you are (physical attributes)
- 📄 Three types of encryption:
 - 📄 symmetric-key: one key is used; 40 or 128 bits
 - 📄 asymmetric-key: uses a pair of keys; one encrypts and one decrypts
 - 📄 one-way: uses a hash table
- 📄 A virtual private network (VPN) allows secure communication across long distances.
- 📄 VPNs are tunneling protocols, which means they encapsulate data packets into other data packets.
- 📄 RAS (Remote Access Service) requires users to dial-up and log on to a RAS server. (uses a callback feature)
- 📄 Point-to-point Tunneling Protocol is a popular VPN protocol.
- 📄 L2TP is an IETF tunneling protocol.
- 📄 IPSec provides packet level encryption.
- 📄 SSL allows private exchange over public networks.
- 📄 SSL uses digital certificates (asymmetric key).
- 📄 Digital Certificates contain digital signatures to ensure that a message has not been altered.
- 📄 Firewall: a secure system placed between a trusted network and an untrusted one (e.g. Internet)
- 📄 Firewalls allow users from a protected network to access a public network while making the protected network available to the public.
- 📄 A packet filter is a device that inspects a packet for predefined content; works at the Data Link, Network, and Transport Layers of the OSI/RM.
- 📄 A Proxy Server replaces IP addresses on a network with another contingent address.
 - 📄 circuit-level gateway: proxy between the Internet and internal systems
 - 📄 application-level gateway: can serve as an SMTP firewall
- 📄 Firewall Topology:
 - 📄 packet filter: inspects only Internet addresses and port numbers
 - 📄 single-homed bastion: one computer acts as a firewall and a network interface
 - 📄 dual-homed bastion: has two or more NICs with IP forwarding disabled
 - 📄 screened subnet (demilitarized): creates a secure space between the Internet and a network

CIW-Internet Fundamentals

- ❏ The Internet was formed in 1968 by the Advanced Research Project Agency and was originally called ARPANET.
- ❏ In 1989, ARPANET decommissioned and switched over to National Science Foundation (NSFNet).
- ❏ The World Wide Web resembles an electronic library; each location is like a book.
- ❏ Hypertext Markup Language (HTML): standard authoring language used to develop Web pages.
- ❏ The Web is not a network like the Internet, but a set of software programs.
- ❏ Internet communication is made possible by TCP/IP.
- ❏ TCP/IP divides data into packets and sends each packet separately across the Internet.
- ❏ Every device on the Internet has an Internet Protocol (IP) address.
- ❏ IP address format is referred to as dotted quads.
- ❏ Internet Protocol version 6(IPv6) is the new protocol for the Internet.
- ❏ Ipv6 supports approximately four trillion IP addresses by using 128-bit IP addresses.
- ❏ Ipv6 solves address shortages as well as a routing table problem inherent with the current Internet Protocol version 4 (IPv4)
- ❏ The Client/Server model is a distributed computing system in which tasks are divided between the server and the client.
- ❏ Three elements required for the client/server model:
 - ❑ client software application on the end user's host
 - ❑ server-software application on the information provider's host
 - ❑ network hardware allowing communication between the client and server
- ❏ The Internet was initially designed to operate on the UNIX operating system.
- ❏ Pull technology refers to a computer that requests information from another computer.
- ❏ Push technology sends data to a computer without the request.
- ❏ Six elements are required to support an Internet client:
 - ❑ computer
 - ❑ operating system
 - ❑ TCP/IP
 - ❑ client software
 - ❑ Internet connection
 - ❑ Internet addresses
- ❏ Connection types:
 - ❑ dial-up: use a modem to connect to the Internet
 - ❑ direct: continuous access to the Internet
- ❏ Serial Line Internet Protocol (SLIP) has been replaced by Point-to-Point Protocol (PPP) for the following reasons:
 - ❑ SLIP only supports IP addresses whereas PPP supports other protocols
 - ❑ SLIP does not support authentication
- ❏ Direct Internet connection types:
 - ❑ LAN
 - T1: 1.544 Mbps
 - T3: 44.736 Mbps
 - ❑ Cable
 - 512 Kbps-52Mbps
 - ❑ DSL
 - 512 Kbps-10Mbps

- 📄 HTTP is the protocol used to transfer Web pages from a Web server to a Web client.
- 📄 FTP is the protocol used to transfer files between computers.
- 📄 SMTP is the protocol used to send e-mail.
- 📄 POP is the protocol used to receive e-mail.
- 📄 IMAP is the protocol used to sort e-mail once it arrives on the server; it forwards the e-mail to the correct SMTP client.
- 📄 Telnet is the protocol used with shell accounts (text only).
- 📄 Usenet newsgroups use NNTP.
- 📄 Gopher is an older menu-based program in UNIX based systems.
- 📄 Domain Name System translates IP addresses into recognizable names.
- 📄 A fully qualified domain name (FQDN) is the complete domain name of an Internet computer.
- 📄 Top-level domains:
 - 📄 .com
 - 📄 .edu
 - 📄 .gov
 - 📄 .mil
 - 📄 .org
 - 📄 .net
 - 📄 .int
- 📄 Internet Corporation for Assigned Names and Numbers (ICANN): verifies which companies can serve as domain name registrars.
- 📄 Internet Network Information Center (InterNIC): the company that registers domain names on the Internet.
- 📄 Virtual domain: provides a private Web address, regardless of where the Web site is hosted
- 📄 Uniform Resource Locator (URL): text string that supplies the Internet address, and the method by which it can be accessed.
- 📄 Intranet: an in house Web site used by employees within a company
- 📄 Extranet: a Web site provided for existing customers, not available to the Internet public

