



Red Hat build of OpenJDK 21

Using jlink to customize Java runtime environment

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Abstract

Red Hat build of OpenJDK 21 is a Red Hat offering on the Red Hat Enterprise Linux platform. The [Using jlink to customize Java runtime images](#) guide provides an overview of Jlink, and explains how to create a customized Java runtime image by using jlink.

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PROVIDING FEEDBACK ON RED HAT BUILD OF OPENJDK DOCUMENTATION

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Procedure

1. Click the following link to [create a ticket](#).
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MAKING OPEN SOURCE MORE INCLUSIVE

Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see [our CTO Chris Wright's message](#).

CHAPTER 1. OVERVIEW OF JLINK

Jlink is a Java command line tool that is used to generate a custom Java runtime environment (JRE). You can use your customized JRE to run Java applications.

Using jlink, you can create a custom runtime environment that only includes the relevant class file.

CHAPTER 2. CREATING A CUSTOM JAVA RUNTIME ENVIRONMENT FOR NON-MODULAR APPLICATIONS

You can create a custom Java runtime environment from a non-modular application by using the **jlink** tool.

Prerequisites

- Install [Installing Red Hat build of OpenJDK on RHEL using an archive](#) .



NOTE

For best results, use portable Red Hat binaries as a basis for a Jlink runtime, because these binaries contain bundled libraries.

Procedure

1. Create a simple Hello World application by using the **Logger** class.
 - a. Check the base Red Hat build of OpenJDK 21 binary exists in the **jdk-17** folder:

```
$ ls jdk-17
bin conf demo include jmods legal lib man NEWS release
$ ./jdk-17/bin/java -version
openjdk version "17.0.10" 2021-01-19 LTS
OpenJDK Runtime Environment 18.9 (build 17.0.10+9-LTS)
OpenJDK 64-Bit Server VM 18.9 (build 17.0.10+9-LTS, mixed mode)
```

- b. Create a directory for your application:

```
$ mkdir -p hello-example/sample
```

- c. Create **hello-example/sample/HelloWorld.java** file with the following content:

```
package sample;

import java.util.logging.Logger;

public class HelloWorld {
    private static final Logger LOG = Logger.getLogger(HelloWorld.class.getName());
    public static void main(String[] args) {
        LOG.info("Hello World!");
    }
}
```

- d. Compile your application:

```
$ ./jdk-17/bin/javac -d . $(find hello-example -name \*.java)
```

- e. Run your application **without** a custom JRE:

```

$ ./jdk-17/bin/java sample.HelloWorld
Mar 09, 2021 10:48:59 AM sample.HelloWorld main
INFO: Hello World!
```

The previous example shows the base Red Hat build of OpenJDK requiring 311 MB to run a single class.

- f. (Optional) You can inspect the Red Hat build of OpenJDK and see many non-required modules for your application:

```

$ du -sh jdk-17/
313M jdk-17/
```

```

$ ./jdk-17/bin/java --list-modules
java.base@17.0.1
java.compiler@17.0.1
java.datatransfer@17.0.1
java.desktop@17.0.1
java.instrument@17.0.1
java.logging@17.0.1
java.management@17.0.1
java.management.rmi@17.0.1
java.naming@17.0.1
java.net.http@17.0.1
java.prefs@17.0.1
java.rmi@17.0.1
java.scripting@17.0.1
java.se@17.0.1
java.security.jgss@17.0.1
java.security.sasl@17.0.1
java.smartcardio@17.0.1
java.sql@17.0.1
java.sql.rowset@17.0.1
java.transaction.xa@17.0.1
java.xml@17.0.1
java.xml.crypto@17.0.1
jdk.accessibility@17.0.1
jdk.attach@17.0.1
jdk.charsets@17.0.1
jdk.compiler@17.0.1
jdk.crypto.cryptoki@17.0.1
jdk.crypto.ec@17.0.1
jdk.dynalink@17.0.1
jdk.editpad@17.0.1
jdk.hotspot.agent@17.0.1
jdk.httpserver@17.0.1
jdk.incubator.foreign@17.0.1
jdk.incubator.vector@17.0.1
jdk.internal.ed@17.0.1
jdk.internal.jvmstat@17.0.1
jdk.internal.le@17.0.1
jdk.internal.opt@17.0.1
jdk.internal.vm.ci@17.0.1
jdk.internal.vm.compiler@17.0.1
jdk.internal.vm.compiler.management@17.0.1
```

```
jdk.jartool@17.0.1
jdk.javadoc@17.0.1
jdk.jcmd@17.0.1
jdk.jconsole@17.0.1
jdk.jdeps@17.0.1
jdk.jdi@17.0.1
jdk.jdwp.agent@17.0.1
jdk.jfr@17.0.1
jdk.jlink@17.0.1
jdk.jpackage@17.0.1
jdk.jshell@17.0.1
jdk.jobject@17.0.1
jdk.jstatd@17.0.1
jdk.localedata@17.0.1
jdk.management@17.0.1
jdk.management.agent@17.0.1
jdk.management.jfr@17.0.1
jdk.naming.dns@17.0.1
jdk.naming.rmi@17.0.1
jdk.net@17.0.1
jdk.nio.mapmode@17.0.1
jdk.random@17.0.1
jdk.sctp@17.0.1
jdk.security.auth@17.0.1
jdk.security.jgss@17.0.1
jdk.unsupported@17.0.1
jdk.unsupported.desktop@17.0.1
jdk.xml.dom@17.0.1
jdk.zipfs@17.0.1
```

