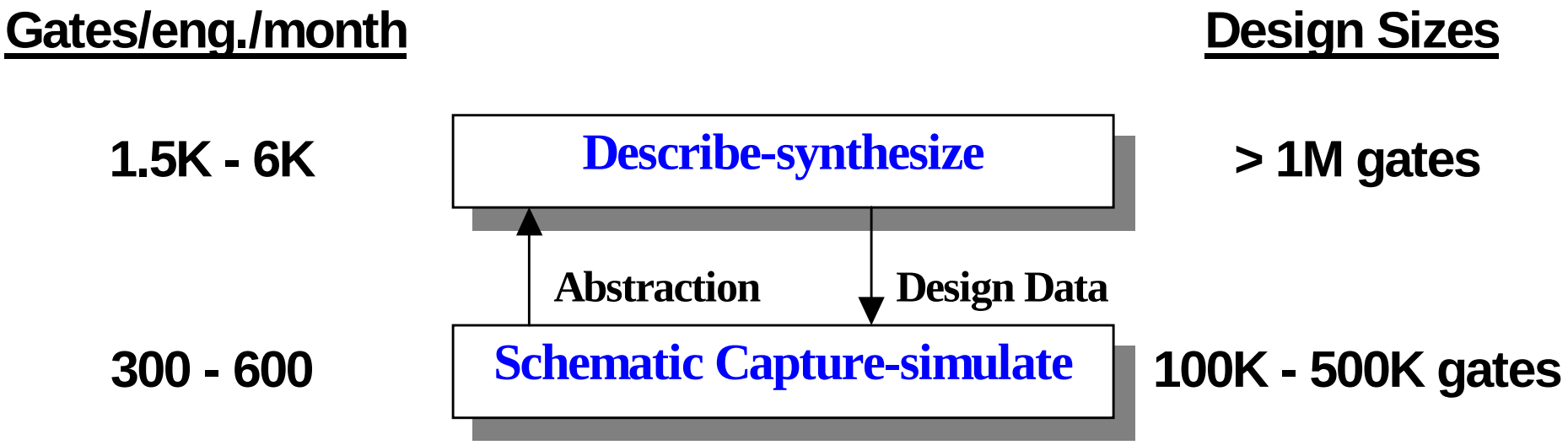

EECS 318 CAD
Computer Aided Design
LECTURE 1: Introduction

CAD Design approaches

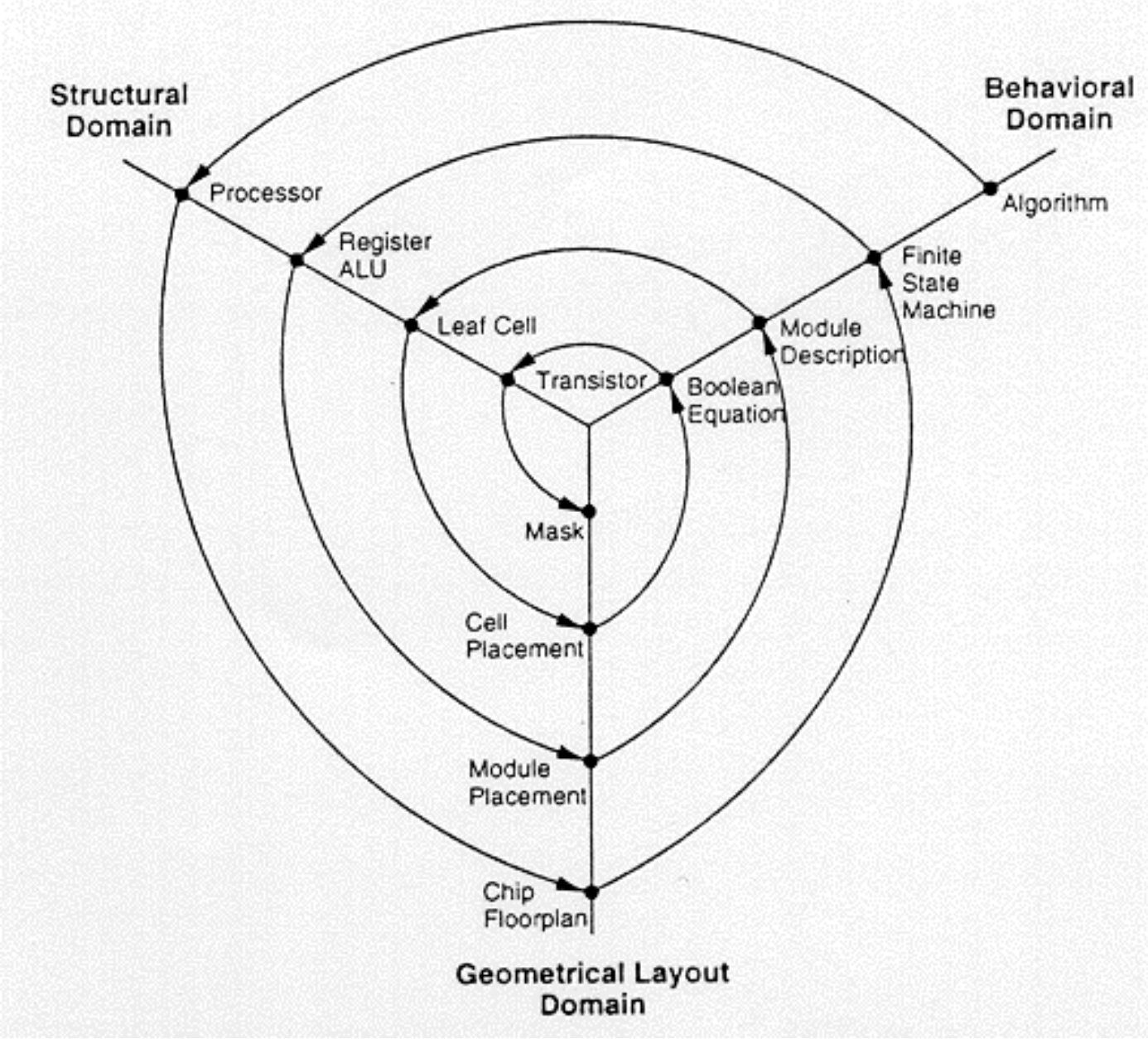
- Goal of each CAD design flow methodology is to increase productivity of the design engineer
- Increasing the abstraction level of the design methodology and tools is one approach:



SoC: System on a Chip

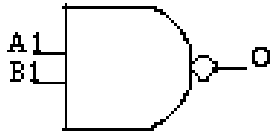
- The 2001 prediction: SoC's will be > 12M gates
- How do you create million gate ASICs with same amount of resources?
  - ...while
    - Decrease development time
    - Increase functionality and performance
    - Keep small design teams
  - Design Methodology (Design flow)
  - Tools that support the Methodology
  - IP reuse (Intellectual Property)

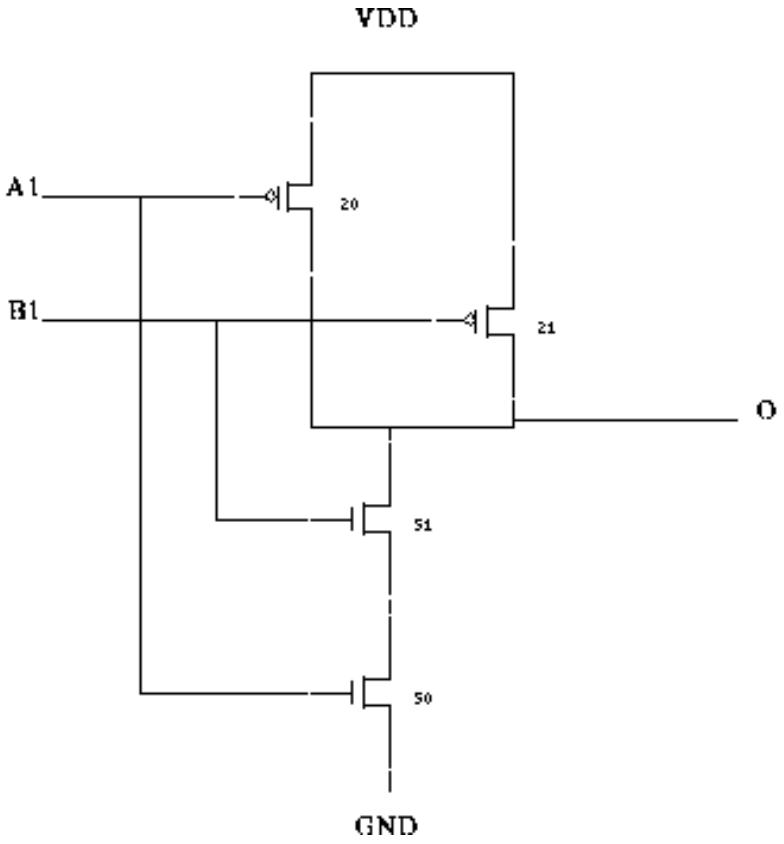
ASIC and SoC Design flow

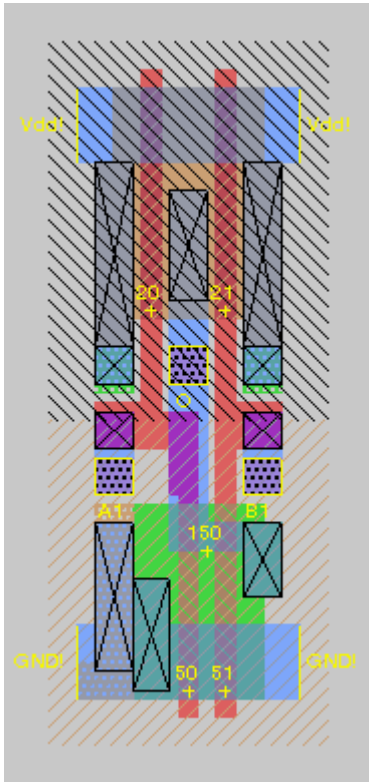


Nand gate: behaviorial, transistor, layout

O <= NOT (A1 AND B1);



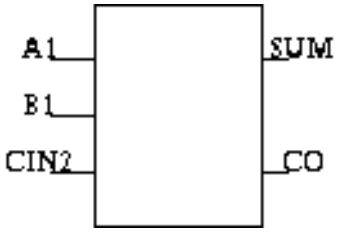




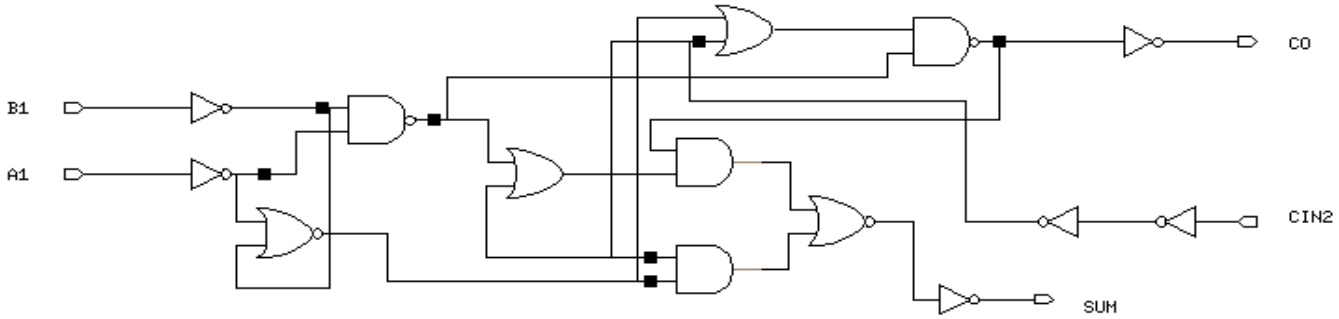
Boolean Equation **Transistor** **Mask**

