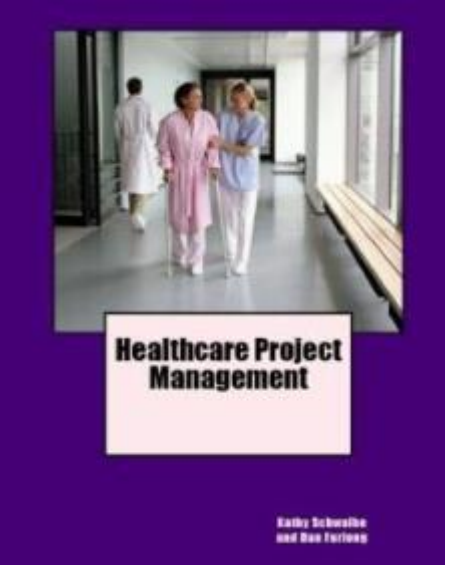


Chapter 5:
Planning Projects, Part 2
(Project Time and Cost Management)

Note: See the text itself for full citations.

Learning Objectives

- List several planning processes and outputs for project time and cost management
- Describe the six project time management planning processes, and prepare an activity list and attributes, milestone list, project schedule network diagram, activity resource requirements, activity duration estimates, and project schedule
- Understand how to find the critical path and its implications on timely project completion
- Explain the concept of critical chain scheduling and how it can be used in healthcare organizations
- Discuss the three project cost management planning processes
- Create a cost estimate, cost baseline, and project funding requirements

Figure 5-1. Planning Processes and Outputs for Project Time and Cost Management

Knowledge area	Planning process	Outputs
Project time management	Plan schedule management	Schedule management plan
	Define activities	Activity list
		Activity attributes
		Milestone list
	Sequence activities	Project schedule network diagrams
		Project documents updates
		Activity resource requirements
	Estimate activity resources	Resource breakdown structures
		Project documents updates
		Activity duration estimates
	Estimate activity durations	Project documents updates
		Schedule baseline
	Develop schedule	Project schedule
		Schedule data
		Project calendars
		Project management plan updates
		Project documents updates
Project cost management	Plan cost management	Cost management plan
	Estimate costs	Activity cost estimates
		Basis of estimates
		Project documents updates
	Determine budget	Cost baseline
		Project funding requirements
		Project documents updates

Project Time Management

- Project time management involves the processes required to ensure timely completion of a project

- The main documents produced are a schedule management plan, an activity list and attributes, a milestone list, a project schedule network diagram, the activity resource requirements, the activity duration estimates, and a project schedule

Planning Schedule Management

- The purpose of this process is to determine the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.

- The project team holds meetings, consults with experts, and analyzes data to help produce a schedule management plan, which becomes a component of the project management plan.

Defining Activities

- The goal of the defining activities process is to ensure that project team members have a complete understanding of all the work they must do as part of the project scope so that they can start scheduling the work

- An **activity** is a distinct, scheduled portion of work performed during the course of the project

Creating the Activity List and Attributes

- The **activity list** is a tabulation of activities to be included on a project schedule
- It should include the activity name, an activity identifier or number, and a brief description of the activity
- The **activity attributes** provide schedule-related information about each activity, such as predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity
- Both should be in agreement with the WBS and WBS dictionary and be reviewed by key project stakeholders

Figure 5-2. WBS 100% Rule

All work required for a deliverable is included in its sub-deliverables

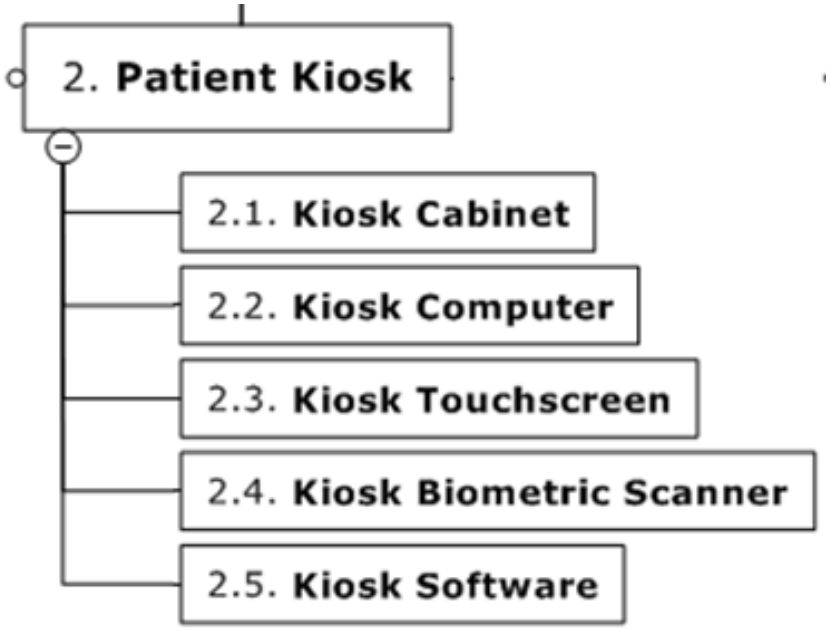


Figure 5-3. Report Requirements Activity List

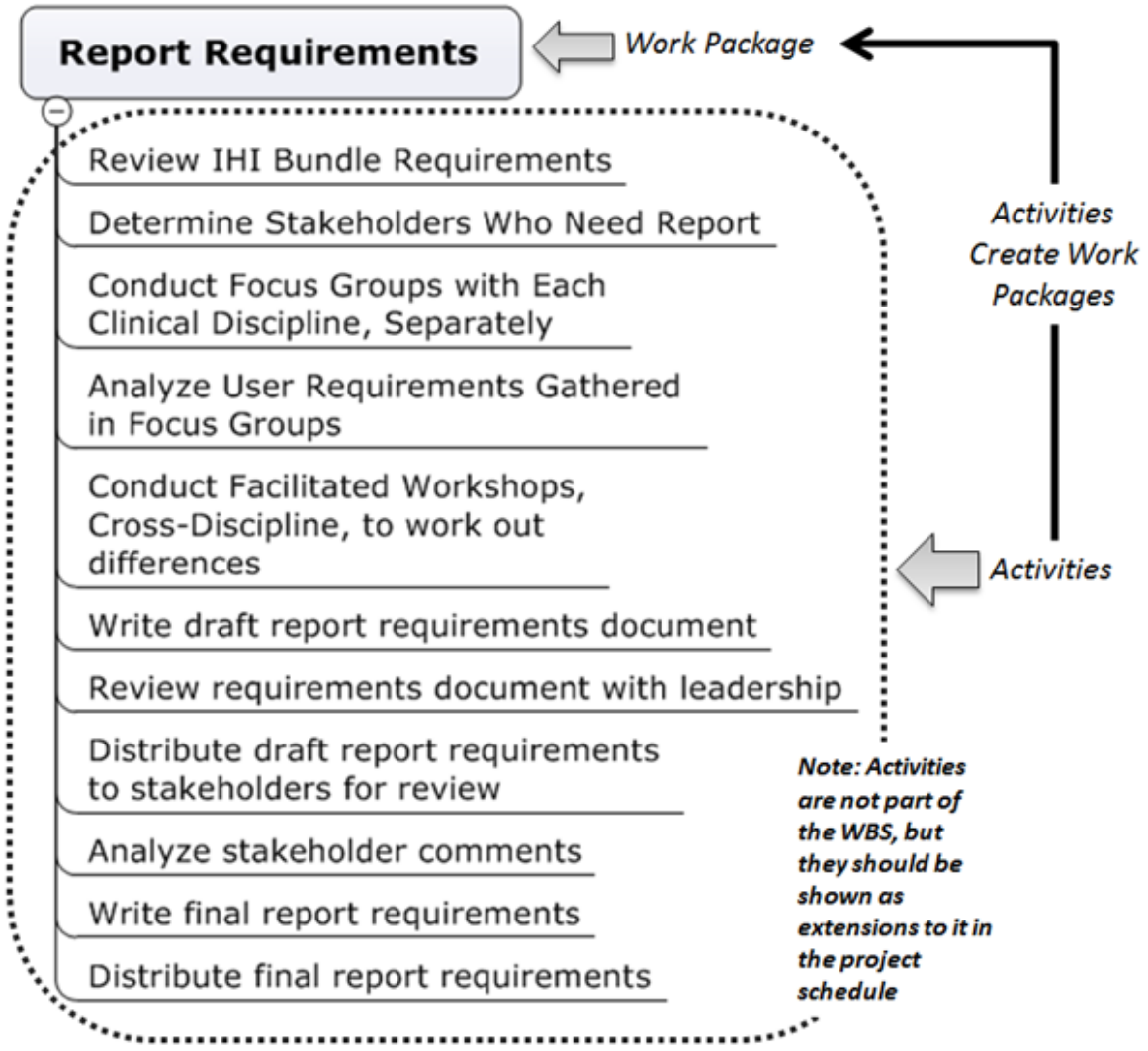


Figure 5-4. Sample Activity List and Attributes

ACTIVITY LIST AND ATTRIBUTES

Project Name	VAPR Project
Activity Number	1.5.1.5
Activity Name	Conduct facilitated workshops
Details	Cross-discipline workshop to work out differences in user report requirements.
Predecessors	1.5.1.4 Analyze user requirements gathered in focus groups
Successors	1.5.1.6 Write draft report requirements document
Logical Relationships	finish-to-start (FS)
Leads and Lags	None
Resource Requirements	Clinical analyst, trained facilitator, data analyst
Constraints	Must be conducted before 7am or after 5pm to accommodate physician schedules
Imposed Dates	None
Assumptions	Physicians and nurses and respiratory therapists will have different and incongruent requirements. It will require a facilitated work to align and integrate their needs.

