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Testing PHP/MySQL Applications with PHPUnit/DbUnit

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Who I Am

- Sebastian Bergmann
- 30 years old next week
- Involved in the PHP Project since 2000
- Developer of PHPUnit
- Helps enterprises with (the introduction of) quality assurance for PHP projects

Who are you?

- Your experience with
  - PHP 5?
  - OOP?
  - Testing?
    - PHPUnit?
    - DbUnit?

Why test?

- Companies develop more and more enterprise-critical applications with PHP
- Tests help to make sure that these applications work correctly

Debugging Sucks!

Testing Rocks!

What needs testing?

Web Application

- Backend
  - Business Logic
    - Database Layer
  - Reusable Components

- Frontend
  - Form Processing, Templates, ...
  - “Rich Interfaces” with AJAX, JSON, ...
  - Feeds, Web Services, ...

And how do we test it?

Web Application

- Backend
  - Functional Testing of the business logic with Unit Tests
  - Reusable Components
    - External components should have their own unit tests

- Frontend
  - Acceptance Tests or System Tests that are run “in the browser”
  - Testing of feeds, web services, etc. with Unit Tests
  - Compatibility Tests for Operating System / Browser combinations
  - Performance Tests and Security Tests

Testing Software

- Component Tests
  - Executable code fragments, so called Unit Tests, test the correctness of parts, units, of the software (system under test)
- System Tests
  - Conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. (Wikipedia)
- Non-Functional Tests
  - Performance, Stability, Security, ...

Testing Software

- Developer Tests
  - Ensure that the code works correctly
- Acceptance Tests
  - Ensure that the code does what the customer wants

Tools for Testing

- To make (code) testing viable, good tool support is needed
- This is where a testing framework such as PHPUnit comes into play
- Requirements
  - Reusable test environment
  - Strict separation of production code and test code
  - Automatic execution of test code
  - Analysis of the result
  - Easy to learn to use and easy to use

Tools for Testing PHP / Web Applications

- Unit Tests
  - PHPUnit
  - SimpleTest
- System Tests
  - Selenium
    - PHPUnit + Selenium RC
- Non-Functional Tests
  - Performance, Load, Stress, Availability, ...
    - ab, httperf, JMeter, Grinder, OpenSTA, ...
  - Security
    - Chorizo

PHPUnit (http://phpun.it/)

- Test Framework
  - Member of the xUnit family of test frameworks
  - Mock Objects
  - DbUnit
- Integration
  - phpUnderControl
  - Selenium RC
- Even More Cool Stuff :-)
  - Code Coverage
  - Software Metrics and Project Mess Detection
  - ...

PHPUnit: Installation

```
sb@vmware ~ % pear channel-discover pear.phpunit.de
Adding Channel "pear.phpunit.de" succeeded
Discovery of channel "pear.phpunit.de" succeeded

sb@vmware ~ % pear install phpunit/PHPUnit
downloading PHPUnit-3.2.11.tgz ...
Starting to download PHPUnit-3.2.11.tgz (201,578 bytes)
.....................................done: 201,578 bytes
install ok: channel://pear.phpunit.de/PHPUnit-3.2.11
```

PHPUnit: A First Example

```php
<?php
class BankAccountTest extends PHPUnit_Framework_TestCase
{









}
```

PHPUnit: A First Example

```php
<?php
class BankAccountTest extends PHPUnit_Framework_TestCase
{

    public function testBalanceIsInitiallyZero()
    {

    }

}
```

PHPUnit: A First Example

```php
<?php
class BankAccountTest extends PHPUnit_Framework_TestCase
{

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

}
```

PHPUnit: A First Example

```php
<?php
class BankAccountTest extends PHPUnit_Framework_TestCase
{
    protected $ba;

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

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

    // ...
}
```

PHPUnit: A First Example

```php
<?php
class BankAccountTest extends PHPUnit_Framework_TestCase
{
    // ...

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

        catch (BankAccountException $e) {
            $this->assertEquals(0, $this->ba->getBalance());

            return;
        }

        $this->fail();
    }

    // ...
}
```

PHPUnit: A First Example

```php
<?php
class BankAccountTest extends PHPUnit_Framework_TestCase
{
    // ...

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

        catch (BankAccountException $e) {
            $this->assertEquals(0, $this->ba->getBalance());

            return;
        }

        $this->fail();
    }

    // ...
}
```