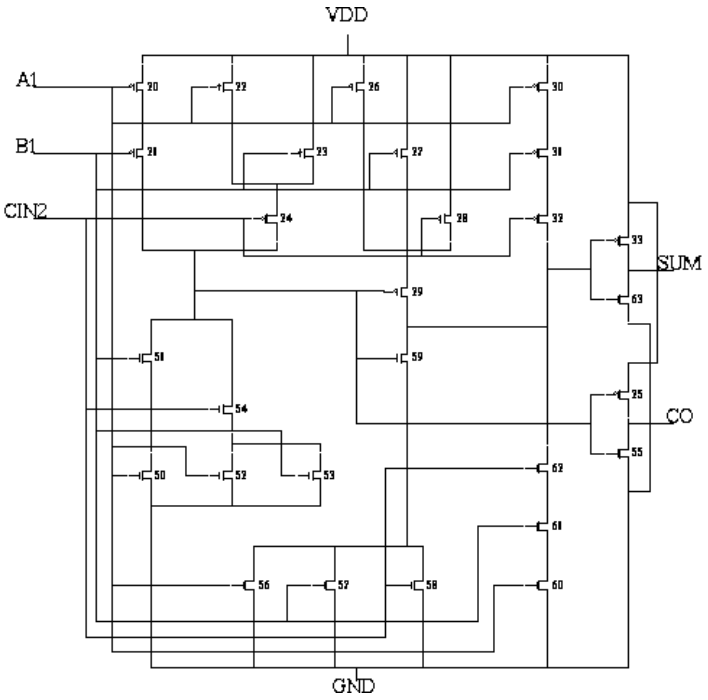
Adder: behavior, netlist, transistor, layout

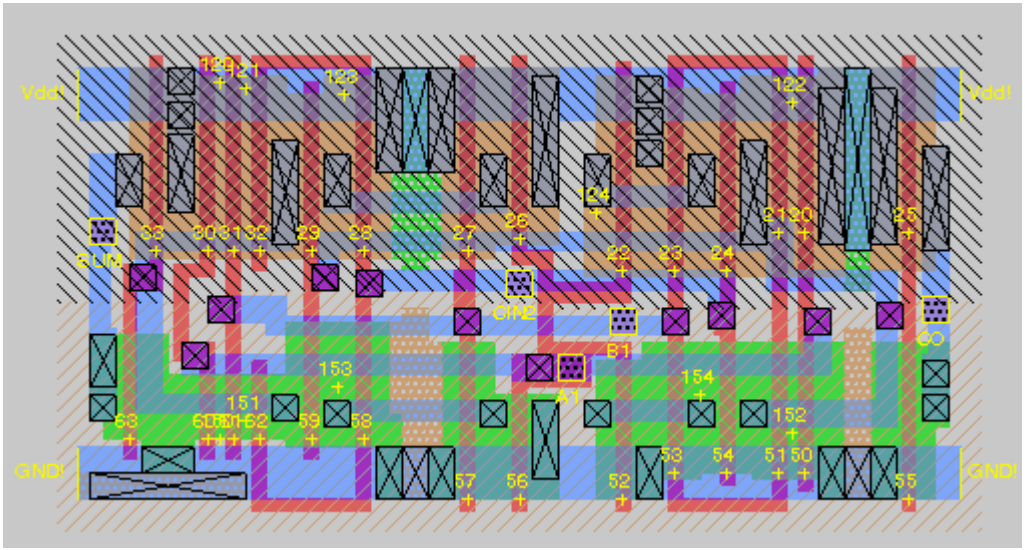
Behavioral model



Structural model





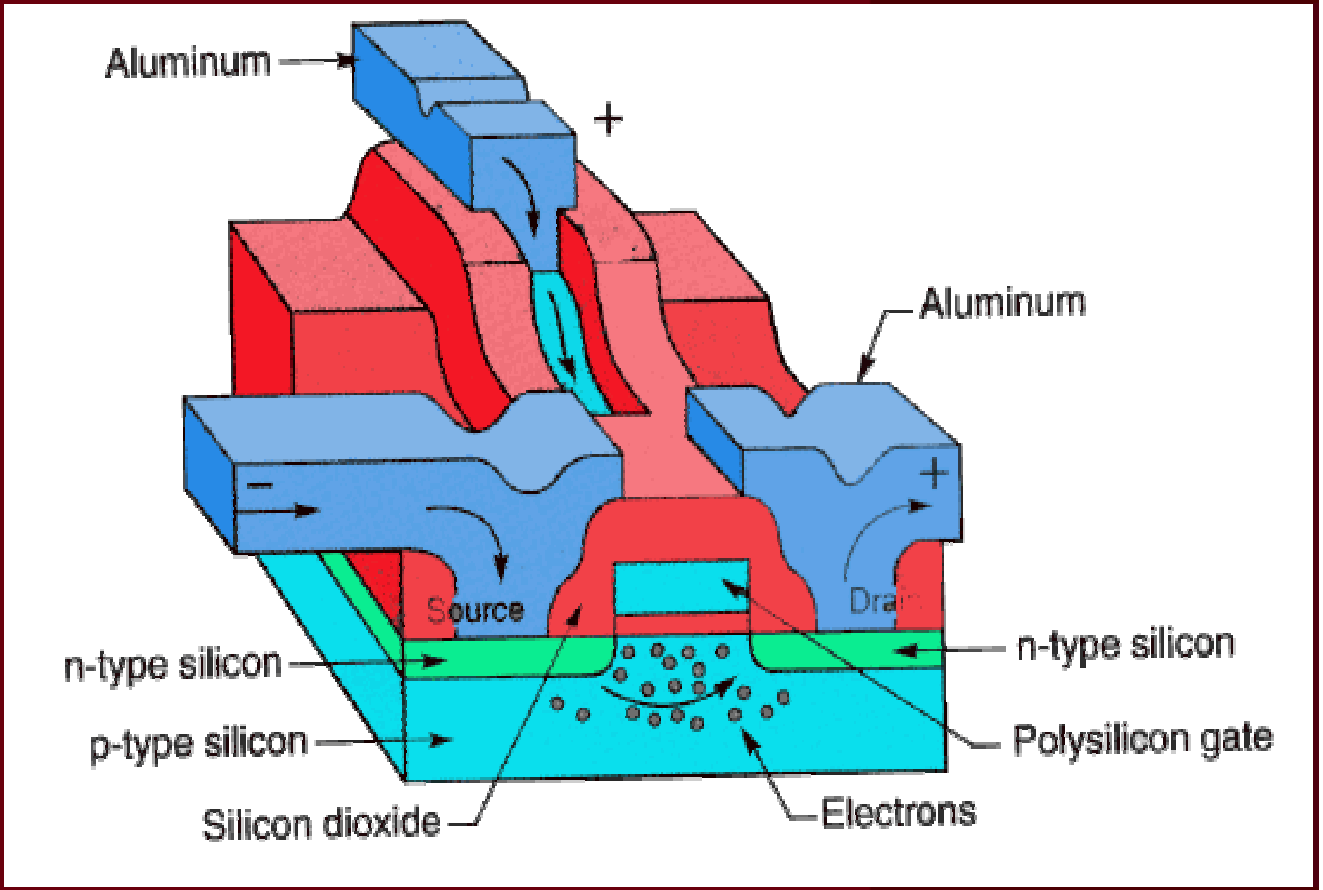


Review

- To appreciate why we need high level design techniques
- We need to look over the past 30 years of chip development and their growing complexity

