The Test Suite Holy Trinity

Dave Liddament

@DaveLiddament

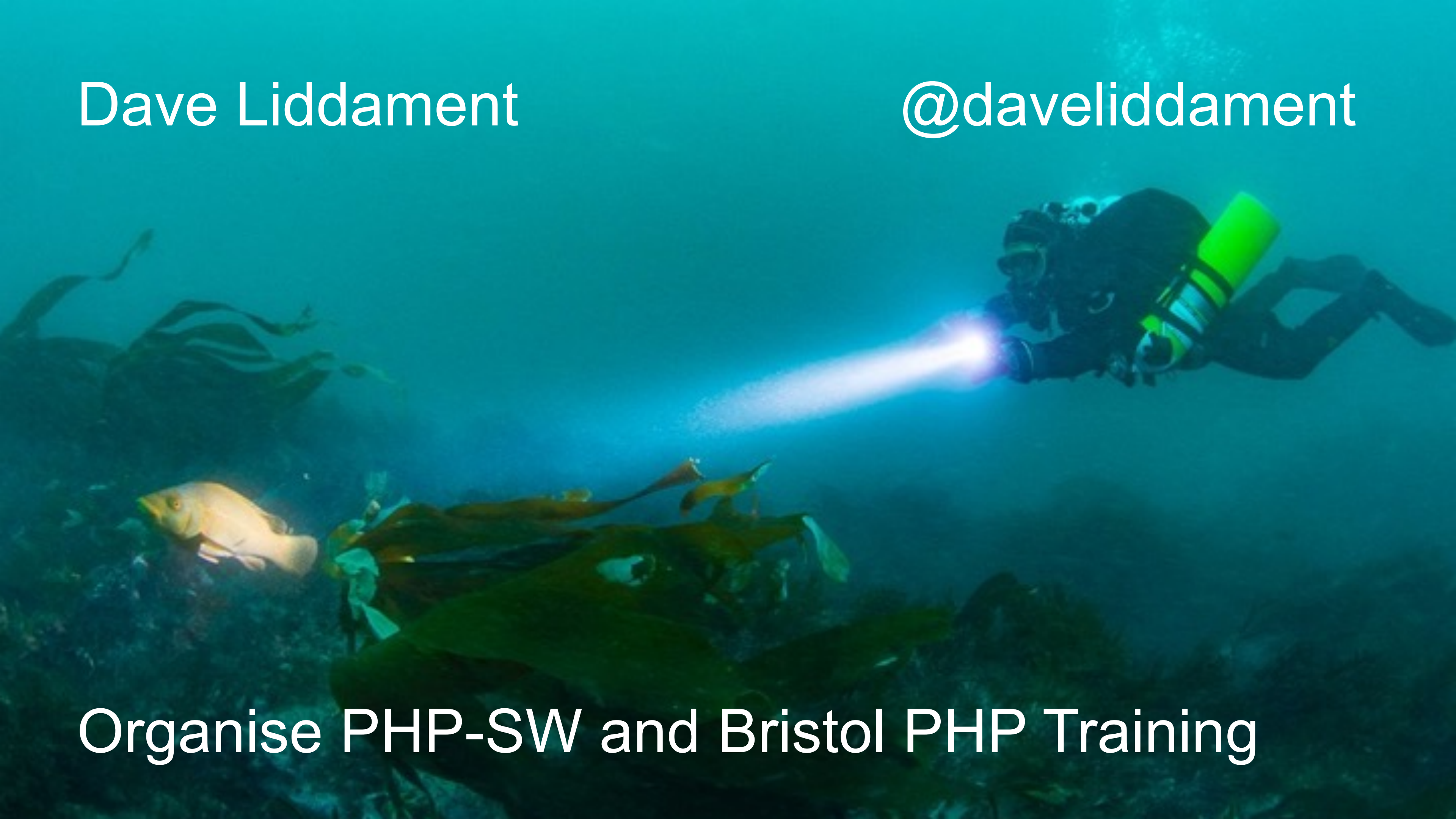
First a sad story….

…. about a dark time

I still have nightmares

Why this talk?

Dave Liddament @daveliddament



Organise PHP-SW and Bristol PHP Training

Back to the nightmare…

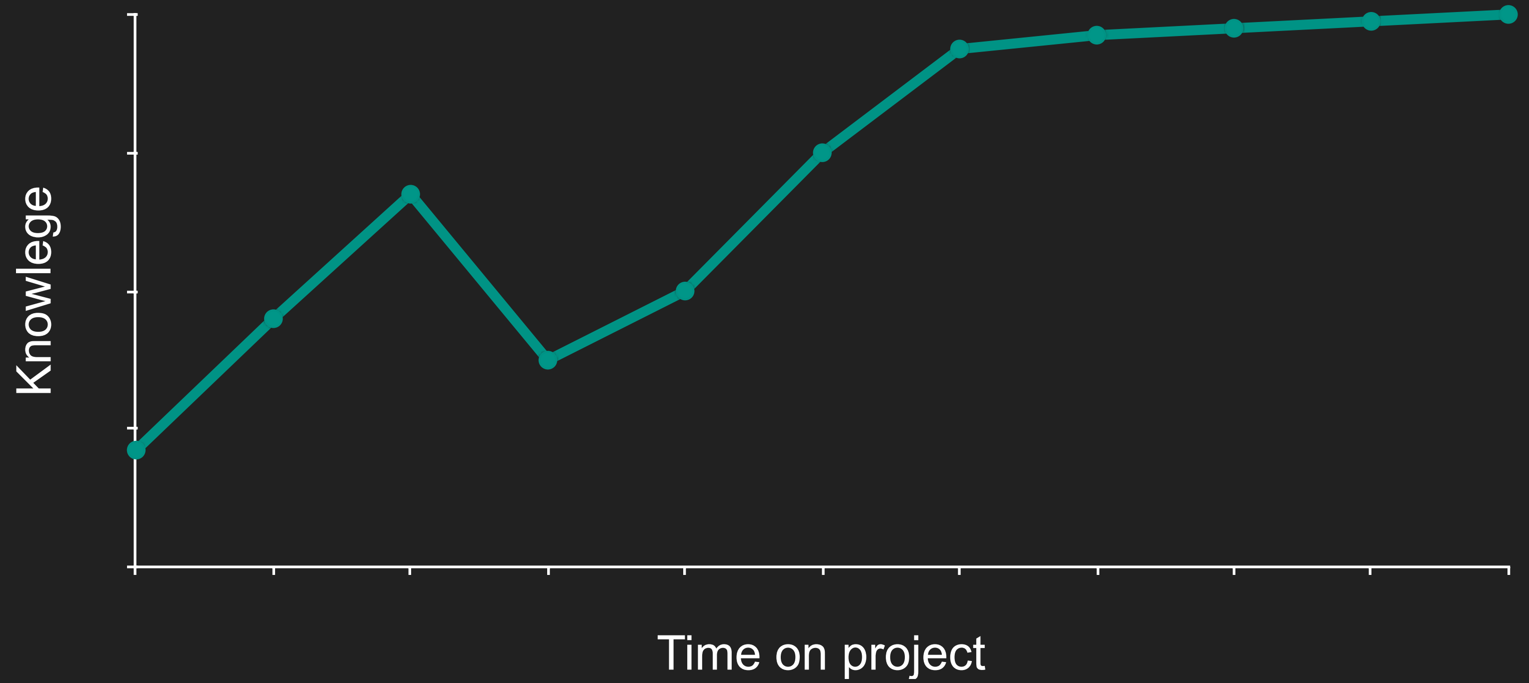
#1 I didn't know much about developing high quality software

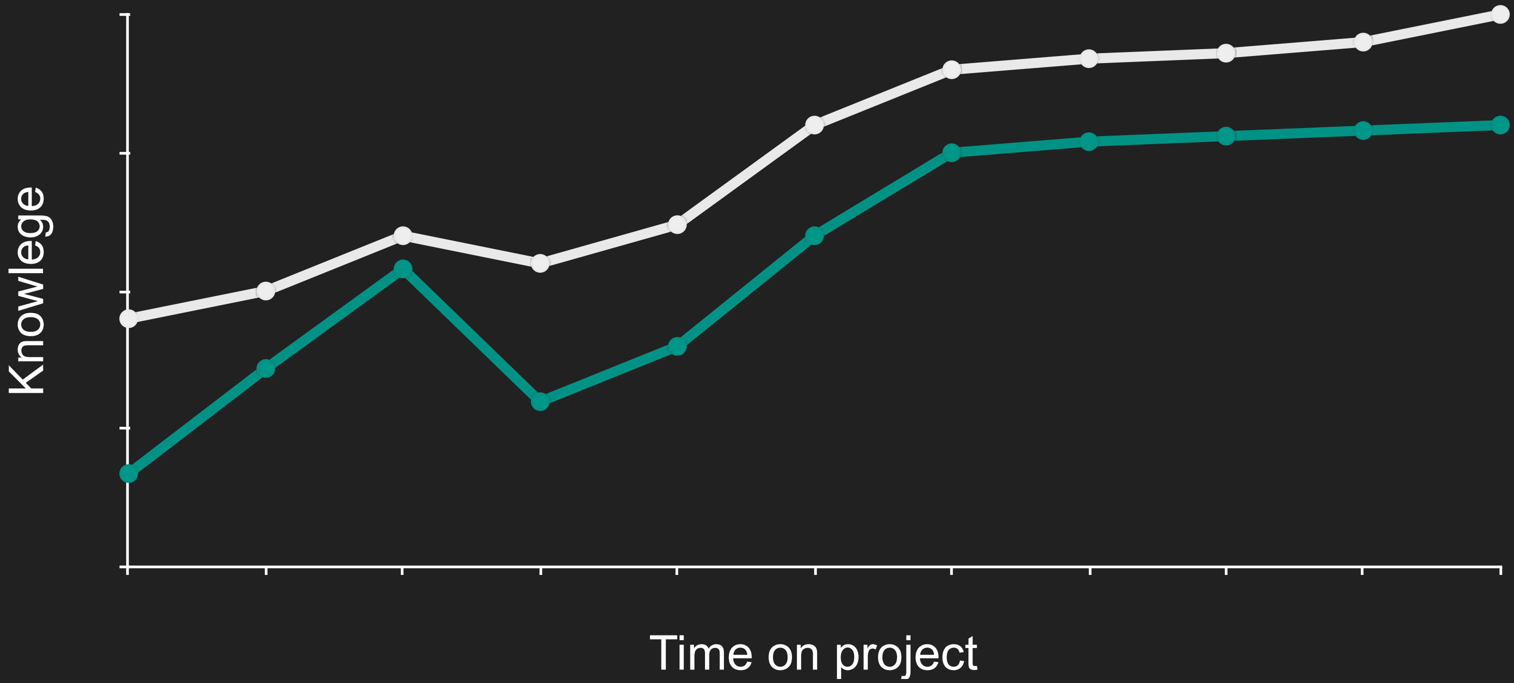
#2 Copy someone who does know about developing high quality software

