Meet the Expert: Operational Supply Planning - Order Based Optimizer

Claus Bosch, Michael Mack, Andrew Boyle, SAP SE
October, 2019
Agenda

Overview

Order-based Optimizer

Order-based Optimizer - Cost

Demo
Overview
SAP Integrated Business Planning

Supply Chain Control Tower
End-to-End Visibility, Exception Handling and Collaboration

IBP for Sales & Operations
Strategic and Tactical Decision Processes

IBP for Demand
Demand Sensing & Statistical Forecasting

IBP for Inventory
Multi-Stage Inventory Optimization

IBP for Response & Supply
Order based planning – Supply/Allocations Planning, Response Planning, Deployment
Unconstrained & Constrained Supply Planning

SAP HANA
SAP Integrated Business Planning for Response & Supply

Choose the right solver(s) to match your planning needs

Supply Heuristics
- Infinite **time-series** heuristic supply plan, with finite supply propagation

Supply Optimization
- Cost-based optimization to create global feasible supply plans

Response Management
- Prioritized and feasible **order based** supply plans, allocation determination, and create order confirmations

Deployment
- Create short-term distribution plans based on defined (ATD) supplies

Built-in Integration
Alerting / Root Cause Analysis
Fair Share Distribution
Push & Pull
Manual Adjustments
Simulation

Fair Share Distribution

© 2019 SAP SE or an SAP affiliate company. All rights reserved. | PUBLIC
Supply Optimizer

Supply Optimization

- SAP has a long history in optimizing supply chains.
- The experience of 20 years is collected in a powerful planning engine.
- This engine is integrated in several solutions for supply-chain planning and tactical and operational level.
- It is one code, but offers different features supported by the different applications.
- This engine drives the supply chains of approximately 700 companies.
Overview of Optimizer Constraints

Create optimized supply plan for Network, with right product mix, taking into consideration constraints and key objectives

<table>
<thead>
<tr>
<th>Hard Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must be satisfied, no solution if not possible</td>
</tr>
<tr>
<td>Examples:</td>
</tr>
<tr>
<td>– Resource Capacities – Production,</td>
</tr>
<tr>
<td>– Stock Balance</td>
</tr>
<tr>
<td>– Minimum and Maximum lot-sizes (unless overwritten by adjusted values)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soft Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Should be satisfied, violations are penalized in the objective function</td>
</tr>
<tr>
<td>Examples:</td>
</tr>
<tr>
<td>– Variable/rate costs for transports, production, external receipts</td>
</tr>
<tr>
<td>– Non-delivery costs for customer demands</td>
</tr>
<tr>
<td>– Fix costs for transports, production and external receipts</td>
</tr>
<tr>
<td>– Inventory holding costs (rate) and safety stock violation costs (rate)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pseudo-hard Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft constraints with a very high penalty cost (usually higher than the sum of all other costs)</td>
</tr>
<tr>
<td>Gets satisfied if possible, but still allows for a solution if not possible</td>
</tr>
<tr>
<td>Examples:</td>
</tr>
<tr>
<td>– Manual adjusted values (internal to the optimizer, very high cost if violated)</td>
</tr>
</tbody>
</table>
Order-based optimizer
Order-based Planning

Overview

Priority-based heuristic

The priority-based heuristic uses a constraint-based heuristic planning approach for the cross-supply-chain checks of capacities, transport availability as well as material availability. The algorithm does that on the basis of predefined demand and supply priorities.

The goal of the priority heuristic is to calculate a feasible solution for fulfilling all demands (based on highest priority) and “match” the demands to the available supply alternatives.

The planning run creates pegging for visibility (supply usage) and gating factors (root cause analysis).

Optimizer

The order-based optimizer uses a cost-based optimization, considering all capacity constraints and material availability in the supply network.

Optimization determines the optimal solution based on predefined costs for supply alternatives and demands.

The optimizer will balance orders to minimize the overall cost of the generated plan.

The planning run creates pegging for visibility (supply usage).
Order-based Planning - Process

Monitoring & Controlling of the Planning Process

Process Step 1 ➔ Process Step 2 ➔ … ➔ Process Step n

Supply/Response Planning Run

- Pegging & Gating Factors
- Manual Input by Planners
- Order-based priority Heuristic
- Optimization
- Management by Exception

Master & Transactional data
Profiles & Settings
Integration to execution Systems
Order-based Optimizer

- **Heuristic**
  - Result based on “local view”
  - Object based data model (orders, pegging)
  - Additional information (gating, detailed pegging, requested dates)

- **Optimizer**
  - Result based on “global view”
  - Key figure based data model
  - No additional information (no gating, no detailed pegging, no requested dates)

**Order-based optimizer**: combine the two approaches to get
- Result based on “global view”
- Object based data model (orders, pegging)
- Additional information (gating, detailed pegging, requested dates)
Order-based Optimizer – How to run

In order to run the order-based optimizer use job template:

- Order-Based Planning: Constrained Forecast Run Using Optimizer

The constrained forecast run in IBP Order-based planning is the basic planning run to plan key figure demand (optional: multiple key figures) and derive the constraint demand key figure(s).

