



MORPHEUS

D8.3.2: Report on MORPHEUS autumn school 2008

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ABSTRACT This report summarizes the actions that took place during the MORPHEUS/AETHER autumn school in October 2008.
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1. Introduction

The Second AETHER - MORPHEUS Workshop- Autumn School "From Reconfigurable to Self-Adaptive Computing" (AMWAS'08) was organized in Lugano, Switzerland from October 7th to 9th 2008. The innovative "School/Workshop" format has been chosen as second time to provide participants with both grounding on a new, challenging scientific area and with exposure to research results and proposals. The AMWAS'08 constituted a meeting-point for researchers and graduate students, interested in innovative next-generation computing architectures.

2. Executive summary

This document is a report about the 3 day event, held in Lugano, Switzerland, from October 7th to 9th 2008 called: AETHER - MORPHEUS Workshop- Autumn School (AMWAS'08). The event has been organized in a one and a half day school as well as a one and a half day workshop. Both events were focused on self-adaptive/dynamically reconfigurable computing architectures. This document gives a summary about the presentations and the speakers. The program committee is also listed and attendees' feedback is given. The event was attended by about 50 students and researchers and received positive feedback (see section 4).

3. AMWAS 2008



AETHER-MORPHEUS
Workshop - Autumn School 2008
"From Reconfigurable to Self-adaptive Computing"
October 7-9, 2008
Lugano, Switzerland



AMWAS 2008 (AETHER – MORPHEUS Workshop and Autumn School), "From Reconfigurable to Self-Adaptive Computing" in Lugano, Switzerland from October 7th to 9th 2008, was the second common event organized between the AETHER and the MORPHEUS projects. The two projects have many points of common interest: in fact MORPHEUS is focusing on dynamic reconfigurable computing, whereas AETHER is studying self adaptive computing systems. Both projects are grounded on computer architecture and software tools. The two projects have in common a set of participants: THALES, CEA-LIST, UK and INTRACOM are in fact participating in both projects.

The web-site www.alari.ch/AMWAS08/ was used to inform about and invite to the AETHER – MORPHEUS Workshop and Autumn School 2008. Additionally emails with call for papers were send to project partners and other persons in the field of reconfigurable computing.

The event was organized in two parts: the autumn school on reconfigurable computing and the autumn workshop on reconfigurable computing. The school was more focused on dissemination and training issues with a participation of about 50 people, mainly students from the university partners of the two projects. The program of the school included, after the introduction from the coordinators P. Bonnot and C. Gamrat, 6 extended talks of one and a half hours each: 3 from MORPHEUS, 3 from AETHER. The school was aimed at raising interest among students about a possible involvement in the projects or in possible further developments on reconfigurable computing. School participants would have been able to get credits by doing assignments but there have been no requests for assignments

3.1. Main goal

Though emphasis was on innovative techniques developed by the AETHER and MORPHEUS research communities, the AMWAS program has not been restricted to the AETHER and MORPHEUS approach but it provided as well a comparative analysis of other proposals and experiences on reconfigurable and self-adaptive computing solutions, from the hardware level to the application level. Various points of view have been presented in after-lecture discussion hours and in focused seminar sessions.

3.2. Main topics

The topics were divided into several sub-themes, which were presented from the viewpoint of the various disciplines involved in the main AETHER and MORPHEUS subprojects. The program included the following sub-topics:

- adaptive systems and self-adaptive systems
- static adaptation
- dynamic adaptation
- dynamic reconfiguration and self-adaptivity
- parallelization and allocation of an application onto reconfigurable architectures

3.3. AMWAS autumn school

Self-adaptive, dynamically reconfigurable systems offer the promise of making actually efficient and effective the potential processing power that will be offered on next-generation chips and that risks remaining under-exploited for large segments of applications. By tuning parallelism at run-time to the requirements of the application, one can envision overcoming the low exploitation of resources that often undermines the performances of high-performance chips. At the same time it optimizes such aspects as power consumption, capacity of survival to faults, etc. Yet, to achieve such end, one must set up suitably designed and compiled software, extracting parallelism and providing efficient and robust concurrency management, while simultaneously reconfigurable hardware architectures must be devised to support a self-adaptive, highly parallel mode of operation.

