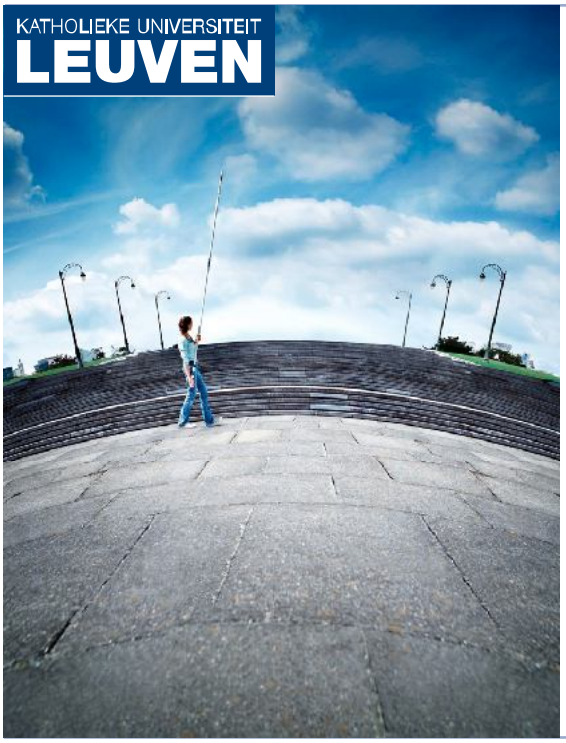
Talk outline

1. Introduction
2. Problem statement
3. Multi-Model traffic simulations
4. Experimentation
5. Conclusions, Lessons learned and future work



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Introduction

Some background

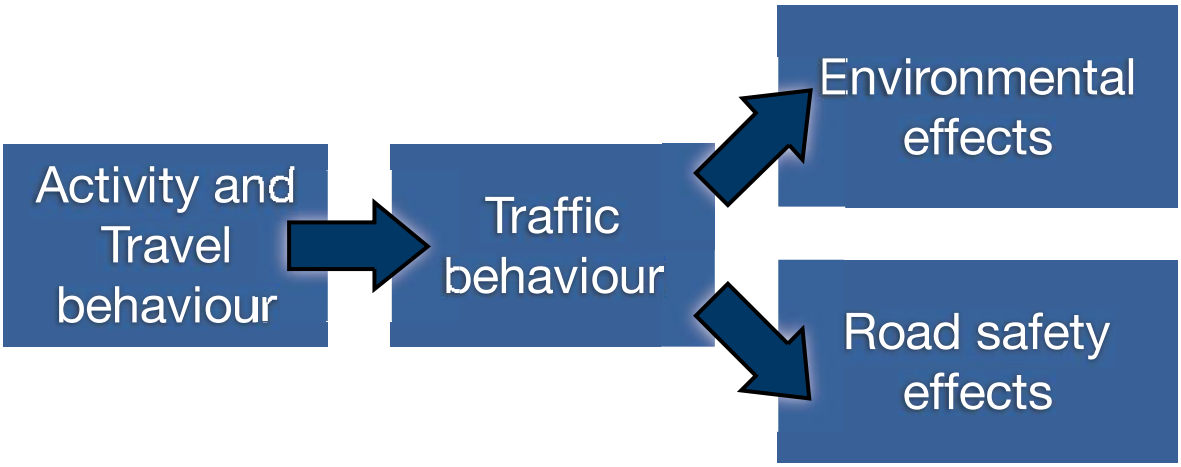
what we consider traffic microsimulation

- Simulation of vehicles in large scale traffic scenarios
- Every vehicle is explicitly modeled in the simulation
- Every vehicle is controlled by a software agent
  - Agents determine routing decisions *during* the simulation

Some background

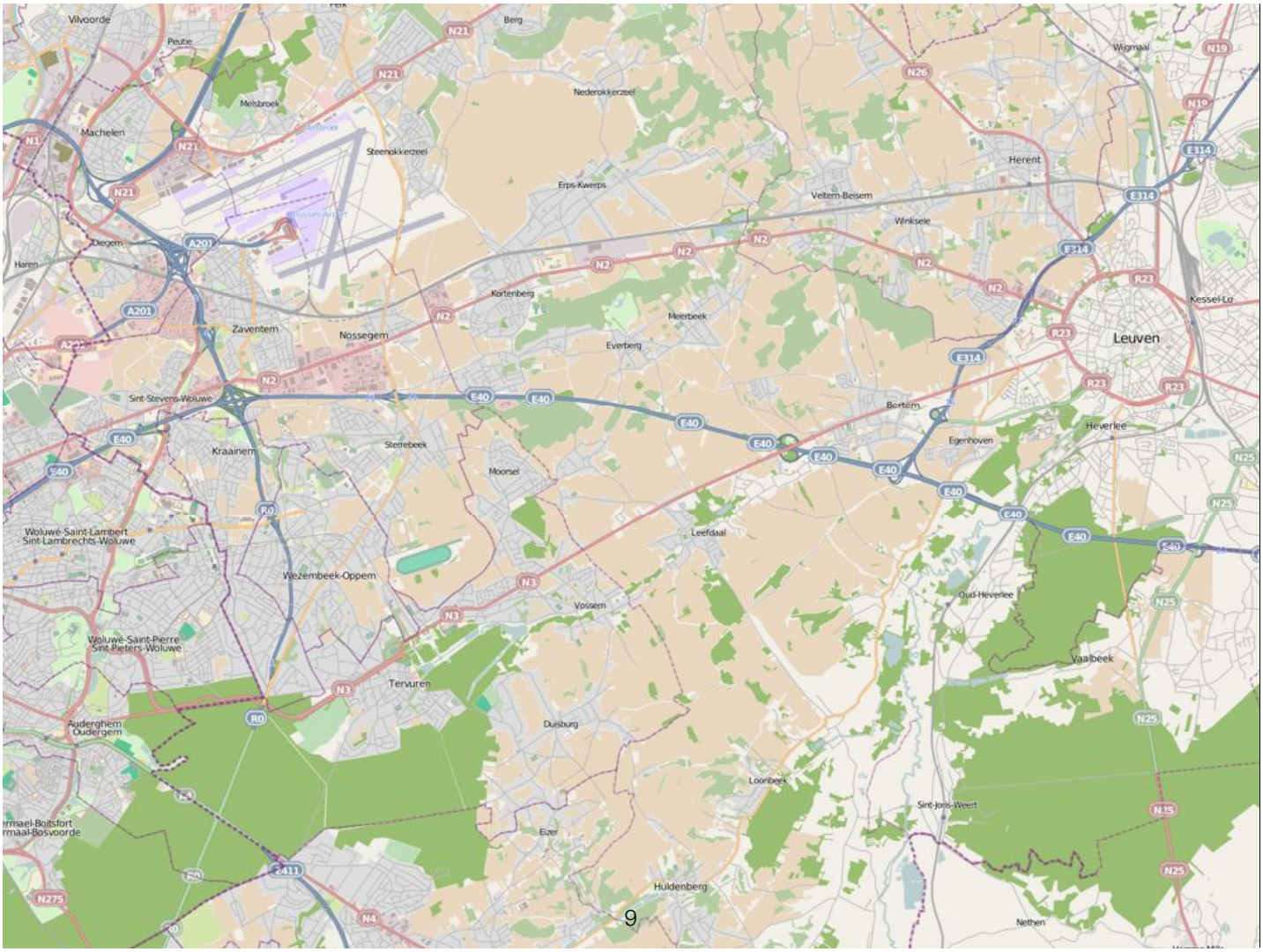
or why am I here?

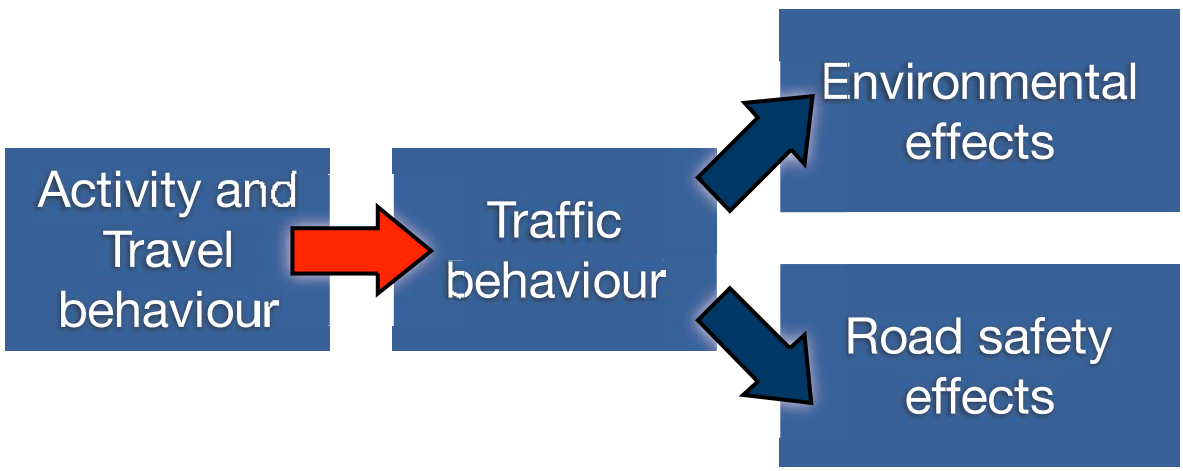
- Why do we use (traffic) microsimulations
  - Simulation for us is often the only way of validating our approach
  - Involvement in the MASE project
- Disclaimer: *simulation and modeling is not our primary focus or expertise*



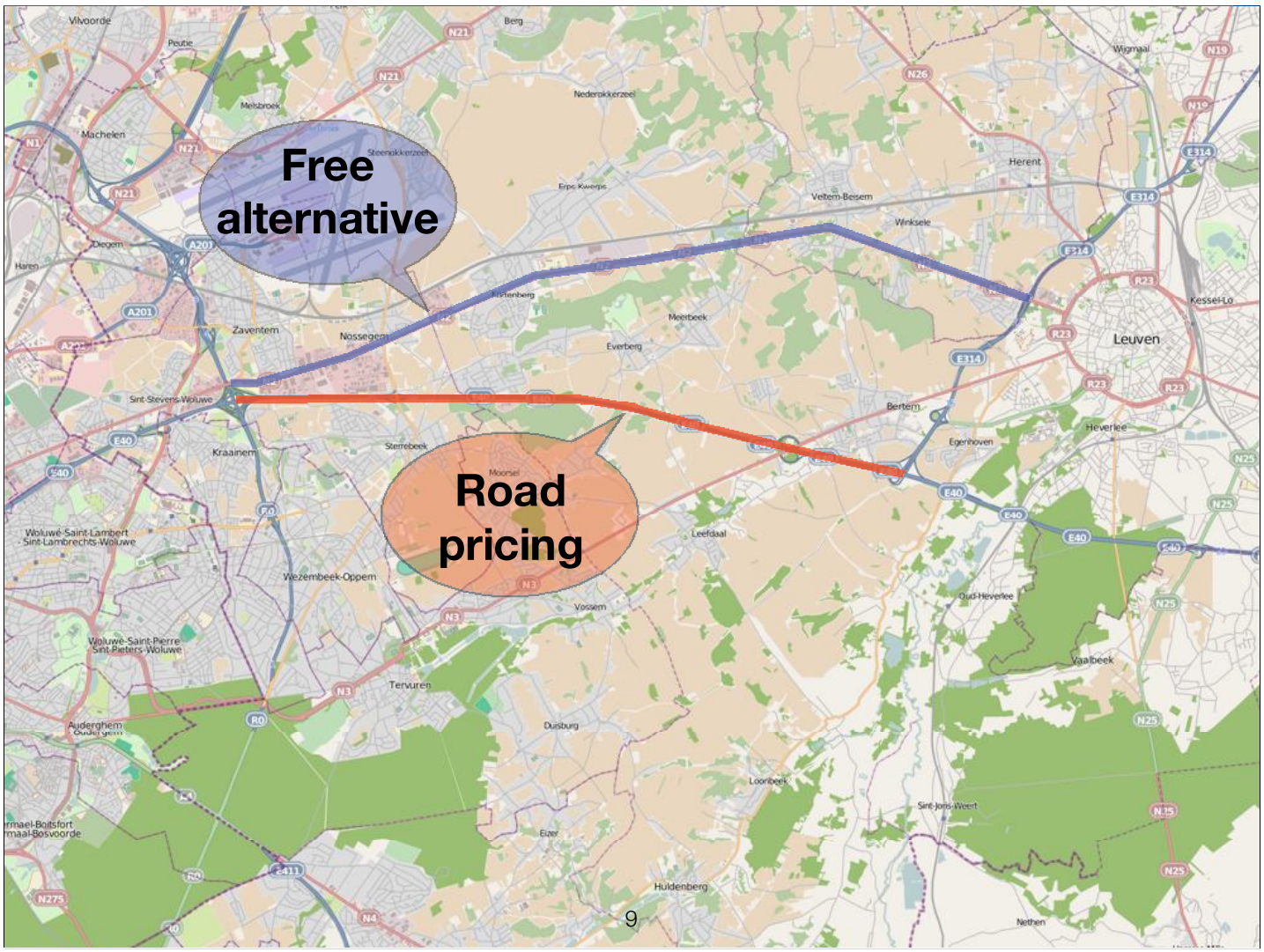
A Model-Based Approach for Evaluating the Safety and Environmental Effects of Traffic Policy Measures

