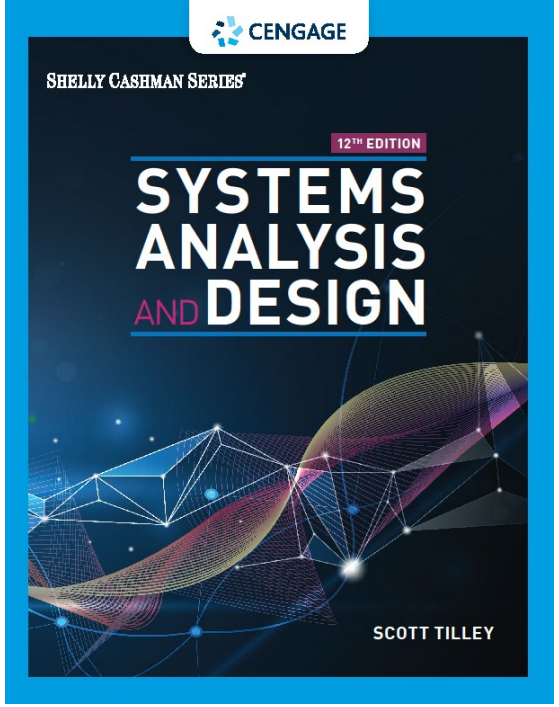
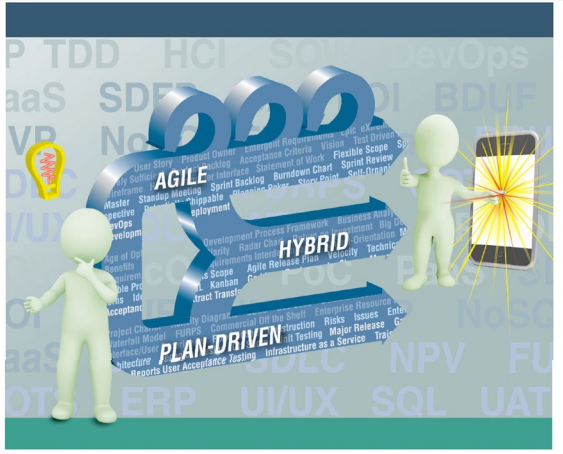




Systems Analysis & Design
in an Age of Options

Gary Spurrier | Heikki Topi

Chapter 3

Managing Systems Projects

Learning Objectives

- Learn the use of Gantt charts for project planning
- Create a Work Breakdown Structure
- Identify the Critical Path for a project
- Identify project issues and risks

The Balancing Act of Project Management

You can't get it all

...so...

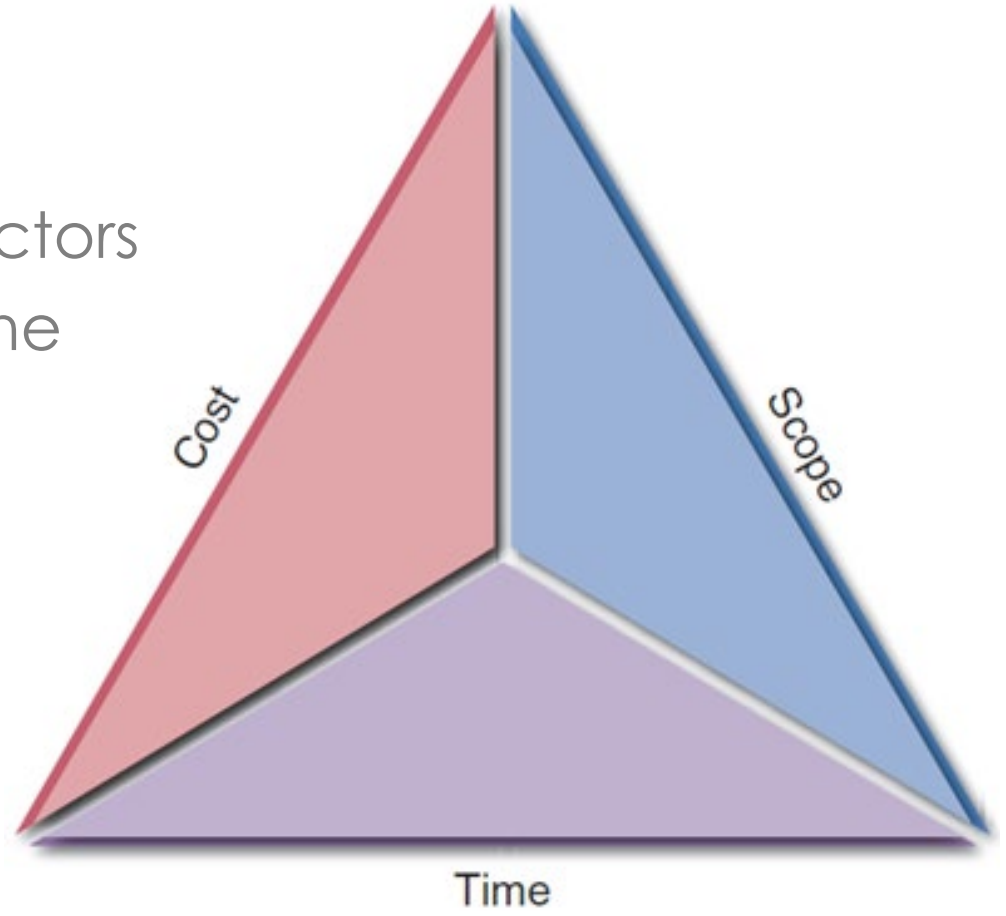
pick any two.

Overview of Project Management (1 of 3)

- Project management
  - Planning, scheduling, monitoring and controlling, and reporting on information system development
- What shapes a project?
  - Successful projects must be completed on time, within budget, meet requirements, and satisfy users

Overview of Project Management (2 of 3)

- What is the project triangle?
  - Challenge:
    find optimal balance among the factors
  - Any change in one side will affect the other sides



Overview of Project Management (3 of 3)

- What does a project manager do?
  - Project planning: identify project tasks and estimate completion time and costs
  - Project scheduling: create a specific timetable showing tasks, task dependencies, and critical tasks that might delay the project
  - Project monitoring: guide, supervise, and coordinate the project team's workload
  - Project reporting: create regular progress reports for management, users, and the project team itself

The Value of Writing Out the Project Plan

- **Writing out answers to complex questions:** Forces making sense of them
- **Project questions:**
  - **Individual areas:** Vision Stakeholders, Business Benefits, Project Timeline, etc.
  - **Relationships between areas:**
    - Vision Stakeholders match Project Roles?
    - Business Benefits match Key Deliverables?
    - Etc.

Key Project Planning Questions

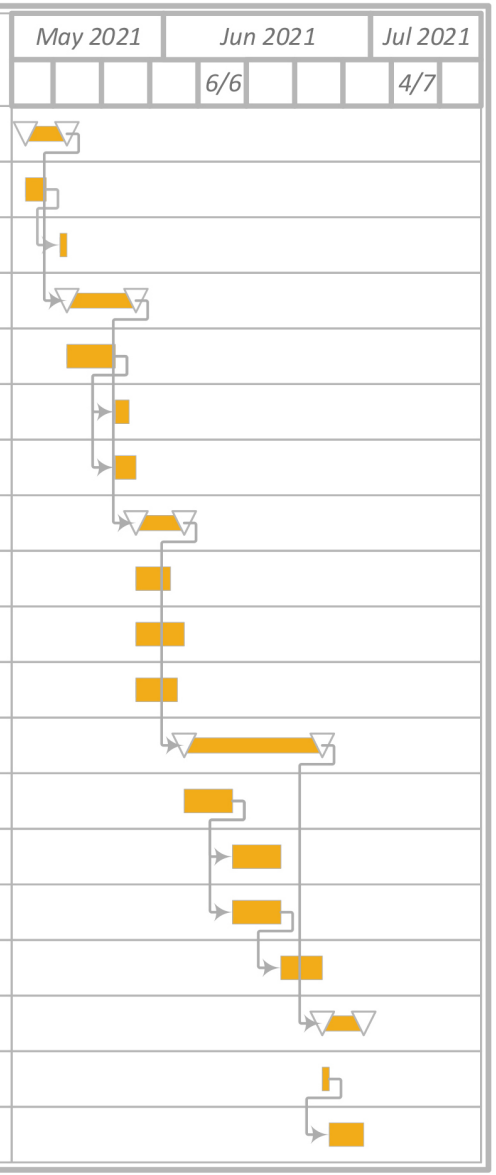
- **Vision:** *What is the project about?*
- **Justification:** *Should we do the project?*
- **Project approach:** *Should we use agile, plan-driven, or hybrid?*
- **Change management:** *What does the business need to do for the project to succeed?*
- **Project roles:** *Who should be involved in the project?*
- **Project timeline:** *When and in what order do we perform project tasks?*
- **Deployment:** *How and how frequently do we deploy software to users?*

