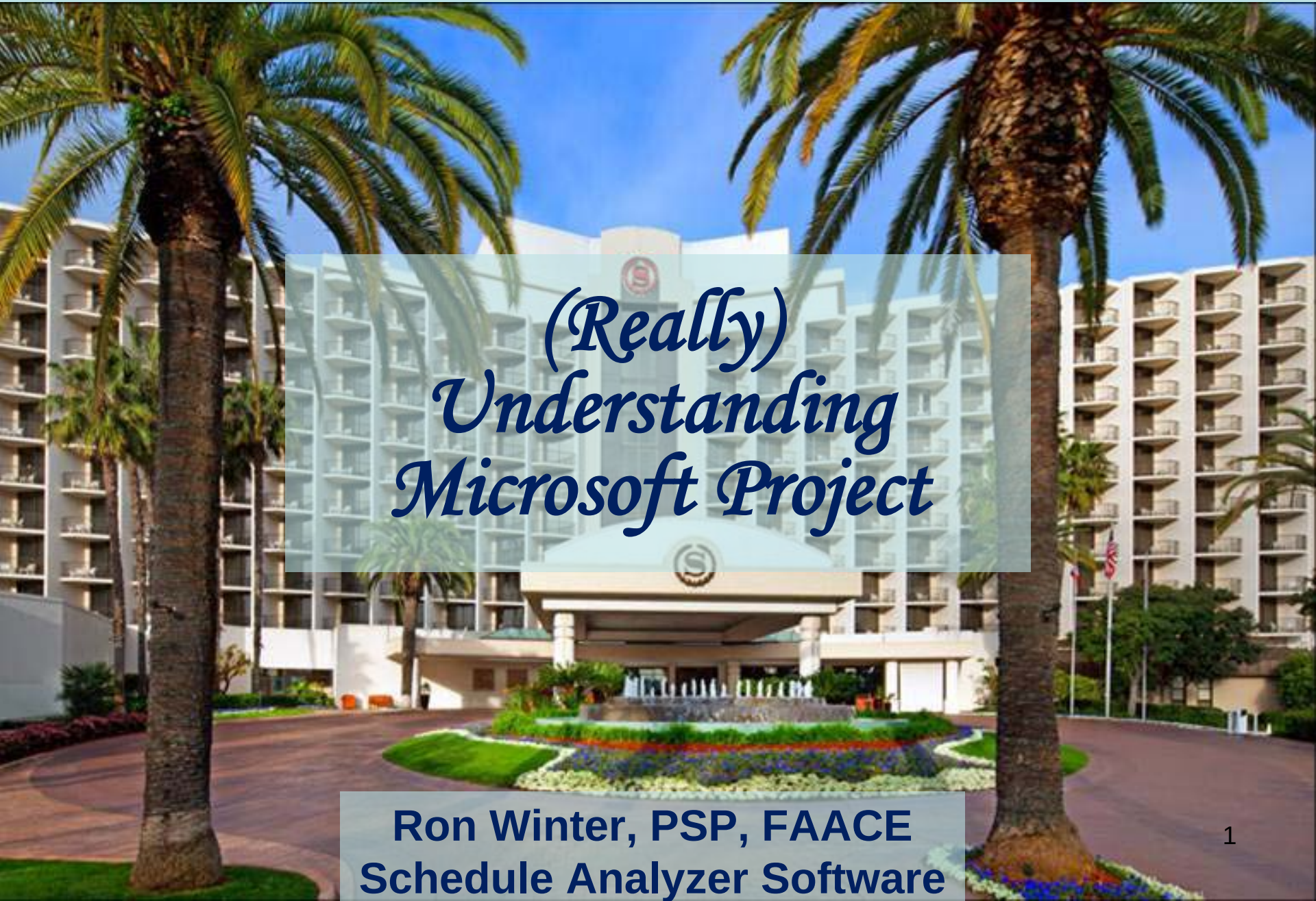
2019 Construction CPM Conference



(Really) Understanding Microsoft Project

Ron Winter, PSP, FAACE
Schedule Analyzer Software

Ron Winter Consulting LLC

Ron Winter, PSP, FAACE

- Bachelor of Science in Engineering
- **Construction Scheduler**
- US Air Force Navigator
- **Construction Scheduler**
- Master of Science in Systems Management
- Programmer, Project Manager, Customer Support, and Industrial Trainer
- **Construction Scheduler**
- Developer of Schedule Analyzer Software

Schedule Analyzer

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Overview

- This is not a ‘Features Presentation’
  - Basic understanding of MS Project CPM
  - How to update schedules
  - How to simulate P6 Retained Progress
- Microsoft Project = MSP

Introduction

- Although Primavera products predominant
- Many contracts specify Microsoft Project (MSP)

<u>Advantages of MSP</u>

- Costs less
- User-friendly
  - Easy to start scheduling activities immediately
- Decent default graphics and reports
- Equipped on most US Federal Government PCs
  - Hard to justify purchase of ‘second’ scheduling software

MSP Introduction

- File based system
- Linking schedules/documents is dangerous
  - Uses direct DOS disk:path\file name references
  - Imported schedules will not properly link or update
- Work performed in memory with manual save
- File check-out model prevents simultaneous use
  - One person at a time uses a schedule
    - Even with MS Project Server
- Best used in localized, small group installations

MSP History

- DOS Versions
  - V1 (1984), V2 (1985), V3 (1986), V4 (1986)
- Windows Versions
  - V1 (1990), V3 (1992), V4 (1993), V4.1 (1995), Project 98 (V9), Project 2000, Project 2002, Project 2003, Project 2007, Project 2010, Project 2013, Project 2016
- MS Project Server Versions
  - Project Central (2000), Project Server (2002), Office Project Server 2003, Office Project Server 2007, Project Server 2010, Project Server 2013, Project Server 2016

MSP History

- Many features only available in newer versions
- Affordable upgrades to earlier license holders
  - WRONG! Only up to MS Project 2007
- We recommend MSP 2007 or later
  - This paper was first written using MSP 2003
  - Updated using MSP 2007
  - Later partially updated using MSP 2013 & 2016

Purchasing MSP

- MSP is not included in MS Office Suites
- MSP version <u>must</u> match your MS Office version
- Available in two editions
  - Standard
    - Project 2016 ~ $500 - $600
    - Project 2013 ~ $500
    - Project 2010 ~ $250
  - Professional
    - Standard + team collaboration tools + connect to Microsoft Project Server
    - Project 2016 ~ $600 - $900
    - Project 2013 ~ $500 - $600

Purchasing MSP

- Boxed set with CD & manual is no longer available
- Two download options
  - PC Download
  - PC Key Card (hard to find)
    - Some resellers offer this option without telling you.
    - Secret is if they are going to mail ‘the software’ to you.

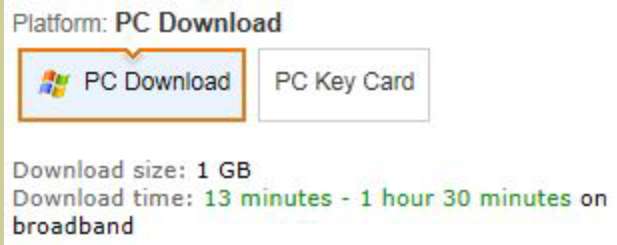
Purchasing MSP

- PC Download
  - ‘Immediate’ use
  - Buy from seller/download from Microsoft website
  - Activate with key code emailed to you from seller
- PC Key Card
  - Intended for OEM manufacturers
  - Normally less expensive option
  - Actual physical card snail-mailed to you
  - Download & activation instructions on the card
  - Only available to USA addresses

Purchasing MSP

- Download confusing
  - Pick the 32-bit or 64-bit version

    - Setup.x64.en-US_ProjectStdRetail.exe = 64-bit
    - Setup.x86.en-US_ProjectStdRetail.exe = 32-bit
  - PC Download or PC Card?



    - PC Download quickest but more expensive
    - PC Key Card mailed to you (for 3rd-party resellers)
      - You still have to download the software

Purchasing MSP

- Download confusing
  - First download a Download Manager
    - Download Manager is a peer-to-peer software
    - Stays resident and helps others download from you
  - Background download continues
    - User typically tries to run download before complete
  - Finished download has no file extension
    - I had to add, “.exe” to the end in order to run (browser issue)
  - Installation smooth after this
  - Uninstall Download Manager

Issues

- Construction schedulers struggle with MSP
- Contracts require periodic updates
  - Assessment of the project status
  - An integral part of project management
  - Critical communication tool between the parties
- MSP update process is confusing
  - Limited baseline management
  - Updating task status (% Complete)
  - Data Date issues
  - 'Ease of use' features
    - Automatically inserts actual dates and remaining durations

