

Chapter 9: Laptops and Mobile Devices



IT Essentials v6.0

Chapter 9 - Sections & Objectives

- 9.1 Laptop Components
 - Explain the purpose and characteristics of laptops.
- 9.2 Laptop Configuration
 - Explain how to configure laptop power settings and wireless settings.
- 9.3 Laptop Hardware and Component Installation and Configuration
 - Explain how to remove and install laptop components.
- 9.4 Mobile Device Hardware Overview
 - Explain the purpose and characteristics of mobile devices.
- 9.5 Common Preventive Maintenance Techniques for Laptops and Mobile Devices
 - Explain how to perform common preventive maintenance techniques for laptops and mobile devices.
- 9.6 Basic Troubleshooting Process for Laptops and Mobile Devices
 - Explain how to troubleshoot laptops and mobile devices.
- 9.6 Chapter Summary

9.1 Laptop Components



Laptops

- Notebooks and laptops are types of portable computers.
- The most significant feature of a laptop is its compact size. The design of the laptop places the keyboard, screen, and internal components into a small, portable case.
- Laptops can be used to take notes in school, present information in a business meeting, or access the Internet in a coffee shop.
- Common uses of laptops include:
 - Taking notes in school or researching papers
 - Presenting information in business meetings
 - Accessing data away from home or the office
 - Playing games while traveling
 - Watching movies while traveling
 - Accessing the Internet in a public place
 - Sending and receiving email in a public place

Laptops vs Desktops

- Common laptop features:
 - Small and portable
 - Smaller cooling devices
 - Designed to product less heat
 - Uses throttling to reduce power consumption and heat
 - Integrated LCD display screen in lid
 - Integrated keyboard and mouse
 - AC power source or rechargeable battery
 - Hot-swappable drives and peripherals
 - Optical Drives
 - Docking station or port replicator
 - PC Card or ExpressCard slots
 - Status indicators, ports, slots, connectors, bays, jacks, vents, and a keyhole are on the exterior of the laptop
- Most of the internal components that are designed for laptops cannot be used for desktops
- Peripheral devices are interchangeable between a laptop and a desktop PC.

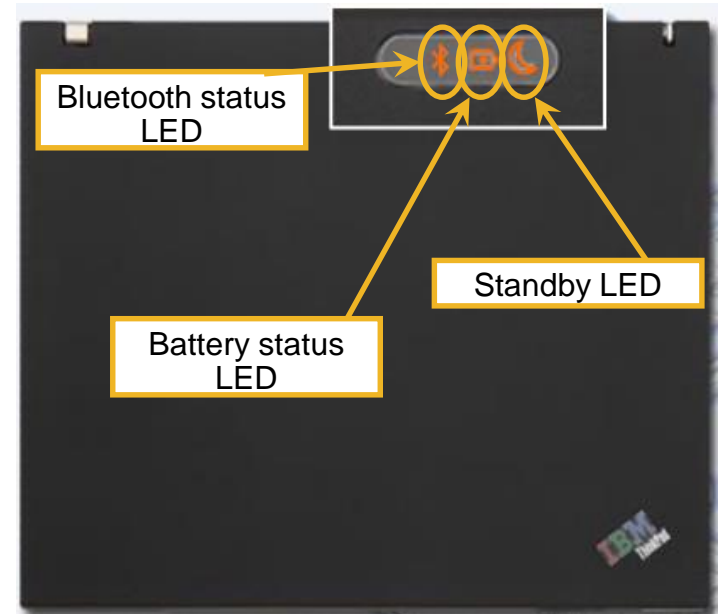
Laptop Components

- Laptop Displays
 - LCD, LED, and OLED Displays
 - 2 types of LCD: Twisted Nematic (TN) and In-Plane Switching (IPS)
 - TN: Offer high brightness, uses less power than IPS, inexpensive
 - IPS: Better color reproduction and better viewing angles
 - LEDs: Use less power and have longer lifespan
 - OLED: Commonly used for mobile devices and digital cameras
 - Backlights and Inverters
 - LCD: Cold Cathode Fluorescent Lamp (CCFL) & Inverter
 - LED: LED based backlights
 - WI-FI Antenna Connectors
 - Typically located above the screen
 - Connects to wireless card
 - Webcam and Microphone
 - Built into most laptops today



Components on the outside of a laptop

- Top view of virtual laptop
 - The Bluetooth status LED indicates when the Bluetooth wireless transceiver is enabled. Bluetooth is a wireless industry standard that enables portable devices to communicate over short distances.
 - The Battery status LED indicates the condition of the computer battery. A laptop computer can use a battery or an AC power adapter to operate. The type of battery and how the laptop is used affects how long a battery charge will last.
 - The Standby LED indicates the power status of the laptop. Standby mode reduces the amount of electricity used by the laptop by shutting off the monitor, hard drive, and CPU. A small amount of electricity is used to keep the RAM active and to make the data available. A laptop computer may enter standby mode when it has not been used for a predefined amount of time.



Components on the outside of a laptop (Cont.)

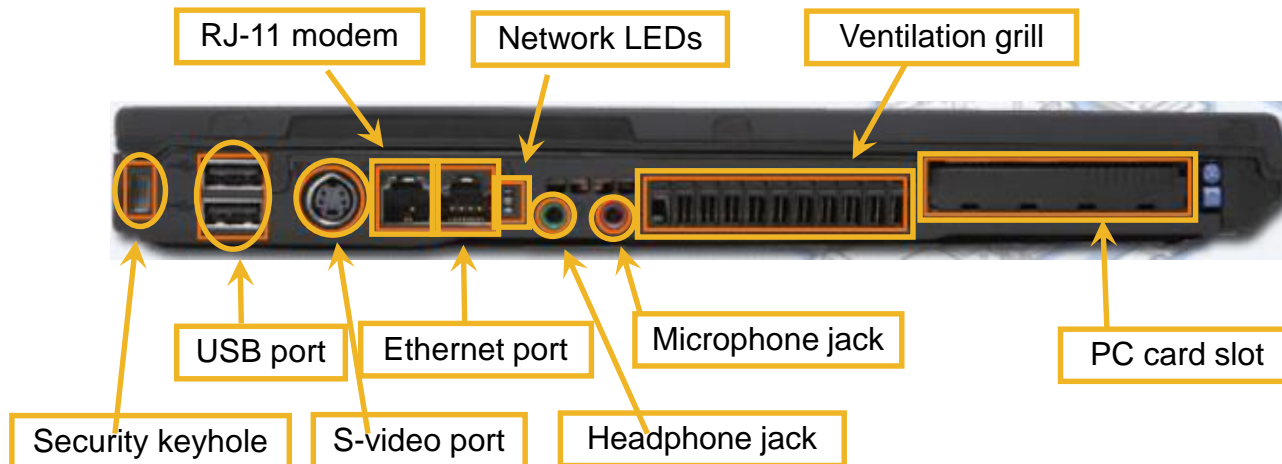
- Rear view of virtual laptop

- The battery bay is a connector that is used to attach a laptop battery.
- The AC power connector is a connector that is used to attach the AC power adapter to the laptop and to charge the battery.
- The parallel port is a socket that is used to connect a device such as a printer or scanner.



