

Understanding Laptops

Introduction

- A Portable computer contains the functionality of a desktop but is portable
- Weight and Size are an important issues
- Architecture similar to desktop
 - Different form factors – space is an issue
 - Heat dissipation is an issue
 - Limited airflow
- Smaller and smaller sizes
 - Netbooks
 - Palm tops

Primary Differences

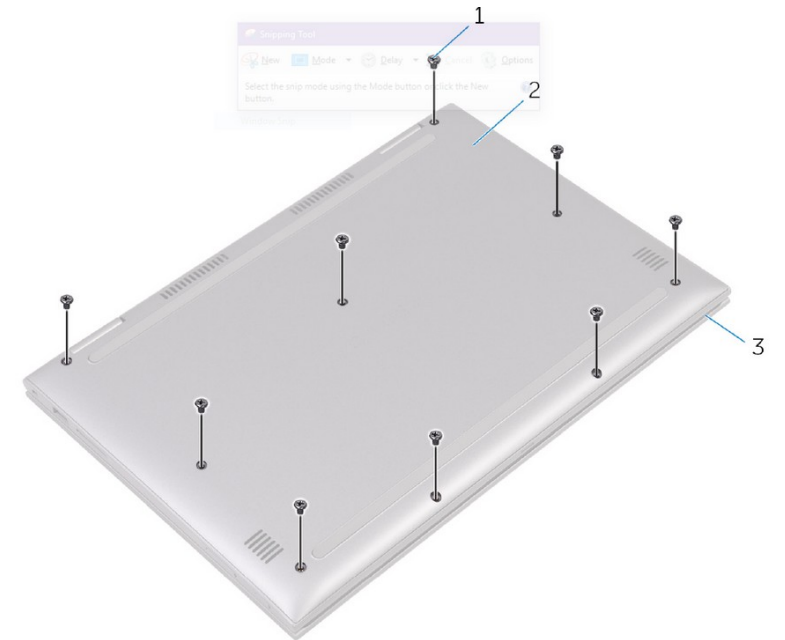
- Portability
 - Uses battery for power where no mains exists
- Cost
 - More expensive than desktop
 - Miniature versions of components
- Performance
 - Laptops compromise performance and portability
- Expandability
 - Desktops designed to have items added to them
 - Upgrades to processors or motherboards are impossible!
 - Use ports
- Quality of Construction
 - Portability brings potential for abuse – need to be durable

