eclipseCON™ 2008

API Tooling in the Eclipse™ SDK

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March 17th, 2008

Overview

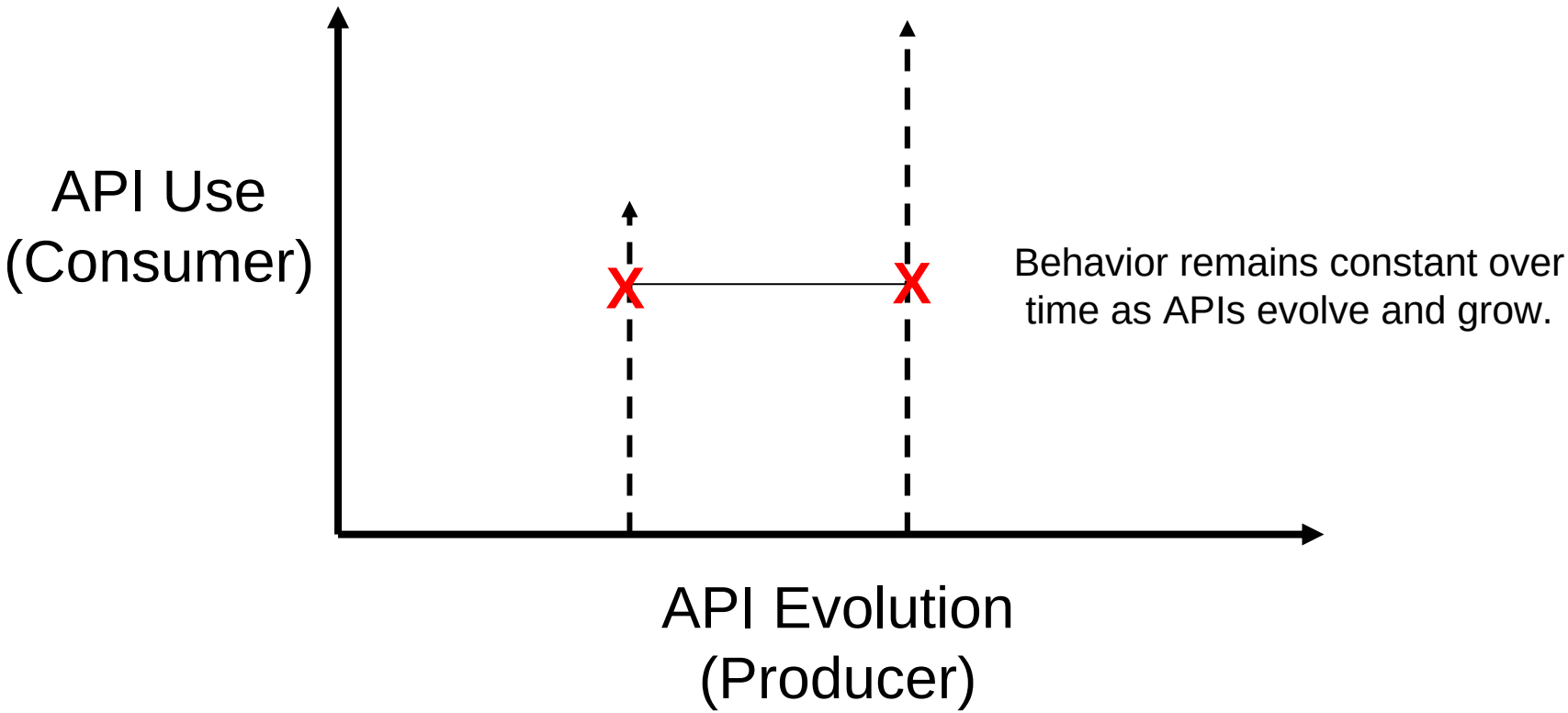
- The need for tooling
- Tooling features
- Tooling architecture
- Future work
- Summary
- Q&A

The Need for Tooling

Define API

- APIs are published contracts
  - Producers specify the contracts
    - Honor contracts release after release
    - Evolve the contracts for enhancements and fix problems
  - Consumers adhere to the contracts
    - Implement the contracts per specification
    - Use provided implementations per contract specifications

API Dimensions



What do we do today as plug-in developers?