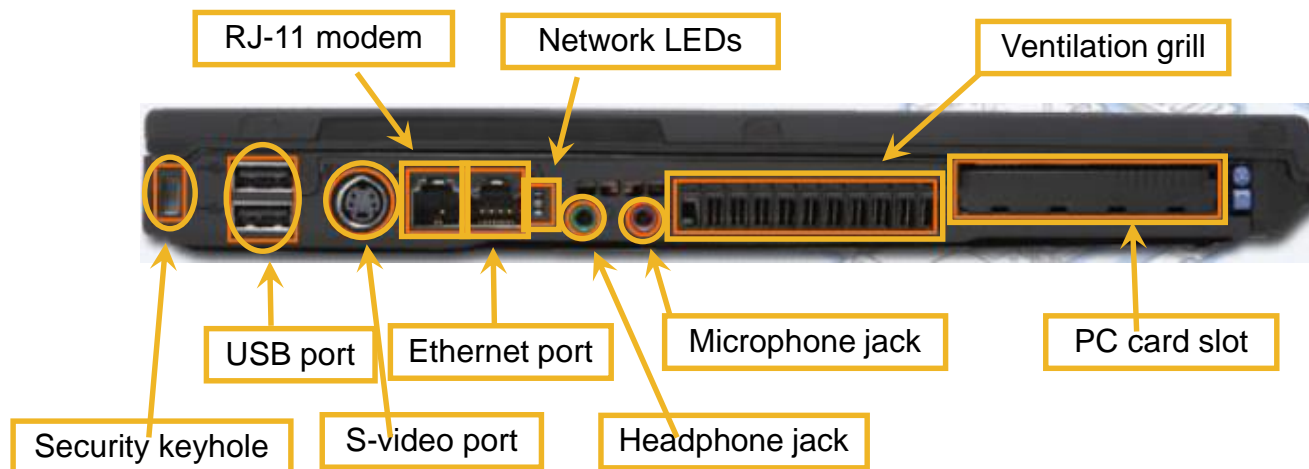
Components on the outside of a laptop (Cont.)

- Left side view of virtual laptop
 - The security keyhole is a hard point in the laptop frame that is used to attach a security cable.
 - The Universal Serial Bus (USB) port is a socket that is used to connect one or more peripherals.
 - The S-video port is a four-pin mini-DIN connector that is used to send video signals to a compatible device. S-video separates the brightness and color portions of a video signal.
 - The RJ-11 modem port is a device that is used to connect the laptop to a standard telephone line. The modem can be used to connect the computer to the Internet, to fax documents, and to answer incoming calls.
 - The Ethernet port is an RJ-45 socket that is used to connect the laptop to a cabled local area network.



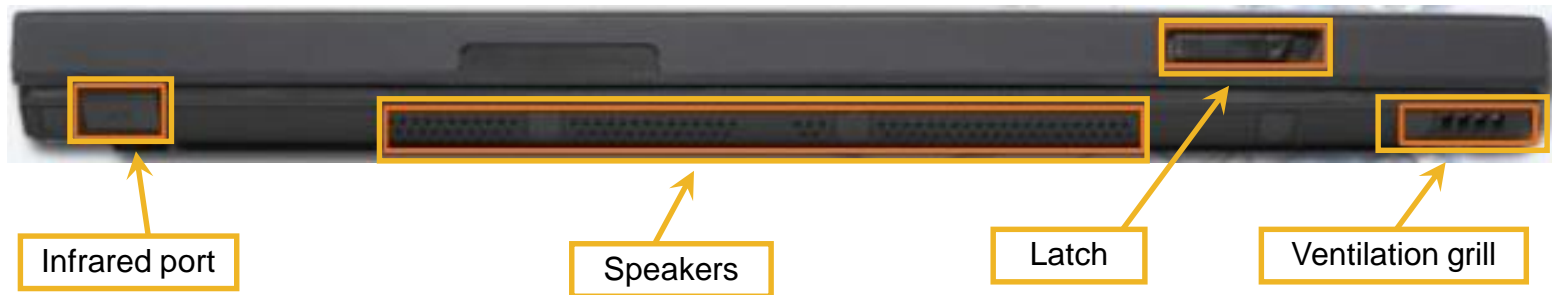
Components on the outside of a laptop (Cont.)

- Left side view of virtual laptop
 - The two network LEDs are lights that indicated the status of the network connection. The green link light indicates network connectivity. The outer LED light indicates the traffic to and from the laptop.
 - The headphone jack is a socket that is used to output audio signals to connected stereo headphones or speakers.
 - The microphone jack is a socket that is used to connect a microphone used for audio input.
 - The ventilation grill is a series of vents that allow hot air to be expelled from the interior of the laptop.
 - The PC combination card slot is an expansion slot that supports the PCExpress expansion cards in the top slot and PC cards in the bottom slot.



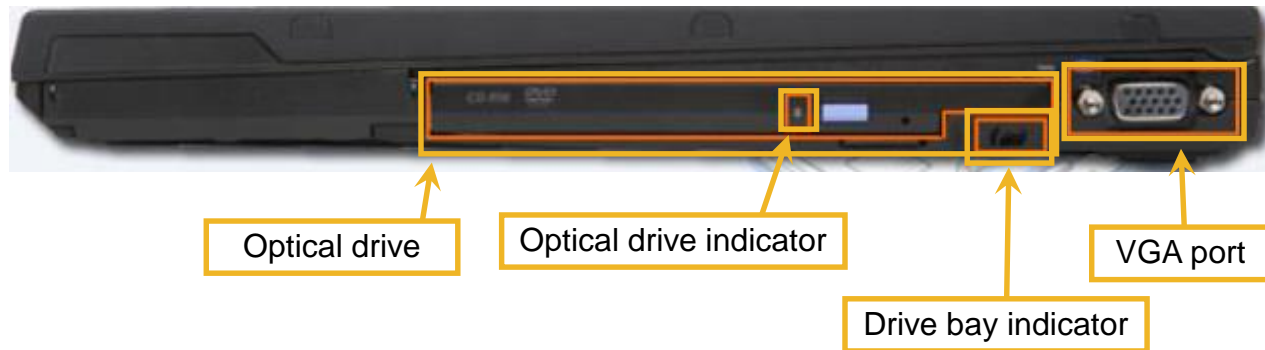
Components on the outside of a laptop (Cont.)

- Front view of virtual laptop
 - The infrared port is a line-of-sight wireless transceiver that is used for data transmission.
 - Speakers are an output device that converts audio signals that are produced within the laptop to sound.
 - The laptop latch is a lever that is used to open the laptop lid.
 - The ventilation grill is a series of vents that allow hot air to be expelled from the interior of the laptop.



