PROJECT PLANNING AND SCHEDULING TECHNIQUES

PROJECT MANAGEMENT

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INTRODUCTION

- **The project schedule is the time-based and/or sequenced description of all of the project activities.**

- **The time element is one of the triple constraints that every project leader must contend with: scope, schedule, and resources/budget. There are a variety of techniques for both displaying the project schedule and analyzing the project schedule. Each technique focuses on a different aspect of the project.**

- **Depending upon the project objectives and major risks, different techniques should be used by the project leader.**

TECHNIQUES FOR DISPLAYING

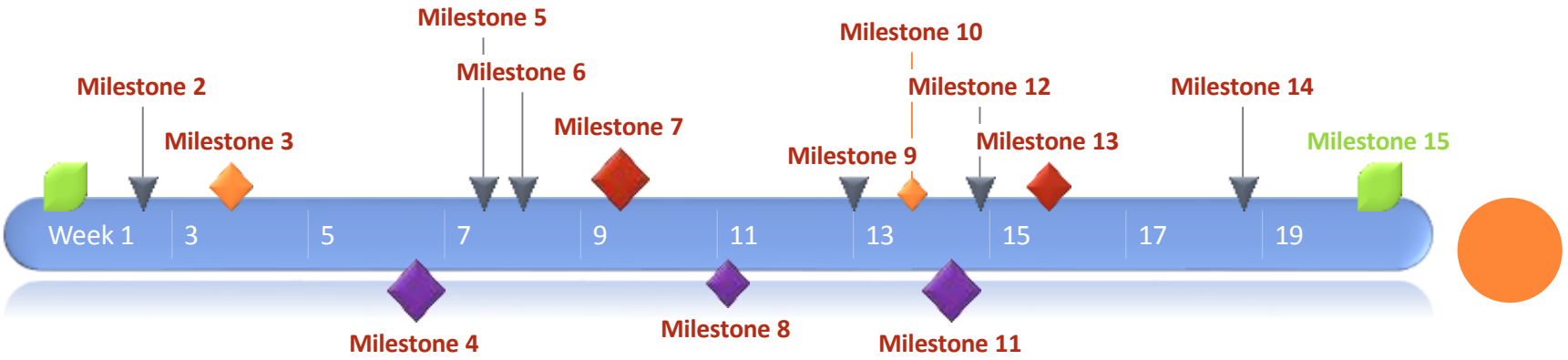
SCHEDULE ANALYSIS TOOLS

TECHNIQUES FOR DISPLAYING

- MILESTONE CHART
- TASK LIST
- GANTT CHART (BAR CHART)
- NETWORK DIAGRAM
- 2-D TASK LIST

MILESTONE CHART

- A Milestone Chart focuses on planned significant events scheduled to occur at specific times in the program.
- Such events could be the initiation or completion of a particularly important or critical activity, equipment deliveries, reviews, or approval dates.
- The milestone chart uses symbols imposed on a calendar to provide information about planned and actual completion dates and any revisions to the milestone schedule.
- There is no standard set of symbols for milestone charts.



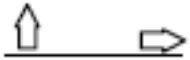
OBJECTIVE

- Milestone charts can be used to illustrate the key events, objectives and targets of any project or plan.
- This makes the milestone template an excellent tool for planning projects or managing programs where visualizing the key components need to be displayed in chronological order on a time schedule.

