Lecture 10
8. Project Time Management

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Introduction

- • Processes required to manage timely completion of the project.
- • Processes involved in the project time management include:
- ◦ Define Activities
- ◦ Sequence Activities
- ◦ Estimate Activity Resources
- ◦ Estimate Activity Durations
- ◦ Develop Schedule
- ◦ Control Schedule
- • Each of these processes occur at least once in every project and in one or more project phases (if the project is divided into phases).

Activity Definition

- An activity or task is an element of work normally found on the WBS that has an expected duration, a cost, and resource requirements.
- Project schedules grow out of the basic documents that initiate a project.
  - The project charter includes start and end dates and budget information.
  - The scope statement and WBS help define what will be done.
- 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 Definition

Activity Definition Overview		
Inputs	Tools and Techniques	Output
1. Project Environmental Factors 2. Organizational Process Assets 3. Project Scope Statement 4. WBS 5. WBS Dictionary 6. Project Scope Management Plan	1. Decomposition 2. Templates 3. Rolling Wave Plan 4. Expert Judgment 5. Planning Components	1. Activity List 2. Activity Attributes 3. List of Milestones 4. Requested Changes

Decomposition of Activities

Features of Decomposition of Activities

- Sub divide work packages into Schedule Activities.
- Define Activities to meet project objectives.
- Activities should be relatively smaller and manageable components.
- Activities may be work packages or lower level items.
- WBS and Activity list may be developed sequentially or concurrently.

Activity Attributes

- An activity list is a tabulation of activities to be included on a project schedule. The list should include:
  - The activity name
  - An activity identifier or number
  - A brief description of the activity
- Activity attributes provide more information about each activity, such as predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity.

Activity Attributes

Activity Attributes Chart		
Activity Name and Description	Deliverables and Acceptance Criteria	Cost Data
Resource Requirements	Dependencies	
Schedule Data	Responsibilities (Individual and Organizational)	Risk and Constraints
Comments		

Activity Sequencing

Activity Sequencing Overview		
Inputs	Tools and Techniques	Outputs
1. Project Scope Statement 2. Activity List 3. Activity Attributes 4. List of Milestones 5. Approved Change Requests	1. Precedence Diagramming Method 2. Arrow Diagramming Method 3. Schedule Network Templates 4. Dependency Determination 5. Apply Leads and Lags	1. Project Schedule Network Diagram 2. Updates Activity List 3. Updates Activity Attributes 4. Requested Changes

Network Diagram

- 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.

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.

Arrow Diagramming Method (ADM)

- Also called activity-on-arrow (AOA) network diagram.
- Activities are represented by arrows.
- Nodes or circles are the starting and ending points of activities.
- Can only show finish-to-start dependencies.

Activity Resource Estimating

- Before estimating activity durations, you must have a good idea of the quantity and type of resources that will be assigned to each activity.
- Consider important issues in estimating resources:
  - How difficult will it be to complete specific activities on this project?
  - What is the organization's history in doing similar activities?
  - Are the required resources available?

Activity Resource Estimating Overview

Activity Resource Estimating Overview		
Inputs	Tools and Techniques	Outputs
1. Enterprise Environment Factor 2. Organizational Process Assets 3. Activity List 4. Activity Attributes 5. Resource Availability 6. Project Management Plan	1. Expert Judgment 2. Alternative Analysis 3. Published Estimating Data 4. Project Management Software 5. Bottom-up Estimating	1. Activity Resource Requirement 2. Updated Activity Attributes 3. Resource Breakdown Structure 4. Updated Resource Calendar 5. Requested Changes

Activity Duration Estimating

- Duration includes the actual amount of time worked on an activity plus the 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.

Activity Duration Estimating Overview

Activity Duration Estimating Overview		
Inputs	Tools and Techniques	Outputs
1. Enterprise Environmental Factor 2. Organizational Process Assets 3. Project Scope Statement 4. Activity List 5. Activity Attribute 6. Activity Resource Requirement 7. Resource Calendar 8. Project Management Plan -- Risk Register -- Activity cost estimates	1. Expert Judgment 2. Analogous Estimating 3. Parametric Estimating 4. Three Point Estimating 5. Reserve Analysis	1. Activity Duration Estimates 2. Updated Activity Attributes

Multi(Three) Point Estimating

- 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 estimates and Monte Carlo simulations.

