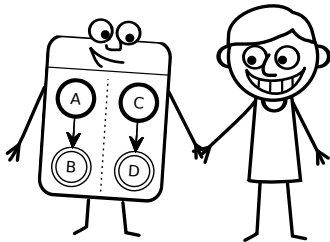


# Taming Graphical Modeling

Hauke Fuhrmann  
Reinhard von Hanxleden

Christian-Albrechts-Universität zu Kiel, Germany  
[www.informatik.uni-kiel.de/rtsys](http://www.informatik.uni-kiel.de/rtsys)

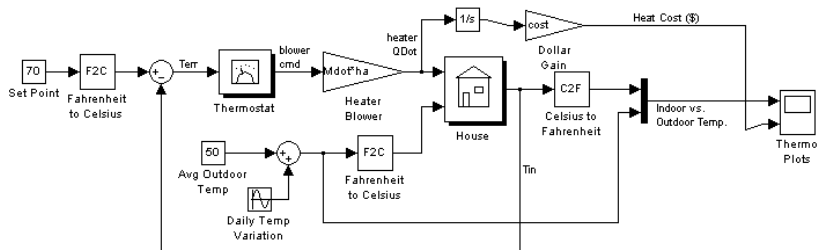
MoDELS 2010, Oslo



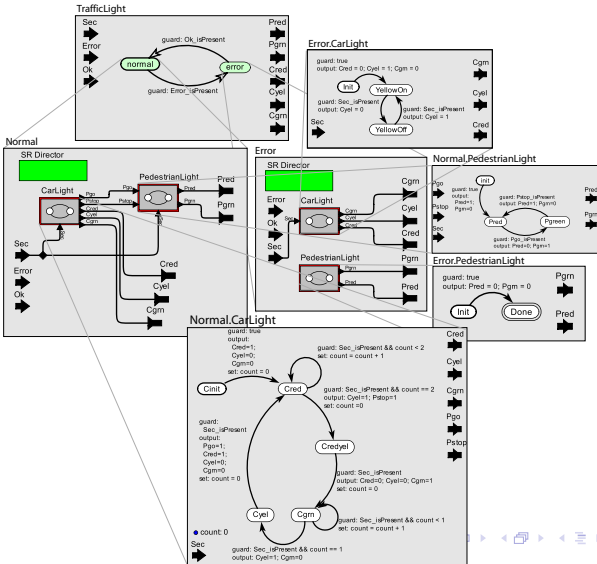
- 1 Problems of Graphical Modeling
- 2 Solution: KIELER
- 3 Evaluation

# Examples 1

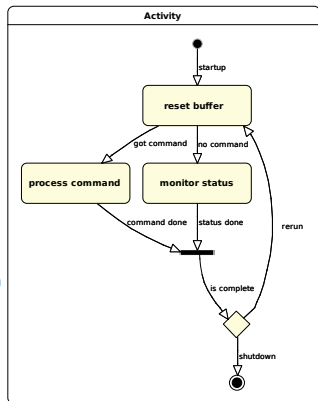
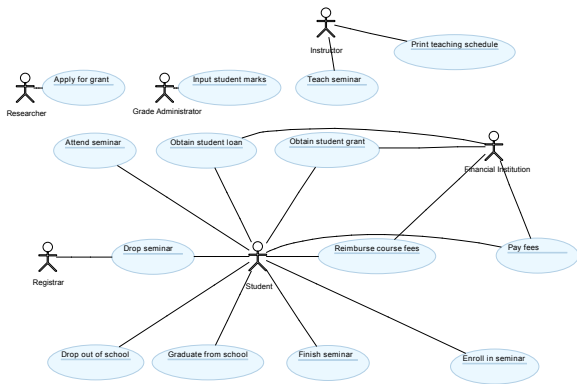
## Mathworks' Simulink



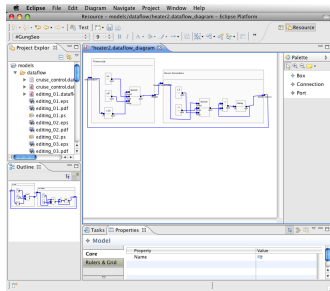
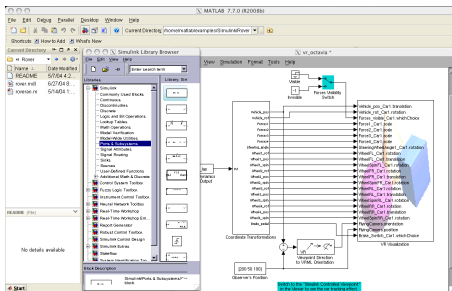
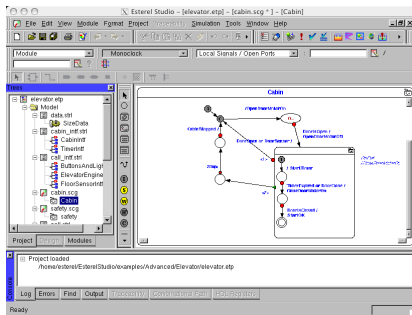
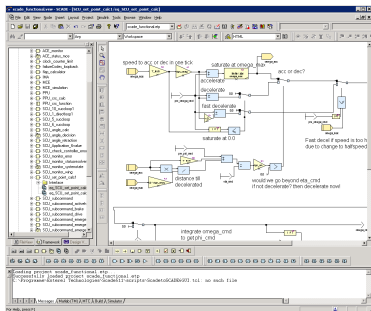
# Examples 2



