Lecture 1

Intro for Net Admin

# Basics

Dr.Lway Faisal Abdulrazak

Basics and Revision

Hardware Organization

CPU

memory

motherboard

hard drive
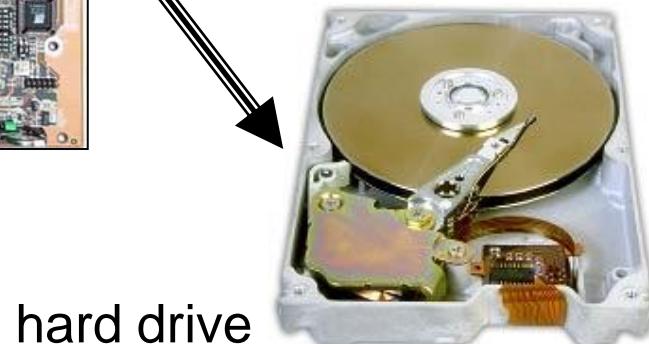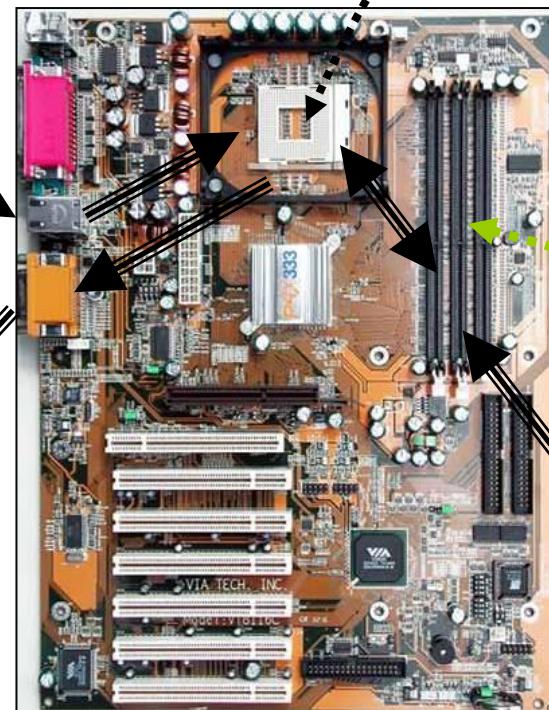
Components of a Computer System

Central Processing Unit (CPU)

Data

control unit (CU)

Arithmetic logic Unit (ALU)

Input units

Memory

RAM

ROM

output units

Auxiliary Memory

Information /Knowledge
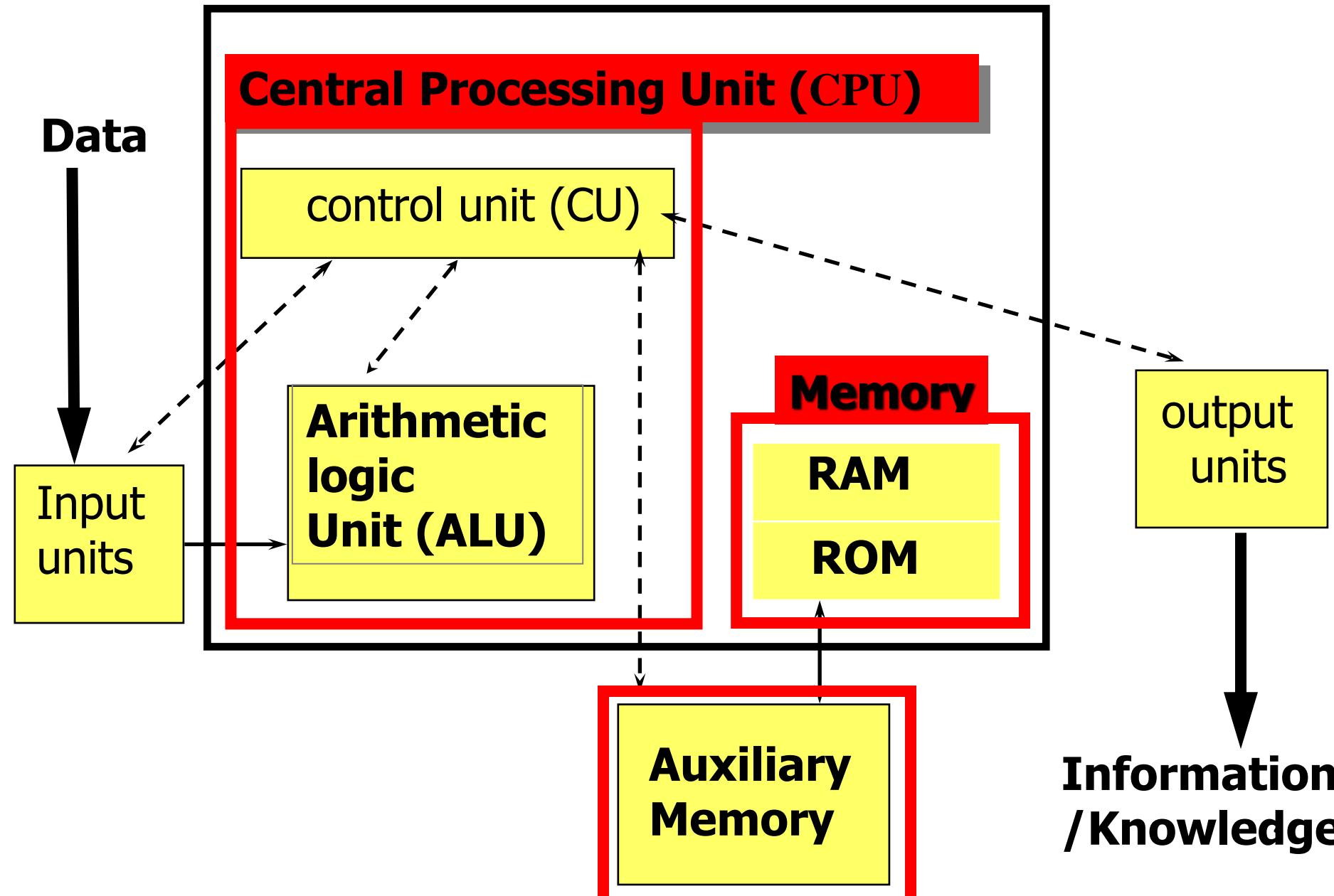
The Hardware

1.1 – BIOS and UEFI

BIOS and UEFI   BIOS Configurations

BIOS Security   Installing BIOS Upgrades

Common types of CPU sockets include the **Pin Grid Array (PGA) and the Land Grid Array (LGA)**

BIOS and UEFI
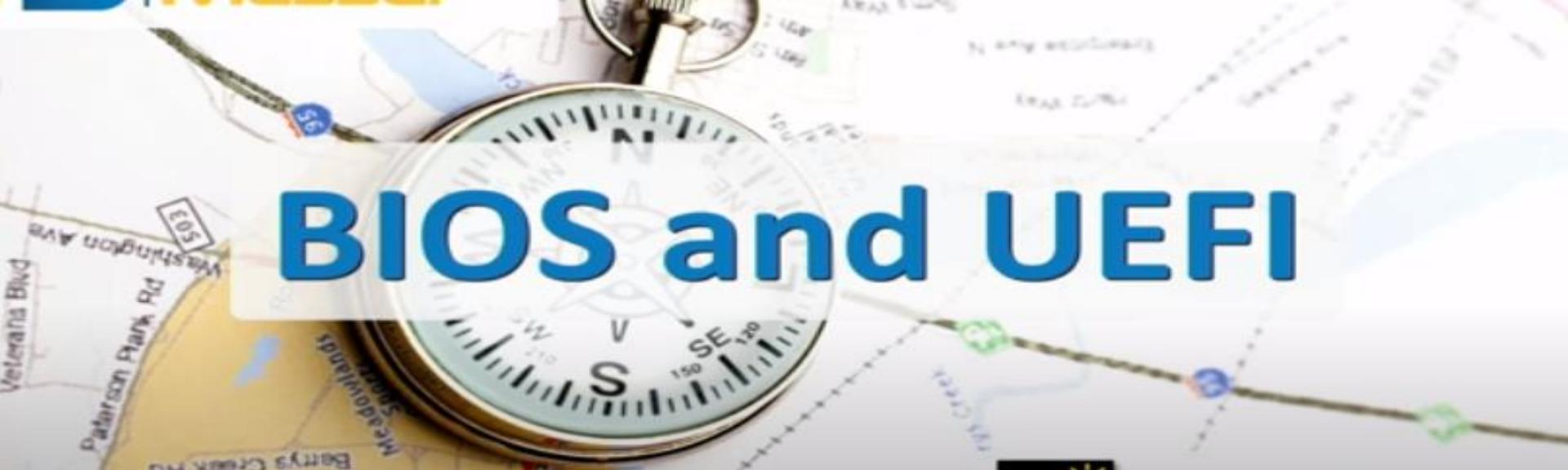
CMOS Setup Utility – Copyright (C) 1985-2004, American Meg

