

# MSDL

**Modelling, Simulation and Design Lab**

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**McGill**

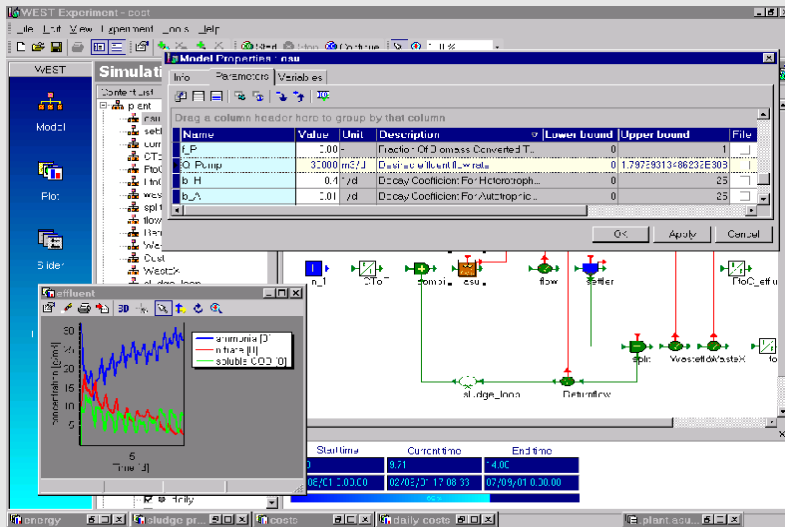
School of Computer Science



Department of Mathematics  
and Computer Science

# Modelling, Simulation and Design Lab

- **applications** of (domain-specific) modelling and simulation-based design



- **visual modelling**

- \* specification of reactive behaviour
- \* link concrete and abstract syntax

- Language engineering: **meta-modelling** and **model transformation**

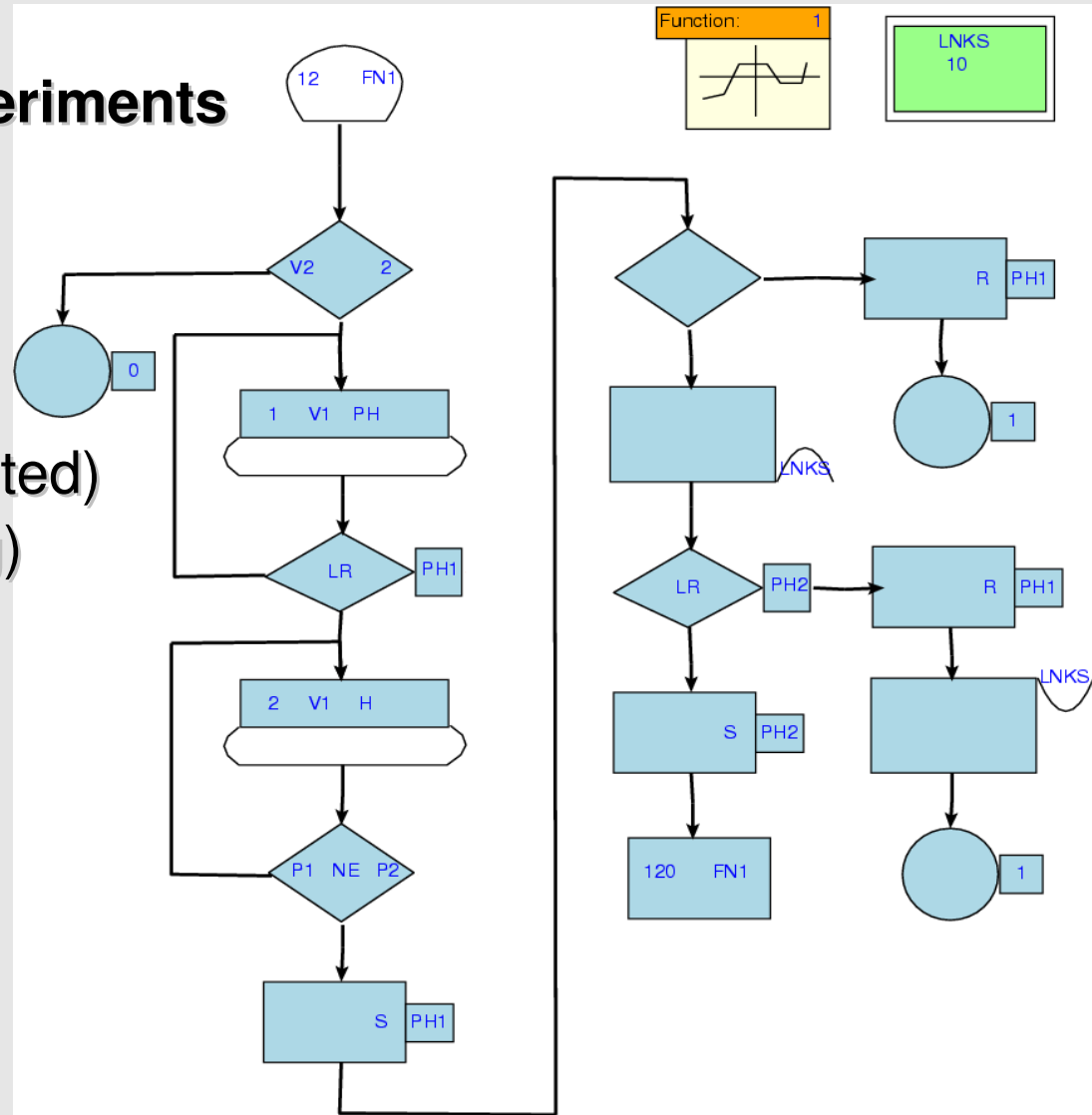
