One Network Enterprises™

Constraint-Based Supply Planning & Execution

WHAT IS CONSTRAINT-BASED SUPPLY PLANNING & EXECUTION?

Constraint-based supply planning is a capability of One Network's NEO Platform, which powers the Digital Supply Chain Network™. Constraint-based supply planning and execution enables companies and their trading partners to collaborate, create and execute supply plans that respect material and capacity constraints across the network. Constraint-based planning improves productivity by automating the process of applying actual lead times, and supplier capacity and material constraints, enabling improved planning and execution decisions.

THE ROLE OF SMART PRESCRIPTIONS

The system will evaluate all viable alternatives and prioritize prescriptive actions based on targeted business objectives. These actions can be taken automatically as part of an autonomous workflow, or they can be presented in a workbench where planners can explore various scenario options based on smart prescriptions in a graphical format.

Planners can interact with these smart prescriptions, by running various scenarios, evaluating the outcomes, and thus determining the best set of resolutions. The system AI framework (called "NEO"), will remember decision sequencing that generated superior results, and then offer those in the future.

Once the planner decides on a scenario, the chosen set of actions can be executed from the workbench as part of the seamless planning/execution platform. Planners thus fulfill demand by evaluating all possible alternatives, such as using different sources, substitute components, or alternative work definitions, and can select the course of action generating the optimal outcome. Multi-party collaboration is a core capability in the decision-making process and all data related to decisions, both structured and unstructured, is attached to the transactions.

Smart prescriptions are contextual and dynamic. It is important to note that constraints generated by demand and supply shifts are constantly changing. Prescriptions to solve for issues are contextual, based on the state of the trading partner network at that moment. Executing exactly to a plan in today's world is difficult, thus daily execution decisions will frequently diverge from the planned world. An in-memory planning system working on a snapshot of yesterday's data will make poor decision recommendations in some parts of the trading partner ecosystem. And those decisions could be material to customer service levels, revenue, and cost.

THE IMPORTANCE OF PLANNING MARRIED TO EXECUTION

Combined planning and execution on a single platform, that can run continuously and incrementally, is required to solve for constrained supply in today's chaotic world. Both ERP and advanced planning solutions must run constrained supply algorithms in batch mode given their architectural designs. Thus, advanced planning and ERP miss real-time contextual changes in the network that are material to decision-making and improved outcomes.

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A constrained supply plan respects constraints by moving orders to earlier time buckets, offloading to an alternate resource/work definition/supply source, modifying transportation modes, or adjusting labor plans. If these measures are insufficient, then the constrained supply plan will constrain demand, running algorithms to optimize for downstream mix and volume. This way trading partners are not expecting to receive goods which are not coming thus reducing overall network chaos and variability.

ERP SOLUTIONS NECESSARILY SHIFT THE BURDEN TO PLANNERS

ERP configurations set flags to allow demand to overrun constrained supply in the case that the constraints cannot be resolved due to their limited visibility across the supply chain network. Planners are then left to try to resolve across multiple application silos and trading partner echelons, which typically doesn't work well.

Furthermore, in these solutions, lead times must be treated as hard constraints when running the plan.

On the NEO Platform, machine learning algorithms determine accurate lead times across trading partners echelons. Demand inside of manufacturing or procurement lead time can be addressed through various means such as last-minute allocation, transportation mode adjustments, or buy vs make.

The Digital Supply Chain Network™ has a real-time single version of the truth across the network with robust demand, supply, and logistics services. This enables trading partners with many more degrees of freedom to solve for demand and supply variability.

In a typical ERP hub and spoke configuration flags are set that allow the planning to run without respecting lead times when demand shifts inside of lead time. And given the separation of planning and execution wouldn't have known the actual lead time in the first place. So, understanding and resolving for constrained supply further upstream in the supply network is beyond the configuration capabilities of an ERP-type solution.

Scenario structures include hard constraints, such as max quantity or days of supply, along with soft constraints, such as demand splits and sourcing or allocation percentages. The linear programming engines will expose the ability to prioritize objectives, ensure soft constraint optimization, and extend goal functions to include variables such as profitability and landed cost. Constraints will forward and back propagate across the network. Less sophisticated heuristics-based planning runs the risk of propagating actions which create more problems than they are solving.

