JBMC: A Bounded Model Checking Tool for Verifying Java Bytecode

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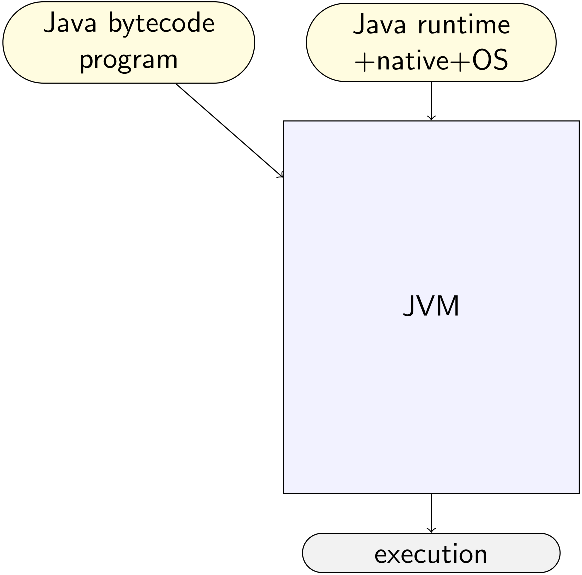
diffblue AI for Code

TACAS / SV-COMP 2023

JVM vs JBMC



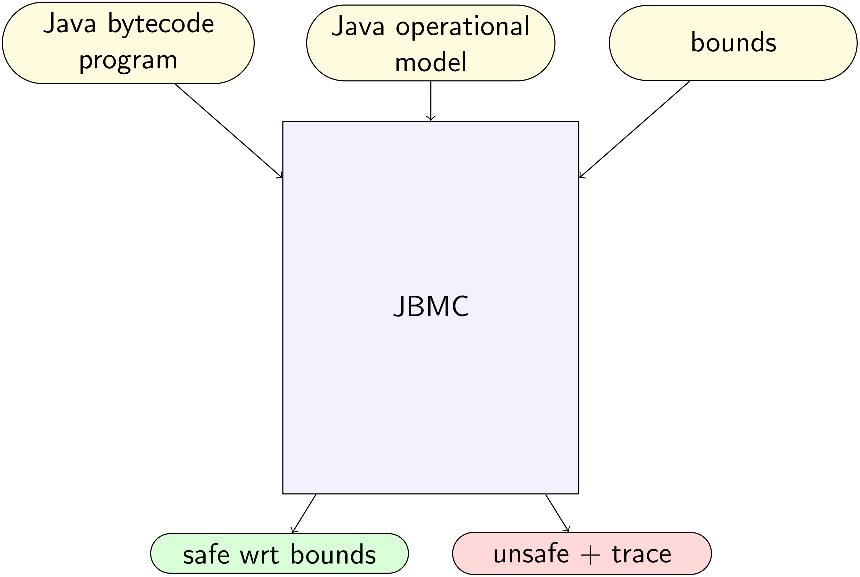
Java bytecode program

Java runtime +native+OS

JVM

execution

JVM vs JBMC



Java bytecode program

Java operational model

bounds

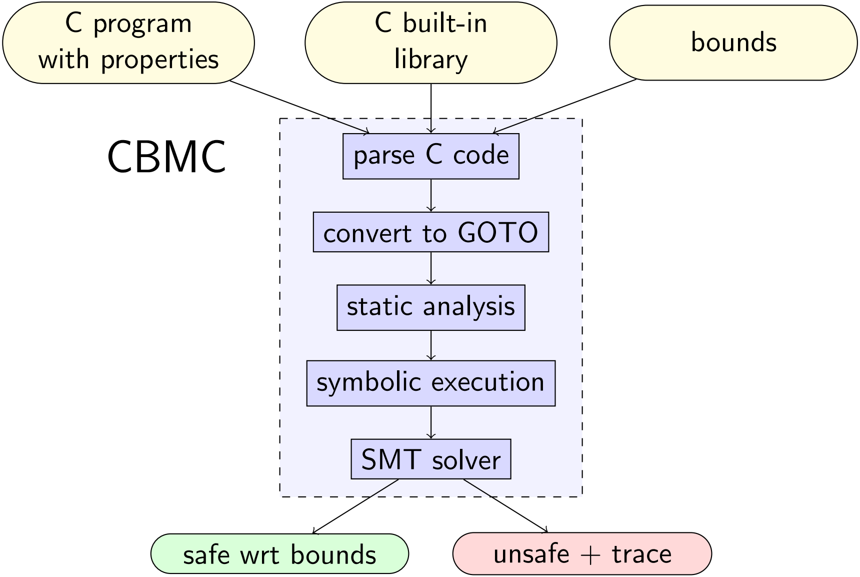
JBMC

safe wrt bounds

unsafe + trace

