Routing in Dallas - Fort Worth

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- Simulation Model
- Iterative Planning Process
  - Improvement during Iteration
  - Selection of Routes for Re-planning
  - Route-Loss
- Specific Comparison to TRANSIMS
- Conclusion

Routing in Dallas - Fort Worth

Given

Time-dependant OD-matrix for traffic network

Wanted

Consistent route-set as input to micro-simulation

Approaches

Traditional solution: Static Assignment

Exact solution: Linear Programming

Today's talk: Iterative Re-planning

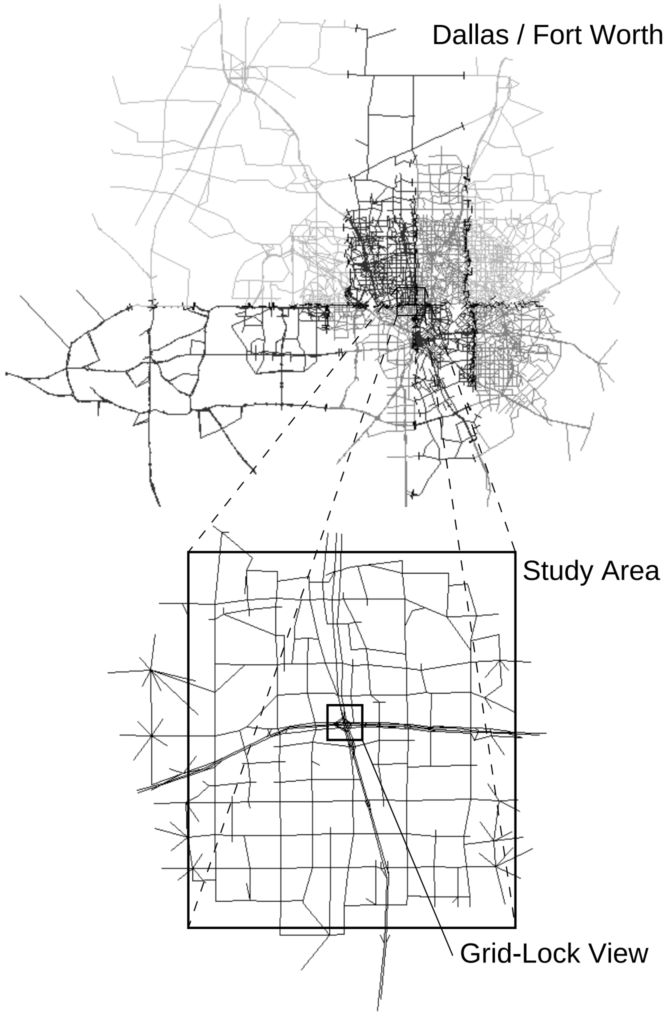
Routing in Dallas - Fort Worth

Routing:

Travel-times inside the study-area are given by previous run of simulation. Travel-times outside the study-area correspond to free-flow speeds.

Simulation:

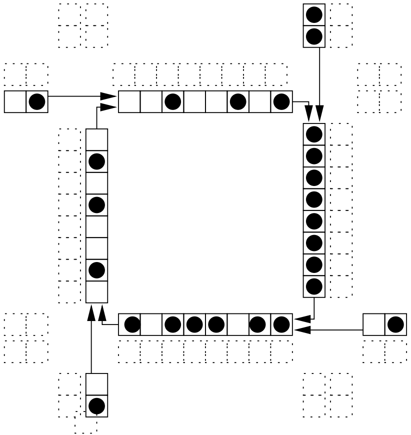
Routes are clipped at the boundaries of the study-area.



