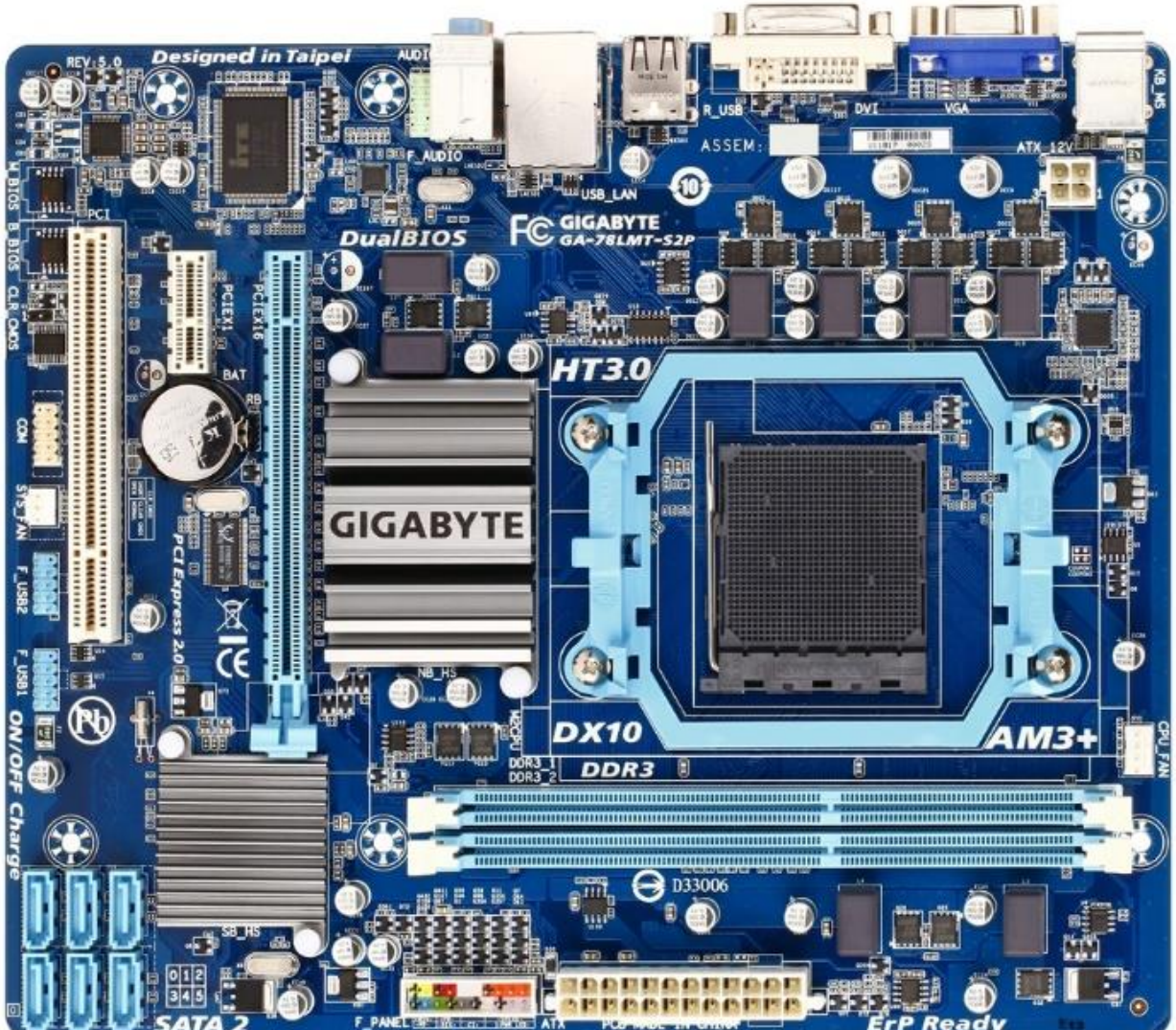
Internal Components of Computer Hardware

Motherboard

- Also known as the mainboard, system board, mobo or logic board
- It is the main circuit board in a computer
- It contains *chips* – *integrated circuits* that contain miniaturised elements such as *wires*, *transistors*, *capacitors* and *resistors*

Motherboard



Main Components of a Motherboard

- Components attached to a motherboard include:
  - Central processing unit (CPU)
  - Memory slots:
    - ROM
    - RAM
    - CMOS
  - Clock
  - Chipset
  - Expansion slots/add on boards for cards
  - Connectors to other devices

