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Computer Programming

Dr. Deepak B Phatak
Dr. Supratik Chakraborty
Department of Computer Science and Engineering
IIT Bombay

Session: Basic Principles of Software Engineering

Recap and Overview

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- We have seen different categories of software
- We noted that practical software is
  - Very large and complex in size
  - Requires significant efforts to design, build, operate, and maintain

- In this session, we will discuss principles of Software Engineering

Size of Software and associated efforts

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- Software size is often expressed as
  - LoC (Lines of Code), or FP (Function Points)
- Different categories based on LoC could be
  - Tiny (1000), small (10,000), medium (100,000)
  - Large (1M), Very Large (10M), Huge (>10M)
- Efforts are often expressed as person-months (PM)
  - One person, working full time for a month
  - Total number of tested, documented, and working LoC delivered
  - Productivity of individuals differ greatly
    - 15 to 25 LoC per day, is a useful indictor

Engineering the Software

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- Software is developed or engineered, not manufactured
  - Hardware does wear out, but Software does not
  - But Software may become un-maintainable
- Engineering is the Analysis, Design, Construction, Verification and Management of Technical (or) Social Entities

IEEE Definition of Software Engineering -1993

- Application of a Systematic, Disciplined, Quantifiable Approach to the Development, Operation and Maintenance of Software
  - i.e., The Application of Engineering to Software

Software Life Cycle

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- Conceptualization, feasibility
- System analysis to detail all functional requirements
- System Design
- Software Development
- Testing and Quality Assurance
- Acceptance and implementation (includes user training)
- Operations
- Maintenance on an ongoing basis

Software Maintenance

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- Software maintenance includes:
  - Bug-fixing (correcting errors discovered during use)
  - Functional enhancement
  - Interfacing to other software applications
- After any software system is put to use, this becomes an ongoing activity for the entire life of software usage
- Constitutes 40% to 80% of total Software life-cycle cost

Write high-quality software in the first place

Coding style

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- We should be concerned with the quality of code we write
  - Correct ('bug' free), Human readable, understandable, modifiable
- Coding style and coding standards
  - Recommended, often enforced by organizations
  - Often Specific to programming languages
- A useful reference to coding style for C++:

http://en.wikibooks.org/wiki/C%2B%2B_Programming/Programming_Languages/C%2B%2B/Code/Style_Conventions

- Another useful reference to coding convention:

http://en.wikipedia.org/wiki/Coding_conventions

Some additional interesting references

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- http://en.wikipedia.org/wiki/The_Mythical_Man-Month
- http://www.geraldmweinberg.com/Site/Programming_Psychology.html
- Several articles in Wikipedia describe different aspects of Software Engineering

Summary

- We have learned the basic principles of software engineering
- Our take-away is to ensure that the C++ programs which we write, should
  - perform the intended functions correctly (are bug-free)
  - be well documented for human perusal
    (in-line and external documentation)
  - preferably be generic and extendible
  - be usable in conjunction with other software