Rolling Wave Planning

~ By John Goodpasture

It is not often possible to foresee the future activities in a project with consistent detail over the entire period of the project. Therefore, planning is often done in "waves" or stages, with the activities in the near term planned in detail and the activities in the longer distance of time left for future detail planning. There may in fact be several planning waves, particularly if the precise approach or resource requirement is dependent or conditioned on the near-term activities. Such a planning approach is commonly called rolling wave planning.

Rolling Wave Characteristics

The fact is that the distinguishing characteristic of the planning done now for a future wave is that both cost accounts and network tasks are "long" (or "large") compared to their near-term counterparts. We have already discussed the long task in this discussion. Project managers can substitute the words "large cost account" for "long task" and all of the statistical discussions apply, except that the principles and techniques are applied to the cost accounts on the WBS (Work Breakdown Structure) and not to the network schedule.

Monte Carlo Effects in the Rolling Wave

Whether you are doing a Monte Carlo analysis on the WBS cost or on the network schedule, the longer tasks and larger work packages have greater variances. The summation of the schedule at its outcome milestone or the summation of the WBS cost at the top of the WBS will be a normal distributed outcome regardless of the rolling waves. However, the Monte Carlo simulation will show you what you intuitively know: the longer task and larger cost accounts, with their comparatively larger variances, will increase the standard deviation of the Normal distribution, flatten its curve, and stretch its tails.

As the subsequent waves come and more details are added, the overall variances will decrease and the Normal distribution of the outcome variable, whether cost or schedule, will become more sharply defined, the tails will be less extreme, and the standard deviation (which provides the project manager entrée to the confidence tables) will be more meaningful.

The Critical Chain

There is a body of knowledge in schedule and resource planning that has grown since 1997 when Eliyahu M. Goldratt wrote Critical Chain, arguably one of the most significant books in project management. In this book, written like a novel rather than a textbook, Goldratt applies to project management some business theories he developed earlier for managing in a production operation or manufacturing environment. Those theories are collectively called the Theory of Constraints. As applied to project management, Goldratt asserts that the
problem in modern project management is ineffective management of the critical path, because the resources necessary to ensure a successful critical path are unwittingly or deliberately scattered and hidden in the project.

The Theory of Constraints

In the Theory of Constraints, described in another Goldratt business novel, The Goal, the idea put forward is that in any systemic chain of operations, there is always one operation that constrains or limits the throughput of the entire chain. Throughput is generally thought of as the value-add product produced by the operation that has value to the customer. If the chain of operations is stable and not subject to too many random errors, then the constraint is stable and identifiable; in other words, the constraint is not situational and does not move around from one job session, batch, or run to the next.

To optimise the operation, Goldratt recommends that if the capacity of the constraint cannot be increased, or the constraint cannot be removed by process redesign, then all activities ahead of the constraint should be operated in such a manner that the constraint is never starved. Also, activities ahead of the constraint should never work harder, faster, or more productively than the minimum necessary to keep the constraint from being starved. Some may recognise this latter point as a plank from the “just-in-time” supply chain mantra, and in fact that is not a bad way to look at it, but Goldratt’s main point was to identify and manage the constraint optimally.

From Theory of Constraints to Critical Chain

When Goldratt carried his ideas to project management, he identified the project constraint as the critical path. By this association, what Goldratt means is that the project is constrained to a certain duration, and that constrained duration cannot be made shorter. The consequence of the critical path is that constrained throughput (valuable deliverables to the project sponsor) cannot be increased, and indeed throughput is endangered if the critical path cannot be properly managed.

Goldratt made several recommendations in his book Critical Chain, but the most prominent are:

- The tasks on the critical path do indeed require statistical distributions to estimate the range of pessimism to optimism. But, unlike PERT (Program Evaluation Review Technique) or CPM (Critical Path Method), Goldratt insists that the median value, the 50% confidence level, be used. Using the median value, the so-called 50-50 point, means that there is equal likelihood that the task will underrun as overrun. (PERT uses the Beta Distribution and requires that the expected value be used. CPM traditionally uses a single-point estimate and, more often than not, the single estimate used is the “most likely” outcome and not the expected value).
- All task activity in the project schedule network that is not on the critical path should be made subordinate to the demands of the critical path.
- There should be "buffers" built into any path that joins the critical path. A buffer is a task of nonzero duration but has no performance requirement. In effect, buffer is another word for reserve. However, Goldratt recommends that these buffers be deliberately planned into the project.
- By using the median figure for each task on the critical path, Goldratt recognises that the median figure is generally more optimistic than the CPM most likely estimate and is often more optimistic than the expected value. Goldratt recommends that the project manager "gather up" the excess pessimism and put it all into a "project buffer" at the end of the network schedule to protect the critical path.

We have already discussed Goldratt’s point about a project buffer in our earlier discussion about how to represent the project schedule risk as calculated on the network with the project sponsor’s business value dates as set in the programme milestones. We did not call it a buffer in that discussion, but for all intents and
purposes, that is what it is. Figure 7-15 illustrates the placement of buffers in critical chain planning.

The critical chain ideas are somewhat controversial in the project management community, though there is no lack of derivative texts, papers, projects with lessons learned, and practitioners that are critical chain promoters. The controversy arises out of the following points:

- Can project teams really be trained to estimate with the median value? If so, then the critical chain by Goldratt’s description can be established.
- Can team leaders set up schedule buffers by taking away schedule “pad” from cost account managers, or does the concept of buffers simply lead to “pad” on top of “pad?” To the extent that all cost account managers and team leaders will manage to the same set of principles, the critical chain can be established.

![Diagram of critical chain planning](image)

**Figure 7-15** Critical Chain Buffers.

References


John shares his views on contemporary topics in project management, methodologies, and the value propositions of programmes and projects on his blog Musings on Project Management

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