IT/Software Project Management

Core Functions

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The following references were mostly used in the preparation of the course; the order reflects the intensity of usage:


Some information were taken from the following sites:

- The Institute of Electrical and Electronics Engineers (IEEE)
- The International Organisation for Standardisation (ISO)
- The Software Engineering Institute (SEI) at Carnegie Mellon University.
Project Time Management
IT COSTS
Objectives

- To introduce Project Time Management and its relation to project management framework
- To discuss the project time management processes
- To explain activity organization, milestones, and project deliverables
- To discuss Gantt chart and the calculation of project critical path
Project Management Framework

Quality & The Triple constraint

- Scope
- Budget
- Time

Quality
Importance of Project Schedules

- Managers often cite delivering projects on time as one of their biggest challenges.

- In 2003 study, 50% of IT projects showed that projects average time overrun increased to 82% from a low of 63 percent in 2000.
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.
A S/W project is a *Risky Business*

- All surveyed SW projects used waterfall lifecycle.
- 53% of projects cost almost 200% of original estimate.
Failure Statistics of SW Projects

- **Success**
  - On-time, On-budget, and with Most of the Features & Functions

- **Failed**
  - **Over**-budget,
  - **Over**-time,
  - and/or with **Fewer** Features & Functions

- **Impaired**
  - Cancelled & Unused
Failure Statistics of SW Projects

**CHAOS 2000 Results**

- Failed: 49%
- Succeed: 28%
- Cancelled: 23%
Failure Statistics of SW Projects

CHAOS History

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<th>Cancelled</th>
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<td>1996</td>
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<td>1994</td>
<td>16%</td>
<td>31%</td>
<td>53%</td>
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Moving Target Problem

Changes are *inevitable*

- Growing companies are always in dynamic change
- Markets evolve, thus needs of people change
- Need to minimize the impact of changes
Project Time Management Processes

- Project time management is often cited as the main source of conflict on projects, and most IT projects exceed time estimates.

- Main processes include:
  - Activity definition
  - Activity sequencing
  - Activity resource estimating
  - Activity duration estimating
  - Schedule development
  - Schedule control
Project Time Management

Processes

- **Activity definition**: Identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables.

- **Activity sequencing**: Identifying and documenting the relationships between project activities.

- **Activity resource estimating**: Estimating how many resources a project team should use to perform project activities.

- **Activity duration estimating**: Estimating the number of work periods that are needed to complete individual activities.

- **Schedule development**: Analyzing activity sequences, activity resource estimates, and activity duration estimates to create the project schedule.

- **Schedule control**: Controlling and managing changes to the project schedule.
Activity or Task Definition

- An activity (or task) is an element of work on the WBS that has:
  - a duration,
  - a cost,
  - and resource requirements.
SMART Criteria

- Tasks should be **SMART**:
  - **Specific**
  - **Measurable**
  - **Assignable**
  - **Realistic**
  - **Time-framed**
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

- A **milestone** is a significant event that normally has no duration.

- It often takes several activities and a lot of work to complete a milestone.

- Examples include completion and customer sign-off on key documents and completion of specific products.
Activity organization: Milestones & Deliverables

- **Milestones**
  - Check point based on:
    - Time
    - Budget
    - Deliverable
  - End-point of logical stage (activity) in the project
  - Has no duration
  - At each milestone there should be a formal output (report) presented to management
    - Management needs documentation & information to judge project progress

- **Deliverables**
  - Are project results delivered to customers
  - Deliverables are usually milestones but milestones need not be deliverables
Milestones Example: Requirements
Engineering process (prototyping)

Deliverables are usually milestones

Sommerville, Software Engineering, Addison Wesley, 2004
Activity Sequencing

- Involves reviewing activities and determining dependencies.

- A dependency or relationship relates to the sequencing of project activities or tasks.

- You must determine dependencies in order to use critical path analysis.
Activity Duration Estimating

- **Duration** includes the actual amount of time worked on an activity *plus* the elapsed time.

- **Effort** is the number of workdays or work hours required to complete a task.

- Effort does not normally equal duration.
Activity Resource Estimating

- Before estimating activity durations, you must have a good idea of the quantity and type of resources that will be assigned to each activity.

- Consider important issues in estimating resources:
  - How difficult will it be to complete specific activities on this project?
  - What is the organization’s history in doing similar activities?
  - Are the required resources available?
Gantt Charts

- **Gantt charts** provide a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in a calendar format.

- Symbols include:
  - **Black diamonds**: Milestones
  - **Thick black bars**: Summary tasks
  - **Lighter horizontal bars**: Durations of tasks
  - **Arrows**: Dependencies between tasks
Gantt Chart for Project X

Note: In Project 2003 darker bars are red to represent critical tasks.
Gantt Chart for Software Launch Project

- WBS hierarchy shown by indentations
- Summary task
- Milestone
- Individual task bar
- Arrows show dependencies
Adding Milestones to Gantt Charts

- Many people like to focus on meeting milestones, especially for large projects.

