

Automated Source-Code Refactoring for Framework Migration and Vulnerability Patches

Zohra Zekeria

07/12/2022

About Me (Zohra Zekeria)

- Master's degree in Computer Science from TU Berlin.
- Worked as Linux System administrator (Debian, Xen)
- Software development PHP (Laravel, MySQL, jQuery)
- Java developer in DEVK since 2021 (Spring, Gitlab, Docker, K8s)

Outline



Motivation



JUnit 4
JUnit 5

spring®
ASHELL 

<https://www.traceable.ai/blog-post/spring4shell-vulnerability-cve-2022-22965-enables-remote-code-execution-when-using-the-spring-framework>

<https://www.arhohuttunen.com/junit-5-migration/>

<https://www.walkme.com/blog/effective-training-software-migration/>

OpenRewrite

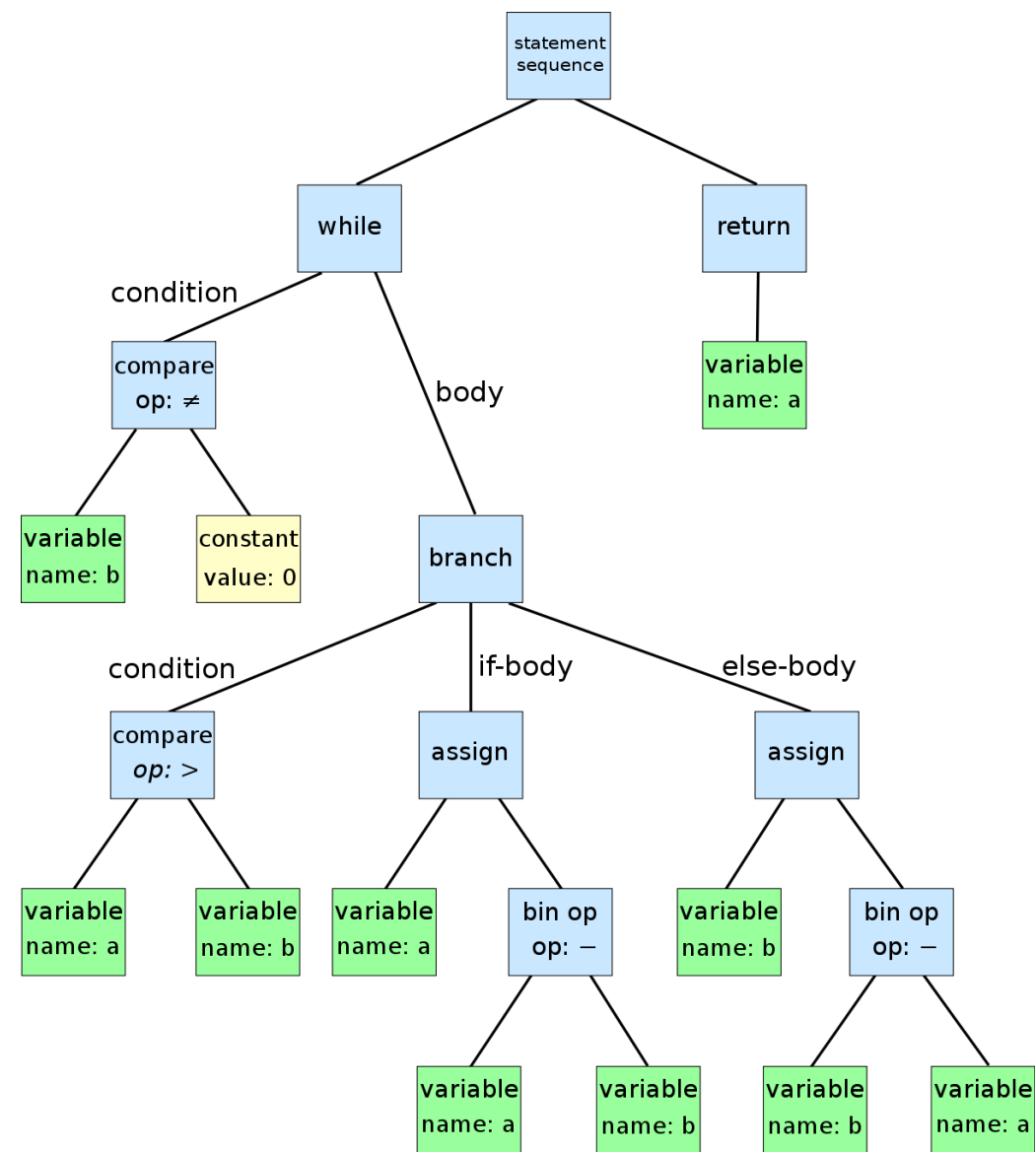
- “It is a semantic code search and transformation ecosystem for Java and other source code”
- “It consists of a platform of pre-packaged refactoring recipes for common framework migration and stylistic consistency tasks”

