



Information Technology Project Management – Fifth Edition



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Project Planning: The Schedule and Budget

Chapter 6

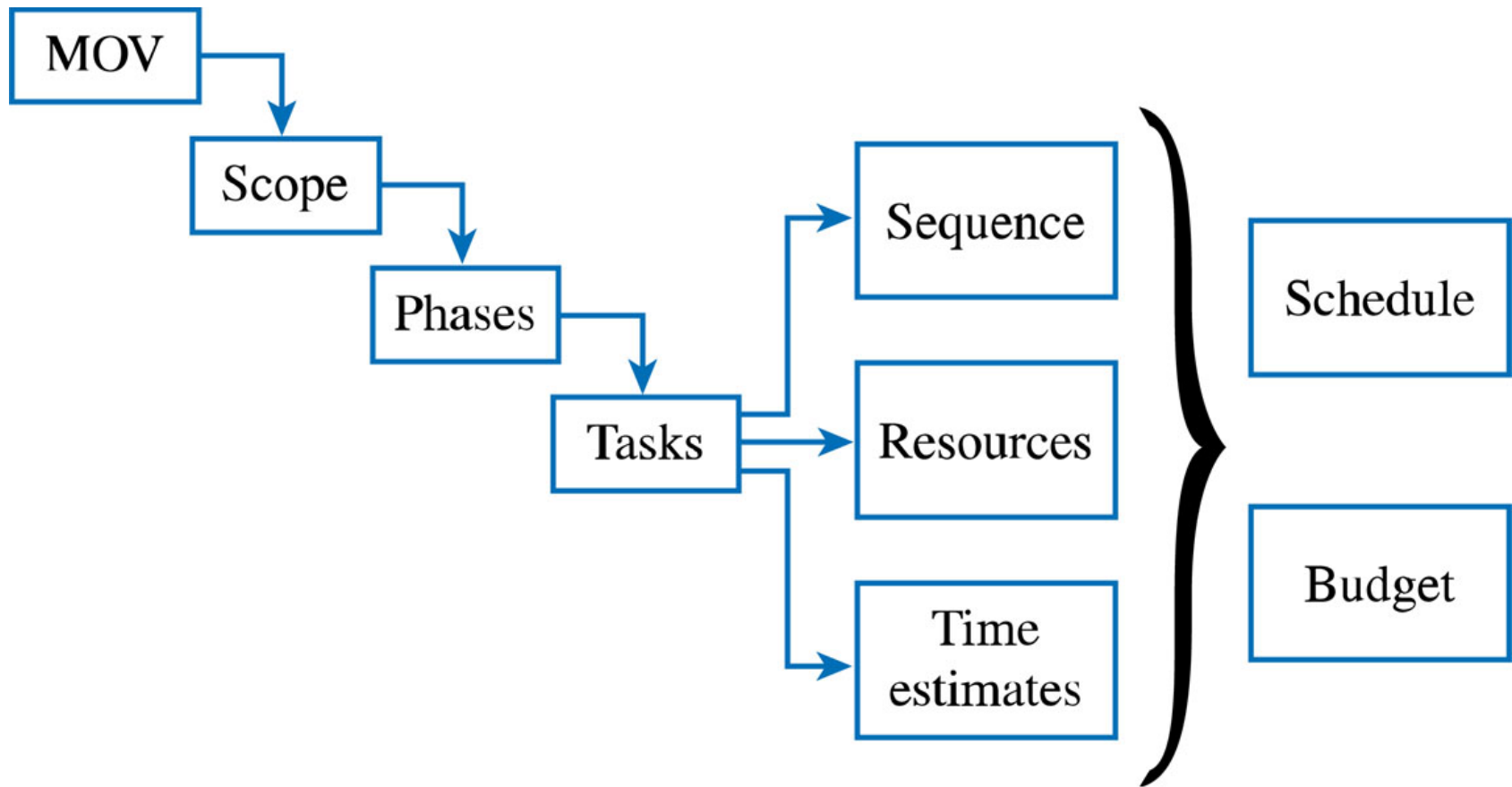
Learning Objectives

- ▶ Develop a GANTT chart.
- ▶ Develop a project network diagram using a technique called activity on the node (AON).
- ▶ Identify a project's critical path and explain why it must be controlled and managed.
- ▶ Develop a PERT diagram.
- ▶ Describe the concept of precedence diagramming and identify finish-to-start, start-to-start, finish-to-finish, and start-to-finish activity relationships.
- ▶ Describe the concept of critical chain project management (CCPM).
- ▶ Describe the various types of costs that make up the project's budget.
- ▶ Define what is meant by the baseline project plan.

