Code Coverage Analysis for Eclipse

EclipseCon 2008, Santa Clara

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Focus

Technical

Java

Eclipse

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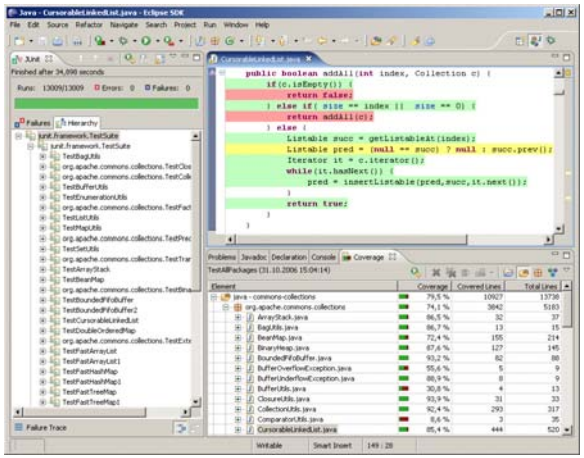
Topics

- Principles and Techniques
- Code Coverage Tools in Eclipse
- Coverage Analysis of Eclipse Apps



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Tutorial Prerequisites

- Eclipse 3.3.x
- Tutorial Data

Tutorial USB Sticks

http://www.eclemma.org/research

EclipseCon 2008

Tutorial: Code Coverage Analysis for Eclipse by Marc R. Hoffmann and Gilles Iachelini at EclipseCon, 2008/03/17

- Presentation
- **Tutorial Data ← Download for tutorial attendees**

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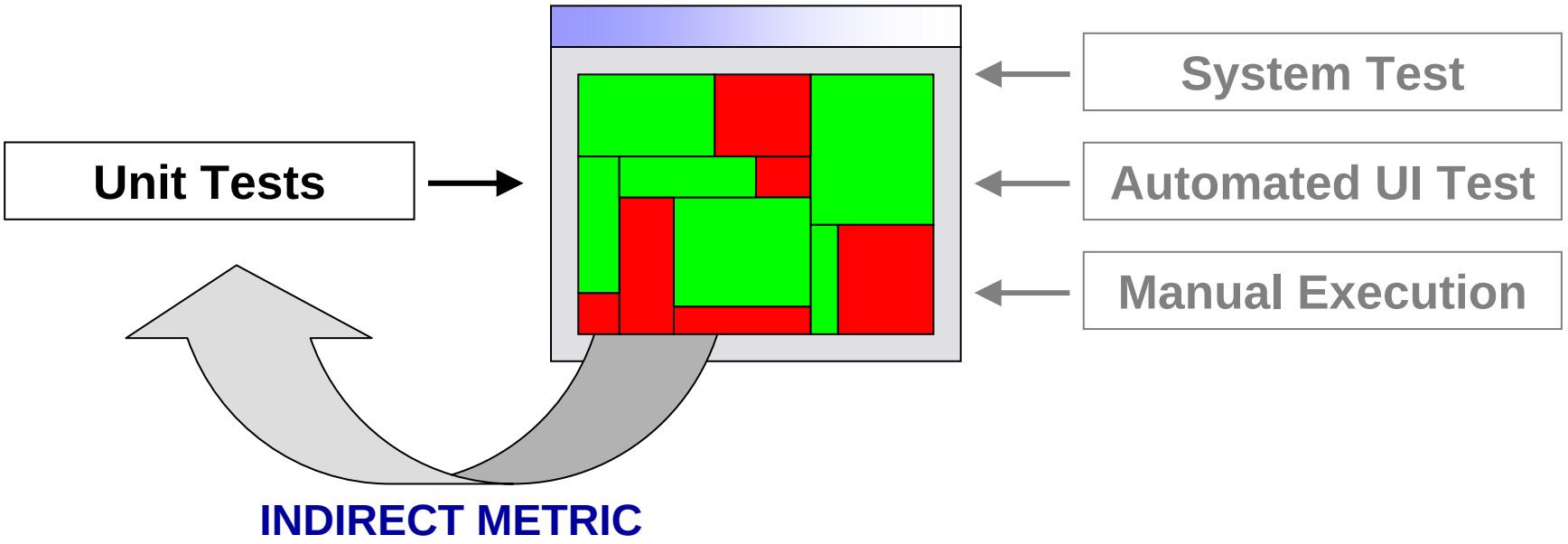
Usage Scenario



