Software Engineering
For BCA 4th Semester
Lecture 6
[Software Project Management, Project Planning, WBS, Gantt Chart, CPM, Phases of Project Management]

Compiled
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Software Project Management

Software project management is an art and science of planning and leading software projects. It is a sub-discipline of project management in which software projects are planned, implemented, monitored and controlled.

To manage new development efforts, companies applied the established project management methods, but project schedules slipped during test runs, especially when confusion occurred in the gray zone between the user specifications and the delivered software. To be able to avoid these problems, software project management methods focused on matching user requirements to delivered products, in a method known now as the waterfall model.

Common Issues in SPM

- Insufficient end-user involvement
- Poor communication among customers, developers, users and project managers
- Unrealistic or unarticulated project goals
- Inaccurate estimates of needed resources
- Badly defined or incomplete system requirements and specifications
- Poor reporting of the project's status
- Poorly managed risks
- Use of immature technology
- Inability to handle the project's complexity
- Sloppy development practices
- Stakeholder politics (e.g. absence of executive support, or politics between the customer and end-users)
- Commercial pressures

Project Planning

Project planning is part of project management, which relates to the use of schedules such as Gantt charts to plan and subsequently report progress within the project environment. Project planning can be done manually or by the use of project management software.

The duration of the tasks is often estimated through a weighted average of optimistic, normal, and pessimistic cases. The critical chain method adds "buffers" in the planning to anticipate potential delays in project execution. Float or slack time in the schedule can be calculated using project

management software. Then the necessary resources can be estimated and costs for each activity can be allocated to each resource, giving the total project cost. At this stage, the project schedule may be optimized to achieve the appropriate balance between resource usage and project duration to comply with the project objectives. Once established and agreed, the project schedule becomes what is known as the baseline schedule. Progress will be measured against the baseline schedule throughout the life of the project. Analysing progress compared to the baseline schedule is known as earned value management.

Work Breakdown Structure

A work-breakdown structure (WBS) in project management and systems engineering, is a deliverable-oriented breakdown of a project into smaller components. A work breakdown structure is a key project deliverable that organizes the team's work into manageable sections. The Project Management Body of Knowledge (PMBOK 5) defines the work-breakdown structure "A hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables."

