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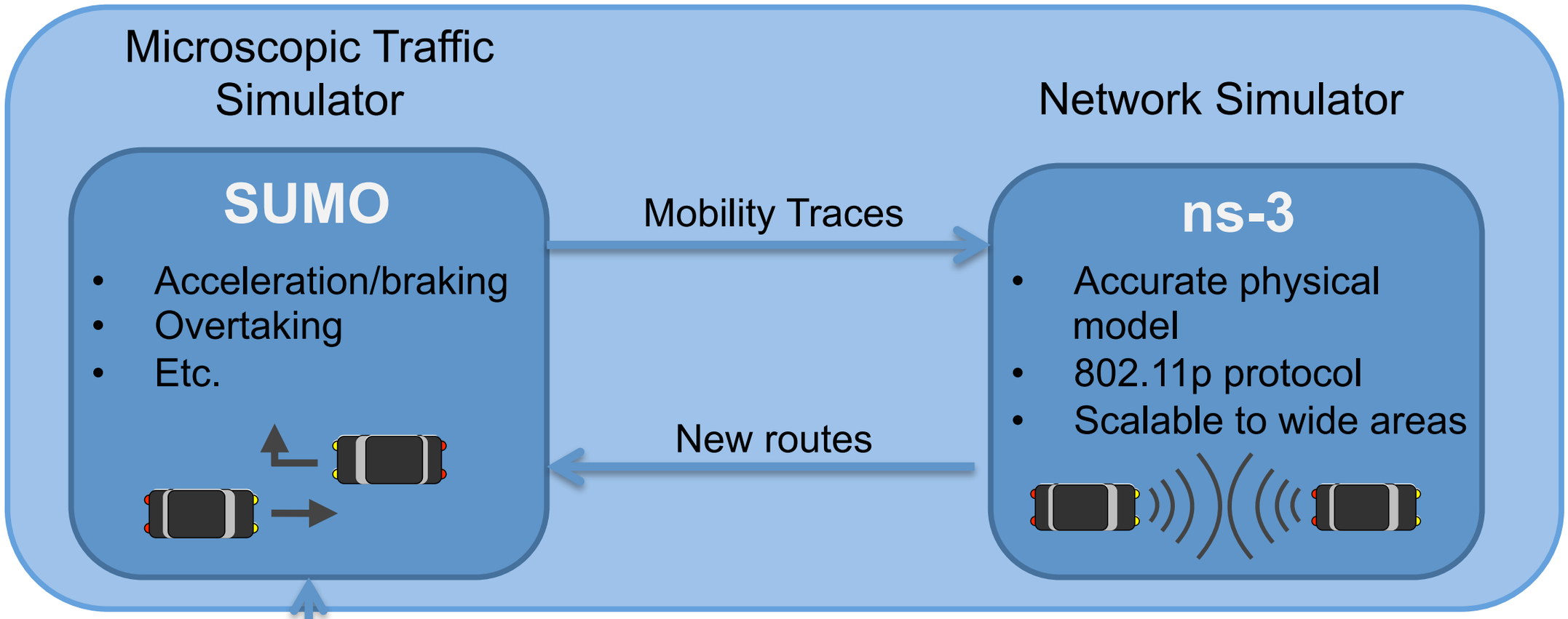
