Abstract

The Java Docs Data Display (jddd) [1-2] is a Java-based tool for creating and running graphical user interfaces for accelerator control systems. It is the standard graphical user interface for operating the European XFEL accelerator. Since Java 8 Oracle introduced a number of major changes in the Java ecosystem's legal and technical contexts that significantly impact Java developers and users. The most impactful changes for our software were the removal of Java Web Start, Oracle’s new licensing model and shorter release cycles. To keep jddd up to date, the source code had to be refactored and new distribution concepts for the different operating systems had to be developed. In this paper the benefits and pitfalls of the jddd migration from Oracle Java to OpenJDK11+ will be described.

Changes in Java ecosystem since Java8

Oracles new licensing model
Starting with Java 11 Oracle offers two distinct Java releases with different license models:
- Oracle JDK under commercial OTN License Agreement for Java SE [3]; with Long Term Support (LTS), but only free of charge for development and tests.
- Oracle OpenJDK under the open source GNU General Public License v2 with Classpath Exception (GPLv2+CPE); free, but no LTS.

New Oracle Java release cycles
Oracle changed from a feature-based to a time-based release cycle:
- Major releases for Oracle JDK and OpenJDK every 6 months, which are only supported until the next release.
- Commercial Oracle JDK LTS releases every 3 years. The most recent LTS release in Java 11, which came out in September 2019 and will be supported until 2026.

Removal of Java Web Start
Java Web Start is not included any more in Java SE11 and later [4].

Our way from Java 8 to OpenJDK 11+

Choosing a Java distribution
Oracle has been and will stay the reference implementation for Java. We have decided to use Oracle OpenJDK, because the license model fits our needs and environment best.

Dealing with shorter release cycles
We have started the jddd migration from Java 8 to OpenJDK11+ in September 2018 with OpenJDK 11, which turned out to be quite easy. No major code changes had to be done. Since OpenJDK11 jddd application are always compiled with the latest OpenJDK release without any problems.

Replacement of Java Web Start
Java Web Start was an easy and uncomplicated way to distribute a completely configured application to everyone’s desktop independent of the operating system. As Java Web Start is not included in OpenJDK11+ any more, another deployment technology had to be found.

Distributing jddd to other users
Using jddd to distribute desktop client programs is as simple as ever:
- Replace the old JRE with the new JRE from OpenJDK.
- Choose a computational platform like Unix or Windows.

Upgrade of the jddd Web Interface

For remote monitoring and expert assistance an HTML5 version of jddd, running in a Tomcat application server, is available [8].

Functionality
On the server side the JDDG application is running in a Tomcat web server. All panels are started in headless mode. A buffered image of each panel is created with an update rate of 0.5 Hz. For client/server communication the WebSocket protocol is used. Images are sent from the server to the client, mouse events are sent in the opposite direction.

Upgrade
The web interface has been successfully tested with OpenJDK11+ and Tomcat 9. No major problems have been observed. The upgrade is scheduled for the end of this year.

Conclusion
For the Java update of our jddd software, the following decisions were made:
- We use Oracle OpenJDK11+.
- We stick to Oracle’s short release cycles and compile and distribute jddd always with the current OpenJDK version.
- We deploy jddd packages including all Java libraries, the complete JDK and the Java core software for starting old applications via jddd.

The migration from Java 8 to OpenJDK11+ was successful. Unfortunately it has not been possible to switch completely to the new Java module system, due to many old libraries. The plan is to replace these old libraries to be able to use jinj in future.

The concept of jddd packages containing the current JDK has proven itself. Even though the packaging and deployment procedure is more complicated now compared to Java Web Start before, the benefit is that jddd no longer depends on the appropriate preinstalled Java version.

References
[1] docs/jdd g: https://docs.web.desy.de