University of Malaya

Course Title :

Software Development Management
(WXGC6106)

Week 7

Project Time Management

(Information Technology Project Management)
Chapter 6

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Learning Objectives

- Understand the importance of project schedules and good project time management
- Define activities as the basis for developing project schedules
- Describe how project managers use network diagrams and dependencies to assist in activity sequencing
- Understand the relationship between estimating resources and project schedules
- Explain how various tools and techniques help project managers perform activity duration estimating

Learning Objectives (Continued)

- Use a Gantt chart for planning and tracking schedule information, find the critical path for a project, and describe how critical chain scheduling and the Program Evaluation and Review Technique (PERT) affect schedule development
- Discuss how reality checks and people issues are involved in controlling and managing changes to the project schedule
- Describe how project management software can assist in project time management and review words of caution before using this software

Importance of Project Schedules

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.

Schedule issues are the main reason for conflicts on projects, especially during the second half of projects

Individual Work Styles and Cultural Differences Cause Schedule Conflicts

One dimension of the Meyers-Briggs Type Indicator focuses on peoples' attitudes toward structure and deadline

Some people prefer to follow schedules and meet deadlines while others do not (J vs. P)

Difference cultures and even entire countries have different attitudes about schedules

Project Time Management Processes

Defining activities: identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables

Sequencing activities: identifying and documenting the relationships between project activities

Estimating activity resources: estimating how many **resources** a project team should use to perform project activities

Estimating activity durations: estimating the number of work periods that are needed to complete individual activities

Developing the schedule: analyzing activity sequences, activity resource estimates, and activity duration estimates to create the project schedule

Controlling the schedule: controlling and managing changes to the project schedule

Project Time Management Summary

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

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

Project Start → **Project Finish**

Defining Activities

An **activity** or **task** is an element of work normally found on the work breakdown structure (WBS) that has an expected duration, a cost, and resource requirements

Activity definition involves developing a more detailed WBS and supporting explanations to understand all the work to be done so you can develop realistic cost and duration estimates

Activity Lists and Attributes

An **activity list** is a tabulation of activities to be included on a project schedule that includes:

- The activity name
- An activity identifier or number
- A brief description of the activity

Activity attributes provide more information such as predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity

Milestones

A **milestone** is a significant event that normally has no duration.

It often takes several activities and a lot of work to complete a milestone.

They're useful tools for setting schedule goals and monitoring progress.

Examples include obtaining customer sign-off on key documents or completion of specific products

Sequencing Activities

Involves reviewing activities and determining dependencies

A **dependency** or **relationship** is the sequencing of project activities or tasks
You *must* determine dependencies in order to use critical path analysis

Three types of Dependencies

Mandatory dependencies: inherent in the nature of the work being performed on a project, sometimes referred to as hard logic

Discretionary 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

External dependencies: involve relationships between project and non-project activities

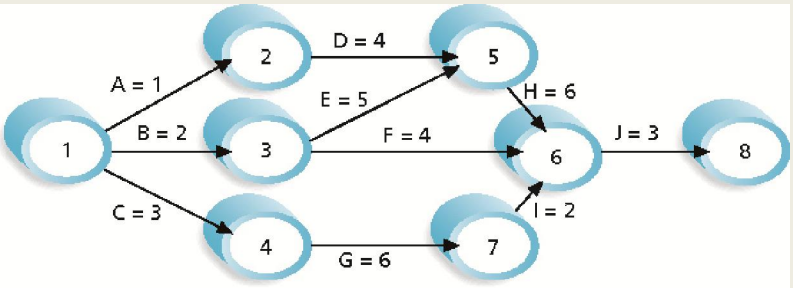
Network Diagrams

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

Two main formats are the arrow and precedence diagramming methods

Sample Activity-on-Arrow (AOA) Network Diagram for Project X



Note: Assume all durations are in days; A=1 means Activity A has a duration of 1 day.

