MODULE IV

Understanding Laptop Architecture

Laptops are similar to desktop computers in architecture in that they contain many parts that perform similar functions. However, the parts that make up a laptop are completely different from those in desktop computers.

Laptops vs. Desktops

Primary differences between laptops and desktops:

1.Portability

Desktops are large in size and have a separate monitor. While it's possible to take a desktop from place to place, it's cumbersome and not the choice for portability. They are designed to be used in a single location and not moved around much, if at all.

Laptops are very portable due to their compact size. They were designed to be taken from place to place, carried in a backpack or laptop carrying case. They are great for on-the-go use.

2.Cost

There is a wide variety of component options available for desktops, allowing for a large range of prices, but the starting point is relatively cheap.

Laptops can have a fairly wide variety of component options, but they are more limited than desktops. To get a more powerful laptop (higher speed, better graphics, more storage space, etc.), the price can be considerably higher.

3.Performance

By and large, laptops are always going to lose out somewhere in the performance department. Compromises must often be made between performance and portability,and considering that portability is the major feature of a laptop, performance is what usually suffers.

4.Expandability

Desktop computers were designed to be modular, their capabilities can be upgraded quite easily.

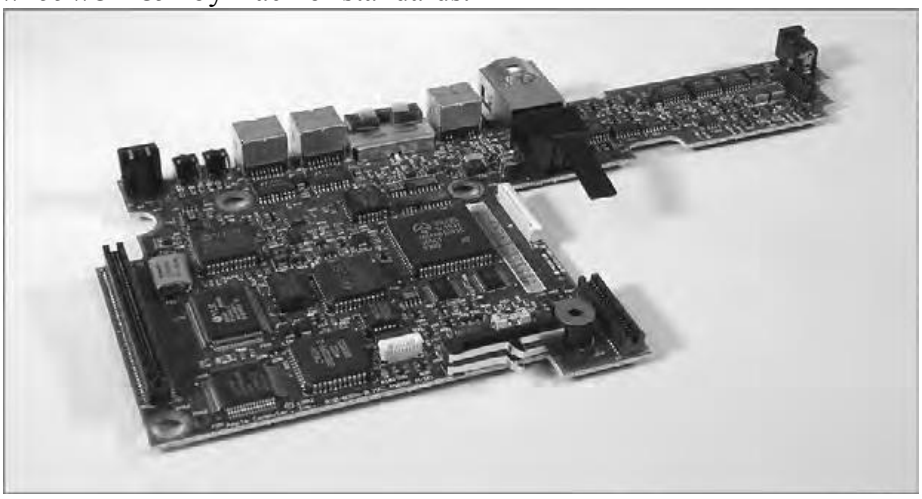
Other than memory and hard drives, most laptop upgrades consist of adding an external device through one of the laptop's ports, such as a USB port.

Motherboards and Processors

As with desktop computers, the motherboard of a laptop is the backbone structure to which all internal components connect. However, with a laptop, almost all components must be integrated onto the motherboard, including onboard circuitry for the serial, parallel, USB, IEEE 1394, video, expansion, and network ports of the laptop. With desktop systems, the option remains to not integrate such components.

1) **Laptop Motherboards**

The primary differences between a laptop motherboard and a desktop motherboard are the lack of standards and the much smaller form factor. As mentioned earlier, mostmotherboards are designed along with the laptop case so that all the components will fit inside. Therefore, the motherboard is nearly always proprietary, and that's what we mean by "lack of standards."



To save space, components of the video circuitry (and possibly other circuits as well) are placed on a thin circuit board that connects directly to the motherboard. This circuit board is often known as a riser card or a *daughterboard*.

Having components performing different functions (such as video, audio, and networking) integrated on the same board is a mixed bag. On one hand, it saves a lot of space. On the other hand, if one part goes bad, you have to replace the entire board, which is more expensive than just replacing one expansion card.

2) Laptop Processors

Just as with desktop computers, the processor is the brain of the laptop computer. And just like everything else, compared to desktop hardware devices, laptop hardware devices are smaller and not quite as powerful. The spread between the speed of a laptop CPU and that of a desktop motherboard can be a gigahertz or more. Laptops have less space, and thus, heat is a major concern. Add to that the fact that processors are the hottest-running component and you can see where cooling can be an issue. To help combat this heat problem, laptop processors are engineered with the following features:

1. **Streamlined connection to the motherboard** Nearly all desktop processors mount using pin connectors, whether on the CPU or on the motherboard (as is the case with LGA sockets). Pins and sockets are big and bulky, meaning they're not a laptop's friends. Laptop processors are generally either soldered directly to the motherboard or attached using the Micro-FCBGA (Flip Chip Ball Grid Array) standard, which uses balls instead of pins. In most cases, this means that the processor cannot be removed, meaning no processor upgrades are possible.
2. **Lower voltages and clock speeds** Two ways to combat heat are to slow the processor down (run it at a lower speed) or give it less juice (run it at a lower voltage). Again, performance will suffer compared to a desktop processor, but lowering heat is the goal here.
3. **Active sleep and slowdown modes** Most laptops will run the processor in a lower power state when on battery power, in an effort to extend the life of the battery. This is known as processor throttling. The motherboard works closely with the operating system to determine if the processor really needs to run at full speed. If it doesn't, it's slowed down to save energy and to reduce heat. When more processing power is needed, the CPU is throttled back up. One of the best features of many laptop processors is that they include built-in wireless networking. One of the earliest laptop-specific chipsets that gained a ton of popularity was the Pentium M chip made by Intel.

