



# **BACHELOR OF COMPUTER APPLICATIONS SEMESTER 6**

## **DCA3245 SOFTWARE PROJECT MANAGEMENT**

# Unit 3

## Project Planning

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## 1. INTRODUCTION

In the last unit, you have studied an overview of project management. In this unit, you are going to study about the first step in project management viz. project planning.

For any successful project implementation we need to have a proper plan in place. Planning is required for any task that needs to be completed. Since the project is typically a group activity where a team of resources work in tandem to achieve the project objectives, planning becomes all the more important. Project planning is often considered as waste of time, and project teams think they can directly start with the implementation instead. However, once the project implementation progresses, we will come to know the importance of planning when we start facing problem like lack of coordination among the team members, resource sharing, and other issues. In the current unit, we will discuss about the project planning tasks, life cycle models, and WBS (Work Breakdown Structures).

### 1.1 Objectives:

*After studying this unit, you should be able to:*

- ❖ *Define various tasks in project planning*
- ❖ *Explain work breakdown structures*
- ❖ *Understand various planning method*
- ❖ *List and explain various development life cycle models*
- ❖ *Explain a generic project model*

Let us see the general statement of project planning: and phases of planning:

A project manager creates the project roadmap during the project planning phase of project management, which also includes the work breakdown structure, project constraints, project scope, and risk analysis. Whether the project involves creating a new website or a new building, the planning phase serves as a road map and a management tool for the entire undertaking. The basic project planning steps that every project manager needs to know can be broken down as parts of the first two phases of project management:

1. Initiation Phase and
2. Planning Phase

While those phases give a broad outline of what should be happening at different stages of a project's lifecycle, they don't provide much of a clear picture of how to go about your project planning.

**Initiation:** The first step in transforming an intangible idea into a worthwhile objective is the project commencement phase. You must create a business case and provide a broad definition of the project at this point. You must first ascertain the project's need and establish a project charter in order to do that.

**Planning:** Complete diligence is required throughout the project planning stage, which establishes the project's road map. The second stage of project management is anticipated to take close to half of the total project time, unless you're employing a contemporary project management approach like agile project management.

Steps involves in Project Panning:

If you're looking for something that gives you an easier to follow roadmap, the following project planning steps should provided Basically it will be done on two phases first phase includes identifying and meeting the stakeholders for approval and second phase is then set the goal and objective of the set process flow. So in these two phases we will have follows certain key points to achieve this like the key points given below:

1. Create and Analyze Business Case
2. Identify and Meet Stakeholders for Approval
3. Define Project Scope
4. Set Goals and Objectives
5. Determine Deliverables

Managing a project is no easy feat, no matter what the scale and scope are. From planning the minutia to handling the ever-changing demands of clients to shipping the deliverables on time, there's a lot that can go wrong. When you divide the project into manageable stages, each with its own goals and deliverables, it's easier to control the project and the quality of the output. The following are the breakdowns of the work:

1. Create Project Schedule and Milestones
2. Assignment of Tasks
3. Carry Out Risk Assessment of project management:
4. Initiation and Planning.

While those phases give a broad outline of what should be happening at different stages of a project's lifecycle, they don't provide much of a clear picture of how to go about your project planning.

Project planning doesn't have to be difficult or cause any nervous stress since the beginning of every project is basically the same. In a project management guide, if you are somehow in a position where you are expected to manage projects for your organization and are feeling overwhelmed, it's better to start learning the basic stages of the project life cycle phases.

- You can follow the same set project planning steps and hone them through experience of every project you are involved with. Because the beginning of every project is fundamentally the same, project planning does not have to be complex or unpleasant.

Let us see the steps involved in planning phases one by one in detail:

### **1. Create and Analyse the business case:**

A business case is a project management document that explains how the benefits of a project outweigh its costs and why it should be executed. Business cases are prepared during the project initiation phase and their purpose is to include all the project's objectives, costs and benefits to convince stakeholders of its value.

- A business case is an important project document to prove to your client, customer or stakeholder that the project you're pitching is a sound investment. Below, we illustrate the steps to writing one that will sway them.
- The business case is the reason why your organization needs to carry out the project. It should outline the problem, such as a lack of repeat customers or a day longer supply line than competitors and describe how this will be solved and how much monetary benefit should accrue to the organization once the project is completed.



**2. Identifying and meeting the relevant stake holders:**

Identifying project stakeholders means listing anyone who will be affected by your project, so includes the public and government regulatory agencies. For the project planning phase however, it should only be necessary to meet those who will directly decide whether the project will happen or not. Compiling a list of all the people and organisations that will be impacted by the project is called "identifying project stakeholder." Identifying and meeting relevant stakeholders is a crucial step in project planning and execution. Stakeholders are individuals or groups who have an interest in or are affected by the project's outcome. Effective stakeholder management helps ensure that their needs, expectations, and concerns are addressed, which in turn contributes to the project's success.

**3. Defining the project scope:**

Defining the project scope is a critical step in project planning that involves outlining the boundaries, objectives, deliverables, and constraints of the project. A well-defined project scope provides clarity and helps ensure that everyone involved understands what is included and what is not ,

- The scope of your project is an guideline of what it is and isn't setting out to achieve.
- It is necessary to delineate the boundaries of your project riseo prevent "scope creep", i.e. your resources going towards something that's not in your project's goals.

**4. Set Goals and objectives:**

Everyone in your team must have a clear idea of project goals. From goals for project managers to individual team members, everyone needs to be on the same page. For that, there needs to be a defined process in place Identification is the first step in the project goal-setting process. Without identifying your project goals, nothing can be determined. So, how does one identify project goals?

Simply identify what is important. When undertaking a project, it is essential to have all three parties – clients, managers, and team members – on the same page. Then, it is important for everyone to have a discussion and identify what is to be achieved during the project and what's the end goal

- The goals and objectives for your project will build on the initial objectives outlined in the business plan.

- At this step you will give finer detail to the initial broad ideas and set them in a project charter as reference points for your project as it proceeds.

