Objectives

• Learn about special considerations when supporting notebooks that are different from supporting desktop computers
• Learn how to install, configure, optimize, troubleshoot, and repair peripheral devices used with notebooks
• Learn how to troubleshoot, upgrade, and replace internal notebook components
Special Considerations When Supporting Notebooks

• Notebook (laptop): portable computer
  – Varieties: tablet PCs and netbooks

• Comparing notebooks to full-sized computers
  – Support requires same skills
  – Built as a single system with modifications
  – Smaller, portable, and uses less power
  – Replacement parts cost more

• Factors to consider
  – Warranty, service manuals, and diagnostic software
  – Customized OS installation, and obtaining parts
Warranty Concerns

• Do not void warranty
  – Opening case, removing part labels, installing other-vendor parts, upgrading OS, disassembling

• Contacting technical support: information needed
  – Notebook model and serial number
  – Purchaser name, phone number, address

• Service options
  – On-site
  – Ship to authorized service center
  – Phone assistance
Figure 11-2 The model and serial number stamped on the bottom of a notebook are used to identify the notebook to service desk personnel. Courtesy: Course Technology/Cengage Learning
Service Manuals and Other Sources of Information

• Service manuals save time
  – Enables safe notebook disassembly

• Locating documentation
  – Manufacturer’s physical manual
  – Internet
  – Manufacturer’s Web site
  – Third party websites

• User manual
  – Provides basic maintenance tasks
Figure 11-3 A notebook service manual tells you how to use diagnostic tools, troubleshoot a notebook, and replace components. Courtesy: Course Technology/Cengage Learning

Figure 11-4 The Compaq Web site (www.hp.com) provides detailed instructions for troubleshooting and replacing components. Courtesy: Course Technology/Cengage Learning
Diagnostic Tools Provided By Manufacturers

• Pinpoints problem components
  – Sources:
    • Manufacturer’s Web site
    • CDs bundled with the notebook
    • Hard drive or floppy disk
  – Example: PC-Doctor
    • Included with Lenovo, IBM ThinkPad, Fujitsu, and HP notebooks
    • Can be purchased separately
The OEM Operating System Build

• Operating system preinstalled at the factory
  – Original equipment manufacturer (OEM)
  – OS Build
    • Customized installation of the OS
  – Proprietary drivers
  – Customized diagnostic software
• Use caution when upgrading to new OS
The OEM Operating System Build (cont’d.)

• Recovery CDs and recovery partitions
  – Contains installable version of OS preinstalled on the notebook
    • Provided by manufacturer
    • CD bundled with PC or requested from manufacturer
  – Hard drive partition can contain OS
    • May be hidden
    • Files protected from access
    • See user manual for access
  – Additional software on CD
    • Drivers and application setup programs
**Figure 11-6** This notebook hard drive has a recovery partition that can be used to recover the system. Courtesy: Course Technology/Cengage Learning
The OEM Operating System Build (cont’d.)

- Operating system upgrades
  - Perform only if necessary
- Tips:
  - Upgrade using OS build from the OEM
  - Ensure supporting device drivers included
  - Follow OEM’s specific instructions
- Off-the-shelf OS advice:
  - Verify system component compatibility
  - Ensure device drivers available
  - Flash BIOS before upgrade, if necessary
Caring For Notebooks

• General guidelines:
  – Do not touch LCD panel with sharp objects
  – Do not connect notebook to phone line in a storm
  – Use OEM recommended battery packs
  – Use passwords with each Windows user account
  – Do not tightly pack in a suitcase
  – Do not pick up or hold by the display panel
  – Do not move while hard drive is being accessed
  – Do not put close to appliances generating strong magnetic field
Caring For Notebooks (cont’d.)

• General guidelines: (cont’d.)
  – Keep OS current
  – Never use public connection without a software firewall
  – Keep notebook at a controlled temperature
  – Keep away from smoke, water, sand
  – Do not power up and down unnecessarily
  – Do not power on unless at room temperature
  – Protect notebook against ESD
  – Remove CD/DVD before traveling
  – Take precautions if notebook gets wet
Caring For Notebooks (cont’d.)