Answering Project Planning Questions

Needs sustained involvement of:

- **Customers**
- **Management**
- **Technology team**

ID	Task Name	Start	Finish	Duration
1	**Foundation**	**5/12/2021**	**5/17/2021**	**4d**
2	Site Work & Footings	5/12/2021	5/14/2021	3d
3	Pour Concrete	5/17/2021	5/17/2021	1d
4	**Rough Carpentry**	**5/18/2021**	**5/27/2021**	**8d**
5	Framing	5/18/2021	5/24/2021	5d
6	Doors & Windows	5/25/2021	5/26/2021	2d
7	Roof	5/25/2021	5/27/2021	3d
8	**Systems**	**5/28/2021**	**6/3/2021**	**5d**
9	Electrical	5/28/2021	6/1/2021	3d
10	Plumbing	5/28/2021	6/3/2021	5d
11	Heating & Cooling	5/28/2021	6/2/2021	4d
12	**Finish Work**	**6/4/2021**	**6/23/2021**	**14d**
13	Drywall	6/4/2021	6/10/2021	5d
14	Paint	6/11/2021	6/17/2021	5d
15	Kitchen & Bath	6/11/2021	6/17/2021	5d
16	Floors	6/18/2021	6/23/2021	4d
17	**Closeout**	**6/24/2021**	**6/29/2021**	**4d**
18	Inspections	6/24/2021	6/24/2021	1d
19	Fixes	6/25/2021	6/29/2021	3d

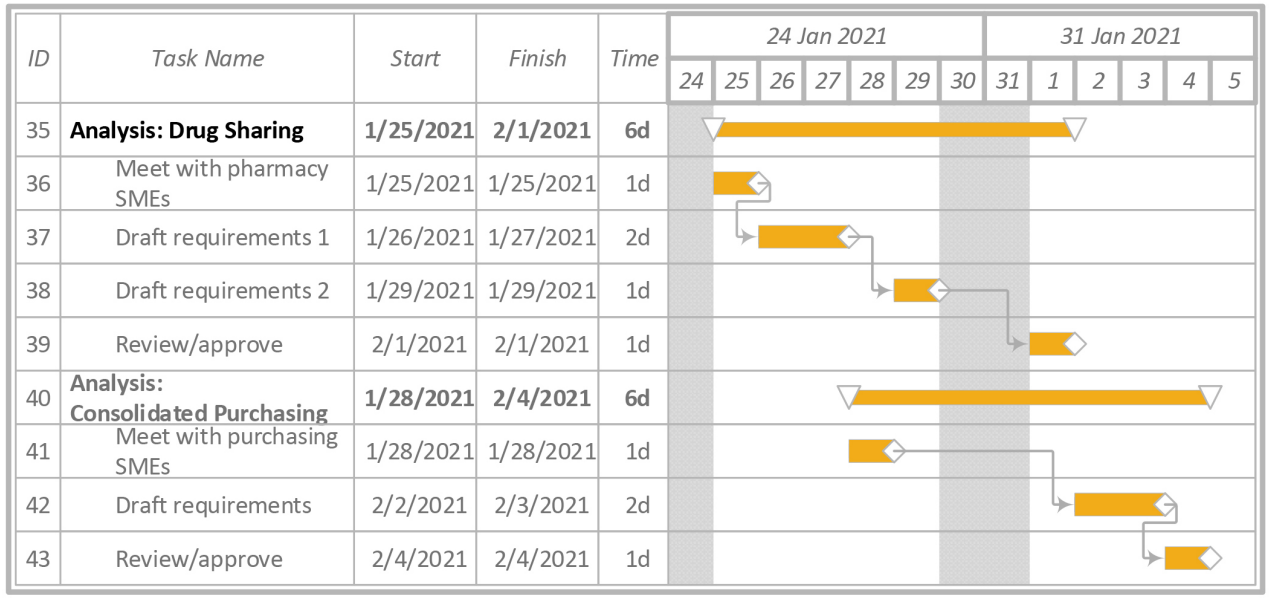


Gantt Charts

Traditional Project Planning Tool

- **Mathematically-driven**
- **Good for highly predictable projects:**
  - Building multiple houses using same blueprint
  - Minimizing replication risk
- **Bad for highly unpredictable projects:**
  - Constructing new software
  - Facing high design risk
  - Yet still useful!

Unpredictability of Systems Project Planning

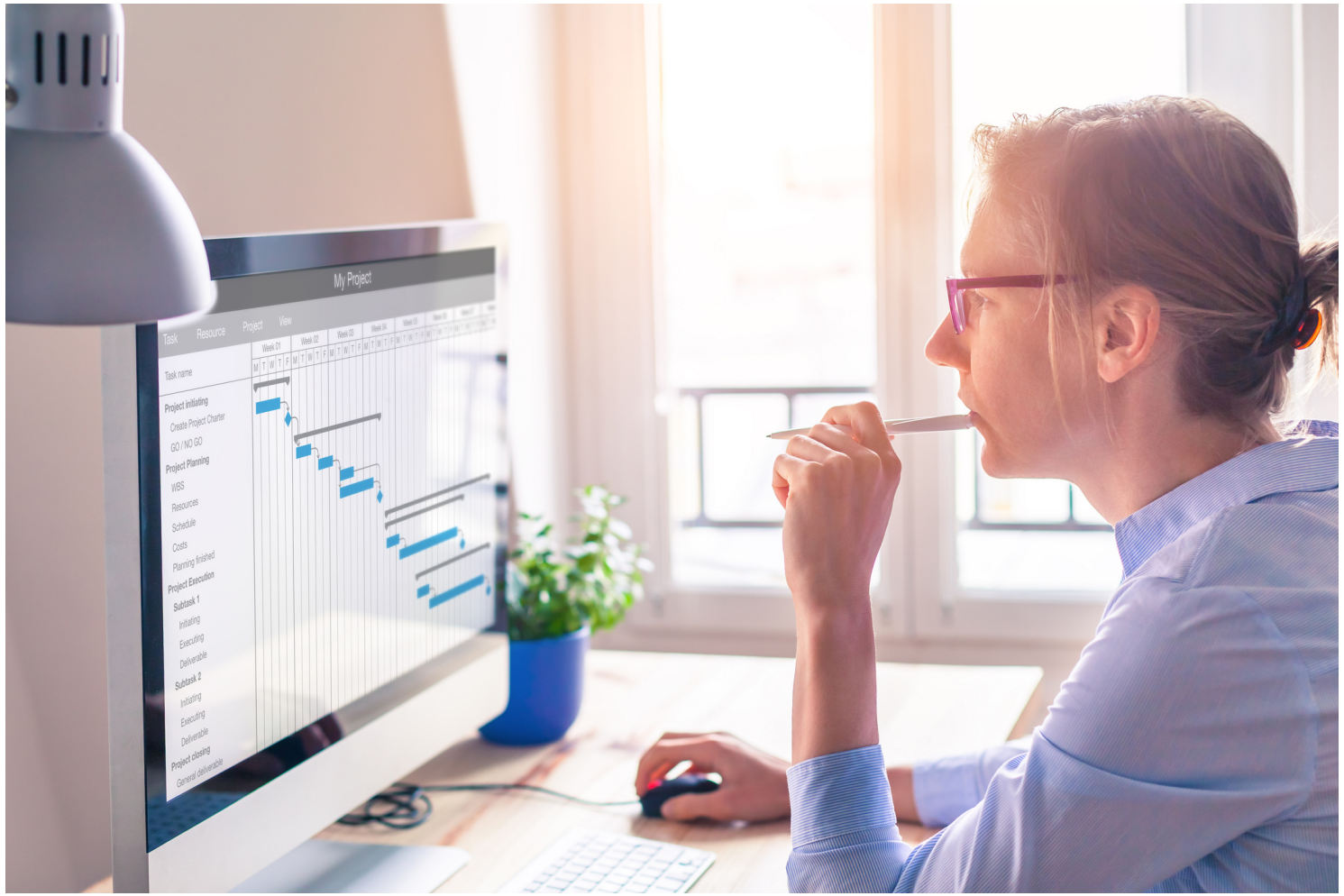


ID	Task Name	Start	Finish	Time
35	**Analysis: Drug Sharing**	**1/25/2021**	**2/1/2021**	**6d**
36	Meet with pharmacy SMEs	1/25/2021	1/25/2021	1d
37	Draft requirements 1	1/26/2021	1/27/2021	2d
38	Draft requirements 2	1/29/2021	1/29/2021	1d
39	Review/approve	2/1/2021	2/1/2021	1d
40	**Analysis: Consolidated Purchasing**	**1/28/2021**	**2/4/2021**	**6d**
41	Meet with purchasing SMEs	1/28/2021	1/28/2021	1d
42	Draft requirements	2/2/2021	2/3/2021	2d
43	Review/approve	2/4/2021	2/4/2021	1d

