Introduction to Software Engineering (1/2)

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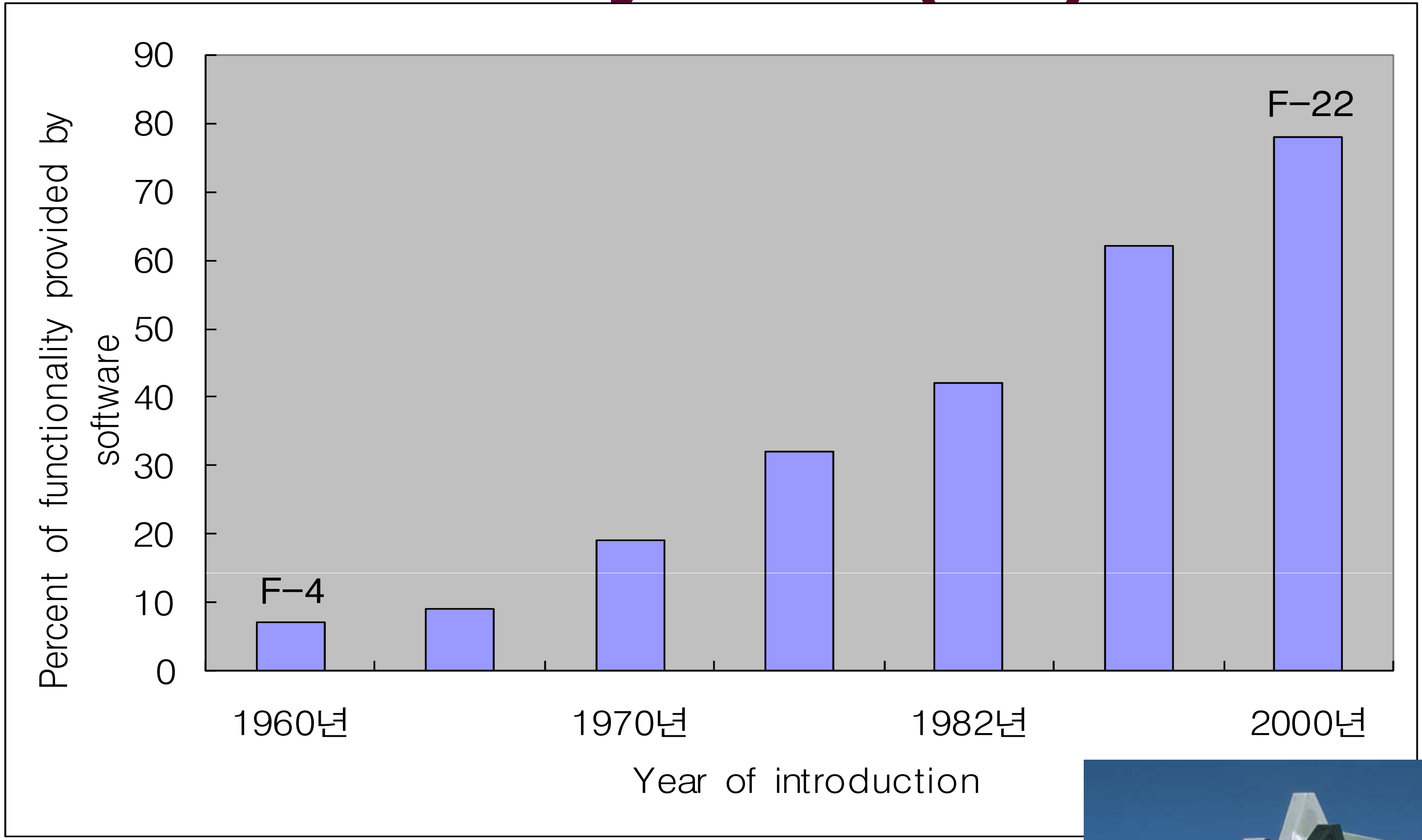
(slides adapted from CS550 ‘06 taught by prof. D. Bae)