Lesson 2: Browsing the World Wide Web

- 📄 Tim Berners-Lee created the World Wide Web at the European Laboratory for Particle Physics (CERN).
- 📄 The Worldwide Web Consortium (W3C) promotes standards and encourages interoperability among Web products.
- 📄 Legacy applications are applications that have existed for many years.
- 📄 The History folder allows easy access to previously viewed Web pages in your Web browser.
- 📄 Browser cache is a folder on your hard drive that stores downloaded files.
- 📄 Two situations when image loading should be disabled:
 - 📄 when conducting research
 - 📄 when there is a slow Internet connection
- 📄 Wireless Application Protocol (WAP): standard protocol for wireless devices
- 📄 Wireless Markup Language (WML): markup language that allows text portions of Web pages to be presented to wireless devices

Lesson 3: E-Mail

- 📄 All e-mail addresses use the following format:
 - 📄 [name@domain](#)
- 📄 E-mail is sent using SMTP
- 📄 In order to send e-mail you must configure the following:
 - 📄 an SMTP server address
 - 📄 an e-mail address
- 📄 E-mail is received using POP or IMAP.

- 📁 In order to receive e-mail you must configure the following:
 - 📁 a POP server address
 - 📁 an account name
 - 📁 an account password
- 📁 Netiquette is common sense, politeness, and general rules for Internet etiquette.
- 📁 An e-mail signature is a few lines of text at the bottom of each of your sent messages.
- 📁 An employer has legal ownership of any e-mail created at your job.
- 📁 E-mail is a written record
- 📁 Almost any kind of file can be attached to an e-mail message.
- 📁 Mailing lists allow hundreds of people to discuss tightly focused topics.

Lesson 4: FTP, Telnet, and Newsgroups

- 📁 FTP is a TCP/IP suite protocol that allows the transfer of files between computers.
- 📁 Two types of resources available by FTP are:
 - 📁 large text files
 - 📁 binary files: a file made up of ones and zeros
- 📁 The GET command is used to download a file using FTP.
- 📁 The PUT command is used to upload a file using FTP.
- 📁 Newsgroups are loosely part of a bulletin-board system called UseNET (User Network).
- 📁 10 Internet wide categories of newsgroups:
 - 📁 biz: entirely commercial topics
 - 📁 comp: topics related to computers
 - 📁 news: topics related to Usenet news
 - 📁 rec: topics related to recreation
 - 📁 sci: scientific topics
 - 📁 soc: social discussions
 - 📁 talk: controversial topics
 - 📁 humanities: humanities
 - 📁 misc: miscellaneous topics
 - 📁 alt: adult-oriented; alternative topics
- 📁 Newsgroups have a standard tree structure.
- 📁 Telnet is similar to a dial-up shell account.
- 📁 Telnet is a protocol used on a UNIX operating system.

Lesson 5: Objects, Plug-Ins, and Viewers

- 📁 Objects enable Web authors to include numerous multimedia effects, also called active content, into Web sites.
- 📁 C is a programming language used primarily to create operating systems.
- 📁 Object-Oriented Programming (OOP) is a programming concept based on objects and data instead of logic and action.
- 📁 C++ is a superset of C that uses OOP.
- 📁 Java is an OOP that is cross-platform functional.
- 📁 Java applets are programs written in Java and designed to run within a web browser.
- 📁 Java applets can be dynamic and interactive
- 📁 Java applet special effects include:
 - 📁 inline video, changing text, and animation: dynamic objects that can be embedded in Web pages without the need for external applications or plug-ins
 - 📁 audio: sound files that play when an applet is invoked
 - 📁 user interaction: interaction between the user and a displayed applet
 - 📁 real-time data feeds: feeds that maintain an open connection between the server and an applet on a Web page
- 📁 JavaScript was the first scripting language developed exclusively for online content design.
- 📁 JavaScript is an event driven scripting language.
- 📁 Java is an object-oriented programming language.