Real transistor

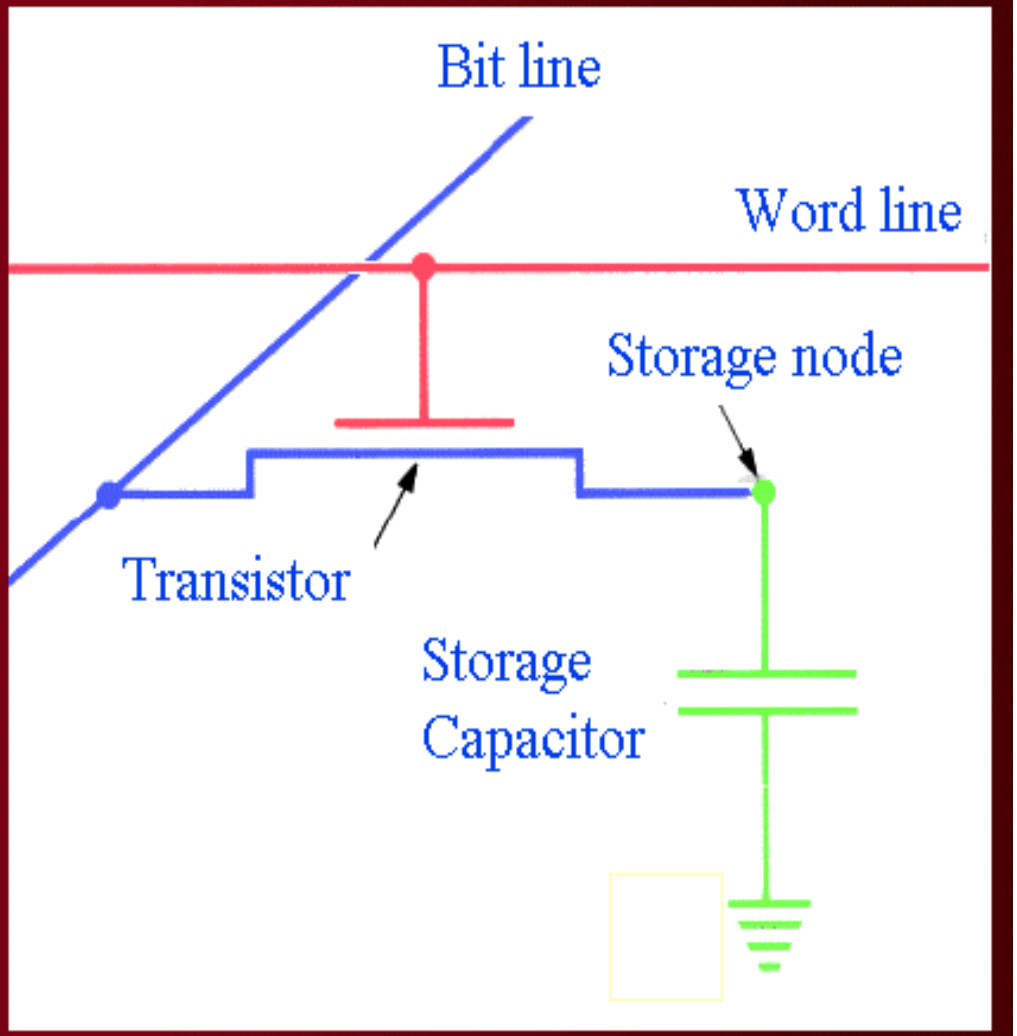
- 3-D structure
- Real materials



Ref: http://www.msm.cam.ac.uk/dmg/teaching/m101999/Ch8/index.htm

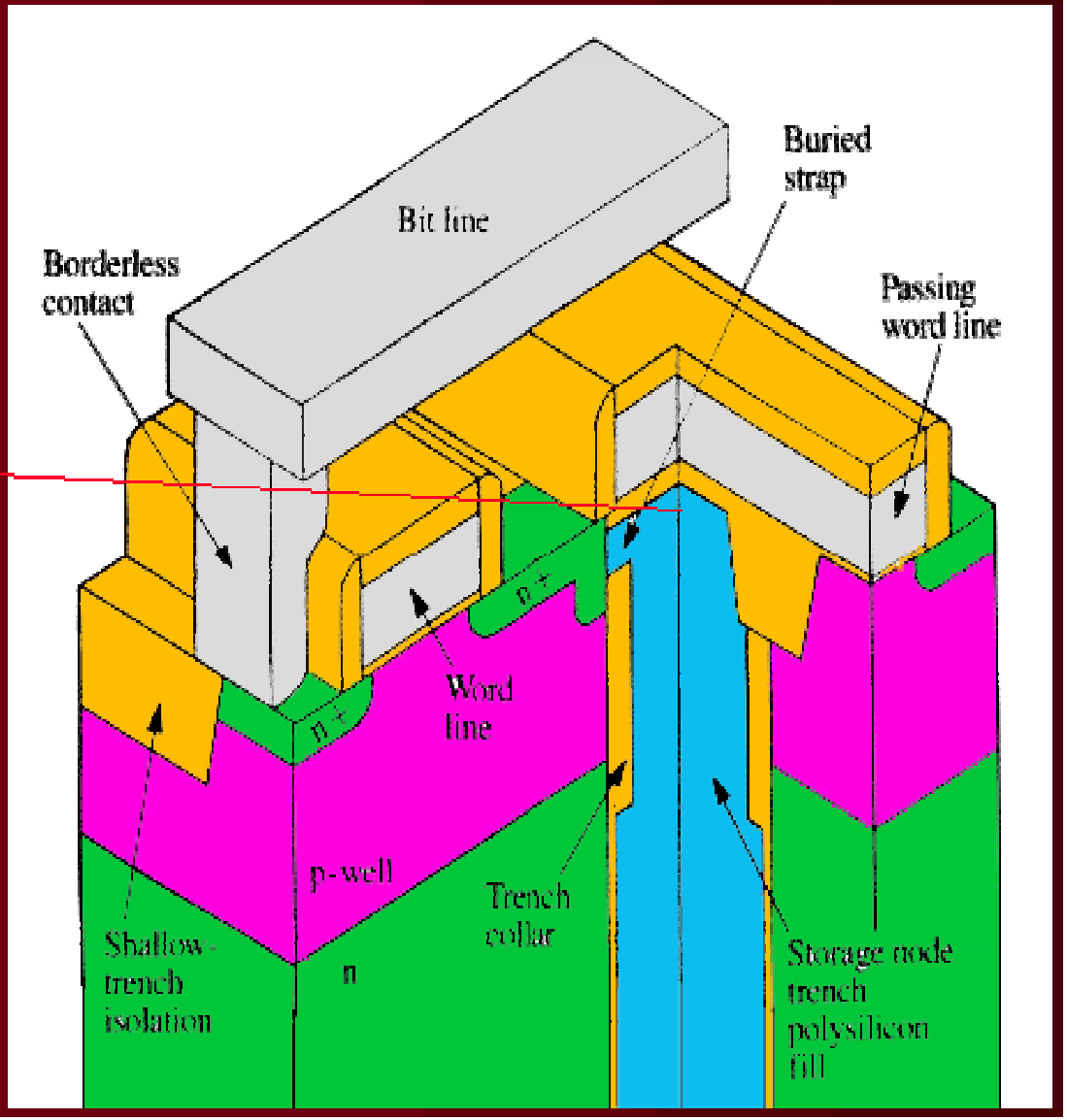
Basic DRAM design

- DRAM replaces all but one transitors of flip-flop with a capacitor
- => smaller!
- Capacitor stores information
