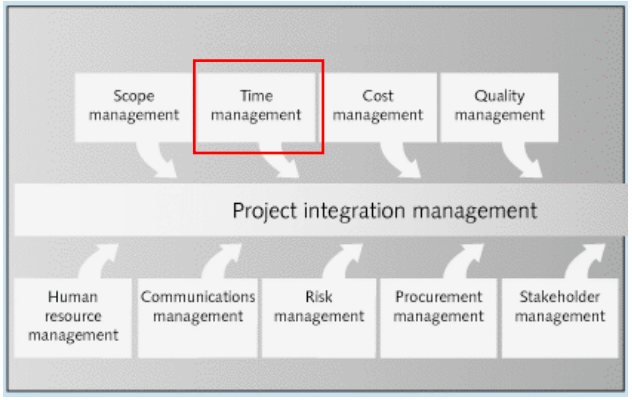
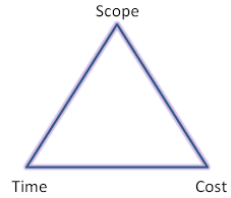
Project Time Management



Importance of Project Schedules



- Managers often identify delivering projects on time as one of their biggest challenges
- Time has the least amount of flexibility
  - Unlike the scope, time is easy to measure
  - It is usually easier to negotiate scope and cost changes with clients than the project completion date
- Schedule issues are the main reason for internal and external conflicts, especially at later project stages
- Different cultures and countries have different attitudes about importance of time constraint that may cause misunderstanding

Figure 6-1. Project Time Management Summary

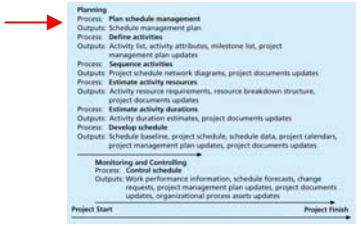
- To be an effective time manager, you need to clearly understand the activities of the project and have the necessary skills to plan, schedule and control a project timeline
- You need to learn how to manage your own time before you can get down to project time management

Planning
Process: **Plan schedule management**
Outputs: Schedule management plan
Process: **Define activities**
Outputs: Activity list, activity attributes, milestone list, project management plan updates
Process: **Sequence activities**
Outputs: Project schedule network diagrams, project documents updates
Process: **Estimate activity resources**
Outputs: Activity resource requirements, resource breakdown structure, project documents updates
Process: **Estimate activity durations**
Outputs: Activity duration estimates, project documents updates
Process: **Develop schedule**
Outputs: Schedule baseline, project schedule, schedule data, project calendars, project management plan updates, project documents updates

Monitoring and Controlling
Process: **Control schedule**
Outputs: Work performance information, schedule forecasts, change requests, project management plan updates, project documents updates, organizational process assets updates

Project Start → **Project Finish**

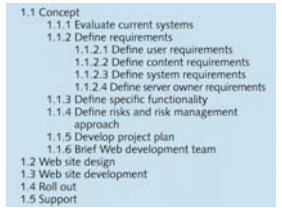
Planning Schedule Management



- Project start and finish dates are recorded in the Project Charter that sets the time constraints
- The project team uses expert judgment, analytical techniques, and meetings to develop the Schedule Management Plan
- Schedule Management Plan includes:
  - Project schedule model to be used
  - Level of accuracy and units of measure (days or hrs)
  - Control thresholds – critical deviations (e.g. 10%)
  - Rules of progress measurement
  - Reporting format and frequency (e.g. weekly reports)
  - Time Management process description

