PHPUnit Pocket Guide

Quick Lookup and Advice

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Preface

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

For a very long time my answer to the question "When will you write documentation for PHPUnit?" has been "You do not need documentation for PHPUnit. Just read the documentation for JUnit or a buy a book on JUnit and adapt the code examples from Java and JUnit to PHP and PHPUnit." When I mentioned this to Barbara Weiss and Alexandra Follenius from the O'Reilly Germany office, they encouraged me to think it over and write a book that would serve as the documentation for PHPUnit.

Requirements

The topic of this book is PHPUnit, an open source framework for test-driven development with the PHP programming language. This edition covers Version 2.3 of PHPUnit. Most of the examples should work, however, with PHPUnit versions 2.0-2.2. The "PHPUnit for PHP 4" section, later in this book, covers the older, no longer actively developed version of PHPUnit for PHP 4.

The reader should have a good understanding of object-oriented programming with PHP 5. To German readers I can recommend my own book on PHP 5, [Bergmann2005], as an introduction to object-oriented programming with PHP 5. A good English book on the subject is [GuBaRe2005] by Andi Gutmans, Stig Bakken, and Derick Rethans.

This Book Is Free

Conventions Used in This Book

The following is a list of typographical conventions used in this book:

Italic	Indicates new terms, URLs, email addresses, filenames, file extensions, pathnames, directories, and Unix utilities.
`Constant width`	Indicates commands, options, switches, variables, functions, classes, namespaces, methods, modules, parameters, values, objects, the contents of files, or the output from commands.
`Constant width bold`	Shows commands or other text that should be typed literally by the user.
`Constant width italic`	Shows text that should be replaced with user-supplied values.

You should pay special attention to notes set apart from the text with the following styles:

Note

This is a tip, suggestion, or general note. It contains useful supplementary information about the topic at hand.

Warning

This is a warning or note of caution.

Acknowledgements

I would like to thank Kent Beck and Erich Gamma for JUnit and the inspiration to write PHPUnit. I would also like to thank Kent Beck for his "JUnit Pocket Guide" [Beck2004], which sparked the idea for this book. I would like to thank Allison Randal, Alexandra Follenius, and Barbara Weiss for sponsoring this book at O'Reilly.

I would like to thank Andi Gutmans, Zeev Suraski, and Marcus Börger for their work on the Zend Engine 2, the core of PHP 5. I would like to thank Derick Rethans for Xdebug, the PHP extension that makes PHPUnit's Code Coverage functionality possible. Finally, I would like to thank Michiel Rook, who wrote the PHPUnit tasks for Phing.

Chapter 1. Automating Tests

Caution

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Even good programmers make mistakes. The difference between a good programmer and a bad programmer is that the good programmer uses tests to detect mistakes as soon as possible. The sooner you test for a mistake the greater your chance of finding it and the less it will cost to find and fix. This explains why leaving testing until just before releasing software is so problematic. Most errors do not get caught at all, and the cost of fixing the ones you do catch is so high that you have to perform triage with the errors because you just cannot afford to fix them all.

Testing with PHPUnit is not a totally different activity from what you should already be doing. It is just a different way of doing it. The difference is between *testing*, that is, checking that your program behaves as expected, and *performing a battery of tests*, runnable code-fragments that automatically test the correctness of parts (units) of the software. These runnable code-fragments are called unit tests.

In this chapter we will go from simple `print`-based testing code to a fully automated test. Imagine that we have been asked to test PHP's built-in `array`. One bit of functionality to test is the function `sizeof()`. For a newly created array we expect the `sizeof()` function to return `0`. After we add an element, `sizeof()` should return `1`. Example 1.1, “Testing Array and sizeof()” shows what we want to test.

Example 1.1. Testing Array and sizeof()

```
<?php
$fixture = array();
// $fixture is expected to be empty.

$fixture[] = 'element';
// $fixture is expected to contain one element.
?>
```

A really simple way to check whether we are getting the results we expect is to print the result of `sizeof()` before and after adding the element (see Example 1.2, “Using print to test Array and sizeof()”). If we get `0` and then `1`, `array` and `sizeof()` behave as expected.

Example 1.2. Using print to test Array and sizeof()

```
<?php
$fixture = array();
print sizeof($fixture) . "\n";

$fixture[] = "element";
print sizeof($fixture) . "\n";
?>
```

```
0
1
```

Now, we would like to move from tests that require manual interpretation to tests that can run automatically. In Example 1.3, “Comparing expected and actual values to test Array and sizeof()”, we write the comparison of the expected and actual values into the test code and print `ok` if the values are equal. If we ever see a `not ok` message, we know something is wrong.

Example 1.3. Comparing expected and actual values to test Array and sizeof()

```
<?php
$fixture = array();
print sizeof($fixture) == 0 ? "ok\n" : "not ok\n";

$fixture[] = 'element';
print sizeof($fixture) == 1 ? "ok\n" : "not ok\n";
?>
```

```
ok
ok
```

We now factor out the comparison of expected and actual values into a function that raises an Exception when there is a discrepancy (Example 1.4, “Using an assertion function to test Array and sizeof()”). This gives us two benefits: the writing of tests becomes easier and we only get output when something is wrong.

Example 1.4. Using an assertion function to test Array and sizeof()

```
<?php
$fixture = array();
assertTrue(sizeof($fixture) == 0);

$fixture[] = 'element';
assertTrue(sizeof($fixture) == 1);

function assertTrue($condition)
{
    if (!$condition) {
        throw new Exception('Assertion failed.');
    }
}
?>
```

The test is now completely automated. Instead of just *testing* as we did with our first version, with this version we have an *automated test*.

The goal of using automated tests is to make fewer mistakes. While your code will still not be perfect, even with excellent tests, you will likely see a dramatic reduction in defects once you start automating tests. Automated tests give you justified confidence in your code. You can use this confidence to take more daring leaps in design (Refactoring), get along with your teammates better (Cross-Team Tests), improve relations with your customers, and go home every night with proof that the system is better now than it was this morning because of your efforts.

Chapter 2. PHPUnit's Goals

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So far, we only have two tests for the `array` built-in and the `sizeof()` function. When we start to test the numerous `array_*()` functions PHP offers, we will need to write a test for each of them. We could write the infrastructure for all these tests from scratch. However, it is much better to write a testing infrastructure once and then write only the unique parts of each test. PHPUnit is such an infrastructure.

Example 2.1, "Testing Array and sizeof() with PHPUnit" shows how we have to rewrite our two tests from Example 1.4, "Using an assertion function to test Array and sizeof()" so that we can use them with PHPUnit.

Example 2.1. Testing Array and sizeof() with PHPUnit

```
<?php
require_once 'PHPUnit2/Framework/TestCase.php';

class ArrayTest extends PHPUnit2_Framework_TestCase {
    public function testNewArrayIsEmpty() {
        // Create the Array fixture.
        $fixture = array();

        // Assert that the size of the Array fixture is 0.
        $this->assertEquals(0, sizeof($fixture));
    }

    public function testArrayContainsAnElement() {
        // Create the Array fixture.
        $fixture = array();

        // Add an element to the Array fixture.
        $fixture[] = 'Element';

        // Assert that the size of the Array fixture is 1.
        $this->assertEquals(1, sizeof($fixture));
    }
}
?>
```

Example 2.1, "Testing Array and sizeof() with PHPUnit" shows the basic steps for writing tests with PHPUnit:

1. The tests for a class `Class` go into a class `ClassTest`.
2. `ClassTest` inherits (most of the time) from `PHPUnit2_Framework_TestCase`.
3. The tests are public methods that expect no parameters and are named `test*`.
4. Inside the test methods, assertion methods such as `assertEquals()` (see Table 14.1, "Assertions") are used to assert that an actual value matches an expected value.

A framework such as PHPUnit has to resolve a set of constraints, some of which seem always to conflict with each other. Simultaneously, tests should be:

Easy to learn to write.	If it's hard to learn how to write tests, developers will not learn to write them.
Easy to write.	If tests are not easy to write, developers will not write them.
Easy to read.	Test code should contain no extraneous overhead so that the test itself does not get lost in noise that surrounds it.
Easy to execute.	The tests should run at the touch of a button and present their results in a clear and unambiguous format.
Quick to execute.	Tests should run fast so so they can be run hundreds or thousands of times a day.
Isolated.	The tests should not affect each other. If the order in which the tests are run changes, the results of the tests should not change.
Composable.	We should be able to run any number or combination of tests together. This is a corollary of isolation.

There are two main clashes between these constraints:

Easy to learn to write versus easy to write.	Tests do not generally require all the flexibility of a programming language. Many testing tools provide their own scripting language that only includes the minimum necessary features for writing tests. The resulting tests are easy to read and write because they have no noise to distract you from the content of the tests. However, learning yet another programming language and set of programming tools is inconvenient and clutters the mind.
Isolated versus quick to execute.	If you want the results of one test to have no effect on the results of another test, each test should create the full state of the world before it begins to execute and return the world to its original state when it finishes. However, setting up the world can take a long time: for example connecting to a database and initializing it to a known state using realistic data.

PHPUnit attempts to resolve these conflicts by using PHP as the testing language. Sometimes the full power of PHP is overkill for writing little straight-line tests, but by using PHP we leverage all the experience and tools programmers already have in place. Since we are trying to convince reluctant testers, lowering the barrier to writing those initial tests is particularly important.

PHPUnit errs on the side of isolation over quick execution. Isolated tests are valuable because they provide high-quality feedback. You do not get a report with a bunch of test failures, which were really caused because one test at the beginning of the suite failed and left the world messed up for the rest of the tests. This orientation towards isolated tests encourages designs with a large number of simple objects. Each object can be tested quickly in isolation. The result is better designs *and* faster tests.

PHPUnit assumes that most tests succeed and it is not worth reporting the details of successful tests. When a test fails, that fact is worth noting and reporting. The vast majority of tests should succeed and are not worth commenting on except to count the number of tests that run. This is an assumption that is really built into the reporting classes, and not into the core of PHPUnit. When the results of a test run are reported, you see how many tests were executed, but you only see details for those that failed.

Tests are expected to be fine-grained, testing one aspect of one object. Hence, the first time a test fails, execution of the test halts, and PHPUnit reports the failure. It is an art to test by running in many small tests. Fine-grained tests improve the overall design of the system.

When you test an object with PHPUnit, you do so only through the object's public interface. Testing based only on publicly visible behaviour encourages you to confront and solve difficult design problems earlier, before the results of poor design can infect large parts of the system.

Chapter 3. Installing PHPUnit

Caution

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The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

PHPUnit [http://www.phpunit.de/] should be installed using the PEAR Installer [http://pear.php.net/]. This installer is the backbone of PEAR, which provides a distribution system for PHP packages, and is shipped with every release of PHP since version 4.3.0.

The PEAR channel (`pear.phpunit.de`) that is used to distribute PHPUnit needs to be registered with the local PEAR environment:

```
pear channel-discover pear.phpunit.de
```

This has to be done only once. Now the PEAR Installer can be used to install packages from the PHPUnit channel:

```
pear install phpunit/PHPUnit
```

Note

Previous installations of the `PHPUnit` and `PHPUnit2` packages from the `pear.php.net` channel have to be uninstalled.

After the installation you can find the PHPUnit source files inside your local PEAR directory; the path is usually `/usr/lib/php/PHPUnit`.

Although using the PEAR Installer is the only supported way to install PHPUnit, you can install PHPUnit manually. For manual installation, do the following:

1. Download a release archive from `http://pear.phpunit.de/get/` and extract it to a directory that is listed in the `include_path` of your `php.ini` configuration file.

2. Prepare the `phpunit` script:

   a. Rename the `pear-phpunit` script to `phpunit`.

   b. Replace the `@php_bin@` string in it with the path to your PHP command-line interpreter (usually `/usr/bin/php`).

   c. Copy it to a directory that is in your `PATH` and make it executable (`chmod +x phpunit`).

Chapter 4. The Command-Line Test Runner

Caution

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The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

The PHPUnit command-line test runner can be invoked through the `phpunit` command. The following code shows how to run tests with the PHPUnit command-line test runner:

```
phpunit ArrayTest
PHPUnit 2.3.0 by Sebastian Bergmann.

..

Time: 0.067288

OK (2 tests)
```

For each test run, the PHPUnit command-line tool prints one character to indicate progress:

`.` Printed when the test succeeds.

`F` Printed when an assertion fails while running the test method.

`E` Printed when an error occurs while running the test method.

`I` Printed when the test is marked as being incomplete or not yet implemented (see Chapter 7, *Incomplete Tests*).

PHPUnit distinguishes between *failures* and *errors*. A failure is a violated PHPUnit assertion. An error is an unexpected exception or a PHP error. Sometimes this distinction proves useful since errors tend to be easier to fix than failures. If you have a big list of problems, it is best to tackle the errors first and see if you have any failures left when they are all fixed.

