Plug-in Development 101
The Fundamentals

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October 13, 2009

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
- Q&A

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What is Eclipse?

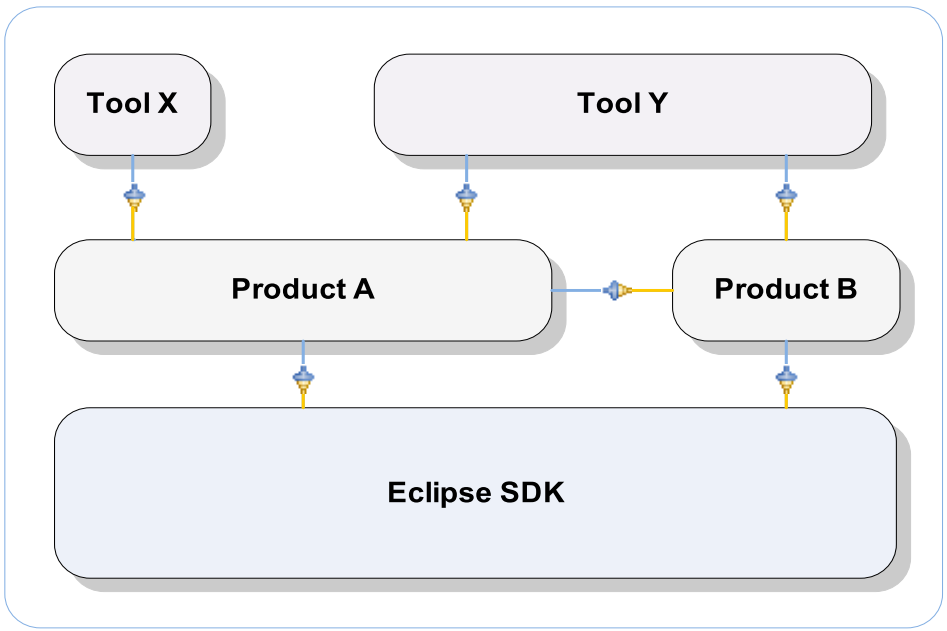
A very popular Java™ IDE
and much more…

What is Eclipse?

An open platform for anything and nothing in particular

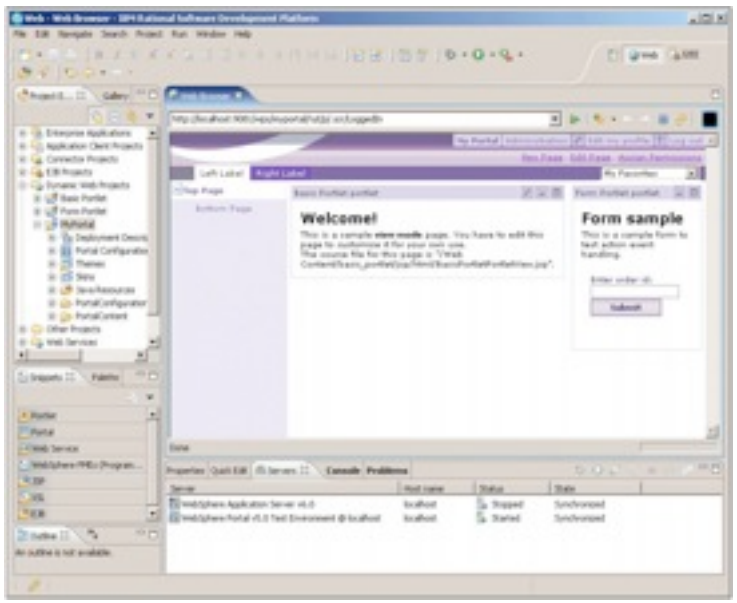
An Open Platform

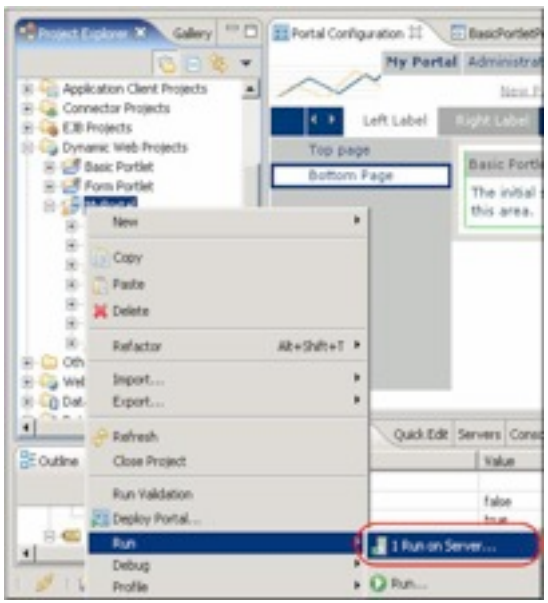
Eclipse is designed to be easily and infinitely extensible by third parties



An Open Platform for anything

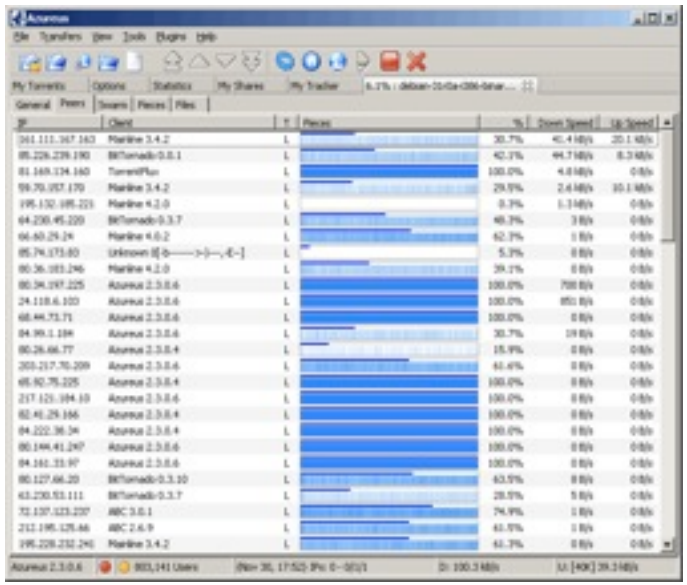
IBM© Rational© Application Developer (RAD):
An Integrated Development Environment (IDE)

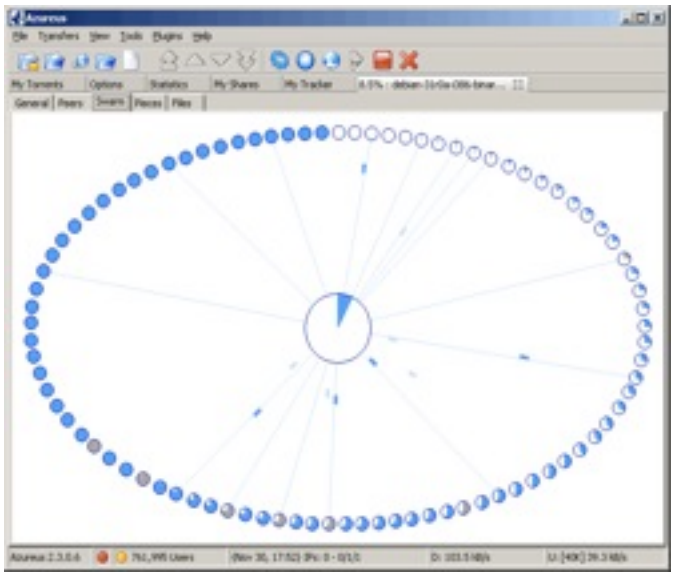




An Open Platform for anything

Azureus: a Java BitTorrent client



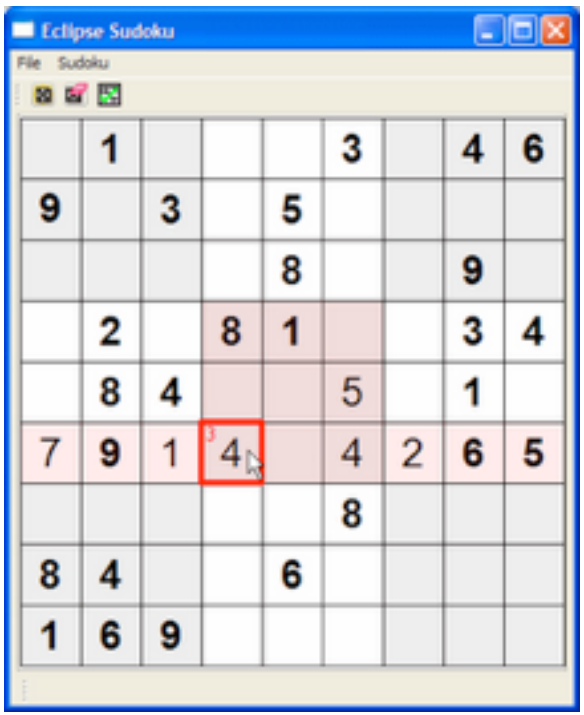


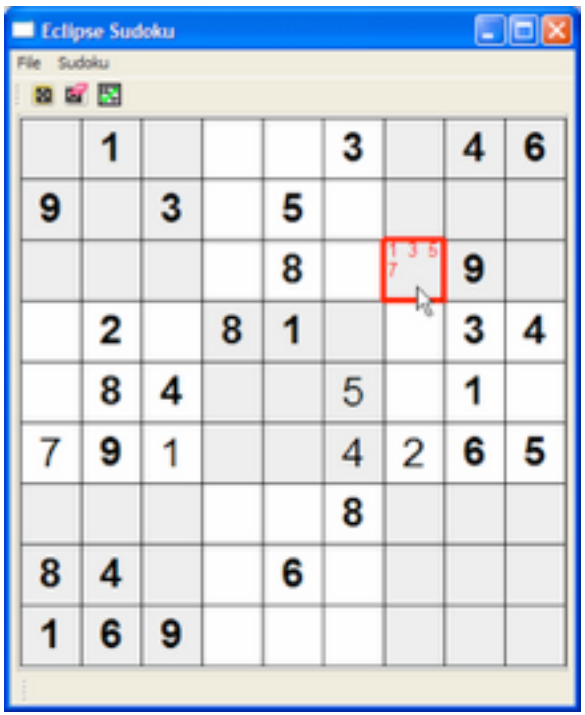
An Open Platform for anything

IBM Lotus SameTime 7.5: a chat client

An Open Platform for anything

Games!: Sudoku



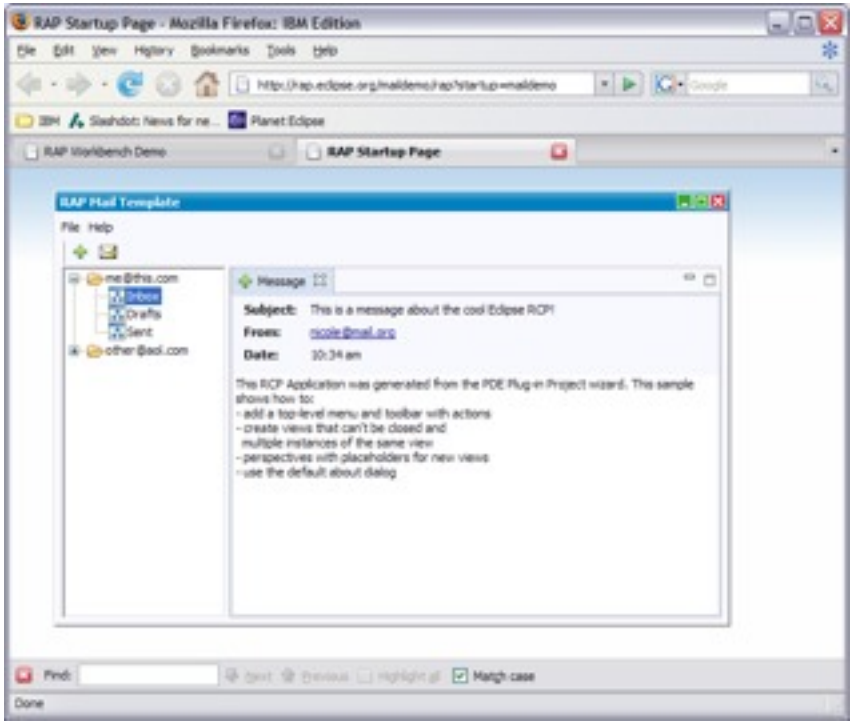


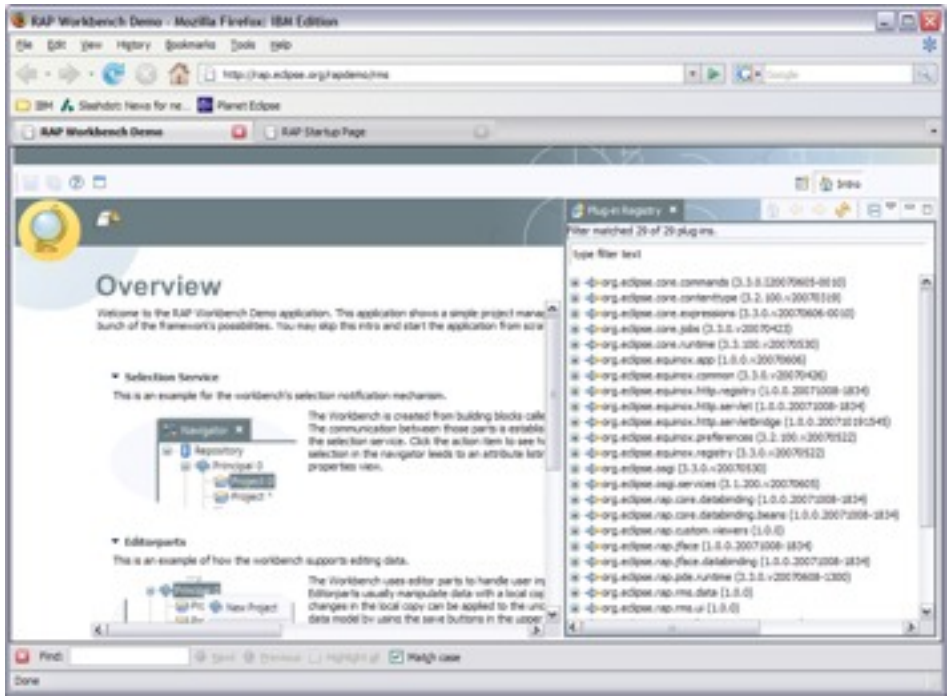
An Open Platform for anything

embedded Rich Client Platform: simple mobile applications

An Open Platform for anything

Rich Ajax Platform (RAP): RCP meets the Web!