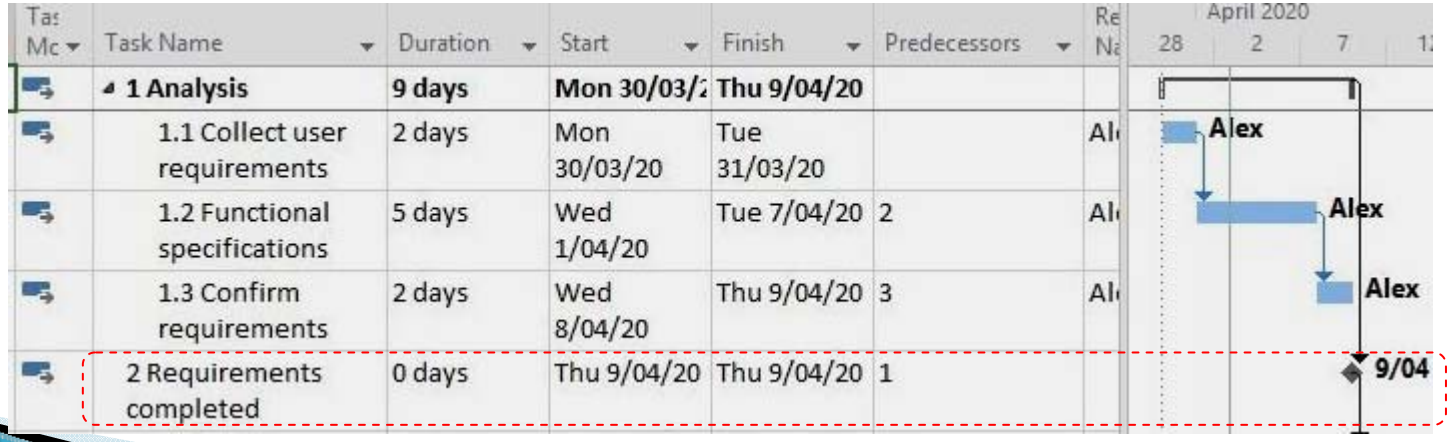
Defining Activities

- The team may need to review and analyze the scope baseline focusing on
  - subdivision of project scope into tasks/subtasks
  - milestones
  - task attributes
- A task or activity is an element of the work breakdown structure that has
  - expected duration
  - cost
  - resource requirements
- Task definition should be complemented with supporting explanations (WBS Dictionary) to elaborate all work to be done so you can develop more realistic duration estimates



Milestones

- A milestone is a significant event that normally has 0 duration in the WBS
- It often takes several activities to complete a milestone
- Milestones are useful tools for setting schedule goals and monitoring project progress
- Usually, completion of a milestone is confirmed by a client's signature in the project document



Task Mc	Task Name	Duration	Start	Finish	Predecessors	Re Na
	1 Analysis	**9 days**	**Mon 30/03/2**	**Thu 9/04/20**		
	1.1 Collect user requirements	2 days	Mon 30/03/20	Tue 31/03/20		Al
	1.2 Functional specifications	5 days	Wed 1/04/20	Tue 7/04/20	2	Al
	1.3 Confirm requirements	2 days	Wed 8/04/20	Thu 9/04/20	3	Al
	2 Requirements completed	0 days	Thu 9/04/20	Thu 9/04/20	1	

Three types of Dependencies

- Some project activities may depend on other activities so that they scheduling needs to follow certain logic
  - **Mandatory dependencies:** are referred to as hard logic

    Example: you cannot integrate a module into a system until the module is implemented
  - **Discretionary dependencies:** are referred to as soft logic defined by the project team. They should be used with care since they may limit later scheduling options

    Example: a team may prefer developing GUI before an SQL query module
  - **External dependencies:** define relationships between a project activity and external factors

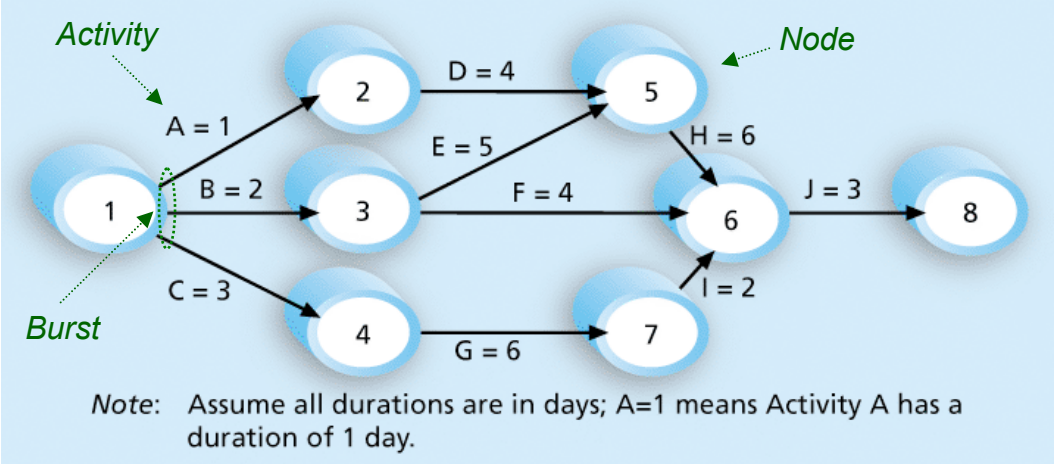
    Example: a system may be installed on client computers only after they have been delivered by suppliers

    External tasks are passive tasks with no active work done by project teams

Network Diagrams: AOA

- A network diagram is a schematic display of the logical relationships between project activities
- Network diagrams are the preferred technique for visualizing activity sequencing
- Activity-On-Arrow network diagrams represent activities by arrows

- *Activity* – work to be done before the project is completed
- *Node* – to link related activities
- *Bursts* - a single node is followed by two or more activities
- *Merge* - two or more nodes precede a single node



