IBM

API Tools in Eclipse: An introduction

Learn to manage your application's API using Eclipse

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Summary: Crafting Application Public Interface (API) and especially managing API among different releases is difficult. Learn how to take advantage of Eclipse's PDE API Tools to make this process easier and seamlessly integrated into your daily development. Note that this article is specific to Eclipse V3.4: Ganymede.

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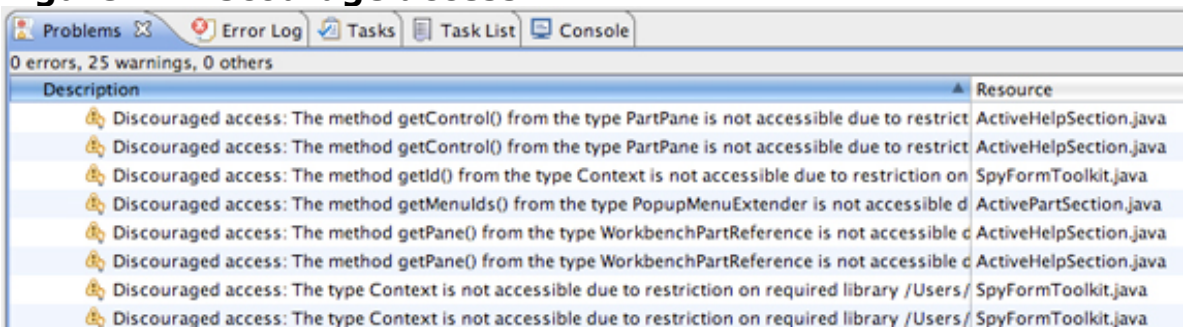
Before we get into detail about the Application Public Interface (API) Tools within the Eclipse Plug-in Development Environment (PDE), let's talk a little bit about what it means to be API in Eclipse.

What is API?

Ever get the following warnings or errors in Eclipse and wonder what they mean?

Figure 1. Discourage access



Internal packages

On top of naming conventions, what really makes a package API or not within a plug-in is whether the package is exported in the MANIFEST.MF file. If it is, it's considered API. To make something not API, you can tag an exported package with

an `x-internal:=true` attribute. This instructs Eclipse that the package you exported is available for use, but is considered internal.

The most probable reason for those warnings is that you're accessing code that isn't meant to be publicly accessed using some form of API. API elements, in general, are well documented and have a specification of some type. On the other hand, non-API elements are considered *internal implementation details* and usually ship without published documentation. The access to these internal elements is what Eclipse was notifying you about in the figure above. Eclipse was trying to politely warn you that you are accessing code that may change and isn't officially supported. So then, what exactly is API?

Since Eclipse is based on the Java™ programming language, we have four types of API elements. Let's look at each.

API package
A package that contains at least one API class or API interface.

Table 1. Package naming conventions in the Eclipse platform

Naming Convention	Example Packages
org.eclipse.xyz.*	org.eclipse.ui, org.eclipse.swt.widgets
org.eclipse.xyz.internal.*	org.eclipse.compare.internal, org.eclipse.ui.internal
org.eclipse.xyz.internal.provisional.*	org.eclipse.equinox.internal.provisional.p2.engine

API class or interface
A `public` class or interface in an API package, or a `public` or `protected` class or interface member declared in or inherited by some other API class or interface.

API method
A `public` or `protected` method or constructor either declared in or inherited by an API class or interface.

API field
A `public` or `protected` field either declared in or inherited by an API class or interface.

Now that we are aware of the different kinds of API elements, let's discuss API Tools and how it can manage these API elements for you.

What is API Tools?

The goal of API Tools is to help you maintain good APIs. API Tools accomplishes this by reporting API defects, such as binary incompatibilities, incorrect plug-in version numbers, missing or incorrect `@since` tags and usage of non-API code between plug-ins. Specifically, it's designed to:

- Identify binary compatibility issues between two versions of a software component or product.
- Update version numbers for plug-ins based on the Eclipse versioning scheme.
- Update `@since` tags for newly added classes, interfaces, and methods.
- Provide new `javadoc` tags and code assist to annotate types with special restrictions.
- Leverage existing information (in MANIFEST.MF) to define the visibility of packages between bundles.
- Identify usage of non-API code between plug-ins.
- Identity leakage of non-API types into API.