▶ Standard CMOS Features   ▶ Cell_Menu

▶ Advanced BIOS Features   Load Fail-Safe Def

▶ Advanced Chipset Features   Load Optimized Def

▶ Integrated Peripherals   BIOS Setting Passw

▶ Power Management Features   Save & Exit Setup

▶ PNP/PCI Configurations   Exit Without Savin

▶ PC Health Status

↑↓←→:Move   Enter:Select   +/-/:Value   F10:Save   ESC:Exit   F
F6:Load Optimized Defaults   F7 :Load Fail-Safe De

Set Frequency, Spread Spectrum Function ...

v02.58 (C)Copyright 1985-2004, American Megatrends

/ISUS EFI BIOS Utility - Advanced Mode

Main   AI Tweaker   Advanced   Monitor   Boot

CPU Temperature   +47°C / +116°F   CPU Temperature

MB Temperature   +35°C / +95°F

CPU Fan Speed   1762 RPM

Chassis Fan 1 Speed   N/A

Power Fan 1 Speed   N/A

Chassis Fan 2 Speed   N/A

Power Fan 2 Speed   N/A

CPU Q-Fan Control   Enabled

CPU Fan Speed Low Limit   600 RPM

CPU Fan Profile   Standard

Chassis Q-Fan Control   Enabled

Chassis Fan Speed Low Limit   600 RPM

Chassis Fan Profile   Standard

←→: Select Screen
↑↓: Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previous Values
F5: Optimized Defaults
F10: Save   ESC: Exit

Version 2.00.1201, Copyright (C) 2010 American Megatrends
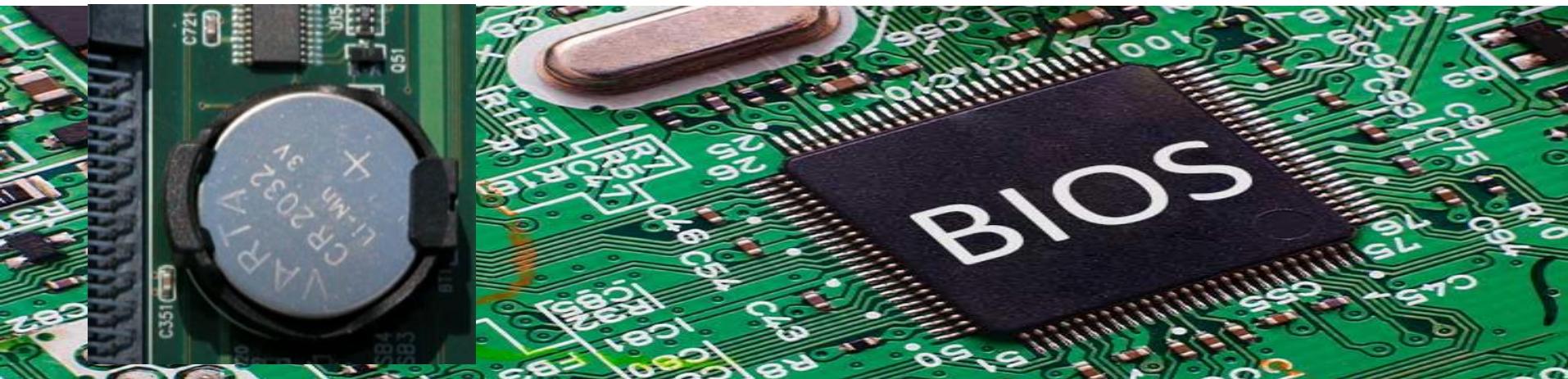
- System BIOS, ROM BIOS
- ROM or flash memory

- Initializes CPU and memory
  - Build the workspace

- POST
  - Power-On Self-Test

- Look for a boot loader
  - Start the operating system

- Older operating systems talked to hardware through the BIOS
  - Instead of accessing hardware directly

- Limited hardware support
  - No drivers for modern network, video, and storage devices

MBR
Master
boot
record

- Unified Extensible Firmware Interface
  - Based on Intel's EFI
    (Extensible Firmware Interface)

- Boot from large (> 2.2 TB)
  GUID partition table (GPT) disks
  - Also supports FAT and removable media

- Includes a pre-boot environment
  - This isn't an operating system
  - Has its own shell, drivers, and applications
  - Browse the Internet, backup a storage drive
  - Remote diagnostics, even without an OS

- Complementary metal-oxide semiconductor (CMOS)

- Launching the system setup
  - Del, F1, F2, Ctrl-S, Ctrl-Alt-S

VT-X, Hyper V, Virtualization

To Enable your Vertualization:

- Go through CMD, systeminfo.exe, check the virtualization.

- Msconfig, CPU, Virtualization enabled.

- Win+setting+Update and security+Recovary+advanced setup+Restart.

- Intel has implemented its (UEFI) by 2020 in an effort to improve security.

- Its key purposes remained intact - run the POST (power-on self-test) to identify and initialize key system components (CPU, RAM, GPU, storage), lead to OS boot.

shutdown /r /o /f /t 00

- **RAM**
  - View and configure memory settings

- **Hard drive / SSD**
  - Drive settings

- **Optical drive**
  - Enable / Disable

- **CPU**
  - CPU types

PhoenixBIOS Setup Utility

Main

Secondary Master [CD-ROM]		Item Specific Help

Type: [CD-ROM]
Device: VMware Virtual IDE CDROM

Multi-Sector Transfers: [Disabled]
LBA Mode Control: [Disabled]
32 Bit I/O: [Disabled]
Transfer Mode: [FPIO 4 / DMA 2]
Ultra DMA Mode: [Mode 2]

Item Specific Help:
User = you enter parameters of hard-disk drive installed at this connection.
Auto = autotypes hard-disk drive installed here.
1-39 = you select pre-determined type of hard-disk drive installed here.
CD-ROM = a CD-ROM drive is installed here.
ATAPI Removable = removable disk drive is installed here.

F1   Help   ↑↓ Select Item   -/+   Change Values   F9   Setup Defaults
Esc Exit   ←→ Select Menu   Enter Select ► Sub-Menu   F10 Save and Exit

BIOS Password / User Password
- System won't start
- Need the password to start the operating system

Supervisor Password
- Restrict BIOS changes
- Must use supervisor password to change any BIOS configurations

PhoenixBIOS Setup Utility

| Main | Advanced | Security | Boot | Exit |

Supervisor Password Is: Clear
User Password Is: Clear

Set User Password   [Enter]
Set Supervisor Password   [Enter]

Password on boot: [Disabled]
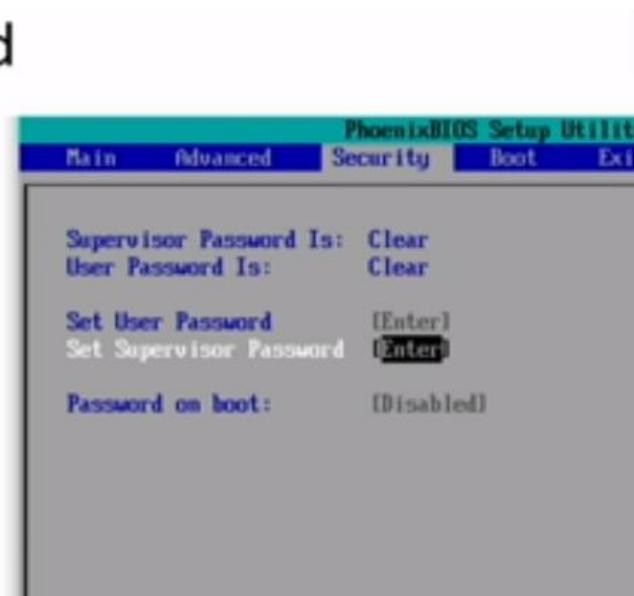
Full Disk Encryption

- Windows BitLocker disk encryption
  - BIOS integrates with TPM

- TPM - Trusted Platform Module
  - Can be added to many motherboards
  - Built-in to some systems
  - Adds advanced cryptographic functions
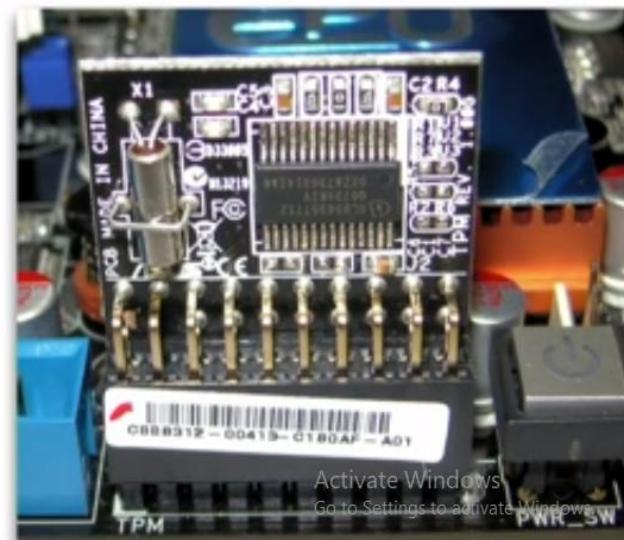
Motherboard

