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| PU | Public | X |
| PP | Restricted to other programme participants (including the Commission Services) | |
| RE | Restricted to a group specified by the consortium (including the Commission Services) | |
| CO | Confidential, only for members of the consortium (including the Commission Services) | |

Abstract:

To promote the exploitation and use of the project results Quasimodo invests in activities for communication, dissemination, and use of project results. Different activities are organized in this respect. This deliverable is an intermediate report of past and planned activities for dissemination and use of Quasimodo results. These include Quasimodo specific activities such as Quasimodo workshops, demonstrators, and the Quasimodo book, and more general activities such as conferences, symposia, (summer) schools, local and international workshops, and courses in which Quasimodo is involved and where Quasimodo results are presented, related projects, programmes, and networks where partners from the Quasimodo consortium are involved and where there are opportunities for cross-fertilization, spin-off activities, and the possibilities of exploitation of the Quasimodo results by the industrial partners in their organizations.

Keyword list: Quasimodo, dissemination, use of results, exploitation.

Table of Contents

| | |
|---|----|
| ABBREVIATIONS..... | 2 |
| 1 INTRODUCTION | 3 |
| 2 QUASIMODO SPECIFIC ACTIVITIES | 3 |
| 3 DISSEMINATION | 4 |
| 4 RELATIONS TO OTHER PROJECTS AND CROSS-FERTILIZATION | 8 |
| 5 APPLICATION IN OWN PRODUCTS OR PROCESSES..... | 10 |
| BIBLIOGRAPHY..... | 12 |

Abbreviations

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| AAU | Aalborg University, DK |
| CFV | Centre Fédéré en Vérification, B |
| CNRS | National Center for Scientific Research, FR |
| ESI | Embedded Systems Institute, NL |
| ESI/RU | Radboud University Nijmegen, NL |
| ESI/UT | University of Twente, NL |
| Hydac | Hydac Electronic GmbH, D |
| RWTH | RWTH Aachen University, D |
| SU | Saarland University, D |

1 Introduction

The Quasimodo project develops methods, techniques, and tools for handling quantitative properties in model-driven development of real-time embedded systems. To promote the exploitation and use of the project results Quasimodo also invests in activities for communication, dissemination, and use of project results. Different activities are organized in this respect. Some specific Quasimodo activities are organized such as the Quasimodo website, Quasimodo workshops, Quasimodo demonstrators, and the Quasimodo book. Furthermore, the consortium members are involved in the organization of various symposia, conferences, (summer) schools, and workshops where results and topics related to the project are presented for a wider scientific and industrial audience. Publication of Quasimodo results in the relevant international journals and conferences, both scientific and professional, is another way of dissemination. Moreover, the members of the consortium give key note and invited presentations, tutorials, summer school lectures, and industrial presentations. Quasimodo actively promotes interaction and cross-fertilization with related projects and networks, in particular with those in which Quasimodo partners participate. The academic partners use the Quasimodo results in their regular academic courses, the research institutes use these results in courses and training programmes for industry in the area of embedded system engineering, and the industrial partners in the Quasimodo project attempt to exploit the project results directly in their daily business.

This deliverable provides an intermediate report on past and planned activities for dissemination and use of Quasimodo results. The next section describes the specific Quasimodo activities. Section 2 contains conferences, symposia, (summer) schools, local and international workshops, and courses in which Quasimodo is involved and where Quasimodo results are presented. Section 3 mentions related projects, programmes, and networks where partners of the Quasimodo consortium are involved and cross-fertilization takes place. The last section reports on potential use of the Quasimodo results by the industrial partners in their respective organizations. This deliverable does not contain a list of regular publications; these can be found in the Quasimodo bibliography system [2] on the Quasimodo website [1]. A final update of this deliverable is planned for December 2010 (D5.11: Final Report on Dissemination and Exploitation).

2 Quasimodo Specific Activities

A couple of specific activities are organized by Quasimodo:

1. Quasimodo has created a website [1] with all information regarding the project, its organization, current status, results, publications, events, related projects, and activities.
2. A Quasimodo workshop was organized during the FM week, November 6, 2009, in Eindhoven (NL), with participants from academia, industry, and Quasimodo itself. A keynote was given by Prof. Rance Cleaveland (University of Maryland), and the workshop was concluded with an industrial panel with members from Reactive Systems, Philips, OCE, and ESI/ASML.
3. A final Quasimodo symposium is planned for the autumn of 2010.
4. The first Quasimodo demonstrator was shown during the Quasimodo Workshop on November 5, 2009. The demonstrator is based on the CHES Wireless Sensor Network (WSN) case. It shows that the outer nodes of a number of nodes that are physically placed in a linear configuration can lose synchronization. This illustrates the issue that was found with model-checking the gMAC protocol layer of the WSN with Uppaal, and thus it shows that Uppaal is effective in detecting such synchronization errors.