A Main Theme of Software Engineering

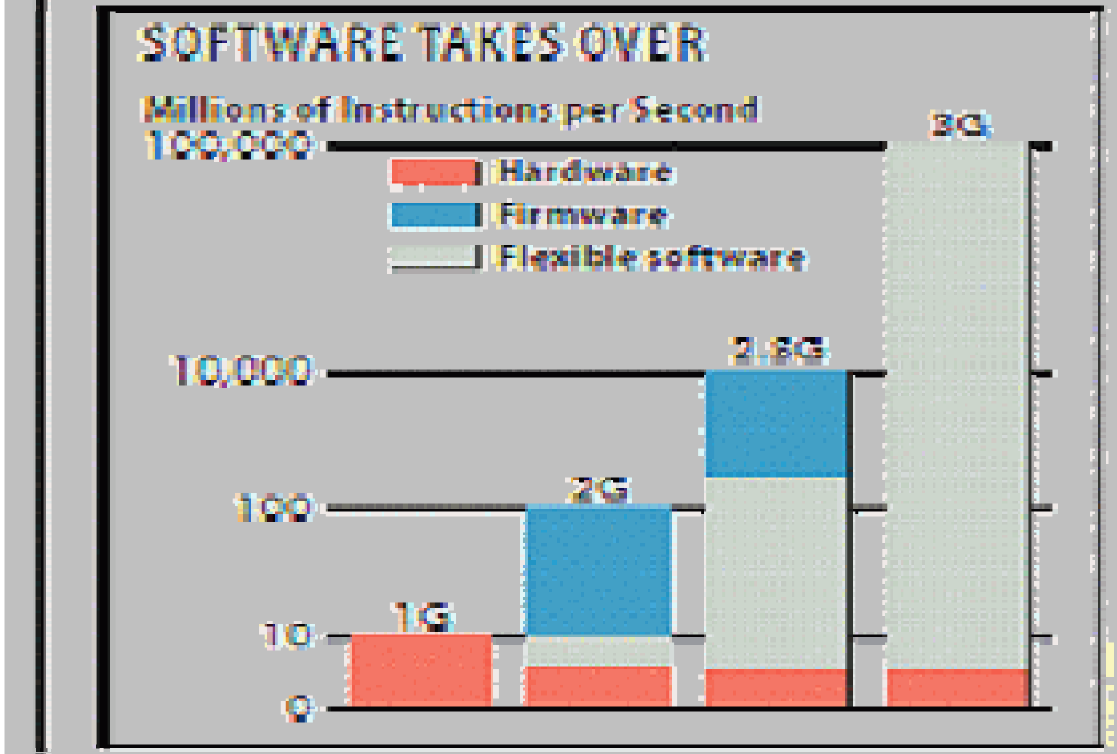
- SE involves various assets of technical/social/economic issues for
  - Profit (money)
    - Productivity
      - How fast
    - Maintenance
    - Reliability

Role of S/W: Increased in Everywhere(1/2)



자료출처: Watts Humphrey 2002

Role of S/W: Increased in Everywhere(2/2)