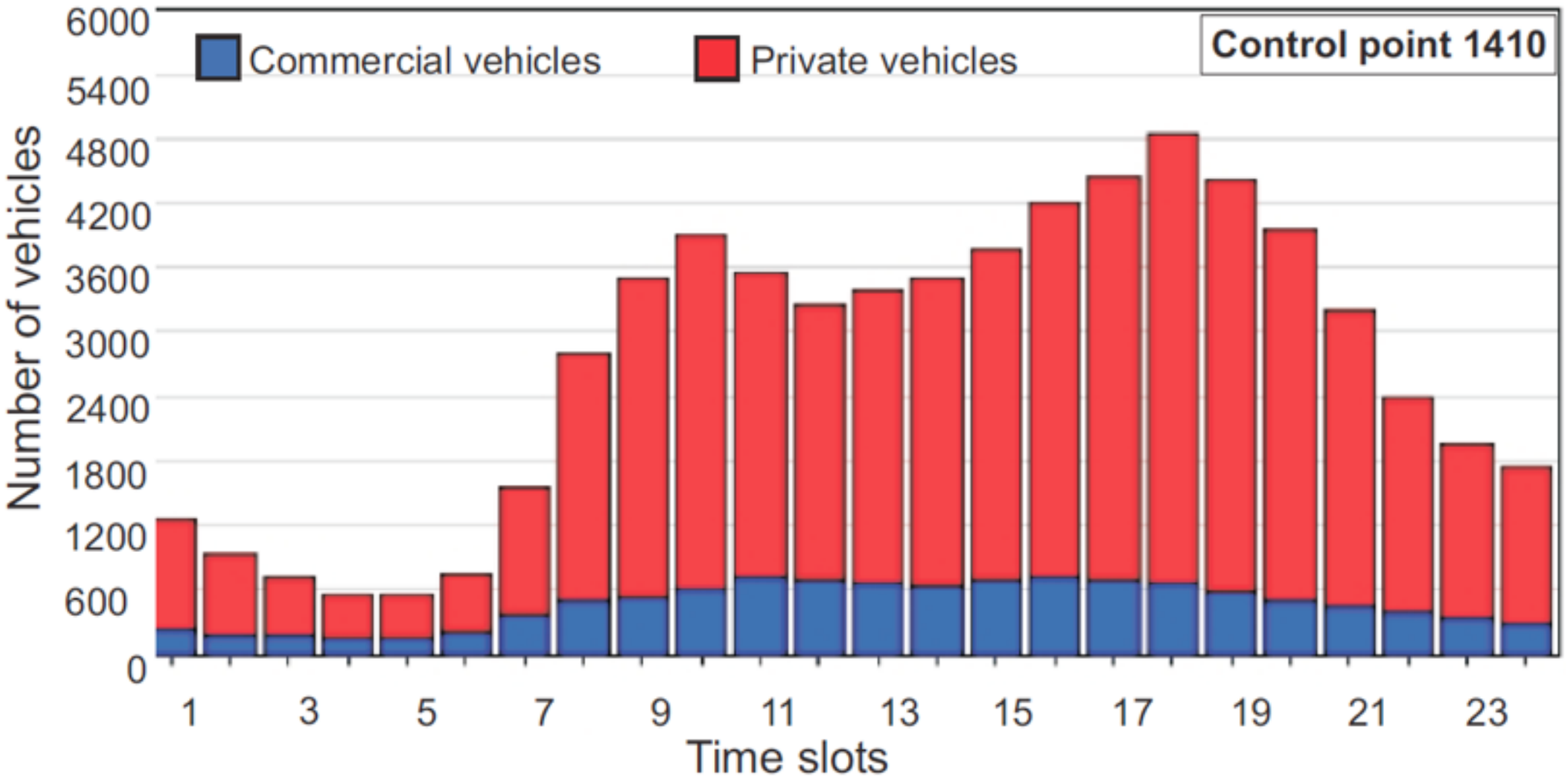
Optimization of the Mobility

