Intro to Embedded Systems
CSCI 255

- What is an embedded system?

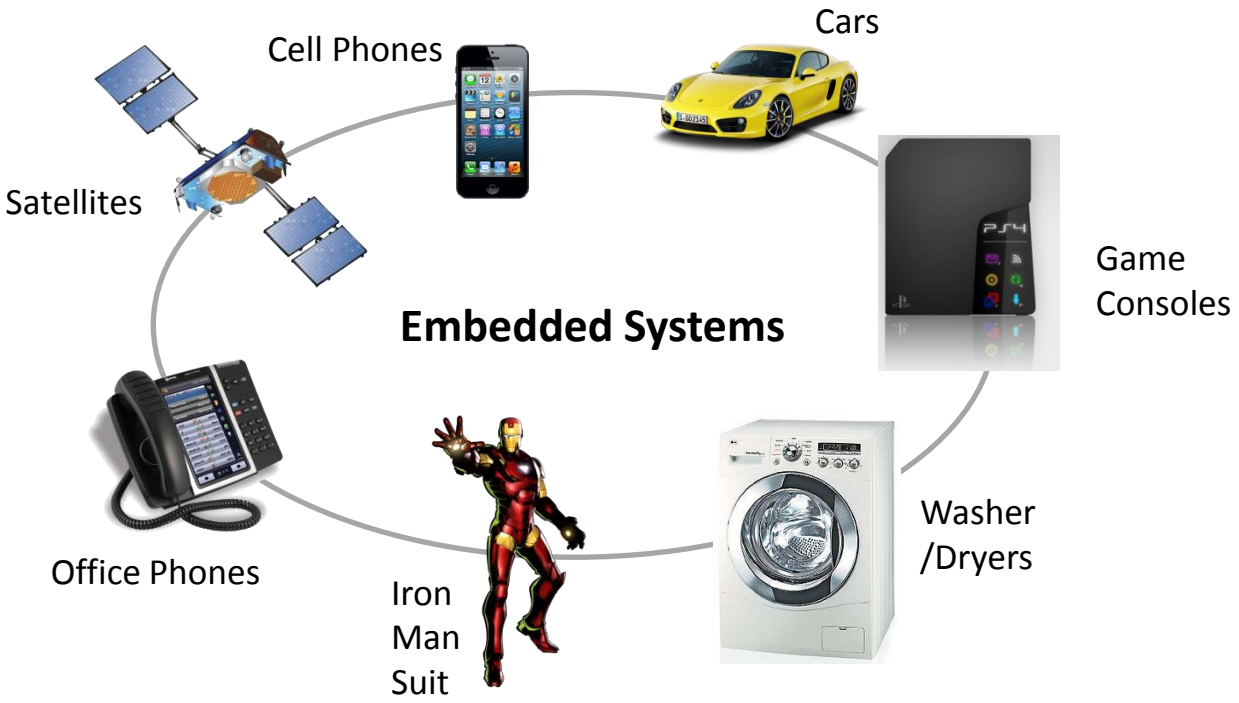
  An electronic toy that makes other toys work

- A more technical definition:

  A designed system in which requires a “computation” solution in order to manage its inputs to generate the correct output “states”

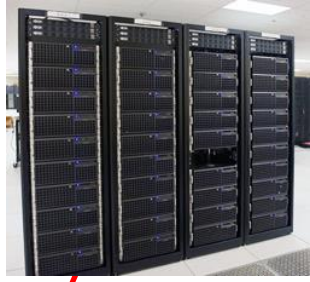
- Why learn embedded systems?