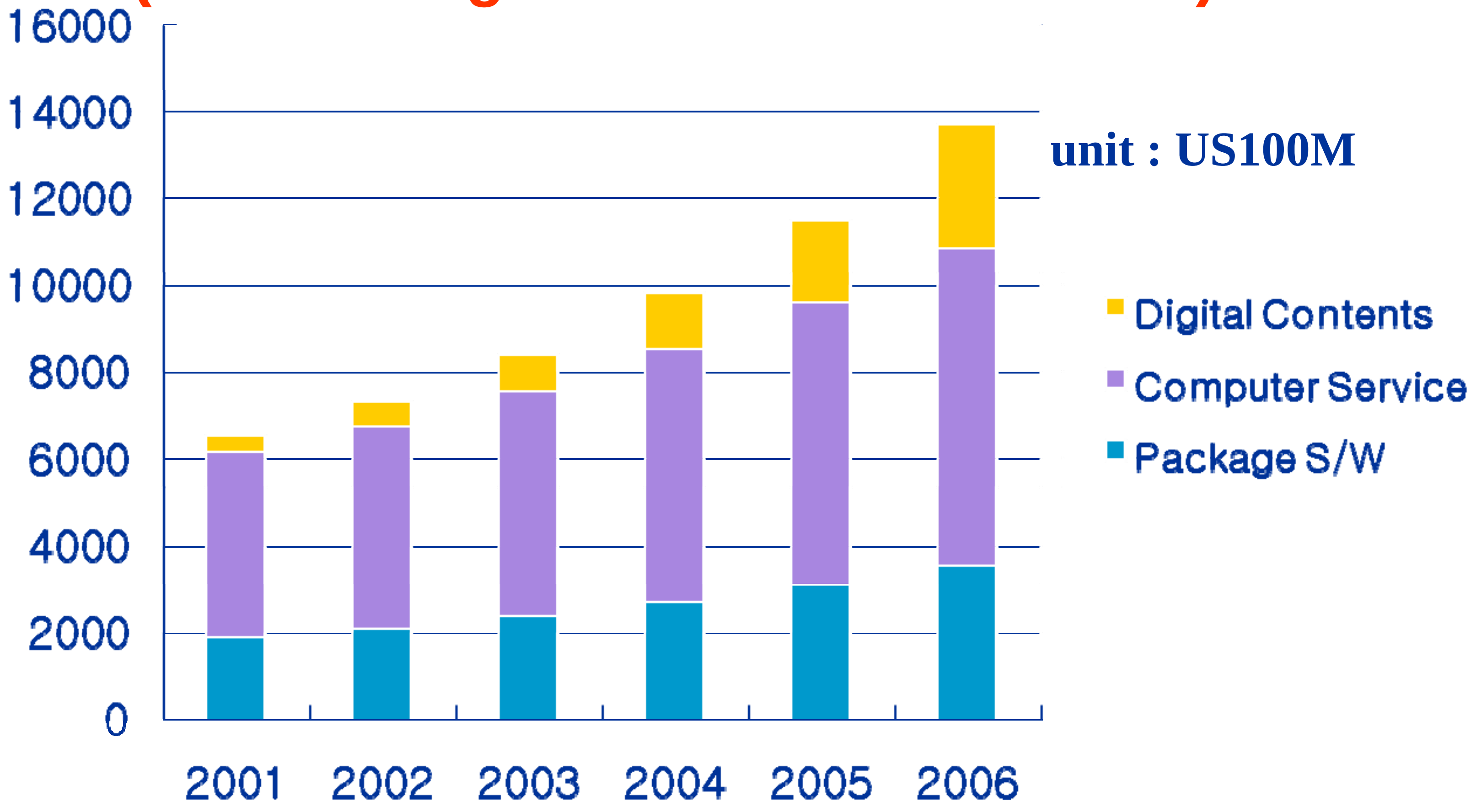


Successive generations of wireless technology (denoted by "G" numbers) will shift more processing into software.

From Deborah Shapely "The Universal Cell Phone" MIT Technology Review, 2001

World S/W Market

(4Times larger than Semiconductor)



- ’99– 2001 top 10 industry growth rate: IT equipment 29%, S/W 46%
- Market growth expectation for next 5 years : H/W 5.1%, S/W 11.8%

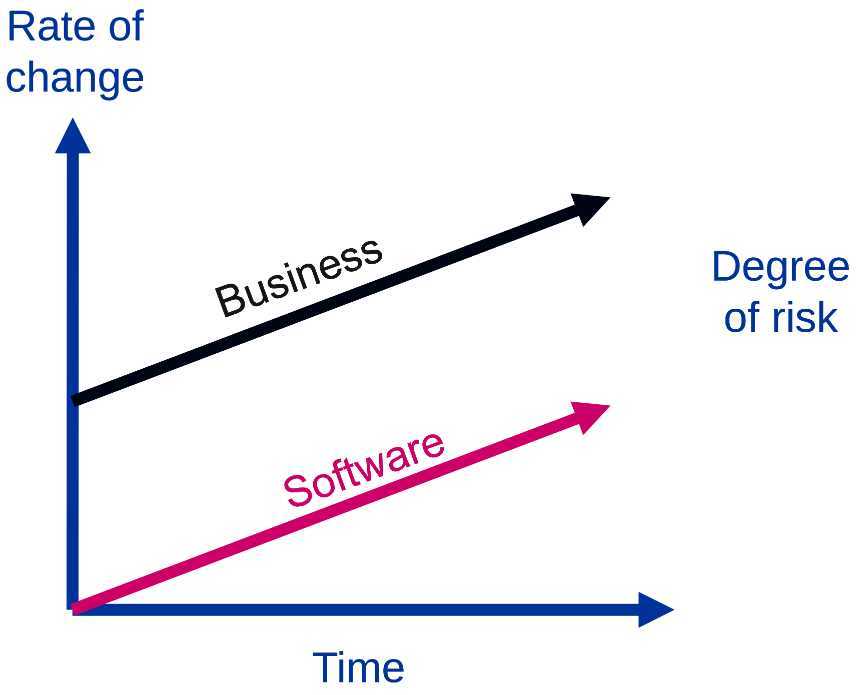
World SW Companies Recent Trends(1/2)

