Energy-Aware Computing Systems

Energiebewusste Rechensysteme

XII. Research & Remarks

Timo Hönig

2019-07-25

EA
SY

Recap (I)

- **infrastructure**
  - indirect resource demand $\rightarrow$ costs
  - must be considered for design and operation of system
- **metrics**
  - use-case specific metrics (i.e., PUE)
  - correlation with heating, ventilation and air conditioning (HVAC)

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- **metrics**
  - use-case specific metrics (i.e., PUE)
  - correlation with heating, ventilation and air conditioning (HVAC)
- **systems**
  - temperature-aware workload placement
  - building operating system services
  - runtime system for heterogeneous HPC clusters

Recap (II)

- uncharted lecture
- Topic: Energy-Efficient Optical Networks
- Speaker: Ralph Schlenk (technical manager in the software engineering department of the optical networks division at Nokia)

Agenda

Remarks

Evaluation

Research Projects and Thesis Topics

Postlude: “Three Dimensions”

Remarks

- Energy-Aware Computing Systems Lecture (SS 19)
  - General Topics and Basic Principles (Lecture 1 — 3)
  - Energy-Aware Components, Subsystems, and Systems (Lecture 5 — 7)
  - Energy-Aware System Software (Lecture 8 — 10)

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  - broad scope in topics and time
  - embedded software $\rightarrow$ power provisioning in warehouse-sized computers
  - from 1994 $\rightarrow$ 2019

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  - Energy Model
  - Energy Optimisation

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  - Energy Optimisation
- Excursion, Uncharted Lecture: Nokia

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 SWS[1] (i.e., 2.5 ECTS) each

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  - propose desired date within the official audit period
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  - brought up in the manner of an "expert talk"
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- **intermediate** participation rate

- **target** participation rate

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- Feedback and Discussion

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Postlude: “Three Dimensions”

Power-Aware Critical Sections

PAX

[2] `http://univis.uni-erlangen.de` → Research projects → PAX

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

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  - mutual exclusion, guarded sections, transactions
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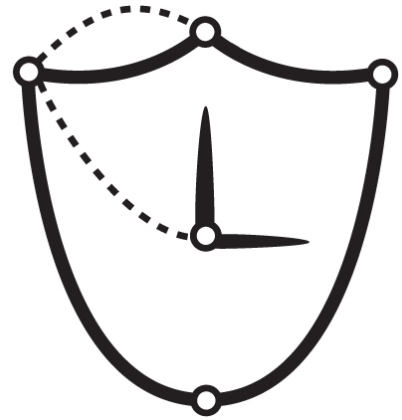
Latency- and Resilience-Aware Networking



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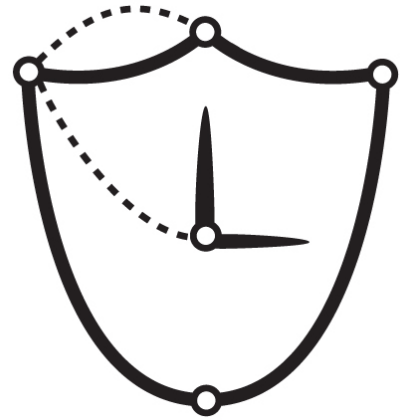

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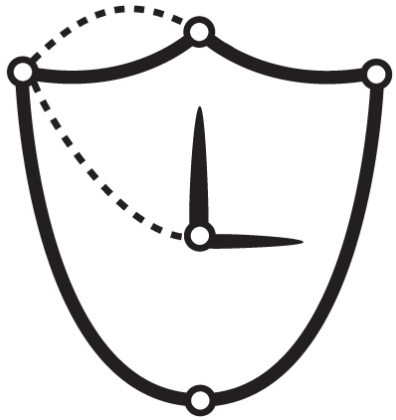

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  Auffassung von der kausalen [Vor]bestimmtheit allen Geschehens bzw. Handelns (Duden)

  - latency-aware communication endpoints, optimised protocol stack
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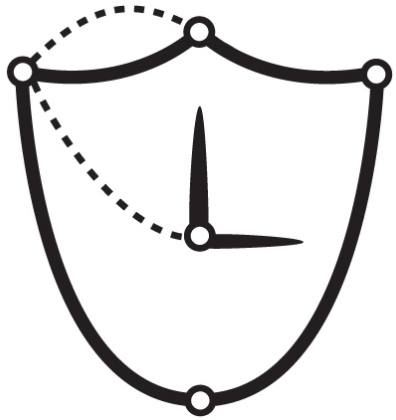

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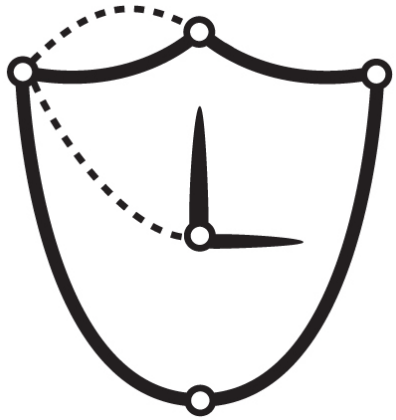

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Three Dimensions

- Power, Time, ...

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...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