Realistic VANET simulation



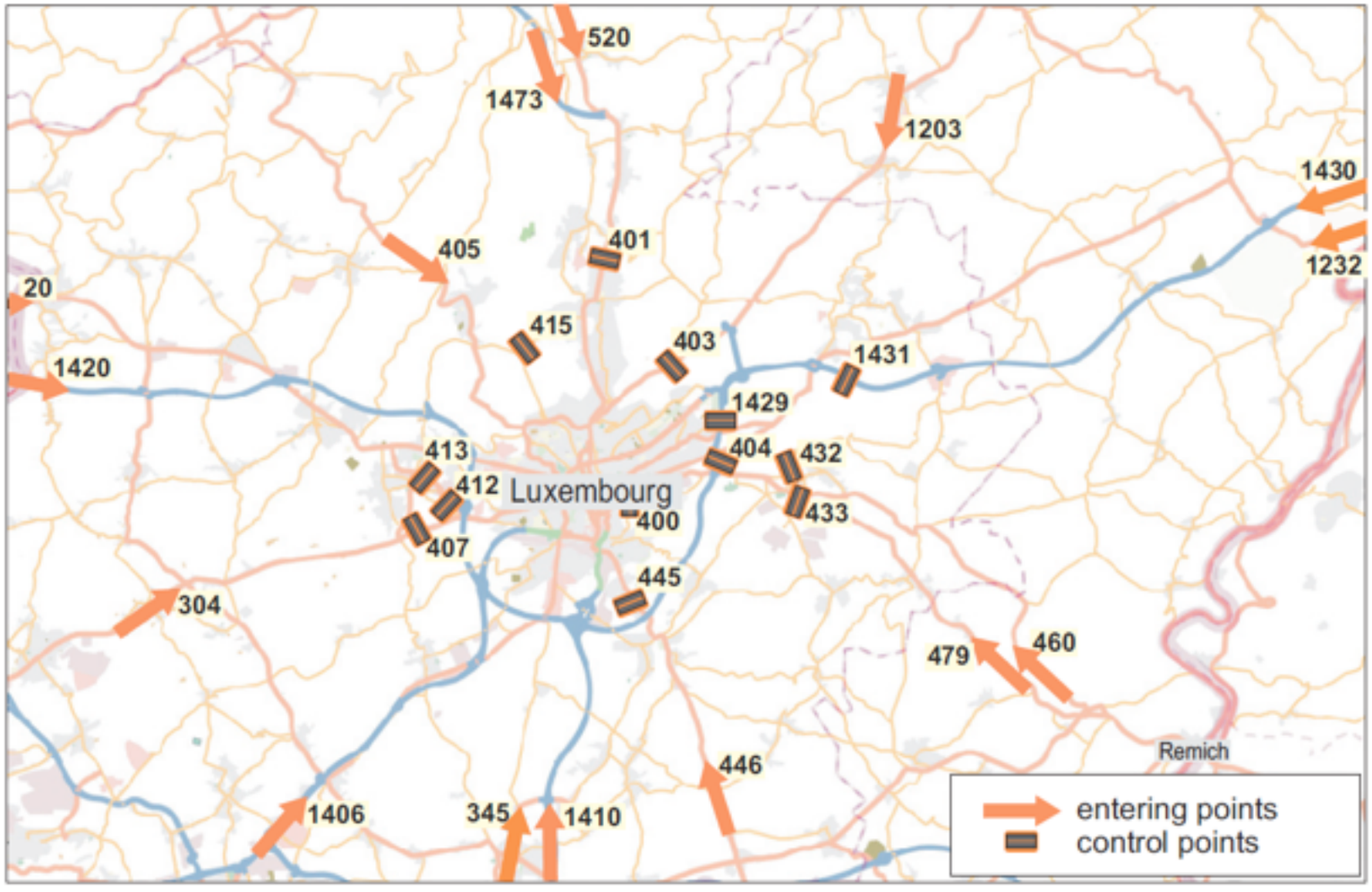
Realistic flows needed!