Creating a Milestone List

- A **milestone** is a significant event in a project
- It often takes several activities and a lot of work to complete a milestone, but the milestone itself is like a marker to help identify necessary activities
- There is usually no cost or duration for a milestone
- Project sponsors and senior managers often focus on major milestones when reviewing projects
- Sample milestones for many projects include:
  - Sign-off of key documents
  - Completion of specific products
  - Completion of important process-related work, such as awarding a contract to a supplier

Figure 5-5. Sample Milestone List

VAPR MILESTONES

Milestone	Estimated Date
Project kickoff meeting held	June 1
IHI bundle & data sources identified	July 15
Database developed	August 20
Report requirements identified	October 1
Online reports completed	December 30
Clinical workflows designed	February 15
Training curriculum developed	April 15
Training delivered	May 30
Go live	June 15

Best Practice

- The SMART criteria suggest that milestones should be:
  - **S**pecific
  - **M**easureable
  - **A**ssignable
  - **R**ealistic
  - **T**ime-framed

- You can also use milestones to help reduce schedule risk by following these best practices:
  - Define milestones early in the project and include them in the Gantt chart to provide a visual guide
  - Keep milestones small and frequent
  - The set of milestones must be all-encompassing
  - Each milestone must be binary, meaning it is either complete or incomplete
  - Carefully monitor the milestones on the critical path*

*Luc K. Richard, "Reducing Schedule Risk, Parts 1 and 2," (*www.Gantthead.com) (November* 10, 2003 and January 31, 2005).

Sequencing Activities

- Sequencing activities involves reviewing the activity list and attributes, project scope statement, and milestone list to determine the relationships or dependencies between activities

- A **dependency** or **relationship** relates to the sequencing of project activities or tasks
  - For example, does a certain activity have to be finished before another one can start?
  - Can the project team do several activities in parallel?
  - Can some overlap?

- Sequencing activities has a significant impact on developing and managing a project schedule

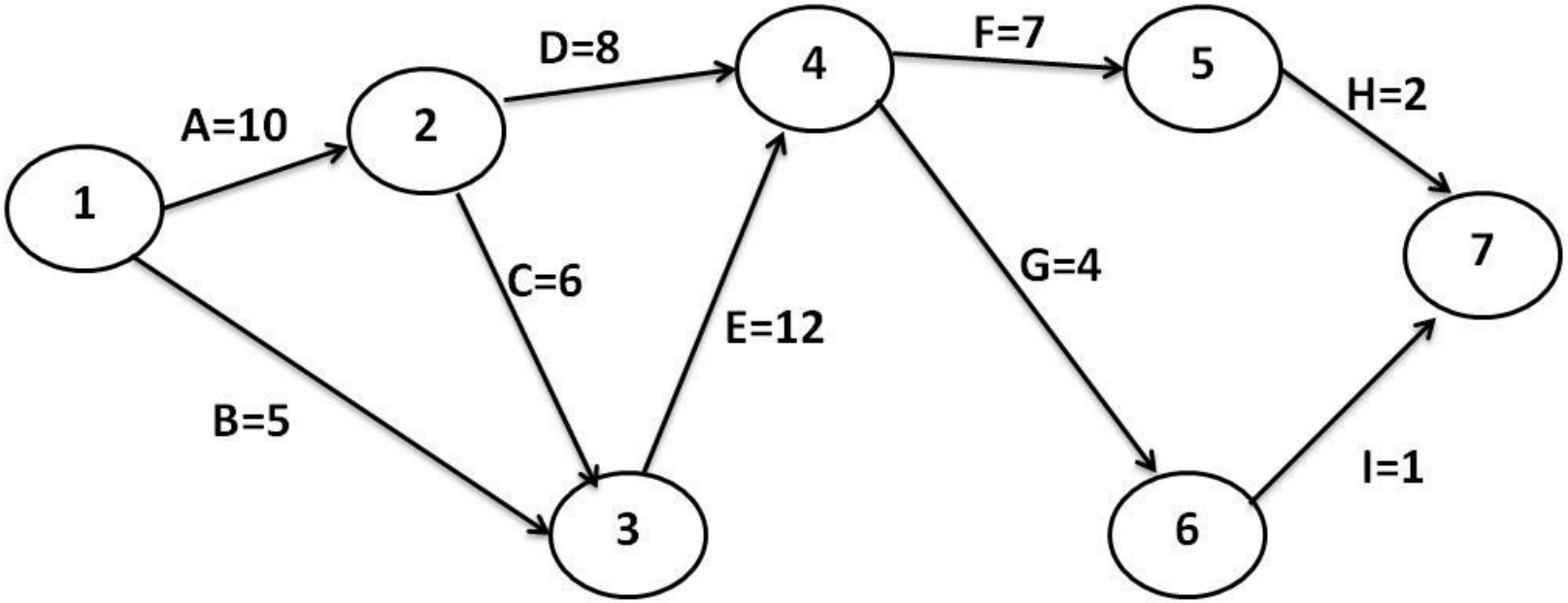
Reasons for Creating Dependencies

- **Mandatory dependencies** are inherent in the nature of the work being performed on a project
  - You cannot hold training classes until the training materials are ready
- **Discretionary dependencies** are defined by the project team
  - A project team might follow good practice and not start detailed design work until key stakeholders sign off on all of the analysis work
- **External dependencies** involve relationships between project and non-project activities
  - The installation of new software might depend on delivery of new hardware from an external supplier. Even though the delivery of the new hardware might not be in the scope of the project, it should have an external dependency added to it because late delivery will affect the project schedule

Network Diagrams

- Network diagrams are the preferred technique for showing activity sequencing
- A **network diagram** is a schematic display of the logical relationships among, or sequencing of, project activities
  - In the **activity-on-arrow (AOA)** approach, or the **arrow diagramming method (ADM),** activities are represented by arrows and connected at points called **nodes** (starting and ending point of an activity) to illustrate the sequence of activities; only show finish-to-start dependencies (most common type of dependency)
  - The **precedence diagramming method (PDM)** is a network diagramming technique in which boxes represent activities. These are more widely used as they can show all dependency types

Figure 5-6. Activity-on-Arrow (AOA) Network Diagram for Project X



Note: Assume all durations are in days;
A=10 means Activity A has a duration of 10 days.

More on Network Diagrams

- Keep in mind that the network diagram represents activities that must be done to complete the project; it is not a race to get from the first node to the last
- *Every* activity on the network diagram must be completed for the project to finish
- Not every item on the WBS needs to be on the network diagram; only activities with dependencies need to be shown on the network diagram

Steps for Creating an AOA Network Diagram

1. Find all of the activities that start at Node 1. Draw their finish nodes, and draw arrows between Node 1 and each of those finish nodes. Put the activity letter or name on the associated arrow. If you have a duration estimate, write that next to the activity letter or name

2. Continue drawing the network diagram, working from left to right. Look for bursts and merges
   - **Bursts** occur when two or more activities follow a single node
   - A **merge** occurs when two or more nodes precede a single node

3. Continue drawing the AOA network diagram until all activities with dependencies are included on the diagram

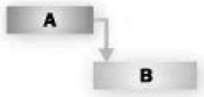
4. As a rule of thumb, all arrowheads should face toward the right, and no arrows should cross on an AOA network diagram. You might need to redraw the diagram to make it look presentable

Figure 5-7. Activity on Arrow vs. Activity on Node

Distinguishing Factor	Activity on Arrow	Activity on Node
Line information	Represents activities & precedence	Represents precedence
Node shape	Circle shape	Box shape
Activity information	Only duration typically shown	Often includes duration, start date, end date, and assigned resource
Line shape	Straight	Utilize right angles
Line direction	Always moves rightward	Can move backwards, depending upon relationship (FF, FS, SF, SS)

Figure 5-8. Activity Dependency Types

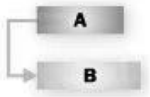
Finish-to-Start link (fs)



Task B can't start until Task A is done. This is the default link type in Project, and the most commonly used.

Example: *Dig foundation* (Task A) must be complete before your team can start *Pour concrete* (Task B).

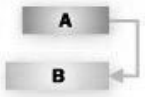
Start-to-Start link (ss)



Task B can't start until Task A starts. They don't have to start at the same time: Task B can begin any time after Task A begins.

Example: To save time, you want to level concrete at one end of the foundation while it is still being poured at the other end. But *Level concrete* (Task B) can't start until *Pour concrete* (Task B) has also started.

Finish-to-Finish link (ff)



Task B can't finish until Task A is done. They don't have to end at the same time: Task B can end any time after Task A ends.

