Preferred citation style

Axhausen, K.W. (2008) Agent-based modeling of the travelers and their infrastructure demand, paper presented at the ESC conference *Smart Energy 2008*, Zürich, September 2008.

Agent-based modelling of the travellers and their infrastructure demand

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September 2008

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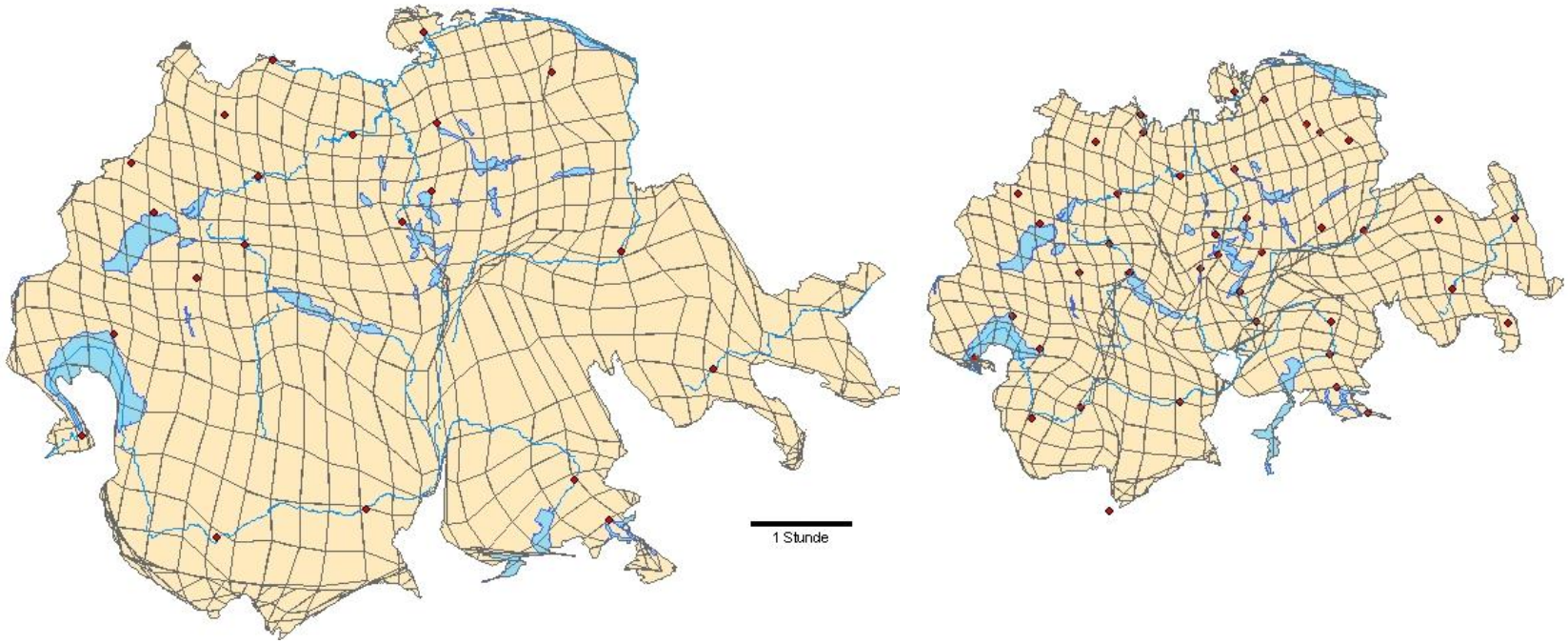
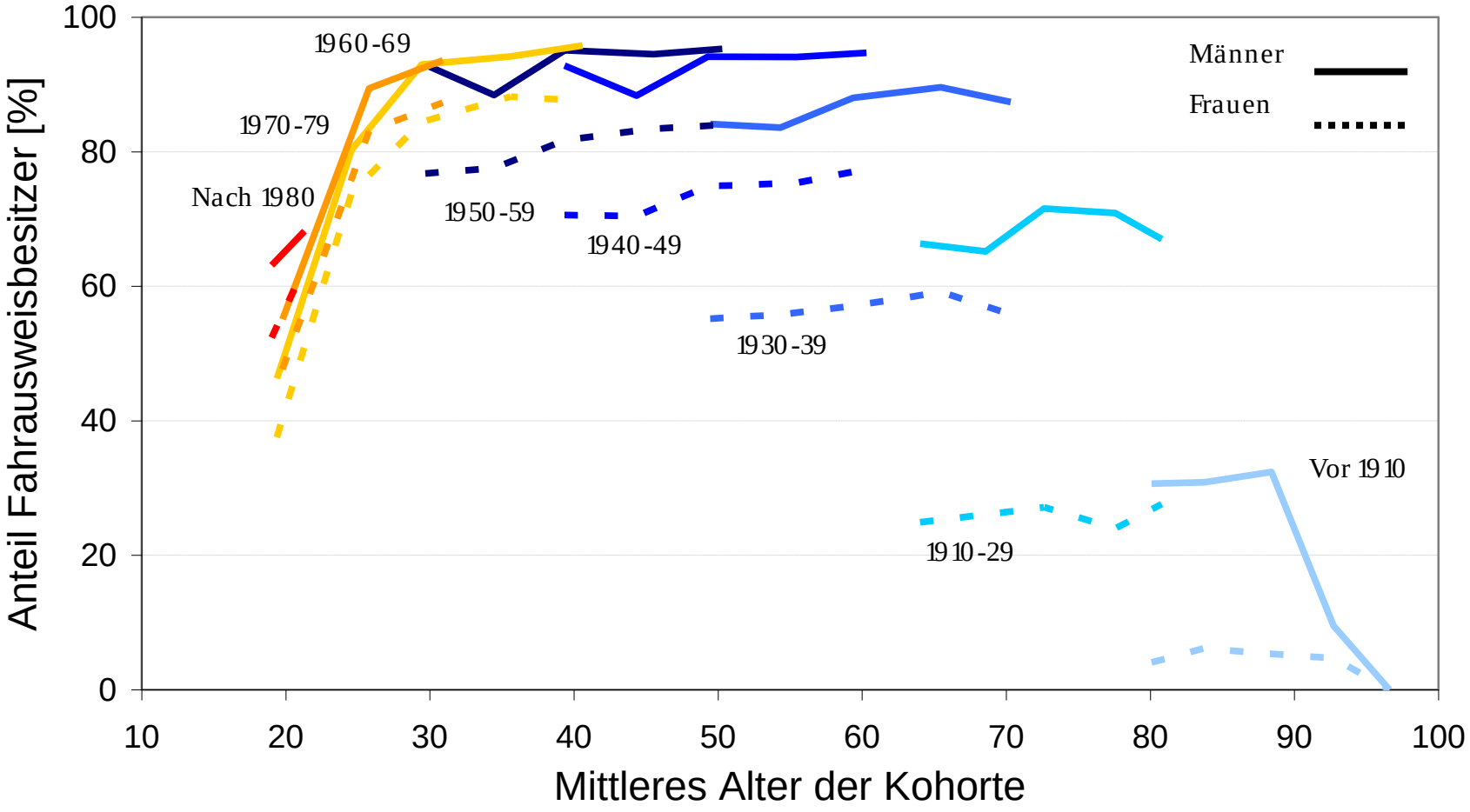
Setting the scene