We need tests

We need a test suite

Ability to refactor is important


Knowledge
Time on project


Knowlege
Time on project

A quick recap…

A test suite…

#1 Proves code works
#2 Stops regression
#3 Enables refactoring

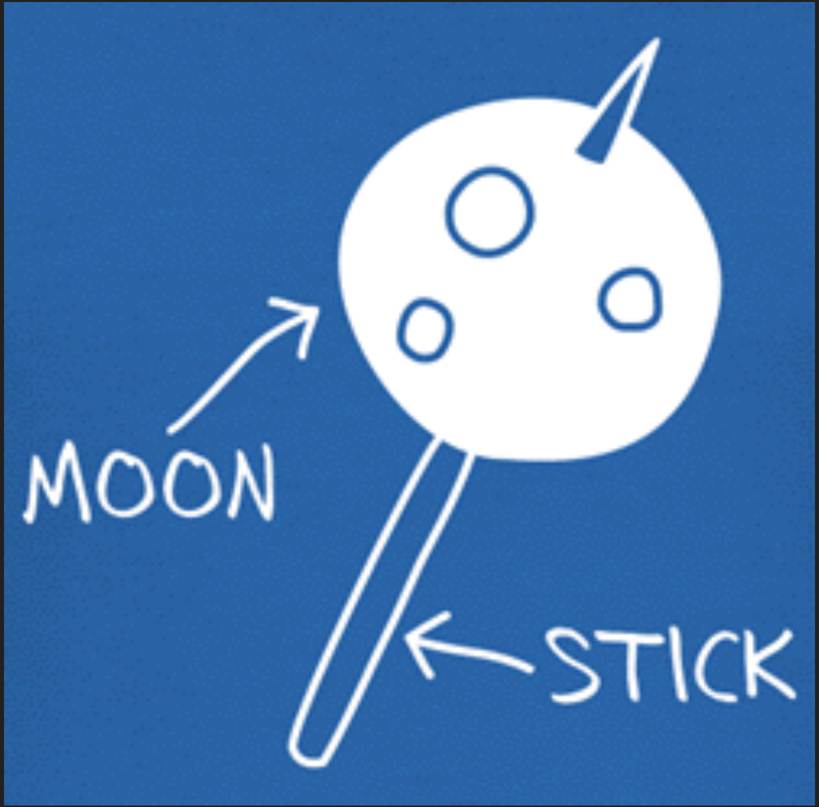
@DaveLiddament

The ideal test suite…

Fast to execute

High coverage

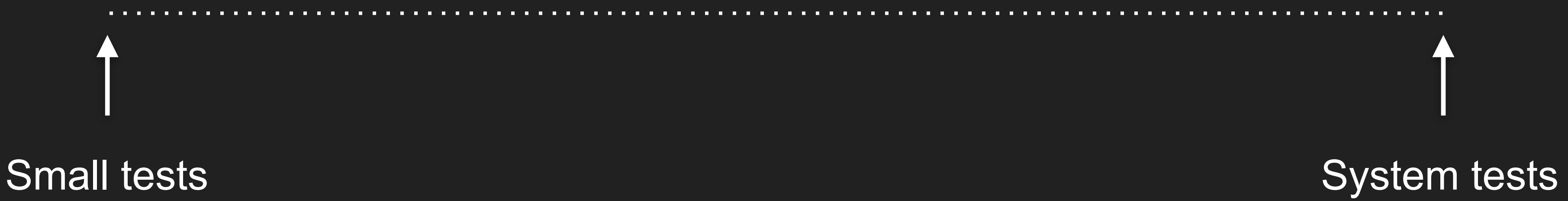
Low maintenance


MOON
STICK

The Holy Trinity…

#1 Fast to execute
#2 High coverage
#3 Low maintenance

Testing Continuum



Small test example

```
class PasswordValidator
{

  /**
   * Returns true if password meets following criteria:
   *
   * - 8 or more characters
   * - at least 1 digit
   * - at least 1 upper case letter
   * - at least 1 lower case letter
   */
   public function isValid(string $password) : bool
```

Test cases required

- Valid password:
    - Passw0rd
- Invalid passwords
    - Too short: Passw0r
    - No digit: Password
    - No upper case: psssw0rd
    - No lower case: PASSW0RD

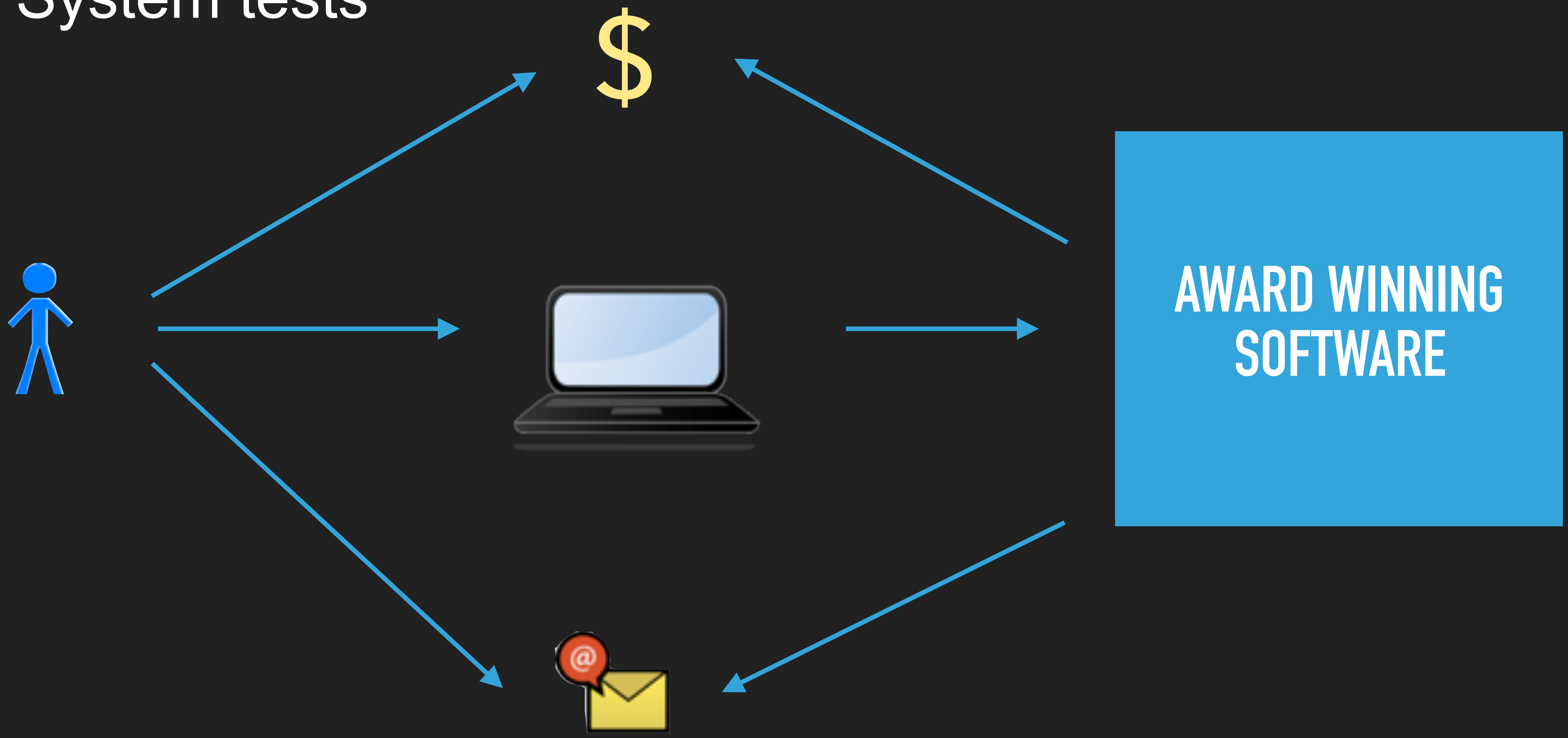
```
class PasswordValidatorTest extends TestCase
{

    public function dataProvider() : array
    {
        return [
           [ “valid”       => [ true,  “Passw0rd” ]],
           [ “tooShort”    => [ false, “Passw0r”  ]],
           [ “noDigit”     => [ false, “Password” ]],
           [ “noUpperCase” => [ false, “passw0rd” ]],
           [ “noLowerCase” => [ false, “PASSW0RD” ]],
           ];
    }

…
```

…

```
    /**
     * @dataProvider dataProvider
     */
    public function testValidator(
         bool $expectedResult,
         string $inputValue
     ) {

         $validator = new PasswordValidator();
         $actualResult = $validator->isValid($inputValue);
         $this->assertEquals($expectedResult, $actualResult);
    }
```

