

Fleet Dynamics

Using expertise in mathematical optimisation, CSIRO has helped overcome fleet scheduling challenges for THL.

Car and campervan rental companies face a difficult problem during fleet management: how to ensure that each customer receives a satisfactory vehicle.

The seemingly simple question Is there a vehicle for this booking request? must be answered preserving a delicate balance between maximizing fleet use and minimising potentially expensive vehicle relocations and substitutions.

Tourism Holdings Limited (THL) runs recreational vehicle rental companies in Australia and New Zealand. Their fleet totals 4 000 vehicles ranging from 4WD vehicles through to 6-berth mobile homes. The company handles tens of thousands of bookings per year. Many bookings have long horizons and more than half involve pick-up and drop-off at different locations. Bookings can be accommodated by substituting one vehicle type for another (at some cost in terms of customer satisfaction) or by relocating a vehicle.

CSIRO has developed two systems to enable THL to maximise fleet efficiency. The first system answers a question faced every day by vehicle rental companies: What relocations and substitutions must be made to meet bookings requirements at



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minimum cost? The second system answers the minute-to-minute question: Is there a vehicle available for this booking request?

Minimising costs and maximising quality of service

Optimal management of a vehicle fleet requires many considerations:

- Are there enough vehicles at each location to meet demand?
- Is it necessary to shuffle vehicles between locations at different times to cover the bookings?
- When demand for each vehicle type does not match the vehicles available, should a vehicle be

upgraded to a better quality substitute at the same price?

- When is it better to make a vehicle substitution rather than relocating a vehicle?
- How to deal with the dynamic nature of the fleet where vehicle maintenance, disposals and entry of new vehicles constantly change the number of vehicles available.

CSIRO's Vehicle Allocation and Scheduling System (VASS) finds the best allocation of vehicles to rental bookings by producing a schedule of vehicle allocations that minimises the overall cost of relocations and

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substitutions, including a notional cost for the dissatisfaction of customers who do not receive the car they were expecting. The system uses vehicle assignment, relocation and substitution to allow more bookings to be accepted and removes the guess-work from fleet operations.

D-VASS (Dynamic-Vehicle Allocation and Scheduling System) is an extension of VASS and is incorporated into the main bookings and reservation system. D-VASS enables continuous, dynamic operation by answering the query 'Is there a vehicle available for this booking request?' D-VASS makes

complex adjustments to the vehicle schedule in order to incorporate new bookings at minimum cost. Squeezing the most out of the vehicle fleet allow more bookings to be accepted and has a positive impact on the rental company's profits.

"CSIRO's software is at the heart of our Aurora system that handles Reservation, Customer Service, Scheduling and Fleet Management functions at THL Rentals division. The software provides real time availability and fleet scheduling information to over 100 concurrent users in many locations in Australia and New Zealand. It is a critical component to THL Rentals success."
JiFong Chen - THL

The next phase of development will introduce revenue management techniques into the fleet management system. Currently, when deciding whether to accept a booking, the system can only rely on bookings already taken. Revenue management techniques will allow the system to use predictions of future demand to help refine the decision.

Optimal solutions to scheduling problems

There are many potential solutions to a vehicle allocation scenario. Optimisation is about finding the best possible solution, mathematically.

Optimisation finds the highest peak in a landscape of possible solutions; the point representing the absolute least cost solution for the data presented.

The difference between the mathematical optimum and a solution constructed 'by hand' may only be 5%, but that is a saving that comes straight off the cost of running a vehicle fleet – and can represent huge dollar savings.

Many industries face booking and scheduling challenges similar to recreational vehicle hire companies. CSIRO is interested in working with industrial partners to solve complex scheduling and logistics challenges.

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