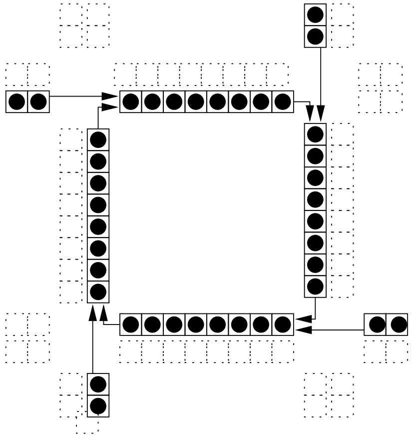
Traffic Model

Gridlock

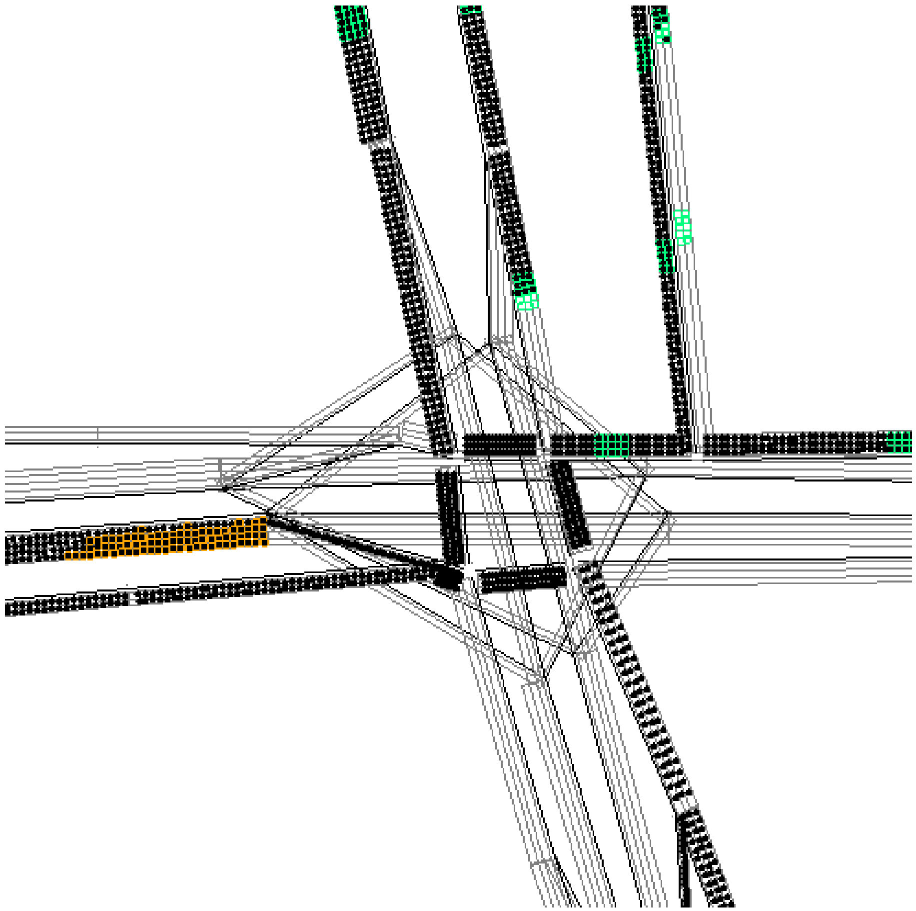
CA model may grid-lock if traffic volume is too high. Re-planning resolves grid-locks through huge feed-back travel-times.



before dead-lock



after dead-lock



Traffic Model

Implementation

- Geometric distribution of network on CPUs
- Links are split at the center as boundaries
- Message passing with PVM or MPI
- Static load-balancing using average execution times of previous iteration as link costs

