

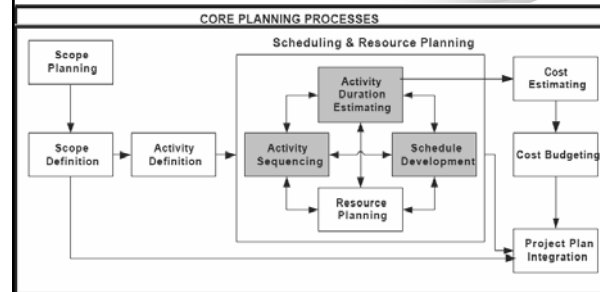
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Sumber : City of Los Angeles – Project Management and Training Division
Information Technology Agency

Overview of Project Scheduling



Overview of Project ... (2)

- Following the definition of project activities, a project schedule is developed by associating resources and time with the activities.
- The project schedule provides a graphical or tabular representation of when tasks will start, when tasks will be completed, when significant events (called milestones) will occur, logical dependencies between tasks, and resource requirements.
- It is very important that the definition of completion criteria for each task is documented and clear. Otherwise the dates on the schedule will not be meaningful.

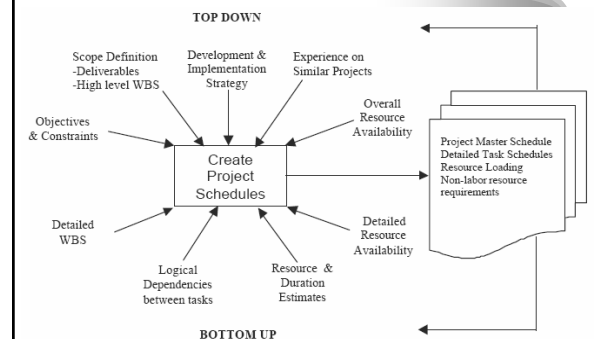
Overview of Project ... (3)

- Project scheduling and resource planning are inextricably intertwined. A realistic schedule must be supported by a realistic staffing plan, with the right mix of critical skills available at the right time.
- The outputs of the combination are the project schedule in the form of a Gantt chart, or equivalent, and time phased resource requirements.
- Resource planning activities that are required to acquire the necessary resources including skilled staff and needed equipment. These tasks are usually on the critical path and must be shown on the master project schedule.

Overview of Project ... (4)

- Several iterations of project scheduling and resource planning may be required to balance the schedule and the available resources.
- If a satisfactory balance that meets management goals and project commitments cannot be achieved, Scope and Activity Definitions may need to be revisited.

Project Scheduling Process



Project Scheduling ... (2)

- In the early stages of a project a high level master schedule (target) is developed top down.
- The top-down process starts with the output of Scope Planning, including project objectives, constraints, the project scope and development and implementation strategies.
- The master schedule is developed based on the above items, together with the project manager's and project team's experiences.
- The master schedule provides a framework for the development of the detailed schedule.

Project Scheduling ... (3)

- A master schedule is usually developed before all the activities have been defined and before the entire project team members are on board.
- In this case, a schedule review by the new team members is essential.
- This may uncover necessary changes to the schedule, resources and costs. Therefore, it is important to build in sufficient time and cost contingencies in the early planning activities.

Project Scheduling ... (4)

- The detailed schedule is a bottom-up process that starts with the WBS and task statements developed in Scope Definition and Activity Definition.
- The schedule is developed by combining and balancing duration estimates for each task, task inter-dependencies, and the available resources into a logical, time-phased plan.

Project Scheduling ... (5)

- Initially the project manager may find that the available skilled staff and other resources are insufficient to complete the project by the target completion date.
- Thus, the scheduling process becomes iterative to balance the objectives, scope and resources to create an achievable schedule that meets the overall business objectives of the stakeholders.
- Unsatisfactory results from the scheduling process may cause the scope definition, activity definition and resource estimates to be reviewed and modified.

Project Scheduling ... (6)

1. Identify the major project milestones for the master schedule
2. Sequence the activities based on their logical dependencies
3. Estimate the task duration and resource requirements for each activity
4. Develop an initial project schedule by assigning resources and time-frames to the activities
5. Identify the critical path
6. Tune the schedule to achieve the objectives while balancing or smoothing the resource requirements
7. Document the assumptions
8. Assess the risks inherent in the assumptions and in the resource estimates
9. Review the schedule with the stakeholders and make modifications as necessary

Identify Major Milestones

- The completion of an important action is denoted as a milestone.
- Milestones are important events that happen at a point in time and have no duration. For example, deliverables are often represented as milestones, while efforts to produce the deliverable are referred to as tasks.