1.2 – Motherboards

- An Overview of Motherboard Types
- Motherboard Expansion Slots and Bus Speeds
- Motherboard RAM Slots
- Motherboard Jumpers and Connectors
- CPU Sockets
- Motherboard Chipsets

Motherboard


ASUS P5AD2-E Motherboard
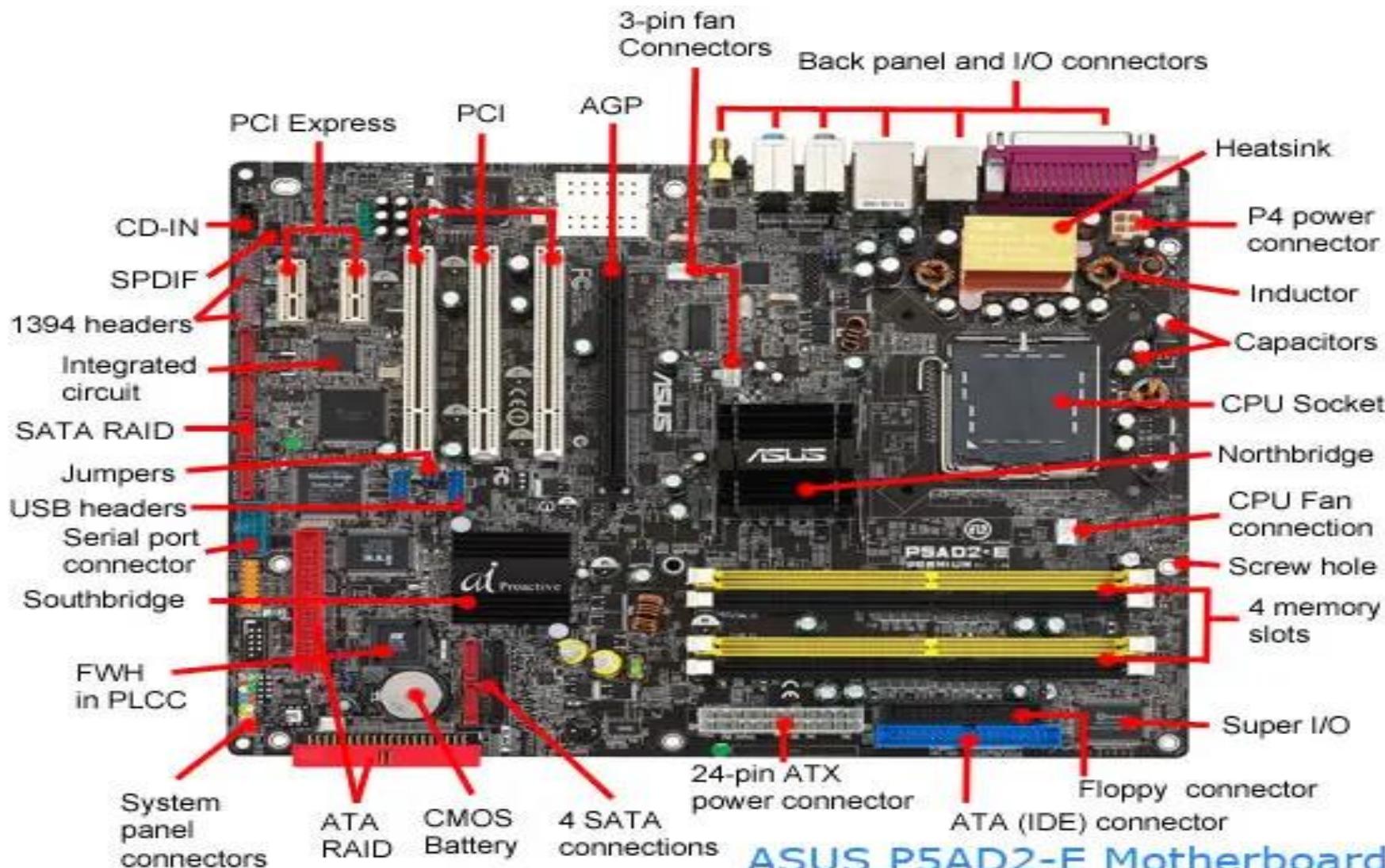
Expansion slots /Bus

ISA: Industry Standard Architecture

PCI
PCIe
PCIx
Mini-PCI
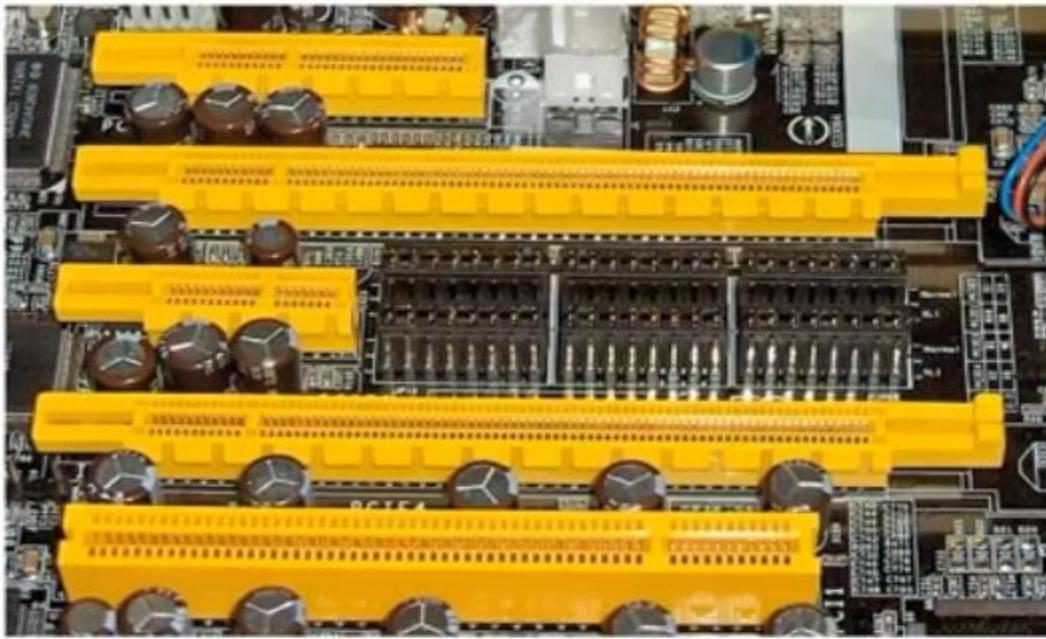
AGP Accelerated Graphics Cart
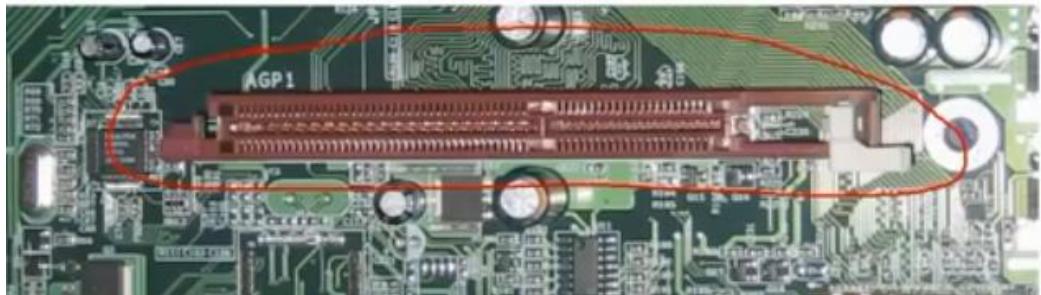
The expansion bus

- "Width" in bits
  - Big roads, little roads
  - Width is changing to bandwidth

- Clock speed of the bus
  - The expansion bus gets its own clock
  - 1 MHz (megahertz) = 1 million cycles per second
  - 1 GHz = 1000 MHz

Conventional PCI

- Peripheral Component Interconnect
  - Nobody ever calls it that
  - Created in 1994

- A common expansion interface
  - 32-bit and 64-bit bus width
  - Parallel communication

- Throughput varies by bus version
  - 133 MB/s (32-bit at 33 MHz)
  - 266 MB/s (32-bit at 66 MHz or 64-bit at 33 MHz)
  - 533 MB/s (64-bit at 66 MHz)

32-bit PCI parallel bus

Southbridge
(I/O Controller Hub)
USB, Ethernet, IDE, SATA, etc.