Traffic Model

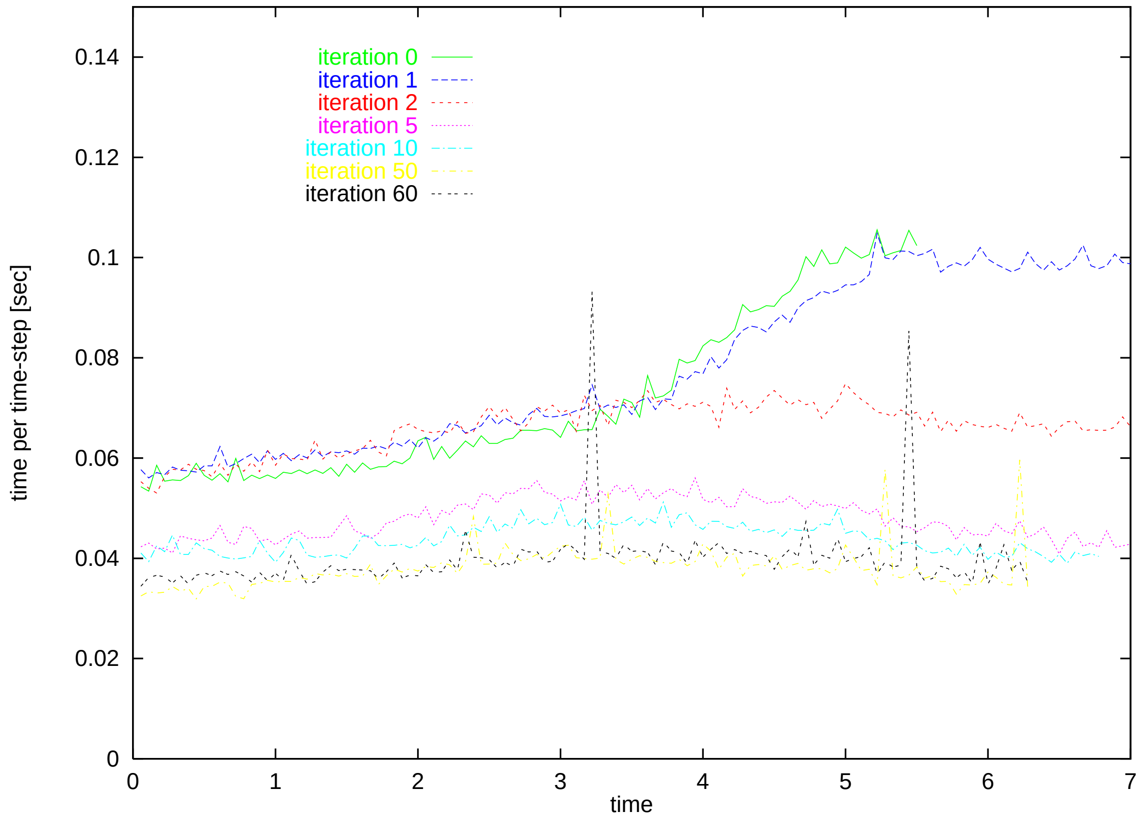
Computational Speed

- Real-Time-Ratio is approx. 15 with 8 CPUs SUN-Enterprise 4000E (250Mhz)
- Clipping: 6 minutes (overlays planning)
- Simulation: 30-40 minutes
- Planning: 6-15 minutes
- Overall time per iteration: 36-61 minutes

Traffic Model

Load Balancing

Execution time of links and nodes is fed back into the next iteration to improve initial distribution.