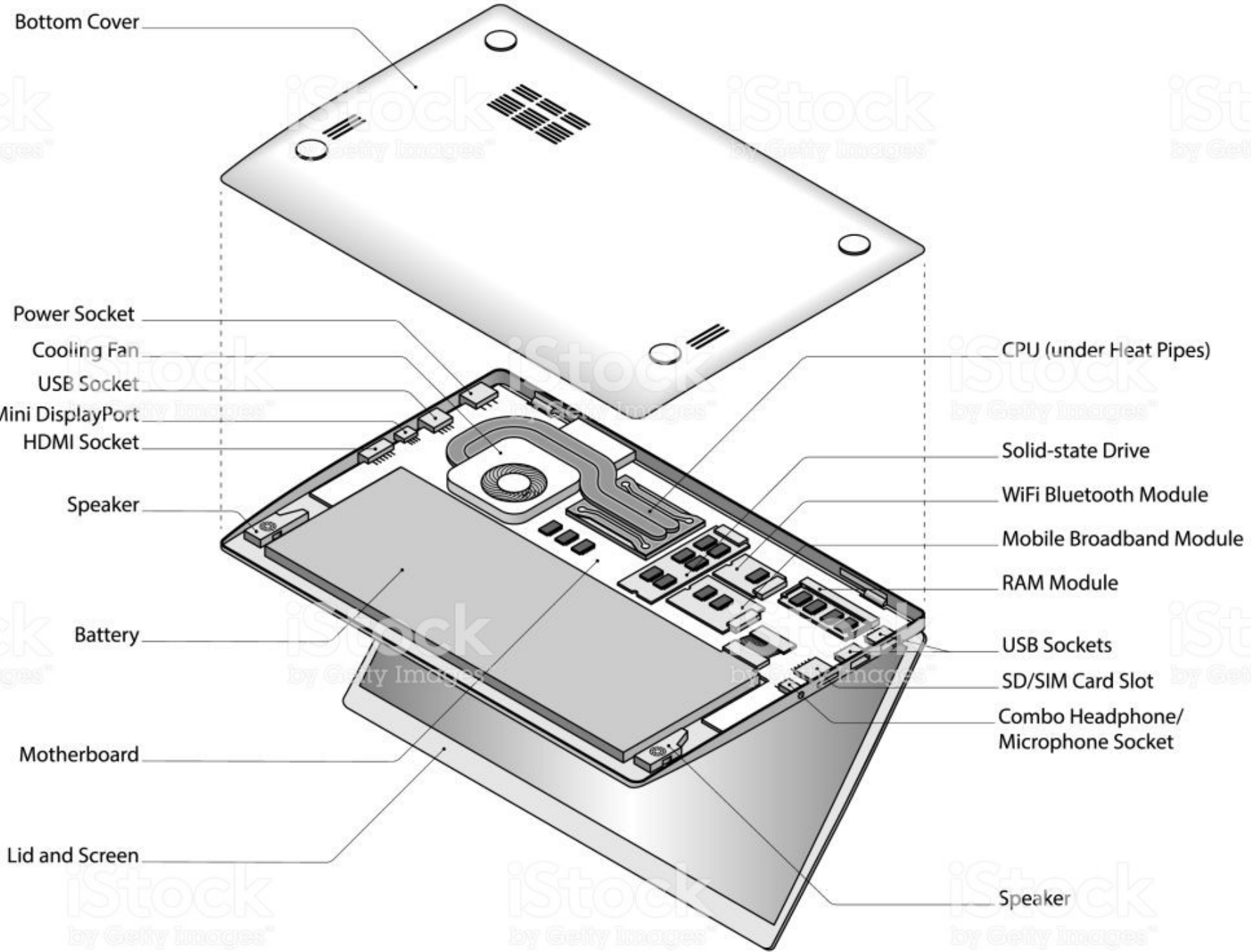
Disassembling and Reassembling Laptops

- Space is at a premium in laptops
- Lots of screws!
- Use ESD precautions
- Need a decent toolkit
- Need the manufacturers documentation
- YouTube videos are very helpful

Disassemble a Laptop

- Toolkit
 - Make sure you get the right driver for the right job
 - Sometimes only the basics are required
- Be Organised!
 - Lots of screws
 - Use a methodical storage approach
 - Try card and pushing screws into the card
 - Take pictures
 - Use post-it notes to label screws





Laptop Case

- 3 Main components
 - Display
 - Internal Case Structure to provide strength and rigidity
 - The external plastic or aluminium case
- Plastics and frame used interchangeably
- Most common is the Clamshell design
 - Two halves hinged together at the back
- Be careful opening case – do not damage it!

Dismantling a Laptop

- Turn off the computer
- Disconnect all external peripherals and cables
 - Including the PSU
- Ensure workspace is clear and well illuminated
- Watch the video first
- Read the technical manual for instructions
- Have the correct tools to use at hand
- Use ESD principles
 - Ground yourself
 - Use a wristband

Repairing Laptops

- Use the right tools
- Use manufacturers documents and READ them
- Use the correct model number
- Check if its still in warranty
- Draw a map of the laptop to know which screw goes where
- Usually involves removing everything including the bezel, lid, hinge etc







Interior Laptop Components

Component	Description
Motherboard	Similar to desktop motherboards, except: <ul style="list-style-type: none">• Smaller• Reduced power consumption• More integrated components• More power options
CPU	<ul style="list-style-type: none">• Lower power consumption than desktop CPUs• Lower heat generation than desktop CPUs• No fans• Surface-mounted or socket-based
Storage drive	<ul style="list-style-type: none">• 1.8-inch, 2.5-inch, and 3.5-inch form factors• Slower than desktop HDDs• Newer laptops have SSDs and hybrid drives.• Ease of removal varies widely

Interior Laptop Components

Component	Description
Memory	<ul style="list-style-type: none">• More expensive than desktop RAM• SODIMMs, MicroDIMMs, and proprietary memory modules• Flash memory
Optical drive	Similar to desktop optical drives, except smaller
Wireless card	Integrated into or independent from the motherboard
Webcam	<ul style="list-style-type: none">• Still images and video• Resolution up to 1080p HD• Software for image manipulation
Microphone	<ul style="list-style-type: none">• Supports web conferencing and web calling• Can be part of a headset• Noise-cancelling capabilities

Motherboards and Processors

- Motherboards are manufacturer specific
- Many shapes and sizes
- Small form factor
- Contains all the interfaces
- Daughter boards plug into motherboards
- For A+ also called system board



