Preferred citation style

Axhausen, K.W. (2009) Moving agent-based simulations into Chinese science, presentation at the seminar *Sino Swiss Science and Technology Cooperation - Today and Tomorrow*, September 2010.

Moving agent-based simulations into Chinese science

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September 2010

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Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Starting point

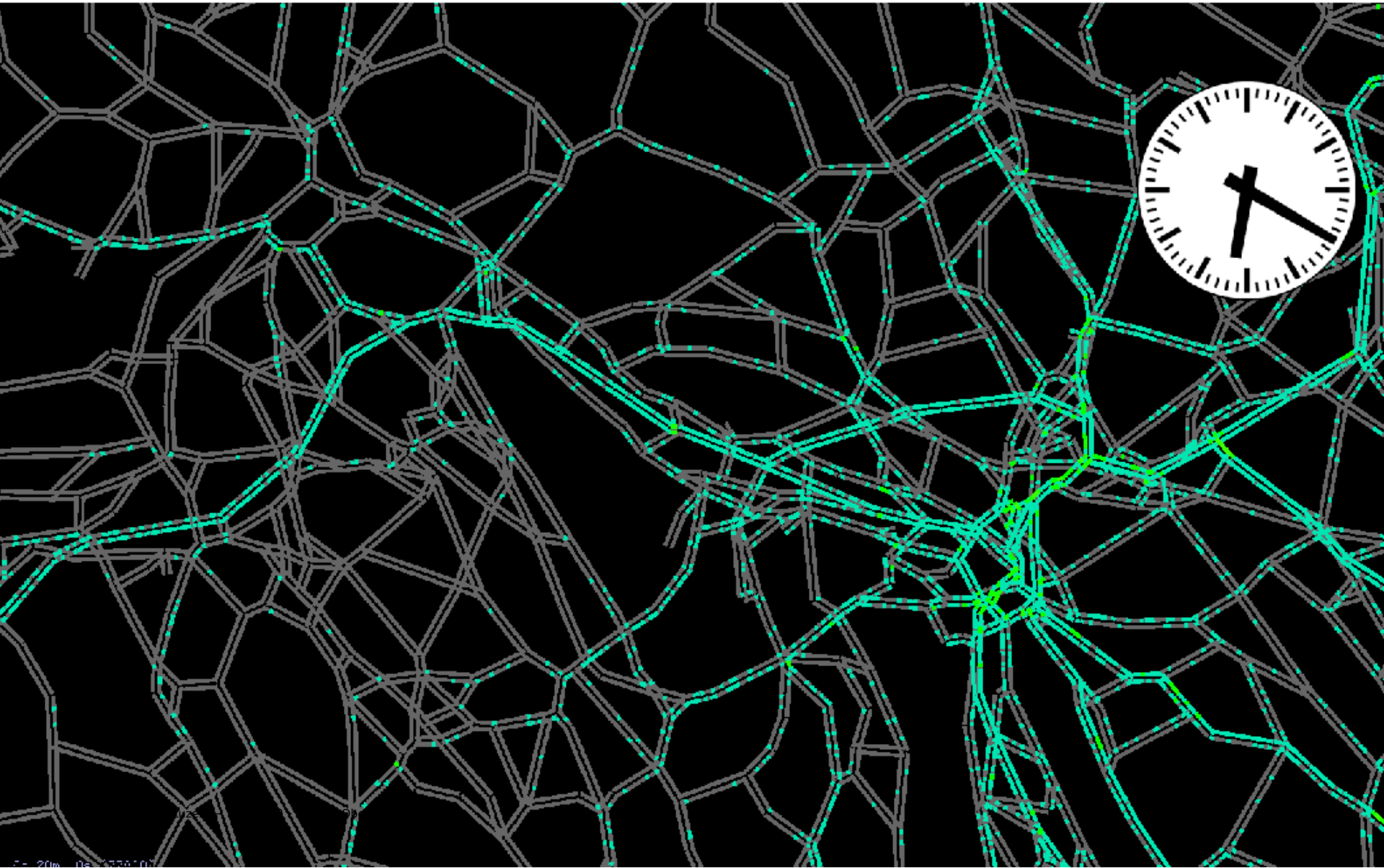
Repeated exchanges with Tongji

Prof. Ou (Signal control)