- Charge leakage requires periodic refreshment (sense & rewrite)



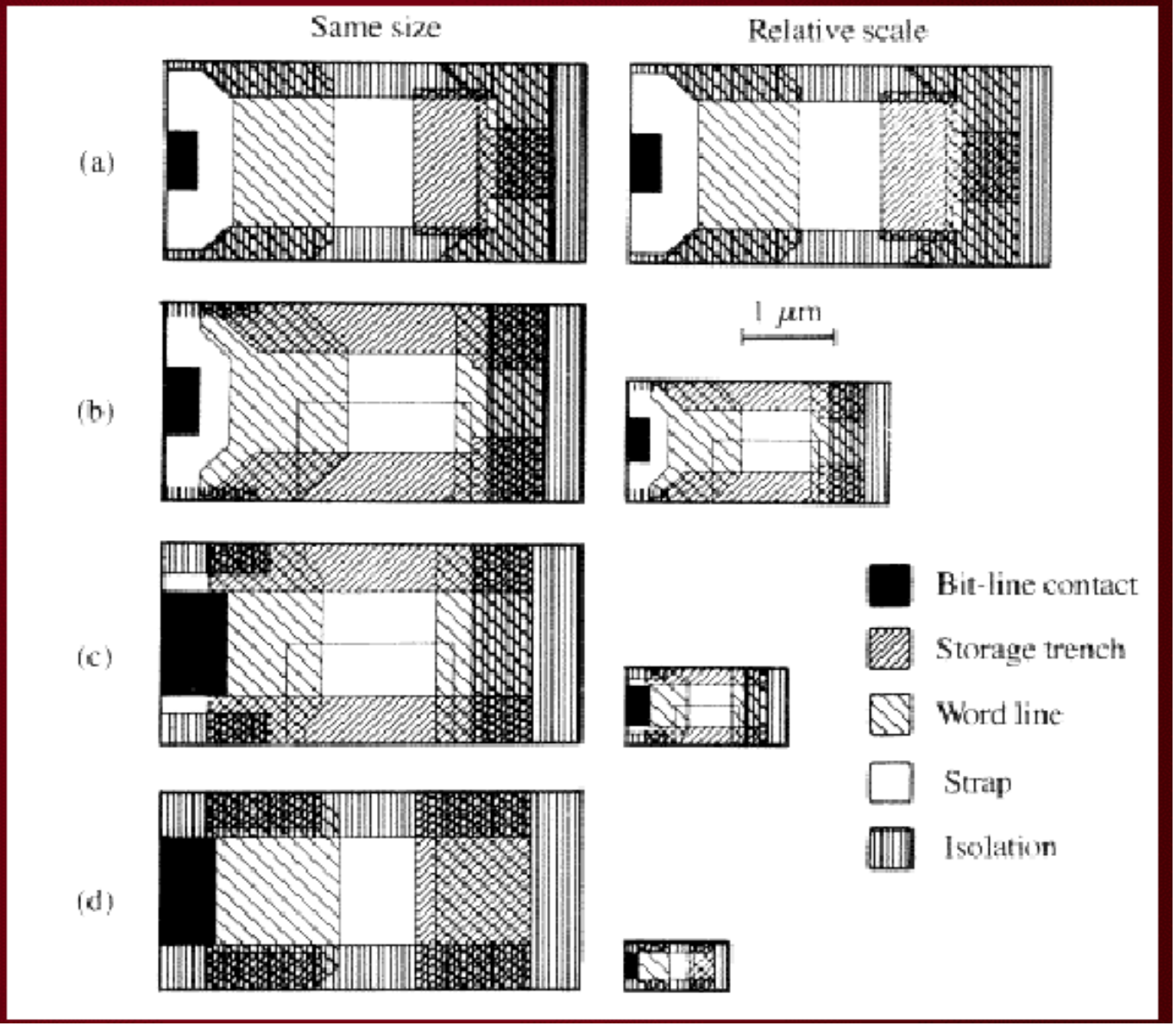
256Mb DRAM

- Increased vertical integration
- Word line passes over capacitor and contact
- Cell area ~0.5μm^2
- Capacitor area smaller - dielectric must be thinner
- =>higher quality dielectric required