Problem statement





A Model-Based Approach for Evaluating the Safety and Environmental Effects of Traffic Policy Measures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Nethen


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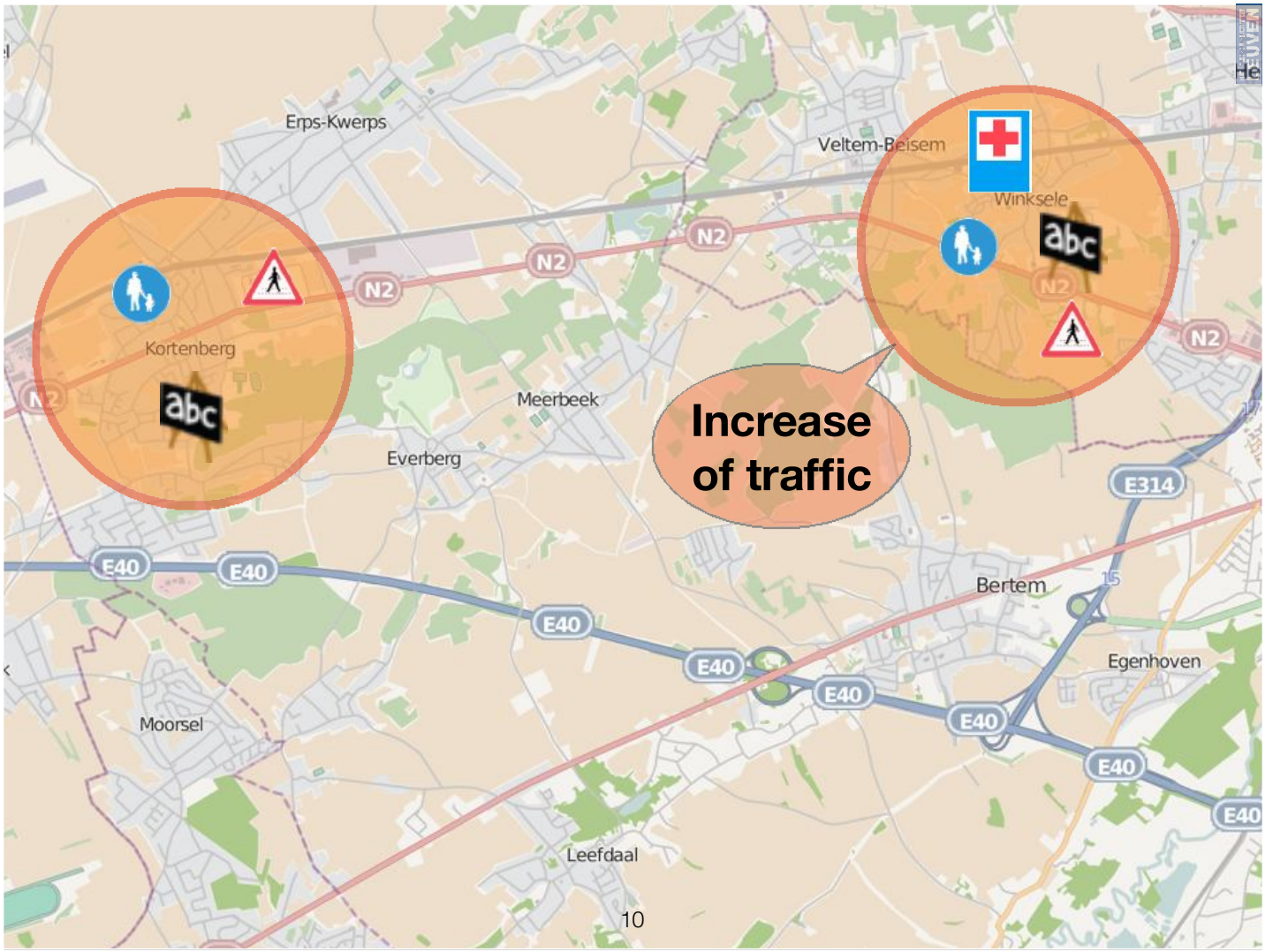
Large scale simulations are needed to capture these effects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Increase of traffic
Bertem
Egenhoven
Moorsel
Leefdaal
N2
E40
E314
abc


Erps-Kwerps
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Winksele
Kortenberg
Meerbeek
Everberg
Increase of traffic
Bertem
Egenhoven
Moorsel
Leefdaal
N2
E40
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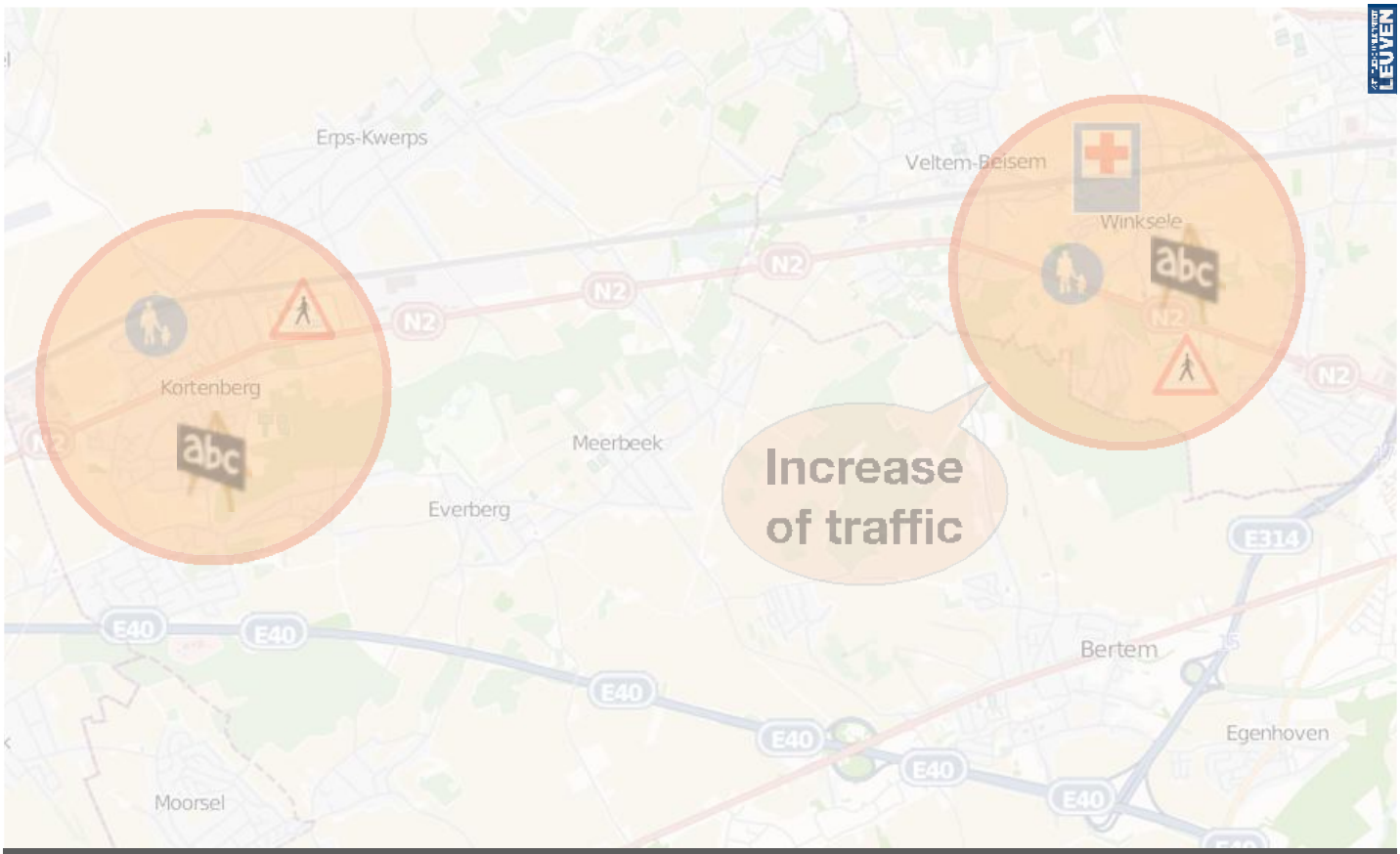
Microsimulation is required

- Software agents responsible for activity based routing.

  Routes will be chosen depending on the activity of the driver

- Clear link between activity and traffic.

  Insight in responsibility for emissions, safety hazards, etc...



Highly detailed simulation is needed to study impact of traffic on pollution, emissions, ...

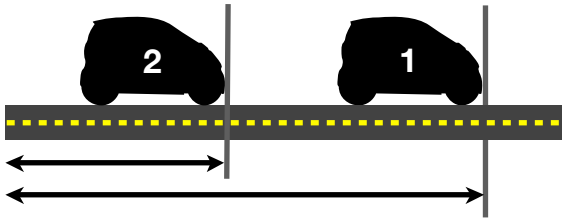
Multi-Model Traffic Simulations

Our approach

- Not starting with purely technical solutions
- Instead, focus on domain specific opportunities in the traffic domain

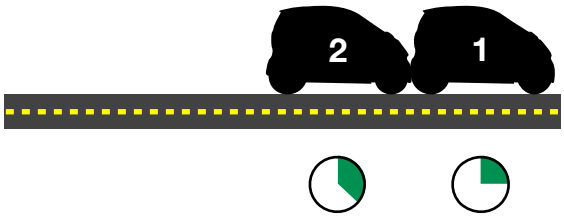
2 models, 2 possibilities

Detailed model



[1] P. Paruchuri, A. Pullalarevu, and K. Karlapalem. Multi agent simulation of unorganized traffic. In *Proceedings of the first international joint conference on Autonomous agents and multiagent systems: part 1*, pages 176–183. ACM New York, NY, USA, 2002.

Queue model



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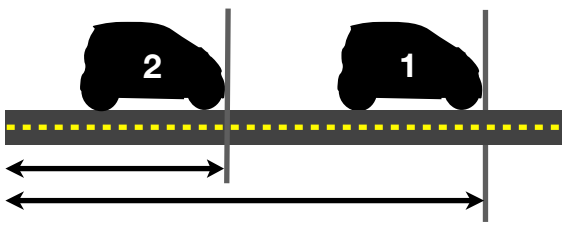
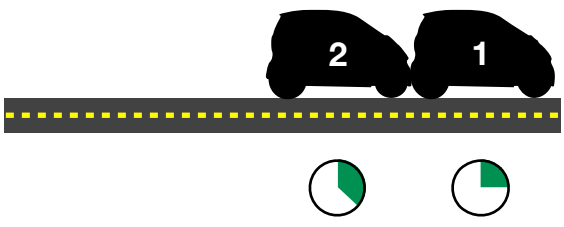
2 models, 2 possibilities

Detailed model

Queue model





− computationally expensive	+ computationally cheap
+ accurate & detailed	− no vehicle interactions

How to switch?

