Making effective use of the outputs from Schedule Risk Analysis (SRA) and using SRA with Agile methodologies

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2018 EVMP Forum – August 22nd & 23rd

Learning Objectives

A quick overview as to WHY we perform Risk Analysis

Understand the RESULTS of a Risk Analysis

Use those Results to IMPROVE your Chance of Success

Using Schedule Risk Analysis with AGILE methodologies

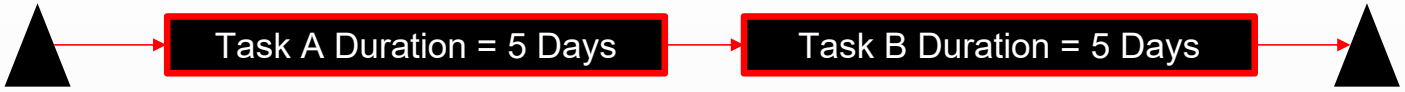
Why Schedule Risk Analysis?

Traditional Critical Path Method (CPM) project management solutions like Microsoft Project and all other major scheduling tools produce a single, deterministic, prediction for project delivery.

However, in the real world, there is always some uncertainty and this can quickly render such deterministic predictions invalid and very often overly optimistic.

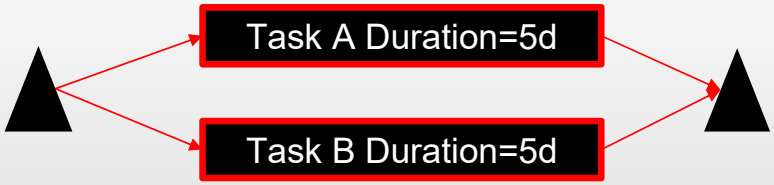
Rather than try to guess the exact duration of a future task, a more realistic approach would use a range of estimates for each task.

The effect of uncertainty with just two tasks



Assume each task is just as likely to finish a little early as a little late.

In this ‘serial’ example, if Task A is delayed, we can potentially make up the time while executing Task B.



In this ‘parallel’ example, if Task A is delayed, then the delivery is delayed regardless how well we perform on Task B.

Task A	Task B	Project
Early/On-Time	Early/On-Time	Early/On-Time
Late	Early/On-Time	Late
Early/On-Time	Late	Late
Late	Late	Late

In this simple example there is a **75% chance** the project will **not be delivered on time!**

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How does it work?

Monte Carlo Simulation is performed to determine the probability of completion of a project (or target milestone) by a desired date.

- The simulation ‘executes’ the project many times using a random sampling of durations for each task bounded by Best Case (Optimistic), Most Likely, and Worst Case (Pessimistic) estimates for each task (3 Point Estimates)
- Not every task needs a range estimate. Focus on Critical, Near Critical, and High Risk tasks.

Probability of Success

As we saw in the earlier slide, it is unlikely we will have a 50% chance of success even if our estimates and execution are excellent. Even if it was 50%, do we really want to execute our projects with just a 50/50 chance/probability of success?

Most organizations choose to aim for between 80% and 90% chance of success.

Aiming for 100% chance of success is usually cost prohibitive and not worth it unless the cost of failure is extreme.

An 80% probability of success might also be described as an 80% level of confidence and is also sometimes shortened to P80.

Schedule Quality Matters

- Must include entire scope of the project.
- Must be logically sequenced.
- Must not be artificially constrained.
- Take care with Level of Effort (LOE) and other reporting mechanisms, especially in Microsoft Project.
- Milestones to identify deliverables.

The Process

- Add uncertainty to the model using range estimates focusing on Critical, Near-Critical, and known High Risk tasks.
- Simulate the execution of the project many times using durations sampled from the range estimates (schedule risk analysis).
- Review the outputs.
- If an acceptable probability of success by a desired date/cost is not achieved, then **modify the inputs**.
- Repeat…
- Communicate outcomes to stakeholders.

Modify the Inputs…

If the results of the simulations do not meet requirements or commitments then something has to change!

This is not bad news! This is an opportunity to improve our chance of success before we even start. Options include:

- Change the underlying (CPM) model to Finish Earlier.
- Reduce Uncertainty.
- Add Risk Mitigation to the model.

