CS 310: Computer Organization and Programming

Lecture 1: Overview

Goals

- Understand the fundamental components of computer systems
  - Hardware
  - Machine language
  - Assemblers
  - Compilers
  - Operating Systems
- Learn to program the machine at its most basic level
  - Why? Can't we just use a high level language?
  - SW design decisions are driven by the HW
  - Understand program performance
  - It's pretty darn cool!
- Without this knowledge, it's kind of like being an architect without knowing anything about construction

Logistics

Lectures   **MW 3:30pm, WAG 101**

Lecturers   **Prof. Fussell**

TAs   **Bert Maher, Dong Li**

Discussions   **Th 10-11 – RAS 211A**

   Th 1-2 – RAS 211A

   Th 10-11 – JES A207A

   Th 2-3 – RAS 313A

More Logistics

Grading:

In-class Quizzes	30% (15% each for 2 highest)
Quiz 1	Wednesday, Feb. 25
Quiz 2	Wednesday, April 8
Quiz 3	Wednesday, May 6
Final Exam	35%, Exam week
Homework/Pgms	25%
Participation	10% (discussion section)

Textbooks: *Introduction to Computing Systems: From Bits and Gates to C and Beyond*, by Patt and Patel, 2nd edition

Course Reader

CS310 Online

URL:
`www.cs.utexas.edu/users/fussell/cs310`

Email List: **for class announcements**
(see web page to sign up)

newsgroup: `utexas.csclass.cs310`

My Favorite Program

```
a[0] = 1;
a[1] = 1;
for(i=2; i<100; i++) {
   a[i] = a[i-1] + a[i-2];
}
```

1, 1, 2, 3, 5, 8, 13, 21, ...