- **theory/foundations:**

new formalisms, multi-formalism modelling, formalism weaving (e.g., structure & behaviour), formalism transformation

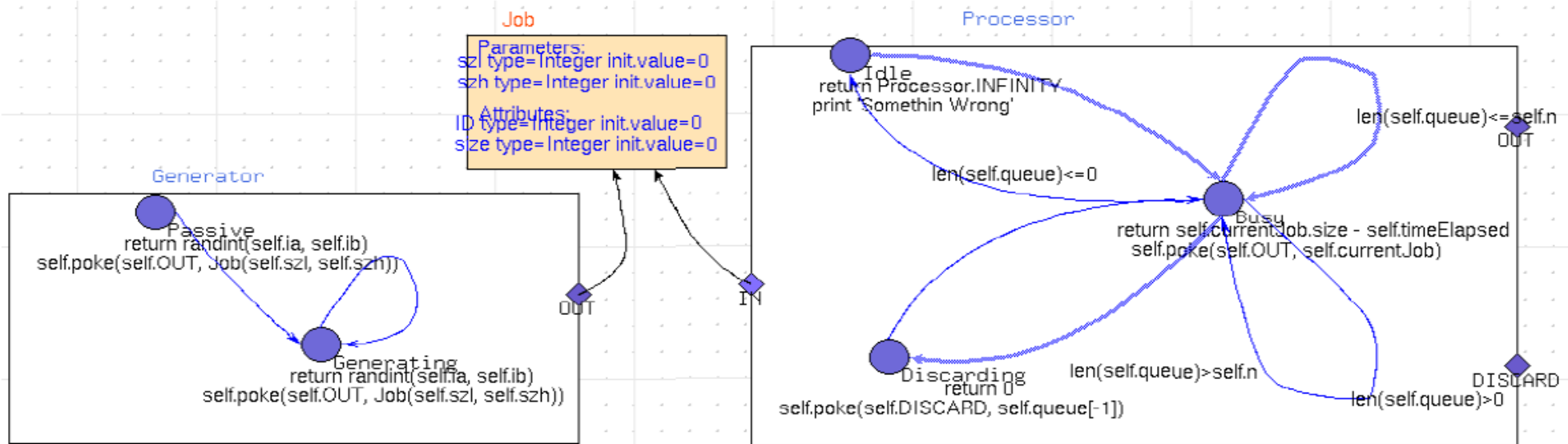


# Designing Modelling Languages/Simulators

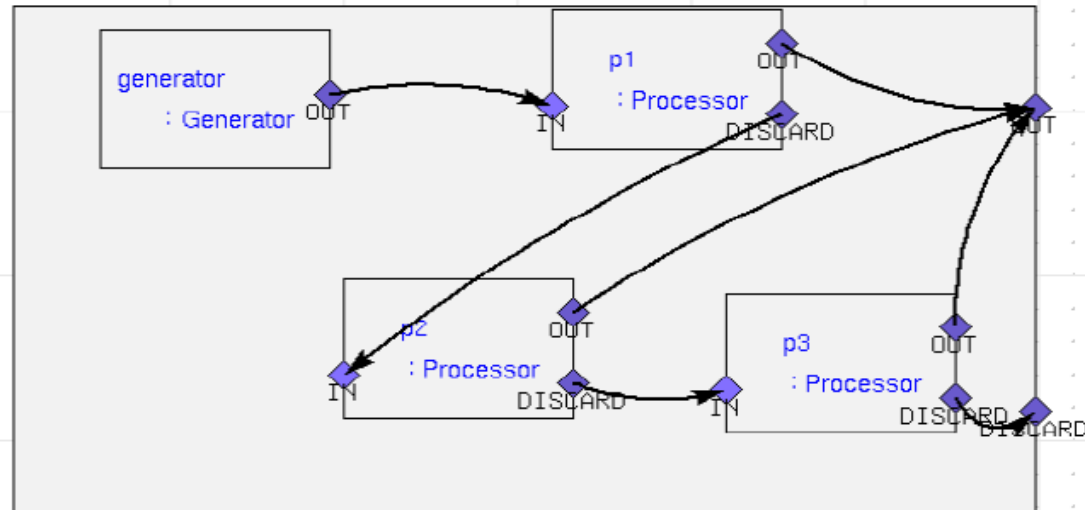
- **CSSL simulators**
- **Real-time simulators, fixed point code**  
(AD10, ADI RTS)
- **Distributed simulators and experiments**  
(Time Warp)
- **Discrete-event simulators**  
DEVS  
Hierarchical GPSS  
kiltera (piCalculus + time + distributed)
- **MSL-USER** (non-causal modelling)  
Modelica  
recently: mix SE with EOOL



