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A Practical Step-by-Step Approach
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PMBOK Guide 5th Edition and Oracle Primavera P6: A Practical Step by Step Approach for Time Management

By Satya Narayan Dash, PMP, PMI-ACP

1. Abstract

While Project Management Institutes' (PMI) Project Management Body of Knowledge (PMBOK) is one of the most used project management guides worldwide, it is entirely theoretical and does not address the practical usage via a practical tool. In fact, it was not meant to be. Nevertheless, with tools like Oracle Primavera P6, the theoretical principles of PMBOK can be practically implemented. This paper talks about the Practical Applicability of Time Management Knowledge Area, one of 10 knowledge areas in PMBOK, with the help of Oracle Primavera P6.

2. Introduction

In this paper, the major comparisons between PMBOK and Primavera P6 are outlined with focus on Time Management. There are various major constraints defined in PMBOK guide, [v.i.z.] scope, quality, budget, schedule, resources and risk. Here though the primary focus is on Time Management, parts of Scope Management principles from PMBOK have been taken into account to have a detailed understanding.

This paper is based on PMBOK Guide 5th Edition and Oracle Primavera P6 Professional Release 8.4. The conceptual understanding will remain same for earlier versions of Primavera P6, e.g., R8.3 or R8.2.

To have a complete understanding, certain Input, Tools and Techniques and Outputs (ITTO) of other Knowledge Areas (KA), such as Scope Management KA, Human Resource Management KA and Integration Management KA from PMBOK guide, have been used. In some places of the document, PMP and PMBOK Guide have been used interchangeably. In many places, the software tool has been shortened as Primavera P6 or has been plainly referred as Primavera.

3. PMBOK Guide 5th Edition

Every Knowledge Area in PMBOK Guide comes with various Process Areas (PA) or processes. Time Management KA in PMBOK comes with 7 Process Areas, which are:

 (i)   Plan Schedule Management
 (ii) Define Activities
 (iii) Sequence Activities
 (iv) Estimate Activity Resources
 (v)   Estimate Activity Durations
 (vi) Develop Schedule
 (vii) Control Schedule

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Other than the above PAs, one PA from Scope Management, i.e., Create WBS has been taken in, as WBS forms the backbone of creation of activities not only PMBOK but also in Primavera P6. As a good practice in Oracle Primavera, WBS creation is encouraged before proceeding to Activities.

In this paper, for all PA(s), the key ITTOs are highlighted some of which are further elaborated along with the help of Primavera P6.

3.1 Create WBS: (Scope Management)

Input	Output
Scope Management Plan	Scope Baseline
Project Scope Statement	
Requirements Documentation	

Scope Baseline is the combination of Scope Statement, Work Breakdown Structure (WBS) and WBS Dictionary. Decomposition techniques are used to create the WBS. Primavera P6 asks for the creation of WBS before proceeding having a Schedule Management Plan.

Following are the seven PAs, defined in Time Management KA, along with some of the major ITTOs.

3.2. Plan Schedule Management: (Time Management)

Input	Output
Project Management Plan	Schedule Management Plan
Project Charter	

3.2. Define Activities: (Time Management)

Input	Output
Schedule Management Plan	Activity List
Scope Baseline	Activity Attributes
	Milestone List

Decomposition and Rolling Wave Planning/Progressive Elaboration are the two major ITTOs in this PA, where we can take the help of Primavera P6.

3.3. Sequence Activities: (Time Management)

Input	Output
Schedule Management Plan	Project Schedule Network Diagrams
Project Scope Statement	
Activity List	
Activity Attributes	
Milestone List	

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Precedence Diagramming Method, Dependency Determination, Leads and Lags are the major ITTOs where Primavera P6 can be used to create the final Project Schedule Network diagram.

3.4 Estimate Activity Resources: (Time Management)

Input	Output
Schedule Management Plan	Activity Resource Requirements
Activity List	Resource Breakdown Structure
Activity Attributes	
Resource Calendars	

Other major inputs are Risk Register and Activity Cost Estimates, which will not be focussed as we are talking of primarily Time Management, though Risk Management and Cost Management can be aptly managed by Primavera P6. However, some of the important tools and techniques such as Resource Breakdown Structure (RBS), Resource Calendars that can be managed with Primavera P6 are discussed.

3.5. Estimate Activity Durations: (Time Management)

Input	Output
Schedule Management Plan	Activity Duration Estimates
Project Scope Statement	
Activity List	
Activity Attributes	
Activity Resource Requirements	
Resource Breakdown Structure	
Resource Calendars	

Estimates for each Activity can be done with the help of Primavera P6 to create the final project estimate and schedule.

3.6. Develop Schedule: (Time Management)

Input	Output
Schedule Management Plan	Schedule Baseline
Project Schedule NW Diagram	Project Schedule
Activity Lists	Schedule Data
Activity Attribute	Project Calendars
Activity Resource Requirements	Project Management Plan Updates
Resource Calendars	
Activity Duration Estimates	
Project Scope Statement	
Resource Breakdown Structure	
Project Staff Assignment	

Other major inputs are Risk Register, which is again beyond the scope of this paper. However, we will check some of the important tools and techniques in Develop Schedule, such as

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Schedule Network Analysis, Critical Path Method, Resource Optimization Techniques, Leads and Lags, Schedule Compression and of course the Schedule Tool, which is Primavera P6.

3.7. Control Schedule: (Time Management)

Input	Output
Project Management Plan	Work Performance Information
Project Schedule	Schedule Forecasts
Work Performance Data	Project Management Plan Updates
Project Calendars	
Schedule Data	

We will check some of the important tools and techniques in Control Schedule such as Resource Optimization Techniques, Leads and Lags, Schedule Compression and of course Project Management Software along with Schedule Tool, which is Primavera P6.

4. Times Management Process Interaction

"Create WBS" PA provides the WBS to "Define Activities" from where the list of activities is generated. All these activities are sequenced to create the Schedule Network Diagram in "Sequence Activities" PA.

Simultaneously activity resource requirements are determined from "Estimate Activity Resources" PA and then durations for each activity are estimated from "Estimate Activity Durations" PA. The Project Schedule along with the Schedule Baseline is created in "Develop Schedule" Process Area.

The overall process interaction for Time Management KA has been shown below.