- Cleaning tips:
  - Do not disassemble for routine cleaning
  - Clean LCD panel with a soft dry cloth
  - Use compressed air
    - Keyboard, track ball, touch pad, air vents, sticking keys
  - Use contact cleaner
    - Under key caps
    - Battery connections
Supporting Notebook Peripheral Devices

- Ports on the back or sides for connecting peripherals

Figure 11-8 Ports on the back of a notebook
Courtesy: Course Technology/Cengage Learning
Port Replicators and Docking Stations

• Port replicator
  – Easy connection to full-sized monitor, keyboard, AC power adapter, and other devices

• Docking station
  – Same functions as port replicator
  – Additional slots for adding secondary storage devices and expansion cards

• Hardware profiles
  – XP: enables storage of hardware configurations
  – Vista: not required
**Figure 11-10** A port replicator makes it convenient to connect a notebook computer to resources and peripherals at your office. Courtesy of IBM Corporation

**Figure 11-11** A docking station can provide extra secondary storage for a laptop. Courtesy of IBM Corporation
PC Card, CardBus, and ExpressCard Slots

- Connect peripheral devices to notebooks
- Personal Computer Memory Card International Association (PCMCIA)
  - Develops standards for PC card slots
- PCMCIA cards
  - Used in many devices
  - Include variations of PC Card, CardBus, ExpressCard
  - Three standards pertaining to size and thickness
    - Type 1, Type II, Type III
PC Card, CardBus, and ExpressCard Slots (cont’d.)

• PC Card slot technologies
  – 16-bit ISA and 32-bit PCI
• CardBus
  – Increases bus width to 32 bits
  – Backward compatible with earlier standards
• ExpressCard matches PCI Express and USB 2.0
  – Two sizes: ExpressCard/34 and ExpressCard/54
  – Not backward compatible
  – Hot-pluggable, hot-swappable, and supports autoconfiguration
PC Card, CardBus, and ExpressCard Slots (cont’d.)

• Windows services for PC Card or ExpressCard
  – Socket service and card service

• Removing card from PC card or ExpressCard slot
  – Click Unplug or Eject Hardware icon in system tray
  – Click Stop to open Stop a Hardware device dialog box
  – Click OK and proceed to eject the card

• Tips:
  – Ensure system turned on when inserting card
  – Install drivers before inserting card
Using Bluetooth, Cellular, and Wi-Fi Connections

• Embedded wireless network adapter
  – Connects Wi-Fi network
• Bluetooth or infrared adapter
  – Supports personal area network (PAN)
• Supporting Wi-Fi connections
  – Internal wireless adapter uses internal antenna
  – External wireless adapter may need external antenna
Using Bluetooth, Cellular, and Wi-Fi Connections (cont’d.)

• Supporting Bluetooth connections
  – Verify wireless switch turned on
  – Verify Windows sees Bluetooth enabled
  – Download all windows updates
  – Look in Device Manager for errors
  – Make sure other device has Bluetooth turned on
  – Lower Bluetooth software security mode
  – Uninstall and reinstall the Bluetooth drivers
  – Use manufacturers websites
Using Bluetooth, Cellular, and Wi-Fi Connections (cont’d.)

• Supporting Cellular WAN Connections
  – Notebook WiMAX device
    • ExpressCard or PC Card slot or USB port
  – Internet card (air card)
    • Device connecting to a cell phone network
  – Mobile broadband Internet access on a 3G network
    • Use Internet card and mobile service

Figure 11-23 Sierra Wireless AirCard 402 modem card fits a PC Card or ExpressCard slot
Courtesy of Sierra Wireless
Using Bluetooth, Cellular, and Wi-Fi Connections (cont’d.)

• Troubleshooting cellular WAN connection
  – Check Device Manager and Event Viewer
  – Install Windows updates
  – Reinstall software
  – Check cellular WAN provider Web site
  – Check notebook and Internet card manufacturer websites
  – Activate card in the service provider coverage area
  – Verify software firewall allows application access
Power and Electrical Devices

• Notebook power sources
  – AC adapter, DC adapter, battery pack
• Auto-switching AC adapter feature
  – Device automatically switches from 110 V to 220 V AC power
• Types of batteries:
  – Ni-Cad (nickel-cadmium)
  – NiMH (nickel-metal-hydride)
  – Lithium Ion
  – Direct Methanol Fuel Cell (DMFC): experimental
Power and Electrical Devices (cont’d.)

• Notebook power needs
  – One or more batteries, a DC adapter for travel, an AC adapter at home and for recharging the batteries
  – Inverter changes DC to AC

![Image](image.png)

*Figure 11-25* An inverter changes DC to AC and provides an outlet for your laptop’s AC adapter. Courtesy: Course Technology/Cengage Learning
Power and Electrical Devices (cont’d.)

