Software Engineering

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Software Project Management and Estimation

Software Estimation:

How much did Windows Vista Cost?

Remember, it was extended from Windows XP

Software Estimation: Windows Vista

According to The Seattle Times, Microsoft took 10,000 employees about five years to ship Vista. If each employee costs Microsoft about $200,000 a year, the estimated payroll costs alone for Windows Vista hover around $10 billion.

Software Estimation:

How much did Twitter cost?

Software Estimation: Twitter

Twitter obtained nearly $60 million in venture funding for startup costs, with the majority going towards server costs and development

Software Estimation:

How much did Facebook Cost?

Software Estimation: Facebook

The creator did it out of boredom and eventually got a $500,000 dollar grant of the creator of Paypal its all on wiki.

I suspect a great deal of sweat equity.

Software Estimation:

How much is the cost of a extending software hardware from previous projects to develop Space Shuttle Endeavor?

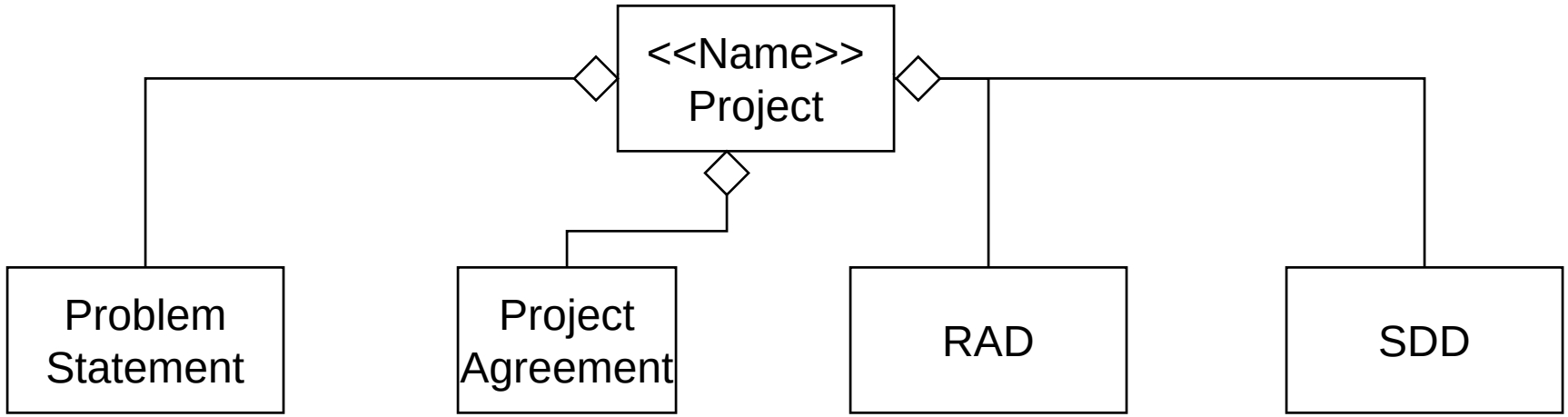
Software Estimation: Space Shuttle Endeavor

$1.7 Billion (includes systems cost)

Software Project Management Plan (IEEE Std 1058)

- 0. Front Matter
- 1. Introduction
- 2. Project Organization
- 3. Managerial Process
- 4. Technical Process
- 5. Work Elements, Schedule, Budget
  - 5.1 Work Breakdown Structure (WBS)
  - 5.2 Dependencies between tasks
  - 5.3 Resource Requirements
  - 5. 4 Budget
  - 5.5 Schedule
- Optional Inclusions

WBS Based on Project Documents (Entity-oriented)



