Preferred citation style

Axhausen, K.W. (2014) MATSim platform and applications in Europe and elsewhere, presentation at "Demonstration of an Integrated Dynamic Policy Sensitive Model of Travel Demand for the Mega-Region of New York", New York City, May 2014.

.

MATSim platform and applications in Europe and beyond

KW Axhausen

IVT
ETH
Zürich

May 2014

Institut für Verkehrsplanung und Transportsysteme
Institute for Transport Planning and Systems

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Thinking about equilibrium

DUE, SO & SUE

Wardrop (1952):

1. The journey times on all the routes actually used are equal, and less than those which would be experienced by a single vehicle on any unused route.
2. The average journey time is **a** minimum.

Daganzo and Sheffi's (1977) define SUE for the aggregate case:

"In a SUE network, no user believes he can improve his travel time by unilaterally changing routes."

Packing problem of the DUE, SO & SUE

Given the

Agent's daily schedules of predetermined detail

Subject to some

Max F

up to the resolution of the agents, links and facilities

Matching the

Expected elasticities with respect to the generalized costs

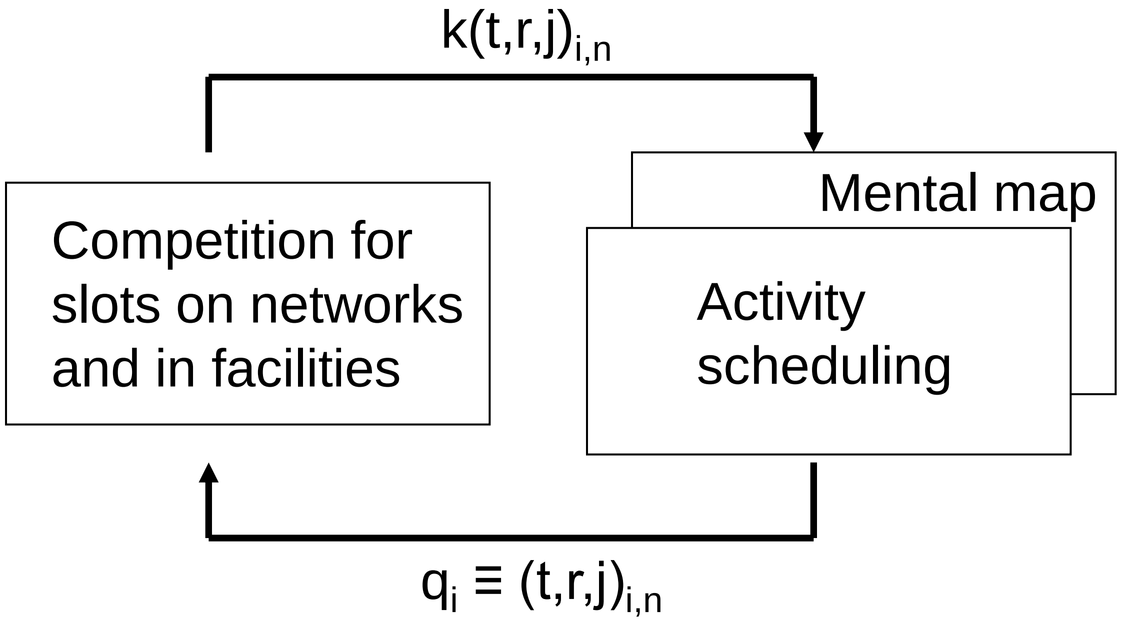
Known correlations between the details of the plans

