

EC-252: COMPUTER ARCHITECTURE AND MICROPROCESSORS

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CS252 Structure and Syllabus

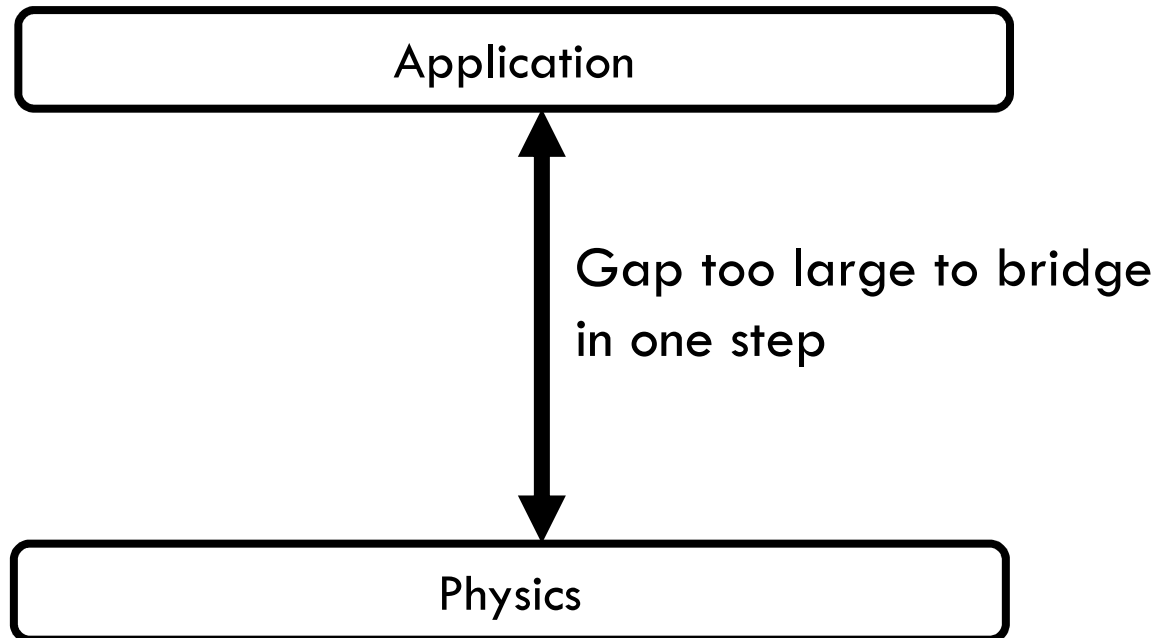
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Six modules

1. Processor organization (ALU, Datapaths, Registers, System buses)
2. Processor control (micro-operations, instruction fetch & execute cycles)
3. Simple machine design (ISAs, microprogramming, opcodes and operands, assembly language programming, addressing modes and formats)
4. Memory hierarchy (DRAM, caches, optimizations) plus virtual memory systems, exceptions, interrupts
5. I/O organization (interrupts, polling, DMA), Synchronous vs. asynchronous I/O
6. 8/16/32/64 bit microprocessor families

What is Computer Architecture?

