Testgetriebene Entwicklung mit PHPUnit

- PHP Professional Training
- 22th of November 2007

About me

- Kore Nordmann
  - Studying computer science at the University Dortmund
  - Working for eZ systems on eZ components
  - Maintainer and / or Developer in multiple open source projects: Image_3D, KaForkl, ezcGraph, Torii, Busimess, PHPUnit, WCV, ...
  - Talks about this, because:
    - Maintainer of MockObjects in PHPUnit
    - Develops in test driven developed projects

•Start

- Ever written bugfree code?

•Agenda

- Why you should (unit)test
- Writing tests with PHPUnit
- MockObjects
- Selenium
- Continuous Integration

•Goal of testing

- Write software with less bugs
  - More customer satisfaction
  - Spend less time on software maintenance
- Test complete public API
  - Ensure BC (backwards compability)

•"Old school" development

- Write requirements specification
- Design software
- Implementation phase
- Testing phase

•Test driven development

- Write requirements specification
- Write tests
  - The tests specify the public API
  - The tests specify the internal APIs
- Make tests pass

•Testing helps!

- Microsoft Case Study
  - TDD project has twice the code quality
  - Writing tests requires 15% more time
- IBM Case Study
  - 40% fewer defects
  - No impact on the team's productivity
- John Deere / Ericsson Case Study
  - TDD produces higher quality code
  - Impact of 16% on the team's productivity

•Example ezcGraph

- Really complex project
  - 81k lines of code (including comments)
  - 66 bugs (including documentation bugs) in 1,5 years of development.
- Warm and fuzzy feeling about BC, stability, ... ;)
  - Test output helps debugging strange platform issues

•What should be tested? (1)

- Everything :)
  - Test successful execution
  - Test for failures
  - Test for edgecases

•What should be tested? (2)

- Backend
  - Business logic
  - Components / Libraries
- Frontend
  - User interaction (forms)
  - Content integration (templates)
  - Rich interfaces (AJAX, ...)
  - Webservices

•Types of tests (1)

- Backend
  - Functional testing (UnitTests)
- Frontend
  - System tests (through the browser, UnitTests)
  - Compability tests (different OSs / browsers)
  - Performance tests / security tests / acceptance tests

•Types of tests (2)

- Unit tests
  - Test code fragments (units) of the software
  - Seperates your code into fine grained testable units
- System tests
  - Test the behaviour of a complete system
  - Test the response of a webservice
  - Test the end result of a library
  - Use browsers to test a web application

•Types of tests (3)

- Acceptance tests
  - Ensure the applications meets the customers expectations
- Performance tests
  - Test for: performance, load, stress, reliability
  - Tools: ab, httperf, siege
- Security tests
  - Automatic scanning for common vulnerabilities
    - For example: Chorizo
    - Manual audits (SectionEins GmbH)

•Agenda

- Why you should (unit)test
- Writing tests with PHPUnit
- MockObjects
- Selenium
- Continuous Integration

- PHPUnit
  - Installation
    - With pear
      - pear channel-discover pear.phpunit.de
      - pear install phpunit/PHPUnit
    - Details:
      - http://www.phpunit.de/pocket_guide/3.2/en/installation.html
  - Documentation
    - http://www.phpunit.de/pocket_guide/3.2/en/index.html

•What will we test?

- A very simple vector class.
  - Does not really matter ;)
- Test Setup
  - component/
    - VectorTest.php
    - Vector.php
    - Tests/
      - Create.php
      - Add.php

•1: The test suite

- Groups your test classes
- ```
  // Require tests classes - you may just use your autoload mechanism here...
  require_once dirname( __FILE__ ) . '/Vector.php';

  // Include tests
  require_once dirname( __FILE__ ) . '/Tests/Create.php';

  class VectorTest extends PHPUnit_Framework_TestSuite
  {
      public function __construct()
      {
          parent::__construct();
          $this->setName( 'Vector Tests' );

          $this->addTest( VectorCreateTest::suite() );
      }

      public static function suite()
      {
          return new VectorTest( __CLASS__ );
      }
  }
  ```
  ```

•1: The test

- Contains the actual tests
- ```
  class VectorCreateTest extends PHPUnit_Framework_TestCase
  {
      public static function suite()
      {
          return new PHPUnit_Framework_TestSuite( __CLASS__ );
      }
  }
  ```
  ```