- MS, IBM, Oracle, SAP: a few global companies dominating
  - Top 10 companies market share : 1995, 6% → 2000, 28%
- Fierce competition among IT companies due to IT market stagnation.
- Large enterprise centered SW industry restructuring through M&A
- R&D investment increased to accommodate fast technology change
  - High S/W companies investment on R&D: R&D/Revenue, 18%

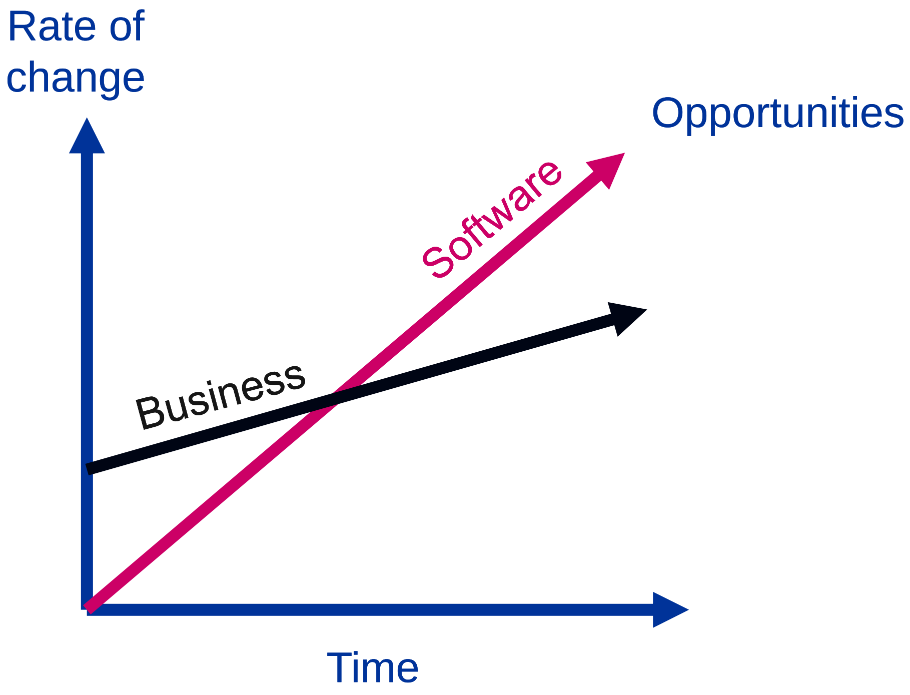
World SW Companies Recent Trends(2/2)

- Platform competition in ubiquitous environment among international companies
  - MS's .NET framework, Sun' Java, IBM's Linux support
- New players entering HW & SW market in Post PC era
  - Smart phone OS competition between Nokia and MS
    - New addition: Android OS from Google phone
  - Blurred boundaries between SI companies and traditional embedded system companies
- Government's SW industry supporting policy in R&D, standardization, trading policy, technology education, intellectual property rights, etc
  - Open source supported by government

The Business Implications of Software Change



When it takes longer to change the software than to change the business, the business is at risk



