

30.11.2012

Analysis and Visualization of Monitoring Data in 3D

KoSSE-Symposium
Application Performance Management
Kieker Days 2012

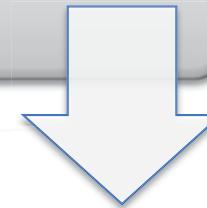
Jan Waller

Kiel University, Department of Computer Science, Software Engineering Group
Kieker Project

Outline

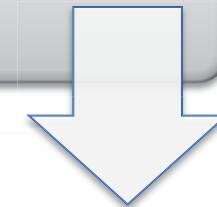
3D Visualization Approaches

- for Software Systems



Monitoring Concurrency

- Event-based Monitoring
- Java Thread vs. Hardware Thread
- Java Monitors (e.g., synchronized)

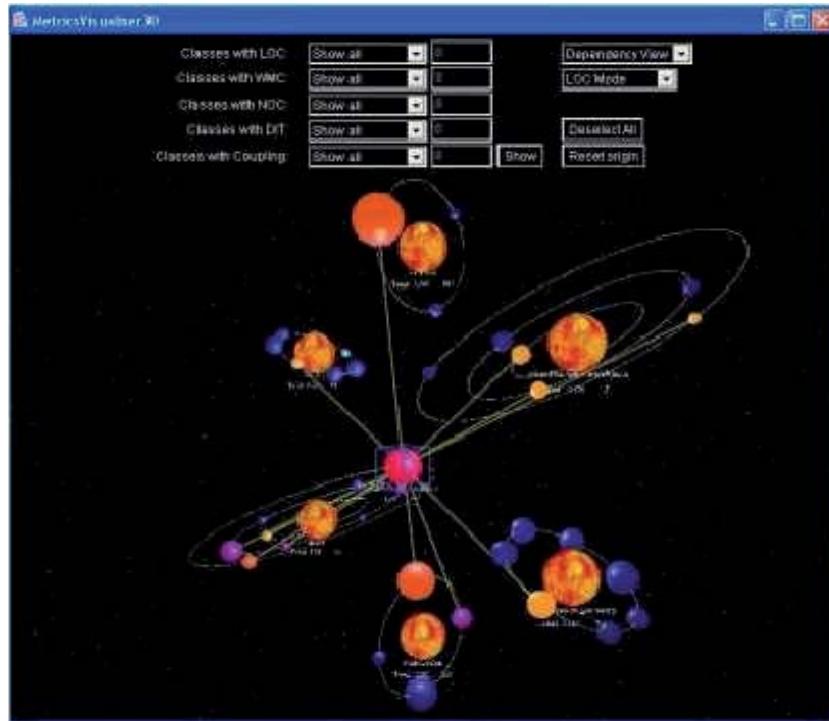


Approaches in the Kieker Context

- Bachelor Thesis, Christian Wulf (2010)
- Diploma Thesis, Björn Konarski (2012)
- Master Thesis, Philipp Döhring (2012)

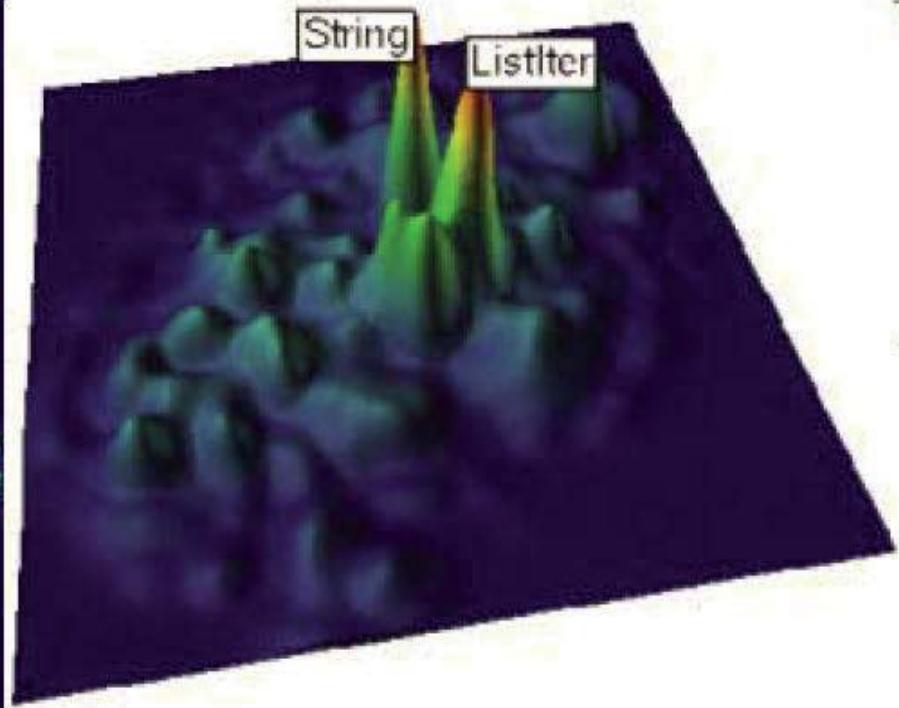
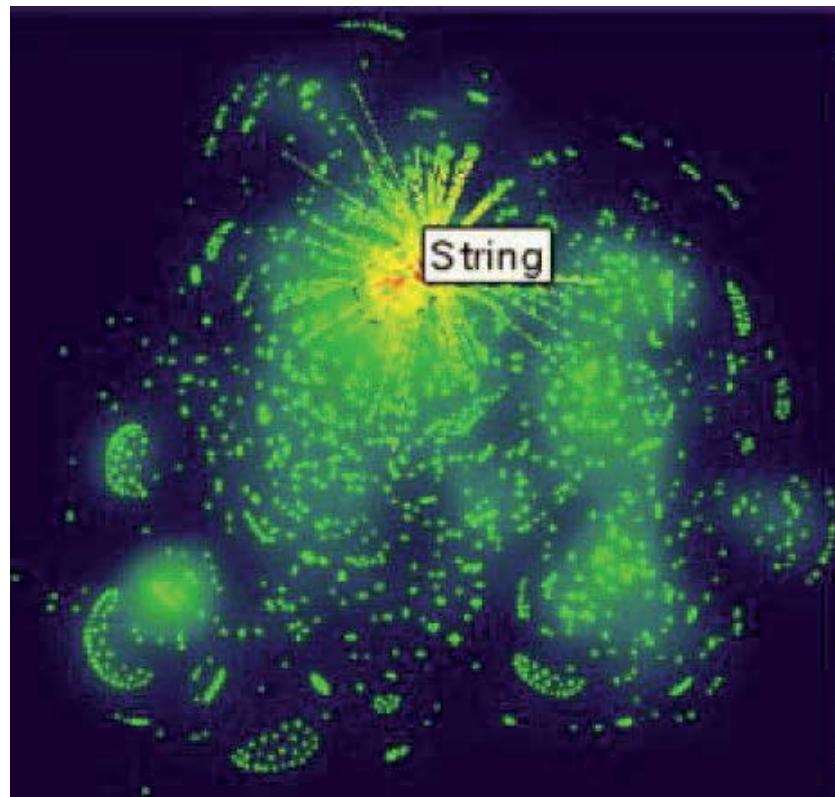
An (incomplete) overview on several different ...

