Lecture 3

Project Management


Project management

- Organising, planning and scheduling software projects

Objectives

- To introduce software project management and to describe its distinctive characteristics
- To discuss project planning and the planning process
- To show how graphical schedule representations are used by project management
- To discuss the notion of risks and the risk management process

Topics covered

- Management activities
- Project planning
- Project scheduling
- Risk management

Software project management

- Concerned with activities involved in ensuring that software is delivered on time and on schedule and in accordance with the requirements of the organisations developing and procuring the software
- Project management is needed because software development is always subject to budget and schedule constraints that are set by the organisation developing the software
Software management distinctions

- The product is intangible
- The product is uniquely flexible
- Software engineering is not recognized as an engineering discipline with the same status as mechanical, electrical engineering, etc.
- The software development process is not standardized
- Many software projects are 'one-off' projects

Management activities

- Proposal writing
- Project planning and scheduling
- Project costing
- Project monitoring and reviews
- Personnel selection and evaluation
- Report writing and presentations

Management commonalities

- These activities are not peculiar to software management
- Many techniques of engineering project management are equally applicable to software project management
- Technically complex engineering systems tend to suffer from the same problems as software systems

Project staffing

- May not be possible to appoint the ideal people to work on a project
  - Project budget may not allow for the use of highly-paid staff
  - Staff with the appropriate experience may not be available
  - An organisation may wish to develop employee skills on a software project
- Managers have to work within these constraints especially when (as is currently the case) there is an international shortage of skilled IT staff

Project planning

- Probably the most time-consuming project management activity
- Continuous activity from initial concept through to system delivery. Plans must be regularly revised as new information becomes available
- Various different types of plan may be developed to support the main software project plan that is concerned with schedule and budget

Types of project plan

<table>
<thead>
<tr>
<th>Plan</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality plan</td>
<td>Describes the quality procedures and standards that will be used in a project</td>
</tr>
<tr>
<td>Validation plan</td>
<td>Describes the approach, resources and schedule used for system validation</td>
</tr>
<tr>
<td>Configuration management plan</td>
<td>Describes the configuration management procedures and structures to be used</td>
</tr>
<tr>
<td>Maintenance plan</td>
<td>Predicts the maintenance requirements of the system, maintenance costs and effort required</td>
</tr>
<tr>
<td>Staff development plan</td>
<td>Describes how the skills and experience of the project team members will be developed</td>
</tr>
</tbody>
</table>
Project planning process

Establish the project constraints
Make initial assessments of the project parameters
Define project milestones and deliverables
while project has not been completed or cancelled
end if
end loop

Project plan structure

- Introduction
- Project organisation
- Risk analysis
- Hardware and software resource requirements
- Work breakdown
- Project schedule
- Monitoring and reporting mechanisms

Activity organization

- Activities in a project should be organised to produce tangible outputs for management to judge progress
- Milestones are the end-point of a process activity
- Deliverables are project results delivered to customers
- The waterfall process allows for the straightforward definition of progress milestones

Milestones in the RE process

<table>
<thead>
<tr>
<th>Activities</th>
<th>Milestones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feasibility study</td>
<td>Feasibility report</td>
</tr>
<tr>
<td>Design study</td>
<td>Requirements specification</td>
</tr>
<tr>
<td>Design study</td>
<td>Specification</td>
</tr>
<tr>
<td>Requirements definition</td>
<td>Requirements specification</td>
</tr>
</tbody>
</table>

Project scheduling

- Split project into tasks and estimate time and resources required to complete each task
- Organize tasks concurrently to make optimal use of workforce
- Minimize task dependencies to avoid delays caused by one task waiting for another to complete
- Dependent on project managers intuition and experience

The project scheduling process

- Identify activities
- Identify activity dependencies
- Estimate resources for activities
- Allocate people to activities
- Create project charts
- Activity bars and charts
Scheduling problems

- Estimating the difficulty of problems and hence the cost of developing a solution is hard
- Productivity is not proportional to the number of people working on a task
- Adding people to a late project makes it later because of communication overheads
- The unexpected always happens. Always allow contingency in planning

Bar charts and activity networks

- Graphical notations used to illustrate the project schedule
- Show project breakdown into tasks. Tasks should not be too small. They should take about a week or two
- Activity charts show task dependencies and the critical path
- Bar charts show schedule against calendar time

Task durations and dependencies

<table>
<thead>
<tr>
<th>Task</th>
<th>Duration (days)</th>
<th>Dependencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>15</td>
<td>T1 (M1)</td>
</tr>
<tr>
<td>T3</td>
<td>15</td>
<td>T1 (M1)</td>
</tr>
<tr>
<td>T4</td>
<td>10</td>
<td>T2, T4 (M2)</td>
</tr>
<tr>
<td>T5</td>
<td>10</td>
<td>T2, T4 (M2)</td>
</tr>
<tr>
<td>T6</td>
<td>5</td>
<td>T1, T2 (M1)</td>
</tr>
<tr>
<td>T7</td>
<td>20</td>
<td>T1 (M1)</td>
</tr>
<tr>
<td>T8</td>
<td>25</td>
<td>T1 (M1)</td>
</tr>
<tr>
<td>T9</td>
<td>15</td>
<td>T1, T6 (M4)</td>
</tr>
<tr>
<td>T10</td>
<td>15</td>
<td>T5, T7 (M7)</td>
</tr>
<tr>
<td>T11</td>
<td>7</td>
<td>T9 (M6)</td>
</tr>
<tr>
<td>T12</td>
<td>10</td>
<td>T11 (M8)</td>
</tr>
</tbody>
</table>