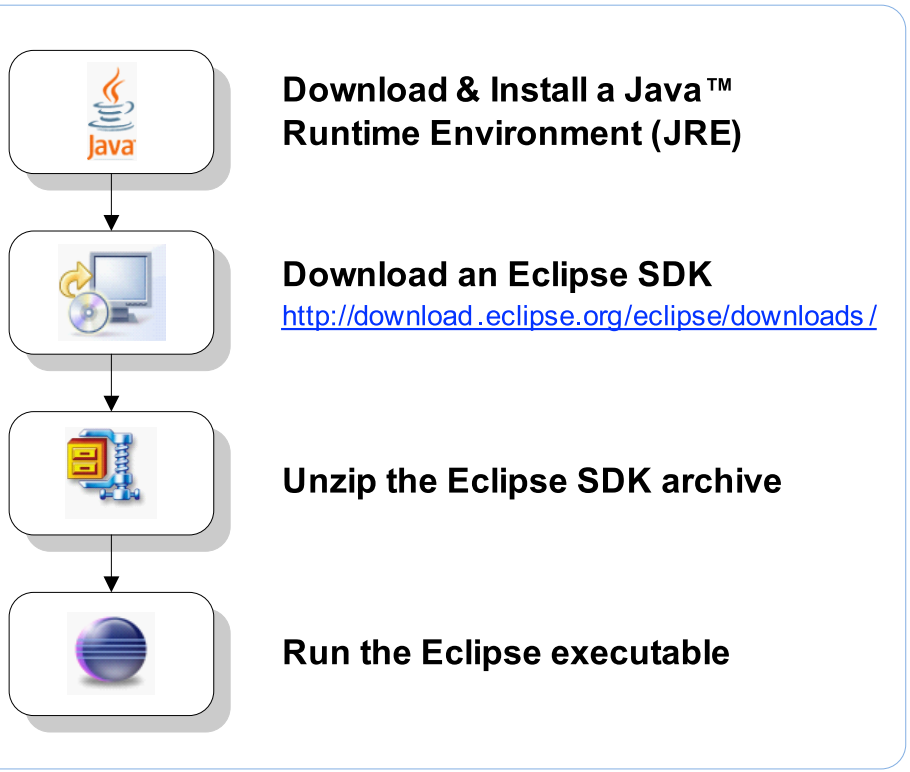
An Open Platform for Nothing in Particular

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

Eclipse.org

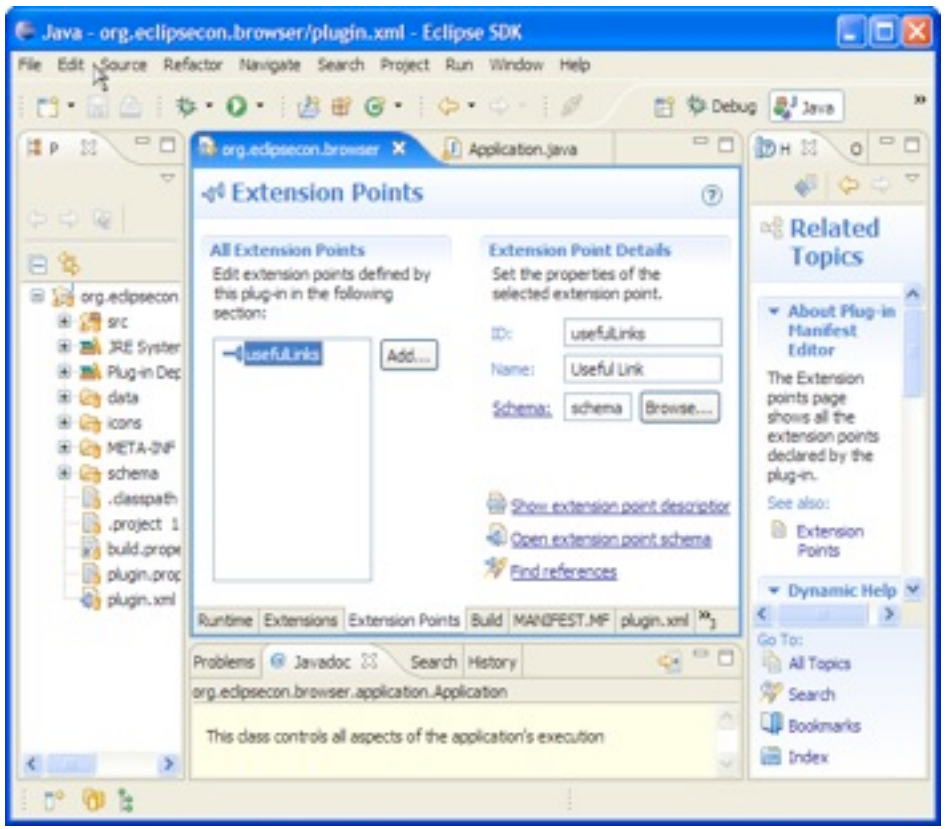
An open source community that hosts over 60 open source projects