From detailed to queue

For every vehicle, given the vehicles current position, calculate how long it would take the vehicle to reach the end of the segment.

distance → time

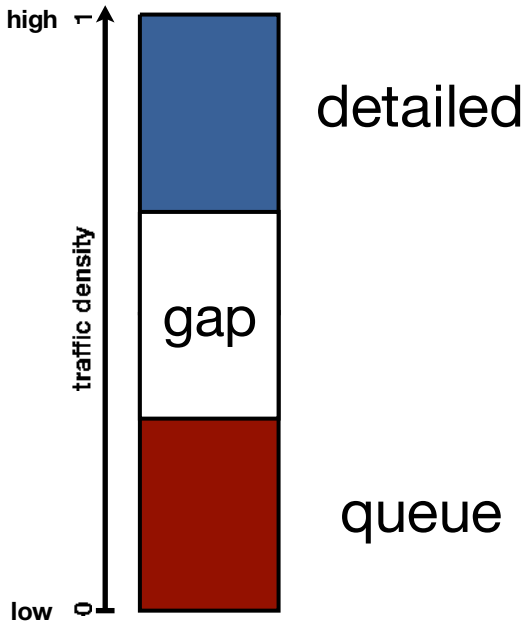
From queue to detailed

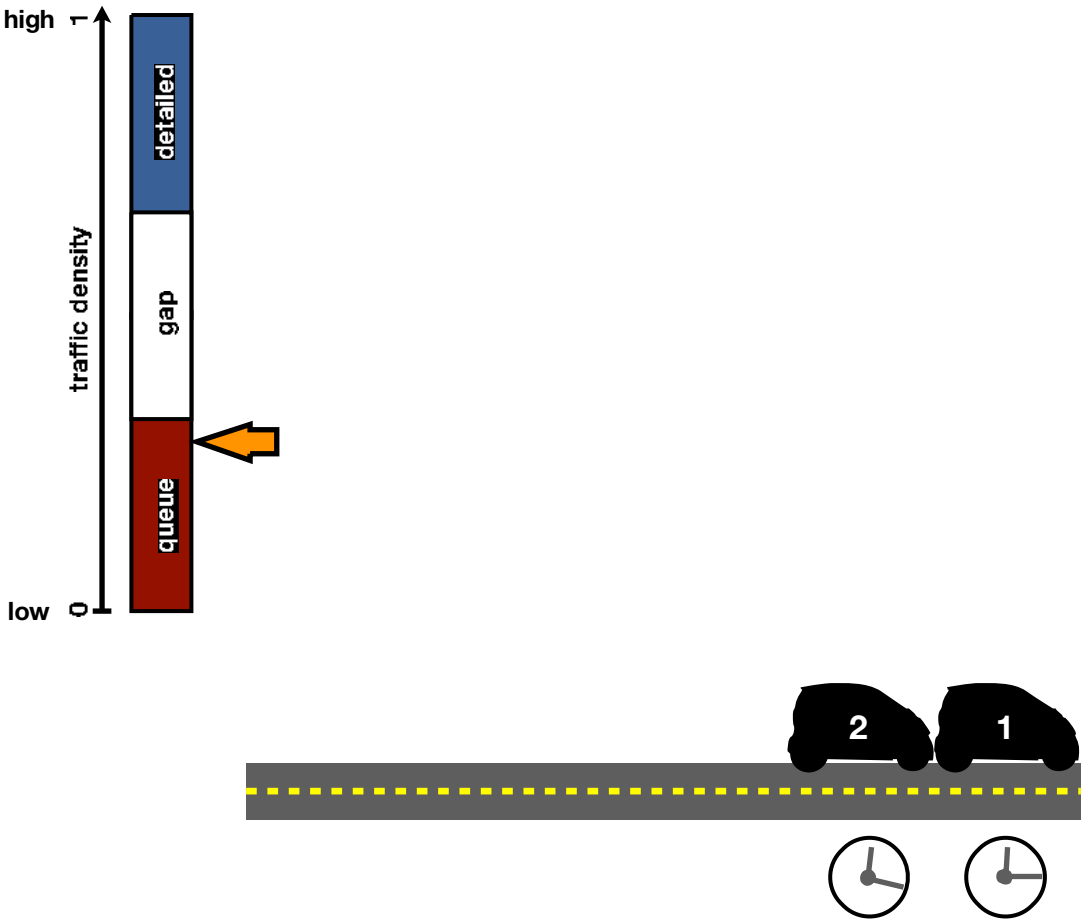
For every vehicle, given its arrival at the end of the segment, calculate the distance it still has to travel and move it back this far.

time → distance

When to switch?

- Need for monitoring
- Need for a heuristic
  - Looking at location
  - Looking at situation
- Avoid “flickering”