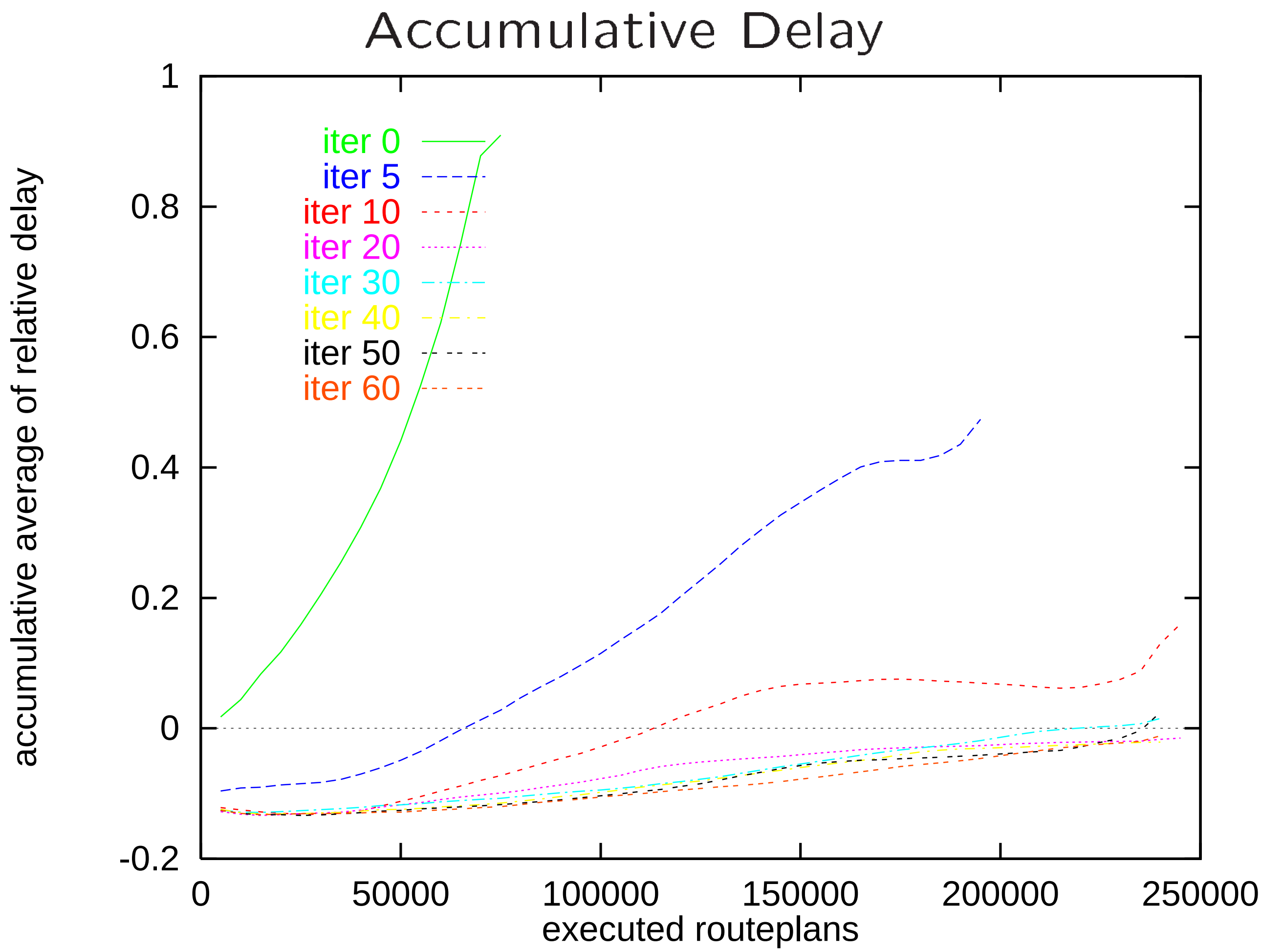


Iterative Routing

Basic Algorithm

- Start with an initial route-set,
- (*) Clip routes to study-area using free-flow velocities,
- Run micro-simulation ($\rightarrow$ link travel times),
- Re-plan fraction p_0 of routes using link travel times,
- Go to (*) if neccessary.