A work-breakdown structure element may be a product, data, service, or any combination thereof. A WBS also provides the necessary framework for detailed cost estimating and control along with providing guidance for schedule development and control.
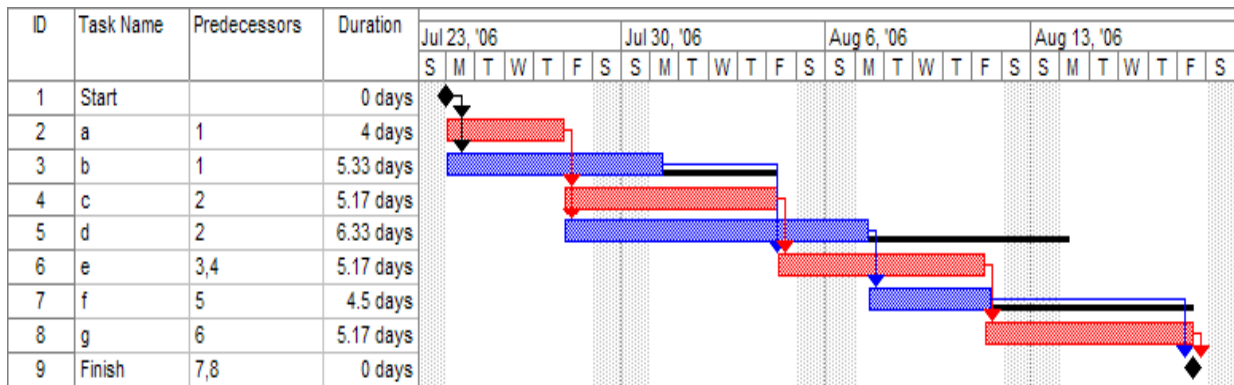
Example
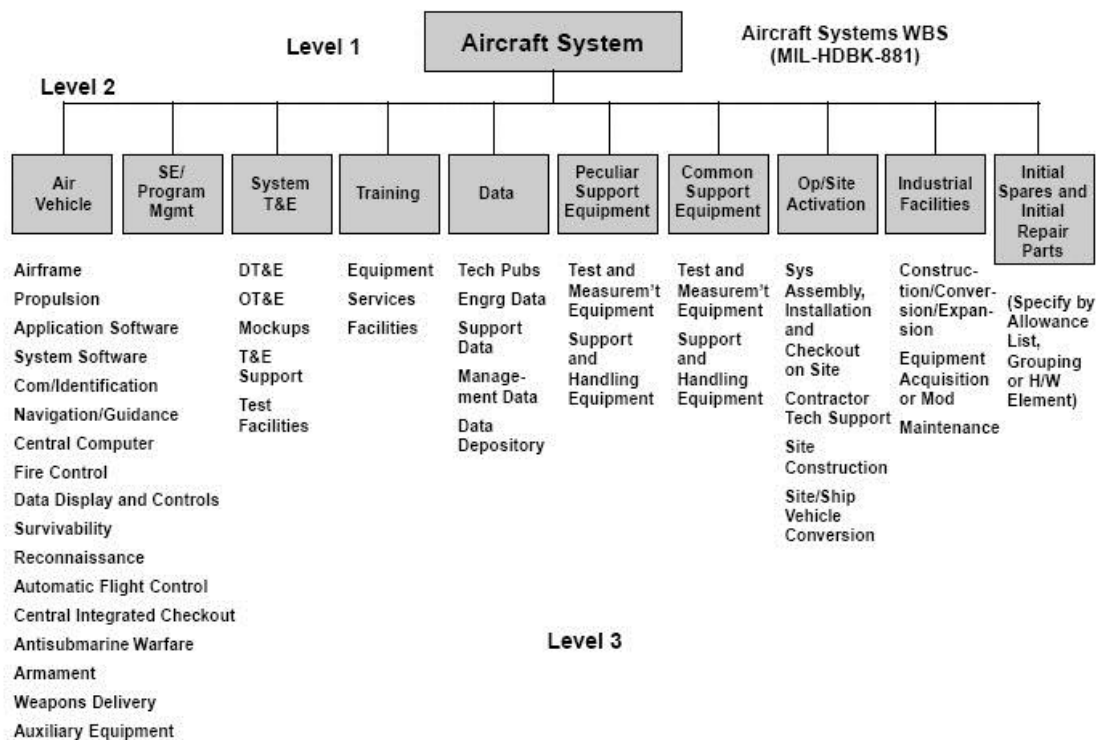
Gantt Chart

A Gantt chart is a type of bar chart that illustrates a project schedule, named after its inventor, Henry Gantt (1861–1919), who designed such a chart around the years 1910–1915. Modern Gantt charts also show the dependency relationships between activities and current schedule status.

A Gantt chart, or harmonogram, is a type of bar chart that illustrates a project schedule. This chart lists the tasks to be performed on the vertical axis, and time intervals on the horizontal axis. The width of the horizontal bars in the graph shows the duration of each activity. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements constitute the work breakdown structure of the project. Modern Gantt charts also show the dependency (i.e., precedence network) relationships between activities. Gantt charts can be used to show current schedule status using percent-complete shadings and a vertical "TODAY" line as shown here.

Gantt charts are sometimes equated with bar charts.

Gantt charts are usually created initially using an early start time approach, where each task is scheduled to start immediately when its prerequisites are complete. This method maximizes the float time available for all tasks.

Activity	Predecessor	Time estimates			Expected time (T_E)
		Opt. (*O*)	Normal (*M*)	Pess. (*P*)	
a	—	2	4	6	4.00
b	—	3	5	9	5.33
c	*a*	4	5	7	5.17
d	*a*	4	6	10	6.33
e	*b, c*	4	5	7	5.17
f	*d*	3	4	8	4.50
g	*e*	3	5	8	5.17

| ID	Task Name	Predecessors	Duration	Jul 23, '06	Jul 30, '06	Aug 6, '06	Aug 13, '06
				S M T W T F S	S M T W T F S	S M T W T F S	S M T W T F S
1	Start		0 days				
2	a	1	4 days				
3	b	1	5.33 days				
4	c	2	5.17 days				
5	d	2	6.33 days				
6	e	3,4	5.17 days				
7	f	5	4.5 days				
8	g	6	5.17 days				
9	Finish	7,8	0 days				

Critical Path Method (CPM)

The critical path method (CPM), or critical path analysis (CPA), is an algorithm for scheduling a set of project activities. It is commonly used in conjunction with the program evaluation and review technique (PERT). A critical path is determined by identifying the longest stretch of dependent activities and measuring the time required to complete them from start to finish.