high
1
traffic density
0
low
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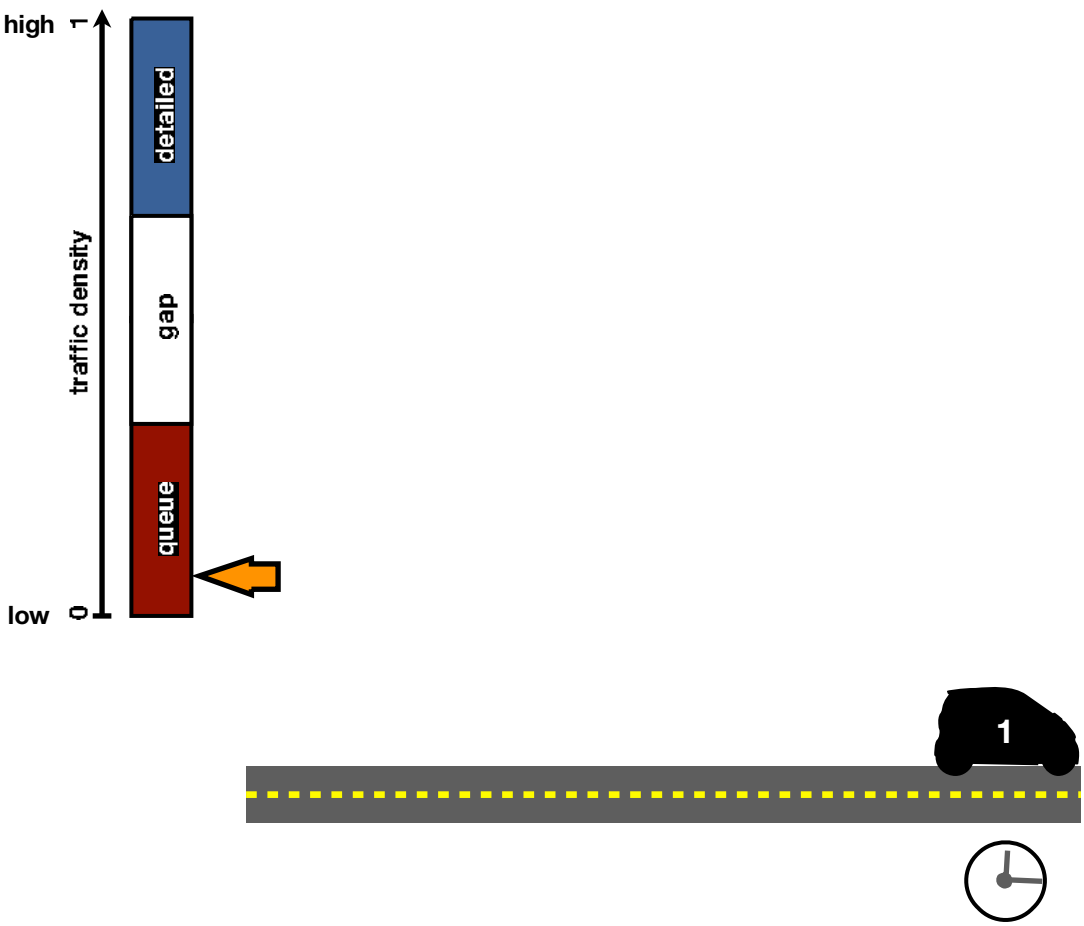
gap
queue
2
1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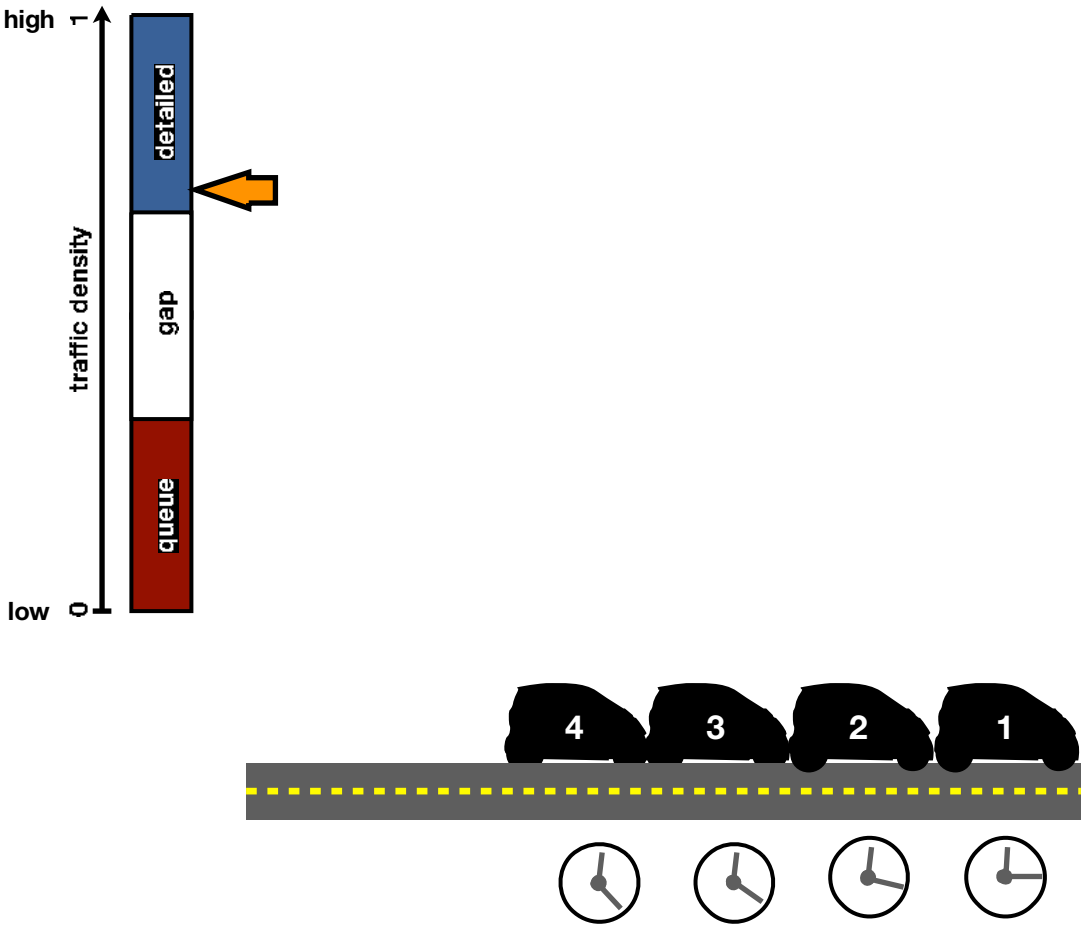
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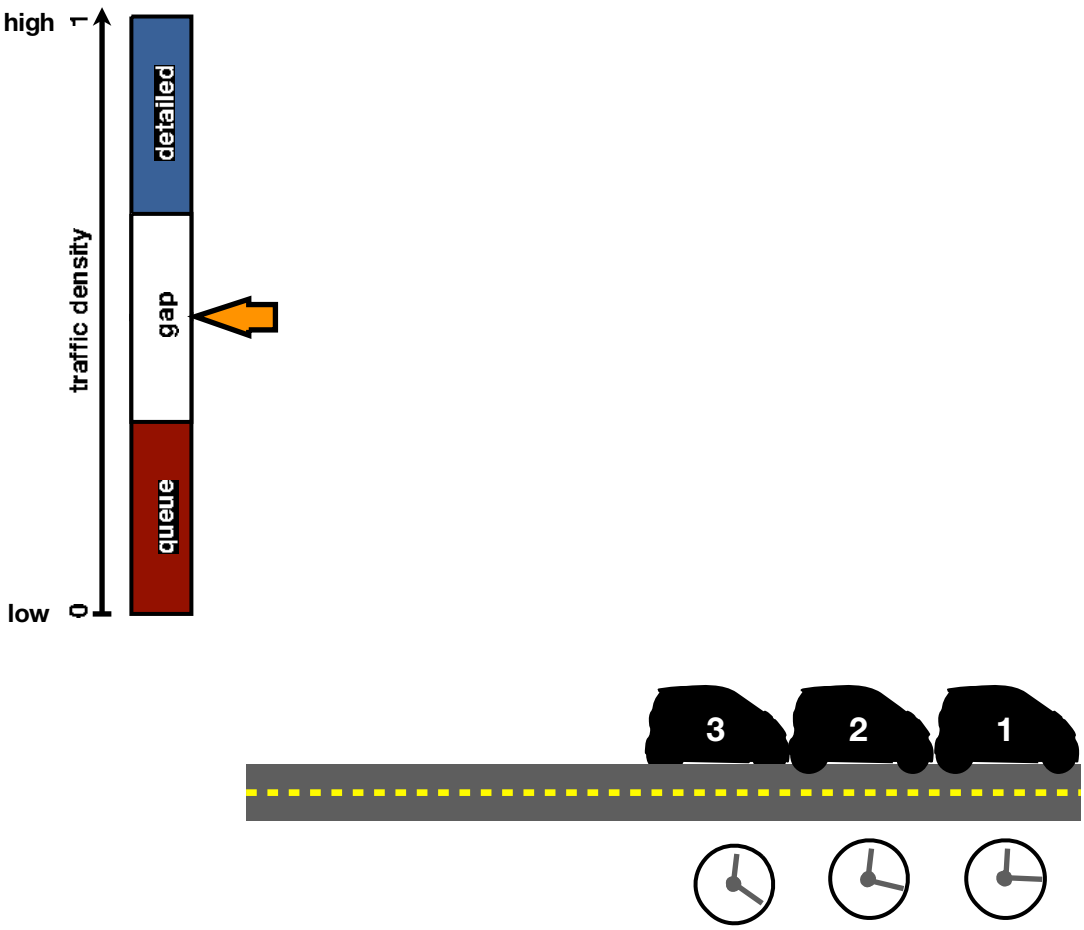
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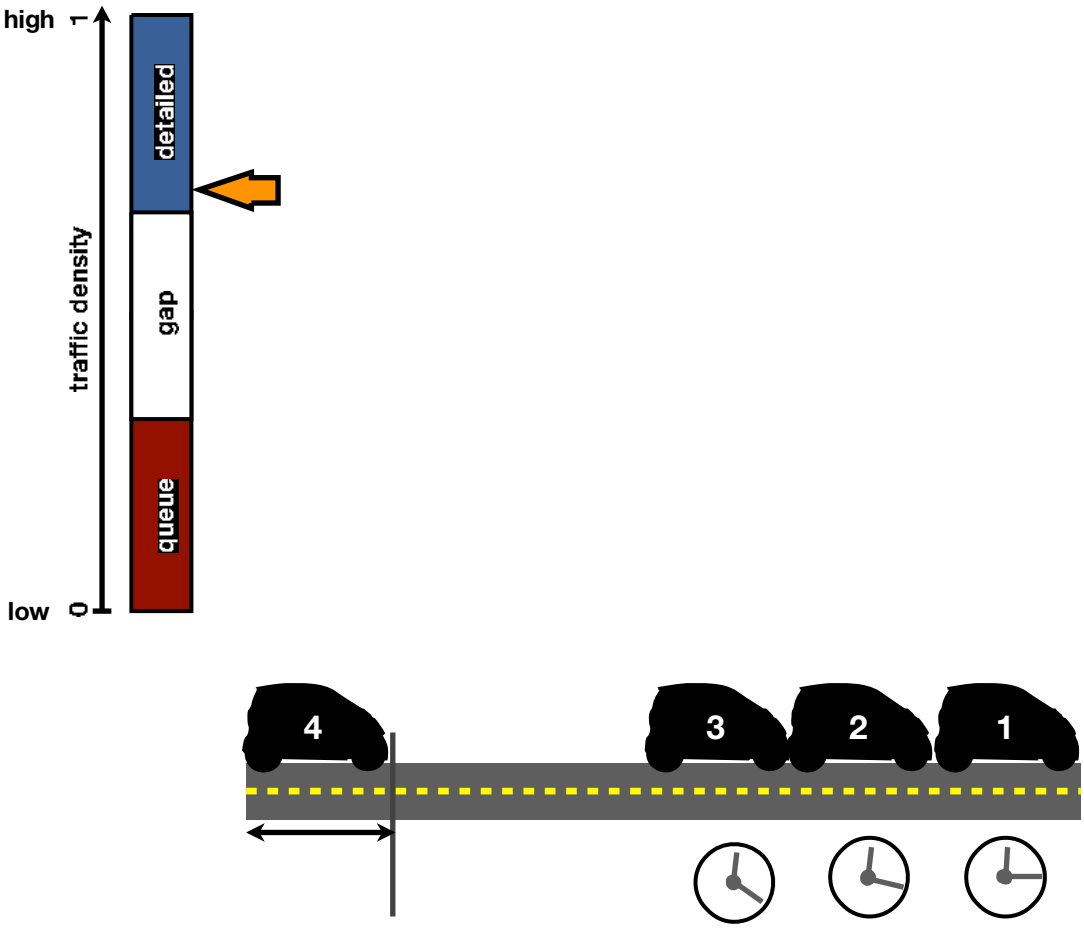
