



Project Management

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Customer Questions

Customers have several questions to be answered:

- ▶ Do you understand my problem and my needs?
- ▶ Can you design a system that will solve my problem or satisfy my needs?
- ▶ How long will it take you to develop such a system?
- ▶ How much will it cost to have you develop such a system?

Project Schedule

► **A project schedule:**

- Describes the software development cycle for a particular project by enumerating the phases or stages of the project and breaking each into discrete tasks or activities to be done.
- Portrays the interactions among these activities and estimates the time that each task or activity will take.
- Is a timeline that shows when activities will begin and end, and when the related development products will be ready.

Project Schedule

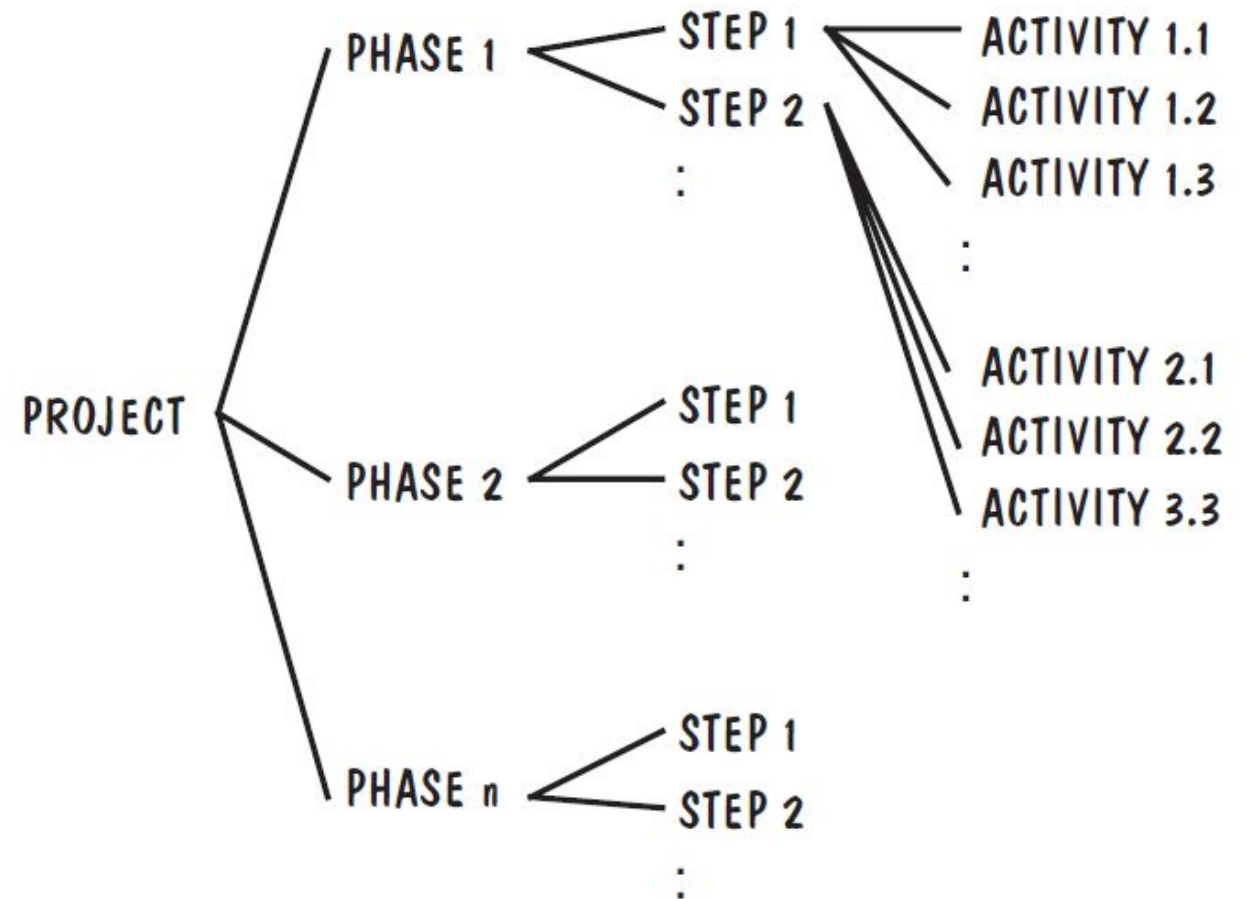
- ▶ We begin by working with customers and potential users to understand what they want and need. At the same time, we make sure that they are comfortable with our knowledge of their needs. We list all project **deliverables**, that is, the items that the customer expects to see during project development.
- ▶ Among the deliverables may be:
 - Documents
 - Demonstrations of function
 - Demonstrations of subsystems
 - Demonstrations of accuracy
 - Demonstrations of reliability, security, or performance