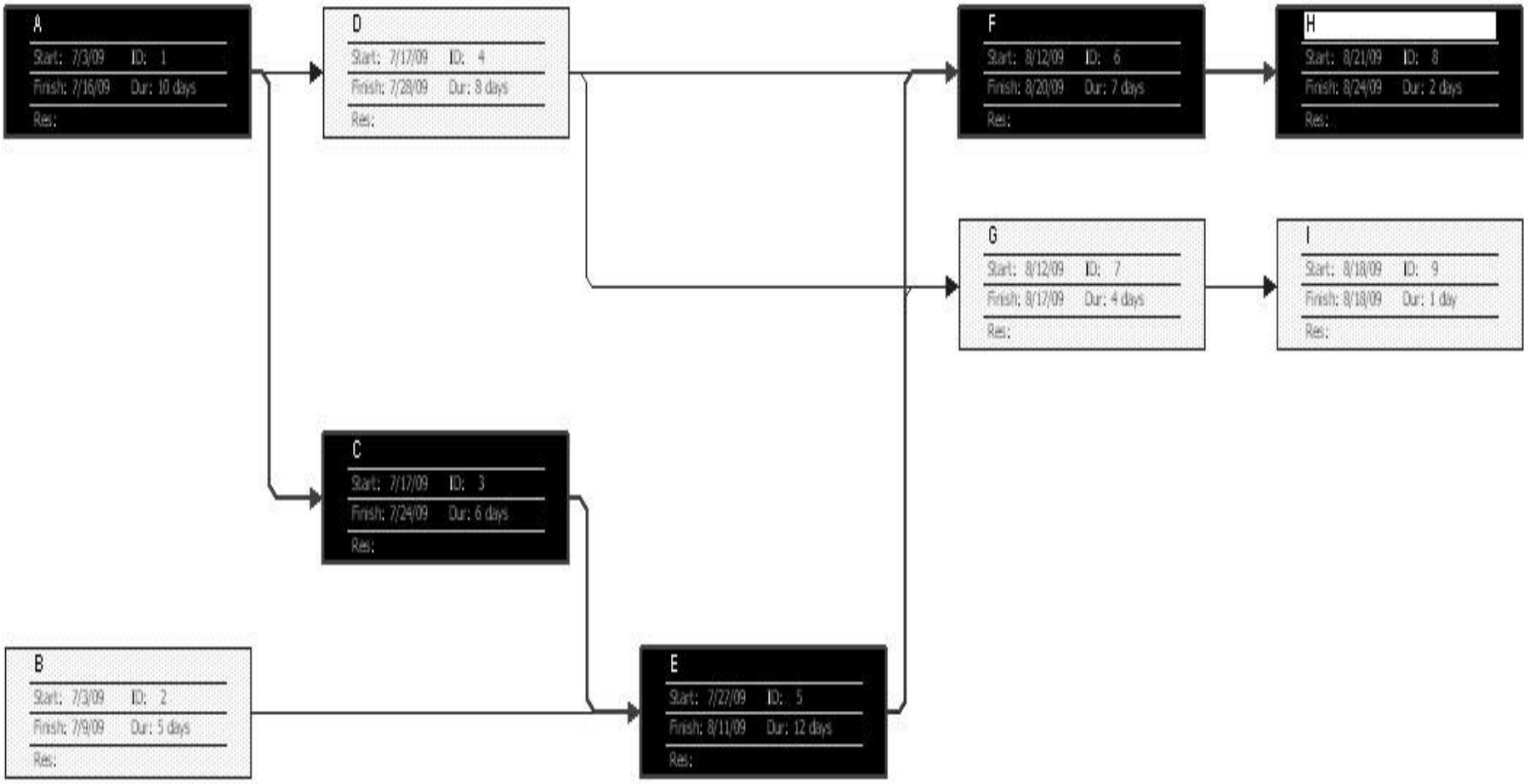
Example: Your team is adding the wiring to the building and inspecting it at the same time. Until *Add wiring* (Task A) gets done, you won't be able to finish *Inspect electrical* (Task B).

Start-to-Finish link (sf)

Task B can't finish until Task A begins. Task B can finish any time after Task A begins. This type of link is rarely used.

Example: The roof trusses for your building are built off-site. You can't finish *Assemble roof* (Task B) until *Truss delivery* (Task A) begins.

Figure 5-9. Precedence Diagramming Method (PDM) Network Diagram for Project X



Lead and Lag

- **Lag** time is a gap in time
- **Lead** time is when activities can be overlapped

Figures 5-10 and 5-11. Lag Examples for VAPR Training and Server Installation

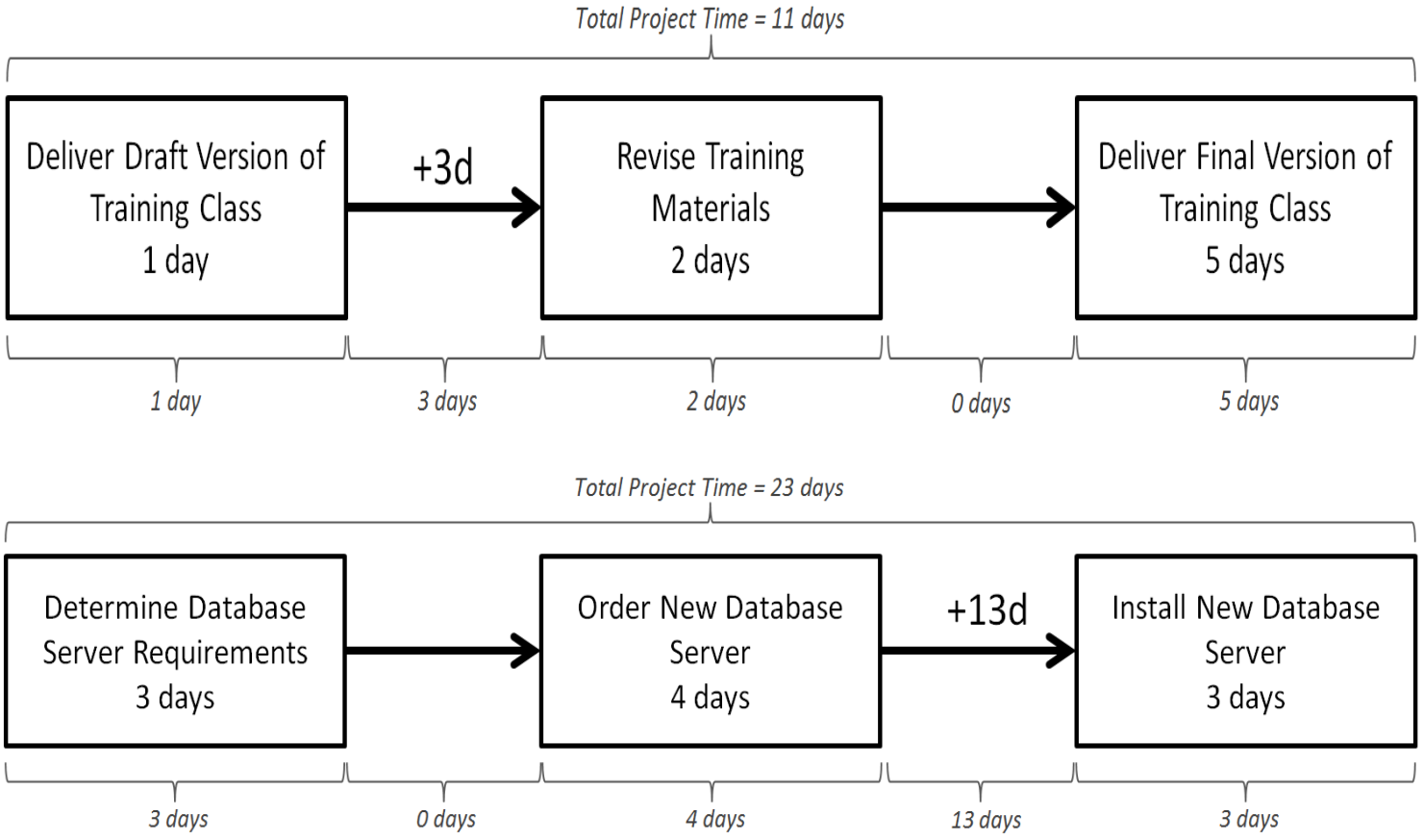
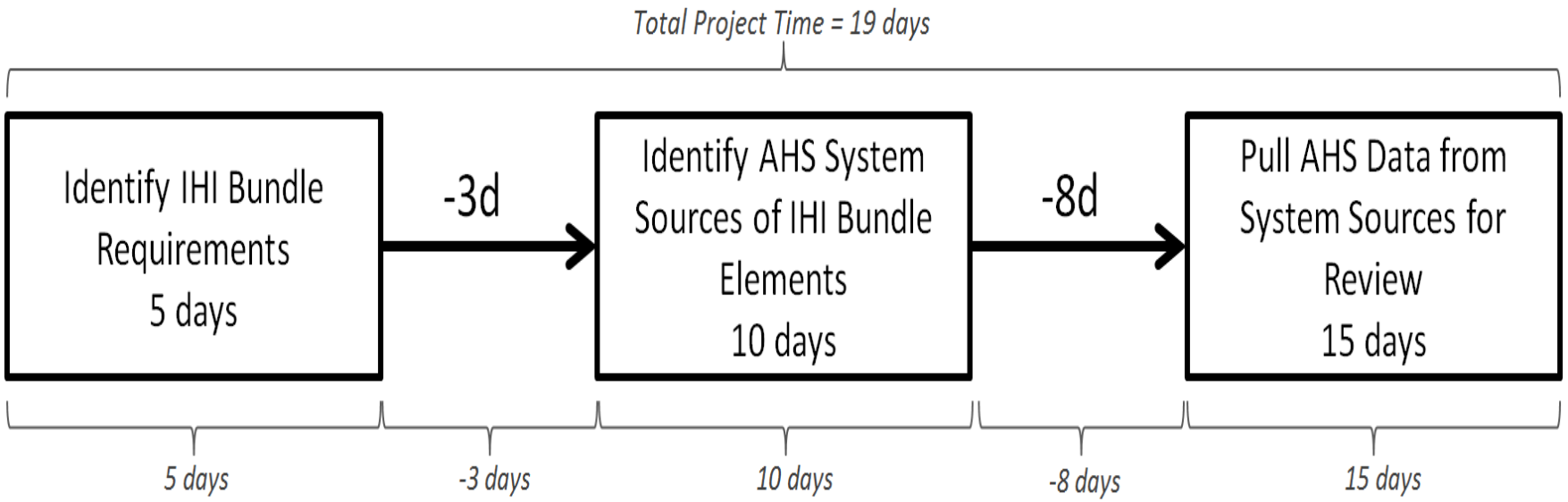
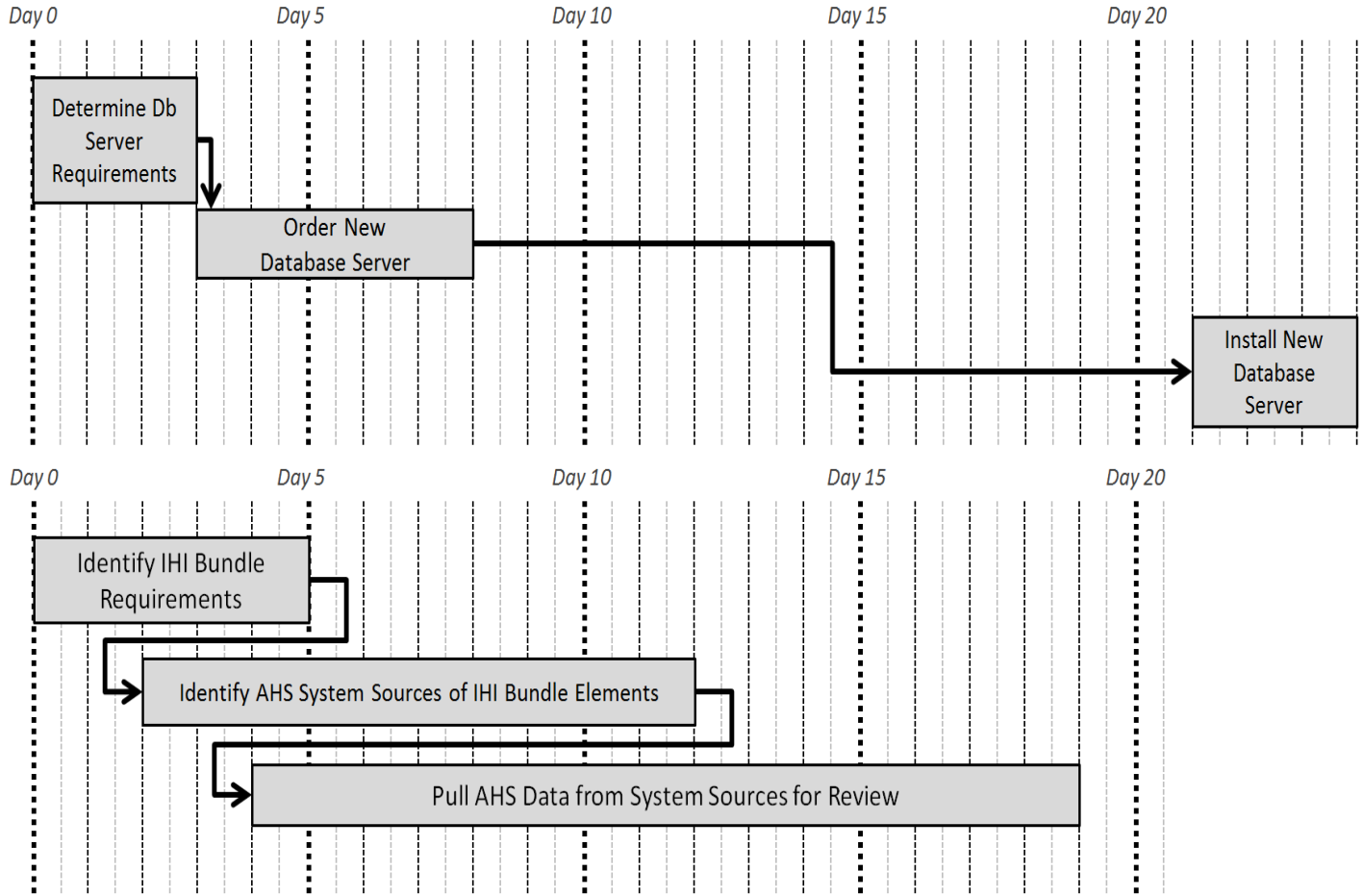