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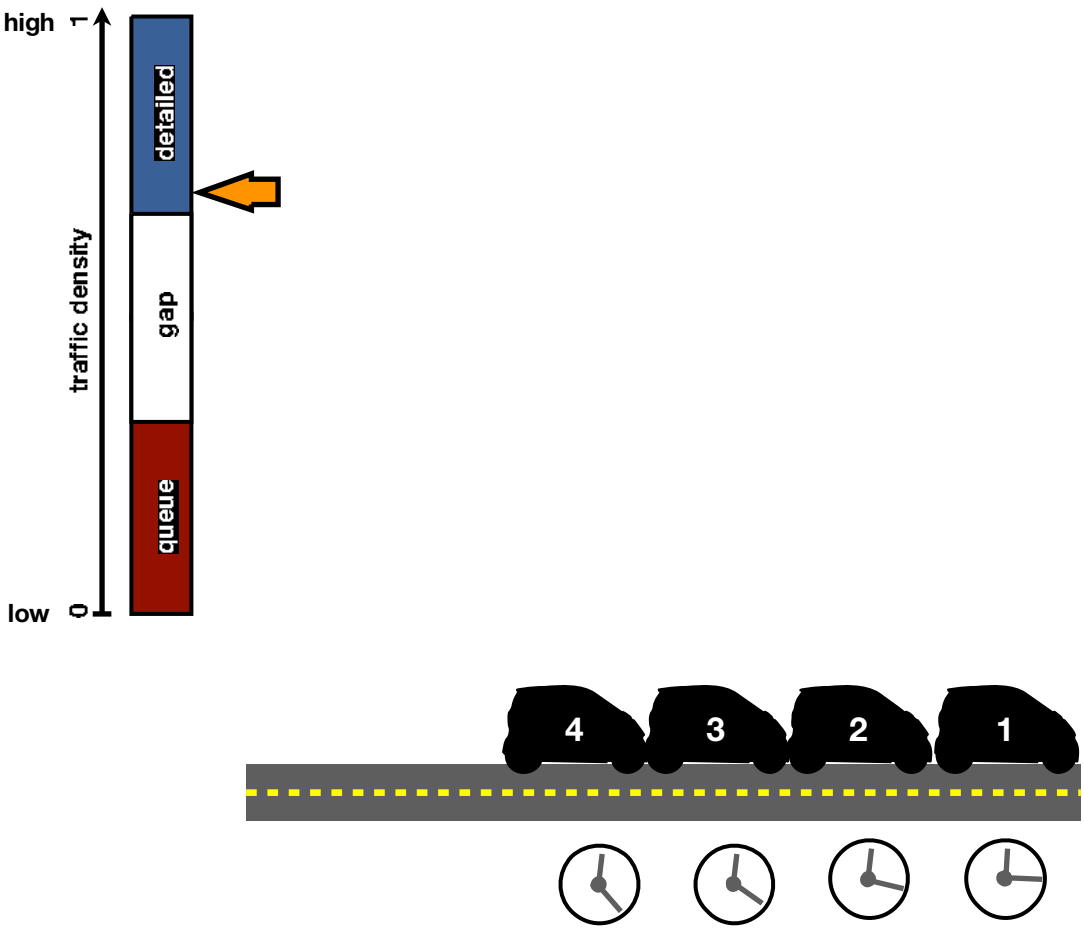
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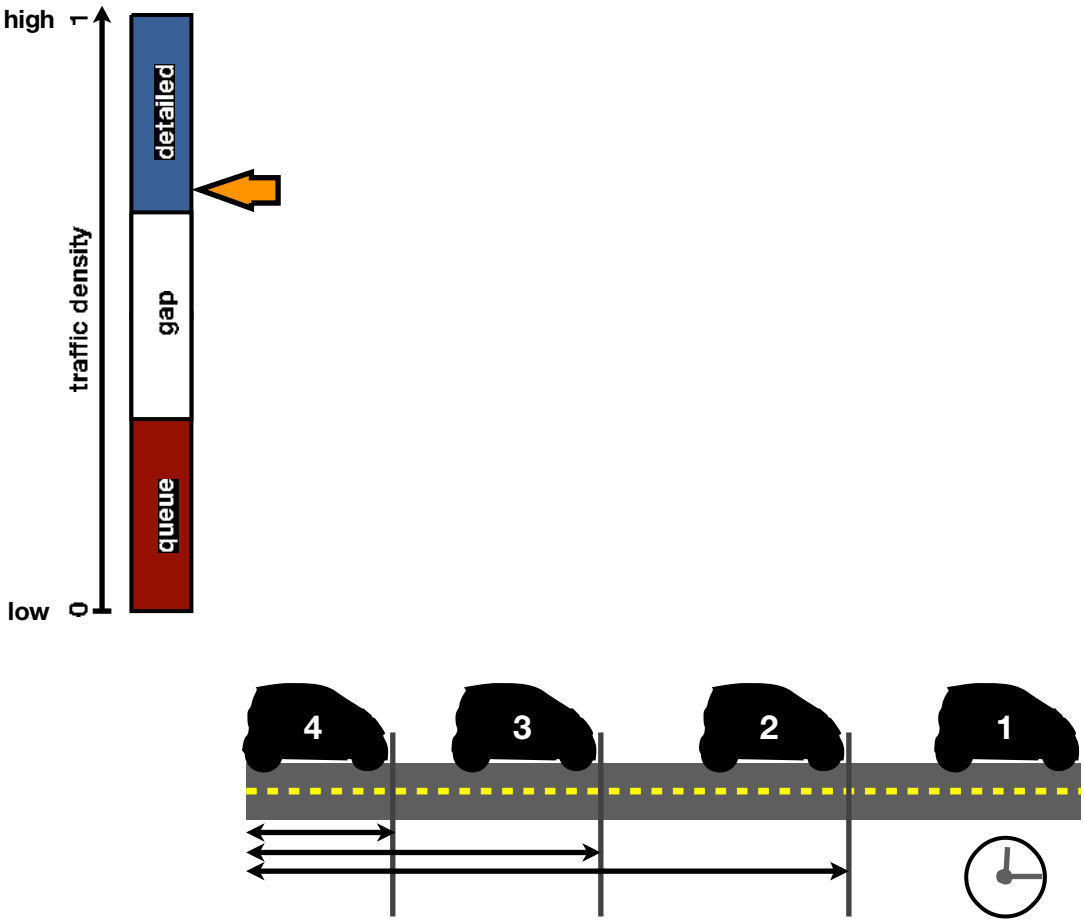
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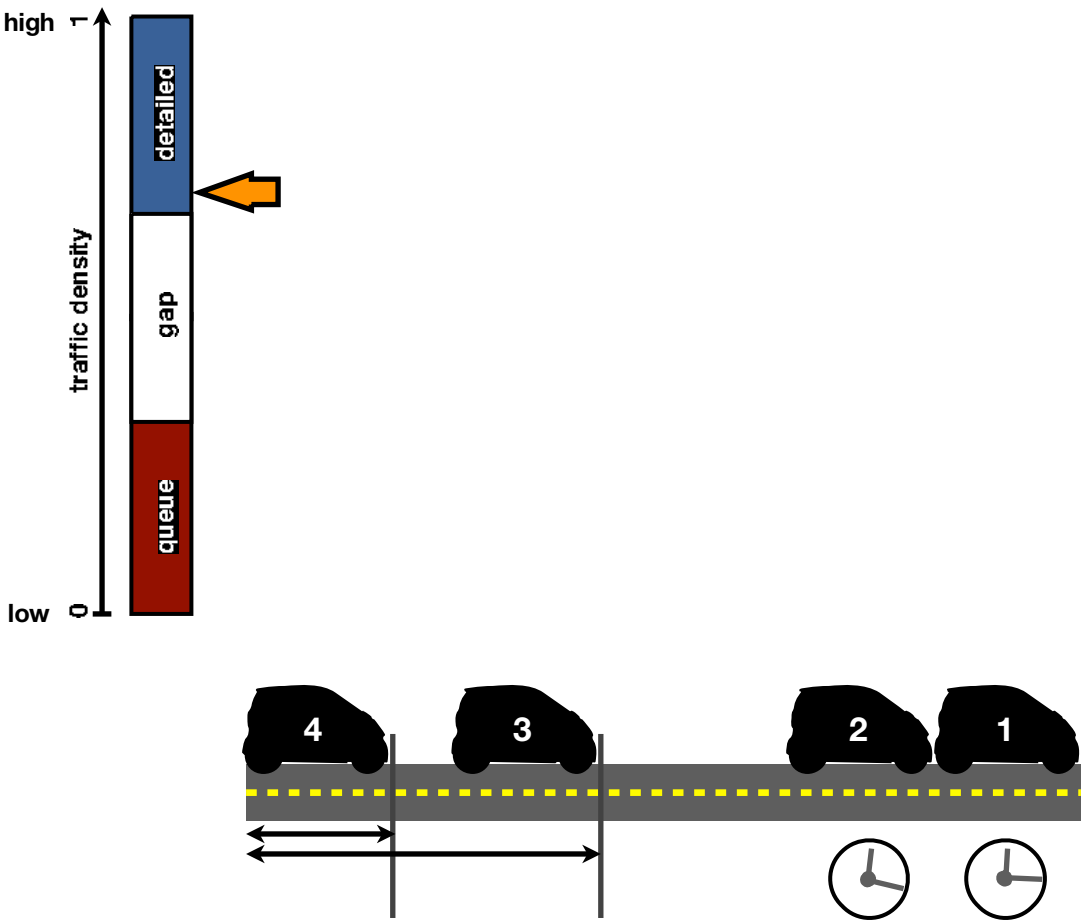
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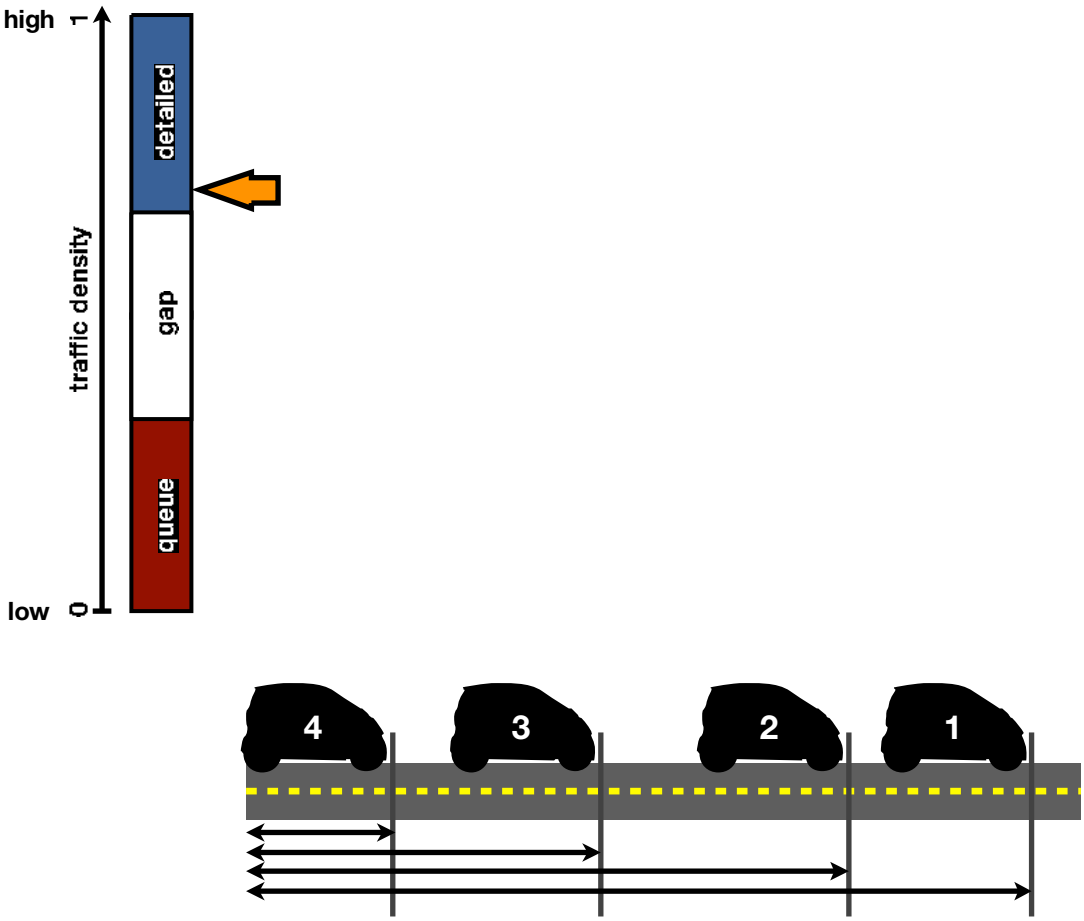
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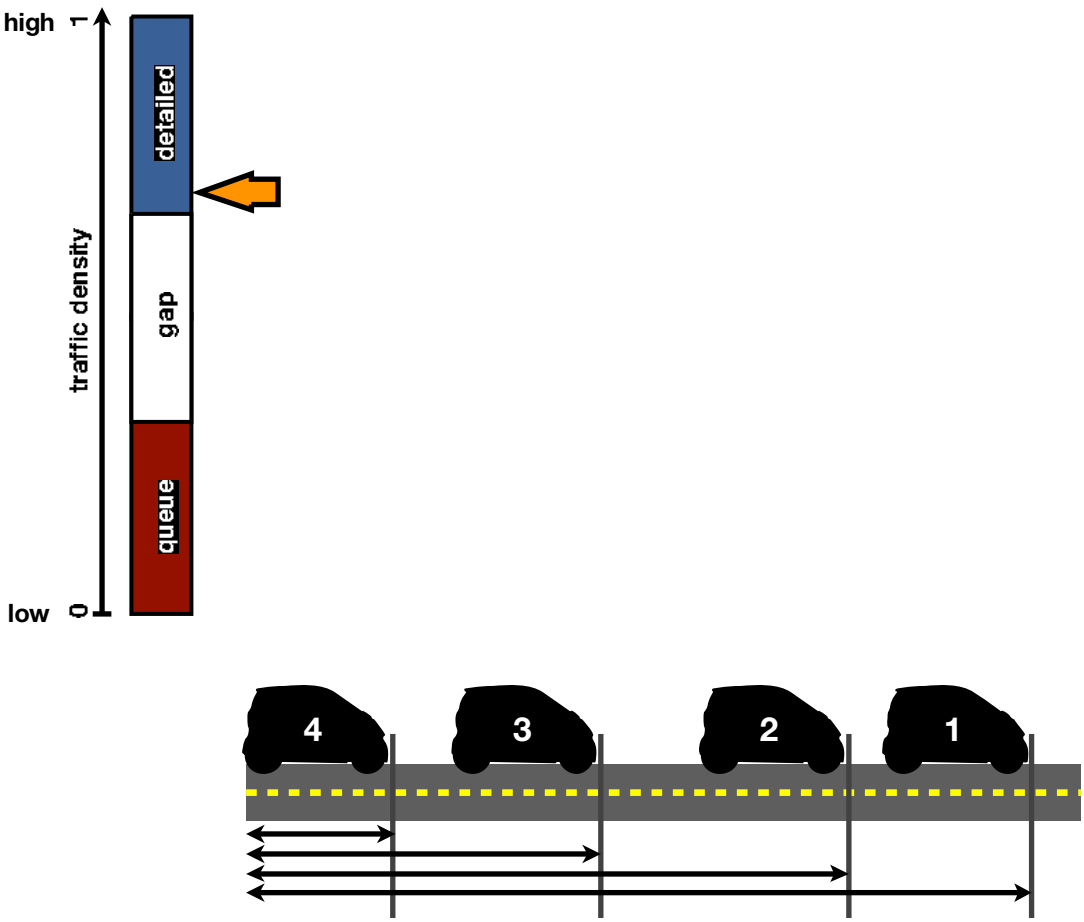
