IT Project Management(ITec5111)

Chapter 6
Project Schedule Management

The Importance of Project Schedules

- Project Managers often cite delivering projects on time as one of their biggest challenges
  - Time has the least amount of flexibility; it passes no matter what happens on a project
- Individual work styles and cultural differences may cause schedule conflicts
  - Different cultures and even entire countries have different attitudes about schedules
  - For example,
    - in some countries businesses close for several hours every afternoon to have rests.
    - countries may have different holidays, which means not much work will be done at certain times of the year
- With all the possibilities for schedule conflicts, it is important for project managers to use good project time management.

The Importance of Project Schedules (cont'd)

- **Project time management,** simply defined as the processes required to ensure timely completion of a project.
- Seven main processes are involved in project time management:
  - Planning schedule management
  - Defining activities
  - Sequencing activities
  - Estimating activity resources
  - Estimating activity durations
  - Developing the schedule
  - Controlling the schedule

The Importance of Project Schedules (cont'd)

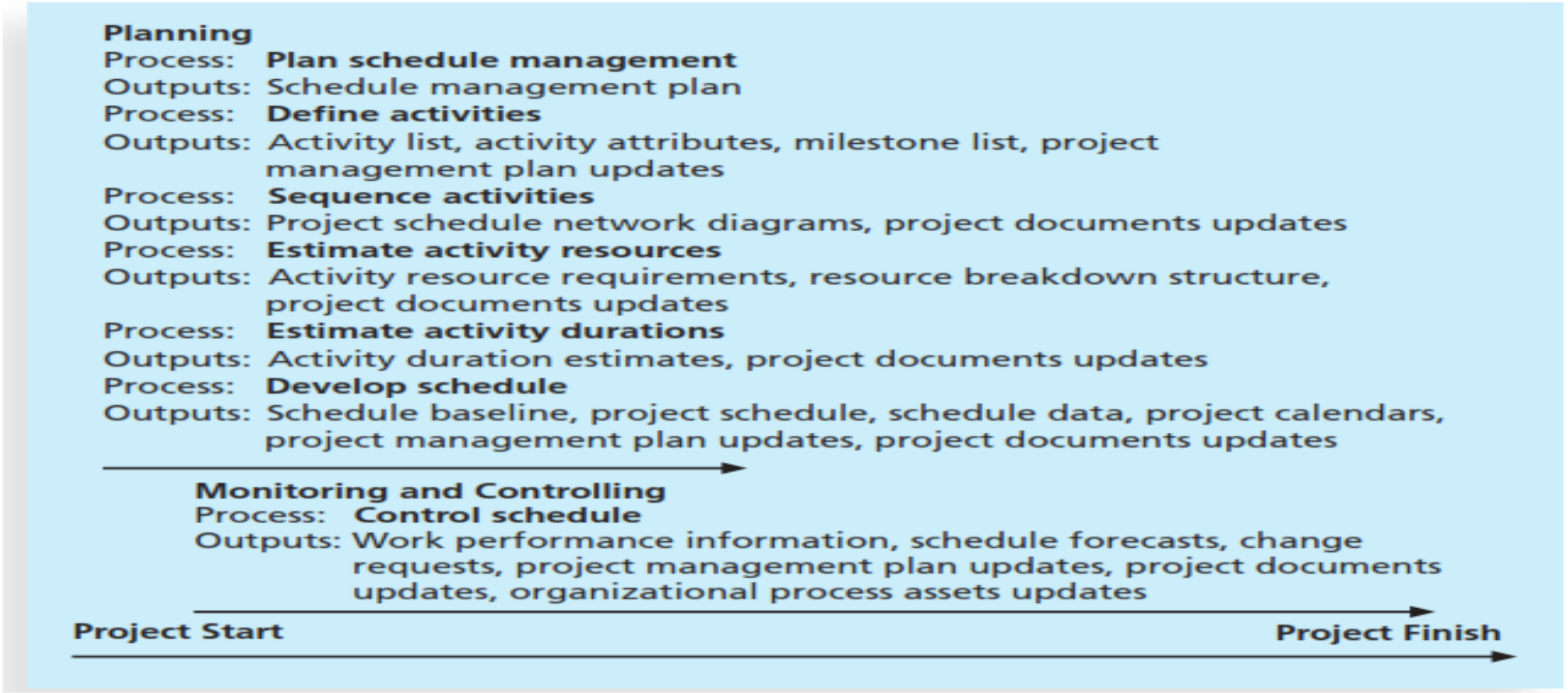

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FIGURE 6-1 Project time management summary

