CSC 501:

SOFTWARE ENGINEERING

SOFTWARE MAINTENANCE

By

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What is Software Maintenance?

- Is an activity done after software has long been launched into operation.
- Is the process of changing, modifying, and updating software.
  - **Error corrections**
  - **Performance enhancements**
  - **Deletion of obsolete capabilities**
  - **Overall software optimization**
- Its objective is to keep software viable with current customer needs.
- Is necessary because a good software should adapt to technological changes and market demands.

Types of Software Maintenance

- There are 4 types of software maintenance –

1. **Corrective Software Maintenance**: This is a modification made on software due to the presence and effect of defects.
2. **Preventative Software Maintenance**: This is a change, upgrade or adaptation enforced on software for futuristic purposes. The issues addressed may lack immediate significance but will have larger impact on more serious problems in the future.
3. **Perfective Software Maintenance**: This involves adjusting software by adding new features and removing ineffective or irrelevant ones to suit current needs and for better usage.
4. **Adaptive Software Maintenance**: This involves making changes as a result of moving the software to a different software or hardware platform. E.g., operating system, compiler, cloud storage, or processor.

Software Maintenance Process

- Software Analysis: Analyzing the program in order to determine a clear understanding of the software.
- Proposing Maintenance Plan that will help to accomplish the implementation of the maintenance objective.
- Finding and Fixing of Bugs and Loopholes as a consequence of program modifications (Regression testing).
- Testing of Modified Program to ensure that it has the same reliability level as before.

Software Maintenance Cost

- The cost of maintaining software is usually high. It can consume more than 50% of the SDLC budget.
- However, it does not neutralize the importance of software maintenance.
- The high cost is a result of multiple factors involved in maintenance. E.g.,
  - the older the software, the more the maintenance cost.
  - It may take much time (in hours) due to trial and error approach caused by inability to target exact issues to upgrade.

Estimation of Maintenance Cost

- **Belady and Lahman Model:**
- This model usually comes to play if the person or group of persons that developed the software is no longer available to perform maintenance. It is usually expressed as the total expended effort, M.

$$M = P + Ke^{(c-d)}$$

where P = productive effort involving analysis, design, coding, testing

K = constant

c = complexity measure resulting from lack of good design and documentation

d = degree to which maintenance team is familiar with the software

Estimation of Maintenance Cost

- **Boehm Model**:
- This model uses quantities called Annual Change Traffic (ACT) and Annual Maintenance Effort (AME) defined as:

$$ACT = \frac{KLOC_{added} + KLOC_{deleted}}{KLOC_{total}}$$

$$AME = ACT + SDE$$

where SDE = software development effort in person-month

Problems of Software Maintenance

- Difficulty to have access to real software designers.
- The program modifier may be someone who does not have clear understanding of it.
- If the system was not originally designed to accommodate change.
- When there is information gap between user and developer.

Potential Solution to Maintenance Problems

- Investing more time and resources to development specification and design of more maintainable systems.
- Regular maintenance of existing system alongside emerging technologies.
- Complete replacement of an existing system if the cost for maintenance is as much as developing a new one.