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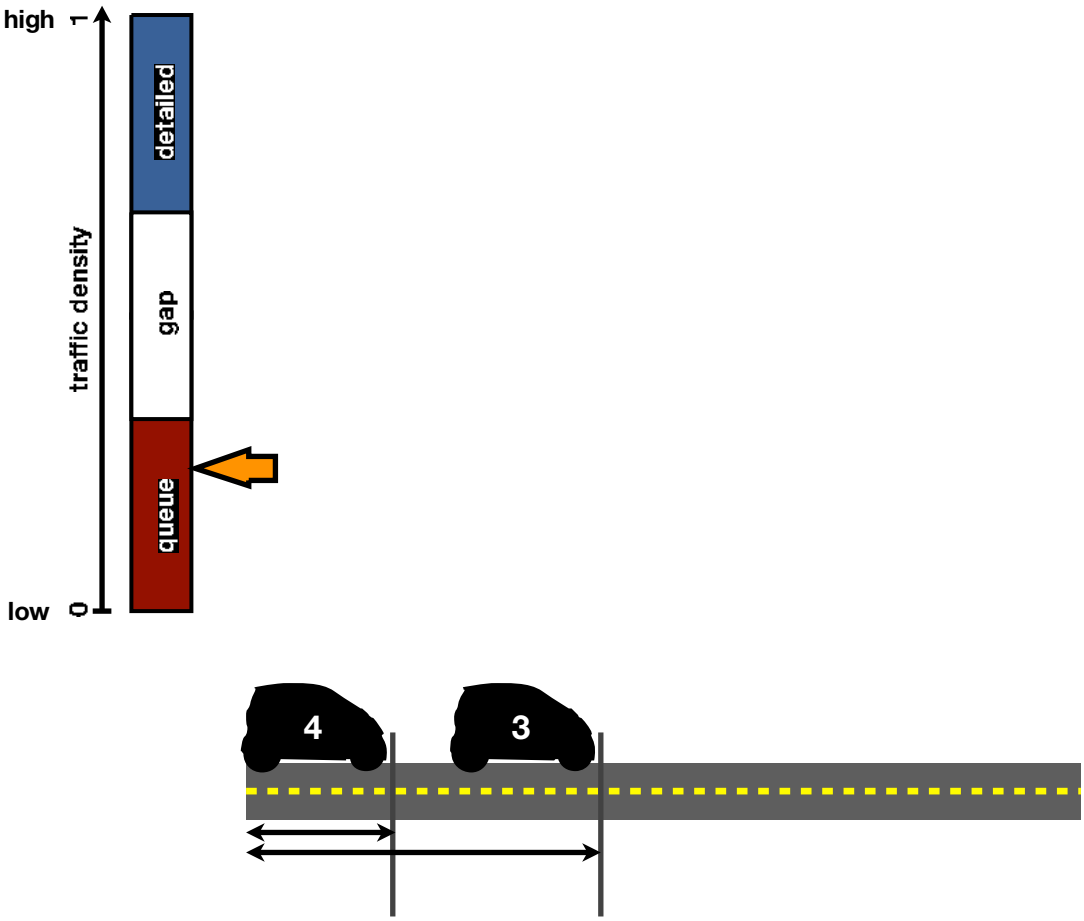
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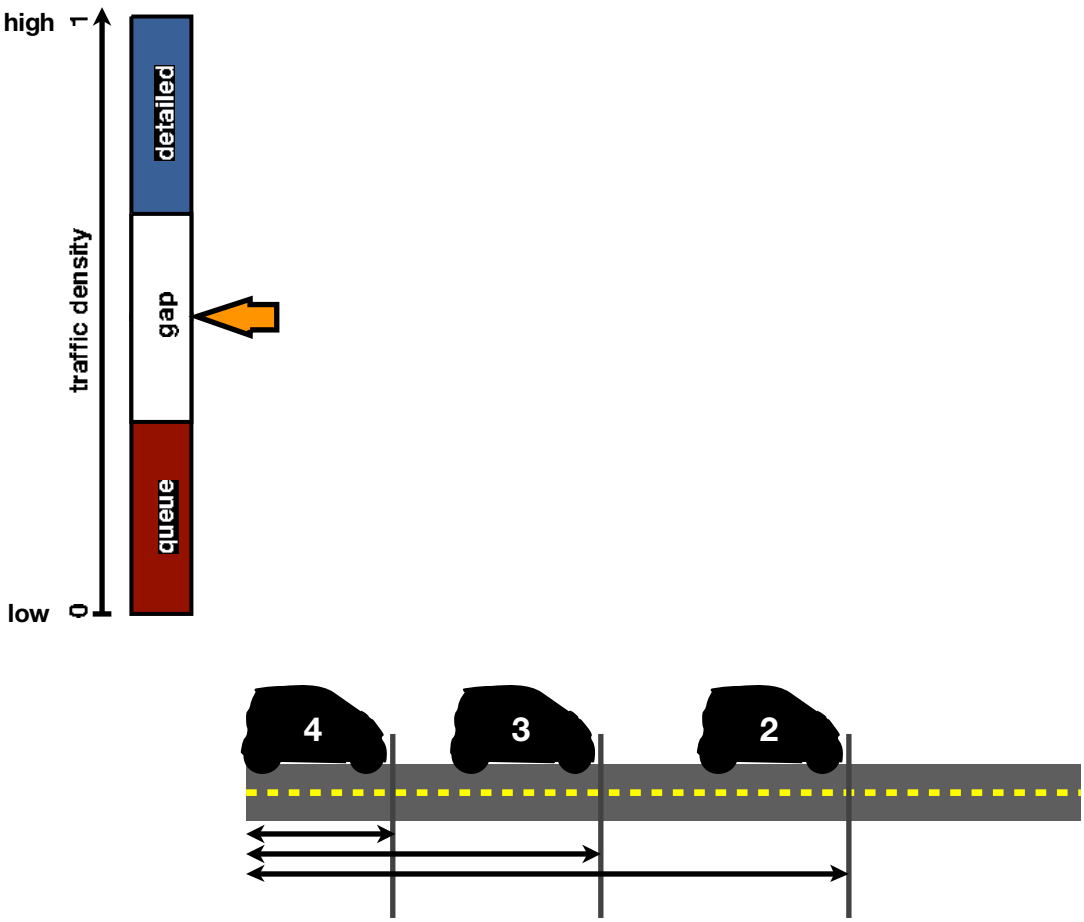
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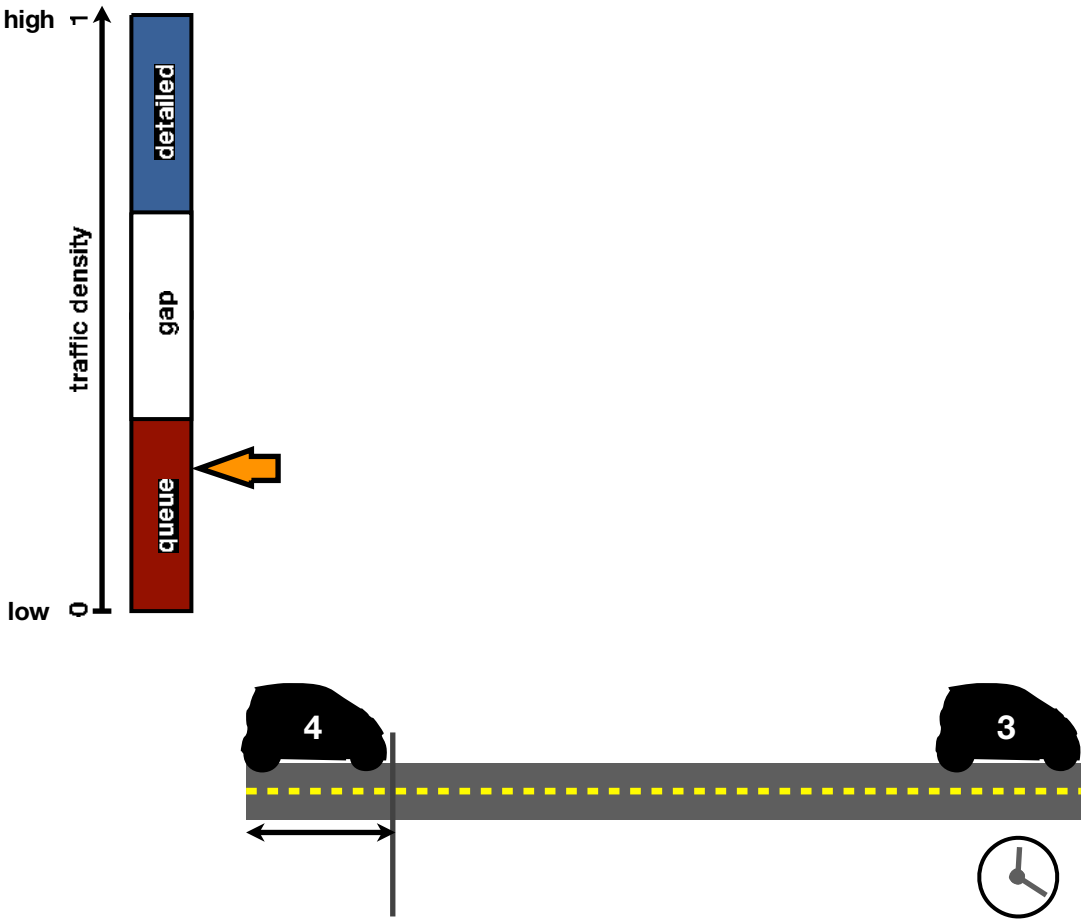
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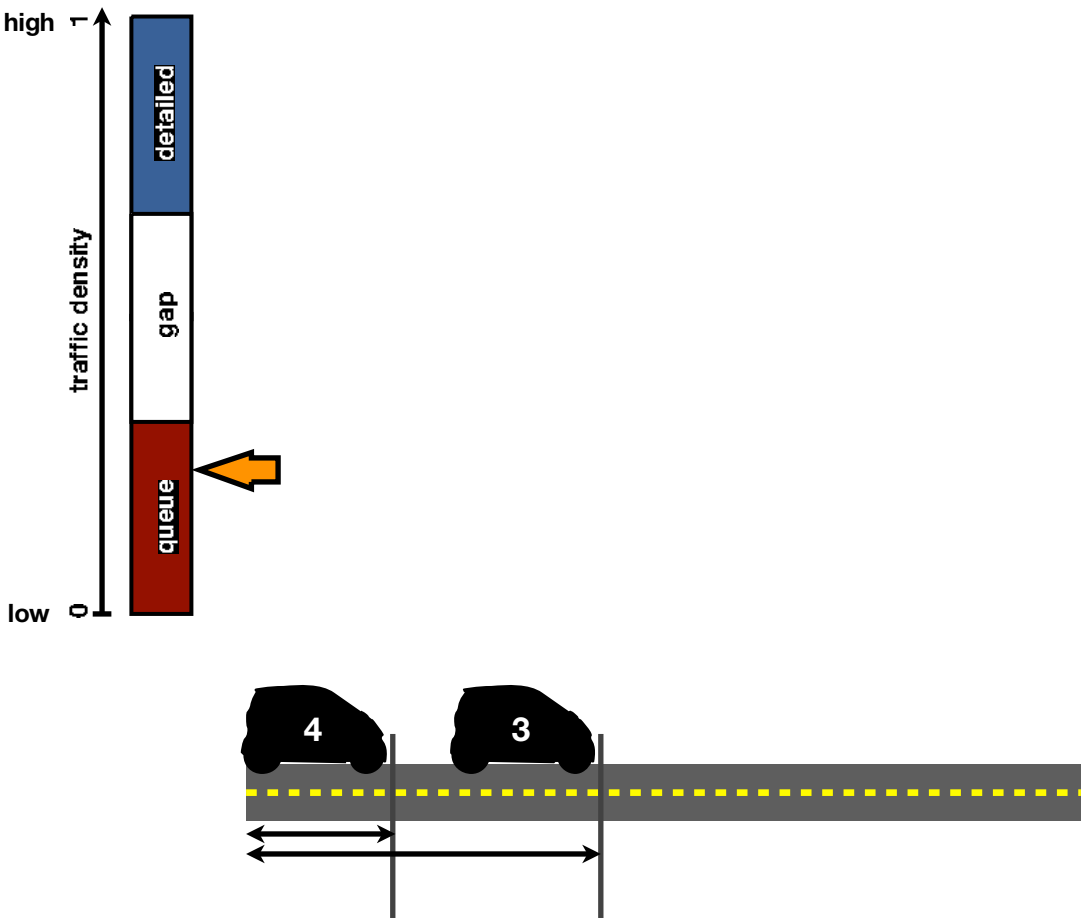
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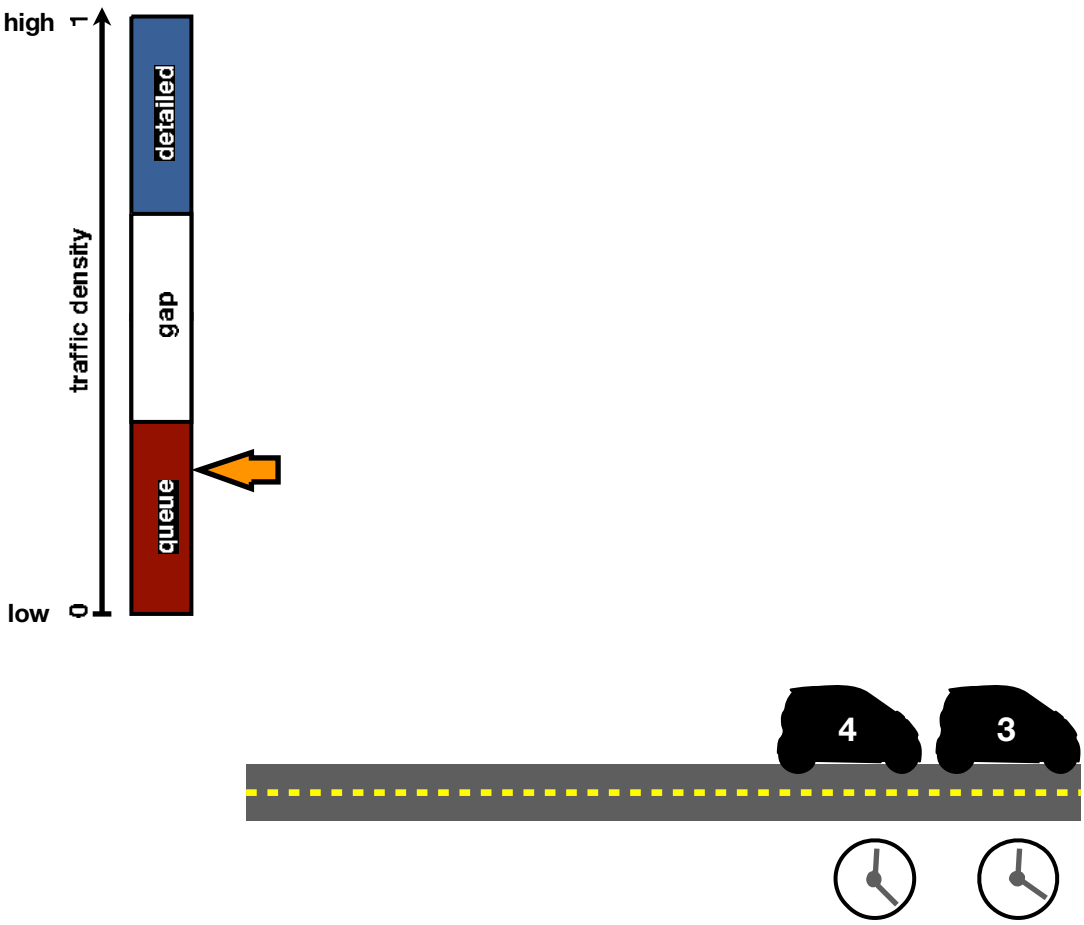
Experimentation