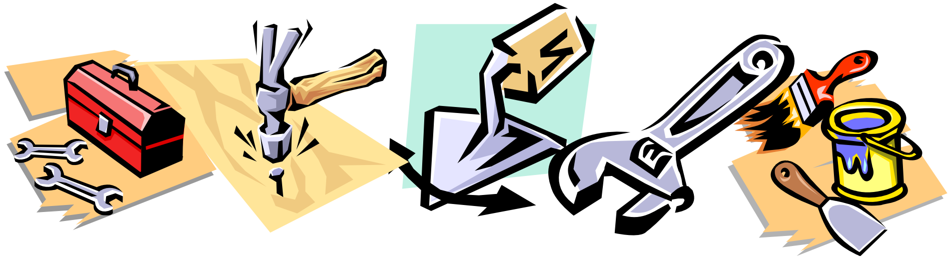
When software changes faster than the business, the business creates strategic opportunities

Analogy of SE with Civil Engineering

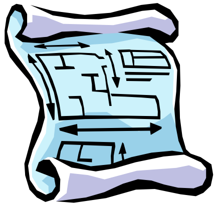
There are various kinds of construction from a house to a building complex

Analogy with Civil Engineering(Cont.)

When building a small house,...

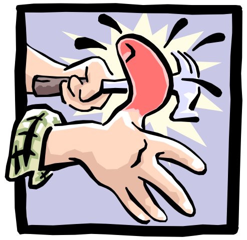


With simple tools



From just a blueprint

By small group of novice workers



Some failures are endurable

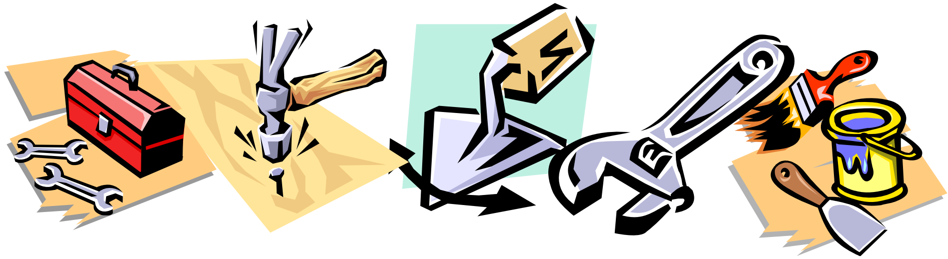
Analogy with Civil Engineering(Cont.)

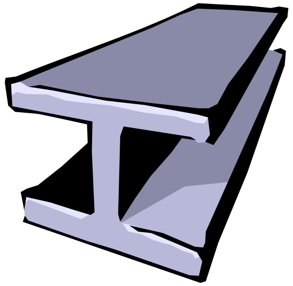
When constructing a building complex,...
we must re-think everything

Analogy with Civil Engineering(Cont.)

With scalable tools

as well as simple ones

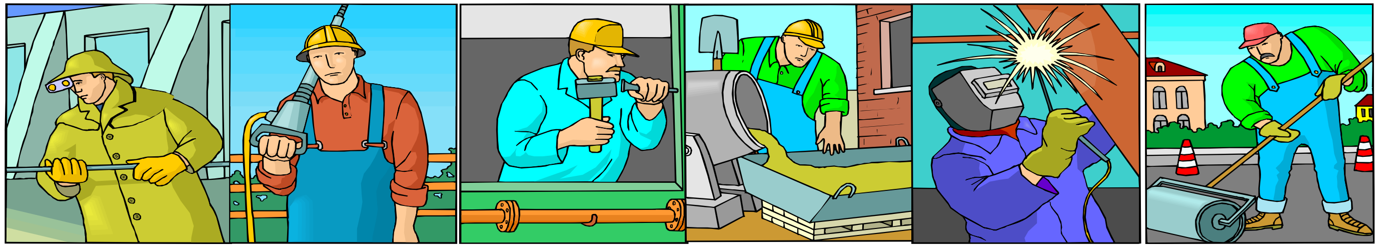




Use different materials

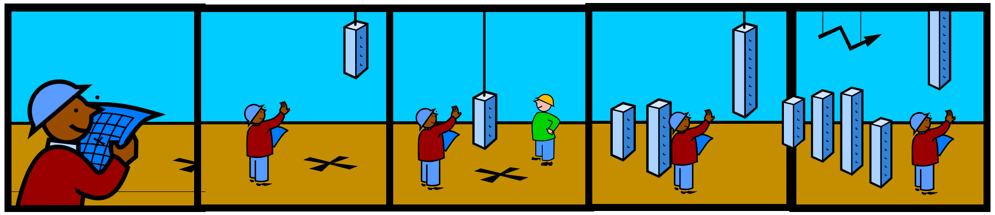
Analogy with Civil Engineering(Cont.)

