Chapter 14: Introduction to Networking

Complete CompTIA A+ Guide to PCs, 6e

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Chapter Objectives

• How different networks are wired (or wireless)
• How to identify common network cables
• How Ethernet works
• About the OSI and TCP/IP models and different protocols
• To identify a MAC, IPv4, and IPv6 address
• To set up a wired and wireless network
• About common network troubleshooting tools
• To configure and access a network printer
• How to configure apps on a mobile device
• How to be a proactive technician
CompTIA A+ Exam Objectives Covered in This Chapter

801-1.2: Differentiate between motherboard components, their purposes, and properties.
801-1.7: Compare and contrast various connection interfaces and explain their purpose.
801-2.1: Identify types of network cables and connectors.
801-2.2: Categorize characteristics of connectors and cabling.
801-2.3: Explain properties and characteristics of TCP/IP.
801-2.4: Explain common TCP and UDP ports, protocols, and their purpose.
801-2.5: Compare and contrast wireless networking standards and encryption types.
801-2.6: Install, configure, and deploy a SOHO wireless/wired router using appropriate settings.
801-2.7: Compare and contrast Internet connection types and features.
801-2.8: Identify various types of networks.
801-2.9: Compare and contrast network devices, their functions, and features.
801-2.10: Given a scenario, use appropriate networking tools.
801-3.1: Install and configure laptop hardware and components.
801-3.2: Compare and contrast the components within the display of a laptop.
801-3.3: Compare and contrast laptop features.
CompTIA A+ Exam Objectives Covered in This Chapter

801-4.2: Given a scenario, install, and configure printers.
801-5.1: Given a scenario, use appropriate safety procedures.
802-1.2: Given a scenario, install and configure the operating system using the most appropriate method.
802-1.3: Given a scenario, use appropriate command-line tools.
802-1.4: Given a scenario, use appropriate operating system features and tools.
802-1.5: Given a scenario, use Control Panel utilities.
802-1.6: Setup and configure Windows networking on a client/desktop.
802-1.8: Explain the differences among basic OS security settings.
802-1.9: Explain the basics of client-side virtualization.
802-3.2: Establish basic network connectivity and configure email.
802-3.5: Execute and configure mobile device synchronization.
802-4.2: Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU, and power with appropriate tools.
802-4.5: Given a scenario, troubleshoot wired and wireless networks with appropriate tools.
802-4.8: Given a scenario, troubleshoot and repair common laptop issues while adhering to the appropriate procedures.
Types of Networks

- PAN (Personal Area Network)
- LAN (Local Area Network)
- MAN (Metropolitan Area Network)
- WAN (Wide Area Network)
- WLAN (Wireless LAN)
- WWAN (Wireless WAN)

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Local Area Network

Corporate domain environment

Home network devices

Client/Server Network
Peer-to-Peer Network
Domain
Workgroup

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Network Topologies

- Star Topology
- Extended Star Topology
- Hierarchical Topology
- Ring Topology
- Bus Topology
- Mesh Topology
- Hybrid Topology
Copper Media

- STP (Shielded Twisted-Pair)
- UTP (Unshielded Twisted-Pair)
- RJ-11 Phone Jack or Connector
- RJ-45 Network Jack or Connector
- Coaxial Cable

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UTP Cable Categories

Cat 3

Cat 6a

Cat 5

Cat 6

Cat 5e
Network Cables

Straight-Through Cable

Crossover Cable
Single Mode  Multi Mode
Network Cabling Tools

- Toner Probe
- Wire Stripper
- Punch-Down Tool
- Network Cable Tester
- Crimper
# Ethernet Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10BaseT</td>
<td>10Mbps over CAT 3 or 5 UTP cable</td>
</tr>
<tr>
<td>100BaseT</td>
<td>100Mbps over CAT 5 or higher UTP cable</td>
</tr>
<tr>
<td>1000BaseT</td>
<td>1000Mbps or 1Gbps over CAT 5 or higher UTP cable</td>
</tr>
<tr>
<td>1000BaseSX</td>
<td>1Gbps using multi-mode fiber</td>
</tr>
<tr>
<td>1000BaseLX</td>
<td>1Gbps using single-mode fiber</td>
</tr>
<tr>
<td>10GBaseSR</td>
<td>10Gbps over multi-mode fiber</td>
</tr>
<tr>
<td>10GBaseLX4</td>
<td>10Gbps over multi-mode and single-mode fiber</td>
</tr>
<tr>
<td>10GBaseLR</td>
<td>10Gbps up to 6.2 miles (10 km) using single-mode fiber</td>
</tr>
<tr>
<td>10GBaseER</td>
<td>10Gbps up to 24.85 miles (40 km) using single-mode fiber</td>
</tr>
<tr>
<td>10GBaseT</td>
<td>10Gbps over UTP (CAT 5e or higher) or STP cable</td>
</tr>
</tbody>
</table>
OSI (Open Systems Interconnect) Model

1. Physical Layer
2. Data Link Layer
3. Network Layer
4. Transport Layer
5. Session Layer
6. Presentation Layer
7. Application Layer
TCP/IP (Transmission Control Protocol/Internet Protocol) Model

- Application Layer
- Transport Layer
- Internet Layer
- Network Access Layer
Network Addressing

- MAC (Media Access Control) Address
- IP (Internet Protocol) Address
- IPv4 (IP Version 4)
- IPv6 (IP Version 6)
- Subnet Mask
IPv4 Subnetting

Classes

Network Address

Broadcast Address

Network Number

Host Number

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Class A
- Network: 0-127
- Host: 0-255
- Host: 0-255
- Host: 0-255