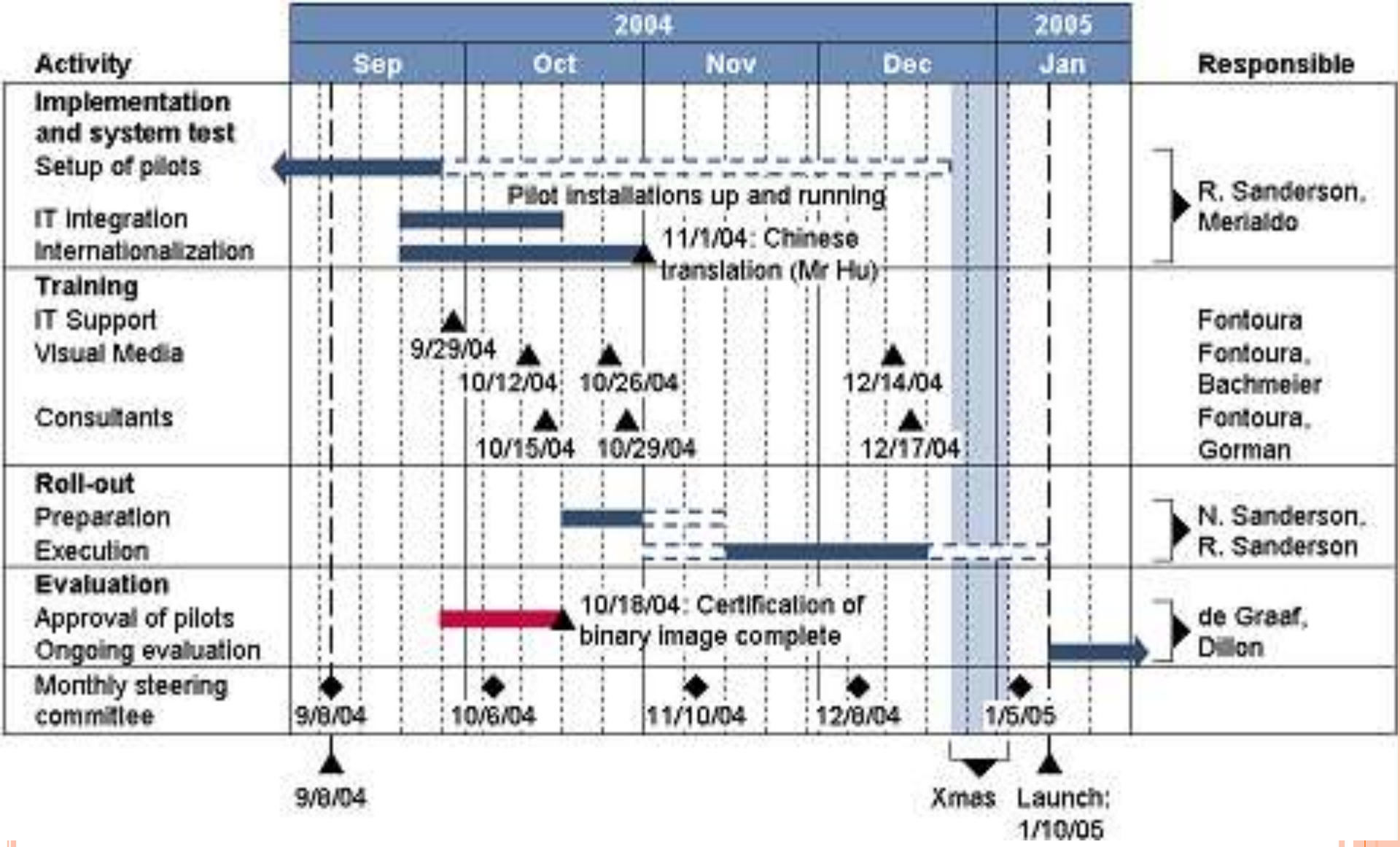
The Figure below shows examples of the symbols prescribed for reporting milestone information

Standard symbols have been adapted for Air Force milestone schedules. The most common symbols used and their meanings are shown below.

Basic Symbol	Meaning
	Schedule Completion
	Actual Completion
	Previous Scheduled Completion—Still in Future
	Previous Scheduled Completion—Date Passed

Representative Uses	Meaning
 	Anticipated Slip—Rescheduled Completion
 	Actual Slip—Rescheduled Completion
 	Actual Slip—Actual Completion
	Actual Completion Ahead of Schedule
	Time Span Action
	Continuous Action

