
Horizontal Cooperation in Dial-a-Ride Services

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Abstract

A dial-a-ride system is an application of demand-dependent, collective people transportation. Users request a trip between an origin and a destination of choice, to which service level requirements are linked. The service provider attempts to develop efficient vehicle routes and time schedules, respecting these requirements and the technical constraints of a pickup and delivery problem. Given the ageing population, dial-a-ride systems gain importance to complement regular transportation modes. They also prevent isolation of vulnerable groups in society.

The current practice consists in that users choose a service provider to submit their request. Multiple providers operating in the same area solve separate routing problems based on the requests they received. However, research in freight transportation shows that horizontal cooperation may allow carriers to obtain joint operational benefits. The aim of the present research is to determine whether this also applies to people transportation, characterized by tighter quality requirements. Providers may exchange requests that are difficult to serve in their own routes and/or relocate vehicles among their depots.

Computational tests are carried out using a new large neighborhood search algorithm. Different data sets are used, ranging from artificial benchmark instances to data with real-life characteristics, such as clustered requests. Horizontal cooperation considerably reduces joint distance traveled and required fleet size. A pattern can be observed in which requests are exchanged among providers. These results provide support for the creation of an overarching body which collects all user requests in a certain area, after which a globally optimal route planning can be constructed.

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