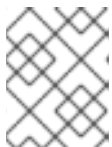
This sample **Hello World** application has very few dependencies. You can use jlink to create custom runtime images for your application. With these images you can run your application with only the required Red Hat build of OpenJDK dependencies.

2. Determine module dependencies of your application using **jdeps** command:

```
$/jdk-17/bin/jdeps -s ./sample/HelloWorld.class
HelloWorld.class -> java.base
HelloWorld.class -> java.logging
```

3. Build a custom java runtime image for your application:

```
$/jdk-17/bin/jlink --add-modules java.base,java.logging --output custom-runtime
$ du -sh custom-runtime
50M custom-runtime/
$/custom-runtime/bin/java --list-modules
java.base@17.0.10
java.logging@17.0.10
```



NOTE

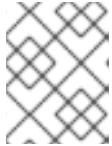
Red Hat build of OpenJDK reduces the size of your custom Java runtime image from a 313 M runtime image to a 50 M runtime image.

4. You can verify the reduced runtime of your application:

```
$ ./custom-runtime/bin/java sample.HelloWorld  
Jan 14, 2021 12:13:26 PM HelloWorld main  
INFO: Hello World!
```

The generated JRE with your sample application does not have any other dependencies.

You can distribute your application together with your custom runtime for deployment.



NOTE

You must rebuild the custom Java runtime images for your application with every security update of your base Red Hat build of OpenJDK.

CHAPTER 3. CREATING A CUSTOM JAVA RUNTIME ENVIRONMENT FOR MODULAR APPLICATIONS

You can create a custom Java runtime environment from a modular application by using the **jlink** tool.

Prerequisites

- Install [Installing Red Hat build of OpenJDK on RHEL using an archive](#) .



NOTE

For best results, use portable Red Hat binaries as a basis for a Jlink runtime, because these binaries contain bundled libraries.

Procedure

1. Create a simple Hello World application by using the **Logger** class.
 - a. Check the base Red Hat build of OpenJDK 21 binary exists in the **jdk-17** folder:

```
$ ls jdk-17
bin conf demo include jmods legal lib man NEWS release
$ ./jdk-17/bin/java -version
openjdk version "17.0.10" 2021-01-19 LTS
OpenJDK Runtime Environment 18.9 (build 17.0.10+9-LTS)
OpenJDK 64-Bit Server VM 18.9 (build 17.0.10+9-LTS, mixed mode)
```

- b. Create a directory for your application:

```
$ mkdir -p hello-example/sample
```

- c. Create **hello-example/sample/HelloWorld.java** file with the following content:

```
package sample;

import java.util.logging.Logger;

public class HelloWorld {
    private static final Logger LOG = Logger.getLogger(HelloWorld.class.getName());
    public static void main(String[] args) {
        LOG.info("Hello World!");
    }
}
```

- d. Create a file called **hello-example/module-info.java** and include the following code in the file:

```
module sample
{
    requires java.logging;
}
```

- e. Compile your application:

```
$ ./jdk-17/bin/javac -d example $(find hello-example -name \*.java)
```

- f. Run your application *without* a custom JRE:

```
$ ./jdk-17/bin/java -cp example sample.HelloWorld
Mar 09, 2021 10:48:59 AM sample.HelloWorld main
INFO: Hello World!
```

The previous example shows the base Red Hat build of OpenJDK requiring 311 MB to run a single class.