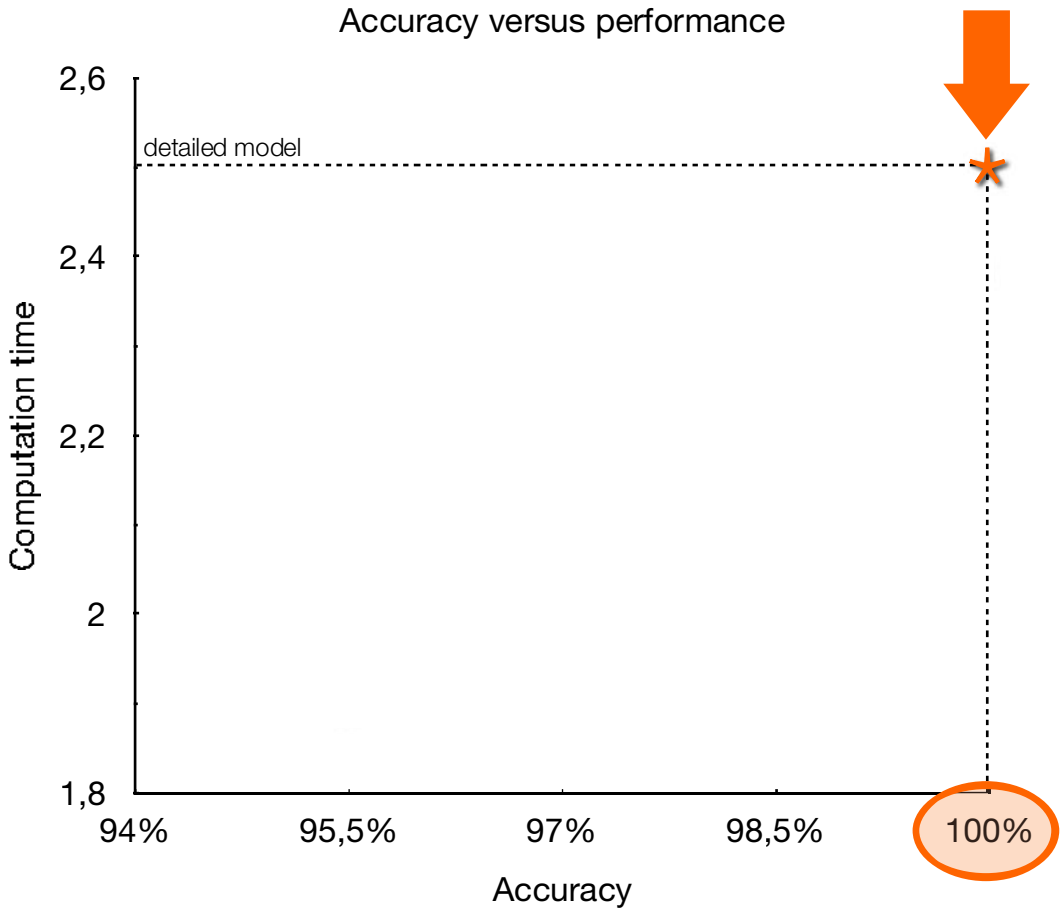
Experiment heuristic

- The heuristic used tries to maintain the accuracy
- The heuristic is parameterized
- Finding good parameters is one of the simulation goals