PHPUnit: A First Example

```
sb@vmware ~ % phpunit BankAccountTest
PHPUnit 3.3.0 by Sebastian Bergmann.

...

Time: 0 seconds


OK (3 tests)
```

```
sb@vmware ~ % phpunit --testdox BankAccountTest
PHPUnit 3.3.0 by Sebastian Bergmann.

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

PHPUnit: The DbUnit Extension

- Michael Lively Jr. has ported the DbUnit extension for JUnit to PHPUnit
  - `PHPUnit_Extensions_Database_TestCase`
    - is used to test database-driven projects and
    - puts your database into a known state between test runs
      - This avoids problems with one test corrupting the database for other tests
    - has the ability to export and import your database data to and from XML datasets

PHPUnit: The DbUnit Extension

- DbUnit uses PDO to connect to the database-under-test
- The tested application does not have to use PDO itself for this to work
  - You can therefore use `ext/mysqli` in your application and `ext/pdo_mysql` in your tests, for instance

PHPUnit: The DbUnit Extension

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

class BankAccountDBTest extends PHPUnit_Extensions_Database_TestCase {

}
```

PHPUnit: The DbUnit Extension

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

class BankAccountDBTest extends PHPUnit_Extensions_Database_TestCase {
    protected $pdo;

    public function __construct() {
        $this->pdo = PHPUnit_Util_PDO::factory(
          'mysql://test@localhost/test'
        );

        BankAccount::createTable($this->pdo);
    }









}
```

PHPUnit: The DbUnit Extension

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

class BankAccountDBTest extends PHPUnit_Extensions_Database_TestCase {
    protected $pdo;

    public function __construct() {
        $this->pdo = PHPUnit_Util_PDO::factory(
          'mysql://test@localhost/test'
        );

        BankAccount::createTable($this->pdo);
    }

    protected function getConnection() {
        return $this->createDefaultDBConnection($this->pdo, 'mysql');
    }



}
```

PHPUnit: The DbUnit Extension

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

class BankAccountDBTest extends PHPUnit_Extensions_Database_TestCase {
    protected $pdo;

    public function __construct() {
        $this->pdo = PHPUnit_Util_PDO::factory(
          'mysql://test@localhost/test'
        );

        BankAccount::createTable($this->pdo);
    }

    protected function getConnection() {
        return $this->createDefaultDBConnection($this->pdo, 'mysql');
    }

    protected function getDataSet() {
        return $this->createFlatXMLDataSet('/path/to/seed.xml');
    }
}
```

PHPUnit: The DbUnit Extension

```
<dataset>
  <account account_number="159349036496204 86" balance="100.00" />
  <account account_number="159364872302150 67" balance="1216.00" />
  <account account_number="123486123572361 85" balance="89.00" />
  <account account_number="159364872302150 67" balance="1216.00" />
</dataset>
```

PHPUnit: The DbUnit Extension

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

class BankAccountDBTest extends PHPUnit_Extensions_Database_TestCase {
    // ...

    public function testNewAccount() {









    }
}
```

PHPUnit: The DbUnit Extension

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

class BankAccountDBTest extends PHPUnit_Extensions_Database_TestCase {
    // ...

    public function testNewAccount() {
        $ba = new BankAccountDB('12345678912345678', $this->pdo);









    }
}
```

PHPUnit: The DbUnit Extension

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

class BankAccountDBTest extends PHPUnit_Extensions_Database_TestCase {
    // ...

    public function testNewAccount() {
        $ba = new BankAccountDB('12345678912345678', $this->pdo);

        $set = $this->createFlatXMLDataSet(
          '/path/to/after-new-account.xml'
        );









    }
}
```

PHPUnit: The DbUnit Extension

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

class BankAccountDBTest extends PHPUnit_Extensions_Database_TestCase {
    // ...

    public function testNewAccount() {
        $ba = new BankAccountDB('12345678912345678', $this->pdo);

        $set = $this->createFlatXMLDataSet(
          '/path/to/after-new-account.xml'
        );

        $this->assertTablesEqual(
          $set->getTable('account'),
          $this->getConnection()
               ->createDataSet()
               ->getTable('account')
        );
    }
}
```

PHPUnit: The DbUnit Extension

