SV-COMP 2025

14th Competition on Software Verification

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Motivation - Goals

1. Community suffers from unreproducible results
   → Establish set of benchmarks
2. Publicity for tools that are available
   → Provide state-of-the-art overview
3. Support the development of verification tools
   → Give credits and visibility to developers
4. Establish standards
   → Specification language, Witness formats,
   Benchmark definitions, Validation process

Schedule of Sessions at ETAPS

Session 1:

- Competition report by organizers
- System presentations, 4 min by each team
- Short discussion

Session 2:

- Open jury meeting, community discussion, moderated by organizers

Schedule of Sessions at Chiemsee

Session 1:

- Competition report by organizers
- System presentations, 10 min by each team
- Short discussion

Sessions 2–4:

- Community discussion, plans for future
- Session 2: category structures, scores, ranking, rules
- Session 3: organization committe, timeline, registration
- Session 4: validation track

Procedure – Time Line

Three Steps – Three Mile Stones:

- Benchmark submission deadline
- System submission
- Notification of results (approved by teams)

The mile stones are further supported by several deadlines, such as the benchmark freezing, tool submission for training, ...

Verification Problem

Input:

- C program (GNU/ANSI C standard) and property
  → Reachability safety
  → No overflow
  → Memory safety (valid-deref, valid-free, valid-memtack)
  → Memory cleanup
  → Termination
  → No Data race
- or Java program and property
  → Assertion validity
  → No rutime exception

Output:

▶ TRUE + correctness witness	(property holds)
▶ FALSE + violation witness	(property does not hold)
▶ UNKNOWN	(failed to compute result)

Environment

Machines (1000 $ consumer machines):

- CPU: 3.4 GHz 64-bit Quad-Core CPU
- RAM: 33 GB
- OS: GNU/Linux (Ubuntu 24.04)

Resource limits for **verification**:

- 15 GB memory
- 15 min CPU time on 4 processing units

Resource limits for **validation**:

- 7 GB memory
- 15 min CPU time on 2 processing units (correctness)
- 1.5 min CPU time on 2 processing units (violation)

Scoring Schema

Common principles: Ranking measure should be

- easy to understand
- reproducible
- computable in isolation for one tool for verification track

SV-COMP:

- Ranking measure reflects the quality of verification work
- Expressed by a community-agreed score
- Tie-breaker is CPU time

For the validation track, the verdicts of the witnesses are based on voting, because we cannot afford the manual effort necessary to establish the ground truth for thousands of generated witnesses.

Scoring Schema (2025, unchanged)

Reported result	Points	Description
UNKNOWN	0	Failure, out of resources, . . .
FALSE correct	$+1$	Error found and confirmed
FALSE incorrect	-16	False alarm (imprecise analysis)
TRUE correct	$+2$	Proof found and confirmed
TRUE incorrect	-32	Missed bug (unsound analysis)

Fair and Transparent

Jury:

- Team: one member of each participating candidate
- Term: one year (until next participants are determined)

Systems:

- All systems are openly available at Zenodo
- Essential information available in FM-Tools repository
- Configurations and Setup in GitLab repository
  → Integrity and reproducibility guaranteed

80 Competition Candidates in 2025

Qualification:

- 62 in verification track
- 18 in validation track
- One person can participate with different tools
- One tool can participate with several configurations (frameworks, no tool-name inflation)

