

Testing

Steve Loughran

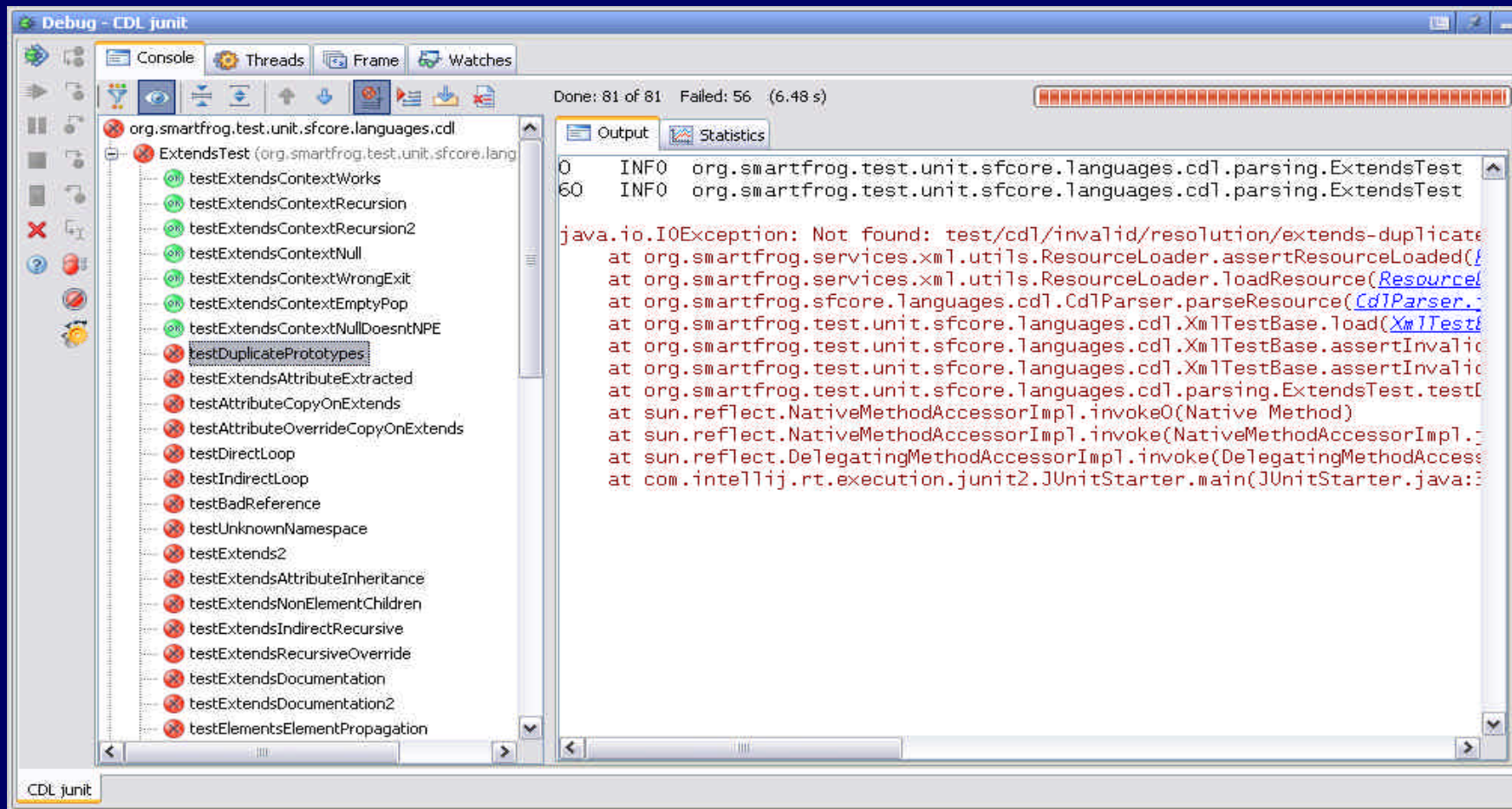
HP Laboratories

Thursday November 6th, 2006

your code doesn't work

i know this because...

my code doesn't work



it's OK to write code
that doesn't work

just don't ship it

A problem has been detected and windows has been shut down to prevent damage to your computer.