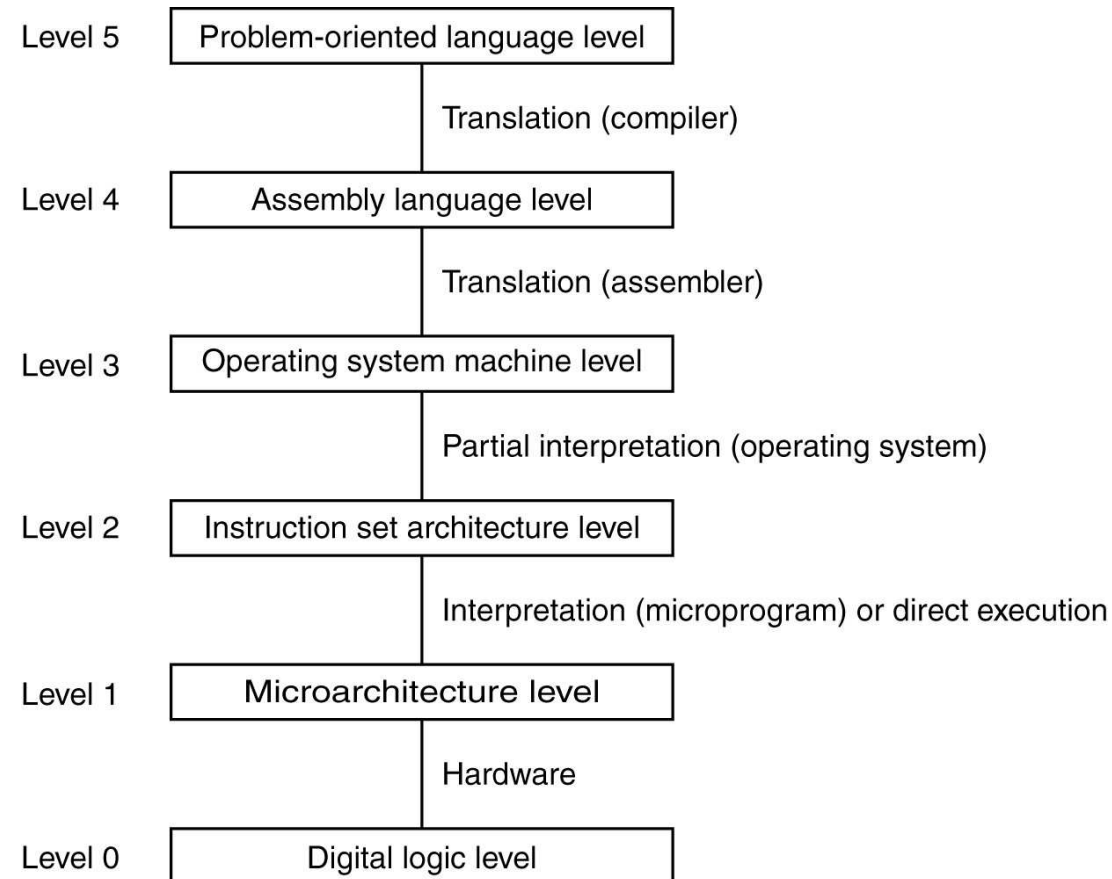
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In its broadest definition, computer architecture is the *design of the abstraction layers* that allow us to implement information processing applications efficiently using available manufacturing technologies.

Contemporary Multilevel Machines

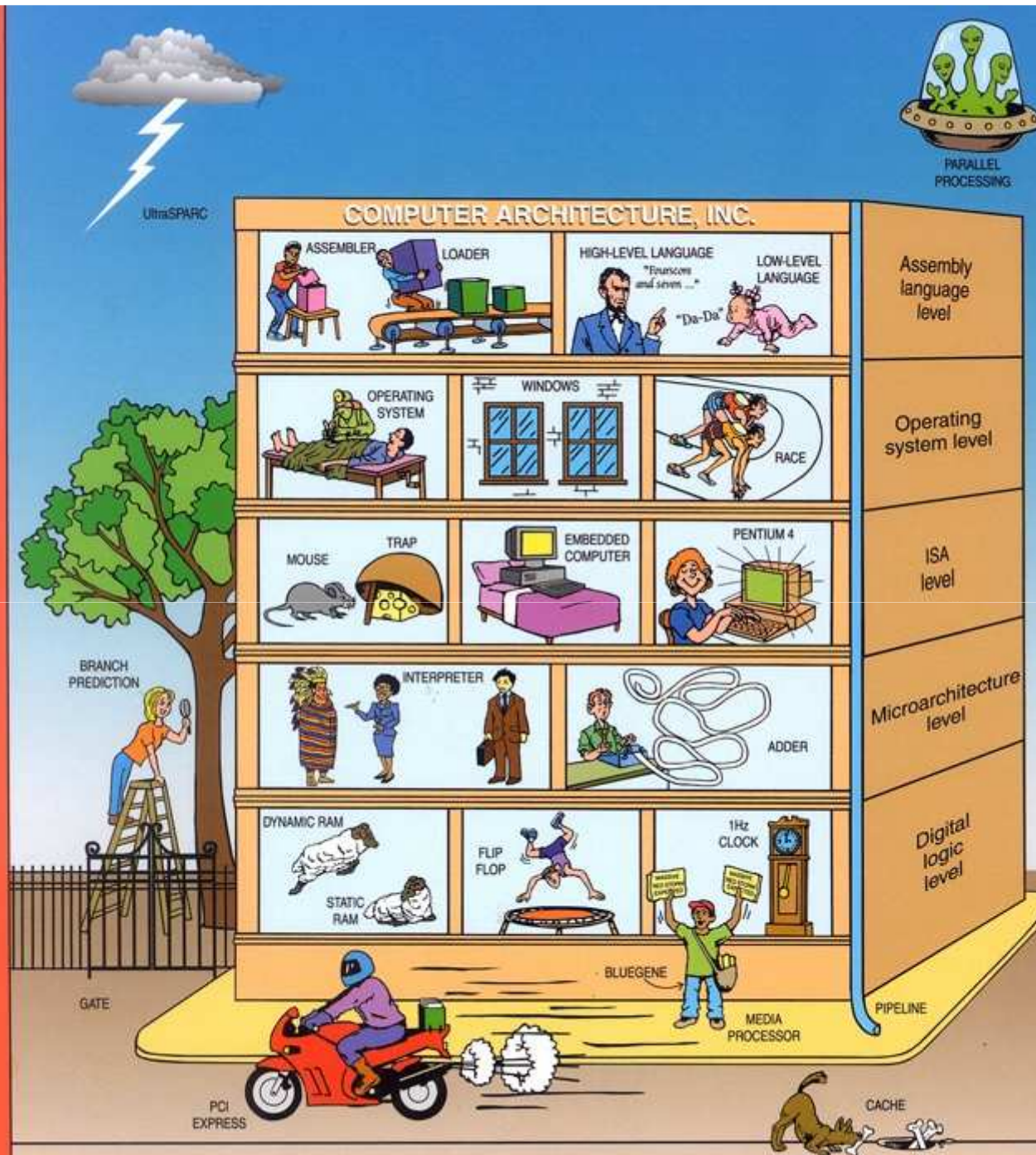
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Six abstraction levels of a computer

