CS 310H: 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 cool!
- Without this knowledge, it's kind of like being an architect without knowing anything about construction

Logistics

Lectures	**MWF 10:00am, RLM 6.116**
Lecturers	**Prof. Fussell**
TA	**Aditya Rawal**
Discussions	**Th 9-10 – GAR 1.134**
	Th 11-12 – PAR 204

More Logistics

Grading:

In-class Quizzes	30% (15% each for 2 highest)
Final Exam	30%, Exam week
Homework/Pgms	30%
Participation	10% (discussion section)

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

CS310 Online

URL:

`www.cs.utexas.edu/users/fussell/cs310h`

Email List: **for class announcements**

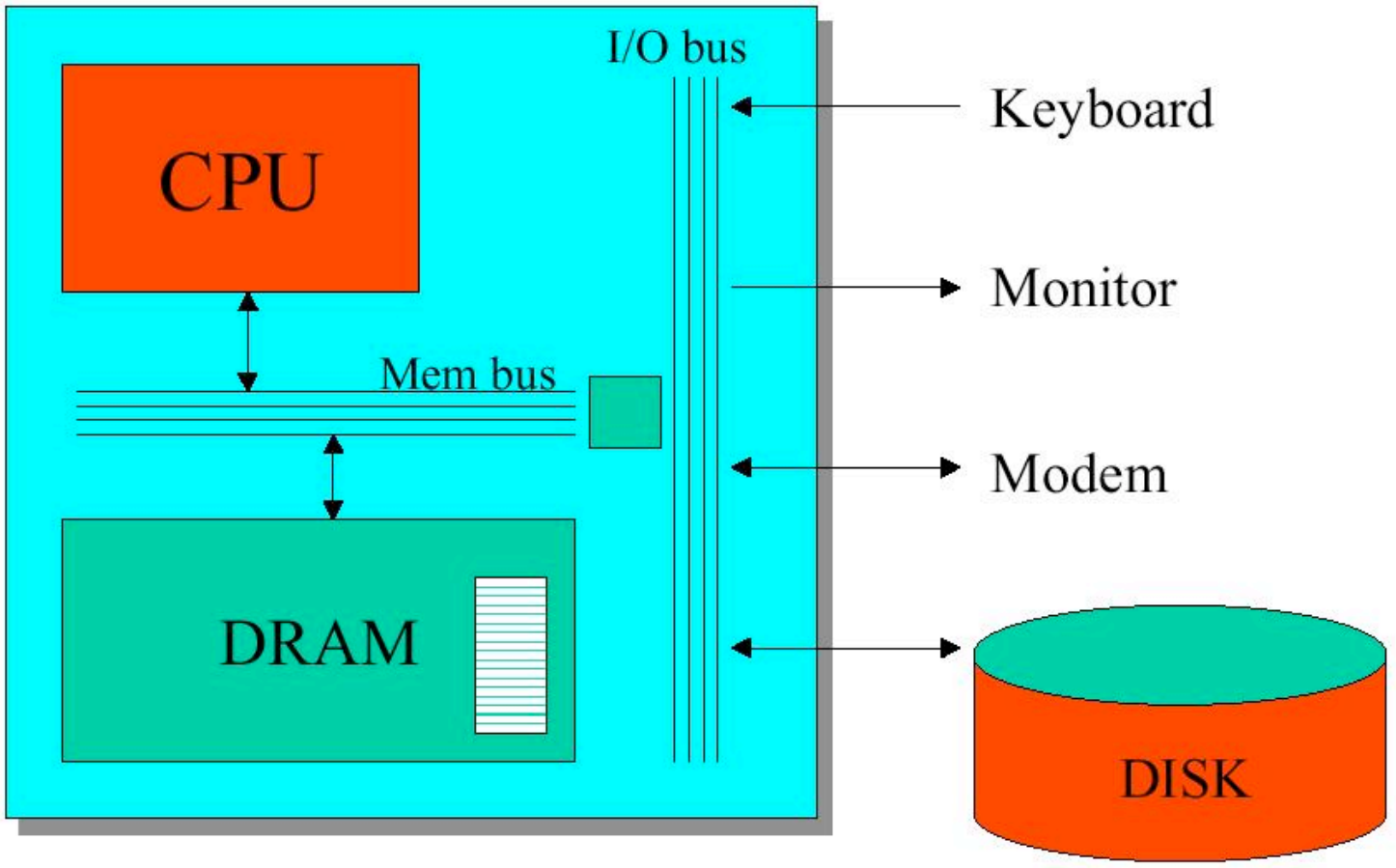
(see web page to sign up)