Downloading and Running the Eclipse SDK

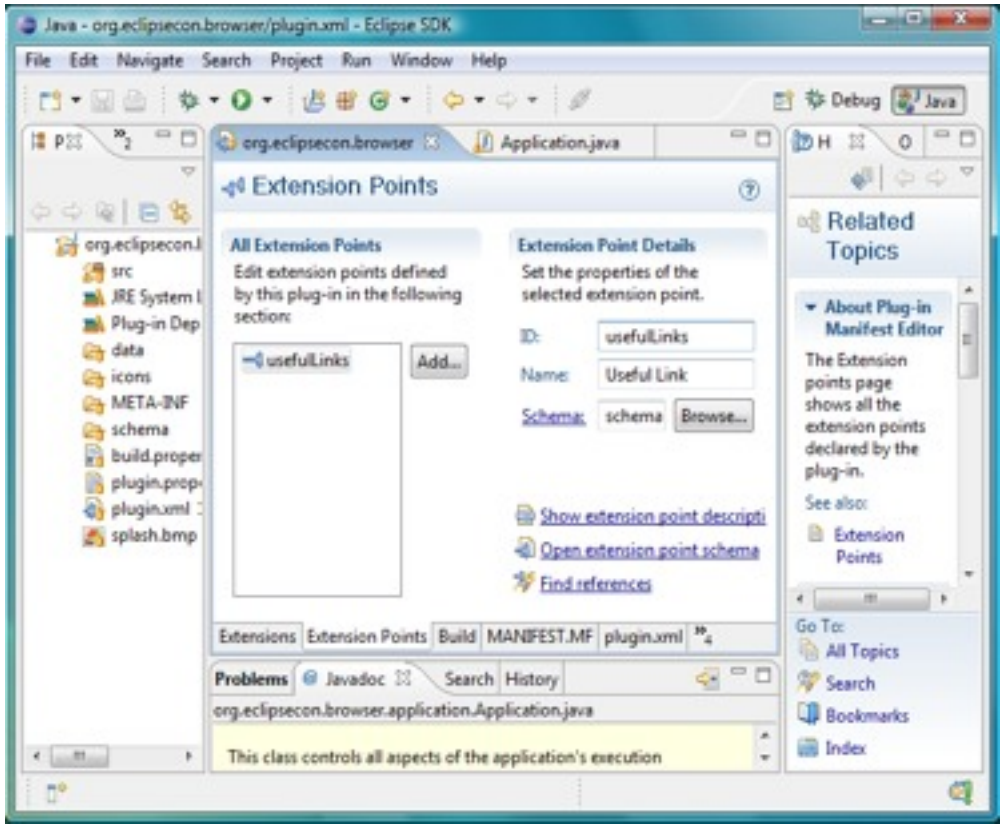


Supported Platforms

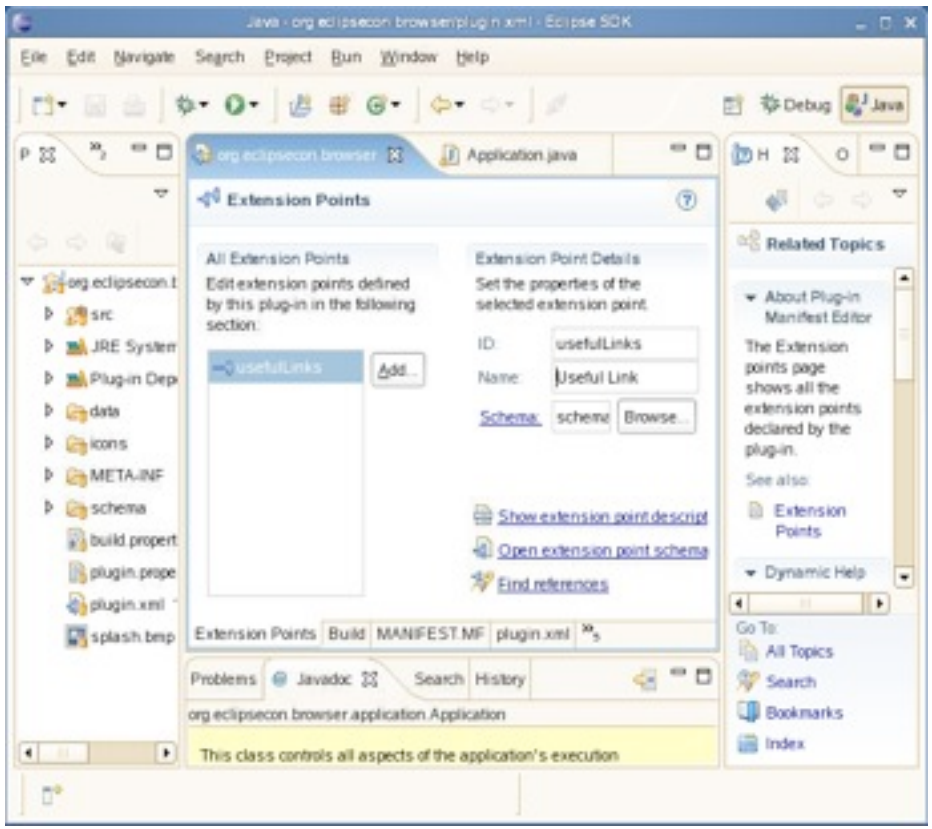
Eclipse on Windows™ XP



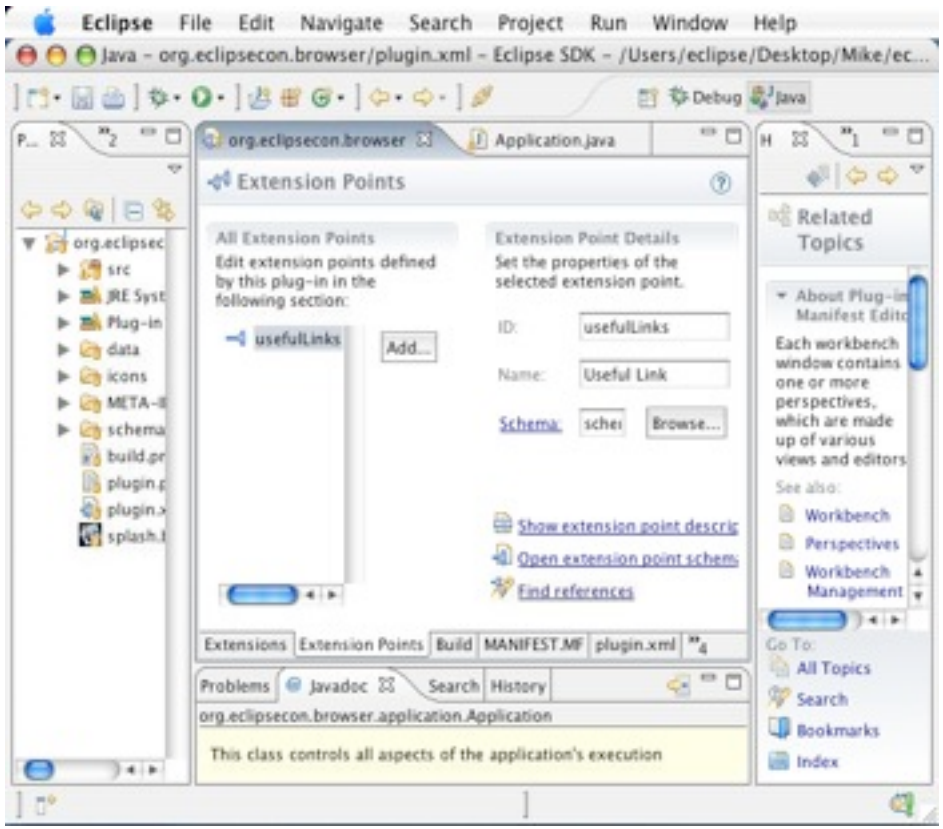
Eclipse on Windows Vista



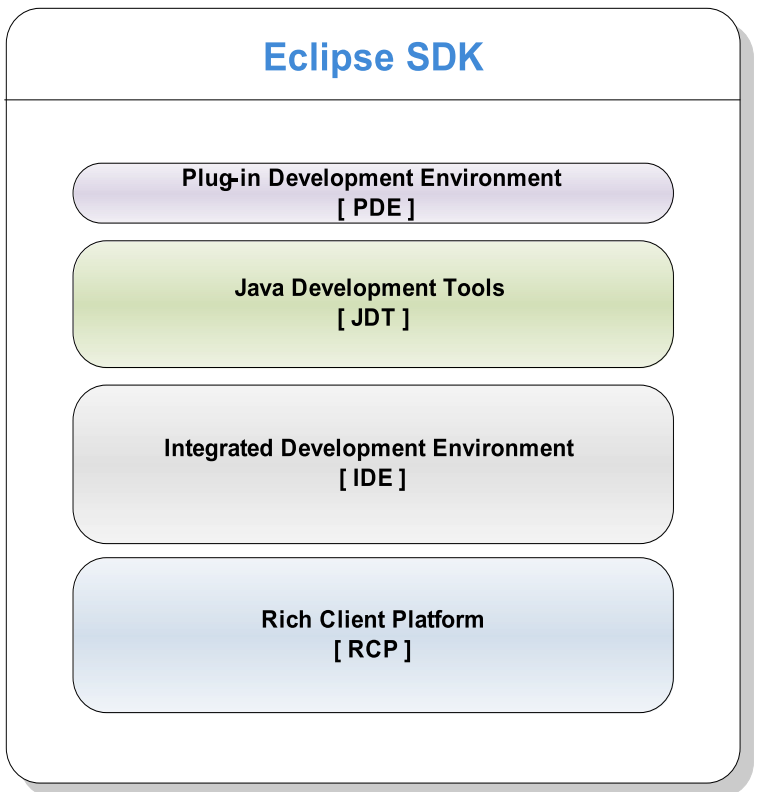
Eclipse on Linux™



Eclipse on Mac OSX

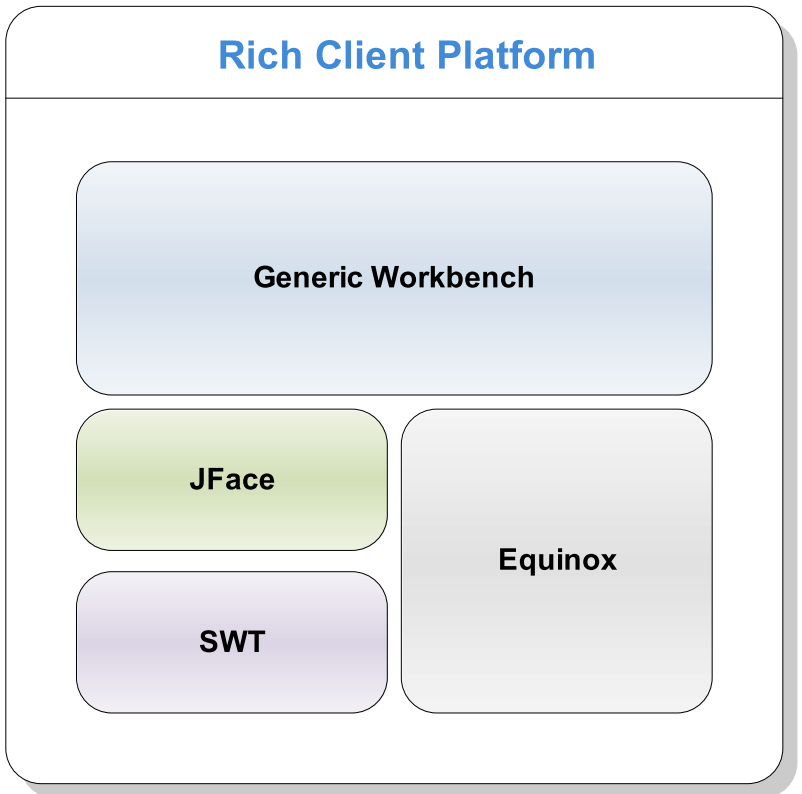


Inside the Eclipse SDK



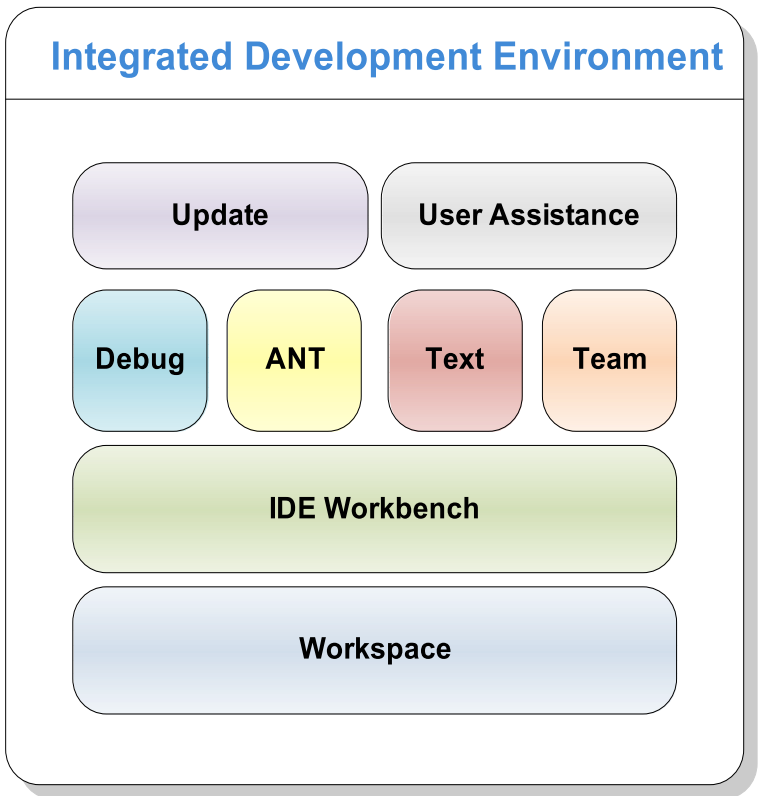
- RCP provides the architecture and frameworks to build any rich client application
- IDE is a tools platform and a rich client application in itself
- JDT is a complete Java IDE and a platform in itself
- PDE provides all the tools necessary to develop plug-ins and RCP applications

Rich Client Platform (RCP)



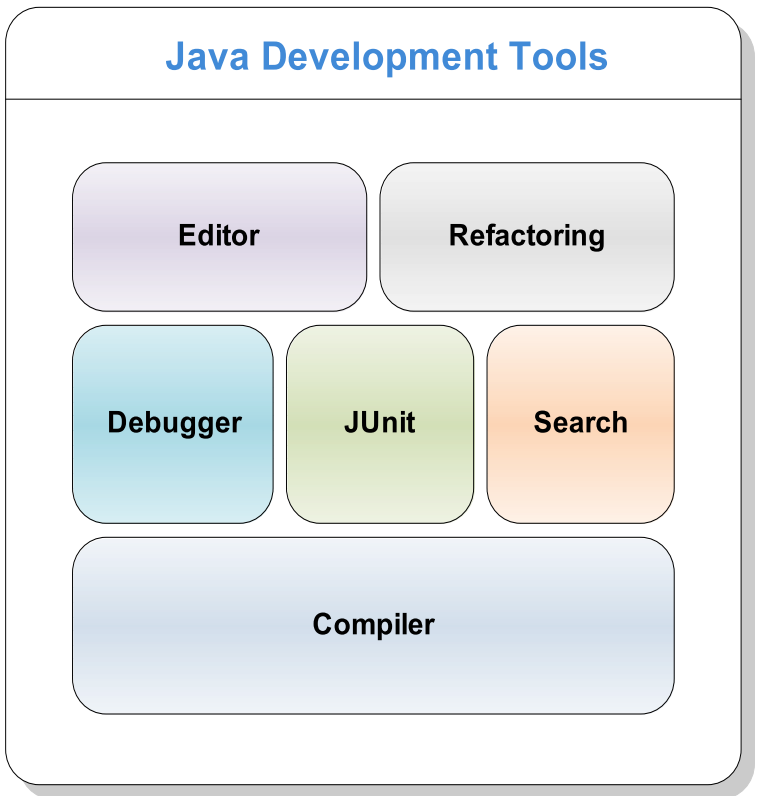
- Equinox is the runtime
- Standard Widget Toolkit (SWT) is a portable and native widget toolkit for Java
- JFace is a framework for common UI programming tasks
- Generic Workbench provides the UI personality of the Eclipse platform

Integrated Development Environment (IDE)



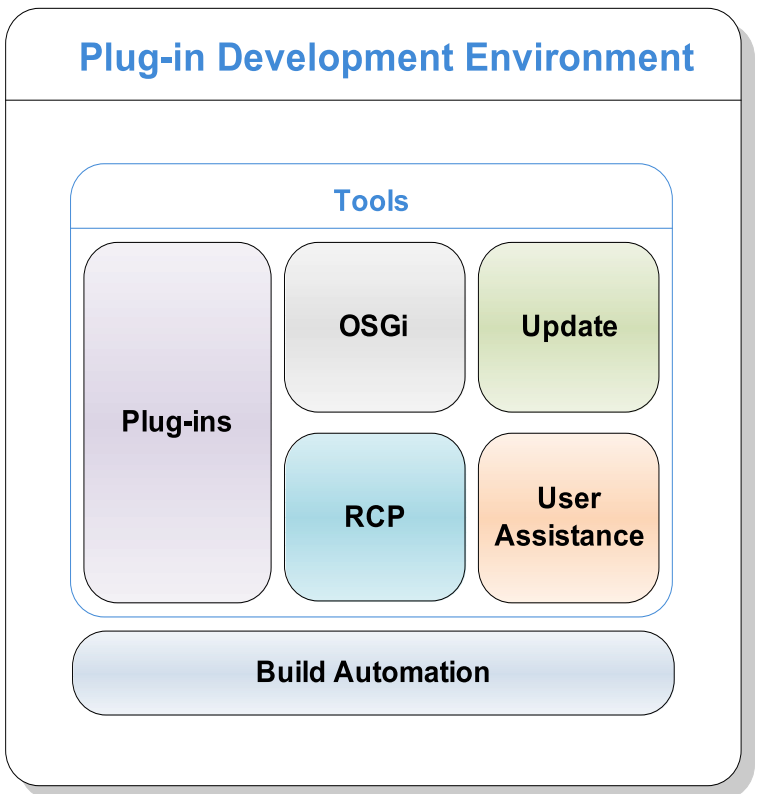
- The IDE Workbench defines the Eclipse presentation
- IDE is an open tools platform:
  - Resource management
  - Text editing framework
  - A Language-independent debug model
  - Ant integration
  - Team repository integration
  - Help system
  - Update manager

Java Development Tools (JDT)



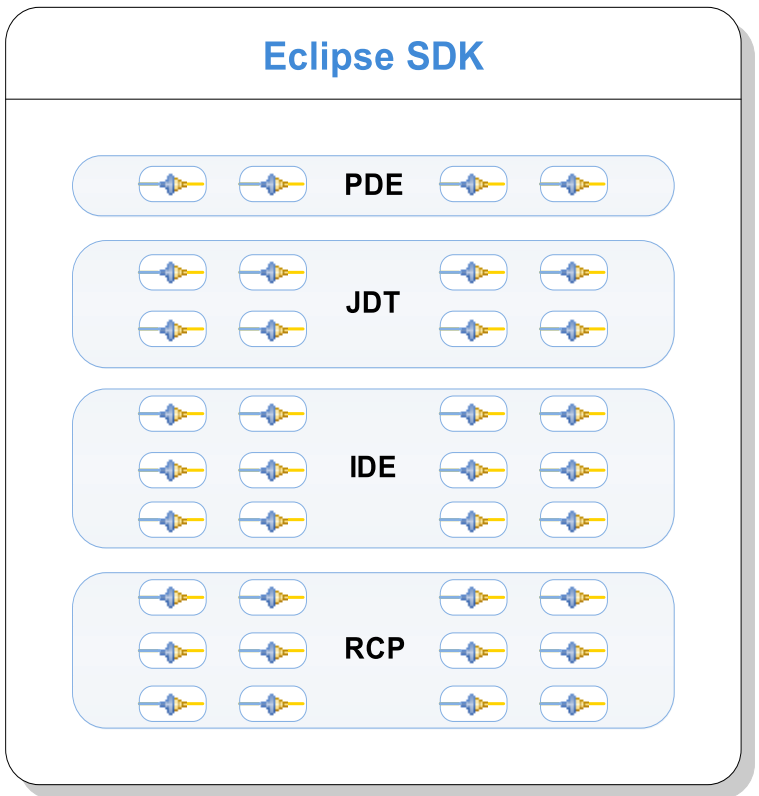
- JDT provides a complete Java IDE
- The compiler, which operates in incremental and batch modes, is also available as a separate download
- JDT is extensible:
  - Search and refactoring participants
  - Quick-Fix processors
  - Code Formatters
  - etc…

Plug-in Development Environment (PDE)



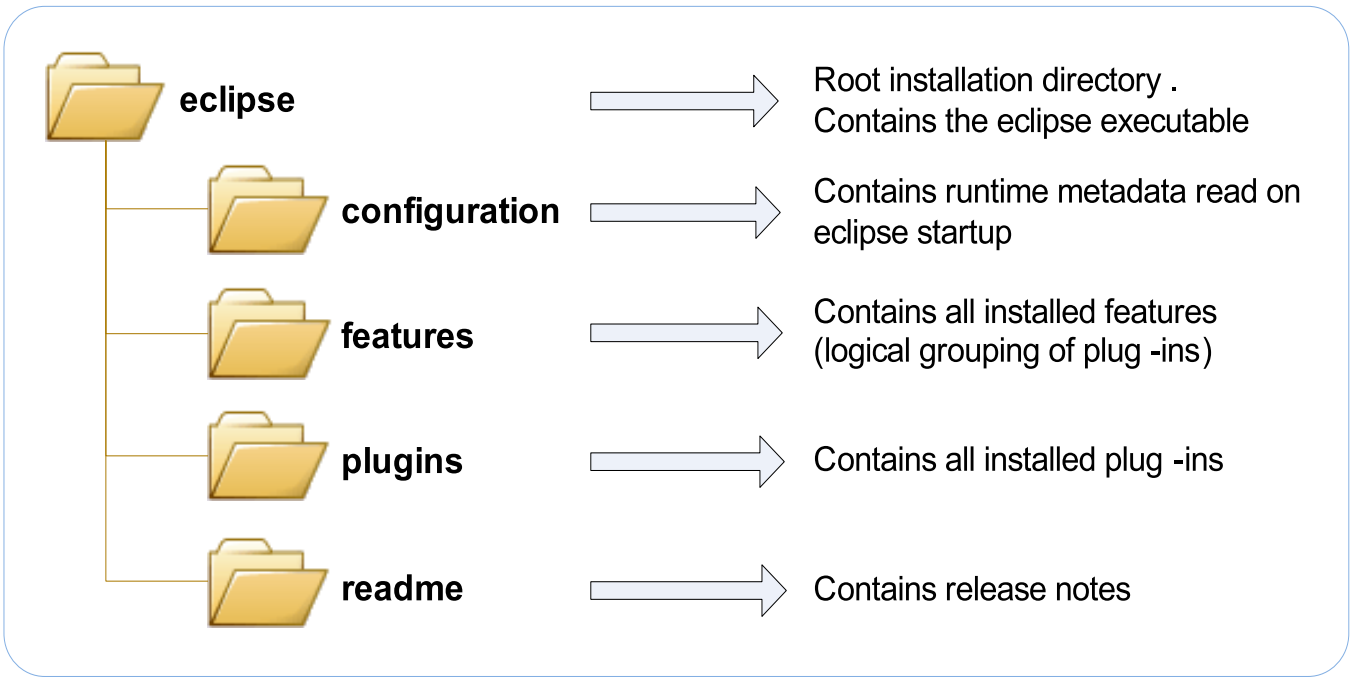
- PDE Does Plug-ins
- PDE Does RCP
- PDE Does Features and Update Sites
- PDE Does OSGi
- PDE Does User Assistance (as of Eclipse 3.3)