- ☐ Java can create stand-alone applications and Java applets.
- ☐ JavaScript must reside within HTML documents to run.
- ☐ JavaScript adds interactivity to Web pages without the need for specialized server-based programs.
- ☐ Jscript is the Microsoft version of JavaScript.
- ☐ ActiveX is an open set of technologies for integrating components on the Internet and within Microsoft applications
- ☐ ActiveX objects can play sounds, show video clips, animation sequences, or demonstrate 3-D reality simulations.
- ☐ VBScript is Microsoft's response to JavaScript.
- ☐ VBScript can manipulate objects in two categories:
 - ☑ standard HTML object: display button, radio button, check box, or password field
 - ☑ ActiveX control: more powerful and flexible; invoked by user action
- ☐ A Plug-In is a program installed as part of the Web browser to extend its functionality.
- ☐ Three ways in which a plug-in can appear:
 - ☑ full-screen: the plug-in completely fills the browser
 - ☑ embedded: the plug-in appears as part of a larger document
 - ☑ hidden: the plug-in is not visible but running in the background
- ☐ Two types of plug-in installation are:
 - ☑ online: installed with the browser open
 - ☑ offline: requires download and installation
- ☐ Types of plug-ins:
 - ☑ RealPlayer: used for streaming audio and video
 - ☑ Shockwave and Flash: a group of multimedia players that deliver animation, sound, and graphics
 - ☑ QuickTime: method of storing video and audio files in digital format
 - ☑ Windows Media Player: standards based plug-in that plays streaming audio and video
- ☐ Virtual Reality Modeling Language (VRML) is a three dimensional authoring language that features the following:
 - ☑ high performance viewing: 3-D spaces can be accessed at high speeds
 - ☑ animation: VRML accommodates objects with lifelike behaviors
 - ☑ navigation: VRML enables 3-D navigation via simulated walking, flying, or pointing
- ☐ Viewers are scaled-down versions of applications; designed for viewing and printing files.
- ☐ Types of viewers:
 - ☑ Microsoft PowerPoint Viewer: allows you to view Microsoft PowerPoint slides presentations
 - ☑ Adobe Acrobat Reader: allows you to view files created in Adobe Acrobat
 - portable document format: a general file format that can be created and read on any computer, regardless of the operating system
- ☐ Moving Pictures Expert Group (MPEG): a standard for digital audio and video compression that provides extremely high quality and resolution
 - ☑ MPEG plug-ins allow browsers to view MPEG video that has been formatted with proprietary software.
 - ☑ MPEG video files are not inherently bandwidth-friendly and do not stream well on slower connections.
- ☐ MPEG-1 Audio Layer-3 (MP3) is a standard for compressing audio files that uses the MPEG-1 standard; it compresses audio files to one-twelfth its original size.
- ☐ MP3 files are non-streaming in that users download them before playing the files.
- ☐ LiveVideo is Netscape's built-in support product for standard Audio Video Interleave (AVI) files; it allows users to instantly view AVI movies embedded in Web pages, without downloading the files for later playback.
- ☐ RealTime Streaming Protocol (RTSP): streaming format that can be embedded and directly executed within the Netscape Navigator browser; it is fully cross-platform.

- 📁 Types of audio files:
 - 📁 Audio Interchange File Format (AIFF): high quality audio format developed by Apple
 - 📁 AU: audio format used by UNIX servers
 - 📁 MIDI
 - 📁 Waveform (WAV)
- 📁 Encapsulated PostScript (EPS) is a file format that can be used to import and export graphic files between operating systems and applications.
- 📁 EPS provides three preview formats:
 - 📁 PICT: Macintosh
 - 📁 TIFF: IBM-compatible
 - 📁 EPSI: platform-independent
- 📁 Tagged Image File Format (TIFF) is a popular customizable graphic format commonly used for medical imaging and desktop publishing.
- 📁 TIFF supports grayscale, 8-bit and 24-bit color, and monochrome formats.
- 📁 Rich Text Format (RTF) is a portable text file format created by Microsoft that allows image insertion and text formatting.
- 📁 RTF is a level above simple DOS text formatting.
- 📁 RTF is a near-universal format.

Lesson 6: Search Engines

- 📁 A search engine is a powerful software program that searches the Internet for specified information.
- 📁 Keywords are used to find information on a specific subject.
- 📁 A “relevancy” is used to determine how closely a Web site matches your topic.
- 📁 The <META> tag is used to embed information for searches into a Web page.
- 📁 <META> information can be:
 - 📁 keywords
 - 📁 an expiration date
 - 📁 author of the web site
 - 📁 a site description
- 📁 Three types of search indexes:
 - 📁 static index/site map: allows users to manually search through directories to located indexed information
 - 📁 keyword index: allow users to enter keywords into a search engine to query an index
 - 📁 full text index: allows users to enter any text string that might exist within a file into the search engine
- 📁 Yahoo finds three types of information:
 - 📁 alphabetized hypertext categories that match the keywords entered into the search engine
 - 📁 sites that match the keywords entered into the search engine
 - 📁 Yahoo categories that list those end sites
- 📁 AltaVista was originally designed to index the entire Internet.
- 📁 Lycos is one of the largest and most complete databases.
- 📁 WebCrawler was started as a private project to offer free searching to Internet users.
- 📁 Excite not only allows keyword searches, but also contains a cross-referencing field for conceptual searches.
- 📁 Boolean operators allow users to narrow their searches by requiring important keywords or excluding keywords that may not be pertinent to a search. (AND, OR, NOT, NEAR)
- 📁 A static index search for graphic files is located at Surf Madison Public File Libraries.
- 📁 People search databases are created through:
 - 📁 Internet activity (people who are online)
 - 📁 A registration process, whereby the individual must submit his or her personal data before listed.
 - 📁 Traditional telephone books, proprietary phone listings, and other public directories that list people who are not necessarily connected to the Internet.

