9 Project Scheduling

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Learning objectives

By the time you have completed this chapter you should be able to:

- ☐ Understand the concept of project time planning and scheduling.
- ☐ Compare and contrast logic driven and resource driven scheduling.
- ☐ Draw a network and a Gantt chart to illustrate a simple work package.
- ☐ Understand the concept of Critical Path Method (CPM).
- ☐ Identify the critical activities, critical path and total duration of the network.
- ☐ Calculate the early and late times for each activity.
- ☐ Compare and contrast deterministic and probabilistic scheduling.
- ☐ Appreciate the need for rescheduling at different stages of the PLC
- ☐ Apply the concept of Crashing as an example of trade-off analysis
- ☐ Understand the difference between concurrent engineering and fast track.

Introduction

Delivering the project by the imposed deadline is a primary objective in many projects and is typically one of the project constraints. Therefore, the ability to develop and manage the project schedule is a critical competence for any project manager. Scheduling projects involves defining the duration of activities, determining the optimum start and completion date of activities and calculating the cost of accelerating projects in a traditional manner. In some cases, in order to reduce the calculated total duration of the project, it is imperative to explore different options such as phased concurrent engineering and fast tracking. This chapter explains the stages in developing a project schedule, from developing

and analysing a project network to creating the Gantt charts required for the project plan. The chapter also discusses the concept of project crashing as an example of trade-off analysis between time and cost.

9.1 Project scheduling

The statement of work which is derived from the scope statement is the first building block in project scheduling. The statement of work includes the details of the project deliverables that can be divided into phases, elements and work packages, by breaking down the bigger chunks of work into simpler forms.

Work breakdown structure (WBS)

The work breakdown structure is a useful technique that can be applied to any complex structure take it into its simplest form. This can be applied to all types of work including, but not limited to, projects. Typically, in projects the WBS is deliverable based and should have a list of tasks or activities in order to facilitate more accurate time and cost estimates. In addition, the WBS can be a very useful tool in risk management during the risk identification stage. Ideally, the WBS should reach five to seven levels. At the higher levels of the WBS, projects can be broken down into phases, then elements then work packages. The lowest level will reflect the activities which will feed into building the project schedule. At the activity level, the WBS should reflect deliverables rather than processes, which might be acceptable at higher level. So for example, at the work package level, 'design' can be an appropriate title, but at the lowest level of this work package, the deliverables should be the output of this design process such as drawings, specifications and quantities. An example of a WBS for a software project is shown in Figure 9.1.

Project scheduling includes all the processes required to accomplish timely completion of a project. Scheduling processes include:

- **Activity definition:** Determining the list of activities needed to accomplish each project deliverable.
- **Activity sequencing:** Determining the order in which each activity should be executed and identifying the dependences among the activities.
- **Activity timing:** Calculating the duration of each activity
- **Resource allocation:** Determining the level of resources required to execute each activity.

- **Schedule control:** Controlling changes to the project schedule. These are the timetables and charts required to monitor and control the project activities. There are two types of project schedules: Project network diagrams and Gantt Charts

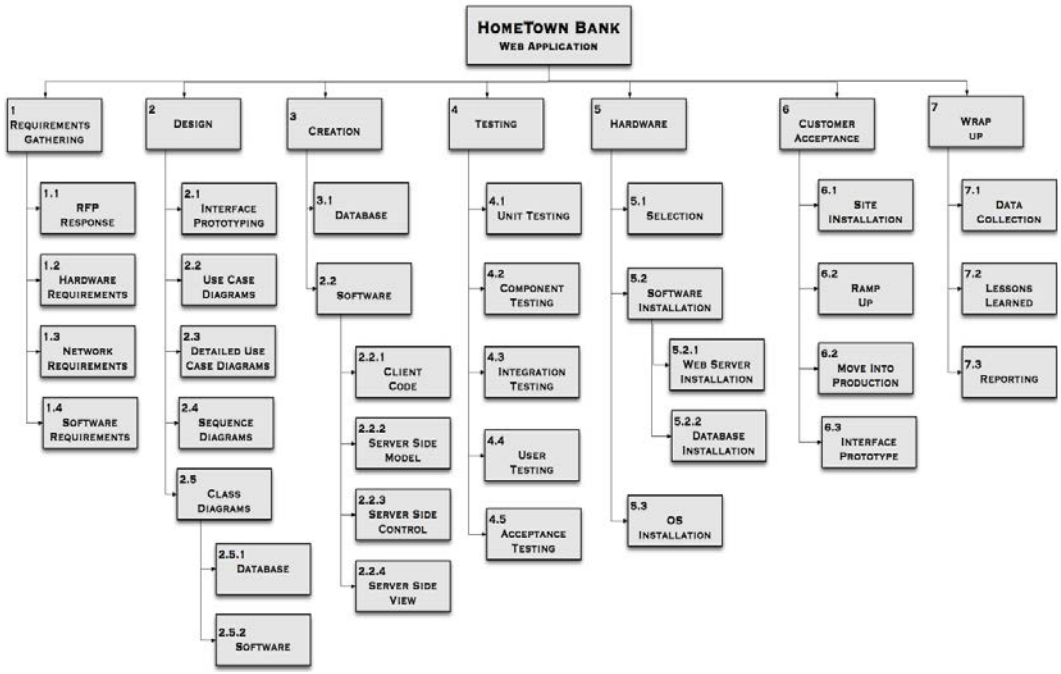

Figure 9.1: WBS for a software project. Source : Emily Wadsworth, (2016) http://diagram.cf/w/wbs-example-software-project.html

9.2 Project network diagrams

A project network diagram is a schematic representation of the project, developed from the WBS. It identifies all the activities within the project, the start and completion time of each activity, the logical sequence in which activities should be performed, the dependent activities and the critical activities that define the project duration.

Activities within the network diagram are those tasks that must be performed to complete the project. They usually refer to the work packages at the lowest level of the WBS, as these are the first level of deliverables that are individually planned, resourced and priced. However, as the WBS is only broken down to work package level, the network diagram is the perfect tool for identifying the activities within each work package and determining the logical sequence in which they should be performed.