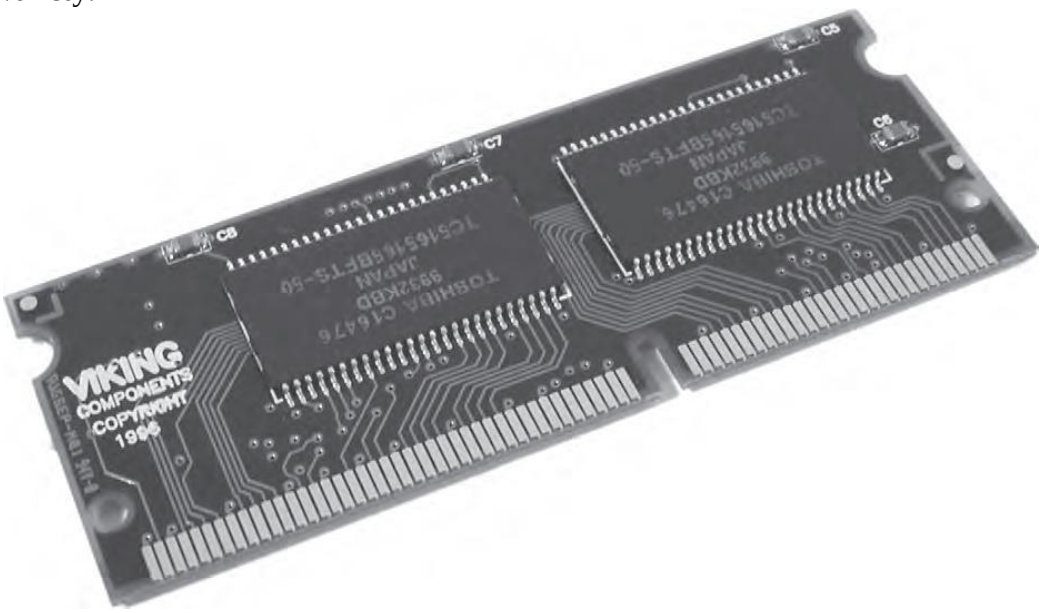
Memory

Laptop don't use standard desktop computer memory chips, because they're too big. there are now two common types of laptop memory package: SODIMM and MicroDIMM.

1. SODIMM

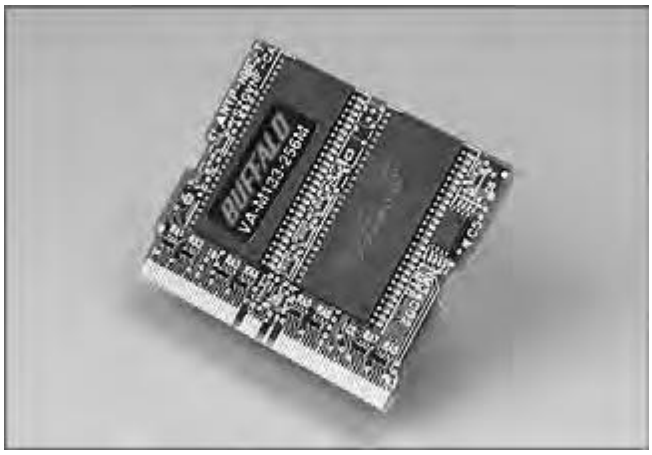
The most common memory form factor for laptops is called a Small Outline DIMM (SODIMM). They're much smaller than standard DIMMs, measuring about 67 millimeters (2.6g) long and 32 millimeters (1.25g) tall. SODIMMs are available in a variety of configurations, including 32-bit (72-pin) and 64-bit (144-pin SDRAM,

200-pin DDR, 200-pin DDR2, and 204-pin DDR3) options. Figure shows an example of the classic 144-pin variety.



2. MicroDIMM

Although no longer new, the MicroDIMM is the most recent form factor for laptop memory modules. The MicroDIMM is an extremely small RAM form factor. In fact, it is over 50 percent smaller than a SODIMM—only about 45.5mm (about 1.75g) long and 30mm (about 1.2g, a bit bigger than a US quarter) wide. Another major difference is that the MicroDIMM does not have any notches on the bottom. Figure 9.3 shows a 172-pin MicroDIMM. It was designed for the ultralight and portable subnotebook style of computer. Popular MicroDIMM form factors include 64-bit modules with 172 or 214 pins for DDR2.