Step 1: Add Uncertainty

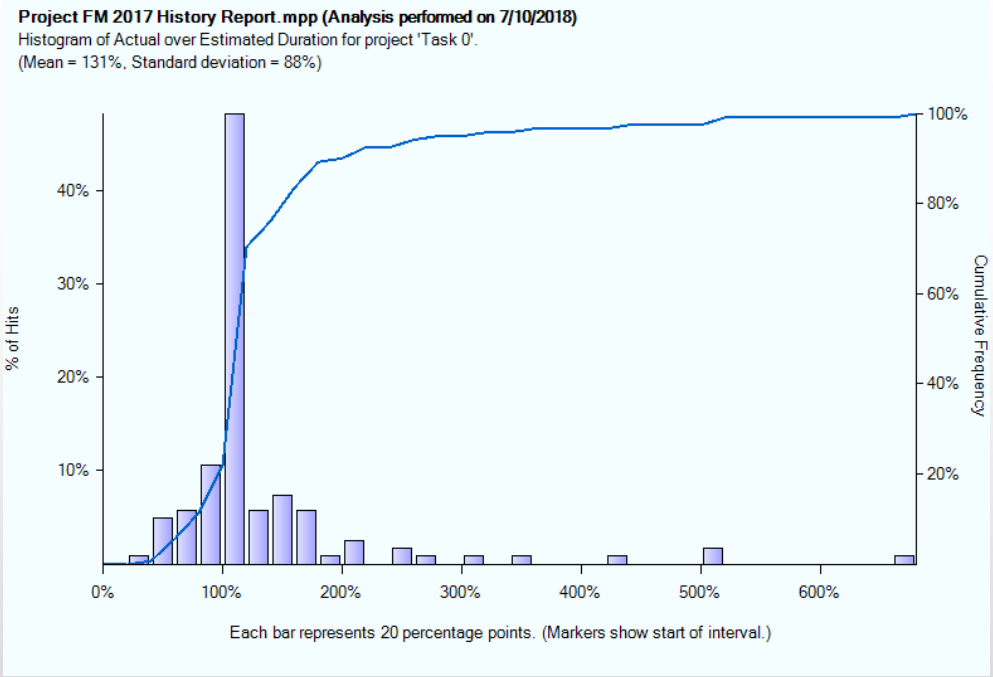
- Focus on Critical, Near-Critical, and Known High Risk Tasks.
- For Known High Risk Tasks, typically obtain discrete (real duration) Best, Most Likely, Worst case estimates.
- For more generic work you can often use percentages based on historical performance of types/disciplines of work.

11	SW Task 1	18 days	Triangular	95%	100%	115%	100%
12	SW Task 2	18 days	Triangular	17 days	18 days	25 days	100%

- Distribution types (Triangular, Normal, Beta) are a less important input. Focus on the duration estimates. Triangular and Beta are commonly used as they can be skewed.

Use Historical Data to Justify Assumptions

- This analysis of historical data shows that on this completed project, duration estimates were correct roughly 50% (48.4%) of the time. However some tasks finished earlier and others much later than planned.
- This data could justify using a Beta distribution with best case of 50%, Most Likely of 100% and Worst case of say 250% for future work.



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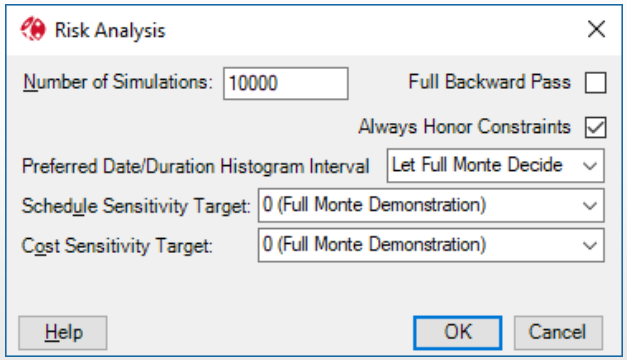
Step 2: Perform the Analysis

- The more simulations the better.
- Focus Sensitivity Analysis on next major deliverable or entire project.
- Some tools allow you to suppress constraints that artificially prevent dates moving into the future.



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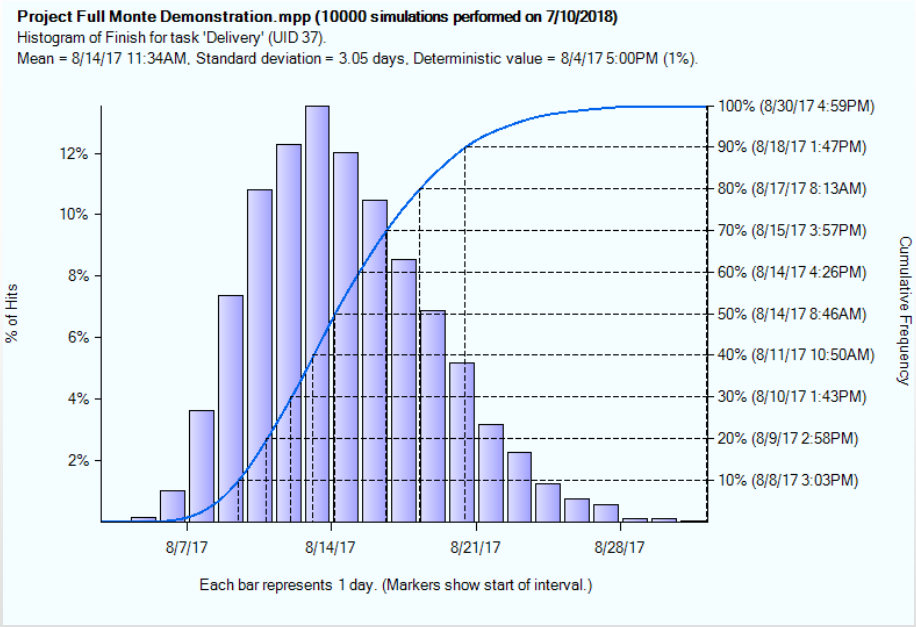
Step 3: Review Outputs - Histogram