White Box Testing

Black Box Testing

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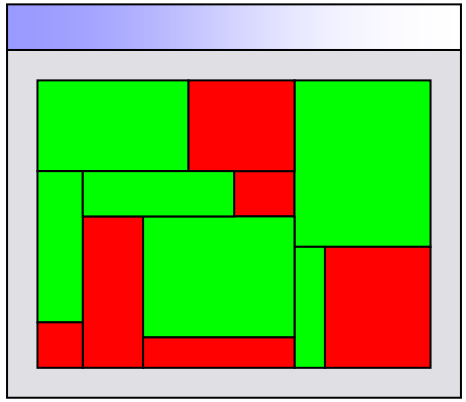
Coverage Units



- Control Flow Coverage
  - → Classes
  - → Methods
  - → Lines
  - → Statements
  - → Branches
  - → Paths

$$\textbf{Coverage Ratio} = \frac{\textbf{Covered Units}}{\textbf{Total Units}}$$

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Statement Coverage

```
public int clip(int lower, int upper, int x) {
    if (x < lower) {
        x = lower;
    }
    if (x > upper) {
        x = upper;
    }
    return x;
}
```

Test Set for Full Statement Coverage:

```
clip(1, 9, 0)
clip(1, 9, 10)
```

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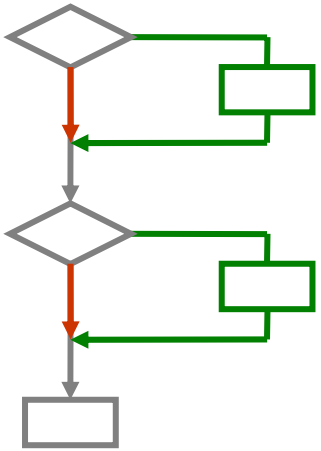
Branch Coverage

```
public int clip(int lower, int upper, int x) {
    if (x < lower) {
        x = lower;
    }
    if (x > upper) {
        x = upper;
    }
    return x;
}
```



Test Set for Full Branch Coverage:

```
clip(1, 9, 0)
clip(1, 9, 10)
```

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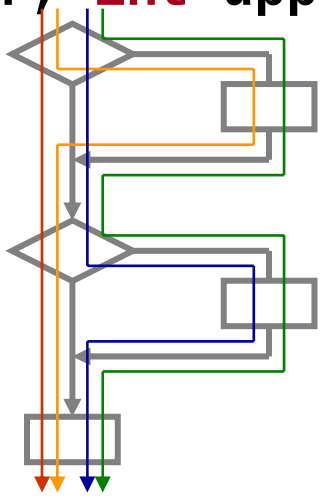
Path Coverage

```
public int clip(int lower, int upper, int x) {
    if (x < lower) {
        x = lower;
    }
    if (x > upper) {
        x = upper;
    }
    return x;
}
```



Test Set for Full Path Coverage:

```
clip(1, 9, 0)
clip(1, 9, 10)
clip(1, 9, 5)
clip(9, 1, 5)
```

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Granularity

OVERALL COVERAGE SUMMARY

name	method, %	line, %
all classes	85% (5733/6738)	79% (27528/34699)

COVERAGE BREAKDOWN BY PACKAGE

name	method, %	line, %
org.apache.commons.collections	81% (1632/2017)	75% (9580,8/12753)
org.apache.commons.collections.bag	69% (157/229)	77% (726,3/945)
org.apache.commons.collections.list	91% (534/585)	79% (2947,6/3723)
org.apache.commons.collections.set	89% (287/321)	83% (863,8/1041)
org.apache.commons.collections.comparators	89% (125/141)	80% (525,6/657)
org.apache.commons.collections.map	88% (1265/1440)	81% (5203,6/6449)
org.apache.commons.collections.iterators	82% (549/668)	79% (2402,1/3046)
org.apache.commons.collections.collection	90% (201/224)	83% (943,4/1141)
org.apache.commons.collections.buffer	91% (286/315)	86% (1455,9/1692)
org.apache.commons.collections.functors	76% (168/221)	86% (609,9/709)
org.apache.commons.collections.bidimap	92% (428/467)	89% (1851,4/2070)
org.apache.commons.collections.keyvalue	92% (101/110)	88% (417,6/473)

```
152     public boolean addAll(int index, Collection c) {
153         if(c.isEmpty()) {
154             return false;
155         } else if(_size == index || _size == 0) {
156             return addAll(c);
157         } else {
158             Listable succ = getListableAt(index);
159             Listable pred = (null == succ) ? null : succ.prev();
160             Iterator it = c.iterator();
161             while(it.hasNext()) {
162                 pred = insertListable(pred,succ,it.next());
163             }
164             return true;
165         }
166     }
```

