Fundamentals of Plug-in and RCP Development

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Tutorial Outline

The Basics

Anatomy of a Plug-in

Exercise One: The Eclipse Browser Plug-in

The Plug-in Manifest Editor

The Development Lifecycle of a Plug-in

The Rich Client Platform

Developing for the Rich Client Platform

Exercise Two: The Eclipse Browser Product

The Basics

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What is Eclipse?

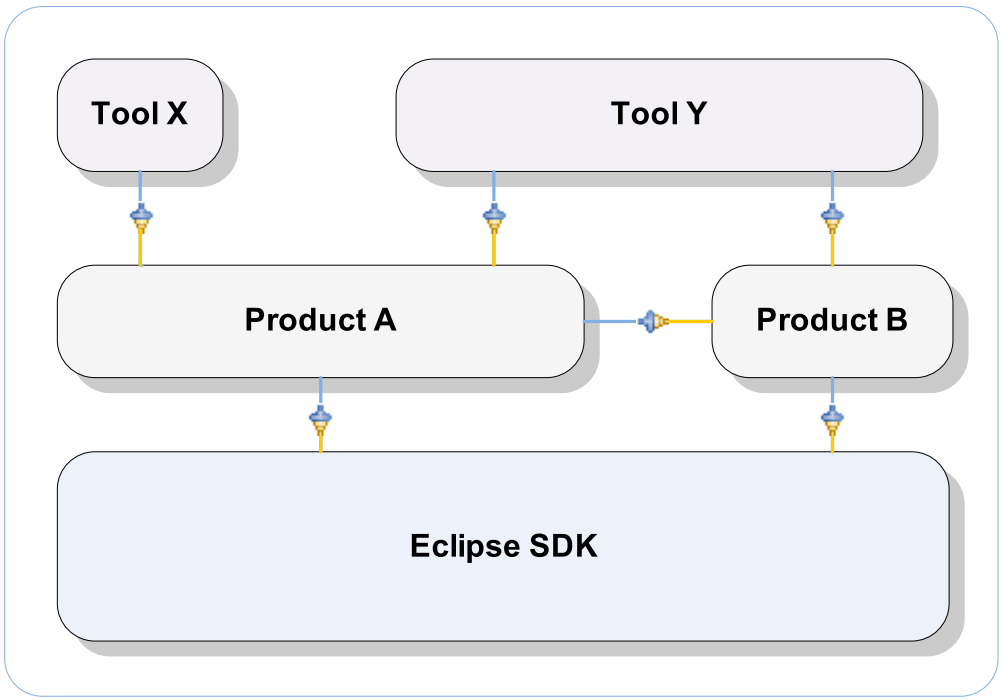
A very popular Java™ IDE
and much more…

What is Eclipse?

An open platform for anything and nothing in particular

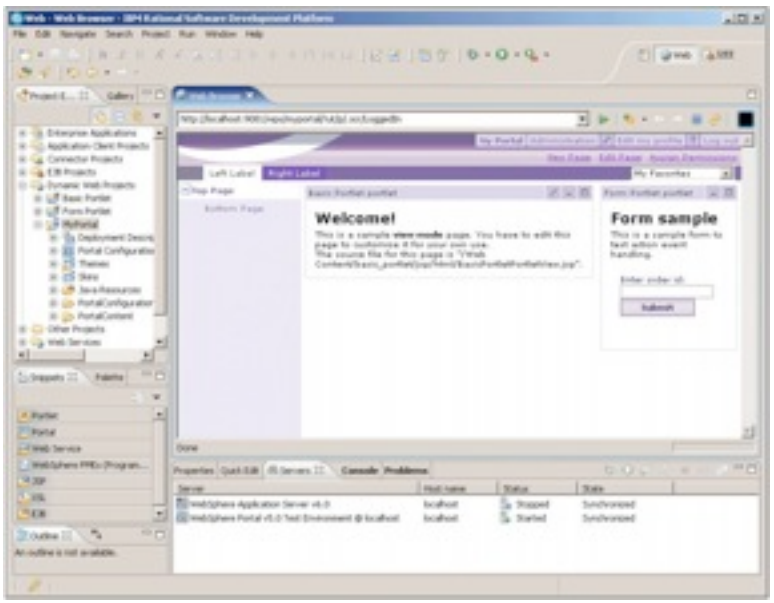
An Open Platform

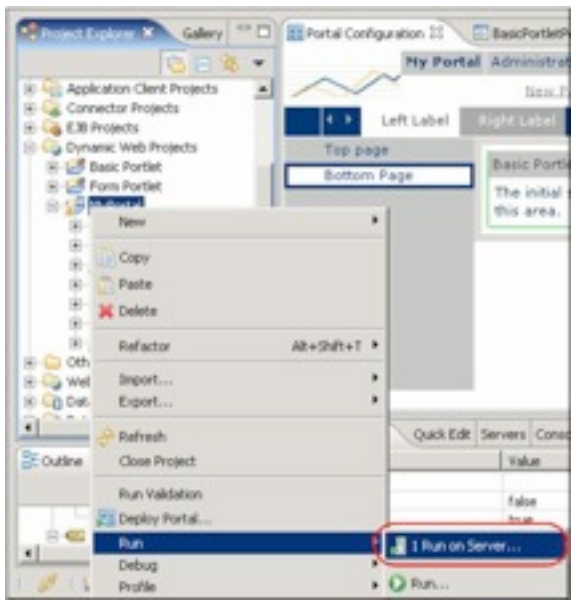
Eclipse is designed to be easily and infinitely extensible by third parties



An Open Platform for anything

IBM© Rational© Application Developer (RAD):
An Integrated Development Environment (IDE)





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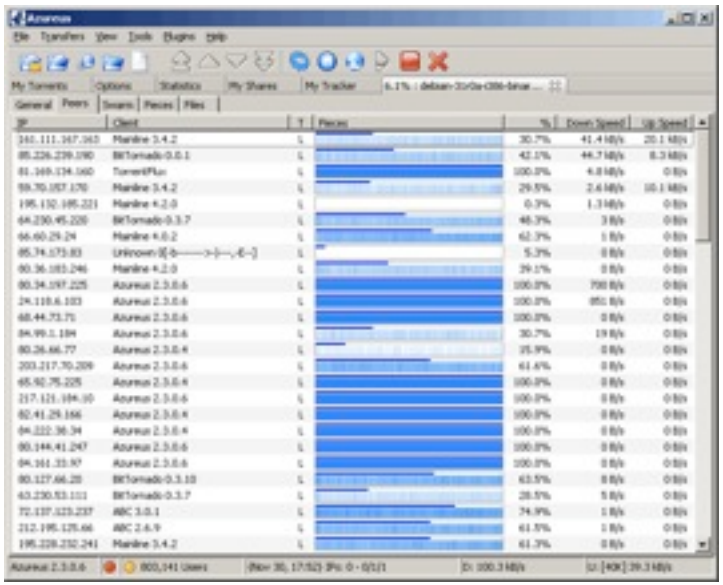
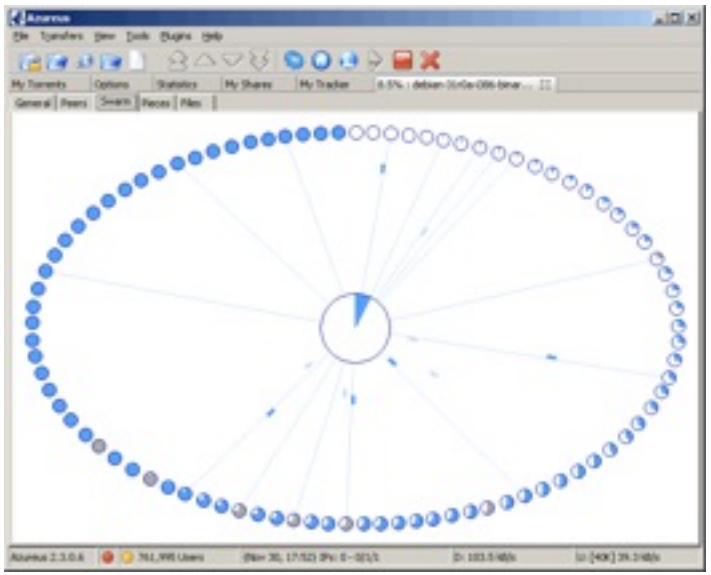
An Open Platform for anything

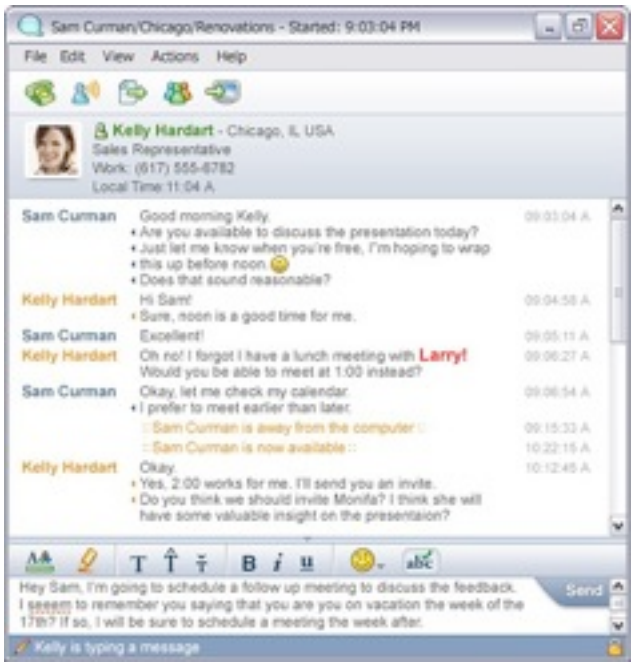
Azureus: a Java BitTorrent client





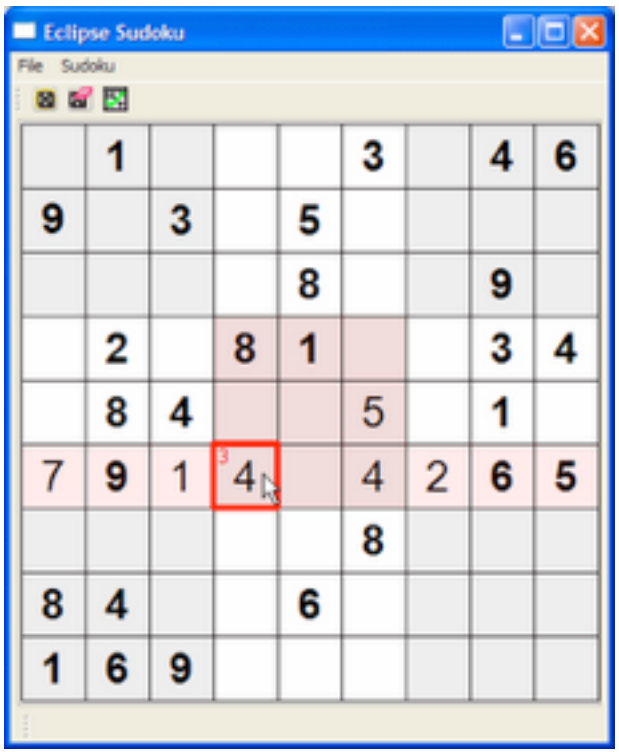
An Open Platform for anything

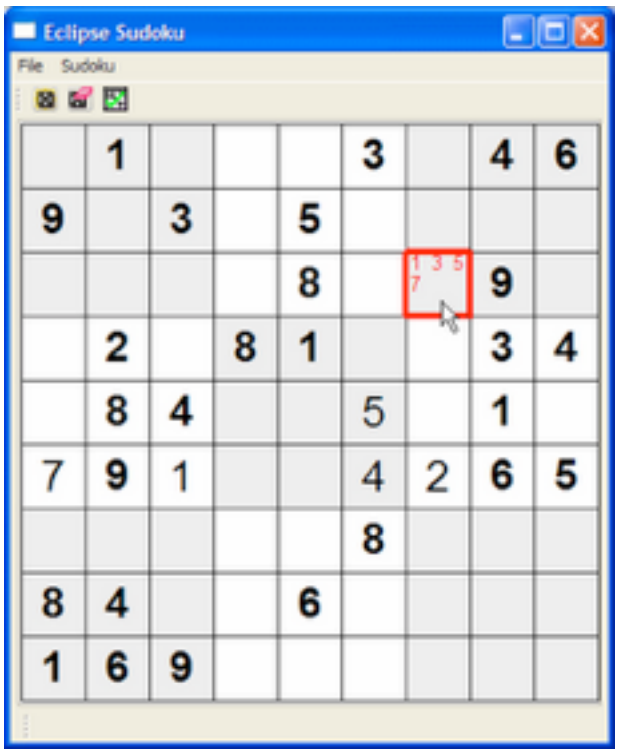
IBM Lotus SameTime 7.5: a chat client



An Open Platform for anything

Games!: Sudoku





An Open Platform for Nothing in Particular

- No bias in the platform toward any particular domain or discipline
- Eclipse plug-in development is a level playing field

Eclipse.org

An open source community that hosts over 60 open source projects

Enterprise Development

Application Frameworks

Embedded + Device Development

Language IDE

Rich Client Platform

Downloading and Running the Eclipse SDK

1. Download & Install a Java™ Runtime Environment (JRE)
2. Download an Eclipse SDK
   - http://download.eclipse.org/eclipse/downloads/
3. Unzip the Eclipse SDK archive
4. Run the Eclipse executable

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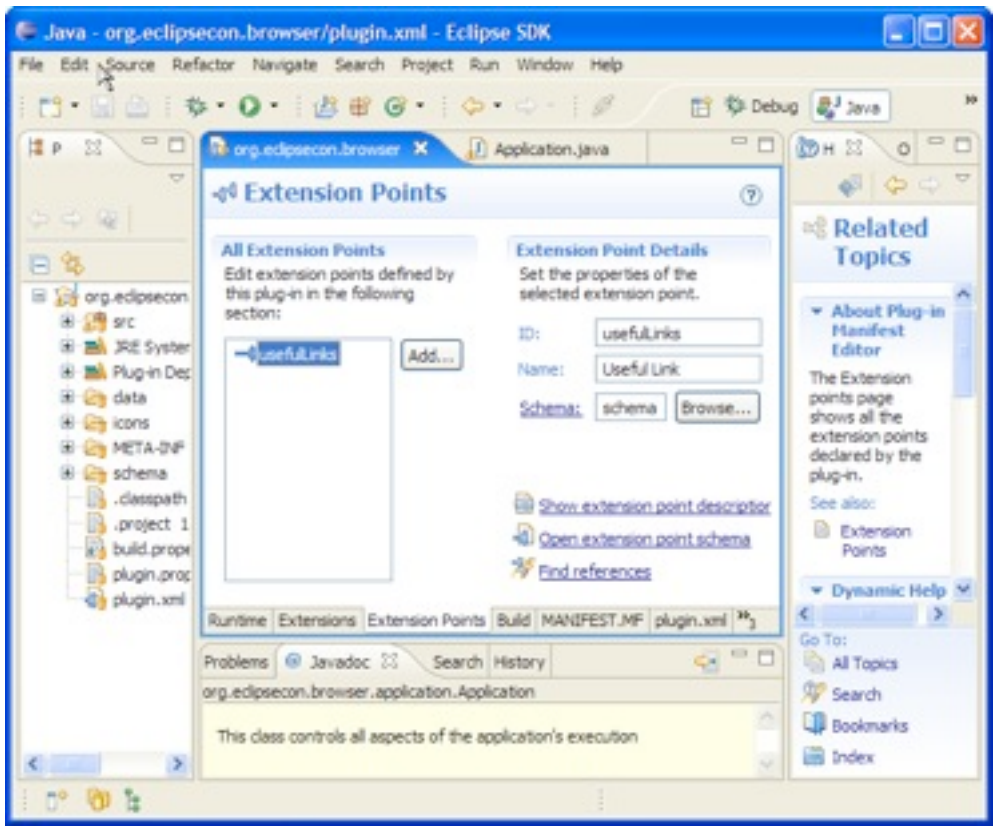
Supported Platforms

- Windows™
- Solaris 8™
- Mac OSX™
- AIX™
- Linux™
- HP-UX™

Eclipse on Windows™ XP



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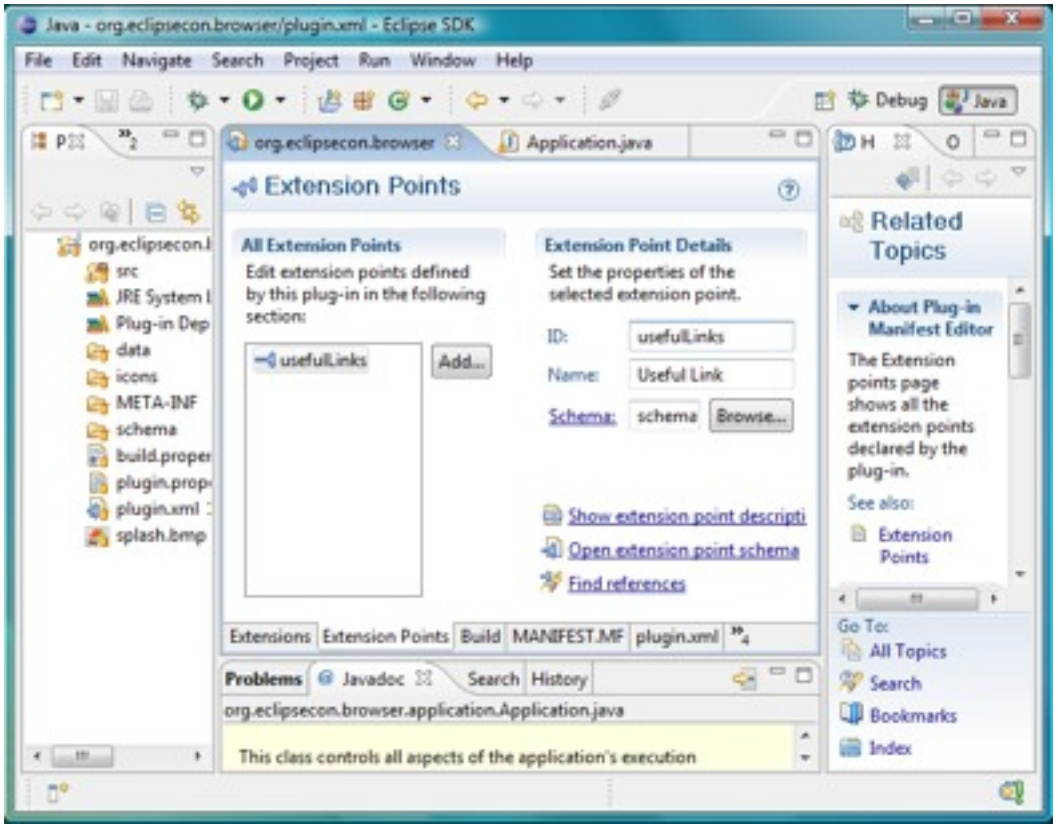
Eclipse on Windows Vista™