Arrow Diagramming Method (ADM)

Also called activity-on-arrow (AOA) network diagrams

Activities are represented by arrows

Nodes or circles are the starting and ending points of activities

Can only show finish-to-start dependencies

Process for Creating AOA Diagrams

1. Find all of the activities that start at node 1. Draw their finish nodes and draw arrows between node 1 and those finish nodes. Put the activity letter or name and duration estimate on the associated arrow.

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

3. Continue drawing the project network diagram until all activities are included on the diagram that have dependencies.

4. As a rule of thumb, all arrowheads should face toward the right, and no arrows should cross on an AOA network diagram.

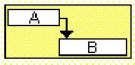
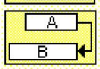
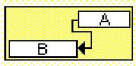
Precedence Diagramming Method (PDM)

- Activities are represented by boxes
- Arrows show relationships between activities
- More popular than ADM method and used by project management software
- Better at showing different types of dependencies

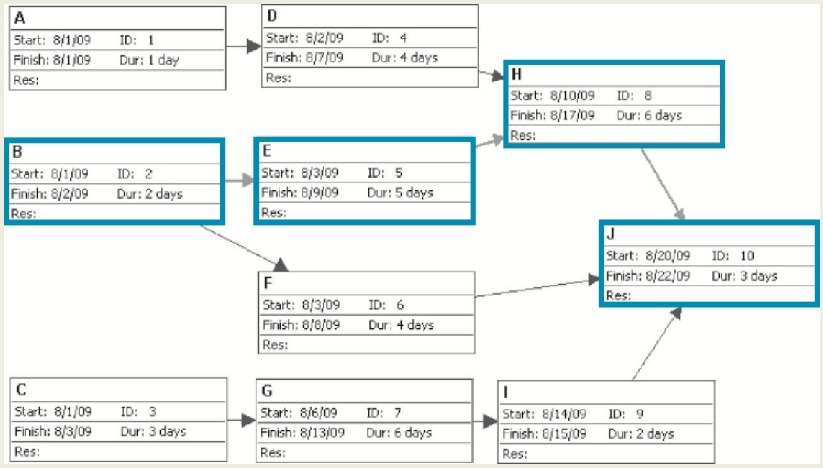
Task Dependency Types

Task dependencies

The nature of the dependencies between 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.

Sample PDM Network Diagram



Estimating Activity Resources

Before estimating activity durations, you must 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 difficult will it be to do specific activities on this project?
- What is the organization's history in doing similar activities?
- Are the required resources available?

A **resource breakdown structure** is a hierarchical structure that identifies the project's resources by category and type

Activity Duration Estimating

Duration includes the actual amount of time worked on an activity *plus* elapsed time

Effort is the number of workdays or work hours required to complete a task

Effort does not normally equal duration

People doing the work should help create estimates, and an expert should review them

Three-Point Estimates

Instead of providing activity estimates as a discrete number, such as four weeks, it's often helpful to create a **three-point estimate**

> An estimate that includes an **optimistic**, **most likely**, and **pessimistic estimate**, such as three weeks for the optimistic, four weeks for the most likely, and five weeks for the pessimistic estimate

Three-point estimates are needed for PERT and Monte Carlo simulations

Developing the Schedule

Uses results of the other time management processes to determine the start and end date of the project

Ultimate goal is to create a realistic project schedule that provides a basis for monitoring project progress for the time dimension of the project

Important tools and techniques include Gantt charts, critical path analysis, and critical chain scheduling, and PERT analysis

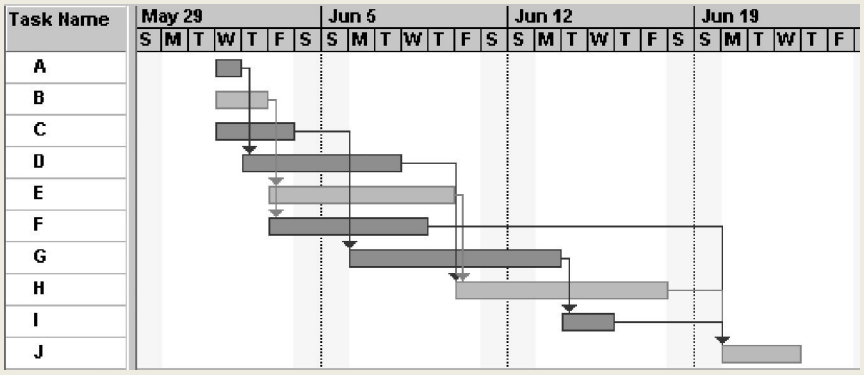
Gantt Charts

Gantt charts provide a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in a calendar format

