

Eclipse Code Recommenders



TECHNISCHE
UNIVERSITÄT
DARMSTADT

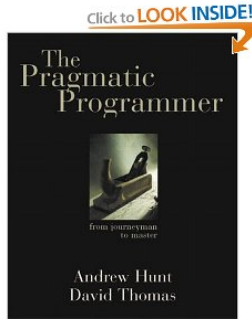
IDE 2.0: Eclipse meets Social (and Crowds)

tw: @MarcelBruch
g+: +Marcel Bruch

Eclipse Stammtisch Zurich

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[Andrew Hunt](#) (Author), [David Thomas](#) (Author)

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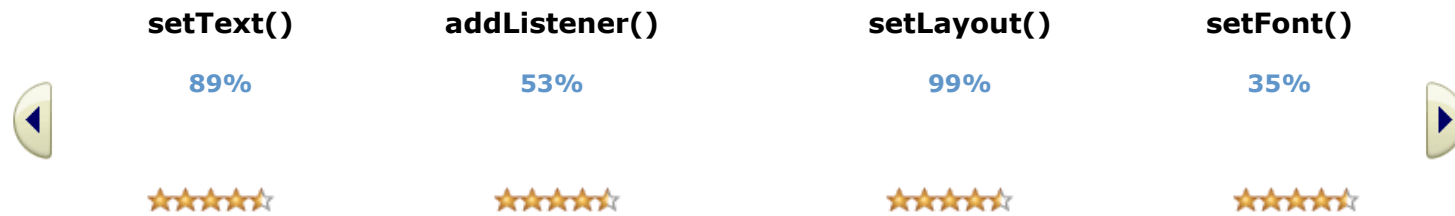
Eclipse Code Recommenders

All Frameworks Search Code GO Cart Wish List

Code Advanced Search Browse Subjects New Releases Bestsellers The New York Times® Bestsellers Libros En Español Bargain Books Textbooks

```
demo.preferences
SimpleFieldsPreferencePage
  prefs: MyPreferenceStore
  uiCalendarURL: Text
  uiEnablePopupNotifications: Button
  createContents(Composite): Control
  performOk(): boolean
  createContainer(Composite): Composite
  createReminderGroup(Composite): Group
  init(IWorkbench): void
  @Override
  protected Control createContents(Composite parent)
  {
    Composite pageContainer = createContainer(parent);
    Group reminderGroup = createReminderGroup(pageContainer);
    Label label = new Label(reminderGroup, SWT.NONE);
    label.setText("Calendar URL:");
    uiCalendarURL = new Text(reminderGroup, SWT.BORDER);
  }
```

Developers Who Called "new Text ()" Method Also Called



What Do Developers Ultimately Override After Extending This Class?

100 % overwrote
PreferencePage.createContents()

96 % overwrote
PreferencePage.performOk()

5 % overwrote
PreferencePage.performCancel()

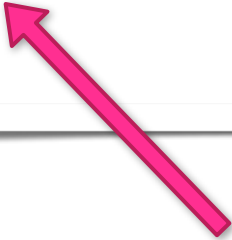
“Other developers frequently ~~thought~~ used the following methods...”

INTELLIGENT CODE COMPLETION

Code Completion...

```
@Override
protected Control createDialogArea(final Composite parent) {
    Composite container = (Composite) super.createDialogArea(parent);

   .swtTextWidget = new Text(container, SWT.BORDER);
   .swtTextWidget.|
    return container;
}
```



What does the developer need, i.e., which methods should the code completion present to the user?

- view : NSView - Control
- addControlListener(ControlListener listener) : void - Control
- addDisposeListener(DisposeListener listener) : void - Control
- addDragDetectListener(DragDetectListener listener) : void - Control
- addFocusListener(FocusListener listener) : void - Control
- addHelpListener(HelpListener listener) : void - Control
- addKeyListener(KeyListener listener) : void - Control
- addListener(int eventType, Listener listener) : void - Control
- addMenuDetectListener(MenuDetectListener listener) : void - Control
- addModifyListener(ModifyListener listener) : void - Control
- addMouseListener(MouseListener listener) : void - Control
- addMouseMoveListener(MouseMoveListener listener) : void - Control
- addMouseTrackListener(MouseTrackListener listener) : void - Control
- addMouseWheelListener(MouseWheelListener listener) : void - Control
- addPaintListener(PaintListener listener) : void - Control
- addSelectionListener(SelectionListener listener) : void - Control
- addTraverseListener(TraverseListener listener) : void - Control
- addVerifyListener(VerifyListener listener) : void - Control
- append(String string) : void - Text
- clearSelection() : void - Text
- computeSize(int wHint, int hHint) : Point - Control
- computeSize(int wHint, int hHint, boolean resizable) : Point - Control
- computeTrim(int x, int y, int width, int height) : Point - Control
- copy() : void - Text
- cut() : void - Text
- dispose() : void - Control
- dragDetect() : boolean - Control
- dragDetect(int x, int y) : boolean - Control
- equals(Object object) : boolean - Control
- forceFocus() : void - Control
- getAccess() : Access - Control
- getBackground() : Color - Control
- getBackgroundImage() : Image - Control
- getBorderWidth() : int - Control
- getBounds() : Rectangle - Control
- getCaretLineNumber() : int - Text
- getCaretLocation() : Point - Text
- getCaretPosition() : int - Text
- getCharCount() : int - Text
- getClass() : Class<?> - Object
- getClientArea() : Rectangle - Scrollable
- getCursor() : Cursor - Control
- getData() : Object - Widget
- getData(String key) : Object - Widget
- getDisplay() : Display - Widget
- getDoubleClickEnabled() : boolean - Text
- getDragDetect() : boolean - Control
- getEchoChar() : char - Text
- getEditable() : boolean - Text
- getEnabled() : boolean - Control
- getFont() : Font - Control
- getForeground() : Color - Control
- getHorizontalBar() : ScrollBar - Scrollable
- getLayoutData() : Object - Control
- getLineCount() : int - Text
- getLineDelimiter() : String - Text
- getLineHeight() : int - Text
- getListeners(int eventType) : Listener[] - Control
- getLocation() : Point - Control
- getMenu() : Menu - Control
- getMessage() : String - Text
- getMonitor() : Monitor - Control
- getOrientation() : int - Text
- getParent() : Composite - Control
- getRegion() : Region - Control
- getSelection() : Point - Text
- getSelectionCount() : int - Text
- getSelectionText() : String - Text
- getShell() : Shell - Control
- getTopIndex() : int - Text
- getTopPixel() : int - Text
- getVerticalBar() : ScrollBar - Scrollable
- getVisible() : boolean - Control
- hashCode() : int - Object
- insert(String string) : void - Text
- internal_dispose_GC(long context, GCData data) : void - Control
- internal_new_GC(GCData data) : long - Control
- isDisposed() : boolean - Widget
- isEnabled() : boolean - Control
- isFocusControl() : boolean - Control
- isListening(int eventType) : boolean - Control
- isReparentable() : boolean - Control
- isVisible() : boolean - Control
- moveAbove(Control control) : void - Control
- moveBelow(Control control) : void - Control
- notify() : void - Object
- notifyAll() : void - Object
- notifyListeners(int eventType, Event event) : void - Control
- pack() : void - Control
- pack(boolean changed) : void - Control
- paste() : void - Text
- print(GC gc) : boolean - Control
- redraw() : void - Control
- redraw(int x, int y, int width, int height, boolean changed) : void - Control
- removeControlListener(ControlListener listener) : void - Control
- removeDisposeListener(DisposeListener listener) : void - Control
- removeDragDetectListener(DragDetectListener listener) : void - Control
- removeFocusListener(FocusListener listener) : void - Control
- removeHelpListener(HelpListener listener) : void - Control
- removeKeyListener(KeyListener listener) : void - Control
- removeListener(int eventType, Listener listener) : void - Control
- removeMenuDetectListener(MenuDetectListener listener) : void - Control
- removeModifyListener(ModifyListener listener) : void - Control
- removeMouseListener(MouseListener listener) : void - Control
- removeMouseMoveListener(MouseMoveListener listener) : void - Control
- removeMouseTrackListener(MouseTrackListener listener) : void - Control
- removeMouseWheelListener(MouseWheelListener listener) : void - Control
- setData(Object data) : void - Widget
- setData(String key, Object value) : void - Widget
- setDoubleClickEnabled(boolean doubleClickEnabled) : void - Text
- setDragDetect(boolean dragDetect) : void - Control
- setEchoChar(char echo) : void - Text
- setEditable(boolean editable) : void - Text
- setEnabled(boolean enabled) : void - Control
- setFocus() : boolean - Control
- setFont(Font font) : void - Control
- setBackgroundImage(Image image) : void - Control
- setBounds(Rectangle rect) : void - Control
- setBounds(int x, int y, int width, int height) : void - Control
- setCapture(boolean capture) : void - Control
- setCursor(Cursor cursor) : void - Control
- setData(Object data) : void - Widget
- setData(String key, Object value) : void - Widget
- setDoubleClickEnabled(boolean doubleClickEnabled) : void - Text
- setDragDetect(boolean dragDetect) : void - Control
- setEchoChar(char echo) : void - Text
- setEditable(boolean editable) : void - Text
- setEnabled(boolean enabled) : void - Control
- setFocus() : boolean - Control
- setFont(Font font) : void - Control
- toControl(Point point) : Point - Control
- toControl(int x, int y) : Point - Control
- toDisplay(Point point) : Point - Control
- toDisplay(int x, int y) : Point - Control
- toString() : String - Widget
- traverse(int traversal) : boolean - Control
- traverse(int traversal, Event event) : boolean - Control
- traverse(int traversal, KeyEvent event) : boolean - Control
- update() : void - Control
- wait() : void - Object
- wait(long timeout) : void - Object
- wait(long timeout, int nanos) : void - Object
- DELIMITER : String - Text
- LIMIT : int - Text


All 164 Methods of Text ?

JButton? 381 Methods.

Code Completion...

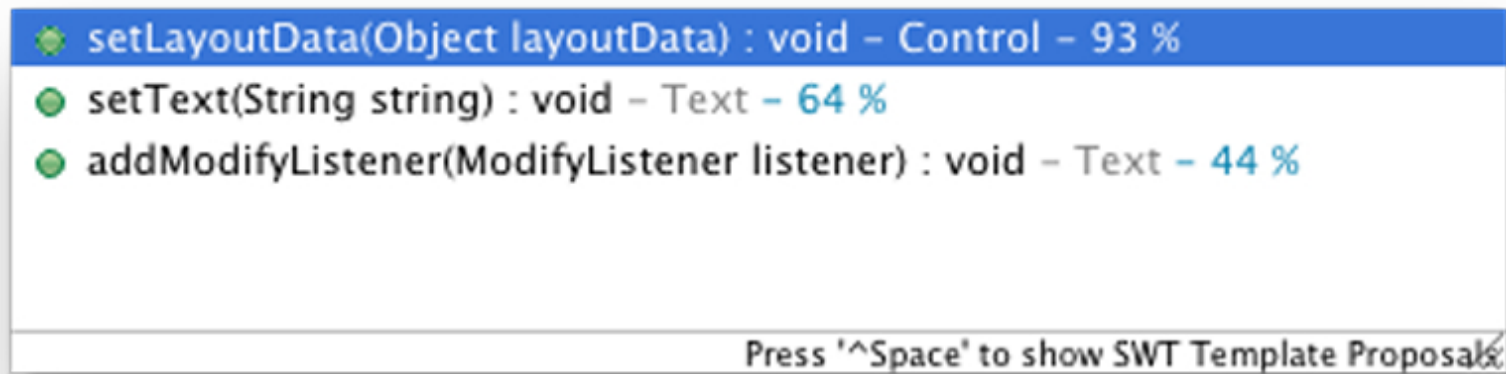
```
@Override
protected Control createDialogArea(final Composite parent) {
    final Composite container = (Composite) super.createDialogArea(parent);

   .swtTextWidget = new Text(container, SWT.BORDER);
   .swtTextWidget.|
    return container;
}
```



What does the developer need, i.e., which methods should the code completion present to the user?

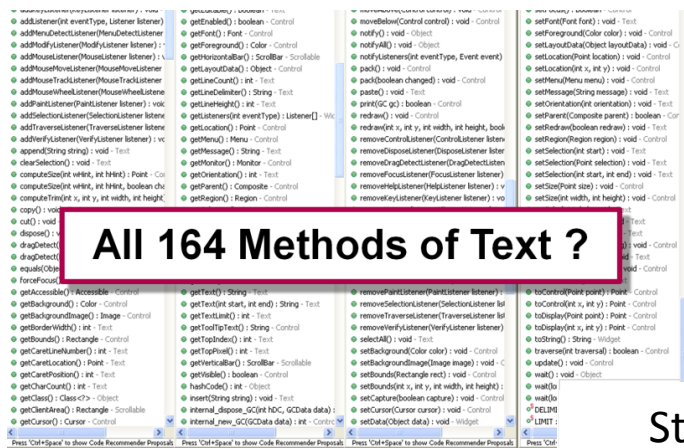
Intelligent Code Completion



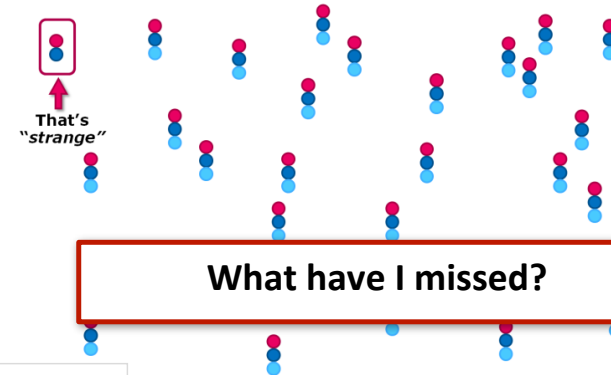
... or just the three missing ones?