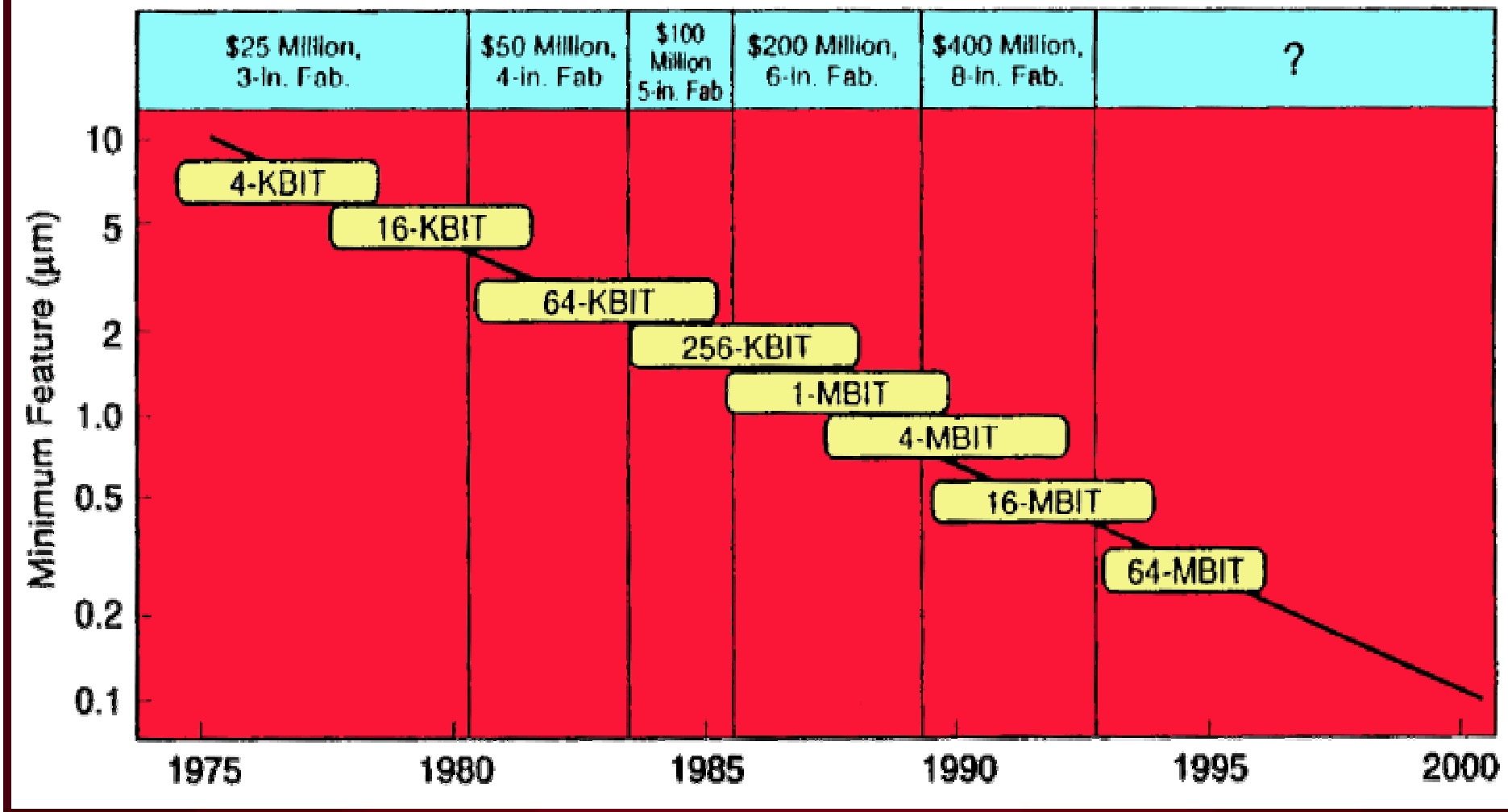


Memory Technology: DRAM Evolution

DRAM evolution (II)

