Results

Current research activities concentrate on the development of reactive embedded real-time systems. Key areas are

- The model-based design of complex reactive systems and
- Deterministic concurrency and synchronous languages.

The activities on the **model-based design of complex reactive systems** concentrate on the *modeling pragmatics*, that is, the practical aspects of creating, maintaining and visualizing graphical system models. The Kiel Integrated Environment for Layout Eclipse Rich Client (KIELER) is a prototypical modeling environment that serves as a test bed to explore and validate novel modeling approaches. A key enabler is the ability to automatically compute the layout of graphical models. This frees the user from the tedious task of manually drawing diagrams, and allows novel techniques such as customized views during simulation. Novel developments in 2011 include the reimplementation of the main automatic layout algorithm and improvement of the concept for processing port constraints, the extension of the layer-based approach for the layout of compound graphs, and a web service for graph layout and graph format conversion. Also, KIELER's layout capabilities within UC Berkeley's Ptolemy system have been improved.

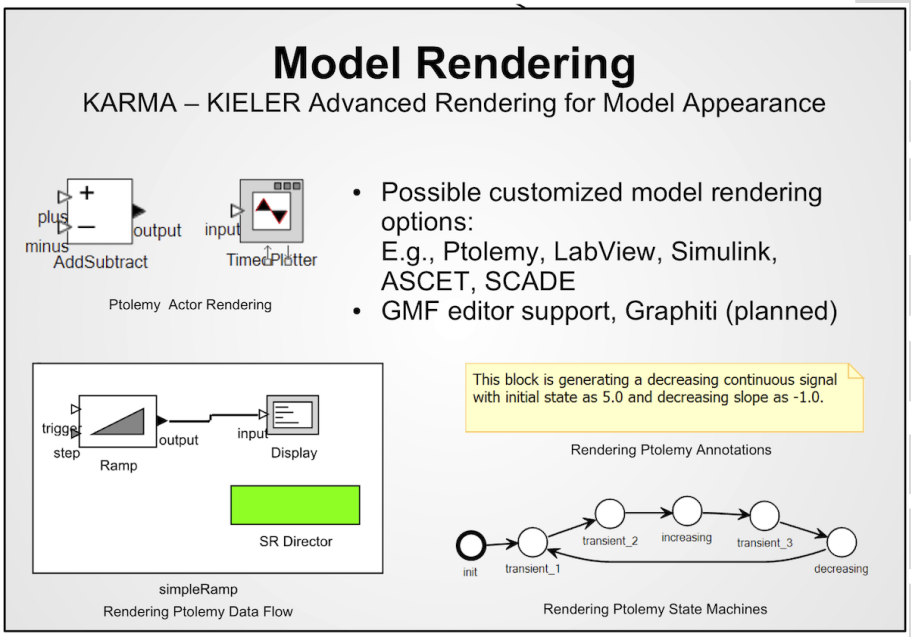
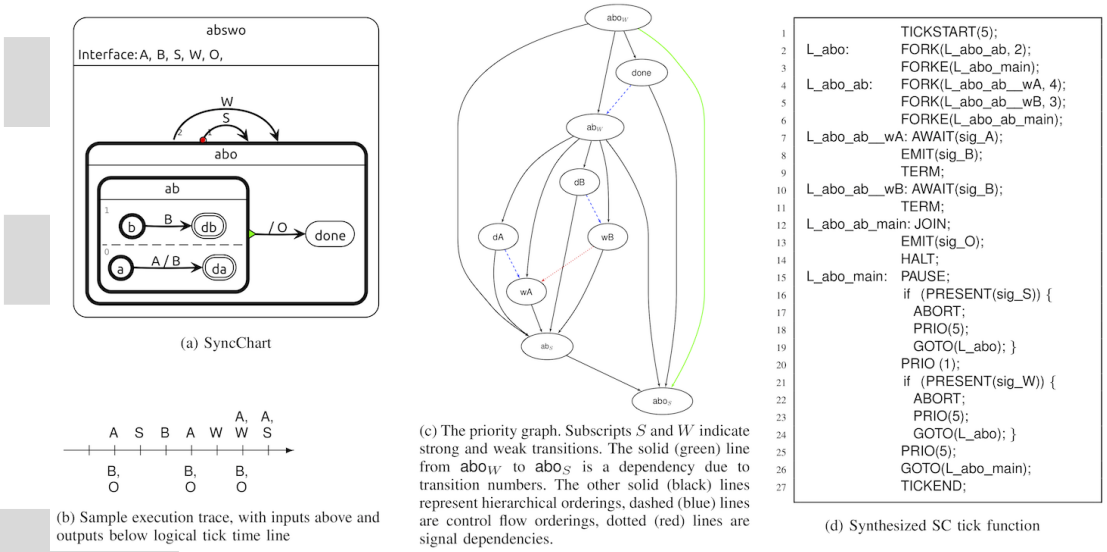