• General dos and don’ts:
  – Use extra battery packs
  – Learn how to recharge, use, and store a battery
  – Use OS power-management features
  – Connect to electrical outlet to use DVD or burn a CD
  – Use standby and hibernate modes
  – Plug into AC/DC outlet upon battery low message
  – Reduce LCD panel brightness to conserve power
  – Use external surge protector
  – Verify notebook has power
Power Management

- ACPI-compliant BIOS helps manage power
  - Minimize power consumption
  - Varying degrees of suspend or sleep modes
- Vista power-saving states
  - Sleep mode: corresponds to ACPI S3 mode
  - Hibernation: work is saved to hard drive and powers system down
  - Hybrid sleep: work is saved to hard drive and system maintains a trickle of power
- Windows XP standby corresponds to ACPI S3 mode
Power Management (cont’d.)

• Managing power in Windows
  – Vista: Power Options window
  – XP: Power Options Properties dialog box
  – Example: hibernates after set time

• Wake on LAN
  – Wired or wireless network activity powers up or wakes up computer
  – Feature must be enabled in BIOS setup
    • Network adapter or wireless network adapter must be configured to wake the computer
Input Devices

• Keyboard: primary laptop input device
• Common laptop pointing devices
  – Touch pad, TrackPoint or point stick, USB wired or wireless mouse, and graphics tablet

Figure 11-37 The touch pad is the most common pointing device on a notebook
Courtesy: Course Technology/Cengage Learning
Input Devices (cont’d.)

• Graphics tablet (digitizing tablet or digitizer)
  – Uses a USB port and stylus that works like a pencil

Figure 11-39 A graphics tablet and stylus are used to digitize a hand drawing. Courtesy: Course Technology/Cengage Learning
Input Devices (cont’d.)

• Adjust touch pad or TrackPoint
  – Mouse Properties box:
    • Adjust pointer speed, mouse trails, pointer size, how the touch pad buttons work, other settings for pointing devices

• Tablet PCs
  – Stylus controlled from the Pen and Input Devices box
    • Accessed from Vista or XP Control Panel

• Pointing device software provides utility to manage the device
Video

• Laptop video system
  – LCD panel
  – Video controller
    • Embedded on motherboard
    • Video card installed as an internal component

• Laptop ports
  – Analog 15-pin VGA port
    • External monitor
  – S-Video Out port
    • Allows television as an external display device
Video (cont’d.)

• Troubleshooting problems with video
  – LCD panel shows a black screen and power light on
    • Verify LCD cutoff switch or button on
    • Use an external monitor to check Device Manager and Event Viewer
    • Update video drivers
    • Potential problem with LCD panel assembly
      – Verify LCD panel display settings
      – Update video drivers
      – Adjust brightness
Troubleshooting, Replacing, and Upgrading Internal Parts

• Topics:
  – Alternatives to consider before taking on complex repair projects
  – How to upgrade memory
  – How to exchange a drive
  – How to perform other complex repair projects
    • Exchanging an LCD panel or motherboard
Three Approaches to Dealing with a Broken Internal Device

• Factors to consider before starting repair project:
  – Time the repair will take
  – Alternatives to fixing (upgrading)
    • Return notebook to OEM or service center
    • Substitute external component for internal device
    • Replace the internal device
Three Approaches to Dealing with a Broken Internal Device (cont’d.)

• Substitute internal device with an external device
  – Disable internal device within BIOS setup
  – Install external peripheral device
• Preparation for servicing notebook
  – Back up important data if possible
  – Protect against ESD
  – Remove PC Cards, CDs, and DVDs
  – Turn off attached devices, and shut down notebook
  – Disconnect AC adapter
  – Undock (if necessary) and remove the battery
Upgrading Memory

• Memory used in notebooks
  – SO-DIMMs (small outline DIMMs)
  – SO-RIMMs (small outline RIMMs)
  – MicroDIMMs
    • Smaller than SO-DIMMs and have a 64-bit data path