Storage

Nearly all laptops have a hard drive, but not all laptops have both a floppy drive and an optical drive. Many times there just isn't room for both, and considering floppy drives are practically obsolete In some cases, the floppy drive is an external device that you connect with a special cable to a proprietary connector. Figure 9.4 shows an example of one of these connectors, and Figure 9.5 shows an example of a laptop floppy drive with a proprietary connector.

floppy drives that attach to the laptop through a USB port are more common today.

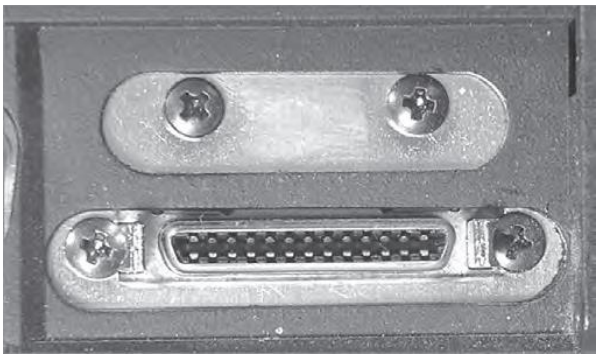


Fig: A proprietary floppy connector

Fig: A laptop floppy drive

Fig:A desktop DVD drive compared to a laptop DVD drive

Input Devices

Because of the small size of laptops, getting data into them presents unique challenges todesigners. They must design a keyboard that fits within the case of the laptop.

1. **Keyboards**

A standard-sized desktop keyboard wasn't designed to be portable. It wouldn't fit well with the portable nature of a laptop. That usually means laptop keys are not normal size; they must be smaller and packed together m ore tightly.

Laptop keyboards are built into the lower portion of the clamshell. Sometimes, they can be removed easily to access peripherals below them like memory and hard drives.

Special Function Keys

Because of the much smaller space available for keys, some laptop keys (like the number pad, Home, Insert, PgUp, and PgDn keys) are consolidated into special multifunction keys. These keys are accessed through the standard keys by using a special *function (Fn) key*.

It's typically near the Windows key on the keyboard and labeled in lettering of an alternate color (usually blue) that matches the lettering of the labels for alternate functions on other keys. To use a multifunction key, you

press and hold the Fn key (as you would the Shift, Ctrl, and Alt keys) and then tap the key labeled with the function you want, finally releasing the Fn key. Figure below shows an example of a function key.

The function key combinations can control many laptop functions, but the most common are video, audio, and networking settings. The specific keys used will vary by laptop model.

2. Mice and Pointing Devices

In addition to using the keyboard, you must have a method of controlling the onscreen pointer in the Windows interface. There are many methods of doing this, but there are some that are more common:

NN Trackball
NN Touchpad
NN Point stick
NN Touchscreen

a) Trackball

Many early laptops used trackballs as pointing devices. A *trackball* is essentially the same as a mouse turned upside down. The onscreen pointer moves in the same direction and at the same speed you move the trackball with your thumb or fingers. Trackballs are cheap to produce. However, the primary problem with trackballs is that they do not last as long as other types of pointing devices; a trackball picks up dirt and oil from operators' fingers, and those substances clog the rollers on the trackball and prevent it from functioning properly.

b) Touchpad

A Touchpad is a device that has a pad of touch-sensitive material. The user draws with their finger on the Touchpad, and the onscreen pointer follows the finger motions. Included with the Touchpad are two buttons for left- or right-clicking

c) Point Stick

The point stick is a pointing device that uses a small rubber-tipped stick. When you push the point stick in a particular direction, the onscreen pointer goes in the same direction. The harder you push, the faster the onscreen pointer moves.

d) **Touchscreen**

Instead of a keyboard and mouse, these computer screens have a film over them that is sensitive to touch. This technology is known as a *Touchscreen*

A typical Touchscreen

<u>Expansion Buses and Ports</u>

Although laptop computers are less expandable than their desktop counterparts, they can be expanded to some extent. Laptops have expansion ports similar to those found on desktop computers as well as a couple that are found only on laptops.

PCMCIA (PC Card) Expansion Bus

The PCMCIA was organized to provide a standard way of expanding portable computers. The PCMCIA bus was originally designed to provide a way of expanding the memory in a small, handheld computer, referred to generically as a PCMCIA host.

ExpressCard

ExpressCard was launched by PCMCIA as a way to support USB 2.0 and PCI Express (hence the term *Express*Card) connectivity for portable computers.

Mini PCI and Mini PCIe

Mini PCI is an adaptation of the Peripheral Component Interconnect (PCI) standard used in desktop computers. As its name implies, it's just a smaller version (about 1⁄4 the size of PCI cards) designed primarily for laptops. These cards reside internally in the laptop, with their connection ports generally lining up with the edge of the outside of the case. Mini PCI is functionally identical to the PCI version 2.2, meaning it's a 32-bit, 33MHz bus with a 3.3V-powered connection. It also supports bus mastering and DMA. There are three different Mini PCI form factors: Type I, Type II, and Type III.