The demonstrator consists of

- a. 10 WSN nodes (the CHES Myriated Development Kit for Wireless Sensor Networks [4]) in a linear configuration with LEDs indicating synchronization;
- b. the Uppaal model of the gMAC synchronization protocol;
- c. the Uppaal counter-example showing that the nodes can lose synchronization
- d. presentation slides explaining the issue;
- e. a two-page description of the experiment;
- f. a picture of the first demonstration at the Quasimodo Workshop.

5. Work has started on a joint effort of writing a "Handbook on Quantitative Model-Driven Development for Embedded Systems" to be published at the end of the project.

3 Dissemination

Quasimodo has been, and will be involved in the organization of several conferences, local and international workshops, (summer) schools, events, and courses related to Quasimodo work:

1. AAU: DaNES Simulink/Labview Course, April 7-10, 2008, Sønderborg, Denmark (25 participants).
2. AAU: DaNES Tools Days, April 23-24, 2008, Aalborg, Denmark (30 participants).
3. AAU: DaNES Mini Projects, May 22-23, 2008, DTU, Denmark.
4. AAU: Testnet Conference, October 30, 2008, Aalborg, Denmark.
5. AAU: Opening of the VKR Center of Excellence, MT-LAB, November 19-20, 2008, DTU, Denmark.
6. AAU: DaNES Mini Projects, March 12-13, 2009, Sønderborg, Denmark with participation of CHESS.
7. AAU: MT-LAB Advisory Board Meeting, DTU, Denmark, September 15, 2009.
8. AAU, CNRS, CVF: GASICS workshop at CAV'09, Grenoble, France, June 28, 2009 (www.lsv.ens-cachan.fr/Events/gasics09).
9. AAU, RWTH: QUANTLOG - workshop on quantitative logics, Satellite event of ICALP'09, Rhodes, Greece, July 11, 2009 (quantlog09.web.auth.gr) Organized by Kim G Larsen and Joost-Pieter Katoen and with contribution from several Quasimodo members (Patricia Bouyer-Dicitre, Nicolas Markey, Jean-Francois Raskin).
10. AAU: VVPS - Workshop on Verification and Validation of Planning and Scheduling Systems, co-located with ICAPS 2009, Rhodes, Greece, September 20, 2009 (www-vvps09.imag.fr/index.php)
11. AAU: "The Energy Aware House" Exhibition at BrightGreen, Forum, Copenhagen, December 12-13, 2009.
12. AAU, RWTH: PhD School on Quantitative Model Checking, Copenhagen, Denmark, March 2-5, 2010 (<http://qmc.cs.aau.dk>).
13. AAU, CNRS, CFV: 2nd GASICS workshop at CONCUR'10, Paris, August 2010.
14. AAU, CNRS: Dagstuhl seminar "Quantitative Models: Expressiveness and Analysis", Schloss Dagstuhl (D), January 18-22, 2010.
15. CNRS: Summer school MOVEP 2008 (see <http://www.univ-orleans.fr/evenements/movep2008/>) about specifying, modeling, and verifying parallel and concurrent processes for control of real-time applications, reactive, and critical systems (Franck Cassez (CNRS), François Laroussinie (CNRS): steering committee, and Patricia Bouyer (CNRS), Ed Brinksma (ESI), Kim Larsen (AAU), and Jean-Francois Raskin (CFV): program committee. Nicolas Markey (CNRS): tutorial on timed systems).
16. CNRS: CONCUR'10 - 21st Int. Conf. on Concurrency Theory, Paris, August 2010.
17. CNRS: TIME'10 - 17th Int. Symposium on Temporal Representation and Reasoning Paris, September 2010.
18. CFV: Co-organization of the GAMES summer school, Bertinoro (I), May 31-June 6 (<http://www.games.rwth-aachen.de/Activities/bertinoro.html>).
19. RWTH: YR-CONCUR 2009 Workshop, Bologna (I), September 5, 2009.
20. RWTH: Co-organization of the COMPASS Workshop (post-ETAPS workshop), York (UK), March 29, 2009.
21. RWTH: Co-organization of MOVEP Summerschool, Aachen (D), June 28-July 2, 2010,
22. RWTH: CONCUR'11 - 22nd Int. Conf. on Concurrency Theory, Aachen (D), September 2011.
RWTH: QEST'11 - 8th Int. Conf. on Quantitative Evaluation of Systems, Aachen (D), September 2011.
23. SU: A summer School 'Fun with Automata' dedicated to 3rd year Bachelor students, September 2008.
24. SU, CNRS, CFV, AAU: Springschool "Automatic Verification and Analysis of Complex Systems" with invited lectures by Jean-Francois Raskin, Kim G. Larsen, Patricia Boyer, Holger Hermanns; Oldenburg, March 15-19, 2010.
25. ESI/UT, CHESS: Dutch IPA Spring Days on Integrated Formal Methods, May 2008.
26. ESI/UT: Dutch Model Checking Day, April 2, 2009, University of Twente (NL), (<http://fmt.cs.utwente.nl/dmcd2009>).
27. ESI/UT: CeDICT Day on Dependable ICT Systems, April 24, 2009, Utrecht, the Netherlands (<http://nirict.3tu.nl/meetings-nirict/24-04-09CeDICT>).