# DEVS: visual modelling, efficient simulation

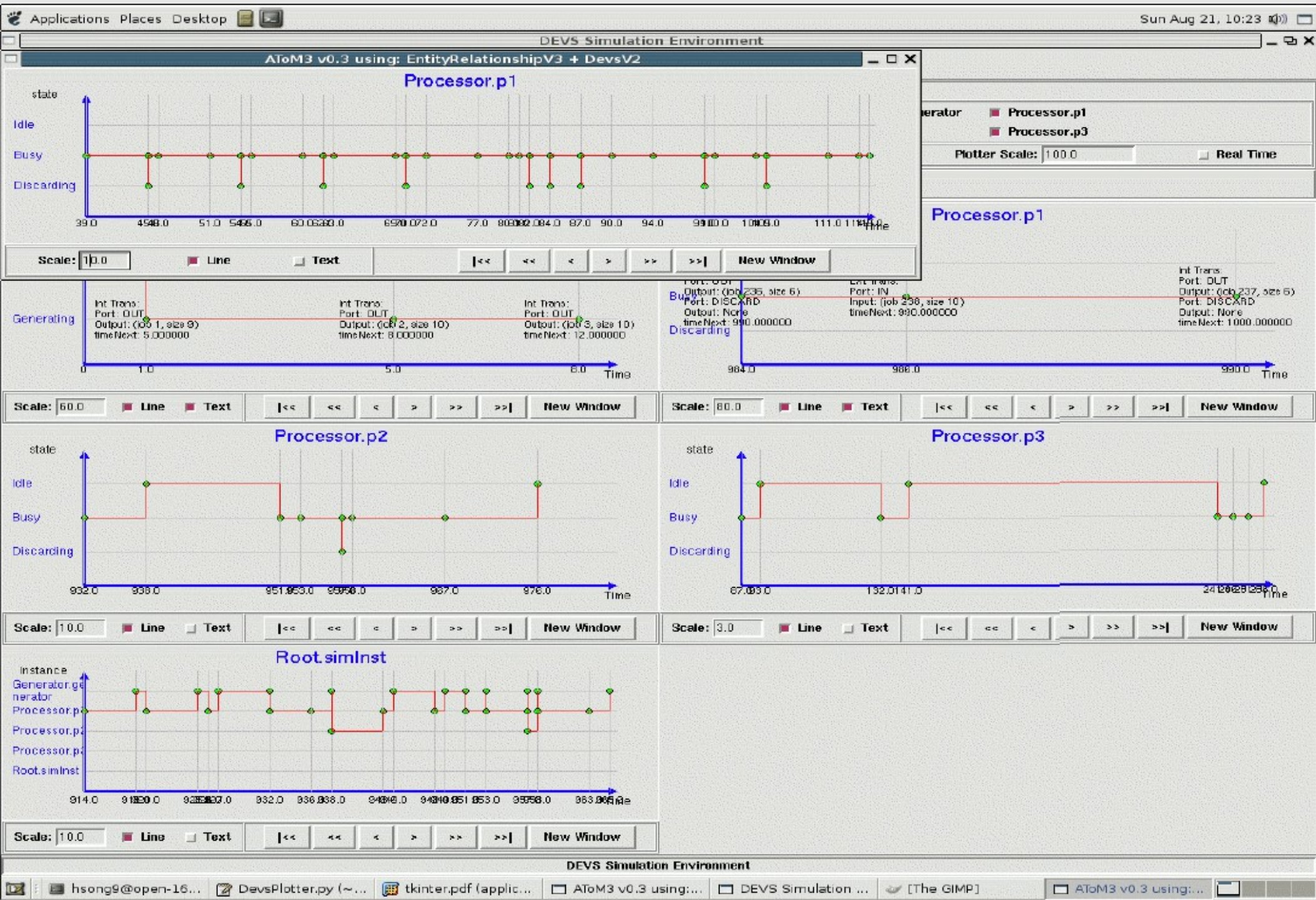


Root



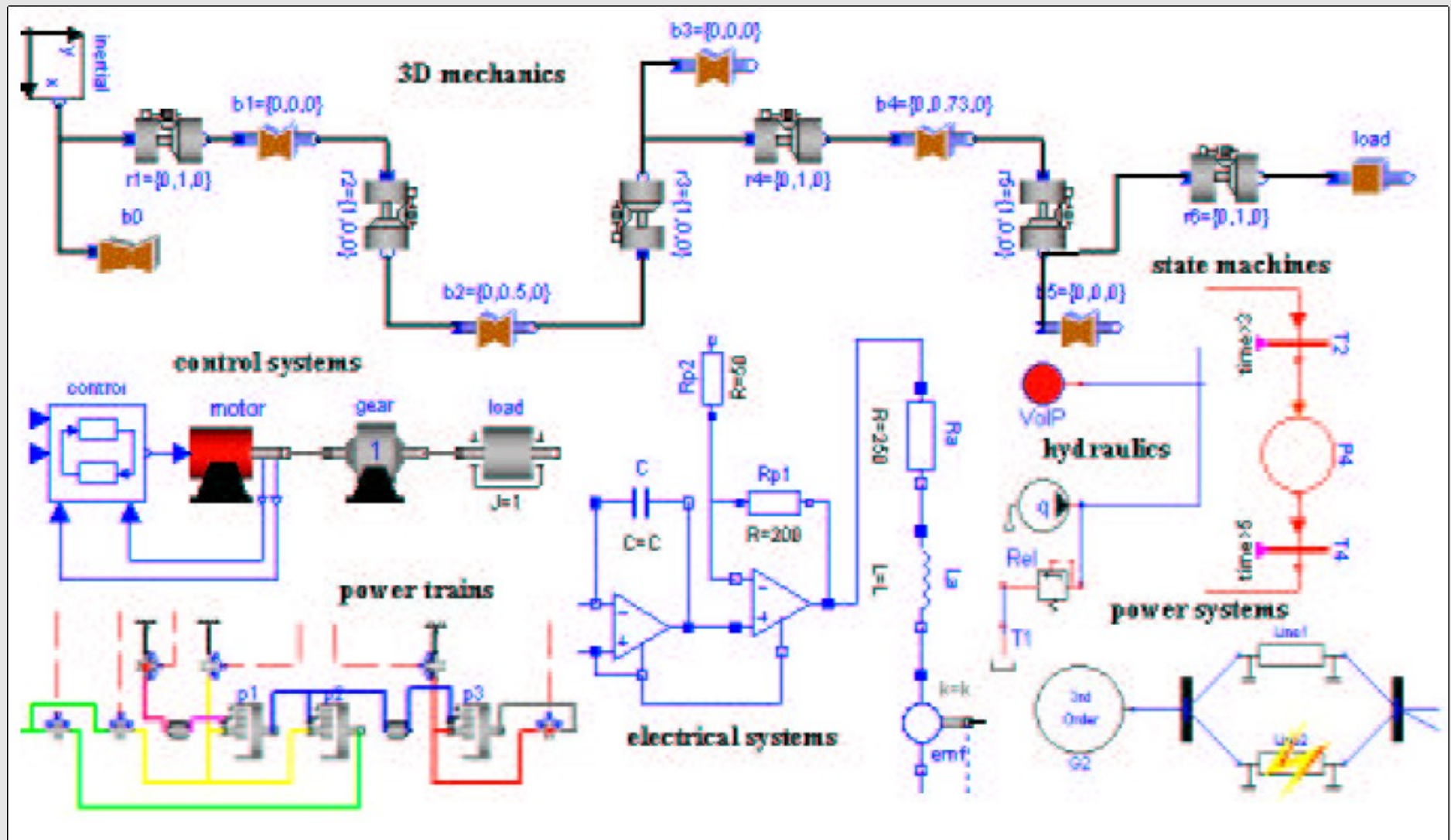