The critical path method (CPM) is a project modelling technique developed in the late 1950s by Morgan R. Walker of DuPont and James E. Kelley Jr. of Remington Rand. Kelley and Walker related their memories of the development of CPM in 1989. Kelley attributed the term "critical path" to the developers of the PERT which was developed at about the same time by Booz Allen Hamilton and the U.S. Navy. The precursors of what came to be known as Critical Path were developed and put into practice by DuPont between 1940 and 1943 and contributed to the success of the Manhattan Project.

Critical Path Analysis is commonly used with all forms of projects, including construction, aerospace and defense, software development, research projects, product development, engineering, and plant maintenance, among others. Any project with interdependent activities can apply this method of mathematical analysis. The first time CPM was used for major skyscraper development was in 1966 while constructing the former World Trade Centre Twin Towers in New York City. Although the original CPM program and approach is no longer used, the term is generally applied to any approach used to analyse a project network logic diagram.
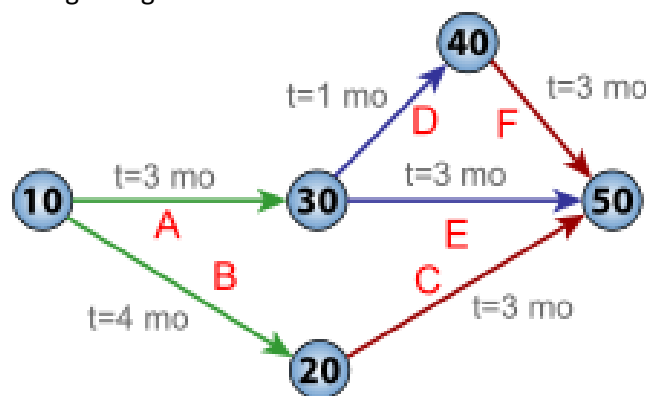
PERT chart for a project with five milestones (10 through 50) and six activities (A through F). The project has two critical paths: activities B and C, or A, D, and F – giving a minimum project time of 7 months with fast tracking. Activity E is sub-critical, and has a float of 1 month.

Components

The essential technique for using CPM is to construct a model of the project that includes the following:

- A list of all activities required to complete the project (typically categorized within a work breakdown structure),
- The time (duration) that each activity will take to complete,
- The dependencies between the activities and,
- Logical end points such as milestones or deliverable items.

Project Management

Project management is the practice of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time. The primary challenge of project management is to achieve all of the project goals within the given constraints. This information is usually described in project documentation, created at the beginning of the development process. The primary constraints are scope, time, quality and budget. The secondary—and more ambitious—challenge is to optimize the allocation of necessary inputs and apply them to meet pre-defined objectives.
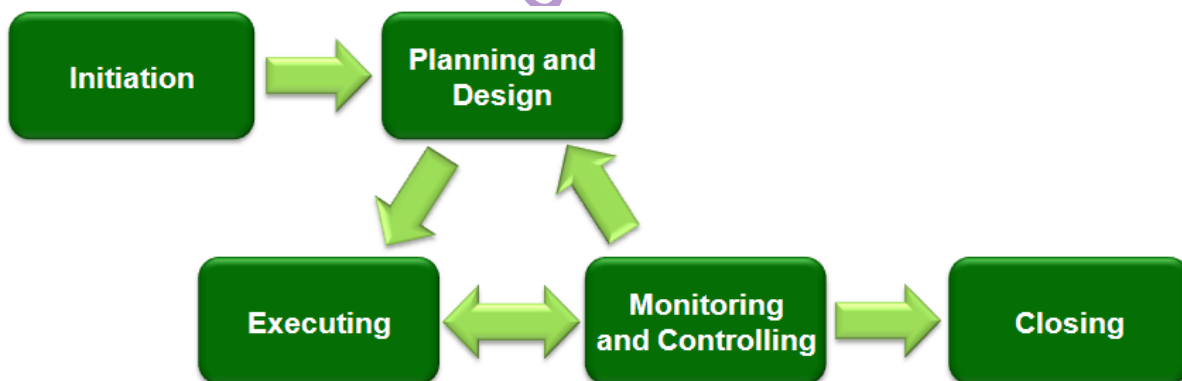
Initiating