- Milestones emphasize important events or accomplishments in projects.

- You typically create milestone by entering tasks that have a zero duration, or you can mark any task as a milestone.
# Sample Tracking Gantt Chart

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<th>Task Name</th>
<th>March</th>
<th>April</th>
<th>May</th>
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<td>26 3 6 9 12</td>
<td>22 24 27</td>
<td>30 2 5 8 11</td>
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<td>2 5 8 11</td>
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<td>14 Final Report and Presentation</td>
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**Planned dates**

**Actual dates**

**Slipped milestone**
Critical Path Method (CPM)

- **CPM** is a network diagramming technique used to predict total project duration.

- A **critical path** for a project is the series of activities that determines the *earliest time by which the project can be completed*.

- The critical path is the *longest path* (time) through the network diagram and has the least amount of slack or float.

- **Slack** or **float** is the amount of time an activity can be delayed without delaying a succeeding activity or the project finish date.
Calculating the Critical Path

- Develop a good network diagram.

- Add the duration estimates for all activities on each path through the network diagram.

- The longest path (time) is the critical path.

- If one or more of the activities on the critical path takes longer than planned, the whole project schedule will slip unless the project manager takes corrective action.
More on the Critical Path

- A project team at Apple computer put a stuffed gorilla on top of the cubicle of the person who was currently managing a critical task.

- The critical path does not necessarily contain all the critical activities; it only accounts for time.

- There can be more than one critical path if the lengths of two or more paths are the same.

- The critical path can change as the project progresses.
Using Critical Path Analysis to Make Schedule Trade-offs

- **Free slack** or **free float** is the amount of time an activity can be delayed without delaying the early start of any immediately following activities.

- **Total slack** or **total float** is the amount of time an activity can be delayed from its early start without delaying the planned project finish date.

- A **forward pass** through the network diagram determines the early start and finish dates.

- A **backward pass** determines the late start and finish dates.
Using the Critical Path to Shorten a Project Schedule

- Three main techniques for shortening schedules:
  - **Shortening** the duration of critical activities or tasks by adding more resources or changing their scope.
  - **Crashing** activities by obtaining the greatest amount of schedule compression for the least incremental cost.
  - **Fast tracking** activities by doing them in parallel or overlapping them.
Many Horror Stories Related to Project Schedules

- Creating realistic schedules and sticking to them is a key challenge of project management.

- Crashing and fast tracking often cause more problems, resulting in longer schedules.
Importance of Updating Critical Path Data

- It is important to update project schedule information to meet time goals for a project.

- The critical path may change as you enter actual start and finish dates.

- If you know the project completion date will slip, negotiate with the project sponsor.
Three-Point Estimates

- Instead of providing activity estimates as a discrete number, such as four weeks, it’s often helpful to create a **three-point estimate**:
  - An estimate that includes an optimistic, most likely, and pessimistic estimate, such as three weeks for the optimistic, four weeks for the most likely, and five weeks for the pessimistic estimate.

- Three-point estimates are needed for PERT estimates and Monte Carlo simulations.
PERT Formula and Example

- **PERT weighted average =**
  
  \[ \frac{\text{optimistic time} + 4 \times \text{most likely time} + \text{pessimistic time}}{6} \]

- **Example:**

  PERT weighted average =
  
  \[ \frac{8 \text{ workdays} + 4 \times 10 \text{ workdays} + 24 \text{ workdays}}{6} = 12 \text{ days} \]

  where:
  - optimistic time = 8 days
  - most likely time = 10 days
  - pessimistic time = 24 days

  Therefore, you’d use **12 days** on the network diagram instead of 10 when using PERT for the above example.
Task Estimation

- Increase your original estimate to cover anticipated & unanticipated problems
  - Add 30% for anticipated problems
  - Add 20% for omissioning (unanticipated problems)
Project Scheduling

- Identify activities
- Estimate activity effort
- Estimate resources needed per activity
- Allocate people
- Create project charts
The project scheduling process

1. Identify activities
2. Identify activity dependencies
3. Estimate resources for activities
4. Allocate people to activities
5. Create project charts

Software requirements

Activity charts and bar charts
Scheduling Problems

- Adding people to a late project may make it later because of communication overheads.

- Murphy’s Law: The unexpected always happens. Always allow contingency in planning Murphy.
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
Gantt Chart for a Project

Note: In Project 2003 darker bars are red to represent critical tasks.
Example: Project Precedence Table

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<th>Task</th>
<th>Duration (Weeks)</th>
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<td>G</td>
<td>7</td>
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Critical Path

Critical Path: B-D-F-G

forward pass

backward pass
## Project Precedence Table

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Critical task
Working with People Issues

- Project managers should use:
  - Empowerment
  - Incentives
  - Discipline
  - Negotiation
Staff allocation

Fred
Fred
Jane
Anne
Jim
Mary

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