Let's take a look at the command-line test runner's switches in the following code:

```
phpunit --help
PHPUnit 2.3.0 by Sebastian Bergmann.

Usage: phpunit [switches] UnitTest [UnitTest.php]
  --coverage-data <file> Write Code Coverage data in raw format to file.
  --coverage-html <file> Write Code Coverage data in HTML format to file.
  --coverage-text <file> Write Code Coverage data in text format to file.

  --testdox-html <file>  Write agile documentation in HTML format to file.
  --testdox-text <file>  Write agile documentation in Text format to file.
  --log-xml <file>       Log test progress in XML format to file.

  --loader <loader>      TestSuiteLoader implementation to use.

  --skeleton             Generate skeleton UnitTest class for Unit in Unit.php.

  --wait                 Waits for a keystroke after each test.
```

```
  --help                 Prints this usage information.
  --version              Prints the version and exits.
```

`phpunit UnitTest`

Runs the tests that are provided by the class `UnitTest`. This class is expected to be declared in the `UnitTest.php` sourcefile.

`UnitTest` must be either a class that inherits from `PHPUnit2_Framework_TestCase` or a class that provides a `public static suite()` method which returns an `PHPUnit2_Framework_Test` object, for example an instance of the `PHPUnit2_Framework_TestSuite` class.

`phpunit UnitTest UnitTest.php`

Runs the tests that are provided by the class `UnitTest`. This class is expected to be declared in the specified sourcefile.

`--coverage-data`, `--coverage-html`, and `--coverage-text`

Control the collection and analysis of Code Coverage information for the tests that are run. (See Chapter 9, *Code-Coverage Analysis*.)

`--testdox-html` and `--testdox-text`

Generates agile documentation in HTML or plain text format for the tests that are run. (See Chapter 11, *Other Uses for Tests*.)

`--log-xml`

Generates a logfile in XML format for the tests run.

The following example shows the XML logfile generated for the tests in `ArrayTest`:

```
<?xml version="1.0" encoding="UTF-8"?>
<testsuites>
  <testsuite name="ArrayTest" tests="2" failures="0" errors=
    <testcase name="testNewArrayIsEmpty" class="ArrayTest" t
    <testcase name="testArrayContainsAnElement" class="Array
  </testsuite>
</testsuites>
```

This XML logfile was generated for two tests, `testFailure` and `testError`, of a test-case class named `FailureErrorTest` and shows how failures and errors are denoted.

```
<?xml version="1.0" encoding="UTF-8"?>
<testsuites>
  <testsuite name="FailureErrorTest" tests="2" failures="1"
    <testcase name="testFailure" class="FailureErrorTest" ti
      <failure message="" type="PHPUnit2_Framework_Assertion
    </testcase>
    <testcase name="testError" class="FailureErrorTest" time
      <error message="" type="Exception"></error>
    </testcase>
  </testsuite>
</testsuites>
```

`--loader`

Specifies the `PHPUnit2_Runner_TestSuiteLoader` implementation to use.

The standard test suite loader will look for the sourcefile in the current working directory and in each directory that is specified in PHP's `include_path` configuration directive. Following the PEAR Naming Conventions, a class name such as `Project_Package_Class` is mapped to the sourcefile name `Project/Package/Class.php`.

`--skeleton`

Generates a skeleton test-case class `UnitTest` (in `UnitTest.php`) for a class `Unit` (in `Unit.php`). For each method in the original class, there will be an incomplete test-case (see Chapter 7, *Incomplete Tests*) in the generated test-case class.

The following example shows how to generate a a skeleton test class for a class named `Sample`.

```
phpunit --skeleton Sample
PHPUnit 2.3.0 by Sebastian Bergmann.

Wrote test class skeleton for Sample to SampleTest.php.

phpunit SampleTest
PHPUnit 2.3.0 by Sebastian Bergmann.

I

Time: 0.007268
There was 1 incomplete test case:
1) testSampleMethod(SampleTest)


OK, but incomplete test cases!!!
Tests run: 1, incomplete test cases: 1.
```

When you are writing tests for existing code, you have to write the same code fragments as in the following example:

```
public function testSampleMethod() {
}
```

over and over again. PHPUnit can help you by analyzing the existing code and generating a skeleton test-case class for it.

`--wait`

Waits for a keystroke after each test. This is useful if you are running the tests in a window that stays open only as long as the test runner is active.

Note

When the tested code contains PHP syntax errors the TextUI test runner might exit without printing error information. The standard test suite loader will check the test suite sourcefile for PHP syntax errors, but not sourcefiles included by the test suite sourcefile. Future versions of PHPUnit will solve this issue by using a sandboxed PHP interpreter.

Chapter 5. Fixtures

Caution

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The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

One of the most time-consuming parts of writing tests is writing the code to set the world up in a known state and then return it to its original state when the test is complete. This known state is called the *fixture* of the test.

In Example 2.1, “Testing Array and sizeof() with PHPUnit”, the fixture was simply the array that is stored in the `$fixture` variable. Most of the time, though, the fixture will be more complex than a simple array, and the amount of code needed to set it up will grow accordingly. The actual content of the test gets lost in the noise of setting up the fixture. This problem gets even worse when you write several tests with similar fixtures. Without some help from the testing framework, we would have to duplicate the code that sets up the fixture for each test we write.

PHPUnit supports sharing the setup code. Before a test method is run, a template method called `setUp()` is invoked. `setUp()` is where you create the objects against which you will test. Once the test method has finished running, whether it succeeded or failed, another template method called `tearDown()` is invoked. `tearDown()` is where you clean up the objects against which you tested.

We can now refactor Example 2.1, “Testing Array and sizeof() with PHPUnit” and use `setUp()` to eliminate the code duplication that we had before. First we declare the instance variable, `$fixture`, that we are going to use instead of a method-local variable. Then we put the creation of the `array` fixture into the `setUp()` method. Finally, we remove the redundant code from the test methods and use the newly introduced instance variable, `$this->fixture`, instead of the method-local variable `$fixture` with the `assertEquals()` assertion method.

Example 5.1. Using setUp() to create the Array fixture

```
<?php
require_once 'PHPUnit2/Framework/TestCase.php';

class ArrayTest extends PHPUnit2_Framework_TestCase {
    protected $fixture;

    protected function setUp() {
        // Create the Array fixture.
        $this->fixture = array();
    }

    public function testNewArrayIsEmpty() {
        // Assert that the size of the Array fixture is 0.
        $this->assertEquals(0, sizeof($this->fixture));
    }

    public function testArrayContainsAnElement() {
        // Add an element to the Array fixture.
        $this->fixture[] = 'Element';

        // Assert that the size of the Array fixture is 1.
        $this->assertEquals(1, sizeof($this->fixture));
    }
}
?>
```

`setUp()` and `tearDown()` will be called once for each test method run. While it might seem frugal to only run these methods once for all the test methods in a test-case class, doing so would make it hard to write tests that are completely independent of each other.

Not only are `setUp()` and `tearDown()` run once for each test method, but the test methods are run in fresh instances of the test-case class (see Chapter 13, *PHPUnit's Implementation*).

More setUp() than tearDown()

`setUp()` and `tearDown()` are nicely symmetrical in theory but not in practice. In practice, you only need to implement `tearDown()` if you have allocated external resources like files or sockets in `setUp()`. If your `setUp()` just creates plain PHP objects, you can generally ignore `tearDown()`. However, if you create many objects in your `setUp()`, you might want to `unset()` the variables pointing to those objects in your `tearDown()` so they can be garbage collected. The garbage collection of test case objects is not predictable.

Variations

What happens when you have two tests with slightly different setups? There are two possibilities:

- If the `setUp()` code differs only slightly, move the code that differs from the `setUp()` code to the test method.
- If you really have a different `setUp()`, you need a different test-case class. Name the class after the difference in the setup.

Suite-Level Setup

PHPUnit does not provide convenient support for suite-level setup. There are few good reasons to share fixtures between tests, but in most cases the need to share a fixture between tests stems from an unresolved design problem.

A good example of a fixture that makes sense to share across several tests is a database connection: you log into the database once and reuse the database connection instead of creating a new connection for each test. This makes your tests run faster. To do this, write your database tests in a test-case class named `DatabaseTests` and wrap the test suite in a `TestSetup` decorator object that overrides `setUp()` to open the database connection and `tearDown()` to close the connection, as shown in Example 5.2, “Writing a suite-level setup decorator”. You can run the tests from `DatabaseTests` through the `DatabaseTestSetup` decorator by invoking, for instance, PHPUnit's command-line test runner with **`phpunit DatabaseTestSetup`**.

Example 5.2. Writing a suite-level setup decorator

```
<?php
require_once 'PHPUnit2/Framework/TestSuite.php';
require_once 'PHPUnit2/Extensions/TestSetup.php';

class DatabaseTestSetup extends PHPUnit2_Extensions_TestSetup {
    protected $connection = NULL;

    protected function setUp() {
        $this->connection = new PDO(
          'mysql:host=wopr;dbname=test',
          'root',
          ''
        );
    }
```

```
    protected function tearDown() {
        $this->connection = NULL;
    }

    public static function suite() {
        return new DatabaseTestSetup(
          new PHPUnit2_Framework_TestSuite('DatabaseTests')
        );
    }
}
?>
```

It cannot be emphasized enough that sharing fixtures between tests reduces the value of the tests. The underlying design problem is that objects are too closely bound together. You will achieve better results solving the underlying design problem and then writing tests using stubs (see Chapter 10, *Stubs*), than by creating dependencies between tests at runtime and ignoring the opportunity to improve your design.

Chapter 6. Testing Exceptions and Performance Regressions

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

PHPUnit provides two extensions to the standard base-class for test classes, `PHPUnit2_Framework_TestCase`, that aid in the writing of tests for exceptions and performance regressions.

Exceptions

How do you test exceptions? You cannot directly assert that they are raised. Instead you have to use PHP's exception handling facilities to write the test. The following example demonstrates testing exceptions:

```
<?php
require_once 'PHPUnit2/Framework/TestCase.php';

class ExceptionTest extends PHPUnit2_Framework_TestCase {
    public function testException() {
        try {
            // ... Code that is expected to raise an Exception ...
        }

        catch (Exception $expected) {
            return;
        }

        $this->fail('An expected Exception has not been raised.');
    }
}
?>
```

If the code that is expected to raise an exception does not raise an exception, the subsequent call to `fail()` (see Table 14.2, “Bottleneck Methods”) will halt the test and signal a problem with the test. If the expected exception is raised, the `catch` block will be executed, and the test will end successfully.

Alternatively, you can extend your test class from `PHPUnit2_Extensions_ExceptionTestCase` to test whether an exception is thrown inside the tested code. Example 6.1, “Using PHPUnit2_Extensions_ExceptionTestCase” shows how to subclass `PHPUnit2_Extensions_ExceptionTestCase` and use its `setExpectedException()` method to set the expected exception. If this expected exception is not thrown, the test will be counted as a failure.

Example 6.1. Using PHPUnit2_Extensions_ExceptionTestCase

```
<?php
require_once 'PHPUnit2/Extensions/ExceptionTestCase.php';

class ExceptionTest extends PHPUnit2_Extensions_ExceptionTestCase {
    public function testException() {
        $this->setExpectedException('Exception');
```

```
    }
}
?>
```

```
phpunit ExceptionTest
PHPUnit 2.3.0 by Sebastian Bergmann.

F

Time: 0.006798
There was 1 failure:
1) testException(ExceptionTest)
Expected exception Exception

FAILURES!!!
Tests run: 1, Failures: 1, Errors: 0, Incomplete Tests: 0.
```

Table 6.1, “ExceptionTestCase external protocols” shows the external protocol implemented by `PHPUnit2_Extensions_ExceptionTestCase`.

Table 6.1. ExceptionTestCase external protocols

Method	Meaning
`void setExpectedException(string $exceptionName)`	Set the name of the expected exception to `$exceptionName`.
`String getExpectedException()`	Return the name of the expected exception.

Performance Regressions

You can extend your test class from `PHPUnit2_Extensions_PerformanceTestCase` to test whether the execution of a function or method call, for instance, exceeds a specified time limit.

Example 6.2, “Using PHPUnit2_Extensions_PerformanceTestCase” shows how to subclass `PHPUnit2_Extensions_PerformanceTestCase` and use its `setMaxRunningTime()` method to set the maximum running time for the test. If the test is not executed within this time limit, it will be counted as a failure.

Example 6.2. Using PHPUnit2_Extensions_PerformanceTestCase

```
<?php
require_once 'PHPUnit2/Extensions/PerformanceTestCase.php';

class PerformanceTest extends PHPUnit2_Extensions_PerformanceTestCase {
    public function testPerformance() {
        $this->setMaxRunningTime(2);
        sleep(1);
    }
}
?>
```

Table 6.2, “PerformanceTestCase external protocols” shows the external protocol implemented by `PHPUnit2_Extensions_PerformanceTestCase`.

Table 6.2. PerformanceTestCase external protocols

Method	Meaning
`void setMaxRunningTime(int $maxRunningTime)`	Set the maximum running time for the test to `$maxRunningTime` (in seconds).

Method	Meaning
`integer getMaxRunningTime()`	Return the maximum running time allowed for the test.