Classic Gantt chart for a systems project showing a small subset of tasks and dependencies

SA&D requirements activities highly unpredictable

- Time/effort needed for
  - Business analysis and functional/technical designs?
  - How large and complex are the requirements?
  - How many meetings?
  - Impacts of uncertain user availability, interruptions, rescheduling, etc.
- Difficult to plan and the plan frequently changes



Planning and replanning project tasks rather than creating working software

Planning and Re-Planning Project Tasks

Traditional project planning can collapse because of high uncertainty

- **Requirements:** Can be highly unpredictable
- **Construction:** Need for flexible, iterative software construction

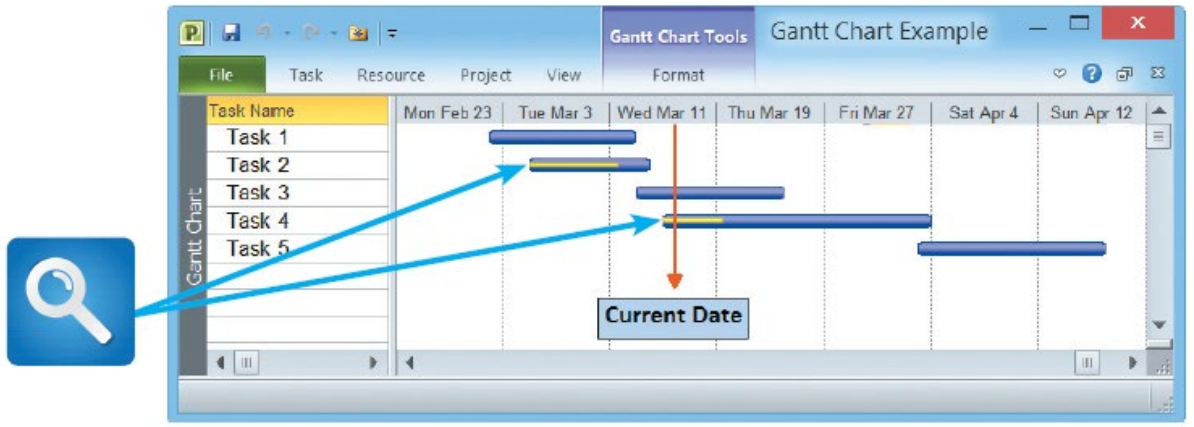
Key reasons why agile approach advocates argue:

- **Planning:** Is a waste of time
- **Instead focus:** On creating working software

But then how to plan pre-construction activities…?

Creating a Work Breakdown Structure (1 of 8)

- Breaking down a project into a series of smaller tasks
  - Gantt Chart
    - Horizontal bar chart representing a set of tasks
    - Shows planned and actual progress on a project
    - Simplifies complex projects using a task group



Creating a Work Breakdown Structure (2 of 8)

- PERT/CPM charts
  - Program Evaluation Review Technique (PERT)
    - Developed by the U.S. Navy
    - Utilizes a bottom-up technique
    - Useful for scheduling, monitoring, and controlling actual work
    - Displays complex task patterns and relationships
  - Critical Path Method (CPM)
    - Developed by private industry

Creating a Work Breakdown Structure (3 of 8)

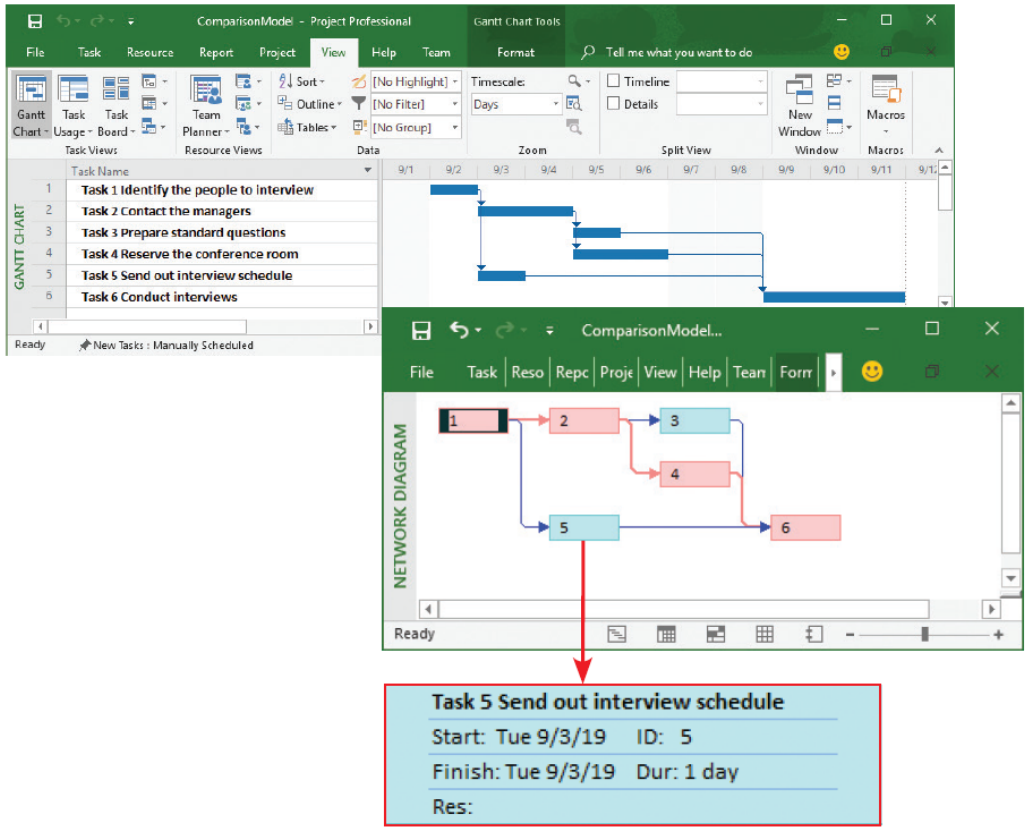


FIGURE 3-4 The top screen shows a Gantt chart with six tasks. The PERT chart in the bottom screen displays an easy-to-follow task pattern for the same project. When the user mouses over the summary box for Task 5, the details become visible.