3D VISUALIZATION APPROACHES



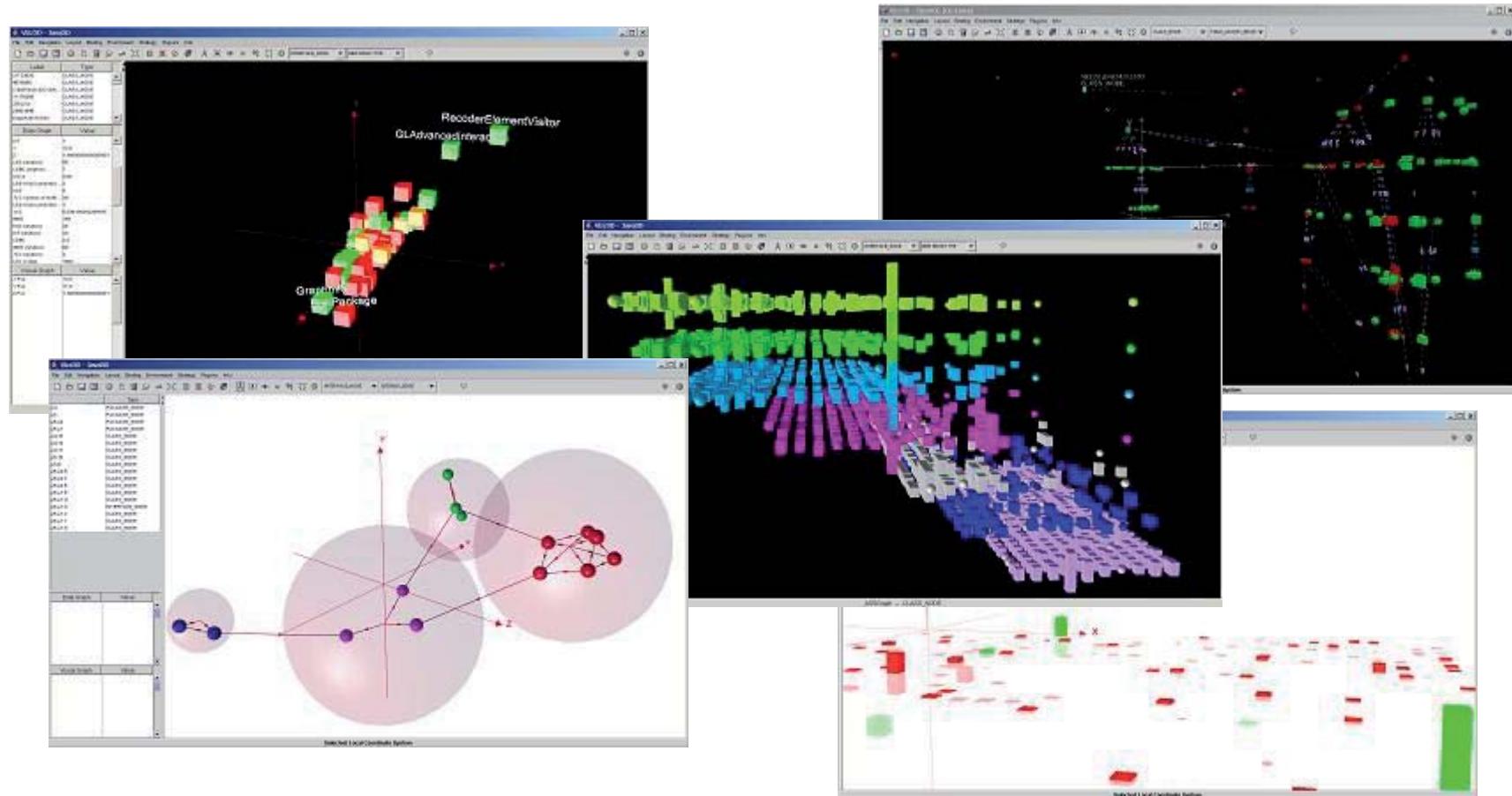
Solar Metric Visualization

Hamish Graham, Hong Yul Yang, Rebecca Berrigan. *A Solar System Metaphor for 3D Visualisation of Object Oriented Software Metrics.* In Proceeding of the 2004 Australasian symposium on Information Visualisation (APVis '04), pp. 53-59, ACM, 2004.



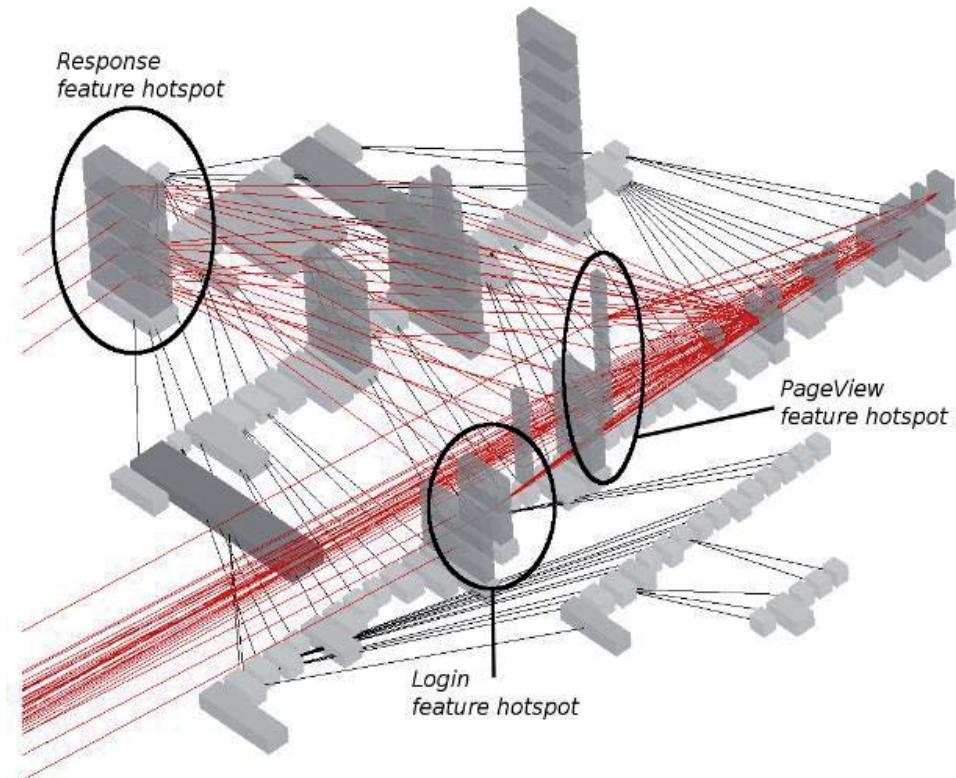
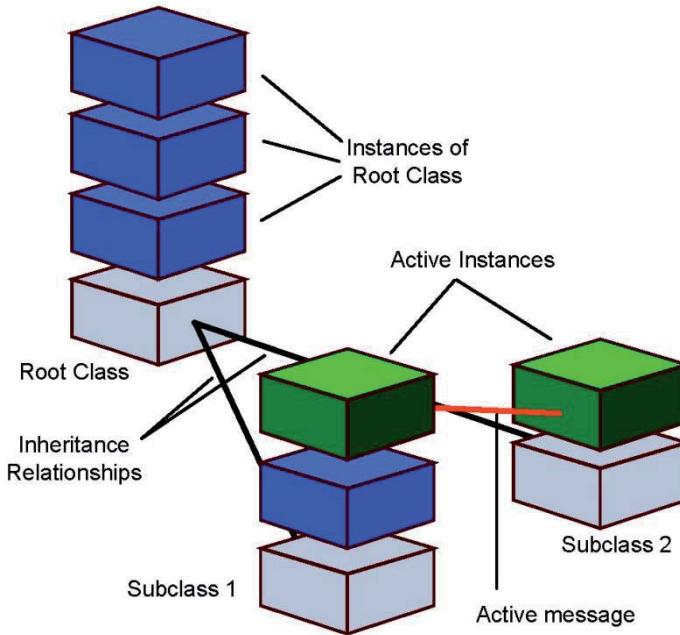
3D Landscape

Alexandru Telea, Lucian Voinea. *A Framework for Interactive Visualization of Component-Based Software.* In Proceedings of the 30th Euromicro Conference, pp. 567-574, IEEE Computer Science, 2004.