- 📄 Sites devoted to mailing list searches are:
 - 📄 Listz
 - 📄 Publicly Accessible Mailing Lists (PAML)
- 📄 Deja.com is a way to search for Newsgroups according to subject.
- 📄 Archie conducts searches on FTP sites using a Telnet or Archie client.
- 📄 Web search engines have almost replaced Archie.
- 📄 Gopher allows users to navigate and search computers without the addresses of the servers that store the information.
- 📄 Gopher uses a search method called tunneling.
- 📄 Very Easy Rodent-Oriented Netwide Index (VERONICA) is used to search Gopher servers.

Lesson 7: Security

- 📄 Cookies are small text files created by a Web server that resides on a client's computer.
- 📄 Cookies allow Web site managers to gain marketing information about their visitors, and can customize their Web site to a visitor's preferences.
- 📄 Cookies are saved in different locations, depending on which browser you are using.
- 📄 Encryption is used to scramble data between your computer and a secure web server.
- 📄 A secure Web site is identified by using the protocol https://.
- 📄 Authentication means verifying the identity of the user who logs on to a system. It is also used for verifying integrity of transmitted data.
- 📄 Types of authentication:
 - 📄 anonymous access: no user name or password is required
 - 📄 basic authentication: user name and password are required but no information is encrypted.
 - 📄 secure authentication: user name and password required and encrypted
 - 📄 digital certificates: you must have the proper digital certificate to gain access to the site
- 📄 A digital certificate is a digital ID issued by a certificate authority to authenticate and validate Internet data transfers.
- 📄 Each browser offers its own security features.
- 📄 Encryption is the encoding or scrambling of information using algorithms known as a key.
- 📄 A key is a string of numbers used by software that scrambles plain text messages into encrypted text.
- 📄 Typical encryption uses either 40-bit or 128-bit keys.
- 📄 A virus is a malicious program designed to damage computer systems.
- 📄 Virus updates are important for anti-virus software because not even the best virus program will not protect if the anti-virus files are outdated.
- 📄 A proxy server is an intermediary between a LAN and the Internet.
- 📄 A proxy server provides enhanced security and caching functions.
- 📄 Proxy servers provide the following services:
 - 📄 caching of Web documents reducing network traffic
 - 📄 corporate firewall access providing safe passage for users through a firewall
- 📄 A firewall is the collection of hardware, software, and policy that protects a LAN from the Internet.
- 📄 A firewall performs the following functions:
 - 📄 restricts unauthorized users
 - 📄 retains control of private information
 - 📄 prevents unauthorized export of data and information
- 📄 The most common type of firewall is called a screen. It blocks traffic on specific routes of access, but allows designated travel to specific sites.

Lesson 8: E-Commerce

- 📄 E-Commerce is the integration of communications, data management, and security capabilities to allow the exchange of information related to the sale of goods and services.

- ☞ Three main elements of e-commerce:
 - ☑ communication: support the transfer of information from buyer to seller
 - ☑ data management: define the exchange format of information
 - ☑ security: authenticate the source of information and guarantee integrity and privacy
- ☞ Two types of e-commerce:
 - ☑ business-to-business: high volume, low price
 - ☑ business-to-consumer: high price, low volume
- ☞ Electronic Document Interchange (EDI): interorganization exchange of documents in standardized electronic form directly between participating computers.
- ☞ The goals of EDI:
 - ☑ to enable easy and inexpensive communication of structured information throughout the lifetime of an electronic transaction
 - ☑ to reduce the amount of data capture and transcriptions
 - ☑ to ensure faster handling of transactions to get an equivalent increase in cash flow
- ☞ EDI is encoded in a format governed by ANSI X12, and UN/EDIFACT.
- ☞ Companies that should use EDI:
 - ☑ handle a large volume of repetitive standard transactions
 - ☑ operate on a very tight margin
 - ☑ face strong competition, requiring productivity improvements
 - ☑ operate in a time sensitive environment
 - ☑ received requests from partner companies to convert to EDI
- ☞ Secure Electronic Transactions (SET) a standard protocol used on the Internet to secure online credit card payments
- ☞ Principal features of SET:
 - ☑ enhanced identification
 - ☑ merchant never sees the credit card number
 - ☑ all sensitive information must be encrypted and signed
 - ☑ designed to support credits, returns, reversals, and charge backs
- ☞ A payment gateway is a system that interfaces between the merchant and the merchant's bank to perform credit card authorizations
- ☞ Unicode is a text and script character standard that can interchange, process, and display text of all languages.
- ☞ Three models of payment processing:
 - ☑ cash model: the hardest to implement
 - ☑ check model: funds are not transferred in real time
 - ☑ credit model: immediate response for all transactions
- ☞ A smart card replaces the magnetic strip of a credit card with an integrated circuit for storing and processing data.
- ☞ Smart cards enhance authentication.
- ☞ Secure Sockets Layer is a technology embedded in Web servers and browsers that encrypts traffic.
- ☞ Copyright laws protect original works fixed in a tangible medium of expression; elements include expression and originality.
- ☞ The Information Infrastructure Task Force (IITF) codifies copyright laws.
- ☞ The World Intellectual Property Organization (WIPO) is a specialized UN agency formed to protect worldwide intellectual property.
- ☞ In order to license someone else's copyrighted material, you must contact the owner and ask for permission.
- ☞ A trademark is a word, slogan, symbol, name, package design, or device that marks and distinguishes a product from other products in trade.

