

Large agent-based transport simulations

Kai Nagel | TU Berlin

Slides ...

... sometimes also under <https://svn.vsp.tu-berlin.de/repos/public-svn/lehre/veranstaltungen/current/> .

Information ...

... see http://www.vsp.tu-berlin.de/menue/studium_und_lehre/veranstaltungen/semesteruebersicht/ss_2017/0533_I_013/ .

Most information will be in ISIS.

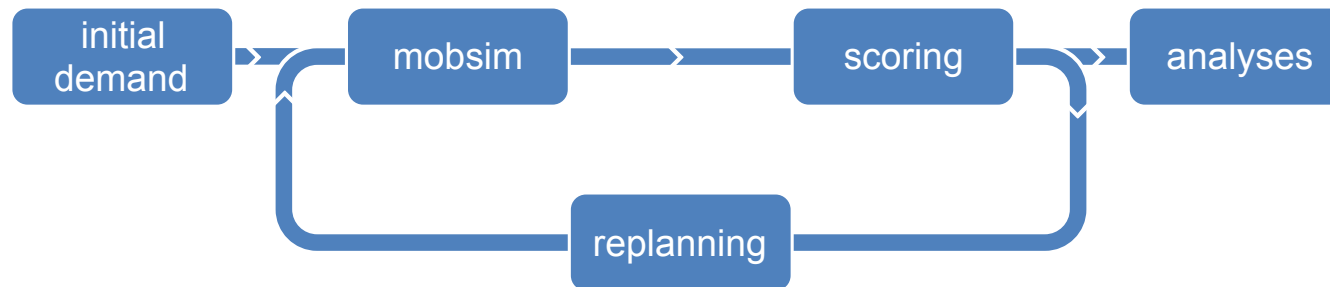
Example

Example: simulation of Berlin incl. PT

[[berlin-bvg09]]

General design of the simulation system

General design of simulation system



Initial demand

= Synthetic persons with at least 1 plan/person

Mobsim

= mobility sim. = synth. reality = netw. loading = traff. flow sim.

Scoring

= each synthetic person obtains score (\approx utility value)

Replanning

Some agents change plans

Analyses

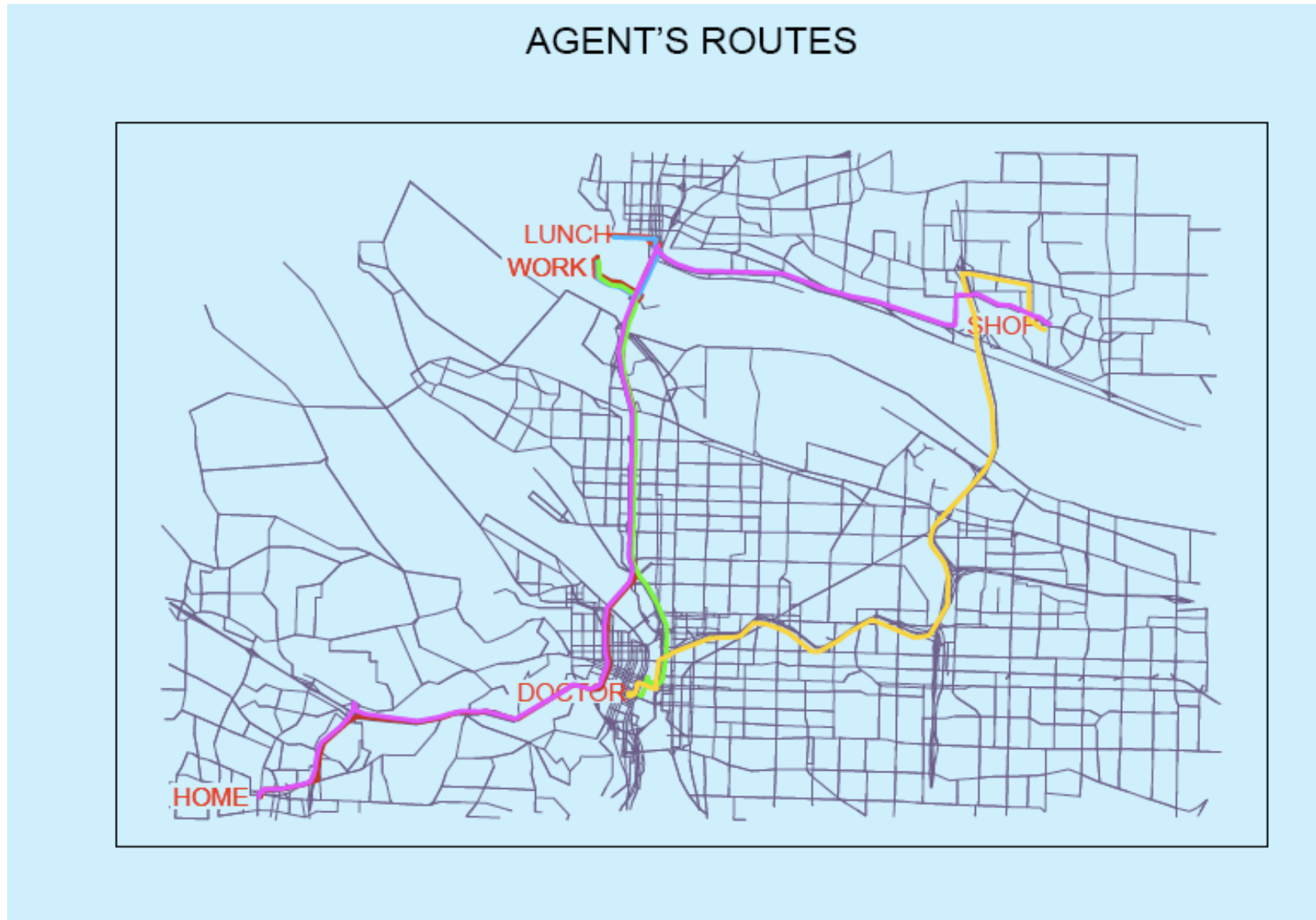
E.g. utility changes, emissions, accessibility, ...