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MS Project Differences

MSP Differences

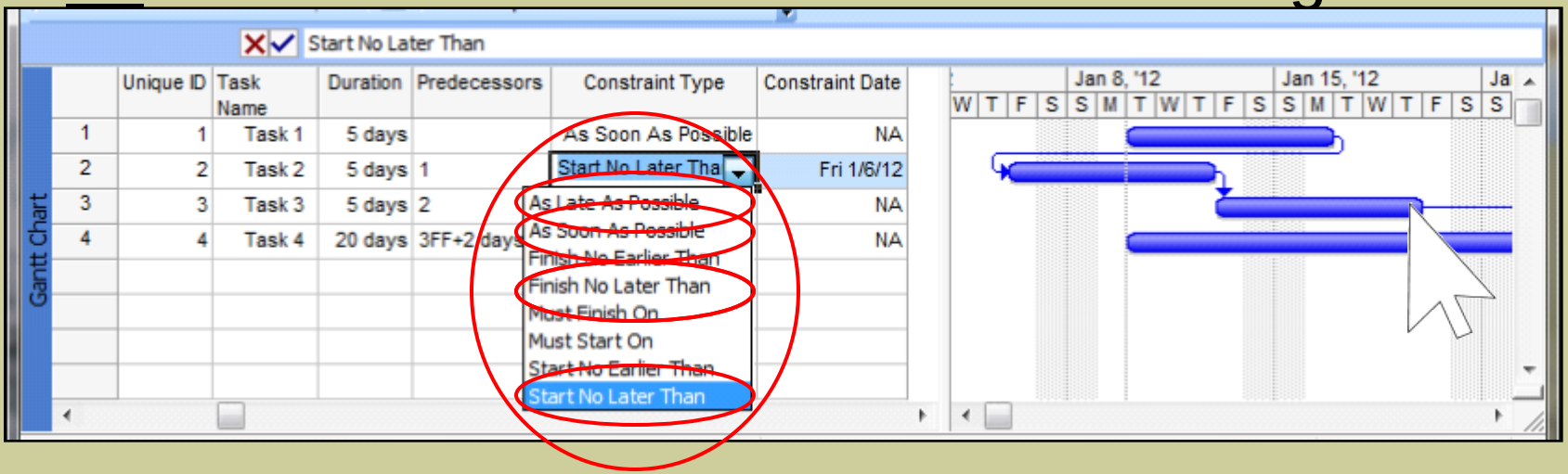
- MS Project operates differently from
  - Oracle/Primavera P6™ and P6 Professional™
  - Oracle/Primavera Enterprise Project Portfolio Manager (EPPM)™
- Understanding the differences helps to understand MSP

Differences from P6

- Changes to database only saved when closed
  - P6 changes saved when entered
- Activities do not have an Original Duration
- Non-fixed Activity IDs
  - Problem for automated comparison
  - Does have non-editable Unique ID field
- MSP float called “Slack”
  - “0” Slack for completed activities
- One relationship between two activities
- Has unique concepts
  - Deadlines, Reoccurring Tasks

Differences from P6

- All MSP activities have a constraint assigned



- Activities can only have one constraint
- ‘As Soon As Possible’ is the default
- ‘Start/Finish No Later Than’ overrides logic
- ‘As Late As Possible’ uses Total Float (not Free Float)
- Dragging activity bar creates FNLT constraint

MSP Summary Tasks

- Inherit status data from their detail tasks
  - Actual Start automatically assigned when summarized task given an actual start
  - Actual Finish assigned when all tasks given actual dates
  - Percent Complete = (Sum Actual) / (Sum At Completion)
  - Problematic when exporting to P6
    - Creates unnecessary duplicate WBS element
    - Links to tasks cause errors when exporting
      - Generated when tasks are indented

MSP Summary Tasks

- Manual Update of Summary Tasks
  - Manual updates ‘Push-Down Status’
  - Not used in construction environments
  - Affects all the detail tasks below it
- Summary Tasks can be moved
  - Changes tasks being summarized
- Summary baseline dates unchanged when tasks adjusted
- “Roll Up Baselines” resets baseline dates

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Differences from P6

- No ‘real’ milestone activities
  - Display both Start & Finish Dates
  - Zero-duration activities 'tagged' as milestones
  - No calendar (scheduled immediately)
- WBS can be blank
  - This will generate an error importing to P6
- Some scheduling terms different in MSP
  - Multiple Critical Paths
  - Baseline Schedules
  - Summary Tasks

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Differences from P6

- Calculated Percent Complete
  - P6: (Original Duration – Remaining Duration) / OD
  - MSP: Actual Duration / (Actual + Remaining Duration)
    - Why the difference?
    - **MS Project does not have an Original Duration!**
- MSP lacks basic CPM functionality
  - No activity Original Duration
  - No Longest Path
  - Different internal calculations than P6

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Calculation Differences

P6	MSP

* Except for P6 Actual Dates calculation mode

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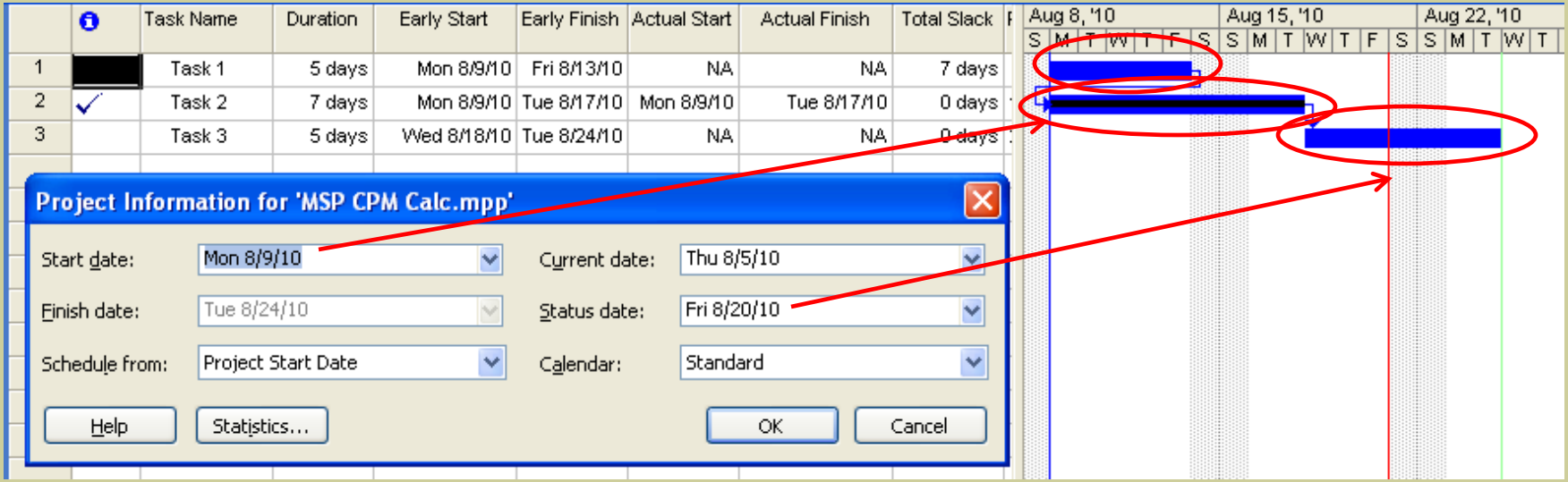
Status Date Ignored

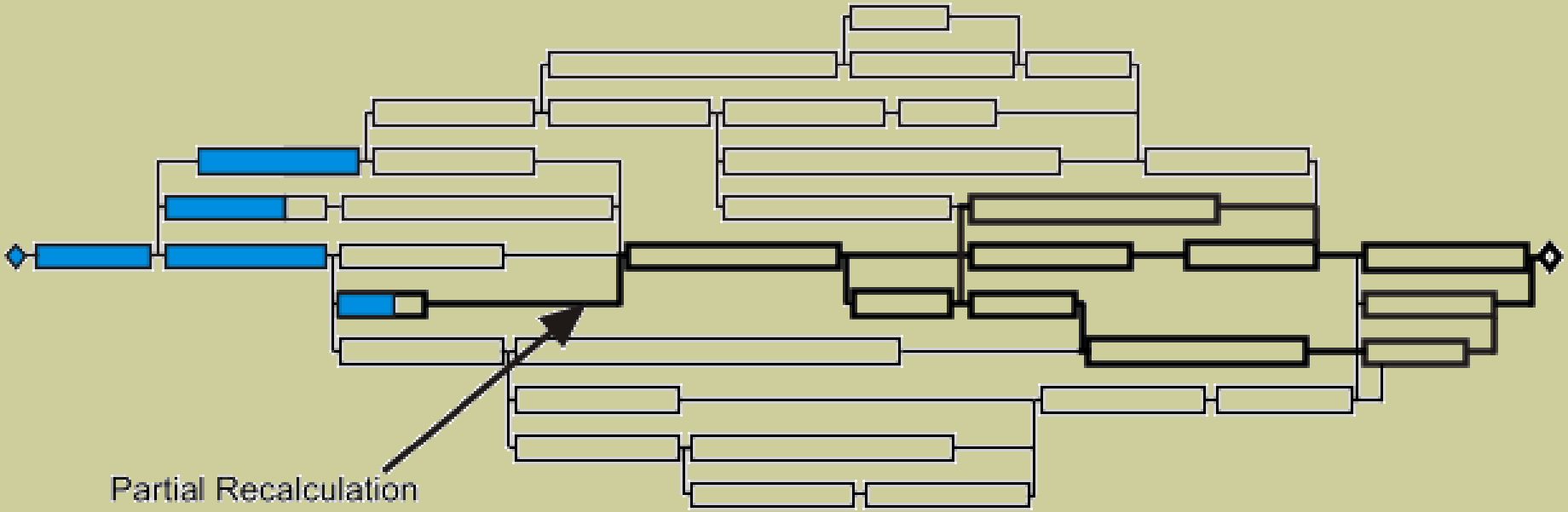


- Task 1 not started in the ‘past’
- Task 2 complete
- Task 3 planned start in the ’past’