VehILux: from traffic volume counts to flows

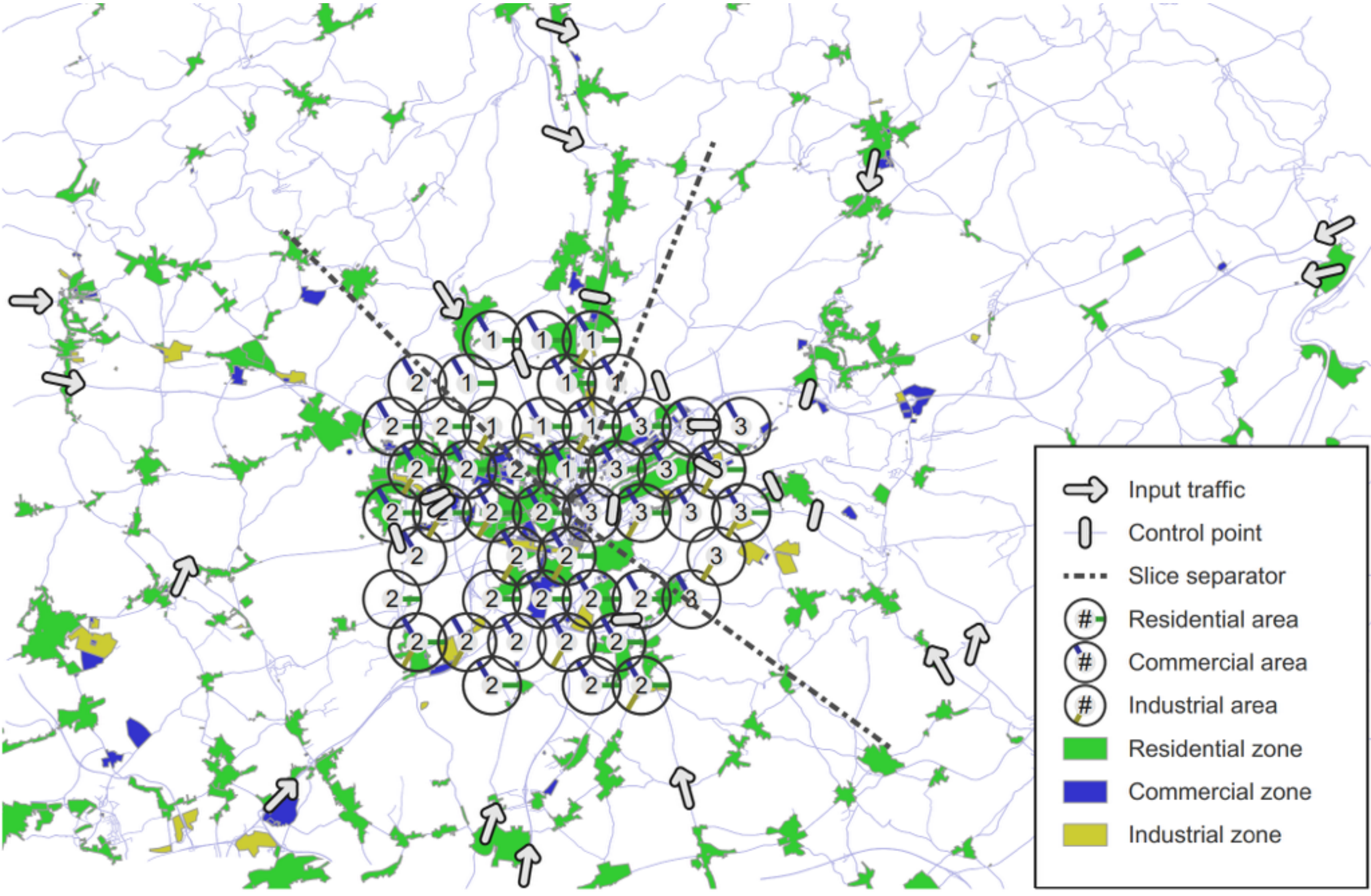


VehILux model (cont.)