- The Finish Histogram is the most commonly viewed output.
- The histogram itself is not very useful!
- The S-Curve shows the cumulative chance of finishing by specific dates/costs. Much more useful!
- The software is predicting just a 1% chance of achieving the date produced by the scheduling tool.



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Review Outputs – Sensitivity Tornado Chart

ID	Task Name	Remaining Duration	Percent Critical	Percent Critical (Sensitivity)	Sensitivity Index	Sensitivity Index 20.0 40.0	Optimistic Finish of Project	Pessimistic Finish of Project	2017 Aug 06 13 20	Early Finish Histogram	Schedule Sensitivity Bar Basis
11	SW Task 1	18 days	81%	81%	56%		8/10/17 11:51AM	8/22/17 9:10AM		Graph	Estimated
14	SW Task 4	18 days	81%	81%	56%		8/10/17 11:51AM	8/22/17 9:10AM		Graph	Estimated
12	SW Task 2	18 days	41%	41%	28%		8/11/17 3:25PM	8/21/17 9:32AM		Graph	Estimated
13	SW Task 3	18 days	41%	41%	28%		8/11/17 3:28PM	8/21/17 9:29AM		Graph	Estimated
8	HW Task 4	4 wks	19%	19%	6%		8/14/17 10:50AM	8/16/17 8:15AM		Graph	Estimated
5	HW Task 1	4 wks	19%	19%	6%		8/14/17 10:50AM	8/16/17 8:15AM		Graph	Estimated
7	HW Task 3	4 wks	10%	10%	3%		8/14/17 11:19AM	8/15/17 1:52PM		Graph	Estimated
6	HW Task 2	4 wks	9%	9%	3%		8/14/17 11:18AM	8/15/17 1:44PM		Graph	Estimated

The Tornado chart shows the tasks creating uncertainty in the target outcome. With this example we can see that the SW Tasks are creating the most variability/uncertainty in the outcome. The Green bar shows that the milestone/project tends to finish earlier when the SW tasks finish early. The red bar shows how tasks finishing late causes the project to tend to finish late.

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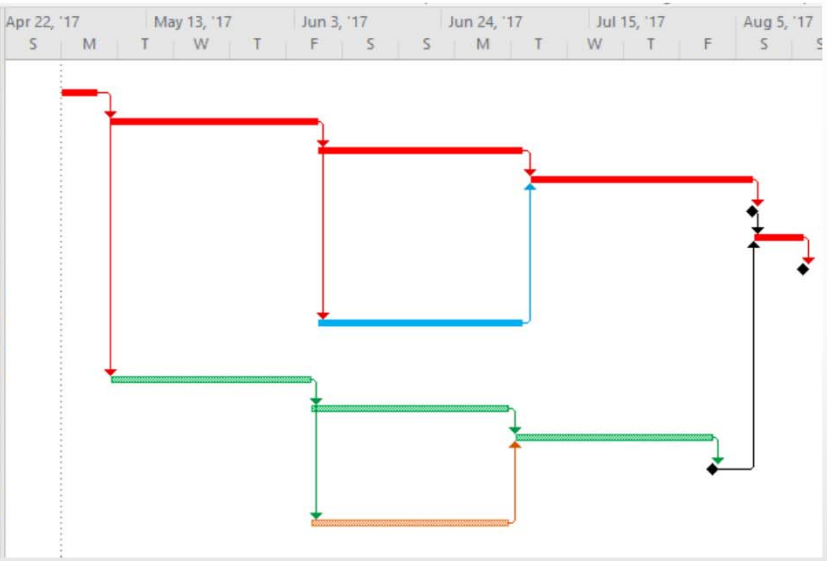
Review Outputs – Risk Path Analysis

