How can be simulated urban transport for a week?

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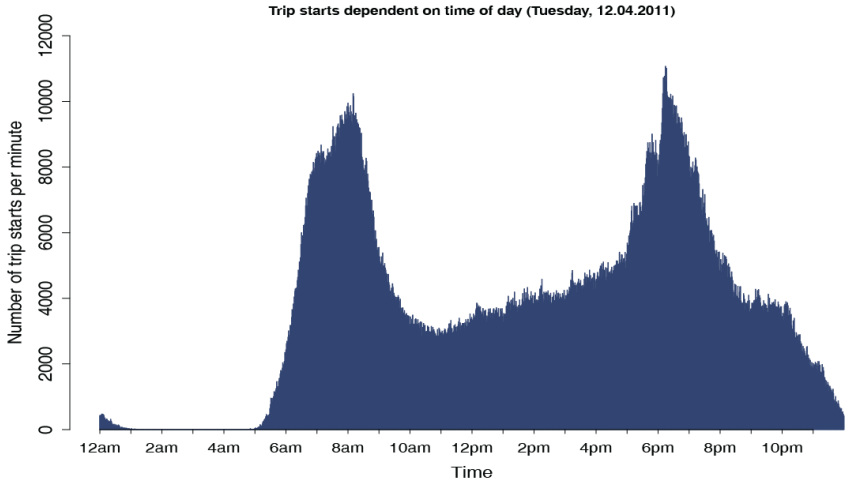
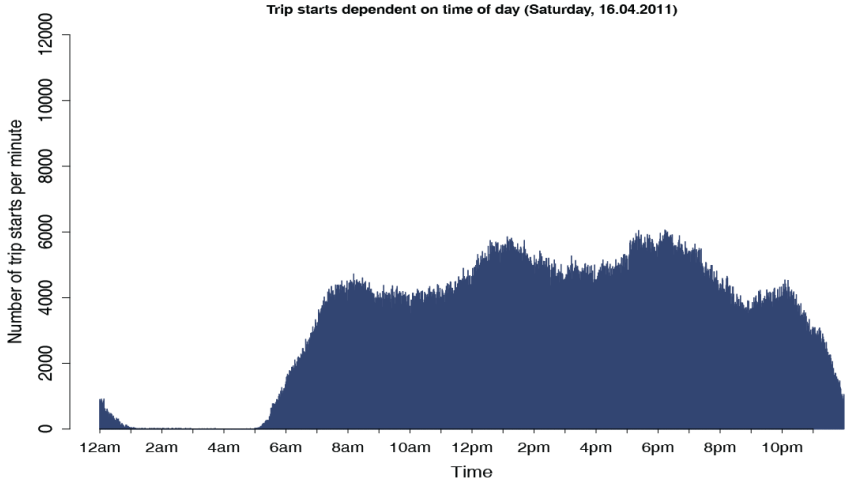
Weekly urban transport

For current transport planning challenges, one week time horizon allows:

- Analyze behavioral variety of travelers (e. g. clustering).
- Simulate individual mode choice over time, identifying mode clienteles.
- Include restrictions like time and money budgets.
- Include a complete cycle of work and leisure.