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What **else** is Computer Architecture?

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- **Computer Architecture** refers to the attributes of a system visible to a programmer — i.e., attributes that have a direct impact on the logical execution of a program.

- **Architectural Attributes** include
 - ▣ the instruction set,
 - ▣ the number of bits used to represent various data types,
 - ▣ I/O mechanisms, and
 - ▣ techniques for addressing memory.

What is Computer Organization?

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- **Computer organization** refers to the operational units and their interconnections that realize the architectural specifications.

- **Organizational attributes** include those hardware details transparent to the programmer:
 - control signals,
 - interfaces between the computer and peripherals,
 - the memory technology, ...

Architecture vs. Organization

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- Whether or not a computer can support a multiplication instruction is an **architectural issue**.
- However, whether the multiplication is performed by a special multiply unit or by a mechanism that makes repeated use of the add unit is an **organizational issue**.

Architecture vs. Organization

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- Following IBM, many computer manufacturers offer a **family** of computer models — all with the same architecture but with differences in organization.
- An architecture may survive many years but its organization changes with changing technology.
- In short, as the technology changes, the organization changes while architecture may remain unchanged.

Duties of a Computer Architect (1)

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- A computer architect is concerned about:
 - ▣ The form in which programs are represented to and interpreted by the underlying machine,
 - ▣ The methods with which these programs address the data, and
 - ▣ The representation of data.

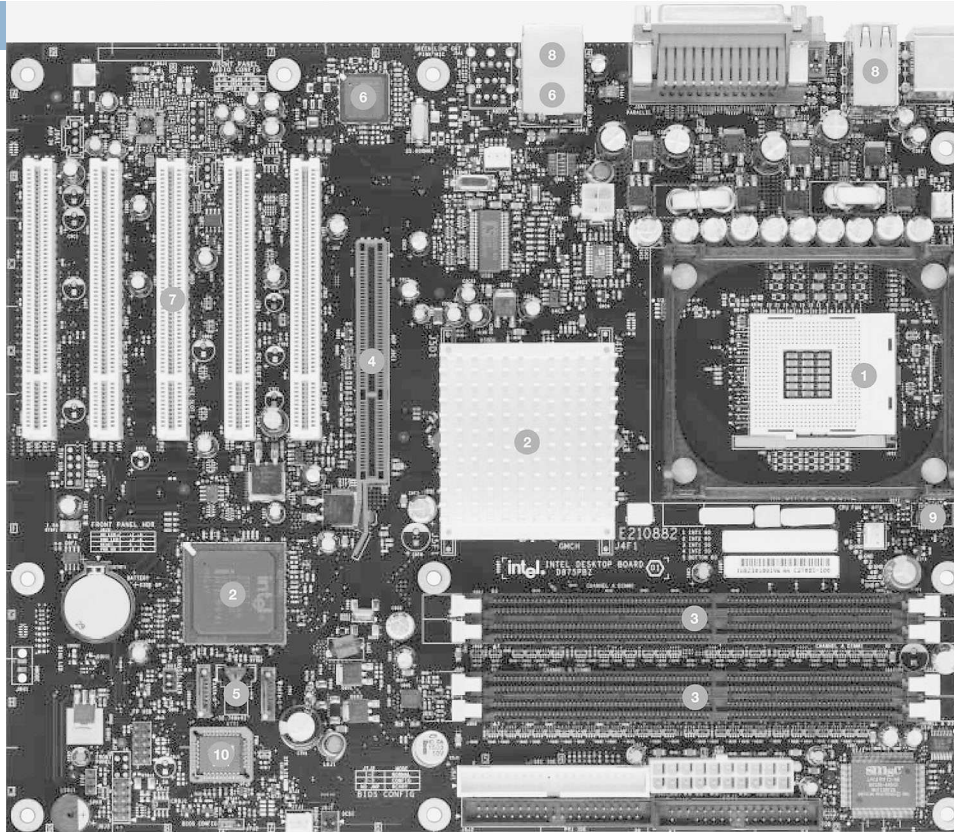
Duties of a Computer Architect (2)

