

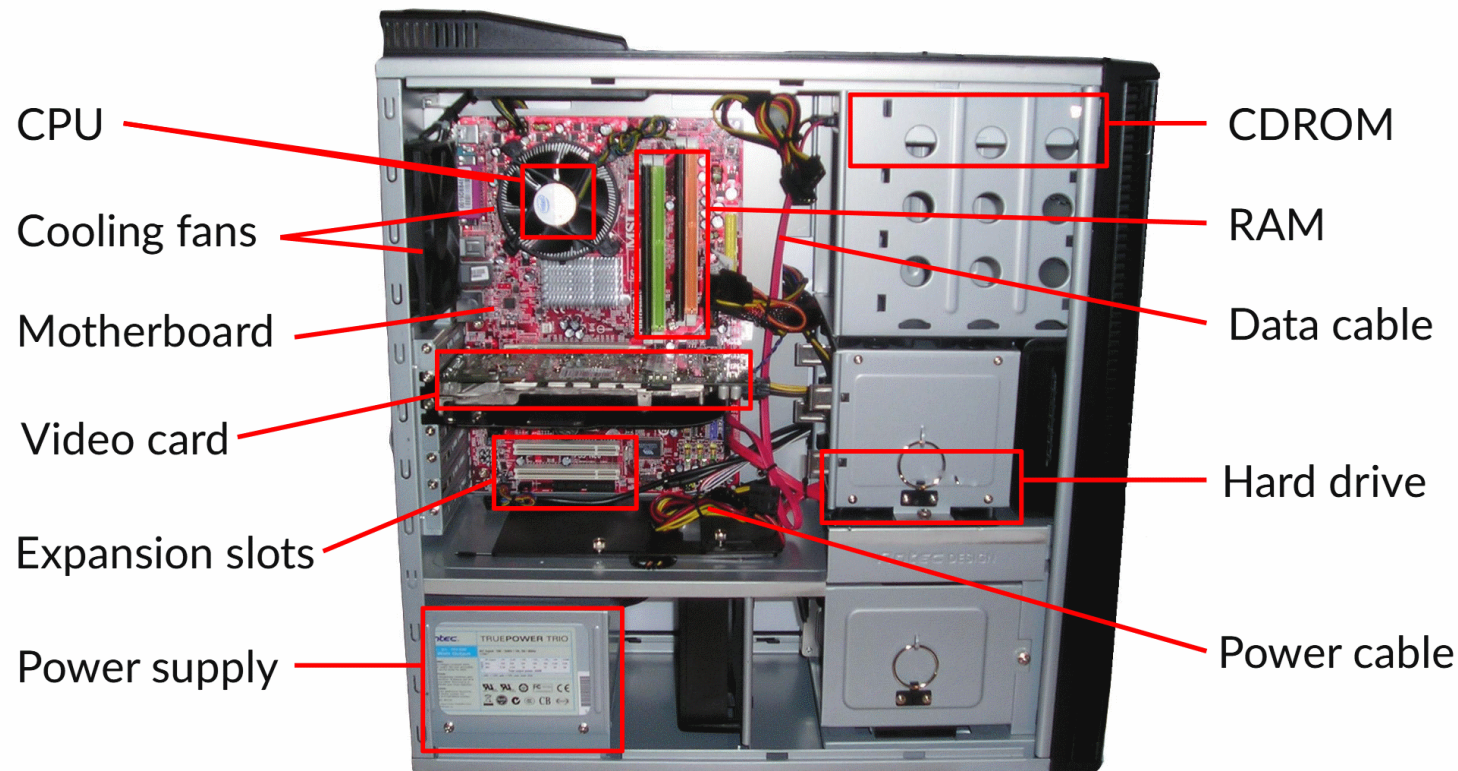
# **Module 1**

## **Computers and the Internet (from 10k feet)**

# Introduction to Computers

# What's Inside a Computer?

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- The *motherboard* is the big circuit board that holds all the other parts together
  - It provides fast connectivity between the major components within the computer