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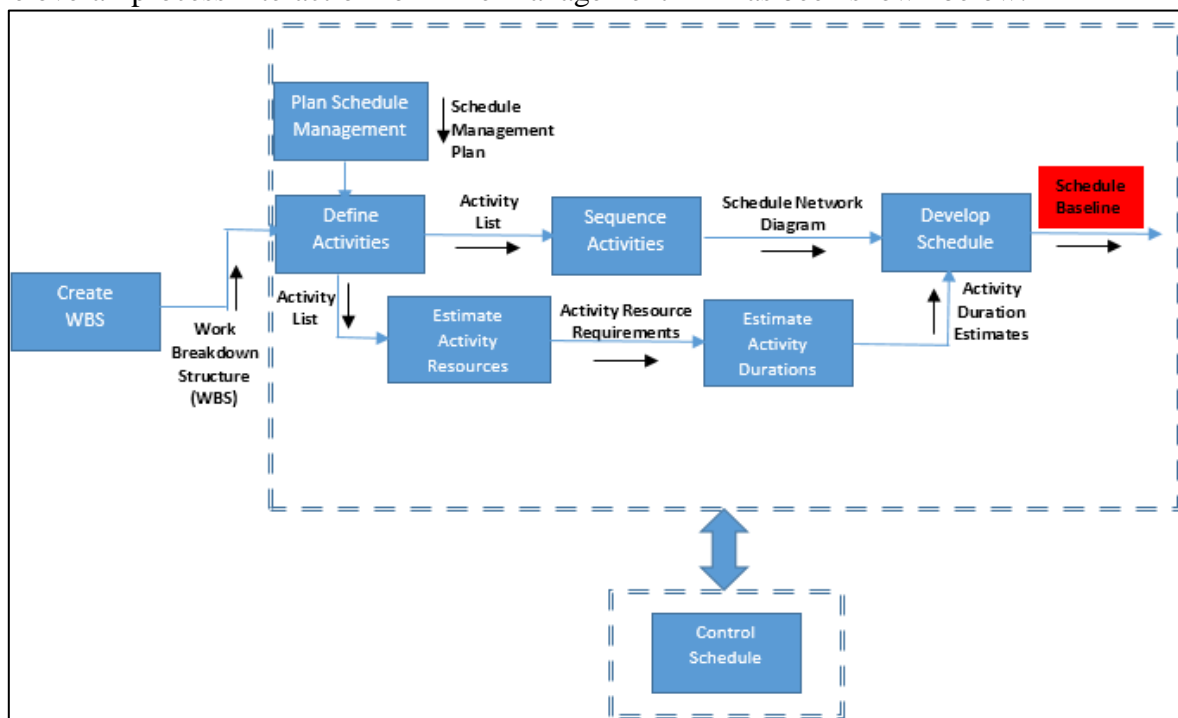
The "Control Schedule" PA falls under the Monitoring and Control Process Group which is overseeing the other 6 planning PA and performs the control operations. All changes are tracked with respect to the Schedule Baseline and finally integrated via Integration Management KA.

While developing the schedule for Primavera P6, similar kind of process is being followed. It must be noted that human, non-human and material resources are actually taken from Human Resource Management and Procurement Management from where the duration for each activity is determined. The "Schedule Baseline" is simply called "Baseline" in Primavera P6 and changes are tracked with respect to the baseline.

5. A Step by Step Practical Approach to PMBOK

5.1. PMBOK and Primavera: The Convergence

"Convergence" here means that certain terms and terminologies are conceptually and terminologically same in both Primavera P6 and PMBOK Guide. They are elaborated in detail in the following subsections.

5.1.1. Project (PMBOK/Primavera P6):

A "Project" is at the highest level of a WBS. A project can be further broken down into phases or deliverables.

In Primavera P6, a Project is part of Enterprise Project Structure (EPS). A project can be part of an existing EPS or can be part of a newly created EPS. When an EPS is created, it is associated with an ID. The EPS forms the hierarchical structure of database of projects.

Each EPS node can be divided into multiple levels. The number of levels and its structure depend on the scope of the projects in an organization.

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As shown above, the EPS is created with an EPS ID and EPS Name. This particular EPS is being managed by an Enterprise Project Manager. Primavera P6 being an EPPM tool provides option to change the manager or assign a manager to a project.

A Project is part of the EPS and is created under it in Primavera. Like every EPS has an Identifier, every Project under the selected EPS has an associated Identifier and an associated Name. After a project is created, it becomes part of the project structure and is displayed as shown below.

5.1.2 Work Breakdown Structure – WBS (PMBOK/Primavera P6)

Work Breakdown Structure (WBS) is created in "Create WBS" process of "Scope Management" KA. As per PMBOK, the WBS is the hierarchal decomposition of work to be carried out by the project team to create the project deliverables. A WBS is created from the Scope Management Plan and Project Scope Statement.

In Primavera P6, first the creation of WBS is a needed as a good practice. Without WBS, you can have activities too, but that will be an unnatural thing to do. Also, as per PMBOK, a WBS is created first and from it, activities are further derived to get the schedule.

Example: The below WBS has been broken down to few levels from the highest level, i.e., the Project. The WBS is launched from the Project Toolbar with associated layout as "Layout: WBS Standard View". It can also be launched from Project menu → WBS.

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5.1.3 Work Package (PMBOK/Primavera P6):

