

MSDL

Modelling, Simulation and Design Lab

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Modelling, Simulation and Design Lab

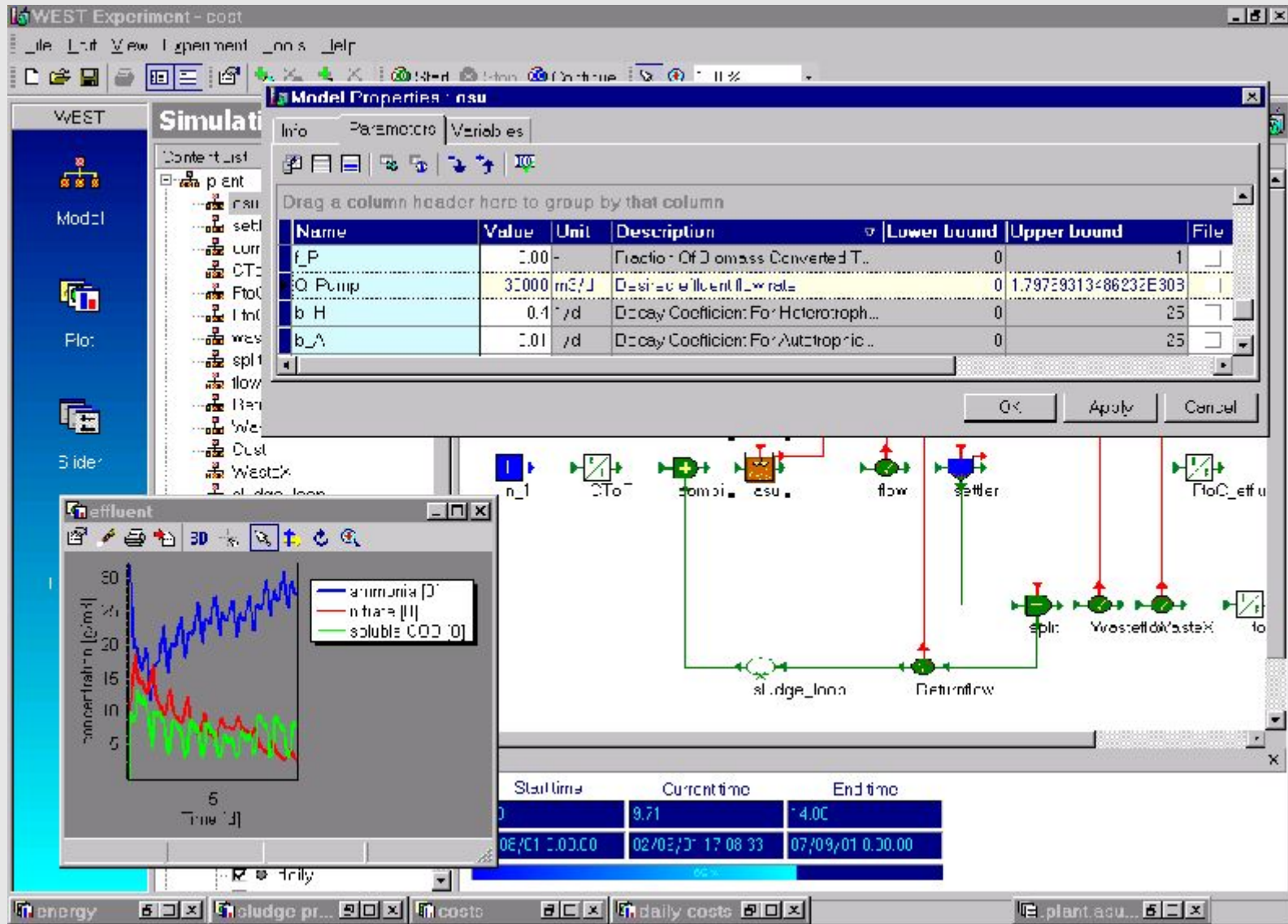


- started in 2001 (after > 10 years at Ghent University)
- expertise in Modelling and Simulation applied to Software Engineering
- on average 3 Ph.D., 10 M.Sc., 1 PostDoc
- fundamental research => prototypes => deployment

Modelling, Simulation and Design Lab

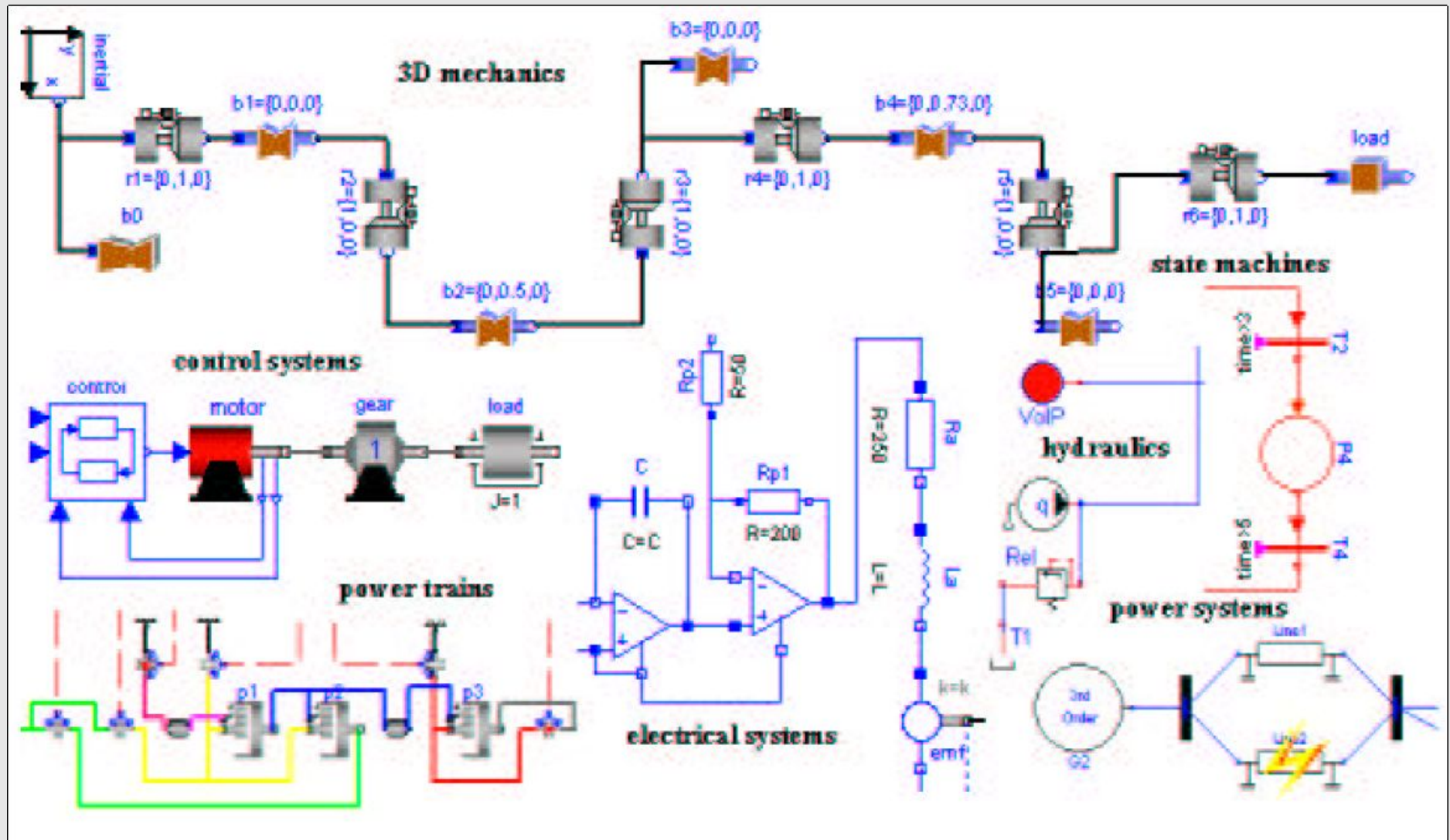
- **applications** of domain-specific modelling (and simulation)
 - software design
 - environment
 - traffic
- domain-specific **visual modelling**
 - specification of reactive behaviour
 - link concrete and abstract syntax
- **meta-modelling** and **model transformation (GG)**
- **theory/foundations:**
 - new formalisms, multi-formalism modelling
 - formalism transformation