- 📄 Two ways to implement a storefront:
 - 📁 in-house solution:
 - complete control of the hardware and software infrastructure
 - easier integration into existing back-end enterprise systems
 - 📁 instant storefront:
 - quick and easy to implement
 - less expensive
 - ❖ online: uses the service provider's infrastructure
 - ❖ offline: build and maintain the storefront offline and publish the contents to the Internet
- 📄 Project management is a set of techniques, practices, and principles that assist in controlling the main elements of a project.
- 📄 A project is a temporary effort to create a unique product such as an e-commerce site.
- 📄 The main elements of a project are:
 - 📁 project schedule
 - 📁 costs
 - 📁 performance risks
- 📄 Scope is the size of a project
- 📄 Scope creep is gradual changes in the scope.
- 📄 The Design Development Project Cycle is as follows:
 - 📁 business process/functionality design: the overall goals of the project
 - business requirements document: identifies the customers' needs
 - scope matrix document: lays out the project scope
 - 📁 technology/architecture design: plans the project's design
 - technical architecture document: contains design and formal specifications of the product
 - 📁 implementation/development: developing the product according to the project plan
 - 📁 pilot/parallel: inspecting and testing the product
 - testing hot links: make sure all links function properly
 - testing different browsers: make sure the Web pages render in as many browsers as possible
 - testing for e-commerce site failure and corruption: make sure the e-commerce aspects of the site function properly
 - testing heavy traffic: make sure the Web servers can handle many simultaneous users
 - testing various connection speeds: make sure all users can download pages and content in a reasonable amount of time
 - 📁 cutover/live: live release of the product
- 📄 Two key resources of Project Management are:
 - 📁 Project Management Institute (PMI) is a non-profit membership organization that publishes standards and offers education regarding the project management profession.
 - 📁 The International Organization for Standardization (ISO) 9000 series is a worldwide grouping of national standards bodies from more than 120 countries.

CIW-Internet Fundamentals

Lesson 1: Introduction to Web Page Authoring

- 📄 HTML is the standard authoring language used to develop Web pages.
- 📄 Wireless Application Protocol (WAP): standard protocol for wireless devices
- 📄 Wireless Markup Language (WML): markup language that allows text portions of Web pages to be presented to wireless devices
- 📄 Text editors require that you write HTML code manually.
- 📄 GUI editors allow you to create HTML pages without touching the actual code.
- 📄 Accessible Web pages have two characteristics:
 - a user friendly interface “front-end”
 - easy download to visitor’s computers “back-end”
- 📄 An accessible Web page should:
 - incorporate attractive images and graphical elements
 - contain constantly updated content
 - use tables wisely
 - present carefully designed forms
 - use the most current technologies appropriately
 - use images sparingly
 - be easily navigable
 - provide alternate navigation links
- 📄 Design and branding standards focus on:
 - target markets
 - market messages
 - media choices
 - color combinations
 - sales strategies
 - technologies to use
- 📄 Because HTML pages require a relatively small amount of disk space, they are easy to download over a network.
- 📄 Any file downloaded over a network requires bandwidth.
- 📄 HTTP 404: the requested file does not exist on the server

Lesson 2: Hypertext Markup Language (HTML)

- 📄 Tim Berners-Lee of MIT created HTML, along with his colleagues from CERN, as a means of distributing nonlinear text to multiple points across the Internet.
- 📄 Hyperlinks are embedded instructions within a text file that link it to a separate file.
- 📄 Hypertext was originally conceived by Ted Nelson in 1965.
- 📄 HTML files are plain text files that have been “marked up” with tags.
- 📄 Tags are code that is enclosed in angle brackets that provide instructions to programs that interpret HTML.
- 📄 The World Wide Web Consortium (W3C) is a standards organization that controls the evolution of HTML.
- 📄 HTML 3.2 is an older but still functional standard.
- 📄 HTML 4.01 is the latest version of HTML, which allows cascading style sheets and support multiple languages.
- 📄 Cascading Styles Sheets (CSS) is a technology that uses embedded information to define fonts, colors, and phrase elements used on an HTML page.
- 📄 Three flavors of HTML 4.01:
 - transitional: allows developers to insert formatting using CSS or traditional layout instructions
 - strict: requires exclusive use of CSS
 - frameset: required for pages that use frames

- 📄 XHTML combines HTML and Extensible Markup Language (XML).
- 📄 XHTML uses the same flavors as HTML 4.01.
- 📄 A Web Browser is an application designed to render hypermedia.