- We <u>can</u> make MSP schedule dates similar to P6

CPM Recalculation

- MSP status updates only affect successor activities
  - No ‘F9’ re-calculate entire schedule
  - Partial re-calculation



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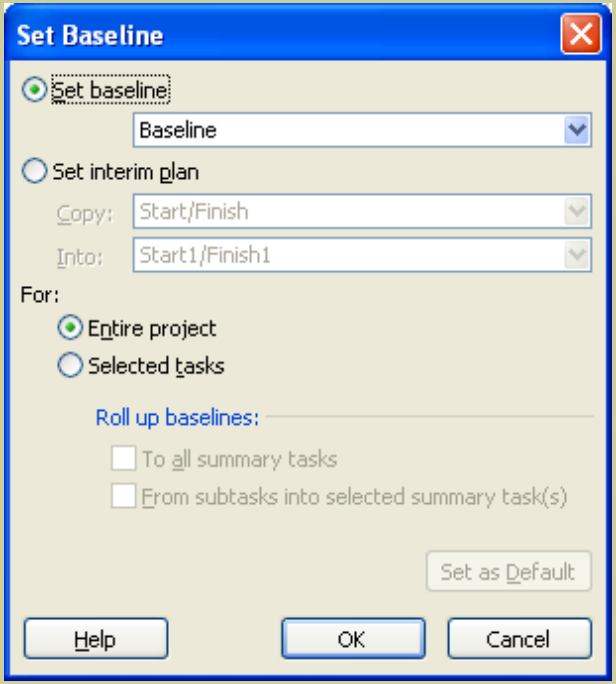
Baseline Schedules

- When MSP creates a baseline schedule
  - Early Start & Early Finish dates copied to Baseline Start & Finish Date fields
  - Duration copied to Baseline Duration
  - Task Costs & Work copied to Baseline Costs/Work fields
  - Nothing else is saved
- 2 dates + 1 duration + 1 cost + 1 work-hour count

Tools / Tracking / Set Baseline*



* MS Project menu navigation command (printed in green) to reach that screen

Baseline Schedules

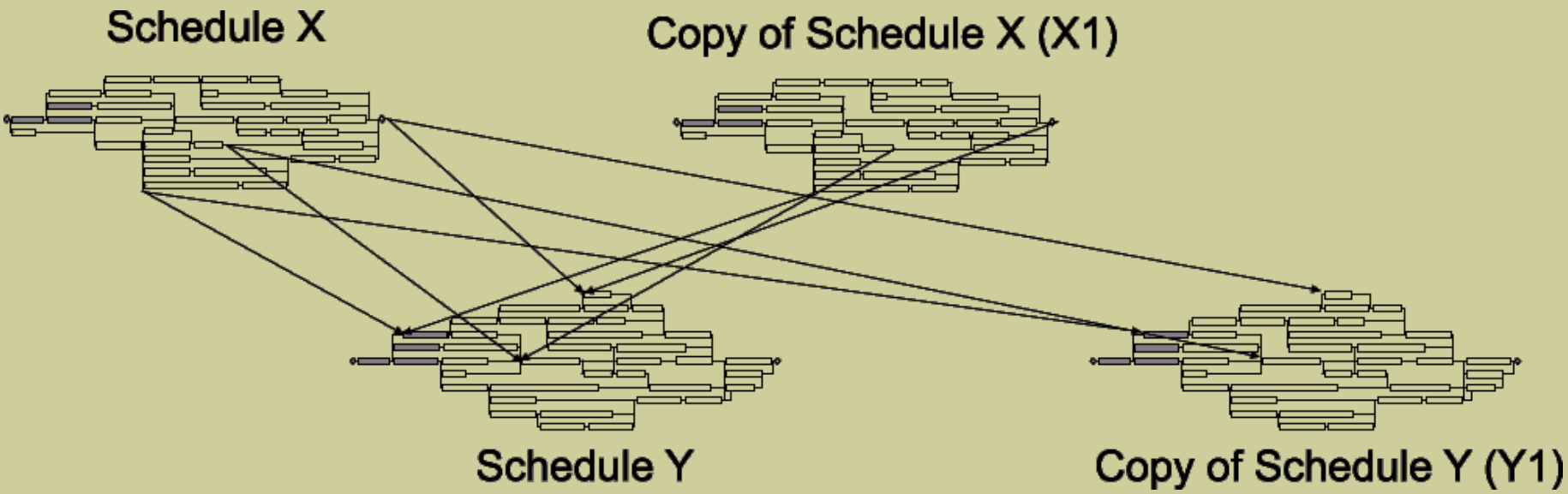
- MSP Baseline a partial snapshot of the schedule
  - Used for Earned Value calculations
  - Does not store logic, float, or constraints
  - Cannot recalculate any of the stored information
  - Late Start and Late Finish dates are not stored
    - All variance measurements assessed from the early dates
  - Baseline fields can be edited by users

Baseline Schedules

- Not sufficient for recreating a schedule
  - Cannot convert back into a fully functional schedule
- Not sufficient for a year's worth of updates
  - Allows for a maximum of 11 baselines
- Interim Plan feature is like a Baseline
  - Similar functionality as baselines
  - Stores less information than a baseline
    - Only Early Start and Early Finish dates of tasks

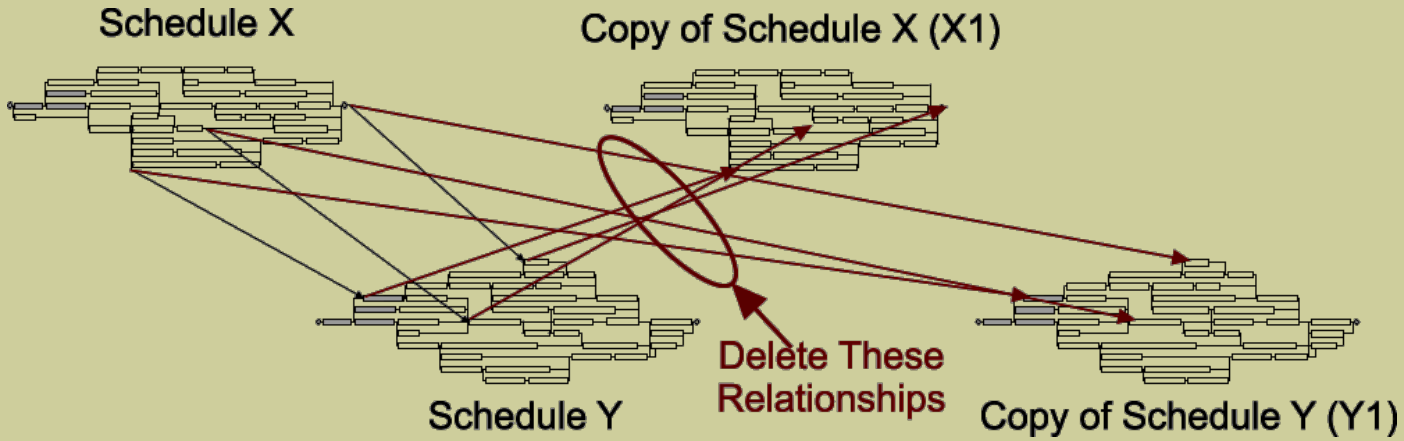
Baseline Schedules

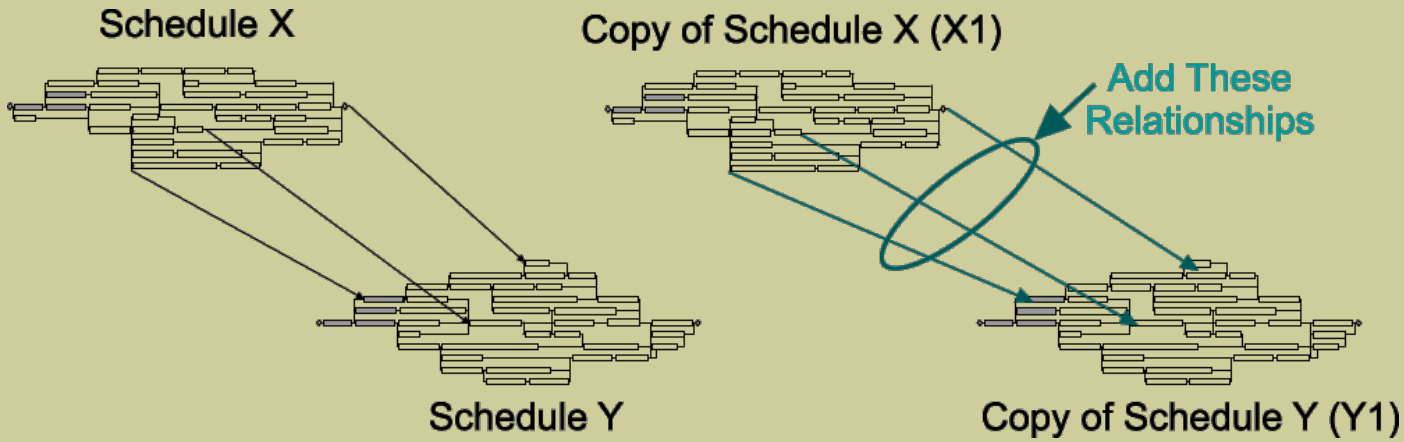
- Solution:
  - Save the various versions of the entire file
  - Rename MS Project file with the status date
    - Remember that links are file-name specific