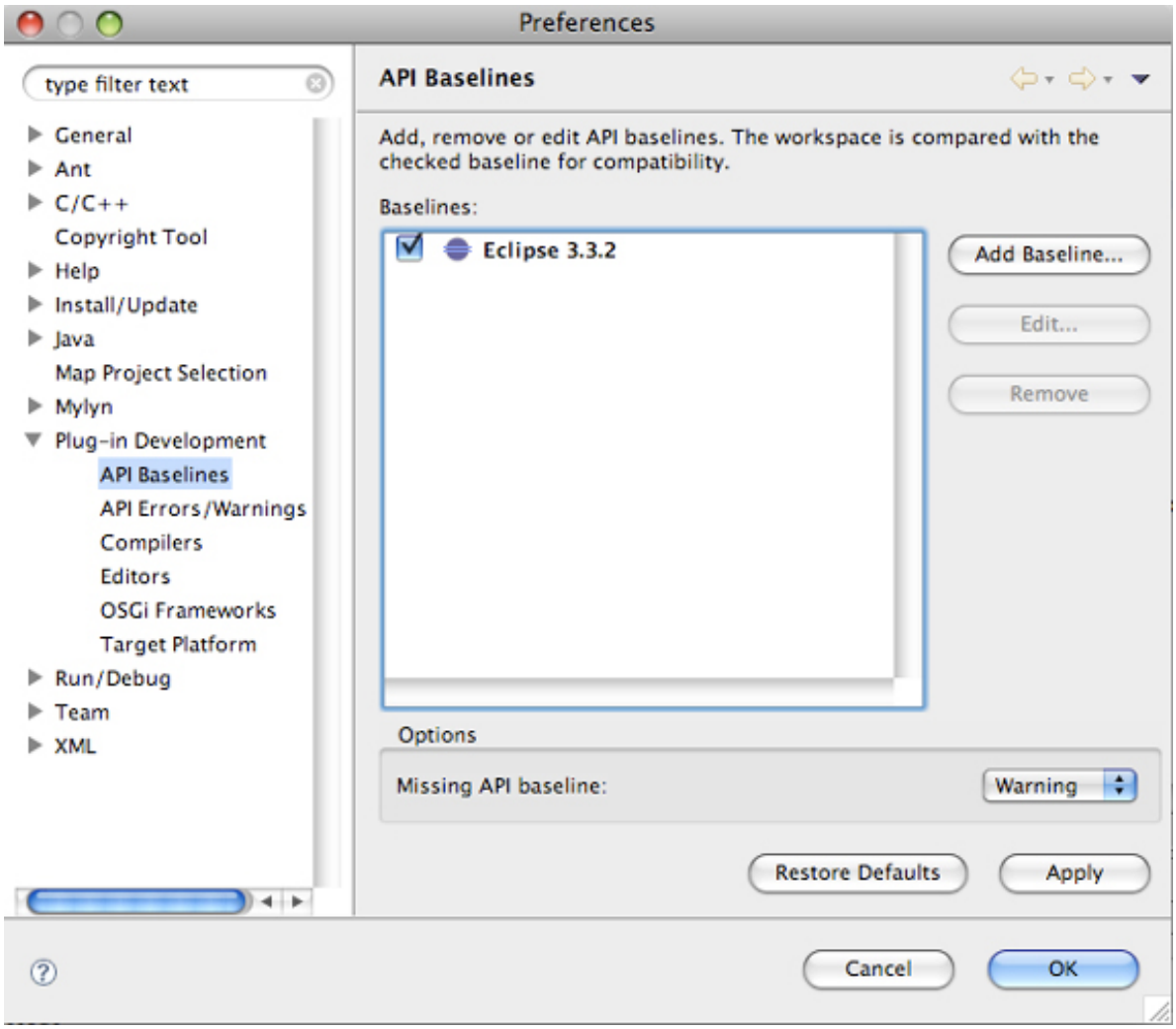
Adding API Tools

To use API Tools within your projects, you need to do two things: set an API baseline and add the API Tools nature to the projects of interest.

Setting an API baseline

To know whether you are breaking API, you need to set some type of baseline for compatibility analysis. In API Tools, this is called an API Baseline and may be set via the API Baselines preference page (see Figure 2). Setting an API Baseline is as simple as pointing to an existing Eclipse-based installation. API Tools will generate a baseline for you on the fly when it scans for plug-ins. Once you have a baseline set, you need to have your Eclipse projects take advantage of API Tools. Note, this process can also be done in a headless manner as part of your build system, but this is outside the scope of this article, and I recommend checking out the API Tools wiki for more information (see Resources).

