3   Project Planning

The next step, after you selected your project topic, is project planning. Project planning subject is taught, one way or another, at different schools. Some address it during teaching thesoftware engineering module/course and some others teach it as an individual module/course. Studentsmight even have some experience of planning through their previousindividual/group assignments. Despite the fact, it is quite a common phenomenon among the students to undermine this step extensively, which cause them to submit incomplete projects or face late submission.

Actually, in software engineering and development, project planning is intertwined into the methodology in a way that sometimes it is difficult to separate these subjects from each other. However, to understand the whole roadmap of conducting a project, these two concepts would be discussed in two different chapters, though the relation between the two would be maintained and addressed wherever appropriate. Having this, in the current chapter we will focus on the planning step, then we will discuss the methodology and its influence, and impacts on the project planin the next chapter.

To understand how to prepare a plan for your project, let us considerthe situation that you are standing in. You are in the final year of your study; you have several modules to study, you have other assignments and you have to pass several other exams; and finally you have to do your project as well. Now, other duties that you have would normally be scheduled by the university and/or the school. In fact, you are obliged to stick with the timetables that the university/school enforces, and therefore, the degree of freedom is not totally under your control. However, the scheduling and controlling your project is at your disposal. As a result, this situation makes the project planning of paramount importance in the whole process.

Obviously, lack of planning and being careless about schedulingcan create an irreversible catastrophic circumstance that puts your entire project in a hazardous situation. The dangerous outcomes can be very different. The extent can be from low quality project delivery, at one extreme, to a total failure, at the other. Now, how can you prevent this unwanted scenario? How can you guarantee that your project would provide the requirements to a pass, as a minimum achievement? How can you turn it to a real success then? Indeed, taking simple steps can help you to overcome with this situation, properly.

To illustrate, we begin with the assumption that you have already studied some project management techniques, therefore, you have the required knowledge of project planning and scheduling. If this is the case, then presumably, you already have familiarity with software development techniques, as well. Consequently, you are required to apply the knowledge that you have already obtained, efficiently. As a first action, if you are already familiar with the planning concepts and using Gantt charts as a scheduling tool then consider the following steps:

Main phases of a project plan

- Using one of the tools, such as Microsoft Project, Microsoft Visio, and OpenProj, etc. that can help you in preparing a Gantt chart, devise a first-cut plan including the following major steps:

  - Understanding the problem area

  - Literature Review

  - Requirements Management

  - Analysis

  - Design

  - Implementation

  - Test

  - Project Report

  - Presentation

If you are not familiar with the Gantt chart, which was mentioned in the previous step, and have not experienced the tools that you can use to createone at this stage,do not worry because these concepts would be presented in the following sections. However, although we are not going to discuss these concepts in a very detailed format, you can find general explanations that canhelp you plan and manage your projects, effectively.

3.1   Project Plan

Project plan in a simple format is a document that explains 4Ws+H, which means **W**hat is going to bedone, **W**hen it is going to be done, **W**ho is going to do it, **W**here this is going to be done, and **H**ow it is going to be done. This concept has been rephrased again as below:

Questions about Project Plan

- What are the main steps that the project goes through?

- What is the project timeline (i.e. what happens when)?

- What are the deliverables that the project should deliver?

- What are the quality criteria?

- What are the acceptance criteria?

- How the project would be conducted?

However, although the above topics are typical for all projects, every specific project has its own specialties, which makes its project planning unique.

Many students underestimate this activity. They think that this is an individual activity that is totally under their control; hence, there is no need for wasting time on this somehow "superficial" and "mechanical" activity. As it was stated before, if you do not know how you are going to do your project, it is highly likely to fail doing it.

At the first step, the plan seems to be very vague to you. At this stage, do not worry about the details. Simply, think about the major steps that you should take and make a list that depicts those major steps, which should be taken. Look at the following example to find out how it can be done. As you can realize these may slightly be different in your case, however, the main theme remains similar. This task – making a list by breaking down the whole job into specific manageable tasks – is called Work Breakdown and the result of which is called Work Breakdown Structure or simply (WBS).