28. ESI/UT: Dutch Dependability Day, May 12, 2009, University of Twente (NL), with 40 int. participants (<http://fmt.cs.utwente.nl/ddd2009>).
29. ESI/UT: Four co-located conferences ICGT/SPIN/PDMC/HiBi, Enschede (NL), September 27-29, 2010, with: 5th Int. Conf. on Graph Transformation (ICGT 2010), 17th Int. SPIN Workshop on Model Checking of Software (SPIN 2010), 9th Int. Workshop on Parallel and Distributed Methods in Verification (PDMC 2010), and the High Performance Computational Systems Biology Workshop (HiBi 2010).
30. ESI/RU: FORMATS'09 - 7th Int. Conf. on Formal Modeling and Analysis of Timed Systems, Budapest, September 13-16, 2009, chaired by Frits Vaandrager (RU; together with Joël Ouaknine, Oxford). The conference, which was supported financially by Quasimodo, was successful and was attended by more than 80 participants. Three papers in the proceedings acknowledge support by Quasimodo, and all (academic) Quasimodo partners were present.
31. ESI/RU: Course on model checking with UPPAAL for Dutch high-school students. Several times during 2008-2010 Frits Vaandrager (RU) has given an extensive masterclass on model checking at various high schools in the Netherlands. Course material has been developed, including assignments and a 20 page Uppaal manual (in Dutch). The objective is to develop a module of 12 lessons that is widely used in Computer Science education at high schools and that teaches kids the importance (and fun) of making models.
32. ESI/UT/RU: Basic Course IPA (Dutch Institute for Programming research and Algorithmics) for PhD students on Formal Methods, August 23-27, 2008.
33. ESI/RU, ESI: DWFTT 2009: 3rd Dutch Workshop on Formal Testing Techniques, Nijmegen (NL), April 23, 2009.
34. ESI, ESI/UT: Involved in the organization of "De Nederlandse Testdag" (The Dutch Testing Day), Nov. 27, 2008, and Nov. 4, 2009.
35. ESI: The ESI Symposium, presenting all ESI projects including Quasimodo, Dec. 4, 2008, Dec. 8, 2009, and Dec. 2, 2010.
36. ESI: Co-organization of Bits&Chips Embedded Systems, Oct. 9, 2008, and Nov. 12, 2009.
37. ESI: Co-organization of INCOSE 2008 (18th Annual Int. Symposium of the Int. Council on Systems Engineering), June 15-19, 2008.
38. ESI: The 2nd Int. Joint Workshop on Embedded Software and System Engineering Design Challenges, Daegu, Korea, May 19-23, 2008.
39. ESI: Embedded Systems track on the Artemisia/ITEA Symposium, Oct. 22, 2008.
40. ESI: DATE session on MBSE (Model Based Software Engineering), 2009.
41. ESI: Involvement in FM 2009 (Int. Conference of Formal Methods), Nov. 2-6, 2009.
42. CHES: Coordinating the bi-annual Industry Day through our participation in the board of the Formal Techniques Industry Association (ForTIA), a subgroup of Formal Methods Europe, at FM2008 in Turku (Fin), May 28, 2008 (see <http://www.fm2008.abo.fi>), and at FM2009, Eindhoven (NL), November 5, 2009.
43. CHES: Organize an internal workshop (possible jointly with Quasimodo partners) on modelling and analysis of the two case studies using the Quasimodo tools and techniques (in 2010) and organize a public event (possibly a summer school) for the benefit of other SME companies in The Netherlands through our involvement in DevLab and FHI (in 2010). Furthermore, CHES offers several BSc, MSc and PhD student research projects to work on related projects in our company (throughout the project). Currently we facilitate students from Free University of Amsterdam, University of Twente and the Radboud University Nijmegen. Furthermore, CHES participates regularly in industry fairs and outreach meetings where we are in the position to present some of the Quasimodo results or the products based on those results.
44. Hydac: A couple of internal seminars and workshops will be organized to disseminate the Quasimodo results to software engineers, at the end of the Quasimodo project.