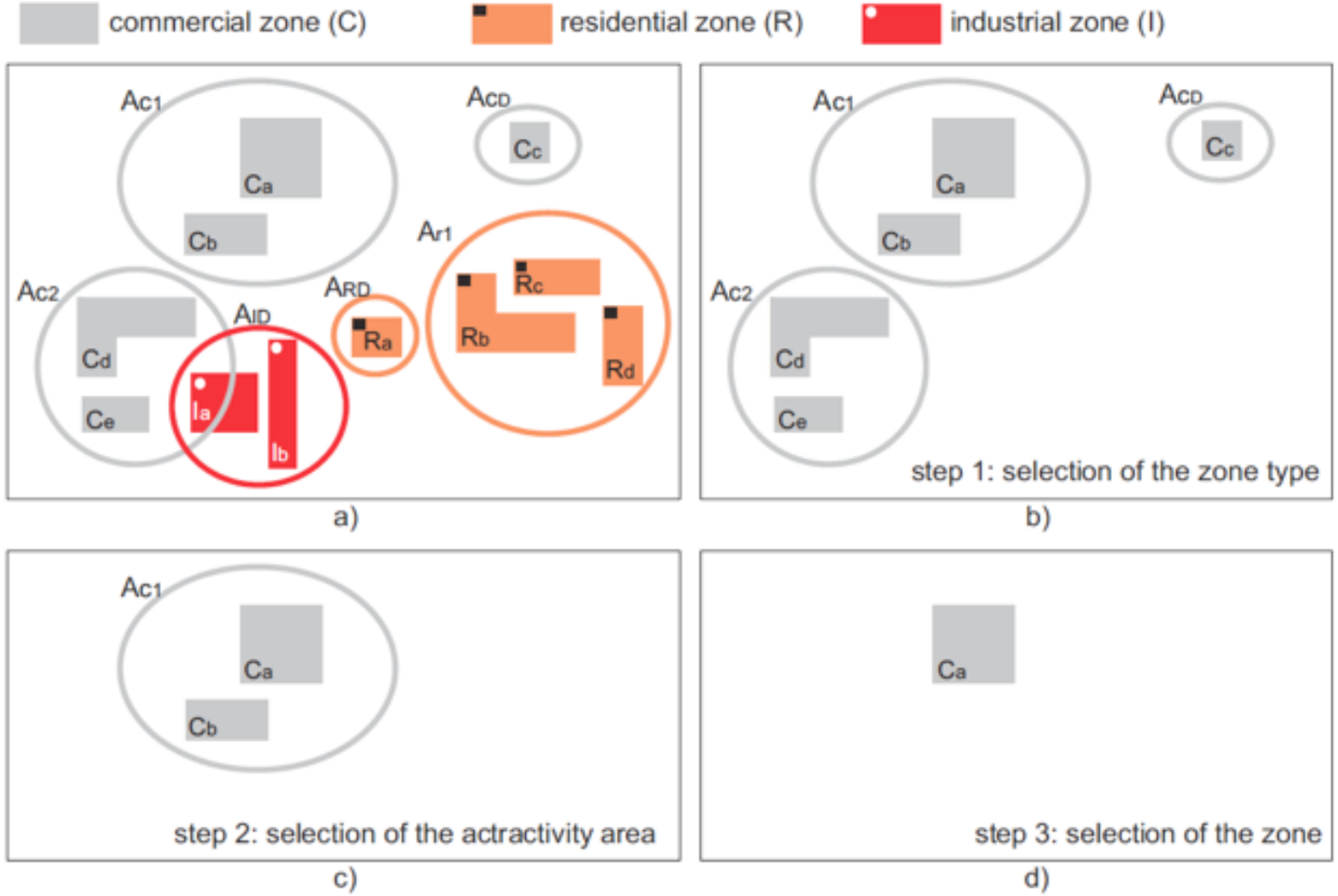
1. Classification of traffic counts as entering and control points
2. Generation of traffic flows from entering points
   - Selection of a destination: a probabilistic model
   - Injection of inner traffic at random residential areas
3. Verification of the points using control points



Areas and zones in Luxembourg



Zones, atractivity areas and probabilities



- A probabilistic selection of a destination is performed for each vehicle originating from the control point
- The problem: discovery of the parameters values

VehiLux model details

- Destination is a randomly selected zone z based on the probability

$$P(z) = P_T \times P(z.a) \times \frac{S(z)}{S(z.a)}$$

- P_T: Probability of type
  - Comercial
  - Industrial
  - Residential
- P(z.a): Probability of choosing area z.a
- S(z) and S(z.a): Size of zone z and area z.a, respectively

