

May 22, 2013

ABSTRACT

One of the major challenges facing a project team when planning a project is the level of granularity required to meet the project's objective while meeting the necessary conditions of schedule, cost and scope. The dilemma is that if the level of detail is modeled at a high level it provides the 'Big Picture' but may not provide the level of detail required to successfully executing the project. Congruently if the level of detail is modeled at a level providing greater detail, the number of tasks in the plan, the basis for the project schedule may be simply overwhelming.

One of the first decisions the team must make is exactly what type of data and work should be included in the plan. There are many important functions and requirements that may be more effectively managed with other legacy systems and not in the project schedule. The team should consider embedding certain requirements within the task as an appended 'notes' or 'list' if they do not meet the criterion to be a stand-alone task.

Another decision the team must make is how to model the project plan. In the case of large, complex projects the sheer number of tasks may make the project schedule too large to comprehend and subsequently effectively manage. If critical chain methodology is being used then there are multiple options available to the team.

The critical chain method provides two powerful attributes not available with critical path methodology.

- The planned critical chain unlike the planned critical path does not change in execution.
- Identifying the areas of higher risk and inserting time buffers that are monitored in execution provide protection against the inevitable variability in execution.

Rather than building an extremely large single project that is very difficult to visualize or comprehend, it is now possible to build multiple smaller projects. Obviously these smaller projects must synchronize the team's efforts in order to achieve the objective: on time, within cost and scope. These projects will be part of a portfolio of projects and clearly identified as projects mapping back to the original plan.

Critical Chain: Modeling Complex and Large Projects

The Critical Chain methodology has proven an effective advancement of project management. The emphasis and the time required in constructing a solid project network is essential and a basic building block for developing a feasible and executable critical chain schedule. In execution there is a high probability that the critical chain, unlike the critical path will remain stable and does not change as the inevitable variability impacts the project.

A frequently asked question is what level of granularity should the individual tasks be scheduled? The dilemma of course is, if the schedule is overly detailed then it will be more complex, with many more dependencies and at some point becomes difficult to visualize the scope and flow of the project. And if the project doesn't have the required amount of detail then it may not meet the needs of the project team. The project schedule must meet everyone's needs while at the same time achieving agreement on the proper level of granularity.

This can be reached by following a simple, yet disciplined approach that should guide the team as they build the project plan and turn into a feasible and achievable schedule. It is suggested the team start with the first step described below, however the process is iterative as the team learns more about the work and details of the plan.

Step 1 – The Team achieve complete agreement on the project exit criterion that indicates when the project objective is reached. This is crucial and is the foundation for building a good project schedule. Once agreement is reached then definition of the final task will become clear. Stephen Covey taught us to “Start with the end in mind” so the team should start building the project plan network from right to left. That means after identifying the final task, which means the projective objective has been achieved, the predecessor tasks; should be defined, the dependencies established, the task duration and the required resources agreed to until there are no more predecessor tasks in the network.

Step 2 – All previous assumptions and current practices must be challenged such as:

- What is the best and logical sequence of the work flow
- Extract all of the safety time embedded in individual tasks
- The scheduled duration time of a task must be the anticipated touch time of the work content. In other words it must be the known, (touch time) and not the unknown (variability in execution). The aggregated time buffers will provide the protection for variability on the task during execution
- Not every effort has to be a task in the schedule. There are many important functions that may be more appropriately scheduled using other legacy systems or databases. All required reminders or more detailed steps in a task should be included in the dropdown lists within a scheduled task.

- Normally a critical chain schedule should not include dedicated tasks for tracking material sourcing, kitting, technical data requirements, etc. They are normally identified inside a task. For critical items they can be scheduled as a 1 day task identifying receipt, as a predecessor to the task requiring this deliverable.

Step 3 – The team should start building the project network (right to left) initially focusing on capturing the ‘Big Picture’ by creating the backbone network.

- Then starting adding additional, more detailed tasks to the network
- If the project is very large with many tasks it may become difficult to visualize the entirety of the project. At this point the team should consider turning this large project into multiple smaller project schedules in order to better visualize the effort that lies ahead.

