

# PROB: System Description for SMT-COMP 2016

Sebastian Krings and Michael Leuschel  
Institut für Informatik, University of Düsseldorf  
{krings,leuschel}@cs.uni-duesseldorf.de

## System Description

PROB [5, 6, 4] is a constraint solver, animator and model checker for software models written using the specification languages B and Event-B. In order to get access to the benchmarks and test cases collected in the SMT-LIB, we developed a translator from SMT-LIB to B. An SMT-LIB model is transformed into a (partial) B specification and fed into PROB's constraint solver. If a solution is found, it is translated back into the corresponding SMT model.

Internally, PROB uses constraint logic programming, relying mostly on custom extensions to the CLP(FD) library of SICStus Prolog [1]. PROB includes a back-end relying on SMT solvers rather than CLP(FD) and an integrated solver combining both [3]. For SMT-COMP 2016 however, we will only use the CLP(FD) backend.

How the constraint solving kernel of PROB can be used as a prover is outlined in [2], where we compared its performance to other SMT solvers using B and Event-B proof obligations as benchmarks. Now, the tables are turned and SMT problems will be used as benchmarks in SMT-COMP.

## Supported Logics

The translation from SMT-LIB to B supports all logics not including real arithmetic. In particular, we expect the performance of integer arithmetic to be quite well. Support for uninterpreted functions, arrays and bit vectors is weak when compared to state-of-the-art SMT solvers. This is mostly because current versions of PROB rely too much on enumeration in these cases.

In consequence, for 2016 we are participating in the main track in the (QF\_)LIA and (QF\_)NIA logics. We plan to improve translation and support for other logics in the future.

## Availability and Usage

PROB is released under the Eclipse Public License v1.0 and is available from <http://stups.hhu.de/ProB/Download>. Source code is available there as well. In order to compile or run from source you need SICStus Prolog. The pre-build version can be used without a SICStus license.

You can start PROB on SMT-LIB files by passing them on the command line: `probcli benchmark.smt2`. A REPL can be started using a command line switch: `probcli --smtlib-cli`.

## Acknowledgments

Several other authors have made contributions to ProB: Michael Butler, Jens Bendisposto, Daniel Plagge, Lukas Ladenberger, Ivaylo Dobrikov, Marc Fontaine, Fabian Fritz, Corina Spermann, Michael Jastram, Dominik Hansen, Philipp Krner, Joy Clark, Edward Turner, Dennis Winter, Sonja Holl, Jens Krger, Michael Birkhoff, Carla Ferreira, Stphane Lo Presti, Leonid Mikhailov, Laksono Adhianto, and many more.

## References

- [1] M. Carlsson, G. Ottosson, and B. Carlson. An Open-Ended Finite Domain Constraint Solver. In *Proceedings PLILP*, pages 191–206. Springer, 1997.
- [2] S. Krings, J. Bendisposto, and M. Leuschel. From Failure to Proof: The ProB Disprover for B and Event-B. In *Proceedings SEFM'2015*, volume 9276 of *LNCS*. Springer, 2015.
- [3] S. Krings and M. Leuschel. Smt solvers for validation of b and event-b models. In *Proceedings iFM 2016*, volume 9681 of *LNCS*, 2016.
- [4] M. Leuschel, J. Bendisposto, I. Dobrikov, S. Krings, and D. Plagge. From Animation to Data Validation: The ProB Constraint Solver 10 Years On. In J.-L. Boulanger, editor, *Formal Methods Applied to Complex Systems: Implementation of the B Method*, chapter 14, pages 427–446. Wiley ISTE, Hoboken, NJ, 2014.
- [5] M. Leuschel and M. Butler. ProB: A model checker for B. In *Proceedings FME*, volume 2805 of *LNCS*, pages 855–874. Springer, 2003.
- [6] M. Leuschel and M. Butler. ProB: An automated analysis toolset for the B method. *Software Tools for Technology Transfer*, 10(2):185–203, 2008.