# DEV(S): simulation, standardize traces



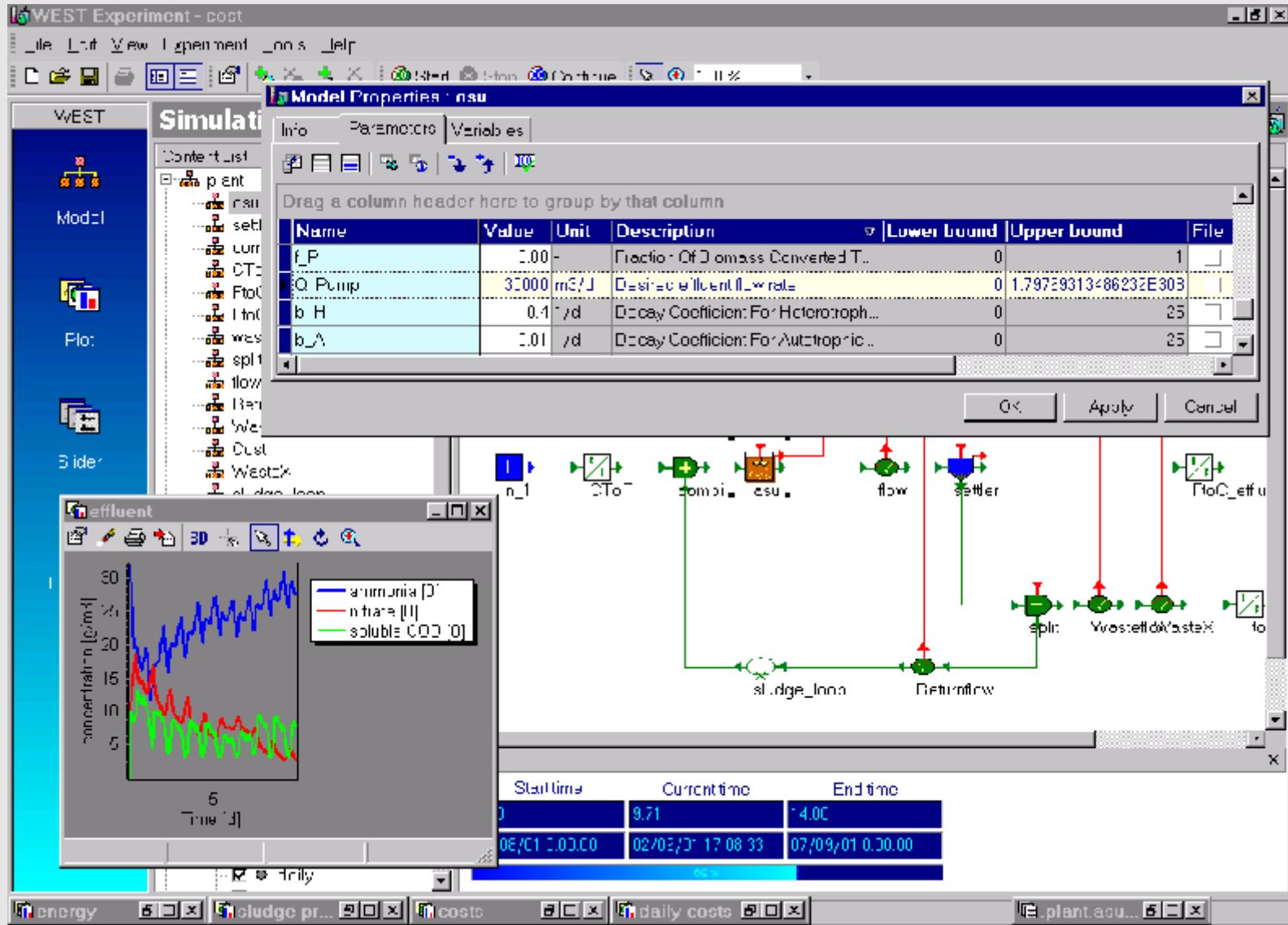


# Modelica (www.modelica.org)



SiE spin-off, muModelica compiler (multi-formalism, SE+EOOL)

