

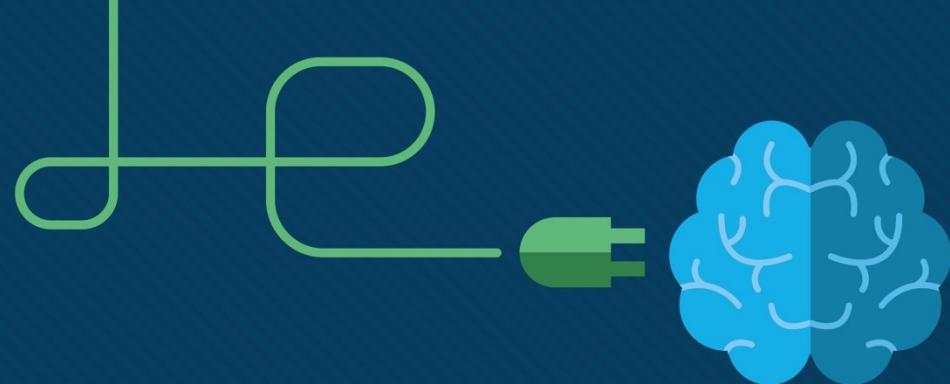
# Chapter 7: Laptops and Other Mobile Devices

Instructor Materials



# Chapter 7: Laptops and Other Mobile Devices

**IT Essentials 7.0 Planning Guide**



# Chapter 7: Laptops and Other Mobile Devices



# Chapter 7 - Sections & Objectives

- **7.1 Characteristics of laptops and other mobile devices**

- Describe the features of mobile devices.
  - Describe the features of laptop components.
  - Compare the types of laptop displays.

- **7.2 Laptop Configuration**

- Explain how to configure power settings on laptops.
  - Explain how to configure wireless communication on laptops.

- **7.3 Laptop Hardware and Component Installation and Configuration**

- Explain how to remove and install laptop memory and adapter modules.
  - Explain how to remove and install laptop hardware.

- **7.4 Other Mobile Device Hardware Overview**

- Describe common mobile device hardware.
  - Describe the hardware components of specialty mobile devices.

# Chapter 7 - Sections & Objectives (Cont.)

- **7.5 Network Connectivity and Email**
  - Explain how to configure wireless and cellular data settings.
  - Explain how to pair Bluetooth devices.
  - Explain how to configure email settings.
  - Explain how to synchronize data.
- **7.6 Preventive Maintenance for Laptops and other Mobile Devices**
  - Explain how to schedule and perform laptop and mobile device maintenance.
- **7.7 Basic Troubleshooting Process for Laptops and other Mobile Devices**
  - Explain the six steps of troubleshooting Laptops and other Mobile Devices.
  - Describe common problems and solutions related to Laptops and other Mobile Devices.

# 7.1 Characteristics of Laptops and Other Mobile Devices

## Mobile Device Overview

# Mobility

- Mobility in information technology means the ability to access information electronically from different locations outside of the home or office.
- Mobile connectivity is limited only by the availability of cellular or data networks.
- Mobile devices:
  - have self-contained power (rechargeable batteries)
  - are generally small and lightweight
  - do not rely on other connected peripheral devices to operate.



# Laptops

- Laptops are portable computers that usually run full versions of operating systems such as Microsoft Windows, iOS or Linux.
- Laptops can have the same computing power and memory resources as desktop computers.
- Laptops integrate a screen, keyboard, and a pointing device, such as a touchpad, in one portable device.
- Laptops can be run from an internal battery or from an electrical outlet.
- They offer connectivity options such as wired or wireless Ethernet networking and Bluetooth.
- Laptops offer device connection options such as USB and HDMI, but may lack the expansion capability of desktops.
  - In order to make laptops more portable, some peripheral connection options may require additional hardware, such as a dock or port replicator.

# Smartphone Characteristics

- Smartphones run special operating systems that are designed for mobile devices.
- Smartphones may have limited OS upgradability and can require the purchase of a new model to take advantage of the latest OS features and apps.
- Software for smartphones is usually limited to apps that can be downloaded from stores such as Google Play or the Apple App Store.
- Smartphones use cellular connectivity options for voice, text, and data services.
- Other data connections include Bluetooth and Wi-Fi.



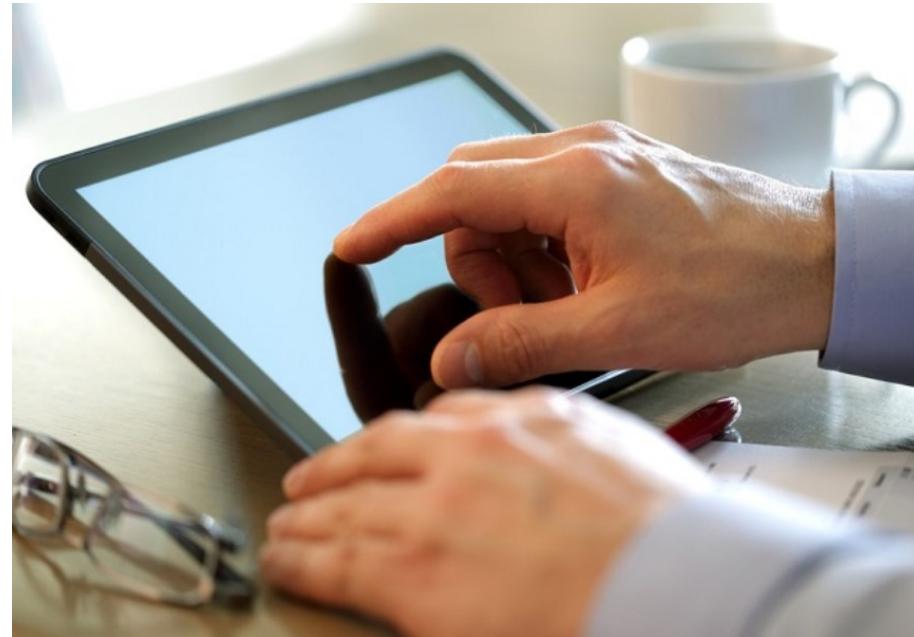
# Smartphone Features

- Most smartphones include global positioning system (GPS) functionality.
  - A GPS receiver in the phone uses satellites to determine the geographic location of the device.
  - Some apps allow a smartphone to act as a navigational GPS that provides guidance for driving, biking, or walking.
- Devices without a GPS service can still determine the location, in a less precise way, by using info coming from nearby mobile service antennas or nearby Wi-Fi access points.
- Another feature of some smartphones is the ability to "tether", or share, the cellular data connection with other devices.



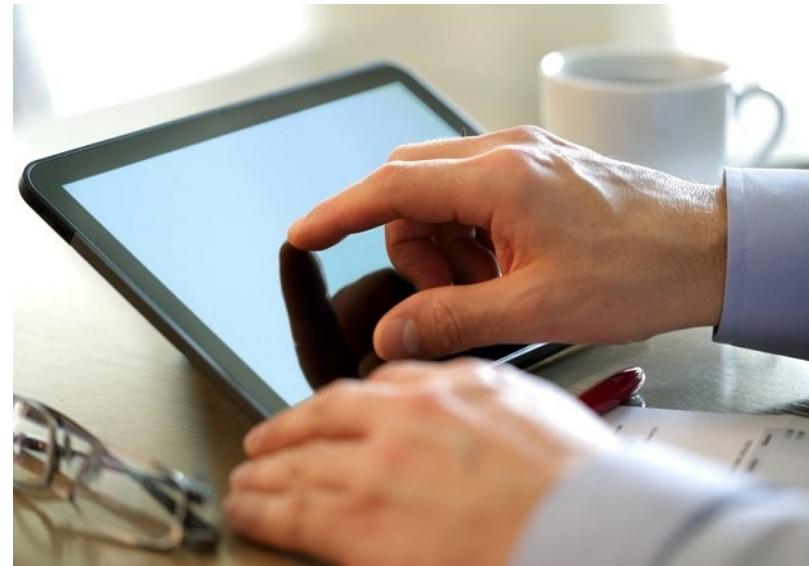
# Tablets and E-Readers

- Tablets are similar to smartphones in that they use special mobile operating systems like Android or iOS.
- Tablets usually offer Wi-Fi and Bluetooth connectivity and most have USB and audio ports.
- Most of the apps that work on phones are also available for tablets.
- Unlike smartphones, tablets normally have larger touch-screen displays.
- Most tablets do not have the ability to access cellular networks and they usually do not include GPS receivers.



# Tablets and E-Readers (Cont.)

- E-readers, such as the Amazon Kindle, are special purpose devices with black and white displays that have been optimized for reading text.
- Although they resemble tablets, they lack many of the features and functions that tablets provide.
- Many have touch displays that make it easy to turn pages, change settings, and access eBooks online.
- For connectivity, some offer free cellular data connections for downloading books from a specific store, but most rely on Wi-Fi.
- E-reader battery life is usually longer than tablets.



# Wearables: Smartwatches and Fitness Trackers

- Wearables are smart devices that are meant to be worn on the body or attached to clothing.
- Smartwatches are a type of wearable that includes a microprocessor, a special operating system, and apps.
  - Sensors in the smartwatch can gather data about various aspects of the body and use Bluetooth to report this information back to another device
  - Some smartwatches can connect directly to a cellular network, utilize GPS location services, provide convenient displays for notifications from apps, and store and play music and playlists.
- Fitness trackers are similar to smartwatches but are limited to monitoring the body such as physical activity, sleep, and exercise.



# Wearables: Augmented and Virtual Realities

- In Augmented Reality (AR), computer graphics are integrated with what is seen in the real world.
  - The graphics overlays can range from cartoon characters in a game application to information for emergency management training for first responders.
- In Virtual Reality (VR), a user wears a special headset which displays graphics from a separate computer.
  - The graphics are immersive 3D and create very realistic worlds.
  - The VR user's motions are detected by sensors which allow the user to interact with and move around in the virtual environment.