How OpenRewrite works?

- OpenRewrite generates Abstract Syntax Trees ASTs from the source code.
- Then writes source code files back to the AST after the code refactoring.

Abstract Syntax Tree

```
while b ≠ 0
  if a > b
    a := a - b
  else
    b := b - a
  return a
```



OpenRewrite's AST

Typed Attribute

Format-Preserving

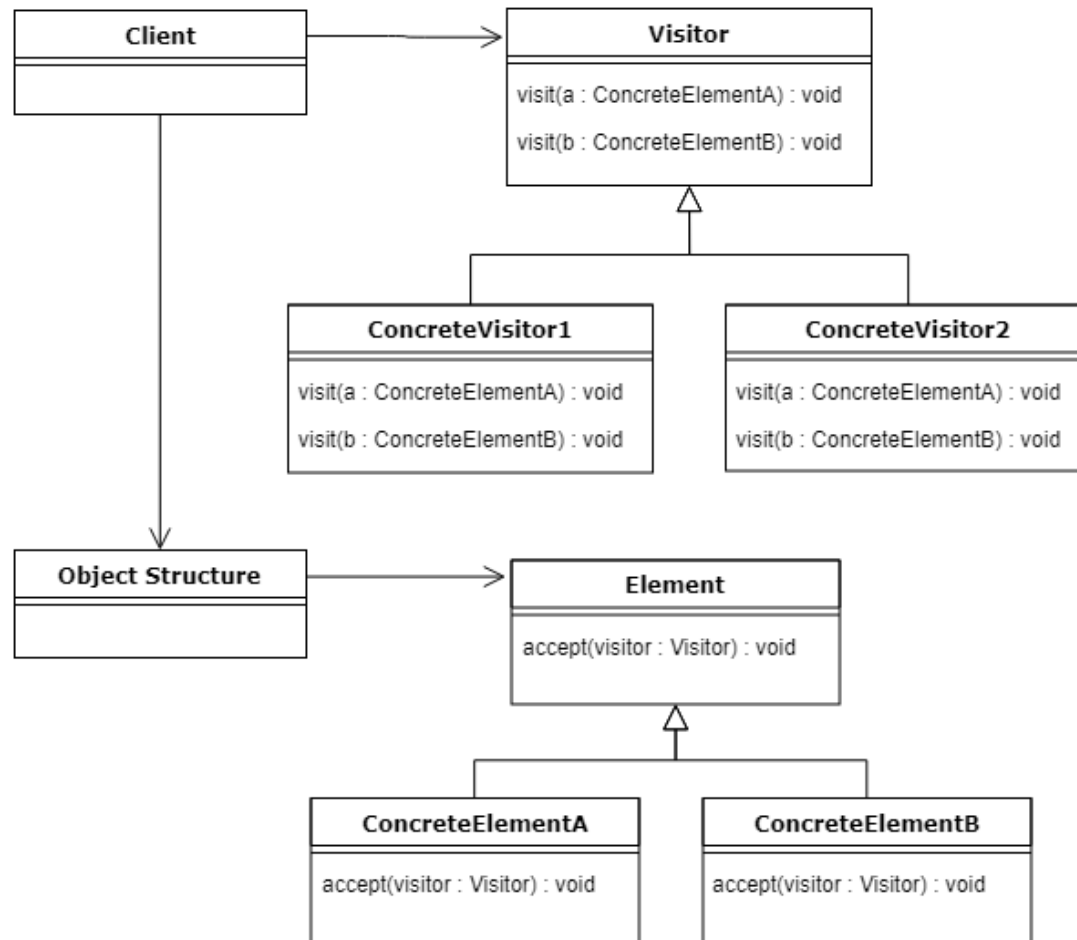
Acyclic and serializable

Ex: `class A<T extends A<T>>`

Refactoring

- The code refactoring is performed using the visitor design pattern. Visitors can be compared to event-handlers that include a single refactoring change which is called recipe.
- For example, change all imports to static imports.
- Or many operations in one recipe, Migrating to a new framework

Visitor Pattern



Recipes for Common Problems

- mvn rewrite:discover
 - Change method invocations to static method calls.
 - migration from SpringBoot 1 to SpringBoot 2.
 - Log4jToSlf4j
 - migrate.Java8toJava11
 - SpringBoot2JUnit4to5Migration

Demo



- Shopizer 2.16.0
- Java 8
- Recipes:
 - `migrate.Java8toJava11`
 - `SpringBoot2JUnit4to5Migration`



<https://github.com/shopizer-ecommerce/shopizer/tags>


Demo Cont...



Possible solution to the Java heap Problem:

```
export MAVEN_OPTS="-Xmx1024M -Xss128M -XX:MetaspaceSize=512M -XX:MaxMetaspaceSize=1024M -XX:  
+CMSClassUnloadingEnabled"
```

```
<plugin>  
  <groupId>org.openrewrite.maven</groupId>  
  <artifactId>rewrite-maven-plugin</artifactId>  
  <version>4.37.0</version>  
  <configuration>  
    <activeRecipes>  
      <recipe>org.openrewrite.java.migrate.Java8toJava11</recipe>  
    </activeRecipes>  
  </configuration>  
  <dependencies>  
    <dependency>  
      <groupId>org.openrewrite.recipe</groupId>  
      <artifactId>rewrite-migrate-java</artifactId>  