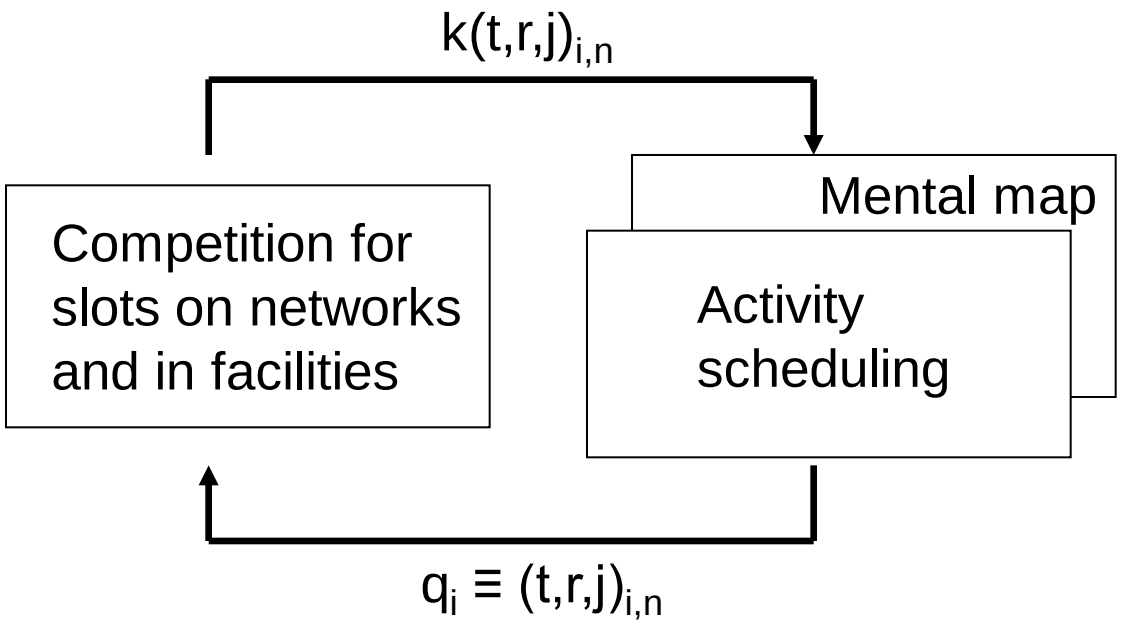
Prof. Zhang (Agent-based simulation)

Starting point

Peak hour in Zürich



Learning approach of the generic transport model



Full sets of requirements

Traffic flow simulation

- Disaggregate simulation of car traffic
  - Detailed traffic control
  - Detailed parking facilities
  - Detailed recharging facilities for electric vehicles
- Disaggregate simulation of public transport
- Disaggregate simulation of cyclists
- Disaggregate simulation of pedestrians

Activity scheduling

- 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
        - Movement between sequential locations
            - Location of access and egress from the mean of transport
                - Parking type
            - Vehicle/means of transport
            - Route/service
            - Group travelling together
            - Expenditure division

Relevant individual long(er) term choices

- Social network geography
- Social commitments
- Amount and type(s) of occupation

    - Work location(s)
    - School location
    - Home location

        - Mobility tools
        - Discount cards
        - Season tickets
        - Vehicles (by body type, fuel, energy efficiency)

Relevant supply side long(er) term choices

- Facility construction
- (Transport) infrastructure provision
- Regulation of production
- Regulation of markets
- Regulation of migration

    - Location of production and service firms
    - Delimitation of markets served
    - Choice of the type of service or good offered

        - Capacity choice
        - Area wide signal control optimisation
        - Pricing

MATSim today

MATSim: A GNU public licence software project

Current partners

- TU Berlin (Prof. Nagel)
- ETH Zürich
- Senezon (Drs. Balmer, Rieser)

Coordination via:

- User meeting
- Developer meeting

Help for new users

- Tutorial (e.g. March 2011)
- www.matsim.org

MATSim: Current instances

All aspects:

- Switzerland (Zürich)
- Berlin
- München
- Gauteng Province

DTA only:

- Toronto
- Tel-Aviv
- Seoul

MATSim evolutionary process

Read scenario

Generate initial demand (schedules)

Do until convergence

- Select schedule to execute with a biased random approach
- Execute schedules (traffic flow simulation)
- Score all schedules
- Add a new schedule to a random subset of the agents
- Delete worst schedule, if necessary