Chapter 7. Incomplete Tests

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

When you are working on a new test-case class, you might want to begin by writing empty test methods such as:

```
public function testSomething() {
}
```

to keep track of the tests that you have to write. The problem with empty test methods is that they are interpreted as a success by the PHPUnit framework. This misinterpretation leads to the test reports being useless -- you cannot see whether a test is actually successful or just not yet implemented. Calling `$this->fail()` in the unimplemented test method does not help either, since then the test will be interpreted as a failure. This would be just as wrong as interpreting an unimplemented test as a success.

If we think of a successful test as a green light and a test failure as a red light, we need an additional yellow light to mark a test as being incomplete or not yet implemented. `PHPUnit2_Framework_IncompleteTest` is a marker interface for marking an exception that is raised by a test method as the result of the test being incomplete or currently not implemented. `PHPUnit2_Framework_IncompleteTestError` is the standard implementation of this interface.

Example 7.1, “Marking a test as incomplete” shows a test-case class, `SampleTest`, that contains one test method, `testSomething()`. By raising the `PHPUnit2_Framework_IncompleteTestError` exception in the test method, we mark the test as being incomplete.

Example 7.1. Marking a test as incomplete

```
<?php
require_once 'PHPUnit2/Framework/TestCase.php';
require_once 'PHPUnit2/Framework/IncompleteTestError.php';

class SampleTest extends PHPUnit2_Framework_TestCase {
    public function testSomething() {
        // Optional: Test anything here, if you want.
        $this->assertTrue(TRUE, 'This should already work.');

        // Stop here and mark this test as incomplete.
        // You could use any Exception which implements the
        // PHPUnit2_Framework_IncompleteTest interface.
        throw new PHPUnit2_Framework_IncompleteTestError(
          'This test has not been implemented yet.'
        );
    }
}
?>
```

An incomplete test is denoted by an `I` in the output of the PHPUnit command-line test runner, as shown in the following example:

```
phpunit SampleTest
PHPUnit 2.3.0 by Sebastian Bergmann.
```

```
I

Time: 0.006657
There was 1 incomplete test case:
1) testSomething(SampleTest)
This test has not been implemented yet.

OK, but incomplete test cases!!!
Tests run: 1, incomplete test cases: 1.
```

Chapter 8. Test-First Programming

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

Unit Tests are a vital part of several software development practices and processes such as Test-First Programming, Extreme Programming [http://en.wikipedia.org/wiki/Extreme_Programming], and Test-Driven Development [http://en.wikipedia.org/wiki/Test-driven_development]. They also allow for Design-by-Contract [http://en.wikipedia.org/wiki/Design_by_Contract] in programming languages that do not support this methodology with language constructs.

You can use PHPUnit to write tests once you are done programming. However, the sooner a test is written after an error has been introduced, the more valuable the test is. So instead of writing tests months after the code is "complete", we can write tests days or hours or minutes after the possible introduction of a defect. Why stop there? Why not write the tests a little before the possible introduction of a defect?

Test-First Programming, which is part of Extreme Programming and Test-Driven Development, builds upon this idea and takes it to the extreme. With today's computational power, we have the opportunity to run thousands of tests thousands of times per day. We can use the feedback from all of these tests to program in small steps, each of which carries with it the assurance of a new automated test in addition to all the tests that have come before. The tests are like pitons, assuring you that, no matter what happens, once you have made progress you can only fall so far.

When you first write the test it cannot possibly run, because you are calling on objects and methods that have not been programmed yet. This might feel strange at first, but after a while you will get used to it. Think of Test-First Programming as a pragmatic approach to following the object-oriented programming principle of programming to an interface instead of programming to an implementation: while you are writing the test you are thinking about the interface of the object you are testing -- what does this object look like from the outside. When you go to make the test really work, you are thinking about pure implementation. The interface is fixed by the failing test.

What follows is necessarily an abbreviated introduction to Test-First Programming. You can explore the topic further in other books, such as *Test-Driven Development* [Beck2002] by Kent Beck or Dave Astels' *A Practical Guide to Test-Driven Development* [Astels2003].

BankAccount Example

In this chapter, we will look at the example of a class that represents a bank account. The contract for the `BankAccount` class not only requires methods to get and set the bank account's balance, as well as methods to deposit and withdraw money. It also specifies the following two conditions that must be ensured:

- The bank account's initial balance must be zero.
- The bank account's balance cannot become negative.

Following the Test-First Programming approach, we write the tests for the `BankAccount` class before we write the code for the class itself. We use the contract conditions as the basis for the tests and name the test methods accordingly, as shown in Example 8.1, “Tests for the BankAccount class”.

Example 8.1. Tests for the BankAccount class

```
<?php
```

```
require_once 'PHPUnit2/Framework/TestCase.php';
require_once 'BankAccount.php';

class BankAccountTest extends PHPUnit2_Framework_TestCase {
    private $ba;

    protected function setUp() {
        $this->ba = new BankAccount;
    }

    public function testBalanceIsInitiallyZero() {
        $this->assertEquals(0, $this->ba->getBalance());
    }

    public function testBalanceCannotBecomeNegative() {
        try {
            $this->ba->withdrawMoney(1);
        }

        catch (Exception $e) {
            return;
        }

        $this->fail();
    }

    public function testBalanceCannotBecomeNegative2() {
        try {
            $this->ba->depositMoney(-1);
        }

        catch (Exception $e) {
            return;
        }

        $this->fail();
    }

    public function testBalanceCannotBecomeNegative3() {
        try {
            $this->ba->setBalance(-1);
        }

        catch (Exception $e) {
            return;
        }

        $this->fail();
    }
}
?>
```

We now write the minimal amount of code needed for the first test, `testBalanceIsInitiallyZero()`, to pass. In our example this amounts to implementing the `getBalance()` method of the `BankAccount` class, as shown in Example 8.2, "Code needed for the testBalanceIsInitiallyZero() test to pass".

Example 8.2. Code needed for the testBalanceIsInitiallyZero() test to pass

```
<?php
class BankAccount {
    private $balance = 0;
```

```
    public function getBalance() {
        return $this->balance;
    }
}
?>
```

The test for the first contract condition now passes, but the tests for the second contract condition fail because we have yet to implement the methods that these tests call.

```
phpunit BankAccountTest
PHPUnit 2.3.0 by Sebastian Bergmann.

.
Fatal error: Call to undefined method BankAccount::withdrawMoney()
```

For the tests that ensure the second contract condition to pass, we now need to implement the `withdrawMoney()`, `depositMoney()`, and `setBalance()` methods, as shown in Example 8.3, “The complete BankAccount class”. These methods are written in a such a way that they raise an `InvalidArgumentException` when they are called with illegal values that would violate the contract conditions.

Example 8.3. The complete BankAccount class

```
<?php
class BankAccount {
    private $balance = 0;

    public function getBalance() {
        return $this->balance;
    }

    public function setBalance($balance) {
        if ($balance >= 0) {
            $this->balance = $balance;
        } else {
            throw new InvalidArgumentException;
        }
    }

    public function depositMoney($amount) {
        if ($amount >= 0) {
            $this->balance += $amount;
        } else {
            throw new InvalidArgumentException;
        }
    }

    public function withdrawMoney($amount) {
        if ($amount >= 0 && $this->balance >= $amount) {
            $this->balance -= $amount;
        } else {
            throw new InvalidArgumentException;
        }
    }
}
?>
```

The tests that ensure the second contract condition now pass, too:

```
phpunit BankAccountTest
PHPUnit 2.3.0 by Sebastian Bergmann.

```

```
....

Time: 0.057038

OK (4 tests)
```

Alternatively, you can use the static assertion methods provided by the `PHPUnit2_Framework_Assert` class to write the contract conditions as design-by-contract style assertions into your code, as shown in Example 8.4, “The BankAccount class with Design-by-Contract assertions”. When one of these assertions fails, an `PHPUnit2_Framework_AssertionFailedError` exception will be raised. With this approach, you write less code for the contract condition checks and the tests become more readable. However, you add a runtime dependency on PHPUnit to your project.

Example 8.4. The BankAccount class with Design-by-Contract assertions

```php
<?php
require_once 'PHPUnit2/Framework/Assert.php';

class BankAccount {
    private $balance = 0;

    public function getBalance() {
        return $this->balance;
    }

    public function setBalance($balance) {
        PHPUnit2_Framework_Assert::assertTrue($balance >= 0);

        $this->balance = $balance;
    }

    public function depositMoney($amount) {
        PHPUnit2_Framework_Assert::assertTrue($amount >= 0);

        $this->balance += $amount;
    }

    public function withdrawMoney($amount) {
        PHPUnit2_Framework_Assert::assertTrue($amount >= 0);
        PHPUnit2_Framework_Assert::assertTrue($this->balance >= $amount);

        $this->balance -= $amount;
    }
}
?>
```

By writing the contract conditions into the tests, we have used Design-by-Contract to program the `BankAccount` class. We then wrote, following the Test-First Programming approach, the code needed to make the tests pass. However, we forgot to write tests that call `setBalance()`, `depositMoney()`, and `withdrawMoney()` with legal values that do not violate the contract conditions. We need a means to test our tests or at least to measure their quality. Such a means is the analysis of code-coverage information that we will discuss next.

Chapter 9. Code-Coverage Analysis

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

You have learned how to use unit tests to test your code. But how do you test your tests? How do you find code that is not yet tested -- or, in other words, not yet *covered* by a test? How do you measure testing completeness? All these questions are answered by a practice called Code-Coverage Analysis. Code-Coverage Analysis gives you an insight into what parts of the production code are executed when the tests are run.

PHPUnit's Code-Coverage Analysis utilizes the statement coverage functionality provided by the Xdebug [http://www.xdebug.org/] extension. An example of what statement coverage means is that if there is a method with 100 lines of code, and only 75 of these lines are actually executed when tests are being run, then the method is considered to have a code coverage of 75 percent.

Figure 9.1, “The BankAccount class, not completeley covered by tests” shows a code-coverage report for the `BankAccount` class (from Example 8.3, “The complete BankAccount class”) in HTML format generated by the PHPUnit command-line test runner's `--coverage-html` switch. Executable code lines are black; non-executable code lines are gray. Code lines that are actually executed are highlighted.

Figure 9.1. The BankAccount class, not completeley covered by tests

The code-coverage report shows that we need to write tests that call `setBalance()`, `depositMoney()`, and `withdrawMoney()` with legal values in order to achieve complete code-coverage. Example 9.1, “The BankAccount class, completeley covered by tests” shows tests that need to be added to the `BankAccountTest` test-case class to completely cover the `BankAccount` class.

Example 9.1. The BankAccount class, completeley covered by tests

```
<?php
require_once 'PHPUnit2/Framework/TestCase.php';
require_once 'BankAccount.php';

class BankAccountTest extends PHPUnit2_Framework_TestCase {
    // ...

    public function testSetBalance() {
        $this->ba->setBalance(1);
        $this->assertEquals(1, $this->ba->getBalance());
    }

    public function testDepositAndWidthdrawMoney() {
        $this->ba->depositMoney(1);
        $this->assertEquals(1, $this->ba->getBalance());
```

```
        $this->ba->withdrawMoney(1);
        $this->assertEquals(0, $this->ba->getBalance());
    }
}
?>
```

In Figure 9.2, “The BankAccount class is completely covered by tests”, we see that the `BankAccount` class is now completely covered by tests.

Figure 9.2. The BankAccount class is completely covered by tests

```
<?php
class BankAccount {
	private $balance=0;

	public function getBalance() {
			return $this->balance;
	}

	public function setBalance($balance) {
			if ($balance >=0) {
					$this->balance=$balance
			} else {
					throw new InvalidArgumentException;
			}
	}

	public function depositMoney($amount)
			if ($amount >=0) {
					$this->balance+=$amount;
			} else {
					throw new InvalidArgumentException;
	}
}

	public function withdrawMoney($amount) {
			if ($amount >=0 && $this->balance >= $amount) {
					$this->balance -=$amount;
			} else {
					throw new InvalidArgumentException;
			}
	}
}
?>
```

In Chapter 12, *PHPUnit and Phing* you will learn how to use Phing to generate more detailed code-coverage reports.

Chapter 10. Stubs

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

Tests that only test one thing are more informative than tests where failure can come from many sources. How can you isolate your tests from external influences? Simply put, by replacing the expensive, messy, unreliable, slow, complicated resources with stubs made from plain PHP objects. For example, you can implement what is in reality a complicated computation by returning a constant, at least for the purposes of a single test.

Stubs solve the problem of allocating expensive external resources. For example, sharing a resource, such as a database connection, between tests by using the `PHPUnit2_Extensions_TestSetup` decorator helps, but not using the database for the purposes of the tests at all is even better.

Design improvement is one effect of using stubs. Widely used resources are accessed through a single façade, so you can easily replace the resource with the stub. For example, instead of having direct database calls scattered throughout the code, you have a single `Database` object, an implementor of the `IDatabase` interface. Then, you can create a stub implementation of `IDatabase` and use it for your tests. You can even create an option for running the tests with the stub database or the real database, so you can use your tests for both local testing during development and integration testing with the real database.