Capacity constraints on the links, services and facilities

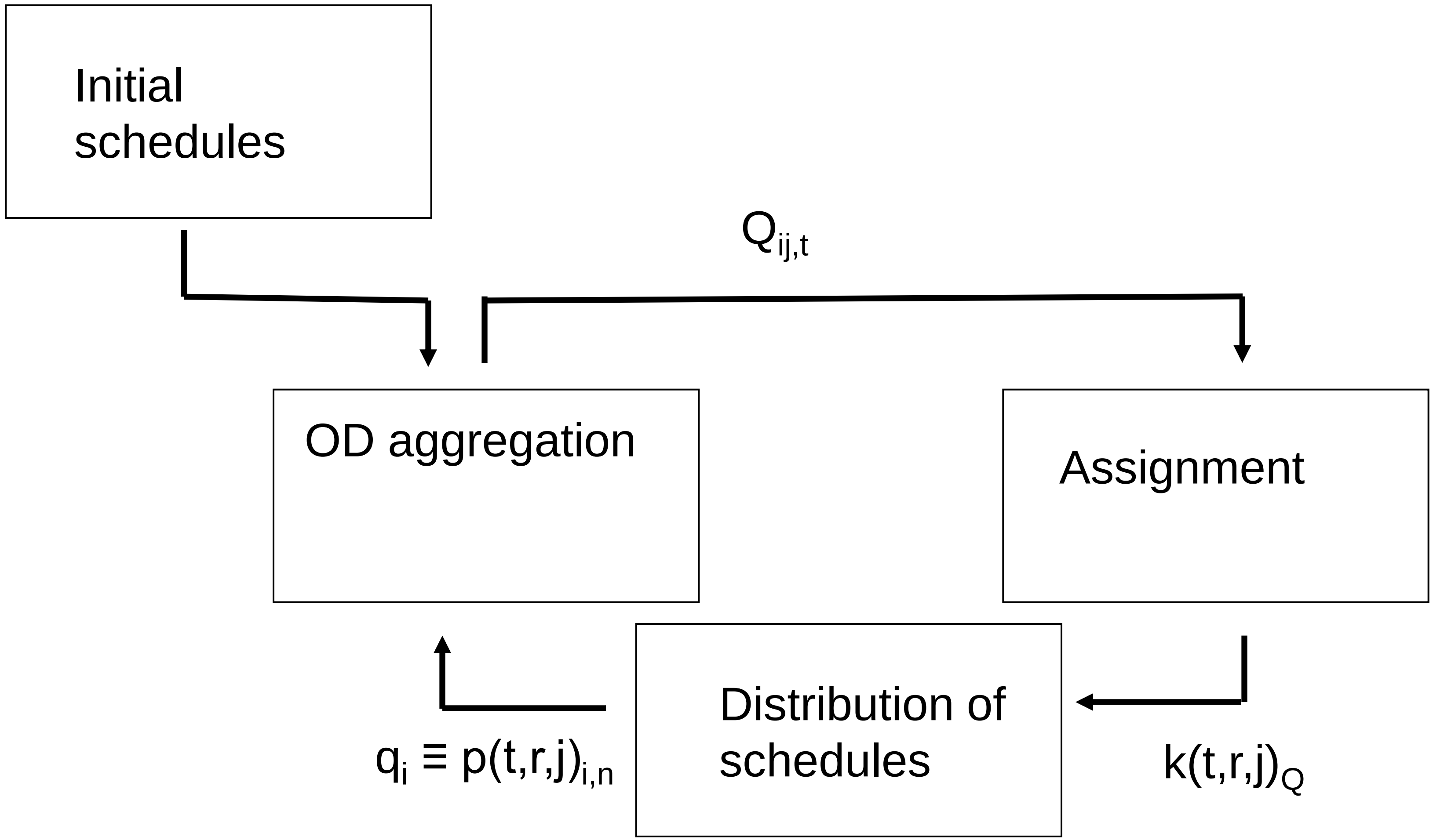
Minimum loads for some of the facilities

How to find the SUE in an agent-based approach ?