- For large projects with a big number of activities, it's better to add only summary tasks to a AOA diagram, or use several AOA diagrams

Network Diagrams: PDM

- AOA network diagrams can only show finish-to-start dependencies
- Precedence Diagramming Method (PDM) is more flexible and can show all possible types of dependencies between project activities
- Activities are represented in PDM by boxes
- Arrows show relationships between activities
- PDM is more popular than AOA and is commonly used by project management software, including MS Project
- More intuitive and easier to interpret

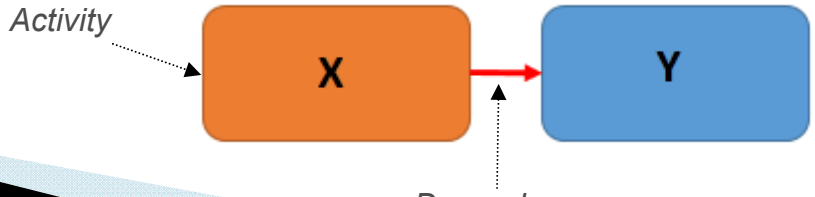
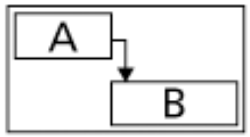
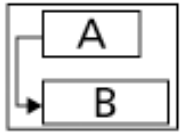
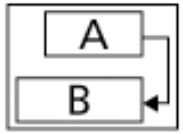


