Software Project Management

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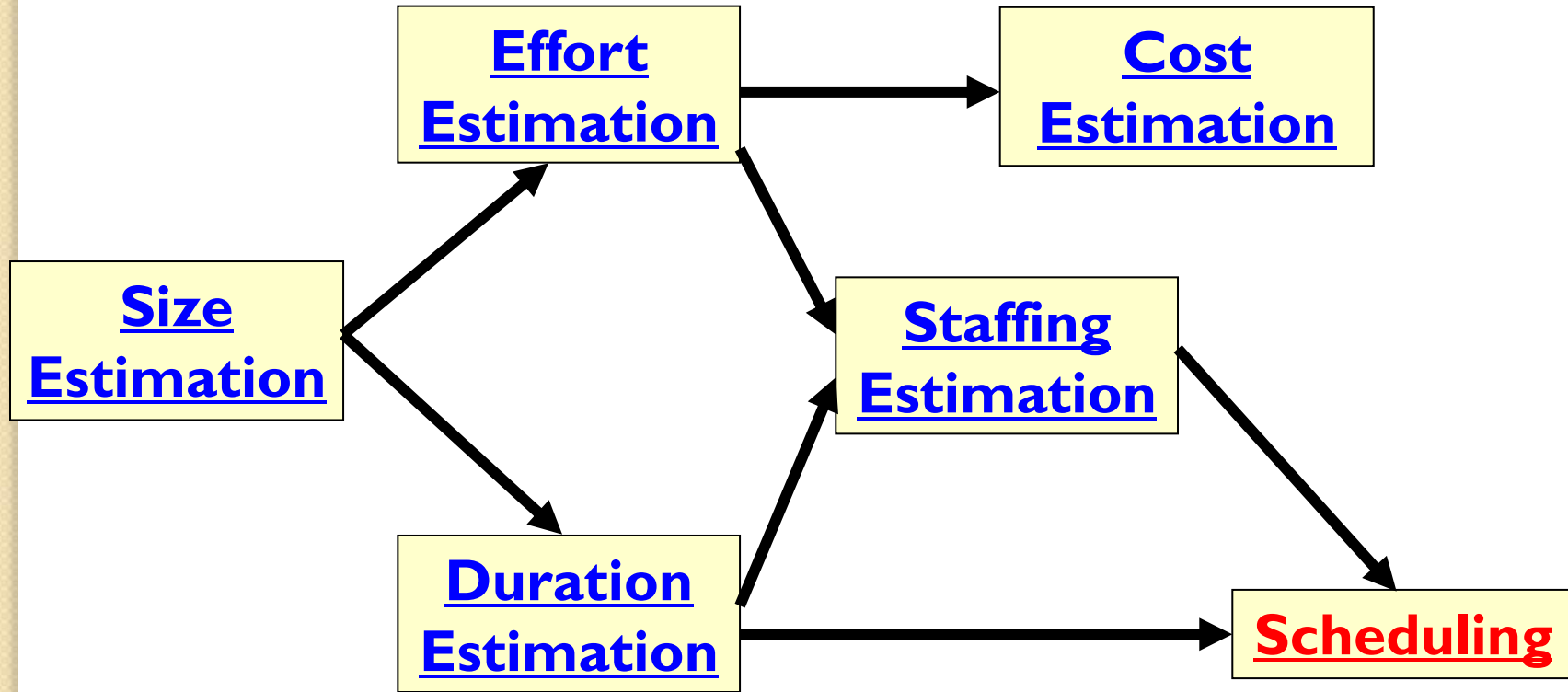
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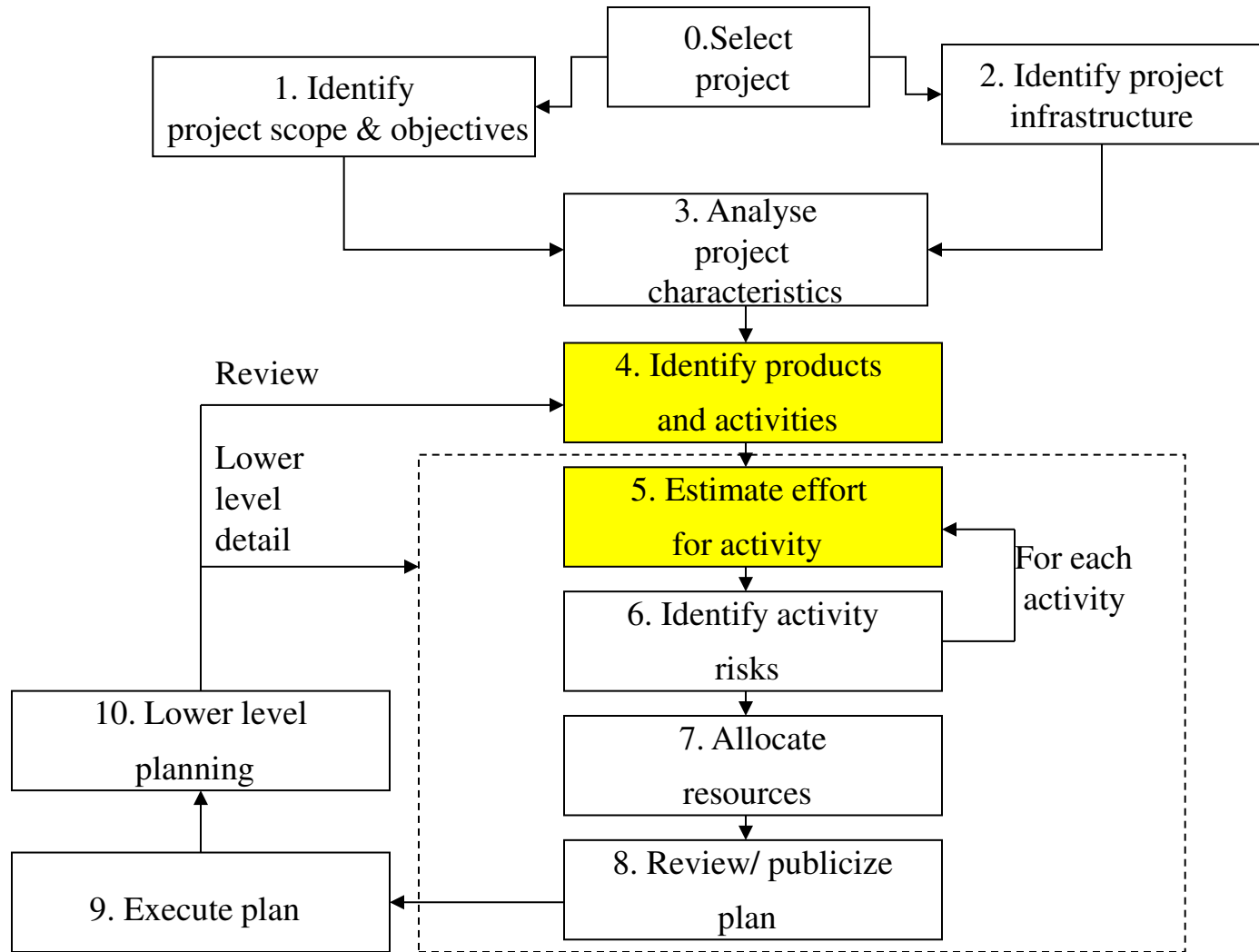
Project Scheduling

