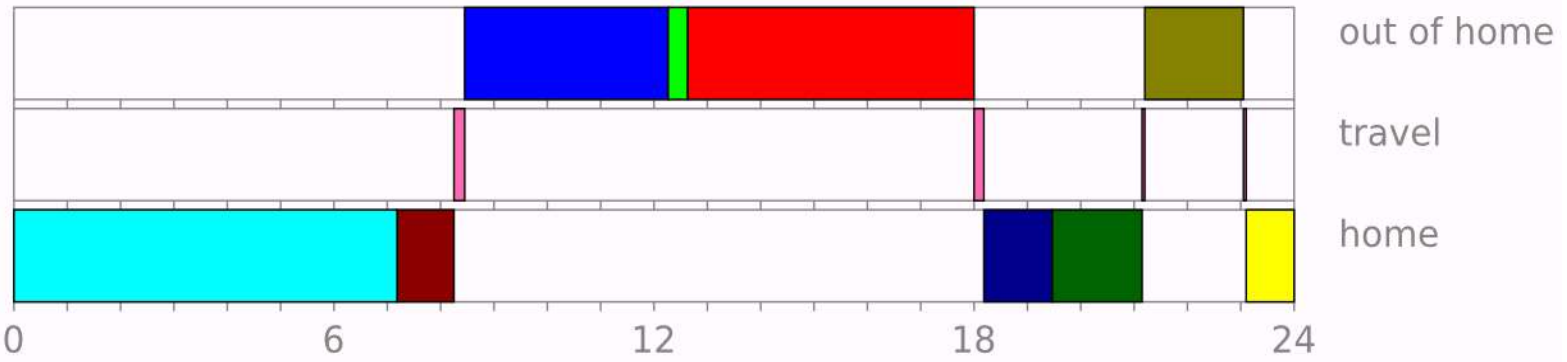
Preferred citation style for this presentation

Meister, Konrad (2005) Genetic algorithm-based household scheduler, presentation at the 84th Annual Meeting of the Transportation Research Board, Washington D.C., January 13th, 2005.