  …they are used everywhere



- Differences of an Embedded System and Computer:

Embedded Processor	Computer Processor
Single processing unit	Multiple processing cores
Simple memory (registers)	Memory Levels (Cache levels)
Design for specific purposes	Design for general purposes
Cheaper processing solution	Higher cost solution
Slower frequency speeds (MHz)	Fast frequency speeds (GHz)
99% of all computing solutions	1% of all computing solutions

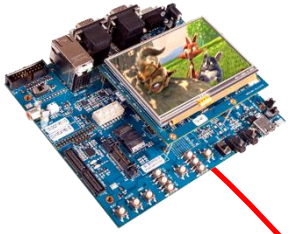


HPC Cluster Systems

- Machine Layers:

It increases in:*

- Processing speed,
- Memory/storage size,
- Machine size,
- Cost
- Energy



Embedded Systems

Tablets

Laptops

Personal Desktops

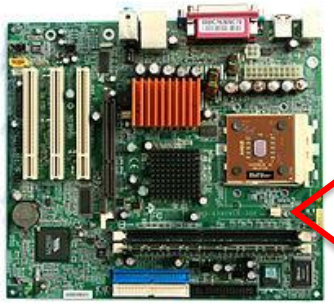
High-End Workstations

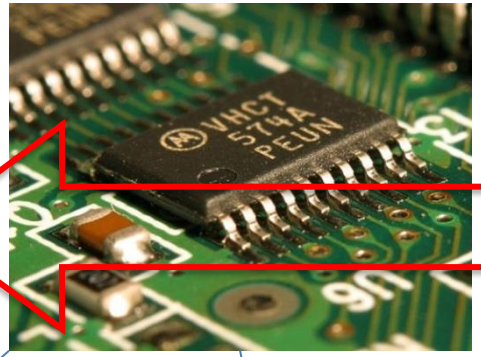
Server Systems

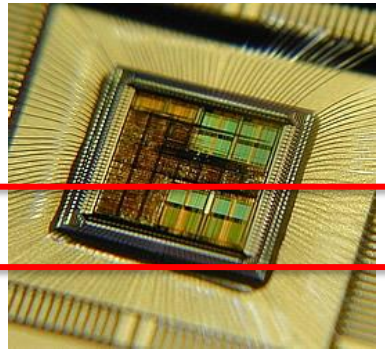
*The opposite is true going the other direction: Decrease in all items

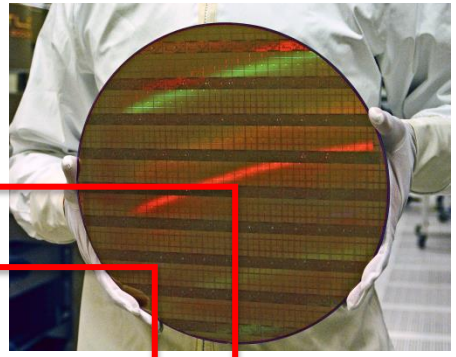
Learn about IC Fabrication here:
http://youtu.be/35jWSQXku74
Link also on the "Notes" page

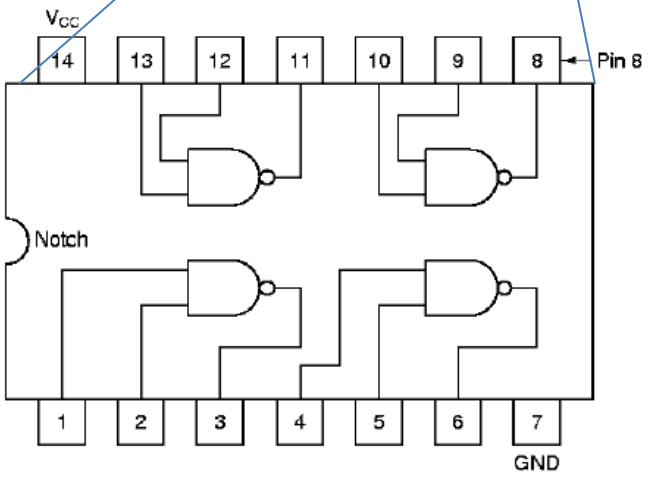
- Hardware Layers:

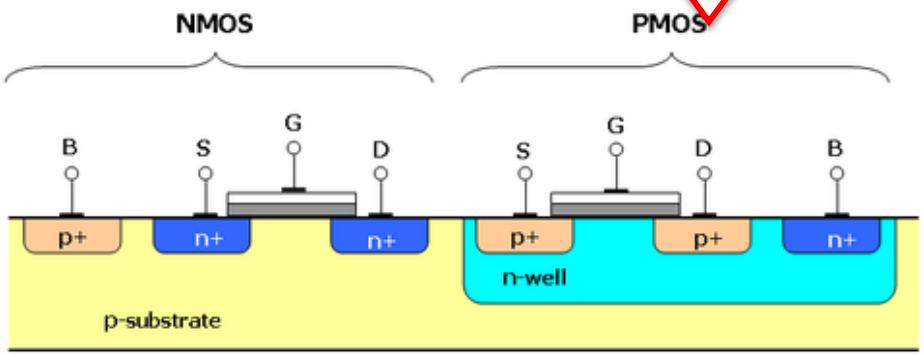




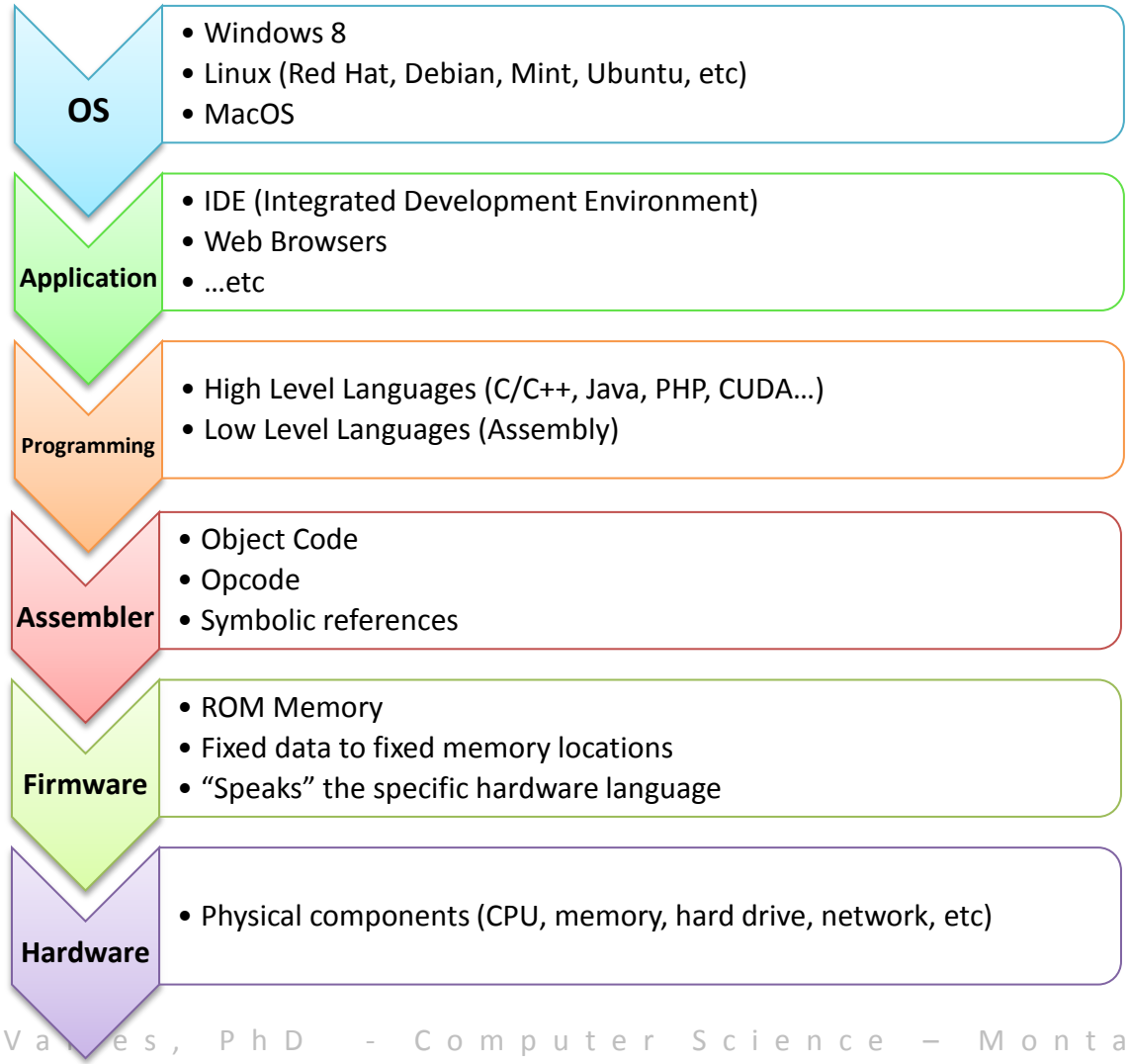




