Preferred citation style

Axhausen, K.W. (2009) MATSim: An overview, presentation at *the 2nd MATSim User Meeting*, Zürich, May 2010.

MATSim: An overview

KW Axhausen

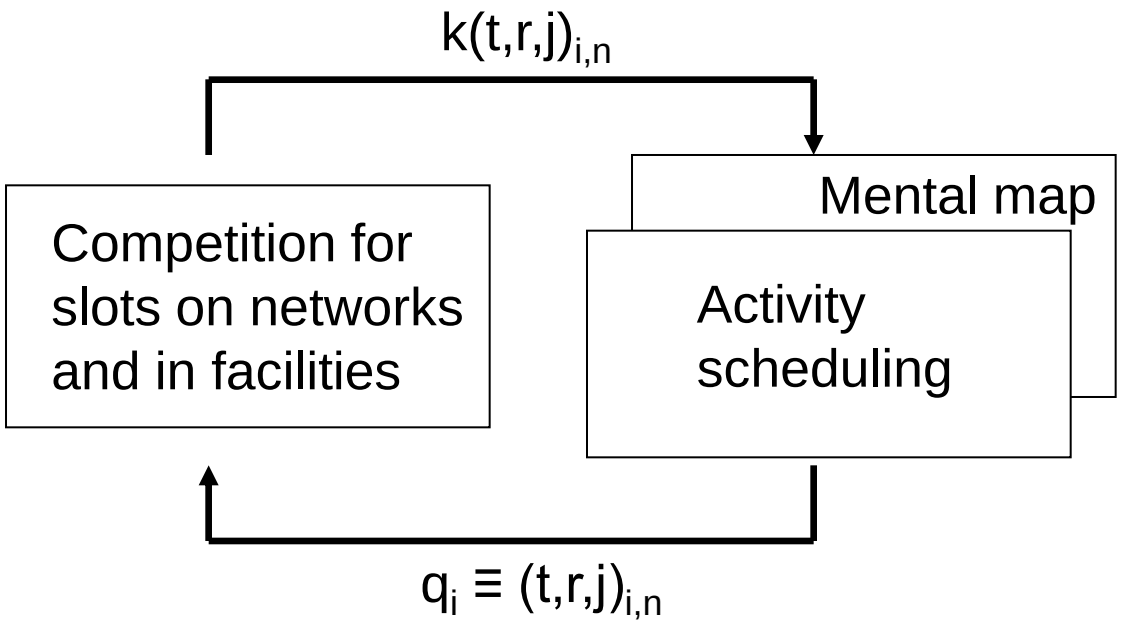
IVT
ETH
Zürich

May 2010

Institut für Verkehrsplanung und Transportsysteme
Institute for Transport Planning and Systems

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Learning approach of the generic transport model



Possible equilibria

	Perfect knowledge	Imperfect knowledge
Average user cost	Deterministic user equilibrium	**Stochastic user equilibrium**
Social cost	System optimum	

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 demographic long(er) term choices/events

- Deaths
- In- and out-migration

    - Partnership
    - Births
    - Divorce

        - Full- and part-time education

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: A GNU public licence software project

Main partners

- TU Berlin (Prof. Nagel)
- ETH Zürich
- Axon Active (Dr. Balmer, Rieser)

Coordination via:

- User meeting
- Developer meeting

Help for new users

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

Challenges

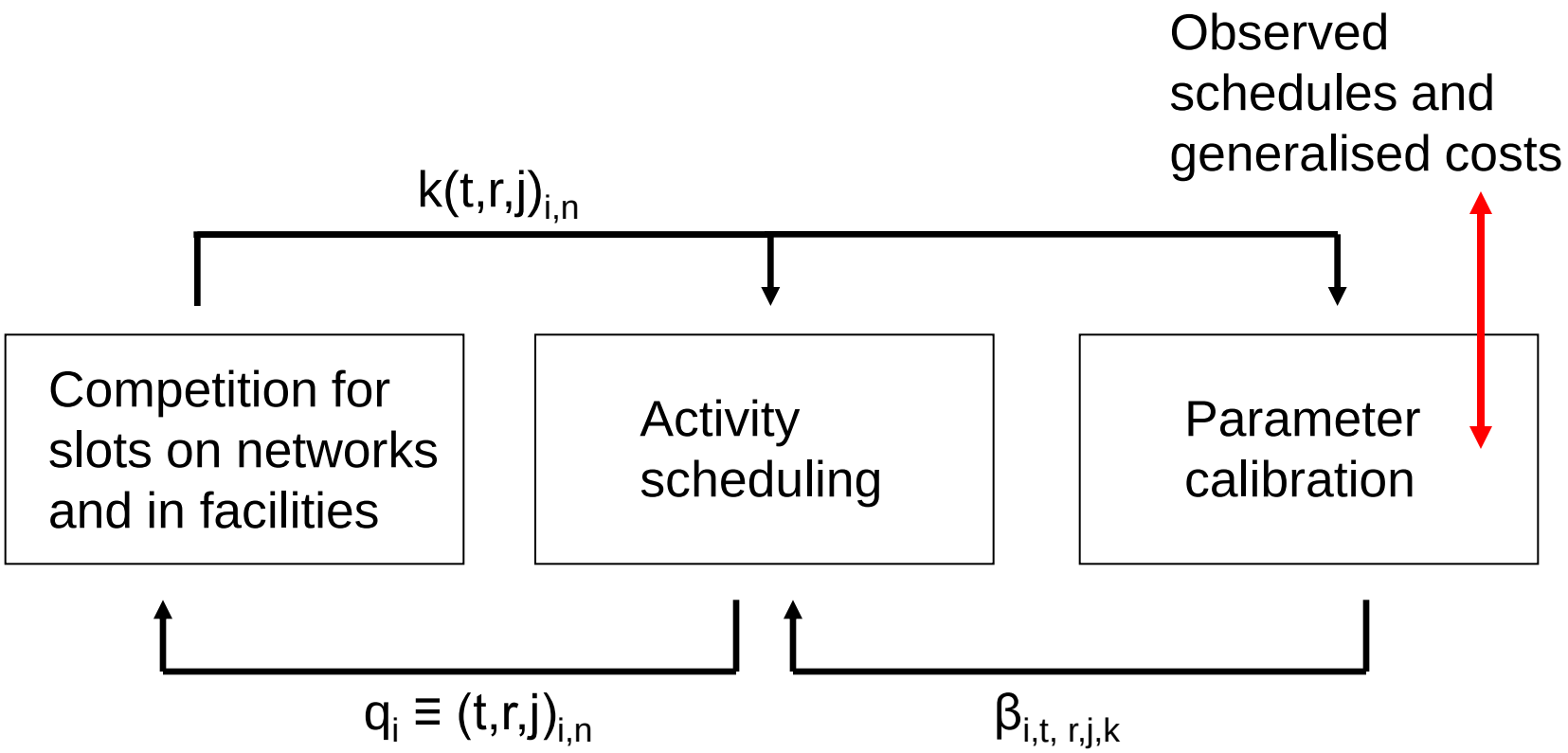
How to find the equilibrium ?

The point in the joint search space, when no agent can unilaterally improve its situation by changing its behaviour

