Project Scheduling – Duration, Tracking and Gantt Chart

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PROJECT SCHEDULING AND TRACKING

- *Software project scheduling* is an activity that distributes estimated effort across the planned project duration by allocating the effort to specific software engineering tasks.
- During early stages of project planning, a *macroscopic schedule* is developed.
- This type of schedule identifies all major software engineering activities and the product functions to which they are applied.
- As the project gets under way, each entry on the macroscopic schedule is refined into a *detailed schedule.*

Basic Concept

Why software is delivered late?

- An **unrealistic deadline** established
- **Changing customer requirements** that are not reflected in schedule changes.
- **Underestimate** of the *amount of effort* and/or the *number of resources* that will be required to do the job.
- Predictable and/or unpredictable **risks** that were not considered when the project commenced.
- **Technical difficulties** that could not have been foreseen in advance.
- **Human difficulties** that could not have been foreseen in advance.
- **Miscommunication** among project staff that results in delays.
- A **failure by project management** to recognize that the project is falling behind schedule and a lack of action to correct the problem.

What should we do when management demands that make a deadline that is impossible?

- Perform a detailed estimate using historical data from past projects. Determine the estimated effort and duration for the project.

- Using an incremental process model that will deliver critical functionality by the imposed deadline. Document the plan.

- Meet with the customer and (using the detailed estimate), explain why the imposed deadline is unrealistic.
- Offer the incremental development strategy as an alternative

Basic principle

- **Compartmentalization:** The project must be compartmentalized into a number of manageable activities and tasks.
- To accomplish compartmentalization, both the product and the process are decomposed.
- **Interdependency.** The interdependency of each compartmentalized activity or task must be determined.
- Some tasks must occur in sequence while others can occur in parallel.
- Some activities cannot commence until the work product produced by another is available.

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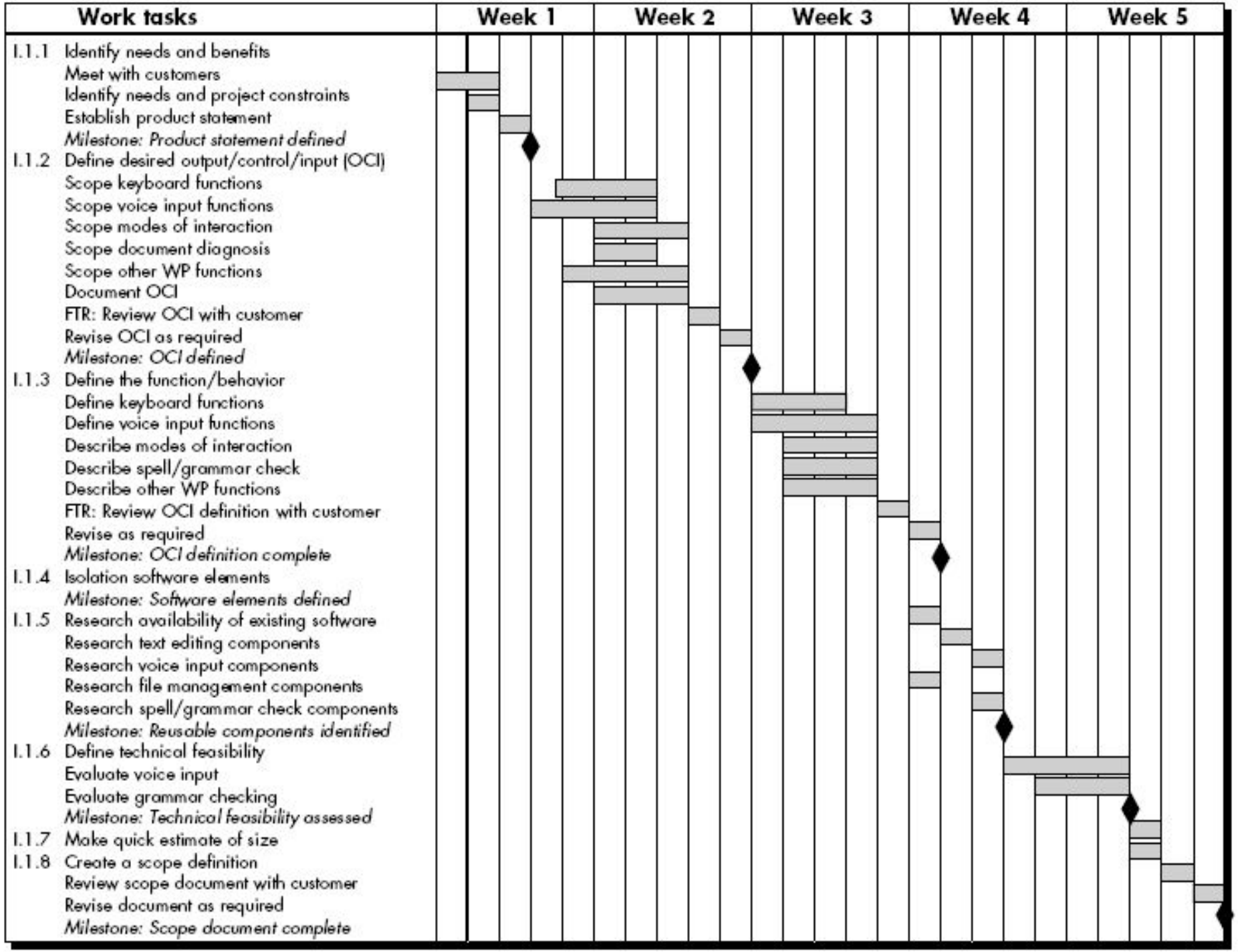
- **Time allocation.** Each task to be scheduled must be allocated some number of work units (e.g., person-days of effort).
- In addition, each task must be assigned a start date and a completion date that are a function of the interdependencies
- **Effort validation.** As time allocation occurs, the project manager must ensure that no more than the allocated number of people have been scheduled at any given time.
- **Defined responsibilities**. Every task that is scheduled should be assigned to a specific team member.
- **Defined outcomes.** Every task that is scheduled should have a defined outcome. For software projects, the outcome is normally a work product or deliverable.
- **Defined milestones.** A milestone is accomplished when one or more work products has been reviewed for quality and has been approved.

Gantt Chart (Timeline Chart)

- Gantt chart is a type of a bar chart that is used for illustrating project schedules.
- Gantt charts can be used in any projects that involve effort, resources, milestones and deliveries.
- Gantt charts allow project managers to track the progress of the entire project.
- Through Gantt charts, the project manager can keep a track of the individual tasks as well as of the overall project progression.
- In addition to tracking the progression of the tasks, Gantt charts can also be used for tracking the utilization of the resources in the project. These resources can be human resources as well as materials used.

Gantt Chart

- The planner always begins with a set of tasks (the work breakdown structure).
- Secondly, the project should have identified its milestones and deliveries.
- If automated tools are used, the work breakdown is input as a task network or task outline.
- Effort, duration, and start date are then input for each task. In addition, tasks may be assigned to specific individuals.
- A timeline chart enables you to determine what tasks will be conducted at a given point in time.
- A timeline chart can be developed for the entire project.
- Alternatively, separate charts can be developed for each project function or for each individual working on the project.


Work tasks
Week 1
Week 2
Week 3
Week 4
Week 5
I.1.1 Identify needs and benefits
Meet with customers
Identify needs and project constraints
Establish product statement
Milestone: Product statement defined
I.1.2 Define desired output/control/input (OCI)
Scope keyboard functions
Scope voice input functions
Scope modes of interaction
Scope document diagnosis
Scope other WP functions
Document OCI
FTR: Review OCI with customer
Revise OCI as required
Milestone: OCI defined
I.1.3 Define the function/behavior
Define keyboard functions
Define voice input functions
Describe modes of interaction
Describe spell/grammar check
Describe other WP functions
FTR: Review OCI definition with customer
Revise as required
Milestone: OCI definition complete
I.1.4 Isolation software elements
Milestone: Software elements defined
I.1.5 Research availability of existing software
Research text editing components
Research voice input components
Research file management components
Research spell/grammar check components
Milestone: Reusable components identified
I.1.6 Define technical feasibility
Evaluate voice input
Evaluate grammar checking
Milestone: Technical feasibility assessed
I.1.7 Make quick estimate of size
I.1.8 Create a scope definition
Review scope document with customer
Revise document as required
Milestone: Scope document complete

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- All project tasks are listed in the left-hand column.
- The horizontal bars indicate the duration of each task.
- When multiple bars occur at the same time on the calendar, task concurrency is implied.
- The diamonds indicate milestones.
- Once the information necessary for the generation of a timeline chart has been input, the majority of software project scheduling tools produce *project tables*
- It is a tabular listing of all project tasks, their planned and actual start- and end-dates, and a variety of related information.
- Project tables enable the project manager to track progress.

Project Table

Work tasks	Planned start	Actual start	Planned complete	Actual complete	Assigned person	Effort allocated	Notes
I.1.1 Identify needs and benefits							Scoping will require more effort/time
Meet with customers	wk1, d1	wk1, d1	wk1, d2	wk1, d2	BLS	2 p-d	
Identify needs and project constraints	wk1, d2	wk1, d2	wk1, d2	wk1, d2	JPP	1 p-d	
Establish product statement	wk1, d3	wk1, d3	wk1, d3	wk1, d3	BLS/JPP	1 p-d	
Milestone: Product statement defined	wk1, d3	wk1, d3	wk1, d3	wk1, d3			
I.1.2 Define desired output/control/input (OCI)							
Scope keyboard functions	wk1, d4	wk1, d4	wk2, d2		BLS	1.5 p-d	
Scope voice input functions	wk1, d3	wk1, d3	wk2, d2		JPP	2 p-d	
Scope modes of interaction	wk2, d1		wk2, d3		MLL	1 p-d	
Scope document diagnostics	wk2, d1		wk2, d2		BLS	1.5 p-d	
Scope other WP functions	wk1, d4	wk1, d4	wk2, d3		JPP	2 p-d	
Document OCI	wk2, d1		wk2, d3		MLL	3 p-d	
FTR: Review OCI with customer	wk2, d3		wk2, d3		all	3 p-d	
Revise OCI as required	wk2, d4		wk2, d4		all	3 p-d	
Milestone: OCI defined	wk2, d5		wk2, d5				
I.1.3 Define the function/behavior							

Tracking the Schedule

- Project schedule defines the tasks and milestones that must be tracked and controlled as the project proceeds.
- Tracking can be accomplished in a number of different ways:
  - Conducting periodic project status meetings in which each team member reports progress and problems.
  - Evaluating the results of all reviews conducted
  - Determining whether formal project milestones (i.e. diamonds) have been accomplished by the scheduled date.
  - Comparing actual start-date to planned start-date for each project task listed in the resource table.
  - Using earned value analysis to evaluate progress quantitatively.

EARNED VALUE ANALYSIS

- The earned value system provides a common value scale for every task, regardless of the type of work being performed.
- Simply stated, earned value is a measure of progress.
- It enables us to assess the “percent of completeness” of a project using quantitative analysis
- The total hours to do the whole project are estimated, and every task is given an earned value based on its estimated percentage of the total.

To determine the earned value

- The *budgeted cost of work scheduled (BCWS) is determined for each work task* represented in the schedule.
  - BCWS*i is the effort planned for work task i.*
  - To determine progress at a given point along the project schedule, the value of BCWS is the sum of the $BCWS_i$ values for all work tasks for that point in time.
- The BCWS values for all work tasks are summed to derive the *budget at completion,* BAC.
- Hence,

$$BAC = \sum (BCWS_k) \text{ for all tasks } k$$

- Next, the value for *budgeted cost of work performed* (BCWP) is computed.
- The value for BCWP is the sum of the BCWS values for all work tasks that have actually been completed by a point in time on the project schedule.
  - BCWS - budget of the activities that were planned to be completed
  - BCWP - budget of the activities that actually were completed."
- Given values for BCWS, BAC, and BCWP, important progress indicators can be computed:
  - Schedule performance index, **SPI = BCWP/BCWS**

  SPI is an indication of the efficiency with which the project is utilizing scheduled resources.
- SPI value close to 1.0 indicates efficient execution of the project schedule.

- **Percent scheduled for completion = BCWS/BAC**
  - Indication of the percentage of work that should have been completed by time *t.*
- **Percent complete = BCWP/BAC**
  - provides a quantitative indication of the percent of completeness of the project at a given point in time, t.
- Actual cost of work performed, ACWP, is the sum of the effort actually expended on work tasks that have been completed by a point in time on the project schedule. It is then possible to compute
  - Cost performance index, **CPI = BCWP/ACWP**
- CPI value close to 1.0 provides a strong indication that the project is within its defined budget

PROBLEMS

- Suppose you have a budgeted cost of a project at $900,000. The project is to be completed in 9 months. After a month, you have completed 10 percent of the project at a total expense of $100,000. The planned completion should have been 15 percent.

PROBLEMS

- BAC = $900,000
- AC = $100,000
- Planned Value = Planned Completion (%) * BAC

  = 15% * $ 900,000 = $ 135,000
- Earned Value = Actual Completion (%) * BAC

  = 10% * $ 900,000 = $ 90,000
- **Cost Performance Index (CPI)** = EV / AC = $90,000 / $100,000 = 0.90.
  - This means for every $1 spent, the project is producing only 90 cents in work.
- **Schedule Performance Index (SPI)** = EV / PV = $90,000 / $135,000 = 0.67.
  - This means for every estimated hour of work, the project team is completing only 0.67 hours (approximately 40 minutes).

PROBLEMS

- Suppose you are managing a software development project. The project is expected to be completed in 8 months at a cost of $10,000 per month. After 2 months, you realize that the project is 30 percent completed at a cost of $40,000. You need to determine whether the project is on-time and on-budget after 2 months.

PROBLEMS

- Budget at Completion (BAC) = $10,000 * 8 = $80,000
- Actual Cost (AC) = $40,000
- Planned Completion = 2/8 = 25%
- Actual Completion = 30%
- Planned Value = Planned Completion (%) * BAC = 25% * $ 80,000 = $ 20,000
- Earned Value = Actual Completion (%) * BAC = 30% * $ 80,000 = $ 24,000
- **Cost Performance Index (CPI)** = EV / AC = $24,000 / $40,000 = 0.6
- **Schedule Performance Index (SPI)** = EV / PV = $24,000 / $20,000 = 1.2

Thank You…