As per PMBOK, a work package can be assigned to multiple people and can be broken down to "Activity" level. A "Work Package" in PMBOK corresponds to lowest level of WBS in Primavera P6.
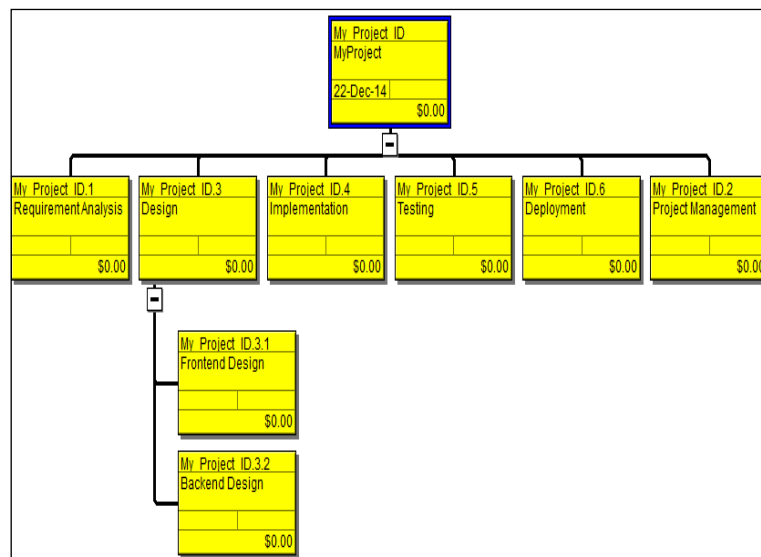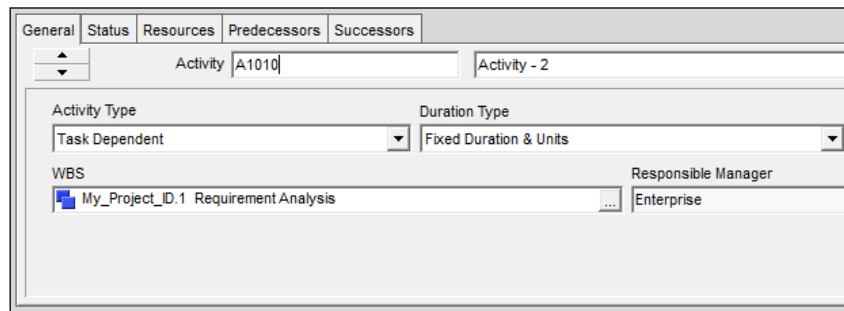
As shown above, the **Graphical WBS** can be launched from Project menu → WBS and then by applying the Layout view "WBS Chart". The lowest level in the WBS is called "Work Package". It is the work package which will be broken further down into activities.

5.1.4 Activity (PMBOK/Primavera P6):

The Activities are created in "Define Activities" PA under "Time Management" KA. By "Decomposition", a work package is further broken down into activities. An "Activity" is the smallest unit which can be assigned to a person. Generally, one person is assigned to an activity, though more people can also be assigned.

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In Primavera P6, the lowest level of WBS is broken further to activities. By default, an Activity is of "Task Dependent" type and of "Fixed Duration and Units" Duration type.
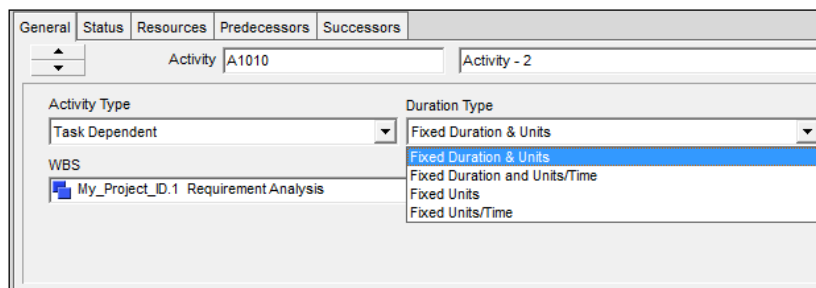
Other possible types of Activities are – "Resource Dependent", "Level of Effort", "Start Milestone", "Finish Milestone", and "WBS Summary".

5.1.5 Activity List (PMBOK/Primavera P6):

A collection of activity is called Activity List and it is created in "Define Activities" PA of "Time Management" KA. In Primavera P6, a collection of Activities can also be called as "Activity List".

5.1.6 Activity Duration (PMBOK/Primavera P6):

Activity Duration is estimated in "Define Activity Durations" PA of "Time Management" KA as defined in PMBOK. In Primavera P6, duration is calculated as the default duration type for an activity is "Fixed Duration & Units". It shown under the "General" tab of each activity.

Other possible Duration Types are – "Fixed Duration and Units/Time", "Fixed Units", "Fixed Units/Time". Depending on the need of the scheduling, the activity type and duration type helps in determining the final schedule.

5.1.7 Relationship/Dependencies (PMBOK/Primavera P6)

As per PMBOK, there are 3 kinds of dependencies: [namely] mandatory dependency (or hard logic), discretionary dependency (soft logic), and external dependency. The relationships among dependencies can be Finish-to-Start (FF), Start-to-Start (SS), Start-to-Finish (SF), and Finish-to-Finish (FF). The most common type of relationship is FS.

In similar fashion, for Primavera P6, the relationships can be one of the aforementioned four types. For a particular activity, the relationship with a predecessor activity can be viewed in the

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"Relationship" Tab of "Activity Details" pane when the Activities Layout is opened. The default layout for Activities is "Layout: Classic Schedule Layout".

The notations in the bar area of the various relationships in Primavera P6 will be as shown below.

Relationship	Notations
Finish-to-Start (FS)	Activity 1 / Activity 2
Finish-to-Finish (FF)	Activity 1 / Activity 2
Start-to-Start (SS)	Activity 1 / Activity 2
Start-to-Finish (SF)	Activity 1 / Activity 2

5.1.8 Milestone/Milestone List (PMBOK/Primavera P6)

Milestone List is created in "Define Activities" PA of "Time Management" KA. Milestone list is a set of milestones. The meaning of word Milestone is same for both PMBOK and Primavera P6. It is an event which of "zero duration". It is a time in the project where a significant event happened and it is normally imposed from outside. For practical tools, it becomes an activity with zero duration.

Milestones, in Primavera P6, can be of two types – "Start Milestone" and "Finish Milestone". This can be done in the "Activity Type" dropdown menu in General tab of activity "Details" pane for each activity. The milestones/activities can be seen via Project menu → Activities.
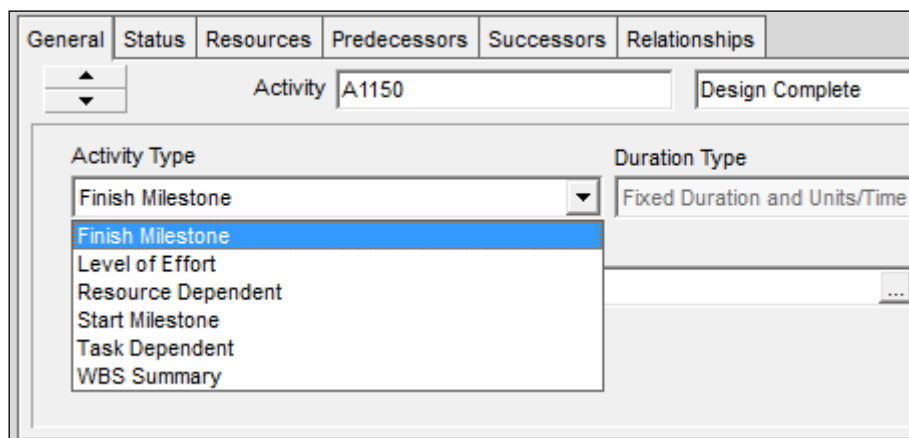
5.1.9 Lags (and Leads) (PMBOK/Primavera P6)

In PMBOK, a Lag is the amount of time by which the successor activity can be delayed with respect to its predecessor activity. A lead is the opposite of it, i.e., will be of positive value.