Complete daily plans of synthetic travellers

Plans in XML

```
...  
<plan>  
  <act type="home" ... link="5834" end_time="07:00" />  
  <leg mode="car" trav_time="00:25">  
    <route>1932 1933 1934 1947</route>  
  </leg>  
  <act type="work" ... link="5844" end_time="16:00" />  
  <leg mode="car" trav_time="00:14">  
    <route>1934 1933</route>  
  </leg>  
  <act type="shop" ... link="123" />  
  ...  
</plan>  
...
```

A plan visualized



Plan with public transit (PT)

```
<act type="home" ... link="31135" end_time="10:16:46" />
<leg mode="walk" trav_time="00:10:34"> <route></route></leg>
<act type="pt interaction" ... link="tr_9376" dur="00:00:00" />
<leg mode="pt" trav_time="00:09:38">
  <route> PT1===U9 </route>
</leg>
<act type="pt interaction" ... link="tr_9381" dur="00:00:00" />
<leg mode="walk" trav_time="00:00:00"> <route></route> </leg>
<act type="pt interaction" ... link="tr_10332" dur="00:00:00" />
<leg mode="pt" trav_time="00:02:51">
  <route> PT1===S5 </route>
</leg>
...
<act type="work" ... link="17723" />
...
```

Mobsim = mobility simulation

= traffic flow simulation = synthetic reality

Mobsim

Mobsim: execute all plans simultaneously in a simulation of the physical world

⇒ Synthetic Reality

Protocol of Events [[m2_events]]

```

<event time="28680.0" type="arrival" person="passenger1" link="4077" legMode="walk" />
< ... "28680.0" ... "actstart" ... link="4077" activityType="pt interaction" />
< ... "28680.0" ... "actend" ... link="4077" ... "pt interaction" />
< ... "28680.0" ... "departure" ... link="4077" legMode="pt" />
< ... "PersonEntersVehicle" ... vehicle="tr_0" transitRouteId="B-M44.101.901.H" />
< ... "PersonLeavesVehicle" ... vehicle="tr_0" transitRouteId="B-M44.101.901.H" />
< ... "30108.0" ... "arrival" ... link="3964b" legMode="pt" />
< ... "30108.0" ... "actstart" ... link="3964b"... "pt interaction" />
< ... "30138.0" ... "actend" ... link="3964b"... "pt interaction" />
< ... "30138.0" ... "departure" ... link="3964b" legMode="pt" />
< ... "PersonEntersVehicle" ... vehicle="tr_19" transitRouteId="B-344.101.901.H" />
< ... "PersonLeavesVehicle" ... vehicle="tr_19" transitRouteId="B-344.101.901.H" />
< ... "30945.0" ... "arrival" ... link="3891R" legMode="pt" />
< ... "30945.0" ... "actstart" ... link="3891R" act... "pt interaction" />
< ... "30946.0" ... "actend" ... link="3891R" act... "pt interaction" />
< ... "30946.0" ... "departure" ... link="3891R" legMode="walk" />
< ... "31066.0" ... "arrival" ... link="3889R" legMode="walk" />
< ... "31066.0" ... "actstart" ... link="3889R" act... "shopping" />

