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Technische Universität Darmstadt

Software Engineering

Software Quality

Software Quality

- **Software Quality Factors**

  B. Meyer; Object-oriented software construction; Prentice Hall, 1997

We distinguish between **internal** and **external software quality factors**.

- The internal quality factors can only be perceived by computer professionals
- The external quality factors are ultimately the relevant ones, as they are perceived by the user

However, the external quality factors depend on the internal quality factors.

We distinguish between **internal** and **external software quality factors**.

- Correctness
- Robustness
- Extendibility
- Reusability
- Compatibility
- Efficiency
- Portability
- Ease of use
- Functionality

The user encompasses all stake holders:
- the owner,
- the “end user”,
- the administrator,
- ...

Correctness is the ability of software products to perform their tasks as defined by their specification.

- To achieve correctness a precise requirements definition is needed
- Correctness is usually only conditional - we guarantee the correctness of our program on the assumption that the lower layers - upon which our product is built - are correct
  (E.g. we assume that a processor calculates correctly, that the compiler compiles our program correctly, …)

Robustness is the ability of software systems to react appropriately to abnormal conditions.

- Robustness characterizes what happens “outside of the specification”
- Robustness complements correctness

Extendibility characterizes the ease of adapting software products to changes of the specification.

- Important principles to achieve extendibility:
  - Design simplicity
    A simple architecture is easier to adapt.
  - Decentralization
    Autonomous modules (modules which have minimal coupling to other modules → Software Engineering Design & Construction) are easier to change.

Change is pervasive in software development.

- **Reusability** is the ability of software elements to serve for the construction of many different applications
- **Compatibility** is the ease of combining software elements with others
- **Portability** characterizes the ease of transferring software products to various hardware and software environments (i.e., porting it from Android to iOS; porting it from Windows to Linux,…)

Efficiency is the ability of a software system to place as few demands as possible on hardware resources.

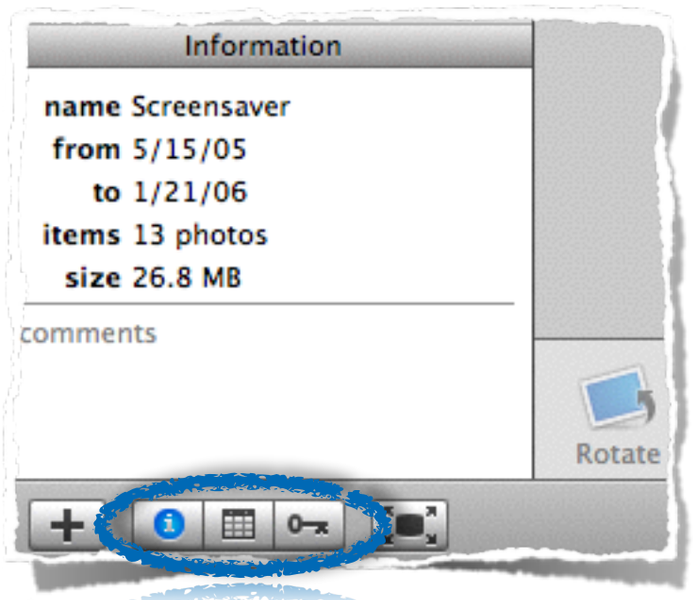
- Resources are the processor time, the space occupied in internal and external memories, the bandwidth used in communication devices, ...
  ...
- Always try to use “good” algorithms over “bad” ones, because a computer that is twice as fast as a previous model can handle problem sizes near 2*N if the algorithm’s complexity is O(n).
  Do ask yourself: If the complexity is $O(2^n)$ a computer that is twice as fast can handle problems of size?

Do not worry how fast it is unless it is also right! Efficiency nearly always have to be balanced with other goals.

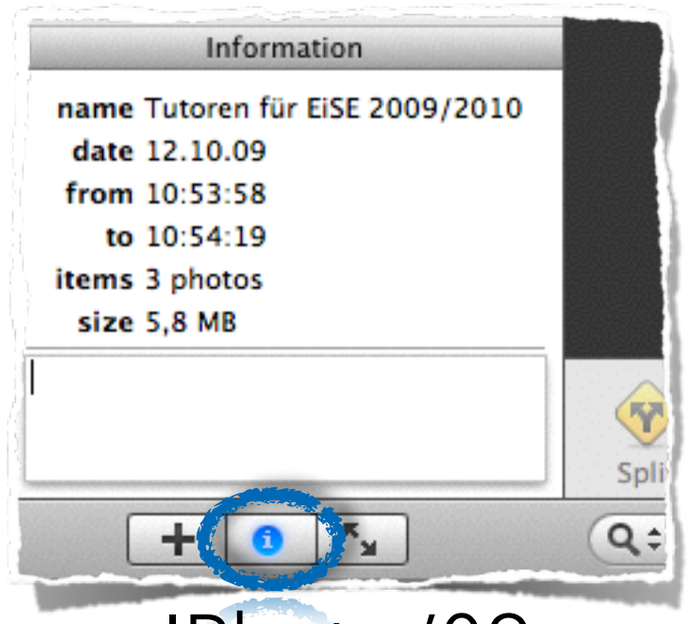
Functionality characterizes the extent of possibilities provided by a system.

- Avoid featurism; remain consistent with existing features if you add new ones

Ease of Use is the ease with which people of various backgrounds and qualifications can learn to use software products and apply them to solve problems.



IPhoto ‘06



IPhoto ‘09

Software Quality

- … or the lack thereof.

Software failures can be disastrous.

- Therac-25

  People died due to an overdosis of radiation (1985)

- Ariane 5

  A system from Ariane 4 was reused but the specification was ignored (1996)

- Mars Climate Orbiter

  There was some confusion about the units (i.e. metric system or english system) that are used (1999).

- ...

Software failures can be disastrous.

- hessische Schulsoftware LUSD
  "just" unusable (2007)
- ...


TEC CHANNEL
IT EXPERTS INSIDE

Suchbegriff hie
Sortierung

HOME | FOKUS | WHITEPAPER | SICHERHEIT | NETZWERK | SERVER | ST
SERVICE
Aktuelle Themen | News | News-Archiv | Newsletter | PDF Newsletter | PDA-News

THEMENÜBERBLICK / NEWS

Weitere News

Vom 14.09.2007

Hessen erlebt Desaster mit neuer Schulsoftware von CSC

Das Kultusministerium hat eine für 20 Millionen Euro entwickelte Verwaltungssoftware an den Schulen installieren lassen, die nicht funktioniert.

Bereits seit dem vergangenen Schuljahr versuchen rund 2000 hessische Schulen mit der neuen Schulverwaltungssoftware LUSD (Lehrer- und Schülerdatenbank) zu arbeiten. Bis heute ist sie jedoch unbrauchbar. Entwickelt wurde die Schulsoftware von CSC. Start der Konzeption und der Entwicklung war der 1. Juni 2006. Mit der Implementierung in den Schulen hatte CSC im Oktober 2006 begonnen.

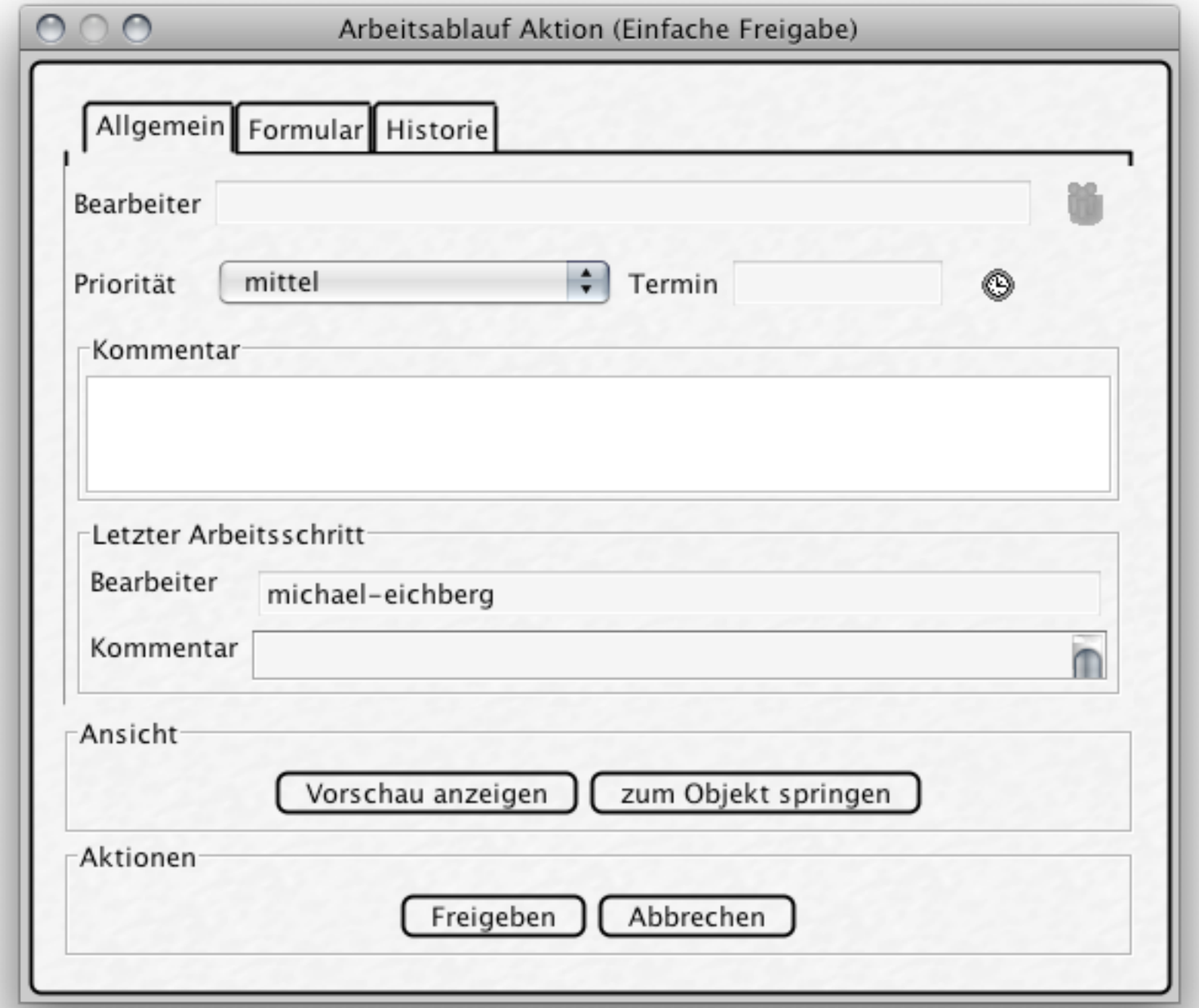
Lack of software quality.