## **5. Determine the deliverables:**

To find out what exactly is deliverables, Deliverables are the concrete results that your project produces. Determining project deliverables is a crucial step in project planning, as it involves identifying and documenting the specific outputs or results that the project will produce. Deliverables provide a clear focus for the project team, stakeholders, and clients, helping to ensure that everyone is aligned on the expected outcomes

One of the most important project planning steps is to decide on what these deliverables will be and who is responsible for both producing and receiving them. Deliverables are the quantifiable items or services that must be offered at different project stages as well as at the project's conclusion. Deliverables make it possible to allocate resources wisely and keep projects on track

The different steps/ breakdowns involved in project planning are discussed in detail here:

As listed in the previous session let's all discuss in detail, about the steps or the breakdowns involved in project planning phases :

- 1. Create project schedule and milestones:** A well-structured schedule helps ensure that tasks are completed in a timely manner, resources are allocated efficiently, and progress is tracked effectively

Your project schedule is a very important document that outlines when different tasks of a project are due to begin and end, along with major measurement milestones. It will be referred to when measuring project progress. It will be available to all stakeholders and should be adhered to as closely as possible. Project Assigning tasks clearly should remove any uncertainty about roles and responsibilities on your team.

## **2. Assignment of task:**

Assigning tasks in project management involves allocating specific responsibilities and activities to individual team members or groups. Effective task assignment is crucial for ensuring that project work is distributed appropriately, team members are clear about their roles, and project goals are achieved efficiently. Here's how you can approach task

assignment: Your project schedule is a very important document that outlines when different tasks of a project are due to begin and end, along with major measurement milestones

Within your team everyone should know what their role is and who is responsible for different elements of the project. Assigning tasks clearly should remove any uncertainty about roles and responsibilities on your team.

### **3. Carry out Risk Assessment:**

Carrying out a risk assessment is a step in project management to identify, analyze, and mitigate potential risks that could impact the project's success. By proactively addressing risks, you can develop strategies to minimize their impact and increase the likelihood of achieving project objectives. :

The plans created during this phase will help you manage time, cost, quality, changes, risk, and related issues.

Project planning is at the heart of the project life cycle, and tells everyone involved where you're going and how you're going to get there.

The planning phase is when the project plans are documented, the project deliverables and requirements are defined, and the project schedule is created.

### **4. Initiation and planning:**

Initiation and planning are the foundational phases of project planning, and they play essential roles in setting the stage for a successful project. Each phase involves specific activities and objectives that help define the project's purpose, scope, goals, and approach. Let's explore the roles of initiation and planning in project planning:

The process of project planning comprises creating a set of plans to aid in leading one's team through the implementation and closure phases of the project. To complete the project on schedule and within budget, project planning also controls staff and external suppliers.

It involves creating a set of plans to help guide your team through the implementation and closure phases of the project. They will also help you control staff and external suppliers to ensure that you deliver the project on time, within budget, and within schedule.



The purpose of the project planning phase is to:

- Establish Business Requirements
- Establish cost, schedule, list of deliverables, and delivery dates
- Establish resources plans
- Obtain management approval and proceed to the next phase

## 2. TASKS IN PROJECT PLANNING

Dear student, project planning is the first activity of the project management. Planning essentially consists of creation of the project schedule and the subsequent reporting of the project progress with the project baseline. The scope of the project is determined and the appropriate methods to implement the project are determined as part of project initiation. From the project scope document, the work breakdown structure (WBS) is determined and individual tasks are listed out. Time needed for each of the task is estimated. The dependencies among the tasks are noted down using Gantt Chart or Network activity diagrams. The purpose of finding the dependencies is to arrange the tasks in the logical order and for proper resource allocation for each of the tasks. The scheduling chart also helps to identify the critical path of the project. The project plan is further optimized by noting down the Float or Slack time in the schedule. The project schedule thus obtained above will have the optimal resource allocation and using this cost of the project can be estimated. The project plan then gets reviewed to ensure that project objectives are met; any necessary changes are done to schedule at this stage. After getting the approval the plan becomes baseline for the project.

Progress of the project is measured against the baseline throughout the implementation phases of the project. Any deviation from the baseline is analyzed and reported for the earned value management of the project.

Every project starts with initiation, in which project scope, pros and cons are discussed. The scope of the project will be used for further analysis on the tasks and schedule needed for project implementation. For the tasks listing project team is formed which invariably consists of a project manager and technical leads or architects who are expert in the project domain. For analyzing the scope of the work to be handled, effort estimation, and project planning some basic information is necessary for the project team. They are listed as follows

- 1) Project start date
- 2) Project completion date
- 3) Project life cycle to be followed – sometimes this will be decided by the project team based on the nature of the requirements. Also determine if any particular deliverables needed for each phase of the project
- 4) Whether all the features are to be released in one release or multiple releases – also
- 5) Review methodologies to be used for the project
- 6) Determine any schedule constraints or interim milestones to be met
- 7) From the resources front – determine the skill set of resources needed, number of resources needed and the current availability of the resources
- 8) Dependency among the tasks and number of tasks that can be run in parallel
- 9) Review methodologies and check points to monitor the progress of the project
- 10) Project cost estimation and cost-benefit analysis

### 3. WORK BREAKDOWN STRUCTURES (WBS)

For any project to be able to meet its goal, we need to have the control over the functionality we are implementing in the project. This functionality or feature that is being implemented should be estimated and tracked down for proper implantation. However for the feature we want to implement cannot be tracked efficiently if it is considered at the very high level. For example, if we consider store automation as the feature to be implemented, we cannot plan the effort involved and track the implementation unless we know the number of departments we need to automate, kind of transactions we need to support etc. All these smaller features put together will form the final goal of automation of the store. We can control the smaller activities easily like resource requirement, schedule, tracking the progress so that overall goal of the project is achieved.

Project planning will be easier when we have clear understanding on the tasks to be carried and their dependencies so that accurate estimation on the effort/time can be done and the right resource can be assigned to the task. Knowing the dependencies will help for proper sequencing of the tasks in the plan.

The Work Breakdown Structure (WBS) technique is widely used to divide the task into sub tasks and generate the task list from the overall goal of the project.

A *Work Breakdown Structure* (WBS) is a hierarchic decomposition or breakdown of a project or major activity into successively levels, where each level is a finer breakdown of the preceding one.

Let us in detail about the Creation of workbreak structure:

- After outlining the deliverables and tasks in order of completion, you can then assign each task to a project team member. Ensure no team member carries the majority of the project's weight by spreading duties and responsibilities across the team.
- Before you create a work breakdown structure, it's essential to first assess the project scope by talking to all stakeholders and key team members involved.
- As the project manager, you want to ensure that all critical input and deliverables are gathered and transparently prioritized.
- It's crucial to assess the project scope before creating a work breakdown structure by speaking to all stakeholder and key team members involved.