In Primavera P6 as well, the concepts are same and they apply to the activities. Similar to PMBOK, in Primavera, lag is noted with a positive value, whereas lead is noted with a negative

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value. This can scheduled in "Relationship" tab (or "Predecessor"/ "Successor" tab) of the Activity "Details" pane.

5.1.10 Resource Breakdown Structure – RBS (PMBOK/Primavera P6):

Resource Breakdown Structure (RBS) is an output from "Estimate Activity Resources" PA of "Time Management" KA of PMBOK. It structures the resources based on Category and Type.

In similar lines, resources defined in Primavera P6 are of 3 types: i.e., "Labor Resources", "Nonlabor Resources" and "Material Resources" resources.

> *Labor Resources:* People/Human Resources and will have times based usage. It is defined as "Labor Resources", as these resources will actually labor.
> *Nonlabor Resources:* These can be machinery, equipment resources and also will have time based usage. It is defined as "Nonlabor Resources", as these resources belong to non-human/non-labor category.
> *Material Resources:* These resources will be consumed, like supplies or DVD for final software shipment. These resources do not perform any work on its own, but they are used for your project.

Once the resources are created, they will be available in the RBS, which can be shown in a Table view or Chart View.

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The view for RBS can be seen a graphical manner in Primavera.
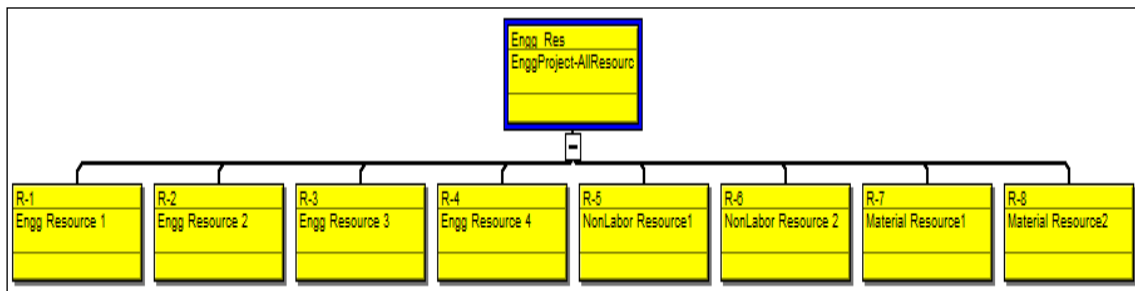
5.1.12 Project Calendar (PMBOK/Primavera P6)

"Project Calendar" is available in "Develop Schedule" PA of "Time Management" KA. As defined in PMBOK, Project Calendar is then fed into "Control Schedule" PA for monitoring and controlling of the project schedule. Project Calendar contains all information at the project level – such a various holidays, organization specific non-working date or any other exception cases.

In similar lines, for Primavera P6, there is a concept of "Project Calendar". The project calendar can be the default "Corporate – Standard Full Time" calendar or can be a custom calendar meeting the project specific needs. In this calendar, all holidays, project specific non-working days and any other project specific information are noted.
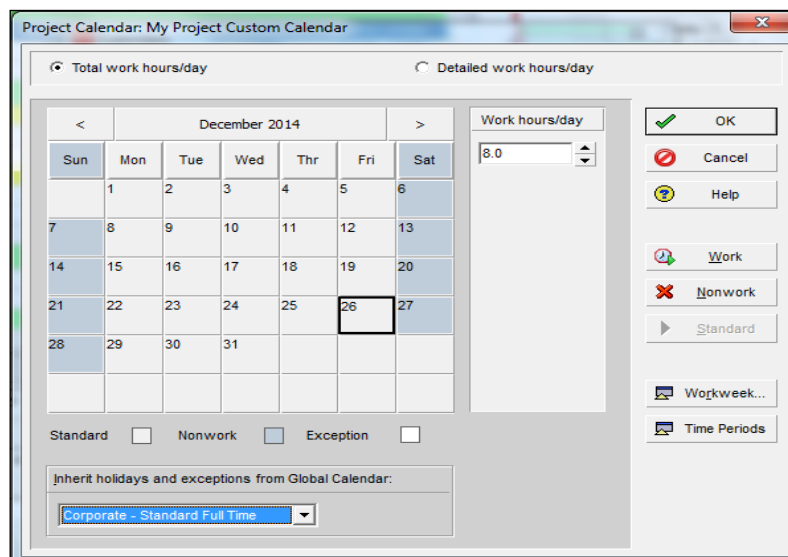
The Calendar functionality can be invoked in Primavera from Enterprises menu → Calendars sub-menu.

5.1.13 Resource Calendar (PMBOK/Primavera P6)

Resource Calendars are created in the "Acquire Project Team" PA of "Human Resource Management" KA in PMBOK guide. Resource Calendar applies to Human as well as Non-Human Resources.

