

SCIEX Projects in the Dynamic Analysis Group, Università della Svizzera italiana

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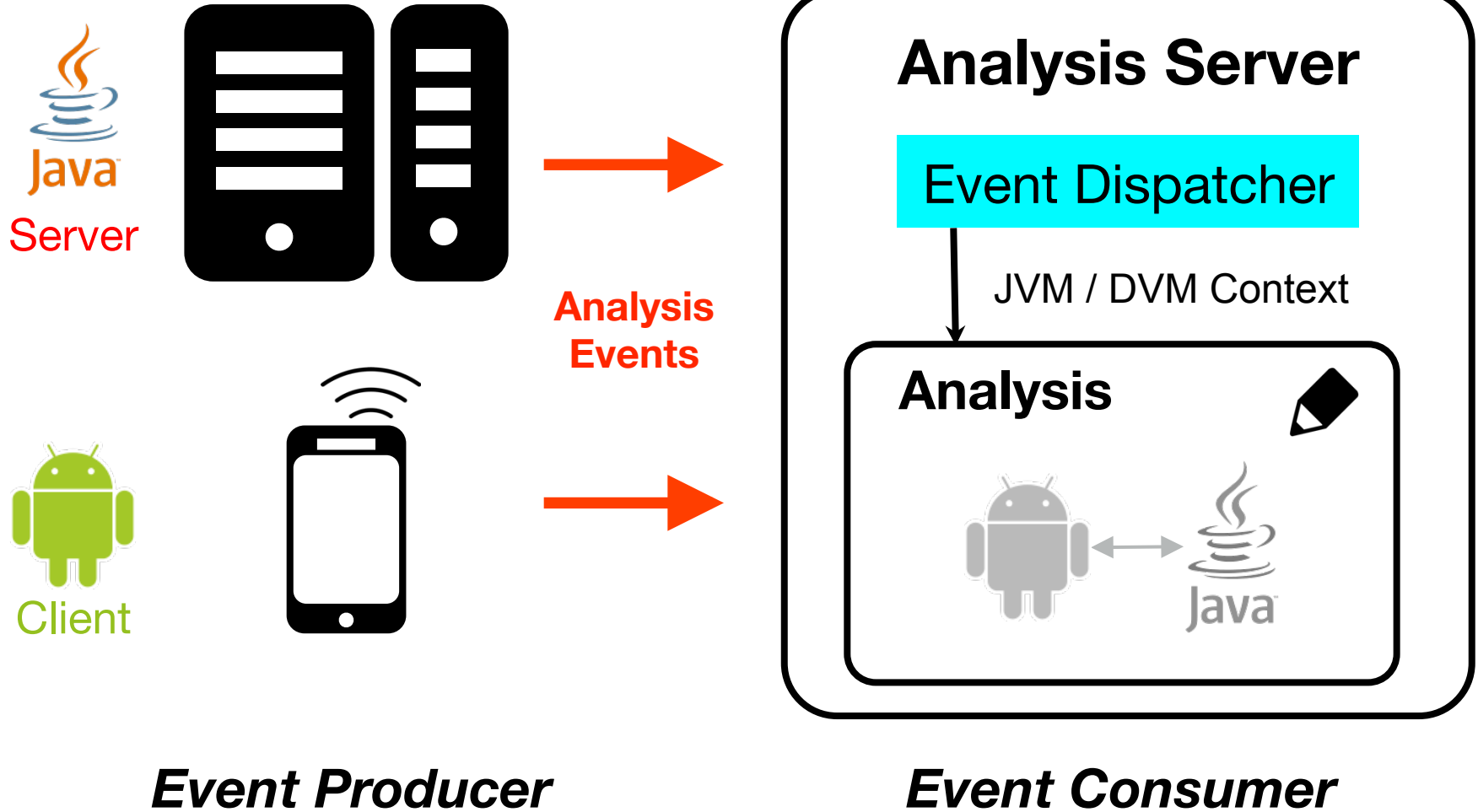
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- **PEARL, June 2011 – May 2012**
 - Productive and Efficient dynamic Analysis thRough aspect-oriented domain-specific Languages
 - SCIEX Fellow: Lukáš Marek (PhD student)
- **DYNASTY, July 2012 – December 2012**
 - DYNAmic Analysis for diSTributed sYstems
 - SCIEX Fellow: Lubomír Bulej (Post-doctoral researcher)
- **WORLD, May 2013 – October 2014**
 - WORkLoad analysis and consolidation for Datacenters
 - SCIEX Fellow: Andrej Podzimek (PhD student)