Road Switzerland 1950 and 2000

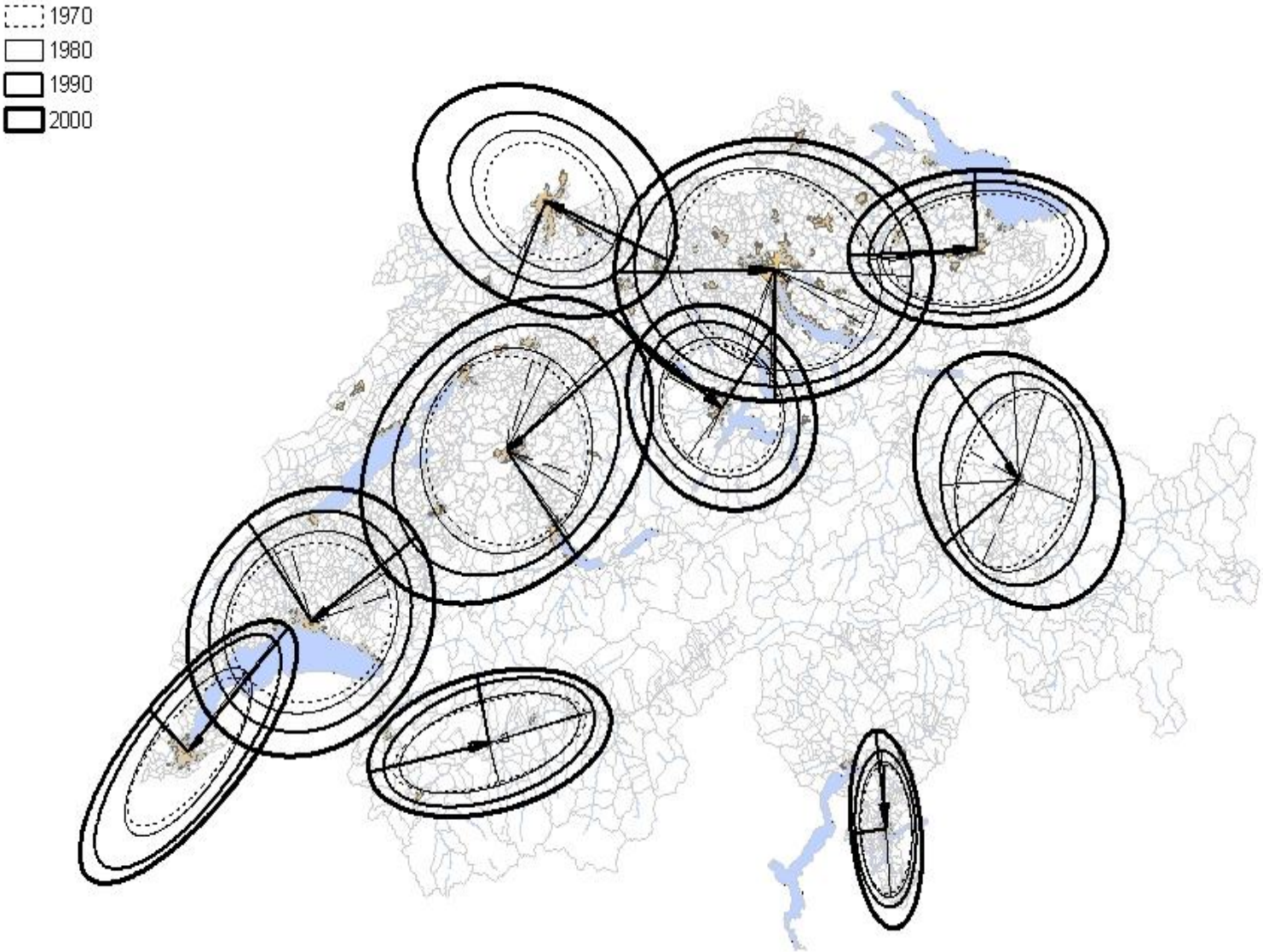


Scherer, 2004

Driving licences by gender and cohort

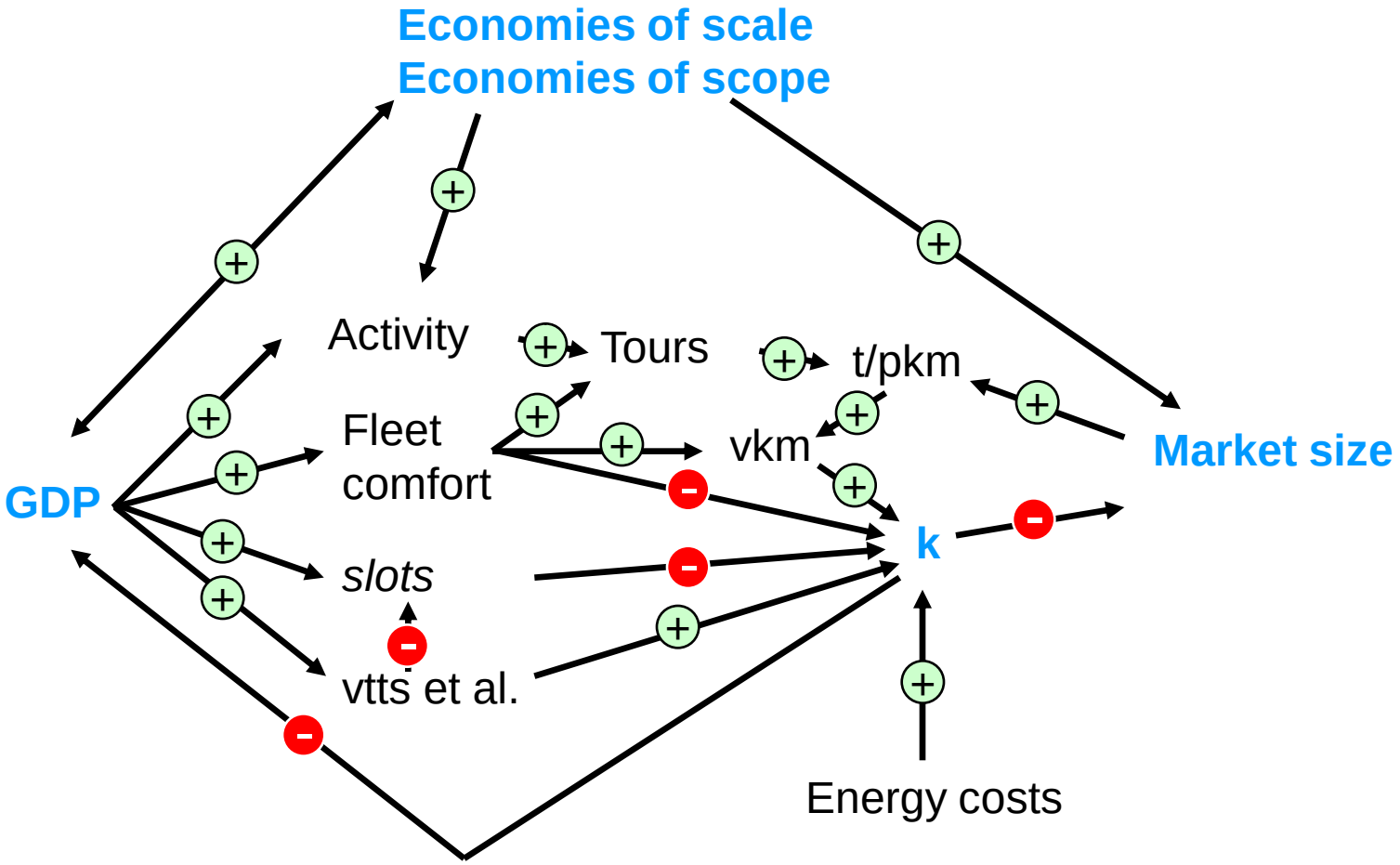


Suburbanisation since 1970



Adapted from Botte, 2003

A conceptual model of traffic growth



⊕ Elasticity > 0

⊖ Elasticity < 0

Slots: possibilities to move goods or people
