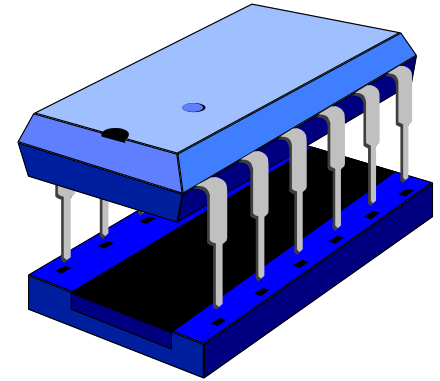


COMPUTER ARCHITECTURE



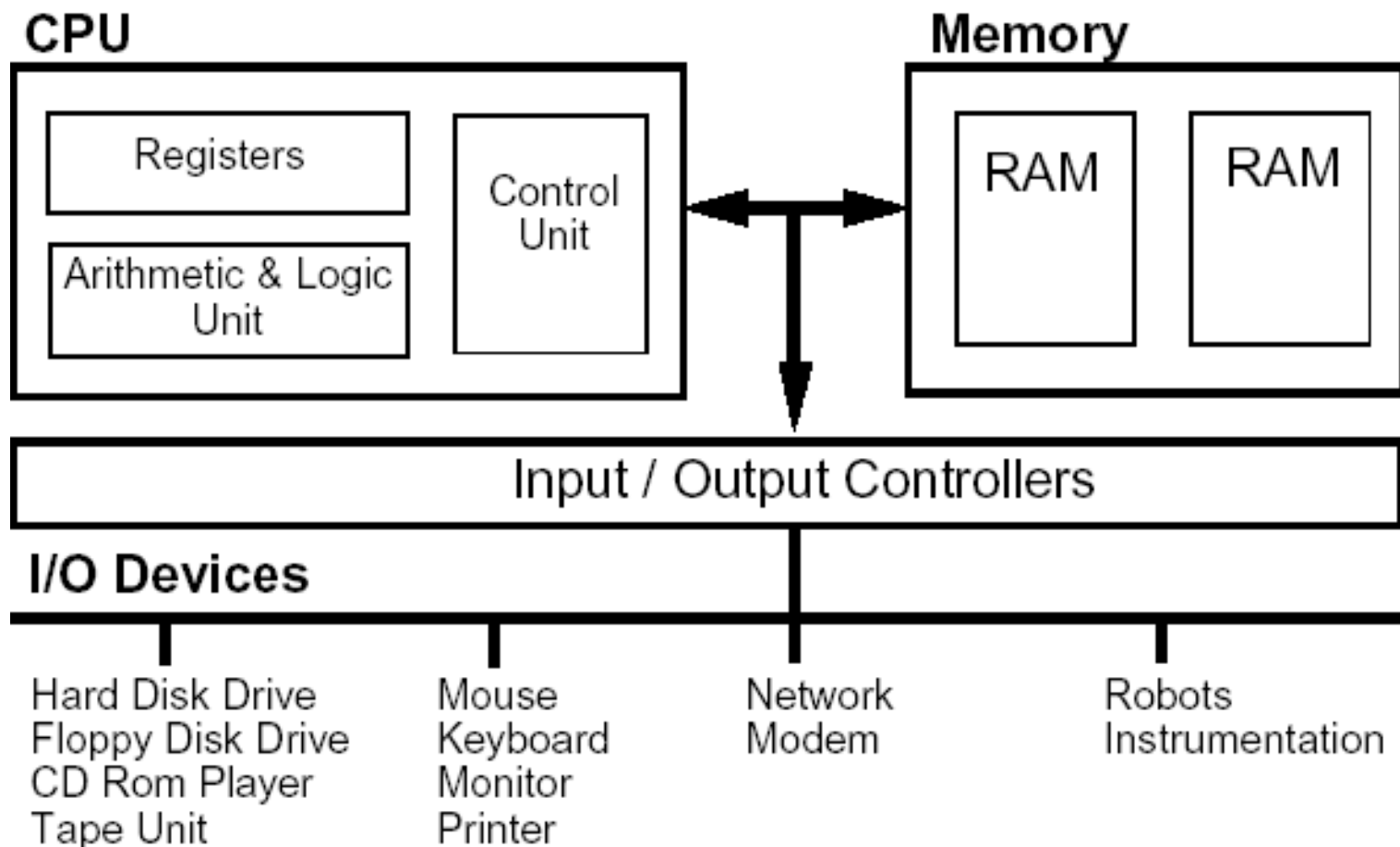
Introduction

Anandha Gopalan (with thanks to **N. Dulay** and **E. Edwards**)