# Building WWTP DSM&E environment the hard way

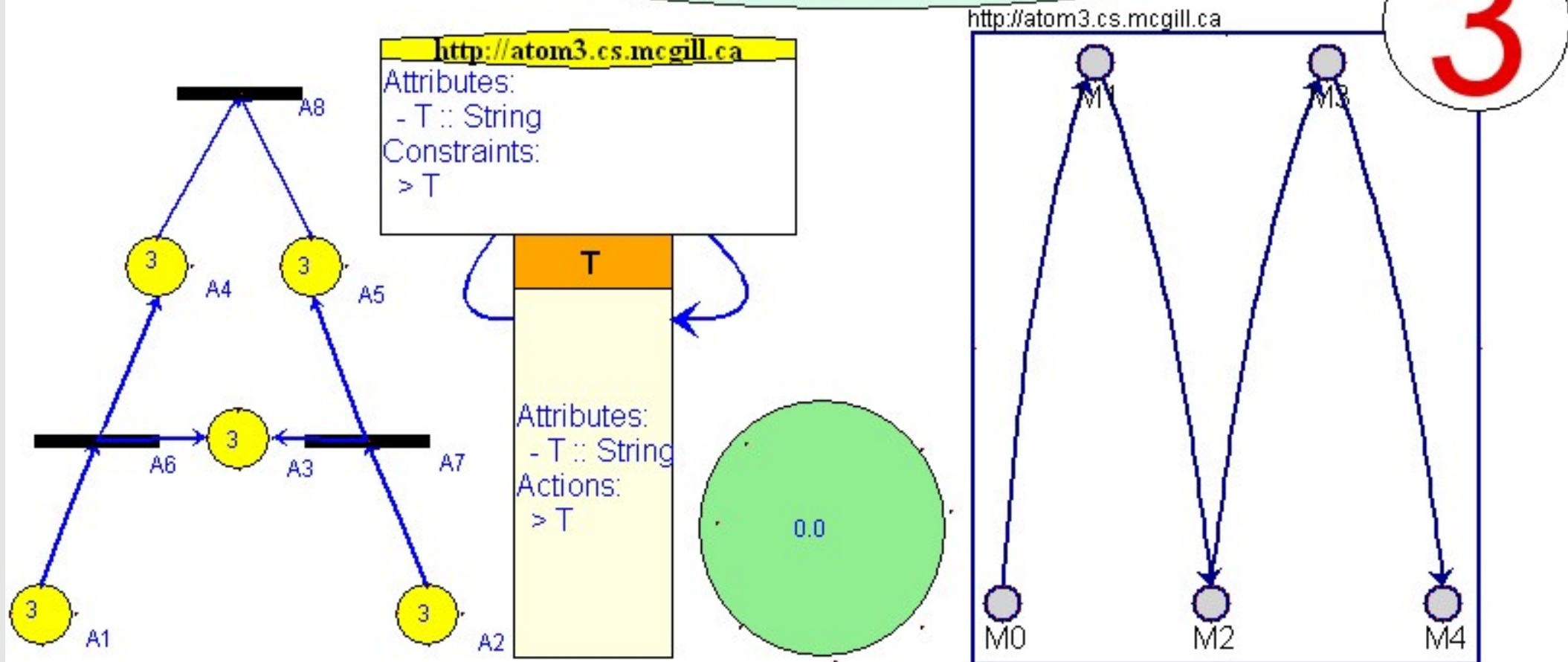


DSM, model transformation, experiment management, optimization, model storage, distributed simulation&experimentation, ...

# Our CAMPaM tool ...

A Tool for Multi-formalism and Meta-Modeling

Even our logos are modeled!