32-bit PCI Bus

32-bit PCI Expansion Slot

32-bit PCI Expansion Slot

64-bit PCI parallel bus

Southbridge
(I/O Controller Hub)
USB, Ethernet, IDE, SATA, etc.

64-bit PCI Bus

64-bit PCI Expansion Slot

64-bit PCI Expansion Slot

http://www.ProfessorMesser.com
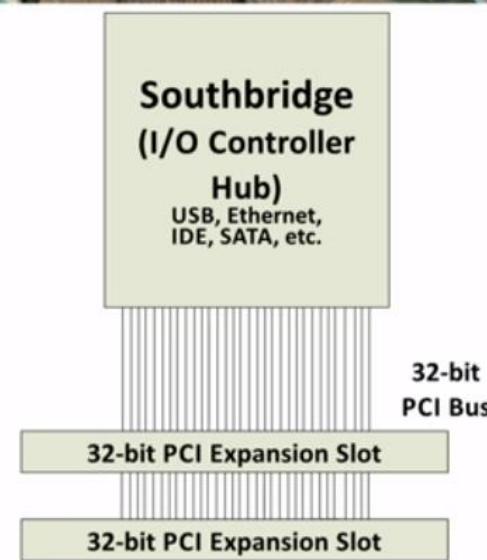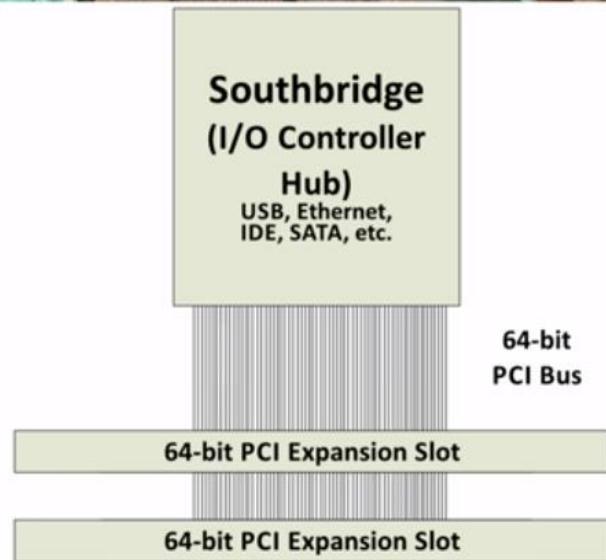
PCI 32-bit and 64 bit slots

RCC-1B6568-P04
0120KU200

PCI 32-bit expansion card

3.3V notch

5V notch

PCI 64-bit expansion card

3.3V notch

5V notch

64 bit notch
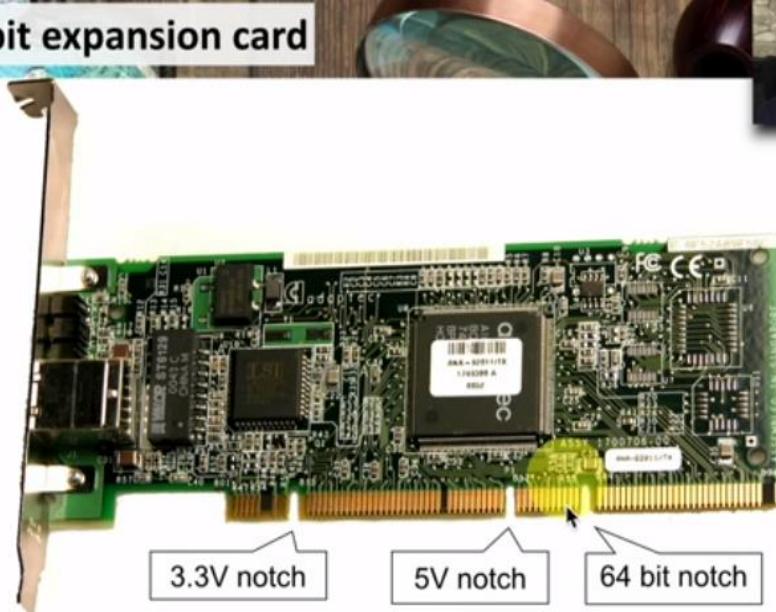
PCI-X

- PCI eXtended
  - Based on conventional PCI
  - Designed for servers

- Higher bandwidth
  - Four-times the clock speed
  - Built to handle higher-speed network and storage
  - 1,064 MB/s throughput
  - Parallel communication

- This is not PCI Express
  - A completely different standard

PCI Express

- PCI Express
  - Also known as PCIe
  - Replaced PCI, PCI-X, and AGP (Accelerated Graphics Port)

- Communicates serially
  - Unidirectional serial "lanes"
  - Slower devices don't slow down everyone

- One, two, four, eight, sixteen, or thirty-two full-duplex lanes
  - x1, x2, x4, x8, x16, x32
  - "x" is pronounced "by"
    - i.e., "by 4," "by 16"

PCI Express serial communication

Northbridge (Memory Controller Hub)

PCI Express Lane

PCI Express x1 slot

PCI Express serial communication

Northbridge (Memory Controller Hub)

PCI Express Lanes

PCI Express x4 slot
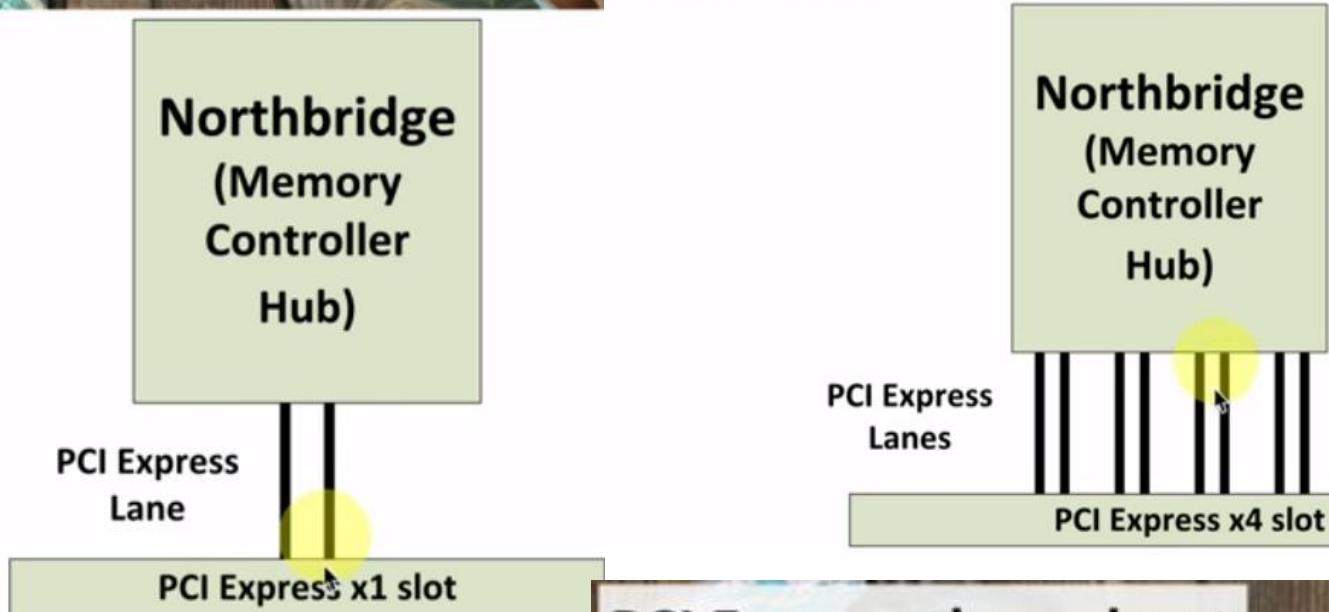
PCI Express throughput

- Different versions of PCIe
  - Improvement in speed with each iteration

- Per-lane throughput in each direction
  - v1.x: 250 MB/s
  - v2.x: 500 MB/s
  - v3.0: ~ 1 GB/s
  - v4.0 (expected in 2016): ~ 2 GB/s

SATA
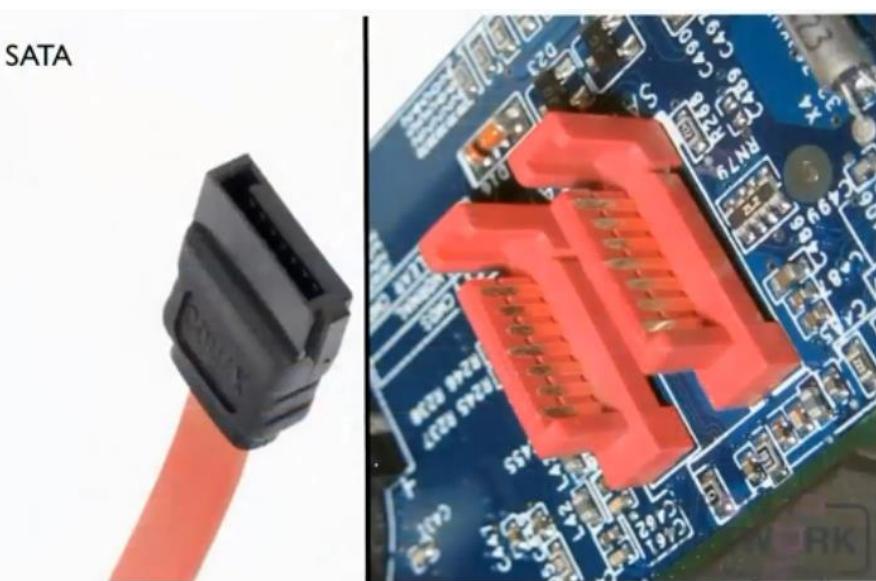
Mini PCI and PCI Express Mini Card

- Mini PCI and PCI Express for laptops
  - Shrink it down for mobile use

- Expand features of laptops
  - WiFi, mobile broadband, etc.