- **Dynamic program analysis**
 - Understanding how programs work
 - Designing programs that analyze other programs
- **Obstacles in observing programs**
 - Runtimes built for performance, not for observability
 - Analysis influences observed program
 - Trade-offs in tool design and development
 - Lack of high-level abstractions
 - Limited expressive power
 - Limited code coverage
 - High overhead
- **Contributions**
 - High-level, powerful, complete, and efficient analysis
 - Isolation of analysis and observed program
 - Multi-platform analysis (Java, Android)

Framework Overview



Results: Software Releases

- Open-source releases of DiSL and ShadowVM
`http://dis1.ow2.org/`
- Endorsed by the SPEC Research Group
`http://research.spec.org/tools/
overview/dis1.html`

Project results

- Sarimbekov A., Zheng Y., Ansaloni D., Bulej L., Marek L., Binder W., Tůma P., and Qi Z. **Dynamic Program Analysis - Reconciling Developer Productivity and Tool Performance**. Science of Computer Programming, 95(3):344-358, Elsevier, 2014.

Follow-up results

- Sarimbekov A., Stadler L., Bulej L., Sewe A., Podzimek A., Zheng Y., and Binder W. **Workload Characterization of JVM Languages**. Software: Practice & Experience, early view, Wiley, 2015.
- Marek L., Zheng Y., Ansaloni D., Bulej L., Sarimbekov A., Binder W., and Tůma P. **Introduction to Dynamic Program Analysis with DiSL**. Science of Computer Programming, 98(1):100-115, Elsevier, 2015.
- Zheng Y., Kell S., Bulej L., Sun H., and Binder W. **Comprehensive Multi-platform Dynamic Program Analysis for Java and Android**. Accepted, IEEE Software, 2015.

Project results

- Podzimek A., Bulej L., Chen L. Y., Binder W., and Tůma P. **Analyzing the Impact of CPU Pinning and Partial CPU Loads on Performance and Energy Efficiency**. 15th IEEE/ACM International Symposium on Cluster, Cloud, and Grid Computing (CCGRID), Shenzhen, China, 2015.
Best Research Paper Runner Up Award.
- Ansaloni D., Kell S., Zheng Y., Bulej L., Binder W., and Tůma P. **Enabling Modularity and Re-use in Dynamic Program Analysis Tools for the Java Virtual Machine**. 27th European Conference on Object-Oriented Programming (ECOOP), Montpellier, France, pp. 352-377, 2013.
- Marek L., Villazón A., Zheng Y., Ansaloni D., Binder W., and Qi Z. **DiSL: A Domain-Specific Language for Bytecode Instrumentation**. 11th International Conference on Aspect-oriented Software Development (AOSD), Potsdam, Germany, pp. 239-250, 2012.

Follow-up results

- Zheng Y., Bulej L., and Binder W. **Accurate Profiling in the Presence of Dynamic Compilation**. ACM/SIGPLAN international conference on Object Oriented Programming, Systems, Languages, and Applications (OOPSLA), Pittsburgh, USA, 2015.
- Sun H., Zheng Y., Bulej L., Villazón A., Qi Z., Tůma P., and Binder W. **A Programming Model and Framework for Comprehensive Dynamic Analysis on Android**. 14th International Conference on Modularity (MODULARITY), Fort Collins, USA, pp. 133-145, 2015
- Marek L., Kell S., Zheng Y., Bulej L., Tůma P., Binder W., Ansaloni D., Sarimbekov A., and Sewe A. **ShadowVM: Robust and Comprehensive Dynamic Program Analysis for the Java Platform**. 12th International Conference on Generative Programming: Concepts & Experiences (GPCE), Indianapolis, USA, pp. 105-114, 2013.