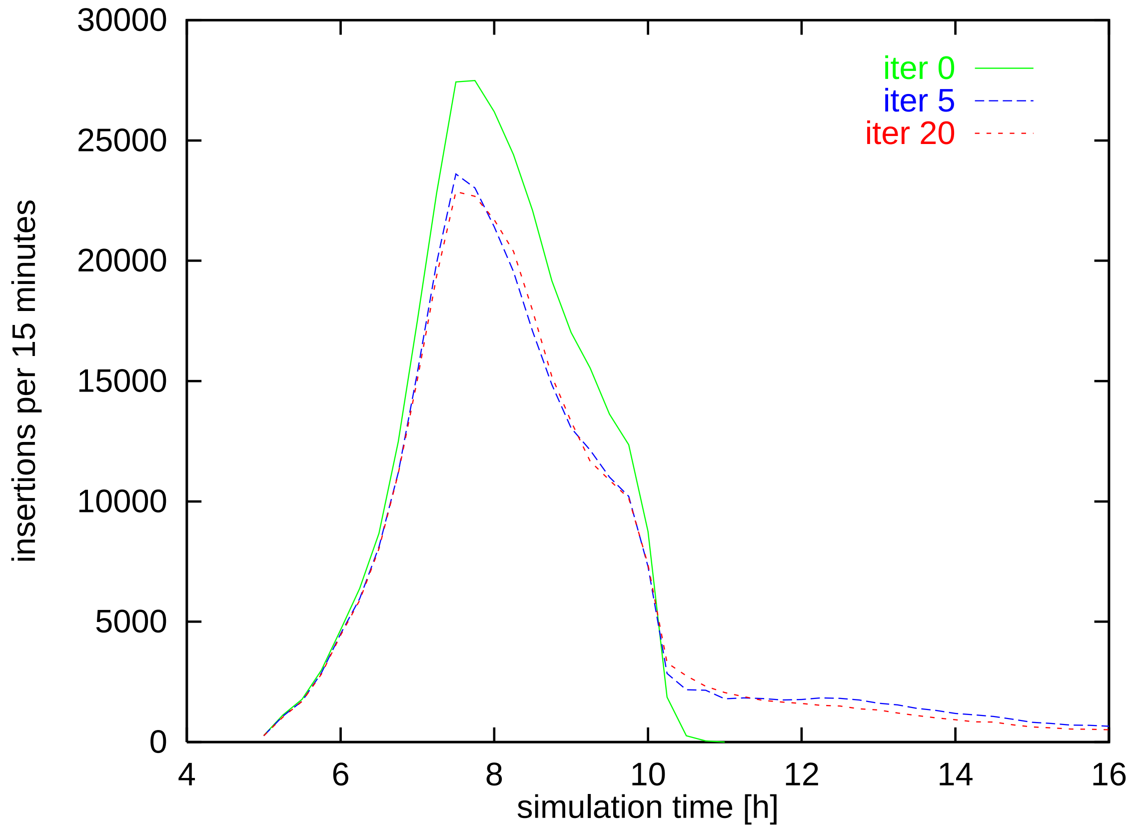
Iterative Routing



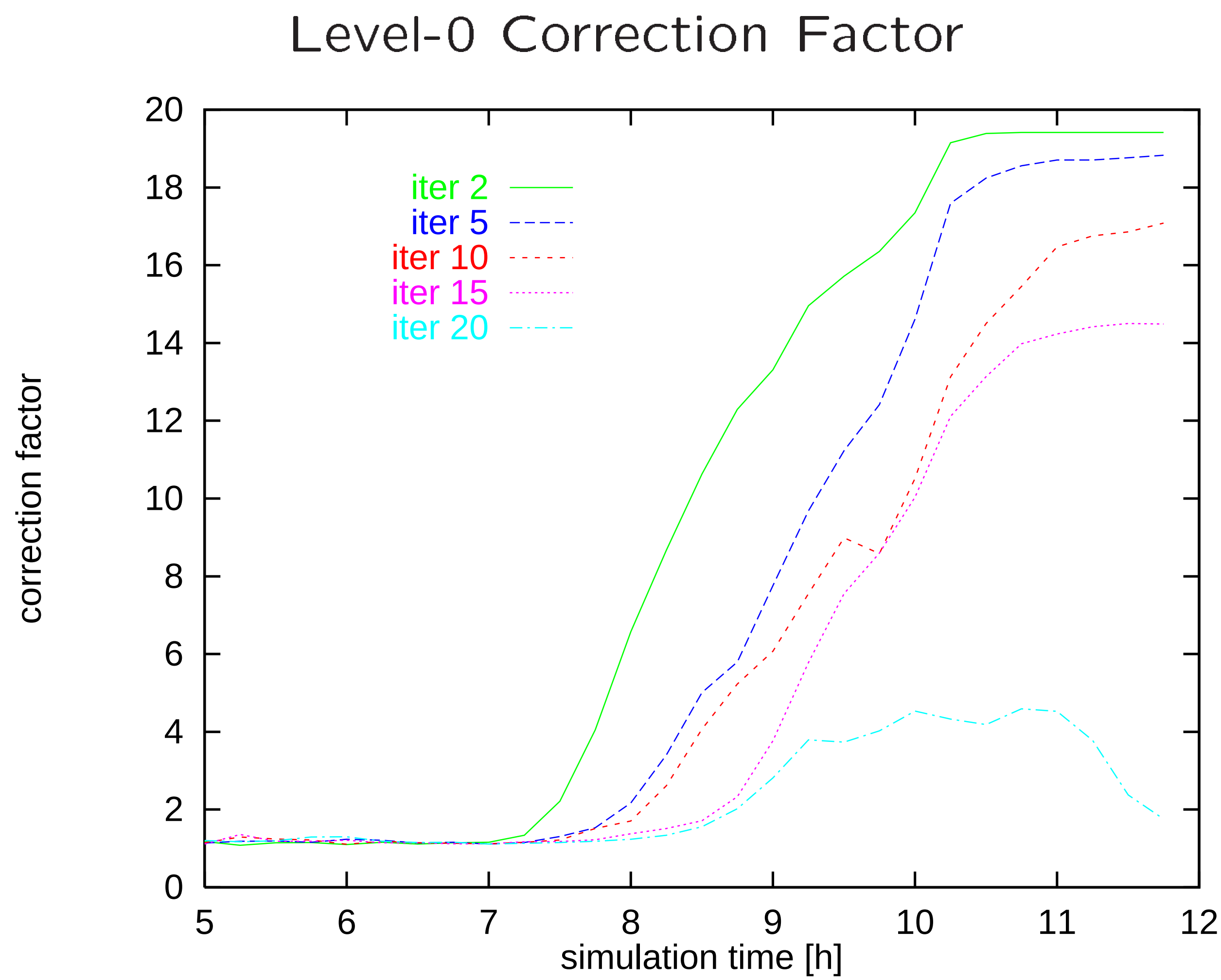
Iterative Routing

Level-0 Correction

Instead of leaving the study-area, the insertions times are shifted outside the simulation period.