Genetic Algorithm-based household scheduler

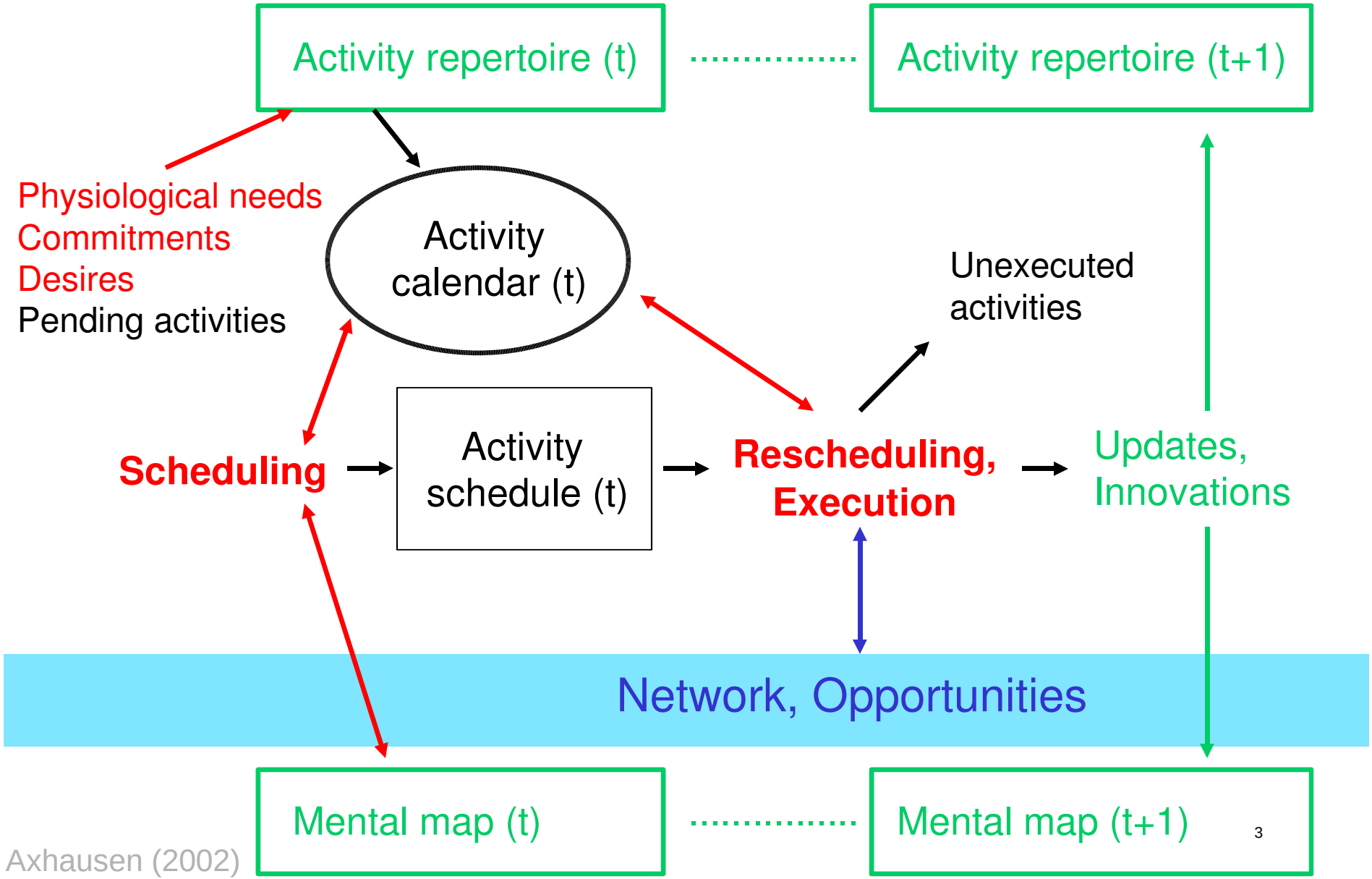


K Meister
M Frick
KW Axhausen

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

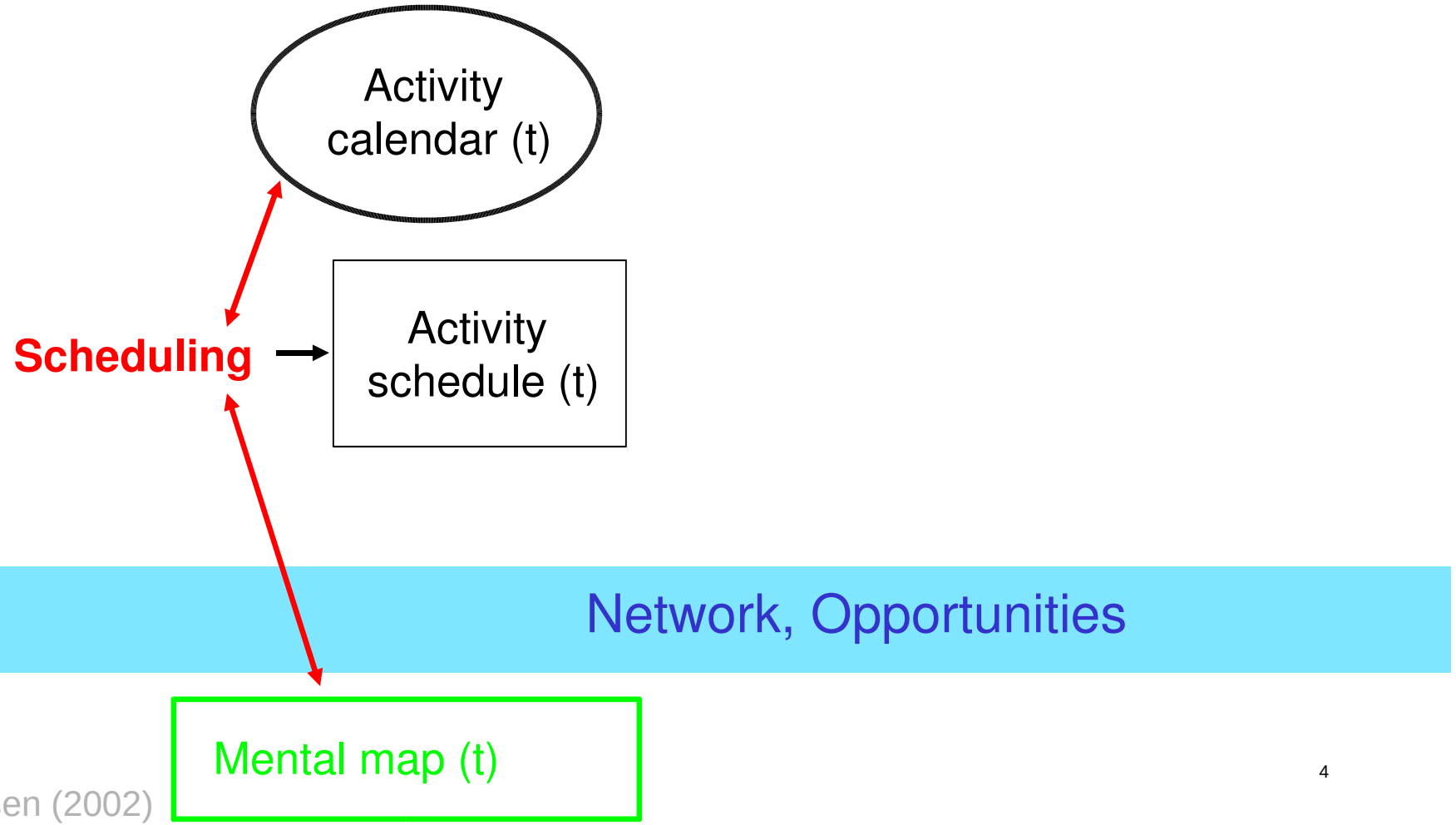
Institut für Verkehrsplanung und Transportsysteme
Institute for Transport Planning and Systems

Conceptual framework (1/2)



Axhausen (2002)

Conceptual framework (2/2)

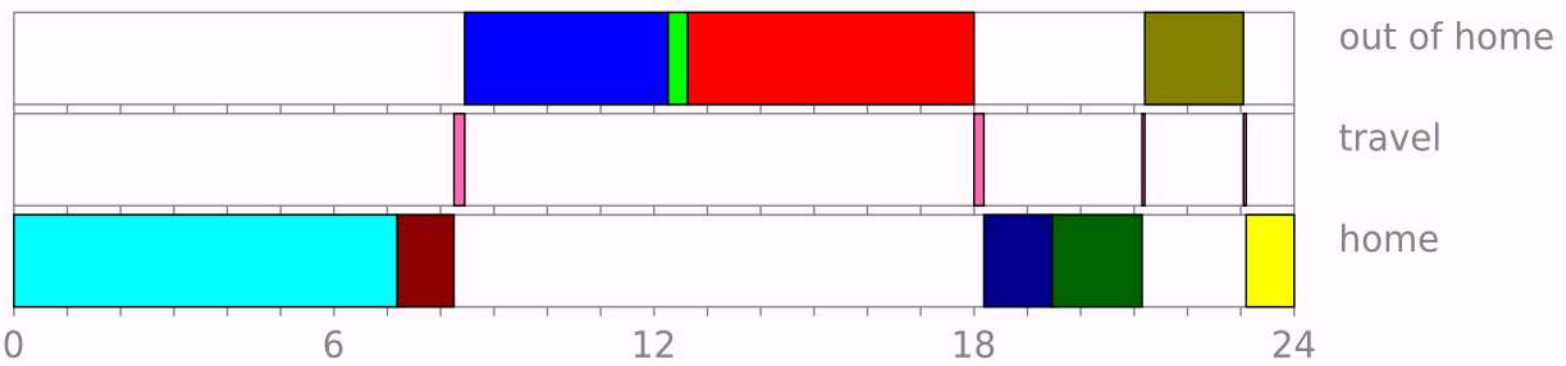


Axhausen (2002)

Input: Activity calendar

Variable	*Example 1:* Breakfast	*Example 2:* Soccer
priority (1, 2, 3…)	2	3
kind of participation	joint	individual
participating hh members	ABC	C
working point [h]	1	2
latest start time	---	17:00
earliest end time	---	18:00
associated need	hunger	---
facility	home	leisure

Output: Activity schedule



An activity

- is scheduled or dropped
- is located at a certain place in the schedule
- has a starting time and a duration
- is performed at a chosen location

= Encoding

Each trip is defined by:

- the chosen means of transportation
- (a route)

Intra-household interaction

Basic model generated schedules for *isolated individuals*

(Charypar and Nagel, 2003).

