1 - Introduction

ECE 474A/574A
COMPUTER-AIDED LOGIC DESIGN

Technology In Our Everyday Lives

Computers

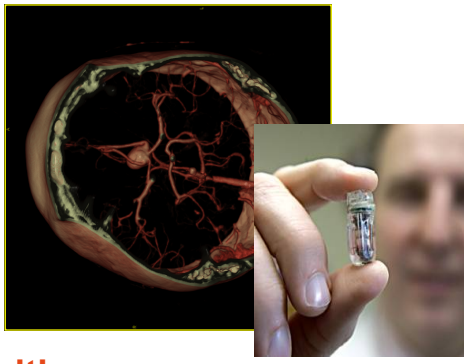
Rice Cookers

Military

Automotive

20-80 microprocessor controlling break systems, airbags, infotainment, safety, driver assistance, etc.

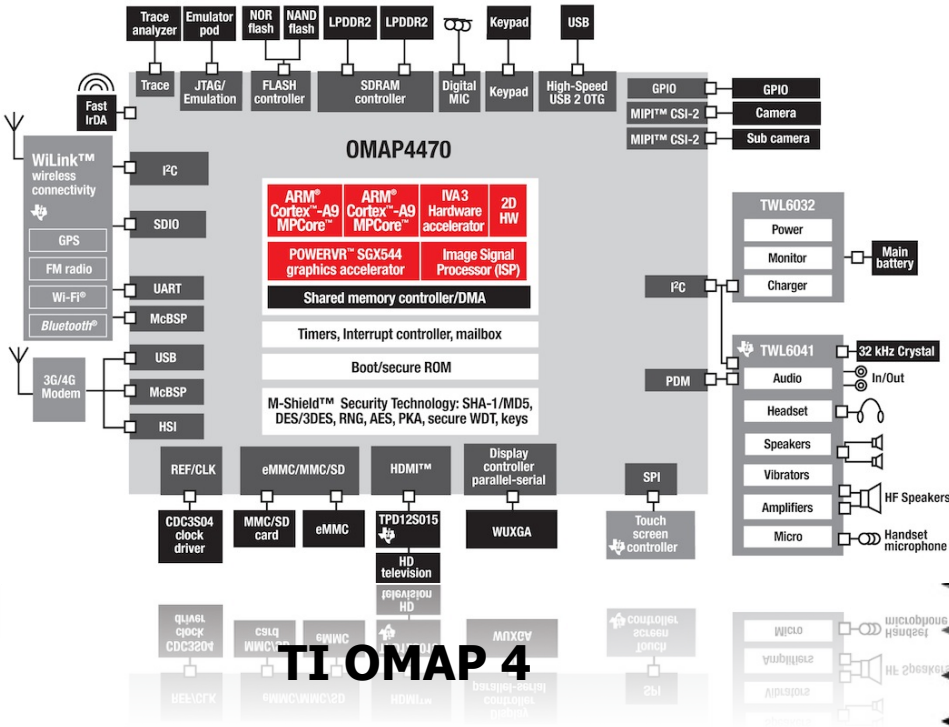
Entertainment



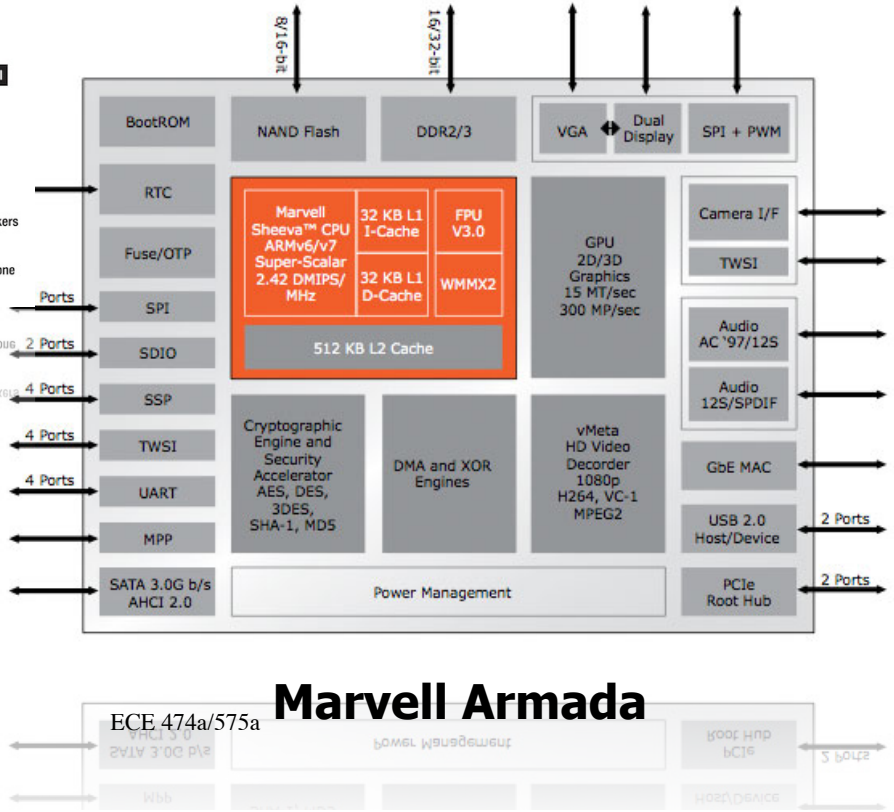
Healthcare

Smart Pills electronically track and instructed to deliver medicine to specific location, better imaging, remote surgery, etc.

What's Inside? Lot's of Hardware!!