The problem seems to be caused by the following file: aries.sys

PAGE_FAULT_IN_NONPAGED_AREA

If this is the first time you've seen this Stop error screen, restart your computer. If this screen appears again, follow these steps:

Check to make sure any new hardware or software is properly installed. If this is a new installation, ask your hardware or software manufacturer for any windows updates you might need.

If problems continue, disable or remove any newly installed hardware or software. Disable BIOS memory options such as caching or shadowing. If you need to use Safe Mode to remove or disable components, restart your computer, press F8 to select Advanced Startup Options, and then select Safe Mode.

Technical information:

*** STOP: 0x00000050 (0xFFFFFFFF8,0x00000000,0xF9CF5C88,0x00000000)

*** aries.sys - Address F9CF5C88 base at F9CF5000, DateStamp 424bb23f

Beginning dump of physical memory

Physical memory dump complete.

Contact your system administrator or technical support group for further assistance.

especially if it matters



how do you get from
"broken" to "shipping"?


```

protected void doGet(HttpServletRequest request,
                    HttpServletResponse response)
    throws ServletException, IOException {
    PrintWriter out = response.getWriter();
    out.println("<html><head><title>Happiness Page</title></head><body>");
    boolean happy = true;
    String message = "<i>The database is configured </i>";
    //happy = areDatabasePropsSet(out);

    if (happy) {
        happy = checkDatabaseConnection(out);
        if (!happy) {
            message = "<i>Unable to connect to the database</i>";
        }
    } else {
        message = "<i>Database configuration parameters are missing</i>";
    }
    if (!happy) {
        response.setStatus(HttpServletResponse.SC_INTERNAL_SERVER_ERROR);
    }
    para(out,message);
    out.println("</body></html>");
}

```

ship and see

prove it works

test it!

A problem has been detected and windows has been shut down to prevent damage to your computer.

The problem seems to be caused by the following file: aries.sys

PAGE_FAULT_IN_NONPAGED_AREA

If this is the first time you've seen this stop error screen, restart your computer. If this screen appears again, follow these steps:

Check to make sure any new hardware or software is properly installed. If this is a new installation, ask your hardware or software manufacturer for any windows updates you might need.

If problems continue, disable or remove any newly installed hardware or software. Disable BIOS memory options such as caching or shadowing. If you need to use Safe Mode to remove or disable components, restart your computer, press F8 to select Advanced Startup Options, and then select Safe Mode.

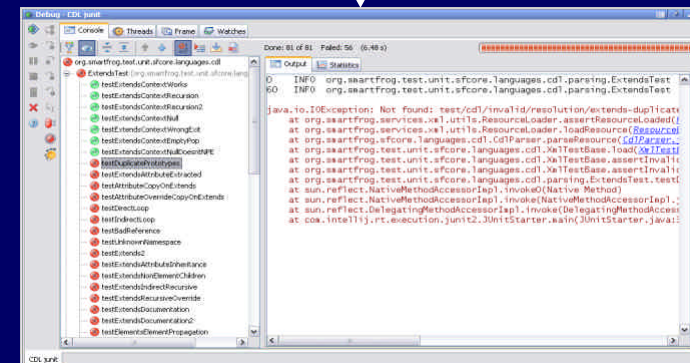
Technical Information:

*** STOP: 0x00000050 (0xFFFFFFFF8,0x000000000,0xF9CF5C88,0x000000000)

*** aries.sys - Address F9CF5C88 base at F9CF5000, DateStamp 424bb23f

Beginning dump of physical memory
Physical memory dump complete.
Contact your system administrator or technical support group for further assistance.

