Embedded Systems Architecture

Session #9

Hardware Issues

- Hardware Augmentation
- Hardware Supplementation
- Hardware / Software Partitioning
- Hardware Development Tools

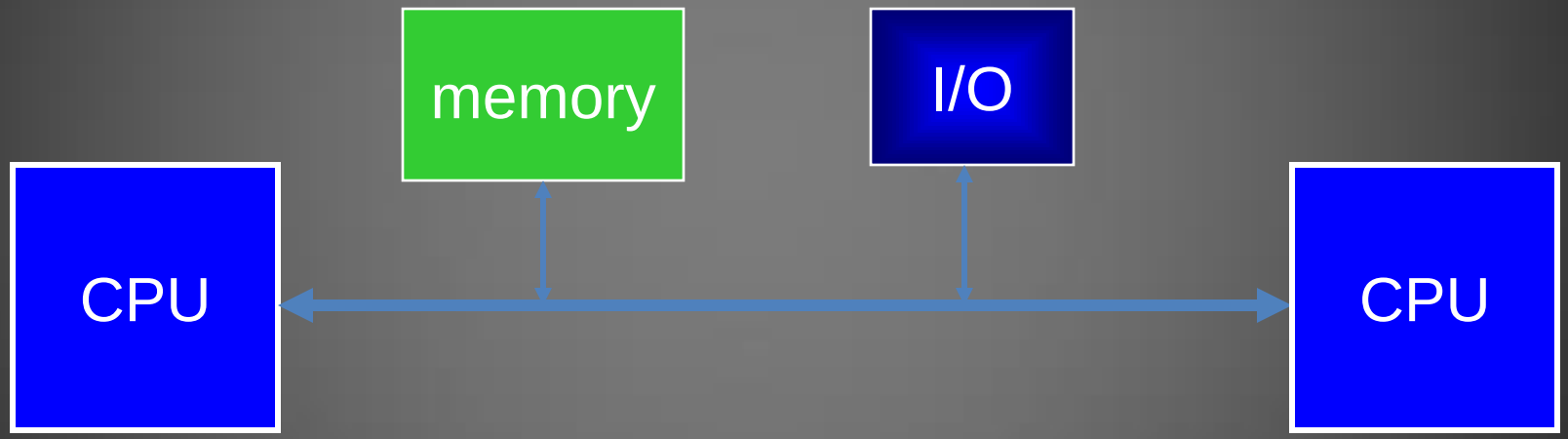
Hardware Augmentation

- Faster processor
- Larger memory

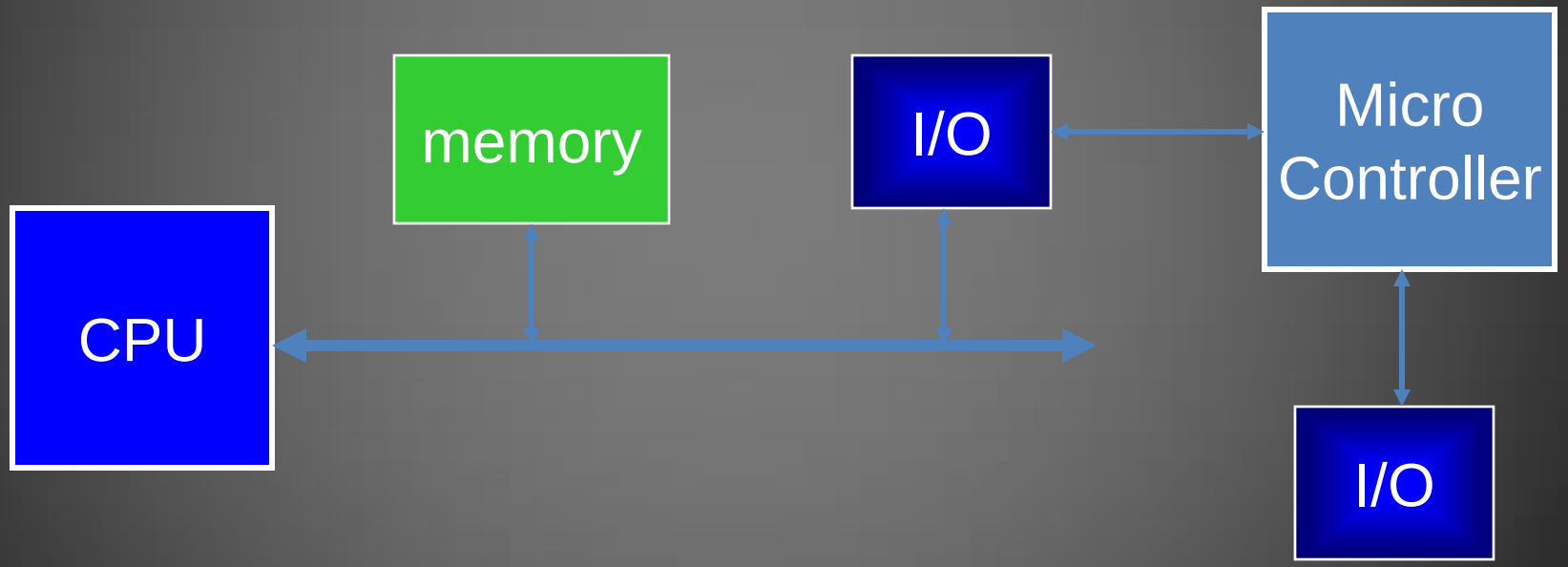
Hardware Supplementation

- Multiple processor