Task Name	Duration	Start	Finish	Start Percentile (80%)	Finish Percentile (80%)
Risk Path: 1	**70d**	**5/1/17 8:00 AM**	**8/4/17 5:00 PM**		
Initiate	5 days	5/1/17 8:00 AM	5/5/17 5:00 PM	5/1/17 8:00 AM	5/5/17 5:00 PM
SW Task 1	18 days	5/8/17 8:00 AM	5/31/17 5:00 PM	5/8/17 8:00 AM	6/8/17 9:30 AM
SW Task 2	18 days	6/1/17 8:00 AM	6/26/17 5:00 PM	6/8/17 9:30 AM	7/10/17 9:25 AM
SW Task 4	18 days	6/27/17 8:00 AM	7/20/17 5:00 PM	7/11/17 9:32 AM	8/10/17 8:13 AM
SW Complete	0 days	7/20/17 5:00 PM	7/20/17 5:00 PM	8/10/17 8:13 AM	8/10/17 8:13 AM
Integration	5 days	7/31/17 8:00 AM	8/4/17 5:00 PM	8/10/17 8:13 AM	8/17/17 8:13 AM
Delivery	0 days	8/4/17 5:00 PM	8/4/17 5:00 PM	8/17/17 8:13 AM	8/17/17 8:13 AM
Risk Path: 2	**18d**	**6/1/17 8:00 AM**	**6/26/17 5:00 PM**		
SW Task 3	18 days	6/1/17 8:00 AM	6/26/17 5:00 PM	6/8/17 9:30 AM	7/10/17 8:59 AM
Risk Path: 3	**60d**	**5/8/17 8:00 AM**	**7/28/17 5:00 PM**		
HW Task 1	20 days	5/8/17 8:00 AM	6/2/17 5:00 PM	5/8/17 8:00 AM	6/6/17 10:15 AM
HW Task 2	20 days	6/5/17 8:00 AM	6/30/17 5:00 PM	6/6/17 10:16 AM	7/4/17 4:23 PM
HW Task 4	20 days	7/3/17 8:00 AM	7/28/17 5:00 PM	7/5/17 11:25 AM	8/3/17 8:07 AM
HW Complete	0 days	7/28/17 5:00 PM	7/28/17 5:00 PM	8/3/17 8:07 AM	8/3/17 8:07 AM
Risk Path: 4	**20d**	**6/5/17 8:00 AM**	**6/30/17 5:00 PM**		
HW Task 3	20 days	6/5/17 8:00 AM	6/30/17 5:00 PM	6/6/17 10:16 AM	7/4/17 4:29 PM



Risk Path Analysis shows the various potential critical paths to the deliverable based on their chance of being critical.

Verify the expected tasks/logic is driving the project.

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Step 5: Is the result acceptable?

Delivery date from CPM 4Aug17.

Predicted P80 delivery date 17Aug17.

Primary critical path is shown through Software tasks rather than the Hardware tasks because of higher uncertainty on Software.

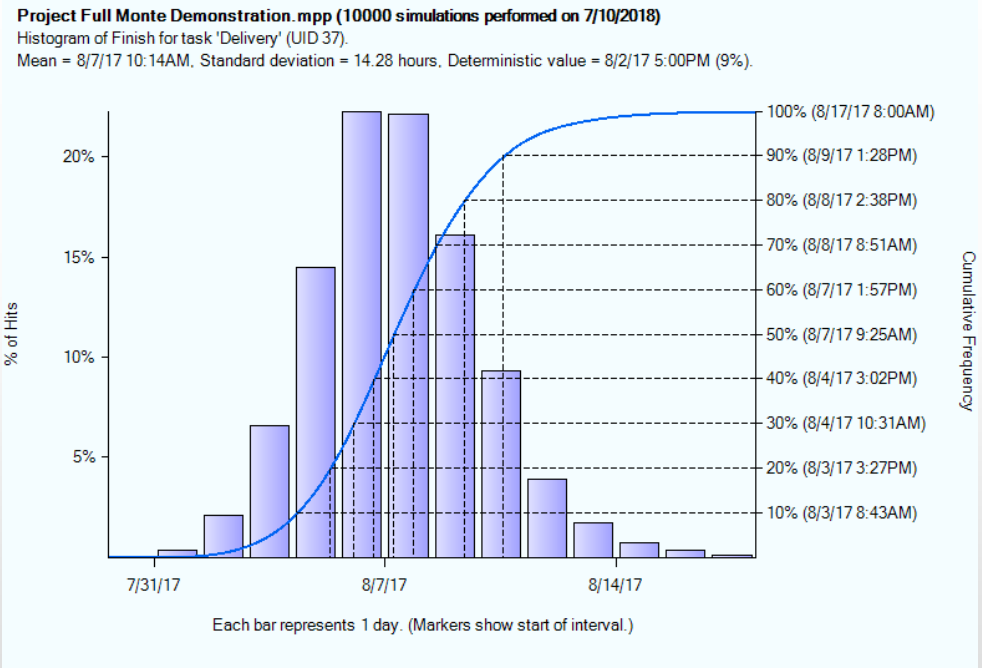
Did we already commit to 4Aug17? The analysis shows a very low chance (1%) of achieving that date. If we need to meet that date we need to revise the schedule.