The limitation that is being addressed is not a technology limitation. There are critical chain software solutions capable of scheduling and executing very large projects consisting of many hundreds up to several thousands of tasks. The issue is, how many tasks in a project do the team feel comfortable managing? In addition many large projects have well defined phases or sections that are de facto managed as individual projects during execution.

Step 4 - If the team decides to break this large project into multiple smaller projects they can be managed as individual projects during execution. There are several options for modeling the relationship between the projects; the best option is in large part determined by the scope and type of the project and the culture of the team. The key requirement is that all of the project(s) work is synchronized toward achieving the final objective and due date.

These are some of the project modeling options.

- A. Project is divided into different Phases; build smaller (subordinate) critical chain projects for each of the Phases
- B. Maintain the backbone project and build smaller (subordinate) critical chain projects that feed into the backbone project
- C. After building a backbone Network Plan; using the backbone network, develop individual project critical chain schedules. The team will have to determine either by major section, phases or scope etc. what will constitute a subordinate project.
- D. Managing Multi Portfolios

The individual projects critical chain schedules do not have to be ‘physically’ connected. Rather they must all be synchronized and subordinated to the final objective by the individual subproject due date’s relative to tasks in the backbone of the main project. The four modeling techniques below are examples of approaches

for planning, scheduling and executing large and, complex and high uncertainty projects. They are certainly not the only or perhaps even the best techniques. Rather they should be viewed as options for better visualizing and managing projects. These techniques leverage the critical chain multi-project solution permitting managing subordinate projects with buffer management and other powerful information to guide your actions. Sometimes it may be beneficial to develop a hybrid approach by combining elements of the three options.

Option A

There are many types of projects that have well defined Phases. Such as large construction, software development etc. that could benefit from using the Option A approach. In construction there may be Phase 1 Land Acquisition, Phase 2 Land Development, Phase 3 Architecture and Engineering, Phase 4 Construction, Phase 5 Sales. These projects are very different yet all part of a much larger effort that must be synchronized. Figure 1 below provides a notional approach, allowing for managing the individual phase critical chain projects while maintaining connectivity between the phases.

Critical Chain Project Phases

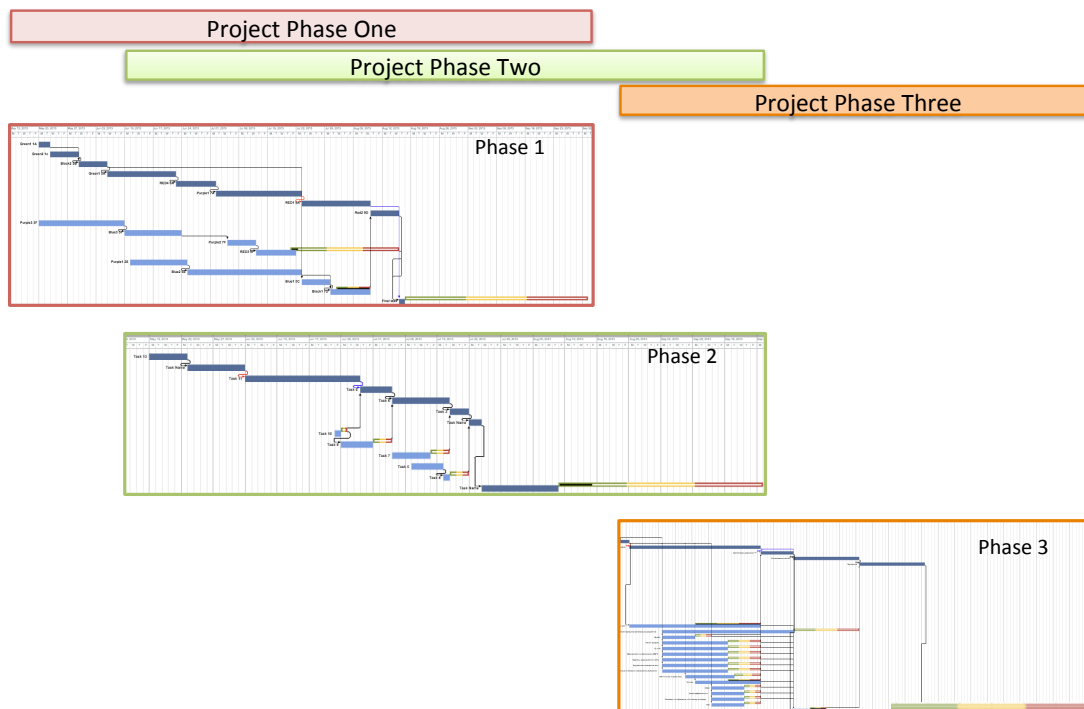


Figure 1.