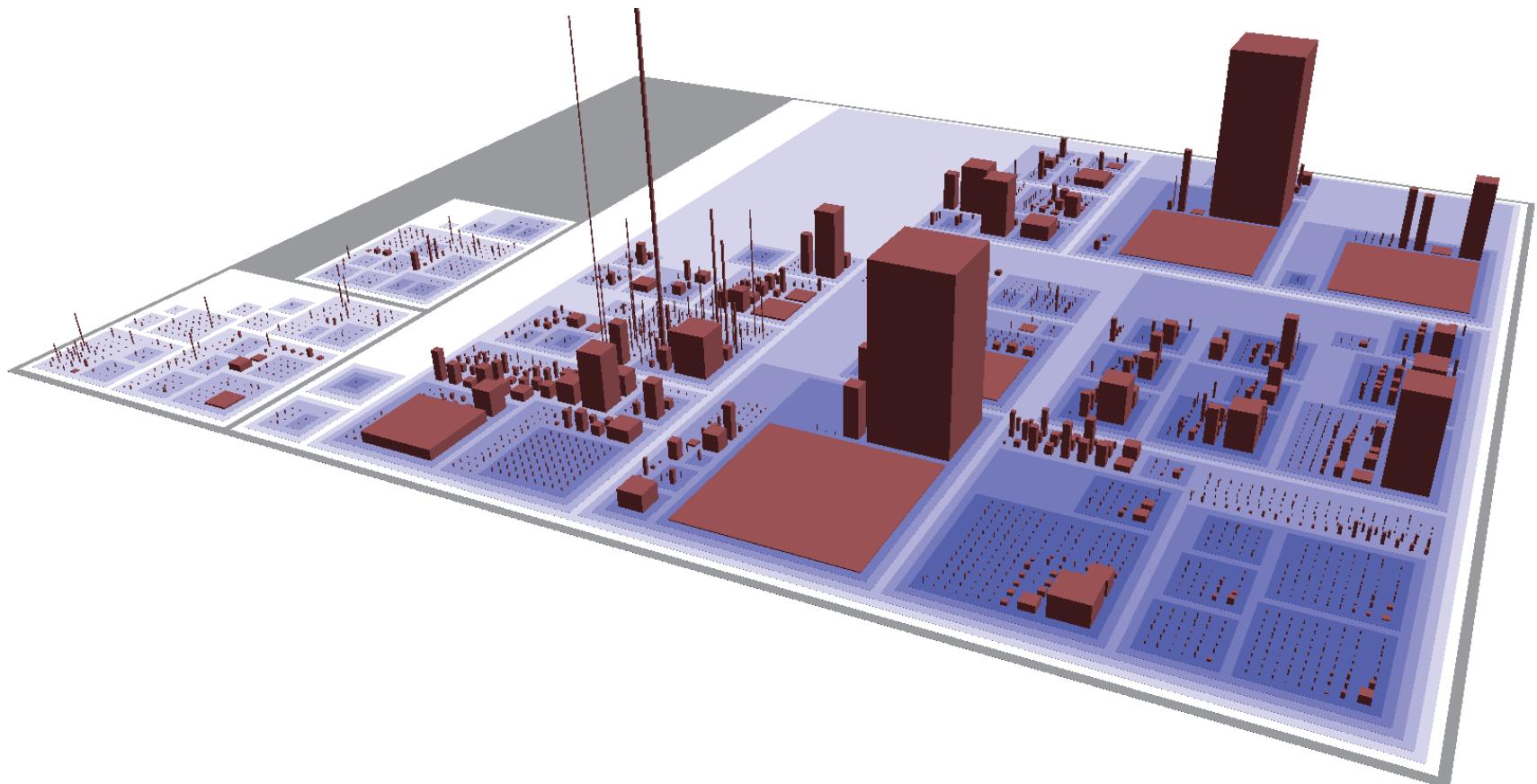
Vizz3D

Welf Löwe, Thomas Panas. *Rapid Construction of Software Comprehension Tools*. In International Journal of Software Engineering and Knowledge Engineering, 15:6, pp. 995-1025, World Scientific, 2005.



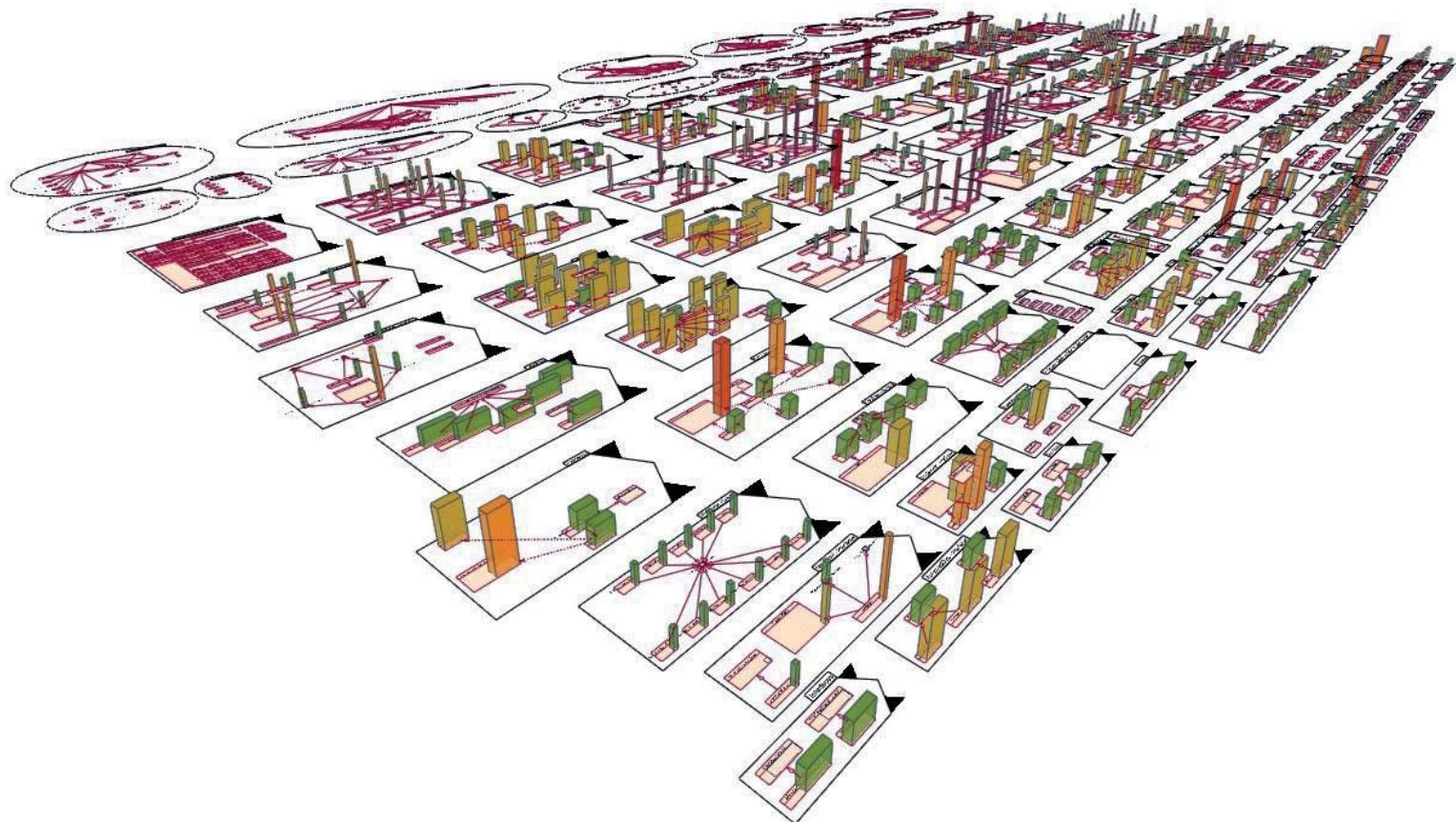
TraceCrawler

Orla Greevy, Michele Lanza, Christoph Wysseier. Visualizing live software systems in 3D. In Proceedings of the 2006 ACM symposium on Software visualization (SoftVis 2006)., pp. 47-56, ACM 2006.