Your Computer
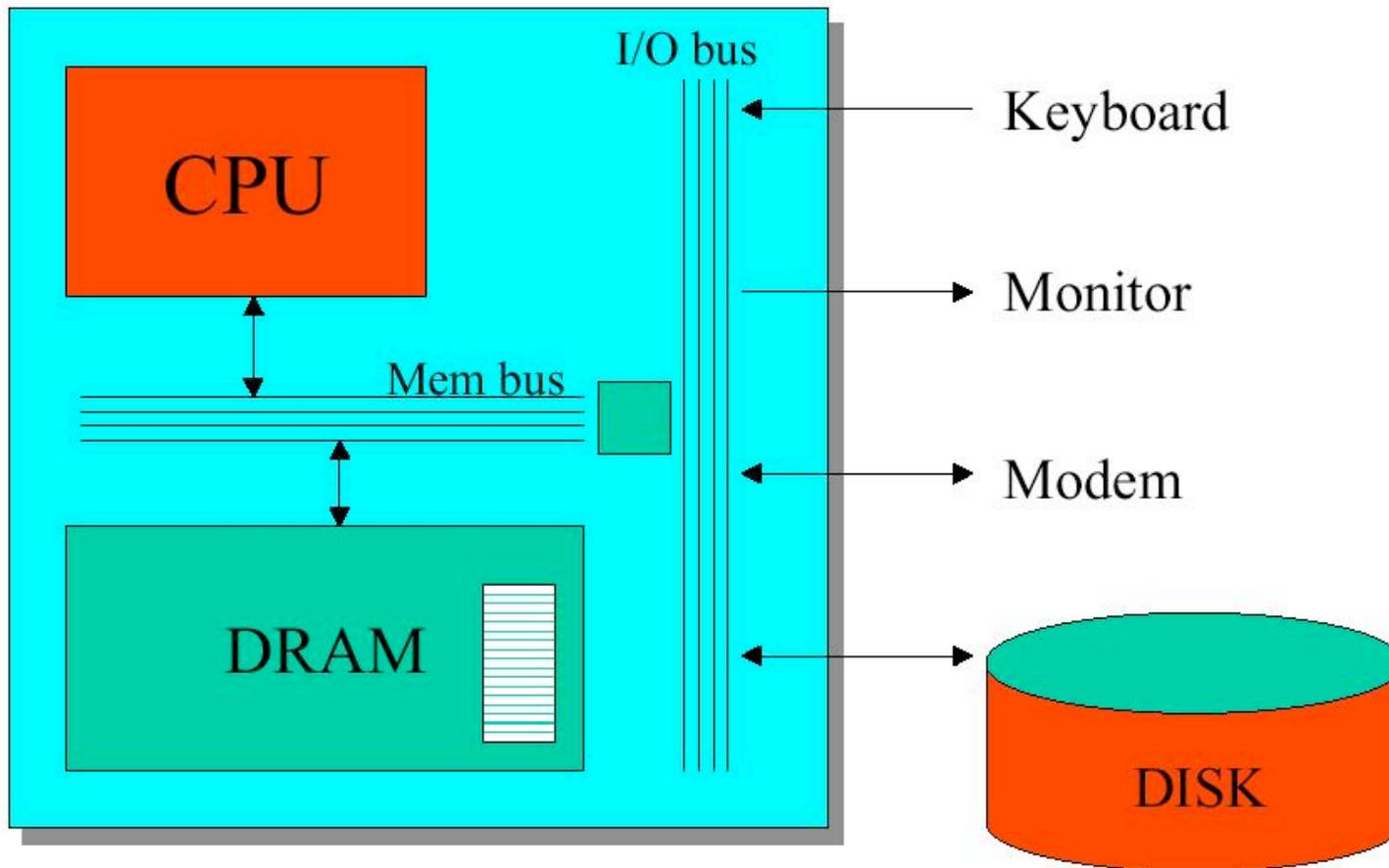
Layers of Abstraction

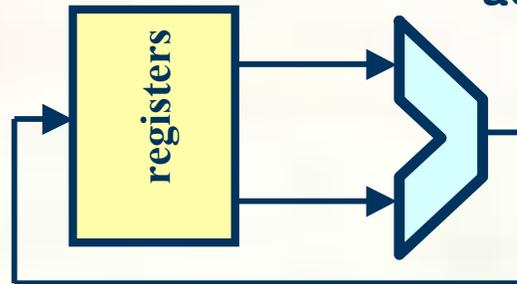**Specification**   compute the fibonacci sequence