If Necessary, Modify The Inputs

Using data from the Sensitivity Tornado Chart and Risk Path Analysis focus on tasks most likely to improve overall duration.

After a first path through revising estimates the results improve.

P80 is now 8Aug17 rather than 17Aug17. 4Aug17 has increased to 40% chance.



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Modify again…

ID	Task Name	Remaining Duration	Percent Critical	Percent Critical (Sensitivity)	Sensitivity Index	Sensitivity Index 20.0 40.0	Optimistic Finish of Project	Pessimistic Finish of Project	2017 Jul Aug 30 06	Early Finish Histogram	Schedule Sensitivity Bar Basis
11	SW Task 1	16 days	31%	31%	32%		8/4/17 4:12PM	8/11/17 8:35AM		Graph	Estimated
14	SW Task 4	16 days	31%	31%	26%		8/4/17 4:52PM	8/10/17 10:01...		Graph	Estimated
5	HW Task 1	4 wks	69%	69%	40%		8/4/17 1:53PM	8/9/17 3:50PM		Graph	Estimated
8	HW Task 4	4 wks	69%	69%	40%		8/4/17 1:53PM	8/9/17 3:50PM		Graph	Estimated
13	SW Task 3	18 days	16%	16%	18%		8/7/17 9:01AM	8/10/17 11:46...		Graph	Estimated
12	SW Task 2	18 days	15%	15%	18%		8/7/17 9:04AM	8/10/17 11:25...		Graph	Estimated
7	HW Task 3	4 wks	35%	35%	20%		8/7/17 8:22AM	8/9/17 10:40AM		Graph	Estimated
6	HW Task 2	4 wks	34%	34%	20%		8/7/17 8:24AM	8/9/17 10:34AM		Graph	Estimated

The Sensitivity Analysis shows that we should now focus on HW/SW tasks 1 and 4. The green shows the project tends to finish earlier when these tasks finish early.

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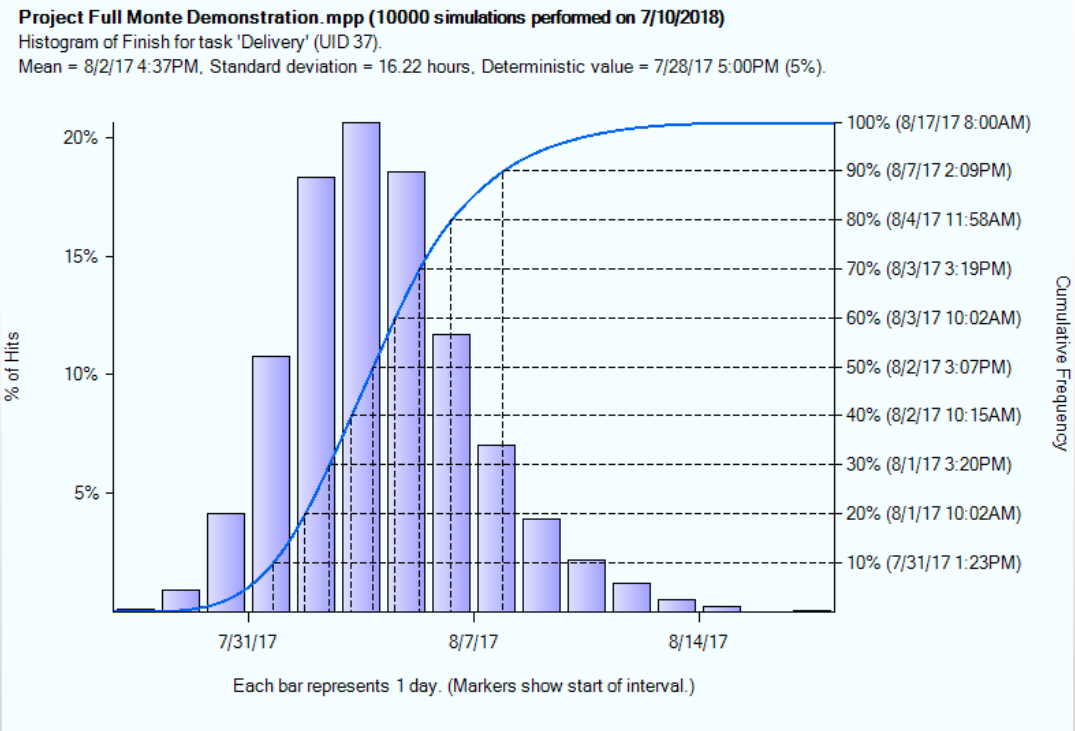
Success!

- The Risk Analysis is now showing we have an 80% chance of achieving 4Aug17.
- The underlying CPM model now shows a finish of 28Jul17.
- This needs to be communicated carefully!