Tools Outline

Intelligent Code Completion

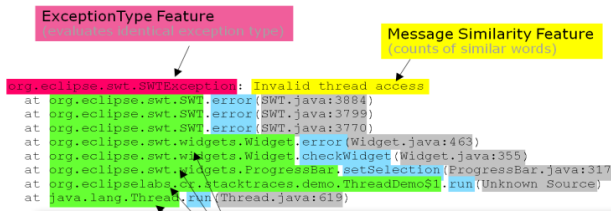


Smart Bug Detection

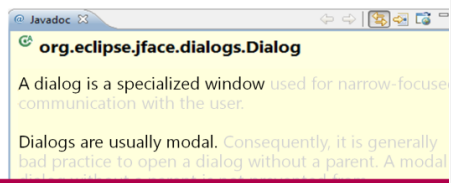


What have I missed?

Stacktrace Search Engine



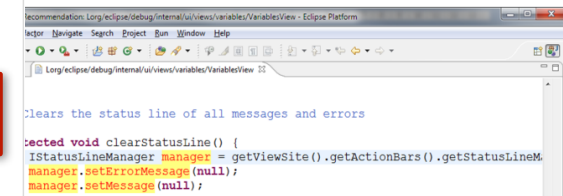
Extended Documentation



But what are the hot-spots of Dialog?

the first dialog potentially blocking the UI

Code Example Recommender



How do I get an instance of...?

“Developers who ~~bought~~ overwrote this method typically also overwrote...”

USAGE-DRIVEN JAVADOC



01010011 01101111 01000011

In ~~good~~ documentation we trust...

```
/**
 * Rollsback the transaction if any and clears different lists to
 * start with an empty resource again.
 * Note that the super.doUnload is not called because that clears
 * the list resulting in all kinds of undesirable inverseremoves.
 */
@Override
protected void doUnload() {
    ...
}
```

No? Are you sure?

Generating high-quality API documentation

```
/**
 * The number of questions.
 */
private int numberOfQuestions;

/**
 * Sets the number of questions.
 *
 * @param numberOfQuestions the number of questions
 * @throws IllegalArgumentException the illegal argument exception
 */
public void setNumberOfQuestions(int numberOfQuestions)
    throws IllegalArgumentException {
    if (numberOfQuestions < 0) {
        throw new IllegalArgumentException("numberOfQuestions < 0");
    }
    this.numberOfQuestions = numberOfQuestions;
}
```

Generating ~~high-quality~~ API documentation

```
/**
 * The number of questions.
 */
private int numberOfQuestions;

/**
 * Sets the number of questions.
 *
 * @param numberOfQuestions the number of questions
 * @throws IllegalArgumentException the illegal argument exception
 */
public void setNumberOfQuestions(int numberOfQuestions)
    throws IllegalArgumentException {
    if (numberOfQuestions < 0) {
        throw new IllegalArgumentException("numberOfQuestions < 0");
    }
    this.numberOfQuestions = numberOfQuestions;
}
```


What people say about JAutodoc...

| | | |
|----------------------------|-----------|---------------------|
| User:Anonymous | Rating: 9 | 2009-08-02 11:32:37 |
| Wow exactly what I needed! | | |

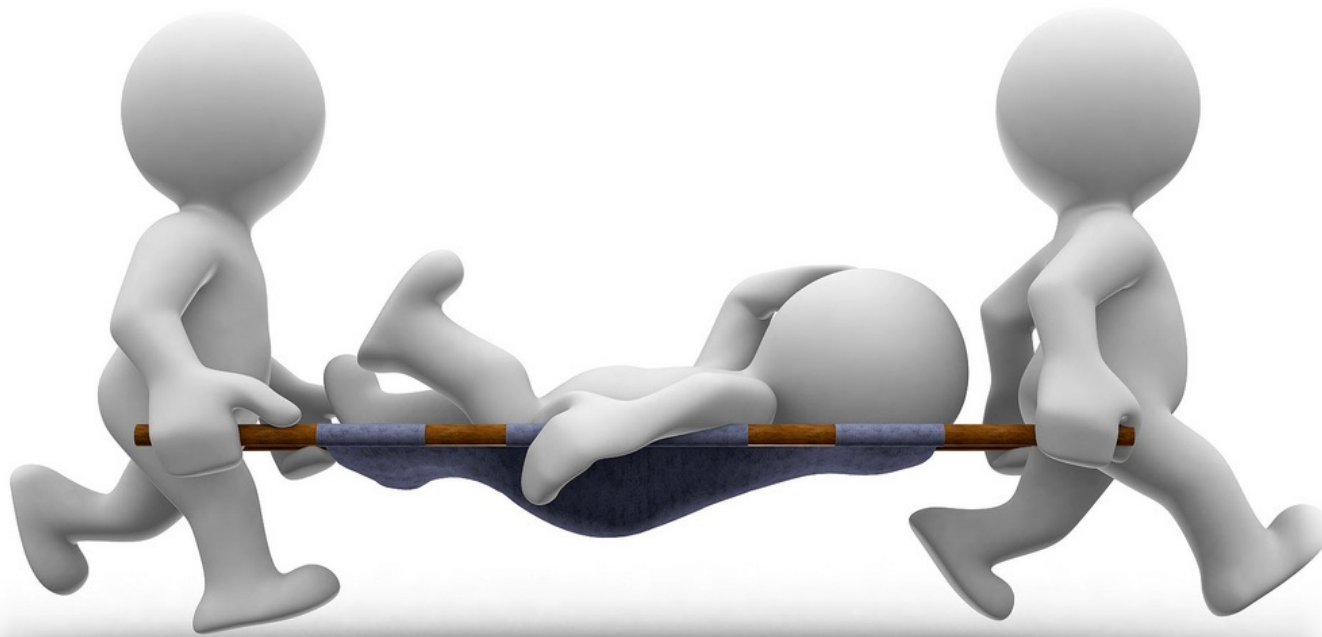
| | | |
|---------------------------------|-----------|---------------------|
| User:Anonymous | Rating: 9 | 2009-02-13 19:58:32 |
| Thank you... this plugin rocks! | | |

| | | |
|-------------------------------------------|-----------|---------------------|
| User:Anonymous | Rating: 9 | 2009-02-13 19:58:32 |
| Works perfectly. Smarter than I expected! | | |



WTH? What did you expect?!

How Recommenders is coming to rescue...



“Templates meet Social - reloaded!”

SNIPMATCH

Eclipse Java Editor Templates

| | | | |
|--------------------------------------------------|-----------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------|
| <input checked="" type="checkbox"/> @author | Javadoc | author name | |
| <input checked="" type="checkbox"/> | Javadoc | | |
| <input checked="" type="checkbox"/> <code> | Javadoc | <code></code> | |
| <input checked="" type="checkbox"/> <i> | Javadoc | <i></i> | |
| <input checked="" type="checkbox"/> <pre> | | | |
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| <input checked="" type="checkbox"/> arrayadd | <input checked="" type="checkbox"/> Image | SWT statements | new Image |
| <input checked="" type="checkbox"/> arraymerge | <input checked="" type="checkbox"/> instanceof | Java statements | dynamic type test and cast |
| <input checked="" type="checkbox"/> Browser | <input checked="" type="checkbox"/> Label | SWT statements | new Label |
| <input checked="" type="checkbox"/> Button | <input checked="" type="checkbox"/> lazy | | |
| <input checked="" type="checkbox"/> cast | <input checked="" type="checkbox"/> Link | <input checked="" type="checkbox"/> Scale | SWT statements new Scale |
| <input checked="" type="checkbox"/> catch | <input checked="" type="checkbox"/> List | <input checked="" type="checkbox"/> ScrolledComposite | SWT statements new ScrolledComposite |
| <input checked="" type="checkbox"/> Combo | <input checked="" type="checkbox"/> main | <input checked="" type="checkbox"/> Shell | SWT statements new Shell |
| <input checked="" type="checkbox"/> Composite | <input checked="" type="checkbox"/> mainloop | <input checked="" type="checkbox"/> Spinner | SWT statements new Spinner |
| <input checked="" type="checkbox"/> DateTime | <input checked="" type="checkbox"/> new | <input checked="" type="checkbox"/> static_final | Java type members static final field |
| <input checked="" type="checkbox"/> do | <input checked="" type="checkbox"/> nls | <input checked="" type="checkbox"/> StyledText | SWT statements new StyledText |
| <input checked="" type="checkbox"/> else | <input checked="" type="checkbox"/> null | <input checked="" type="checkbox"/> StyleRange | SWT statements new StyleRange for a StyledText |
| <input checked="" type="checkbox"/> elseif | <input checked="" type="checkbox"/> private_method | <input checked="" type="checkbox"/> switch | Java statements switch case statement |
| <input checked="" type="checkbox"/> execute | <input checked="" type="checkbox"/> private_static_method | <input checked="" type="checkbox"/> synchronized | Java statements synchronized block |
| <input checked="" type="checkbox"/> ExpandBar | <input checked="" type="checkbox"/> protected_method | <input checked="" type="checkbox"/> syserr | Java statements print to standard error |
| <input checked="" type="checkbox"/> ExpandItem | <input checked="" type="checkbox"/> public_method | <input checked="" type="checkbox"/> sysout | Java statements print to standard out |
| <input checked="" type="checkbox"/> fall-through | <input checked="" type="checkbox"/> runnable | <input checked="" type="checkbox"/> systrace | Java statements print current method to standard out |
| <input checked="" type="checkbox"/> false | <input checked="" type="checkbox"/> SashForm | <input checked="" type="checkbox"/> TabFolder | SWT statements new TabFolder |

42x Java Templates.
35x SWT Templates.
7 Years.

| | | |
|-------------------------------------------|-----------------|---------------------------|
| <input checked="" type="checkbox"/> while | Java statements | iterate with enumeration |
| <input checked="" type="checkbox"/> while | Java statements | iterate with iterator |
| <input checked="" type="checkbox"/> while | Java statements | while loop with condition |

The rise of code snippet repositories

SNIPPLR CODE 2.0

all code snippets

github:gist

 **Kodejava**

JExamples

Java Examples in Open Source Code 

We analyze the source code of production Java open source projects such as Ant, Tomcat and Spring and load that analysis into a java examples database designed for easy searching. You enter the name of a Java API Class you want to see example invocations of and

and many more...

Searching snippets in your IDE...

```
import java.io.File;

public class Test {

    public static void main(String[] args) {

        String settingsPath = "settings.txt";

        File file = new File(settingsPath);
    }
}
```

read file sett|

read fileObject from **settingsPath**

read list of files in folder **settingsPath**

read file **<fileObject>** into a string

read fileObject from **<filePathString>**

read lines in **<fileObject>** into an array

read list of files in folder **<pathString>**



“Why is Google Codesearch not ‘google for code search’?”

CODE-SEARCH ENGINES LIFT OFF

How many request per minutes do
code search engines have?



20

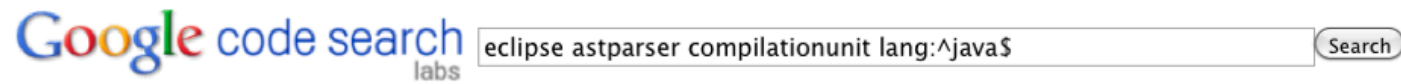
Number for koders.com in 2009 according to “Analyzing and mining a code search engine usage log”
<http://dx.doi.org/10.1007/s10664-010-9144-6> 23

Navigating the API jungle...

```
private CompilationUnit createCompilationUnit(String source) {  
  
    // how can I create and configure an ASTParser?  
    ASTParser parser = null;  
    parser.setSource(source.toCharArray());  
  
    // ASTParser --> CompilationUnit: how?  
    CompilationUnit cu = null;  
    return cu;  
}
```

**How to solve
String -> ASTParser -> CompilationUnit?**

When asking Google code search...



Results 1 - 10 of 515 (0.912 seconds)

Why?



eclipse astparser compilationunit lang:java\$

Search

Results 1 - 10 of 515 (0.912 seconds)

[JML3/.../jml3-syntax_highlighting/JML3Core/src/org/jmlspecs/eclipse/jml/dom/CompilationUnit.java](#) [Show 12 matches](#) [Show duplicates](#)

```
127: /**
128:  * The Java element (an org.eclipse.jdt.core.ICompilationUnit or an org.eclipse.jdt.core.ICompilationUnit2)
129:  * this compilation unit was created from, or null
130:  */
131:
132: * <p>
133: * Each call to {@link ASTParser#createAST(org.eclipse.core.runtime.IProgressMonitor, org.eclipse.jdt.core.IJavaProject,
134: * gives rise to separate universe of binding objects. This method
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470: *
471: *
472: *
473: *
474: *
475: *
476: *
477: *
478: *
479: *
480: *
481: *
482: *
483: *
484: *
485: *
486: *
487: *
488: *
489: /**
490:  * The Java element (an org.eclipse.jdt.core.ICompilationUnit or an org.eclipse.jdt.core.ICompilationUnit2)
491:  * this compilation unit was created from, or null
```

Text-based retrieval!

Inexpressive query language!

Ignores prior knowledge!