- No access to the card
  - It's inside the laptop
  - Can't touch it

MiniPCI

1.3 – RAM

An Overview of PC Memory Types   Understanding PC Memory

DIMM

- DIMM
  - Dual inline memory module
  - Electrical contacts are different on each side

- 64 bit data width

- DDR SDRAM - 184 pins, DDR2 and DDR3 SDRAM - 240 pins

SO-DIMM

- Small Outline Dual In-line Memory Module
  - 68 mm x 32 mm

- DDR and DDR2 SDRAM - 200 pins
  DDR3 SDRAM - 204 pins

SO-DIMM DDR
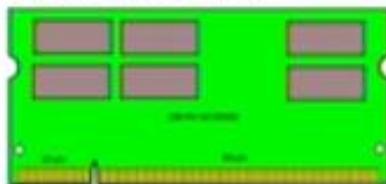
SO-DIMM DDR 2

SO-DIMM DDR 3

© 2016 Messer Studios
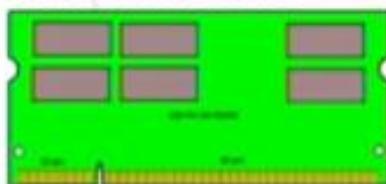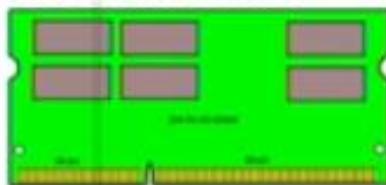
Micro-DIMM

- Smaller form-factors
  for mobile devices
  - 54 mm x 30 mm
  - Higher memory density

- DDR
  - 172 pin

- DDR2 and DDR3
  - 214 pins

Memory modules

DIMM
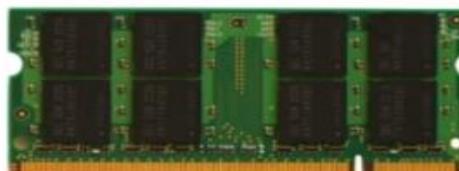
SO-DIMM

Micro-DIMM

CPU sockets

- Motherboards are matched with CPUs
  - CPUs have specific socket requirements

- CPU socket is usually the largest thing on the board
  - And usually central to everything

- Not easily upgradable
  - And often not an option

Zero Insertion Force (ZIF) socket

PGA370
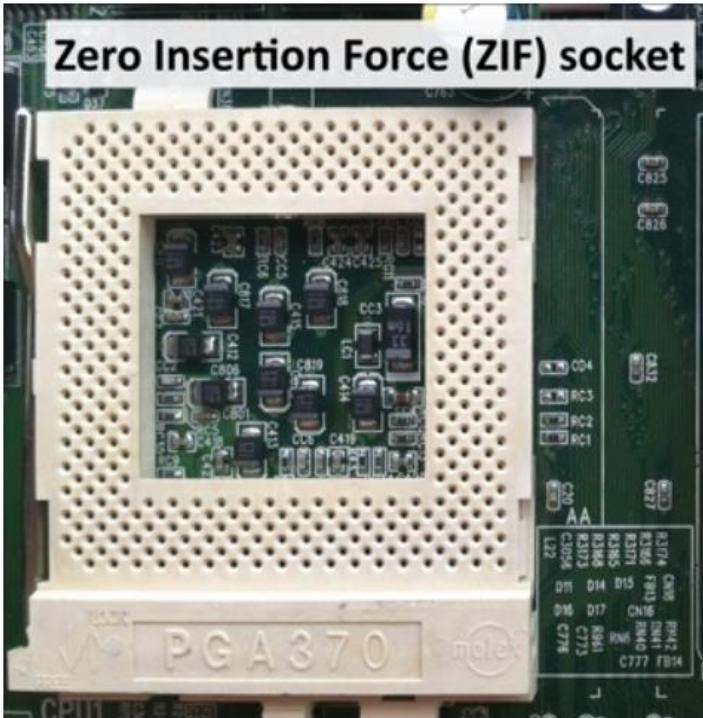
Land Grid Array (LGA)

- Reverse the PGA
  - Pins are on the motherboard

- No pin to damage on the CPU
 - Easier to damage the motherboard

PGA: Pin grid array

Motherboards / system boards

- Everything begins or ends on the motherboard

- Sometimes called the mobo (not just the hipsters)

- Standard sizes

- Constant change
  - Chipsets
  - Bus speeds
  - Cooling methods
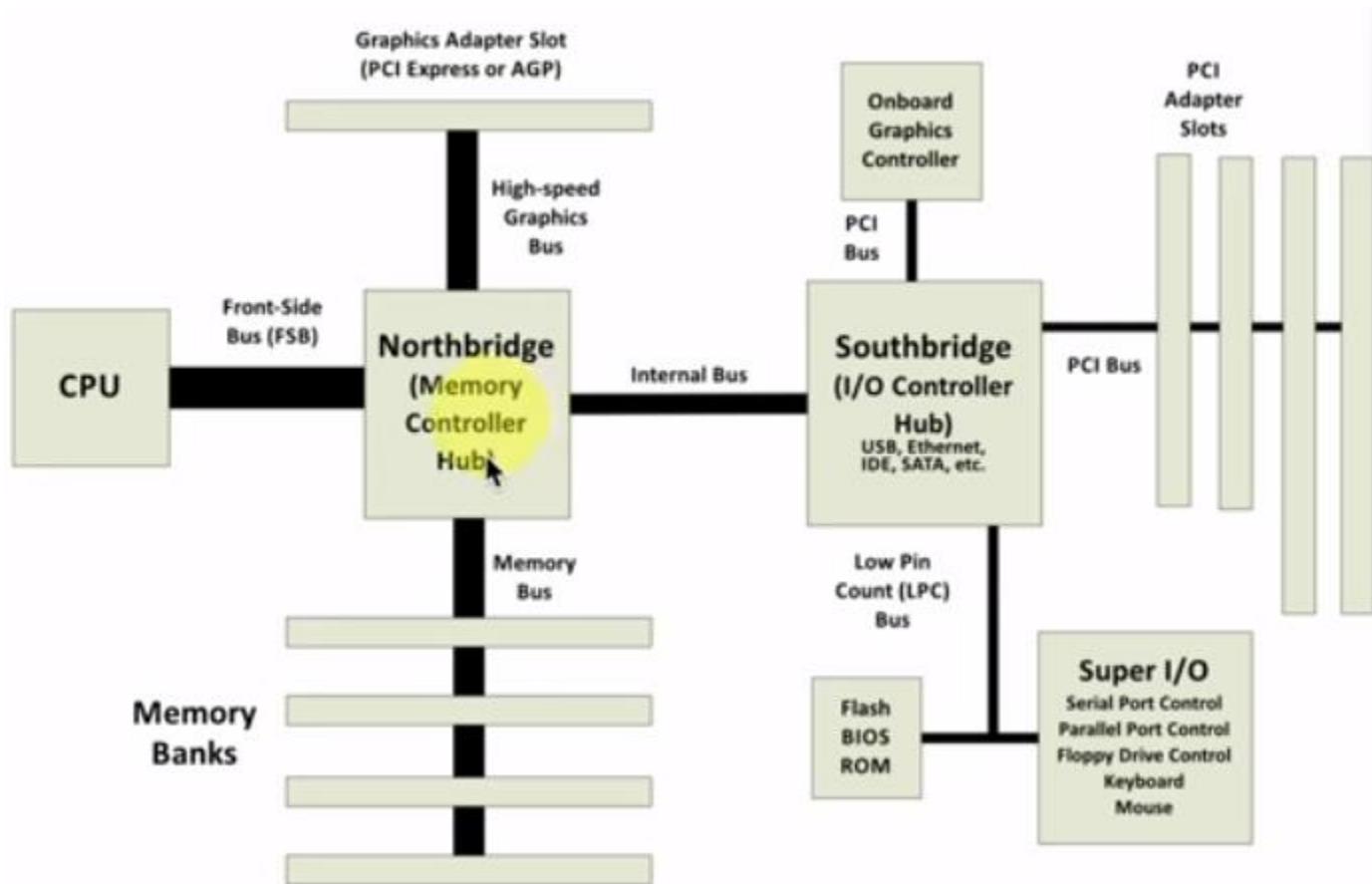
Northbridge (memory controller hub)