Enhanced for n-person-households:

- A-priori classification of activities by kind of participation (Zhang et al., 2004):
  - individual
  - joint (additional utility)
  - allocated
- means of transportation
  - ownership / availability of cars, bikes...
  - part of a schedule's encoding

Genetic Algorithms (GA)

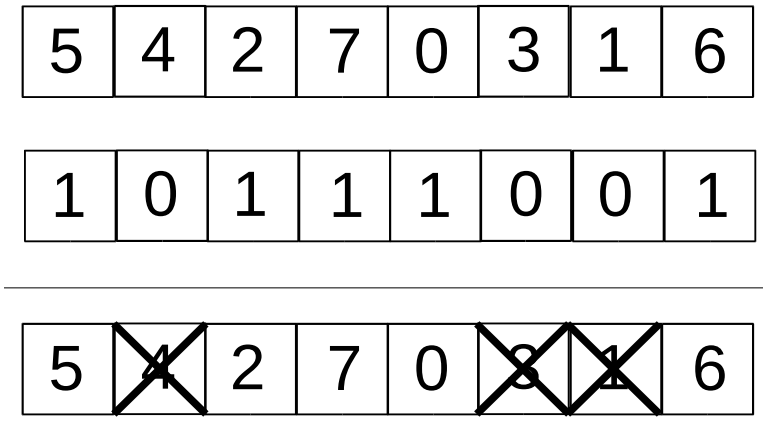
- huge solution space:
  5 variables / activity
  ~ 8 activities / agent
  2 agents / household

  ~ 80 variables / schedule to be optimized

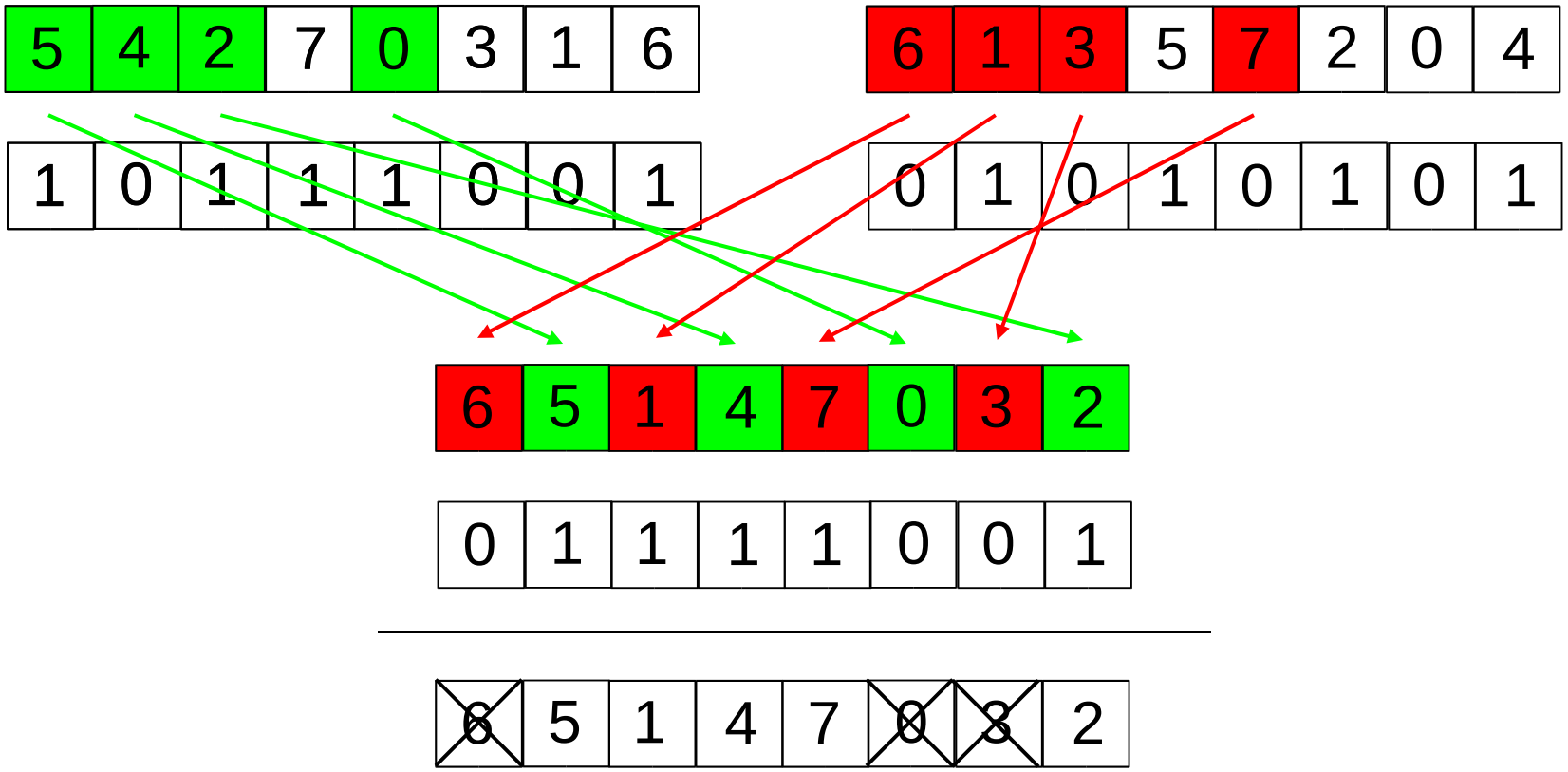
- *structures*
  - individual – activity schedule
  - population
  - generation