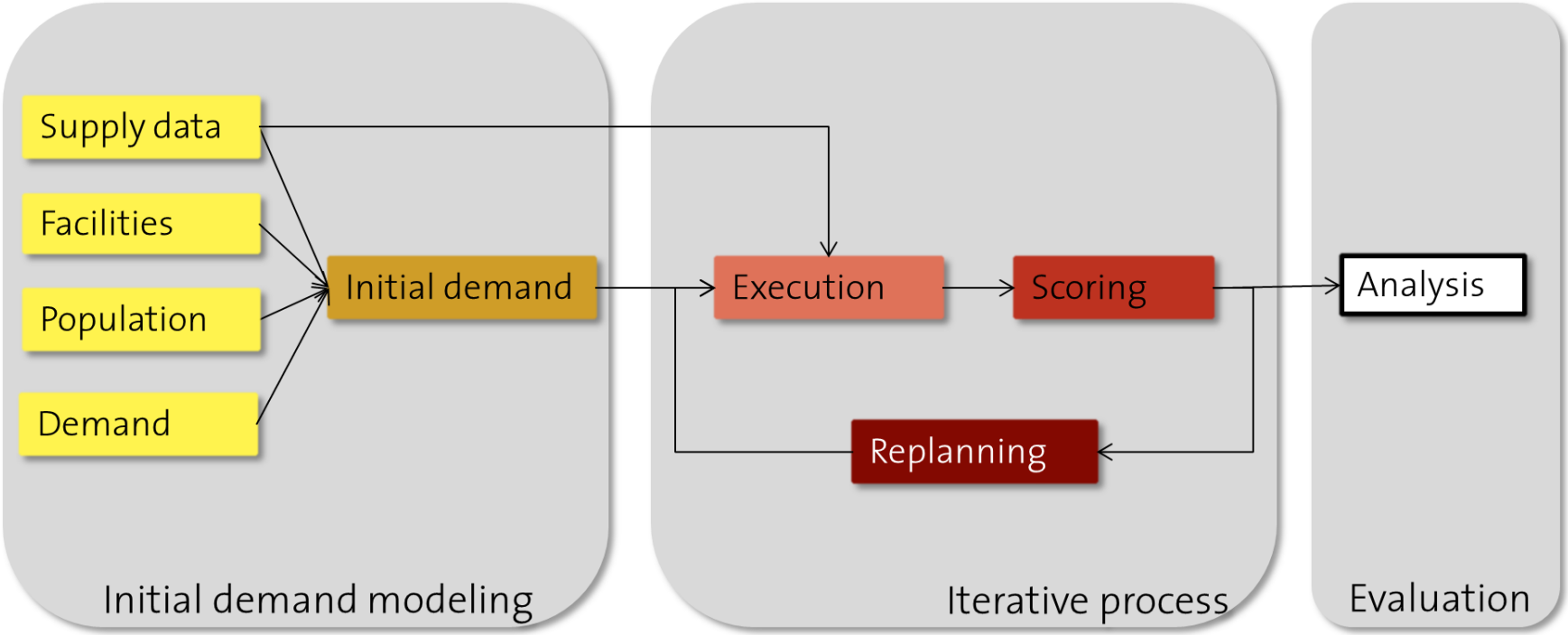




Source: EZLink data, public transport trips, generated by Artem Chakirov

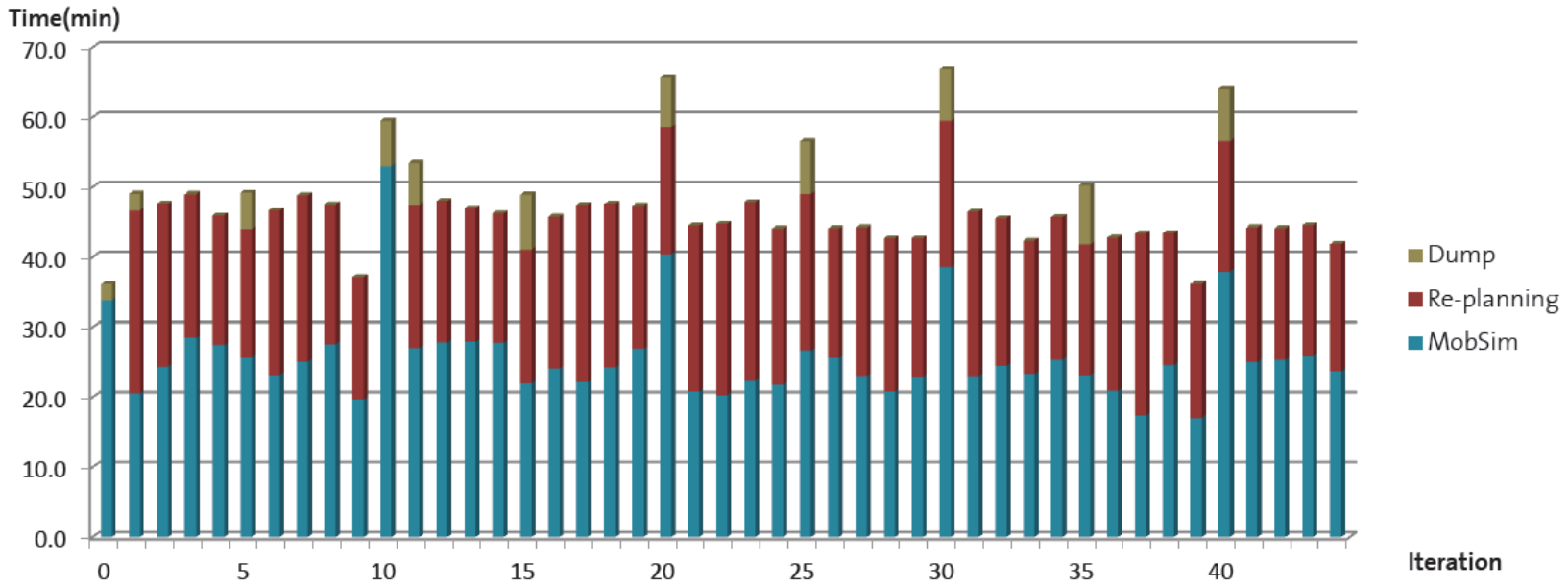
MATSim-T

- Multi-agent
- Activity-based
- Large-scale
- Building-level
- One day
- Multi-modal
- Iterative optimization
- Disaggregated results
- Mesoscopic simulation