### **Characteristics of a WBS:**

**Hierarchical Structure:** The work breakdown structure (WBS) is hierarchical, meaning that the project is divided into ever more granular sub-tasks. As a result, the scope of the project can be represented in a way that is both obvious and concise.

**Complete Scope Coverage:** The WBS needs to include everything that needs to be done to finish the project. There should be no missing major deliverables or tasks.

**Mutually Exclusive Elements:** Each level of the WBS should have its own unique set of components. This guarantees that no effort is wasted and that everyone is on the same page.

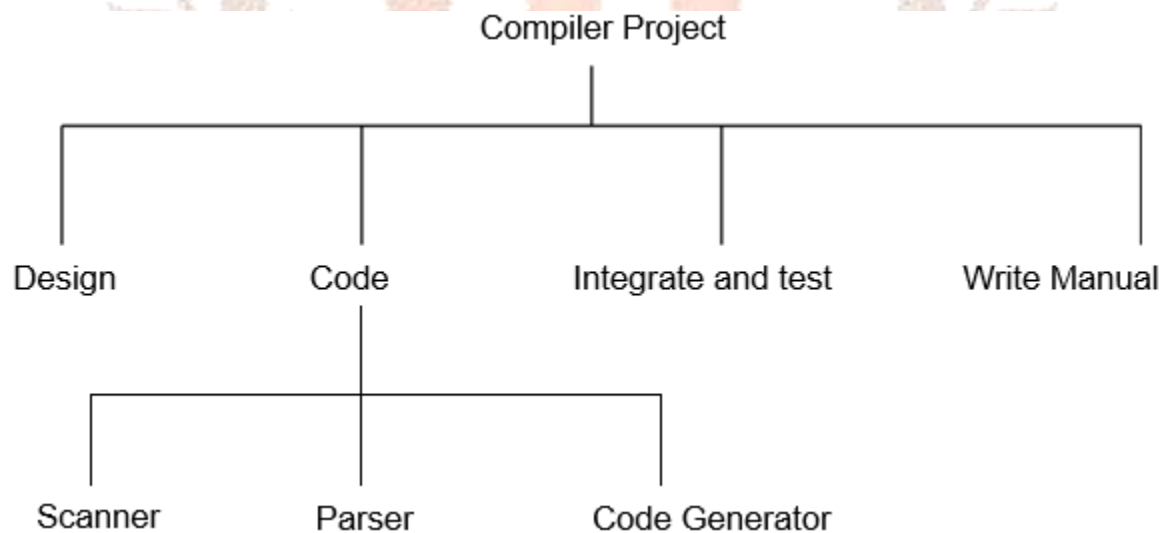
**Progressive Decomposition:** Each level of the WBS further dissects the components of the preceding level into smaller, more manageable chunks of work. Work packages are defined by continuing this process of incremental decomposition.

**Client-Oriented:** Deliverables and results that are important to the client or stakeholders should be reflected in the WBS's structure. It fits in with the goals that should be set.

**Flexibility:** As the project develops, the WBS can be modified to reflect those changes. The Work Breakdown Structure (WBS) may need to be revised due to changes in scope, needs, or methodology.

**Visual Representation:** An indented outline or a tree structure are common visual representations of the WBS that facilitate both comprehension and communication.

WBS is a semiformal way of breaking down the tasks into sub-tasks until each task can be independently estimated and implemented with proper tracking. It can be considered as arranging the tasks in a tree structure with root indicating the overall goal or functionality to be achieved and each layer of the tree indicating the sub-tasks in the hierarchical order. The leaves of the tree indicate the final set of tasks that can be managed in terms of size, complexity, and resource allocation. Consider as an example a compiler development project. The goal of the project is to develop a compiler. But we cannot estimate or plan properly considering the compiler development as a task itself. Hence we will go into WBS trying to find the sub-tasks we can identify to meet our goal of compiler development. Fig 3.1 represents a sample work breakdown structure that can be applied for compiler project.



**Fig. 3.1:** Work breakdown structure for a compiler project

As we discussed earlier, the objective of WBS is to identify the list of tasks that the project must undertake. In the compiler example we considered the first level of sub tasks we identified are the design, code, integrate and test, and write manual. Now each of these sub



tasks can be further broken down if needed. In the Fig 3.1, the design task is considered to be at the leaf level; which means we will estimate the design activity and schedule it as one single item. Instead we can sub divide the design task into scanner design, parser design etc. This kind of decision will be taken by the project team that consists of Project manager and team of experts identified to analyze the scope document and derive at the task list.

Once we have the tasks list finalized we can estimate the duration of effort needed for completion of each task identified. This can be represented in the form of a diagram or can be represented in the tabular form. When representing the tasks in the tabular form each level is represented in consecutive numbering (e.g. 1.0, 2.0, 3.0...). Each item at next level is represented with numbering of its parent item (e.g. 3.1, 3.2, 3.3...etc. for child items of 3rd item at level 1). Table 3.1 depicts sample effort for compiler project we discussed earlier.

**Table 3.1:** First level of Work Breakdown Structure for a compiler project

| WBS Number | Task Description   | Estimated Time |
|------------|--------------------|----------------|
| 1.0        | Design             | 45             |
| 2.0        | Code               | 260            |
| 2.1        | Scanner            | 20             |
| 2.2        | Parser             | 60             |
| 2.3        | Code Generation    | 180            |
| 3.0        | Integrate and Test | 90             |
| 4.0        | Write Manual       | 90             |

As we can see the title of table represents the overall goal to be achieved (compiler project), and the same can be retained for the project plan. The first level are numbered 1.0, 2.0, etc. The second level tasks (code) are numbered 2.1, and so on. This demonstrates the typical decomposition of tasks we do in order to arrive at an agreeable list of tasks.

A manageable task is one for which the expected result can easily identified, the execution status of the task like completion, success, failure can be easily ascertained, and the resource



requirement can be easily understood and met. The WBS helps to prepare such list of tasks from the overall goal of the project.

As stated earlier, the tasks listed from WBS will be used for project scheduling as part of preparing the project plan. The list of tasks with the estimated effort needed is uncovered from WBS. Now we will have to see the dependencies among the tasks so that we can maintain the proper ordering of the tasks, and try to run tasks in parallel if they are independent from each other. All these activities will be done as part of preparing project schedule by project manager to help timely completion of the project. Generally we use PERT charts or Gantt chart for representing the scheduling information. We will look into this in the next section.