Take away:
Unit test this kind of logic

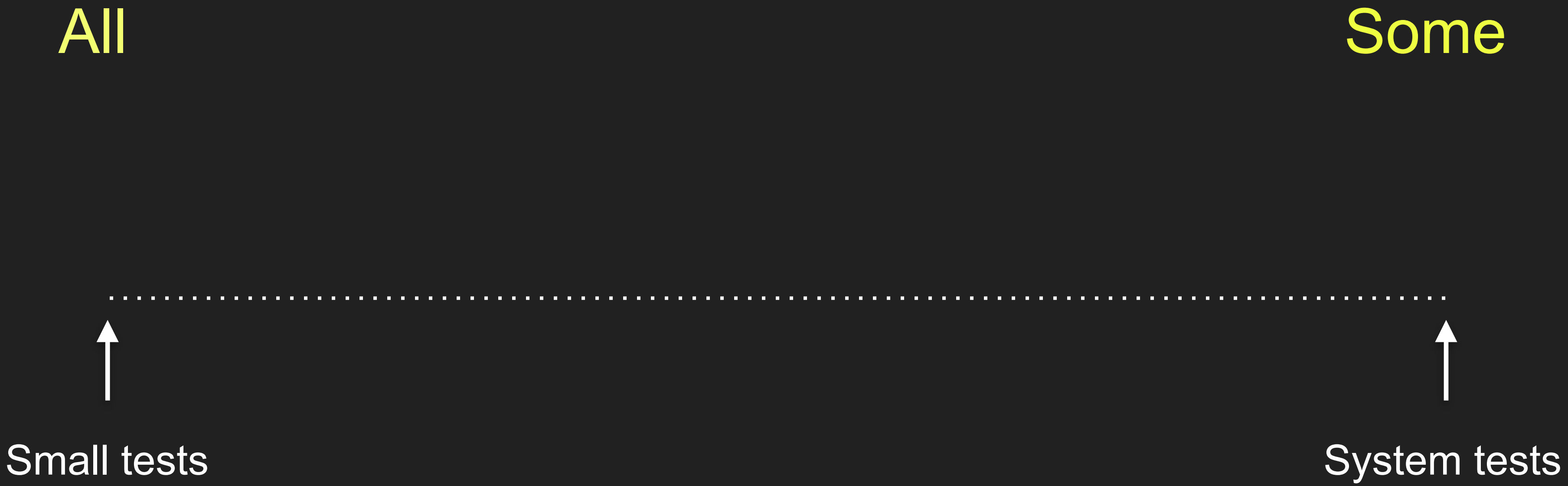
System tests



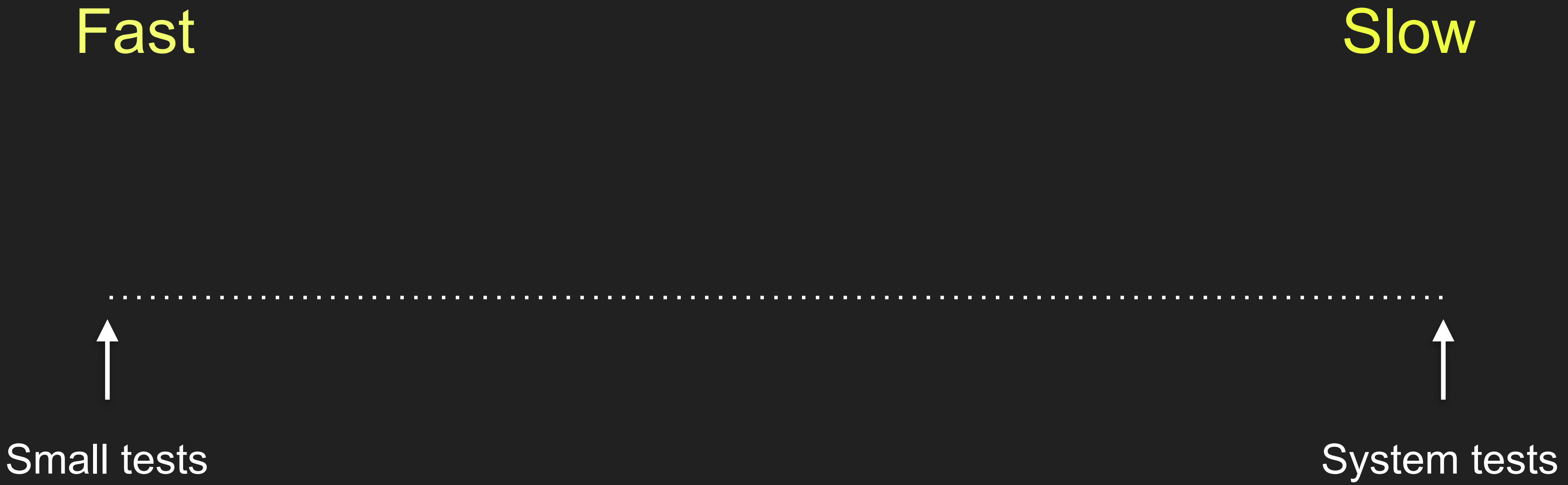
Testing continuum

Testing continuum
#1 Fast to execute

Testing Continuum: Automation



Testing Continuum: Speed of execution



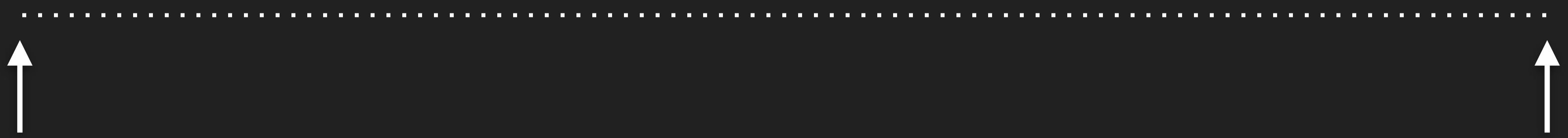
@DaveLiddament

Testing continuum
#2 High coverage

Testing Continuum: Coverage

High — Low

Low — High

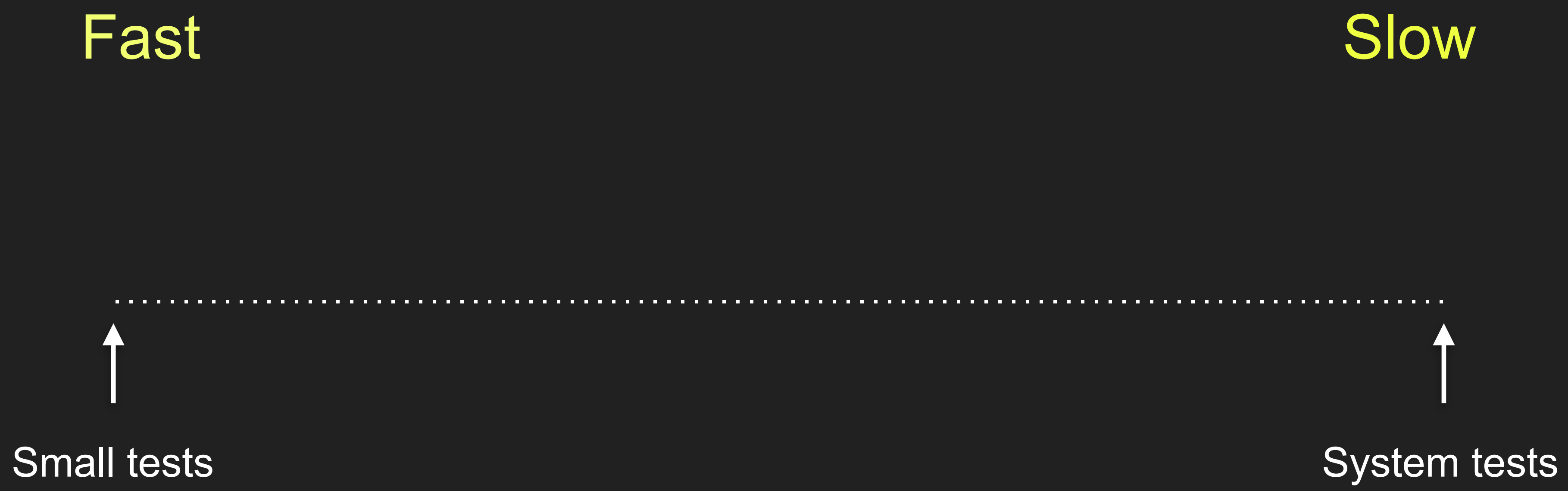


Small tests — System tests

@DaveLiddament

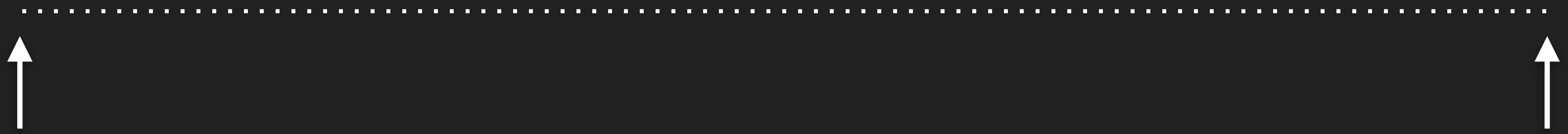
Testing continuum
#3 Low maintenance

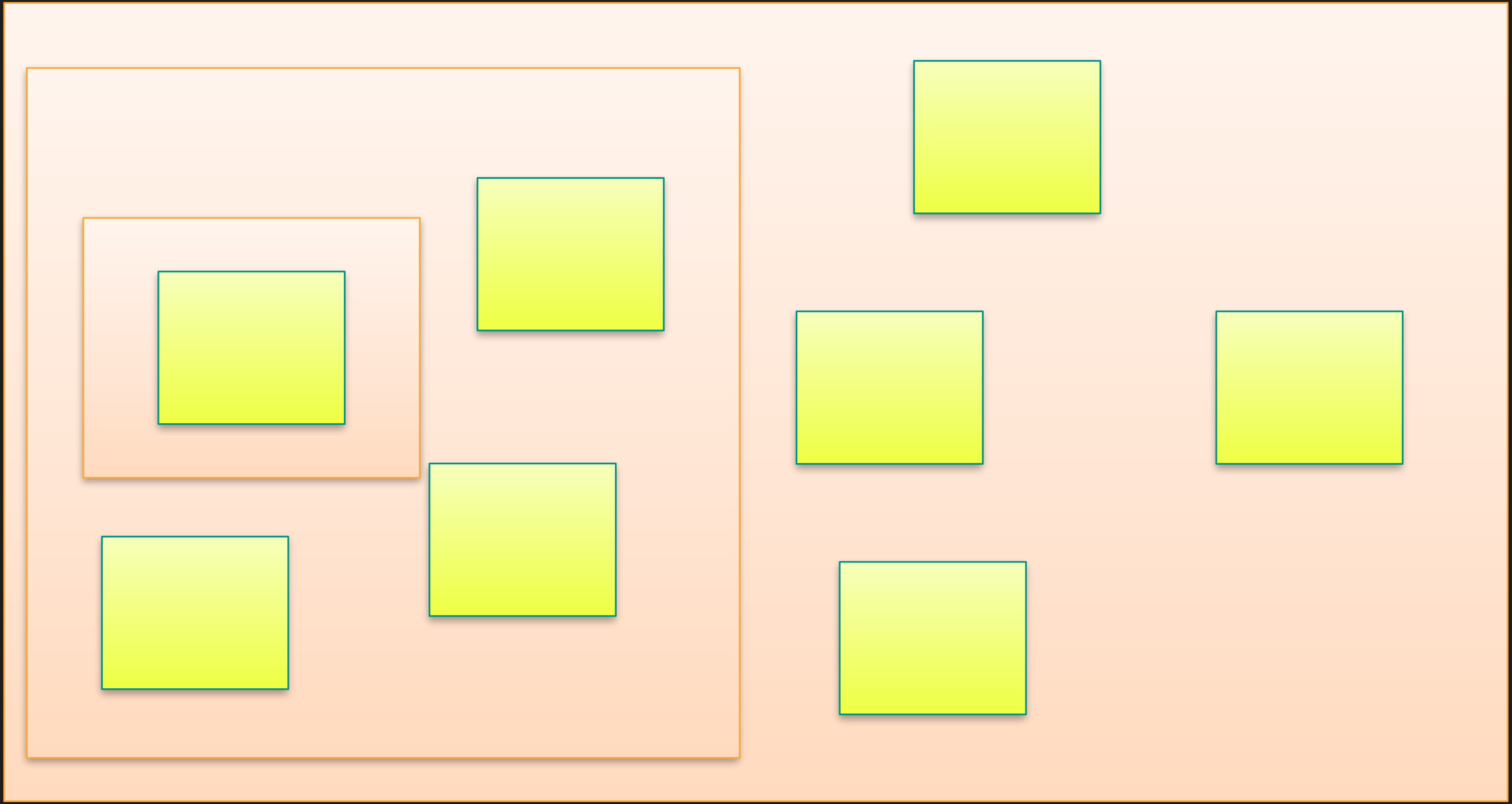
Testing Continuum: Speed of writing