axgopala@imperial.ac.uk

Course Aims

- To understand the elements of a computer



Learning Outcomes

- At the end of this course you should:
 - Know the basic the elements of a computer and understand how these elements link together
 - Know the different forms of memory organisation
 - Understand the basics of logic and number representation
 - Comprehend the different levels of programs
 - Understand the structure of the Toy and Pentium processor
 - Be able to write assembler programs

What is a Computer?



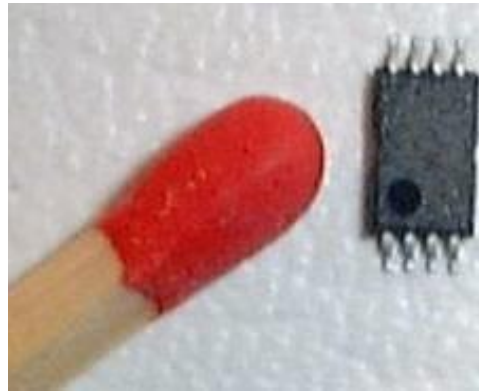




Downsizing



Matchbox
computer



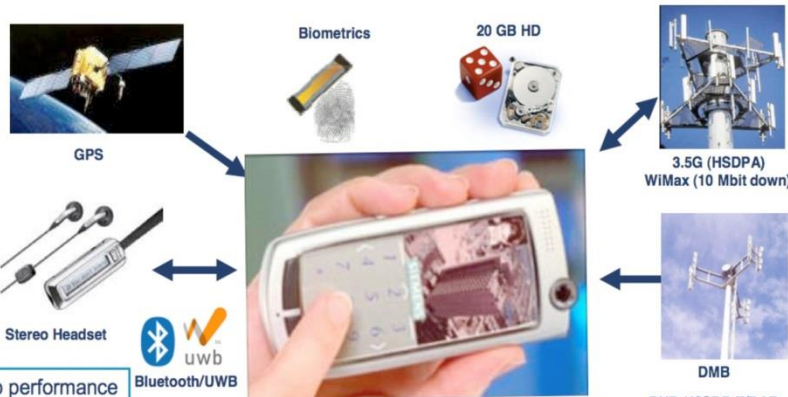
Web
Server



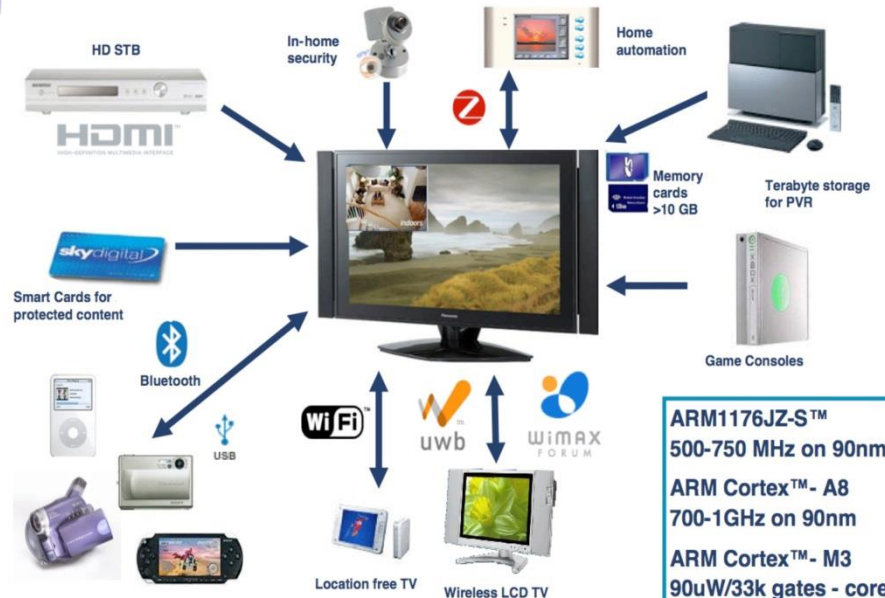
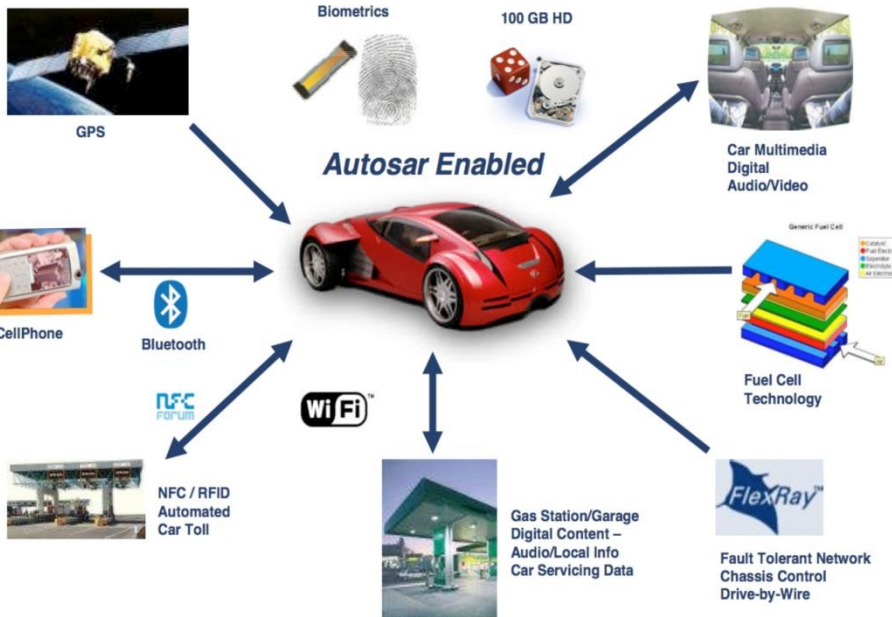
UC Berkeley
Mote



<http://boole.stanford.edu/cebit> (<http://www.tiqit.com/>)