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

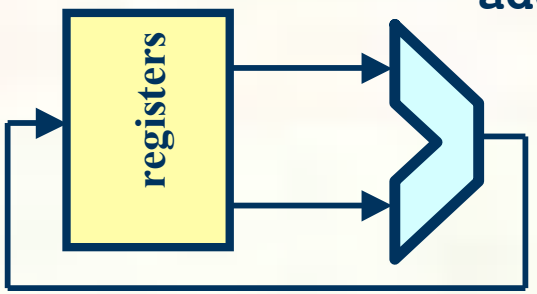
Program

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

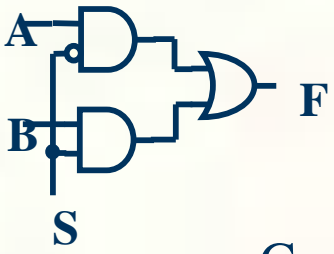
ISA (Instruction Set Architecture)

```
load r1, a[i];
add  r2, r2, r1;
```

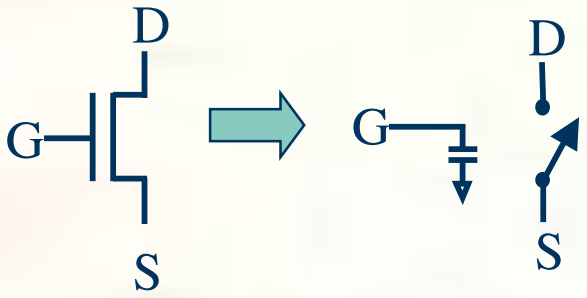
microArchitecture



Logic

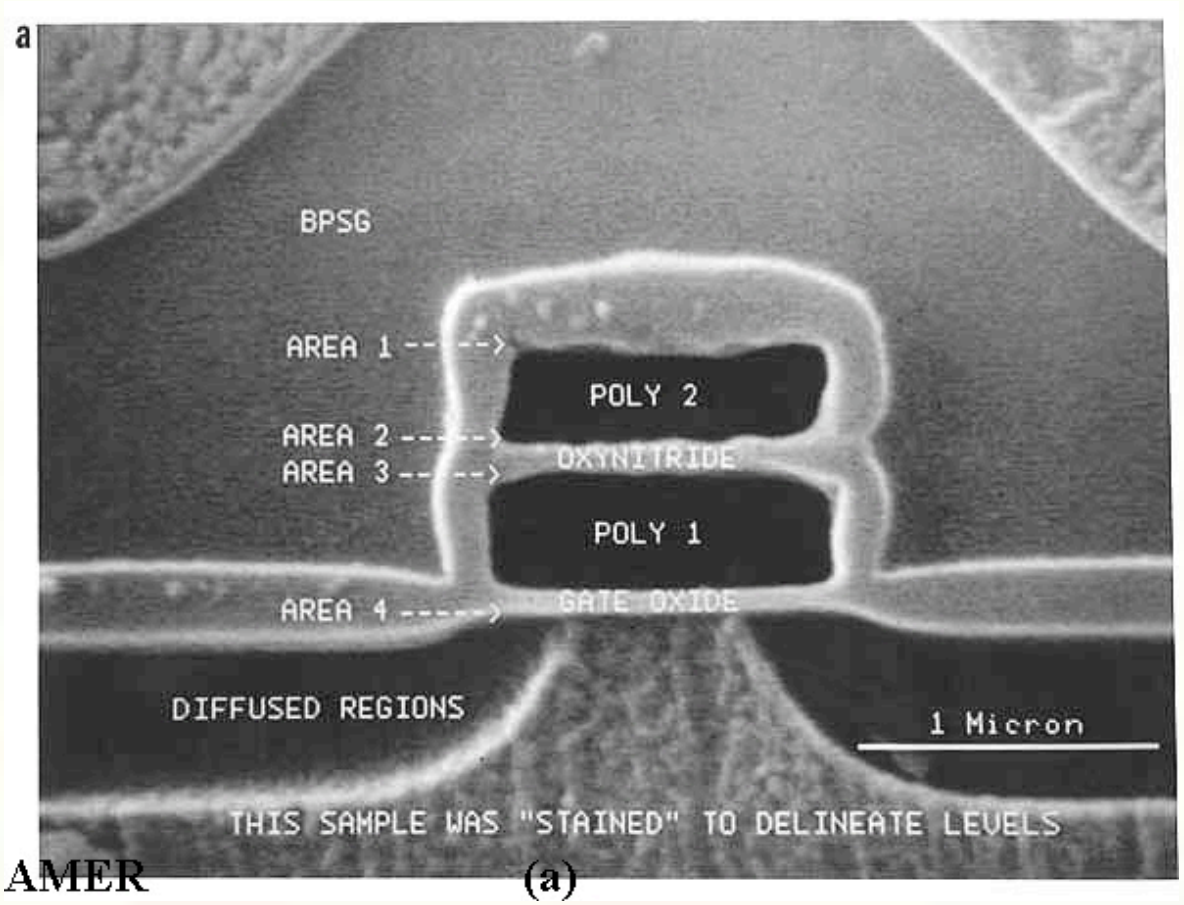


Transistors

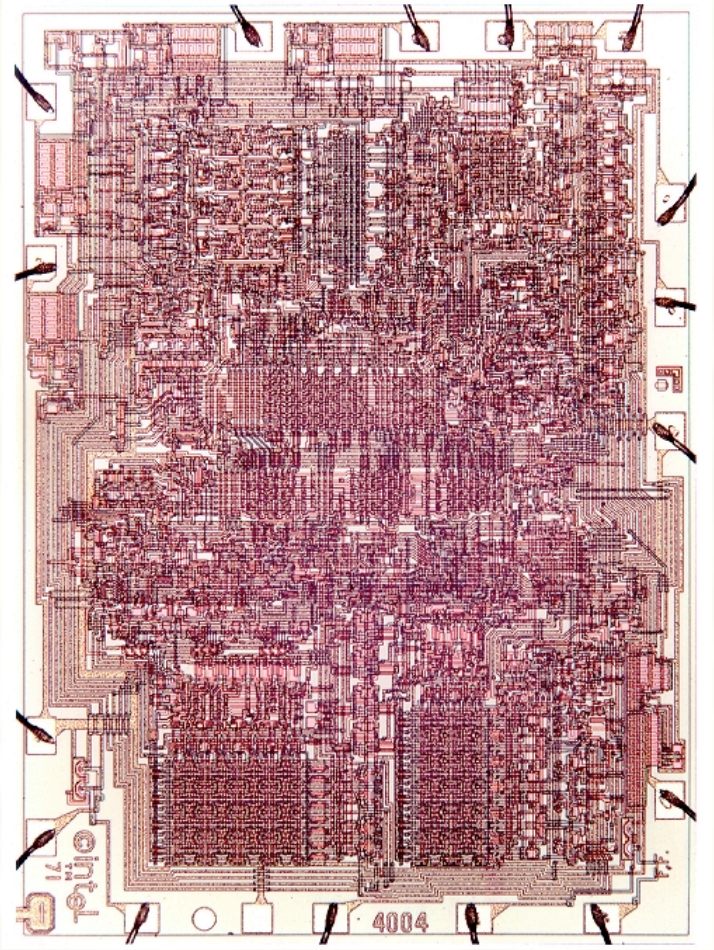


Physics/Chemistry

The Mighty Transistor!