Schedule and Budget Development

- ▶ The project's schedule can be determined based upon the tasks and time estimates in the WBS
 - ▶ The schedule will also depend on how these activities are sequenced
- ▶ The project's budget can be determined based upon the activities and time estimates from the WBS as well as the cost of the resources assigned to the WBS tasks
- ▶ Iterations may still be necessary
- ▶ The objective is to create a realistic project schedule and budget!

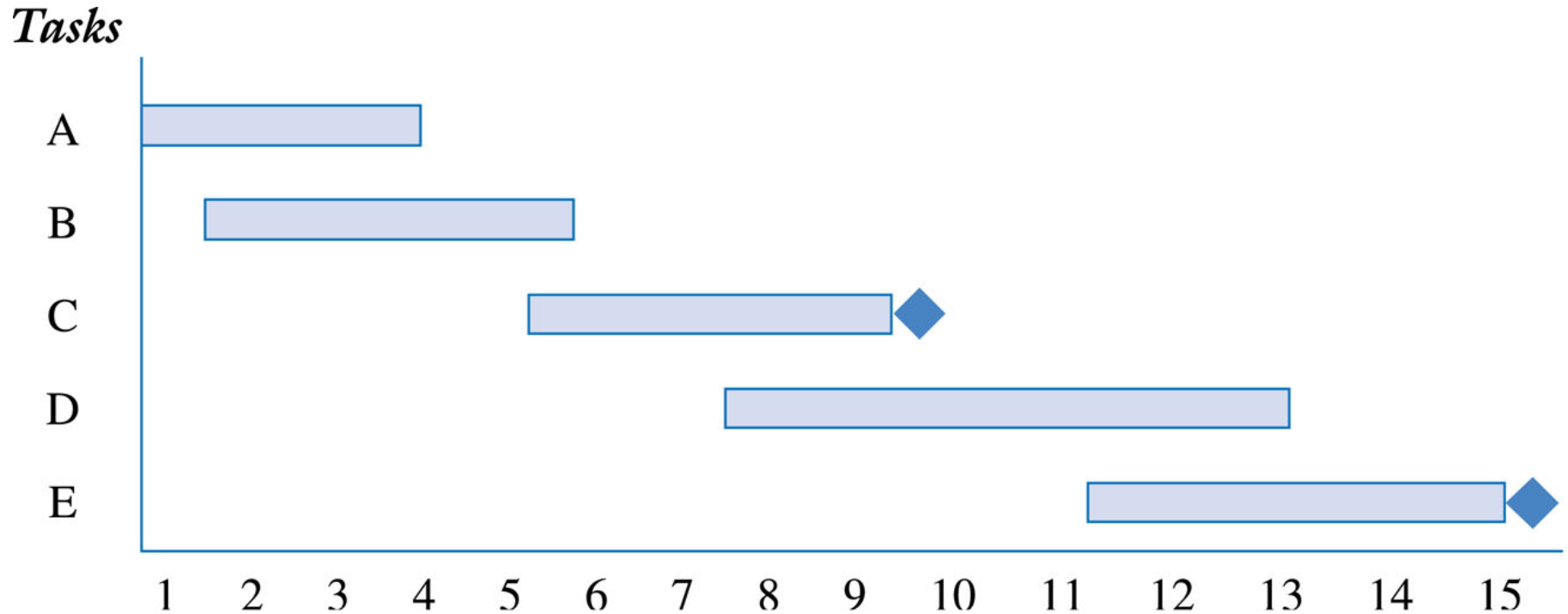
The Project Planning Framework



Developing the Project Schedule

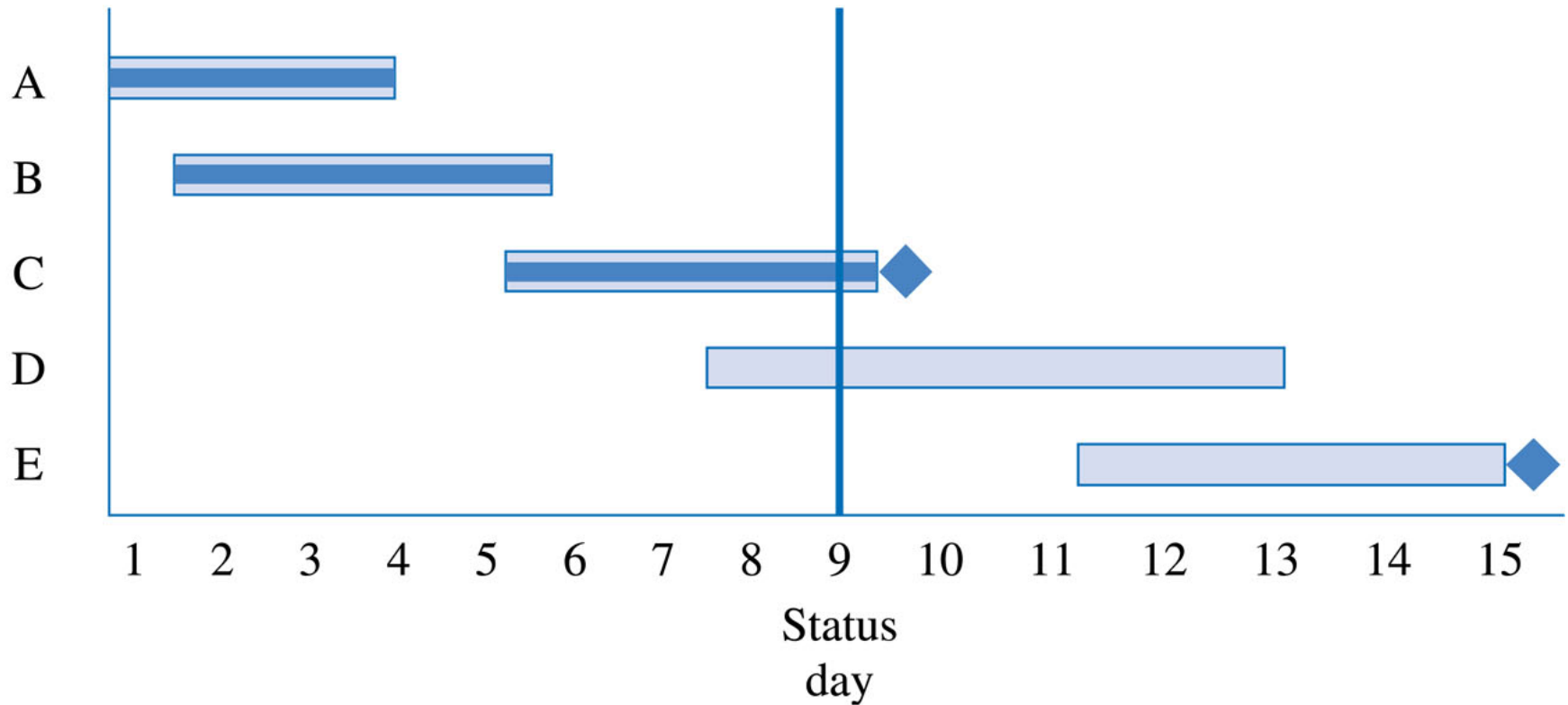
- ▶ Project Management Tools
 - ▶ Gantt Charts
 - ▶ Project Network Diagrams
 - ▶ Activity on the Node (AON)
 - ▶ Critical Path Analysis
 - ▶ Program Evaluation and Review Technique (PERT)
 - ▶ Precedence Diagramming Method (PDM)