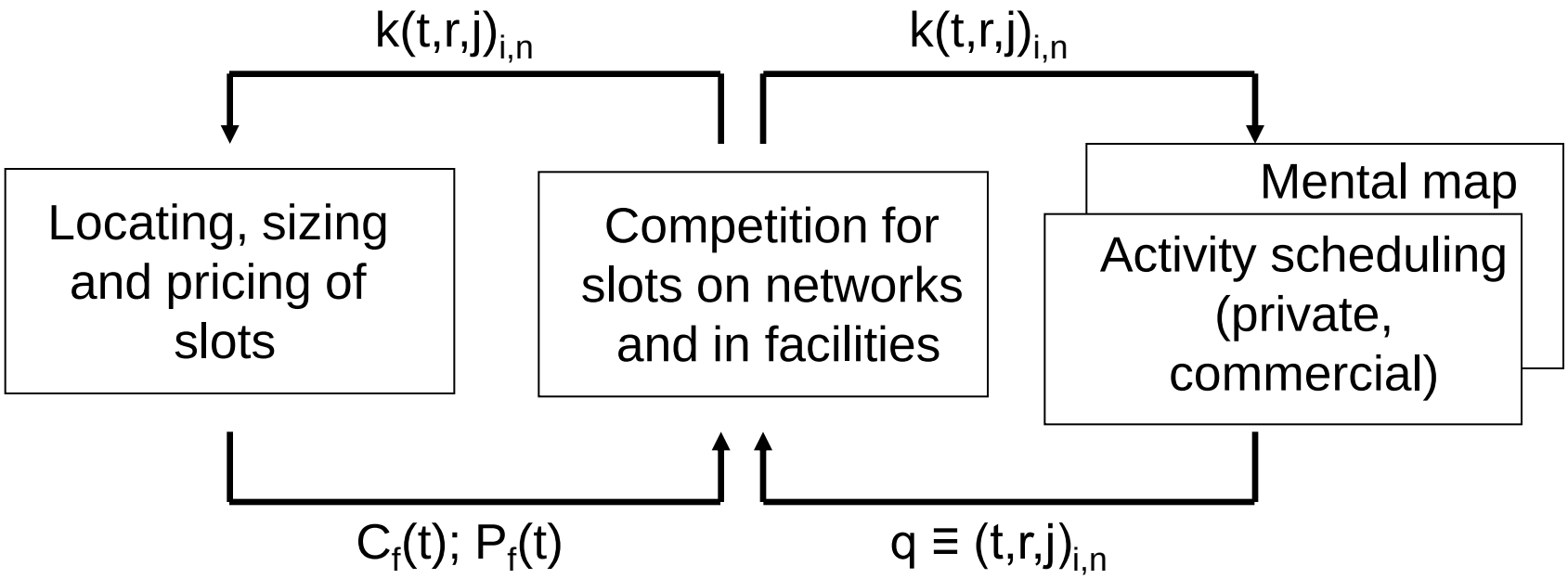
How to find it fast enough to be useful ?

Claim: The overnight policy run is fast enough (for now)

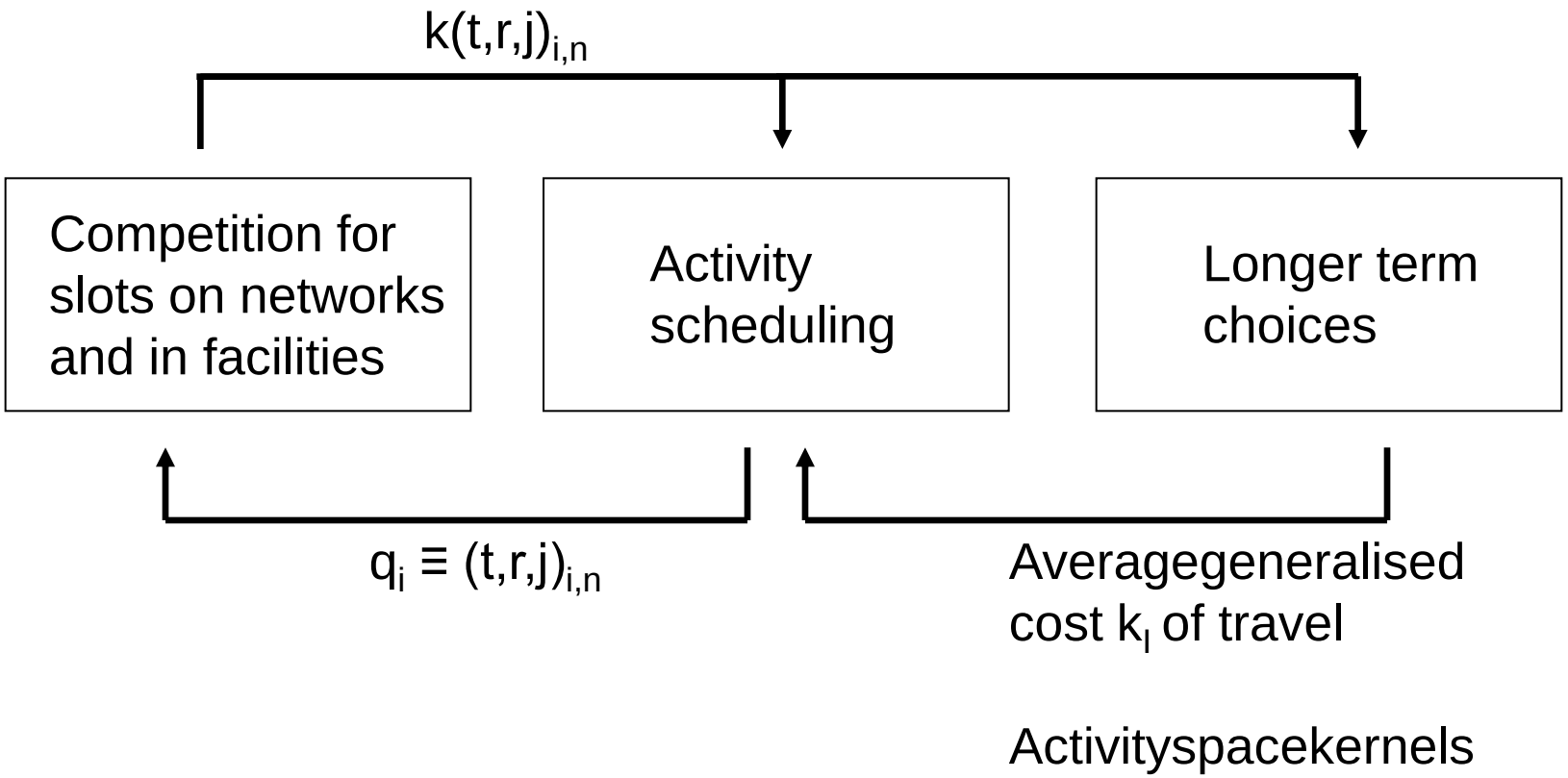
Which equilibrium ? With parameters ?