DSM: Wastewater Treatment



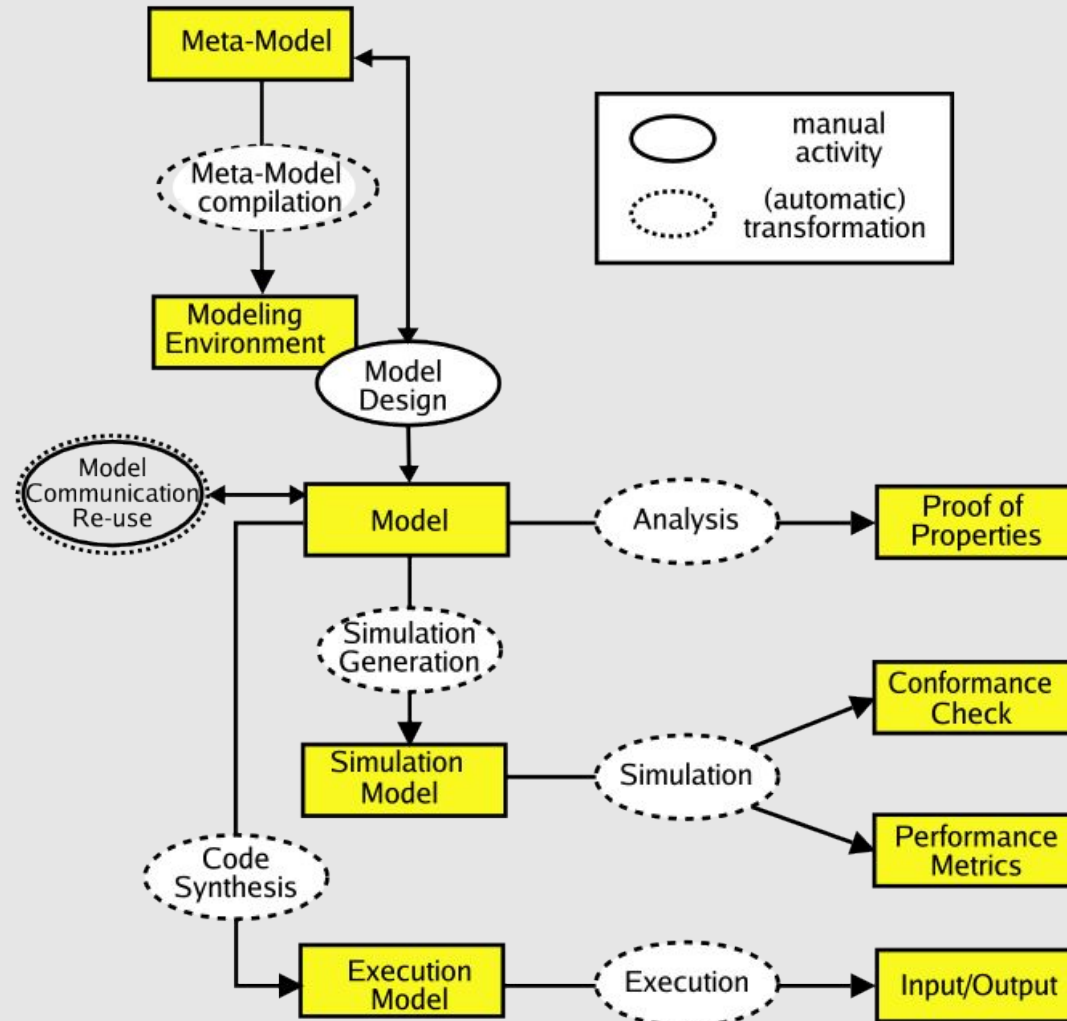
DSM, model transformation, experiment management, optimization, model storage, distributed simulation, ...

Modelica (www.modelica.org)