Gantt Chart for Planning



Gantt Chart Reporting Project's Progress

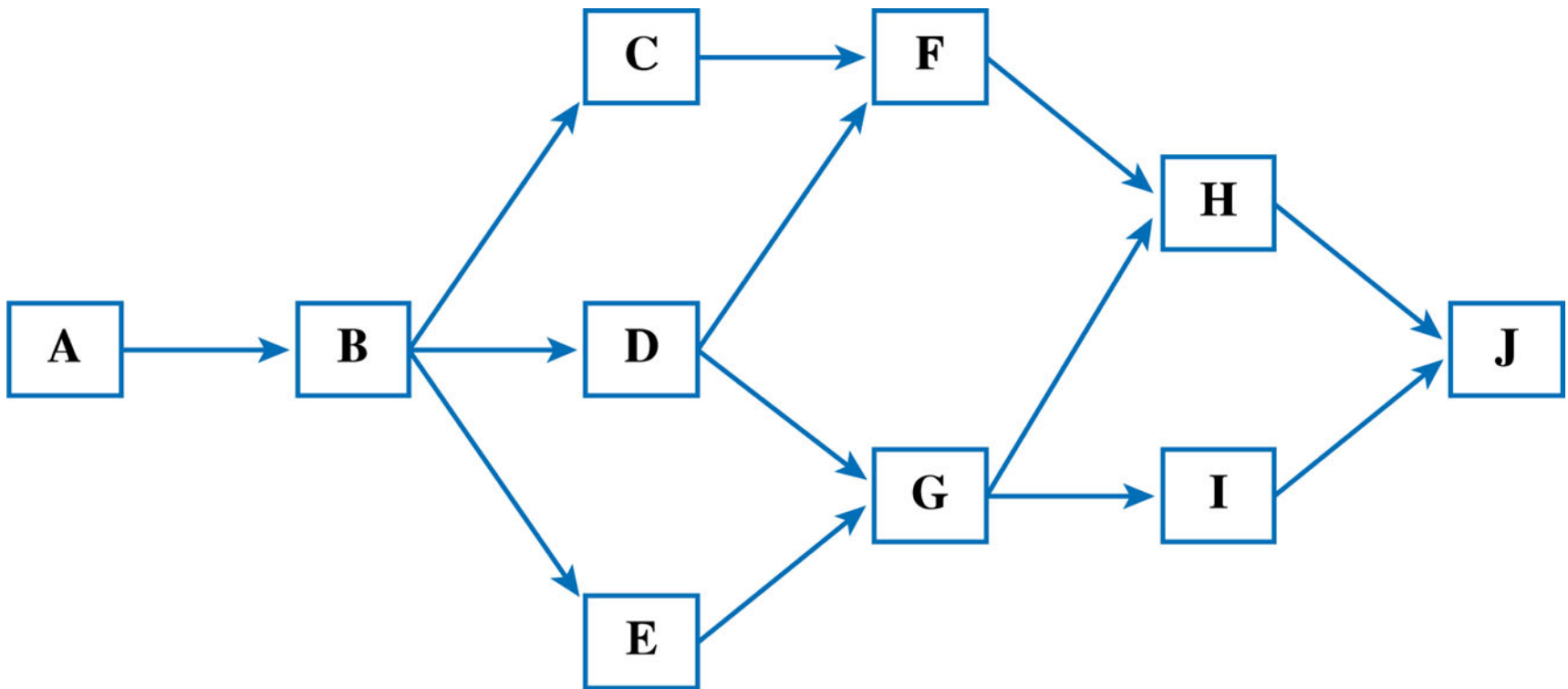
Tasks



Activity Analysis for AON

Activity	Description	Estimated Duration (Days)	Predecessor
A	Evaluate current technology platform	2	None
B	Define user requirements	5	A
C	Design Web page layouts	4	B
D	Set-up Server	3	B
E	Estimate Web traffic	1	B
F	Test Web pages and links	4	C,D
G	Move web pages to production environment	3	D,E
H	Write announcement of intranet for corp. newsletter	2	F,G
I	Train users	5	G
J	Write report to management	1	H,I

Activity on the Node (AON) Network Diagram



Possible Activity Paths

Possible Paths	Path	Total
Path 1	A+B+C+F+H+J	18
	2+5+4+4+2+1	
Path 2	A+B+D+F+H+J	17
	2+5+3+4+2+1	
Path 3	A+B+D+G+H+J	16
	2+5+3+3+2+1	
Path 4	A+B+D+G+I+J	19*
	2+5+3+3+5+1	
Path 5	A+B+E+G+I+J	17
	2+5+1+3+5+1	

* The
Critical
Path

Critical Path

- ▶ Longest path
- ▶ Shortest time project can be completed
 - ▶ Zero slack (or float)
 - ▶ The amount of time an activity can be delayed before it delays the project
- ▶ Must be monitored and managed!
 - ▶ Project manager can expedite or crash by adding resources
 - ▶ Fast tracking – running activities in parallel which were originally planned as sequential
 - ▶ The CP can change
 - ▶ Can have multiple CPs

PERT

- ▶ Program Evaluation and Review Technique
- ▶ Developed in 1950s to help manage the Polaris Submarine Project
- ▶ Developed about the same time as the Critical Path Method
 - ▶ Often combined as PERT/CPM
- ▶ Employs both a project network diagram with a statistical distribution

Activity Analysis for PERT

Activity	Predecessor	Optimistic Estimates (Days)	Most Likely Estimates (Days)	Pessimistic Estimates (Days)	Expected Duration $\frac{(a+4b+c)}{6}$
A	None	1	2	4	2.2
B	A	3	5	8	5.2
C	B	2	4	5	3.8
D	B	2	3	6	3.3
E	B	1	1	1	1.0
F	C,D	2	4	6	4.0
G	D,E	2	3	4	3.0
H	F,G	1	2	5	2.3
I	G	4	5	9	5.5
J	H,I	.5	1	3	1.3

Possible PERT Activity Paths

Possible Paths	Path	Total
Path 1	A+B+C+F+H+J	18.8
	2.2+5.2+3.8+4.0+2.3+1.3	
Path 2	A+B+D+F+H+J	18.3
	2.2+5.2+3.3+4.0+2.3+1.3	
Path 3	A+B+D+G+H+J	18.6
	2.2+5.2+3.3+3.0+2.3+1.3	
Path 4	A+B+D+G+I+J	20.5*
	2.2+5.2+3.3+3.0+5.5+1.3	
Path 5	A+B+E+G+I+J	18.2
	2.2+5.2+1.0+3.0+5.5+1.3	

* The Critical Path

Precedence Diagramming Method - PDM

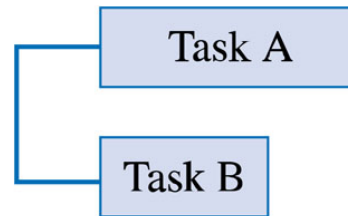
- ▶ Based on 4 fundamental relationships
 - ▶ Finish-To-Start (FS)
 - ▶ Start-To-Start (SS)
 - ▶ Finish-To-Finish (FF)
 - ▶ Start-To-Finish (SF)

