eXtreme Programming

(summary of Kent Beck's XP book)

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Contents

- The software development problem
- The XP solution
- The JUnit testing framework

The SW development problem

Four variables

Overview

- **cost**
- **time**
- **quality**
- **scope**

external forces (customers, management) pick the values of 3 v.

solution: make the four variables visible

interaction between the variables

- time: more time can improve quality and increase scope
  too much time will hurt it
- quality: short-term gains by deliberately sacrificing quality; but the cost (human, business, technical) is enormous
- less **scope** => better quality (as long as the business problem is still solved)

Four values

Overview

- communication
- simplicity
- feedback
- courage

short-term vs. long term thinking (I)

- communication: effect of pair programming, unit testing, task estimation: programmers, customers and managers have to communicate
- simplicity: it is better to do a simple thing today and pay a little more tomorrow to change it if it needs than to do a more complicated thing today that may never be used anyway

short-term vs. long term thinking (II)

- feedback: when customers write new „stories“ (description of features, simplified use cases), the programmers immediately estimate them; customers and testers write functional tests for all the stories
- courage: throwing parts of the code away and start over on the most promising design

Basic principles (derived from the four values)

Basic principles (I)

- rapid feedback
- assume simplicity
- incremental change
- embracing change
- quality work

Basic principles (II)

- small initial investment
- play to win
- concrete experiments
- open, honest communication
- work with people‘s instincts, not against them

Basic activities

Basic activities in the XP development process

- coding
- testing
- listening
- designing

The solution

XP practices

Practices (I)

- planning game: determine the scope of the next release; as reality overtakes the plan update the plan
- small releases: release new versions on a very short cycle after putting a simple system into production quickly
- metaphor: guide development with a simple shared story of how the whole system works

Practices (II)

- simple design: as simple as possible but not simpler (A. Einstein)
- testing: continually write unit tests
- refactoring: restructure the system to remove duplication (c.f. framelets, etc.)
- pair programming: two programmers at one machine
- collective ownership

Practices (III)

- continous integration: integrate the system many times a day, every time a task is complete
- 40-hour week
- on-site customer: include a real, live customer
- coding standards

Mangement strategy

Overview

- decentralized decision making based on
  - metrics
  - coaching
  - tracking
  - intervention
- using business basics: phased delivery, quick and concrete feedback, clear articulation of the business needs, specialists for special tasks

Metrics

- don‘t have too many metrics
- numbers are regarded as a way of gently and noncoercively communicating the need for change
- ratio between the estimated development time and calendar time is the basic measure for running the Planning Game

Coaching

- be available as a development partner
- see long-term refactoring goals
- explain the process to upper-level management

  => no lead programmer, system architect, etc.

Intervention

- when problems cannot be solved by the emergent brillance of the team, the manager has to step in, make decisions and see the consequences through to the end
- sample situations: changing the team‘s process, personnel changes, quitting a project

Planning strategy

Overview

- bring the team together
- decide on scope and priorities
- estimate cost and schedule
- give everyone confidence that the system can be done
- provide a benchmark for feedback

  put the most valuable functionality into production asap

Summary

What makes XP hard?

It‘s hard to ...

- do simple things
- admit you don‘t know (eg, basics about computer/software science in the context of pair programming)
- to collaborate
- to break down emotional walls

XP & Kent Beck (I)

Kent Beck is afraid of:

- doing work that doesn‘t matter
- having projects canceled
- making business decisions badly
- doing work without being proud of it

XP & Kent Beck (II)

Kent Beck is not afraid of:

- coding
- changing his mind
- proceeding without knowing everything about the future
- relying on other people
- changing the analysis and design of a running system
- writing tests

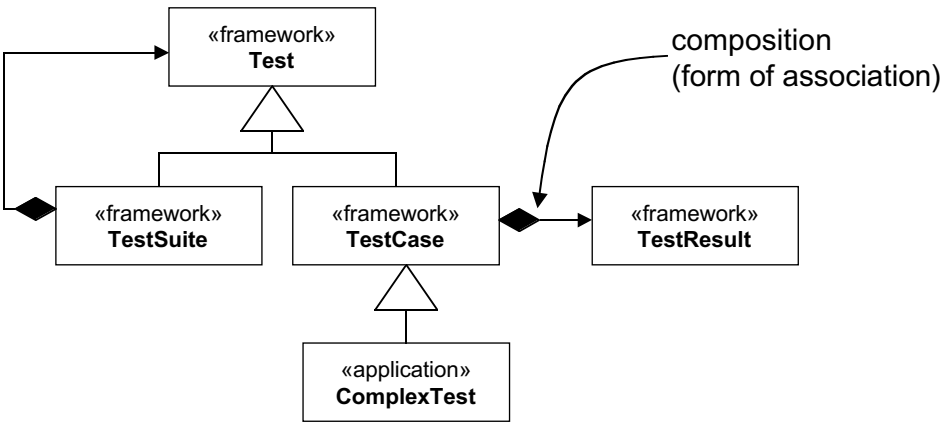
The JUnit testing framework

The JUnit components (I)

- Adding new test cases: JUnit provides a standard interface for defining test cases and allows the reuse of common code among related test cases.
- Tests suites: Framework users can group test cases in test suites.
- Reporting test results: the framework keeps flexible how test results are reported. The possibilities include storing the results of the tests in a database for project control purposes, creating HTML files that report the test activities.

The JUnit components (II)

Overview of the JUnit design - Class ComplexTest defines test cases for complex numbers

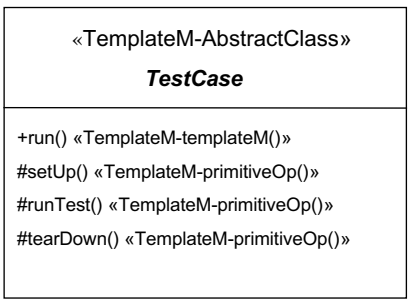


The TestCase variation point (I)

- The initialization part is responsible for creating the text fixture.
- The test itself uses the objects created by the initialization part and performs the actions required for the test.
- Finally, the third part cleans up a test.

The TestCase variation point (II)

The TestCase design is based on the Template Method design pattern - method run() controls the test execution

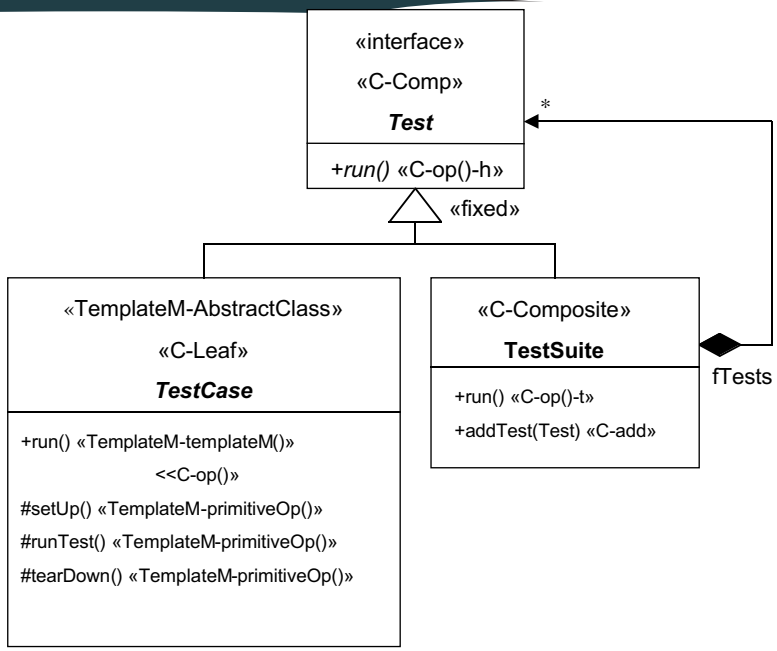



```
public void run() {
        setUp();
        runTest();
        tearDown();
}
```

The TestSuite variation point

TestCases are grouped into TestSuites—a variation of the Composite design pattern

Black-box adaptation

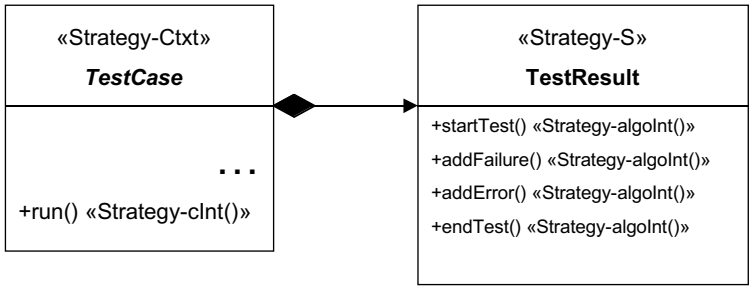


The TestResult variation point (I)

- Failures are situations where the assert() method does not yield the expected result.
- Errors are unexpected bugs in the code being tested or in the test cases themselves.
- The TestResult class is responsible for reporting the failures and errors in different ways.

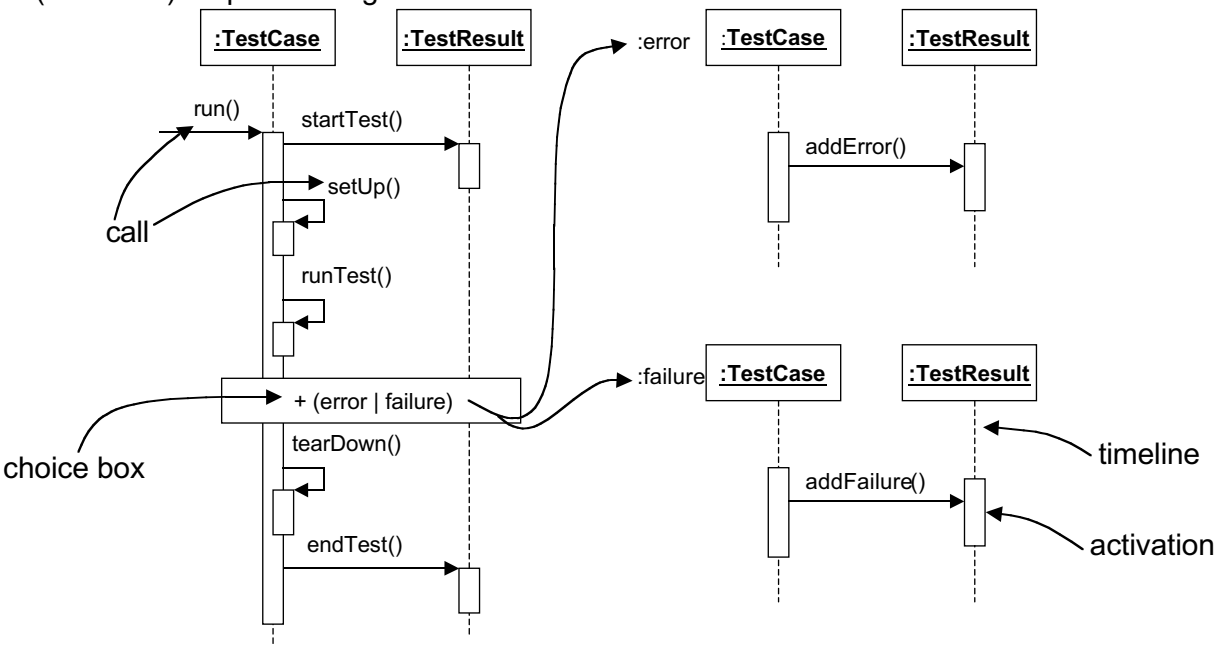
The TestResult variation point (II)

- TestResult must provide four methods:
  - startTest() - initialization code
  - addFailure() - reports a failure
  - addError() - reports an error
  - endTest() - clean-up code



The TestResult variation point (III)

(extended) sequence diagram



Adapting JUnit

- Cookbook recipes and UML-F diagrams for each of the JUnit variation points
  - Create a test case (ComplexTest)
  - Create a test suite (for the ComplexTest methods)
  - Create an HTML reporting mechanism

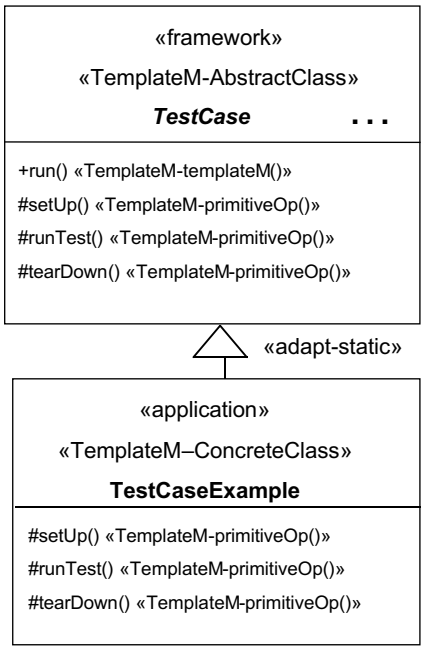
Adapting TestCase (I)

- TestCase adaptation recipe:
  - Subclass TestCase
  - Override setUp() (optional). The default implementation is empty
  - Override runTest()
  - Override tearDown() (optional). The default implementation is empty

Adapting TestCase (II)

TestCaseExample exemplifies the code that has to be added by the application developer

White-box adaptation



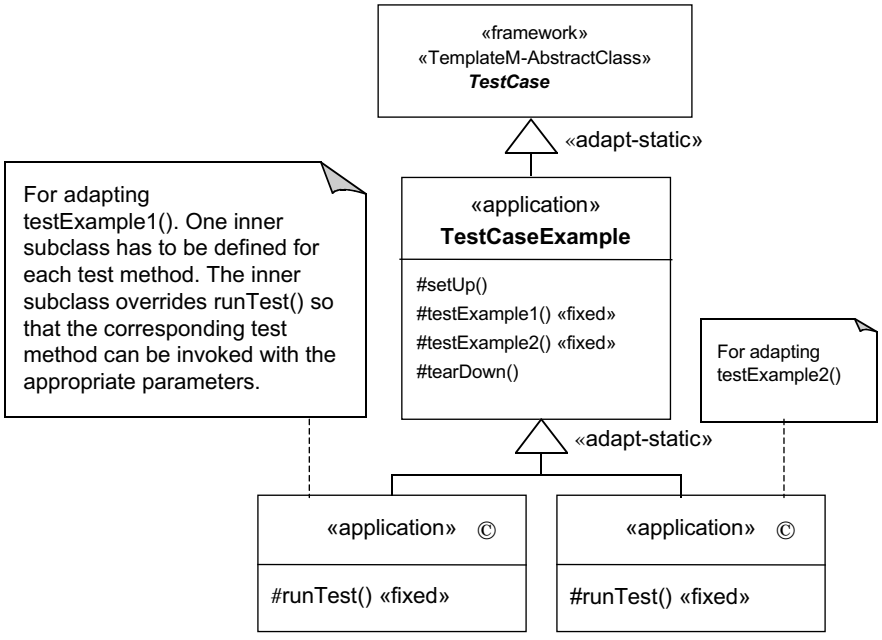
Adapting TestCase (III)

For possible adaptation examples, considering the optional hook methods

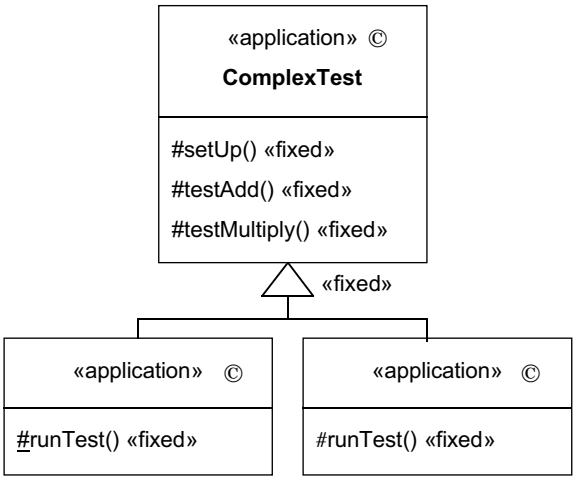
Adapting TestCase (IV)

- One aspect in the TestCase class cannot be captured in UML-F design diagrams
  - Method runTest() takes no parameters as input
  - Different test cases require different input parameters.
  - The interface for theses test methods has to be adapted to match runTest().

Adapting TestCase (V)



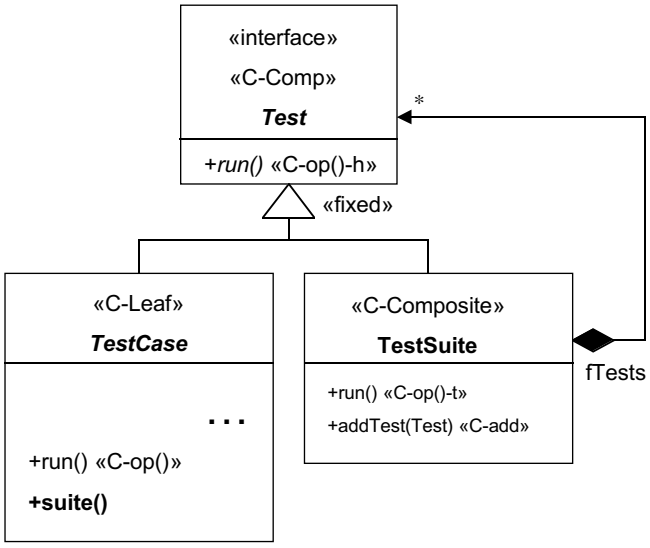
Adapting TestCase (VI)

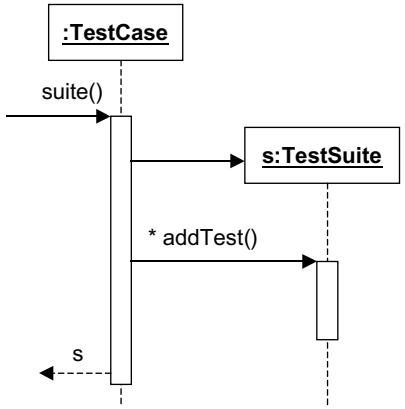



```
public class ComplexTest extends TestCase {
        private ComplexNumber fOneZero;
        private ComplexNumber fZeroOne;
        private ComplexNumber fMinusOneZero;
        private ComplexNumber fOneOne;

protected void setUp() {
        fOneZero = new ComplexNumber(1, 0);
        fZeroOne = new ComplexNumber(0, 1);
        fMinusOneZero = new ComplexNumber(-1, 0);
        fOneOne = new ComplexNumber(1, 1);
}

public void testAdd() {
        //This test will fail !!!
        ComplexNumber result = fOneOne.add(fZeroOne);
        assert(fOneOne.equals(result));
}

public void testMultiply() {
        ComplexNumber result = fZeroOne.multiply(fZeroOne)
        assert(fMinusOneZero.equals(result));
}
```


Adapting TestSuite (I)

Adaptation by overriding the **suite()** method



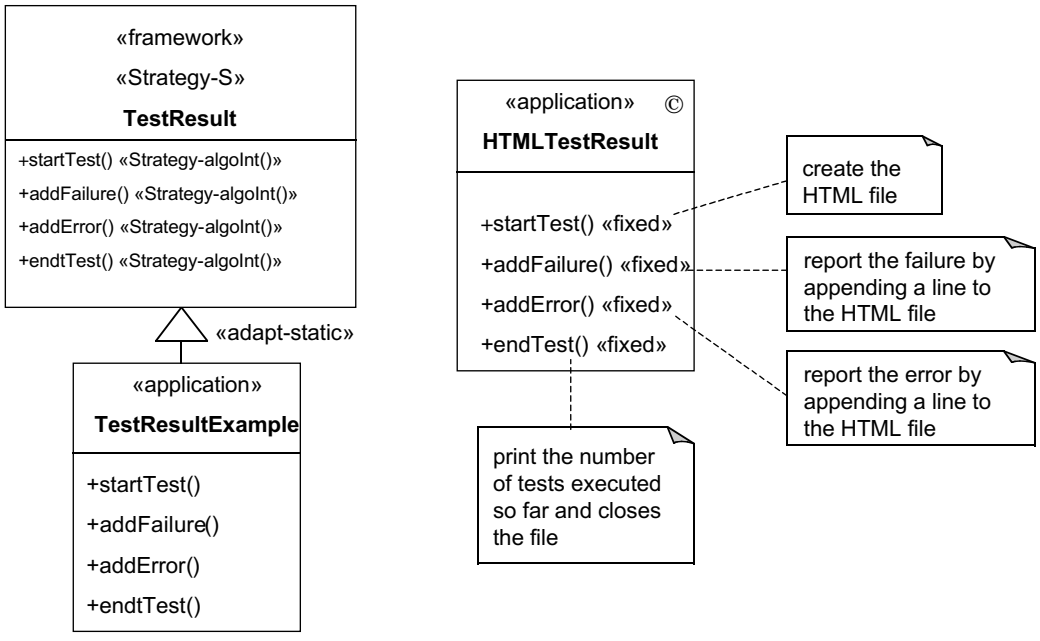


Adapting TestSuite (II)

TestCase and TestSuite are related variation points

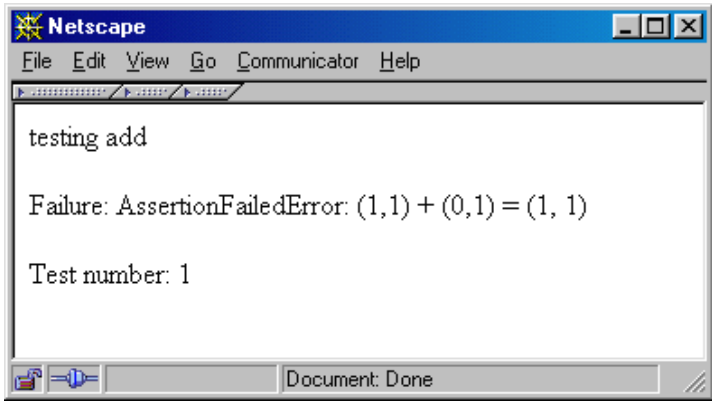
```
public static Test suite() {
        TestSuite suite = new TestSuite();
        suite.addTest(new ComplexTest("testing add") {
                        protected void runTest() { this.testAdd(); }
        } );
        suite.addTest(new ComplexTest("testing multiply") {
                        protected void runTest() { this.testMultiply(); }
        } );
        return suite;
}
```


Adapting TestResult (I)



Adapting TestResult (II)

Display of a sample HTML file that reports a failure.



Pattern-annotated diagrams

Pattern-annotated diagram for the main JUnit classes