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IRSES

Ongoing Deliverable D1.2

Description of Research Seminar: Delay management with rerouting

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Participants:	UGOE UNIKL DTU UOA UC
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Research Seminar

offered by Marie Schmidt (ES-UGOE-2)

in February 2011,

in Auckland, New Zealand

Subject: Optimization in public transportation - Delay management with rerouting

Problem: Delay management deals with the short-term adaption of a given timetable to small delays as they occur in daily train operations. The task of delay management is to decide whether trains should wait for delayed feeder trains or should depart on time and to update the timetable to a disposition timetable accordingly. In classical delay management models passengers are assumed to take their originally planned routes. When connections on these routes are not maintained because of delays, the passengers are assumed to wait one time period for the next train. However, after the wait-depart decisions are made, passengers will certainly change to the best possible route according to these decisions instead of waiting at the station for one time period. We propose a model where such a *re-routing* of passengers is incorporated in the delay management process. More precisely, given the initial timetable, information about origins and destinations of the passengers, and the delays, we try to make the wait-depart decisions, determine a disposition timetable and find passenger routes such that every passenger reaches his or her destination and such that the overall travel time is minimized. This problem is called *delay management with re-routing (DMwRR)*.

Main Results: Classical delay management models represent the timetable in an event-activitiy network. We find that by adding some additional events and activities and such incorporating origins and destinations in the model,

passenger routes can be represented as paths in the EAN. Hence the modelling framework of the EAN can be used to model DMwRR.

DMwRR is NP-hard in general, but can be solved in quadratic time if there is only one OD-pair and some assumption on the network structure hold using a modified shortest path algorithm in the EAN. Even if these assumptions do not hold, the algorithm can be used to generate a lower bound on the objective value.

Modifying an integer programming formulation for classical delay management adding multi-commodity flow constraints for the passenger flows, DMwRR can be solved by integer programming. The lower bound provided by the modified shortest path algorithm for instances of DMwRR with one OD-pair can speed-up the solution of the integer program. Computational experiments based on real-world data from Netherlands Railways show that significant improvements (up to 7%) with respect to the passengers' traveling times can be obtained by taking the re-routing of passengers into account in the model.

Participants: students and researchers from UOA.

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