

# What is a Computer?

## [Syllabus](#)

### Why Study Computer Organization

*"The Medium is the Message"* - Marshall McLuhan

- We must be effective at understanding the medium (computers) in order to more effectively understand how to use them.
- Why some methods are more effective than others
- Why do supercomputers run numerical methods multiple times
- Why is a program written differently depending on the machine, for some languages

### Abstraction is the KEY to Computing

Abstraction	Examples
Multi-level translation	Different Languages and systems can work together
Number Representations	Applied in Networks
Processor Design and Pipelining	Different architecture for different needs

### What is a Computer

Anything with a processor, and the ability to "compute"!

#### A computer is divided into 3 classes

- Desktop
- Servers
- Embedded Computers

A PMD (personal mobile device) is a newer class of computers, that have become larger than these other types of computers. It can be carried around, however this develops the problem of conserving power. PMD have batteries, and they are portable making them different than the other types.

### Eight Great Architectural Ideas

- Design for Moore's Law
- Use abstraction to simplify design
- Make common case fast
- Performance via parallelism
- Performance via pipelining

- Performance via prediction
- Hierarchy of memories
- Dependability of redundancy

## Design For Moore's Law

- The number of transistors on a chip doubles every 18-24 months
- Architects have to anticipate where technology will be when the design of a system is completed
- Use of the principle is limited by Dennard Scaling

| *Dennard Scaling - Law of Diminishing returns*

## Use of abstraction to simplify design

- Abstraction is used to represent different levels of a design
- Lower-level details can be hidden to provide a simpler model at higher levels

## Make the common case fast

- Identify the common case and try and improve it
- Most cost efficient method

## Via Parallelism

### Via pipelining

- Break tasks into smaller tasks so they can be simultaneously performed in different stages
- Commonly used to improve instruction throughput

### Via Prediction

- Sometimes faster to assume a particular result than waiting until the result is known
- Known as speculation and is used to guess branches

## Use a hierarchy of memories

- Make the fastest, smallest, and most expensive per bit memory the first level accessed and the slowest largest, and cheapest per bit memory the last level accessed
- Allows most of the accesses to be caught at the first level and be able to retain most of the information

| *Moving some of the memory to specific places so we can find it faster*

## Improve dependability via redundancy

- Include redundant components that can both detect and often correct failures
- Used at many different levels

## Program Levels and Translation

The computer speaks in terms of electrical signals

- | 0V is "on" and 0V is "off"
- 1 is "on", 0 is "off"

| *The Compiler only takes you as far as assembly code*

Stage	Definition
Compiler	Translates a high-level language to assembly
Assembler	Symbolic representation of instructions
Linker	Combines multiple files into a single ex

For day 2 notes check [Performance](#)