Parameters to optimize

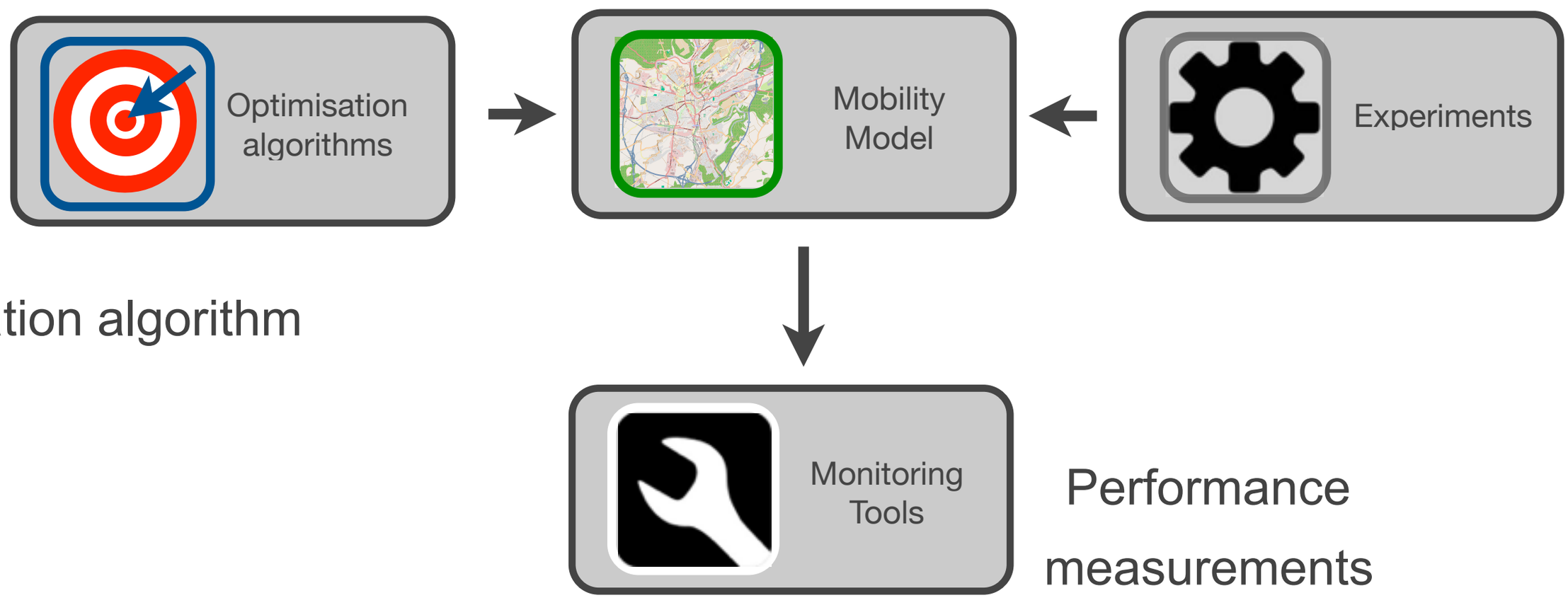
- Probabilities to go to each defined zone
- Inner traffic generation