In addition to regular paper presentations, the Quasimodo results have been presented in the following invited talks, tutorials, and (summer) schools:

1. AAU: Invited talk at Workshop of CDC, Tallin, Estonia, January 21-22, 2008 (Kim Larsen).
2. AAU: Invited talk at SSV08, Sidney, Australia, Feb 25-27, 2008 (Kim Larsen).
3. AAU: Invited lecture at WODES 2008, Göteborg, Sweden, May 28-30, 2008 (Kim Larsen).
4. AAU: Invited lecture at Pan-European conference on Systematic Testing, Berlin June 4-5, 2008 (Kim Larsen, Brian Nielsen).
5. AAU: Invited lectures at Marktorberdorff summer school, August 5-17, 2008 (Kim Larsen).

6. AAU, ESI: Lectures at the ARTIST2 summer school in Europe, Grenoble, France, September 8-12, 2008 (Kim Larsen, Ed Brinksma).
7. AAU: Keynote on "Timing and Performance Analysis: Static Analysis versus Model Checking" at the Honoris Causa ceremony for Professor Dr. Reinhard Wilhelm from RWTH Aachen (D), October 24, 2008. (Kim Larsen).
8. AAU: Invited Talk on "Probabilistic Modal Transition Systems". COMBEST meeting on Interfaces, Rennes (F), March 3-4, 2009. (Kim Larsen)
9. AAU: Keynote on "Verification and Controller Synthesis of Real-Time Systems". 3rd Int. Conf. on Fundamentals of Software Engineering, FSEN09, April 15-17, Kish Island, Iran. (Kim Larsen)
10. AAU: Invited Talk on "Verification and Performance Analysis of Real-Time and Embedded Systems" at Joint China/Denmark Symposium on ICT, April 21-23, 2009, Odd Fellow Palæ, Copenhagen. (Kim Larsen)
11. AAU: Invited Talk on "Quantitative and Compositional Model Checking" at 7th Int. Andrei Ershov Memorial Conference, June 15-19, 2009, Novosibirsk, Russia. (Kim Larsen)
12. AAU: Invited Tutorial on "Real-Time Systems Validation and Synthesis" at Software Engineering Summer School, July 15-22, SEI East China Normal University, Shanghai, China. (Kim Larsen)
13. AAU: Invited Tutorial on "Real-Time Systems Validation and Synthesis" at ARTIST Summer School in China, July 19-24, 2009, Tsinghua University, Beijing, China. (Kim Larsen)
14. AAU: Keynote on "Verification and Performance Analysis of Embedded Systems" at TASE, 3rd IEEE Int. Symp. on Theoretical Aspects of Software Engineering, July 29 - 31, 2009, Tianjin, China. (Kim Larsen)
15. AAU: Invited Tutorial on "Validation, Performance Analysis and Synthesis of Embedded Systems" at ARTIST Summer School in Europe, September 7-11, 2009, Autrans (F). (Kim Larsen)
16. AAU: Invited talk on "On Determinism in Modal Transition Systems" at Symposium for Mogens Nielsen's 60th birthday, October 3-4, 2009, Aarhus, Denmark (Kim Larsen with Nikola Benes, Jan Kretinsky and Jiri Srba).
17. AAU: Invited talk on "Playing Games with Timed Interfaces" at Workshop on Foundations and Applications of Component-Based Design, Grenoble, France, October 11. (Kim Larsen and Axel Legay).
18. AAU: Invited talk on "Optimal and Real Time Scheduling using Model Checking Technology" at OR Day, Aarhus, Denmark, November 4, 2009. (Jacob Illum and Kim Larsen)
19. AAU: Invited talk on "Model-based GUI testing using UPPAAL at Novo Nordisk" at FMWeek Industry Day, Eindhoven, The Netherlands, November 5, 2009. (Jacob Illum and Ulrik Hjorth).
20. AAU: Invited talk on "Real-Time Interfaces" at FMCO, Eindhoven, The Netherlands, November 6, 2009. (Kim Larsen)
21. AAU: Invited talk on "Quantitative Modal Logics for Specification and Verification" at Methods for Modalities, Copenhagen, Denmark, November 13, 2009. (Kim Larsen)
22. AAU: Invited talk on "Priced Timed Automata: Theory and Tools" at FSTTCS, Kanpur, India, December 15-17, 2009. (Kim Larsen)
23. AAU: Invited lectures on "Validation, Performance Analysis and Synthesis of Embedded Systems" at CoSBI Centre, Trento, Italy, February 15-19, 2010. (Kim Larsen)
24. AAU: Invited lecture on "Validation, Performance Analysis and Synthesis of Embedded Systems" at AVACS Summerschool, Oldenburgh, Germany, March 15-19, 2010. (Kim Larsen)
25. AAU: Invited talk at the British Colloquium for Theoretical Computer Science, Edinburgh, Scotland, April 6-9, 2010. (Kim Larsen)
26. AAU: Invited tutorial at Weighted Automata: Theory and Applications, Leipzig, Germany, May 3-7, 2010. (Kim Larsen)
27. AAU: Keynote at ACSD, Braga, Portugal, June 21-25, 2010. (Kim Larsen)
28. AAU: Invited lectures on "Model-based Verification and Analysis for Real-Time Systems" at NATO Summerschool, Marktobendorf, August 3-15, 2010 (Kim Larsen).
29. AAU: Invited talk at 4th workshop on Reachability Problems, Brno, Czech Republic, August 27-29, 2010. (Kim Larsen)
30. CFV: Invited talk at TACAS 2010, Cyprus, March 2010 (Jean-François Raskin).
31. CFV: Lecturer at Summer School "Games", Bertinoro (I), May 31-June 6, (Jean-François Raskin).
32. CFV: Invited talk at the General Meeting of the Authomatha project, Liège, 2009 (Jean-François Raskin).
33. CNRS: Invited talk on "Weighted Automata" at DLT'09 (Benedikt Bollig and Paul Gastin).
34. CNRS: Invited lectures on "Quantitative analysis of timed automata and timed games" at MSR'09 (Patricia Bouyer-Decitre).