Creating a Work Breakdown Structure (4 of 8)

- Identifying tasks in a WBS
  - Task or activity: any work that has a beginning and end
    - Requires the use of company resources such as people, time, or money
    - Should be small and manageable
  - Projects have events or milestones
    - recognizable reference points used to monitor progress
    - typically completion of a logical block of work

Creating a Work Breakdown Structure (5 of 8)

- Listing the tasks
  - Tasks might be embedded in a document
- Estimating task duration
  - Can be hours, days, or weeks
- Time estimates made by project managers
  - Simple estimate based on experience
  - Best case-estimate (B), probable-case estimate (P), and worst-case estimate (W) and calculates duration like: estimate = (B +4P +W)/6

Creating a Work Breakdown Structure (6 of 8)

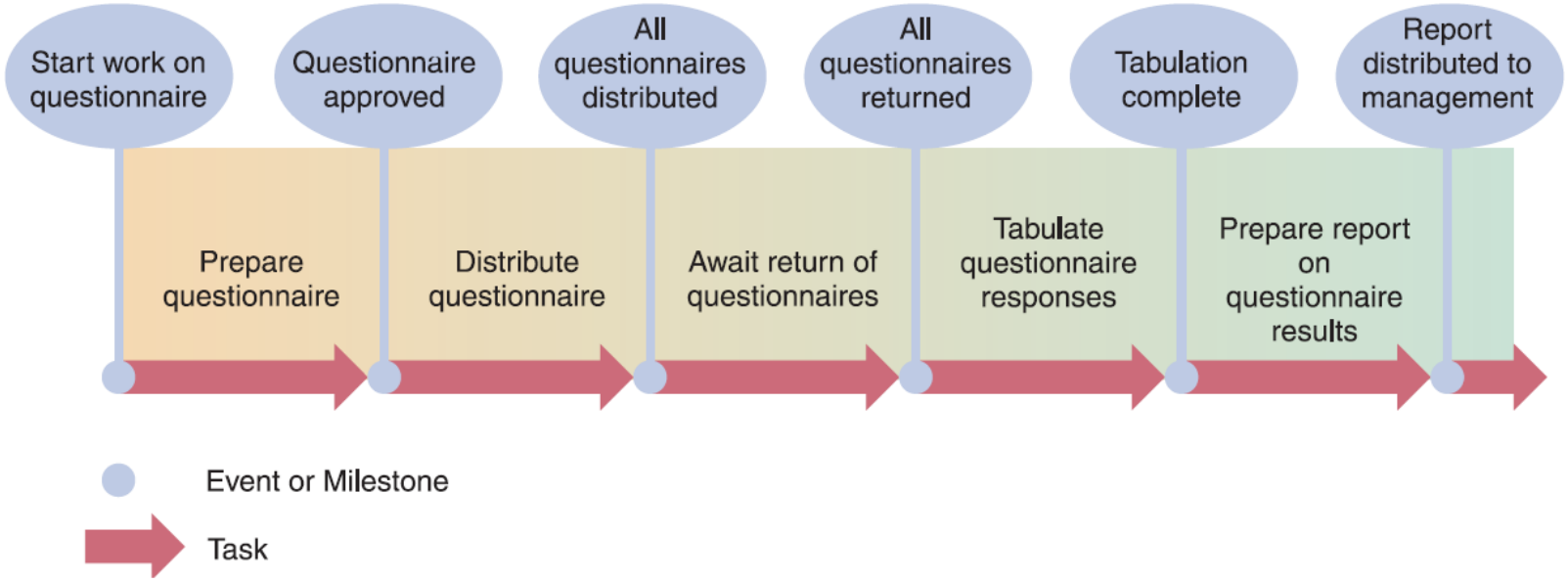


FIGURE 3-5 Using a questionnaire requires a series of tasks and events to track the progress. The illustration shows the relationship between the tasks and the events, or milestones, that mark the beginning and end of each task.

Creating a Work Breakdown Structure (7 of 8)

- Factors affecting duration
  - Project size
    - Identify all project tasks and time required
    - Consider time taken for events affecting productivity
  - Human resources
    - Assemble and guide a development team that has the skill and experience to handle the project
    - Deal with factors that could affect the schedule

Creating a Work Breakdown Structure (8 of 8)

- Experience with similar projects
  - Develop time and cost estimates based on the resources used for similar, previously developed information systems
- Constraints
  - Define system requirements that can be achieved realistically within the required constraints

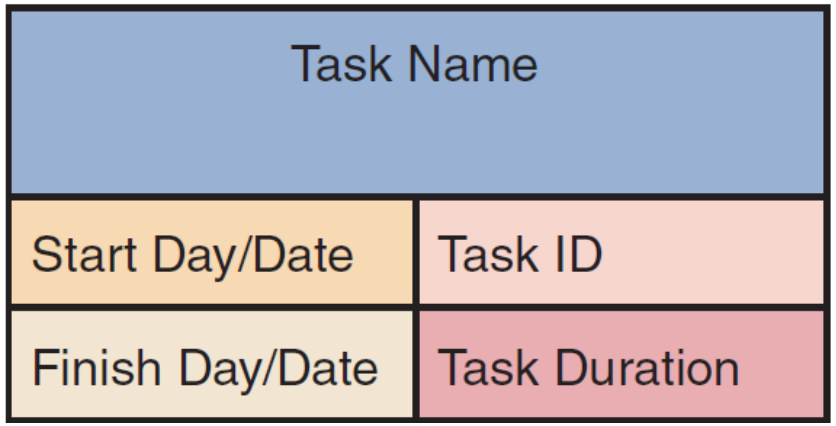
Task Patterns (1 of 6)

- Arrangement of tasks in a logical sequence
  - Dependent tasks
  - Multiple successor tasks
  - Multiple predecessor tasks

Task Patterns (2 of 6)

- Using task boxes to create a model

FIGURE 3-10 Each section of the task box contains important information about the task, including the Task Name, Task ID, Task Duration, Start Day/Date, and Finish Day/Date.



Task Patterns (3 of 6)

- Dependent tasks
  - Completed in a sequence
    - One task can be initiated only after the prior task has been completed

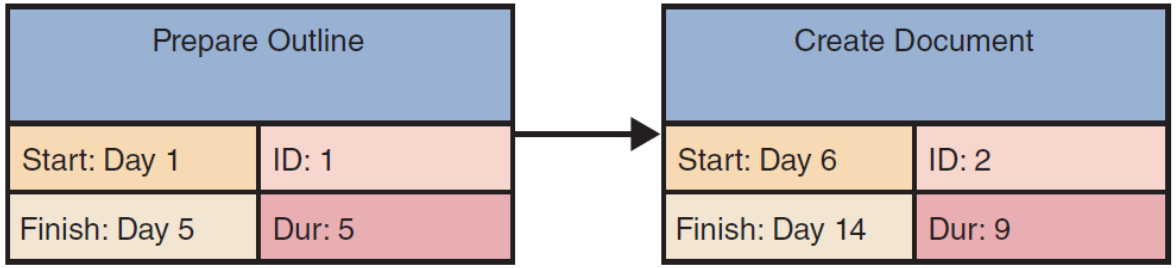


FIGURE 3-12 This example of a dependent task shows that the finish time of Task 1, Day 5, controls the start date of Task 2, which is Day 6.

Task Patterns (4 of 6)

- Multiple successor tasks
  - Tasks that can be initiated simultaneously
    - Termed concurrent
    - Often, two or more concurrent tasks depend on a predecessor task

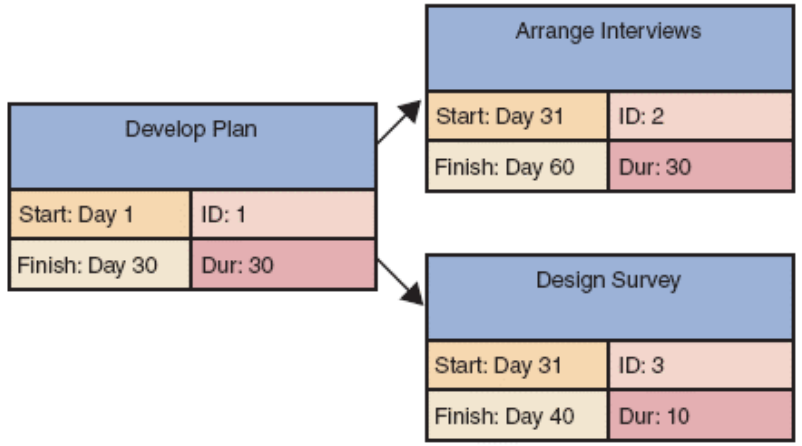
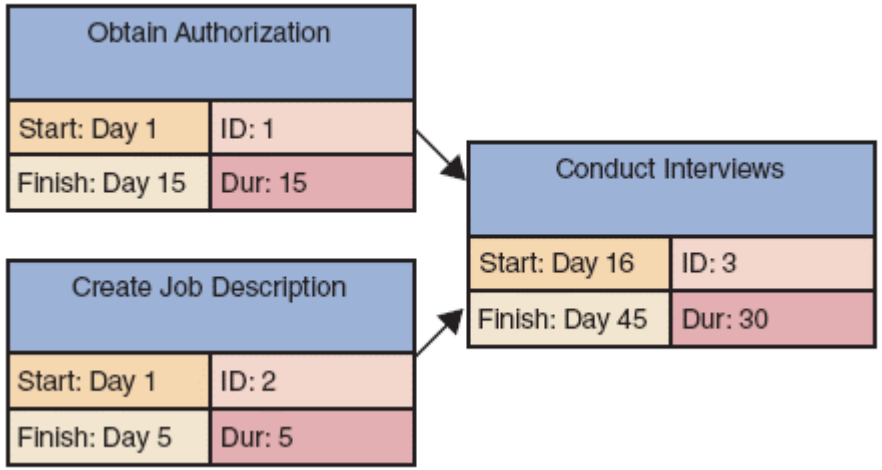


FIGURE 3-13 This example of multiple successor tasks shows that the finish time for Task 1 determines the start time for both Tasks 2 and 3.