#### **SELF-ASSESSMENT QUESTIONS – 1**

1. Project scope, pros and cons are discussed in the initiation phase. (True/ False)
2. A semiformal way of breaking down the goal is called the\_\_\_\_\_.
3. Two general notations used for scheduling are \_\_\_\_\_charts and \_\_\_\_\_ charts.

## **4. PLANNING METHODS**

As discussed in previous section, the objective planning a project is to determine the sequence of tasks as per their dependencies, and complexities. At the later stage the agreed on plan called as baseline helps us to find out any deviations from the actual plan, so that any corrective action needed can be taken to bring the project back on track. The project status need to be continuously monitored so that any deviation from schedule can detected and taken care of. There are several methods available for planning.

These are just a few of the project planning methods or laid down procedures for the successful execution of a project. The ability to effectively plan, execute, and control projects is crucial, and this is where project management methodologies come in. These techniques aid businesses in completing their missions, making the most of available resources, and delivering high-quality results.

- Think about it for a second, at one point in your life, you must have placed an order for an equipment or tool with a lot of disconnected parts that cannot be correctly put together with the aid of an instruction manual. Same goes for project management.
- There are a lot of interconnected and interdependent tasks; ergo the need for a set of generally accepted instructions to serve as a guide for managing project activities.

Among the several methods the most two common methods are as follows:

- 1) PERT Chart
- 2) Gantt Chart

### **PERT Chart:**

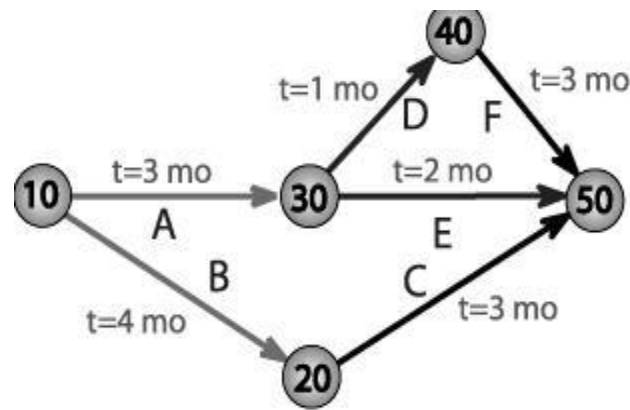
PERT (Program Evaluation and Review Technique) is basically a method to analyze the tasks involved in completing a given project, especially the time needed to complete each task, and identifying the minimum time needed to complete the total project.

A PERT chart is represented with boxes and arrows. Each box represents an activity (ex. Design is an activity, Testing is an activity). The arrows are used to show the dependency of activities on one another. The activity at the head of the arrow cannot start until the activity at the tail of the arrow is finished. For developing this PERT chart, one must first list all the activities required for the completion of the project and estimate how long each will take, and then one must determine the dependencies of activities on one another.

Following are the Salient features of PERT chart:

- 1) It helps the project managers in planning.
- 2) It shows the dependencies among the tasks of the project.
- 3) It helps to determine the critical path(s) of the project (refer Unit 5) and helps to determine alternate approaches in case of problems.
- 4) It helps in scheduling and simulation of alternate schedules.

Example: Figure 3.2 shows a PERT network chart for a seven-month project with five milestones and six activities.



**Fig. 3.2:** PERT network chart for a seven-month project with five milestones (10 through 50) and six activities (A through F).

An elaborate explanation of PERT charts, along with examples is available in Unit – 5 – Project Scheduling.

### Gantt Chart:

Gantt chart is a project methodology used to represent project planning. It is used for primarily for presenting the schedule of a project. Additionally, using this schedule we can perform the budgeting, cost estimation, resource planning. This is a type of bar chart developed by Henry L Gantt .

Main features of Gantt chart are

- It is used for clear and easy graphical representation of the schedule
- It allows showing the resource allocation to the tasks
- It can be used for tracking of the schedule
- It provides the history of the project.

As we can see, the chart helps in scheduling the tasks. Gantt charts are used for resource allocation. Gantt chart cannot depict the inter-task dependencies as clearly as done by PERT chart. We need to use additional arrow pointers between the tasks to represent any dependencies between the tasks. Elaborate explanation of Gantt chart is covered in unit 5.

The PERT chart focusses mainly on monitoring the timely progress of the project, the Gantt chart helps in planning better resource utilization in the project.

**SELF-ASSESSMENT QUESTIONS – 2**

4. The purpose of planning a project is to identify the sequence of activities as per their complexities and dependencies. (True / False)
5. PERT stands for \_\_\_\_\_.
6. \_\_\_\_\_ do not highlight inter-task dependencies.
  - a) Gantt charts
  - b) PERT charts
  - c) Both a) and b)
  - d) None of the above

**Different types of Planning Methods**

To know more about the planning, let us discuss in details about some of the different types of project planning methods one by one in detail,

1. PRINCE2
2. CCPM
3. CPM
4. APF
5. XPM
6. PRISM
7. BRM
8. CRYSTAL

**1. PRINCE (Project in Controlled Environment)**

- PRINCE2 is a project management method that enforces the need to split project accountability between a board and a project manager. While the board's responsibility is to bring in the required resources and focus on business justification, the project manager handles all tasks and manages the team on a daily basis.
- A process-oriented approach to project management that emphasises defining tasks and assigning responsibility at each stage. It's a methodical way to handle projects of any scale.

Improved resource management, increased risk management, clearly defined team roles and responsibilities, a focus on the end user and the final product, a consistent approach to review cycles, well-organized plans, and manageable project management are all benefits of RIN-E2. All the tools, practises, and procedures necessary to successfully complete a project are included in this project management methodology.

## **2. Critical Chain Project Management:**

Time buffers (also known as project buffers) are built into the schedule in this way to ensure that crucial activities are completed on time.

Timeliness is a key consideration in the Critical Chain Project Management approach, which emphasises reducing duration estimates, calculating buffers, notifying of activity completion, measuring progress, and establishing priorities. Any PM-using project team kicks things off with a project schedule.

- Then, based on resource availability, they establish the task dependencies and activities that must be completed so that the rest of the project can be finished successfully without any delay.
- This is the “Critical Chain”. It’s the longest path until the project’s end after you’ve done resource leveling.
- It is utilised to plan and oversee the execution of complicated projects by breaking down individual tasks into manageable chunks and establishing a timeline for their completion. The critical route is the longest chain of interdependent jobs that together define the total project duration.