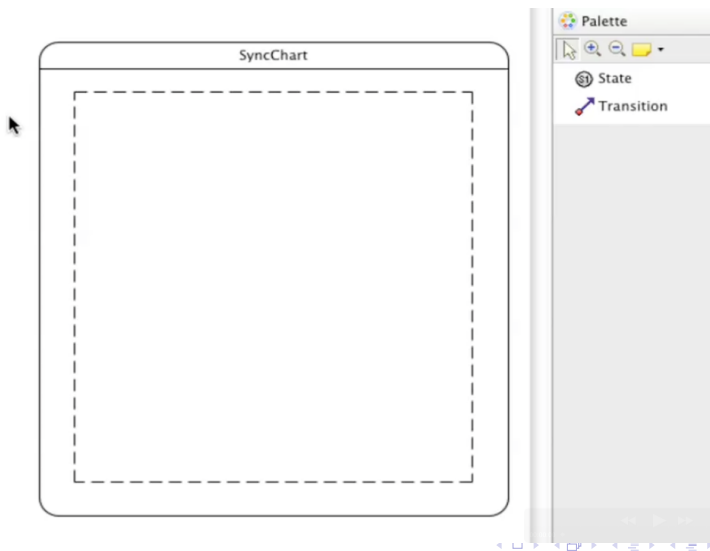
## Examples 3



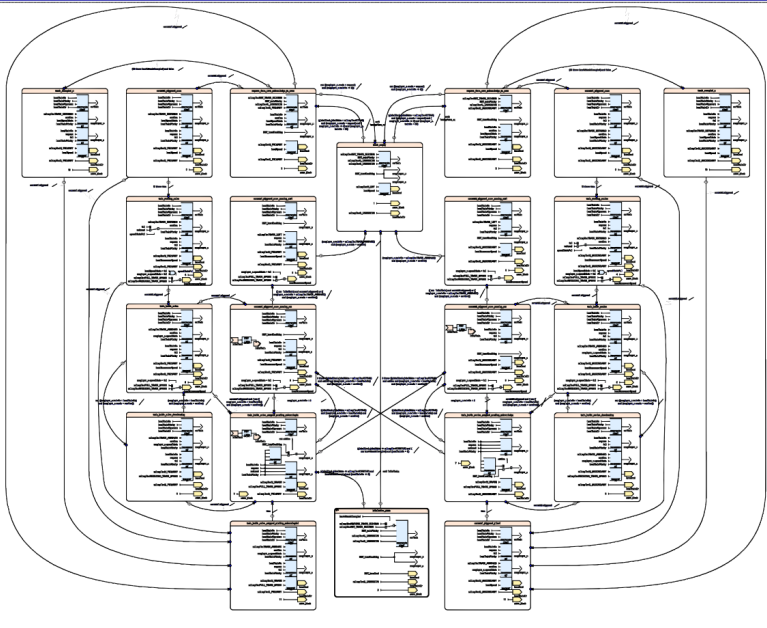
# Editors



# WYSIWYG Drag-n-Drop Freehand Editing

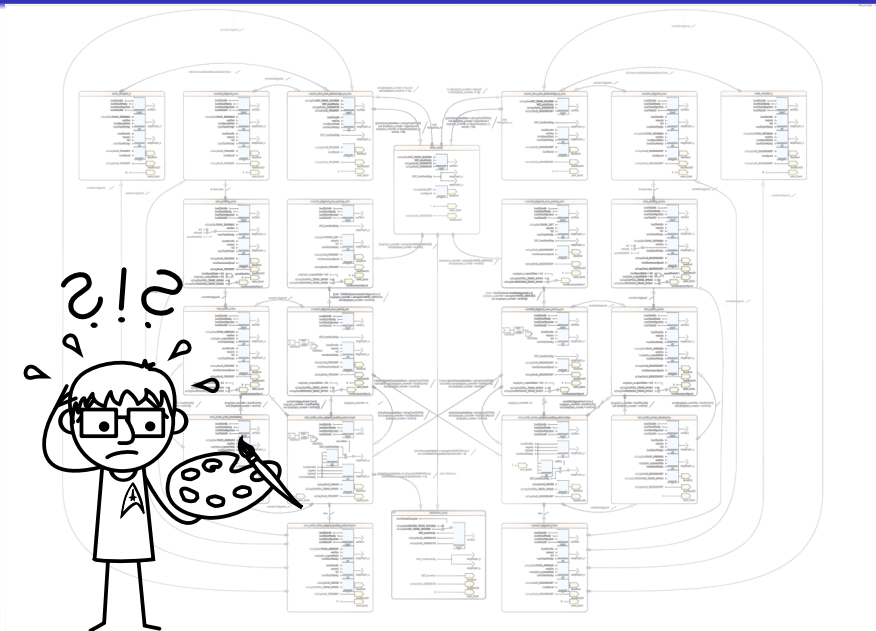


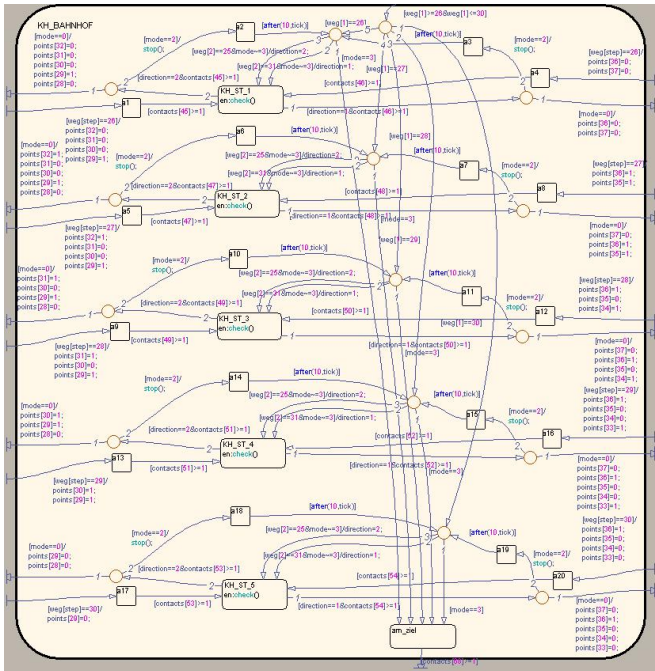
# Complex Diagrams



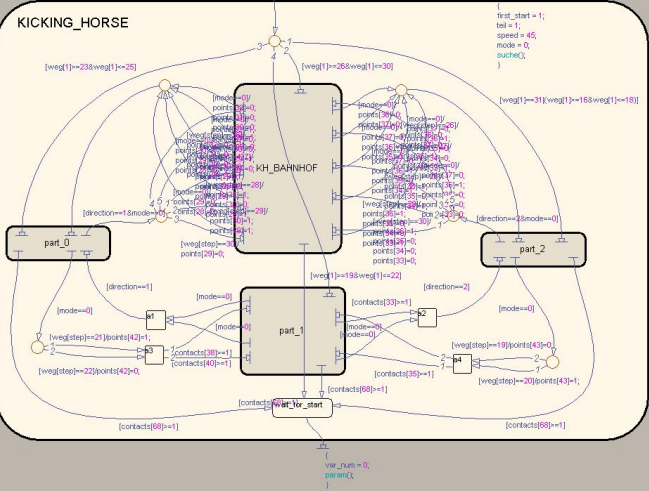
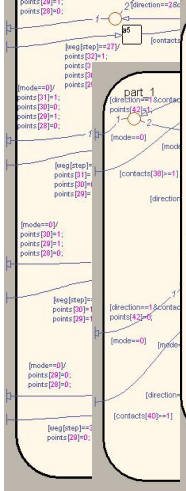
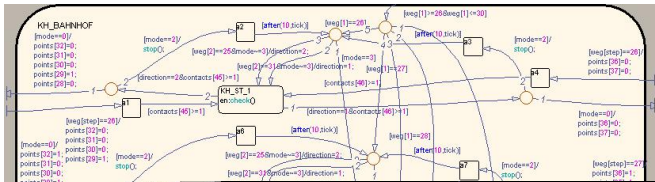


# Complex Diagrams









# Loosing the Context

The screenshot shows a Simulink model window for 'scade\_functional'. The left pane displays a hierarchical tree of submodels, including 'ACE\_monitor', 'MCE\_simulation', 'SCU\_10\_sucloop1', and 'SCU\_setpoint\_calc1'. The main workspace contains a complex block diagram with the following annotated parts:

- speed to acc or dec in one tick:** A block that takes  $\omega_{ref\_acc}$  and  $\omega_{ref\_dec}$  as input and outputs  $\omega_{acc}$  and  $\omega_{dec}$ .
- saturate at  $\omega_{max}$ :** A block that takes  $\omega_{acc}$  and  $\omega_{dec}$  as input and outputs  $\omega_{phi\_acc}$  and  $\omega_{phi\_dec}$ .
- accelerate / decelerate / fast decelerate:** A set of blocks that take  $\omega_{phi\_acc}$  and  $\omega_{phi\_dec}$  as input and output  $\omega_{phi\_cmd}$ .
- saturate at 0.0:** A block that takes  $\omega_{phi\_cmd}$  as input and outputs  $\omega_{phi\_cmd}$ .
- distance till decelerated:** A block that takes  $\omega_{phi\_cmd}$  and  $\omega_{phi\_acc}$  as input and outputs  $\omega_{phi\_cmd}$ .
- would we go beyond  $\eta_{cmd}$  if not decelerate? then decelerate now!**: A block that takes  $\omega_{phi\_cmd}$  and  $\omega_{phi\_acc}$  as input and outputs  $\omega_{phi\_cmd}$ .
- integrate  $\omega_{phi\_cmd}$  to get  $\phi_{cmd}$ :** An integrator block that takes  $\omega_{phi\_cmd}$  as input and outputs  $\phi_{cmd}$ .

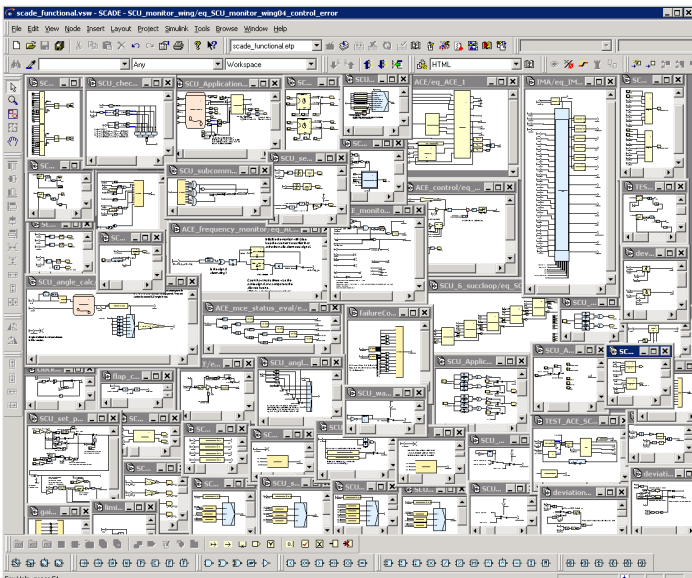
Additional annotations include 'acc or dec?' and 'Fast decel if speed is too h due to change to halfspeed'.

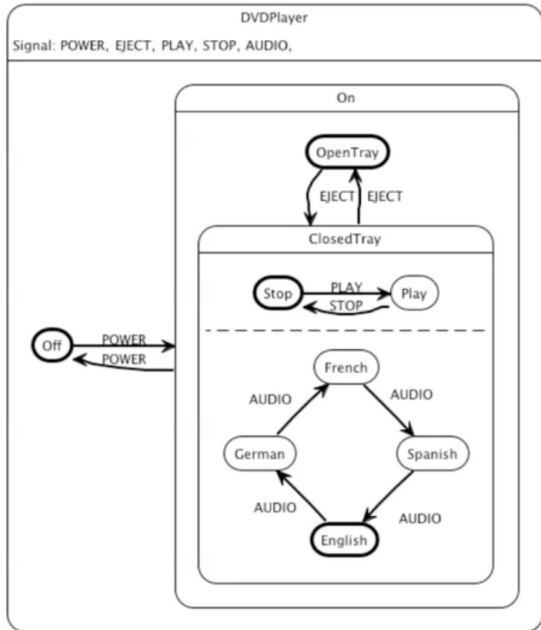
The bottom status bar shows the following messages:

```

Loading project scade_functional.etp ...
Successfully loaded project scade_functional.etp
C:\Programme\Estrel Technologies\Scade511\scripts\ScadetoSCADE6GUI.tcl: no such file
  