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



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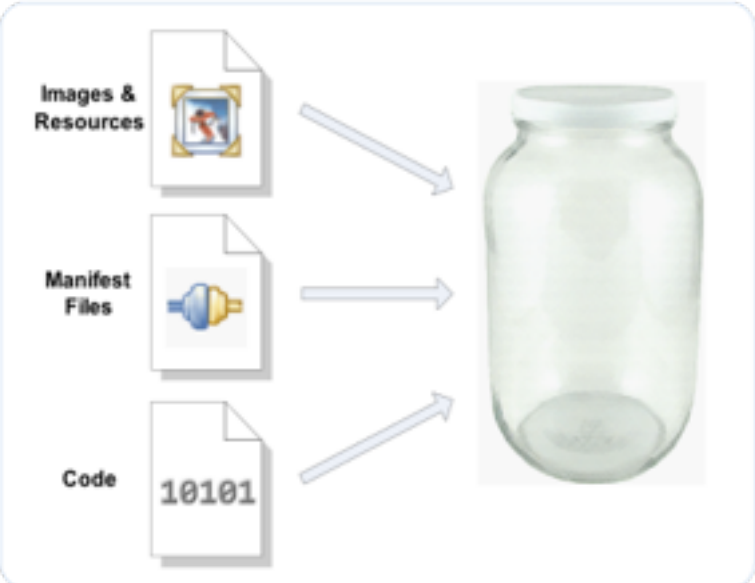
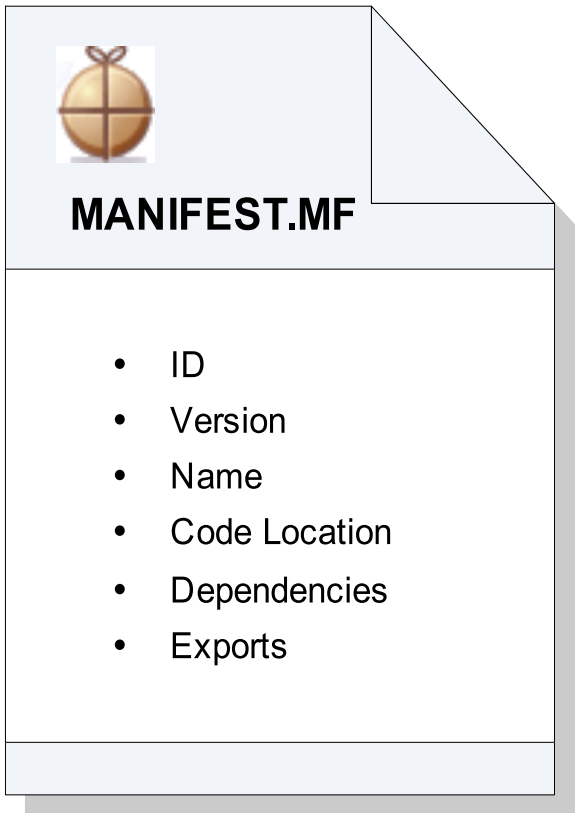
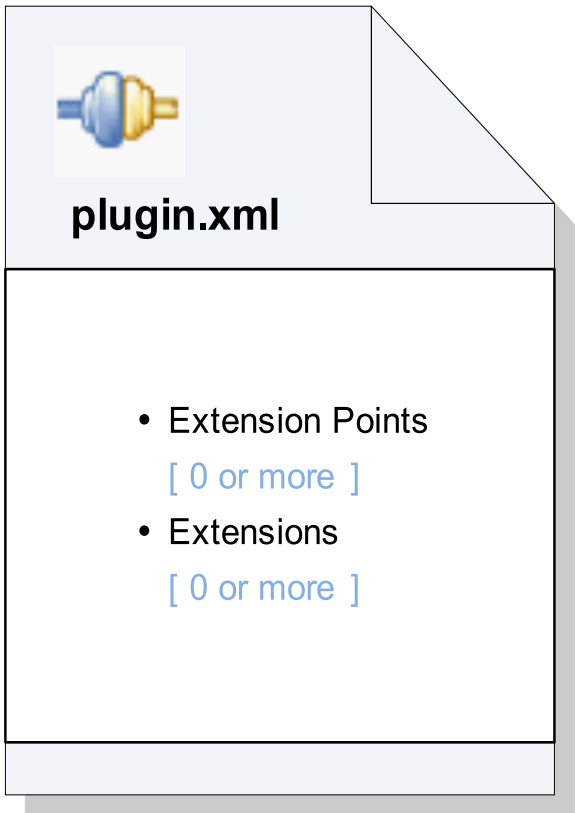
A Fundamental Building Block



- 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

A Tale of Two Manifest Files





A Mechanism for Extensibility

Extension Point

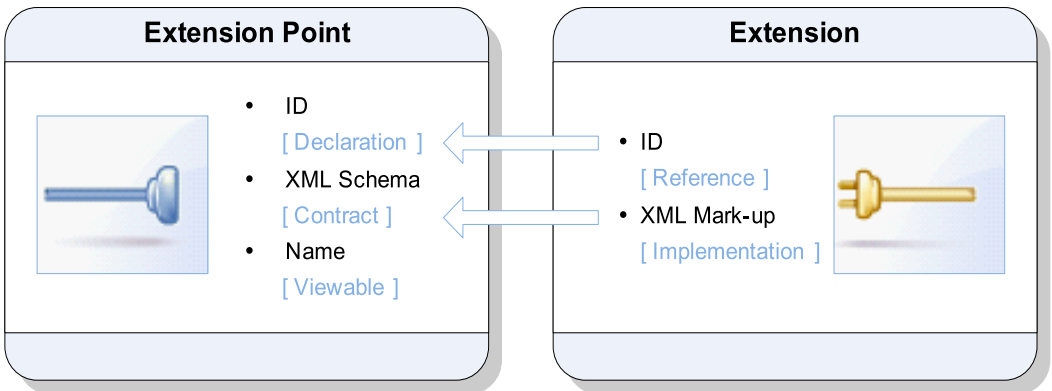
Extension

- 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…

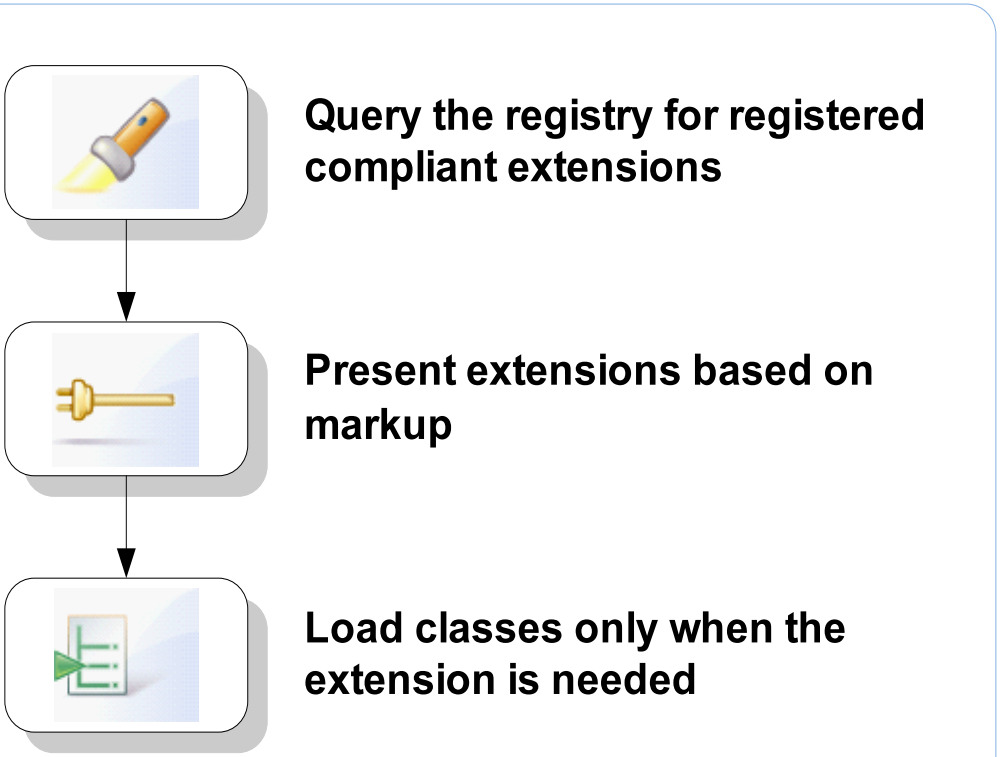
- So many extension points…
- Each extension point is unique
- Each extension point declares a contract
- The extension point provider accepts only extensions that abide to the terms of its contract

A Declarative Approach

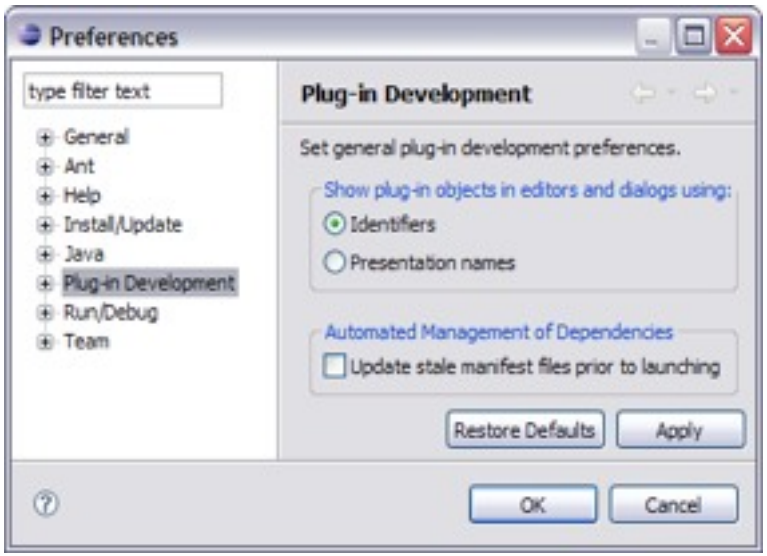


- Extension points and extensions are declared in the plugin.xml file
- The runtime is able to wire extensions to extension points and form an extension registry using XML markup alone

Extensibility in Pictures



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?

The Electric Outlet and the Plug

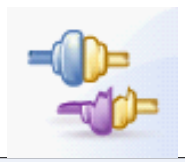
Extension Point

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

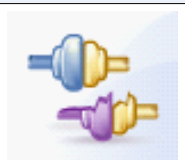
Extension

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

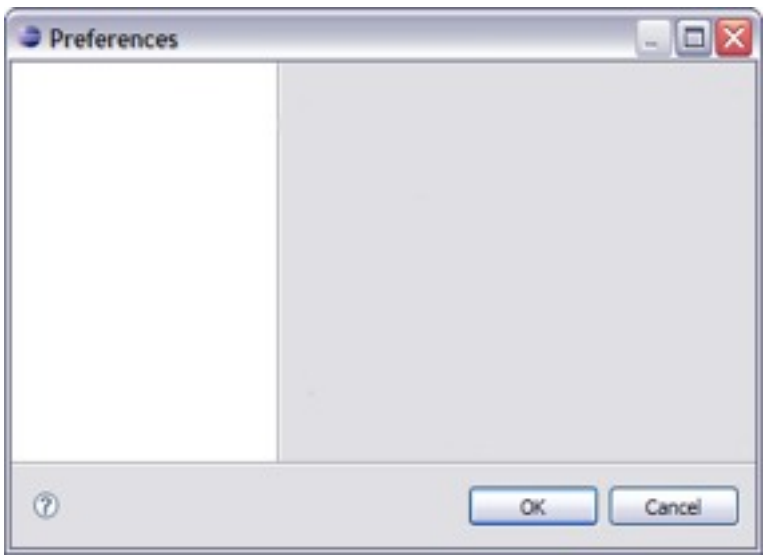
org.eclipse.ui



org.eclipse.pde.ui

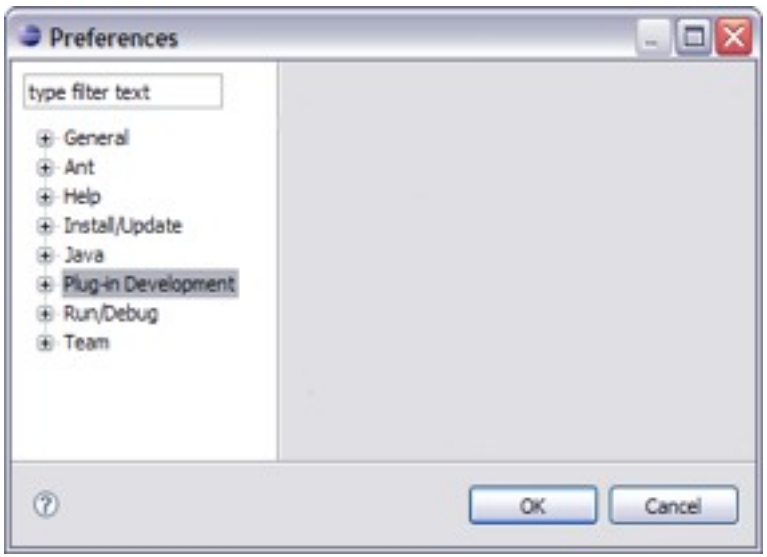


Create the Preferences Dialog (1/3)



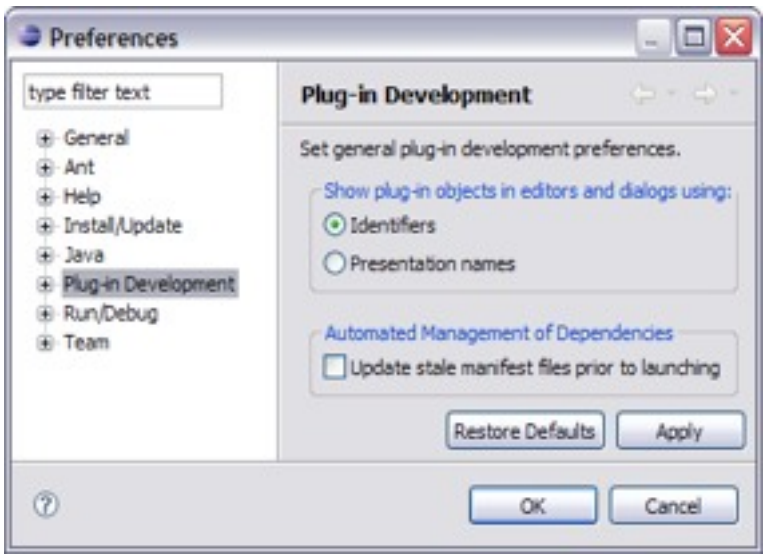
- The UI plug-in provides the `org.eclipse.ui.preferencePages` extension point
- The UI plug-in first creates an empty Preferences dialog
- Now the dialog needs to be populated…

