Software Engineering

[CACS253]

BCA 4th Sem

Er. Sital Prasad Mandal

Mechi Multiple Campus
Bhadrapur, Jhapa, Nepal

https://ctal-softwareeng.blogspot.com/

Unit 8

Managing Software Projects

1. Needs for the Proper Management of Software Projects
2. Management Activities:
    a. Project Planning
    b. Project Scheduling
    c. Estimating Costs
    d. Risk Management
    e. Managing People

What Is A Project?

- A project is a planned activity that involves non-routine tasks and has a clearly defined beginning and an end.
- Other project characteristics:
  - Specific **objectives are to be met**
  - Specific **resources are assigned for use on the project**
  - A **schedule should be met**

What to Measure?

- **Product size:** count lines of code, function points, object classes, number of requirements, or GUI elements.
- **Estimated and actual duration (calendar time) and effort (labor hours):** track for individual tasks, project milestones, and overall product development.
- **Work effort distribution:** record the time spent in development activities (project management, requirements specification, design, coding, testing) and maintenance activities (adaptive, perfective, corrective).
- **Defects:** count the number found by testing and by customers and their type and status (open or closed).

Software Project Management

- ✓ Concerned with activities involved in ensuring that software is delivered on time and on schedule and in accordance with the requirements of the organisations developing and procuring the software.
- ✓ Project management is needed because software development is always subject to budget and schedule constraints that are set by the organisation developing the software.