Project Schedule

- ▶ An **activity** is a part of the project that takes place over a period of time.
- ▶ A **milestone** is the completion of an activity—a particular point in time.
- ▶ A **precursor** is an event or set of events that must occur before the activity can begin; it describes the set of conditions that allows the activity to begin.
- ▶ The **duration** is the length of time needed to complete the activity.
- ▶ The **due date** is the date by which the activity must be completed, frequently determined by contractual deadlines.
- ▶ Signifying that the activity has ended, the **endpoint** is usually a milestone or deliverable.

Project Schedule

- ▶ We can separate development into a succession of phases. Each phase is composed of steps, and each step can be subdivided further into activities



Work Breakdown Structure

- ▶ Dividing Complex projects to simpler and manageable tasks is the process identified as Work Breakdown Structure (WBS)
- ▶ It depicts the project as a set of discrete pieces of work.

Phase 1: Landscaping the lot			Phase 2: Building the house		
<i>Step 1.1: Clearing and grubbing</i>			<i>Step 2.1: Prepare the site</i>		
Activity 1.1.1: Remove trees			Activity 2.1.1: Survey the land		
Activity 1.1.2: Remove stumps			Activity 2.1.2: Request permits		
	<i>Step 1.2: Seeding the turf</i>		Activity 2.1.3: Excavate for the foundation		
Activity 1.2.1: Aerate the soil			Activity 2.1.4: Buy materials		
Activity 1.2.2: Disperse the seeds				<i>Step 2.2: Building the exterior</i>	
Activity 1.2.3: Water and weed			Activity 2.2.1: Lay the foundation		
		<i>Step 1.3: Planting shrubs and trees</i>	Activity 2.2.2: Build the outside walls		
Activity 1.3.1: Obtain shrubs and trees			Activity 2.2.3: Install exterior plumbing		
Activity 1.3.2: Dig holes			Activity 2.2.4: Exterior electrical work		
Activity 1.3.3: Plant shrubs and trees			Activity 2.2.5: Exterior siding		
Activity 1.3.4: Anchor the trees and mulch around them			Activity 2.2.6: Paint the exterior		
			Activity 2.2.7: Install doors and fixtures		
			Activity 2.2.8: Install roof		
				<i>Step 2.3: Finishing the interior</i>	
			Activity 2.3.1: Install the interior plumbing		
			Activity 2.3.2: Install interior electrical work		
			Activity 2.3.3: Install wallboard		
			Activity 2.3.4: Paint the interior		
			Activity 2.3.5: Install floor covering		
			Activity 2.3.6: Install doors and fixtures		