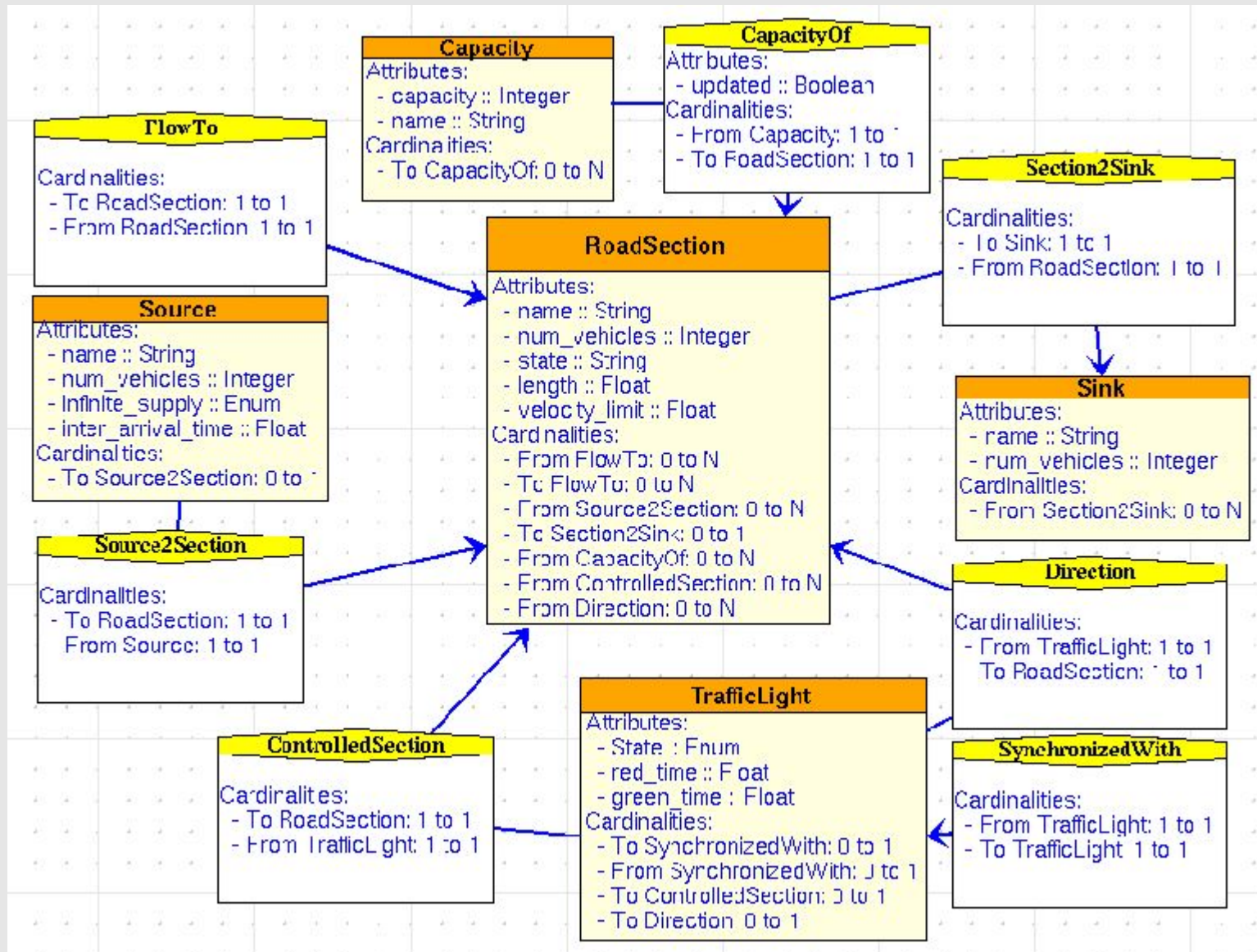
SiE spin-off, co-founder, muModelica compiler