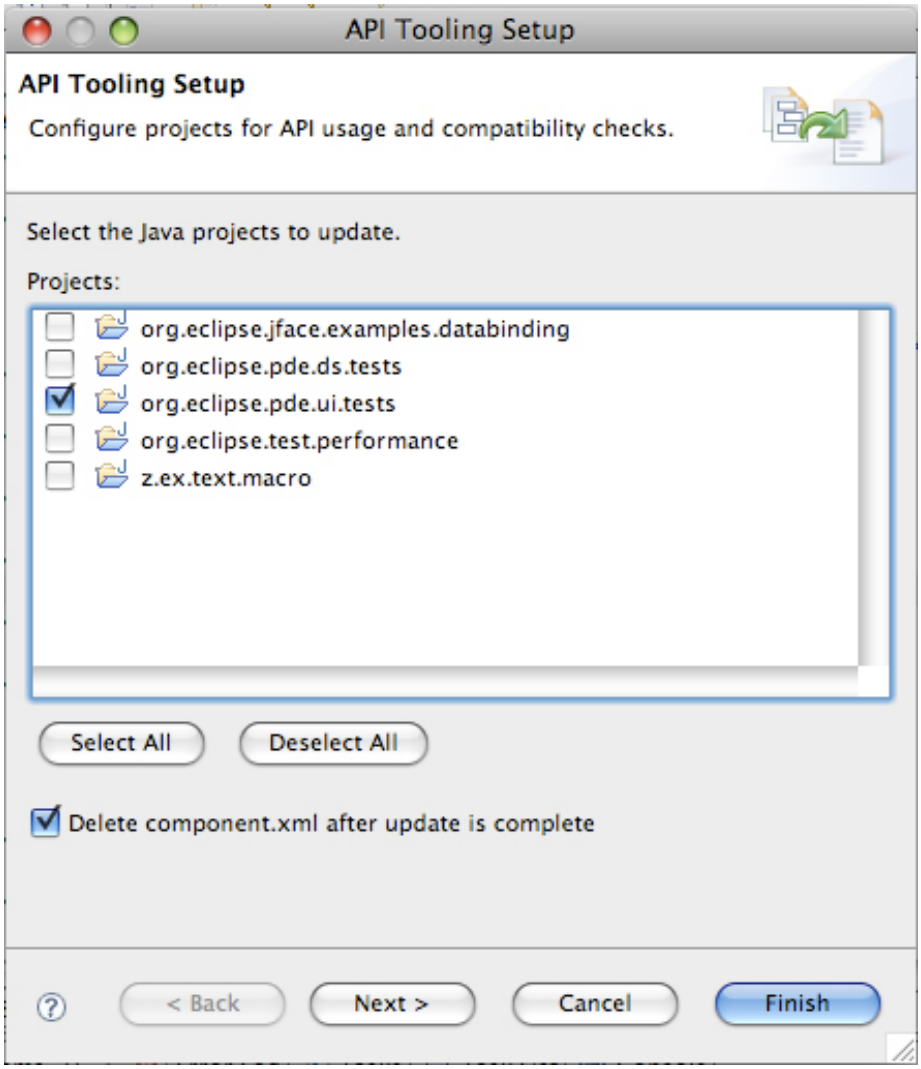
Figure 2. Adding an API baseline



Adding the API Tools project nature

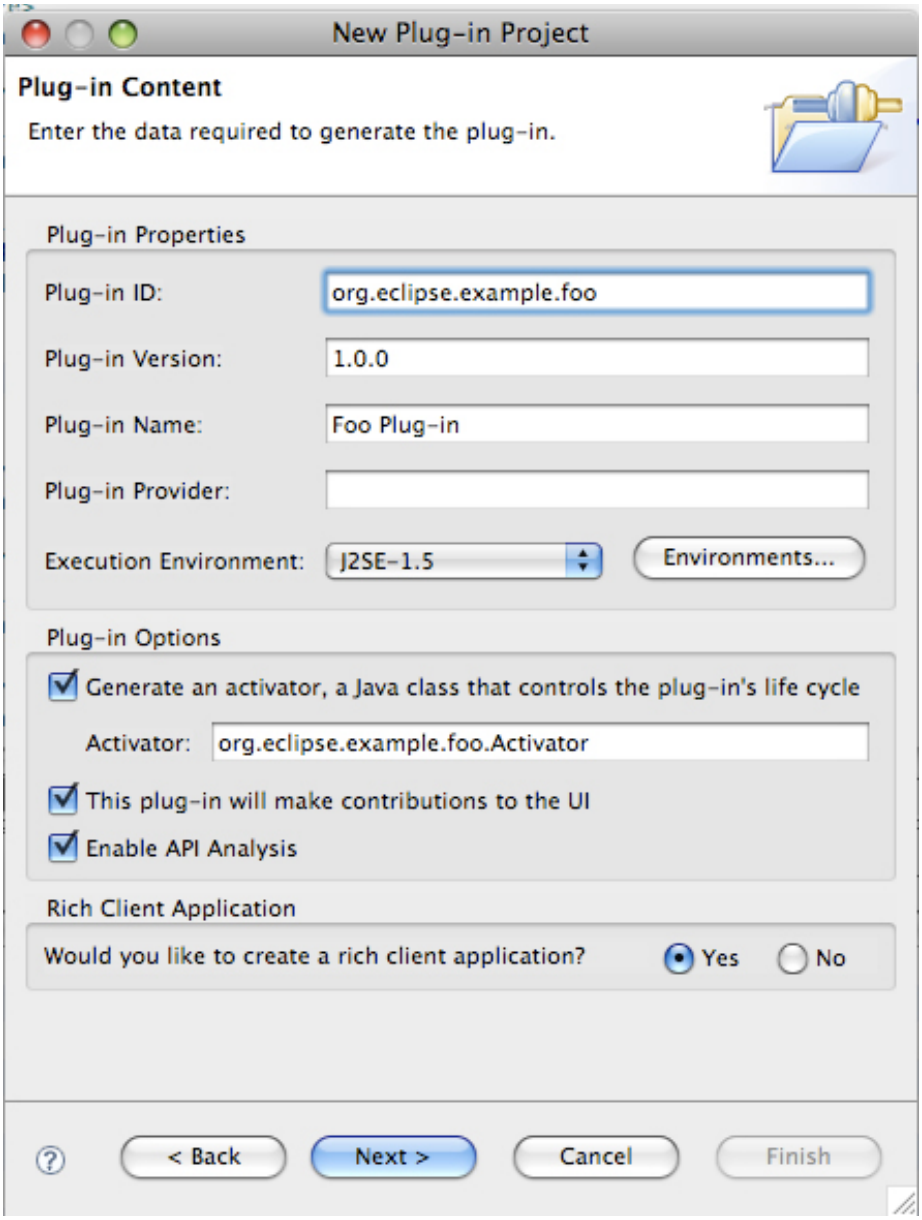
To see any errors or warnings associated with API Tools, your projects need to have the API Analysis nature and builder added to them. This can be accomplished in two ways and depends whether you're applying API Tools to existing projects. If you're working with existing projects, the recommended approach is to use the API Tooling Setup wizard (see Figure 3). The wizard can be accessed by right-clicking your project and selecting **PDE Tools > API Tooling Setup**. In the wizard, simply click the projects you want converted to use API Tools and click **Finish**. That's it.