# Lab – Mobile Device Information

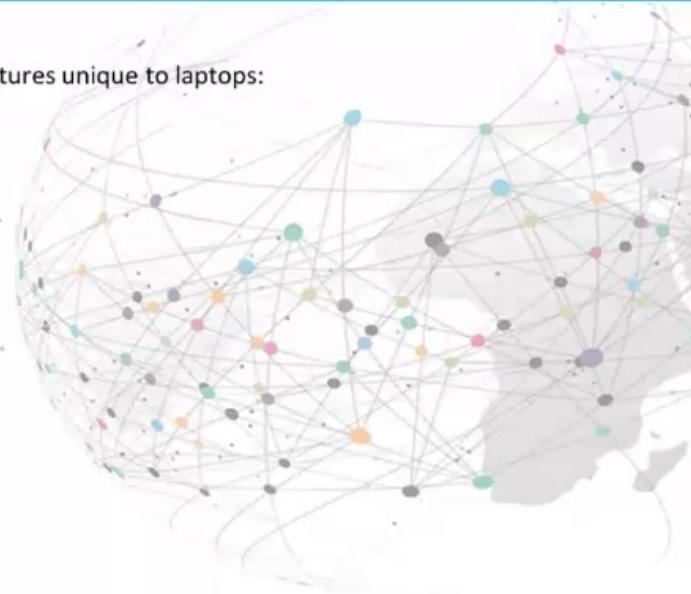
In this lab, you will use the internet, a technical journal, or a local store to gather information about an Android and an iOS device. You will document the specifications of each Android and iOS device onto this worksheet. Be prepared to discuss your decisions regarding the devices you select.

# Video Explanation – External Features Unique to Laptops

### Video Explanation: External Features Unique to Laptops

In this video explanation, you will learn about external features unique to laptops:

- Lid
- Secure Digital multi-media card reader
- Ventilation grill
- Ports
- Security key hole
- PC card slot
- DVD-RW drive
- Ethernet and phone jacks
- Battery
- RAM access panel
- Wireless card access panel
- Hard drive access panel

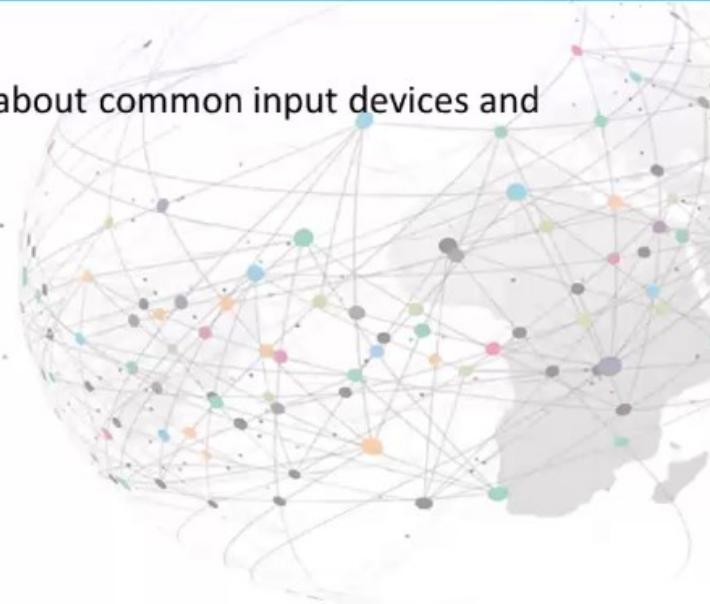


# Video Explanation – Common Input Devices and LEDs in Laptops

### Video Explanation: Common Input Devices and LEDs in Laptops

In this video explanation, you will learn about common input devices and LEDs in laptops:

- Video input and audio input devices
- Wireless network card
- Touchpad
- Keypad and function keys
- Capacitive items
- LED lights
- Fingerprint scanner



# Laptop Components

## Motherboards

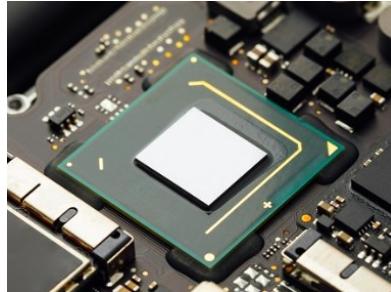
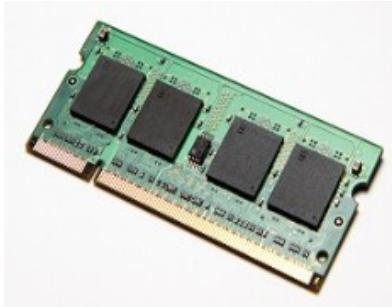
- The compact nature of laptops requires a number of internal components to fit in a small amount of space.
  - The size restrictions result in a variety of form factors for a number of laptop components, such as the motherboard, RAM, CPU, and storage devices.
  - Some laptop components, such as the CPU, may be designed to use less power.
- Desktop motherboards have standard form factors.
  - The standard size and shape allow motherboards from different manufacturers to fit into common desktop cases.
  - Laptop motherboards vary by manufacturer and are proprietary.

**Laptop and Desktop Design Comparison**

Component	Laptop	Desktop
Motherboard form factor	Proprietary	ATX, Micro-ATX, Mini-ITX, ITX
Expansion Slot	Mini-PCI	PCI, PCI-X, PCIe, miniPCI
RAM slot type	SODIMM	DIMM

# Internal Components

- Laptop internal components are designed to fit into the confined spaces of the laptop form factor:
  - **RAM** – Laptops use Small Outline Dual In-line Memory Modules (SODIMM)
  - **CPUs** – Laptop processors are designed to use less power and create less heat than desktop CPUs
  - **SATA drives**- Laptop storage devices are typically 1.8in or 2.5in in width.
  - **Solid-state drives** – Laptops use SSD drives for high performance, small size, and low power consumption.



# Special Function Keys

- The purpose of the Function (Fn) key is to activate a second function on a dual-purpose key.
- The feature that is accessed by pressing the Fn key in combination with another key is printed on the key in a smaller font or different color or with an icon.



- Some examples of functions that can be accessed:
  - Dual displays
  - Volume settings
  - Media options such as fast forward or rewind
  - Keyboard backlight
  - Screen orientation
  - Screen brightness
  - WiFi, cellular, and Bluetooth on or off
  - Media options such as play or rewind
  - Touchpad on or off
  - GPS on or off
  - Airplane mode

# Video Explanation – Docking Station versus Port Replicator

### Video Explanation: Docking Station versus Port Replicator

In this video explanation, you will learn about features of a docking station and a port replicator:

- Ports
- Connectors
- Locking laptop into docking connector
- Differences between the docking station and a port replicator



# Lab – Research Docking Stations and Port Replicators

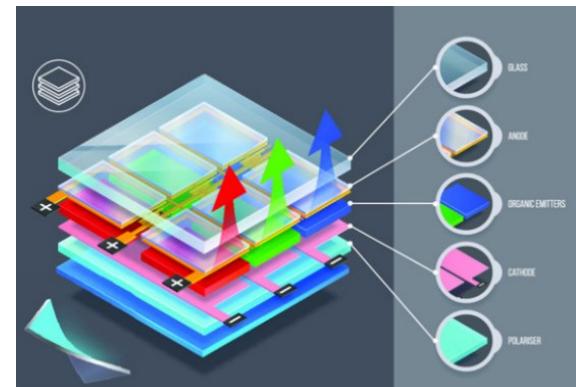
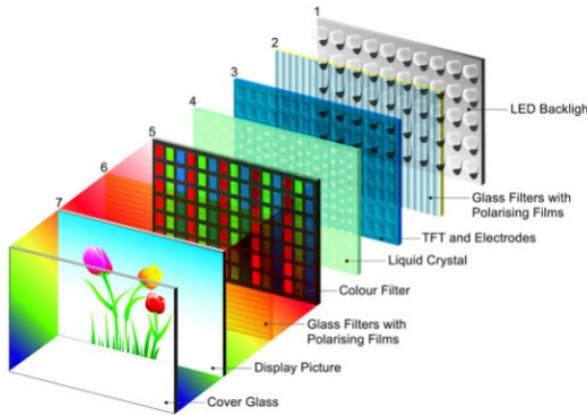
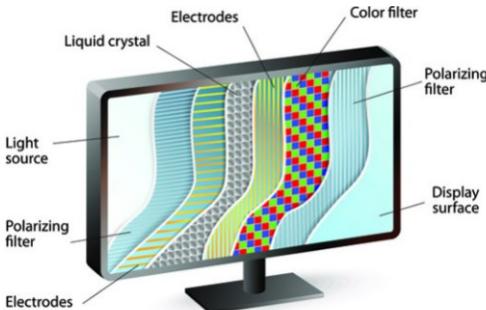
A docking station uses proprietary connectors that turn laptops into a desktop system by connecting to other peripheral devices, such as mice, keyboards, and external monitors. A port replicator can provide some or all of the functionality of docking station; however, it usually connects to the laptops via USB or Thunderbolt connection.

In this lab, you will research the specifications for a proprietary laptop docking station and a generic port replicator for a specific laptop model. Be prepared to discuss your decisions regarding your choices.