**OLPC XO-1.5
B1 Prototype**

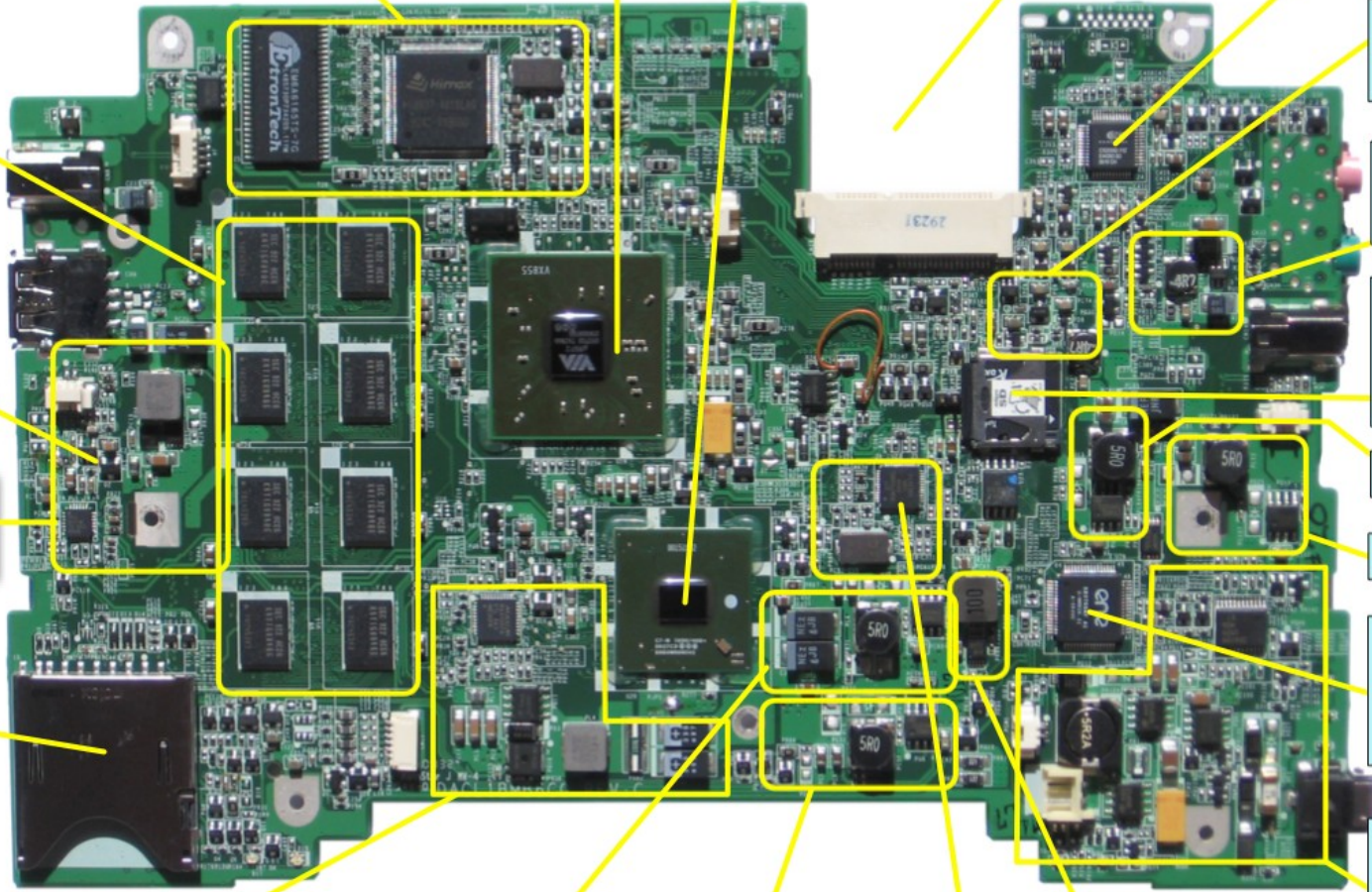
- DCON**
Hymax HX8837
- Companion Chip**
Via VX855
- Processor**
Via C7-M ULV
0.4 - 1.0 GHz
- WLAN**
Marvell 8686
SDIO connect
- HD Audio Codec**

RAM
DDR2 SDRAM
128 MBytes each

+2.8V Pwr Sup.