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In similar lines, for Primavera, every resource will have a Resource Calendar associated with it. These can be modified and also exported to be used as one of the "Global Calendars".
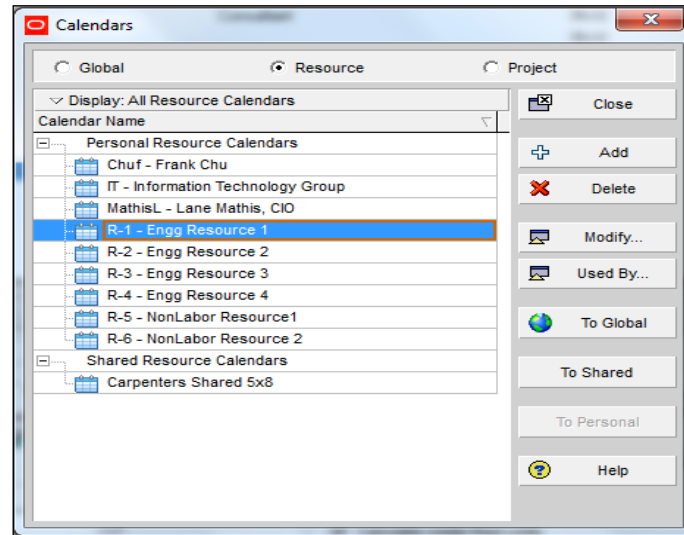
Resource Calendars are auto available in the "Resources tab" in the bottom portion of layout as shown below. For each resource, default calendar is made available in the Details tab of the bottom pane, under "Profile" section. They can be modified individually for the resources.
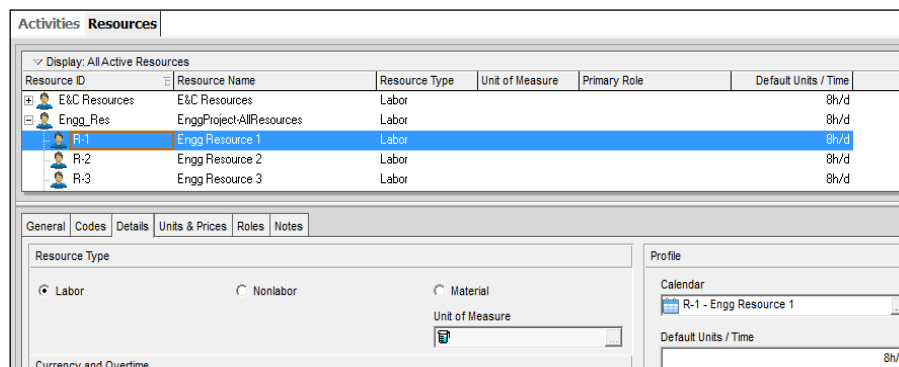
5.1.14 Critical Path (PMBOK/Primavera P6)

Critical Path method is defined as one of the Tools and Techniques in "Schedule Development" PA under Time Management KA of PMBOK guide.

A project's critical path is the combination of activities that, if any are delayed, will delay the project's finish. The primary objective of it is to determine the project's finish date and to determine the extent to which an activity can be delayed without delaying the project. The activities on a critical path will have zero slack. All activities in Critical Path are called Critical Activities.

The concept of critical path is same in Primavera P6. The options for Critical Activities can be set in the General Tab of Tools → Schedule → Options → Schedule Options.

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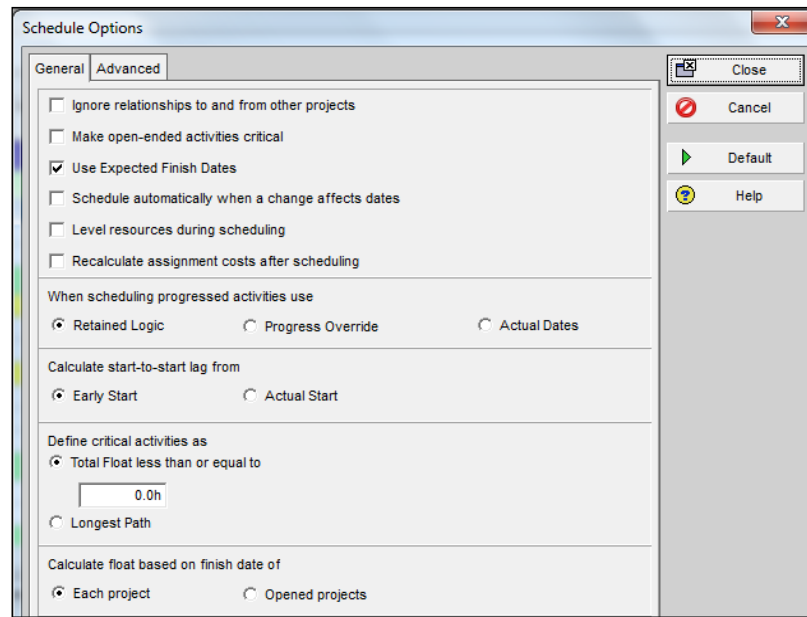
If the option for Total Float of 'less than or equal to' is taken, then the maximum float time for activities should be specified, before they are marked critical. A new number and time unit can be entered.

If Longest Path is selected, then the activities on the longest path in the network are considered critical. Next, the "Scheduler" of Primavera has to run. Based on the options set, the Activities will be marked as Critical.
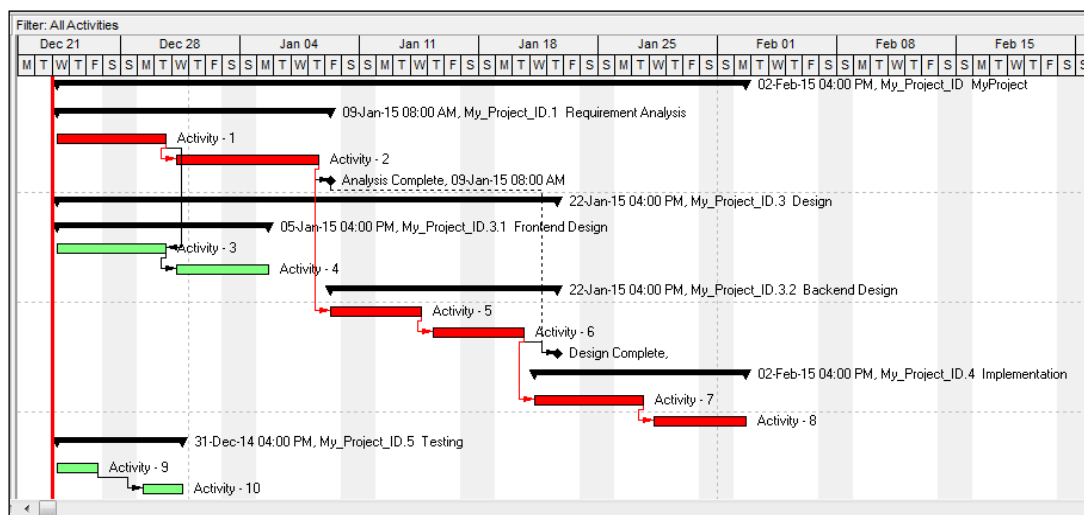
As shown above, the activities marked in red are in Critical Path and they are Critical Activities.

5.1.14 Resource Optimization Techniques - Resource Levelling (PMBOK/Primavera P6)

"Resource Optimization Techniques" is one of the Tools and Techniques defined in "Develop Schedule" and "Control Schedule" PA under Time Management KA as defined in PMBOK guide. One of the Resource Optimization Techniques is "Resource Levelling", which means no resource should be more than 100% allocated.