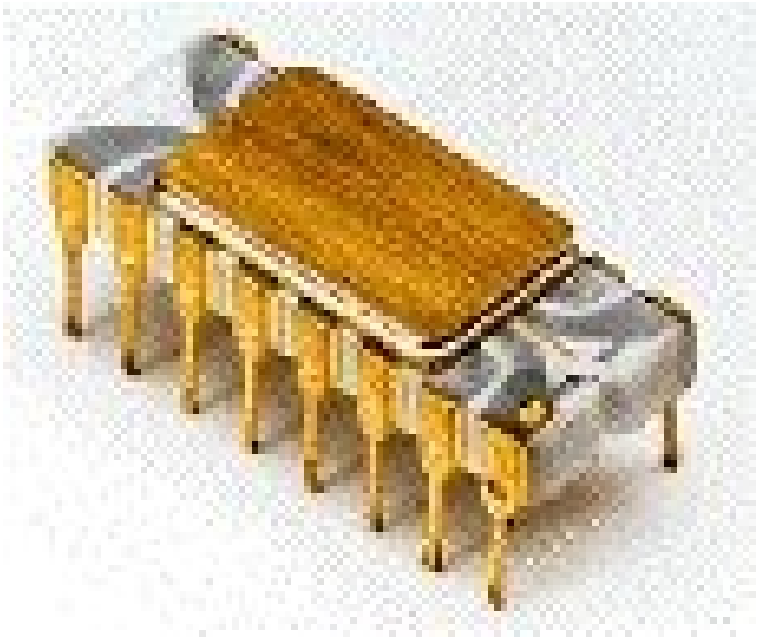


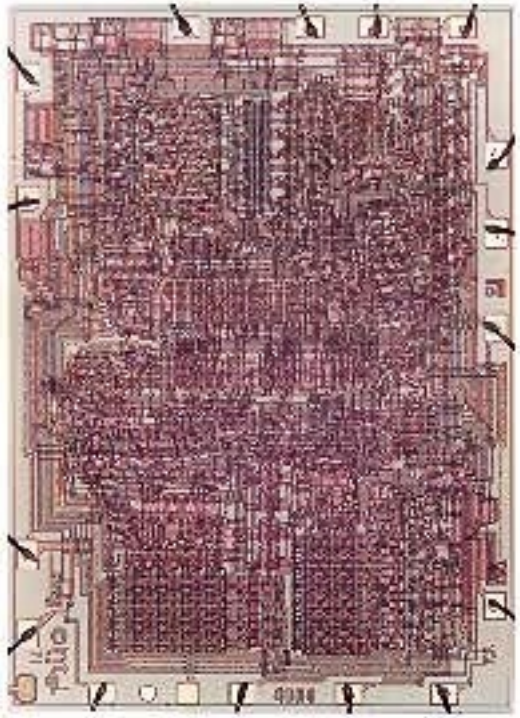
DRAM development



SoC: Intel Microprocessor History: 4004

- 1971 Intel 4004, 4-bit, 0.74 Mhz, 16 pins, 2250 Transistors

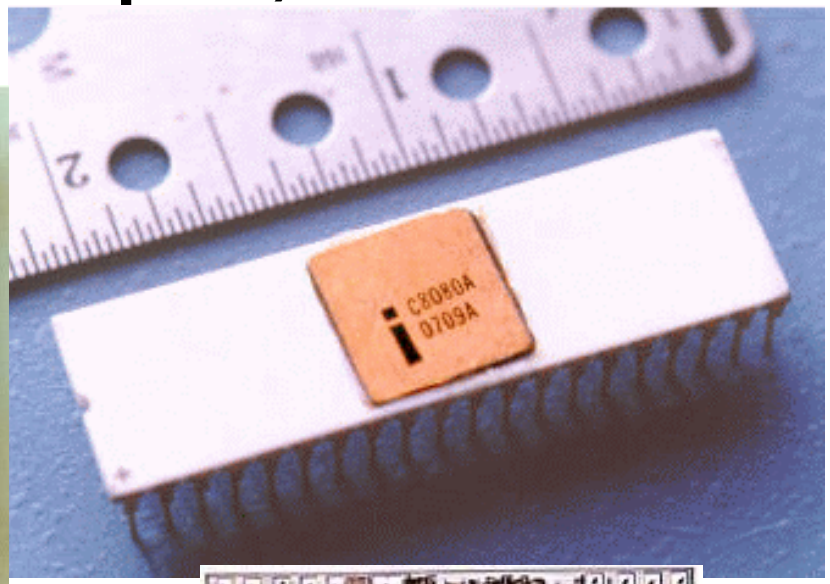


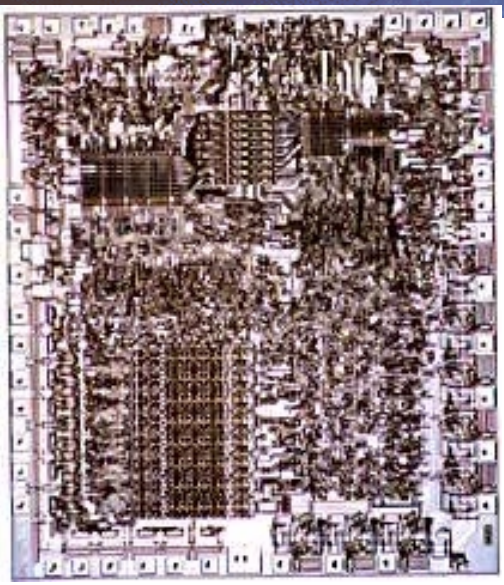


- Intel publicly introduced the world's first single chip microprocessor: U. S. Patent #3,821,715.
- Intel took the integrated circuit one step further, by placing CPU, memory, I/O on a single chip