For a given infrastructure and commercial and private fleet

Time horizons of transport planning

	System	Person
Long term	slots Regulation	Home/work location Car ownership Social networks
Medium term	Services offered Prices Awareness	Season tickets
Short term	Operation	**Daily schedule**

Task and solution methods

Understanding scheduling

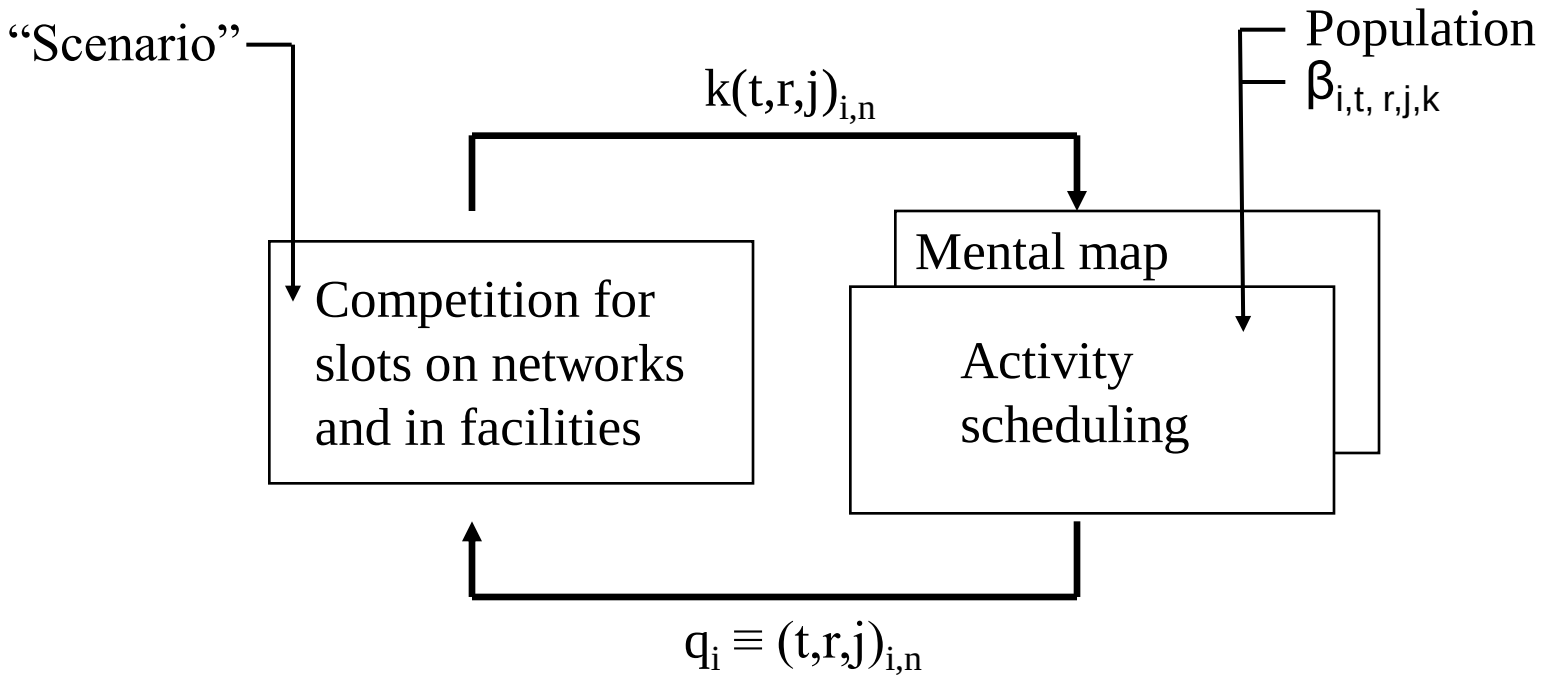
- Budget constraints
- Capability constraints

- Generalised costs of the schedule

  - Generalised cost of travel
  - Generalised cost of activity participation

    - Risk and comfort-adjusted weighted sums of time, expenditure and social content

What does MATSim-T do ?



