First mile and Last mile delivery for oil and gas distribution

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About the Client

Coextrix technologies is an innovative information technology and services company providing offshore software development, product engineering, analytics and infrastructure and consulting services. Coextrix has been in the service of these challenging problems since 2009. The company is located in J.P. Nagar, Banaglore, Karnataka. Last mile delivery for oil and gas distribution is one of its on-going projects and GDPL is partering with them as solution provider for the optimization problem.

Motivation

Last mile delivery is one of the challenging problems existing in many different fields. This forms a last leg in the distribution chain for several manufacturing products. This is a costlier and complex step in the distribution chain as it involves many practical problems such as meeting the time varying demands, planning proper delivery schedule taking into account of available delivering agents such as delivery persons and vehciles. In addition to last mile problem, first mile problem involves where to procure the products so that total cost of procurement and travel is kept minimum. Finding optimal solution to this last mile and first mile problem would make the distribution efficient such that product availability is ensured at all demand points and more importantly the solution will increase the profit margin.

The solution will also ensure efficient utilization of resources such as delivery persons, fuels for truck etc. Current project involves solving this problem for the distribution of oil and gas products to several outlets located across different parts of a country.

Problem

The project involves scheduling of trucks and drivers for last mile delivery of oil and gas products to several demand points located across a country. Specifically one need to answer the following questions to minimize the total cost including procurement charges and freight charges.

- Among several suppliers available, which supplier to choose for each demand point?
- How much to procure from the identified suppliers?
- At what time the delivery should be made inorder to meet the time varying demands?
- Given the schedule of drivers like place of start, time of start and working time, which driver to take which truck and route?

The problem involves several demand and supply options which are located across a country. This is a large scale problem involving several millions of variables and several thousands of constraints.

Solution

GDPL is involved as solution provider to the client. Following are various technical contributions made by GDPL team for the project:

- A sample database was developed to reflect the original problem, having all possible complexities in terms of demands, supplier information, volumes in Gallons, purchase and freight charges, truck types, driver information and time varying demand and prices
- The above mentioned database is used to model the problem and generate mathematical equations for objective functions and constraints, using PYTHON environment
- Depending on the complexity of the problem, heuristics are developed to solve the problem in reasonable time.
- Solve the problem using an open source solver (CBC) and subsequently establish the POC
- For the actual/original large scale data base, analyse the field data and design several pre-processing steps to make the database well defined, so that valid data points are included in solving the model.
- Add various practical pre-checks for the given large scale database so that problem is feasible
- Support work in actual implementation and assessment of the solution(s) provided to the client.