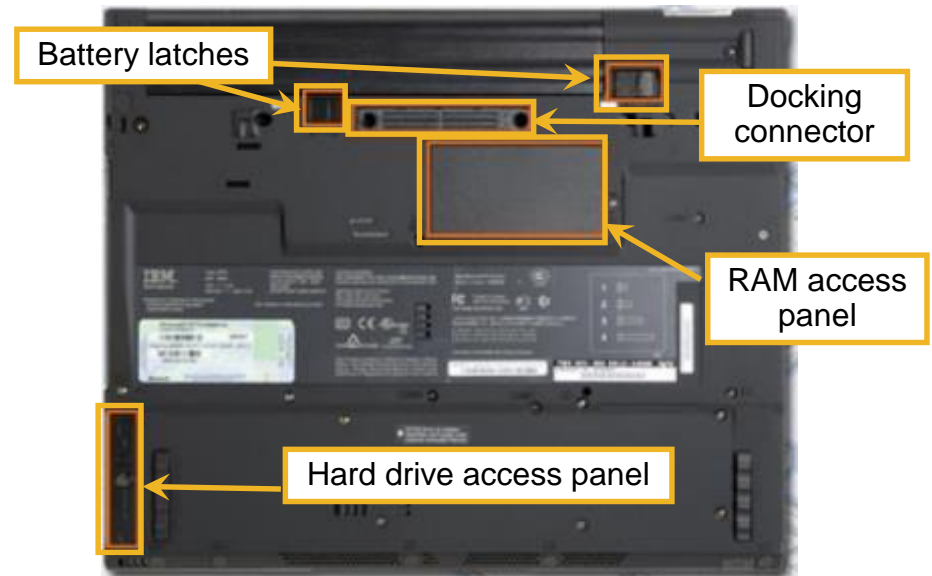
Components on the outside of a laptop (Cont.)

- Right side view of virtual laptop
 - The optical drive is a disk drive that is used to read and write to CDs and DVDs.
 - The optical drive activity indicator is an LED that illuminates when the drive is in use.
 - The drive bay status indicator is an LED that illuminates when a drive is installed in the laptop bay.
 - The VGA port is a 15-pin socket that connects to external displays and projectors.



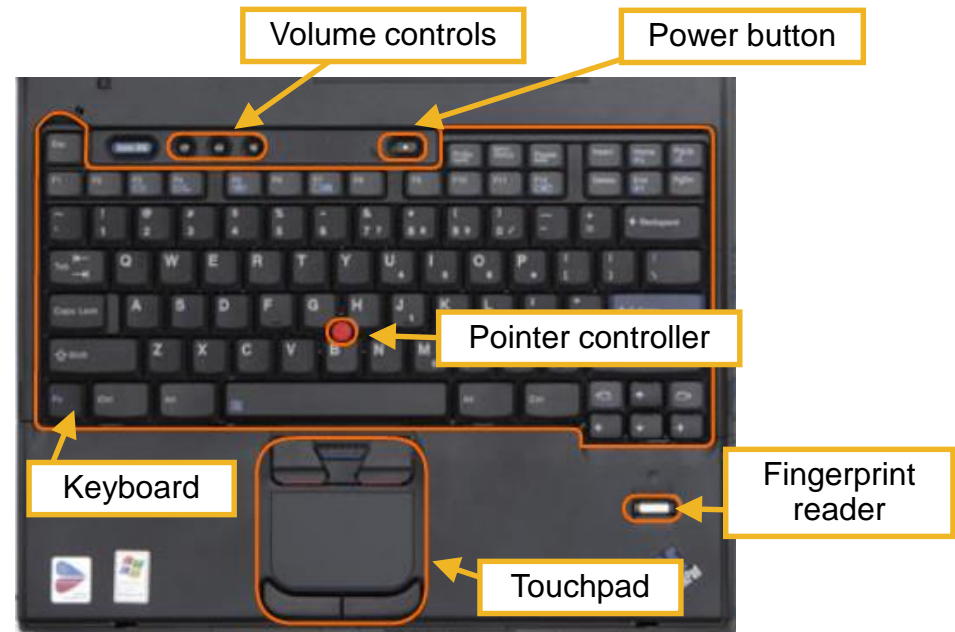
Components on the outside of a laptop (Cont.)

- Underside view of virtual laptop
 - The hard drive access panel is a cover that provides access to the internal hard drive bay.
 - The two battery latches are levers that are used when inserting, removing or securing the laptop battery.
 - The docking connector is a socket that is used to attach a laptop to a docking station.
 - The RAM access panel is a cover that provides access to the expansion memory.



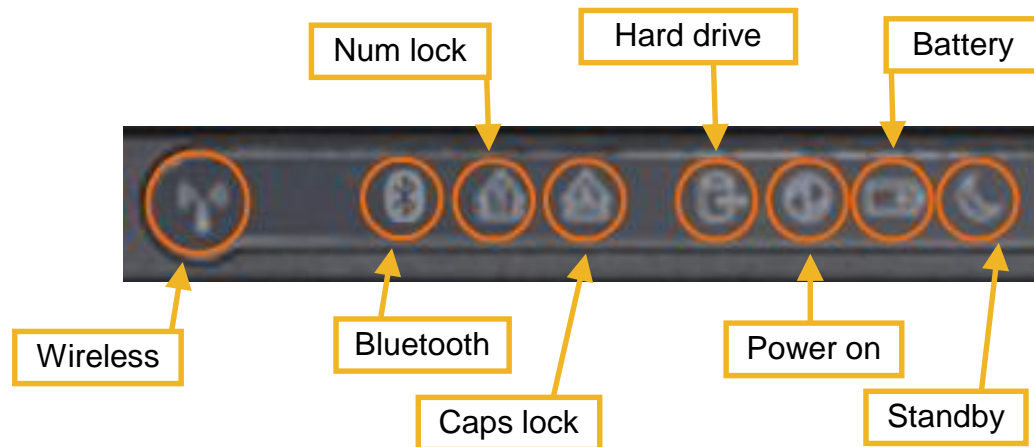
Components on the inside of a laptop

- Open view of laptop
 - The keyboard is a compact input device and has multi-functional keys.
 - The volume controls are buttons that control audio output.
 - The input devices are the touch pad, which consists of right and left click buttons, and a pointer controller. The touchpad and pointer controller can be used instead of a mouse for the laptop.
 - The power button is a control that turns the laptop on and off.
 - The fingerprint reader is an input device used for security authentication.
- Not all laptop input devices are built-in.
- Laptops use input devices to add functionality to the laptop. Installing input devices might require downloading drivers from the manufacturer's website.
- Some input devices might need to be configured or optimized for speed, sensitivity, scrolling, or the number of taps needed.



Components on the inside of a laptop (Cont.)

- LEDs inside laptop
 - The wireless LED indicates the activity of the wireless network connection.
 - The Bluetooth status LED indicates when the Bluetooth wireless transceiver is enabled. Bluetooth is a wireless industry standard that enables portable devices to communicate over short distances.
 - The num lock LED indicates the on/off status of the 10-key number pad.
 - The caps lock LED indicates the on/off status of the caps lock.
 - The hard drive activity LED indicates the activity of the hard drive.
 - The power on LED indicates the on/off status of the laptop.
 - The battery status LED indicates the condition of the laptop battery. A laptop can use a battery or an AC power adapter to operate.
 - The hibernate or standby LED indicates whether the computer is in standby mode or if it is entering or leaving hibernate mode.



Laptop Components (Cont.)

- **Port Replicator** - may contain a SCSI port, a networking port, PS/2 ports, USB ports, and a game port.
- **Docking Station** - has the same ports as a port replicator, but adds the ability to connect to PCI cards, additional hard drives, optical drives, and floppy drives.
 - A laptop connected to a docking station has the same functionalities as a desktop computer.