Reserve Time

- A reserve time is a percentage of the project duration or a preset number of work periods and is usually added to the end of the project schedule.
- Reserve time may also be added to individual activity durations based on risk or uncertainty in the activity duration. When activities are completed late, the additional time for the activity is subtracted from the reserve time.
- As the project moves forward, the reserve time can be reduced or eliminated as the project manager sees fit.
- Reserve time decisions should be documented.

Schedule Development

- Uses results of the other time management processes to determine the start and end dates 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, critical chain scheduling, and PERT analysis.

Schedule Development(contd.)

- To develop a schedule, one needs to
  - Define the activities (WBS),
  - Put them in order of how the work will be done (activity sequencing), and then
  - Estimate the duration of each activity (activity duration estimating).

Schedule Development

Schedule Development		
Inputs	Tools and Techniques	Outputs
1. Organizational Process Assets 2. Project Scope Statement 3. Activity List 4. Activity Attributes 5. Project Schedule Network Diagram 6. Resource Calendar 7. Activity Duration Estimates 8. Project Management Plan --Risk Register	1. Schedule Network 2. Critical Path Method 3. Schedule Compression 4. What-If scenario Analysis 5. Resource Leveling 6. Critical chain Method 7. Project Management Software 8. Applying Calendars 9. Adjusting Leads and Lags 10. Schedule Model	1. Project Schedule 2. Schedule Model Data 3. Schedule Base Line 4. Updated Resource Requirements 5. Updated Activity Attributes 6. Updated Project Calendar 7. Requested Changes 8. Updated Project Management Plan -Updated Schedule Management Plan

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.
- Milestones are useful tools for setting schedule goals and monitoring progress.
- Examples include completion and customer sign-off on key documents and completion of specific products.

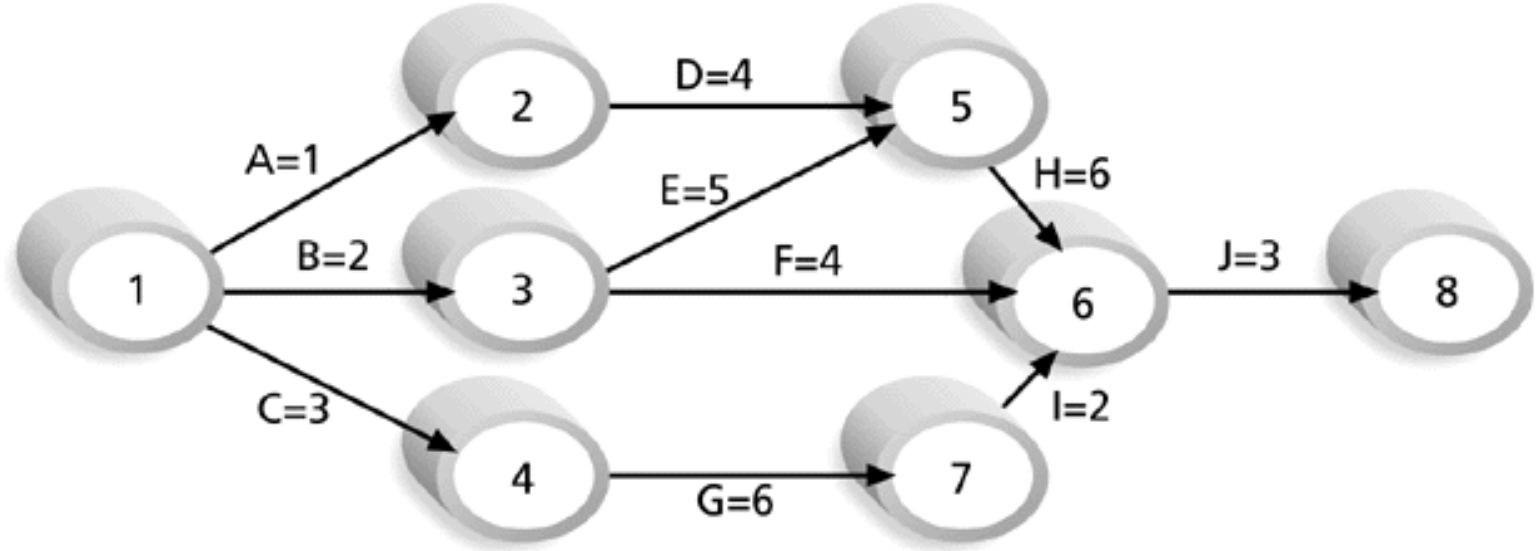
Critical Path Method (CPM)

- 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 can be delayed without delaying a succeeding activity or the project finish date.

Calculating the Critical Path

- 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.

Figure 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.

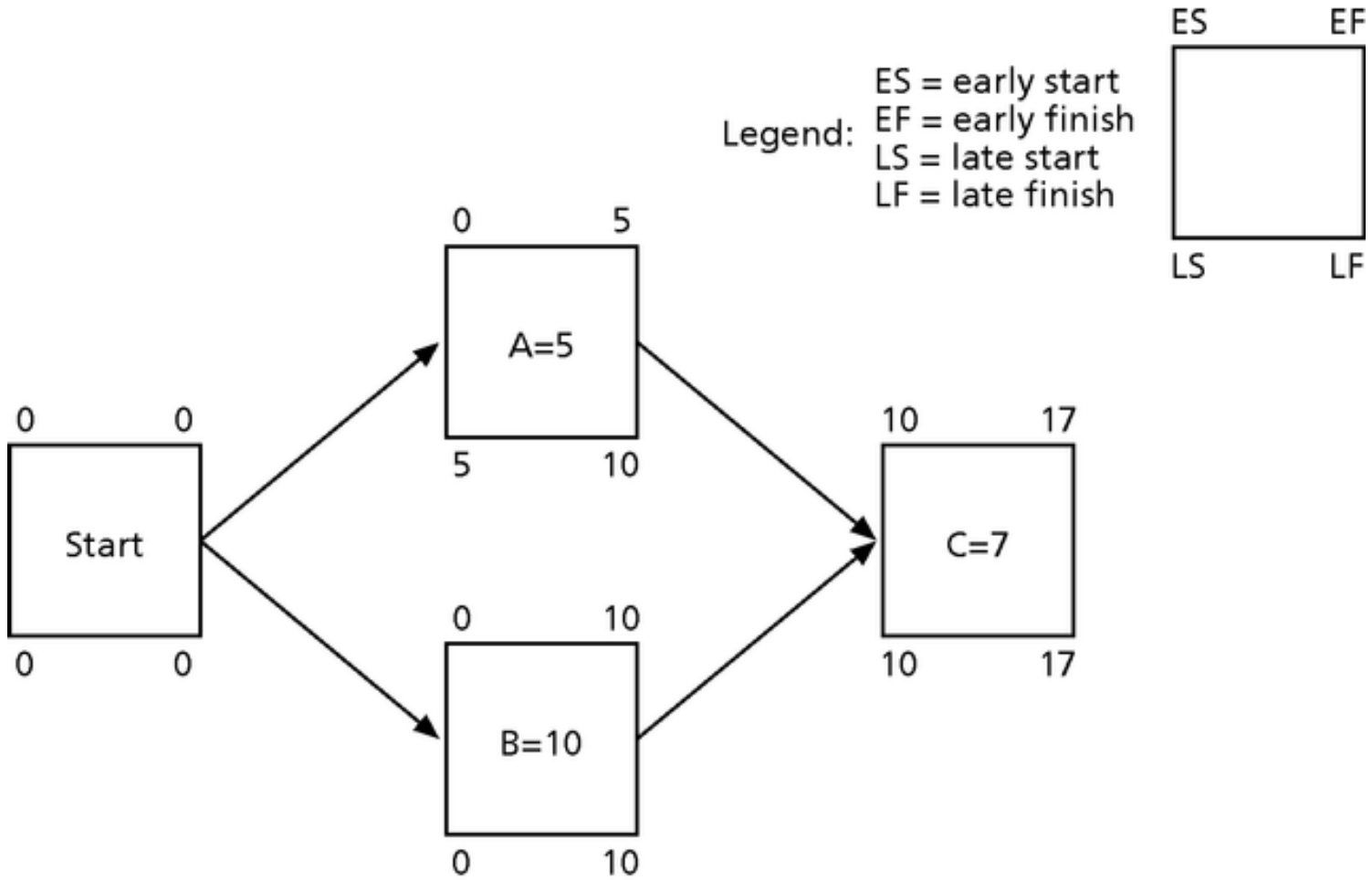
More on the Critical Path

- A project team at Apple computer put a stuffed gorilla on top of the cubicle of the person who was currently managing a critical task.
- The critical path does not necessarily contain all the critical activities; it only accounts for time.
