

Software Engineering

Dr. Young-Woo Kwon

SOFTWARE MAINTENANCE

What is Software Maintenance?

- Software Evolution

'Software development does not stop when a system is delivered but continues throughout the lifetime of the system'. (Sommerville, 2004)

- The system changes relate to changing business and user needs
- The system evolves throughout its lifetime through a seamless process

What is Software Maintenance?

- IEEE Definition:
 - the process of modifying the software system or component after delivery to correct faults, improve performance or other attributes, or adapt to a change in the environment.
- Software maintenance is concerned with modifying software once it is delivered to a customer

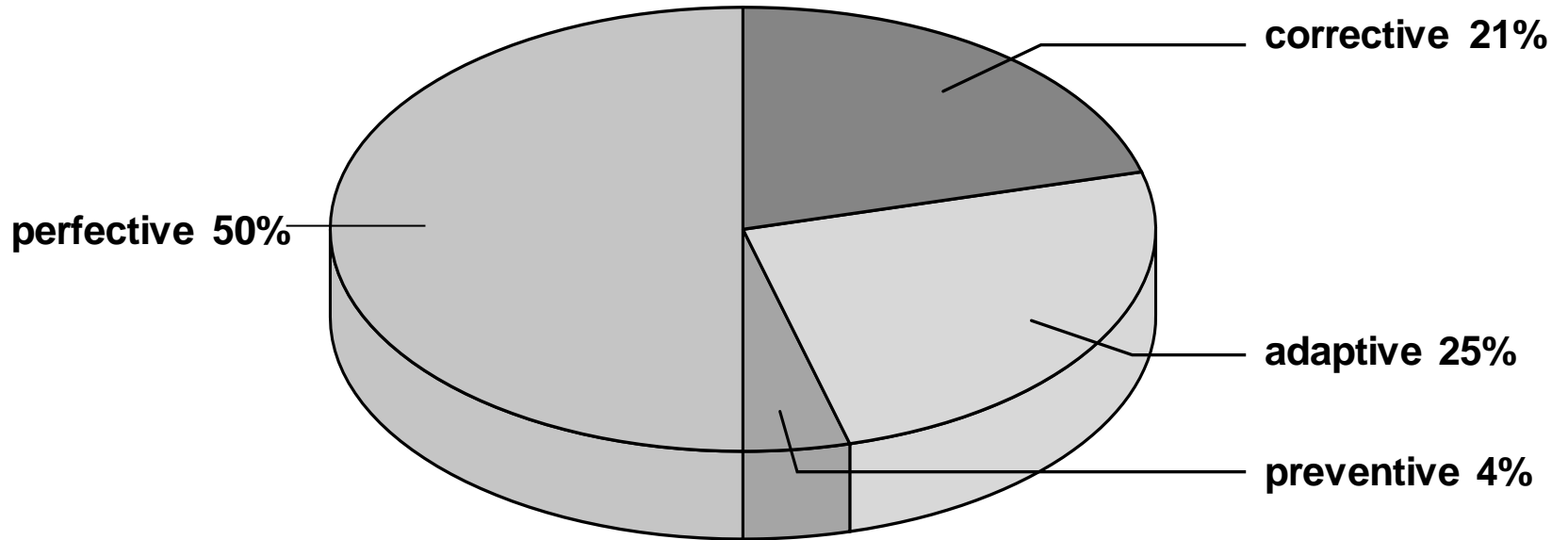
Maintenance Examples

- Y2K
 - many, many systems had to be updated
 - language analyzers (find where changes need to be made)
- Anti-Virus Software
 - don't usually have to update software, but must send virus definitions

S/W Maintenance Categories

- ***corrective maintenance***: correcting errors
- ***adaptive maintenance***: adapting to changes in the environment (both hardware and software)
- ***perfective maintenance***: adapting to changing user requirements
- ***preventive maintenance***: increasing the system's maintainability