Demand q are the i^{th}movements of person p from the current location at time t on route (connection) r to location j. The resulting generalised costs k are used to adjust the schedules and to change the capacities C and prices P of facilities f

MATSIM-T: Steady-state version

- Scale:
  - 7.5 mio agents,
  - 2 mio homes
  - 1 mio facilities
  - 1 mio links and nodes

- Continuous time resolution: Seconds
- Spatial resolution: Address (individual facilities)

Choices modelled

- *Number and type of activities*
- *Sequence of activities*
  - Start and duration of activity
  - Composition of the group undertaking the activity
  - Expenditure division
  - *Location of the activity*
    - Connection between sequential locations
      - Location of access and egress from the mean of transport
      - *Vehicle/means of transport*
      - Route/service
      - Group travelling together
      - Expenditure division

Utility function: Individual schedules

$$U_{plan} = \sum_{i=1}^{n} U_{act,i} + \sum_{i=2}^{n} U_{trav,i-1,i}$$

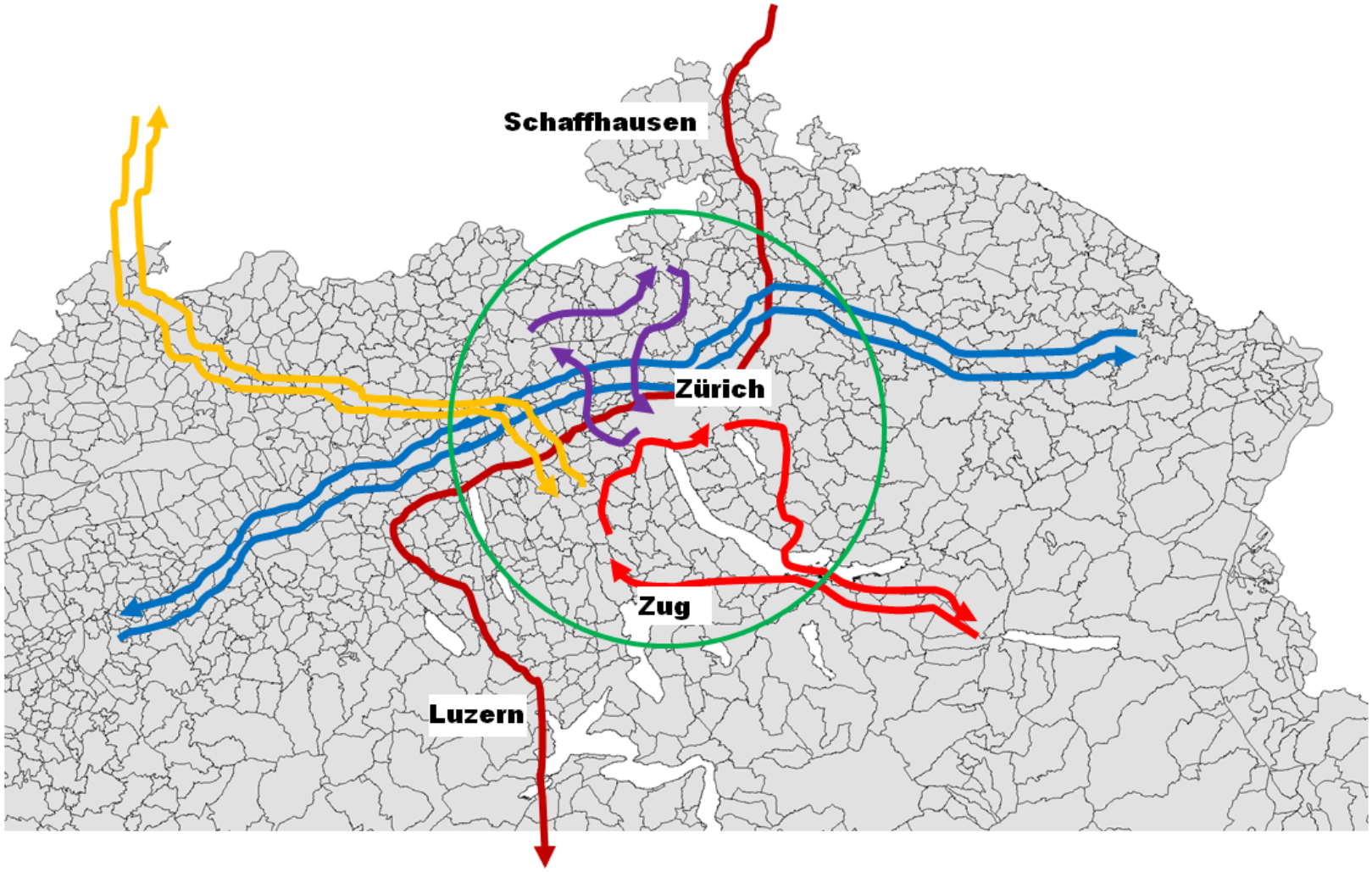
$$U_{act,i} = U_{dur,i} + U_{late.ar,i}$$