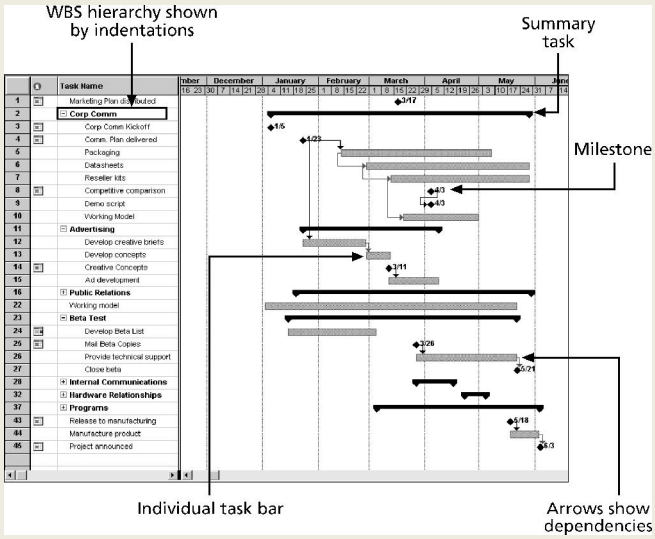
Symbols include:

Black diamonds: milestones
Thick black bars: summary tasks
Lighter horizontal bars: durations of tasks
Arrows: dependencies between tasks

Gantt Chart for Project X



Gantt Chart for Software Launch Project



Adding Milestones to Gantt Charts

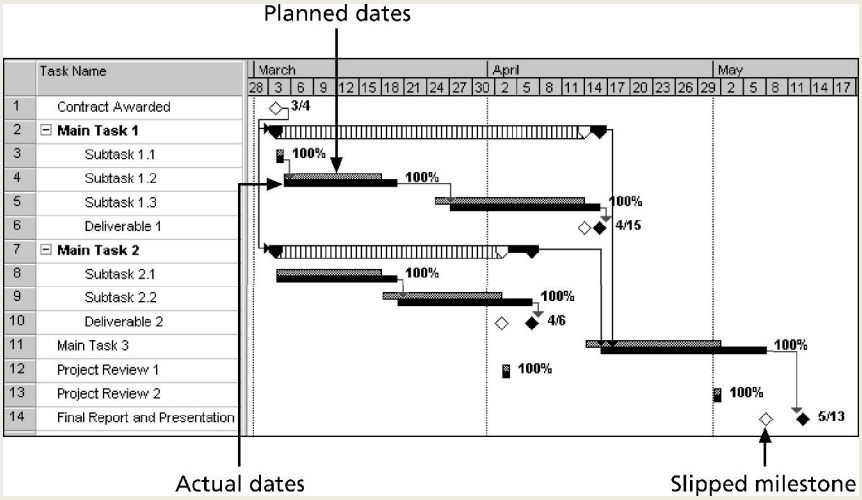
Many people like to focus on meeting milestones, especially for large projects
Milestones emphasize important events or accomplishments on projects
Normally create milestone by entering tasks with a zero duration, or you can mark any task as a milestone

SMART Criteria

Milestones should be:

- **S**pecific
- **M**easurable
- **A**ssignable
- **R**ealistic
- **T**ime-framed

Sample Tracking Gantt Chart



Critical Path Method (CPM)

CPM is a network diagramming technique used to predict total project duration

A **critical path** for a project is the series of activities that determines the *earliest time* by which the project can be completed