Figure 11-45 Installing a MicroDIMM in a subnotebook computer
Courtesy: Course Technology/Cengage Learning
<table>
<thead>
<tr>
<th>Memory Module Description</th>
<th>Sample Memory Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.66&quot; 204-pin SO-DIMM contains DDR3 memory. The one notch on the module is offset from</td>
<td><img src="image_url" alt="Image" /> Courtesy of Kingston Technology Corporation</td>
</tr>
<tr>
<td>the center of the module.</td>
<td></td>
</tr>
<tr>
<td>2.66&quot; 200-pin SO-DIMM contains DDR2 SDRAM. One notch is near the side of the module.</td>
<td><img src="image_url" alt="Image" /> Courtesy of Kingston Technology</td>
</tr>
<tr>
<td>2.66&quot; 200-pin SO-DIMM contains DDR SDRAM. One notch near the side of the module is</td>
<td><img src="image_url" alt="Image" /> Courtesy of Crucial Technology</td>
</tr>
<tr>
<td>slightly offset from the notch on a DDR2 SDRAM module.</td>
<td></td>
</tr>
<tr>
<td>2.66&quot; 144-pin SO-DIMM contains SDRAM and is outdated. One notch is slightly offset from</td>
<td><img src="image_url" alt="Image" /> Courtesy of Crucial Technology</td>
</tr>
<tr>
<td>the center of the module.</td>
<td></td>
</tr>
<tr>
<td>2.35&quot; 72-pin SO-DIMMs are outdated. They contain FPM or EDO memory and have no notch on</td>
<td><img src="image_url" alt="Image" /> Courtesy: Course Technology/Cengage Learning</td>
</tr>
<tr>
<td>the edge connector.</td>
<td></td>
</tr>
<tr>
<td>160-pin SO-DIMM contains Rambus memory and has two notches.</td>
<td><img src="image_url" alt="Image" /> Courtesy of High Connection Barefoot, Inc.</td>
</tr>
</tbody>
</table>

**Table 11-2** Memory modules used in notebook computers
Upgrading Memory (cont’d.)

• How to upgrade notebook memory:
  – Upgrade process is similar to desktops
  – Considerations:
    • Make sure warranty not being voided
    • Search for best buy on a suitable and authorized part
  – General steps:
    • Decide how much memory to upgrade
    • Purchase memory
    • Install it
Replacing a Hard Drive

• General guidelines:
  – Check with OEM for drive sizes and connector types
  – Be aware of voiding manufacturer’s warranty
  – Watch for proprietary form factors and connectors

• Shopping:
  – Notebook drive: 2.5 inches wide
    • May use SSD (solid state device) technology
  – Hard drives connector: SATA connector or 44-pin IDE
  – IDE drive may use adapter to interface between proprietary connector and motherboard 44-pin IDE connector
Replacing a Hard Drive (cont’d.)

• Issues to consider before replacing hard drive:
  – Old drive crashed
    • Recovery CD and notebook drivers CDs required
  – Upgrade: must transfer data from old drive to new one
  – Older notebook computers required disassembly

• Newer notebooks: easy to replace
  – If BIOS setup uses autodetect:
    • System boots up and BIOS recognizes new drive
    • Searches for an operating system
    • If a new drive: boot from Windows recovery CD
**Figure 11-53** This one screw holds the hard drive in position  
Courtesy: Course Technology/Cengage Learning

**Figure 11-54** Push the drive out of its bay  
Courtesy: Course Technology/Cengage Learning
Disassembling and Reassembling a Notebook Computer

• Requires special tools and extra patience

Figure 11-55 To protect the system against ESD, attach the alligator clip of a ground strap to an I/O port on the back of the notebook. Courtesy: Course Technology/Cengage Learning

Figure 11-56 Tools for disassembling a notebook computer. Courtesy: Course Technology/Cengage Learning
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Many small screws of various sizes, lengths

• Work methodically:
  – Keep screws and components organized
  – Place screws in a pillbox (label each compartment)
  – Place screws on soft padded work surface
    • Use white labeling tape
  – Place screws on notebook paper
    • Write where screw belongs
  – Tape screw beside manufacturer documentation
  – Keep notes to help with reassembly
Figure 11-58 Using a notepad can help you organize screws so you know which screw goes where when reassembling. Courtesy: Course Technology/Cengage Learning

Figure 11-59 Tape screws beside the step in the manufacturer documentation that told you to remove the screw. Courtesy: Course Technology/Cengage Learning
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Disassembly tips:
  – Find the hardware service manual
  – Consider the warranty
  – Take the time necessary, do not force anything
  – Protect against ESD
  – Understand ZIF connectors
  – Pry up plastic covers with dental pick or small screwdriver
  – Plastic screws may be used only once
  – Disassemble components in order
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Reassembly tips:
  – Reassemble notebook in the reverse order
  – Tighten, but not over tighten, all screws
  – Before installing the battery or AC adapter verify there are no loose parts inside the notebook
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Replacing the keyboard:
  – Power down and unplug notebook
  – Remove screws on notebook bottom
  – Open Lid
    • Push keyboard toward lid while pulling it up to release it from the case
  – Bring keyboard out of the case and forward
    • Expose keyboard ribbon cable
    • Use screwdriver to lift cable connector up and out
  – Replace keyboard following steps in reverse order
Disassembling and Reassembling a Notebook Computer (cont’d.)