- We use Javadoc™ to document contracts
  - This class is not intended to be instantiated or subclassed by clients.
  - Has no effect if not read
  - Inconsistent wording, placement, and use
- Use `component.xml` to specify API restrictions
  - Out of date, not maintained
  - Why? Because there's no tooling and it's separate from the code
- We use package names to categorize as public/internal, but all packages are exported
- We use OSGi package exports to limit visibility, but does not prevent access to internal types
- We use Eclipse's "access rules" to discourage use, but this can be turned off

More things we do today…

- Manually examine API changes or use some external tool before a release
  - Changes between releases can be significant
  - Validation is time consuming and error prone
  - Lost development time (due to checking and bugs found)

Some Existing Tools

- Diff
  - used to track API addition after the API freeze for the past releases.
- PDE incubator API tooling
  - used snapshots to be able to diagnose API breakages
- AUS (API Usage Scanner)
  - IBM tool to detect wrong usage of APIs
    http://www.alphaworks.ibm.com/tech/aus
- JDiff (used by TPTP)
  - http://www.jdiff.org/
- Open-source tool for jar comparison:
  - http://sab39.netreach.com/Software/Japitools/42/ (GPL)
- WTP tool using component.xml.
  - Error-prone as there is no tooling to maintain the component.xml file.

Disclaimer

- API design is still your problem
  - Designing quality APIs
  - Ensuring consistent behavior

- But there are things that tooling can with…

API Tooling Features

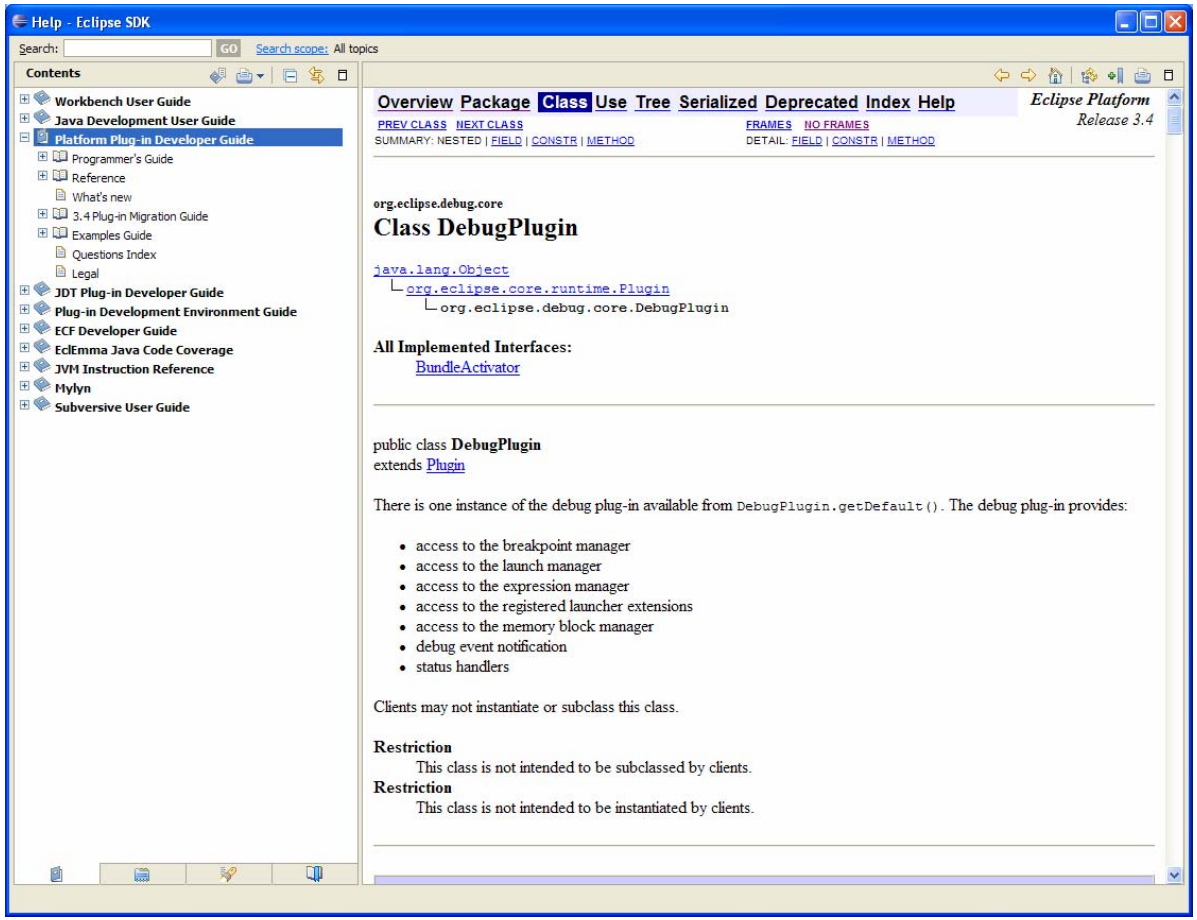
API Tooling to the Rescue!