Modelling and Simulation Based Design

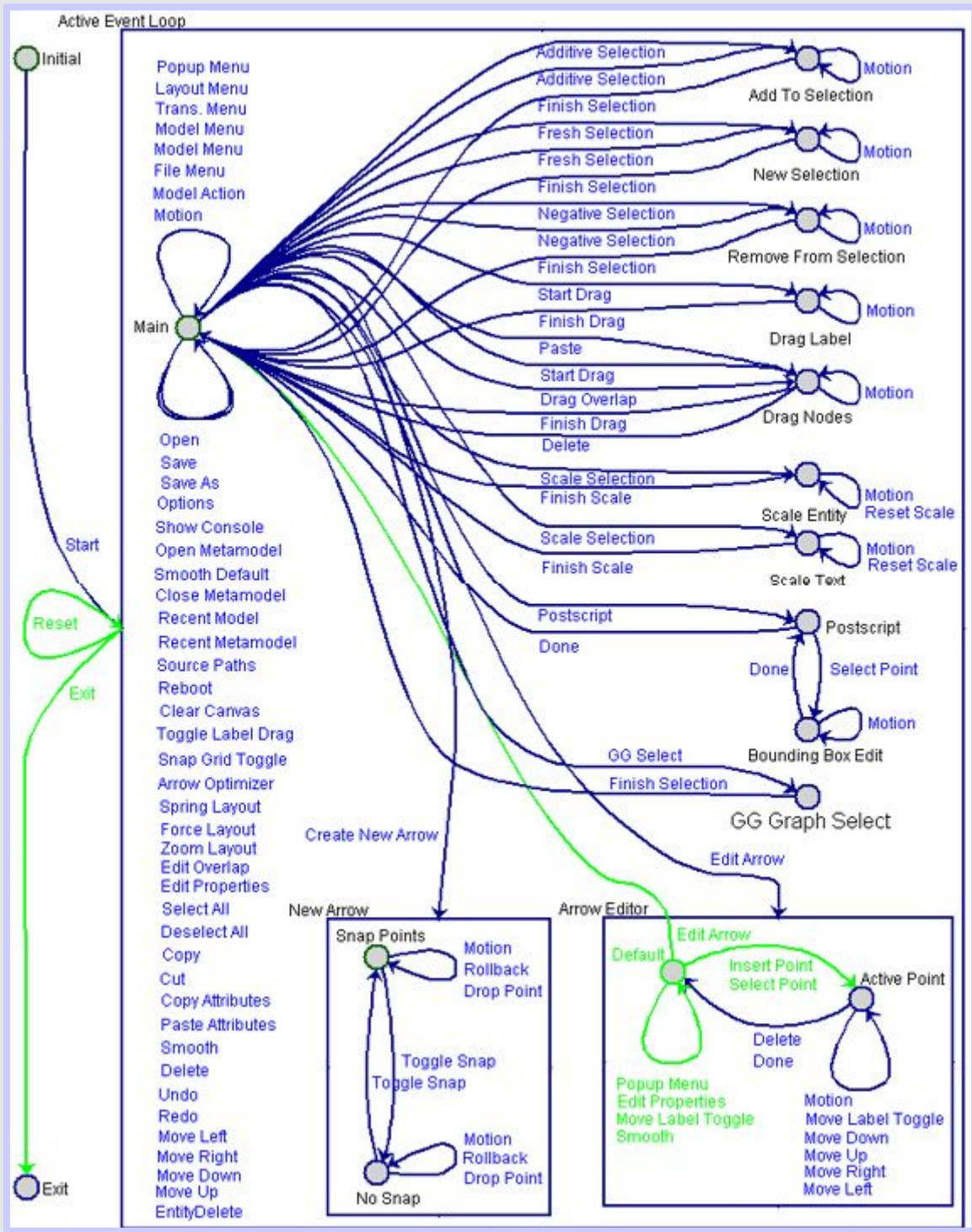




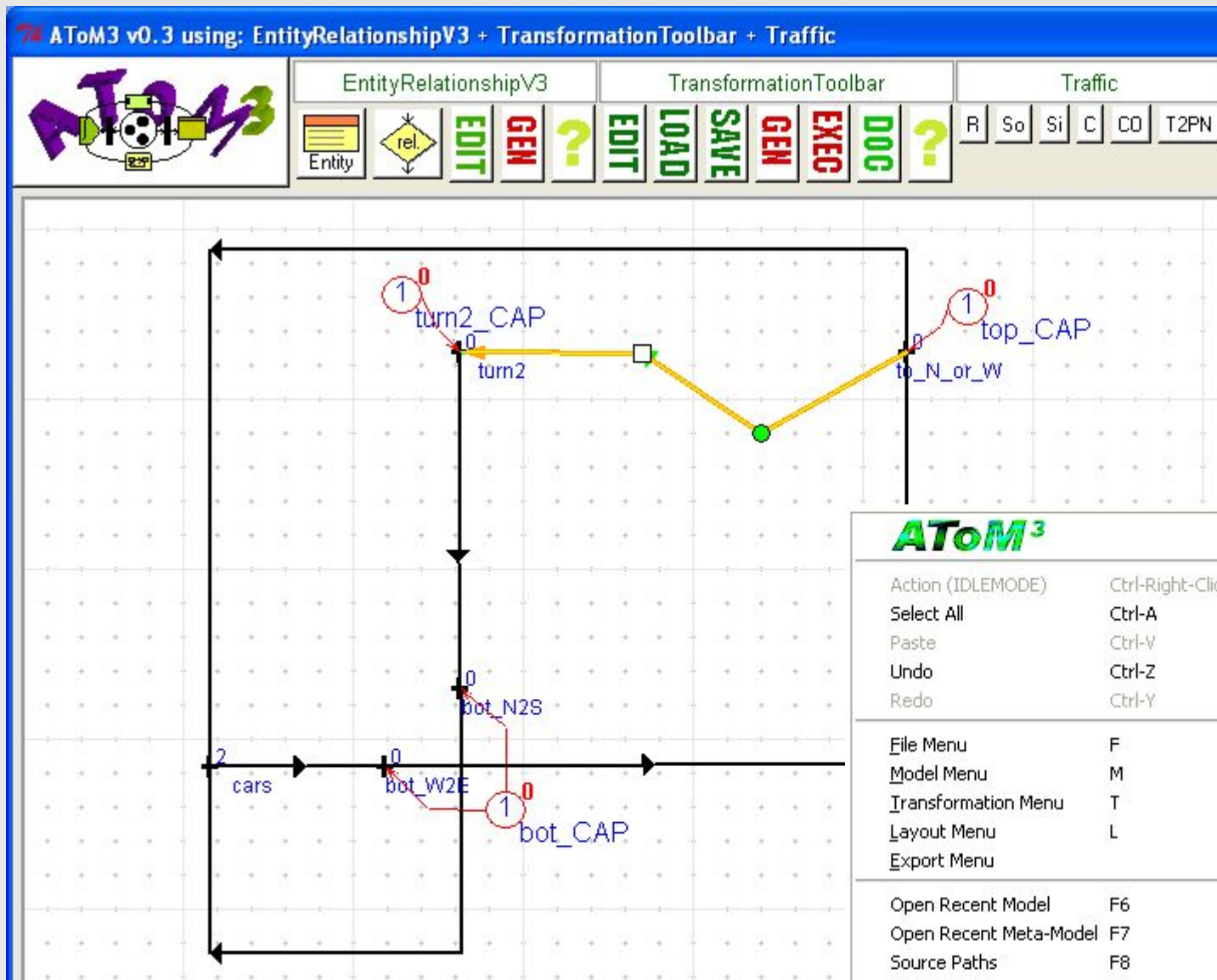
Meta-modelling Traffic



Dchart modelling of reactive behaviour of a visual modelling environment ... has spawned a whole new thread of research on the modelling, analysis and synthesis of advanced user interfaces ...



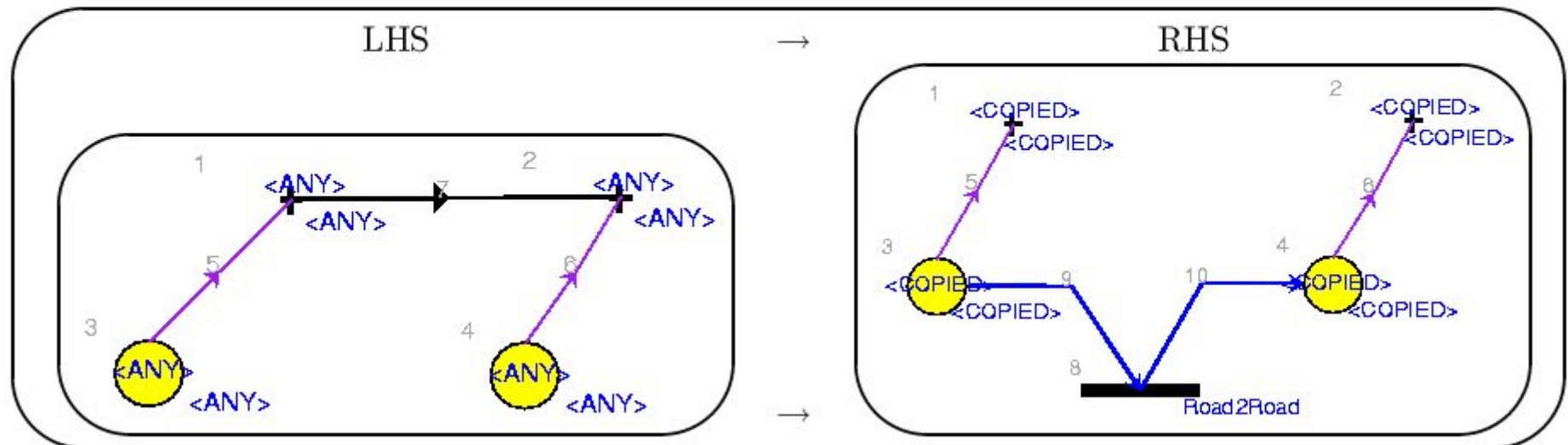
synthesized Traffic-specific modelling environment