- Connects the CPU to memory and high-speed graphics card
  - High bandwidth communication

- Modern computers include cooling options
  - Heatsink
  - Fans

Southbridge

- Manages connections
  - PCI interface slots
  - Other peripherals
    (USB, Ethernet, IDE, etc.)
 - Onboard graphics controllers
  - BIOS

Motherboard Components
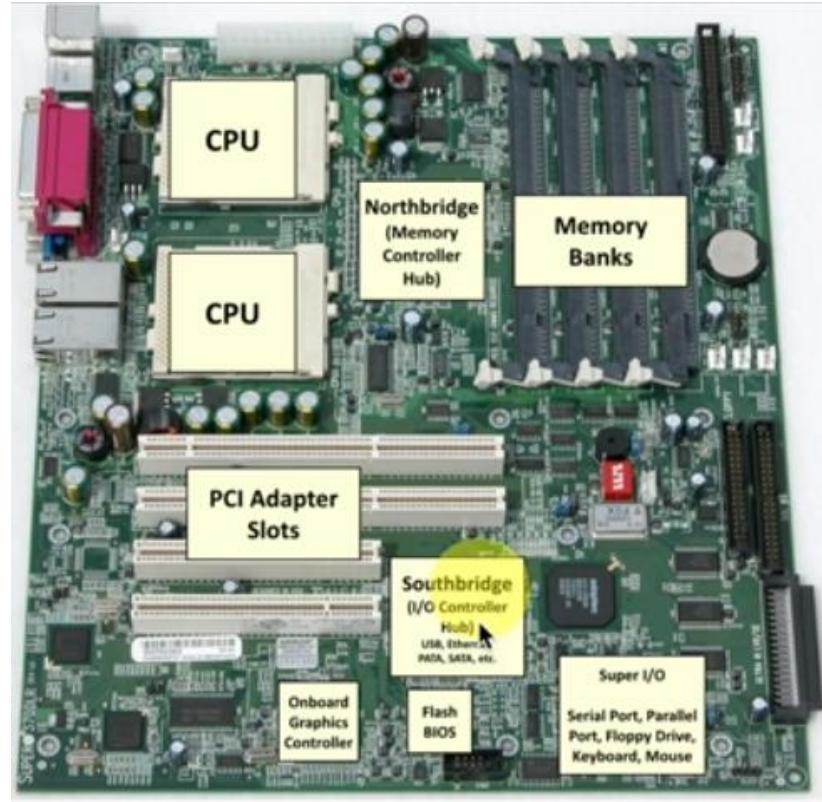
What is memory?

- Random Access Memory (RAM) is the most common
  - But it's not the only kind of memory

- RAM is not referring to hard drive or SSD storage
  - Don't mix the two terms
  - Data is stored permanently on the drive

- Data and programs can only be used when moved to RAM
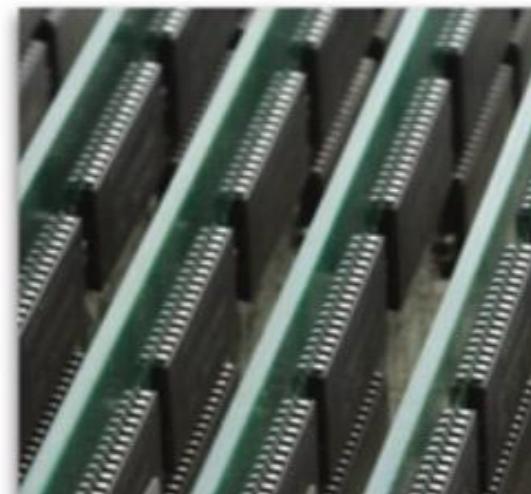
Read Only Memory (ROM)

- Can't be changed or erased
  - A good place for a BIOS

- PROM
  - Programmable ROM
    - Write once

- EPROM
  - Erasable PROM
    - Write / Erase / Write again

- EEPROM
 - Electrically Erasable PROM
    - Flash memory and SSD
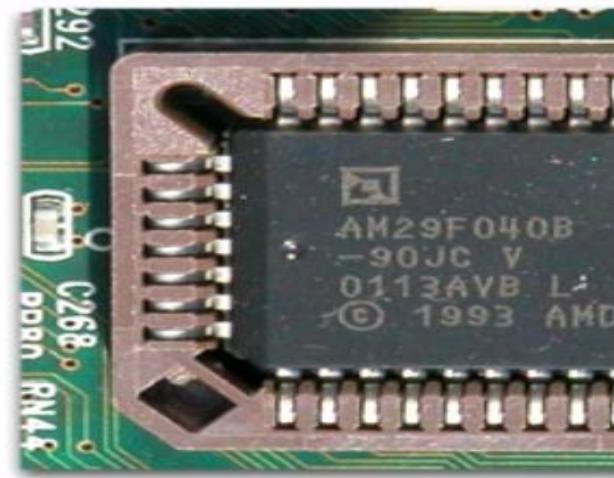
Static RAM (SRAM)

- Very fast memory

- Very expensive memory

- Very big memory

- Used often in
 processor caches
  - L1, L2, L3
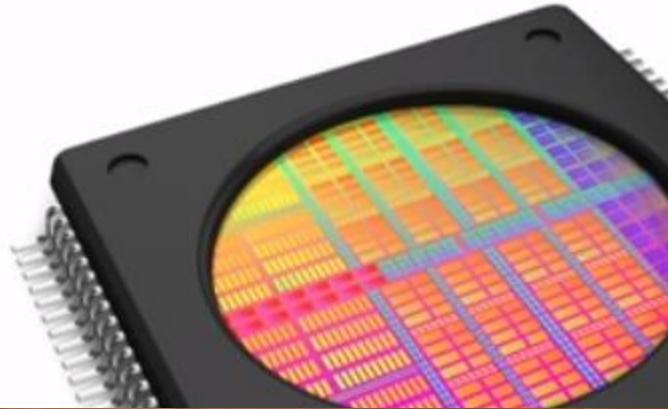
Dynamic Random Access Memory (DRAM)

- The RAM we know and love

- Dynamic
  - Needs constant refreshing
  - Without refreshing, the data in
    memory disappears

- Random access
  - Any storage location can be
    accessed directly
  - Unlike magnetic tape
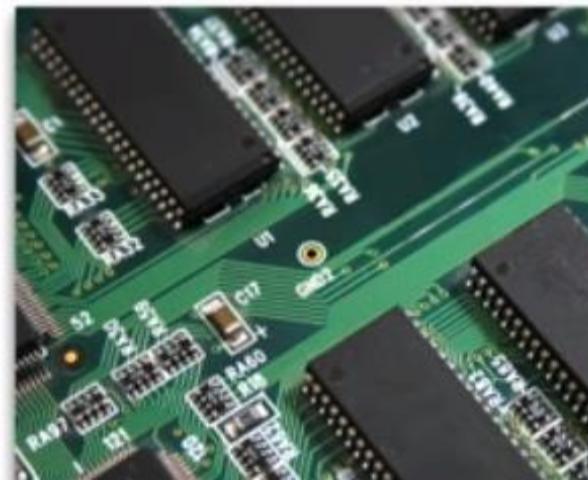
SDR SDRAM

- Single Data Rate (SDR) Synchronous DRAM (SDRAM) - 168 pins
- SDRAM is synchronous with the common system clock
  - Queue up one process while waiting for another
  - Classic DRAM didn't wait for a clock signal
- Don't confuse SDRAM with Static RAM (SRAM)
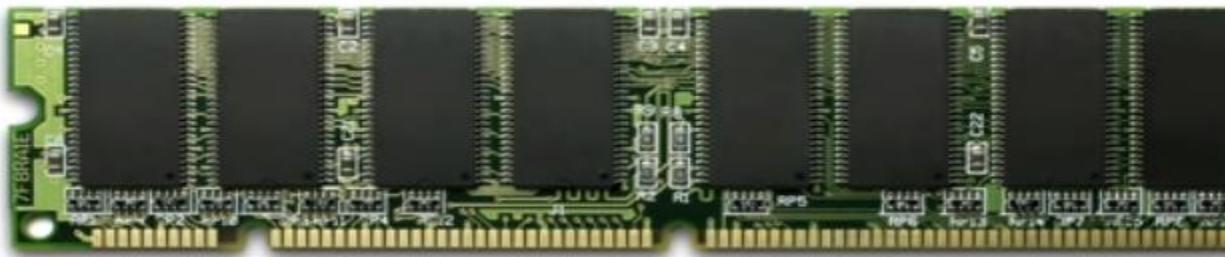
Double Data Rate (DDR) SDRAM