The initiating processes determine the nature and scope of the project.[35] If this stage is not performed well, it is unlikely that the project will be successful in meeting the business' needs. The key project controls needed here are an understanding of the business environment and making sure that all necessary controls are incorporated into the project. Any deficiencies should be reported and a recommendation should be made to fix them.

These tend to include:

- RACI (Q) chart. At least one Responsible and exactly one Accountable person are designated for each project and planning activity in project management simulation SimulTrain.
- project proposal (idea behind project, overall goal, duration)
- project scope (project direction and track)
- product breakdown structure (PBS) (a hierarchy of deliverables / outcomes and components thereof)
- work breakdown structure (WBS) (a hierarchy of the work to be done, down to daily tasks)
- responsibility assignment matrix (RACI) (roles and responsibilities aligned to deliverables / outcomes)
- tentative project schedule (milestones, important dates, deadlines)
- analysis of business needs and requirements against measurable goals
- review of the current operations
- financial analysis of the costs and benefits, including a budget
- stakeholder analysis, including users and support personnel for the project
- project charter including costs, tasks, deliverables, and schedules
- SWOT analysis: strengths, weaknesses, opportunities, and threats to the business

Planning

After the initiation stage, the project is planned to an appropriate level of detail (see example of a flowchart). The main purpose is to plan time, cost and resources adequately to estimate the work needed and to effectively manage risk during project execution. As with the Initiation process group, a failure to adequately plan greatly reduces the project's chances of successfully accomplishing its goals.

Project planning generally consists of:

- determining the project management methodology to follow (e.g. whether the plan will be defined wholly up front, iteratively, or in rolling waves);
- developing the scope statement;
- selecting the planning team;
- identifying deliverables and creating the product and work breakdown structures;
- identifying the activities needed to complete those deliverables and networking the activities in their logical sequence;
- estimating the resource requirements for the activities;
- estimating time and cost for activities;
- developing the schedule;
- developing the budget;
- risk planning;
- developing quality assurance measures;
- Gaining formal approval to begin work.

Executing

While executing we must know what the planned terms that need to be executed are. The execution/implementation phase ensures that the project management plan's deliverables are executed accordingly. This phase involves proper allocation, co-ordination and management of human resources and any other resources such as material and budgets. The output of this phase is the project deliverables.

Monitoring and controlling

Monitoring and controlling consists of those processes performed to observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken, when necessary, to control the execution of the project. The key benefit is that project performance is observed and measured regularly to identify variances from the project management plan.

Monitoring and controlling includes:

- Measuring the ongoing project activities ('where we are');
- Monitoring the project variables (cost, effort, scope, etc.) against the project management plan and the project performance baseline (where we should be);
- Identifying corrective actions to address issues and risks properly (How can we get on track again);
- Influencing the factors that could circumvent integrated change control so only approved changes are implemented.

In multi-phase projects, the monitoring and control process also provides feedback between project phases, to implement corrective or preventive actions to bring the project into compliance with the project management plan.

Project maintenance is an ongoing process, and it includes:

- Continuing support of end-users
- Correction of errors
- Updates to the product over time

Closing

Closing includes the formal acceptance of the project and the ending thereof. Administrative activities include the archiving of the files and documenting lessons learned.

This phase consists of:

Contract closure: Complete and settle each contract (including the resolution of any open items) and close each contract applicable to the project or project phase.

Project close: Finalize all activities across all of the process groups to formally close the project or a project phase

Also included in this phase is the Post Implementation Review. This is a vital phase of the project for the project team to learn from experiences and apply to future projects. Normally a Post

Implementation Review consists of looking at things that went well and analysing things that went badly on the project to come up with lessons learned.