Figure 5-12. Lead Examples for VAPR IHI Bundle



Figures 5-13 and 14. Lead Examples (Gantt Chart)



Estimating Activity Resources

- Questions to consider:
  - How difficult will it be to perform specific activities on this project?
  - Is there anything unique in the project's scope statement that will affect resources?
  - Are there specific resources better suited to perform the activities?
  - What is the organization's history in doing similar activities?
  - Does the organization have appropriate people, equipment, and materials available for performing the work?
  - Does the organization need to acquire more resources to accomplish the work?

Figure 5-15. Sample Activity Resource Requirements Information

VAPR RESOURCE REQUIREMENTS

Item Number	**1.1.1**
Item Name	Identify IHI Bundle Requirements
Resources Source	Internal staffing from Enterprise Data Analytics
Resource Requirements	The analyst assigned must be knowledgeable of best-practices, standards, and measures as the IHI bundle will most likely be defined in those terms. They must also be knowledgeable of the current AHS clinical documentation workflows so that they can identify the data elements in AHS terms.
Item Number	1.3.2
Item Name	Database Design
Resources Source	Internal staffing from Enterprise Data Warehouse team
Resource Requirements	This work package will require data architects to review the database requirements and create the resulting database structure to support eventual reporting requirements.

Activity Duration Estimating

- **Duration** includes the actual amount of time spent working on an activity *plus* elapsed time
  - For example, even though it might take one workweek or five workdays to do the actual work, the duration estimate might be two weeks to allow extra time needed to obtain outside information or to allow for resource availability
- **Effort** is the number of workdays or work hours required to complete a task
  - A duration estimate of one day could be based on eight hours of work or eighty hours of work
- Duration relates to the time estimate, not the effort estimate; the two are related, so project team members must document their assumptions when creating duration estimates and update the estimates as the project progresses

Discrete, Range, and Three-Point Estimates

- **Duration estimates** are often provided as discrete estimates, such as four weeks
- A **range estimate** might be between three and five weeks
- A **three-point estimate** is an estimate that includes an optimistic, most likely, and pessimistic estimate, such as three, four, and five weeks

Program Evaluation and Review Technique (PERT)

- **Program Evaluation and Review Technique (PERT)** is a network analysis technique used to estimate project duration when there is a high degree of uncertainty about the individual activity duration estimates.

- **PERT weighted average** =

$$\frac{\text{optimistic time} + 4 \times \text{most likely time} + \text{pessimistic time}}{6}$$

- **Example: PERT weighted average** =

(1 workday+4×2 workdays+9 workdays)/6 = 3 workdays

- Instead of using the most likely time of two workdays for this task, you'd use three workdays with a PERT estimate

Monte Carlo Simulations and Probabilities

- Some people prefer using a Monte Carlo simulation over PERT because it accounts for various probabilities
- To perform a Monte Carlo simulation, in addition to the three-point estimate, you also collect probabilistic information for each activity duration estimate
  - For example, estimators must provide a probability of each activity being completed between the optimistic and most likely times
  - You then run a computer simulation to find probability distributions for the entire schedule being completed by certain times

Sample Activity Duration Estimates

- Jeff and his team decided to enter realistic discrete estimates for each activity instead of using PERT or a Monte Carlo simulation
- He stressed that people who would do the work should provide the estimate, and they should have 75 percent confidence in meeting each estimate

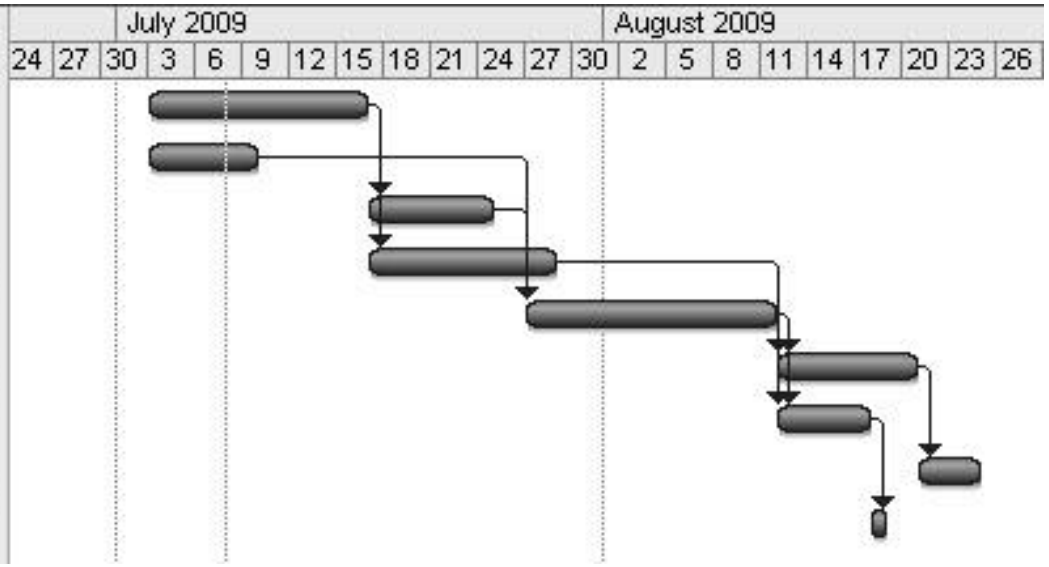
Figure 5-16: Estimating Can Be Difficult! (www.xkcd.com)

Developing the Project Schedule

- Schedule development uses the results of all the preceding project time management processes to determine the start and end dates of project activities and of the entire project
- The resulting project schedule is often shown on a **Gantt chart**, a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in a calendar format
- The ultimate goal of schedule development is to create a realistic project schedule that provides a basis for monitoring project progress for the time dimension of the project

Figure 5-17. Gantt Chart for Project X

Task Name	Duration
A	10 days
B	5 days
C	6 days
D	8 days
E	12 days
F	7 days
G	4 days
H	2 days
I	1 day