PDM Relationships

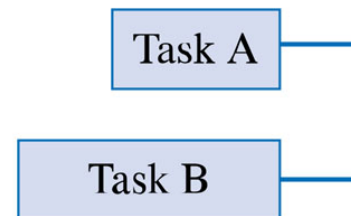
Finish-to-Start



Start-to-Start



Finish-to-Finish



Start-to-Finish



Lead and Lag times

- ▶ Lead is starting the next task before the first task is complete
 - ▶ Example: Begin installing the operating systems when half of the PCs are set up
- ▶ Lag (or negative lead) is the adding of a buffer of time before the next task begins
 - ▶ Example: Once the walls have been painted, wait one day before laying the carpet so that the walls have had a chance to dry

Critical Chain Project Management (CCPM)

- ▶ Introduced in 1997 in a book called *Critical Chain* by Eliyahu Goldratt
- ▶ Based on his previous work called the *Theory of Constraints*
- ▶ *CCPM is based on the idea that people often inflate or add cushioning to their estimates to create a form of “safety” to compensate for uncertainty or risk because ...*
 - ▶ *Your work is dependent upon the work of someone else, and you believe that starting your work will be delayed*
 - ▶ *Your pessimism from previous experience where things did not go as planned*
 - ▶ *Your belief that the project sponsor or customer will cut your project schedule or budget so you inflate your estimates to guard against this cut*

If people build safety into their estimates, then ...

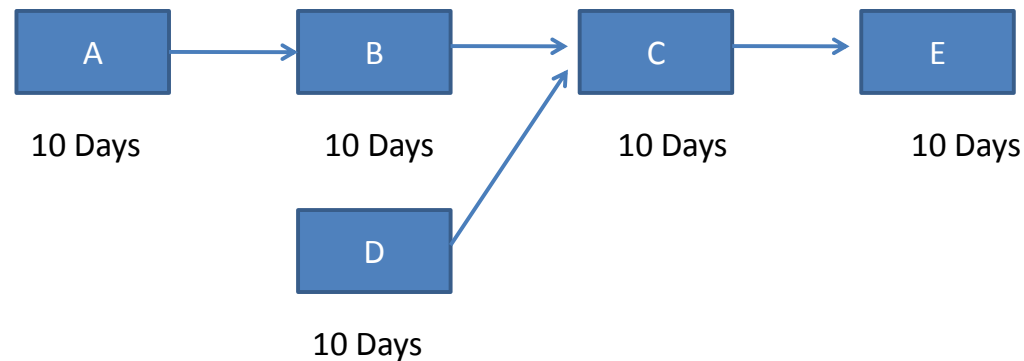
- ▶ Why are projects still late?
 - ▶ **Student's Syndrome** or procrastinating until the last minute before starting to work on a task
 - ▶ **Parkinson's Law** or the idea that work expands to fill the time available
 - ▶ People will rarely report finishing something early because there is little incentive to do so or because they may fear that management will cut their estimates next time
 - ▶ Multitasking of resources or “**resource contention**”
 - ▶ A person is often assigned to more than one project or required to attend meetings, training, etc. As a result, they can no longer devote their time to tasks that are on the critical path

CCPM Assumptions

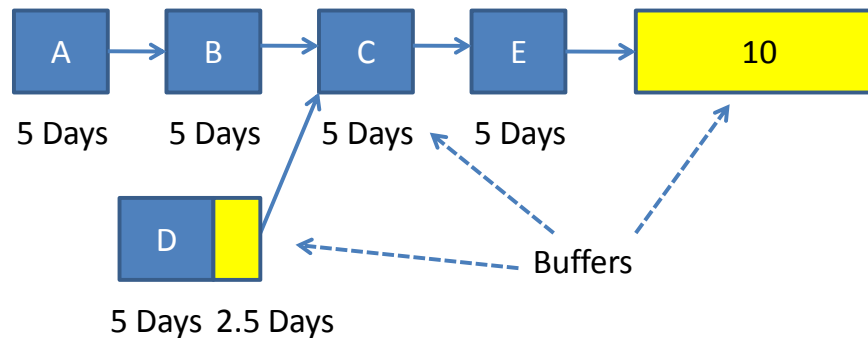
- ▶ Begins by asking each person or team working on a task to provide an estimate that would have a 50% chance of being completed as planned
 - ▶ About half of the project tasks will be completed on time, about half won't
- ▶ Instead of adding safety to each task, put that safety in the form of buffers where it is needed most
 - ▶ Feeding buffers
 - ▶ Reduce the likelihood of bottlenecks by ensuring that critical tasks will start on time when a task acts as a feeder to another task on the critical path
 - ▶ Resource buffers
 - ▶ Reduce resource contention
 - ▶ End of Project buffers
 - ▶ Are equal to one-half of the time saved from putting safety into each task