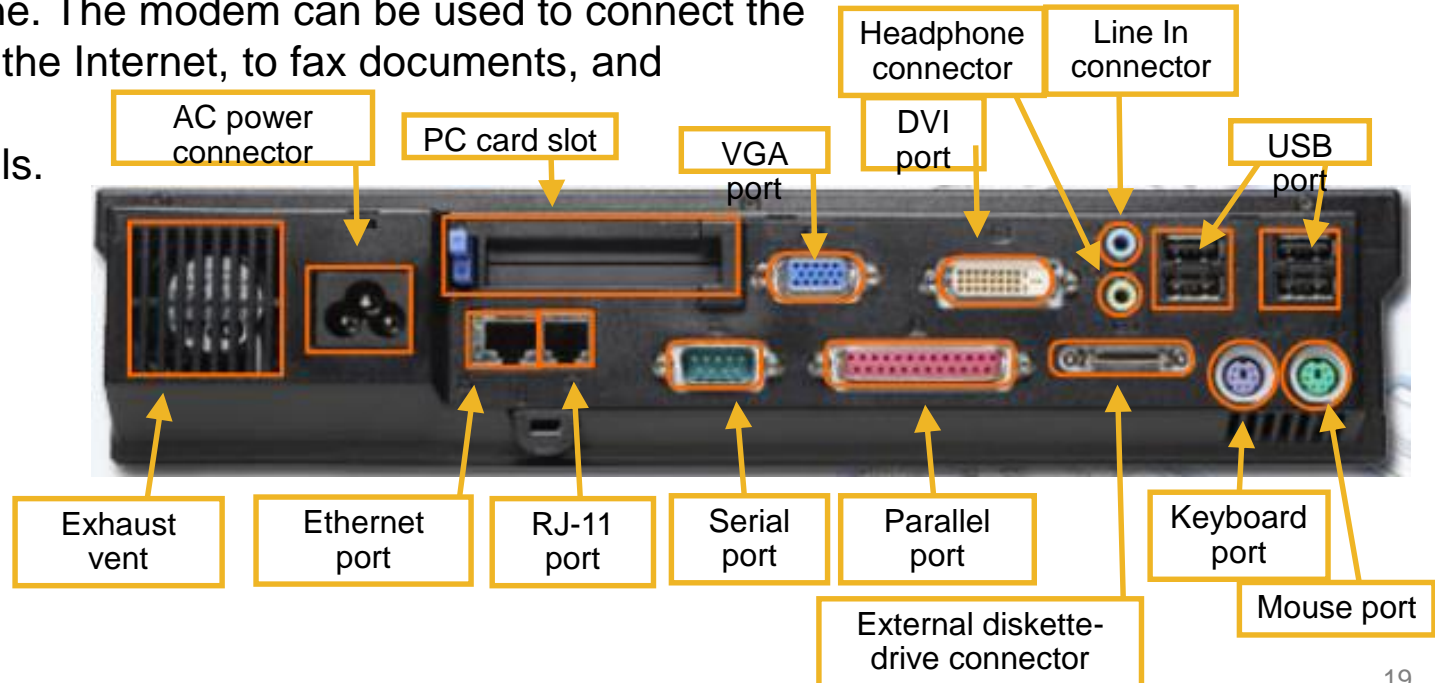
Components on a Docking Station

- Top view of docking station
 - The docking connector is a socket that is used to attach a laptop to a docking station. Docking stations and port replicators use a variety of connection types:
 - Manufacturer- and model-specific
 - USB or FireWire
 - PC-Card or ExpressCard
 - The eject button is a lever that releases the laptop from the docking station so that the laptop can be removed.
 - The power button is a control that turns the power on and turns the power off to the laptop when the laptop is connected to the docking station.



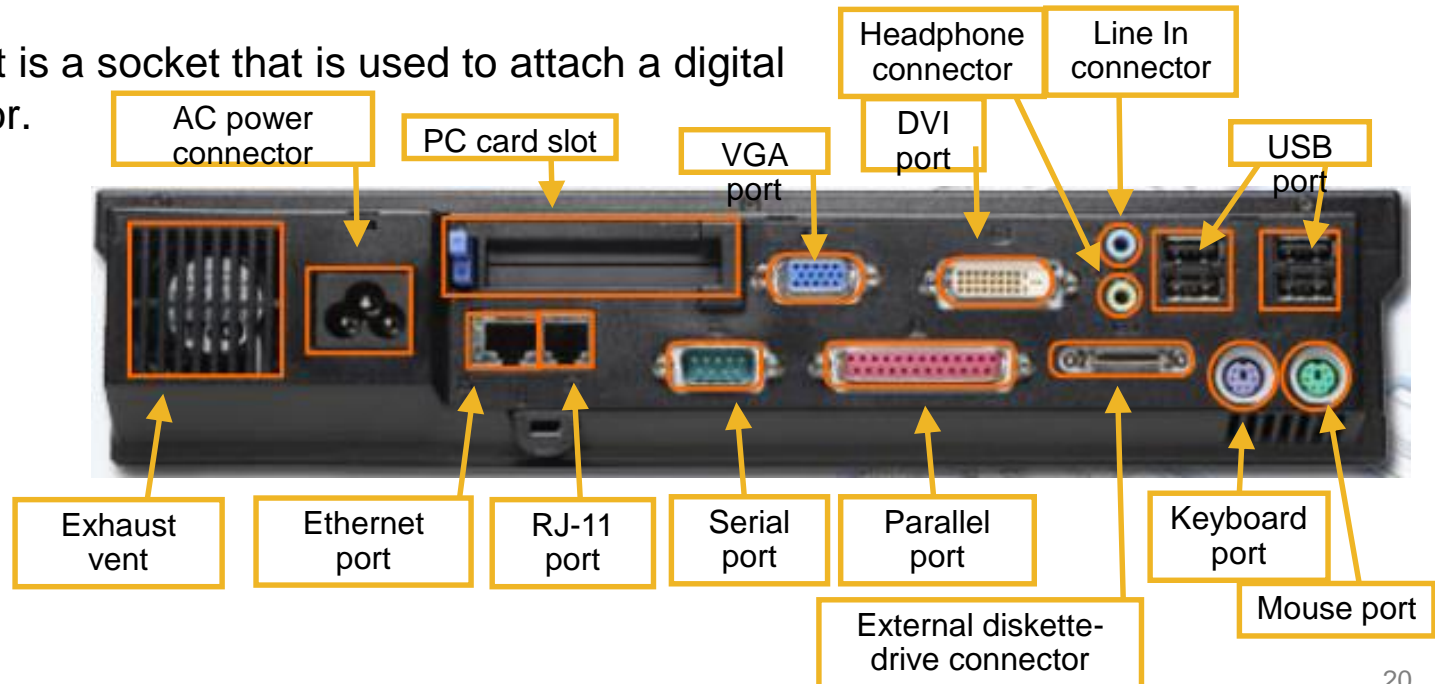
Components on a docking station (Cont.)

- Rear view of docking station
 - The exhaust vent is an outlet that expels hot air from the interior of the docking station.
 - The AC power connector is a socket that is used to connect the AC power adapter to the docking station.
 - The Ethernet port is an RJ-45 socket that is used to connect the laptop to a cabled local area network.
 - The RJ-11 modem port is a device that is used to connect the laptop to a standard telephone line. The modem can be used to connect the computer to the Internet, to fax documents, and to answer incoming calls.



Components on a docking station (Cont.)