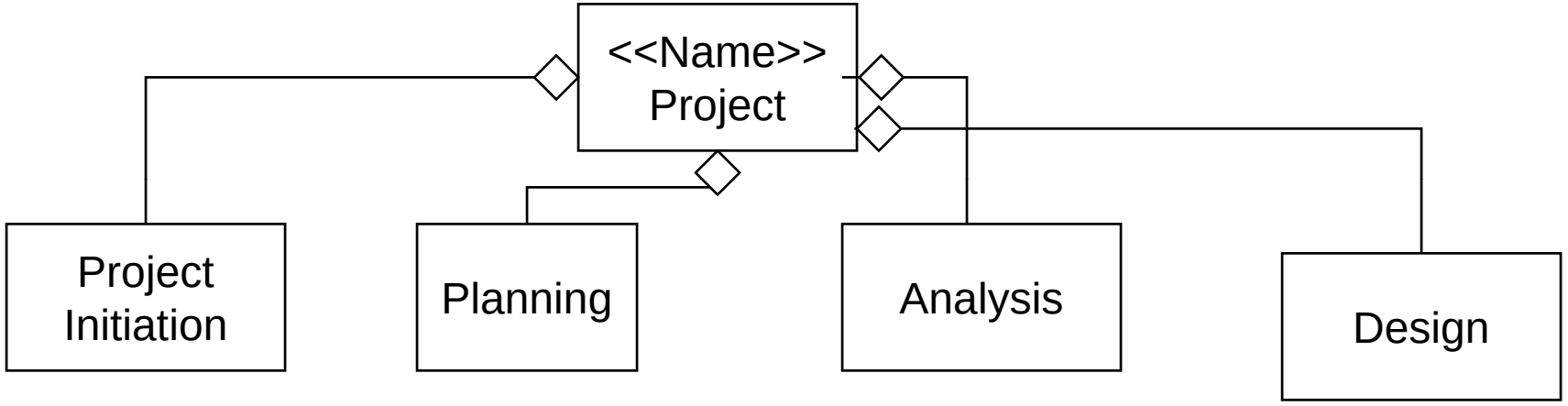
- Write Introduction
- Write Requirements
- Write Constraints
- ...

- Write Requirements
- Write Constraints
- Write Acceptance Criteria
- Promise delivery date

- Write Introduction
- Describe Functional Model
- Describe Object Model
- Describe Dynamic Model
...

- Write Design Goals
- Write Hardware Software mapping
-Write boundary conditions
- Write Data Management
- Write Open Issues

WBS Based on Software Process (Activity-oriented)



- Establish guidelines
- Formulate requirements with client
- Establish scenarios
- Write project agreement

- Determine WBS
- Determine dependencies between tasks
- Write SPMP
- Assign teams to subsystems
- Establish project calendar

- Brainstorm on application domain objects
- Develop class diagram
- Partition objects into boundary, entity and control objects
- Develop use cases

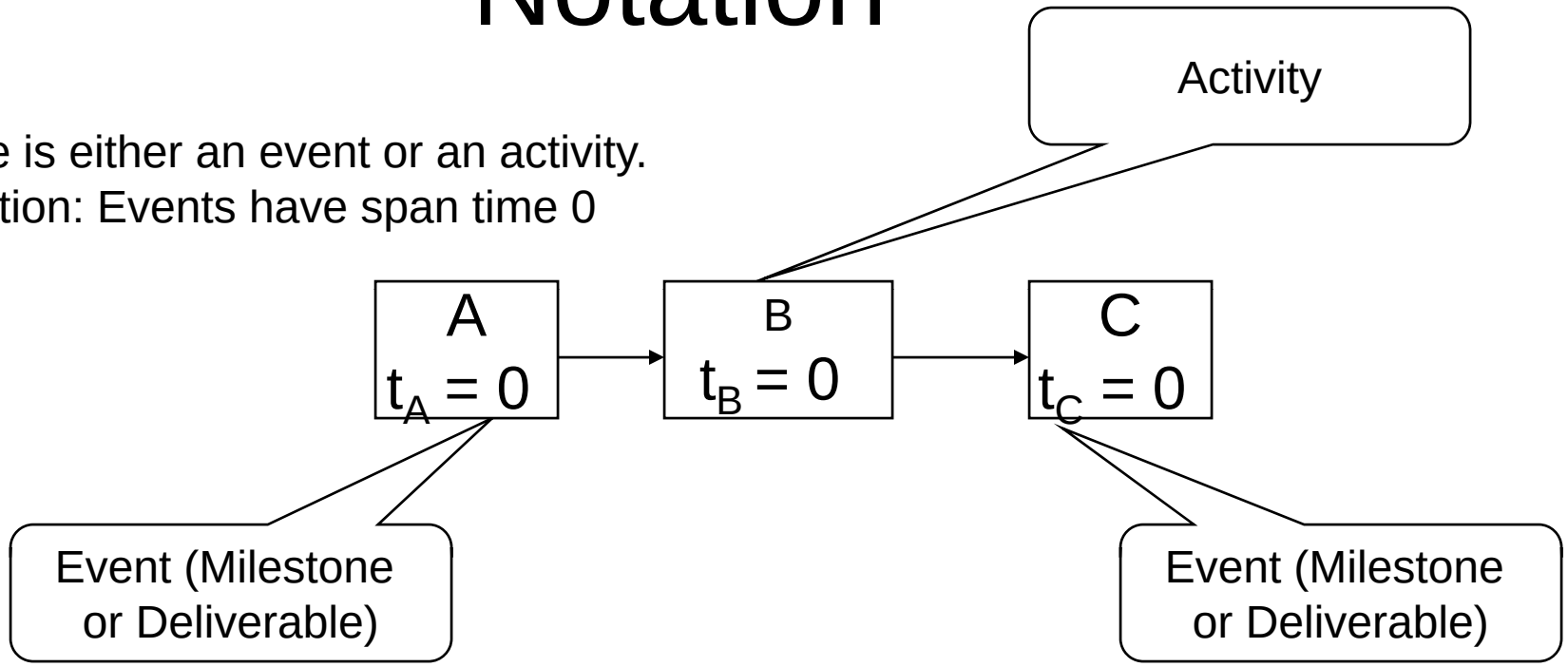
- Develop Models
- Write code
- Present problems to coach
- Give status reports
- Write RAD
- Write SDD
- Write ODD