Work Breakdown Structure

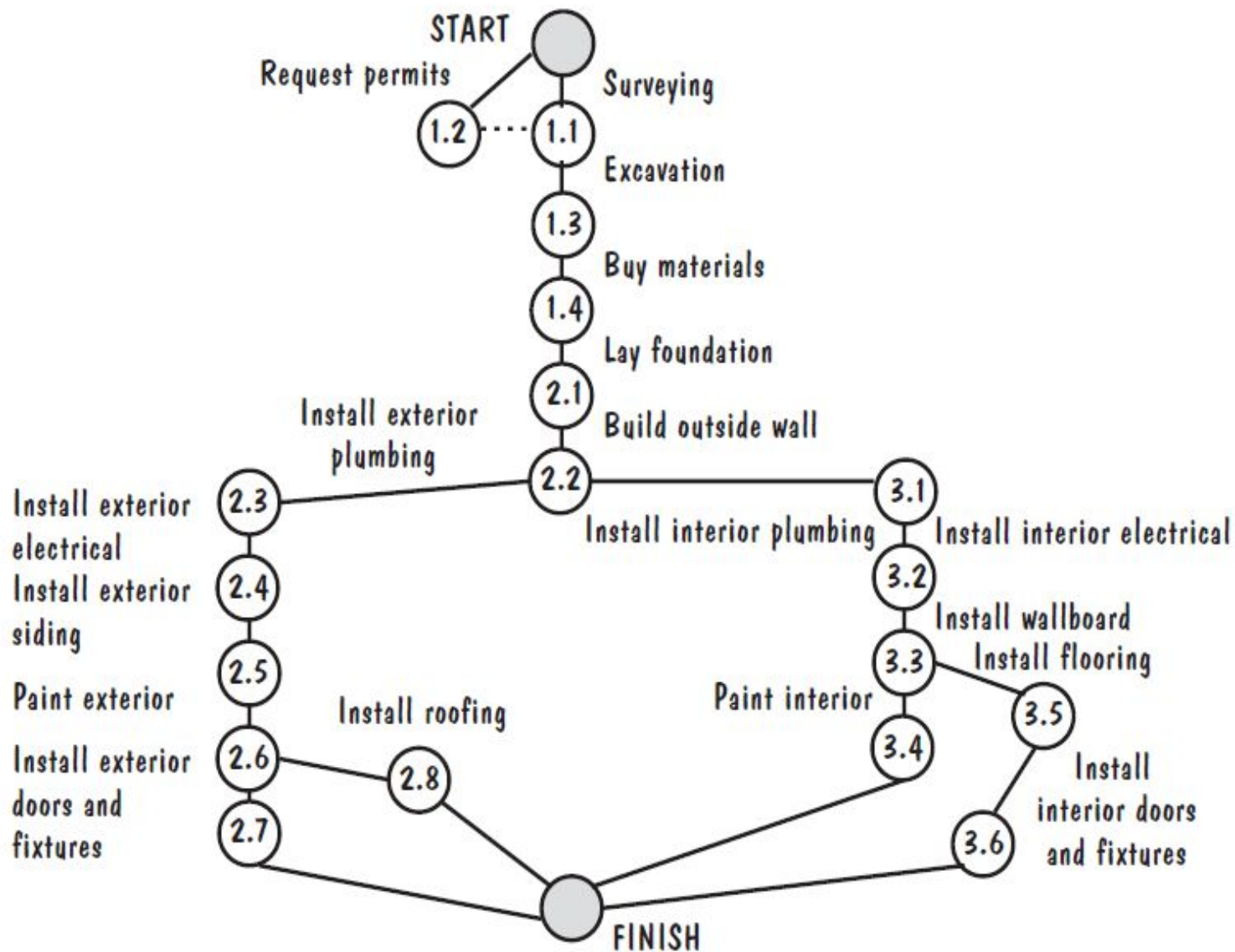


FIGURE 3.2 Activity graph for building a house.

