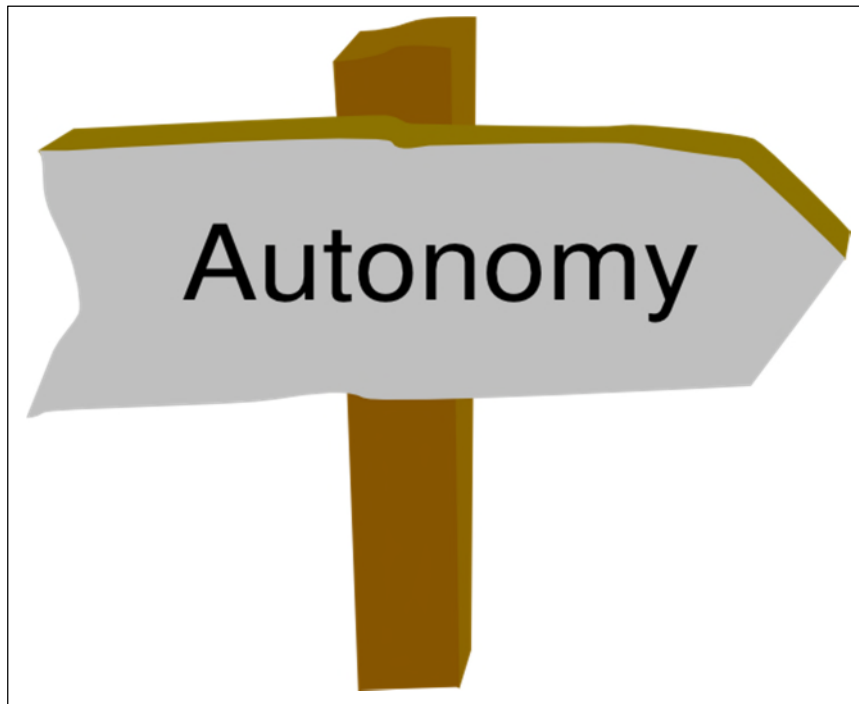


Hauptseminar SS2016: „Autonomic Computing“

State of the Art – Promises – Impact

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Context

Software has never been as important as today – and its impact on life, work and society is growing at an impressive rate. We are in the flow of a software-induced transformation of nearly all aspects of our way of life and work ([4], [5]). The dependence on software has become almost total. Malfunctions and unavailability may threaten vital areas of our society, life and work at any time.

The two massive challenges of software are one hand the *complexity* of the software and on the other hand the *disruptive environment*.

Complexity of the software is a result of the size, the continuously growing functionality, the more complicated technology and the growing networking. The unfortunate consequence is that complexity leads to many problems in design, development, evolution and operation of software-systems, especially of large software-systems.

All software-systems live in an *environment*. Many of today's environments can be *disruptive* and cause severe problems for the systems and their users. Examples of disruptions are attacks, failures of partner systems or networks, faults in communications or malicious activities.

Traditionally, both growing complexity and disruptions from the environment have been tackled by better and *better software engineering*. The development and operating processes

are constantly being improved and more powerful engineering tools are introduced. For defending against disruptions, *predictive methods* – such as risk analysis or fault trees – are used. All these techniques are based on the ingenuity, experience and skills of the engineers!

However, the growing complexity and the increasing intensity of possible disruptions from the environment make it more and more questionable, if people are really able to successfully cope with this raising challenge in the future. Already, serious research suggests that this is not the case anymore and that we need *assistance* from the software-systems themselves!

Here enters “**autonomic computing** ([1], [2], [3])” – A promising branch of software science which enables software-systems with *self-configuring*, *self-healing*, *self-optimization* and *self-protection* capabilities. Autonomic computing systems are able to re-organize, optimize, defend and adapt themselves with no real-time human intervention. Autonomic computing relies on many branches of science – especially computer science, artificial intelligence, control theory, machine learning, multi-agent systems and more.

Autonomic computing is an active research field which currently transfers many of its results into software engineering and many applications. This Hauptseminar offers the opportunity to learn about the fascinating technology “autonomic computing” and to do some personal research guided by a professor and assisted by the seminar peers.

Seminar Work

This seminar will work on the central theme: **Which are the state of the art, the promises, and the impact of Autonomic Computing?**

Each participant chooses one of the 3 questions:

1. Which are the promising *software architectures* and *software technologies* for Autonomic Computing?
2. How does Autonomic Computing enable *future applications*?
3. What is the *impact* of Autonomic Computing on people, work and society in 2025?

The Hauptseminar has 3 seminar days (see separate work program, dates below):

- An introduction day: Autonomic Computing will be introduced in a lecture by Professor Dr. Frank J. Furrer, and the parts of the Hauptseminar (Paper, presentation) will be defined,
- Individual, guided research in the selected area and authoring of a scientific paper. Feedback from peer reviewers,
- A first seminar day: The participants will present their results and receive feedback from the audience,
- Improvement of the paper and the presentation, based on the peer feedback,
- A second seminar day: The participants will present their improved results and receive feedback from the audience,
- Delivery of the final paper.