Option B

In some instances it may be advantageous to construct and maintain a critical chain master schedule at a high level of detail in large projects. Again this should be viewed in context of addressing the dilemma of needing tasks scheduled at a fairly granularly detailed level while having to maintain a single overall master schedule. Unlike Option A that does not have an overarching master schedule, if required, Option B would appear to be a better option.

This would be applicable to large programs that with de facto multiple major yet functionally separate requirements. Several examples are a Department of Defense and NASA acquisition program, pharmaceuticals, or a new product development effort. There are very well defined milestone and phases, with sequenced requirements and program decision points that drive monetary disbursements. The subordinate critical chain schedules would map back to a large task on the master schedule. The due date of the subordinate schedule will be the same date as the scheduled start date of the actual task in the master schedule. As depicted in Figure 2 below, there is no physical connection between the Master Schedule task and the subordinate project. They are connected electronically via the same due date and are started earlier in time, finishing in time to meet the master schedule needs.



Subordinate Critical Chain Projects

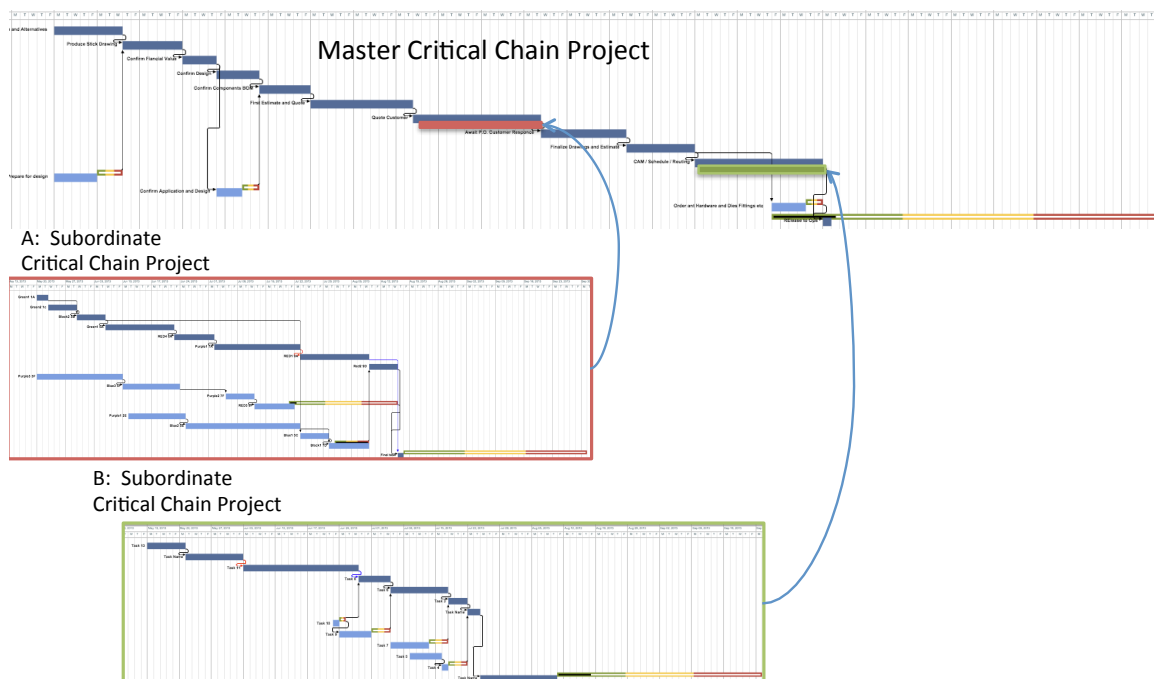


Figure 2.

Option C

Some very large and complex projects requiring many, many tasks become extremely challenging to visualize and very difficult to plan and manage in execution. Option C should be considered during the Planning effort before a critical chain schedule is developed. As a reminder this approach is not addressing a technical limitation. Rather two other limitations, one of them is a human factor the other is managing variability.