```

# Loosing the Details





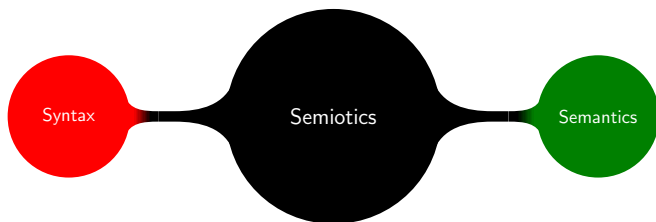
Palette



State

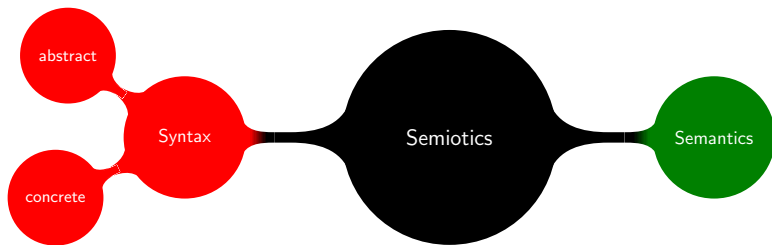
Transition

# Semiotics

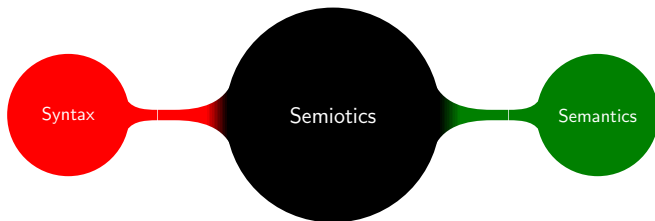




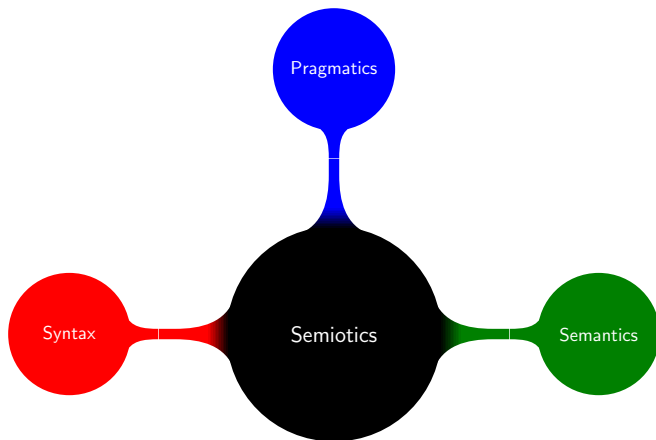
# Semiotics



# Semiotics



# Semiotics



# KIELER Objectives



# KIELER Objectives



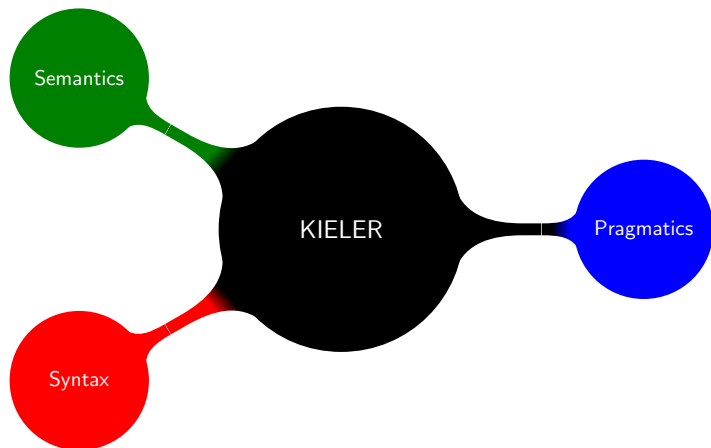
- Free user of manual mechanical work.
  - Manual placing of graphical objects.
  - Manual navigation in complex models.

# KIELER Objectives

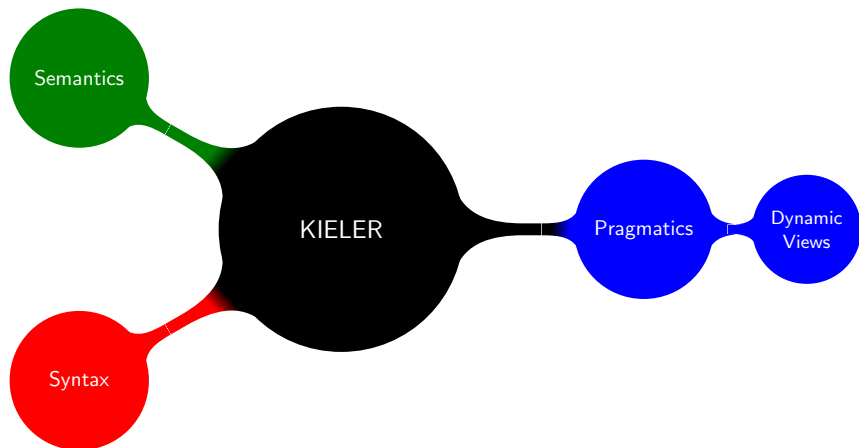


- Free user of manual mechanical work.
  - Manual placing of graphical objects.
  - Manual navigation in complex models.
- Focus on **pragmatics**.
  - New interaction methodologies.
  - New analysis methodologies.
  - New ways to synthesize models.