[trunk/CrystalPlugin/test/edu/cmu/cs/crystal/cfg/eclipse/CFGTestUtils.java](#)

```
33: import org.eclipse.core.resources.ResourcesPlugin;
34: import org.eclipse.core.runtime.CoreException;
35: import org.eclipse.jdt.core.ICompilationUnit;
36: import org.eclipse.jdt.core.IJavaProject;
37: import org.eclipse.jdt.core.JavaCore;
38: import org.eclipse.jdt.core.dom.AST;
39: import org.eclipse.jdt.core.dom.ASTParser;
40: import org.eclipse.jdt.core.dom.CompilationUnit;
41: import org.eclipse.jdt.core.dom.MethodDeclaration;
```

<http://crystalsaf.googlecode.com/svn> - LGPL - Java

[sdk/.../android/ide/eclipse/adt/internal/refactorings/extractstring/ExtractStringRefactoring.java](#) [Show 20 matches](#)

```
7: *
8: *      http://www.eclipse.org/org/documents/epl-v10.php
9: *
17: package com.android.ide.eclipse.adt.internal.refactorings.extractstring;
21: import com.android.ide.eclipse.adt.AdtConstants;
22: import com.android.ide.eclipse.adt.internal.editors.AndroidXmlEditor;
```


Example code search engine

```
public class MyJavaEditor extends EditorPart {  
    private CompilationUnit createCompilationUnit(String source) {  
        // how can I create and configure an ASTParser?  
        ASTParser parser = null;  
        parser.setSource(source.toCharArray());  
  
        // ASTParser --> CompilationUnit: how?  
        CompilationUnit cu = null;  
        return cu;  
    }  
}
```

Query

Search methods similar to 'createCompliationUnit(String)'

Press '^Space' to show Chained Java Code Proposals

Sample search query

Extracted from MyJavaEditor.createCompilationUnit():

--- data ---

```
extends: org.eclipse.ui.EditorPart
uses:    org.eclipse.jdt.core.CompilationUnit
uses:    org.eclipse.jdt.core.ASTParser
calls:   org.eclipse.jdt.core.ASTParser.setSource(char[])
```

--- requested ---

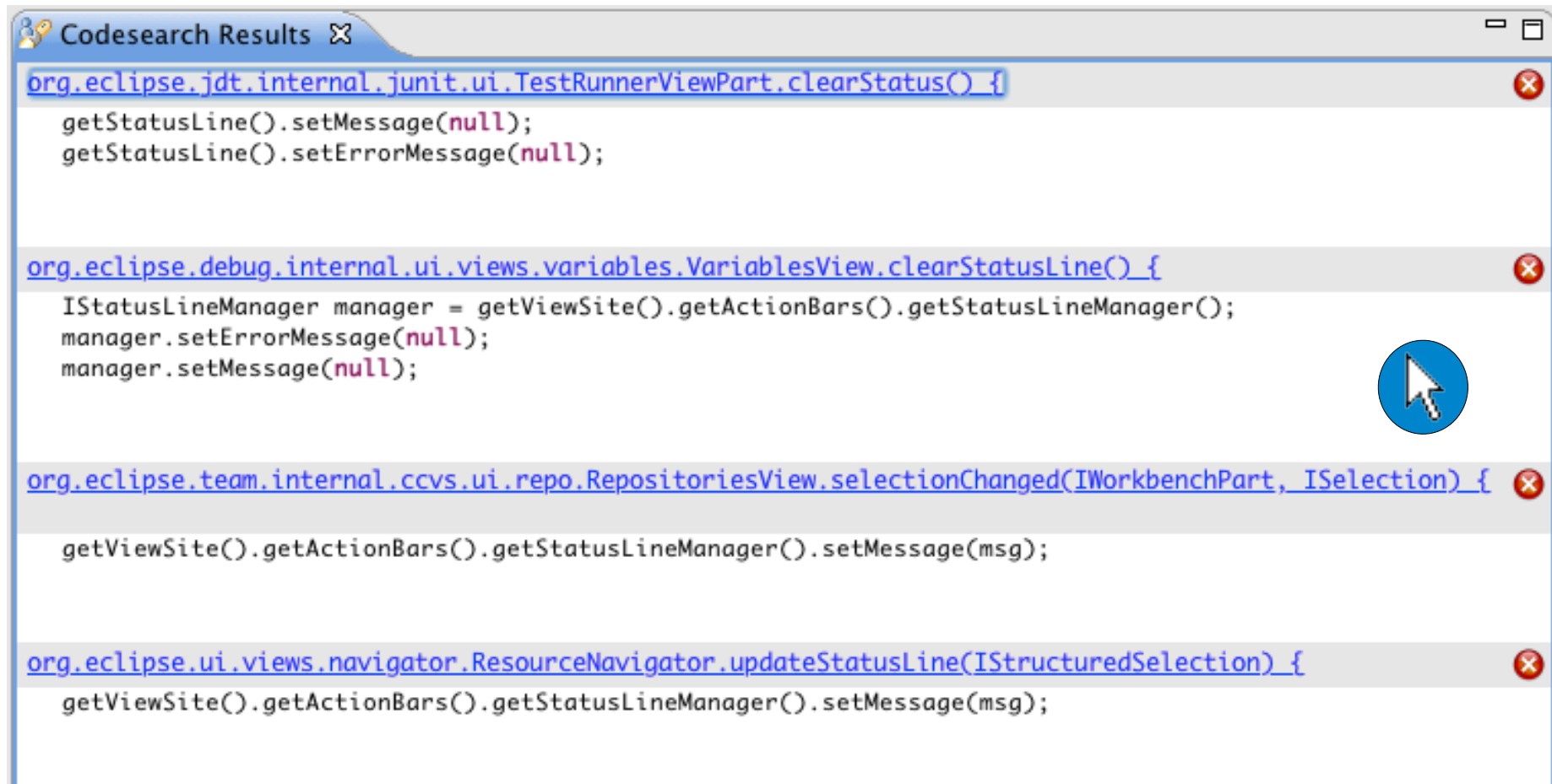
```
def:      org.eclipse.jdt.core.CompilationUnit (def=null)
def:      org.eclipse.jdt.core.ASTParser       (def=null)
```

In development...

“Why is Google Codesearch not ‘google for code search’?”

LEVERAGING USER FEEDBACK TO IMPROVE CODE SEARCH ENGINES

Leveraging user feedback

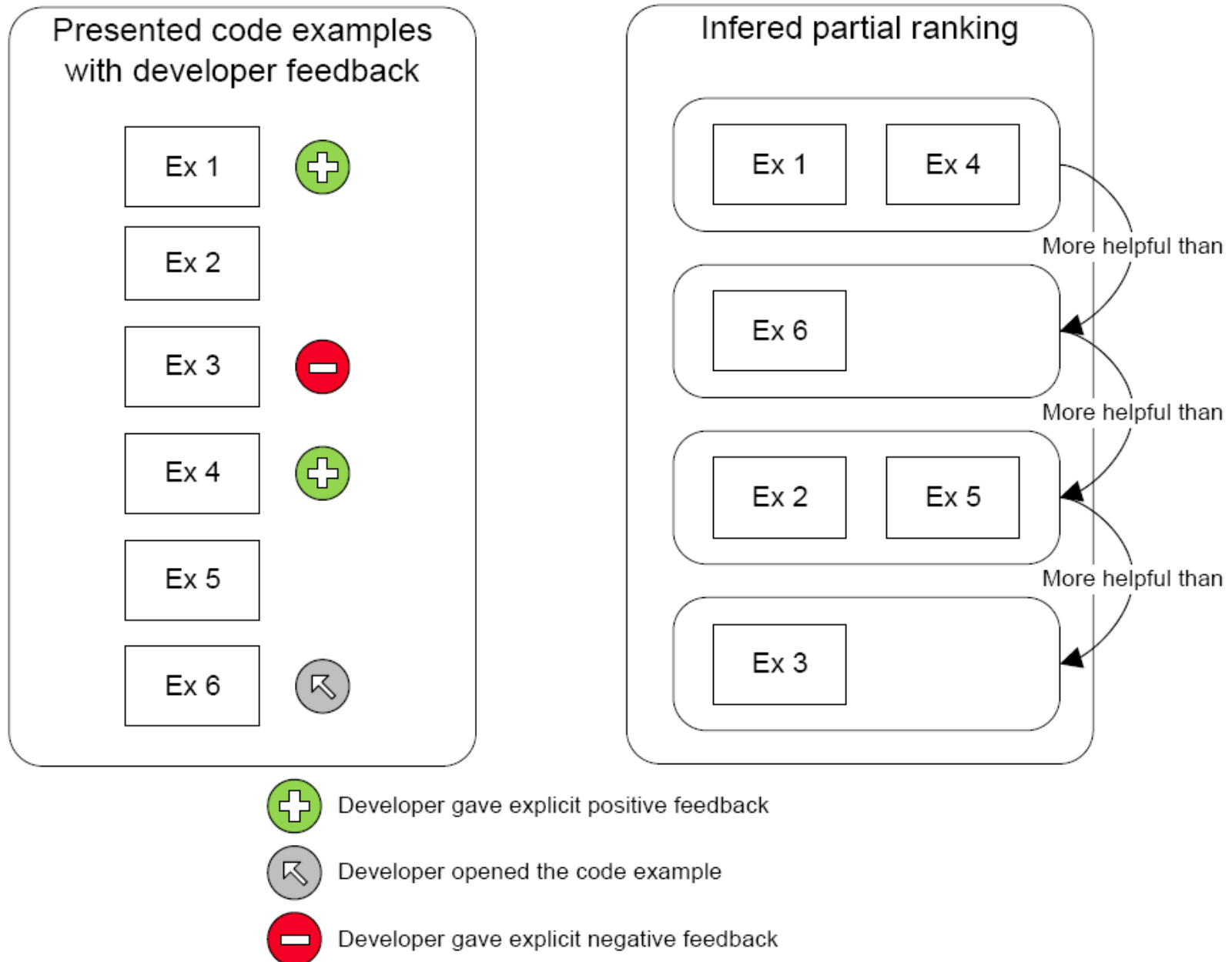


The screenshot shows the Eclipse IDE's Code Search Results window. The window title is "Code Search Results" with a search icon. It displays four search results, each with a red 'X' icon in the top right corner. The results are:

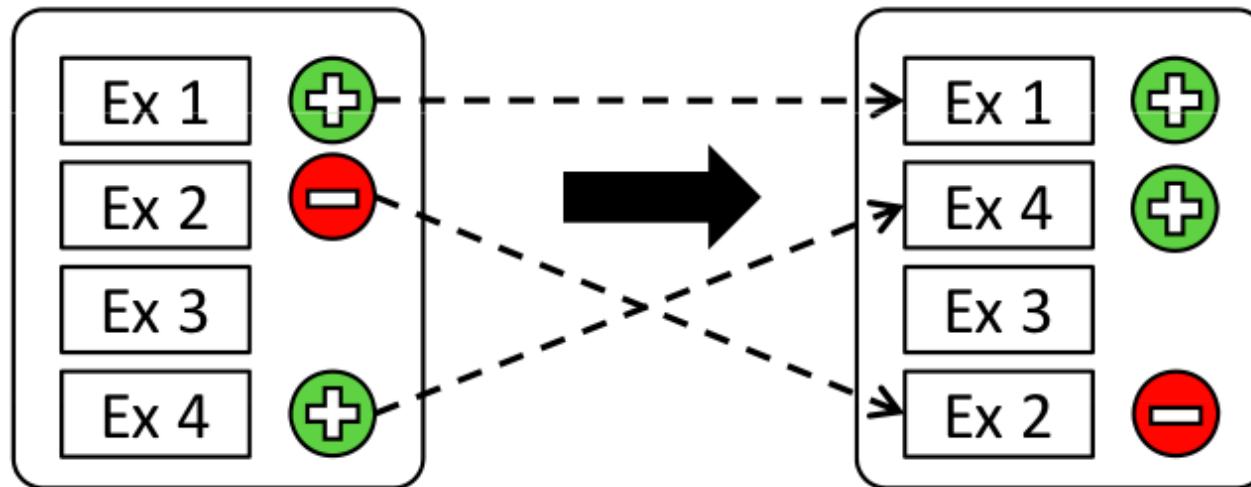
- `org.eclipse.jdt.internal.junit.ui.TestRunnerViewPart.clearStatus() {`
`getStatusLine().setMessage(null);`
`getStatusLine().setErrorMessage(null);`
- `org.eclipse.debug.internal.ui.views.variables.VariablesView.clearStatusLine() {`
`IStatusLineManager manager = getViewSite().getActionBars().getStatusLineManager();`
`manager.setErrorMessage(null);`
`manager.setMessage(null);`
- `org.eclipse.team.internal.ccvs.ui.repo.RepositoriesView.selectionChanged(IWorkbenchPart, ISelection) {`
`getViewSite().getActionBars().getStatusLineManager().setMessage(msg);`
- `org.eclipse.ui.views.navigator.ResourceNavigator.updateStatusLine(IStructuredSelection) {`
`getViewSite().getActionBars().getStatusLineManager().setMessage(msg);`

A mouse cursor icon is visible over the second result.