Functionality that needs to be stubbed out tends to cluster in the same object, improving cohesion. By presenting the functionality with a single, coherent interface, you reduce the coupling with the rest of the system.

Self-Shunting

Sometimes you need to check that an object has been called correctly. You can create a complete stub of the object to be called, but that can make it inconvenient to check for correct results. A simpler solution is to apply the *Self Shunt Pattern* and use the test-case object itself as a stub. The term self-shunting is taken from the medical practice of installing a tube that takes blood from an artery and returns it to a vein to provide a convenient place for injecting drugs.

Here is an example: suppose we want to test that the correct method is called on an object that observes another object. First, we make our test-case class an implementor of `Observer`:

```
class ObserverTest extends PHPUnit2_Framework_TestCase implements Observer {
}
```

Next, we implement the one `Observer` method, `update()`, to check that it is called when the state of the observed `Subject` object changes:

```
public $wasCalled = FALSE;

public function update(Subject $subject) {
    $this->wasCalled = TRUE;
}
```

Now, we can write our test. We create a new `Subject` object and attach the test object to it as an observer. When the state of the `Subject` changes -- for instance, by calling its `doSomething()` method -- the `Subject` object has to call the `update()` method on all objects that are registered as observers. We use the `$wasCalled` instance variable that is set by our implementation of `update()` to check whether the `Subject` object does what it is supposed to do:

```
public function testUpdate() {
    $subject = new Subject;
    $subject->attach($this);
    $subject->doSomething();

    $this->assertTrue($this->wasCalled);
}
```

Notice that we create a new `Subject` object instead of relying on a global instance. Stubbing encourages this style of design. It reduces the coupling between objects and improves reuse.

If you are not familiar with the self-shunt pattern, the tests can be hard to read. What is going on here? Why is a test case also an observer? Once you get used to the idiom, the tests are easy to read. Everything you need to understand the test is in one class.

Chapter 11. Other Uses for Tests

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

Once you get used to writing automated tests, you will likely discover more uses for tests. Here are some examples.

Agile Documentation

Typically, in a project that is developed using an agile process, such as Extreme Programming, the documentation cannot keep up with the frequent changes to the project's design and code. Extreme Programming demands *collective code ownership*, so all developers need to know how the entire system works. If you are disciplined enough to consequently use "speaking names" for your tests that describe what a class should do, you can use PHPUnit's TestDox functionality to generate automated documentation for your project based on its tests. This documentation gives developers an overview of what each class of the project is supposed to do.

PHPUnit's TestDox functionality looks at a test class and all the test method names and converts them from camel case PHP names to sentences: `testBalanceIsInitiallyZero()` becomes "Balance is initially zero". If there are several test methods whose names only differ in a suffix of one or more digits, such as `testBalanceCannotBecomeNegative()` and `testBalanceCannotBecomeNegative2()`, the sentence "Balance cannot become negative" will appear only once, assuming that all of these tests succeed.

The following code shows the agile documentation for the `BankAccount` class (from Example 8.1, "Tests for the BankAccount class") generated by running **`phpunit --testdox-text BankAccountTest.txt BankAccountTest`**:

```
BankAccount
 - Balance is initially zero
 - Balance cannot become negative
```

Alternatively, the agile documentation can be generated in HTML format by using `--testdox-html BankAccountTest.htm`.

Agile Documentation can be used to document the assumptions you make about the external packages that you use in your project. When you use an external package, you are exposed to the risks that the package will not behave as you expect, and that future versions of the package will change in subtle ways that will break your code, without you knowing it. You can address these risks by writing a test every time you make an assumption. If your test succeeds, your assumption is valid. If you document all your assumptions with tests, future releases of the external package will be no cause for concern: if the tests succeed, your system should continue working.

Cross-Team Tests

When you document assumptions with tests, you own the tests. The supplier of the package -- who you make assumptions about -- knows nothing about your tests. If you want to have a closer relationship with the supplier of a package, you can use the tests to communicate and coordinate your activities.

When you agree on coordinating your activities with the supplier of a package, you can write the tests together. Do this in such a way that the tests reveal as many assumptions as possible. Hidden assumptions are the death of cooperation. With the tests, you document exactly what you expect from the supplied package. The supplier will know the package is complete when all the tests run.

By using stubs (see the section "Stubs", earlier in this book), you can further decouple yourself from the supplier: The job of the supplier is to make the tests run with the real implementation of the package. Your job is to make the tests run for your own code. Until such time as you have the real implementation of the supplied package, you use stub objects. Following this approach, the two teams can develop independently.

Debugging Tests

When you get a defect report, your impulse might be to fix the defect as quickly as possible. Experience shows that this impulse will not serve you well; it is likely that the fix for the defect causes another defect.

You can hold your impulse in check by doing the following:

1. Verify that you can reproduce the defect.
2. Find the smallest-scale demonstration of the defect in the code. For example, if a number appears incorrectly in an output, find the object that is computing that number.
3. Write an automated test that fails now but will succeed when the defect is fixed.
4. Fix the defect.

Finding the smallest reliable reproduction of the defect gives you the opportunity to really examine the cause of the defect. The test you write will improve the chances that when you fix the defect, you really fix it, because the new test reduces the likelihood of undoing the fix with future code changes. All the tests you wrote before reduce the likelihood of inadvertently causing a different problem.

Refactoring

Refactoring, the controlled technique for improving the design of an existing code base, can be applied safely only when you have a test suite. Otherwise, you might not notice the system breaking while you are carrying out the restructuring. Refactoring can be broken down into a series of small behavior-preserving transformations.

The following conditions will help you to improve the code and design of your project, while using unit tests to verify that the refactoring's transformation steps are, indeed, behavior-preserving and do not introduce errors:

1. All unit tests run correctly.
2. The code communicates its design principles.
3. The code contains no redundancies.
4. The code contains the minimal number of classes and methods.

Chapter 12. PHPUnit and Phing

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

Phing (PHing Is Not GNU make) [http://www.phing.info/] is a project build system based on Apache Ant [http://ant.apache.org/]. In the context of PHP, where you do not need to build and compile your sources, the intention of Phing is to ease the packaging, deployment, and testing of applications. For these tasks, Phing provides numerous out-of-the-box operation modules ("tasks") and an easy-to-use, object-oriented model for adding your own custom tasks.

Phing can be installed using the PEAR Installer, as shown in the following command line:

```
pear channel-discover pear.phing.info
pear install phing/phing
```

Phing uses simple XML build files that specify a target tree where various tasks get executed. One of the out-of-the-box tasks that comes with Phing is the `<phpunit2>` task that runs test cases using the PHPUnit framework. It is a functional port of Apache Ant's JUnit task.

Example 12.1, “Phing build.xml file for the BankAccount tests” shows a Phing `build.xml` file that specifies a `<project>` named "BankAccount". The project's default `<target>` is called *test*. Using the `<phpunit2>` task, this target runs all test cases that can be found in source files that match the `*Test.php` condition. This is done by using a `<batchtest>` element that collects the included files from any number of nested `<fileset>` elements. In this example, the tests declared in the class `BankAccountTest` in the source file `BankAccountTest.php` will be run.

Example 12.1. Phing build.xml file for the BankAccount tests

```
<?xml version="1.0"?>

<project name="BankAccount" basedir="." default="test">
  <target name="test">
    <phpunit2 haltonfailure="true" printsummary="true">
      <batchtest>
        <fileset dir=".">
          <include name="*Test.php"/>
        </fileset>
      </batchtest>
    </phpunit2>
  </target>
</project>
```

Invoking Phing in the directory that contains `build.xml` (Example 12.1, “Phing build.xml file for the BankAccount tests”), `BankAccount.php` (Example 8.3, “The complete BankAccount class”), and `BankAccountTest.php` (Example 8.1, “Tests for the BankAccount class”) will run the tests by executing the project's default target, *tests*:

```
phing
Buildfile: /home/sb/build.xml

BankAccount > test:
 [phpunit2] Tests run: 4, Failures: 0, Errors: 0, Time elapsed: 0.00067 sec

BUILD FINISHED
```

```
Total time: 0.0960 seconds
```

Table 12.1, “Attributes for the <phpunit2> element” shows the parameters that can be used to configure the `<phpunit2>` task.

Table 12.1. Attributes for the <phpunit2> element

Name	Type	Description	Default
`codecoverage`	`Boolean`	Collect Code Coverage information.	`false`
`haltonerror`	`Boolean`	Stops the build process if an error occurs during the test run.	`false`
`haltonfailure`	`Boolean`	Stops the build process if a test fails. Errors are considered failures as well.	`false`
`printsummary`	`Boolean`	Prints one-line statistics for each test case.	`false`

The following example shows the `<phpunit2>` task's output when a test fails:

```
phing
Buildfile: /home/sb/build.xml

BankAccount > test:
 [phpunit2] Tests run: 4, Failures: 1, Errors: 0, Time elapsed: 0.00067 sec
Execution of target "test" failed for the following reason:
/home/sb/build.xml:5:37: One or more tests failed

BUILD FAILED
/home/sb/build.xml:5:37: One or more tests failed
Total time: 0.0968 seconds
```

Formatting Feedback

Besides the required `<batchtest>` element, the `<phpunit2>` element allows for another nested element: `<formatter>` is used to write test results in different formats. Output will always be sent to a file, unless you set the `usefile` attribute to `false`. The name of the file is predetermined by the formatter and can be changed by the `outfile` attribute. There are three predefined formatters:

`brief` Prints detailed information in plain text only for test cases that failed.

`plain` Prints one-line statistics in plain text for all test cases.

`xml` Writes the test results in XML format.

Table 12.2, “Attributes for the <formatter> element” shows the parameters that can be used to configure the `<formatter>` task.

Table 12.2. Attributes for the <formatter> element

Name	Type	Description	Default
`type`	`String`	Use a predefined formatter (xml, plain, or brief).	

Name	Type	Description	Default
`classname`	`String`	Name of a custom formatter class.	
`usefile`	`Boolean`	Determines whether output should be sent to a file.	`true`
`todir`	`String`	Directory the file is written to.	
`outfile`	`String`	Name of the file that is written to.	`Depends on the formatter used.`

To generate a test report in HTML format, you can use the `<phpunit2report>` task, which applies an XSLT stylesheet to the XML logfile created by the `<formatter>` task. Phing ships with two XSLT stylesheets -- `phpunit2-frames.xsl` and `phpunit2-noframes.xsl` -- that generate HTML reports with or without frames, respectively.

Example 12.2, "Applying an XSLT stylesheet to get a test report" shows a `build.xml` file for Phing that runs the tests from the `BankAccountTest` class and generates a test report in HTML format using the `phpunit2-frames.xsl` XSLT stylesheet. The HTML files generated for the report will be written to the `report/` directory that is created by the *prepare* `<target>` and deleted by the *clean* `<target>`.

Example 12.2. Applying an XSLT stylesheet to get a test report

```
<?xml version="1.0"?>

<project name="BankAccount" basedir="." default="report">
  <target name="prepare">
    <mkdir dir="report"/>
  </target>

  <target name="clean">
    <delete dir="report"/>
  </target>

  <target name="report" depends="prepare">
    <phpunit2>
      <batchtest>
        <fileset dir=".">
          <include name="*Test.php"/>
        </fileset>
      </batchtest>

      <formatter type="xml" todir="report" outfile="logfile.xml"/>
    </phpunit2>

    <phpunit2report infile="report/logfile.xml"
                    styledir="/usr/lib/php/data/phing/etc"
                    format="frames"
                    todir="report"/>
  </target>
</project>
```

The following example shows the output of the `phing` command as it runs:

```
phing
Buildfile: /home/sb/build.xml

BankAccount > prepare:
```

```
    [mkdir] Created dir: /home/sb/report

BankAccount > report:

BUILD FINISHED

Total time: 0.1112 seconds
```

Figure 12.1, “The generated test report” shows the title page of the generated test report.