CBMC

Clarke, Kroening & Lerda, TACAS'04



C program with properties

C built-in library

bounds

CBMC

parse C code

convert to GOTO

static analysis

symbolic execution

SMT solver

safe wrt bounds

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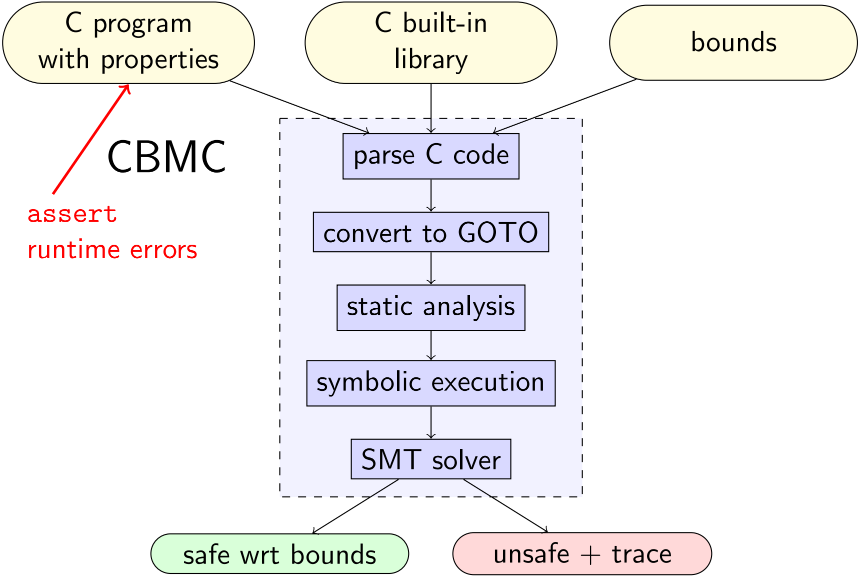
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runtime errors

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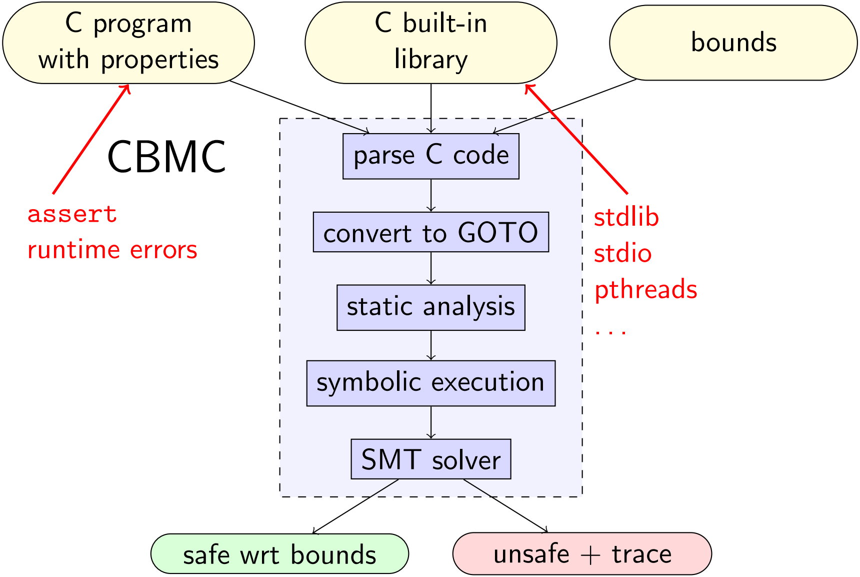