- g. (Optional) You can inspect the Red Hat build of OpenJDK and see many non-required modules for your application:

```
$ du -sh jdk-17/
313M jdk-17/
```

```
$ ./jdk-17/bin/java --list-modules
java.base@17.0.1
java.compiler@17.0.1
java.datatransfer@17.0.1
java.desktop@17.0.1
java.instrument@17.0.1
java.logging@17.0.1
java.management@17.0.1
java.management.rmi@17.0.1
java.naming@17.0.1
java.net.http@17.0.1
java.prefs@17.0.1
java.rmi@17.0.1
java.scripting@17.0.1
java.se@17.0.1
java.security.jgss@17.0.1
java.security.sasl@17.0.1
java.smartcardio@17.0.1
java.sql@17.0.1
java.sql.rowset@17.0.1
java.transaction.xa@17.0.1
java.xml@17.0.1
java.xml.crypto@17.0.1
jdk.accessibility@17.0.1
jdk.attach@17.0.1
jdk.charsets@17.0.1
jdk.compiler@17.0.1
jdk.crypto.cryptoki@17.0.1
jdk.crypto.ec@17.0.1
jdk.dynalink@17.0.1
jdk.editpad@17.0.1
jdk.hotspot.agent@17.0.1
jdk.httpserver@17.0.1
jdk.incubator.foreign@17.0.1
jdk.incubator.vector@17.0.1
jdk.internal.ed@17.0.1
jdk.internal.jvmstat@17.0.1
jdk.internal.le@17.0.1
```

```
jdk.internal.opt@17.0.1
jdk.internal.vm.ci@17.0.1
jdk.internal.vm.compiler@17.0.1
jdk.internal.vm.compiler.management@17.0.1
jdk.jartool@17.0.1
jdk.javadoc@17.0.1
jdk.jcmd@17.0.1
jdk.jconsole@17.0.1
jdk.jdeps@17.0.1
jdk.jdi@17.0.1
jdk.jdwp.agent@17.0.1
jdk.jfr@17.0.1
jdk.jlink@17.0.1
jdk.jpackage@17.0.1
jdk.jshell@17.0.1
jdk.jsobject@17.0.1
jdk.jstatd@17.0.1
jdk.localedata@17.0.1
jdk.management@17.0.1
jdk.management.agent@17.0.1
jdk.management.jfr@17.0.1
jdk.naming.dns@17.0.1
jdk.naming.rmi@17.0.1
jdk.net@17.0.1
jdk.nio.mapmode@17.0.1
jdk.random@17.0.1
jdk.sctp@17.0.1
jdk.security.auth@17.0.1
jdk.security.jgss@17.0.1
jdk.unsupported@17.0.1
jdk.unsupported.desktop@17.0.1
jdk.xml.dom@17.0.1
jdk.zipfs@17.0.1
```

This sample **Hello World** application has very few dependencies. You can use jlink to create custom runtime images for your application. With these images you can run your application with only the required Red Hat build of OpenJDK dependencies.

2. Create your application module:

```
$ mkdir sample-module
$ ./jdk-17/bin/jmod create --class-path example/ --main-class sample.HelloWorld --module-version 1.0.0 -p example sample-module/hello.jmod
```

3. Create a custom JRE with the required modules and a custom application launcher for your application:

```
$ ./jdk-17/bin/jlink --launcher hello=sample/sample.HelloWorld --module-path sample-module --add-modules sample --output custom-runtime
```

4. List the modules of the produced custom JRE.
Observe that only a fraction of the original Red Hat build of OpenJDK remains.

```
$ du -sh custom-runtime
50M custom-runtime/
```



```
$ ./custom-runtime/bin/java --list-modules
java.base@17.0.10
java.logging@17.0.10
sample@1.0.0
```

**NOTE**

Red Hat build of OpenJDK reduces the size of your custom Java runtime image from a 313 M runtime image to a 50 M runtime image.

5. Launch the application using the **hello** launcher:

```
$ ./custom-runtime/bin/hello
Jan 14, 2021 12:13:26 PM HelloWorld main
INFO: Hello World!
```

The generated JRE with your sample application does not have any other dependencies besides **java.base**, **java.logging**, and **sample** module.

You can distribute your application that is bundled with the custom runtime in **custom-runtime**. This custom runtime includes your application.

**NOTE**

You must rebuild the custom Java runtime images for your application with every security update of your base Red Hat build of OpenJDK.

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