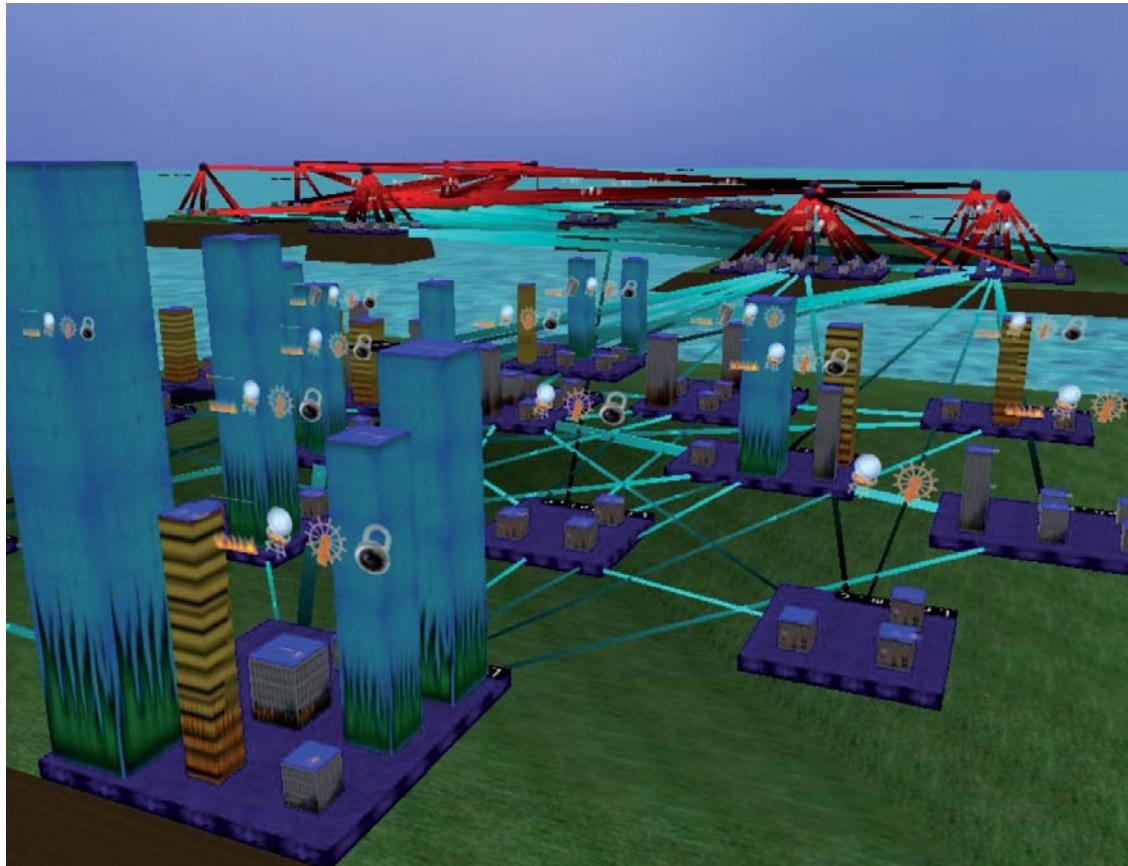
Codecity

Richard Wettel, Michele Lanza. *Visualizing Software Systems as Cities.* In Proceedings of the 4th IEEE International Workshop on Visualizing Software For Understanding and Analysis (VISSOFT 2007), pp. 92-99, IEEE Computer Society Press, 2007.



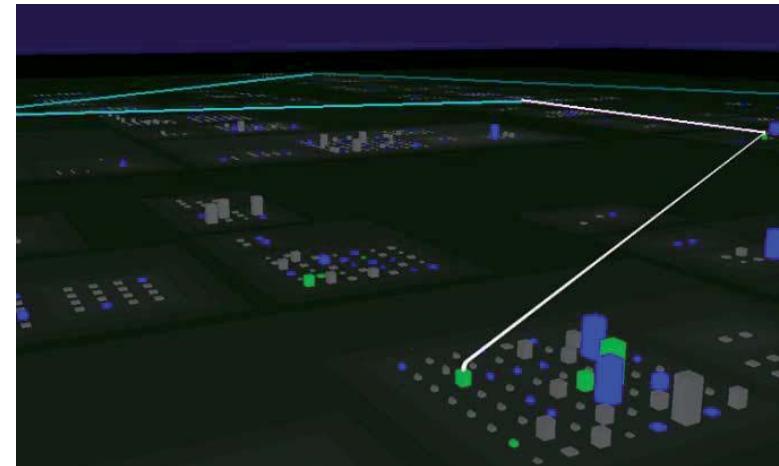
UML-City

Christian F. J. Lange, Michel R. V. Chaudron. *Interactive Views to Improve the Comprehension of UML Models - An Experimental Validation.* In Proceedings of the 15th International Conference on Program Comprehension (ICPC '07), pp. 221–230. IEEE Computer Society Press, 2007.



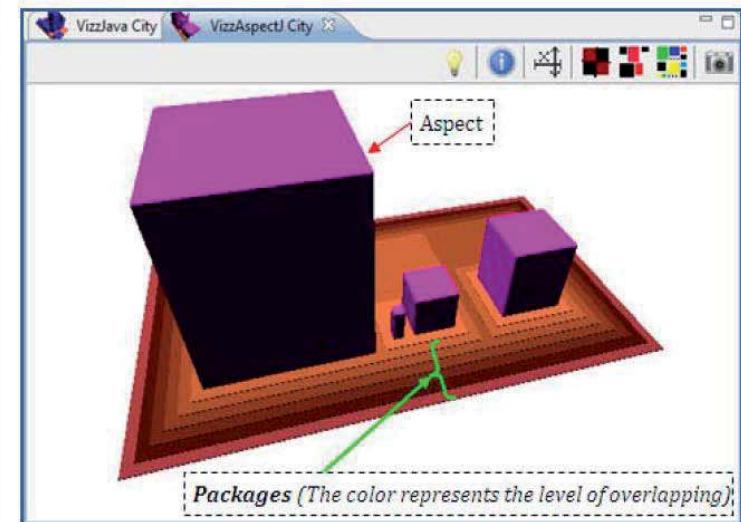
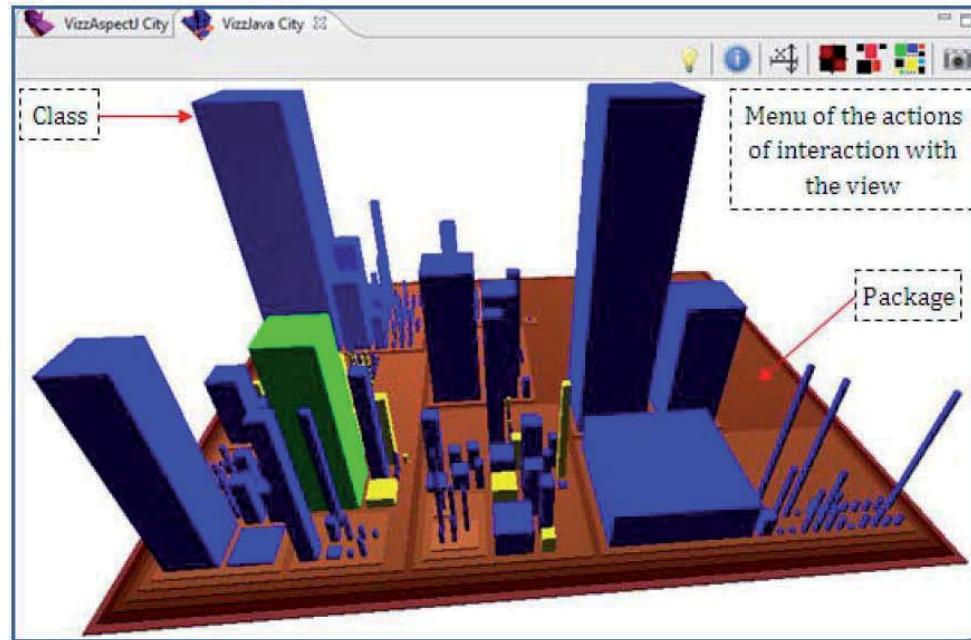
Vizz3D Cities

Thomas Panas, Thomas Epperly, Daniel Quinlan, Andreas Sæbjørnsen, Richard Vuduc. *Communicating Software Architecture using a Unified Single-View Visualization.* In Proceedings of the 12th IEEE International Conference on Engineering Complex Computer Systems, pp. 217-228, IEEE Computer Society Press, 2007.



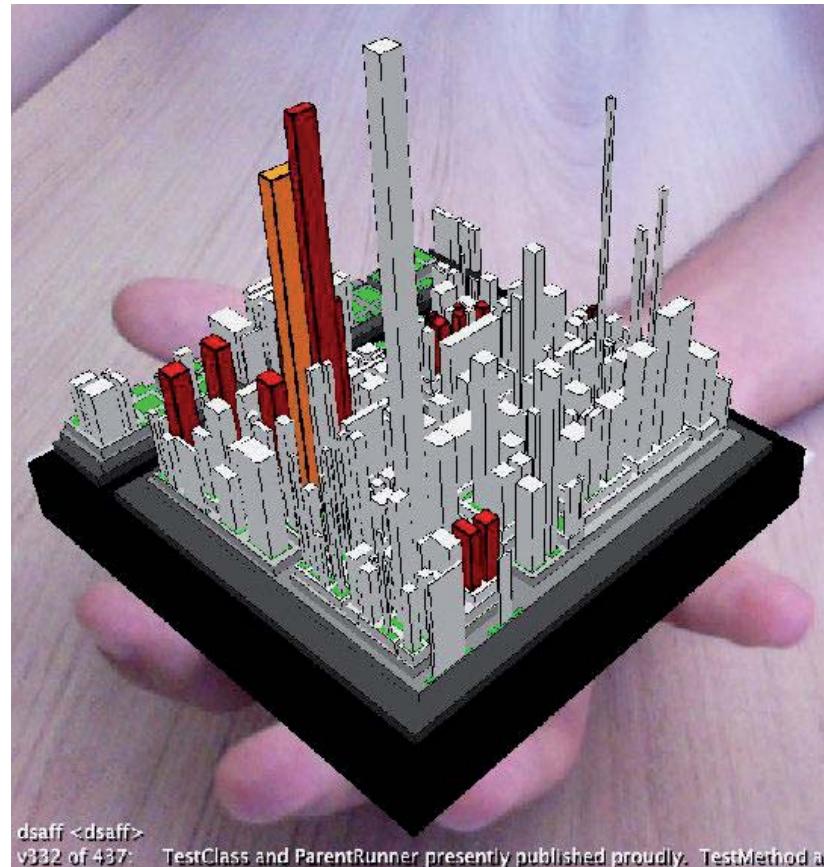
EvoSpaces

Philippe Dugerdil, Sazzadul Alam. *Execution Trace Visualization in a 3D Space.* In Proceedings of the 5th International Conference on Information Technology: New Generations (ITNG 2008), pp. 38-43, IEEE Computer Society Press, 2008.



