# Software Dependability Report

Gianluca Ronga

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## 1 Context of the Project

The major disadvantage of the Java platform is that still today the only portable way to start a Java application relies on a single point of entry: the public static void main(String[]) method.

Having a single-point of entry is a valid solution for client applications, where interactively a user can command to the application to quit, but in those cases where the application is not interactive (server applications) there is currently no portable way to notify the Virtual Machine of its imminent shutdown.

The Apache Commons Daemon project is part of the Apache Commons library and provides utilities for creating, managing, and running Java applications as daemons or services. A ”daemon” (on Unix-based systems) or ”service” (on Windows) is a background process that runs independently of any interactive user session, which makes it suitable for applications that need to perform tasks without requiring user intervention, like servers, network applications, or scheduled background jobs.

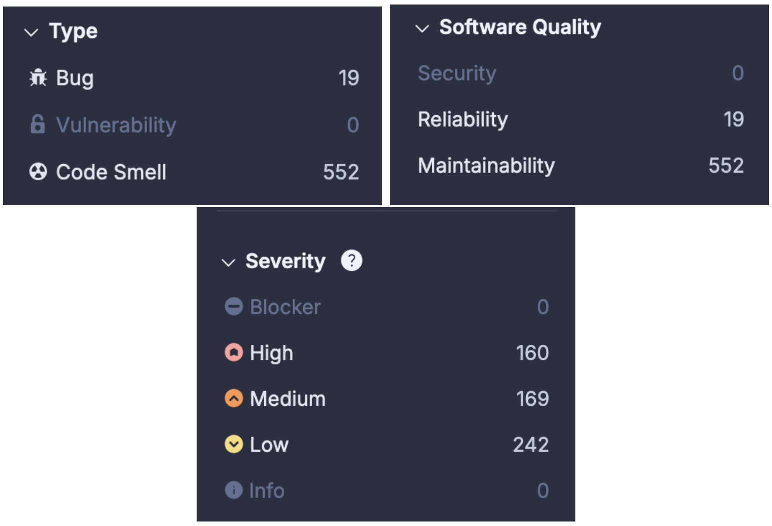
## 2 Goal of the Project

The goal of the Apache Commons Daemon project is to provide a standardized framework for creating and managing Java applications that run as background services. In particular, Apache Commons Daemon simplifies the process of running Java applications as persistent low-level background services that start and stop with the operating system. The project includes tools and utilities to ensure that Java applications can be controlled using typical system administration commands, such as starting, stopping, and restarting.

## 3 Methodology

### 3.1 SonarCloud

SonarCloud was used to perform an in-depth analysis of the software's quality. After analyzing the code, the following issues were found:



| Type | |
|---|---|
| Bug | 19 |
| Vulnerability | 0 |
| Code Smell | 552 |

| Software Quality | |
|---|---|
| Security | 0 |
| Reliability | 19 |
| Maintainability | 552 |

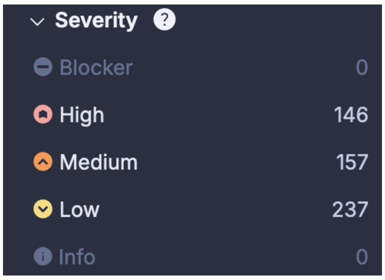
| Severity ? | |
|---|---|
| Blocker | 0 |
| High | 160 |
| Medium | 169 |
| Low | 242 |
| Info | 0 |

3.1.1 SonarCloud Report

The focus was set on Maintainability issues, in particular:

- A total of 150 issues were classified as high-severity code smells, most of them regarding the Cognitive Complexity of functions being too high. Cognitive complexity is a measure of how hard it is to understand the control flow of a unit of code. Code with high cognitive complexity is hard to read, understand, test, and modify.
- A total of 153 issues were classified as medium severity code smells, they were of several types: replacing the system.err or system.out with a logger, catching the Exception instead of a Throwable and some ”unused” and ”redundancy” errors.
- A total of 242 issues were classified as low severity, they were all code smells and include: deprecated functions, redundant casts, resolve the TODO comments, etc.

Some of these issues were solved from all of the three severity of errors, lowering the number of issues as follows:



| Severity | |
|---|---|
| Blocker | 0 |
| High | 146 |
| Medium | 157 |
| Low | 237 |
| Info | 0 |

3.1.2 Issues Severity after Corrections

The decision not to address many Cognitive Complexity issues was primarily due to two factors: the risk of introducing new bugs or code smells during refactoring, as these are inherently complex functions, and the challenge of isolating them. These functions often have numerous dependencies, so refactoring would require extensive modifications to other parts of the code.

## 3.2 Docker

Docker is an open-source platform designed to automate the deployment, scaling, and management of applications in lightweight, portable containers. In order to achieve containerization, a Dockerfile was needed, a file that contains collections of commands that will be automatically executed, in sequence, in the Docker environment to build a new Docker image.

In the Dockerfile, the following code was written:

```
FROM openjdk:8
ADD target/simple−docker.jar simple−docker.jar
ENTRYPOINT [”java”, ”−jar”,”simple−docker.jar”]
EXPOSE 8080
```

- FROM: The FROM keyword tells the Docker the base image for the build.
- ADD and ENTRYPOINT: those keywords find and manage the new jar file created in the /target directory.
- EXPOSE: this keyword makes the 8080 port available outside the Docker container.

