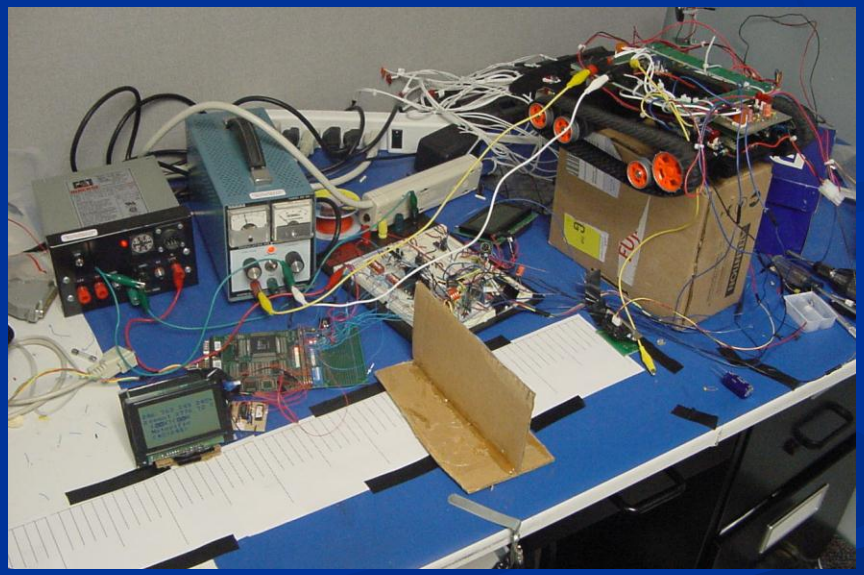
JUnit

Introduction to Unit Testing in Java

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

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.

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)

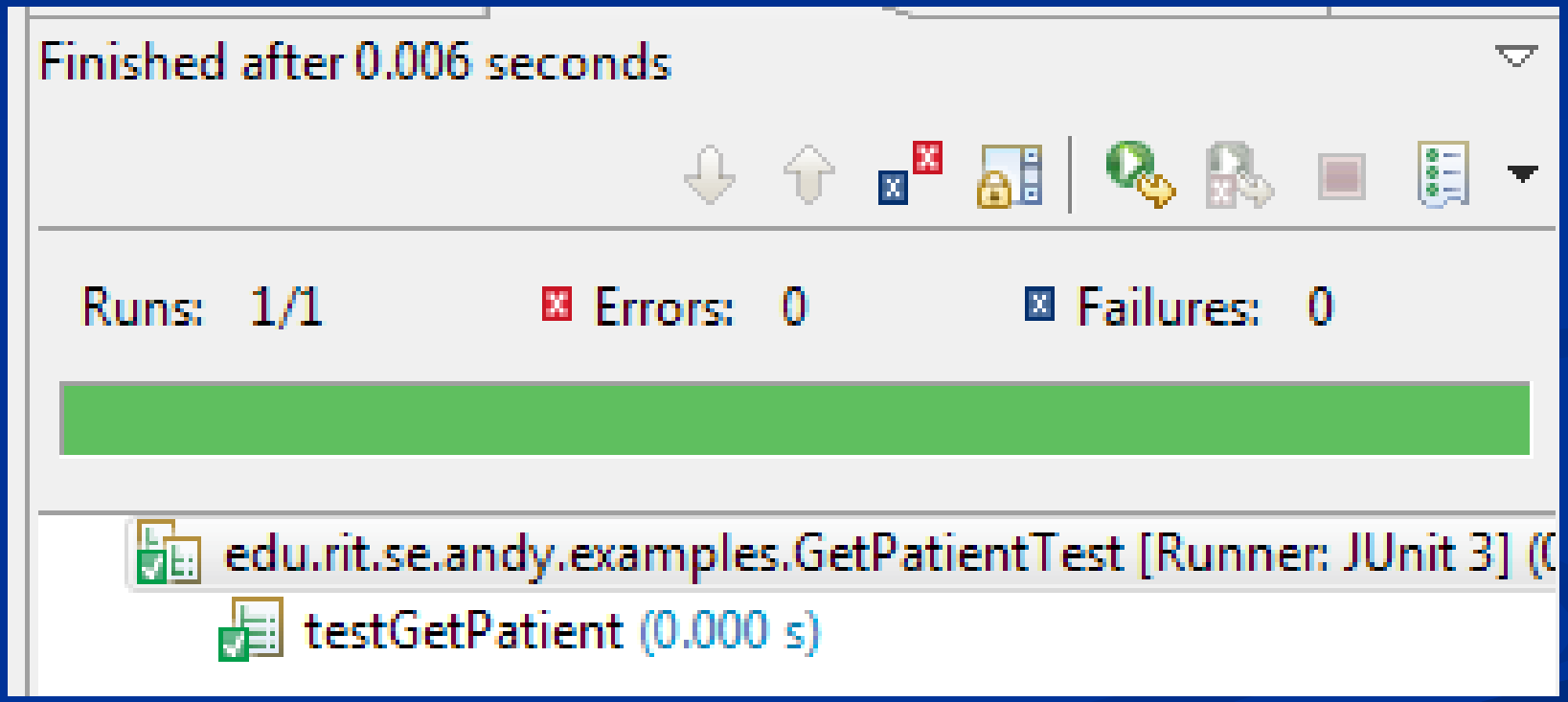
Test Hierarchies

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

  (and so on …)

Green Bar!

- If all tests pass, green bar!



Test for Exceptions!

- Sometimes you *expect* an exception
  1. First, run the code that should cause an exception
  2. Catch *the specific exception you expect*
  3. If that exception is not thrown, then fail the test with fail("message")
  4. Assert the exception's message, in the catch block

```
public void testNegativeID() throws Exception {
    try {
        database.getPatient(-1L);
        fail("exception should have been thrown");
    } catch (PatientNotFoundException e) {
        assertEquals("exception's message", "No patient found with ID -1");
    }
}
```

A Day in the Unit Tested-Life

- Every day you are coding, do the following:
  - Write code
  - Write unit tests for that code
  - Doesn't need to be exhaustive – hit the three types
  - Fix unit tests.
  - Go back to writing code
- Green bar every day. No excuses.

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

Test-Driven Development *

- An advanced skill that takes years to master

- General outline of events
  1. Write a unit test.
  2. You can't run your unit test because it doesn't compile… you haven't written that class yet. Write a stub.
  3. Run your test again. Test runs, but fails because the class does nothing.
  4. Implement the simplest possible solution (e.g. hardcode) to make that unit test pass.
  5. Run all of your unit tests again. Fix until green bar.
  6. Refactor (e.g. extract constants, methods, etc.).
  7. Run all of your unit tests again. Green bar!
  8. Go back to step 1 (or 3 if you have more ways to test that one method).

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