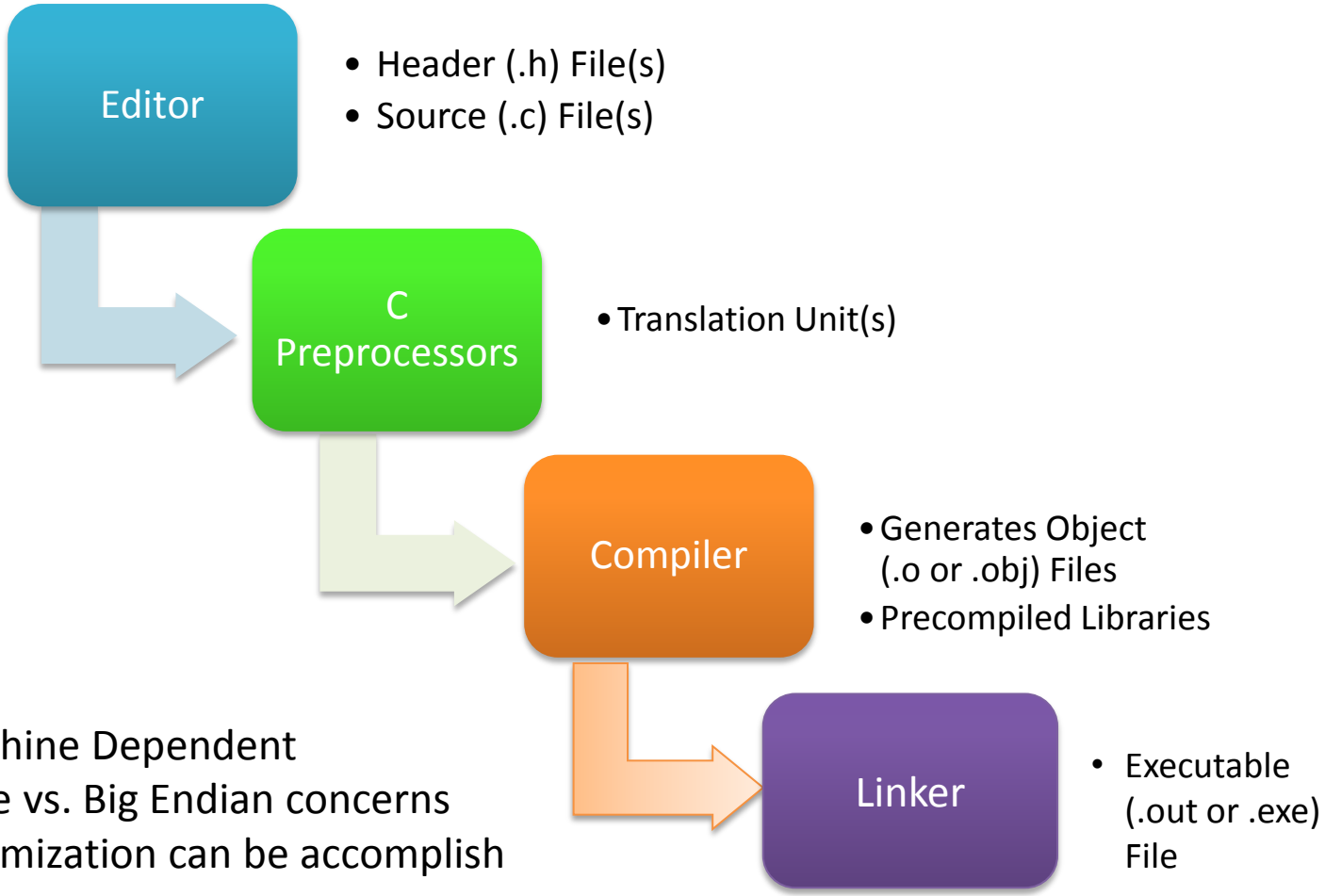




- System Layers:

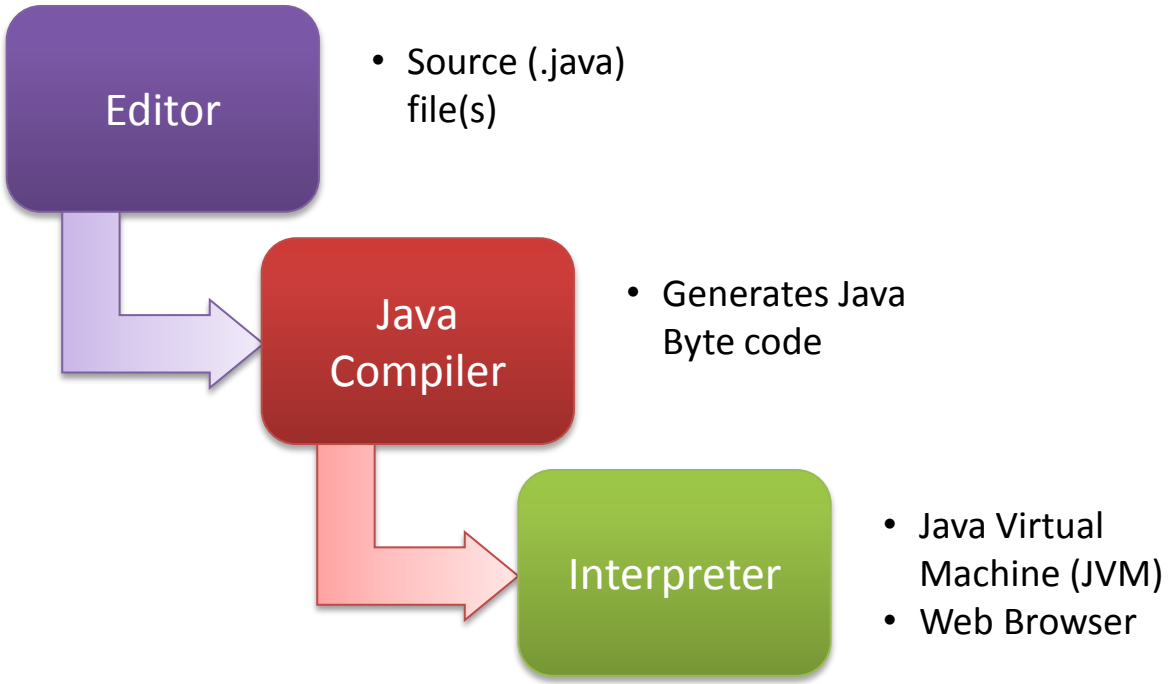


- Compiling Programs: C-code



- Machine Dependent
- Little vs. Big Endian concerns
- Optimization can be accomplish

- Compiling Programs: Java-code



- Machine Independent
- No Little vs. Big Endian concerns
- Result may vary on different systems

- High Level Languages (HLL's)
  - No worries about machine's architecture
  - Easier to read & write than low-level languages
  - Usually result in higher programmer productivity
  - We will use C-programming for the MSP430
  - Exs: Java, C/C++, Python, FORTRAN
- Low Level Languages (LLL's)
  - Must have knowledge of the architecture
  - We will begin learning LL-Language of MSP430 first
  - lower programmer productivity
  - higher performing code
  - Exs: Arduino, 8051/8052, TI-MSP430

- IDE (Integrated Development Environment)
  - Code Composer Studio (CCS) Version 5.x
  - Get Windows installation file on “Links” Page
  - Follow install steps
  - Linux version available

- Other IDEs
  - IAR Embedded Workbench
  - MSPGCC (open-source)
  - Energia
  - Modkit
  - You may experiment with these IDEs
  - **Work must be shown on CCS IDE**