Generate the Preference Page Index (2/3)



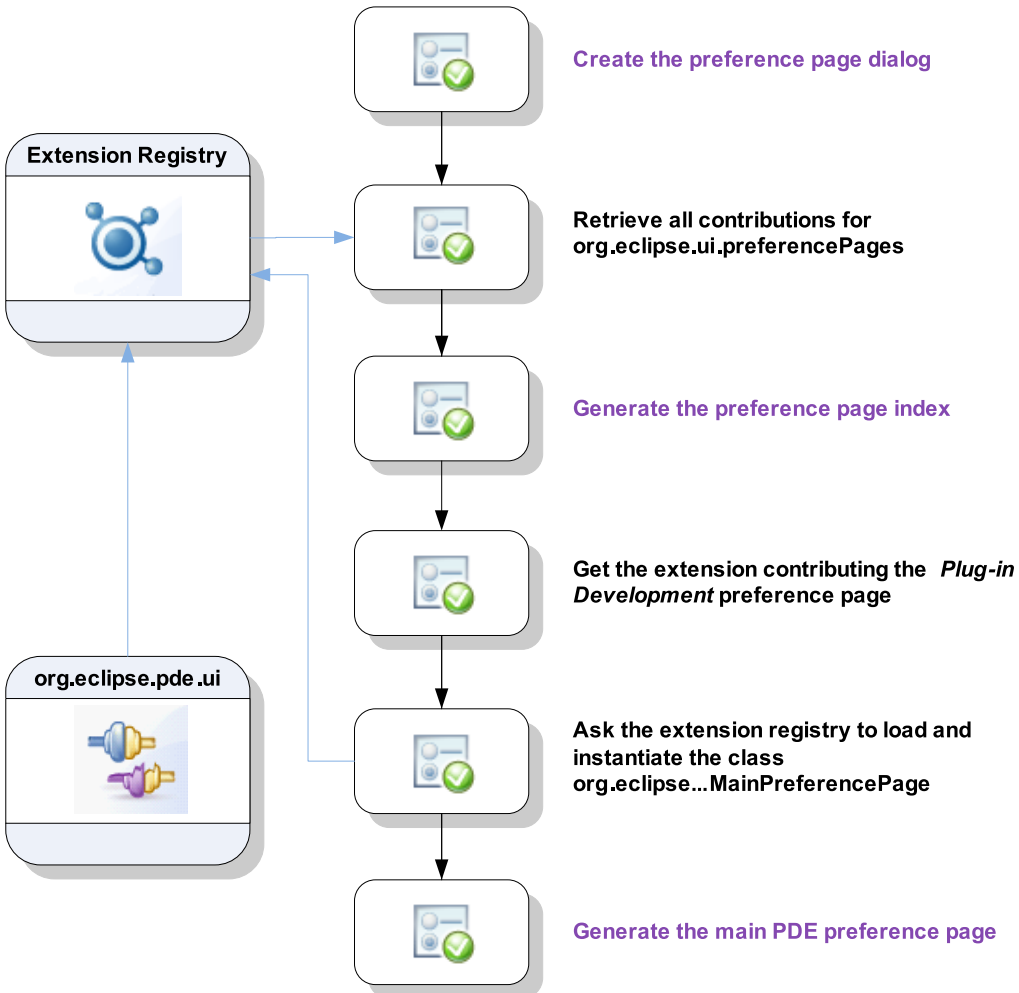
- The UI plug-in queries the extension registry for all `org.eclipse.ui.preferencePages` extensions
- The preference page index is then generated using the xml markup only:
  - Names for available preference pages are displayed in the tree using the `name` attribute
  - The `category` attribute is used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

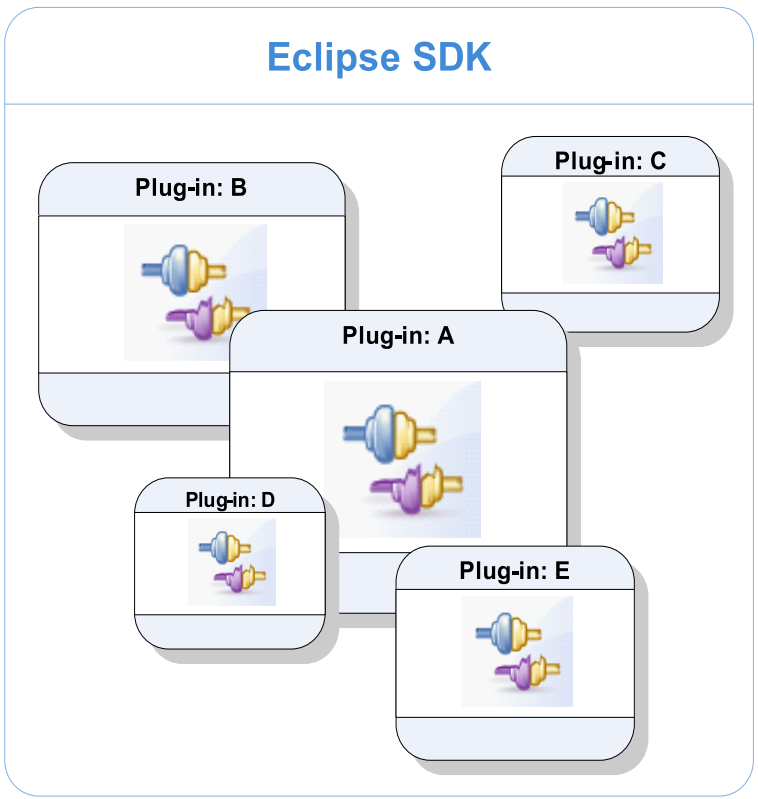
Lazy Loading



Tip of the Iceberg

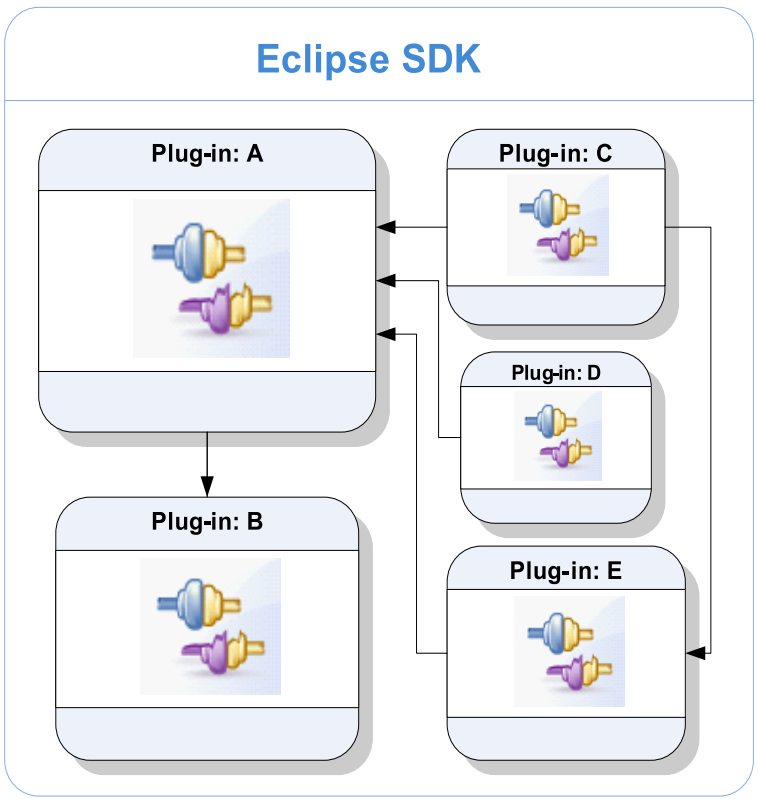
- Plug-ins are connected without loading any of their code
- Code is loaded only when it is needed
- The lightweight declarative and lazy approach scales well
- An installed plug-in is not necessarily an active plug-in

A Society of Plug-ins



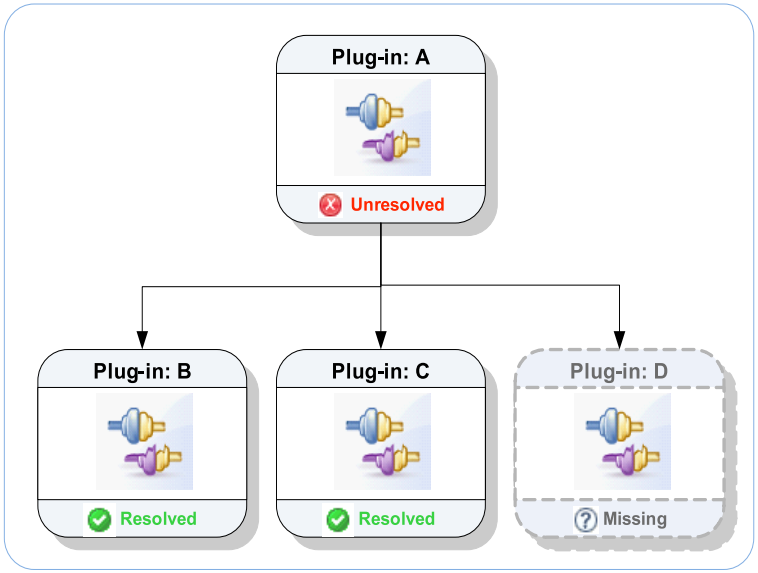
- An Eclipse product is the sum of its constituent plug-ins
- Plug-ins are discovered upon Eclipse startup
- Plug-ins do not know how to play and interact with each other on their own

An Ordered Society of Plug-ins



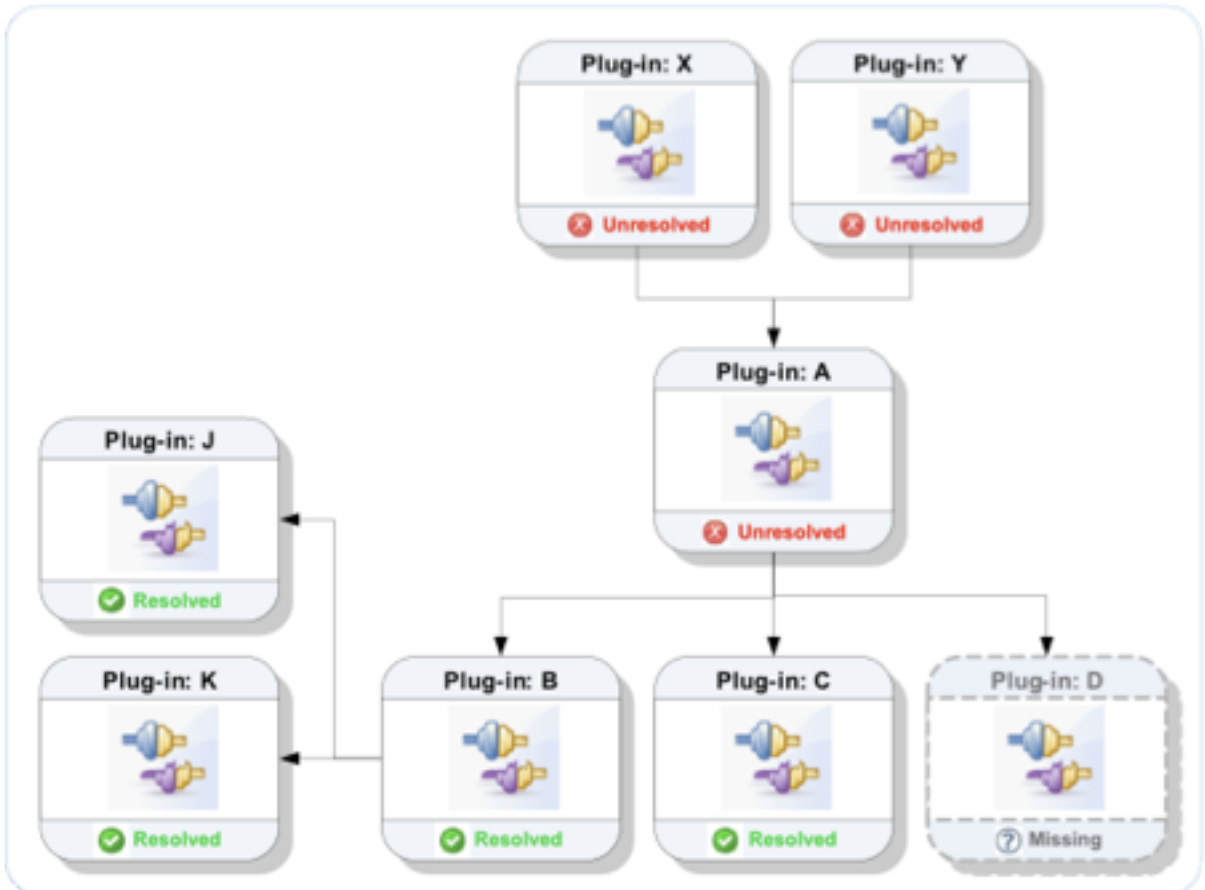
- The Eclipse runtime manages all installed plug-ins and brings order and collaboration to their society
- A classpath for each plug-in is dynamically constructed based on the dependencies declared in its MANIFEST.MF file
- Every plug-in gets its own classloader

Unresolved Plug-ins

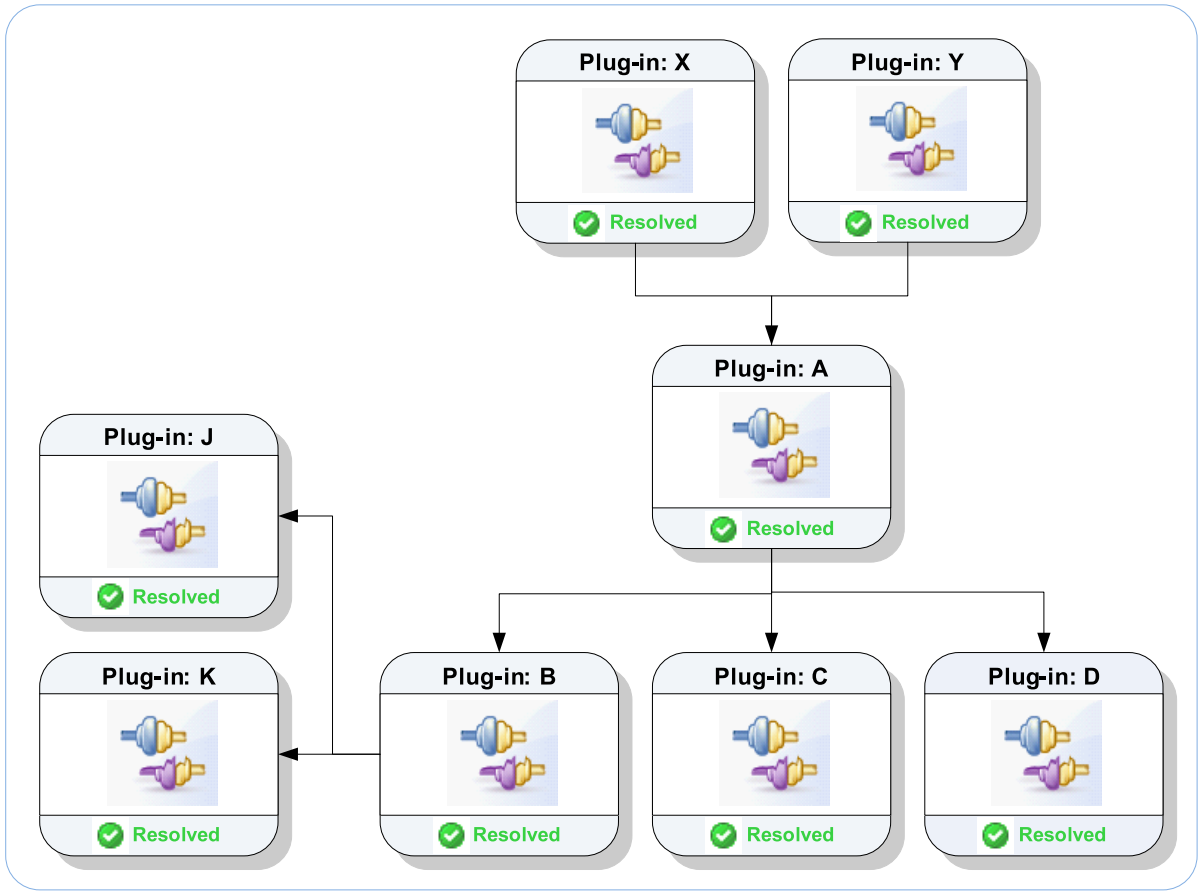


- If a plug-in has a dependency that is not met, the plug-in is deemed UNRESOLVED
- An unresolved plug-in does not get to interact with the rest of the plug-ins

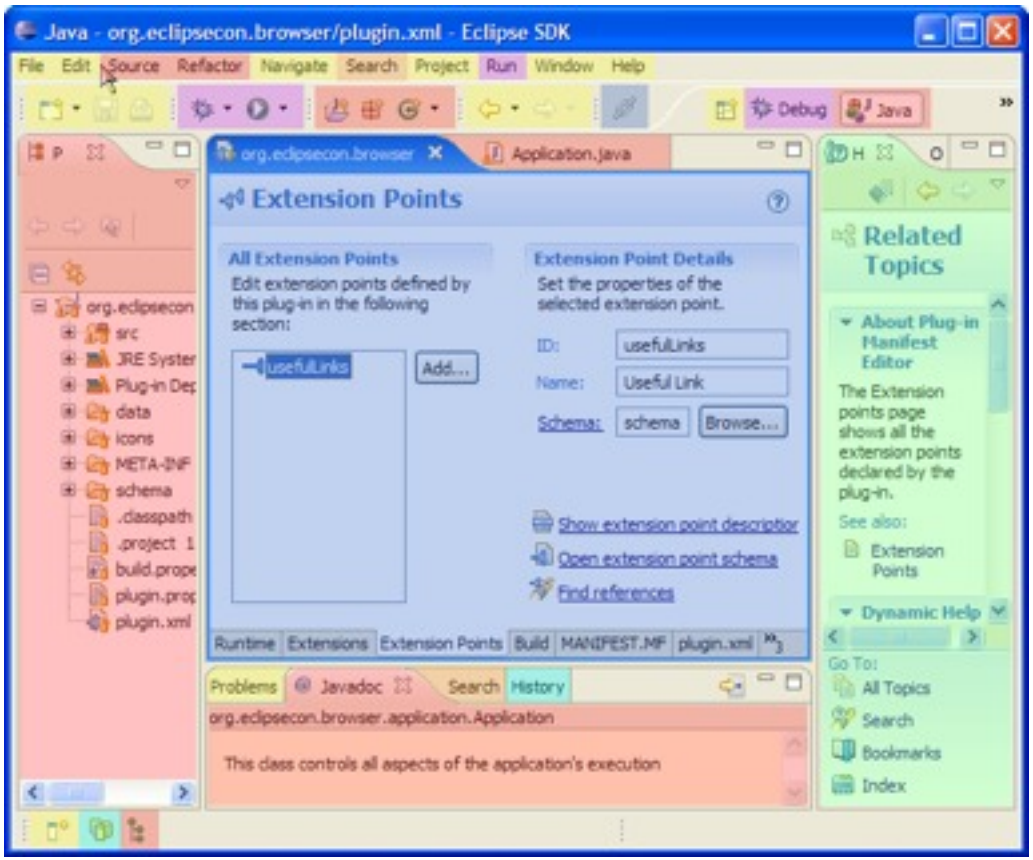
A Chain Reaction



Resolving the Unresolved



Seamless Integration of Components



Component Legend

- PDE
- JDT
- User Assistance
- Debug
- Workbench
- Search
- Team

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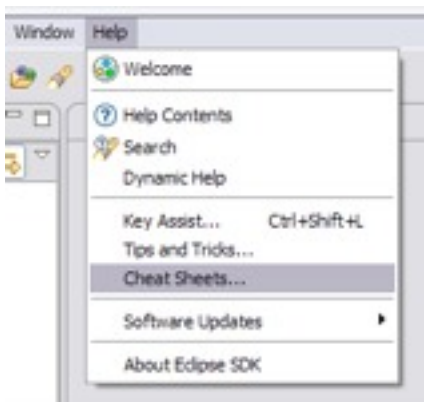
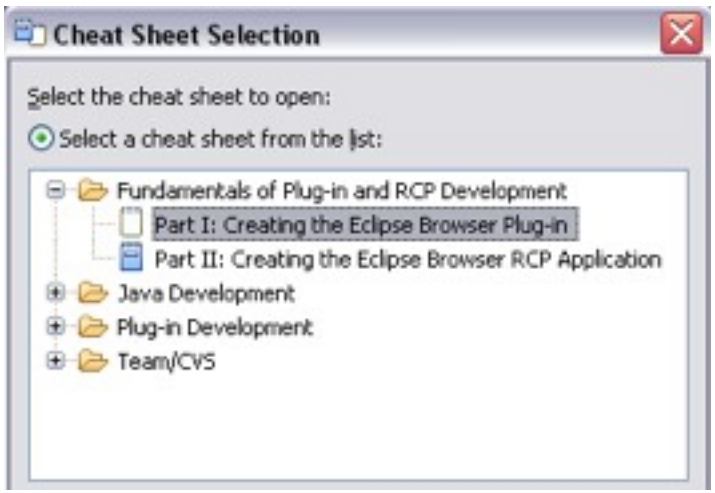
Exercises In the Form of Cheat Sheets

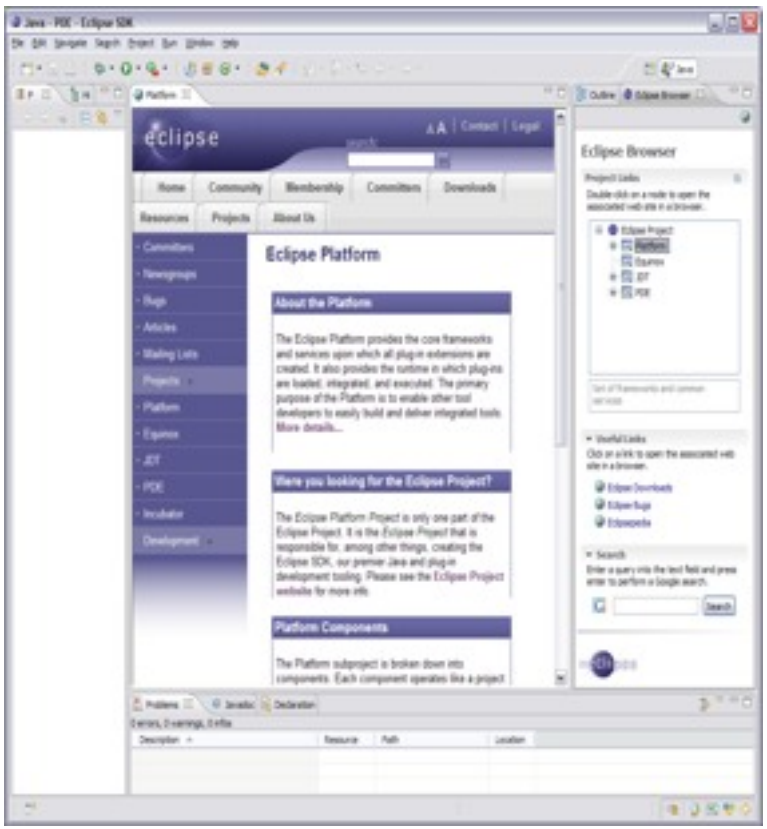
- Unzip both plug-ins into the “plugins” directory of your Eclipse installation
- Tutorial exercises can be accessed via Help > Cheat Sheets… from the main menu





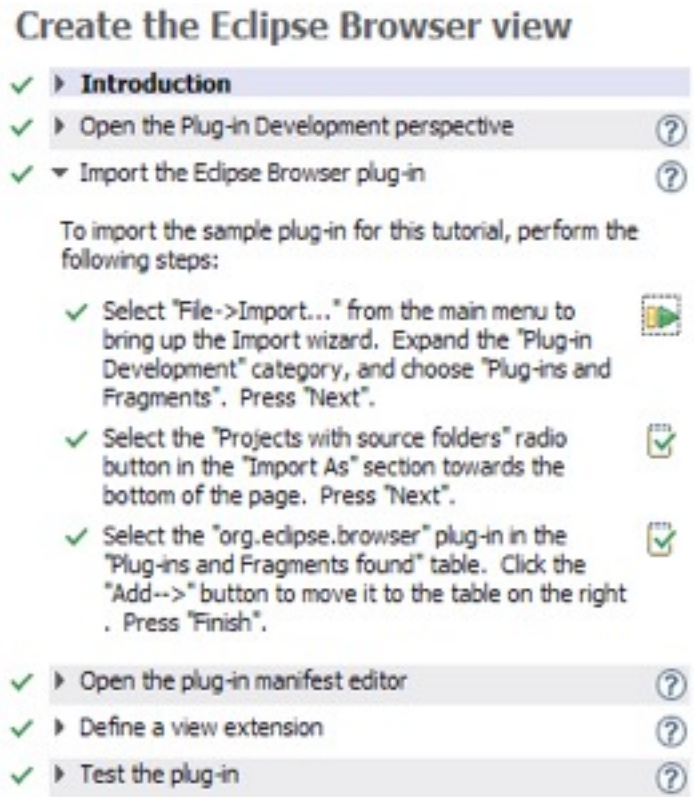
Exercise One: The Eclipse Browser Plug-in

Exercise One: The End Result



- A view that shows an overview of the Eclipse project structure
- You can open associate web pages by clicking on nodes
- The view seamlessly integrates with the SDK

Create the Eclipse Browser View



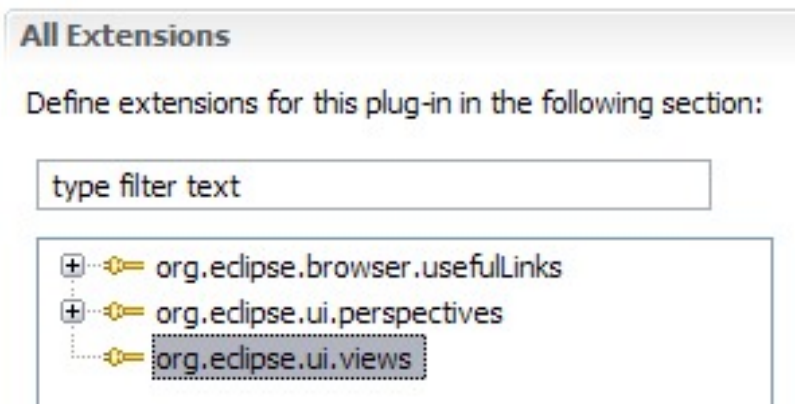
- This exercise is structured as a 5-step cheat sheet
- You use the plug-in import wizard to import the plug-in into the workspace
- You use the plug-in manifest editor to define the extension
- You use the Eclipse Application launcher to test the plug-in

Import the Eclipse Browser Plug-in

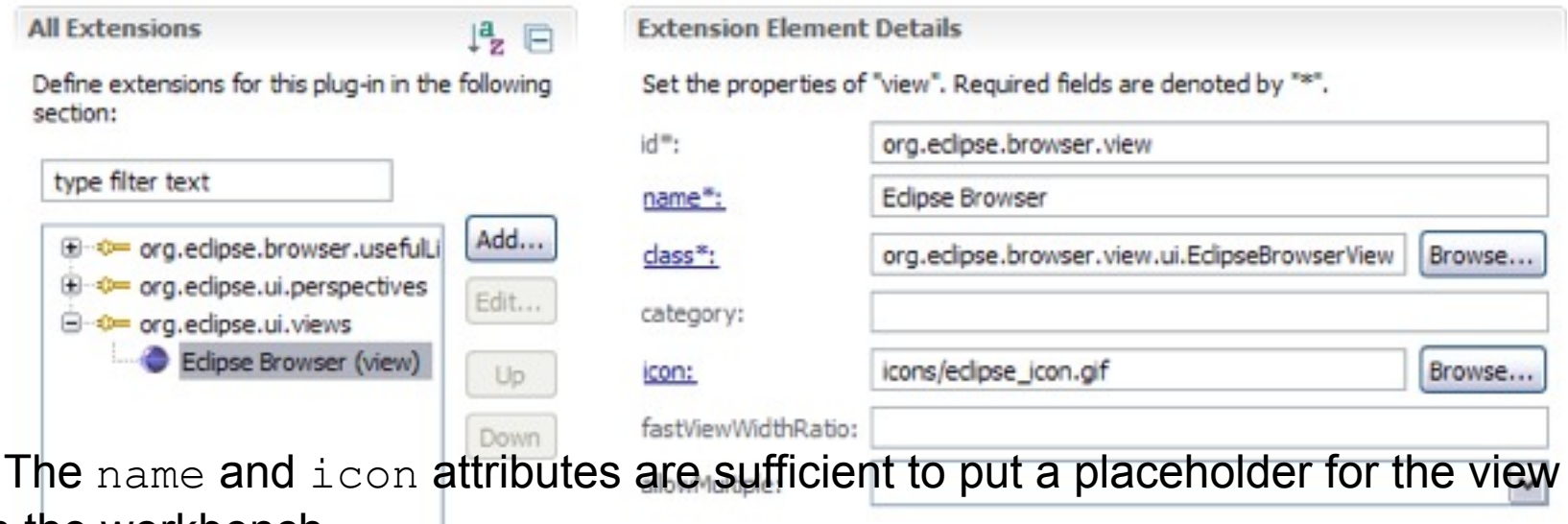
- The plug-in import wizard brings a plug-in from the file system into the workspace
- The plug-in is converted from its deployed form (a JAR) to its development form (a workspace project)
- Choose to import the plug-in as “Project with source” if you wish to modify it.