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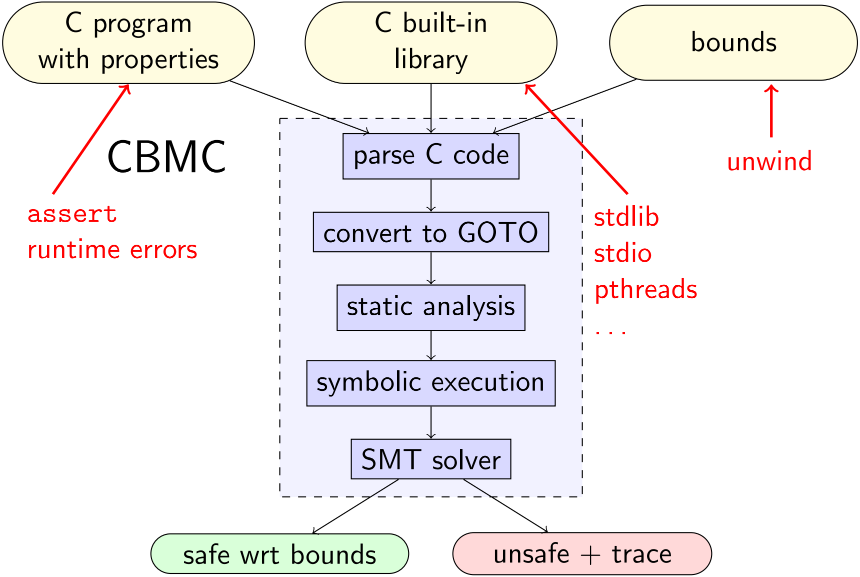

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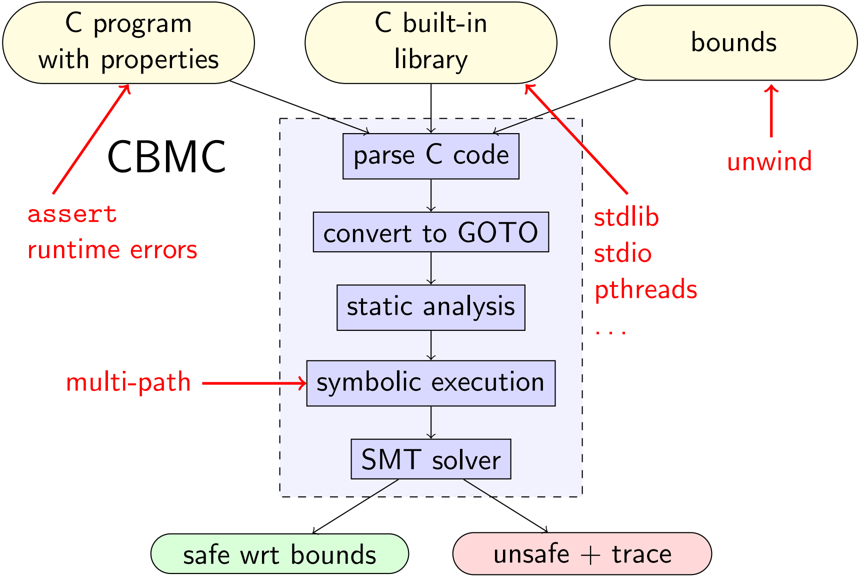