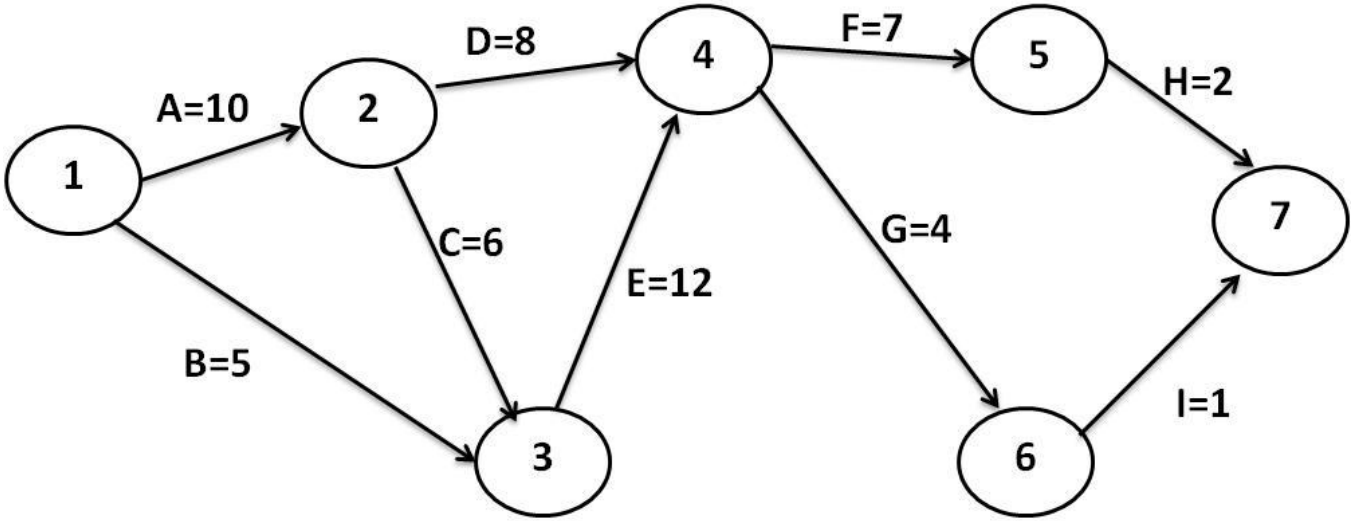
Critical Path Analysis

- **Critical path method (CPM)**—also called **critical path analysis**—is a network diagramming technique used to predict total project duration

- A **critical path** for a project is the series of activities that determine the *earliest* time by which the project can be completed. It is the *longest* path through the network diagram and has the least amount of slack or float
  - **Slack** or **float** is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date

- The longest path or the path containing the critical tasks is what is driving the completion date for the project

Figure 5-18. Critical Path Calculation for Project X



Note: Assume all durations are in days.

Path 1: A-D-F-H	**Length = 10+8+7+2 =27**
Path 2: A-D-G-I	**Length = 10+8+4+1=23**
Path 3: A-C-E-F-H	**Length = 10+6+12+7+2=37**
Path 4: A-C-E-G-I	**Length = 10+6+12+4+1 = 33**
Path 5: B-E-F-H	**Length = 5+12+7+2=26**
Path 6: B-E-G-I	**Length = 5+12+4+1=22**

What Does the Critical Path Really Mean?

- *The critical path shows the shortest time in which a project can be completed*
- If one or more of the activities on the critical path takes longer than planned, the whole project schedule will slip *unless* the project manager takes corrective action
- For example: Apple Computer team members put a stuffed gorilla on top of the cubicle of whoever was in charge of a critical task, so they would not distract him or her

Growing Grass Can Be on the Critical Path

- The fact that its name includes the word “critical” does *not* mean that the critical path includes all critical activities
- Frank Addeman, executive project director at Walt Disney Imagineering, explained in a keynote address at the May 2000 PMI-ISSIG Professional Development Seminar that growing grass was on the critical path for building Disney’s Animal Kingdom theme park
- This 500-acre park required special grass for its animal inhabitants, and some of the grass took years to grow
- So, growing grass was driving the completion date of the theme park; not what most people would think of as a critical activity

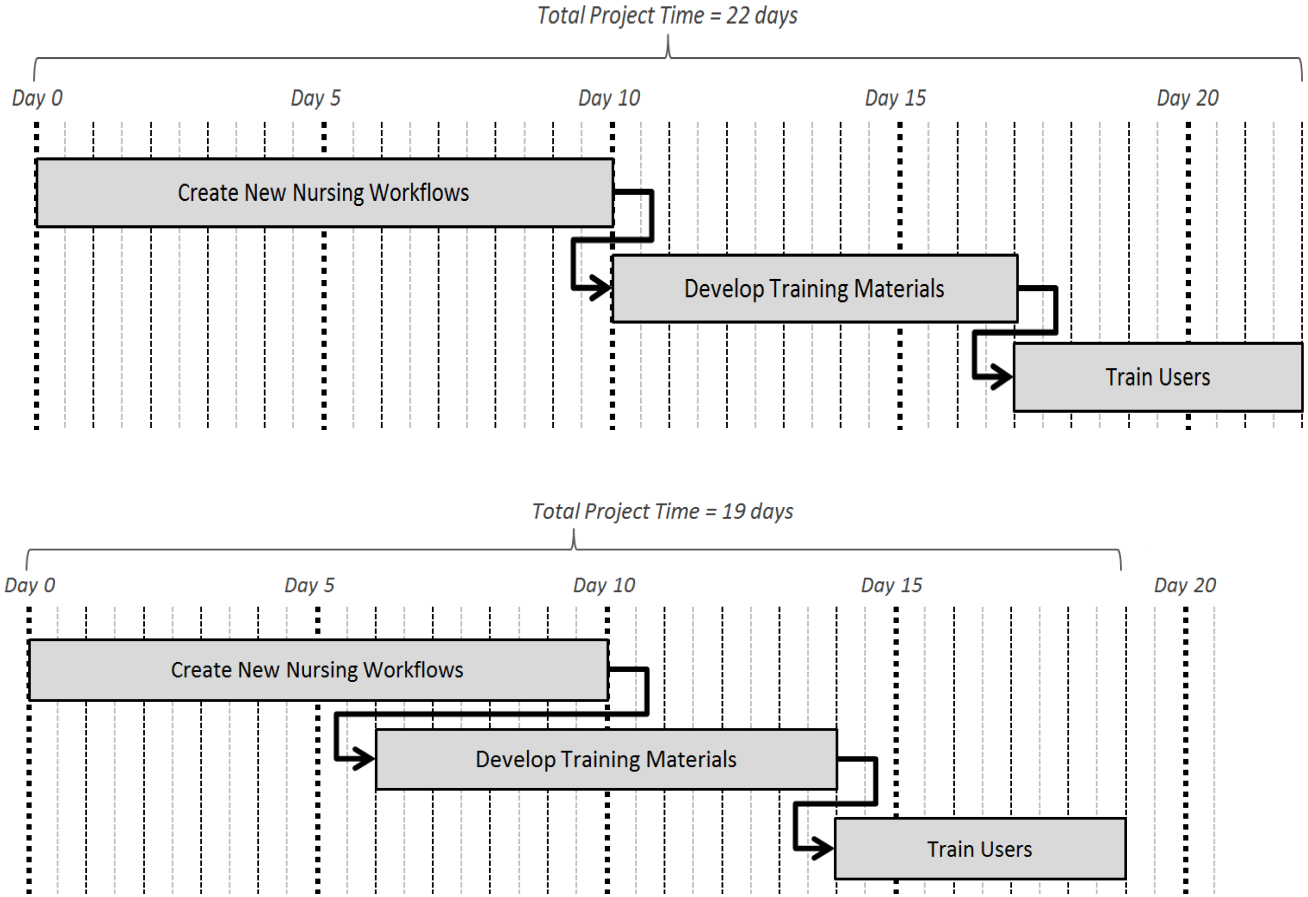
Using Critical Path Analysis to Make Schedule Trade-offs

- It is important to know what the critical path is throughout the life of a project so that the project manager can make trade-offs
- If one of the tasks on the critical path is behind schedule, should the schedule be renegotiated with stakeholders, or should more resources be allocated to other items on the critical path to make up for that time?
- It is also common for project stakeholders to want to shorten project schedule estimates, so you need to know what tasks are on the critical path

Schedule Compression Techniques

- **Crashing** is a technique for making cost and schedule trade-offs to obtain the greatest amount of schedule compression for the least incremental cost
  - If two critical tasks each take two weeks, and it will take $100 to shorten Task 1 by a week and $1,000 to shorten Task 2 by a week, shorten Task 1
- **Fast tracking** involves doing activities in parallel that you would normally do in sequence
  - Instead of waiting for Task 1 to be totally finished before starting Task 2, start Task 2 when Task 1 is halfway done
- **De-scoping**, is commonly used when project stakeholders have included ancillary deliverables to the primary project objectives, and they can be removed to reduce the project timeline.
- Schedule compression often backfires by causing cost, human resource, and quality problems, which lead to even longer schedules