$\exists x:$
 $(\forall y \in [1..x]:$
 $f(y) > 0)$



Device Drivers

Formal Methods

Test-Driven

proofs of correctness

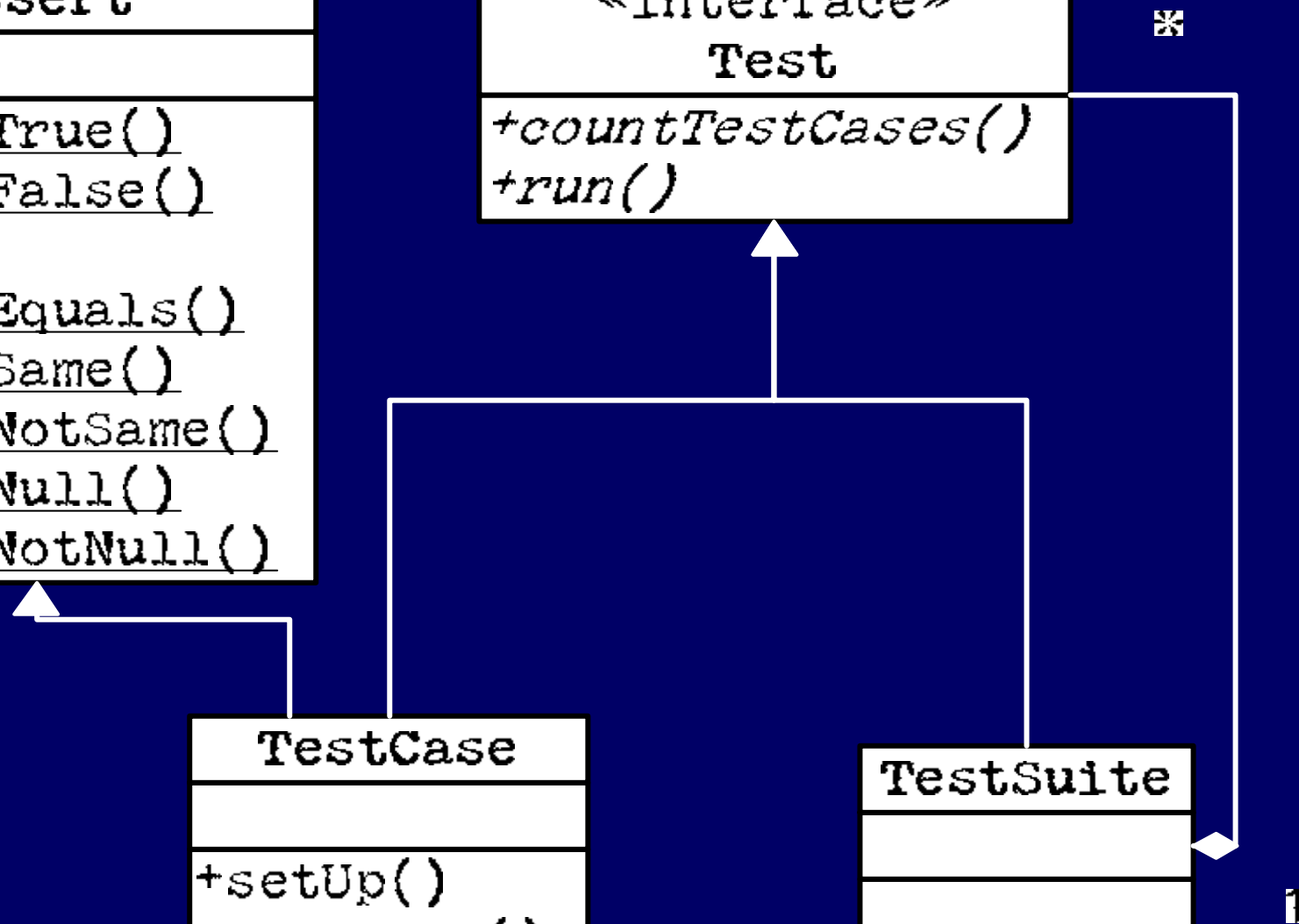
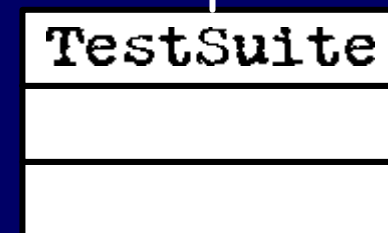
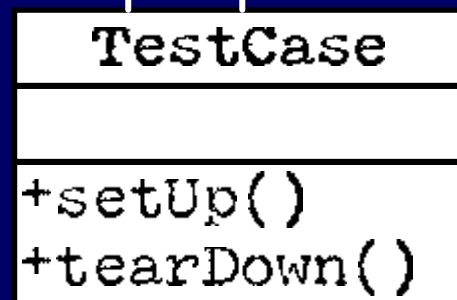
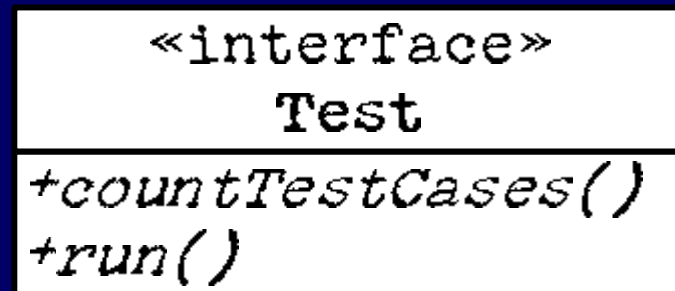
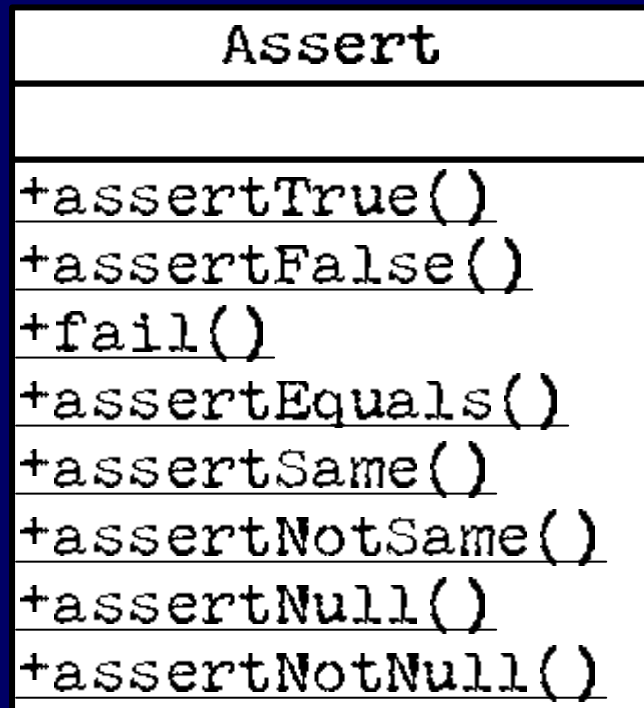
- + shows an algorithm really works
- + good for concurrency
- + and distributed things
- makes assumptions about system
- needs lots of maths/CS skills
(Pi-Calculus, The HOL System)
- regression proofs?