Activity Graph

TABLE 3.2 Milestones in Building a House

- 1.1. Survey complete
 - 1.2. Permits issued
 - 1.3. Excavation complete
 - 1.4. Materials on hand
 - 2.1. Foundation laid
 - 2.2. Outside walls complete
 - 2.3. Exterior plumbing complete
 - 2.4. Exterior electrical work complete
 - 2.5. Exterior siding complete
 - 2.6. Exterior painting complete
 - 2.7. Doors and fixtures mounted
 - 2.8. Roof complete
 - 3.1. Interior plumbing complete
 - 3.2. Interior electrical work complete
 - 3.3. Wallboard in place
 - 3.4. Interior painting complete
 - 3.5. Floor covering laid
 - 3.6. Doors and fixtures mounted
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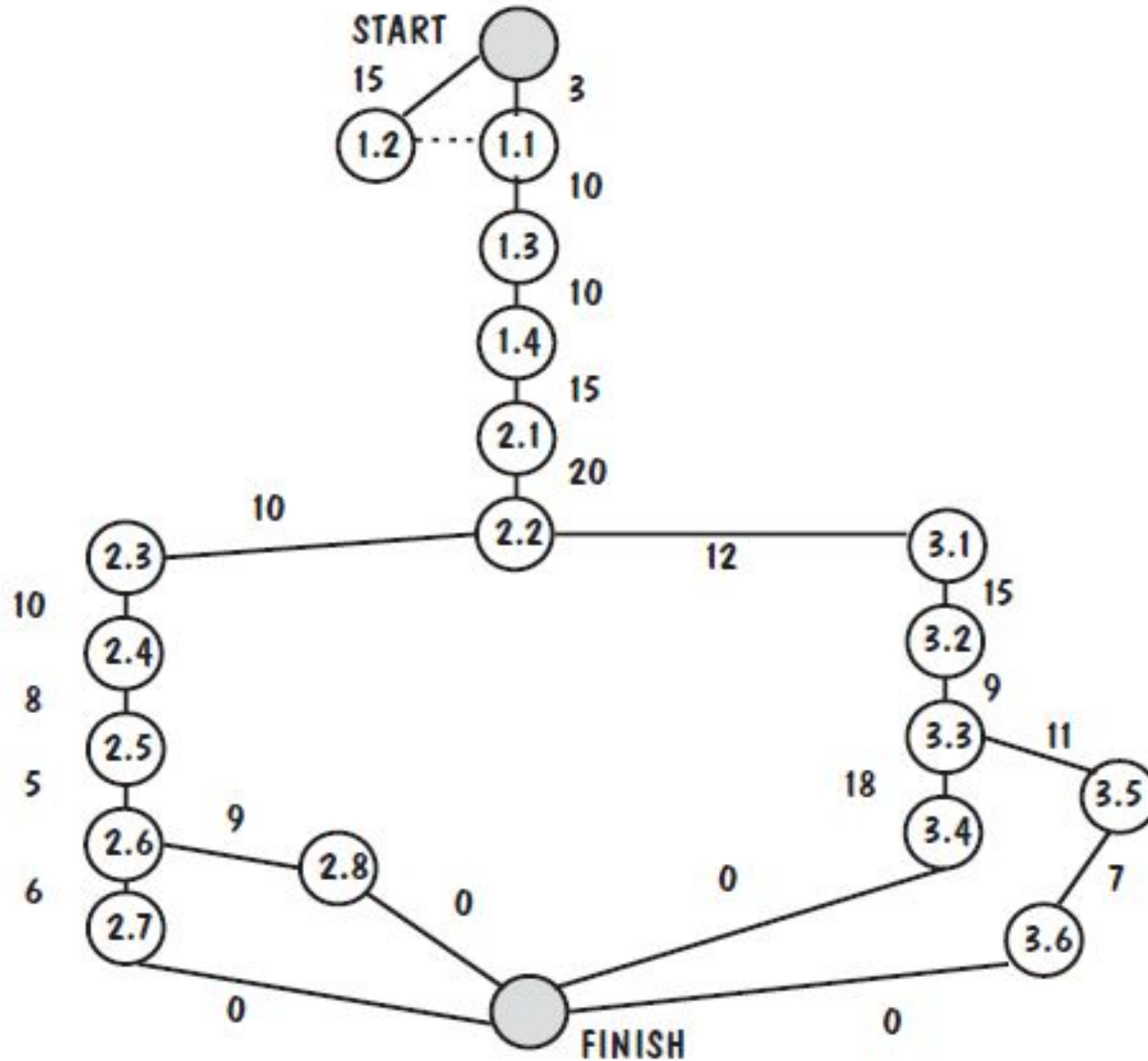


Milestones

TABLE 3.3 Activities and Time Estimates

Activity	Time Estimate (in Days)
<i>Step 1: Prepare the site</i>	
Activity 1.1: Survey the land	3
Activity 1.2: Request permits	15
Activity 1.3: Excavate for the foundation	10
Activity 1.4: Buy materials	10
<i>Step 2: Building the exterior</i>	
Activity 2.1: Lay the foundation	15
Activity 2.2: Build the outside walls	20
Activity 2.3: Install exterior plumbing	10
Activity 2.4: Install exterior electrical work	10
Activity 2.5: Install exterior siding	8
Activity 2.6: Paint the exterior	5
Activity 2.7: Install doors and fixtures	6
Activity 2.8: Install roof	9
<i>Step 3: Finishing the interior</i>	
Activity 3.1: Install interior plumbing	12
Activity 3.2: Install interior electrical work	15
Activity 3.3: Install wallboard	9
Activity 3.4: Paint the interior	18
Activity 3.5: Install floor covering	11
Activity 3.6: Install doors and fixtures	7

Estimating Completion



CPM Activity Graph with Time Durations

Critical Path Method



Analyzing the paths among the milestones of a project is called the **Critical Path Method (CPM)**.



The paths can show us the **minimum amount of time** it will take to complete the project, given our estimates of each activity's duration.



CPM reveals those activities that are most critical to completing the project on time.