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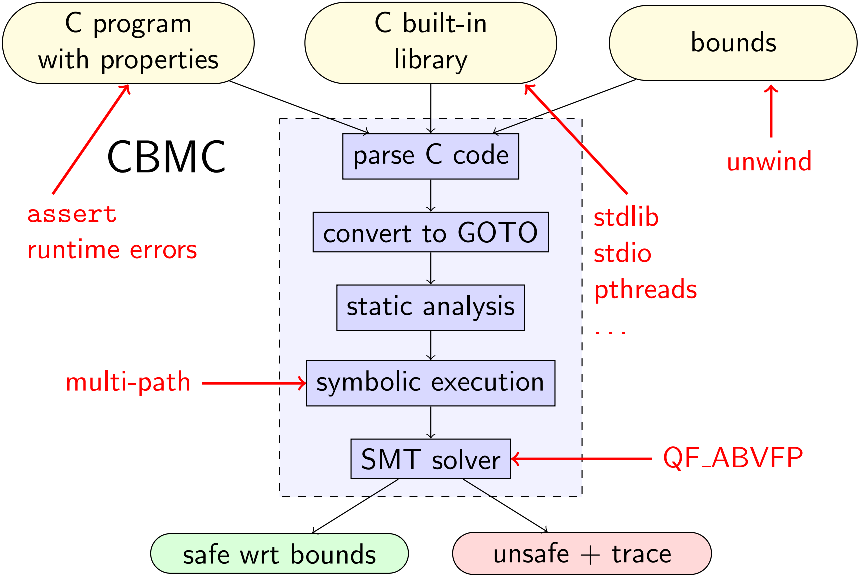
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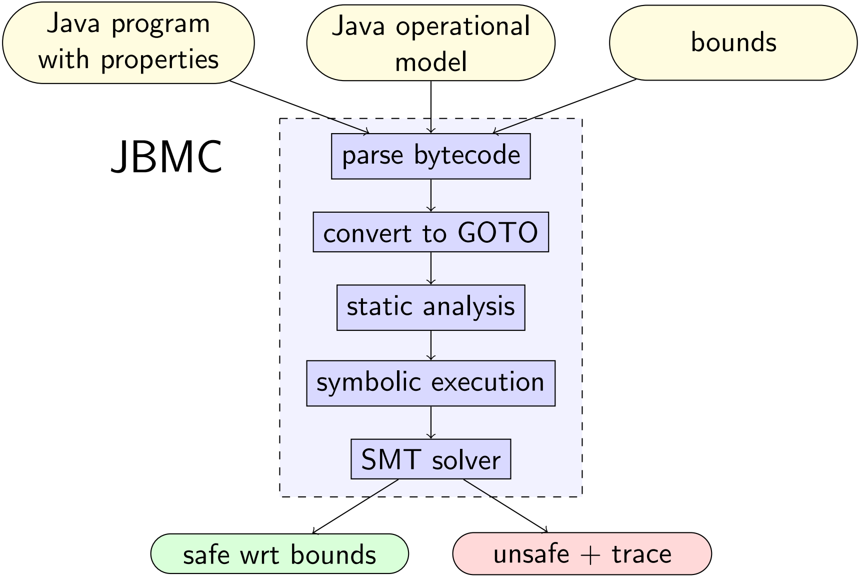
QF_ABVFP