# KIELER Semiotics

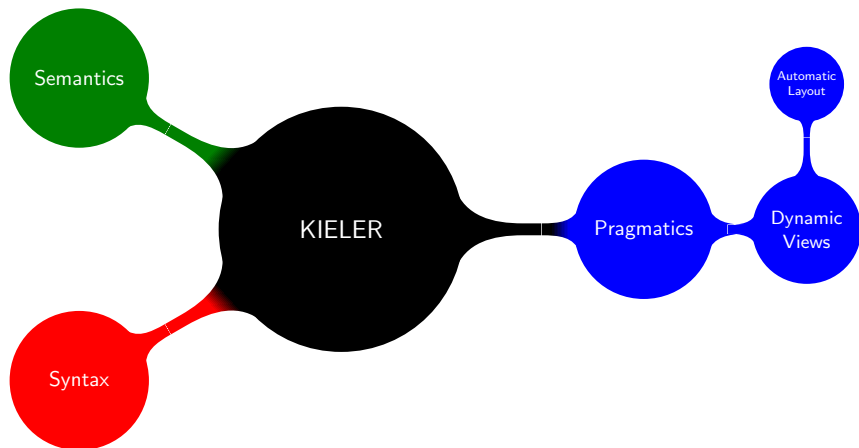


# KIELER Semiotics

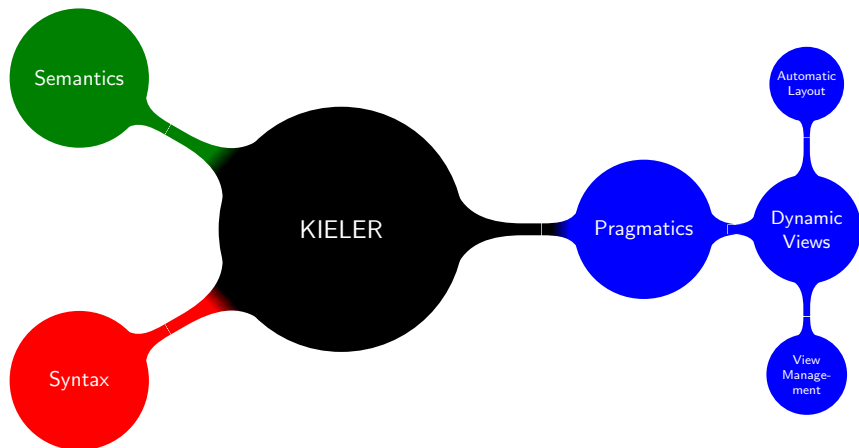




# KIELER Semiotics



# KIELER Semiotics



# Automatic Layout

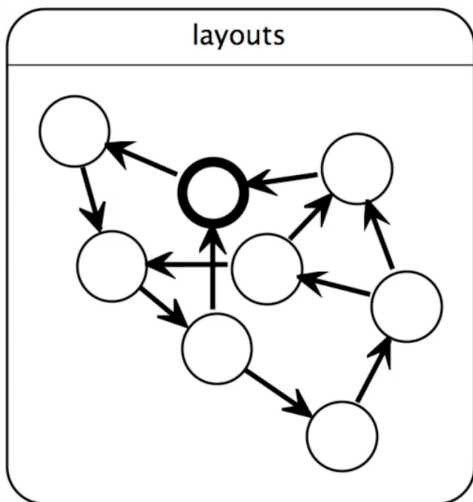
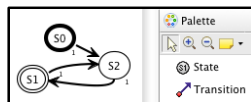


Diagram Editor View



Layout Algorithm

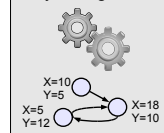
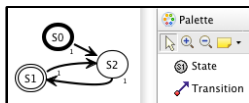
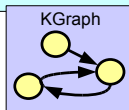
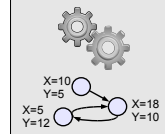
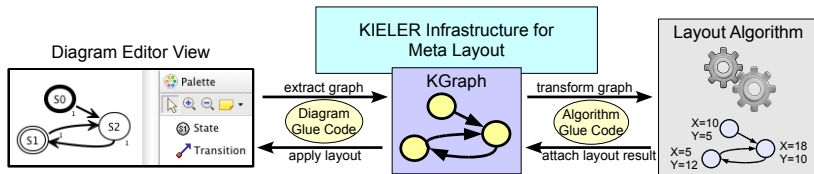


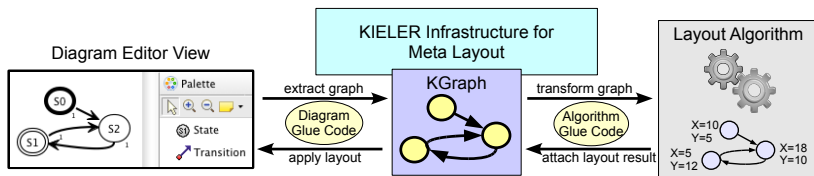
Diagram Editor View

KIELER Infrastructure for  
Meta Layout

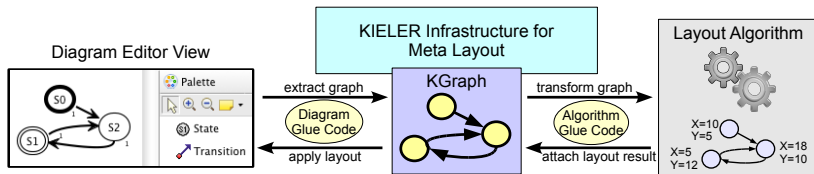
Layout Algorithm







- Eclipse  
GMF
- Graphiti  
(ongoing)
- ...

