



CPACHECKER

Marian Lingsch-Rosenfeld

Daniel Baier, Dirk Beyer, Marek Jankola, Matthias Kettl, Philipp Wendler

May 5, 2025
LMU Munich, SoSy-Lab



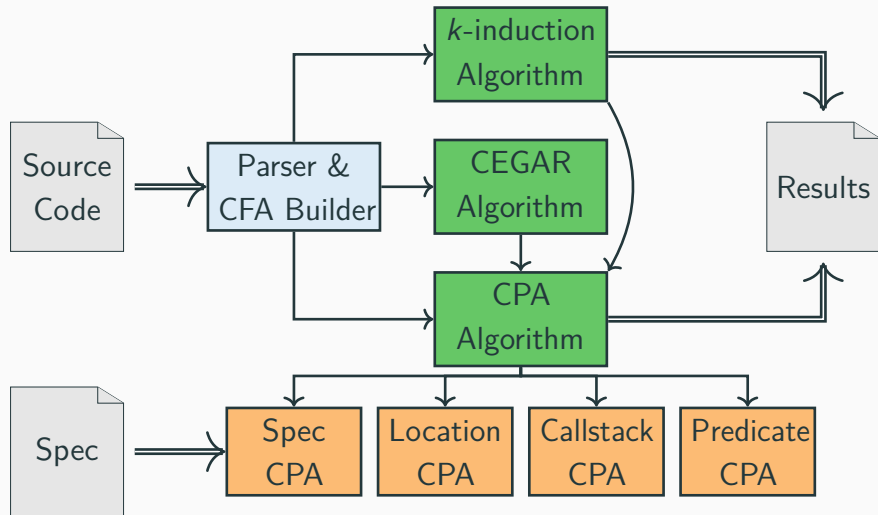
Overview

CPACHECKER is a modern and versatile framework for building software-verification and witness-validation analyses.

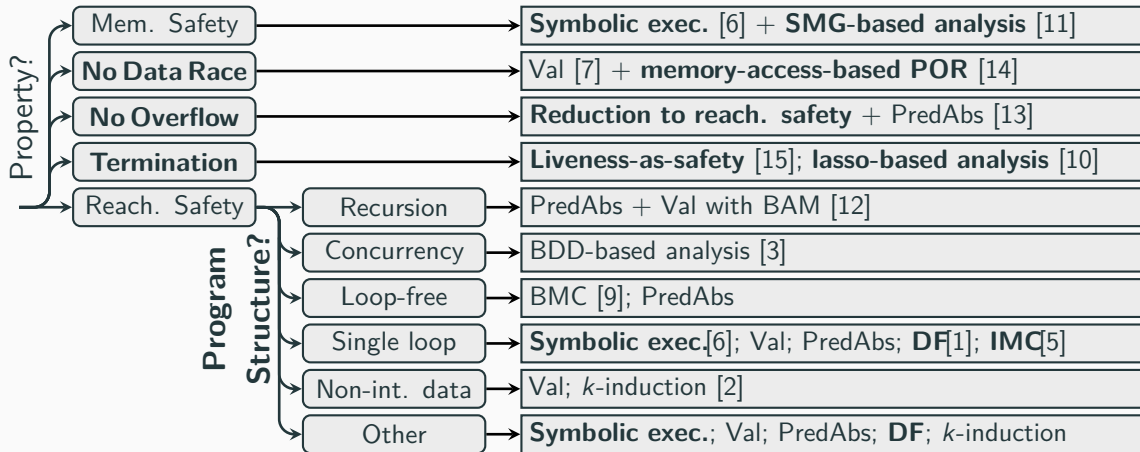
- Supports all SV-COMP properties and categories of C programs
- Can export and validate all witness types and formats
- Utilizes many different algorithms