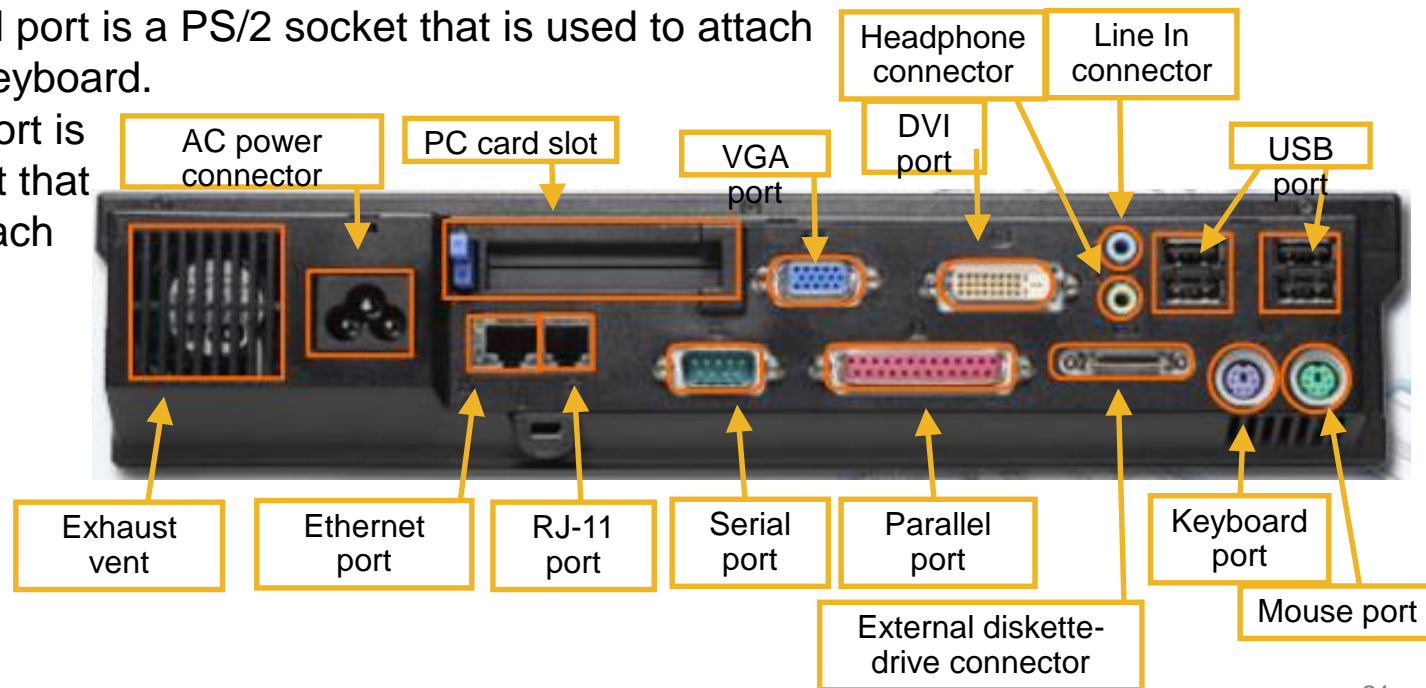
- Rear view of docking station
 - The PC combination card slot is an expansion slot that supports the PC Express expansion cards in the top slot and PC cards in the bottom slot.
 - The serial port is a socket that is used to connect a device such as a mouse or trackball.
 - The VGA port is a 15-pin socket that allows output to external displays and projectors.
 - The parallel port is a socket that is used to connect a device such as a printer or scanner.
 - The DVI port is a socket that is used to attach a digital video monitor.



Components on a docking station (Cont.)

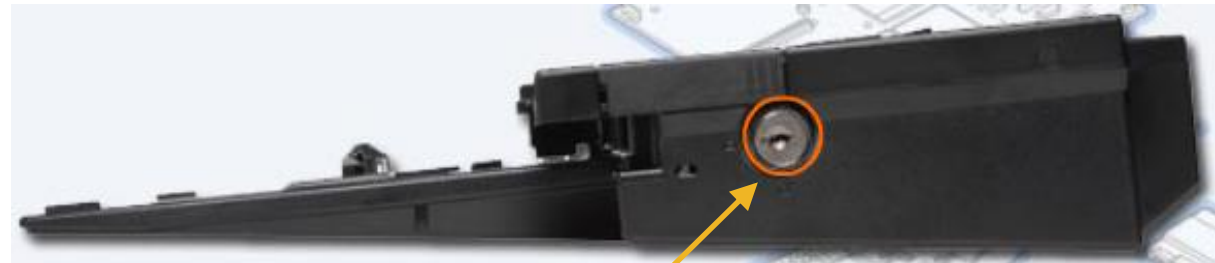
▪ Rear view of docking station

- The external-diskette-drive connector is a socket that is used to connect an external disk drive.
- The headphone connector is a socket that is used to attach an audio output device.
- The Line In connector is a socket that is used to attach an audio source.
- The Universal Serial Bus (USB) port is a socket that is used to connect one or more peripherals.
- The keyboard port is a PS/2 socket that is used to attach an external keyboard.
- The mouse port is a PS/2 socket that is used to attach an external mouse.



Components on a docking station (Cont.)

- Right side view of docking station
 - The key lock is a socket into which a key is inserted to lock the laptop to the docking station.



Key lock

9.2 Laptop Configuration



Laptop Configuration

- Power Settings Configuration

- Power Management

- Advanced Configuration and Power Interface (ACPI) standards
 - Creates a bridge between hardware and Operating System
 - Provides power management schemes for better performance
 - Standards: S0 – S5

- Managing ACPI Settings in the BIOS

- Managing Laptop Power Options

- Sleep
 - Hibernate
 - Shutdown



Laptop Configuration

- **Wireless Configuration**

- **Bluetooth**

- Personal Area Network (PAN)
 - 3 Classes: Most common is Class 2 with a range of approx. 33 feet
 - 4 Specifications: Version 4 is newest with more advanced capabilities
 - Supports 128-bit encryption and PIN authentication

- **Cellular WAN**

- Tethering: Can be made using Wi-Fi, Bluetooth, or USB cable
 - Laptops can have integrated cellular WAN capabilities.

- **WI-FI**

- Mini-PCI: older laptops, 124 pins, 802.11a, 802.11b, and 802.11g
 - Mini-PCIe: Most common, 54 pins, all 802.11 standards
 - PCI Express Micro: ½ size of Mini-PCIe, 54 pin, all 802.11 standards