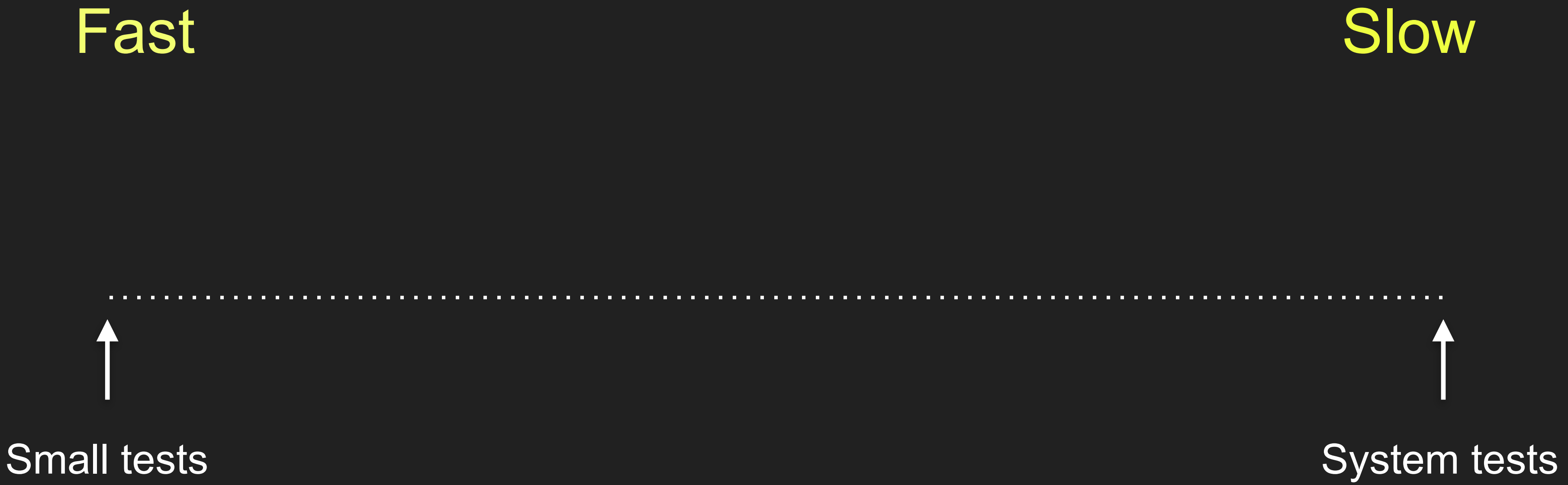
@DaveLiddament

Testing Continuum: Debug speed

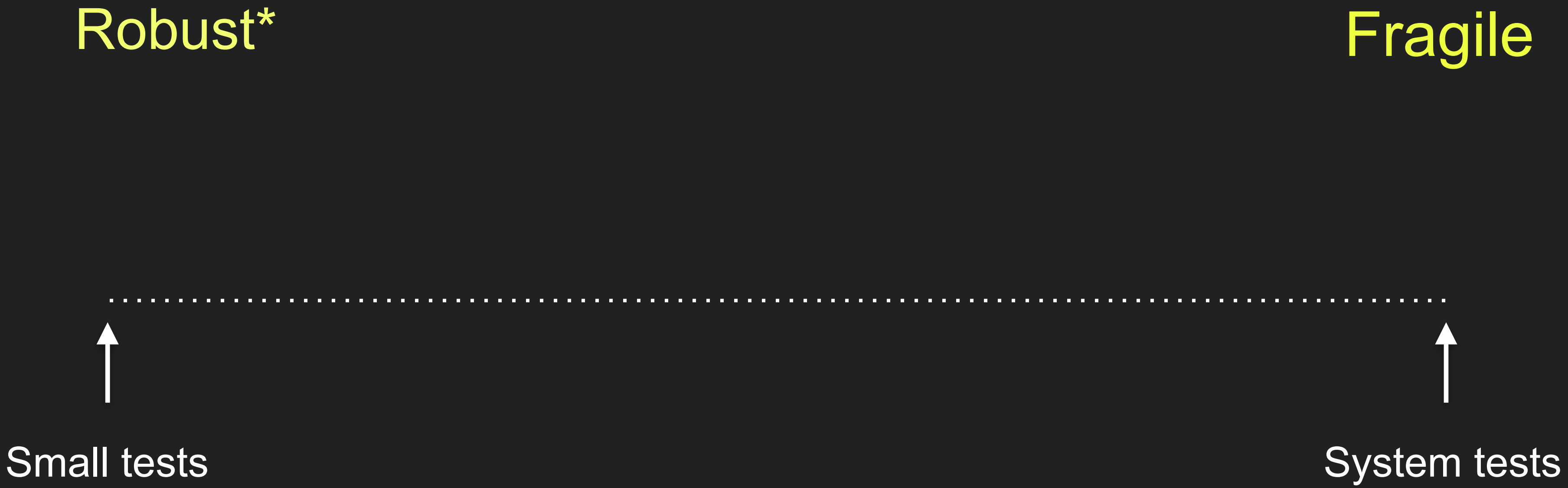




Testing Continuum: Debug speed

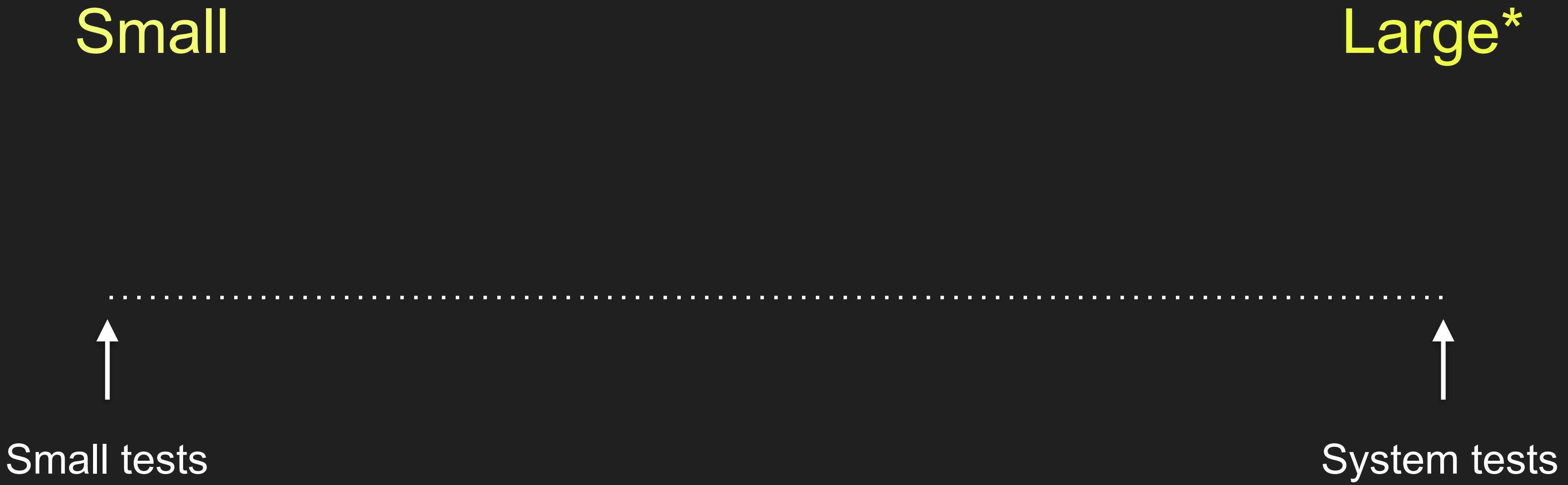


Testing Continuum: Robustness



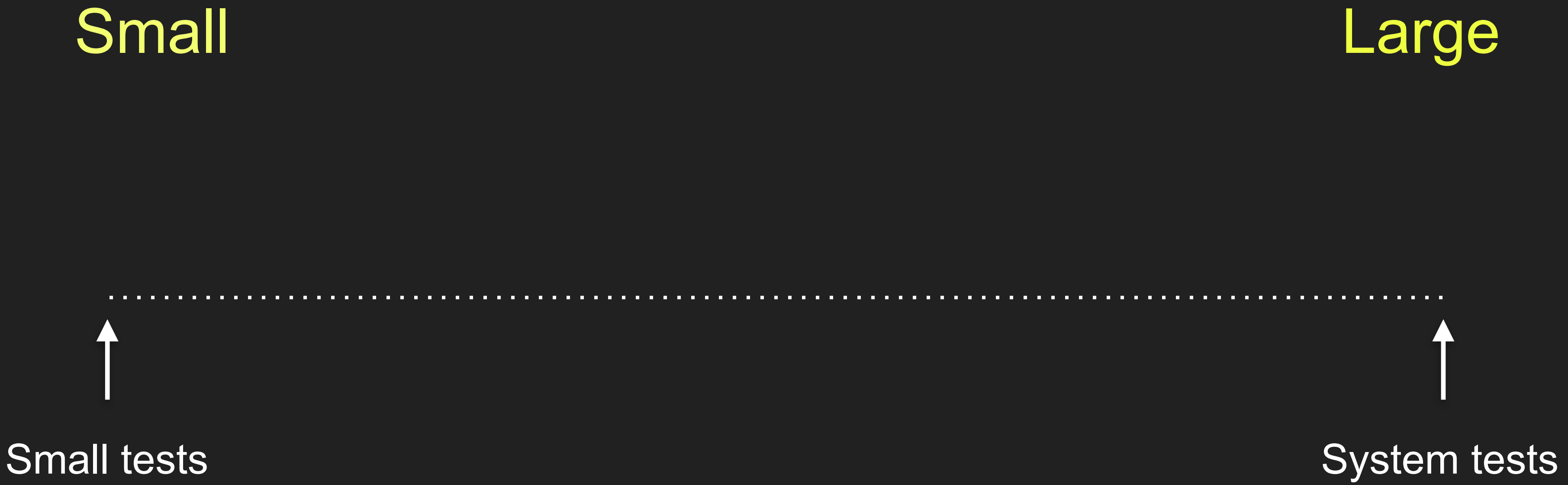
@DaveLiddament

Testing Continuum: Refactoring scope



Other considerations

Testing Continuum: Phew factor



@DaveLiddament

Testing Continuum: Bearing on reality

Not much

Close

Small tests

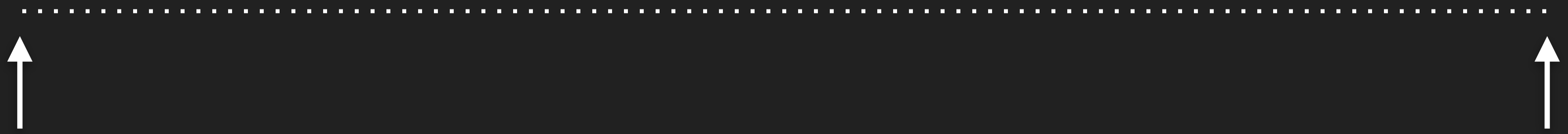
System tests

@DaveLiddament

So far nothing too controversial

Where along the testing continuum should we test?

