## *Avoiding Project Pain: Buffers and Critical Chain Project Management*

The concept of building in contingencies to project plans goes back to the beginning of time, but the specific idea of buffers is much more recent, and is attributed to Eliuahu Goldratt. His seminal book "Theory of Constraints" (published by North River Press) has lead to a new practice called *Critical Chain Project Management (CCPM).*

The Critical Chain concept has its basis in the idea that the output of an organization is limited by a "critical" resource. By optimizing the productivity of that resource, you optimize the output of the organization. In project management thinking this means arranging everything to make sure that the resource is optimally scheduled.

One of the ideas in critical chain thinking goes something like this.

If you schedule tasks realistically, something always goes wrong which creates a slip that messes up the downstream plan. Alternatively, if you plan very conservatively, people don't see the urgency of action, get interrupted, start work at the last minute, and naturally cause slips that mess up the downstream plan.

An unpredictable schedule prevents the optimum use of the critical resources which actually control the outcome of the project.

Note that the critical resource may not be who or what you think it is.

For example, in many companies a management committee must approve a final product announcement. The committee meets monthly, but the agenda may be set many weeks in advance. Hence, you really have to make the right meeting or take a big slip. Moreover, if you schedule and then reschedule your approval request, you loose credibility and priority very quickly.

Naturally budget cycles, industry tradeshows, and other calendered events have similar characteristics. So do commitments to your project by contractors, consultants, and internal service groups such as writing, compliance testing, and quality control. All of them want to know, well ahead of time, when their services are required. And the penalty for not being ready for them at the pre-agreed time may be severe and out of proportion to their effort in the context of the whole project.

**Buffers, The Risk Medicine!**

The solution is to plan work on the realistic or even optimistic side, but then create a reserve of time that can absorb the statistically likely slips. This "reserve" or "buffer" protects the following task (milestone, customer deliverable, approval, tradeshow, etc.) from schedule variations, at least up to the point that a major problem has occurred.

Moreover, by monitoring the utilization of your reserves, you gain lead time in both seeing and solving problems.

In some projects a single reserve at the end of the schedule (a Project Buffer) will be sufficient, but for others, several buffers will be needed so that all critical commitments can be met.

As a practical matter, each "reserve" has to be put somewhere in the schedule. In traditional planning tools this is difficult to do. If you make it a task, it will act like a stick and push the dependencies. If you make it a link with a delay it becomes both a stick and invisible, which helps no one. If you make it a "don't start before date" constraint on the dependency or it becomes a side effect of a resource leveler, you have no way to set and measure the amount of reserve remaining until it is much too late.

A buffer must act like an accordion. The front end of the buffer attaches itself to the backend (finish dates) of its predecessors. The back end of the buffer is attached to the task or milestone you want to stabilize. The duration of the buffer is a measure of the remaining reserve in the schedule. A comparison of the remaining duration with its original buffer duration is a very good measure of the safety of the schedule.

So as predecessors slip, the slip propagates downstream until it crashes into the front end of the buffer. The buffer collapses to absorb the slip, leaving the rest of the schedule intact. Conversely, if something gets done early, the buffer expands and makes everyone feel better.

Now, experienced critical path project schedulers will point out that a buffer provides nothing more than the slack analysis of the project schedule. While true, the statement is missing the real point. Slack is a invisible mathematical side effect of the schedule design. In practice, people tend to manipulate the schedule to squeeze out all of the slack. Buffers, on the other hand, are a way to explicitly create, visualize, and track contingency time. Skilled project analysts understand slack. Line managers and customers understand buffers, especially ones that are shinking!

Obviously a buffer requires special scheduling techniques. This is built into the Project Gateway repository rescheduling facility and activated by the presence of buffer assignments.

**Buffer Assignments In Project Gateway**

In Project Gateway, a Buffer Assignment is a special kind of project task. You can put any number of buffer assignments into a project plan. You can create them manually or using Schedule Templates. Buffers have a unique visual appearance with a graphical "availability" meter displayed on the form. They also automatically track their own life histories so that you can see how the availability has changed during the life of the project.

The Schedule Template system allows you to build buffers into your prototype projects and deploy them automatically into your generated plans. The Repository Rescheduling facility implements the buffering behavior and allows you to preview buffer availability before committing a schedule change to the repository. Special project reports provide a quick summary of buffer performance.

Since a buffer assignment exists to control the scheduling of a project and to provide feedback to management, it is not a work instruction to a participant. Therefore buffer assignments do not normally have any planned work or checklists, and are disabled from timesheet and checksheet reporting. In most cases the buffers are logically assigned to the project manager.

Buffer assignments must have predecessors and a successor. The predecessor chain must be realistic. That is, it must reflect the sequence in which the work is actually going to be done. You can get some flexibility by linking the buffer to several predecessors, but in the end you must have a rational network to get much value from a buffer.

Buffer assignments should have realistic initial durations. Having a 3 day reserve in a 6 month project is unlikely to be of any value. A month would be at least useful and two months would be better. Since Information Technology projects have a terrible reputation for taking much longer than expected anyway, buffers need to be long enough to absorb a reasonable amount of mis-estimation. Note that, if after you have inserted the buffer into the schedule, the time remaining for the work looks too short, it probably is!

**Project Buffers**

You can use as many buffers as you like in a project, but we ask you to specifically designate the project buffer if you have one. The system will report the remaining duration of the project buffer as measurement of the project performance in the project statistics. The assumption is that the project

leader has correctly placed the buffer into the project network so that it provides as realistic measurement. In every other way, a project buffer behaves exactly as other buffers.

**Benefits of Buffers**

There are a number of advantages to using buffers.

First, the schedule is built to keep people busy by having fairly aggressive goals for each task. This discourages interruptions and multitasking. Small slips can tolerated with a minimum of emotion because they were anticipated in the plan.

Second, when critical resources or events arrive, you are ready to utilize them.

Third, the project milestones are stabilized by the buffers so that, to senior management, the project appears stable and predictable. This reduces the hassle for the project leader who otherwise has to explain the constant movement of the milestones caused by rescheduling even when that movement is of no significance to the project outcome. In the end, there may be nothing more important to a corporate project than the credibility of its project leader, and that credibility begins with a stable schedule.

Fourth, the buffer gives the project leadership something to measure and graph. This helps them recognize and correctly assess the relative urgency of each project task and communicate this to the team members. This is really very important because while all slips are bad, some are much worse than others in terms of the effect on the project outcome and customer perception. Clearly if you need to move resources around, you take them from the schedule threads with the biggest remaining buffers and put them on the treads with the smallest ones.

Finally, to the extent that scope changes are required, it may be possible to trade off buffer time for additional work without changing the downstream dates. Clearly, a clever project leader who anticipates scope changes will use buffers. In the best case, they will not approve scope changes until the project has progressed far enough to reallocate some of the "not likely to be needed" buffer to the changes. Contrast this to the more conventional situation where you either need to take a schedule hit (not your fault, but who is going to remember that at review time), or get out the whip and start buying the pizza.

The downside to buffers is that they look like easy prey to managers who want to pretend that schedules can be compressed. It takes a certain degree of organizational maturity to accept plans that include explicit reserves.

**Summary**

Buffers provide a more realistic way to plan than conventional techniques. They help stabilize the schedule so as to make optimal use of your key resources. Project Gateway makes buffers a simple, routine tool for every level of project.