Building
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White Paper

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Consulting Insights

into SNP Solvers of CTM and Heuristics

K.Srinivas

Key Concept

Solvers in APO Supply Network Planning are important tools to do requirement planning for a network, based on a demand plan. SNP offers essentially three solved in APO namely Heuristics, Capable-to-Match (CTM) and Optimizer.

Choosing a solver for an SNP project is a crucial decision as it sets the very basis of the SNP design. This document provides some practical insights into the important thought processes when deciding on the solver. Although each project in APO SNP may have its own uniqueness, it may be useful to go through these thought processes.

This document has been written based on working experience in the 4.1 version of APO.

This document is intended to create an understanding of some of the possibilities and limitations of frequently used solvers in SNP.

For more information, contact askus@infosys.com

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We understand that Heuristics, CTM and Optimizer offer an increasing amount of sophistication. They also offer business benefits along with complexity to maintain the solution. It is also important to understand that, in a business context, sometimes the business benefit may simply outweigh the increased overhead due to the solution. Deciding on the solver in your APO SNP project goes a long way in ensuring sustenance of the design among key stakeholders.

A recent project required our team to decide on an appropriate solver to a business. We went through the SAP help site and decided to prove to ourselves how the different planning methods work in the unique business context.

> *Note: For more information about different solver methods in SNP and its comparison, please refer to the link http://help.sap.com/saphelp_scm41/helpdata/en/de/7c5c3c3806af06e10000000a11402f/content.htm.*

It must be added here that some of the thought processes and assumptions, before the decision to go in for a solver, were revisited as the project went live. Additionally, we maintained the solution for the next one year. The points, initially considered and later revisited, are summarized in the document.

The below-mentioned points are important ones that were discussed and debated through the different stages of the project:

1. Material Constrained Planning: In many businesses, raw materials could be a constraint. This could be an actual constraint, based on annual contracts, which an organization may enter with its supplier. The emergence of this constraint can be attributed to long procurement lead times or financial positioning. In other situations, this constraint could be self-imposed by an organization, owing to the annual budgets on raw materials that help squeeze the maximum out of their supply chain. This planning is particularly helpful in simulation mode.

   Heuristics and CTM behave very differently in a materially constrained situation. While Heuristics still propose a supply violating material constraint, CTM shorts the demand. Therefore, if alerts are setup appropriately in the system, CTM can quickly get planner attention to help alleviate the situation. Planners could renegotiate the contracts with suppliers, or apply a different raw material constraint.

   In a situation where material availability is a hard constraint, it is highly recommended to opt for CTM solver, since this constraint is respected by CTM.

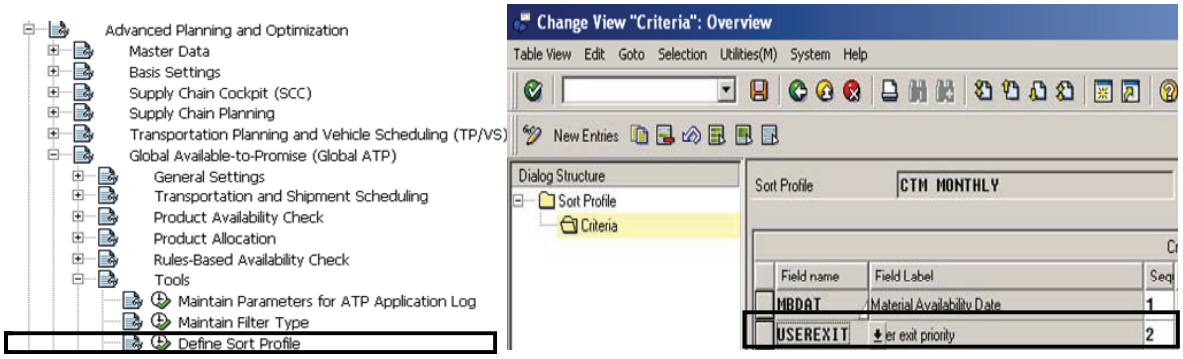
> *Note: Capacity constraints are dealt by CTM and Heuristics very differently. While CTM can take material and capacity constraint in one planning sweep, it needs to be done in a second separate step for Heuristics.*

