



Modelling Collaborative Systems and Automated Negotiations

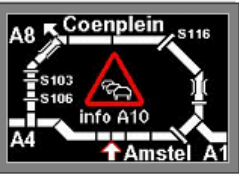
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7 November 2016

14th Overture Workshop

Agenda

- Background: traffic management seen from a CPS perspective
- The problem we are tackling and how we do it
- The model and the demonstrator
- Results, conclusions, and future work



Traffic management

Aims:

- enhance vehicle safety
- optimize throughput of the network
- provide reliable information (journey times) for travellers

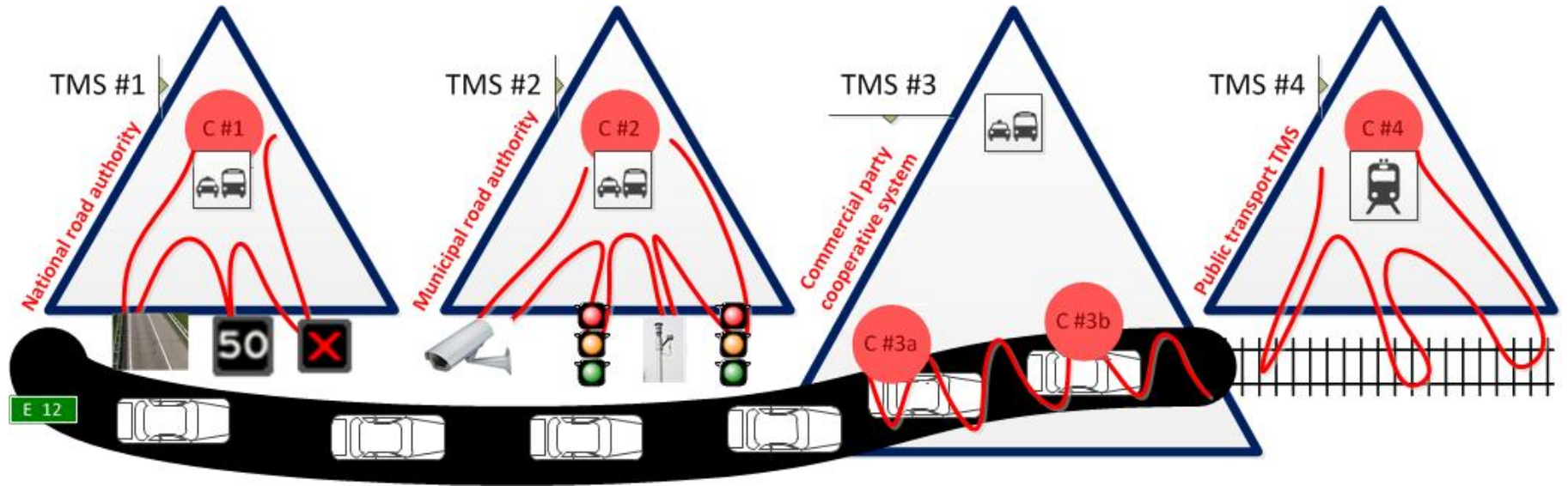
operating within legal constraints and fulfilling sustainability demands



Traffic management systems

- A traffic management system (TMS) is a cyber-physical system that integrates multiple technologies to improve the flow of vehicle traffic and improve safety.
- It is a geographically distributed system:
 - traditionally controlled at *traffic control centres* (TCCs); sometimes with an internal hierarchy
 - using *sensors* (cameras, induction loops, radar, etc.)
 - and *actuators* (VMSs, traffic lights, signs and signals, ramp metering)

Current situation



In-car navigation
systems are not
aligned with real
life situation or
not working
together with
traditional road
authorities

Vrachtverkeer raakt verdwaald in straatjes centrum / Roermond bant de TomTom

Fenneke Sysling – 26/07/07, 00:00

**In Roermond moet de navigator uit, en het gezonde verstand weer aan.
Nieuwe verkeersborden moeten chauffeurs daarop wijzen.**

Meer over

De gemeente is het meer dan zat dat buitenlandse vrachtwagens verdwaald raken in de smalle straten van het centrum omdat ze vertrouwen op hun elektronische navigatiesysteem. Dat werkt in Roermond namelijk slecht omdat het wegennet is ontregeld door de aanleg van nieuwe snelwegen.