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In order to level the resources, the ability of the organization to supply resources is determined and over allocated (or under allocated) resources are properly assigned. In Primavera P6, the concept of resource levelling is same. Resource levelling options is launched from the "Tools" menu.
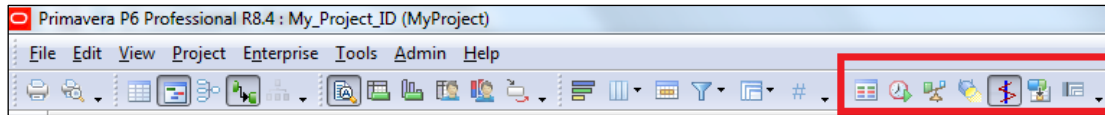
Both manual or auto resource levelling option can be set with the Levelling Option dialog box in Primavera P6. The dialog box is shown below.
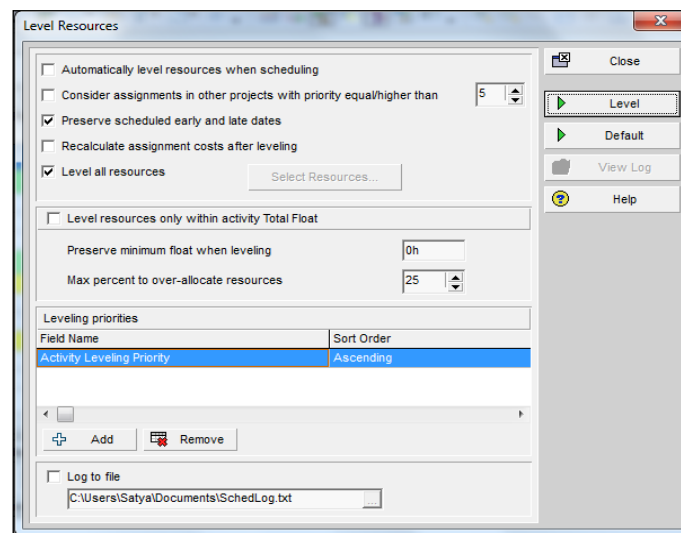
5.1.15 Schedule Compression (PMBOK/Primavera P6)

Schedule compression technique is used to shorten the schedule without reducing the project scope in order to meet project constraints such as a scheduled milestone. They are of two types, [v.i.z] "Crashing" and "Fast Tracking".

In Primavera P6, the concept is similar. Fast tracking is typically done by having dependencies such as SS or FF and Crashing is done by adding more resources to the activity. To exemplify, let us consider 3 activities each of duration 5 days and with various resources assigned as shown. The total duration is 15 days.

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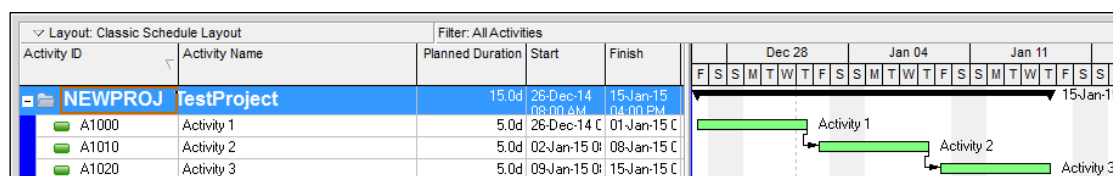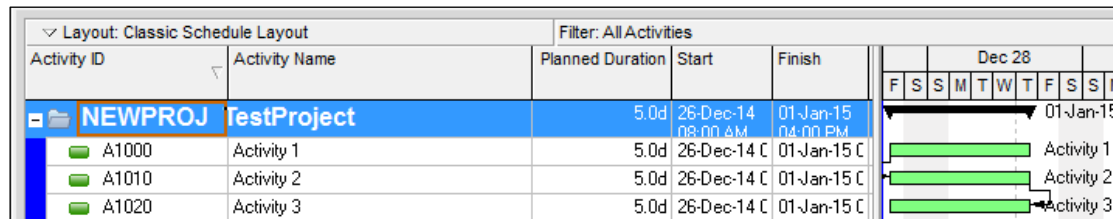
Fast tracking

As can be inferred from the above diagram, fast tracking has been done by applying SS and FF dependencies. The duration has been changed to 5 days from 15 days. Leads and Lags can also be applied along with the dependencies to compress the schedule further.

Crashing
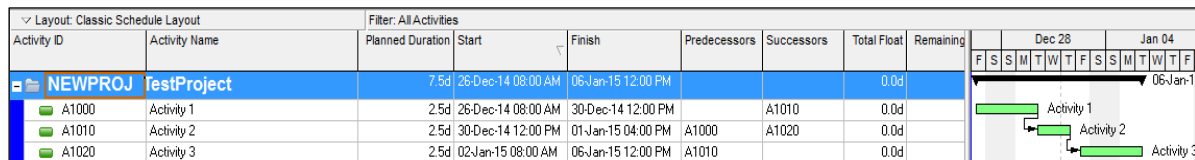
In crashing, more resources are added to the activities to compress the schedule. For the above scenario, two resources are added to each activity. The duration has been changed to 7.5 days from 15 days.

5.2. PMBOK and Primavera P6: The Comparison

"Comparison" here means that though certain concepts are similar in both Primavera P6 and PMBOK Guide, the terms and terminologies used are slightly different. They are elaborated in detail in the following subsections.

5.2.1 Sequencing (PMBOK) Vs Linking (Primavera P6)

Sequencing is an operation which is defined as "Sequence Activities" PA in the "Time Management" KA of PMBOK guide. Here, the activities are sequenced in the order in which they will be executed by the team members of a project. While sequencing the activities, dependencies between the activities are defined.

Dependencies can in the form of mandatory or discretionary or external dependencies.

Similarly in "Activity Linking" of Primavera, a sequencing of Activities or linking of activities is done with one type of dependency (relationship) as elaborated in Section 5.1.7. After linking is performed on each Activity, the "Predecessors" and "Successors" columns in the Gantt chart can be checked.