Experiment setup

- Small traffic network.
- Various traffic input rates.
- Accuracy defined as

$$accuracy = 1 - \frac{\sqrt{(\bar{v} - \bar{v}_{sim})^2}}{\bar{v}}$$


Accuracy versus performance
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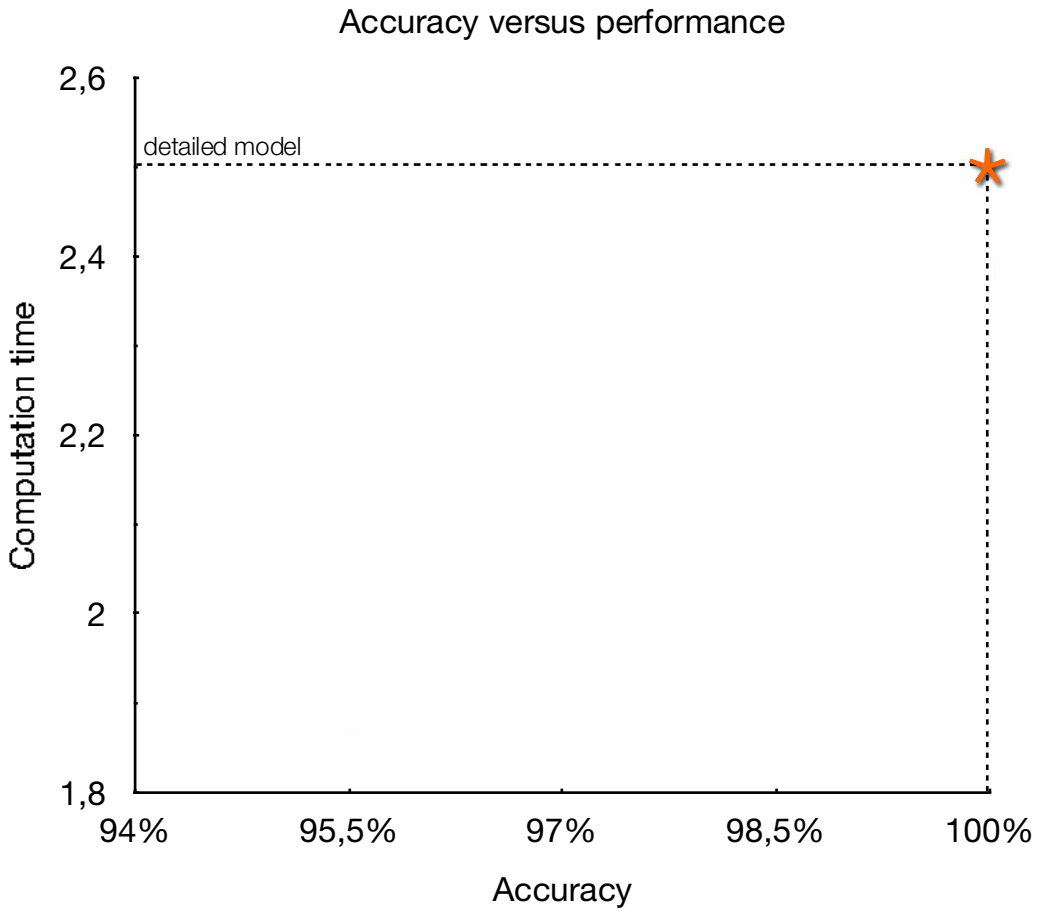
100%
Accuracy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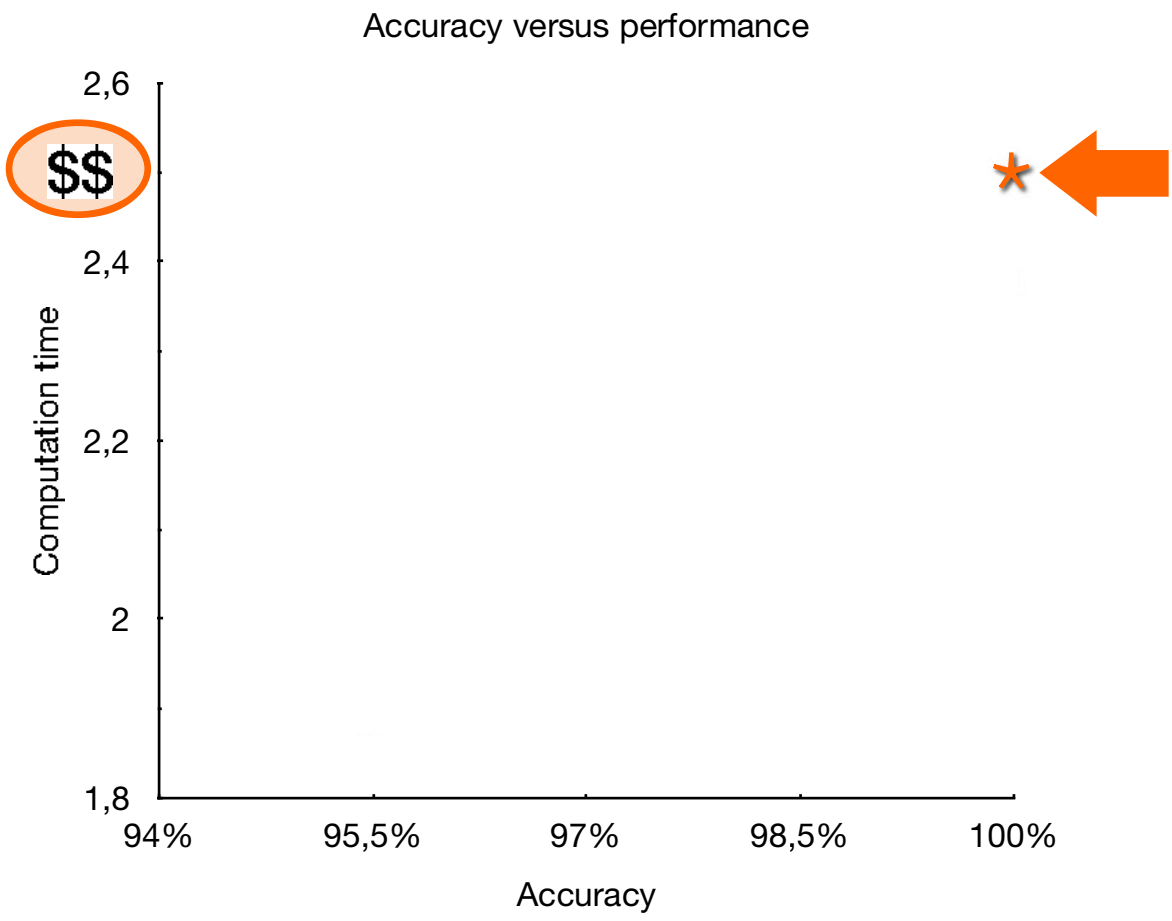
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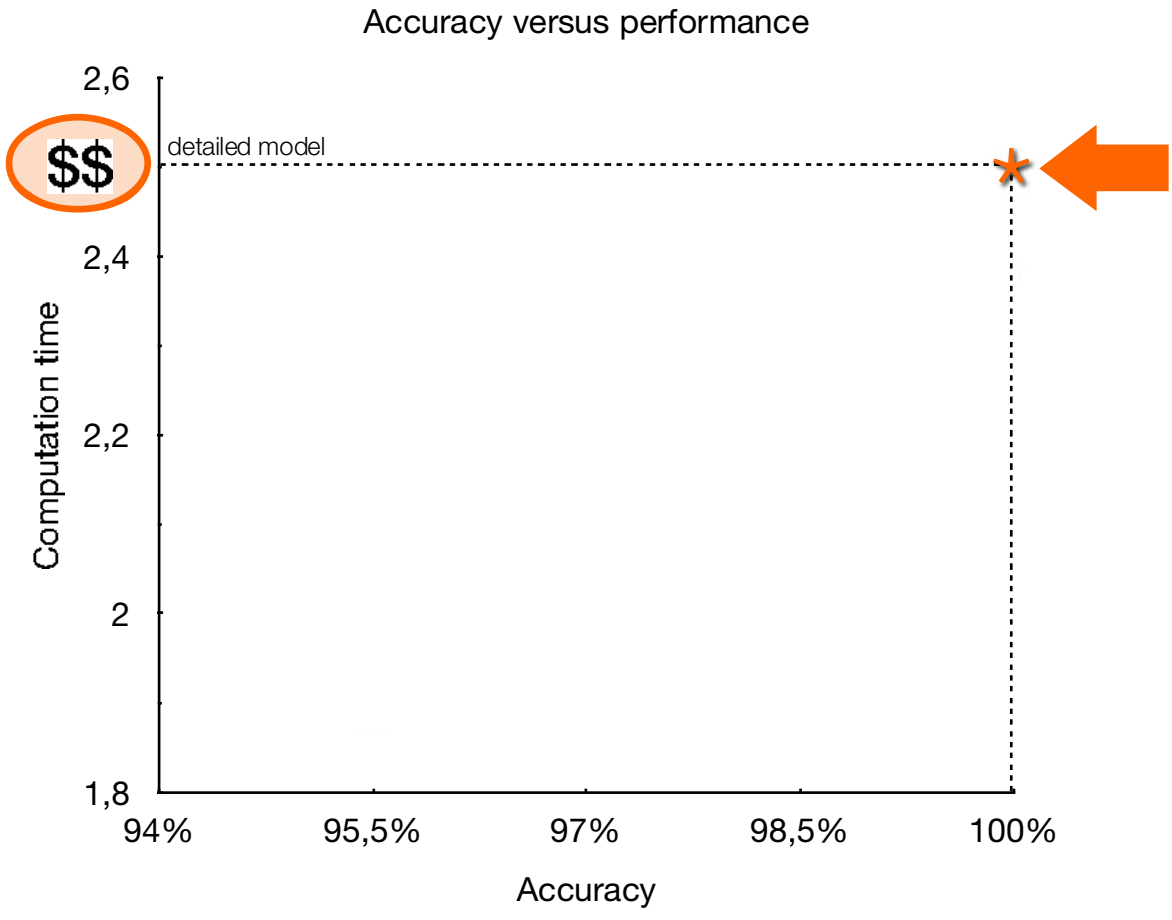
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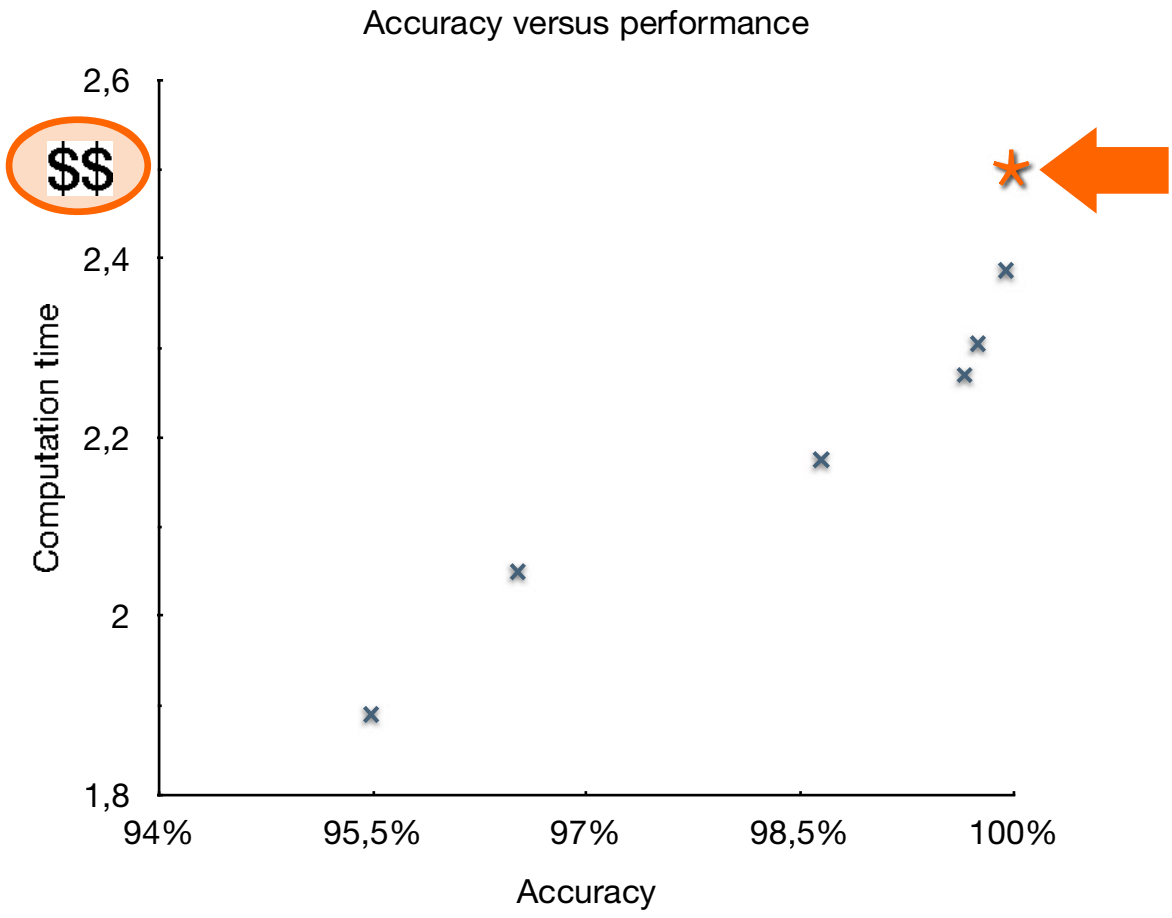
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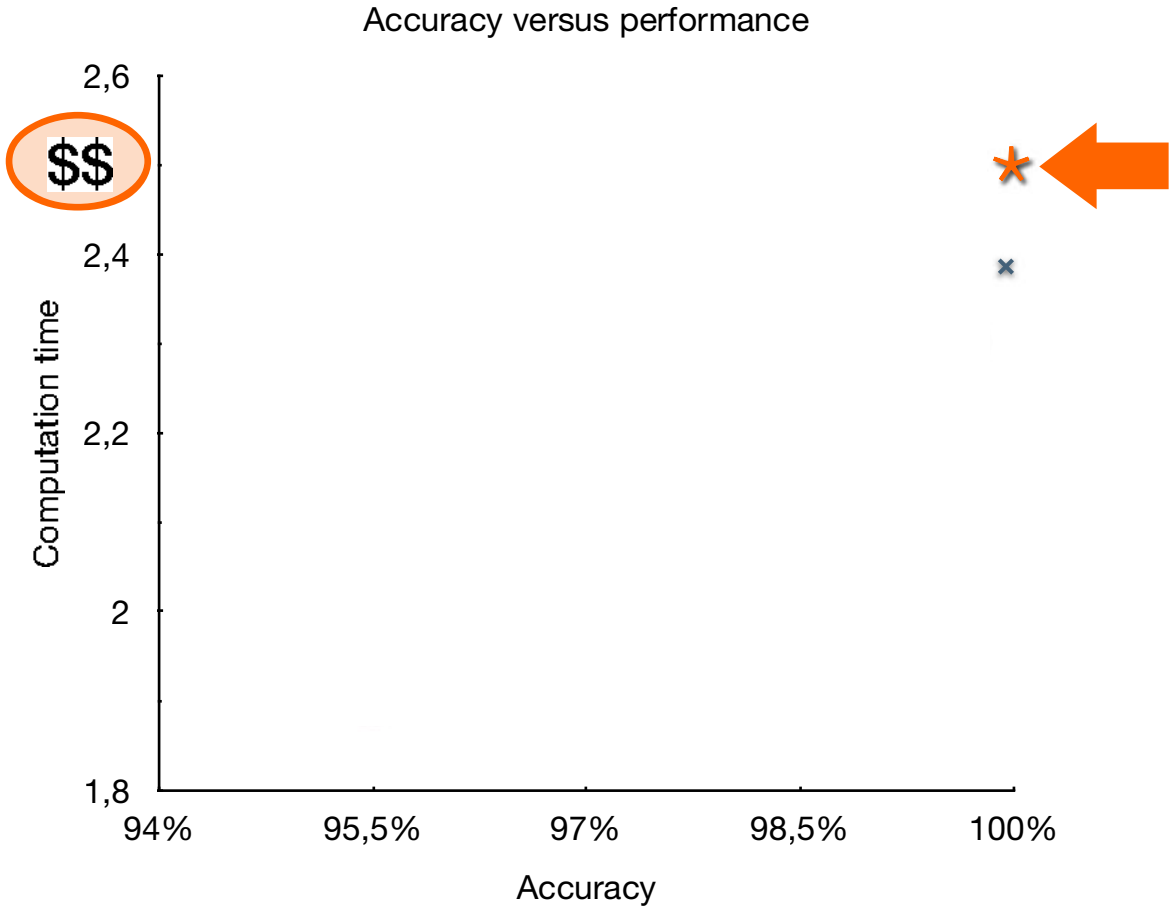
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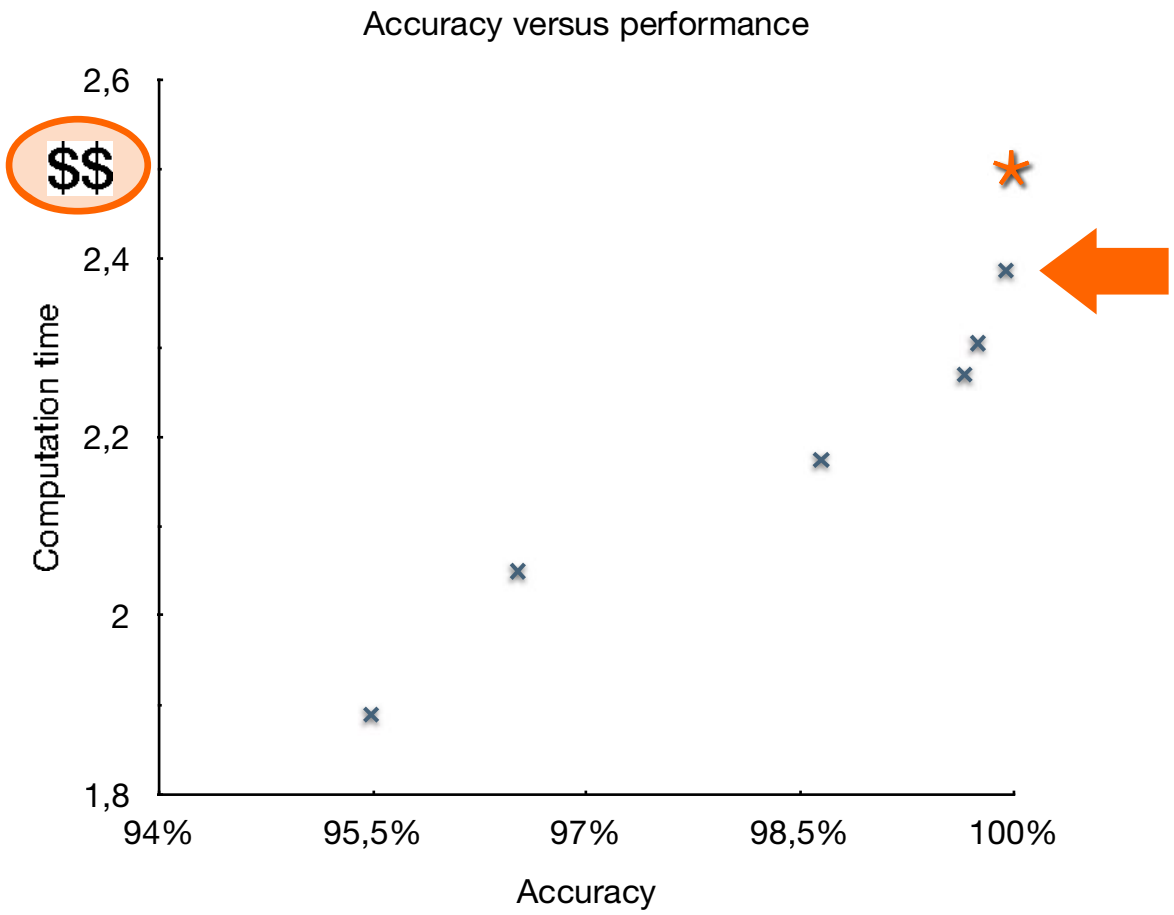
Conclusions, Lessons learned and Future work



Future work

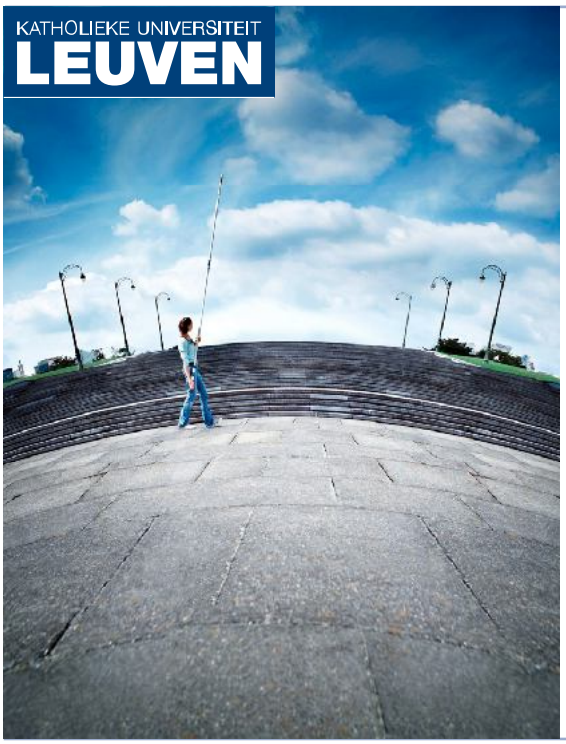
The experiments described in this paper are limited. Future work involves:

- A thorough examination of switching heuristics
- Experiments on a larger scale to further evaluate our multi-resolution simulation
- Alternatives to model switching

Conclusions

- Using multiple models offers more flexibility in the performance versus accuracy trade-off.
- The experiments are small, the results are promising.
- Much of the performance improvement can be attributed to the difference in cost between the queue and the detailed

This research was funded by the IWT - SBO project ‘MASE’ (project no. 060823) and by the Interuniversity Attraction Poles Programme Belgian State, Belgian Science Policy, and by the Research Fund K.U.Leuven



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