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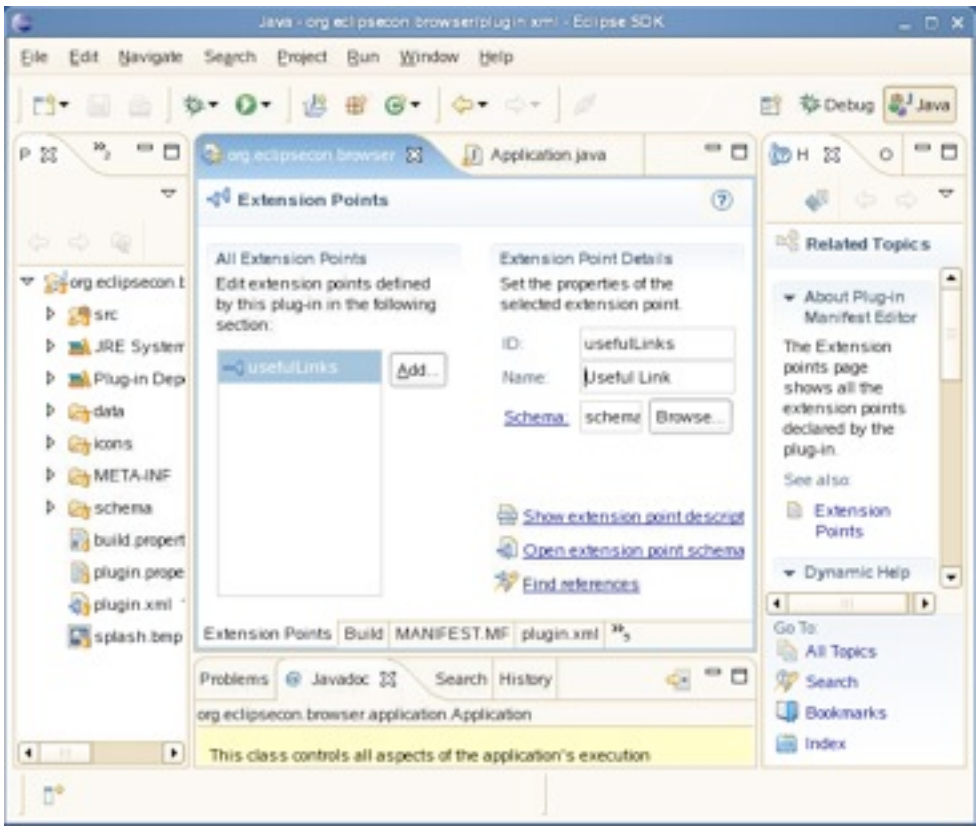
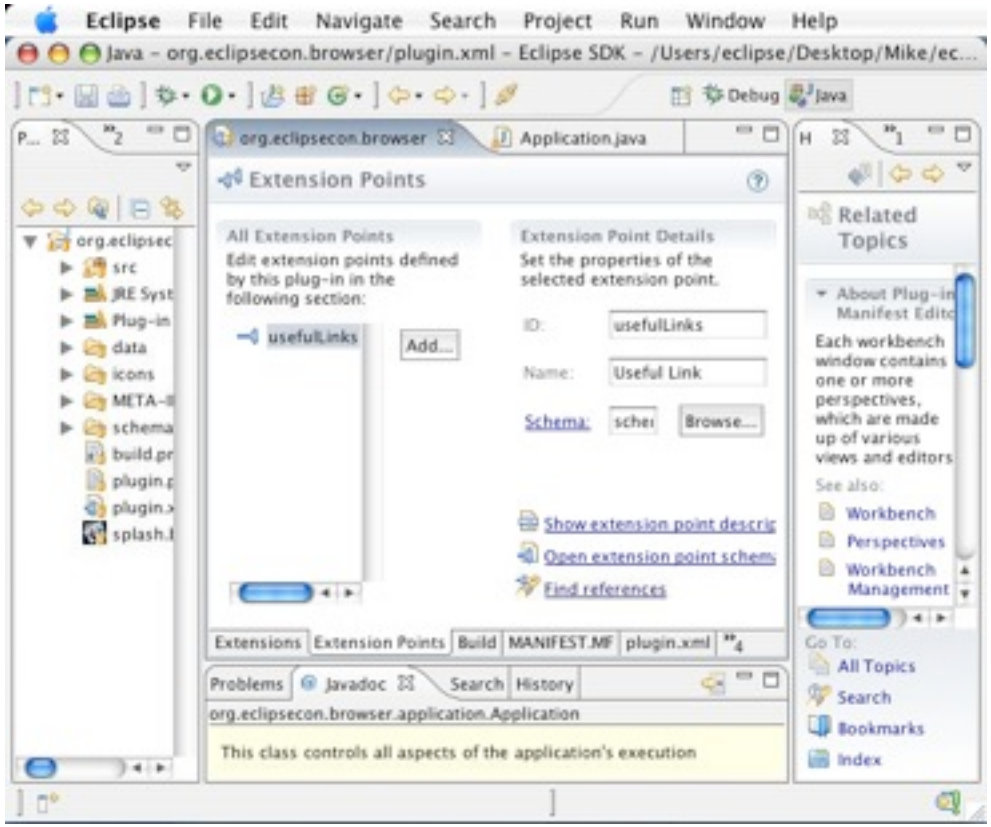
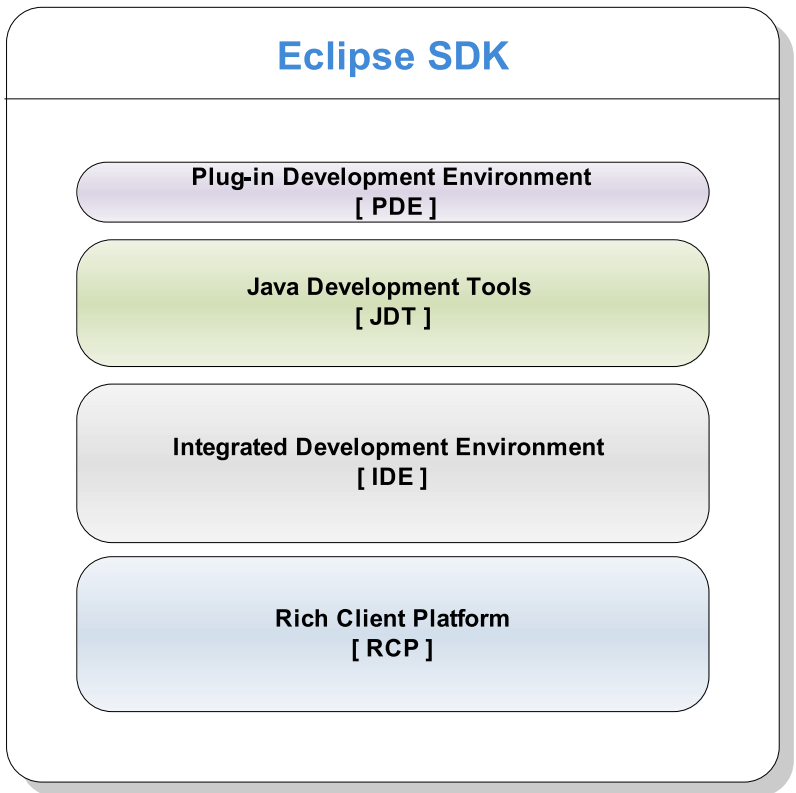
Eclipse on Linux™



Eclipse on Mac OSX™

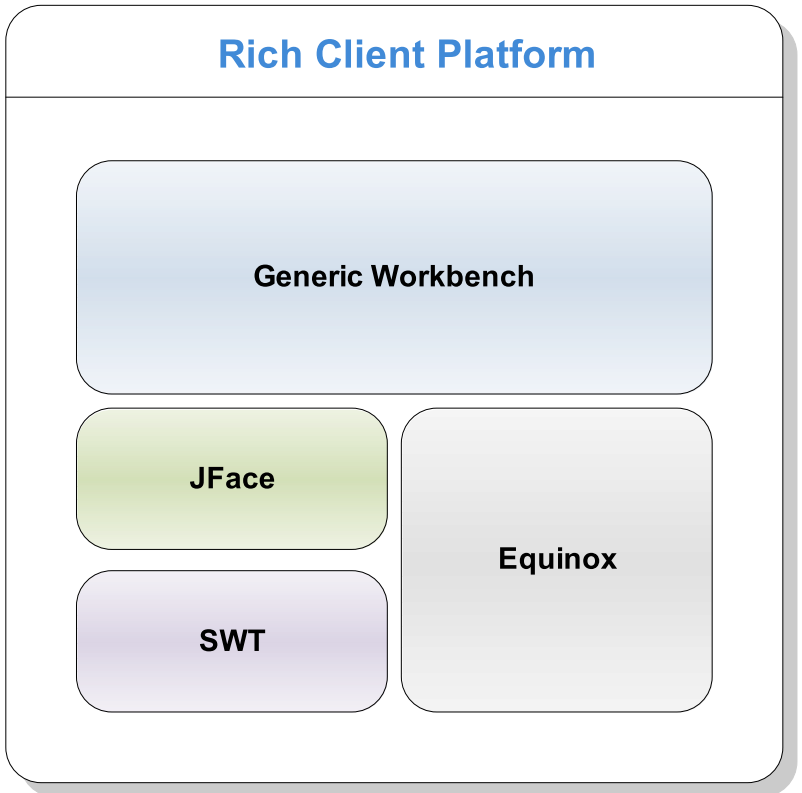


Inside the Eclipse SDK



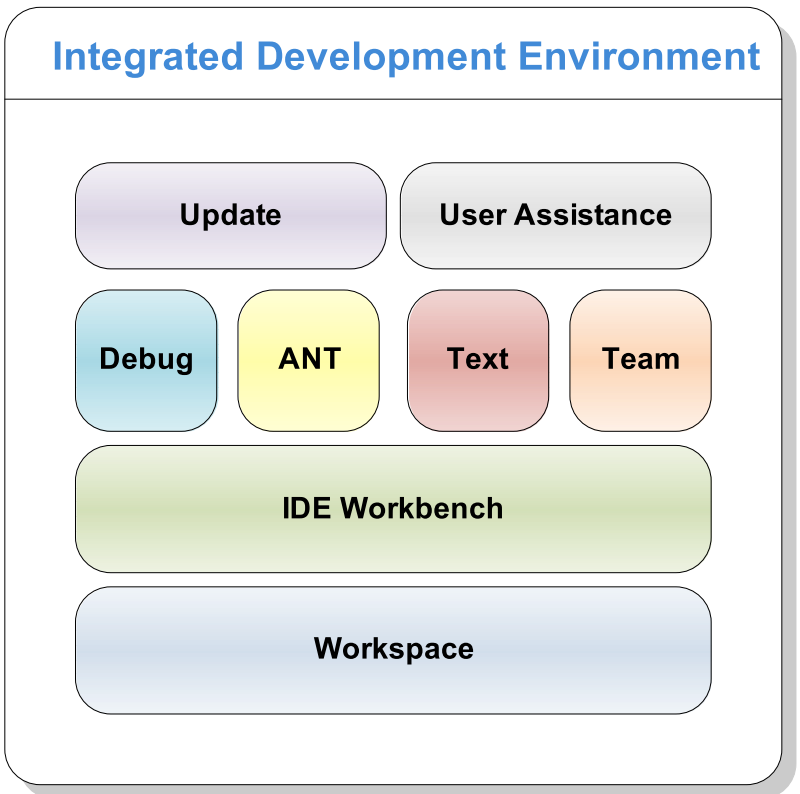
- RCP provides the architecture and frameworks to build any rich client application
- IDE is a tools platform and a rich client application in itself
- JDT is a complete Java IDE and a platform in itself
- PDE provides all the tools necessary to develop plug-ins and RCP applications

Rich Client Platform (RCP)



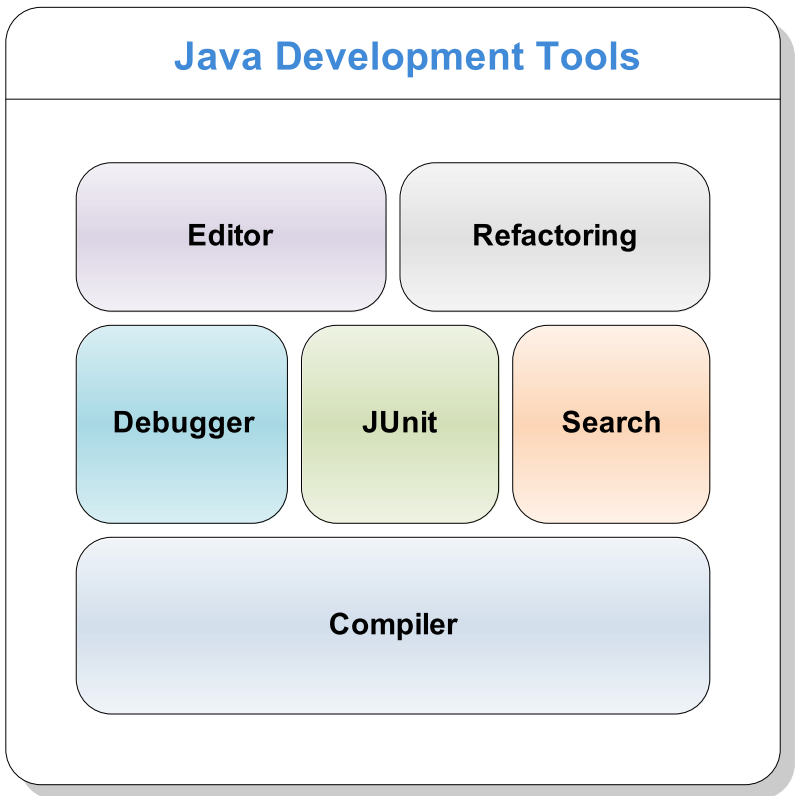
- Equinox is the runtime
- Standard Widget Toolkit (SWT) is a portable and native widget toolkit for Java
- JFace is a framework for common UI programming tasks
- Generic Workbench provides the UI personality of the Eclipse platform

Integrated Development Environment (IDE)



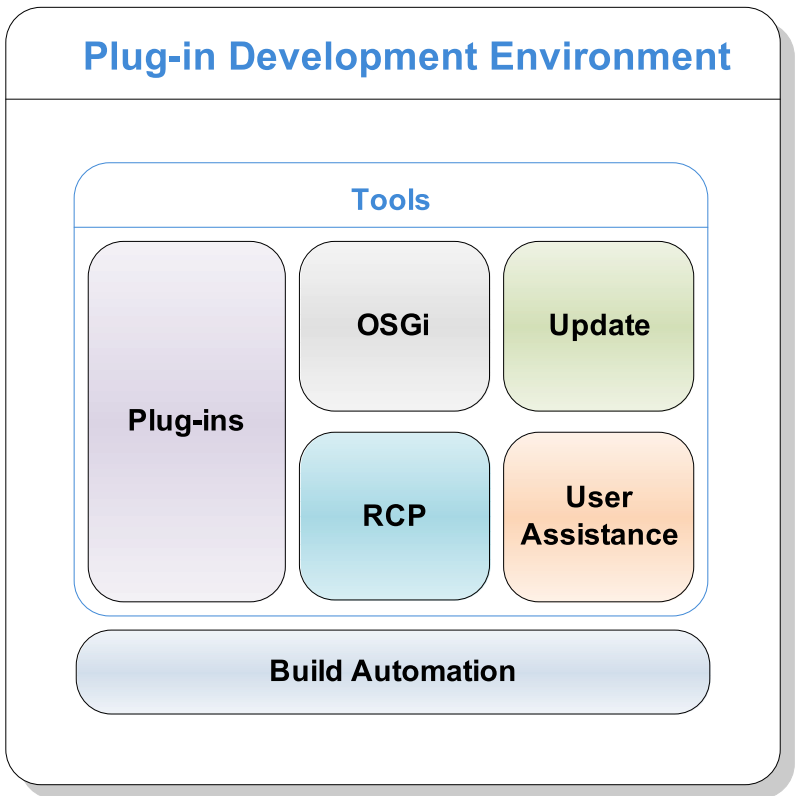
- The IDE Workbench defines the Eclipse presentation
- IDE is an open tools platform:
  - Resource management
  - Text editing framework
  - A Language-independent debug model
  - Ant integration
  - Team repository integration
  - Help system
  - Update manager

Java Development Tools (JDT)



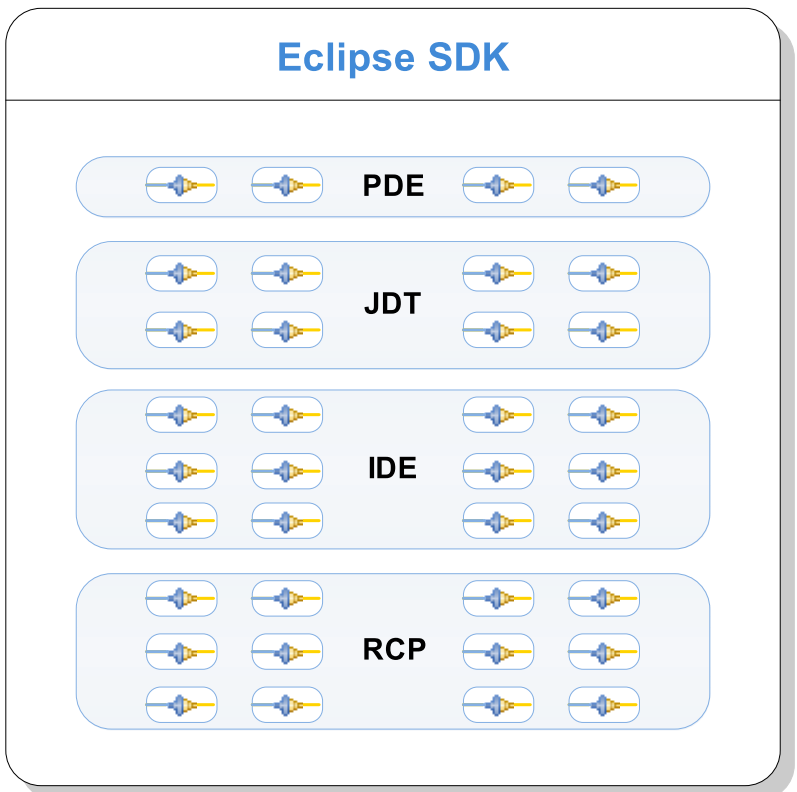
- JDT provides a complete Java IDE
- The compiler, which operates in incremental and batch modes, is also available as a separate download
- JDT is extensible:
  - Search and refactoring participants
  - Quick-Fix processors
  - Code Formatters
  - etc…

Plug-in Development Environment (PDE)



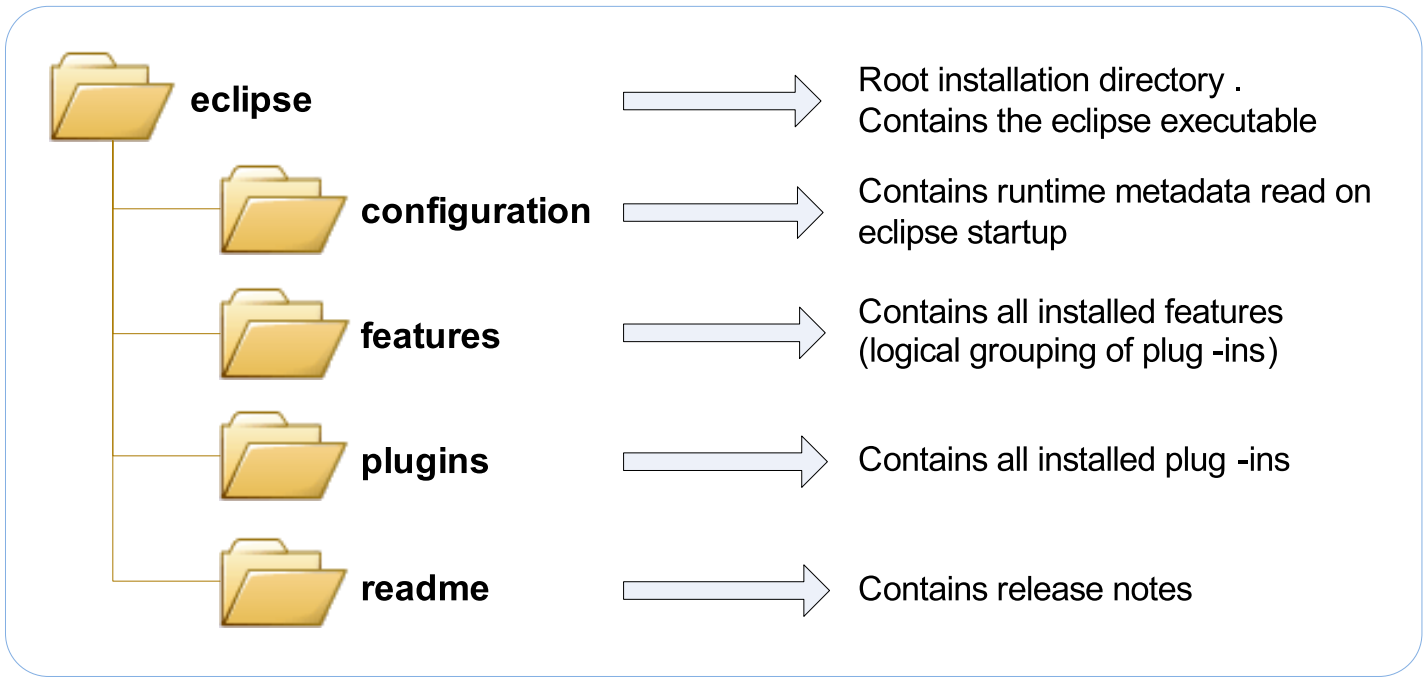
- PDE Does Plug-ins
- PDE Does RCP
- PDE Does Features and Update Sites
- PDE Does OSGi
- PDE Does User Assistance (as of Eclipse 3.3)

Plug-ins All the Way Down



- A plug-in is the fundamental building block of an Eclipse product
- Plug-ins build on top of and use other plug-ins
- To extend Eclipse, you must write plug-ins
- To write a rich client application, you must write plug-ins

Layout of an Eclipse product



Tutorial Outline

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Anatomy of a Plug-in

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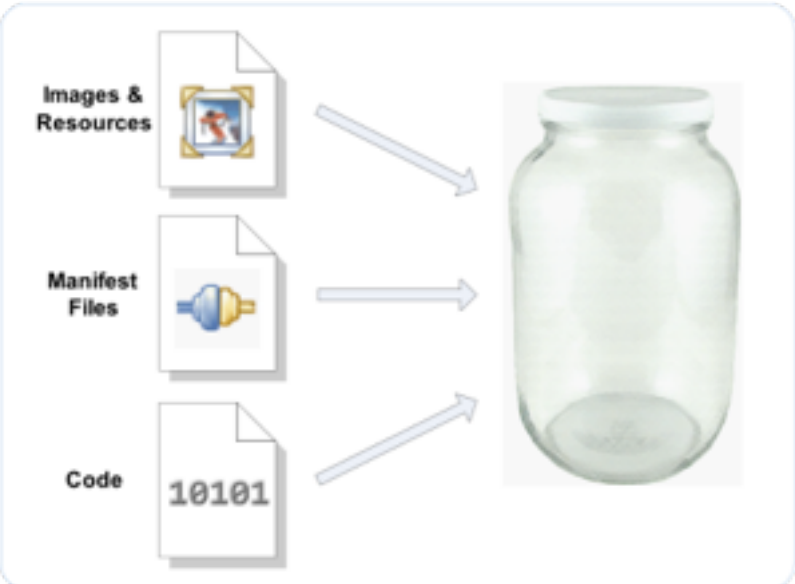
A Fundamental Building Block



- A plug-in is a **J**ava **Ar**chive (JAR)
- A plug-in is self-contained
  - houses the code and resources that it needs to run
- A plug-in is self-describing
  - who it is and what it contributes to the world
  - what it requires from the world

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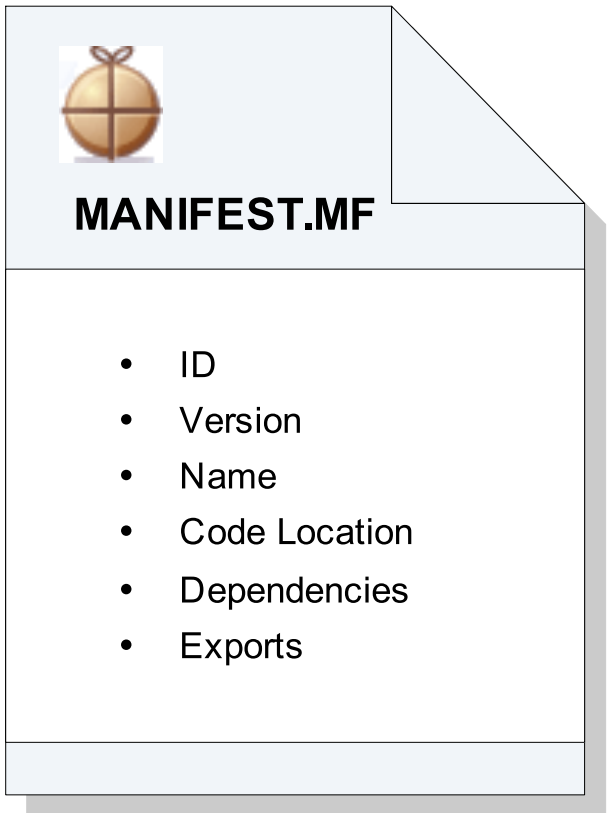
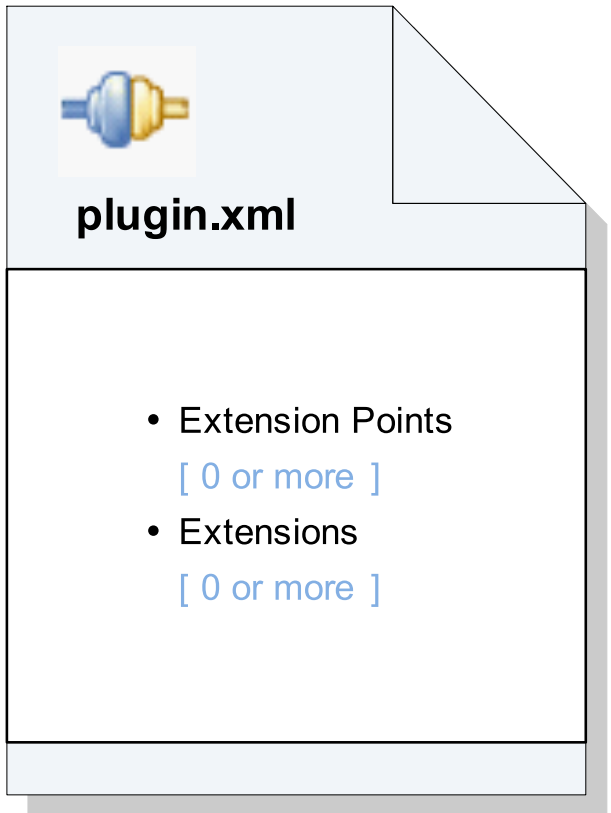
A Tale of Two Manifest Files





A Mechanism for Extensibility

- Extensibility in Eclipse is achieved via loose coupling
- Plug-in A exposes an extension point (the electric outlet)
- Plug-in B extends plug-in A by providing an extension (the plug) that fits into plug-in A's outlet
- Plug-in A knows nothing about plug-in B

If the Extension Fits…

- So many extension points…
- Each extension point is unique
- Each extension point declares a contract
- The extension point provider accepts only extensions that abide to the terms of its contract

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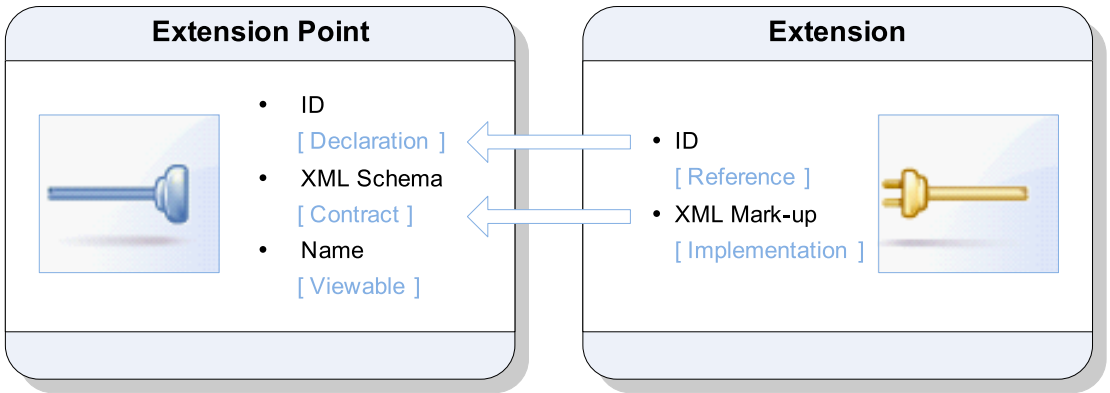
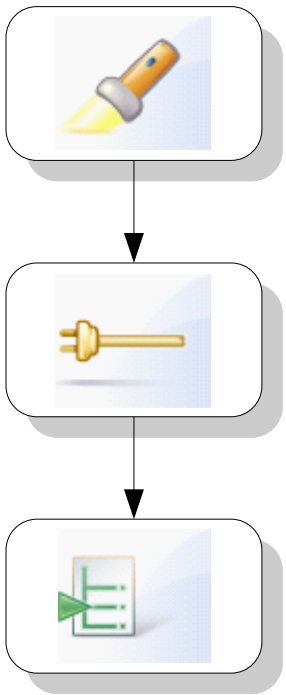
A Declarative Approach



- Extension points and extensions are declared in the plugin.xml file
- The runtime is able to wire extensions to extension points and form an extension registry using XML markup alone

Extensibility in Pictures

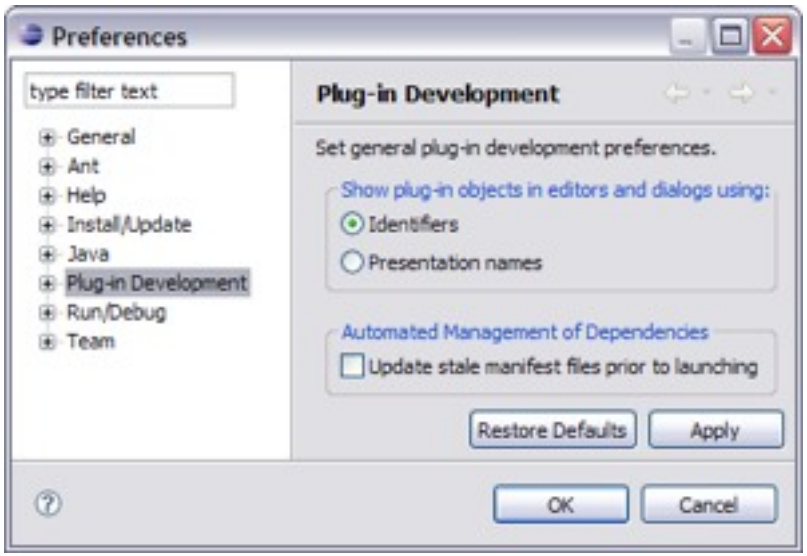


Query the registry for registered compliant extensions

Present extensions based on markup

Load classes only when the extension is needed

Extensibility in Action



- Plug-ins may contribute preference pages
- All preference pages are assembled and categorized in the Preferences dialog
- How is the Preferences dialog created?
- How and when is a particular preference page created?

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The Electric Outlet and the Plug

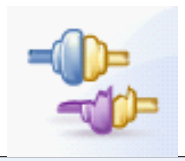
Extension Point

```
<extension-point
        id="preferencePages "
        name="Preference Pages "
        schema="schema/preferencePages .exsd"/>
```

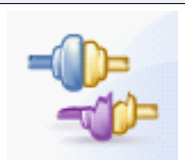
Extension

```
<extension
        point="org.eclipse.ui.preferencePages ">
        <page
                class="org.eclipse…MainPreferencePage "
                id="MainPreferencePage ">
                name =”Plug-in Development”
        </page>
…
</extension>
```

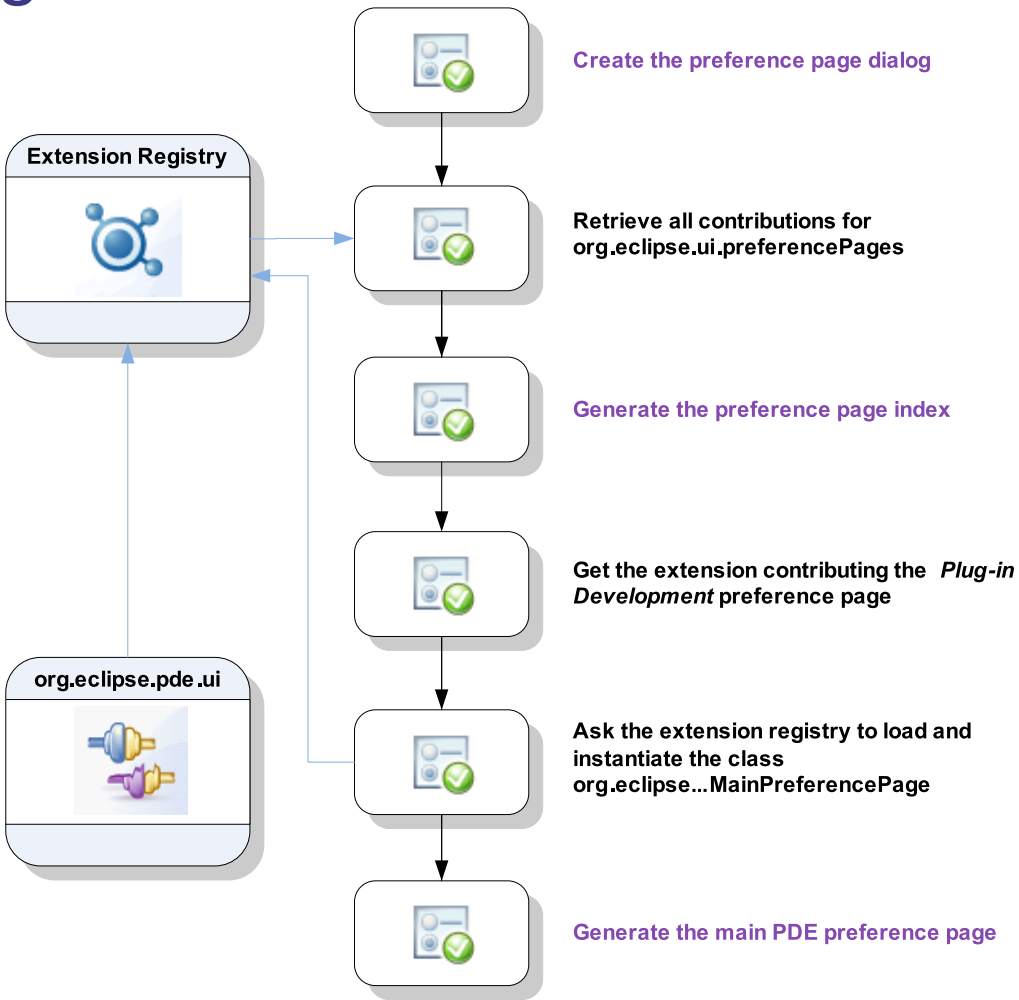
org.eclipse.ui



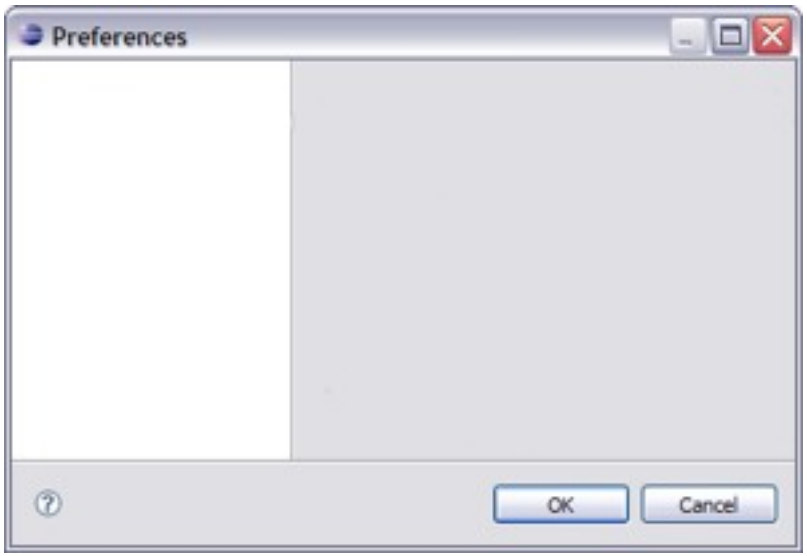
org.eclipse.pde.ui



Lazy Loading



Create the Preferences Dialog (1/3)



- The UI plug-in provides the `org.eclipse.ui.preferencePages` extension point
- The UI plug-in first creates an empty Preferences dialog
- Now the dialog needs to be populated…

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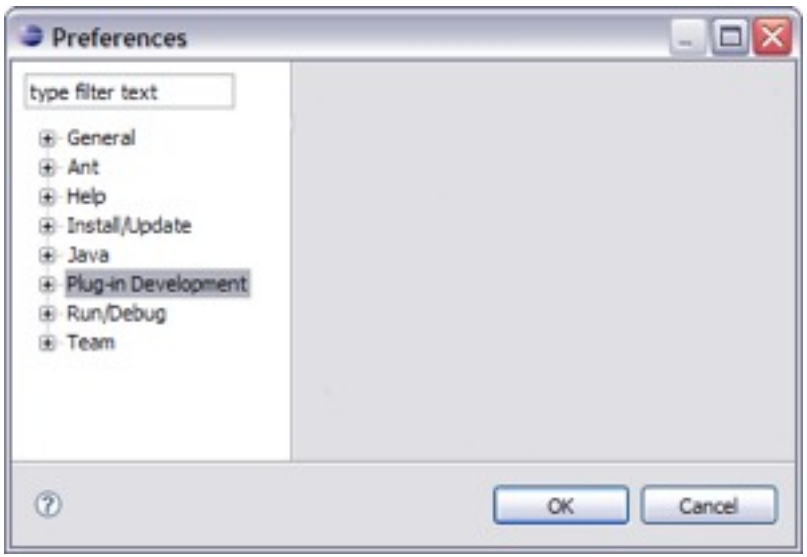
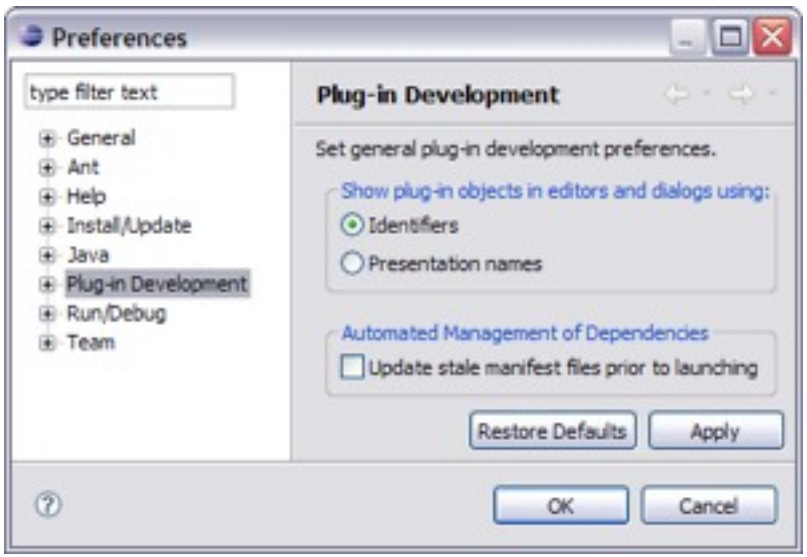
Generate the Preference Page Index (2/3)



