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

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