By a big group of various technicians



With collaborations and guides

Set of blueprints

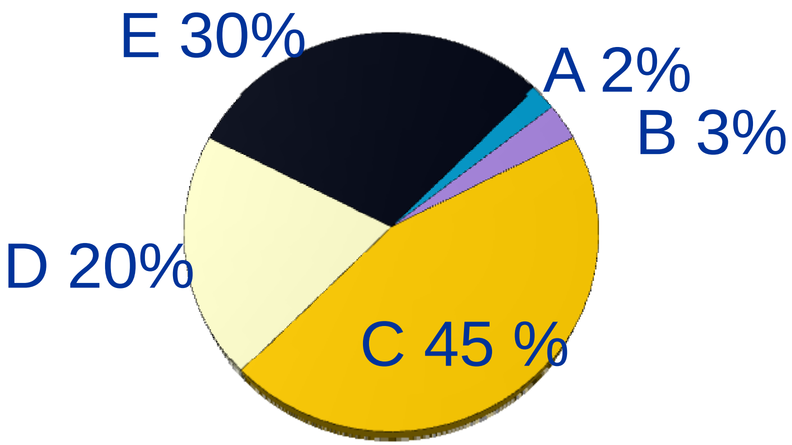


As well as careful plans

Forces Behind the Emergence of S/W Engineering

- The inability of organizations to predict the time, effort, and cost in software development.
- The poor quality of the software.
- Changes in the ratio of hardware to S/W costs
- The increasingly important role of maintenance
- Advances in hardware
- Advances in software techniques
- Increased demands for software
- The demand for larger and more complex S/W systems

Software Crisis



- A: worked on delivery
- B: worked after some corrections
- C: delivered but never successfully used
- D: used but either extensively reworked or abandoned
- E: paid for, but never delivered

Why Software Project Fail ?

Lack of s/w mind

Insufficient software project management

Lack of appropriate SE knowledge

I'LL GO UP AND FIND OUT WHAT THEY NEED AND THE REST OF YOU START CODING !
SKELTON

Why Software Development is so Difficult ?

- Characteristics
  - Complex
  - Flexible
  - Cannot be fully automated; human being involved
  - Relatively short history

- Difficulties
  - Hard to guarantee its correctness
  - Scientific disciplines applied hardly in the field
  - Hard to understand

Hardware v.s. Software

- Flexibility leads to low development cost
  - Minimal costs for HW board manufacturing > 20K$
  - Minimal costs for SW development = 0$