Refine the ranking based on feedback



Learning how to rank



Ranking the examples

$$\text{score}(d, q) = \sum_{i=0}^n w_i \cdot f_i(d, q)$$


document → query → score(*d*, *q*)

weight (-∞..+∞) → *w_i*

feature-score *i* [0..1] → *f_i*(*d*, *q*)

Updating the feature weights...


| feature | weight | Ex 1 | Ex 2 | Ex 3 | Ex 4 |
|---------|--------|------|------|------|------|
| f_1 | 1.0 | 1.0 | 0.2 | 0.5 | 0.8 |
| f_2 | 0.5 | 0.4 | 0.0 | 0.8 | 0.0 |
| f_3 | 1.0 | 0.2 | 1.0 | 0.1 | 0.1 |
| score | — | 1.4 | 1.2 | 1.0 | 0.9 |



(a) before optimization

10.000 *

| feature | weight | Ex 1 | Ex 2 | Ex 3 | Ex 4 |
|---------|--------|------|------|------|------|
| f_1 | 2.0 | 1.0 | 0.2 | 0.5 | 0.8 |
| f_2 | 0.5 | 0.4 | 0.0 | 0.8 | 0.0 |
| f_3 | -1.0 | 0.2 | 1.0 | 0.1 | 0.1 |
| score | — | 2.0 | -0.6 | 1.3 | 1.5 |

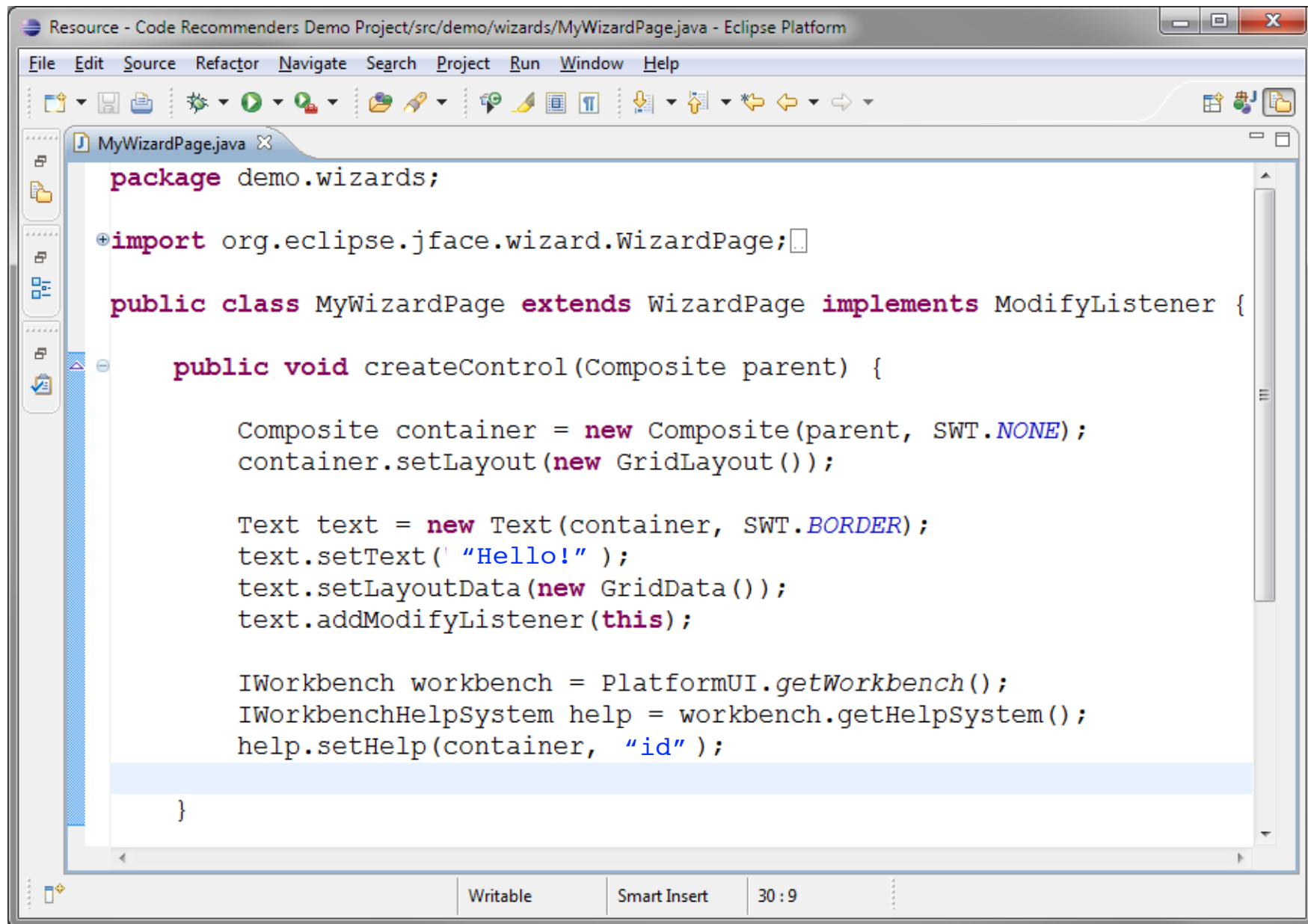


(b) after optimization

“The good ones in the crock, the bad ones in... the problem view.”

SMART BUG DETECTION – DRIVEN BY REAL USAGES

What's wrong with this code?



```
Resource - Code Recommenders Demo Project/src/demo/wizards/MyWizardPage.java - Eclipse Platform
File Edit Source Refactor Navigate Search Project Run Window Help
MyWizardPage.java
package demo.wizards;

import org.eclipse.jface.wizard.WizardPage;

public class MyWizardPage extends WizardPage implements ModifyListener {

    public void createControl(Composite parent) {

        Composite container = new Composite(parent, SWT.NONE);
        container.setLayout(new GridLayout());

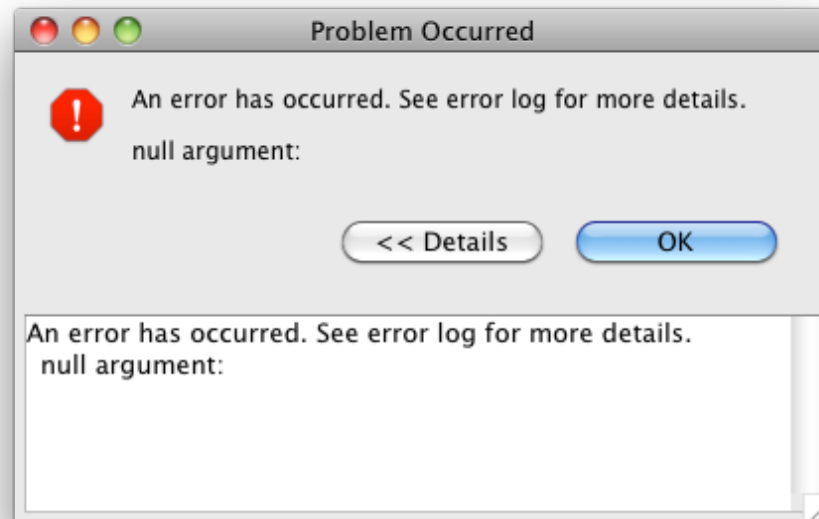
        Text text = new Text(container, SWT.BORDER);
        text.setText("Hello!");
        text.setLayoutData(new GridData());
        text.addModifyListener(this);

        IWorkbench workbench = PlatformUI.getWorkbench();
        IWorkbenchHelpSystem help = workbench.getHelpSystem();
        help.setHelp(container, "id");

    }
}
```

Writable Smart Insert 30:9

At runtime you get...



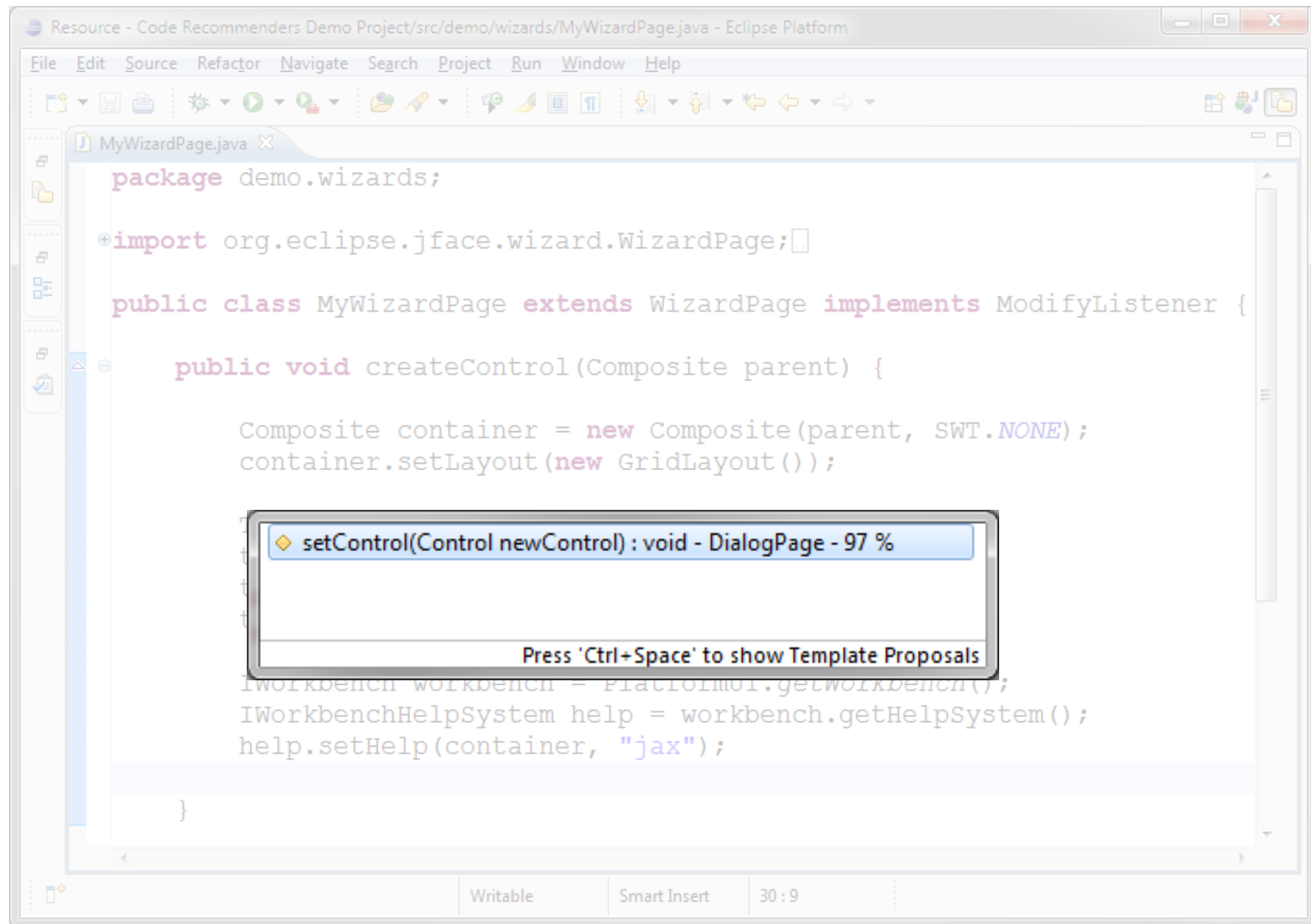
...and a lengthy stacktrace

```
org.eclipse.core.runtime.AssertionFailedException: null argument:  
  at org.eclipse.core.runtime.Assert.isNotNull(Assert.java:85)  
  at org.eclipse.core.runtime.Assert.isNotNull(Assert.java:73)  
  at org.eclipse.jface.wizard.Wizard.createPageControls(Wizard.java:174)  
  at org.eclipse.jface.wizard.WizardDialog.createPageControls(WizardDialog.java:734)  
  at org.eclipse.jface.wizard.WizardDialog.setWizard(WizardDialog.java:1162)  
  at org.eclipse.jface.wizard.WizardDialog.updateForPage(WizardDialog.java:1221)  
  at org.eclipse.jface.wizard.WizardDialog.access$4(WizardDialog.java:1218)  
  at org.eclipse.jface.wizard.WizardDialog$6.run(WizardDialog.java:1207)  
  at org.eclipse.swt.custom.BusyIndicator.showWhile(BusyIndicator.java:70)  
  at org.eclipse.jface.wizard.WizardDialog.showPage(WizardDialog.java:1205)  
  at org.eclipse.ui.internal.dialogs.ImportExportPage.treeDoubleClicked(ImportExportPage.java)  
  at org.eclipse.ui.internal.dialogs.ImportPage$2.doubleClick(ImportPage.java:72)  
  at org.eclipse.jface.viewers.StructuredViewer$1.run(StructuredViewer.java:824)  
  at org.eclipse.core.runtime.SafeRunner.run(SafeRunner.java:42)  
  at org.eclipse.ui.internal.JFaceUtil$1.run(JFaceUtil.java:49)  
  at org.eclipse.jface.util.SafeRunnable.run(SafeRunnable.java:175)  
  at org.eclipse.jface.viewers.StructuredViewer.fireDoubleClick(StructuredViewer.java:822)  
  at org.eclipse.jface.viewers.AbstractTreeViewer.handleDoubleSelect(AbstractTreeViewer.java)  
  at org.eclipse.jface.viewers.StructuredViewer$4.widgetDefaultSelected(StructuredViewer.java)
```

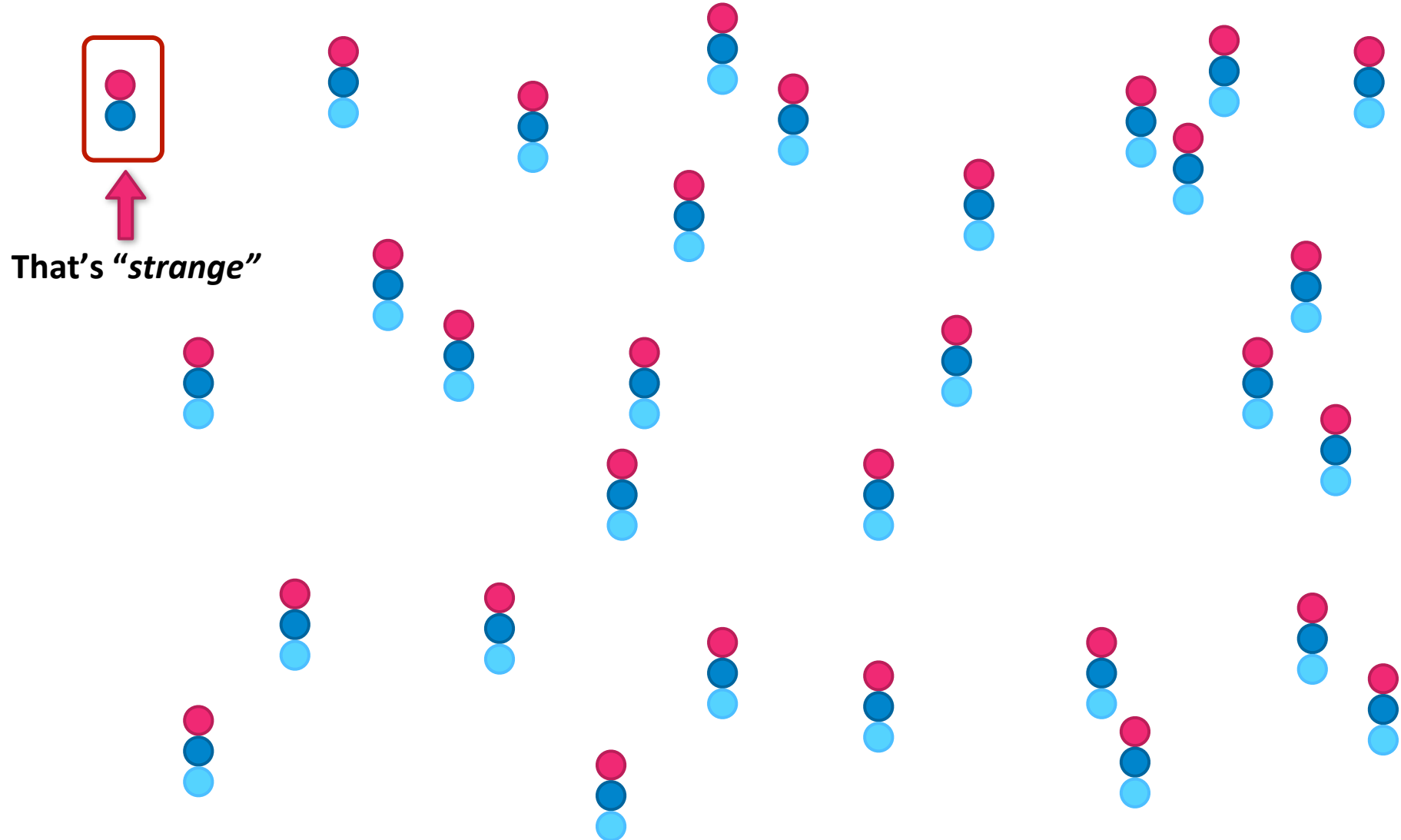


So what have we missed?