Result of each iteration: Plan

```
<person id="22018">
    <plan score="157.72" selected="yes">
        <act type="h" x="703600" y="236900" link="5757"
                                                    end_time="07:35:04" />
        <leg num="0" mode="car" dep_time="07:35:04" trav_time="00:16:31">
            <route>1900 1899 1897</route>
        </leg>
        <act type="w" x="702500" y="236400" link="5749" dur="08:12:05" />
        <leg num="1" mode="car" dep_time="16:03:40" trav_time="01:10:22">
            <route>1899 1848 1925 1924 1923 1922 1068</route>
        </leg>
        <act type="l" x="681450" y="246550" link="2140" dur="01:20:00" />
        <leg num="2" mode="car" dep_time="" trav_time="00:34:35">
            <route>1067 1136 1137 1921 1922 1923 1925 1848 1899</route>
        </leg>
        <act type="h" x="703600" y="236900" link="5757" />
    </plan>
</person>
```

Example scenario

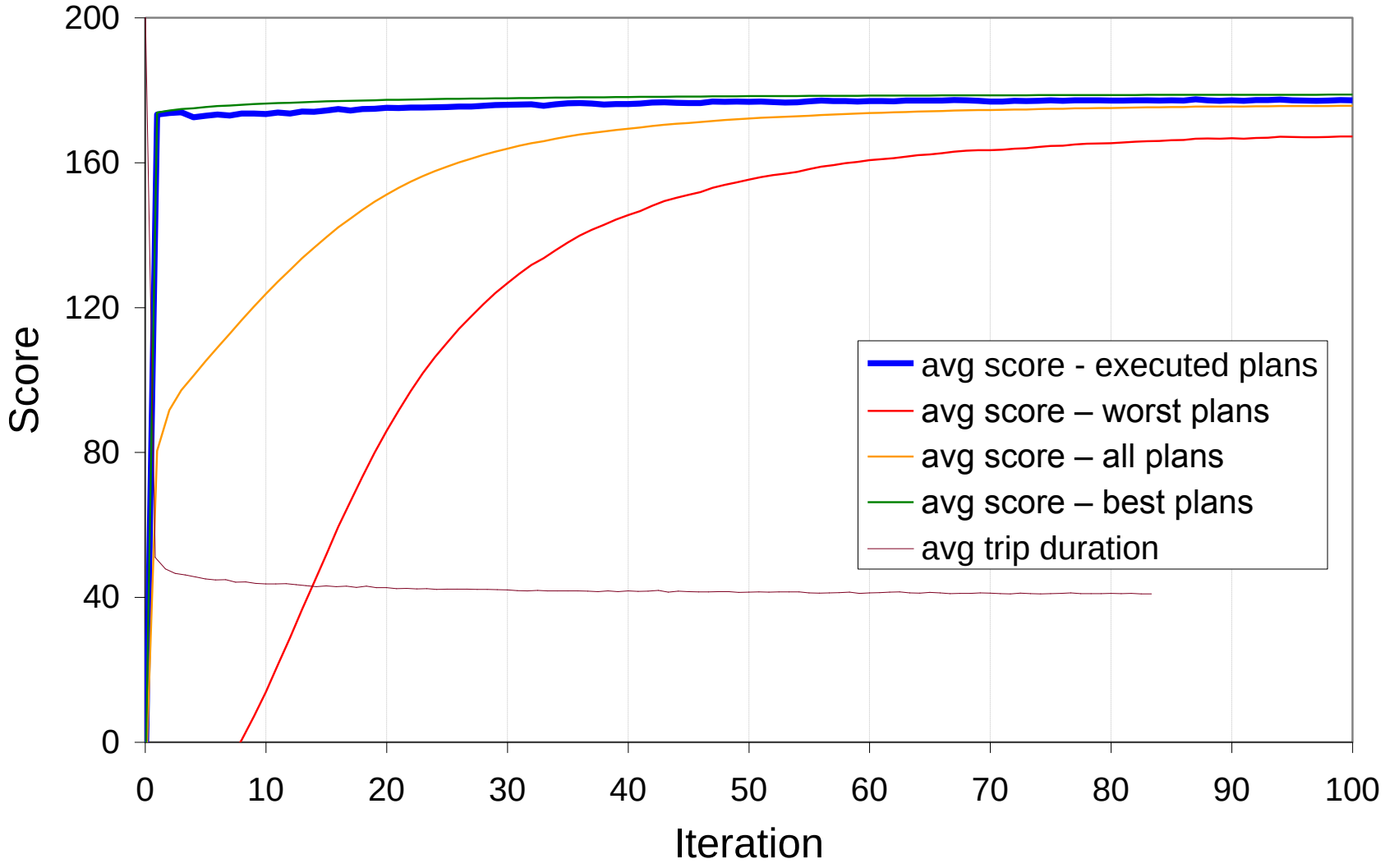
Study area and population (3% of Swiss population)