Lesson 3: HTML Coding

- 📄 HTTP is the protocol used for transporting HTML files over the Internet.
- 📄 Two types of HTML tags:
 - 📄 container tags: used in pairs; has an opening and closing tag
 - 📄 empty tags: stand-alone; does not have a closing tag
- 📄 Tags are not case-sensitive.
- 📄 A tag can consist of three items inside the wickets:
 - 📄 element: the main instructions of the tag
 - 📄 attribute: specifies the quality or describes certain aspects of the element
 - 📄 value: gives value to the element and its attribute
- 📄 All HTML 4.01 documents must contain a <DOCTYPE>, <HEAD>, <TITLE>, and <BODY> tag.
- 📄 <HTML> identifies the document type as HTML.
- 📄 <HEAD> encloses the HEAD section of the document. The title of the document will appear in this section.
- 📄 <TITLE> encloses the text that will appear in the browser title bar when the page is loaded.
- 📄 <BODY> encloses the BODY of the document. Text typed in the BODY section will appear in the browser window when that page is loaded.
- 📄 The Document Type Declaration (DTD) or <!DOCTYPE> tag describes the nature of the HTML code.
- 📄 Two reasons for using the DTD tag:
 - 📄 consider the future and how code might be used
 - 📄 use DTD as an HTML validator
- 📄 Using the DTD tag improves the ability to work with browsers
- 📄 DTD statements are placed before the <HTML> tag.
- 📄 The <META> tag describes the contents of a page.
- 📄 Block-level elements are HTML elements that affect an entire paragraph or multiple paragraphs.
- 📄 Text-level elements are HTML elements that affect something as small as a character or a word.
- 📄 The <P> tag is a text-level element that defines the start of a new paragraph. It can be an empty or container tag.
- 📄 The
 tag specifies that a line break is to be inserted wherever the tag occurs;
 is always an empty tag.
- 📄 HTML uses six Heading Levels:
 - 📄 <H1> through <H6> are container tags and block-level elements.
- 📄 The <PRE> tag allows all line breaks and spacing to be displayed in a browser exactly how they are in the original text.
- 📄 The <DIV> container tag is used for indenting paragraphs.
- 📄 The <BLOCKQUOTE> container tag is used to center and indent text.
- 📄 The <CENER> container tag can also be used to center and indent text, but the HTML 4.01 recommendation deprecates this tag in favor of the <DIV> tag.
- 📄 Text-level elements include:
 - 📄
 - 📄
 - 📄 <I>
 - 📄
 - 📄 <U>
- 📄 and <I> are text-level elements. and are phrase elements.
- 📄 Lists are compound block-level elements used to create bulleted and numbered lists.

- 📄 There are two types of HTML lists:
 - 📌 ordered: a numbered list that uses the container tag
 - 📌 unordered: a bulleted list that uses the container tag
 - : the empty tag used to specify items in a list
- 📄 The syntax for including a comment within your document is as follows:
 - 📌 <!-- comment -->

Lesson 4: HTML Horizontal Rules and Graphical Elements

- 📄 The <HR> empty tag is used to create a horizontal line in an HTML document.
- 📄 Attributes of the <HR> tag:
 - 📌 ALIGN: used to align the horizontal rule on the left, right, or center of the page
 - 📌 NOSHADE: used to remove the 3-D shading from the line
 - 📌 SIZE: specify the size in pixels of the line
 - 📌 WIDTH: specify the percentage of the window or the width in pixels of the line
- 📄 The empty tag displays a graphic image.
 - 📌 The key attribute is SRC, this is the source of the image to be displayed.
 - 📌 Image file formats:
 - Graphics Interchange Format (GIF): supports fewer colors than JPEG
 - ❖ GIF 87a
 - ❖ GIF 89a: supports transparency, interlacing, and animation
 - Joint Photographic Experts Group (JPEG): supports more colors and file compression
 - Portable Network Graphics (PNG): proposed as a future standard; compresses the image further than JPEG; combines technology of GIF and JPEG
 - 📌 ALIGN attributes for the tag:
 - BOTTOM
 - MIDDLE
 - TOP
 - LEFT
 - RIGHT
 - 📌 The ALT attribute designates alternate text to appear in the browser while the graphic is loading or in non-graphical browsers.
- 📄 HTML used to create special characters:
 - 📌 ©: © or ©
 - 📌 ®: ® or ®
 - 📌 `e: é
 - 📌 <: <
 - 📌 >: >
 - 📌 no breaking space:
- 📄 There are currently 216 Web safe colors.
- 📄 Dithering is the ability of computers to approximate a color by combining the RGB values.
- 📄 BGCOLOR: attribute that adds color to the background of an HTML document
 - 📌 hexadecimal values: 00-FF
 - 📌 RGB values: 0-255
 - 📌 color names: blue, green, etc.
- 📄 TEXT: attribute used to designate text color
- 📄 ALINK: used to specify the color of a hyperlink upon mouse press
- 📄 LINK: used to specify the color of an unvisited hyperlink
- 📄 VLINK: used to specify the color of a visited hyperlink
- 📄 BACKGROUND: attribute used to specify a background image of an HTML document
- 📄 The container tag allows the change of font size, color, and typeface in an HTML document.
 - 📌 size: 1-7
- 📄 CSS has deprecated the tag in HTML 4.01.