USB Ports

The USB port is the most common type for portable memory devices known as flash drives. These handy little sticks can hold up to 32GB of data.

Mouse/Keyboard Port

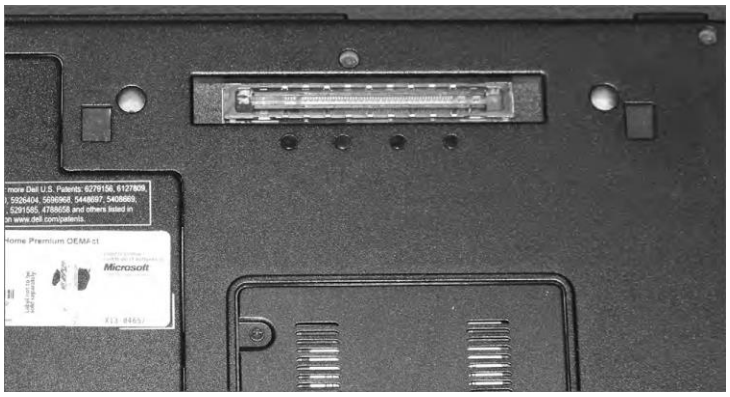
Some laptops come with a combination *keyboard/mouse port* that allows you to connect either an external keyboard or an external mouse.

Communications Ports

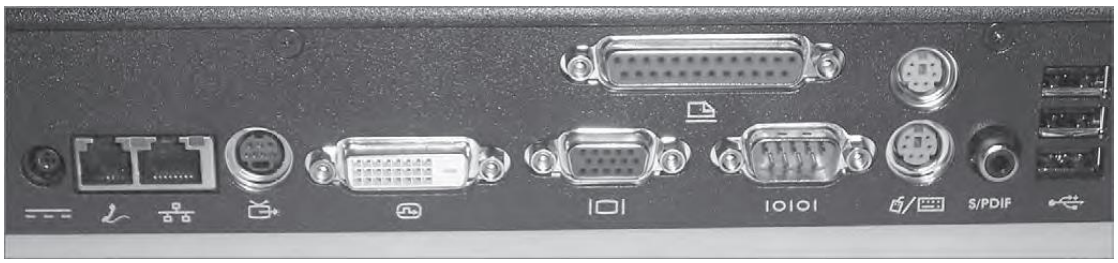
Several communication methods are available; nearly all new laptops come equipped with some version of an 802.11 wireless card. Others may have connections for an analog dial-up modem or an infrared, cellular, Bluetooth, or Ethernet device. Each of these can also be added to laptops through USB or PC Card connection.

Docking Stations

Some laptops are designed to be desktop replacement laptops. That is, they will replace a standard desktop computer for day-to-day use and are thus more full-featured than other laptops. These laptops often have a proprietary docking port. A docking port (as shown in Figure 9.15) is used to connect the laptop to a special laptop-only peripheral known as a *docking station*. A docking station is basically an extension of the motherboard of a laptop. Because a docking station is designed to stay behind when the laptop is removed, it can contain things like a full-sized drive bay and expansion bus slots. Also, the docking station can function as a port replicator.



A port replicator reproduces the functions of the ports on the back of a laptop so that peripherals such as monitors, keyboards, printers, and so on that don't travel with the laptop can remain connected to the dock and don't have to all be physically unplugged each time the laptop is taken away. Figure 9.16 is a photo of the back of a docking station, showing the replicated ports, some of which are only available on the docking station and not on the laptop.Finally, there are accessory bays (also called media bays). These external bays allow you to plug your full-sized devices into them and take your laptop with you (for example, a fullsized hard drive that connects to an external USB or FireWire port). As a point of clarification
(or perhaps confusion), media bays and accessory bays are sometimes used to refer to laptop drive bays.



Docking ports and docking stations are *proprietary*. That is, the port works only with docking stations designed by the laptop's manufacturer and vice versa.

Power Systems

Because portable computers have unique characteristics as a result of their portability, they have unique power systems as well. Portable computers can use either of two power sources: batteries or adapted power from an AC or DC source.

Batteries

There are many different battery chemistries that come in various sizes and shapes. Nickel cadmium (NiCd), lithium-ion (Li-ion), and nickel-metal hydride (NiMH) have been the most popular chemistries for laptop batteries. Battery chemistries can be compared by energy density and power density. Energy density measures how much energy a battery can hold. Power density measures how quickly the stored energy can be accessed.

Power Adapters

Most notebook computers can also use AC power with a special adapter (called an *AC adapter*) that converts AC-power input to DC output. The adapter can be integrated into the notebook, but more often it's a separate "brick" with two cords, one that plugs into the back of the laptop and another that plugs into a wall outlet.