SoC: Intel Microprocessor History: 8080

- 1974 Intel 8080, 8-bit, 2 Mhz, 40 pins,
  4500 Transistors



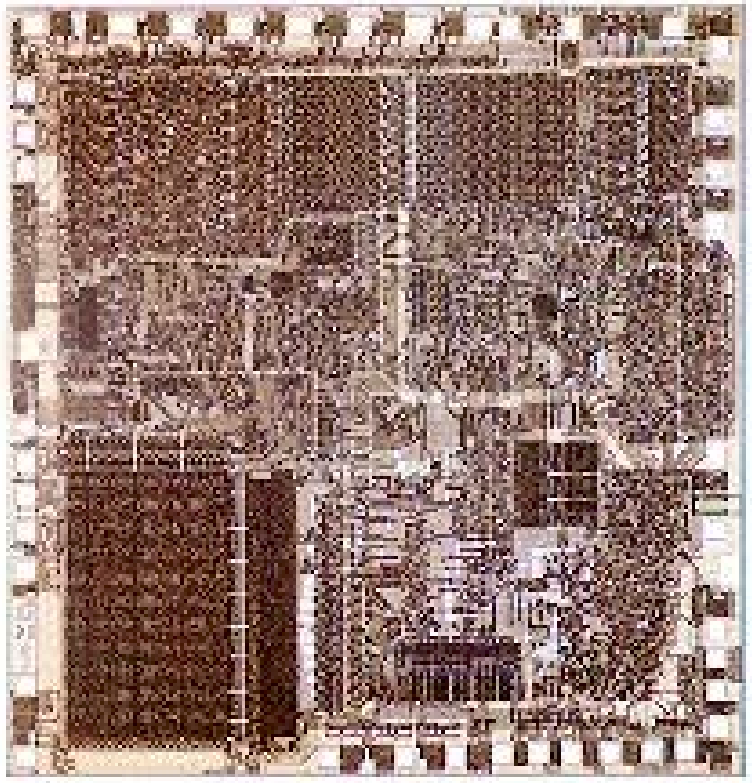


Bill Gates & Paul Allen

write their first Microsoft
software product: Basic

SoC: Intel Microrocessor History: 8088

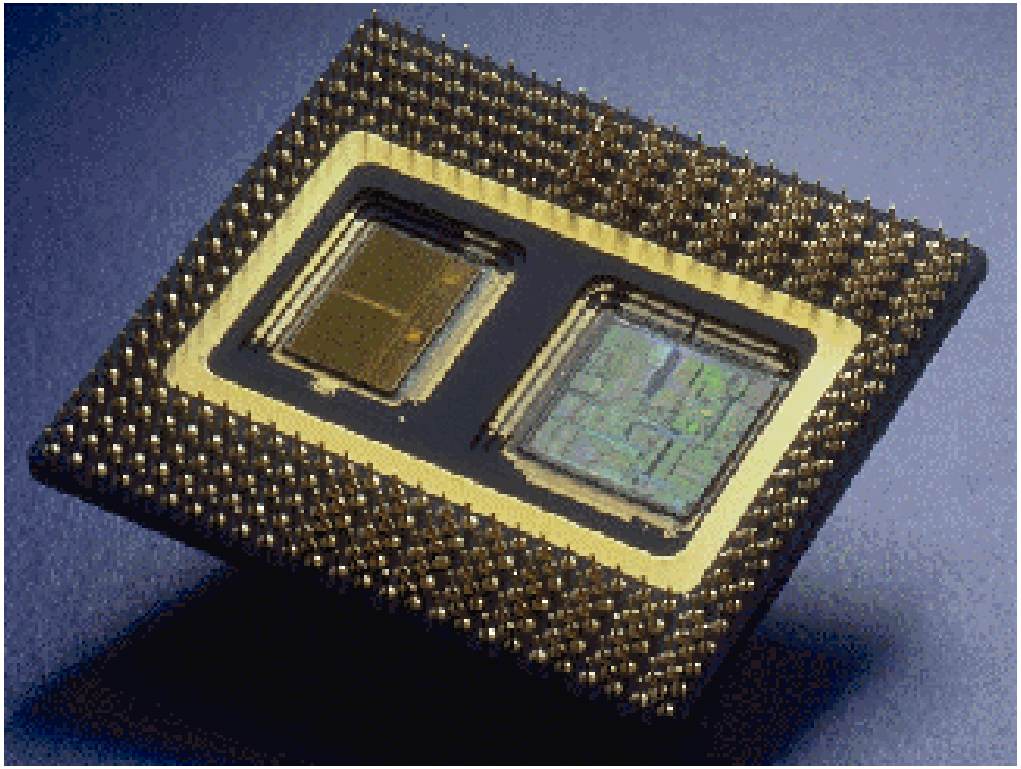
- 1979 Intel 8088, 16-bit internal, 8-bit external, 4.77 Mhz, 40 pins, 29000 Transistors

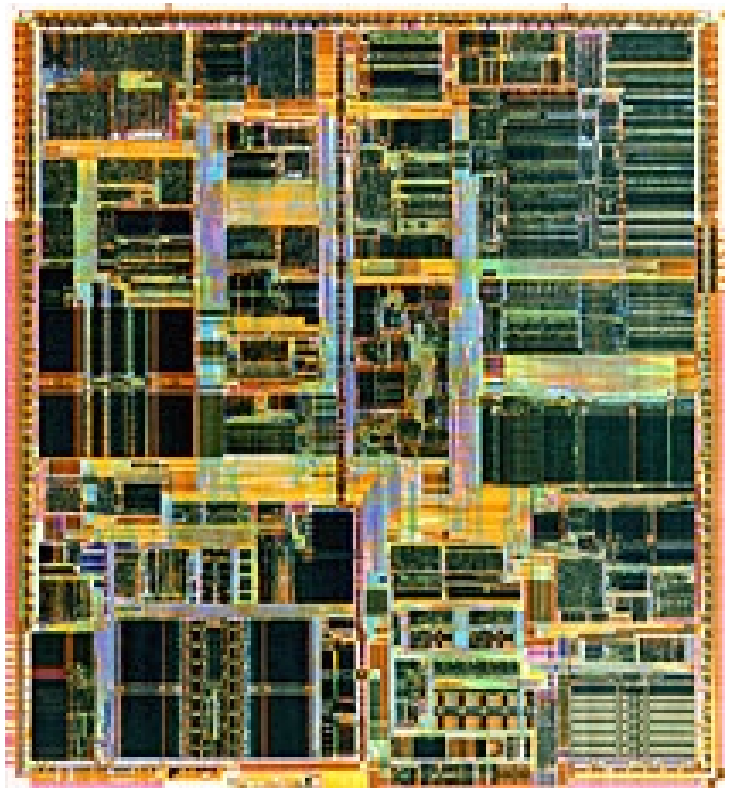


- 0.128M - 0.640M RAM
- 0.360Kb, 5.25” Floppy
- 10M Hard Disk

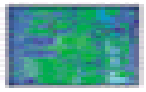
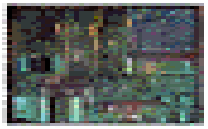
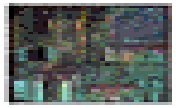
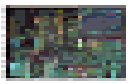
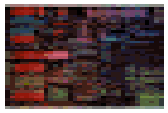
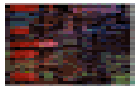
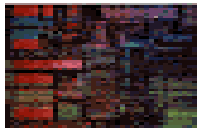
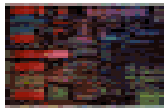
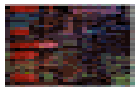
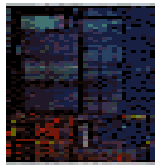
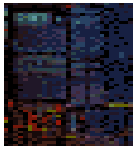
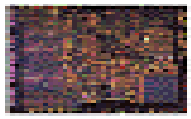
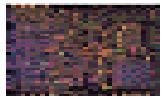
SoC: Intel Processor History: Penitum Pro

- **1995 Intel Pentium Pro, 32-bit ,200 Mhz internal clock, 66 Mhz external, Superpipelining, 16Kb L1 cache, 256Kb L2 cache, 387 pins, 5.5 Million Transistors**





Intel's microprocessor evolution

silicon process technology	1.5µ	1.0µ	0.8µ	0.6µ	0.35µ	0.25µ
Intel® Pentium® III processors						
Pentium® II processors						
Pentium® Pro processor						
Pentium® processor						
Intel486™ DX processor						
Intel386™ DX processor						

SoC: System on a chip (beyond Processor)

- **The 2001 prediction: SoC's will be > 12M gates**