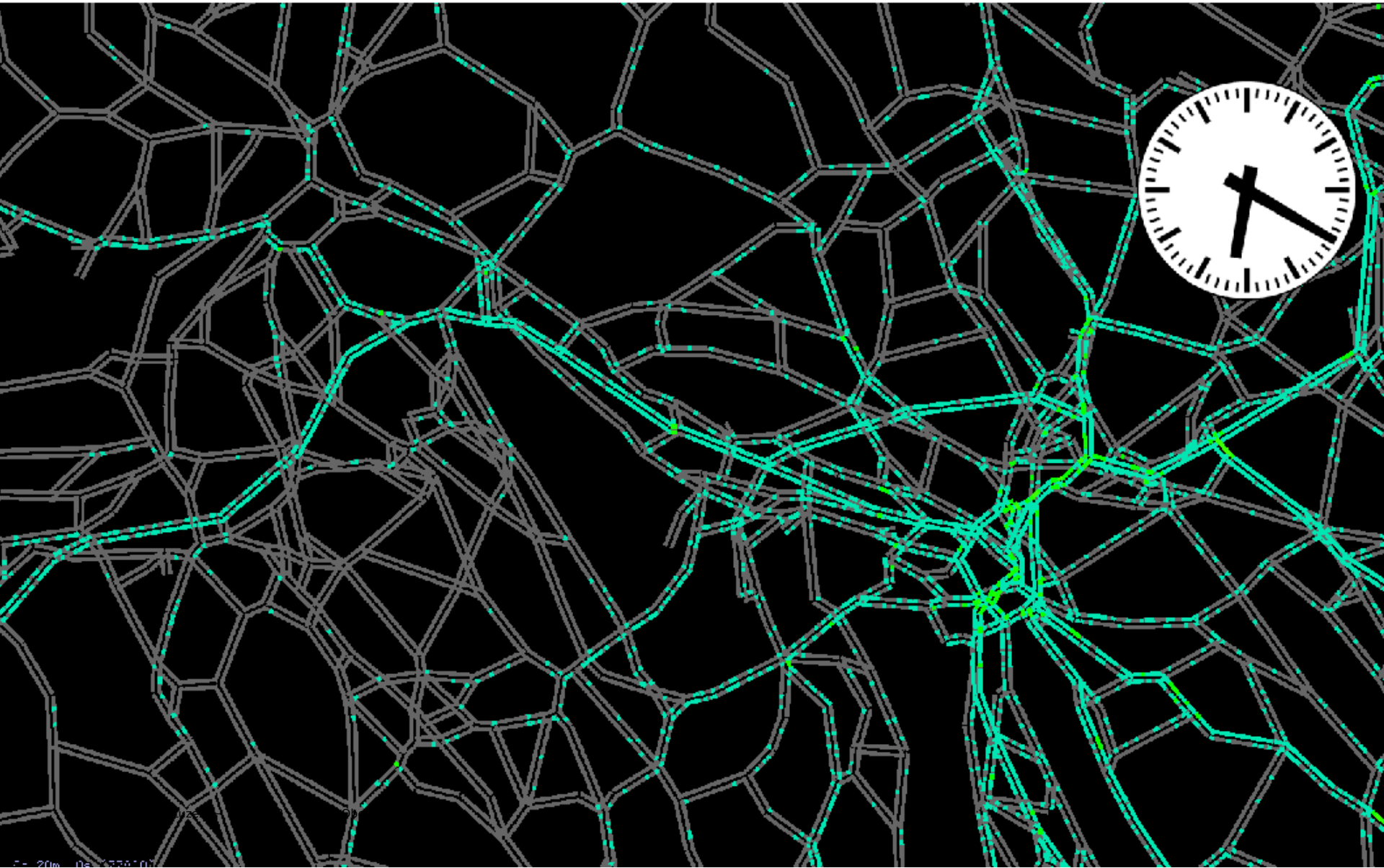
Computing times by step

Operation	Unit	Units/sec
Initial demand		0.12h
Scheduling (fixed components)		14.40h
Scheduling (planomat)	Agent	100
Scheduling (routing)	Agent	1000
Time-step based traffic flow simulation	Agent	300
Learning	Agent	250’000
Total iteration (with I/O)		0.22h
Total run (with I/O) (100 iterations)		23h