PERT

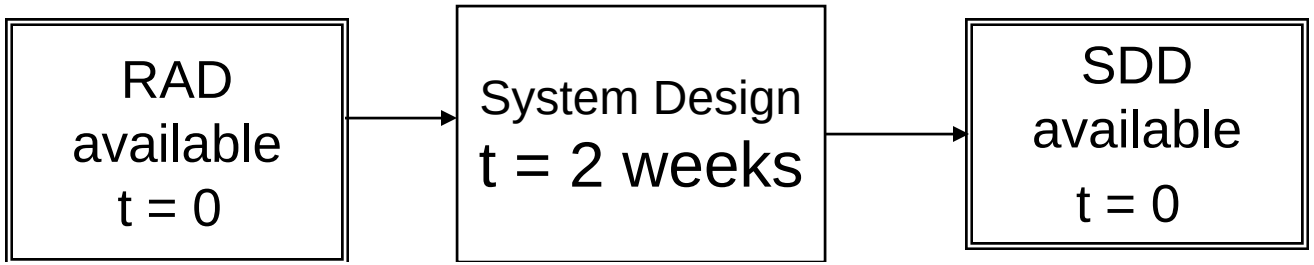
- PERT is an activity-on-the-arrow notation
- PERT = Program Evaluation and Review Technique
- Developed in the 50s to plan the Polaris weapon system in the USA.
- PERT allows to assign optimistic, pessimistic and most likely estimates for the span times of each activity.
- You can then compute the probability to determine the likelihood that overall project duration will fall within specified limits.