The AETHER-MORPHEUS Autumn School provided attendants with insight into innovative software and tools for concurrency management and into architectures for self-adaptivity and reconfiguration, based on research carried out in the European projects AETHER and MORPHEUS. Further details on the technical program are given below.

The School targeted in particular PhD students interested in the new and challenging field of self-adaptive and reconfigurable systems. For PhD student who ask to obtain credits from the summer school, assignments have been set up and evaluated.

Tuesday, October 7, 2008: School

- Introduction & Welcome: AMWAS'08 opening (Coordinators: Ch. Gamrat/Ph.Bonnot)
- Keynote 1: Processing Architecture Needs for Embedded Systems”, Ph. Bonnot
- Keynote 2: Ch. Gamrat
- **Software aspects: Toolchain and System Software Part I**
 - Talk 1: AETHER: μ threaded run-time environment for adaptive programming, Chris Jesshope
 - Talk 2: MORPHEUS: MORPHEUS Global Toolset overview, Philippe Millet, Thales France
- **Software aspects: Toolchain and System Software Part II**
 - Talk 3: AETHER SP3 The S-NET Environment, Clemens Grellck, University of Hertfordshire
- **Session: Exploitation of reconfigurability: The hardware aspects**
 - Talk 4: Implementation of heterogeneous multi-core processors, Fabio Campi, ST, Italy

Wednesday, October 8, 2008: School

- **Session: Exploitation of reconfigurability: The hardware aspects**
 - Talk 5: AETHER: SP1 Design of adaptive hardware using run-time reconfigurable devices, Jean-Marc Philippe, CEA LIST, Martin Danek, UTIA
 - Talk 6: MORPHEUS: Application Scenarios in MORPHEUS, Sean Whitty, Henning Sahlbach, TU Braunschweig, Germany and Cyrille Batarriere, Thales, France
 - End of AMWAS 08 Autumn School: Final Comments (Coordinators)

Table 3-1 Content of the Autumn School on Reconfigurable Computing

3.4. AMWAS workshop

The workshop was highly interactive and engaged participants in fruitful discussions on its topics. There was no registration fee for participants. It featured keynote presentations as well as solicited papers, each of them to be presented by one of its authors. The duration of the presentation of each paper was 20 minutes plus 5 minutes for discussions. Authors submitted an extended abstract of their presentation to the Workshop Coordinator.

Whereas the School was more focused on training issues and addressed students, the Workshop addressed the industrial partners of the two projects, extending the participation to partners of other European projects and to European Commission. Table 2 contains a summary of the contents of the workshop. More details about the presentation can be found in a booklet that has been designed for both, school and workshop. Therein, extended abstracts as well as full papers are summarized.

- Wednesday, 8 October 2008: Workshop
- **Session 1: Model Environment for Self-adaptive systems**
 - *Spatial design backend: CDFGmapping on eFPGA and DREAM IPs*
Loic Lagadec and Damien Picard, University of Brest, France
 - *On Simulating Operating Environment Decisions in a SANE Network*
Milad El Khodary¹, Jean-Philippe Diguët¹, Guy Gogniat¹, Fabrice Muller² and Michel Auguin²
¹LabSTICC, Université de Bretagne-Sud, UEB- CNRS, Lorient, France
²LEAT, Université de Nice-Sophia Antipolis- CNRS, Valbonne, France
 - *S-Net Type System and Operational Semantics*
Haoxuan Cai¹, Susan Eisenbach¹, Clemens Grelck^{2,3}, Frank Penczek³, Sven-Bodo Scholz³ and Alex Shafarenko³
¹Dept of Computing, Imperial College, London, UK
²Informatics Institute, University of Amsterdam, Netherlands
³Dept of Computer Science, University of Hertfordshire, UK
- **Session 2: Architecture issues for self-adaptation**
 - *Heterogeneous Multi-Core Architecture: The Added value of Physical Design*
Fabio Campi, STMicroelectronics, Italy
 - *Low-level design of a self-adaptive system*
Javier Soto, J. Manuel Moreno, Jordi Madrenas, Joan Cabestany, UPC, Spain