Fig. 1: KARMA in KIELER (from [Motika, Spönemann et al. 2011]).

The major result in the area **deterministic concurrency and synchronous languages** is the development of *Synchronous C (SC)* and *Synchronous Java (SJ)*, which are light-weight mechanisms to embed deterministic concurrency in C and Java. SC and SJ are inspired by the reactive processing paradigm, but are implemented as macros/classes expressed in standard C/Java, available as open-source code. In 2011, the main developments were improvements in SJ and an adaption for Lego Mindstorms NXT.



(a) SyncChart

(b) Sample execution trace, with inputs above and outputs below logical tick time line

(c) The priority graph. Subscripts S and W indicate strong and weak transitions. The solid (green) line from abo_W to abo_S is a dependency due to transition numbers. The other solid (black) lines represent hierarchical orderings, dashed (blue) lines are control flow orderings, dotted (red) lines are signal dependencies.

(d) Synthesized SC tick function

Fig. 2: Example Synthesis of Synchronous C (SC) Code from a SyncChart (from [Traulsen, Amende and von Hanxleden 2011]).

Personnel

Head of the group: Prof. Dr. R. von Hanxleden; Secretary: G. Walsdorf (50%)
Technical Staff: T. Grebien (50%)

Scientific Staff:

Dipl.-Inf. H. Fuhrmann	01.01.-30.04.2011	EU
MENGES		
Dipl.-Inf. C. Motika	01.01.-31.12.2011	Land
Dipl.-Inf. C. Schneider	01.03.-31.12.2011	EU
MENGES		
Dipl.-Inf. C. D. Schulze	01.09.-31.10.2011	EU
MENGES		
Dipl.-Inf. C. D. Schulze	01.11.-31.12.2011	Land
Dipl.-Inf. J. Schönborn	01.01.-30.09.2011	Land
Dipl.-Inf. M. Spönemann	01.01.-31.12.2011	Land

Lectures, Seminars, and Laboratory Course Offers

Winter 2010/2011

Inf-BS: Betriebssysteme, 3 hrs Lecture/Week,
R. von Hanxleden

Übung zu: Betriebssysteme, 2 hrs Exercise/Week,
R. von Hanxleden (+ H. Peters, C. Motika)

Fig. 3: The RTSYS group at a climbing excursion in Eckernförde (11.07.).

MS1101: Modellierung nebenläufiger Systeme, 4 hrs Lecture/Week,
R. von Hanxleden (+ R. Berghammer)

Übung zu: Modellierung nebenläufiger Systeme, 2 hrs Exercise/Week,
R. von Hanxleden (+ M. Spönemann)

MSP1101: Masterprojekt - Echtzeitsysteme/Eingebettete Systeme, 4 hrs Exercise/Week,
R. von Hanxleden (+ M. Spönemann, C. Motika, H. Fuhrmann)

MSS1101: Seminar - Echtzeitsysteme/Eingebettete Systeme, 2 hrs Seminar/Week,
R. von Hanxleden (+ C. Motika)

