



RFC 197 – OSGi Package and Type Annotations

Final

16 Pages

Abstract

OSGi may soon move to full Java 5 language support include annotations. Some standard OSGi annotations, such as package version, type role, etc., need to be defined. This RFC proposes an initial set of standard OSGi package and type annotations.

0 Document Information

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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/>.

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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 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	March, 2013	David Bosschaert, Red Hat, initial version.
2 nd draft	5 March 2013	Repurpose the RFC as the initial set of standard OSGi annotations.
3 rd draft	18 March 2013	Change RFC name to be more explicit about its purpose.
Final	7 Feb 2014	Final version for voting.

1 Introduction

There are several OSGi concepts that would be useful to express in Java source code such as package versions, the role of a type (producer or consumer) in a package. To date, there has been no OSGi standard way of expressing these things in the Java source code. OSGi will soon move to full Java 5 language feature support

including annotations. When Java 6 reaches end-of-life and OSGi moves to Java 7, javac will no longer support the `-target jsr14` option. So when we transition to `-target 1.5`, we will be able to use standard Java annotations like `@Override` and `@Deprecated`. We will also be able to define and use standard OSGi package and type annotations.

2 Application Domain

2.1 Package Versioning

Package versioning is a key part of OSGi development. In the OSGi Alliance we carefully version our packages. Others also need to version their packages. The current version number of a package must be recorded. JDK has the `package-info.java` source file which contains package level information such as documentation and annotations but there is no standard package version annotation.

2.2 Type Role

One of the key concepts in OSGi is the practice of Semantic Versioning. This is described in more details in the Semantic Versioning White-paper [3]. Part of the Semantic Versioning mechanics concern whether an API is implemented by providers of the technology or by consumers of the technology. This distinction governs how the version of this API is updated given a change to the Interface.

OSGi bundles describe their bundle and package versions in the Bundle Manifest. The following is an example:

```
Bundle-ManifestVersion: 2
Bundle-SymbolicName: test.bundle
Bundle-Version: 2.7.1.Final
Export-Package: org.acme.foo; version="1.7"
```

The bundle version itself is 2.7.1.Final, but the version of the `org.acme.foo` package inside the bundle is 1.7. Assume that the bundle contains a Java type `org.acme.foo.Bar`:

```
package org.acme.foo;

public interface Bar {
    void operation();
}
```

Modifying this interface will always result in a version change to a certain degree, but especially when adding a new method to the interface the role of the type becomes significant in relation to how the package version changes. Assume the following modification to the `Bar` interface:

```
package org.acme.foo;

public interface Bar {
    void operation();
    void operation2();
}
```

This modification is not *source* compatible with any existing implementors of the Bar interface (compilation will fail because the operation2() method was added), but it is *binary* compatible with users of the Bar interface. Existing users will not be aware of the new operation and will continue to function.

How this change affects the version number of the exported org.acme.foo package depends on the *role* of the Bar type.

If the Bar interface is only implemented by providers of the technology with which Bar is associated then consumers will continue to work. For example, if the Bar interface is used for a service registered in the OSGi Service registry and this service is provided as part of the technology of which Bar is part, then consumers of this service will continue to function given the change above. In this case the version of the org.acme.foo package will have its minor number increased to become 1.8.

However, if the interface is to be implemented by consumers of the technology the impact of the change above is much larger as a change as it will cause compilation errors for all the consumers. Examples where an interface is to be implemented by a consumer is where the consumer provides a callback object via an API or where the consumer registers a service implementing this API in the Service Registry which is then picked up by the technology to be handled. The latter is known as the Whiteboard Pattern.

Tools such as BND, the Eclipse Build system and the Aries Versioning Plugin have ways to manage version number changes automatically and some of these provide means to mark an interface to be either implemented by consumers or providers.

2.2.1 Eclipse Build

The Eclipse Build and the OSGi internal build system use a Javadoc taglet to mark an interface as not being implemented by consumers. Interfaces without this taglet are assumed to be implemented by consumers.

```
/**
 * @noimplement
 */
public interface Foo {
    ...
}
```

The Eclipse build system provides a mechanism to transfer this information to the binary bundle by preserving this metadata in a .api_description file.

2.2.2 Bnd

Bnd also provides a mechanism to specify the role of an interface. This is done using annotations. The @aQute.bnd.annotation.ProviderType and @aQute.bnd.annotation.ConsumerType annotations can be added to interface types to declare their role. These annotations have retention policy CLASS, which means that they introduce a compile-time dependency, but no runtime dependency. The information can however be read by tools that process the .class files of these interfaces.