<ul style="list-style-type: none"> ○ <i>Evaluating flexible CGRA cells</i> Giovanni Ansaloni, Paolo Bonzini, Laura Pozzi, University of Lugano, Faculty of Informatics, Lugano, Switzerland ● Round Table/ Panel: preparing AETHER and MORPHEUS aftermath: what project shall we propose?
<ul style="list-style-type: none"> ● Thursday, 9 October 2008: Workshop 9:00-10:15 ● Session 3: Practical HW and Application Issues <ul style="list-style-type: none"> ○ <i>Self-Adaptive Computing Networked Entities for DSP: Evaluation of One Possible Implementation</i> Jiri Kadlec, Martin Danek, Roman Bartosinski, Lukas Kohout, UTIA AV CR, v.v.i., Pod Vodarenskou vezi 4, Praha 8, Czech Republic ○ <i>Enabling Self-adaptivity at Application Level</i> Onur Derin, Alberto Ferrante, ALaRI, Faculty of Informatics, University of Lugano, Lugano, Switzerland ○ <i>Mapping of a Film Grain Removal Algorithm to a Heterogeneous Reconfigurable Architecture</i> Sean Whitty, Henning Sahlbach, Rolf Ernst, Technical University of Braunschweig, Germany Wolfram Putzke-Röming, Deutsche Thomson OHG, Germany ● Session 4: Systems concepts <ul style="list-style-type: none"> ○ <i>Embedding Self-Adaptivity in Future Computing Devices using the SANE Concept: Model, Implementation on Reconfigurable Hardware and Example Application</i> Jean-Marc Philippe, Benoît Tain, Christian Gamrat, CEA, LIST, France ○ <i>Dynamic Reconfiguration of Nano Architectures using Application Independent Fault Detection</i> Mahtab Niknahad, Christian Schuck, Michael Hübner, Jürgen Becker, Universität Karlsruhe (TH), Germany ○ <i>A Guarantee of Service Protocol for Pervasive Distributed Systems</i> Alberto Ferrante, Roberto Pompei, Anastasia Stulova, Antonio Vincenzo Taddeo, ALaRI, Faculty of Informatics, University of Lugano, Lugano, Switzerland ● Session 5: Run-time reconfiguration <ul style="list-style-type: none"> ○ <i>Running S-Nets on Shared Memory Multicore Systems</i> Clemens Grelck^{1,2} and Frank Penczek¹ ¹ University of Hertfordshire, Department of Computer Science, UK ²University of Amsterdam, Institute of Informatics Amsterdam, Netherlands ○ <i>Towards Reconfiguration and Self-Adaptivity in S-Net</i> Frank Penczek¹Sven-Bodo Scholz¹, Clemens Grelck^{1,2} ¹University of Hertfordshire, Department of Computer Science, UK ²University of Amsterdam, Institute of Informatics, Amsterdam, Netherlands ○ <i>Graph Walker: Implementing S-Net on the Self-adaptive Virtual Processor</i> K. Bousias, C. R. Jesshope, Institute for Informatics, University of Amsterdam, Netherlands J. Thiyagalingam, S. Scholz, A. Shafarenko, Department of Computer Science, University of Hertfordshire, UK

- Closing Session: Final remarks (Coordinators of Aether and Morpheus)

Table 3-2 Content of the ÆTHER MORPHEUS Workshop

3.5. Organisation

3.5.1 Program Committee

Christian GAMRAT (Commissariat à l'Energie Atomique - CEA LIST)

Michel AUGUIN (Centre National de la Recherche Scientifique - CNRS)

Jürgen BECKER (Universität Karlsruhe (TH) - UK ITIV)

Joan CABESTANY (Universitat Politècnica de Catalunya - UPC)

Gilbert EDELIN (THALES Research & Technologies - TRT)

Chris JESSHOPE (Universiteit van Amsterdam - UvA)

Jiří KADLEC (Akademie věd České Republiky - ÚTIA AV CR)

Mariagiovanna SAMI (Università della Svizzera italiana - USI)

Alex SHAFARENKO (University of Hertfordshire - UH)

Bernard POTTIER (Université de Bretagne Occidentale – UBO)

Koen BERTELS (TU Delft - TUD)

3.5.2 Hosting

The event was hosted at the premises of Università della Svizzera italiana – USI. Local organization was provided by its subsidiary ALaRI which is a partner in ÆTHER.