- Twice the data rate as SDR (ordinary) SDRAM
  - But at the same clock speed
  - 184 pins
- DDR-200 - 200 million transfers per second
  - Multiply by 8 to get throughput in megabytes per second (MB/s)
  - 200 x 8 = 1,600 = PC1600

SDR vs DDR

One Clock Cycle

Clock

SDR

| Data 1 | Data 2 | Data 3 | Data 4 | Data 5 | Data 6 |

Data

One Clock Cycle

Clock

DDR

| Data 1 | Data 2 | Data 3 | Data 4 | Data 5 | Data 6 | Data 7 | Data 8 | Data 9 | Data 10 | Data 11 | Data 12 |
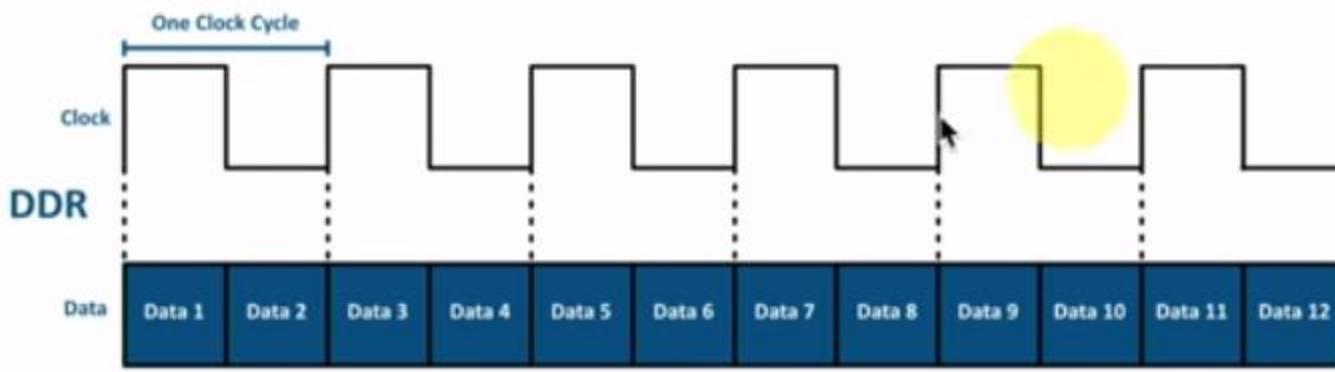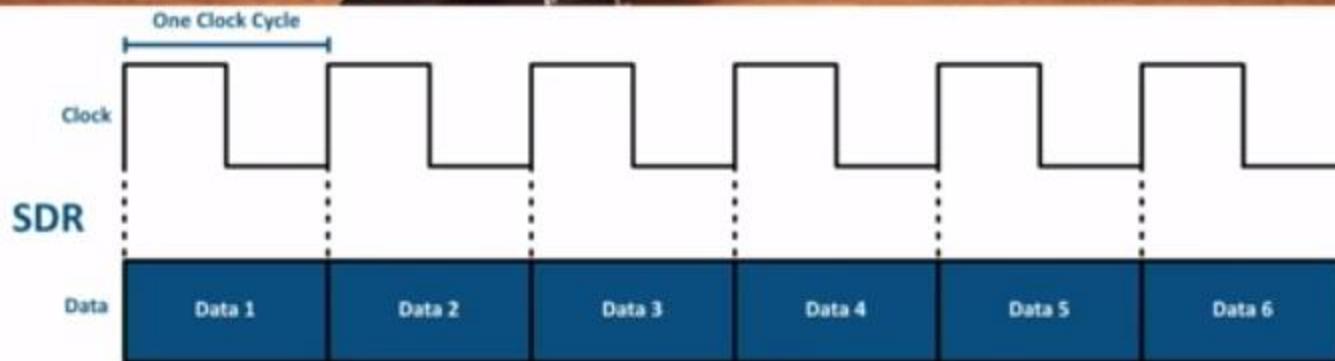
Data

Double Data Rate 2 (DDR2) SDRAM

- Faster speeds
  - Twice as fast as DDR
  - 240 pins

- Not backwards compatible
  - DDR2 won't work in DDR slots

Double Data Rate 3 (DDR3) SDRAM

- Twice the data rate of DDR2
  - Larger chip capacities
  - Also 240 pins (same as DDR2)

- Again, no backwards compatibility
  - Speed brings sacrifice
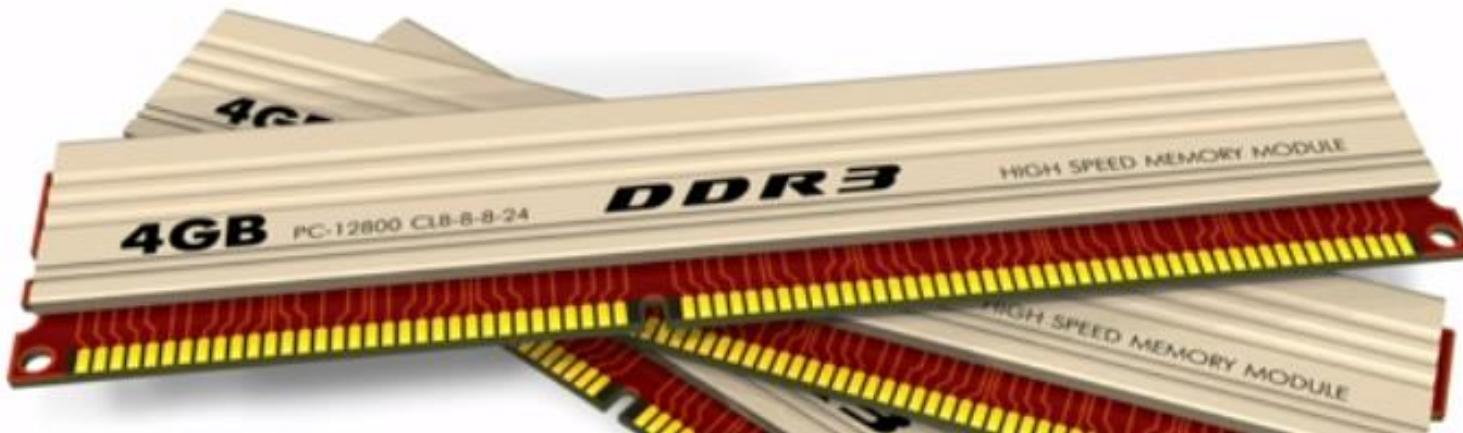
DDR comparisons

Memory Type	Memory Clock Speed	I/O Bus Clock Speed	DDR Speed	Transfers per Second	Transfer Rate	Module Name
DDR	100 MHz	100 MHz	DDR-200	200 Million	1,600 MB/s	PC1600
DDR2	100 MHz	200 MHz	DDR2-400	400 Million	3,200 MB/s	PC2-3200
DDR3	100 MHz	400 MHz	DDR3-800	800 Million	6,400 MB/s	PC3-6400

1.5 – Storage Devices

An Overview of Storage Devices An Overview of RAID

Optical formats

- Small bumps read with a laser beam
  - Microscopic binary storage

- CD-ROM (Compact Disc ROM)
  - 700 megabytes (MB) capacity

- DVD-ROM (Digital Versatile Disc)
  - 4.7 gigabytes (GB) for single-layer
  - 8.5 GB for dual-layer

- Blu-ray Disc
 - 25 GB for single-layer
  - 50 GB for dual-layer

Writing to optical media

- "Burners" don't create bumps
  - They darken photosensitive dye

- Compact Disc-ReWritable (CD-RW)

- DVD Read and Rewritable (DVD-R/RW)
  - And Dual Layer (DVD-R DL)

- Blu-ray Disc Recordable (BD-R)