JBMC

Cordeiro et al CAV'18



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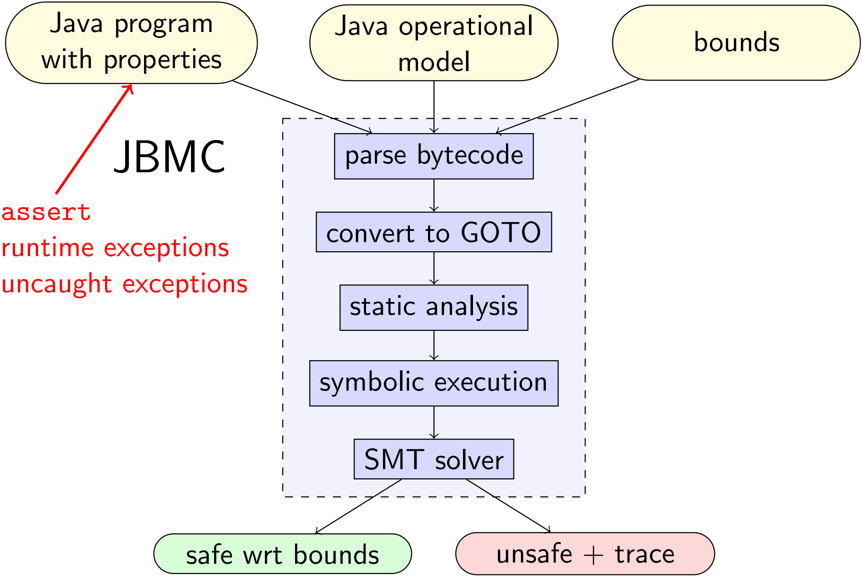
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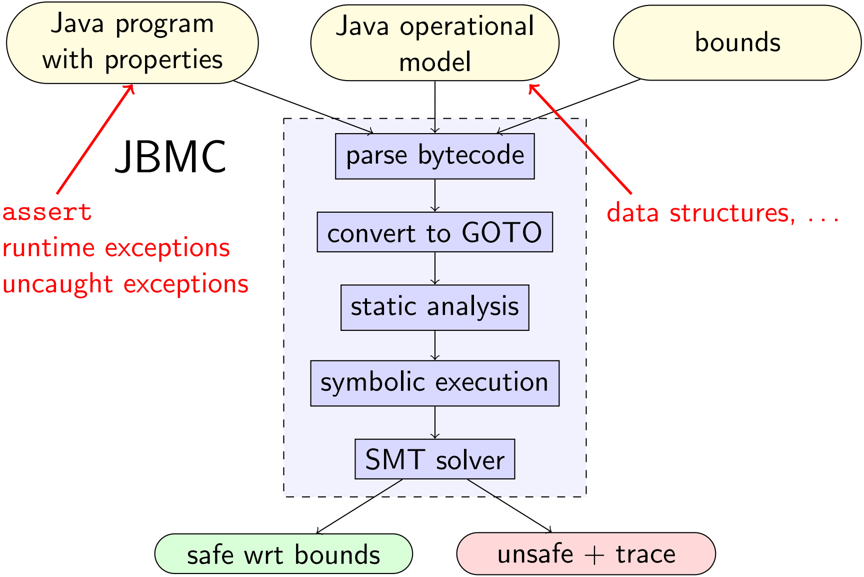
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data structures, ...

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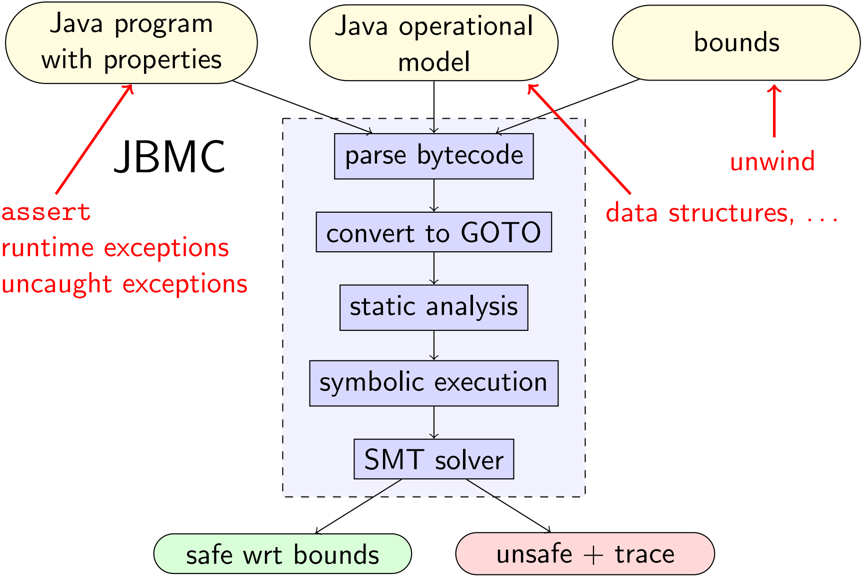
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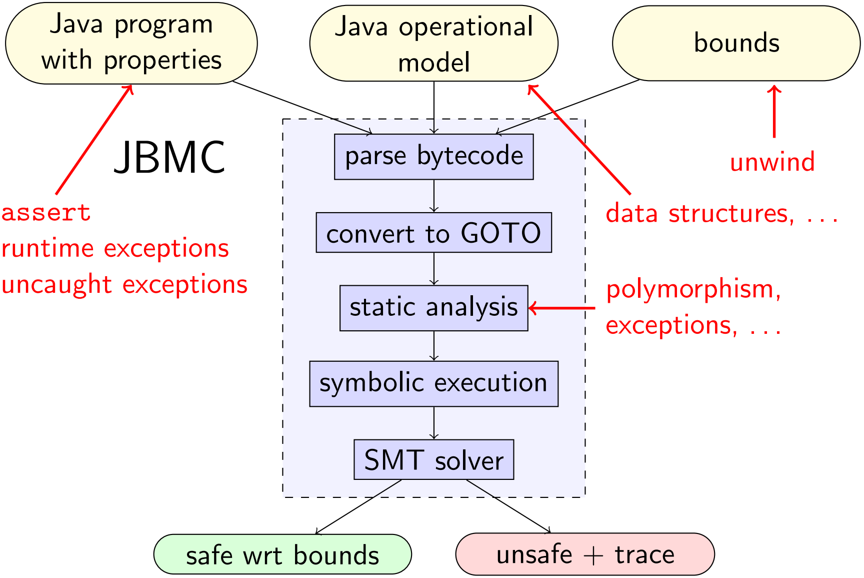
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data structures, ...