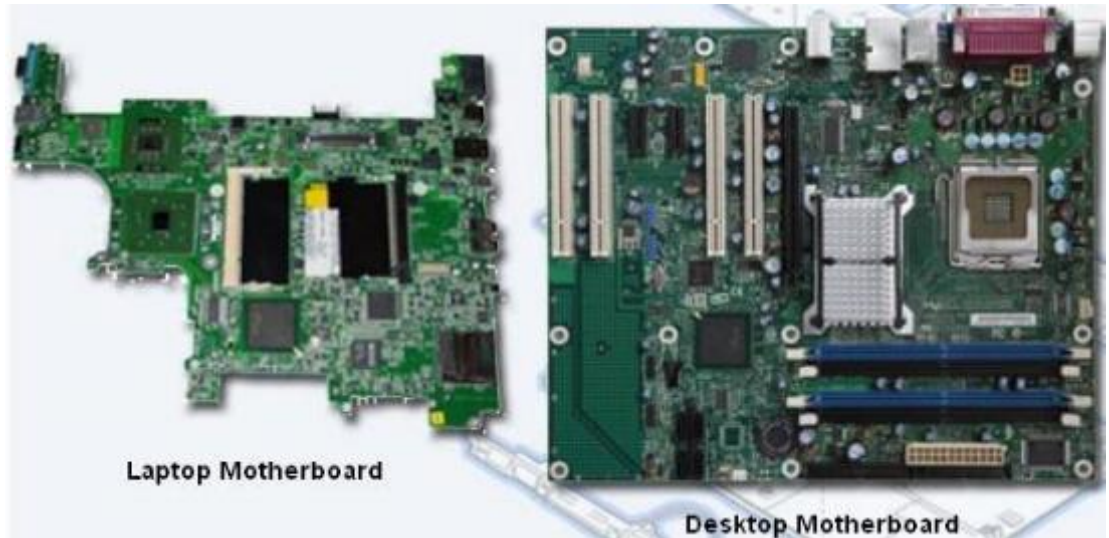


9.3 Laptop Hardware and Component Installation and Configuration



Compare Desktop and Laptop Motherboards

- Desktop motherboards have standard form factors, which allow desktop motherboards from different manufacturers to be interchangeable.
 - Form factors include: AT, LPX, NLX, ATX, and BTX.
 - Expansion slot types include: PCI, PCIe, ISA, and AGP.
 - RAM slot types include: SIMM, DIMM, and RIMM.
- Laptop motherboards vary by manufacturer and are proprietary. It is strongly recommended that you obtain a replacement motherboard from the manufacturer of the laptop.
 - Expansion slot types include: Mini-PCIe or PCI Express Micro
 - RAM slot types include: Small Outline Dual In-line Memory Modules (SODIMMs) to accommodate space restrictions



Laptop Hardware and Component Installation and Configuration

- Expansion Slots

- Expansion Cards

- 2 Models: ExpressCard/34 & ExpressCard/54
 - Add functionality to laptop: Additional memory card reader, External hard drive access, TV tuner cards, USB and FireWire ports, Wi-Fi Connectivity



- Flash Memory

- External Flash Drive (SSD)
 - Flash Cards (SD, SDHC)



- Smart Card Readers

- Contact – requires a physical connection
 - Contactless – works on a radio frequency

- SODIMM Memory

- **Small form factor**
 - 32-bit: 72-pin and 100-pin
 - 64-bit: 144-pin, 200-pin, and 204-pin



Laptop Hardware and Component Installation and Configuration

- Replacing Hardware Devices
 - Overview of Hardware Replacement
 - Customer-Replaceable Units (CRUs)
 - Field-Replaceable Units (FRUs)
 - Power
 - Most batteries are CRU
 - Signs Battery needs to be replaced: Does not hold charge, overheats, leaking
 - Keyboard, Touchpad, and Screens
 - Internal Storage Drive and Optical Drive
 - Wireless Card
 - Speakers
 - CPU
 - Motherboard
 - Plastic Frames



Special Function Keys

- Used to toggle features off and on.
- Press the function (fn) key + appropriate key to activate
- Common Keys:
 - Display (Dual Monitors)
 - Wireless On/Off
 - Volume Settings
 - Screen Brightness
 - Bluetooth On/Off
 - Keyboard Backlight
 - Numeric Pad
 - Battery Status
 - Sleep States
- The purpose of the Function keys F1-to-F12 depends on the operating system and the application running.



Dual Monitor
Fn + <display>



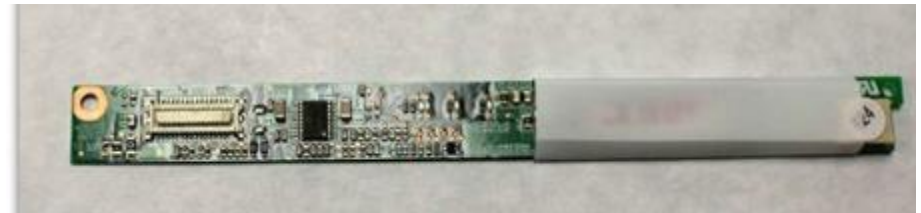
External Switch for Wireless

Laptop Display Types

- Laptop monitors are built-in displays. There are four types of laptop displays:
 - LCD - Liquid Crystal Display
 - LED – Light Emitting Diode - uses less power and has a longer lifespan than LCD monitors
 - OLED - Organic LED
 - Plasma – rarely used in laptops due to high power consumption

Backlights, Inverters and Wi-Fi Antenna

- The **Inverter** converts DC power to the higher voltage AC power that is required by the backlight.



- The **Backlight** shines through the screen and illuminates the display.
 - Two common types of backlights are **cold cathode fluorescent lamp (CCFL)** and **LED**.
- **Wi-Fi antennas** transmit and receive data carried out over wireless signals. Wi-Fi antennas in laptops are typically located above the screen,

Configure Laptop Power Settings

- The **Advanced Configuration and Power Interface (ACPI)** standards create a bridge between the hardware and OS and allow technicians to create power management schemes to get the best performance from the computer.
- The ACPI standards are applicable to most computers, but they are particularly important when managing power in laptops.
- **Power options are available through the BIOS settings and Windows Power Options utility.**
- These are the steps to access the ACPI settings in the BIOS:
 - Enter BIOS setup by pressing the appropriate key or key combination while the computer is booting. Typically this is the Delete key or the F2 key, but there are several other options.
 - Locate and enter the “Power Management settings” menu item.
 - Use the appropriate keys to enable ACPI mode.
 - Save and Exit BIOS setup.
- Proper configuration of the power settings will help you get the maximum performance from a laptop, such as increasing the length of time the laptop can be used on battery power.

Configure Laptop Power Settings

- ACPI Standards
 - S0: The computer is on and the CPU is running.
 - S1: The CPU is not running. However, the CPU and RAM are still receiving power.
 - S2: The CPU is off, but the RAM is refreshed. The system is in a lower power mode than S1.
 - S3: The CPU is off, and the RAM is set to a slow refresh rate. This mode is often called “Save to RAM”. In Windows XP, this state is known as the Standby mode.
 - S4: The CPU and RAM are off. The contents of RAM have been saved to a temporary file on the hard disk. This mode is also called “Saved to Disk”. In Windows XP, this state is known as the Hibernate mode.
 - S5: The computer is off and nothing has been saved.

Configure Laptop Power Settings

- **NOTE:** The ACPI power management mode must be enabled in BIOS to allow the OS to configure all of the power management states.
- Technicians frequently are required to configure power settings by changing the settings found in BIOS. Configuring power settings in BIOS affects the following conditions:
 - System states
 - Battery and AC modes
 - Thermal management
 - CPU PCI bus power management
 - Wake-On-LAN (WOL)
- **NOTE:** WOL might require a cable connection inside the computer from the network adapter to the motherboard.
- **NOTE:** There is no standard name for each power management state. Manufacturers might use different names for the same state.
- **NOTE:** These steps are common to most laptops and should be used only as a guideline. Be sure to check your laptop manual for specific configuration settings.

Power Settings in Windows

- The Power Options feature in Windows allows you to reduce the power consumption of a number of devices or of the entire system. Use Power Options to control the power management features of the following:
 - Laptop
 - Hard drive
 - Display
 - Sleep timers
 - Low-battery warnings
- To configure your power settings, click:
Start > Control Panel > Power Options

Laptop Communication Methods

■ Laptops use several different communication methods:

- Bluetooth
- Infrared
- Cellular WAN
- Wi-Fi

■ Wi-Fi antennas are commonly located above the laptop screen.