Planning Schedule Management

- The first step in project time management is **planning how the schedule will be managed** throughout the life of the project.
- Project schedules grow out of the basic documents, ***project charter***, that initiate a project.
- The project charter often mentions planned **project start** and **end dates**, which serve as the starting points for a more detailed schedule.
- After reviewing the project management plan, project charter, enterprise environmental factors, and organizational process assets, the project team uses expert judgment, analytical techniques, and meetings to develop the schedule management plan.
- The schedule management plan, like the scope management plan, is **detailed project time management description** based on the needs of the project.

Planning Schedule Management(cont'd)

- S**chedule management plan** includes the following information:
  - Project schedule model development:
    - which contains project activities with estimated durations, dependencies, and other planning information that can be used to produce a project schedule
  - Level of accuracy and units of measure:
    - discusses how accurate schedule estimates should be and determines whether time is measured in hours, days, or another unit.
  - Control thresholds:
    - Variance thresholds, such as ±10%, are established for monitoring schedule performance.
  - Rules of performance measurement:
    - team members are expected to track the percentage of work completed, this section specifies how to determine the percentages.
  - Reporting formats:
    - describes the format and frequency of schedule reports required for the project.
  - Process descriptions:
    - The schedule management plan also describes how all of the schedule management processes will be performed.

Defining Activities

- All project work has been defined in **enough detail** after planning scope management, but it is often necessary to describe activities in more detail as part of schedule management.
- **Defining activities** involves identifying the specific actions that will produce the project deliverables in enough detail **to determine resource** and **schedule estimates**.
- **Outputs of defining activities:** include an activity list, activity attributes, a milestone list, and project management plan updates.
  - Activity list: a tabulation of activities to be included on a project schedule
    - Activity name, activity identifier or number, and brief description of the activity
  - Activity attributes: provide more information
    - Predecessors, successors, logical relationships, resource requirements, constraints, assumptions related to the activity etc.
  - A milestone: is a significant event that normally has no duration
    - They’re useful tools for setting schedule goals and monitoring progress
    - Examples: obtaining customer sign-off on key documents or completion of specific products

Sequencing Activities

- After defining project activities, the next step in project time management is sequencing them or determining their dependencies.
- Sequencing process involves **evaluating** the reasons for dependencies and the different types of dependencies
  - A dependency or relationship is the sequencing of project activities or tasks
    - **Mandatory dependencies**: inherent in the nature of the work being performed on a project, sometimes referred to as hard logic
      - For example, you cannot test code until after the code is written.
    - **Discretionary/Flexible dependencies**: defined by the project team, sometimes referred to as soft logic and should be used with care since they may limit later scheduling options
      - For example, a project team might follow good practice and not start the **detailed design** of a new information system until the **users sign off on all of the analysis work**
    - **External dependencies**: involve relationships between project and non-project activities
      - For example, the installation of a new operating system and other software may depend on delivery of new hardware from an external supplier.

Sequencing Activities (cont'd)

- **Network diagrams:** are the preferred technique for showing activity sequencing
  - Graphic display of the logical relationships among, or sequencing of, project activities
  - Two main formats are the **arrow** and **precedence** diagramming methods