Task Patterns (5 of 6)

- Multiple predecessor tasks
  - Initiation of a task depends on completion of two or more prior tasks

FIGURE 3-14 This example of multiple predecessor tasks shows that the start time for a successor task must be the latest (largest) finish time for any of its preceding tasks. In the example shown, Task 1 ends on Day 15, while Task 2 ends on Day 5, so Task 1 controls the start time for Task 3.



Task Patterns (6 of 6)

- Working with complex task patterns
  - When several task patterns combine, the facts must be studied very carefully to understand the logic and sequence
    - A project schedule will not be accurate if the underlying task pattern is incorrect

The Critical Path (1 of 3)

- Series of tasks which, if delayed, will affect the completion date of the overall project
  - If any task on the critical path falls behind schedule, the entire project will be delayed
- Calculating the critical path
  - Review patterns
  - Determine start and finish dates, which will define the critical path

The Critical Path (2 of 3)

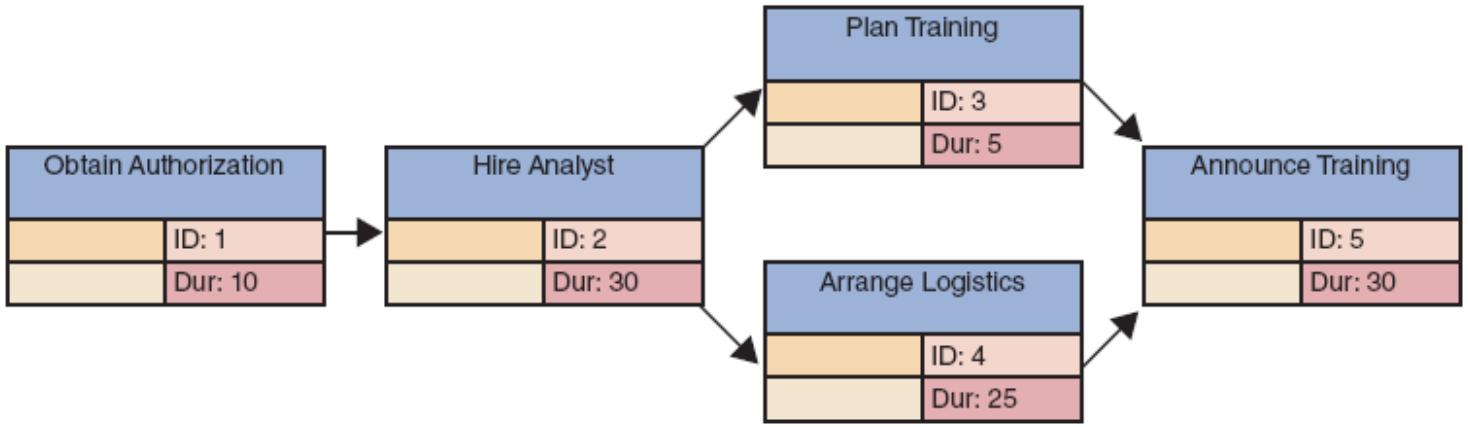


FIGURE 3-18 Example of a PERT/CPM chart with five tasks. Task 2 is a dependent task that has multiple successor tasks. Task 5 has multiple predecessor tasks. In this figure, the analyst has arranged the tasks and entered task names, IDs, and durations.

The Critical Path (3 of 3)

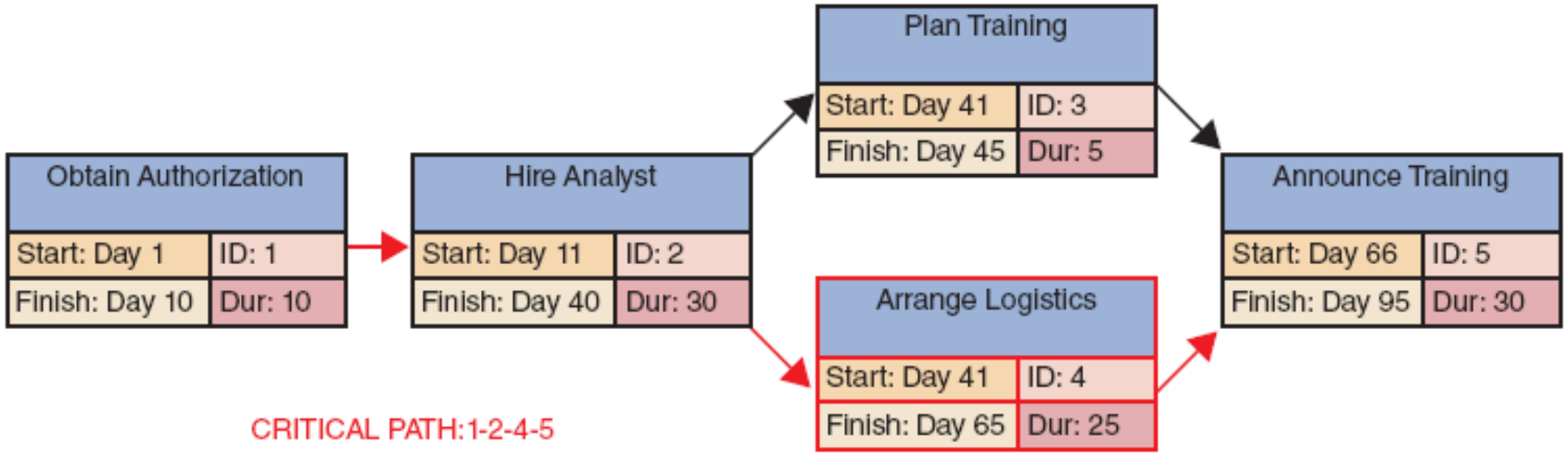


FIGURE 3-19 Now the analyst has entered the start and finish times, using the rules explained in this section. Notice that the overall project has a duration of 95 days.

Project Management Example (1 of 2)