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polymorphism, exceptions, ...

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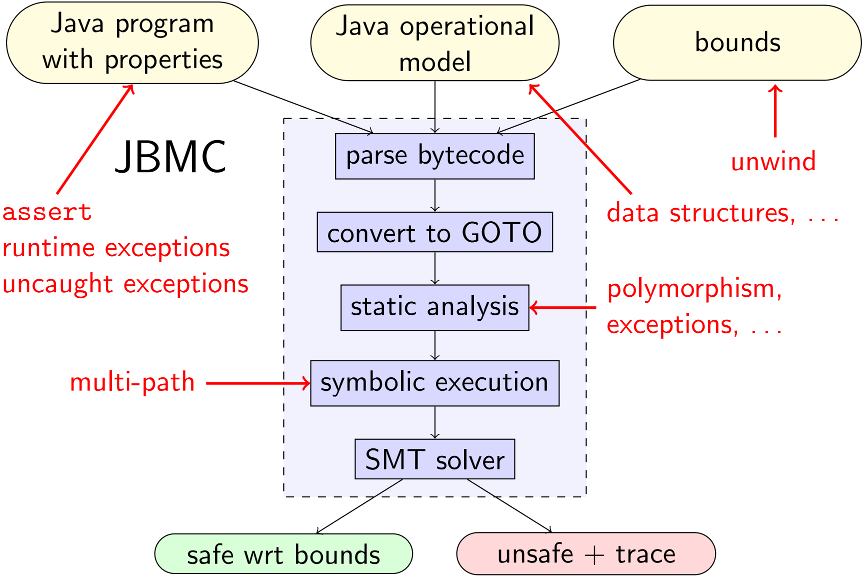

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data structures, ...

polymorphism,
exceptions, ...

multi-path

JBMC

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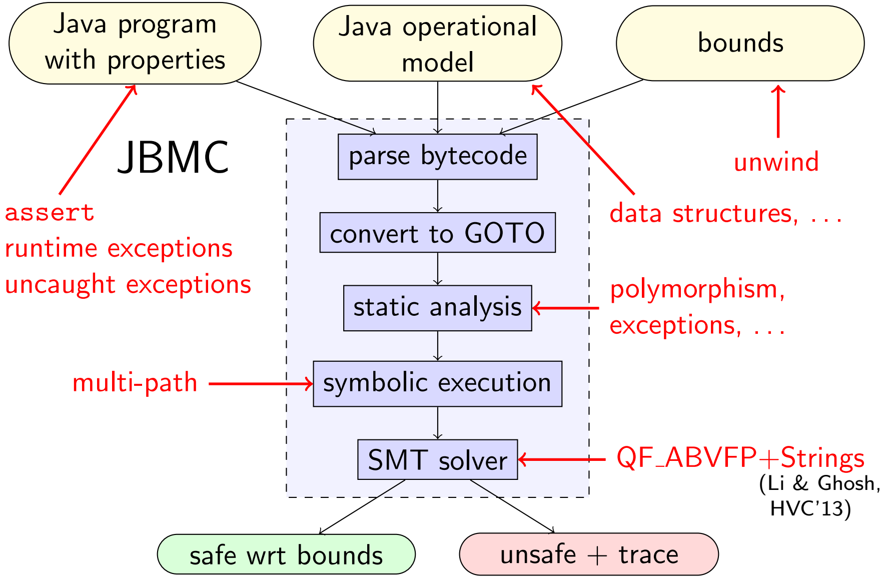