- The UI plug-in queries the extension registry for all `org.eclipse.ui.preferencePages` extensions
- The preference page index is then generated using the xml markup only:
  - Names for available preference pages are displayed in the tree using the `name` attribute
  - The `category` attribute is used to categorize the pages

Create the *Plug-in Development* Preference Page (3/3)



- When the *Plug-in Development* preference page gets selected, the UI plug-in asks the extension registry to load and instantiate the Java class specified by the `class` attribute of the corresponding extension
- The class gets loaded and the preference page gets created
- The plug-in providing that extension (i.e. the `org.eclipse.pde.ui` plug-in) may then get activated, if it's not already active

Tip of the Iceberg

- Plug-ins are connected without loading any of their code
- Code is loaded only when it is needed
- The lightweight declarative and lazy approach scales well
- An installed plug-in is not necessarily an active plug-in

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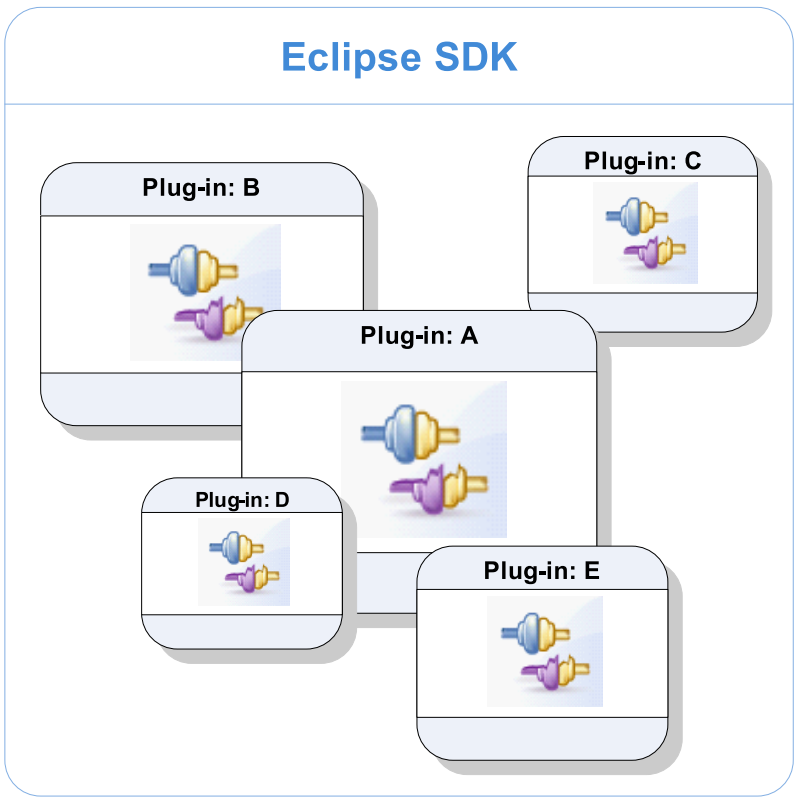
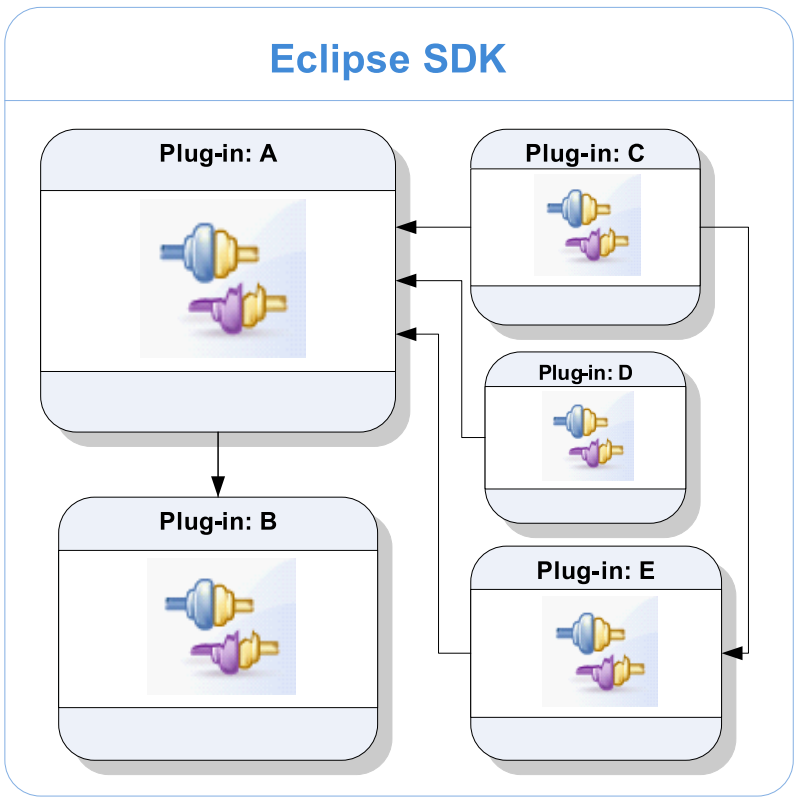
A Society of Plug-ins



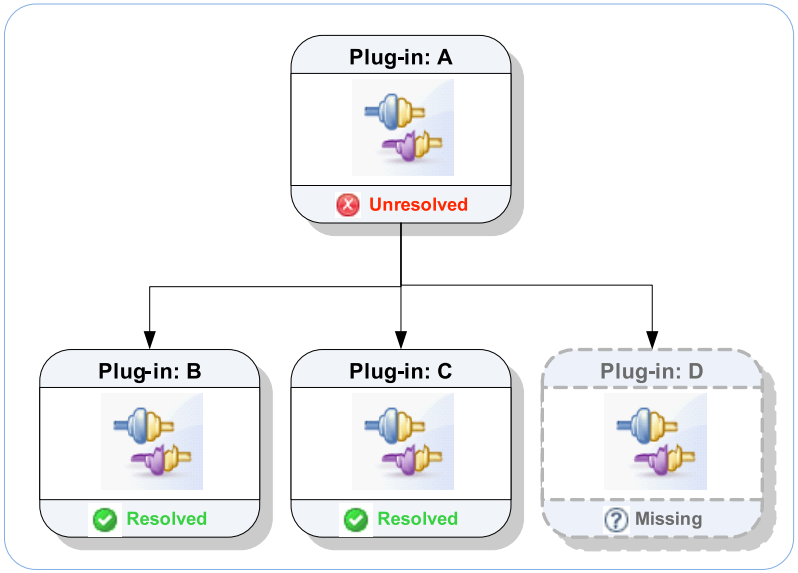
- An Eclipse product is the sum of its constituent plug-ins
- Plug-ins are discovered upon Eclipse startup
- Plug-ins do not know how to play and interact with each other on their own

An Ordered Society of Plug-ins



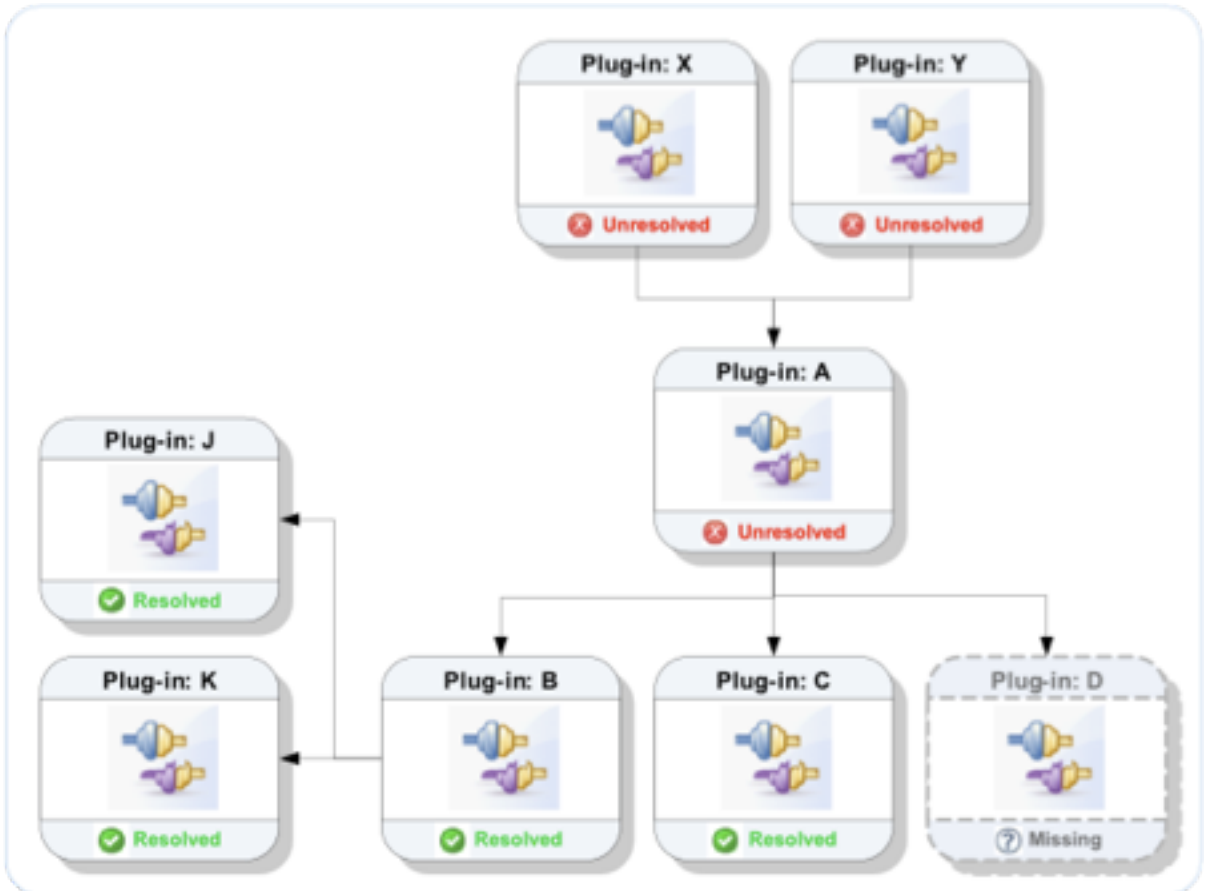
- The Eclipse runtime manages all installed plug-ins and brings order and collaboration to their society
- A classpath for each plug-in is dynamically constructed based on the dependencies declared in its MANIFEST.MF file
- Every plug-in gets its own classloader

Unresolved Plug-ins

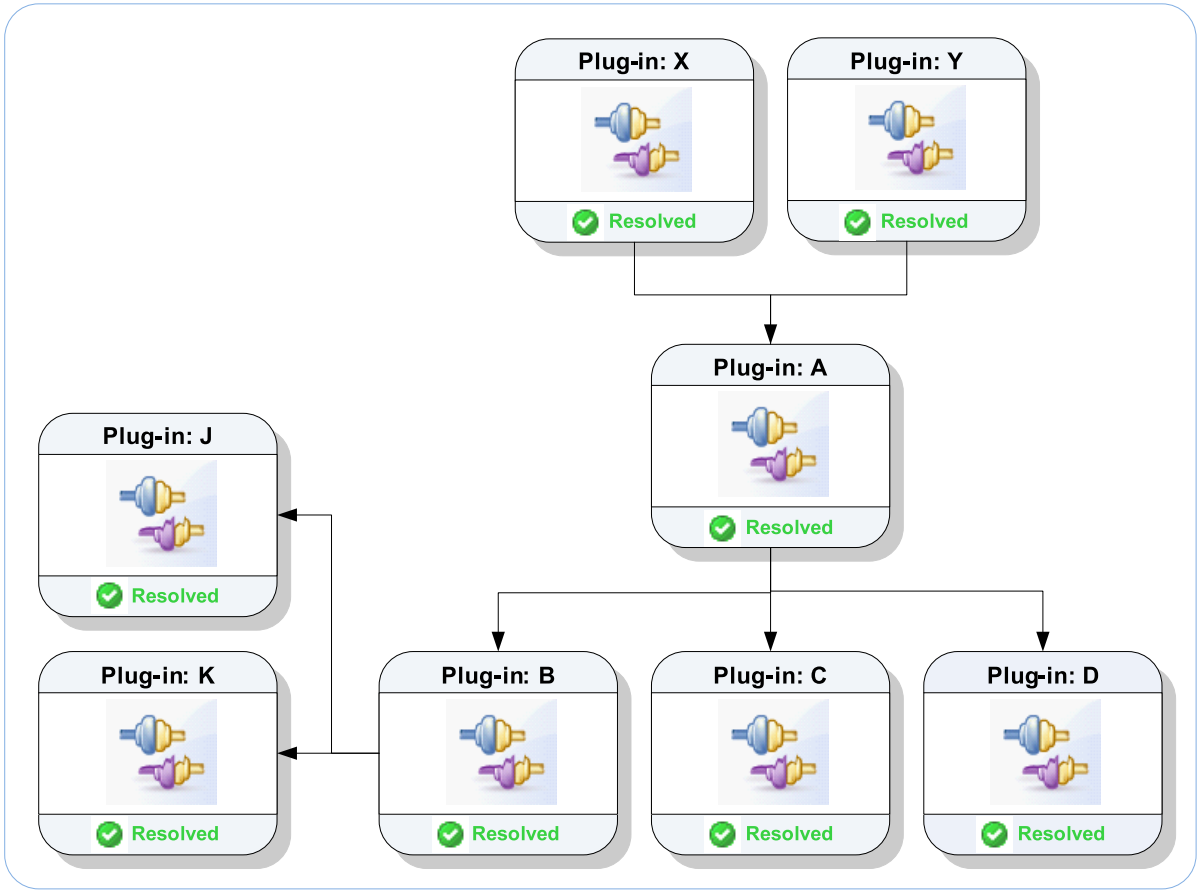


- If a plug-in has a dependency that is not met, the plug-in is deemed UNRESOLVED
- An unresolved plug-in does not get to interact with the rest of the plug-ins

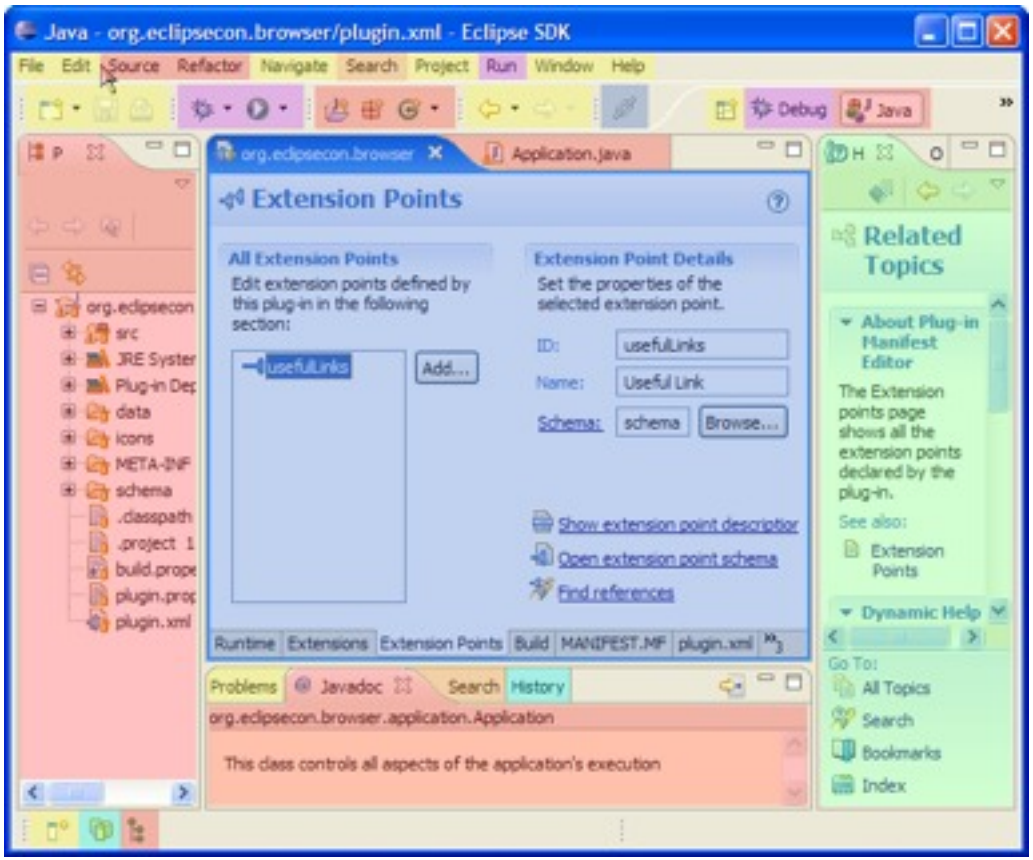
A Chain Reaction

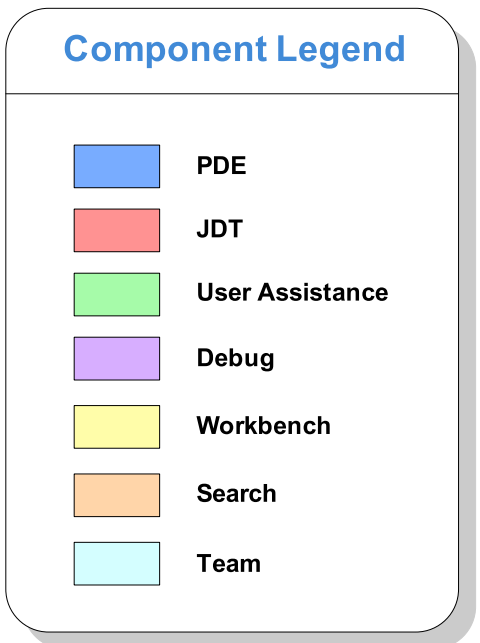


Resolving the Unresolved



Seamless Integration of Components





Presentation Outline

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Exercise One: The Eclipse Browser Plug-in