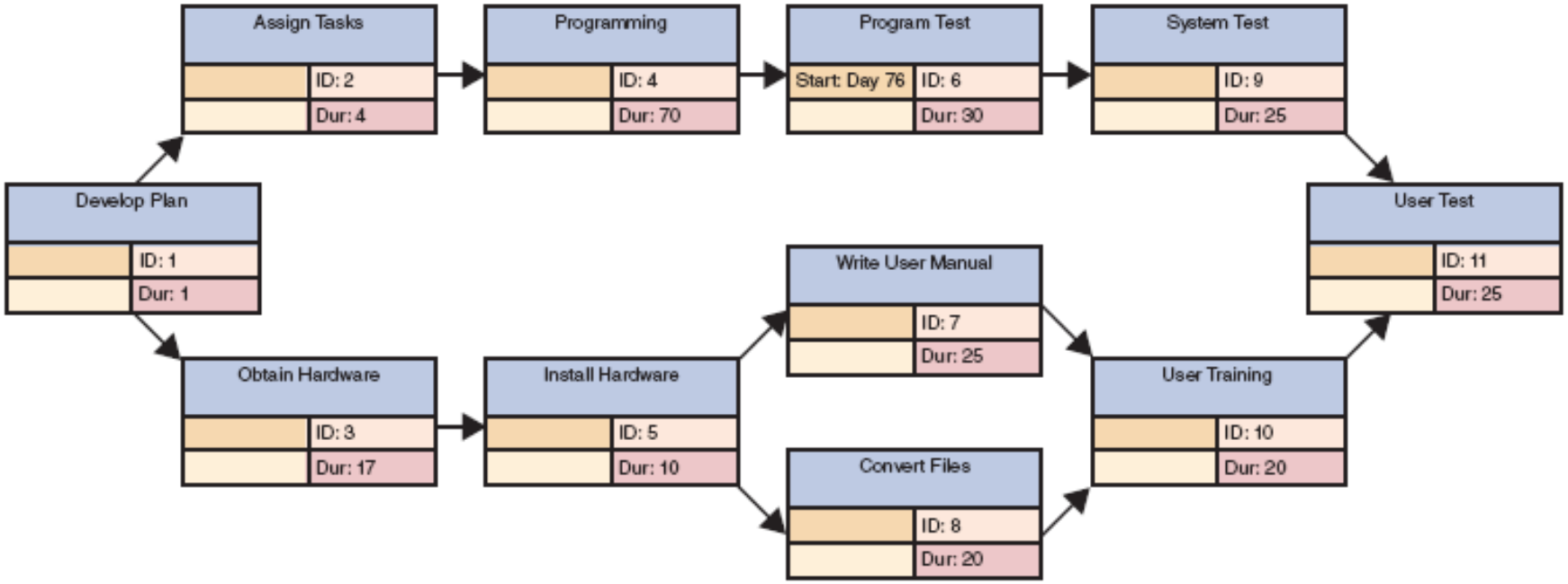


FIGURE 3-22 To transform a task list into a PERT/CPM chart, you first enter the task name, ID, duration, and predecessors for each task. Notice that this example includes dependent tasks, tasks with multiple successors, and tasks with multiple predecessors.

Project Management Example (2 of 2)

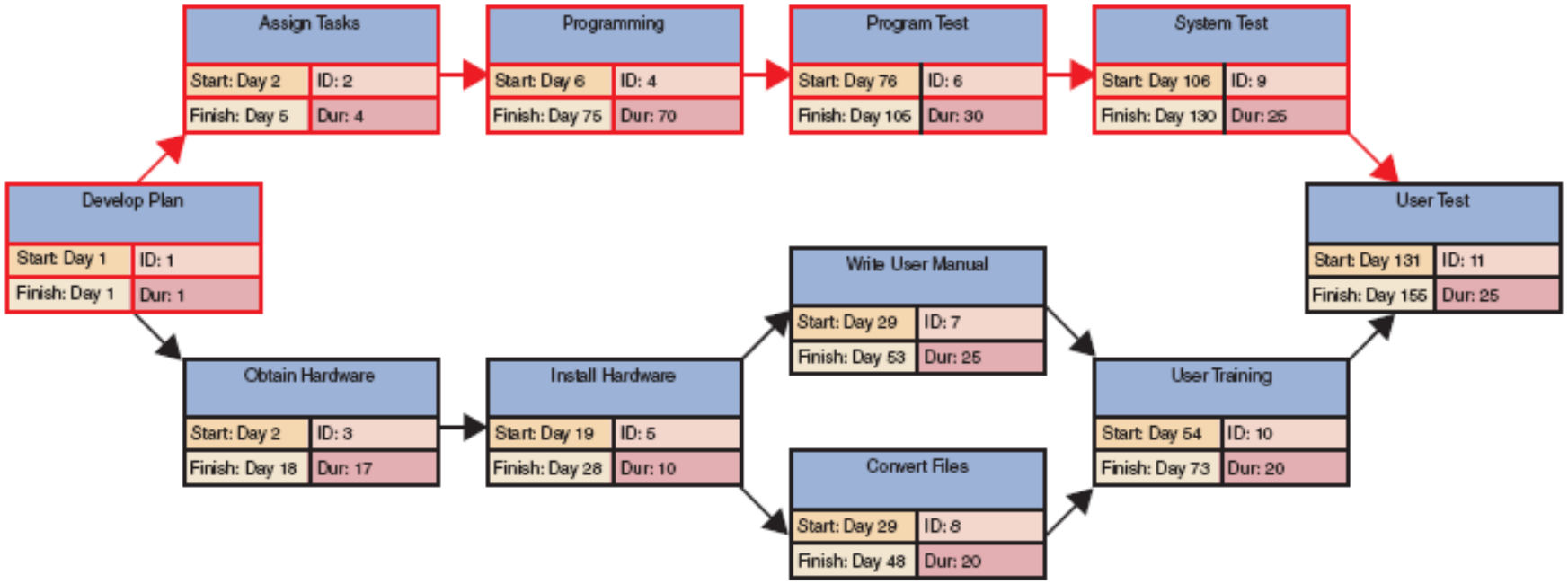
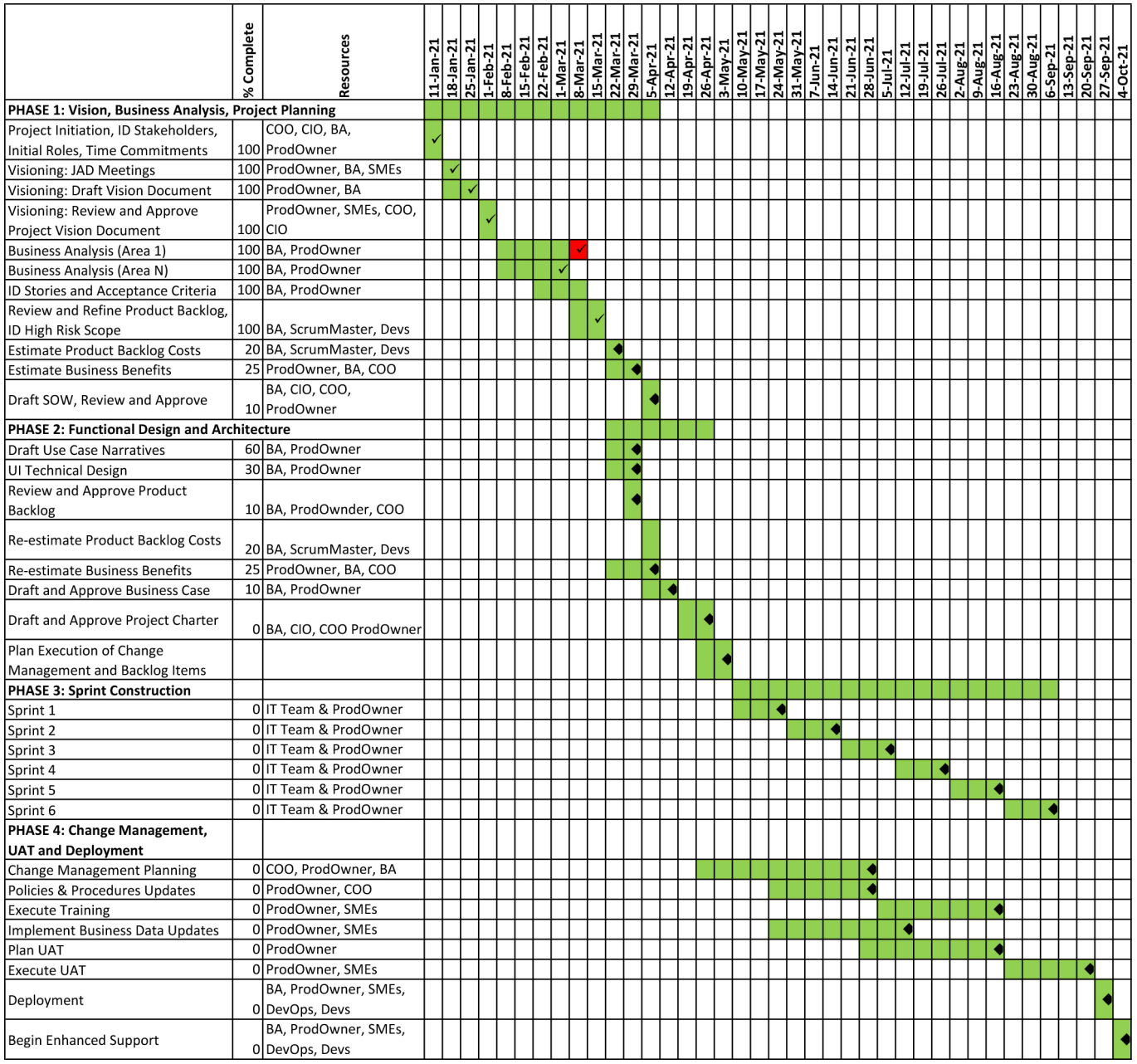


FIGURE 3-23 To complete the PERT/CPM chart, you apply the guidelines explained in this section. For example, Task 1 has a one-day duration, so you enter the start and finish for Task 1 as Day 1. Then you enter Day 2 as the start for successor Tasks 2 and 3.