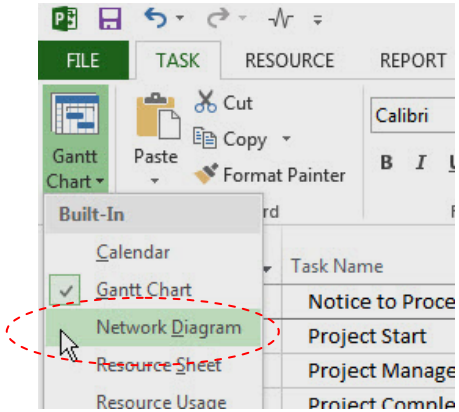
Figure 6-3. Task Dependency Types

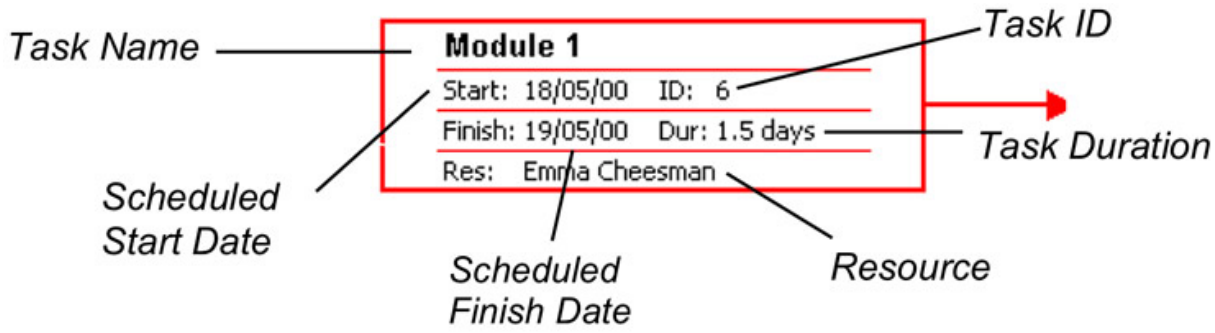
Task dependencies

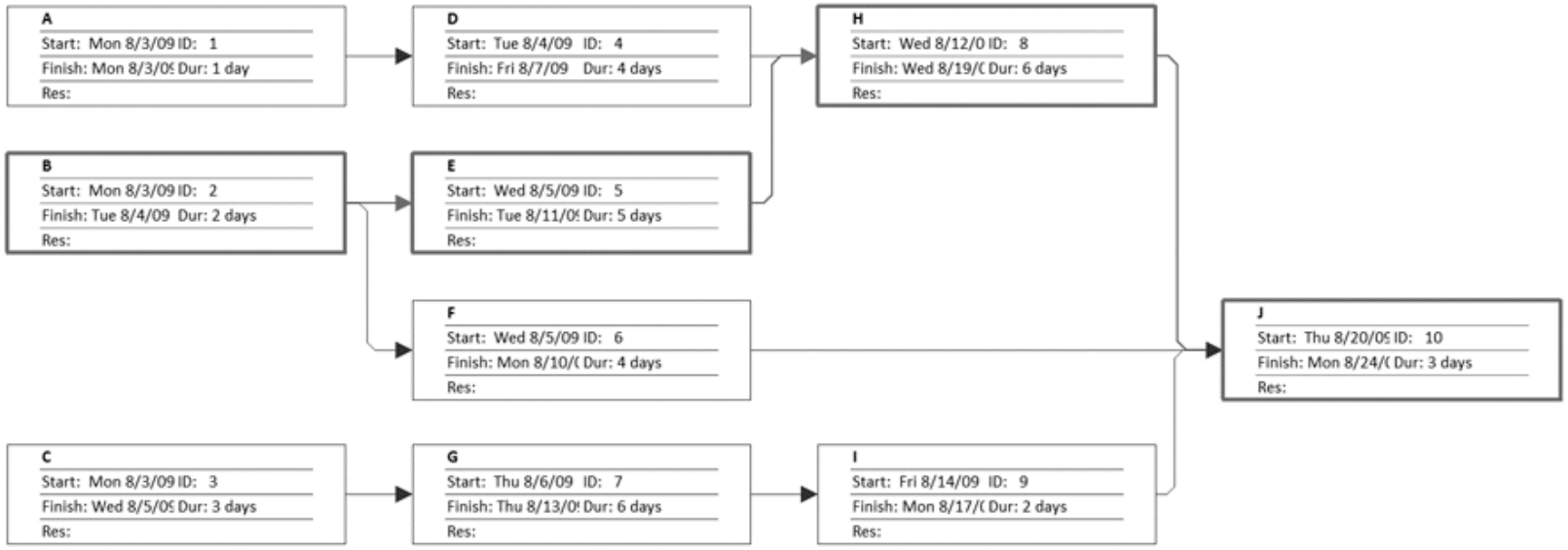
The nature of the relationship between two linked tasks. You link tasks by defining a dependency between their finish and start dates. For example, the "Contact caterers" task must finish before the start of the "Determine menus" task. There are four kinds of task dependencies in Microsoft Project.

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.

Precedence Network Diagrams







Estimating Activity Resources

- Before estimating activity (task) durations, you should have a good idea of the quantity and type of resources that will be assigned to each activity
- Resources are people, equipment, and materials
- Consider important issues in estimating resources
  - How technically difficult is the task?
  - What is the organization's history in doing similar activities?
  - Are the required resources available?
- A resource breakdown structure is a hierarchical structure that lists required resources by category and type

```
Resource Breakdown Structure

1. Human Resources
   1.1 Manager
         1.1.2 Business analyst
         1.1.3 Programming team
               1.1.3.1 Software Engineer (4)
               1.1.3.2 UI Designer
               1.1.3.3 System architect
         1.1.4 Hardware team
               1.1.4.1 HW system architect
               1.1.4.2 Technician
2. Equipment
    .   .   .   .
```

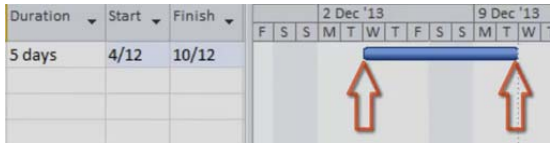
Activity Duration Estimating

- To avoid mistakes in project scheduling, you need to understand the difference between Effort (Work), Duration and Span (Elapsed time)
  - **Effort (Work)** is the number of workdays or work hours required to complete a task

    Example: 40 hrs are needed to implement a network module
  - **Duration** includes the amount of time that can be allocated to complete a task

    Example: A network module has to be implemented within 5 days

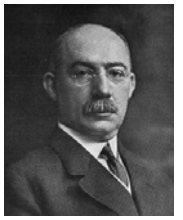
    Thus, 40hrs / (5* 8hrs) = 1 programmer can be assigned to this task
  - **Span** includes all calendar days (duration + weekends)