Slack Time

- ▶ The **real time** or **actual time** for an activity is the estimated amount of time required for the activity to be completed.
- ▶ The **available time** is the amount of time available in the schedule for the activity's completion.
- ▶ **Slack time** or **float** for an activity is the difference between the available time and the real time for that activity:

$$\text{Slack time} = \text{available time} - \text{real time}$$

- ▶ Another way of looking at slack time is to compare the earliest time an activity may begin with the latest time the activity may begin without delaying the project.

$$\text{Slack time} = \text{latest start time} - \text{earliest start time}$$

TABLE 3.4 Slack Time for Project Activities

Activity	Earliest Start Time	Latest Start Time	Slack
1.1	1	13	12
1.2	1	1	0
1.3	16	16	0
1.4	26	26	0
2.1	36	36	0
2.2	51	51	0
2.3	71	83	12
2.4	81	93	12
2.5	91	103	12
2.6	99	111	12
2.7	104	119	15
2.8	104	116	12
3.1	71	71	0
3.2	83	83	0
3.3	98	98	0
3.4	107	107	0
3.5	107	107	0
3.6	118	118	0
Finish	124	124	0

Calculation of Slack Time

Calculation of Slack Time

- ▶ The longest path has a slack of zero for each of its nodes, because it is the path that determines whether or not the project is on schedule. For this reason, it is called the critical path.
- ▶ Thus, the **critical path** is the one for which the slack at every node is zero in this example.