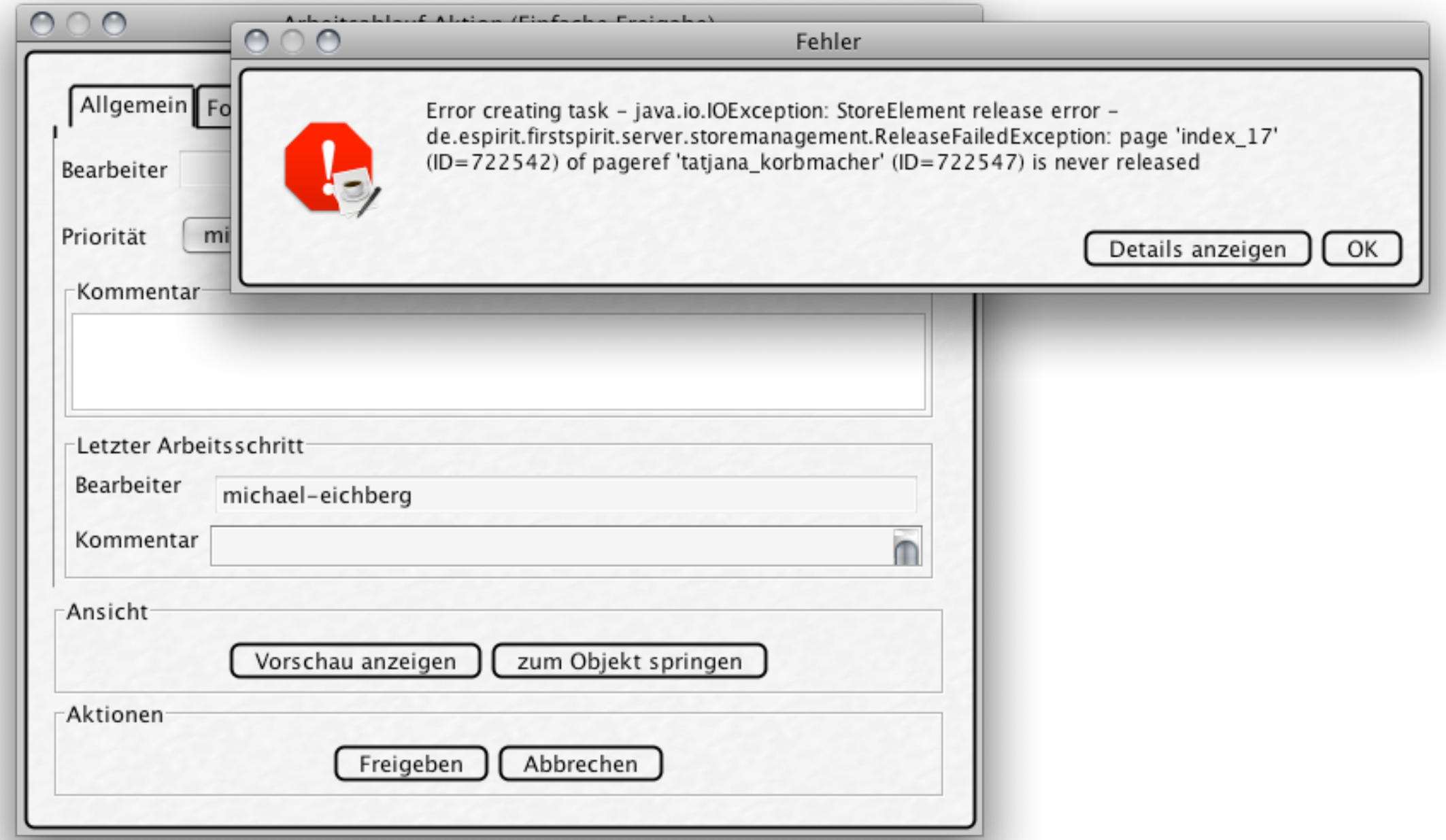
- CampusNet error message shown to the end user (2010)

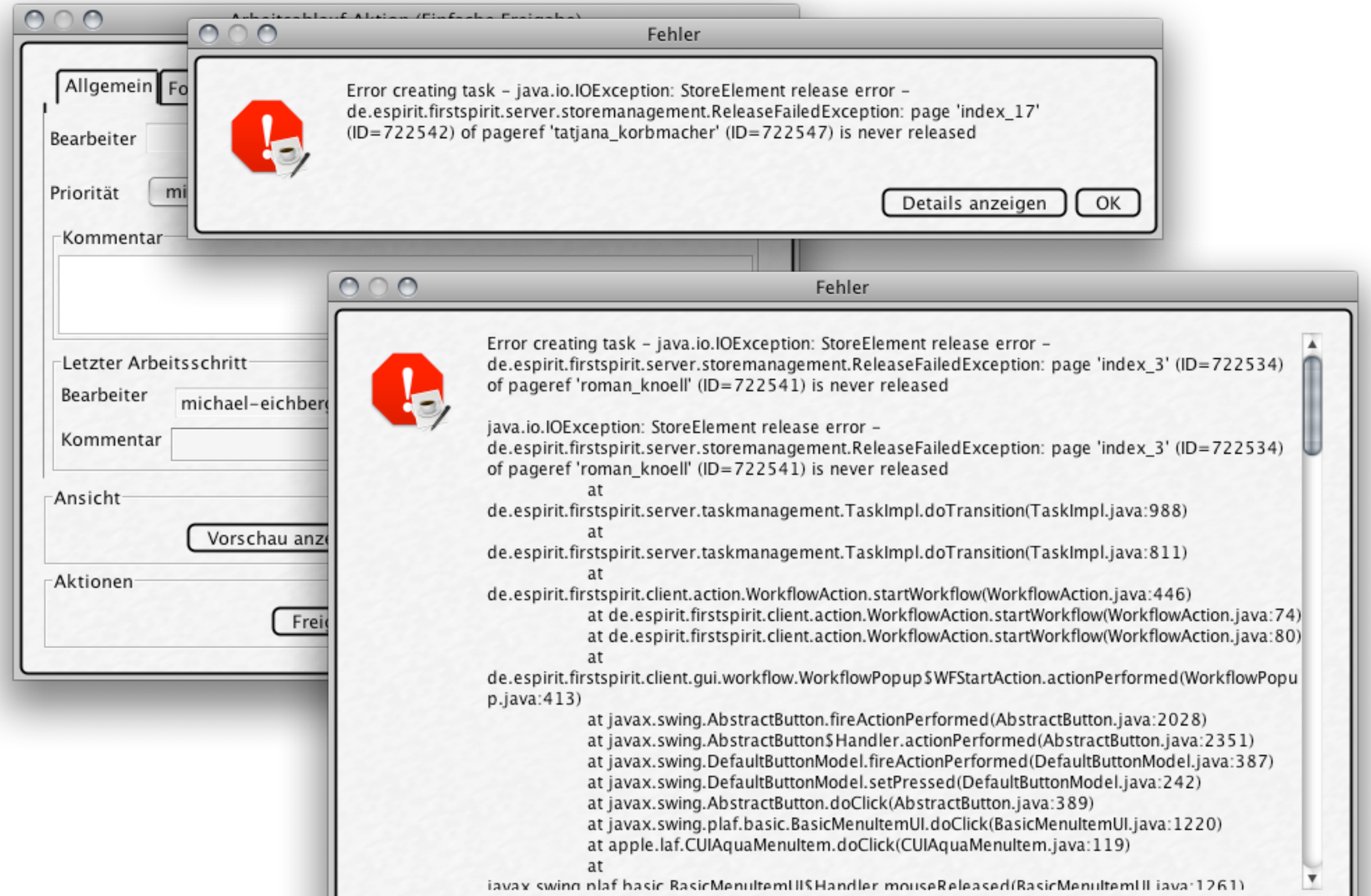
Magic uniPaaS Partitioning Message

Error: "The Requester could not connect to the Enterprise Server" (-109)

Enterprise Server	cmapp1.cn.pvw.tu-darmstadt.de/3300
Application	CampusNet
Program	ACTION


Arbeitsablauf Aktion (Einfache Freigabe)
Allgemein
Formular
Historie
Bearbeiter
Priorität
mittel
Termin
Kommentar
Letzter Arbeitsschritt
Bearbeiter
michael-eichberg
Kommentar
Ansicht
Vorschau anzeigen
zum Objekt springen
Aktionen
Freigeben
Abbrechen


Fehler
Error creating task – java.io.IOException: StoreElement release error –
de.espirit.firstspirit.server.storemanagement.ReleaseFailedException: page 'index_17'
(ID=722542) of pageref 'tatjana_korbmacher' (ID=722547) is never released
Details anzeigen
OK
Allgemein
Bearbeiter
Priorität
Kommentar
Letzter Arbeitsschritt
Bearbeiter
michael-eichberg
Kommentar
Ansicht
Vorschau anzeigen
zum Objekt springen
Aktionen
Freigeben
Abbrechen


Allgemein
Bearbeiter
Priorität
Kommentar
Letzter Arbeitsschritt
Bearbeiter
Kommentar
Ansicht
Aktionen
Fehler
Error creating task – java.io.IOException: StoreElement release error – de.espirit.firstspirit.server.storemanagement.ReleaseFailedException: page 'index_17' (ID=722542) of pageref 'tatjana_korbmacher' (ID=722547) is never released
Details anzeigen
OK
Fehler
Error creating task – java.io.IOException: StoreElement release error – de.espirit.firstspirit.server.storemanagement.ReleaseFailedException: page 'index_3' (ID=722534) of pageref 'roman_knoell' (ID=722541) is never released
java.io.IOException: StoreElement release error – de.espirit.firstspirit.server.storemanagement.ReleaseFailedException: page 'index_3' (ID=722534) of pageref 'roman_knoell' (ID=722541) is never released
at de.espirit.firstspirit.server.taskmanagement.TaskImpl.doTransition(TaskImpl.java:988)
at de.espirit.firstspirit.server.taskmanagement.TaskImpl.doTransition(TaskImpl.java:811)
at de.espirit.firstspirit.client.action.WorkflowAction.startWorkflow(WorkflowAction.java:446)
at de.espirit.firstspirit.client.action.WorkflowAction.startWorkflow(WorkflowAction.java:74)
at de.espirit.firstspirit.client.action.WorkflowAction.startWorkflow(WorkflowAction.java:80)
at de.espirit.firstspirit.client.gui.workflow.WorkflowPopup$WFStartAction.actionPerformed(WorkflowPopup.java:413)
at javax.swing.AbstractButton.fireActionPerformed(AbstractButton.java:2028)
at javax.swing.AbstractButton$Handler.actionPerformed(AbstractButton.java:2351)
at javax.swing.DefaultButtonModel.fireActionPerformed(DefaultButtonModel.java:387)
at javax.swing.DefaultButtonModel.setPressed(DefaultButtonModel.java:242)
at javax.swing.AbstractButton.doClick(AbstractButton.java:389)
at javax.swing.plaf.basic.BasicMenuItemUI.doClick(BasicMenuItemUI.java:1220)
at apple.laf.CUIAquaMenuItem.doClick(CUIAquaMenuItem.java:119)
at javax.swing.plaf.basic.BasicMenuItemUI$Handler.mouseReleased(BasicMenuItemUI.java:1261)
Details verbergen
OK

Missing software quality in commercial software.

- Lufthansa Buchungssystem "Totalausfall" (2004)
- …

Handelsblatt.com

Konsequenz aus System-Ausfall
14.10.2004

Lufthansa will Check-In-Technik besser absichern

Nachdem das weltweiten Check-In-Systems bei der Lufthansa vor drei Wochen komplett ausgefallen ist zieht die Airline nun Konseque… Eine Entscheidung darüber werde… Unternehmenssprecherin am Don…

HB FRANKFURT. Der für die Techn… bei dem Ausfall das vorhandene … entscheidender Stelle auf das aus… am 23. September weltweit die Fl… Hand eingecheckt. Neben zahlrei… Prinzipiell sei ein eigenständiges … „So etwas ist natürlich nicht kosten… Back-up-Systems liege beim Kun… Nach Einschätzung von Technike… Betrieb bereit stünde, binnen we… System würde rund zehn Mill. € z… Köln bei Technikanbietern für de…

Über möglichen Schadenersatz besteht bei Lufthansa noch keine Klarheit. „Ob und in welcher Höhe Schadenersatzforderungen geltend gemacht werden, wird momentan noch geprüft", teilte die Unternehmens-Sprecherin mit.

Eine Wiederholung der konkreten Ursache für den Check-In-Ausfall gilt mittlerweile als ausgeschlossen. „Es handelte sich um eine Verkettung von gleich drei Problemen", sagte Systems-Chef Franke. Die US-Firma Unisys, deren Betriebssystem Lufthansa beim Check-In verwendet, hatte in der Nacht ein Software-Update ausgeführt. Im Gefolge davon kam es zu einem Systemabsturz, weil eine Speicherdatei vollgelaufen war.

> … hatte in der Nacht ein Software-Update ausgeführt. Im Gefolge davon kam es zu einem Systemabsturz, weil eine Speicherdatei vollgelaufen war.…

Missing software quality in commercial software.