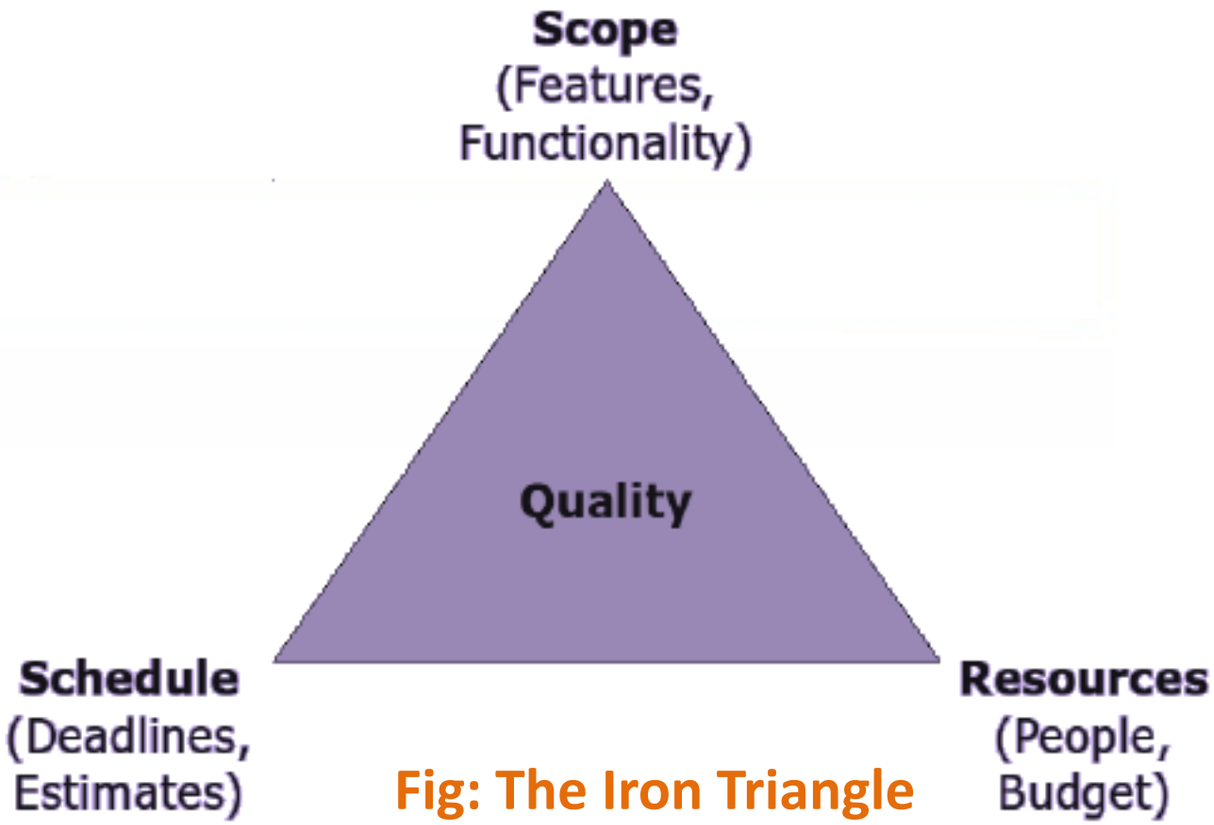


Fig: The Iron Triangle

Management Activities

- **Project Planning**
  Project managers are responsible for planning. estimating and scheduling project development and assigning people to tasks.
- **Reporting & Controlling**
  Project managers are usually responsible for reporting on the progress of a project to customers and to the managers of the company developing the software.
- **Risk Management**
  Project managers assess the risks that may affect a project, monitor these risks and take action when problems arise.
- **People Management**
  Project managers have to choose people for their team and establish ways of working that leads to effective team performance.

Project Planning

- ✓ Project planning involves breaking down the work into parts and assign these to project team members, anticipate problems that might arise and prepare tentative solutions to those problems.
- ✓ The project plan, which is created at the start of a project, is used to communicate how the work will be done to the project team and customers, and to help assess progress on the project.

Planning Stages

- At the proposal stage, when you are bidding for a contract to develop or provide a software system.
- During the project startup phase, when you have to plan who will work on the project, how the project will be broken down into increments, how resources will be allocated across your company, etc.
- Periodically throughout the project, when you modify your plan in the light of experience gained and information from monitoring the progress of the work.

Proposal Planning

- Planning may be necessary with only outline software requirements.
- The aim of planning at this stage is to provide information that will be used in setting a price for the system to customers.
- In a plan-driven development project, a project plan sets out the resources available to the project, the work breakdown and a schedule for carrying out the work.

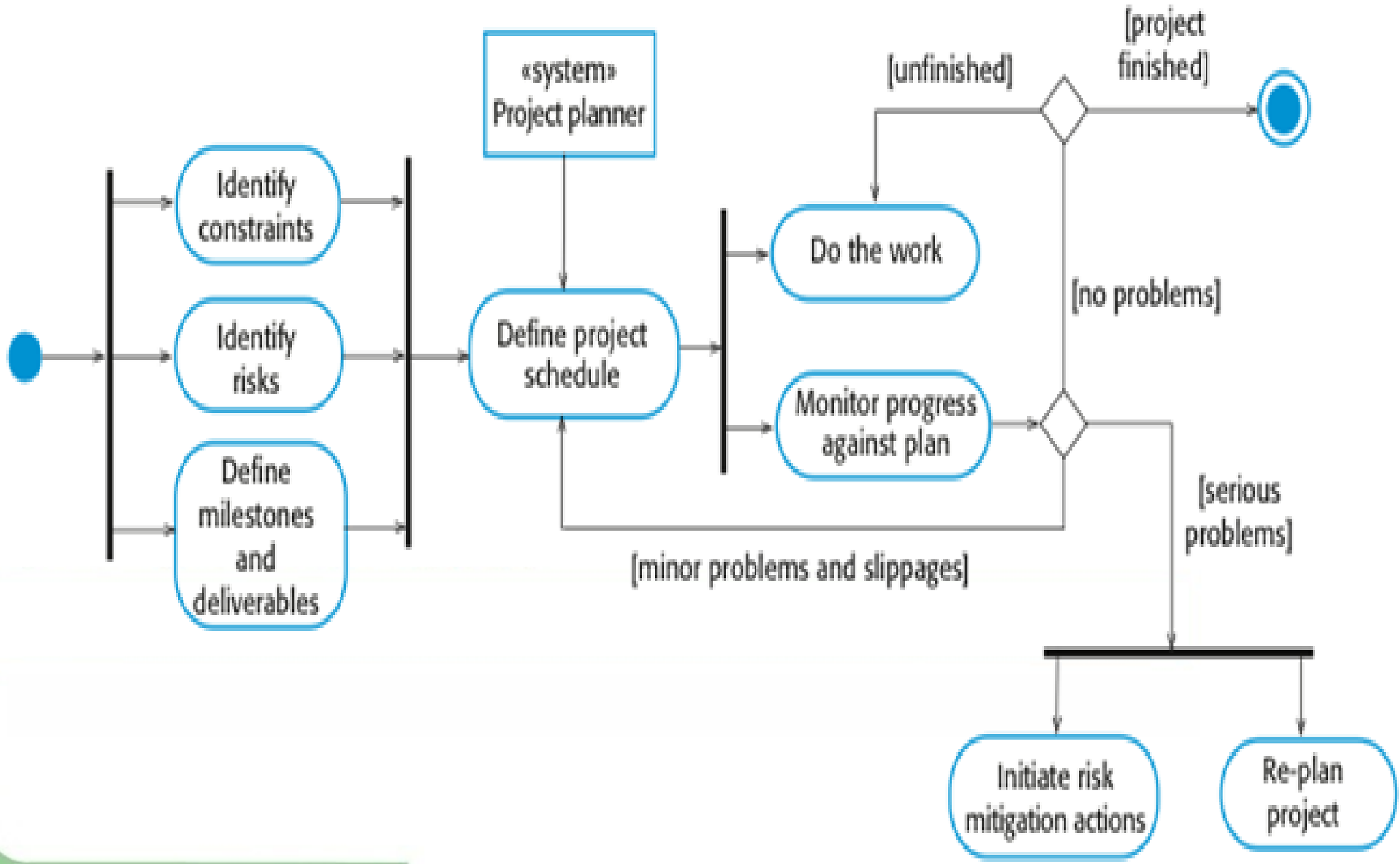
Plan sections :