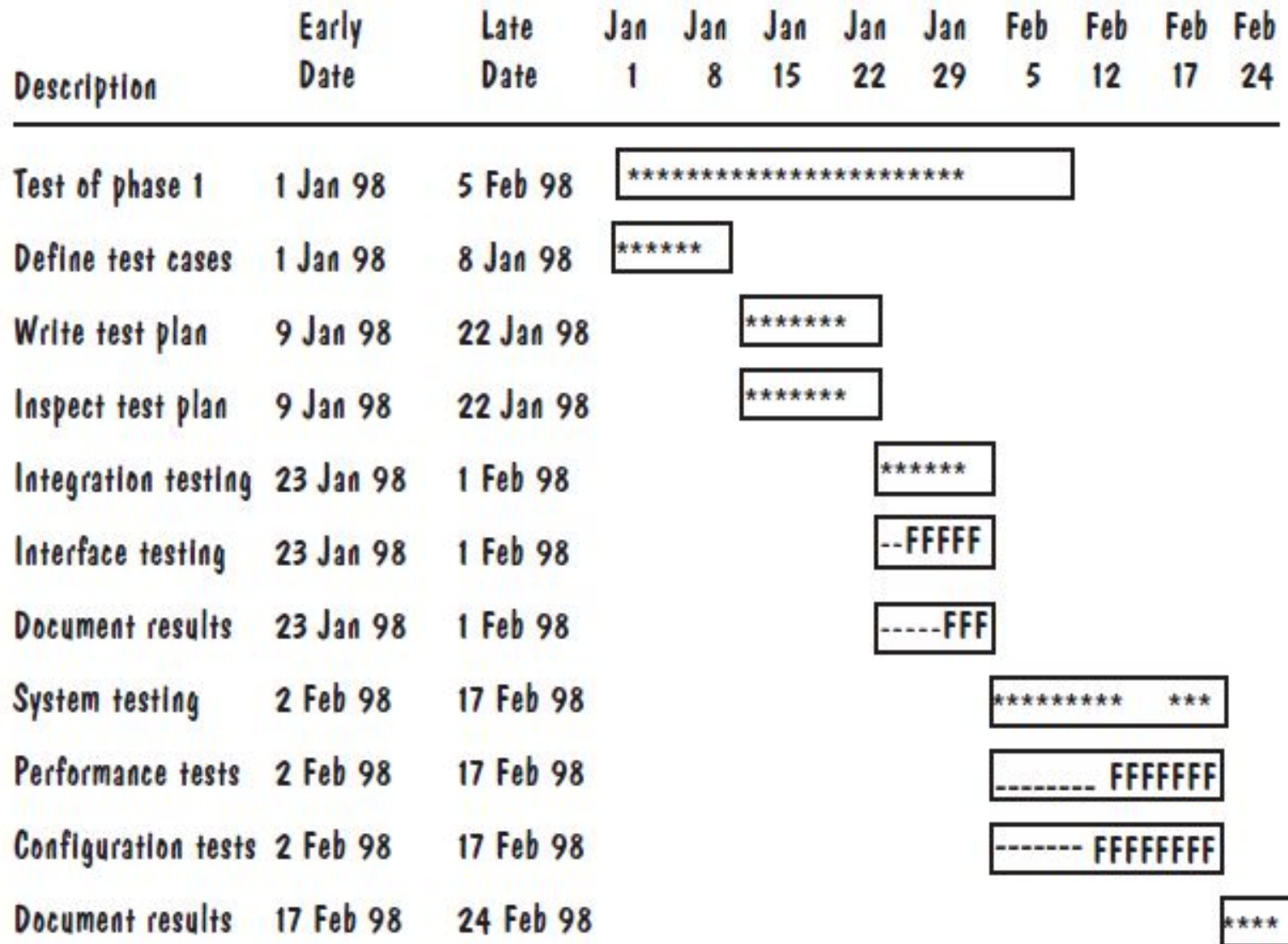


FIGURE 3.4 CPM bar chart.