Testing Continuum: Where should we test?



Small tests

System tests

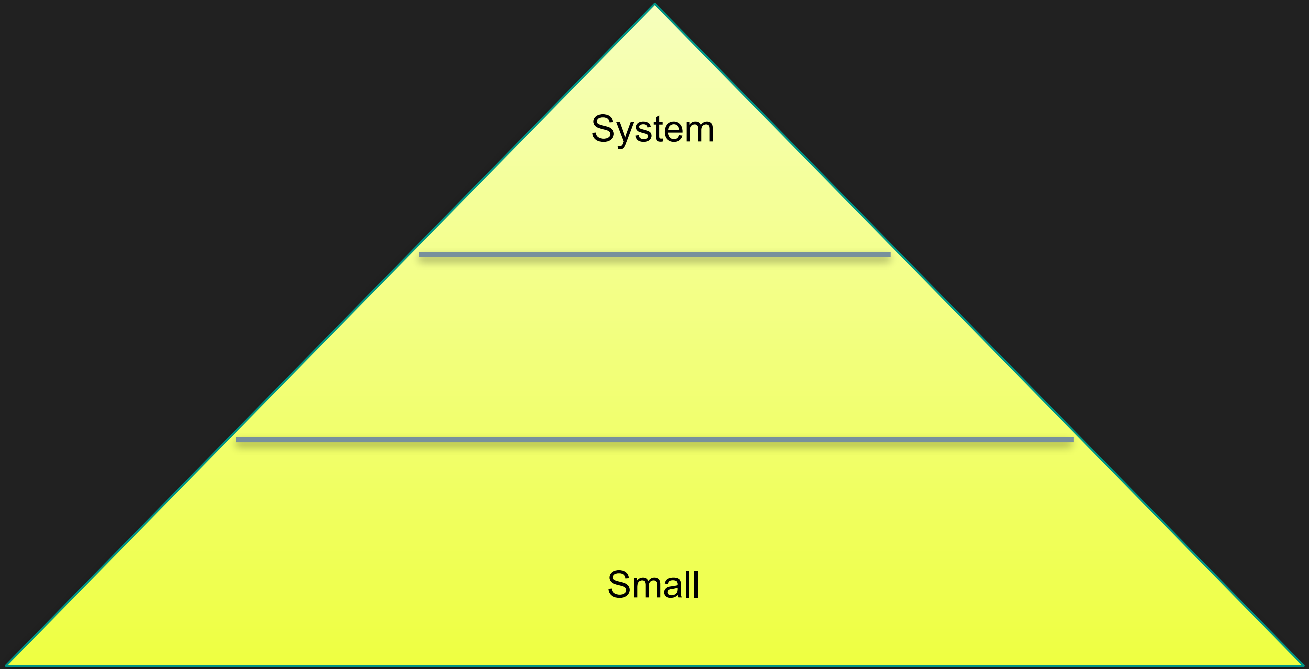
@DaveLiddament

Nothing is black and white

Everything is a compromise

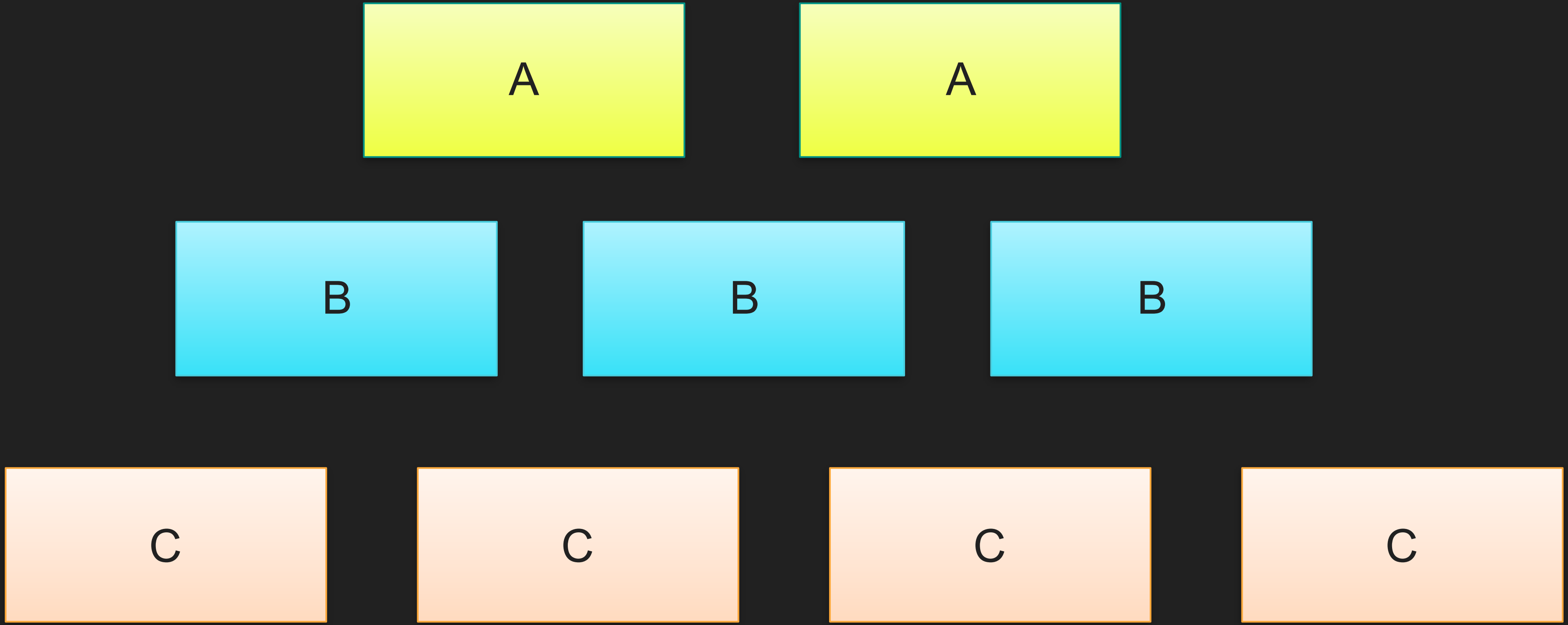
Be pragmatic

Test Pyramid



Test pyramid is still a compromise

Test in layers



Test in layers - we all do this

PHP application code

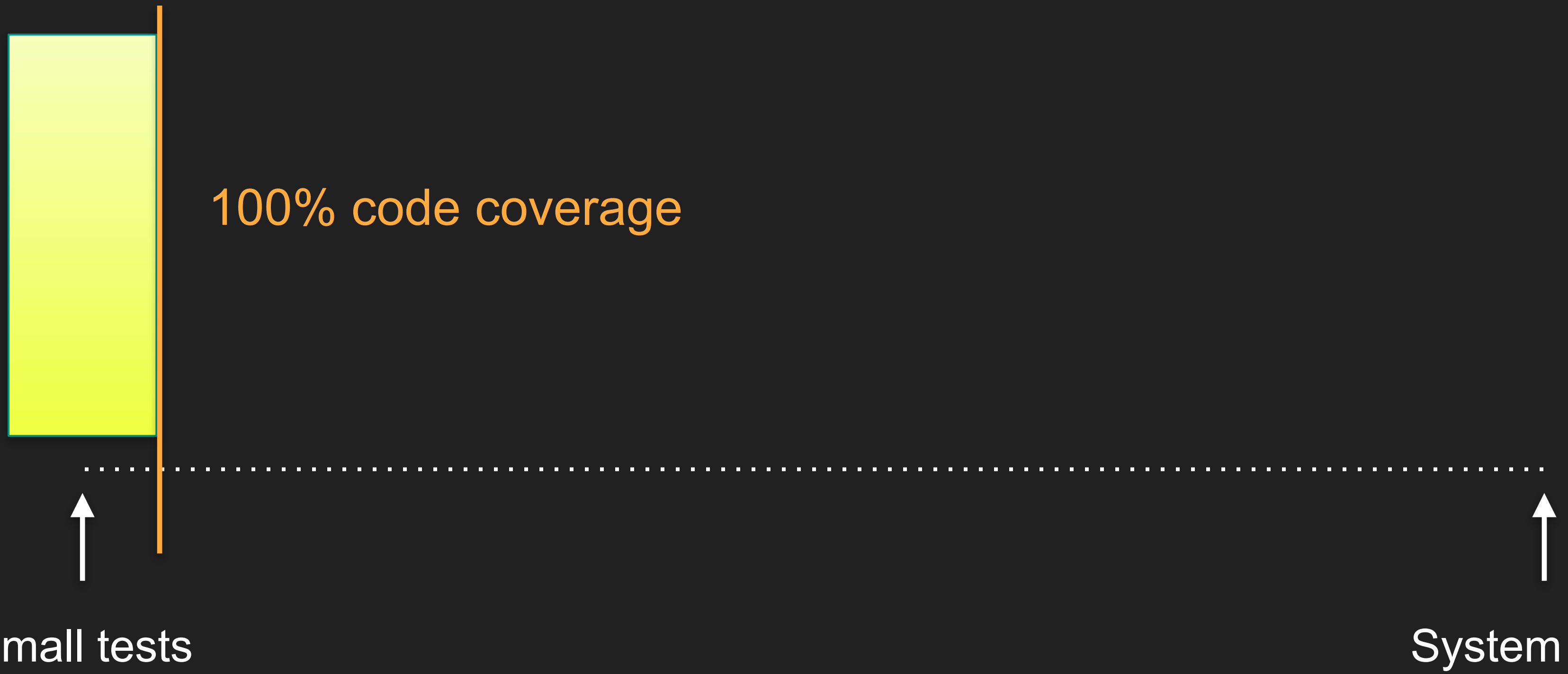
PHP instructions / 3rd party libraries

Machine code running on computer

VALUE OF SMALL TEST		
HIGH	Algorithms	Complex code
LOW	Trivial code	Coordinators
	LOW	HIGH

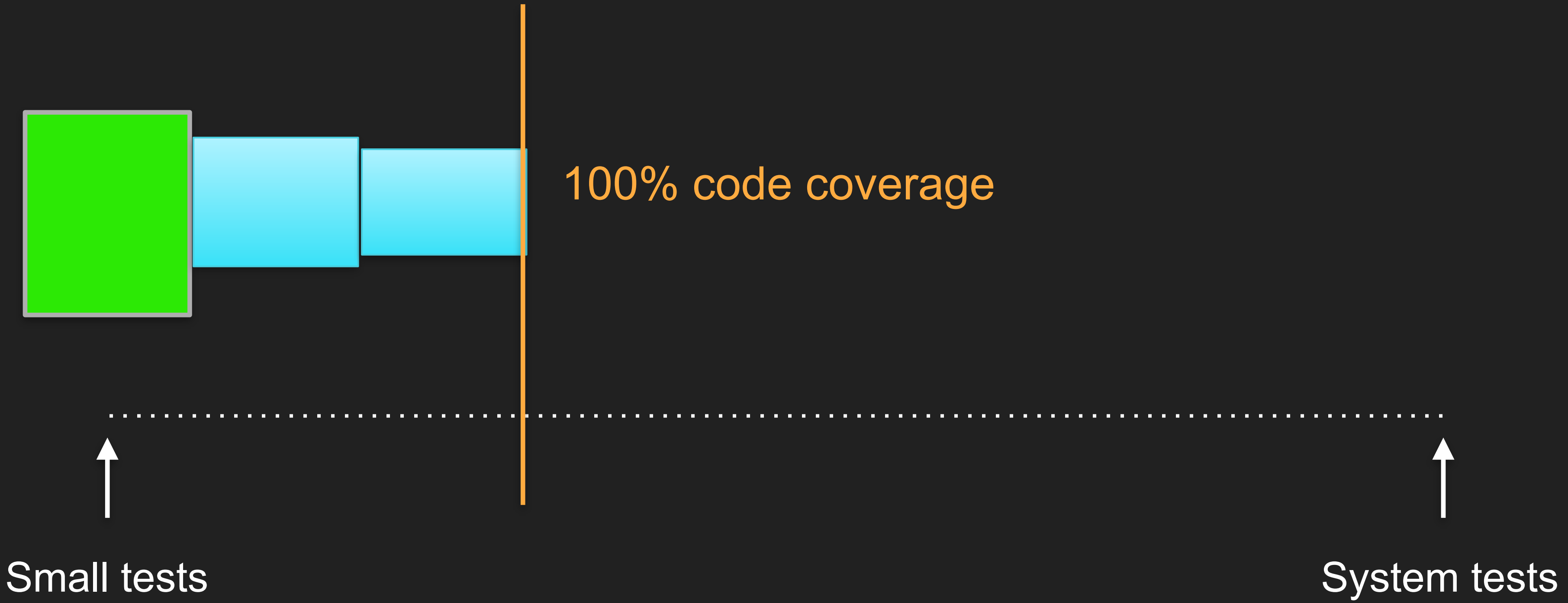
COST

Should all production code be ‘unit tested’ ?



