Lecture No. 02

Introduction to Software Development

2.1 Software Development

We have seen in our previous discussion that software engineering is nothing but a disciplined approach to develop software. Now we will look at some of the activities involved in the course of software development. The activities involved in software development can broadly be divided into two major categories first is construction and second is management. The construction activities are those that are directly related to the construction or development of the software. While the management activities are those that complement the process of construction in order to perform construction activities smoothly and effectively. A greater detail of the activities involved in the construction and management categories is presented below.

Construction

The construction activities are those that directly related to the development of software, e.g. gathering the requirements of the software, develop design, implement and test the software etc. Some of the major construction activities are listed below.

- Requirement Gathering
- Design Development
- Coding
- Testing

Management

Management activities are kind of umbrella activities that are used to smoothly and successfully perform the construction activities e.g. project planning, software quality assurance etc. Some of the major management activities are listed below.

- Project Planning and Management
- Configuration Management
- Software Quality Assurance
- Installation and Training

As we have said earlier that management activities are kind of umbrella activities that surround the construction activities so that the construction process may proceed smoothly. This fact is empathized in the figure 1. The figure shows that construction is surrounded by management activities. That is, all construction activities are governed by certain processes and rules. These processes and rules are related to the management of the construction activities and not the construction itself.
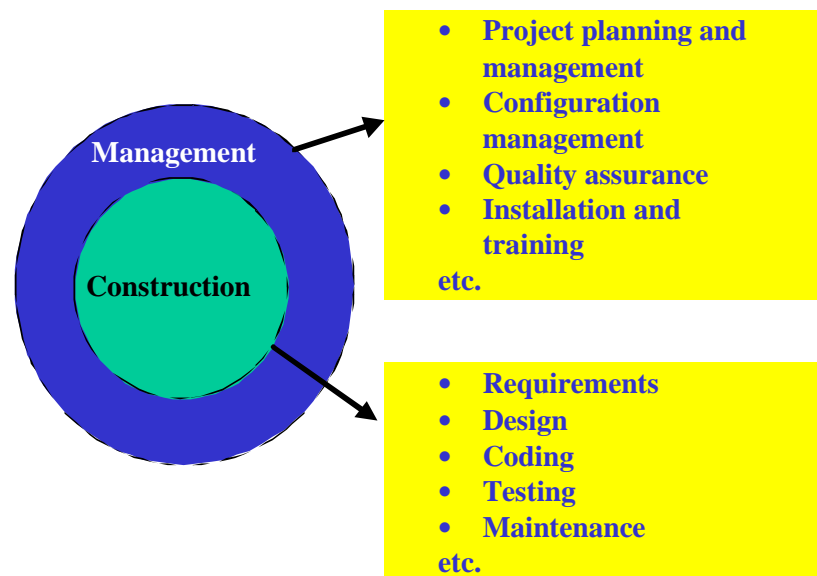
Figure1: Development activities

2.2 A Software Engineering Framework

Any Engineering approach must be founded on organizational commitment to quality. That means the software development organization must have special focus on quality while performing the software engineering activities. Based on this commitment to quality by the organization, a software engineering framework is proposed that is shown in figure 2. The major components of this framework are described below.

Quality Focus: As we have said earlier, the given framework is based on the organizational commitment to quality. The quality focus demands that processes be defined for rational and timely development of software. And quality should be emphasized while executing these processes.

Processes: The processes are set of key process areas (KPAs) for effectively manage and deliver quality software in a cost effective manner. The processes define the tasks to be performed and the order in which they are to be performed. Every task has some deliverables and every deliverable should be delivered at a particular milestone.

Methods: Methods provide the technical "how-to's" to carryout these tasks. There could be more than one technique to perform a task and different techniques could be used in different situations.

Tools: Tools provide automated or semi-automated support for software processes, methods, and quality control.
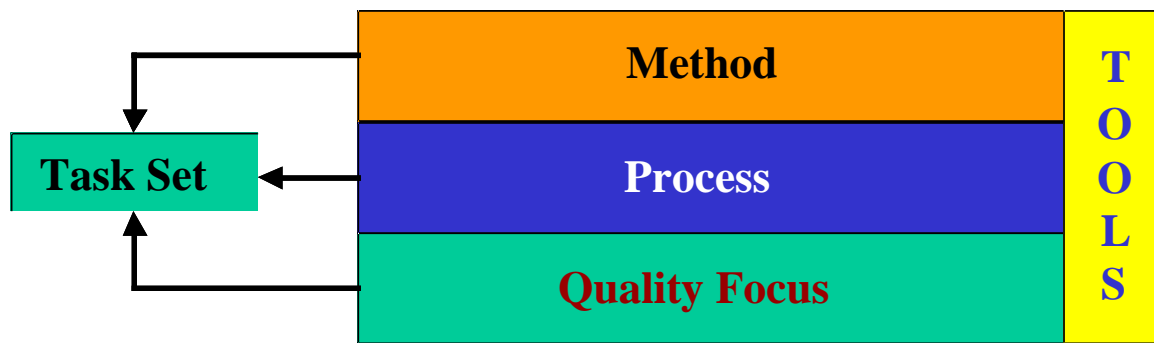
Method