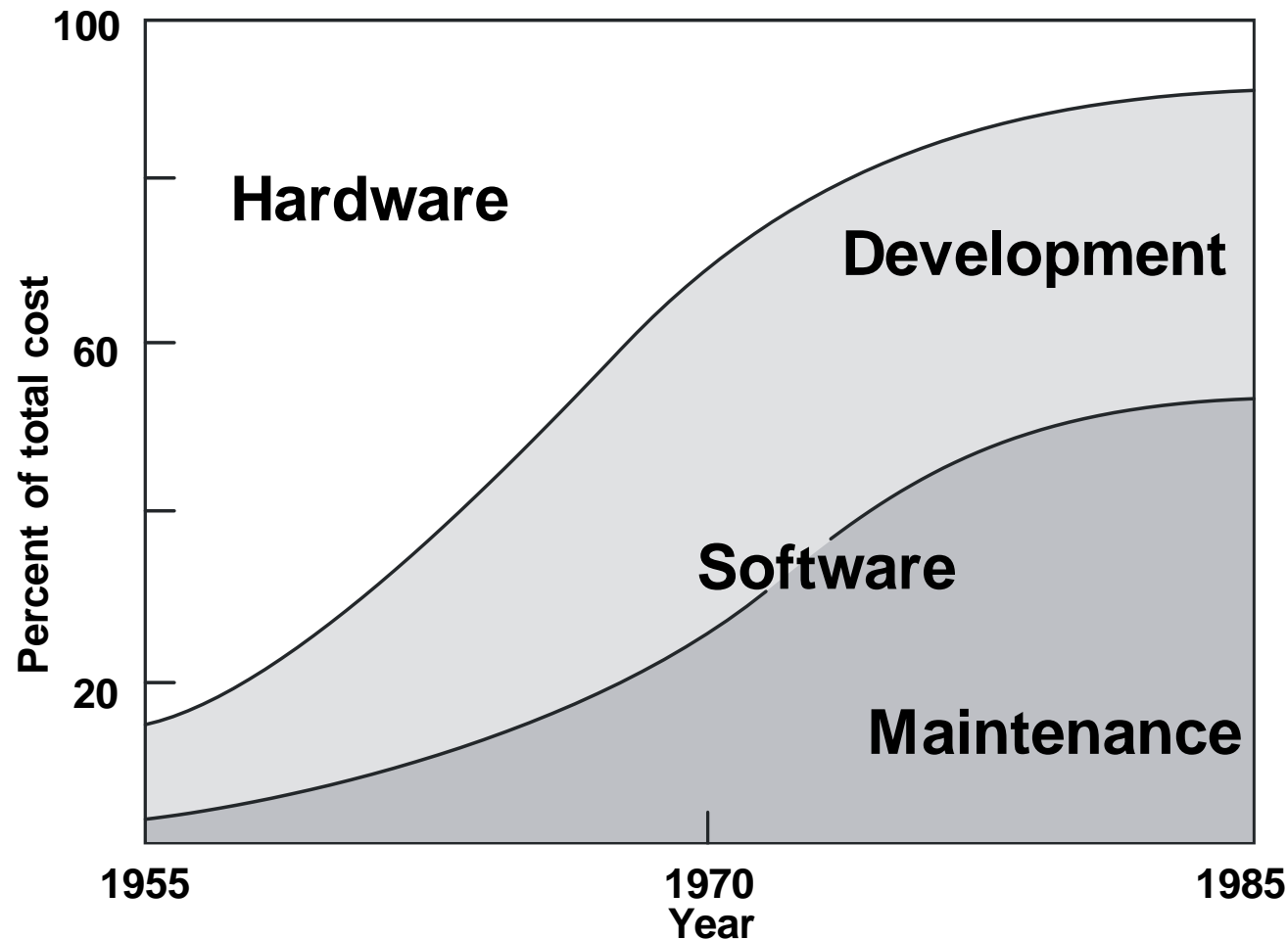
Maintenance Mctivities



Problems of Software Maintenance

- Direct software costs
 - Major economic importance: 40 – 90% of the total lifecycle costs
 - 50-80% of the time of an estimated one million programmers or programming managers spent on maintenance. ... [Corbi89]
 - for every \$1 allocated for a new development project, \$9 will be spent on maintenance for the life cycle of the project. [Mit]
 - ...