The Critical Chain Project Schedule

Project Schedule with Safety in Each Task



Critical Chain Project Schedule



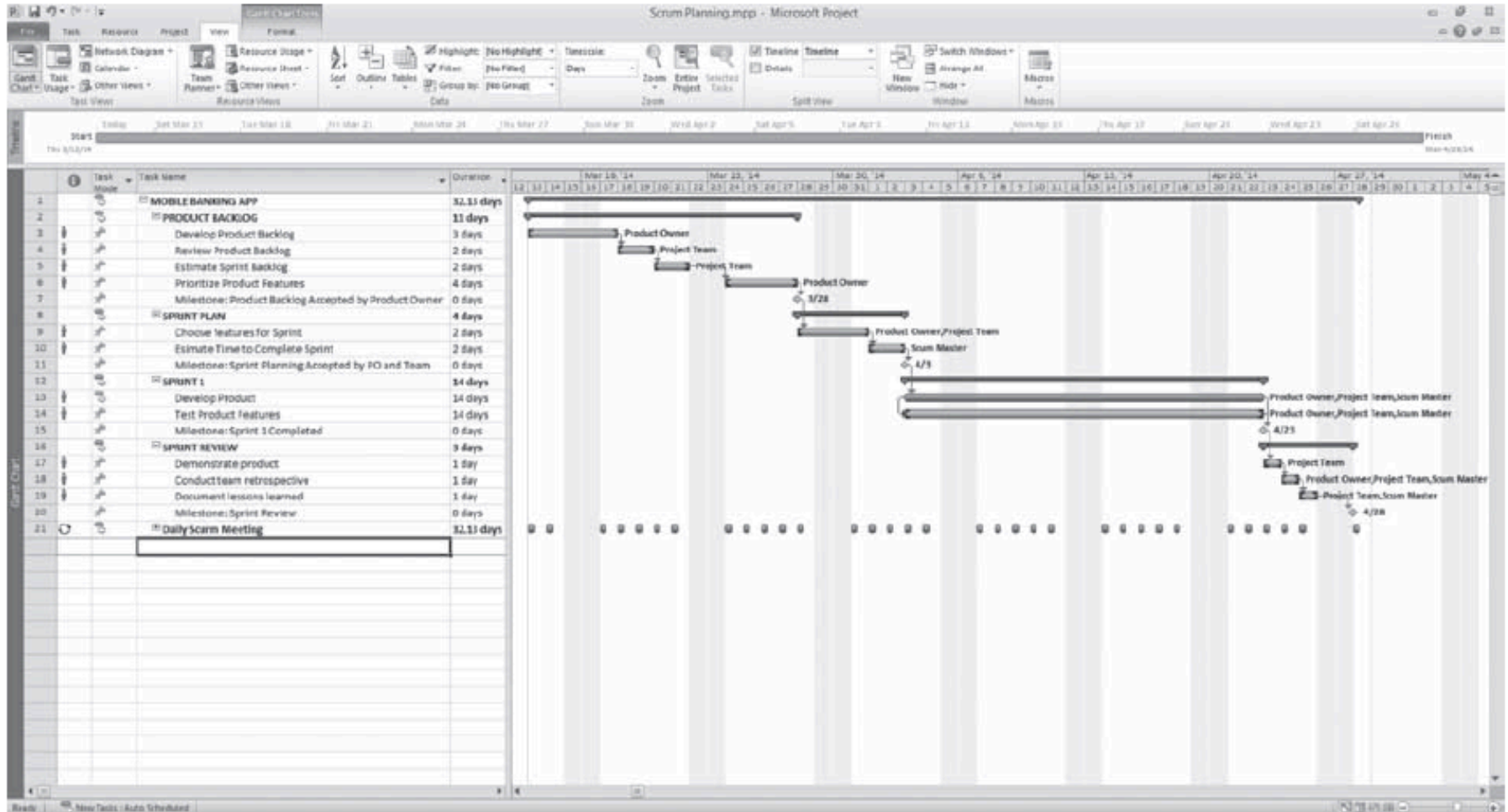
Critical Chain Project Management

- ▶ And the critical path are similar
 - ▶ The difference is the CCPM takes into account resource contention
- ▶ Takes a more project portfolio view
 - ▶ Other projects should be scheduled so that a resource can be dedicated to a particular task
- ▶ Requires that everyone understand that each project task has a 50% chance of being completed as scheduled, so about half of the tasks will be late.
 - ▶ This is the reason for having the project buffer.
 - ▶ Instead of tracking each task individually, we become more concerned with the project buffer –i.e., the project will be late only if it uses more than the allotted project buffer.
- ▶ Instead of penalties for being late, bonuses or other incentives for completing tasks early may be needed