```

Scoring of executed plans

Scoring of (executed) plans

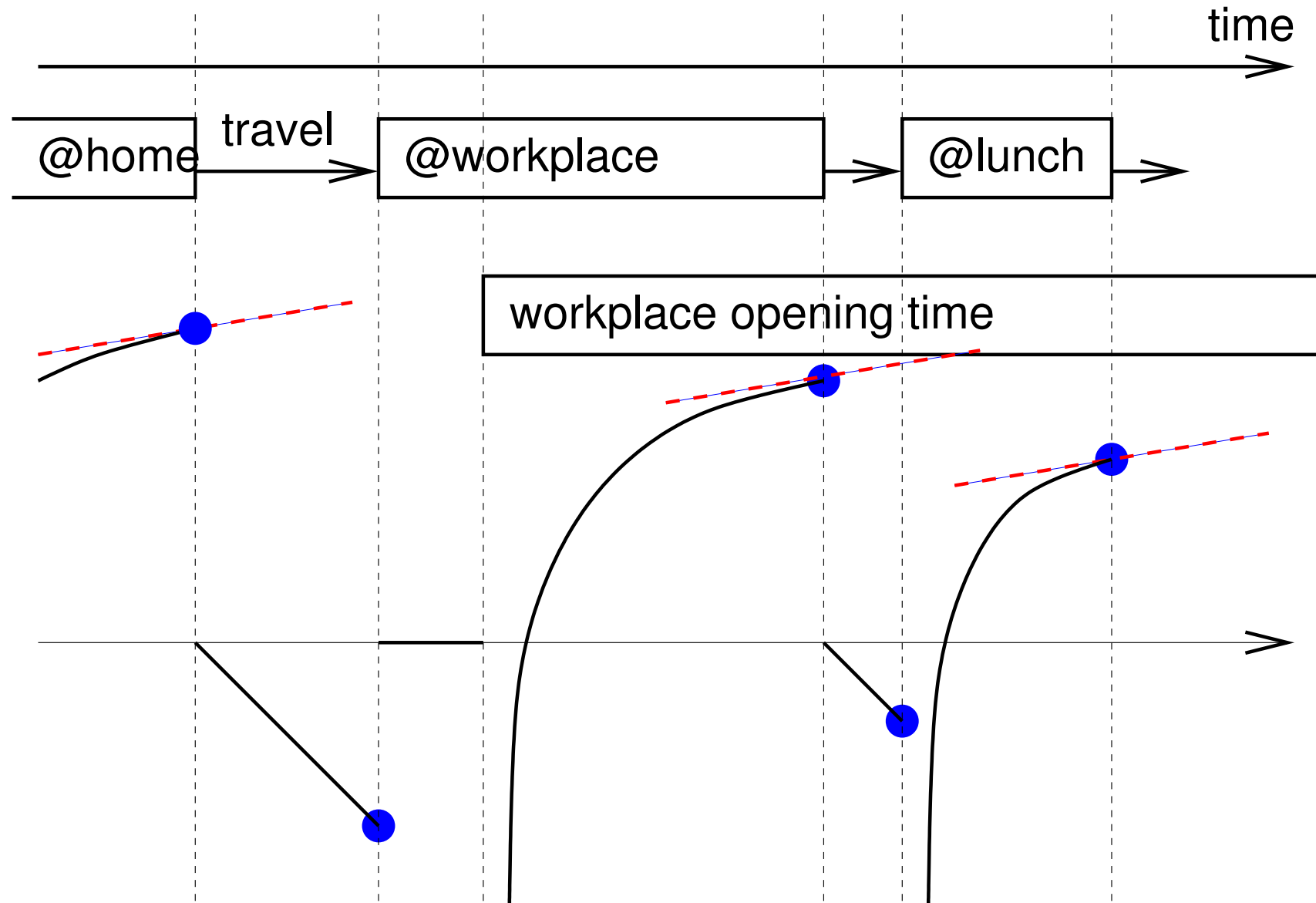
Elements:

- Reward for performing activities
- Penalty for travel
- (Penalty for late arrival)

Sum up over day.

See next slide for example ...