Baseline Schedules

You are going to need to ‘fix’ the relationships





MSP & P6 Exchanges

- These are the tested configurations
  - Microsoft Project 2002 - MPP, MPX
  - Microsoft Project 2003 - MPP, MPX
  - Microsoft Project 2007 through 2016 – XML
- You need to prep the MSP import file
  - No ‘empty’ MSP lines
  - No logic to summary activities
  - No blank WBS entries
  - Lags might be based on a hourly calendar
  - Embedded/linked MSP projects will not be imported

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Tracking Progress

Tracking Progress

Properly tracking progress requires planning

- Schedule Set-up
- Setting a Baseline
- Updating the schedule
- Comparing schedule updates

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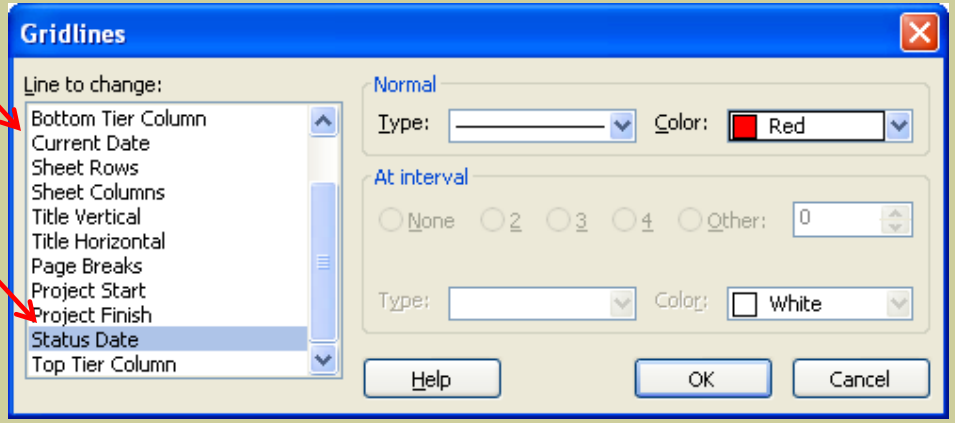
Schedule Set-up

- Settings must be set before adding activities
  - No manual general schedule recalculation
- Proper display of status date
  - Hide Current Date
    - Computer date
  - Show Status Date
    - P6 Data Date

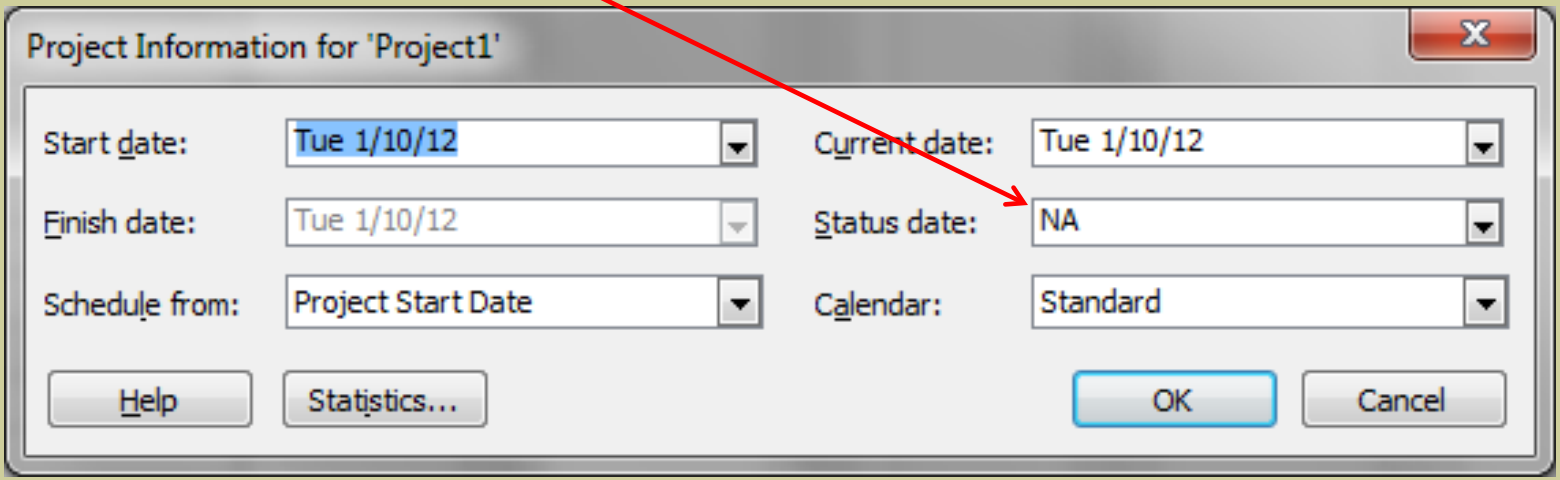
Format / Guidelines



Schedule Set-up

- Set the status date
  - P6 Data Date

Project / Project Information



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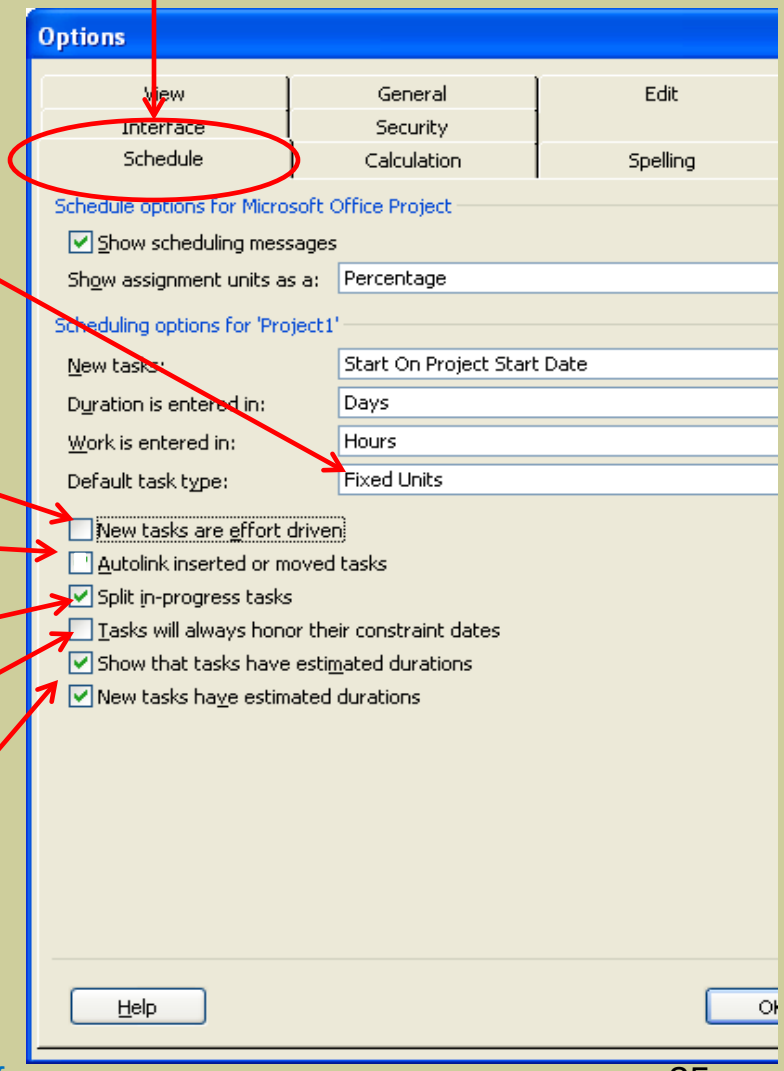
Schedule Options

Tools / Options / Schedule Tab

- Default Task Type
  - NOT Fixed Duration
- New Tasks effort driven
  - Unchecked
- Autolink inserted
  - Unchecked
- Split in-progress tasks
  - Checked
- Always honor constraints
  - Unchecked
- Estimate Durations?



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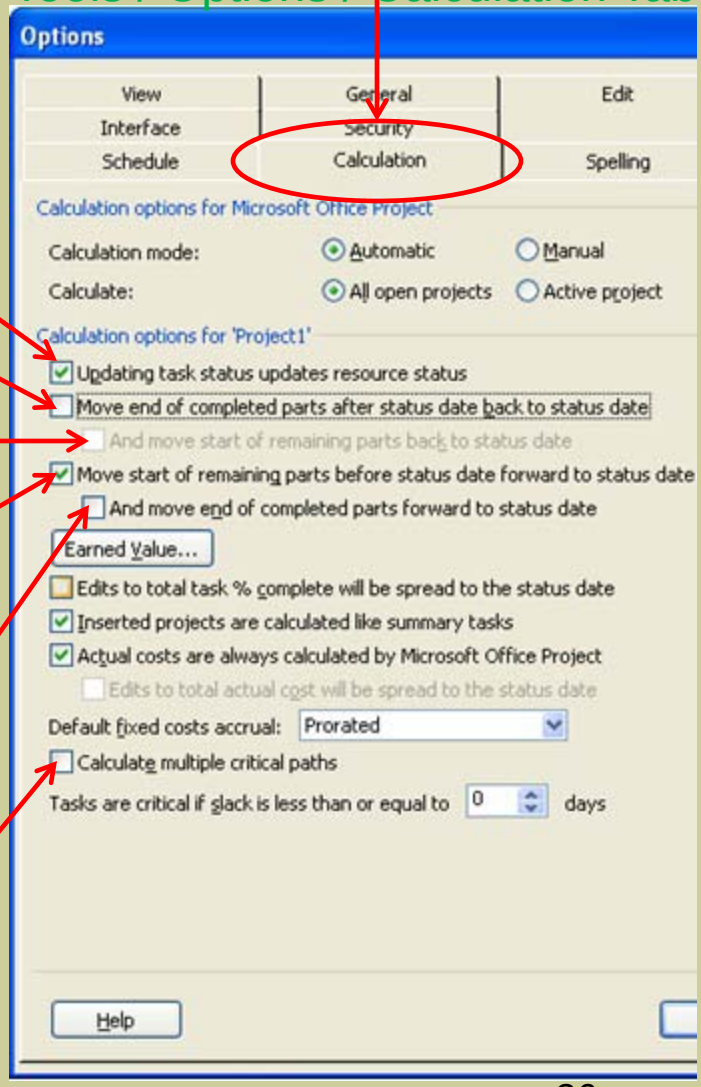
Calculation Options

