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Shipper collaboration

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Abstract

The interest in collaborative logistics is fuelled by the ever increasing pressure on companies to operate more efficiently, the realization that suppliers, consumers, and even competitors, can be potential collaborative partners in logistics, and the connectivity provided by the Internet. Logistics exchanges or collaborative logistics networks use the internet as a common computing platform to implement strategies designed to reduce "hidden costs" such as asset reposition costs. Through collaboration shippers may be able to identify and submit tours with little or no asset repositioning to a carrier, as opposed to submitting individual lanes, in return for more favorable rates. In this paper, we focus on finding a set of tours connecting regularly executed truckload shipments so as to minimize asset repositioning. Mathematically, the truckload shipper collaboration problem translates into covering a subset of arcs in a directed Euclidean graph by a minimum cost set of constrained cycles. We formulate the lane covering problem, propose several solution algorithms, and conduct a computational study on the effectiveness of these methodologies.

1. Introduction

The growing interest in collaborative logistics is fuelled by the ever increasing pressure on companies to operate more efficiently; the realization that suppliers, consumers, and even competitors, can be potential collaborative partners in logistics; and the connectivity provided by the internet.

In the trucking industry, both shippers and carriers are desperately searching for ways to operate more efficiently. Shippers are under continuous pressure from the market place to increase logistics performance while reducing costs. They have to move smaller product quantities more often to meet shorter customer lead times. Furthermore, the buffers that once protected against shortages have shrunk, as inventory

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volumes grow smaller. Mistakes that were once covered by excess inventory now emerge as expedited logistics costs. Carriers are facing challenges to profitability too. Margins are at an all-time low and driver turnover is at an all-time high. To make matters worse, fuel costs are surging and carrier insurance costs are on the rise as well.

Traditionally shippers and carriers have focused their attention on controlling their own costs to increase profitability, i.e., improve those business processes that the organization controls independently. The key to collaborative logistics lies in identifying and reducing "hidden costs" that all participants in a logistics system pay, but none control individually. An example of a hidden cost is asset repositioning. To execute shipments from different shippers a carrier often has to reposition its assets. Shippers have no insight in how the interaction between the various shipments affects a carrier's asset repositioning costs. In other words, no single participant in the logistics system controls the asset repositioning costs. Asset repositioning is expensive. A recent report estimates that 18% of all trucks movements every day are empty. In a $ 921 billion US logistics market, the collective loss is staggering: more than $ 165 billion.

Logistic exchanges or collaborative logistics networks, such as those offered and managed by Nistevo, Elogex, and Transplace use the Internet as a common computing platform to give shippers and carriers visibility to hidden costs. Through collaboration, participants of logistics networks can implement strategies specifically designed to reduce or eliminate these hidden costs.

A good example that reveals the benefits of collaboration involves scheduling truckload movements of multiple shippers. Through collaboration, two members of the Nistevo network created and are using a dedicated 2500-mile continuous move route, reaching several Midwestern and Eastern US cities, involving seven stages, and encompassing various distribution centers, production facilities, and retail outlets for both companies. The route has little asset repositioning and gives the carrier's drivers a repeatable schedule. The route resulted in a combined 19% savings for both shippers. The carrier is experiencing higher margins and lower driver turnover through more regular driver schedules.

When shippers consider collaborating, their goal is to identify sets of lanes that can be submitted to a carrier as a bundle, rather than individually, in the hope that this results in more favorable rates. Carriers are often willing to provide more favorable rates for bundles when a bundle of lanes provides repeatable work for a driver and covering the lanes in the bundle involves little or no asset repositioning. The shipper collaboration problem can thus be stated as follows: given a set of lanes, find a set of tours that covers all lanes and that minimizes the asset repositioning.

We will focus on the simplest variant, which is static and involves only full truckloads. This setting is relevant for companies that regularly send full truckloads, say once a week, and are looking for collaborative partners in similar situations. The underlying assumption is that shipment schedules can be adjusted so that the resulting tours can be executed in practice.

Identifying tours that minimize asset repositioning costs in a collaborative logistics network is not easy. As the number of participants in the network, hence the number of truckload movements, grows the number of potential routes to examine becomes prohibitively large. Optimization technology is needed to assist the logistics network provider's analysts in identifying tours with little or no asset repositioning.

In practice, there will be various restrictions limiting the set of acceptable tours such as a restriction on the maximum number of legs that can make up a tour or on the maximum length of a tour. Our initial analysis shows that such constraints make the underlying optimization problem more difficult, from a theoretical perspective, but they may make it easier to construct high-quality solutions, from a practical