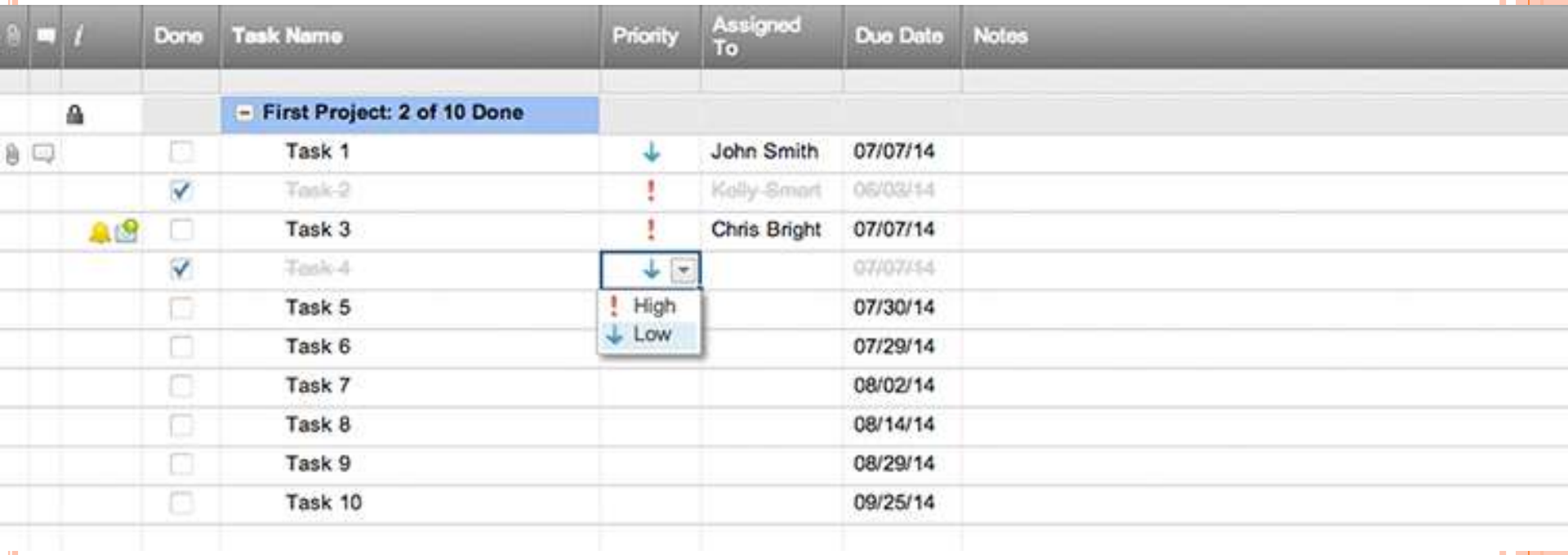
EXAMPLE


2004
2005
Activity
Sep
Oct
Nov
Dec
Jan
Responsible
Implementation and system test
Setup of pilots
Pilot installations up and running
IT integration
Internationalization
11/1/04: Chinese translation (Mr Hu)
R. Sanderson, Merlaldo
Training
IT Support
Visual Media
9/29/04
10/12/04
10/26/04
12/14/04
Consultants
10/15/04
10/29/04
12/17/04
Fontoura
Fontoura, Bachmeier
Fontoura, Gorman
Roll-out
Preparation
Execution
N. Sanderson, R. Sanderson
Evaluation
Approval of pilots
Ongoing evaluation
10/18/04: Certification of binary image complete
de Graaf, Dillon
Monthly steering committee
9/8/04
10/6/04
11/10/04
12/8/04
1/5/05
9/8/04
Xmas
Launch: 1/10/05

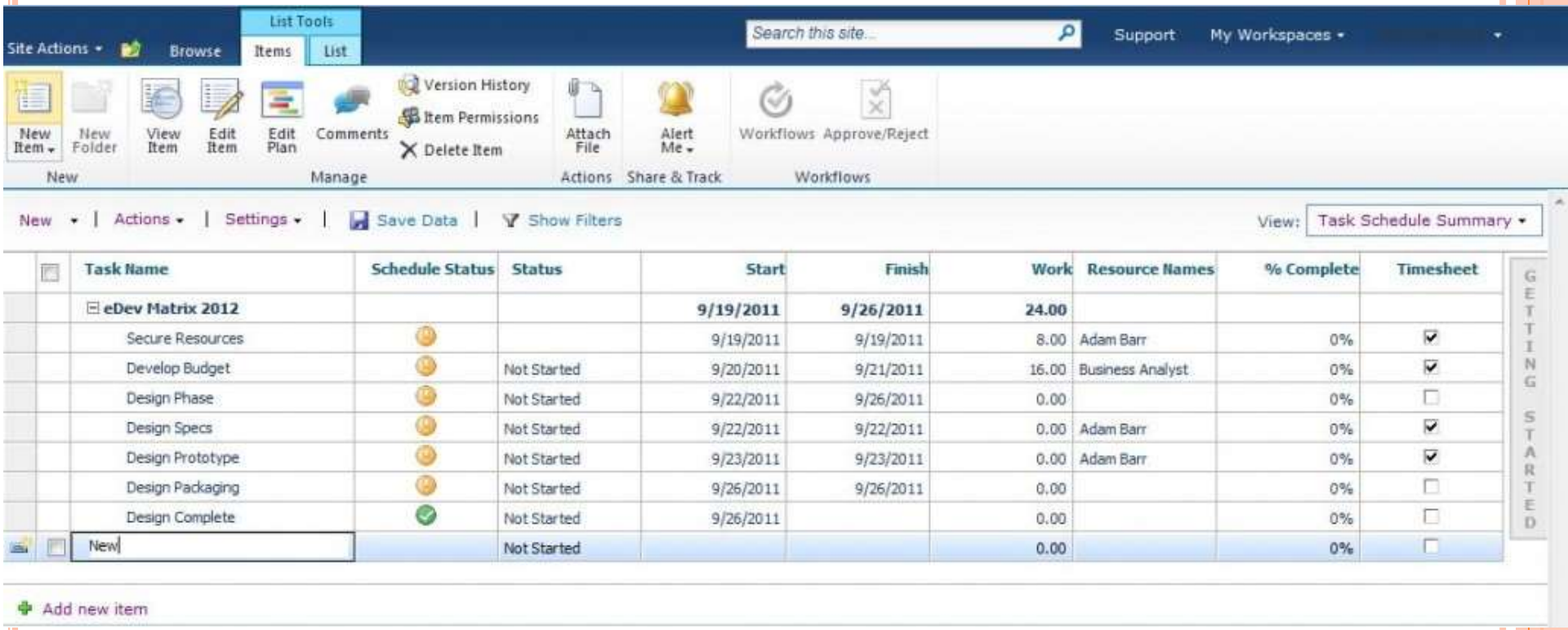
TASK LIST

- The Task List is the simplest of the schedule format tools, yet it can be the most powerful and useful tool with extended members of the project team.
- A Task List is just an action item list for the team member that contains all of the tasks that individual is responsible for completing.
- This provides a focus for the individual as to what they need to do.
- This format works very well with extended team members on large projects.