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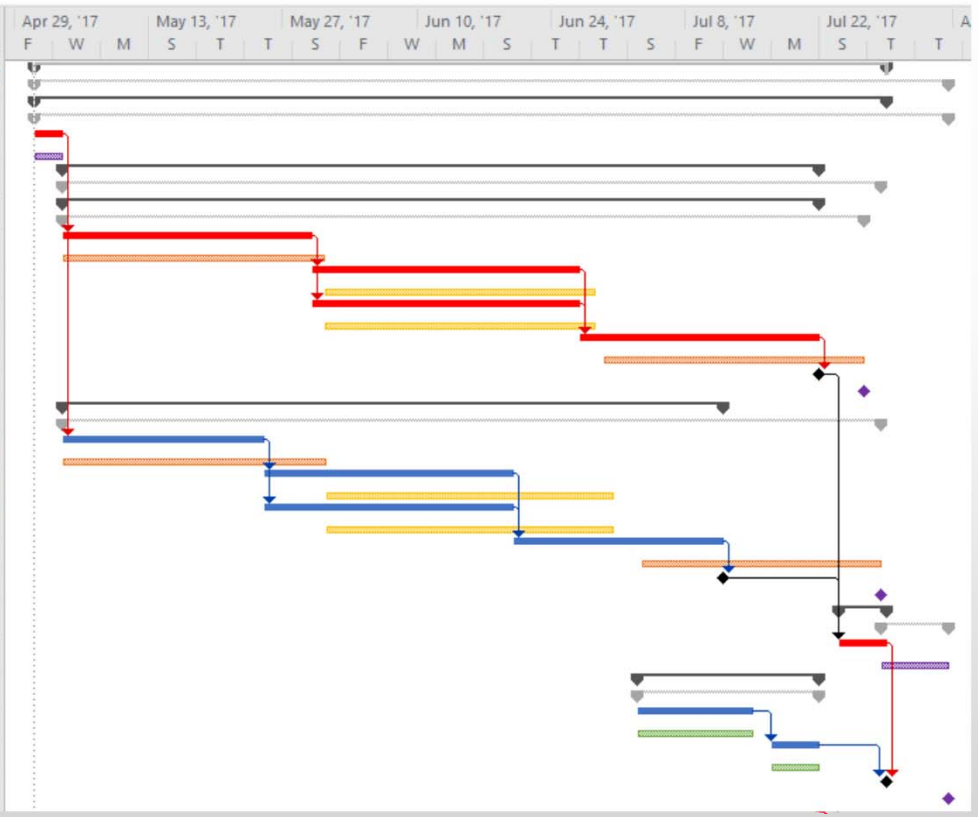
Step 6: Communicate

- The CPM model shows what we PLAN to do. We will try to finish by 28Jul17 ready for delivery on 4Aug17.
- DO NOT COMMIT TO THE EARLIER DELIVERY DATE!
- That is our goal. We will work toward that goal BUT we know uncertainty will almost certainly affect the final outcome. We are still committing to 4Aug17. We have an 80% chance of achieving the committed deliverable (4Aug17).
- We actually only have a 5% chance of completing by 28Jul17 but it remains our goal for execution.
-