4. Feedback

About one month after the workshop a questionnaire was send to all persons involved in the MORPHEUS project and who participated to the event. The questions and the anonymous answers can be found below.

SCHOOL PART

1. Do you think the content of the presentation had tutorial character? Was the content too specific? What would you recommend for improvement?

- Yes I think the presentation had tutorial character even if they were based on specific technologies. This is due to the fact that these technologies claim to have potential broad spectrum of utilisation. This is the case for instance for SNET language, MicroThread API, MORPHEUS heterogeneous architecture and MORPHEUS HW/SW design toolset.
- The content was maybe a bit too specific, could have been a little more focused on a students' audience (a few too many notions were assumed) But this is probably due to the low ration of students vs EU project members.
- The content did not really have tutorial character - it consisted in my opinion of extended length presentations. Often they were too long. The school part must be more differentiated from the workshop in more ways than only presentation length.
- Some presentations were extremely long which made listening really exhausting. The content was more or less ok, but I would recommend to plan shorter but more presentations next time.

2. Was the time frame of 1.5 days sufficient for the school part? Did you like the balance of 1.5 days school and 1.5 days workshop?
 - [...] I finally think it was a good choice. It allowed a reasonable number of lectures and presentations both with quite adequate durations.
 - I would suggest 2 days for the school and 1 day for workshop. On the other hand I liked the idea of having short presentations for the workshop and long for the school. Unfortunately some school presentations were extended workshop presentation.
 - Yes, this was a good balance.
3. What topics did you miss in the school part of AMWAS?
 - Maybe more emphasis could have been done on self-adaptation and dynamic reconfiguration. This was actually done through AETHER architecture and MORPHEUS toolset presentations but a specific presentation combining these two topics could have been interesting.
 - MORPHEUS was very under-represented (Comment: This is true for the workshop but not for the school. Half of the school presentations were given by MORPHEUS partners).
 - What I missed was an overview of both projects (AETHER and MORPHEUS) regarding project objectives and project organisation. I am familiar with MORPHEUS but I had the impression that AETHER consists of various parts without interfaces (which most probably is not true). But maybe I missed that part as we joined the school at the 2nd day.
4. Overall recommendations: Do you have any ideas for the improvement of the school part? Let us know your good and bad experiences in the school part
 - I liked the school part because it also well presented the increased maturity of the technologies that are at the heart of both projects. 1 or 2 years ago we could wonder: will these technologies be useful one day? Now, even for industry partner, this is really much more understandable.
 - It should be stressed that is a school, and speakers should be more aware of this point. Students should be somehow awarded for asking questions and participating more actively. I would also say audience should be restricted to student but then again this would limit too much the audience. [...].
 - See response to #1. Good experience was organization, facilities, etc. But the school program itself did not seem exceptionally strong. However, I only participated in the second day (meaning 0.5 days total) of the school and was not present for the first.
 - Shorter but more presentations. What I liked was the professional organization of the complete event. Although Lugano is a nice place for such an event, it did not attract many students as USI is a small university. So maybe the event would have attracted more students and researchers if it would have taken place in a bigger city somewhere in the middle of Europe.

WORKSHOP

5. What is your opinion about the workshop: Did you like the number of papers, the length of the presentations, the topics?
 - It was of very good quality as well as for the form and the content. Presentations length was OK. A few more presentation from MORPHEUS could have been added (on retargetable compilation, on formal methods for example).
 - Yes, quite. Broad, but not generic. Also, the presentation length was ideal. Same stands for the school.

- Yes, I enjoyed the workshop and the number of papers seemed well planned and made for a good overall program. On the second day, the entire second afternoon was devoted to SANE topics, which was unfortunate and simply too much for one afternoon.
- Yes, the amount of papers and the length of the presentation was just fine. Regarding the topics I had the feeling that MORPHEUS was a little bit under-represented.

6. What would you like to improve in the workshop?

- A panel discussion may have been nice, but only if attendance was ready to participate.
- More contributions, more diverse program (on second afternoon), more MORPHEUS presence.
- In general, the workshop was fine. Maybe the topics can be a little bit more balanced between the projects. In AETHER there were many talks about S-Net topics which were a bit monotonous.