Tools / Options / Calculation Tab

- Updating task status
  - Checked
- Move end of completed
  - Unchecked
- And move end of complete
  - N/A
- Move start of remaining
  - Checked
- And move end of complete
  - Unchecked
- Calc multiple critical paths



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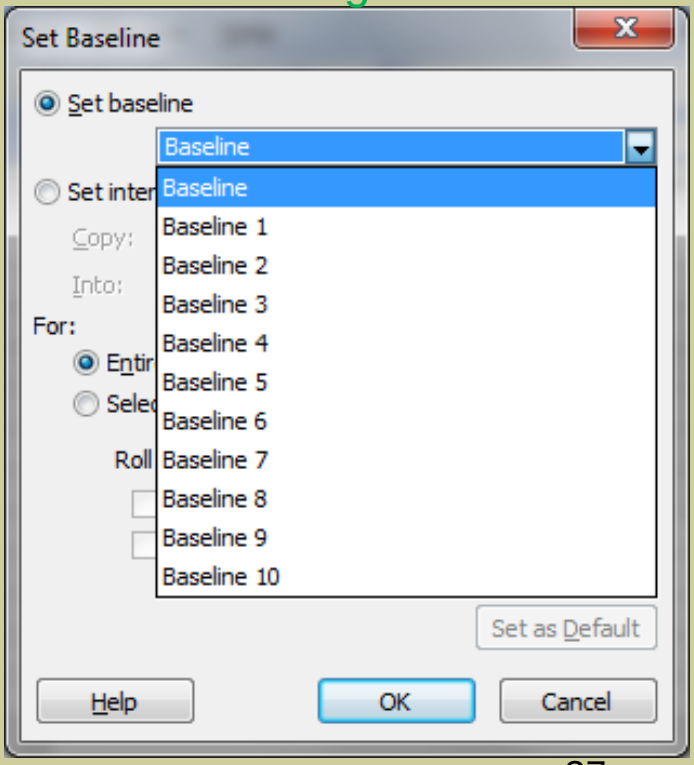
Setting a Baseline

- MSP Baseline versus Baseline Schedule
  - Baseline schedule dates stored internally
- Needed to display comparison bars
- Saves:
  - Early Start date
  - Early Finish date
  - Duration
    - Actual + Remaining Duration
  - Activity cost
  - Activity work
- Also resets Summary Tasks

Tools / Tracking / Set Baseline



Updating the Schedule

- Where P6 schedulers have problems
  - Do not understand update components
- Components are interlinked
  - Duration (not Original Duration)
    - **Actual + Remaining Duration**
  - Actual Duration
    - **Duration x (1 - Percent Complete)**
  - Remaining Duration
    - **Duration – Actual Duration**
  - Percent Complete
    - **Actual Duration / Duration**

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Updating Rules

- Key is what gets recalculated

IF CHANGED	MS PROJECT WILL			
	Duration	% Complete	Actual Duration	Remaining Duration
Duration		Recalculate	Leave As-Is	Recalculate
% Complete	Leave As-Is		Recalculate	Recalculate
Actual Duration	Leave As-Is	Recalculate		Recalculate
Remaining Duration	Recalculate	Recalculate	Leave As-Is	

- % Complete & Remaining Duration always recalculated
- Remember value that stays the same

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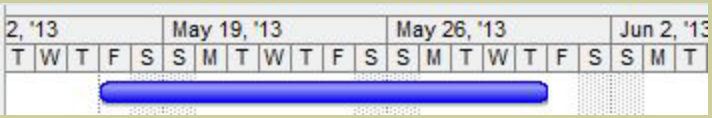
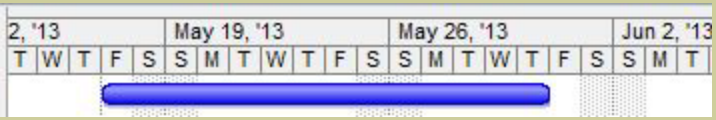
Updating Rules

Task Name	Duration	Actual Duration	Remaining Duration	Actual Start	Actual Finish	% Complete
Task 1	10 days	0 days	10 days	NA	NA	0%



Add Actual Start

Task Name	Duration	Actual Duration	Remaining Duration	Actual Start	Actual Finish	% Complete
Task 1	10 days	0 days	10 days	Fri 5/17/13	NA	0%

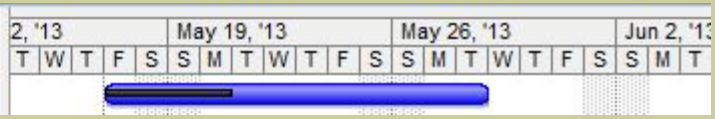


Change Remaining Duration

Task Name	Duration	Actual Duration	Remaining Duration	Actual Start	Actual Finish	% Complete
Task 1	8 days	0 days	8 days	Fri 5/17/13	NA	0%

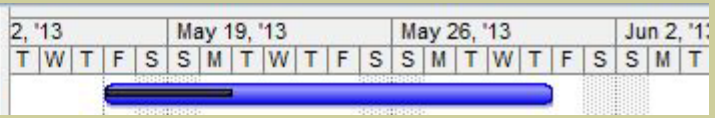
Add Actual Duration

Task Name	Duration	Actual Duration	Remaining Duration	Actual Start	Actual Finish	% Complete
Task 1	8 days	2 days	6 days	Fri 5/17/13	NA	25%



Change Duration

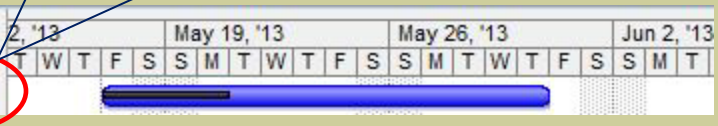
Task Name	Duration	Actual Duration	Remaining Duration	Actual Start	Actual Finish	% Complete
Task 1	10 days	2 days	8 days	Fri 5/17/13	NA	20%



OR

Add Percent Complete

Task Name	Duration	Actual Duration	Remaining Duration	Actual Start	Actual Finish	% Complete
Task 1	10 days	2 days	8 days	Fri 5/17/13	NA	20%



Updating MSP

- Assign Actual Dates first
- Work <u>with</u> the system
  - (Still) assess remaining duration
  - Divide Remaining Duration by Duration
  - Enter a % Complete
  - Confirm all other fields are correct
- Adjust Actual Duration & Remaining Duration
  - If Actual Duration line not up to Status Date, adjust
  - Re-enter Remaining Duration
  - Do not worry about Duration number

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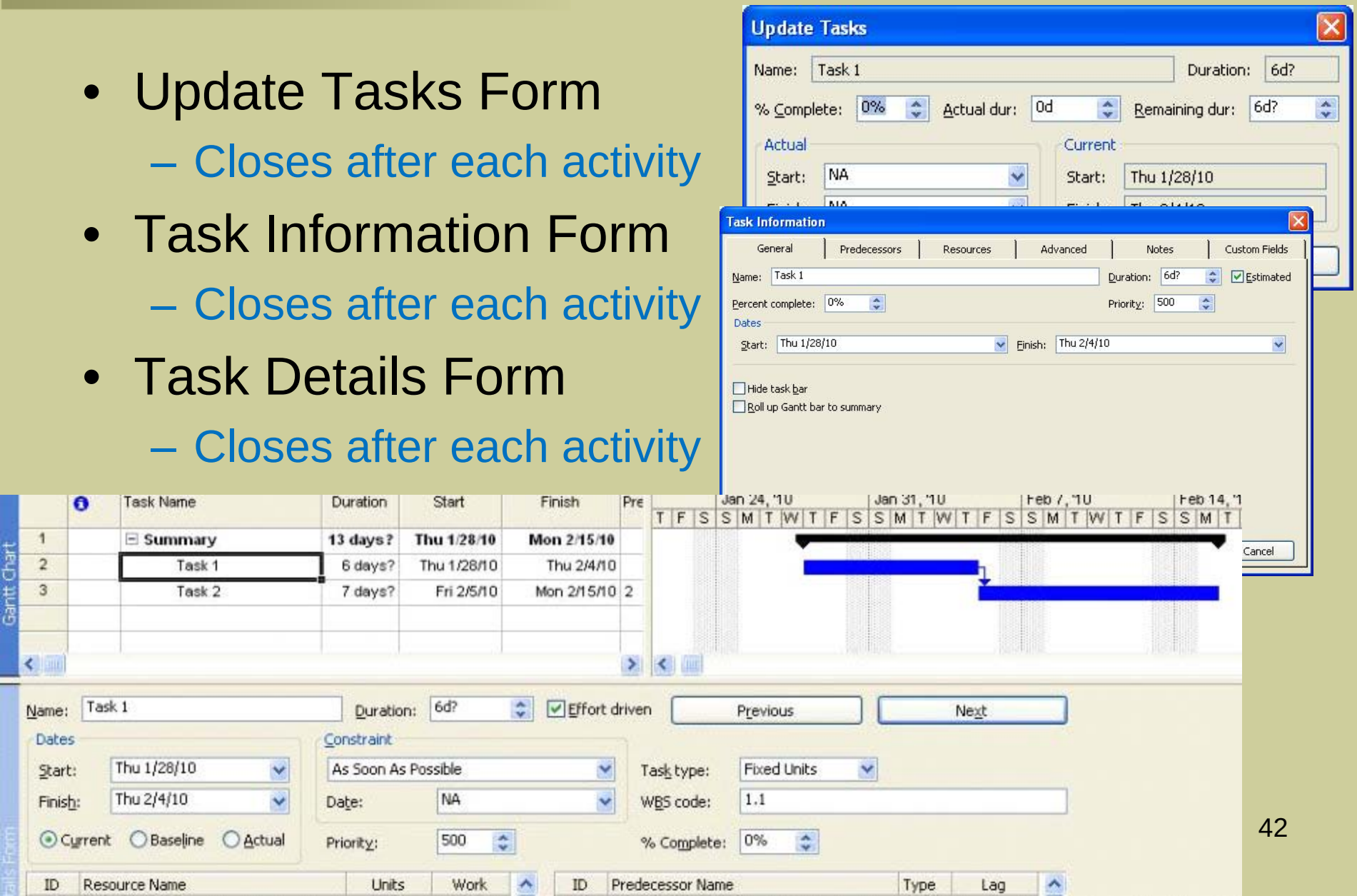
Update Methods