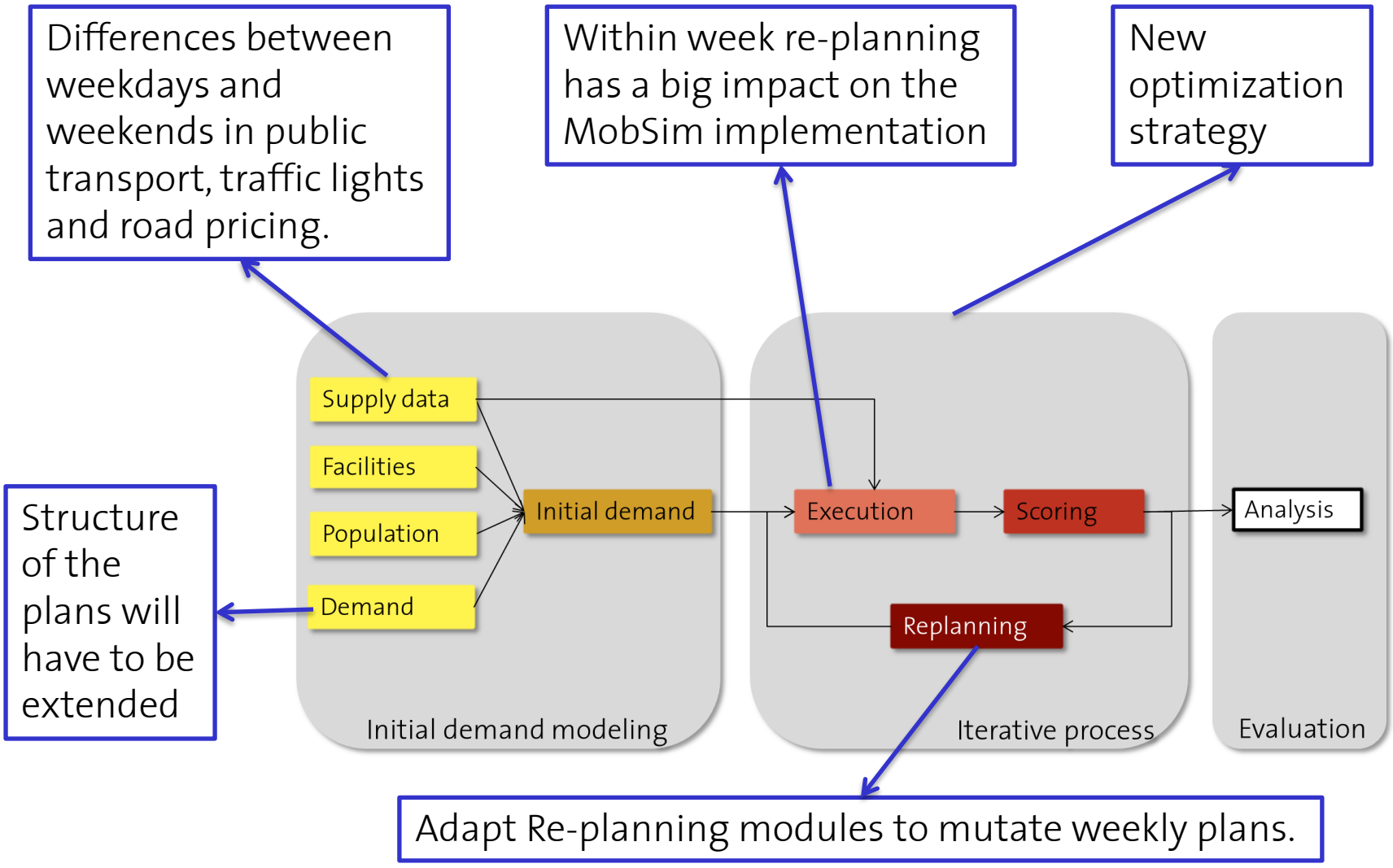


Base scenario

- 25% sample
- 670720 agents
- 5 plans-per-agent
- 150000 locations
- 3.3 activities-per-plan
- 80000 links
- 362 pt lines
- 40 cores (2.4 GHz)
- 80GB (19 plans, 45 MS)