Oberseminar - Echtzeitsysteme und Eingebettete Systeme, 2 hrs Seminar/Week,
R. von Hanxleden

Summer 2011

Inf-EntEinSys: Entwurf eingebetteter Echtzeitsysteme, 4 hrs Lecture/Week,
R. von Hanxleden

Übung zu: Entwurf eingebetteter Echtzeitsysteme, 2 hrs Exercise/Week,
R. von Hanxleden (+ C. Motika)

Inf-EmSysDes: Embedded System Design, 4 hrs Lecture/Week,
R. von Hanxleden

Übung zu: Embedded System Design, 2 hrs Exercise/Week,
R. von Hanxleden (+ C. Motika)

A5.3.3: Fortgeschrittenenpraktikum - Echtzeitsysteme/Eingebettete Systeme (Modellierung in Eclipse), 4 hrs Exercise/Week,
R. von Hanxleden (+ M. Spönemann)

MSP1101: Masterprojekt - Echtzeitsysteme/Eingebettete Systeme (Modellierung in Eclipse), 4 hrs Exercise/Week,
R. von Hanxleden (+ M. Spönemann)

BA6.1: Projektmodul - Echtzeitsysteme/Eingebettete Systeme, 6 hrs Exercise/Week,
R. von Hanxleden (+ M. Spönemann)

Inf-Sem-Echtz: Bachelorseminar Echtzeitsysteme/Eingebettete Systeme, 2 hrs Seminar/Week,
R. von Hanxleden (+ R. Berghammer)

MSS1101: Seminar - Echtzeitsysteme / Eingebettete Systeme (Modellierung Nebenläufiger Systeme), 2 hrs Seminar/Week,
R. von Hanxleden (+ R. Berghammer)

MSS1102: Masterabschlussseminar - Echtzeitsysteme / Eingebettete Systeme, 2 hrs Seminar/Week,
R. von Hanxleden

Winter 2011/2012

MS1102: Synchrone Sprachen, 4 hrs Lecture/Week,
R. von Hanxleden

Übung zu: Synchrone Sprachen, 2 hrs Exercise/Week,
R. von Hanxleden (+ C. Motika)

MSP1101: Masterprojekt - Echtzeitsysteme / Eingebettete Systeme, 4 hrs Exercise/Week,
R. von Hanxleden (+ C. Motika)

BA6.1: Projektmodul - Echtzeitsysteme / Eingebettete Systeme, 6 hrs Exercise/Week,
R. von Hanxleden

Inf-Sem-Echtz: Bachelorseminar Echtzeitsysteme/Eingebettete Systeme (Layoutalgorithmen für Graphen), 2 hrs Seminar/Week,
R. von Hanxleden (+ M. Spönemann)

MSS1101: Masterseminar - Echtzeitsysteme / Eingebettete Systeme (Layoutalgorithmen für Graphen), 2 hrs Seminar/Week,
R. von Hanxleden (+ M. Spönemann)

MSS1102: Masterabschlussseminar - Echtzeitsysteme / Eingebettete Systeme, 2 hrs Seminar/Week,
R. von Hanxleden

Third-Party Funds

Zukunftsprogramm Wirtschaft (ZPW), *Modellbasierte Entwurfsmethoden für eine neue Generation elektronischer Stellwerke (MENGES)*, 01.08.2009-31.07.2012 (217.560 EUR)

DAAD Programm des Projektbezogenen Personenaustauschs (PPP) USA, *Model Engineering und Predictable Processing*, 01.01.2010-31.12.2011 (15.318 EUR)

DFG Sachbeihilfe, *Precision-Timed Synchronous Reactive Processing (PRETSY)*, 01.11.2011-30.10.2014 (251.925 EUR)

