**CTI 120**

**Test #1 (chapters 1-6 Dean) Study Guide**

* Which OSI Model layer relies on routing protocols to find the best route for a packet? Network
* What device do you need if your network has multiple LANs that need to communicate with each other? Router
* With which topology are all the devices connected to a central switch? Star
* What protocol does an email client use to send an email to the first server? SMTP
* What should you look for if you want to know if your Web browser session is secure? HTTPS
* In which type of network does each computer control its own resources and communicate directly with other computers? Peer-to-peer
* On which layer of the OSI Model do you find both a connection–oriented and a connectionless protocol that is responsible for transporting data from one application to another? Transport
* Which of the following is required by the client–server model? Network operating system
* Which OSI Model layer sends bits over wired or wireless media? Physical
* Which topology is most likely to use a token? Ring
* What is the term for the use of the same network to deliver multiple types of communication services such as video, voice, and fax? Convergence
* Which of the following is an advantage of client–server networks over peer–to–peer networks? User accounts are assigned to one place
* Which type of network is the smallest geographically? PAN
* Five computers are connected to a switch in a star topology. What type of network is this? LAN
* Which part of a computer’s address is used by the host to access another network? Default gateway
* If you have a computer with two network adapters and want to see the IP address configuration for all the adapters, which command should you use? Ipconfig /all
* Which of the following is a valid IPv6 address? 2001:DB8::1
* What type of software can you use to capture and examine the contents of network messages? Protocol analyzer
* What protocol is used by the ping utility to send echo request and echo reply packets? ICMP
* How many octets is the network portion of a Class C address? 3
* What type of DNS server holds the master copy of a DNS zone and is responsible for transferring the data to another server when changes are made to the zone? Primary
* Which type of address is embedded on a NIC? MAC address
* Which of the following is the range of well–known Transport layer ports? 0 to 1023
* You want to find out if the TCP/IP services are working correctly on the computer you are working on. Which command should you use? Ping localhost
* What does the Transport layer use as an addressing method to identify an application running on a host? Port number
* Which port is used by the DNS process? 53
* Which utility uses the TTL value of an IP packet to elicit responses from routers along the path to the destination? Tracert
* What type of routing ensures that the routing table is updated when a router is added to the network? Dynamic
* What is the process by which routers learn about all of the devices on their network? Neighbor discovery
* What command should you enter to see the routing table on a Cisco router? Show ip route
* What command should you usually use first when troubleshooting an interface error? Ping
* Which troubleshooting tool should you use if you want to see details about TCP connections on a host? Netstat
* Which field in a TCP segment determines how many bytes of data may be transferred before the sending computer must receive an acknowledgement from the receiving computer? Window size
* What is the transmission called used by TCP to request a connection? SYN
* Which of the following is NOT a task typically performed by a router? Build a table that maps MAC addresses to ports
* Which TCP/IP protocol works with IPv4 to map MAC addresses to IPv4 address? ARP
* What type of device is used to guard against momentary increases in voltage? Surge protector
* What type of communication method is most like talking on a telephone? Full-duplex
* Which of the following is most likely to use fiber–optic cabling? Backbone wiring
* If you experience a temporary dimming of lights, what have you experienced? A brownout
* What is the highest layer of the OSI model at which NICs operate? Data link
* What feature should you look for in a UPS if your electrical power has a lot of noise? Line conditioning
* Where are you most likely to find an organization’s main servers? MDF
* Which standard describes structured cabling? TIA/EIA–568
* What can you use to do a physical component test on a NIC? Loopback plug
* What type of device should you consider for a network that frequently experiences total blackouts for long periods of time? Generator
* Where does a service provider’s network end and the customer network begin? At the demarc
* Which command should you use to test IPv6 functionality on the local NIC? ping ::1
* What type of transmission technology carries multiple signals on a single media and is used for cable Internet service? Broadband
* What type of device can be used to mitigate the effects of attenuation? Amplifier
* What device should you use to measure the amount of light that is transmitted on a fiber–optic line? OPM
* What type of cable do you need to connect two switches together when neither switch has an autosense function? Crossover
* Which of the following is NOT a type of fiber–optic cable connector? DB
* Which type of signal multiplexing is used with fiber–optic cable and divides a beam of light into 40 different wavelengths? WDM
* What type of signals vary infinitely and appear as a wavy line when graphed over time? Analog
* What type of connector is used with UTP cabling for Ethernet applications? RJ-45
* What property of twisted–pair cabling provides resistance to cross–talk? Twists
* On a fiber–optic cable, what surrounds the light–carrying fibers that reflects light back into the middle of the fiber? Cladding
* What type of noise occurs when a signal traveling on one wire infringes on the signal traveling on an adjacent wire? Cross-talk
* Which WLAN layout uses several APs that work as peer devices on the same network? Mesh
* What process allows a network technician to install an application onto a user’s mobile device to give the device trusted access to certain portions of the network? On-boarding
* What characteristic of wireless signals is caused by objects with small dimensions and rough surfaces? Scattering
* What type of antenna is best used for creating a wireless point–to–point link? Unidirectional
* What are the most common frequencies used on Wi–Fi networks? 2.4 GHz, 5 GHz
* Which WLAN layout should you use if you do not have an AP? Ad hoc
* Which security technique prevents an AP from authenticating a device that has not been approved? MAC filtering
* What Wi–Fi security threat uses a rogue access point with a legitimate–sounding SSID? Evil twin
* What does your mobile device need to do before it can access the Internet at a Wi–Fi hot spot? Make an association
* What method is used by 802.11 devices to access a shared medium? CSMA/CA
* The Seven-Layer OSI Model
  + Application - Describes the interface between two applications, each on separate computers. Application programs that provide services to a user, such as a browser and Web server using the HTTP Application layer protocol. Utility programs that provide services to the system, such as SNMP (Simple Network Management Protocol) programs that monitor and gather information about network traffic and can alert network administrators about adverse conditions that need attention. Data that is passed between applications or utility programs and the operating system is called a [**payload that is passed between applications or utility programs and the operating system, and includes control information.**](javascript://) payload Data that is passed between applications or utility programs and the operating system, and includes control information.
  + Presentation - responsible for reformatting, compressing, and/or encrypting data in a way that the application on the receiving end can read. For example, an email message can be encrypted at the Presentation layer by the email client or by the operating system.
  + Session - how data between applications is synced and recovered if messages don’t arrive intact at the receiving application. For example, the Skype application works with the operating system to establish and maintain a session between two end points for as long as a voice conversation or video conference is in progress. API call to make a request of the OS.
  + Transport - is responsible for transporting Application layer payloads from one application to another. The two main Transport layer protocols are TCP, which guarantees delivery, and UDP, which does not:
    - TCP (Transmission Control Protocol) - Makes a connection with the end host, checks whether the data is received, and resends it if it is not. TCP is, therefore, called a [**connection-oriented protocol.**](javascript://) connection-oriented protocol A type of Transport layer protocol that requires the establishment of a connection between communicating nodes before it will transmit data. TCP is used by applications such as Web browsers and email. Guaranteed delivery takes longer and is used when it is important to know that the data reached its destination.
    - UDP (User Datagram Protocol) - Does not guarantee delivery by first connecting and checking whether data is received; thus, UDP is called a **connectionless protocol or best-effort protocol**best-effort protocol A type of Transport layer protocol that services a request without requiring a verified session and without guaranteeing delivery of data. . UDP is used for broadcasting, such as streaming video or audio over the Web, where guaranteed delivery is not as important as fast transmission. UDP is also used to monitor network traffic.
    - Beginning of payload is called the Header
    - Adding header to data inherited from layer above is called encapsulation.
    - The Transport layer header addresses the receiving application by a number called a port number.
    - If the message is too large to transport on the network, TCP divides it into smaller messages called segments.
    - In UDP, the message is called a datagram
  + Network - sometimes called the Internet layer, is responsible for moving messages from one node to another until they reach the destination host. The principal protocol used by the Network layer is IP (internet protocol)
    - IP adds its own Network layer header to the segment or datagram, and the entire Network layer message is now called a packet.
    - An IP address is an address assigned to each node on a network, which the Network layer uses to uniquely identify them on the network.
    - IP relies on several routing protocols to find the best route for a packet when traversing several networks on its way to its destination: ICMP and ARP.
    - If a Network layer protocol is aware that a packet is larger than the maximum size for its network, it will divide the packet into smaller packets in a process called fragmentation.
  + Data Link - Examples of Link layer protocols are Ethernet and Wi-Fi.
    - The Link layer puts its own control information in a Link layer header and also attaches control information to the end of the packet in a trailer.
    - Entire Link layer message is called a frame.
    - Address called MAC address, Physical address, hardware address, or Data Link layer address
  + Physical - is the simplest layer of all and is responsible only for sending bits via a wired or wireless transmission. These bits can be transmitted as wavelengths in the air (for example, Wi-Fi), voltage on a copper wire (for example, Ethernet with twisted-pair cabling), or light (for example, Ethernet with fiber-optic cabling).
  + Simplification: Layer 7, 6, 5 – Payload or data
    - Layer 4 – Segment (TCP) or datagram (UDP)
    - Layer 3 – Packet
    - Layer 2 – Frame
    - Layer 1 – Bit
* Range of ports – name and #s: **Registered ports** TCP/IP ports in the range of 1024 to 49,151. These ports can be used by network users and processes that are not considered standard processes. Default assignments of these ports must be registered with IANA.
  + **Dynamic port** TCP/IP ports in the range of 49,152 through 65,535, which are open for use without requiring administrative privileges on a host or approval from IANA.
  + **Well-known ports** The TCP/IP port numbers 0 to 1023, so named because they were long ago assigned by Internet authorities to popular services (for example, FTP and Telnet), and are, therefore, well known and frequently used.
* DWDM - (dense wavelength division multiplexing) A multiplexing technique used over single-mode or multimode fiber-optic cable in which each signal is assigned a different wavelength for its carrier wave. In DWDM, little space exists between carrier waves to achieve extraordinary high capacity.
* Broadband/baseband
  + **Baseband** A form of transmission in which digital signals are sent through direct current pulses applied to a wire. This direct current requires exclusive use of the wire’s capacity, so baseband systems can transmit only one signal, or one channel, at a time. Every device on a baseband system shares a single channel.
  + **Broadband** A form of transmission in which signals are modulated as radio frequency analog pulses with different frequency ranges. Unlike baseband, broadband technology does not involve binary encoding. The use of multiple frequencies enables a broadband system to operate over several channels and, therefore, carry much more data than a baseband system.
* Simplex/half-duplex/full-duplex
  + Half-duplex A type of transmission in which signals may travel in both directions over a medium, but in only one direction at a time.
  + Full-duplex A type of transmission in which signals may travel in both directions over a medium simultaneously; also called, simply, duplex.
  + Simplex A type of transmission in which signals may travel in only one direction over a medium.
* Type of fiber optic cable - A form of cable that contains one or several glass or plastic fibers in its core. Data is transmitted via a pulsing light sent from a laser or light-emitting diode (LED) through the central fiber (or fibers). Fiber-optic cables offer significantly higher throughput than copper-based cables. They may be single-mode or multimode and typically use wave-division multiplexing to carry multiple signals.
  + MMF (multimode fiber) A type of fiber-optic cable containing a core that is usually 50 or 62.5 microns in diameter, over which many pulses of light generated by a laser or light-emitting diode (LED) travel at different angles.
  + SMF (single mode fiber) A type of fiber-optic cable with a narrow core of 8 to 10 microns in diameter that carries light pulses along a single path from one end of the cable to the other end. Data can be transmitted faster and for longer distances on single mode fiber than on multimode fiber. However, single mode fiber is more expensive.
  + MT-RJ (Mechanical Transfer-Registered Jack) The most common type of connector used with multimode fiber-optic cable.
* Beacon frame in wireless transmission - beacon frame in the context of wireless networking, a frame issued by an access point to alert other nodes of its existence.
* Sheath: The outer cover, or jacket, of a cable.
* Domain name: The last two parts of an FQDN, such as mycompany.com. Usually, a domain name is associated with the company’s name and its type of organization, such as a university or military unit.
* Bend radius: The radius of the maximum arc into which a cable can be looped without impairing data transmission. Generally, a twisted-pair cable’s bend radius is equal to or greater than four times the diameter of the cable.
* SMTP: Simple Mail Transfer Protocol (SMTP) An earlier protocol for email that handles outgoing mail.
* Convergence: The use of data networks to carry voice, video, and other communications services in addition to data.
* Wireless topologies (???)
  + Wireless gateway An AP that provides routing functions and is used as a gateway.
  + Wireless router A device used for a home-based Wi-Fi network that combines several networking technologies.
  + Wireless analyzer Software that can evaluate Wi-Fi network availability as well as help optimize Wi-Fi signal settings or help identify Wi-Fi security threats.
  + WLAN (wireless local area network) A LAN that uses wireless connections for some or all of its transmissions.
  + Self-healing a characteristic of dual-ring topologies that allows them to automatically reroute traffic along the backup ring if the primary ring becomes severed.
  + Physical topology the physical layout of the media, nodes, and devices on a network. A physical topology does not specify device types, connectivity methods, or addressing schemes. Physical topologies are categorized into three fundamental shapes: bus, ring, and star. These shapes can be mixed to create hybrid topologies.
  + partial-mesh WAN A version of a mesh topology WAN in which only critical sites are directly interconnected and secondary sites are connected through star or ring topologies. Partial mesh WANs are less expensive to implement than full-mesh WANs.
* BSS/ESS
  + ESS (extended service set) A group of access points and associated stations (or basic service sets) connected to the same LAN.
  + BSS (basic service set) In IEEE terminology, a group of stations that share an access point.
* TTL (what happens when it reaches 0)
  + Time to Live (TTL) Indicates the maximum duration that an IPv4 packet can remain on the network before it is discarded. Although this field was originally meant to represent units of time, on modern networks it represents the number of times a packet can still be forwarded by a router, or the maximum number of router hops remaining.
* MAC address – OUI: OUI (Organizationally Unique Identifier) A 24-bit character sequence assigned by IEEE that appears at the beginning of a network interface’s physical address and identifies the NIC’s manufacturer.
* Bus, star, star-bus topologies
  + star-bus topology A hybrid topology in which groups of workstations are connected in a star fashion to connectivity devices that are networked via a single bus.
  + star topology A physical topology in which every node on the network is connected through a central device.
  + bus topology A topology in which a single cable connects all nodes on a network without intervening connectivity devices
* IPv6 global unicast address: global unicast address An IPv6 address that can be routed on the Internet. These addresses are similar to public IPv4 addresses. Most global addresses begin with the prefix 2000::/3, although other prefixes are being released.
* TCP - (Transmission Control Protocol) A core protocol of the TCP/IP suite that makes a connection with the end host, checks whether data is received, and resends it if it is not.
* Demarc: The point of division between a telecommunications service carrier’s network and a building’s internal network.
* Scattering/diffraction:
  + scattering The diffusion, or the reflection in multiple directions, of a wireless signal that results from hitting an object that has small dimensions compared with the signal’s wavelength. Scattering is also related to the roughness of the surface a wireless signal encounters. The rougher the surface, the more likely a signal is to scatter when it hits that surface.
  + diffraction In the context of wireless signal propagation, the phenomenon that occurs when an electromagnetic wave encounters an obstruction and splits into secondary waves. The secondary waves continue to propagate in the direction in which they were split. If diffracted wireless signals were visible, they would appear to be bending around the obstacle. Objects with sharp edges—including the corners of walls and desks—cause diffraction.
* Modem: A device that modulates digital signals from a computer into analog signals at the transmitting end for transmission over telephone lines, and demodulates analog signals into digital signals at the receiving end so a computer can read the received transmission.
* Encapsulation/de-encapsulation: encapsulation The process of adding a header to the data inherited from the layer above.