Purpose of a Motherboard

- Components such as the CPU, memory and chipset are plugged directly onto a motherboard
- Peripheral devices are also connected by connectors such as USB
- It integrates a computer's main functions by controlling the communications between the components
- Controls the inputs to and outputs from a computer
- Features differentiating one motherboard from another include the number of available expansion slots, type and speed of the CPU and RAM and number and type of hard drives that can be connected

Central Processing Unit (CPU)

- The CPU is located on the motherboard
- It is the main *chip* in the computer
- It processes data
- It exchanges data with other hardware components and peripheral devices
- It is also known as a computer's processor/microprocessor

Clock

- A computer’s clock is found on a microchip that regulates the timing and speed of all a computer’s functions
- It is also known as the internal clock or real-time clock (RTC)
- Faster clock speeds result in more operations being performed in a set time
- A clock’s speed is measured in Megahertz (MHz) or Gigahertz (GHz)
- Typical clock speeds are 3 GHz - three thousand million times a second
- The clock rate influences the performance of CPUs, making some CPUs work faster than others

Memory

- Computer memory includes the following types:
  - Random Access Memory (RAM)
  - Read Only Memory (ROM)
  - Firmware
  - Virtual memory
  - Complementary metal-oxide-semiconductor (CMOS)

RAM

- Is a computer's main memory located on a motherboard
- It is used to hold programs while they are being used
- It is used to hold data while it is being processed
- Its data and instructions can be accessed in any order, which is why it's given the name 'random access'
- RAM's access speeds can be as fast as 8 billionth of a second or 8 nanoseconds
- It is classed as *volatile*, that is, data is lost when a computer's power is turned off
- Extra RAM can be installed in a computer system

ROM

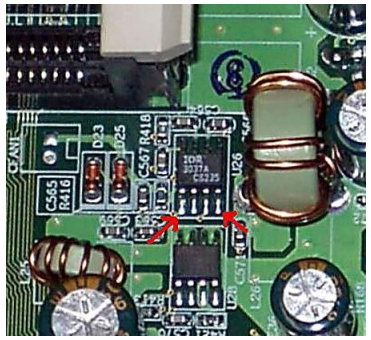
- Used to store instructions and information permanently
- Information stored in ROM is read-only and cannot be changed
- It is fast, non-volatile memory
- Instructions stored in ROM include ordering a computer to start up (boot-up) and loading a computer's operating system
- Instructions needed during booting-up are referred to as firmware
- Types of ROM include:
  - PROM
  - EPROM
  - EEPROM

Firmware

- Firmware is software that is stored in a computer or other hardware device's ROM
- It is written directly onto a hardware component
- It provides instruction on how a component should operate

CMOS

- CMOS is a small amount of RAM supplied by a battery located on a motherboard
- It stores information about a computer's components and the settings for the components
- As RAM chips lose the information stored in them when a computer's power is switched off, the CMOS battery supplies constant power to the CMOS chip and the information contained in CMOS is retained



Chipset

- A group of chips which act as an interface between a CPU and the devices connected to a computer
- Functions are contained in two chips – a northbridge chip and a southbridge chip
- A northbridge chip forms an interface between a CPU, RAM and components such as a graphics/video display cards
- A southbridge chip acts as an interface with input and output devices
- Chipsets are usually designed to work with a particular ‘family’ of processors

Expansion Slots

- Motherboards contain expansion slots that various components can be slotted into
- Components can include:
  - RAM chips
  - Expansion cards such as:
    - Network interface cards (NICs)
    - Graphics cards/video display cards
    - Sound cards
- The above are used to upgrade/enhance a computer system’s functions