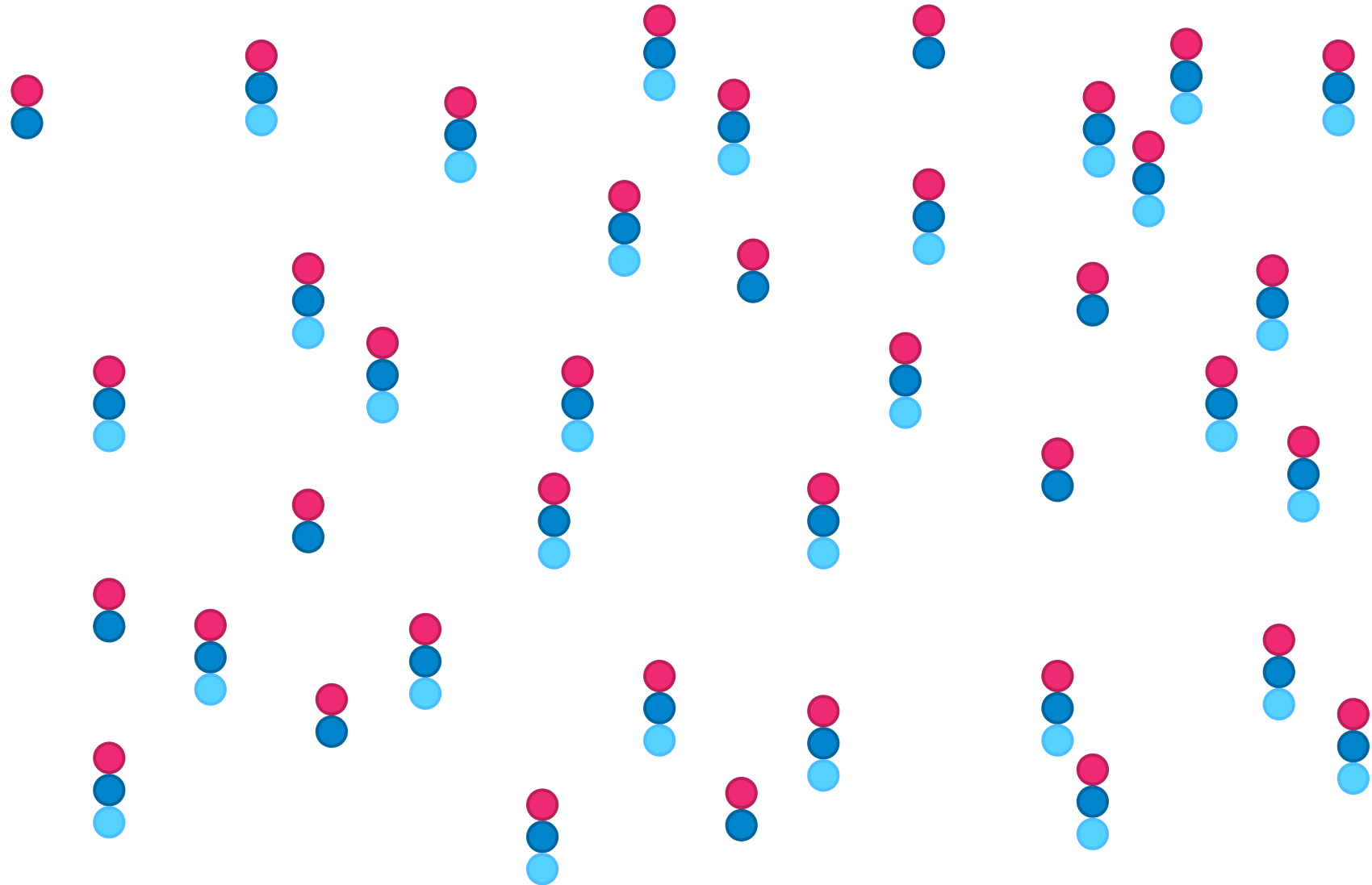
If all of your colleagues do it – why don't you?



How to detect such wrong uses?

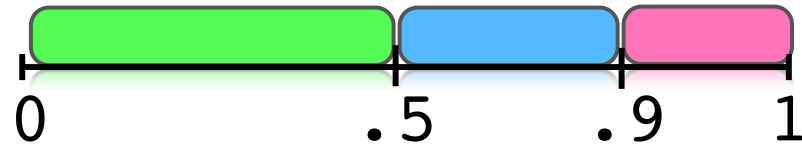


How to detect such wrong uses?



Just one formula...

$$\textit{strangeness}(x) = 1 - \frac{|E(x)|}{|E(x)| + |A(x)|}$$



x = {observed method calls on a variable}

E(x) = {*exact* similar usages for variables of type x in the code base}

A(x) = {*almost* similar usages, i.e., x+1 method call}

Missing Calls Detector in Eclipse



```
*MyWizardPage.java ✕  
package org.eclipse.recommenders.examples.demo;  
  
import org.eclipse.jface.wizard.WizardPage;  
  
public class MyWizardPage extends WizardPage {  
  
    private Text text;  
  
    @Override  
    public void createControl(final Composite parent) {  
  
    }  
}
```

Usage of 'this' is fishy [95%]. Is 'this.setControl(Control)' missing?

Applied on Eclipse 3.5...

  **BUGS**[CONTACT](#) | [LEGAL](#)
  

Bugzilla - Bug List

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| [Help](#) | [Log out](#) bruch@st.informatik.tu-darmstadt.de | [Terms of Use](#) | [Copyright Agent](#)

Mon Aug 15 2011 12:43:31 EDT

Reporter: monperrus

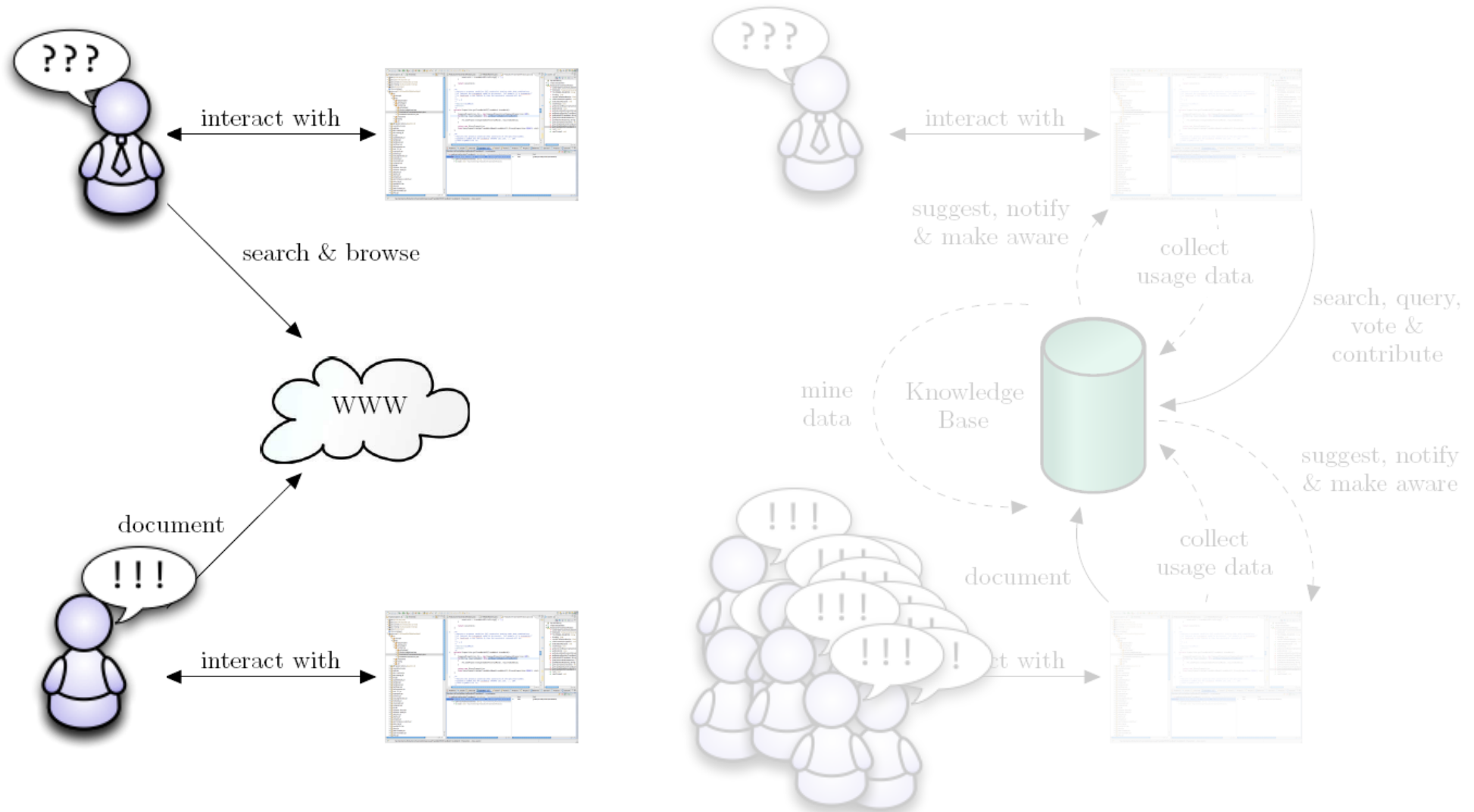
18 bugs found.

| ID ▼ | Sev | Pri | Status | Resolution | Summary |
|------------------------|---------------------|---------------------|------------------------|----------------------------|------------------------------------------------------------------------------------------------------------|
| 326504 | min | P3 | RESO | FIXE | [patch] useless composite in NewNodeDialog.createDialogArea |
| 296784 | nor | P3 | RESO | FIXE | [patch] Layout of RefactoringStatusDialog not standard |
| 296782 | enh | P3 | RESO | FIXE | CreateProfileDialog.createDialogArea should extend the super implementation of Dialog.createDialogArea |
| 296781 | min | P3 | RESO | FIXE | AlreadyExistsDialog.initializeComposite clones Dialog.createDialogArea |
| 296581 | min | P3 | VERI | FIXE | NameValuePairDialog.createDialogArea should use super.createDialogArea |
| 296552 | min | P3 | VERI | FIXE | ExpressionInputDialog.dispose is called twice |
| 296483 | min | P3 | VERI | FIXE | GoToAddressDialog should not modify parent composite layout |
| 296481 | min | P3 | VERI | FIXE | AddSourceContainerDialog.createDialogArea should use super.createDialogArea |
| 297840 | min | P3 | NEW | --- | Strange Code in ExpressionInputDialog.dispose |
| 296578 | min | P3 | NEW | --- | [About] the computation of topContainerHeightHint could reuse existing code (AboutDialog.createDialogArea) |
| 296568 | min | P3 | NEW | --- | [ui] TrustCertificateDialog.createDialogArea: why setting the layout of a Tree? |

“IDE 2.0? Leveraging the wisdom of the (Eclipse) community...”

ECLIPSE CODE RECOMMENDERS

From IDE 1.0 to IDE 2.0



Leveraging your IDE's build environment

The image shows the Eclipse IDE interface with several annotations:

- context**: Points to the package and import statements at the top of the `MyDialog.java` file.
- object usage**: Points to the `createDialogArea` method call in the code.
- project environment**: Points to the Package Explorer on the left side of the IDE.
- selected proposals**: Points to the list of code completion suggestions for the `return` statement.
- click feedback**: Points to the star rating in the ExtDoc window.
- Stacktraces**: Points to the console output showing an `InvalidThreadAccessException`.