- Update Tasks Form
  - Closes after each activity
- Task Information Form
  - Closes after each activity
- Task Details Form
  - Closes after each activity



Update Methods

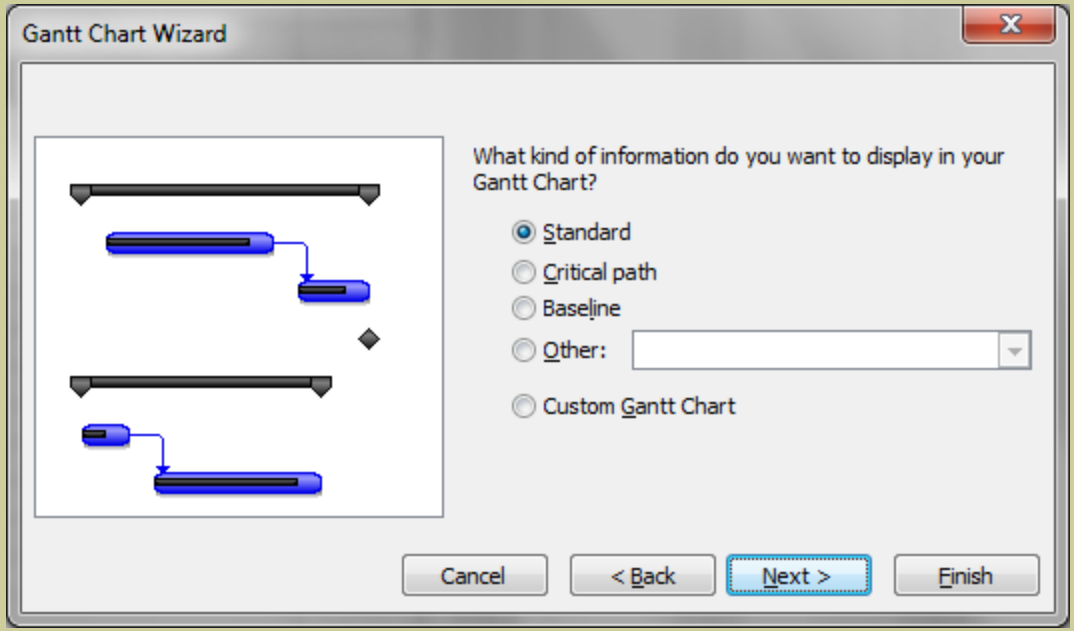
- Tracking Table in the Gantt Chart
  - Recommended for speed and accuracy
  - Show all columns to spot accidental changes

Duration	Actual Duration	Remaining Duration	% Complete	Actual Start	Actual Finish	Start	Finish
13 days?	**0 days**	**13 days?**	**0%**	**NA**	**NA**	**Thu 1/28/10**	**Mon 2/15/10**
6 days?	0 days	6 days?	0%	NA	NA	Thu 1/28/10	Thu 2/4/10
7 days?	0 days	7 days?	0%	NA	NA	Fri 2/5/10	Mon 2/15/10

Analyze Progress

- Identifying Variances
  - Start Variance & Finish Variance columns can be used
  - Can display baseline & schedule update in same view
  - Gantt chart wizard

Format / Gantt Chart Wizard



Analyze Progress

- MSP 2007 and later has a ‘Compare Project Versions’ utility
  - Graphically compares tasks and resources
  - Hard to understand
    - Confusing
    - Not very useable for presentations
- MSP has a built-in VBA programming language
  - Allows for development of custom comparison software
    - Cannot prevent copying and altering

Analyze Progress

- Exporting schedules to MS Access or Excel
  - Use it to compare the two schedules
- Third-party software comparison tools
  - If it reads multiple CPM software, does one size fit all?
    - MSP does not have an Original Duration field

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The Correct CPM Setup

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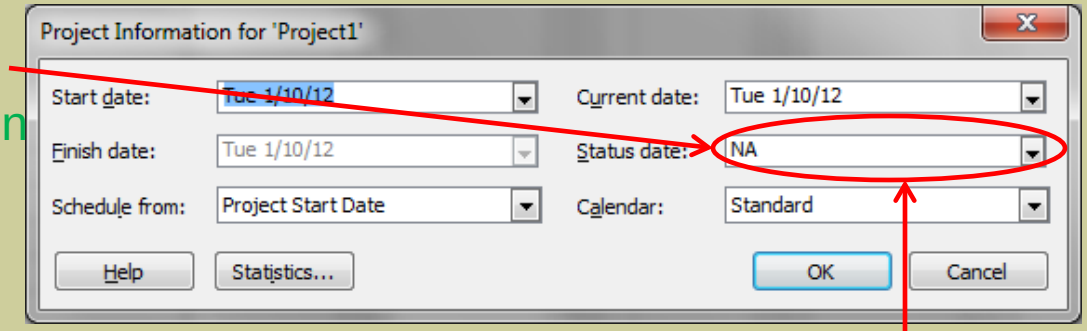
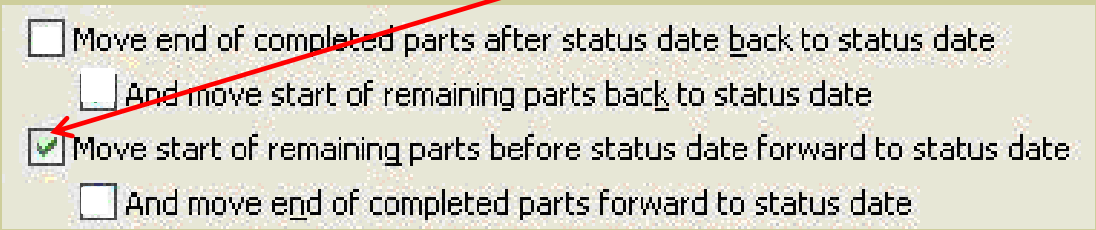
Process Overview