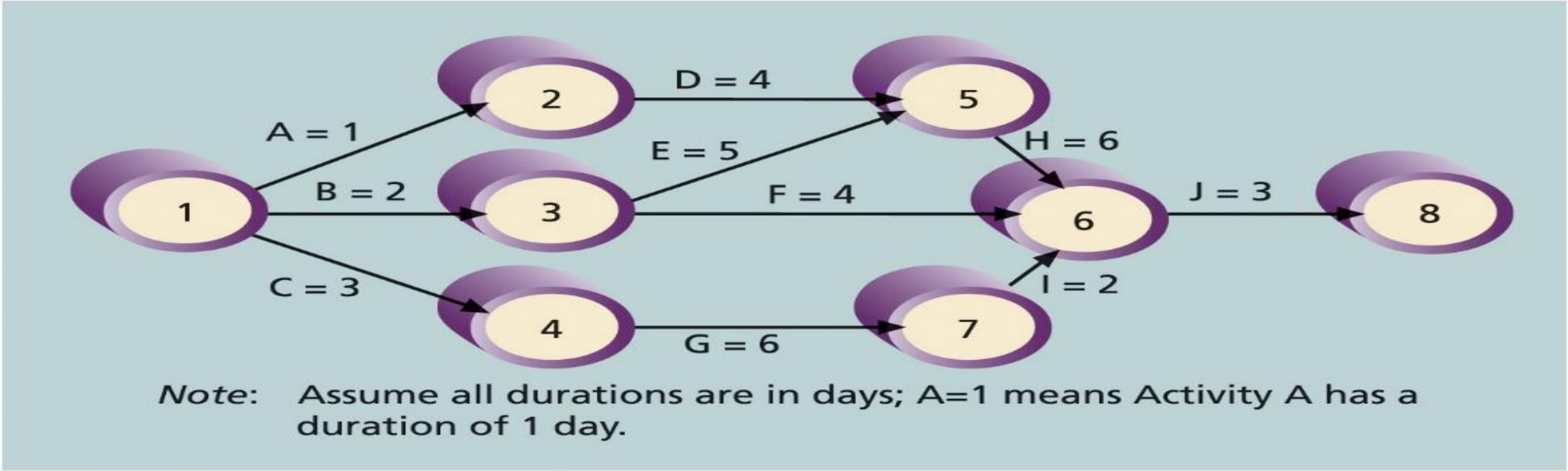


FIGURE 6-2 Network diagram for project X

Sequencing Activities (cont'd)

- The main elements on the above network diagram.
  - **The letters A through J represent activities** with **dependencies** that are required to complete the project.
  - These activities come from the WBS and activity definition process described earlier.
  - The **arrows represent the activity sequencing** or **relationships between tasks.**
    - For example, Activity A must be done before Activity D, and Activity D must be done before Activity H.
  - A **node is simply the starting and ending point of an activity**.
    - The first node(**node 1**) signifies the start of a project, and the last node(**node 8**) represents the end.
- Keep in mind that the network diagram represents activities that must be done to complete the project

Sequencing Activities (cont'd)

- The format of network diagram uses:

1. Arrow Diagramming Method (ADM) or Activity-On-Arrow(AOA) network diagrams

- Activities are represented by arrows
- Nodes or circles are the starting and ending points of activities
- Only show **finish-to-start** dependencies: **Finish the first task to start the second task**

2. Precedence Diagramming Method (PDM)

- Network diagramming technique in which **boxes represent activities**
- Types of dependencies or relationships between activities
  - Finish-to-start
  - Start-to-start
  - Finish-to-finish
  - Start-to-finish

Sequencing Activities (cont'd)

Task dependencies

The nature of the relationship between two linked tasks. You link tasks by defining a dependency between their finish and start dates. For example, the "Contact caterers" task must finish before the start of the "Determine menus" task. There are four kinds of task dependencies in Microsoft Project.

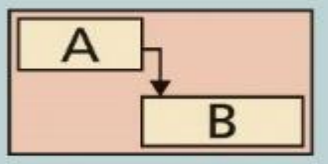
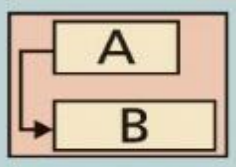
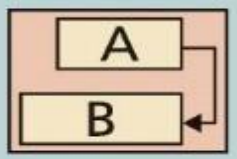
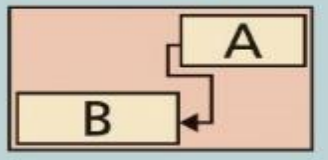
Task dependency	Example	Description
Finish-to-start (FS)		Task (B) cannot start until task (A) finishes.
Start-to-start (SS)		Task (B) cannot start until task (A) starts.
Finish-to-finish (FF)		Task (B) cannot finish until task (A) finishes.
Start-to-finish (SF)		Task (B) cannot finish until task (A) starts.