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Tool Matrix

	Cmd	Ant	Eclipse
Clover		✓	✓
Coverlipse			✓
Cobertura	✓	✓	
EMMA/EclEmma	✓	✓	✓
TPTP			✓

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Coverage While You Work

Install EclEmma
`02_EclEmma_1.3.1/eclemma-1.3.1.zip`

Import sample application
`03_Exercise_1/...simplemath.zip`

Run **`FormulasTest`** as JUnit test

Identify lines in class Formulas not covered by the test cases.

Add test cases to get full coverage

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Coverage Data Analysis

Import Apache Collections Library
`04_Exercise_2/...collections.zip`

Run **`TestAllPackes`** as JUnit test

Explore Results in Coverage view

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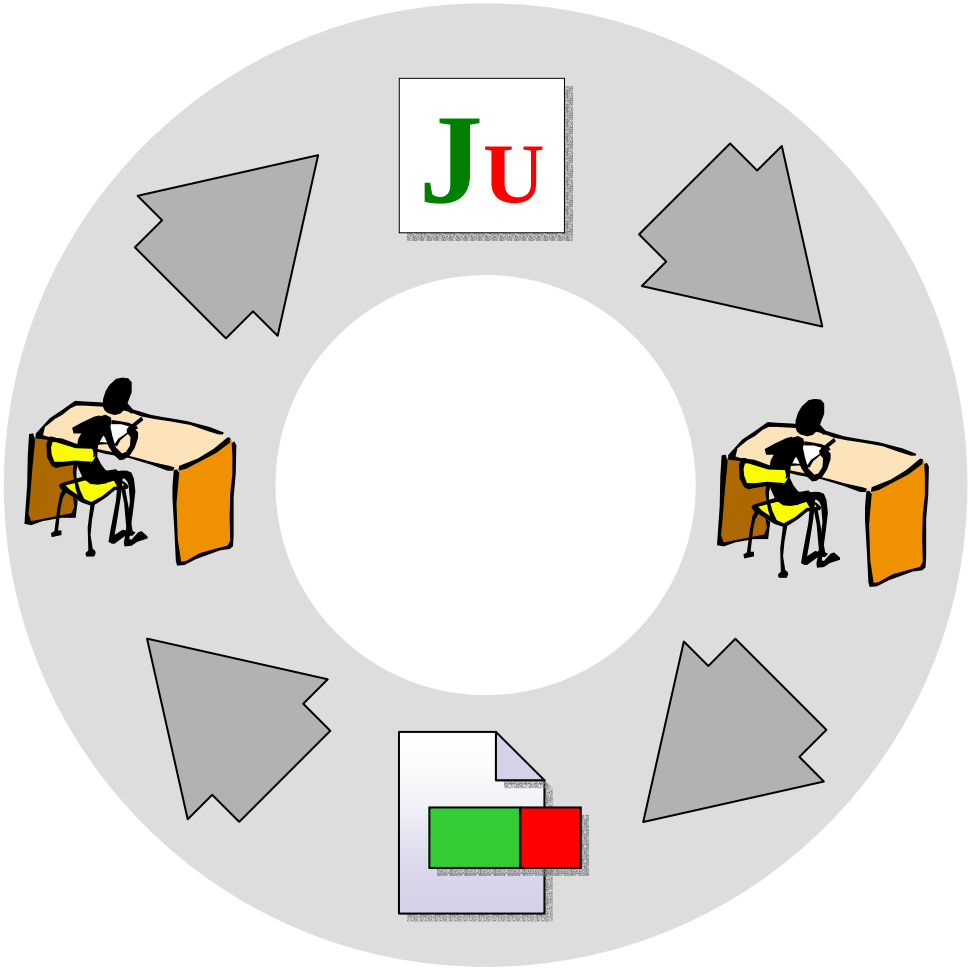
Feedback Loop