- –Introduction
- –Project organization
- –Risk analysis
- –Hardware and software resource requirements
- –Work breakdown
- –Project schedule
- –Monitoring and reporting mechanisms

Project Plan Supplements

Plan	Description
Quality plan	Describes the quality procedures and standards that will be used in a project.
Validation plan	Describes the approach, resources, and schedule used for system validation.
Configuration management plan	Describes the configuration management procedures and structures to be used.
Maintenance plan	Predicts the maintenance requirements, costs, and effort.
Staff development plan	Describes how the skills and experience of the project team members will be developed.

Project Plan Process



Project Scheduling

- Project scheduling is the process of deciding how the work in a project will be organized as separate tasks, and when and how these tasks will be executed.
- You estimate the calendar time needed to complete each task, the effort required and who will work on the tasks that have been identified.
- You also have to estimate the resources needed to complete each task, such as the disk space required on a server, the time required on specialized hardware, such as a simulator, and what the travel budget will be.

Project Scheduling Activities

Milestones and deliverables

- Milestones are points in the schedule against which you can assess progress, for example, the handover of the system for testing.
- Deliverables are work products that are delivered to the customer, e.g. a requirements document for the system.

Project Scheduling Activities

- Split project into tasks and estimate time and resources required to complete each task.
- Organize tasks concurrently to make optimal use of workforce.
- Minimize task dependencies to avoid delays caused by one task waiting for another to complete.
- Dependent on project managers experience.