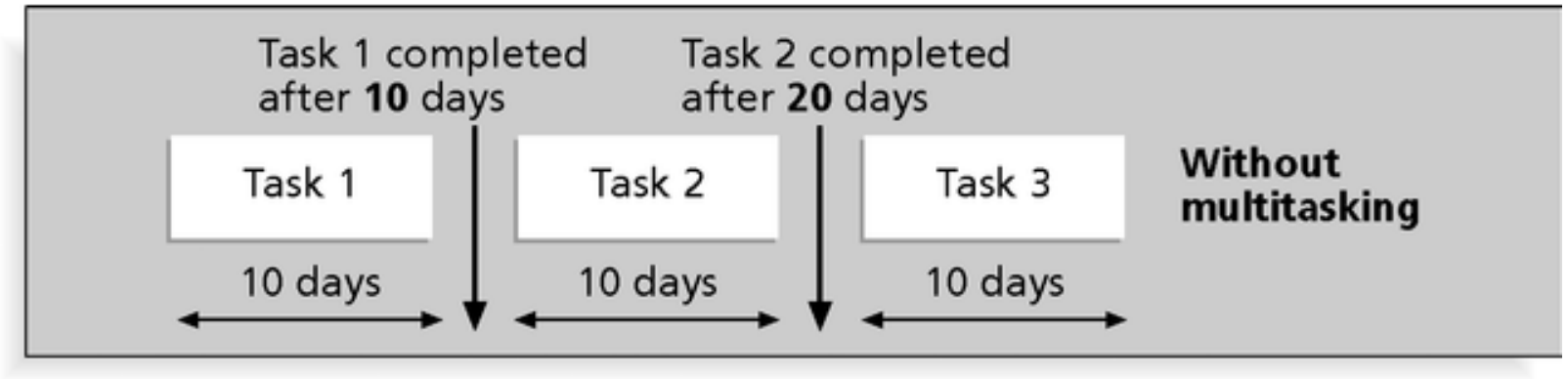
Figure 5-19. Original (top) and fast-tracked (bottom) VAPR Timeline



Critical Chain Scheduling

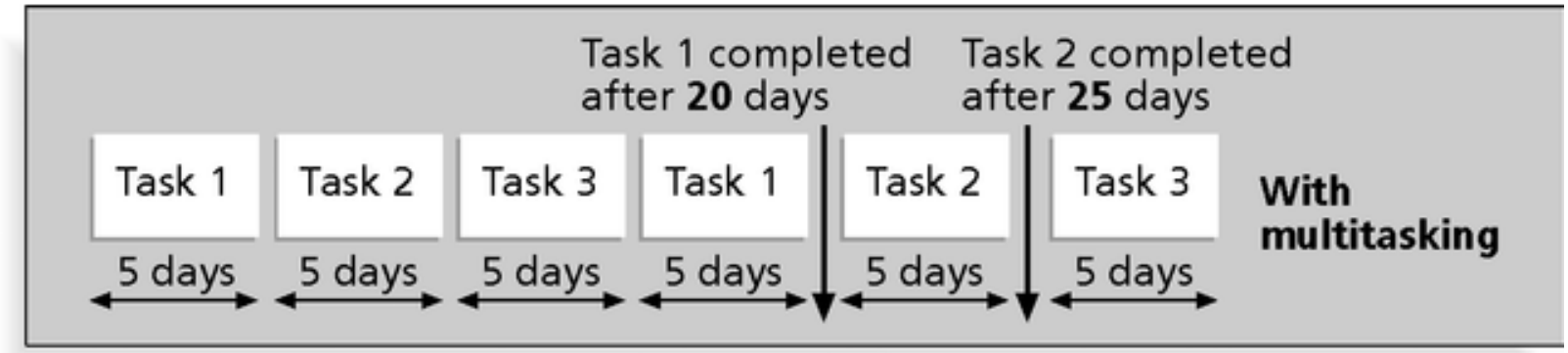
- **Critical chain scheduling** is a method of scheduling that considers limited resources when creating a project schedule and includes buffers to protect the project completion date
- It uses the **Theory of Constraints (TOC)**, a management philosophy developed by Eliyahu M. Goldratt and introduced in his book *The Goal*
- It attempts to minimize **multitasking**, which occurs when a resource works on more than one task at a time

Figure 5-20. Three Tasks Without Multitasking



Schwalbe, Information Technology Project Management, Sixth Edition, 2010

Figure 5-21. Three Tasks With Multitasking

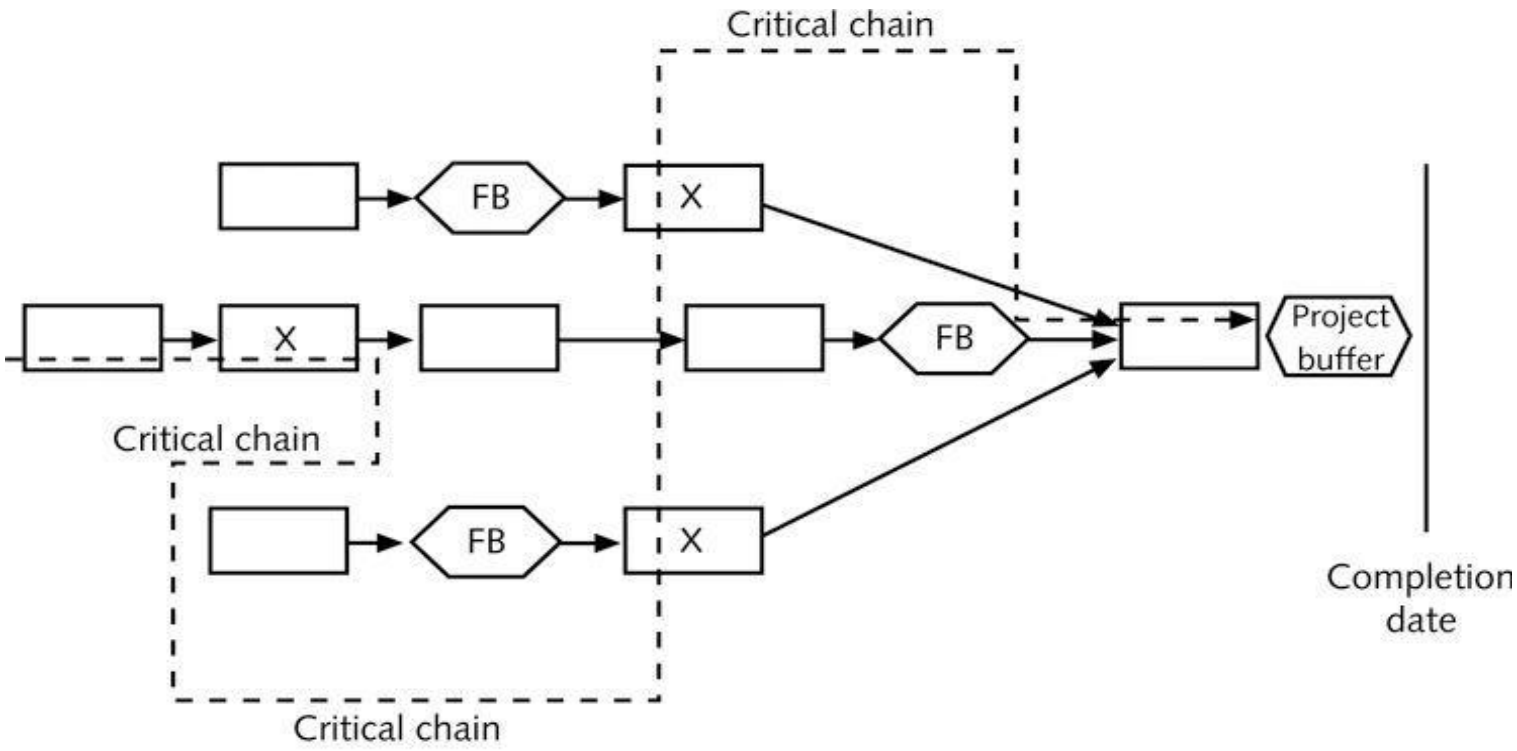


Schwalbe, Information Technology Project Management, Sixth Edition, 2010

Buffers and Critical Chain

- A **buffer** is additional time to complete a task.
- **Murphy's Law** states that if something can go wrong, it will.
- **Parkinson's Law** states that work expands to fill the time allowed.
- In traditional estimates, people often add a buffer to each task and use it if it's needed or not.
- Critical chain scheduling removes buffers from individual tasks and instead creates
  - a **project buffer** or additional time added before the project's due date.
  - **feeding buffers** or additional time added before tasks on the critical path.

Figure 5-22. Example of Critical Chain Scheduling*



X = Activities done by limited resource

FB = Feeding buffer

*Eliyahu Goldratt, Critical Chain. Great Barrington, MA: The North River Press, 1997, p. 218.