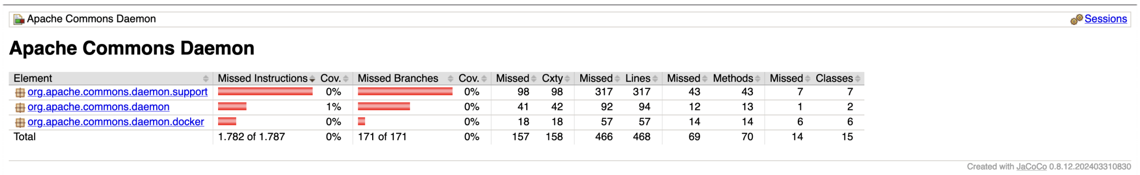
Additionally, several Java classes were created to simulate a Daemon process and test whether the project was runnable. The goal was to generate two files: output.txt and log.txt. One class writes to the output.txt file, whereas a thread monitors changes to this file and logs the infos in log.txt. The Daemon process includes a 5-second cooldown to prevent the log.txt file from overflooding due to excessive inputs.

There is the full fileDaemon.java class (excluding imports):

```
public class fileDaemon {

    private static final Logger logger = Logger.getLogger(example.class.getName());
    static class FileMonitorDaemon implements Runnable {
        private final String monitoredFile;
        private final String logFile;
        private long lastModified = 0;

        public FileMonitorDaemon(String monitoredFile, String logFile) {
            this.monitoredFile = monitoredFile;
            this.logFile = logFile;
        }

        @Override
        public void run() {
            System.out.println("File monitor daemon avviato.");
            while (true) {
                try {
                    Thread.sleep(5000);
                    checkForNewEntries();
                } catch (InterruptedException | IOException e) {
                    logger.log(Level.SEVERE, "An error occurred", e);

                    if (e instanceof InterruptedException) {
                        Thread.currentThread().interrupt();
                    }
                }
            }
        }

        private void checkForNewEntries() throws IOException {
            File file = new File(monitoredFile);
            if (file.exists() && file.lastModified() > lastModified) {
                logEntry(logFile, "File " + monitoredFile +
                " modificato alle " + new Date(file.lastModified()));
                lastModified = file.lastModified();
            }
        }

        private void logEntry(String logFileName, String message) throws IOException{
            try (OutputStream logFile = new FileOutputStream(logFileName, true);
                 PrintStream logOut = new PrintStream(logFile)) {
                SimpleDateFormat fmt = new SimpleDateFormat("yyyy-MM-dd HH:mm:ss");
                String logEntry = fmt.format(new Date()) + " - " + message;
                logOut.println(logEntry);
            }
        }
    }
}
```

## 3.3 JaCoCo

JaCoCo was used in order to measure code coverage. By employing this tool it was possible to generate a comprehensive report that shows the extent to which the code has been covered. These pictures below provides a clear and concise overview of the code coverage achieved:



Apache Commons Daemon

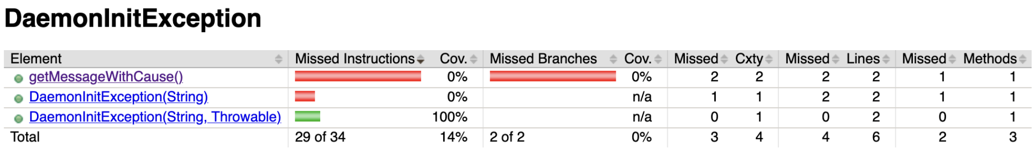
Apache Commons Daemon

| Element | Missed Instructions | Cov. | Missed Branches | Cov. | Missed | Cxty | Missed | Lines | Missed | Methods | Missed | Classes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| org.apache.commons.daemon.support | | 0% | | 0% | 98 | 98 | 317 | 317 | 43 | 43 | 7 | 7 |
| org.apache.commons.daemon | | 1% | | 0% | 41 | 42 | 92 | 94 | 12 | 13 | 1 | 2 |
| org.apache.commons.daemon.docker | | 0% | | 0% | 18 | 18 | 57 | 57 | 14 | 14 | 6 | 6 |
| Total | 1.782 of 1.787 | 0% | 171 of 171 | 0% | 157 | 158 | 466 | 468 | 69 | 70 | 14 | 15 |

Created with JaCoCo 0.8.12.202403310830

3.3.1 JaCoCo Project Report

As shown in the image 3.3.1, the Instructions and Branches coverages are basically 0%, in the following image we can see the report of the only class that had some coverage, that is DaemonInitException:



**DaemonInitException**

| Element | Missed Instructions | Cov. | Missed Branches | Cov. | Missed | Cxty | Missed | Lines | Missed | Methods |
|---|---|---|---|---|---|---|---|---|---|---|
| getMessageWithCause() | 🟥 | 0% | 🟥 | 0% | 2 | 2 | 2 | 2 | 1 | 1 |
| DaemonInitException(String) | 🟥 | 0% |  | n/a | 1 | 1 | 2 | 2 | 1 | 1 |
| DaemonInitException(String, Throwable) | 🟩 | 100% |  | n/a | 0 | 1 | 0 | 2 | 0 | 1 |
| Total | 29 of 34 | 14% | 2 of 2 | 0% | 3 | 4 | 4 | 6 | 2 | 3 |

3.3.2 JaCoCo DaemonException Report

The probable reason on why this class was the only one tested may be that Commons Daemon is a project designed to facilitate the integration of Java applications with system daemons. A significant portion of its core functionality relies heavily on native code (C/C++) and interaction with the operating environment. This strong dependency on external systems may have rendered Java unit tests less effective in thoroughly verifying the project's behavior. As a result, the developers might have prioritized manual testing or system-level integration tests, leaving the implementation of a comprehensive Java unit test suite as a lower priority.

## 3.4 Pitest

Pitest is an open-source tool designed for mutation testing in Java applications. This testing approach evaluates the quality of a test suite by intentionally injecting defects, known as mutations, into the code and checking whether the test suite can identify them. Pitest works by generating altered versions of the source code using different mutation operators, such as eliminating method calls or modifying mathematical operators. Each mutation simulates a possible defect, helping to gauge the effectiveness of the test suite.