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QF_ABVFP+Strings (Li & Ghosh, HVC'13)

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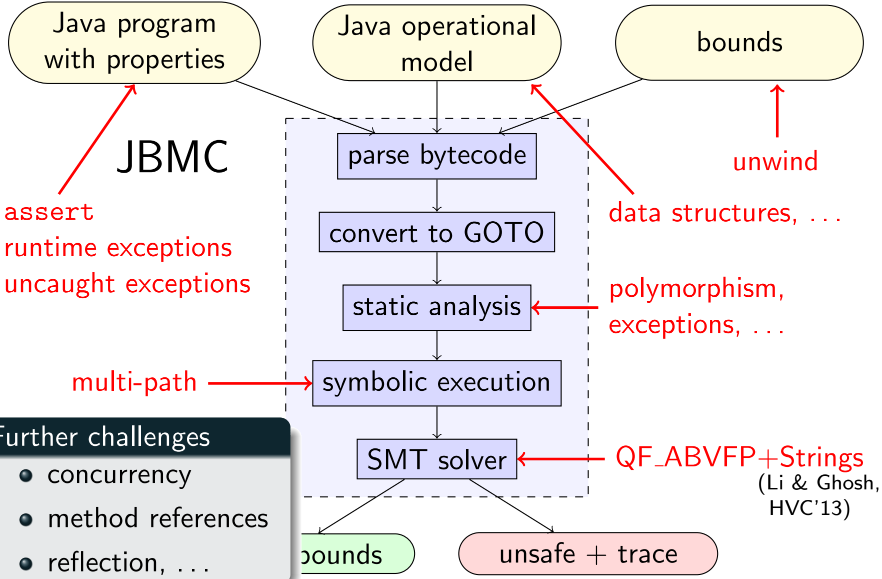
Cordeiro et al CAV'18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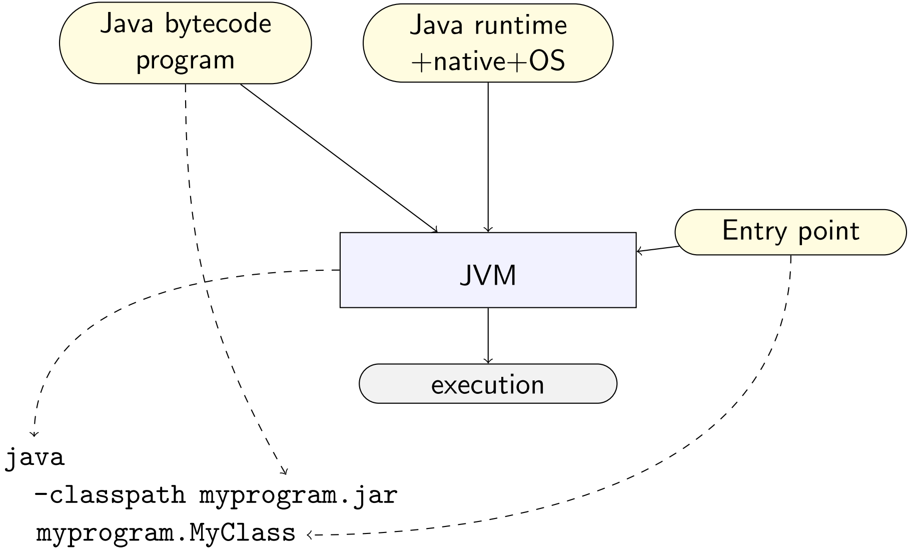
Further challenges

- concurrency
- method references
- reflection, . . .