Task	Date
Conduct ABC analysis	4/25
Prepare test plan	5/15
Build test samples	5/15
Analyze test data	6/7



- In those cases, the project may contain hundreds of tasks but often the extended team member is only involved in a small number of those tasks.
- The extended team member can review their task list and understand what they must do on the project without going through the hundreds of tasks, searching for those requiring their effort.
- If the team has many extended team members with limited involvement in the total project, this technique usually is the best method for communicating and tracking scheduling of the work from those extended team members.



2-D TASK LIST

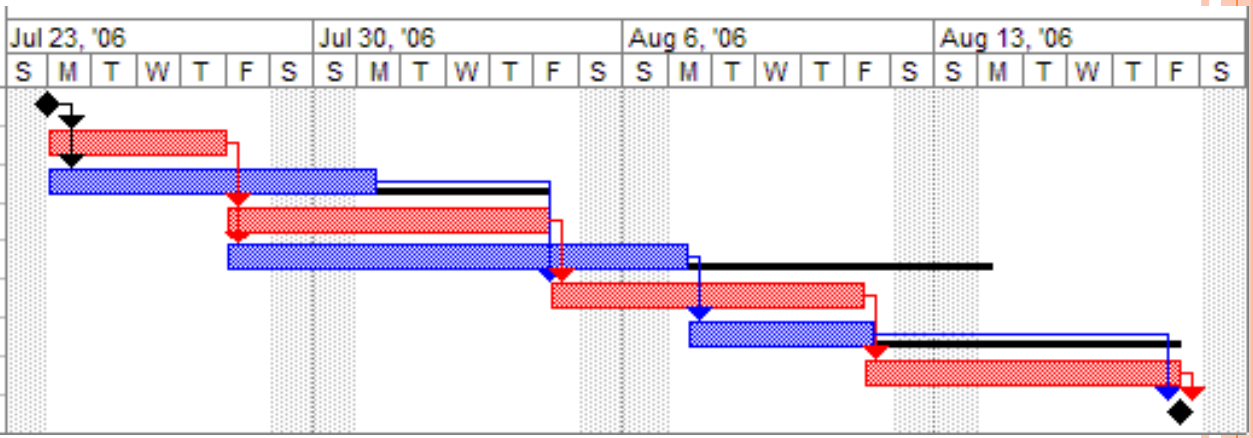
- The 2-Dimensional Task List is only needed occasionally.
- This technique is used for scheduling and tracking a large quantity, or batch, of items through the same set of project tasks or activities.
- The 2-D task list is a matrix with the vertical side being a list of the items in the batch and the horizontal being the set of tasks.
- As a task is completed, normally the background color of the cell in the matrix is changed so that it shows completion.
- This change in color allows the project manager to quickly see when one item in the batch starts to fall behind or when many items in the batch become bottlenecked at one step in the set of tasks.