FIGURE 6-3 Task dependency types

Sequencing Activities (cont'd)

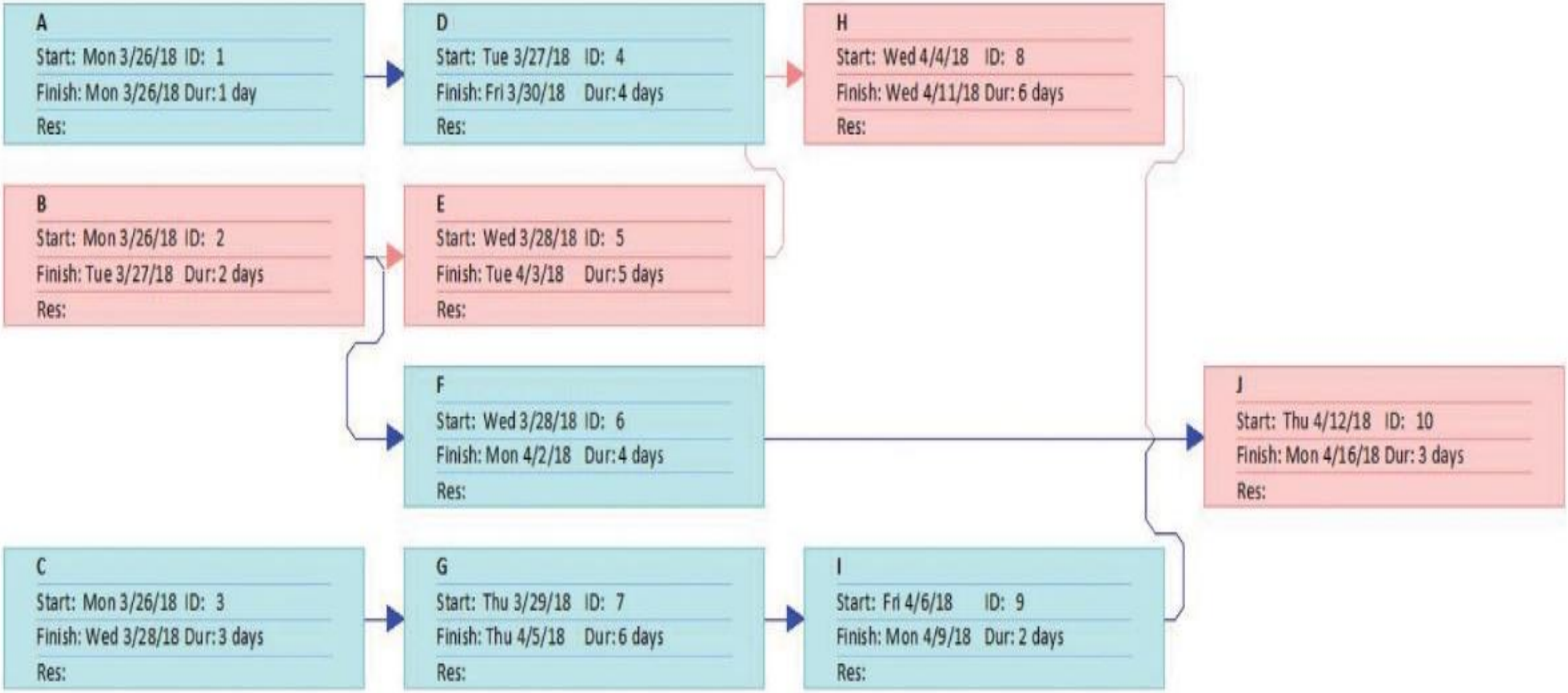


FIGURE 6-4 Precedence diagramming methods (PDM) network diagram for project X

Estimating Activity Resources

- Before you are trying **to estimate the duration for each activity**, you must have a good idea of the **quantity and type of resources** (people, equipment, and materials) that will be assigned to each activity.
  - **The nature of the project and the organization will affect resource estimates.**
- The people who help determine what resources are necessary must have **experience and expertise in similar projects** and with the organization performing the project.
- Important questions to answer when estimating activity resources include:
  - How difficult will specific activities be on this project?
  - What is the organization's history in doing similar activities? Has the organization done similar tasks before? What level of personnel did the work?
  - Does the organization have people, equipment, and materials that are capable and available for performing the work? Could any organizational policies affect the availability of resources?
  - Does the organization need to acquire more resources to accomplish the work? Would it make sense to outsource some of the work? Will outsourcing increase or decrease the amount of resources needed and when they will be available?

Estimating Activity Durations

- After working with key stakeholders to define activities, determine their dependencies, and estimate their resources, the next process in project time management is to **estimate the duration of activities**.
- **Duration includes the actual amount of time worked on an activity plus elapsed time**
- Inputs to activity duration estimates:
  - including the schedule management plan, activity list, activity attributes, activity resource requirements, risk register, enterprise environmental factors, and organizational process assets etc.
- One of the most important considerations in making activity duration estimates is the availability of resources, especially **human resources**.
  - What **specific skills** do people need to do the work?
  - What are the **skill levels** of the people assigned to the project?
  - **How many people** are expected to be available to work on the project at one time?