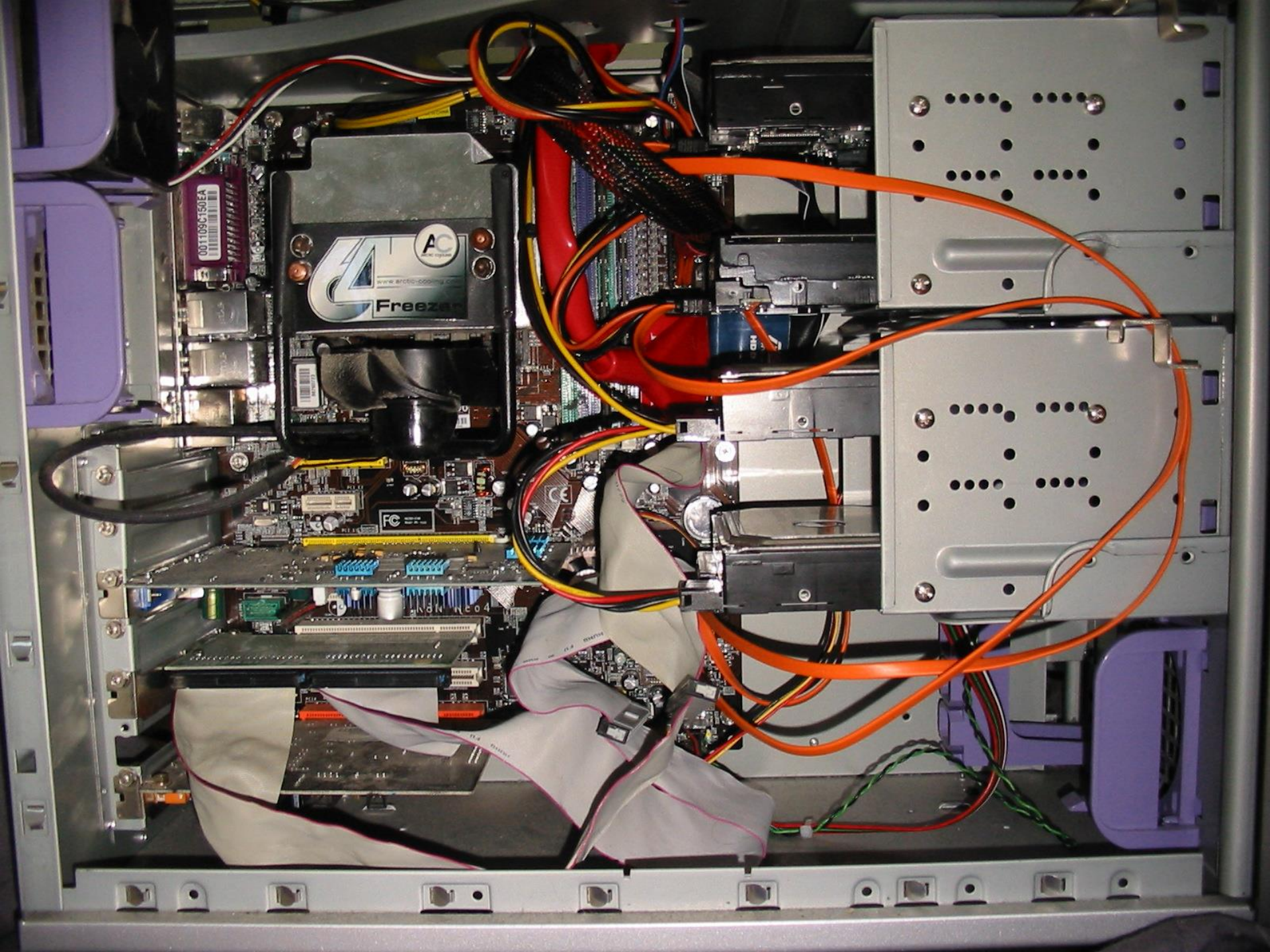


- Handheld desktop performance
- ARM Cortex-A8 CPU
- Camcorder SD H.264 enc/dec
- 3D Graphics processor
- 256MB DRAM, 64MB Flash
- WVGA screen (852x480)
- 4 mega pixel camera