Another power accessory that is often used is a *DC adapter*, which allows a user to plug the laptop into the power source (usually a cigarette lighter) inside a car or on an airplane. These adapters allow people who travel frequently to use their laptops while on
the road (literally).

Some adapters have a fixed AC input requirement. Purchasing the wrong unit can result in lack of functionality or damage to the laptop.

Other adapters are autoswitching, meaning they are able to automatically switch the input voltage they expect based on the voltage supplied by the wall outlet. These units are often labeled with voltage-input ranges, such as 100 to 240V, and frequency ranges, such as 50 to60Hz.

Laptop Displays

Much like all other laptop components, the display is more or less a smaller version of its desktop counterpart. What is unique to laptop displays, though, is that for some time, the technology used in them was actually more advanced than what was commonly used in desktops. This is due to liquid crystal display (LCD) technology.
we'll focus here onthe different components that are required to make these types of displays work.

1. **Video Card**

The video card in a laptopresponsible for generating and managing the image sent to the screen. most LCD monitors are digital. Figure shows an ABIT video card, with a digital video interface (DVI) port on the right and an analog (VGA) port on the left. The port in the middle is an S- video/composite video port.

2. **Backlight**

LCD displays do not produce light, so to generate brightness, LCD displays have a *backlight*. A backlight is a small fluorescent lamp placed behind, above, or to the side of an LCD display. The light from the lamp is diffused across the screen, producing brightness. The typical laptop display uses a *cold cathode fluorescent lamp (CCFL)* as its backlight.

3. **Inverter**

The only problem with fluorescent lighting, and LCD backlights in particular, is that they require fairly high-voltage, high-frequency energy. Another component is needed to provide the right kind of energy, and that's the *inverter*. The inverter is a small circuit board installed behind the LCD panel that takes DC current and inverts it to AC for the backlight. If you are having problems with flickering creens or dimness, it's more likely that the inverter is the problem and not the backlight itself.

Screen

The screen on a laptop does what you might expect—it produces the image that you see. The overall quality of the picture depends a lot on the quality of the screen and the technology your laptop uses. Current options include LCD, LED, OLED, and plasma.

Disassembling and Reassembling Laptops

Using the Right Tools

Two critical camps of materials you need are the manufacturer's documentation and the right hand tools.

Using the Manufacturer's Documentation

Even experienced technicians will tell you to not remove a single screw until you have the documentation handy unless you're incredibly familiar
with that particular laptop. Most laptop manufacturers give you access to repair manuals on their website

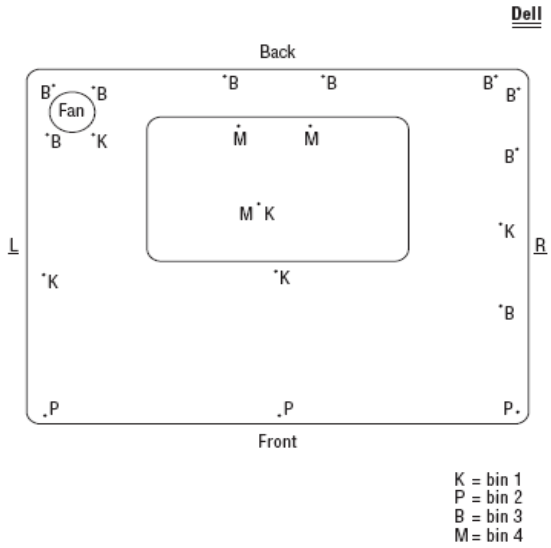
Using the Right Hand Tools

For some laptops, you only need the basics, such as small Phillips-head and straight-edge screwdrivers. For others, you may need a Torx driver.

Replacing Laptop Components

You have your manual, screwdrivers, and screw container handy and are ready to go. Now you just need to figure out how to get to the defective component to replace it. It would be nice if we could just tell you one simple way to do this for all laptops, but that's not going to happen. Internal laptop structure, components that can be replaced, and how to get to those components varies widely between models. It's impractical to list steps to remove all of these devices because the steps we would list here will only help you if you're working on the same model of laptop we're using for an example.

FIGURE 9.22 Laptop repair "road map"



The list of components that may be replaceable could include input devices such as the keyboard and Touchpad; storage devices, including hard drives and optical drives; core components such as memory, the processor, and the motherboard; expansion options, including wireless cards and mini-PCIe cards; and integrated components such as the screen, plastics, speakers, battery, and DC jack. Again, depending on the make and model of the laptop you're working on, the list of replaceable components might be longer or shorter. The model we're going to use in the examples in the rest of this chapter is a Dell Latitude C640.

Replacing Hard Drives and Memory

Hard drives and memory are the two most common components people usually upgrade in a laptop.

Replacing a Laptop Hard Drive

1. Turn off the computer.
2. Disconnect the computer and any peripherals from their power sources, and remove any installed batteries.
3. Locate the hard drive door and remove the screw holding it in place.
4. Lift the hard drive door until it clicks.
5. Slide the hard drive out to remove it.