      <version>1.13.0</version>  
    </dependency>  
  </dependencies>  
</plugin>
```



Demo Cont...

```
<plugin>
  <groupId>org.openrewrite.maven</groupId>
  <artifactId>rewrite-maven-plugin</artifactId>
  <version>4.37.0</version>
  <configuration>
    <activeRecipes>
      <recipe>org.openrewrite.java.spring.boot2.SpringBoot2JUnit4to5Migration
    </recipe>
    </activeRecipes>
  </configuration>
  <dependencies>
    <dependency>
      <groupId>org.openrewrite.recipe</groupId>
      <artifactId>rewrite-spring</artifactId>
      <version>4.29.0</version>
    </dependency>
  </dependencies>
</plugin>
```

Recipe Development Environment

- JDK (version 1.8+)
- Gradle (version 4.0+) or Maven (version 3.2+)
- Text Editor or IDE with Java support.
- Use rewrite-recipe-starter template

Demo

- SayHelloRecipe

Demo Cont...

```
<plugin>
  <groupId>org.openrewrite.maven</groupId>
  <artifactId>rewrite-maven-plugin</artifactId>
  <version>4.37.0</version>
  <configuration>
    <activeRecipes>
      <recipe> com.hello.app.Hello</recipe>
    </activeRecipes>
  </configuration>
  <dependencies>
    <dependency>
      <groupId>com.hello.app</groupId>
      <artifactId>Hello</artifactId>
      <version>1.0.0-SNAPSHOT</version>
    </dependency>
  </dependencies>
</plugin>
```

Demo Cont...

rewrite.yml

type: specs.openrewrite.org/v1beta/recipe

name: com.hello.app.Hello

recipeList:

- com.hello.app.HelloCyberLand:

 - fullyQualifiedClassName: com.myapp.Mytest



Q&A

References

- <https://riECKpil.de/automatic-java-code-migration-with-openrewrite-mockito-example/>
- <https://docs.openrewrite.org>
- <https://astexplorer.net/>
- <https://refactoring.guru/design-patterns/visitor>



Thank you

Zohra Zekeria

zohra.zekeria@devk.de