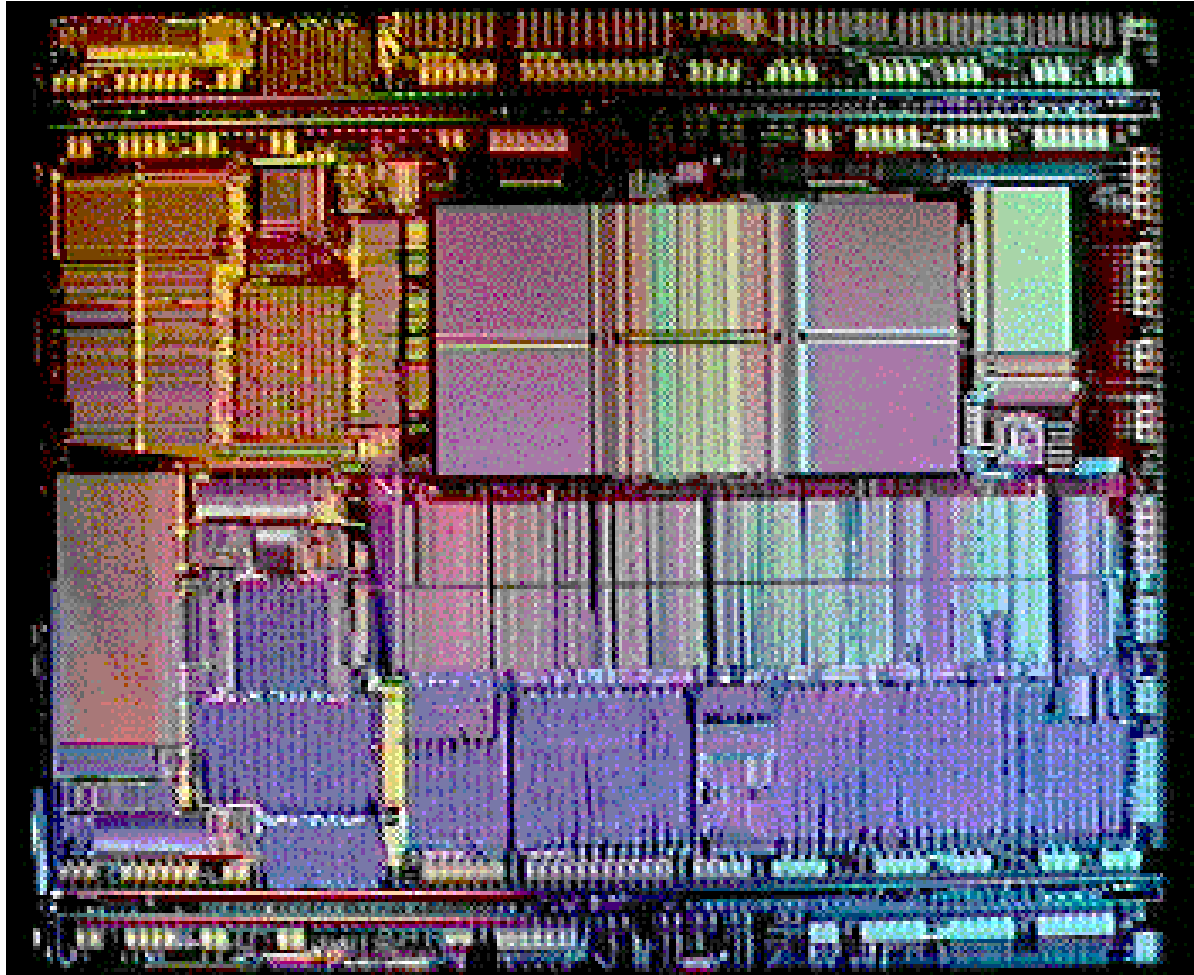


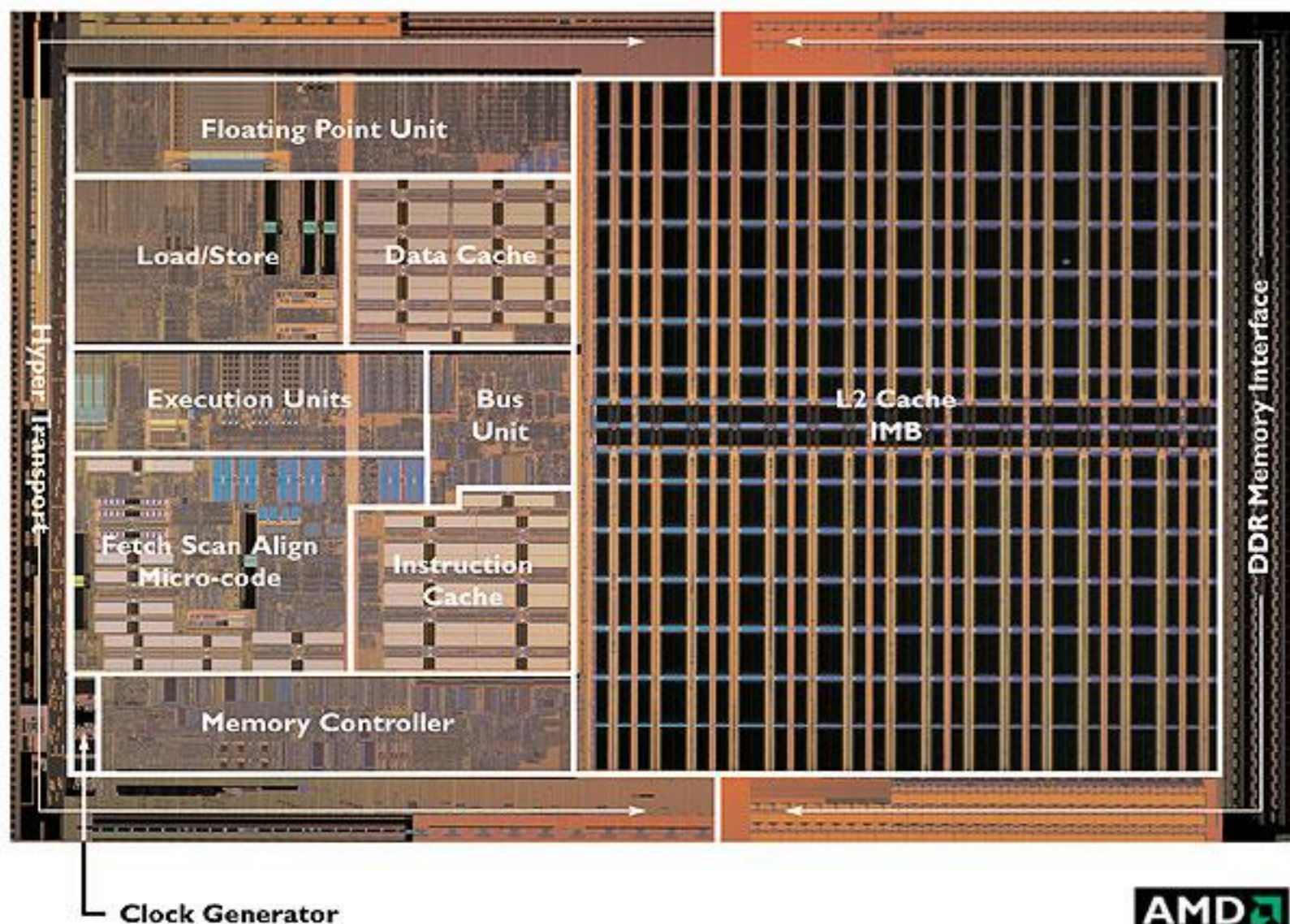
ARM1176JZ-S™
 500-750 MHz on 90nm
ARM Cortex™- A8
 700-1GHz on 90nm
ARM Cortex™- M3
 90uW/33k gates - core