Activity Duration is 5 days
Activity Span (Elapsed Time) is 7 calendar days

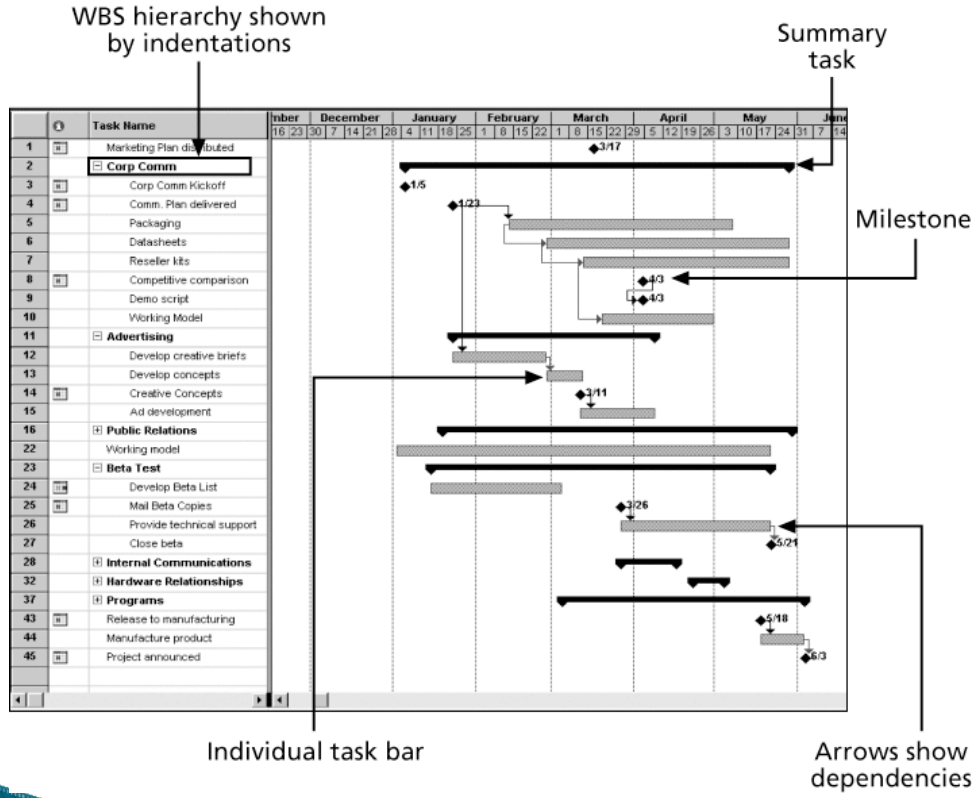
The column Work is not displayed by default

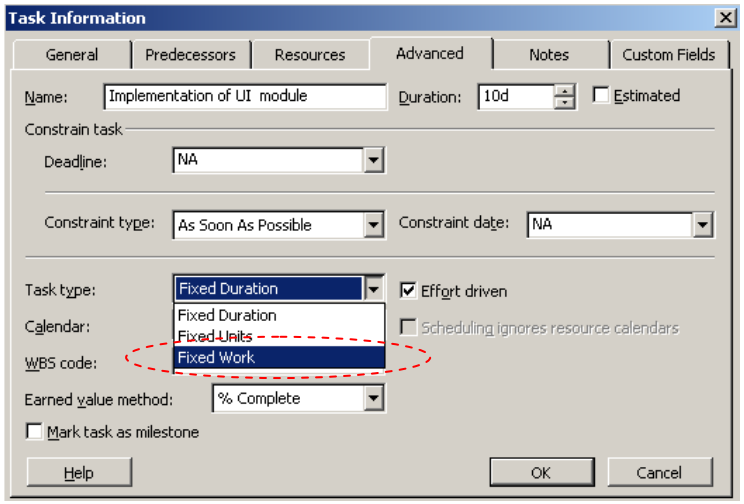
Gantt Charts



Henry Gantt

- A Gantt chart is a bar chart that shows a project schedule





- *Work = Duration * UnitsOf(8hr/day)*
- If you set a Fixed Work task
  - Work will become fixed
  - If you allocate more staff to work on the task, Duration will be automatically recalculated

Video recording module	10 days	Fri 17/04/20	Thu 30/04/20	80 hrs	Alex
Video recording module	5 days	Fri 17/04/20	Thu 23/04/20	80 hrs	Alex,Peter

Tracking Gantt Charts

- WBS and Gantt chart that you create and save before the project execution begins are called the baseline
- To monitor project progress, you can analyse the differences between the baseline and actually completed work and milestones
- Tracking Gantt charts displays two charts, one on top of the other
- Grey bars show baseline start and finish dates, while the blue bars show actual start and finish dates

To display Tracking Gantts
- Select the View tab
- Select Tracking Gantt option from the Gantt Chart drop down menu