Identify Major Milestones (2)

While milestones are unique to each project, some typical project milestones are shown below:

- Requirements Approval
- End-of-Phase Review
- Prototype Approval
- Approval of Design
- Hardware and/or Software Installed and Tested
- Unit Test Completed
- Integration Test Completed and Approved
- Acceptance Test Completed and Approved
- System Acceptance by User
- Production Implementation

Identify Major Milestones (3)

- A milestone can occur at the end of a work package in the WBS and serve as a measurable item in the baseline plan.
- Major project milestones should be included on the master schedule.
- For contracted work, a milestone is often used as a point in the project where an interim payment is made.
- If this approach is used, mutual agreement is necessary on the content of the milestone and the payment associated with that milestone.

Sequence the Activities

Two basic kinds of logical dependencies need to be considered when sequencing project activities:

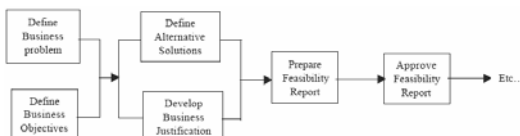
1. *Mandatory dependencies* are those which are inherent in the nature of the work being done. For example, requirements definition comes before design that comes before programming. However all requirements need not be completed before design can start, and not all design must be completed before some programming can start. Therefore, task dependencies must be defined at a more detailed level.

Sequence the Activities (2)

2. *Discretionary dependencies* are those that are defined voluntarily by the project manager in order to, for example, support the use of best practices, limit parallelism and complexity in the project plan or take into account the known resource limitations. An example of a resource driven dependency is when you have only one person with a particular skill available, which results in doing tasks in series when, with more skilled staff, the tasks could be done in parallel.

Sequence the Activities (3)

- One way to develop and present the task dependencies is the network diagram. Network program is a good tool for thinking through and presenting the basic task dependencies.



Sequence the Activities (4)

ID	WBS	Task Name	Aug '98	Sep '98	Oct '98	Nov '98	Dec '98
1	1	Feasibility Study	[Gantt bar spanning Aug, Sep, Oct]				
2	1.1	Define Business Problem	[Gantt bar spanning Aug]				
3	1.2	Define Business Objectives	[Gantt bar spanning Aug]				
4	1.3	Define Alternative Solutions	[Gantt bar spanning Aug]				
5	1.4	Business Justification	[Gantt bar spanning Aug]				
6	1.5	Prepare Feasibility Report	[Gantt bar spanning Aug]				
7	1.6	Approve Feasibility Report	[Gantt bar spanning Aug]				
8	2	Analysis	[Gantt bar spanning Sep, Oct, Nov]				
9	2.1	Functional Requirements	[Gantt bar spanning Sep, Oct]				
10	2.1.1	Develop Req'ts	[Gantt bar spanning Sep, Oct]				
11	2.1.2	Approve Req'ts	[Gantt bar spanning Sep, Oct]				
12	2.2	Perf. & Reliab. Req'ts	[Gantt bar spanning Sep, Oct]				
13	2.3	Design Alternatives	[Gantt bar spanning Sep, Oct]				
14	2.4	Cost/Benefit Analysis	[Gantt bar spanning Sep, Oct]				
15	2.5	Dev. & Implem. Strategies	[Gantt bar spanning Sep, Oct]				
16	2.6	Approve Analysis	[Gantt bar spanning Sep, Oct]				

Sequence the Activities (5)

ID	WBS	Task Name	Duration	Start	Finish	Predecessors
1		Feasibility Study	33 days	8/5/98	9/18/98	
2	1.1	Define Business Problem	5 days	8/5/98	8/11/98	
3	1.2	Define Business Objectives	5 days	8/10/98	8/14/98	2SS+3 days
4	1.3	Define Alternative Solutions	10 days	8/17/98	8/28/98	3
5	1.4	Business Justification	10 days	8/24/98	9/4/98	4SS+5 days
6	1.5	Prepare Feasibility Report	5 days	9/7/98	9/11/98	5
7	1.6	Approve Feasibility Report	0 days	9/18/98	9/18/98	6FS+5 days
8	2	Analysis	63 days	9/14/98	12/9/98	
9	2.1	Functional Requirements	35 days	9/14/98	10/30/98	
10	2.1.1	Develop Req'ts	30 days	9/14/98	10/23/98	6
11	2.1.2	Approve Req'ts	0 days	10/30/98	10/30/98	10FS+5 days
12	2.2	Perf. & Reliab. Req'ts	8 days	10/19/98	10/28/98	10FS-5 days
13	2.3	Design Alternatives	20 days	10/29/98	11/25/98	12
14	2.4	Cost/Benefit Analysis	15 days	11/12/98	12/2/98	13FF+5 days
15	2.5	Dev. & Implem. Strategies	20 days	10/29/98	11/25/98	13SS
16	2.6	Approve Analysis	0 days	12/9/98	12/9/98	14FS+5 days

Estimate Task Duration and Resource Requirements for each Activity

- The quality of a schedule is completely dependent on the accuracy of the activity resource and duration estimates.
- Management can provide objectives and guidelines, but, if the team members responsible for a task do not buy into the estimate, it is very unlikely that the task will be completed on time or within budget.
- The estimation process is complex because activity duration is affected by numerous variables that must be dealt with concurrently in the planning phase.
- Some of these variables include staff availability, the skill level of the person assigned to the task, unexpected events, efficiency of work time, and mistakes and misunderstandings during the development of the project.