Project results

- Sarimbekov A., Zheng Y., Ansaloni D., Bulej L., Marek L., Binder W., Tůma P., and Qi Z. **Productive Development of Dynamic Program Analysis Tools with DiSL**. 22nd Australian Software Engineering Conference (ASWEC), Melbourne, Australia, pp. 11-19, 2013.
- Zheng Y., Ansaloni D., Marek L., Sewe A., Binder W., Villazón A., Tůma P., Qi Z., and Mezini M. **Turbo DiSL: Partial Evaluation for High-Level Bytecode Instrumentation**. 50th International Conference on Objects, Models, Components, Patterns (TOOLS), Prague, Czech Republic, pp. 353-368, 2012.
- Ansaloni D., Binder W., Bockisch Ch., Bodden E., Hatun K., Marek L., Qi Z., Sarimbekov A., Sewe A., Tůma P., and Zheng Y. **Challenges for Refinement and Composition of Instrumentations: Position Paper**. 11th International Conference on Software Composition (SC), Prague, Czech Republic, pp. 86-96, 2012.

Follow-up results

- Zheng Y., Bulej L., Zhang C., Kell S., Ansaloni D., and Binder W. **Dynamic Optimization of Bytecode Instrumentation**. 7th workshop on Virtual Machines and Intermediate Languages (VMIL), Indianapolis, USA, pp. 11-20, 2013.
- Sarimbekov A., Podzimek A., Bulej L., Zheng Y., Ricci N., and Binder W. **Characteristics of Dynamic JVM Languages**. 7th workshop on Virtual Machines and Intermediate Languages (VMIL), Indianapolis, USA, pp. 21-30, 2013.
- Sarimbekov A., Kell S., Bulej L., Sewe A., Zheng Y., Ansaloni D., and Binder W. **A Comprehensive Toolchain for Workload Characterization Across JVM Languages**. 11th ACM/SIGPLAN Workshop on Program Analysis for Software Tools and Engineering (PASTE), Seattle, USA, pp. 9-16, 2013.
- Kell S., Ansaloni D., Binder W., and Marek L. **The JVM is not observable enough (and what to do about it)**. 6th workshop on Virtual Machines and Intermediate Languages (VMIL), Tucson, USA, pp. 33-38, 2012.

Project results

- Podzimek A., Chen L. Y., Bulej L., Binder W., and Tůma P. **Showstopper: The Partial CPU Load Tool**. 22nd International Symposium on Modeling, Analysis & Simulation of Computer and Telecommunication Systems (MASCOTS), Paris, France, pp. 510-513, 2014.
- Marek L., Zheng Y., Ansaloni D., Bulej L., Sarimbekov A., Binder W., and Qi Z. **Introduction to Dynamic Program Analysis with DiSL**. 4th ACM/SPEC International Conference on Performance Engineering (ICPE), Prague, Czech Republic, 2013.

Follow-up results

- Sun H., Zheng Y., Bulej L., Kell S., and Binder W. **Custom Full-Coverage Dynamic Program Analysis for Android**. ACM Conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH), Pittsburgh, USA, ACM, 2015.
- Sun H., Zheng Y., Bulej L., Kell S., and Binder W. **Analyzing Distributed Multi-platform Java and Android Applications with ShadowVM**. 13th Asian Symposium on Programming Languages and Systems (APLAS), Pohang, Korea, 2015.
- Marek L., Zheng Y., Ansaloni D., Sarimbekov A., Binder W., Tůma P., and Qi Z. **Java Bytecode Instrumentation Made Easy: The DiSL Framework for Dynamic Program Analysis**. 10th Asian Symposium on Programming Languages and Systems (APLAS), Kyoto, Japan, pp. 256-263, 2012.

Collaboration Aspects

- **Complementary expertise brought by SCIEX Fellows**
 - Performance analysis and modeling
 - Operating systems
 - Distributed systems
- **New research directions taken by SCIEX Fellows**
 - Dynamic program analysis
 - Workload characterization
- **Excellent progress in careers of SCIEX Fellows**
 - Dr. Lukáš Marek: dissertation defended
 - Prof. Lubomír Bulej: assistant professor at Charles Univ.
 - Andrej Podzimek: dissertation in progress

Collaboration Aspects

- Frequent research meetings with Prof. Tůma and Prof. Bulej in Lugano and in Prague
 - Software design and development
 - Maintenance of open-source software releases
 - Publications
 - Seminar talks
- Joint organization of conferences
 - PPPJ '16 in Lugano
- ERASMUS agreement between USI and Charles University
- Elected Professorem Hospitem of Charles University