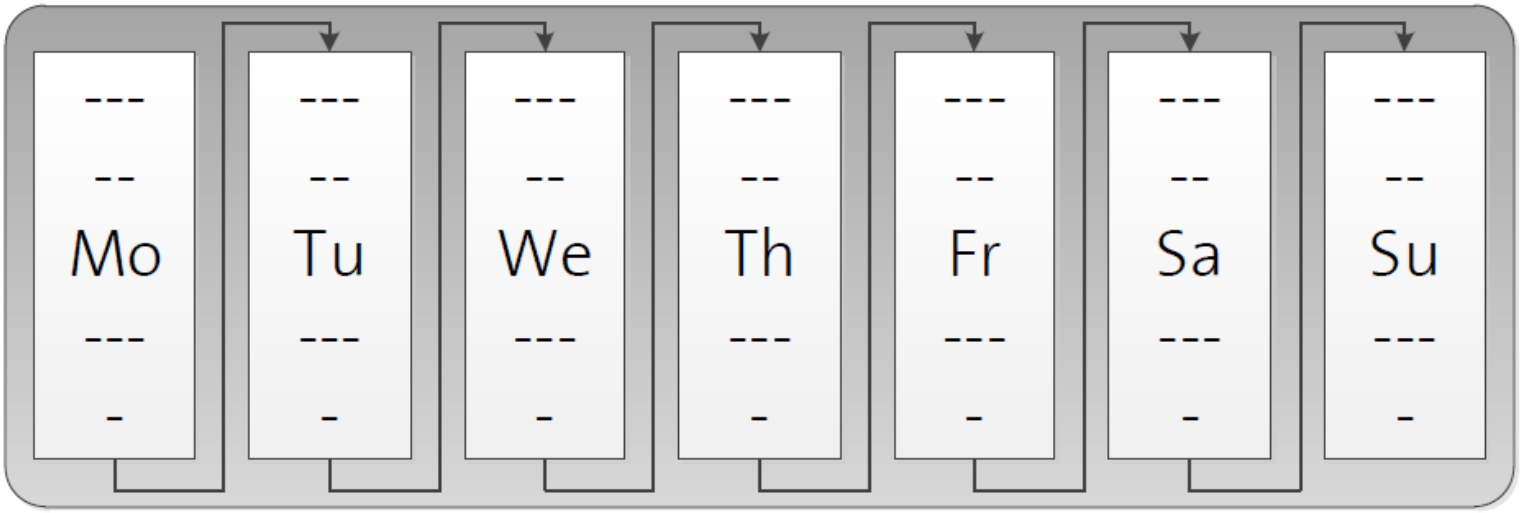


MATSim plus


Differences between weekdays and weekends in public transport, traffic lights and road pricing.
Within week re-planning has a big impact on the MobSim implementation
New optimization strategy
Supply data
Facilities
Population
Demand
Initial demand
Execution
Scoring
Analysis
Replanning
Initial demand modeling
Iterative process
Evaluation
Structure of the plans will have to be extended
Adapt Re-planning modules to mutate weekly plans.

Optimization strategy (1)

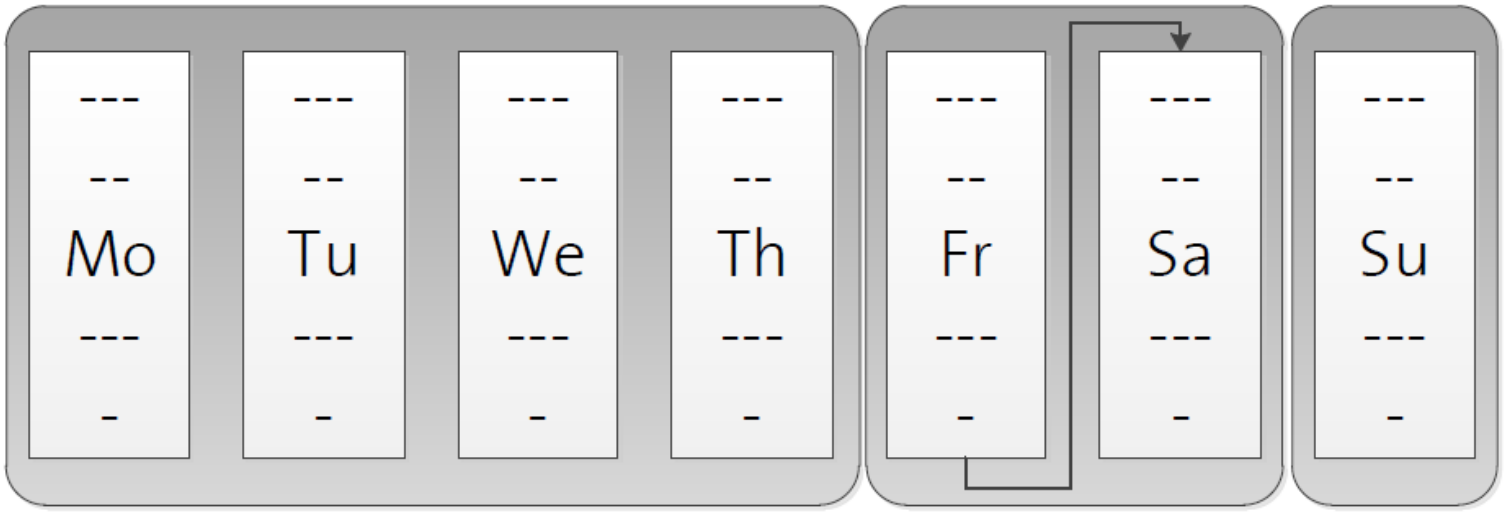
1.



2.

Optimization strategy (2)

3.