Write Tests



Fix It

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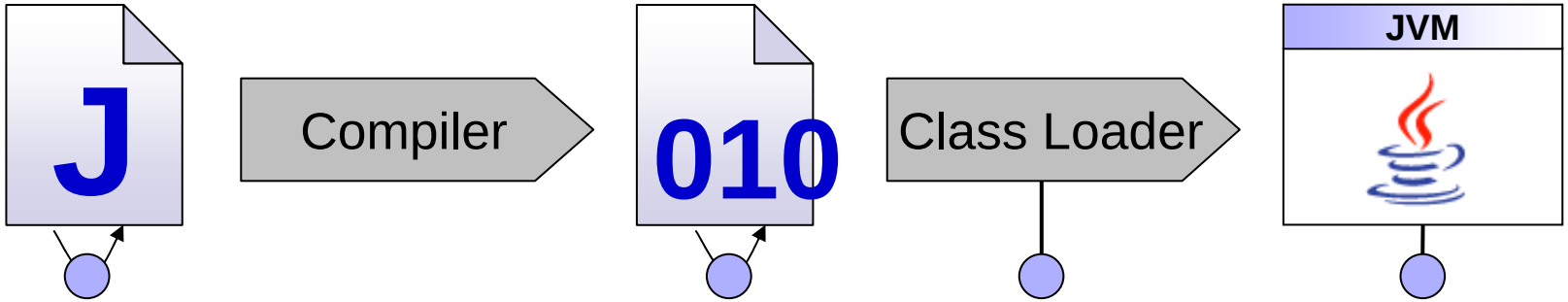
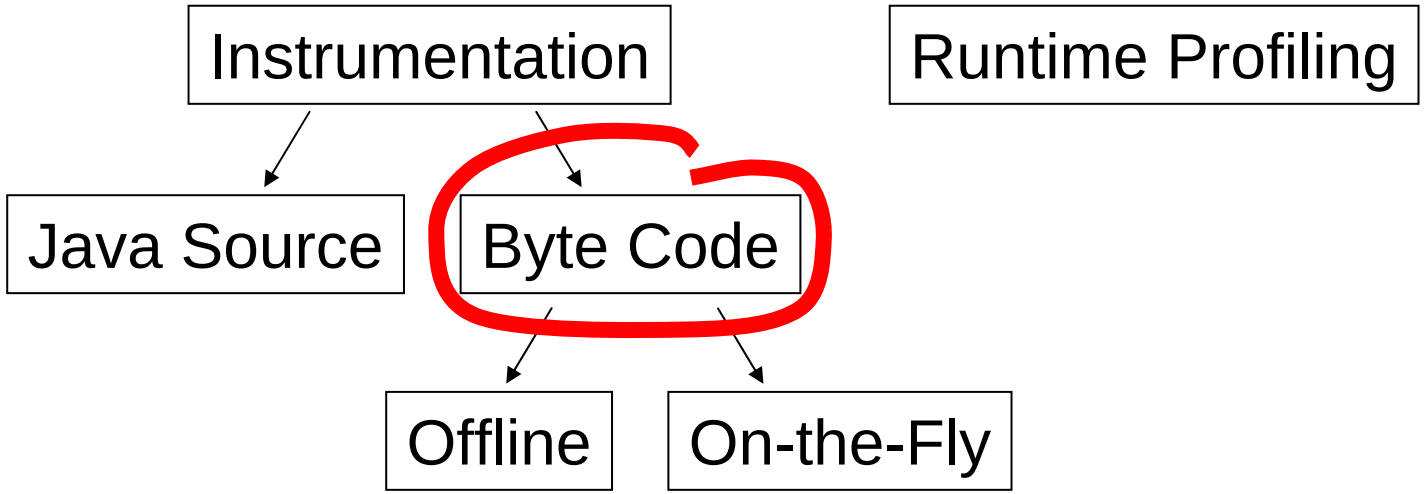
Implementation Strategies





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Why Byte Code Instrumentation?