@DaveLiddament

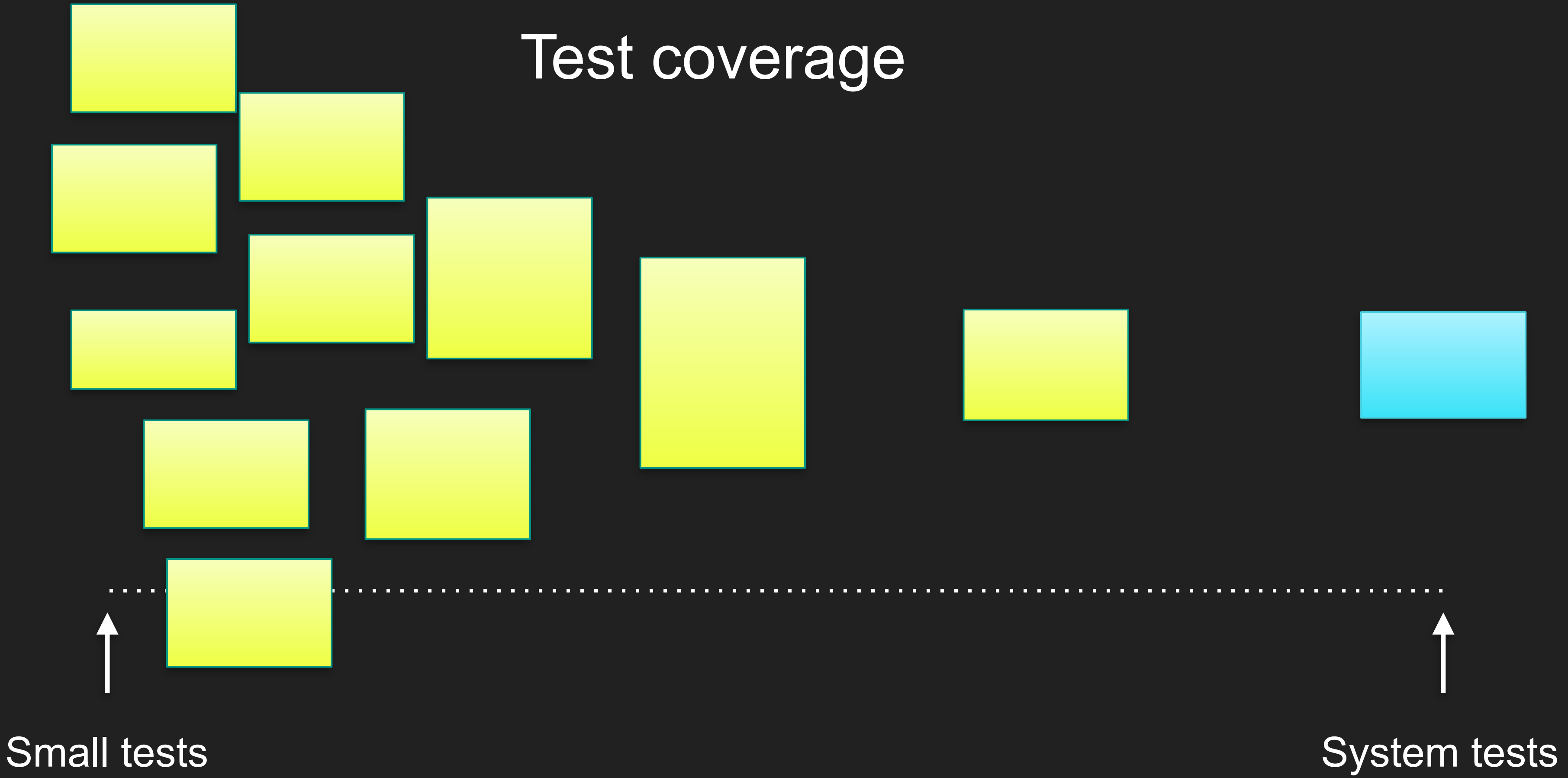
Get coverage from more than small test



I’m going to transfer £100 to you*

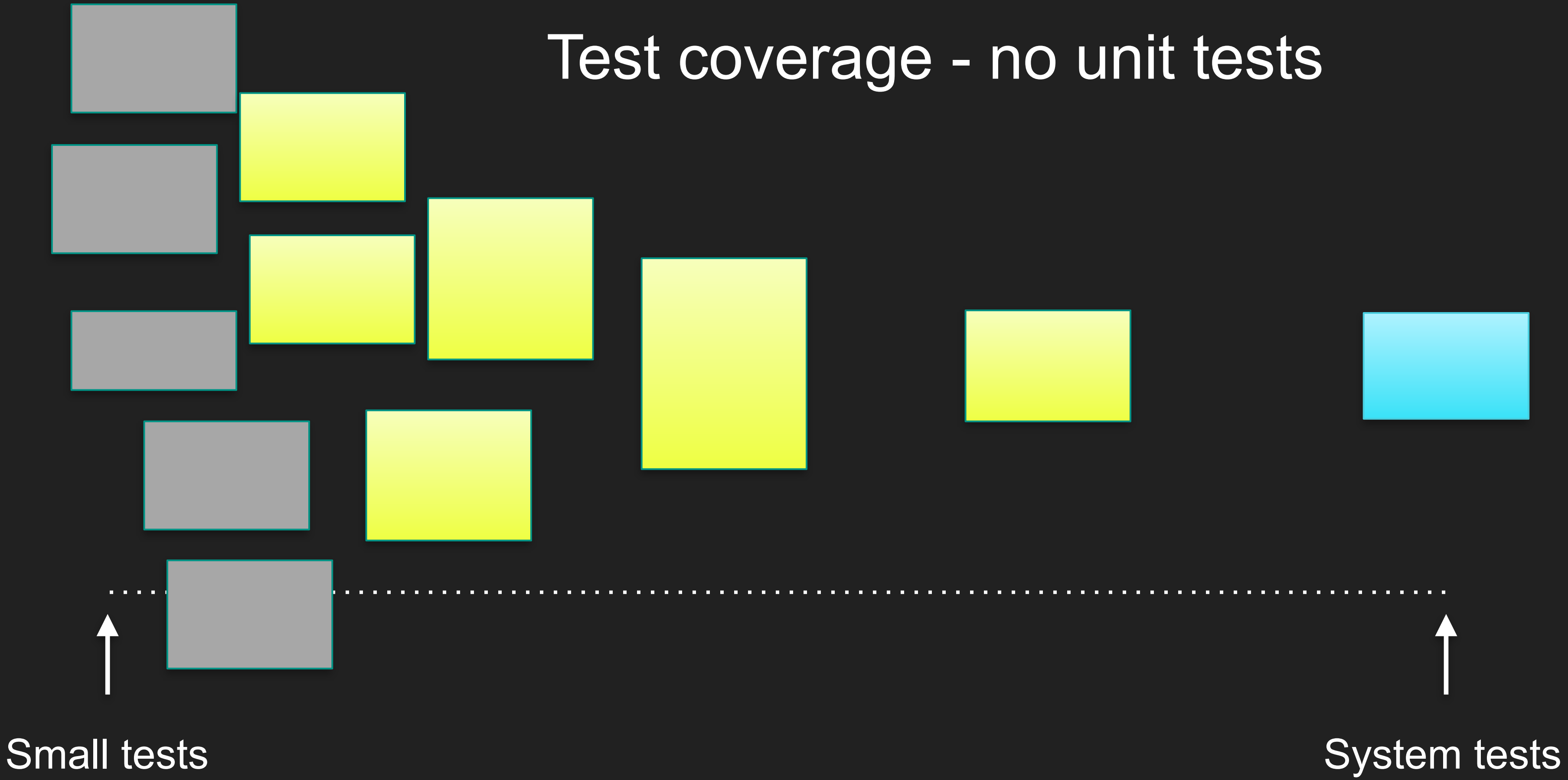
*Assuming everything works

Test coverage



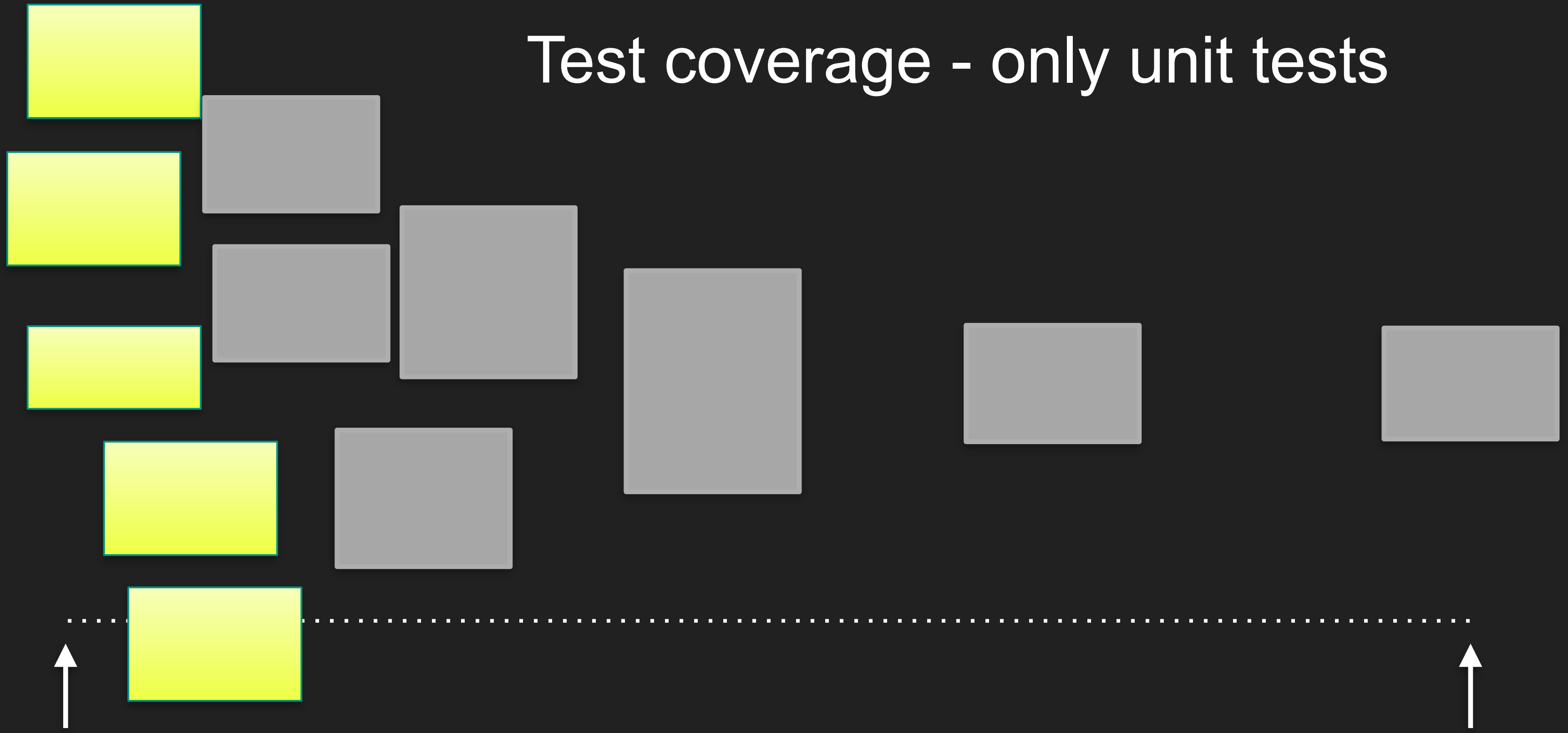
@DaveLiddament

Test coverage - no unit tests



@DaveLiddament

Test coverage - only unit tests



Small tests

System tests

@DaveLiddament

Put the tests where there is highest value

A quick recap…

A test suite…

#1 Proves code works
#2 Stops regression
#3 Enables refactoring

The Holy Trinity…

#1 Fast to execute
#2 High coverage
#3 Low maintenance

Architecture

The codebase isn’t
difficult to test,
it’s poorly architected

Password Validator

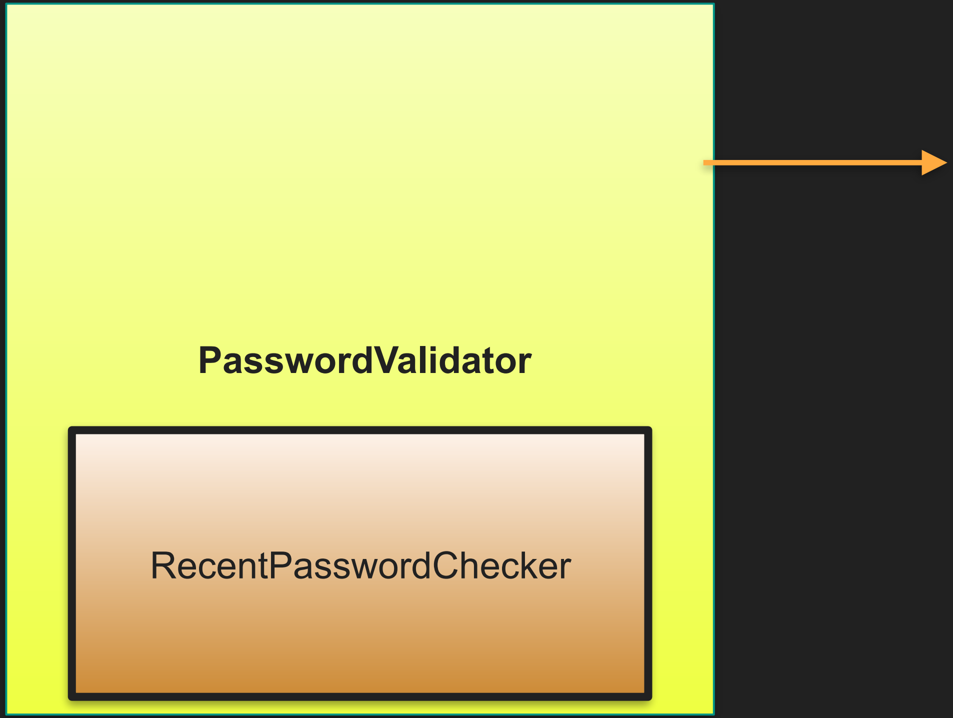
```
class PasswordValidator
{

  /**
   * Returns true if password meets following criteria:
   *
   * - 8 or more characters
   * - at least 1 digit
   * - at least 1 upper case letter
   * - at least 1 lower case letter
   */
   public function isValid(string $password) : bool
```

Extended Password Validator

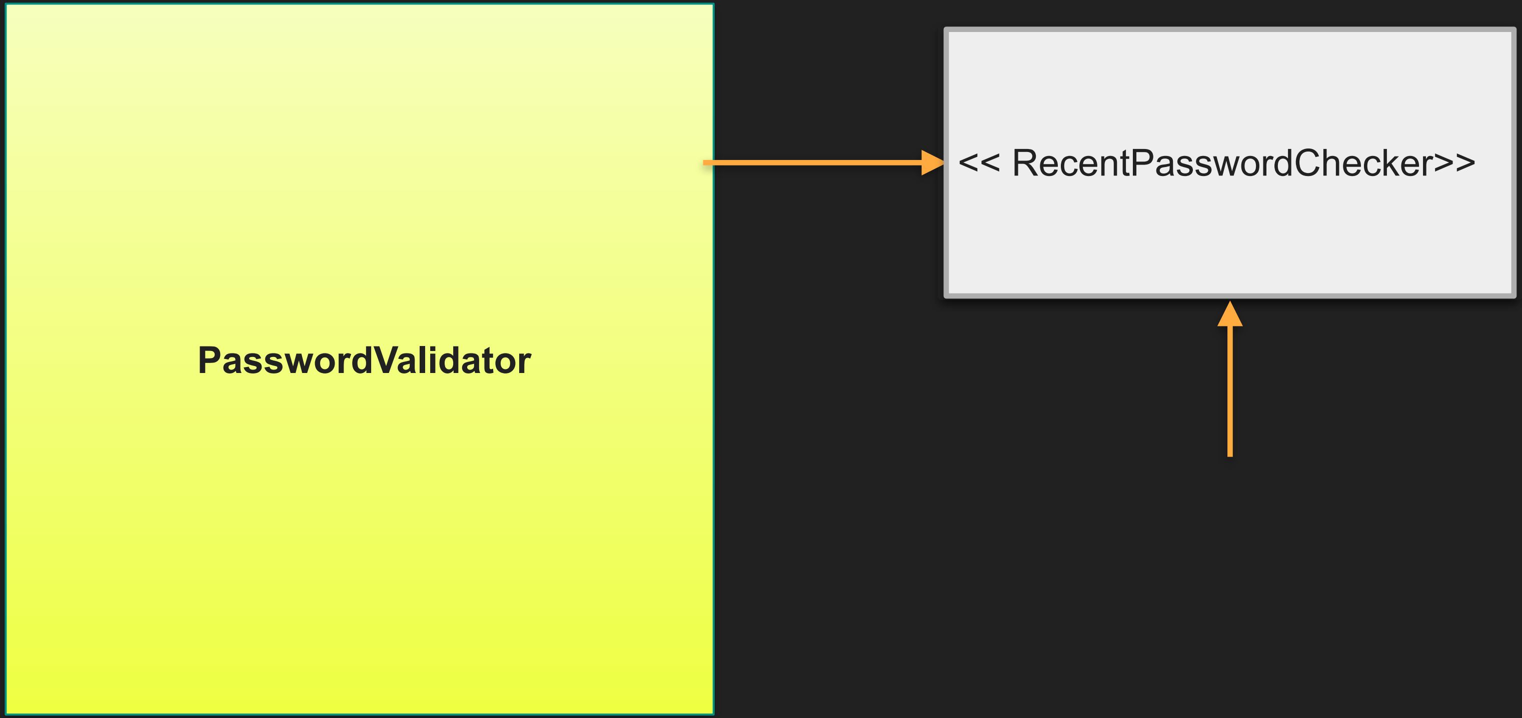
```
class PasswordValidator
{

   /**
    * Returns true if password meets following criteria:
    *
    * - 8 or more characters
    * - at least 1 digit
    * - at least 1 upper case letter
    * - at least 1 lower case letter
    * - not one the previous user's 5 passwords
    */
    public function isValid(string $password, User $user) : bool
```

