

CS305

Computer Architecture

What is Computer Architecture?

Why Study Computer Architecture?

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<http://www.cse.iitb.ac.in/~br>

Computer Architecture

- “Architecture”
 - The art and science of designing and constructing buildings
 - A style and method of design and construction
 - Design, the way components fit together
- Computer Architecture
 - The overall design or structure of a computer system, including the hardware and the software required to run it, especially the internal structure of the microprocessor

Pre-Requisites

- Data Structures and Algorithms (CS213)
 - Arrays, pointers, stack, queue
- Logic Design (CS210)
 - Switching theory
 - Number systems, computer arithmetic
 - Logic circuits, combinatorial logic, K-maps
 - Finite state machines in hardware
 - Arithmetic unit, control unit design
 - CAD, FPGA, VHDL

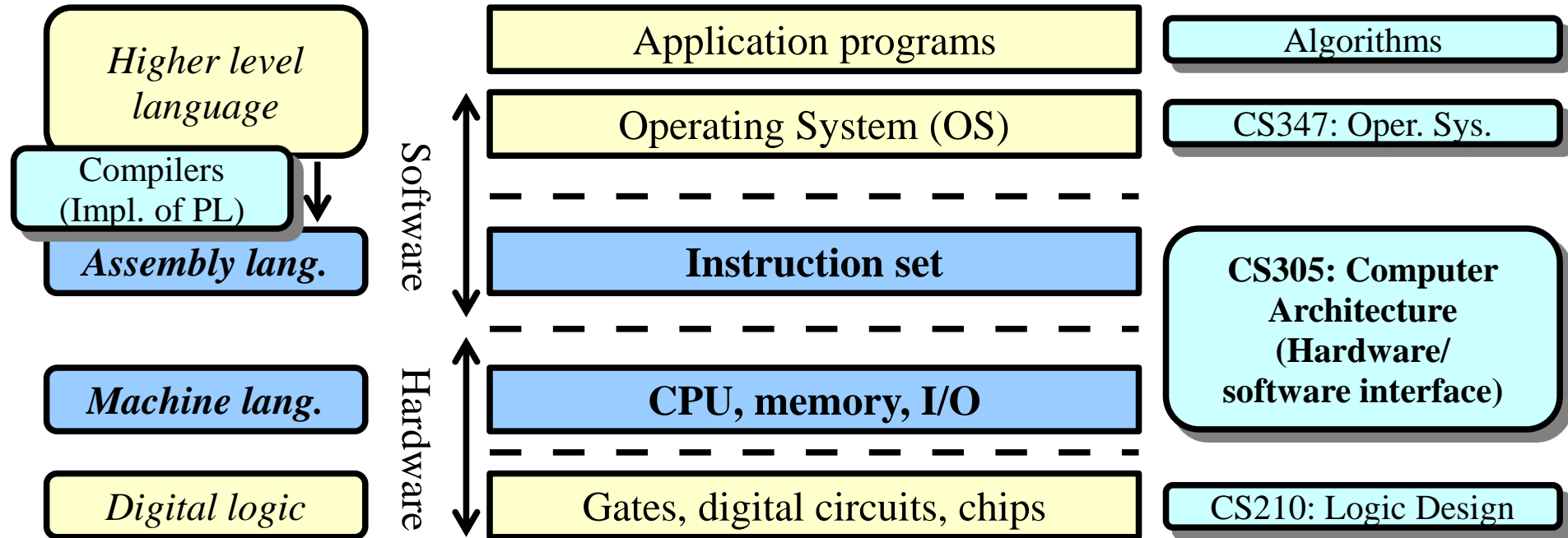
Course Contents

- Computer organization, von Neumann arch.
- Instruction set design
- Measuring performance, Amdahl's law, CPI
- Datapath and control path
- Pipelining, hazards

Course Contents (continued)

- Memory hierarchy, cache design, cache performance
- Disk storage
- RAID
- Error correction codes, Hamming codes
- I/O Buses