■ A new wireless connection can be configured at:

- Start > Control Panel > Networking and Sharing Center > Set up a new connection or network

Wireless Adapter Types



Mini PCI



Mini PCIe



PCI express Micro

Bluetooth

- Bluetooth is a short range wireless technology designed to eliminate the need for cables between portable or fixed-configuration devices.
 - Operates at 2.4 to 2.485 GHz in the unlicensed Industrial, Scientific, and Medical band
 - Low power
 - Low cost
 - Small size
 - Uses adaptive frequency hopping
- Allows a mobile device to share an Internet connection with other devices via tethering.

Version	Description
1.2	1.2 Mbps
2.0 + Enhanced Data Rate (EDR)	3 Mbps
3.0 + High Speed (HS)	24 Mbps

Infrared

- A short-range, low-throughput wireless technology used as a data transmission medium.
- Infrared light signals operate in the lowest light frequency.
- Distances are limited to a few feet or meters.
- IR cannot penetrate any object that blocks the light signal.
- Three types of IR networks:
 - Line of sight - The signal is transmitted only if there is a clear, unobstructed view between devices.
 - Scatter - The signal is bounced off ceilings and walls.
 - Reflective - The signal is sent to an optical transceiver and is redirected to the receiving device.

Cellular WAN

- To connect a laptop to a cellular WAN, you install an adapter that is designed to work with cellular networks.
 - Cellular WAN cards are plug-and-play.
 - Can be plugged in to the PC card slot or is built in to the laptop.
 - Also, access with a USB adapter or by using a mobile hotspot.
- Laptops with integrated cellular WAN capabilities require no software installation and no additional antenna or accessories.

Wi-Fi

- Wi-Fi is a wireless technology that provides a simple connection from anywhere within the range of a base station.
- Connection distances of 300 feet (91 meters) or more, depending on the environment.
- Ease of access makes Wi-Fi a simple solution for network connectivity.
- The Wi-Fi antenna is commonly located above the laptop screen.
- Changing the orientation of the laptop might help with connection issues.

Wi-Fi

Laptops access the internet by using wireless adapters

- **Mini-PCI** - Commonly used by older laptops. Mini-PCI cards have 124 pins and are capable of 802.11a, 802.11b and 802.11g wireless LAN connection standards.
- **Mini-PCle** - Most common type of wireless card in laptops. Mini-PCle cards have 54 pins and support all wireless LAN standards.
- **PCI Express Micro** - Commonly found in newer and smaller laptops, such as Ultrabooks, because they are half the size of Mini-PCle cards.

Near Field Communication

- **Near Field Communication (NFC)** is a short-range high frequency wireless communication technology that enables the exchange of data between devices over about a 10 cm distance.
- Apps like Bump, QuikShare, or ApplePay



Laptop Expansion Options

- PC Card or ExpressCard slots used to add functionality such as:
 - Wi-Fi connectivity
 - Ethernet access
 - USB and FireWire ports
 - External hard drive access
 - Additional memory
- ExpressCard is the newer model of expansion card and is most commonly used:
 - ExpressCard /34 - 34 mm wide
 - ExpressCard /54 - 54 mm wide

Laptop Expansion Options

- **Flash Memory**
 - External Flash Drive
 - Flash Cards and Flash Card Readers
- **SODIMM** - smaller profile/form factor memory chip used by laptops
 - 72-pin and 100-pin configurations for support of 32-bit transfers.
 - 144-pin, 200-pin, and 204-pin configurations for support of 64-bit transfers.
- **Note:** Before purchasing and installing additional RAM, consult the laptop documentation or the website of the manufacturer for form-factor specifications and maximum RAM each slot can support.

Replacing Hardware Devices

- **Customer Replaceable Units (CRUs)** can be replaced by the customer.
- **Field Replaceable Units (FRUs)** should only be replaced by a qualified field technician typically in a repair center. Repairs include:
 - Hardware and software diagnostics
 - Data transfer and recovery
 - Hard drive installation and upgrades
 - RAM installation and upgrades
 - Keyboard and fan replacement
 - Internal laptop cleaning
 - LCD screen repair
 - LCD inverter and backlight repair

Battery Replacement

- Battery may need to be replaced when:
 - Laptop shuts off immediately when AC power is removed.
 - Battery is leaking.
 - Battery overheats.
 - Battery does not hold a charge.



Replacing or Upgrading Memory

- Memory (SO-DIMM) (May be located on the bottom of the laptop or under the keyboard)
- Press outward on the clips that hold the sides to remove it.
- **CAUTION:** Always disconnect and remove all sources of power before installing or removing laptop components that are not hot-swappable.



Keyboard, Touchpad and Screen Replacement

- The keyboard and touchpad are input devices considered to be FRUs.
- A laptop's display screen is often the most expensive component to replace.



- Note: Incorrect display properties will make the display appears stretched and pixelated

Hard Drive and Optical Drive Replacement

Storage devices are CRUs, unless a warranty requires technical assistance.

- Laptop hard drives are 1.8 in. (4.57 cm.) or 2.5 in. (6.35 cm.) in width.
- External USB hard drive connects to a laptop using the USB port.
- IEEE 1394 external hard drive connects to the FireWire port.

Replacing Hardware Devices

- Before replacing a wireless card, determine which form factor is required by the laptop.
- Before a CPU can be replaced, the technician must remove the fan and heat sink.
 - NOTE: A CPU is one of the most fragile components in a laptop. It should be handled with great care.
 - Don't forget to apply/reapply thermal paste before installing the heat sink.
- Before replacing a laptop motherboard, make sure that the replacement meets the design specifications of the laptop model.
- CPU throttling is the ability to modify CPU clock speed as needed.

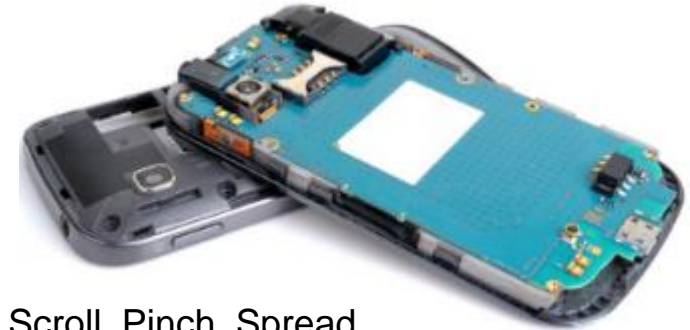
9.4 Mobile Device Hardware Overview



Mobile Device Hardware Overview

- Mobile Device Hardware

- Mobile Device Parts
- Non-Upgradeable Hardware
- Touchscreens
 - Recognize two or more points of contact
 - Common Gestures: Swipe, Double touch, Long touch, Scroll, Pinch, Spread
- Solid State Drives
 - Advantages: Power efficiency, Reliability, Lightweight, Compact, Performance, No noise
- Connection Types
 - Wired: Micro/Mini USB, Lightning, Proprietary vendor specific ports
 - Wireless: NFC, IR, Bluetooth
- Accessories
 - External Battery
 - Docking Station
 - Portable Chargers
 - Ear Buds
 - Headsets
 - Speakers
 - Game Pad
 - SD cards
 - Credit Card Reader