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- A computer architect should:
 - ▣ Analyze the requirements and criteria — Functional requirements
 - ▣ Study the previous attempts
 - ▣ Design the conceptual system
 - ▣ Define the detailed issues of the design
 - ▣ Tune the design — Balancing software and hardware
 - ▣ Evaluate the design
 - ▣ Implement the design — Technological trend

Entrails of a Personal Computer

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1. Pentium 4 socket
2. 875P Support chip
3. Memory sockets
4. AGP connector
5. Disk interface
6. Gigabit Ethernet
7. Five PCI slots
8. USB 2.0 ports
9. Cooling technology
10. BIOS

A printed circuit board is at the heart of every personal computer. This figure is a photograph of the Intel D875PBZ board. The photograph is copyrighted by the Intel Corporation, 2003.

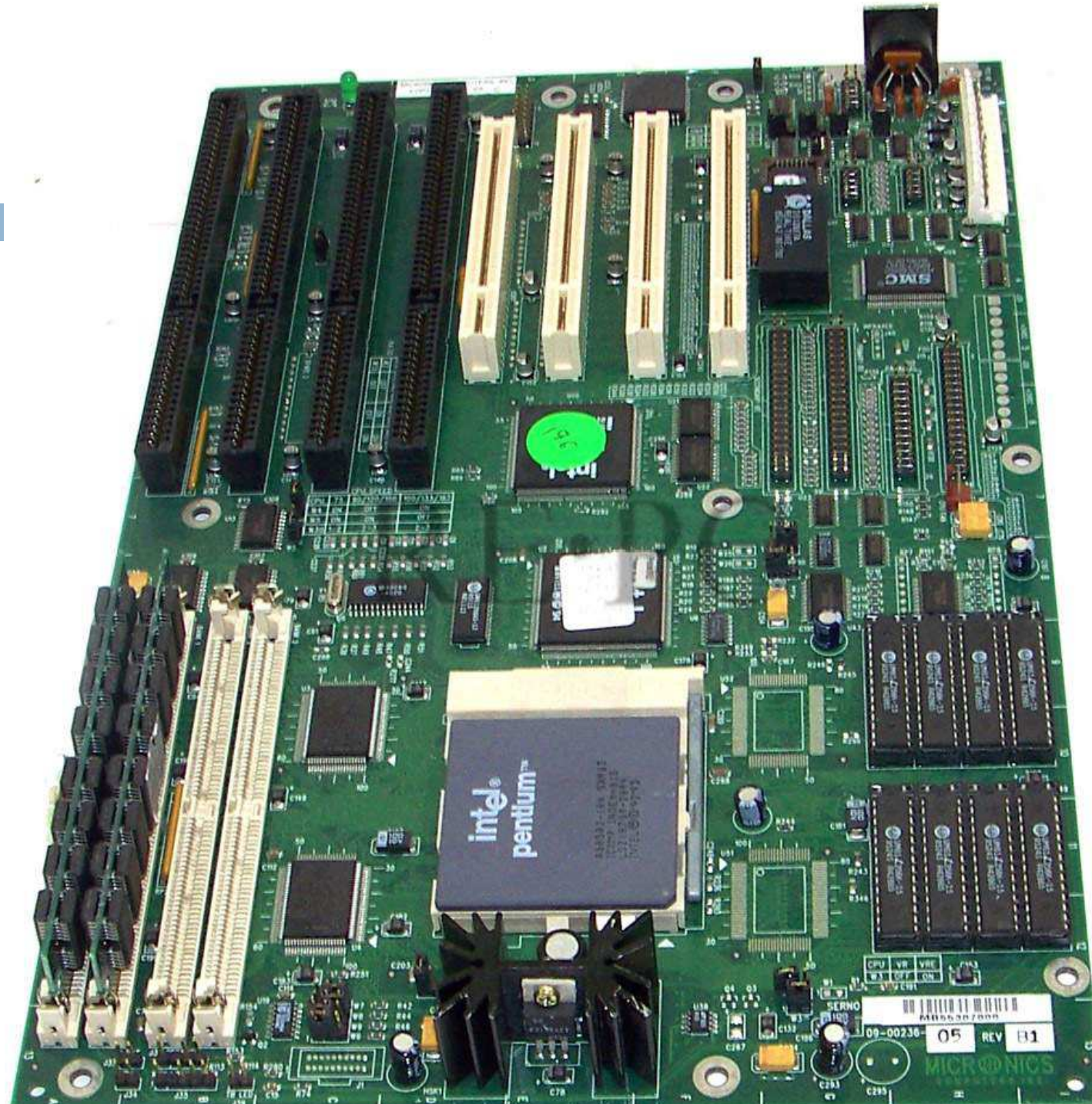
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Entrails of a Personal Computer