Inside a hard disk drive

Actuator

A1
30TZ

Arm

Platter

Spindle

Head

Inside a hard disk drive

A1
30TZ
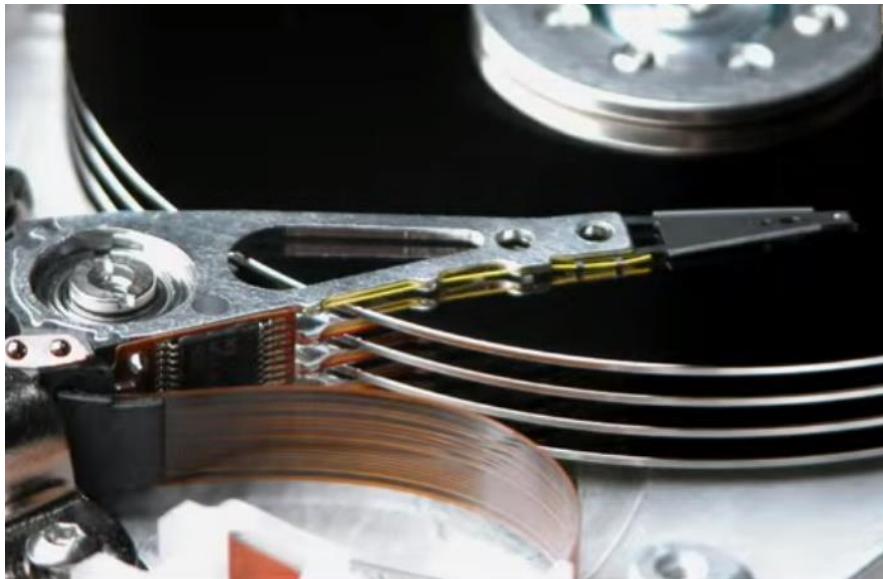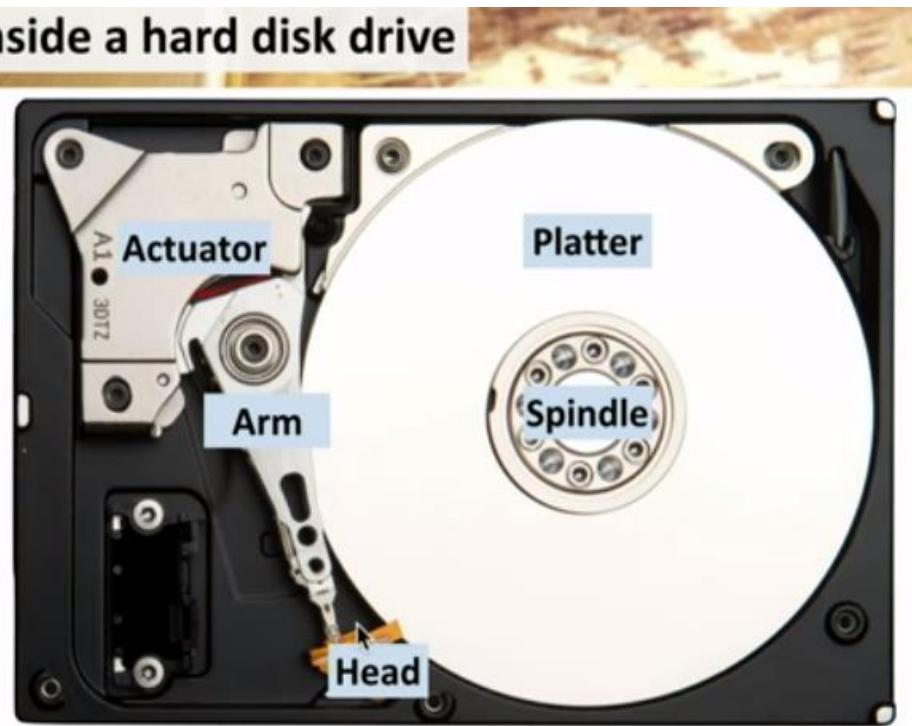
Rotational Speed (rpm)	Average Latency
10,000	3 ms
7,200	4.16 ms
5,400	5.55 ms

Parallel ATA Vs SATA
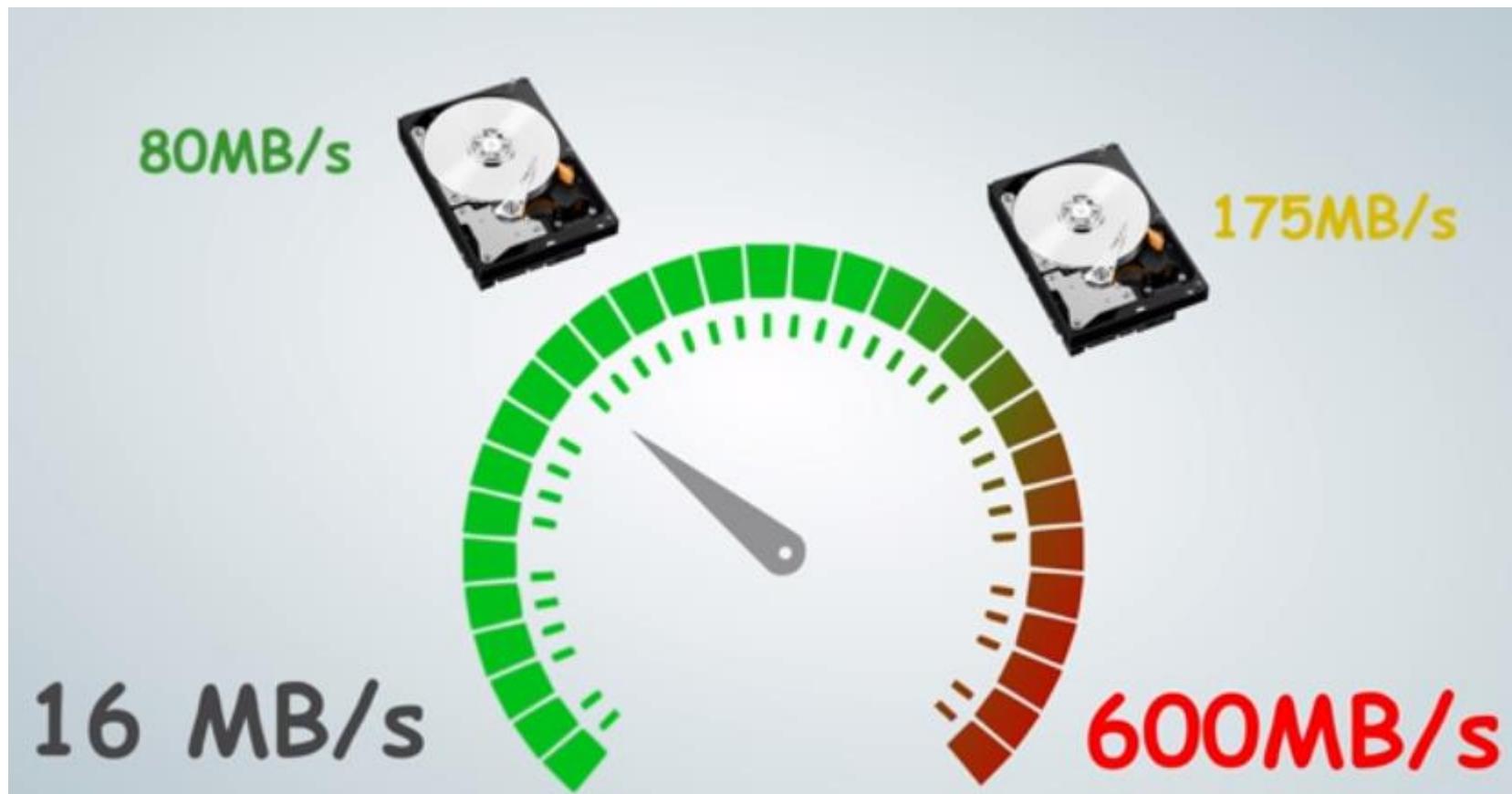
HDD VS SSD

Laptops

HDD or SSD

mSATA SSD

Smartphones

Internal
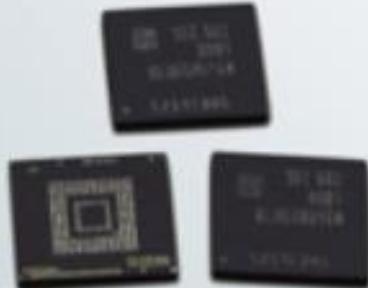
MicroSD Card

Solid-state drives (SSD)

Sata slot
And
M.2slot faster

SSD

Solid State Drive
MODEL No.
DC === 5V 1.5A
Capacity: 256GB

Hybrid drives

- Solid State Hybrid Drive (SSHD)
  - Both a spinning drive
    and SSD in a single device

- SSD caches the slower
  spinning hard drive data
  - Increases speed without the
    cost of an SSD-only system

- Looks like a normal
  hard drive or SSD
  - Same form factor

Hot swappable drives

- Add and remove while the system is running
  - The connection is "hot"

- USB
  - Add and remove any device

- FireWire
  - Common to connect and disconnect while running

- SATA, eSATA
  - Part of the standard

Flash memory

USB Flash Drive

CompactFlash (CF)

Secure Digital (SD)

miniSD

microSD

xD-Picture Card

eMMC

- Thank you