- Not <u>designed</u> to calculate CPM using a Status Date
- Set the Status Date

  Project / Project Information

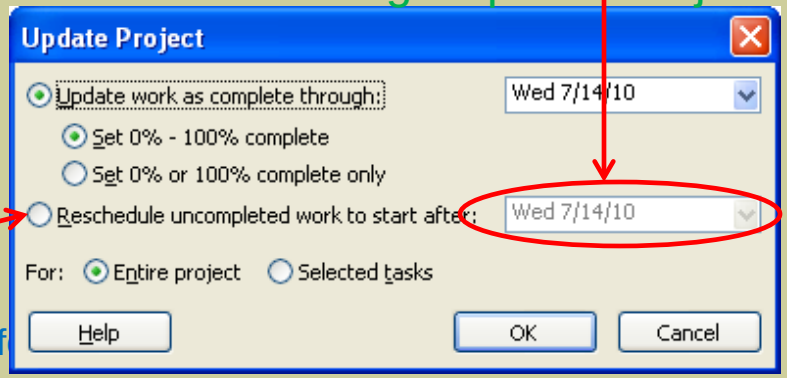


- Force MSP to observe the Status Date



Tools / Options / Calculation options

Tools / Tracking / Update Project



- Change w/ Update Project
  - Reschedule uncompleted

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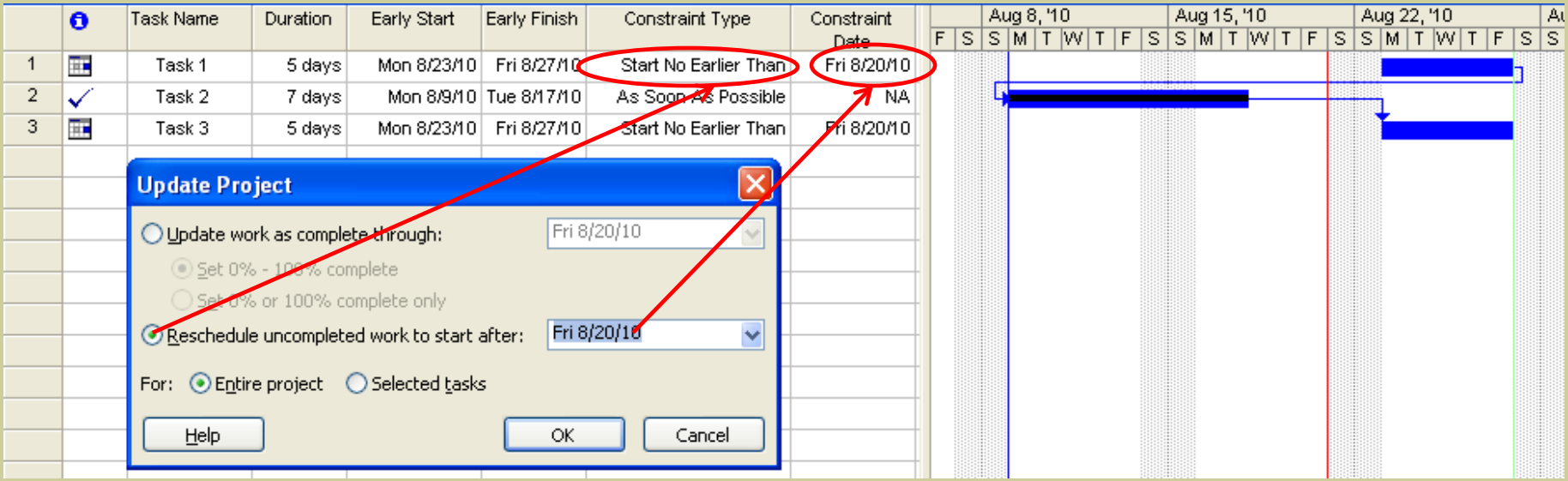
Process Overview

- Unstarted tasks
  - Start No Earlier Than constraint = Project Status date
- In-progress tasks
  - Resume Date set to the Update Project date
- Tasks lose any existing constraints



Disadvantages

- One constraint per task – existing deleted
- In-progress tasks resume date set to update project date
- Only one out-of-sequence calculation mode
- Problems later if destatusing the project
- Update Project feature does not update the graphical Status Date setting
- Can still have tasks in future with actual dates
  - Same as P6 except,
  - No automatic notice in CPM computations report

Disadvantages

- Does not change the start of CPM calculations
  - Still Project Start
- These are not true CPM Calculation Modes
  - “Constraint-Based CPM Calculation Mode”

CPM Checklist

- Split In-Progress Tasks option must be selected
- Must select desired options before tasks added
- Updating task status updates resource status option must be checked
- Task duration type must not be “Fixed Duration”
  - Opposite of normal P6 setting
- Tasks only reflect the CPM options if updated by
  - Percent Complete (MS 2003)
  - Percent Complete or Remaining Duration (MS 2007+)

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Putting It All Together

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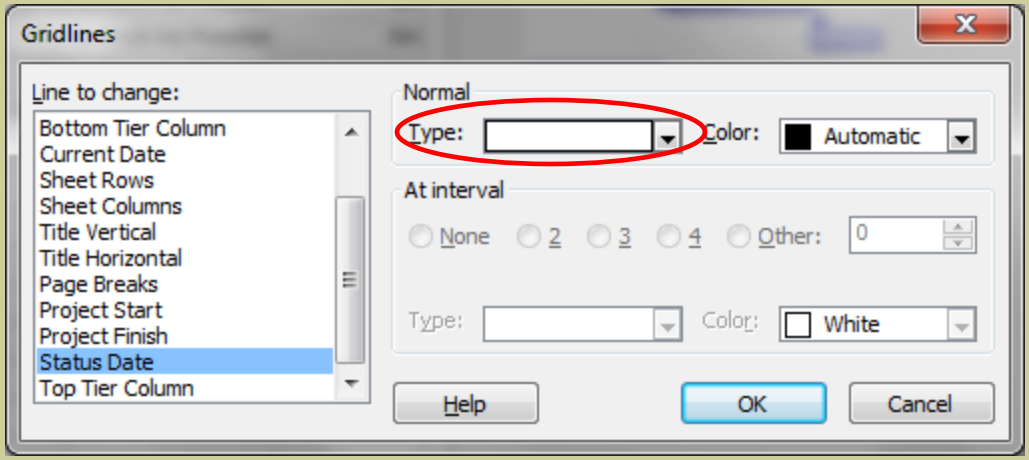
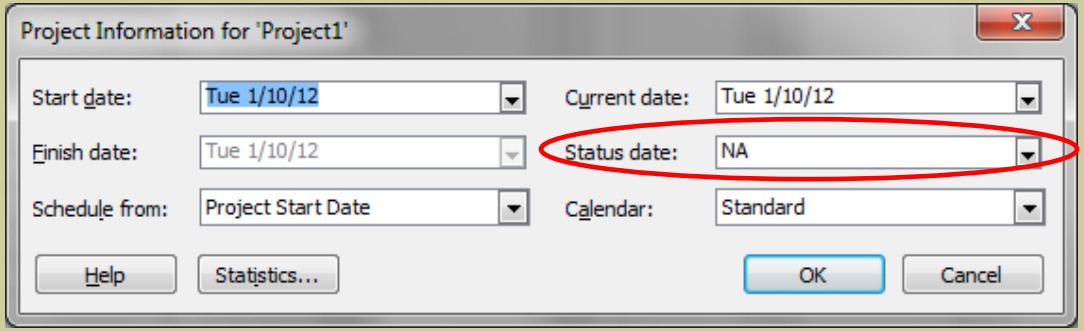
Before Set-Up



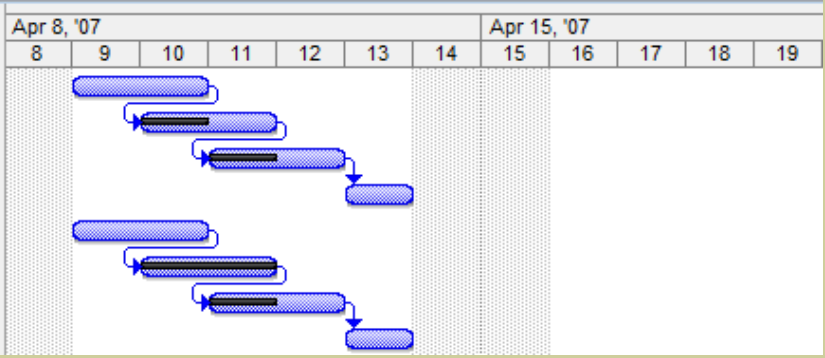
Format / Guidelines

Project / Project Information



Difference

Task Name	Duration	Remaining Duration	Actual Duration	% Complete	Constraint Type	Constraint Date
Unstarted Task A	2 days	2 days	0 days	0%	As Soon As Possible	NA
Partially Complete Task B	2 days	1 day	1 day	50%	As Soon As Possible	NA
Partially Complete Task C	2 days	1 day	1 day	50%	As Soon As Possible	NA
Unstarted Task D	1 day	1 day	0 days	0%	As Soon As Possible	NA
Unstarted Task A	2 days	2 days	0 days	0%	As Soon As Possible	NA
Completed Task B	2 days	0 days	2 days	100%	As Soon As Possible	NA
Partially Complete Task C	2 days	1 day	1 day	50%	As Soon As Possible	NA
Unstarted Task D	1 day	1 day	0 days	0%	As Soon As Possible	NA



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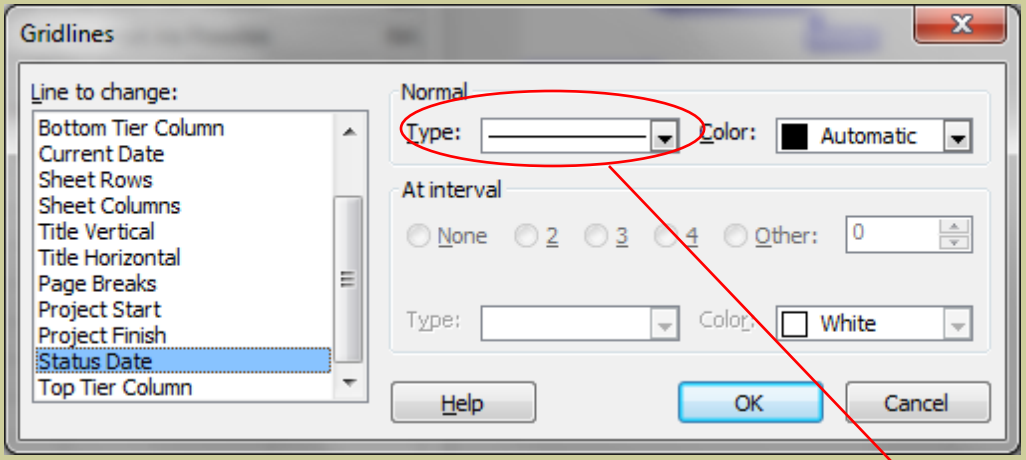
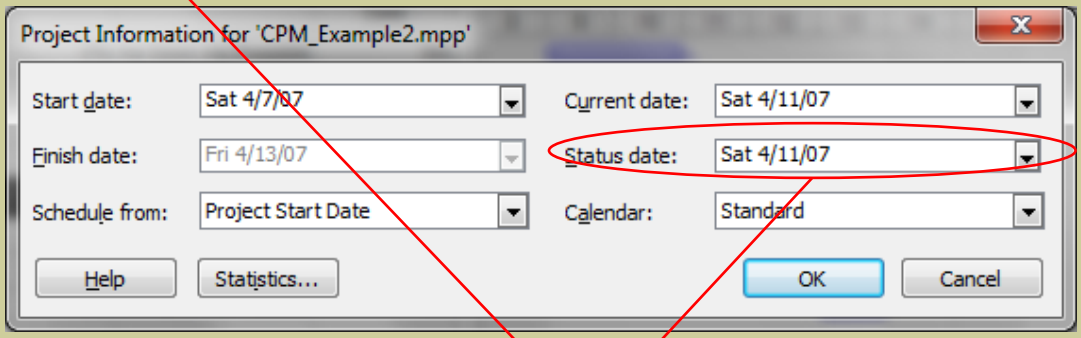
After Setting Status Date