Figure 3. API Tooling setup wizard



The other approach to take advantage of API Tools is at the time of plug-in project creation. In Eclipse V3.4, the **New Plug-in Project** wizard was enhanced with an additional checkbox, *Enable API Analysis*, to add the API Analysis nature to your project.

Figure 4. API Tools in the New Plug-in Project Wizard



Using API Tools

Now that we know how to set up projects to use API Tools, let's look at some examples on how API Tools can help us. API Tools has a set of annotations you can use on your various API elements to enforce restrictions.

Table 2. API restrictions

Annotation	Valid API elements	Description
@noimplement	Interfaces	Indicates that clients must not implement this interface. Any class using the implements or extends keyword for the associated interface will be flagged with problem.

@noextend	Classes	Indicates that clients must not extend this class. Any class using the extends keyword for the associated class will be flagged with a problem.
@noinstantiate	Classes	Indicates that clients must not instantiate this class. Any code that instantiates the associated class with any constructor will be flagged with a problem.
@nooverride	Methods	Indicates that clients must not redeclare this method. Any subclass that defines a method that overrides the associated method will be flagged with a problem.
@noreference	Methods, constructors and fields (nonfinal)	Indicates that clients must not reference this method, constructor, or nonfinal field. Any code that directly invokes the associated method or constructor or references the associated nonfinal field will be flagged with a problem.

Now that you have an idea of the available API restriction annotations, let's look at some examples of how this would work in the real world.

API restriction examples

Let's start with a really simple example, like a plug-in with an API that allows you to produce widgets.

Listing 1. IWidget.java

```
package org.eclipse.example.widgetfactory;

/**
 * A simple widget
 *
 * @noimplement
 */
public interface IWidget {

        public String getName();

        public long getId();

}
```

In this example, a widget simply has a name and an identifier. We annotated the interface with a restriction to tell clients not to implement this interface as we want our clients to implement the abstract widget listed below.

Listing 2. AbstractWidget.java

```
package org.eclipse.example.widgetfactory;

/**
 * An abstract widget
 */
public abstract class AbstractWidget implements IWidget {

        /**
         * @nooverride
         */
        public long getId() {
                return Math.round(Math.random());
        }

}
```

The abstract widget we have has a method that is annotated with an API restriction telling clients not to override this method. Let's create a default widget people can use.

Listing 3. DefaultWidget.java

```
package org.eclipse.example.widgetfactory;

/**
 * A default widget, this class isn't meant to be extended.
 *
 * Implementation is provided as-is.
 *
 * @noextend
 */
public class DefaultWidget extends AbstractWidget {

        public String getName() {
                return "The default widget";
        }

}
```

The default widget we have provided for our clients is simply as-is. It's meant to be used, but not extended. We are free to extend this class within our own plug-in and create other default widgets people could use. So, let's pretend we are a client of this widget API and see what happens. Let's create two classes: `MyWidget` (implements `IWidget`) and `MyDefaultWidget` (extends `DefaultWidget`). As a client of the widget API, what would I see? For the `MyWidget` class, we will see a warning that we are implementing an API interface that isn't meant to be implemented by clients (see Figure 5). For the `MyDefaultWidget` class, we will see warnings about illegally extending

the `DefaultWidget` class and also illegally overriding the `getId()` method.