Lesson 5: HTML Hyperlinks

- 📄 Links are created using the <A> anchor tag; this is a container tag.
- 📄 HREF: attribute used to specify the target of a link
- 📄 Internal links require internal bookmarks to be specified within the document; this is done with the anchor tag.
- 📄 Two steps for creating internal links:
 - 🔖 use <A> with the name attribute to define an area as a target
 - 🔖 create a link that points to that target

Lesson 6: HTML Tables

- 📄 Tables were first introduced in HTML 2.0.
- 📄 The <TABLE> container tag is used to create tables in HTML.
 - 🔖 Attributes for the <TABLE> tags:
 - BORDER: thickness of the outside line
 - CELSPACING: spaces between cell border and text
 - CELLPADDING: distance between cells
 - WIDTH: width in pixels or percentage
- 📄 The <CAPTION> container tag is an optional tag that can be used to add an attached caption.
- 📄 The <TR> container tag is a required tag that contains all data from the current row.
- 📄 The <TH> container tag is an optional tag that can be used to designate that top row or left column.
- 📄 The <TD> container tag is a required tag unless you are using the <TH> tag. This tag encloses all table contents.
- 📄 The ALIGN attribute specifies the horizontal alignment in an HTML table.
- 📄 The VALIGN attribute specifies the vertical alignment in an HTML table.
- 📄 Elements that can use the VALIGN attribute:
 - 🔖 <TR>
 - 🔖 <TH>
 - 🔖 <TD>
- 📄 Elements that can use the ALIGN attribute:
 - 🔖 <TABLE>
 - 🔖 <TR>
 - 🔖 <TH>
 - 🔖 <TD>
 - 🔖 <CAPTION>
- 📄 ROWSPAN and COLSPAN allow rows and columns to be span across multiple rows or columns.

Lesson 7: HTML Forms

- 📄 Truly functional HTML forms use Common Gateway Interface (CGI).
- 📄 CGI can use server-side or client-side scripting.
- 📄 CGI scripts on the server perform two functions:
 - 🔖 receives data from the Web browser
 - 🔖 processes and formats the data
- 📄 The <FORM> container tag is used to create an HTML form.
- 📄 The <FORM> element has two attributes:
 - 🔖 METHOD: specifies which method the browser will use to send the form data to the server
 - GET: data is appended to the URL for use in a query string
 - POST: data is posted to the URL that is specified in the code
 - 🔖 ACTION: specifies the name and location of the CGI script used to process the form

- 📄 The <INPUT> empty tag is used to create text boxes, check boxes, radio buttons, and the Submit and Reset buttons in an HTML form.
- 📄 The <SELECT> container tag is used to create lists and multi-select lists.
- 📄 The <TEXTAREA> container tag is used to create a text area.
- 📄 <INPUT> and <SELECT> use the TYPE attribute to designate whether you want a text box, radio button, select list, and so forth.
- 📄 The NAME attribute identifies information from a user and associates it with the value specified.
- 📄 A text box is used to collect a single line of data. It is the most common form field.
 - 📌 SIZE: specifies the width of the text box in pixels
 - 📌 MAXLENGTH: restricts user entries to the specified number of characters
- 📄 The Submit button sends data processed by the ACTION attribute.
- 📄 The Reset button resets all fields in the form.
- 📄 Radio buttons are never stand-alone items. They are reserved for two or more mutually exclusive options and they share the same NAME attribute.
- 📄 Check boxes are used for non-exclusive choices. You can check more than one item if you choose.
- 📄 Select lists are drop-down lists of predetermined options
 - 📌 The value passed on when the user clicks Submit is contained within the <OPTION> element.
 - 📌 The MULTIPLE attribute allows for multiple options.
 - 📌 The SIZE attribute determines how many items will appear in the list box.
- 📄 The textarea element is used to gather more than one line of text from a user.
 - 📌 <TEXTAREA> is a container tag.
 - 📌 Attributes of the <TEXTAREA> element:
 - COLS: width of the text box
 - ROWS: number of rows of text to display
 - WRAP: "none" means the text will continue on one line of the text box; "virtual" means the text will wrap as it approaches the border of the text box

Lesson 8: HTML Image Techniques

- 📄 An image map is a set of coordinates that creates a "hot spot" on a particular image. The "hot spots" act as hyperlinks once they are clicked on.
- 📄 An image map can use client-side or server-side scripting. Server-side image maps require a CGI script.
- 📄 The USEMAP attribute indicates that an image is being used with a map.
- 📄 <MAP> is the container tag used to define an image map.
- 📄 <AREA> is the empty tag used to specify what coordinates and shape the "hot spots" are going to be.
- 📄 The SHAPE attribute can be any of the following:
 - 📌 rect: any two points can define a rectangle
 - 📌 circle: defined by two coordinates and a radius
 - 📌 polygon: defined by each individual point of the polygon; up to 100 pair of coordinates
- 📄 GIF 89a supports transparency.
- 📄 PNG files can also be transparent.
- 📄 Interlacing allows an image to progressively display as it is downloaded into the browser.
- 📄 An interlaced image scans left to right:
 - 📌 1st pass: 13%
 - 📌 2nd pass: 25%
 - 📌 3rd, 4th, and 5th pass: 25%
- 📄 GIF 87a, 89a, and PNG support interlacing.
- 📄 GIF 89a supports animation.