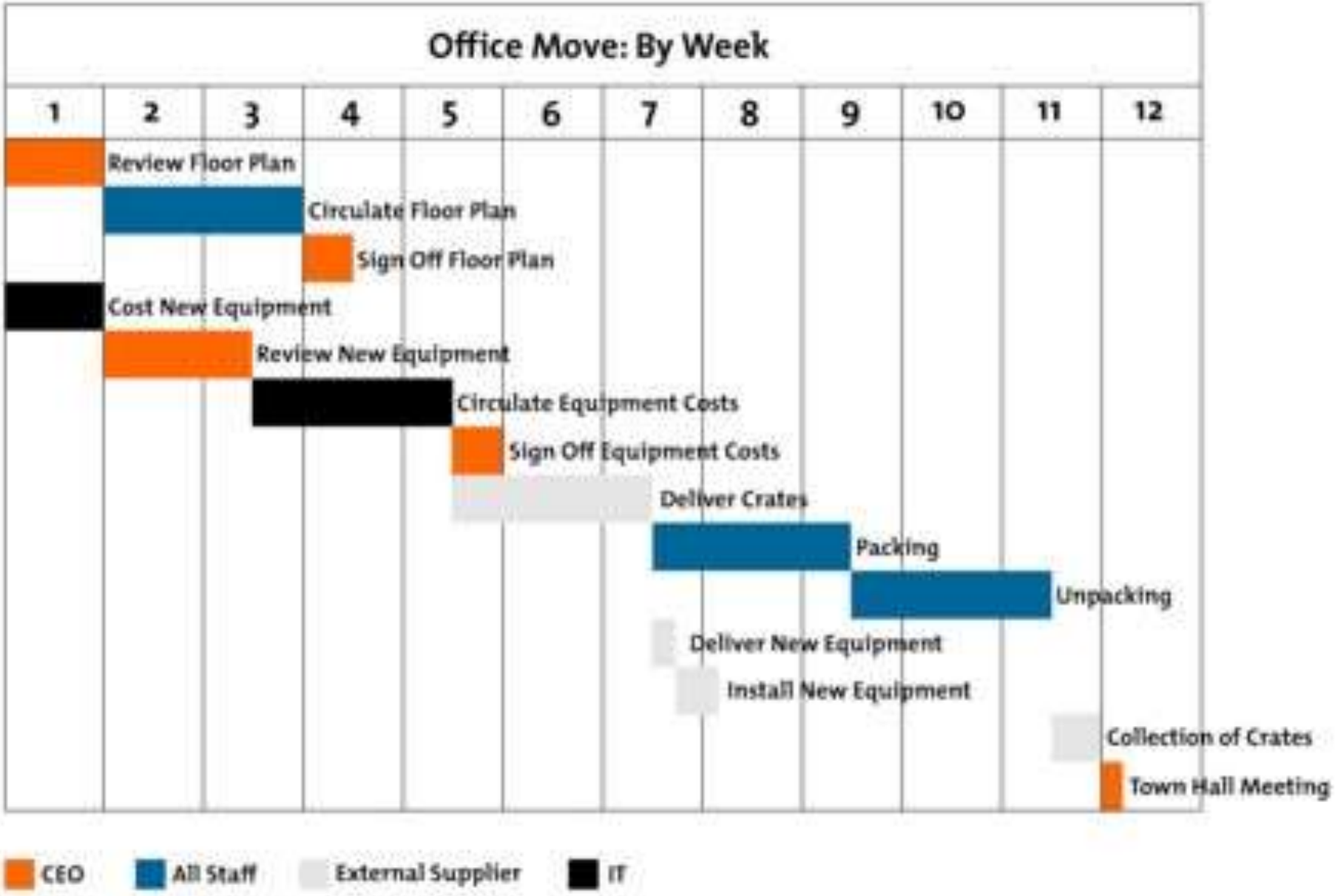
Job	Category	Date Logged	Priority	Deadline	Completed Y/N	Details
Adjust the speed controls for Manchester Bus	Character	04/03/13	High	07/03/13	Y	Character spinning out of control when colliding with wall
Create Invisble walls for 'Track One'	Objects and Interaction	04/03/13	High	07/03/13	Y	Movement in midair will negate all Y-axis velocity
Random Spawning collectables	Objects and Interaction	03/06/13	High	03/06/13	Y	Must spawn bronze, silver and gold coins
Apply a sound to a vehicle	Attributes	03/06/13	Med	05/06/13	Y	Bus accelleration noise.
Re-size the resolution for 'Track Two'	Objects and Interaction	05/06/13	High	05/06/13	Y	Make each image divisible by 2 or 4.
Fix walls in Track One	Objects and Interaction	05/06/13	High	07/06/13	Y	Make sure there are no right anles within the track.
Iplement Timer for both levels	Attributes	05/06/13	High	07/06/13	Y	60 for the first level and 90 seconds for the second one.
Implement coin scoring for both levels	Objects and Interaction	07/06/13	High	09/06/13	y	Bronze = 10, Silver=20, Gold=30

GANTT CHART

- The Gantt, or Bar, chart is the most common schedule format used on projects. In the Gantt chart, every task is represented by a bar of a time line chart.
- The left edge of the bar is located at the time the task is planned to start and the right edge of the bar is located at the time the task is planned to end.
- As the project unfolds, the edges of the bars are often modified to reflect when the task actually started or ended.
- This format creates focus for tracking progress because it is clear to see whether a task should be completed, underway, or pending at any given time.
- The Gantt chart is used for daily/weekly tracking of project progress.
- It is easy to use and maintain.
- It has become the most commonly used project schedule chart because of its simplicity and the focus it creates when tracking the project.