- Lufthansa Buchungssystem "Totalausfall" (2009)
- …

sueddeutsche.de

Computerpanne bei Lufthansa
30.09.2009, 12:26

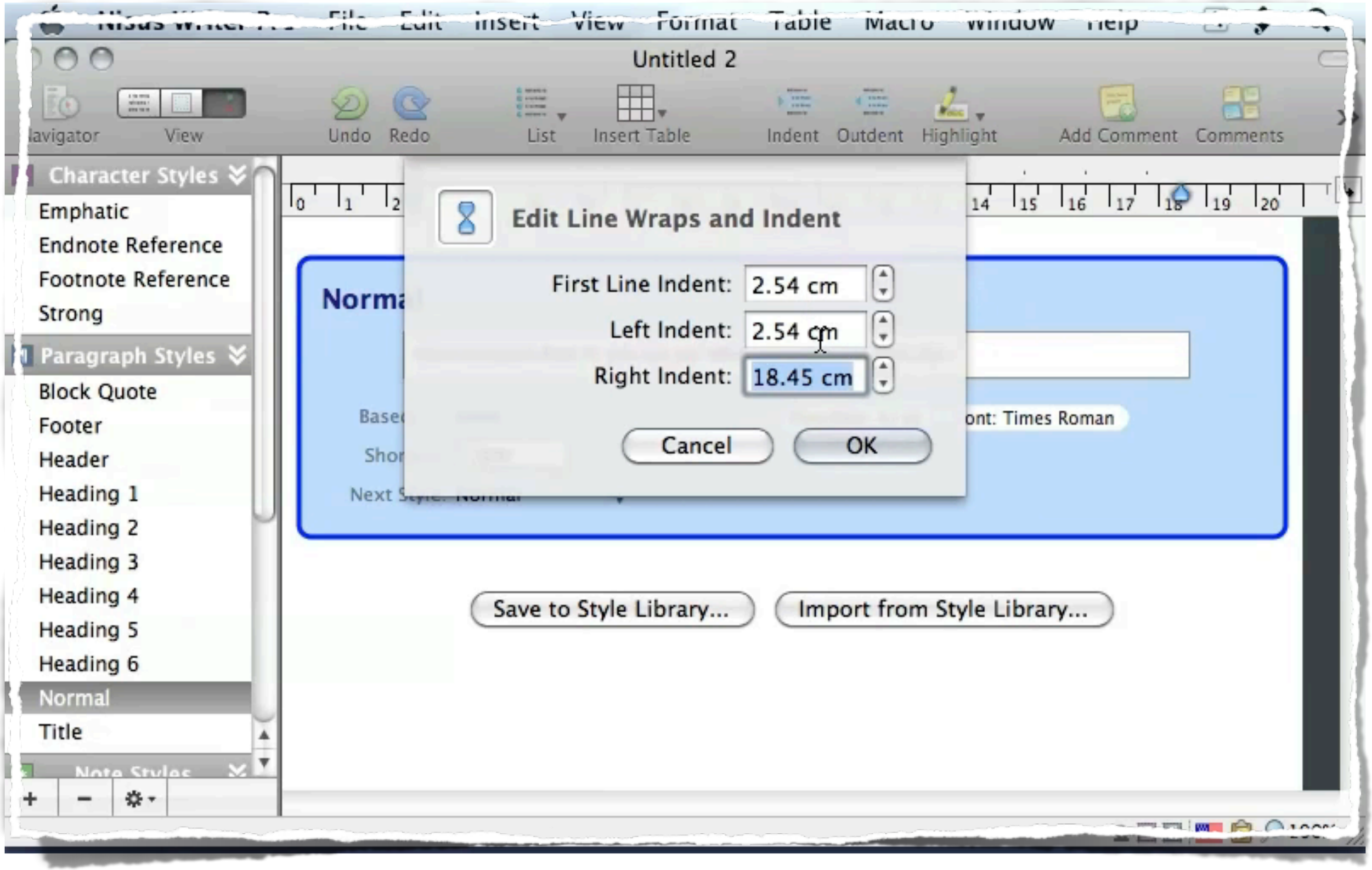
Mit Zettel und Stift musste die Lufthansa heute ihre Passagiere einchecken. Eine Computerpanne hatte den Check-In lahmgelegt.

Mit Verspätungen muss wegen der Computerpanne noch bis morgen gerechnet werden. (*Foto: ddp*)
Ein Ausfall des zentralen Lufthansa-Check-In-Systems hat weltweit zu Verzögerungen bei der Abfertigung sowie zu Verspätungen und einzelnen Flugausfällen geführt.

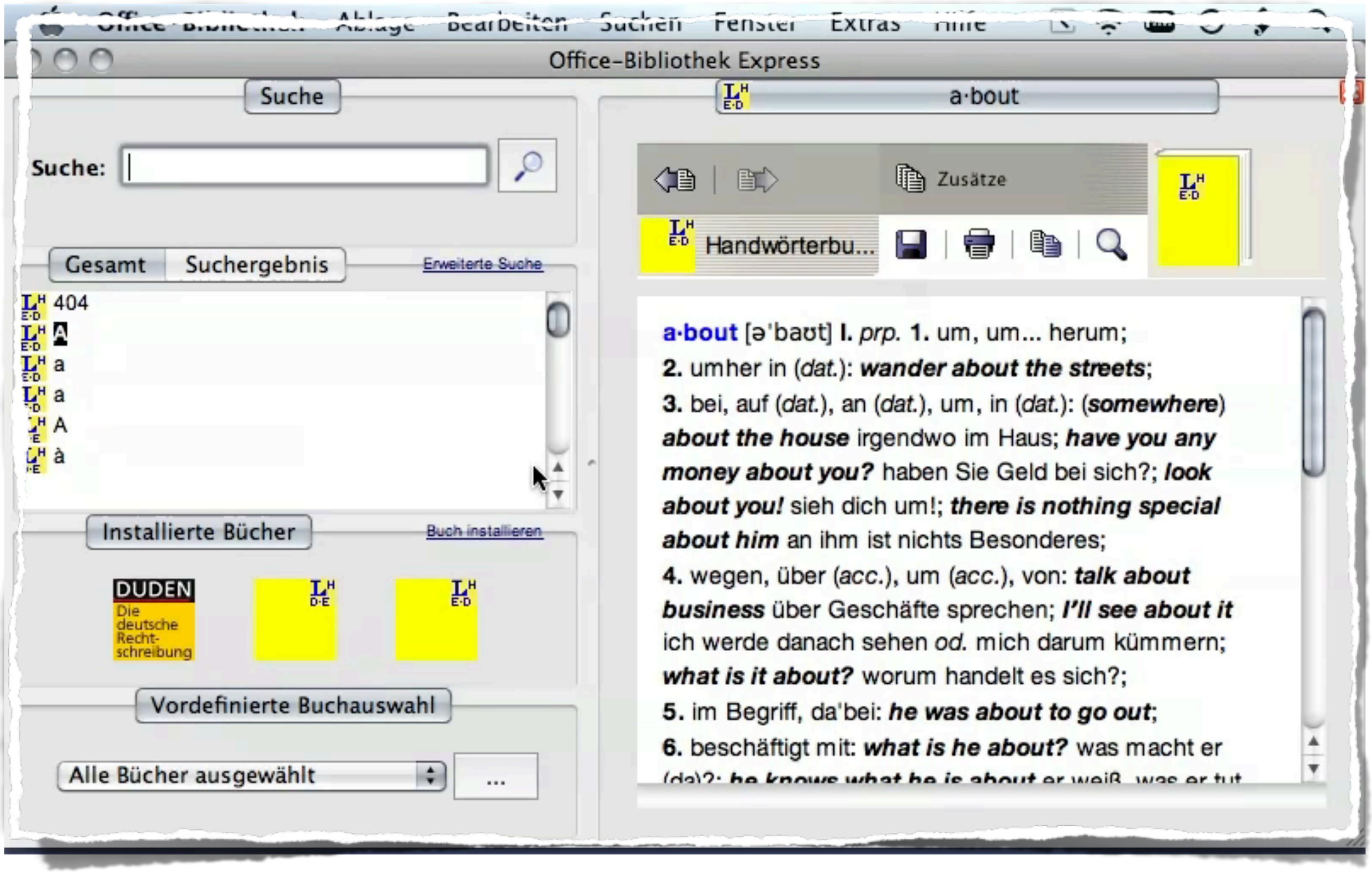
Das System kam kurz vor 04.00 Uhr während eines routinemäßigen Software-Updates zum Stillstand, wie ein Sprecher sagte. Zwar habe man den Server um 08.00 Uhr wieder starten können. Bis zum Mittwochabend könne es aber zu Verspätungen kommen.

Wegen des Systemausfalls musste die Lufthansa weltweit auf manuelles Einchecken umstellen. Passagiere wurden per Hand mit Stift und Papier eingecheckt werden, sagte Lufthansa-Sprecher[…]

Missing software quality in commercial software.



Missing software quality in commercial software.



We distinguish between **internal** and **external** **software quality factors**.

- Internal quality factors
  - modular
  - readable
  - …

} This lecture series' main subject

An example of missing internal quality.


```
/// <summary>
/// Turns true into false and false into true
/// <param name="_booInpt">True of false</param>
/// <returns>False or true</returns>
private bool trueandorfalse(bool _booInpt)
{
    // I'm quite sure though there is a very
    // clever C# standard command doing this,
    // I just can't find it right now ...
    if (_booInpt == true)
        return false;
    return true;
}
```

An example of missing internal quality.


```
/**
 * Checks to see if Australia is typed into the other country box
 */
function checkContactCountry(inputBox)
{
   var validator = new RegExp(
         /^(A|a)(U|u)(S|s)(T|t)(R|r)(A|a)(L|l)(I|i)(A|a)
          |(N|n)(E|e)(W|w)(Z|z)(E|e)(A|a)(L|l)(A|a)(N|n)(D|d)
          |(N|n)(E|e)(W|w) (Z|z)(E|e)(A|a)(L|l)(A|a)(N|n)(D|d)$/);

   if(validator.test(inputBox.value))
   {
      alert("Your Residential Address must be outside Australia. "
          + "Enter your residential address outside this country,"
          + "or visit redacted-travel.com.au to make a booking if "
          + "you live in Australia.");
      inputBox.focus();
      inputBox.select();
   }
}
```

Internal quality.


```
def isAnnotatedWith(
    classFile: ClassFile,
    annotationTypes: Iterable[ObjectType]): Boolean = {

    var bufferOutput: Iterable[Object] = Iterable.empty
    val runtimeVisibleAnnotations = classFile.runtimeVisibleAnnotations
    val runtimeInvisibleAnnotations = classFile.runtimeInvisibleAnnotations
    for (annotationType ← annotationTypes) {
        bufferOutput = bufferOutput ++ runtimeVisibleAnnotations.filter {
            case Annotation(`annotationType`, _) ⇒ true
            case _                               ⇒ false
        }
        bufferOutput = bufferOutput ++ runtimeInvisibleAnnotations.filter {
            case Annotation(`annotationType`, _) ⇒ true
            case _                               ⇒ false
        }
    }

    annotationTypes.nonEmpty &&
        !classFile.isAnnotationDeclaration &&
        bufferOutput.nonEmpty
}
```

Where is the issue/are the issues?