In Primavera, for each Activity, this information will be available in the bottom portion of the Activity layout. It can also be viewed in the top portion of the layout.
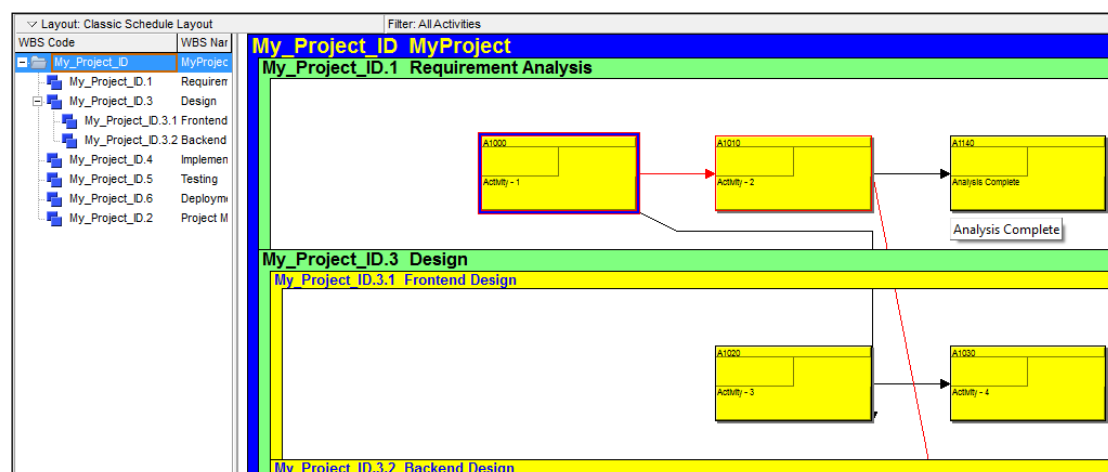
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5.2.2 Project Schedule Network Diagram (PMBOK) Vs Activity Network Diagram (Primavera P6)

Project Schedule Network Diagram is created in "Sequence Activities" PA of "Time Management" KA. The Activities are sequenced with their dependencies and finally the network diagram is created. This is then fed into "Develop Schedule" PA to create the final Project Schedule.

In Primavera P6, it is known as simply "Activity Network" (or Activity Network Diagram). It is one of the many views defined in Primavera P6, where the default "Layout: Classic Schedule Layout" is used.

With the help of Sequencing or Linking among activities, as discussed under Section 5.2.1, the Activity Network View will be created. Post this, resources are assigned and durations are estimated and the Activity Network View is further refined. This ultimately leads to the project schedule as shown the diagram under Section – 4: Time Management Process Interaction.

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For each WBS element in the WBS, the Activity Network for that segment can be shown. As shown above, the Activity Network is for the highest level of the WBS, i.e., the Project. By selecting each WBS element, corresponding section's Activity Network will be shown.
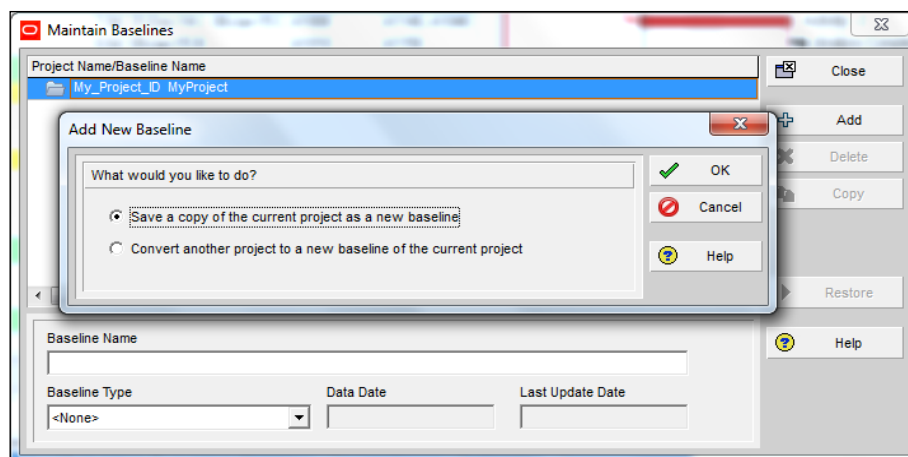
Also in Primavera P6, for each activity, all predecessors and successors can be seen with the help of an advanced functionality called Trace Logic. This can be launched by selecting View menu → Show on Bottom → Trace Logic.
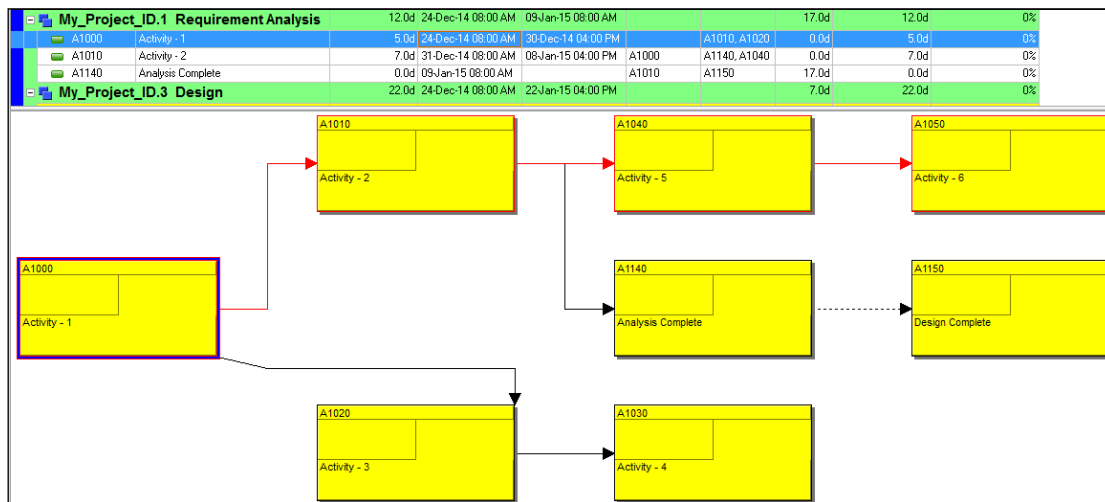
### 5.2.3 Schedule Baseline (PMBOK) Vs Baseline (Primavera P6)

"Schedule Baseline" is created in the "Develop Schedule" PA of "Time Management KA" as defined in PMBOK Guide. As the name suggests, base-lining is done when enough planning for the schedule has been done and the manager of the project has been given the go ahead from the concerned stakeholders or sponsor(s). At this stage, the actual percentage of completion or the current status of the project is not entered.