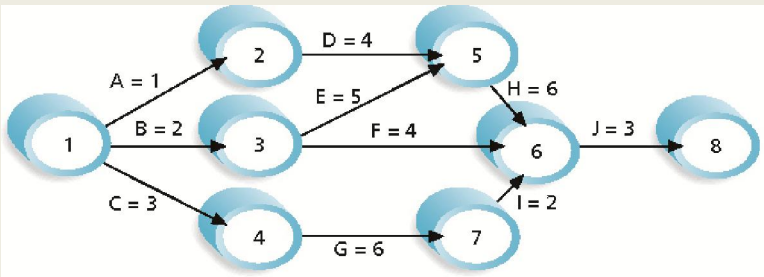
The critical path is the *longest path* through the network diagram and has the least amount of slack or float

Slack or **float** is the amount of time an activity may be delayed without delaying a succeeding activity or the project finish date

Calculating the Critical Path

- First develop a good network diagram
- Add the duration estimates for all activities on each path through the network diagram
- The 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

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.

Using Critical Path Analysis to Make Schedule Trade-offs

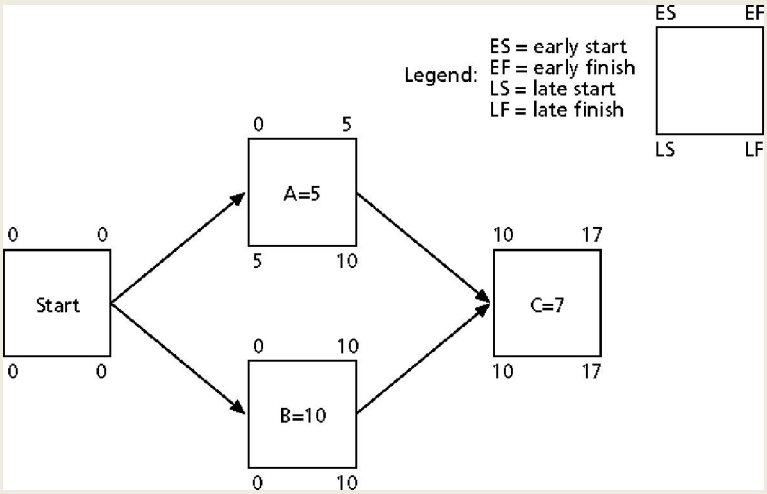
Free slack or **free float** is the amount of time an activity can be delayed without delaying the early start of any immediately following activities

Total slack or **total float** is the amount of time an activity may be delayed from its early start without delaying the planned project finish date

A **forward pass** through the network diagram determines the early start and finish dates

A **backward pass** determines the late start and finish dates

Calculating Early and Late Start and Finish Dates



Using the Critical Path to Shorten a Project Schedule

Three main techniques for shortening schedules

Shortening durations of critical activities/tasks by adding more resources or changing their scope

Crashing activities by obtaining the greatest amount of schedule compression for the least incremental cost

Fast tracking activities by doing them in parallel or overlapping them

Program Evaluation and Review Technique (PERT)

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 uses **probabilistic time estimates**

Duration estimates based on using optimistic, most likely, and pessimistic estimates of activity durations, or a three-point estimate

PERT weighted average = $\frac{\text{optimistic time} + 4X \text{ most likely time} + \text{pessimistic time}}{6}$

Example:

PERT weighted average = $\frac{8 \text{ workdays} + 4 \text{ X } 10 \text{ workdays} + 24 \text{ workdays}}{6}$ = **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

Schedule Control Suggestions

- Perform reality checks on schedules
- Allow for contingencies
- Don't plan for everyone to work at 100% capacity all the time
- Hold progress meetings with stakeholders and be clear and honest in communicating schedule issues

Controlling the Schedule

Goals are to know 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:

- Progress reports
- A schedule change control system
- Project management software, including schedule comparison charts like the tracking Gantt chart
- Variance analysis, such as analyzing float or slack
- Performance management, such as earned value (Chapter 7)

Any questions?

You can download the slides in following link (My Billboard section):

http://www.malaysianexpert.com.my/UL/Profile.aspx?MID=1