35. CNRS: Invited lectures on "Quantitative analysis of timed automata and timed games" at QUANTLOG'09 (Patricia Bouyer-Decitre).
36. CNRS: Invited lectures on "Quantitative analysis of timed automata and timed games" at ACTS'09 (Patricia Bouyer-Decitre).
37. CNRS: Invited lectures on "Quantitative analysis of timed automata and timed games" at the ARTISTdesign school QMC'10 (Patricia Bouyer-Decitre and Nicolas Markey).
38. RWTH: Lectures on Probabilistic Model Checking, at the Nanjing University (June 12-14, 2008) and at the Tshinghua University in Beijing (June 28-July 2, 2008).
39. RWTH: Keynote at the Nordic Workshop on Programming Theory (NWPT), Copenhagen (DK), October 14-16, 2009 (Joost-Pieter Katoen).
40. RWTH: Keynote at the Formal Methods Week soiree (FMWeek), Eindhoven (NL), November 5, 2009 (Joost-Pieter Katoen).
41. RWTH: Invited Talk at Formal Methods for Components and Objects (FMCO), Eindhoven (NL), November 5, 2009 (Joost-Pieter Katoen).
42. SU: Lecture series on "Quantitative model checking" at RIO 2009 Summerschool, Rio Cuarto, Argentina, February 16-20, 2009 (Holger Hermanns).
43. SU: Invited speaker at MLQA 2009, York, March 27, 2009 (Holger Hermanns).
44. SU: Lecture on "Probabilistic model checking" in Lucca (I), May 13, 2009 (Holger Hermanns).
45. SU: Lecture series on "Quantitative model checking" in Florence (I), May 14-15, 2009 (Holger Hermanns).
46. SU: Keynote at QFM 2009, Eindhoven (NL), November 3, 2009 (Holger Hermanns).
47. SU: Invited speaker at FMES 2009, Eindhoven (NL), November 5, 2009 (Holger Hermanns).
48. SU: Lectures on "Quantitative model checking" at NATO Summerschool, Marktoberdorf, August 3-15, 2010 (Holger Hermanns).
49. SU: Invited speaker at CONCUR 2010, Paris, August 31-September 3, 2010 (Holger Hermanns).
50. ESI: Lectures at EJCP (Ecole Jeunes Chercheurs en Programmation), Rennes, May 29-June 6, 2008, and June 3-12, 2009 (Jan Tretmans; <http://ejcp2009.inria.fr>).
51. ESI: Lectures at the TAROT Summer School, Bath (UK), June 22-27, 2008 (Jan Tretmans), and Madrid, July 6-10, 2009 (Julien Schmaltz).
52. ESI: Lectures at the Artist2 Summer School in China, Shanghai, July 12-18, 2008 (Ed Brinksma).
53. ESI/UT: Keynote SAVCBS: 9th Workshop on Specification And Verification of Component-Based Systems, Amsterdam, August 24, 2009 (Mariëlle Stoelinga).
54. ESI: Several industrial presentations about "Model-Based Testing": Thales, OCE, CHESS, TestNet (Dutch Professional Organization of Software Testers).

