Project management

• Organizing, planning and scheduling software projects

• DISCUSSION
  - Project Managers?

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 organizations 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 organization 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

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 organization 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 plans may be developed to support the main software project plan that is concerned with schedule and budget

Types of project plans

<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 plan structure

• Introduction
• Project organization
• Risk analysis
• Hardware and software resource requirements
• Work breakdown
• Project schedule
• Monitoring and reporting mechanisms

Activity organization

• Activities in a project should be organized 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

**MILESTONES**

- Feasibility study
- Requirements analysis
- Prototype development
- Design study
- Requirements specification

**ACTIVITIES**

- Feasibility report
- Requirements definition
- Evaluation report
- Architectural design
- Requirements specification

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

**MILESTONES**

- Identify activities
- Identify activity dependencies
- Estimate resources for activities
- Allocate people to activities
- Create project charts

**ACTIVITIES**

- Software requirements
- Activity charts and bar charts

Scheduling problems

- Estimating the difficulty of problems and the cost of developing a solution is not easy
- 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></td>
</tr>
<tr>
<td>T3</td>
<td>15</td>
<td>T1 (M1)</td>
</tr>
<tr>
<td>T4</td>
<td>10</td>
<td></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 (M3)</td>
</tr>
<tr>
<td>T7</td>
<td>20</td>
<td>T1 (M1)</td>
</tr>
<tr>
<td>T8</td>
<td>25</td>
<td>T4 (M5)</td>
</tr>
<tr>
<td>T9</td>
<td>15</td>
<td>T3, 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

Staff allocation

<table>
<thead>
<tr>
<th>Staff</th>
<th>4/7</th>
<th>11/7</th>
<th>18/7</th>
<th>25/</th>
<th>1/8</th>
<th>8/8</th>
<th>15/8</th>
<th>22/8</th>
<th>29/8</th>
<th>5/9</th>
<th>12/9</th>
<th>19/9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fred</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>T11</td>
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<td></td>
</tr>
<tr>
<td>Jane</td>
<td>T4</td>
<td>T8</td>
<td></td>
<td></td>
<td></td>
<td>T11</td>
<td>T12</td>
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<td></td>
</tr>
<tr>
<td>Anne</td>
<td>T1</td>
<td>T3</td>
<td>T9</td>
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<tr>
<td>Jim</td>
<td></td>
<td>T10</td>
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</tr>
<tr>
<td>Mary</td>
<td>T7</td>
<td>T5</td>
<td></td>
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Risk management

- Risk management is concerned with identifying risks and drawing up plans to minimize 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 organization developing or procuring the software
- PROJECT
  - Any risk planning?

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 minimize the effects of the risk
- Risk monitoring
  - Monitor the risks throughout the project

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 organizational management with different priorities.</td>
</tr>
<tr>
<td>Hardware unavailability</td>
<td>Project</td>
<td>Hardware that 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>Product</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>
Risk identification

- Technology risks
- People risks
- Organizational risks
- Requirements risks
- Estimation risks

Risks and risk types

<table>
<thead>
<tr>
<th>Risk type</th>
<th>Possible risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>The database used in the system cannot process as many transactions per second as expected. Software components that should be reused contain defects limiting their functionality.</td>
</tr>
<tr>
<td>People</td>
<td>It is impossible to recruit staff with the skills required.</td>
</tr>
<tr>
<td>Organizational</td>
<td>The organization is restructured so that different management is responsible for the project. Organizational financial problems force reductions in the project budget.</td>
</tr>
<tr>
<td>Tools</td>
<td>The code generated by CASE tools is inefficient. CASE tools cannot be integrated.</td>
</tr>
<tr>
<td>Requirements</td>
<td>Changes to requirements requiring major design rework are proposed. Customers fail to understand the impact of requirements changes.</td>
</tr>
<tr>
<td>Estimation</td>
<td>The time required to develop the software is underestimated. The rate of defect repair is underestimated. The size of the software is underestimated.</td>
</tr>
</tbody>
</table>

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

Risk planning

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