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Formation PHPUnit et Tests sous Symfony

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Introduction

Présentation

- Romain Bohdanowicz
  Ingénieur EFREI 2008, spécialité en Ingénierie Logicielle
- Expérience
  Formateur/Développeur Freelance depuis 2006
  Plus de 5000 heures de formation
- Langages
  Expert : HTML / CSS / JavaScript / PHP / Java
  Notions : C / C++ / Objective-C / C# / Python / Bash / Batch
- Certifications
  PHP 5 / PHP 5.3 / PHP 5.5 / Zend Framework 1
- Et vous ?
  Langages ? Expérience ? Utilité de cette formation ?

Tests automatisés

Tests automatisés

- Vérification manuelle
  - Ecrire une recette de tests et demander à une personne de la rejouer à des étapes clés (nouvelle version)
  - Ecrire le test sous la forme de code, et vérifier visuellement que les résultats attendus soit les bons
- Tests automatisés
  - Le test est codé, la vérification se fait dans un rapport
- Historique
  - sUnit en 1994 (SmallTalk), JUnit en 1997 (Java)
  - Les frameworks s'inspirant de jUnit sont catégorisés xUnit (PHPUnit, CUnit…)

Tests manuels

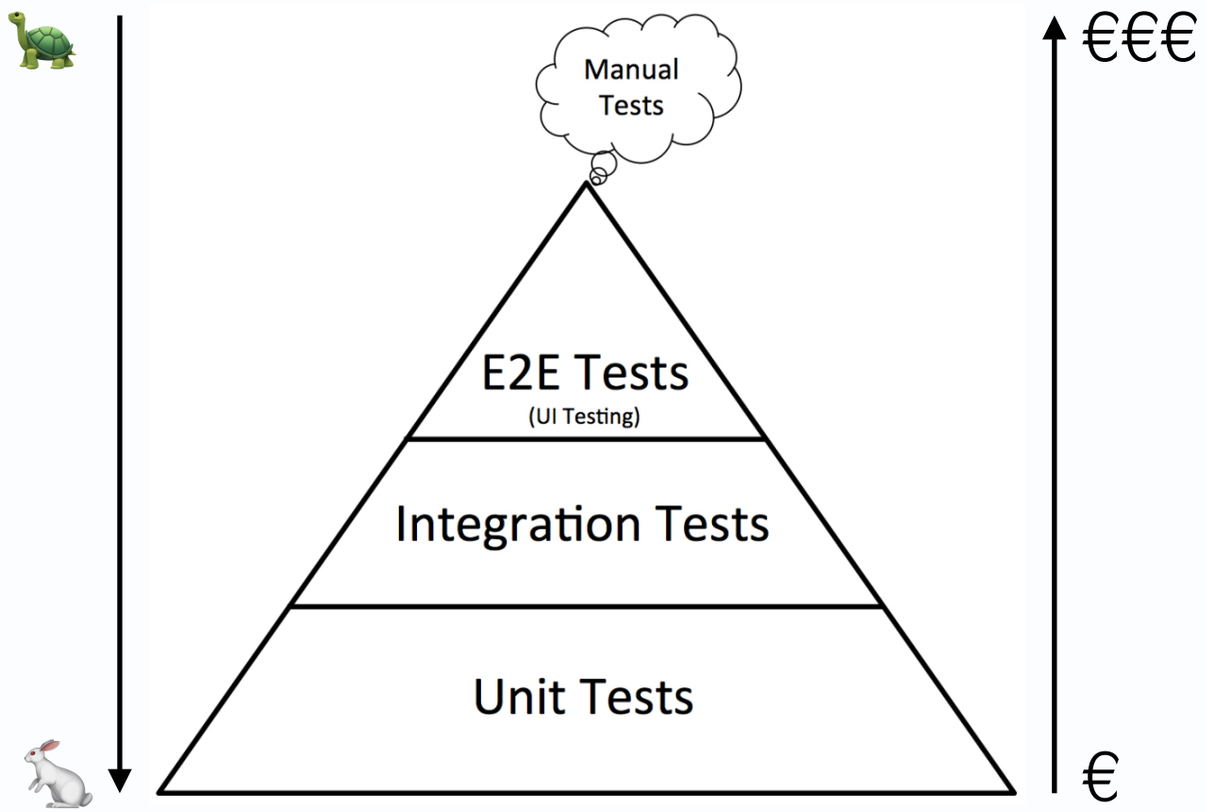
- Avantages de tester manuellement
  - intuition humaine
  - détection UX
  - exploratoire
- Inconvénients
  - lents
  - répétitifs
  - non fiables
  - coûteux
  - difficiles à rejouer exactement

Tests automatisé

- Avantages
  - rapides
  - reproductibles
  - exécutables en CI/CD
  - sécurisent les refactorings
  - documentation vivante

Pyramide des Tests

- Types de tests
  - **Unitaire** : tests des méthodes d'une classe
  - **Intégration** : teste l'intégration entre plusieurs classes
  - **Fonctionnels** : teste l'application du point de vue du client (HTTP dans le cas du web)
  - **End-to-End (E2E)** : teste l'application dans le client (y compris JavaScript, CSS…)



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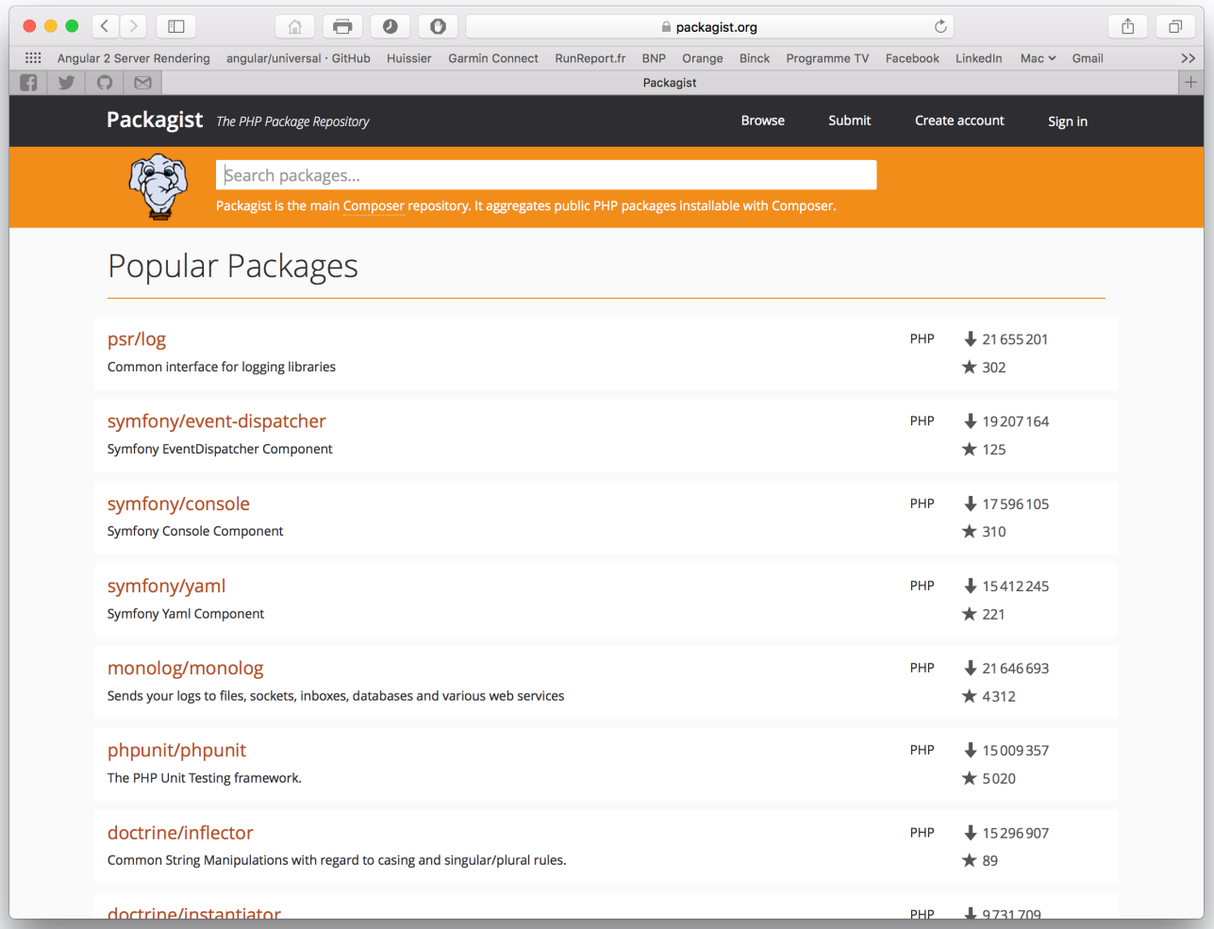
PHPUnit