Apart from scientific and technical articles in journals and on conferences (see the Quasimodo bibliography system [2] on the Quasimodo website [1]), Quasimodo has published, and plans to publish professional articles and books:

1. AAU: The regular CISS magazine (in Danish) is published 1-2 times a year and distributed in more than 3.000 copies. The targeted audience is future industrial collaborators and political decision makers.
2. ESI/RU: A short introduction on model checking (in Dutch) was completed that is used in courses for high school students [2].
3. RWTH: A monograph on "Principles of Model Checking" was published by Christel Baier and Joost-Pieter Katoen (MIT Press), which covers quite some material on quantitative verification.
4. SU: Preliminary plans exist for a book on "Modelling and Evaluation of Distributed Embedded Systems".

Some of the Quasimodo results will be exploited via spin-off activities:

1. AAU: Currently the UPPAAL classic tool as of January 2007 is marketed by the Swedish registered company UP4AAL.
2. AAU: Together with UP4AAL, AAU exploits the UPAAL branch CORA for testing medical devices at the company Novo Nordisk.
3. AAU: The activities on testing are exploited by the company TK Validate in a product V+ for testing web-services and graphical interfaces.
4. ESI/UT: An STW (Dutch Technology Foundation) valorization grant proposal to support a start-up SME on model-based testing was submitted (Mariëlle Stoelinga).

5. ESI participates in the spin-off stimulation program of the Eindhoven University of Technology, through which all ESI PhD students are offered a course on entrepreneurship.

The results of Quasimodo will be used in regular courses and teaching by the Quasimodo participants:

1. AAU: The CS curriculum offers various courses where the tools exploited and developed within Quasimodo (UPPAAL and its various branches) play a central role:
 - o TOV (Test and Verification) aimed at last semester CS students;
 - o Embedded Systems Validation (PhD course);
 - o MTV (Model-Driven Test and Verification) aimed at third year EE students.
2. RWTH: A seminar on "Quantitative Verification" is planned, and new Quasimodo results will be incorporated in the optional master course "Advanced Model Checking".
3. RWTH: Quasimodo results have been incorporated in the courses on "Model Checking" (update), and "Testing Theory of Reactive Systems" (new).
4. SU: Master level courses on "Modelling and Analysis of Embedded Systems".
5. SU: The CHES WSN protocol and the MyriaNed nodes are the main practical focus of our master course "Problem Solving in Computer Science". The students use quantitative model checking techniques to develop protocols running on these nodes. See <http://depend.cs.uni-saarland.de/index.php?515>.
6. SU, ESI: Two-weeks course on "Model-Based Testing" at SU given by ESI (Julien Schmalz), March 2009.
7. CFV/ULB: An advanced course on "Verification".
8. CNRS: Researchers from CNRS are involved in the Parisian Master of Research in Computer Science; see <http://mpri.master.univ-paris7.fr/english/index.html>. Teachers from CNRS are involved in the lectures on "Foundations of Verification for Timed and Concurrent Systems".
9. ESI/RU: Several experiments with the application of model checking are conducted in courses, for instance, in a first year course on operating systems; see <http://www.cs.ru.nl/ita/publications/papers/fvaan/MCinEdu>.
10. ESI/RU: Master level courses on "Analysis of Embedded Systems" and "Testing Techniques" directly benefit from Quasimodo results. The CHES Wireless Sensor Network case is used in "Analysis of Embedded Systems", and the model-based testing tool JTorX developed at UT is used in "Testing Techniques".
11. ESI/UT: Within the Embedded Systems track of the Computer Science curriculum a course has been started on "Design of Embedded Systems (MDDP)" where Quasimodo results are be used.
12. ESI/UT: The model-based testing tool JTorX is used in the Master's course "Testing Techniques" (theory and lab exercises).
13. ESI: Guest Lectures at Eindhoven University of Technology presented Quasimodo results.
14. ESI: A post-academic, industry-oriented Competence Development Program is organized, leading to a Master's in Embedded Systems Engineering, in which parts of the Quasimodo results will be used.