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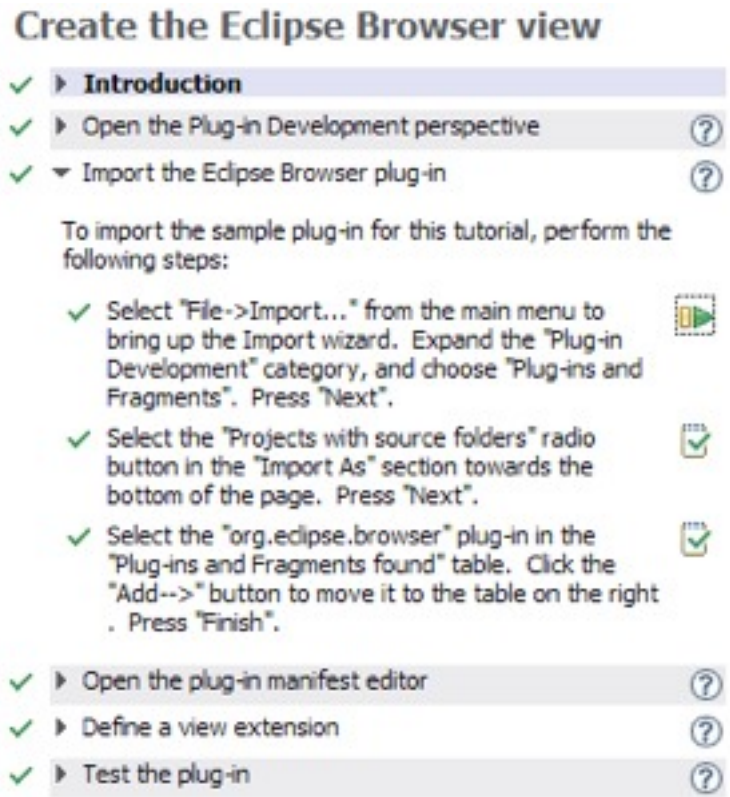
Part I: Create the Eclipse Browser View



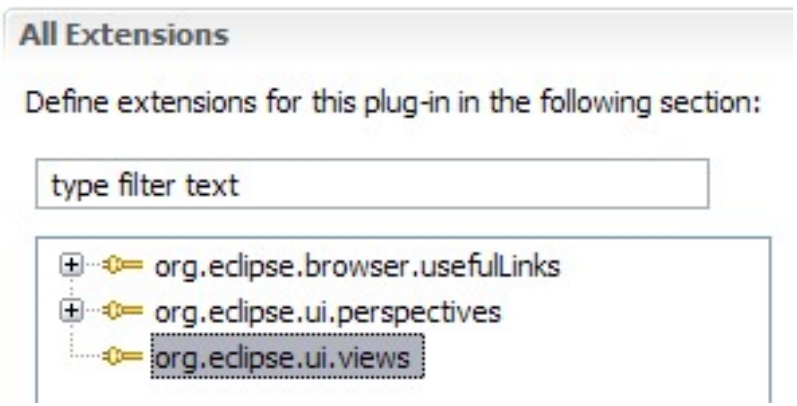
- This exercise is structured as a 5-step cheat sheet
- You use the plug-in import wizard to import the plug-in into the workspace
- You use the plug-in manifest editor to define the extension
- You use the Eclipse Application launcher to test the plug-in

Import the Eclipse Browser Plug-in

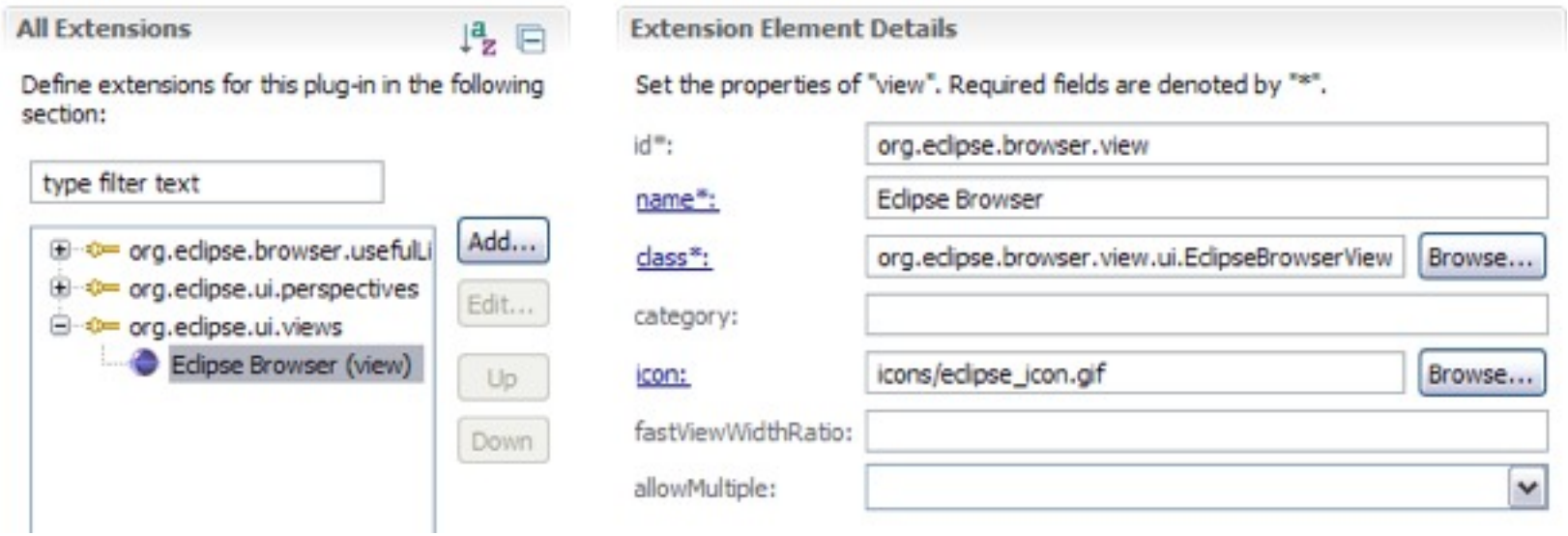
- The plug-in import wizard brings a plug-in from the file system into the workspace
- The plug-in is converted from its deployed form (a JAR) to its development form (a workspace project)
- Choose to import the plug-in as “Project with source” if you wish to modify it.

Add a View Extension

- To create a view to the workbench, you must extend the `org.eclipse.ui.views` extension point

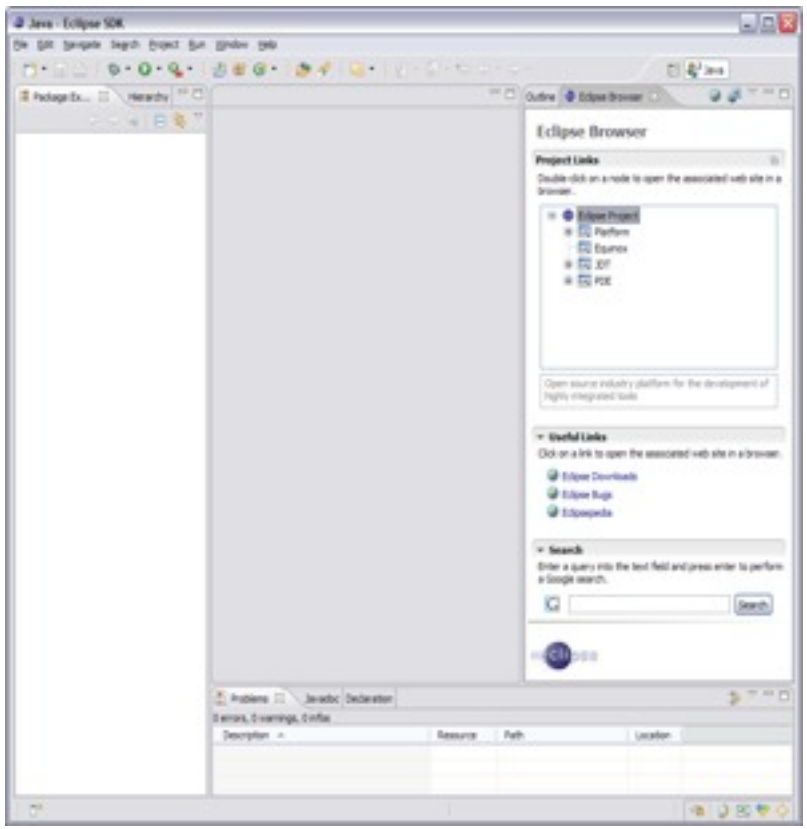


Define the Eclipse Browser View



- The `name` and `icon` attributes are sufficient to put a placeholder for the view in the workbench
- The `class` is loaded only when the view is opened by the user

Test the Plug-in



- PDE launches a second Eclipse instance to show your plug-in in action
- Second instance uses a different workspace (i.e. a sandbox)

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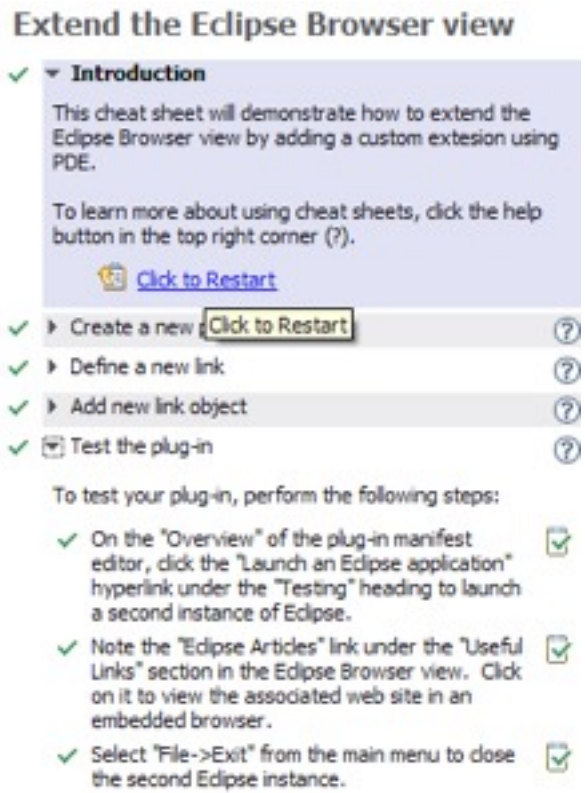
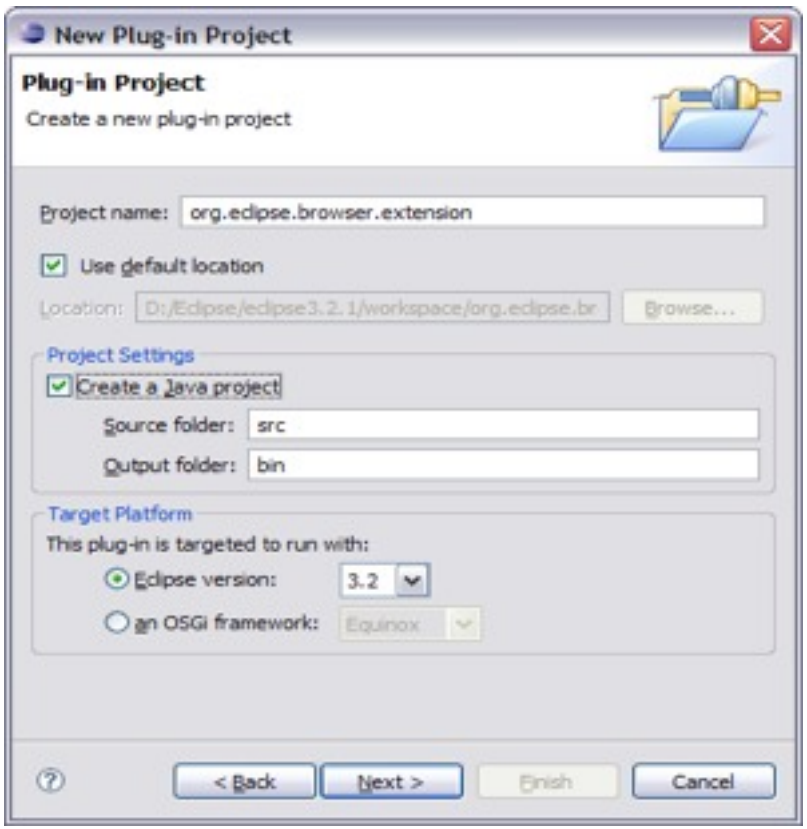
Part II: Extend the Eclipse Browser View



- This exercise is structured as a 4-step cheat sheet
- You create a new plug-in that extends the `org.eclipse.browser` plug-in
- You create an extension that extends the Eclipse Browser view by contributing a link to it

Create a Plug-in Project



- Recommended to use the reverse domain naming convention to name the plug-in project
- Whether or not a plug-in project is a Java project depends on whether it will contribute code
- Plug-ins contributing Help documentation, for example, do not contribute code

The Contract

Identifier: org.eclipse.browser.usefulLinks

Since: 1.0.0

Description:

This extension point is used to add additional links to the Useful Links section of the Links view.

Configuration Markup:

```
<!ELEMENT extension (linkObject)+>
<!ATTLIST extension
  point CDATA #REQUIRED
  id    CDATA #IMPLIED
  name  CDATA #IMPLIED>

<!ELEMENT linkObject (description?)>
<!ATTLIST linkObject
  name CDATA #REQUIRED
  link CDATA #REQUIRED>
```

- **name** - a translatable name to be displayed in the Links View.
- **link** - URL of the link

```
<!ELEMENT description (#PCDATA)>
```

human-readable description of the link

- To contribute a new link to the *Useful Links* section of the Eclipse Browser view, you must extend and conform to the grammar of the `org.eclipse.browser.usefulLinks` extension point

The Contributed Link in Action

- The new link contributed by the `org.eclipse.browser.extension` plug-in integrated seamlessly with the links provided by the `org.eclipse.browser` plug-in

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- Developing for the Rich Client Platform
- Exercise Two: The Eclipse Browser Product

The Plug-in Manifest Editor

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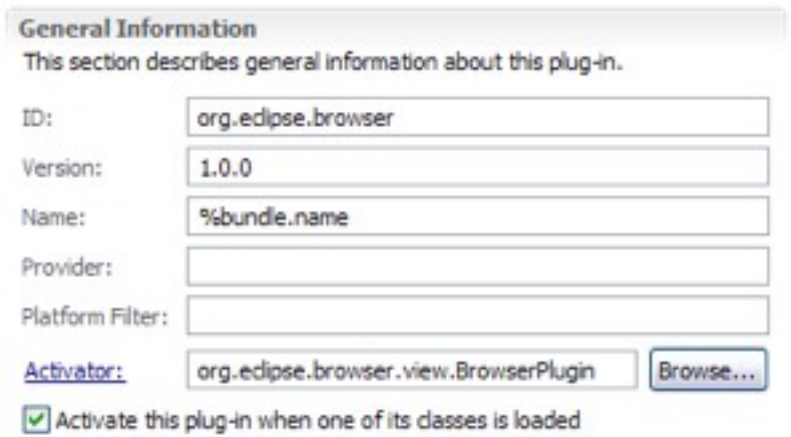
General Information



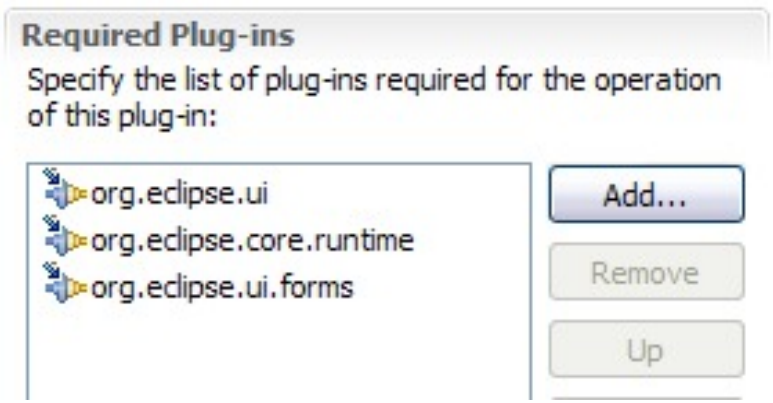
- A plug-in must have an ID, version and a name
- A platform filter is an optional field to specify under what conditions the plug-in should be allowed to run
- An activator controls the plug-in's lifecycle and may do initialization upon startup and cleaning up at shutdown

 |

Execution Environment

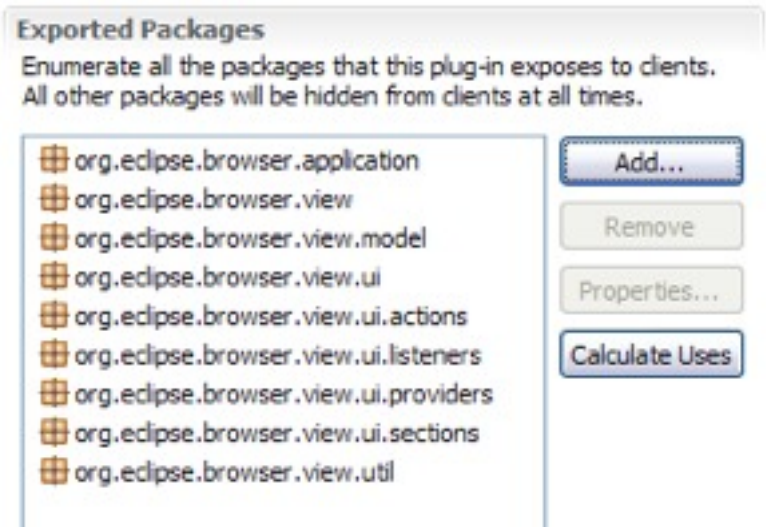
- An Execution Environment is the minimum JRE level required for a plug-in to run
- If a plug-in declares a J2SE-1.5 Execution Environment and Eclipse is running using a 1.4 JRE, the plug-in gets disabled gracefully

Dependencies



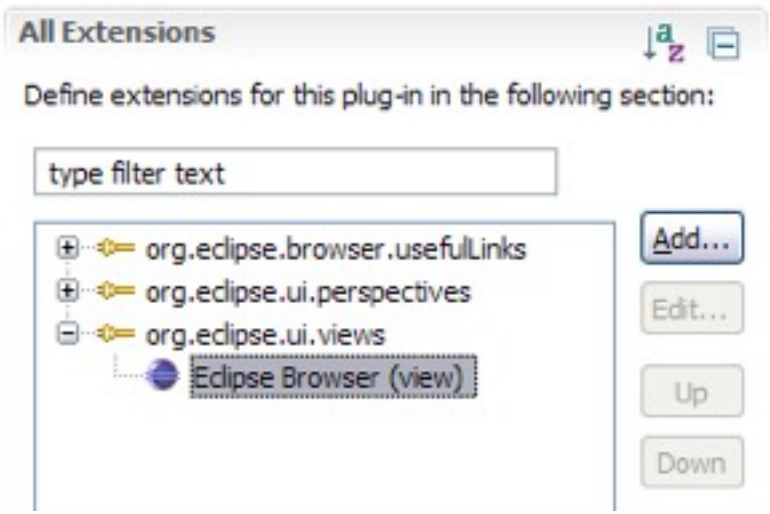
- A plug-in must list all plug-ins that it needs to compile
- The runtime and development classpaths are computed based strictly on dependencies in the MANIFEST.MF
- PDE manages and updates the development classpath for you
- All plug-in dependencies must be met before a plug-in is resolved

Exported Packages



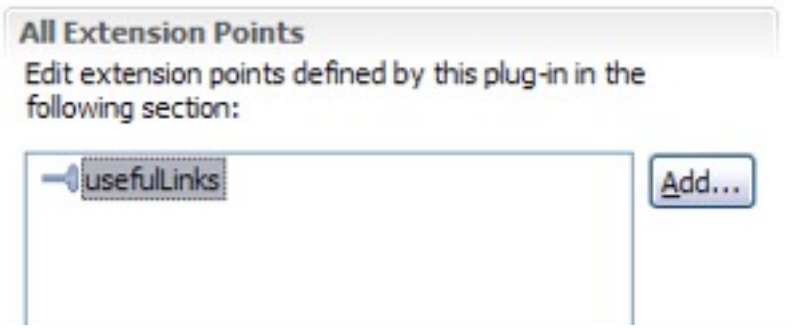
- A plug-in may expose it code to downstream clients
- Downstream plug-ins may then make a dependency on the plug-in and use code from it

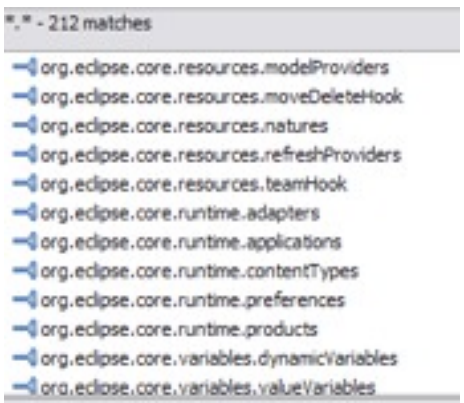
Extensions



- The Extensions section lists all the contributions the plug-in makes to Eclipse
- The plug-in manifest editor makes creating extensions easy because it is aware of the XML schema for all available extension points
- Hot links are available to jump back and forth between the manifest files and the source code

Extension Points





- A plug-in may contribute 0 or more extension points to the platform
- The Eclipse SDK provides hundreds of extension points

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Development Lifecycle of a Plug-in

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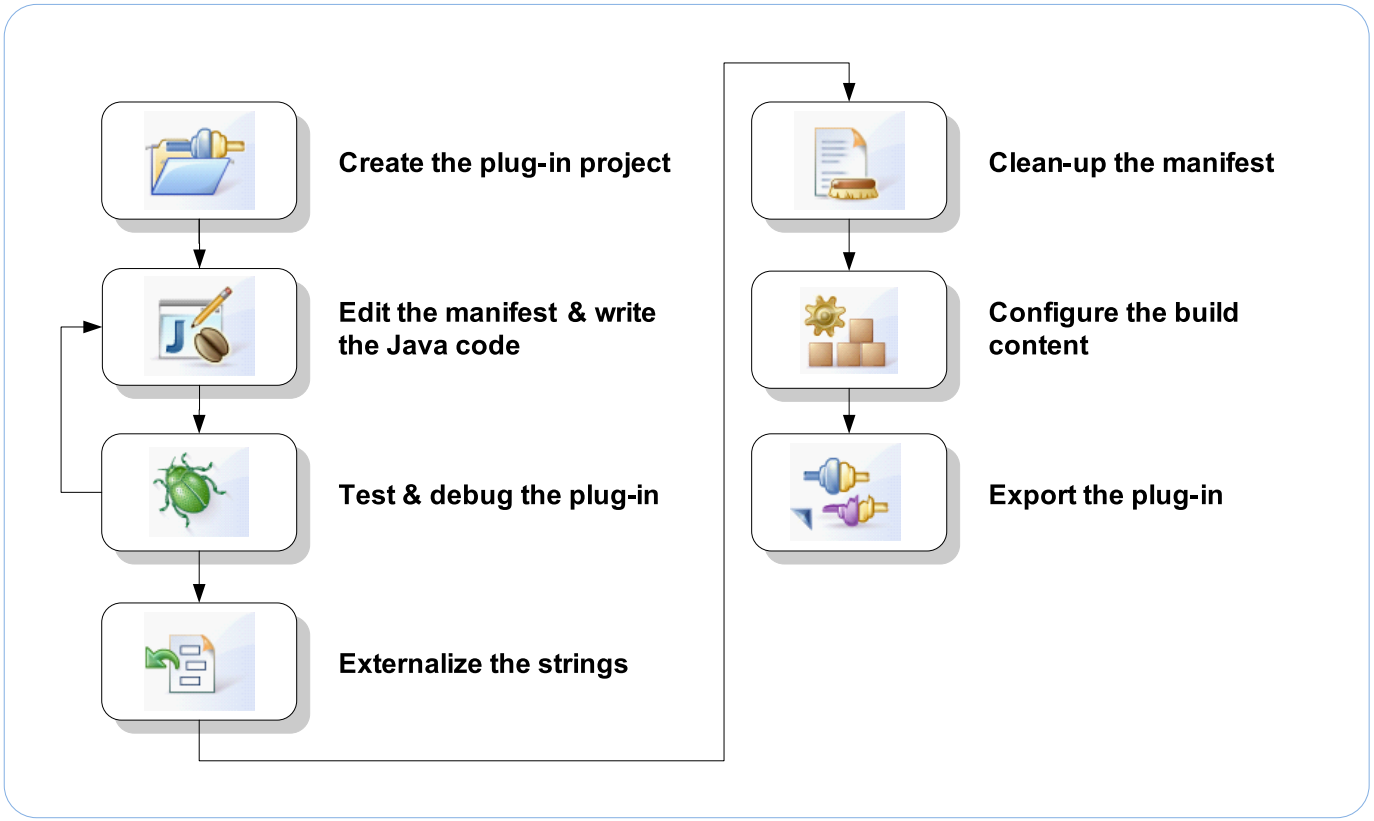
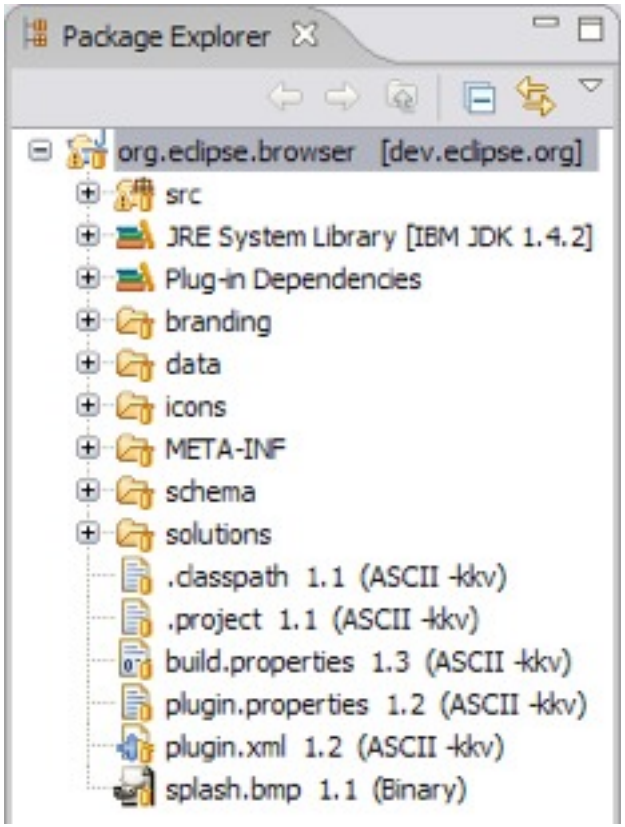
From Genesis to Deployment



Plug-in Creation

- The *New Plug-in Project* creation wizard generates a project complete with manifest files and, optionally, source code
- The wizard also provides templates for popular extension points such as action sets, views, preference pages
- Templates save a lot of time and allow you to create and run a plug-in in a few minutes

Life in the Workspace

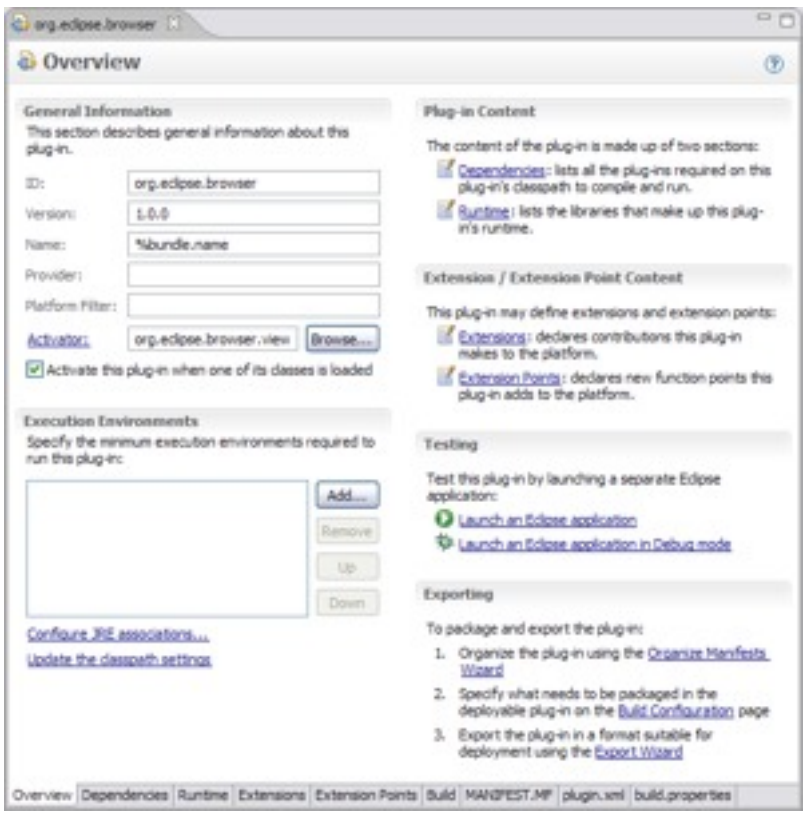


- The internal structure of a plug-in project in the workspace mirrors that of a deployed plug-in

- Two notable differences:
  1. The code is in source folders
  2. The plug-in project contains extra development metadata that are not part of the deployed plug-in

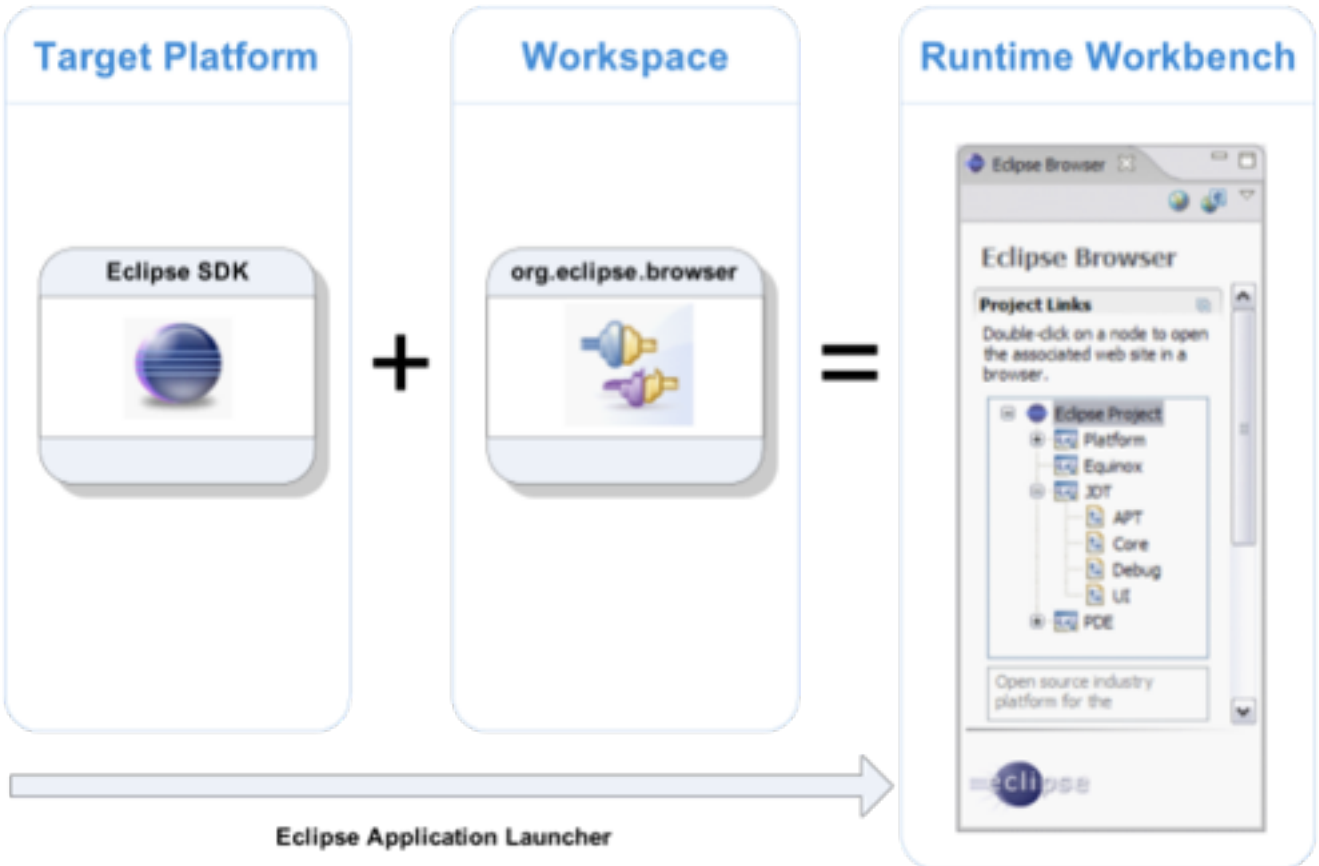
 |

Editing the Plug-in

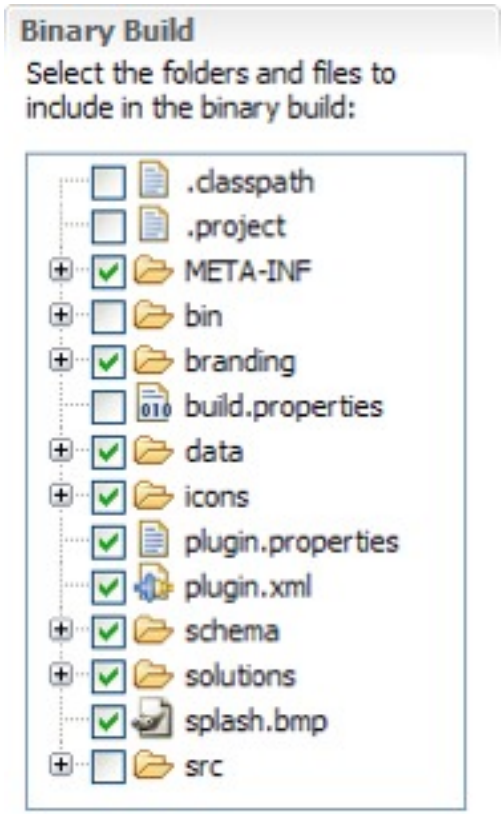


- The plug-in manifest editor is the central place to manage your plug-in
- It provides hot links to
  - test and debug plug-ins
  - launch relevant wizards
  - quick navigation between source code and the manifest files

Testing the Plug-in



Configure the Build Content

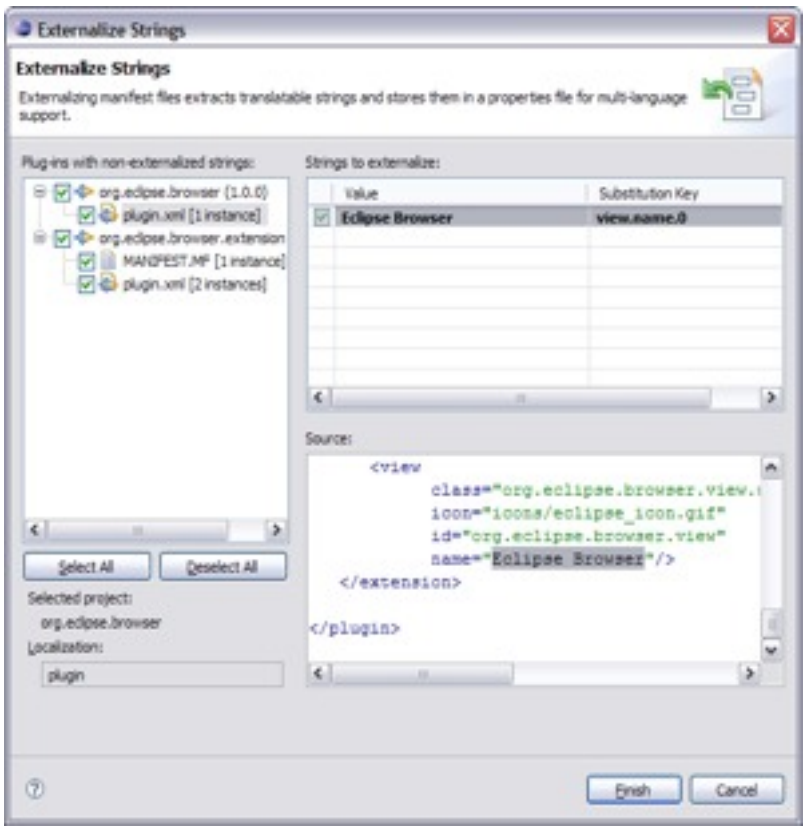


- The plug-in project contains development-time metadata that should not be part of the deployed plug-in.
- On the Build page of the plug-in manifest editor, you check the list of files and folders that should be packaged

Exporting the Plug-in

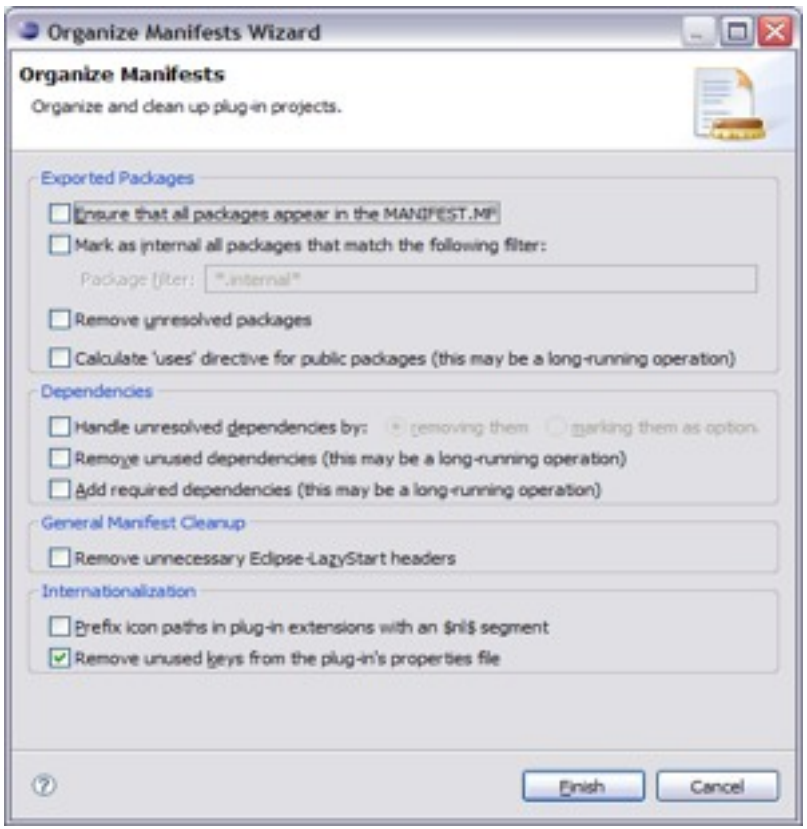
- The Plug-in Export wizard packages a plug-in into a deployable format
- Plug-ins can be exported en masse
- Plug-ins can be exported as an archive or as a directory structure

Externalize the Strings



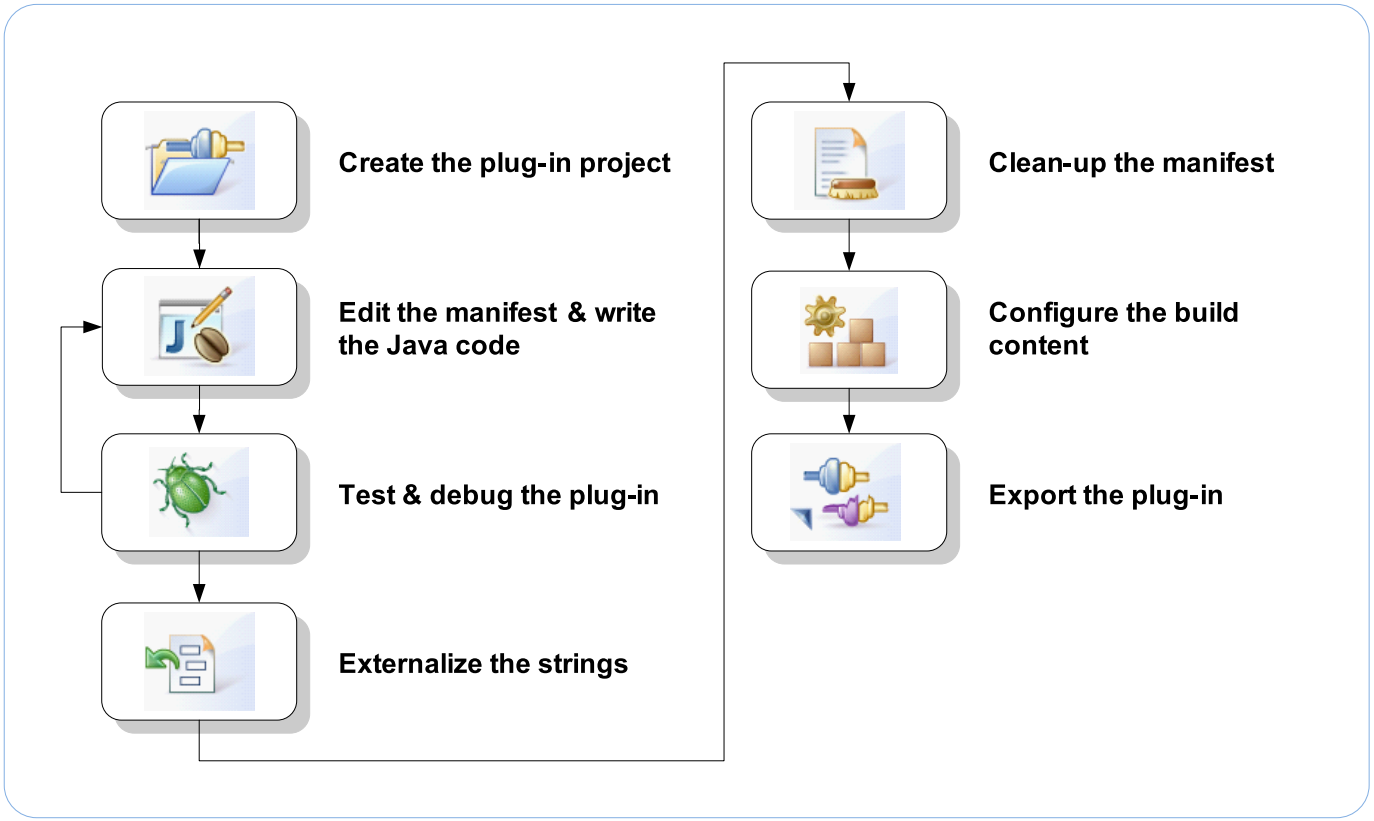
- PDE provides an *Externalize Strings* wizard that extracts translatable strings and stores them in a properties file for multi-language support.
- This allows the plug-in manifest files to remain intact, while the properties files get translated

Clean up the Manifests



- As the plug-in evolves, it may accumulate stale data
- The *Organize Manifests* wizard that inspects your code and manifests and removes or updates stale data

From Genesis to Deployment



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The Rich Client Platform

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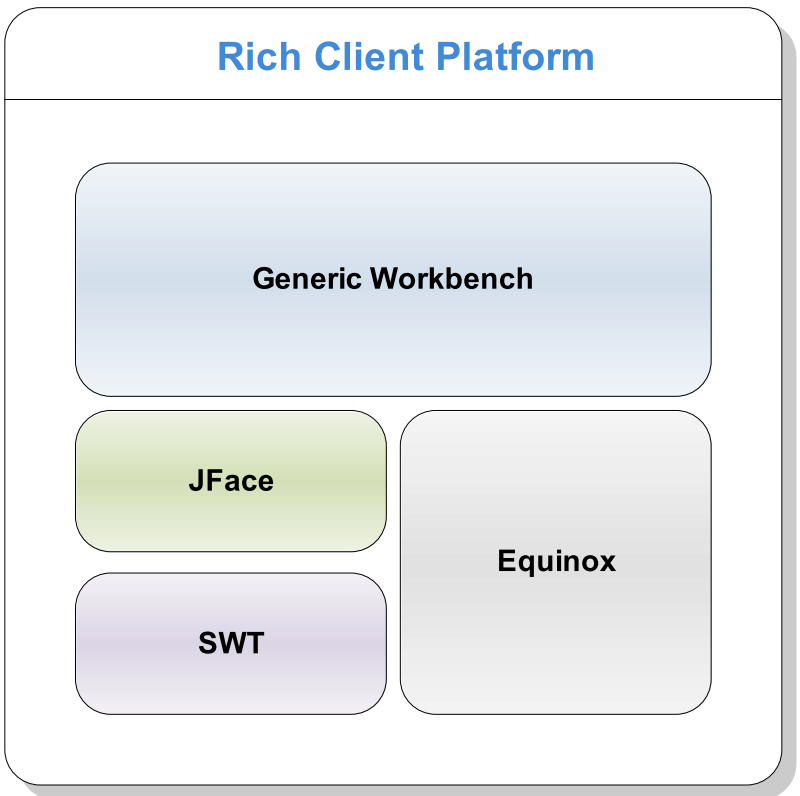
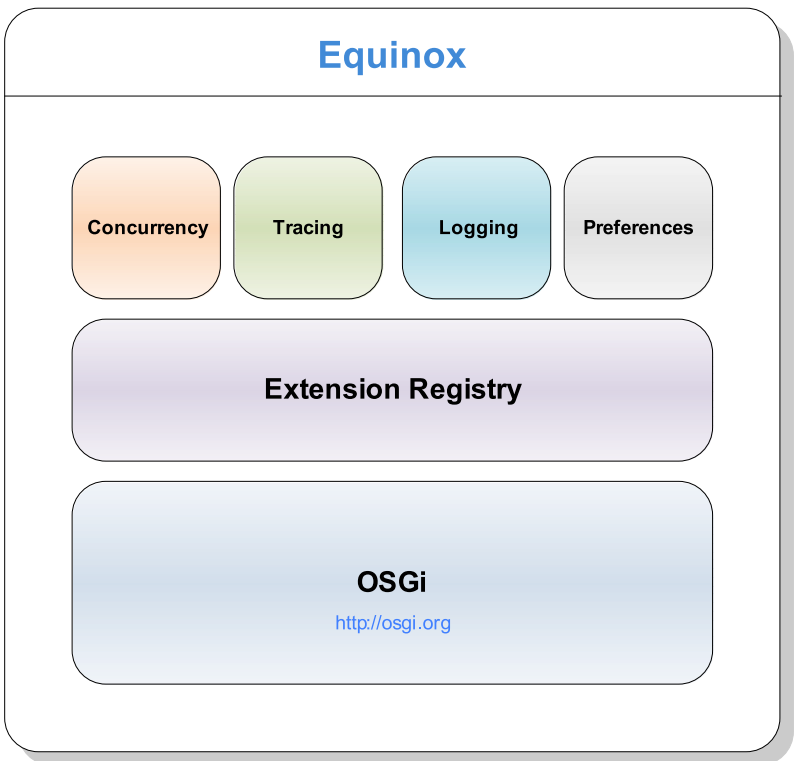
Rich Client Platform (RCP)



- Equinox is the runtime
- Standard Widget Toolkit (SWT) is a portable and native widget toolkit for Java
- JFace is a framework for common UI programming tasks
- Generic Workbench provides the UI personality of the Eclipse platform

Equinox

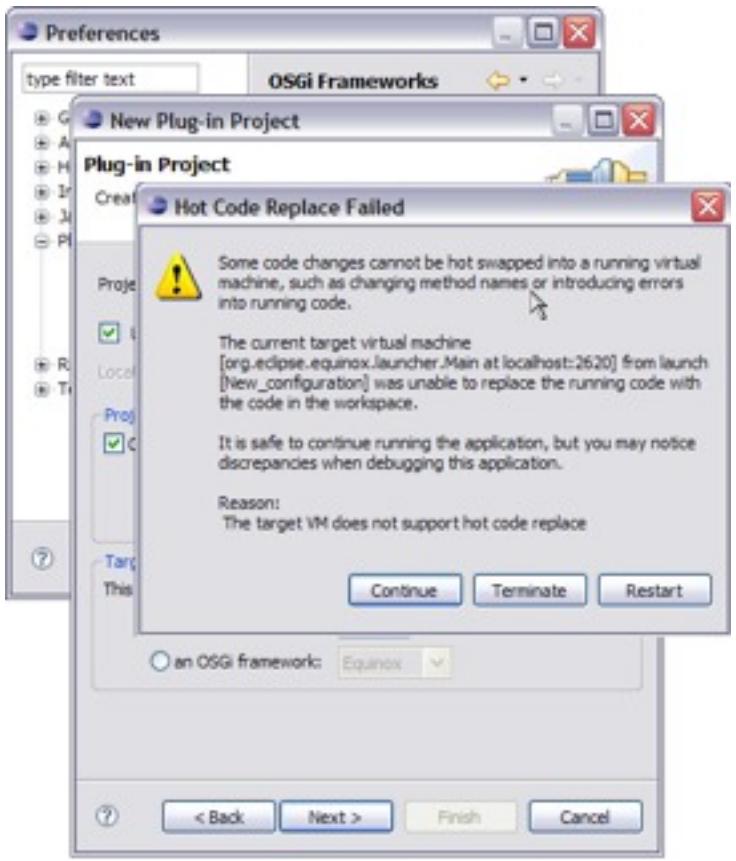


- OSGi is a framework that manages bundles
- Plug-in == Bundle
- The extension registry manages extensions and extension points
- The concurrency infrastructure allows for running background jobs
- Other runtime facilities include tracing, logging and preferences

Standard Widget Toolkit (SWT)

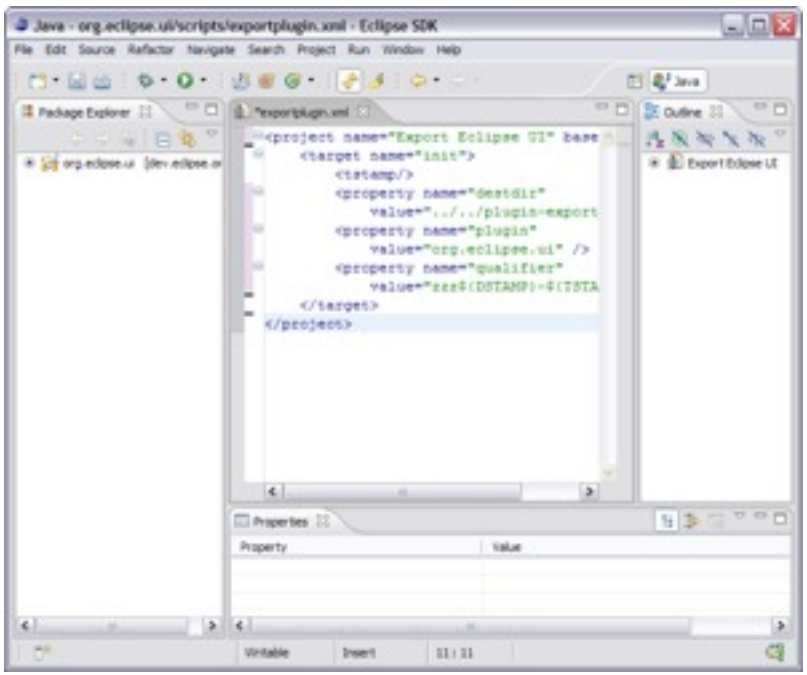
- SWT is a low-level graphics library that provides UI controls such as buttons, trees, combo boxes,…
- SWT uses native widgets as much as possible
- SWT has OS-independent API and is thus portable
- SWT is independent of the Eclipse runtime

JFace



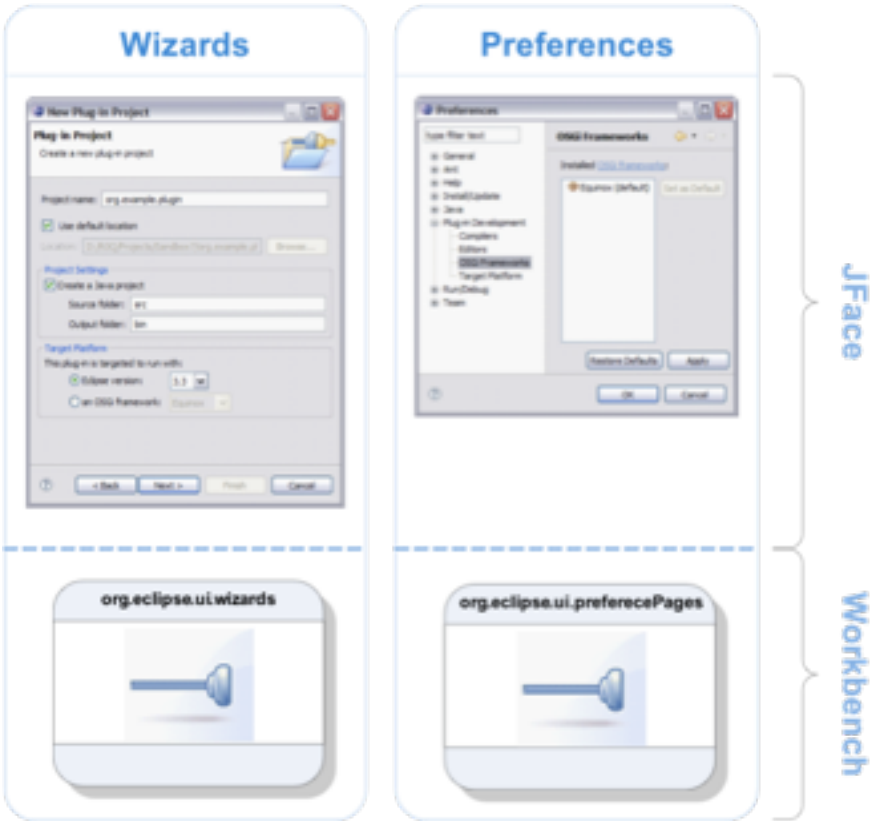
- Built on top of SWT, JFace adds the model layer to the SWT widgets, e.g. tree viewers
- JFace provides common UI constructs such as wizards and dialogs
- JFace can be used standalone without the need for the Eclipse runtime

Generic Workbench



- The Workbench defines common user-defined paradigms:
  - Views, e.g. the Package Explorer
  - Editors, e.g. the Java and plug-in manifest editors
  - Perspectives: arrangement of views and editor

Contribution-Based Extensibility



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 |

Why Use Eclipse RCP?


An elegant plug-in architecture


Eclipse RCP does the middleware. You do your job.


From servers to embedded devices, RCP applications are portable

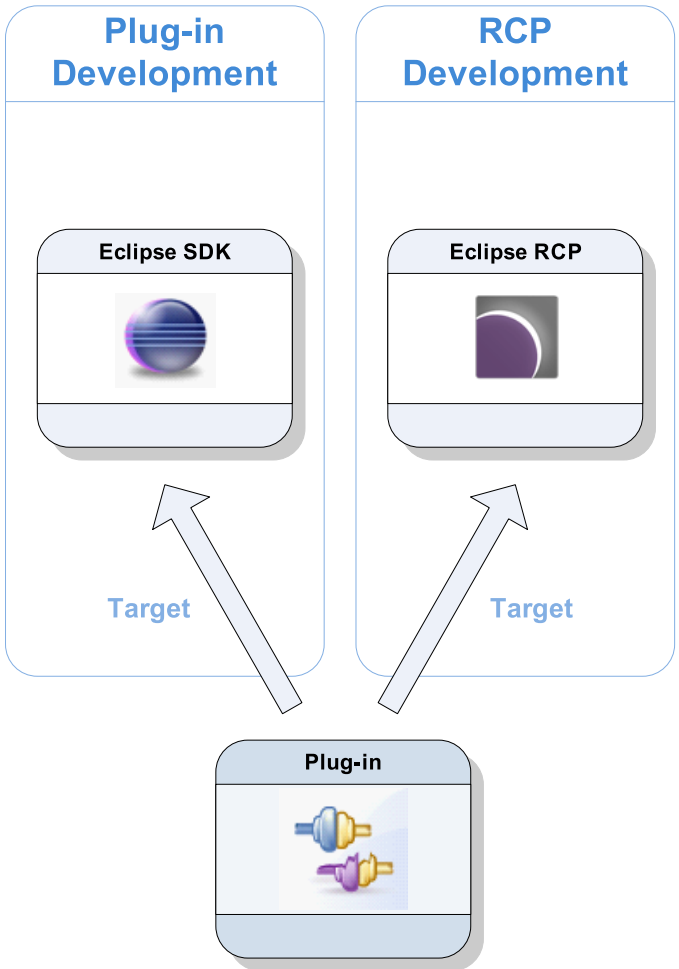
RCP applications provide a native user experience


JDT and PDE provide a first-class development environment

A Plug-in is a Plug-in is a Plug-in

- Developing plug-ins for a rich client application is identical to writing plug-ins for the Eclipse SDK
- Notable differences include:
  - Target Platform
  - Workbench configuration
  - Defining an application
  - Defining a product

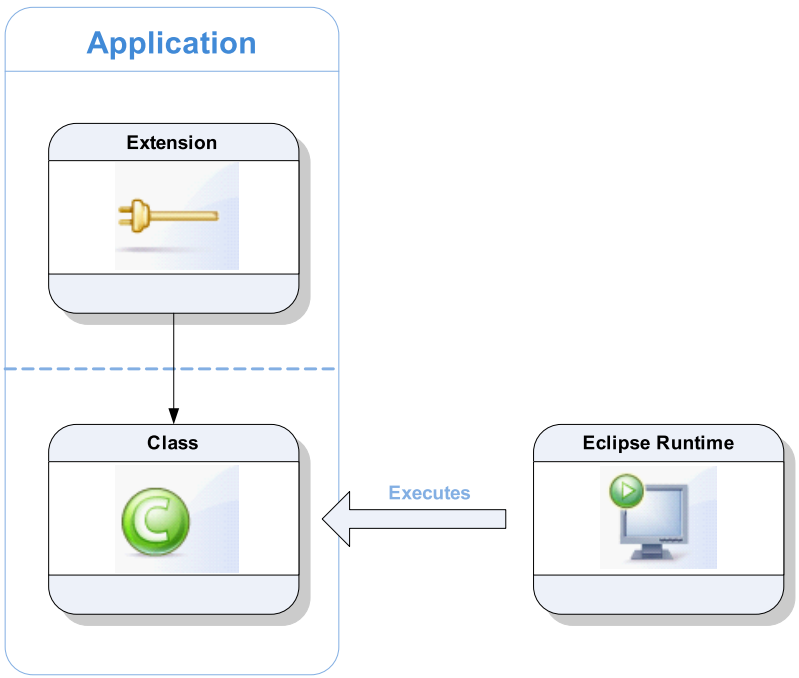
A Smaller Target



Customizing the Generic Workbench

- When writing a plug-in for the SDK, you can extend (i.e. add) to the workbench, but you cannot remove or override
- When writing an RCP application, you can configure every aspect of the workbench

Applications



- An application is to Eclipse what to the `main()` method is to a regular Java program
- To run Eclipse, an application has to be specified
- When you launch Eclipse, an application supplied by the IDE is run
- In an RCP scenario, you supply your own application

Products

- A product is the Eclipse unit of branding
- Branding gives the rich client application a personality
- Branding encompasses window images, splash screen, a custom launcher
- A product is defined declaratively as an Eclipse extension

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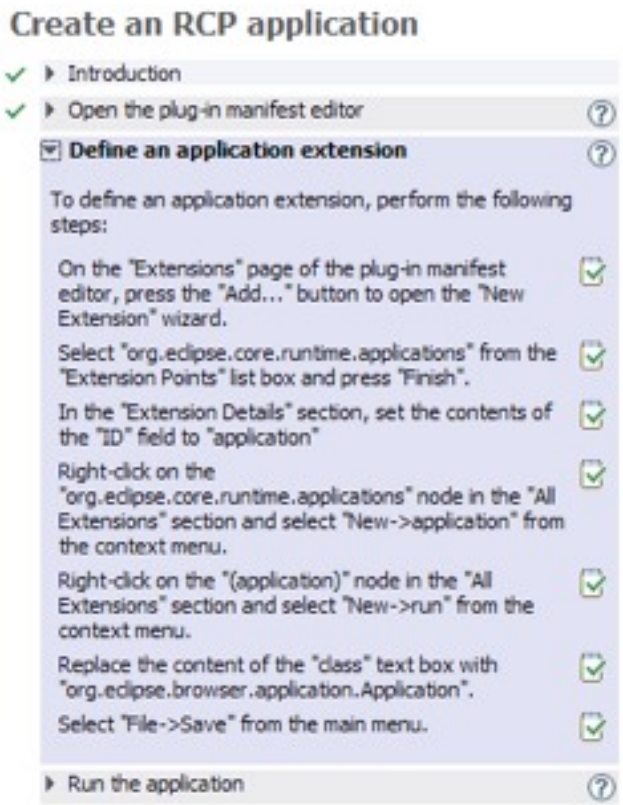
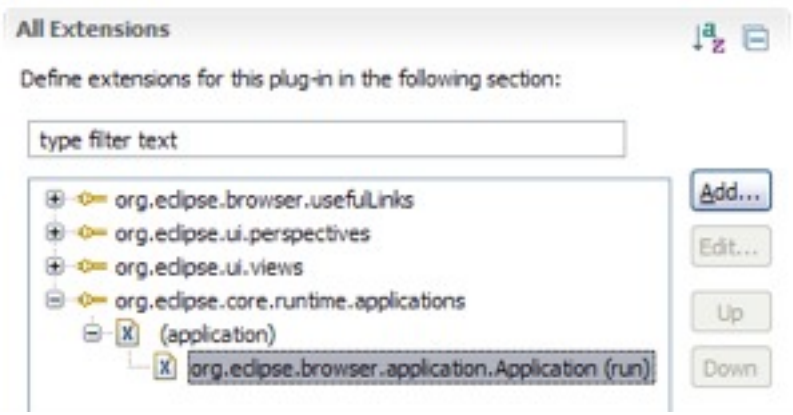
Exercise Two: The Eclipse Browser Product

Part I: Create an Eclipse Application



- This exercise is structured as a 3-step cheat sheet
- You use the plug-in manifest editor to create an application extension
- You launch the new application and you see that the same Browser view has seamlessly integrated into a different application

Define an Application Extension

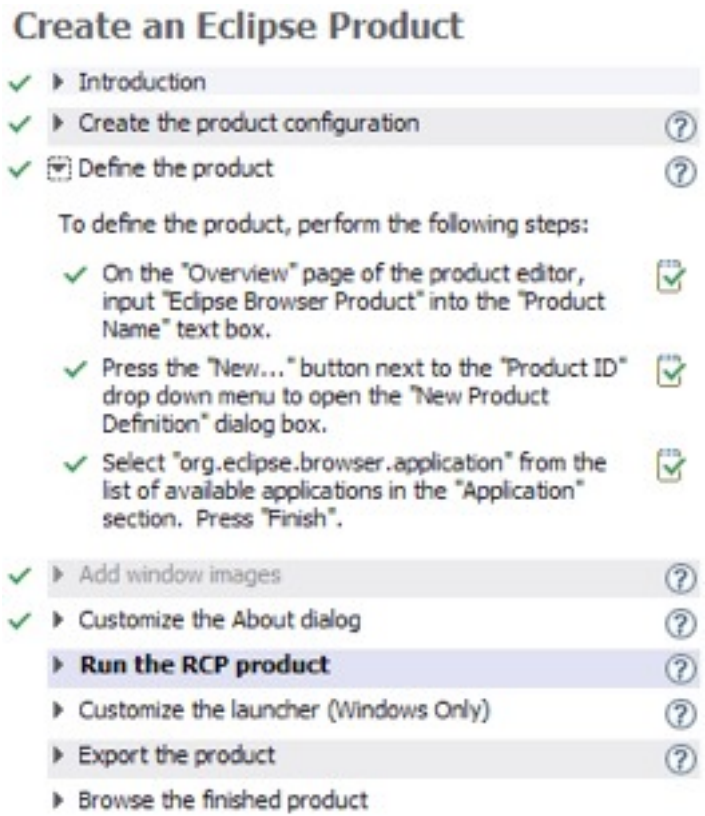


- An application is an `org.eclipse.core.runtime.applications` extension
- It specifies a class which serves as the entry point to the application
- For a typical UI application, the application creates, configures and runs a workbench
- The application exits when the workbench exits

Eclipse Browser Application

- The RCP application provides a standalone window with File and Help menus
- The Browser plug-in integrates seamlessly with the application without any code changes
- Don't underestimate this minimalistic application. It can go toe-to-toe with any other RCP application. It is configurable, extensible, …

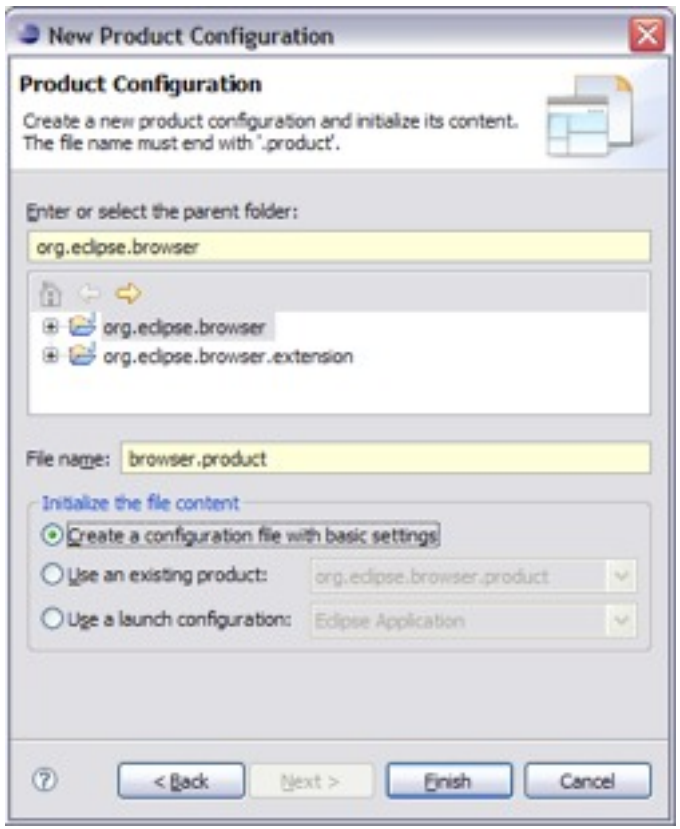
Part II: Create an Eclipse Product



- This exercise is structured as a 8-step cheat sheet
- You use the product editor to define every aspect of your product: launcher, window images, About Dialog
- You export and run a fully-branded standalone product

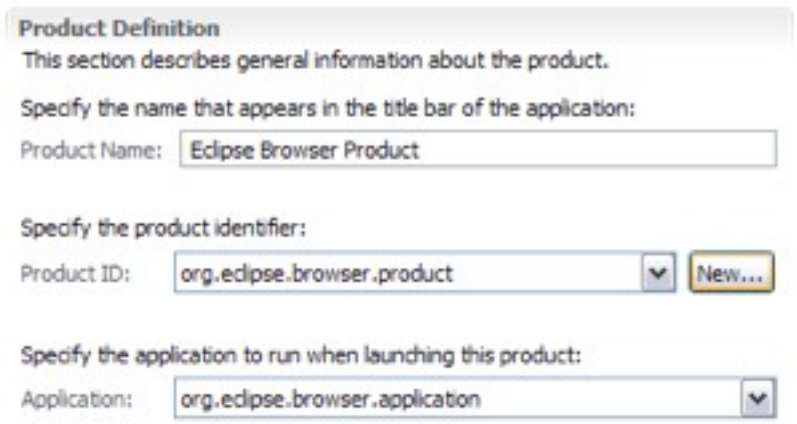
 |

A New Product Configuration



- A product configuration is the central place to manage all aspects of your product
- A product configuration is used by PDE to define and assemble a product
- A product configuration is neither read nor interpreted by the runtime

Product Definition



- A product is associated with an application
- A product provides branding and customization for the application
- A product name appears in the title bar of the application
- PDE uses this data to create an `org.eclipse.core.runtime.products` extension in the plug-in's manifest file

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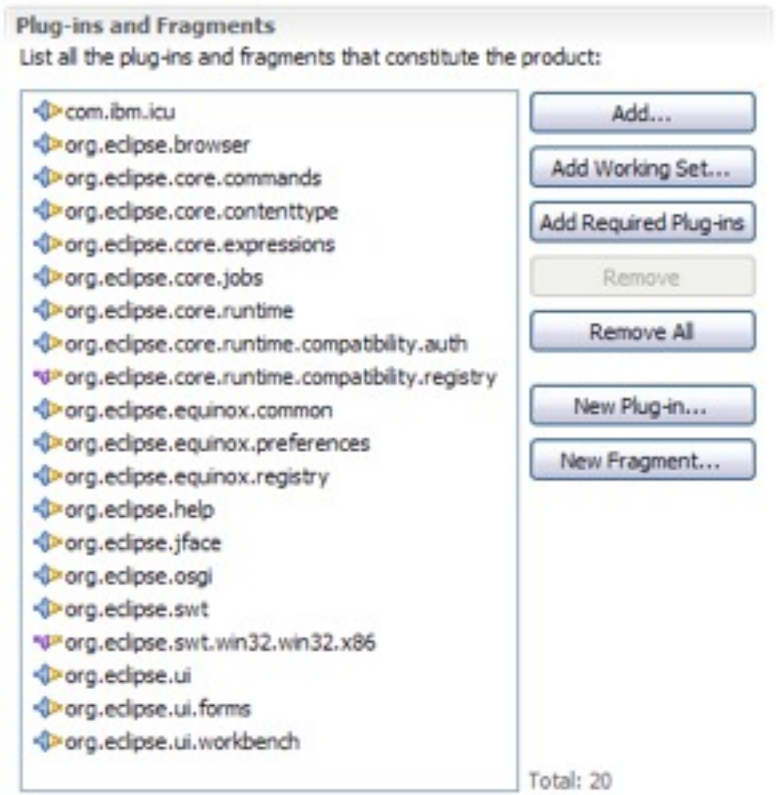
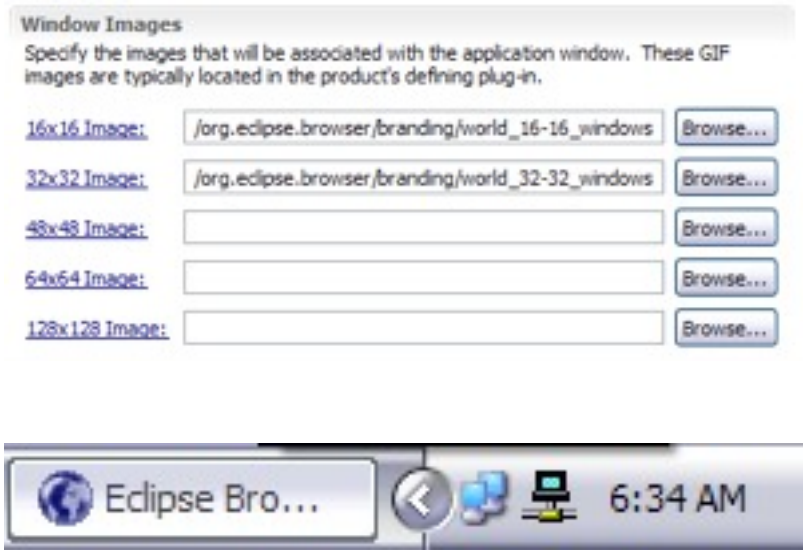
Building Blocks



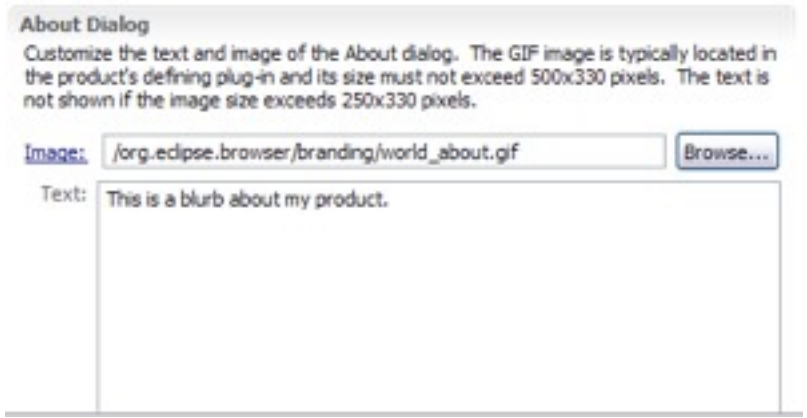
- A product must list all its constituent plug-ins. This list is only used by PDE to determine what to build and package
- Plug-ins that are in source form in the workspace are compiled and packaged
- Plug-ins that are already built (e.g. target plug-ins) are assembled as-is into the final product

Window Images

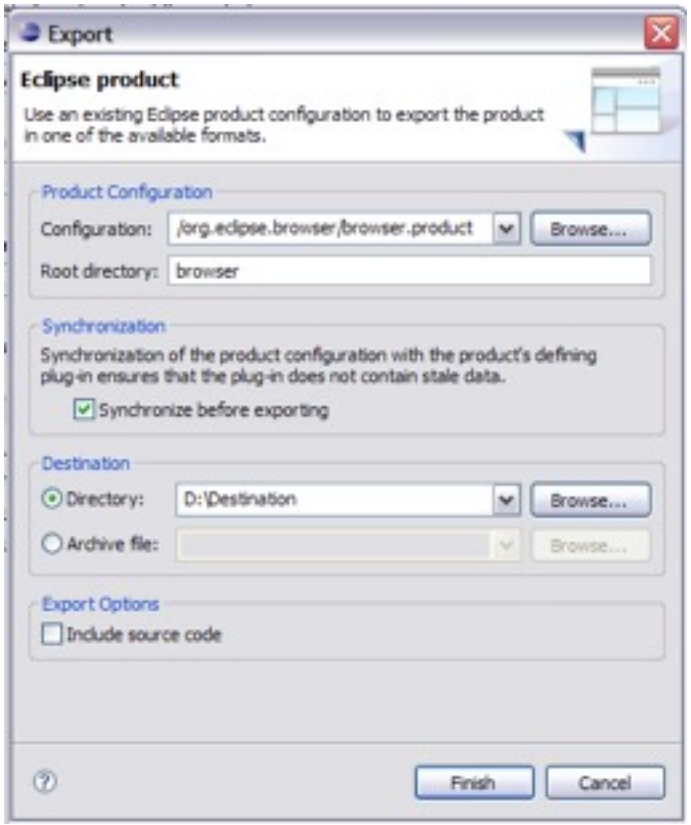


- Window Images are shown in the application window, task bar, … depending on the windowing system
- On Windows, the 16x16 GIF image is used for the task bar and the 32x32 GIF is used in the Alt-Tab application switcher

Customizing the About Dialog

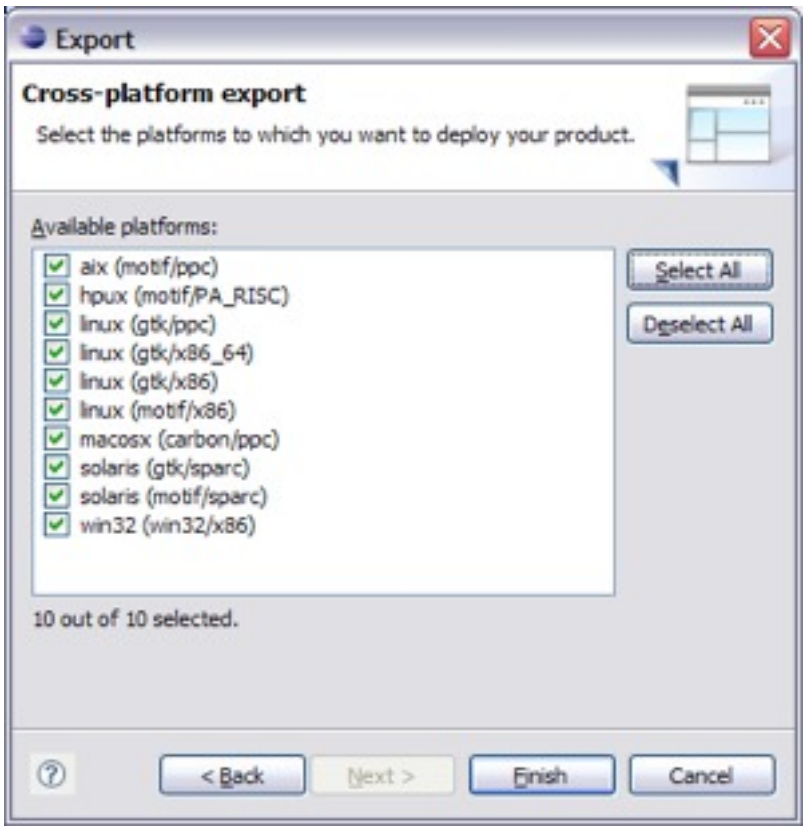


One-click Export



- PDE provides a Product Export wizard that takes a product configuration file as input
- The name of the root directory of the product is customizable
- Options to export the product as a directory structure or an archive

One-click Export to Multiple Platforms



- The RCP delta pack is a separately downloaded archive that contains all OS-specific fragments and executables
- When present, you are able to export your plug-ins to all supported platforms in a single step

 |

A Finished Product

The End

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