Estimating Activity Durations (cont'd)

- **The people who will actually do the work, should participate in activities duration estimates.**
- **It is also helpful to review similar projects and seek the advice of experts in estimating activity durations.**
- Duration estimates are often provided **as a discrete number**, such as 8 days, 4 weeks; **as a range**, such as three to five weeks
- Project team members must update the estimates as the project progresses.
  - ***If scope changes occur on the project, the duration estimates should be updated to reflect those changes.***

Developing the Schedule

- Schedule development uses results of the preceding time management processes to determine the start and end date of the project and its activities
  - **Ultimate goal is to create a realistic project schedule that provides a basis for monitoring project progress for the time dimension of the project**
- The main outputs of this process are the project schedule, a schedule baseline, schedule data, project calendars, project management plan updates, and project documents updates.
- **Important tools and techniques used for developing schedule**:
  - Gantt Charts
  - Critical Path Method/Analysis(--- find the longest path)
  - Critical Chain Scheduling(----avoid resource assignment in multitasking)

Developing the Schedule(cont'd): Gantt Charts

- Gantt Charts: provide a standard format for **displaying project schedule information** by listing project activities and corresponding start and finish dates in a calendar form
  - Symbols
    - Thick black bars: summary tasks
    - Light gray horizontal bars: durations of tasks
    - Arrows: dependencies between tasks
    - Black diamond: milestones