6. Remove the two screws holding the hard drive to the hard drive door.

7. Attach a new hard drive to the hard drive door.
8. Slide the new hard drive back into the hard drive bay.

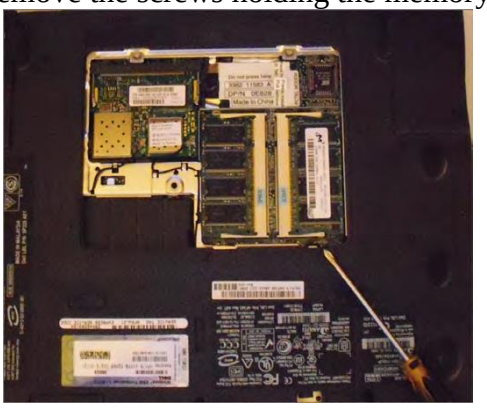
9. Snap the hard drive door back into place, and insert and tighten the screw to hold the door in place.

Replacing Laptop Memory

1. Turn off the computer.

2. Disconnect the computer and any peripherals from their power sources, and remove any installed batteries.

3.Remove the screws holding the memory door in place.



4. Use your fingers to gently separate the plastic tabs holding the memory module in place. The module should pop up so you can grab it.

5. Align the notch in the new memory module to the one in the connector.

6. Insert the new memory module into the socket at a 45-degree angle. Once full contact is made, press the module down. It should click into place.

7. Replace the memory door and fasten the screws

Removing a Laptop Video Card

1. Turn off the computer.

2. Disconnect the computer and any peripherals from their power sources, and remove any installed batteries.

3. Remove the Mini PCI card and the optical drive.

4. Remove the hard drive, the hinge cover, the keyboard, the display assembly, and the palm rest.

5. Loosen the two captive screws holding the video card/thermal cooling assembly in place.

6.Lift up on the video card/thermal cooling assembly to remove it from the motherboard.

Removing a Laptop Keyboard

1. Turn off the computer.

2. Disconnect the computer and any peripherals from their power sources, and remove any installed batteries.

3. Remove the hard drive.

4. On the bottom of the laptop, remove the five screws marked with the letter *K*.

5. Turn the laptop over and open the display.

6. Remove the center control cover by inserting a small flat-edged screwdriver into the notch at the right end of the center control cover and prying it loose.

7. To release the keyboard, use a small flat-edged screwdriver to pry up on its right edge, near the blank key.

8. Lift the keyboard up about an inch and rotate it forward so the keys are facing on the palm rest. Don’t pull the keyboard too far or you might damage the connector cable.

9. Pull up on the keyboard connector to disconnect it from the keyboard interface connector on the motherboard.

10. Set the keyboard aside.

Removing the Processor Cooling Assembly and Processor

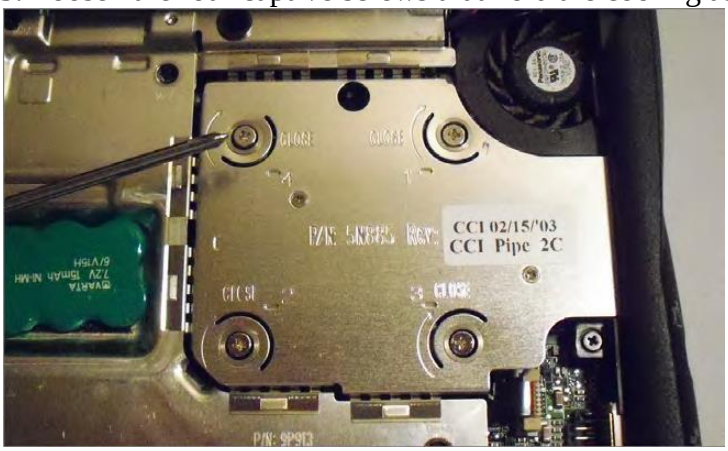
1. Turn off the computer.

2. Disconnect the computer and any peripherals from their power sources, and remove any installed batteries.

3. Remove the hard drive.

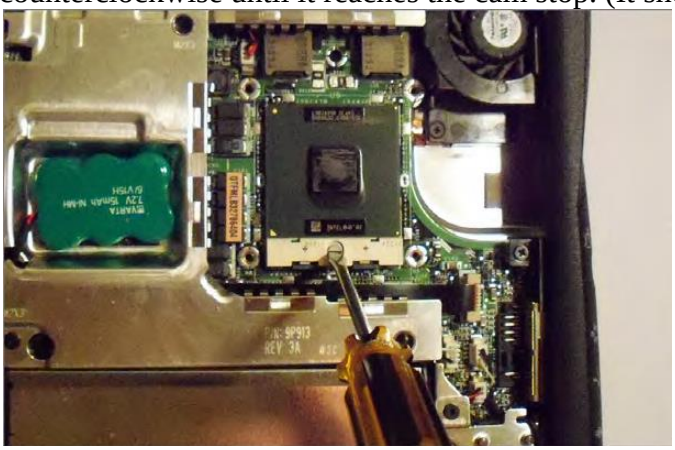
4. Remove the keyboard.