7. Would you like to continue with the workshop? Maybe conjuncted to another workshop or conference? Maybe conjuncted with other EU projects?

- I think it could be useful to continue AMWAS. When discussing with partners from both projects I got the feeling this was useful for all of them. They appreciate the different levels of maturity of the objectives.
- I guess it needs to be conjuncted with EU projects; else it would be yet another workshop in a crowded scenario. Maybe more than 2 EU projects could be involved at a time? In this frame, yes it could/should continue. Unrelated to EU projects, it does not make much sense to me.
- Yes, absolutely! I feel like the weaknesses can be addressed.
- Yes, I really liked the workshop. Maybe it can be conjuncted with an existing small conference so we can attract more participants and students from outside the projects. So it would be nice to have AMWAS-III (or similar) next year.

8. **Overall Comments**

- The AMWAS event was a nice event (both school and workshop): presentations quality, well balance program. The nice location and good organisation from Lugano and Karlsruhe universities (and project coordinators involvement) contribute to its quality.
- The school is a great idea, but it should be planned more in advance. Agreements should be taken in order to grant credits to students/phd students for participation, especially if coming from different universities from the one hosting the event. Would be great if the EU projects involved were able to offer scholarships (from dissemination budget) to allow one student to work for a short time within the project with a small student assignment (i.e. map a small application on MORPHEUS).
- I really enjoyed the organization and understand that this year, there were few submissions. Daniela and Christian Gamrat did an outstanding job during the event. One additional negative point is the length of the "What comes after MORPHEUS/AETHER" discussion, which dragged on and on despite most people being extremely tired and not really able to contribute after a long day. This should have been ended after 30 minutes or so rather than 90 minutes. It should probably also not occur just before the social event, at the end of the day. Overall, really good – thanks!
- In general, it was really a nice event with professional organisation and infrastructure (thanks to the organisation team). Lugano maybe was not the optimal place for attracting students and other researchers, who missed three interesting days.

The school and workshop both did draw an audience of about 50 persons. Students counted for about 20 of them, mostly local students from USI. The remaining audience was mostly split between members of the AETHER and MORPHEUS projects.

5. Concluding section

5.1. Conclusion

The second AMWAS school and workshop event has been a similar success and it was well appreciated by the auditorium. This is evident when having a look at the number of participants which was about the same as in the year 2007 and the feedback from the questionnaires.

5.2. Glossary

ACA	Advanced Computer Architectures
ADeVA	Advanced Design and Verification of Abstract Systems, a state/transition based language for system specification from ALCATEL-LUCENT
AES	Advanced Encryption Standard
ÆTHER	Self-Adaptive Embedded Technology for Pervasive Computing Architectures
AHB	Advanced High-performance Bus
AMBA	Advanced Microcontroller Bus Architecture
AMWAS	ÆTHER MORPHEUS Workshop and Autumn School
ANSI	American National Standards Institute
API	Application Programming Interface
APTIX	An FPGA platform
ARC	Configurable processor
ARCES	Advanced Research Center on Electronic Systems
ARCS	Architecture of Computing Systems conference
AVEL	Concurrent process system description environment
C	A computer programming language
CAD	Computer Aided Design
CASCADE	Embedded software design tool by CBlue
CASTNESS	Computing Architectures and Sw Tools for Numerical Embedded Scalable Systems: a dissemination event promoted by SHAPES EC project
CDFG	Control Data Flow Graph
CMOS	Coupled Metal Oxide Semiconductor
CONQUEST	International conference on Quality Engineering in Software Technology
ConvergenSC	Design tool
CoWare	Design tool
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CS	Computer Science