Risk Adjusted Gantt

Task Name	Duration	Start	Finish	Start Percentile (80%)	Finish Percentile (80
Full Monte Demonstration	**65 days**	**5/1/17 8:00 AM**	**7/28/17 5:00**	**5/1/17 8:00 AM**	**8/4/17 11:58 AM**
Full Monte 2017	**65 days**	**5/1/17 8:00 AM**	**7/28/17 5:00 PM**	**5/1/17 8:00 AM**	**8/4/17 11:58 AM**
Initiate	3 days	5/1/17 8:00 AM	5/3/17 5:00 PM	5/1/17 8:00 AM	5/3/17 5:00 PM
Development	**57 days**	**5/4/17 8:00 AM**	**7/21/17 5:00 PM**	**5/4/17 8:00 AM**	**7/28/17 11:58 AM**
Hardware	**57 days**	**5/4/17 8:00 AM**	**7/21/17 5:00 PM**	**5/4/17 8:00 AM**	**7/26/17 4:20 PM**
HW Task 1	18 days	5/4/17 8:00 AM	5/29/17 5:00 PM	5/4/17 8:00 AM	5/31/17 9:09 AM
HW Task 2	20 days	5/30/17 8:00 AM	6/26/17 5:00 PM	5/31/17 9:10 AM	6/28/17 3:42 PM
HW Task 3	20 days	5/30/17 8:00 AM	6/26/17 5:00 PM	5/31/17 9:10 AM	6/28/17 3:45 PM
HW Task 4	19 days	6/27/17 8:00 AM	7/21/17 5:00 PM	6/29/17 10:41 AM	7/26/17 4:20 PM
HW Complete	0 days	7/21/17 5:00 PM	7/21/17 5:00 PM	7/26/17 4:20 PM	7/26/17 4:20 PM
Software	**49 days**	**5/4/17 8:00 AM**	**7/11/17 5:00 PM**	**5/4/17 8:00 AM**	**7/28/17 9:17 AM**
SW Task 1	15 days	5/4/17 8:00 AM	5/24/17 5:00 PM	5/4/17 8:00 AM	5/31/17 10:49 AM
SW Task 2	18 days	5/25/17 8:00 AM	6/19/17 5:00 PM	5/31/17 10:50 AM	6/30/17 11:17 AM
SW Task 3	18 days	5/25/17 8:00 AM	6/19/17 5:00 PM	5/31/17 10:50 AM	6/30/17 10:50 AM
SW Task 4	16 days	6/20/17 8:00 AM	7/11/17 5:00 PM	7/3/17 11:24 AM	7/28/17 9:17 AM
SW Complete	0 days	7/11/17 5:00 PM	7/11/17 5:00 PM	7/28/17 9:17 AM	7/28/17 9:17 AM
Integration	**5 days**	**7/24/17 8:00 AM**	**7/28/17 5:00 PM**	**7/28/17 11:59 AM**	**8/4/17 11:58 AM**
Integration	5 days	7/24/17 8:00 AM	7/28/17 5:00 PM	7/28/17 11:59 AM	8/4/17 11:58 AM
Marketing	**15 days**	**7/3/17 8:00 AM**	**7/21/17 5:00 PM**	**7/3/17 8:00 AM**	**7/21/17 5:00 PM**
Brochure Development	10 days	7/3/17 8:00 AM	7/14/17 5:00 PM	7/3/17 8:00 AM	7/14/17 5:00 PM
Brochure Printing	5 days	7/17/17 8:00 AM	7/21/17 5:00 PM	7/17/17 8:00 AM	7/21/17 5:00 PM
Delivery	0 days	7/28/17 5:00 PM	7/28/17 5:00 PM	8/4/17 11:58 AM	8/4/17 11:58 AM



Risk Adjusted Gantt cont.

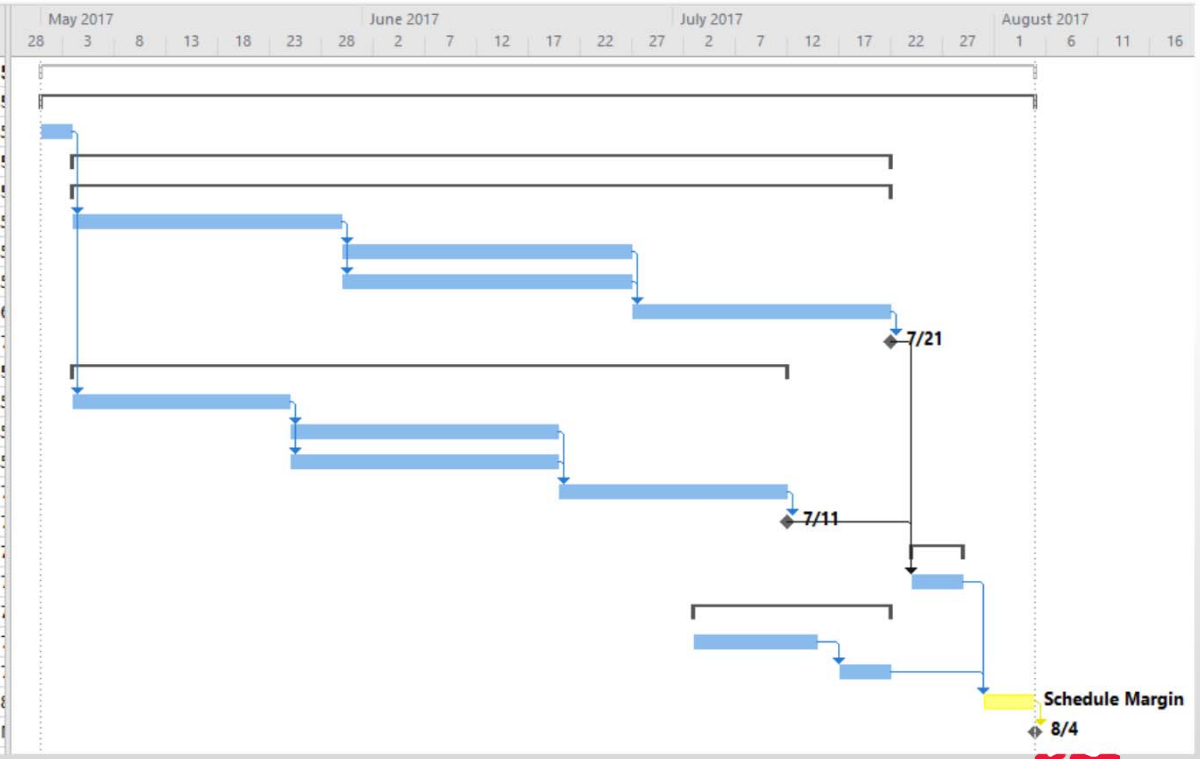
- The Risk Adjusted Gantt view shows the difference between what we plan to do (finish by 28Jul17) and are likely to do after taking into account uncertainty at a specific level of confidence (in this case 80%).
- Always execute against the underlying plan (aim to finish by 28Jul)
- Make commitments to stakeholders based on the risk adjusted bars. Ensure they understand the difference.
- DO NOT COMMIT to deliver any earlier based on the underlying schedule dates.