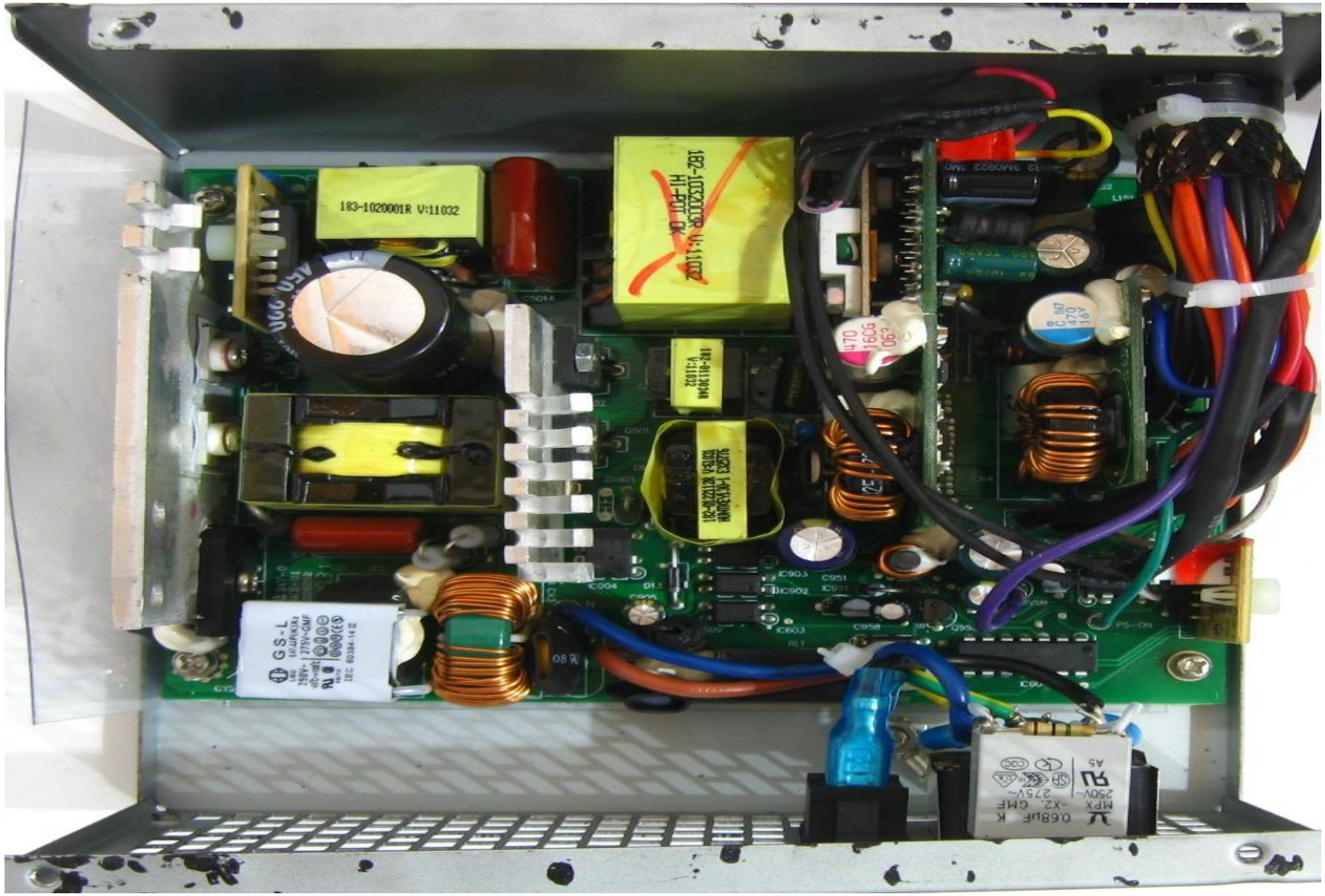
Expansions and Chipsets

- It should be noted that chipset manufacturers are placing more functions in chipsets instead of in expansion cards
- These functions include:
  - Video card (integrated into the northbridge)
  - Sound card (integrated into the southbridge)
  - Modem (integrated into the southbridge)
  - Network (integrated into the southbridge)

Power Supply

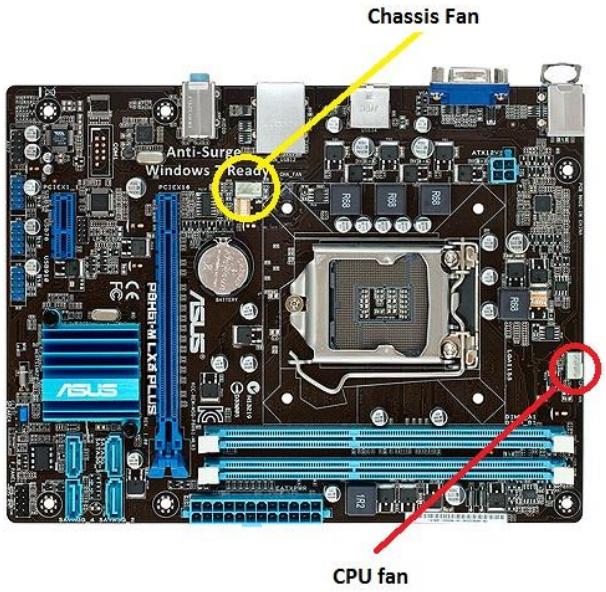
- This component supplies power to all components in a computer
- It includes a transformer, voltage control and a cooling fan
- It transforms mains voltage into the voltages required by a computer’s components

