Publications: Vladimír Štill

Here I summarize my publication results in the field of program analysis. For my most important papers, I also include a short description of the paper and a description of my contribution to the paper. The remainder of papers are mostly either older papers to which I have contributed less or short report papers for the Software Verification Competition (SV-COMP).

Most Significant Papers

Local Nontermination Detection for Parallel C++ Programs

In this paper, we present our approach to ensuring that parallel programs do not hang or wait indefinitely – i.e., there are no deadlocks, livelocks, and the program proceeds towards its goals. The paper contains the theoretical description of our approach and evaluation of our publicly available implementation.

My Contribution: The algorithm design, implementation and writing of the paper was done by me, my advisor Jiří Barnat helped by consulting the theory with me and proofreading the paper. I have presented this paper on the SEFM 2019 conference. 90 %

Vladimír Štill and Jiří Barnat. "Local Nontermination Detection for Parallel C++ Programs". In: *Software Engineering and Formal Methods*. Cham: Springer International Publishing, 2019, pp. 373–390. ISBN: 978-3-030-30446-1. DOI: 10.1007/978-3-030-30446-1_20

Model Checking of C++ Programs Under the x86-TSO Memory Model

Here we present a novel approach to verification of parallel programs with respect to the memory model of Intel processors. The approach improves the efficiency of explicit-state model checking by decreasing amount of nondeterminism in the program. The paper contains evaluation and is accompanied by a publicly available implementation.

My Contribution: The algorithm design, implementation and writing of the paper was done by me, Jiří Barnat helped by consulting the theory with me and proofreading the paper. I have presented this paper on the ICFEM 2018 conference. 90 %

Vladimír Štill and Jiří Barnat. "Model Checking of C++ Programs Under the x86-TSO Memory Model". In: *Formal Methods and Software Engineering*. Cham: Springer International Publishing, 2018, pp. 124–140. ISBN: 978-3-030-02450-5. DOI: 10.1007/978-3-030-02450-5_8

Using Off-the-Shelf Exception Support Components in C++ Verification

In this paper, we present an extension of DIVINE that allows it to verify programs that contain C++ exceptions and C programs with a non-local transfer of control flow (`setjmp`/`longjmp`). We show that with careful design, we can successfully reuse exception handling code from the standard C++ library. The result is that virtually any exception handling constructs working in the standard C++ are now available in DIVINE.

My Contribution: I have designed the exception support for DIVINE 4, implemented it and performed the evaluation for this paper. I have also written most of the text for the paper. Petr Ročkai and Jiří Barnat helped by consulting the design and implementation and also helped with the paper text. I have presented this paper on the QRS 2017 conference. The paper and its presentation were awarded the best paper award. 75 %

Vladimír Štill, Petr Ročkai, and Jiří Barnat. "Using Off-the-Shelf Exception Support Components in C++ Verification". In: *IEEE International Conference on Software Quality, Reliability and Security (QRS)*. July 2017, pp. 54–64. DOI: 10.1109/QRS.2017.15

Model Checking of C and C++ with DIVINE 4

In this tool paper, we describe the overall architecture of DIVINE 4 and changes in the tool compared to DIVINE 3. Most significantly, this paper describes the modular nature of DIVINE: DIVINE 4 is built around an efficient interpreter which, together with a small, verification-oriented operating system and a set of runtime libraries, enables verification of real-world code written in C and C++.

My Contribution: The text of the paper is written mostly by me, with additions and proofreading by Petr Ročkai and Jiří Barnat. The architecture design was mostly due to Petr Ročkai, with additions by me and Jan Mrázek. The implementation includes code by all the co-authors with most significant contributions by (in the order of significance) Petr Ročkai, me, and Jan Mrázek. 30 %

Zuzana Baranová, Jiří Barnat, Katarína Kejstová, Tadeáš Kučera, Henrich Lauko, Jan Mrázek, Petr Ročkai, and Vladimír Štill. "Model Checking of C and C++ with DIVINE 4". In: *International Symposium on Automated Technology for Verification and Analysis (ATVA)*. vol. 10482. Lecture Notes in Computer Science. 2017. DOI: 10.1007/978-3-319-68167-2_14

DiVM: Model Checking with LLVM and Graph Memory

This paper introduces the concept of a virtual machine with graph memory as a core component for explicit-state and abstraction-based verification of

software. The paper is accompanied by an implementation of the virtual machine which runs LLVM IR (which can be obtained from C or C++ using the clang compiler) and an evaluation which compares the new approach to a more traditional design of an LLVM-based model checker as well as a symbolic model checker.