  - Remember the example in which growing grass was on the critical path for Disney's Animal Kingdom.
- There can be more than one critical path if the lengths of two or more paths are the same.
- The critical path can change as the project progresses.

Using CP 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 can 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

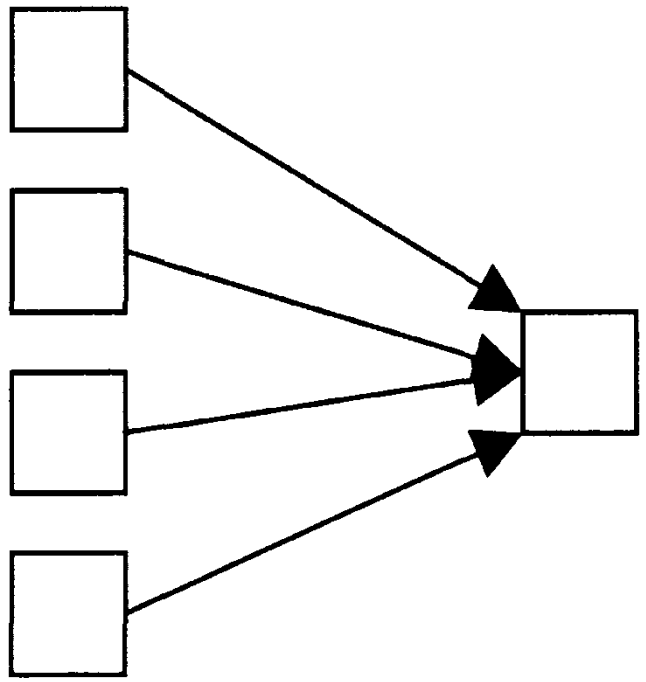


Float

- Total Float $F_T=(T_L^j-T_E^i)-t^{ij}$
- Free Float $F_F=(T_E^j-T_E^i)-t^{ij}$
- Independent Float $F_{ID}=(TE^j-TL^i)-t^{ij}$
- Interfering Float $F_{IN}=F_T-F_F$