```
<dataset>
  <account account_number="159349036496204 86" balance="100.00" />
  <account account_number="159364872302150 67" balance="1216.00" />
  <account account_number="123486123572361 85" balance="89.00" />
  <account account_number="159364872302150 67" balance="1216.00" />
  <account account_number="123456789123456 78" balance="0.00" />
</dataset>
```

Avoid testing against MySQL if you can

- When testing PHP code that uses PDO to connect to a database, it makes sense to keep your SQL compatible with SQLite
  - No server ⇒ No inter-process communication
  - In-Memory Databases ⇒ No Disk I/O

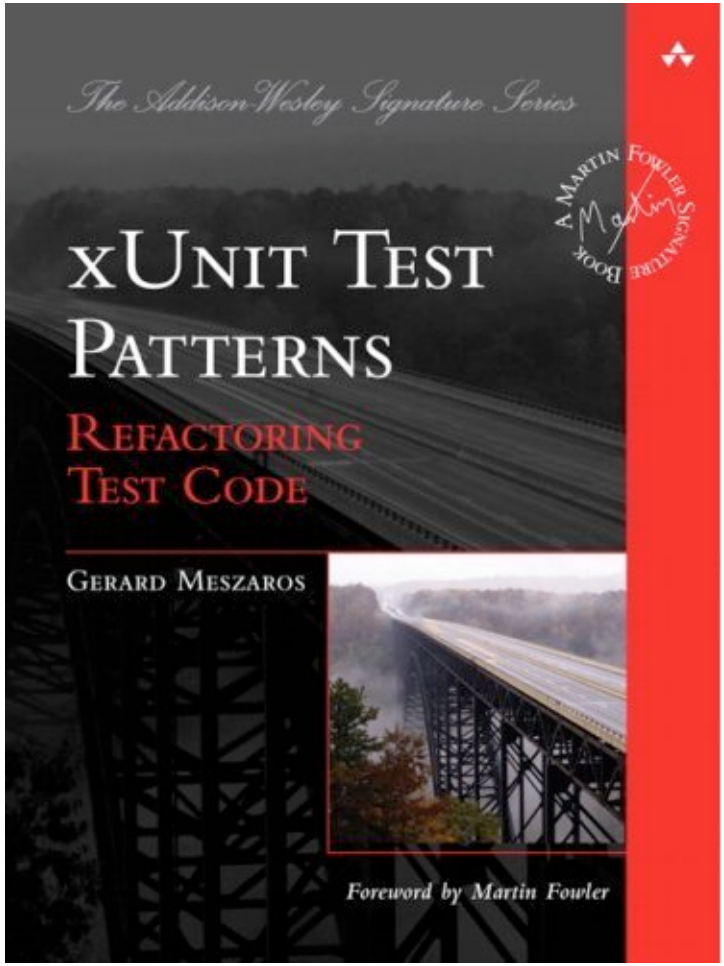
	User	System	CPU	Total
PDO / MySQL	3.95s	0.87s	40%	12.046s
PDO / SQLite (file)	5.01s	1.54s	63%	10.359s
PDO / SQLite (memory)	3.16s	0.68s	99%	3.849s

Stubs and Mocks

- 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 that are automatically generated for the purpose of your tests

Stubs and Mocks

- Dummy
  - Not the real object
- Fake
  - Usable for testing but not for real job
- Stub
  - Fake that returns canned data
- Spy
  - Stub that records called methods, etc.
- Mock
  - Spy with expectations



Stubs and Mocks

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

class ObserverTest extends PHPUnit_Framework_TestCase {
    public function testUpdateIsCalledOnce() {









    }
}
?>
```

Stubs and Mocks

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

class ObserverTest extends PHPUnit_Framework_TestCase {
    public function testUpdateIsCalledOnce() {
        $observer = $this->getMock(
          'Observer', array('update')
        );









    }
}
?>
```

Stubs and Mocks

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

class ObserverTest extends PHPUnit_Framework_TestCase {
    public function testUpdateIsCalledOnce() {
        $observer = $this->getMock(
          'Observer', array('update')
        );

        $observer->expects($this->once())
                 ->method('update')
                 ->with($this->equalTo('something'));




    }
}
?>
```

Stubs and Mocks

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

class ObserverTest extends PHPUnit_Framework_TestCase {
    public function testUpdateIsCalledOnce() {
        $observer = $this->getMock(
          'Observer', array('update')
        );

        $observer->expects($this->once())
                 ->method('update')
                 ->with($this->equalTo('something'));

        $subject = new Subject;
        $subject->attach($observer);
        $subject->doSomething();
    }
}
?>
```

Mocking the Database

- Ideally the *business logic* and the *persistence logic* of a domain entity such as the bank account is (modelled and) implemented in separate classes
  - Separation of Concerns
- This allows for mocking either object to test the other in isolation
  - But you still want to test the *real interaction* between the two, too
- Future Work
  - Leverage MySQL Proxy to mock the database

The End

- Thank you for your interest!
- These slides will be available shortly on http://sebastian-bergmann.de/talks/.

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