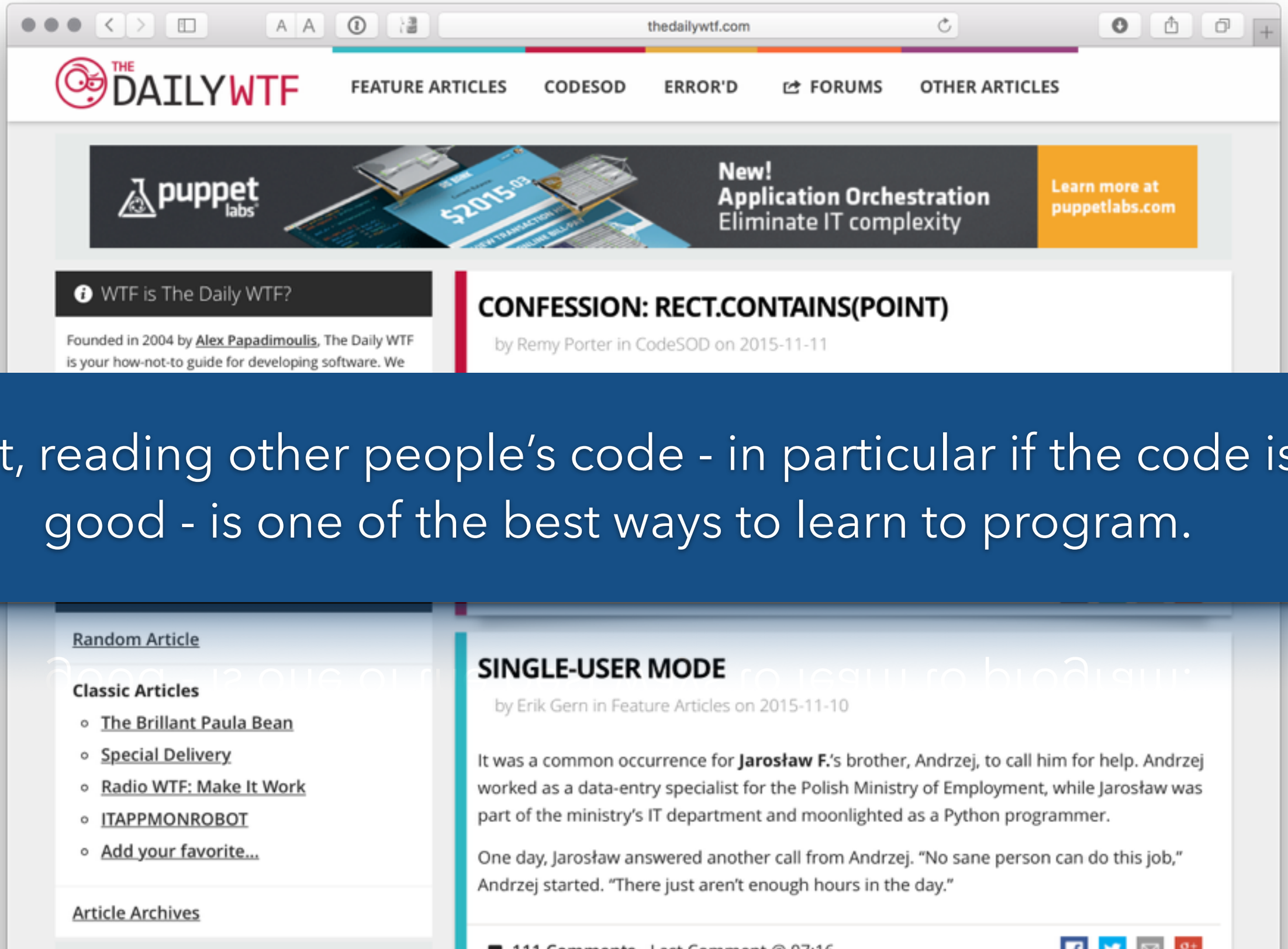
> *[…] Have you ever noticed that* ***when someone checks in some complex and, oftentimes, horrific piece of code, the check-in is greeted with an almost deafening silence?*** *[…]*
>
> *The explanation for why this occurs was first given by C. Northcote Parkinson […] He stated that if you were building something complex, then few people would argue with you because few people could understand what you were doing. If you were building something simple […] which most anyone could build, then everyone would have an opinion.*

Just one reason for "bad code"...

George V. Neville-Neil

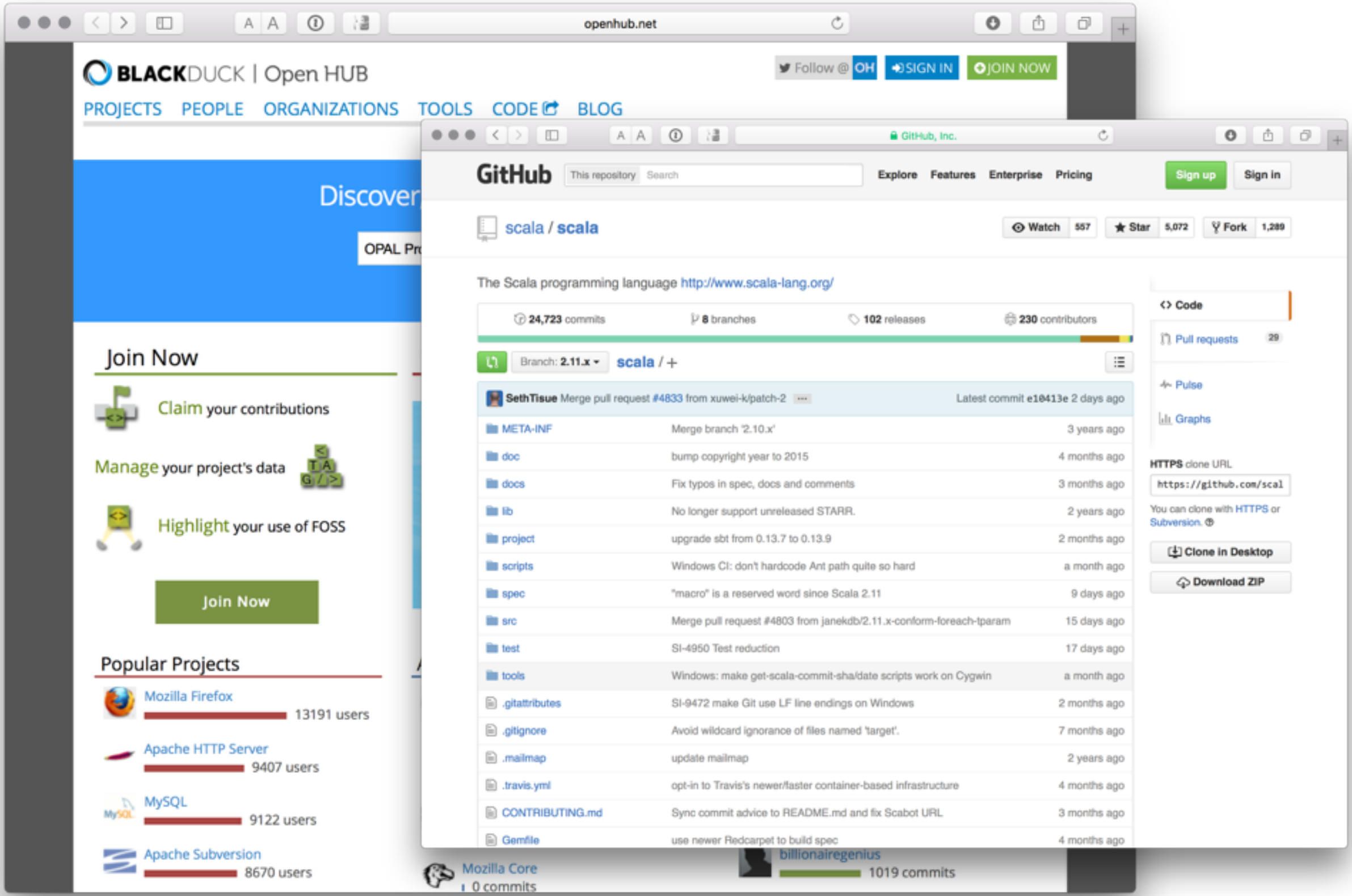
Painting the Bike Shed - A sure-fire technique for ending pointless coding debates; ACM Queue, ACM 2009
1542-7730/09/0600

If you want to study code with missing quality...



But, reading other people's code - in particular if the code is good - is one of the best ways to learn to program.

If you want to study code...



Software quality in commercial software.

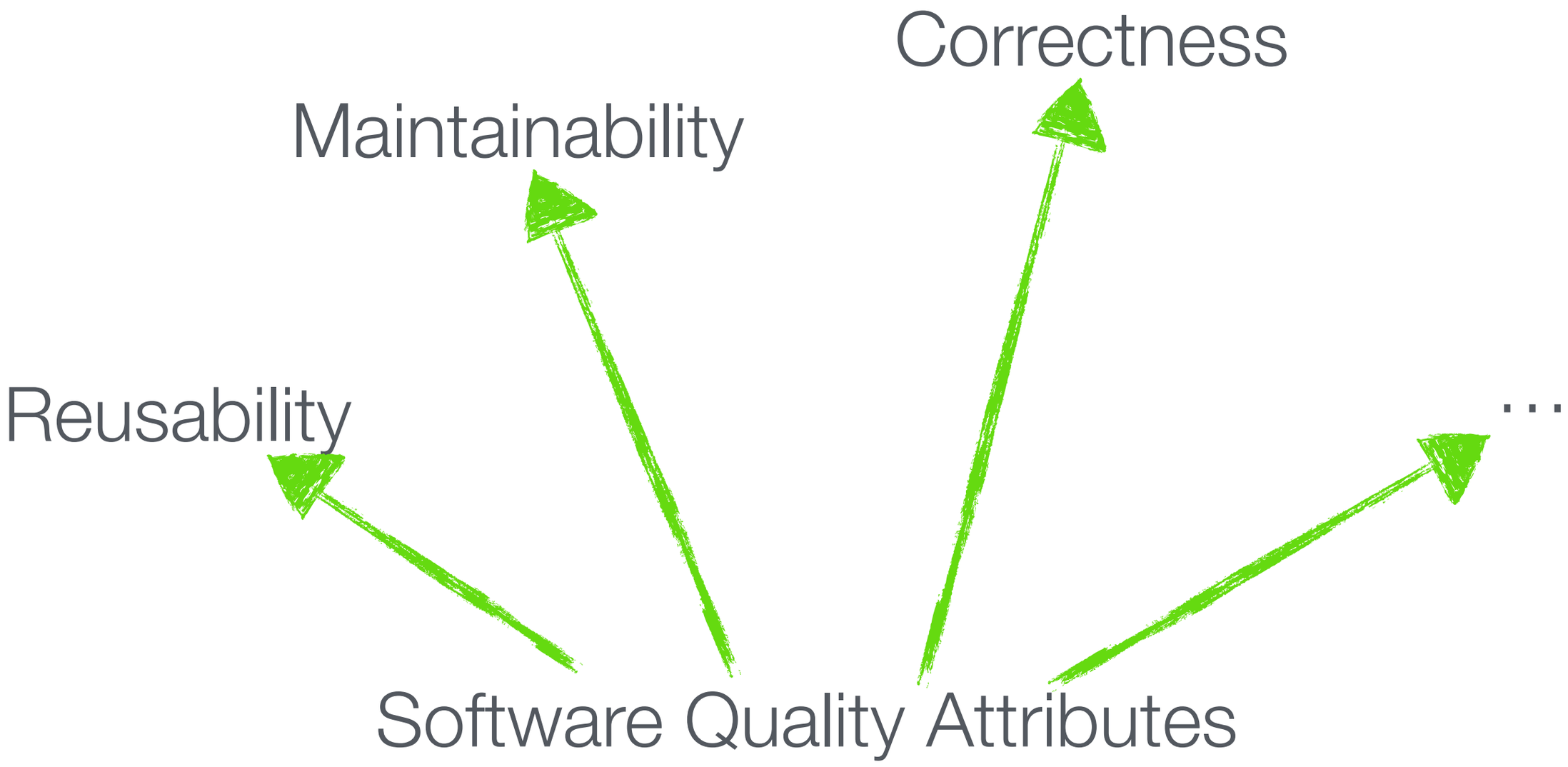
Part of the source code for Comanche, build 055.
It is part of the source code for the Command Module's (CM) Apollo Guidance Computer (AGC), Apollo 11.

```
                                                    SET EB

                                                    EGEXIT.

                                                    / .3048) /2VS
50                  VXSC    PDVL
51                          -KVSCALE        # KVSCALE = .81491944
52                          UNITW           # FULL UNIT VECTOR
53                  VXV     VXSC            # VREL = V - WE*R
54                          UNITR
55                          KWE
56                  VAD     STADR
57                  STORE   -VREL           # SAVE FOR ENTRY GUIDANCE.      REF COORDS
58
59                  UNIT    LXA,1
60                          36D             # ABVAL( -VREL) TO X1
61                  STORE   UXA/2           # -UVREL                        REF COORDS
62
63                  VXV     VCOMP
64                          UNITR           # .5 UNIT                       REF COORDS
65                  UNIT    SSP             # THE FOLLOWING IS TO PROVIDE A STABLE
66                          S1              # UN FOR THE END OF THE TERMINAL PHASE.
67  SPVQUIT         DEC     .019405         # 1000/ 2 VS
68                  TIX,1   VLOAD           # IF V-VQUIT POS, BRANCH.
69                          CM/POSE2        # SAME UYA IN OLDUYA
```

http://googlecode.blogspot.com/2009/07/apollo-11-missions-40th-anniversary-one.html

It is often not possible to improve all software quality attributes.