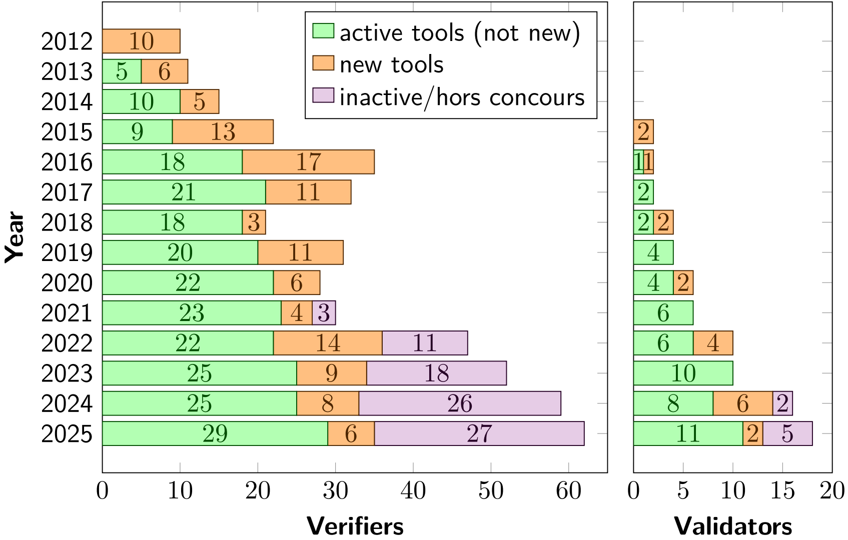
Benchmark quality:

- Community effort, documented on GitLab

Role of organizer:

- Just service: Advice, Technical Help, Executing Runs, Evaluation

Number of Participants



Benchmark Sets

- Everybody can submit benchmarks (conditions apply)
- Eight meta categories when closed (scores normalized):
  - ReachSafety: 11 268 tasks
  - MemSafety: 4 042 tasks
  - ConcurrencySafety: 3 175 tasks
  - NoOverflows: 8 211 tasks
  - Termination: 2 328 tasks
  - SoftwareSystems: 4 329 tasks
  - Overall: 33 353 tasks
  - JavaOverall: 673 tasks

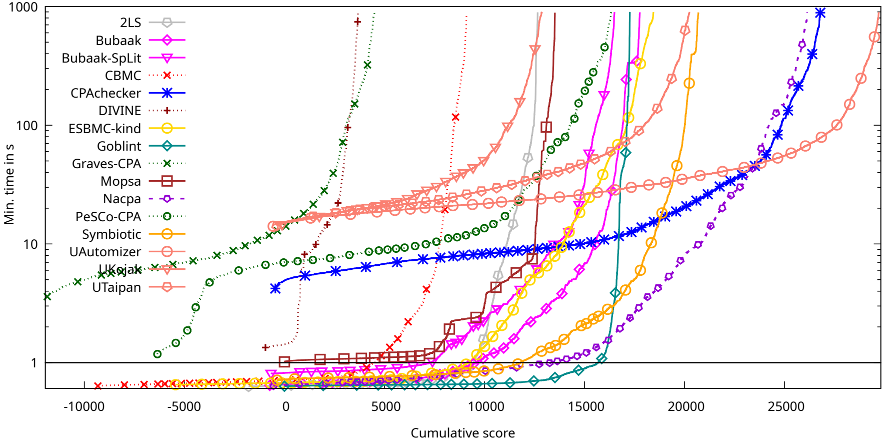
Reproducibility

- SV-Benchmarks:
  `https://gitlab.com/sosy-lab/benchmarking/sv-benchmarks`
- SV-COMP Setup:
  `https://gitlab.com/sosy-lab/sv-comp/bench-defs`
- Resource Measurement and Process Control:
  `https://github.com/sosy-lab/benchexec`
- Archives:
  `https://gitlab.com/sosy-lab/benchmarking/fm-tools`
- Witnesses:
  `https://doi.org/10.5281/zenodo.15012077`

Computation Effort:

- 942 284 verification runs (2 312 days of CPU time),
  pre-runs: 3.3 million verification runs (17 years of CPU time)
- 21.8 million validation runs, pre-runs: 88 million validation runs

Results – Example: Overall



Impact / Achievements

- Large benchmark set of verification tasks
  → established and used in many papers
  for experimental evaluation
- Good overview over state-of-the art
  → covers model checking and program analysis
- Participants have an archived track record
  of their achievements
- Infrastructure and technology for
  controlling the benchmark runs (cf. StarExec)