The participants will learn: (a) to do focused research in a specific area (“Autonomic Computing”), (b) to author a scientific paper, (c) to improve their L_ATeX expertise, (d) to experience the peer-review process and (e) to hold convincing presentations, and (f) to benefit

from a considerable broadening of their perspective in the field of technology, software, applications, and impact.

As a final outcome of the seminar, a *proceedings* volume – including all the papers produced by the participants – will be assembled and made available in electronic form to anybody interested.

Seminar language is English. Three seminar days will be held and 3 ECTS credits are awarded for the successful participation. Audience is limited to 7 participants. Please register in advance.

Seminar Schedule:

Kick-Off Meeting (Introduction): Wednesday, **April 20, 2016** / 11:10 – 12:40 in APB/INF 2101

Seminar Day 1: Wednesday, **June 8, 2016** / 09:20 – 10:50 & 11:10 – 12:40 in APB/INF 2101

Seminar Day 2: Wednesday, **July 13, 2016** / 09:20 – 10:50 & 11:10 – 12:40 in APB/INF 2101

References

1) Mandatory Reading:

[1] The seminal work:

IBM Research Paper, 2001: **Autonomic Computing – IBM’s Perspective on the State of Information Technology**. Downloadable from:

http://people.scs.carleton.ca/~soma/biosec/readings/autonomic_computing.pdf [last accessed: 2.2.2016]

[2] Introduction to the Architecture:

IBM White Paper: **An architectural blueprint for autonomic computing**. 3rd edition, June 2005. Downloadable from: <http://www-03.ibm.com/autonomic/pdfs/AC%20Blueprint%20White%20Paper%20V7.pdf> [last accessed: 2.2.2016].

[3] The fundamental knowledge:

Philippe Lalanda, Julie A. McCann, Ada Diaconescu: **Autonomic Computing – Principles, Design and Implementation**. Springer-Verlag, London UK, 2014. ISBN 978-1-4471-5006-0.

2) Additional Reading:

Context:

[4] Erik Brynjolfsson, Andrew McAfee: **The Second Machine Age – Work, Progress, and Prosperity in a Time of Brilliant Technologies**. W.W. Norton & Company, Inc., N.Y., USA, 2014. ISBN 978-0-393-23935-5

[5] Klaus Schwab: **The Fourth Industrial Revolution**. World Economic Forum, Geneva, 2016. ISBN 978-1-944835-00-2

Additional Autonomic Computing References:

- [6] Hausi A. Müller, Liam O'Brien, Mark Klein, Bill Wood: Autonomic Computing. Carnegie Mellon University, Technical Note CMU/SEI-2006-TN-006, 2006. Downloadable from: <http://www.sei.cmu.edu/reports/06tn006.pdf> [last accessed 14.1.2016]
- [7] Phan Cong-Vinh (Editor): **Formal and Practical Aspects of Autonomic Computing and Networking – Specification, Development, and Verification**. Premier Reference Source, Information Science Reference Publishing, 2011. ISBN 978-1-60960-845-3
- [8] Salim Hariri, Manish Parashar (Editors): **Autonomic Computing - Concepts, Infrastructure, and Applications**. CRC Press Inc., Boca Raton, USA, 2006. ISBN 978-0849393679
- [9] Richard Murch: **Autonomic Computing**. IBM Press, Prentice Hall PTR, NJ, USA, 2004. ISBN 978-0-13-315319-3
- [10] Daniel A. Menascé, Jeffrey O. Kephart: **Autonomic Computing – Editor's Introduction**. IEEE Computer Society, 2007. Downloadable from: <https://www.computer.org/csdl/mags/ic/2007/01/w1018.pdf> [last accessed 12.3.2016]
- [11] Ozalp Babaoglu, Mark Jelasity, Alberto Montresor, Christof Fetzer, Stefano Leonardi, Aad van Morsel, Maarten van Steen (Editors): **Self-star Properties in Complex Information Systems – Conceptual and Practical Foundations**. Lecture Notes in Computer Science / Theoretical Computer Science and General Issues, LNCS 4360, Springer Verlag Heidelberg, 2008. ISBN 978-3-540-26009-7
- [12] Robert Morris: **Autonomic Computing**, IBM Almaden Research Center, 2001. Downloadable from: http://www.almaden.ibm.com/almaden/talks/Morris_AC_10-02.pdf [last accessed 12.3.2016]
- [13] IEEE International Conference on Cloud and Autonomic Computing (ICCAC): <http://www.autonomic-conference.org/> [last accessed 12.3.2016]
- [14] Simon Dobson, Roy Sterritt, Paddy Nixon, Mike Hinchey: **Fulfilling the Vision of Autonomic Computing**. IEEE Computer Society, January 2010. Downloadable from: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.376.1739&rep=rep1&type=pdf> [last accessed 12.3.2016]

Hauptseminar Website:

<http://st.inf.tu-dresden.de/teaching/hs/auco16>

Where you find latest news, additional material and the slides of the presentations.