### Line Coverage

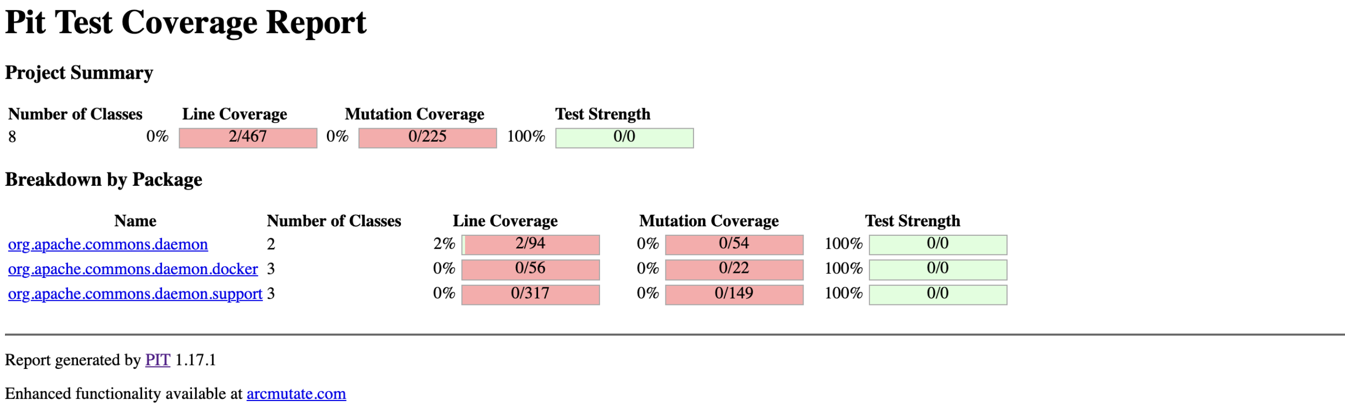
Line coverage measures the percentage of code lines executed during testing. It identifies which lines of the source code are reached by the test suite, ensuring that critical paths in the application are exercised. However, high line coverage does not guarantee comprehensive testing, as it doesn't account for untested logic or edge cases.

### Mutation Coverage

Mutation coverage evaluates the quality of the test suite by introducing small changes (mutations) to the code, such as altering operators or variables, and checking if the tests fail as expected. If tests do not catch these mutations, it indicates insufficient coverage. This approach highlights gaps in testing logic that might otherwise be missed by traditional metrics like line coverage.

### Test Strenght

Test strength refers to the ability of a test suite to detect bugs or subtle errors in the code. It assesses whether the tests not only execute the code but also validate its correctness against expected behavior. A strong test suite ensures robust validations, covering edge cases, boundary conditions, and error scenarios effectively.



**Pit Test Coverage Report**

**Project Summary**

| Number of Classes | Line Coverage | Mutation Coverage | Test Strength |
|---|---|---|---|
| 8 | 0% 2/467 | 0% 0/225 | 100% 0/0 |

**Breakdown by Package**

| Name | Number of Classes | Line Coverage | Mutation Coverage | Test Strength |
|---|---|---|---|---|
| org.apache.commons.daemon | 2 | 2% 2/94 | 0% 0/54 | 100% 0/0 |
| org.apache.commons.daemon.docker | 3 | 0% 0/56 | 0% 0/22 | 100% 0/0 |
| org.apache.commons.daemon.support | 3 | 0% 0/317 | 0% 0/149 | 100% 0/0 |

Report generated by PIT 1.17.1

Enhanced functionality available at arcmutate.com

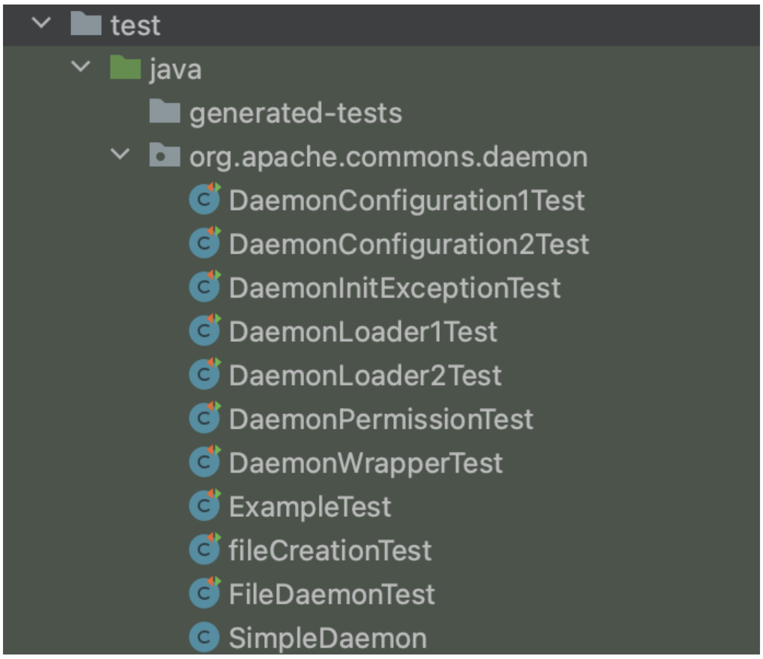
3.4.1 Pitest Project Report

As shown in the image, the mutation coverage value is nearly identical to the line coverage. Given the current state of the project, it is meaningless to delve deeper into the coverage reports without first creating additional test cases.

