Multi-release JAR Support

Draft

10 Pages

Abstract

Java 9 adds the concept of Multi-release JAR files which contain versions of classes for different major versions of Java. OSGi needs to support Multi-release JAR files as they are being adopted by the Java community.

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0.3 Feedback

This document can be downloaded from the OSGi Alliance design repository at https://github.com/osgi/design The public can provide feedback about this document by opening a bug at https://www.osgi.org/bugzilla/.

0.4 Table of Contents

0.5 Terminology and Document Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY" and "OPTIONAL" in this document are to be interpreted as described in 10.1.

`Source code is shown in this typeface.`

0.6 Revision History

The last named individual in this history is currently responsible for this document.

Revision	Date	Comments
Initial	2017-12-12	Initial draft. BJ Hargrave, IBM
2nd draft	2017-12-13	Second draft after first EG review. BJ Hargrave, IBM

1 Introduction

Java SE 9 added support for the Java Platform Module System to Java SE. One of the main goals of adding module support to Java SE was to modularize the Java platform API itself. This is in support of encapsulating implementation details of the platform to avoid application code from being dependent on implementation details

as was common in many applications. A common example of this is the sun.misc.Unsafe class which is used by many applications.

Once the platform is modularized and can hide implementation detail, new API can be added to replace the platform implementation API which applications has become dependent upon. But this means that different implementations of the application may be needed for pre-Java 9 usage and post-Java 8 usage. The pre-Java 9 implementation would use the older platform implementation details and the post-Java 8 implementation would use the new-to-Java 9 API which replaces the now inaccessible platform implementation details.

So the application provider would be in the situation of having to deliver 2 artifacts for their application: One which runs on pre-Java 9 platforms and one which runs on post-Java 8 platforms. This is awkward for both the application provider as well as consumers of the application.

To ameliorate this issue, the Java SE 9 platform also introduced the concept of Multi-release JAR files in JEP 238 [3]. A multi-release JAR file is a normal JAR where the base version of the application code is in the normal place but the JAR contains the manifest header `Multi-Release: true` as well as classes in the META-INF/versions folder which is for specific major versions of the Java platform.

The OSGi framework, and tooling generating bundles, must support multi-release JAR file as they begin to be utilized by the Java community.

2 Application Domain

A bundle is a JAR file with additional OSGi metadata which further describes the bundle. Many developers, specifically in open source projects, generate artifacts which can be used as both vanilla JAR files as well as OSGi bundles. They often use available tools such as maven plugins based upon Bnd which decorate the JAR file with OSGi metadata based upon analysis of the JAR contents. This way many JARs are available to the OSGi community directly from the JAR provider.

As developers move to support Java 9, independent of the Java Platform Module System, they find they may need different implementation of select classes to replace use of platform implementation details which are no longer accessible on Java 9 with the use of newly added API. These developers are then choosing to use a multi-release JAR so that can deliver a single artifact which contains the implementations for pre-Java 9 and post-Java 8 platforms.

Currently neither the OSGi framework nor tooling which generates bundle understand or support the multi-release JAR format [4]. So as developers begin to utilize multi-release JAR files, they will no longer be able to also support OSGi without the hassle of generating a separate OSGi-specific artifact.

3 Problem Description

The OSGi framework specification does not address the new Multi-release JAR specification [4]. The OSGi framework specification must be updated to support Bundle-ClassPath elements which conform to the Multi-release JAR specification.

4 Requirements

Support for multi-release JARs in OSGi must be done in the spirit of multi-release JARs where the purpose of multi-release JARs is to support alternate implementation of select classes to deal with changes in the visible APIs of the Java platform. That is, it is not meant as a means to supply new function or new API on different Java platform version.

MR0010 – Bundle class loaders must support the Multi-release JAR format for each element of the Bundle-ClassPath. This include the main bundle itself when '.' is on the Bundle-ClassPath. '.' is the default Bundle-ClassPath.

MR0020 – The framework must support replacement values for the Import-Package and Require-Capability manifest headers when the bundle is marked as a multi-release JAR.

5 Technical Solution

5.1 Bundle Metadata

Since different implementations of a Java class for different versions of the Java platform can affect the requirements of the bundle, the OSGi framework must support alternate values for the `Import-Package` and `Require-Capability` manifest headers for different versions of the Java platform.

When processing the metadata for a bundle, if, after processing the manifest in `META-INF/MANIFEST.MF`, the bundle is declared to be a multi-release JAR via the manifest header:

```
Multi-Release: true
```

the framework must then look for a supplemental manifest file `OSGI-INF/MANIFEST.MF` in a versioned folder. For example:

```
META-INF/versions/9/OSGI-INF/MANIFEST.MF
```

First the versioned folder for the major version of the Java platform is examined and then prior versioned folders in descending order. The first supplemental manifest file found is used and the framework must replace the values of the `Import-Package` and `Require-Capability` manifest headers in the manifest with the values of these headers, if present, in the supplemental manifest file. The supplemental manifest file can contain one or both of these headers. Any other headers in the supplemental manifest file must be ignored.