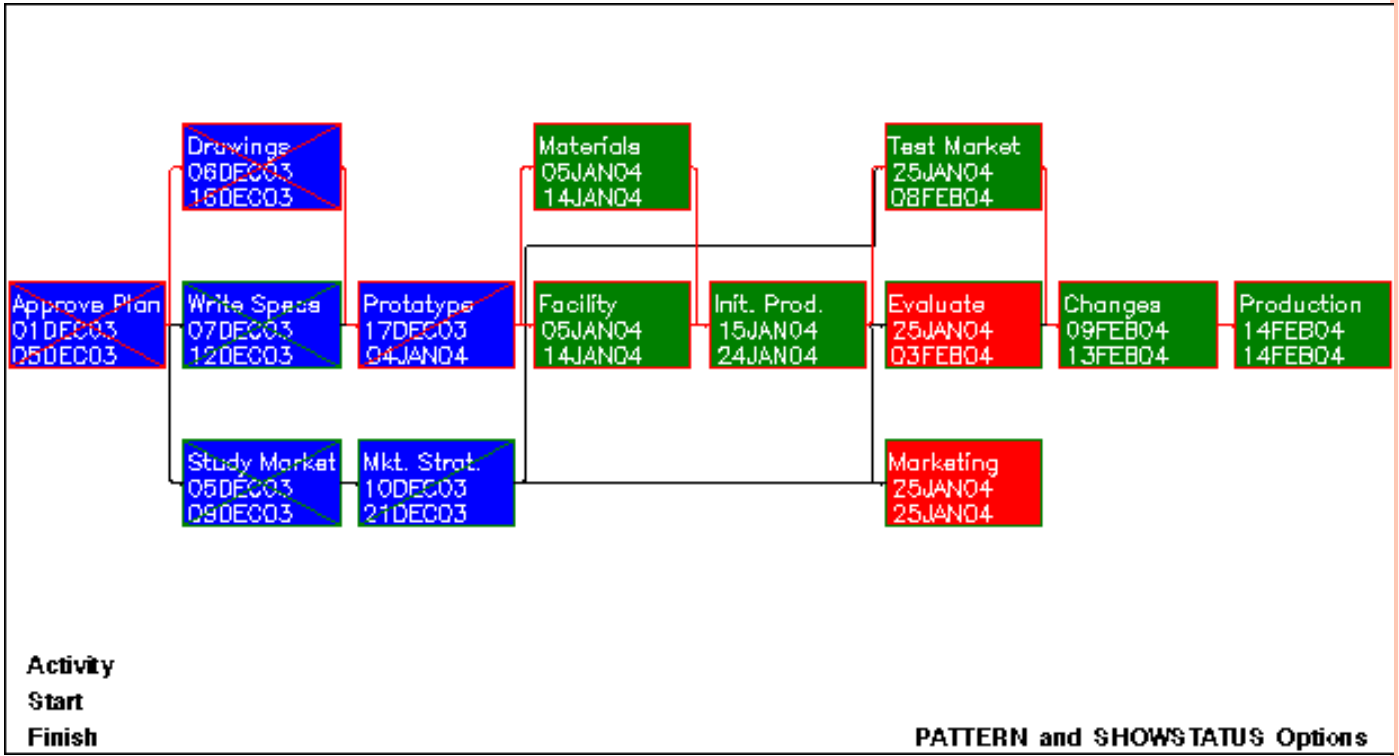
ID	Task Name	Predecessors	Duration
1	Start		0 days
2	a	1	4 days
3	b	1	5.33 days
4	c	2	5.17 days
5	d	2	6.33 days
6	e	3,4	5.17 days
7	f	5	4.5 days
8	g	6	5.17 days
9	Finish	7,8	0 days




Office Move: By Week
1
2
3
4
5
6
7
8
9
10
11
12
Review Floor Plan
Circulate Floor Plan
Sign Off Floor Plan
Cost New Equipment
Review New Equipment
Circulate Equipment Costs
Sign Off Equipment Costs
Deliver Crates
Packing
Unpacking
Deliver New Equipment
Install New Equipment
Collection of Crates
Town Hall Meeting
CEO
All Staff
External Supplier
IT

NETWORK DIAGRAM

- The Network Diagram is essentially a flowchart of the project tasks.
- This format is a foundational technique for several analytical techniques.
- The network is created by determining predecessor and successor relationships and connecting the tasks based upon those relationships.
- In a complex project with many organizations/individuals involved, this technique can provide guidance as to who is the internal customer for each task.
- The Network Diagram shifts the focus for uncertain tasks from arbitrary start and end dates to completion of the work and a handoff to the next task/activity.