**+1.8V Mem.
Pwr Supply**

SD/MMC Slot



**VCORE
Power
Supply**

**+1.2V
Power
Supply**

**+1.05V
Power
Supply**

**Clock
Synth
ICS9UM702**

**3VPCU
Power
Supply**

**LCD Power
Supply**

**Backlight
Power Supply**

**Internal
microSD Slot
4+ GB Flash**

+5V Supply

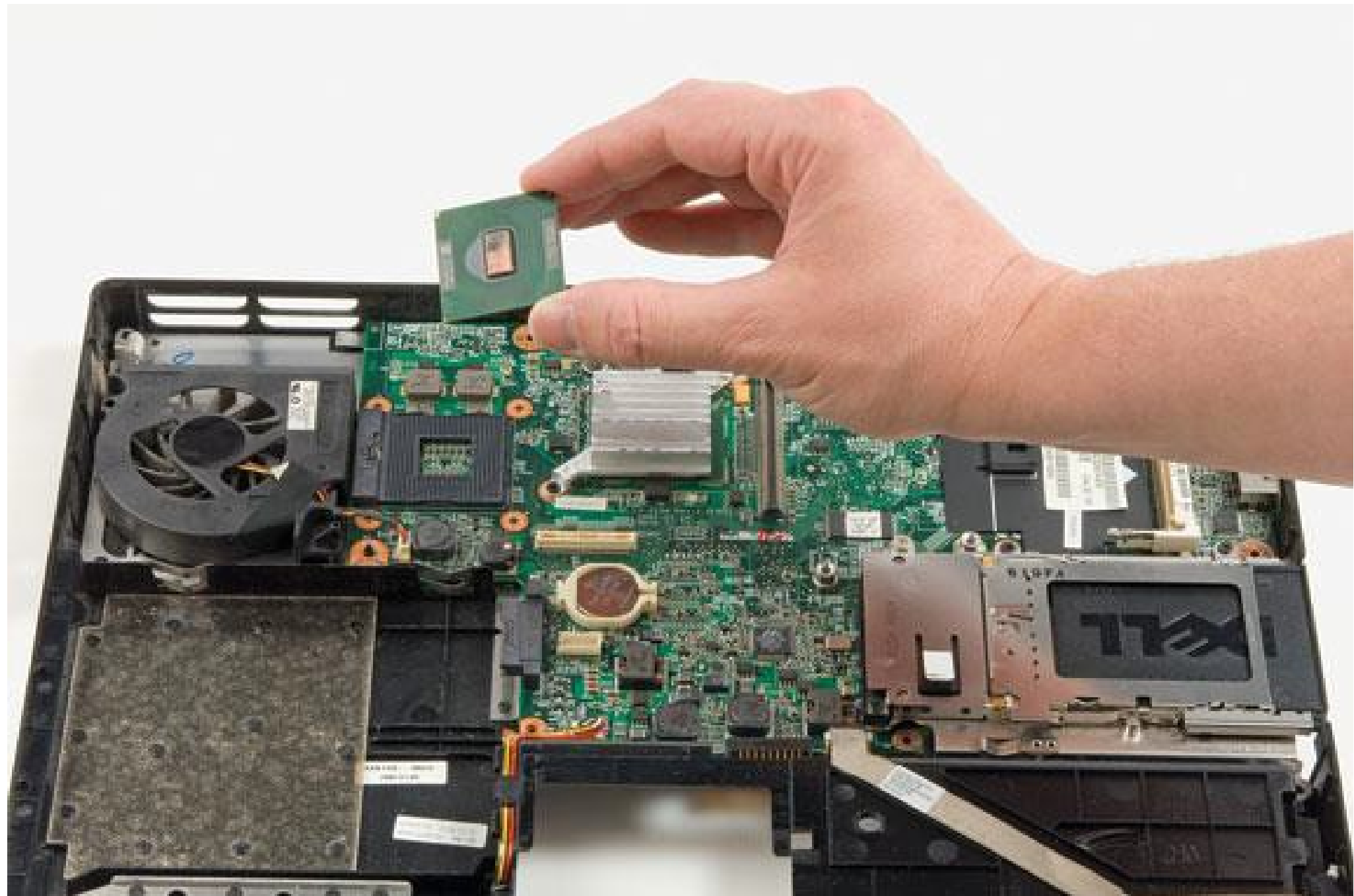
+3.3V Supply

**Embedded
Controller
ENE KB3700**

**Battery
Charger
Fujitsu MB39A129**

Laptop Processors

- Streamlined connection – no pins and socket. Either soldered directly onto board or use micro FCBGA (Flip Chip Ball Grid Array)
- Processor cannot easily be removed/replaced
- Lower voltages and clock speed – mainly to consume less power and generate less heat
- Active sleep and slowdown modes – throttling used to conserve battery and use minimum power
- Built in Wireless networking which includes integrated graphics memory, wireless LAN and CPU
- Dedicated processor or cut down version of desktop equivalent



Memory

- Originally only available from laptop manufacturer
- Now, two standards
 - SODIMM (small outline dual inline memory module) (67mm x 32mm)
 - MicroDIMM (45mm x 30mm)
- Available as DDR, DDR2, DDR3 etc
- 32 bit or 64 bit
- 72 pins to 214pins
- MicroDIMM has no notch and aimed at ultralight netbooks etc.
- Often under a flap for easy removal



