Project Management

Based on Sommerville’s “Software Engineering” textbook

Software Project Management

- Aimed to ensure that the software is delivered on time, within budget and schedule constraints, and satisfies the requirements of the client
- Management of software projects is different from other types of management because:
  - Software is not tangible
  - Software processes are relatively new and still "under trial"
  - Larger software projects are usually "one-off" projects
  - Computer technology evolves very rapidly

Management Activities

- Writing proposals
- Planning the project
- Scheduling the project
- Estimating the cost of the project
- Monitoring and reviewing the project’s progress
- Selecting, hiring, and evaluating personnel
- Writing reports and giving presentations
**Project Planning**

- A *project plan* should be drawn at the start of the project. This plan drives the project and needs to be continuously adjusted.
- The role of the project manager is to anticipate possible problems and be prepared with solutions for these problems.
- Other plans that need be developed:
  - Quality plan
  - Validation and verification plan
  - Configuration management plan
  - Maintenance plan
  - Staff development plan

**Project Planning**

- **Milestone** = end-point of a specific, distinct software process activity or task (for each milestone a report should be presented to the management).
- **Deliverable** = project result delivered to the client.
- In order to establish milestones the phases of the software process need be divided in basic activities/tasks. Example for requirements engineering:
  - **Feasibility study**
  - **Requirements analysis**
  - **Requirements definition**
  - **Prototype development**
  - **Design study**
  - **Architectural design**
  - **Design specification**
  - **Implementation**

**Project Scheduling**

- Software managers:
  - Divide the project in activities/tasks
  - Estimate time and resources needed to finish the project
  - Allocate resources to tasks
  - Try to employ efficiently all the project personnel
  - Minimize dependencies between tasks and teams
  - Prepare contingency plans
  - Rely on experience and intuition
Scheduling Process

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

Project Scheduling

- Graphical notations used in software project scheduling:
  - Tables: summary description of tasks
  - Bar charts: show schedule against the time
  - Activity charts: graphs that depict dependencies between tasks and indicate the critical path (the longest path in the activity graph)

Tabular description of tasks

<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 (M3)</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 (M4)</td>
</tr>
<tr>
<td>T11</td>
<td>7</td>
<td>T5 (M4)</td>
</tr>
<tr>
<td>T12</td>
<td>10</td>
<td>T11 (M4)</td>
</tr>
</tbody>
</table>
Activity Chart

Gantt Chart

Staff Allocation Chart
Risk Management

- **Risk** = some adverse circumstance that may happen and affect negatively the project, the product, and/or the business
- **Categories of risk:**
  - Project risks
  - Product risks
  - Business risks
- **Risk management** means anticipating risks and preparing plans to reduce their effect

### Types of Risks

<table>
<thead>
<tr>
<th>Risk</th>
<th>Affects</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>Changes in requirements may produce changes in the schedule.</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 underestimation</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 supported 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 Management Process

1. **Risk Identification**
   - List of potential risks
2. **Risk Analysis**
   - Prioritized risk list
3. **Risk Planning**
   - Risk avoidance and contingency plans
4. **Risk Monitoring**
   - Risk assessment
Risk Categories

<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 high-powered workstations</td>
</tr>
<tr>
<td>Requirements</td>
<td>Many requirements change requests, customer complaints</td>
</tr>
<tr>
<td>Estimation</td>
<td>Failure to meet agreed schedule, failure to clear reported defects</td>
</tr>
</tbody>
</table>

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 there are shortages of trained staff.
Why is Project Management so hard?

- Engineers and Architects who build skyscrapers and bridges have it easy
- Software Engineers and Software Architects have it hard... why?
- What makes these two design activities so different?
- Why did the Waterfall process used to be so common for software?
- Could Agile be used for skyscrapers and bridges?