**3. Critical Path Method:** Zero-float task sequences are the critical path. The critical route is the longest sequence of steps in the project, and it is the one most responsible for delaying the project's end date. By analysing and identifying the sequence of tasks that must be performed on time to ensure the effective completion of the project within a particular timeframe, the Critical Path Method (CPM) is a technique used in project management for scheduling and managing complicated projects. The critical route is the longest chain of interdependent jobs that together define the total project duration.

An approach used in project management, the Critical Path Method (CPM) analyses and identifies the sequence of actions that must be executed on time to ensure the effective



completion of the project within a certain timeframe. The critical path is the longest series of sequential tasks that collectively determine the total time required to complete the project.

This method helps teams identify milestones, task dependencies, and deadlines with ease.

To begin with, create a model of the project and add four elements:

- A list of the tasks that need to be completed
- The duration of each task
- The dependencies between activities
- The endpoint of a task

**4. Adaptive Project Framework:** Each team is responsible for a certain subset of the overall project. The latter are accountable for analysing each project team's results and thinking of strategies to boost productivity.

The Adaptive Project Framework (APF) takes ideas and processes from a variety of different project management frameworks. You can put these to use in a unique way for your own projects. The way a project is made is what sets F apart. A decision is made to select the most appropriate existing approach and modify it for use in the project at hand. The Adaptive Project Framework (APF) is a framework for managing projects that draws heavily on various approaches. Smaller task groups and teams take on individual projects. When the results of a project are unclear, APF often proves more effective than more traditional forms of project management. Clients are included in the project development process to ensure they understand all of the decisions that are made.

#### **5. Extreme Project Management (XPM):**

Extreme project management is not a methodology, it is stressed. Instead, it is a "flexible framework for project management" and "a set of leadership practises for delivering value in the face of volatility." according to Doug DeMarco, author of Extreme Project Management. You may choose to use the Extreme Project Management (XPM) approach if your project has a lot of moving parts, is difficult to predict, and is very dynamic. It takes concepts from agile software development and adapts them for use in non-software development project management. The unpredictable and ever-changing nature of some projects means that tried-and-true methods of project management might not always yield the best results.

In XPM, plans are no longer reliable. Situations can change every second. Project team members have the freedom to bring their own touch to a project or task for which they hold complete accountability. A radical shift in the way your team thinks and regards a project will happen.

- Work through XPM is done at a fast pace and with several twists and turns. Extreme Project Management is required by projects with unpredictable development or that face considerably more changes than traditional projects do. Doug also states that “It is applied in complex project environments when:
- Failure is not an option
- Speed, innovation and profitability count
- Quality of life is important.”

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#### **6. PRiSM (Projects Integrating Sustainable Methods):**

Construction, architecture, landscaping, and any other field where there may be an environmental impact would benefit greatly from this approach. This PM methodology was developed with environmental factors and how they can affect PM in mind from the start. It aids project teams in getting rid of waste and pollution and conserving power. Rationalism is about more than just how you treat nature; it also addresses issues like human rights, labour values, and corruption prevention. This method ensures that the expected results of

a corporate transformation or policy initiative are well-defined, quantifiable, and present a compelling case for investment.

A framework for assuring stakeholders that a project has delivered the promised advantages, advantages Realisation Management (BRM). When all expected benefits have been realised, the project is complete.

### **7. Benefits Realization Management (BRM):**

Management of surplus benefits is a crucial task for any initiative. Many programmes provide excellent capability but fail to realise advantages because little or no arrangements are made to ensure that gains are materialised. Benefits Realisation Management (BRM) is a strategic approach used to guarantee that a project's or program's intended results are realised. It involves keeping an eye on everything from the moment an initiative is conceived to the moment its results are evaluated. The purpose of business relationship management (BRM) is to bridge the gap between project management and business outcomes by ensuring that projects and programmes are aligned with an organization's strategic goals and producing measurable value.

- Robust benefits management is a critical activity in any program. Many programs deliver great capability but fail to realize benefits due to insufficient or no arrangements being made to ensure that benefits are elementsalized. To ensure that the desired outcomes of a project or programme are achieved, a strategic strategy known as Benefits Realisation Management (BRM) must be implemented. It requires overseeing the full benefits cycle, from benefit identification in the planning phase to benefit realisation and evaluation after an initiative has been implemented. By ensuring that projects and programmes are in line with an organization's strategic goals and delivering demonstrable value, BRM is meant to close the gap between project management and business outcomes.

### **8. Crystal**

The three elements common to all Crystal family members are frequent delivery, close communication, and reflective improvement. Crystal Clear, Yellow, and Orange have been used on projects from three to 50 people in size, informal projects, and ISO 9001 projects

We reached out to Dr. Alistair Cockburn, the developer of the Crystal methodology and one of the initiators of the Agile Movement, to have him resume this methodology in a few words: “Crystal is a family of related agile methodologies based on the ideas that:

- No one methodology can fit all projects
- They should be tuned by the project participants to fit themselves,
- They should be light and communication-centric.

## 5. DEVELOPMENT LIFE CYCLE MODELS

The software development life cycle model refers to the methodology that is adopted in grouping of various activities and sequencing of these activities to complete the implementation of the project. Typically a software life cycle model contains the following phases in a software project – requirement gathering, design phase, implementation, integration, testing, installation, and maintenance support. A lifecycle model puts the guideline on the flow of activity across multiple phases, baselines, milestones that need to be captured, transition and feedback mechanism, review, and the deliverables.

The software lifecycle models themselves are described in very generic terms. Typically organizations when they conduct any project decide on the life cycle model to be adopted by looking into standard lifecycle models. They make the necessary changes in the procedures and processes documented in standard models as per organizational needs.