Multi-objective Optimization of the Mobility Traces Generator for VANETs

Optimization of Mobility

VehiLux

Configuration of simulations



Optimization algorithm

Performance measurements

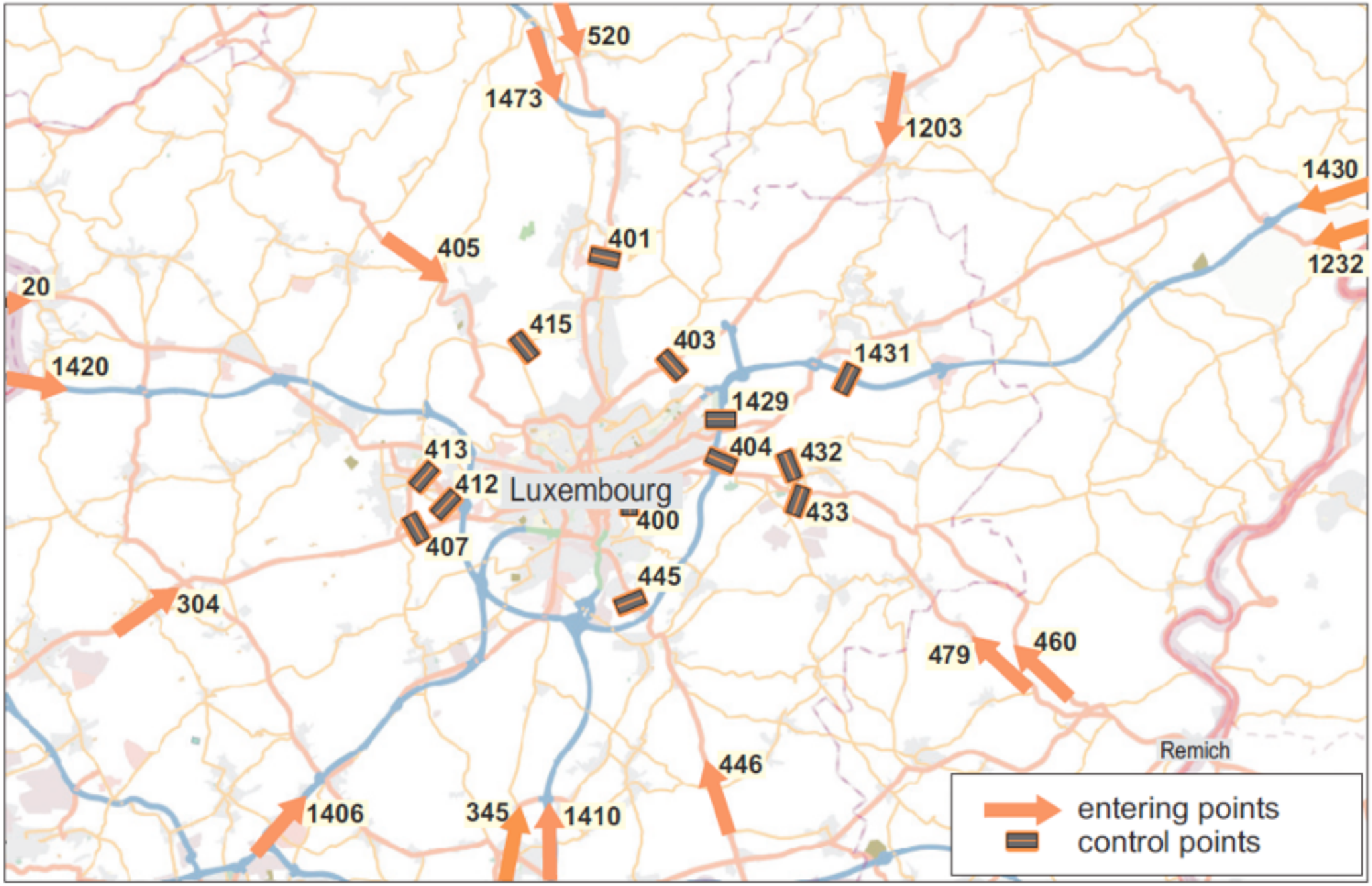
Optimization algorithm

- Minimize the difference between simulated and real traffic flows

$$F = \sum_{c=1}^{C} \sum_{t=1}^{T} |r_c(t) - c_c(t)|$$

- $r_c(t)$: real traffic count at control point c in time slot t
- $c_c(t)$ simulated traffic count at control point c in time slot t

Optimization algorithm



Fitness function: difference between real traffic counts and counts from generated flows (at **control points**).

Mobil. optimization problem representation

- Problem representation

Global Type Propability			Residential Attractivity Areas		Commercial Attractivity Areas			Industrial Attractivity Areas		Inner Traffic Ratio	Shifting Ratio
P_R	P_C	P_I	D_R	P_{R1}	D_C	P_{C1}	P_{C2}	D_I	P_{I1}	P_{IR}	P_{SR}

- Sample solution

Zone Types			Residential Attractivity Areas		Commercial Attractivity Areas			Industrial Attractivity Areas		Inner Traffic Ratio	Shifting Ratio
15	25	60	12	88	10	60	30	30	70	35	25
1	2	3	4	5	6	7	8	9	10	11	12