One Network's constrained supply capabilities include the typical configurations found in both advanced planning and ERP, but they go much further in terms of driving value. The network is capable of redistributing progressively downstream any upstream material constraints. The constraints are often complicated by lead time, lot sizes, and multi-level sourcing of items. Considerations include simultaneous component usage, plant capacity, and the time to produce and ship.

To gain clarity, let's look at three examples of modeling constructs of constrained supply in a supply chain network:

Advanced Replenishment. This is a multi-echelon constrained supply planner in a purely distribution tier operation (i.e., no assembly). It is based on a network flow type algorithm and the goal is to meet demand, especially in highly variable situations. At every network node there is optional "sourcing" which takes the form of primary/secondary/tertiary, etc., and at every node there are also optional allocation priorities. Retail customers typically deploy a version of this capability named Last Minute Allocation (LMA).

Site-Based Constrained Supply Planning. This capability enables constrained supply planning for a single site which then extends across "parallel" sites, i.e., sites that don't feed into each other as well as upstream feeder supply sites. This is based on a Mixed Integer Program algorithm. We enable the capability to resolve for constrained supply across a "full" multi-echelon supply chain by chaining the algorithmic engines. We can generally decompose a "full" multi-echelon supply chain into advanced replenishment (AR) across the network as follows - AR Distribution Tier -> Site Based CSP (constrained supply planning) Manufacturing Tier -> AR Distribution Tier -> CSP Manufacturing Tier and upstream to as many tiers as required.

Network BOM CSP. In this engine we can run a full, multi-echelon supply chain that spans distribution and manufacturing tiers, based on a modified network "max flow" algorithm. The goal is to optimize constrained supply based on fluctuating demand. It will support distribution, internal moves, sourcing (with generic/specific and sourcing rules), allocation, assembly, and many other constructs. Networks are comprised of groups of trading partners that require response speed as demand and supply conditions change during the day or week. It includes support for the incremental planning of a network (routed) bill of material, and other types of related incremental planning operations. S&OP, planning and execution systems. Their issues only get worse as they are bombarded by exceptions due to variances in supply and demand when they attempt to execute their plans across their supply chain network operations.

FLEXIBLE TO SUPPORT A RANGE OF SUPPLY NETWORKS

These modeling constructs, along with others available in the platform can be used to enable high value solution configurations such as; multi-tier demand propagation forecast collaboration, fully constrained capacity and material forecasts, multi-tier demand driven constrained supply planning, optimized product mix and allocation based on constrained supply, constrained production order forecasts, multi-echelon inventory optimization (MEIO), concurrent order/logistics planning and execution, and goal-based channel allocation.

ONE PLATFORM FOR CONCURRENT PLANNING & EXECUTION ACROSS DEMAND, SUPPLY, AND LOGISTICS

Given that the real world will vary from what was planned, and the real world still needs to deliver as well as hit

targeted performance metrics, concurrency in both planning and execution is a critical capability in constrained supply planning. Dynamic workflow, which runs across enterprise and trading partner roles in real time will optimize the entire process in the face of constrained supply, including replenishment, sourcing, order aggregation, load balancing, order collaboration, appointment scheduling, transportation optimization, order promising, fully integrated global and domestic logistics, linkage of order, shipment and inventory, serial and lot tracking, shipment ETA, auto scheduling and rescheduling, in transit stock reallocation, AI-based prescriptive problem resolutions, in transit stock allocation, and vendor management via score carding, certification and charge backs.

Real time concurrency across orders and logistics based on a single version of the truth, enables optimized execution, by combining planning and execution across the inbound supply process. As the network resolves for constrained supply issues, it is constantly replanning based on actual conditions, to generate targeted outcomes based on system rules and policies.

In summary, constrained supply planning is a hot topic in board rooms across the globe. With today's increased demand variability (through omnichannel expansion) a more sophisticated supply chain network is required in order to achieve the highest customer service levels at the least landed cost. Concurrency across demand, supply, and logistics must be achieved to be viable in today's market. With the concurrency of a real time single version of the truth, advanced capabilities around constrained supply can be enabled to generate improved outcomes in both evenue and cost.

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