Relative distribution of software/hardware costs



Problems of Software Maintenance

- It is necessary to add, to the direct cost of maintenance, the consequences of the maintenance...
 - **Deterioration of software**
 - Lost of software structure because of maintenance
 - May imply software “death” and its benefits
 - May have catastrophic consequences
 - **Client dissatisfaction**
 - Difficulty to deal with all the modification requests
- Even if indirect costs are difficult to estimate, they often play a major role

Problems of Software Maintenance

- Other problems of software maintenance
 - a neglected topic !
 - Maintainability is difficult to measured
 - Requirements is volatile
 - Too many factors

Problems of Software Maintenance

- No interest
- **Industry**
 - Do you want to work in a software maintenance project ?
 - Few resources devoted to software maintenance teams
- **Research**
 - Projects focus on development
 - Only few conferences and books on software maintenance
 - Only ICSM
- **University**
 - Almost no courses on software maintenance

Problems of software maintenance

- Maintainability is difficult to measure
- Respect of Metrics
 - Software maintenance should be measured and managed using metrics to reach a quality software.
 - However, we don't know how to measure maintainability.

Problems of software maintenance

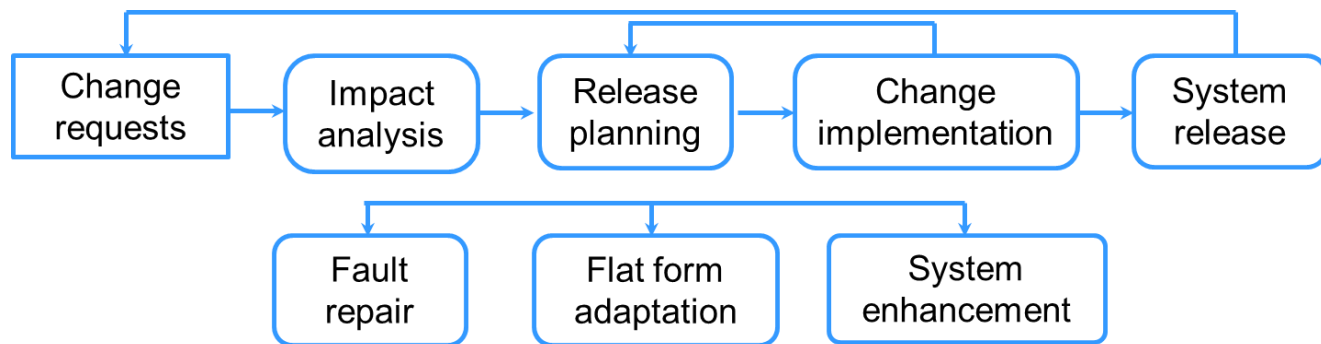
- Requirements are the foundation of the software release process.
 - Changing requirements during the software maintenance process impacts the cost, schedule, and quality of the resulting product.

Problems of software maintenance

- What Influences Maintainability?
 - Application type
 - System novelty
 - Turnover of maintenance staff
 - System life span
 - Hardware characteristics
 - Design, code, documentation, and testing

The Maintenance Process

- Maintenance process vary considerably depending on the types of software being maintained, the development processes used in an organization and people involved in the process.



The Maintenance Process

- **begins**

 - when a **request for change** is initiated by a user

- **ends**

 - when the system passes testing, is accepted by the user and is released for operation

- **in between**

 - there are many activities that must be planned and coordinated by use of change management

The Maintenance Process

- Seven-step approach [IEEE-1219]:
 - Step 1 - Problem/modification identification, classification, and prioritization.
 - Change Management
 - Step 2 - Analysis
 - Step 2.1 feasibility analysis
 - Impact Analysis
 - Step 2.2 detailed analysis
 - System Release Planning
 - Step 3 – Design (the Changes)
 - Step 4 - Implementation
 - Code the Changes
 - Step 5 - Regression/system testing
 - Step 6 - Acceptance testing.
 - Step 7 - Delivery
 - System Release

Maintenance Process: Impact Analysis

Aims:

- to **determine the scope** of the requested change for planning and implementation of the change
- to **develop accurate estimates of resources**
- to **analyse cost/benefits** of the change
- to **communicate the complexity** of the change

Maintenance Process: Test the Changes

Maintenance / Development Differences

- only changes need to be reviewed
- only new test cases that exercise the changes need to be developed
- existing and new test cases are required to test the changes
- test results are compared against previous test results

Summary: Software Maintenance

- The process of modifying a software system or
- component after delivery to correct faults, improve
- performance or other attributes, or adapt to a
- changed environment