5. Loosen the four captive screws that hold the cooling assembly in place.



6. Insert a small screwdriver into the recess in the front left side of the assembly and pry the assembly from the motherboard. If this is the first time removing the assembly, it might take some force because it's likely glued to the processor. Set the assembly aside.

7. Use a small flat-edged screwdriver to loosen the processor's ZIF socket by rotating the cam screw counterclockwise until it reaches the cam stop. (It should take about a one-quarter turn.)



Replacing the CMOS Battery

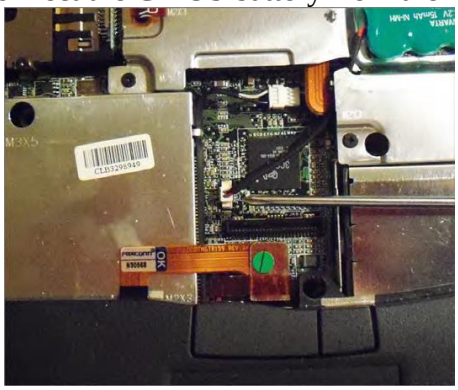
1. Turn off the computer.

2. Disconnect the computer and any peripherals from their power sources, and remove any installed batteries.

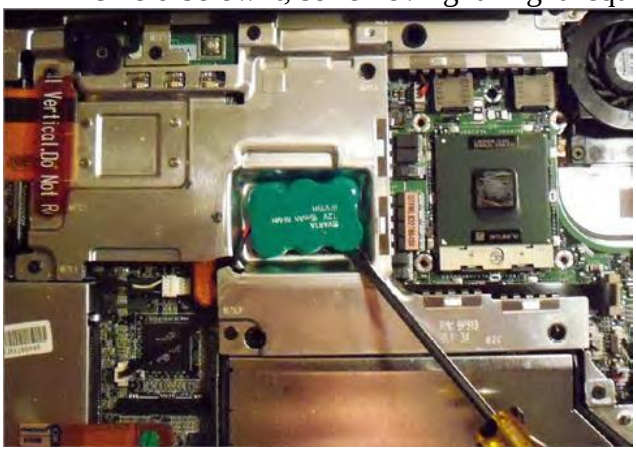
3. Remove the hard drive.

4. Remove the keyboard.

5. Disconnect the CMOS battery from the motherboard.



4. Pry the battery from its seat with a small straight-edged screwdriver. Note that it's adhered to the EMI shield below it, so removing it might require some force.



7. Connect the new battery to the appropriate connector on the motherboard.
8. Peel away the backing from the adhesive bottom of the new CMOS battery. Press the battery into the battery tray.)
9. Upgrade the BIOS using a flash BIOS CD.

Flashing the System BIOS

1. Turn off the computer.
2. Ensure that the computer is plugged into AC power and that the main battery is installed properly.
3. Turn on the computer and press F2 to enter the BIOS setup.
4. Reset the system boot order to ensure that the system boots from the CD first.
5. Insert the flash BIOS update CD, and reboot the computer. The disc will flash the BIOS and automatically reboot.
6. Upon reboot, press F2 again to enter the BIOS setup. Verify that the settings are correct, and change the boot sequence to your preferred setting.
7.Remove the flash BIOS CD.

Removing External Devices

1. You need to stop the device first (this is good policy even for USB devices), using the Safely Remove Hardware icon in the system tray here (it looks like a card with a green arrow over it).
2. Once you've clicked the icon, you will get a screen similar to the one shown here:
3. Highlight the device you want to remove, and click Stop. Windows will then notify you that it's safe to remove the device. If it's a cabled device, just detach it. If it's PCMCIA, you can press the Eject button next to the slot in which the card is located. Other types of hardware in some laptops require you to release a latch. The following
photo shows a modular front-load bay, and the right side has a CD-ROM in it:
4. Turn the computer over, and you can see the release latch. Slide it to the side, and pull on the grip on the underside of the CD-ROM. Out it comes.