[Competition Report and System Descriptions
are archived in Proceedings of TACAS 2025]

New Development in 2025

- Organization committee
- More verification tasks (in each meta category)
- New Java property: no runtime exceptions (demo)
- Handcrafted witnesses in validation track
- New base categories (most prominently Intel-TDX-Module)
- Witnesses in format 2.0 also for violation witnesses
- Split hor concours into *inactive* and *meta verifiers*
- Void tasks and empty categories excluded from score computation
- Medals only for positive scores
- Sponsorship program with Huawei

Better Support of Witness Format 2.0 by Validators

Validator	Witness Format 1.0		Witness Format 2.0	
	Correctness	Violation	Correctness	Violation
ConcurrentW2T		✓		
CPAchecker	✓	✓	✓	✓
CPA-w2t$^{\varnothing}$		✓		
CProver-w2t$^{\varnothing}$		✓		
Dartagnan		✓		
Goblint			✓	
GWIT$^{\varnothing}$		✓		
JCWIT$^{\varnothing}$	✓			
LIV	✓		✓	
MetaVa	✓	✓	✓	✓
MetaVal++$^{\text{new}}$			✓	
Mopsa			✓	
NITWIT$^{\varnothing}$		✓		
Symbiotic-Witch		✓		
UAutomizer	✓	✓	✓	✓
UReferee	✓		✓	
Wit4Java		✓		
Witch				✓

Voting of Validators: Violation Witnesses 1.0

witnesses format	1.0		correct	34%
validators	11	(2 for Java)	wrong	6%
witnesses	125214		undecided	59%

refutations

6	1	0	0	0	0	0	0	0	0
5	14	5	1	0	0	0	0	0	0
4	164	72	19	63	2	0	0	0	0
3	2940	1933	3463	235	132	13	0	0	0
2	2839	7481	7394	1873	430	320	180	0	0
1	6922	15420	20894	5640	5406	4079	677	164	0
0	2198	7188	6866	5944	4131	7429	1496	847	339
	0	1	2	3	4	5	6	7	8

witness confirmations

Voting of Validators: Violation Witnesses 2.0

witnesses format	2.0	correct	28%
validators	4	wrong	1%
witnesses	29819	undecided	71%

refutations

4	21	0	0	0	0
3	31	4	0	0	0
2	248	2006	81	0	0
1	2794	8740	1159	605	0
0	2789	3686	1864	4997	794
	0	1	2	3	4

witness confirmations

Voting of Validators: Correctness Witnesses 1.0 and 2.0

witnesses format	1.0		correct	52%
validators	6	(1 for Java)	wrong	0%
witnesses	195918		undecided	48%

refutations						
2	104	14	16	0	0	0
1	864	1105	663	67	35	0
0	31340	60818	64778	22927	11039	2148
	0	1	2	3	4	5

witness confirmations

witnesses format	2.0		correct	71%
validators	8		wrong	0%
witnesses	87147		undecided	29%

refutations									
1	530	604	643	159	7	6	0	0	0
0	8497	15118	19540	18854	17546	4014	1261	284	84
	0	1	2	3	4	5	6	7	8

witness confirmations

Planned Changes for 2026

- Benchmark-category renaming and property renaming
- Extended witness formats (termination, non-termination, concurrency) (?)
- Lower limit for validation of correctness witnesses
- Instant score results (during preruns)
- Instant (but incomplete) validation results (preruns)
- Smoke tests via FM-Weck
- . . . and maybe more

Sponsorship

New sponsorship agreement with Huawei!

- Travel support (see web site)
- Demo category with awards
- Hardware support
- Student assistants

Huawei will contribute more industrial benchmark programs, will define a demo category on those, and assign prices.

Thanks to:

- TACAS (PC Chairs + TACAS SC, thanks!)
- Organization committee
- Competition jury/program committee
- Participants from community (111 people)
- Participants from Cyberagentur
- Sponsors: Huawei and LMU Munich
- Next we celebrate the winners

Report: