Institut für Informatik

C | A | U

Christian-Albrechts-Universität zu Kiel

Faculty of Engineering

Department of Computer Science

Enhancements of Statechart Modeling – The KIEL Environment

Motivation

Observations:

- Statecharts possess high complexity (combinations of components, dependencies, system dynamics, concurrency)
- Tools for modeling Statecharts provide restricted facilities to enter and understand complex system behavior

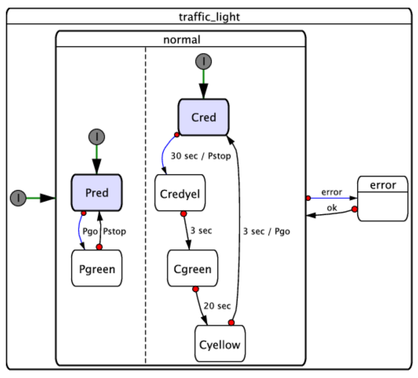
Goals:

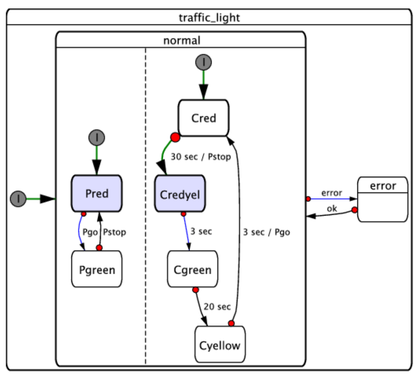
- Formulation of improvements for easy modeling, analyzing and understanding complex Statecharts
- Establishment of these improvements in a highly configurable tool for modeling and simulation

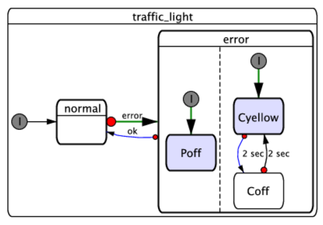
KIEL (Kiel Integrated Environment for Layout)

- Prototypical modeling tool for complex reactive systems
- Novel paradigms in
  - Editing
  - Browsing
  - Simulation
- Not restricted to a specific Statechart dialect
- Implemented in Java
- Highly configurable
- Follows the Model-View-Controller principle

Dynamic Statechart Simulation [1]

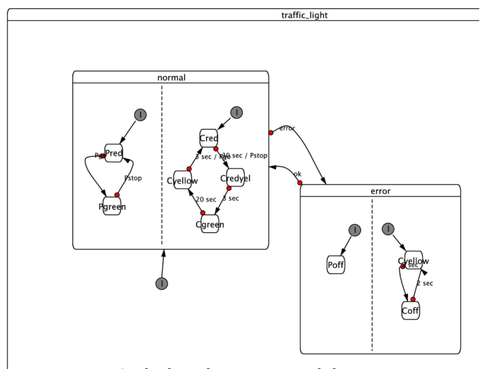






Hiding of inactive sub-states during dynamic simulation

Automatic Statechart Layout [1]

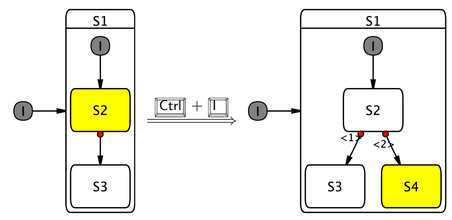


Original, manual layout (imported from Esterel Studio)

Automatically generated Statechart layout (Statechart Normal Form)