As we all know the “Waterfall” model was the first publically documented lifecycle model. It was documented by Royce in 1970; since then many other models that have been documented are used in practice across multiple organizations. The commonly used software life cycle models are listed below:

- Waterfall model
- Spiral Model
- Throwaway prototyping model
- Evolutionary prototyping model
- Incremental/iterative development
- Automated software synthesis

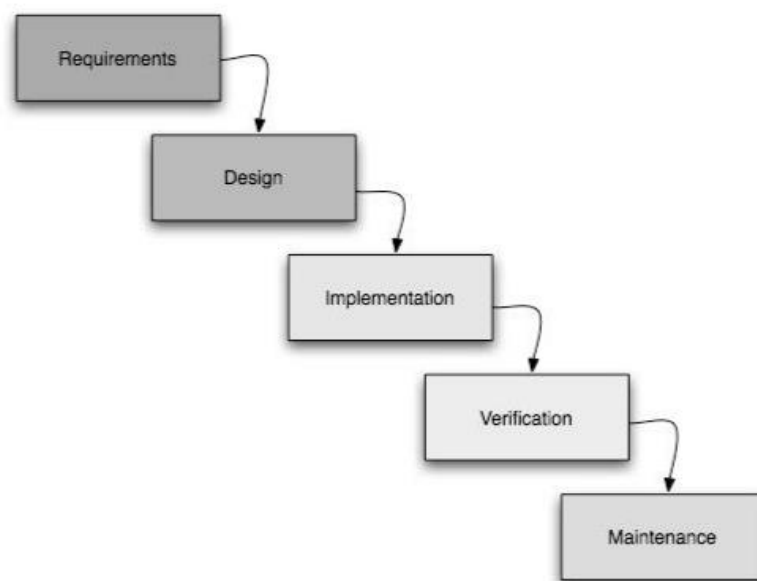


## Waterfall model

Waterfall model is the base model for all other life cycle models. This is the least flexible and most obsolete of the life cycle models. As mentioned earlier it was documented in 1970 and as the name suggests the direction of the flow of the activities across phases of the project (requirement, design, etc.) is similar to a waterfall hence the name. This type of model is well suited for projects that have low risk in the area of user interface and requirements and budget and schedule are high concern and importance. In other words this model is best suited where we have stable requirements. The following are the phases covered in waterfall model and are also typical phases of any project

- Analysis or Requirements
- Design
- Implementation
- Testing or verification
- Maintenance

As the name suggests the phases are carried out one time and after completing one phase completely the next phase of the project starts. Hence this model is termed as one-time model and is not an evolutionary model. Figure 3.3 shows the waterfall model



**Fig. 3.3: Waterfall Model**



We can see from the diagram that we proceed from one phase to the other phase after completion of the previous phase of the project. The initial phase is the requirement gathering. The design phase starts only after all the requirements are gathered and frozen. In other words, we do not expect any changes in the requirement after the requirement phase is over. Similarly, the implementation begins after the design of the system is completed and reviewed. In the same lines the verification or testing phase is carried out after the coding (implementation) is completed. Finally after the testing phase is over, the software is installed and maintained as needed.

In Waterfall model, we can see each phase is worked on after succeeding phase is implemented completely, and there is no going back. Hence this kind of model is best suited where requirements are stable and schedule, budget is of high importance.

### **Spiral Model**

Spiral model is documented in 1985 by Bohem; this model focusses mainly on risk management. Most life cycle models can be derived as special cases of the spiral model. Spiral model combines the features of incremental approach followed by iterative life cycle model along with risk management. Hence, this model is best suited for large, complicated projects.

Some advantages of spiral model are:

- High risk elements are tackled first leaving the low risk items for next iteration
- Employs prototyping as risk reduction strategy
- Focusses on reusability because of iterative nature of implementation
- Accommodates life-cycle evolution, growth, and requirement changes
- Incorporates software quality objectives into the product
- Focus on early error detection and design flaws
- Sets completion criteria for each project activity to answer the question: "How much is enough?"
- Uses identical approaches for development and maintenance
- Can be used for hardware-software system development

**Throwaway Prototyping Model**

This type of model is used mainly for requirement elicitation process. In some cases, the clear cut requirements will not be available for the system to be developed. The customers are also not very sure on the expected behavior of the new system. In such cases the small prototype of the system to be developed is built as “proof of concept” and using the prototype the requirements will be described and extracted. After the requirement phase is over the prototype is not needed for further phases of the project implementation. Hence this model is known as Throwaway Prototype Model.

**Evolutionary Prototyping Model**

In this model, the prototypes are built mimicking user interface and using the prototype the feedback of the customer is obtained on expected behavior of the system on continuous basis. This model is used in projects that have low risk in the area of budget, project control, or large system integration but has higher risk in the area of user interface design.

**Incremental/iterative Development**

Incremental or iterative approach is followed for projects where features are built in multiple releases in successive iteration. This model is considered as an evolutionary model. This life cycle consists of development of the product using stepwise approach. The logical steps of the product defined for each iteration. The software containing the features defined for the current iteration is released to the customer at the end of each release cycle. Every release will go through all the phases of the project defined in waterfall model. In other words for each incremental iteration we will have requirement gathering, design, implementation, and testing phase before the product is released to customer.

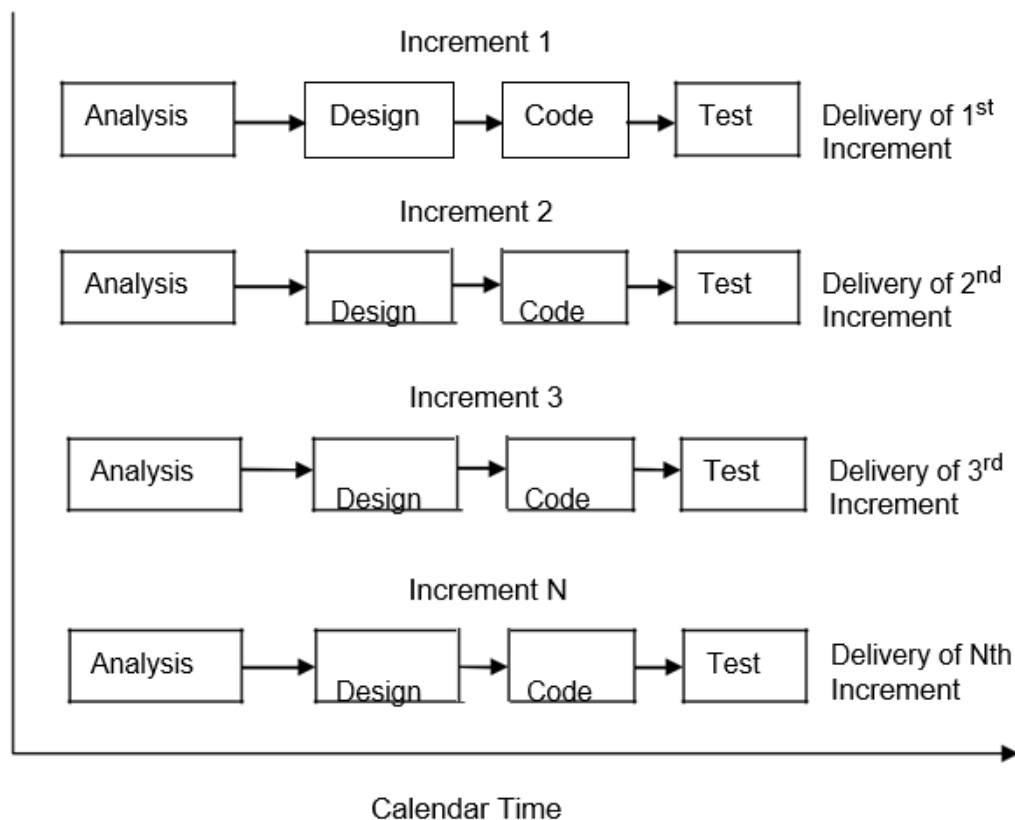
The requirements for the next iteration will be developed considering the requirements of the previous iteration as the base point. Hence this model is termed to be incremental in nature. It is like the basic requirements are addressed in one release and the subsequent features are addressed in subsequent releases.

