LEC # 04

SOFTWARE ENGINEERING

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System Development Life Cycle Models

Final Words

"Organizations that attempt to put software Engineering Discipline in place before putting project management discipline in place are domed to fail"

Burlton 1992

Software & Project management

- Primary causes of software escape
  - Project Objectives not fully specified
  - Bad planning and estimating
  - Technology new to the organization
  - Inadequate/No project management methodology
  - Insufficient senior staff on the team

Issues in Managing Projects

- Big team, so communication problem
- Managing the size of projects
- Managing time and cost.
- Change of requirements.

Project

- A project is a sequence of tasks with a beginning and an end that is bound by time, resources, and desired results.
- A project has
  - A specific desired outcome
  - A deadline or target date
  - And a budget
- A project is a temporary venture undertaken to create a unique product or services

- Definitions put a clear emphasis on the project's being a planned activity. Another key aspect of a project is that the undertaking is non-routine: a job which is repeated a number of times is not a project.

Project Characteristics

- **Triple Constraint:**
  - Every project is constrained in different ways by its scope, time goals, and cost goals
- Scope:
  - What is to be accomplished? What unique product or service expected
- Time:
  - How long should it take to complete and what is schedule?
- Cost:
  - What should it cost

Project Characteristics

- Key characteristics that distinguish projects:
  - Non-routine tasks are involved
  - Planning is required
  - Specific objectives to be met or a specified product be created
  - has a predetermined time span (absolute or relative)
  - Work is carried out for someone other than yourself
  - Work involves several specialists
  - Work is carried out in several phases
  - Resources availability are constrained
  - The project is large or complex
  - Involves uncertainty

Management

- The group of individuals who make decisions about how a business is run.
- A stream of decision and actions to achieve goal's efficiently and effectively.

"Management is the process of designing and maintaining an environment in which individuals, working together in groups, efficiently and effectively to accomplish selected aims"

Management Activities

Management involves the following activities:

- Planning
  - Deciding what is to be done
- Organizing
  - Making arrangements
- Staffing
  - Selecting the right people for the job.
- Directing
  - Giving instructions
- Monitoring
  - Checking on progress
- Controlling
  - Taking action to remedy hold-ups
- Innovating
  - Coming up with new solutions
- Representing
  - Liaising with users etc.

Management Challenges

- Looking at the management through the **challenges faced** by the managers.
  - Coping with **deadlines**
  - Coping with **resource constraints**
  - **Communicating effectively** among task groups
  - **Gaining commitment** from team members
  - Establishing **measurable milestones**
  - Coping with **changes**
  - Working out **project plan agreement** with their team
  - Dealing with **conflict**

Project Management - Definitions

"Project management consists of managing the production of a product within given time and funding limits. Since this requires human resources, project management involves not only technical and organizational skills, but also the art of managing people. Project management is no mundane activity: It can be as gripping as landing a jumbo jet on a short airstrip." – Braude, 2001

"Project management involves the planning, monitoring, and control of the people, process and events that occur as software evolves from preliminary concept to operational implementation." – Pressman, 2000

Project Management – Overview

- What is it?
  - Planning, monitoring and control of
    - People
    - Process
    - Events
  - as software evolves from preliminary concept to operational implementation
- Who does it?
  - Everyone, to some extent, e.g.:
    - A software engineer manages his/her daily activities: planning, monitoring and controlling technical tasks
    - A project manager plans, monitors and controls the activities of a team of software engineers
    - A senior manager coordinates the interactions between business and software professionals

Project Management – Overview

- Why is it important?
  - As we saw earlier, many projects fail
  - Software development is a complex task
    - particularly if it involves many people and lasts a long time

  " there are no technical failures; only management failures" – Braude, 2001

- What are the steps in project management?

Steps in Managing Projects

- Understanding the 4 P's
- People: the most important element of a successful project.
- Product: the software to be built.
- Process: The set of framework activities and software engineering tasks to get the job done.
- Project: all work required making the product a reality.

We will focus on people and project

The People

- People working on software projects play various roles, which can be organized into five basic types:
  - Senior managers
    - Define business issues that often have great impact on project
  - Project managers
    - Plan, motivate, organize and control the people who do technical aspects of work – the practitioners
  - Practitioners
    - Deliver necessary technical skills to engineer the product
  - Customers & Stakeholders
    - Specify requirements and scope for software
  - End-Users
    - Interact with software product once it is released
- To be effective, the *Team Leader* must organize the project team so as to maximize each person's skills and abilities

The Team Leader

- Project management is a *people-oriented* activity
  - People with great technical skills don't necessarily make good team leaders – people skills are needed too
- Weinberg suggests an MOI model of leadership
  - Motivation
    - Ability to encourage technical people to work to the best of their abilities (push or pull)
  - Organization
    - Ability to adapt existing processes, or devise new ones, to enable the concept to be turned into a product
  - Ideas/Innovation
    - Ability to encourage people to create, and to feel creative, within the bounds of the particular product
- Team leader must let everyone know, by words and deeds, that quality is important – lead by example!