VizzJava City & VizzAspectJ City

Sassi Bentrad, Djamel Meslati. *2D and 3D Visualization of AspectJ Programs.* In Proceedings of the 10th International Symposium on Programming and Systems (ISPS), pp. 183-190, IEEE Computer Society Press, 2011.



dsaff <dsaff>

v332 of 437: TestClass and ParentRunner presently published proudly. TestMethod and

ScyscrapAR

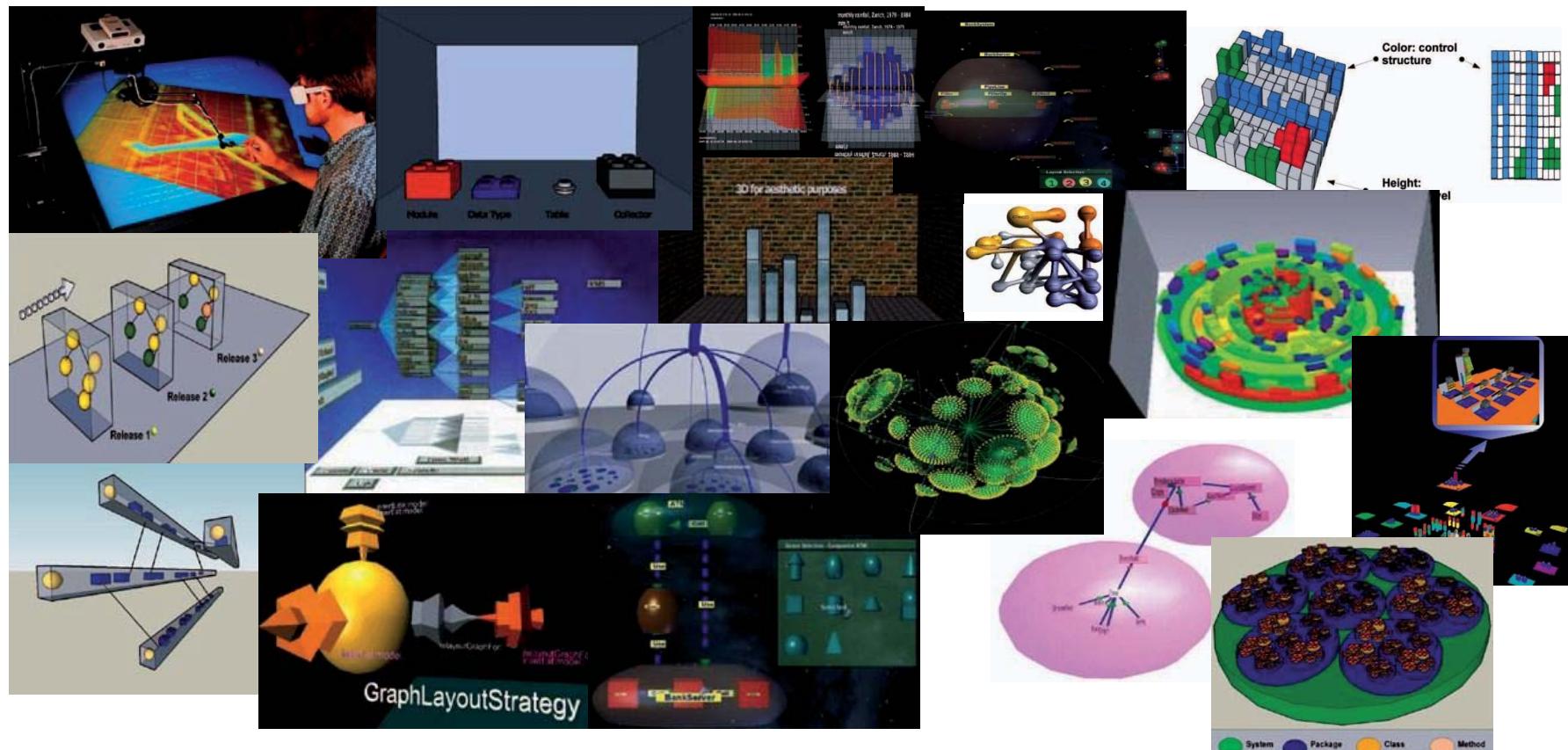
Rodrigo Souza, Bruno Silva, Thiago Mendes, Manoel Mendonça. *SkyscrapAR: An Augmented Reality Visualization for Software Evolution.* In II Brazilian Workshop on Software Visualization (WBVS 2012), pp. 17-24, SBC, 2012.



CodeTrees

Ugo Erra, Giuseppe Scanniello. *Towards the Visualization of Software Systems as 3D Forests: the CodeTrees Environment.* In Proceedings of the 27th Annual ACM Symposium on Applied Computing (SAC 2012), pp. 981-988, ACM, 2012.

Kieker keeps an eye on your software



An Overview on Further 3D Software Visualizations

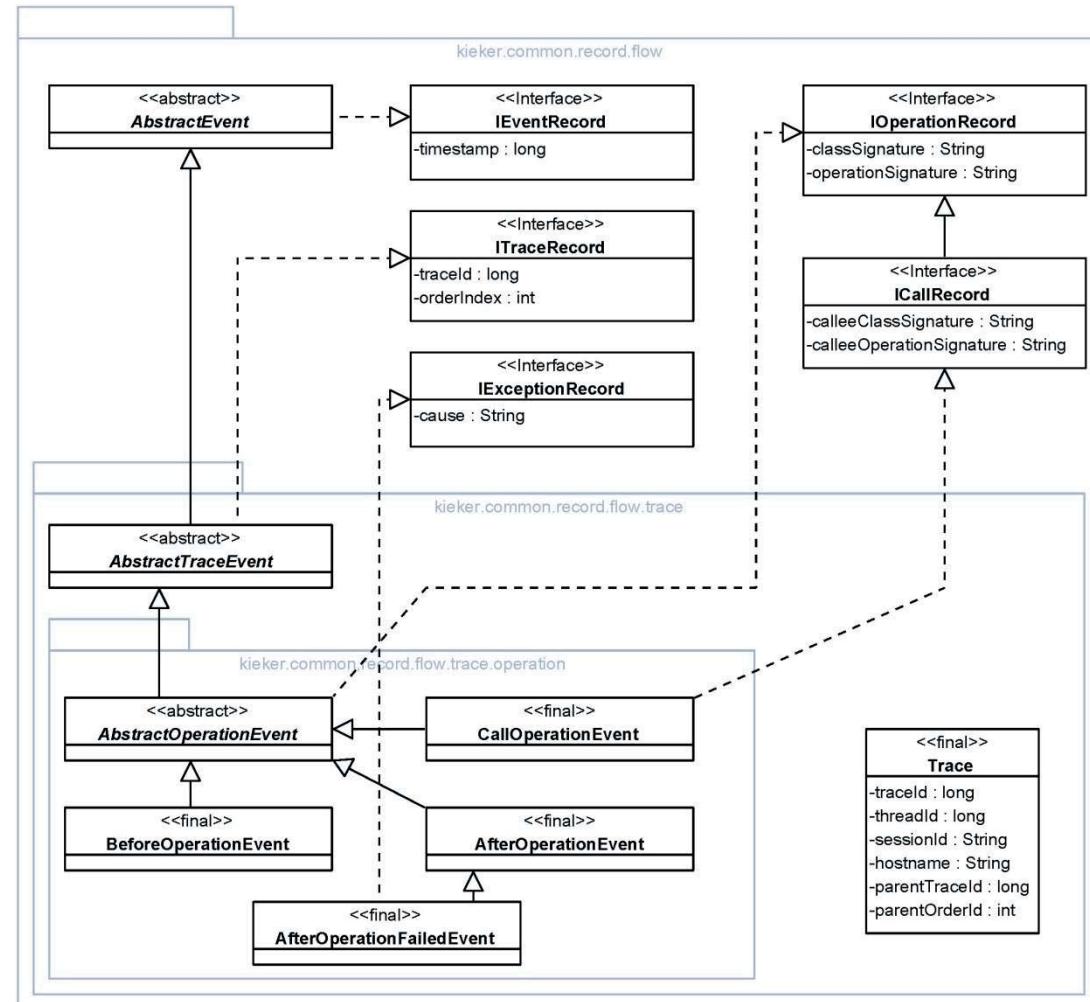
Alfredo R. Teyseyre, Marcelo R. Campo. *An Overview of 3D Software Visualization*. In IEEE Transactions on Visualization and Computer Graphics, pp. 87-105, IEEE Computer Society, 2008.