Sometimes they are at odds.



Software Quality

- **Good Software**

  Ian Sommerville; Software Engineering - Eighth Edition; Addison Wesley, 2007

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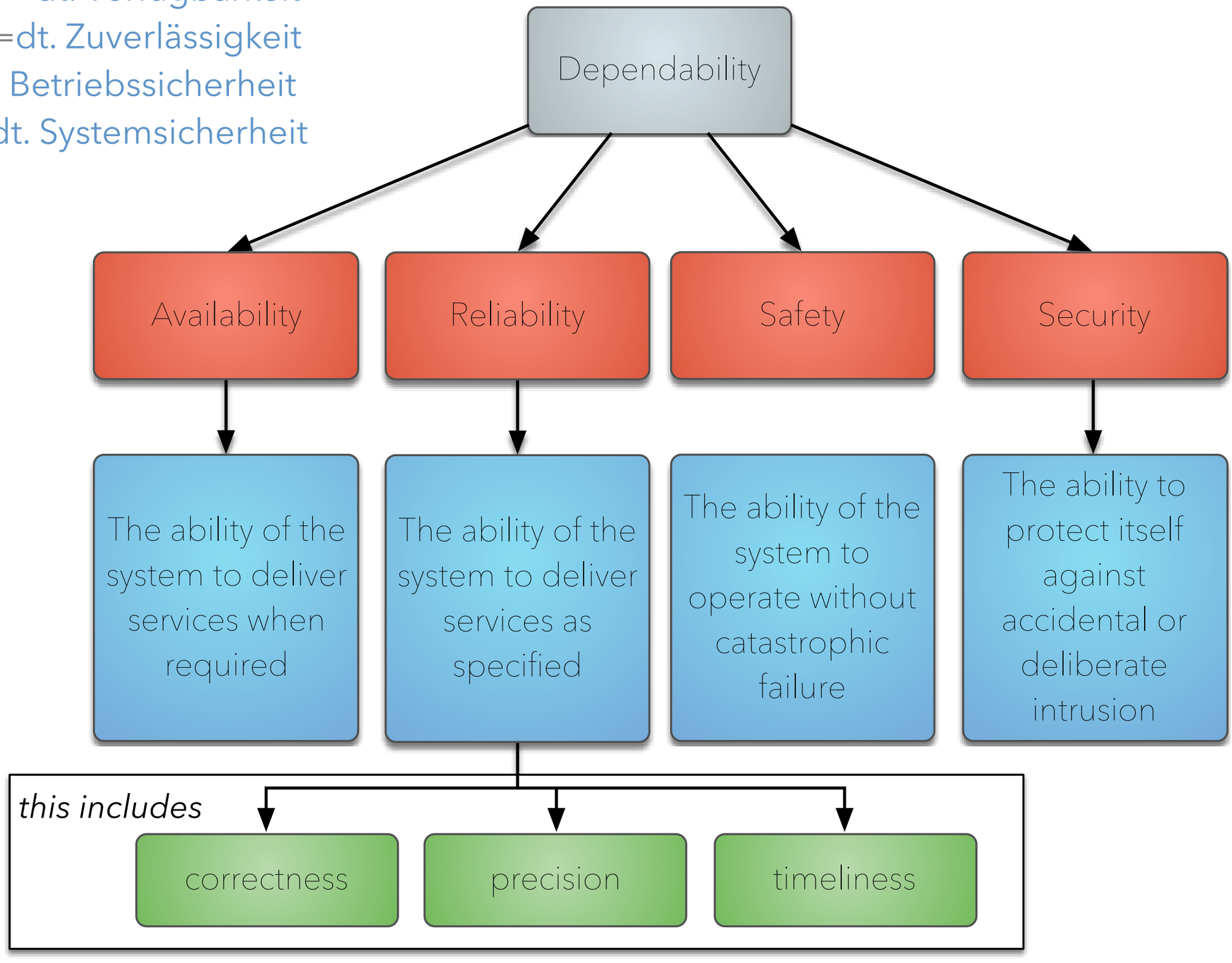
Attributes of “good Software”

- **Maintainability**
  Software should be written in such a way that it may evolve to meet changing needs of customers.
- **Efficiency**
  Software should not waste system resources; it includes: responsiveness, processing time, memory utilisation, etc.
- **Usability**
  Software must be usable by the intended users.
- **Dependability** (dt. Verlässlichkeit)
  Dependable software does not cause physical or economic damage in the event of system failure. Further properties: Repairability, Survivability, Error Tolerance...

Some Aspects of Dependable Systems

Availability =dt. Verfügbarkeit
Reliability =dt. Zuverlässigkeit
Safety =dt. Betriebssicherheit
Security =dt. Systemsicherheit



Software Engineering; Ian Sommerville; 2007

Software Quality Assurance (SQA)

- Constructive vs. Analytical

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Fostering Software Quality by Means of…

Constructive SQA and Analytical SQA

Programming Languages

Software Architecture

Scalable Static Analyses

Domain Specific Languages

Lightweight Formal Methods

Metrics

Software Development Processes

Machine Learning

…

Type Systems (Language Based Security)

….

Integrated Development Environments

Null Values…

- found in *java.nio.file.FileTreeWalker next()*

```
if (ioe != null) {
    ioe = e;
} else {
    ioe.addSuppressed(e);
}
```