Healthcare Perspective

- Several healthcare organizations have applied the theory of constraints (TOC) to improve patient flow. Consider a relatively simple system of a physician's office or clinic. The steps in the process could be patients checking in, filling out forms, having vital signs taken by a nurse, seeing the physician, seeing the nurse for a prescribed procedure such as vaccination, and so forth. These steps could take place in a simple linear sequence or chain ...Each link in this chain has the ability to perform its tasks at different average rates. In this example, the first resource can process 13 patients, charts, or blood samples per an hour; the second can process 17, and so forth. One may think that this process can produce 13 per hour, the average of all resources. In fact, this process or chain only can produce an average of eight [patients, charts, or blood samples] per hour. The chain is only as strong as its weakest link and the rate of the slowest resource in this example, the weakest link, is eight. This is true regardless of how fast each of the other resources can process individually, how much work is stuffed into the pipeline, or how complex the process or set of interconnected processes is to complete. Moreover, improving the performance of any link besides the constraint does nothing to improve the system as a whole.[4]

- The CEO of a large healthcare organization in England described the success they had in reducing the length of hospital stays by using TOC. "With the help of Theory of Constraint we have been able to move Barnet & Chase Farm Hospitals NHS Trust from one of the worst performing trusts in England to one of the top performing. In Q4 (2007-2008) we were the top performing trust in London for the 4 hour target and 6th across England. Also, by applying the Theory of Constraints to our discharge process we have been able to reduce our length of stay by 27% and we know we can improve further on this."[5]

Figure 5-23. Sample Project Schedule

	Activity Name	Duration	Man Days	Start	Finish	Predecessors
1	**Phase I**	**244 days**	**721**	**7/1/13**	**6/5/14**	
2	**IHI VAP Bundle Definitions**	**19 days**	**28**	**7/1/13**	**7/25/13**	
3	Review IHI VAP bundle require	1 day	1	7/1/13	7/1/13	
4	Review a min of six VAP bundle research studies that	9 days	9	7/2/13	7/12/13	3
5	Identify clinical discipline that typically provides each of the	10 days	10	7/2/13	7/15/13	3
6	Create VAP bundle definition c	6 days	6	7/16/13	7/23/13	4,5
7	IHI Bundle Buffer	2 days	2	7/24/13	7/25/13	6
8	IHI Bundle Defined	0 days	0	7/25/13	7/25/13	7
9	**AHS VAP Bundle Data Sources**	**46 days**	**46**	**7/26/13**	**9/27/13**	
10	Review VAP bundle definition	2 days	2	7/26/13	7/29/13	8
11	Determine if VAP bundle elements are currently	4 days	4	7/30/13	8/2/13	10
12	Update VAP bundle definition document with corrected	3 days	3	8/5/13	8/7/13	11
13	Determine if the discipline documents the data	2 days	2	8/8/13	8/9/13	12
14	Identify the systems where the information is	3 days	3	8/12/13	8/14/13	13
15	Review systems and determine if the data is	12 days	12	8/15/13	8/30/13	14
16	Review extracted data sets for	13 days	13	9/2/13	9/18/13	15
17	Update VAP bundle definition document with system and	3 days	3	9/19/13	9/23/13	16
18	VAP Bundle Data Sources Buffe	4 days	4	9/24/13	9/27/13	17
19	Current Data Extracted	0 days	0	9/27/13	9/27/13	18

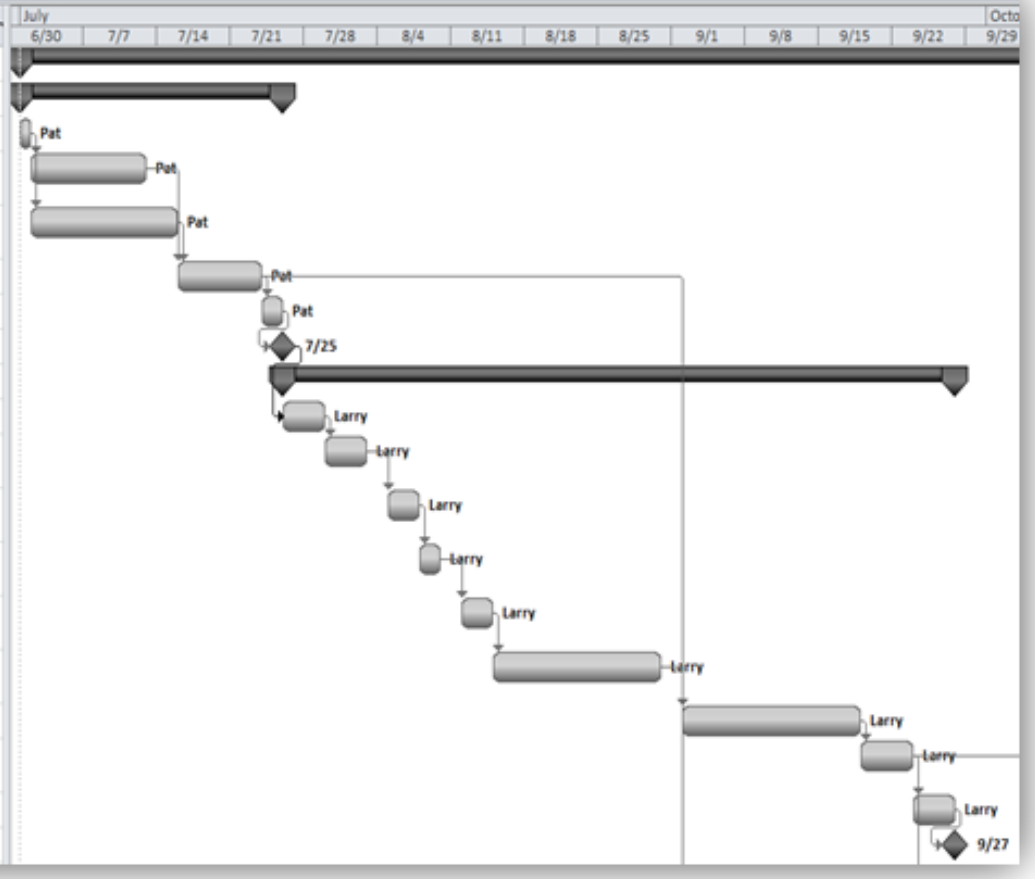
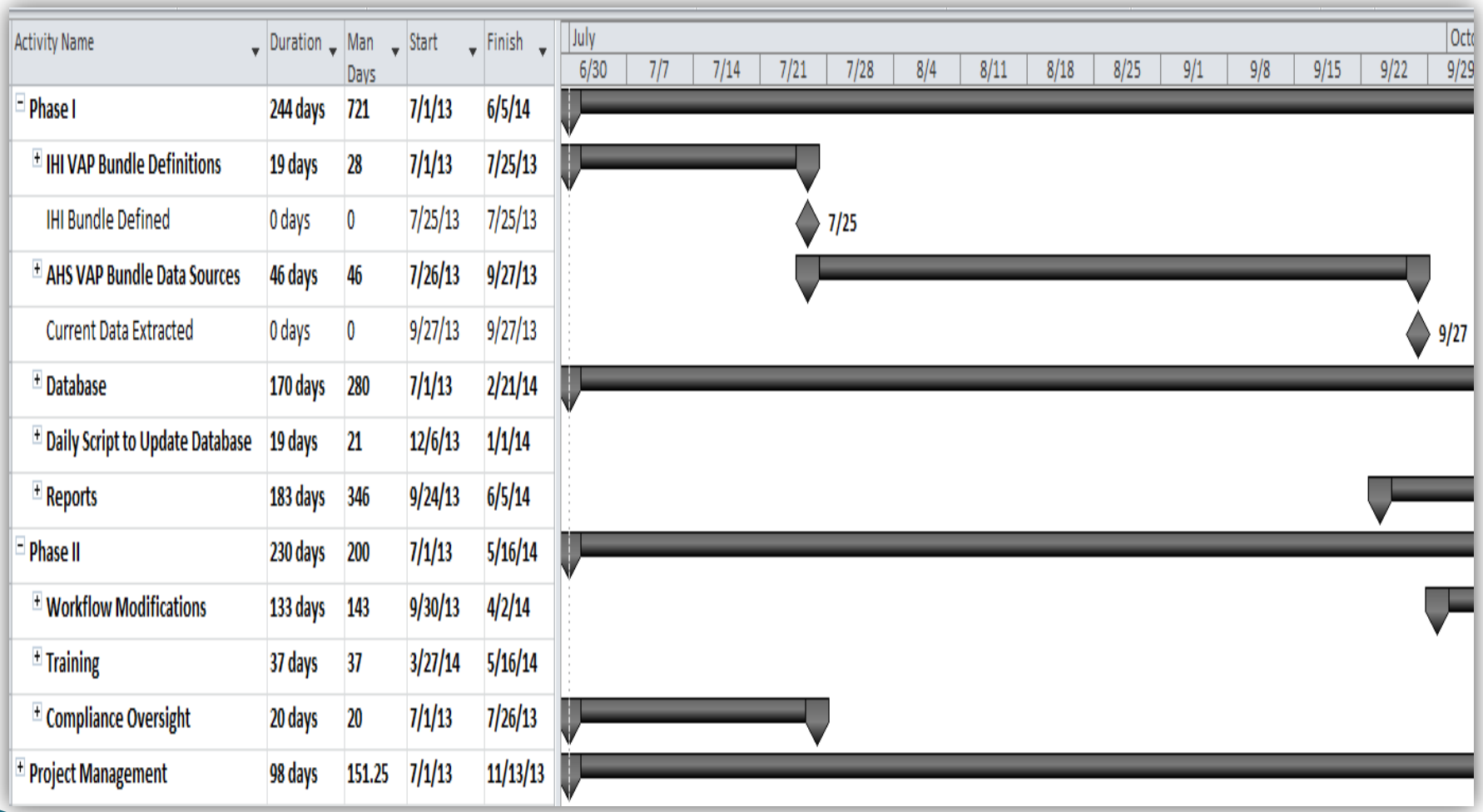


Figure 5-24. Sample Gantt Chart Showing Summary Activities and Milestones



Activity Name	Duration	Man Days	Start	Finish
Phase I	244 days	721	7/1/13	6/5/14
IHI VAP Bundle Definitions	19 days	28	7/1/13	7/25/13
IHI Bundle Defined	0 days	0	7/25/13	7/25/13
AHS VAP Bundle Data Sources	46 days	46	7/26/13	9/27/13
Current Data Extracted	0 days	0	9/27/13	9/27/13
Database	170 days	280	7/1/13	2/21/14
Daily Script to Update Database	19 days	21	12/6/13	1/1/14
Reports	183 days	346	9/24/13	6/5/14
Phase II	230 days	200	7/1/13	5/16/14
Workflow Modifications	133 days	143	9/30/13	4/2/14
Training	37 days	37	3/27/14	5/16/14
Compliance Oversight	20 days	20	7/1/13	7/26/13
Project Management	98 days	151.25	7/1/13	11/13/13

Project Cost Management

- Project cost management includes the processes required to ensure that a project team completes a project within an approved budget
- The main planning tasks are planning cost management, estimating costs, and determining the budget
- The main documents produced include a cost management plan, a cost estimate, and a cost performance baseline

Planning Cost Management

- The purpose of this process is to determine the policies, procedures, and documentation for planning, managing, executing, and controlling project costs.