PORTABLE COMPUTING DEVICES

- **Netbooks**

Netbook is a generic name given to a category of small, lightweight, legacy-free, and inexpensive laptop computers that were introduced in 2007. Netbooks compete in the same market segment as tablet computers and Chromebooks (a variation on the portable network computer).At their inception in late 2007 as smaller notebooks optimized for low weight and low cost—netbooks omitted certain features (e.g., the optical drive), featured smaller screens and keyboards, and offered reduced computing power when compared to a full-sized laptop. Over the course of their evolution, netbooks have ranged in size

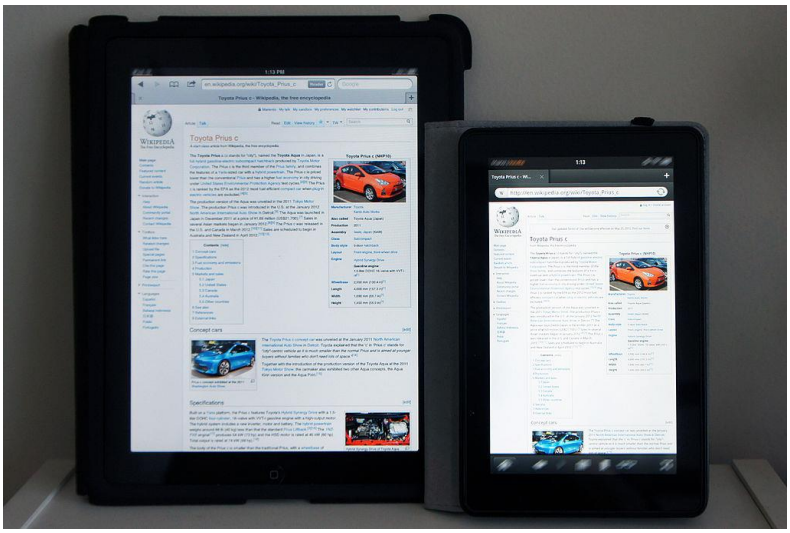
from below 5" screen diagonal to 12". A typical weight is 1 kg (2.2 pounds). Often significantly less expensive than other laptops, by mid-2009, netbooks began to be offered by some wireless data carriers to their users "free of charge", with an extended service contract purchase.

- **Ultrabooks**

Intel have specified and trademarked Ultrabook as a brand for a class of high-end subnotebook computers featuring reduced bulk without compromising battery life. Ultrabooks use low-power Intel Core processors, solid-state drives, and a unibody chassis to help meet these criteria. Due to their limited size, Ultrabooks typically omit common laptop features such as optical disc drives and Ethernet ports. The name "Ultrabook" represents a portmanteau of the words "ultraportable" and "notebook".

- **Tablet PCs**

A **tablet computer**, commonly shortened to **tablet**, is a thin, flat mobile computer with a touchscreen display, which is usually in color, processing circuitry, and a rechargeable battery in a single device. Tablets often come equipped with sensors, including digital cameras, a microphone, and an accelerometer so images on screens are always displayed upright. The touchscreen display uses the recognition of finger or stylus gestures to replace the mouse, trackpad and keyboard used in laptops.Tablets are typically larger than smartphones or personal digital assistants with screens 7 inches (18 cm) or larger, measured diagonally. However much of a tablet's functionality resembles that of a modern smartphone, like having a virtual keyboard or running a dedicated 'mobile' operating system.



- **Features and capabilities of Mobile Devices**

A mobile device (or handheld computer) is a small computing device, typically, small enough to hold and operate in the hand and having an operating system capable of running mobile apps. These may provide a diverse range of functions. Typically, the device will have a display screen with a small numeric or alphanumeric keyboard or a touchscreen providing a virtual keyboard and buttons (icons) on-screen. Many such devices can connect to the Internet and interconnect with other devices such as car entertainment systems or headsets via Wi-Fi, Bluetooth or near field communication (NFC). Integrated cameras, digital media players, mobile phone and GPS capabilities are common. Power is typically provided by a lithium battery.
Characteristics

Device mobility can be viewed in the context of several dimensions:

- ✓ Physical dimensions and weight
- ✓ Whether or not the device is mobile or some kind of host to which it is attached to is mobile
- ✓ What kind of host devices can be bound to
- ✓ How devices are attached to a host
- ✓ When the mobility occurs

- **Touchscreen technology- Enhancing Hardware- Configuration- Security**

A **touchscreen** is a input and output device normally layered on the top of an electronic visual display of an information processing system. A user can give input or control the information processing system through simple or multi-touch gestures by touching the screen with a special stylus and/or one or more fingers.Some touchscreens use ordinary or specially coated gloves to work while others may only work using a special stylus/pen. The user can use the touchscreen to react to what is displayed and to control how it is displayed; for example, zooming to increase the text size.

The touchscreen enables the user to interact directly with what is displayed, rather than using a mouse, touchpad, or any other such device (other than a stylus, which is optional for most modern touchscreens).Touchscreens are common in devices such as game consoles, personal computers, tablet computers, electronic voting machines, point of sale systems ,and smartphones. They can also be attached to computers or, as terminals, to networks. They also play a prominent role in the design of digital appliances such as personal digital assistants (PDAs) and some e-readers.

The popularity of smartphones, tablets, and many types of information appliances is driving the demand and acceptance of common touchscreens for portable and functional electronics. Touchscreens are found in the medical field and in heavy industry, as well as for automated teller machines (ATMs), and kiosks such as museum displays or room automation, where keyboard and mouse systems do not allow a suitably intuitive, rapid, or accurate interaction by the user with the display's content.