Program
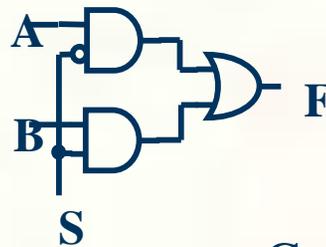```
for(i=2; i<100; i++) {
    a[i] = a[i-1]+a[i-2];}
```

**ISA** (Instruction Set Architecture)
```
load r1, a[i];
add r2, r2, r1;
```

**microArchitecture**

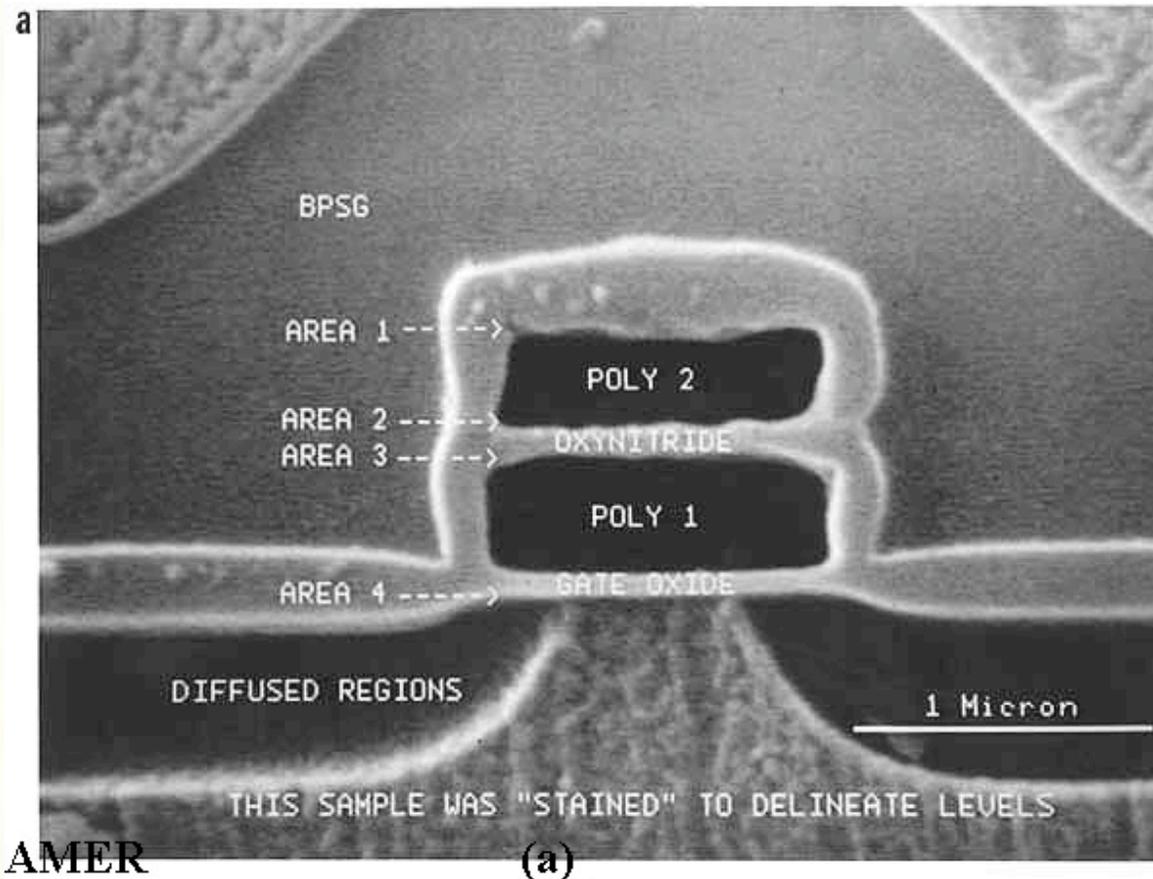registers

**Logic**

A
B
F
S