Activity-in-the-node Diagram Notation

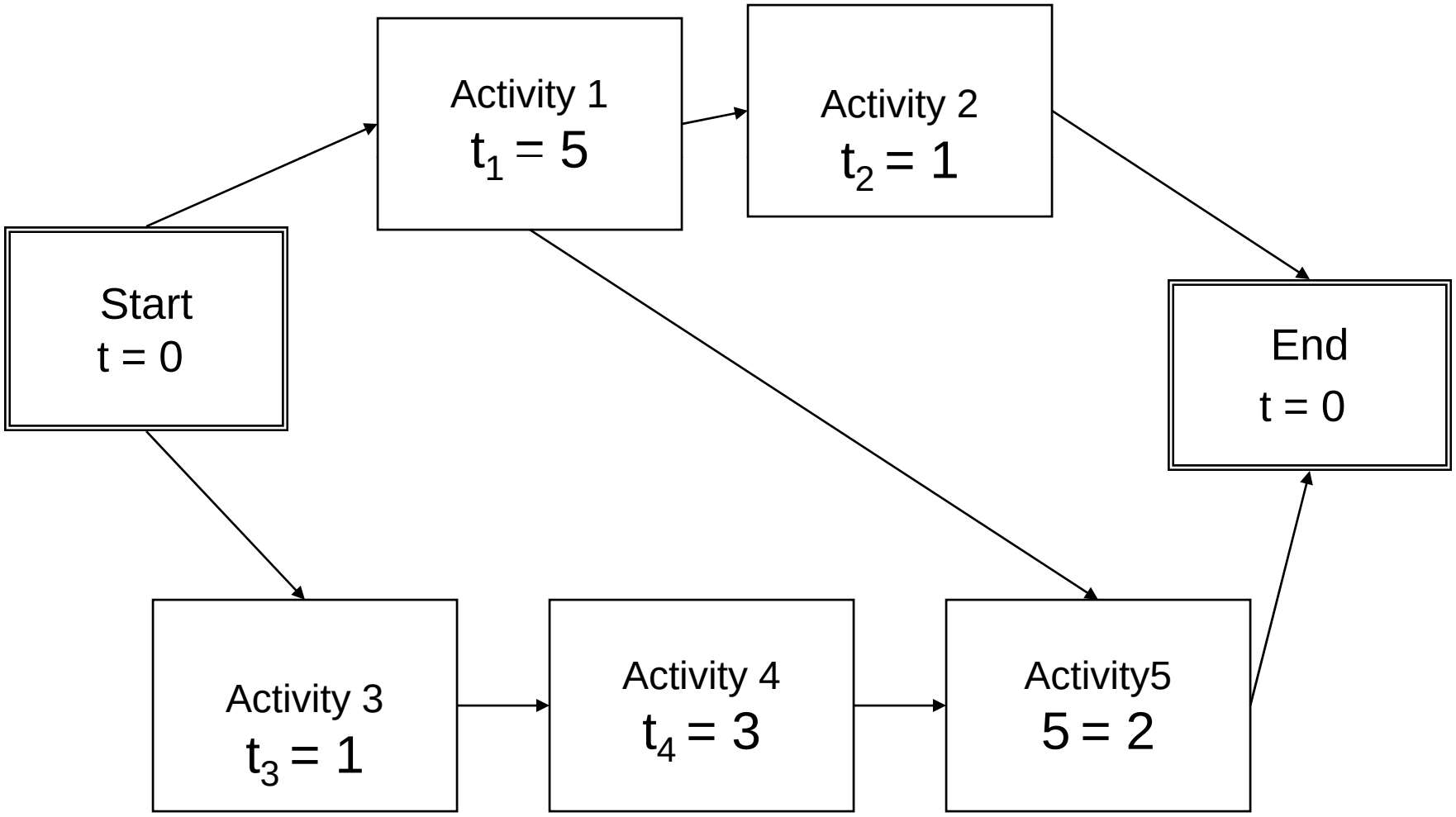
A Node is either an event or an activity.
Distinction: Events have span time 0