- Performance Issues with JVM Profilers
- No Source Required
- Works on 3rd party JAR‘s
- Platform independent

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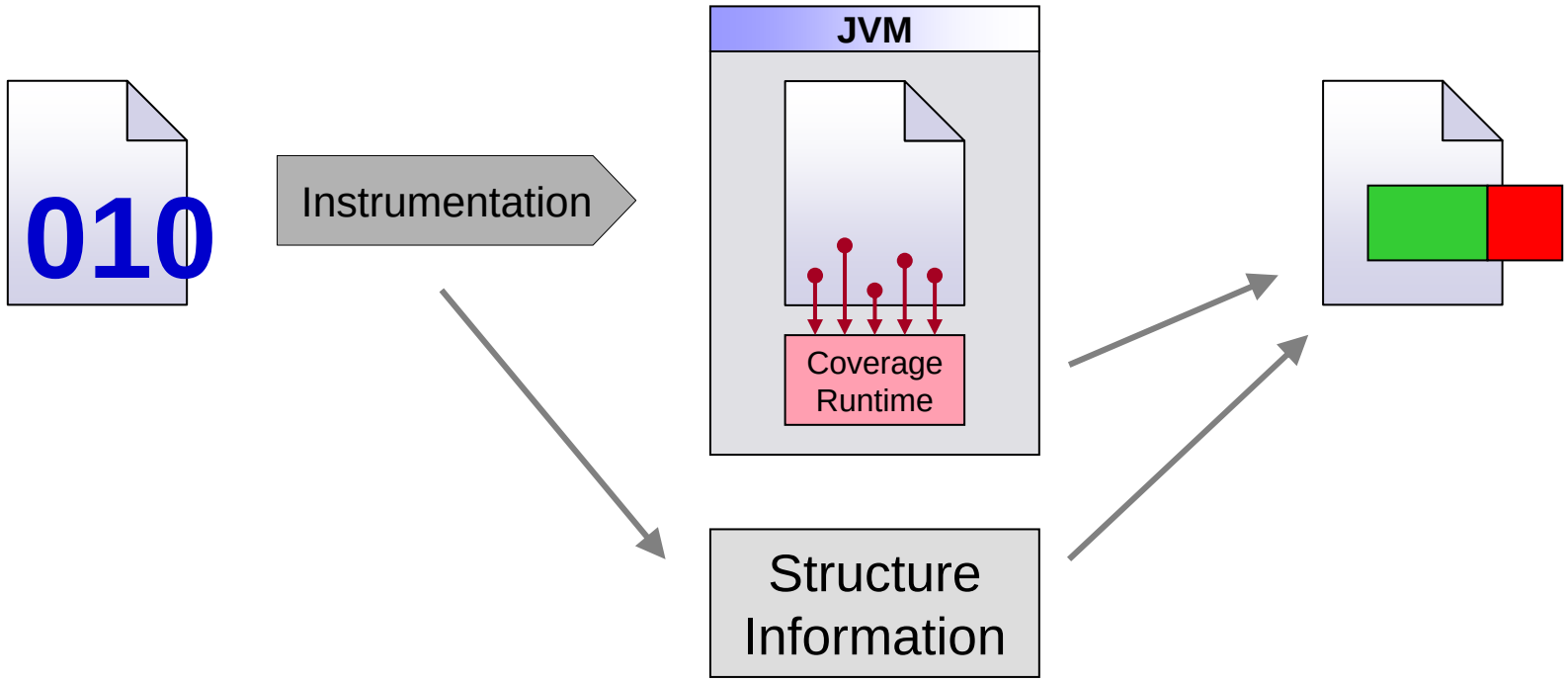
Byte Code Instrumentation



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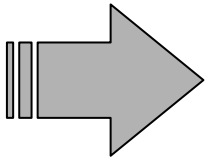
Byte Code Probes

```
  // access flags 9
  public static clip(III)I



   L0
    LINENUMBER 6 L0
    ILOAD 2
    ILOAD 0




    IF_ICMPGE L1
   L2
    LINENUMBER 7 L2
    ILOAD 0
    ISTORE 2



[…]
```



```
  // access flags 9
  public static clip(III)I
   L0
    GETSTATIC Formulas.$VRc : [[Z
   L1
    ICONST_1
    AALOAD
    ASTORE 3
   L2
    LINENUMBER 6 L2
    ILOAD 2
    ILOAD 0
   L3
    ALOAD 3
    ICONST_0
    ICONST_1
    BASTORE
    IF_ICMPGE L4
   L5
    LINENUMBER 7 L5
    ILOAD 0
    ISTORE 2
    ALOAD 3
    ICONST_1
    ICONST_1
    BASTORE
[…]
```