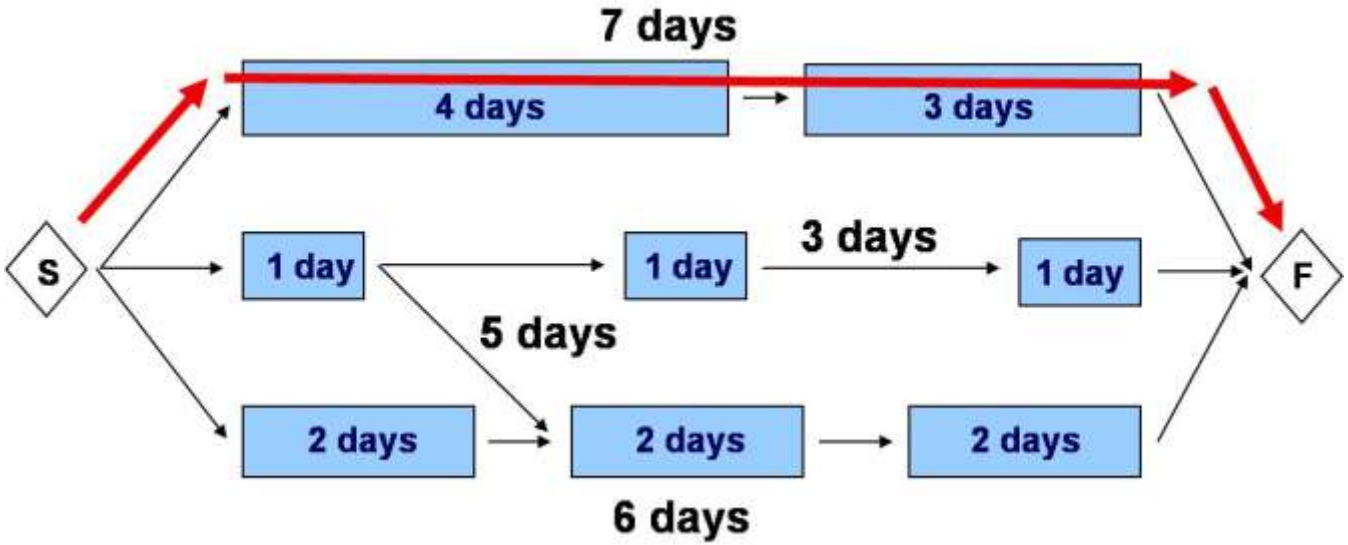


TECHNIQUES FOR ANALYZING PROJECT SCHEDULES

CRITICAL PATH ANALYSE | CRITICAL CHAIN | PERT | RESOURCE LEVELING | SCHEDULE ACCLERATION

CRITICAL PATH ANALYSE

- The critical path of a project is the sequential string of activities that takes the longest time to complete, recognising any dependencies between tasks in this sequence (e.g. one cannot start till another finishes).
- Arrowed lines represent activities with circles at each end representing milestones (start and finish).
- The critical path method (CPM) determines by adding the times of all activities on the critical path, the earliest time that the project can be completed



CRITICAL CHAIN ANALYSE

- This technique builds on the analysis done using critical path and resource leveling techniques.
- It is used when the resource leveling technique has delayed the end date of the project.
- Critical chain reprioritizes the work, applying principles of the Theory of Constraints, and provides simple tracking principles to accelerate the project and ease the burden on project management.
- This is done by determining the best allocation of the critical or constraining resource and shifting the tracking approach to concentrate on this resource.
- The critical chain approach requires the development of the network diagram and the critical path and resource leveling calculation to have been done.

PERT
(Program Evaluation and Review Technique)

- The PERT estimate is a simple risk-mitigation approach that considers the best case and worst case of a task estimate but also includes a most likely estimate that is between the two and is heavily weighted.
- The three estimates are averaged using the PERT formula to create the PERT estimate for the task.
- A PERT analysis starts with a network diagram.
- Each task duration is estimated three times, the best case, worst case, and most likely case.
- A worst case schedule is developed using only worst case estimates.
- A best case schedule is developed using only best case estimates.
- A PERT estimate is determined for each task.
- A PERT project schedule is then set using the PERT estimates.