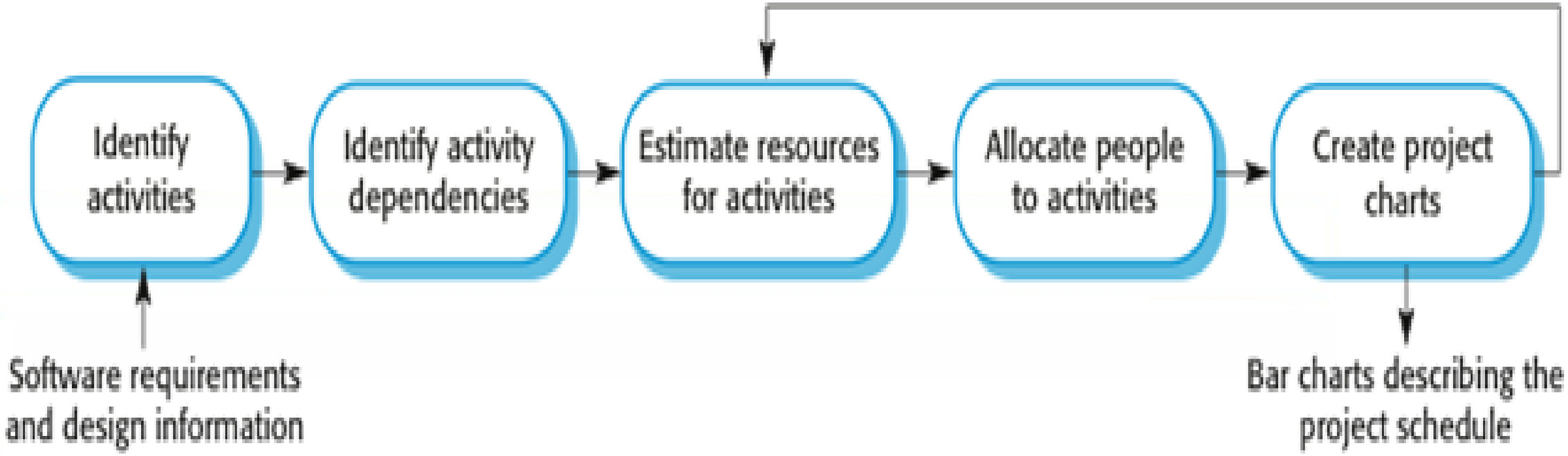


Fig: Project Scheduling Process

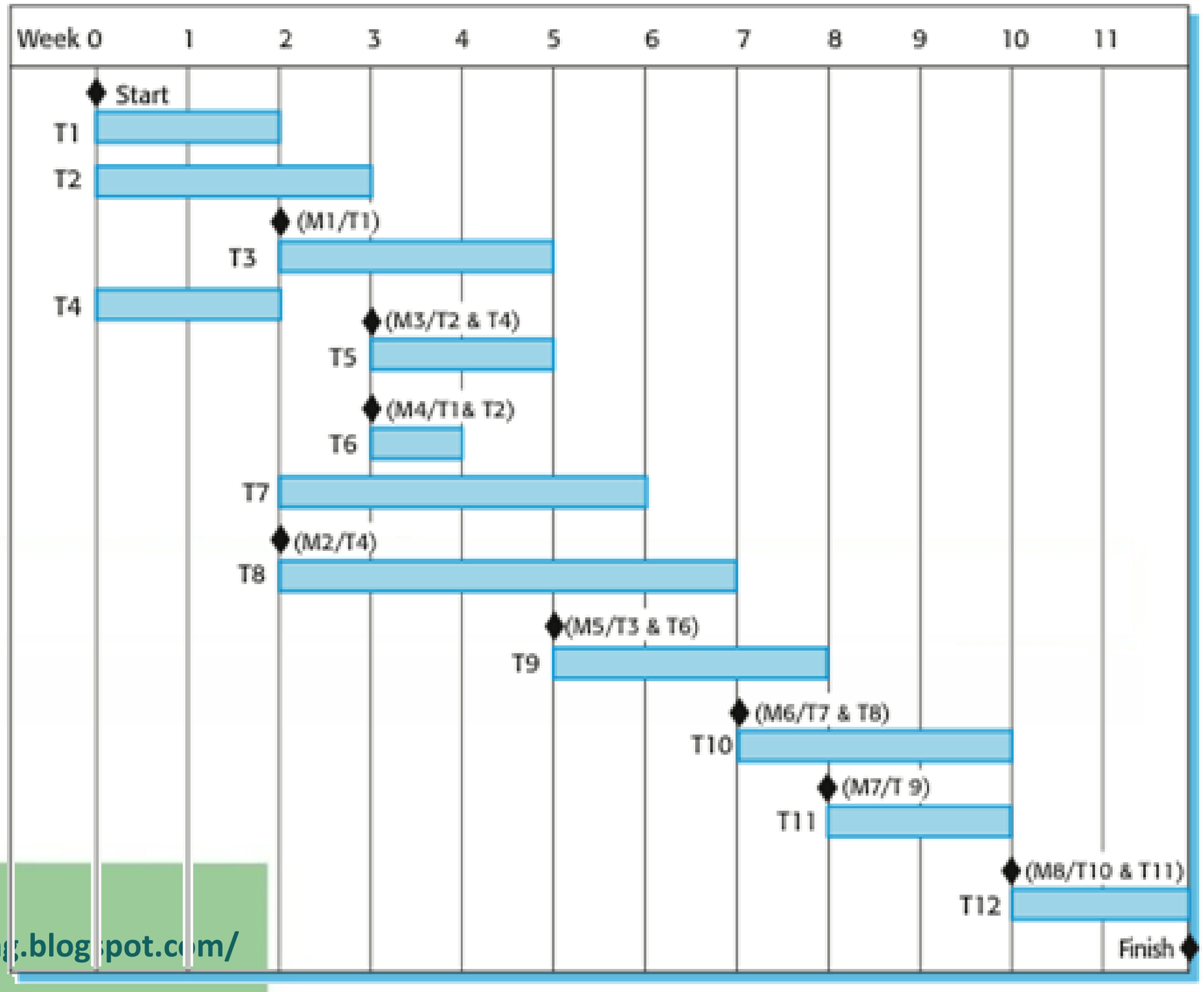
Project Scheduling Activities

Scheduling Problems

- Estimating the difficulty of problems and hence the cost of developing a solution is hard.
- Productivity is not proportional to the number of people working on a task.
- Adding people to a late project makes it later because of communication overheads.
- The unexpected always happens. Always allow contingency in planning.

Project Scheduling Activities

Activity Bar Chart



Estimating Costs

COCOMO Model

Constructive Cost Estimation Model

- COCOMO is one of the most widely used software estimation models in the world
- COCOMO predicts the **efforts** and **schedule** of a software product based on the **size** of the software. and a number of **cost drivers** that affect productivity.

Estimating Costs

COCOMO Model

- COCOMO has three different models that reflect the **complexity**:
  - the Basic Model
  - the Intermediate Model
  - and the Detailed Model

The first level, **Basic COCOMO** can be used for quick and slightly rough calculations of Software Costs. Its accuracy is somewhat restricted due to the absence of sufficient factor considerations.

Intermediate COCOMO takes these Cost Drivers into account and **Detailed COCOMO** additionally accounts for the influence of individual project phases, i.e in case of Detailed it accounts for both these cost drivers and also calculations are performed phase-wise hencef orth producing a more accurate result.