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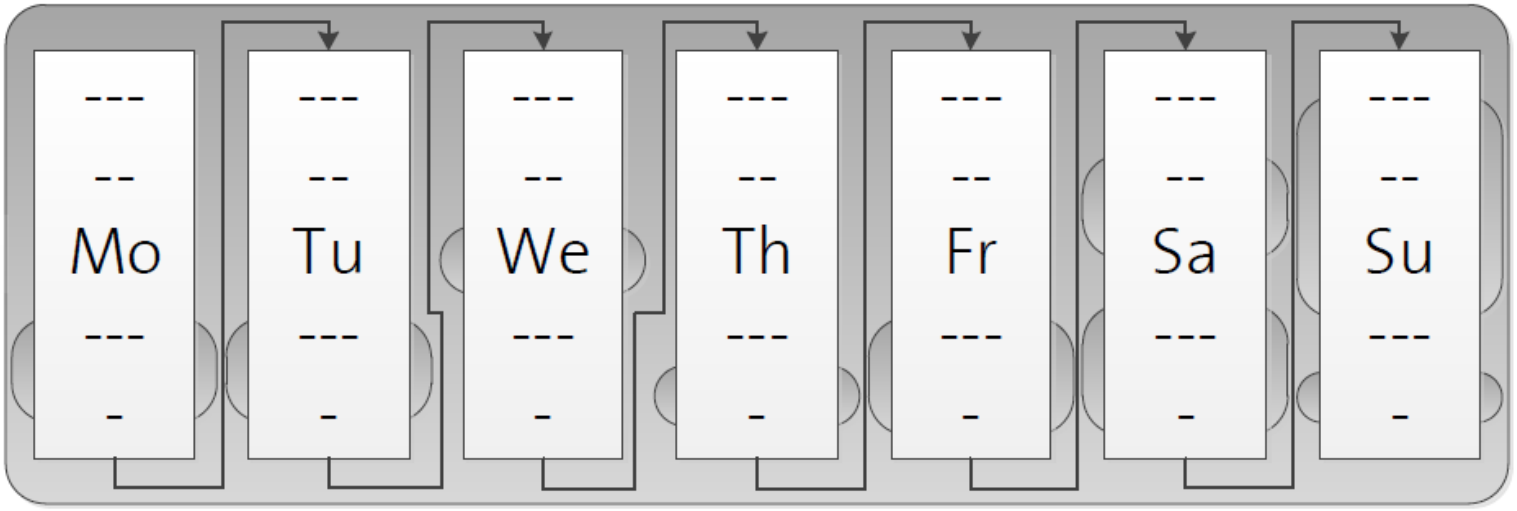


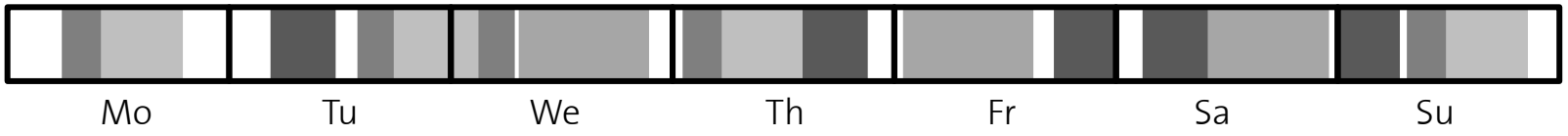
Optimization strategy (3)

5. Continuous planning:

- Drop the iterative optimization strategy
- Simulate a week only once
- Agents take decisions on-the fly (activities and travels)
- Based on agents needs
- A distributed environment is needed (independency of mental processes)
- Agents find local optima (In reality people can not find global optima because they don't know all the alternatives or they don't have time to calculate, Simon (1955))
- Drastic MATSim structure modification

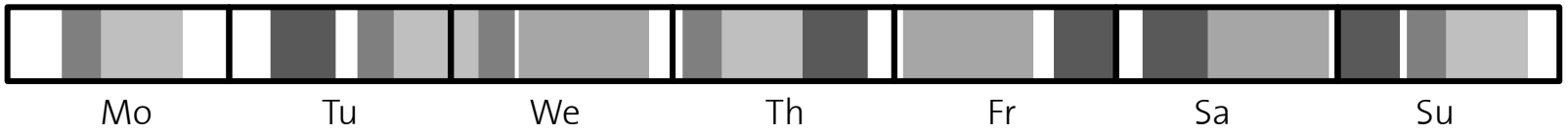
Weekly scheduling (1)