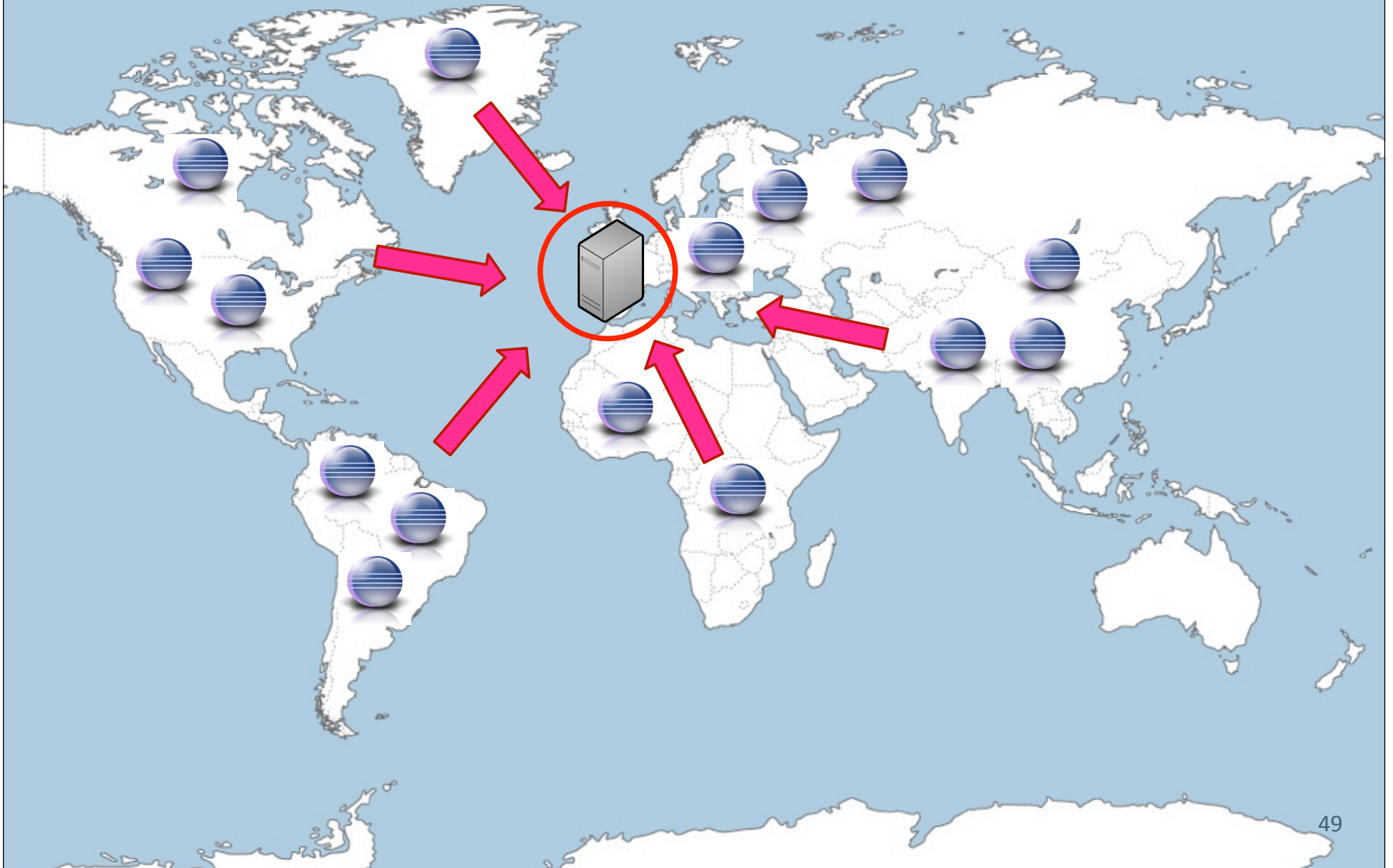
```
1 package org.eclipse.recommenders.examples.demo;
2
3 import org.eclipse.jface.dialogs.Dialog;
4
5
6
7
8
9
10 public class MyDialog extends Dialog {
11
12     private Text swtTextWidget;
13
14
15     @Override
16     protected Control createDialogArea(final Composite parent) {
17         final Composite container = createContainer(parent);
18         swtTextWidget = new Text(container, SWT.NONE);
19         swtTextWidget.setText(" ");
20         return container;
21     }
22
23
24 }
```

| Method | Call | Frequency |
|--------|------------------------------------------------------|-----------------|
| should | call <code>createDialogArea(Composite)</code> | 868 times - 80% |
| rarely | call <code>getShell()</code> | 207 times - 19% |
| rarely | call <code>convertWidthInCharsToPixels(int)</code> | 204 times - 19% |
| rarely | call <code>convertHorizontalDLUsToPixels(int)</code> | 163 times - 15% |
| rarely | call <code>convertHeightInCharsToPixels(int)</code> | 120 times - 11% |

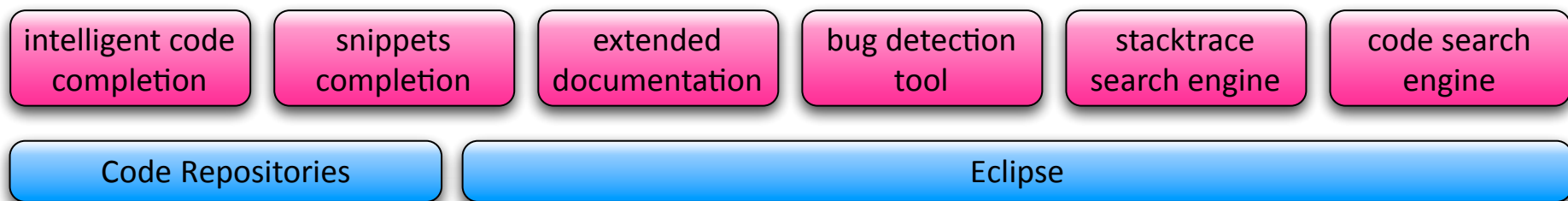
Console Output:

```
InvalidThreadAccessDemo [Java Application] /System/Library/Java/JavaVirtualMachines/1.6.0.jdk/Contents/Home/bin/java (Jul 25, 2011 10:34:25 PM)
Exception in thread "Thread-3" java.lang.RuntimeException: org.eclipse.swt.SWTException: Invalid thread access
    at org.eclipse.recommenders.examples.demo.stacktraces.InvalidThreadAccessDemo.run(InvalidThreadAccessDemo.java:680)
    at java.lang.Thread.run(Thread.java:680)
Caused by: org.eclipse.swt.SWTException: Invalid thread access
    at org.eclipse.swt.SWT.error(SWT.java:4083)
    at org.eclipse.swt.SWT.error(SWT.java:3998)
    at org.eclipse.swt.SWT.error(SWT.java:3969)
    at org.eclipse.swt.widgets.Widget.error(Widget.java:715)
    at org.eclipse.swt.widgets.Widget.checkWidget(Widget.java:532)
```

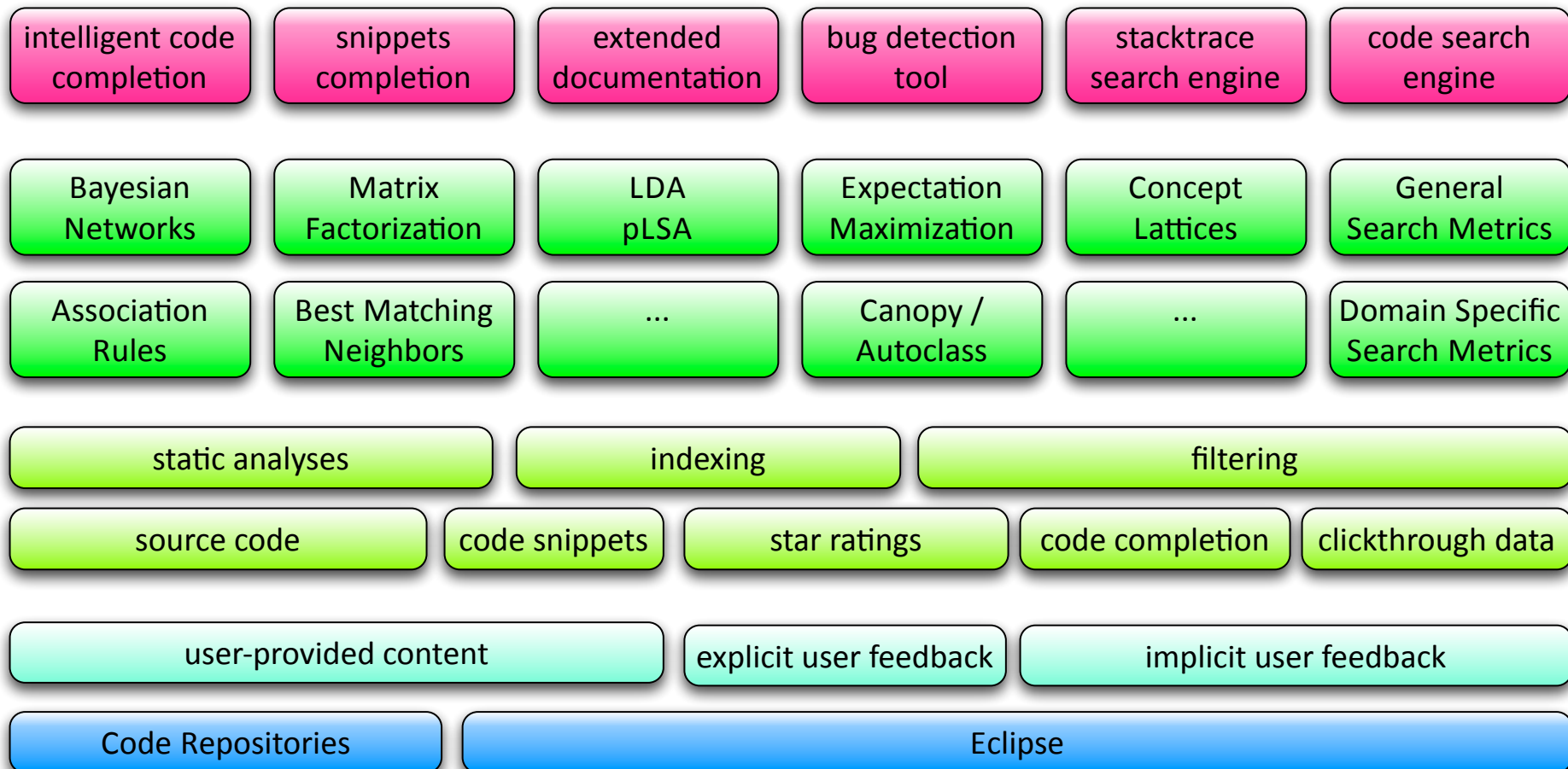

Crowd-sourcing...



Eclipse Code Recommenders Technology Stack



Eclipse Code Recommenders Technology Stack

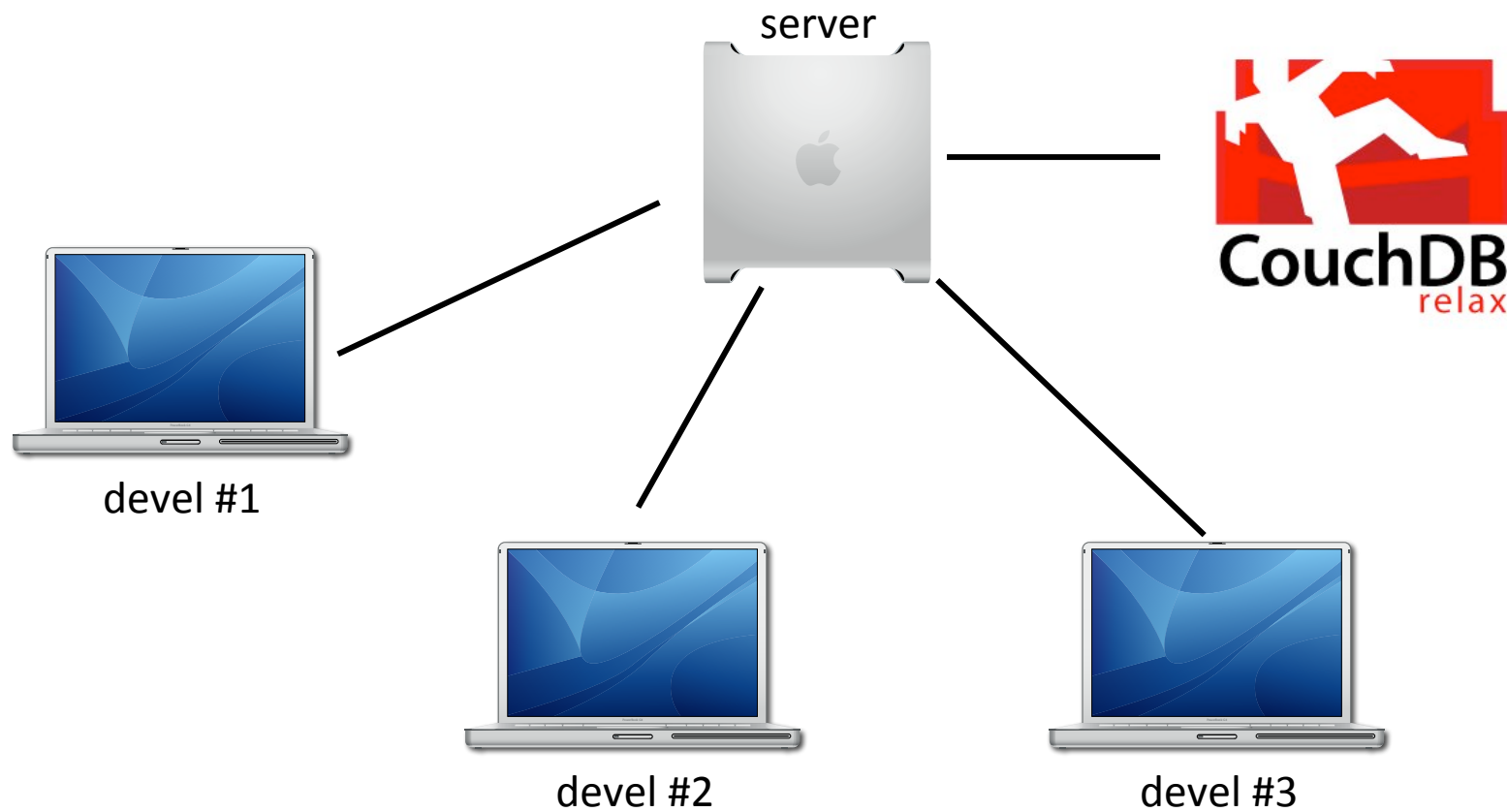


“Support your own framework. Live walk-through...”