- Replacing optical drives:
  - Remove keyboard
  - Remove screw holding DVD drive to notebook
  - Slide drive out of the bay and new drive into the bay
    - Ensure connection with drive connector
    - Replace the screw

- Replacing expansion cards:
  - Newer notebook use Mini PCI Express slots
    - Three types: Type I, Type II, Type III
  - Older notebooks use a Mini PCI slot
Disassembling and Reassembling a Notebook Computer (cont’d.)

- Steps to remove a Mini PCIe wireless network card:
  - Disconnect antenna from Wi-Fi card
  - Remove the one screw at the top of the card
  - Pull card forward and out of the slot

Figure 11-70 How to remove a Mini PCI Express card
Courtesy: Course Technology/Cengage Learning
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Remove a Mini PCI wireless network card:
  – Remove hinged cover and keyboard
  – Disconnect cable to the wireless antenna
  – Pull outward on the securing tabs
  – After card pops, lift it out of the cavity

Figure 11-71 Remove a Mini PCI Card
Courtesy: Course Technology/Cengage Learning
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Replacing the card:
  – Align card in the cavity
    • Press down until it pops in place and secures tabs
  – Reconnect the wireless antenna cable
  – Replace keyboard and hinged cover

• Distinguishing between Mini PCIe and Mini PCI slot
  – Clips on the side of the Mini PCI slot

• Distinguishing between Mini PCIe and Mini PCI card
  – Notches on sides of a mini PCI card
  – Long, unbroken edge connector on the card
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Mini PCI and Mini PCI Express cards
  – Enhance notebook communications options

• Features when selecting Mini PCI or Mini PCIe card:
  – Bluetooth comes in three versions
    • Use a later version of Bluetooth
  – Some Mini PCI and Mini PCle provide both Wi-Fi and Bluetooth ability
  – Mini PCI Express slots are not backward compatible with Mini PCI slots
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Replacing the motherboard and CPU:
  – Run diagnostic software to verify problem
  – Use CPU supported by manufacturer and notebook model
  – Replacing the motherboard requires complete disassemble of the entire notebook
    • Except LCD assembly
Disassembling and Reassembling a Notebook Computer (cont’d.)

• Diagnosing dim or black LCD panel:
  – Connect external monitor to video port
  – Toggle between LCD panel, external monitor, and both the panel and monitor
    • If external monitor works: LCD panel assembly likely broken
    • If LCD display entirely black: replace LCD assembly
    • If LCD display dim: video inverter problem
  – Consider field replaceable units
  – High-end notebooks contain video card
    • May need to replace it too
Disassembling and Reassembling a Notebook Computer (cont’d.)

• How to replace an LCD panel assembly:
  – Remove AC adapter and battery pack
  – Remove the keyboard
  – Remove screws holding hinge in place
    • Remove hinge cover
  – Remove screws holding LCD panel to the notebook
  – Remove LCD panel from the notebook
  – Remove screws holding the top cover and LCD panel
  – Disconnect old inverter and install the new one
  – Reattach LCD panel assembly to the notebook
Summary

• A notebook (laptop) is a portable computer
  – OS build: notebook OS customized by the OEM
  – PCMCIA develops standards
    • PC card, CardBus, ExpressCard slots
  – Power Options Properties
    • Configures AC and DC power management schemes
  – Input devices include:
    • Keyboard, mouse, graphics tablet
Summary (cont’d.)

• Troubleshooting notebooks:
  – Like troubleshooting desktops
  – Memory and hard drive are doable
  – Other components are harder

• Notebook memory modules include:
  – SO-DIMMs, SO-RIMMs, MicroDIMMs

• Additional topics covered:
  – Mini PCIe and Mini PCI specifications
  – Motherboard, CPU, and LCD panel replacement