JUnit

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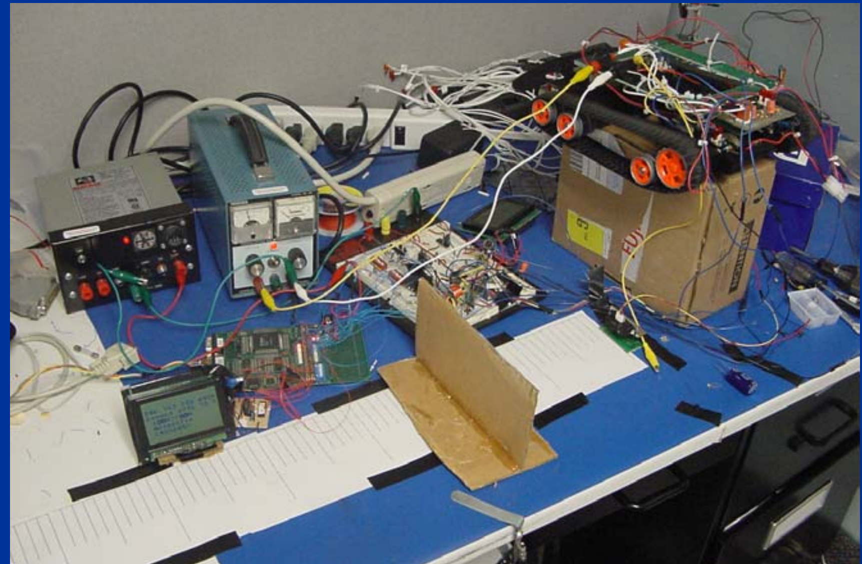
Agenda

- Background – Unit Testing
- JUnit Features - SimpleTest
- Looking Under the Hood
- More JUnit Examples

Testing, 1 – 2 – 3 – 4, Testing…



What Does a Unit Test Test?

- The term “unit” predates the O-O era.
- Unit – “natural” abstraction unit of an O-O system: class or its instantiated form, object.
- Unit Tests – verify a small chunk of code, typically a path through a method or function.
- Not application level functionality.

How Do We Unit Test?

- Print Statements (diffs against benchmarks)
- Debuggers – examine variables, observe execution paths.
- Typically done by unit developer.
- Best benefit if running of tests is ***automated***.
- Tests best run in isolation from one another.
- Tests built incrementally as product code is developed.

The Typical Test Cycle

- Develop a suite of test cases
- Create some test fixtures to support the running of each test case.
- Run the test – capture test results.
- Clean-up fixtures, if necessary.
- Report and analyze the test results.

Why is Unit Testing Good?

- Identifies defects early in the development cycle.
- Many small bugs ultimately leads to chaotic system behavior
- Testing affects the design of your code.
- Successful tests breed confidence.
- Testing forces us to read our own code – spend more time reading than writing
- Automated tests support maintainability and extendibility.

Why Don’t We Unit Test?

- “Coding unit tests takes too much time”
- “I’m to busy fixing bugs to write tests”
- “Testing is boring – it stifles my creativity”
- “My code is virtually flawless…”
- “Testing is better done by the testing department”
- “We’ll go back and write unit tests after we get the code working”

What is JUnit?

- JUnit is an open source Java testing framework used to write and run repeatable tests.
- It is an instance of the xUnit architecture for unit testing frameworks.
- JUnit features include:
  - Assertions for testing expected results
  - Test fixtures for sharing common test data
  - Test suites for easily organizing and running tests
  - Graphical and textual test runners

The JUnit Test Template

- Create a test class that extends TestCase
- Create a testxxx() method for each individual test to be run.
- Create a test fixture – resources needed to support the running of the test.
- Write the test, collect interesting test behavior
- Tear down the fixture (if needed)
- Run the tests with a text or Swing interface.

SimpleTest

```
import java.util.*;
import junit.framework.*;

public class SimpleTest extends TestCase{

    public void testEmptyCollection() {
        Collection testCollection = new ArrayList();
        assertTrue( testCollection.isEmpty());
    }


    public static void main(String args[]){
        junit.textui.TestRunner.run(SimpleTest.class);
    }
}
```

Key JUnit Concepts

- assert -
  - assertEquals(expected, actual) – also NotEquals
  - assertNull(actual result) – also NotNull
  - assertTrue(actual result) - also False
- failures –
  - Exceptions raised by asserts (expected)
- errors –
  - Java runtime exceptions (not expected)

Test Hierarchies

- JUnit supports test hierarchies
  - Test Suite-A
    - Test Case1
    - Test Case2
    - Test Suite-B
      - Test Case3
  - Test Suite-C

(and so on …)

JUnit Under the Hood

Originally written by Kent Beck and Erich Gamma. – design patterns.

