

RACERF: Data Race Detection with Frama-C

SV-COMP'25

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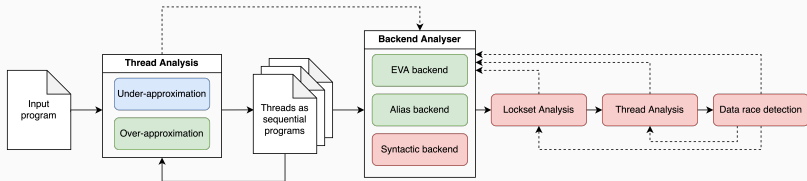
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* Supported by Brno Ph.D. Talent scholarship

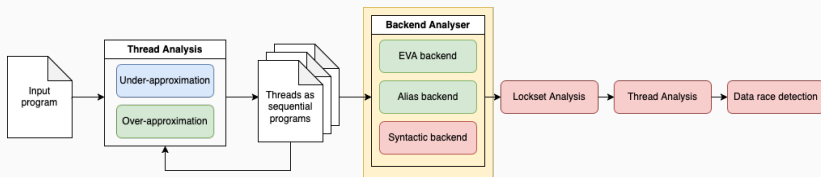
The RACERF Analyser

- Lightweight static **detection of data races**
- Analysis of concurrent programs using a **backend analyser of sequential programs**
- Heuristic approach **combining under- and over-approximation** + careful ranking
- Implemented as a plugin of the **Frama-C platform**

Analysis Overview



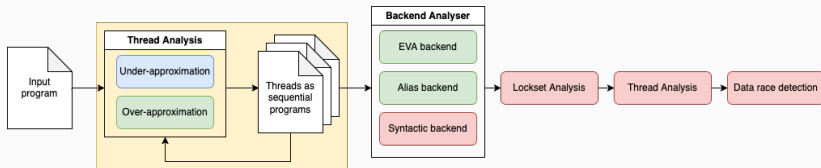
Analysis Overview



Backend analysers of sequential programs

- **EVA** – Frama-C's value analysis (used in SV-COMP)
- **Alias** – Frama-C's alias analysis
- **Syntactic** – fast but imprecise syntactic reasoning

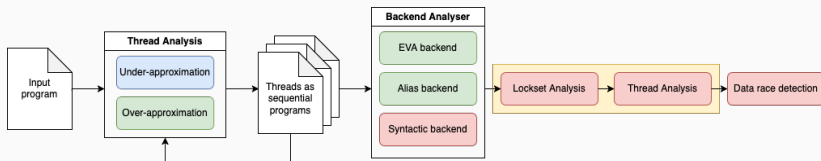
Analysis Overview



Thread Analysis

- Iteratively discovers threads and analyse them as seq. programs
- Each thread is analysed with the initial state given as:
 - **Under-approximation**: join of all states in which it was created
 - **Over-approximation**: join of all discovered states

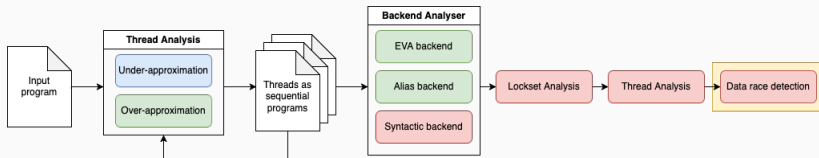
Analysis Overview



May-happen-in-parallel analyses

- Checks whether two analysis contexts can **happen in parallel**
- **Lockset analysis** – lock synchronization
- **Active-thread analysis** – create-join synchronization

Analysis Overview



Data race detection

- Classification to may-/must-races (using results of prev. phases)
- Under-approximation + must-race \rightsquigarrow violation
- Over-approximation + no may-races \rightsquigarrow program claimed correct

Results

	Analyser	Correct		Wrong		OOR	Score	Time [s]
		True	False	True	False			
1.	GOBLINT	712	0	0	0	3	1424	2320
2.	RACERF	674	68	0	4	0	1352	1300
3.	DEAGLE	685	0	1	0	43	1338	10 000

OOR – Out of time/memory, Time – total time (excluding timeouts)

- Second place in *NoDataRace* sub-category
- Only analyser providing (correct) results for all programs derived from the Linux kernel (among most complex in the sub-category)