The constrained forecast run creates multi-level receipts and considers the different valid sources of supply available. Constraints considered in the constraint forecast run are:

- Resource Capacity
- Supplier Constraint
- Material availability and lead time
Order-based Optimizer – Key capabilities

The order-based optimizer is primarily designed to support supply optimization.

Typically the optimizer determines either key constraints for later use in operational planning or generates production and distribution plans for execution.

Key capabilities are:

- Right product mix utilizing cost penalties
- Utilize alternatives to meet network demand – alternate sources of supply
- Strike balance between pre-build and late delivery
- Push Production
- Multiple Mode of Transports to manage cost-effective distribution
Order-based Optimizer – Key functionalities (IBP1908)

Key planning functionality that order-based optimizer supports:

• Adjusted values
• Safety Stock, Max Stock
• Lot sizes (no period lot size)
• Validity of IBP PDS (production data structure)
• Multiple PDS activities (assignment of component lead time)
• Assembly scrap
• Calendar (Factory Calendar)
• Maximum lateness
• Pegging
• …
Integration – Order Based Planning

Master Data:
- Material
- Location
- Resource
- BOM
- Capacity Consumption
- Transportation Lane
- Supplier

Transactional Data:
- Sales Order
- Purchase Requ/Order,
- Planned/Prod Order,
- Stock Transfer Requ/Order
- Stock
Order-based optimizer - Cost
What costs are in scope

- Inventory holding costs
- Safety Stock violation costs
- Procurement cost (In order based Data Model at SoS level)
- Transportation costs
- Costs for producing the components
- Costs for producing the finished products
- Delay and penalty costs for demands
Cost Maintenance

Cost values are most critical to define. Run through a couple of optimization scenarios with the business users, and check if the costs maintained give the correct results according to the business requirements. Regularly check quality of costs.

There are different levels/ways how control cost for order-based optimizer can be maintained.

- **Global Cost**
  - determined by demand/supply priorities

- **Static Cost**
  - maintained in Planning Run Profile

- **Time-dependent Cost**
  - maintained via Key Figures

Recommended
## Where and how are they maintained?

<table>
<thead>
<tr>
<th>Cost Type</th>
<th>Global Parameter (in Job Template)</th>
<th>Key Figure based</th>
<th>Planning Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late-Delivery Cost Rate for Forecast</td>
<td>Yes</td>
<td>No</td>
<td>Yes*</td>
</tr>
<tr>
<td>key figure 1..5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Delivery Cost Rate for Forecast</td>
<td>Yes</td>
<td>No</td>
<td>Yes*</td>
</tr>
<tr>
<td>key figure 1..5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inventory Holding Cost Rate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Safety Stock Violation. Cost Rate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Transportation Cost Rate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fixed Transportation Cost</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Production Cost Rate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Fixed Production Cost</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Procurement Cost Rate</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Fixed Procurement Cost</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Outlook

Performance

- Latest Gurobi-Solver
- Heuristic as root-solution
- Decomposition
- Flexible / telescopic planning buckets
- Inbound Quota
- Fair Share
- Shipping/receiving resource
- Transportation resource (for Push)
- Deployment Optimization
- Cost Generation
- Periodic lot-sizes

Automatic Scaling/
Numeric Tuning

Extensibility

More information,
warnings

Simplification

Gating Factor improvement

Subject to change

Business Features

© 2019 SAP SE or an SAP affiliate company. All rights reserved. | PUBLIC
Demo

SAP IBP – Order-based optimizer in action
Supply Network

Demand: -300

Stock FA1: 100

Stock FA2: 200
Locations & Master Data

5d_2levelprod: 5 days factory calendar, 2 production levels
Questions?

Find answers and ask your questions about SAP IBP on our Q&A community

https://answers.sap.com/questions/ask.html
2019 Webinar Series on SAP IBP

Available Sessions focusing on operational supply planning:

Meet the Expert : SAP IBP Webinar: Operational Supply Planning - Overview  PDF | Recording

Meet the Expert – SAP IBP Operational Supply Planning - Deployment Planning  PDF | Recording

Meet the Expert - Operational Supply Planning: Supplier Commit Scenario w/ Ariba  PDF | Recording

Meet the Expert - Operational Supply Planning: Integration - SDI, etc.  PDF | Recording
Recent Webinars & Blogs

Webinar series: How the order based, finite priority heuristic satisfies demands?

- Webinar 1:  
- Webinar 2:  
- Webinar 3:  

Webinar: Learn about Rules for demand prioritization:  

Webinar: Learn about Planning Run Types - Process Choreography:  

Webinar series: Planning Area SAP7

- Webinar 1:  
- Webinar 2:  

Webinar: How to best create prototypes with SAP Integrated Business Planning order-based planning  

Webinar: Order based Integration using SDI  
Recent Webinars & Blogs

How to visualize a Freeze horizon in IBP Excel?

What’s new in IBP Response and Supply 1805 – Order-based Planning

What’s new in IBP Response and Supply 1808 – Order-based Planning

What’s new in IBP Response and Supply 1902 – Order-based Planning

What’s new in IBP Response and Supply 1905 – Order-based Planning

FAQ on Order-based Planning:
https://wiki.scn.sap.com/wiki/x/5AHXHQ
Thank you.

Contact information:

Claus Bosch, Michael Mack, Andrew Boyle
SAP Integrated Business Planning, SAP SE
claus.bosch@sap.com