TEAM SERVER FOR ANDROID

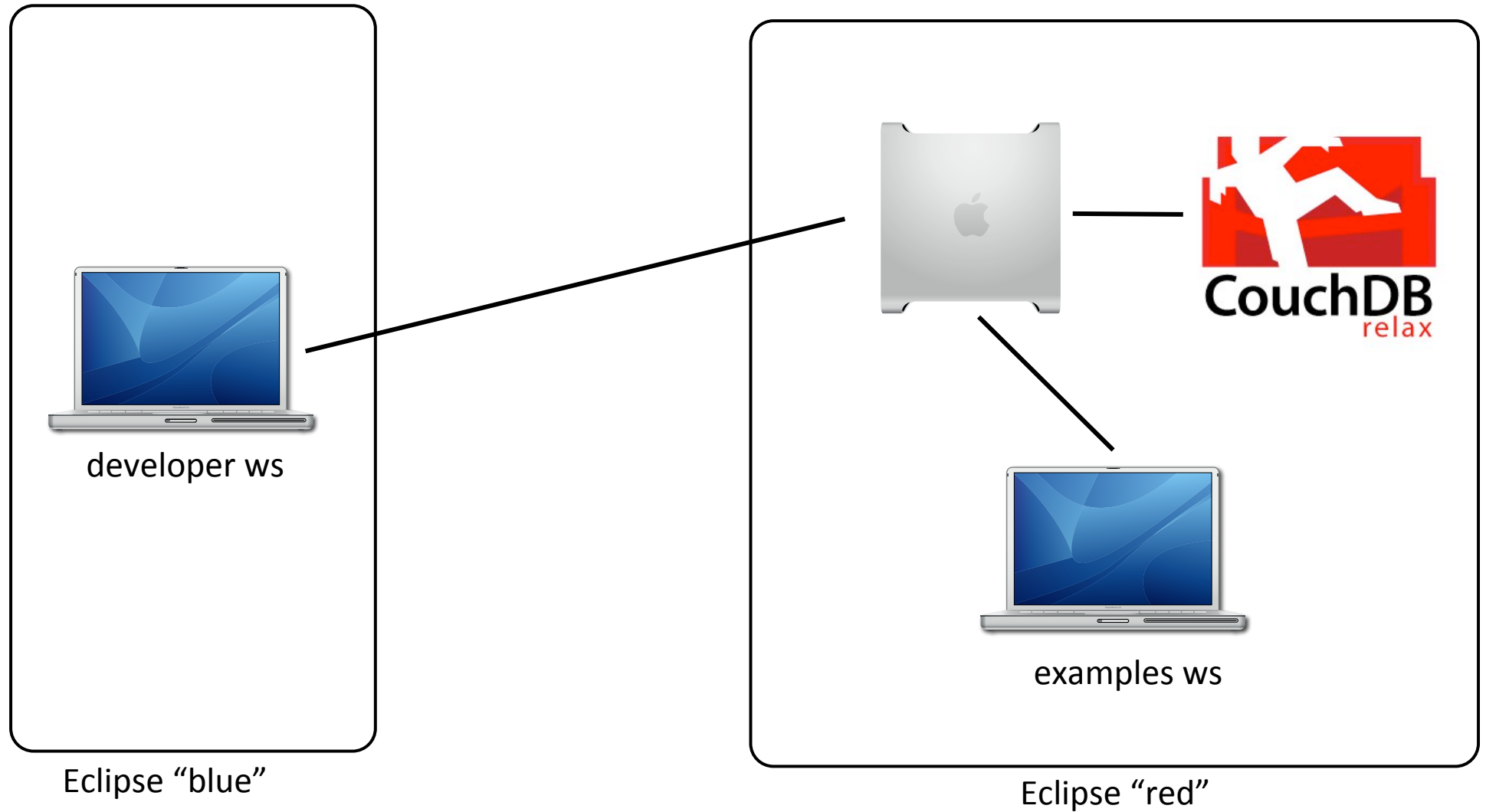


Code Recommenders team server



In development...

Demo setup

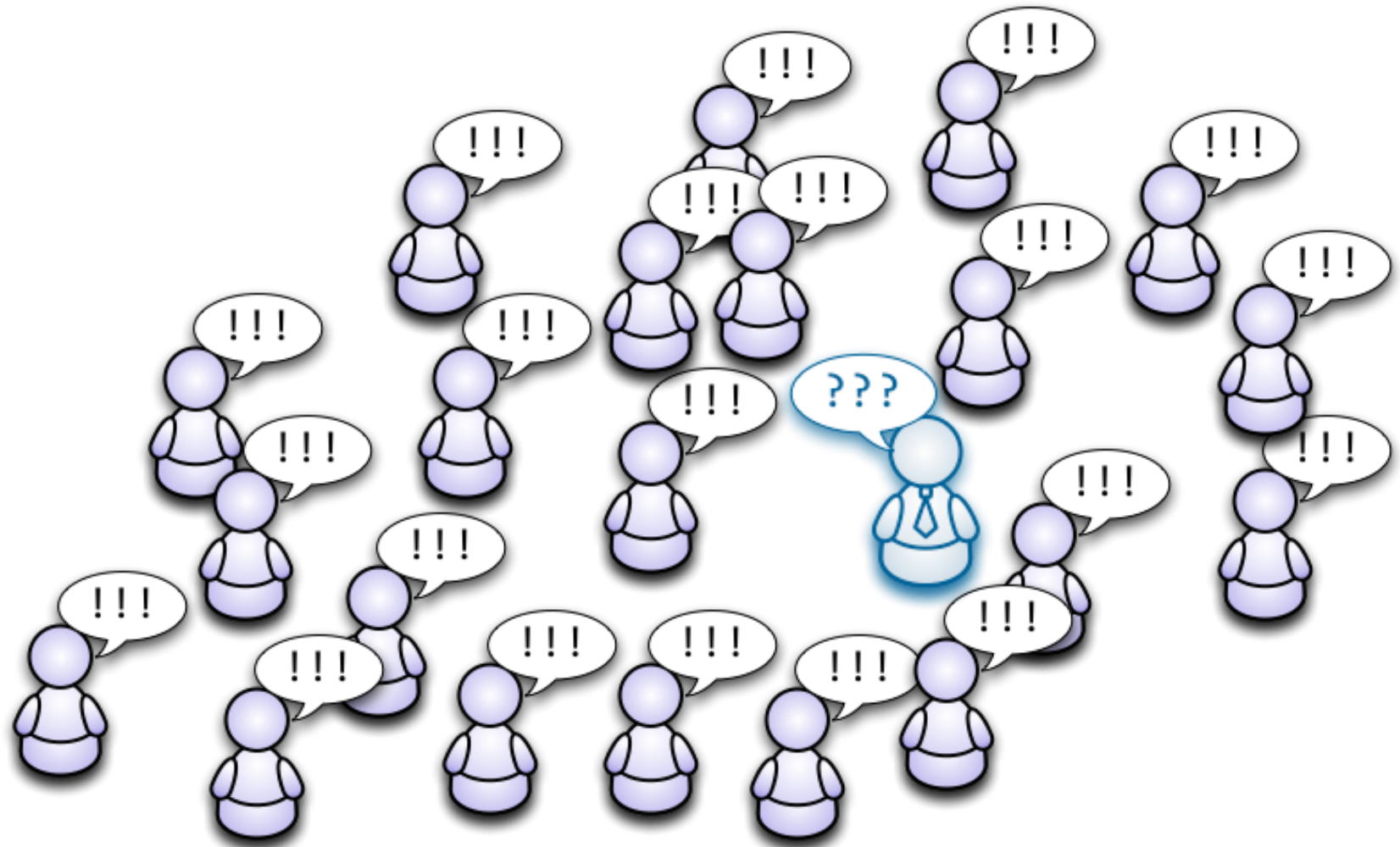


Contributors so far...

Jan Kassens, Peter Schroeder, Daniel Glöckner, Maik Görtz, Johannes Lerch, Johannes Born, Mohsen Parisay, Andreas Sewe, Sebastian Ahlfeld, Sebastian Kasten, Daniel Staesche, David Kalnischkies, Sebastian Wörner, Boyan Yurukov, Jan Stolzenburg, Nico Wombacher, Dirk Kröhan, Florianrian Jakob, Julius Rückert, Steffen Remus, Christopher Mann, Stefan Henss, Andreas Kaluza, Nikolay Shindov, Michael Novotny, Kristin Arand, Sinem Emeröz, Michael Kutschke, Sebastian Proksch, Tomasz Kalbarczyk, Marko Martin, Sheip Dargutev, David Schuld, Jens Krause, Kristijan Madunic, Daniel Brandtner, Roman Getto, Christian Kilb, Johannes Kastl, Dennis Sängler, Annie Liu, Markus Migenda, Tjark Vandommele, Sebastian Denel, Florian Nöll, Gary Fritz, Dennis Siebert, Peter Sinzig, Laura Altmüller, Paul Schatygin, Jan-Michael Heller, Minh Hoang Nguyen, Sascha Nordquist, Paul Emmanuel Faidherbe, ...



Q & A



It's there.



<http://eclipse.org/recommenders/>

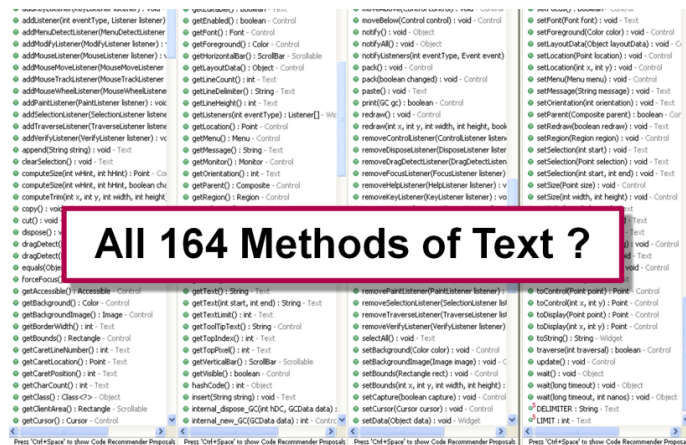
Follow me on twitter: @MarcelBruch
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“People that ~~thought~~ had this NullPointerException, made this mistake:...”

WHAT CAUSED THAT STACKTRACE?

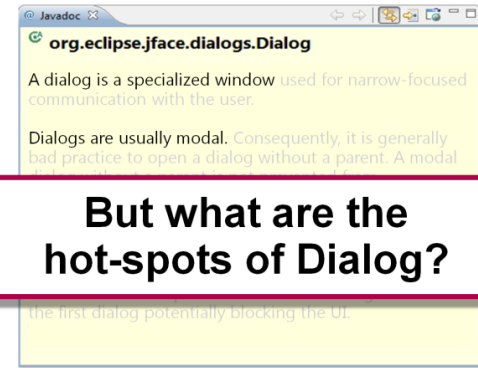
So far we have...

Intelligent Code Completion



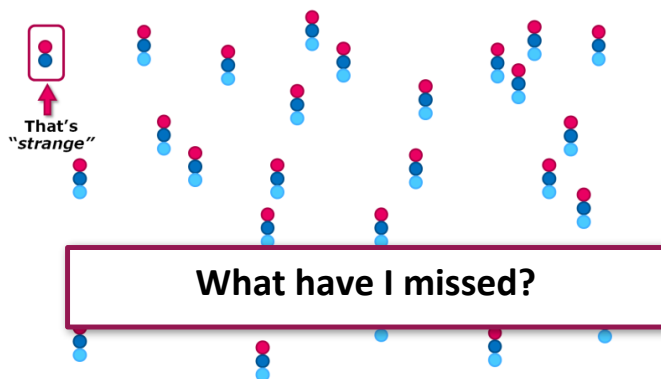
All 164 Methods of Text ?

Extended Documentation

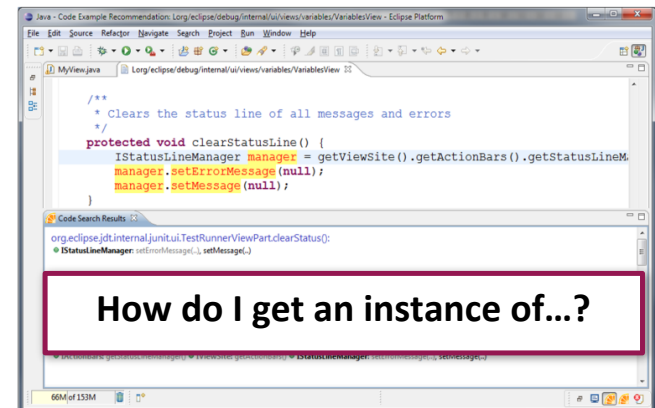


But what are the hot-spots of Dialog?