Developing the Schedule(cont'd): Gantt Charts

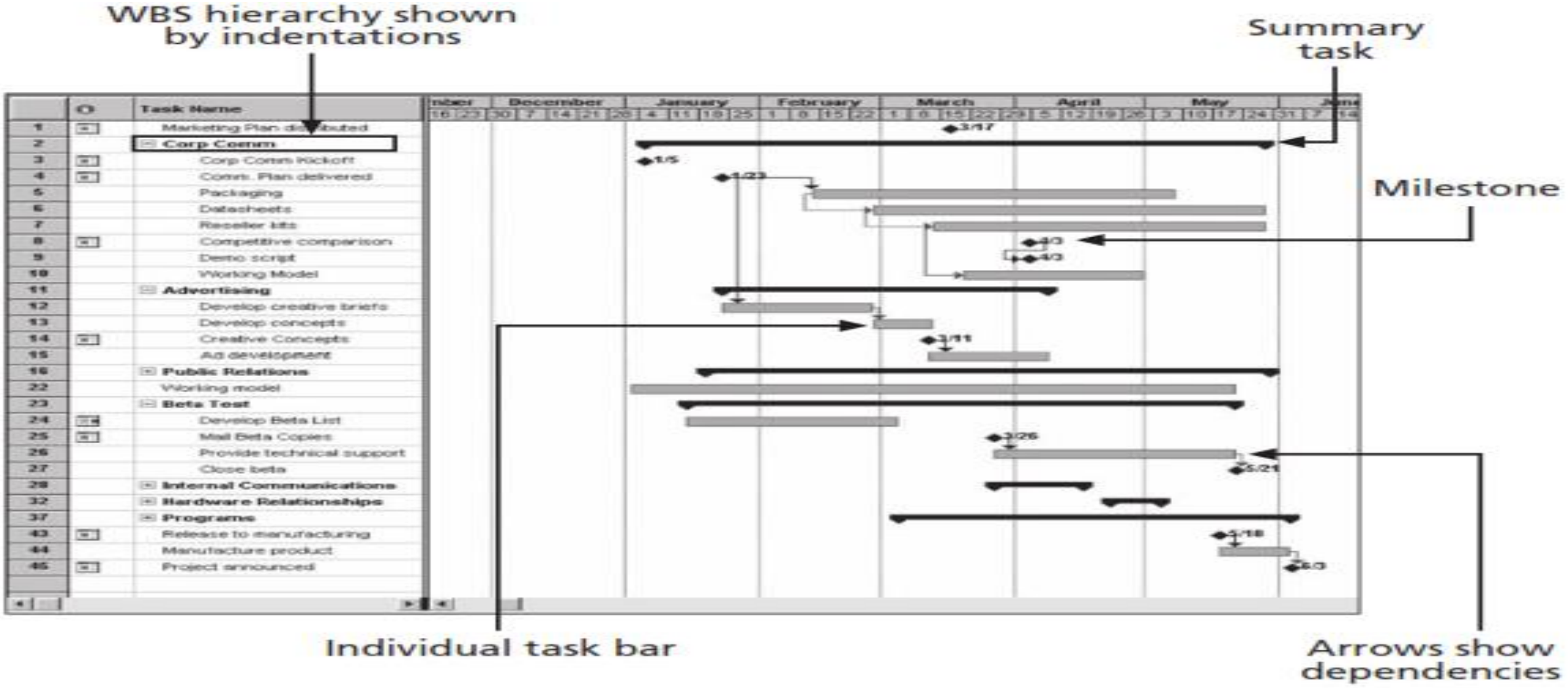


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FIGURE 6-6 Gantt chart for software launch project

Developing the Schedule(cont'd): Gantt Charts

- Adding milestones to Gantt charts
  - Many people like to focus on meeting milestones, especially for large projects
    - Milestones emphasize important events or accomplishments on projects
- SMART Criteria for milestones
  - Specific
  - Measurable
  - Assignable
  - Realistic
  - Time-framed