Figure 5. MyWidget.java

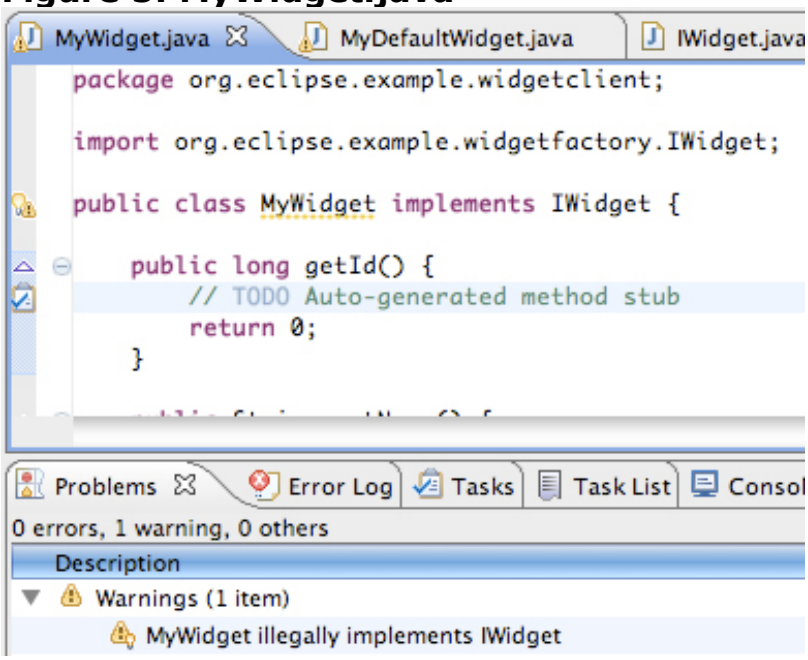
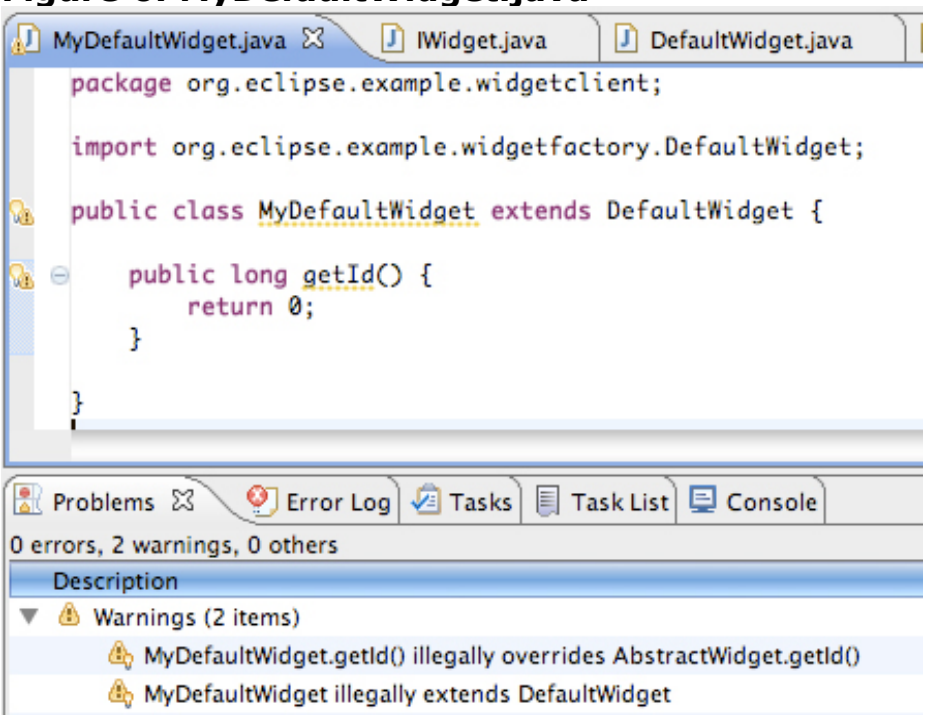