- processes
  - creation
  - crossover
  - mutation
  - selection – fitness

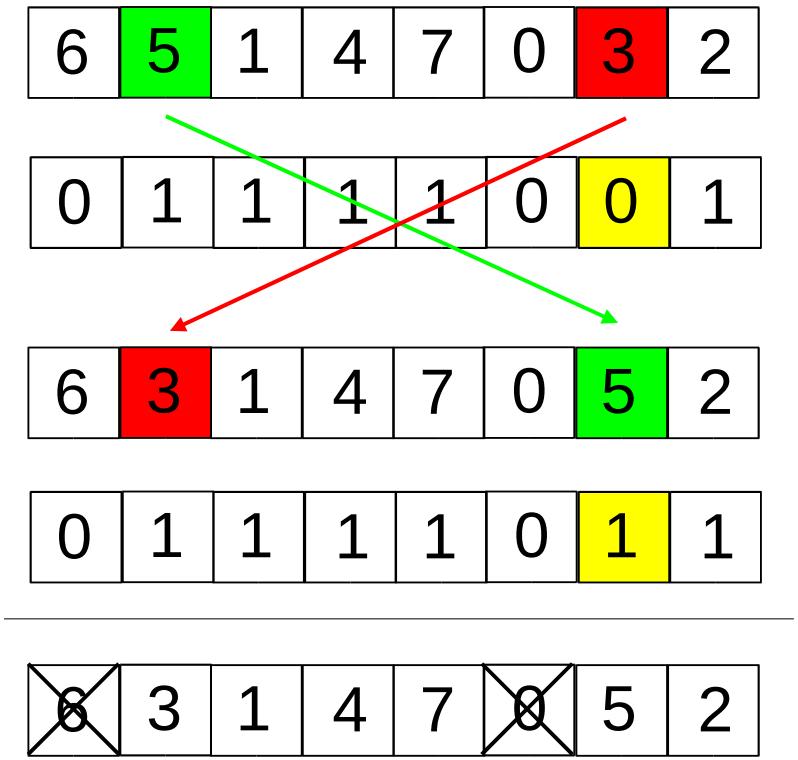
GA – Creation Crossover Mutation



GA – Creation Crossover Mutation



GA – Creation Crossover Mutation



A good day – Fitness / Utility function

- Fitness = Household utility function with members *m*

$$F = HUF = \sum_{m} U_{m}$$

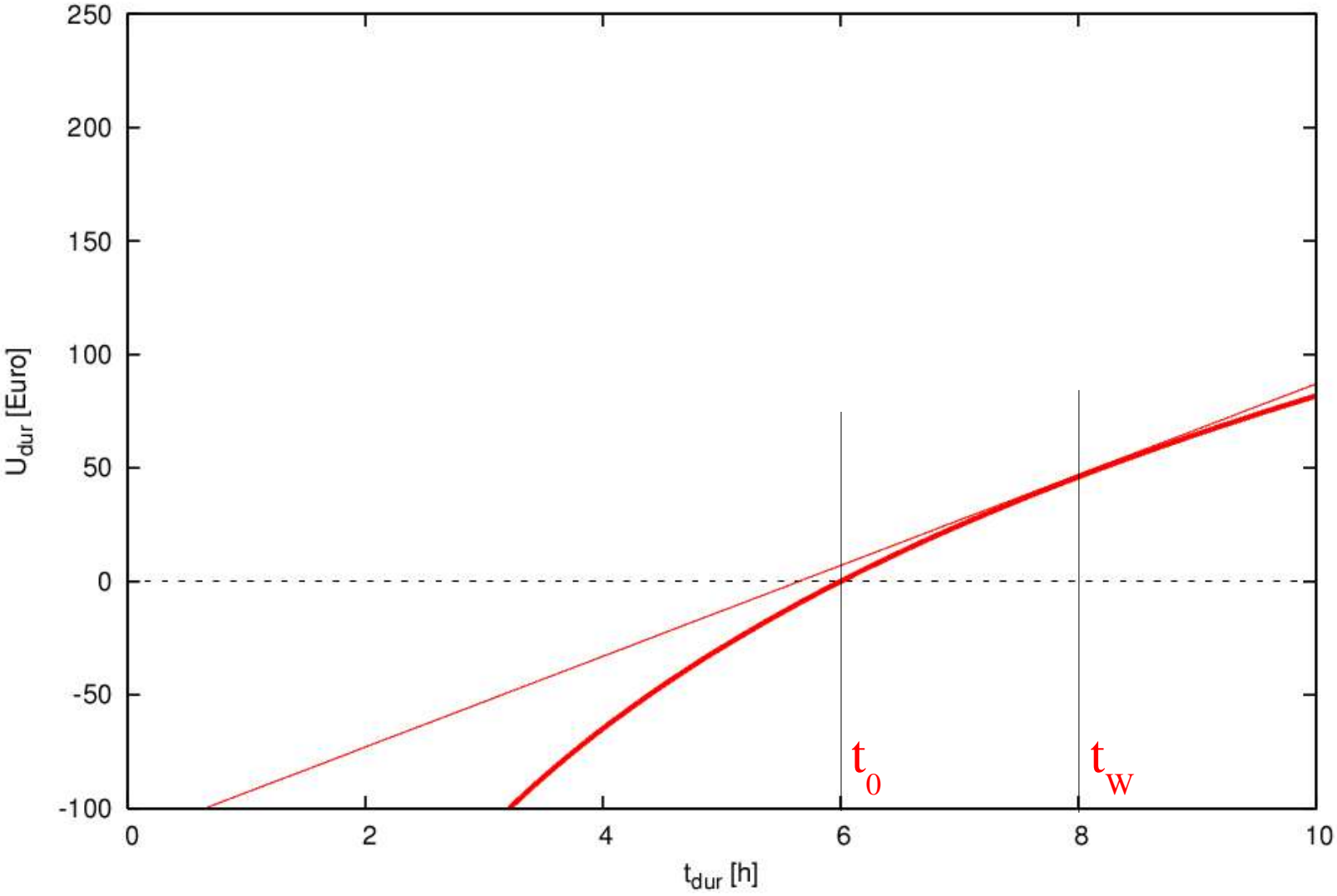
- An agent *m*'s utility

$$U_{m} = \sum_{i} U_{total,i}$$

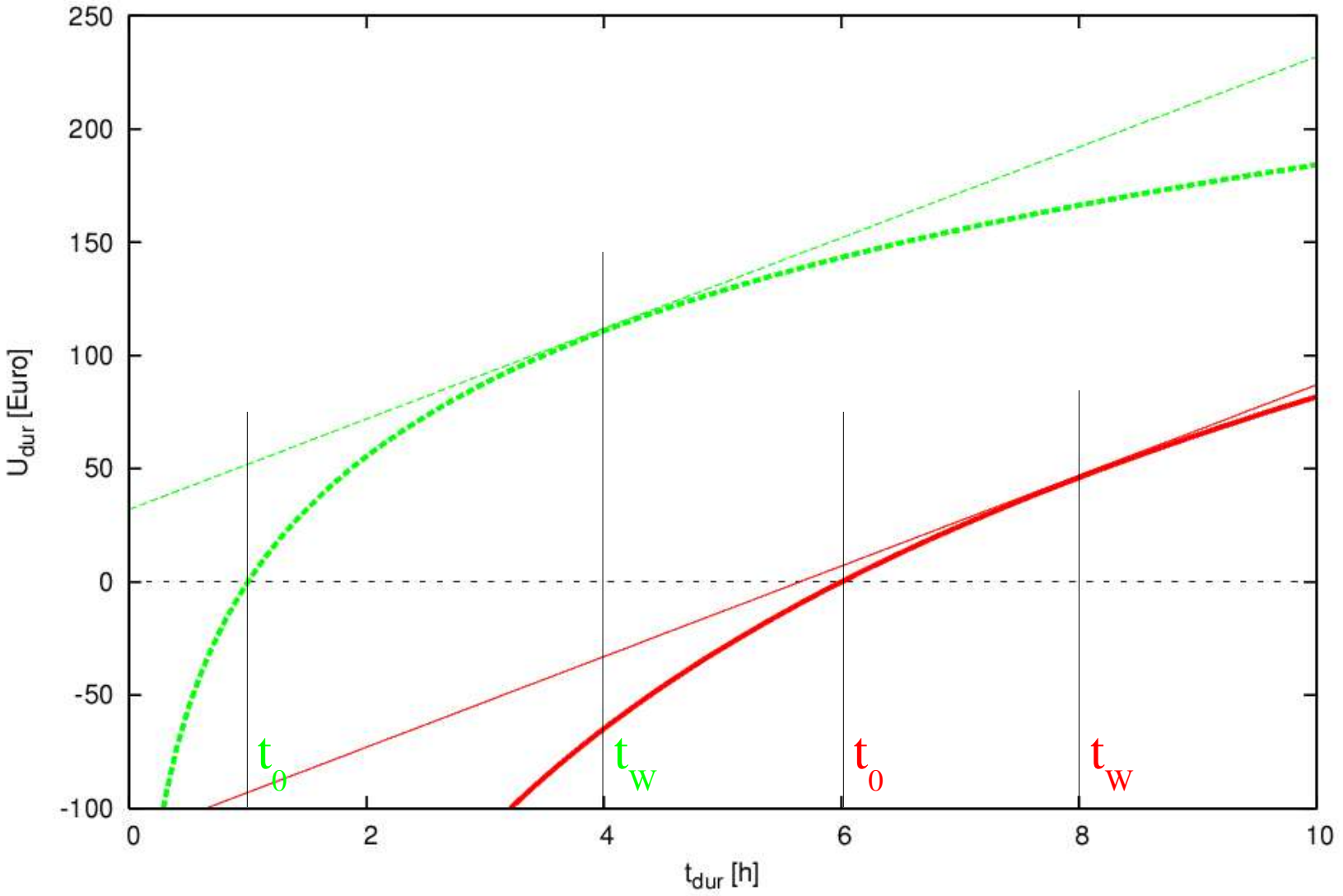
- Utility of a performed activity *i*

$$U_{total,i} = U_{dur,i} - c_{travel,i} - c_{late.ar,i} - c_{early.dp,i} - c_{short,i} - c_{wait,i}$$