## 3.5 Randoop

Randoop is an automated test generation tool for Java programs. It creates unit tests by randomly exploring the program's behavior, constructing sequences of method calls, and validating the program's output against its contracts, such as avoiding exceptions or returning consistent results.

This tool was used in order to drastically increase the amount of code coverage of the project, and it's output was limited to 1000 in order to reduce the generation time.



test
java
generated-tests
org.apache.commons.daemon
DaemonConfiguration1Test
DaemonConfiguration2Test
DaemonInitExceptionTest
DaemonLoader1Test
DaemonLoader2Test
DaemonPermissionTest
DaemonWrapperTest
ExampleTest
fileCreationTest
FileDaemonTest
SimpleDaemon

3.5.1 Test Classes Generated by Randoop

The tests generated by Randoop encountered compatibility issues with the JUnit version being used, specifically due to the use of the generic "assert" method. This issue was resolved by replacing occurrences of "assert" with the appropriate specific assertions, such as "assertNull" and "assertNotNull" throughout the test classes.

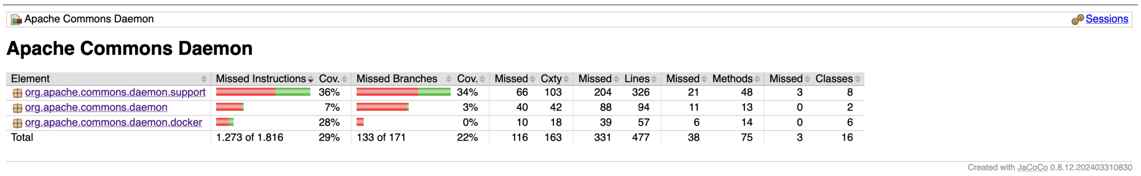
Randoop encountered challenges in generating effective tests for the DaemonWrapper class, as the tests produced were inconclusive. Additionally, compatibility issues with the JUnit version used led to numerous errors and, as a result, GitHub Copilot was utilized to generate test suite specifically for that class.

## 3.6 Github Copilot

GitHub Copilot is an AI-powered code assistant developed by GitHub in collaboration with OpenAI. It integrates directly into popular code editors, like IntelliJ IDEA, to provide real-time code suggestions, auto-completions, and solutions based on the context of the code being written.

GitHub Copilot was utilized to generate the test suite for the DaemonWrapper class due to multiple issues encountered with Randoop. The generated tests were specifically tailored for JUnit 5 to ensure compatibility. Additionally, GitHub Copilot was employed to create a test case for the load() method of the DaemonLoader class, as Randoop did not adequately test that method.

The following images display the updated JaCoCo reports for both the entire project and the ”support” package, which contains the highest number of Java classes in the project.



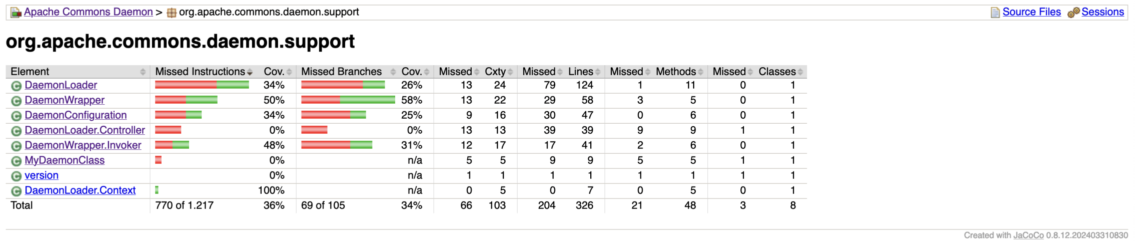
Apache Commons Daemon | Sessions

Apache Commons Daemon

| Element | Missed Instructions | Cov. | Missed Branches | Cov. | Missed | Cxty | Missed | Lines | Missed | Methods | Missed | Classes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| org.apache.commons.daemon.support | | 36% | | 34% | 66 | 103 | 204 | 326 | 21 | 48 | 3 | 8 |
| org.apache.commons.daemon | | 7% | | 3% | 40 | 42 | 88 | 94 | 11 | 13 | 0 | 2 |
| org.apache.commons.daemon.docker | | 28% | | 0% | 10 | 18 | 39 | 57 | 6 | 14 | 0 | 6 |
| Total | 1.273 of 1.816 | 29% | 133 of 171 | 22% | 116 | 163 | 331 | 477 | 38 | 75 | 3 | 16 |

Created with JaCoCo 0.8.12.202403310830

3.6.1 JaCoCo Project Report After Testing



Apache Commons Daemon > org.apache.commons.daemon.support | Source Files | Sessions