Figure 12.1. The generated test report

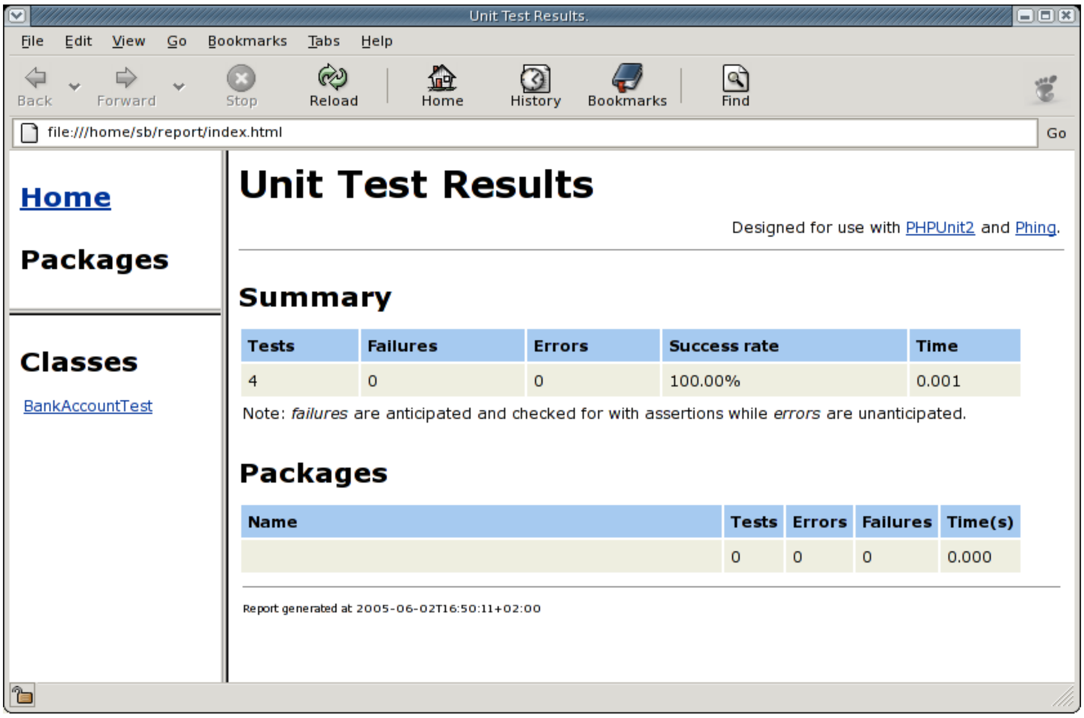


Table 12.3, “Attributes for the <phpunit2report> element” shows the parameters that can be used to configure the `<phpunit2report>` task.

Table 12.3. Attributes for the <phpunit2report> element

Name	Type	Description	Default
`infile`	`String`	The filename of the XML results file to use.	`testsuites.xml`
`format`	`String`	The format of the generated report. Must be `frames` or `noframes`.	`noframes`
`styledir`	`String`	The directory where the stylesheets are located. The stylesheets must conform to the following conventions: the stylesheet for the `frames` format must be named `phpunit2-frames.xsl`, the stylesheet for the	

Name	Type	Description	Default
		`noframes` format must be named `phpunit2-noframes.xsl`.	
`todir`	`String`	The directory where the files resulting from the transformation should be written to.	

In addition to the test report that we just generated, Phing can generate a code-coverage report. For this, we need the `<coverage-setup>` and `<coverage-report>` tasks. The former prepares a database in which code-coverage information is stored while the tests are run; the latter formats such a database into a report in HTML format using XSLT stylesheets.

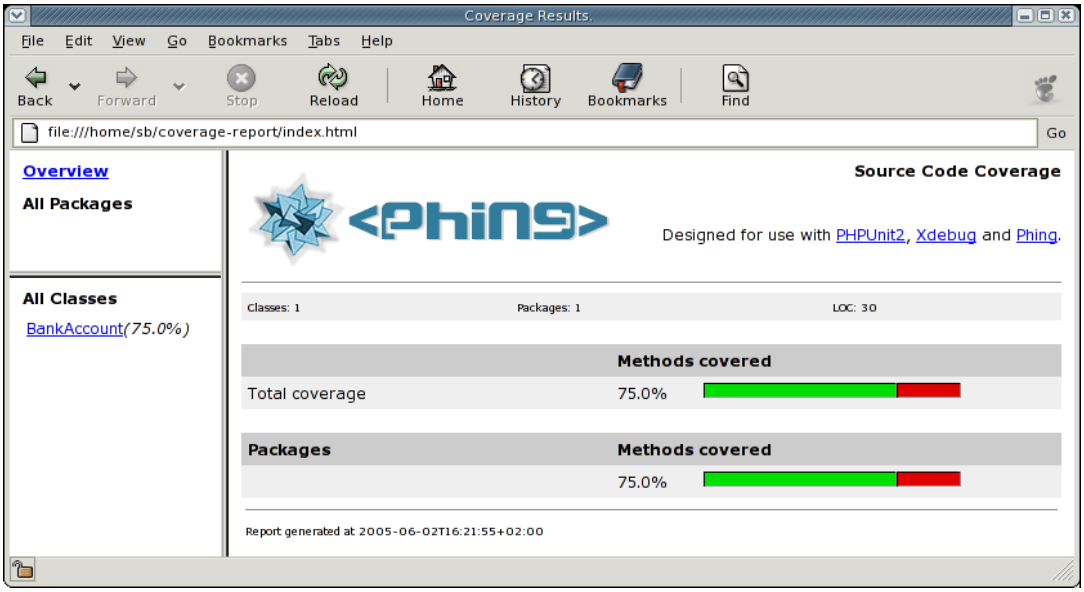
Example 12.3, “Generating a code-coverage report” shows a `build.xml` file for Phing that runs the tests from the `BankAccountTest` class and generates a code-coverage report in HTML format.

Example 12.3. Generating a code-coverage report

```
<?xml version="1.0"?>

<project name="BankAccount" basedir="." default="coverage-report">
  <target name="prepare">
    <mkdir dir="coverage-report"/>
  </target>

  <target name="clean">
    <delete dir="coverage-report"/>
  </target>

  <target name="coverage-report" depends="prepare">
    <coverage-setup database="./coverage-report/database">
      <fileset dir=".">
        <include name="*.php"/>
        <exclude name="*Test.php"/>
      </fileset>
    </coverage-setup>

    <phpunit2 codecoverage="true">
      <batchtest>
        <fileset dir=".">
          <include name="*Test.php"/>
        </fileset>
      </batchtest>
    </phpunit2>

    <coverage-report outfile="coverage-report/coverage.xml">
      <report styledir="/usr/lib/php/data/phing/etc"
              todir="coverage-report"/>
    </coverage-report>
  </target>
</project>
```

Figure 12.2, “The generated code-coverage report” shows the title page of the generated code-coverage report.

Figure 12.2. The generated code-coverage report



Chapter 13. PHPUnit's Implementation

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

The implementation of PHPUnit is a bit unusual, using techniques that are difficult to maintain in ordinary application code. Understanding how PHPUnit runs your tests can help you write them.

A single test is represented by a `PHPUnit2_Framework_Test` object and requires a `PHPUnit2_Framework_TestResult` object to be run. The `PHPUnit2_Framework_TestResult` object is passed to the `PHPUnit2_Framework_Test` object's `run()` method, which runs the actual test method and reports any exceptions to the `PHPUnit2_Framework_TestResult` object. This is an idiom from the Smalltalk world called *Collecting Parameter*. It suggests that when you need to collect results over several methods (in our case the result of the serveral invocations of the `run()` method for the various tests), you should add a parameter to the method and pass an object that will collect the results for you. See the article "JUnit: A Cook's Tour" by Erich Gamma and Kent Beck [GammaBeck1999] and "Smalltalk Best Practice Patterns" by Kent Beck [Beck1997].

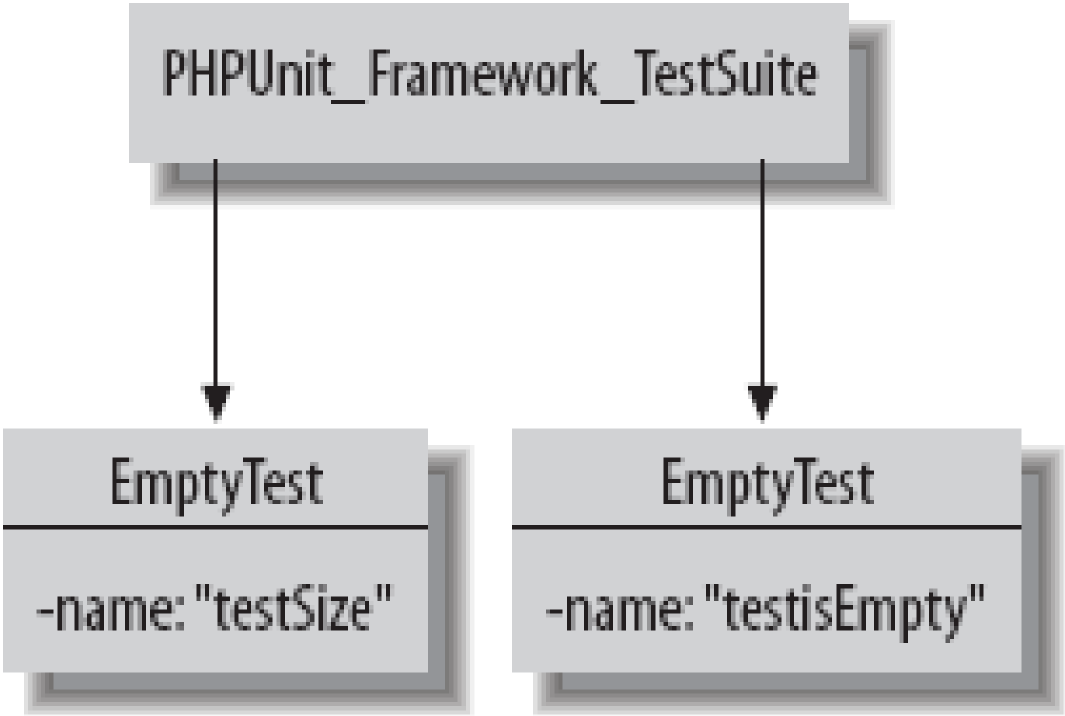
To further understand how PHPUnit runs your tests, consider the test-case class in Example 13.1, “The EmptyTest class”.

Example 13.1. The EmptyTest class

```
<?php
require_once 'PHPUnit2/Framework/TestCase.php';

class EmptyTest extends PHPUnit2_Framework_TestCase {
    private $emptyArray = array();

    public function testSize() {
        $this->assertEquals(0, sizeof($this->emptyArray));
    }

    public function testIsEmpty() {
        $this->assertTrue(empty($this->emptyArray));
    }
}
?>
```

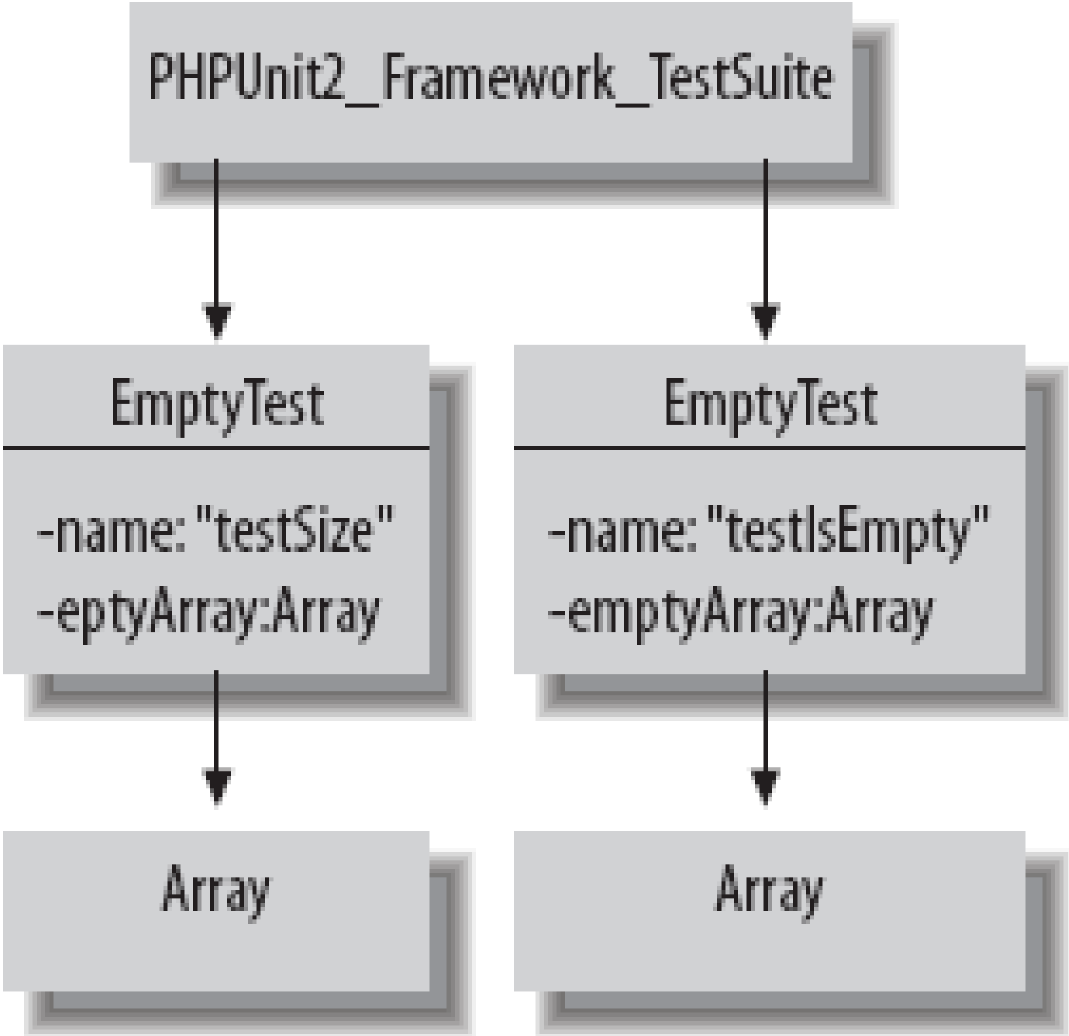
When the test is run, the first thing PHPUnit does is convert the test class into a `PHPUnit2_Framework_Test` object -- here, a `PHPUnit2_Framework_TestSuite` containing two instances of `EmptyTest`, as shown in Figure 13.1, “Tests about to be run”.

