Comparison of Methods for Increasing the Performance of a DUA Computation

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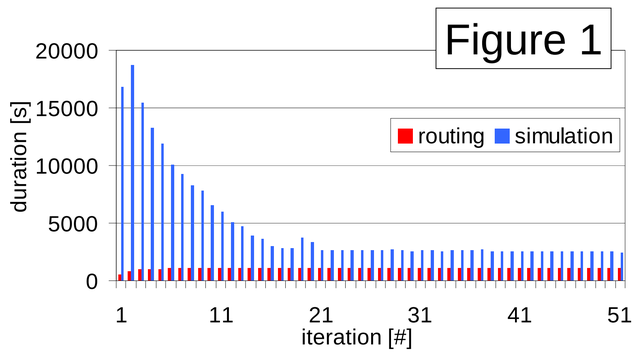
Introduction

The approach developed by Christian Gawron in 1998 which we use for traffic assignment computes a dynamic user equilibrium by iteratively performing the simulation and computing new vehicle routes. The results are valid, but the computation is very time consuming due to the need to perform both the complete simulation and rerouting of all vehicles within each iteration step.

Problem Evaluation

To identify the reasons for the large computation time the plot of the execution times of both applications in Figure 1 helps. Most of the computation time is used by the simulation during the first runs. This is due to the large number of vehicles that get into jams and so incrementally fill the study area.

Figure 1



Proposed Solution Methods

1. “inc_sim”: successive increase of simulated vehicles

While route computation is still done for all vehicles in each iteration step with reference to the edge travel times computed by the simulation, the simulation only uses a fraction of the vehicles in the analyzed scenario. In each iteration step, this number of vehicles emitted into the simulation is increased. The number X is used to name the different scenarios (“inc_simX”): X (fraction of all vehicles) is the amount by which the number of simulated vehicles is increased in each iteration.

2. “inc_time“: increase of simulated time

Instead of increasing the amount of vehicles within the whole simulation, this approach uses the complete number of vehicles, but now the simulation end-time is increased in regular intervals. The number X is used to name the different test runs (“inc_timeX”): it is the time by which the end-time is extended between the iterations.

Evaluation of Proposed Methods

All methods are more efficient than the original. The times needed to achieve the same mean travel times (red part in Figure 2), used as the major indicator for the assignment‘s quality, are remarkably lower than the original algorithms and the same number of iterations can be performed faster (complete size of the bars in Figure 2). This results in lesser mean travel times after 50 iterations when compared to the original algorithm (Figure 3). The maximum number of vehicles running simultaneously within the simulation is also reduced remarkably (Figure 4).

Figure 2

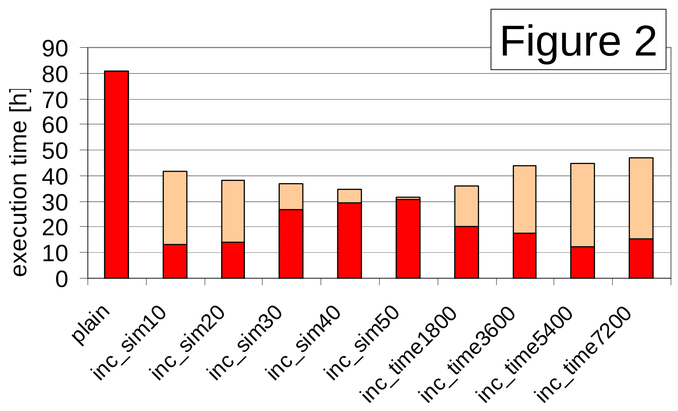


Figure 3

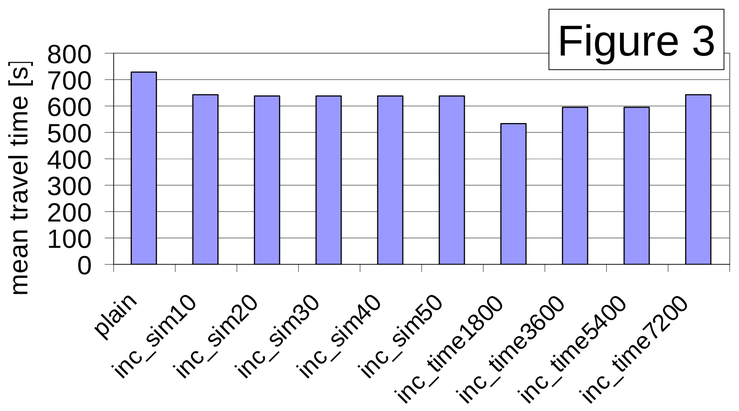
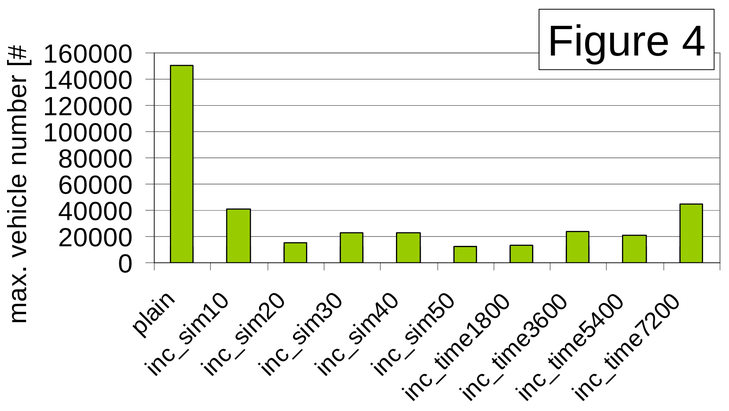


Figure 4



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