An incremental development is an evolutionary model. This approach consists of step wise development, in which parts of some stages are postponed in order to produce some useful set of functions earlier in the development of the project. Increments may be delivered to the customer as they are developed. The development begins with the analysis of an increment

at the requirements level. Each increment is then separately designed, coded, tested, integrated and delivered. In other words, the waterfall model is still followed, but for each separate increment.

The incremental model delivers software in small units, called increments. In general, each increment builds on those that have already been delivered.

The incremental model is as shown in Figure 3.4



**Fig. 3.4:** The Incremental Model

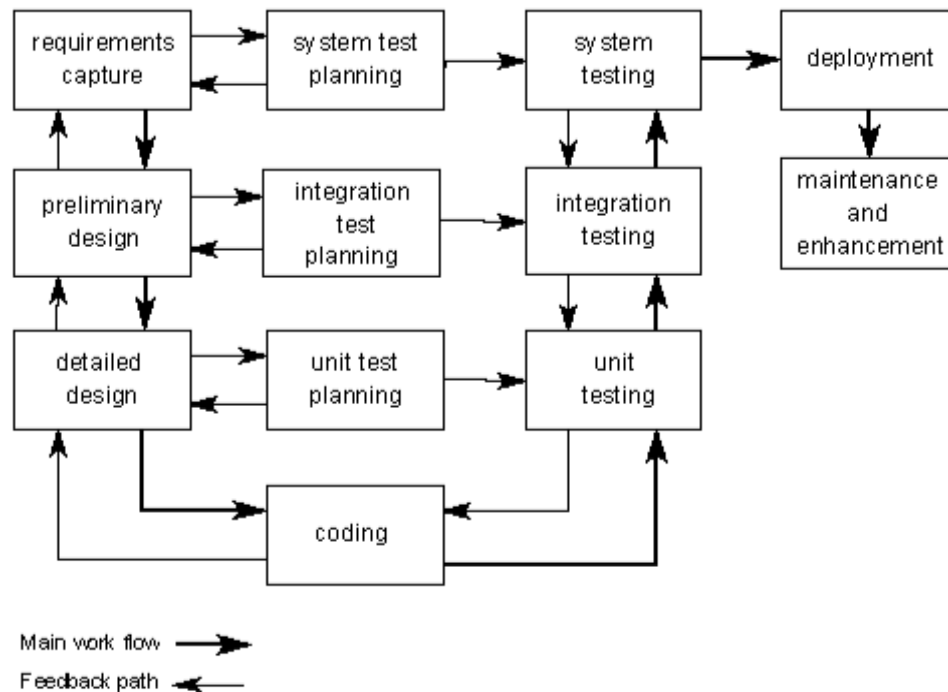
### Automated Software Synthesis

This is comparatively new model that is being emerged and researched. In this approach we are considering the automated tools that transform the requirements into the operational code. The formal requirements are created and maintained using the specification tools using the standard procedure. These requirements will be transformed to working code using the tool that accepts formal requirement and generates standard code as per

requirement. As mentioned earlier, this is still in research state and practical tools yet to be available that follows this approach.

## 6. A GENERIC PROJECT MODEL

The below figure 3.5 shows a generic project model for software development. It contains all the phases necessary for developing a software.



**Fig. 3.5:** A generic project model

Determine Deliverables:

5. Determine the deliverables:

To find out what exactly is deliverables, Deliverables are the concrete results that your project produces. Determining project deliverables is a crucial step in project planning, as it involves identifying and documenting the specific outputs or results that the project will produce. Deliverables provide a clear focus for the project team, stakeholders, and clients, helping to ensure that everyone is aligned on the expected outcomes

- One of the most important project planning steps is to decide on what these deliverables will be and who is responsible for both producing and receiving them. Deliverables are the quantifiable items or services that must be offered at different project stages as well as at the project's conclusion. Deliverables make it possible to allocate resources wisely and keep projects on track.

#### Project Planning:

##### 4. Initiation and Planning:

Initiation and planning are the foundational phases of project planning, and they play essential roles in setting the stage for a successful project. Each phase involves specific activities and objectives that help define the project's purpose, scope, goals, and approach.

Let's explore the roles of initiation and planning in project planning:

- The process of project planning comprises creating a set of plans to aid in leading one's team through the implementation and closure phases of the project. To complete the project on schedule and within budget, project planning also controls staff and external suppliers.
- It involves creating a set of plans to help guide your team through the implementation and closure phases of the project.
- They will also help you control staff and external suppliers to ensure that you deliver the project on time, within budget, and within schedule.

#### The Project Planning Phase:

You may also need to plan your communications and procurement activities, as well as contract any third-party suppliers.

- The project planning phase is often the most challenging phase for a project manager, as you need to make an educated guess about the staff, resources, and equipment needed to complete your project.

#### Purpose of the Project Planning Phase:

##### **The purpose of the project planning phase is to:**

- Establish Business Requirements



- Establish cost, schedule, list of deliverables, and delivery dates
- Establish resources plans
- Obtain management approval and proceed to the next phase

Example-Work Breakdown Structure:

- As a project manager, you may have to experiment to see which WBS works best for you and your team.

Consider as an example a compiler development project. The goal of the project is to develop a compiler. But we cannot estimate or plan properly considering the compiler development as a task itself. Hence we will go into WBS trying to find the sub-tasks we can identify to meet our goal of compiler development

As we discussed earlier, the objective of WBS is to identify the list of tasks that the project must undertake. In the compiler example we considered the first level of sub tasks we identified are the design, code, integrate and test, and write manual.