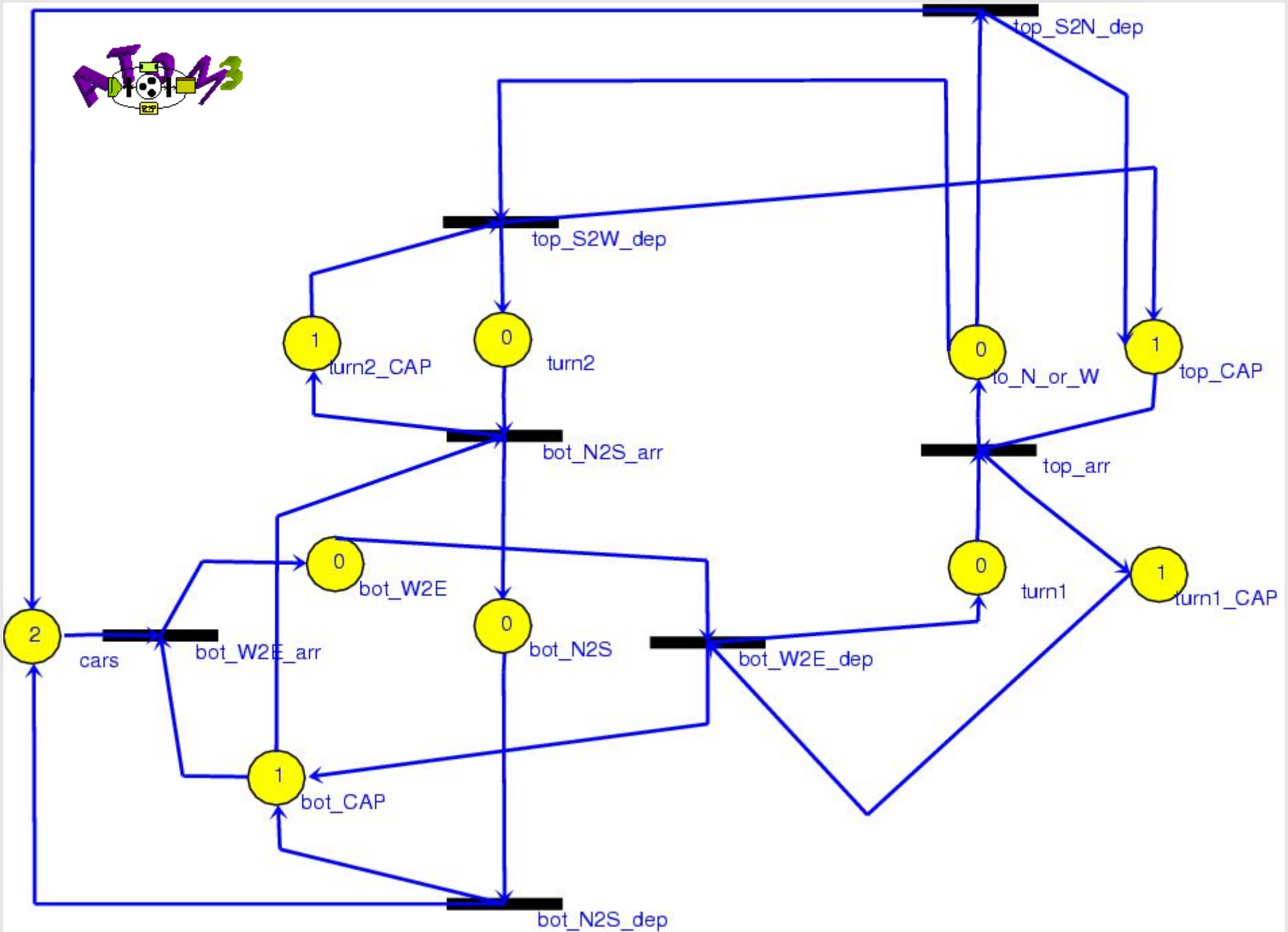
Explicitly model model transformation (using GG)