CPM Bar Chart

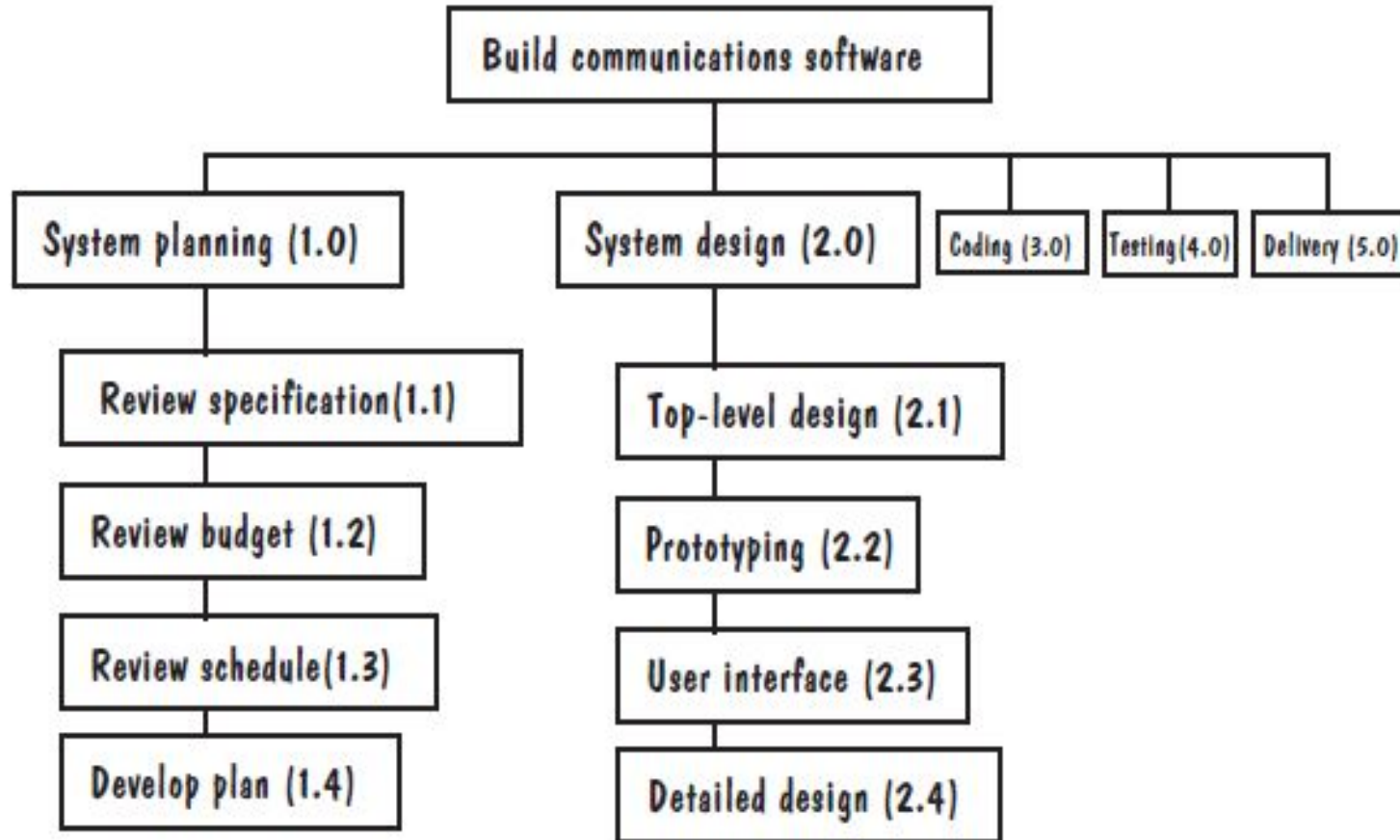
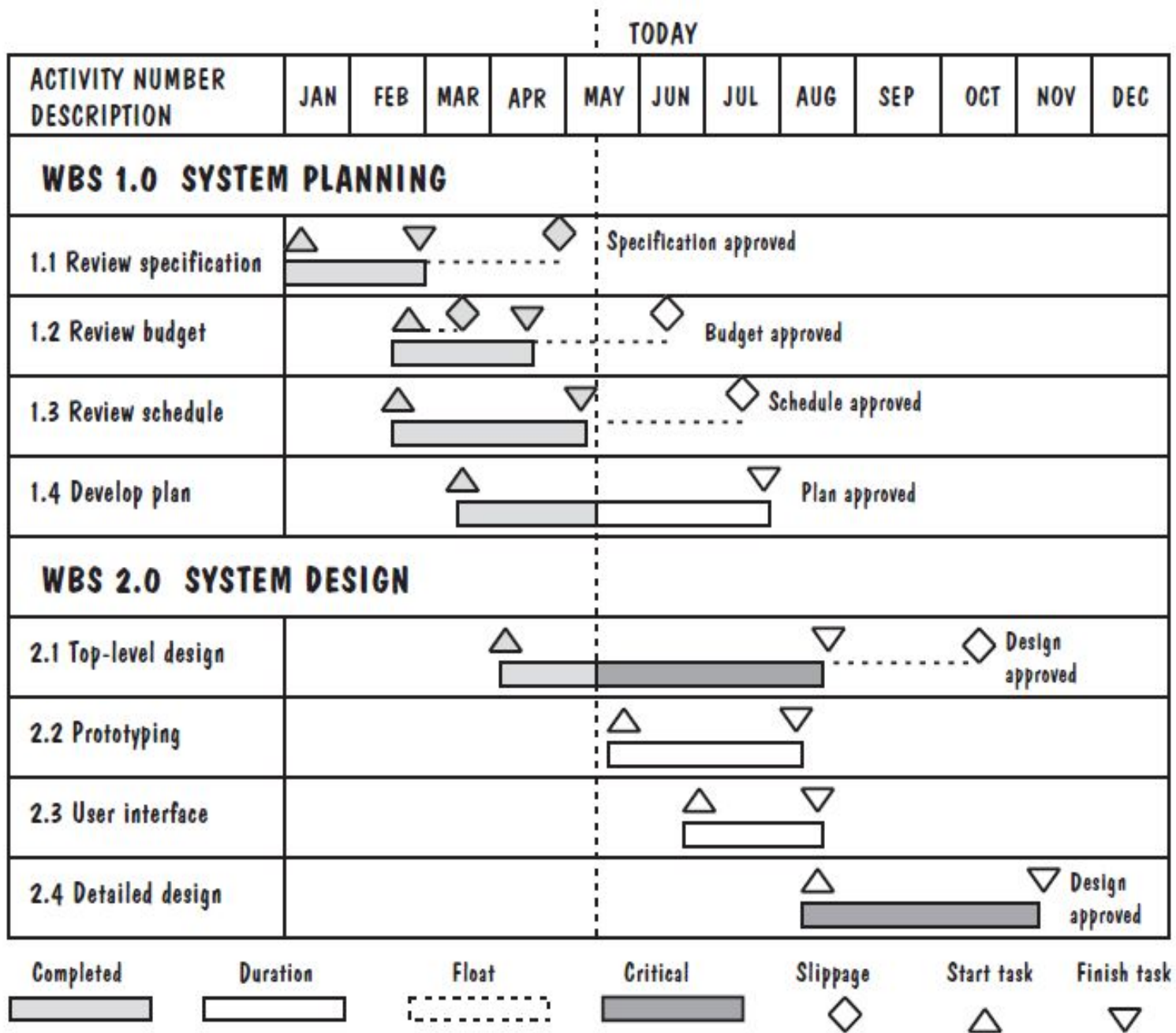


FIGURE 3.5 Example work breakdown structure.

WBS for
Communication
Software



Gantt Chart

FIGURE 3.6 Gantt chart for example work breakdown structure.