Figure 6. MyDefaultWidget.java

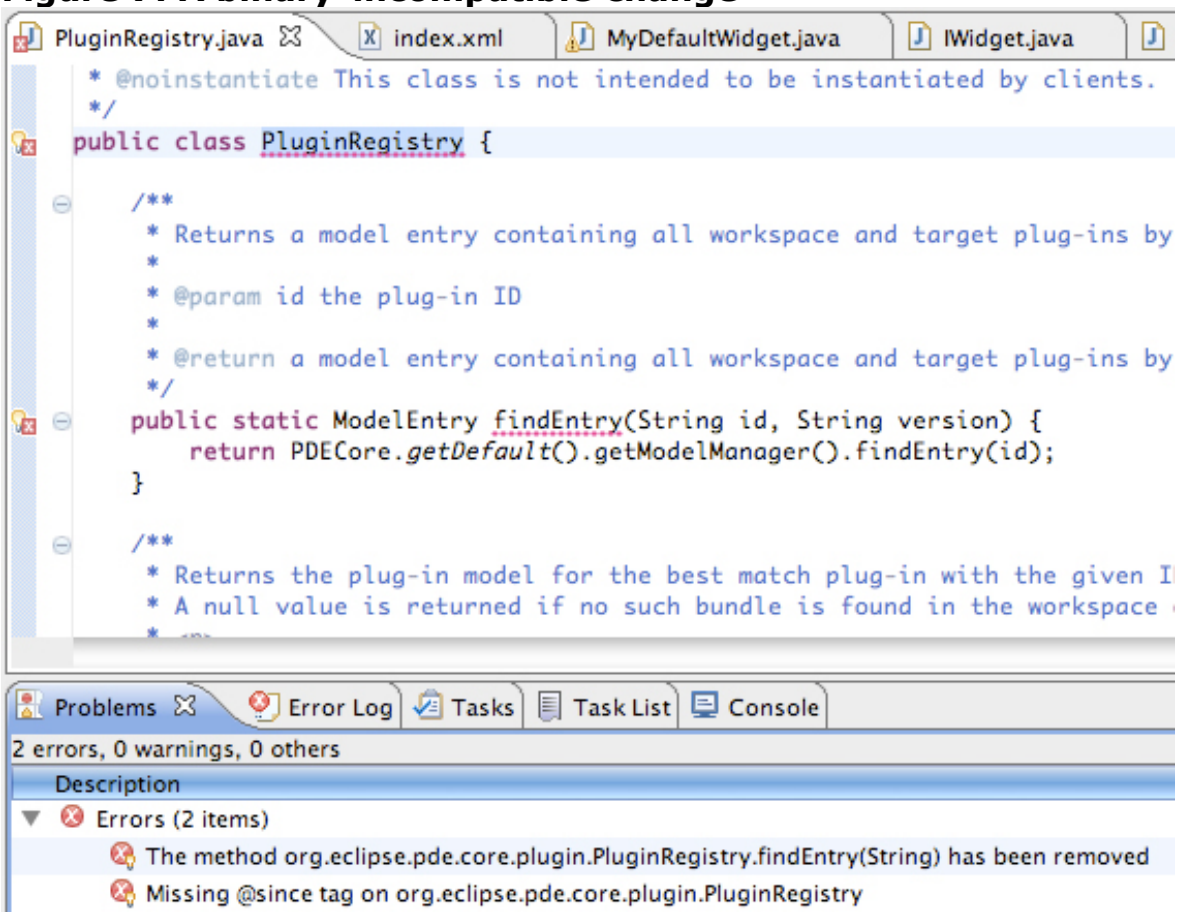


This simple example should give you a clear idea of how clients of your API will be presented with usage information about your API.

Binary incompatibilities

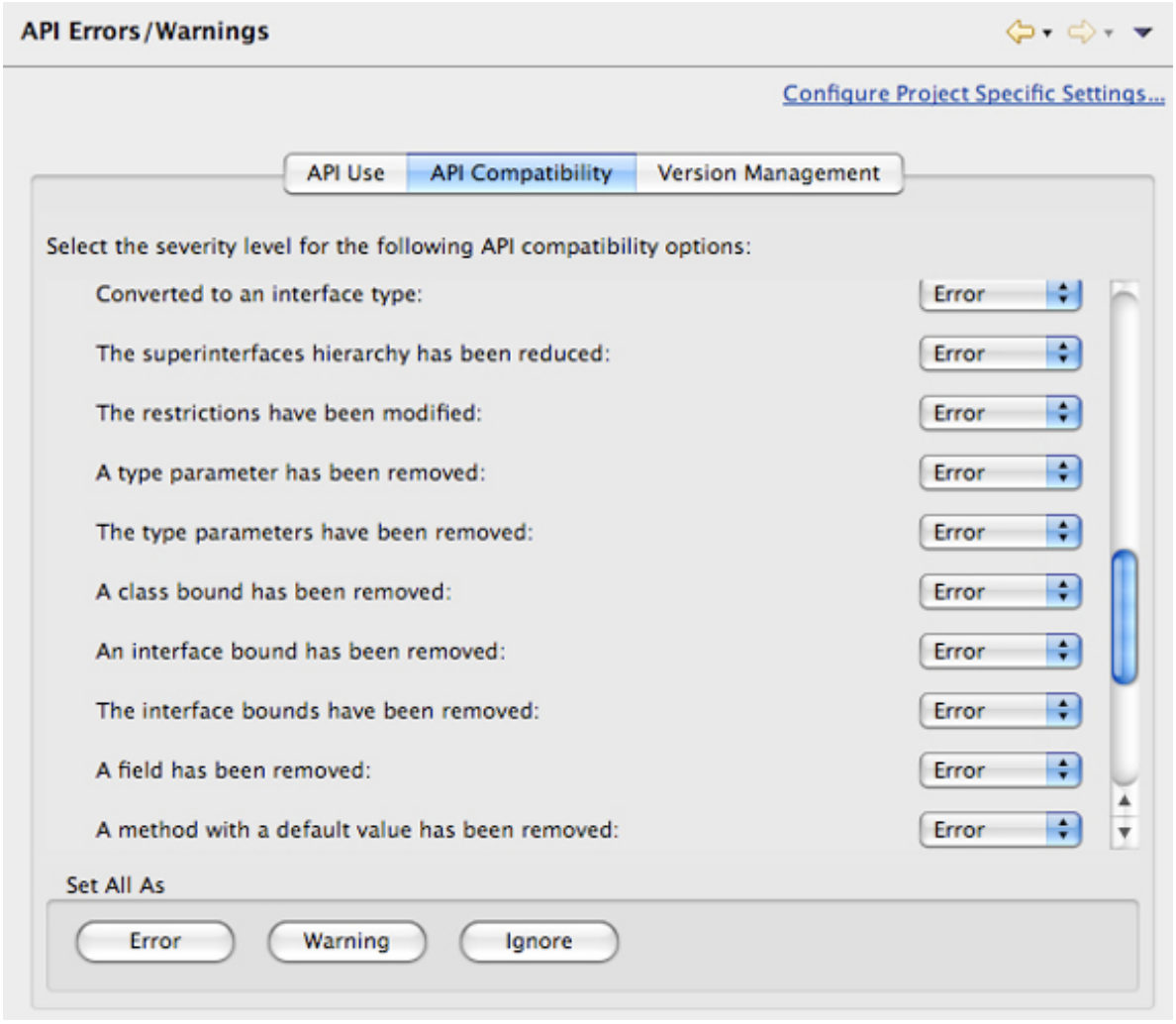
A difficult problem when declaring API is to know when you actually break API from version to version of your software. For example, an easy way to break API is to change the method signature of a previously defined API method. To illustrate, I'll do that in the Eclipse code base with the popular `PluginRegistry` class.