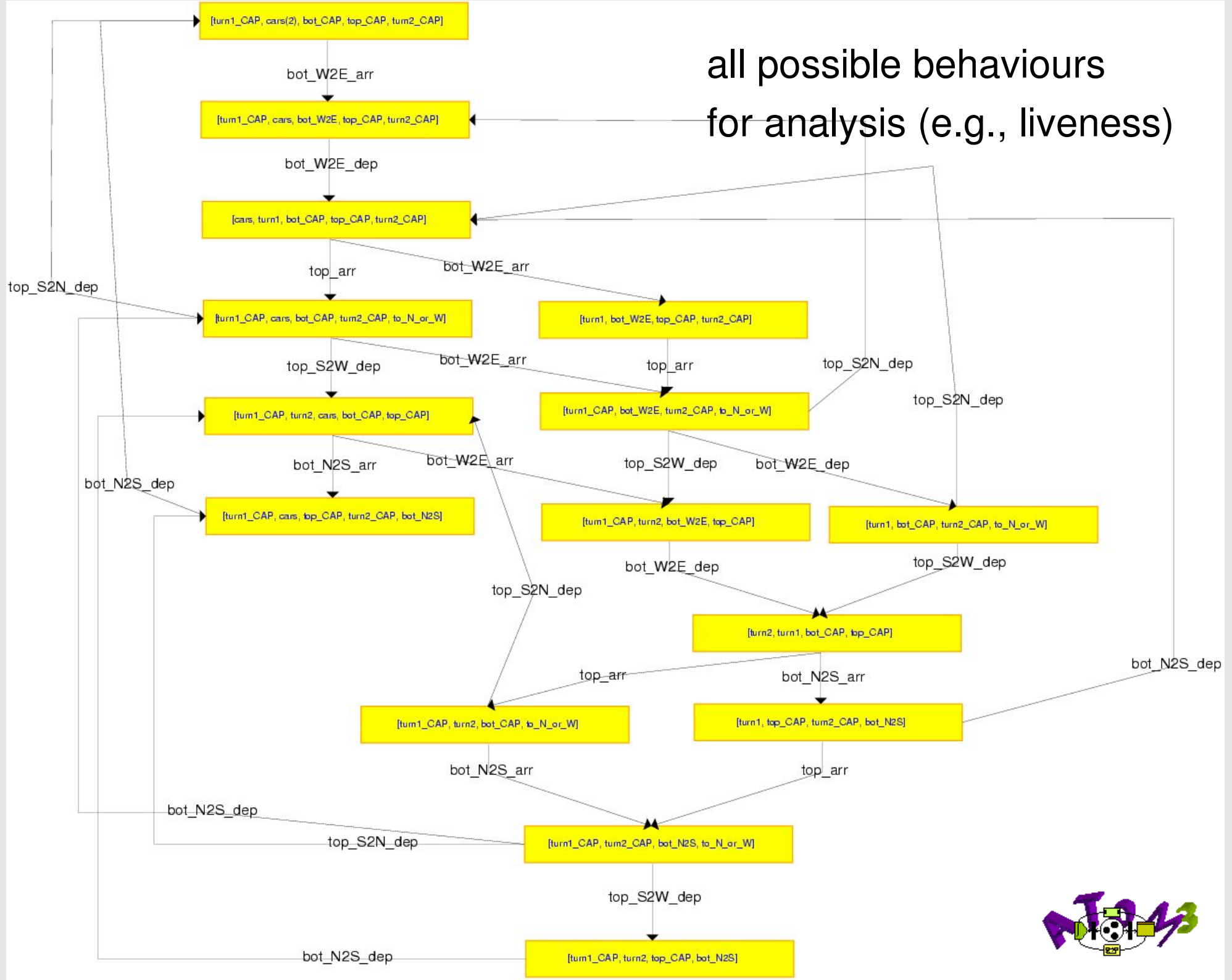
Rule 2 (Order 2): FlowTo2PNTransition



Result of transformation: Traffic dynamics in terms of Petri Nets



all possible behaviours
for analysis (e.g., liveness)



```
=====
=
= Conservation Analysis Results: =
=
=====
```

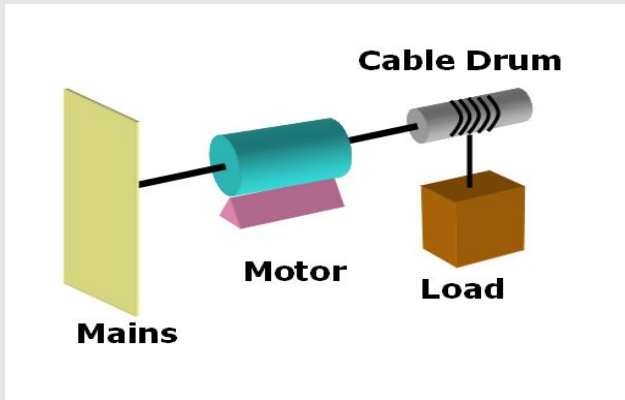
$$1.0 \text{ x[turn1_CAP] + 1.0 x[turn1] = 1.0}$$

$$1.0 \text{ x[cars] + 1.0 x[bot_W2E] + 1.0 x[turn1] +} \\ 1.0 \text{ x[to_N_or_W] + 1.0 x[turn2] + 1.0 x[bot_N2S] = 2.0}$$

$$1.0 \text{ x[top_CAP] + 1.0 x[to_N_or_W] = 1.0}$$

$$1.0 \text{ x[turn2_CAP] + 1.0 x[turn2] = 1.0}$$

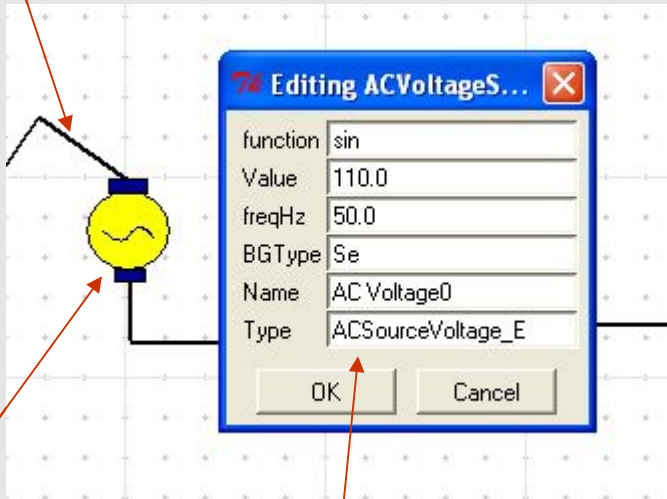
$$1.0 \text{ x[bot_CAP] + 1.0 x[bot_W2E] + 1.0 x[bot_N2S] = 1.0}$$



modelling of physical systems
(collaboration with The Mathworks)