Sequence of Estimations and Scheduling

Introduction to Scheduling

- Scheduling the project tasks is an important project planning activity.

- The scheduling problem, in essence, consists of deciding which tasks would be taken up when and by whom.

- Once a schedule has been worked out and the project gets underway, the project manager monitors the timely completion of the tasks and

  ◦ takes any corrective action that may be necessary whenever there is a chance of schedule slippage.

Steps for Scheduling

In order to schedule the project activities, a project manager needs to do the followings:

1. Identify all the major activities that need to be carried out to complete the project.

2. Break down each activity into tasks.

3. Determine the dependency among different tasks.

4. Establish the estimates for the time durations necessary to complete the tasks.

Steps for Scheduling

5. Represent the information in the form of an activity network.

6. Determine task starting and ending dates from the information represented in the activity network.

7. Determine the critical path. A critical path is a chain of tasks that determines the duration of the project.

8. Allocate resources to tasks.

Steps for Scheduling cont …

- The first step in scheduling a software project involves identifying all the activities necessary to complete the project. A good knowledge of the intricacies of the project and the development process helps the managers to effectively identify the important activities of the project.
- Next, the activities are broken down into a logical set of smaller activities (sub-activities). The smallest sub-activities are called **tasks** which are assigned to different developers.
- A project manager breakdowns the tasks systematically by using the work breakdown structure (WBS).

Scheduling   cont …

- After the project manager has broken down the activities into tasks, he has to find the dependency among the tasks. Dependency among the different tasks determines the order in which the different tasks would be carried out.

- If a task A requires the results of another task B, then task A must be scheduled after task B and A is said to be dependent on B.