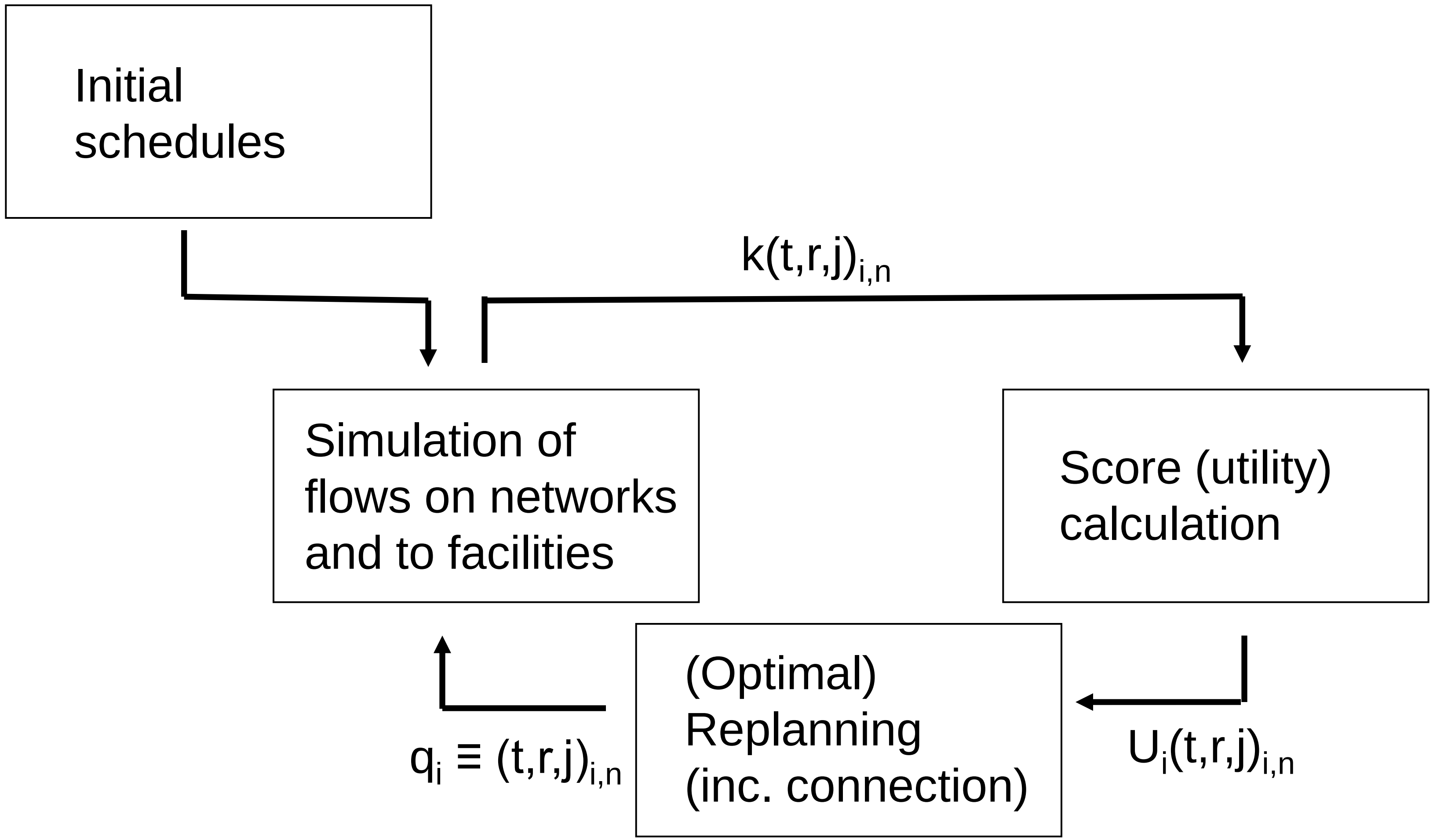
Learning approach of the generic one-day transport model



Equilibrium search in „ABM“ & assignment combinations



Equilibrium search in MATSim



MATSim: A GNU public licence software project

MATSim: A GNU public licence software project

Main partners:

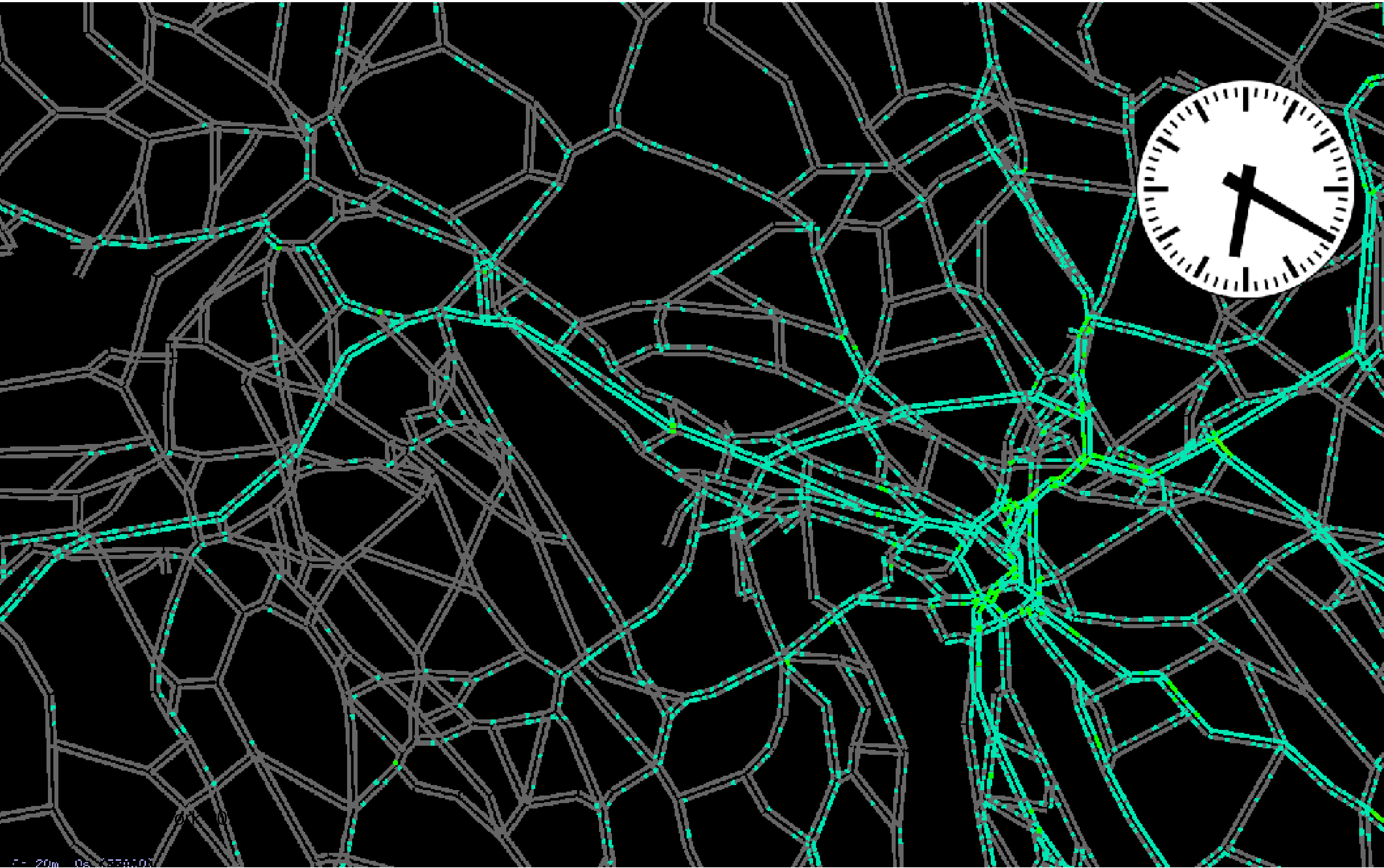
- TU Berlin (Prof. Nagel)
- ETH Zürich
- senozon (Dr. Balmer, Dr. Rieser)

Contributors, users, e.g.:

- TU Poznan
- University of Pretoria
- CASA, UCL, London
- Forschungszentrum Jülich

MATSim today

Following the agents



MATSim: Logic of the co-evolution – Step 0

Agent 1

Plan 1.1 H-W-H; 8:00, 17:00; C,C;

Agent 2

Plan 2.1 H-W-H; 8:00, 17:00; C,C;