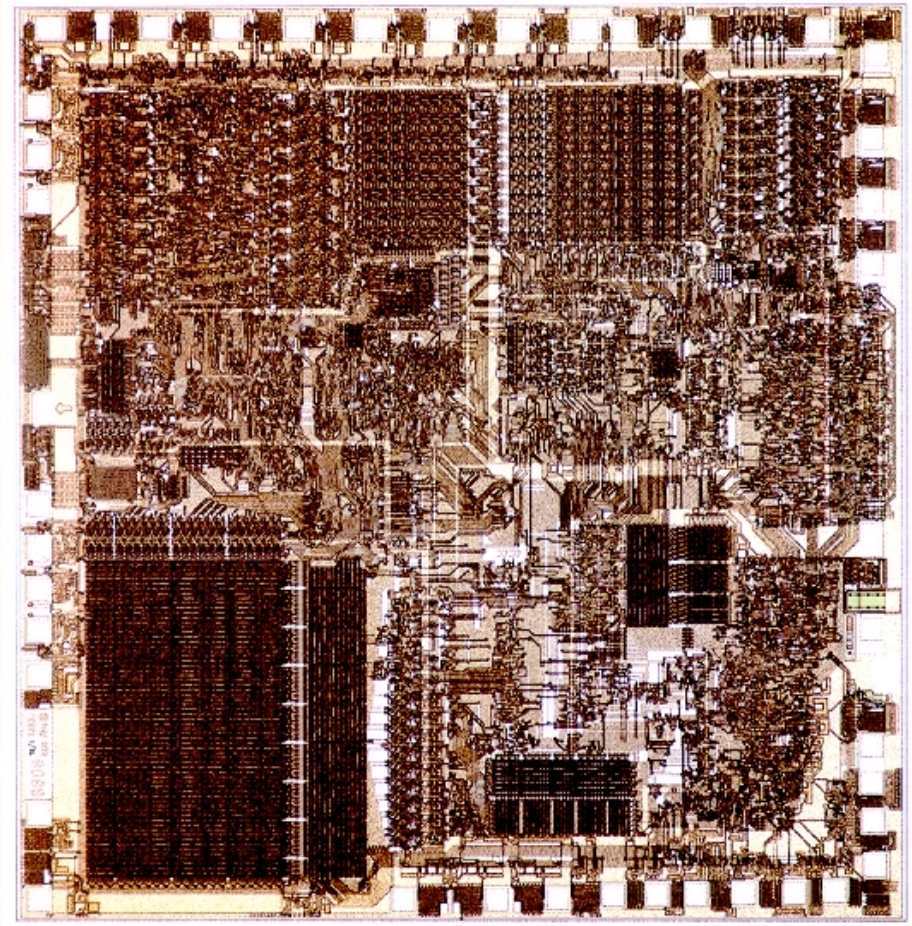


Intel 4004 - 1971



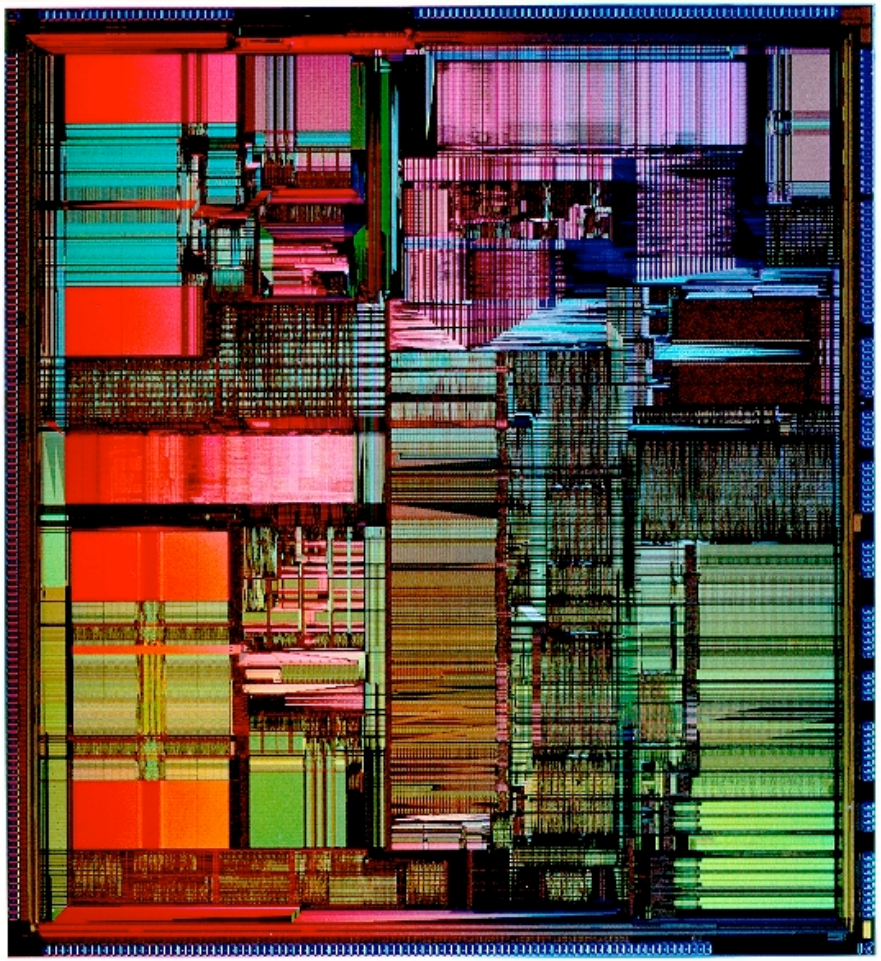
- The first microprocessor
- 2,300 transistors
- 108 KHz
- 10μm process