- The task dependencies define a partial ordering relation among tasks, i.e. each task may precede a subset of other tasks, but some tasks might not have any precedence ordering defined between them (called concurrent tasks).

- The dependency among the activities are represented in the form of an activity network.

Steps for Scheduling   cont …

- Once the activity network representation has been worked out, resources are allocated to each activity. Resource allocation is typically done using a Gantt Chart.

- After resource allocation is done, a project evaluation and review technique (PERT) chart representation is developed. The PERT chart representation is useful to a project manager to carry out project monitoring and control.

- Let us now discuss the work break down structure, activity network, Gantt and PERT charts.

Work Breakdown Structure

- Work breakdown structure (WBS) is used

  ◦ to recursively decompose a given set of activities into smaller activities.

- Tasks are the lowest level work activities in a WBS hierarchy.

- They also form the basic units of work that are allocated to the developer and scheduled.

Necessity of breaking down project activities into tasks

- Once project activities have been decomposed into a set of tasks using WBS,
  - the time frame when each activity is to be performed is to be determined.
- The end of each important activity is called a *milestone*.
- The project manager tracks the progress of a project by monitoring the timely completion of the milestones.
- If he observes that some milestones start getting delayed,
  - he carefully monitors and controls the progress of the tasks, so that the overall deadline can still be met.

Work Breakdown Structure

- WBS provides a notation for representing
  - the activities, sub-activities, and tasks needed to be carried out in order to solve a problem.

- Each of these is represented using a rectangle as node of a tree. The root of the tree is labeled by the problem name.

- Each node of the tree is broken down into smaller activities that are made the children of the node.

- It is not useful to subdivide tasks into units which take less than a week or two to execute.

  - Finer subdivisions mean that a large amount of time must be spent on estimating and chart revision.

Work Breakdown Structure - Example
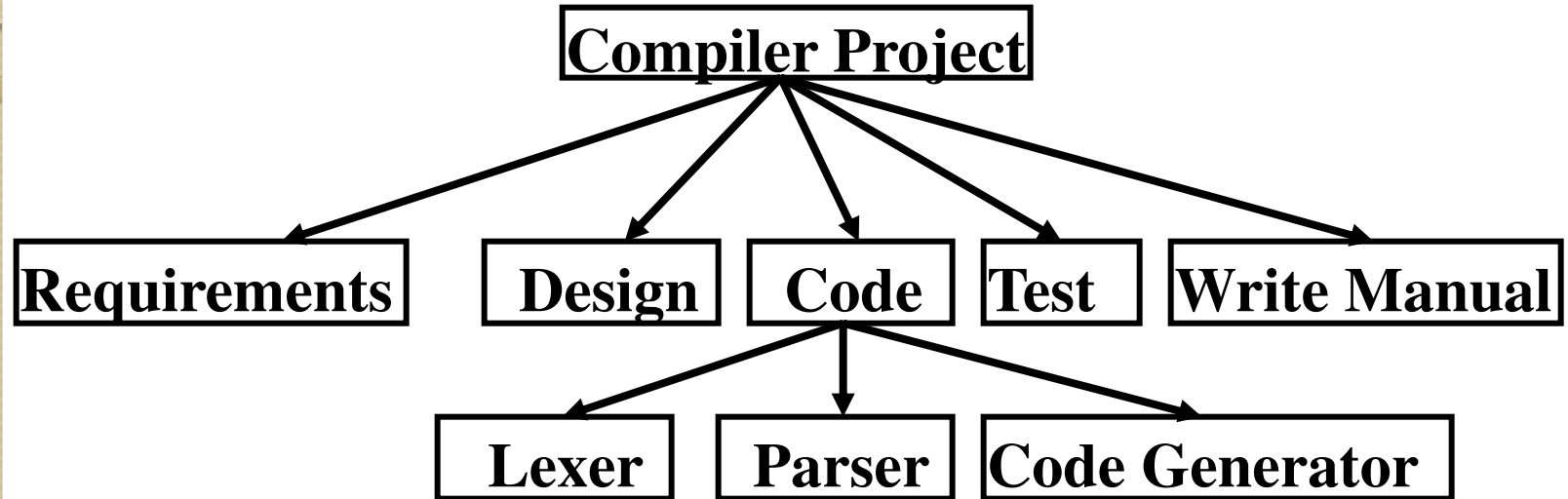
How long to decompose

- The decomposition of the activities is carried out until any of the following is satisfied:

  ◦ A leaf-level subactivity (a task) requires approximately two weeks to develop.

  ◦ Hidden complexities are exposed,

    • so that the job to be done is understood and can be assigned as a unit of work to one of the developers.