here, `ioe` is null

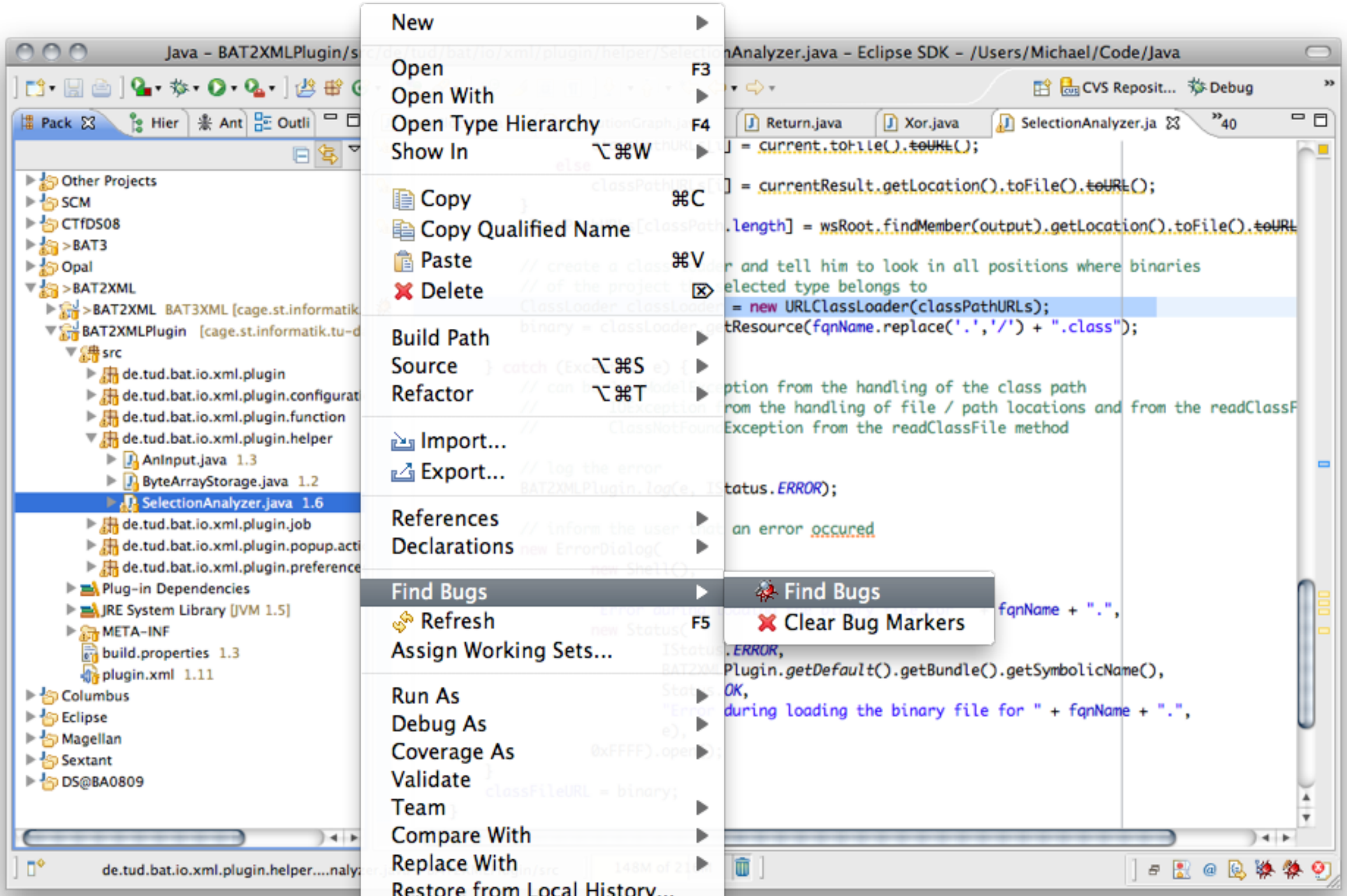
Constructive SQA

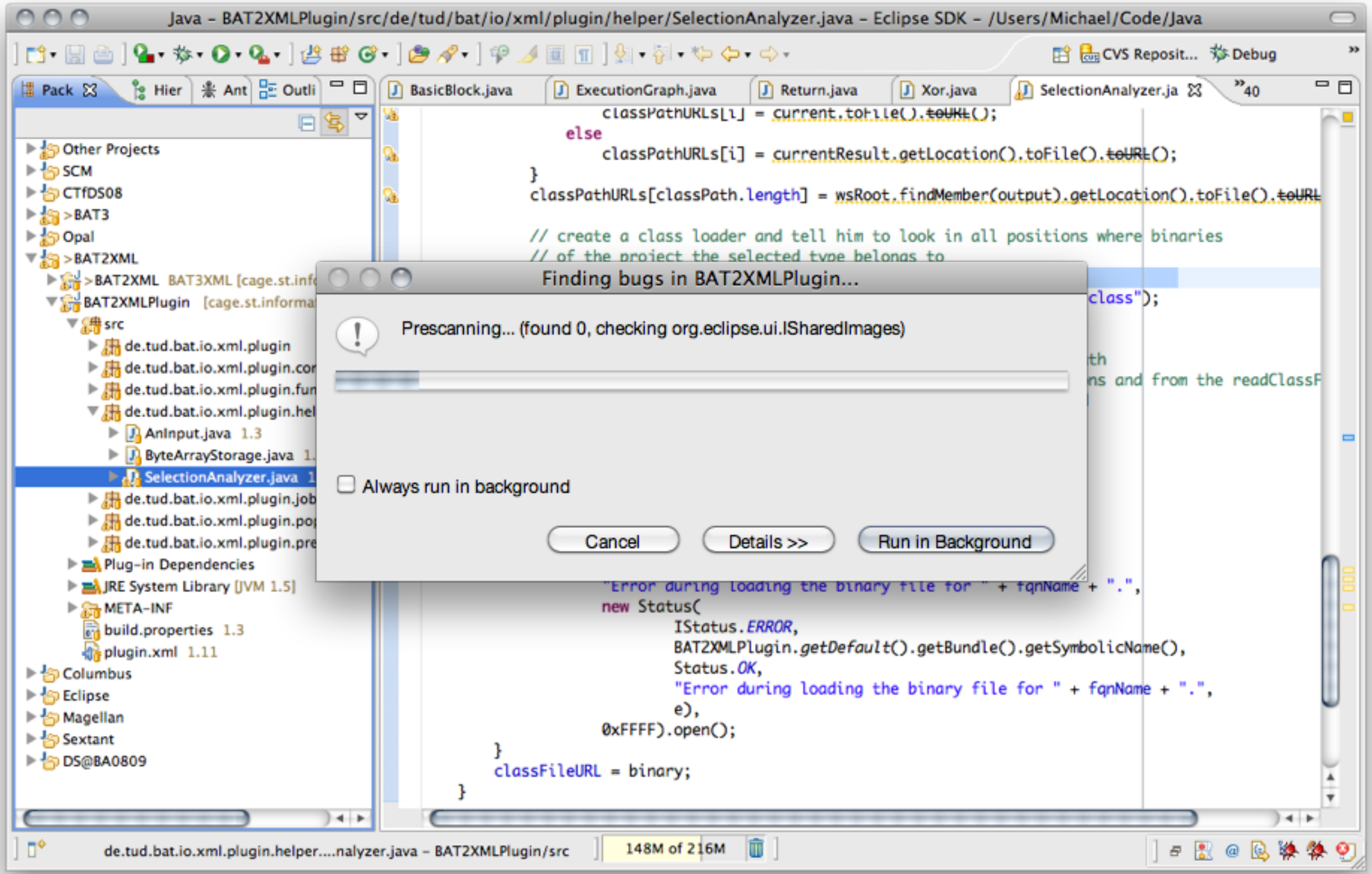
A Few (Well Known)

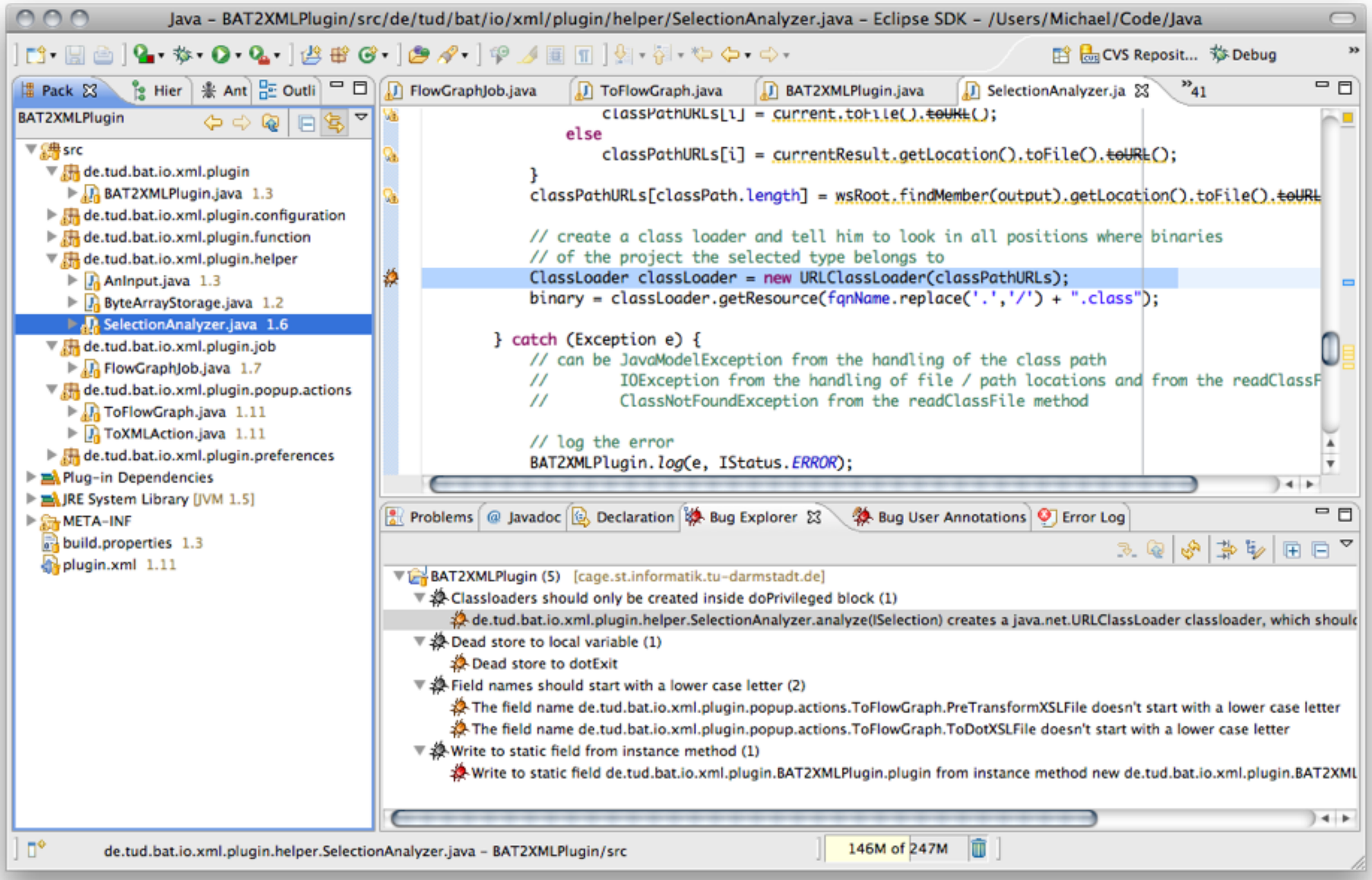
Static Analysis Tools

- FindBugs
  Lightweight static analyses on top of Java Bytecode.
- PMD
  Lightweight static analyses on top of the AST using Java Visitors or XPath based rules.
- CheckStyle
  Lightweight static analyses on top of the AST using Java Visitors.
- CheckerFramework
  Static analyses using pluggable types.
- ConQAT
  Code Clone Detection.


FindBugs™ – Find Bugs in Java Programs
http://findbugs.sourceforge.net/index.html
Google
UNIVERSITY OF MARYLAND 18 56
FindBugs™
because it's easy
Docs and Info
Demo and data
Users and supporters
FindBugs blog
Fact sheet
Manual
Manual(ja/日本語)
FAQ
Bug descriptions
Mailing lists
Documents and Publications
Links
Downloads
FindBugs Swag
Development
Open bugs
Reporting bugs
Contributing
Dev team
API [no frames]
Change log
FindBugs™ - Find Bugs in Java Programs
This is the web page for FindBugs, a program which uses static analysis to look for bugs in Java code. It is free software, distributed under the terms of the Lesser GNU Public License. The name FindBugs™ and the FindBugs logo are trademarked by The University of Maryland. As of July, 2008, FindBugs has been downloaded more than 700,000 times.
FindBugs requires JRE (or JDK) 1.5.0 or later to run. However, it can analyze programs compiled for any version of Java. The current version of FindBugs is 1.3.9, released on 20:11:47 EDT, 21 August, 2009. We are very interested in getting feedback on how to improve FindBugs.
Changes | Talks | Papers | Sponsors | Support
New
JavaOne talk: Slides from my JavaOne talk, Mistakes That Matter.
FindBugs community review: We are previewing FindBugs community review, in which anyone can review issues in open source projects (i.e., mark issues as "must fix" or "mostly harmless"), and those reviews are automatically shared with other reviewers.
This is a pre-beta release, not ready for deployment. The implementation will be undergoing significant changes before general availability.
Initially, we are posting results for:


New
Open F3
Open With
Open Type Hierarchy F4
Show In ⌥⌘W
Copy ⌘C
Copy Qualified Name
Paste ⌘V
Delete
Build Path
Source ⌥⌘S
Refactor ⌥⌘T
Import...
Export...
References
Declarations
Find Bugs
Refresh F5
Assign Working Sets...
Run As
Debug As
Coverage As
Validate
Team
Compare With
Replace With
Restore from Local History...
Properties ⌥↩
Find Bugs
Clear Bug Markers
Java – BAT2XMLPlugin/s
nAnalyzer.java – Eclipse SDK – /Users/Michael/Code/Java
Pack
Hier
Ant
Outli
CVS Reposit...
Debug
Return.java
Xor.java
SelectionAnalyzer.ja
Other Projects
SCM
CTfDS08
>BAT3
Opal
>BAT2XML
>BAT2XML BAT3XML [cage.st.informatik
BAT2XMLPlugin [cage.st.informatik.tu-d
src
de.tud.bat.io.xml.plugin
de.tud.bat.io.xml.plugin.configurat
de.tud.bat.io.xml.plugin.function
de.tud.bat.io.xml.plugin.helper
AnInput.java 1.3
ByteArrayStorage.java 1.2
SelectionAnalyzer.java 1.6
de.tud.bat.io.xml.plugin.job
de.tud.bat.io.xml.plugin.popup.acti
de.tud.bat.io.xml.plugin.preference
Plug-in Dependencies
JRE System Library [JVM 1.5]
META-INF
build.properties 1.3
plugin.xml 1.11
Columbus
Eclipse
Magellan
Sextant
DS@BA0809
de.tud.bat.io.xml.plugin.helper....naly
current.toFile().toURL();
currentResult.getLocation().toFile().toURL();
.length] = wsRoot.findMember(output).getLocation().toFile().toURL
r and tell him to look in all positions where binaries
elected type belongs to
= new URLClassLoader(classPathURLs);
tResource(fqnName.replace('.','/') + ".class");
ption from the handling of the class path
rom the handling of file / path locations and from the readClassF
Exception from the readClassFile method
tatus.ERROR);
an error occured
fqnName + ".",
.ERROR,
Plugin.getDefault().getBundle().getSymbolicName(),
OK,
during loading the binary file for " + fqnName + ".",


Java – BAT2XMLPlugin/src/de/tud/bat/io/xml/plugin/helper/SelectionAnalyzer.java – Eclipse SDK – /Users/Michael/Code/Java
CVS Reposit...
Debug
Pack
Hier
Ant
Outli
BasicBlock.java
ExecutionGraph.java
Return.java
Xor.java
SelectionAnalyzer.ja
40
Other Projects
SCM
CTfDS08
>BAT3
Opal
>BAT2XML
>BAT2XML BAT3XML [cage.st.inf
BAT2XMLPlugin [cage.st.informa
src
de.tud.bat.io.xml.plugin
de.tud.bat.io.xml.plugin.cor
de.tud.bat.io.xml.plugin.fun
de.tud.bat.io.xml.plugin.hel
AnInput.java 1.3
ByteArrayStorage.java 1.
SelectionAnalyzer.java 1
de.tud.bat.io.xml.plugin.job
de.tud.bat.io.xml.plugin.po
de.tud.bat.io.xml.plugin.pre
Plug-in Dependencies
JRE System Library [JVM 1.5]
META-INF
build.properties 1.3
plugin.xml 1.11
Columbus
Eclipse
Magellan
Sextant
DS@BA0809
Finding bugs in BAT2XMLPlugin...
Prescanning... (found 0, checking org.eclipse.ui.ISharedImages)
Always run in background
Cancel
Details >>
Run in Background
classPathURLs[i] = current.toFile().toURL();
else
classPathURLs[i] = currentResult.getLocation().toFile().toURL();
}
classPathURLs[classPath.length] = wsRoot.findMember(output).getLocation().toFile().toURL
// create a class loader and tell him to look in all positions where binaries
// of the project the selected type belongs to
class");
th
ns and from the readClassF
"Error during loading the binary file for " + fqnName + ".",
new Status(
IStatus.ERROR,
BAT2XMLPlugin.getDefault().getBundle().getSymbolicName(),
Status.OK,
"Error during loading the binary file for " + fqnName + ".",
e),
0xFFFF).open();
}
classFileURL = binary;
}
de.tud.bat.io.xml.plugin.helper....nalyzer.java – BAT2XMLPlugin/src
148M of 216M