Test Driven Development

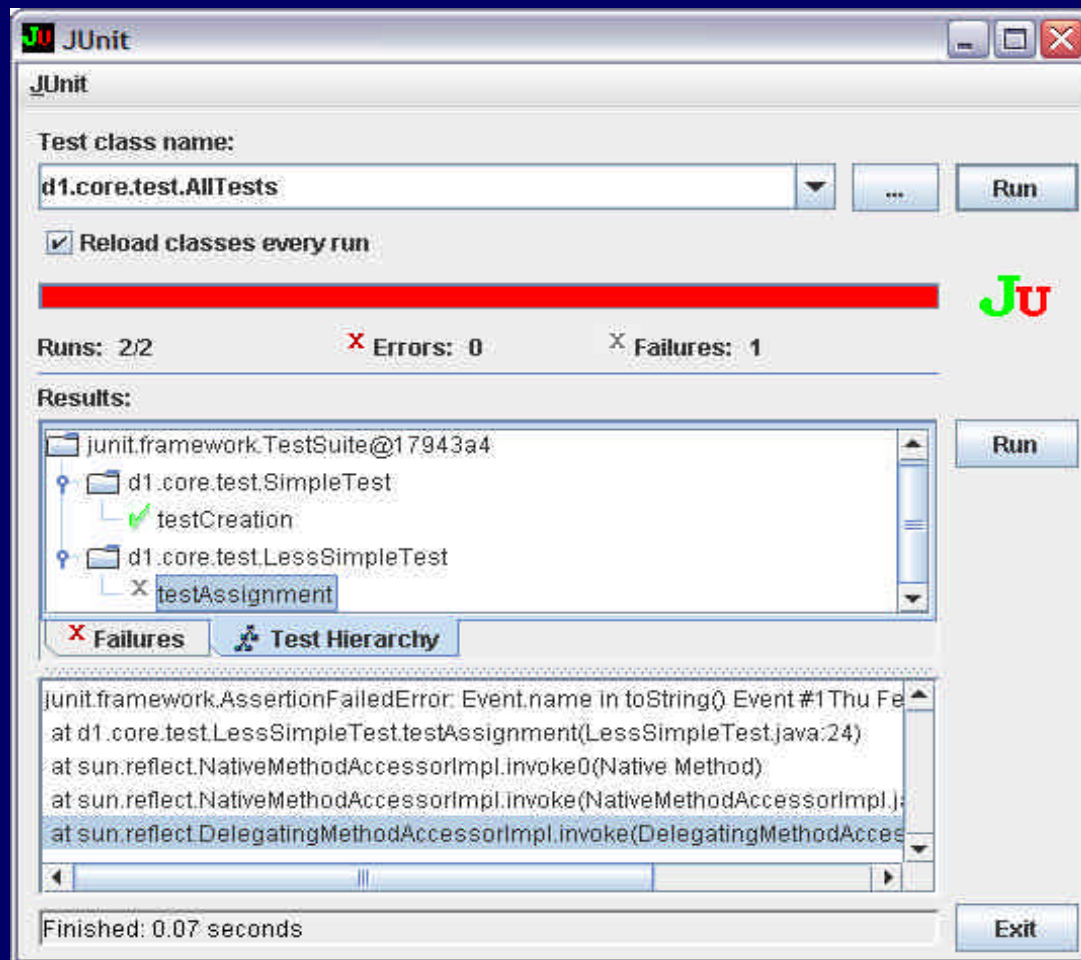
any feature without a test
doesn't exist

JUnit

- * unit test framework in Java
 - versions for C++, Python, Ruby...
- * simple to learn
- * good tool support
- * somewhat low-level
- * extensions for system testing