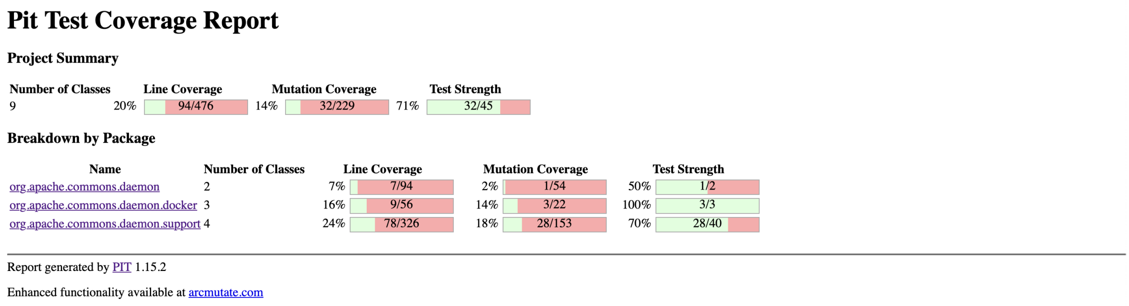
org.apache.commons.daemon.support

| Element | Missed Instructions | Cov. | Missed Branches | Cov. | Missed | Cxty | Missed | Lines | Missed | Methods | Missed | Classes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DaemonLoader | | 34% | | 26% | 13 | 24 | 79 | 124 | 1 | 11 | 0 | 1 |
| DaemonWrapper | | 50% | | 58% | 13 | 22 | 29 | 58 | 3 | 5 | 0 | 1 |
| DaemonConfiguration | | 34% | | 25% | 9 | 16 | 30 | 47 | 0 | 6 | 0 | 1 |
| DaemonLoader.Controller | | 0% | | 0% | 13 | 13 | 39 | 39 | 9 | 9 | 1 | 1 |
| DaemonWrapper.Invoker | | 48% | | 31% | 12 | 17 | 17 | 41 | 2 | 6 | 0 | 1 |
| MyDaemonClass | | 0% | | n/a | 5 | 5 | 9 | 9 | 5 | 5 | 1 | 1 |
| version | | 0% | | n/a | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| DaemonLoader.Context | | 100% | | n/a | 0 | 5 | 0 | 7 | 0 | 5 | 0 | 1 |
| Total | 770 of 1.217 | 36% | 69 of 105 | 34% | 66 | 103 | 204 | 326 | 21 | 48 | 3 | 8 |

Created with JaCoCo 0.8.12.202403310830

3.6.2 JaCoCo Support Package Report After Testing

The PIT Test Coverage Report shows a significant improvement compared to the previous analysis, where the project had almost no test coverage. The current report indicates 20% line coverage, 14% mutation coverage, and 71% test strength across the entire project. Within the ”support” package the mutation coverage increased to 18%, with a notable test strength of 70%. While the mutation coverage is still relatively low, these metrics highlight the progress made in testing the project, demonstrating the effectiveness of the test cases introduced since the initial evaluation.



Pit Test Coverage Report

Project Summary

| Number of Classes | Line Coverage | | Mutation Coverage | | Test Strength | |
|---|---|---|---|---|---|---|
| 9 | 20% | 94/476 | 14% | 32/229 | 71% | 32/45 |

Breakdown by Package

| Name | Number of Classes | Line Coverage | | Mutation Coverage | | Test Strength | |
|---|---|---|---|---|---|---|---|
| org.apache.commons.daemon | 2 | 7% | 7/94 | 2% | 1/54 | 50% | 1/2 |
| org.apache.commons.daemon.docker | 3 | 16% | 9/56 | 14% | 3/22 | 100% | 3/3 |
| org.apache.commons.daemon.support | 4 | 24% | 78/326 | 18% | 28/153 | 70% | 28/40 |

Report generated by PIT 1.15.2

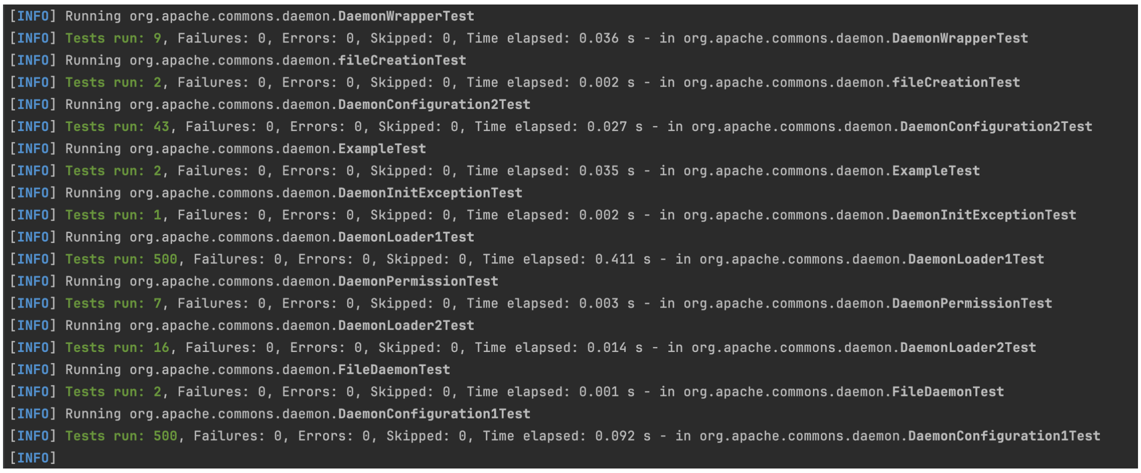
Enhanced functionality available at arcmutate.com

3.6.3 Pitest Project Report After Testing

## 3.7 JMH

JMH (Java Microbenchmark Harness) is a Java library developed by the same team that created the Java Virtual Machine (JVM). It is designed for building reliable and accurate benchmarks to measure the performance of Java code. JMH handles complexities such as JVM optimizations, warm-up phases, and multi-threading, ensuring precise and reproducible benchmarking results.

