The Inner Workings of P6™
Part 1: P6 Durations and Dates

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Overview

• Primavera introduced ‘P6’ in 1998
  – P6 is not a later version of P3

• All of the following are “P6”
  – Primavera Enterprise
  – P3e
  – P3 Engineering and Construction
  – P3e/c
  – Teamplay
  – Primavera
  – P6
  – Enterprise Project Portfolio Manager (EPPM)
  – Professional Project Manager (PPM)
  – P6 Professional
Overview

• P6 Durations
• P6 Dates
• P6 Date Fields
  – Project & WBS Dates
  – Activity Dates
  – Resource Dates
  – Relationship Dates
  – Audit Dates
• Putting This All Together
P6 DURATIONS

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Duration Conversions

- User can enter durations in ‘days’
- P6 stores all entries in decimal hours
- Later displays hours back as ‘days’
- Automatic conversions using a factor
  - 2 days X 8.0 hours/day = 16.0 hours
- “Hours per time period”
  - Hours/Day
  - Hours/Week
  - Hours/Month
  - Hours/Year
Duration Conversions

- Can display durations in hours, days, weeks, years
- Converts durations from days to hours & back again
  - Using the ‘Hours per Time Period’ setting
    - Admin / Admin Preferences / Time Periods (default)
    - User / User Preferences / Time Units (pre-version 7)
P6 Time Display

- P6v7+ Admin Preferences Option
  - Use calendar to set # of work hours per time period
  - Enterprise / Calendars / Modify / Time Periods
- If grayed-out, Admin-set
- Each calendar lists conversion factors
Duration Conversions

• Using the Administrator Setting is still the default
• All calendars default to 8.0 hours/day
  – Even 24-hour calendars
• Use new calendar for accelerations
  – New calendar when workdays change
  – New calendar when work hours change
  – May need to split activities
Duration Conversion Process

• Administrator set the factors
  – One setting for the entire system

• Each User sets the factors
  – One setting for the entire schedule
  – Must remember which factor to use for each schedule

• Each activity’s calendar sets the factors
  – Best solution

• Direct entry of hours is safest
  – Instead of entering “4”, enter “32h”
Smallest Unit of Measurement

- Configure P6 to display in hours to 2 decimal places
- Enter hourly Original Duration of
  - 0.01 (0.6 minutes) & P6 changes it to 0.02
  - 0.02 (1.2 minutes) -> [1 minute]
  - 0.03 (1.8 minutes) -> [2 minutes]
  - 0.04 (2.4 minutes) & P6 changes it to 0.03
  - 0.05 (3.0 minutes) -> [3 minutes]
How P6 Looks at Durations

• P6 calculates the CPM to the nearest minute
• 1 minute = 0.0166667 hours
• How P6 looks at the previous example:
P6 DATES
How P6 Looks at Dates

• P6 stores dates as
  – Julian day number + fractions of a day
  – P6 dates are rounded to the nearest minute
• Julian day number is number of days since 14-SEP-1752
  – (Earliest continuous day number from England)
• 1 day = 1.0
• 1 hour = (1 / 24) = 0.0416666 day
• 1 minute = (1 / 24 / 60) = 0.0006944 day
• Example: 07MAR14 08:00
  – 07MAR14 = Julian day number 41705
  – 08:00 = 8.0 / 24.0 = 0.3333328
  – 07MAR14 08:00 = 41705.3333328
How P6 Looks at Dates

07MAR14 08:00 = 41705.3333328

41705.6708321 = 07MAR14 08:06

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Displaying P6 Dates

• Only the display format is user-selectable
• Recommend users display time as well as date
  – Especially during date entry
• Default Time Issue
  – Enter just a date, time defaults to 00:00
  – Finish dates become {date} 00:00
    • Start of the day
    • Finish one day earlier {date – 1} 16:00
  – Version 7+ sometimes corrects Actual Start & Finish
    • Best to confirm your actual entries
  – Problem persists for constraints, suspend, etc.
Dates & Durations Summary

• P6 dates consist of
  – Date (whole number of days)
  – Time (fraction of day)
    • Hour
    • Minute

• P6 durations consist of
  – Hours and fractions of hours
  – Low = 1 minute
  – High = \(2.05075648512 \times 10^{304}\) years
DATE FIELDS

- Started: 28-Feb-14 08:00
- Finished: 13-Mar-14 17:00
- Exp Finish: [blank]
## Date Fields Overview