Lesson 9: HTML Frames

- 📄 Frames are panes created in HTML in which individual pages can be displayed in separate scrollable regions; a single element of a frameset is also known as a frame.
- 📄 A frameset document is a Web page that defines a set of frames in which other pages are displayed in each frame.
- 📄 Frames combine static and dynamic information.
- 📄 The <FRAMESET> container tag allows a defined region in the browser window and assign separate files to each region; requires the COLS and ROWS attribute.
- 📄 The COLS and ROWS attributes designate the number and size of each frame in a browser window.
- 📄 The <FRAME> empty tag defines the content in each frame and is contained within the <FRAMESET> tag.
- 📄 The SRC attribute specifies what file appears in each frame.
- 📄 In a frameset document, <FRAMESET> replaces the <BODY> tag.
- 📄 The <FRAMESET> tag is placed immediately after the closing </HEAD> tag.
- 📄 The <FRAMESET> tag must contain the ROWS or COLS attribute but both attributes cannot appear in the same <FRAMESET>.
- 📄 The <NOFRAMES> container tag is used to display text in browsers that do not support frames.
- 📄 The TARGET attribute is used to specify which frame to open a hyperlink in.
- 📄 The <BASE> empty tag allows you to specify the URL and default TARGET frames to use for all hyperlinks in a file.
- 📄 The <BASE> tag goes in the <HEAD> section of an HTML document.
- 📄 The FRAMEBORDER attribute designates the appearance of a border around each frame.
 - ❑ 0: no border
 - ❑ 1: border
- 📄 The MARGINWIDTH and MARGINHEIGHT attributes designate the space in pixels between the frame's contents and the left and right or top and bottom margins.

Lesson 10: Graphical User Interface (GUI) HTML Editors

- 📄 WYSIWYG (wiz-ee-wig): an HTML editor with a GUI interface.
- 📄 Page editors only allow the design of individual Web pages.
 - ❑ Netscape Composer
 - ❑ Microsoft FrontPage Express
- 📄 Site management editors provide page creation and site management functionality.
 - ❑ Macromedia Dreamweaver
 - ❑ Microsoft FrontPage
 - ❑ Allaire HomeSite
- 📄 Some basic features offered by most GUI editors include:
 - ❑ Templates and Wizards: create custom pages to meet your specifications
 - ❑ Text Style Options: insert text in different styles, alter and apply formats
 - ❑ Icon Bars: perform the same function as those in text-based toolbars
 - ❑ Inline Images: easily insert graphics into a Web page
 - ❑ Hypertext Links: created links to other pages and files
 - ❑ Import HTML Pages: import Web pages from the Internet and save them to a local drive
 - ❑ Table Creation: add tables to arrange data and organize page layout
 - ❑ Publish Documents: post pages to a Web server with the click of a button

Lesson 11: HTML Extensions

- 📄 Cascading Style Sheets: a specification for creating lists of formatting instructions with which you can customize your Web pages.
- 📄 HTML 4.01 strict demands the use of CSS.

- 📄 CSS is broken down into four elements:
 - 📄 selector: any HTML element you want to include
 - 📄 declaration: the Property and Value assigned to the selector
 - 📄 property: the customization of the selector
 - 📄 value: defining the property (color, size, font)
- 📄 The HTML element is the selector in CSS.
- 📄 You should separate each declaration with a semicolon.
- 📄 CSS1 can be applied in four ways:
 - 📄 inline style: modify the HTML inside the <BODY> of an HTML document using the container tag or the <STYLE>empty tag.
 - 📄 embedded style sheet: use the <STYLE> tag within the <HEAD> of an HTML document
 - embedded styles remain in force until overridden with an inline style
 - 📄 external (linked) style sheet: ensures that all pages have the same look and feel; uses a two part strategy:
 - create a text file separately from the HTML document
 - <LINK> the created file within the <HEAD> tag of an HTML document
 - 📄 imported style sheet: a link to an external file that contains the @import url(filename.css) at the beginning of the document
- 📄 JavaScript is an object-oriented scripting language that allows interactivity to Web pages.
- 📄 JavaScript must reside within an HTML document.
- 📄 Object-Oriented Programming: programming that links data to the processes that manipulate it.
- 📄 The <SCRIPT> container tag is used to embed JavaScript into an HTML document.
- 📄 The alert () and prompt () functions allow the author to communicate with the user.
- 📄 The document.write () function places output text to the window.
- 📄 JavaScript can be used for copyright protection.
- 📄 Dynamic HTML (DHTML) is an HTML enhancement that allows for animation, interaction, and dynamic updating in Web pages.
- 📄 Some features of DHTML:
 - 📄 automatic adjustment of font sizes
 - 📄 absolute positioning
 - 📄 new document content without refreshing the page
 - 📄 granular control over animation, audio, and video
- 📄 Three technologies need to be mastered in order to use DHTML:
 - 📄 HTML 4.01
 - 📄 CSS
 - 📄 Document Object Model (DOM)
- 📄 The Document Object Model (DOM) describes the elements within a document rendered by a Web browser.
- 📄 To use the DOM for any Web browser, you must use a scripting language.
- 📄 Extensible HTML (XHTML) is a combination of XML and HTML.
- 📄 XML allows you to create your own markup language by describing the function and context of the content within a document.
- 📄 XML is a reduced version of the Standard Generalized Markup Language (SGML).
- 📄 Two characteristics of XML:
 - 📄 it must be well formed
 - 📄 it must be valid
- 📄 Well formed XML:
 - 📄 must contain the DTD: defines the validity of all subsequent tags
 - 📄 root element: a container tag that surrounds all others
 - 📄 property declared container tags (there are no empty tags in XML)
 - 📄 think ahead and define every element
 - 📄 tree structure
- 📄 Use a style sheet to format XML, either:
 - 📄 CSS
 - 📄 XSL (Extensible Style sheet Language): can transform XML into an HTML document