Schedule Margin

- The difference between the schedule finish date (28Jul17) and the committed delivery date at the required level of confidence (4Aug17) is effectively schedule contingency, often known as Schedule Margin.
- The Schedule Margin is a buffer/contingency between what you are trying to do vs what you are committing to do.
- It is a best practice to create a Schedule Margin task in the underlying schedule to highlight the contingency and prevent it being forgotten.

Schedule margin cont.

Task Name	Duration	Start	Finish
Full Monte Demonstration	**70 days**	**5/1/17 8:00 AM**	**8/4/17 5:00 PM**
Full Monte 2017 Demonstration	**70 days**	**5/1/17 8:00 AM**	**8/4/17 5:00 PM**
Initiate	3 days	5/1/17 8:00 AM	5/3/17 5:00 PM
Development	**57 days**	**5/4/17 8:00 AM**	**7/21/17 5:00 PM**
Hardware	**57 days**	**5/4/17 8:00 AM**	**7/21/17 5:00 PM**
HW Task 1	18 days	5/4/17 8:00 AM	5/29/17 5:00 PM
HW Task 2	20 days	5/30/17 8:00 AM	6/26/17 5:00 PM
HW Task 3	20 days	5/30/17 8:00 AM	6/26/17 5:00 PM
HW Task 4	19 days	6/27/17 8:00 AM	7/21/17 5:00 PM
HW Complete	0 days	7/21/17 5:00 PM	7/21/17 5:00 PM
Software	**49 days**	**5/4/17 8:00 AM**	**7/11/17 5:00 PM**
SW Task 1	15 days	5/4/17 8:00 AM	5/24/17 5:00 PM
SW Task 2	18 days	5/25/17 8:00 AM	6/19/17 5:00 PM
SW Task 3	18 days	5/25/17 8:00 AM	6/19/17 5:00 PM
SW Task 4	16 days	6/20/17 8:00 AM	7/11/17 5:00 PM
SW Complete	0 days	7/11/17 5:00 PM	7/11/17 5:00 PM
Integration	**5 days**	**7/24/17 8:00 AM**	**7/28/17 5:00 PM**
Integration	5 days	7/24/17 8:00 AM	7/28/17 5:00 PM
Marketing	**15 days**	**7/3/17 8:00 AM**	**7/21/17 5:00 PM**
Brochure Development	10 days	7/3/17 8:00 AM	7/14/17 5:00 PM
Brochure Printing	5 days	7/17/17 8:00 AM	7/21/17 5:00 PM
Schedule Margin	5 days	7/31/17 8:00 AM	8/4/17 5:00 PM
Delivery	0 days	8/4/17 5:00 PM	8/4/17 5:00 PM



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Summary

- Risk Analysis helps produce more achievable plans.
- It will almost certainly require changes to the original schedule to achieve an acceptable chance of success.
- Execute against the underlying plan.
- Schedule Margin is a placeholder to represent contingency for uncertainty.
- Continue to run risk analysis throughout the life cycle of the project.

Using Schedule Risk Analysis with Agile methodologies

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Agile is a Risk Reduction technique

…it does NOT mean there is no design.

For any significant development, a scope of work is still broken down into WBS components/deliverables which can be modelled with a high level ‘release’ schedule.

This high level schedule supports both Earned Value Performance Management and Schedule Risk Assessments.

However at the Sprint level, no formal schedule is available and is replaced by backlog lists. The actual sprint process is good at resolving and mitigating risks especially because it tends to fail early.

Risk Analysis on High Level Schedules

The Monte Carlo simulation technique can be used with schedules of any level of detail, but the Merge Bias effect may not be as great on a high level schedule because there tend to be fewer parallel paths of similar duration.

This is unfortunate since Merge Bias in one of the larger causes of unforeseen delay in a schedule.

Worst case durations for high level deliverable should reflect the loss of merge bias. Also consider using correlation to increase the range of results and produce more realistic 80-90% probability dates.

For More Information…

White Papers

Risk Free trial software

www.barbecana.com

Questions about the presentation or Schedule Risk Analysis

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