Workshop
“Dependability and Fault Tolerance“

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Foreword

The growing use of networked computers in work environments as well as individual homes has demonstrated the importance of system dependability also to a broader public. The criticality of dependable, fault-tolerant IT system design will further increase in the future because continuously decreasing feature sizes of standard CMOS semiconductor technologies cause the fundamental device operation to become increasingly sensitive to various forms of fabrication and environment related variations. Designing dependable systems from inherently unreliable components has been articulated as a grand challenge of technical informatics (ARCS report March 2008). To thoroughly address and solve this fundamental problem, a variety of approaches is being developed and discussed. It is the aim of this workshop to present contributions to the mentioned area and to bring together scientists working in this field.

The Common Technical Committee on Dependability and Fault Tolerance (VERFE) of the three German computing societies, Gesellschaft für Informatik (GI), Informationstechnische Gesellschaft (ITG), and Gesellschaft für Mess- und Automatiserungswesen (GMA) is continuously working to support and coordinate activities in the research area of dependable computing within the German research community. With this conference event, we proceed in a series of workshops which has started ten years ago in connection with the ARCS 1999 conference in Jena, and was continued with the ARCS 2002 Conference in Karlsruhe, the ARCS 2004 Conference in Augsburg, the ARCS 2006 Conference in Frankfurt, and the ARCS 2007 Conference in Zürich.

In this year, the workshop is held in common responsibility with the GI/ITG/GMM Technical Committee on Computer-Aided Circuits and Systems Design (RSS). The programme committee has selected ten contributions to be presented in the workshop programme. The contributions are covering a rich spectrum of dependability problems and solutions, including fault-tolerant hardware systems, fault-tolerant disk storage, redundancy schemes, and scheduling aspects of fault tolerance. One invited keynote speech considering dependability aspects of organic computing completes the program.

Finally, we would like to thank the members of the programme committee for their reviewing work, and the local organizers from the Delft University of Technology for their activities to organize this workshop event.

Sankt Augustin / Munich, January 2009

K.-E. Großpietsch, A. Herkersdorf

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ARCS-Workshop "Dependability and Fault Tolerance"
Delft, March 11, 2009

Programme

9.00 – 9.10 Welcome

9.10 – 10.00 Invited Talk
E. Maehle (Lübeck)
Dependability and Fault Tolerance **–** the Organic Computing Way

10.00 – 10.30 Coffee Break

10.30 – 12.00 Hardware Fault Tolerance
T. Koal, H.T. Vierhaus (Cottbus)
Logic Self Repair Based on Regular Building Blocks

A. Bouajila, T. Sommer, J. Zeppenfeld, W. Stechele, A. Herkersdorf (Munich)
A Fault-Tolerant Processor Architecture

C. Albrecht, R. Koch, T. Piontek (Lübeck); P.Glösekötter (Münster)
Towards a Flexible Fault-Tolerant System-on-Chip

12.00 – 13.00 Fault-Tolerant Disk Storage
H. Klein (Augsburg), J. Keller (Hagen)
RAID Architecture with Correction of Corrupted Data in Faulty Disk Blocks

P. Sobe (Lübeck)
Coding for Reliable Data Storage on Different Hardware Platforms

13. 00 – 14.00 Lunch Break

14.00 – 15.30 Redundancy Schemes
K. Echtle, T. Kimmeskamp (Duisburg-Essen)
Fault-Tolerant and Fail-Safe Control Systems Using Remote Redundancy

B. Fechner, J. Keller (Hagen)
Efficient Fault-Tolerant Addition by Operand Width Consideration

M. Komann, F. Taubert, D. Fey (Jena)
On the Usefulness of Detecting Soft Errors in Parallel Pipelines for High-Speed Machine Vision Based on Organic Computing

15.30 – 16.00 Coffee Break

16.00 – 17.00 Scheduling Aspects for Fault Tolerance
M. Schölzel (Cottbus)
A Delay Estimation of Rescheduling Schemes for Static Scheduled Processor Architectures

S. Einer (Bern); B. Fechner, J. Keller (Hagen)
Petri Net Analysis of Non-Redundant and Redundant Execution Schemes

Dependability and Fault Tolerance – the Organic Computing Way

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Mastering complexity is one of the greatest challenges for future dependable information processing systems. Traditional fault tolerance techniques relying on explicit fault models seem not to be sufficient to meet this challenge. During their evolution living organisms have, however, developed very effective and efficient mechanisms like the autonomic nervous system or the immune system to make them adaptive and self-organizing also in case of new unforeseen situations. These systems operate unconsciously and in an emergent way to make the body self-protecting, self-healing, self-optimizing and self-configuring. Organic Computing has the goal to apply these principles to computing system, in particular embedded systems. In this talk the organic computing approach to achieve dependability and fault tolerance will be discussed in more detail. As a case study the control architecture ORCA (Organic Robot Control Architecture) which is currently developed at the University of Lübeck is presented)*. Its target platforms are complex distributed embedded real-time systems, in particular mobile autonomous robots. In contrast to defining fault models explicitly, the "health status" of the system is continuously monitored by so called OCUs (Organic Control Units). OCUs are closely coupled with BCUs (Basic Control Units) which implement the regular behaviours. The ORCA architecture has been implemented on an experimental six-legged walking robot OSCAR (Organic Self-Configuring and Adapting Robot). Techniques for anomaly detection and self-reconfiguration in case of e. g. defective legs have been developed and evaluated.

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