  ◦ Opportunities for reuse of existing software components is identified.

Breaking down tasks to too coarse levels versus too fine levels

- Let us investigate the implications of carrying out the decompositions to very coarse levels versus decomposing to very fine levels.

- When the granularity of the tasks is several months, by the time a problem (schedule delay) is noticed and corrective actions are initiated, it may be too late for the project to recover.

- On the other hand, if the tasks are decomposed into very small granularity (one or two days), then the milestones get too closely spaced.

- This would require frequent monitoring of the project status and entail frequent revisions to the plan document.

- This becomes a high overhead on the project manager and his effectiveness in project monitoring and control gets reduced.

Breaking down tasks to too coarse levels versus too fine levels cont …

- While breaking down an activity into smaller tasks, a manager often has to make some hard decisions.

- If an activity is broken down into a large number of very small sub-activities, these can be distributed to a larger number of developers.

- If the task ordering permits that solutions to these can be carried out independently (parallely), it becomes possible to develop the product faster (with the help of additional manpower of course!).

- Therefore, to be able to complete a project in the least amount of time, the manager needs to break large tasks into smaller ones, expecting to find more parallelism.

- However, it is not useful to subdivide tasks into units which take less than a week or two to execute.

Scheduling

- Many managers believe
  - ◦ an aggressive schedule motivates the engineers to do a better and faster job.
  - ◦ However, careful experiments show:
    - unrealistic aggressive schedules cause engineers to compromise on intangible quality aspects,
   - also cause schedule delays.

Scheduling   cont …

- A good way to achieve accuracy:
  - let people set their own schedules.
- Schedule for a large-sized task may take too long:
  - Managers need to break large tasks into smaller ones to find more parallelism
    - can lead to shorter development time.
    - Small-sized tasks help in better tracking

Example

- Consider a project for development of a management information system (MIS).

- The project manager has identified the main development activities to be

  ◦ Requirements specification

  ◦ Design

  ◦ Code

  ◦ Test

  ◦ document

WBS of management information system (MIS)
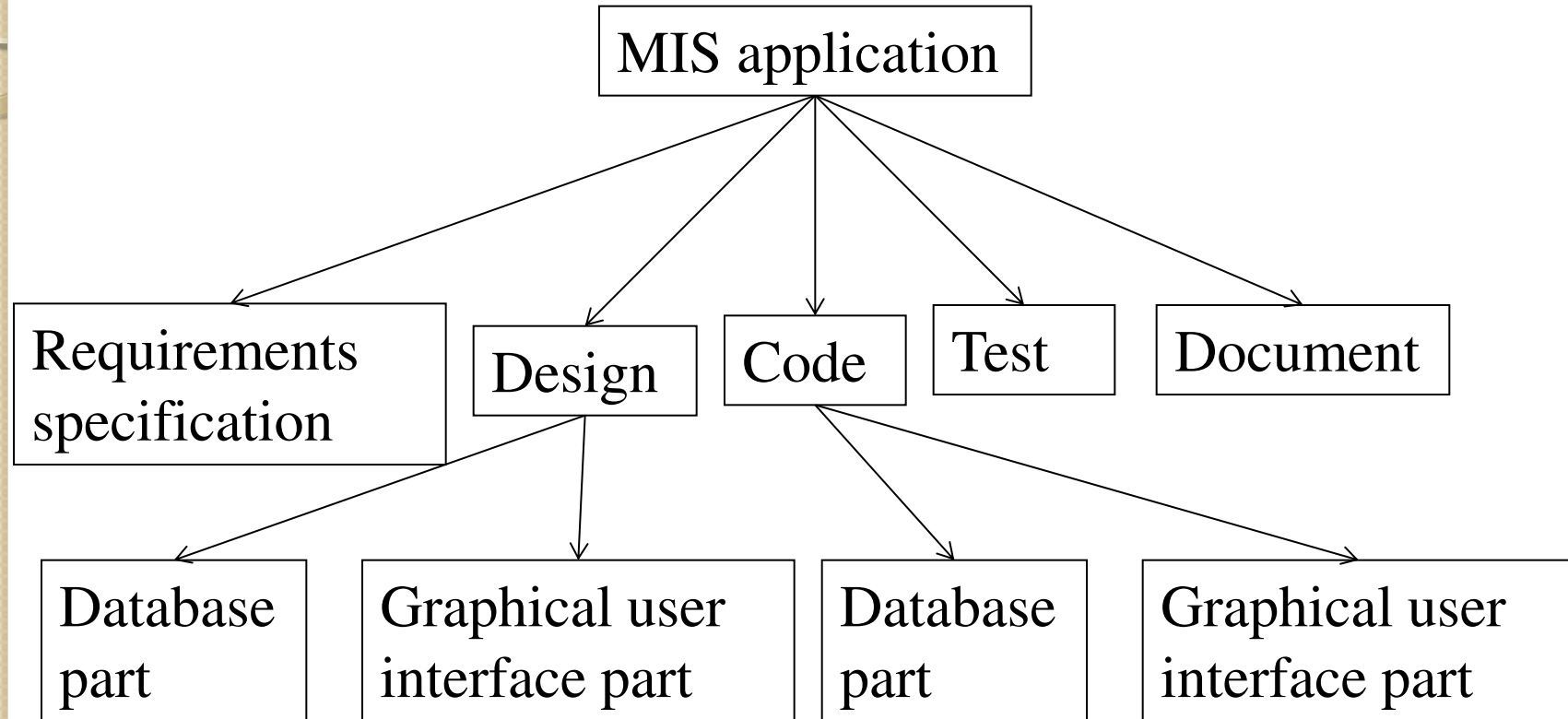
Activity Planning