Work Breakdown Structure (WBS) sample

- Preparing Problem Statement

- Understanding general requirements

- Meeting with my supervisor

- Literature Review

- Implementation

- Testing

- Writing Project report

- Preparing Presentation

Now, this list needs two important things, which should be addedto it in order to make it a plan: timing and resourcing. By timing, I mean, you have to say when the task is expected to be started and when it is expected to be accomplished (finished). By resourcing, I mean the human beings and any material/ equipment that any specific task of the above list needs to have in order to be done. In fact, in your specific project, the main human resource of the project is you. However, sometimes you need other resources such as your supervisor. In terms of material/equipment you may need a computer (which you normally have one) and in some cases specific devices or software that should be obtained before the task is started.

Having these items ready, it is good to know that there are two major approaches with adding these details to your plan and applying the required changes: top-down approach and bottom-up approach. As the names imply, and as you might have heard about these approaches in other courses/modules, if we follow the former approach we start from top task in the list and will apply resources and timings one by one until we reach to the end of the list. Whereas if we follow the latter approach, we should start from the last task and assign resources and timings to task backwardly.

There are different reasons for having these two approaches, which discussing them is beyond the scope of this book. However, if you are interested in having more details you can consult thebibliography section at the end of the book. Nevertheless, in your case the bottom-up approach is the better choice than the top-down. The main reason for this is that the delivery time of your project is very restricted and normally bound to the specific university timetable for the assessment schedules. Hence, some major dates are not under your control and you are obliged to stick with a predefined university/school plan.

Let us apply the approach on the mentioned example. All you need is to have pen and paper, or a word processor, and a calendar. We assume that the project should be done within a semester. For the sake of simplicity, we assume the semester starts at October 1, and ends at January 27. Again, suppose you should submit your project by January 15 and you should be ready to present your project on January 22. Having this information, let us prepare a schedule based on which you can conduct your project.

Applying bottom-up approach implies that we should start from the last date, which is January 20 and set this date as the finish date for the last task, which is "Presentation". Then, we examine the mentioned task and we estimate a duration within which we think that the task is getting accomplished.We try to be as realistic as we can in this regard. However, you may ask how you should know that how long the task might take to get accomplished. In reality, there are different ways that help project plannerswith the time estimation process, which unfortunately most of them do not work for you and therefore we are not discussing them, here. In fact, you have to establish this version of your schedule by guessing the required time for accomplishing each task. Then, you have to refine it by consulting your supervisor, later.

Suppose that based on a rough estimation the presentation task needs you to spend 3 days in order to prepare it. Assuming the presentation day as January 22, you should have finished your presentation no later thanJanuary 21, which is exactly a day before your presentation day. This assumption sets the end date of the "Preparing Presentation" task on January 21 and therefore, the start date on January 19. However, for the time being assume that you are off at the weekends. Considering this, puts the start date of the task on January 17. By applying this technique, you can obtain the first version of your scheduling as you can see in Table 3-1.

ID	Task	Duration	Start	End
1	Preparing Problem Statement	?	?	?
2	Understanding general requirements	?	?	?
3	Meeting with my supervisor	?	?	?
4	Literature Review	?	?	?
5	Implementation	?	?	?
6	Testing	?	?	?
7	Writing Project Report	?	?	?
8	Preparing Presentation	3 days	01/17/13	01/21/13

Table 3-1 Project Scheduling – Bottom Up – First Attempt

As you can see, we have created a table including the first cut tasks that we already recognized and calculated the duration, start date, and end date for the last task. We can calculate the start and end date for each task by applying the same technique. Let us do it for "Writing Project Report" task. Suppose that this task needs 10 days to be accomplished. However, later in this chapter you will see that this task should not be considered as a short-term task, rather a continuous task that is spanning throughout the entire project. Nevertheless, for the time being we put this issue aside.The result schedule will be asit appears in Table 3-2.

ID	Task	Duration	Start	End
1	Preparing Problem Statement	?	?	?
2	Understanding general requirements	?	?	?
3	Meeting with my supervisor	?	?	?
4	Literature Review	?	?	?
5	Implementation	?	?	?
6	Testing	?	?	?
7	Writing Project Report	10 days	01/03/13	01/16/13
8	Preparing Presentation	3 days	01/17/13	01/21/13

Table 3-2 Project Scheduling – Bottom Up (Continued)

Finally, if we continue to apply this method we would end up to the first cut schedule for our sample project as you can find in Table 3-3.