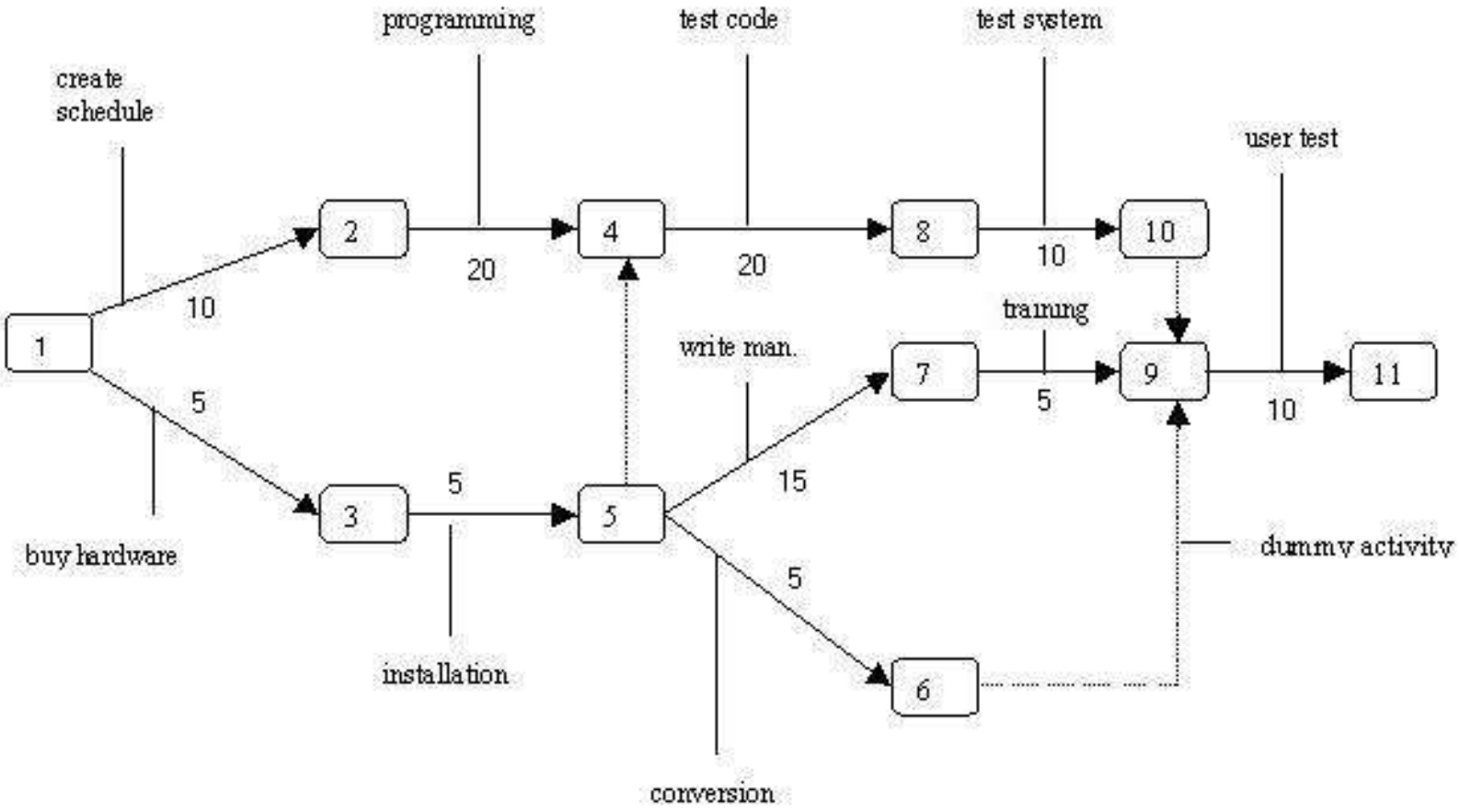


Fig. 1:
PERT Chart

* Numbered rectangles are nodes and represent events or milestones.
* Directional arrows represent dependent tasks that must be completed sequentially.
* Diverging arrow directions (e.g. 1-2 & 1-3) indicate possibly concurrent tasks
* Dotted lines indicate dependent tasks that do not require resources.

RESOURCE LEVELING

- Resource Leveling is a technique used to smooth out the peaks and valleys in the required project resources.
- This leveling process usually results in changes to the project schedule.
- Through the use of leveling, the best allocation of resources assigned to the project can be determined.
- The resource leveling technique applies when the project has been planned with a high degree of parallelism.
- Usually in this case many of the different parallel paths will have float (unless they are a critical path).
- That float is used to reposition tasks so that the resources required to conduct that task are not needed at the same time on another task.
- To do resource leveling, first the network diagram is developed and the task durations and resources requirements for each task are determined.
- Next the critical path is calculated.

SCHEDULE ACCLERATION

- Schedule acceleration techniques are used to shorten the overall length of the project.
- While they reduce the planned total duration of the project, they do so by increasing risk in some other aspect of the project.
- They need to be deployed carefully, and always with an update to the project risk management plan.
- There are five schedule acceleration techniques - each with its own unique set of risks.
- Selecting the technique, or combination of techniques, to be used depends on the characteristics of the activities to be accelerated and the overall risk sensitivity in the project.

1. Buffer Management
2. Crashing
3. Fast - tracking
4. Split to phases
5. Mainline offline scheduling

Buffer Management -

1. Buffer management reduces the buffer that is inherent in the estimates of uncertain activities.
2. When estimating uncertain activities, project managers tend to allow for the uncertainty by using a conservative estimate.
3. Buffer management removes the buffer from the activity estimate, thereby creating an aggressive activity estimate.
4. The setting of aggressive activity goals will often result in a reduced activity duration.
5. However, the risk is that now there is a much higher probability that the activity will finish late as compared to the plan. When this technique is used, the project manager needs to maintain a project-level schedule reserve to compensate for the activities that will be late.

Crashing -

1. Crashing accelerates an activity by adding additional resources.
2. Some activity durations are limited by resource availability - more resources would allow a faster completion. While this is not true for all activities, it is true for some.
3. This will often increase the overall cost of the project as the additional resources are often added at a premium.

Fast-tracking -

1. Fast-tracking accelerates the project by starting activities prior to the completion of all the predecessor activities.
2. This can only be done when there is a preliminary result of the predecessor activities.
3. This technique is viable when the predecessor activity has a preliminary deliverable that the project management team believes is stable.

Split-to-Phases -

1. The Split-to-Phases technique is used when the project has multiple, separable objectives.
2. The scope of the project is divided into phases based upon the activities that are unique to a project objective.
3. This allows a focusing of project resources on the activities supporting one of the objectives at the expense of the activities supporting a different objective.
4. This will result in an early completion of a portion of the project, but usually causes a delay in another portion of the project and often an increase in cost because of activities that must be repeated for each of the phases.
5. This acceleration technique is appropriate only when the completion of the first phase is able to immediately start producing some business benefit, without the completion of the succeeding phases.

Mainline-Offline Scheduling -

1. The Mainline-Offline technique separates the work within an activity into two components.
2. The first is that which can be done generically without specific knowledge of the results of predecessor activities.
3. The second is that which can only be done once the predecessor activities are complete. An example would be creating a project requirements document.
4. A generic template can be created based upon the general understanding of the project.
5. The specific requirements are identified based upon meetings with stakeholders or analysis of business processes.