Scoring of (executed) plans, example

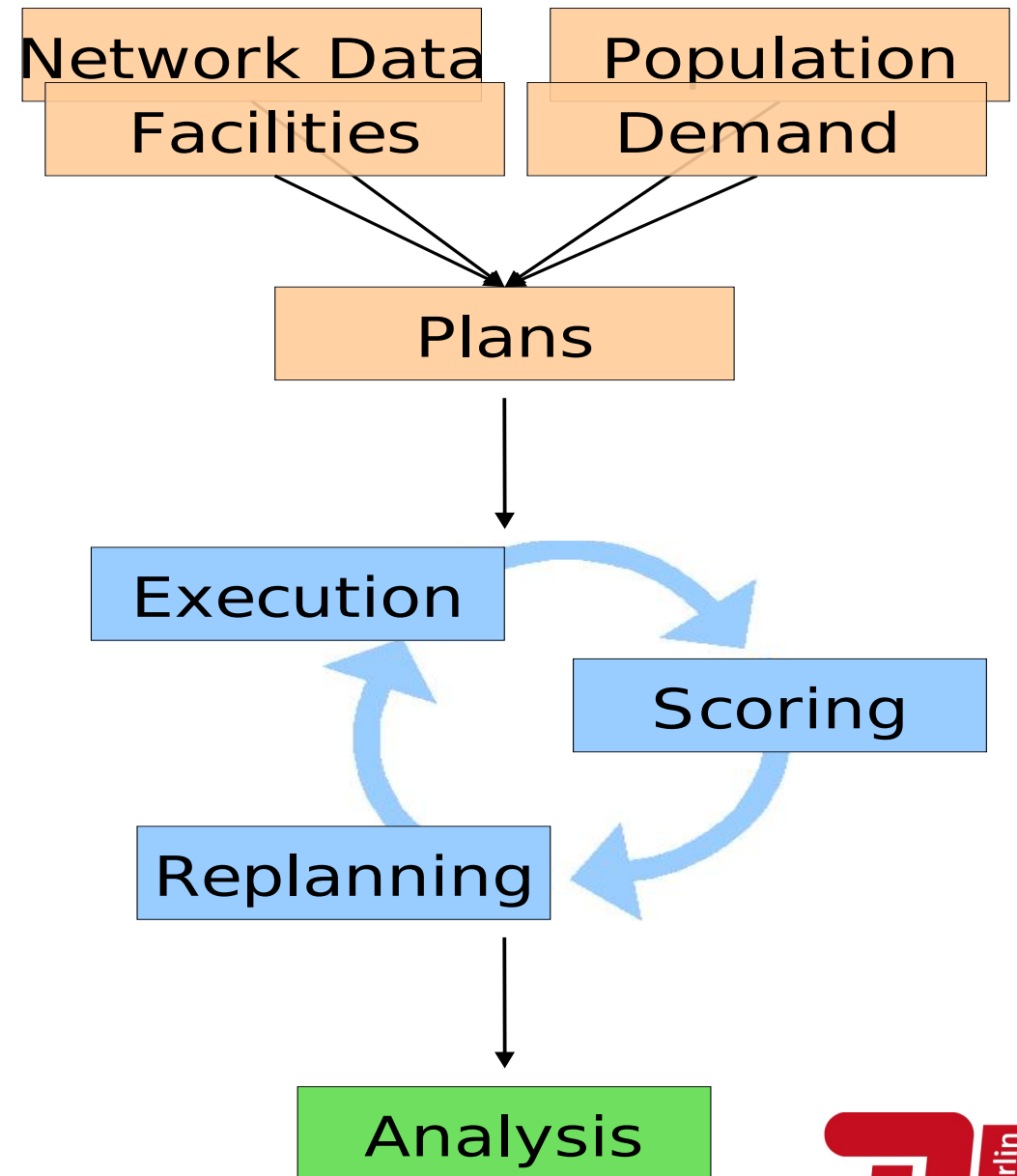


- Blue points = values that are summed up
- Marginal score identical at optimum (red lines)

Learning/Adaptation of synthetic travellers

Some variant of:

1. Every synthetic traveller has one or more plans.
2. One (“selected”) plan per agent will be executed in the mobsim, and scored.
3. Some agents generate/obtain new plans for themselves; all others select between memorized plans.
4. Go to 2.