ID	Task	Duration	Start	End
1	Preparing Problem Statement	3 days	01/10/12	03/10/12
2	Understanding general requirements	12 days	04/10/12	19/10/12
3	Meeting with my supervisor	3 days	20/10/12	23/10/12
4	Literature Review	10 days	24/10/12	06/11/12
5	Implementation	30 days	07/11/12	18/12/12
6	Testing	10 days	22/12/12	01/01/13
7	Writing Project Report	10 days	01/03/13	01/16/13
8	Preparing Presentation	3 days	01/17/13	01/21/13

Table 3-3 Project Scheduling – Bottom Up (First Draft)

If you prepare a Gantt chart for Table 3-1, the outcome would become something such as what you can see in Figure 3-1.

ID	Task
1	Preparing Problem Statement
2	Understanding general requirements
3	Meeting with my supervisor
4	Literature Review
5	Implementation
6	Testing
7	Writing Project Report
8	Preparing Presentation
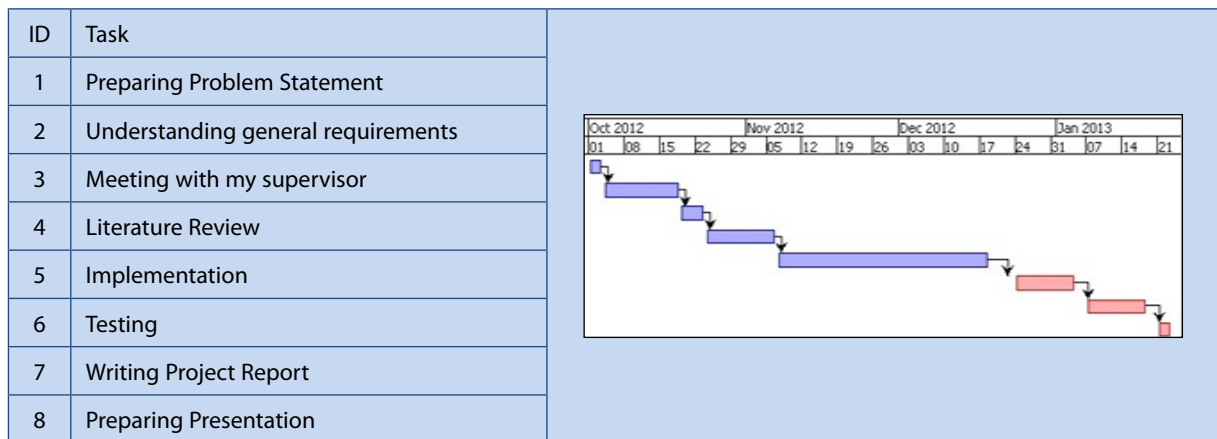
Figure 3-1 Project Scheduling – Gantt chart (First Draft)

The arrows in Figure 3-1 shows how the defined tasks are related to each other in a way that each successive task starts when its predecessor finishes, which resembles a waterfall. However, in reality this is not the case. To illustrate, let us have a closer look at this Gantt chart. Clearly "Meeting with my supervisor" is not a task that you would do once and then you have done with it. Actually, this task is of a type that we can call it an "ongoing" task, which starts when you start your project and will finish right before you present your project.

Again, "Writing Project Report" task can begin very earlier, when you have done part of "Literature Review" task, for example, and can continue throughout the project up to the presentation time. During this time, you might send it to your supervisor, as a draft, in order to receive some feedbacks to improve the final version. Indeed, these instances show that this first cut project plan needs some revision to make it a plan that can be as applicable as the reality requiresit to be. Consequently, after preparing the first cut plan it should be reviewed and refined. This revision process would be discussed in the next section.