Add a View Extension

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

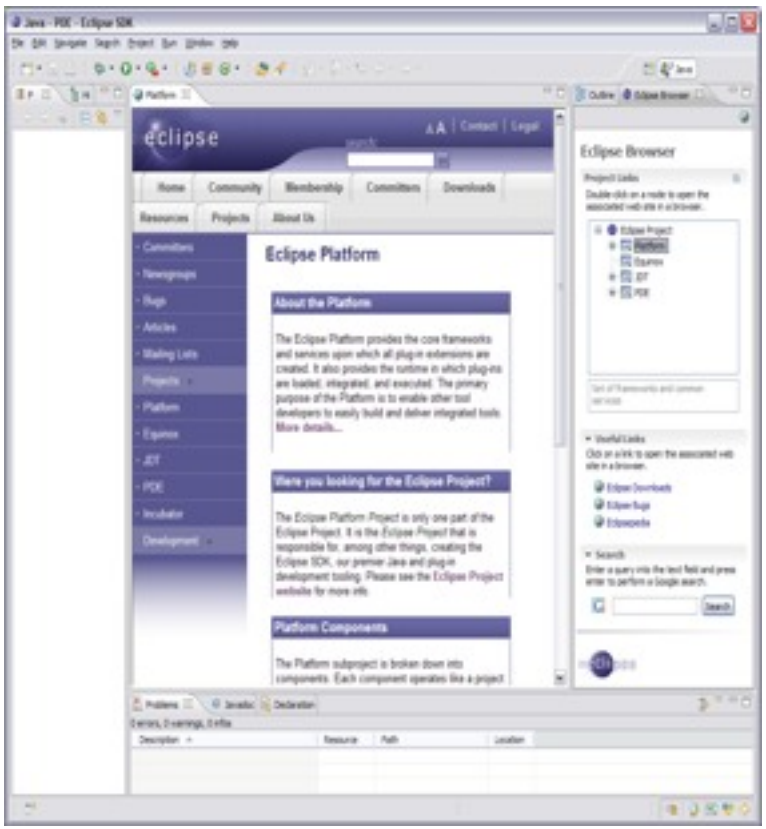


Define the Eclipse Browser View



- 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)

Tutorial Outline

- The Basics
- Anatomy of a Plug-in
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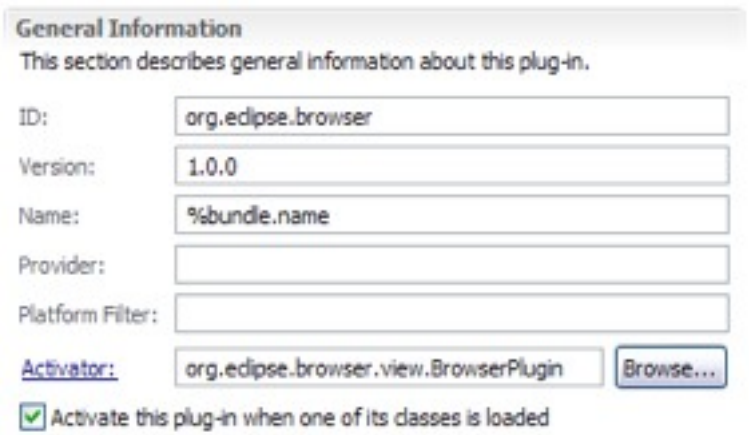
- **The Plug-in Manifest Editor**
- The Development Lifecycle of a Plug-in
- Q&A

General Information

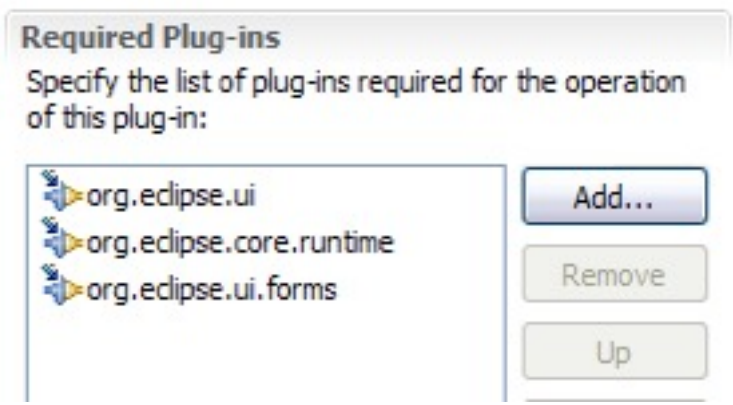


- A plug-in must have an ID, version and a name
- A platform filter is an optional field to specify under what conditions the plug-in should be allowed to run
- An activator controls the plug-in's lifecycle and may do initialization upon startup and cleaning up at shutdown

Execution Environment

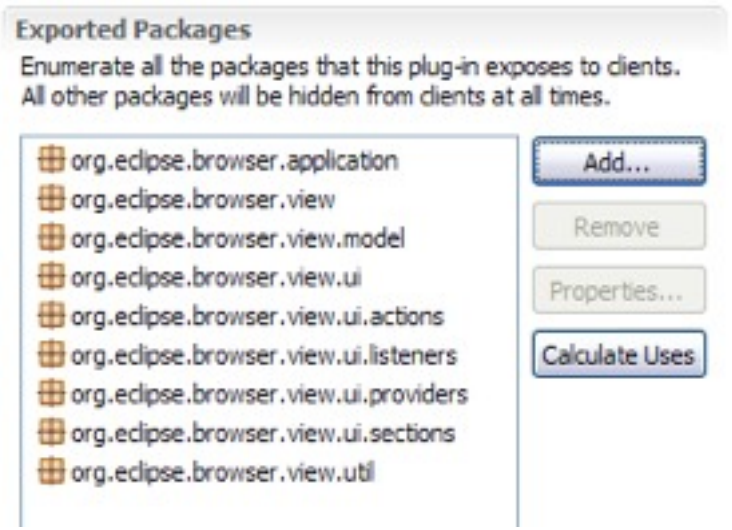
- An Execution Environment is the minimum JRE level required for a plug-in to run
- If a plug-in declares a J2SE-1.5 Execution Environment and Eclipse is running using a 1.4 JRE, the plug-in gets disabled gracefully

Dependencies



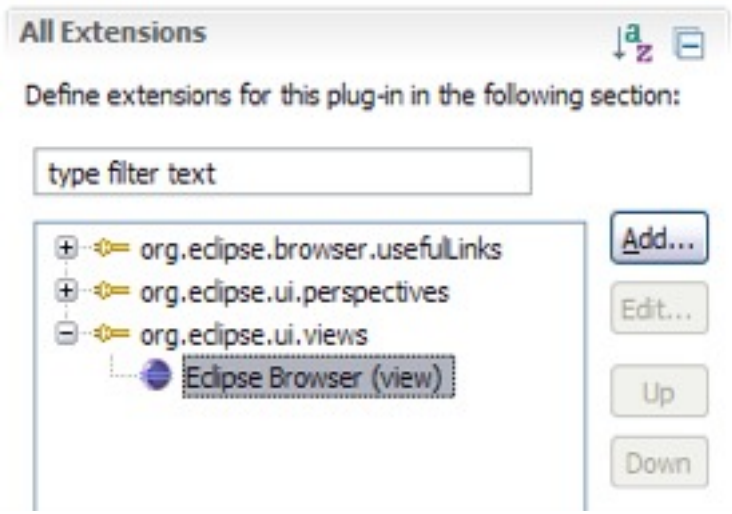
- A plug-in must list all plug-ins that it needs to compile
- The runtime and development classpaths are computed based strictly on dependencies in the MANIFEST.MF
- PDE manages and updates the development classpath for you
- All plug-in dependencies must be met before a plug-in is resolved

Exported Packages



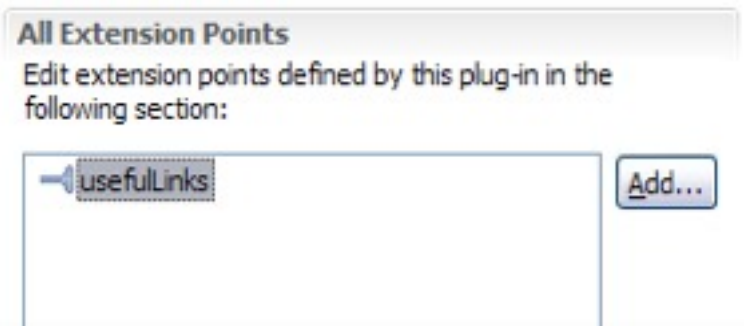
- A plug-in may expose it code to downstream clients
- Downstream plug-ins may then make a dependency on the plug-in and use code from it

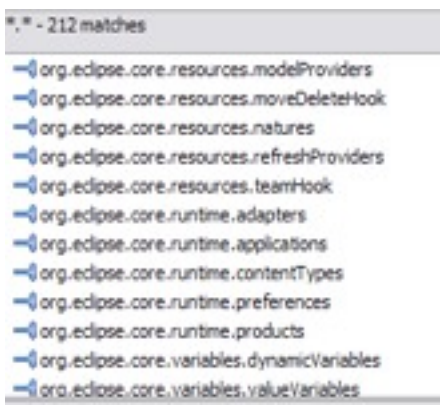
Extensions



- 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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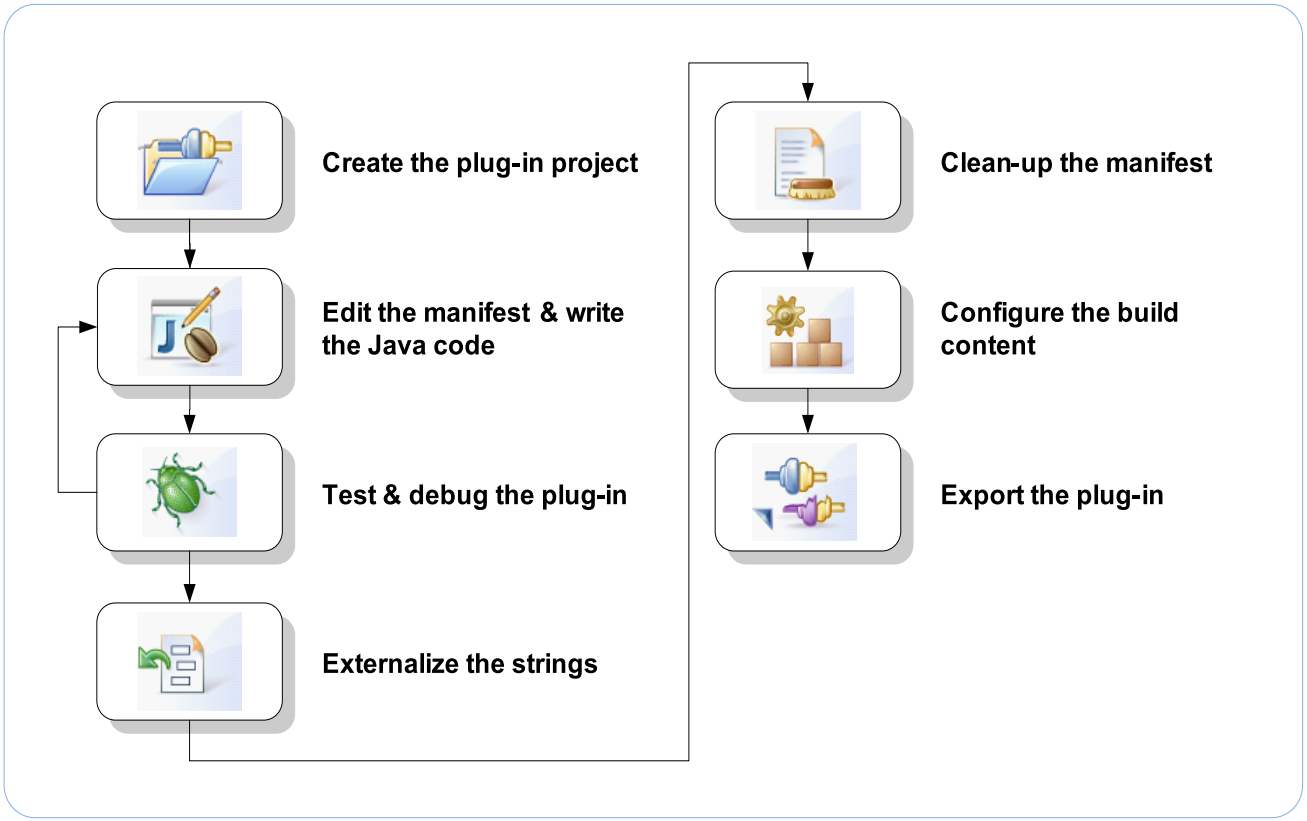
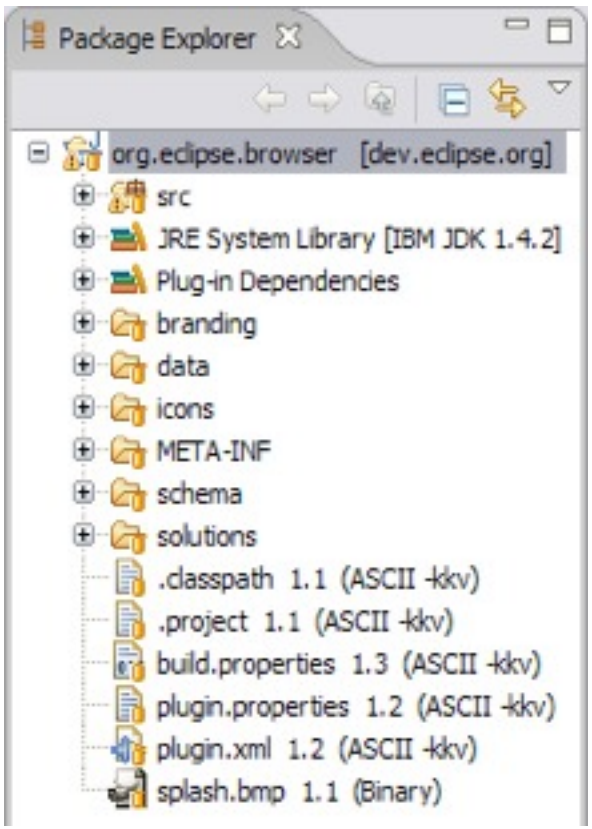
From Genesis to Deployment