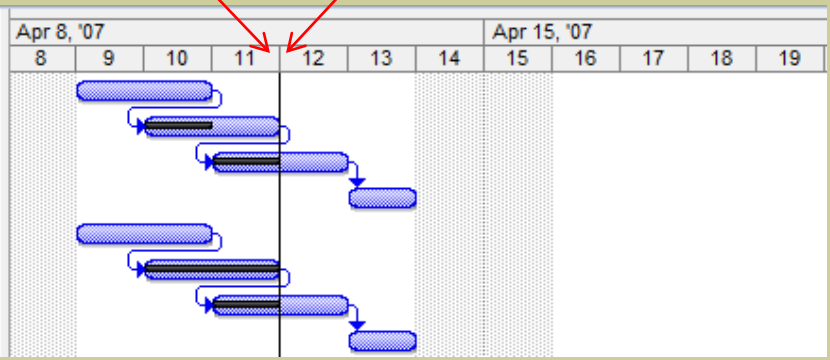


Format / Guidelines

Project / Project Information



Task Name	Duration	Remaining Duration	Actual Duration	% Complete	Constraint Type	Constraint Date
Unstarted Task A	2 days	2 days	0 days	0%	As Soon As Possible	NA
Partially Complete Task B	2 days	1 day	1 day	50%	As Soon As Possible	NA
Partially Complete Task C	2 days	1 day	1 day	50%	As Soon As Possible	NA
Unstarted Task D	1 day	1 day	0 days	0%	As Soon As Possible	NA
Unstarted Task A	2 days	2 days	0 days	0%	As Soon As Possible	NA
Completed Task B	2 days	0 days	2 days	100%	As Soon As Possible	NA
Partially Complete Task C	2 days	1 day	1 day	50%	As Soon As Possible	NA
Unstarted Task D	1 day	1 day	0 days	0%	As Soon As Possible	NA



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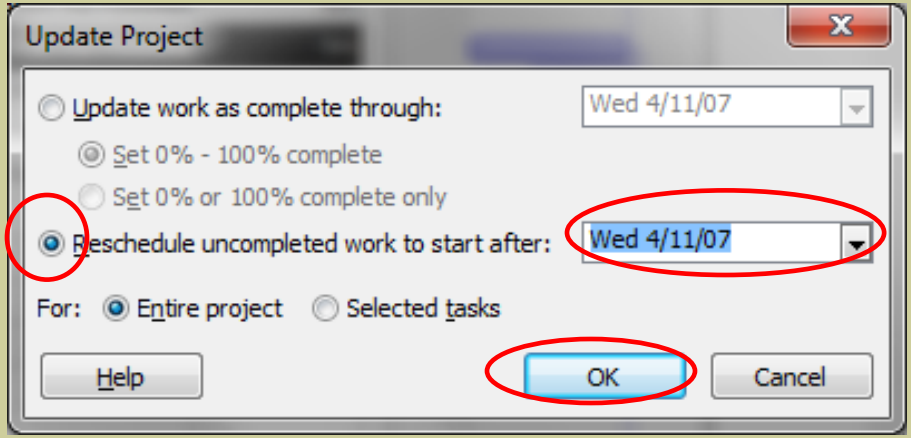
Reschedule Work

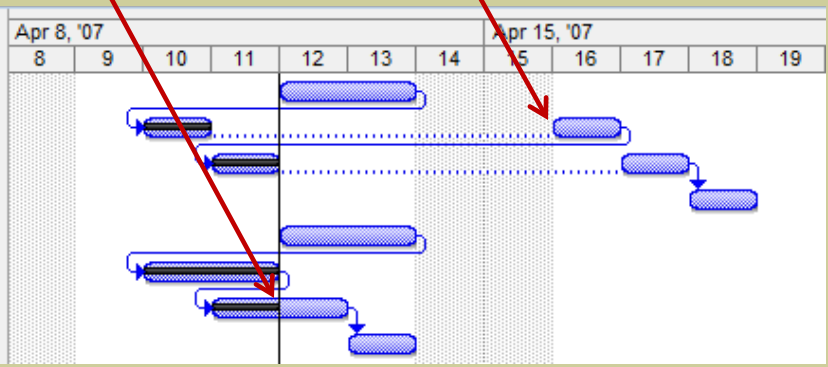
Tools / Tracking / Update Project



'Progress Override'

'Retained Logic'

Task Name	Duration	Remaining Duration	Actual Duration	% Complete	Constraint Type	Constraint Date
Unstarted Task A	2 days	2 days	0 days	0%	Start No Earlier Than	Wed 4/11/07
Partially Complete Task B	2 days	1 day	1 day	50%	As Soon As Possible	NA
Partially Complete Task C	2 days	1 day	1 day	50%	As Soon As Possible	NA
Unstarted Task D	1 day	1 day	0 days	0%	As Soon As Possible	NA
Unstarted Task A	2 days	2 days	0 days	0%	Start No Earlier Than	Wed 4/11/07
Completed Task B	2 days	0 days	2 days	100%	As Soon As Possible	NA
Partially Complete Task C	2 days	1 day	1 day	50%	As Soon As Possible	NA
Unstarted Task D	1 day	1 day	0 days	0%	As Soon As Possible	NA



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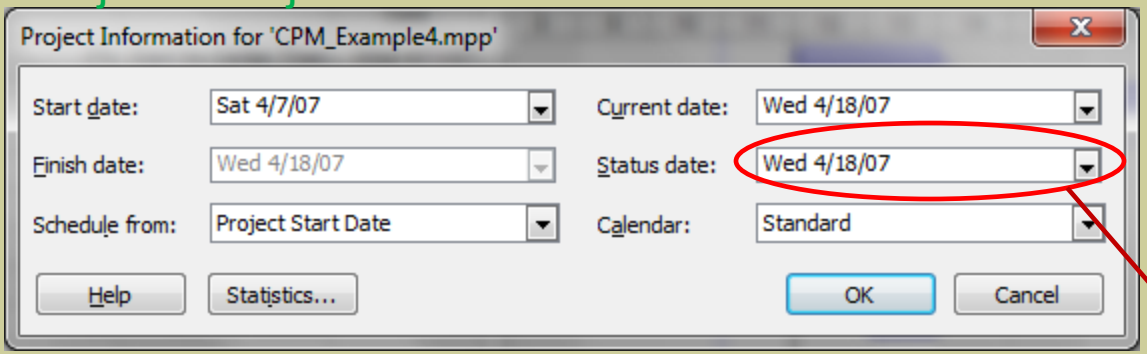
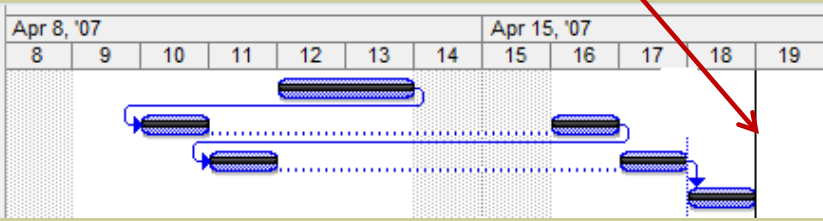
After Final Update

Project / Project Information



Task Name	Duration	Remaining Duration	Actual Duration	% Complete	Constraint Type	Constraint Date
Unstarted Task A	2 days	0 days	2 days	100%	Start No Earlier Than	Wed 4/11/07
Partially Complete Task B	2 days	0 days	2 days	100%	As Soon As Possible	NA
Partially Complete Task C	2 days	0 days	2 days	100%	As Soon As Possible	NA
Unstarted Task D	1 day	0 days	1 day	100%	As Soon As Possible	NA



Notice that Actual Duration is incorrect

Conclusions

Conclusions

- MS Project is easy to set-up a schedule
- Baseline functionality is poor
- Updating typically causes unintended changes
- Built-in update help routines may corrupt status
  - Automatic insertion of made-up dates and durations
- Data Date issues complicate update process
- Hard to note uncompleted work in the past
- Difficult to identify variances
- Impossible to accurately remove status
  - Time Impact Analysis / What-If Schedules

Assessment of MSP

- Microsoft Project can be properly used in construction
  - Easy to build a schedule
  - More difficult to status accurately
    - User-assist features can change actual data
  - Very difficult to monitor status
    - Easy to have un-finished work in the ‘past’
  - Forensic analysis depends on saved backups
    - Baseline feature not capable of rebuilding activity
- Recommend version MS Project 2007 or later

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