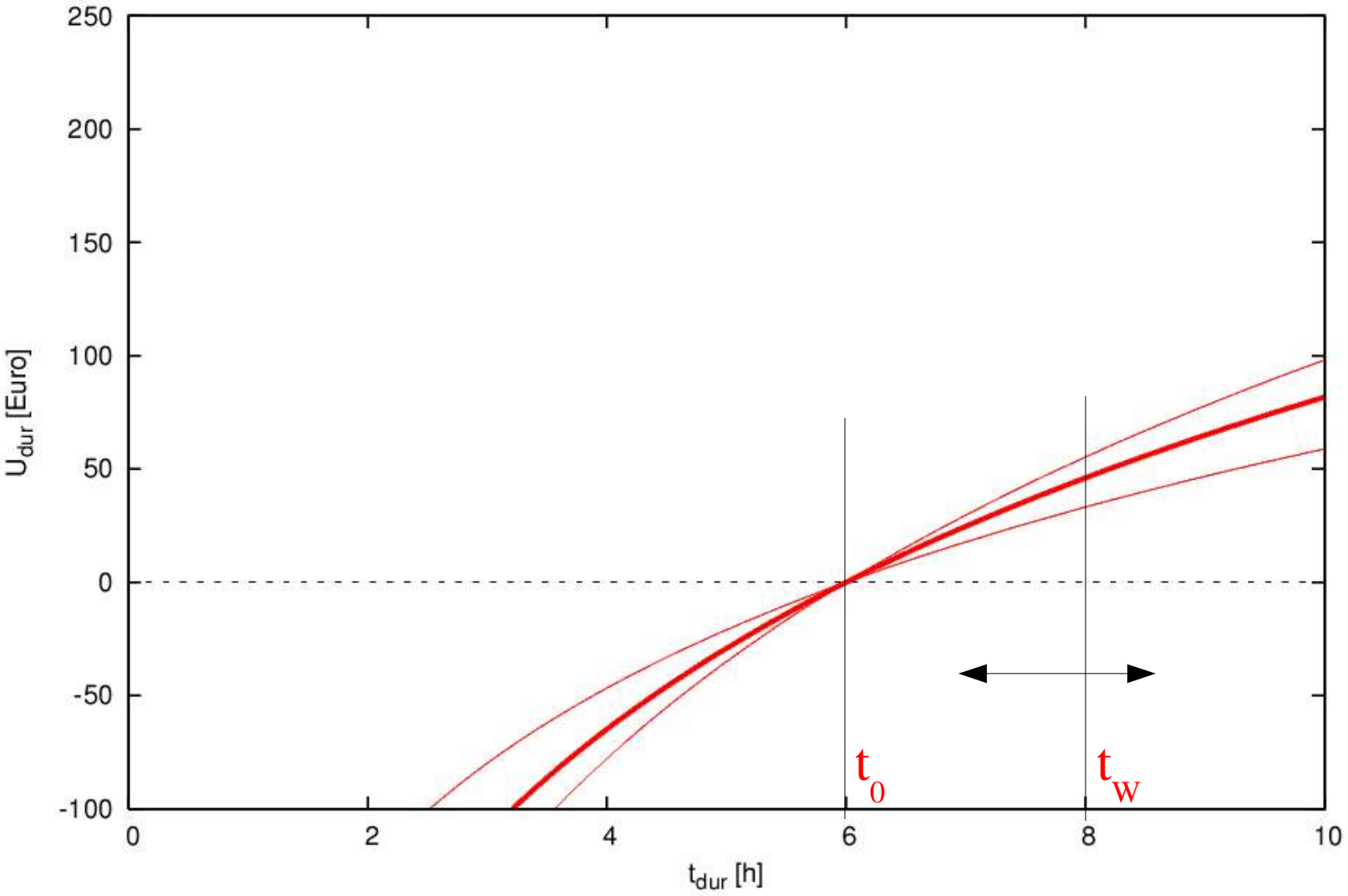
A good day – Basic utility function



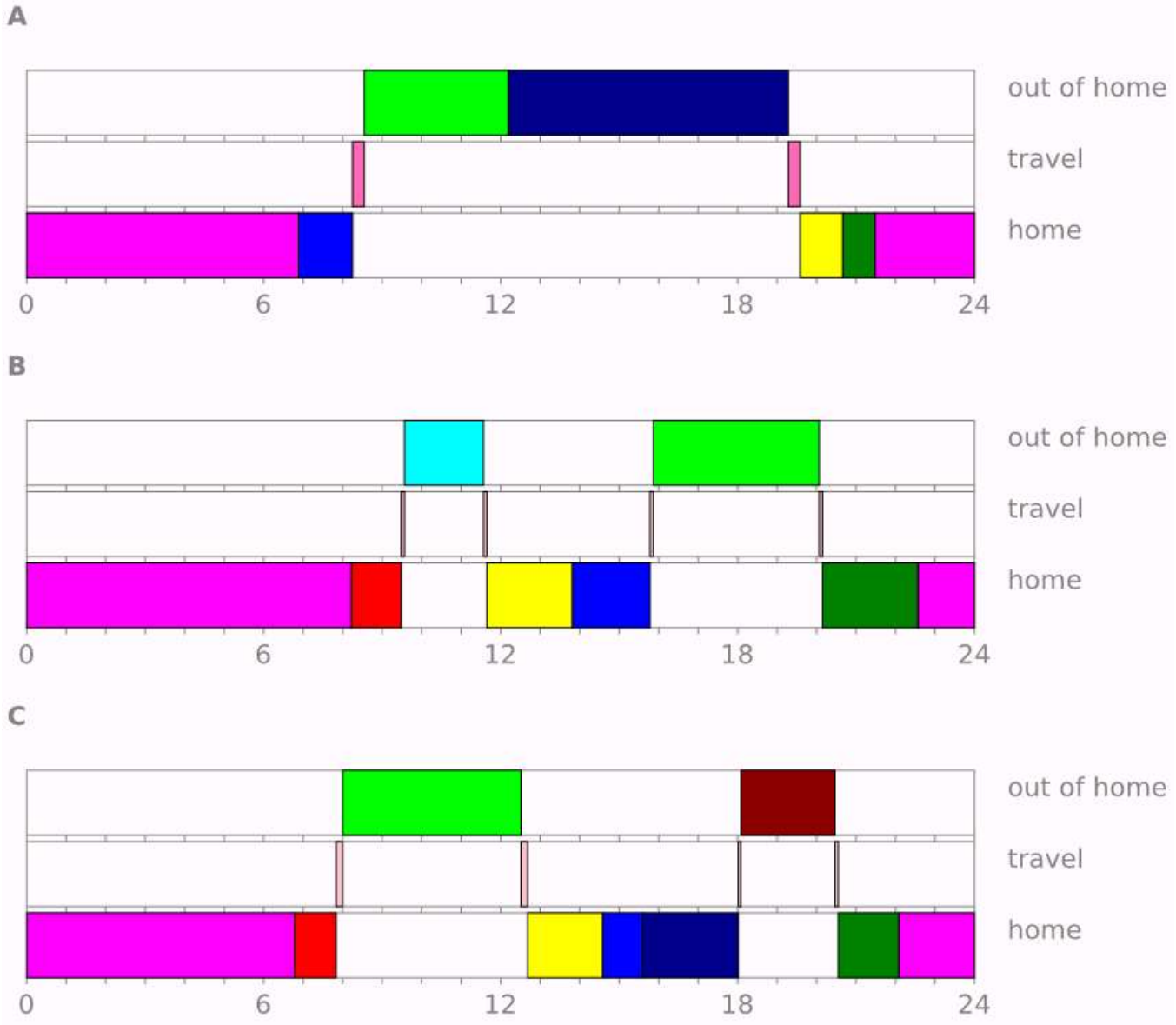
A good day – Effect of priority



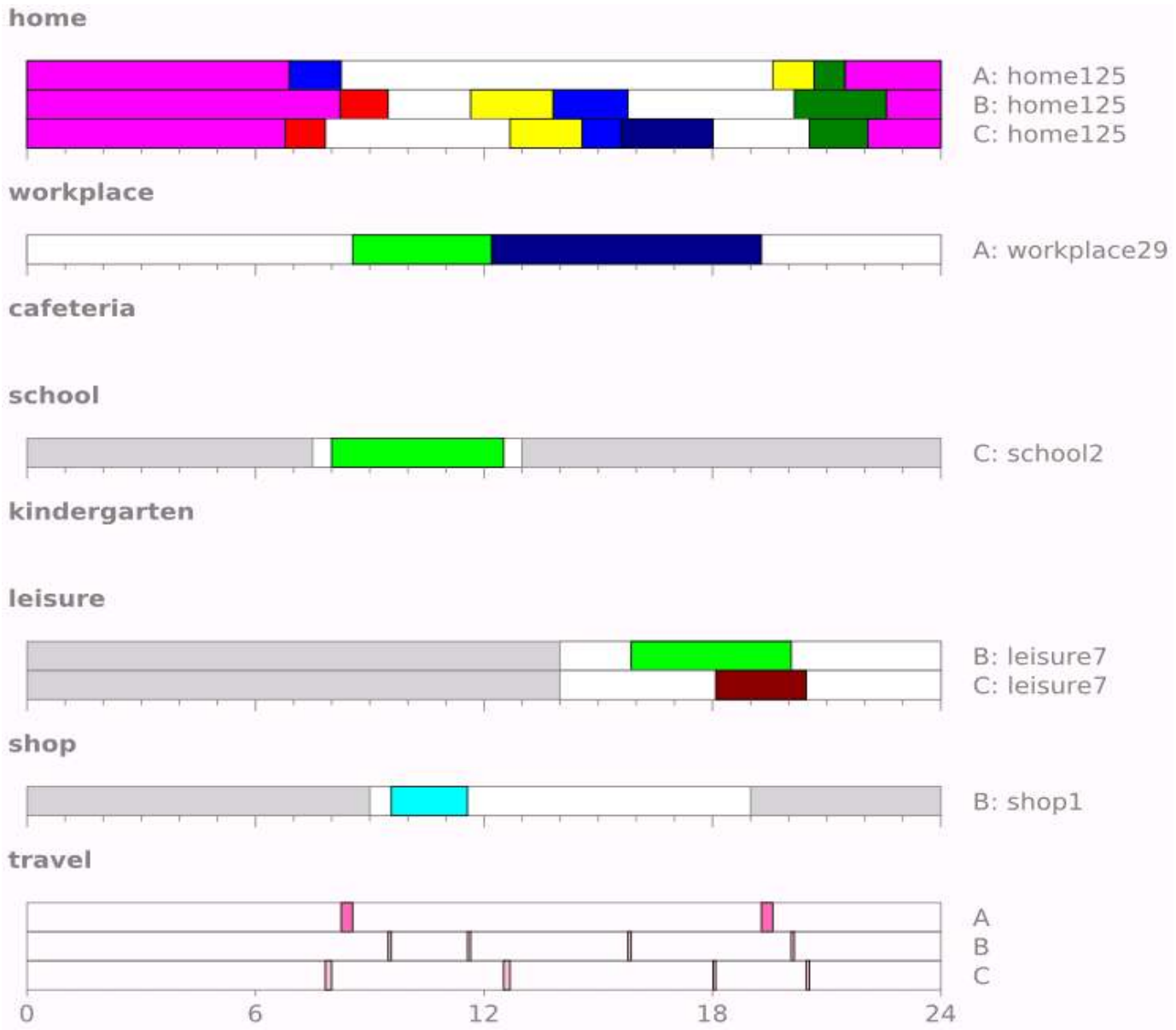
A good day – Utility modification



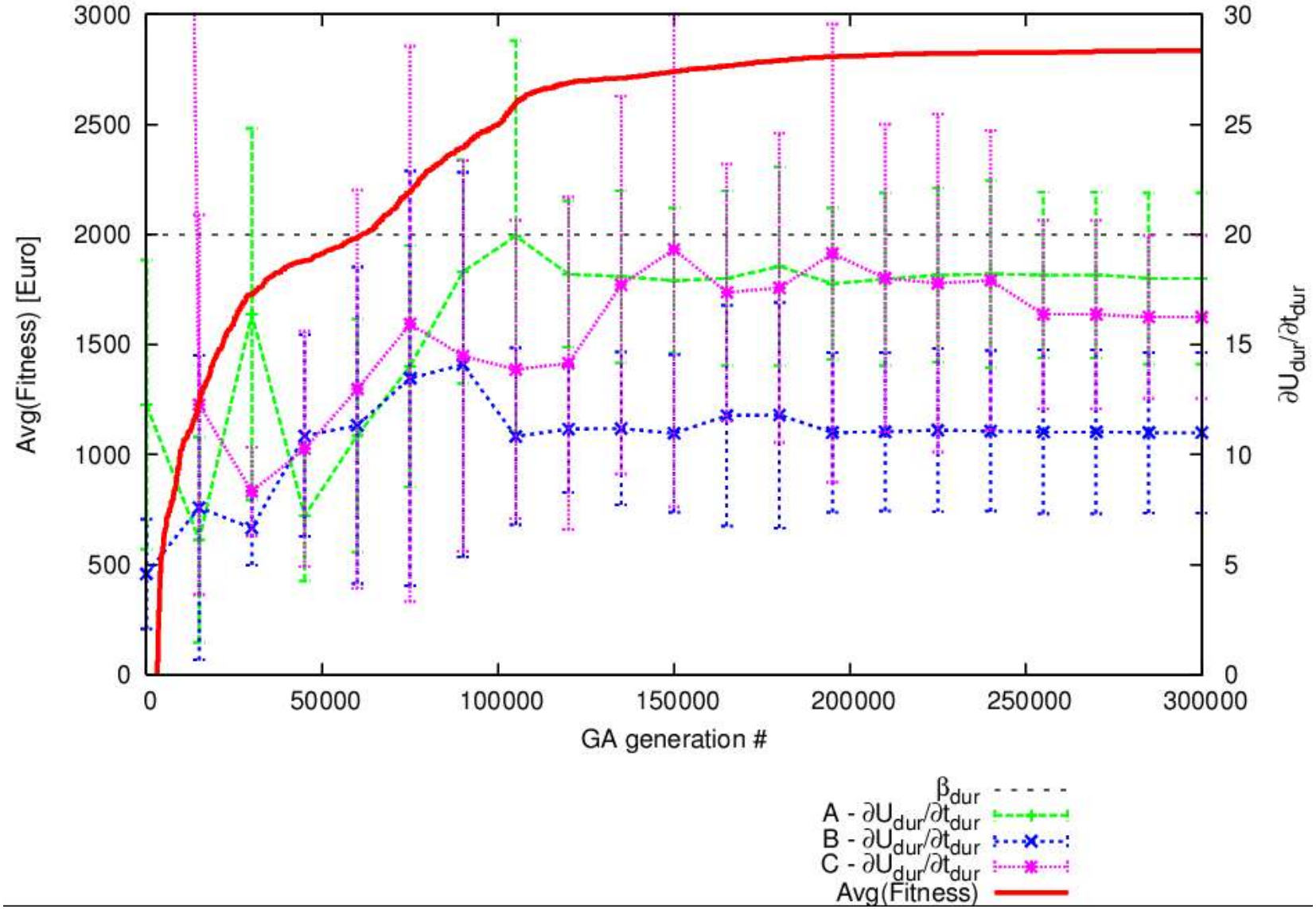