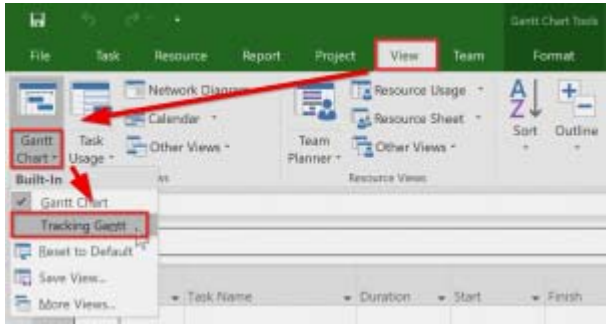
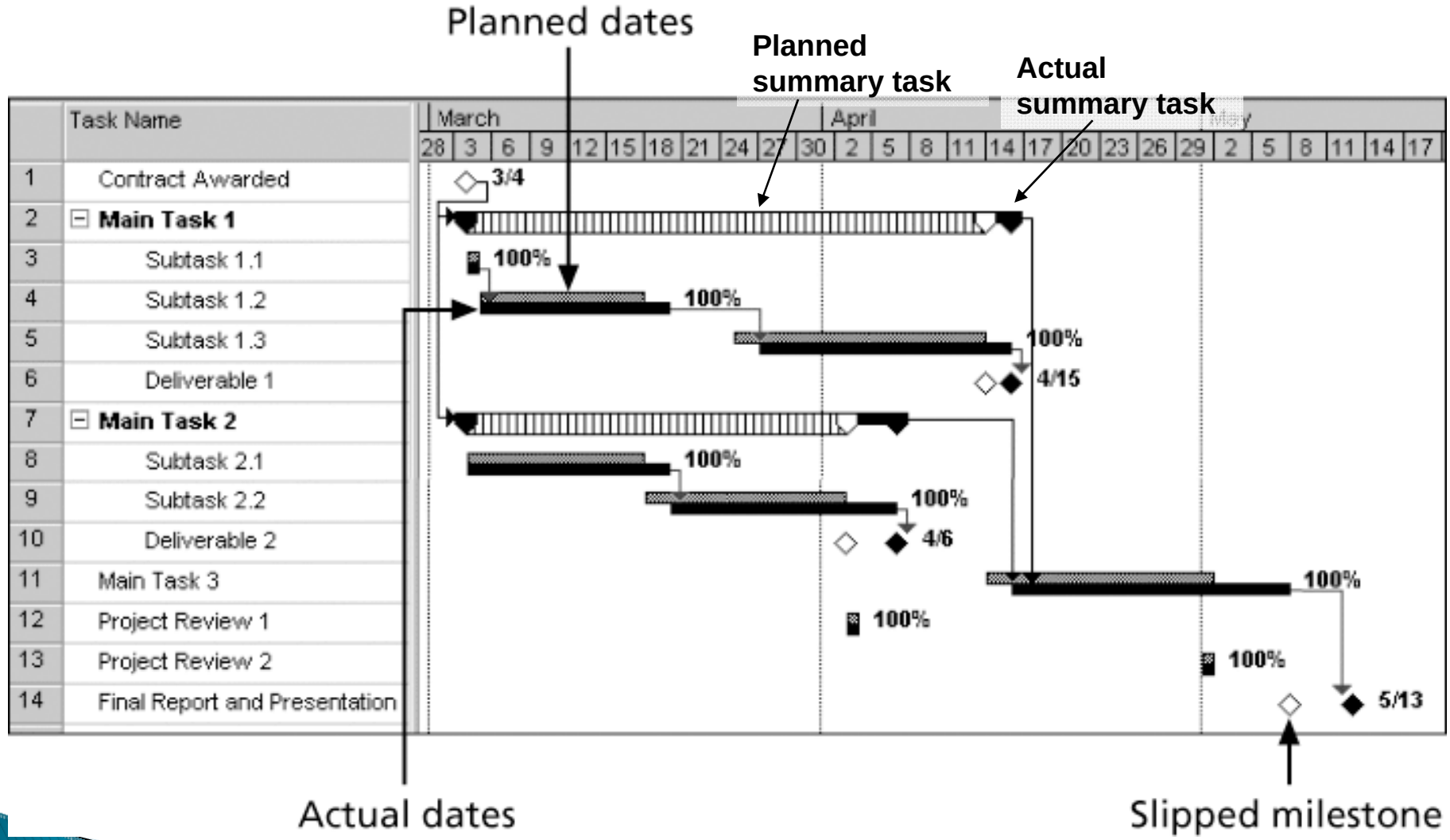
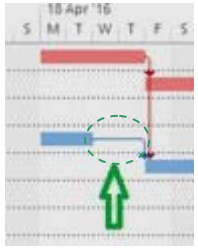