# Laptop Display Components

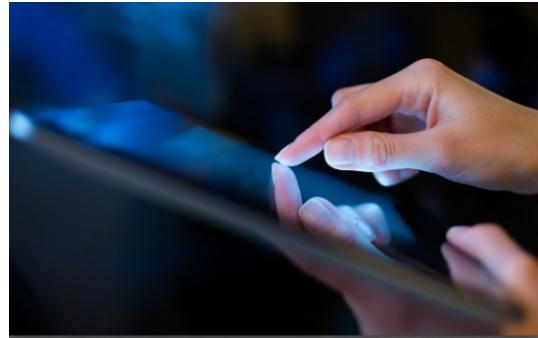
## LCD, LED, and OLED Displays

- There are three types of laptop displays:
  - **Liquid-crystal display (LCD)** - Commonly uses Twisted Nematic (TN) or In-Plane switching (IPS).
  - **Light-emitting diode (LED)** – Uses less power and has a longer lifespan than LCD.
  - **Organic light-emitting diode (OLED)** – Used commonly for mobile devices and digital cameras.



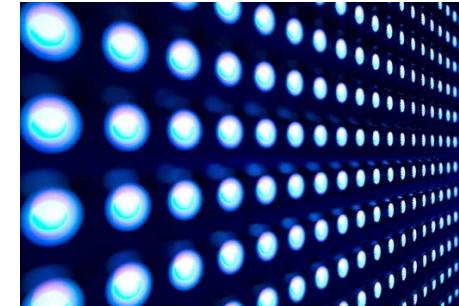
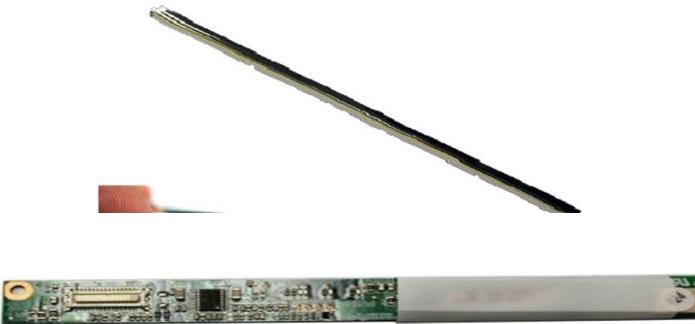
# Laptop Display Features

- Some common laptop display features include:
  - **Detachable screens** – Some laptops permit the touchscreen to be used like a tablet when the display is detached.
  - **Touch screens** – Laptops with touchscreens have a special glass attached to the front of the screen known as a digitizer.
  - **Cutoff switches** – A cutoff switch helps conserve power by turning off the display.



# Backlights and Inverters

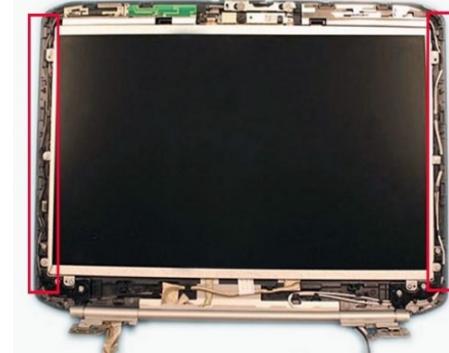
- Two common types of backlights are:
  - cold cathode fluorescent lamp (CCFL)
  - Light-emitting diode (LED)
- Display Components include:
  - Backlights and Inverters
  - Fluorescent backlight
  - Inverter
  - LED backlights



# Laptop Display Components

## Wi-Fi Antenna Connectors

- Wi-Fi components include:
  - **Wi-Fi antenna connectors** – Wi-Fi antennas in laptops are typically located above the screen.
  - **Wi-Fi antenna leads** – The Wi-Fi antenna is connected to a wireless card by an antenna wire and antenna leads.
  - **Wi-Fi antenna wire guides** – The wires are fastened to the display unit by wire guides located on the sides of the screen.



## Laptop Display Components

# Webcam and Microphone

- Most laptops today have a webcam and microphone built-in.
- The webcam is normally positioned at the top, center of the display.
- The internal microphone can often be found next to the webcam.
  - Some manufacturers may place the microphone next to the keyboard, or on the side of the laptop.



# 7.2 Laptop Configuration

# Power Settings Configuration

## Power Management

- Configuring laptop power settings to better manage power usage ensures that the battery is used efficiently.
- Power management controls the flow of electricity to the components of a computer.
- The Advanced Configuration and Power Interface (ACPI) creates a bridge between the hardware and the operating system and allows technicians to create power management schemes to get the best performance from a laptop.

ACPI Power States	
State	Description
S0	The computer is on and the CPU is running.
S1	The CPU and RAM are still receiving power, but unused devices are powered down.
S2	The CPU is off, but the RAM is refreshed. The system is in a lower 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". This state is known as suspend 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 "save to disk". This state is known as hibernate mode.
S5	The computer is off.

## Power Settings Configuration

# Managing ACPI Settings in the BIOS

- Technicians are frequently required to configure power settings by changing the settings in the BIOS or UEFI setup.
- Configuring the power settings affects the following:
  - System states
  - Battery and AC modes
  - Thermal management
  - CPU PCI bus power management
  - Wake on LAN (WOL)
- The ACPI power management mode must be enabled in the BIOS or UEFI to allow the OS to configure the power management states.



# Video Demonstration – Managing Laptop Power Options

### Video Explanation: Managing Laptop Power Options

In this video explanation, you will learn about managing laptop power options:

- Choose what the power buttons do
- Choose or customize a power plan
- Select advanced power settings



# Bluetooth

- The Bluetooth technical specification is described by the Institute of Electrical and Electronics Engineers (IEEE) 802.15 standard.
- Bluetooth devices are capable of handling voice, music, videos, and data.
- The distance of a Bluetooth personal area network (PAN) is limited by the amount of power used by the devices in the PAN
  - The most common Bluetooth technology has a range of approximately 33 ft (10 m).
- Security measures are included in the Bluetooth standard.
  - The first time that a Bluetooth device connects, the device is authenticated using a PIN.
  - This is known as pairing. Bluetooth supports both 128-bit encryption and PIN authentication.

# Bluetooth Laptop Connections

- Windows activates connections to Bluetooth devices by default.
  - If the connection is not active, look for a switch on the front face or on the side of the laptop.
  - Some laptops may have a special function key on the keyboard to enable the connection.
- If a laptop does not include Bluetooth technology, you can purchase a Bluetooth adapter that plugs into a USB port.
- Before installing and configuring a device:
  1. Make sure that Bluetooth is enabled in the BIOS.
  2. Turn on the device and make it discoverable.
  3. Use the Bluetooth Wizard to search and discover Bluetooth devices that are in discoverable mode.

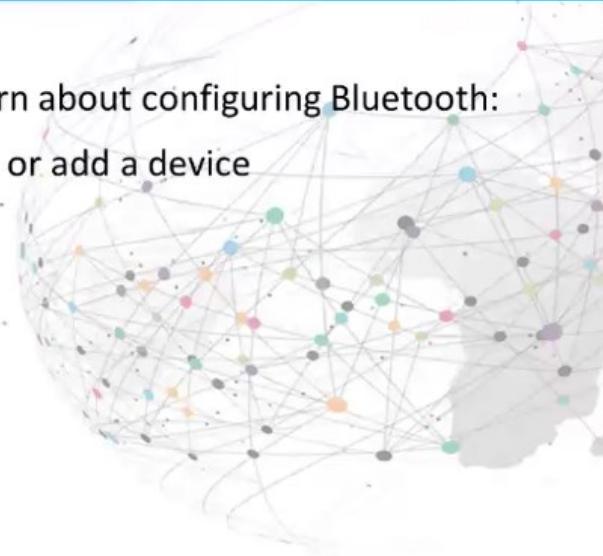


# Video Demonstration – Bluetooth Configuration

Video Explanation: Bluetooth configuration on a mobile device or laptop

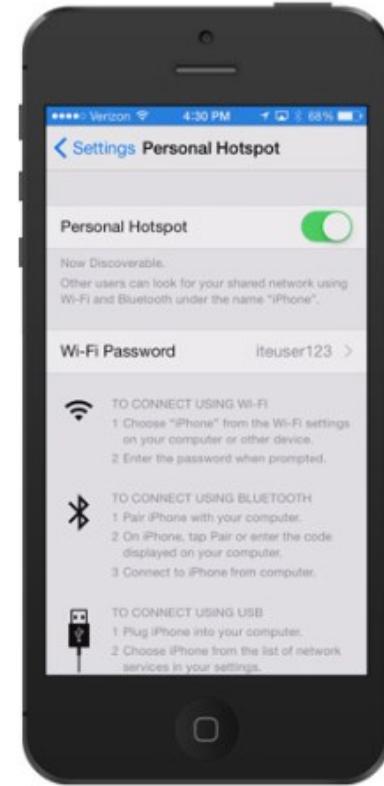
In this video explanation, you will learn about configuring Bluetooth:

- Manage Bluetooth through settings or add a device
- Pairing a device



# Cellular WAN

- Laptops with integrated cellular WAN capabilities require no software installation and no additional antenna or accessories.
  - Some laptops may use a special function key on the keyboard to enable the connection or a physical switch on the front or side of the laptop.
- Many cell phones provide the ability to connect other devices to the Internet.
  - This connection, known as tethering, can be made using Wi-Fi, Bluetooth, or by using a USB cable.
- When a cellular phone allows Wi-Fi devices to connect and use the mobile data network, this is called a hotspot.
  - You can also access a cellular network by using a cellular hotspot device.



# Wireless Configuration

## Wi-Fi

- Laptops usually access the Internet by using wireless adapters.
- Wireless adapters can be built-in or attached through a USB or expansion port
  - Mini-PCI cards are capable of 802.11a, 802.11b, and 802.11g wireless LAN connections.
  - Mini-PCIe and PCI Express Micro cards support the above standards and 802.11n and 802.11ac.