### Project & WBS Date Fields (per EPS field)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipated Start</td>
<td>Anticipated Finish</td>
</tr>
<tr>
<td>Actual Start</td>
<td>Actual Finish</td>
</tr>
<tr>
<td>Planned Start</td>
<td>Finish Date</td>
</tr>
<tr>
<td>Forecast Start</td>
<td>Forecast Finish</td>
</tr>
<tr>
<td>Must Finish By</td>
<td></td>
</tr>
</tbody>
</table>

### Activity Date Fields (per activity)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Finish</td>
</tr>
<tr>
<td>Early Start</td>
<td>Early Finish</td>
</tr>
<tr>
<td>Planned Start</td>
<td>Planned Finish</td>
</tr>
<tr>
<td>Remaining Early Start</td>
<td>Remaining Early Finish</td>
</tr>
<tr>
<td>Remaining Late Start</td>
<td>Remaining Late Finish</td>
</tr>
<tr>
<td>Actual Start</td>
<td>Actual Finish</td>
</tr>
<tr>
<td>External Early Start</td>
<td>External Late Finish</td>
</tr>
<tr>
<td>Baseline Start Dates</td>
<td>Baseline Finish Dates</td>
</tr>
<tr>
<td>Variance BL1 Start Date</td>
<td>Variance BL1 Finish Date</td>
</tr>
<tr>
<td>Primary &amp; Secondary Constraint Dates</td>
<td>Expected Finish Date</td>
</tr>
</tbody>
</table>

### Resource Date Fields (per activity resource assignment)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
<td>Finish</td>
</tr>
<tr>
<td>Actual Start</td>
<td>Actual Finish</td>
</tr>
<tr>
<td>Planned Start</td>
<td>Planned Finish</td>
</tr>
<tr>
<td>Remaining Early Start</td>
<td>Remaining Early Finish</td>
</tr>
<tr>
<td>Remaining Late Start</td>
<td>Remaining Late Finish</td>
</tr>
</tbody>
</table>

### Relationship Date Fields

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship Early Start</td>
<td>Relationship Early Finish</td>
</tr>
<tr>
<td>Relationship Late Start</td>
<td>Relationship Late Finish</td>
</tr>
</tbody>
</table>

### Audit Date Fields (per record for Project/Activity/Step/Activity Code/Relationship/Expense issues)

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date Created</td>
<td>Date Last Updated</td>
</tr>
<tr>
<td>Date Deleted</td>
<td></td>
</tr>
</tbody>
</table>
Types & Numbers of Date Fields

- Project and WBS Date Fields: 9
- Activity Date Fields: 20
- Task Resource Date Fields: 10
- Relationship Date Fields: 4
- Audit Record Date Fields: 3

- A resource-loaded 1,000-activity schedule
  - At least 50,000 date fields set aside
PROJECT & WBS DATES

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Project & WBS Dates

• Anticipated Start & Finish
  – Project Manager set

• Planned Start
  – Start of CPM calculations

• Must Finish By
  – Imposed finish date

• Forecast Start & Forecast Finish
  – Resource leveled start & finish dates
  – or Early Finish Date

• Project Early Finish date
• Actual Start & Finish
ACTIVITY DATES
Early Start/Finish Dates

- Calculated dates are the basis of CPM
- Even completed activities have computed dates
  - Displayed if using Retained Logic mode

<table>
<thead>
<tr>
<th>Activity ID</th>
<th>Activity Name</th>
<th>Original Duration</th>
<th>Remaining Duration</th>
<th>Actual Start</th>
<th>Actual Finish</th>
<th>Early Start</th>
<th>Early Finish</th>
<th>Late Start</th>
<th>Late Finish</th>
</tr>
</thead>
<tbody>
<tr>
<td>0277X-12</td>
<td>PREP - F...</td>
<td>40.00</td>
<td>0.00</td>
<td>03-Apr-06 08:00</td>
<td>14-Jun-06 17:00</td>
<td>04-Dec-06 00:00</td>
<td>04-Dec-06 00:00</td>
<td>11-May-07 08:00</td>
<td>11-May-07 08:00</td>
</tr>
<tr>
<td>0277X-14</td>
<td>APPROVE ...</td>
<td>15.00</td>
<td>0.00</td>
<td>15-Jun-06 08:00</td>
<td>29-Jun-06 17:00</td>
<td>04-Dec-06 00:00</td>
<td>04-Dec-06 00:00</td>
<td>11-May-07 08:00</td>
<td>11-May-07 08:00</td>
</tr>
<tr>
<td>0277X-16</td>
<td>PROCURE ...</td>
<td>60.00</td>
<td>0.00</td>
<td>30-Jun-06 08:00</td>
<td>29-Sep-06 17:00</td>
<td>04-Dec-06 00:00</td>
<td>04-Dec-06 00:00</td>
<td>11-May-07 08:00</td>
<td>11-May-07 08:00</td>
</tr>
<tr>
<td>0277X-19</td>
<td>REQ by - F...</td>
<td>0.00</td>
<td>0.00</td>
<td>30-Sep-06 08:00</td>
<td>30-Sep-06 08:00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Use the Start and Finish columns for display
Suspend/Resume Dates