	% Complete	Resources
PHASE 1: Vision, Business Analysis, Project Planning		
Project Initiation, ID Stakeholders, Initial Roles, Time Commitments	100	COO, CIO, BA, ProdOwner
Visioning: JAD Meetings	100	ProdOwner, BA, SMEs
Visioning: Draft Vision Document	100	ProdOwner, BA
Visioning: Review and Approve Project Vision Document	100	ProdOwner, SMEs, COO, CIO
Business Analysis (Area 1)	100	BA, ProdOwner
Business Analysis (Area N)	100	BA, ProdOwner
ID Stories and Acceptance Criteria	100	BA, ProdOwner
Review and Refine Product Backlog, ID High Risk Scope	100	BA, ScrumMaster, Devs
Estimate Product Backlog Costs	20	BA, ScrumMaster, Devs
Estimate Business Benefits	25	ProdOwner, BA, COO
Draft SOW, Review and Approve	10	BA, CIO, COO, ProdOwner
PHASE 2: Functional Design and Architecture		
Draft Use Case Narratives	60	BA, ProdOwner
UI Technical Design	30	BA, ProdOwner
Review and Approve Product Backlog	10	BA, ProdOwnder, COO
Re-estimate Product Backlog Costs	20	BA, ScrumMaster, Devs
Re-estimate Business Benefits	25	ProdOwner, BA, COO
Draft and Approve Business Case	10	BA, ProdOwner
Draft and Approve Project Charter	0	BA, CIO, COO ProdOwner
Plan Execution of Change Management and Backlog Items		
PHASE 3: Sprint Construction		
Sprint 1	0	IT Team & ProdOwner
Sprint 2	0	IT Team & ProdOwner
Sprint 3	0	IT Team & ProdOwner
Sprint 4	0	IT Team & ProdOwner
Sprint 5	0	IT Team & ProdOwner
Sprint 6	0	IT Team & ProdOwner
PHASE 4: Change Management, UAT and Deployment		
Change Management Planning	0	COO, ProdOwner, BA
Policies & Procedures Updates	0	ProdOwner, COO
Execute Training	0	ProdOwner, SMEs
Implement Business Data Updates	0	ProdOwner, SMEs
Plan UAT	0	ProdOwner
Execute UAT	0	ProdOwner, SMEs
Deployment	0	BA, ProdOwner, SMEs, DevOps, Devs
Begin Enhanced Support	0	BA, ProdOwner, SMEs, DevOps, Devs

Predicting the Unpredictable with Gantt-lite Charts

Meaningful but not precise project plans—way to merge traditional and agile project planning techniques

- **Similar to traditional Gantt charts:**
  - Project tasks over time
  - Team member assignments
  - Percentage task completion
- **Differ from traditional Gantt charts:**
  - Not mathematically driven
  - Driven by judgment, experience, and negotiation
  - Task precedences fuzzy but meaningful

Project Monitoring and Control (1 of 2)

- Monitoring and control techniques
  - Structured walk-through: review of a project team member's work by other team members
    - Takes place throughout the SDLC
    - Known as design, code, or testing reviews based on the phase in which they occur

Project Monitoring and Control (2 of 2)

- Maintaining a schedule
  - Projects run into problems or delays
  - Projects managers monitor and control work
    - Anticipate problems, avoid them, and minimize impact
    - Identify potential solutions and select the best way to solve the problem
- Tasks and the critical path
  - Project managers spend most of their time tracking the tasks along the critical path

Managing for Success

- Project management is a challenging task
  - Project managers must be alert, technically competent, and highly resourceful
- Projects get derailed for a wide variety of reasons
  - Business issues
  - Budget issues
  - Schedule issues

Beyond Project Management
Assumptions, Constraints, Issues & Risks

- **Assumption:**
  - **Current factor assumed to be true**
  - **Supporting project success**
- **Constraint:**
  - **Current factor assumed to be true**
  - **Limiting ability to deliver project success**
- **These are part of normal planning process**

Threats to Project Success: Risks and Issues

- **Risks and Issues:** Many ways things can go wrong
  - **Tolstoy:**
    "Happy families are all alike; every unhappy family is unhappy in its own way."
  - **Systems project relevance:**
    - Project success depends on success of all key items: scope, process, budget, timing, infrastructure, etc. etc.
    - Practically infinite number of things can go wrong
    - Each threatens overall project success

- **Risk:** A *potential future* problem
- **Issue:** A *current*
  - Problem
  - Question
  - Source of uncertainty

Risks

- **Risk:** A *potential future* problem
- **Risk Identification:**
  - Wide range of possible risks
  - May use lists of typical systems project risks to help identify
- **Risk Evaluation:**
  - Likelihood of occurrence
  - Impact if occurs
    guides approach to
  - Risk mitigation

Issues

- Issue: A *current*
  - Problem
  - Question
  - Other source of uncertainty
- Monitor:
  - Responsible team member
  - Status (Open or closed)
  - Response

- Issues vs. risks:
  - Issues are *current* vs. risks are *future*
  - Issues therefore only have impacts, not likelihoods (already occurred)
  - Issues are frequently risks that have occurred

ID	Description	Impact	Response	Status	Responsible
I1	Need to clarify cost trend formula	High	Avoid	Open	Sivaraman
I2	Lack of skills in new reporting technology (was R1)	Med.	Outsource to ABC Consultants	Closed	Sarker

Frequently Encountered Systems Project Risks

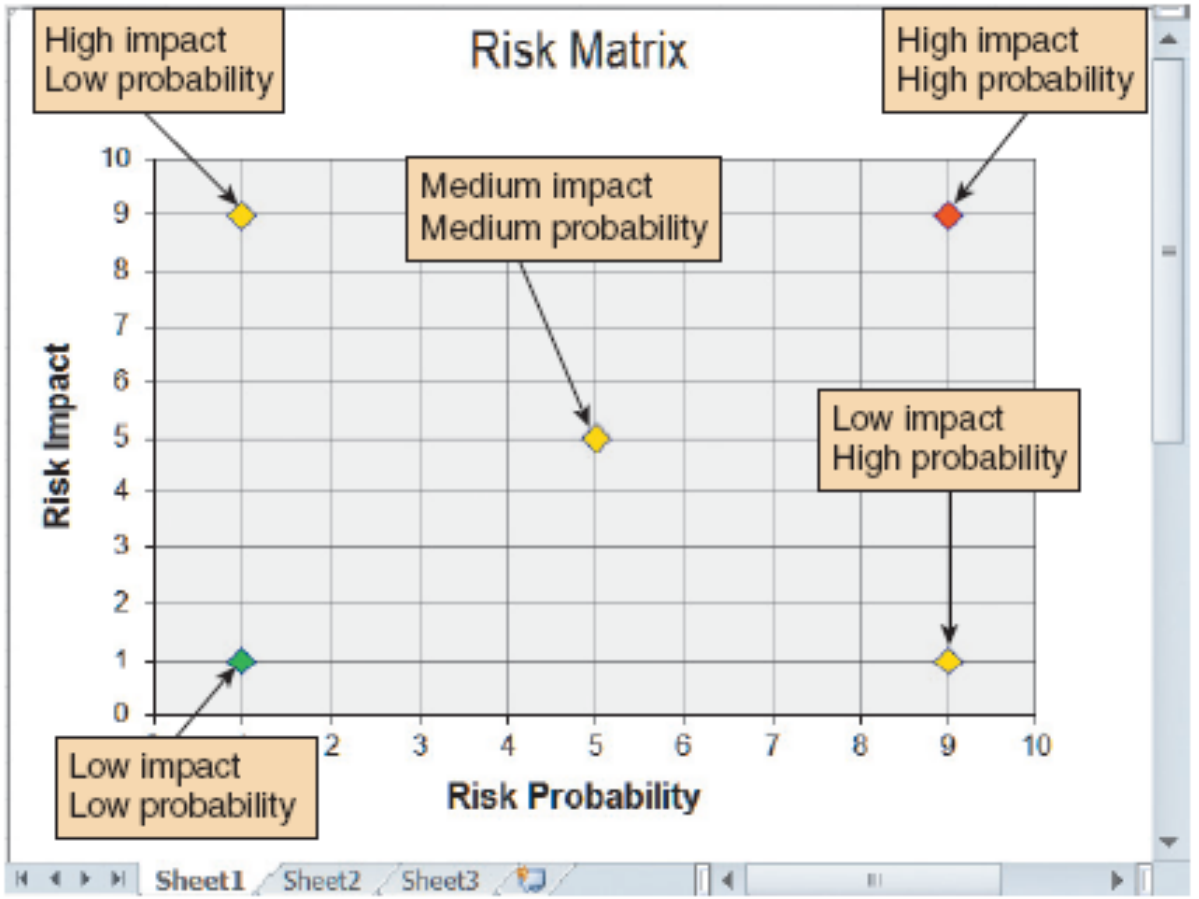
May use to identify specific risks in a particular project