Mini-PCI



Mini-PCIe



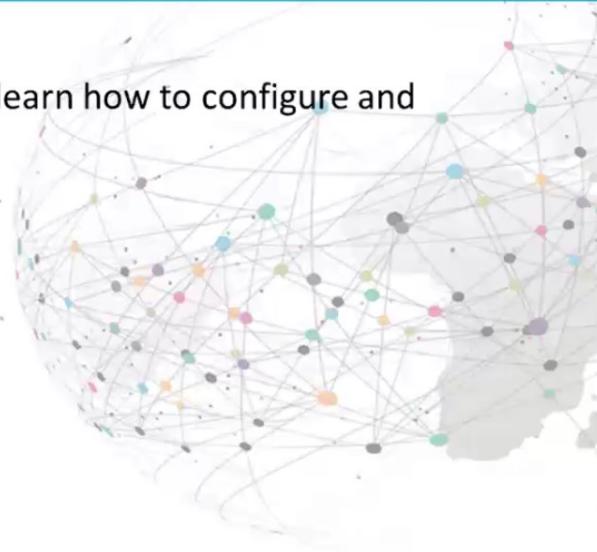
PCI Express Micro

# Video Demonstration – Wi-Fi Configuration

### Video Demonstration: Wi-Fi Configuration

In this video demonstration, you will learn how to configure and connect to Wi-Fi:

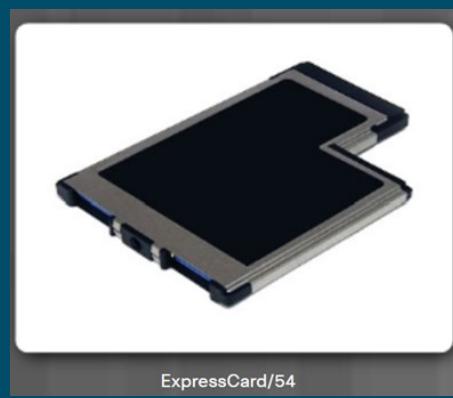
- Network and Sharing Center
- Connect to a wireless network
- Connection options



# 7.3 Laptop Hardware and Component Installation and Configuration

# Express Cards

- Express Bus: ExpressCard/54
- Size: 75mm x 54mm
- Thickness: 5mm
- Interface: PCI Express, USB 2.0, or USB 3.0
- Examples: Smart Card reader, Compact Flash reader, 1.8 inch disk drive



ExpressCard/54

- Express Bus: ExpressCard/34
- Size: 75mm x 34mm
- Thickness: 5mm
- Interface: PCI Express, USB 2.0, or USB 3.0
- Examples: Firewire, TV Tuner, Wireless NIC



ExpressCard/34

## Expansion Slots

# Flash Memory

### ▪ External Flash Drive

- A removable storage device that connects to an expansion port such as USB, eSATA, or Firewire.
- Flash drives provide fast access to data, high reliability, and reduced power usage.



### ▪ Flash Cards

- A flash card is a data storage device that uses flash memory to store information.
- Flash cards are small, portable, and require no power to maintain data.



### ▪ Flash Card Readers

- Most modern laptops feature a flash card reader for Secure Digital (SD) and Secure Digital High Capacity (SDHC) flash cards.



# Smart Card Reader

- A smart card is similar to a credit card, but has an embedded microprocessor that can be loaded with data.
  - It can be used for telephone calling, electronic cash payments, and other applications.
  - The microprocessor on the smart card can hold much more information than that of a magnetic stripe.
- Smart card readers are used to read and write to smart cards.
- There are two types of smart card readers:
  - **Contact** - This type of reader requires a physical connection to the card, made by inserting the card into the reader
  - **Contactless** - This type of reader works on a radio frequency that communicates when the card comes close to the reader.



# SODIMM Memory

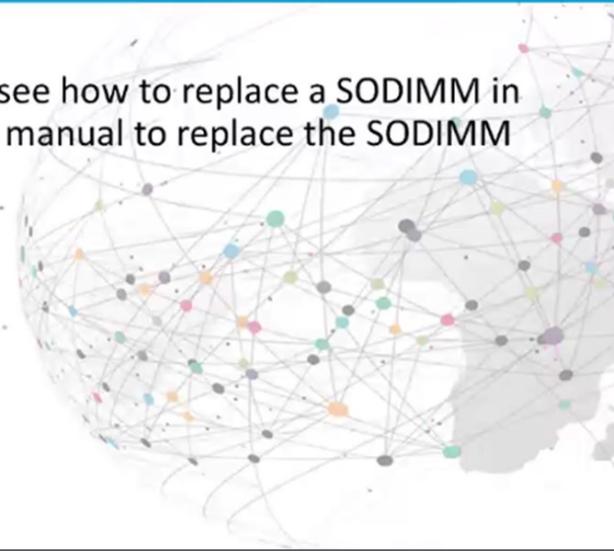
- Most desktop computers use memory that fits into a DIMM slot.
- Most laptops use a smaller profile memory module that is called SODIMM. **Note:** SODIMMs can be further classified by DDR version. Different laptop models require different types of SODIMMs.
- On most laptops, RAM is inserted into slots behind a cover on the underside of the case.
  - On some laptops, the keyboard must be removed to access the RAM slots.
- You can view the currently installed amount of RAM in the POST screen, BIOS, or System Properties window.



# Video Demonstration – Install SODIMM

### Video Demonstration: Install SODIMM

In this video demonstration, you will see how to replace a SODIMM in a laptop. Refer to the manufacturer's manual to replace the SODIMM in your specific laptop model.



# Overview of Hardware Replacement

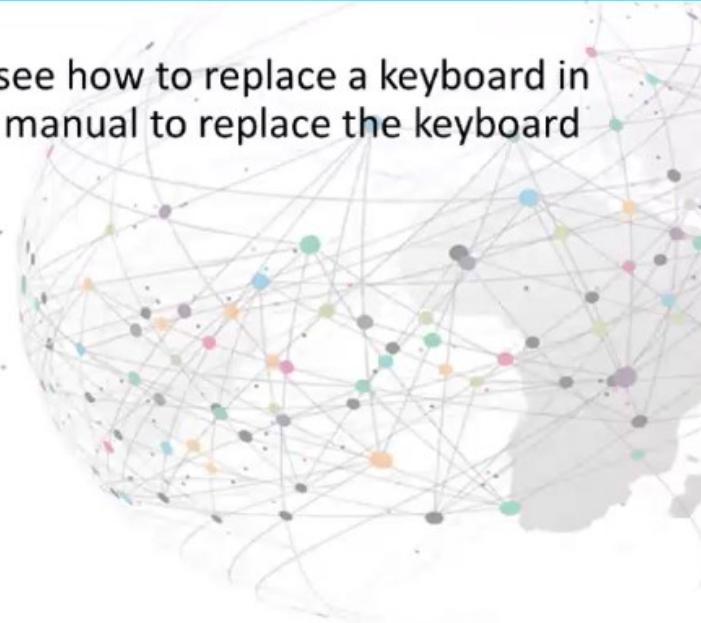
- Some parts of a laptop, typically called customer-replaceable units (CRUs), can be replaced by the customer.
  - CRUs include components such as the laptop battery and RAM.
- Parts that should not be replaced by the customer are called field-replaceable units (FRUs).
  - FRUs include components such as the motherboard, LCD display, and keyboard.
- The following are common repairs performed at local repair centers:
  - Hardware and software diagnostics
  - Data transfer and recovery
  - Keyboard and fan replacement
  - Internal laptop cleaning
  - Screen repair
  - LCD inverter and backlight repair

# Replacing Laptop Components

## Keyboard Replacement

### Video Demonstration: Keyboard Replacement

In this video demonstration, you will see how to replace a keyboard in a laptop. Refer to the manufacturer's manual to replace the keyboard in your specific laptop model.

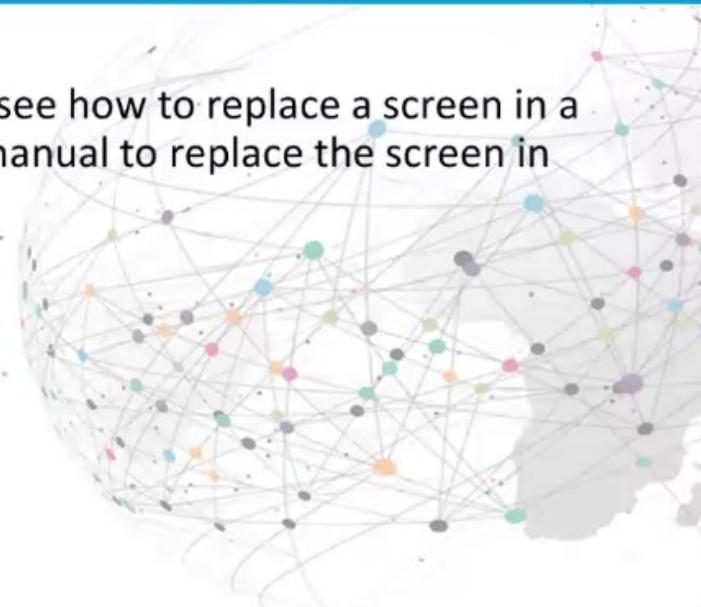


# Replacing Laptop Components

## Screen Replacement

### Video Demonstration: Screen Replacement

In this video demonstration, you will see how to replace a screen in a laptop. Refer to the manufacturer's manual to replace the screen in your specific laptop model.



## Lab- Research Laptop Screens

In this lab, you will use the internet or a local store to gather information and then record the specifications for a laptop display onto this worksheet.