**Transistors**

D
G
S

D
G
S
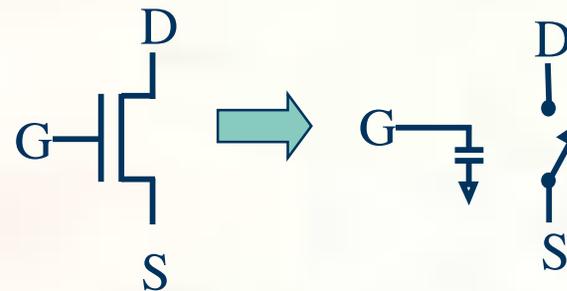
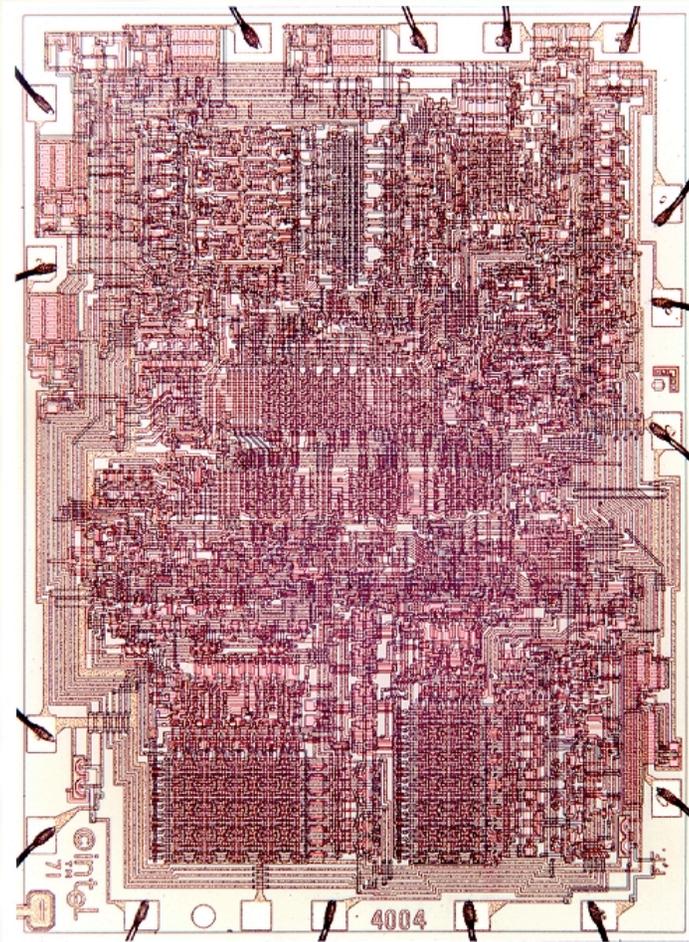**Physics/Chemistry**

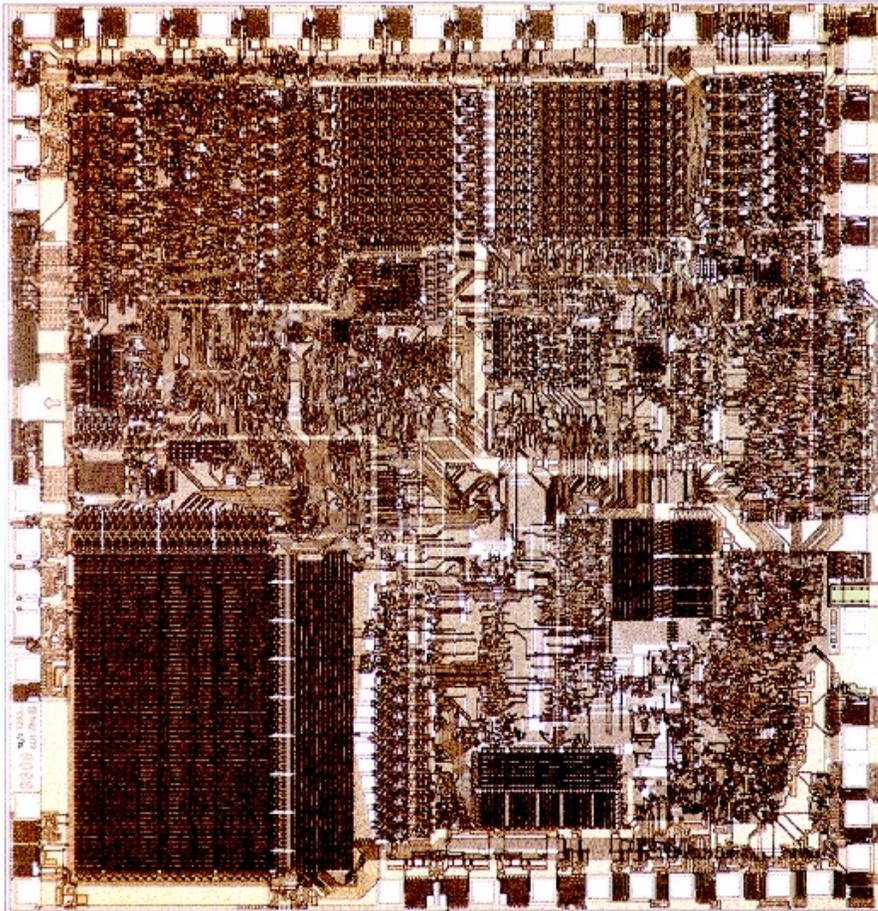# The Mighty Transistor!

# Intel 4004 - 1971



■ The first microprocessor

■ 2,300 transistors