Diploma, Bachelor and Master Theses

C. Schneider, *(Diploma Thesis) On the Pragmatics of Graphical Modeling*, 05.05.2011
U. Rüegg, *(Bachelor Thesis) Interactive Transformations for Visual Models*, 28.03.2011
H. Wree, *(Bachelor Thesis) Ein Gleisplaneditor basierend auf Graphiti*, 31.03.2011
C. D. Schulze, *(Diploma Thesis) Optimizing Automatic Layout for Data Flow Diagrams*, 28.07.2011
S. Wersig, *(Diploma Thesis) Ein Web Service für das automatische Layout von Graphen*, 31.10.2011

Dissertations / Postdoctoral Lecture Qualifications

H. Fuhrmann, *On the Pragmatics of Graphical Modeling,* 05.05.2011

Publications

Published in 2011

C. Motika, M. Spönemann, H. Fuhrmann, C. Krüger, J. Carstens, R. von Hanxleden, *KIELER Actor Oriented Modeling (KAOM),* Poster presented at 9th Biennial Ptolemy Miniconference (PTCONF'11), Berkeley, CA, USA, (2011)

C. Traulsen, T. Amende, R. von Hanxleden, *Compiling SyncCharts to Synchronous C,* In Proceedings of the Design, Automation and Test in Europe Conference (DATE'11), Grenoble, France, IEEE, 563 - 566 (2011)

R. von Hanxleden, H. Fuhrmann, M. Spönemann, *KIELER-The KIEL Integrated Environment for Layout Eclipse Rich Client,* n Proceedings of the Design, Automation and Test in Europe University Booth (DATE 11), Grenoble, France, (2011)

R. von Hanxleden, N. Holsti, B. Lisper, E. Ploedereder, R. Wilhelm, A. Bonenfant, H. Casse, S. Bünte, W. Fellger, S. Gepperth, J. Gustafsson, B. Huber, N. M. Islam, D. Kästner, R. Kirner, L. Kovacs, F. Krause, M. de Michiel, M. C. Olesen, A. Prantl, W. Puffitsch, C. Rochange, M. Schoeberl, S. Wegener, M. Zolda, J. Zwirchmayr, *WCET Tool Challenge 2011: Report,* In Proceedings of the 11th International Workshop on Worst-Case Execution Time (WCET) Analysis, Porto, Portugal, (2011)

C. Bachmaier, F. J. Brandenburg, P. Effinger, C. Gutwenger, J. Katajainen, K. Klein, M. Spönemann, M. Stegmaier, M. Wybrow, *The Open Graph Archive: A Community-Driven Effort,* Poster at the 19th International Symposium on Graph Drawing, Technische Universiteit Eindhoven, Netherlands, (2011)

U. Rüegg, C. Motika, R. von Hanxleden, *Interactive Transformations for Visual Models,* In 3rd Workshop Methodische Entwicklung von Modellierungswerkzeugen (MEMWe 2011) at conference INFORMATIK 2011, GI-Edition - Lecture Notes in Informatics (LNI) Berlin, Germany, Bonner Köllen Verlag, (2011)

C. Motika, *Interactive Esterel to SyncCharts Transformation for executing Esterel with Ptolemy,* Presentation at the 18th International Open Workshop on Synchronous Programming (SYNCHRON 11), Dammarie-les-Lys, France, (2011)

M. Chimani, C. Gutwenger, P. Mutzel, M. Spönemann, H.M. Wong, *Crossing Minimization and Layouts of Directed Hypergraphs with Port Constraints,* In Proceedings of the 18th International Symposium on Graph Drawing (GD 10), volume 6502 of LNCS, 141 - 152 (2011)

R. von Hanxleden, *Synchronous C + WCRT Algebra 101,* Presentation at the 18th International Open Workshop on Synchronous Programming (SYNCHRON'11), Dammarie-les-Lys, France, (2011)

Presentations

C. Motika, M. Spönemann, H. Fuhrmann, C. Krüger, J. J. Carstens, R. von Hanxleden, *KIELER Actor Oriented Modeling (KAOM),* Poster presented at 9th Biennial Ptolemy Miniconference (PTCONF 11), Berkeley, CA, USA, 16.02.2011