# Replacing Laptop Components

## Power

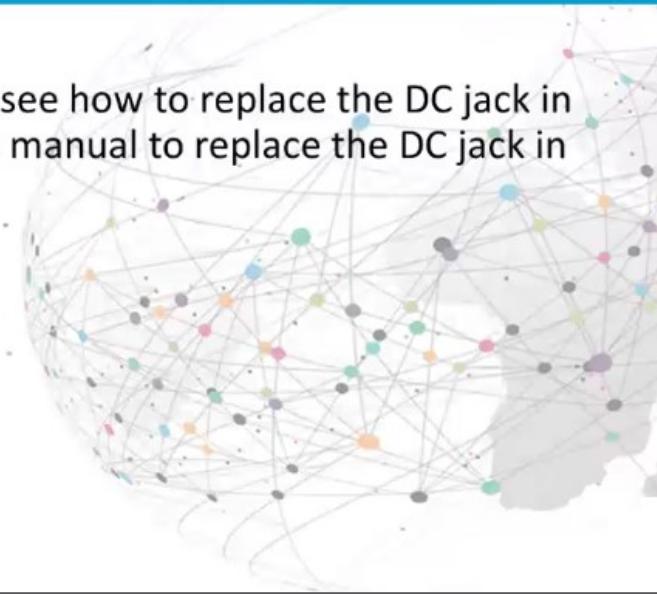
- These are some signs that the battery may need to be replaced:
  - The battery does not hold a charge.
  - The battery overheats.
  - The battery is leaking.
- If you experience problems that you suspect are battery related, exchange the battery with a known, good battery that is compatible with the laptop.
  - A replacement battery must meet or exceed the specifications of the laptop manufacturer.
  - New batteries must use the same form factor as the original battery.
  - Voltages, power ratings, and AC adapters must also meet manufacturer specifications.



# Video Demonstration – DC Jack Replacement

### Video Demonstration: DC Jack Replacement

In this video demonstration, you will see how to replace the DC jack in a laptop. Refer to the manufacturer's manual to replace the DC jack in your specific laptop model.



## Lab- Research Laptop Batteries

In this lab, you will use the internet or a local store to gather information and then record the specifications for a laptop battery.

# Internal Storage and Optical Drive

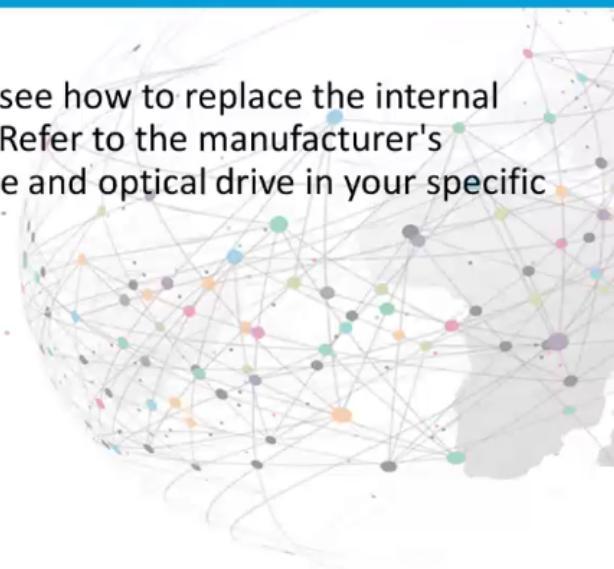
- The form factor of an internal storage device is smaller for a laptop than for a desktop computer.
  - Laptop drives are 1.8 in. (4.57 cm.) or 2.5 in. (6.35 cm.) in width.
- Most storage devices are CRUs unless a warranty requires technical assistance.
  - On most laptops, the internal hard drive and the internal optical drive are inserted into bays that are protected by a removable cover on the case.
  - On some laptops, the keyboard must be removed to access these drives.
- To view the currently installed storage devices, check the POST screen or BIOS.



# Video Demonstration – Internal Storage and Optical Drive Replacement

### Video Demonstration: Internal Storage and Optical Drive Replacement

In this video demonstration, you will see how to replace the internal storage and optical drive in a laptop. Refer to the manufacturer's manual to replace the internal storage and optical drive in your specific laptop model.



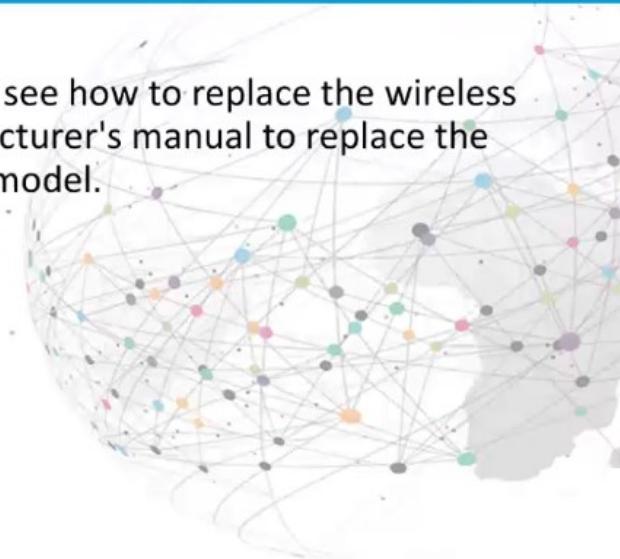
## Lab- Research Laptop Drives

In this lab, you will use the internet or a local store to gather information about storage and optical drives for a laptop.

# Video Demonstration – Wireless Card Replacement

### Video Demonstration: Wireless Card Replacement

In this video demonstration, you will see how to replace the wireless card in a laptop. Refer to the manufacturer's manual to replace the wireless card in your specific laptop model.



# Video Demonstration – Speakers Replacement

### Video Demonstration: Speakers Replacement

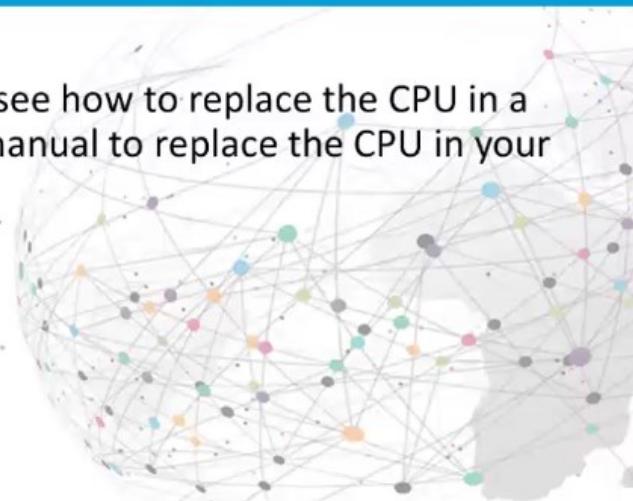
In this video demonstration, you will see how to replace speakers in a laptop. Refer to the manufacturer's manual to replace the speakers in your specific laptop model.



# Video Demonstration – CPU Replacement

### Video Demonstration: CPU Replacement

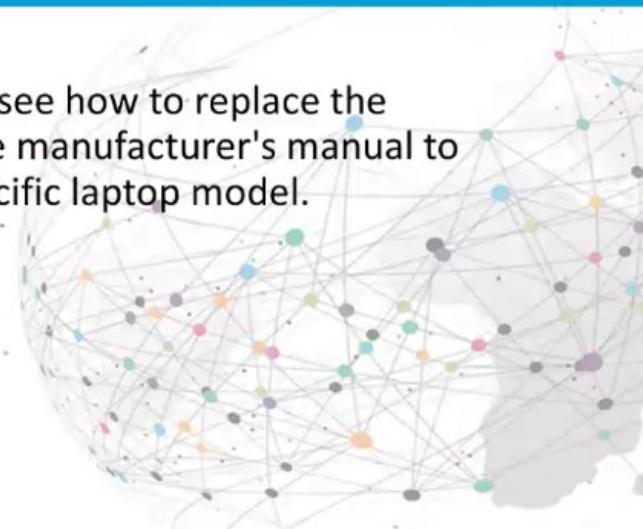
In this video demonstration, you will see how to replace the CPU in a laptop. Refer to the manufacturer's manual to replace the CPU in your specific laptop model.



# Video Demonstration – Motherboard Replacement

### Video Demonstration: Motherboard Replacement

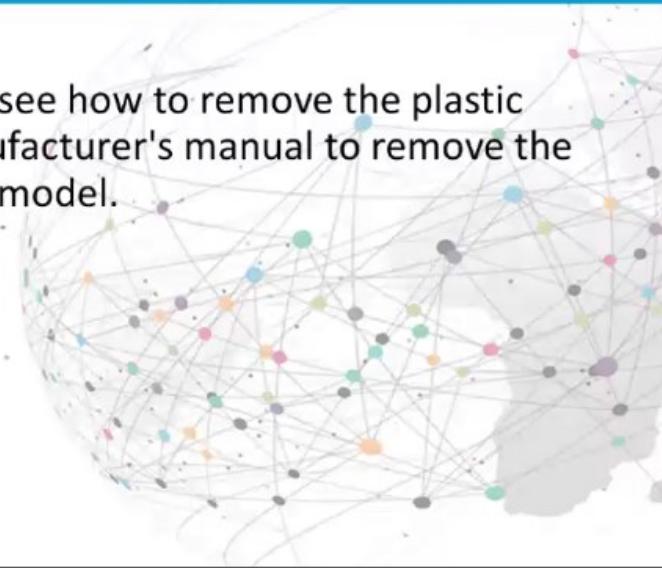
In this video demonstration, you will see how to replace the motherboard in a laptop. Refer to the manufacturer's manual to replace the motherboard in your specific laptop model.



# Video Demonstration – Plastic Frames

### Video Demonstration: Plastic Frames

In this video demonstration, you will see how to remove the plastic frames of a laptop. Refer to the manufacturer's manual to remove the plastic frames in your specific laptop model.



# 7.4 Other Mobile Device Hardware

# Cell Phone Parts

- The cell phone contains one or more of these field replaceable parts:
  - Memory, a SIM card, and a battery.
- A SIM card contains information used to authenticate a device to mobile telephone and data providers.
  - The card can also hold user data such as personal contacts and text messages.
- A Secure Digital (SD) card is used to add memory to many mobile devices.
- When a mobile device malfunctions, it is usually sent to the manufacturer for repair or replacement.