- Definition of weekdays and generation of weekends
  - Munizaga et al. (2011)
  - Lack of weekend travel diaries
  - Weekday survey and several observations of weekend schedules
  - Convex combination of some of the weekend schedules
- Pre-calculated schedules
  - Full agents schedules are defined before the simulation
  - Generation with classic methods, or algorithms like Kuhnimhof and Gringmuth (2009) or Doherty et al. (2002)
  - Seven times the current memory used by MATSim is needed



Weekly scheduling (2)

- Definition of fixed and floating activities
  - The schedule is partially defined (fixed activities)
  - Floating activities are defined on-the-fly
  - Test of simple and complex algorithms (Kuhnimhof and Gringmuth (2009) or Doherty et al. (2002))
- Continuous activity scheduling:
  - Märki et al. (2011).
  - Full schedule definition on-the-fly
  - Based on agents needs
  - Distributed environment is needed (independency of mental processes)

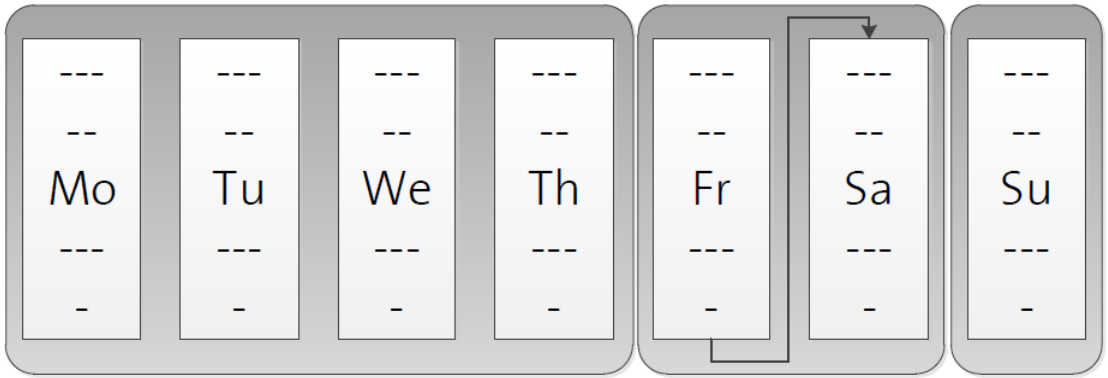


Proposed methodology (1)

1. Model Multi-day transport supply data;

2. Generate a small scenario with full week plans;

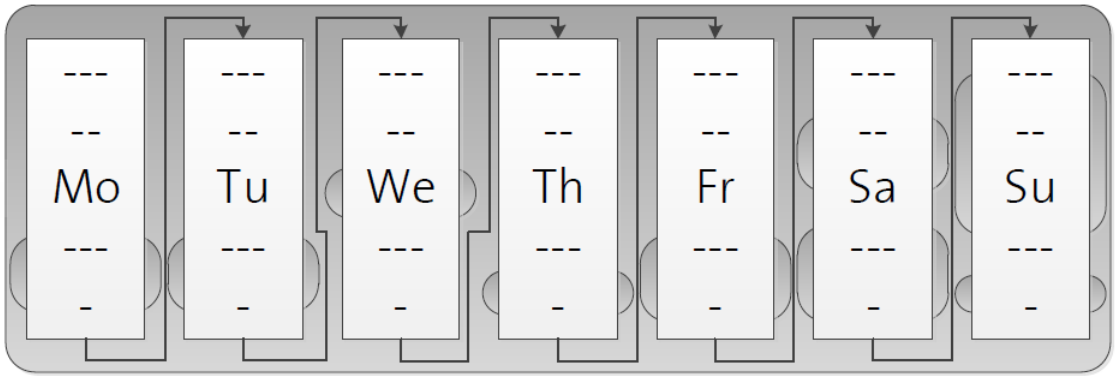
3. Simple optimization strategy:
   a. Data structures for full weekly activity plans (extensive and intensive);
   b. Model the categorization of days proposed;
   c. Develop a MATSim Controller for this strategy;
   d. Run and test.