# CPU and RAM

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- **Connected to the motherboard is a *CPU* (*central processing unit*)**
  - Also called "the processor", it is "the brain" of the computer
  - It executes instructions that a programmer wrote to control the processing of data
  - It gets HOT when running and is usually attached under a fan and a heat sink!
  - Most modern CPUs have more than one processor core (dual-core, quad-core, etc)
- **Also connected to the motherboard is *RAM* (*random access memory*)**
  - RAM is very fast memory that holds instructions and data *while the computer is running*
    - \* It is *volatile storage* and does NOT provide long-term storage and files; if you turn the computer off, it's erased
  - Personal computers often have 8GB or 16GB of RAM, although there may be more or less

# Persistent Storage

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- ***Persistent (or non-volatile)* storage holds data even when the computer is turned off**
- ***Disk drives provide non-volatile storage for files***
  - May be very large (125GB - 2TB or more!) and inexpensive, though slower than RAM
  - There are two basic types of disk drives
    - \* Hard disk drives (HDD) store data on a magnetically coated platter that spins at a high speed
    - \* Solid state drives (SSD) store data on non-volatile semiconductor chips that have no moving parts
- **Computers often provide some type of removable storage device as well, including:**
  - USB connections for reading/writing to flash drives
  - Optical disc drives for reading/writing to DVDs or CD-ROMs
  - Floppy disk drives for reading/writing to ancient floppy disks

# Expansion Cards

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- **Other important "cards" that plug into expansion slots on the motherboard may include:**
  - a NIC card (network interface card) that is an adapter that allows the computer to connect to a network
  - a wireless NIC card that lets a computer use radio signals to connect to a network wirelessly
  - a video or graphics card that is an adapter to let the computer output display on a monitor
  - a sound card to let the computer play sound from speakers
- **Finally, there are power-related items within the case**
  - a power supply
  - a heat sink and one or more fans to help dissipate the heat

# How do you Connect Peripherals to a Computer?

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- Connectors provide a way to connect a peripheral device to your computer

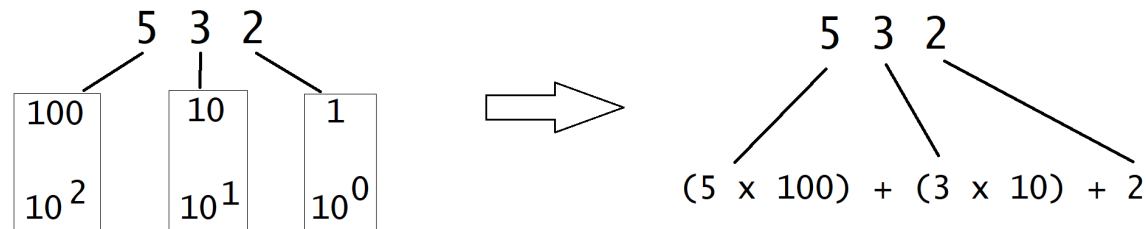


- The main ones used today include:
  - USB provides a hot-swappable connection for data and power transfer (includes USB 2.0, USB 3.0, USB-C)
  - HDMI carries high-speed video and sound

# Counting Like a Computer

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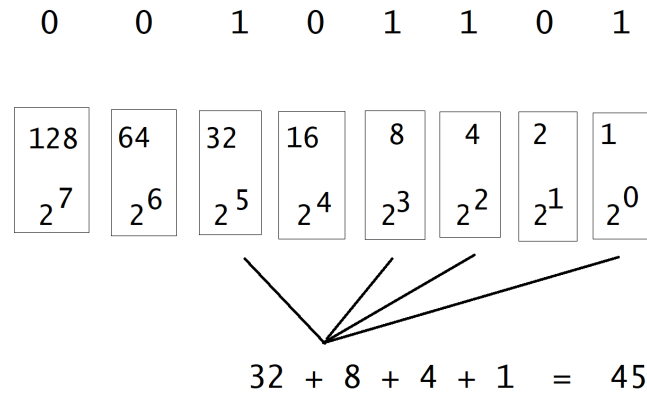
- When we count as human beings, we use numbers that are powers of 10
  - Every digit can be one of 10 different values 0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 (decimal numbers)





- But we measure quantity in the computing world with numbers that are powers of 2
  - Every digit can be one of 2 different values 0 - 1 (binary numbers)
  - Each *binary digit* (**bit**) represents an on / off state

What does the  
number 45 look  
like in binary?