Visit MSDL at <http://msdl.cs.mcgill.ca>

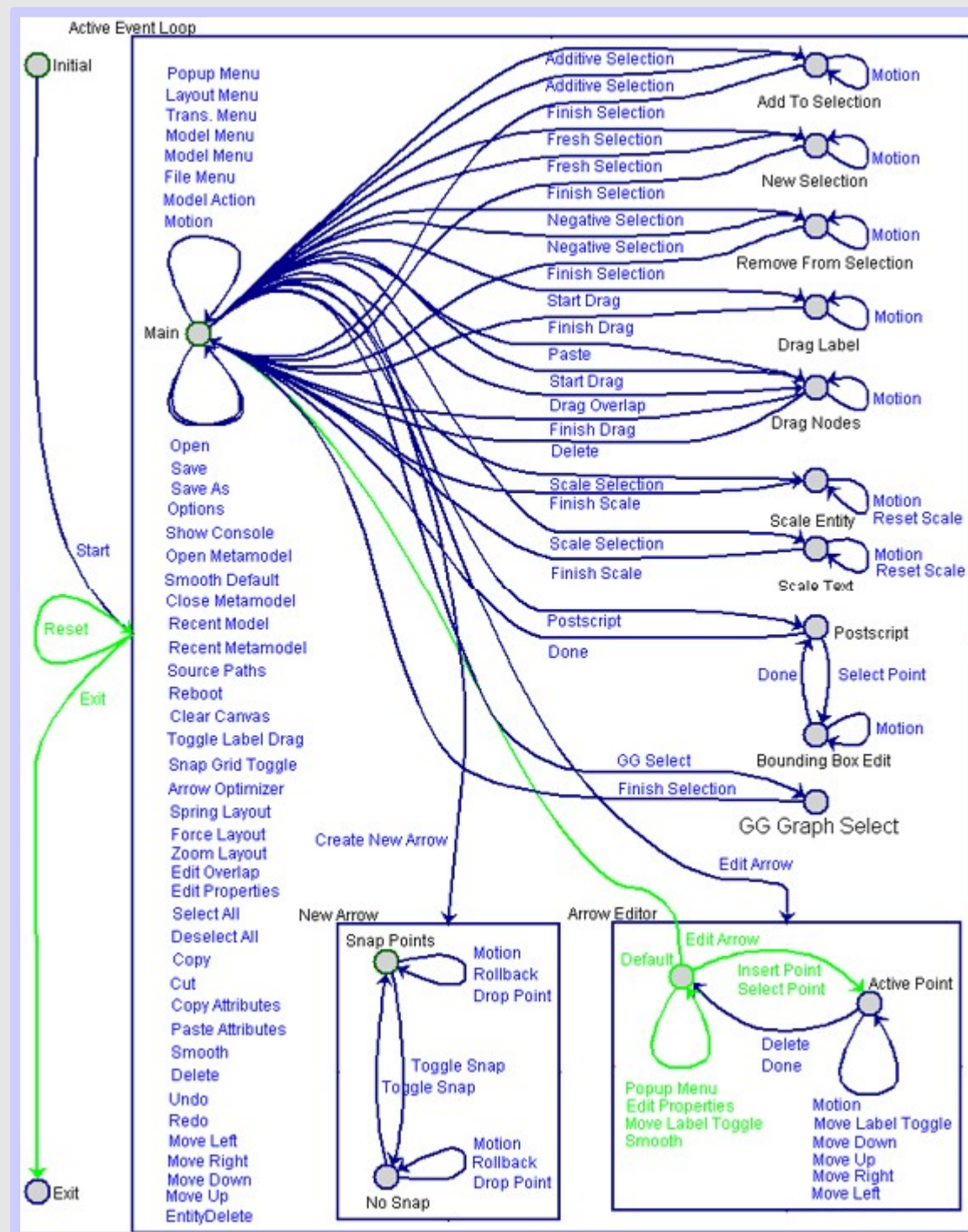


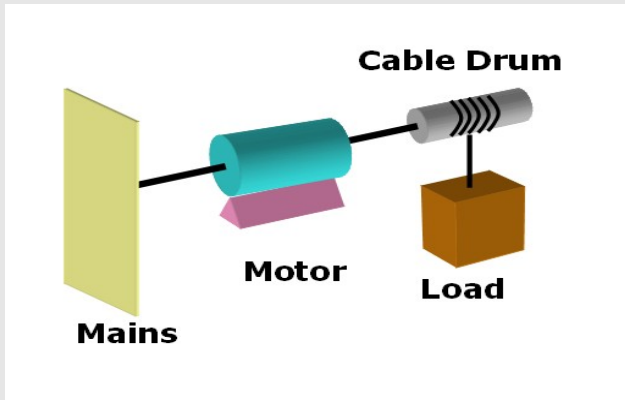
# Hierarchically linked Statecharts

(HIS) modelling of reactive behaviour of a visual modelling environment

... has spawned a new thread of research on the modelling, analysis and synthesis of advanced user interfaces ...

HIS == assembly language of UI modelling ?

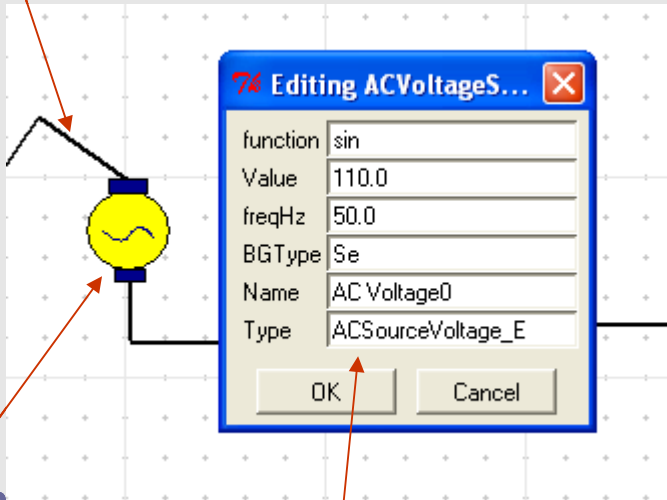




- modelling of **physical systems**
- domain-specific **design-space exploration** based on genetic algorithms

