February 2005
Donald L. Miller, Ph.D.

Caveat Emptor

What you don't learn about your scheduling system before you buy, you will certainly learn after

Generating feasible schedules in a chemical or pharmaceutical process requires dealing with many physical constraints. These include:

1. Two tasks do not overlap on the same piece of equipment.
2. Utilities and labor required to run a task are available during the scheduled time.
3. Ingredients for a task are available when required.
4. Sufficient storage is available to handle the products of a task until such time as another task consumes those products.
5. If the processing vessel is used to store the product, no new task can begin until the previous batch is completely fed to downstream equipment.

Constraint #1 is fairly easy to handle and most systems on the market today will generate schedules which are feasible with respect to these constraints. One reason this is true is that infeasible schedules would be readily apparent on the Gantt chart due to tasks overlapping. While many systems do not handle constraint #2, some do and this is also not particularly difficult.

Constraints #3, #4, and #5 are another matter entirely. These constraints are very difficult to handle and are routinely ignored by most software systems on the market today. These constraints represent the gold standard for process scheduling and we at APC have spent the last decade developing algorithms that ensure these constraints are satisfied. Every schedule generated by VirtECS™ satisfies **all** of these constraints, **all** the time. We do not cut corners and then leave it to the user to fix things up manually.

Other systems either ignore these constraints entirely or require the user to handle them manually. This can cause significant difficulty because schedules which violate any of the above constraints cannot be run in the real world. Vendors can successfully market such software for two reasons. First, violations of these constraints are easily hidden, they are not readily apparent upon inspecting the Gantt chart. The prospective customer must request the vendor produce solutions to problems which are similar to the customer's process and then examine the schedules carefully in order to discover the problem. Second, many vendors have become particularly adept at concealing the shortcomings in their systems until after the sale. These infeasibilities are frequently discovered only after the customer is heavily invested in the project. At this point, even the customer has a strong incentive to just live with the limitations.

Questions Best Verified By System Performance *Before* Purchase

- Does the system prevent me from dragging a task on the chart to a place where there will be no material available to feed that task or no storage available to hold the products?
- Does the system detect the lack of feed material availability by showing a negative number on an inventory plot, which I must then remedy manually?
- What if anything, prevents me from dragging a task to a later date and thereby making tasks which consume the products infeasible?
- What safeguards, if any, exist to prevent the scheduling of production tasks which will overflow available storage for intermediates?
- Many processes have vessels which produce material that can be stored only in the production vessel. In these cases, the product must remain in the vessel which produced it until downstream tasks have consumed the entire batch. How does the system ensure that the schedule generated does not start new tasks on such vessels before the previous batch has been emptied?
- Does the system allow dragging of tasks which utilize process vessel only storage, and if so, what prevents me from producing an infeasible schedule by such a move?
- Does the system require me to model each step of a process separately?
- How does the system prevent, or even detect, the use of a single intermediate storage silo to hold several intermediate materials at one time?

Scheduling Pitfall: If you're looking to evaluate a scheduling package for operational use, be sure to ask the hard questions raised in this article, and if the sales team makes claims they can't demonstrate… ***caveat emptor***

Advanced Process Combinatorics

3000 Kent Ave. West Lafayette, IN 47906
Tel (765) 497-9969 FAX (765) 463-5126
info@combination.com
http://www.combination.com