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Code Coverage for Eclipse/OSGi Bundles

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Code Coverage for JUnit Plug-In Tests

Import EclEmma Plug-ins
`05_Exercise_3/eclemma_core.zip`

Run **`AllEclEmmaCoreTests`** JUnit plug-in test

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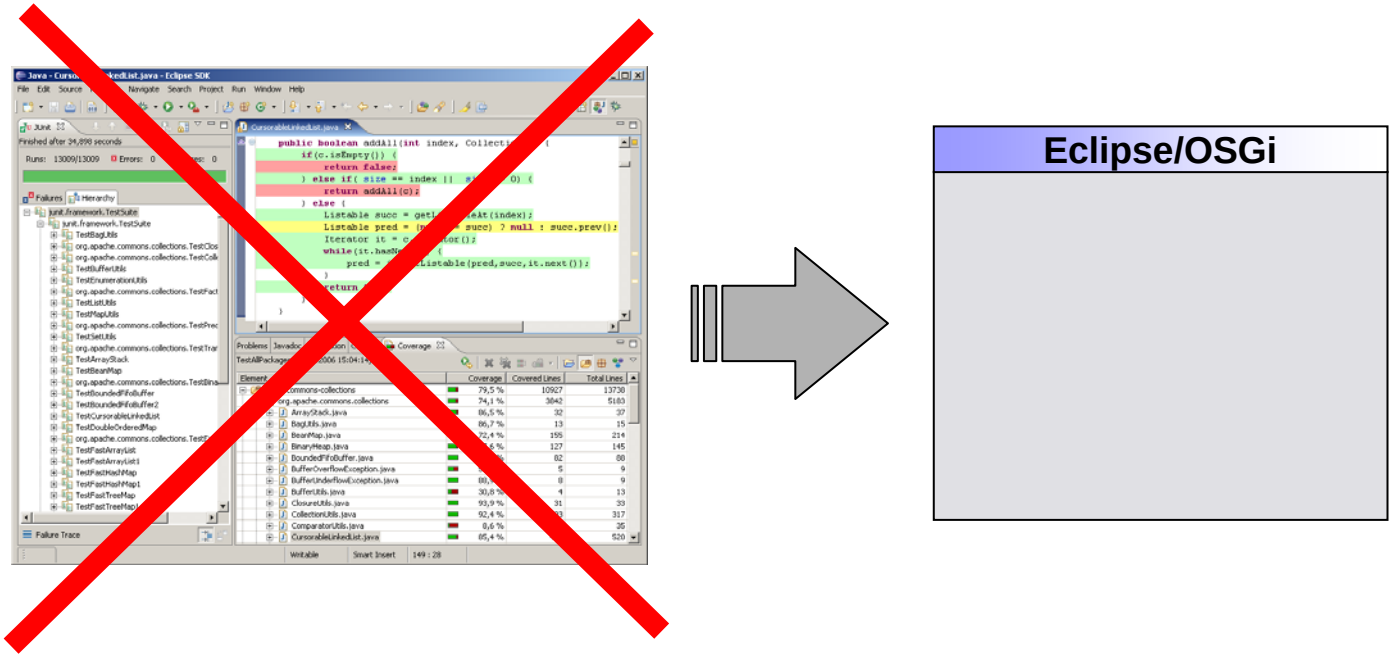
Headless?



