

# 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

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## 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

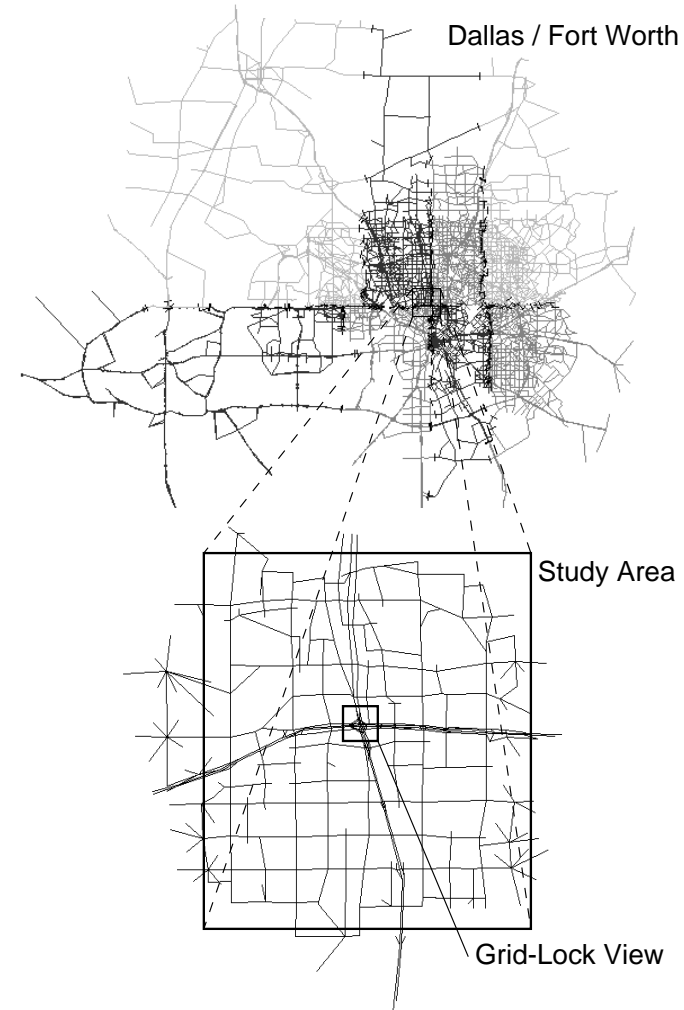
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## Routing:

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:

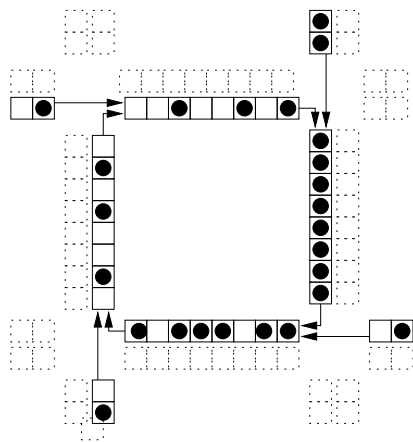
Routes are clipped at the boundaries of the study-area.



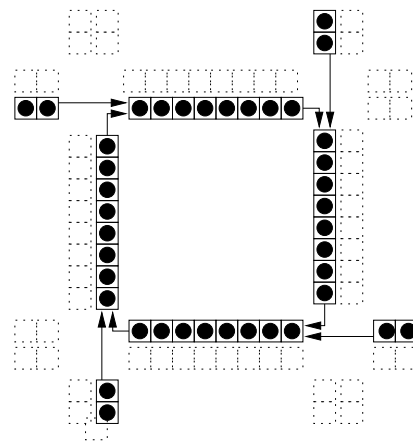
# Traffic Model

## 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

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## 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

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## Computational Speed

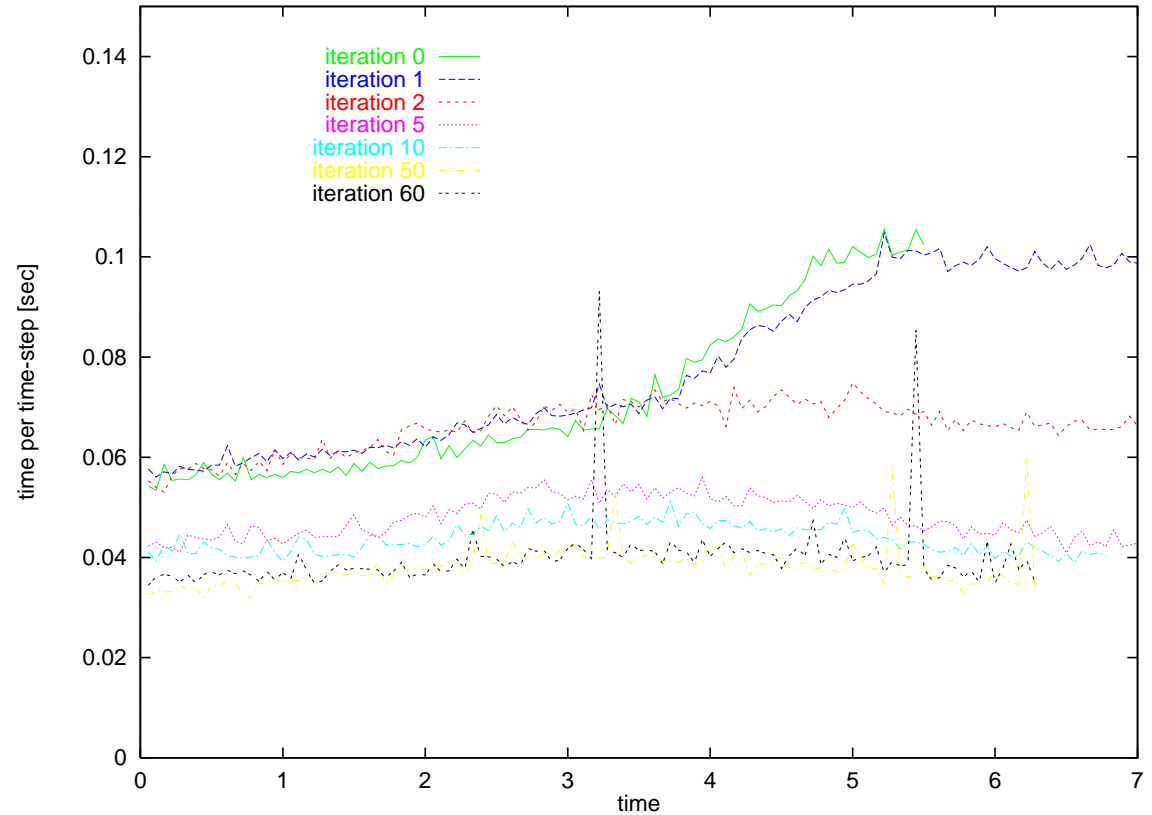
- Real-Time-Ratio is approx. 15 with 8 CPUs  
SUN-Enterprise 4000E (250Mhz)
- Clipping: 6 minutes (overlays planning)
- Simulation: 30-40 minutes
- Planning: 6-15 minutes
- Overall time per iteration: 36-61 minutes



# Traffic Model

## Load Balancing

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



# Iterative Routing

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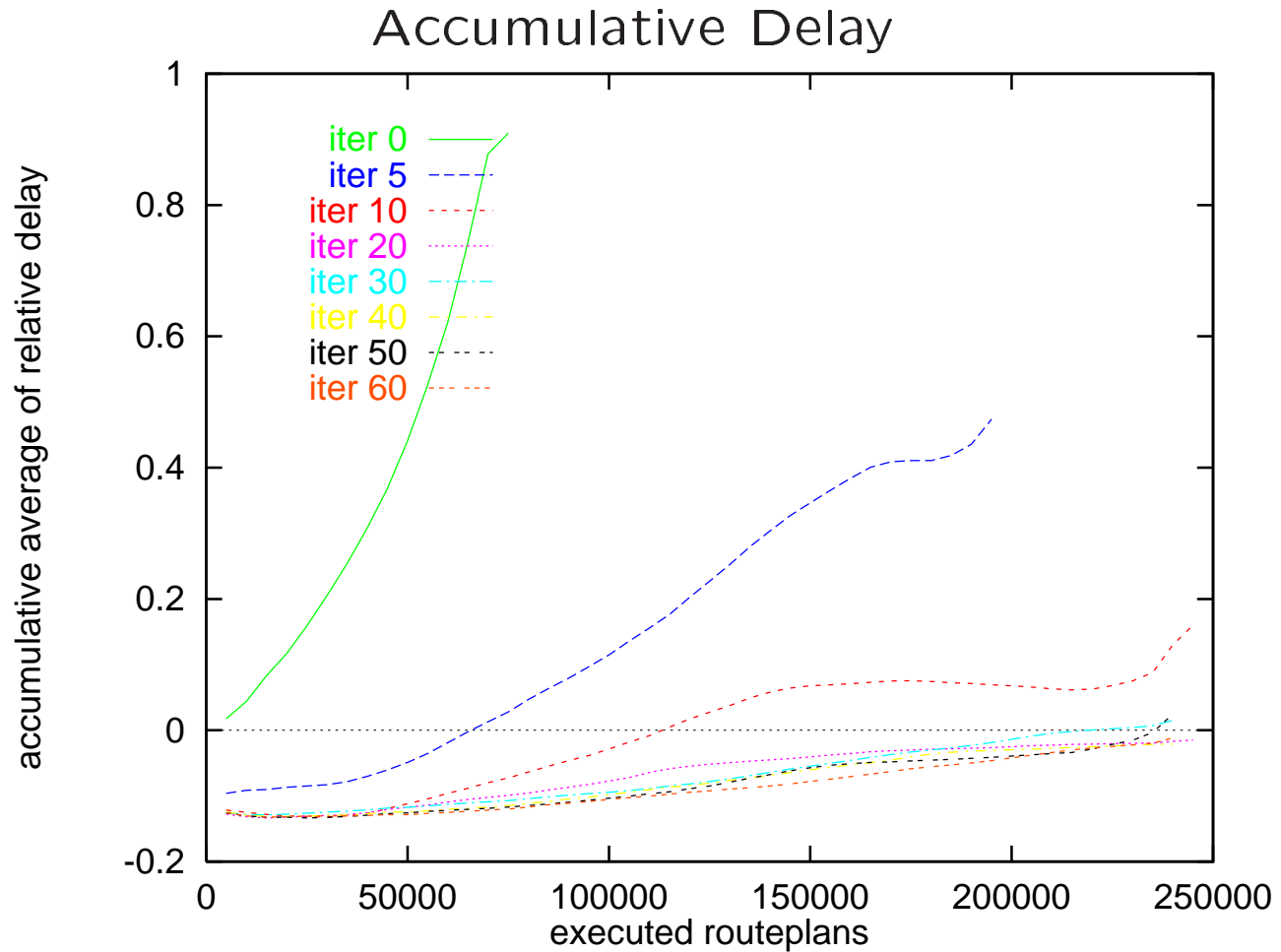
## Basic Algorithm

- 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 necessary.





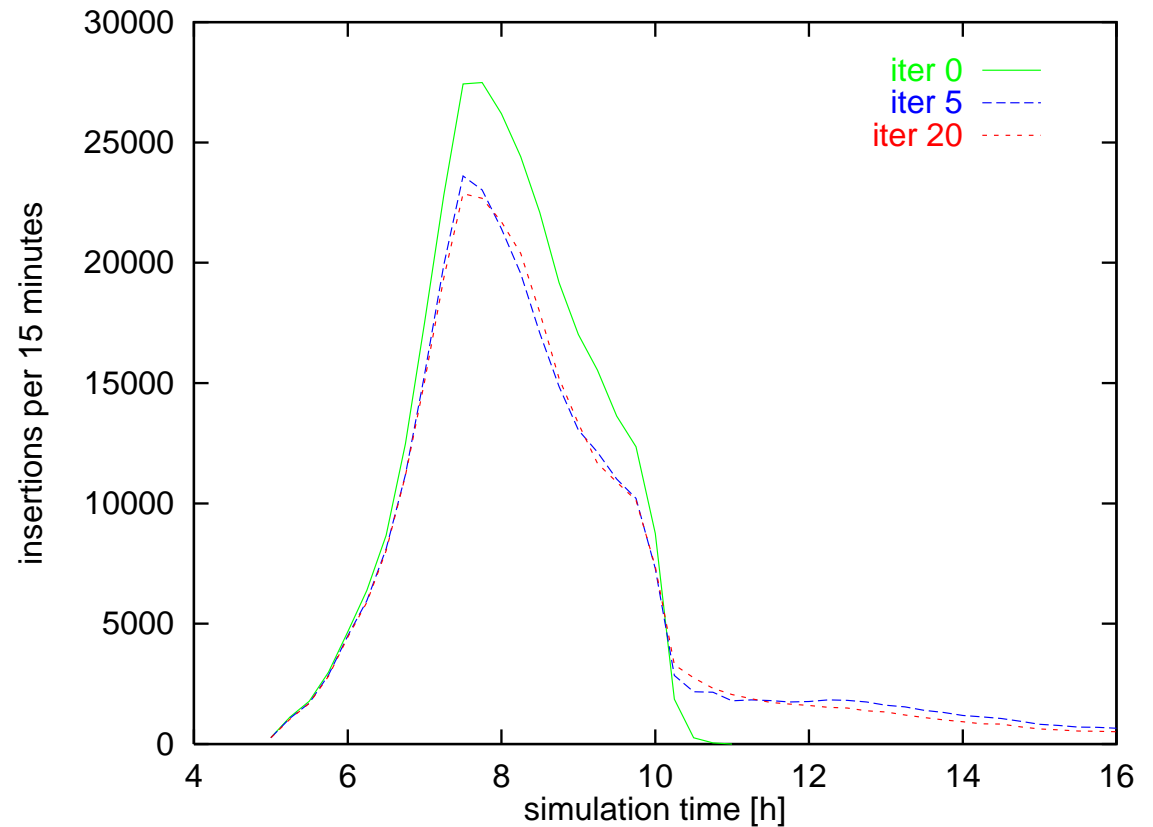
# Iterative Routing



# Iterative Routing

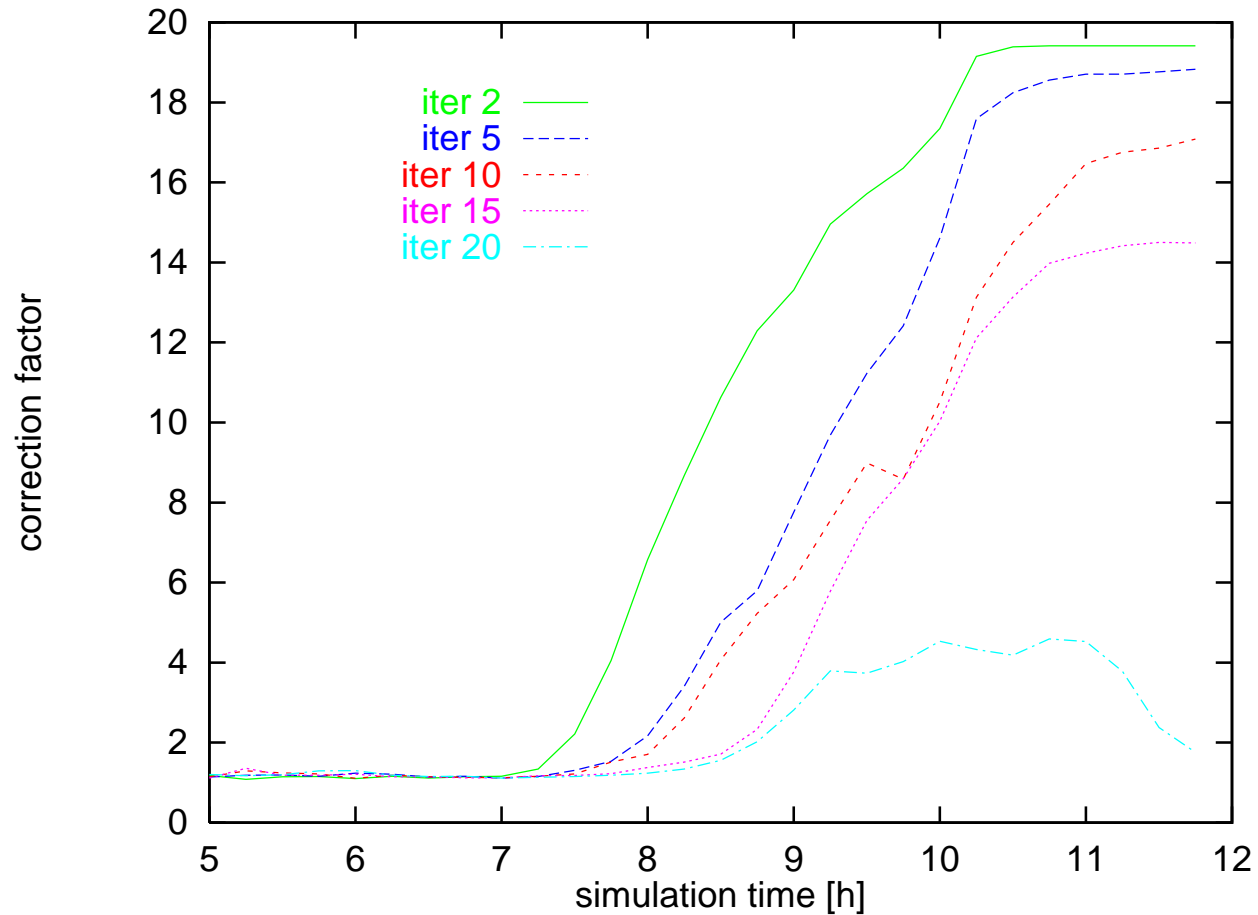
## Level-0 Correction

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



# Iterative Routing

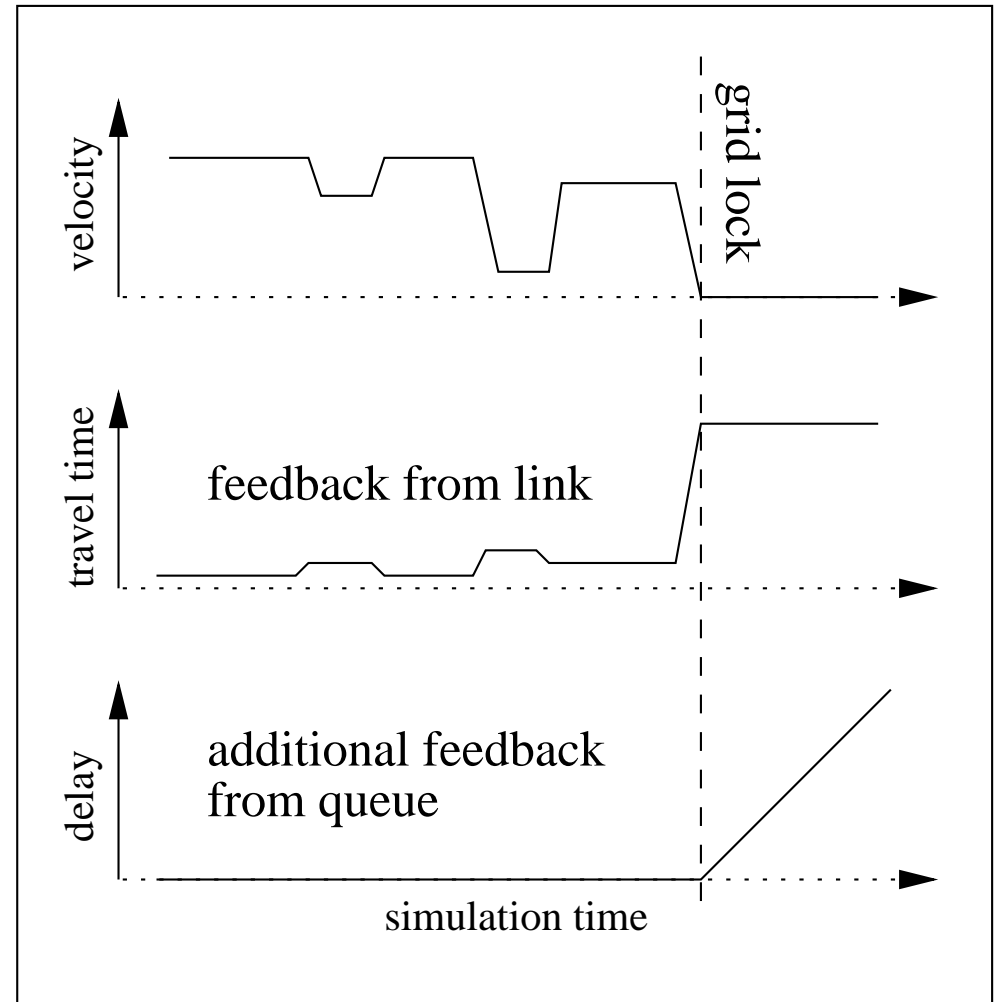
## Level-0 Correction Factor



# Iterative Routing

## Queue Feedback

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



# Iterative Routing

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## 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