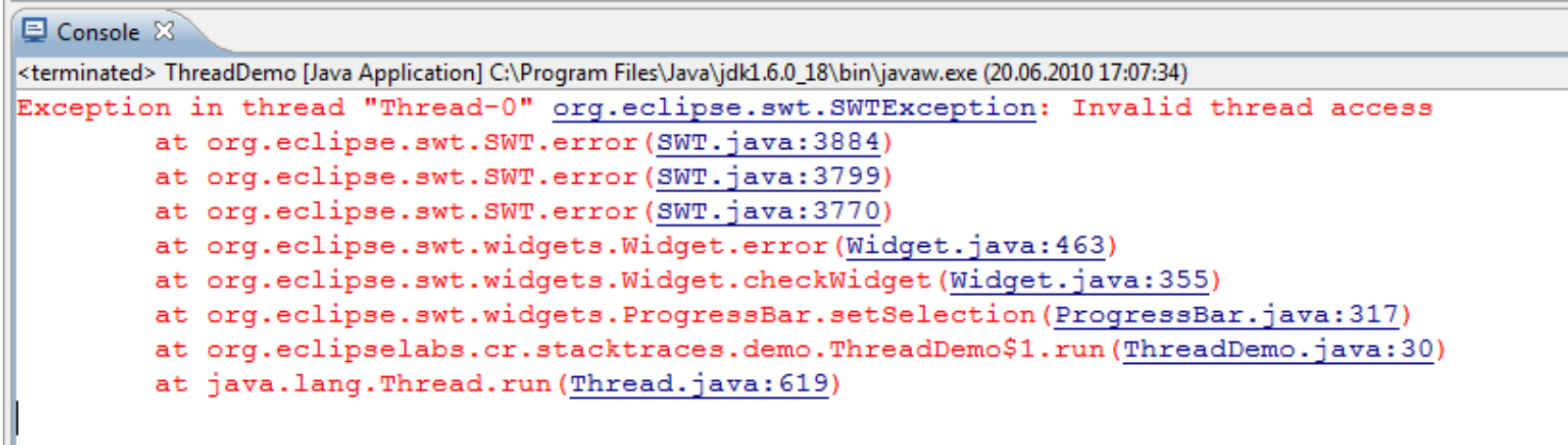
Smart Bug Detection



Code Example Recommender




But what if you get this?



```
Console X
<terminated> ThreadDemo [Java Application] C:\Program Files\Java\jdk1.6.0_18\bin\javaw.exe (20.06.2010 17:07:34)
Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access
    at org.eclipse.swt.SWT.error(SWT.java:3884)
    at org.eclipse.swt.SWT.error(SWT.java:3799)
    at org.eclipse.swt.SWT.error(SWT.java:3770)
    at org.eclipse.swt.widgets.Widget.error(Widget.java:463)
    at org.eclipse.swt.widgets.Widget.checkWidget(Widget.java:355)
    at org.eclipse.swt.widgets.ProgressBar.setSelection(ProgressBar.java:317)
    at org.eclipselabs.cr.stacktraces.demo.ThreadDemo$1.run(ThreadDemo.java:30)
    at java.lang.Thread.run(Thread.java:619)
```


Debugging – the old way

```
Console X
<terminated> ThreadDemo [Java Application] C:\Program Files\Java\jdk1.6.0_18\bin\javaw.exe (20.06.2010 17:07:34)
Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access
    at org.eclipse.swt.SWT.error(SWT.java:3884)
    at org.eclipse.swt.SWT.error(SWT.java:3799)
    at org.eclipse.swt.SWT.error(SWT.java:3770)
    at org.eclipse.swt.widgets.Widget.error(Widget.java:463)
    at org.eclipse.swt.widgets.Widget.checkWidget(Widget.java:355)
    at org.eclipse.swt.widgets.ProgressBar.setSelection(ProgressBar.java:317)
    at org.eclipselabs.cr.stacktraces.demo.ThreadDemo$1.run(ThreadDemo.java:30)
    at java.lang.Thread.run(Thread.java:619)
```




Debugging – the old way

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 Exception in thread "Thread-0" org.eclipse.s: Suche

Ungefähr 940 Ergebnisse (0,09 Sekunden) [Erweiterte Suche](#)

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▾ Mehr Optionen

[Invalid Thread access - Java @ tutorials.de: Forum & Hilfe](#)
11 Einträge - 2 Autoren - Letzter Eintrag: 6. Aug. 2008
isDisposed() { //-> **Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access //label.setText(System. ...**
[www.tutorials.de/.../208390-invalid-thread-access.html](#) - Im Cache - Ähnliche

[\[news.eclipse.newcomer\] Re: SWT Threads](#) - [[Diese Seite übersetzen](#)]
6 Jul 2005 ... **Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access.** In other words if I change my code in LongRunningThread ...
[dev.eclipse.org/newlists/...eclipse.../msg03346.html](#) - Im Cache - Ähnliche

[\[SWT\] Countdown-Label -> SWTException \[Archiv\] - mrunix.de](#)
7. Mai 2005 ... **Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access** at org.eclipse.swt.SWT.error(SWT.java:2860) ...
[www.mrunix.de > ... > Programmieren > Java-Forum](#) - Im Cache - Ähnliche

[SWT GUI, Observer pattern und Invalid thread access](#)
15. Juni 2006 ... **Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access** at org.eclipse.swt.SWT.error(SWT.java:2942) ...
[newsgroups.derkeiler.com > ... > 2006-06](#) - Im Cache - Ähnliche

[SWT Threads - DevX.com Forums](#) - [[Diese Seite übersetzen](#)]
3 Einträge - 3 Autoren - Letzter Eintrag: 13. Juli 2005
Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access. If I hard code the user name and password in my code ...
[forums.devx.com > DevX Developer Forums > Java](#) - Im Cache - Ähnliche

[Java Development Tools - SWT anomaly: org.eclipse.swt](#)
... - [[Diese Seite übersetzen](#)]
Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access.
At org.eclipse.swt.SWT.error (SWT.java: 2942). At org.eclipse.swt. ...
[www.anyang-window.com.cn/swt-anomaly-orgeclipseswtswtexception-invalid-thread-access/](#) - Im Cache - Ähnliche

But more often we get...

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InvalidArgumentException: "org.eclipse.jface.IllegalStat

[Erweiterte Suche](#)

 **Alles**

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Deutschland](#)

Mehr Optionen

Es wurden keine mit Ihrer Suchanfrage - **InvalidArgumentException:**
"org.eclipse.jface.IllegalState" - übereinstimmenden Dokumente gefunden.

Vorschläge:

- Vergewissern Sie sich, dass alle Wörter richtig geschrieben sind.
- Probieren Sie andere Suchbegriffe.
- Probieren Sie allgemeinere Suchbegriffe.
- Probieren Sie weniger Suchbegriffe.

How can we fix that?

Don't stacktraces share some commonalities?

exception type

message

```
org.eclipse.swt.SWTException: Invalid thread access
at org.eclipse.swt.SWT.error(SWT.java:3884)
at org.eclipse.swt.SWT.error(SWT.java:3799)
at org.eclipse.swt.SWT.error(SWT.java:3770)
at org.eclipse.swt.widgets.Widget.error(Widget.java:463)
at org.eclipse.swt.widgets.Widget.checkWidget(Widget.java:355)
at org.eclipse.swt.widgets.ProgressBar.setSelection(ProgressBar.java:317)
at org.eclipselabs.cr.stacktraces.demo.ThreadDemo$1.run(Unknown Source)
at java.lang.Thread.run(Thread.java:619)
```

stackframes

other information

How about stacktraces.org?



The screenshot shows a web browser window with the address bar containing `http://www.stacktraces.org/`. The main content area displays a Java exception stack trace:

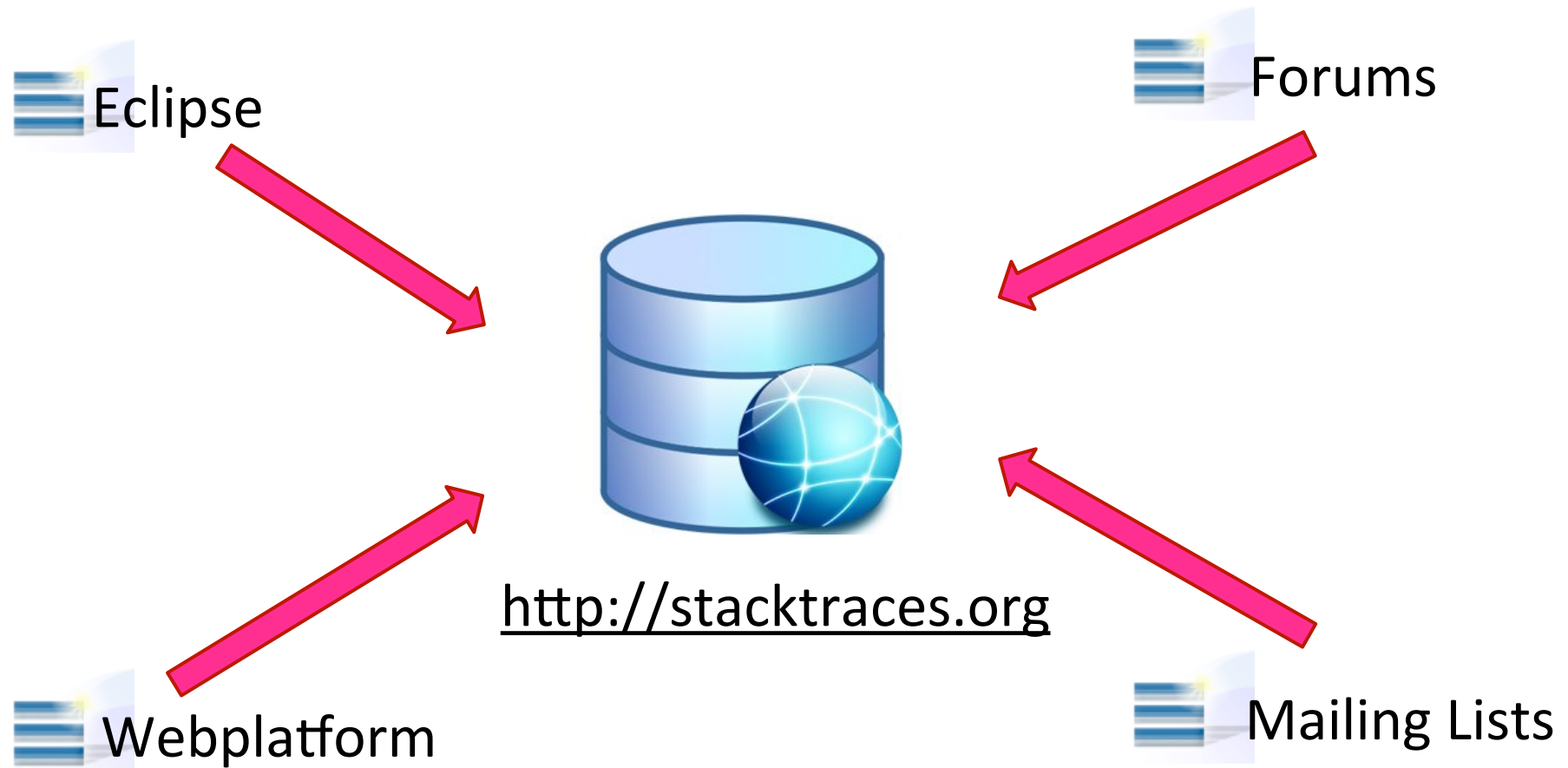
```
Exception in thread "Thread-0" org.eclipse.swt.SWTException: Invalid thread access
at org.eclipse.swt.SWT.error(SWT.java:3884)
at org.eclipse.swt.SWT.error(SWT.java:3799)
at org.eclipse.swt.SWT.error(SWT.java:3770)
at org.eclipse.swt.widgets.Widget.error(Widget.java:463)
at org.eclipse.swt.widgets.Widget.checkWidget(Widget.java:355)
at org.eclipse.swt.widgets.ProgressBar.setSelection(ProgressBar.java:317)
at ExampleWorker$1.run(ExampleWorker.java:32)
at java.lang.Thread.run(Unknown Source)
```

Below the stack trace are two buttons: "Neues Thema anlegen" and "Themen suchen".

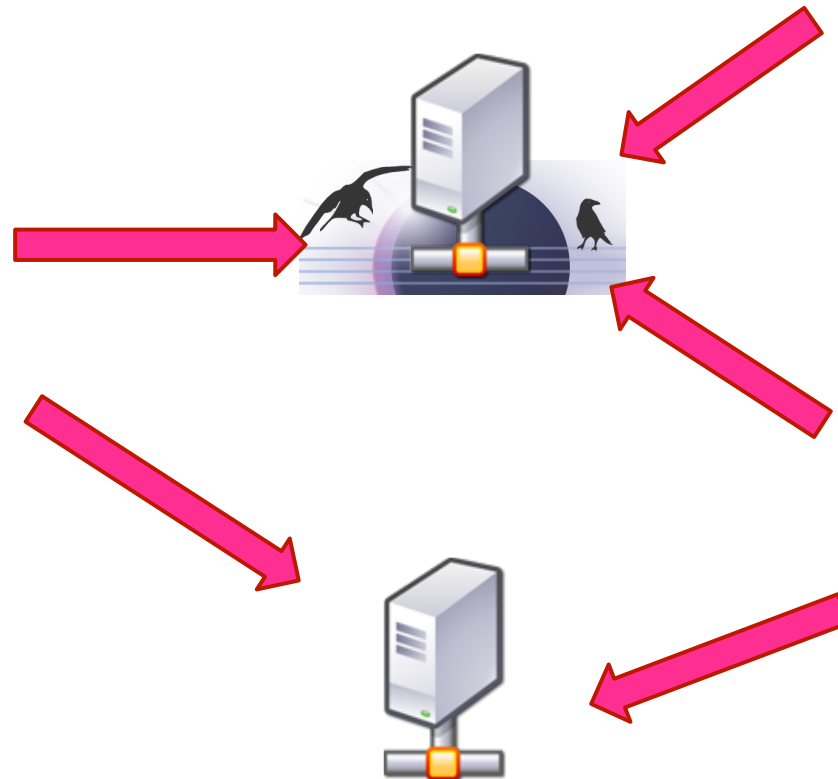
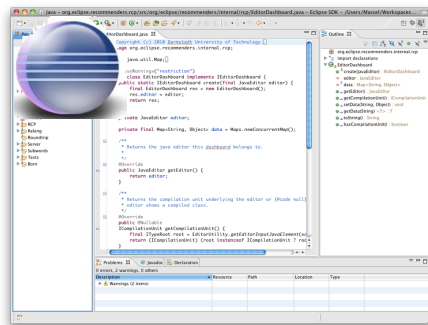
Under the heading "Relevante Themen", there is a table with the following data:

| Übereinstimmung | Bewertung | Titel |
|-----------------|-----------|------------------------------------------------------------|
| 95% | 104 | Zugriff auf SWT-Komponenten aus verschiedenen Threads |
| 45% | 35 | Verwendung der Eclipse-Shell statt eigener Display-Instanz |
| 35% | -12 | Brauche Hilfe bei Fehler |

Knowledge sources



Application scenarios for your company



Community-driven (forums, mailinglists,...)

Company Knowledgebase