1: The result

- Output on CLI
- ```
  $ phpunit VectorTest
  PHPUnit 3.2.0 by Sebastian Bergmann.

  F

  Time: 0 seconds

  There was 1 failure:

  1) Warning(PHPUnit_Framework_Warning)
  No tests found in class "VectorCreateTest".

  FAILURES!
  Tests: 1, Failures: 1.
  ```
  ```

2: Add some tests

- Test vector creation
- ```
  public function testCreateDefaultVector()
  {
      $vector = new Vector();

      $this->assertSame( $vector->x, 0 );
      $this->assertSame( $vector->y, 0 );
  }

  public function testCreateVector()
  {
      $vector = new Vector( 1, 2 );

      $this->assertSame( $vector->x, 1 );
      $this->assertSame( $vector->y, 2 );
  }
  ```
  ```

2: Also test for potential failures

- Also test for potential failures
- ```
  public function testCreateVectorFromStrings()
  {
      try
      {
          $vector = new Vector( 'invalid' );
      }
      catch ( Exception $e )
      {
          // Expected
          return;
      }

      $this->fail( 'Expected Exception.' );
  }
  ```
  ```

2: Run the tests

```
$ phpunit VectorTest
PHPUnit 3.2.0 by Sebastian Bergmann.

EEF

Time: 0 seconds

There were 2 errors:

1) testCreateDefaultVector(VectorCreateTest)
Undefined property: Vector::$x
.../Tests/Create.php:14

2) testCreateVector(VectorCreateTest)
Undefined property: Vector::$x
.../Tests/Create.php:22

--

There was 1 failure:

1) testCreateVectorFromStrings(VectorCreateTest)
Expected Exception.
.../Tests/Create.php:38

FAILURES!
Tests: 3, Failures: 1, Errors: 2.
```

3: Start the implementation

```
class Vector
{
    public $x;
    public $y;

    public function __construct( $x = 0, $y = 0 )
    {
        if ( !is_numeric( $x ) || !is_numeric( $y ) )
        {
            throw new Exception( 'Only numeric values are
allowed as parameters.' );
        }

        $this->x = $x;
        $this->y = $y;
    }
}
```

3: Run the tests

- ```
  $ phpunit VectorTest
  PHPUnit 3.2.0 by Sebastian Bergmann.

  ...

  Time: 0 seconds
  ```

- ```
  OK (3 tests)
  ```

4: Add another test class

```
class VectorTest extends PHPUnit_Framework_TestSuite
{
    public function __construct()
    {
        parent::__construct();
        $this->setName( 'Vector Tests' );

        $this->addTest( VectorCreateTest::suite() );
        $this->addTest( VectorAddTest::suite() );
    }
    // ...
}
```

4: Add one new test

```
/**
 * Test vector sum with data provider
 *
 * @dataProvider vectorDataProvider
 */
public function testSumVectors(
    Vector $sum1, Vector $sum2, Vector $res )
{
    $this->assertEquals(
        $sum1->add( $sum2 ),
        $res
    );
}
```

4: Define test data

```
    public static function vectorDataProvider()
    {
        return array(
            array(
                new Vector(), new Vector(), new Vector(),
            ),
            array(
                new Vector( 1, 2 ), new Vector( 2, 3 ), new
Vector( 3, 5 ),
            ),
            array(
                new Vector(), new Vector( .3, .74 ), new Vector(
.3, .74 ),
            ),
            array(
                new Vector( 1 ), new Vector( -12, 2 ), new
Vector( -11, 2 ),
            ),
        );
    }
```

4: Run the tests

- ```
  $ phpunit VectorTest
  PHPUnit 3.2.0 by Sebastian Bergmann.