4 Relations to Other Projects and Cross-Fertilization

The Quasimodo partners participate in several other projects, programmes, and networks, which are related in content to Quasimodo. These involve both research projects and application-oriented industrial projects. These projects may serve as knowledge providers as well as knowledge consumers for Quasimodo. In particular, the industrial projects provide valuable platforms, on the one hand for the exploitation of Quasimodo results, and on the other for hand feedback and reality check of Quasimodo techniques and tools.

Research Projects:

1. AAU: Danish research project MoDES.
2. AAU: The newly formed VKR Center of Excellence MT-LAB (<http://www.mtlab.dk/>) being a collaboration between DTU, ITU and Aalborg University with a focus on combining static analysis and model checking aiming at verification and analysis of complex interacting software systems.

3. AAU, ESI: ARTIST Design. European NoE on Embedded Systems, where Aalborg coordinates the activities on Modeling and Validation. Several partners of Quasimodo are involved as either core or affiliated partners.
4. RWTH: There is a strong cross-fertilization with the research training group Algosyn (Algorithmic Synthesis for Reactive Systems), and with the cluster of excellence UMIC.
5. SU: DFG-funded Sonderforschungsbereich SFB-TR 14-AVACS. The work on quantitative model checking is developed in close collaboration with AVACS, where it is applied in the analysis of self stabilising systems.
6. ESI/UT: UT is project leader of the European project EC-MOAN on the modelling and analysis of molecular mechanisms in the E-coli bacteria, where hybrid techniques are used, so cross fertilization with Quasimodo takes place.
7. ESI/UT: LIST (Laboratory for Integration of Small Tools), where the integration of tools is studied, some of which will be developed in Quasimodo.
8. ESI/RU: There is strong cross-fertilization with the theory-oriented projects FRAAI and ARTS funded by NWO (Dutch National Science Foundation).
9. CNRS: The French project (ANR) DOTS (Distributed Open and Timed Systems; see <http://www.lsv.ens-cachan.fr/anr-dots/?l=en>, about the design and verification of complex systems. In DOTS, researchers from LSV cooperate LaBRI, IRISA, IRCCyN, and LAMSADE.
10. CNRS, CFV, AAU, RWTH: participation in the GASICS project, an Eurocores project of the ESF on the study of game theoretic formalizations of interactive computational systems and algorithms for their analysis and synthesis. In this project, CNRS, CFV, AAU, RWTH collaborate with researchers from Warwick, Aachen, and Paris.
11. AAU, ESI: EU Artemis, EU FP7 NoE Artist2, and STREP Multiform.
12. ESI: EU FP7 Genesys.
13. CHESS: Chess is participating in the EU FP7 project "Design Support and Tooling for Embedded Control Software": DESTECS. This project will research and develop methods and open tools that support the collaborative design of dependable real-time embedded control systems using a model-based approach. This means that engineers can perform design evaluation and analysis using co-simulation of models expressed in different tools that reflect in a natural way the relevant aspects of the design but which can be analyzed consistently and rapidly together. This requires advances in continuous time modeling, formal discrete event modeling of controllers and architectures, fault modeling and tolerance, and open tools frameworks. Bringing these together in methods and tools has the potential to substantially improve the cost-effectiveness of model-based design. DESTECS was awarded in the fourth call of the FP7 ICT call and has started on January 1, 2010 and will run for three years. The tools and techniques developed in Quasimodo are complementary to those researched in DESTECS, hence Chess expects that a lot of synergy can be obtained from combining and possibly integrating these techniques into the DESTECS approach.

Industrial Projects:

14. AAU: Collaborations with a number of companies within DaNES (Danish Network for embedded Systems) on topics quite affine with those of Quasimodo including model-driven and component-based design; see www.danes.aau.dk.
15. AAU: The Innovation Network INFINIT (<http://www.infinet.dk>) aims at dissemination and collaboration with Danish industry within three strategic areas: pervasive systems, future internet, and embedded systems.
16. AAU: Interaction and integration of the UPPAAL tool suite with Simulink is considered.
17. RWTH: In the ESA Project COMPASS (CORrectness, Modeling, and Performance of Aerospace Systems) Quasimodo results are exploited. Other parties involved in this project are Thales Alenia Space, and Fondazione Bruno Kessler.
18. SU: Quasimodo theory and tools are being applied in the design of asynchronous system architectures developed by Bull, CEA-Leti, and ST Microelectronics as part of the French Pôle de Compétitivité Mondial project Minalogic-Multival.
19. ESI/UT: A collaborative project with NEM Hengelo to explore the use of timed automata for controller design.
20. ESI/UT: Application of the model-based testing tool JTorX for the testing of the XBus application at Neopost, Texas, April-July 2009.
21. ESI/RU, ESI: A couple of collaborative industrial research projects aiming at the application of model checking, of which currently the most important and promising one is a collaboration with OCE in the

context of the ESI Octopus project. In this project UPPAAL is applied in the design of the data path of adaptive copiers and printers. The goal is to integrate model checking in the design process at OCE.

