

**jcoverage™**

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# Chapter 1. Introduction

In a recent interview, James Gosling mused: "I don't think anybody tests enough of anything" (*A Conversation with James Gosling* (<http://www.artima.com/intv/goslingD4.html>)).

The fact is, software today is horrendously under-tested. Software maintenance costs are spiralling because few pieces of software can be changed with any degree of confidence that new bugs aren't being introduced.

Without continual change and improvement, software is unable to continue meeting its users' needs. But without comprehensive automated test-suites, such change can also expose users to very undesirable risks: the risk that critical features no longer function as before, the risk of data loss and the risk of a system crash.

Agile software development methodologies are helping improve the quality of software. Test-driven development, where tests are written to test features *before* those features are added, ensures that every piece of software is coupled with a test-suite.

## Why use a coverage tool?

No matter how good such methodologies are, and how diligently they're followed in an organisation, it isn't possible to ensure that software testing is as comprehensive as it could be. That's where tools can help.

jcoverage™ is a free, simple and easy-to-use tool that will complement your existing Java development practices. It helps you discover exactly where your software is being tested and, more importantly, where it *isn't*. jcoverage will help you to view your software from a number of levels, from the entire system right down to an individual line of code.

## Why use jcoverage?

Sure, there are other coverage tools around, so what makes jcoverage different?

Coverage analysers work by adding instrumentation. For Java, coverage analysers fall into three categories: those that insert instrumentation into the source code, those that add instrumentation to the Java byte-code, and those that run the code in a modified JVM. jcoverage adds instrumentation directly to the bytecode. We feel this is the best approach, since does not require a modified VM, but still retains a big speed advantage over having to recompile all your source code twice.

Secondly, jcoverage is easy to integrate with Apache Ant. It comes with it's own Ant task definitions for you to use. You can choose to instrument any code you wish, from a single class to an entire system.

Finally, jcoverage is completely free and not time-locked, so you can begin to use it today, without having to worry about what to do at the end of an evaluation period. What's more, we believe jcoverage is so easy to use, you'll be up and running in no time. So why not spend the next 15 minutes getting up and running with jcoverage. In that time, you'll certainly find out which parts of your code are completely tested, and where your code could do with a bit more testing...

## Chapter 2. Getting started

This chapter assumes you are already familiar with the Ant build tool from Apache. If you're unfamiliar with Ant, you can find out about it at <http://ant.apache.org>.

### Adding the jcoverage custom tasks to Ant

jcoverage seamlessly integrates with Ant using custom tasks. But before you can use these new tasks, you have to declare them in your Ant build file, typically named `build.xml`. This is done using the `taskdef` element, as shown below. Place this element anywhere in your Ant build file.

**Example 2-1. Adding the jcoverage custom tasks to Ant.**

```
<taskdef classpath="jcoverage.jar" resource="tasks.properties"/>
```

Now we're ready to start using the jcoverage tasks.

### Adding instrumentation to your classes

jcoverage works by inserting instrumentation instructions directly into your compiled Java classes. When these instructions are encountered by the Java Virtual Machine, the inserted code increments various counters so that it is possible to tell which instructions have been encountered and which have not.

You instruct Ant to create instrumented versions of your classes using the `<instrument>` task. The example below assumes the classes belong in a directory called `build/classes`.

**Example 2-2. Instrumenting classes.**

```
<instrument todir="build/instrumented-classes">
  <fileset dir="build/classes">
    <include name="**/*.class"/>
  </fileset>
</instrument>
```

### Running an instrumented application

Once your classes have been instrumented by jcoverage, you can continue testing your application as you would normally via the `<junit>` task.

Simply include a `<classpath>` entry for the instrumented classes *before* any reference to the original classes. This will ensure that the instrumented classes are loaded in preference to the original classes.

**Example 2-3. Testing the instrumented application**

```
<junit fork="yes">
  <classpath location="${build.instrumented.dir}"/>
  <classpath location="${build.classes.dir}"/>
  ...
</junit>
```

The instrumented classes found in `${build.instrumented.dir}` will be loaded before those found in `${build.classes.dir}` ensuring that the instrumented classes are used by `<junit>`.

An instrumented class serializes information into the file, `coverage.ser`. Any existing information found in this file will be merged with the current information. In this way the instrumentation for several sessions of a running program can be merged together, producing a single coverage report. For example, the instrumentation from unit and functional tests can be merged together to produce a single coverage report.

**coverage reporting**

An instrumented class serializes coverage information to the file `coverage.ser`. Using the `<report>` tag, coverage can generate coverage reports in either HTML or XML format.

**Example 2-4. HTML coverage report**

The default format for a coverage report is HTML.

```
<target name="coverage">
  <report srcdir="${src.dir}" destdir="${build.coverage.dir}"/>
</target>
```

**Example 2-5. XML coverage report**

The type of report generated is controlled by the `format` attribute of the `<report>` tag, which may be either “html” or “xml”. If the `format` is not supplied then it defaults to “html”.

```
<target name="coverage">
  <report format="xml" srcdir="${src.dir}" destdir="${build.coverage.dir}"/>
</target>
```

**coverage session merging**

Sometimes it is necessary to merge several coverage sessions together, for example, to produce a single consolidated coverage report from several different test runs of an application.

**Example 2-6. Session merging with the <merge> tag**

```

<merge>
  <fileset dir="{basedir}">
    <include name="**/jcoverage.ser"/>
  </fileset>
</merge>

```

The above fragment from an ANT build file, will merge together any serialised instrumentation that has been generated by jcoverage and produce a single consolidated instrumentation record.

**Taking control with jcoverage and <check>**

All too often testing is something that is left until the end of the development cycle. For example, a coverage report is run on a weekly basis over the codebase, only when the coverage metrics fall below a certain pain threshold are the developers directed to increase their test coverage and quality.

With jcoverage development teams can choose to enforce *test driven development* on their codebase, by using the <check> tag in their ANT build scripts.

After each *instrumented* unit test sequence, jcoverage can do a “health check” to ensure that the codebase is being tested to the standard that has been demanded by the team. If coverage standards fall below the criteria set by the team, <check> will fail the build.

Our intention with <check> is to ensure that test driven development practices are being followed by the entire development team. Inadequate testing will result in an immediate *automated* build failure, without having to study the entire coverage report.

**Example 2-7. <check>**

```

<check branch="80" line="80">
  <regex pattern="com.jcoverage.util.*" branch="85" line="95"/>
  <regex pattern="com.jcoverage.tool.*" branch="55" line="80"/>
  <regex pattern="com.jcoverage.coverage.*" branch="85" line="90"/>
</check>

```



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