An (incomplete) overview on aspects of ...

MONITORING CONCURRENCY

Event-based Monitoring (kieker.*.flow.* packages)

- Replaces OER
 - Modular
 - Extensible
- Sub-Traces
 - split event
 - join event
- “Annotations”
 - e.g., object-ids



Java Threads vs. Hardware Threads

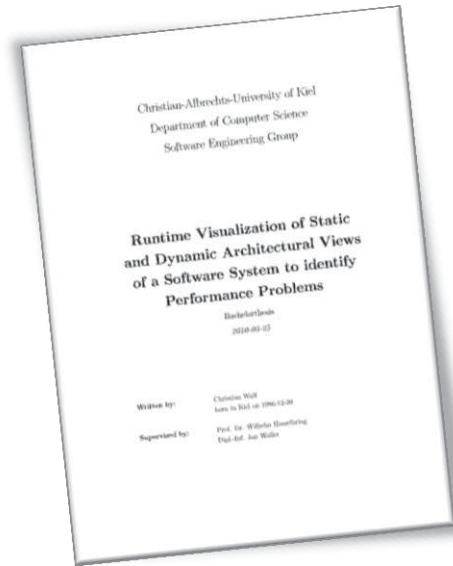
- The CPUID x86 processor instruction
 - Query information on processor
 - Get currently executing (logical) core
- Java Native Interface ([JNI](#)) required
 - System specific library required
 - Additional overhead for JNI calls
- Specific event-based records
 - inserted into trace
 - periodically polled

Java Monitors (e.g., synchronized)

- Java Monitor
 - Mutual exclusion of access
 - 3 states for each call: request / entry / exit
- Instrumentation using AspectJ
 - Support with -Xjoinpoints:synchronization
 - Probes: @Before("lock()") @After("lock()") @Before("unlock()")
 - Corresponding event-based records
- Preliminary limited support: wait / notify

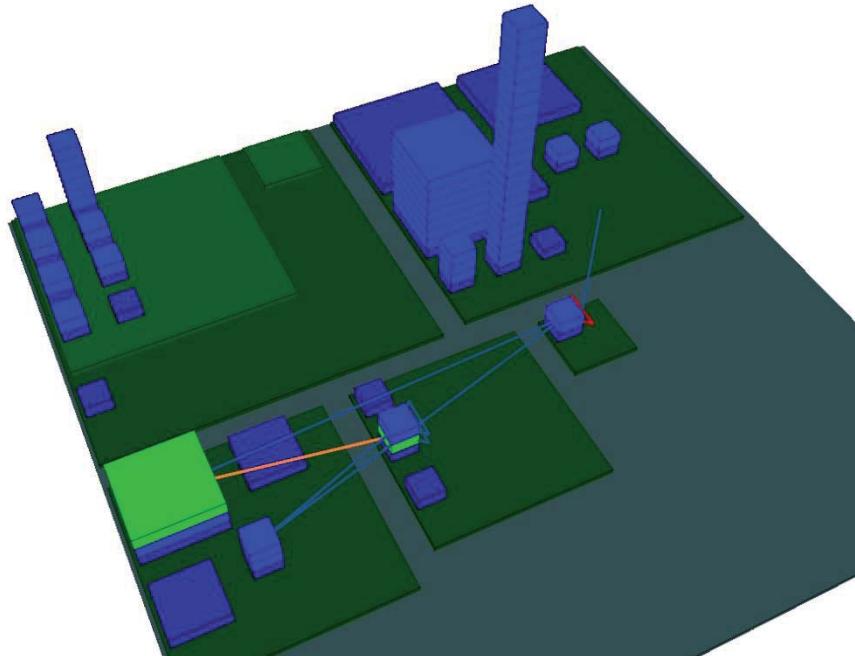
Runtime Visualization of
Static and Dynamic Architectural Views
of a Software System to identify Performance Problems

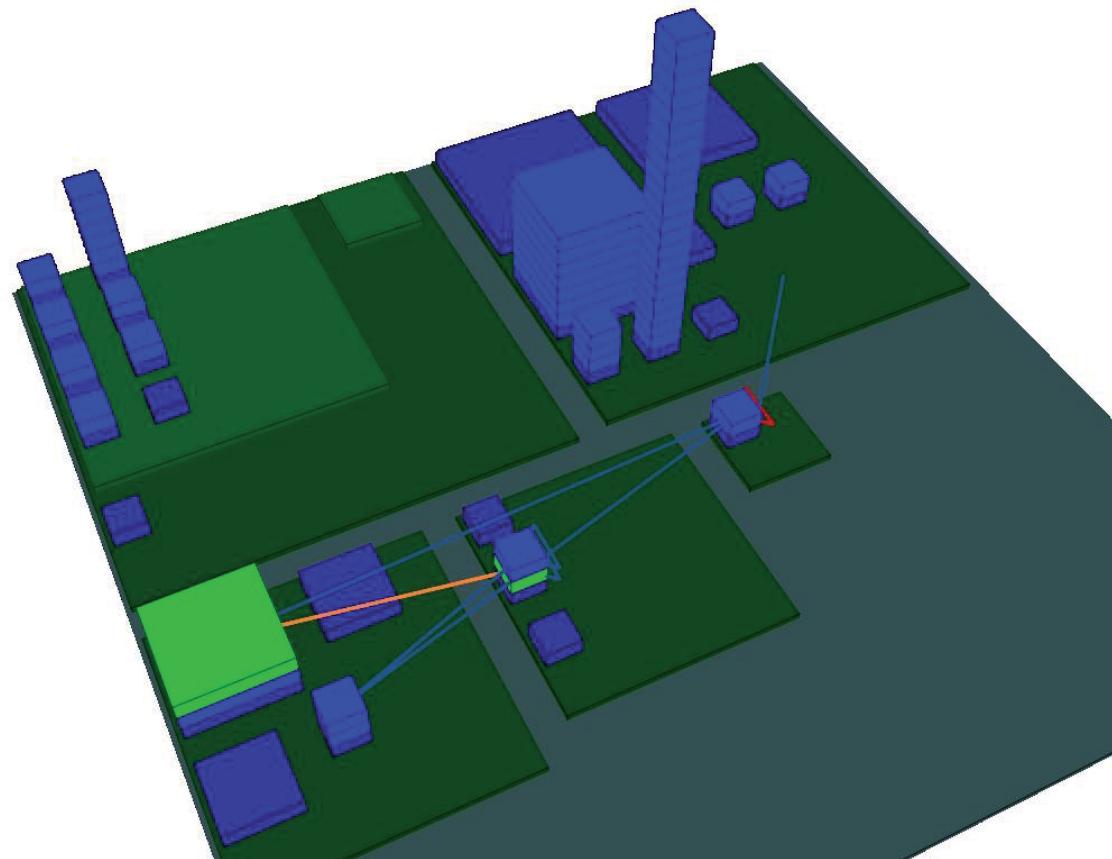
BACHELOR THESIS CHRISTIAN WULF (2010)



DyVis — Features

- Combination of *Codecity* and *TraceCrawler*
- “Static” imported as KDM-Model
- “Dynamic” imported from Kieker log





DyVis

Christian Wulf. *Runtime Visualization of Static and Dynamic Architectural Views of a Software System to identify Performance Problems.* Bachelor thesis, Kiel University, Kiel, Germany, 2010.