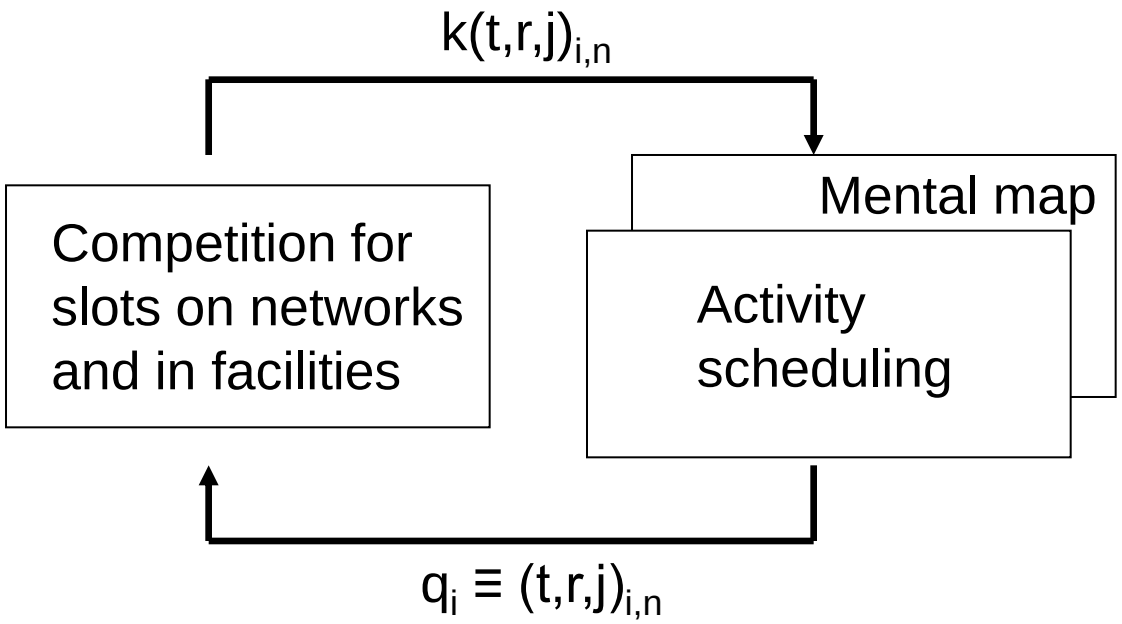
Which equilibrium ? With prices and capacities?



