

OSM for Traffic Simulation

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Simulation

- Predict the reaction of a traffic system to a policy measure.
- Traffic system includes users. Desired outcome: People are better off than before.
- Use a multi-agent simulation to include behavior of individual users.

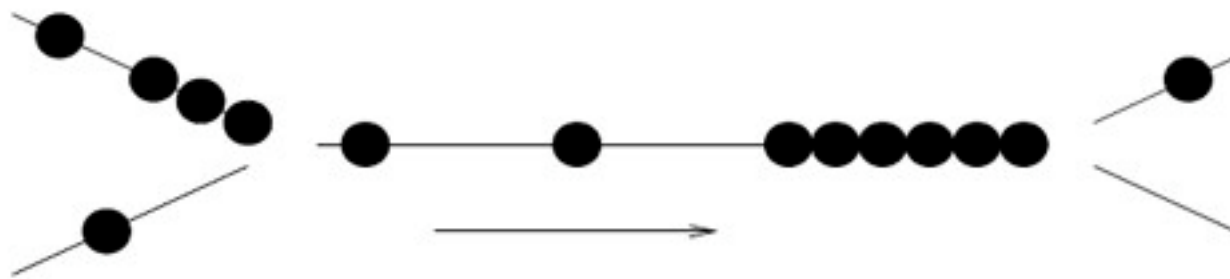
Physics and behavior

- Physical layer: Agents concurrently execute travel plans, compete for system capacity.
- Mental layer: Agents evaluate outcome of their plan, consider their options and change some aspect of behavior.

Policy measure and reactions

- Example: Introduce evening toll.
- Some possible reactions:
 - use different route to avoid toll
 - travel earlier
 - switch to public transport