PHPUnit - Introduction

- Créé en 2001 par Sebastian Bergmann
- Framework de tests de référence en PHP
  Utilisé, même étendu par Symfony et Zend Framework
- Documentation
  https://phpunit.de/documentation.html
- Open Source
  Licence BSD Modifiée
- Concurrents :
  atoum (FR), Behat (BDD), SimpleTest



PHPUnit - Installation globale

- PHAR
  - Dernière Version
    https://phar.phpunit.de/phpunit.phar
  - Version spécifique
    https://phar.phpunit.de/phpunit-X.Y.Z.phar
- Composer
  - Dernière Version
    `composer global require phpunit/phpunit`
  - Version spécifique
    `composer global require phpunit/phpunit:5.0.*`
  - Penser à ajouter le répertoire bin global au PATH, sur UNIX :
    `~/.composer/vendor/bin`

PHPUnit - Installation locale

- Composer
  - Dernière Version
    `composer require phpunit/phpunit --dev`
  - Version spécifique
    `composer require phpunit/phpunit:5.0.* --dev`
  - Ou en éditant directement le fichier composer.json puis composer update

```
{
    "require-dev" : {
        "phpunit/phpunit": "5.1.*"
    }
}
```

  - Exécution depuis la racine du projet :
    `./vendor/bin/phpunit`

PHPUnit - Structure d’un test

- Conventions
  - Un test PHPUnit est une méthode dont le nom commence par test : testMaFonction()
  - Cette méthode se trouve dans une classe dont le nom se termine par Test et qui hérite de \PHPUnit_Framework_TestCase ou \PHPUnit\Framework\TestCase
- Bonnes pratiques
  - Ne pas hésiter à être le plus verbeux possible dans le nom des méthodes
  - L’arborescence du répertoire test correspond au répertoire src (ex : src/MonNamespace/MaClasse.php -> tests/MonNamespaceTest/MaClasseTest.php)

PHPUnit - Exemple

```php
<?php

namespace FormationTechTest\Entity;

use FormationTech\Entity\CompteBancaire;

class CompteBancaireTest extends \PHPUnit_Framework_TestCase
{
    public function testCrediter()
    {
        $compte = new CompteBancaire(0);
        $compte->crediter(1000);
        $this->assertEquals(1000, $compte->getSolde());

        $compte->crediter(500);
        $this->assertEquals(1500, $compte->getSolde());
    }
}
```

```
MBP-de-Romain:PrepaFormationPHPUnit romain$ ./vendor/bin/phpunit tests/Entity/CompteBancaireTest.php --colors
PHPUnit 5.1.3 by Sebastian Bergmann and contributors.

.                                                                   1 / 1 (100%)

Time: 39 ms, Memory: 1.50Mb

OK (1 test, 2 assertions)
```

PHPUnit - Appels automatiques

- PHPUnit peut appeler des méthodes avant et après chaque test
  - setUp
  - tearDown
- Avant ou après chaque classe (méthodes statiques)
  - setUpBeforeClass
  - tearDownAfterClass
- Utile pour éviter de créer des dépendances entres les tests

PHPUnit - CLI

```
$ ./vendor/bin/phpunit -h
PHPUnit 13.0.5 by Sebastian Bergmann and contributors.

Usage:
  phpunit [options] <directory|file> ...

Configuration:

  --bootstrap <file>                    A PHP script that is included before the tests run
  -c|--configuration <file>             Read configuration from XML file
  --no-configuration                    Ignore default configuration file (phpunit.xml)
  --extension <class>                   Register test runner extension with bootstrap <class>
  --no-extensions                       Do not register test runner extensions
  --include-path <path(s)>              Prepend PHP's include_path with given path(s)
  -d <key[=value]>                      Sets a php.ini value
  --cache-directory <dir>               Specify cache directory
  --generate-configuration              Generate configuration file with suggested settings
  --migrate-configuration               Migrate configuration file to current format
  --generate-baseline <file>            Generate baseline for issues
  --use-baseline <file>                 Use baseline to ignore issues
  --ignore-baseline                     Do not use baseline to ignore issues

Selection:

  --all                                 Ignore test selection from XML configuration file
  --list-suites                         List available test suites
  --testsuite <name>                    Only run tests from the specified test suite(s)
  --exclude-testsuite <name>            Exclude tests from the specified test suite(s)
  --list-groups                         List available test groups
  --group <name>                        Only run tests from the specified group(s)
  --exclude-group <name>                Exclude tests from the specified group(s)
  --covers <name>                       Only run tests that intend to cover <name>
  --uses <name>                         Only run tests that intend to use <name>
  --requires-php-extension <name>       Only run tests that require PHP extension <name>
  --list-test-files                     List available test files
  --list-tests                          List available tests
  --list-tests-xml <file>               List available tests in XML format
  --filter <pattern>                    Filter which tests to run
  --exclude-filter <pattern>            Exclude tests for the specified filter pattern
  --test-suffix <suffixes>              Only search for test in files with specified suffix(es). Default: Test.php,.phpt
  --test-files-file <file>              Only run test files listed in file (one file by line)
```

PHPUnit - CLI

```
Execution:

  --process-isolation                 Run each test in a separate PHP process
  --globals-backup                    Backup and restore $GLOBALS for each test
  --static-backup                     Backup and restore static properties for each test

  --strict-coverage                   Be strict about code coverage metadata
  --strict-global-state               Be strict about changes to global state
  --disallow-test-output              Be strict about output during tests
  --enforce-time-limit                Enforce time limit based on test size
  --default-time-limit <sec>          Timeout in seconds for tests that have no declared size
  --do-not-report-useless-tests       Do not report tests that do not test anything

  --stop-on-defect                    Stop after first error, failure, warning, or risky test
  --stop-on-error                     Stop after first error
  --stop-on-failure                   Stop after first failure
  --stop-on-warning                   Stop after first warning
  --stop-on-risky                     Stop after first risky test
  --stop-on-deprecation               Stop after first test that triggered a deprecation
  --stop-on-notice                    Stop after first test that triggered a notice
  --stop-on-skipped                   Stop after first skipped test
  --stop-on-incomplete                Stop after first incomplete test

  --fail-on-empty-test-suite          Signal failure using shell exit code when no tests were run
  --fail-on-warning                   Signal failure using shell exit code when a warning was triggered
  --fail-on-risky                     Signal failure using shell exit code when a test was considered risky
  --fail-on-deprecation               Signal failure using shell exit code when a deprecation was triggered
  --fail-on-phpunit-deprecation       Signal failure using shell exit code when a PHPUnit deprecation was triggered
  --fail-on-phpunit-notice            Signal failure using shell exit code when a PHPUnit notice was triggered
  --fail-on-phpunit-warning           Signal failure using shell exit code when a PHPUnit warning was triggered
  --fail-on-notice                    Signal failure using shell exit code when a notice was triggered
  --fail-on-skipped                   Signal failure using shell exit code when a test was skipped
  --fail-on-incomplete                Signal failure using shell exit code when a test was marked incomplete
  --fail-on-all-issues                Signal failure using shell exit code when an issue is triggered

  --do-not-fail-on-empty-test-suite   Do not signal failure using shell exit code when no tests were run
  --do-not-fail-on-warning            Do not signal failure using shell exit code when a warning was triggered
  --do-not-fail-on-risky              Do not signal failure using shell exit code when a test was considered risky
  --do-not-fail-on-deprecation        Do not signal failure using shell exit code when a deprecation was triggered
  --do-not-fail-on-phpunit-deprecation Do not signal failure using shell exit code when a PHPUnit deprecation was
                                      triggered
  --do-not-fail-on-phpunit-notice     Do not signal failure using shell exit code when a PHPUnit notice was triggered
  --do-not-fail-on-phpunit-warning    Do not signal failure using shell exit code when a PHPUnit warning was triggered
  --do-not-fail-on-notice             Do not signal failure using shell exit code when a notice was triggered
  --do-not-fail-on-skipped            Do not signal failure using shell exit code when a test was skipped
  --do-not-fail-on-incomplete         Do not signal failure using shell exit code when a test was marked incomplete

  --cache-result                      Write test results to cache file
  --do-not-cache-result               Do not write test results to cache file

  --order-by <order>                  Run tests in order:
                                      default|defects|depends|duration|no-depends|random|reverse|size
  --random-order-seed <N>             Use the specified random seed when running tests in random order
```