  - Same type of processor
  - Different types of processor
- Dedicated bus
- Accelerators

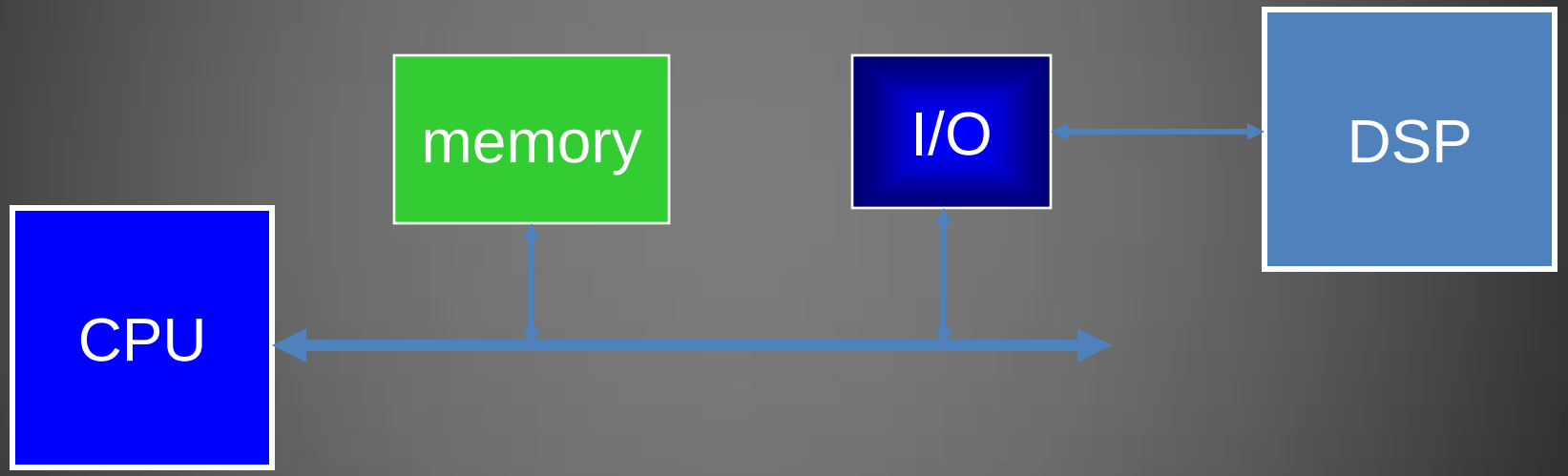
Same Type of Processor



Different Types of Processor



Dedicated Bus



Accelerators

- An accelerator appears as a device on the bus.
- Could be a computational engine (like a DSP or FPU).
- Could be a channel controller.

