Software Management

Dr. Marouane Kessentini
Department of Computer Science
What is Project Management?

• Project management encompasses all the activities needed to plan and execute a project:
  – Deciding what needs to be done
  – Estimating costs
  – Ensuring there are suitable people to undertake the project
  – Defining responsibilities
  – Scheduling
  – Making arrangements for the work
  – …
Goals of Software Project Management

• End results of the project satisfy the customer’s needs

• All the desired and the needed product/project attributes (quality, security, productivity, cost, schedule, etc.) are met

• Team members are operating effectively and at a high level of morale

• Required tools and other resources are made available and are effectively utilized
Project Management “Process”

• Why do we need project management?
• Why can’t we just follow one of the software development process and be left alone?

All projects – small and large – need project management because all projects need some degree of POMA:

1. - Planning
2. - Organizing
3. - Monitoring of status
4. - Adjustment
This process looks sequential at the macro level, but may be very iterative at the micro level.
Planning (POMA)

- The 1st step of project planning is to understand the requirements of the project.
  - This step itself may be a mini-project
- Then the following 4 steps are included in the rest of project planning:
  1. Perform Estimation of
     - the work effort,
     - the schedule, and
     - the needed resources
  2. Clearly define and establish measurable ‘goals’ for the project
  3. Determine the project resource allocations of
     - people,
     - process,
     - tools, and
     - facilities
  4. Identify and analyze the project risks
Organizing (POMA)

- Once a project plan is formulated or partially formulated, organizing may start
  - Organization structure needs to be designed
  - Human resource hiring needs to start and be completed along with acquisition of other resources
  - Any required education and training have to be completed
Monitoring (POMA)

- Once the project is organized and set into motion, there still needs to be regular tracking to ensure that it is headed in the right direction. (*Projects can not be left to coast along by itself.*)

- 3 main components of project monitoring:
  1. Project status information collection
  2. Analysis and evaluation of collected information
  3. Presentation and communication of the project status
Adjusting (POMA)

- It is highly unlikely that a software project progresses with no problem. As soon as the project status suggests potential problem, we must **not be afraid to make changes**.

- 3 main areas of adjustments are (or combinations of):
  - Resources
  - Schedule
  - Project content
Software Project Management Process is not the same as

- Software Development Process or
- Software Life Cycle
Cost estimation

• To estimate how much software-engineering time will be required to do some work.
  – Elapsed time
    • The difference in time from the start date to the end date of a task or project.
  – Development effort
    • The amount of labour used in person-months or person-days.
    • To convert an estimate of development effort to an amount of money:
      You multiply it by the weighted average cost (burdened cost) of employing a software engineer for a month (or a day).
Principles of effective cost estimation

• **Principle 1: Divide and conquer.**
  – To make a better estimate, you should divide the project up into individual subsystems.
  – Then divide each subsystem further into the activities that will be required to develop it.
  – Next, you make a series of detailed estimations for each individual activity.
  – And sum the results to calculate the total estimate for the project.
Principles of effective cost estimation

• **Principle 2: Include all activities when making estimates.**
  – The time required for all development activities must be taken into account.
  – Including:
    – Prototyping
    – Design
    – Inspecting
    – Testing
    – Debugging
    – Writing user documentation
    – Deployment.
Principles of effective cost estimation

• Principle 3: Base your estimates on past experience combined with knowledge of the current project.
  – If you are developing a project that has many similarities with a past project:
    • You can expect it to take a similar amount of work.
  – Base your estimates on the personal judgement of your experts or
  – Use algorithmic models developed in the software industry as a whole by analyzing a wide range of projects.
    • They take into account various aspects of a project’s size and complexity, and provide formulas to compute anticipated cost.
Principles of effective cost estimation

• Principle 4: Be sure to account for differences when extrapolating from other projects.
  – Different software developers
  – Different development processes and maturity levels
  – Different types of customers and users
  – Different schedule demands
  – Different technology
  – Different technical complexity of the requirements
  – Different domains
  – Different levels of requirement stability
Principles of effective cost estimation

- **Principle 5: Anticipate the worst case and plan for contingencies.**
  - Develop the most critical use cases first
    - If the project runs into difficulty, then the critical features are more likely to have been completed
  - Make three estimates:
    - Optimistic (O)
      - Imagining a everything going perfectly
    - Likely (L)
      - Allowing for typical things going wrong
    - Pessimistic (P)
      - Accounting for everything that could go wring
Some Cost Estimation Techniques

- Planning and Organizing: **Work Breakdown Structure**
  - Estimation of the complete project by
    - Tasks required to develop the deliverables
    - Resources required to perform the tasks
Work Breakdown Structure (WBS) Steps

1. **Identify the steps and tasks** required to produce each of the deliverables, including the tasks that are required to produce any intermediate internal deliverables.

2. **Sequence the tasks**, showing any potential for parallelism.

3. **Provide an estimate size** of each of the tasks.

4. Provide an **estimate of the productivity of the personnel** that is most likely to be assigned to each of the tasks.

5. **Calculate the time required** to accomplish each task.

6. For each of the external deliverable, **lay out the timeline** of all the tasks needed to produce that deliverable and label the resources that will be assigned to the tasks.
Example of: **Task Network** with **Estimated Time Units**
<table>
<thead>
<tr>
<th>Tasks</th>
<th>Person</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X,Y,Z</td>
<td>12 units</td>
</tr>
<tr>
<td>2</td>
<td>X,Y,Z</td>
<td>2</td>
</tr>
<tr>
<td>3a</td>
<td>X</td>
<td>6</td>
</tr>
<tr>
<td>3b</td>
<td>Y</td>
<td>6</td>
</tr>
<tr>
<td>3c</td>
<td>Z</td>
<td>6</td>
</tr>
<tr>
<td>4a</td>
<td>Z</td>
<td>2</td>
</tr>
<tr>
<td>4b</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>4c</td>
<td>Y</td>
<td>2</td>
</tr>
<tr>
<td>5a</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>5b</td>
<td>Y</td>
<td>1</td>
</tr>
<tr>
<td>5c</td>
<td>Z</td>
<td>1</td>
</tr>
</tbody>
</table>

End result of WBS = Initial Schedule Estimate
Gantt charts

- A Gantt chart is used to graphically present the start and end dates of each software engineering task
  - One axis shows time.
  - The other axis shows the activities that will be performed.
  - Important deadline dates, at which specific events may occur
Example of a Gantt chart

- Select administrative and medical staff
- Select site and do site survey
- Prepare final construction plans and layout
- Select equipment
- Bring utilities to the site
- Interview applicants and fill positions in nursing staff, maintenance and security
- Develop an information system
- Install the equipment
- Purchase and take delivery of equipment
- Construct the hospital
- Train nurses and support staff
Difficulties and Risks in Project Management

– Accurately estimating costs is a constant challenge
  • *Follow the cost estimation guidelines.*

– It is very difficult to measure progress and meet deadlines
  • *Improve your cost estimation skills so as to account for the kinds of problems that may occur.*
  • *Develop a closer relationship with other members of the team.*
  • *Be realistic in initial requirements gathering, and follow an iterative approach.*
  • *Use earned value charts to monitor progress.*
Difficulties and Risks in Project Management

– Communicating effectively in a large project is hard

• Take courses in communication, both written and oral.
• Learn how to run effective meetings.
• Review what information everybody should have, and make sure they have it.
• Make sure that project information is readily available.
• Use ‘groupware’ technology to help people exchange the information they need to know