- Reports
  - Illegal API use
  - Binary incompatibility relative to a baseline
  - Incorrect bundle version numbers
  - Missing or malformed @since tags
  - Leakage of non-APIs types inside APIs
- Tightly integrated toolset in the Eclipse SDK
  - Currently limited to Plug-in projects/OSGi bundles
  - Runs as a builder (auto-build, incremental and full builds)
  - Immediate feedback as you develop and use APIs

Specifying API Contracts

- Use Javadoc tags
  - E.g. *@noimplement, @noextend, @noreference, @noinstantiate*
- Benefits
  - Contracts live with the code for producers and consumers
  - Content assist helps developers
  - Available for projects that are not using 1.5 annotations
  - Restrictions appear in published Javadoc APIs in a standard way
  - Tools can process tags

Example of Published API



API Usage

- Once the APIs are specified, the user needs to make sure that he/she is using them appropriately.
- API usage is flagging any kind of illegal usage of API: reference to an API that is not supposed to be referenced, implementation of an interface that is not supposed to be implemented, ….
- A consequence of wrong API usage is a potential binary incompatible change error.

Validating Binary Compatibility

- Evolving APIs such that they are backwards compatible with existing binaries
  - http://wiki.eclipse.org/index.php/Evolving_Java-based_APIs
  - It is easy to get it wrong
  - Now the tooling takes care of this
- The user simply specifies an API baseline
  - Generally this means pointing to the previous release (N – 1)