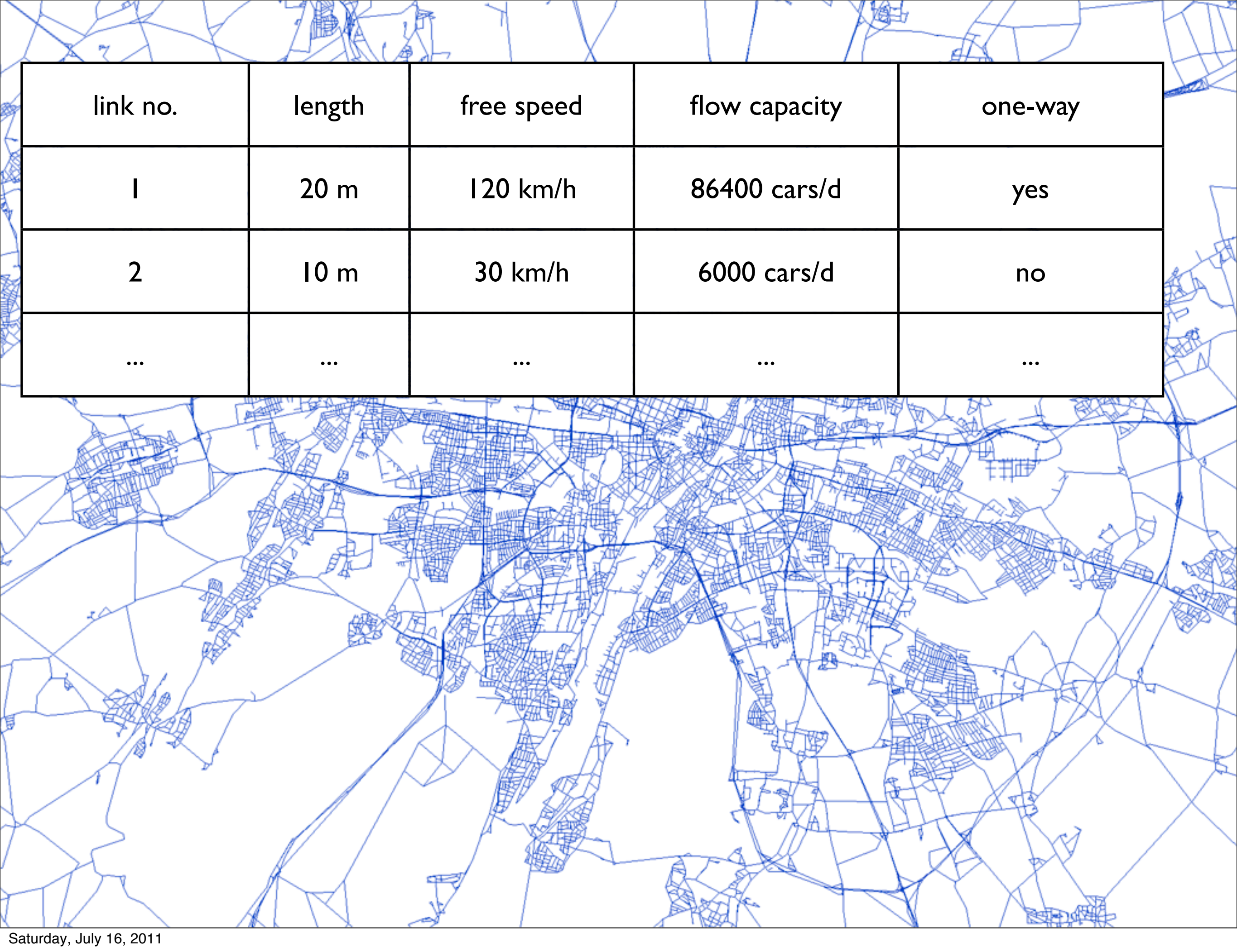
Queuing model



$$q = Q(\text{length, free speed, flow capacity})$$

- Vehicles enter link, move to the end of the queue at *free speed*.
- Queue is served according to *flow capacity*.
- If queue is *longer* than link, it spills back: No more vehicles can enter.

(Gawron, 1998)

A detailed blue line map of a city street network, showing a dense grid of roads and some larger open spaces. The map is positioned behind a table in the upper portion of the image.

link no.	length	free speed	flow capacity	one-way
1	20 m	120 km/h	86400 cars/d	yes
2	10 m	30 km/h	6000 cars/d	no
...	...	...	...	...

Network from OSM

- Map `highway` tags to link attributes (*free speed, flow capacity*) based on handbooks and experience.

Network from OSM

	legal speed limit (km/h)	Avg. speed / legal speed limit	flow capacity (veh/h)	number of lanes
motorway	100	1.2	2000	2
trunk	50	0.5	1000	2
tertiary	30	0.8	600	1
living street	15	1.0	300	1
...	...	...	...	...

Population

- synthetic population
- equipped with individual travel diaries
- generated from polls

AGENT'S ACTIVITIES



```
<person id="241">  
  <plan>  
    <act type="home" x="123.4" y="445.6"  
      end_time="07:00:00" />  
    <act type="work" x="13.5" y="440.5"  
      end_time="17:00:00" />  
    <act type="home" x="123.4" y="445.6" />  
  </plan>  
</person>
```

Travel diaries

- We usually need some kind of survey where people volunteer complete travel diaries.
- But sometimes a commuter matrix is all we have.

Commuter Matrix

trip pairs/day	Potsdam	Berlin	Brandenburg
Potdam	28863	13281	509
Berlin	13014	...	...
Brandenburg	1680	...	...



Population and OSM

- Link commuter matrix to administrative boundaries from OSM. Draw locations from shapes.
- Could incorporate `landuse` for more realistic distribution.

Public transport

- In Germany: Complete, machine-readable transit schedules are hard to come by.
- GTFS contains all we need. Except for routes matched to OSM network.
- No luck yet with using OSM public transport route relations (tried Berlin, Zurich).

Additional data

- Traffic counts for calibration and validation.
- Signal plans.
- Typically come from some local agency.
Need to map-match to OSM and keep consistent.
- Different departments in the same administration use different networks!

Vision: Instant Scenario

- User selects study area, hits 'run'.
- System gets network from OSM, transit from a GTFS database, counts or observed link speeds from somewhere else.
- System generates commuters, freight and other traffic from (probably heavily aggregated) public data. Simulates.

Using OSM tools

- Filter and convert OSM network using a custom Osmosis plugin.
- Visualize traffic flow with OpenGL layer on top of JMapView component.
- Use JOSM for some custom, local tagging.

Turn lanes

- Use a separate queue for each lane for more realistic node simulation.
- Need: Length and destination link for each lane.

Turn lanes for JOSM



(Benjamin Schulz, 2011)

Conclusion

- It is possible, in principle, to set up a basic simulation scenario based only on OSM and a commuter matrix.
- Network quality is fine for our purposes.
- Great tools and availability often make OSM the data source of choice, also for teaching.

Outlook

- Volunteered information on the demand side: Collect travel diaries the Wiki/OSM way?
- As long as we don't have that: How to properly disaggregate population data with the help of OSM?

MATSim

- Written in Java
- Free software (GPL), look on Sourceforge
- Co-developed by TU Berlin, ETH Zürich and Senozon AG
- Commercial support available



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Multi-Agent Transport Simulation Toolkit

<http://www.matsim.org>

Thank you for listening.

Iteration