# Wired Connectivity

- A **mini-USB cable** is used to connect a mobile device to an electrical outlet charger or to another device in order to charge and/or transfer data.
- A **USB-C cable and port** can be plugged in either direction and are used on mobile devices to connect to an electrical outlet charger or to another device in order to charge and/or transfer data.
- A **micro-USB cable** is used to connect a mobile device to an electrical outlet charger or to another device in order to charge and/or transfer data.
- A **Lightning cable and port** is used to connect Apple devices to host computers and other peripherals such as USB battery chargers, monitors, and cameras.



A USB-C cable



A micro-USB cable



Lightning cable and port



Proprietary cables and ports

# Wireless Connections and Shared Internet Connections

- Besides Wi-Fi, mobile devices also use the following wireless connections:
  - **Near field communication (NFC)** – NFC enables mobile devices to establish radio communications with other devices by placing the devices close together or by touching them together.
  - **Infrared (IR)** – If a mobile device is IR enabled, it can be used to control other IR controlled devices remotely, such as a TV, set top box, or audio equipment.
  - **Bluetooth** – This allows data exchange over a short distance between two Bluetooth-enabled devices or connect to other Bluetooth-enabled peripheral devices, such as speakers or headphones.
- A smartphone's internet connection can be shared with other devices.
  - **Tether** – This uses your cellular phone as a modem for another device, such as a tablet or laptop.
  - **Mobile hotspot** – A hotspot is where devices connect using Wi-Fi to share a cellular data connection.

# Wearable Devices

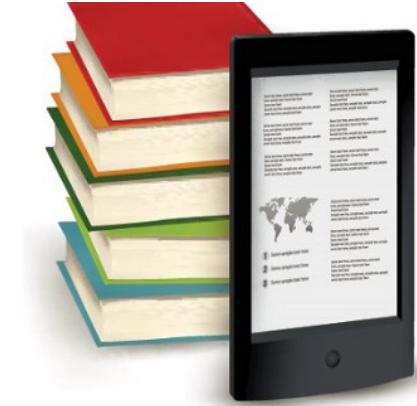
- Wearable devices are clothing or accessories that have miniature computing devices.
  - Smartwatches, fitness monitors, and smart headsets are some examples.
- Fitness monitors measure and collect activity data and can connect with other Internet-connected devices to upload the data for later review.
- VR headsets provide the wearer with a complete immersion experience shutting out the physical world.
- Augmented reality (AR) headsets overlay digital elements to a live view of the physical world often using the camera of a smartphone.



# Specialty Mobile Devices

## Specialty Devices

- There are many other types of smart devices that benefit from network connectivity and advanced functions.
- Global Positioning System (GPS) is a satellite-based navigation system.
  - GPS satellites are located in space and transmit signals back to Earth.
- An electronic reader, or e-reader, is a device optimized for reading electronic books, e-books, newspapers, and other documents.
  - These have Wi-Fi or cellular connectivity for downloading content.



# 7.5 Network Connectivity and Email

# Wireless Data Networks

- The ability of a laptop, tablet, or cell phone to wirelessly connect to the internet has provided people with the freedom to work, learn, communicate, and play wherever they want.
- Mobile devices typically have two wireless internet connectivity options:
  - **Wi-Fi** - Wireless network connection is provided using local Wi-Fi settings.
  - **Cellular** - Wireless network connection is provided for a fee using cellular data. Cellular networks require cellular towers and satellites to create a mesh of global coverage.
- Wi-Fi is usually preferred over a cellular connection because it is usually free and Wi-Fi radios use less battery power than cellular radios.
- Many businesses, organizations, and locations now also offer free Wi-Fi connections to attract customers.
- It is important to take precautions and secure home Wi-Fi networks. Use the highest Wi-Fi security framework possible and use encryption such as a VPN connection.

# Lab- Mobile Wi-Fi

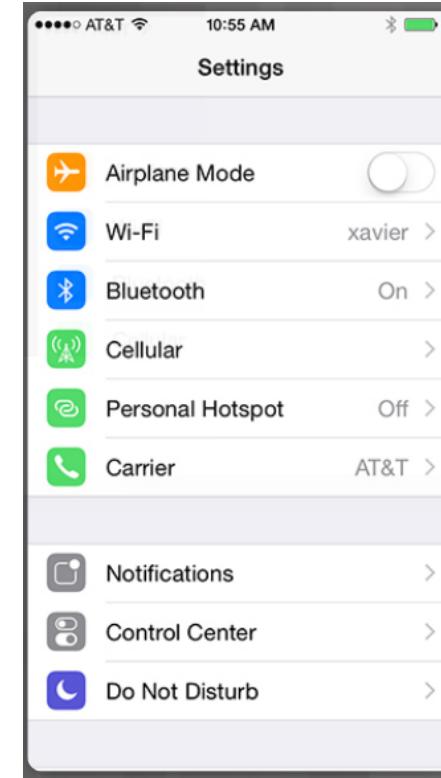
In this lab, you will turn the Wi-Fi radio on and off, forget a found Wi-Fi network, and find and connect to a WiFi network.

# Cellular Communication Standards

- Cellular standards have not been adopted uniformly around the world so some cell phones may only work in one country and not operate in other countries.
- Cellular technology has evolved approximately every 10 years.
  - **1G** – Introduced in the 1980s, first generation (1G) standards used analog standards.
  - **2G** - Introduced in the 1990s, the second generation (2G) standards switched from analog to digital standards. 2G provided speeds up to 1 Mb/s and supported higher call quality. 2G also introduced Short Message Service (SMS) and Multimedia Message Service (MMS).
  - **3G** – Introduced in the late 1990s, third-generation (3G) standards enabled speeds up to 2 Mb/s to support mobile internet access, web browsing, video calls, video streaming, and picture sharing.
  - **4G** – Introduced in the late 2000s, 4G standards enables speeds of 100 Mb/s and up to 1Gb/s to support gaming services, high-quality video conferencing, and high-definition television. Long Term Evolution (LTE) adds improvements to 4G.
  - **5G** – Introduced in 2019, 5G is the latest standard. It is more efficient than previous standards and may support speeds up to 20 Gb/s.

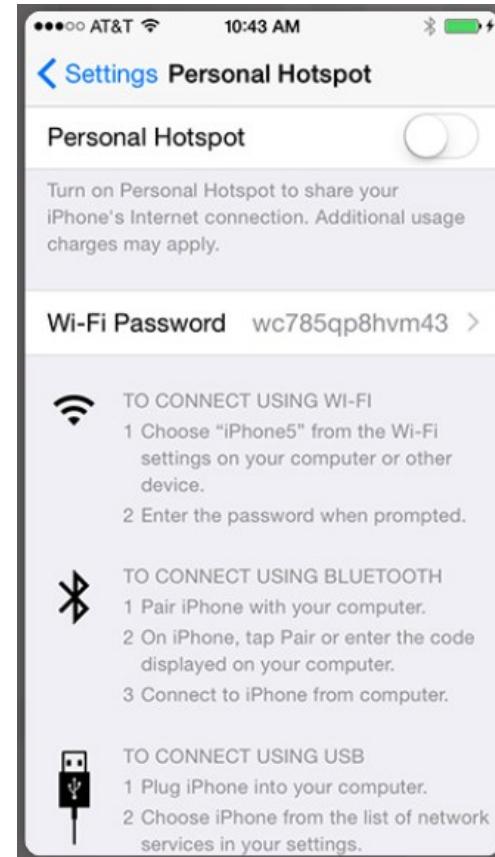
# Airplane Mode

- Most mobile devices have a setting called Airplane Mode.
  - This setting turns off all cellular, as well as Wi-Fi and Bluetooth radios.
  - Most mobile device functions are still usable, but communication is not possible.
- Airplane Mode is useful when traveling on an airplane or when traveling where accessing data is prohibited or expensive.
- You can also enable or disable cellular access specifically on a device instead of using the Airplane Mode setting.



## Hotspot

- A hotspot is when a cellular device is used to provide an internet connection to other devices.
  - A cell phone can be used as a bridge to the internet, through the cellular carrier's network.
  - The Wi-Fi devices could select the cellular device at its Wi-Fi connection.
- To enable an iOS device to become a personal hotspot, touch Personal Hotspot
  - The iOS Personal Hotspot feature can also connect Bluetooth or USB connected devices to the internet.
- A hotspot is sometimes referred to as tethering.



# Bluetooth for Mobile Devices

- Common Bluetooth devices for mobile devices include:
  - Wireless speakers
  - Wireless headphones
  - Wireless keyboard or mouse
  - Wireless gaming consoles



Wireless Speaker



Wireless Headphones



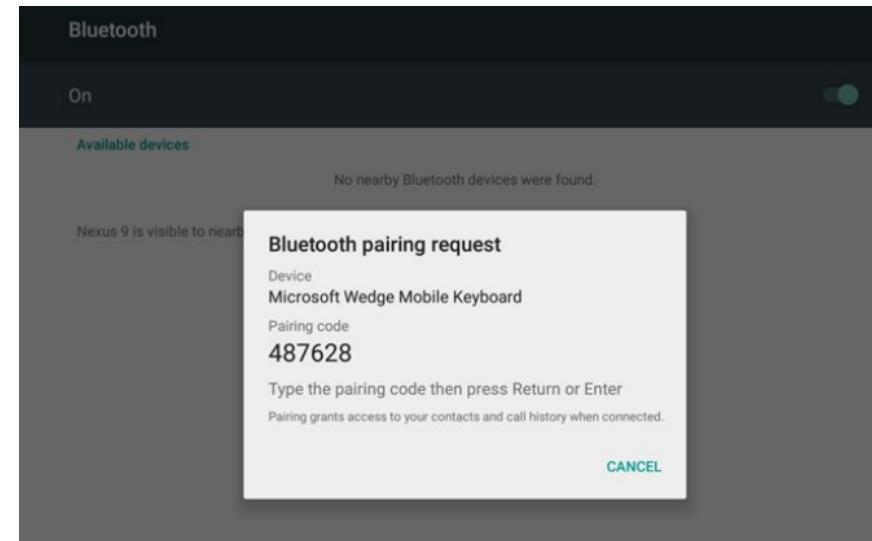
Wireless Keyboard or  
Mouse



Wireless Gaming  
Controller

## Bluetooth Pairing

- Bluetooth pairing is when two Bluetooth devices establish a connection to share resources.
  - When a Bluetooth device is in discoverable mode, it transmits Bluetooth and device information such as device name, services that the device can use, Bluetooth class and device name.
- During the pairing process, a PIN may be requested to authenticate the pairing process
  - The PIN is often a number, but can also be a numeric code or passkey.
  - The PIN is stored using pairing services, so it does not have to be entered the next time the device tries to connect.