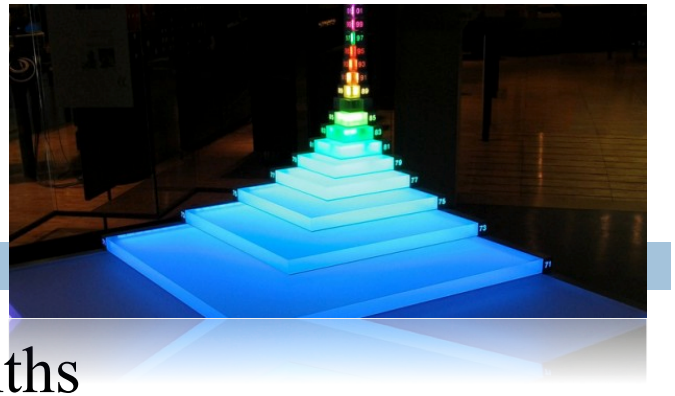


TI OMAP 4

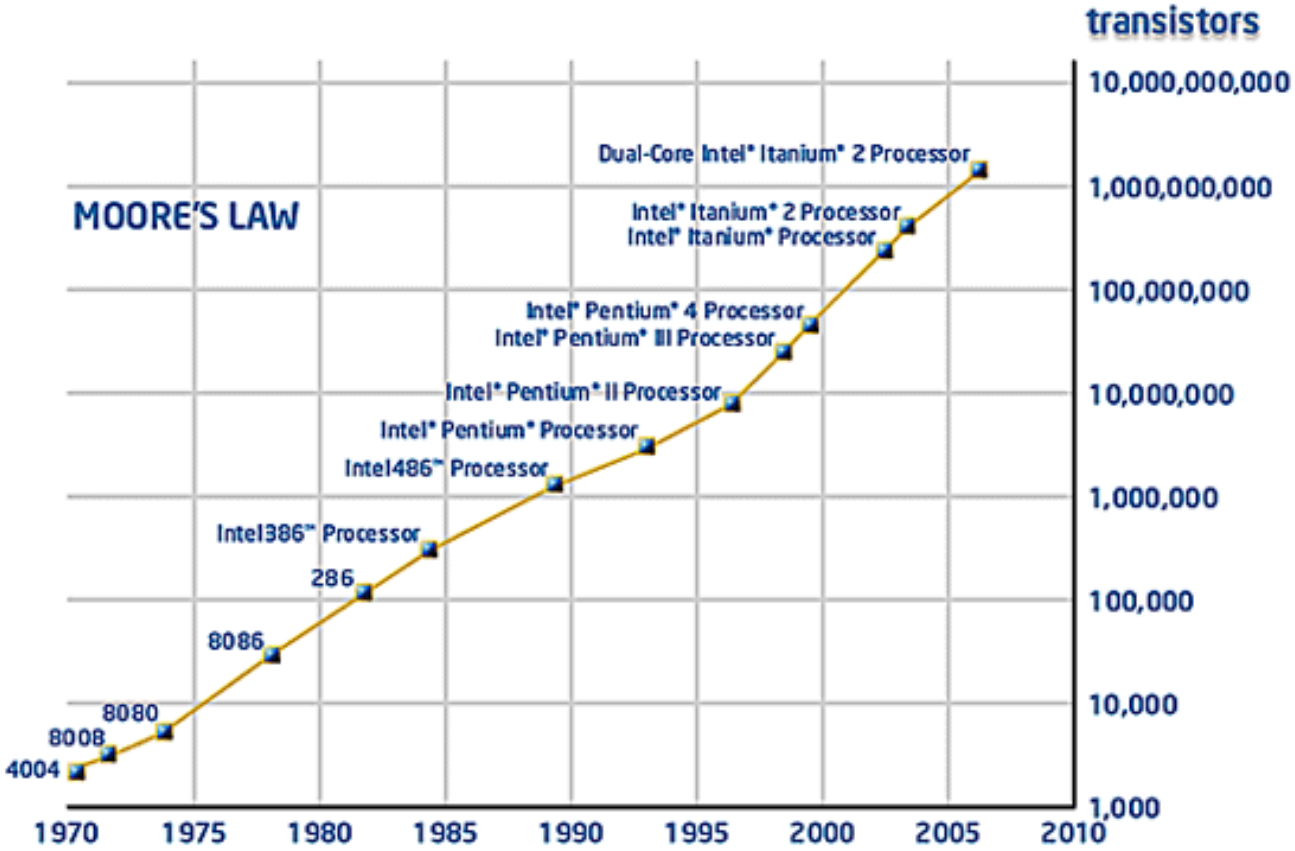


Marvell Armada

Moore's Law

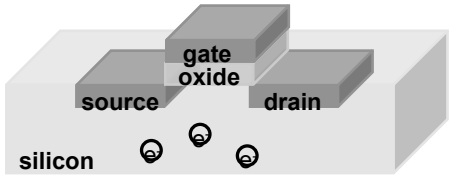


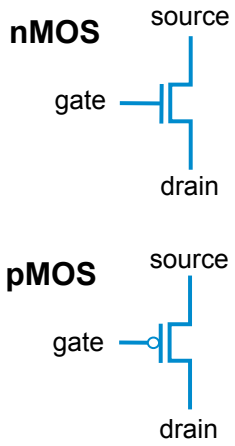
- Doubling of IC capacity every 18 months