Milestone boxes are often highlighted by double-lines



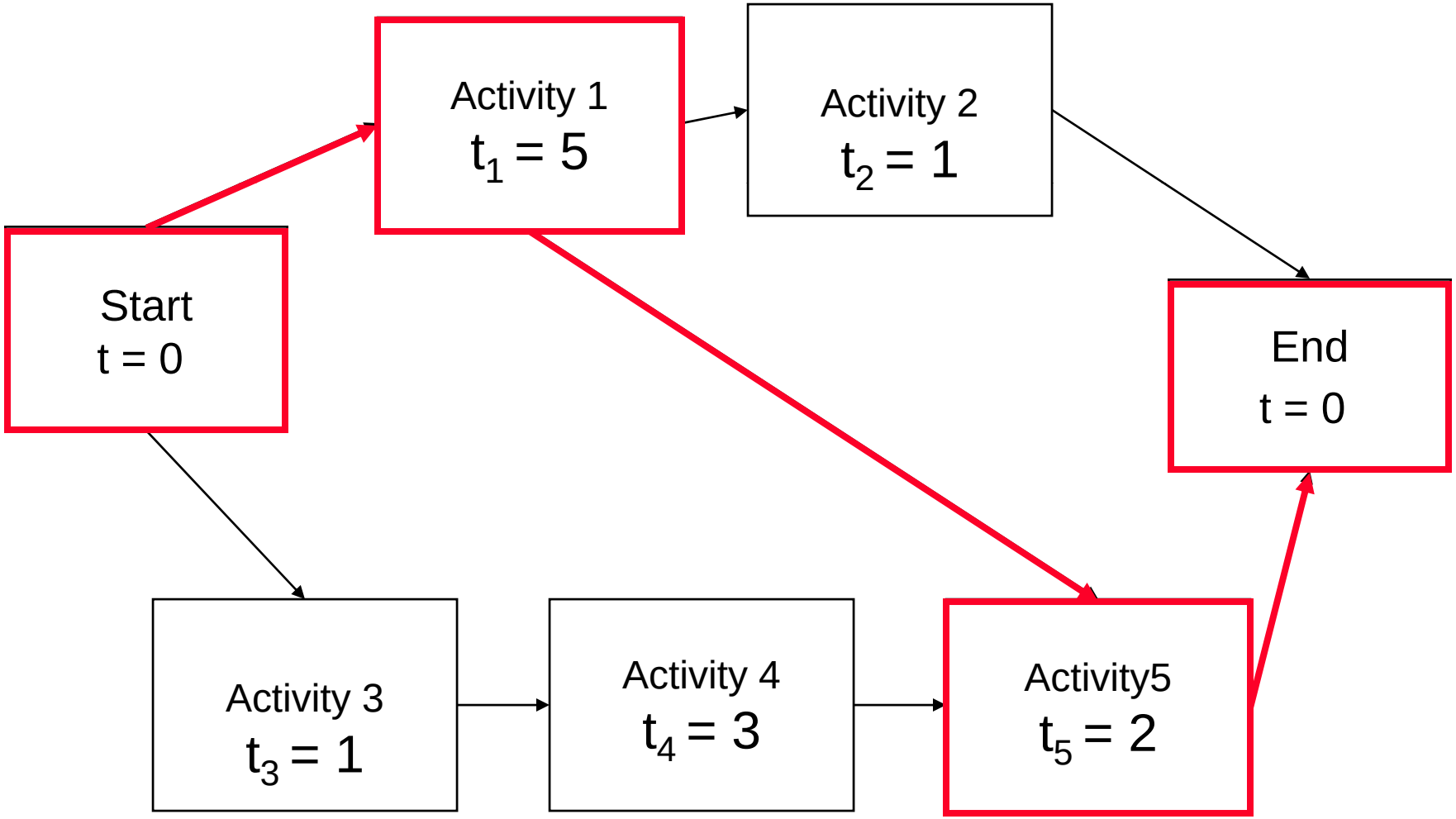
Example of an Activity-in -the - Node Diagram



Definitions: Critical Path and Slack Time

- Critical path:
  - A sequence of activities that take the longest time to complete
  - The length of the critical path(s) defines how long your project will take to complete.
- Noncritical path:
  - A sequence of activities that you can delay and still finish the project in the shortest time possible.
- Slack time:
  - The maximum amount of time that you can delay an activity and still finish your project in the shortest time possible.

Example of a critical path



Frequently used formats for dependency graphs

- **Milestone View ("Key-Events report"):**
  - A table that lists milestones and the dates on which you plan to reach them.
- **Activities View:**
  - A table that lists the activities and the dates on which you plan to start and end them
- **Gantt chart View:**
  - A graphical illustrating on a timeline when each activity will start, be performed and end.
- **Combined Gantt Chart and Milestone View:**
  - The Gantt Chart contains activities as well as milestones.

Key-Events Report

Date	Milestone
August 26	Project Kickoff (with Client)
October 16	Analysis Review
October 26	System Design Review
November 7	Internal Object Design Review
November 20	Project Review (with Client)
Nov 26	Internal Project Review
Dec 11	Acceptance Test (with Client)