2. Fair-Sharing of Demands: CTM is an order-by-order planning tool. It is also Rule-Based, which means business rules - such as parameter-based order prioritization or location product substitution - can be leveraged. Prioritization can be based on parameters - such as location, product, order date, order size, delivery priority - or even a distribution channel. Unfortunately, fair-sharing of demands among destination locations is something that is not very easily configurable in CTM. If the default sorting criteria is specified, CTM will randomly chose one of the destination locations to meet the demand bucket after bucket shorting demands arising from other destination locations for the same limited supply. This is obviously undesirable behavior from a business standpoint.

There are 3 possible ways to alleviate this situation.

Using Sort Profiles through User Exits, which requires intensive coding and testing. See Figure 1

Figure 1 IMG Path for defining Custom Sort Profiles used in CTM demand prioritization



Using the deployment Fair-Share rule, after running CTM. However, deployment being a separate sub-module completely, it requires extended solution design. Deployment can be made to run in a "reduce" mode, where Distribution Demand (Planned) can be consumed by Deployment proposed orders. Thus, supply constraints can help one meet the demands in Destination Locations, based on deployment Fair-Share rules. Deployment also offers other possible ways of doing Fair-Share rules, based on target levels of stock.

a. The Supply Distribution feature in CTM can, to some extent, meet the requirement of Fair-Share rule. It is possible to define business rules to distribute any surplus receipts. Supply Distribution can be made to refer the outbound quota arrangements. The Supply Distribution feature is not a default available feature of CTM. Before switching this feature 'ON', a few iterations of configuration and testing are required.

Note: Outbound Quota Arrangement can meet any Fair-Share requirement in the Heuristics run. However, Outbound Quota is not respected by CTM, unless Supply Distribution is configured. Inbound Quota Arrangements is definitely compatible with CTM.

3. Order Splitting: SNP solvers create supplies for demands in the system, based on sources of supply, supply constraints, resource constraints, lead times, and Lot Sizes. CTM and Heuristics behave very differently while planning supply for demand. While CTM is an order-by-order planning tool, Heuristics consolidates the demand in a bucket before planning for a supply. Due to the CTM nature of planning, order sizes could be as small as the production/ procurement minimum lot sizes defined in the system. Consider a situation where there are a number of demand orders in the same time bucket. Even in this situation, CTM plans order-by-order and there may be supply orders of minimum or close to minimum lot sizes. This may not be an acceptable business situation. Heuristics would behave very differently. There may be limits on the number of orders it can create in a bucket, based on Global SNP settings. However, it will not do Order Splitting to come up with orders of very small sizes. This behavior would be more acceptable to the business.