  - Gordon Moore predicted trend in 1965 and continues today

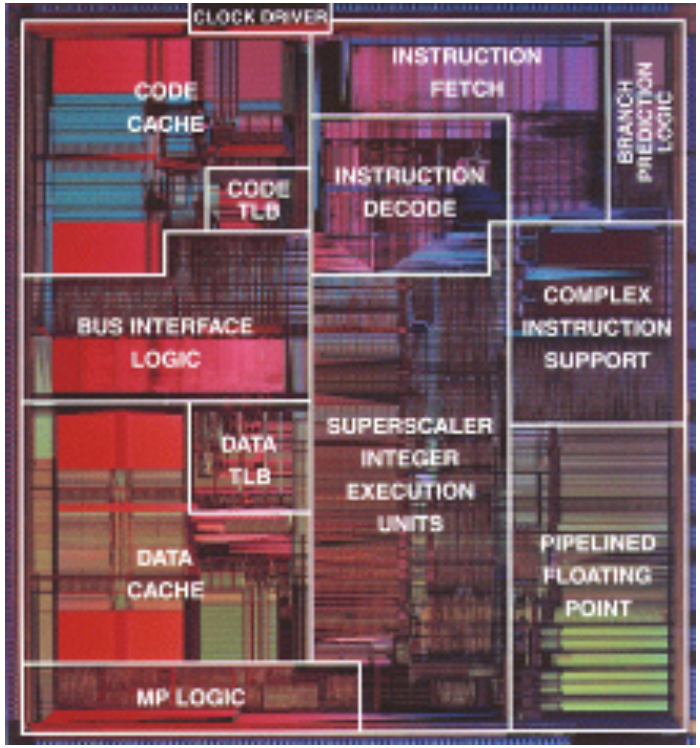


Increasing Number of Transistors

- What does Moore's Law mean?
  - Increasing functionality
  - Increased speed
  - Decreasing costs
  - More compactness