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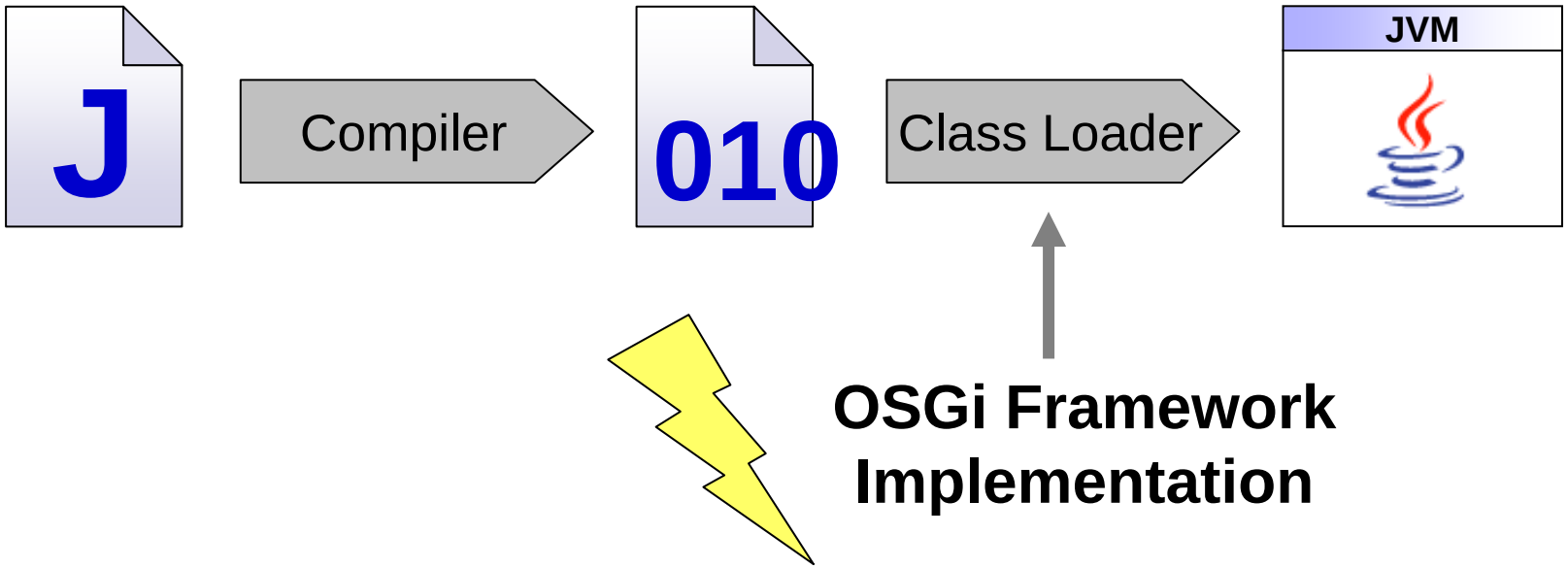
Class Loading via OSGi



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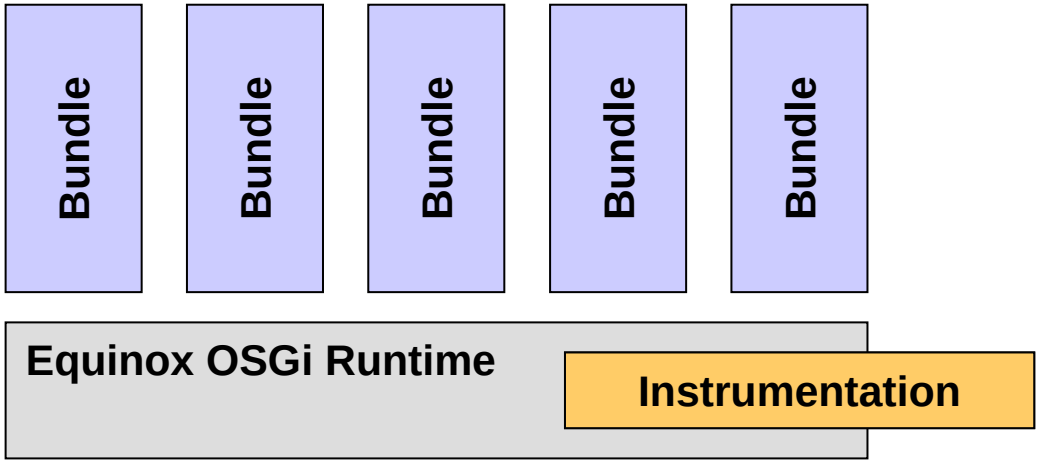
Equinox Adapter Hooks



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Code Coverage for Equinox

Copy to your plugins folder
`06_Exercise_4/…osgihook`

Insert into config.ini

```
osgi.framework.extensions=
  com.mountainminds.eclemma.osgihook
```