Usage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JVM
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```
java
  -classpath myprogram.jar
  myprogram.MyClass
```

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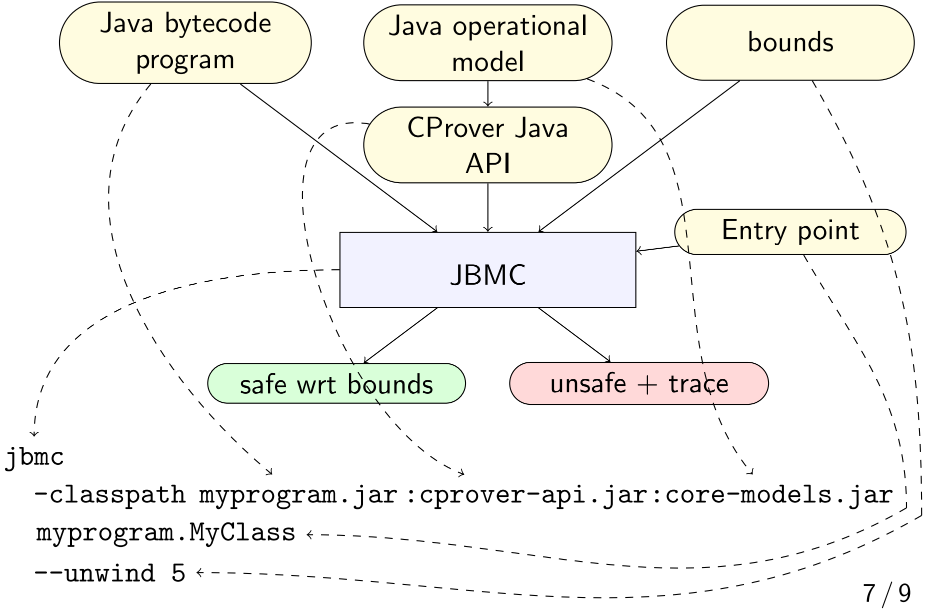


Java bytecode program

Java operational model

bounds

CProver Java API

Entry point

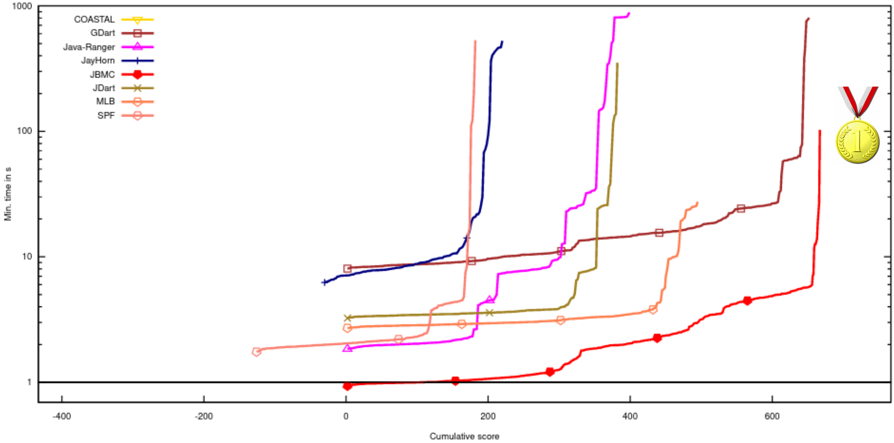
JBMC

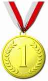
safe wrt bounds

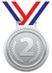
unsafe + trace

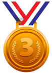
```
jbmc
  -classpath myprogram.jar:cprover-api.jar:core-models.jar
  myprogram.MyClass
  --unwind 5
```

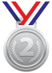
SV-COMP 2023 Results

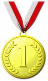


2019 

2020 

2021 

2022 

2023 

What's next

JBMC:

- Improved dynamic analysis
- Improved witness output

SV-COMP Java track:

- More and better benchmarks
- RuntimeException category
- Correctness witness checking

`https://github.com/diffblue/cbmc/tree/develop/jbmc`