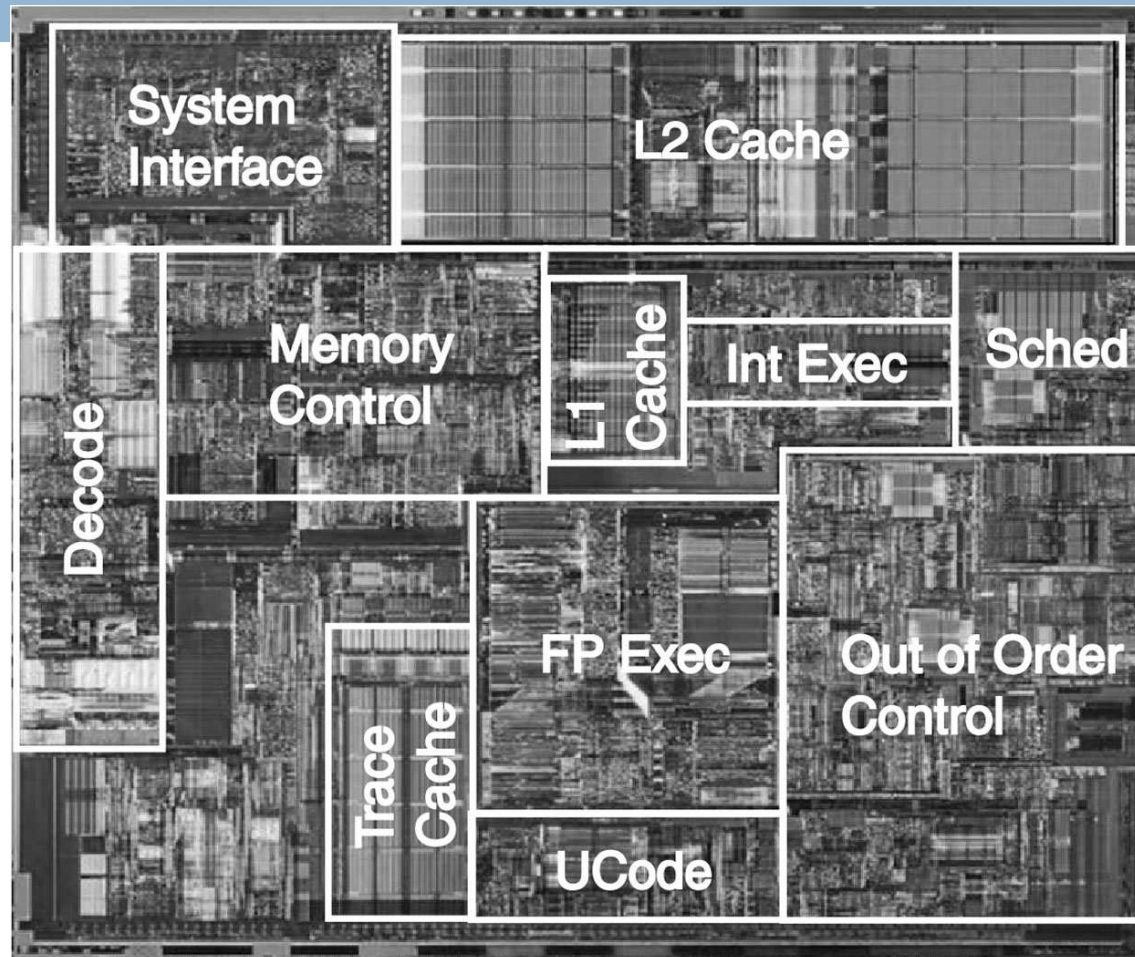
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Entrails of a Processor

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The Pentium 4 chip. (copyrighted by the Intel Corp. 2003)

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