Power Supply



Fan

- Computers can overheat and a fan is located on a CPU as CPUs are prone to overheating



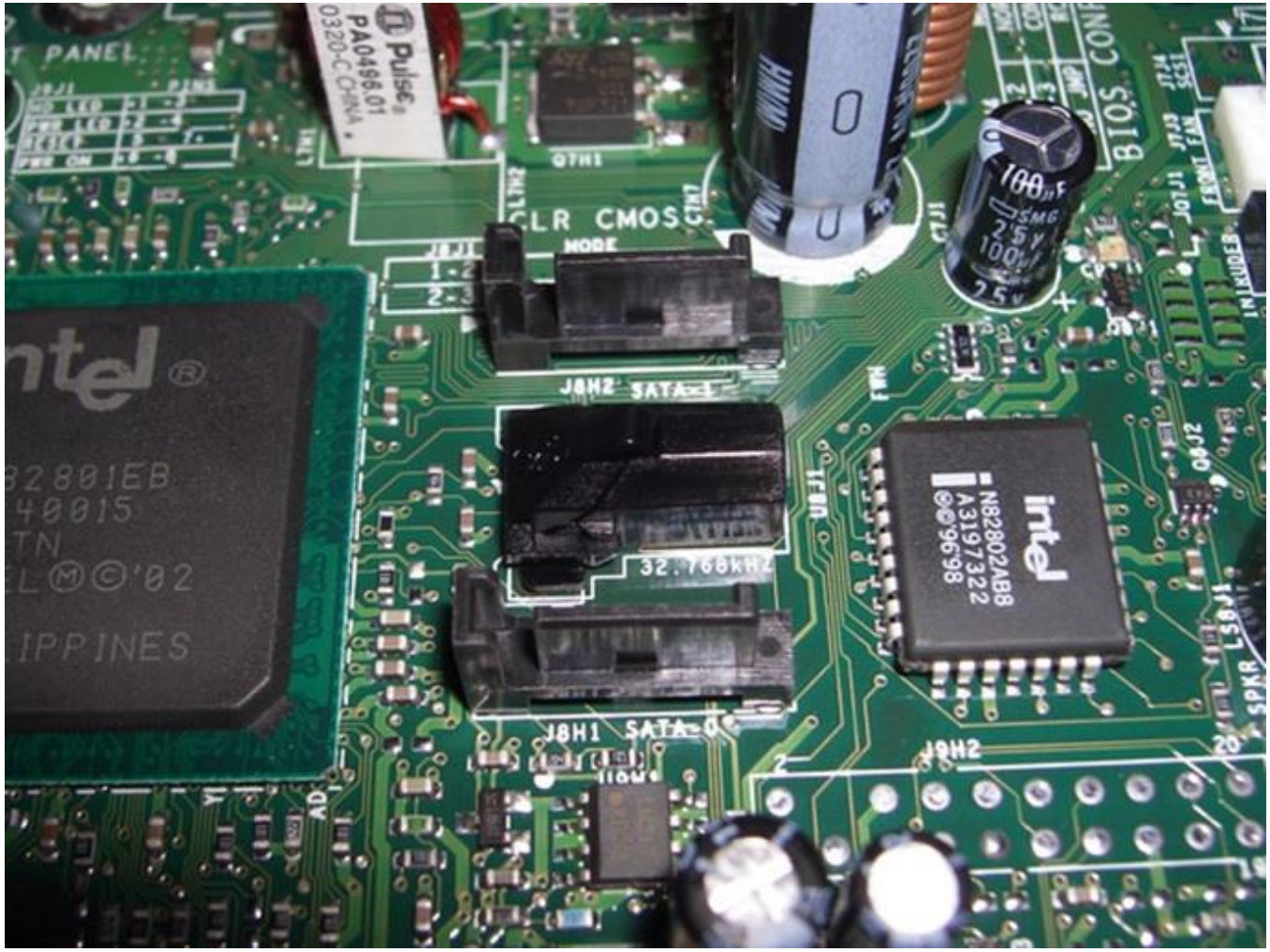
How Internal Components Communicate with Each Other