144pin SO-DIMM DDR1



172pin MICRODIMM



184pin RIMM



200pin SO-DIMM DDR2



30pin SIMM



184pin DDR 1



72pin SIMM



240pin DDR2



204pin SO-DIMM DDR3



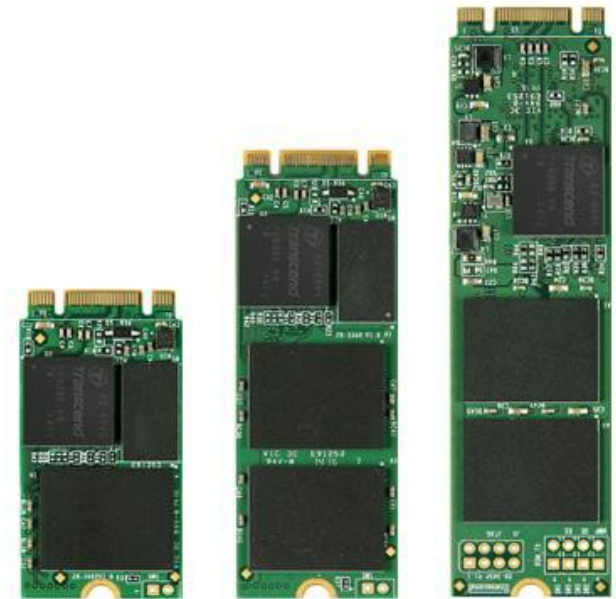
168pin DIMM



240pin DDR3

Storage

- Built in Vs Cloud based
- Hard Drives
- Smaller sized HD than desktop
- 2.5" vs 3.5"
- .5" tall
- Same controllers (PATA and SATA)
- SSD vs HDD (SSD more shockproof so better for laptops)
- M.2 SSD
- Connectors often have power and data integrated
- Hybrid drives
- Optical drives

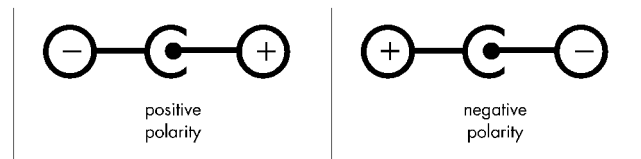


Data Migration

- Upgrade Laptop HDD to SSD
- Copy the data manually
 - Slow process and you can miss something important
- Use cloning software
 - Allows copy of applications too
 - Be aware of differing disk sizes

Power for Laptops

- From mains (AC) or batteries (DC)
- Mains charger/adaptor will convert AC to DC (<https://www.youtube.com/watch?v=2jqJZxxX6gQ>)
- Display screens need AC so inverter used to change DC back to AC for screen
- Battery types: NiMH, NiCd, Li-ion, Li-Po
- Battery charging: Metal batteries have chemical memory loss, Li-ion suffer from digital memory loss.
- Occasional full discharge is useful. Otherwise partial discharge followed by recharge extends battery life.
- Make sure adapter is correct size, voltage, power and polarity (of central conductor)



Chargers



Laptop Displays

- LCD screens used in laptops before for stand alone monitors
- Video card built into motherboard
- Video memory is shared with processor
- Can be reassigned in BIOS
- Backlight – needed for LCD displays - use CCFL (cold cathode fluorescent light) or LEDs (don't need inverter)
- Inverter – small circuit board sitting behind LCD that converts DC to AC (high voltage)
- Screen types – already covered!

Display



Types of Laptop Displays

- Most are TFT
 - Thin Film Transistor
 - TN – Twisted Nematic
 - IPS – Inplane Switching



TFT



OLED



Removable



Rotating



Touch screen

Laptop Display Components

Component	Description
Inverter	Converts DC power to AC power needed for the display.
Backlight	Fluorescent or LED lighting that illuminate an LCD display from the back or the sides.
Wi-Fi antenna	Installed around the sides of the display and connects to the network card for wireless network connectivity.
Webcam	Often built into the plastics above the display and provides real-time video streaming over a network.
Microphone	Often built into the plastics near the webcam and enables audio input,
Digitizer	On touch screen displays, a layer of sensors between the LCD display and a layer of glass that enables the translation of the analog touch signal to a digital signal.

Input Devices

- Keyboard
 - Original keyboards not designed to be portable
- Special Function Keys
 - Some keys are multi-function
 - Switching to external monitor
 - Volume controls
 - Media Options
- Pointing Devices
 - Trackball
 - Touchpad
 - Point Sticky
 - Touchscreen
- Know how to enable/disable Touchpad if mouse will be used.

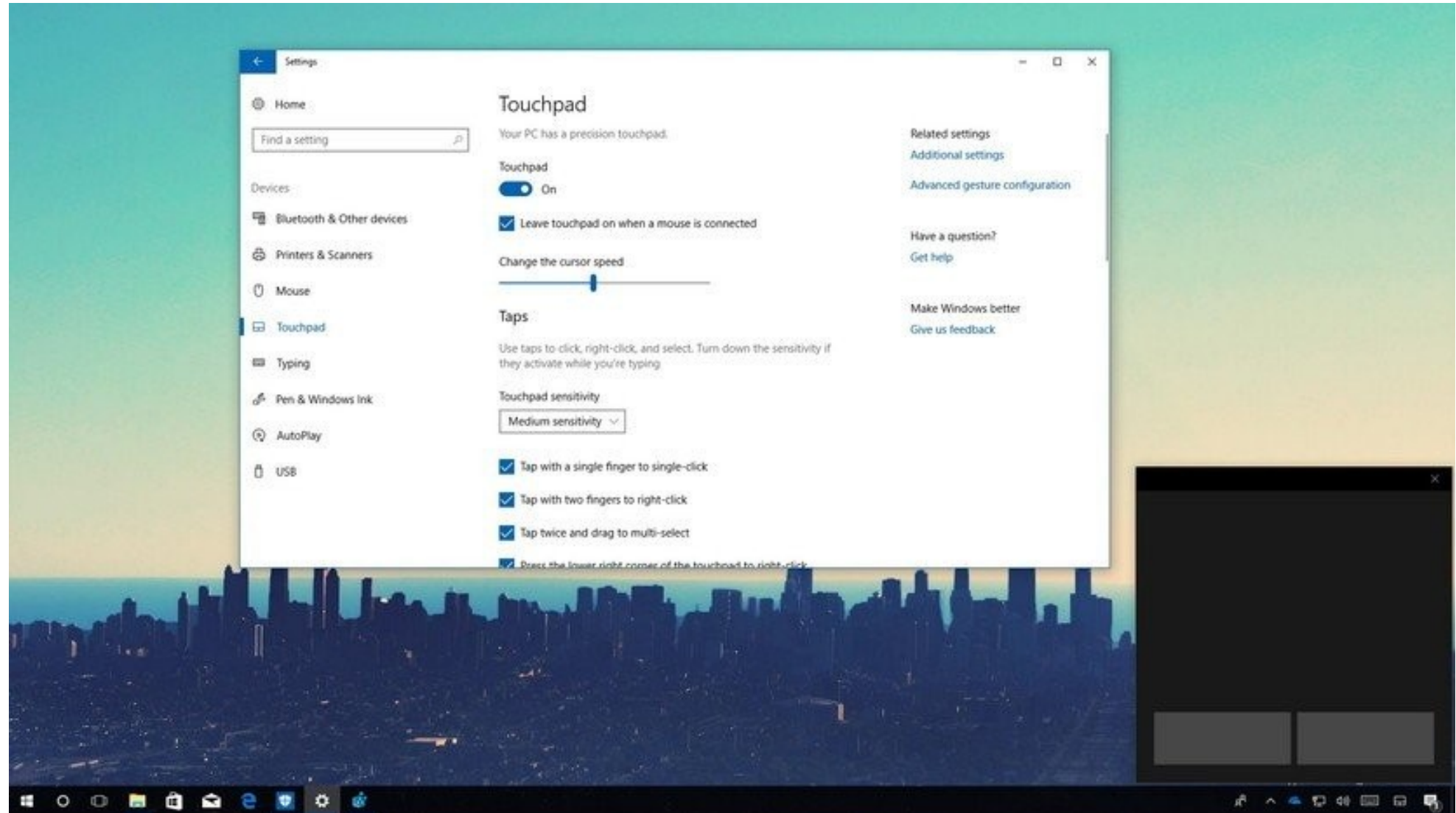
Laptop brightness adjust keys



Enable/Disable Touchpad

- Open the Start Menu.
- Click on Settings.
- Click on Devices.
- In the left pane of the window, click on Touchpad.
- In the right pane of the window, locate a toggle right under Touchpad, and turn this toggle Off.
- Close the Settings window.