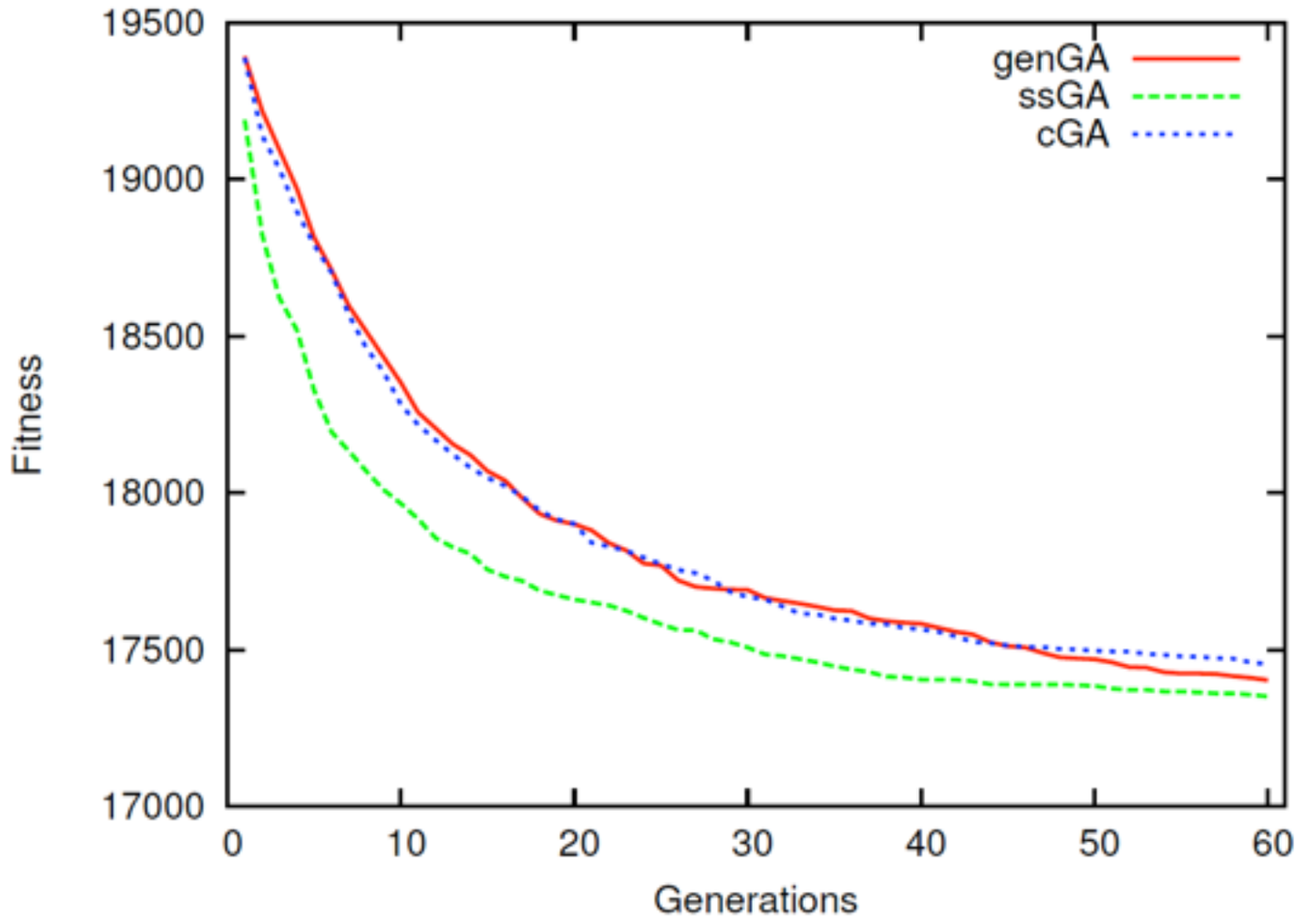
Network and mobility simulators parameters

- VehiLux
  - Realistic road network topology (OpenStreetMaps)
  - Real traffic counting data from the Luxembourg Ministry of Transport

- Simulation area: 1700km^2
- Number of entering points: 15
- Number of control points: 12
- Simulation time period 12AM-12PM (12 time slots)

- Process the output of the simulator
  - Simulated traffic count at every counter

Results: comparison of the algorithms



EXPERIMENTAL RESULTS (FITNESS VALUES) OBTAINED WITH THE GENGA, SAGA AND CGA.

Algorithm	Best Result	Avg. Result
genGA	16209	17416.76 $\pm$511.42
ssGA	**15717**	**17368.07** $\pm$704.79
cGA	16135	17474.45 $\pm$686.69

Real vs. generated flows at control points