  ...PHP Fatal error:  Call to undefined method Vector::add()
  in .../Tests/Add.php on line 36
  ```
  ```

5: Implement the addition

```
public function add( $vector )
{
    $this->x += $vector->x;
    $this->y += $vector->y;

    return $this;
}
```

5: Run the tests again

```
$ phpunit VectorTest
PHPUnit 3.2.0 by Sebastian Bergmann.

.......

Time: 0 seconds


OK (7 tests)
```

5: Check the coverage report

```
$ phpunit --coverage-html report/ VectorTest
PHPUnit 3.2.0 by Sebastian Bergmann.

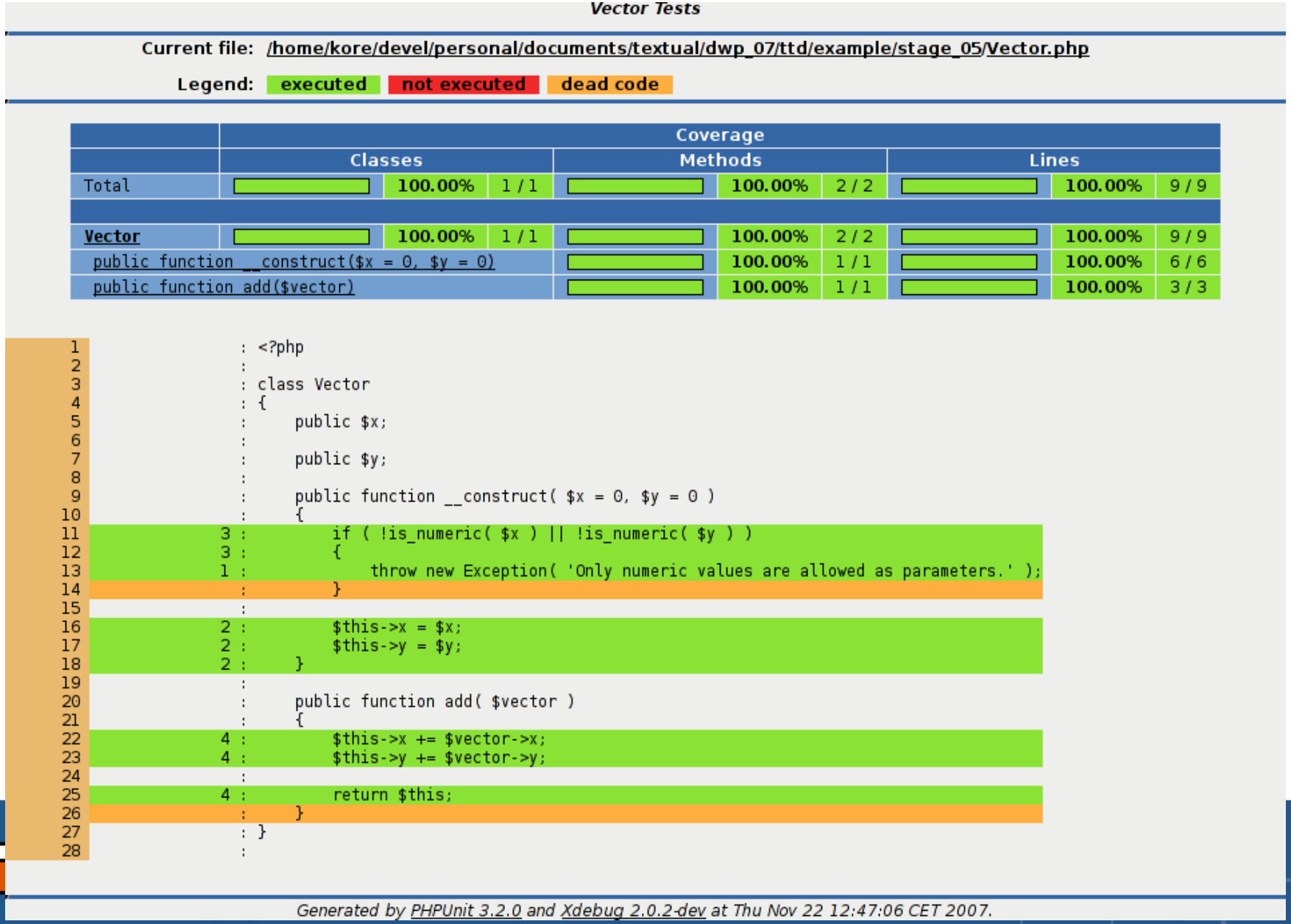
.......

Time: 0 seconds


OK (7 tests)

Generating code coverage report, this may take a moment.
```

5: The coverage



Vector Tests

Current file: /home/kore/devel/personal/documents/textual/dwp_07/ttd/example/stage_05/Vector.php

Legend: executed | not executed | dead code

	Coverage								
	Classes			Methods			Lines		
Total		100.00%	1 / 1		100.00%	2 / 2		100.00%	9 / 9
Vector		100.00%	1 / 1		100.00%	2 / 2		100.00%	9 / 9
public function __construct($x = 0, $y = 0)					100.00%	1 / 1		100.00%	6 / 6
public function add($vector)					100.00%	1 / 1		100.00%	3 / 3

```
  1                 : <?php
  2                 :
  3                 : class Vector
  4                 : {
  5                 :     public $x;
  6                 :
  7                 :     public $y;
  8                 :
  9                 :     public function __construct( $x = 0, $y = 0 )
 10                 :     {
 11               3 :         if ( !is_numeric( $x ) || !is_numeric( $y ) )
 12               3 :         {
 13               1 :             throw new Exception( 'Only numeric values are allowed as parameters.' );
 14                 :         }
 15                 :
 16               2 :         $this->x = $x;
 17               2 :         $this->y = $y;
 18               2 :     }
 19                 :
 20                 :     public function add( $vector )
 21                 :     {
 22               4 :         $this->x += $vector->x;
 23               4 :         $this->y += $vector->y;
 24                 :
 25               4 :         return $this;
 26                 :     }
 27                 : }
 28                 :
```

Generated by PHPUnit 3.2.0 and Xdebug 2.0.2-dev at Thu Nov 22 12:47:06 CET 2007.

5: Full code coverage

- But there are still missing edge cases!
  - Someone?
- Conclusion:
  - Incomplete coverage = Untested code
  - Complete coverage != Fully tested code

6: PHPUnit can handle non fatal errors

```
    /**
     * @group error
     */
    public function testInvalidVectorSum()
    {
        $vector = new Vector();

        try
        {
            $vector->add( 2 );
        }
        catch ( PHPUnit_Framework_Error $e )
        {
            $this->assertSame(
                strpos( $e->getMessage(), 'Argument 1 passed to
Vector::add() must be an instance of Vector, integer given' ),
                0,
                'Expected error message: "Argument 1 passed to
Vector::add() must be an instance of Vector, integer given, ..."'
            );
        }
    }
```

6: Run test from one group

- ```
  $ phpunit --group error VectorTest
  PHPUnit 3.2.0 by Sebastian Bergmann.

  ..

  Time: 0 seconds


  OK (2 tests)
  ```
  ```

More essential features

- setUp() and tearDown()
  - Handle information / ressources across test cases
- Lots of other different assertions then assertSame()
  - assertEquals(): Type does no matter, optional delta value
    - May also take DOMDocuments as parameters
  - assertAttributeEquals(): Check for (private) Object attributes
  - assertRegExp(), assertType(), assertTrue(), ...

Agenda

- Why you should (unit)test
- Writing tests with PHPUnit
- MockObjects
- Selenium
- Continuous Integration

•Use of Mock Objects

- Test object interaction
- Mock unstable, unreliable, untestable, slow, messy backends
  - Stubs for data from slow databases
  - Spys for calls to backends generating binary data

•The basics

- Dummy
  - A random variable
- Fake
  - Faking the expected object (inheritance)
- Stub
  - Provide canned data as return value
- Spy
  - Log requests to object
- Mock
  - Combination of Spy & Stub

Code examples – Stub

```
public function testStub()
{
    // Create, receive and assigne mocked class
    $caller = new exampleCaller();
    $listener = $this->getMock( 'exampleListener', array(
        'call',
        'update',
    ) );
    $caller->setListener( $listener );

    // Set up stubs
    $listener
        ->expects( $this->any() )
        ->method( 'call' )
        ->will( $this->returnValue( true ) );

    $listener
        ->expects( $this->any() )
        ->method( 'update' )
        ->will( $this->returnValue( false ) );

    // Run tested classes, using the stubs
    $caller->run();
}
```

•Code examples – Spy

```
public function testSpy()
{
    // Create, receive and assigne mocked class
    $caller = new exampleCaller();
    $listener = $this->getMock( 'exampleListener', array(
        'call',
    ) );
    $caller->setListener( $listener );

    // Set up expectations
    $listener
        ->expects( $this->once() )
        ->method( 'call' )
        ->with(
            $this->equalTo( 'signal'  ),
            $this->equalTo( array( 1, 2, 3 ) )
        );

    // Run tested classes, to match expectations
    $caller->run();
}
```

•Code examples – Mock

```
public function testMock()
{
    // Create, receive and assigne mocked class
    $caller = new exampleCaller();
    $listener = $this->getMock( 'exampleListener', array(
        'call',
        'update',
    ) );
    $caller->setListener( $listener );

    // Set up expectations and return values
    $listener
        ->expects( $this->at( 0 ) )
        ->method( 'call' )
        ->with(
            $this->equalTo( 'signal'  ),
            $this->equalTo( array( 1, 2, 3 ) )
        )
        ->will( $this->returnValue( true ) );

    $listener
        ->expects( $this->at( 1 ) )
        ->method( 'update' )
        ->will( $this->returnValue( false ) );

    // Run tested classes
    $caller->run();
}
```

•Not possible yet

- Mock final methods
- Mock internally used classes
  - Patch for overloading new available

•Agenda

- Why you should (unit)test
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•Selenium (1)

- Test web applications
  - Regular expressions on the result on a local host?
    - Fails for "rich interfaces"
    - Does not respect browser incompabilities
- We need to control the browsers somehow
  - They are all so f***ing different

•Selenium (2)

- Works around all browser and OS quirks
  - Windows: Internet Explorer 6.0 and 7.0, Firefox 1.5.0.8 and 2.0, Opera 8.5.4 and 9.0.2 (Firefox 0.8 to 2.0, Mozilla Suite 1.6+, 1.7+, Seamonkey 1.0, Opera 8.5+, 9)
  - Mac OS X: Firefox 1.5.0.4 and 2.0 (Safari 1.3+, Firefox 0.8 to 2.0, Camino 1.0a1, Mozilla Suite 1.6+, 1.7+, Seamonkey 1.0)
  - Linux: Firefox 1.5.0.8 and 2.0, Opera 9.0.2, Konqueror 3.5.3 (Firefox 0.8 to 2.0, Mozilla Suite 1.6+, 1.7+, Konqueror 3.5+, Opera 8.5+, 9)

•Selenium (3)

- Test web applications directly in the browser
  - System tests
  - Browser compability testing, by using different browsers
- Full usage of all browser features
  - ECMAScript, XMLHttprequest, (AJAX), ...

•Selenium IDE

- IDE for Selenium tests
  - Firefox Extension
- Work with test in your browser
  - Record
  - Execute
  - Edit
  - Debug

•Selenium RC

- Automated execution of Selenium tests
- Test may be specified in any language
  - PHP Bindings: PEAR:PHP_Selenium
  - PHPUnit: PHPUnit_Extensions_SeleniumTestCase
- One test may be executed in multiple browser / OS combinations
  - Use and control virtual machines

•Agenda

- Why you should (unit)test
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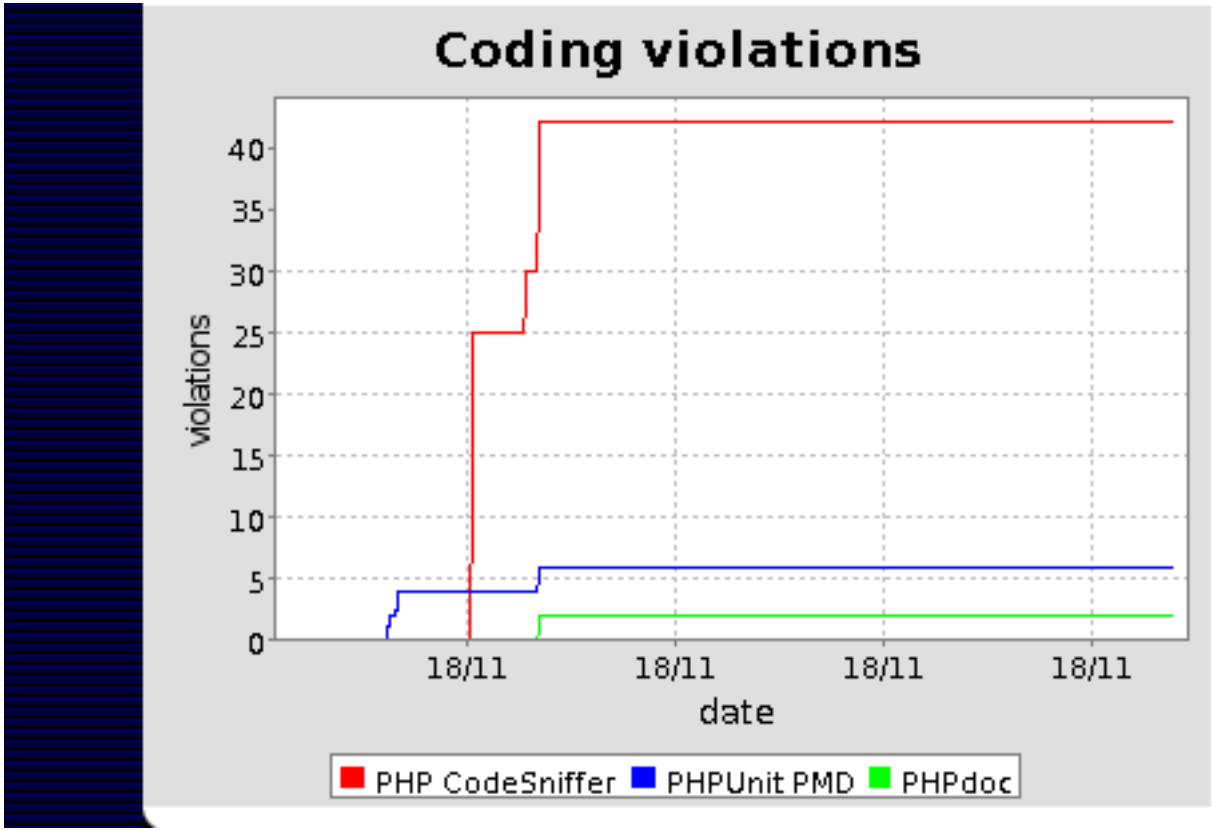
•Continuous Integration

- Continuously runs your tests
  - After each commit to your VCS (version control system)
  - After a configured timespan
- Shows broken builds
  - Sends mails to your project manager ;)
  - Makes conflicting changes easily visible

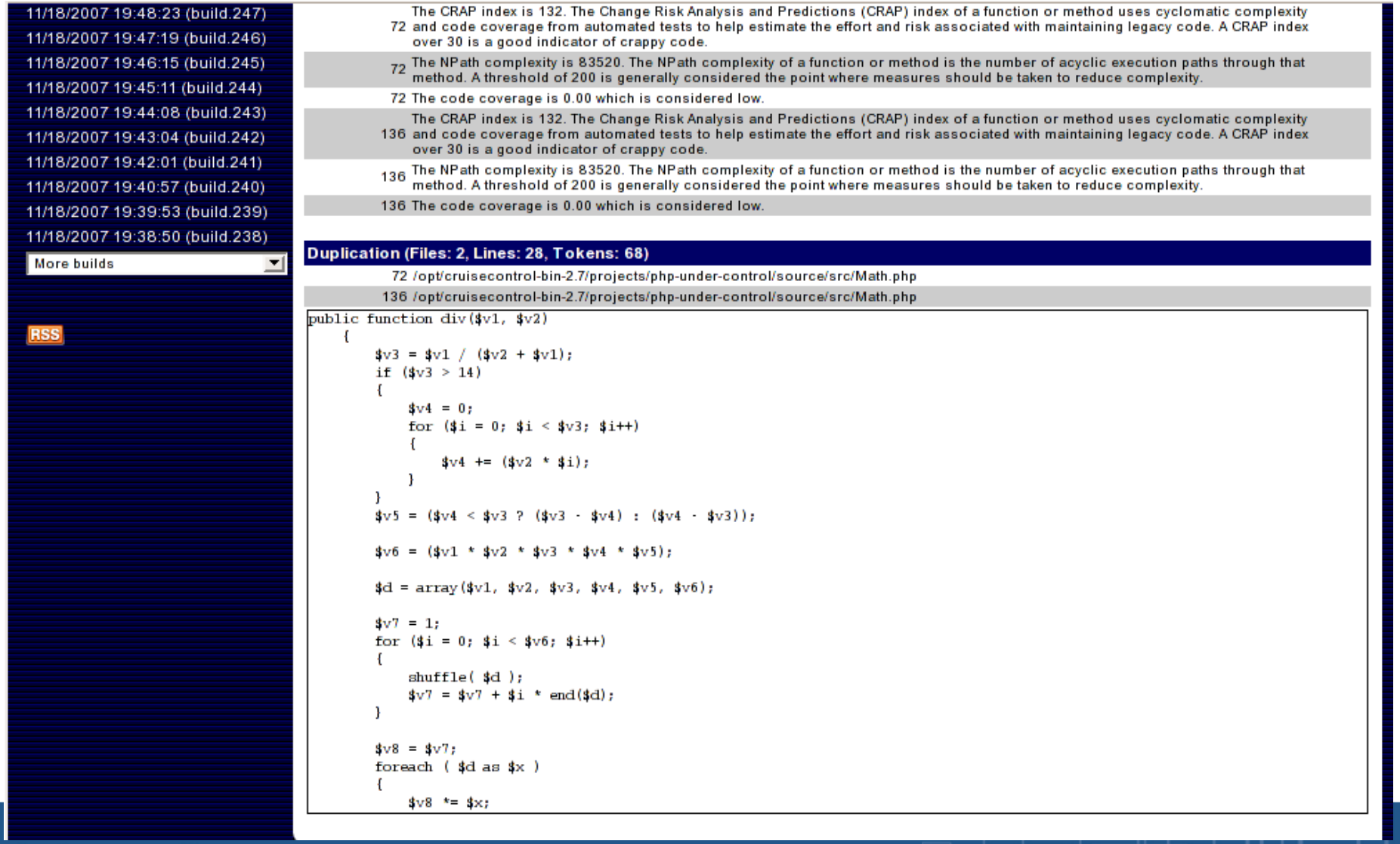
•CruiseControl

- Java based framework for continious integration
  - New BSD licensed
- Integration with PHP tools
  - phpUnderControl by Manuel Pichler
    - Integrates PHPUnit, CodeSniffer & CruiseControl

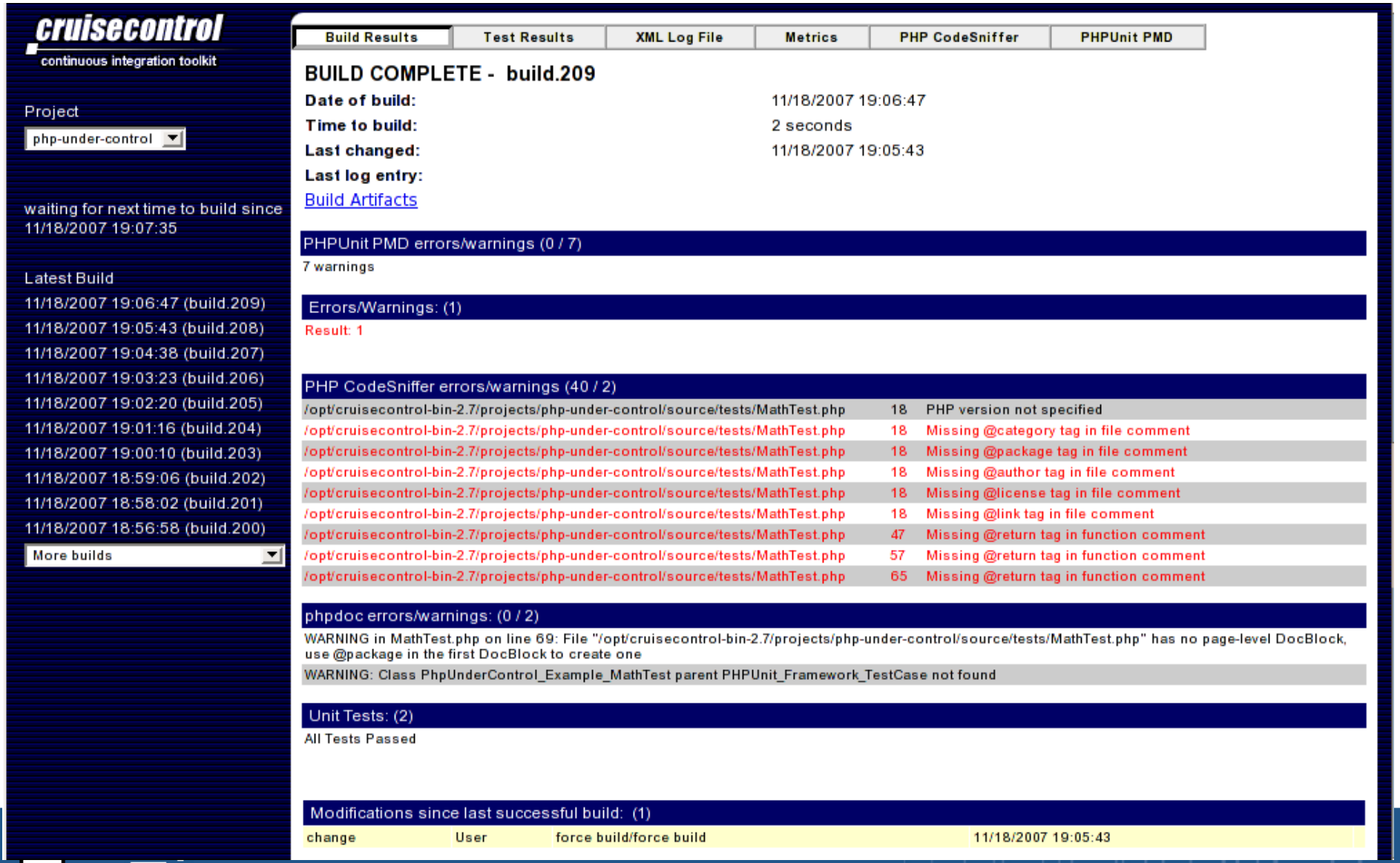
•phpUnderControl – Screenshot (1)



•phpUnderControl – Screenshot (2)



•phpUnderControl – Screenshot (3)



•Questions?

- Open questions?
- Ressources:
  - http://phpunit.de
  - http://kore-nordmann.de
  - xUnit Test Patterns (ISBN: 978-0131495050)
- Contact
  - kore@php.net
  - mail@kore-nordmann.de

The end

- Thanks for listening