Developing the Schedule(cont'd): Gantt Charts

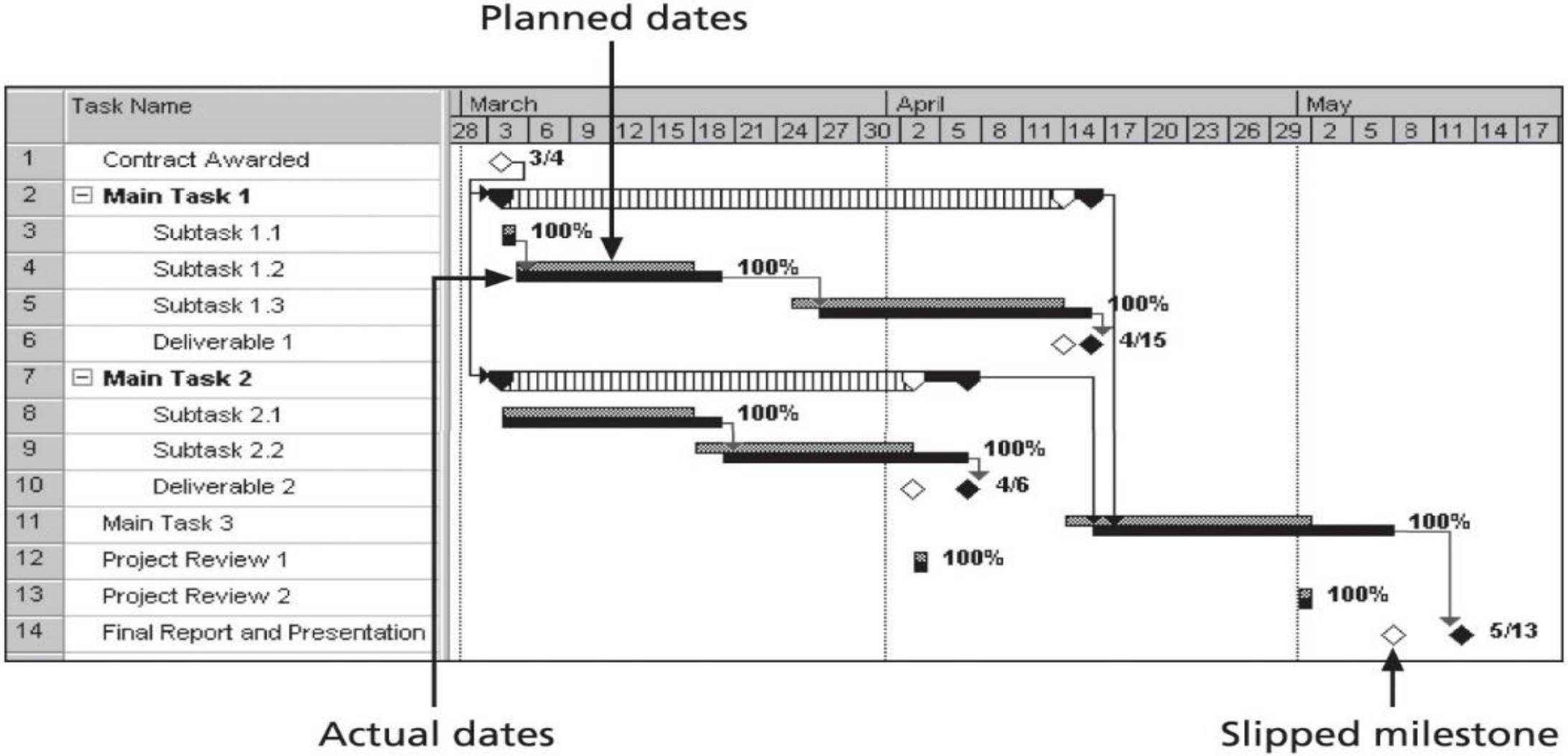
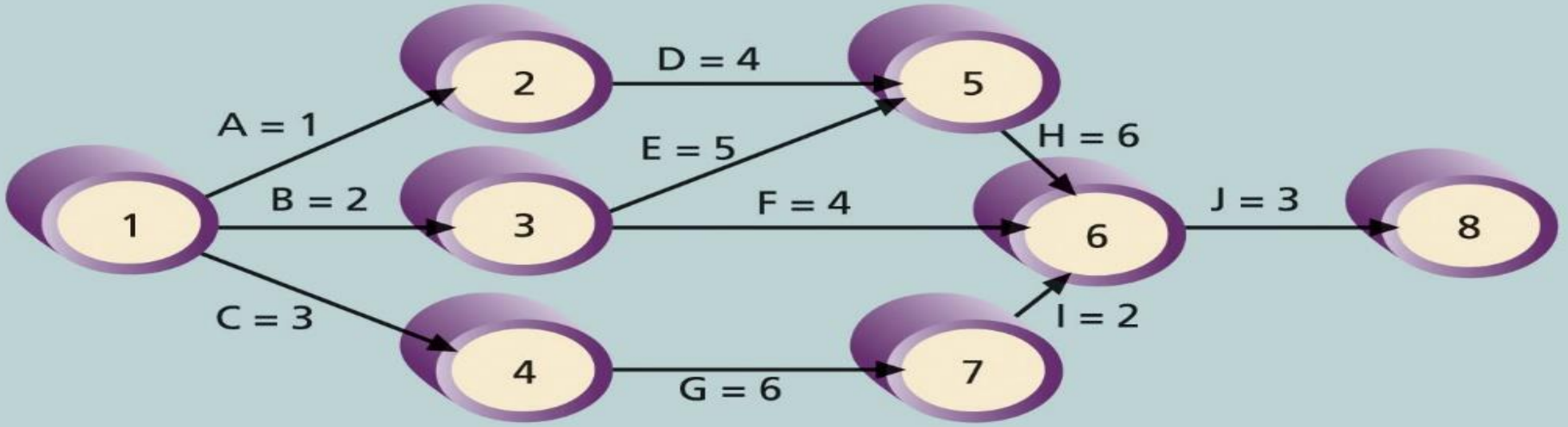


FIGURE 6-7 Sample tracking Gantt chart

Developing the Schedule(cont'd): Critical Path Method (CPM)

- **Critical Path Method/Analysis** :is network diagramming technique used to predict total project duration
  - Critical path: series of activities that determine the earliest time by which the project can be completed
  - Calculating the critical path
    - Develop a good network diagram and add the duration estimates for all activities on each path through the network diagram
      - Longest path is the critical path
  - ***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***

Developing the Schedule(cont'd): Critical Path Method (CPM)



Note: Assume all durations are in days.

Path 1:	A-D-H-J	Length = 1+4+6+3 = 14 days
Path 2:	B-E-H-J	Length = 2+5+6+3 = 16 days
Path 3:	B-F-J	Length = 2+4+3 = 9 days
Path 4:	C-G-I-J	Length = 3+6+2+3 = 14 days

Since the critical path is the longest path through the network diagram, Path 2, B-E-H-J, is the critical path for Project X.

