Keshmesh: Detecting Concurrency Bug Patterns in Java Programs

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ABOUT
As multithreaded application development becomes more popular, an increasing number of programmers are having difficulty creating applications that behave as expected. Keshmesh is a plugin for the popular IDE Eclipse that makes bug pattern detection in multithreaded Java applications easier. Keshmesh analyzes the Java bytecode to find certain patterns that are commonly associated with concurrency related bugs, and it then reports them to the programmer using the Eclipse FindBugs interface.

GOALS
• Deepen my understanding of multithreaded programming
• Identify common pitfalls programmers make when developing multithreaded applications
• Evaluate Keshmesh on open source projects
• Contribute to the open source community by reporting concurrency related bugs

PROTECTING SHARED FIELDS
Certain measures must be taken to protect access to shared variables amongst threads. Otherwise, the program can exhibit non-deterministic behavior, which is extremely difficult to debug. To protect shared fields, programmers should do one of the following:

• Mark the field as volatile
• Use an Atomic* object as the shared field
• Access the field in a synchronized block

Keshmesh reports violations of the above as bug pattern type VNA00-J

PROGRESS
• When designing complex applications, ensuring thread safety is becoming increasingly more difficult
• Most recently, Keshmesh found several concurrency related bugs in the open source application OkHttp (see above for an example)
• The issue was reported, and the developers confirmed and fixed the bug
• Keshmesh has helped identify concurrency related issues in many open source projects

“Nice find on the OkHttp bug. I have no idea how you found it, but it's a real problem and I got a fix out. The threading code in OkHttp is pretty subtle, especially for SPDY where there's a lot of threads to coordinate. I'd love to do more static analysis on it to figure out where the other problems are.”

--OkHttp Developer, in response to a bug discovered with the help of Keshmesh

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