3.2   Refining the Project Plan

During the previous section, you prepared your first cut project plan. It was shown that this first cut version of the plan needed to be reviewed based on the characteristics of each task, in order to adapt it to the real situation. For example, the following tasks should start earlier:

- Implementation
- Testing
- Writing Project Report

Furthermore, you can do some tasks in parallel. Well, when we talk about parallelism do not forget that the concept should be understood in its context. Indeed, although it seems that these tasks are in parallel, but they are not. Because you have only one resource to perform these tasks, andit is you, yourself. Therefore, in this case, the situation resembles more to multitasking rather than parallelism. To understand it better, you can compare the situation with the multiprocessor and single processor concept that you might have seen in the Operating Systemscontext. A single processor in your computer does several jobs in a multitask format which seems to be done in parallel.

Below is a group of tasks that can be done in parallel:

- Meeting with my supervisor
- Literature Review

Again, this is another group:

- Implementation
- Testing
- Writing Project Report

However, do not forget that you cannot do the above tasks literally simultaneously. In fact, it means that if you have three tasks in parallel for a specific period, you are dividing your efforts and timing according to the nature of each task. Again, this means that you need to accomplish a portion of one task at a time, and then you perform another task, and then another one, until you cover all the tasks by swapping between them. Figure 3-2 shows the refined version of the Gantt chart of Figure 3-1. This new versions has been obtained through applying the techniques that were discussed in the current section.
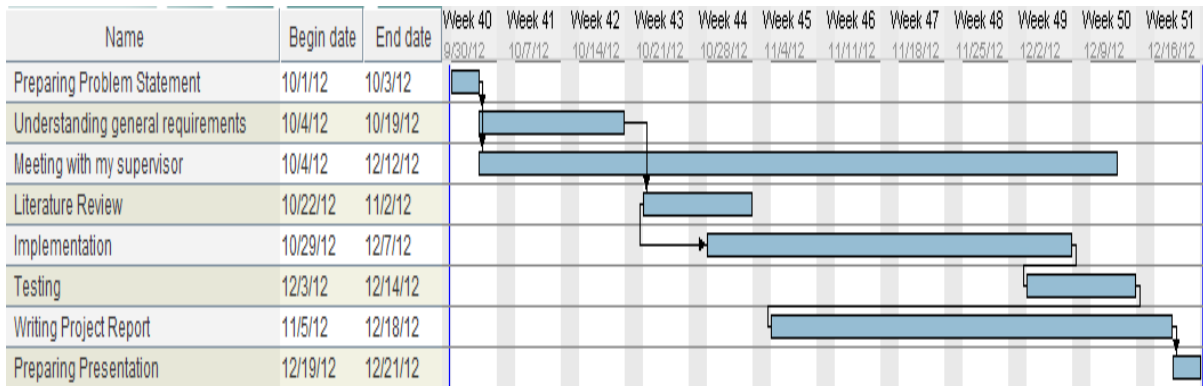
Name	Begin date	End date	Week 40 9/30/12	Week 41 10/7/12	Week 42 10/14/12	Week 43 10/21/12	Week 44 10/28/12	Week 45 11/4/12	Week 46 11/11/12	Week 47 11/18/12	Week 48 11/25/12	Week 49 12/2/12	Week 50 12/9/12	Week 51 12/16/12
Preparing Problem Statement	10/1/12	10/3/12												
Understanding general requirements	10/4/12	10/19/12												
Meeting with my supervisor	10/4/12	12/12/12												
Literature Review	10/22/12	11/2/12												
Implementation	10/29/12	12/7/12												
Testing	12/3/12	12/14/12												
Writing Project Report	11/5/12	12/18/12												
Preparing Presentation	12/19/12	12/21/12												

Figure 3-2 Project Scheduling – Gantt chart (Revised)

In order to show that that the tool that you can use for scheduling does not have a great influence on the results, this new version has been prepared using GanttProject software. GanttProject is an open source software that can be used as one of the many tools that you can find to automate your project scheduling and control. However, bear in mind that using pen and paper, or simply a word processor, or a spreadsheet, you can still prepare, mange, and control your project. Obviously, this is the concept and techniques that is significant, not the tools.

Figure 3-2 shows how some tasks, which are taking place in parallel. In addition, it shows that it is not necessary to finish a task to start its redelated successor. You can observe this case for several tasks such as "Implementation", "Testing", and "Writing Project Report". Although managing several tasks simultaneously is not an easy job, however, you have been doing this for many years during your education, perhaps unconsciously. Actually, while you are studying several modules at the same time you are studying them in parallel. Similar methodis applied to the above parallel tasks, but this time it should be done completely consciously! The way that you can do it and control it would be discussed in the next section.