Figure 7. A binary-incompatible change



In this case, I modified an existing API method, `findEntry(String id)`, and API Tools is smart enough to realize that this would break clients of this API class. There are many other ways to break API, and API Tools provides checks for all of these. As a bonus, all these binary-incompatible changes are configurable using the API Tools preferences page.

Figure 8. API Tools preferences



Versioning

Another difficult problem that surfaces when dealing with API is version management. There are two sides to version management in my opinion: One is coming up with a versioning strategy and the other is enforcing it. API Tools follows the Eclipse Versioning Guidelines (see Resources), which are heavily based on the OSGi versioning scheme. To keep things simple, version numbers are composed of four segments — three integers and a string, respectively named major.minor.service.qualifier.

Headless API Tools and reporting

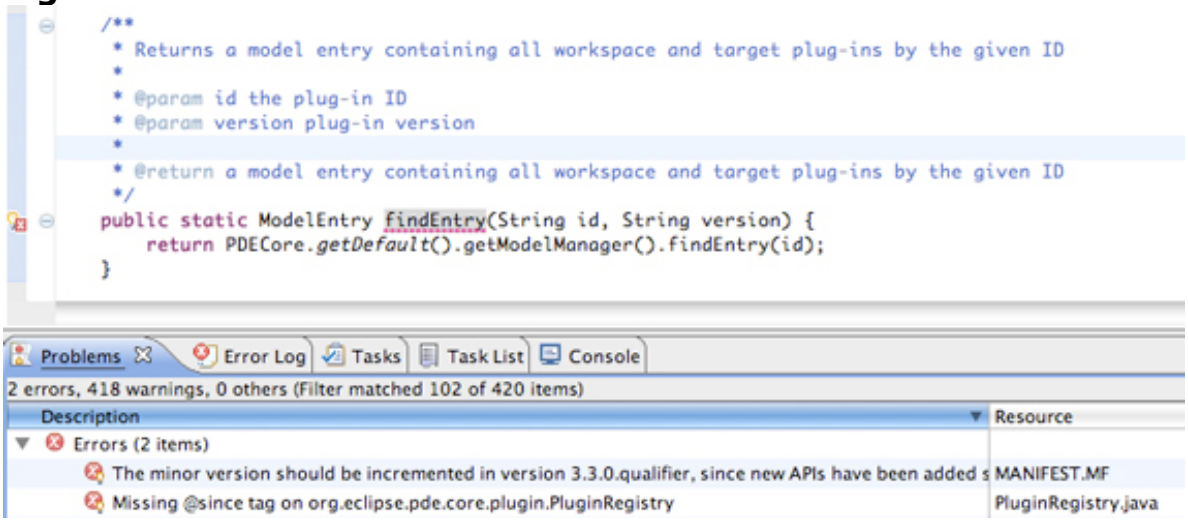
While it's outside the scope of this article to discuss using API Tools in a headless environment, it's possible to do so. This is exactly what the Eclipse build does, it generates API Baselines and API Reports. API Tools includes a few Ant tasks to help you do this. Please see the `org.eclipse.pde.api.tools` plug-in for more information about the Ant tasks.

Each version segment captures a different intent. The major segment indicates

breakage in the API, the minor segment indicates externally visible changes like new API, the service segment indicates bug fixes and the change of development stream, and the qualifier segment indicates a particular build.

