Review of Chapter 2

2.1 Information Storage

- Binary, hexadecimal, decimal
- Bit, byte, word, double word
- Little endian, big endian
- Boolean algebra, bit/logical/shift operation
- E.g: 0x50ea – 64=

  0110 & 1100=

  0110 && 1100=

2.2 Integer representation

- Unsigned encodings
- 2’s complement
- Signed vs unsigned
- E.g :

short int v = -5

unsigned short uv = (unsigned short) v;

print (“v = %d, uv = %u”, v, uv);

2.3 Integer Arithmetic

- Unsigned addition, subtraction, multiplication
- 2's complement addition, subtraction, multiplication
- Dividing by power of 2

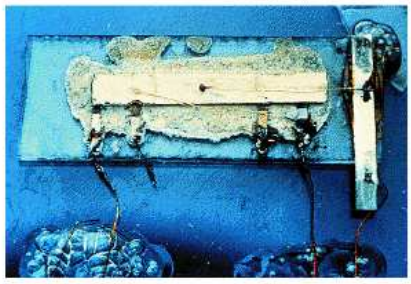
- Remember: mod 2^w

2.4 Floating point representation

- IEEE floating point representation
  - Sign bit
  - Significand M: normalized: 1+f; denormalized: f
  - Exponent E: normalized: e-bias; denormalized: 1-bias
- Rounding
  - Round to even: half way and not half way
  - Round toward zero
  - Round down
  - Round up

Brief history about Assembly Language

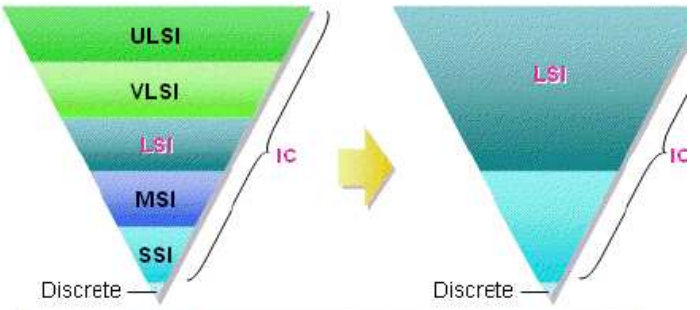
Transistors

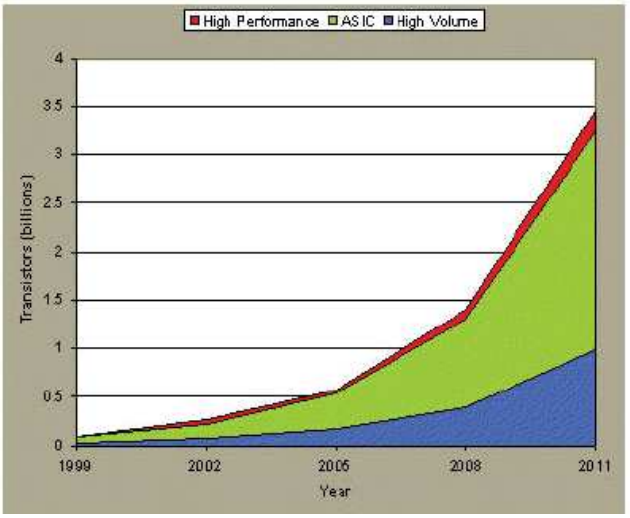


- Vacuum Tubes: A devise to control modify, and amplify electric signals
- Then can transistors
  - Designed by John Bardeen, Will Shockley, and Walter Brattain, scientists at the Bell Telephone Laboratories in Murray Hill, New Jersey - 1947
- In 1960 Jack Kilby and Robert Noyce designed the first integrated circuit (IC)
- Fairchild company manufactured logic gates

Integrated Circuits

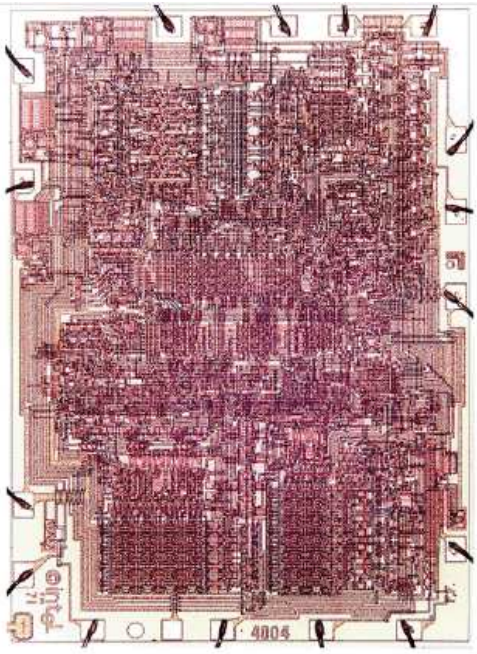
- Advances in manufacturing allowed packing more transistors on a single chip
- Transistors and Integrated Circuits from SSI (Small-Scale Integration) to ULSI
- Birth of a microprocessor and its revolutionary impact