My Contribution: The primary author of this paper is Petr Ročkai. My contribution concerned mostly the C++ support (including program compilation and libraries) and the evaluation and comparison of the new approach with DIVINE 3 and ESBMC. 20 %

Petr Ročkai, Vladimír Štill, Ivana Černá, and Jiří Barnat. "DiVM: Model checking with LLVM and graph memory". In: *Journal of Systems and Software* 143 (2018), pp. 1–13. DOI: 10.1016/j.jss.2018.04.026

Other Papers

Henrich Lauko, Vladimír Štill, Petr Ročkai, and Jiří Barnat. "Extending DIVINE with Symbolic Verification Using SMT". in: *Tools and Algorithms for the Construction and Analysis of Systems*. Cham: Springer International Publishing, 2019, pp. 204–208. ISBN: 978-3-030-17502-3. DOI: 10.1007/978-3-030-17502-3_14

Jan Mrázek, Martin Jonáš, Vladimír Štill, Henrich Lauko, and Jiří Barnat. "Optimizing and Caching SMT Queries in SymDIVINE". in: *Tools and Algorithms for the Construction and Analysis of Systems*. Springer Berlin Heidelberg, 2017, pp. 390–393. ISBN: 978-3-662-54580-5. DOI: 10.1007/978-3-662-54580-5_29

Vladimír Štill, Petr Ročkai, and Jiří Barnat. "DIVINE: Explicit-State LTL Model Checker". In: *Tools and Algorithms for the Construction and Analysis of Systems*. Springer Berlin Heidelberg, 2016, pp. 920–922. ISBN: 978-3-662-49674-9. DOI: 10.1007/978-3-662-49674-9_60

Jiří Barnat, Ivana Černá, Petr Ročkai, Vladimír Štill, and Kristína Zákopčanová. "On Verifying C++ Programs with Probabilities". In: *ACM Symposium on Applied Computing*. 2016, pp. 1238–1243. ISBN: 978-1-4503-3739-7. DOI: 10.1145/2851613.2851721

Vladimír Štill, Petr Ročkai, and Jiří Barnat. "Weak Memory Models as LLVM-to-LLVM Transformations". In: *Mathematical and Engineering Methods in Computer Science, Revised Selected Papers*. Vol. 9548. Lecture Notes in Computer Science. Springer International Publishing, 2016, pp. 144–155. ISBN: 978-3-319-29817-7. DOI: 10.1007/978-3-319-29817-7_13

Jiří Barnat, Petr Ročkai, Vladimír Štill, and Jiří Weiser. "Fast, Dynamically-Sized Concurrent Hash Table". In: *Model Checking Software (SPIN 2015)*. Vol. 9232. Lecture Notes in Computer Science. Springer International Publishing, 2015, pp. 49–65. ISBN: 978-3-319-23403-8. DOI: 10.1007/978-3-319-23404-5_5

Petr Ročkai, Vladimír Štill, and Jiří Barnat. "Techniques for Memory-Efficient Model Checking of C and C++ Code". In: *Software Engineering and Formal Methods*. Vol. 9276. Lecture Notes in Computer Science. Springer International Publishing, 2015, pp. 268–282. ISBN: 978-3-319-22968-3. DOI: 10.1007/978-3-319-22969-0_19

Vladimír Štill, Petr Ročkai, and Jiří Barnat. "Context-Switch-Directed Verification in DIVINE". in: *Mathematical and Engineering Methods in Computer Science*. Vol. 8934. Lecture Notes in Computer Science. Springer International Publishing, 2014, pp. 135–146. ISBN: 978-3-319-14895-3. DOI: 10.1007/978-3-319-14896-0_12

Jiří Barnat, Luboš Brim, Vojtěch Havel, Jan Havlíček, Jan Kriho, Milan Lenčo, Petr Ročkai, Vladimír Štill, and Jiří Weiser. "DiVinE 3.0 – An Explicit-State Model Checker for Multithreaded C & C++ Programs". In: *Computer Aided Verification*. Vol. 8044. Lecture Notes in Computer Science. Springer Berlin Heidelberg, 2013, pp. 863–868. ISBN: 978-3-642-39798-1. DOI: 10.1007/978-3-642-39799-8_60