Intel 8086 - 1978



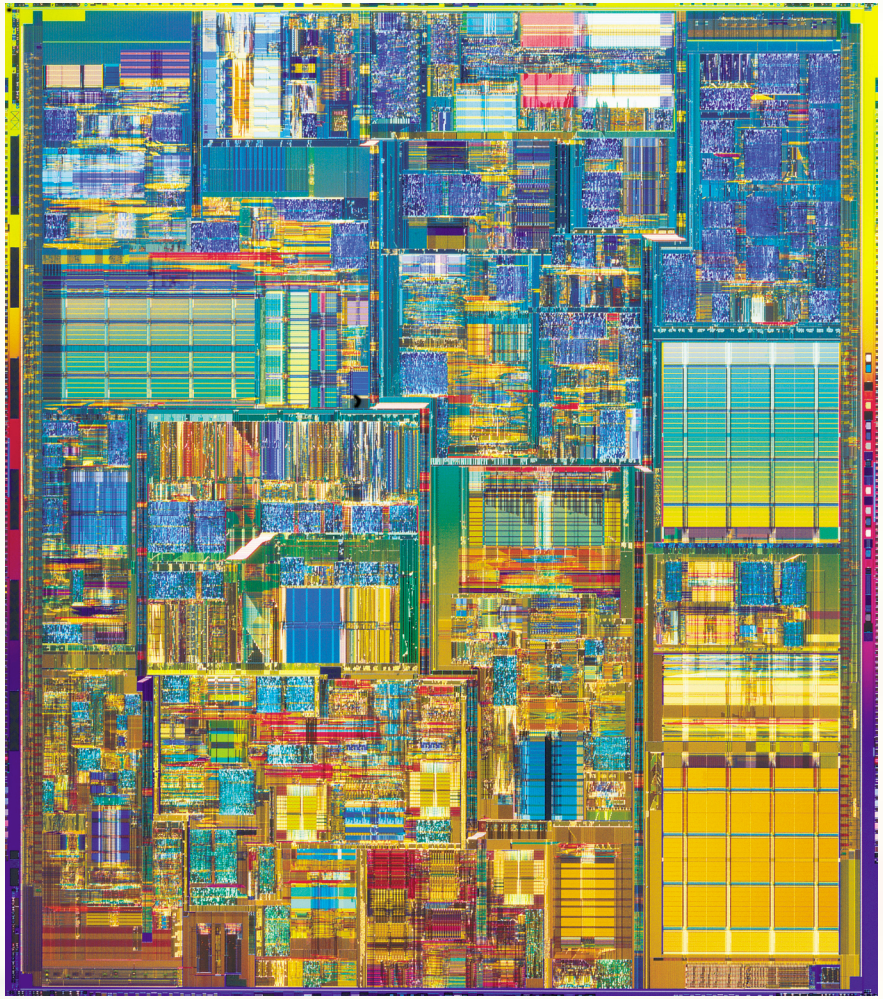
- IBM PC processor
- 29,000 transistors
- 10 MHz
- 3μm process