# Word Sizes

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- **When you bought a computer, do you remember if the marketing material said it was a 32-bit or 64-bit CPU processor?**
  - A 32-bit computer has a "word size" of 32 bits
    - \* This means the biggest signed whole number that it can fit in a word is 2,147,483,647 which is determined by the binary number 01111111111111111111111111111111
    - \* Note: Why does the binary number above start with a 0? Signed binary numbers uses the high-order bit to indicate the number is negative!
  - A 64-bit computer has a "word size" of 64 bits
    - \* This means the biggest signed whole number that it can fit in a word is 9,223,372,036,854,775,807

## Exercise - How Old Are You?

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- Let's figure out how old you are using alternate bases...

- in Base 2?

$\overline{128}$   $\overline{64}$   $\overline{32}$   $\overline{16}$   $\overline{8}$   $\overline{4}$   $\overline{2}$   $\overline{1}$       digits are 0 - 1

- in Base 10 (this should be easy)?

$\overline{100}$   $\overline{10}$   $\overline{1}$       digits are 0 - 9

# What does KB, MB, GB and TB Actually Mean?

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- The smallest "unit" of memory you can access is 8 bits... which is called a *byte*
- Programmers use the term KB for *kilobyte*
  - When describing file sizes, a kilobyte is 1024 bytes
- Not 1000?
  - The International System of Units defines 1K as 1000
  - Software makers use base 2 numbers and define 1K as 1024
- Usually, programmers use the term MB for megabyte.... 1024 units of 1KB
  - That means 1024 x 1024, or 1,048,576 bytes

UNIT	SIZE	BYTES
1 Bit	Single 0 or 1 binary digit	--
1 Byte	8 bits	1 byte
1 Kilobyte (KB)	1024 bytes	1024 bytes
1 Megabyte (MB)	1024 KB	1,048,576 bytes
1 Gigabyte (GB)	1024 MB	1,073,741,824 bytes
1 Terabyte (TB)	1024 GB	1,099,511,627,776 bytes

# Storage Capacity and Network Speeds

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- **It gets more confusing when you introduce hardware**
  - According to software manufacturers, 1 KB = 1024 bytes
    - \* Which means 1 TB =  $1024 * 1024 * 1024 * 1024 = 1,099,511,627,776$  bytes.
  - But hard disk makers don't think average consumers can understand this issue about "kilo" so they use  
1 KB = 1000 bytes and 1 TB = 1,000,000,000,000 bytes
  - Either way you look at it, 1 TB is a lot of capacity!
- **When we specify internet speeds, we specify in *bits per second***
  - What download speed do you get from your internet provider?
  - Today I got 222 **Mbps** (megabits per second)
    - \* That is 232,783,872 **bits** per second or 29,097,984 **bytes** per second

# Which Holds More Data?

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Floppy disk - 1.44 MB



USB thumb drives ... It depends on the size you buy! 8GB? 256GB?



Internal HDD - 10TB drive

## Exercise – Decimal to Binary

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- How would you write the following Base10 (Decimal) numbers in Binary

– 15

— — — — —

– 32

— — — — —

– 117

— — — — —

– 946

— — — — —      — — — — —

## Exercise – Binary to Decimal

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- How would you write the following Binary numbers in Decimal (Base10)

– 00000100

— — — — —

– 00001101

— — — — —

– 00110101

— — — — —

– 01010101 10101010

— — — — —      — — — — —