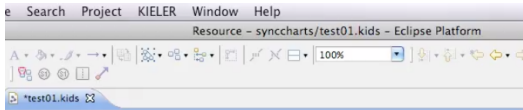


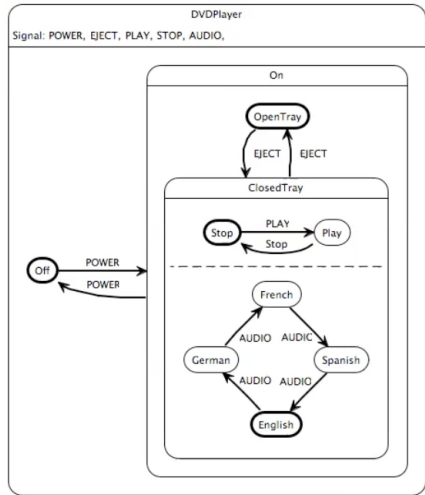
- Eclipse GMF
- Graphiti (ongoing)
- ...
- GraphViz (Dot, Neato, FDP, Twopi, Circo, Radial)
- Open Graph Drawing Framework (OGDF) (Class Diagram, Layer-Based, Force Directed, Orthogonal, Planarization, ...)
- Zest (GEF)
- Own Implementations (Ports, Layer-Based, Planarization, ...)
- ...

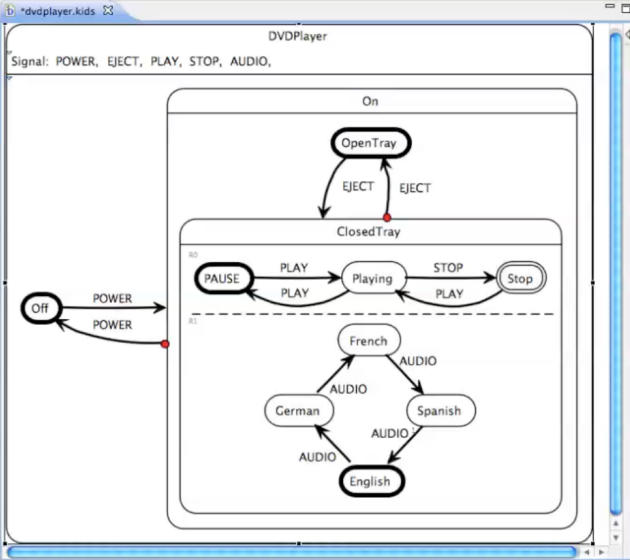


# Build upon Layout: View Management

- Structure-Based Editing
- Textual Editing
- Simulation



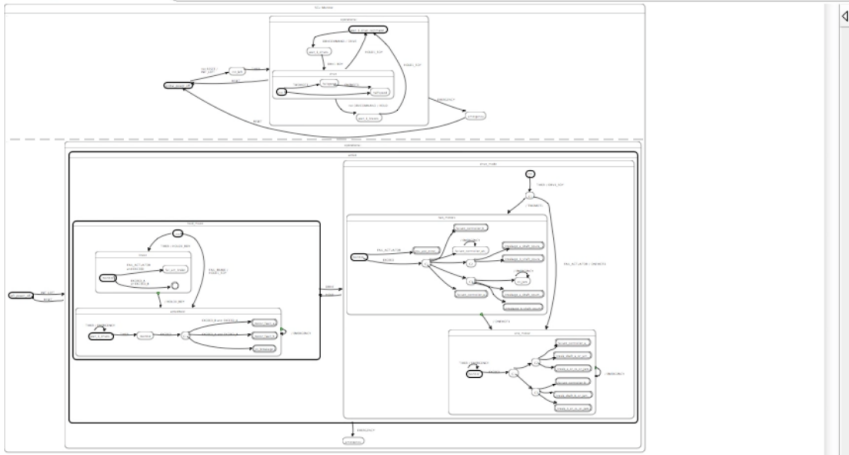




KITS SyncCharts textual view

```

state DVDPlayer {
  input signal POWER
  input signal EJECT
  input signal PLAY
  input signal STOP
  input signal AUDIO
  region R0:
  init state Off
  --> On with POWER
  state On {
    region R0:
    init state OpenTray
    --> ClosedTray with EJECT
    state ClosedTray {
      region R0:
      init state PAUSE
      --> Playing with PLAY
      state Playing
      --> 1 Stop with STOP
      --> 2 PAUSE with PLAY
      final state Stop
      --> Playing with PLAY
    }
  }
  region R1:
  init state English
  --> German with AUDIO
  state German
  --> French with AUDIO
  state French
  --> Spanish with AUDIO
  state Spanish
  --> English with AUDIO
  state English
  --> German with AUDIO
  }
  