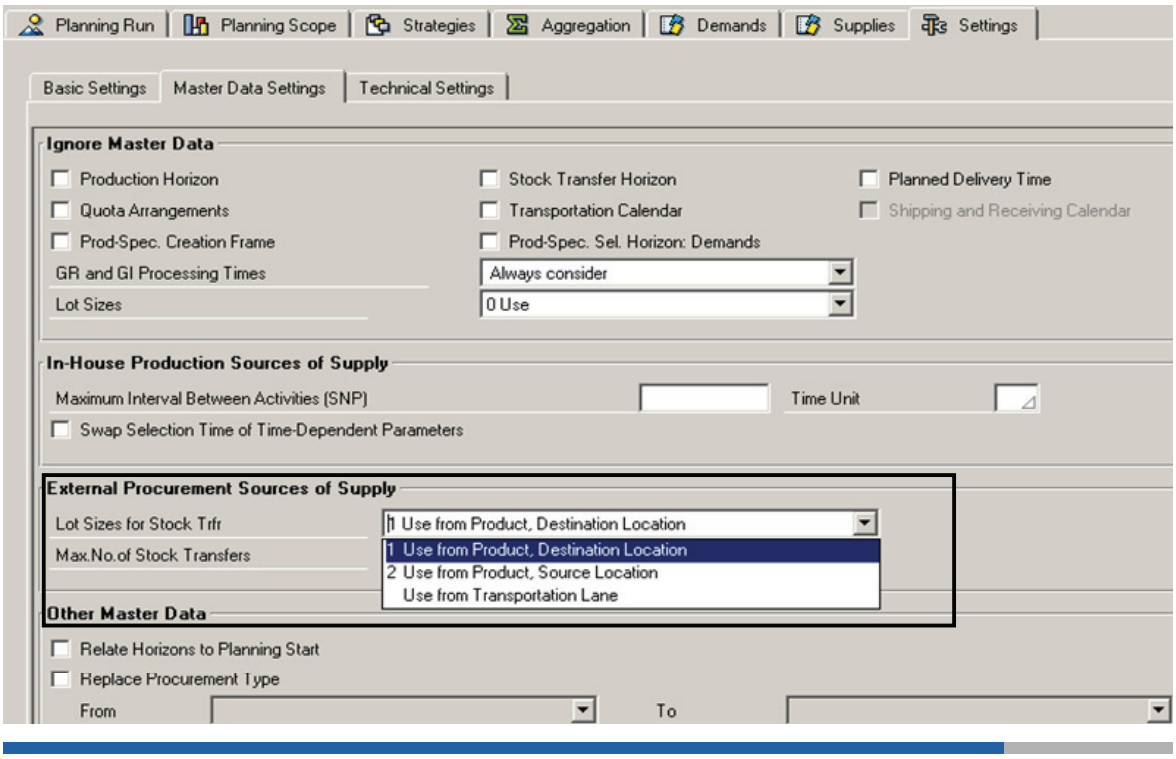
There are ways, though, to alleviate the consequences of intense Order Splitting in CTM, leading to numerous tiny-sized orders. Some of these are:

a. Order Consolidation after CTM run: Once CTM completes the run, one may need to run a follow-up with a custom program that looks at all orders having same start and end dates to consolidate them into one supply order in that bucket. This is a complex program that one may need to write, since orders would need to be created, keeping the pegging relationships intact.

b. Using higher values of Minimum Lot Size: Increasing the value of the minimum lot size to a level that is acceptable to business could reduce the number of tiny-sized supply orders. This will ensure that any leftover supply, created by CTM in a bucket, is used to meet the demand of the next bucket. A downside of this strategy is that there may be excess supply created for demand in a bucket, which would need to be carried over to the next bucket.

Note: It is possible to configure supply order Lot Size determination in CTM with the settings of the Location Product at the source or destination. It is also possible to use the Lot sizes defined in Transportation Lane, as shown in Figure 2.

Figure 2 CTM Profile setting for picking up Lot Sizes for Procurement Planning



4. Storage Resource Modeling: We know, based on help documentation, that only the Optimizer can model all kinds of resources in the system - Production, Transportation, Handling and Storage - in terms of constraints. CTM can only handle Production Resource constraints.

   However, using Heuristics is a smart way to model the storage resource in the system. We can use alerts to identify any storage resource-related violations, while using the setup in Heuristics. Some of the steps to model Storage Resources are:

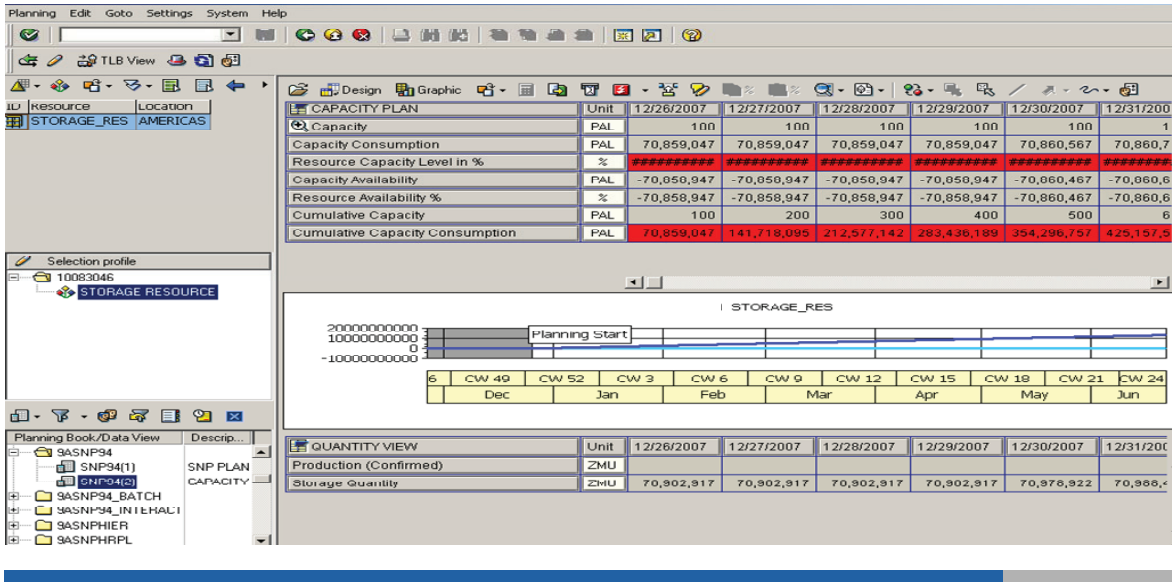
   Step 1: Define a Storage Resource in a Location

   Step 2: In the Location Master, under the Resources tab, define the Storage Resource

   Step 3: Fill up the "Consumption of Storage Capacity per Unit of Material" field in the Location Product master in the GR/ GI tab

Step 4: Setup the Resource overload in bucket (DB alert), which one can view in the Capacity Data View. An example is shown in Figure 3.

Figure 3 Storage Resources showing Alerts after Heuristics Run



Thus upon running Heuristics, one can look at the alerts and take appropriate action.

5. Changing/ Ignoring Master Data real-time in CTM and Heuristics: There may be situations that may require transient reset of certain master data, which is required to influence a certain solver behavior. As an example, it may be required to plan supplies all through the supply horizon, based on open sales orders in the system. The remaining supply may be required to meet unconfirmed demand, such as Forecast.

   In terms of Heuristics, one may require a development object to set and reset, say the Forecast Horizon field in Location Product before and after the Heuristics runs respectively. This method will work for CTM as well.

   Alternatively, this requirement can be met in CTM by using a sorting sequence, containing ATP category and Material Availability Date in that order. The CTM profile also provides the ability to ignore certain Location Product fields as shown in Figure 1. The BADI/ SAPAPO/ CTM_MATLOC also provide the ability to change Location Product master data during the CTM run. The development options, therefore, are less intensive in CTM to meet such kind of requirements.

6. Safety Stock Planning and Concept of Staging Time: Heuristics supports various types of basic and extended Safety Stock Planning methods - such as Days of Supply (static and time-phased) and Quantity Based (static and time-phased).

   Although CTM supports the different safety stock planning features, there is one behavior seen in 4.x version that is noteworthy. In a situation that requires Quantity Based time-phased safety stock planning, it has been found that CTM does not support a ramp-down plan of the safety stock quantity. It keeps the safety stock requirement equal to the maximum ramped-up safety stock quantity.

   One more important difference is in the context of Days of Supply (static and dynamic). Days of Supply, in CTM, is treated more as buffer time of supply before the demand. CTM, thus, does not do any cumulative incremental supply planning and just pre-plans the supply by the buffer time or Days of Supply. This buffer time can be equated to a Staging time at a Location. Based on business requirement, this could be a very powerful feature.

   Now, let us consider some technical aspects, while implementing CTM or Heuristics as SNP solver.