# Introduction to Email

- The email structure relies on email servers and email clients
- Email servers require email software such as Microsoft Server Exchange.
  - Exchange is also a contact manager and calendaring software.
  - It uses a proprietary messaging architecture called Messaging Application Programming Interface (MAPI).
  - MAPI is used by the Microsoft Office Outlook client to connect to Exchange servers, to provide email, calendar, and contact management.

## Email Servers

- Responsible for forwarding email messages sent by their users.
- Servers forward emails to other email servers.
- Servers store emails until retrieved by users.

## Email Clients

- Clients connect to the email servers to retrieve their emails.
- Users utilize email clients to compose, read and manage their messages.
- Email clients can be web-based or standalone applications.
- Standalone email clients are platform dependent.

## Configuring Email

# Introduction to Email (Cont.)

- Email clients and servers use various protocols and standards to exchange emails.

### Post Office Protocol 3 (POP3)

- This is an email client protocol that is used to retrieve emails from a remote server over TCP/IP.
- It enables a client to connect to an email server, download the user email from the server, and then disconnect.
- POP3 typically does not leave a copy of the email on the server.
- POP3 uses TCP port 110.
- Compare with IMAP.

### Internet Mail Access Protocol (IMAP)

- Email client similar to POP3 except that it synchronizes email folders between the server and client and downloads copies of the email from the email server.
- IMAP is faster than POP3 but requires more disk space and more CPU resources.
- It is often used in large networks, such as a university campus.
- The most recent version of IMAP is IMAP4 and it uses TCP port 143.
- Compare with POP3.

### Simple Mail Transfer Protocol (SMTP)

- Email clients use SMTP to send email to servers.
- Email servers also use SMTP to send emails to other email servers.
- A message is sent only after recipients are identified and verified.
- SMTP is text-based and uses only ASCII encoding and requires MIME to send all other file types.
- SMTP uses TCP port 25.

### Multipurpose Internet Mail Extension (MIME)

- MIME is normally used in conjunction with SMTP.
- MIME extends the text-based email format to include other formats, such as pictures and word processor documents.

### Secure Sockets Layer (SSL)

- SSL was developed to transmit files securely.
- Most email clients and servers support encryption of emails.

# Introduction to Email (Cont.)

- Email clients have to be installed on a mobile device.
  - Many clients are configurable using a wizard, however, you still need to know key information to set up an email account.

Email Account Information	Description
Email Address	<ul style="list-style-type: none"><li>• This is the address people need to send email to you.</li><li>• An email address is a username followed by the @ symbol and the domain of the email server (user@example.net).</li></ul>
Display name	<ul style="list-style-type: none"><li>• This can be your real name, nickname, or any name that you want people to see.</li></ul>
Email protocols	<ul style="list-style-type: none"><li>• Email protocols are used by the incoming mail server.</li><li>• Different protocols provide different email services.</li></ul>
Incoming and outgoing mail server names	<ul style="list-style-type: none"><li>• These names are provided by the network administrator or ISP.</li></ul>
Account Credentials	<ul style="list-style-type: none"><li>• This consists of the username that is used to log in to the mail server, and the account password.</li><li>• Always use strong passwords.</li></ul>

# Android Email Configuration

- Android devices are capable of using advanced communication applications and data services.
  - Many of these applications and features require the use of web services provided by Google.
- When you configure an Android mobile device for the first time, you are prompted to sign in to your Google account with your Gmail email address and password.
  - By signing in to your Gmail account, the Google Play store, data and settings backup, and other Google services become accessible.
  - The device synchronizes contacts, email messages, apps, downloaded content, and other information from Google services.

# iOS Email Configuration

- iOS devices ship with a stock Mail app which can handle multiple email accounts simultaneously.
  - The Mail app also supports a number of different email account types including iCloud, Yahoo, Gmail, Outlook and Microsoft Exchange.
- An Apple ID is required to set up an iOS device.
  - An Apple ID is used to access the Apple App Store, the iTunes Store, and iCloud.
  - All of the iOS devices, apps, and content are linked to your Apple ID.
- The iCloud email is free and comes with remote storage for backups, mail, and documents.
- When an iOS device is turned on for the first time, the Setup Assistant guides you through the process of connecting the device and signing in with or creating an Apple ID.
- You can restore settings, content, and apps from a different iOS device from an iCloud backup during the setup process.

# Internet Email

- Email service is provided using either:
  - **Local email** – The email server is managed by a local IT department such as a school network, business network, or organizational network.
  - **Internet email** – The email service is hosted on the internet and controlled by a service provider such as Gmail.
- Users can access their online mailboxes using:
  - Default mobile email app included in the OS such as iOS Mail.
  - Browser-based email client, such as Mail, Outlook, Windows Live Mail, and Thunderbird.
  - Mobile email client apps, including Gmail and Yahoo.
  - Email client apps provide a better user experience when compared to the web interface.



# Types of Data to Synchronize

- Many people use a combination of desktop, laptop, tablet, and smartphone devices to access and store information.
- Data synchronization is the exchange of data between two or more devices while maintaining consistent data on those devices.
- Synchronization methods include synchronization to the cloud, a desktop, and an automobile.
- There are many different types of data to synchronize:
  - Contacts
  - Applications
  - Email
  - Pictures, Music, Videos, Documents
  - Calendar
  - Bookmarks
  - Location data
  - Social media data
  - E-books
  - Passwords

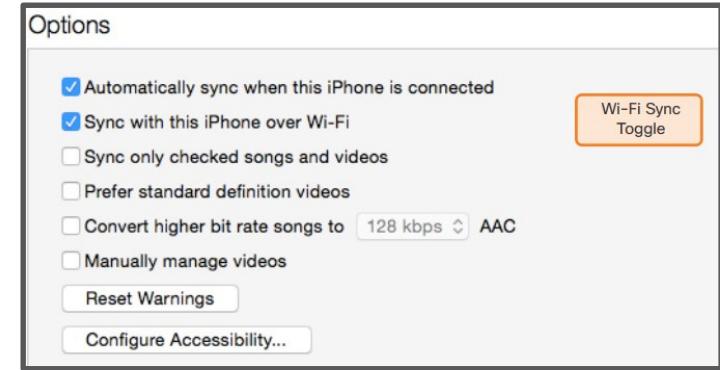
# Mobile Device Synchronization

## Enabling Synchronization

- Sync typically means data synchronization.
- Android devices can synchronize your contacts and other data including that from Facebook, Google, and Twitter.
- All devices using the same Google account will have access to the same data.
- Android Sync also allows the user to choose the types of data to synchronize.
- Android devices also support automatic synchronization with a feature called Auto Sync.
- iOS devices support two types of synchronizing:
  - **Backup** - Copies your personal data from your phone to your computer and includes application settings, text messages, voicemails, and other data types.
  - **Sync** - Copies new apps, music, video, or books from iTunes to your phone and from your phone to iTunes, resulting in full synchronization on both devices.
- A few more useful options are available when performing Sync or Backup on iOS:
  - Backup storage location
  - Backup straight from an iOS device
  - Sync over Wi-Fi

# Synchronization Connection Types

- To synchronize data between devices, the devices use USB or Wi-Fi connections.
- Most Android devices do not have a desktop program for performing data synchronization. Most users sync with Google's different web services.
- iOS devices can use USB or Wi-Fi Sync to synchronize with iTunes.
  - To use Wi-Fi Sync, the iOS device must first synchronize with iTunes using a USB cable.
- Microsoft also offers cloud storage for synchronizing data between devices through the use of OneDrive.



# 7.6 Preventive Maintenance for Laptops and other Mobile Devices

# The Reason for Maintenance

- Because laptops and mobile devices are portable, they are used in different types of environments.
  - As a result, they are more likely than desktop computers to be exposed to harmful materials and situations, including dirt and contamination, spills, drops, excessive heat or cold, and excessive moisture.
- In a laptop, many components are placed in a very small area directly beneath the keyboard.
  - Spilling liquid onto the keyboard can result in severe internal damage.
- Proper care and maintenance can help laptop components run more efficiently and extend the life of the equipment.



# Laptop Preventive Maintenance Program

- The preventive maintenance schedule for a laptop may include practices that are unique to a particular organization but should also include the standard procedures of cleaning, hard drive maintenance, and software updates.
- Routine maintenance includes the monthly cleaning of these laptop components:
  - Exterior case
  - Cooling vents and I/O ports
  - Display
  - Keyboard
  - Touchpad
- When cleaning a laptop, never use harsh cleaners or solutions that contain ammonia.
  - Use nonabrasive materials including compressed air, mild cleaning solutions, cotton swabs, and a soft, lint-free cloth .