Java – BAT2XMLPlugin/src/de/tud/bat/io/xml/plugin/helper/SelectionAnalyzer.java – Eclipse SDK – /Users/Michael/Code/Java
CVS Reposit...
Debug
Pack
Hier
Ant
Outli
BAT2XMLPlugin
src
de.tud.bat.io.xml.plugin
BAT2XMLPlugin.java 1.3
de.tud.bat.io.xml.plugin.configuration
de.tud.bat.io.xml.plugin.function
de.tud.bat.io.xml.plugin.helper
AnInput.java 1.3
ByteArrayStorage.java 1.2
SelectionAnalyzer.java 1.6
de.tud.bat.io.xml.plugin.job
FlowGraphJob.java 1.7
de.tud.bat.io.xml.plugin.popup.actions
ToFlowGraph.java 1.11
ToXMLAction.java 1.11
de.tud.bat.io.xml.plugin.preferences
Plug-in Dependencies
JRE System Library [JVM 1.5]
META-INF
build.properties 1.3
plugin.xml 1.11
FlowGraphJob.java
ToFlowGraph.java
BAT2XMLPlugin.java
SelectionAnalyzer.ja
41
classPathURLs[i] = current.toFile().toURL();
else
classPathURLs[i] = currentResult.getLocation().toFile().toURL();
}
classPathURLs[classPath.length] = wsRoot.findMember(output).getLocation().toFile().toURL
// create a class loader and tell him to look in all positions where binaries
// of the project the selected type belongs to
ClassLoader classLoader = new URLClassLoader(classPathURLs);
binary = classLoader.getResource(fqnName.replace('.','/') + ".class");
} catch (Exception e) {
// can be JavaModelException from the handling of the class path
// IOException from the handling of file / path locations and from the readClassF
// ClassNotFoundException from the readClassFile method
// log the error
BAT2XMLPlugin.log(e, IStatus.ERROR);
Problems
Javadoc
Declaration
Bug Explorer
Bug User Annotations
Error Log
BAT2XMLPlugin (5) [cage.st.informatik.tu-darmstadt.de]
Classloaders should only be created inside doPrivileged block (1)
de.tud.bat.io.xml.plugin.helper.SelectionAnalyzer.analyze(ISelection) creates a java.net.URLClassLoader classloader, which should
Dead store to local variable (1)
Dead store to dotExit
Field names should start with a lower case letter (2)
The field name de.tud.bat.io.xml.plugin.popup.actions.ToFlowGraph.PreTransformXSLFile doesn't start with a lower case letter
The field name de.tud.bat.io.xml.plugin.popup.actions.ToFlowGraph.ToDotXSLFile doesn't start with a lower case letter
Write to static field from instance method (1)
Write to static field de.tud.bat.io.xml.plugin.BAT2XMLPlugin.plugin from instance method new de.tud.bat.io.xml.plugin.BAT2XML
de.tud.bat.io.xml.plugin.helper.SelectionAnalyzer.java – BAT2XMLPlugin/src
146M of 247M

Fork me on GitHub

PMD is a source code analyzer. It finds common programming flaws like unused variables, empty catch blocks, unnecessary object creation, and so forth. It supports Java, JavaScript, XML, XSL.
Additionally it includes CPD, the copy-paste-detector. CPD finds duplicated code in Java, C, C++, C#, PHP, Ruby, Fortran, JavaScript.

- Latest version
- Get Involved
- Plugins
- Recent Announcements
- Next development version
- Previous versions

Latest version

5.2.1 (3rd November 2014)

- Release Notes
- Download (Sourcecode, Documentation)
- Online Documentation

Checkstyle 6.1

Last Published: 2014-11-13 | Version: 6.1

Overview

Checkstyle is a development tool to help programmers write Java code that adheres to a coding standard. It automates the process of checking Java code to spare humans of this boring (but important) task. This makes it ideal for projects that want to enforce a coding standard.

Checkstyle is highly configurable and can be made to support almost any coding standard. An example configuration files are supplied supporting the Sun Code Conventions, Google Java Style.

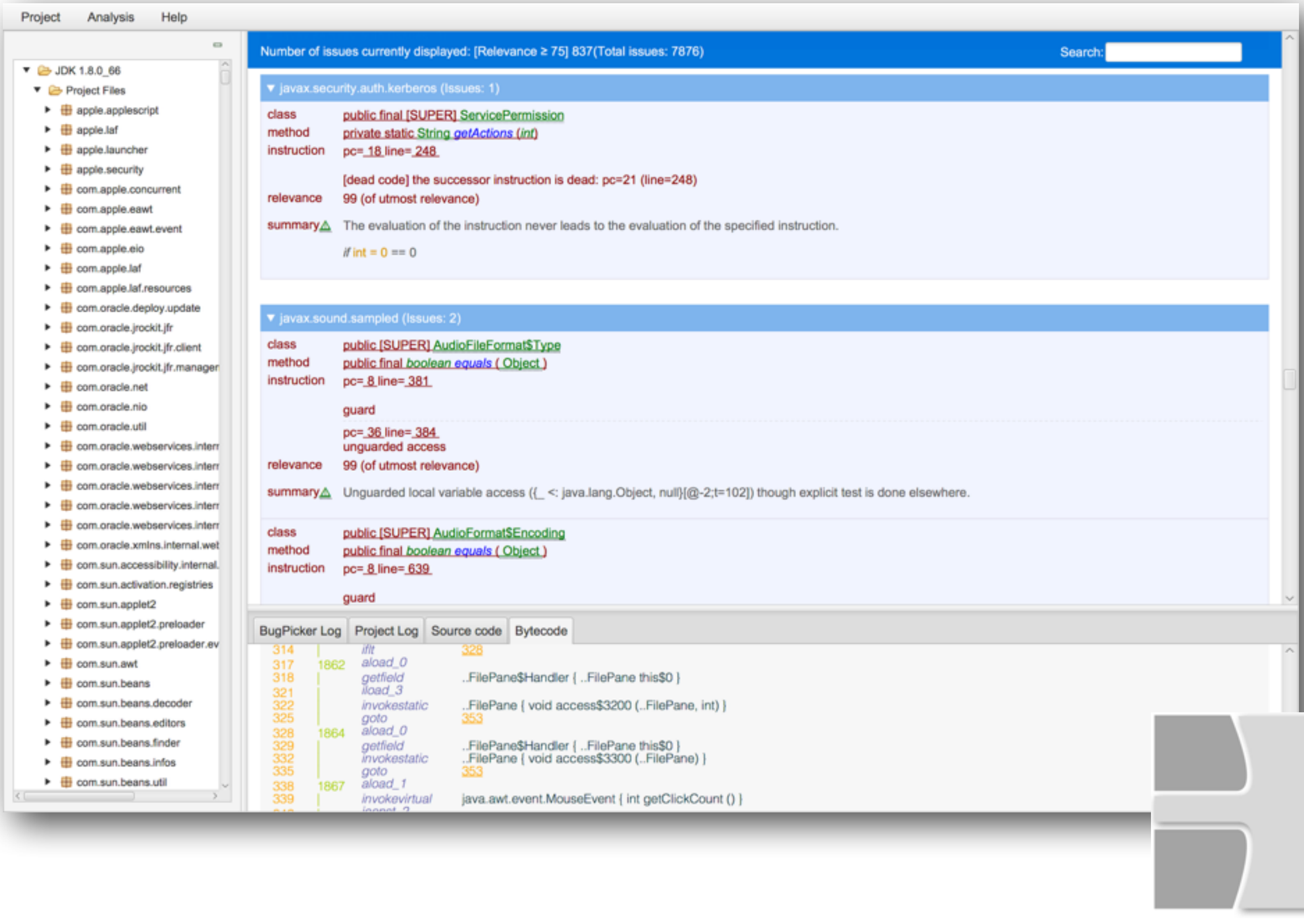
A good example of a report that can be produced using Checkstyle and Maven can be seen here.

Important Development Changes

As of September 2013, the Checkstyle project is using GitHub for hosting the following:

- Source code repository - replacing the Mercurial repository on SourceForge.
- Issue management - replacing the Bugs/Feature/Patches on SourceForge. All new issues should be raised at GitHub, and pull requests are now the preferred way to submit patches.

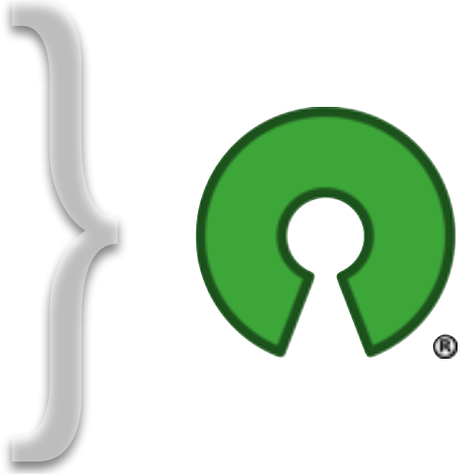
SourceForge will still be used for website hosting and binary hosting for downloads.


Project
Analysis
Help
JDK 1.8.0_66
Project Files
apple.applescript
apple.laf
apple.launcher
apple.security
com.apple.concurrent
com.apple.eawt
com.apple.eawt.event
com.apple.eio
com.apple.laf
com.apple.laf.resources
com.oracle.deploy.update
com.oracle.jrockit.jfr
com.oracle.jrockit.jfr.client
com.oracle.jrockit.jfr.manager
com.oracle.net
com.oracle.nio
com.oracle.util
com.oracle.webservices.intern
com.oracle.webservices.intern
com.oracle.webservices.intern
com.oracle.webservices.intern
com.oracle.webservices.intern
com.oracle.xmlns.internal.wet
com.sun.accessibility.internal.
com.sun.activation.registries
com.sun.applet2
com.sun.applet2.preloader
com.sun.applet2.preloader.ev
com.sun.awt
com.sun.beans
com.sun.beans.decoder
com.sun.beans.editors
com.sun.beans.finder
com.sun.beans.infos
com.sun.beans.util
Number of issues currently displayed: [Relevance ≥ 75] 837(Total issues: 7876)
Search:
javax.security.auth.kerberos (Issues: 1)
class public final [SUPER] ServicePermission
method private static String getActions (int)
instruction pc= 18 line= 248
[dead code] the successor instruction is dead: pc=21 (line=248)
relevance 99 (of utmost relevance)
summary The evaluation of the instruction never leads to the evaluation of the specified instruction.
if int = 0 == 0
javax.sound.sampled (Issues: 2)
class public [SUPER] AudioFileFormat$Type
method public final boolean equals (Object)
instruction pc= 8 line= 381
guard
pc= 36 line= 384
unguarded access
relevance 99 (of utmost relevance)
summary Unguarded local variable access ({_ <: java.lang.Object, null}[@-2;t=102]) though explicit test is done elsewhere.
class public [SUPER] AudioFormat$Encoding
method public final boolean equals (Object)
instruction pc= 8 line= 639
guard
BugPicker Log
Project Log
Source code
Bytecode
314 ifit 328
317 1862 aload_0
318 getfield ..FilePane$Handler { ..FilePane this$0 }
321 iload_3
322 invokestatic ..FilePane { void access$3200 (..FilePane, int) }
325 goto 353
328 1864 aload_0
329 getfield ..FilePane$Handler { ..FilePane this$0 }
332 invokestatic ..FilePane { void access$3300 (..FilePane) }
335 goto 353
338 1867 aload_1
339 invokevirtual java.awt.event.MouseEvent { int getClickCount () }

A Few (Well Known)

Static Analysis Tools

- JDepend
  Structural analysis on top of Java Bytecode.
- DependencyFinder
  Structural analysis on top of Java Bytecode.
- Stan4J
  Structural analysis on top of Java Bytecode.
- Sonargaph (SonarJ)
  Analyzes the structure of applications.