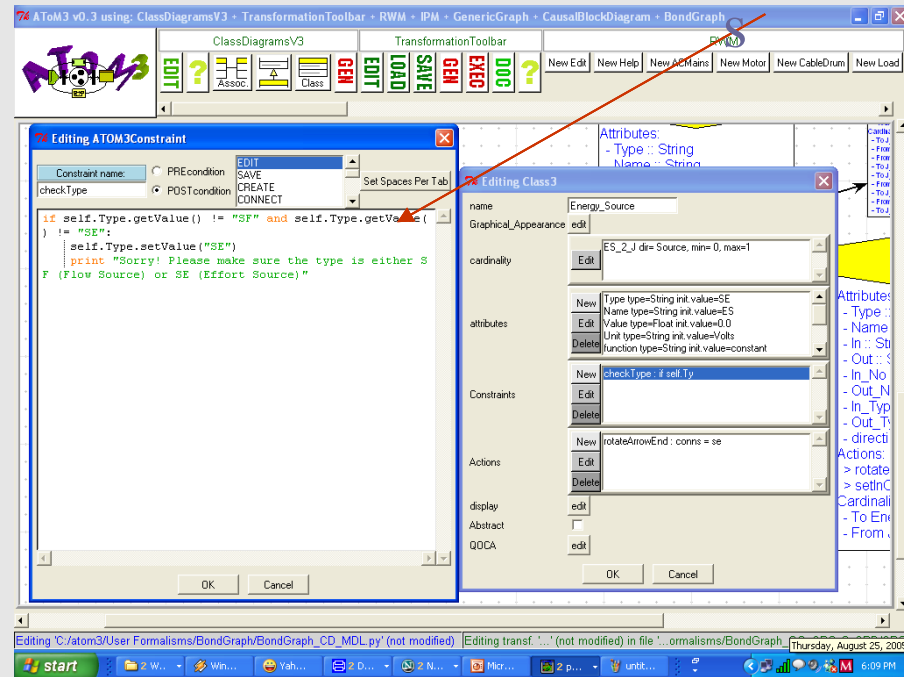
Constraint

Edge

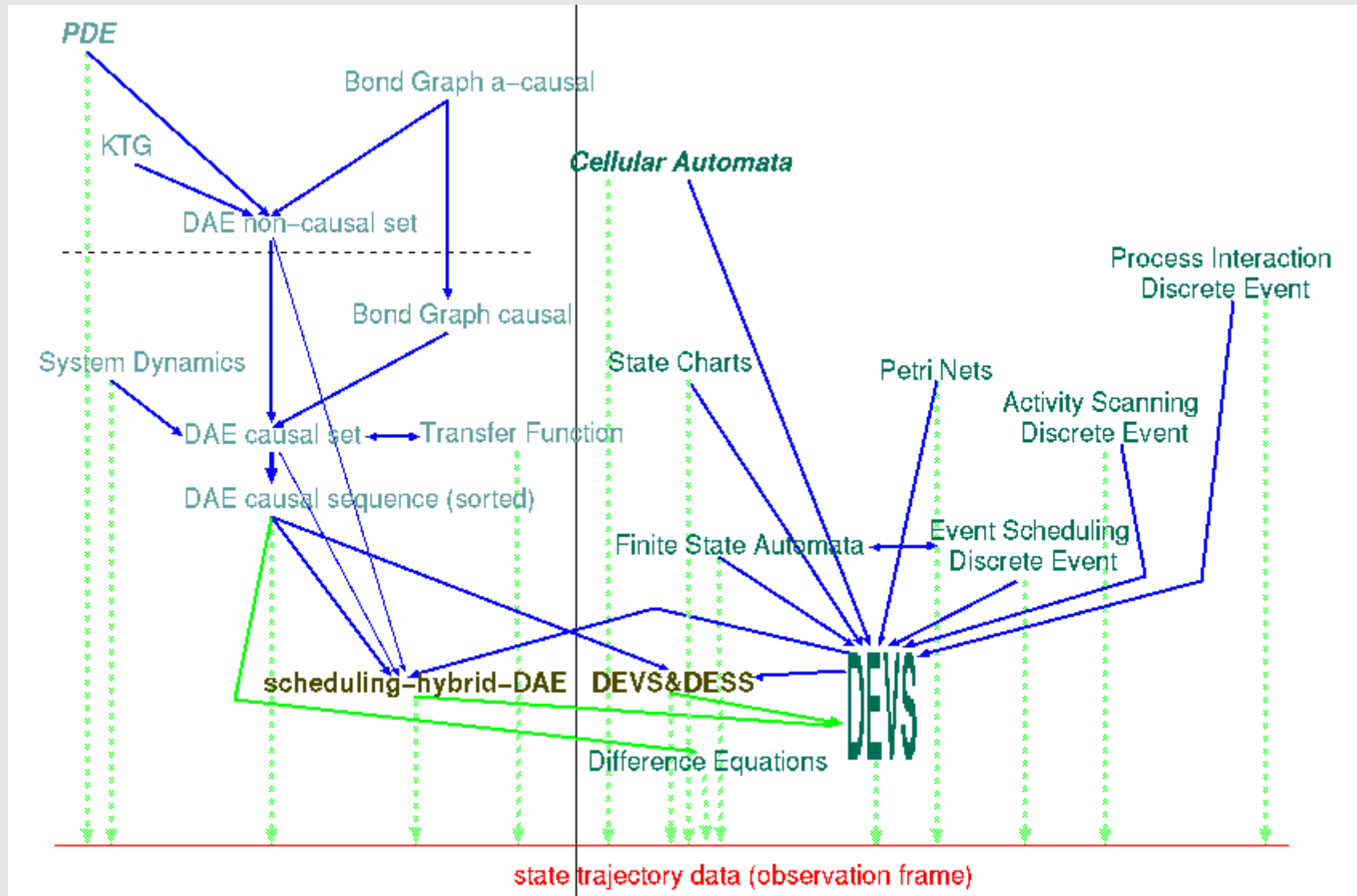


Icon

Attributes



# Formalism Transformation Graph





# Current Work:

- (executable) Meta-Modelling kernel (AToM<sup>3</sup>-redux) (Xiaoxi Dong)
- Industrial-strength model transformation (Eugene Syriani)
  - Debugging
  - Testing (Amr Al Mallah)
  - Scaling (expressiveness, distributed)
  - Bi-directional, consistency
  - Higher-Order Transformation
- (Meta-)model (co-)evolution
- Domain-Specific Languages (Raphael Mannadiar)
  - Lego-blocks vs. multi-view, language “weaving”
  - Debugging
- Formalism Transformations
  - Statecharts 2 DEVS (Reehan Shaikh)
  - Rule-Based ModelTransformation 2 Petri Net (Juan de Lara)
- Modelling/Analysis/Simulation/Synthesis of UIs (HIS, in browser)

# Suggestions for Topics/Work

- CAMPaM “reading” list
- Industrial apps identifying the need for/core problems of CAMPaM
- Standard CAMPaM intro presentation
- Minimal (size) case studies (maximum focus) for specific problems
- Brainstorm session: draw Formalism Transformation Graph
  
- meta-model of transformation, Higher-Order Transformation
- (meta-)model evolution (Traffic/PN case)
- UI modelling
- Scale-able transformation (distributed, optimization)

# Workshop Success Metrics

- Maximize  $\sum \text{participants successMetric}(p)$
- Learn from others
- Convergence of ideas
- Publication of results
- Some solutions on some of the subjects suggested on the previous page

**Modelo Ergo Sum**