Figure 6-7. Sample Tracking Gantt Chart



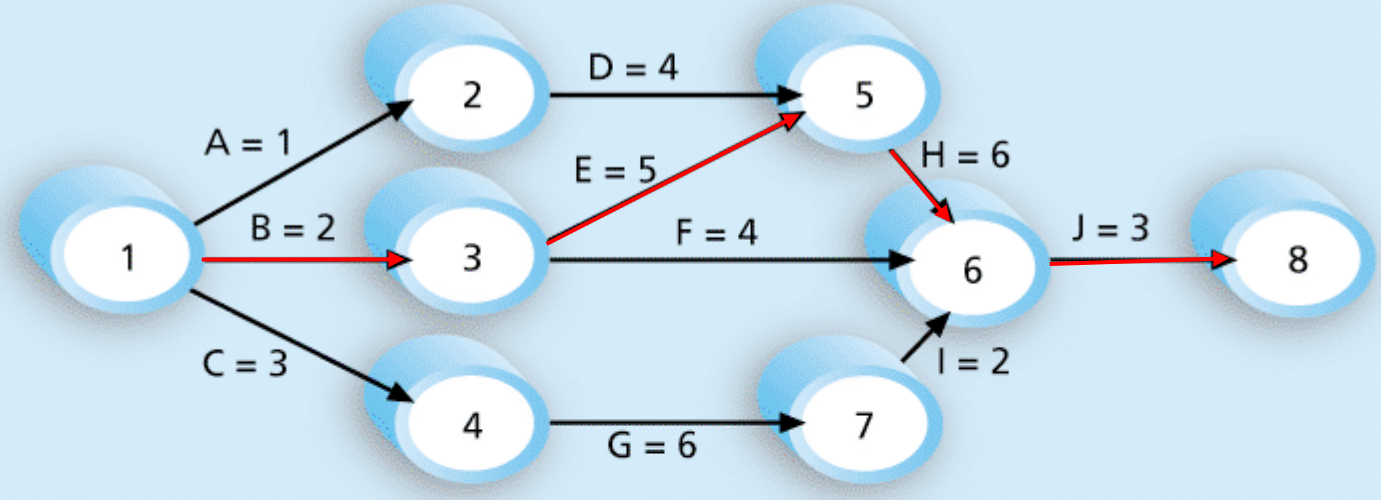
Critical Path Method (CPM)

- Actual duration of project activities may have different effect on the actual project duration
- **CPM** is a network diagramming technique used to predict total project duration
- A **critical path** for a project is a sequence of activities that determines the earliest time by which the project can be completed
- The critical path is the longest path through the network diagram and has the least amount of slack (or float)
- Slack, also called float, is the amount of time a task can slip before it bumps into another task



Slack

Figure 6-8. Determining the Critical Path for Project X

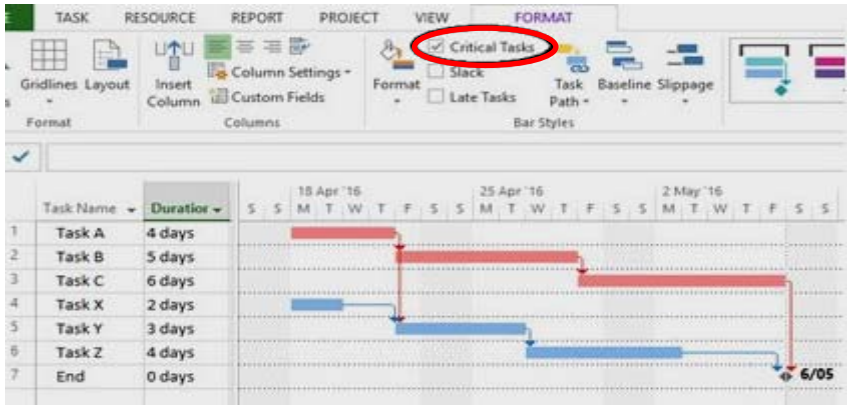


Note: Assume all durations are in days.

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

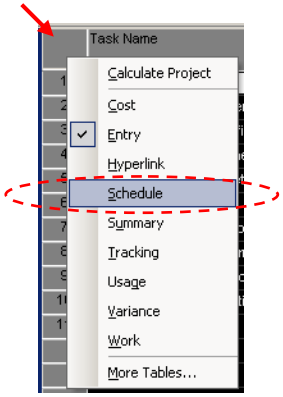
Since the critical path is the longest path through the network diagram, Path 2, B-E-H-J, is the critical path for Project X.

Critical Path Method (CPM)



- Tick the Critical Tasks box in the Format tab to display the critical path
- The critical path is searched automatically and then shown in red
- If any of the activities on the critical path change, the end date of the project will be affected

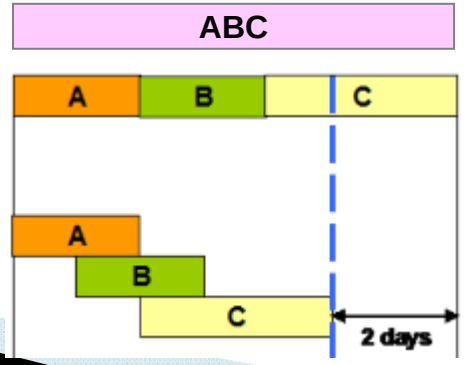
RMB



- Free Slack indicates how many working days this task can be delayed before it starts delaying a subsequent task
- Total Slack indicates how many days this task can be delayed before its impact on other tasks will affect the project duration