De buurten waar de vrachtwagens terechtkomen, klagen nu over onveiligheid voor kinderen en ook de chauffeurs raken geërgerd. De gemeente heeft daarom op de ingangswegen van de stad borden geplaatst met een groot kruis door de navigator. Bestuurders wordt opgeroepen om in de stad toch vooral een 'ouderwets' straatnamenboek of plattegrond te gebruiken en de omleidingsborden te volgen.

„Wij grenzen aan Duitsland en hebben veel internationaal vrachtverkeer”, zegt woordvoerder Mario Ogrinc van de gemeente Roermond. „En dat verkeer vertrouwt op de navigator. Daardoor kijken ze niet meer op onze omleidingsborden en raken vervolgens de weg kwijt. Een Tsjechische vrachtwagenchauffeur liep een keer een heel stuk langs het centrum en

Heavy traffic
expected around
the Amsterdam
Arena. Event
organizers have
no instruments to
influence traffic
flow



Extra verkeersdrukte verwacht rondom Amsterdam Arena. © ANP

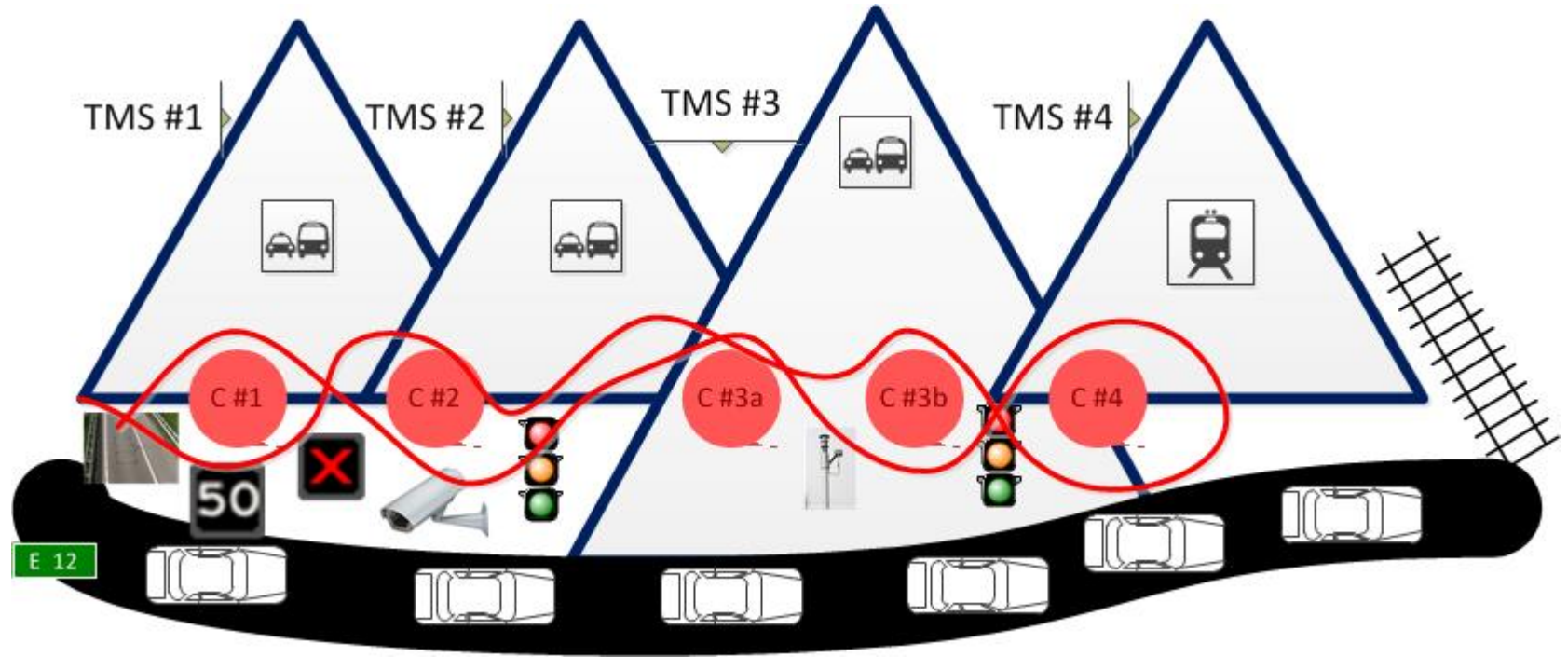


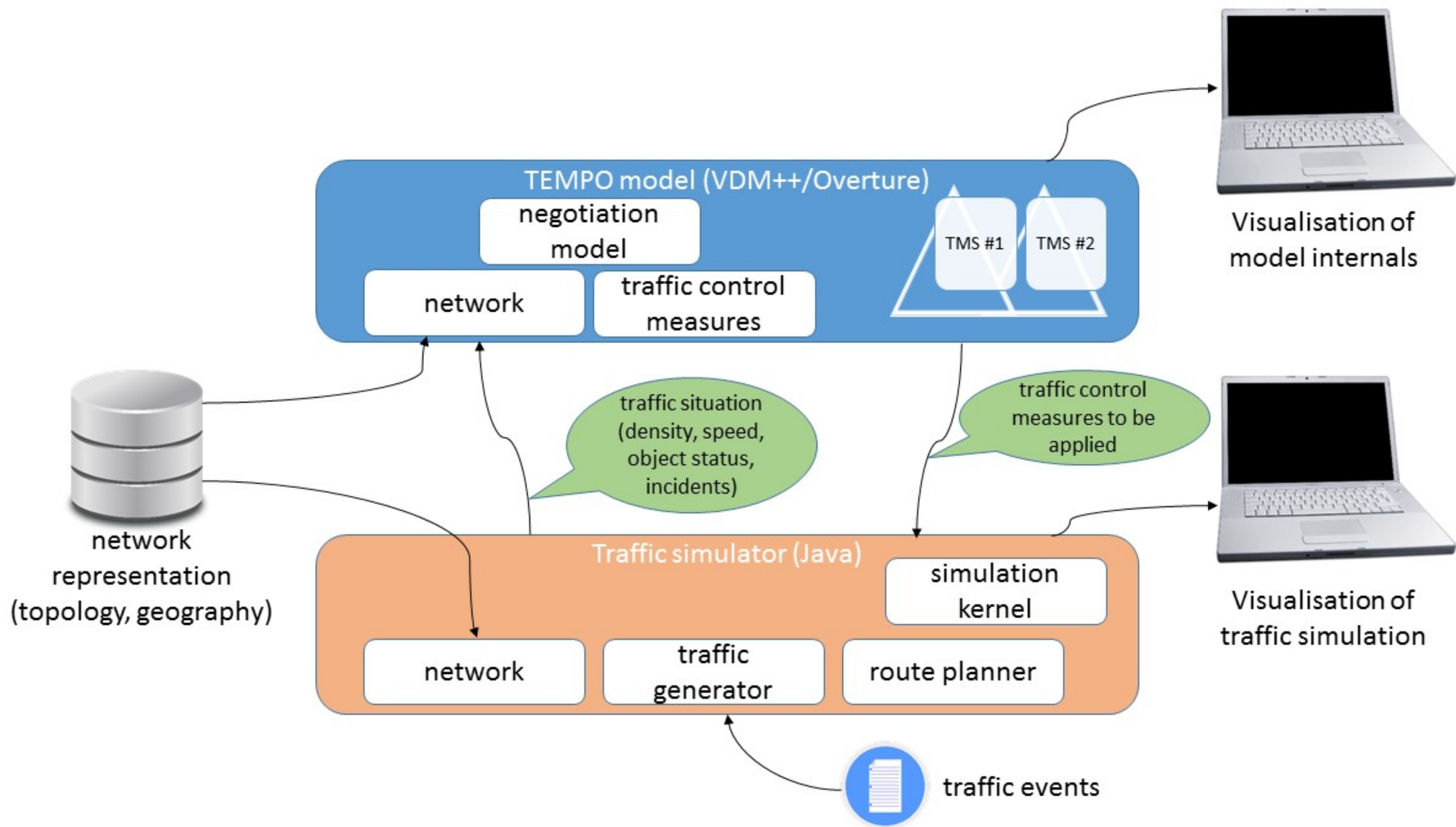
Update - Weggebruikers rondom de Amsterdam Arena moeten vanavond rekening houden met extreme drukte vanwege de wedstrijd van Ajax en twee uitverkochte concerten in de Heineken Music Hall en de Ziggo Dome.

