

Energy-Aware Computing Systems

Energiebewusste Rechensysteme

XII. Research & Remarks

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EASY



Agenda

Remarks

Evaluation

Research Projects and Thesis Topics

Postlude: “Three Dimensions”

©thoenig EASY (ST 2020, Lecture 12) Remarks

4–13

Remarks

- Energy-Aware Computing Systems Lecture (Summer Term 2020)
 - General Topics and Basic Principles (Lecture 1 — 3)
 - Energy-Aware Components, Subsystems, and Systems (Lecture 5 — 7)
 - Energy-Aware System Software (Lecture 8 — 10)
- Research Papers
 - broad scope in topics and time
 - embedded software → power provisioning in warehouse-sized computers
 - from 1994 → 2020
- Exercises
 - Energy Measurement
 - Energy Model
 - Energy Optimisation
- Uncharted Lecture by Ralph Schlenk (Nokia Networks)



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Major Course Assessment

(Ger.) *Leistungsnachweis*

- achievable credit points
 - 5 ECTS (*European Credit Transfer System*)
 - corresponding to a face time of 4 contact hours per week
 - lecture and practice, with 2 SWS¹ (i.e., 2.5 ECTS) each
- German or English, **thirty-minute oral examination**
 - date by arrangement: send e-mail to thoenig@cs.fau.de
 - propose desired date within the official audit period
 - the exception (from this very period) proves the rule...
- examination subjects
 - topics of lecture, blackboard practice, but also computer work
 - brought up in the manner of an “expert talk”
 - major goal is to find out the degree of understanding of inter-relations
- registration through “mein campus”: <https://www.campus.fau.de>



¹abbr. for (Ger.) *Semesterwochenstunden*

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Evaluation

- Feedback and Discussion



Power-Aware Critical Sections

- scalable synchronisation on the basis of **agile critical sections**
 - **infrastructure** ■ load-dependent and self-organised change of protection against race conditions
 - **linguistic support** ■ preparation, characterisation, and capturing of declared critical sections
- automated extraction of critical sections
 - notation language for critical sections
 - program analysis and LLVM integration/adaptation
- power-aware system programming
 - mutual exclusion, guarded sections, transactions
 - dynamic dispatch of synchronisation protocols or critical sections, resp.
- tamper-proof power-consumption measuring
 - instruction survey and statistics based on real and virtual machines
 - energy-consumption prediction or estimation, resp.
- DFG: 2 doctoral researchers, 2 student assistants

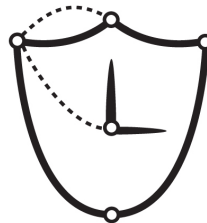
PAX

²<http://univis.uni-erlangen.de> → Research projects → PAX



Latency- and Resilience-Aware Networking

- **real-time capable network communication**
 - transport channel for cyber-physical systems
 - predictable transmission latency
 - in a certain extent guaranteed quality criteria



- **deterministic run-time support**

Auffassung von der kausalen [Vor]bestimmtheit allen Geschehens bzw. Handelns (Duden)

- latency-aware communication endpoints, optimised protocol stack
- specialised resource management, predictable run-time behaviour
 - in time (phase 1) and energy (phase 2) respect
- DFG: doctoral researchers, 2 student assistants (1 FAU, 1 Uni SB)



³<http://univis.uni-erlangen.de> → Research projects → LARN

Three Dimensions

- Power, Time, ...



...and Escher.

"Only those who attempt the absurd will achieve the impossible. I think it's in my basement... let me go upstairs and check."

– M.C. Escher