```



**\*Execution Manager**

syncchart Matching schedules 500ms 1

Component Name | Type | Master

- Synchronous Signal Resetter  Observer/Producer
- Data Table  Producer
- SyncCharts Ptolemy Simulator  Observer/Producer
- Data Table  Observer
- SyncCharts Visualization  Observer

**Data Table**

P	Key	Value
<input type="checkbox"/>	DRVCOMMAND	
<input type="checkbox"/>	EXCEED	
<input type="checkbox"/>	EXCEED_A	
<input type="checkbox"/>	EXCEED_B	
<input type="checkbox"/>	FAIL_ACTUATOR	
<input type="checkbox"/>	FAIL_BRAKE	
<input type="checkbox"/>	RESET	
<input type="checkbox"/>	state	*, , , @states.0/@regions.9/@st
<input type="checkbox"/>	TIMER	

Trigger

Effect

Trigger

Effect

- ButtonTrigger
- SelectionTrigger
- SimulationEventTrigger
- ...

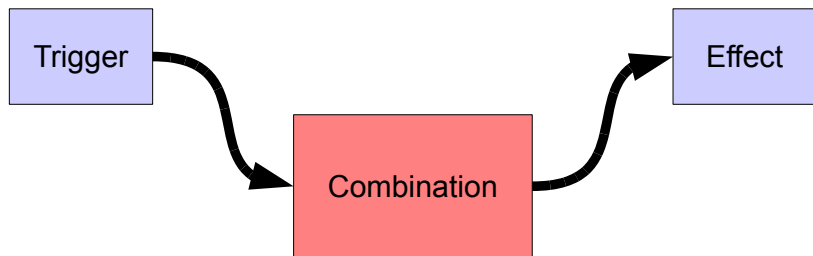
Trigger

- ButtonTrigger
- SelectionTrigger
- SimulationEventTrigger
- ...

Effect

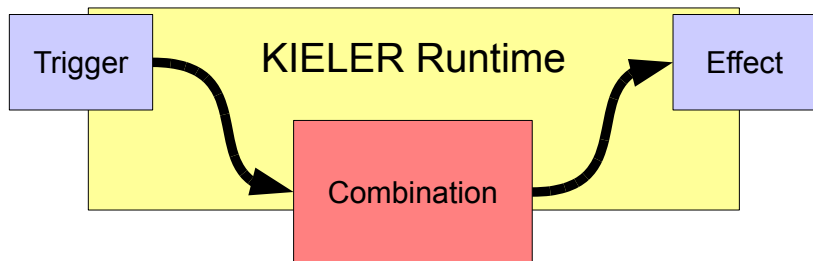
- AutoLayoutEffect
- HighlightEffect
- CollapseEffect
- FilterEffect
- ArrowEffect
- SimulationEffect
- ...





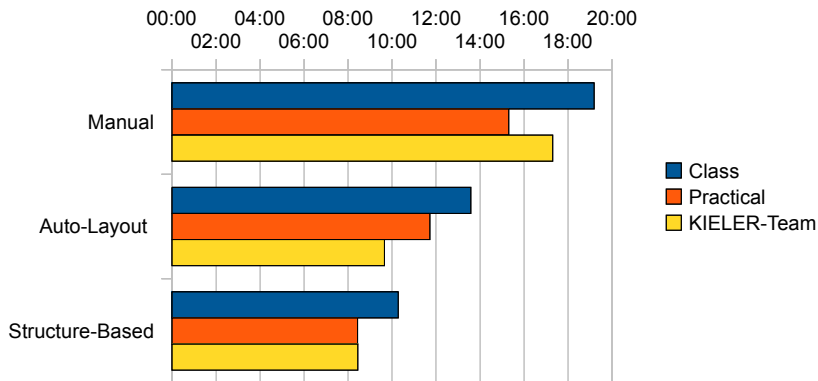
- ButtonTrigger
- SelectionTrigger
- SimulationEventTrigger
- ...

- AutoLayoutEffect
- HighlightEffect
- CollapseEffect
- FilterEffect
- ArrowEffect
- SimulationEffect
- ...



- ButtonTrigger
- SelectionTrigger
- SimulationEventTrigger
- ...
- AutoLayoutEffect
- HighlightEffect
- CollapseEffect
- FilterEffect
- ArrowEffect
- SimulationEffect
- ...

# Evaluation of Structure-Based Editing







- <http://informatik.uni-kiel.de/rtsys/kieler>



- <http://informatik.uni-kiel.de/rtsys/kieler>

