

Research training group „Weak consistency“

Kick-off meeting
Annette Bieniusa

What do these systems have in common?

- A distributed key-value store containing the social network data of millions of users
- A CUDA program running a simulation of biochemical processes
- A web server processing hundreds, thousands of requests per second

Concurrency

- Highly-concurrent access to shared, modifiable data needs to be synchronized
- Problems are caused in particular by
 - ▶ Data replication
 - ▶ Reordering of operations
 - ▶ Memory hierarchies

Strong Consistency

- Strong consistency can be achieved by imposing a (global) total order on operations
- Imposing strong consistency
 - ▶ reduces concurrency
 - ▶ increases latency
 - ▶ impedes scalability

Weak consistency

- A multitude of weaker notions for consistency has been introduced by different communities
 - ▶ Sequential consistency [Lamport 1979]
 - ▶ Causal consistency [Ahamad et al. 1994]
 - ▶ Delta consistency (time-bounded divergence) [Chaplin (ed). 2002]
 - ▶ Eventual consistency [Vogels 2009]
 - ▶

Research topics

- Support for building systems on top of some weakly consistent infrastructure
- Synchronization inference algorithms
- Consistency-aware proof systems
- Novel synchronisation-free data types

Research areas @ TU KL

Data stores

AG Softech

Memory Models

AG Concurrency Theory
AG Embedded Systems

Verification

AG Softech
PL/Verification @ MPI-SWS

Concurrency Theory

AG Concurrency Theory

Related research projects

The logo for the ADVENT project, featuring the word "ADVENT" in blue capital letters on a white rectangular background with a slight drop shadow.

Architecture-driven Verification of Systems Software
(FP7 FET Young Explorers)



Large-scale computation without synchronisation
(FP7 EU Project, ICT)

R2M2

Robustness against Relaxed Memory Models
(DFG Project)

SPDP

Seismic Development and Processing Architecture
(Fraunhofer ITWM)

Participants

Advisors

Annette Bieniusa

Roland Meyer

Arnd Poetzsch-Heffter

Klaus Schneider

Viktor Vafeiadis

Students

Deepthi Devaki Akkoorath

Egor Derevenetc

Marko Doko

Florian Furbach

Maximilian Senftleben

Peter Zeller

Affiliated Students

Santiago Castineira

Daniel Paqué

Sebastian Schweizer

Why a research training group?

- Talk and interact with researchers from other local groups!
- Investigate different aspects of weak concurrency!
- Present your ideas and receive constructive feedback!
- Increase the visibility of your research!

Regular events

Friday 11:00 - 12:00

- Talks by participants

June 06th, 2014

Maximilian Senftleben: Memory model-aware testing

June 13th, 2014

Egor Derevenetc: Robustness against Power is PSPACE-complete

- Invited talks

How to keep up to date

- Mailing list: weacon@cs.uni-kl.de
- Homepage:
<http://concurrency.cs.uni-kl.de/gkweacon.html>

Schedule

- 09.00 - 09.30 Opening (*Annette Bieniusa*)
- 09.30 - 10.10 Consistency-aware data types (*Arnd Poetzsch-Heffter*)
- 10.10 - 10.40 Coffee-break
- 10.40 - 11.20 Consistency at the interface of hardware and software
(*Klaus Schneider*)
- 11.20 - 12.00 Synchronization inference (*Roland Meyer*)
- 12.00 – 14.00 Lunch