Relation to Other Topics/Courses



Text Book References

4th edn: ARM

MIPS

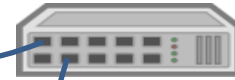
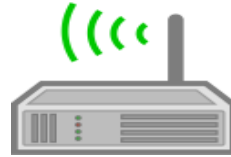
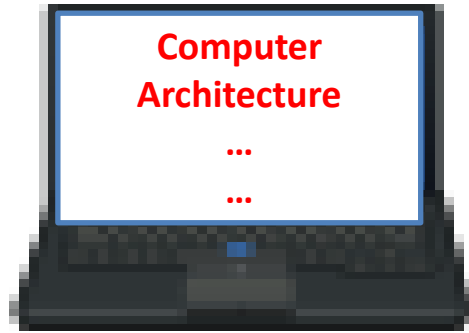
- **“Computer Organization and Design: The Hardware/Software Interface”, 3rd edition, David A. Patterson and John L. Hennessy, Elsevier (Restricted South Asia Edition).**
 - 5th edition available, ok to follow, I'll follow 3rd edn. closely
- **“Computer Architecture and Organization”, John P. Hayes, 3rd edition, McGraw Hill.**
- Low-price editions, e-books available on amazon/flipkart, buy them, no piracy please!
- Notes from other computer architecture courses

Why Study Computer Architecture?

Q: Why do you think Computer Architecture is important (or unimportant)?

Identify Computer Architecture around you

Example-1: This Video



Watching this video on a computer: several computing devices involved in-between

Example-2: Cell-Phones to PCs



A variety of personal devices: the continuum between cell-phones and PCs

Example-3: Servers, Data Centers, Cloud Computing



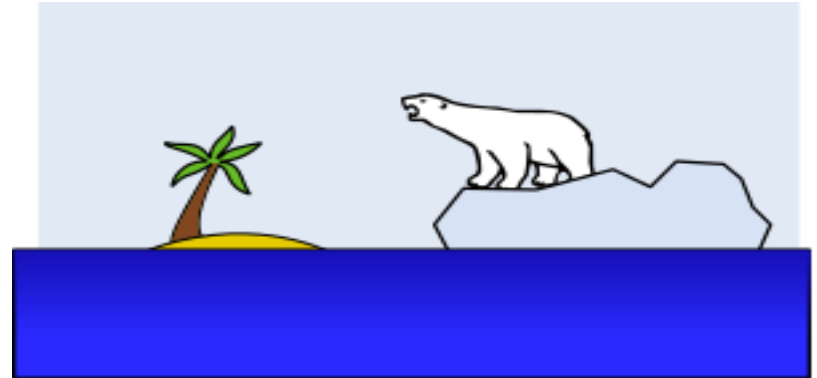
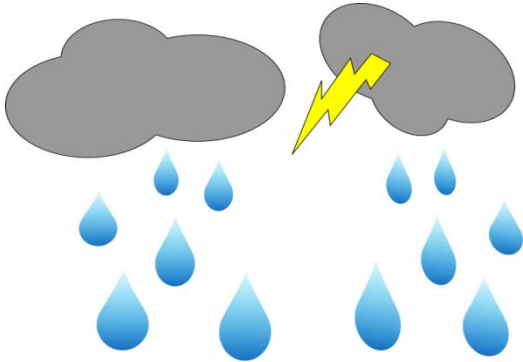
Data storage and computing in the cloud: backbone of major Internet services