- Added to P6 in Version 5
- Default Time Issue can Suspend one day early
- Activity actual duration not include suspend dur.
- Early Start = Resume Date

- Suspend without a Resume is ignored
Start and Finish Dates

• Work similar to those in MS Project™ and P3
• Start = Early Start for unstarted activities

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Early Start</th>
<th>Start</th>
<th>Remaining Early Start</th>
<th>Planned Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity 1</td>
<td>1-Jul-08</td>
<td>1-Jul-08</td>
<td>1-Jul-08</td>
<td>1-Jul-08</td>
</tr>
<tr>
<td>Activity 2</td>
<td>11-Jul-08</td>
<td>11-Jul-08</td>
<td>11-Jul-08</td>
<td>11-Jul-08</td>
</tr>
</tbody>
</table>

• Start = Actual Start if started

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Start</th>
<th>Actual Start</th>
<th>Remaining Early Start</th>
<th>Planned Start</th>
<th>Early Start</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity 1</td>
<td>1-Jul-08 A</td>
<td>1-Jul-08</td>
<td>1-Jul-08</td>
<td>20-Jul-08</td>
<td></td>
</tr>
<tr>
<td>Activity 2</td>
<td>11-Jul-08 A</td>
<td>11-Jul-08</td>
<td>20-Jul-08</td>
<td>20-Jul-08</td>
<td></td>
</tr>
</tbody>
</table>

• Manual entry can overwrite actual dates
Planned Start & Finish Dates

- It is **essential** to understand these dates
- Not just ‘planned’ dates are displayed
- Generated from Early Start & Original Duration
- Change as Early Start & Finish dates change

- Actual Start ‘freezes’ the Planned Start date
- Planned Finish = Actual Start + Original Duration
- Planned Finish is **not** equal to Early Finish
- Planned Finish is **not** equal to Actual Finish
Planned Start & Finish Dates

- Used to generate the ‘S’ Curve graphic
- Used by Progress Spotlight to update progress
  - Will even overwrite actual dates
  - Recommend Global Change Planned to actuals first
- Baseline Planned dates used
  - To calculate variances
  - To compute Earned Value
  - Important: Display baseline dates bar in Gantt Chart
Planned Start & Finish Dates

- If baseline schedule has not been assigned, Planned dates from the current schedule are used
  - To calculate variances
  - Estimate Budgeted Values
  - To compute Earned Value
  - Display Primary Baseline dates bar in Gantt Chart
- If imported schedule layout set to display Baseline and no baseline currently assigned (default)
  - Current schedule’s Planned dates used without notice
- Manual entry:
  - Planned Start changes Actual Start
  - Planned Finish changes Original Duration
External Start and Finish Dates

- Schedules can be ‘linked’ with inter-project relationships.
- Exported separately, P6 inserts External Constraints:
  - External Start constraint
  - External Finish constraint
- Helps exported schedule to simulate missing schedule:
  - Inflexible
- These do not show under Constraints box:
  - Only shows as activity column
- To prevent creating external constraints:
  - Check option setting:
    - “Ignore relationships to and from other projects”
  - Export linked schedules together
RESOURCE DATES

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Task Resource Dates

- Resource dates tracked just like an activity
  - Planned Start/Finish dates
  - Actual Start/Finish dates
  - Remaining Early Start/Finish dates
  - Remaining Late Start/Finish dates
  - Start/Finish dates
Task Resource Dates

- Activity Type should be Fixed Duration if resourced
  - Otherwise resources will change duration
- Activities can be set to “Resource Driven”
  - Activity dates computed using resource calendar
- Resources can be set to “Driving Activity Dates”
  - Activity will not begin until resource begins
- Entering actual date for resource can update activity
  - Resource actuals must be within activity actual dates
- Resource actuals prevent removing activity actual start
- Resource leveled schedules strongly affect dates
Resource Leveling

• Types of resource leveling
  – Constraining activities based on resource availability
  – Using preferential logic
  – Manually adjusting activity timing
  – Automatic Resource Leveling

• Automatic Resource Leveling
  – Can be run automatically after every CPM schedule
  – One way to tell if schedule has been ‘leveled’
    • Early Start/Finish ≠ Remaining Start/Finish
  – Remaining Early/Late Start/Finish a product of leveling
Remaining Dates