3 Problem Description

3.1 Package Versioning

There is no OSGi standard mechanism to declare a package version in source code. We currently use a `package.info` file which is a format defined by `bnd`. All package maintainers need a standard way to record the current version of a package.

3.2 Type Role

Today there is no OSGi standard way to express the role of a given interface, which makes it impossible to write portable tools that handle versioning of packages over their long-term life cycle.

At this point in time there seem to be two prevalent ways of declaring the role of an exported interface. Given a particular bundle, finding out the role of a certain interface is challenging since the presence of this information depends on the build system used. Moreover it may not be present at all as other build systems being used do not record this information at present.

A common mechanism to specify and inspect the role of an interface needs to be specified so that tools and humans have a well-defined way of learning about the role of a given exported interface in an OSGi bundle.

4 Requirements

A01 – The solution **MUST** provide a mechanism to describe the Role of a type in a bundle.

A02 – The solution **MUST** allow the specification of the following roles: implemented by consumers, implemented by providers.

A03 – The solution **MUST** make it possible to find out the role of a type without the need to have access to the type's source code.

A04 – The solution **MUST** make the Role information accessible in such a way that it can be read by tools.

A05 – The solution **MUST** provide a mechanism to describe the version of a package.

A06 – The solution **MUST** allow the information to be placed in the Java source files next to the package or type declaration.

A07 – The solution **MUST NOT** require the use of special “side” files or source processing tools to make the information available to other tools after compilation.

A08 – The solution **MUST NOT** require the presence of any annotations at runtime or the presence of any annotation at compile-time when compiling against marked types.

5 Technical Solution

Annotations will be used as the solution. This will allow the use of existing tooling for compiling and reading annotations. The annotation information will be stored directly in class files which avoid the need for “side” files and keeping them in sync with the source files.

CLASS retention will be used to keep the information in the class files while avoiding the need for the annotation types at runtime or when compiling classes referencing the annotated types.

5.1 Package Versioning

The `org.osgi.annotation.versioning.Version` package annotation is defined. It can be applied to the package declaration in `package-info.java` to specify the version of the package.

5.1.1 Version

Specify the version of a package.

This annotation is not retained at runtime. It is for use by tools to generate bundle manifests or otherwise process the version of a package.

For example:

```
@Version("1.0")  
package org.osgi.annotation.versioning;
```

5.2 Type Role

Two type annotations are defined. `org.osgi.annotation.versioning.ProducerType` is used to mark a type as being implemented by the producer role and `org.osgi.annotation.versioning.ConsumerType` is used to mark a type as being implemented by the consumer role.

5.2.1 ProviderType

A type implemented by the Provider Role.

A non-binary compatible change to a provider type normally requires incrementing the minor version of the type's package. This change will require all providers to be updated to handle the change, but consumers of that package will not require changes since they only use, and do not implement, the provider type.

A type can be marked `ConsumerType` or `ProviderType` but not both. A type is assumed to be `ConsumerType` if it is not marked either `ConsumerType` or `ProviderType`.

This annotation is not retained at runtime. It is for use by tools to understand the semantic version of a package. When a bundle implements a provider type from an imported package, then the bundle's import range for that package must require the package's exact major and minor version.

For example:

```
@ProviderType  
public interface SomeInterface
```


5.2.2 ConsumerType

A type implemented by the Consumer Role.

A non-binary compatible change to a consumer type normally requires incrementing the major version of the type's package. This change will require all providers and all consumers to be updated to handle the change since consumers implement the consumer type and all providers must understand the change in the consumer type.

A type can be marked ConsumerType or ProviderType but not both. A type is assumed to be ConsumerType if it is not marked either ConsumerType or ProviderType.

This annotation is not retained at runtime. It is for use by tools to understand the semantic version of a package. When a bundle implements a consumer type from an imported package, then the bundle's import range for that package must require the exact major version and a minor version greater than or equal to the package's version.

For example:

```
@ConsumerType
```

```
public interface SomeInterface
```

6 Javadoc

OSGi Javadoc

2/7/14 1:04 PM

Package Summary		Page
org.osgi.annotation.versioning	OSGi Versioning Annotations Package Version 1.0.	11

Package org.osgi.annotation.versioning

[@Version](#) (value="1.0")

OSGi Versioning Annotations Package Version 1.0.