Estimating Costs

COCOMO Model

Basic Model

- Applicable to small to medium sized software projects
- Use for a quick and rough estimates
- Three modes of software development are considered
  - Organic
  - Semi-detached
  - Embedded

$$E = a(KLOC)^b$$

$$time = c(Effort)^d$$

$$Personrequired = Effort/time$$

Estimating Costs

COCOMO Model

Mode	*Project size*	*Nature of Project*	*Innovation*	*Deadline of the project*	*Development Environment*
Organic	Typically 2-50 KLOC	Small size project, experienced developers in the familiar environment. For example, pay roll, inventory projects etc.	Little	Not tight	Familiar & In house
Semi detached	Typically 50-300 KLOC	Medium size project, Medium size team, Average previous experience on similar project. For example: Utility systems like compilers, database systems, editors etc.	Medium	Medium	Medium
Embedded	Typically over 300 KLOC	Large project, Real time systems, Complex interfaces, Very little previous experience. For example: ATMs, Air Traffic Control etc.	Significant	Tight	Complex Hardware/ customer Interfaces required

Estimating Costs

COCOMO Model

The basic COCOMO equation

- $E = a_b (KLOC \text{ or } KDSI)^{b_b}$
- $D = c_b (E)^{d_b}$
- $P = E/D$ where
  - **E** is the effort applied in person-months,
  - **D** is the development time in months,
  - **KLOC / KDSI** is the estimated number of delivered lines of code for the project (expressed in thousands)
  - **P** is the number of people required and
  - a_b, b_b, c_b and d_b are coefficients given in next slide.