Earlier, we looked at methods for forecasting the effort required for a project. A detailed plan for the project, must also include a schedule indicating the start and completion times for each activity. This will enable us to:

- ensure that the appropriate resources will be available precisely when required;
- avoid different activities competing for the same resources at the same time;
- produce a detailed schedule showing which staff carry out each activity;
- produce a detailed plan against which actual achievement may be measured; .
- produce a timed cash flow forecast;
- replan the project during its life to correct drift from the target.

Activity Planning   cont …

- To be effective, a plan must be stated as a set of targets, the achievement or non-achievement of which can be unambiguously measured.

- The activity plan does this by providing a target start and completion date for each activity.

- As a project progresses it is unlikely that everything will go according to plan. Much of the job of project management concerns recognizing when something has gone wrong, identifying its causes and revising the plan to mitigate its effects.

- The activity plan should provide a means of evaluating the consequences or not meeting any of the activity target dates and guidance as to how the plan might most effectively be modified to bring the project back to target.

Objectives of Activity Planning

In addition to providing project and resource schedules, activity planning aims to achieve a number of other objectives such as:

- Feasibility assessment: Is the project possible within required timescales and resource constraints?

- Resource allocation: What are the most effective ways of allocating resources to the project. When should the resources be available?

- Detailed costing: How much will be the project cost and when is that expenditure likely to take place?

- Motivation: Providing targets and being seen to monitor achievement against targets is an effective way of motivating staff.

- Coordination: When do the staff in different departments need to be available to work on a particular project and when do staff need to be transferred between projects?

When to Plan

- Planning is an on-going process of refinement, each iteration becoming more detailed and more accurate than the last. Over successive iterations, the emphasis & purpose of planning will shift.

- During the feasibility study and project start-up, the main purpose of planning will be to estimate timescales and the risks of not achieving target completion dates or keeping within budget.

- As the project proceeds beyond the feasibility study, the emphasis will be placed upon the production of activity plans for ensuring resource availability and cash flow control.

- Throughout the project, until the final deliverable has reached the customer, monitoring and replanning must continue to correct any drift that might prevent meeting time or cost targets.

Project Schedules

- Before work commences on a project, the project plan must be developed to the level of showing dates when each activity should start & finish and when and how much of each resource will be required.

- Once the plan has been refined to this level of detail, we call it a project schedule.

- Creating a project schedule comprises four main stages:
  ◦ The first step in producing the plan is to decide what activities need to be carried out and in what order they are to be done. From this we can construct an ideal activity plan – a plan of when each activity would ideally be undertaken were resources not a constraint.
  ◦ The ideal activity plan will then be the subject of an activity risk analysis, aimed at identifying potential problems. This might suggest alterations to the ideal activity plan.

Project Schedules cont …

◦ The third step is resource allocation. The expected availability of resources might place constraints on when certain activities can be carried out, and our ideal plan might need to be adapted to take account of this.

◦ The final step is schedule production. Once resources have been allocated to each activity, we will be in a position to draw up and publish a project schedule, which indicates planned start and completion dates and a resource requirements statement for each activity.

Summary

- Discussed Steps for Scheduling
- Explained Work Breakdown Structure
- Presented Activity Planning
- Discussed about project schedules

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2. R. Mall, *Fundamentals of Software Engineering*, Fifth Edition, PHI Learning Pvt. Ltd., 2018.

Thank you