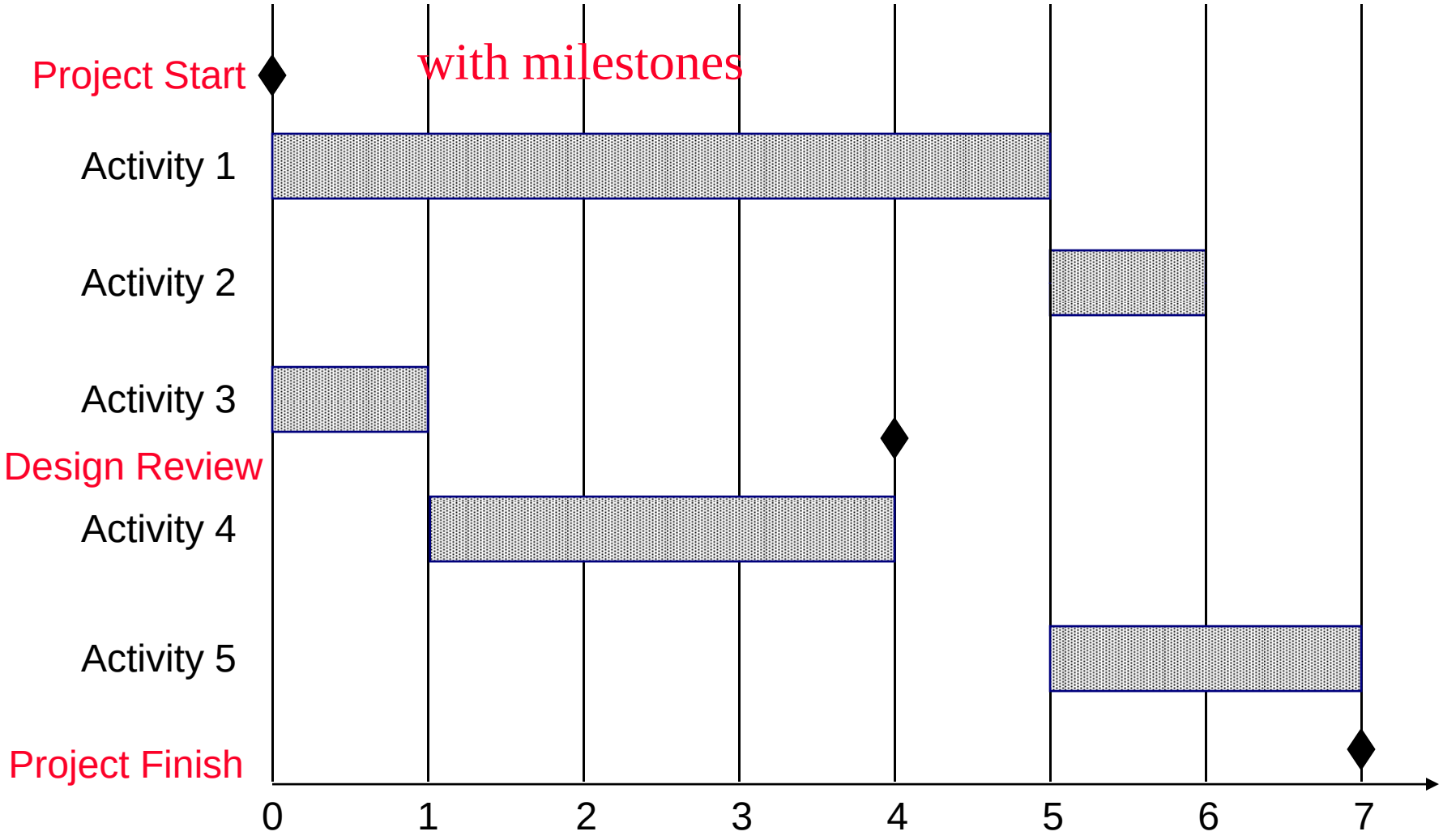
Good for introduction of SPMP and high executive briefings

Activities View

Date	Project Phases
Jul 17-Aug 23	Preplanning Phase
Aug 26 - Sep 24	Project Planning
Sep 11-Oct 8	Requirements Analysis
Oct 9 - Oct 26	System Design
Oct 28-Nov 7	Object Design
Nov 8 - Nov 20	Implementation & Unit Testing
Nov 22 - Dec 4	System Integration Testing
Dec 4 - Dec 10	System Testing
Dec 11- Dec 18	Post-Mortem Phase