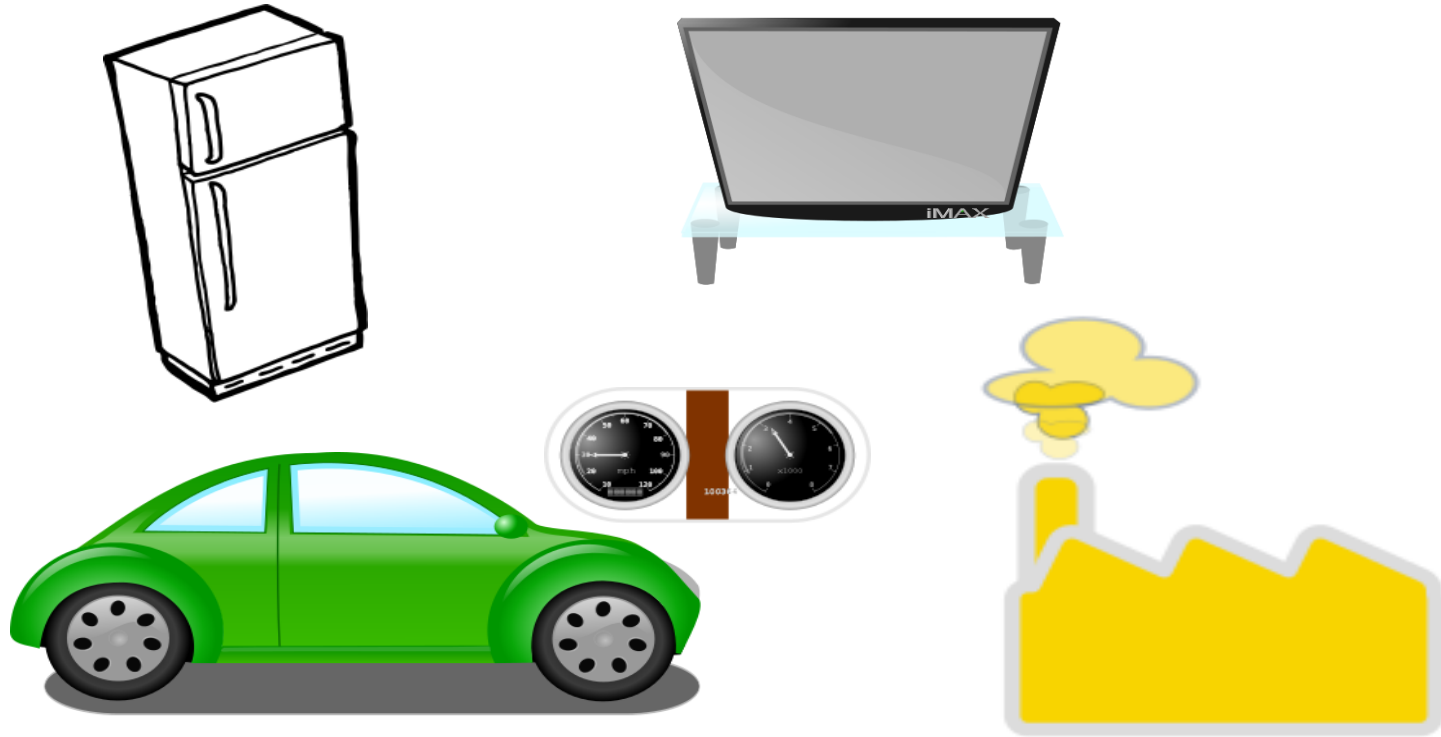
Example-4: Supercomputers



Specialized but
important
applications, high-
end research



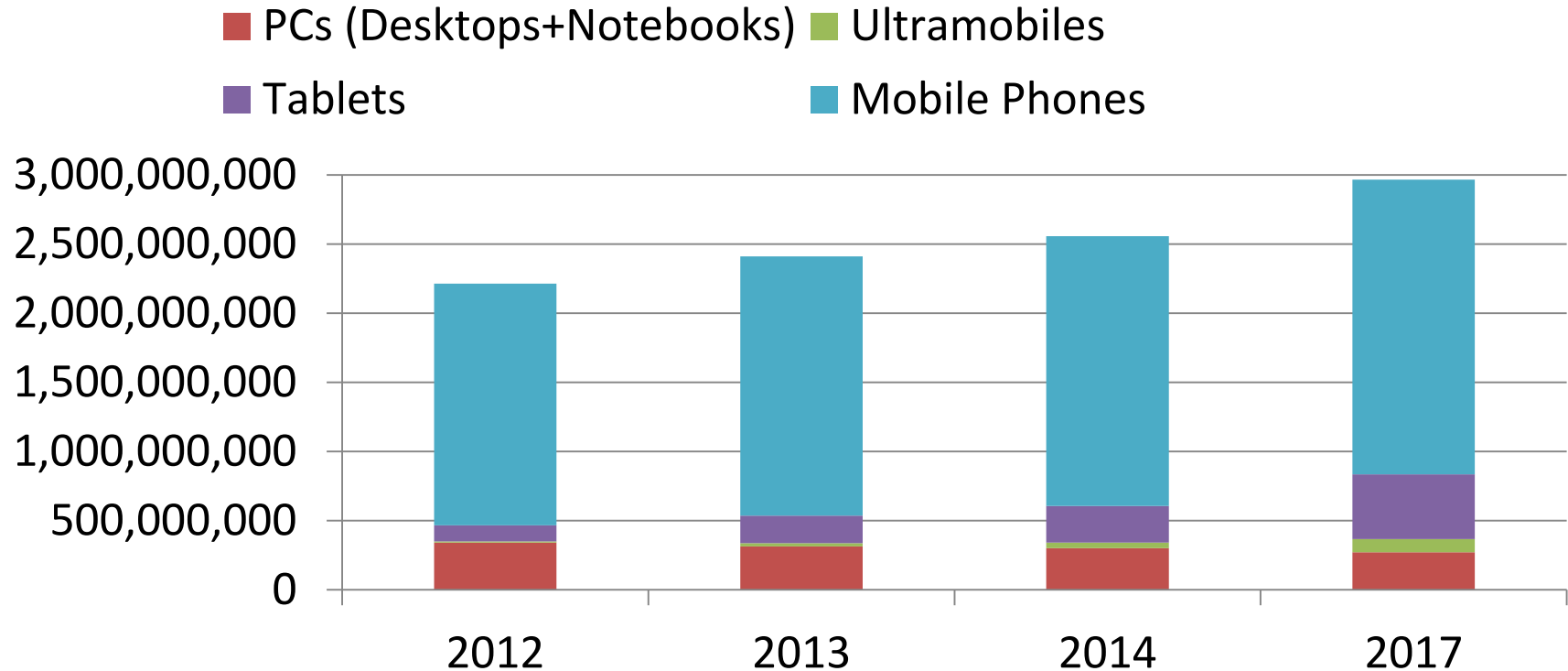
Example-5: Embedded Computers



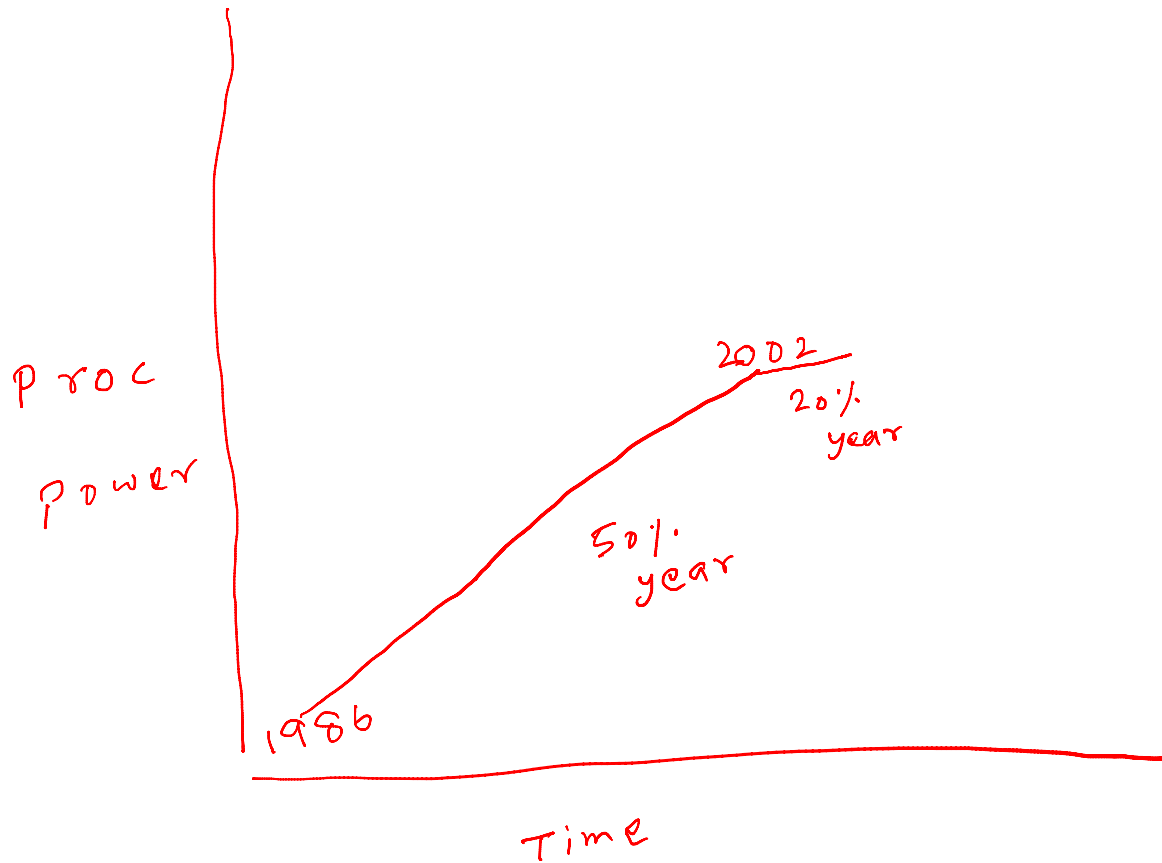
Small but large in number, very critical roles
Home appliances, vehicles, industry automation

Personal Computing Devices in Numbers

Source: Gartner study, Apr 2013



Growth in Processing Power



Moore's Law



Summary: Why Study Computer Architecture?

- Computing central to *information age*
- Computer systems range from very small to very large, low-end to super-computers
- New computing devices, end-user devices
 - How are they designed?
 - What affects their performance?
 - What are the performance optimization metrics?
 - How to optimize these metrics?