The Team Leader

- Another view of what makes a good team leader:
  - Problem solving
    - Decide which technical and organizational issues are most important
    - Create a systematic solution to the problem – or motivate others to do so
    - Apply lessons from past projects to new ones
    - Remain flexible enough to change direction if initial proposed solution doesn't work
  - Managerial Identity
    - Confidence to take charge of project when necessary, but also to let good technical people use their initiative
  - Achievement
    - Reward initiative and accomplishment
    - Demonstrate that controlled risk-taking will not be punished
  - Influence and Team building
    - Be able to "read" people – understand both verbal and non-verbal signals from team members, and react to their needs

Coordination and Communication

- Software projects fail for many reasons. For modern software, issues of scale, uncertainty and interoperability are usually unavoidable
  - Scale: many projects are large, leading to complexity, confusion and major difficulties in coordinating people
  - Uncertainty: scope and requirements change is common, often resulting in continuous addition to the team load

  - Interoperability: new software must communicate with existing systems, and conform to predefined standards and constraints

Coordination and Communication

- To deal with these issues, methods must be established to foster both formal and informal communication between team members, and to coordinate their work
- Project Coordination Techniques
  - Formal, impersonal approaches
    - Software engineering documents and deliverables (including source), technical memos, project milestones, schedules and PM tools, change requests & documentation, error tracking reports, etc.
  - Formal, interpersonal procedures
    - Focus on quality assurance activities applied to the work products: status review meetings, design and code inspections (walkthroughs)

Coordination and Communication

- Project Coordination Techniques cont.
  - Informal, interpersonal procedures
    - Group meetings for communication of information, problem solving, and getting requirements and development staff together
  - Electronic communication
    - Email, bulletin boards, video conferencing
  - Interpersonal network
    - Informal discussions with team members and outside experts
- You should consider applying some or all of these techniques in your group project

Product

The product is the final s/w that is developed after a detailed analysis.

Software scope and Problem should be examined. Scope is the boundary to which you have to go while developing software.

Problem should be decomposed for full functionality achievement.

Process

- *Strategies for the development of software.*

The Project

- Ten signs that indicate that a project is in trouble:
  - Technical people don't understand customer's needs
  - Product scope is poorly defined
  - Change management is poor
  - Change in technology chosen for solution
  - Business needs change or are not well defined
  - Deadlines are not realistic
  - Users are resistant to the proposed solution
  - Sponsorship is lost, or was never actually obtained
  - Project team lacks people with the right skills
  - Managers and team members resist best-practice, and lessons learned on previous projects

The Project

- How does a project manager avoid these problems?
  - Start on the right foot
    - Work *very* hard to understand the problem
    - Set realistic objectives and expectations for team
    - Give team members autonomy, authority and appropriate technology
  - Maintain momentum
    - Provide incentives to minimize turnover of personnel
    - Ensure that team emphasizes quality in every task
    - Avoid getting in team's way!

The Project

- How does a project management avoid these problems? cont.
  - Track progress
    - Work products are produced and approved by formal technical review
    - Project and process metrics can be gathered and compared with historical data
  - Make smart decisions
    - KISS: Keep It Simple, Stupid
      - Use off-the-shelf software and/or components where possible
      - Avoid custom interfaces if a standard is available
      - Identify and avoid obvious risks
      - Allocate more time than you think is needed to risky or complex tasks
  - Conduct a post-mortem analysis
    - Establish a mechanism for extracting lessons-learned from completed projects: planned vs. actual schedule, metrics, feedback from team members and customers
    - Record findings in written form

Why projects fail

- An unrealistic deadline is established
- Changing customer requirements
- An honest underestimate of effort
- Predictable and /or unpredictable risks
- Technical difficulties
- Miscommunication among project staff
- Failure in project management

Key points

- Good project management is essential for project success.
- The intangible nature of software causes problems for management.
- Managers have diverse roles but their most significant activities are planning, estimating and scheduling.
- Planning and estimating are iterative processes which continue throughout the course of a project.
- A project milestone is a predictable state where a formal report of progress is presented to management.
- Project scheduling involves preparing various graphical representations showing project activities, their durations and staffing.
- Risk management is concerned with identifying risks which may affect the project and planning to ensure that these risks do not develop into major threats.