Repeated game

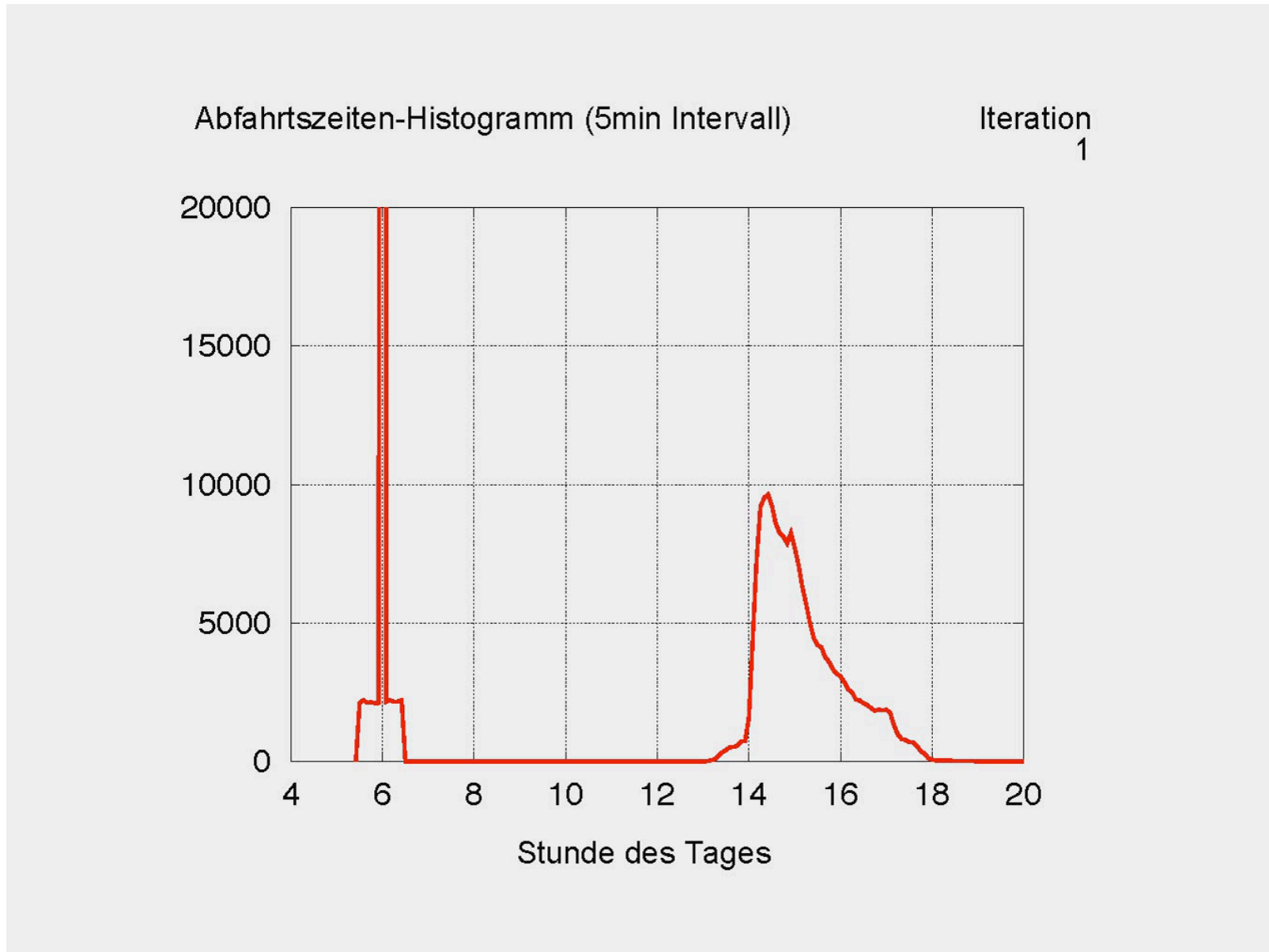
<https://www.youtube.com/watch?v=tSVeDx9fk60>

Agents have multiple plans

Plan	Score
"start at home on link 123 → lv at 07:13 → take car → ar on link 345 for work → ..."	120.3
"start at home on link 123 → lv at 07:03 → take subway → ar on link 345 for work → ..."	123.1
...	...

- Plan is description of intention ("genotype").
- Plans are executed in synthetic reality. This plans execution (gene expression, "phenotype") is the basis for the score.

Adaptation of departure time



Application example: A100 extension in Berlin

Summary

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Simulation follows individual persons, individual vehicles, ...

Persons learn (at this point) day-to-day.