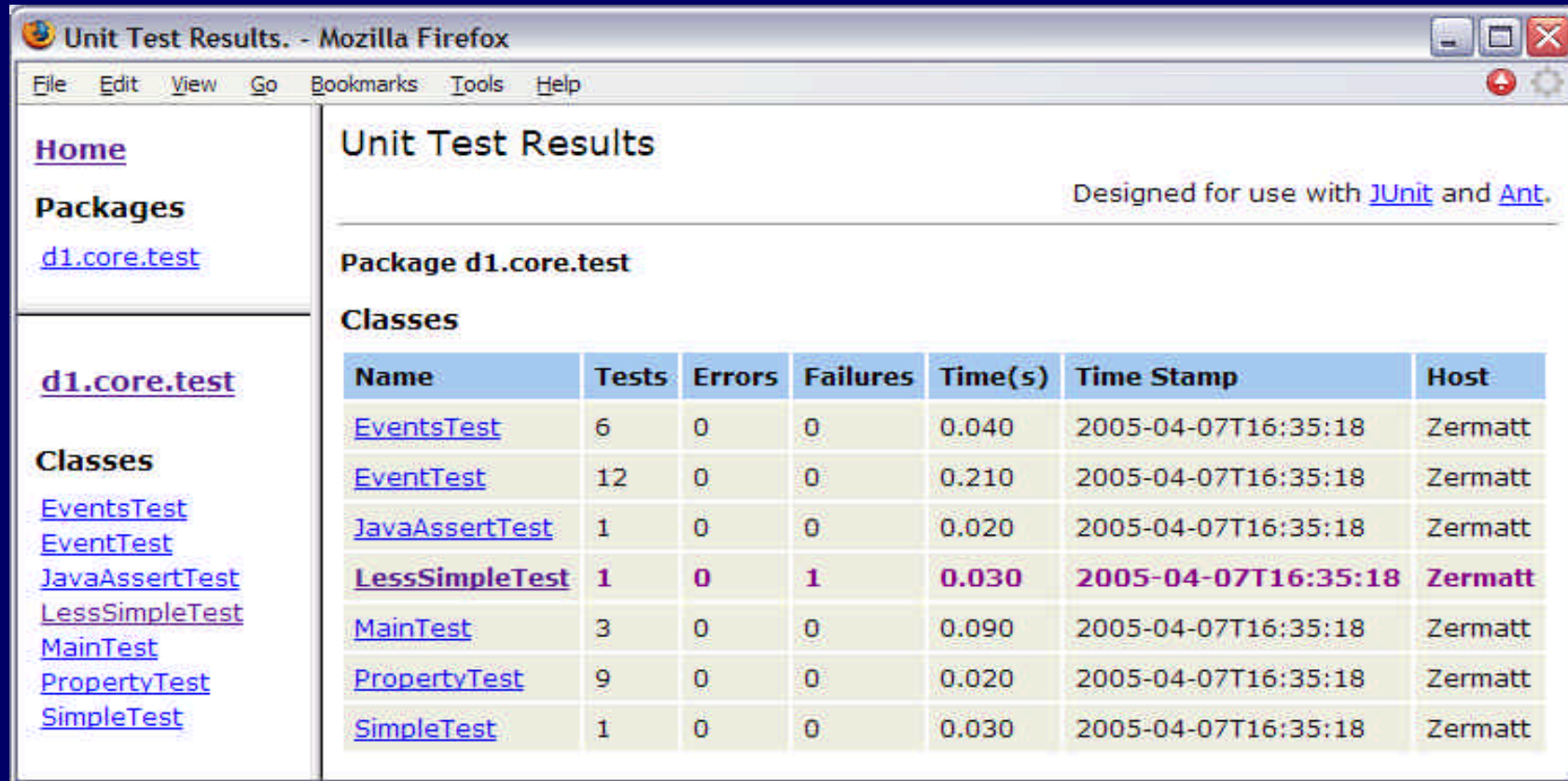


```
public class LessSimpleTest extends TestCase {  
  
    public LessSimpleTest(String s) {  
        super(s);  
    }  
  
    public void testAssignment() {  
        final Date date = new Date();  
        Event event = new Event(UUID.randomUUID(),  
                                date, "now", "Text");  
        assertEquals("self equality failed",  
                    event, event);  
        assertEquals(date, event.getDate());  
        assertNotNull(date.getID());  
    }  
}
```



swing GUI
TestRunner

Ant-generated report



Unit Test Results

Designed for use with [JUnit](#) and [Ant](#).