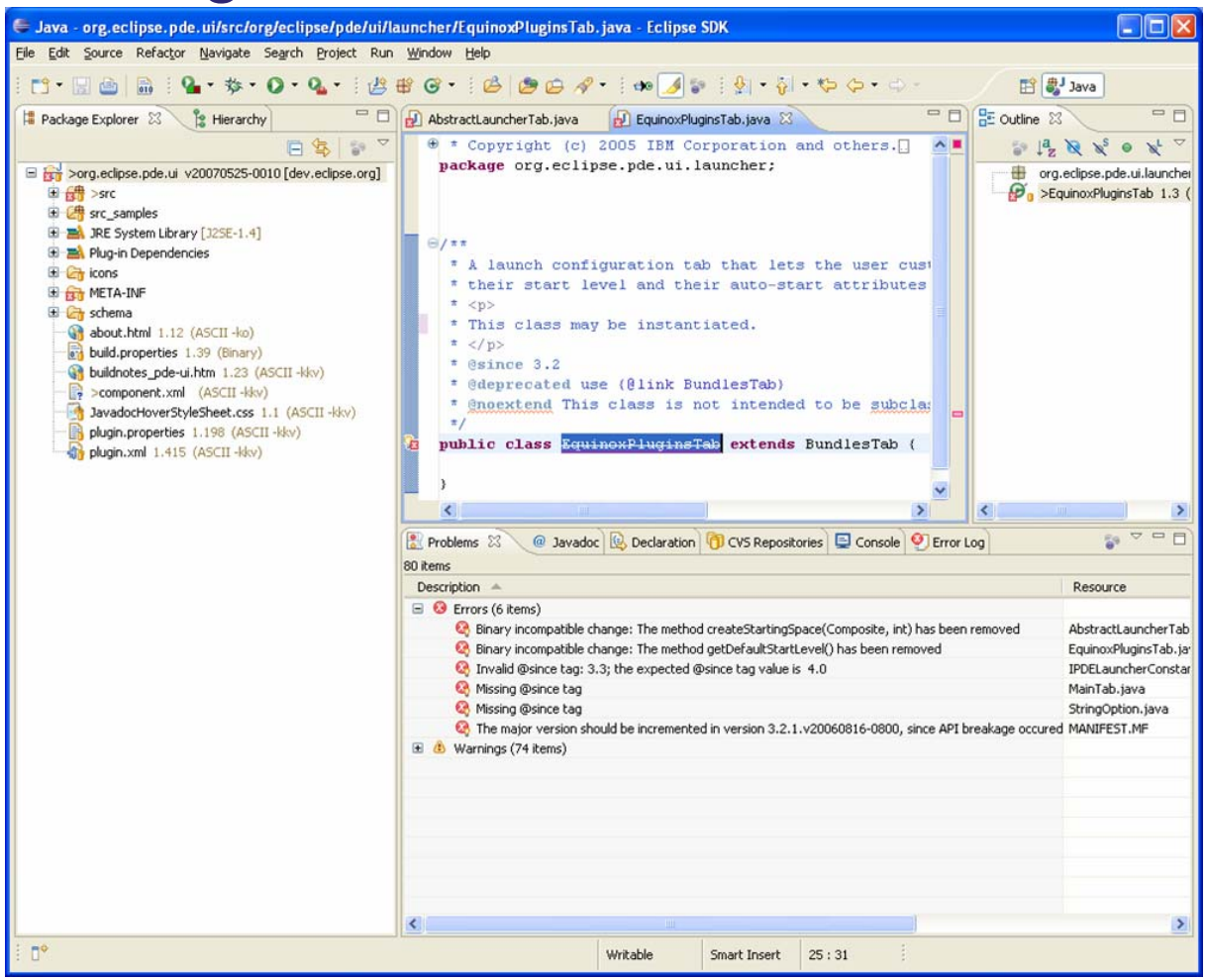
Bundle Version Number Management

- http://wiki.eclipse.org/index.php/Version_Numbering
- The tooling takes care of letting the user know when the minor or major version of a bundle should be changed according to rules described in the document:
  - A new API that is not a breaking change requires the minor version to be incremented
  - A new API that is a breaking change requires the major version to be incremented
- No support for the micro version for the initial release.
  - Technically speaking, this version should be changed as soon as any modification is made in the source code: comment change, method body change,…

Detecting API Leakages

- This is a crucial task to define a good API
- It detects the usage of non-API types inside API definition through return types of methods, method parameter types, thrown exceptions and field's type.
- Having such leaks can make your API unusable since the internal types might not be accessible

API Tooling in Action (simulation of bug 191231/191232)



API Tooling Architecture

API Profile and API Components

- These are the two major pieces used by the API tooling tools to make diagnosis on the code
- An API profile can be seen like a PDE target platform.
- An API profile is a collection of API components.
- An API component maps to an OSGi bundle.
- A profile is initialized using an Eclipse SDK installation plugins directory.
- Inside the IDE, a profile corresponding to the workbench contents is automatically created.

API Description

- This contains the specific restrictions for all the API types of an API component
- It is kept up-to-date inside the workbench by using resource listeners
- It is exported inside the binary bundles or generated at build time using an ant task.