In the project, JMH was utilized to evaluate the performance of various functionalities, as shown in the image 3.7.1.; this analysis identified the class with the most time-consuming test execution, which turned out to be DaemonLoader1Test with 0.411 seconds.



```
[INFO] Running org.apache.commons.daemon.DaemonWrapperTest
[INFO] Tests run: 9, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.036 s - in org.apache.commons.daemon.DaemonWrapperTest
[INFO] Running org.apache.commons.daemon.fileCreationTest
[INFO] Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.002 s - in org.apache.commons.daemon.fileCreationTest
[INFO] Running org.apache.commons.daemon.DaemonConfiguration2Test
[INFO] Tests run: 43, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.027 s - in org.apache.commons.daemon.DaemonConfiguration2Test
[INFO] Running org.apache.commons.daemon.ExampleTest
[INFO] Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.035 s - in org.apache.commons.daemon.ExampleTest
[INFO] Running org.apache.commons.daemon.DaemonInitExceptionTest
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.002 s - in org.apache.commons.daemon.DaemonInitExceptionTest
[INFO] Running org.apache.commons.daemon.DaemonLoader1Test
[INFO] Tests run: 500, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.411 s - in org.apache.commons.daemon.DaemonLoader1Test
[INFO] Running org.apache.commons.daemon.DaemonPermissionTest
[INFO] Tests run: 7, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.003 s - in org.apache.commons.daemon.DaemonPermissionTest
[INFO] Running org.apache.commons.daemon.DaemonLoader2Test
[INFO] Tests run: 16, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.014 s - in org.apache.commons.daemon.DaemonLoader2Test
[INFO] Running org.apache.commons.daemon.FileDaemonTest
[INFO] Tests run: 2, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.001 s - in org.apache.commons.daemon.FileDaemonTest
[INFO] Running org.apache.commons.daemon.DaemonConfiguration1Test
[INFO] Tests run: 500, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.092 s - in org.apache.commons.daemon.DaemonConfiguration1Test
[INFO]
```

3.7.1 Time Spent to Run Tests

The benchmark compares two DaemonLoader constructors with varying inputs (1, 10, 100 actions). The ”With Actions” constructor demonstrates stable performance ( 546k ops/ms) with minimal variation as the number of actions increases. In contrast, the ”Without Actions” constructor shows lower and more variable performance, with a temporary improvement at 10 actions ( 450k ops/ms) followed by a decline at 100. Overall, the ”With Actions” constructor is more consistent and efficient across all number of Actions.

| **Benchmark** | **Actions** | **Score (ops/ms)** | **Error (± ops/ms)** |
|---|---|---|---|
| benchmarkConstructorWithActions | 1 | 546,617.720 | 5,533.537 |
| benchmarkConstructorWithActions | 10 | 546,257.316 | 3,405.375 |
| benchmarkConstructorWithActions | 100 | 544,888.425 | 3,949.784 |
| benchmarkConstructorWithoutActions | 1 | 379,669.034 | 48,684.822 |
| benchmarkConstructorWithoutActions | 10 | 450,315.957 | 13,725.568 |
| benchmarkConstructorWithoutActions | 100 | 381,581.043 | 47,497.208 |

Table 1: JMH Benchmark Results for DaemonLoader Constructors

After analyzing the initial benchmarks, the DaemonLoader class was modified by optimizing logging through the introduction of conditional checks to prevent unnecessary string concatenations, thereby reducing logging overhead. Exception handling was also improved by refactoring the logic to avoid costly try-catch blocks when unnecessary. Following these optimizations, the benchmarks were re-run, demonstrating consistent improvements in performance and reduced variability, as shown in the table 2.

| **Benchmark** | **Actions** | **Score (ops/ms)** | **Error (± ops/ms)** |
|---|---|---|---|
| benchmarkConstructorWithActions | 1 | 558,626.778 | 7,038.149 |
| benchmarkConstructorWithActions | 10 | 557,390.637 | 7,024.314 |
| benchmarkConstructorWithActions | 100 | 554,514.871 | 8,886.876 |
| benchmarkConstructorWithoutActions | 1 | 407,609.975 | 46,338.702 |
| benchmarkConstructorWithoutActions | 10 | 403,775.187 | 48,640.758 |
| benchmarkConstructorWithoutActions | 100 | 378,158.506 | 45,936.472 |

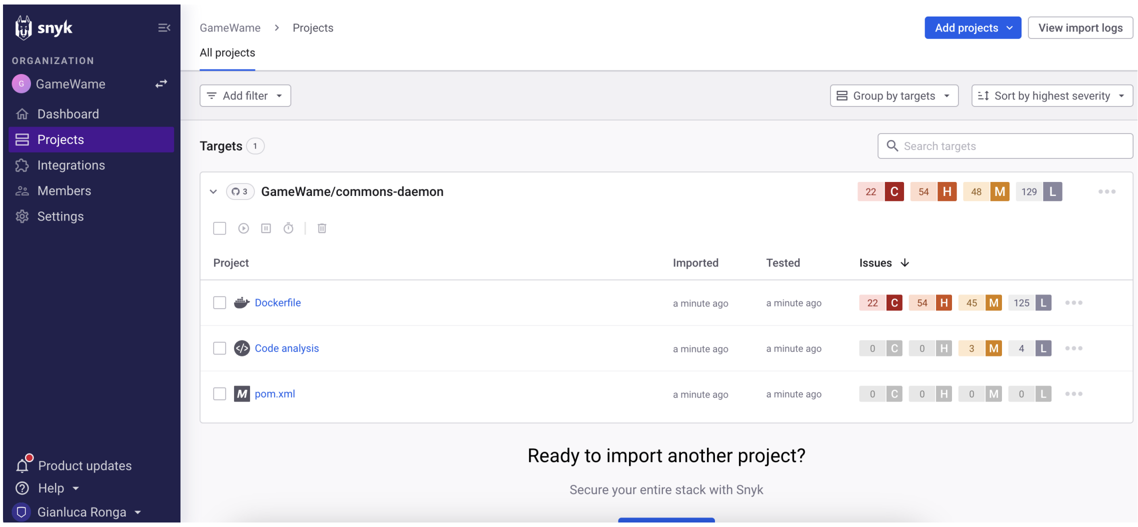
Table 2: JMH Benchmark Results for DaemonLoader after Optimization

From the comparison of these two tables we can see that the first report consistently shows higher throughput and generally similar error margins than the second one. The second benchmark report has better results because the Score (throughput) is higher in all cases. This indicates the code performs more operations per millisecond in the second run, which is the primary metric for evaluating performance.