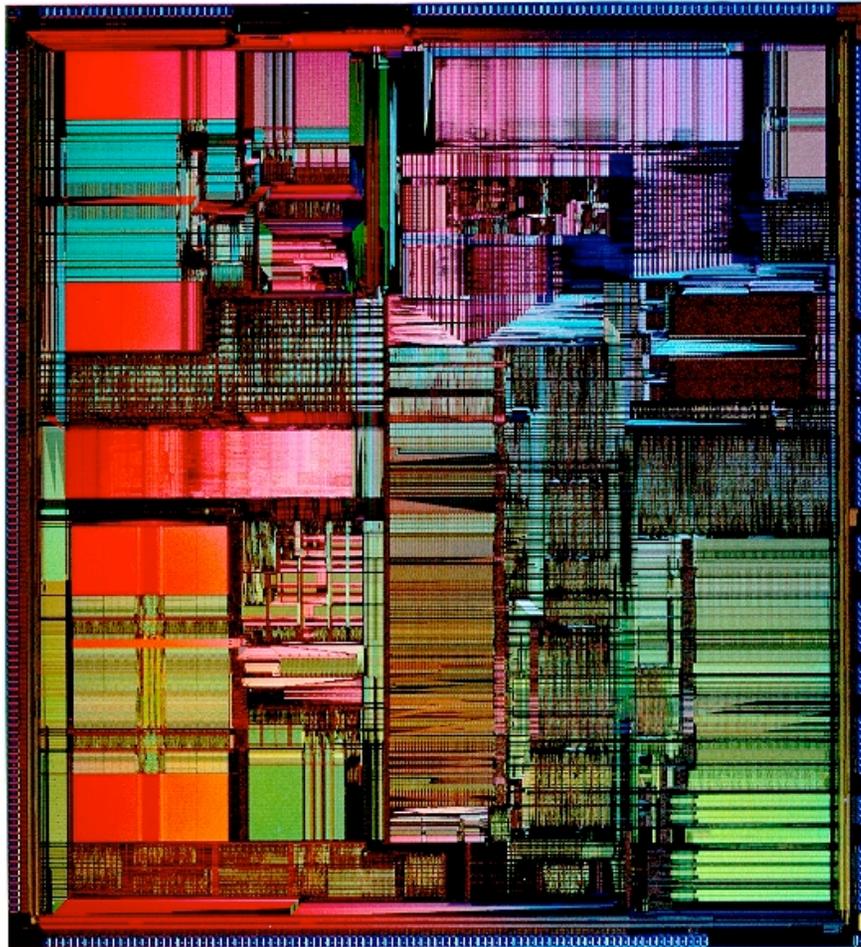■ 108 KHz

■ 10μm process

# Intel 8086 - 1978



- IBM PC processor

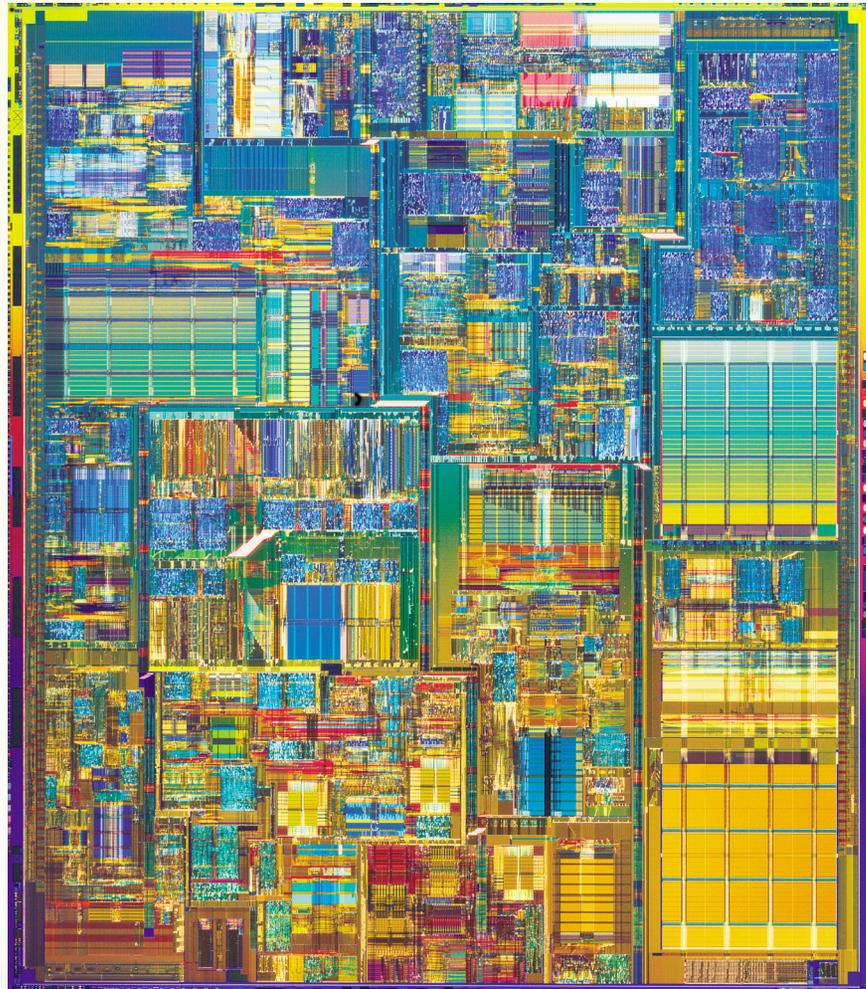- 29,000 transistors
- 10 MHz
- 3μm process

# Intel Pentium - 1993



- First Intel processor to execute more than one instruction per cycle