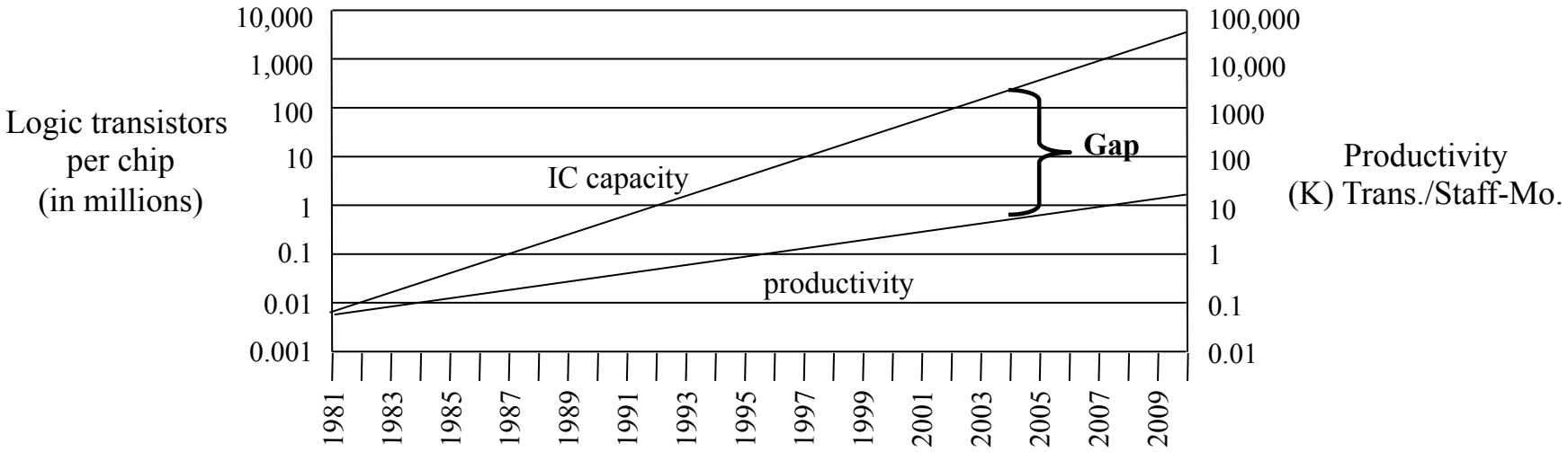




Pentium processor Die Photo

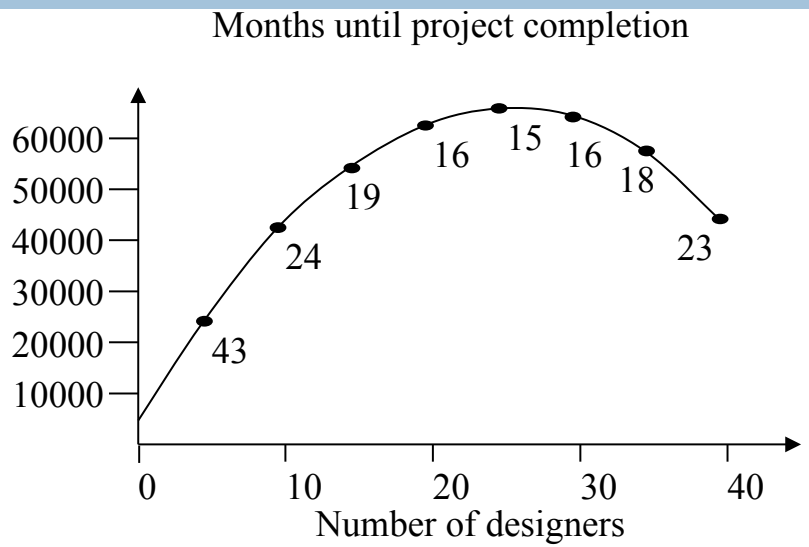
Design Productivity Gap

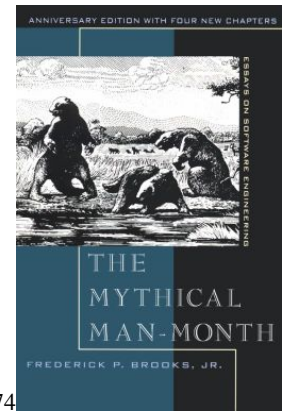
- The number of available transistors grows faster than the ability to design them meaningfully
  - Transistors available increase 58% per year
  - Designers are capable of using additional 21% per year



Can't We Just Hire More Designers?