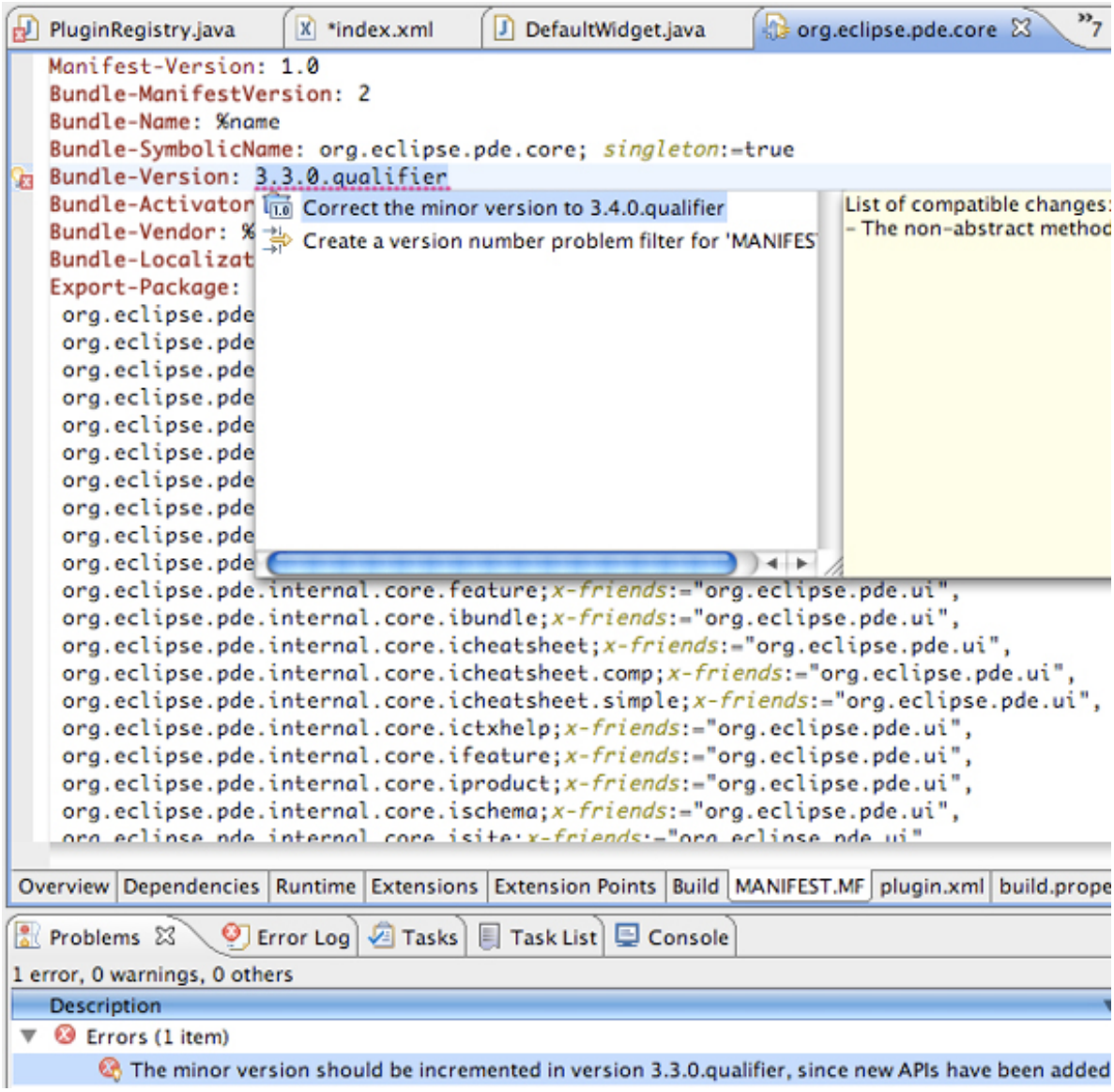
The difficult and error-prone part has always been remembering when to change the version number of your plug-in due to whatever changes you made (like adding a new API method or fixing a bug). A common problem in the past was that developers used to simply bump the minor version when anything changed instead of doing it when new API changed — for example, when the 3.4 stream opened for the Eclipse SDK, it was common to just bump the minor version, assuming changes would be made in the future to actually cause a need to modify the minor version. However, with API Tools, version management isn't error-prone anymore because API Tools is able to enforce and tell you what the proper version should be of your plug-in based on an API Baseline. For example, imagine I added a method to an API class of a plug-in that had a version of 3.3.0, what would API Tools show you?

Figure 9. Version errors



API Tools presents us with two errors, indicating that we should update the `@since` tag for the method to clearly state that the method is part of the 3.4 API. The other error indicates that the plug-in version be bumped in the MANIFEST.MF file. If we look at this specific error in detail, we see that API Tools even kindly offers a proper quick fix to update the version number to the correct version.

Figure 10. MANIFEST.MF Quickfix



Conclusion

This article provided a brief introduction to API Tools and showcased some of its features. It's important to note that this article scratches the surface of what API Tools can do for your projects. For example, you can use API Tools in a headless environment and also have API Tools generate reports for you that catch API violations. I hope you grasp the importance of API and versioning and start using API Tools in your projects.

Resources

Learn

- Learn more about the The Eclipse Plug-in Development Environment (PDE).
- Learn more about the PDE API Tools at the Eclipse Foundation.
- Read "Eclipse platform API rules of engagement" for additional history and background on Eclipse API.
- See "Eclipse Platform API Specification" for a list of Eclipse APIs.
- Learn more about how Eclipse versions its plug-ins at the Eclipse version-numbering page.
- Interested about OSGi? Check out the OSGi Alliance Web site.
- Interested in what's happening inside the Eclipse community? Check out PlanetEclipse.
- Check out the available Eclipse plug-ins at Eclipse Plug-in Central.
- Check out EclipseLive for webinars featuring various Eclipse technologies.
- Want to meet Eclipse committers and learn more about Eclipse projects? Attend EclipseCon, Eclipse's premiere conference.
- Check out the "Recommended Eclipse reading list."
- Browse all the Eclipse content on developerWorks.
- New to Eclipse? Read the developerWorks article "Get started with Eclipse Platform" to learn its origin and architecture, and how to extend Eclipse with plug-ins.
- Expand your Eclipse skills by checking out IBM developerWorks' Eclipse project resources.
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Discuss

- Chat with other Eclipse developers and committers on IRC.
- The Eclipse Platform newsgroups should be your first stop to discuss questions regarding Eclipse. (Selecting this will launch your default Usenet news reader application and open eclipse.platform.)
- The Eclipse newsgroups has many resources for people interested in using and extending Eclipse.
- Participate in developerWorks blogs and get involved in the developerWorks community.

About the author

Chris Aniszczyk is the technical lead for the Eclipse Plug-in Development Environment (PDE) project and principal consultant at Code 9. He tends to be all over the place inside the Eclipse community by committing on various Eclipse projects. He sits on the Eclipse Architecture Council, the Eclipse Foundation Board of Directors and on the

Eclipse Technology PMC. His passions are blogging, software advocacy, tooling, and anything Eclipse. He's always available to discuss open source or Eclipse over a frosty beverage.