## 3.8 Snyk

Snyk is a developer-first security platform designed to help identify and remediate vulnerabilities in code, open-source dependencies, container images, and infrastructure as code. By providing actionable insights and automated fixes, Snyk helps ensure secure application development without disrupting productivity.

When Snyk analyzed the project, the results (shown in image 3.8.1) revealed that nearly all security vulnerabilities were located in the Dockerfile, with no available fixes (as shown in image 3.8.2 and 3.8.3). As a result, the focus shifted towards addressing vulnerabilities in the codebase.



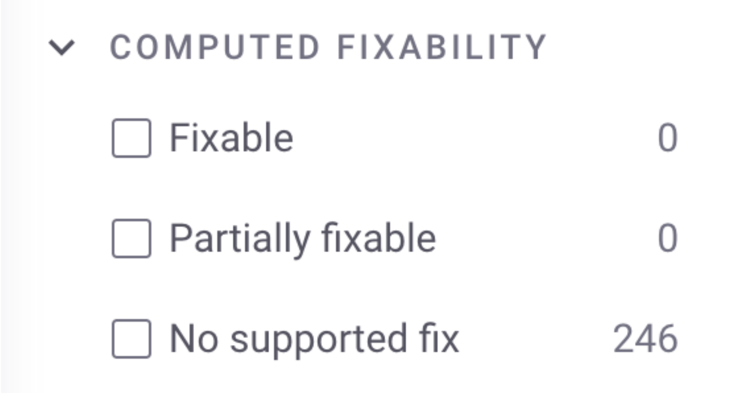
GameWame/commons-daemon — 22 C, 54 H, 48 M, 129 L

| Project | Imported | Tested | Issues |
|---|---|---|---|
| Dockerfile | a minute ago | a minute ago | 22 C 54 H 45 M 125 L |
| Code analysis | a minute ago | a minute ago | 0 C 0 H 3 M 4 L |
| pom.xml | a minute ago | a minute ago | 0 C 0 H 0 M 0 L |

Ready to import another project?

Secure your entire stack with Snyk

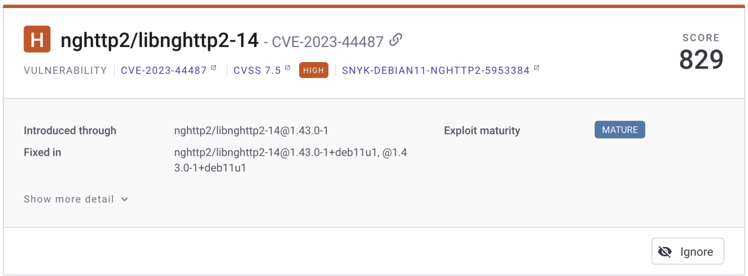
3.8.1 Security Bugs Summary



COMPUTED FIXABILITY

| | |
|---|---|
| □ Fixable | 0 |
| □ Partially fixable | 0 |
| □ No supported fix | 246 |

3.8.2 Security Bugs Fixability (Dockerfile)



H nghttp2/libnghttp2-14 - CVE-2023-44487

VULNERABILITY | CVE-2023-44487 | CVSS 7.5 HIGH | SNYK-DEBIAN11-NGHTTP2-5953384

SCORE 829

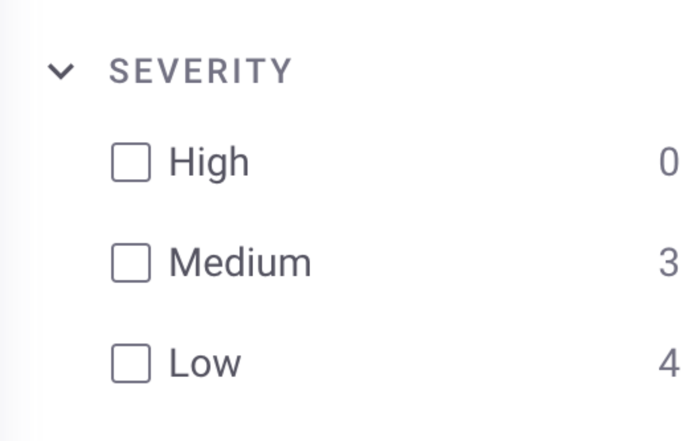
Introduced through: nghttp2/libnghttp2-14@1.43.0-1

Fixed in: nghttp2/libnghttp2-14@1.43.0-1+deb11u1, @1.43.0-1+deb11u1

Exploit maturity: MATURE

3.8.3 Example of Security Bug (Dockerfile)

The code analysis report uncovered several issues, all of medium or low severity, with no high-severity bugs identified (as shown in image 3.8.4). A total of seven bugs were found, including four instances of ”Missing Release of File Descriptor or Handle after Effective Lifetime,” two cases of ”Path Traversal,” and one ”Buffer Overflow.” Notably, only the Path Traversal issues were related to the Java classes, while the remaining bugs originated from the C code in the project.