Figure 13.1. Tests about to be run



When the `PHPUnit2_Framework_TestSuite` is run, it runs each of the `EmptyTest`s in turn. Each runs its own `setUp()` method, creating a fresh `$emptyArray` for each test, as shown in Figure 13.2, “Tests after running, each with its own fixture”. This way, if one test modifies the array, the other test will not be affected. Even changes to global and super-global (like `$_ENV`) variables do not affect other tests.

Figure 13.2. Tests after running, each with its own fixture



In short, one test-case class results in a two-level tree of objects when the tests are run. Each test method works with its own copy of the objects created by `setUp()`. The result is tests that can run completely independently.

To run the test method itself, PHPUnit uses reflection to find the method name in the instance variable `$name` and invokes it. This is another idiom, called *Pluggable Selector*, that is commonly used in the Smalltalk world. Using a Pluggable Selector makes the writing of tests simpler, but there is a tradeoff: you cannot look at the code to decide whether a method is invoked, you have to look at the data values at runtime.

Chapter 14. PHPUnit API

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

For most uses, PHPUnit has a simple API: subclass `PHPUnit2_Framework_TestCase` for your test cases and call `assertTrue()` or `assertEquals()`. However, for those of you who would like to look deeper into PHPUnit, here are all of its published methods and classes.

Overview

Most of the time, you will encounter five classes or interfaces when you are using PHPUnit:

`PHPUnit2_Framework_Assert` A collection of static methods for checking actual values against expected values.

`PHPUnit2_Framework_Test` The interface of all objects that act like tests.

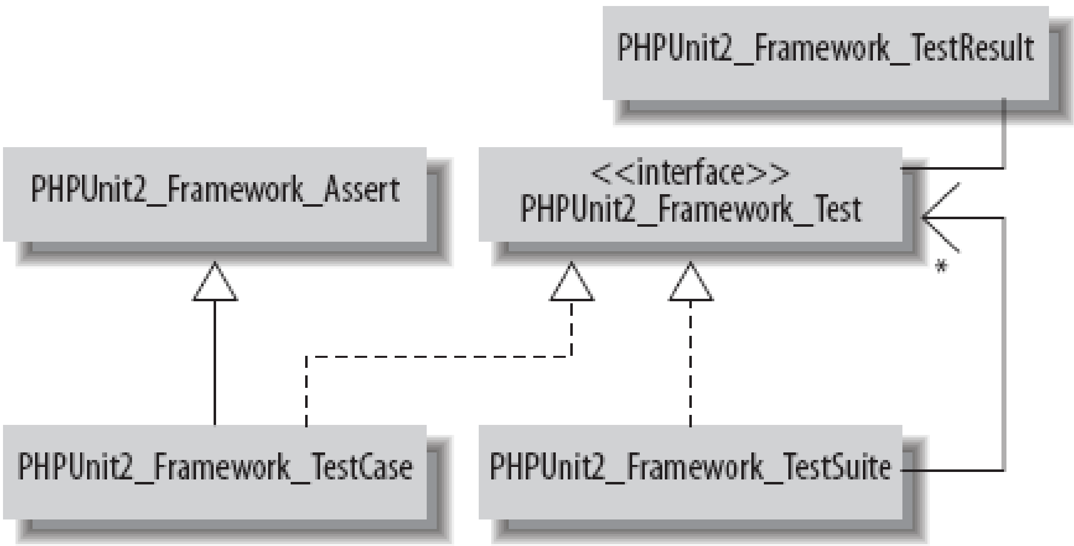
`PHPUnit2_Framework_TestCase` A single test.

`PHPUnit2_Framework_TestSuite` A collection of tests.

`PHPUnit2_Framework_TestResult` A summary of the results of running one or more tests.

Figure 14.1, “The five basic classes and interfaces in PHPUnit” shows the relationship of the five basic classes and interfaces in PHPUnit: `PHPUnit2_Framework_Assert`, `PHPUnit2_Framework_Test`, `PHPUnit2_Framework_TestCase`, `PHPUnit2_Framework_TestSuite`, and `PHPUnit2_Framework_TestResult`.

Figure 14.1. The five basic classes and interfaces in PHPUnit



PHPUnit2_Framework_Assert

Most test cases written for PHPUnit are derived indirectly from the class `PHPUnit2_Framework_Assert`, which contains methods for automatically checking values and reporting discrepancies. The methods are declared static, so you can write design-by-contract style assertions in your methods and have them reported through PHPUnit (Example 14.1, "Design-by-Contract Style Assertions").

Example 14.1. Design-by-Contract Style Assertions

```
<?php
require_once 'PHPUnit2/Framework/Assert.php';

class Sample {
    public function aSampleMethod($object) {
        PHPUnit2_Framework_Assert::assertNotNull($object);
    }
}

$sample = new Sample;
$sample->aSampleMethod(NULL);
?>
```

```
Fatal error: Uncaught exception 'PHPUnit2_Framework_AssertionFailedError'
with message 'expected: <NOT NULL> but was: <NULL>'
```

Most of the time, though, you'll be checking the assertions inside of tests.

There are two variants of each of the assertion methods: one takes a message to be displayed with the error as a parameter, and one does not. The optional message is typically displayed when a failure is displayed, which can make debugging easier.

Example 14.2. Using assertions with messages

```
<?php
require_once 'PHPUnit2/Framework/TestCase.php';

class MessageTest extends PHPUnit2_Framework_TestCase {
    public function testMessage() {
        $this->assertTrue(FALSE, 'This is a custom message.');
    }
}
?>
```

The following example shows the output you get when you run the `testMessage()` test from Example 14.2, "Using assertions with messages", using assertions with messages:

```
phpunit MessageTest.php
PHPUnit 2.3.0 by Sebastian Bergmann.

F

Time: 0.102507
There was 1 failure:
1) testMessage(MessageTest)
This is a custom message.

FAILURES!!!
Tests run: 1, Failures: 1, Errors: 0, Incomplete Tests: 0.
```

Table 14.1, "Assertions" shows all the varieties of assertions.

Table 14.1. Assertions

Assertion	Meaning
`void assertTrue(bool $condition)`	Reports an error if `$condition` is `FALSE`.
`void assertTrue(bool $condition, string $message)`	Reports an error identified by `$message` if `$condition` is `FALSE`.
`void assertFalse(bool $condition)`	Reports an error if `$condition` is `TRUE`.
`void assertFalse(bool $condition, string $message)`	Reports an error identified by `$message` if `$condition` is `TRUE`.
`void assertNull(mixed $variable)`	Reports an error if `$variable` is not `NULL`.
`void assertNull(mixed $variable, string $message)`	Reports an error identified by `$message` if `$variable` is not `NULL`.
`void assertNotNull(mixed $variable)`	Reports an error if `$variable` is `NULL`.
`void assertNotNull(mixed $variable, string $message)`	Reports an error identified by `$message` if `$variable` is `NULL`.
`void assertSame(object $expected, object $actual)`	Reports an error if the two variables `$expected` and `$actual` do not reference the same object.
`void assertSame(object $expected, object $actual, string $message)`	Reports an error identified by `$message` if the two variables `$expected` and `$actual` do not reference the same object.
`void assertSame(mixed $expected, mixed $actual)`	Reports an error if the two variables `$expected` and `$actual` do not have the same type and value.
`void assertSame(mixed $expected, mixed $actual, string $message)`	Reports an error identified by `$message` if the two variables `$expected` and `$actual` do not have the same type and value.
`void assertNotSame(object $expected, object $actual)`	Reports an error if the two variables `$expected` and `$actual` reference the same object.
`void assertNotSame(object $expected, object $actual, string $message)`	Reports an error identified by `$message` if the two variables `$expected` and `$actual` reference the same object.
`void assertNotSame(mixed $expected, mixed $actual)`	Reports an error if the two variables `$expected` and `$actual` have the same type and value.
`void assertNotSame(mixed $expected, mixed $actual, string $message)`	Reports an error identified by `$message` if the two variables `$expected` and `$actual` have the same type and value.
`void assertEquals(array $expected, array $actual)`	Reports an error if the two arrays `$expected` and `$actual` are not equal.
`void assertEquals(array $expected, array $actual, string $message)`	Reports an error identified by `$message` if the two arrays `$expected` and `$actual` are not equal.
`void assertNotEquals(array $expected, array $actual)`	Reports an error if the two arrays `$expected` and `$actual` are equal.
`void assertNotEquals(array $expected, array $actual, string $message)`	Reports an error identified by `$message` if the two arrays `$expected` and `$actual` are equal.

Assertion	Meaning
`void assertEquals(float $expected, float $actual, '', float $delta = 0)`	Reports an error if the two floats `$expected` and `$actual` are not within `$delta` of each other.
`void assertEquals(float $expected, float $actual, string $message, float $delta = 0)`	Reports an error identified by `$message` if the two floats `$expected` and `$actual` are not within `$delta` of each other.
`void assertNotEquals(float $expected, float $actual, '', float $delta = 0)`	Reports an error if the two floats `$expected` and `$actual` are within `$delta` of each other.
`void assertNotEquals(float $expected, float $actual, string $message, float $delta = 0)`	Reports an error identified by `$message` if the two floats `$expected` and `$actual` are within `$delta` of each other.
`void assertEquals(string $expected, string $actual)`	Reports an error if the two strings `$expected` and `$actual` are not equal. The error is reported as the delta between the two strings.
`void assertEquals(string $expected, string $actual, string $message)`	Reports an error identified by `$message` if the two strings `$expected` and `$actual` are not equal. The error is reported as the delta between the two strings.
`void assertNotEquals(string $expected, string $actual)`	Reports an error if the two strings `$expected` and `$actual` are equal.
`void assertNotEquals(string $expected, string $actual, string $message)`	Reports an error identified by `$message` if the two strings `$expected` and `$actual` are equal.
`void assertEquals(mixed $expected, mixed $actual)`	Reports an error if the two variables `$expected` and `$actual` are not equal.
`void assertEquals(mixed $expected, mixed $actual, string $message)`	Reports an error identified by `$message` if the two variables `$expected` and `$actual` are not equal.
`void assertNotEquals(mixed $expected, mixed $actual)`	Reports an error if the two variables `$expected` and `$actual` are equal.
`void assertNotEquals(mixed $expected, mixed $actual, string $message)`	Reports an error identified by `$message` if the two variables `$expected` and `$actual` are equal.
`void assertContains(mixed $needle, array $haystack)`	Reports an error if `$needle` is not an element of `$haystack`.
`void assertContains(mixed $needle, array $haystack, string $message)`	Reports an error identified by `$message` if `$needle` is not an element of `$haystack`.
`void assertNotContains(mixed $needle, array $haystack)`	Reports an error if `$needle` is an element of `$haystack`.
`void assertNotContains(mixed $needle, array $haystack, string $message)`	Reports an error identified by `$message` if `$needle` is an element of `$haystack`.
`void assertContains(mixed $needle, Iterator $haystack)`	Reports an error if `$needle` is not an element of `$haystack`.
`void assertContains(mixed $needle, Iterator $haystack, string $message)`	Reports an error identified by `$message` if `$needle` is not an element of `$haystack`.

Assertion	Meaning
`void assertNotContains(mixed $needle, Iterator $haystack)`	Reports an error if `$needle` is an element of `$haystack`.
`void assertNotContains(mixed $needle, Iterator $haystack, string $message)`	Reports an error identified by `$message` if `$needle` is an element of `$haystack`.
`void assertRegExp(string $pattern, string $string)`	Reports an error if `$string` does not match the regular expression `$pattern`.
`void assertRegExp(string $pattern, string $string, string $message)`	Reports an error identified by `$message` if `$string` does not match the regular expression `$pattern`.
`void assertNotRegExp(string $pattern, string $string)`	Reports an error if `$string` matches the regular expression `$pattern`.
`void assertNotRegExp(string $pattern, string $string, string $message)`	Reports an error identified by `$message` if `$string` matches the regular expression `$pattern`.
`void assertType(string $expected, mixed $actual)`	Reports an error if the variable `$actual` is not of type `$expected`.
`void assertType(string $expected, mixed $actual, string $message)`	Reports an error identified by `$message` if the variable `$actual` is not of type `$expected`.
`void assertNotType(string $expected, mixed $actual)`	Reports an error if the variable `$actual` is of type `$expected`.
`void assertNotType(string $expected, mixed $actual, string $message)`	Reports an error identified by `$message` if the variable `$actual` is of type `$expected`.