C. Traulsen, T. Amende, R. von Hanxleden, *Compiling SyncCharts to Synchronous C In Proceedings of the Design,* Automation and Test in Europe Conference (DATE 11), Grenoble, France, 14.-18.03.2011

R. von Hanxleden, H. Fuhrmann, M. Spönemann, *KIELER-The KIEL Integrated Environment for Layout Eclipse Rich Client In Proceedings of the Design,* Automation and Test in Europe University Booth (DATE 11), Grenoble, France, 14.-18.03.2011

R. von Hanxleden, *Taming Graphical Modeling - On the Pragmatics for the Model-Based Design of Complex Systems,* Innovation Forum Embedded Systems 2011, Munich, 08.04.2011

M. Spönemann, *Model-Based Engineering of Embedded Systems,* Invited talk at Irkutsk State University Supported by the International Center, Irkutsk, Russia, 08.09.2011

M. Spönemann, *Graph Drawing - The Layered Approach,* Talk at the weekly Ptolemy project meeting, EECS Department, University of California at Berkeley, Berkeley, CA, USA, 28.09.2011

U: Rüegg, C. Motika, R. von Hanxleden, *Interactive Transformations for Visual Models In 3rd Workshop Methodische Entwicklung von Modellierungswerkzeugen (MEMWe 2011)*, at conference INFORMATIK 2011, GI-Edition - Lecture Notes in Informatics (LNI) Bonner Köllen Verlag, Berlin, Germany, 06.10.2011

R. Jung, C. Schneider, *Tipps und Tricks für das Arbeiten mit Eclipse*, Kompetenzverbund Software Systems Engineering (KoSSE) Workshop, Kiel, 23.11.2011

R. von Hanxleden, *Synchronous C + WCRT Algebra 101*, Presentation at the 18th International Open Workshop on Synchronous Programming (SYNCHRON 11), Dammarie-les-Lys, France, 28.11.-02.12.2011

C. Motika, *Interactive Esterel to SyncCharts Transformation for executing Esterel with PtolemyInteractive Esterel to SyncCharts Transformation for executing Esterel with Ptolemy*, Presentation at the 18th International Open Workshop on Synchronous Programming (SYNCHRON 11), Dammarie-les-Lys, France, 28.11.-02.12.2011

Further Activities and Events

C. Motika, C. Schneider:

Demonstration of the Model-Railway, Girls'Day 2011 (14.04.) and the Schnupperstudium (18./19.10.)

H. Fuhrmann, C. Motika, C. Schneider, M. Spönemann:

Reviewer for the *International Conference on Embedded Software* (EMSOFT).

R. von Hanxleden:

Chair of the Department of Computer Science. Member of the *ArtistDesign European Network of Excellence on Embedded System Design*. Program Committee member for the *International Conference on Embedded Software (EMSOFT)*, the *Embedded System Design (ESD) Track at the International Symposium on Electronic System Design (ISED) 2011* , and the *Methodische Entwicklung von Modellierungswerkzeugen (MEMWe2011) Workshop* at the *GI-Jahrestagung INFORMATIK 2011*. Reviewer for the *ACM Transactions on Embedded Computing Systems*, the *EURASIP Journal on Embedded Systems*, and the *ACM SIGPLAN/SIGBED Conference on Languages, Compilers, Tools and Theory for Embedded Systems (LCTES) 2011*.

C. Schneider, J. Schoenborn:

Reviewer for the *Embedded System Design (ESD) Track at the International Symposium on Electronic System Design (ISED) 2011*.

C. Motika, C. D. Schulze, M. Spönemann: Reviewer for the *Methodische Entwicklung von Modellierungswerkzeugen (MEMWe2011) Workshop* at the *GI-Jahrestagung INFORMATIK 2011*.