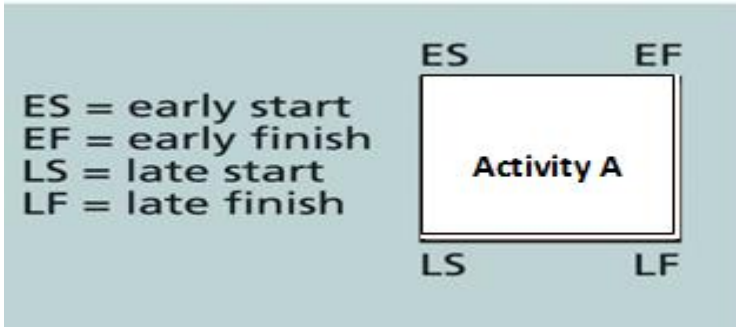
FIGURE 6-8 Determining the critical path for project X

Developing the Schedule(cont'd): Critical Path Method (CPM)

- There can be more than one critical path if the lengths of two or more paths are the same
  - Project managers should closely monitor performance of activities on the critical path to avoid late project completion
  - It is important to know the critical path throughout the life of a project so the project manager *can make trade-offs.*
  - *If a task on the critical path is behind schedule, the project* manager must be aware of the problem and decide what to do about it.
    - **Should the schedule be renegotiated with stakeholders?**
    - **Should more resources be allocated to other items on the critical path to make up for that time?**
    - **Is it acceptable for the project to finish behind schedule?**

Developing the Schedule(cont'd): Critical Path Method (CPM)

- Using Critical Path Analysis to Make Schedule Trade-Offs
  - By keeping track of the critical path, the project manager and the team take a proactive/practical role in managing the project schedule.
  - A technique that can help project managers make schedule trade-offs is determining the ***free slack*** and ***total slack*** for each project activity.
  - **Free slack /free float:** is the amount of time an *activity can be delayed* ***without delaying the early start date*** *of any immediately following/successor activities.*
  - **Total slack /total float:** is the amount of time an *activity can be* ***delayed from its early start*** *without delaying the planned project finish date or deadline.*



Developing the Schedule(cont'd): Critical Path Method (CPM)

- Using Critical Path Analysis to Make Schedule Trade-Offs(cont'd)
  - Project managers calculate free slack and total slack by doing a **forward and backward pass** through a network diagram.
  - A **forward pass:** determines the early start and early finish dates for each activity.
    - The **early start date:** is the **earliest possible time an activity can start** based on the project network logic.
    - The **early finish date:** is the **earliest possible time an activity can finish** based on the project network logic.
  - A **backward pass:** through the network diagram determines the late start and late finish dates for each activity in a similar fashion.
    - The **late start date**: is the **latest possible time an activity might begin** without delaying the project finish date.
    - The **late finish date:** is **the latest possible time an activity can be completed** without delaying the project finish date.

Developing the Schedule(cont'd): Critical Path Method (CPM)

- Main techniques for shortening schedules
  - Shortening durations of critical activities/tasks by **adding more resources**
  - Crashing activities by obtaining the greatest amount of **schedule compression** for the least incremental cost
    - **By focusing on tasks on the critical path that could be done more quickly for no extra cost or a small cost, the project schedule can be shortened.**
  - Fast tracking activities by **doing them in parallel** or overlapping them
- It is important to update the schedule with actual data
  - Note actual activity durations as they are completed
  - Revise estimates for activities in progress
  - Monitor changes to make informed decisions

Developing the Schedule(cont'd): Critical Chain Scheduling

- Another technique that addresses the challenge of meeting or beating project finish dates is an application of the Theory of Constraints called **critical chain scheduling**.
  - **attempts to minimize multitasking when a resource works on more than one task at a time**
- **Critical chain scheduling is assumes that resources don't multitask or at least minimize multitasking**.
  - Someone shouldn't be assigned in two tasks simultaneously on the same project
  - Preventing multitasking avoids resource conflicts
- Multitasking is not a good thing to do if you want to finish a project in a timely manner.
- This situation occurs frequently on projects. People are assigned to multiple tasks within the same project or different tasks on multiple projects.

Controlling the Schedule

- Goals of schedule control
  - Know the status of the schedule
  - Influence the factors that cause schedule changes
  - Determine that the schedule has changed
  - Manage changes when they occur
- Main inputs to schedule control
  - Project management plan
  - Project documents
  - Work performance data
  - Organizational process assets/resources

Reality Checks on Scheduling and the Need for Discipline

- Important activities
  - Review the draft schedule or estimated completion date in the project charter
  - Prepare a more detailed schedule with the project team
  - Make sure the schedule is realistic and followed
  - Alert top management well in advance if there are schedule problems