The Baseline concept in Primavera P6 considers all the above mentioned steps. To create a baseline, choose "Project" menu → "Maintain Baseline" and then click "Add" and then "Choose to save a copy of the current project as a new baseline".

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After the baseline is created, it can be assigned to a project using "Assign Baseline" functionality. Assignment for Baseline in Primavera is done for "Summarization" and "Comparison" purpose. For the latter, up-to three baselines can be used for comparison.

In Primavera, after performing a baseline, there will not be any visible reflection of baseline in the Gantt Chart under "Layout: Classic Schedule Layout". However, to see the baselined data, one can switch to "Layout: Baseline Vs Current".
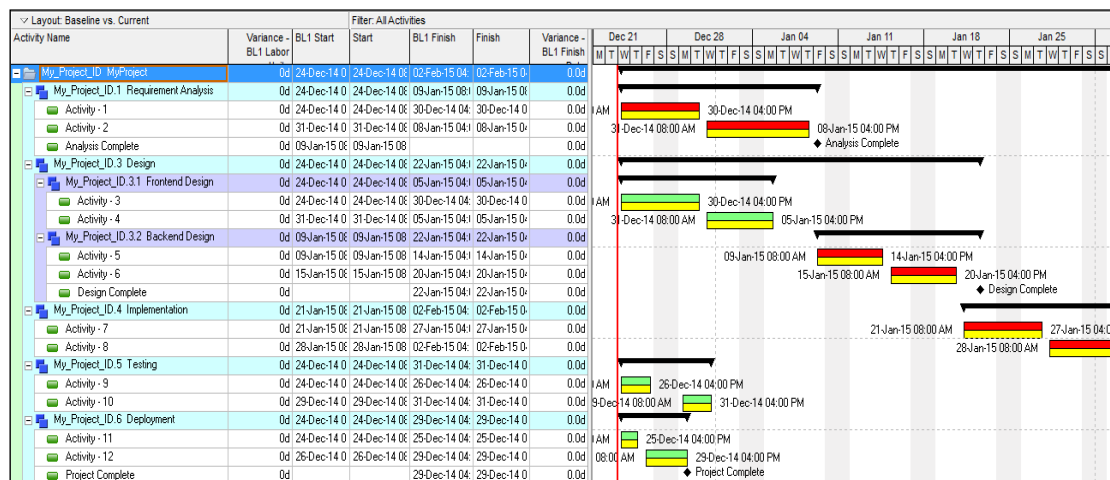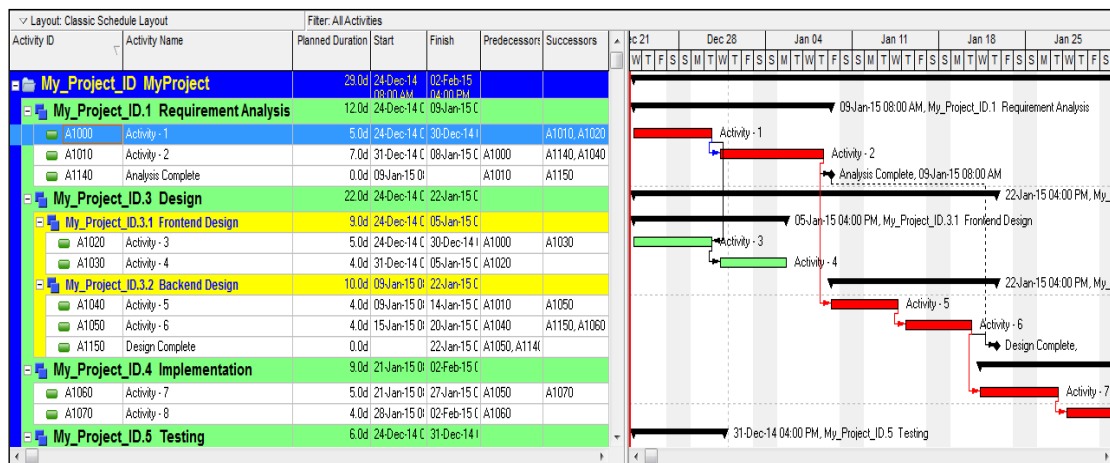

5.2.4 Schedule Management Plan (PMBOK) Vs Oracle Primavera P6 Project Plan (Primavera P6)

In PMBOK Guide, the Project Management Plan consists of many subsidiary plans such as Scope Management Plan, Schedule Management Plan, Quality Management Plan, Risk Management Plan and so on. All these plans can be also be consolidated together and can be called the Project Management Plan. There are additional project documents defined such as Risk Register, Stakeholder Register, etc.

It must be noted that in Primavera P6, there is no such segregation based on various plans.

Scope, Time, Cost, Human Resource etc. are integrated into one plan and it is called the Primavera Project Plan (in dot XER). It is a single file with information on scope, cost, time, quality and integration related information with change requests.

The plan is viewed in the Gantt Chart view under default "Layout: Classic Schedule Layout".

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6. Conclusion

The PMBOK Guide is one of the most widely used reference books for project management professionals. Though it is quite theoretical in its approach, still the concepts defined in PMBOK are real time oriented. A PMI-PMP or a project management professional while using the best principles and practices of PMBOK sometimes finds it difficult for practical application.

To help understand the practical application of PMBOK principles, Oracle Primavera P6, one of the popular tools used by management professionals, can be used. Though there are certain differences between terms and terminologies of PMBOK Guide and Primavera P6, both very much go hand in hand, while going for a real time approach.

As a matter of fact, various knowledge areas defined in PMBOK Guide such as Integration Management, Scope Management, Time Management, Cost Management, Human Resource Management, Risk Management, and Communication Management can be practically applied with the help of Primavera P6. To a certain extent, Quality Management, Stakeholder Management and Procurement Management related activities can also take the help of Oracle Primavera P6.

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Satya Narayan Dash is a management professional with varied experiences as Program Manager, Project Manager and PMO. A certified PMI-PMP since 2008 and a follower of Agile/Scrum/XP practices since 2006, he has coached, mentored, and consulted thousands of Project Management professionals worldwide. He has created new management paradigms such as "Practical PMP with MS Project", "Practical PMP with Oracle Primavera P6" and "Agile PMP" that are used by multiple vendors worldwide. He has a Bachelor of Technology degree in Electronics and Communication Engineering from the National Institute of Technology (NIT), Jalandhar, India.

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