Start/Stop Eclipse

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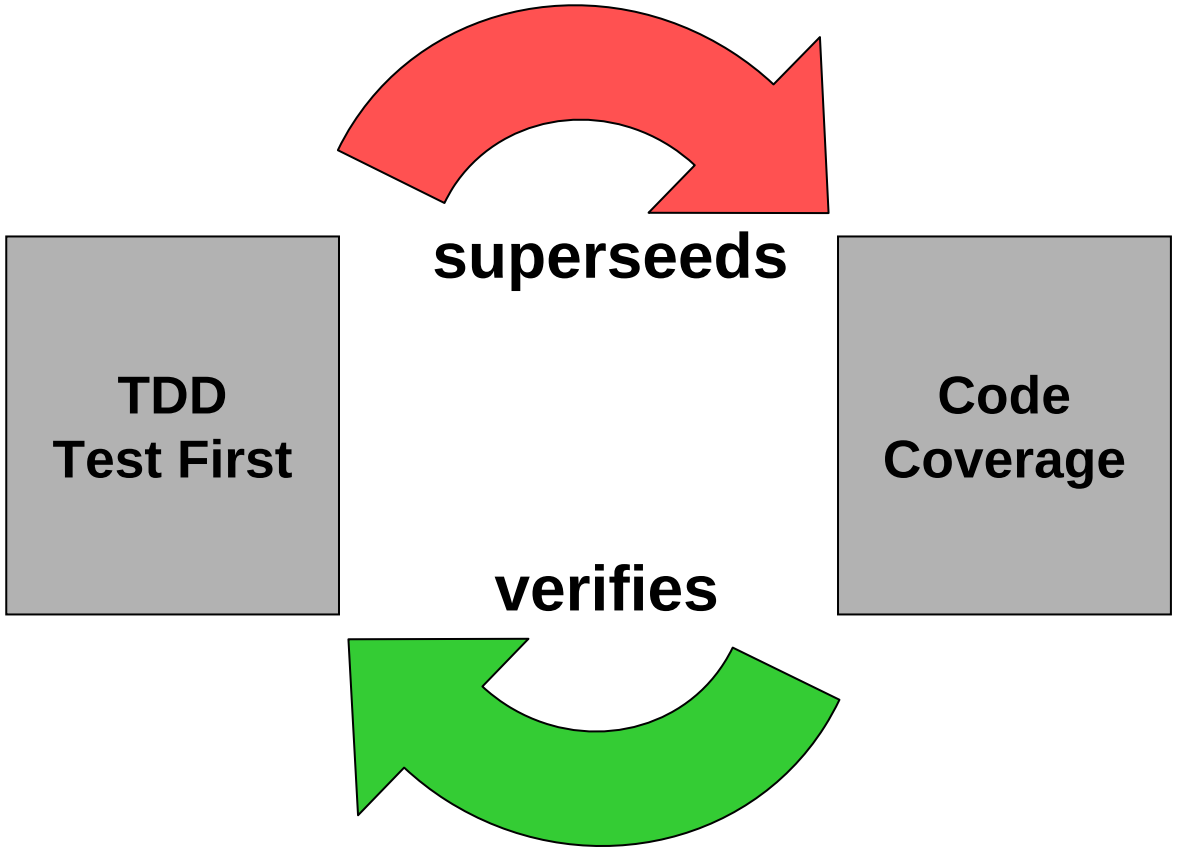
TDD/Test First ↔ Code Coverage



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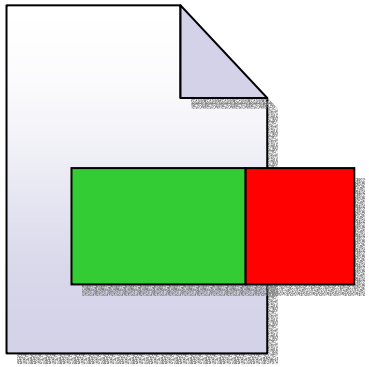
Thank You!

- Use Code Coverage
- It‘s Easy and Helpful



- OSGi/Equinox **is** Code Coverage Ready
- Makes Writing Unit Tests Fun

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References

- Code Coverage Tools
  - → Clover, http://www.atlassian.com/software/clover/
  - → Coverlipse, http://coverlipse.sourceforge.net/
  - → Cobertura, http://cobertura.sourceforge.net/
  - → CodeCover, http://codecover.org/
  - → EclEmma, http://www.eclemma.org/
  - → EMMA, http://emma.sourceforge.net/
  - → TPTP, http://www.eclipse.org/tptp/
- Byte Code Library and Outline Plug-in:
  - → ASM, http://asm.objectweb.org/
- Code Coverage for Equinox
  - → http://www.eclemma.org/research/instrumentingosgi/index.html

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