SEVERITY

☐ High 0

☐ Medium 3

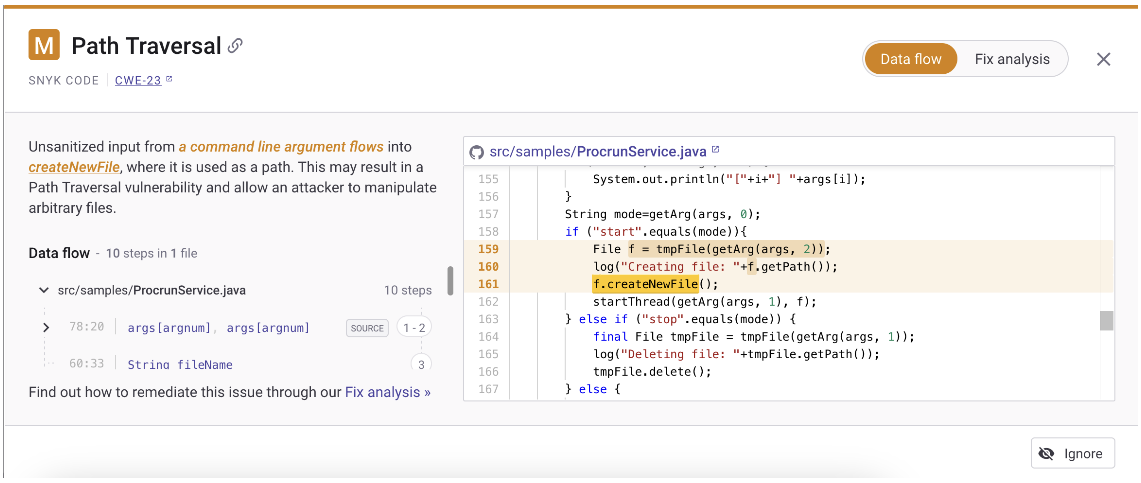
☐ Low 4

3.8.4 Security Bug Severity(Code)

A Directory Traversal attack (also known as path traversal) aims to access files and directories that are stored outside the intended folder. By manipulating files with ”dot-dot-slash (../)” sequences and its variations, or by using absolute file paths, it may be possible to access arbitrary files and directories stored on file system, including application source code, configuration, and other critical system files.

The errors were resolved by modifying the tmpFile method as shown in the following code and creating a ”safe path” for the new temporary file that is created:

```
    private static File tmpFile(String fileName) {
    // Check for path traversal
    if (fileName != null && fileName.contains(”..”)) {
        throw new IllegalArgumentException(”Invalid file name: path traversal detecte
    }

    // Sanitize file name by removing any invalid characters
    String sanitizedFileName = fileName != null ? fileName.replaceAll(”[/\\:∗?\”<>|]”

    // Return the file in the system's temporary directory
    return new File(System.getProperty(”java.io.tmpdir”), sanitizedFileName);
}
```



M Path Traversal

SNYK CODE | CWE-23

Unsanitized input from *a command line argument flows* into *createNewFile*, where it is used as a path. This may result in a Path Traversal vulnerability and allow an attacker to manipulate arbitrary files.

Data flow - 10 steps in 1 file

src/samples/ProcrunService.java 10 steps

```
78:20 | args[argnum], args[argnum]   SOURCE   1 - 2
60:33 | String fileName                       3
```

Find out how to remediate this issue through our Fix analysis »

src/samples/ProcrunService.java

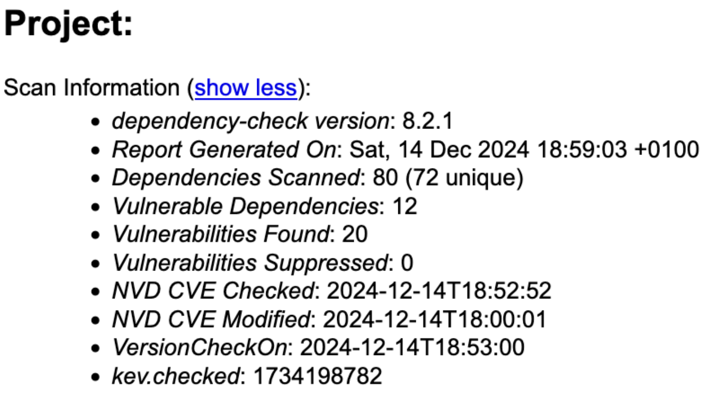
```
            System.out.println("["+i+"] "+args[i]);
        }
        String mode=getArg(args, 0);
        if ("start".equals(mode)){
            File f = tmpFile(getArg(args, 2));
            log("Creating file: "+f.getPath());
            f.createNewFile();
            startThread(getArg(args, 1), f);
        } else if ("stop".equals(mode)) {
            final File tmpFile = tmpFile(getArg(args, 1));
            log("Deleting file: "+tmpFile.getPath());
            tmpFile.delete();
        } else {
```

3.8.5 Security Path Traversal Bug (Code)

## 3.9 OWASP Dependency Check

OWASP Dependency-Check (OWASP DC) is a software composition analysis tool designed to identify vulnerabilities in project dependencies. It scans dependency manifests, libraries, and their transitive dependencies to detect known security issues by cross-referencing public vulnerability databases such as the National Vulnerability Database (NVD).

The first OWASP DC report generated the result shown in the image 3.9.1, where it shows a total of 12 vulnerable dependencies. Since all of them had a CVE count between 0-5, they are suspected as false positive.



**Project:**

Scan Information (show less):

- *dependency-check version*: 8.2.1
- *Report Generated On*: Sat, 14 Dec 2024 18:59:03 +0100
- *Dependencies Scanned*: 80 (72 unique)
- *Vulnerable Dependencies*: 12
- *Vulnerabilities Found*: 20
- *Vulnerabilities Suppressed*: 0
- *NVD CVE Checked*: 2024-12-14T18:52:52
- *NVD CVE Modified*: 2024-12-14T18:00:01
- *VersionCheckOn*: 2024-12-14T18:53:00
- *kev.checked*: 1734198782

3.9.1 OWASP DC Report Summary

After cross-checking with Snyk, it was determined that some of the identified vulnerabilities were false positives, while others were linked to older releases of the dependencies that contained known security issues. To avoid disrupting the project's functionality or introducing unintended issues by upgrading these dependencies, they were left unchanged.