Develop an Initial Project Schedule

Schedule development means determining start and finish dates for project activities. If the start and finish dates are unrealistic the project is unlikely to be completed on schedule. The dates must take into account:

- The task dependencies determined in Activity Sequencing
- The resource and duration estimates
- The availability of resources
- The past experience of the project manager and the project team
- Contingency for unknowns and for risk management

Develop an Initial Project ... (2)

Many projects are dependent on three time-consuming processes over which the Project Manager has very little control, such as:

- Obtaining the project funding approvals
- Acquiring additional staff
- Negotiating contracts

Identify the Critical Path

- The critical path is the sequence of tasks that defines the longest path through a project. It determines the earliest possible completion of the work.
- The critical path is carefully managed because if the critical path tasks slip, the entire project is delayed.
- A key to project planning is to keep as many tasks as possible off the critical path in order to provide management flexibility throughout the project.
- The tasks on the critical path must be the focus of attention and be managed carefully throughout the project in order to minimize project delays.

Tune the Schedule

The initial project schedule seldom meets all of the project objectives and constraints. It must usually be reviewed and tuned in order to:

- Meet the desired completion date
- Smooth the resource loading
- Reduce the number of tasks and the length of the critical path
- Adjust for changes in planning assumptions, including resource availability
- Reduce the project risk

Tune the Schedule (2)

Schedule tuning is accomplished by:

- adjusting resource assignments
- changing discretionary task dependencies, such as putting some tasks in parallel that were sequential
- changing the technical approach and estimate for selected tasks

Tune the Schedule (3)

Project Managers constantly face the challenge of shortening the schedule without changing the project scope. Methods to shorten the schedule include:

- Fast tracking: doing activities in parallel that would normally be done sequentially
- Crashing: analyzing cost and schedule tradeoffs to determine how to obtain maximum schedule compression at the least incremental costs, including such techniques are:
 - Transferring qualified people from tasks with float to activities on the critical path in an attempt to reduce the duration of critical path activity;
 - Scheduling overtime or additional shifts;
 - Subcontract work as a means increasing available resources and opportunities for parallel work.

However, it is very important to recognize that including the above techniques in the initial project schedule increases the risk significantly.

Document the Assumptions

- Since all schedules are built upon currently available knowledge, projections, and assumptions, it is important to document the key assumptions for validation and later reference.
- Assumptions typically include the availability of key resources, timely performance of outside contractors, accuracy of system requirements, and availability of enabling technology, etc.
- If, for example, a schedule is shortened based on the assumption that a highly skilled person will be performing the work, that assumption should be documented. Then, if a less skilled person is actually assigned to perform the task, the project manager can recognize the risk and make the necessary changes and decisions. Without documentation of the assumption, the schedule could be placed in jeopardy later without the project manager realizing it.

Identify Risks and Plan for Contingencies

Scheduling with limited resources has inherent risks. Good scheduling makes allowances for risks in one or more of the following ways:

- Where significant schedule risks exist, add an additional contingency task on the WBS for risk management/risk reduction, so that financial reserves can be set aside to deal with potentially delayed schedules.
- Add additional time to those tasks with significant potential risk. There is no rule of thumb for this multiplier; it depends on the degree of risk and overall importance of the schedule to the project.
- Add a percentage time multiplier to the schedule for particular individuals, particularly if new technology is being used or if the person providing the estimate is an extremely optimistic person.

Review the Schedule

- The development of a schedule requires input from more than one person. No one possesses all the knowledge or understanding of all the factors that affect schedules in every aspect of a project.
- A schedule review also facilitates buy-in to the schedule. Buy-in to the schedule by the people who will actually perform the work is critical to success.
- Participation in scheduling gives staff a stake in the outcome of the project. On the other hand, imposed schedules often create frustration leading to frenzy and inevitable schedule slippage.

Review the Schedule (2)

- Once an initial draft of the schedule is complete, the team should perform a schedule review.
- The activity or task descriptions and the schedule should be reviewed by the people named to do the work who did not participate in the initial estimates, and by independent experts.
- Task description and task duration should be reviewed for completeness, accuracy and realism.