KLOC- Thousand lines of code.
NLOC- Non-comment lines of code.
KDSI- Thousands of delivered source instruction

Estimating Costs

COCOMO Model

Basic COCOMO Coefficients

Software Project	a_b	b_b	c_b	d_b
Organic	2.4	1.05	2.5	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Estimating Costs

COCOMO Model

E.g.1: Suppose that a project was estimated to be 400 KLOC. Calculate the effort and development time for each of the three modes I.e., organic, semidetached and embedded

The basic COCOMO equation take the form:

$$E = a_b(KLOC)^{b_b}$$

$$D = c_b(E)^{d_b}$$

Project	a_b	b_b	c_b	d_b
Organic	2.4	1.05	2.5	0.38
Semi detected	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Estimating Costs

COCOMO Model

Solution

The basic COCOMO equation take the form:

$$E = a_b (KLOC)^{b_b}$$

$$D = c_b (E)^{d_b}$$

Estimated size of the project = 400 KLOC

(i) Organic mode

$$E = 2.4(400)^{1.05} = 1295.31 \text{ PM}$$

$$D = 2.5(1295.31)^{0.38} = 38.07 \text{ PM}$$

Estimating Costs

COCOMO Model

(ii) Semidetached mode

$$E = 3.0(400)^{1.12} = 2462.79 \text{ PM}$$

$$D = 2.5(2462.79)^{0.35} = 38.45 \text{ PM}$$

(iii) Embedded mode

$$E = 3.6(400)^{1.20} = 4772.81 \text{ PM}$$

$$D = 2.5(4772.8)^{0.32} = 38 \text{ PM}$$

Estimating Costs

COCOMO Model

When effort and development time are known, the average staff size to complete the project may be calculated as:

$$\text{Average staff size } (SS) = \frac{E}{D} \, Persons$$

When project size is known, the productivity level may be calculated as:

$$\text{Productivity } (P) = \frac{KLOC}{E} \, KLOC / PM$$

Estimating Costs

COCOMO Model

E.g. 2: We have determined our project fits the characteristics of **Semi-Detached** mode

- We estimate our project will have **32,000** Delivered Source Instructions. Using the formulas, we can estimate:
- **Effort** = $3.0*(32)^{1.12}$ = 146 man-months
- **Schedule** = $2.5*(146)^{0.35}$ = 14 months
- **Productivity** = 32,000 DSI / 146 MM
  = 219 DSI/MM
- **Average Staffing** = 146 MM /14 months
  = 10 FSP

FSP means Full-time-equivalent Software Personnel.
DSI: Delivered Source Instructions
MM: man months

Estimating Costs

COCOMO Model

Example

A project size of 200 KLOC is to be developed. Software development team has average experience on similar type of projects. The project schedule is not very tight. Calculate the effort, development time, average staff size and productivity of the project.

Estimating Costs

COCOMO Model

Solution

The semi-detached mode is the most appropriate mode; keeping in view the size, schedule and experience of the development team.

Hence $E = 3.0(200)^{1.12} = 1133.12$ PM

$D = 2.5(1133.12)^{0.35} = 29.3$ PM

$$\text{Average staff size } (SS) = \frac{E}{D} Persons$$

$$= \frac{1133.12}{29.3} = 38.67 Persons$$

$$\text{Productivity } = \frac{KLOC}{E} = \frac{200}{1133.12} = 0.1765\, KLOC / PM$$

$$P = 176\ LOC / PM$$

Estimating Costs

COCOMO Model

Solution

The semi-detached mode is the most appropriate mode; keeping in view the size, schedule and experience of the development team.

Hence $E = 3.0(200)^{1.12} = 1133.12$ PM

$D = 2.5(1133.12)^{0.35} = 29.3$ PM

$$\text{Average staff size } (SS) = \frac{E}{D} \; Persons$$

$$= \frac{1133.12}{} = 38.67 \; Persons$$

$$\text{Productivity } = \frac{KLOC}{E} = \frac{200}{1133.12} = 0.1765 \; KLOC / PM$$

$$P = 176 \; LOC / PM$$