Java Pathfinder at SV-COMP-2019

Cyrille Artho
KTH Royal Institute of Technology
Stockholm, Sweden
Willem Visser
Stellenbosch University
Stellenbosch, South Africa

and many, many contributors

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What can software model checking do?

➤ Backtrack program execution.
➤ Explore all possible schedules!
➤ Find all program failures.
What is Java PathFinder?

- Born as software model checker for Java bytecode.
- Evolved into multi-purpose tool framework.

Image source: Java PathFinder tutorial, [http://babelfish.arc.nasa.gov/trac/jpf/attachment/wiki/presentations/start/jpf-graphics.z](http://babelfish.arc.nasa.gov/trac/jpf/attachment/wiki/presentations/start/jpf-graphics.z)
Architecture of JPF
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- **JPF**: virtual machine on top of "host JVM".
- Explicit-state model checker.
- No native code in SUT + model classes.
- **Native peer classes** can access native code from underlying JVM.
- Native peers are not managed or backtracked by JPF.

Diagram:

```
Java PathFinder
  SUT
  Model classes
  JPF-level virtual machine
  Native peer classes
Host JVM
```
JPF extensions

JPF extensions:

➤ Separate projects.

➤ Extend or override jpf-core.

➤ New features:
  – Native code bridge.
  – Network I/O.
  – Temporal logics.
  – Symbolic model checking.
History of JPF

- **1999: Project started** at NASA Ames as front end to Spin model checker.
- **2000: Reimplementation** as concrete virtual machine.
- **2003: Introduction of extension interfaces.**
- **2005: Open sourced** on sourceforge.
- **2008: First participation in Google Summer of Code.**
- **2009: Moved to own server, hosting extension projects and wiki.**
- **2017: Moved to github.**
- Many collaborators/users:
  - Academia: > 20 univ. (USA, Canada, Japan, South Africa, Europe).
  - Companies: Fujitsu, other Fortune 500 companies.
Summary/Outlook

➤ SV-COMP 2019 for Java just scratched the surface.

➤ **Wanted:**
  
  – interesting concurrent benchmarks;
  – programs using native code;
  – multi-process (networked) applications.