Statechart Editing

1. Keyboard shortcuts

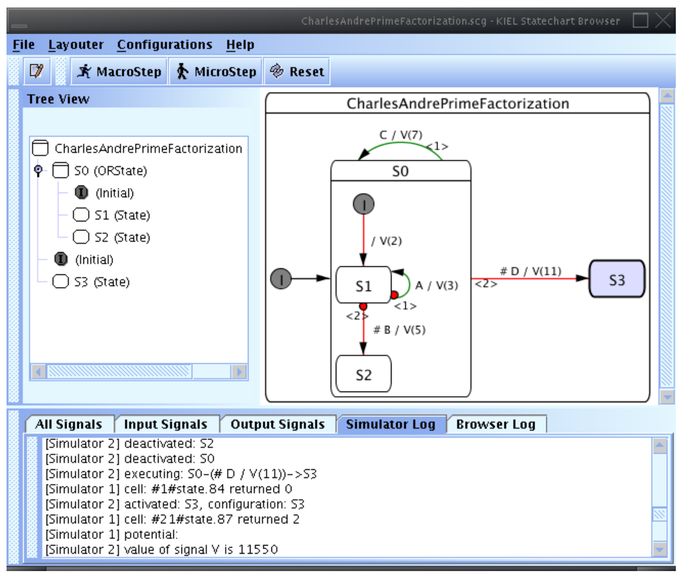


Insertion of a simple successor state with rearrangement of Statechart elements

2. Text-based (KIT)

```
statechart abro[model="Esterel Studio";version="5.0"]{
 input A;
 input B;
 input R;
 output O;
 {
  ->ABO;
  ABO{
   AB{
      ->A;
      A->AF[type=sa;label="A"];
      AF[type=final];
     ||
      ->B;
      B->BF[type=sa;label="B"];
      BF[type=final];
    };
    ->AB;
    AB->Program_Terminated[type=nt;label="/ O"];
    Program_Terminated[type=final];
  };
  ABO->ABO[type=sa;label="R"];
 };
};
```

The KIEL modeling tool



Statechart Import

- Safe State Machines (Esterel Studio)
- Matlab/Simulink/Stateflow
- XMI (ArgoUML)

Statechart Style Checking [3]

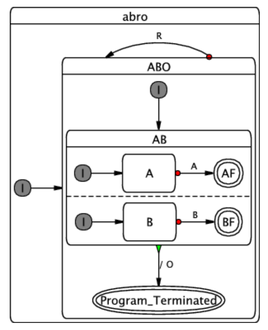
KIEL checks compliance to robustness rules:

- UML wellformedness rules
- Pre-defined dialect-independent OCL rules
- Advanced checks: theorem prover

Statechart Synthesis [2]

```
module ABRO:
input A, B, R;
output O;
loop
  [ await A || await B ];
  emit O;
each R
end module
```

Esterel source



Synthesized SSM

[1] Steffen Prochnow, Reinhard von Hanxleden. Comfortable Modeling of Complex Reactive Systems. In Proceedings of Design, Automation and Test in Europe (DATE'06), Munich, 2006. **[2]** Steffen Prochnow, Claus Traulsen, Reinhard von Hanxleden. Synthesizing Safe State Machines from Esterel. In Proceedings of ACM SIGPLAN/SIGBED Conference on Languages, Compilers, and Tools for Embedded Systems (LCTES'06), Ottawa, Canada, 2006. **[3]** Steffen Prochnow, Gunnar Schaefer, Ken Bell, Reinhard von Hanxleden. Analyzing Robustness of UML State Machines. In Proceedings of the Workshop on Modeling and Analysis of Real-Time and Embedded Systems (MARTES'06), held in conjunction with the 9th International Conference on Model Driven Engineering Languages and Systems, MoDELS/UML 2006, Genua, 2006.

Contact Person:
Steffen Prochnow
Department of Computer Science
Christian-Albrechts-Universität zu Kiel
Olshausenstr. 40, 24098 Kiel, Germany
Phone: +49 (0) 431 880-7282
Fax: +49 (0) 431 880-7615
spr@informatik.uni-kiel.de
http://www.informatik.uni-kiel.de/~spr

Contact Person:
Prof. Dr. Reinhard von Hanxleden
Department of Computer Science
Christian-Albrechts-Universität zu Kiel
Olshausenstr. 40, 24098 Kiel, Germany
Phone: +49 (0) 431 880-7281
Fax: +49 (0) 431 880-7615
rvh@informatik.uni-kiel.de
http://www.informatik.uni-kiel.de/~rvh

Further Information:
http://www.informatik.uni-kiel.de/~rt-kiel

Poster presented at Design, Automation and Test in Europe University Booth (DATE'07), Nice, France, April 2007