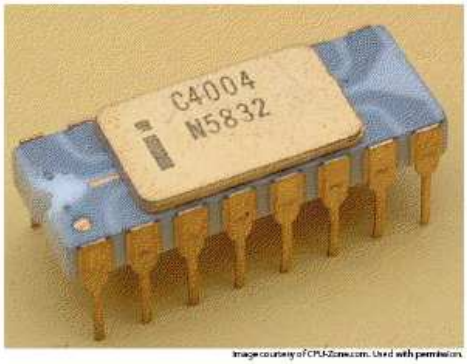




Microprocessors

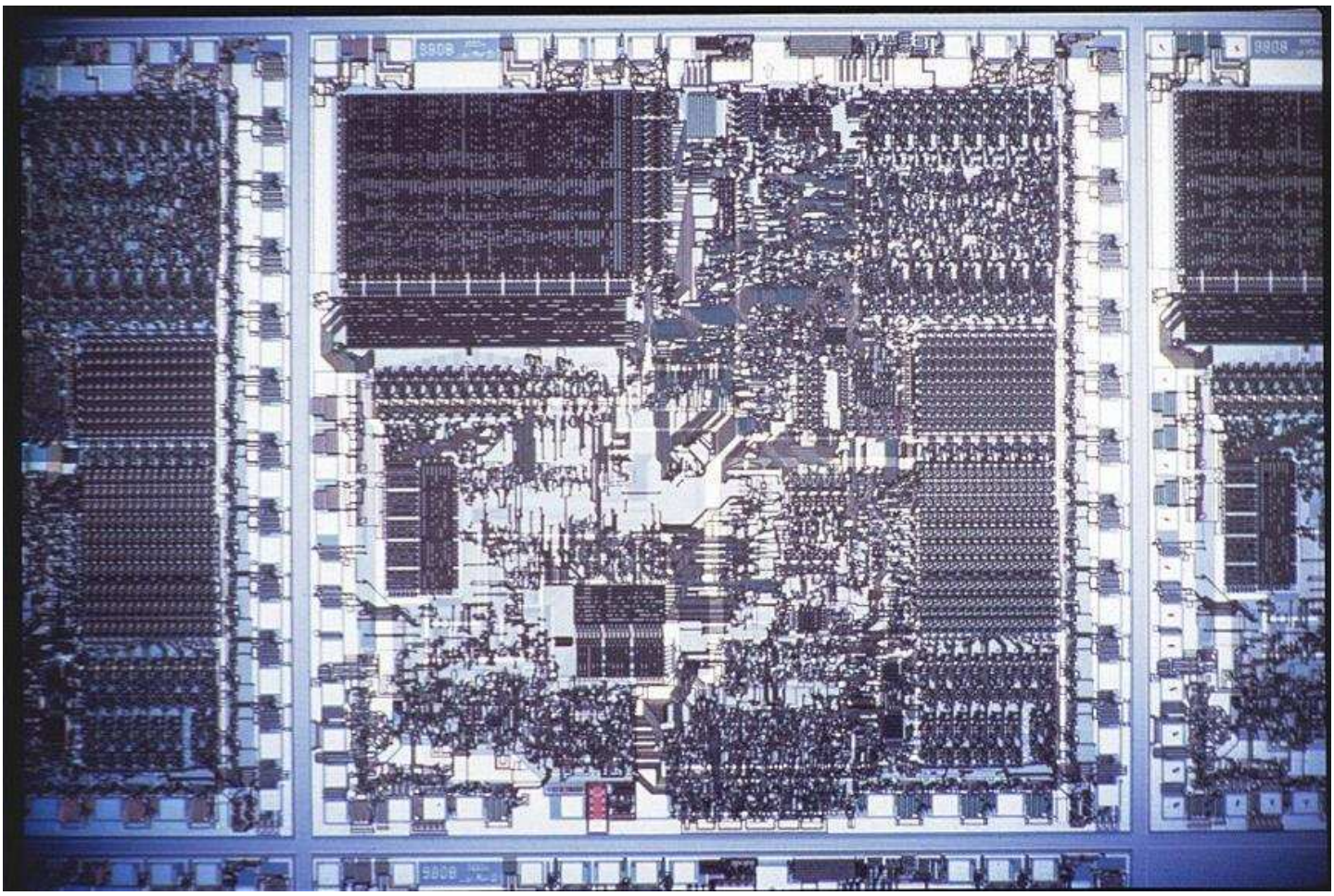
- Noyce and Gordon Moore started Intel
- Intel designed he first calculator
- Intel designed the first programmable calculator
- Intel designed the first microprocessor in 1971
  - Model 4004
  - 4-bit; 2300 transistors, 640 bytes of memory, 108 KHz clock speed