3.3   Controlling the Project

Project planning, as it was mentioned, is one of the early steps that you should take in order to pave the way to accomplish your project. However, having a good plan, solely, does not guarantee your success. Indeed, a good plan without other necessary activities cannot assure any project's success. To achieve your goals you need to control your project properly. To control your project means you have to evaluate your progress and to update your plan to reflect this progress, continuously. Moreover, you have to compare the progress obtained with the progress expected. The positive or negative deviation of the expected progress, or estimated progress if you like, can show if you are ahead or behindthe plan.

To illustrate, let us continue with the example that we had in the previous sections. Suppose that you are at the beginning of the project. You have to prepare the problem statement and you have considered that you should prepare it within 3 days. Again, suppose that based on your estimation it needs 10 hours to be done. Now, it is a good practice to specify how many hours you are going to dedicate to this task in each day of this task's 3 days period. However, if it seems too detailed and too cumbersome to you to do so, then simply evaluate the task in terms of percentage and evaluate your daily progress.Then write these evaluation and progress down on your schedule as a part of your Project Diary, which would be discussed in the next section. This evaluation allows you to examine your progress and to adapt your efforts based on its outcome.

For example, assume you have spent 4 hours on the task "Understanding general requirements" and you have had one meeting of the expected 10 meetings with your supervisor. To update your schedule means that you update the first task's progress by 40% and the second one by 10%. Figure 3-3 shows the resulted Gantt chart. There are different ways that you can show this progress and if you are interested in having more information on this, you can consult the bibliography at the end of the book. But, regardless of the presentation of the progress, this is important to show this progress, on way or another, preferably graphically, to understand where you are standing with regard to your project goals.
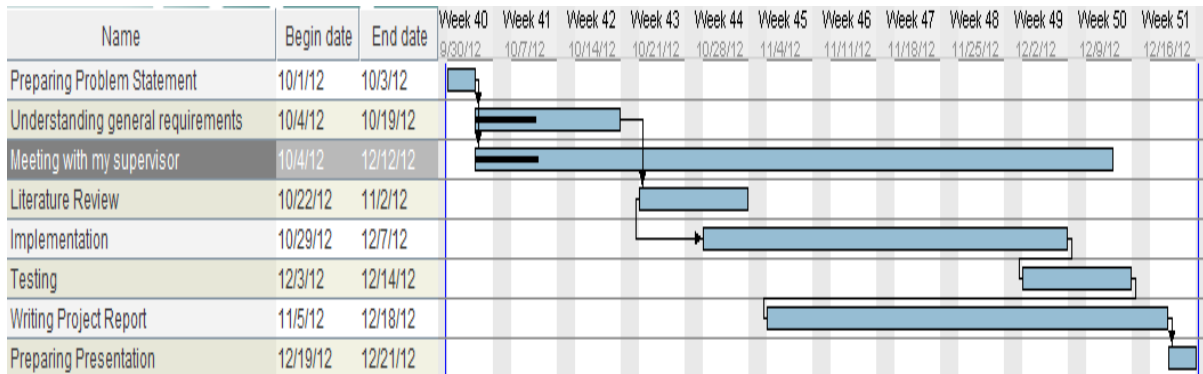

Figure 3-3 Project Scheduling – Gantt chart showing tasks' progress

In addition, there is another key concept in the project control process that you should consider. This concept is the milestone concept. By definition, milestone is an event or a task that consumes no time in the project. OK, what does really it mean? Well, one can say that a "milestone" is a point or moment in a project that one expects a worthy event to happen which is the result of what have already been accomplished during the project. Usually, this event can be finalizing a document, receiving approval for something, and/or delivering some deliverable material, etc. Furthermore, this event would normally have a great influence on the other tasks of the project.