- The project team holds meetings, consults with experts, and analyzes data to help produce a cost management plan, which becomes a component of the project management plan.

Estimating Costs

- Project teams normally prepare cost estimates at various stages of a project, and these estimates should be fine-tuned as time progresses
- It is also important to provide supporting details for the estimates, including ground rules and assumptions (sometimes called the basis of estimates)
- A large percentage of total project costs are often labor costs, so it is important to do a good job estimating labor hours and costs

Video Highlights

- Michael Porter and Robert S. Kaplan, Harvard Business School professors and authors of the Harvard Business Review article "How to Solve the Cost Crisis in Health Care," discuss this topic in a short (less than ten minute) video.
- Porter suggests that many efforts to reduce healthcare costs are ineffective because organizations in healthcare don’t know how to measure their costs properly.
- Kaplan says that the definition of costs should be costs within the system and that the patient should be the fundamental costing unit.
- Costs should focus on particular medical conditions (such as diabetes or knee replacements), and organizations should focus on adding value by comparing costs with patient outcomes.

Cost Estimating Techniques

- **Analogous estimates**, also called **top-down estimates**, use the actual cost of a previous, similar project as the basis for estimating the cost of the current project. This technique requires a good deal of expert judgment and is generally less costly than others are, but it can also be less accurate

- **Bottom-up estimates** involve estimating individual activities and summing them to get a project total. This approach can increase the accuracy of the cost estimate, but it can also be time intensive and, therefore, expensive to develop

- **Parametric modeling** uses project characteristics (parameters) in a mathematical model to estimate project costs

Cost Estimating Process

- See the detailed steps, ground rules, and assumptions that Jeff's team used for developing their cost estimate
- Summary information was documented in a cost model
- Just as projects are unique, so are cost estimates
- Consult with internal and external experts and organizations for assistance

Figure 5-25. Sample Cost Estimate

Task Name	Man Days	Internal Labor Rate	Total Internal Labor	External Labor Rate	Total External	Non-Labor Costs	Total Cost
Phase I							
IHI VAP Bundle Definitions	28	$ 55	$ 12,320	$ -	$ -	$ -	$ 12,320
AHS VAP Bundle Data Sources	46	$ 60	$ 22,080	$ -	$ -	$ -	$ 22,080
Database	243	$ 60	$ 116,640	$ -	$ -	$ 170,000	$ 286,640
Daily Update Script	21	$ 60	$ 10,080	$ -	$ -	$ -	$ 10,080
Reports	346	$ 55	$ 152,240	$ -	$ -	$ 240,000	$ 392,240
Phase II		$ -	$ -	$ -	$ -	$ -	$ -
Workflow Modifications	143	$ 55	$ 62,920	$ -	$ -	$ -	$ 62,920
Training	37	$ -	$ -	$ 70	$ 20,720	$ -	$ 20,720
Compliance Oversight	20	$ 120	$ 19,200	$ -	$ -	$ -	$ 19,200
Project Management	151.3	$ 80	$ 96,800	$ -	$ -	$ -	$ 96,800
Contingency			$ 10,000		$ 10,000	$ 35,000	$ 55,000
Totals			$ 492,280		$ 30,720	$ 445,000	$ 978,000

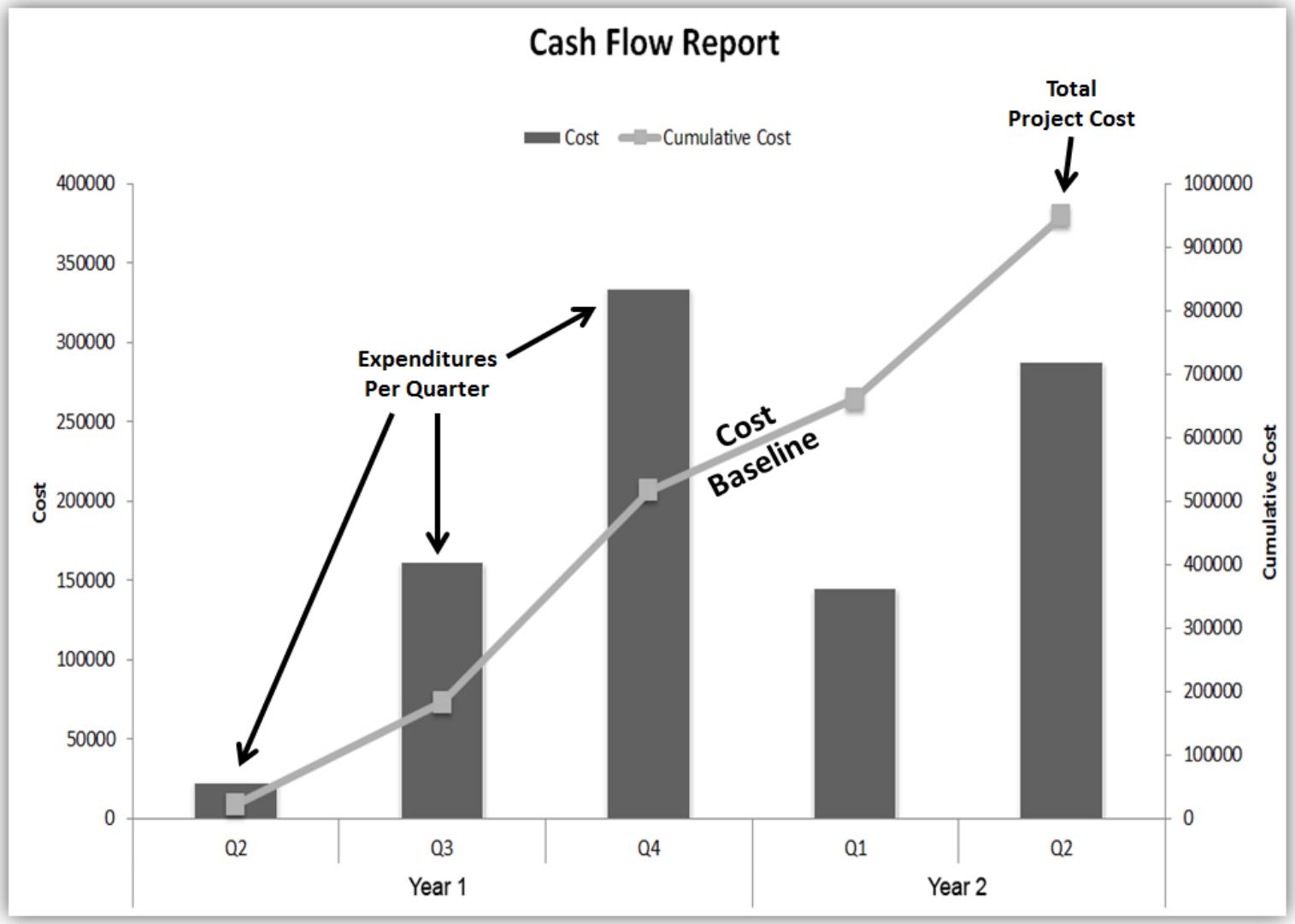
Cost Budgeting

- Project cost budgeting involves allocating the project cost estimate to tasks over time
- The tasks are based on the work breakdown structure for the project
- The main goal of the cost budgeting process is to produce a **cost baseline**, or time-phased budget, that project managers use to measure and monitor cost performance

Figure 5-26. Sample Cost Baseline

VAPR Project	1	2	3	4	5	6	7	8	9	10	11	12	Total
Phase I													
IHI VAP Bundle Definitions	12,320	-	-	-	-	-	-	-	-	-	-	-	$ 12,320
AHS VAP Bundle Data Sources	1,920	10,560	9,600	-	-	-	-	-	-	-	-	-	$ 22,080
Database	13,440	-	5,280	193,520	19,200	18,720	22,080	14,400	-	-	-	-	$ 286,640
Daily Script to Update Database	-	-	-	-	-	9,600	480	-	-	-	-	-	$ 10,080
Reports			4,400	20,240	18,480	10,560	20,240	17,600	18,480	201,760	76,960	3,520	$ 392,240
Phase II													
Workflow Modifications	-	-	480	11,040	9,920	11,440	10,560	11,000	7,600	880	-	-	$ 62,920
Training	-	-	-	-	-	-	-	-	2,130	11,840	6,750	-	$ 20,720
Compliance Oversight	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600	$ 19,200
Project Management	9,680	8,873	9,680	8,873	8,873	8,067	8,873	6,453	6,453	6,453	6,453	8,067	$ 96,800
Contingency	5,500	5,042	5,500	5,042	5,042	4,583	5,042	3,667	3,667	3,667	3,667	4,583	$ 55,000
Totals	$ 44,460	$ 26,075	$ 36,540	$ 240,315	$ 63,115	$ 64,570	$ 68,875	$ 54,720	$ 39,930	$ 226,200	$ 95,430	$ 13,187	$ 978,000

Figure 5-27. Sample Cash Flow Report



Chapter Summary

- A project network diagram shows the sequencing of project activities, and a Gantt chart is a standard format for displaying project schedule information by listing activities and their corresponding start and finish dates in a calendar format.

- It is also important to understand critical path analysis to make schedule trade-off decisions. Critical chain scheduling can also help in scheduling when there are scarce resources involved in a project.

- There are several methods for creating cost estimates, such as analogous, bottom-up, and parametric. A cost baseline is a time-phased budget that project managers use to measure and monitor cost performance.