Dimension	Risk
Users	Users opposed to, resistant to, or fearing project
	Conflicts between users/departments/locations
	Users with negative attitudes toward project
	Lack of user commitment (apathy)
	Lack of user availability (time conflicts with running the organization)
	Unrealistic user expectations/failure to manage user expectations
	Failure to achieve user buy-in on requirements
Requirements	Inadequate up-front requirements planning
	Inability to effectively revise requirements during agile construction
	Inability to manage changes in requirements scope
	Rapidly changing requirements (many late changes)
	Unclear requirements (users don't know what they need)
	Unclear requirements (users can't describe what they need)
	Unclear requirements (users disagree over what they need)
	Requirements highly complex and/or high interdependencies
	Unclear Definition of Done
	Lack of acceptance criteria preventing completion of features (e.g., "gold plating," "creeping elegance")
Project Complexity	Use of immature, "bleeding edge" technology
	Use of technology new to the team
	High level of technical complexity
	Need to integrate new technologies
	Uncertainty regarding technologies/architecture needed
Planning & Control	Lack of top management commitment and involvement
	Poor project planning (process, documents, approvals)
	Poor project execution (monitoring, management, reporting)
	Underestimated costs/effort/time (or not estimated at all)
	Overestimated business benefits (or not estimated at all)
	Poor project planning
	Project milestones not clearly defined
	Inexperienced project managers
	Ineffective communications
	Business fails to implement effective change management (updated policies and procedures, training, data preparation, user testing)
Team	Insufficient team availability and capacity
	Inexperienced team members
	Inadequately trained team members
	Team members lack specialized skill required by project
	Dependence on outside contractors
	Team in multiple locations and/or multiple time zones
Organizational Environment	Major organizational change or instability during the project (e.g., change in leadership, change in ownership, being acquired, bankruptcy)
	Political conflicts and games (competing projects, disagreement over priorities)

Evaluating Identified Risks

- **Two key risk dimensions:** Each risk needs to be evaluated
  - Likelihood of occurring
  - Impact if occurs
- **Risk evaluation scales:** Use same for each dimensions
  - Three levels: 1-Low vs. 2-Medium vs. 3-High
  - Other possibilities (e.g., five levels)
- **Risk Rating:**
  - Overall level of concern
  - Risk Rating = Likelihood X Impact

Risk Management (3 of 3)



Visualizing Risk Ratings with a Risk Register

		Severity of Impact		
Likelihood		1-Low	2-Medium	3-High
	3-High	3	6	9
	2-Medium	2	4	6
	1-Low	1	2	3

Risk register grid allocating risk ratings to red, yellow, and green

Typical levels of concern:

- Green = Low level of concern
- Yellow = Medium level of concern
- Red = High level of concern

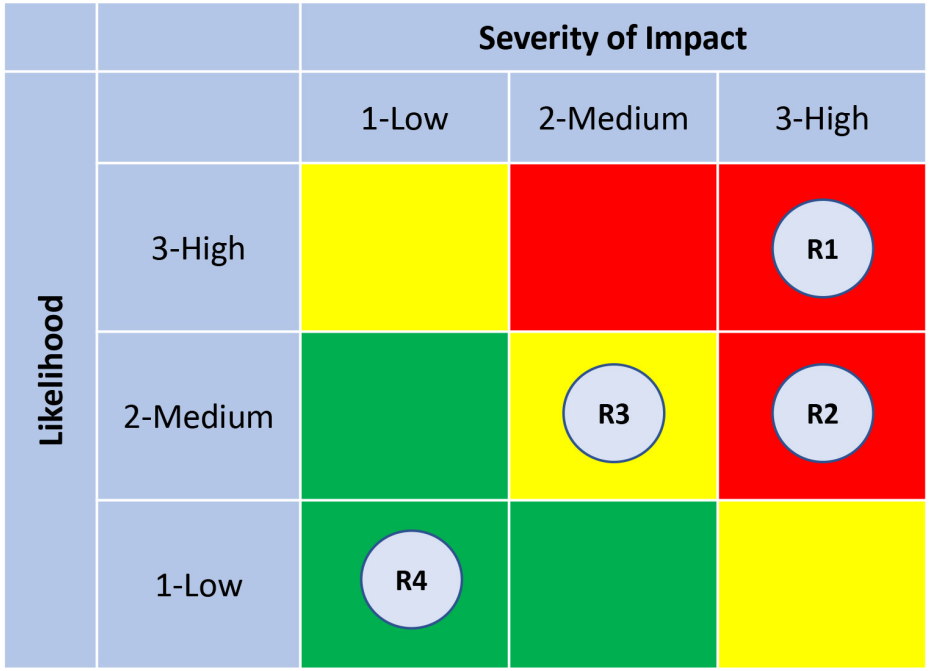
Risk Mitigation

- **Mitigation:** Determining what to do about identified and evaluated risks
- **4 Risk Mitigation Strategies:**
  1. **Risk Avoidance:** Reduce likelihood
  2. **Risk Limitation:** Reduce impact
  3. **Risk Transference:** Transfer to other parties (e.g., outsourcing or insurance)
  4. **Risk Acceptance:** When level of concern is low and costs to avoid/limit/transfer are high

Risk Ratings Example

ID	Description	Likeli-hood	Impact	Overall Risk	Mitigation Strategy	Status	Responsible
R1	User opposition because fear of job loss	High	High	Red	Avoid	Open	Baker
R2	Developers unavailable at beginning of project	Med.	High	Red	Limit	Mitigated	Nakamura
R3	Lack of skills in new reporting technology	Med.	Med.	Yellow	Transfer	Occurred	Sarker
R4	New UI framework may not work	Low	Low	Green	Accept	Mitigated	Sivaraman

Table 12-3 Example risks section



Risk ID	Description	Responsible
R1	User opposition because of fear of job loss	Baker
R2	Developers unavailable at beginning of project	Nakamura
R3	Lack of skills in new reporting technology	Sarker
R4	New UI framework may not work	Sivaraman

Figure 12-15 Risk register portraying the same risks as Table 12-13

Risk Monitoring

- For each risk:
  - Assign to responsible team member
  - Monitor status:
    - Open
    - Mitigated
    - Occurred (may become Issue)

ID	Description	Likeli-hood	Impact	Overall Risk	Mitigation Strategy	Status	Responsible
R1	User opposition because fear of job loss	High	High	Red	Avoid	Open	Baker
R2	Developers unavailable at beginning of project	Med.	High	Red	Limit	Mitigated	Nakamura
R3	Lack of skills in new reporting technology	Med.	Med.	Yellow	Transfer	Occurred	Sarker
R4	New UI framework may not work	Low	Low	Green	Accept	Mitigated	Sivaraman

Table 12-3 Example risks section

Let's Review

- Planning projects is challenging!
- Projects get derailed for a wide variety of reasons
  - Business issues
  - Budget issues
  - Schedule issues
  - Risks that turn into issues
  - Assumptions that turn out to be false
  - Constraints that can't be met
- Tools for Project management
  - WBS
  - Gantt
  - PERT/CPM
  - Risk Tracking & Mitigation
- Bottom Line
  - Project managers must be alert, technically competent, and highly resourceful
  - Strong communication and people skills are necessary
  - When problems occur, the project manager's ability to handle the situation is critical!