Package **d1.core.test**

Classes

Name	Tests	Errors	Failures	Time(s)	Time Stamp	Host
EventsTest	6	0	0	0.040	2005-04-07T16:35:18	Zermatt
EventTest	12	0	0	0.210	2005-04-07T16:35:18	Zermatt
JavaAssertTest	1	0	0	0.020	2005-04-07T16:35:18	Zermatt
LessSimpleTest	1	0	1	0.030	2005-04-07T16:35:18	Zermatt
MainTest	3	0	0	0.090	2005-04-07T16:35:18	Zermatt
PropertyTest	9	0	0	0.020	2005-04-07T16:35:18	Zermatt
SimpleTest	1	0	0	0.030	2005-04-07T16:35:18	Zermatt

scales better; reports published

Continuous Integration

The image shows two overlapping browser windows. The top window is Mozilla Thunderbird, displaying an email from 'CruiseControl Automated Mailer' with the subject '[Cruise:SmartFrog] SmartFrog Build Failed'. The bottom window is Mozilla Firefox, displaying the 'CruiseControl Build Results' page for the 'SmartFrog' project. The page shows a 'BUILD FAILED' status with an 'Ant Error Message' and a list of build artifacts.

Thunderbird Email:

- Subject:** [Cruise:SmartFrog] SmartFrog Build Failed
- From:** CruiseControl Automated Mailer <smartfrog@users.sourceforge.net>
- Date:** 08/11/05 14:32
- To:** steve_l@users.sourceforge.net

Firefox Build Results:

Project: SmartFrog

Current Build Started At: 11/15/2005 13:33:22

Latest Build:

Build Time	Build Number
15/11/2005 00:09:00	(build.579)
14/11/2005 23:27:39	(build.578)
14/11/2005 21:55:02	(build.577)
14/11/2005 21:13:31	(build.576)
14/11/2005 15:23:07	(build.575)
14/11/2005 14:23:05	
14/11/2005 11:34:22	(build.574)
14/11/2005 10:52:54	(build.573)
14/11/2005 08:23:06	(build.572)
10/11/2005 00:21:53	(build.571)
09/11/2005 10:53:46	(build.570)

Build Results:

- BUILD FAILED**
- Ant Error Message:** /home/bob/CC/SmartFrog/core/build.xml:155: The following error occurred w line: /home/bob/CC/SmartFrog/core/common.xml:1061: The following error c /usr/local/jakarta-tomcat-5.0.27/webapps/SmartFrog/junit/testharness
- Date of build:** 11/14/2005 14:23:05
- Time to build:** 8 minutes 15 seconds
- Last changed:** 11/14/2005 14:01:44
- Last log entry:** fixed...
- [Build Artifacts](#)

Errors/Warnings: (986)

Test org.smartfrog.test.unit.sfcore.DaemonTest FAILED (crashed)

Is component "false"

Is component "true"

Is component "true"

Is component "true"

Is component "true"

Is component "true"

Is component "true"

Is component "true"

Is component "true"

Is component "false"

1.4 build.compiler=modern javac.compiler=modern

Note: Some input files use or override a deprecated API

System Testing

- * deploy, then:
HttpUnit, XmlUnit, Cactus
- * needs automated deployment, database setup, teardown
- * performance testing by comparing timings w.r.t. old runs
- * Simulate entire behaviour of the client user/application

Distributed System Testing

- * Still a research topic
- * Set up complex configurations
- * Run tests on remote machines
- * collect results and log data
- * Post-mortem analysis
- * Virtualization can help

see <http://tinyurl.com/y99tez>

limitations of testing

- good tests are hard to write
- distributed tests very hard
- different system configurations are still a problem
- status of "tester" below "coder"

---A good test breaks the application

politics:
resistance to change

developers: ignorance, fear

E. E. E. Educate, Evangelise, Encourage

- * gently show benefits
- * use testing to track down a bug
- * retain test for regression testing
- * add tests for new code and old problems, not existing codebase
- * adopt cruise control, reporting

management: ignorance

"too much time spent on testing"

- * out of date with modern processes
- * belief that testing slows the schedule
(only if you follow the ship-and-see process)

E. E. E., then D. D. D:

Distract, Dissemble, Defeat

Test Driven Standards?

any standard without a test
doesn't exist