Enable/Disable Touchpad



Networking

- Function Keys will have options for
 - Wi-Fi
 - Bluetooth
 - Cellular
 - Airplane mode
- Need to toggle quickly
 - In an aircraft
 - Suspected attack when on public network
 - Sometimes network services hang

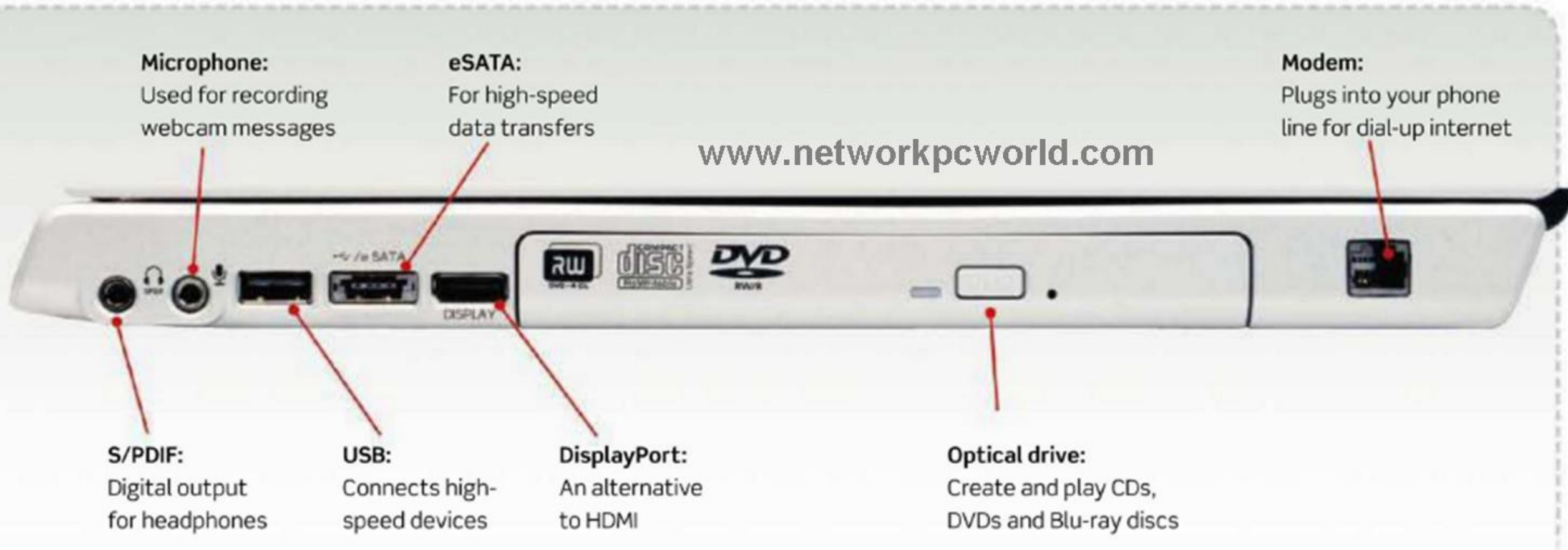
Expansion Buses and Ports

- Express Card – used to be called PCMCIA Card
- used to give additional ports such as Gigabit Ethernet, Firewire, eSATA, SSD, Sound
- Different versions 1.0, 2.0
- Up to 5Gbps ExpressCard 2.0
- Size 75mm x 34mm typical but smaller ones also available
- Express card/34, Express Card/54, card bus adapter
- Bigger – more space for heat dissipation

Laptop Ports

- Laptops only have a few ports so USB can be used to add ports such as:
 - RJ45, Bluetooth, WiFi, HDMI, Thunderbolt, DisplayPort, Optical drives, Smart card reader, ext keyboard and mouse
- DisplayPort - replaces VGA and DVI, can carry audio and video
- Thunderbolt
- Docking Station – proprietary, extension of the motherboard, may have drive bays – e,g DVD
- Port Replicator – only the ports

Laptop Ports



Port Replicators



PC Express Cards



MiniPCle

- Replaces MiniPCI
- Cards rest inside the laptop
- 52 pin adapter
- Full size or half size



M.2

- Even smaller than MiniPCIe
- 22mm with 66pin
- Provide a range of interfaces – wifi, Bluetooth, GPS, NFC, SATA
- Cards have a “key” or notch (with a different letter) that distinguish the different interfaces.
- A – Wifi, Bluetooth and mobile
- B - SATA, PCIe x 2 SSD
- E – WiFi, Bluetooth mobile
- M – PCI x 4 SSD
- Cards can have one or two notchs (B, M , B+M)
- Card must match the keys in the slot (B+M socket will only take a B+M card)

M.2 Cards and Keys

- First one
 - A and E Keyed WiFi Card
- Middle two cards
 - B and M keyed SSD
- Final Card
 - M Keyed SSD



Other Common Laptop Items

- Webcam and microphone usually built into the lid or mic may be built into the bezel or elsewhere
- Wifi Antenna - built into lid and then terminated on motherboard via hinge
 - Most common on the Right Hand Side