Now each of these sub tasks can be further broken down if needed. In the Figure, the design task is considered to be at the leaf level; which means we will estimate the design activity and schedule it as one single item. Instead we can sub divide the design task into scanner design, parser design etc. This kind of decision will be taken by the project team that consists of Project manager and team of experts identified to analyze the scope document and derive at the task list.

Once we have the tasks list finalized we can estimate the duration of effort needed for completion of each task identified.

| WBS Number | Task Description | Estimated Time |
|------------|------------------|----------------|
|            |                  |                |
| 1.0        | Design           | 45             |
|            |                  |                |

|     |                    |     |
|-----|--------------------|-----|
| 2.0 | Code               | 260 |
|     |                    |     |
| 2.1 | Scanner            | 20  |
|     |                    |     |
| 2.2 | Parser             | 60  |
|     |                    |     |
| 2.3 | Code Generation    | 180 |
|     |                    |     |
| 3.0 | Integrate and Test | 90  |
|     |                    |     |
| 4.0 | Write Manual       | 90  |
|     |                    |     |

This can be represented in the form of a diagram or can be represented in the tabular form. When representing the tasks in the tabular form each level is represented in consecutive numbering (e.g. 1.0, 2.0, 3.0...). Each item at next level is represented with numbering of its parent item (e.g. 3.1, 3.2, 3.3...etc. for child items of 3rd item at level 1). Table depicts sample effort for compiler project we discussed earlier. As we can see the title of table represents the overall goal to be achieved (compiler project), and the same can be retained for the project plan. The first level are numbered 1.0, 2.0, etc. The second level tasks (code) are numbered 2.1, and so on. This demonstrates the typical decomposition of tasks we do in order to arrive at an agreeable list of tasks.

A manageable task is one for which the expected result can easily identified, the execution status of the task like completion, success, failure can be easily ascertained, and the resource

requirement can be easily understood and met. The WBS helps to prepare such list of tasks from the overall goal of the project.

As stated earlier, the tasks listed from WBS will be used for project scheduling as part of preparing the project plan. The list of tasks with the estimated effort needed is uncovered from WBS. Now we will have to see the dependencies among the tasks so that we can maintain the proper ordering of the tasks, and try to run tasks in parallel if they are independent from each other. All these activities will be done as part of preparing project schedule by project manager to help timely completion of the project.

#### Deliverable-Based Work Breakdown Structure:

- A Deliverable-Based Work Breakdown Structure clearly demonstrates the relationship between the project deliverables (i.e., products, services or results) and the scope (i.e., work to be executed).
- A Deliverable-Based Work Breakdown Structure clearly demonstrates the relationship between the project deliverables (i.e., products, services or results) and the scope (i.e., work to be executed). So let us see this in brief by taking the example of constructions of a house. Majorly it can be divided into three phase first one is internal, foundation and external, and all these phases is been connected through various levels as shown in the picture. In level 1 of internal phases it covers the electrical and lumbering quotes as a recent l time activity , then in level2 in foundation phase it deals with excavate next step is steel excretion. Followed by the last level called as eternal were it involves masonry work and finally the building g consruiction works gets over successfully

#### Phase-Based Work Breakdown Structure:

- Each of these Elements are typical phases of a project.
- The Level 2 Elements are the unique deliverables in each phase.
- Regardless of the type of WBS, the lower Level Elements are all deliverables. Notice that Elements in different Legs have the same name.
- A Phase-Based WBS requires work associated with multiple elements be divided into the work unique to each Level 1 Element.
- A WBS Dictionary is created to describe the work in each Element.

- So, the right WBS is the one that best answers the question, “What structure makes the project more manageable?”
- A good WBS is simply one that makes the project more manageable.
- Every project is different; every project manager is different and every WBS is different.

Steps to Make a Work Breakdown Structure-Gather Critical Data:

- Gather critical project documents.
- Identify content containing project deliverables, such as the Project Charter, Scope Statement and Project Management Plan (PMP) subsidiary plans.

Steps to Make a Work Breakdown Structure-Identify Key Team Members:

- Identify the appropriate project team members.
- Analyze the documents and identify the deliverables.

Steps to Make a Work Breakdown Structure-Define Level One Elements:

- Level 1 Elements are summary deliverable descriptions which must capture 100% of the project scope
- This requirement is commonly referred to as the 100% Rule

### SELF-ASSESSMENT QUESTIONS – 3

7. The "spiral model", documented in 1970 by Royce was the first publicly documented life cycle model. (True / False)
8. Most life cycle models can be derived as special cases of the\_\_\_\_\_.
9. \_\_\_\_\_ is the least flexible and most obsolete of the life cycle models.
  - a) Spiral model
  - b) Waterfall model
  - c) Throwaway prototyping model
  - d) Iterative / incremental development model

## 7. SUMMARY

Dear student, let's summarize the important points:

- Planning is a very critical activity for any kind of project. In fact the whole success depends on the planning only.
- There are various planning techniques are existed. We have discussed the important once in this chapter. i.e. Gantt charts, PERT charts and critical methods.
- For a successful planning for any project, Life Cycles are very vital.
- Project manager has to choose a life model carefully. We have given introduction to various life cycle models (Waterfall, spiral ...etc) also.

## 8. TERMINAL QUESTIONS

1. List out various tasks in project planning.
2. What do you mean by Work Breakdown Structure?
3. Explain different project planning methods
4. What is life cycle model? List out various life cycle models.

## 9. ANSWERS

### Self Assessment Questions

1. True
2. Work Breakdown Structure (WBS)
3. PERT, Gantt
4. True
5. Program Evaluation and Review Technique
6. a) Gantt charts
7. False
8. Spiral model
9. b) Waterfall model



**Terminal Questions**

1. Every project starts with initiation. In which project scope, pros and cons are discussed. Once the project initiation phase is completed, the project team must determine the scope of the effort necessary to accomplish the necessary tasks. (Refer Section 2)
2. Work Breakdown Structure (WBS) is a semiformal way of breaking down the goal. With this technique, one builds a tree whose root is labeled by the major activity of the project, such as “build a compiler”. (Refer Section 3)
3. There are several methods available for planning. The popular ones are:
  - a) PERT Chart
  - b) Gantt Chart (Refer Section 4)
4. Life cycle models describe the interrelationships between software development phases. The common life cycle models are:
  - a) Spiral model
  - b) Waterfall model
  - c) Throwaway prototyping model
  - d) Evolutionary prototyping model
  - e) Incremental/iterative development
  - f) Automated software synthesis (Refer Section 5)