Agent 3

Plan 3.1 H-W-H; 8:00, 17:00; C,C;

Co-evolution – Step 1.1 – Simulation/scoring

Agent 1		
Plan 1.1	H-W-H; 8:00, 17:00; C,C;	**35**
Agent 2		
Plan 2.1	H-W-H; 8:00, 17:00; C,C;	**35**
Agent 3		
Plan 3.1	H-W-H; 8:00, 17:00; C,C;	**35**

Co-evolution – Step 1.2 – After replanning (1/3)

Agent 1		
Plan 1.1	H-W-H; 8:00, 17:00; C,C;	35
Agent 2		
Plan 2.1	H-W-H; 8:00, 17:00; C,C;	35
Agent 3		
Plan 3.1	H-W-H; 8:00, 17:00; C,C;	35
Plan 3.2	**H-W-H; 8:15, 17:30; C,C**	

Co-evolution – Step 1.3 – After plan selection (best/MNL)

Agent 1			
	Plan 1.1	H-W-H; 8:00, 17:00; C,C;	**100%**
Agent 2			
	Plan 2.1	H-W-H; 8:00, 17:00; C,C;	**100%**
Agent 3			
	Plan 3.1	H-W-H; 8:00, 17:00; C,C;	35
	Plan 3.2	H-W-H; 8:15, 17:30; C,C;	**New**

Co-evolution – Step 2.1 – Simulation/scoring

Agent 1		
Plan 1.1	H-W-H; 8:00, 17:00; C,C;	**45**
Agent 2		
Plan 2.1	H-W-H; 8:00, 17:00; C,C;	**45**
Agent 3		
Plan 3.1	H-W-H; 8:00, 17:00; C,C;	35
Plan 3.2	H-W-H; 8:15, 17:30; C,C;	**60**

Co-evolution – Step 2.2 – After replanning (1/3)

Agent 1		
Plan 1.1	H-W-H; 8:00, 17:00; C,C;	45
Plan 1.2	**H-W-H; 8:00, 17:00; B,B;**	
Agent 2		
Plan 2.1	H-W-H; 8:00, 17:00; C,C;	45
Agent 3		
Plan 3.1	H-W-H; 8:00, 17:00; C,C;	35
Plan 3.2	H-W-H; 8:15, 17:30; C,C;	60

Co-evolution – Step 2.3 – After plan selection (best/MNL)

Agent 1			
	Plan 1.1	H-W-H; 8:00, 17:00; C,C;	45
	Plan 1.2	H-W-H; 8:00, 17:00; B,B;	**New**
Agent 2			
	Plan 2.1	H-W-H; 8:00, 17:00; C,C;	**100%**
Agent 3			
	Plan 3.1	H-W-H; 8:00, 17:00; C,C;	**38%**
	Plan 3.2	H-W-H; 8:15, 17:30; C,C;	62%

Co-evolution – Step 3.1 – Simulation/scoring

Agent 1		
Plan 1.1	H-W-H; 8:00, 17:00; C,C;	45
Plan 1.2	H-W-H; 8:00, 17:00; B,B;	**70**
Agent 2		
Plan 2.1	H-W-H; 8:00, 17:00; C,C;	**45**
Agent 3		
Plan 3.1	H-W-H; 8:00, 17:00; C,C;	**45**
Plan 3.2	H-W-H; 8:15, 17:30; C,C;	60

Co-evolution – Step 3.2 – After replanning (1/3)

Agent 1

Plan 1.1	H-W-H; 8:00, 17:00; C,C;	45
Plan 1.2	H-W-H; 8:00, 17:00; B,B;	70

Agent 2

Plan 2.1	H-W-H; 8:00, 17:00; C,C;	45

Agent 3

Plan 3.1	H-W-H; 8:00, 17:00; C,C;	45
Plan 3.2	H-W-H; 8:15, 17:30; C,C;	60
Plan 3.3	**H-W-H; 7:30, 17:15; B,B**	

Co-evolution – Step 3.3 – After plan selection (best/MNL)