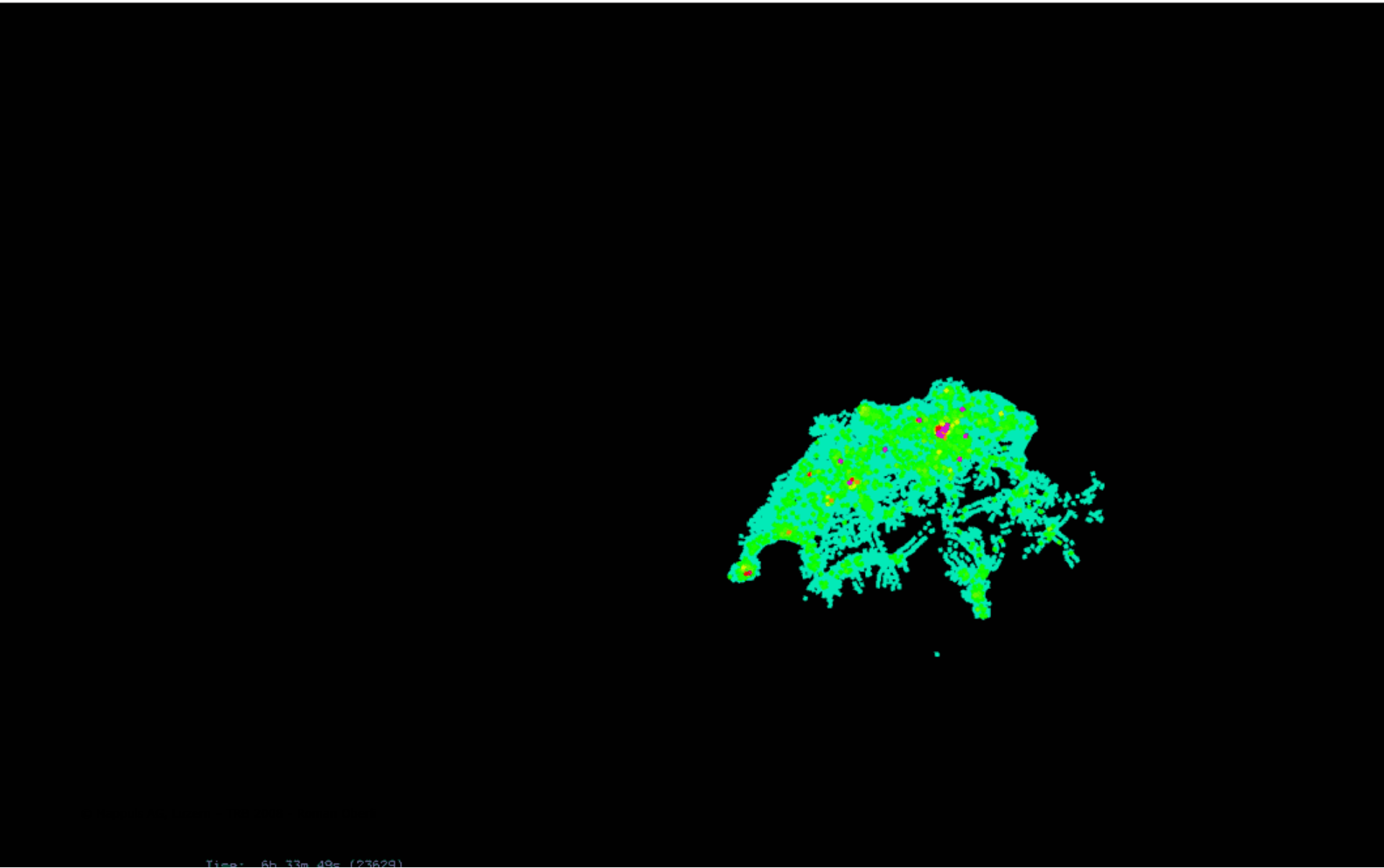
Score by iteration



A peak hour



Zooming in



Outlook

- Shifting further choices to the inside of the learning iteration
- Including supply side agents
- Better description of the vehicles
- Integration of energy supply networks (Plug-in hybrid)
- Environmental accounting

More information

www.matsim.org