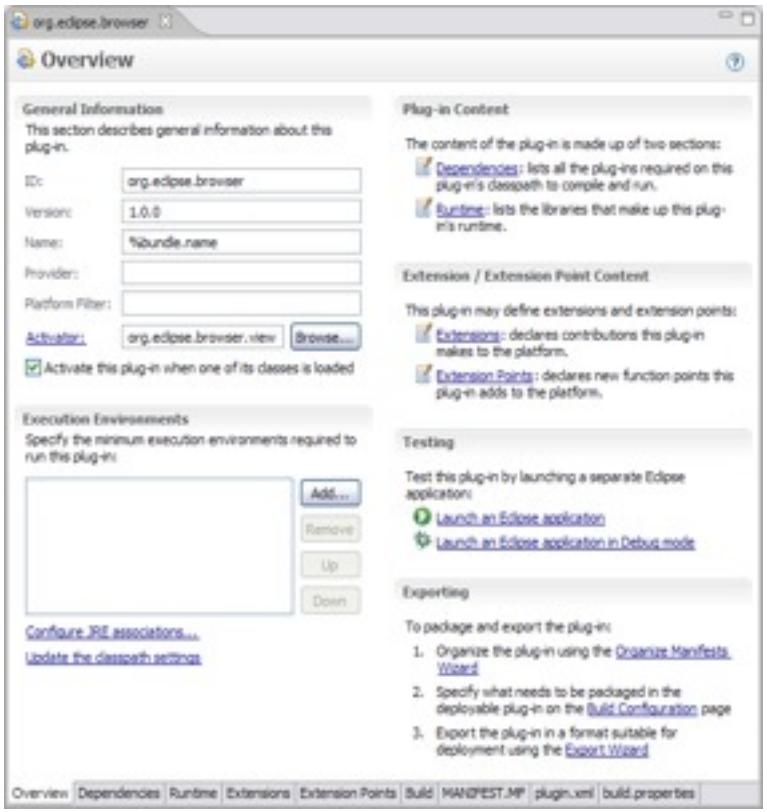
Plug-in Creation

Life in the Workspace



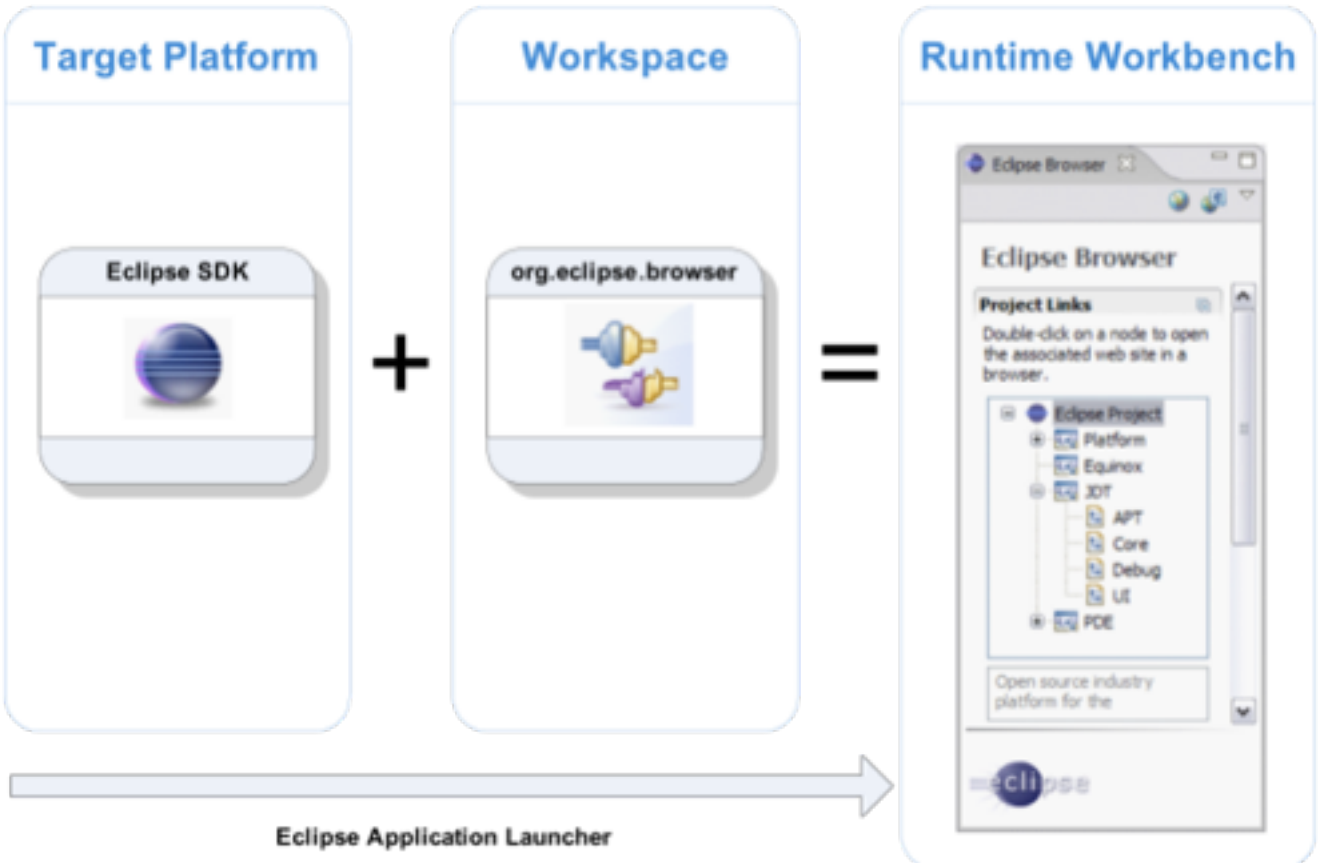
- The internal structure of a plug-in project in the workspace mirrors that of a deployed plug-in
- Two notable differences:
  1. The code is in source folders
  2. The plug-in project contains extra development metadata that are not part of the deployed plug-in

Editing the Plug-in

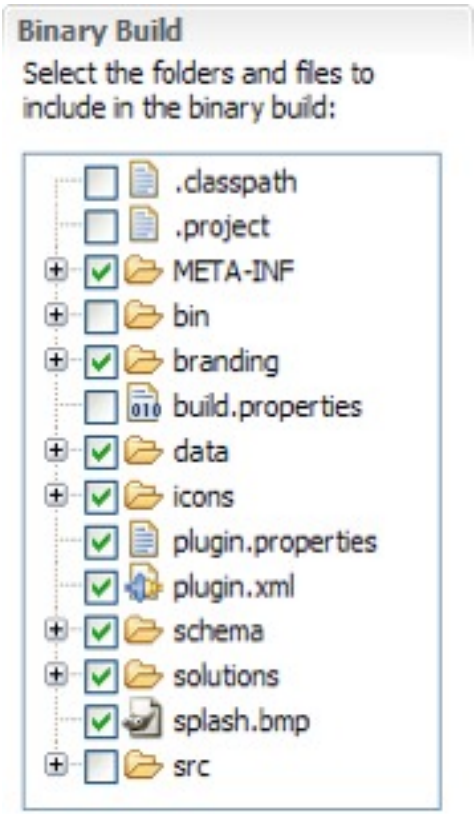


- The plug-in manifest editor is the central place to manage your plug-in
- It provides hot links to
  - test and debug plug-ins
  - launch relevant wizards
  - quick navigation between source code and the manifest files

Testing the Plug-in



Configure the Build Content

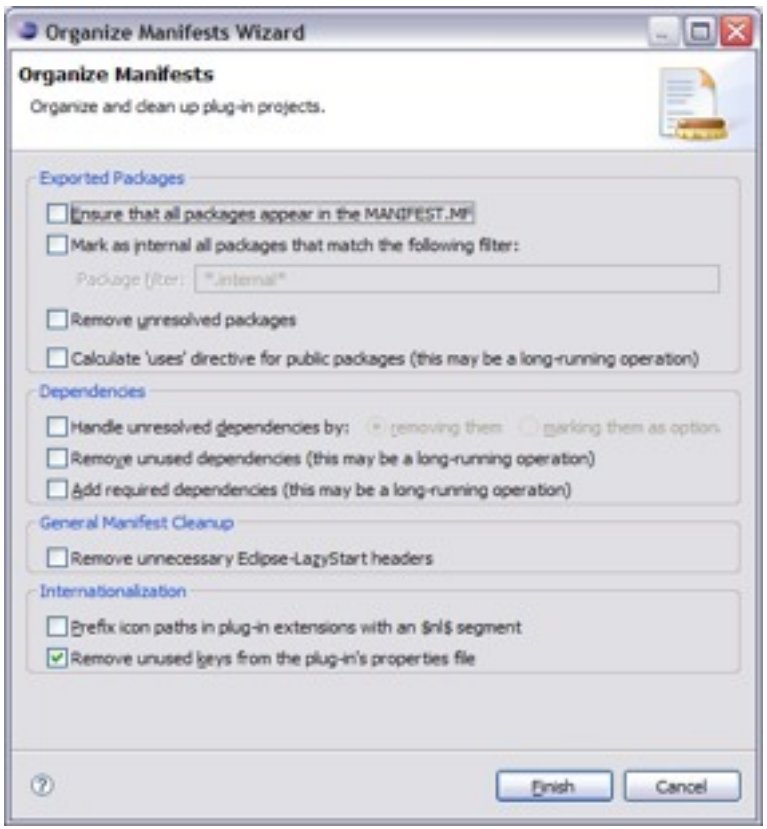


- The plug-in project contains development-time metadata that should not be part of the deployed plug-in.
- On the Build page of the plug-in manifest editor, you check the list of files and folders that should be packaged

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

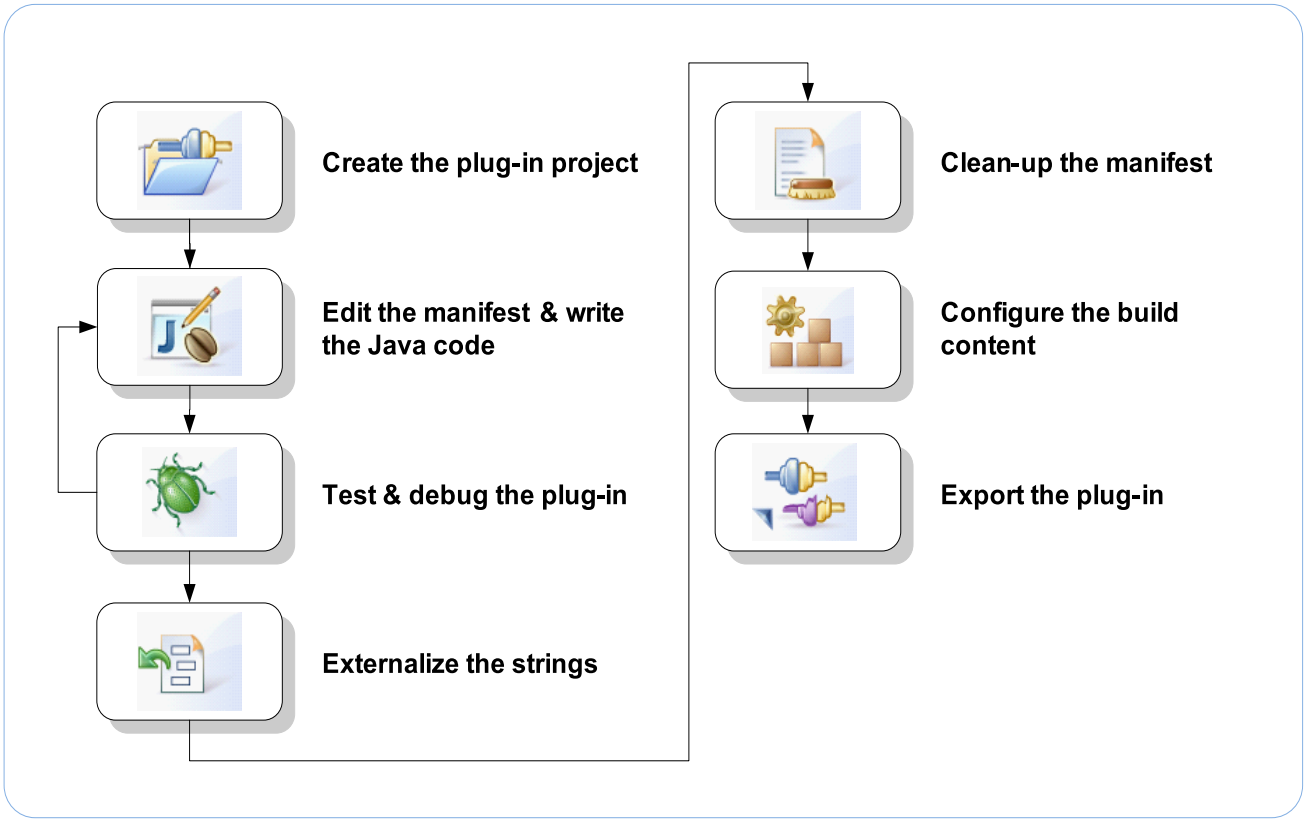


- As the plug-in evolves, it may accumulate stale data
- The *Organize Manifests* wizard that inspects your code and manifests and removes or updates stale data

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

From Genesis to Deployment



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Questions and Answers?

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