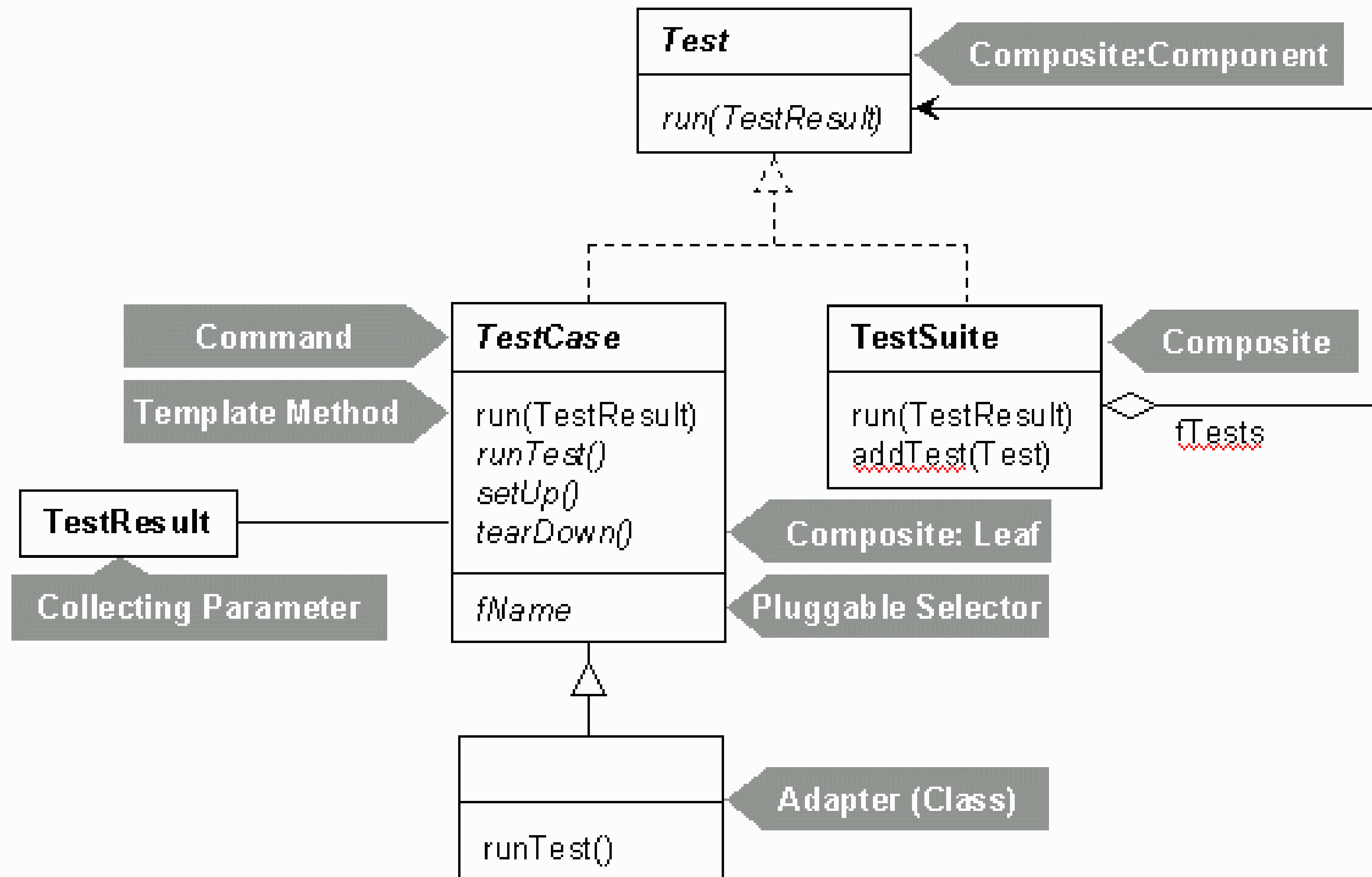
An offspring of a similar framework for Smalltalk (SUnit)

A common xUnit architecture has evolved and has been implemented in a variety of languages.