Agent 1

Plan 1.1	H-W-H; 8:00, 17:00; C,C;		36%
Plan 1.2	H-W-H; 8:00, 17:00; B,B;		**64%**

Agent 2

Plan 2.1	H-W-H; 8:00, 17:00; C,C;		**100%**

Agent 3

~~Plan 3.1~~	~~H-W-H; 8:00, 17:00; C,C;~~		~~45~~
Plan 3.2	H-W-H; 8:15, 17:30; C,C;		60
Plan 3.3	H-W-H; 7:30, 17:15; B,B	**New**	

(The (worst) plan more then memory allows is deleted)

Co-evolution – Summary of best scores

	Iteration 1	Iteration 2	Iteration 3
Agent 1	35	45	80
Agent 2	35	45	45
Agent 3	35	60	60
Mean	**35**	**50**	**62**

Activity schedule dimensions

Activity scheduling dimensions

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

Current Vickrey-type utility function

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

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

Current progress: Berlin

Current progress: Berlin

Network: 113 000 links

Population: 4,5 million agents

Public Transport: 530 lines, 96 transit vehicle types

Mode choice, Departure time choice, Route choice (car + transit)

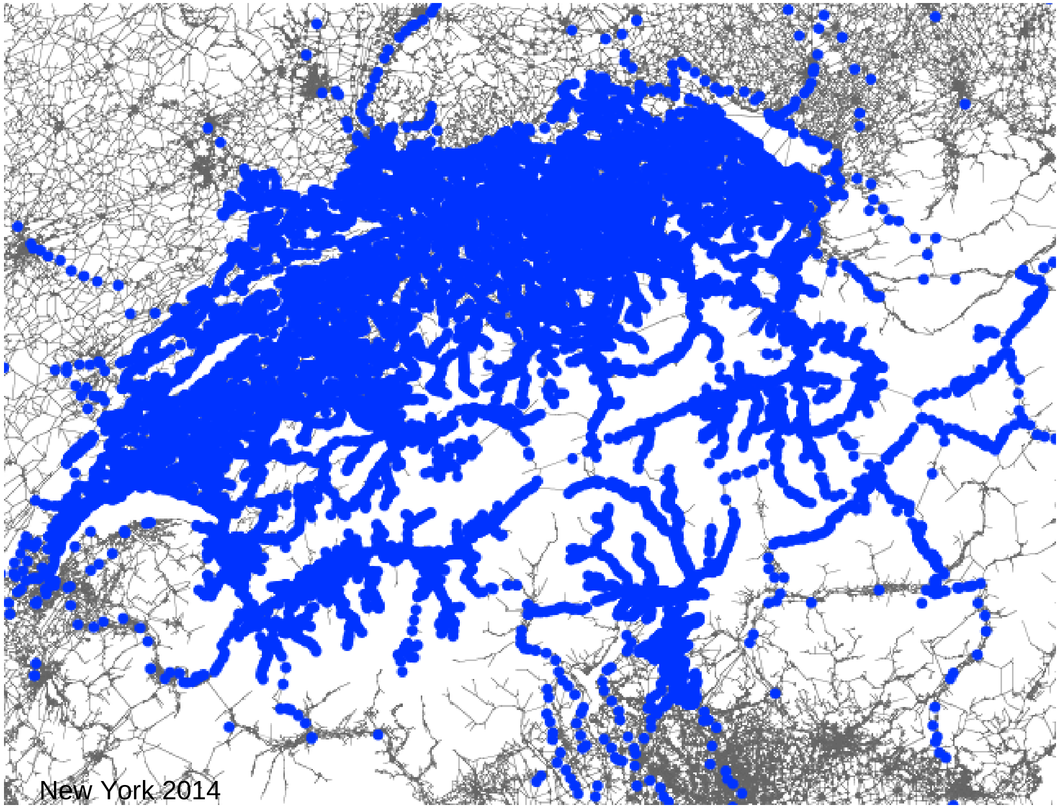
Current progress: Switzerland

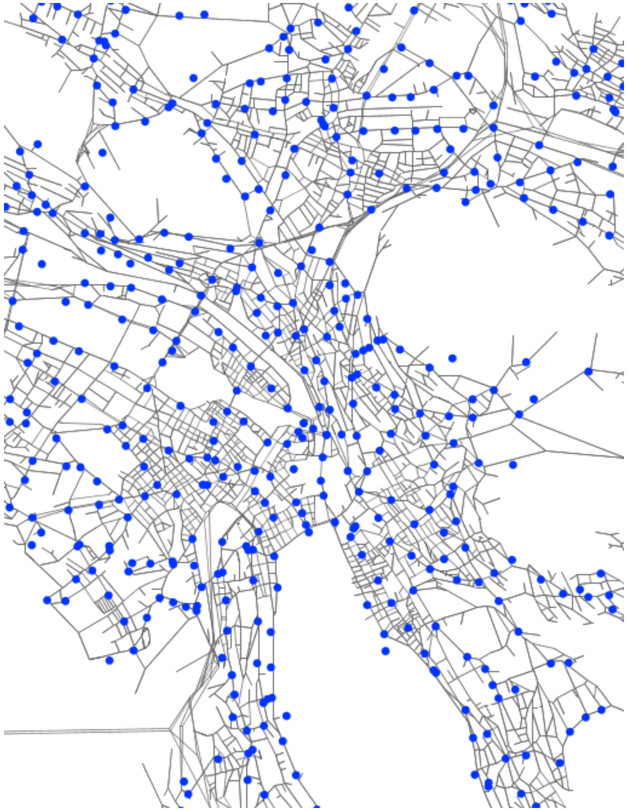
Network: ~ 1 million links (navigation network)

Population: 8 million

Complete public transport (all trains, buses, trams, cablecars, …)

Mode choice, Departure time choice, Route choice (car + transit)





Current progress: Switzerland (cont‘d)