# Mobile Device Preventive Maintenance Program

- Mobile devices can be damaged by drops, excess moisture, heat, or cold
- The touchscreen should be protected using a screen protector.
- Preventative maintenance for mobile devices requires only three basic tasks:
  - Clean using a soft, lint-free cloth and cleaning solution designed for a touchscreen.
  - Back up the data to another source or to a cloud drive.
  - Update the operating system and applications when available.



# 7.7 Basic Troubleshooting Process for Laptops and other Mobile Devices

# Troubleshooting Steps

### The Troubleshooting Process

Step 1. Identify the problem.

Step 2. Establish a theory of probable cause.

Step 3. Test the theory to determine the cause.

Step 4. Establish a plan of action to resolve the problem and implement the solution.

Step 5. Verify full system functionality and if applicable, implement preventive measures.

Step 6. Document findings, actions, and outcomes.

## Identify the Problem

Step 1 - Identify the Problem	
<b>Identify the Problem for Laptops</b>	
Open-ended questions	<ul style="list-style-type: none"><li>• What problems are you experiencing with your laptop?</li><li>• What software has been installed recently?</li><li>• What were you doing when the problem was identified?</li><li>• What error messages have you received?</li></ul>
Closed-ended questions	<ul style="list-style-type: none"><li>• Is the laptop under warranty?</li><li>• 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?</li></ul>
<b>Identify the Problem for Mobile Devices</b>	
Open-ended questions	<ul style="list-style-type: none"><li>• What is the problem you are experiencing?</li><li>• What is the make and model of your mobile device?</li><li>• What service provider do you have?</li></ul>
Closed-ended questions	<ul style="list-style-type: none"><li>• Has this problem happened before?</li><li>• Has anyone else used the mobile device?</li><li>• Is your mobile device under warranty?</li></ul>

# Establish a Theory of Probable Cause

### Step 2: Establish a Theory of Probable Cause

Common causes of laptop problems

- Battery does not have a charge
- Battery will not charge
- Loose cable connections
- Keyboard does not work
- Num Lock key is on
- Loose RAM module

Common causes of mobile device problems

- The Power button is broken
- The battery can no longer hold a charge
- There is excessive dirt in the speaker, microphone, or charging port
- The mobile device has been dropped
- The mobile device has been submerged

# Test the Theory to Determine Cause

Step 3: Test the Theory to Determine Cause	
Common steps to determine cause for laptop problems	<ul style="list-style-type: none"><li>• Use AC adapter with laptop</li><li>• Replace battery</li><li>• Reboot the laptop</li><li>• Check BIOS settings</li><li>• Disconnect and reconnect the cables</li><li>• Disconnect peripherals</li><li>• Toggle Num Lock key</li><li>• Remove and reinstall RAM</li><li>• Caps lock key is on</li><li>• Check for non-bootable media in a boot device</li></ul>
Common steps to determine cause for mobile device problems	<ul style="list-style-type: none"><li>• Restart the mobile device.</li><li>• Plug the mobile device into an AC outlet</li><li>• Replace the mobile device battery</li><li>• Remove any removable battery and reinstall it</li><li>• Clean the speaker, microphone, charging port, or other connection ports</li></ul>

## Six Steps of Troubleshooting Laptops and Other Mobile Devices

# Establish a Plan of Action to Resolve the Problem and Implement the Solution

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

If no solution is achieved in the previous step, further research is needed to implement the solution.

- Helpdesk repair logs
- Other technicians
- Manufacturer FAQ websites
- Technical websites
- News groups
- Computer manuals
- Device manuals
- Online forums
- Internet search

## Six Steps of Troubleshooting Laptops and Other Mobile Devices

# Verify Full System Functionality and if Applicable Implement Preventive Measures

Step 5. Verify Full System Functionality and if Applicable Implement Preventive Measures	
Verify solution and full system functionality for laptops	<ul style="list-style-type: none"><li>• Reboot the laptop.</li><li>• Attach all peripherals.</li><li>• Operate laptop using only battery.</li><li>• Print a document from an application.</li><li>• Type sample document to test keyboard.</li><li>• Check Event Viewer for warnings or errors.</li></ul>
Verify solution and full system functionality for mobile devices	<ul style="list-style-type: none"><li>• Reboot the mobile device.</li><li>• Browse the Internet using Wi-Fi.</li><li>• Browse the Internet using 4G, 3G, or another carrier network type.</li><li>• Make a phone call.</li><li>• Send a text message.</li><li>• Open different types of apps.</li><li>• Operate the mobile device using only the battery.</li></ul>

# Six Steps of Troubleshooting Laptops and Other Mobile Devices

## Document Findings, Actions, and Outcomes

### Step 6: Document Findings, Actions, and Outcomes

Document your findings, actions, and outcomes

- Discuss the solution implemented with the customer.
- Have the customer verify problem has been solved.
- Provide the customer with all paperwork.
- Document the steps taken to solve the problem in the work order and technician's journal.
- Document any components used in the repair.
- Document the time spent to solve the problem.

# Identify Common Problems and Solutions

Laptops and other mobile device problems can be attributed to hardware, software, networks, or some combination of the three. You will resolve some types of problems more often than others.



# Basic Troubleshooting for Laptops and Other Mobile Devices

## Common Problems and Solutions for Laptops and Other Mobile Devices

**Common Problems and Solutions for Laptops**

**Identify the Problem**

The laptop does not power on.	The laptop battery supports the system for a reduced period of time.
The external display has power but no image on the screen.	The laptop is powered on, but nothing is displayed on the display when the laptop lid is reopened.
The image on a laptop screen looks dull and pale.	The image on a laptop display is pixelated.
The laptop display is flickering.	A user is experiencing a ghost cursor that moves on its own.
Pixels on the screen are dead, or not generating color.	The image on the screen appears to flash lines or patterns of different color and size (artifacts).
Color patterns on a screen are incorrect.	Images on a display are distorted.
The network is fully functional, and the wireless connection is enabled, but the laptop cannot connect to the network.	Input devices connected with Bluetooth are not functioning properly.
Keyboard is inserting numbers instead of letters.	The battery is swollen.

**Instructions**

Click a display problem to see probable causes and possible solutions. At any time, click another problem on the left side of the screen. To see a PDF of the entire table, click the Show PDF button on the lower right corner of the screen.

**The laptop does not power on.**

Probable Causes	Possible Solutions
<ul style="list-style-type: none"><li>Laptop is not plugged in.</li><li>Battery is not charged.</li><li>Battery will not hold a charge.</li></ul>	<ul style="list-style-type: none"><li>Plug the laptop into AC power.</li><li>Remove and reinstall the battery.</li><li>Replace battery if it will not charge.</li></ul>

Show PDF

# Basic Troubleshooting for Laptops and Other Mobile Devices

## Common Problems and Solutions for Other Mobile Devices

**Common Problems and Solutions for Other Mobile Devices**

Identify the Problem		Instructions						
The mobile device will not connect to the Internet.	The mobile device will not turn on.	Click a display problem to see probable causes and possible solutions. At any time, click another problem on the left side of the screen. To see a PDF of the entire table, click the Show PDF button on the lower right corner of the screen.						
A tablet fails to charge or charges very slowly when connected to AC power.	A smartphone cannot connect to the carrier's network.							
The mobile device does not power on.	The mobile device battery supports the system for a reduced period of time.							
The mobile device will not connect to the Internet.	The mobile device will not connect with Bluetooth.	<p><b>The mobile device will not connect to the Internet.</b></p> <table border="1"><thead><tr><th>Probable Causes</th><th>Possible Solutions</th></tr></thead><tbody><tr><td><ul style="list-style-type: none"><li>Wi-Fi is not available.</li></ul></td><td><ul style="list-style-type: none"><li>Move to within the boundaries of a Wi-Fi network.</li></ul></td></tr><tr><td><ul style="list-style-type: none"><li>There is no carrier data network in range.</li></ul></td><td><ul style="list-style-type: none"><li>Move to within the boundaries of a carrier data network.</li></ul></td></tr></tbody></table>	Probable Causes	Possible Solutions	<ul style="list-style-type: none"><li>Wi-Fi is not available.</li></ul>	<ul style="list-style-type: none"><li>Move to within the boundaries of a Wi-Fi network.</li></ul>	<ul style="list-style-type: none"><li>There is no carrier data network in range.</li></ul>	<ul style="list-style-type: none"><li>Move to within the boundaries of a carrier data network.</li></ul>
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<ul style="list-style-type: none"><li>There is no carrier data network in range.</li></ul>	<ul style="list-style-type: none"><li>Move to within the boundaries of a carrier data network.</li></ul>							
The battery is swollen.	The touchscreen is not responsive.							
The device exhibits very short battery life.	The device is overheating.	<a href="#">Show PDF</a>						

# Lab – Research Laptop Problems

Laptops often use proprietary parts. To find information about the replacement parts, you may have to research the website of the laptop manufacturer.

## Lab – Gather Information from the Customer

In this lab, you will act as a call center technician and create closed-ended and open-ended questions to ask a customer about a laptop problem.

# Lab – Investigate Support Websites

In this lab, you will investigate the services provided by a local laptop repair company or a laptop manufacturer's support website. Use the internet or a local phone directory to locate a local laptop repair company or laptop manufacturer's support website.

# 7.8 Chapter Summary

## Chapter 7: Laptops and Other Mobile Devices

- Explain the features and functions of laptops and other mobile devices.
- Explain how to configure laptop power settings and wireless settings.
- Explain how to remove and install laptop components.
- Describe the purpose and characteristics of other mobile devices.
- Explain how to configure network connectivity and email on mobile devices.
- Explain common preventive maintenance techniques for Laptops and other Mobile Devices.
- Explain how to troubleshoot Laptops and other Mobile Devices.