JUnit Design Objectives

- A simple framework that encourages developers to write unit tests.
- Minimalist framework – essential features, easier to learn, more likely to be used, flexible
- Test Cases & Test Results are objects
- Patterns – high "density" of patterns around key abstractions : mature framework

JUnit Framework Design

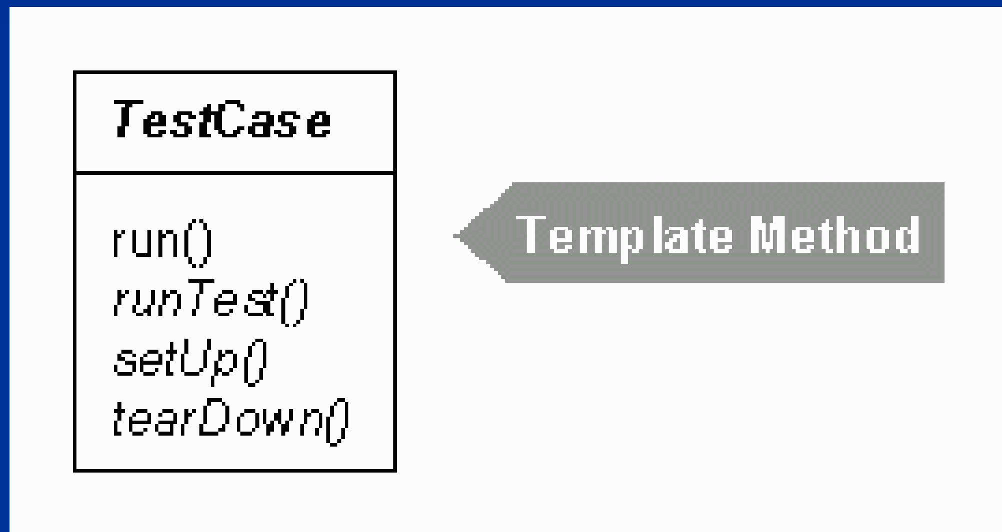


See the JUnit Cook's Tour for a full pattern analysis:
http://junit.sourceforge.net/doc/cookstour/cookstour.htm

TestCase

- TestCase.run() applies Template Method pattern

```
public void run(){
    setup();
    runTest();
    tearDown();
}
```

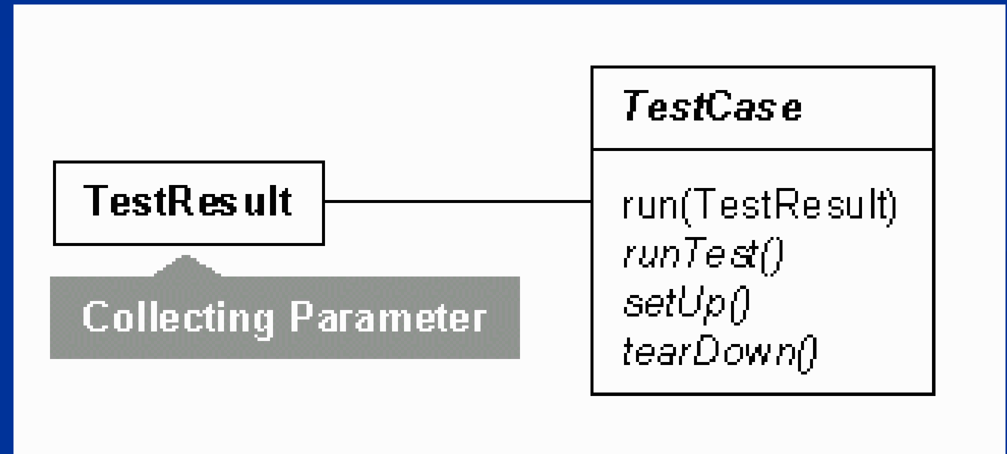


"Define the skeleton of an algorithm in an operation, deferring some steps to subclasses"

TestResult

- TestResult applies Collecting Parameter pattern

```
public void run(TestResult result) {
    result.startTest(this);
    setUp();
    try {
        runTest();
    }
    catch (AssertionFailedError e) {
        result.addFailure(this, e);
    }
    catch (Throwable e) {
        result.addError(this, e);
    }
    finally {
        tearDown();
    }
}
```