* Flow label: flow A sequence of packets issued from one source to one or many destinations. Routers interpret flow information to ensure that packets belonging to the same transmission arrive together. Flow information may also help with traffic prioritization.
* three characteristics of TCP in its role as a reliable delivery protocol
  + UDP (User Datagram Protocol) A core protocol in the TCP/IP suite that does not guarantee delivery because it does not first make the connection before sending data or check to confirm that data is received.
  + UDP (User Datagram Protocol) A core protocol in the TCP/IP suite that does not guarantee delivery because it does not first make the connection before sending data or check to confirm that data is received.
  + IP (Internet Protocol) A core protocol in the TCP/IP suite that operates in the Network layer of the OSI model and provides information about how and where data should be delivered. IP is the subprotocol that enables TCP/IP to internetwork.
* Fragmentation: Network layer service that subdivides packets into smaller packets when those packets exceed the maximum size for the network.
* How many bits in an IPv4 and IPv6 address
  + IPv4 – 32 bits (4 bytes)
  + IPv6 – 128 bits (16 bytes)
* 802.11ac: The IEEE standard for a wireless networking technique that exceeds benchmarks set by earlier standards by increasing its useful bandwidth and amplitude. 802.11ac is the first Wi-Fi standard to approach Gigabit Ethernet capabilities. 802.11ac APs function more like a switch in that they can handle multiple transmissions at one time over the same frequency spectrum. This new standard is being deployed in three waves with Wave 1 devices already available on the market.
* Frequency/amplitude
  + amplitude A measure of a signal’s strength at a given point in time.
  + frequency The number of times that a wave’s amplitude cycles from its starting point, through its highest amplitude and its lowest amplitude, and back to its starting point over a fixed period of time, expressed in cycles per second, or hertz (Hz).
* Ipconfig /all: Displays **all** current TCP/IP network configuration values and refreshes Dynamic Host Configuration Protocol (DHCP) and Domain Name System (DNS) settings. Used without parameters, **ipconfig** displays the IP address, subnet mask, and default gateway for **all** adapters.
* Loopback address: An IP address reserved for communicating from a node to itself, used mostly for troubleshooting purposes. The IPv4 loopback address is always cited as 127.0.0.1, and the IPv6 loopback address is ::1.
* Near end cross talk/ far end cross talk/alien cross talk
  + Near end cross-talk (NEXT) Cross-talk that occurs between wire pairs near the source of a signal.
  + Far end cross-talk (FEXT) Cross-talk measured at the far end of the cable from the signal source.
  + Alien cross-talk Electromagnetic interference induced on one cable by signals traveling over a nearby cable.
* Power flaws – brownout, blackout, noise, surge
  + Brownout A momentary decrease in voltage, also known as a sag. An overtaxed electrical system may cause brownouts, recognizable as a dimming of the lights.
  + Blackout A complete power loss.
  + Noise can degrade or distort a signal. A common source of noise is EMI. Motors, power lines, televisions, copiers, fluorescent lights, microwave ovens, manufacturing machinery, and other sources of electrical activity (including a severe thunderstorm) can cause EMI.
  + Surge a momentary increase in voltage caused by distant lightning strikes, solar flares, or electrical problems.
* Multiplexing: A form of transmission that allows multiple signals to travel simultaneously over one medium.
* What should be done to ensure minimal cross talk during termination of TP cabling
  + Cat 5e or Cat 6a
  + No more than 1 inch of the cable should be exposed.
* Show ip route: command with the mask argument to **display routes** with a specific network mask. Use the **show ip route** command with the bgp, isis, ospf keyword to **display** summary information about all **routes** for the specified protocol.
* Ping: **networking** utility program or a tool to test if a particular host is reachable. It is a diagnostic that checks if your computer is connected to a server. **Ping**, a term taken from the echo location of a submarine, sends data packet to a server and if it receives a data packet back, then you have a connection.
  + Helps to verify IP-level connectivity. When troubleshooting, you can use **ping** to send an ICMP echo request to a target host name or IP address. Use **ping** whenever you need to verify that a host computer can connect to the TCP/IP network and network resources.