PHPUnit - CLI

```
Reporting:

  --colors <flag>                       Use colors in output ("never", "auto" or "always")
  --columns <n>                         Number of columns to use for progress output
  --columns max                         Use maximum number of columns for progress output
  --stderr                              Write to STDERR instead of STDOUT

  --no-progress                         Disable output of test execution progress
  --no-results                          Disable output of test results
  --no-output                           Disable all output

  --display-incomplete                  Display details for incomplete tests
  --display-skipped                     Display details for skipped tests
  --display-deprecations                Display details for deprecations triggered by tests
  --display-phpunit-deprecations        Display details for PHPUnit deprecations
  --display-phpunit-notices             Display details for PHPUnit notices
  --display-errors                      Display details for errors triggered by tests
  --display-notices                     Display details for notices triggered by tests
  --display-warnings                    Display details for warnings triggered by tests
  --display-all-issues                  Display details for all issues that are triggered
  --reverse-list                        Print defects in reverse order

  --teamcity                            Replace default progress and result output with TeamCity format
  --testdox                             Replace default result output with TestDox format
  --testdox-summary                     Repeat TestDox output for tests with errors, failures, or issues

  --debug                               Replace default progress and result output with debugging information
  --with-telemetry                      Include telemetry information in debugging information output

Logging:

  --log-junit <file>                    Write test results in JUnit XML format to file
  --log-otr <file>                      Write test results in Open Test Reporting XML format to file
  --include-git-information             Include Git information in Open Test Reporting XML logfile
  --log-teamcity <file>                 Write test results in TeamCity format to file
  --testdox-html <file>                 Write test results in TestDox format (HTML) to file
  --testdox-text <file>                 Write test results in TestDox format (plain text) to file
  --log-events-text <file>              Stream events as plain text to file
  --log-events-verbose-text <file>      Stream events as plain text with extended information to file
  --no-logging                          Ignore logging configured in the XML configuration file
```

PHPUnit - CLI

```
Code Coverage:

  --coverage-clover <file>              Write code coverage report in Clover XML format to file
  --coverage-openclover <file>          Write code coverage report in OpenClover XML format to file
  --coverage-cobertura <file>           Write code coverage report in Cobertura XML format to file
  --coverage-crap4j <file>              Write code coverage report in Crap4J XML format to file
  --coverage-html <dir>                 Write code coverage report in HTML format to directory
  --coverage-php <file>                 Write serialized code coverage data to file
  --coverage-text=<file>                Write code coverage report in text format to file [default: standard output]
  --only-summary-for-coverage-text      Option for code coverage report in text format: only show summary
  --show-uncovered-for-coverage-text    Option for code coverage report in text format: show uncovered files
  --coverage-xml <dir>                  Write code coverage report in XML format to directory
  --exclude-source-from-xml-coverage    Exclude <source> element from code coverage report in XML format
  --warm-coverage-cache                 Warm static analysis cache
  --coverage-filter <dir>               Include <dir> in code coverage reporting
  --path-coverage                       Report path coverage in addition to line coverage
  --disable-coverage-ignore             Disable metadata for ignoring code coverage
  --no-coverage                         Ignore code coverage reporting configured in the XML configuration file

Miscellaneous:

  -h|--help                             Prints this usage information
  --version                             Prints the version and exits
  --atleast-version <min>               Checks that version is greater than <min> and exits
  --check-version                       Checks whether PHPUnit is the latest version and exits
  --check-php-configuration             Checks whether PHP configuration follows best practices
```

PHPUnit - CLI Principales options

- Configuration de PHPUnit
  - --bootstrap <file> → charger un fichier avant les tests (souvent autoload)
  - -c|--configuration <file> → utiliser un fichier phpunit.xml spécifique
  - --no-configuration → ignorer tout fichier de config
- Sélection des tests
  - --testsuite <name> → exécuter uniquement cette suite
  - --group <name> → exécuter uniquement ce groupe
  - --filter <pattern> → filtrer les tests par nom de classe ou méthode
  - --exclude-group <name> → exclure certains groupes
- Exécution et comportement
  - --process-isolation → exécuter chaque test dans un processus séparé (utile pour tests “sales”)
  - --stop-on-failure → arrêter après la première erreur ou échec
  - --stop-on-error → arrêter après la première erreur
  - --stop-on-warning → arrêter après un avertissement

PHPUnit - CLI Principales options

- Options utiles pour CI/CD
  - --fail-on-empty-test-suite → échouer si aucun test n'a été exécuté
  - --fail-on-warning → échouer si un warning est généré
- Reporting / affichage
  - --colors <auto|never|always> → couleurs dans la console
  - --testdox → sortie lisible style "TestDox" (bon pour documentation vivante)
  - --debug → informations détaillées pour déboguer les tests
  - --no-progress → masquer la barre de progression
- Logging essentiel
  - --log-junit <file> → pour l'intégration avec CI (ex : GitLab, Jenkins)
  - --testdox-html <file> → générer rapport HTML TestDox
- Code Coverage
  - --coverage-html <dir> → rapport HTML simple
  - --coverage-text → résumé texte dans la console
  - --coverage-php <file> → sérialiser les données de couverture pour réutilisation

PHPUnit - phpunit.xml

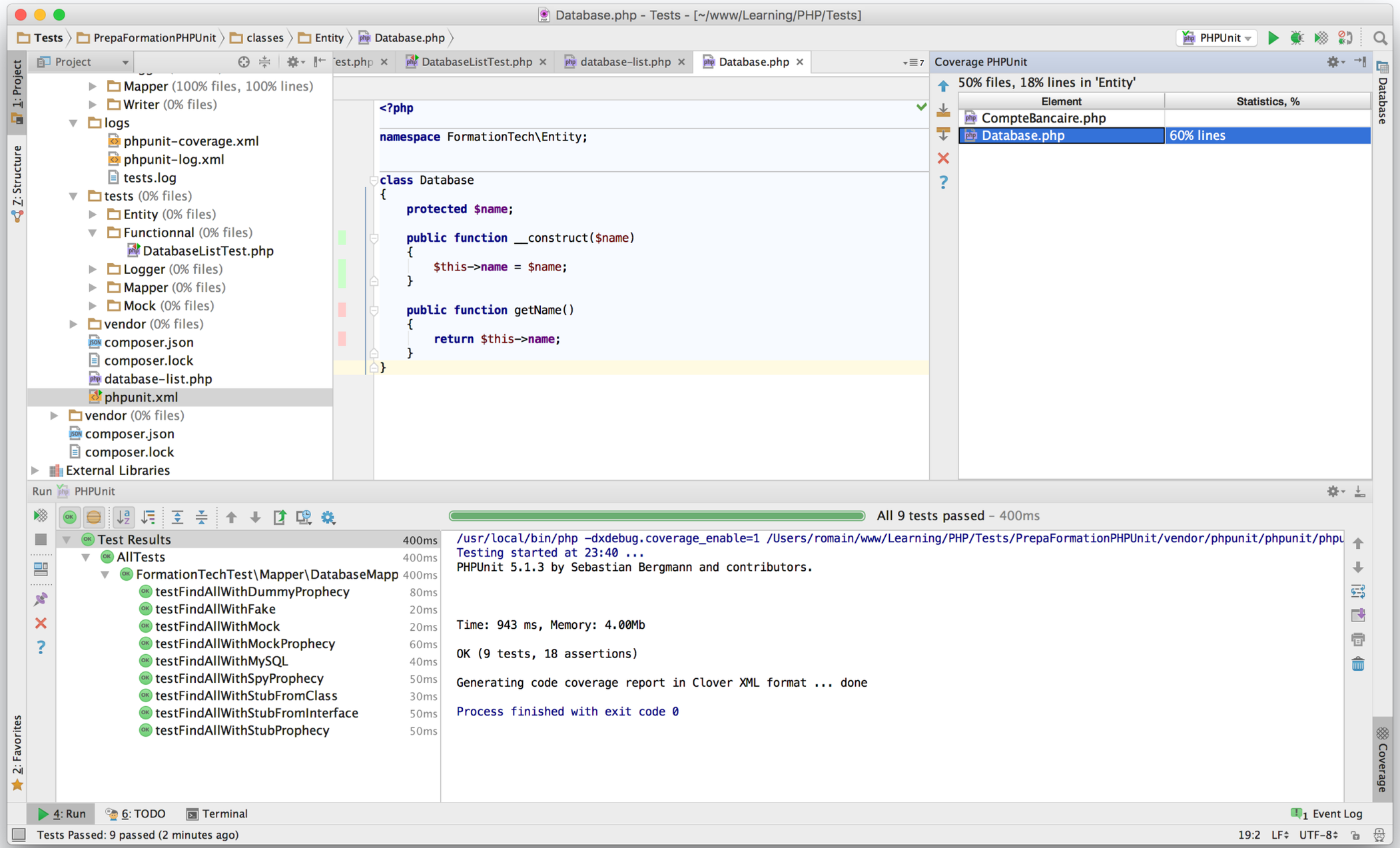
```xml
<?xml version="1.0" encoding="UTF-8"?>
<phpunit colors="true">

    <testsuites>
        <testsuite name="AllTests">
            <directory>tests/Mapper</directory>
        </testsuite>
    </testsuites>

    <filter>
        <blacklist>
            <directory suffix=".php"></directory>
            <file></file>
            <exclude>
                <directory suffix=".php"></directory>
                <file></file>
            </exclude>
        </blacklist>
        <whitelist processUncoveredFilesFromWhitelist="true">
            <directory suffix=".php">classes</directory>
            <file></file>
            <exclude>
                <directory suffix=".php"></directory>
                <file></file>
            </exclude>
        </whitelist>
    </filter>

    <logging>
        <log type="coverage-clover" target="logs/phpunit-coverage.xml"/>
        <log type="junit" target="logs/phpunit-log.xml" logIncompleteSkipped="false"/>
    </logging>

</phpunit>
```