A Few (Well Known)

Static Analysis Tools

- ESC/Java2
  Formal verification using JML Annotations.
- Key
  Formal verification.
- …

Analytical SQA

violations of best practices/bug patterns

code clone detection

	reusability	maintainability	correctness	effort
lightweight static analyses	✓		✓	↓-○
semi formal methods			✓	↓
formal methods			✓	↑
structure analyses	✓	✓		↓
style conformance checking		✓		↓
architecture conformance checking	✓	✓		○-↑

Classifying Found Issues

- **True** and **False** Positives
- **True** and **False** Negatives
- **Irrelevant True** Positives
- **Perceived False** Positives

True and **False** Positives

- a **True** Positive is the correct finding *(of something relevant)*

This is what static analyses should detect.

- a **False** Positive is a finding that is just incorrect

False positives are typically caused by the weaknesses of the analysis.

Example of a **True** Positive

Let's assume that we have a "basic" analysis to detect object accesses (`o.xyz`) that appear in a guarded context (`if (o != null)`) and also outside a guarded context.

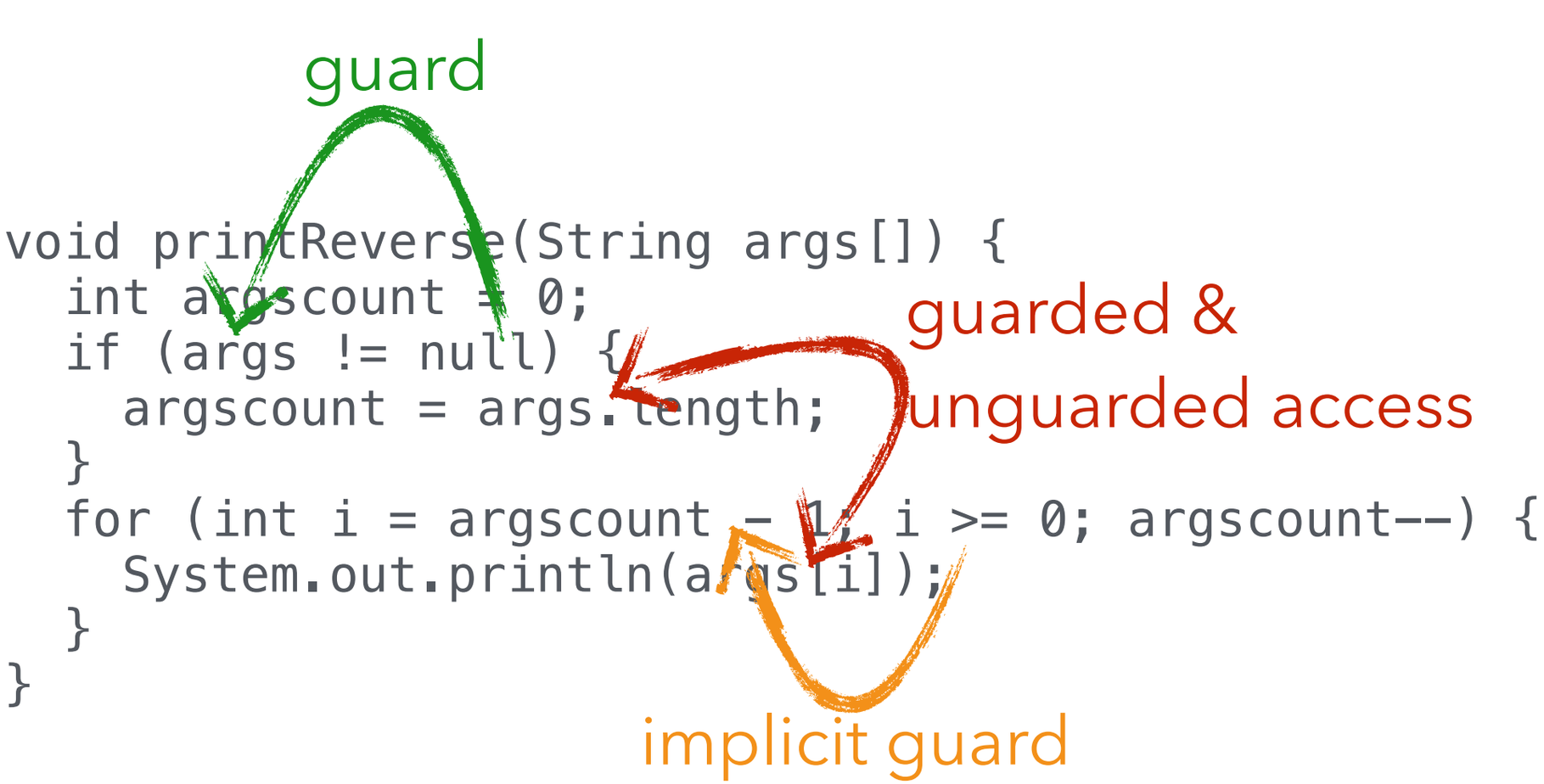
```
void printIt(String args[]) {
  if (args != null) {
    System.out.println("number of elements: " + args.length);
  }
  for (String arg : args) {
    System.out.println(arg);
  }
}
```

guard

guarded & unguarded access

Example of a **False** Positive

Let's assume that we have a "basic" analysis to detect object accesses (`o.xyz`) that appear in a guarded context (`if (o != null)`) and also outside a guarded context.



True and **False** Negatives

- a **True** Negative is the correct finding of no issue.
- a **False** Negative is an issue that is not reported.

Generally, only relevant in the context of formal approaches.

Irrelevant True Positives

- Irrelevancy is context-dependent…
  - Issues related to Serialization are irrelevant when your application doesn't use Serialization at all.
  - A violation of the `hashCode-equals` contract may be completely irrelevant for an (inner) class that is never put in a collection that uses hashes.
  - …

Irrelevant True Positives


```
boolean handleIt(int i) {
    if (i < 0 || i > 2)
        throw new IllegalArgumentException();

    switch (i) {
    case 0:
    case 1:
        return true;

    case 2:
        return false;

    default:
        throw new UnknownError();
    }
}
```

They are typically related to:

- default cases in switch statements
- assertions
- a test that leads to an AssertionError

Perceived False Positives


```
GeneralPath result = new GeneralPath(GeneralPath.WIND_NON_ZERO);
…
if (dx != 0 || dy != 0) {
  AffineTransform tx = AffineTransform.getTranslateInstance(dx, dy);
  result = (GeneralPath)tx.createTransformedShape(result);
}
```

This cast will always fail!

java.awt.font.TextLayout - Line 2404ff

Perceived False Positives


```
GeneralPath result = new GeneralPath(GeneralPath.WIND_NON_ZERO);
…
if (dx != 0 || dy != 0) {
  AffineTransform tx = AffineTransform.getTranslateInstance(dx, dy);
  result = (GeneralPath)tx.createTransformedShape(result);
}
```

```
public Shape createTransformedShape(Shape pSrc) {
  if (pSrc == null) {
    return null;
  }
  return new Path2D.Double(pSrc, this);
}
```

java.awt.font.TextLayout - Line 2404ff

```
interface Shape

class Path2D implements Shape, Cloneable

/*inner*/ class Double extends Path2D implements Serializable
```

Perceived False Positives


```
GeneralPath result = new GeneralPath(GeneralPath.WIND_NON_ZERO);
…
if (dx != 0 || dy != 0) {
  AffineTran
  result = (
}

pub
  i

  }
  return new Path2D.Double(pSrc, this);
}
```

Perceived false positives are the result of issue reports related to complex issues and/or related to reports that are not easy to comprehend.

java.awt.font.TextLayout - Line 2404ff

```
interface Shape

class Path2D implements Shape, Cloneable

/*inner*/ class Double extends Path2D implements Serializable
```

Perceived False Positives


```
protected Icon getIconForType(int messageType) {
      if(messageType < 0 || messageType > 3) return null;
      String propertyName = null;
      switch(messageType) {
      case 0:
          propertyName = “OptionPane.errorIcon"; break;
      case 1:
          propertyName = “OptionPane.informationIcon"; break;
      case 2:
          propertyName = “OptionPane.warningIcon"; break;
      case 3:
          propertyName = “OptionPane.questionIcon"; break;
      }
      if (propertyName != null) {
          return (Icon)DefaultLookup.get(optionPane, this, propertyName);
      }
      return null;
}
```

Dead Code!

javax.swing.plaf.basic.BasicOptionPaneUI

Perceived False Positives


```
protected Icon getIconForType(int messageType) {
      String propertyName = null;
      switch(messageType) {
      case 0:
          propertyName = “OptionPane.errorIcon"; break;
      case 1:
          propertyName = “OptionPane.informationIcon"; break;
      case 2:
          propertyName = “OptionPane.warningIcon"; break;
      case 3:
          propertyName = “OptionPane.questionIcon"; break;
      default:
          return null;
      }
      return (Icon)DefaultLookup.get(optionPane, this, propertyName);
}
```

javax.swing.plaf.basic.BasicOptionPaneUI

Cryptic True Positives


```
boolean process() throws Exception {
  boolean done = false;
  do {
    Thread.sleep(500);
    done = (System.currentTimeMillis() % 100l == 0l);
  } while (!done);
  return !done;
}
```

Dead Edge!

Refactored: `return false;`


```
if (done)
    done = false
else
  done = true
return done
```

A Holistic View is required.

Software Process Model

...

Development Environment

Traceability Tools

Static/Dynamic Analysis Tools

(High-Level) Documentation

Modeling Languages

Domain Specific Languages

Programming Language

Software Quality

- Summary

TECHNISCHE UNIVERSITÄT DARMSTADT

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Does Distributed Development Affect Software Quality? An Empirical Case Study of Windows Vista

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Year of Publication: 2009
ISSN:1542-7730

acmqueue

Browser Security: Lessons from Google Chrome

Google Chrome developers focused on three key problems to shield the browser from attacks.

Charles Reis, Google; Adam Barth, UC Berkeley ; Carlos Pizano, Google

The Web has become one of the primary ways people interact with their computers, connecting people with a diverse landscape of content, services, and applications. Users can find new and interesting content on the Web easily, but this presents a security challenge: malicious Web-site operators can attack users through their Web browsers. Browsers face the challenge of keeping their users safe while providing a rich platform for Web applications.

Browsers are an appealing target for attackers because they have a large and complex trusted computing base with a wide network-visible interface. Historically, every browser at some point has contained a bug that let a malicious Web-site operator circumvent the browser's security policy and compromise the user's computer. Even after these vulnerabilities are patched, many users continue to run older, vulnerable versions.[5] When these users visit malicious Web sites, they run the risk of having their computers compromised.

Generally speaking, the danger posed to users comes from three factors, and browser vendors can help keep their users safe by addressing each of these factors:

- **The severity of vulnerabilities.** By sandboxing their rendering engine, browsers can reduce the severity of vulnerabilities. Sandboxes limit the damage that can be caused by an attacker who exploits a vulnerability in the rendering engine.
- **The window of vulnerability.** Browsers can reduce this window by improving the user experience

Recall the “fifteen principles of Software Engineering”.

Take responsibility!

There are no excuses. If you develop a system, it is your responsibility to do it right. Take that responsibility. Do it right, or don’t do it at all.

The goal of this lecture is to enable you to systematically carry out small(er) software projects that produce quality software.

- Software quality is not just about the (internal) quality of the source code.
- Software quality means different things to different stake holders.
- To produce quality software a holistic view on a software project is required.

- The goal of this lecture is to enable you to systematically carry out small(er) commercial or open-source projects.