The framework APIs which provide access to the bundle metadata, such as `Bundle.getHeaders` and `BundleRevision` and `BundleWiring`, must present the supplemented manifest information. That is, the main manifest with the replacement values from a supplemental manifest, if any, for the Java platform version.

The above also applies to fragment bundles since they can also have different implementations of Java classes.

5.2 Bundle Class Loader

The bundle class loader provides access to classes and resources in the bundle and its attached fragments using the values of the `Bundle-ClassPath` manifest headers of the bundle and each attached fragments. The `Bundle-ClassPath` manifest header defines an ordered list of *container paths* to entries in the bundle such as folders and JAR files. A `Bundle-ClassPath` container path can be '`.`' or '`/`' which represent the root container of the bundle. If `Bundle-ClassPath` is not specified, the default value of '`.`' is used. The bundle class loader must search each container of the `Bundle-ClassPath`, in order, when searching for a class or resource.

Each container referenced by the `Bundle-ClassPath` can be a multi-release container independent of the other containers. For example, a bundle can embed a multi-release JAR and list the path of the entry to that JAR in the `Bundle-ClassPath` while other containers referenced by the `Bundle-ClassPath` are not multi-release. So each container referenced by the `Bundle-ClassPath` must declare if it is a multi-release container to be treated as such. This is done via the

```
Multi-Release: true
```

manifest header in the container's `META-INF/MANIFEST.MF` manifest.

For each `Bundle-ClassPath` container which declares itself to be a multi-release container, the bundle class loader must search the container's `META-INF/versions` folders as specified by the Multi-release JAR specification [4] and then the container's base folder when attempting to locate a class or resource in the container.

The bundle class loader and the framework API which provide access to bundle classes and resources, such as `Bundle.loadClass`, `Bundle.getResource`, `Bundle.getResources`, `BundleWiring.getClassLoader`, and `BundleWiring.listResources`, must all support multi-release `Bundle-ClassPath` containers. In addition to returning versioned resource names in the `META-INF/versions` folder,

In addition, when using the `BundleWiring.listResources` method, if the parameters would include a resource name in the results if the resource was in the base folder and the resource is in a versioned folder visible on the current Java version, the results must include the resource name in the base folder. For example, if the container contains:

```
META-INF/versions/9/com/foo/resources.txt
```

and the call `BundleWiring.listResources("/com/foo", "*.txt", 0)` is made when running on version 9, or later, of the Java platform, the result must include "`com/foo/resources.txt`".

5.3 Bundle Entries

The framework APIs which provide access to bundle content independent of the bundle class loader, such as `Bundle.getEntry`, `Bundle.getEntryPaths`, `Bundle.findEntries`, and `BundleWiring.findEntries`, are not affected by multi-release JAR support. Multi-release JAR support only affect access to bundle content through the bundle class loader. That is, class loading and resource loading.

5.4 Java Versions

Multi-release support only supports alternate versions for Java 9 and higher. This is consistent with [4].

5.5 Indexing

While not an issue at runtime for a framework, when tooling indexes a bundle, the tool does not need to index supplemental manifests. Since the purpose of multi-release jars is to handle changes in the Java platform, any changes to the requirements of a bundle for multi-release are against capabilities of the Java platform. Tooling that builds bundles must complain if supplemental manifest contains requirements to capabilities not supplied by the Java platform for the Java version associated with the supplemental manifest.

6 Data Transfer Objects

This design does not alter any existing DTOs nor define any new DTOs.

7 Javadoc

This design does not add or alter any Java API for the OSGi specifications.

8 Considered Alternatives

None.

9 Security Considerations

Support for multi-release JAR files does not add any additional security considerations. A multi-release bundle can be signed the same as any bundle.

10 Document Support

10.1 References

[1] Bradner, S., Key words for use in RFCs to Indicate Requirement Levels, RFC2119, March 1997.

[2] Software Requirements & Specifications. Michael Jackson. ISBN 0-201-87712-0

[3] JEP 238: Multi-Release JAR Files. http://openjdk.java.net/jeps/238

[4] JAR File Specification. https://docs.oracle.com/javase/9/docs/specs/jar/jar.html

10.2 Author's Address

Name	BJ Hargrave
Company	IBM

10.3 Acronyms and Abbreviations

JAR – Java ARchive file

10.4 End of Document