Using the model also for site assessment and pedestrian counts

Current progress: Los Angeles

Network: 108 000 links

Population: 10+ million agents

Public transport: Estimated travel times only

Mode choice, Departure time choice, Route choice

Current progress: Singapore

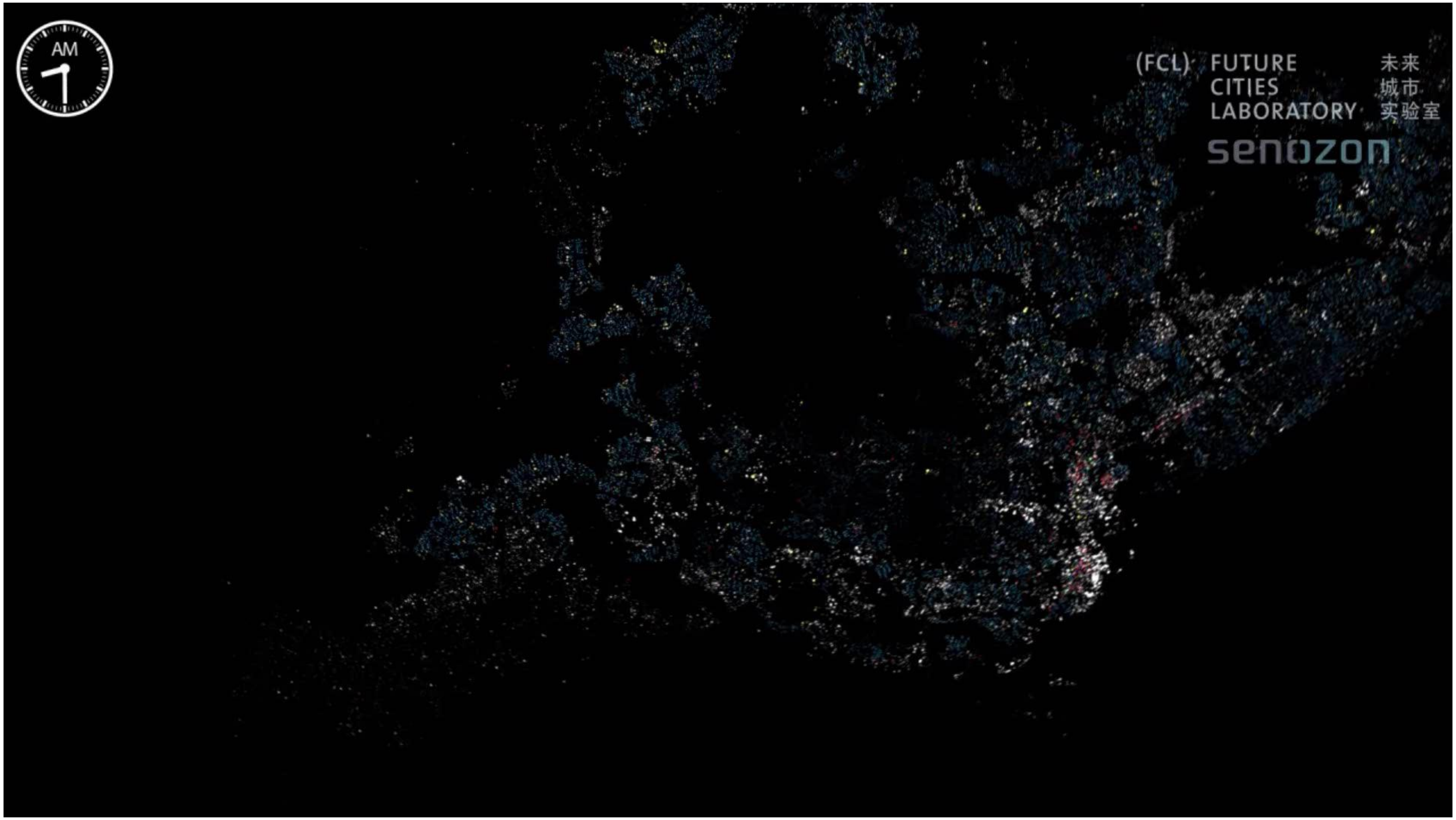
Network: 80 000 links

Population: 5 million

Complete public transport (bus, MRT)

Mode choice, Departure time choice, Route choice (car + transit)

Current progress: Singapore



Schedule detail possibilities (in current stable MATSim)

Number and type of activities **(Feil)**
Sequence of activities **(Ordonez)**

- **Start and duration of activity**
- Composition of the group undertaking the activity **(Kowald, Tan, Fourie)**
- Expenditure division
- **Location of the activity** **(Horni)**

  - Movement between sequential locations

    - **Location of access and egress from the mean of transport**
      - Parking search and type **(Waraich)**