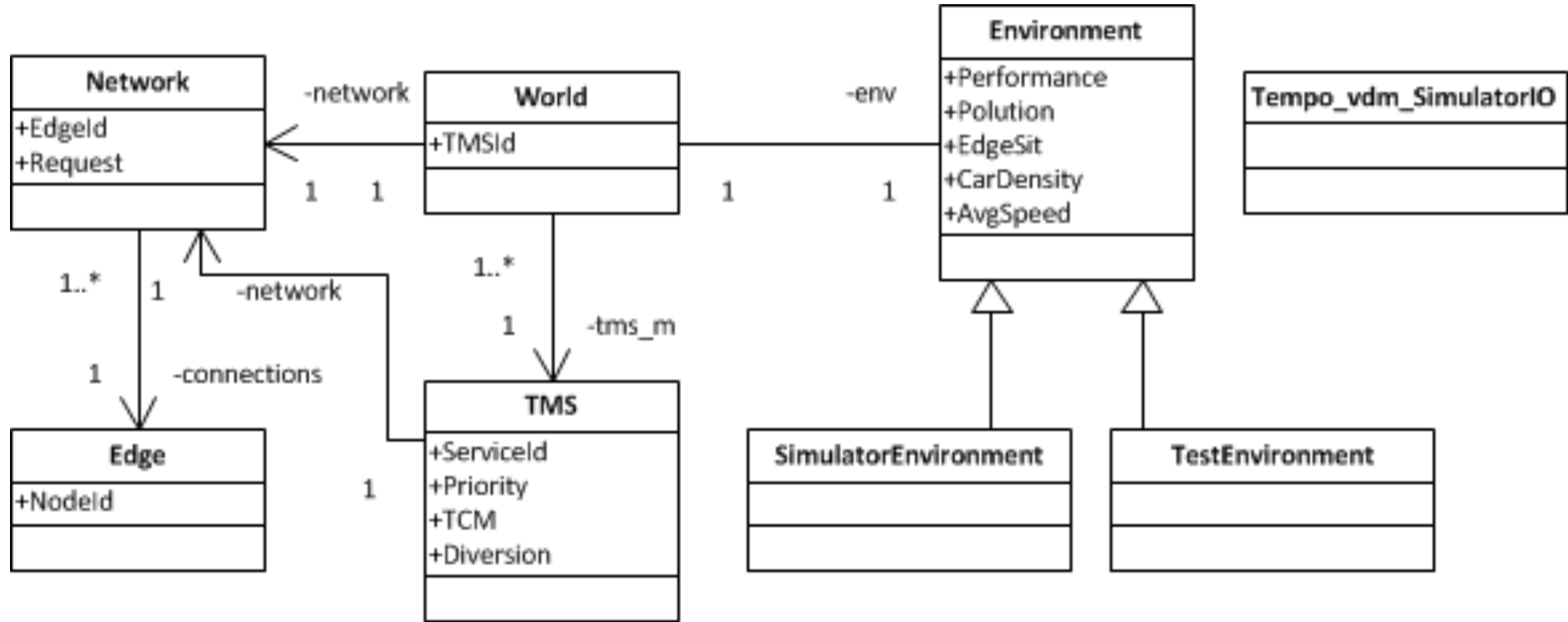
TEMPO fundament and approach

TEMPO uses the Overture technology as a basis for its work. Overture is a platform for modelling and analyzing systems. Models can demonstrate the correctness of designs prior to costly implementation. TEMPO uses Overture to model existing traffic management networks, then demonstrate the feasibility of collaborating traffic management systems.