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



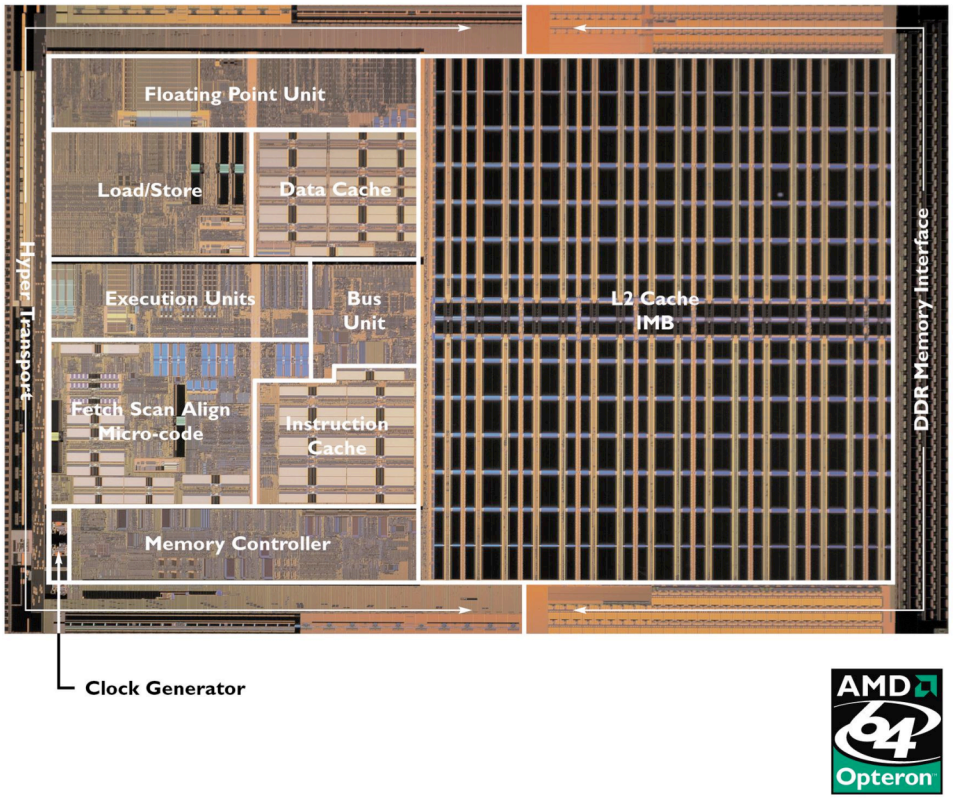
42 million transistors

2GHz

0.13µm process

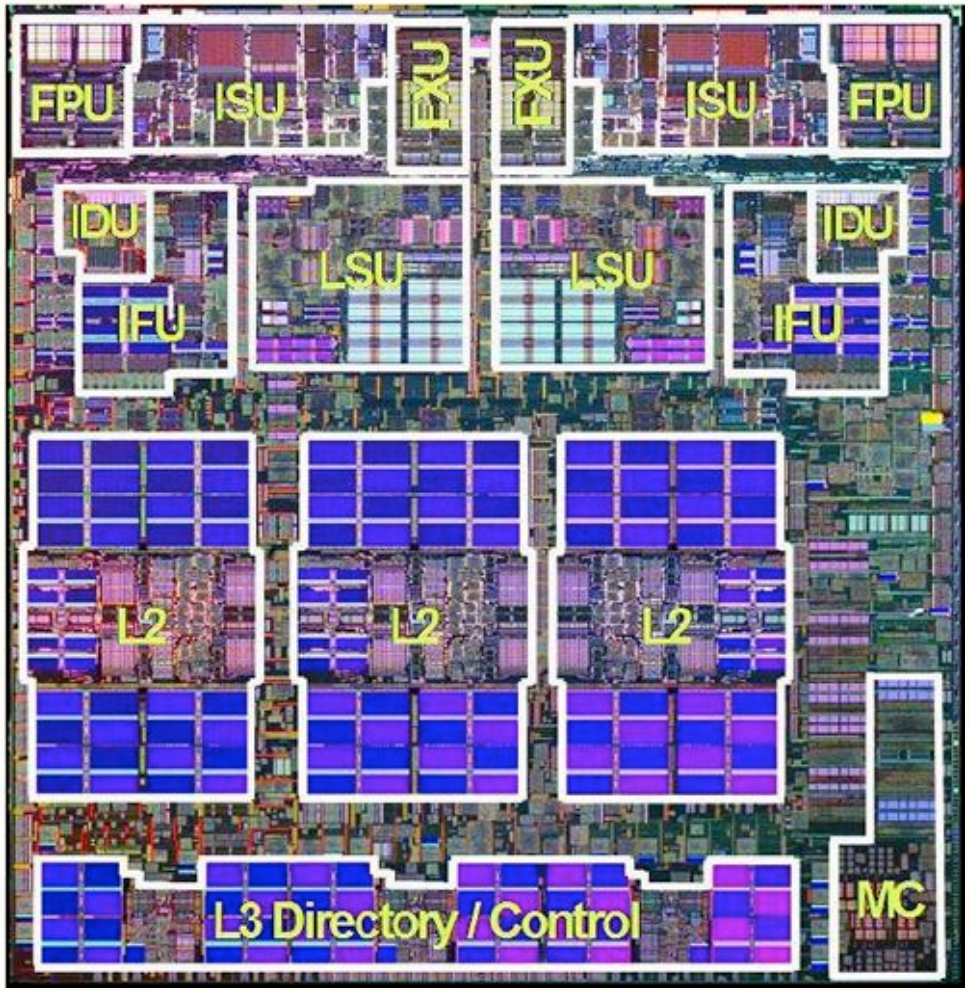
Could fit ~15,000
4004s on this chip!

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