Inside Problem Detection

- A search engine finds all references to “restricted” elements
  - Uses ASM to analyse class files
  - Based on binaries (not source)
- A comparator that builds general purpose deltas describing the differences between API profiles
  - finds method additions, removal, …
  - only checks API packages and types

Filtering of API Problems

- Each component can define a problem filter
- The filtering can be used to remove known breakages from reports.
  - For example, an API breakage has been approved by the PMC and you don't want to get it reported for each build.
- The problem filter is also part of the binary plug-in

Two aspects: IDE and build process

- Each feature is available from within the IDE or inside the build process.
- The IDE support is required to help the Eclipse developer while the code is written
- The build process support is required to provide feedback during the Eclipse build. This also allows other projects to use it inside their builds.

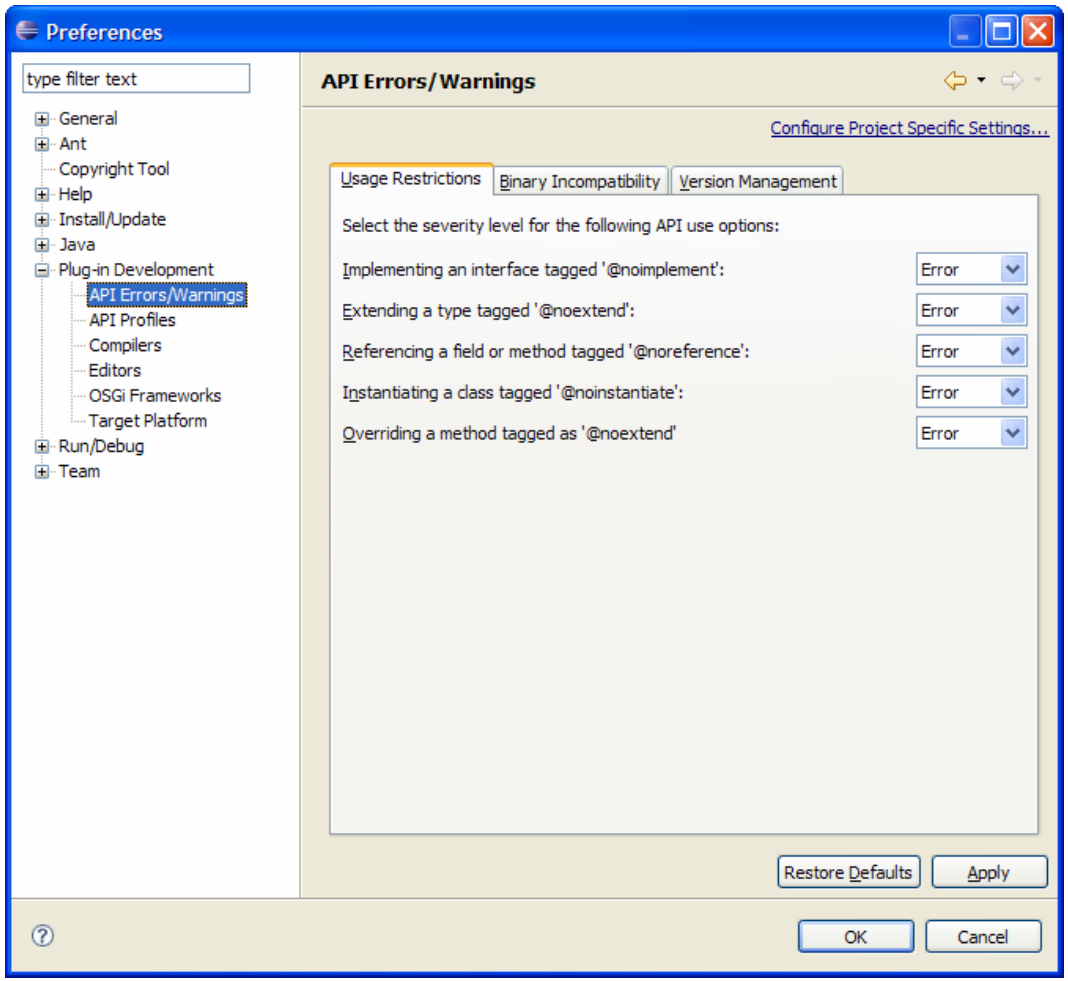
IDE support

- Addition of a new builder
- Addition of a new nature
- Creation of markers for each type of api problems: missing @since tags, binary compatibility issues, api usage, …
- Addition of quickfixes
- Addition of code assist for javadoc tag proposals
- Full build and incremental build support
  - Leverage java builder for incremental dependancy analysis

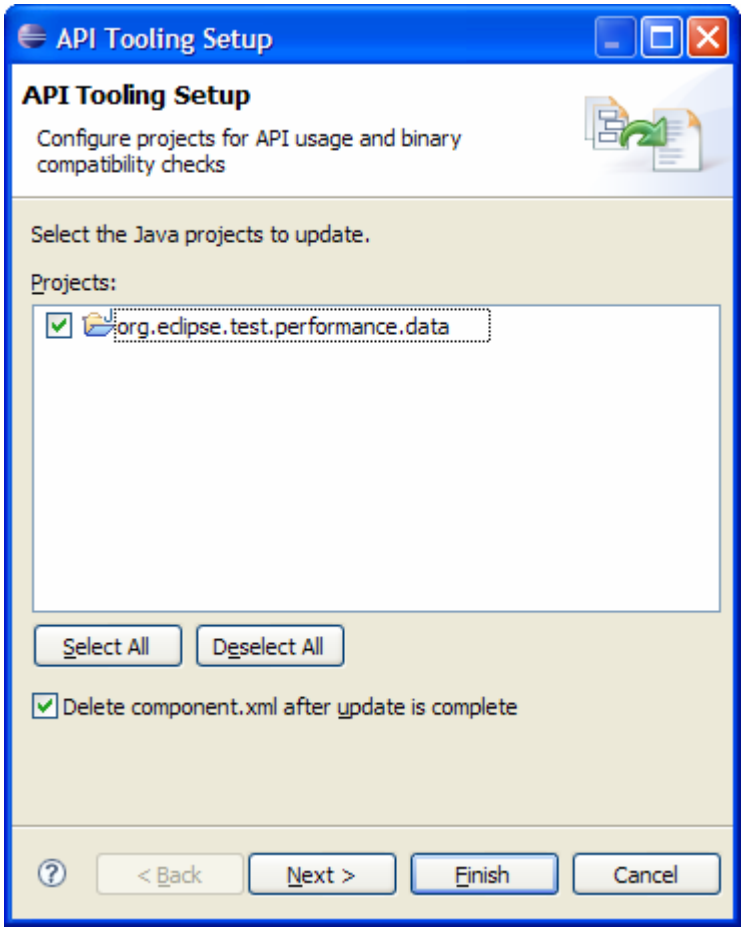
Releng Build support

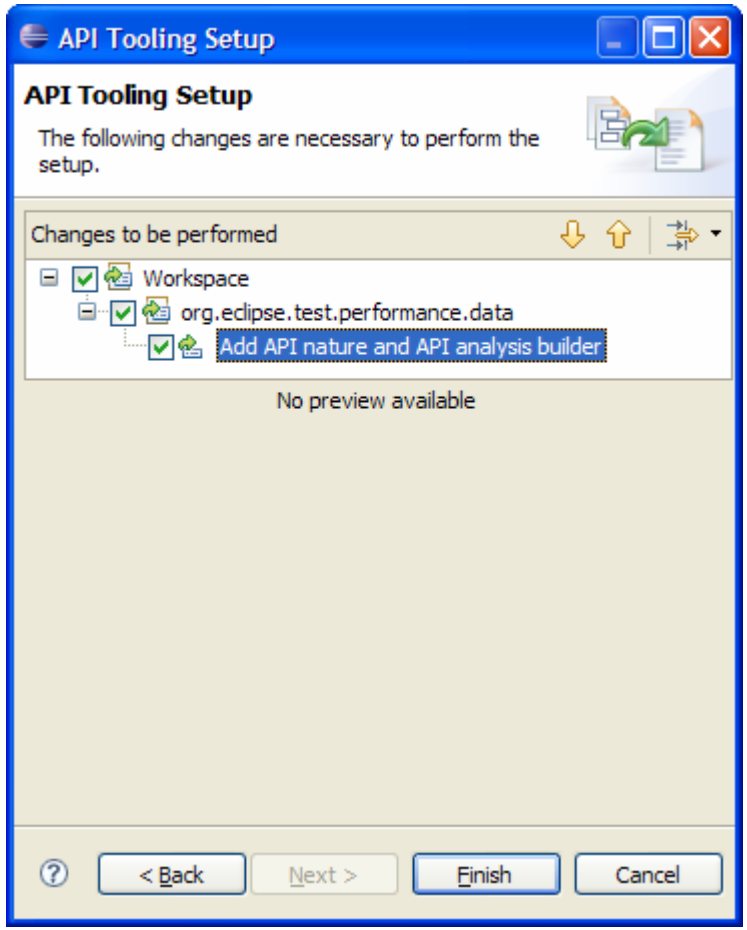
- Addition of new ant tasks:
  - Generation of .api_description file
  - Comparison of SDK drops: binary compatibility, api usage reports
- Integration inside the Eclipse builds (headless mode)
- Integration inside ant build (no Eclipse running)