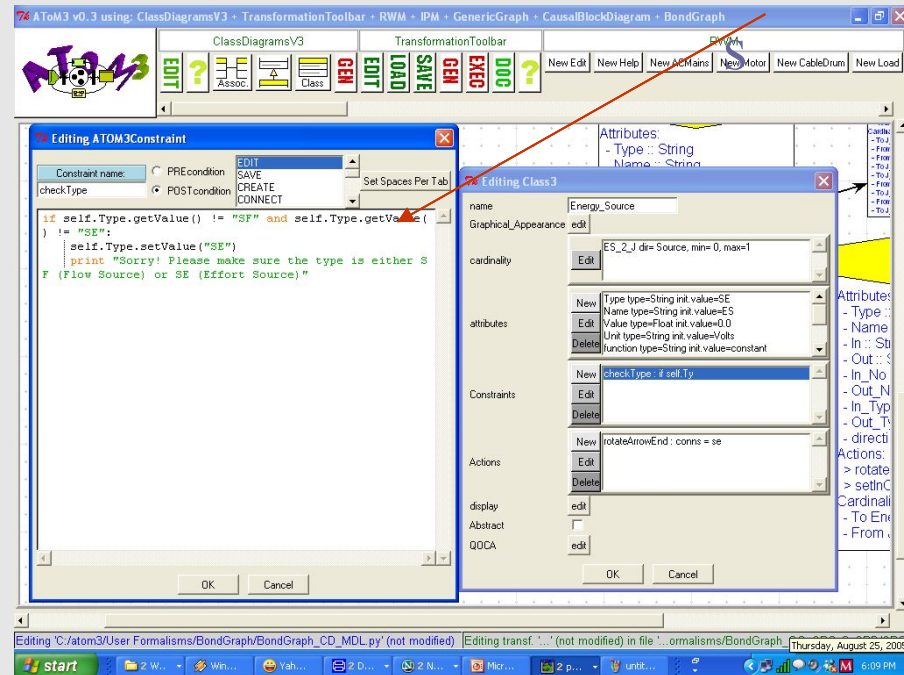
Constraint

Edge



Icon

Attributes



Dsheet: the Designed Spreadsheet

DSheet <observing subject 1> 0.85

File Edit

=avg(B5:B9) B12 01:04

	A	B	C	D	E	F	G	H	I
1	weight	10.0	15.0	25.0	50.0	100.0			
2	max	9.0	14.0	23.0	46.0	92.0			
3									
4		ass1	ass2	midterm	final	grade	letter		
5	marc	6.0	12.0	20.0	38.0	76.0	B+		
6	marie	7.0	11.0	23.0	38.0	79.0	B+		
7	hans	8.0	12.0	23.0	43.0	86.0	A		
8	steve	9.0	14.0	23.0	46.0	92.0	A		
9	anna	3.0	10.0	16.0	38.0	67.0	B-		
10									
11									
12	Average	6.6	11.8	21.0	40.6	80.0			
13	Median	7.0	12.0	23.0	38.0	79.0			
14	Min	3.0	10.0	16.0	38.0	67.0			
15	Max	9.0	14.0	23.0	46.0	92.0			
16									
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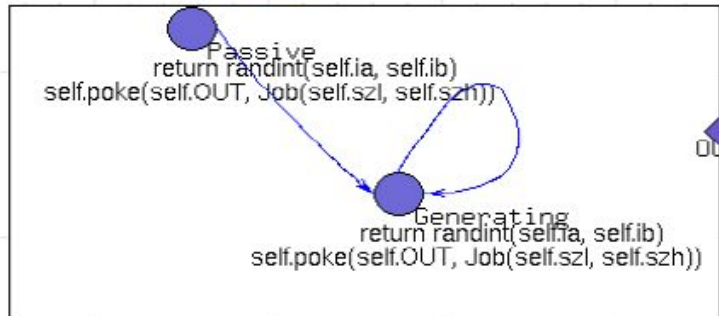


modelling of queueing systems

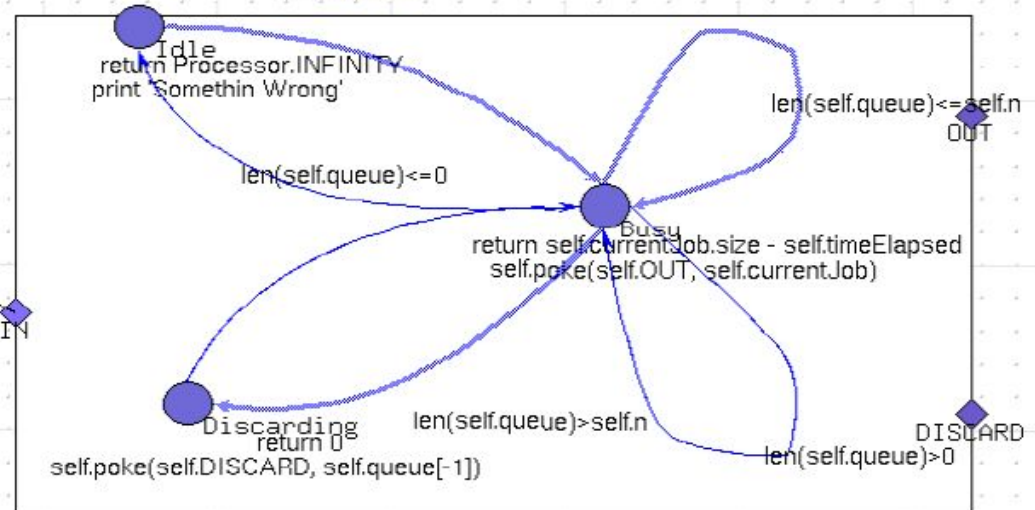
Job

Parameters:
 szl type= Integer init.value=0
 szh type= Integer init.value=0
 Attributes:
 ID type= Integer init.value=0
 size type= Integer init.value=0