2009 MATSim Switzerland: Configuration

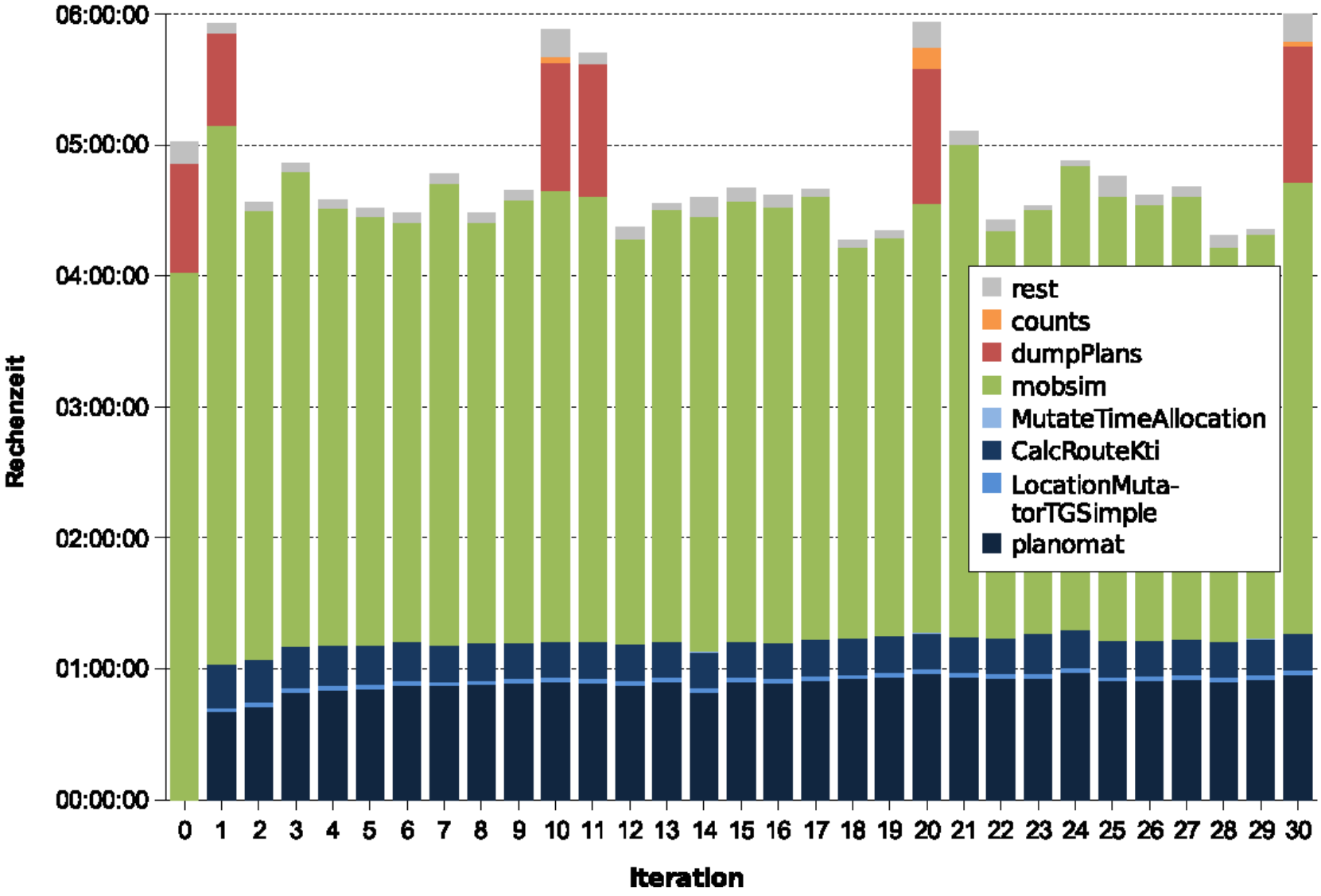
During the iterations:

- Optimisation of start time and duration of the activities
- Random location of the activity (with capacity constraint)
- Vehicle/means of transport at sub-tour level
- Optimal routes
- Event-oriented queue-based traffic flow simulation

For a search space of:

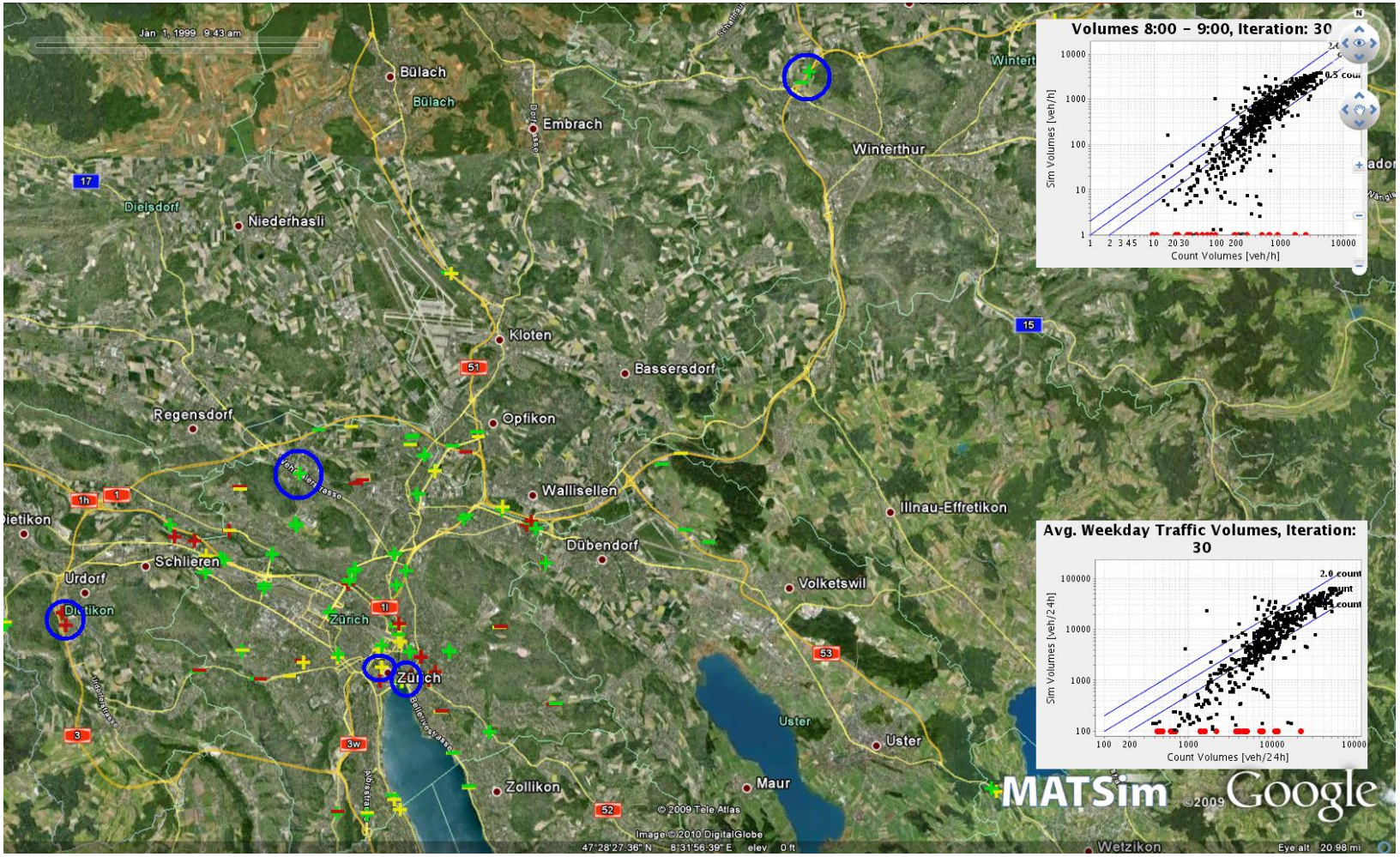
- $6.0 * 10^6$ agents with 11 activity types
- $1.6 * 10^6$ facilities
- $0.8 * 10^6$ links
- 24 * 60 * 60 seconds

2009 MATSim Switzerland: Computing time



Balmer, 2009

Quality of the results: Overall counts



What next ?

2014 MATSim configuration of traffic flow simulation

- **(Parallel) queue based simulation(s) of car traffic**
  - Detailed traffic control
  - Detailed parking facilities
  - Detailed recharging facilities
- **Vehicle – timetabled based simulation of public transport**
- **Disaggregate simulation of cyclists**
- **Disaggregate simulation of pedestrians**

2014 MATSim configuration of activity scheduling

- **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**
        - Parking type
      - **Vehicle/means of transport**
      - **Route/service**
      - **Group travelling together**
      - Expenditure division

2010 MATSim configuration of long(er) term choices

- **Social network geography**
- Social commitments
- Occupation

  - **Work location**
  - School location
  - Home location

    - **Mobility tools**
      - **Discount cards**
      - **Season tickets**
      - **Vehicles (by body type, fuel, energy efficiency)**

2014 MATSim Shanghai : Configuration

During the iterations:

- Optimisation of full schedule
- Quality informed location choice (with capacity constraint)
- Social network geography
- Supply response (timings, prices, capacities)

For a search space of:

- $2.0 * 10^7$ agents with 11 activity types
- $2.0 * 10^7$ facilities
- $5.o * 10^6$ links
- 7 * 24 * 60 * 60 seconds

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