Java Software Evolution Tracker
jSET – in a nutshell

- Software analysis and visualization tool
  - at the moment works with Java software
- Written entirely using Java
- Developed using the Eclipse Platform
- Uses
  - Eclipse Java Development Tools
  - diff-match-patch
  - Bytecode Engineering Library
  - JGraphX
  - GUITAR framework
  - Soot framework
What’s the problem?

Modern software is complex

• FreeMind
  • 544 classes
  • ~65k lines of code
  • ~4000 daily downloads

• jEdit
  • 872 classes
  • ~106k lines of code
  • ~1000 daily downloads
### What’s the problem?

<table>
<thead>
<tr>
<th>Most software is GUI based</th>
<th>Untapped knowledge from academia</th>
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<tbody>
<tr>
<td>• Wide array of devices</td>
<td>• Apply already gained knowledge into useful products</td>
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<td>• Smartphones, Notebooks, Tablets</td>
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<tr>
<td>• Varied user interaction paradigms</td>
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<tr>
<td>• Key&amp;mouse, touch, speech</td>
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jSET – the mission

Guiding ideas

• Provide advanced visualization tools that work without a complicated setup phase.

• Integrate the obtained results in the context of GUI driven applications by offering seamless transition in visualization from GUI level down to viewing the application’s source code.

• Facilitate identification and analysis of changes across versions of a software system from GUI changes to source code modifications.
jSET – under the bonnet

GUITAR toolset
- Developed at University of Maryland
- Tools for automated GUI testing

SOOT framework
- Developed at McGill University
- Static program analysis for Java
jSET – under the bonnet

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Call Graph

- A directed graph
- Nodes are Methods
- Edges are “calls” relationship
- Built statically
- Analyses the entire Java platform for completeness
Earlier efforts

- Developed by Eric Bodden et al.
- Uses early version of Soot for calling relation visualization
- Allows tracking back to source by building the compilation unit’s AST.
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A project file contains:

- GUI model
- Callgraph file
- Application code
- Application source code

A project example

```xml
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<project>
  <ApplicationDirectory>\application</ApplicationDirectory>
  <FrameworkDirectory>..\.framework</FrameworkDirectory>
  <LibraryDirectory>\library</LibraryDirectory>
  <CallgraphFile>\.FreeMind.2000.11.01.CVS.callgraph</CallgraphFile>
  <GUIFile>\.FreeMind.2000.11.01.CVS.GUI.xml</GUIFile>
  <ScreenshotDirectory>\.screenshots</ScreenshotDirectory>
  <MainClass>freemind.main.Freemind</MainClass>
  <ProjectName>FreeMind.2000.11.01.CVS</ProjectName>
  <SourceDirectory>\.src</SourceDirectory>
</project>
```
Project exploration
• Explore a given version of a software system

Project comparison
• Visualize the changes that occurred across versions
Exploration mode

Comparison mode

Screenshot tab
Exploration mode

Comparison mode

Listeners tab
Project exploration
- Explore a given version of a software system

Project comparison
- Visualize the changes that occurred across versions
Exploration mode

Comparison mode

Callgraph comparison view

Method has changed

Method has not changed

Deleted call

New call
How do I get started?

Project repository

- [http://sourceforge.net/projects/javaset/](http://sourceforge.net/projects/javaset/)
- FreeMind
  - 13 versions
  - November 2000 – September 2007
  - Taken from project CVS
- jEdit
  - 17 versions
  - January 2000 – May 2010
  - Released versions 2.3pre2 – 4.3.2
Limitations

• Dynamic user interfaces
  • Some widgets might not be recorded if they’re not displayed all the time
• Native methods
  • Might have unknown side-effects
• Reflection
  • Adds complexity to call graph
• Platform dependency
  • GUITAR is multi-platform
    • but...
  • where is Soot for other platforms?
Future work

• Multi-version views
• Identify changed components across versions
  • already in progress
• Tackle web applications
• Integration with a test running platform
  • already in progress
Thank You!
Bibliography

- GUITAR home
- Soot home
- jSET home
  - https://sourceforge.net/projects/javaset
- Janalyzer home
  - http://sourceforge.net/projects/janalyzer