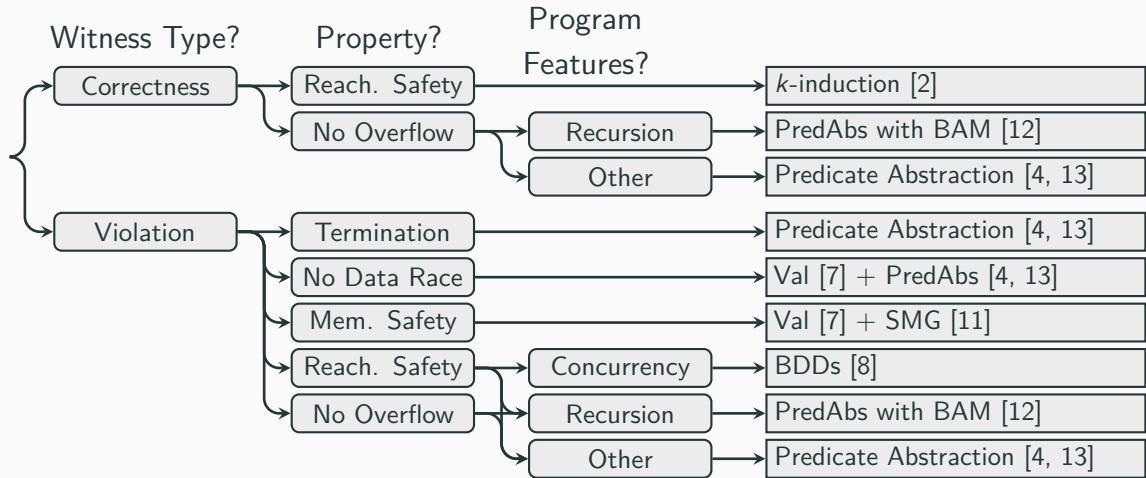
Architecture

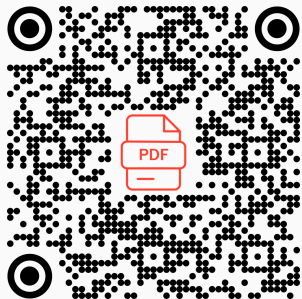


Strategy Selection: Verification



Strategy Selection: Validation

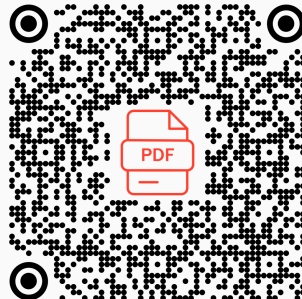




CPACHECKER tutorial
paper

New this year:

- Parallel portfolio of analyses
- Improved memory analysis
- Disabling export of witnesses v1.0



CPACHECKER validator
paper

References i

- [1] Beyer, D., Chien, P.C., Lee, N.Z.: CPA-DF: A tool for configurable interval analysis to boost program verification. In: Proc. ASE. pp. 2050–2053. IEEE (2023). <https://doi.org/10.1109/ASE56229.2023.00213>
- [2] Beyer, D., Dangl, M., Wendler, P.: Boosting k-induction with continuously-refined invariants. In: Proc. CAV. pp. 622–640. LNCS 9206, Springer (2015). https://doi.org/10.1007/978-3-319-21690-4_42
- [3] Beyer, D., Friedberger, K.: A light-weight approach for verifying multi-threaded programs with CPACHECKER. In: Proc. MEMICS. vol. 233, pp. 61–71. EPTCS (2016). <https://doi.org/10.4204/EPTCS.233.6>

References ii

- [4] Beyer, D., Keremoglu, M.E., Wendler, P.: Predicate abstraction with adjustable-block encoding. In: Proc. FMCAD. pp. 189–197. FMCAD (2010), https://www.sosy-lab.org/research/pub/2010-FMCAD.Predicate_Abstraction_with_Adjustable-Block-Encoding.pdf
- [5] Beyer, D., Lee, N.Z., Wendler, P.: Interpolation and SAT-based model checking revisited: Adoption to software verification. arXiv/CoRR **2208**(05046) (July 2022).
<https://doi.org/10.48550/arXiv.2208.05046>
- [6] Beyer, D., Lemberger, T.: CPA-SymExec: Efficient symbolic execution in CPAchecker. In: Proc. ASE. pp. 900–903. ACM (2018).
<https://doi.org/10.1145/3238147.3240478>

References iii

- [7] Beyer, D., Löwe, S.: Explicit-state software model checking based on CEGAR and interpolation. In: Proc. FASE. pp. 146–162. LNCS 7793, Springer (2013). https://doi.org/10.1007/978-3-642-37057-1_11
- [8] Beyer, D., Stahlbauer, A.: BDD-based software model checking with CPACHECKER. In: Proc. MEMICS. pp. 1–11. LNCS 7721, Springer (2013). https://doi.org/10.1007/978-3-642-36046-6_1
- [9] Biere, A., Cimatti, A., Clarke, E.M., Zhu, Y.: Symbolic model checking without BDDs. In: Proc. TACAS. pp. 193–207. LNCS 1579, Springer (1999). https://doi.org/10.1007/3-540-49059-0_14

References iv

- [10] Cook, B., Podelski, A., Rybalchenko, A.: TERMINATOR: Beyond safety. In: Proc. CAV. pp. 415–418. LNCS 4144, Springer (2006).
https://doi.org/10.1007/11817963_37
- [11] Dudka, K., Peringer, P., Vojnar, T.: Byte-precise verification of low-level list manipulation. In: Proc. SAS. pp. 215–237. LNCS 7935, Springer (2013).
https://doi.org/10.1007/978-3-642-38856-9_13
- [12] Friedberger, K.: CPA-BAM: Block-abstraction memoization with value analysis and predicate analysis (competition contribution). In: Proc. TACAS. pp. 912–915. LNCS 9636, Springer (2016).
https://doi.org/10.1007/978-3-662-49674-9_58

References v

- [13] Henzinger, T.A., Jhala, R., Majumdar, R., McMillan, K.L.: Abstractions from proofs. In: Proc. POPL. pp. 232–244. ACM (2004).
<https://doi.org/10.1145/964001.964021>
- [14] Peled, D.: Ten years of partial order reduction. In: Proc. CAV. pp. 17–28. Springer (1998). <https://doi.org/10.1007/BFb0028727>
- [15] Schuppan, V., Biere, A.: Liveness checking as safety checking for infinite state spaces. Electr. Notes Theor. Comput. Sci. **149**(1), 79–96 (2006).
<https://doi.org/10.1016/j.entcs.2005.11.018>