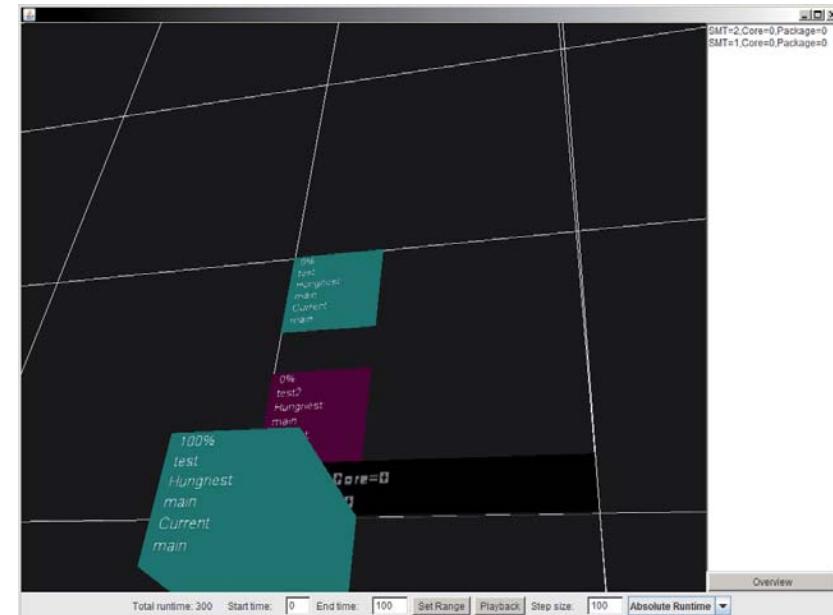
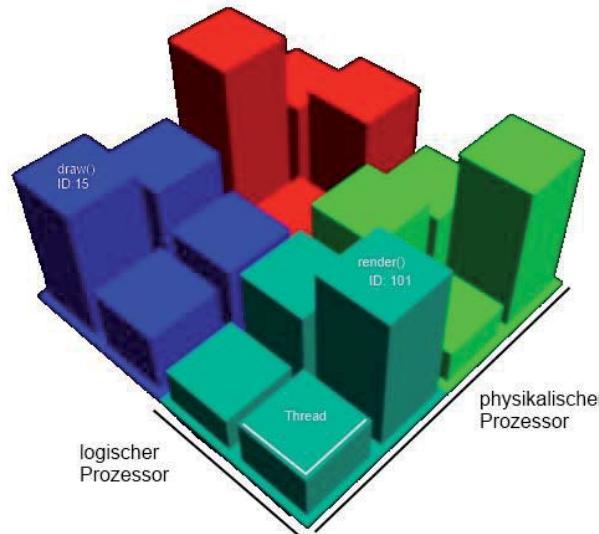
Ein 3D-Ansatz zur Visualisierung der
Kernauslastung in Multiprozessorsystemen

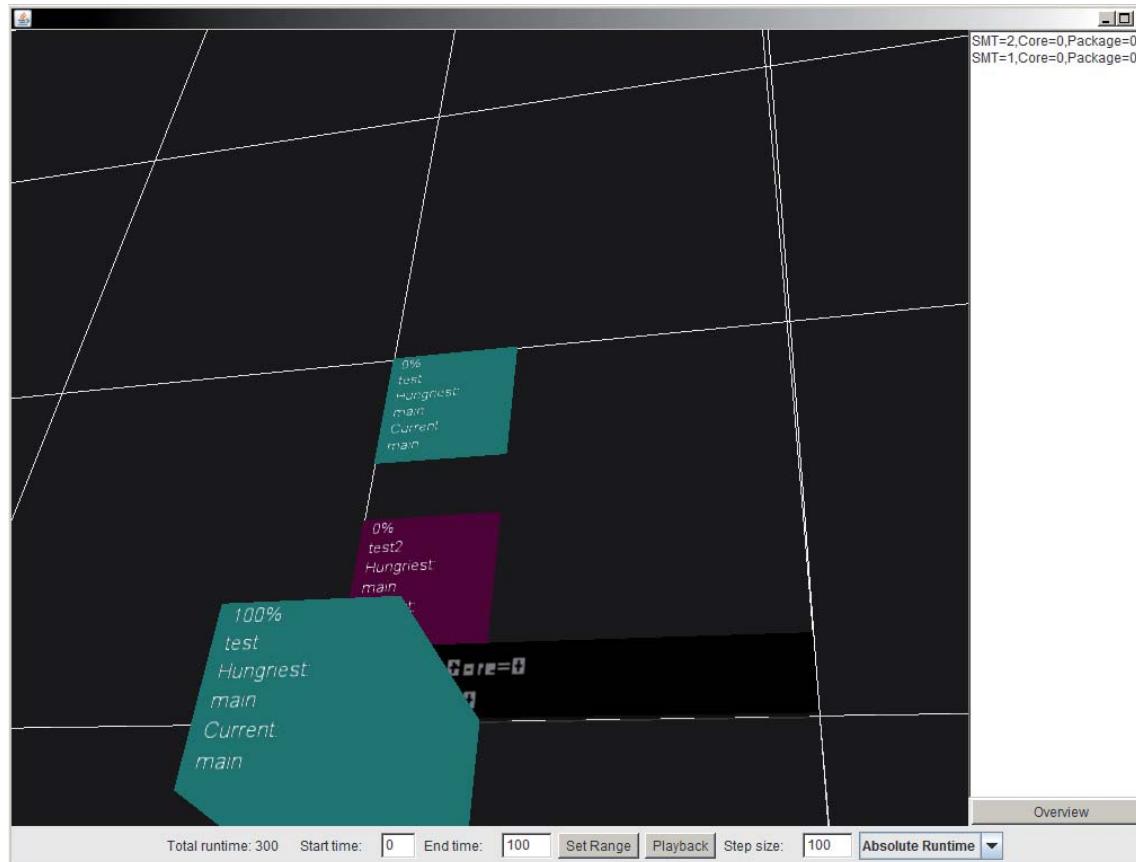
DIPLOMA THESIS

BJÖRN KONARSKI (2012)

ProCity — Features

- Visualization of
 - CPU-Core usage
 - Thread assignment





ProCity

Björn Konarski. *Ein 3D-Ansatz zur Visualisierung der Kernauslastung in Multiprozessorsystemen.* Diploma thesis, Kiel University, Kiel, Germany, 2012.

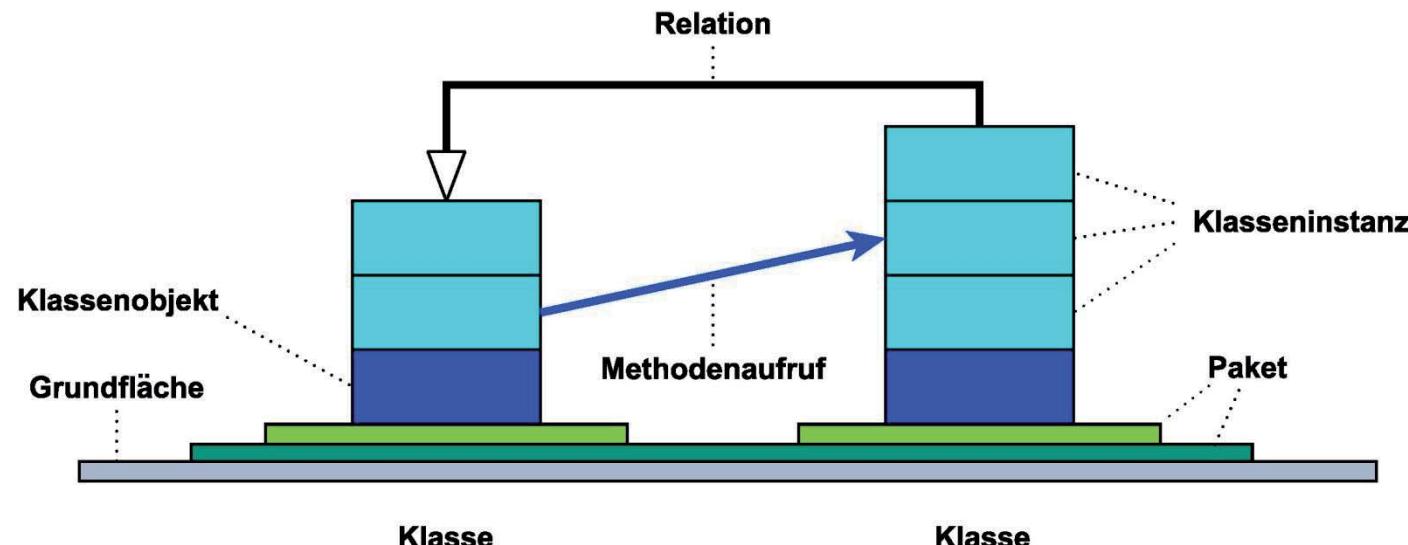
Visualisierung von Synchronisationspunkten
in Kombination mit der Statik und Dynamik
eines Softwaresystems