Monte Carlo Simulation

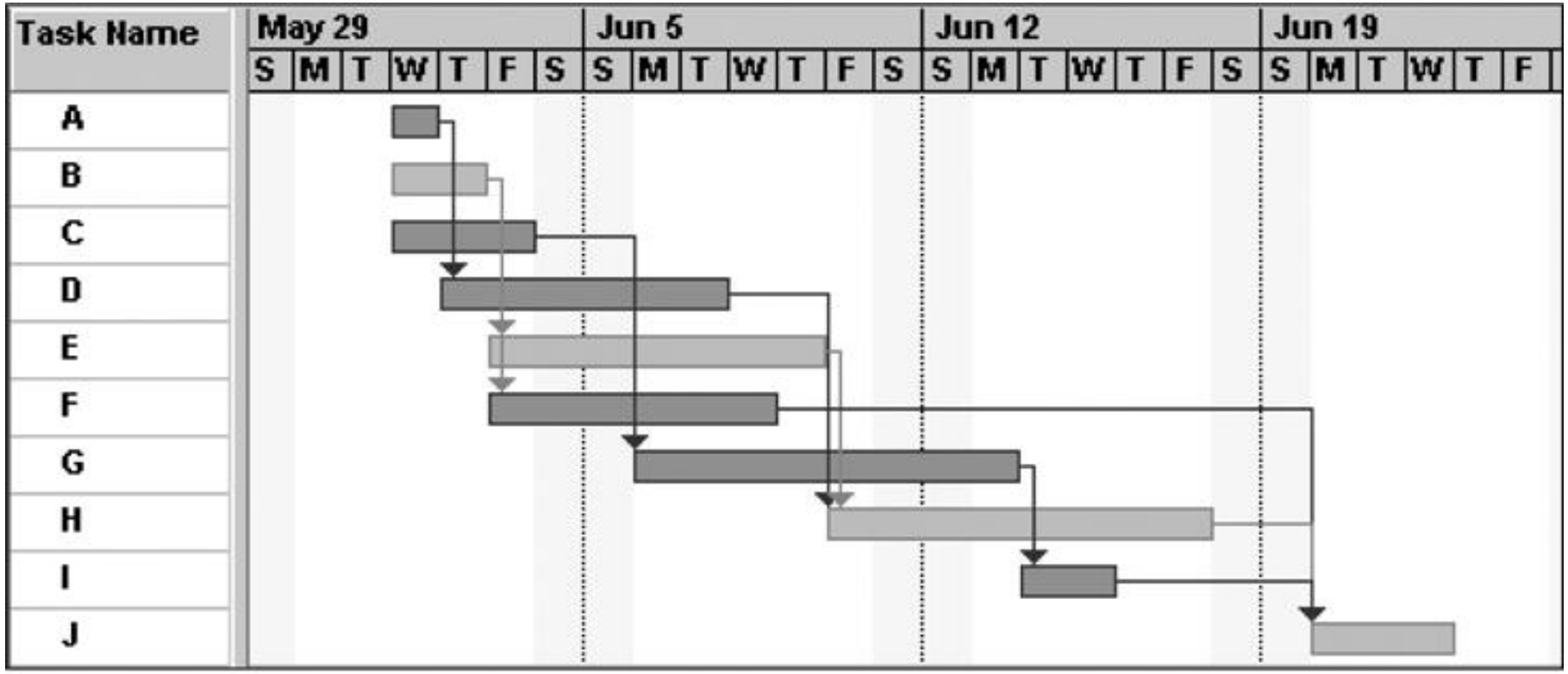
- The simulation can tell you:
- The probability of completing the project on any specific day
- The probability of completing the project for any specific amount of cost
- The probability of any task actually being on the critical path
- The overall project risk



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.

Gantt Chart for Project X



Note: In Project 2003 darker bars are red to represent critical tasks.

Adding Milestones to Gantt Charts

- Many people like to focus on meeting milestones, especially for large projects.
- Milestones emphasize important events or accomplishments in projects.
- You typically create milestone by entering tasks that have a zero duration, or you can mark any task as a milestone.

Schedule Control

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

Schedule Control

Schedule Control Overview		
Inputs	Tools and Techniques	Outputs
1. Schedule Management Plan 2. Schedule Baseline 3. Performance Reports 4. Approved Change Requests	1. Progress Reporting 2. Schedule change Control System 3. Performance Management 4. Project Management Software 5. Variance Analysis 6. Schedule Comparison Bar Chart	1. Updated Schedule Model Data 2. Updated Schedule Baseline 3. Performance Measurements 4. Requested Changes 5. Recommended Corrective Actions 6. Updated Organizational Process Assets 7. Updated Activity List 8. Updated Activity Attributes 9. Updated Project Management Plan

Schedule Control

- 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, such as the tracking Gantt chart.
  - Variance analysis, such as analyzing float or slack.
  - Performance management, such as earned.

Reality Checks on Scheduling

- 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.

For your Patience!

THANK YOU