22. ESI: Several Dutch industrial-academic collaborative projects are executed by ESI, in an “industry-as-laboratory” setting, in which there are several opportunities for transfer of Quasimodo results and obtaining feedback: Boderc, Tangram, Ideals, Trader, Darwin, Falcon, Condor, Poseidon, Octopus, and Alwen; see www.esi.nl/projects for an overview of ESI projects and their descriptions.
23. ESI: In collaboration with the Wings project, an ESI cooperation with ASML, a case study was elaborated for timed and stochastic model checking of a Rapid I/O Packet-Switch in the ASML wafer scanner. The POOSL model developed in Wings was translated to Uppaal and model-checked using results from Quasimodo.
24. ESI, ESI/RU: Commissioned by the Dutch Ministry of Internal Affairs and in cooperation with the Radboud University, Quasimodo results in model-based testing and the test tool TorXakis were applied to testing the new Dutch electronic passport’s smart card for compliance with international standards.
25. ESI/RU: In the project FATs Domino, a project in the context of the Dutch *kennisswerkersregeling*, a collaboration has started with OCE in Venlo (NL) with the goal of performing model-based testing of OCE’s scanner/printer controller software using Quasimodo techniques and tools (TorXakis).
26. CHESS: Chess is involved (either directly or indirectly through FHI DevLab) in five significant Dutch based joint academic / industry research programmes where there are opportunities to use the results achieved in Quasimodo. They are: Viewcorrect (will conclude in 2008), Alwen (ambient living with embedded networks; see also above), Storm (sensor technology on radio modules), Pleister (package label electronics including sensing talkative enhanced radio) and NanoWireless (nanowires on wireless sensor modules). The last four projects have started in 2008 and will continue for several years. CHESS wants to play an active role in disseminating results into these projects and towards the associated partners and network.

5 Application in Own Products or Processes

1. Hydac: It is intended that the Quasimodo work will be applied in the Quasimodo case study, and in the development of safety transducers.
2. Hydac: Preliminary plans exist for implementing the results of the case study in a concrete product at the end of the year.
3. Hydac: On the basis of our experiences in the Quasimodo project we intend to use model-driven software engineering for some upcoming projects. We also plan to validate our code with test cases automatically generated from models.
4. CHESS: The work of the academic partners on the two case studies proposed by CHESS is expected to have direct impact on real products that are currently under development in our company. Our primary focus is on the design and analysis of a novel wireless sensor network protocol based on epidemic style communication. Current design, analysis and verification & validation techniques are not sufficiently expressive and powerful to guarantee correct implementation. This is extremely important since we target implementations in silicon in 2010 to achieve low-cost and high volume implementations. Hence “first time right” is a necessity. We therefore need current and future Quasimodo tools and techniques to address and attack these issues. Our secondary focus is on the design of complex motion control applications whereby modeling and analysis of operating mode changes is complex in relation to safety requirements imposed on those systems. As a case study we use a self-balancing scooter (people mover) as the challenge. This will not necessarily become a CHESS product, but the modeling and analysis strategy and the tools proposed by Quasimodo will help us to develop systems of similar scope and complexity. The long-term objective of Chess is to embed the Quasimodo tools into our in-company design flow for the development of mission critical embedded systems. Furthermore, we plan to enlarge the application scope of these tools from the two case studies to our high performance computing (image processing) and machine-2-machine business lines whenever possible.
5. CHESS, ESI: ESI personnel has worked for two weeks at the Chess premises to seek concrete opportunities for Quasimodo related spin-off opportunities. A Chess internal lecture was provided by ESI on model-based testing, which has lead to two concrete application experiments: firstly the implementation of a conformance testbed for the Chess’ Wireless Sensor Network technology and

secondly, the model-based testing of complex web-based applications at the Chess iBusiness group. Both activities are expected to gain momentum in the last year of the Quasimodo contract.

6. TERMA: The result of Quasimodo will be used by TERMA in upcoming Space missions where highly reliable on board software is to be developed. Presently, certain methodologies and tools are used in this market; these will be assessed against the result coming out of Quasimodo where a specific on board software case acts as the test bench.

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