Collaboration between TMSs





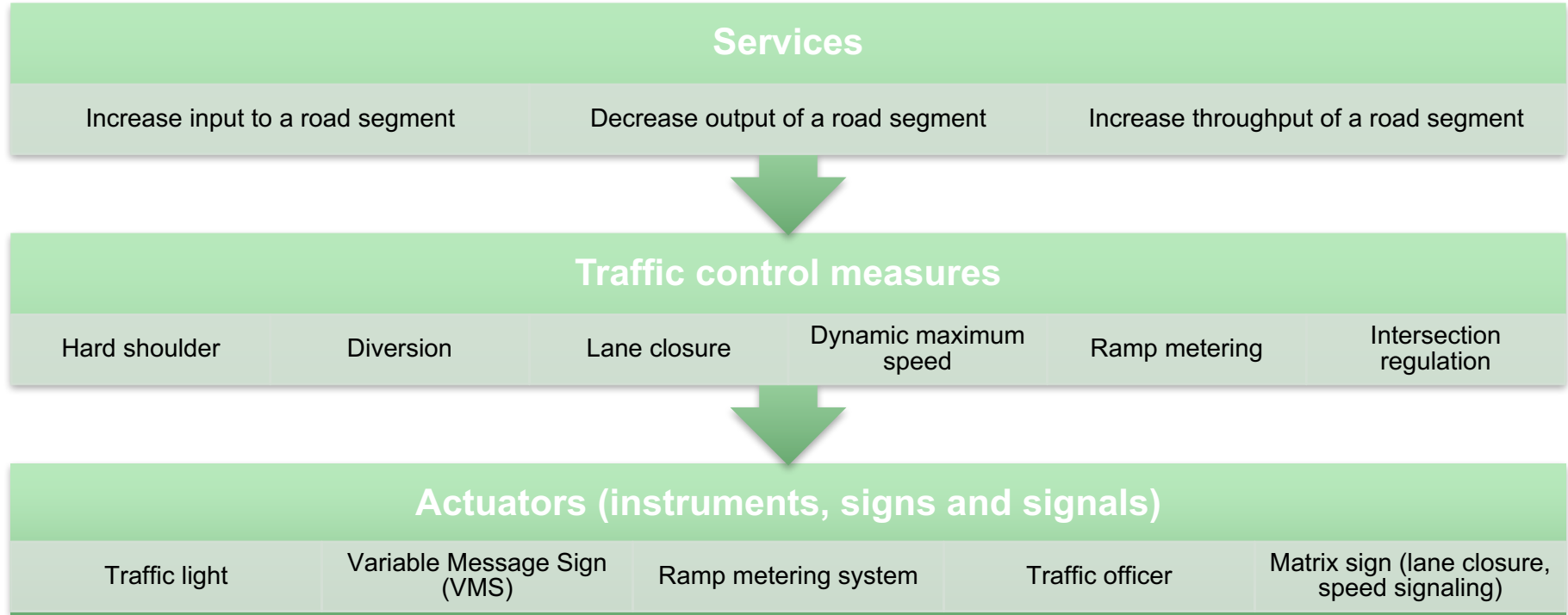


The negotiation process

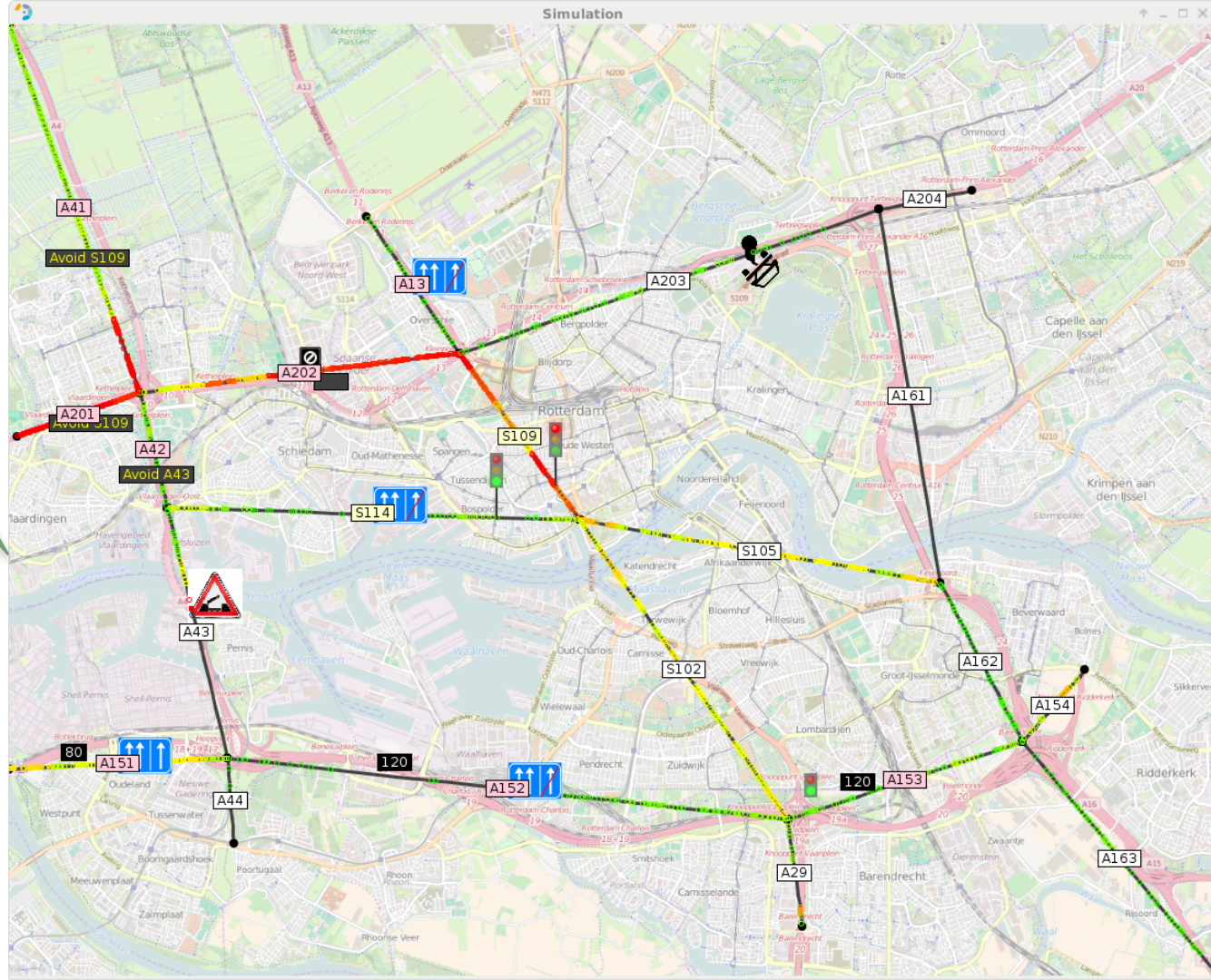
- Takes *costs* and *severity* (depend on severity, severity depends on road priority)
- Steps in the process:
 1. Help yourself first 😊
 2. Ask your neighbors for help, using *services*
 3. Evaluate offers made, determine if associated costs are acceptable
 4. Accept or decline the offer



Services, control measures, and actuators



The TEMPO
engine at
work



Results and conclusions

- We can demonstrate the working of TMSs with and without collaboration (novel in this context)
- We can visualize the evolution of instance variables during execution of a model
- We made first steps with comparing performance of collaborative and non collaborative networks

Future work

- Improving on the performance comparison to get quantitative results
- Sophisticating the negotiation system
- Modeling for different types of TMSs (cooperative systems, “smart mobility” stakeholders, etc.)
- Integration with well known, state of the art traffic simulators
- Migrating the TEMPO engine to a physical setting



Smart Anything Everywhere

Submitted by Nico Plat on Wed, 06/01/2016 - 18:29

The Smart Anything Everywhere (SAE) initiative is a collection of projects established by the EU in 2015 to support innovators. First results from projects receiving SAE funding will be presented at a workshop alongside best practices and lessons learnt. The first results of TEMPO will be presented, The forthcoming

TEMPO

The TEMPO project will create a basis for new approaches to distributed traffic management. It will facilitate the introduction of cooperative vehicles without sacrificing