- 3.1 million transistors
- 66 MHz
- 0.8μm process

# Intel Pentium IV - 2001
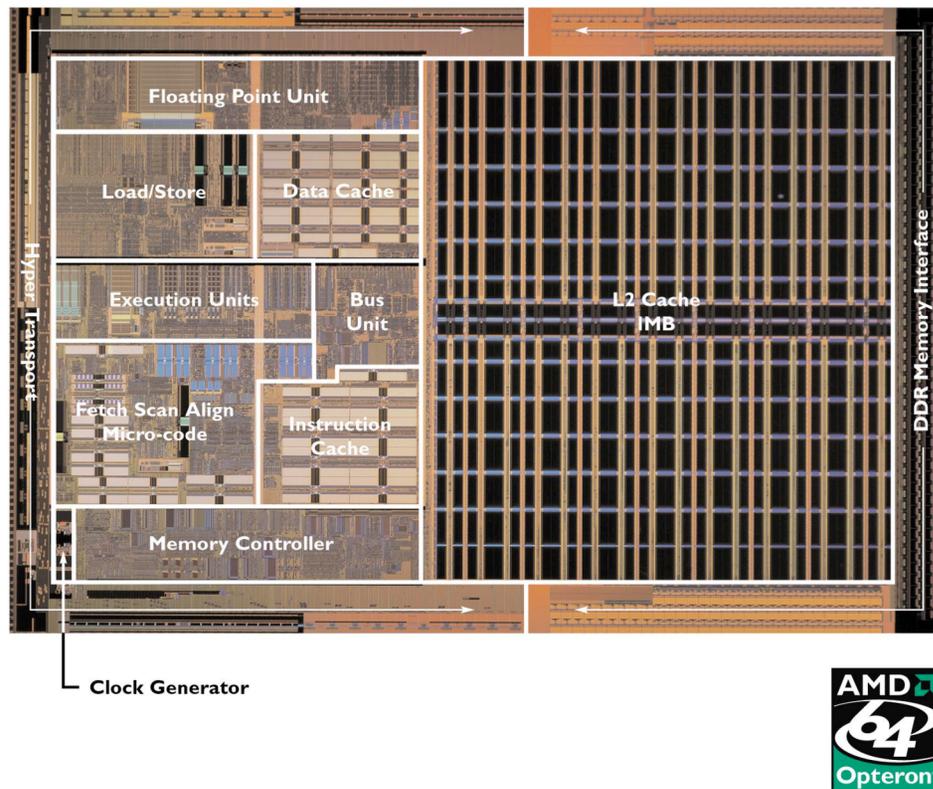


42 million transistors

2GHz

0.13μm process

Could fit ~15,000
    4004s on this chip!
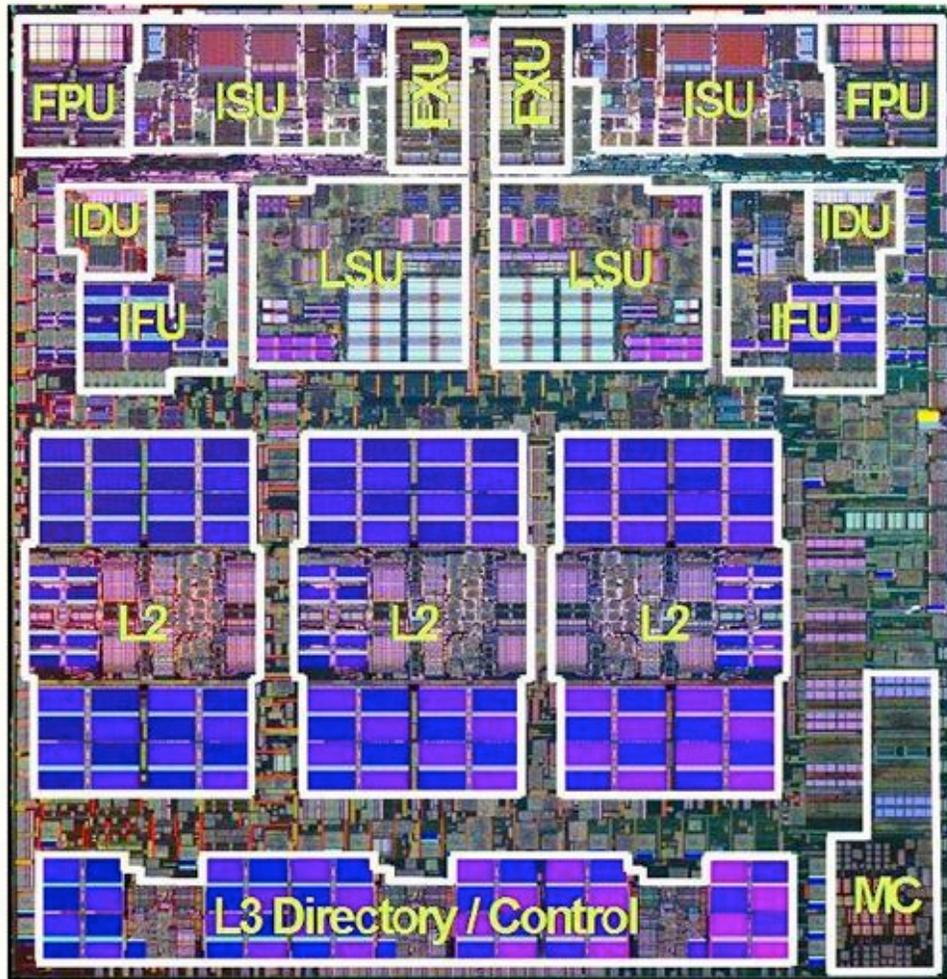
# AMD Opteron - 2004



- **106 million transistors**
- **2.4 GHz**
- **0.13μm process**

# IBM Power 5 - 2004



- **276 million transistors**
- **1.9 GHz**
- **0.13μm process**
- **2 processors**

# Next Time

- Basic (simple) electronics

- Reading assignment:
  - P&P Chapters 1, 2.1, 2.2, 3.1-3.2
  - Maccabe 1.1, 1.2, 2.1