BETTER BUSINESS ANALYTICS

LARGE OIL AND GAS REFINERY AND DISTRIBUTION COMPANY

SHORT SEA INVENTORY - ROUTING OPTIMIZATION

Background

A large ***oil and gas company*** ships crude and refined oil products ***from its refineries to several central distribution facilities*** along the coast, from which these products will then be ***distributed to their final destinations.***

The company ***leases ships of different capacities*** for this purpose, with different ***speeds and operating costs.*** These ships are ***assigned voyages*** where they ***load products at certain refineries*** and ***unload*** them at ***distribution points.*** In some cases, ships are also required to load products at distribution points, to be transferred to other ***distribution facilities.***

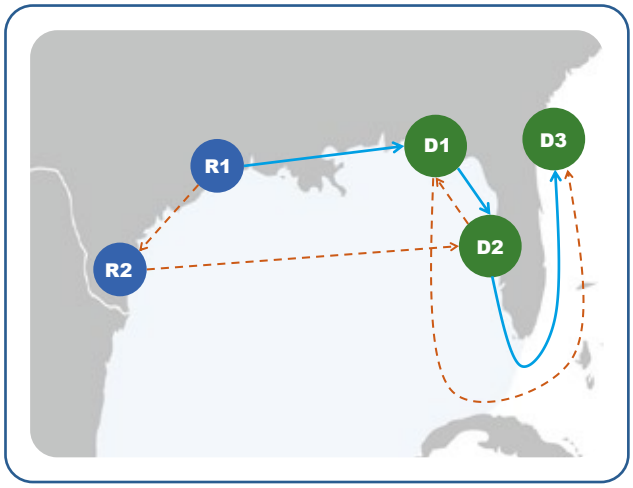
The company needed to ***minimize the total transportation cost*** involved in the operation. This includes the ***cost of operating the fleet of ships,*** as well as minimizing the ***overall number of ships*** necessary.

The Challenge

There are ***infinite possible ways of shipping*** the products.

To begin with, there are all the ***possible paths*** that a ***ship can take.***
Let's assume ***– for simplicity –*** that the ***transportation network*** consists of ***2 refineries*** and ***3 distribution facilities.***

The figure below shows this ***reduced transportation network*** with two refineries, **R1** and **R2,** and three distribution facilities, **D1, D2** and **D3.** The ***figure shows*** just ***two of the many possible ways*** to get from Refinery 1 (**R1**) to Distribution Point 3 **(D3)** —— the solid blue path **(R1 → D1 → D2 → D3)**, and the dotted red path **(R1 → R2 → D2 → D1 → D3).** If we assume that a voyage must ***start at a refinery*** and must include ***at least one distribution point,*** the number of possible, ***unique paths*** is 132.



If we have ***three ships available,*** then the number of possible ***assignments of ships to paths*** is **3 x 132 = 396.** If we have a ***single product to transport,*** and we can ***load any number of barrels*** of the product on a ship – ***up to the ship's capacity*** – then the number of ***possible ways*** to transport the product ***is infinite!***

The actual ***size of the company's transportation network*** is ***much larger,*** consisting of ***several refineries, multiple distribution facilities,*** more than a ***dozen ships,*** and ***several products.*** The ***current scheduling*** of ***product loading*** on ships and ***assigning ships to paths*** is done ***manually*** by a team of planners using very ***complex spreadsheets.*** Obviously, ***manually generated transportation solutions*** are ***not optimal,*** leading to ***unnecessarily high costs*** and ***large amounts of wasted capacity*** on ships.

OptPro Solution

OptPro combines ***advanced analytics methods,*** such as ***mathematical optimization*** and ***artificial intelligence,*** with a ***digital twin representation*** of the actual process.

In this case, the **OptPro** was implemented to simultaneously ***minimize the number of ships*** necessary to ***fulfill shipment requirements*** and the ***total cost of transporting products,*** while meeting ***product demand*** at all ***distribution points.***

The ***system assigns ships to paths,*** and ***schedules daily ship activities,*** from port ***departures and arrivals*** to ***loading and unloading specific products.*** The schedule is then ***validated by a digital twin representation*** of the transportation network, certain adjustments are made to ***resolve conflicts*** (e.g., staggering arrivals when ***two ships*** scheduled to arrive at a port at exactly the ***same time)*** and forwarded to ***maritime operations planners*** to put into operation.

Results

The ***solution*** approach is an ***example of the wide applicability*** of **OptPro,** from ***optimizing production schedules*** at a manufacturing plant to ***optimizing transportation schedules*** in maritime operations.

By using **OptPro,** the ***company will achieve a savings of over 4% per barrel*** of refined products it delivers to distribution facilities across its network, a ***total savings of more than $2MM per month.***

The solution also provides the ***ability to anticipate*** when a ***ship can be repurposed*** for certain periods, such that ***additional savings*** can be ***achieved.***

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