- Without leveling, Remaining Early Start = Early Start

- After leveling, Remaining Early Start = delayed start
RELATIONSHIP DATES
Even Relationships Have Dates

• Relationship with lag acts like activity with duration
• Early and Late dates allow for relationship float
• Relationship float may not be same as activity float
• Exact measurement of controlling relationship
• Basis of Longest Path Software™
  – Schedule Analyzer Software (released December 2003)
• Basis of P6 Multiple Float Paths™
  – Introduced in P6 in Version 5 in 2005
• Relationship dates are re-computed on start-up
Displaying Relationship Dates

- Multiple Float Paths column section
  - Relationship Early Start
  - Relationship Early Finish
  - Relationship Late Start
  - Relationship Late Finish
  - Relationship Total Float
AUDIT DATES
Audit Dates

• Added in Version 5 to every record
  – Activities
  – Relationships
  – Activity Resources
  – Steps, etc.

• Date and User ID for the following
  – Date Created
  – Date Last Updated
  – Date Deleted

• Most dates are not viewable by users
P6 User-Viewable Audit Dates

- **Project**
  - Date Added

- **Resources**
  - Assigned Date

- **Resource Assignments**
  - Assigned Date

- **Issues**
  - Identified Date

- **Risks**
  - Identified On

- **Task Resource**
  - Assigned Date

- **Activity**
  - Added Date
  - Last Modified Date
## Sample Activity Audit Dates

- **View / Columns / Customize / Dates**

<table>
<thead>
<tr>
<th>Activity Name</th>
<th>Original Duration</th>
<th>Remaining Duration</th>
<th>Total Float</th>
<th>Start</th>
<th>Finish</th>
<th>Added By</th>
<th>Added Date</th>
<th>Last Modified By</th>
<th>Last Modified Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Design Analysis</td>
<td>3</td>
<td>0</td>
<td></td>
<td>16-May-07</td>
<td>18-May-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
</tr>
<tr>
<td>Final Design Meeting</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>18-Jul-07</td>
<td>18-Jul-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
</tr>
<tr>
<td>Final Design Submission and Revi</td>
<td>10</td>
<td>10</td>
<td>0</td>
<td>04-Jul-07</td>
<td>17-Jul-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
</tr>
<tr>
<td>Finish Bid Documents Phase</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>01-Aug-07</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
</tr>
<tr>
<td>Finish Development Phase</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>06-Mar-07</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
</tr>
<tr>
<td>Finish Final Design Phase</td>
<td>15</td>
<td>0</td>
<td>0</td>
<td>06-Jun-07</td>
<td>26-Jun-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
</tr>
<tr>
<td>Finish Progress Phase</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>18-Apr-07</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
</tr>
<tr>
<td>Finish schematic Phase</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>24-Jan-07</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
</tr>
<tr>
<td>Notice to proceed for Design Coni</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>01-Jan-07</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td></td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
</tr>
<tr>
<td>OMSI Report &amp; Estimate</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>14-Feb-07</td>
<td>16-Feb-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
</tr>
<tr>
<td>Preliminary Building Finishes Pck.</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>29-Mar-07</td>
<td>04-Apr-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
</tr>
<tr>
<td>Preliminary Cost Estimate</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>01-Jan-07</td>
<td>12-Jan-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
<td>tanya@TCRANMERXP</td>
<td>09-Nov-07</td>
</tr>
</tbody>
</table>

- **Finish Milestones do not show audit dates**

*Construction CPM Conference*
That is a Lot of Dates

- 9 - Project & WBS Dates
- 21 - Activity Dates
- 10 - Resource Dates
- 4 - Relationship Dates
- 3 - Audit Dates
  - For every Project, Activity, Step, Activity Code, Resource, Relationship, and Expense record

- User-Defined Fields can also have dates
PUTTING THIS ALL TOGETHER
Putting This All Together

- P6 schedules are calculated to the nearest minute
- Best to use calendars for conversion factors
- Change calendars when working hours change
- Always show times as well as dates when entering
- Owners should view Start and Finish columns
- Retained Logic displays computed dates for actuals
  - Computed dates can be different from actuals
- Planned Dates are a major component of P6
  - Baseline dates come from Planned columns
  - Planned dates are used for missing Baseline dates
  - ‘S’ Curve reports are taken using Planned dates
Putting This All Together

- Update Progress can change actual dates
- Internal date constraints can be automatically generated on XER export
- Default Gantt Chart displays Start and Finish dates
- Dangerous to manually enter data into computed fields
  - Most fields are inter-connected
- Resource leveling creates Remaining Early/Late dates
• Resources affect activity dates even when not driving
• Relationships have computed dates and float
• You can tell by whom and when an activity last modified