PHPUnit - bootstrap

- Un fichier de bootstrap peut être exécuté au démarrage de PHPUnit
- Intérêts :
  - Autochargement de classe (sauf si phpunit a été installé avec Composer et que l'autoloader est celui de composer)
  - Modification du include_path
  - Chargement de fichiers de configuration

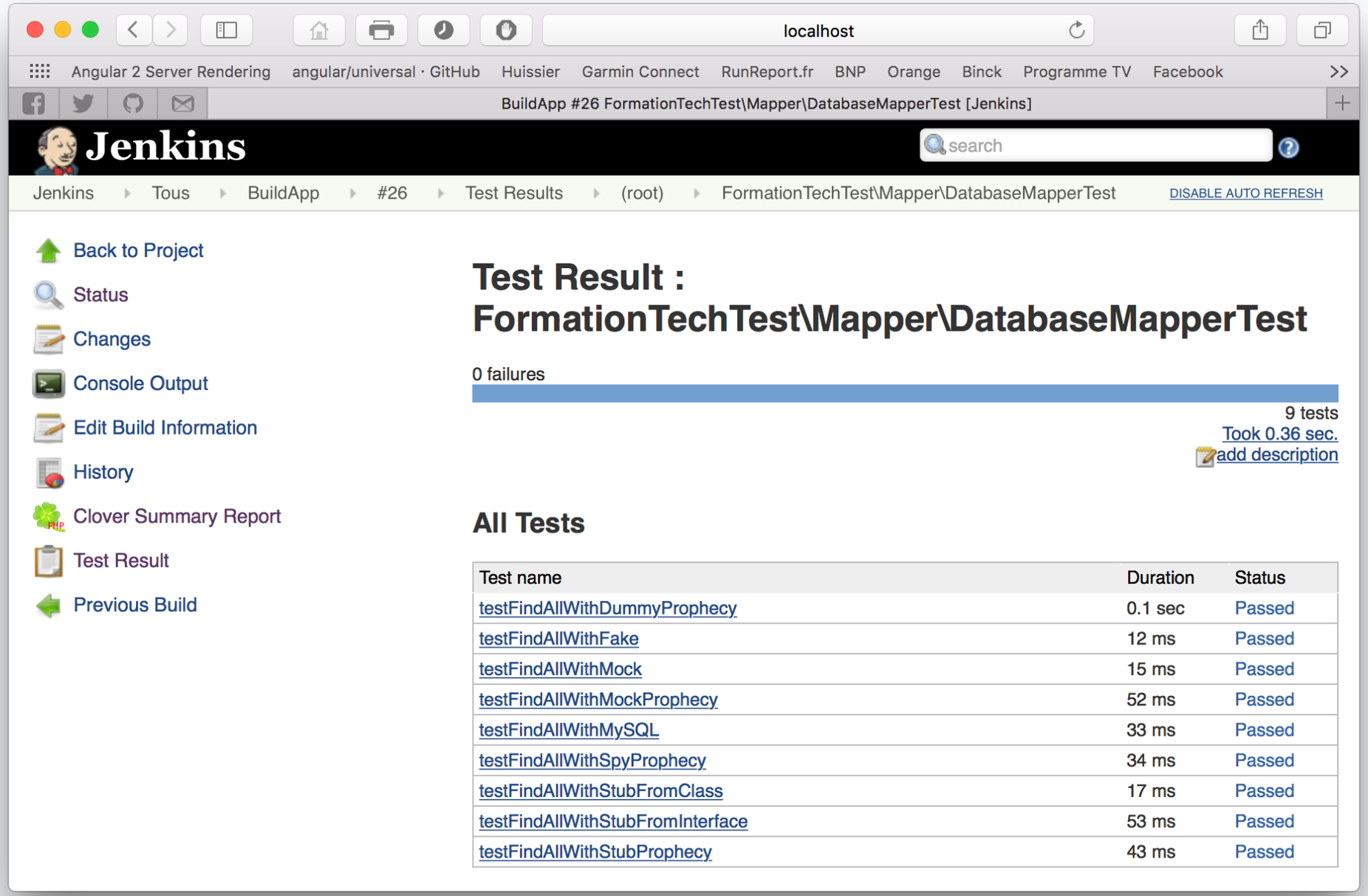
PHPUnit - IDE

- PHPStorm



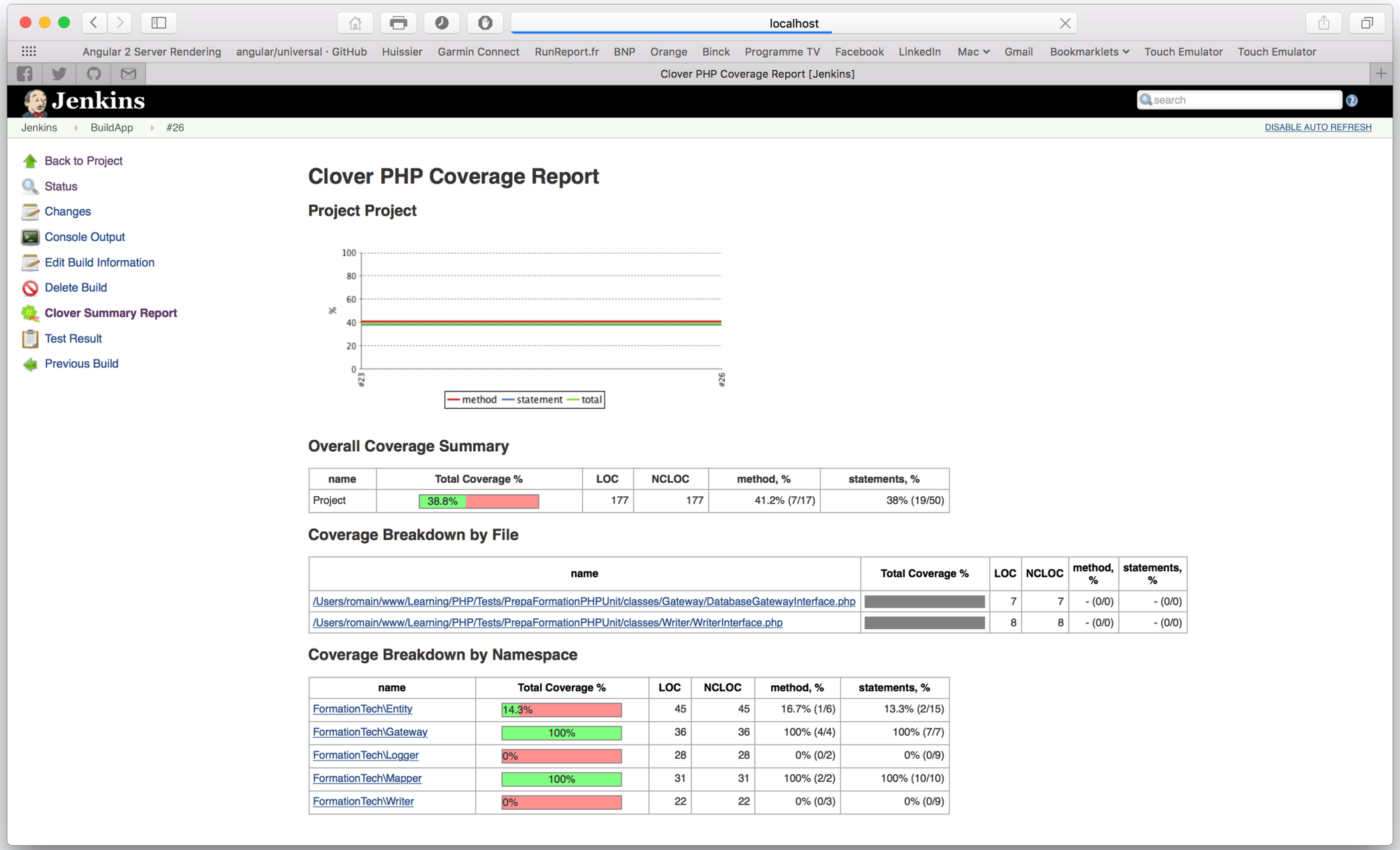
PHPUnit - Intégration continue

- JUnit Plugin



PHPUnit - Intégration continue

- Clover PHP plugin



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Assertions

Assertions - Introduction

- Dans un framework xUnit, les assertions sont les méthodes qui vérifient qu'un résultat espéré corresponde au résultat attendu
- Le test échoue et s'arrête à la première assertion qui n'est pas vérifiée
- Bonnes pratiques :
  - Plusieurs assertions par test
  - Utiliser la méthode d'assertion la plus précise possible pour avoir un message d'erreur clair :
    Ex : `assertEmpty($tableau)`
    plutôt que `assertEquals(0, count($tableau))`
  - Si possible ajouter un message personnalisé

Assertions - Basiques

- assertContains
- assertEquals
- assertFalse
- assertGreaterThan
- assertGreaterThanOrEqual
- assertInfinite
- assertInternalType
- assertLessThan
- assertLessThanOrEqual
- assertNan
- assertRegExp
- assertSame
- assertStringEndsWith
- assertStringMatchesFormat
- assertStringStartsWith
- assertThat
- assertTrue

Assertions - Tableaux

- assertArrayHasKey
- assertArraySubset
- assertCount
- assertContains
- assertContainsOnly
- assertContainsOnlyInstancesOf
- assertEmpty

Assertions - Fichiers et Formats

- Fichiers
  - assertFileEquals
  - assertFileExists
  - assertStringEqualsFile
  - assertStringMatchesFormatFile
- XML
  - assertEqualXMLStructure
  - assertXmlFileEqualsXmlFile
  - assertXmlStringEqualsXmlFile
  - assertXmlStringEqualsXmlString
- JSON
  - assertJsonFileEqualsJsonFile
  - assertJsonStringEqualsJsonFile
  - assertJsonStringEqualsJsonString

Assertions - Classes et Objets

- assertClassHasAttribute
- assertClassHasStaticAttribute
- assertInstanceOf
- assertObjectHasAttribute
- assertNull

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Types de tests

Types de tests - Test Unitaire

```
PrepaFormationPHPUnit
  classes
    Entity
      CompteBancaire.php
  tests
    Entity
      CompteBancaireTest.php
  vendor
  composer.json
  composer.lock
```

```php
<?php

namespace FormationTech\Entity;

class CompteBancaire
{
    protected $solde;

    public function __construct($solde = 0)
    {
        $this->solde = (double) $solde;
    }
    public function getSolde()
    {
        return $this->solde;
    }

    public function debiter($montant)
    {
        $this->solde -= (double) $montant;
    }

    public function crediter($montant)
    {
        $this->solde += (double) $montant;
    }
}
```

```php
<?php

namespace FormationTechTest\Entity;

use FormationTech\Entity\CompteBancaire;

class CompteBancaireTest extends
\PHPUnit_Framework_TestCase
{
    public function testCrediter()
    {
        $compte = new CompteBancaire(0);
        $compte->crediter(1000);
        $this->assertEquals(1000, $compte->getSolde());

        $compte->crediter(500);
        $this->assertEquals(1500, $compte->getSolde());
    }
}
```

```
MBP-de-Romain:PrepaFormationPHPUnit romain$ ./vendor/bin/phpunit tests/Entity/CompteBancaireTest.php --colors
PHPUnit 5.1.3 by Sebastian Bergmann and contributors.

.                                                                   1 / 1 (100%)

Time: 39 ms, Memory: 1.50Mb

OK (1 test, 2 assertions)
```

Types de tests - Test d’intégration

- Exemple de communication entre 2 classes :
  - Logger dépend de Writer (WriterInterface) et est compatible PSR-4
  - FileWriter implémente WriterInterface et sa méthode write

```php
<?php

namespace FormationTech\Logger;

use FormationTech\Writer\WriterInterface;
use Psr\Log\LoggerInterface;
use Psr\Log\LoggerTrait;

class Logger implements LoggerInterface
{
    use LoggerTrait;

    protected $writer;

    public function __construct(WriterInterface $writer)
    {
        $this->writer = $writer;
    }

    public function log($level, $message, array $context = array())
    {
        $datetime = date('Y-m-d H:i:s');
        $logMessage = "[$level] - $datetime - $message";

        $this->writer->write($logMessage);
    }
}
```

```php
<?php

namespace FormationTech\Writer;

class FileWriter implements WriterInterface
{
    protected $fic;

    public function __construct($filePath)
    {
        $this->fic = fopen($filePath, 'a');
    }

    public function write($message)
    {
        fwrite($this->fic, "$message\n");
    }

    public function __destruct()
    {
        fclose($this->fic);
    }
}
```

Types de tests - Test d'intégration

```php
<?php

namespace FormationTechTest\Logger;

use FormationTech\Logger\Logger;
use FormationTech\Writer\FileWriter;
use Psr\Log\LogLevel;

class LoggerTest extends \PHPUnit_Framework_TestCase
{
    public function testLogWithFileWriter()
    {
        $testFile = __DIR__ . '/../../tests.log';
        $fw = new FileWriter($testFile);
        $logger = new Logger($fw);

        $logger->log(LogLevel::NOTICE, 'Un message');
        $content = file_get_contents($testFile);

        $this->assertRegExp('/\[notice\] - \d{4}-\d{2}-\d{2} \d{2}:\d{2}:\d{2} - Un message\n/',
$content);
    }
}
```

```
MBP-de-Romain:PrepaFormationPHPUnit romain$ ./vendor/bin/phpunit tests/Logger/LoggerTest.php --colors
PHPUnit 5.1.3 by Sebastian Bergmann and contributors.

.                                                                   1 / 1 (100%)

Time: 38 ms, Memory: 1.50Mb

OK (1 test, 1 assertion)
```

Types de tests - Test fonctionnel

- Démarrage du PHP Built-in Server
  `php -S localhost:8080`

```php
<?php
require_once __DIR__ . '/vendor/autoload.php';

$pdo = new \PDO('mysql:host=localhost', 'root', '');
$gateway = new \FormationTech\Gateway\DatabaseGateway($pdo);
$dbList = $gateway->listDbs();
?>
<!DOCTYPE html>
<html>
    <head>
        <meta charset="UTF-8">
        <title>Database list</title>
    </head>
    <body>
        <h2>Database list</h2>
        <ul>
            <?php foreach ($dbList as $db) : ?>
            <li><?=htmlspecialchars($db)?></li>
            <?php endforeach; ?>
        </ul>
    </body>
</html>
```

Types de tests - Test fonctionnel

```php
<?php

namespace FormationTechTest\Functionnal;

use Goutte\Client;

class DatabaseListTest extends \PHPUnit_Framework_TestCase
{
    public function testListDbs()
    {
        $client = new Client();
        $crawler = $client->request('GET', 'http://localhost:8080/database-list.php');

        $this->assertEquals(200, $client->getResponse()->getStatus());
        $this->assertEquals('Database list', $crawler->filter('h2')->text());
        $this->assertCount(13, $crawler->filter('ul > li'));
    }
}
```

```
MBP-de-Romain:PrepaFormationPHPUnit romain$ ./vendor/bin/phpunit tests/Logger/LoggerTest.php --colors
PHPUnit 5.1.3 by Sebastian Bergmann and contributors.

.                                                                   1 / 1 (100%)

Time: 38 ms, Memory: 1.50Mb

OK (1 test, 1 assertion)
```

Fonctions Pures

Fonctions Pure

- Une méthode est pure si :
  - Elle ne modifie aucun état extérieur (pas de variables globales, pas de fichiers, pas de base de données…).
  - Elle retourne toujours le même résultat pour les mêmes entrées.
- Exemple pur :

```
function add(int $a, int $b): int {
    return $a + $b;
}
```

- Exemple impure :

```
function addAndLog(int $a, int $b): int {
    file_put_contents('log.txt', "$a + $b\n", FILE_APPEND); // modifie l'extérieur
    return $a + $b;
}
```

Fonctions Pure

Exercice 1

‹/› PHP

```php
class MathUtils {
    public function multiplyByTwo(int $x): int {
        return $x * 2;
    }
}
```

Exercice 2

‹/› PHP

```php
class UserService {
    private array $users = [];

    public function addUser(string $name): void {
        $this->users[] = $name;
    }
}
```

Fonctions Pure

Exercice 3

‹/› PHP

```php
class Randomizer {
    public function getRandomNumber(): int {
        return rand(1, 100);
    }
}
```

Exercice 4

‹/› PHP

```php
class StringUtils {
    public function appendExclamation(string $s): string {
        return $s . "!";
    }
}
```

Fonctions Pure

Exercice 5

‹/› PHP

```php
class Counter {
    private static int $count = 0;

    public function increment(): int {
        self::$count++;
        return self::$count;
    }
}
```

Exercice 6

‹/› PHP

```php
class DateChecker {
    public function isWeekend(): bool {
        return (date('N') >= 6);
    }
}
```

Fonctions Pure

```
public function testAppendExclamationAddsExclamation(): void
{
    $input = "Hello";
    $expected = "Hello!";

    $result = $this->stringUtils->appendExclamation($input);

    $this->assertSame($expected, $result);
}
```

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Doubles

Double - Introduction

- Le code PHP fait souvent appel à des composants externes :
  - Accès aux entrées/sorties
  - Accès à une base de données
  - Accès à un Service Web
- Certaines classes ne peuvent être testées de manières unitaires car elles dépendent d’autres classes.
- Solutions : les Doubles

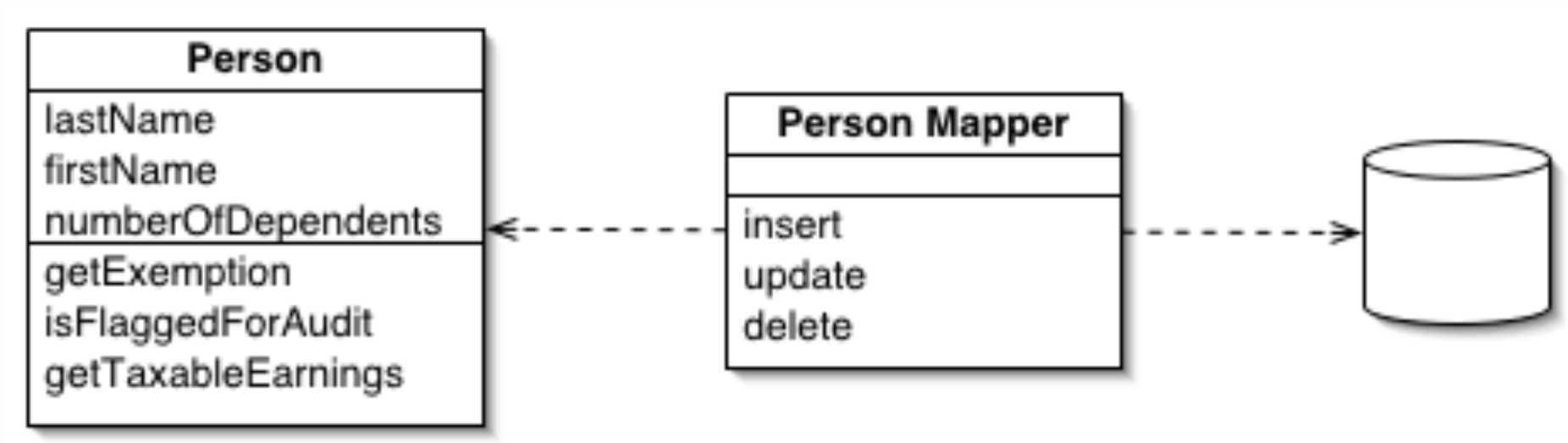
  Objets ou fonctions qui ressemblent et se comportent comme le composant qu’ils imitent, mais qui sont en réalité des versions simplifiée qui permettent de faciliter l’écriture du test.

Double - Introduction

- 5 types de Doubles :
  - Fake (une classe créée par l'utilisateur qui fera les opérations en mémoire)
  - Dummy (une classe générée dont les méthodes ne font rien)
  - Stub (une classe générée dont les méthodes ont le même comportement)
  - Mock (Stub + vérification que les méthodes soient bien appelée)
  - Spy (Dummy + vérification que les méthodes soient bien appelée à postériori)
- Bonnes pratiques :
  - Injection de Dépendance (pas de composition)
  - Registre ou Container d'injection de Dépendance

Double - Classes d’exemple

- Un DataMapper
  http://martinfowler.com/eaaCatalog/dataMapper.html



Double - Classes d’exemple

- Entité

```php
<?php

namespace FormationTech\Entity;

class Database
{
    protected $name;

    public function __construct($name)
    {
        $this->name = $name;
    }

    public function getName()
    {
        return $this->name;
    }
}
```

Double - Classes d’exemple

- Gateway

```php
<?php

namespace FormationTech\Gateway;

class DatabaseGateway implements DatabaseGatewayInterface
{
    protected $pdo;

    public function __construct($pdo)
    {
        $this->pdo = $pdo;
    }

    public function listDbs()
    {
        $stmt = $this->pdo->query('SHOW DATABASES');

        return $stmt->fetchAll(\PDO::FETCH_COLUMN);
    }
}
```

```php
<?php

namespace FormationTech\Gateway;

interface DatabaseGatewayInterface
{
    public function listDbs();
}
```

Double - Classes d’exemple

- Mapper (classe à tester unitairement)

```php
<?php

namespace FormationTech\Mapper;

use FormationTech\Entity\Database;
use FormationTech\Gateway\DatabaseGatewayInterface;

class DatabaseMapper
{
    protected $gateway;

    public function __construct(DatabaseGatewayInterface $gateway)
    {
        $this->gateway = $gateway;
    }

    public function findAll()
    {
        $dbsArray = $this->gateway->listDbs();
        $dbsObj = [];

        if (!$dbsArray) {
            return $dbsObj;
        }

        foreach ($dbsArray as $dbName) {
            $dbsObj[] = new Database($dbName);
        }

        return $dbsObj;
    }
}
```

Double - Sans Double

- Test sans double

```php
<?php

namespace FormationTechTest\Mapper;

use FormationTech\Entity\Database;
use FormationTech\Gateway\DatabaseGateway;
use FormationTech\Mapper\DatabaseMapper;

class DatabaseMapperTest extends \PHPUnit_Framework_TestCase
{
   public function testFindAllWithMySQL()
    {
        $pdo = new \PDO('mysql:host=localhost', 'root', '');
        $gateway = new DatabaseGateway($pdo);
        $mapper = new DatabaseMapper($gateway);

        $dbs = $mapper->findAll();

        $this->assertCount(13, $dbs);
        $this->assertContainsOnlyInstancesOf(Database::class, $dbs);
    }
}
```

- Problème : changement dans la base de données ?
- Solution : fixture dans un setUp ? double ?

Double - Fake

- Fake

```php
<?php

namespace FormationTech\Gateway;

class DatabaseGatewayFake implements DatabaseGatewayInterface
{
    protected $dbs;

    public function __construct(Array $dbs)
    {
        $this->dbs = $dbs;
    }

    public function listDbs()
    {
        return $this->dbs;
    }
}
```

```php
<?php

namespace FormationTechTest\Mapper;

use FormationTech\Entity\Database;
use FormationTech\Gateway\DatabaseGatewayFake;
use FormationTech\Mapper\DatabaseMapper;

class DatabaseMapperTest extends \PHPUnit_Framework_TestCase
{
    public function testFindAllWithFake()
    {
        $gateway = new DatabaseGatewayFake(['db1', 'db2', 'db3']);
        $mapper = new DatabaseMapper($gateway);

        $dbs = $mapper->findAll();

        $this->assertCount(3, $dbs);
        $this->assertContainsOnlyInstancesOf(Database::class, $dbs);
    }
}
```

Double - Prophecy

```php
<?php

namespace FormationTechTest\Mock;

use FormationTech\Mapper\DatabaseMapper;

class MockTest extends \PHPUnit_Framework_TestCase
{
    public function testMockSingleton()
    {
        $mock1 = $this->getMockBuilder(DatabaseMapper::class)->disableOriginalConstructor()->getMock();
        $mock2 = $this->getMockBuilder(DatabaseMapper::class)->disableOriginalConstructor()->getMock();

        $mock1->method('findAll')->willReturn('val1');
        $mock2->method('findAll')->willReturn('val2');

        $this->assertEquals('val1', $mock1->findAll());
        $this->assertEquals('val2', $mock1->findAll());
    }
}
```

```
MBP-de-Romain:PrepaFormationPHPUnit romain$ ./vendor/bin/phpunit tests/Mock/MockTest.php --colors
PHPUnit 5.1.3 by Sebastian Bergmann and contributors.

F                                                                   1 / 1 (100%)

Time: 98 ms, Memory: 1.75Mb

There was 1 failure:

1) FormationTechTest\Mock\MockTest::testMockSingleton
Failed asserting that two strings are equal.
--- Expected
+++ Actual
@@ @@
-'val2'
+'val1'

/Users/romain/www/Learning/PHP/Tests/PrepaFormationPHPUnit/tests/Mock/MockTest.php:19

FAILURES!
Tests: 1, Assertions: 2, Failures: 1.
```

Double - Prophecy

- Sebastian Bergman à propos de l'API de Mock de PHPUnit :
  https://thephp.cc/news/2015/02/phpunit-4-5-and-prophecy
- L'ancien API continue d'exister pour rester compatible avec les anciens tests
- PHPUnit depuis la version 4.5 intègre un framework de test moderne : Prophecy
- Documentation
  https://github.com/phpspec/prophecy

Double - Prophecy Dummy

- Dummy

```php
<?php

namespace FormationTechTest\Mapper;

use FormationTech\Entity\Database;
use FormationTech\Gateway\DatabaseGateway;
use FormationTech\Mapper\DatabaseMapper;

class DatabaseMapperTest extends \PHPUnit_Framework_TestCase
{

    // ...

    public function testFindAllWithDummyProphecy()
    {
        $dummy = $this->prophesize(DatabaseGateway::class);

        $mapper = new DatabaseMapper($dummy->reveal());

        $dbs = $mapper->findAll();

        $this->assertEmpty($dbs);
    }

    // ...

}
```

Double - Prophecy Stub

- Stub

```php
<?php

namespace FormationTechTest\Mapper;

use FormationTech\Entity\Database;
use FormationTech\Gateway\DatabaseGateway;
use FormationTech\Mapper\DatabaseMapper;

class DatabaseMapperTest extends \PHPUnit_Framework_TestCase
{

    // ...

    public function testFindAllWithStubProphecy()
    {
        $stub = $this->prophesize(DatabaseGateway::class);

        $stub->listDbs()->willReturn(['db1', 'db2', 'db3', 'db4']);

        $mapper = new DatabaseMapper($stub->reveal());

        $dbs = $mapper->findAll();

        $this->assertCount(4, $dbs);
        $this->assertContainsOnlyInstancesOf(Database::class, $dbs);
    }

    // ...

}
```

Double - Prophecy Mock

- Mock

```php
<?php

namespace FormationTechTest\Mapper;

use FormationTech\Entity\Database;
use FormationTech\Gateway\DatabaseGateway;
use FormationTech\Mapper\DatabaseMapper;

class DatabaseMapperTest extends \PHPUnit_Framework_TestCase
{

    // ...

    public function testFindAllWithMockProphecy()
    {
        $mock = $this->prophesize(DatabaseGateway::class);

        $mock->listDbs()->willReturn(['db1', 'db2'])->shouldBeCalledTimes(1);

        $mapper = new DatabaseMapper($mock->reveal());

        $dbs = $mapper->findAll();

        $this->assertCount(2, $dbs);
        $this->assertContainsOnlyInstancesOf(Database::class, $dbs);
    }

    // ...

}
```

Double - Prophecy Spy

- Spy

```php
<?php

namespace FormationTechTest\Mapper;


use FormationTech\Entity\Database;
use FormationTech\Gateway\DatabaseGateway;
use FormationTech\Mapper\DatabaseMapper;

class DatabaseMapperTest extends \PHPUnit_Framework_TestCase
{

    // ...

    public function testFindAllWithSpyProphecy()
    {
        $mock = $this->prophesize(DatabaseGateway::class);

        $mapper = new DatabaseMapper($mock->reveal());

        $dbs = $mapper->findAll();

        $this->assertEmpty($dbs);

        $mock->listDbs()->shouldHaveBeenCalledTimes(1);
    }

    // ...

}
```

Double - Autres frameworks

- Mockery
  https://github.com/padraic/mockery
  http://docs.mockery.io/en/latest/
- Phake
  https://github.com/mlively/Phake
  http://phake.readthedocs.org/en/2.1/

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Injection de Dépendance

Symfony

- Composition
  Une composition est un type d'association forte entre 2 objet. La destruction d'un objet entrainerait la destruction de l'objet associé.
  Exemple : Un objet Tasse est composée de Café

```php
<?php

namespace ExpressoComposition;

class Cafe
{
    protected $variete;
    protected $provenance;

    public function __construct($provenance, $variete)
    {
        $this->provenance = $provenance;
        $this->variete = $variete;
    }
}
```

```php
<?php

namespace ExpressoComposition;

class Tasse
{
    protected $contenu;

    public function __construct() {
        $this->contenu = new Cafe("Arabica", "Mexique");
    }
}
```

```php
<?php

require_once 'autoload.php';

$tasseDeCafe = new \ExpressoComposition\Tasse();
```

- Mauvaise Pratique
  La composition est désormais considéré comme une mauvaise pratique.
  Premièrement la classe Tasse n'est très réutilisable, elle ne peut contenir que du café. De plus il n'est pas possible d'écrire d'écrire un test unitaire de Tasse, puisqu'il faudrait en même temps tester Café.
  Globalement il faut essayer de proscrire l'utilisation de new il l'intérieur d'une classe (à l'exception des Values Objects (DateTime, ArrayObject, etc…)

Symfony

- Solution
  La solution est simple, pour éviter le new dans cette classe nous allons injecter la dépendance.

```php
<?php

namespace ExpressoInjection;

interface Liquide {

}
```

```php
<?php

namespace ExpressoInjection;

class Cafe implements Liquide
{
    protected $variete;
    protected $provenance;

    public function __construct($provenance, $variete)
    {
        $this->provenance = $provenance;
        $this->variete = $variete;
    }
}
```

```php
<?php

namespace ExpressoInjection;

class Tasse
{
    protected $contenu;

    public function __construct(Liquide $contenu) {
        $this->contenu = $contenu;
    }
}
```

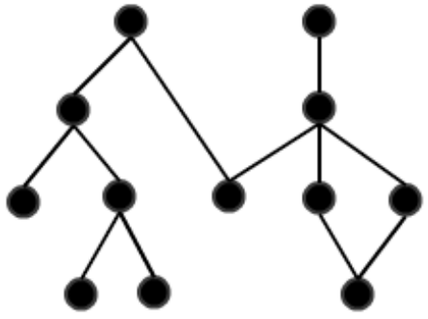
```php
<?php

require_once 'autoload.php';

$cafe = new \ExpressoInjection\Cafe();
$tasseDeCafe = new \ExpressoInjection\Tasse($cafe);
```

Symfony

- Conteneur d'injection de dépendance (DIC)
  Le problème lorsqu'on injecte les dépendances est qu'on peut parfois se retrouver avec des dépendances complexes :



- Dans ce cas il devient utile d'utiliser un conteneur d'injection de dépendance qu'on aura configuré au préalable. En PHP il existe quelques DIC connus :
  - Pimple par Fabien Potencier
  - Dice par Tom Butler
  - PHP-DI par Matthieu Napoli
  - Symfony\Container intégré Symfony2
  - Zend\Di & Zend\ServiceManager intégrés ZF 2

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Tests Symfony

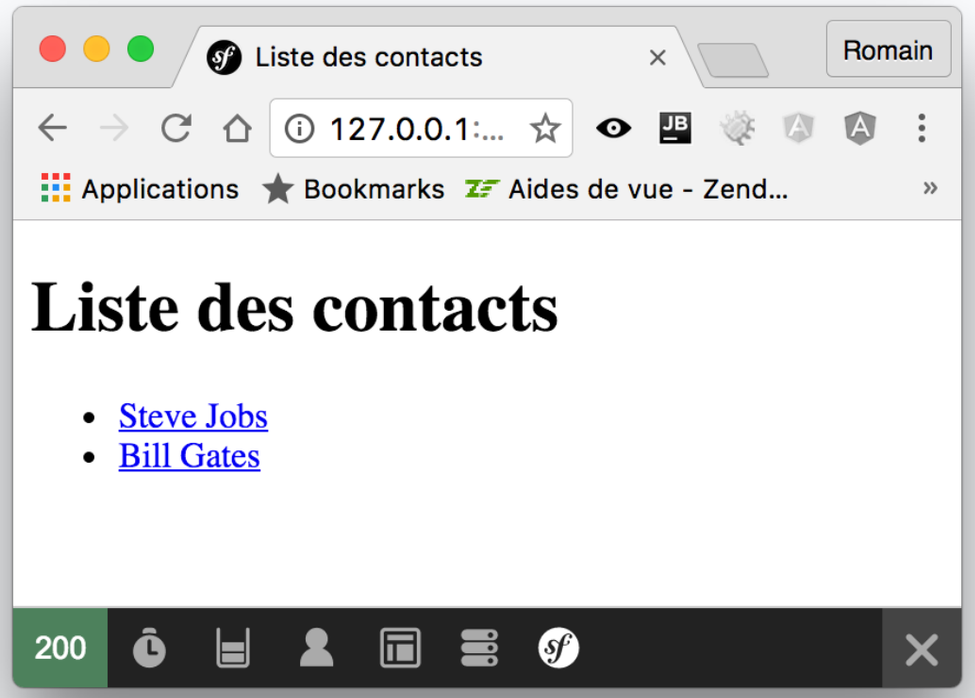
Tests Symfony - Tests Fonctionnels

- Test fonctionnels
  Symfony\Bundle\FrameworkBundle contient 2 classes pour faciliter les tests
- Symfony\Bundle\FrameworkBundle\Test\WebTestCase (et sa méthode createClient pour les tests fonctionnels)
- Symfony\Bundle\FrameworkBundle\Test\KernelTestCase (et sa méthode bootKernel pour les tests qui nécessitent un kernel)

```php
public function listAction()
{
    $repo = $this->getDoctrine()
                 ->getRepository('AppBundle:Contact');

    $contacts = $repo->findAll();

    return $this->render('list.html.twig', array(
        'contacts' => $contacts
    ));
}
```



Tests Symfony - Tests Fonctionnels

- Test fonctionnels

```php
<?php

namespace AppBundle\Tests\Controller;

use Symfony\Bundle\FrameworkBundle\Test\WebTestCase;

class ContactControllerTest extends WebTestCase
{
    public function testListAvecMysql()
    {
        $client = static::createClient();

        $crawler = $client->request('GET', '/contacts/');
        $this->assertEquals(200, $client->getResponse()->getStatusCode());

        $this->assertContains('Liste des contacts', $crawler->filter('h1')->text());

        $this->assertCount(2, $crawler->filter('h1 + ul > li'));
    }
}
```

Tests Symfony - Tests Fonctionnels

- Test fonctionnels (avec mock)

```php
public function testListAvecMock()
{
    $client = static::createClient();

    $contacts = [
        (new Contact())->setId(1)->setPrenom('A')->setNom('B'),
        (new Contact())->setId(2)->setPrenom('C')->setNom('D'),
        (new Contact())->setId(3)->setPrenom('E')->setNom('F'),
    ];

    $mockRepo = $this->prophesize(ContactRepository::class);
    $mockRepo->findAll()->willReturn($contacts)->shouldBeCalledTimes(1);

    $mockRegistry = $this->prophesize(Registry::class);
    $mockRegistry->getConnectionNames()->shouldBeCalledTimes(1);
    $mockRegistry->getManagerNames()->shouldBeCalledTimes(1);
    $mockRegistry->getRepository('AppBundle:Contact')->willReturn($mockRepo->reveal())->shouldBeCalledTimes(1);

    $client->getContainer()->set('doctrine', $mockRegistry->reveal());

    $crawler = $client->request('GET', '/contacts/');

    $this->assertCount(3, $crawler->filter('h1 + ul > li'));
}
```

Tests Symfony - Tests Fonctionnels

- Test fonctionnels (avec couche Service)

```php
public function testListAvecMockEtServiceLayer()
{
    $client = static::createClient();

    $contacts = [
        (new Contact())->setId(1)->setPrenom('A')->setNom('B'),
        (new Contact())->setId(2)->setPrenom('C')->setNom('D'),
        (new Contact())->setId(3)->setPrenom('E')->setNom('F'),
    ];

    $mockRepo = $this->prophesize(ContactManager::class);
    $mockRepo->findAll()->willReturn($contacts)->shouldBeCalledTimes(1);

    $client->getContainer()->set('app.manager.contact', $mockRepo->reveal());

    $crawler = $client->request('GET', '/contacts/list-avec-manager');

    $this->assertCount(3, $crawler->filter('h1 + ul > li'));
}
```

```yaml
# services.yml
services:
    app.manager.contact:
          class: AppBundle\Manager\ContactManager
          arguments: ["@doctrine.orm.entity_manager"]
```

Tests Symfony - Tests de Commande

- Test de Commande

```php
<?php

namespace AppBundle\Command;

use Symfony\Bundle\FrameworkBundle\Command\ContainerAwareCommand;
use Symfony\Component\Console\Input\InputArgument;
use Symfony\Component\Console\Input\InputInterface;
use Symfony\Component\Console\Input\InputOption;
use Symfony\Component\Console\Output\OutputInterface;

class HelloWorldCommand extends ContainerAwareCommand
{
    protected function configure()
    {
        $this->setName('hello:world')
             ->setDescription('A Hello command')
             ->addArgument('name', InputArgument::OPTIONAL, 'Your name')
             ->addOption('upper', 'u', InputOption::VALUE_NONE, 'Capitalize answer');
    }

    protected function execute(InputInterface $input, OutputInterface $output)
    {
        $name = $input->getArgument('name');
        $message = ($name) ? "Hello $name :)" : "Hello !";

        if ($input->getOption('upper')) {
            $message = strtoupper($message);
        }

        $output->writeln($message);
    }
}
```

Tests Symfony - Tests de Commande

- Test de Commande

```php
<?php

namespace Tests\AppBundle\Command;

use AppBundle\Command\HelloWorldCommand;
use Symfony\Bundle\FrameworkBundle\Console\Application;
use Symfony\Bundle\FrameworkBundle\Test\KernelTestCase;
use Symfony\Component\Console\Tester\CommandTester;

class HelloWorldCommandTest extends KernelTestCase
{
    public function testExecute()
    {
        $kernel = $this->createKernel();
        $kernel->boot();

        $application = new Application($kernel);
        $application->add(new HelloWorldCommand());

        $command = $application->find('hello:world');
        $commandTester = new CommandTester($command);
        $exitCode = $commandTester->execute(array(
            'command'  => $command->getName(),
            'name' => 'Romain',
            '-u' => true
        ));

        $output = $commandTester->getDisplay();
        $this->assertEquals(0, $exitCode, 'Returns 0 in case of success');
        $this->assertContains('HELLO ROMAIN :)', $output);
    }
}
```

Tests Symfony - Tests de Formulaire

- Test de Formulaire

```php
<?php

namespace AppBundle\Form;

use Symfony\Component\Form\AbstractType;
use Symfony\Component\Form\FormBuilderInterface;
use Symfony\Component\OptionsResolver\OptionsResolver;

class ContactType extends AbstractType
{
    /**
     * @param FormBuilderInterface $builder
     * @param array $options
     */
    public function buildForm(FormBuilderInterface $builder, array $options)
    {
        $builder
            ->add('prenom')
            ->add('nom')
        ;
    }

    /**
     * @param OptionsResolver $resolver
     */
    public function configureOptions(OptionsResolver $resolver)
    {
        $resolver->setDefaults(array(
            'data_class' => 'AppBundle\Entity\Contact'
        ));
    }
}
```

Tests Symfony - Tests de Formulaire

```php
<?php

namespace AppBundle\Tests\Form;

use AppBundle\Entity\Contact;
use AppBundle\Form\ContactType;
use Symfony\Component\Form\Test\TypeTestCase;

class ContactTypeTest extends TypeTestCase
{
    public function testSubmitValidData()
    {
        $formData = array(
            'prenom' => 'Romain',
            'nom' => 'Bohdanowicz',
        );

        $form = $this->factory->create(ContactType::class);

        $contact = (new Contact())->setPrenom('Romain')->setNom('Bohdanowicz');

        // submit the data to the form directly
        $form->submit($formData);

        $this->assertTrue($form->isSynchronized());
        $this->assertEquals($contact, $form->getData());

        $view = $form->createView();
        $children = $view->children;

        foreach (array_keys($formData) as $key) {
            $this->assertArrayHasKey($key, $children);
        }
    }
}
```