MASTER THESIS PHILIPP DÖHRING (2012)

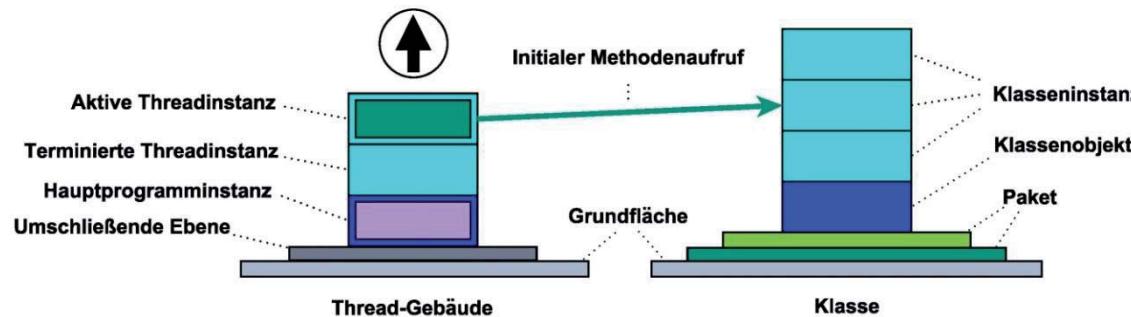


SynchroVis — Features

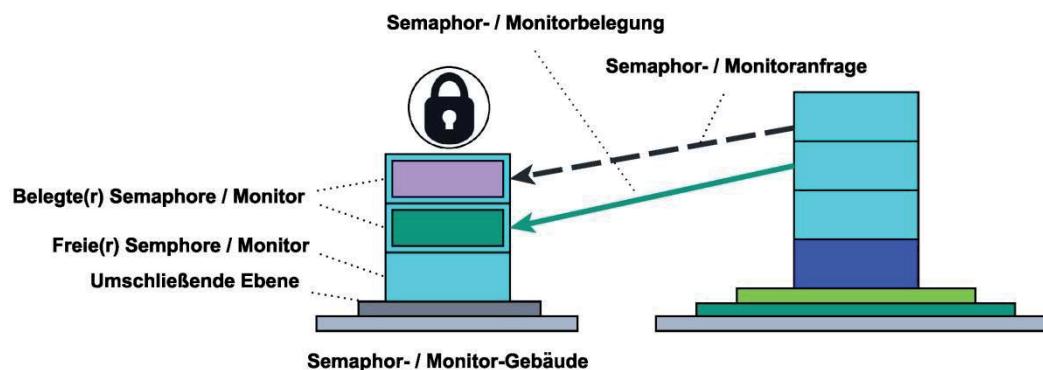
- Continuation of the *DyVis* approach
- Operates on event-based records
- Visualization of concurrency/synchronization



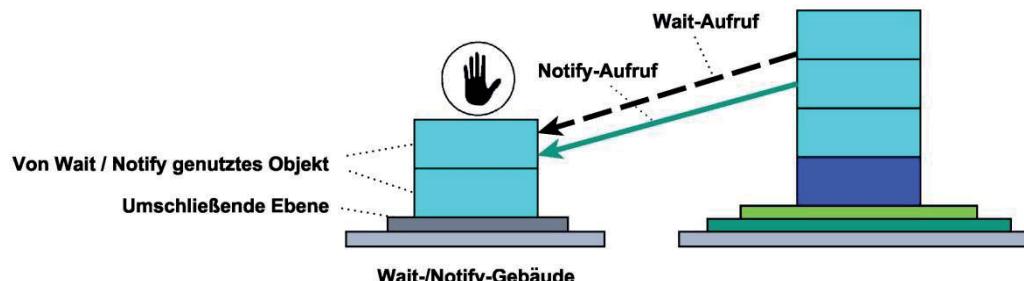
SynchroVis — Features (cont.)



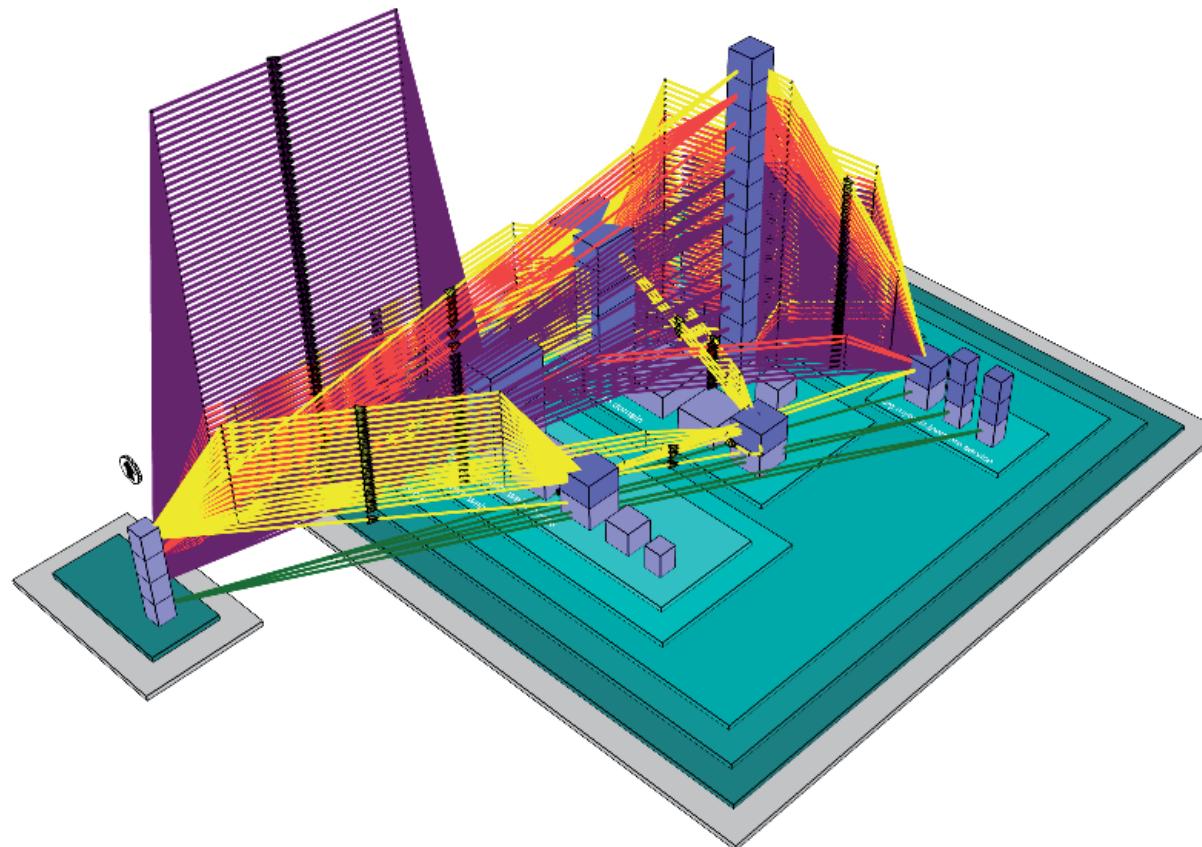
Threads



Monitor



Wait/Notify



SynchroVis

Philipp Döhring. Visualisierung von Synchronisationspunkten in Kombination mit der Statik und Dynamik eines Softwaresystems. Master thesis, Kiel University, Kiel, Germany, 2012.

Conclusions

- Existing 3D Visualization Approaches
- Kieker Monitoring Concurrency Approaches
- Three Kieker 3D Visualization Approaches

Upcoming

- Further visualizations
- Further work on monitoring concurrency



Kieker is distributed as open-source software (Apache License, V. 2.0)



Kieker is distributed as part of SPEC® RG's repository of peer-reviewed tools for quantitative system evaluation and analysis.

<http://research.spec.org/projects/tools.html>

Further Reading

- A. van Hoorn, J. Waller, W. Hasselbring. *Kieker: A Framework for Application Performance Monitoring and Dynamic Software Analysis*. Proc. 3rd ACM/SPEC Int. Conf. Perform. Eng. (ICPE '12), ACM, 2012
- A. van Hoorn, M. Rohr, W. Hasselbring, J. Waller, J. Ehlers, S. Frey, and D. Kieselhorst. *Continuous Monitoring of Software Services: Design and Application of the Kieker Framework*. Technical report TR-0921, Department of Computer Science, University of Kiel, Germany, 2009