For instance, finalizing the literature review can be considered as a milestone, which means you have sent your literature review to your supervisor, then you have received her/his feedback, then you have applied changes, and finally you have received the supervisor's OK on this task. Figure 3-4 shows the Gantt chart of our hypothetical project on which this concept has been applied. If you have a close look at this figure, you can see that a new task "Literature Review Approved" has been inserted to the schedule below the "Literature Review" task. As you can see, a diamond-shape has been shown in front of the task on the Gantt chart's grid section, which is a usual way to show milestones.
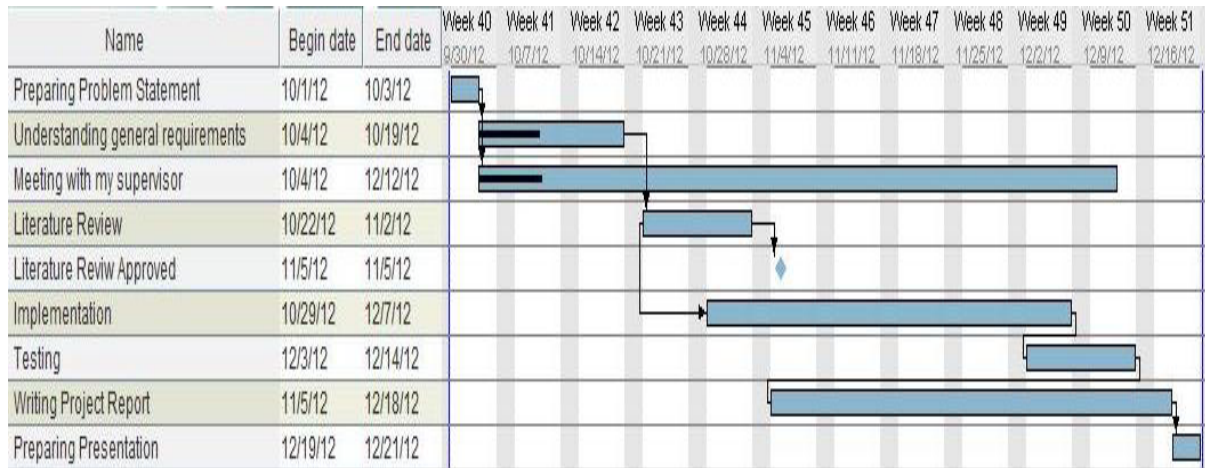
Figure 3-4 Project Scheduling – Gantt chart with Milestone

3.4   Project Diary

Some of the schools/departments encourage students to keep a project diary for the project that they do. Indeed, in some cases they ask students to attach this diary as an attachment/appendix to their final reports on their projects. Regardless of whether this is an obligation to do or not, it would be a great habit and practice to keep a project diary for your project. There is no need to record everything in detail, but having simple notes on what you have done, when you have done it, and what have been the main problems/findings that you faced could be sufficient. As a rule of thumb, a short paragraph addressing the main items in bulleted format would be enough. Do not forget to mention the date and the specific task(s) that you are writing about and the overall time that have dedicated to each item.

Item	Date	From (hh:mm)	To (hh:mm)	Description
1				
2				
3				
4				
….				

Table 3-4 Project Diary template

3.5   Summary

Project planning plays an important role in any project. Although your final year project is normally considered as an individual project, however, it is still crucial to have properly scheduled plan for it. Equally important, the final year project is usually considered as a fully individual activity. However, in this "individual activity" you need to deal with the other demands, such as other modules/courses that you have to study, your supervisor time, probablythe laboratory time and equipment that you might use. This situation requires you should to prepare an efficient program.

Using main steps, which are typical to information technologyand computing projects, you were advised to prepare your first-cut schedule. Afterwards, you were shown how to polish this draft version and to revise it to cover your specific situation. In addition, the concept of the parallel tasks (multitasks, actually!) and the way that you can manage them was discussed. Moreover, the concept of milestones and its importance was introduced. Milestone was defined as a point or a moment in a project that one expects a worthy event to happen. Again, you were advised to identify your project's milestones.

Finally, the project control process and the concept of keeping a project diary were explained. It was shown that project plan and its related schedule could not be useful if they are not updated, properly and regularly, in order to show the project's current situation in any specific moment. Keeping diary short and up to the point, whereas recording main items such as date, amount of effort, main findings/problems, and naming related tasks according to the schedule were presented as a good and helpful practice.