Class B
- Network: 128-191
- Network: 0-255
- Host: 0-255
- Host: 0-255

Class C
- Network: 192-223
- Network: 0-255
- Network: 0-255
- Host: 0-255

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Wireless Networking Devices

- AP (Access Point)
- Wireless NIC (Network Interface Controller/Card)
- Wireless Router
- Wireless Bridge
Wireless Networking

- SSID (Service Set Identifier)
- Channel ID Number
- Omnidirectional Antenna
- Directional Antenna
- Antenna Gain
- MIMO (Multiple Input/Multiple Output)
Network Addressing Configurations

- DHCP (Dynamic Host Configuration Protocol)
- APIPA (Automatic Private IP Addressing)
- Alternative Configuration
- Default Gateway
- DNS (Domain Name System)
Network Troubleshooting

- Ping Command
- Ipconfig Command
- Nslookup
- Tracert Command
Network Connection Types

- POTS (Plain Old Telephone Service)
- ISDN (Integrated Services Digital Network)
- Frame Relay
- 56K Point to Point
- T1
- T3
- DSL (Digital Subscriber Line)
- Broadband Cable or Satellite
- MetroE (MetroEthernet)
- ATM (Asynchronous Transfer Mode)
A good technician is proactive, which means that the technician thinks of ways to improve a situation and anticipates problems and fixes them before being told to.

A proactive technician follows up after a service call to ensure that a repair fixed the problem rather than waiting for another help desk ticket that states that the problem is unresolved.

As a student, practice being proactive with your life.
Know the purpose of the network devices hub, router, AP, and switch and at what layer(s) they operate.

Know the OSI and TCP/IP models, protocols that work at each layer, the purposes of the protocols, and port numbers used by the protocols. Know the difference between TCP and UDP.

Know when to use the appropriate networking tool, whether a physical tool or a command.

Know what to do when one or more computers cannot connect to the Internet or when they have an IP address conflict.

Know how to manually configure an IP address on a computer, an AP, a printer, or any other network device. Know how to configure an alternative configuration on a computer.

Know how to effectively use the ipconfig and ping commands.

Know how to configure Internet Explorer using the various tabs.

Know the different types of wireless networks and their compatibility with each other.

Know how to manually assign 2.4GHz channels so multiple wireless APs can coexist.

Know the purpose of an IP address, a default gateway, and a subnet mask.

Know the difference between an IPv4 address and an IPv6 address.

Recognize when an address is a private IP address and understand the difference between a public IP address and a private IP address.

Know the different types of network connectors.
• Networks are created to share data and devices and connect to the Internet. Types of networks include PANs, LANs, MANs, and WANs.

• Networks can be wired or wireless. Wired networks use copper (UTP, STP, and coaxial) or fiber-optic media.

• A peer-to-peer network is composed of a small number of computers, whereas the client/server type of network is used in companies in a domain environment. A domain environment has a server that provides authentication to resources with a centralized user ID and password. A peer-to-peer network manages the usernames on a computer-by-computer basis, which grows less secure and more difficult to manage as the network grows.

• Ethernet is the most common type of LAN, and it is wired in a star or extended star topology. A hub or switch is used to connect the devices. Each network connects to a router for communication with other networks. The router's IP address is the default gateway for all network devices on a particular LAN.
Chapter Summary

- IP addresses are grouped by classes, with a particular subnet mask for each class. Each default mask can be changed to further subdivide a network for more efficient and manageable addressing. DHCP can be used to provide addresses to network devices or a static address can be assigned. Public addresses are routable on the Internet. Private addresses are used within homes and companies. These addresses can be translated using NAT/PAT to public addresses.

- TCP/IP is a suite of protocols that includes the following important ones: FTP, Telnet, SMTP, DNS, HTTP, HTTPS, POP3, IMAP, RDP, DNS, LDAP, SNMP, SSH, SFTP, TCP, UDP, IP, and ICMP.

- The OSI model is a theoretical model with seven layers: application, presentation, session, transport, network, data link, and physical. The TCP/IP model is a working model and contains four layers: application, transport, internet (internetwork), and network access. Common application protocols include TFTP, FTP, SFTP, Telnet, SMTP, DNS, HTTP, HTTPS, POP3, LDAP, DNS, SNMP, and SSH. The device and applications that work at Layer 3 (network or internet layers) include a router, IP, and ICMP. The devices and applications that work at Layer 2 (data link or network access) include a switch, access point, and ARP. Keep in mind that Ethernet has Layer 2 specifications. That is why a MAC address is a Layer 2 address. The devices that work at Layer 1 (physical or network access) are cable, connectors, hubs, and wireless antennas.
802.11 and Bluetooth are types of wireless networks. Bluetooth is used in PANs, and 802.11 is used in wireless LANs. 802.11 wireless NICs include 802.11a, b, g, and n. 802.11a and n work in the 5GHz range; 802.11b, g, and n work in the 2.4GHz range. 802.11 antennas are either directional or omnidirectional.

The key tools for troubleshooting a networked computer are the ipconfig, ping, nslookup, tracert commands, and a cable tester.

To configure email on any device, you need to know certain parameters, such as the protocol used, the application used, the username, the password, the domain, SSL settings, and port numbers.

Mobile devices are commonly configured for Bluetooth, cellular, and 802.11-based networks, and apps are installed using the networks. Some items are automatically backed up by Google for Android devices and Apple iCloud for iOS devices. iTunes is used to synchronize and update Apple iOS photos, music, movies, and operating systems.

A technician should be proactive as opposed to reactive and should prevent problems and situations whenever possible.