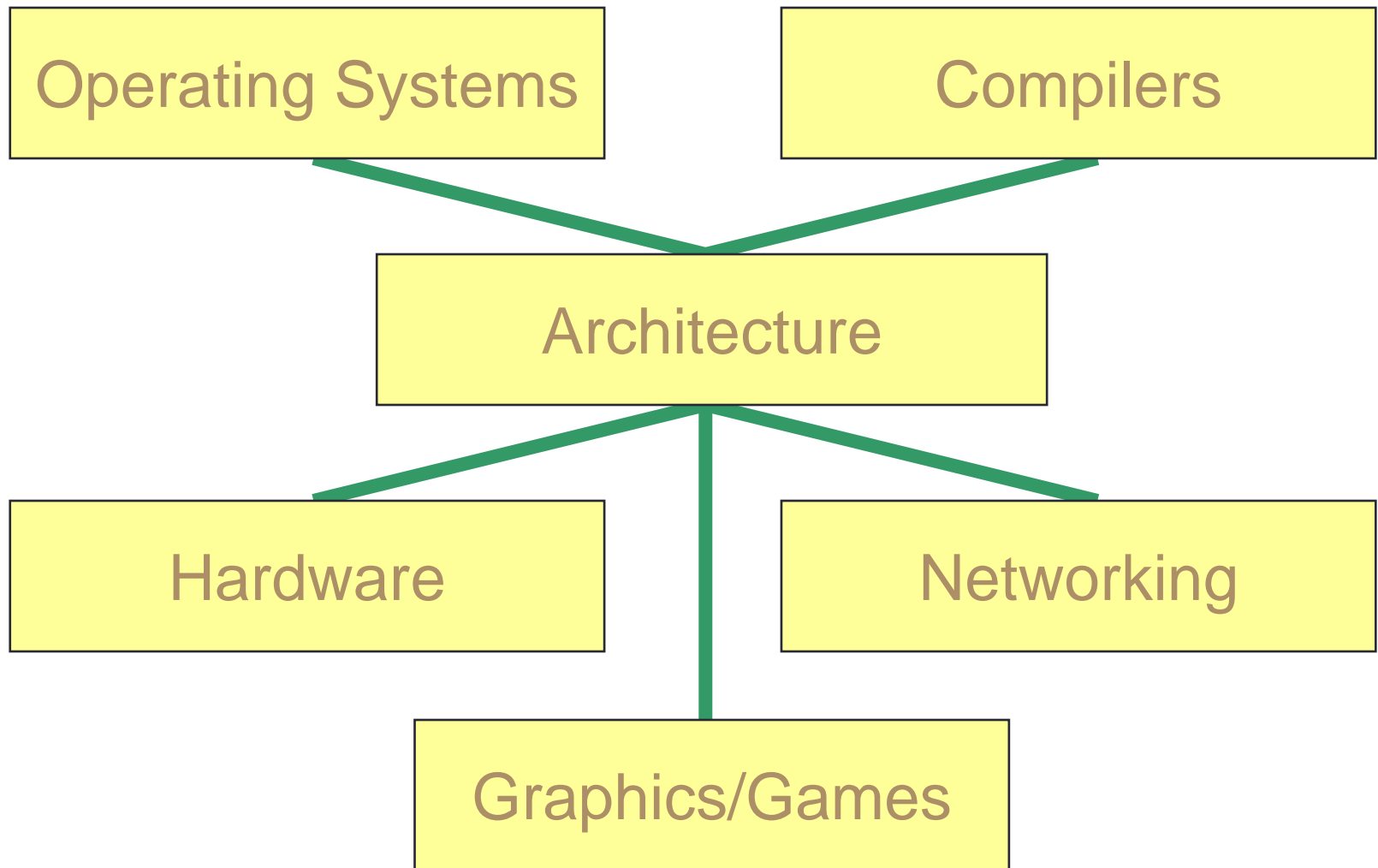


CPU on a Chip -> Microprocessor





Why ?



Computer Architects - What do they do?

- **Instruction Set** Design
- **CPU** Design
- **I/O Interface** Design
- **Bus design**
- **Motherboard** design
-
- **Emulation & testing** of the Architecture in Software
- **Implementation and testing** of the Architecture in Silicon
- **Performance** Evaluation
- Requirements with input from:
Higher Management,
Compiler writers,
Operating System developers,
Sales and marketing,
Existing and potential
Customers
- **Cost/profitability** analysis

Computer Architecture - Who needs to know?

- **Students** of Computer Architecture!
- **Lecturers** of Computer Architecture !!
- Operating System Developers
- Compiler Writers
- **Repair and Maintenance Technicians**
- **Third Party Vendors** e.g. Peripheral makers, Memory suppliers, Add-on card Suppliers (e.g. Co-processors, Graphics Accelerators)
- Sales and Marketing
- **Patent Office Workers**
- Reverse Engineers/Hackers

Course Outline

Part 1

Boolean Algebra and Logic

Basic Circuits and Memory

Chip Design

Main Memory Organisation

Data Representation & Binary Arithmetic

Floating Point Representation

Part 2

CPU Organisation & Representation

Pentium CPU and Programming

Input/Output Control

Recommended Reading

Structured Computer Organisation (5th ed.)

- Andrew S. Tannenbaum, Prentice-Hall International
- Easy to read, also covers 2nd & 3rd year topics

Computer Organisation & Architecture (7th ed.)

- William Stallings, Prentice-Hall International.
- Detailed, academic, also covers 2nd and 3rd year topics

Guide to Assembly Language Programming in Linux

- Sivarama Dandamudi, Springer
- Good introduction to Intel assembly programming

Workload (Architecture – Part 1)

9 Lectures

4 Tutorials

Summer Exam Paper