Proposed methodology (2)

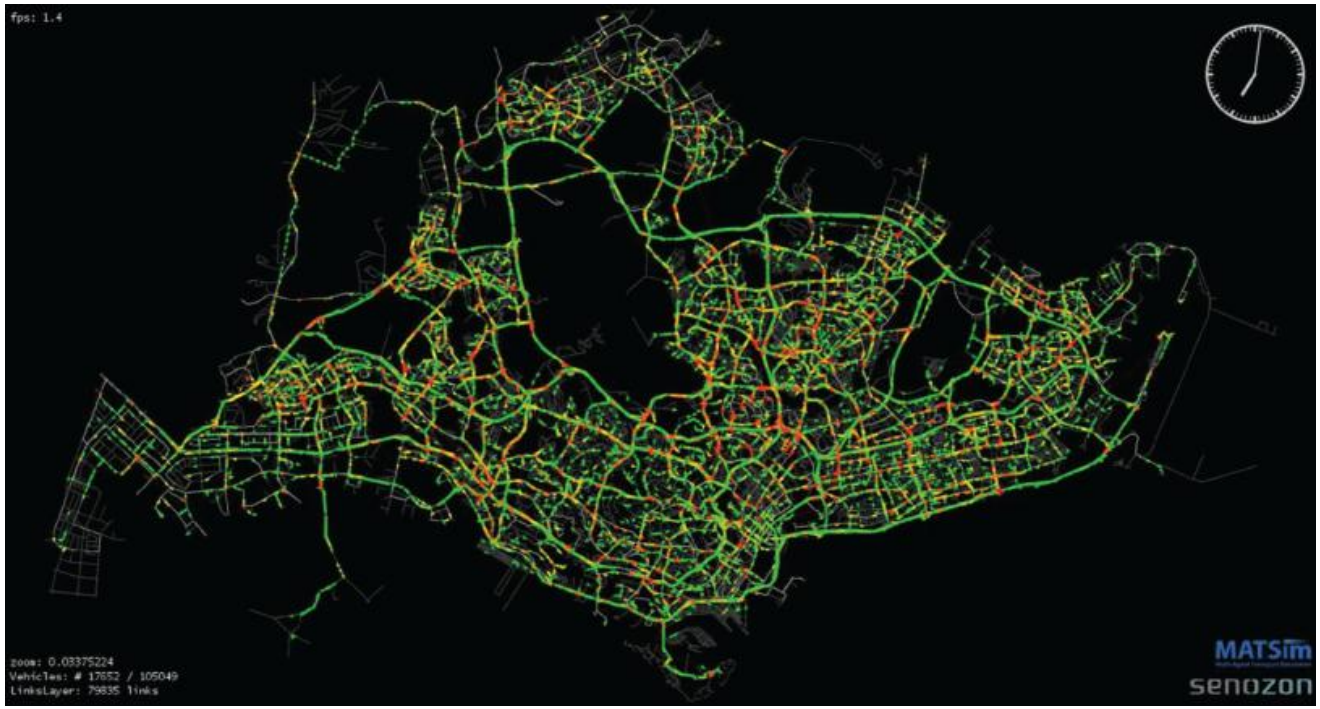
4. Generate a small scenario with incomplete week plans;

5. Simple optimization strategy:
   a. Data structures for incomplete weekly activity plans;
   b. Model the categorization of activities (fixed and float);
   c. Develop a MATSim Controller for this strategy;
   d. Simple and complex within-week scheduling algorithms;
   e. Extend the population model to manage the information needed by the algorithms;
   f. Run and test.

4. 

Proposed methodology (3)

6. Large scale scenario, full week plans;
7. Third optimization strategy large scale;
8. Large scale scenario, incomplete week plans;
9. Fourth optimization strategy large scale;



Proposed methodology (4)

10. (Optional) Continuous planning strategy implementation:
    a. Use need-based theory for implementing the continuous scheduling algorithm;
    b. Extend the population model to manage the information needed by the continuous scheduling algorithm;
    c. Run and test a small population scenario
    d. Calibrate large-scale population parameters
    e. Run and test a large-scale scenario

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