Results (1/3) – Best schedule by person



Results (2/3) – Best schedule by facility



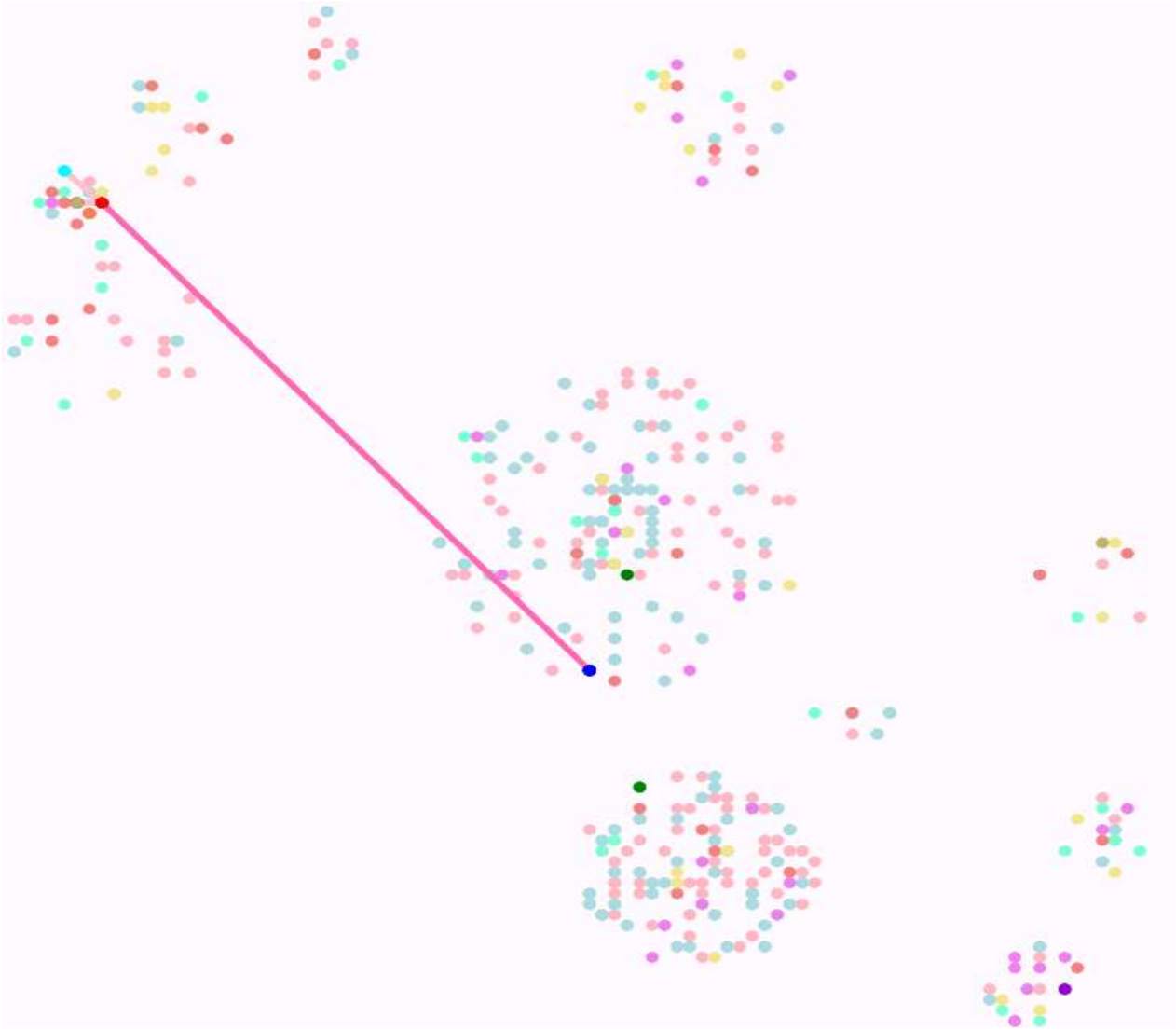
Results (3/3) – GA performance



Outlook

- Acceleration
  - “Hints” for initial schedule creation
  - Recycling of existing solutions
  - Use of fixed activity chains
- Calibration / validation with activity-based surveys (Mobi*drive* and Thurgau 2003)
- joint travel
  - picking up / dropping off children
  - trips to/from joint activities
- demand dependent network travel times

Questions?



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