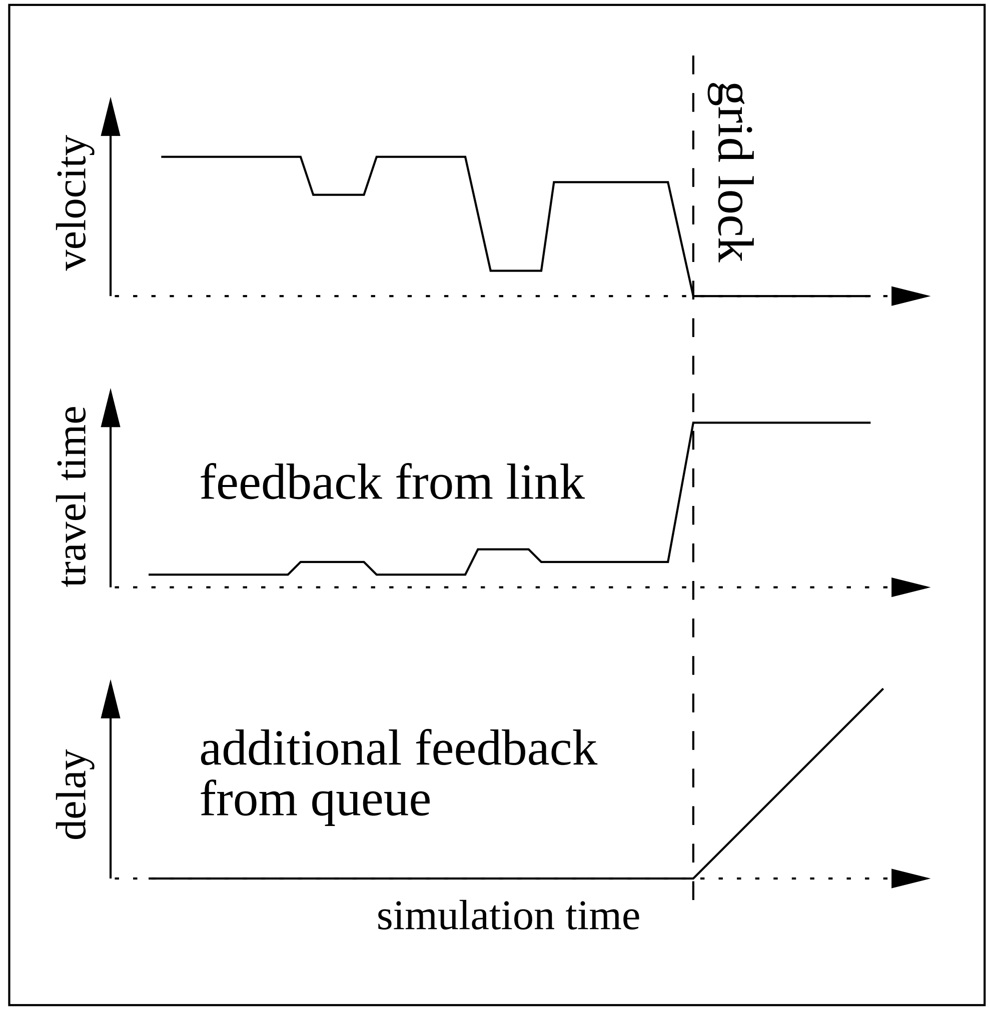
Iterative Routing



Iterative Routing

Queue Feedback

Waiting time at sources is fed back into the planner as additional travel-time of the first link.



Iterative Routing

Conclusion

Re-planning fraction approx. 5%

Select routes by age

Accumulatively re-plan at least twice

Use queue-feedback

Do not use level-0 correction

Use sum of travel-times as convergence criterion