Cable lock – to secure laptop to desk. Also called Kensington Lock

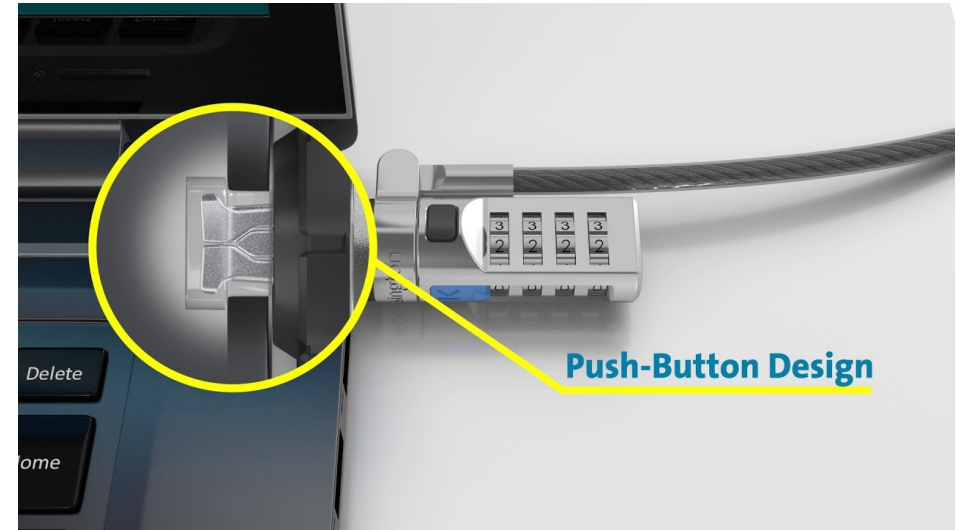
Wi-Fi Antenna



Webcam



Kensington Lock



Troubleshooting Mobile Device Hardware

- Handling and Maintenance Techniques

Technique	Description
Handling	<ul style="list-style-type: none">• Avoid placing mobile devices in pockets where they can be damaged when you sit.• Avoid placing fingerprints on the screen and the screen protector as you apply the protective device.• Avoid dropping mobile devices.• Use protective cases whenever possible.• Avoid temperature extremes.
Maintenance	<ul style="list-style-type: none">• To help with laptop cooling, keep air ducts clear of dust and debris.• Follow manufacturer instructions for charging batteries.• Use approved battery chargers.• Never expose batteries to fire or water.• Do not drop, throw, or otherwise jolt batteries.• Use approved batteries for each device.• Use power management features to extend battery life.• When shipping or transporting devices, select a protective enclosure.• Avoid carrying devices by a corner.

Operating Environment Best Practices

Environmental Factor	Description
High temperature	Exposure to high temperatures can cause expansion within portable computing devices and compromise circuitry. High temperature can also lead to the failure of cooling systems to maintain adequate operating temperatures, leading to the overheating and failure of internal components such as the processor, video processor, and hard drive.
Rapid temperature fluctuation	Rapid changes in temperature, such as those seen when transporting a device from one climate to another, could result in condensation within the device. Devices should be allowed to come to room temperature before being powered on after a temperature change.
High humidity	Avoid operating in high humidity as condensation within the device may occur and promote corrosion. All manufacturers specify operating humidity levels. It is important to follow manufacturer operating procedures/guidelines at all times. Most systems can operate at high humidity without a problem, as long as there is no condensation (5% to 95% relative humidity, non-condensing).
Low humidity	ESD is more likely to occur in low-humidity environments ranging anywhere from 10% - 35% relative humidity.
RFI	Erratic errors can occur when mobile devices are exposed to radio towers, two-way radios, cordless telephones, and microwave ovens. Moving the device further from such sources will help in resolving interference issues. Properly shielded cables for peripherals will also minimize the effects of RFI.

General Mobile Device Issues

- Display issues
- Battery issues
- Device temperature
- Battery power issues
- No power when connected to AC
- Ghost cursor and pointer drift issues

Common Mobile Device Keypad Issues

- Nonstandard key placement
- Function keys
- Numeric keys
- Sticking keys
- Keyboard too small
- Keyboard not responding

Common Touch Screen Issues

- Dirty
- Touch not registering in the correct location
- Touchscreen unresponsive
- Damaged screen
- Erratic behavior
- Can't see screen elements
- User wearing gloves

Common Wireless Connectivity Issues

- Intermittent wireless connectivity
- No Bluetooth connectivity
- No wireless connectivity

Need to Know

- Replace HD
- Replace RAM (tricky if under keyboard)
- Replace internal expansion card (MiniPCle)
- Replace the screen
- Upgrade wireless card and video - IF - its separate
- Removing the processor and cooling assembly
- Removing the keyboard
- Replacing the CMOS battery