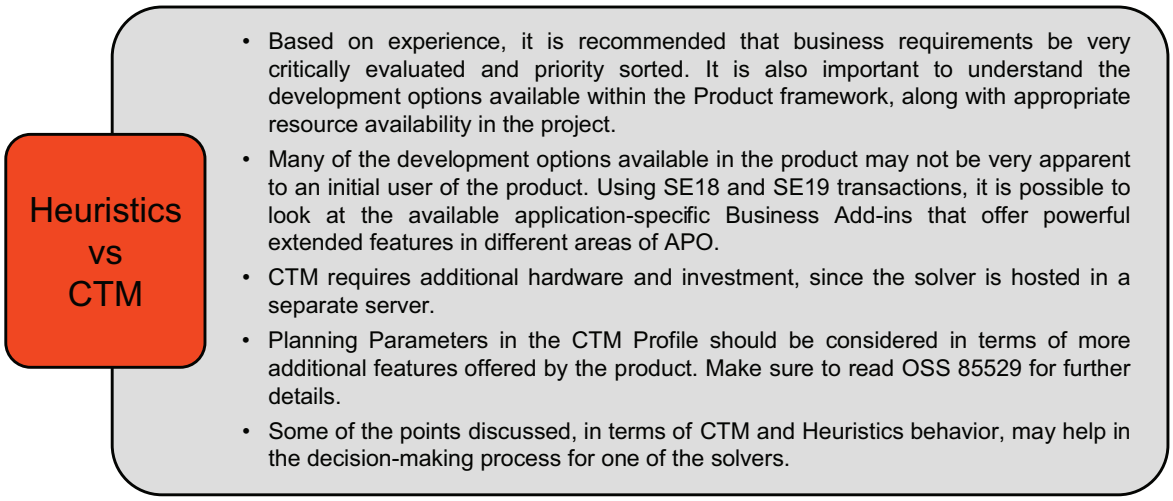
7. Change Pointers with CTM: Unlike Heuristics, it may be a good idea to implement Change Pointers along with CTM. The CTM engine is hosted in a different server. Hence, there is a constant inter-change of data between the Live Cache and CTM server. In a situation where CTM is running and making constant updates to Live Cache, it would be a good idea to stop all CIF queues or configure change pointers in the solution design. This will ensure a controlled manner, where the CTM results are published to the transaction system. Stopping CIF queues and starting it again to account for the CTM run, may cause transient discrepancies in Master and Transaction data between the two systems. Consequently, manual intervention may be required to alleviate any blocks or discrepancies arising at the time of CIF being in a stopped state.

   However, Heuristics does not have any such drawbacks. It is possible to keep the CIF queue in an 'ON' status, while running Heuristics, since there is no separate server involved.

8. Master Data selection check and Low-Level Code determination: A Heuristics run needs to be preceded by a Low-Level Code (LLC) determination check. This LLC determination checks for cyclicality in the network and the order in which multi-level heuristics will run. If there is a cyclicality issue found, technically, Heuristics should not be run. Hence, this check should be run along with heuristics in the same Job as a first step so that the Job fails after the first step at the time of cyclicality identification.

   An equivalent feature is Master Data Check in CTM. However, it has been found that in a situation where there are any Master Data issues such as cyclicality or missing sources of supply, the Master Data Check run in the background logs the error but does not actually fail the job. Even when CTM run follows up this Master Data Check step, the CTM run may actually fail and cause many issues. One may need to do additional development to make the Master Data check job to fail, in case of problem with Master Data.

There are many other powerful features that CTM offers like pushing excess stock to the destination location from a source in an automated fashion or location/ product substitution capabilities (similar to pricing rules in Sales and Distribution module of SAP ECC) that has not been discussed here in this document since they were not found very relevant to our business context. Similarly, Heuristics offers very unique ways of doing capacity leveling as a second step, including custom leveling capabilities. Capacity leveling can also be done as a follow-up step to CTM. It is a useful feature to have uniform load across time horizon for resources



About the Author

Srinivas Krishnamoorthy a certified SAP APO application consultant, is a Senior Supply Chain Consultant in the Enterprise Solutions group of Infosys Limited. He has also worked as a Product Design consultant with i2 Technologies, a best-of-the-breed Supply Chain solution provider. With a total of 9 years experience in Supply Chain, Srinivas currently serves hi-tech clients with complex global implementations of SAP APO, particularly in the areas of Demand Planning, Supply Network Planning and Global Available-To-Promise. He is a leading contributor to SAP Developer Network for APO. He is a Mechanical Engineer from IIT Delhi and a Management Post-Graduate from IIM. You may reach him via email at srinivas_k@infosys.com..

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