DATE	Design Automation and Test Europe: it is the most important conference in Europe about design automation
DFG	Data Flow Graph
DMA	Direct Memory Access
DRAM	Dynamic Random Access Memory
DREAM	The next version of PiCoGA for DSP
DRS	Workshop on Dynamically Reconfigurable Systems
DSP	Digital Signal Processing
DWT	Discrete Wavelet Transformation
EB	Executive Board: a committee composed of the coordinator and work package leader within the MORPHEUS project
EC	European Community
eCos	a real time operating system
EDA	Electronic Design Automation
ECSI	European Electronic Chip & Systems Initiative
eFPGA	Embedded FPGA
ERSA	International Conference on Engineering of Reconfigurable Systems and Algorithms
Ethernet	Distributed packet-switching protocol for local computer networks
EURASIP	Journal of Embedded Systems
EXPRESS	Language to express CDFG
feast	Forum for European-Australian Science and Technology cooperation
FEC	Forward Error Correction
FFT	Fast Fourier Transform
FlexEOS	embedded FPGA macro from M2000
FlexFilm	TUBS project addressing the development of systems for flexible real-time processing of digital film at high resolution
FP	Framework Program
FPGAs	Field Programmable Gate Array
fps	Frames per second
FPL	Field Programmable Logic and applications conference
Gbit/s	Giga bit per second
GPPs	General Purpose Processors
Griffy-C	C-like data flow language
HDL	Hardware Description Language
HoneyComb	Reconfigurable cellular architecture
HW	Hardware
IEEE	Institute of Electrical and Electronic Engineers
ILP	Instruction Level Parallelism

IP	Intellectual Property: it defines any formalized reusable knowledge (hardware, software, or process)
IO	Input Output
IRISA	Institut de recherche en informatique et systèmes aléatoires
ISA	Instruction Set Architecture
IST	Information Society Technologies: a priority within the framework program of European research activities
LUT	Look Up Table
MADEO	Specification architecture tool from UBO
MOLEN	Reconfigurable processor paradigm developed at TU Delf
MORPHEUS	Multi-purpose dynamically Reconfigurable Platform for Intensive Heterogeneous Processing
MOTES	Workshop on Model based Testing for Systems.
MPEG	Motion Picture Expert Group
MPSOC	Multi Processors System on Chip: an international forum about multi-processor applications for system on chip
NASA	National Aeronautics and Space Administration
NoC	Network on Chip
NP	Network Processor
NRE	Non Recurrent Engineering (costs)
NuSMV	Symbolic model checker
OS	Operating System
PAR	Periodic Activity Report
PE	Processing Element
PO	Public Officer
QoS	Quality of Service
QUKU	Coarse Grained PE array overlaid on FPGA fabric
RC	Re-configurable Computing
RCEducation	Conference on Reconfigurable Computing Education
RISC	Reduced Instruction Set Computer
PCI	Peripheral Component Interconnect
PiCoGA	Pico Gate Array: reconfigurable processing element by ST
QSIC	Quality Software International Conference
SAMOS	Embedded Computer Systems: Architectures, Modelling and Simulation: conference on embedded systems, hardware/software co-design, compilation, embedded reconfigurable processors, modelling languages ...

Table 5-1 Glossary

6. Publishable Abstract



MORPHEUS

D.3.2: Report on MORPHEUS autumn school 2008

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Context

This deliverable is part of the MORPHEUS project which is a European initiative financed under the 6th FP and addresses innovative solutions for embedded computing based on dynamically reconfigurable platform and tools.

MORPHEUS project aims at satisfying embedded systems new demanding requirements in terms of computing performance, cost-efficient development, functional flexibility and sustainability by developing a global solution based on a modular heterogeneous SOC platform providing dynamically reconfigurable computing completed by a software oriented design flow and a consistent toolset.

MORPHEUS is a 3-year project started in 2006 and gathering all the required expertises from several countries: academics, industrials, SMEs.

Aim of the deliverable

The focus of the AMWAS '08 workshop and school is entitled "From Reconfigurable to Self-Adaptive Computing". It was organized a second time to provide participants with the latest news and outcomes from the MORPHEUS and AETHER projects that are dealing with a challenging scientific area. Research results have been exposed and new proposals were talked about. The AMWAS'08 constituted a meeting-point for researchers and graduate students, interested in innovative next-generation computing architectures. This deliverable gives a brief description of that event.

Content of the deliverable

This document is a report about the 3 day event, held in Lugano, Switzerland in from October 7th to 9th 2008 called: AETHER - MORPHEUS Workshop- Autumn School (AMWAS'08). The event has been organized in a one and a half day school as well as a one and a half day workshop. Both events were focused on self-adaptive/dynamically reconfigurable computing architectures. This document gives a summary about the presentations and the speakers. Also the program committee is listed. The success and value of this event is demonstrated by attendance figures and feedback forms.