- Adding designers to team should reduce project completion time
- In reality, productivity per designer decreases due to complexities of team management and communication
  - Mythical man-month
  - At some point, can actually lengthen project completion time!

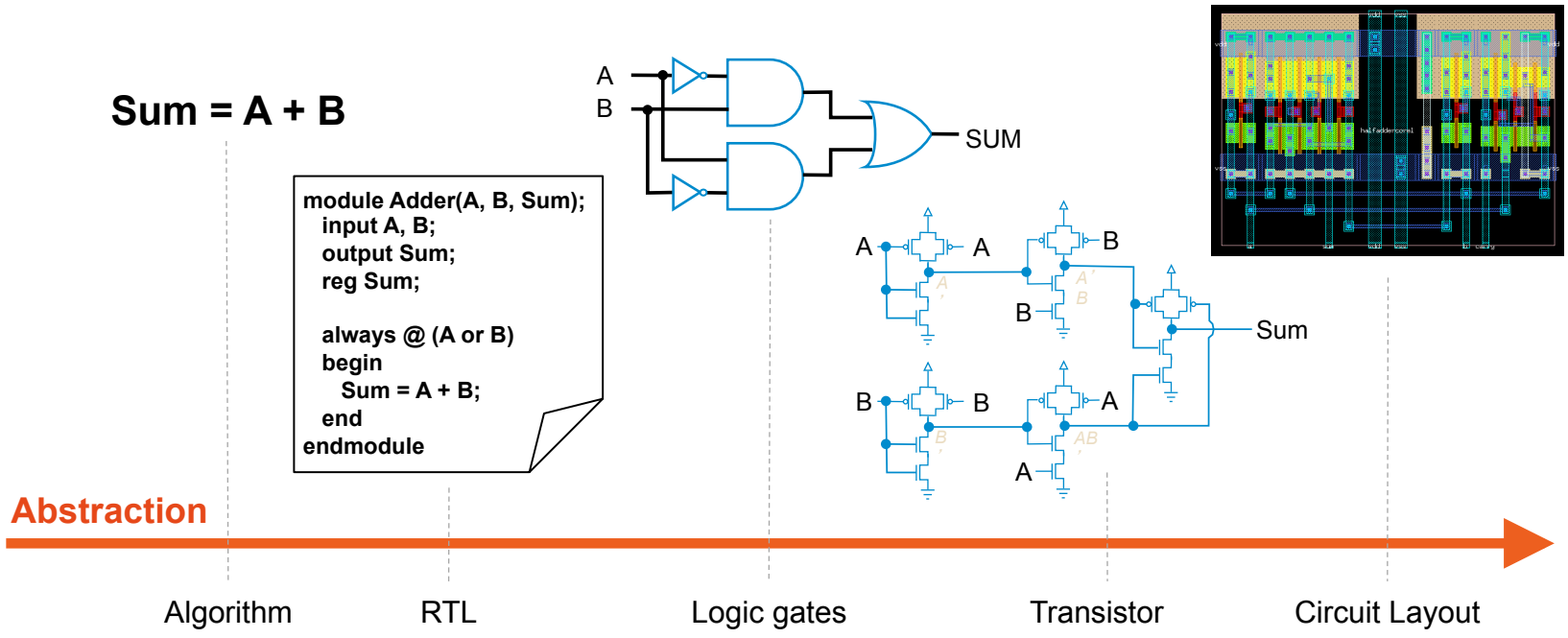




The Mythical Man-Month
Fred Brooks
1975, 1995

Increasing Abstraction

- Higher abstraction level simplify designer effort
  - Description smaller/easier to capture
  - Don't have to know/remember the low-level details
  - Many more possible implementations available



Why CAD?

- Computer-Aided Design (CAD)
  - Large scale management through abstraction
  - Design optimization
  - Reduced design time
  - Bridges the gap between different views of abstractions/domains
- Hardware design evolution
  - Logic synthesis
    - Converts logic equations or FSMs into gates
  - Register-transfer (RT) synthesis
    - Converts FSMDs into FSMs, logic equations, structural components (registers, adders, ALUs)
  - Behavioral/High-level synthesis
    - Converts sequential programs into FSMDs