Which equilibrium ? With longer term individual choices ?



or just: a simple, if extended „Wardrop“ equlibrium



MATSim today and in the near future

MATSim evolutionary process

Read scenario

Generate initial demand (schedules)

Do until convergence

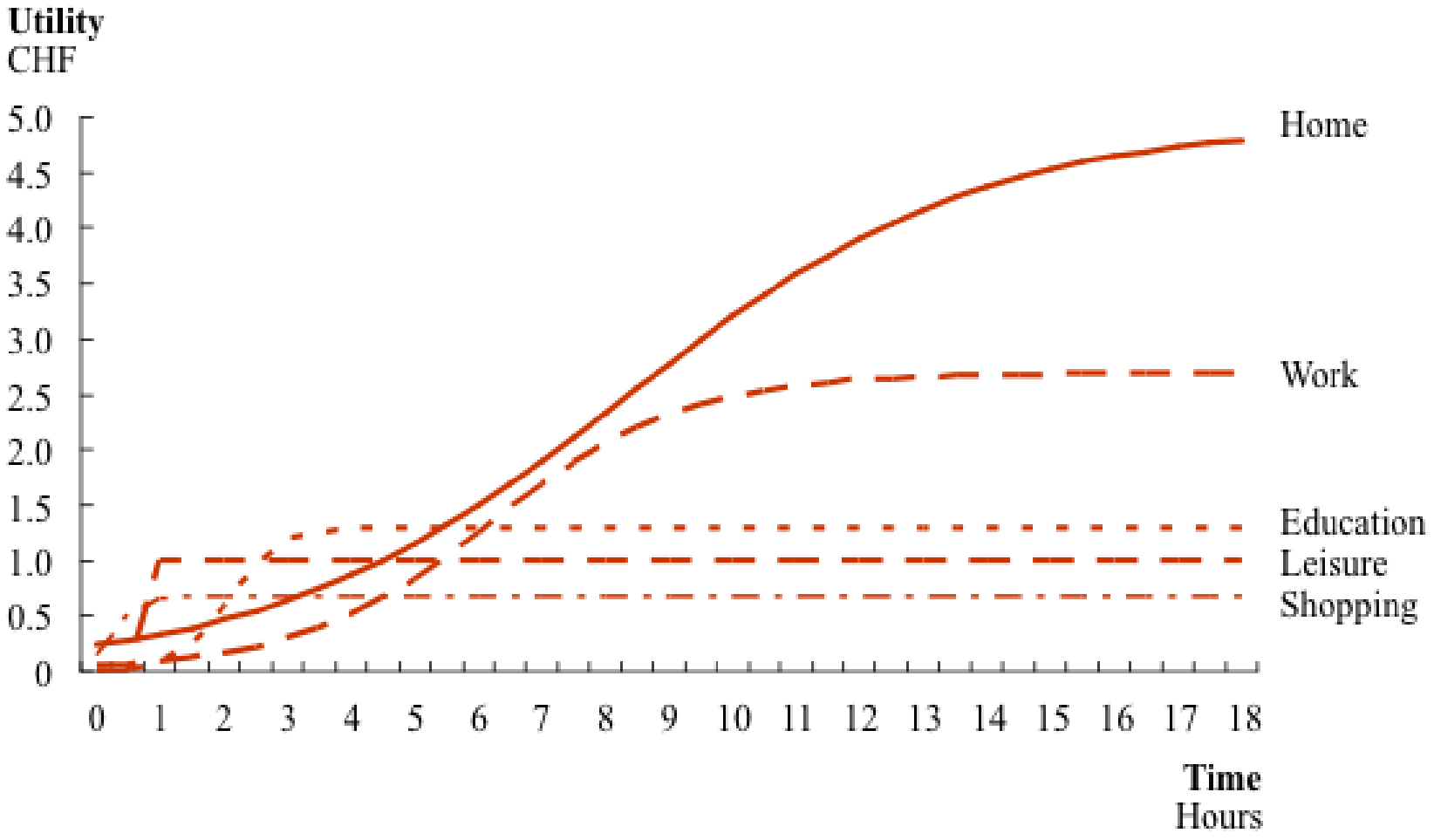
- Select schedule to execute with a biased random approach
- Execute schedules (traffic flow simulation)
- Score all schedules
- Add a new schedule to a random subset of the agents
- Delete worst schedule, if necessary

Current Vickrey-type utility function

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

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

Possible future functions: Joh's suggestion



Feil, Balmer and Axhausen, 2009

2011 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

2011 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

2011 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)**

Diversified MATSims ?

Within-day rescheduling	Time horizon	
	One-day	Open-ended multiple days
Yes	MATSim& (Short-term control; evacuation and events)	[CIRST] (Learning; longer-time horizon demand shifts, impacts of events)
No	MATSim (SUE; project evaluation)	MATSim+ (Learning; Supply-side and demographic adaptations)