Good for SPMP Section 5.5 and during developer meetings

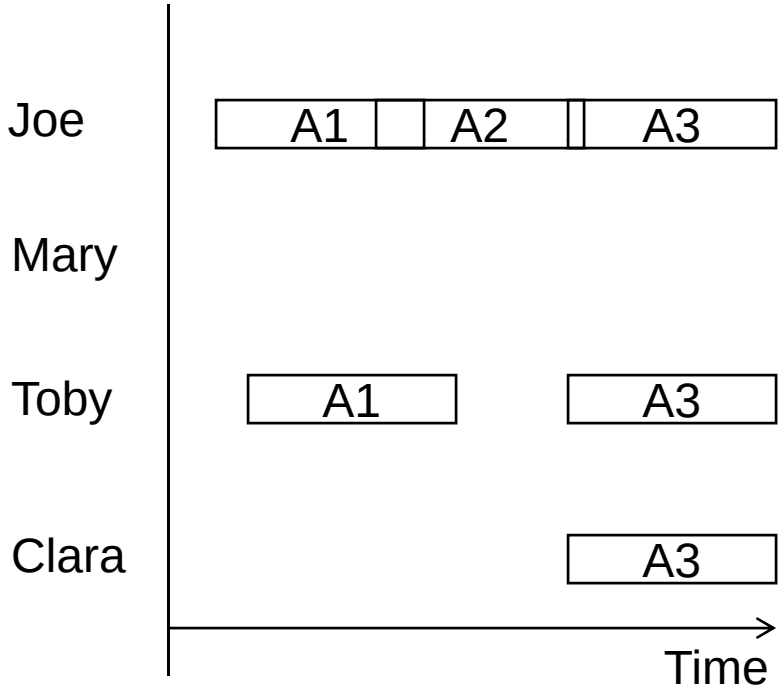
Gantt Chart: Activity View

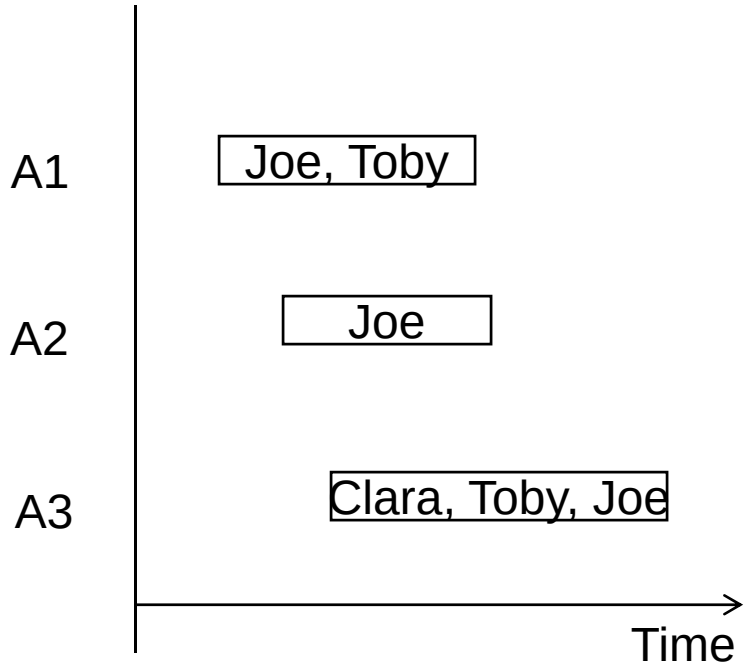


Good for reviews. (basis for MS Project

Two Types of Gantt Charts

- Person-Centered View
  - To determine people‘s load
- Activity-Centered View
  - To identify teams working together on the same tasks





Choose one view, stay with it. Usually base the view on the WBS structure

Managing Experienced Teams: Person-centered view

Managing Beginners: Activity oriented view

Software Cost Estimation

- The Basic Equation
  - *PM = A * ((Size) ^ (B)) * (EM)*
    - PM = Person Months
    - A = Calibration Factor
    - Size – Measure of Functional Size of Software Module (Additive effect on Effort)
    - B = Scale Factor that has exponential effect
    - EM – Effort Multiplier that influence Effort

Cost Estimation Considerations

Product Attributes (Required reliability, size of database, complexity of product)	**Hardware Attributes** (Run-time performance constraints, memory constraints, volatility, required turnabout time)
Personal Attributes (Analyst capability, Software engineering capability, Applications experience, Virtual machine experience, Programming language experience)	**Project Attributes** (Use of software tools, Application of software engineering methods, Required development schedule)

Demonstration (Web-Based Tool):

COCOMO II

http://csse.usc.edu/tools/COCOMOSuite.php

Demonstration (32 bit only): Automated Software Estimation

COCOMO II (for Win/NT/XP)

http://csse.usc.edu/csse/research/COCOMOII/cocomo2000.0/CII2000.exe

In Class Exercise:

Let‘s Start Estimating your Final Project, Use the on-line tool that we demo‘d