You may find that you need other assertions than these to compare objects specific to your project. Create your own `Assert` class to contain these assertions to simplify your tests.

Failing assertions all call a single bottleneck method, `fail(string $message)`, which throws an `PHPUnit2_Framework_AssertionFailedError`. There is also a variant which takes no parameters. Call `fail()` explicitly when your test encounters an error. The test for an expected exception is an example. Table 14.2, “Bottleneck Methods” lists the bottlenext methods in PHPUnit.

Table 14.2. Bottleneck Methods

Method	Meaning
`void fail()`	Reports an error.
`void fail(string $message)`	Reports an error identified by `$message`.

PHPUnit2_Framework_Test

`PHPUnit2_Framework_Test` is the generic interface used by all objects that can act as tests. Implementors may represent one or more tests. The two methods are shown in Table 14.3, “Implementor Methods”.

Table 14.3. Implementor Methods

Method	Meaning
`int countTestCases()`	Return the number of tests.

Method	Meaning
void run(PHPUnit2_ Framework_ TestResult $result)	Run the tests and report the results on $result.

PHPUnit2_Framework_TestCase and PHPUnit2_Framework_TestSuite are the two most prominent implementors of PHPUnit2_Framework_Test. You can implement PHPUnit2_Framework_Test yourself. The interface is kept small intentionally so it will be easy to implement.

PHPUnit2_Framework_TestCase

Your test-case classes will inherit from PHPUnit2_Framework_TestCase. Most of the time, you will run tests from automatically created test suites. In this case, each of your tests should be represented by a method named test* (by convention).

PHPUnit2_Framework_TestCase implements PHPUnit2_Framework_Test::countTestCases() so that it always returns 1. The implementation of PHPUnit2_Framework_Test::run(PHPUnit2_Framework_TestResult $result) in this class runs setUp(), runs the test method, and then runs tearDown(), reporting any exceptions to the PHPUnit2_Framework_TestResult.

Table 14.4, “TestCase external protocols” shows the external protocol implemented by PHPUnit2_Framework_TestCase.

Table 14.4. TestCase external protocols

Method	Meaning
_ _ construct()	Creates a test case.
_ _ construct(string $name)	Creates a named test case. Names are used to print the test case and often as the name of the test method to be run by reflection.
string getName()	Return the name of the test case.
void setName($name)	Set the name of the test case.
PHPUnit2_ Framework_ TestResult run(PHPUnit2_ Framework_ TestResult $result)	Convenience method to run the test case and report it in $result.
void runTest()	Override with a testing method if you do not want the testing method to be invoked by reflection.

There are two template methods -- setUp() and tearDown() -- you can override to create and dispose of the objects against which you are going to test. Table 14.5, “Template Methods” shows these methods.

Table 14.5. Template Methods

Method	Meaning
void setUp()	Override to create objects against which to test. Each test that runs will be run in its own test case, and setUp() will be called separately for each one.
void tearDown()	Override to dispose of objects no longer needed once the test has finished. In general, you only

Method	Meaning
	need to explicitly dispose of external resources (files or sockets, for example) in `tearDown()`.

PHPUnit2_Framework_TestSuite

A `PHPUnit2_Framework_TestSuite` is a composite of `PHPUnit2_Framework_Test`s. At its simplest, it contains a bunch of test cases, all of which are run when the suite is run. Since it is a composite, however, a suite can contain suites which can contain suites and so on, making it easy to combine tests from various sources and run them together.

In addition to the `PHPUnit2_Framework_Test` protocol -- `run(PHPUnit2_Framework_TestResult $result)` and `countTestCases()` -- `PHPUnit2_Framework_TestSuite` contains protocol to create named or unnamed instances. Table 14.6, “Creating named or unnamed instances” shows the instance creation protocol for `PHPUnit2_Framework_TestSuite`.

Table 14.6. Creating named or unnamed instances

Method	Meaning
`_ _ construct()`	Return an empty test suite.
`_ _ construct(string $theClass)`	Return a test suite containing an instance of the class named `$theClass` for each method in the class named `test*`. If no class of name `$theClass` exists an empty test suite named `$theClass` is returned.
`_ _ construct(string $theClass, string $name)`	Return a test suite named `$name` containing an instance of the class named `$theClass` for each method in the class named `test*`.
`_ _ construct(ReflectionClass $theClass)`	Return a test suite containing an instance of the class represented by `$theClass` for each method in the class named `test*`.
`_ _ construct(ReflectionClass $theClass, $name)`	Return a test suite named `$name` containing an instance of the class represented by `$the-Class` for each method in the class named `test*`.
`string getName()`	Return the name of the test suite.
`void setName(string $name)`	Set the name of the test suite.

`PHPUnit2_Framework_TestSuite` also contains protocol for adding and retrieving `PHPUnit2_Framework_Test`s, as shown in Table 14.7, “Protocol for adding and retrieving tests”.

Table 14.7. Protocol for adding and retrieving tests

Method	Meaning
`void addTest(PHPUnit2_ Frame-work_ Test $test)`	Add `$test` to the suite.
`void addTestFile(string $file-name)`	Add the tests that are defined in the class(es) of a given sourcefile to the suite.
`void addTestFiles(array $file-names)`	Add the tests that are defined in the classes of the given sourcefiles to the suite.
`int testCount()`	Return the number of tests directly (not recur-sively) in this suite.

Method	Meaning
PHPUnit2_ Framework_ Test[] tests()	Return the tests directly in this suite.
PHPUnit2_ Framework_ Test testAt(int $index)	Return the test at the $index.

Example 14.3, “Creating and running a test suite” shows how to create and run a test suite.

Example 14.3. Creating and running a test suite

```
<?php
require_once 'PHPUnit2/Framework/TestSuite.php';

require_once 'ArrayTest.php';

// Create a test suite that contains the tests
// from the ArrayTest class.
$suite = new PHPUnit2_Framework_TestSuite('ArrayTest');

// Run the tests.
$suite->run();
?>
```

For an example on how to use PHPUnit2_Framework_TestSuite to hierarchically compose test cases let us look at PHPUnit's own test suite.

Example 14.4, “The AllTests class” shows a cut-down version of Tests/AllTests.php, Example 14.5, “The Framework_AllTests class” a cut-down version of Tests/Framework/AllTests.php.

Example 14.4. The AllTests class

```
<?php
if (!defined('PHPUnit2_MAIN_METHOD')) {
    define('PHPUnit2_MAIN_METHOD', 'AllTests::main');
}

require_once 'PHPUnit2/Framework/TestSuite.php';
require_once 'PHPUnit2/TextUI/TestRunner.php';

require_once 'Framework/AllTests.php';
// ...

class AllTests {
    public static function main() {
        PHPUnit2_TextUI_TestRunner::run(self::suite());
    }

    public static function suite() {
        $suite = new PHPUnit2_Framework_TestSuite('PHPUnit');

        $suite->addTest(Framework_AllTests::suite());
        // ...

        return $suite;
    }
}

if (PHPUnit2_MAIN_METHOD == 'AllTests::main') {
    AllTests::main();
```

```
}
?>
```

Example 14.5. The Framework_AllTests class

```
<?php
if (!defined('PHPUnit2_MAIN_METHOD')) {
    define('PHPUnit2_MAIN_METHOD', 'Framework_AllTests::main');
}

require_once 'PHPUnit2/Framework/TestSuite.php';
require_once 'PHPUnit2/TextUI/TestRunner.php';

require_once 'Framework/AssertTest.php';
// ...

class Framework_AllTests {
    public static function main() {
        PHPUnit2_TextUI_TestRunner::run(self::suite());
    }

    public static function suite() {
        $suite = new PHPUnit2_Framework_TestSuite('PHPUnit Framework');

        $suite->addTestSuite('Framework_AssertTest');
        // ...

        return $suite;
    }
}

if (PHPUnit2_MAIN_METHOD == 'Framework_AllTests::main') {
    Framework_AllTests::main();
}
?>
```

The `Framework_AssertTest` class is a standard test case that extends `PHPUnit2_Framework_TestCase`.

Running `Tests/AllTests.php` uses the TextUI test runner to run all tests while running `Tests/Framework/AllTests.php` runs only the tests for the `PHPUnit2_Framework_*` classes.

This example shows the PHPUnit test suite running:

```
php AllTests.php
PHPUnit 2.3.0 by Sebastian Bergmann.

.........................................
.........................................
.......

Time: 4.642600

OK (89 tests)
```

PHPUnit2_Framework_TestResult

While you are running all these tests, you need somewhere to store all the results: how many tests ran, which failed, and how long they took. `PHPUnit2_Framework_TestResult` collects these results. A single `PHPUnit2_Framework_TestResult` is passed around the whole tree of tests;

when a test runs or fails, the fact is noted in the `PHPUnit2_Framework_TestResult`. At the end of the run, `PHPUnit2_Framework_TestResult` contains a summary of all the tests.

`PHPUnit2_Framework_TestResult` is also a subject than can be observed by other objects wanting to report test progress. For example, a graphical test runner might observe the `PHPUnit2_Framework_TestResult` and update a progress bar every time a test starts.

Table 14.8, “TestResult external protocols” summarizes the external protocols of `PHPUnit2_Framework_TestResult`.

Table 14.8. TestResult external protocols

Method	Meaning
`void addError(PHPUnit2_ Framework_ Test $test, Exception $e)`	Record that running `$test` caused `$e` to be thrown unexpectedly.
`void addFailure(PHPUnit2_ Framework_ Test $test, PHPUnit2_ Framework_ AssertionFailedError $e)`	Record that running `$test` caused `$e` to be thrown unexpectedly.
`PHPUnit2_ Framework_ TestFailure[] errors()`	Return the errors recorded.
`PHPUnit2_ Framework_ TestFailure[] failures()`	Return the failures recorded.
`PHPUnit2_ Framework_ TestFailure[] notImplemented()`	Return the incomplete test cases recorded.
`int errorCount()`	Return the number of errors.
`int failureCount()`	Return the number of failures.
`int notImplementedCount()`	Return the number of incomplete test cases.
`int runCount()`	Return the total number of test cases run.
`boolean wasSuccessful()`	Return whether or not all tests ran successfully.
`boolean allCompletlyImplemented()`	Return whether or not all tests were completely implemented.
`void collectCodeCoverageInformation(bool $flag)`	Enables or disables the collection of Code Coverage information.
`array getCodeCoverageInformation()`	Return the code coverage information collected.

If you want to register as an observer of a `PHPUnit2_Framework_TestResult`, you need to implement `PHPUnit2_Framework_TestListener`. To register, call `addListener()`, as shown in Table 14.9, “TestResult and TestListener”.

Table 14.9. TestResult and TestListener

Method	Meaning
`void addListener(PHPUnit2_ Framework_ TestListener $listener)`	Register `$listener` to receive updates as results are recorded in the test result.
`void removeListener(PHPUnit2_ Framework_ TestListener $listener)`	Unregister `$listener` from receiving updates.

Table 14.10, “TestListener Callbacks” shows the methods that test listeners implement; also see Example 15.3, “A simple test listener”.

Table 14.10. TestListener Callbacks

Method	Meaning
`void addError(PHPUnit2_ Framework_ Test $test, Exception $e)`	`$test` has thrown `$e`.
`void addFailure(PHPUnit2_ Framework_ Test $test, PHPUnit2_ Framework_ AssertionFailedError $e)`	`$test` has failed an assertion, throwing a kind of `PHPUnit2_ Framework_ AssertionFailedError`.
`void addIncompleteTest(PHPUnit2_ Framework_ Test $test, Exception $e)`	`$test` is an incomplete test.
`void startTestSuite(PHPUnit2_ Framework_ TestSuite $suite)`	`$suite` is about to be run.
`void endTestSuite(PHPUnit2_ Framework_ TestSuite $suite)`	`$suite` has finished running.
`void startTest(PHPUnit2_ Framework_ Test $test)`	`$test` is about to be run.
`void endTest(PHPUnit2_ Framework_ Test $test)`	`$test` has finished running.

Package Structure

Many of the classes mentioned so far in this book come from `PHPUnit2/Framework`. Here are all the packages in PHPUnit:

- `PHPUnit2/Framework`

  The basic classes in PHPUnit.

- `PHPUnit2/Extensions`

  Extensions to the PHPUnit framework.

- `PHPUnit2/Runner`

  Abstract support for running tests.

- `PHPUnit2/TextUI`

  The text-based test runner.

- `PHPUnit2/Util`

  Utility classes used by the other packages.

Chapter 15. Extending PHPUnit

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

PHPUnit can be extended in various ways to make the writing of tests easier and customize the feedback you get from running tests. Here are common starting points to extend PHPUnit.

Subclass PHPUnit2_Framework_TestCase

Write utility methods in an abstract subclass of `PHPUnit2_Framework_TestCase` and derive your test case classes from that class. This is one of the easiest ways to extend PHPUnit.

Assert Classes

Write your own class with assertions special to your purpose.

Subclass PHPUnit2_Extensions_TestDecorator

You can wrap test cases or test suites in a subclass of `PHPUnit2_Extensions_TestDecorator` and use the Decorator design pattern to perform some actions before and after the test runs.

PHPUnit ships with two concrete test decorators: `PHPUnit2_Extensions_RepeatedTest` and `PHPUnit2_Extensions_TestSetup`. The former is used to run a test repeatedly and only count it as a success if all iterations are successful. The latter was discussed in Chapter 5, *Fixtures*.

Example 15.1, “The RepeatedTest Decorator” shows a cut-down version of the `PHPUnit2_Extensions_RepeatedTest` test decorator that illustrates how to write your own test decorators.

Example 15.1. The RepeatedTest Decorator

```
<?php
require_once 'PHPUnit2/Extensions/TestDecorator.php';

class PHPUnit2_Extensions_RepeatedTest extends PHPUnit2_Extensions_TestDecorator {
    private $timesRepeat = 1;

    public function __construct(PHPUnit2_Framework_Test $test, $timesRepeat = 1) {
        parent::__construct($test);

        if (is_integer($timesRepeat) &&
            $timesRepeat >= 0) {
            $this->timesRepeat = $timesRepeat;
        }
    }

    public function countTestCases() {
        return $this->timesRepeat * $this->test->countTestCases();
```

```
    }

    public function run($result = NULL) {
        if ($result === NULL) {
            $result = $this->createResult();
        }

        for ($i = 0; $i < $this->timesRepeat && !$result->shouldStop(); $i++) {
            $this->test->run($result);
        }

        return $result;
    }
}
?>
```

Implement PHPUnit2_Framework_Test

The `PHPUnit2_Framework_Test` interface is narrow and easy to implement. You can write an implementation of `PHPUnit2_Framework_Test` that is simpler than `PHPUnit2_Framework_TestCase` and that runs *data-driven tests*, for instance.

Example 15.2, “A data-driven test” shows a data-driven test-case class that compares values from a file with Comma-Separated Values (CSV). Each line of such a file looks like `foo;bar`, where the first value is the one we expect and the second value is the actual one.

Example 15.2. A data-driven test

```
<?php
require_once 'PHPUnit2/Framework/Assert.php';
require_once 'PHPUnit2/Framework/Test.php';
require_once 'PHPUnit2/Framework/TestResult.php';

class DataDrivenTest implements PHPUnit2_Framework_Test {
    private $lines;

    public function __construct($dataFile) {
        $this->lines = file($dataFile);
    }

    public function countTestCases() {
        return sizeof($this->lines);
    }

    public function run($result = NULL) {
        if ($result === NULL) {
            $result = new PHPUnit2_Framework_TestResult;
        }

        $result->startTest($this);

        foreach ($this->lines as $line) {
            list($expected, $actual) = explode(';', $line);

            try {
                PHPUnit2_Framework_Assert::assertEquals(trim($expected), trim($actual));
            }

            catch (PHPUnit2_Framework_ComparisonFailure $e) {
                $result->addFailure($this, $e);
            }
```

```
            catch (Exception $e) {
                $result->addError($this, $e);
            }
        }

        $result->endTest($this);

        return $result;
    }
}

$test   = new DataDrivenTest('data_file.csv');
$result = $test->run();

$failures = $result->failures();
print $failures[0]->thrownException()->toString();
?>
```

```
expected: <foo> but was: <bar>
```

Subclass PHPUnit2_Framework_TestResult

By passing a special-purpose `PHPUnit2_Framework_TestResult` object to the `run()` method, you can change the way tests are run and what result data gets collected.

Implement PHPUnit2_Framework_TestListener

You do not necessarily need to write a whole subclass of `PHPUnit2_Framework_TestResult` in order to customize it. Most of the time, it will suffice to implement a new `PHPUnit2_Framework_TestListener` (see Table 14.10, "TestListener Callbacks") and attach it to the `PHPUnit2_Framework_TestResult` object, before running the tests.

Example 15.3, "A simple test listener" shows a simple implementation of the `PHPUnit2_Framework_TestListener` interface.

Example 15.3. A simple test listener

```
<?php
require_once 'PHPUnit2/Framework/TestListener.php';

class SimpleTestListener
implements PHPUnit2_Framework_TestListener {
  public function
  addError(PHPUnit2_Framework_Test $test, Exception $e) {
    printf(
      "Error while running test '%s'.\n",
      $test->getName()
    );
  }

  public function
  addFailure(PHPUnit2_Framework_Test $test,
             PHPUnit2_Framework_AssertionFailedError $e) {
    printf(
      "Test '%s' failed.\n",
      $test->getName()
    );
```

```
  }

  public function
  addIncompleteTest(PHPUnit2_Framework_Test $test,
                    Exception $e) {
    printf(
      "Test '%s' is incomplete.\n",
      $test->getName()
    );
  }

  public function startTest(PHPUnit2_Framework_Test $test) {
    printf(
      "Test '%s' started.\n",
      $test->getName()
    );
  }

  public function endTest(PHPUnit2_Framework_Test $test) {
    printf(
      "Test '%s' ended.\n",
      $test->getName()
    );
  }

  public function
  startTestSuite(PHPUnit2_Framework_TestSuite $suite) {
    printf(
      "TestSuite '%s' started.\n",
      $suite->getName()
    );
  }

  public function
  endTestSuite(PHPUnit2_Framework_TestSuite $suite) {
    printf(
      "TestSuite '%s' ended.\n",
      $suite->getName()
    );
  }
}
?>
```

Example 15.4, “Running and observing a test suite” shows how to run and observe a test suite.

Example 15.4. Running and observing a test suite

```
<?php
require_once 'PHPUnit2/Framework/TestResult.php';
require_once 'PHPUnit2/Framework/TestSuite.php';

require_once 'ArrayTest.php';
require_once 'SimpleTestListener.php';

// Create a test suite that contains the tests
// from the ArrayTest class.
$suite = new PHPUnit2_Framework_TestSuite('ArrayTest');

// Create a test result and attach a SimpleTestListener
// object as an observer to it.
$result = new PHPUnit2_Framework_TestResult;
$result->addListener(new SimpleTestListener);

// Run the tests.
```

```
$suite->run($result);
?>
```

```
TestSuite 'ArrayTest' started.
Test 'testNewArrayIsEmpty' started.
Test 'testNewArrayIsEmpty' ended.
Test 'testArrayContainsAnElement' started.
Test 'testArrayContainsAnElement' ended.
TestSuite 'ArrayTest' ended.
```

New Test Runner

If you need different feedback from the test execution, write your own test runner, interactive or not. The abstract `PHPUnit2_Runner_BaseTestRunner` class, which the `PHPUnit2_TextUI_TestRunner` class (the PHPUnit command-line test runner) inherits from, can be a starting point for this.

Appendix A. PHPUnit for PHP 4

Caution

You are looking at the documentation for a version of PHPUnit that is no longer supported.

The documentation for the current version of PHPUnit can be found here [../../current/en/index.html].

There is a release series of PHPUnit that works with PHP 4 and does not require PHP 5. Due to PHP 4's limited object model, PHPUnit for PHP 4 is not a complete port of JUnit as PHPUnit for PHP 5 is. It also lacks certain features of PHPUnit for PHP 5, such as code-coverage analysis.

The following command line shows how to install PHPUnit for PHP 4 using the PEAR Installer:

```
pear install -f http://pear.phpunit.de/get/PHPUnit-1.3.3.tgz
```

A test-case class that is used with PHPUnit for PHP 4 is similar to one that is used with PHPUnit for PHP 5. The essential difference is that such a class extends `PHPUnit_TestCase` (which itself extends `PHPUnit_Assert`, the class that provides the assertion methods).

Example A.1, “Writing a test case for PHPUnit 1.x” shows a version of the `ArrayTest` test case that can be used with PHPUnit for PHP 4.

Example A.1. Writing a test case for PHPUnit 1.x

```
<?php
require_once 'PHPUnit/TestCase.php';

class ArrayTest extends PHPUnit_TestCase
{
    var $_fixture;

    function setUp()
    {
        $this->_fixture = array();
    }

    function testNewArrayIsEmpty()
    {
        $this->assertEquals(0, sizeof($this->_fixture));
    }

    function testArrayContainsAnElement()
    {
        $this->_fixture[] = 'Element';
        $this->assertEquals(1, sizeof($this->_fixture));
    }
}
?>
```

PHPUnit for PHP 4 does not provide a TextUI test runner. The most commonly used way to run tests with PHPUnit for PHP 4 is to write a test suite and run it manually, as shown in Example A.2, “Running a test case with PHPUnit 1.x”.

Example A.2. Running a test case with PHPUnit 1.x

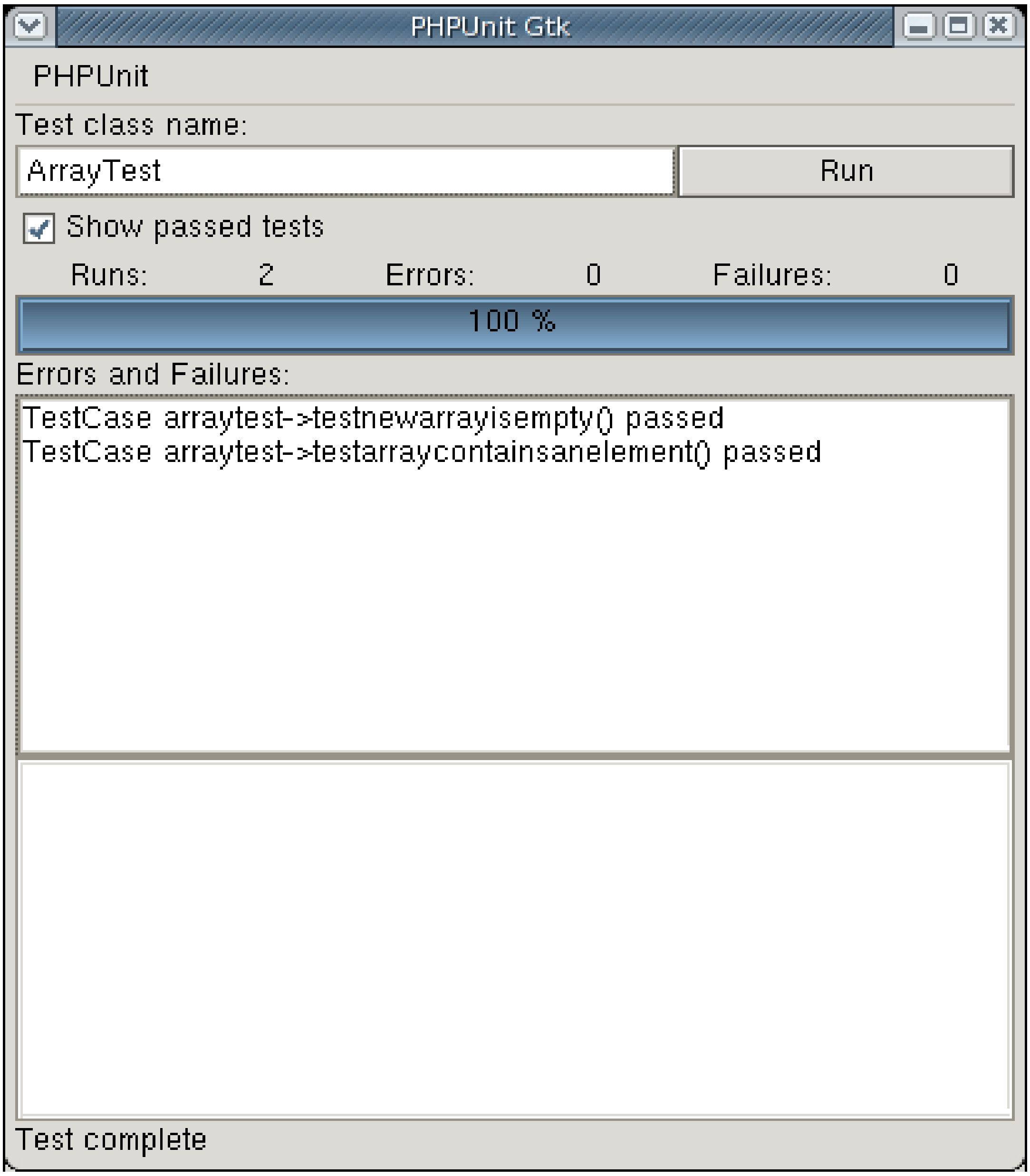
```
<?php
require_once 'ArrayTest.php';
```

```
require_once 'PHPUnit.php';

$suite  = new PHPUnit_TestSuite('ArrayTest');
$result = PHPUnit::run($suite);

print $result->toString();
?>
```

```
TestCase arraytest->testnewarrayisempty() passed
TestCase arraytest->testarraycontainsanelement() passed
```

Figure A.1, “The PHP-GTK Test Runner” shows the one feature that PHPUnit for PHP 4 has that PHPUnit for PHP 5 does not yet have: a test runner with a graphical user interface based on PHP-GTK.

Figure A.1. The PHP-GTK Test Runner



Appendix B. Index

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Appendix C. Bibliography

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Appendix D. Copyright