Mobile Device Hardware Overview

- Other Mobile Devices
 - Wearable Devices
 - Smart Watches
 - Fitness Monitors (activity monitor)
 - Smart Headsets
 - Specialty Devices
 - GPS Receiver
 - Smart Cameras
 - Electronic Readers (e-reader)
 - Longer battery life
 - Harder to read in direct sunlight



9.5 Common Preventive Maintenance Techniques for Laptops and Mobile Devices



Common Preventive Maintenance Techniques for Laptops and Mobile Devices

- Scheduled Maintenance for Laptops and Mobile Devices
 - Scheduled Maintenance
 - More exposure
 - Dirt and contamination
 - Spills
 - Wear and tear
 - Drops
 - Excessive heat & cold
 - Excessive moisture
 - Laptops
 - Cleaning
 - Hard drive maintenance
 - Software updates
 - Mobile Devices
 - Cleaning
 - Backing up the data
 - Updating the system and applications



Preventive Maintenance Techniques

- The Preventive Maintenance Schedule for laptops should include these standard procedures:
 - Cleaning
 - Hard drive maintenance
 - Software updates
- The most effective preventive maintenance programs require a proactive set of routines to be conducted monthly and as needed. This includes:
 - Exterior case
 - Keyboard
 - Monitor
 - Cooling and Ventilation

Proper Cleaning Procedures

- Follow proper cleaning procedures to clean a laptop.
 - Keyboard
 - Floppy drive
 - Ventilation
 - Optical disk drive
 - LCD display
 - CD or DVD disc
 - Touch pad
- **CAUTION:**
 - Turn off laptop, remove batteries, disconnect from electrical outlet, and disconnect all attached devices.
 - Do not spray cleaning solution directly onto the LCD display.
 - Use products specifically designed for cleaning LCD displays.
 - Use a soft, lint-free cloth or cotton swab with an approved mild cleaning solution to avoid damaging laptop surfaces.

9.6 Basic Troubleshooting Process for Laptops and Mobile Devices



Troubleshooting Process

Computer problems can result from a combination of hardware, software, and network issues. Computer technicians must be able to analyze the problem and determine the cause of the error to repair the computer. This process is called troubleshooting.

- Step 1** Identify the problem
- Step 2** Establish a theory of probable causes
- Step 3** Test the Theory to Determine cause
- Step 4** Establish a Plan of Action to Resolve the Problem and Implement the Solution
- Step 5** Verify Full System Functionality and Implement Preventative Measures
- Step 6** Document Findings, Actions, and Outcomes

Step 1 - Identify the Problem

- Laptop information
 - Manufacturer, model, OS, network environment, connection type
- Open-ended questions
 - What problems are you experiencing with the laptop?
 - What software has been installed recently?
 - What were you doing when the problem was first identified?
 - What error messages have you received?
- Closed-ended questions (Can be answered with a 'yes' or no')
 - Is the laptop under warranty?
 - Is the laptop currently using the battery?
 - Can the laptop operate using the AC adapter?
 - Can the laptop boot and show the operating system desktop?

Step 2 - Establish a Theory of Probable Cause

- Create a list of the most common reasons why the error would occur.
 - Battery does not have a charge
 - Battery will not charge
 - Loose cable connections
 - Keyboard does not work
 - Num Lock key is on
 - Loose RAM

Step 3 - Test the Theory to Determine cause

- Test your theories of probable causes one at a time, starting with the quickest and easiest.
 - Use AC adapter with laptop
 - Replace the battery
 - Reboot the laptop
 - Check BIOS settings
 - Disconnect and reconnect the cables
 - Disconnect peripherals
 - Toggle Num Lock key
 - Remove and reinstall RAM
 - If Caps lock key is on, turn it off
 - Non-bootable media in a boot device
 - Password has changed
- If the exact cause of the problem has not been determined after you have tested all your theories, establish a new theory of probable cause and test it.

Step 4 - Establish a Plan of Action to Resolve the Problem and Implement the Solution

- If a quick procedure does not correct the problem, you might need to research the problem further to establish the exact cause.
- Divide larger problems into smaller problems that can be analyzed and solved individually.
- Create a list of possible solutions and implement them one at a time. If you implement a possible solution and it does not work, reverse the solution and try another.

Step 4 - Establish a Plan of Action to Resolve the Problem and Implement the Solution

- If a quick procedure does correct the problem, you can go to step 5 to verify the solution and full system functionality.
 - Evaluate the problem and research possible solutions. Divide larger problems into smaller problems that can be analyzed and solved individually. Prioritize solutions starting with the easiest and fastest to implement.
- Check:
 - Helpdesk repair logs
 - Other techs
 - Manufacturer FAQs
 - Technical websites'
 - News groups
 - Computer manuals
 - Device manuals
 - Online forums
 - Internet search

Step 5 - Verify Full System Functionality and Implement Preventative Measures

- Verify full system functionality and implement any preventive measures if needed. This ensures that you have not created another problem while repairing the computer.
 - Reboot the laptop
 - Attach all peripherals
 - Operate laptop using only battery
 - Print a document from an application
 - Type sample document to test keyboard
 - Check Event Viewer for warnings or errors
- Have the customer verify the solution and system functionality.

Step 6 - Document Findings, Actions, and Outcomes

- Discuss the solution with the customer.
- Have the customer confirm that the problem has been solved.
- Give the customer all appropriate paperwork
- Document the process in the work order and in your technician's journal:
 - Problem description
 - Solution
 - Components used
 - Amount of time spent in solving the problem

9.7 Chapter Summary



Summary

This chapter discussed the features and functionality of laptops and mobile devices, as well as how to remove and install internal and external components. The following concepts from this chapter are important to remember:

- Laptops and mobile devices are lightweight and can operate on battery power.
- Laptops use the same types of ports as desktop computers so that peripheral devices can be interchangeable. Mobile devices can also use some of the same peripheral devices.
- Essential input devices, such as a keyboard and track pad, are built into laptops to provide similar functionality as desktop computers. Some laptops and mobile devices use touchscreens as input devices.
- The internal components of laptops are typically smaller than desktop components because they are designed to fit into compact spaces and conserve energy. The internal components of mobile devices are usually connected to the circuit board to keep the device compact and light weight.
- Laptops feature function keys that can be pressed in combination with the Fn key. The functions performed by these keys are specific to the laptop model.
- Docking stations and port replicators can increase the functionality of laptops by providing the same types of ports that are featured on desktop computers. Some mobile devices use docking station to charge or use peripheral devices.

Summary (Cont.)

- Laptops and mobile devices most commonly feature LCD and LED monitors or touchscreens.
- Backlights and inverters illuminate laptop displays.
- The power settings of laptop batteries can be configured to ensure that power is used efficiently.
- Laptops and mobile devices can feature a number of wireless technologies, including Bluetooth, Infrared, Wi-Fi and the ability to access Cellular WANs.
- Laptops provide a number of expansion possibilities. Users can add memory to increase performance, make use of flash memory to increase storage capacity, or increase functionality by using expansion cards. Some mobile devices can add more storage capacity by upgrading or adding more flash memory, such as MicroSD cards.
- Laptop components consist of CRUs and FRUs.
- Laptop components should be cleaned regularly in order to extend the life of the laptop.

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