Activity network

Activity timeline

Staff allocation
Risk management

- Risk management is concerned with identifying risks and drawing up plans to minimise their effect on a project.
- A risk is a probability that some adverse circumstance will occur.
  - Project risks affect schedule or resources
  - Product risks affect the quality or performance of the software being developed
  - Business risks affect the organisation developing or procuring the software

Software risks

<table>
<thead>
<tr>
<th>Risk</th>
<th>Risk Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff turnover</td>
<td>Project</td>
<td>Experienced staff will leave the project before it is finished.</td>
</tr>
<tr>
<td>Management change</td>
<td>Project</td>
<td>There will be a change of organisational management with different priorities.</td>
</tr>
<tr>
<td>Hardware unavailability</td>
<td>Project</td>
<td>Hardware which is essential for the project will not be delivered on schedule.</td>
</tr>
<tr>
<td>Requirements change</td>
<td>Project and product</td>
<td>There will be a larger number of changes to the requirements than anticipated.</td>
</tr>
<tr>
<td>Specification delays</td>
<td>Project and product</td>
<td>Specifications of essential interfaces are not available on schedule.</td>
</tr>
<tr>
<td>Size underestimate</td>
<td>Project and product</td>
<td>The size of the system has been underestimated.</td>
</tr>
<tr>
<td>CASE tool under-performance</td>
<td>Project</td>
<td>CASE tools which support the project do not perform as anticipated.</td>
</tr>
<tr>
<td>Technology change</td>
<td>Business</td>
<td>The underlying technology on which the system is built is superseded by new technology.</td>
</tr>
<tr>
<td>Product competition</td>
<td>Business</td>
<td>A competitive product is marketed before the system is completed.</td>
</tr>
</tbody>
</table>

The risk management process

- Risk identification
  - Identify project, product and business risks
- Risk analysis
  - Assess the likelihood and consequences of these risks
- Risk planning
  - Draw up plans to avoid or minimise the effects of the risk
- Risk monitoring
  - Monitor the risks throughout the project

Risks and risk types

- Technology risks
- People risks
- Organisational risks
- Requirements risks
- Estimation risks
Risk analysis

- Assess probability and seriousness of each risk
- Probability may be very low, low, moderate, high or very high
- Risk effects might be catastrophic, serious, tolerable or insignificant

<table>
<thead>
<tr>
<th>Risk Type</th>
<th>Probability</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisational financial problems</td>
<td>High</td>
<td>Catastrophic</td>
</tr>
<tr>
<td>Recruitment problems</td>
<td>Moderate</td>
<td>Serious</td>
</tr>
<tr>
<td>Staff illness</td>
<td>Moderate</td>
<td>Serious</td>
</tr>
<tr>
<td>Defective components</td>
<td>Moderate</td>
<td>Serious</td>
</tr>
<tr>
<td>Requirements changes</td>
<td>Moderate</td>
<td>Serious</td>
</tr>
<tr>
<td>Reluctance to use tools</td>
<td>High</td>
<td>Tolerable</td>
</tr>
<tr>
<td>Estimation</td>
<td>High</td>
<td>Tolerable</td>
</tr>
<tr>
<td>Database performance</td>
<td>Moderate</td>
<td>Tolerable</td>
</tr>
<tr>
<td>Underestimated development time</td>
<td>Moderate</td>
<td>Tolerable</td>
</tr>
</tbody>
</table>

Risk planning

- Consider each risk and develop a strategy to manage that risk
- Avoidance strategies
  - The probability that the risk will arise is reduced
- Minimisation strategies
  - The impact of the risk on the project or product will be reduced
- Contingency plans
  - If the risk arises, contingency plans are plans to deal with that risk

Risk factors

<table>
<thead>
<tr>
<th>Risk Type</th>
<th>Potential Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Late delivery of hardware or support software, many reported technology problems</td>
</tr>
<tr>
<td>People</td>
<td>Poor staff morale, poor relationships amongst team member, job availability</td>
</tr>
<tr>
<td>Organisational</td>
<td>Organisational gossip, lack of action by senior management</td>
</tr>
<tr>
<td>Tools</td>
<td>Reluctance by team members to use tools, complaints about CASE tools, demands for higherowered workstations</td>
</tr>
<tr>
<td>Requirements</td>
<td>Many requirements change requests, customer complaints failure to meet agreed schedule, failure to clear reported defects</td>
</tr>
<tr>
<td>Estimation</td>
<td></td>
</tr>
</tbody>
</table>
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

Key points

• A project milestone is a predictable state where some formal report of progress is presented to management.
• Risks may be project risks, product risks or business risks
• 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

Tutorial Question

• Sommerville (6th Edition) Chapter 4:
  – Question 4.2
  – Question 4.6
  – Question 4.9