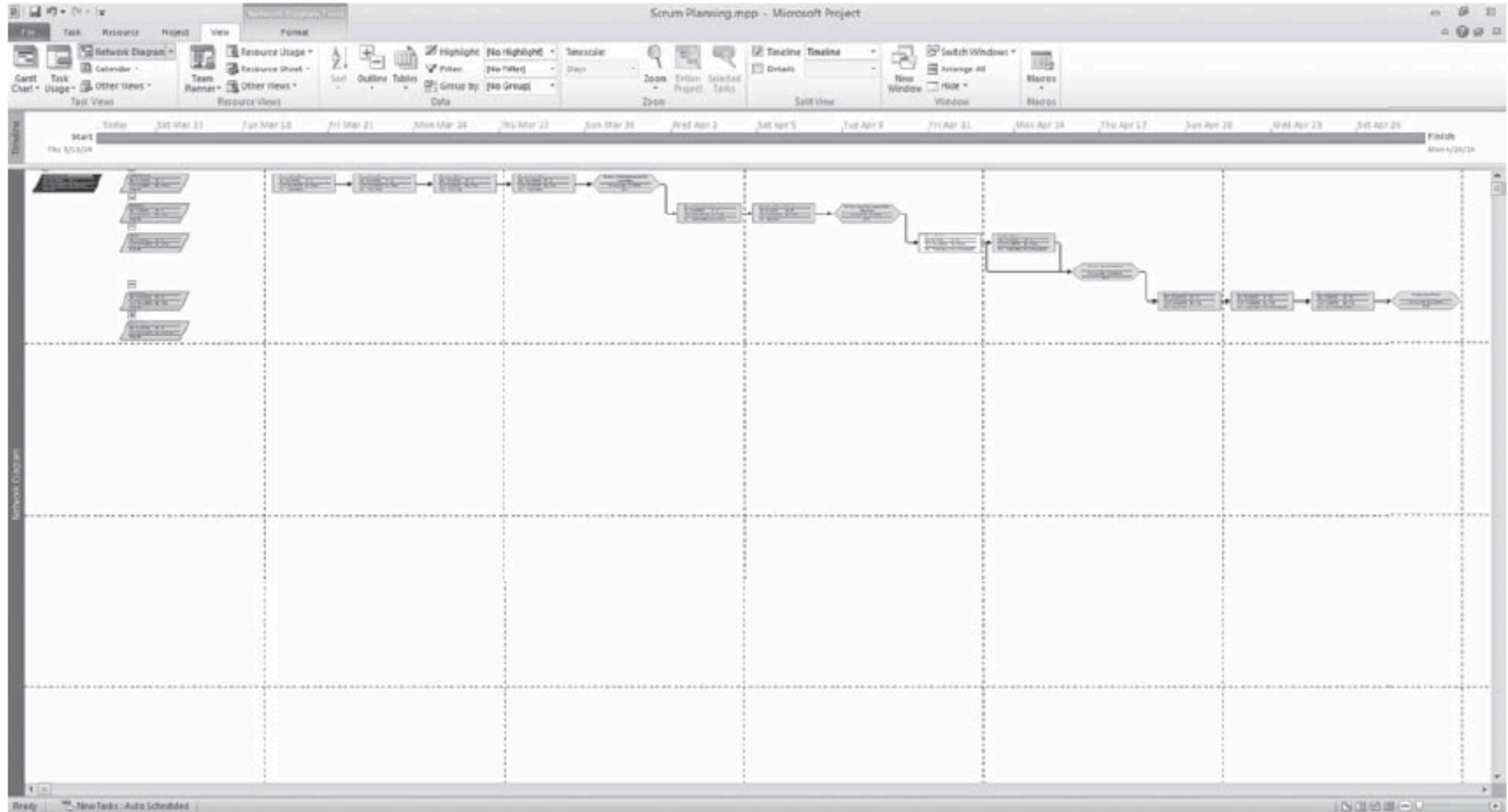
Project Management Software Tools

- ▶ A number of project management software tools are available to plan and track the progress of your project
- ▶ However, having a fundamental understanding of these project management techniques is important to make the most of these software tools