- A motherboard plays an important role in the communication of internal components of a computer system
- It provides electrical connections by which the components can communicate – these are described as b*uses*
- Let’s take a closer look at the function of a bus

Buses

- A bus (data channel/pathway) enables electronic pulses to flow from component to component
- The width of a bus determines how much data can be transferred at any one time
- Bus widths include 16 bit, 32 bit, 64 bits
- A bus has its set of connectors to connect devices, cards or cables
- There are two types of buses: internal buses and external buses
- Internal buses connect between internal components
- External buses connect between external components

Buses



Main Types of Bus

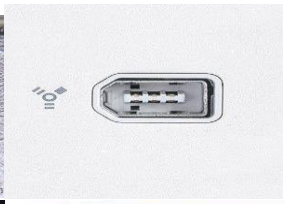
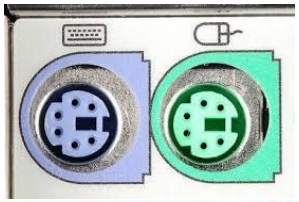
- **Front side bus (FSB)**
  - Connects RAM and the CPU as RAM has the greatest volume of data ‘traffic’
  - Connects the Northbridge to the CPU
- **Peripheral Component Interconnect Bus (PCI) bus**
  - Connects peripheral components such as network interface cards and sound cards
- **Input/output buses**
  - Connect a motherboard to a computer system’s peripheral devices

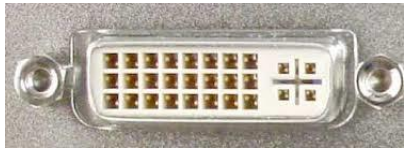
Features of a Bus

- A bus is organised as follows:
- It has **control lines** that signal requests and acknowledgements and inform what type of data is on the data lines
- **Data lines** transmit data between source and destination, such as data and addresses and complex commands
- A **bus transaction** includes two parts: sending an address and receiving or sending data

Connectors

- A connector is a cable that connects a component to a peripheral device
- There are different types that include the following:
  - Universal Serial Bus (USB)
  - Firewire
  - PS/2
  - Ethernet
  - Parallel
  - Serial
  - DVI
  - HDMI

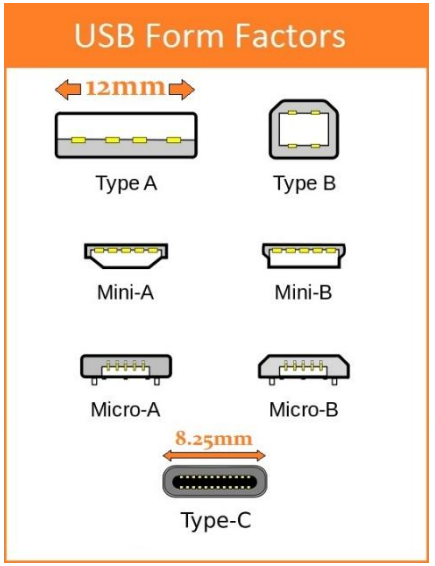

- An exercise will be set on connectors and will be discussed in the tutorial

Firewire

- Its official name is IEEE 1394
- Is used for high-speed communications between digital devices
- Used with audio and video devices, e.g. digital camcorders
- Up to sixty three devices can be connected
- It is faster than USB with rates up to 800Mbps

