Project Planning

“What are you going to do in the project?”

Lecture Objectives

%To discuss the tasks in planning a project
%To describe the tools that can be used for developing a project plan
%To illustrate the use of graphical representations of project activities
%To understand the importance of the critical path in scheduling

Planning

Meaning:
“Organizing project in logical order and Identifying and defining work activities in a manner that help achieve project objectives”

Basic Reasons for Planning

%To element/reduce uncertainty
%To improve efficiency of the operation
%To provide better understanding
%To provide a basis for monitoring and controlling work

Project Planning and Control System

Goals/Objectives → Work Description and Instructions → Network Scheduling → Master/Detailed Schedules → Time/Cost/Performance Tracking → Budgets

Planning Steps

1. Establish objectives
2. Develop a plan
3. Construct project planning diagram
4. Identify timing duration of each activity in planning diagram
5. Identify costs and labor/personnel associated with each activity
**Establish Objectives**

- State objectives
  - Project start/end dates
  - Budgets
  - Technical results
- List milestones
  - Milestone: a scheduled event for which some person is held accountable and which is used to measure and control progress.
- Designate responsible personnel to meet objectives

**Develop A Plan**

- List activities
- Develop Work Breakdown Structure (WBS): The WBS reflects the decomposition of a project into subtasks down to the level for effective planning and control.
- Determine relationships of activities
  - Job precedence/succession
  - Concurrent jobs

**Work Breakdown Structure**

- Break project tasks into successively finer levels: Program - Project - Task - Work Package - Work Unit
- Each work unit
  - Short time span
  - Specific start & end point
  - Budgetable in terms of money, resources
  - Can be assigned an individual responsibility
  - Can be scheduled

**Purpose of WBS**

- Manageable
- Independent
- Integratable
- Measurable

**WBS Example**

- Level 1
  - ABC Project
- Level 2
  - Definition
  - Analysis
  - Design
  - Programming
- Level 3
  - Requirements Documentation
  - Feasibility Study
  - Risk Analysis

**WBS of a simple project**

- Each activity has a duration and consumes resources.
- Each activity has a constraint (example: one must be finished before the other starts; so activities are executed in order).
Program Evaluation and Review Technique (PERT) diagram

- The numerical number represents the duration of each activity.
- PERT is mainly concerned with time of each activity and interrelations among activities.

Critical Path Method (CPM)

- By drawing a network diagram, you can figure out the critical path of your project.
- The critical path is the longest path through the network. If something falls behind schedule on the critical path, the whole project falls behind schedule unless time is made up elsewhere.
- It's easier to adjust other activities (allocate more/less resources) when you know the interdependencies of activities.

Construct Project Planning Diagram

- Draw the logical sequence of activities
- Precedence Diagramming Method (PDM)
  - Activity on Node (AON)
- Arrow Diagramming Method (ADM)
  - Activity on Arrow (AOA)

Terms

- Activity - A task or job which takes time & use up resources
  - Represented by labeled arrow
- Event - An instantaneous point representing the start or finish of an activity
  - Represented by node
- Slack time: indicates that the corresponding activity may consume more than its estimated time, or start later than the earliest possible start time, without affecting the total duration of the project.
- Critical path: a path that has activities without any slack time

Activity-on-Arrow (AOA) Diagram

Each activity has only one arrow associated with it.

Activity Precedence

<table>
<thead>
<tr>
<th>Activity</th>
<th>Immediate Predecessor</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>E</td>
<td>B, C</td>
<td>4</td>
</tr>
<tr>
<td>F</td>
<td>C</td>
<td>5</td>
</tr>
<tr>
<td>G</td>
<td>D, E</td>
<td>3</td>
</tr>
</tbody>
</table>
**Network Characteristics**

- Construct from left to right
- Any activity can have only one start node
- No two activities can have the same start and end node
- Dummy activities are used in AOA
- Start the network by finding those activities that have no predecessors
- Calculate activity times using probabilistic or deterministic means

**Dummy Activity**

- Represented by dotted arrow
- Used when relationships between activities require no work
- Applied when:
  - two activities start and end similarly
  - succeeding activities have partial dependencies on predecessor activities

**PERT and CPM**

**PERT**

- R&D Development
- Originally focused on time only
- Uses probabilistic time estimates
- AOA based
- Critical path & slack

**CPM**

- Construction
- Time and Cost
- Uses deterministic time estimates
- AON based
- Critical path & slack
- Used in most software

**GANTT Charts**

- Horizontal time representation of PERT/CPM, aka Timeline charts
- Slack times shown as dashed lines
- Critical path events are often milestones
- Inadequate for showing dependencies
- PERT/CPM is required to control the schedule
- Can be used as a scheduling mechanism

**Project Planning Summary**

- Objectives
- Scope
- Specs
- Organizational Structure
- Technical Criteria
- Documentation
- WBS
- Responsibility Chart
- Project Plan
- Material & Manpower
- Networks
- Schedules

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*Gantt Chart Example*
Decision Tree Analysis

Software engineering managers are often faced with a make/buy decision to acquire a computer software.
This decision can be solved by computing Decision Tree Analysis.
Example: System X, can be build (in-house developer), reuse, buy or contract (employees outside vendor).

Computing Expected Cost

\[
\text{expected cost} = \sum (\text{path probability}) \times (\text{estimated path cost})
\]

For example, the expected cost to build is:
\[
\text{expected cost}_{\text{build}} = 0.30(\$380K) + 0.70(\$450K) = \$429K
\]

Similarly,
\[
\begin{align*}
\text{expected cost}_{\text{reuse}} &= \$382K \\
\text{expected cost}_{\text{buy}} &= \$267K \\
\text{expected cost}_{\text{contract}} &= \$410K
\end{align*}
\]

References