See:

[Description](#)

Annotation Types Summary		Page
ConsumerType	A type implemented by the Consumer Role.	12
ProviderType	A type implemented by the Provider Role.	13
Version	Specify the version of a package.	14

Package org.osgi.annotation.versioning Description

OSGi Versioning Annotations Package Version 1.0.

This package is not used at runtime.

See Also:

[Semantic Versioning](#)

Annotation Type ConsumerType

org.osgi.annotation.versioning

```
@Documented
@Retention(value=RetentionPolicy.CLASS)
@Target(value=ElementType.TYPE)
public @interface ConsumerType
```

A type implemented by the Consumer Role.

A non-binary compatible change to a consumer type normally requires incrementing the major version of the type's package. This change will require all providers and all consumers to be updated to handle the change since consumers implement the consumer type and all providers must understand the change in the consumer type.

A type can be marked [ConsumerType](#) or [ProviderType](#) but not both. A type is assumed to be [ConsumerType](#) if it is not marked either [ConsumerType](#) or [ProviderType](#).

This annotation is not retained at runtime. It is for use by tools to understand the semantic version of a package. When a bundle implements a consumer type from an imported package, then the bundle's import range for that package must require the exact major version and a minor version greater than or equal to the package's version.

See Also:

[Semantic Versioning](#)

Annotation Type **ProviderType**

org.osgi.annotation.versioning

```
@Documented
@Retention(value=RetentionPolicy.CLASS)
@Target(value=ElementType.TYPE)
public @interface ProviderType
```

A type implemented by the Provider Role.

A non-binary compatible change to a provider type normally requires incrementing the minor version of the type's package. This change will require all providers to be updated to handle the change, but consumers of that package will not require changes since they only use, and do not implement, the provider type.

A type can be marked [ConsumerType](#) or [ProviderType](#) but not both. A type is assumed to be [ConsumerType](#) if it is not marked either [ConsumerType](#) or [ProviderType](#).

This annotation is not retained at runtime. It is for use by tools to understand the semantic version of a package. When a bundle implements a provider type from an imported package, then the bundle's import range for that package must require the package's exact major and minor version.

See Also:

[Semantic Versioning](#)

Annotation Type Version

org.osgi.annotation.versioning

```
@Documented
@Retention(value=RetentionPolicy.CLASS)
@Target(value=ElementType.PACKAGE)
public @interface Version
```

Specify the version of a package.

This annotation is not retained at runtime. It is for use by tools to generate bundle manifests or otherwise process the version of a package.

See Also:
[Semantic Versioning](#)

Required Element Summary		Page
String	value The version of the annotated package.	14

Element Detail

value

```
public abstract String value
```

The version of the annotated package.

The version must be a valid OSGi version string.

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7 Considered Alternatives

7.1 @Export

@Export from bnd was suggested as a possible OSGi annotation. The @Export annotation seems to handle many things. It allows mandatory and non-mandatory attributes to be specified. But this sort of information does not seem to be an inherent part of a package but rather a decision of the bundle exporting the package.

The @Export annotation also allows specifying the include and exclude directives. These directives are for use by existing packages which are poorly design in that implementation specific types are part of a package which is shared as public by the bundle. While a bundle may need to export such a package and control visible to types within that package, if the developer can modify the source code of the package to add OSGi annotations, it would

be better to add annotations to the types rather than package-info. That is, a type annotation like `@NoExport` would be better. The developer could then apply this annotation to all types in the package that should not be exported.

7.2 Concurrency Roles

I originally considered adding concurrency annotations like those in Java Concurrency In Practice. However, I left these out for several reasons. First, these annotations already exist and people are free to use the existing annotations. Even OSGi could use them (except they are RUNTIME retention which seems to create compile-time issue if the annotations are not on the compile classpath). Second, there is some possibility that JSR 305 may bring them into the space of standard Java annotations (although that JSR seems dead). Finally, concurrency annotations are really outside the scope of OSGi “expertise”. That is, they are orthogonal to modularity and services.

8 Security Considerations

The proposed annotations present no security issues.

9 Document Support

9.1 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]. Semantic Versioning Whitepaper. OSGi Alliance.
<http://www.osgi.org/wiki/uploads/Links/SemanticVersioning.pdf>

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9.3 Acronyms and Abbreviations

9.4 End of Document