Using the Critical Path to Shorten a Project Schedule

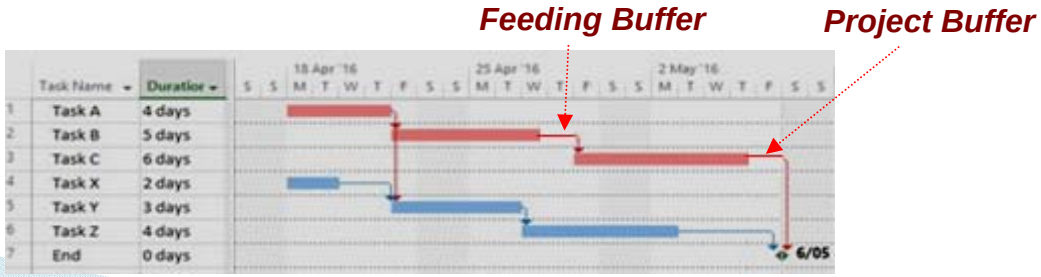
- Requests to finish projects earlier are quite common
- You cannot simply ignore all of these requests
- Three main techniques for shortening schedules
  - **Crashing** : Add extra resource to a critical path task to reduce its duration. '*Double the workers and half the duration*' is not always the case in reality
  - **Task splitting and overlapping :** Take a large task and to split it down into several smaller tasks each of which could start ahead of the completion of the previous one.



Buffers and Critical Chain

"If something can go wrong, it will"

- Slipped tasks along the critical path delay projects
- A buffer is additional time to complete a critical task
- Some managers add a buffer to each project task regardless if it's on the critical path or not
- Critical chain scheduling removes buffers from individual tasks and instead creates
  - Project Buffer is additional time added before the project's due date
  - Feeding Buffers is additional time added before tasks which belong to the critical path



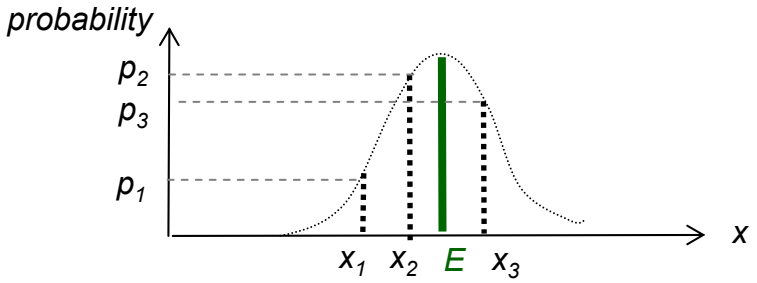
Program Evaluation and Review Technique (PERT)

- PERT is an analysis technique used to estimate task duration when there is a high degree of uncertainty about estimation of its duration
- PERT uses a probabilistic method that is based on using
  - optimistic
  - most likely
  - pessimistic

  estimates of activity durations (a three-point estimate)

The mathematical expectation (average) of a random variable x

$$E = \Sigma x_i p_i$$



PERT Formula and Example

- PERT weighted average **=**

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

- Example:

PERT weighted average =

$$\frac{8 \text{ workdays} + 4 * 10 \text{ workdays} + 24 \text{ workdays}}{6} = \textbf{12 days}$$

where optimistic time= 8 days

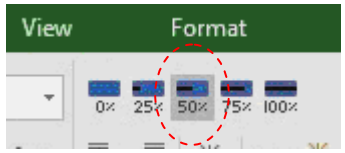
most likely time = **10 days**, and

pessimistic time = 24 days

Therefore, you'd use **12 days** on the network diagram instead of 10 when using PERT for the above example

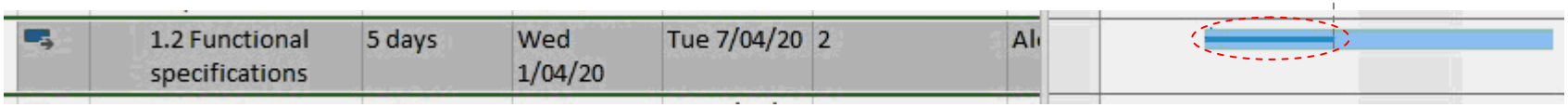
Controlling the Schedule

- It is important to monitor the status of the schedule, influence factors that cause schedule changes, determine that the schedule has changed, and manage changes when they occur
- Tools and techniques include
  - Project progress reports
  - Interaction with relevant stakeholders
  - Project management software



tracking the differences between the baseline and actually completed work

current date



tracking completion of an individual task

Chapter Summary

- Project time management is often cited as the main source of conflict on projects, and most IT projects exceed time estimates
- Main processes include
  - Plan schedule management
  - Define activities
  - Sequence activities
  - Estimate activity resources
  - Estimate activity durations
  - Develop schedule
  - Control schedule

Chapter 6: Project Time Management