The practical human factor limitation is losing all sense of context and visual references when viewing a project with thousands of tasks. The reaction when looking at this level of complexity is simply overwhelming. What is immediately apparent is the sheer number of tasks and feeling of not being able to manage this project. However the additional complexity in the schedule is not apparent at first glance. A very large schedule will have many integration points, each one adding even higher levels of risk.

In execution it becomes extremely challenging to analyze how the inevitable disturbances are impacting the schedule. The other limitation is the increased levels of variability impacting this large schedule. The greater number of tasks and integration points in a project, the greater the exposure and vulnerability to variability. Simply put when variability, our old friend Murphy, is encountered in execution, it sends waves of variance causing disruption to the schedule.

The larger the schedule and the longer the cycle time the more the project is vulnerable to Murphy.

During the Planning effort there are natural areas that can be ‘carved out’ from the high level ‘Backbone’ and developed into stand alone plans. In other words once a high level Plan has been developed a specific group of tasks can be grouped together and become the basis for developing a subordinate plan. This plan will now become a subordinate critical chain schedule, see Figure 3.

A real application of this approach was used on a very large (1200 man year) project with many thousands of tasks. The high level backbone Plan had approximately 150 tasks. The team identified nine ‘groupings’ from the Plan and proceeded in developing 9 subordinate critical chain schedules. The advantages of this approach were apparent to everyone on the team. It directly addressed the two limitations previously mentioned and culminated in a very successful project execution, finishing early and under cost.

As seen in Figure 3, the ‘groupings’ schedules map back to the high level backbone Plan. The individual critical chain schedules are subordinated to the requirements of the Plan. Each of the individual schedules is managed individually, however close communication and coordination between all of the projects is maintained.

Critical Chain Projects: Breaking out the Complexity

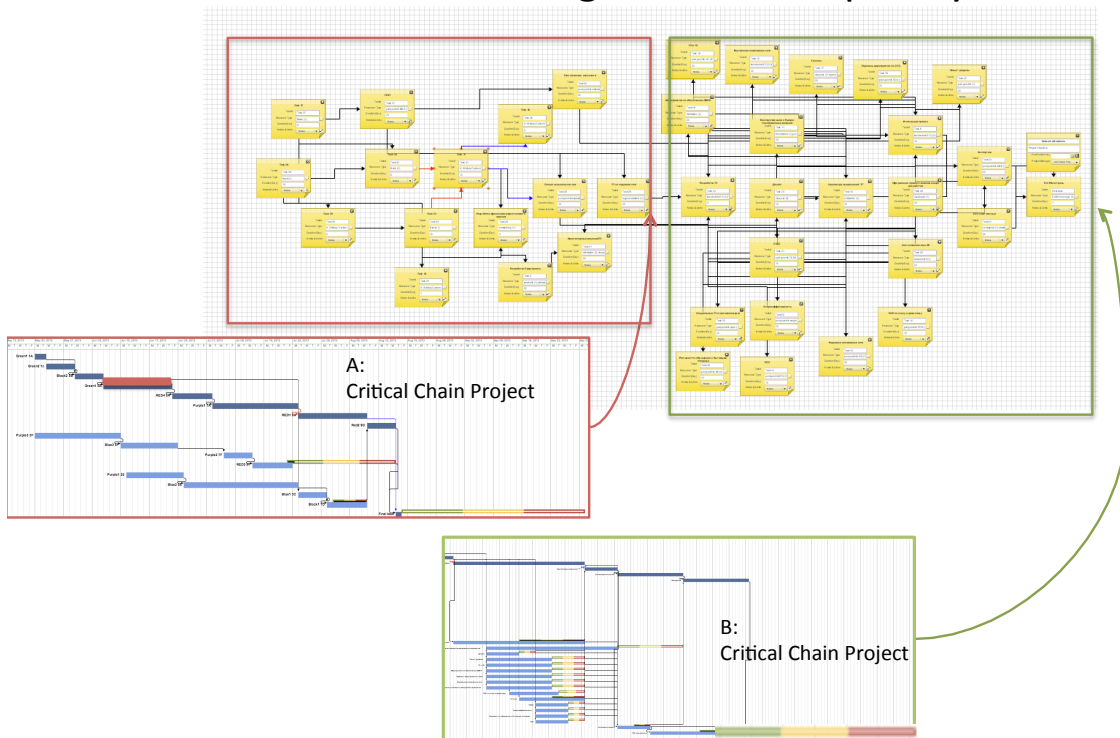


Figure 3.