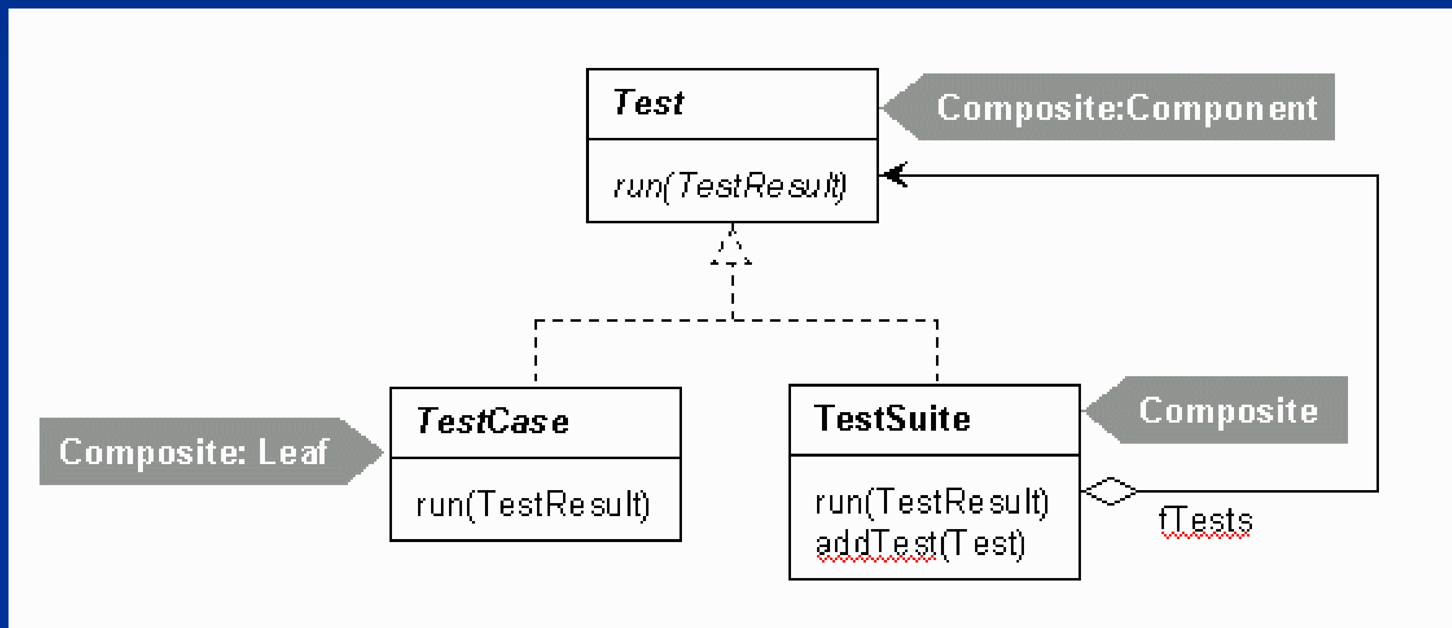


"When you need to collect results over several methods, add a parameter to the method and pass an object that will collect results for you"

(Beck – Smalltalk Best Practice Patterns)

TestSuite

- TestSuite applies Composite pattern



"Composite objects into tree structures to represent part-whole hierarchies. Composite lets clients treat individual objects and compositions of objects uniformly"

More…

- TDD / TFD ???
  - Test Driven Design
  - Test First Design
  - JUnit provides support for these agile techniques, but JUnit is lifecycle agnostic
- Extensions for J2EE applications
- What about GUI's? – JUnit limited

Resources

- JUnit: www.junit.org
- Testing Frameworks : http://c2.com/cgi/wiki?TestingFramework
- cppUnit: http://cppunit.sourceforge.net/doc/1.8.0/index.html
- SUnit: http://sunit.sourceforge.net/
- Unit Testing in Java – How Tests Drive the Code, Johannes Link
- Test-Driven Development by Example, Kent Beck
- Pragmatic Unit Testing in Java with JUnit, Andy Hunt & Dave Thomas
- “Learning to Love Unit Testing”, Thomas & Hunt: www.pragmaticprogrammer.com/articles/stqe-01-2002.pdf