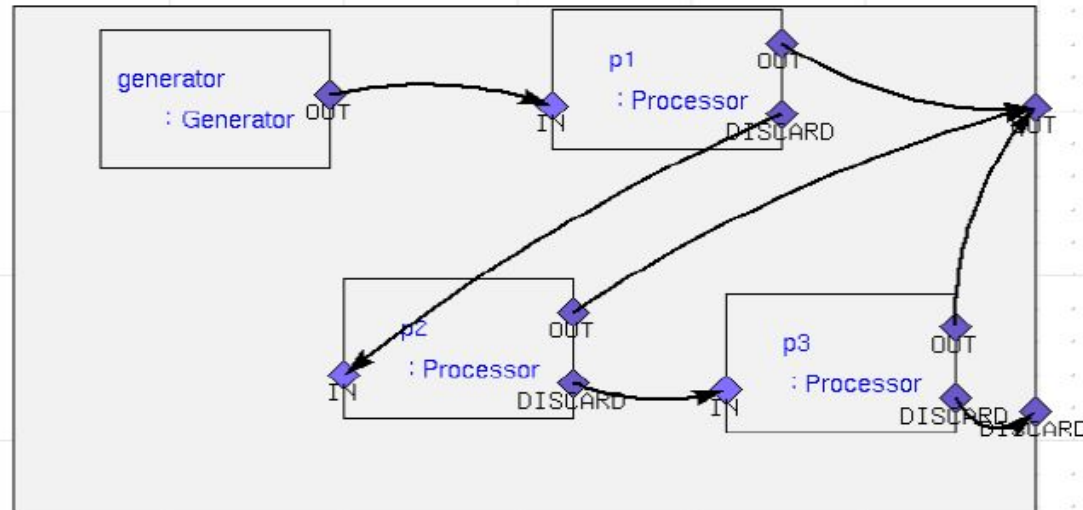
Generator



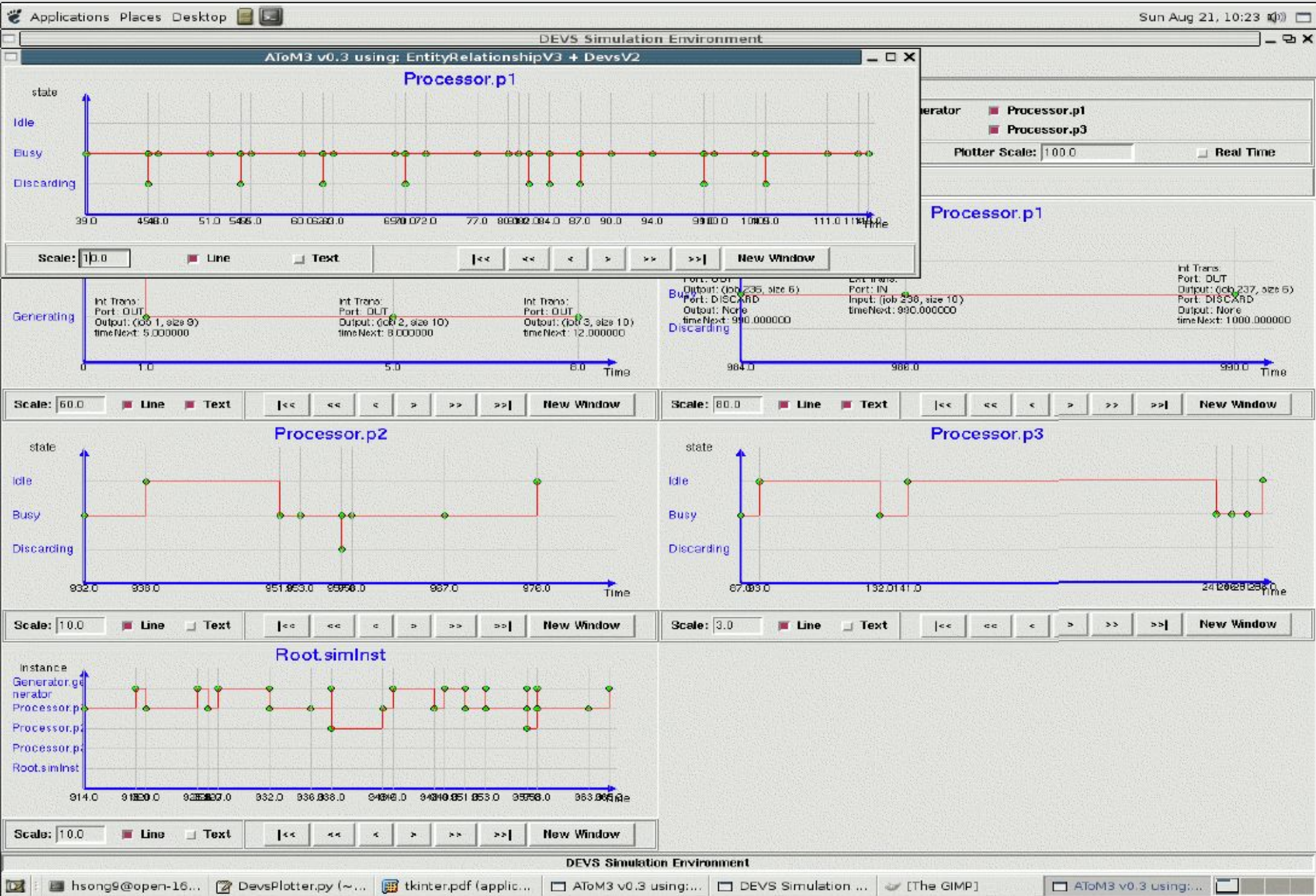
Processor



Root



simulation



(software) process modelling

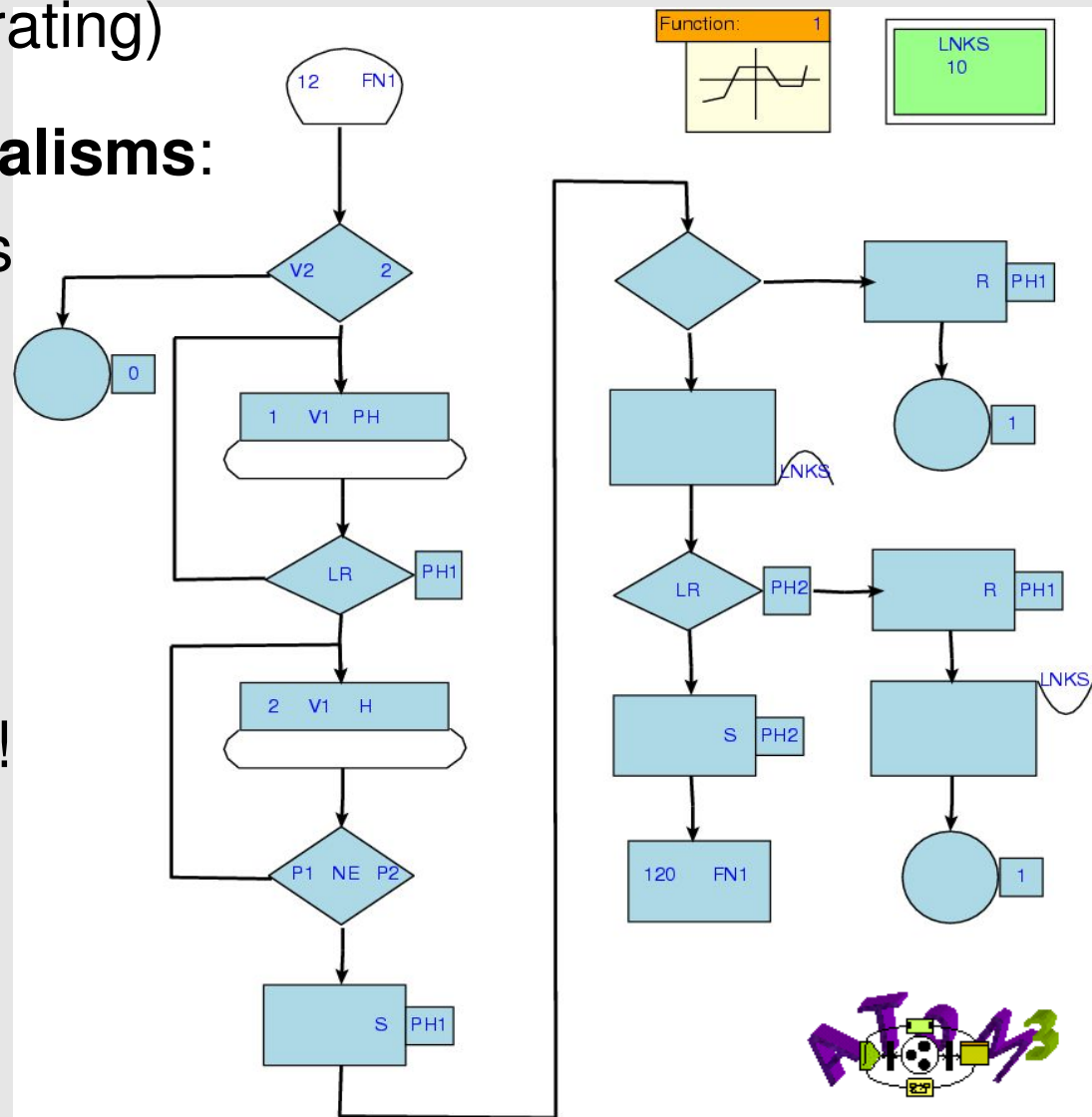
At different **levels of abstraction**:

- “management” level (planning)
- “operational” level (orchestrating)

Using **most appropriate formalisms**:

- Forrester System Dynamics
- Process Interaction
- DEVS
- Statecharts

Continuity between
abstraction levels, formalisms !



Modelling, Simulation and Design Lab

- **applications** of domain-specific modelling
- domain-specific **visual modelling**
 - specification of reactive behaviour
 - link concrete and abstract syntax
- **meta-modelling** and **model transformation (GG)**
 - challenges: (meta-) model evolution,
 - model version control, inverse transformation, ...
- **theory:**
 - new formalisms, multi-formalism modelling
 - formalism transformation