API Error/Warning Preferences

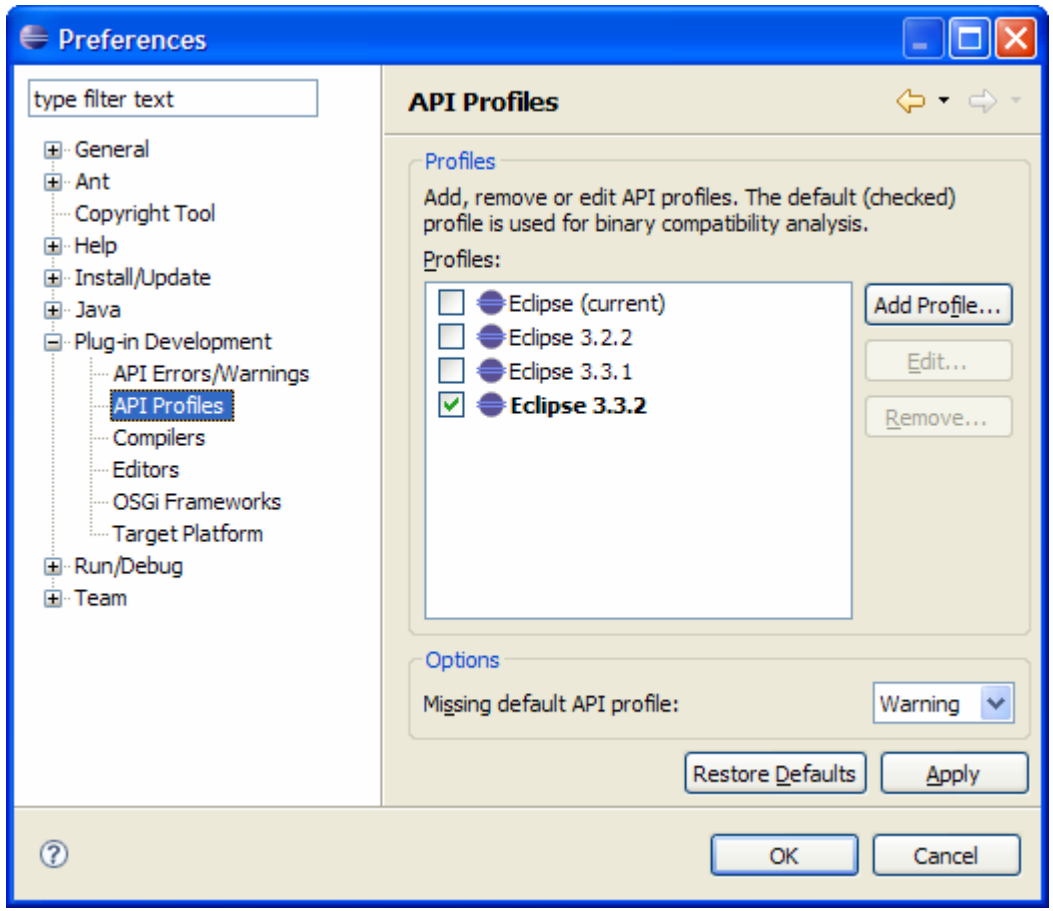


API Setup Wizard

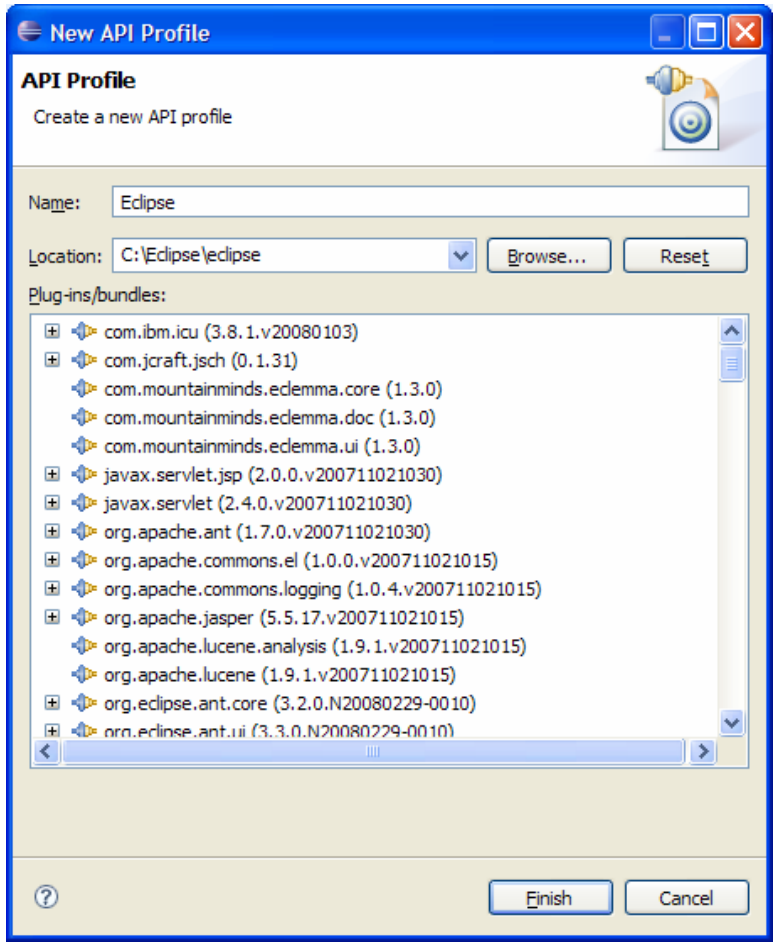




API Profile Preferences



API Profile Wizard



Demos

Stub creator

- API tooling provides an application that can be used to shrink the size of a jar file, a .class file or a set of them (inside a folder)
- A stub is a compressed version of the same .class file in which the tool removes all unnecessary data.
- Several options are provided like preserving the references, visibility filters and compress the stub files.
- A stub version can be used to define an API profile in order to reduce the space used on disk

Future work

To be done post 3.4

- Handling of package versioning
- Support extended to support more than just bundles
  - Pure Java™ projects
  - Consider plug-in extension points
- Global searching inside Eclipse projects
- Detect illegal use of system libraries with regards to the execution environment set for a project
  - i.e. referencing J2SE™-1.5 code when set to J2SE-1.4
- Improve integration with rel-eng build reporting
- Determine compatible version range of required bundles
- And what you might suggest

Summary

API Tooling Today

- Help you to define your API restrictions
- Keep a consistent and standard presentation of API restrictions
- Detect wrong API usage
- Detect binary breakage between a baseline and the current version
- Detect wrong @since tags
- Detect inconsistent bundle versioning
- Detect API leaking

Links

- Wiki
  - http://wiki.eclipse.org/Api_Tooling
- Bugzilla
  - https://bugs.eclipse.org/bugs/enter_bug.cgi?product=PDE
- Please send me any questions you might have to the API tooling team:
  - Darin_Wright@ca.ibm.com
  - Michael_Rennie@ca.ibm.com
  - Olivier_Thomann@ca.ibm.com

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Q & A