USB

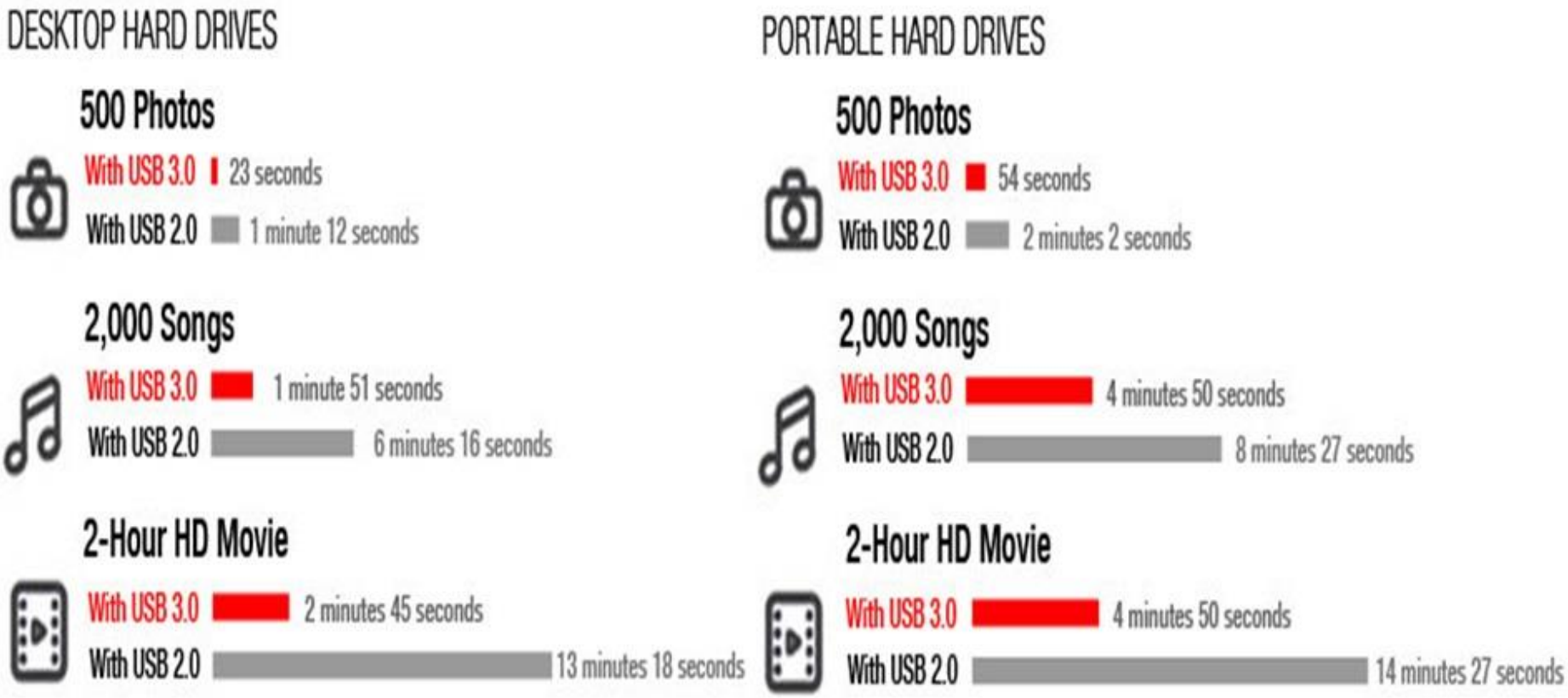
- Is a connector between a computer and a peripheral device, such as a keyboard, mouse, monitor, printer, scanner, camera and camcorder
- ‘Hot Pluggable’ – cables can be connected and disconnected while a computer is running without freezing the computer
- Carry power as well as signals, which allows for USB powered gadgets and recharging batteries in cameras and other USB peripherals
- Designed to make it easy to identify which plug goes into the computer and which plug goes into the peripheral device
- USB cables are a universal standard



USB

USB Standard	Max Transfer Speed	Power Output	Logo	Symbol
USB 2.0	480 Mbit/s	2.5W		
USB 3.0 (USB 3.1 Gen 1)	5 Gbit/s	4.5W		
USB 3.1 (USB 3.1 Gen 2)	10 Gbit/s	100W		

USB


DESKTOP HARD DRIVES
500 Photos
With USB 3.0 23 seconds
With USB 2.0 1 minute 12 seconds
2,000 Songs
With USB 3.0 1 minute 51 seconds
With USB 2.0 6 minutes 16 seconds
2-Hour HD Movie
With USB 3.0 2 minutes 45 seconds
With USB 2.0 13 minutes 18 seconds
PORTABLE HARD DRIVES
500 Photos
With USB 3.0 54 seconds
With USB 2.0 2 minutes 2 seconds
2,000 Songs
With USB 3.0 4 minutes 50 seconds
With USB 2.0 8 minutes 27 seconds
2-Hour HD Movie
With USB 3.0 4 minutes 50 seconds
With USB 2.0 14 minutes 27 seconds