Process

Quality Focus

Task Set

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Figure 2: A Software Engineering Framework

Software Development Loop

Lets now look at software engineering activities from a different perspective. Software development activities could be performed in a cyclic and that cycle is called software development loop which is shown in figure 3. The major stages of software development loop are described below.

Problem Definition: In this stage we determine what is the problem against which we are going to develop software. Here we try to completely comprehend the issues and requirements of the software system to build.

Technical Development: In this stage we try to find the solution of the problem on technical grounds and base our actual implementation on it. This is the stage where a new system is actually developed that solves the problem defined in the first stage.

Solution Integration: If there are already developed system(s) available with which our new system has to interact then those systems should also be the part of our new system. All those existing system(s) integrate with our new system at this stage.

Status Quo: After going through the previous three stages successfully, when we actually deployed the new system at the user site then that situation is called status quo. But once we get new requirements then we need to change the status quo.

After getting new requirements we perform all the steps in the software development loop again. The software developed through this process has the property that this could be evolved and integrated easily with the existing systems.
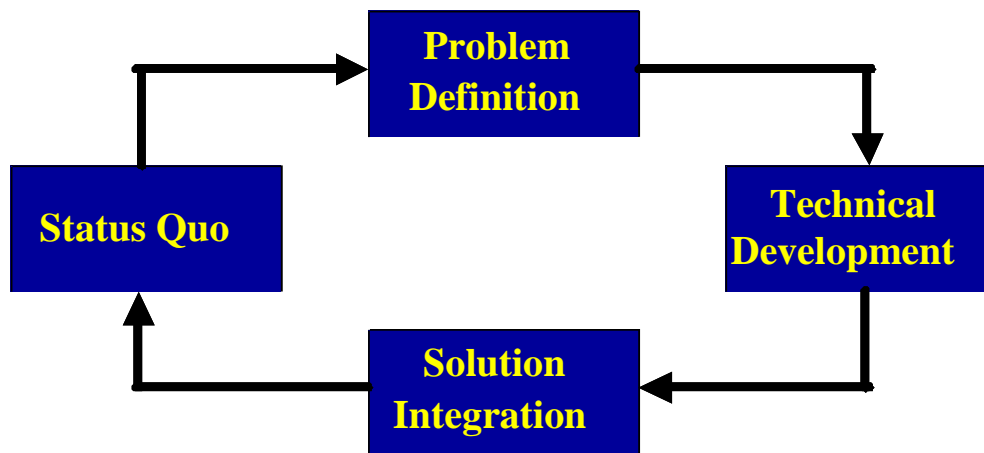
Figure 3: Software Development Loop

Software Construction

Here once again look at the construction activities of the software from a different perspective. This section provides with a sequence of questions that have to answer in different stages of software development.

1. What is the problem to be solved?
2. What are the characteristics of the entity that is used to solve the problem?
3. How will the entity be realized?
4. How will the entity be constructed?
5. What approach will be used to uncover errors that were made in the design and construction of the entity?
6. How will the entity be supported over the long term, when users of the entity request corrections, adaptations, and enhancements?

2.4 Software Engineering Phases

There are four basic phases of software development that are shown in Figure 4.

Vision: Here we determine why are we doing this thing and what are our business objectives that we want to achieve.

Definition: Here we actually realize or automate the vision developed in first phase. Here we determine what are the activities and things involved.

Development: Here we determine, what should be the design of the system, how will it be implemented and how to test it.

Maintenance: This is very important phase of software development. Here we control the change in system, whether that change is in the form of enhancements or defect removal.

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Vision  >  Definition  >  Development  >  Maintenance
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Figure 4: Software Engineering Phases

Maintenance
Correction, adaptation, enhancement
For most large, long lifetime software systems, maintenance cost normally exceeds development cost by factors ranging from 2 to 3.

Boehm (1975) quotes a pathological case where the development cost of an avionics system was $30 per line of code but the maintenance cost was $4000 per instruction

2.5 Summary
☐ Software development is a multi-activity process. It is not simply coding.
☐ Software construction and management
☐ Software Engineering Framework
☐ Software development loop
☐ Software engineering phases
☐ Importance of Maintenance