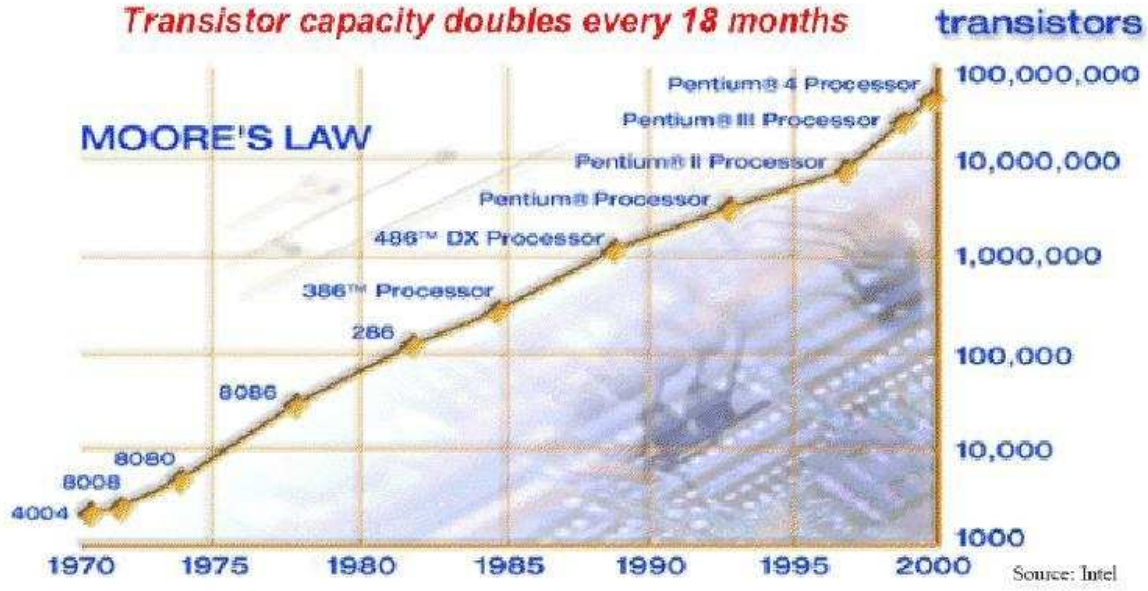
- Later 8008 as an 8 bit µprocessor then 8080 and Motorola 6800.
- 8080 was 10x faster than 8008
- 1978, 8086 microprocessors 16 bit. Addressed 1M byte of memory. Small instruction cache (4-6 bytes). 8087 floating-point coprocessor.

Intel 8086:



- In 1982, 80286 released, identical to 8086 except the adding more addressing modes and higher clock speed.
- i386: 1985, 32 bit microprocessor era.
- 1989, i486 = 80386 +80387co processor + 8KB cache
- 1993, Pentium (80586). Includes 2 execution engines.
- 1995, Pentium Pro included 256K Level 2 cache mechanism as well as Level 1 cache.
- 1997, Pentium 2 included L2 cache on its circuit board (called slot)
- Later Pentium 3 and 4 released with several architectural and technological innovations.

Evolution of CPUs



In 1965, Gordon Moore, co-founder of Intel, indicated that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future.

Instruction Format:

- A typical 386 instruction has the form:

Opcode src, dst

what to do **input source** **result destination**

A suffix on the opcode indicates the size of the data that is being operated on:

- 32 bit values use the suffix l(ong);
- 16 bit values use the suffix w(ord);
- 8 bit values use the suffix b(yte).

- We'll only be using the 32 bit instructions .

Addressing Modes:

- How do we tell the assembler where data comes from?
- Register accesses (reg):
  - %eax: The value in register eax: movl %eax,%edx
- Memory accesses (mem):
  - 8(%eax): the value at the memory location formed by adding 8 and the contents of the eax register:

  movl 8(%eax), %edx
- Immediate (immed):
  - $123: the constant value, 123: movl $123, %edx