    - **Vehicle/means of transport** **(Ciari)**
    - **Route/service** **(Chakirov)**
    - Group travelling together **(Dubernet, Fourie)**
    - Expenditure division

MATSim @ ETHZ, TU Berlin, FCL, Senozon (past & present)

Prof. Kay Axhausen
Dr. Michael Balmer
Patrick Bösch
Dr. David Charypar
Dr. Nurhan Cetin
Artem Chakirov
Dr. Yu Chen
Dr. Francesco Ciari
Dr. Christoph Dobler
Thibaut Dubernet
Dr. Alexander Erath
Dr. Matthias Feil
Dr. Gunnar Flötteröd
Pieter Fourie
Dr. Christian Gloor

Dr. Dominik Grether
Dr. Jeremy K. Hackney
Dr. Andreas Horni
Dr. Johannes Illenberger
Dr. Gregor Lämmel
Nicolas Lefebvre
Prof. Kai Nagel
Dr. Konrad Meister
Manuel Moyo
Kirill Müller
Dr. Andreas Neumann
Dr. Thomas Nicolai
Benjamin Kickhöfer

Sergio Ordonez
Dr. Bryan Raney
Dr. Marcel Rieser
Dr. Nadine Rieser
Lijun Sun
Alexander Stahel
Dr. David Strippgen
Michael Van Eggermond
Dr. Rashid Waraich
Michael Zilske

Questions ?

www.matsim.org

www.ivt.ethz.ch
www.futurecities.ethz.ch

www.senozon.com