GANTT Chart in Microsoft Project ®



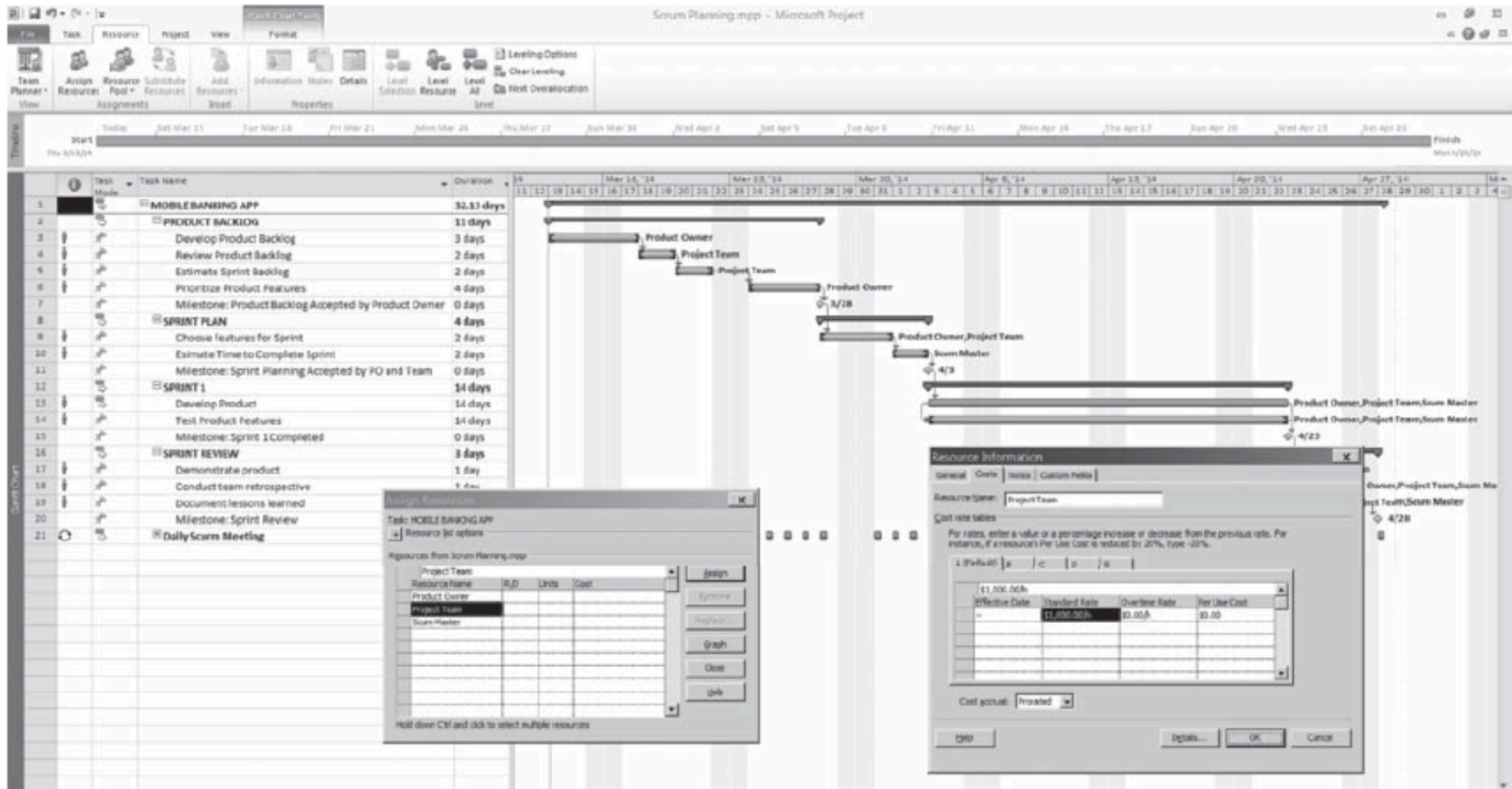
Network Diagram and Critical Path in Microsoft Project ®



Developing the Project Budget

1. Define what resources will be needed to perform the work
2. Determine the quantity of resources that are needed
3. Define the cost of using each resource
4. Calculate the cost of the task or activity
5. Ensure that the resources are leveled, that is, not over allocated. An example of over allocation is assigning a project team member to two tasks scheduled at the same time.

Project Resources Assigned to Project Tasks in Microsoft Project ®



Other Costs

- ▶ **Direct Costs**
 - ▶ The direct cost of labor or other resources
- ▶ **Indirect Costs**
 - ▶ The cost for covering such things as rent, utilities, insurance, etc.
- ▶ **Sunk Costs**
 - ▶ Costs incurred prior to the project, such as a project that has been restarted after a failed attempt
- ▶ **Learning Curve**
 - ▶ Often have to “Build one and throw it away” to understand a problem or a new technology
- ▶ **Prorated Costs**
 - ▶ The idea that there is a cost associated with using a resource
- ▶ **Reserves**
 - ▶ Contingency funds to be used at the discretion of the project manager

Finalizing the Project Schedule and Budget

- ▶ The project schedule and budget may require several iterations before it is acceptable to the sponsor, the project manager, and the project team.
- ▶ **Resource Allocation** – PM reviews project to make sure resources are properly allocated – leveled – not over allocated
- ▶ Once the project schedule and project plan are accepted, the project plan becomes the **baseline plan**.
- ▶ Once accepted, the project manager and project team have the authority to execute or carry out the plan and can have a **Kickoff Meeting**.