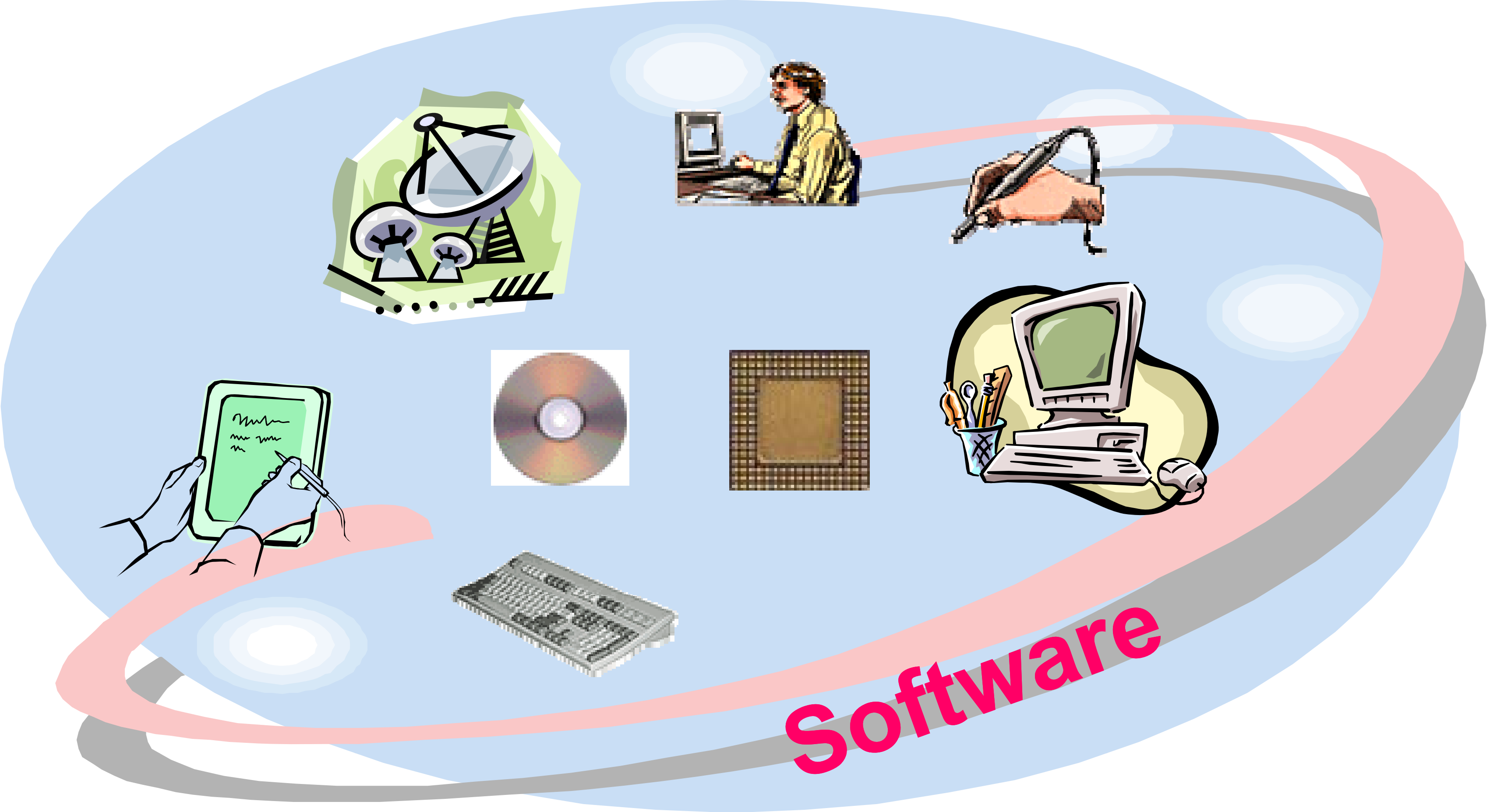
- Growing popularity leads to complex software systems
  - Pentium IV (Willamette): 42 million transistors
  - Windows XP: hundreds million instructions

- **Much harder** to validate/verify (V&V) software
  - HW design exploits symmetry, structure, and components
    - Formal design and V&V tools (e.g. Verilog, VHDL, etc) are popular
      - Standard property spec. language: OVL, PSL, SVA, etc

  - SW design allows maximal degree of freedom in programs
    - Formal principles and techniques have been rarely applied to SW due to
      - Failure to manage (entire) SW complexity
      - Lack of commercial tools and supports
      - (relatively) High learning curve
    - Products of all engineering fields provide warranty *except SW*
      - Ex> Intel CPU provides 3 years warranty
      - Ex> Microsoft Windows® provides no warranty - *Use it at your own risk!!!*

Role of Software

- Gluing/Integrating all hardware



1st Hw: due Feb 17 23:59

- Read the following paper and summarize it with your opinion in one A4 (around 500 words)
  - "No silver bullet: essence and accidents of software engineering" Computer, 20(4):10-19, April 1987
- Your summary and opinion must flow logically
  - Write a key sentence at the head of a paragraph
  - Then, write/enumerate supportive sentences for the key sentence
    - ex. "These days, technologies to develop reliable software become a key power for industrial competition. First, software takes more and more portion in embedded systems. For example, F22(a military fighter jet) controls more than 80% of its functionalities with software. … Second, production cost for software takes a significant portion in total product cost. … Finally, product's time to market must be kept in schedule, which is not possible without proper means of quality control of software… "
- Submit a hard copy to HW Box by the due
- Academic dishonesty will be handled with severe penalty