Having multiple schedules for a well-defined section of the overall effort will provide the team with feasible and executable project schedules. These subordinate, stand-alone critical chain schedules are much more comprehensible and easier to manage. The project team will effectively have greater and real time information for making timely management decisions.

It is necessary to synchronize and coordinate the efforts of these smaller, subordinate schedules. The advantages are many. The impact of variability on larger projects is greater than smaller projects. First of all larger projects are vulnerable to the impact of variability for a longer period of time. And the larger the project the more dependencies between tasks exist. So the variability encountered in execution will impact many more tasks and of course the project.

Option D

We shall define a project portfolio simply as a collection of projects using a common resource pool of resources.

The A, B, C options described previously address the dilemma of modeling large and complex projects. Selecting one of the options may be used as a guideline for modeling. Sometimes it may be better to combine parts of the three options and develop a unique hybrid approach.

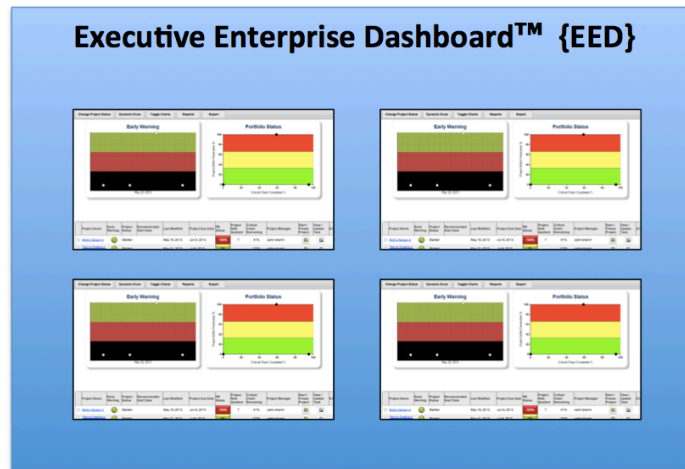
Many organizations have projects that use very different types of resources and have very little commonality. In some cases this can be accommodated by simply including all of the resources into a common resource pool and maintain a single portfolio. In other instances such as compartmentalizing projects, mandatory security protocols or regulatory challenges there may be a need for managing projects in separate portfolios. Major programs consisting of many projects would benefit from having their own dedicated portfolio. Enterprises with multiple divisions and multiple companies have a requirement for multiple portfolios.

The currently available software project management tools are focused solely on Project Portfolio Management (PPM), this is the focus of Options A, B, C, addressing the single portfolio business solution. However the enterprises competing in the global market need more.

With the significant advancements in thinking, technology and means of delivering solutions, it is now possible to manage multi-portfolios, simultaneously and in real time. **Exepron™**, a SaaS business solution has developed this capability and the initial results are remarkable. This business solution may very well be a disruptive insertion to current thinking. Figure 4 shows a multi-portfolio **Exepron™** screen with executive level information on the status of all the projects in the company's four portfolios. The user simply clicks on a dot, which represents a project in one of the portfolios to access more detailed information on this project.

By using the **EED™** it is possible to access and manage multiple projects within a portfolio or across multiple portfolios in real time. This de facto removes the barriers for accessing information within a company, across divisions and enterprises. The information is real time, available 24 hours a day, which is crucial for business collaboration.

EED™:
A Single
Executive Portal
to review every
company project
in a single
dashboard



Clicking an **EED™** project - Navigates to individual Project Portfolio Account
Individual Accounts accommodating individual Resource Pools



Figure 4.

Daniel P. Walsh is a sought after lecturer, leading TOC expert, and thought leader. He has held executive positions in large organizations; successfully lead change management teams resulting in real improvement to the P&L.

*His latest efforts led to co-founding with John Thompson, **Exepron™**, a SaaS cloud based critical chain project management business solution.*