Digital Signal Processor (DSP)

- Digital Filters
- Control Systems

Hardware / Software Partitioning

- *How often does function execute?*
- *How fast does function need to execute?*
- Characterize advantages and disadvantages of implementing function in hardware and then in software.

Hardware Development Tools

- Schematic Capture
- Printed Circuit Board Layout
- Programmable Logic Device Design
- Simulation

Schematic Capture

- Graphically enter schematic information of:
  - Component
  - Interconnectivity
- Reports
  - Bill of Material (BOM)
  - Net list
  - Design rule check

Schematic Capture Tools

- P-CAD
- OrCAD
- PADS
- Mentor Graphics
- gEDA

Printed Circuit Board Layout

- Graphically enter printed circuit board information of:
  - Component placement
  - Trace routing
  - *Stack-up*
- Reports
  - Design rule check
- Outputs Gerber format files

Printed Circuit Board Layout Tools

- P-CAD
- OrCAD
- PADS
- Mentor Graphics
- gEDA

Programmable Logic Device Design

- Graphically and / or textually (HDL) enter logic design information.
- Hardware Definition Languages (HDL)
  - Verilog
  - VHDL (VHSIC Hardware Definition Language)
  - SystemC
- Vendors
  - Xilinx / Actel / Altera / Lattice

Simulation

- Analog
- Digital
- Signal Integrity
- General use math software

Analog Simulation

- SPICE (Simulation Program with Integrated Circuit Emphasis)
  - Hspice
  - PSPICE

Digital Simulation

- ModelSim

Signal Integrity

- Signal Integrity is a field of study half-way between digital design and analog circuit theory. It's about ringing, crosstalk, ground bounce, and power supply noise. It's all about how to build really fast digital hardware that really works. It's about practical, real-world solutions to high-speed design problems.

Signal Integrity Analysis

- Printed Circuit Board Geometries:
  - Stack-up
  - Signal planes
  - Power planes
- Digital driver and receiver information:
  - IBIS models
- Outputs waveforms of victim traces.

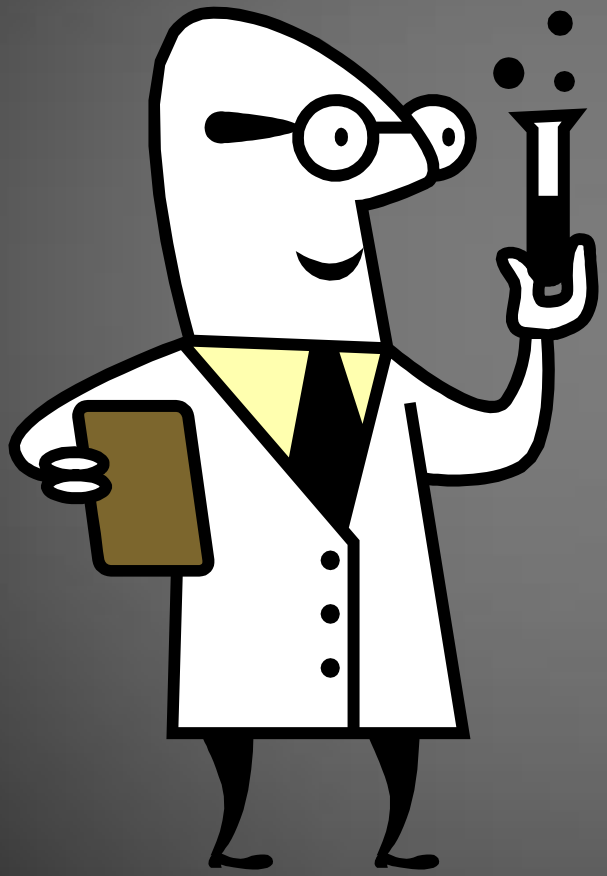
Signal Integrity Tools

- XTK
- Hyperlynx

General use math software

- MathCad
- Matlab
- Mathmatica
- TK Solver
- Any spread sheet s/w

Lab Session #9



- *My Design Project Architecture Model*

My Design Project Architecture Model