@DaveLiddament

Architecture: Small tests



Architecture: Small tests

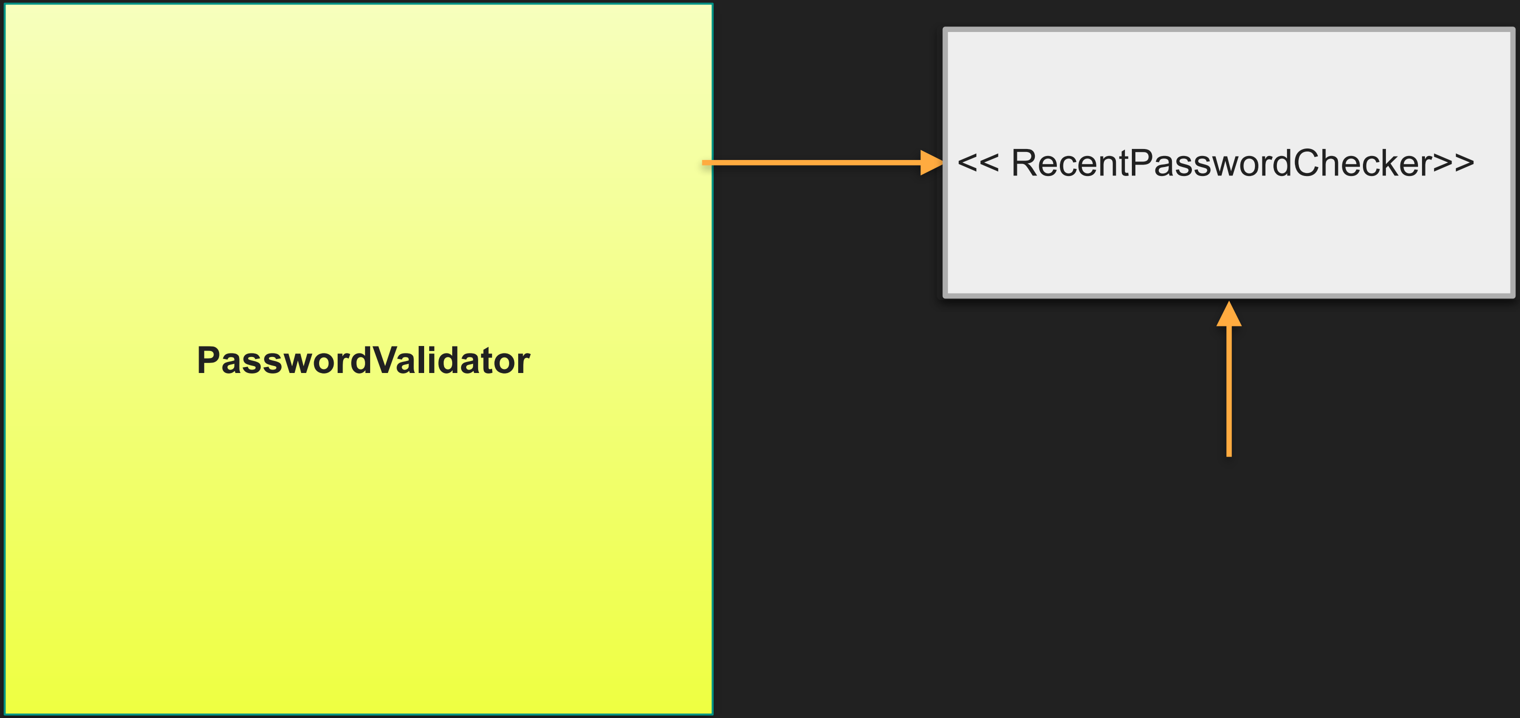


@DaveLiddament

Password Validator - Checking Previous Passwords

```
interface RecentPasswordChecker
{

  /**
   * Returns true if password has been used by user
   * in previous 5 passwords
   *
   */
  public function isRecentPassword(
   string $password, User $user) : bool
```

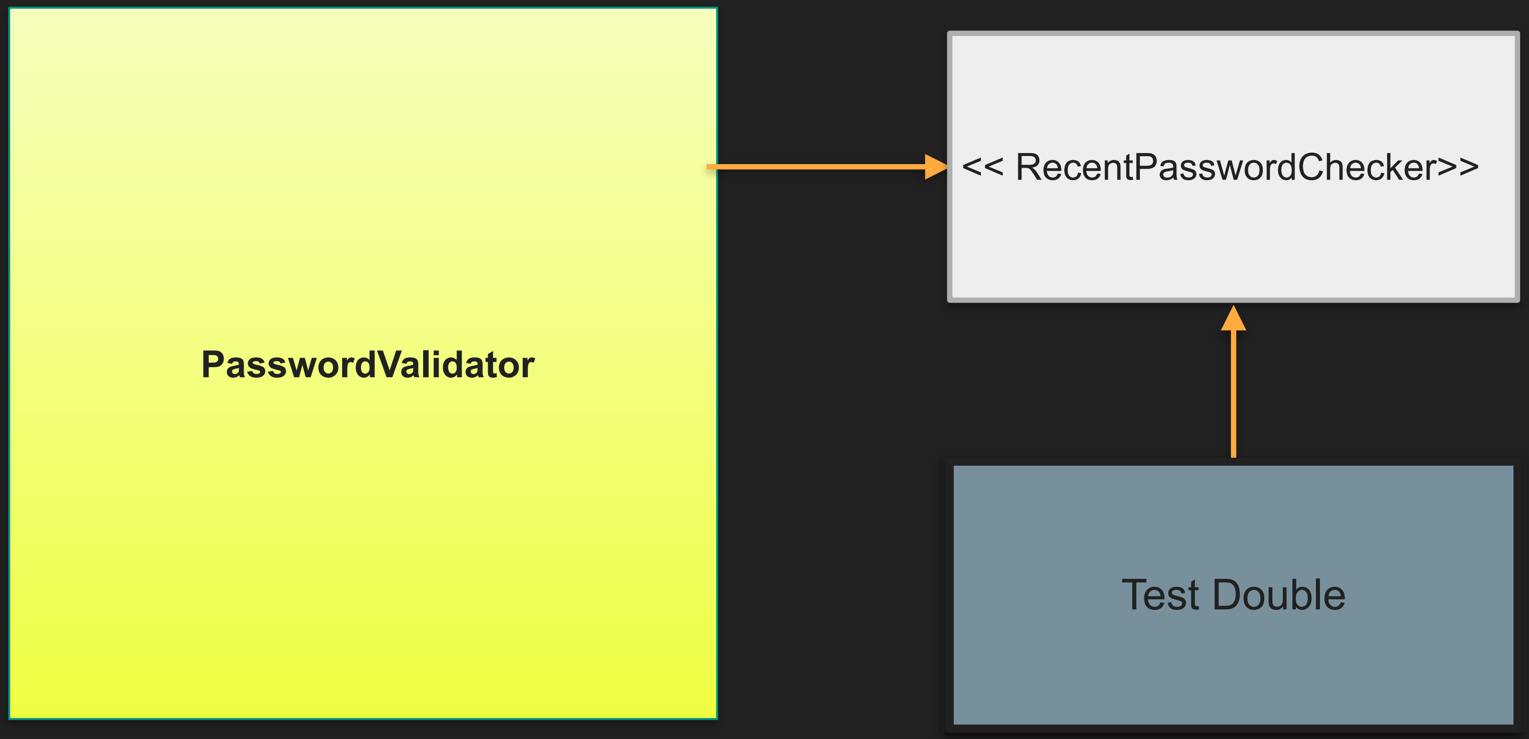
Architecture: Small tests



What do we do with collaborating objects?

- Real version
- Test dummy
    - Stub
    - Mock
    - Fake

Architecture: Small tests



Test double is an approximation

Interface test double must implement

```
interface RecentPasswordChecker
{

   /**
    * Returns true if password has been used by user
    * in previous 5 passwords
    *
    */
   public function isRecentPassword(
    string $password, User $user) : bool
```

New tests (1): Not recent password

- Assume we call isValidPassword with Passw0rd
- Assert isValidPassword returns true
- Mock for RecentPasswordChecker
- isRecentPassword called once
- isRecentPassword returns false
- isRecentPassword called with Passw0rd

New tests (2): Recent password

- Assume we call isValidPassword with Passw0rd
- Assert isValidPassword returns false
- Mock for RecentPasswordChecker
- isRecentPassword called once
- isRecentPassword returns true
- isRecentPassword called with Passw0rd

Existing tests?

Password Validator implementation

```
class PasswordValidator
{
  public function isValid(string $password, User $user) : bool
  {
     if ($this->recentPasswordChecker->isRecentPassword(
              $password, $user)) {
       return false;
     }

     if (… password too short …) return false;
     if (… password has no digit …) return false;

    … remaining checks …

    return true;
  }
```

Existing tests

- Test inputs as before
- Mock for RecentPasswordChecker
- isRecentPassword called once
- isRecentPassword returns false
- isRecentPassword called with test value

Password Validator implementation refactored

```
class PasswordValidator
{
  public function isValid(string $password, User $user) : bool
  {
     if (… password too short …) return false;
     if (… password has no digit …) return false;

    … remaining checks …

     if ($this->recentPasswordChecker->isRecentPassword(
              $password, $user)) {
       return false;
     }

    return true;
  }
```

@DaveLiddament

Our tests start failing

High maintenance test suite (which is bad)

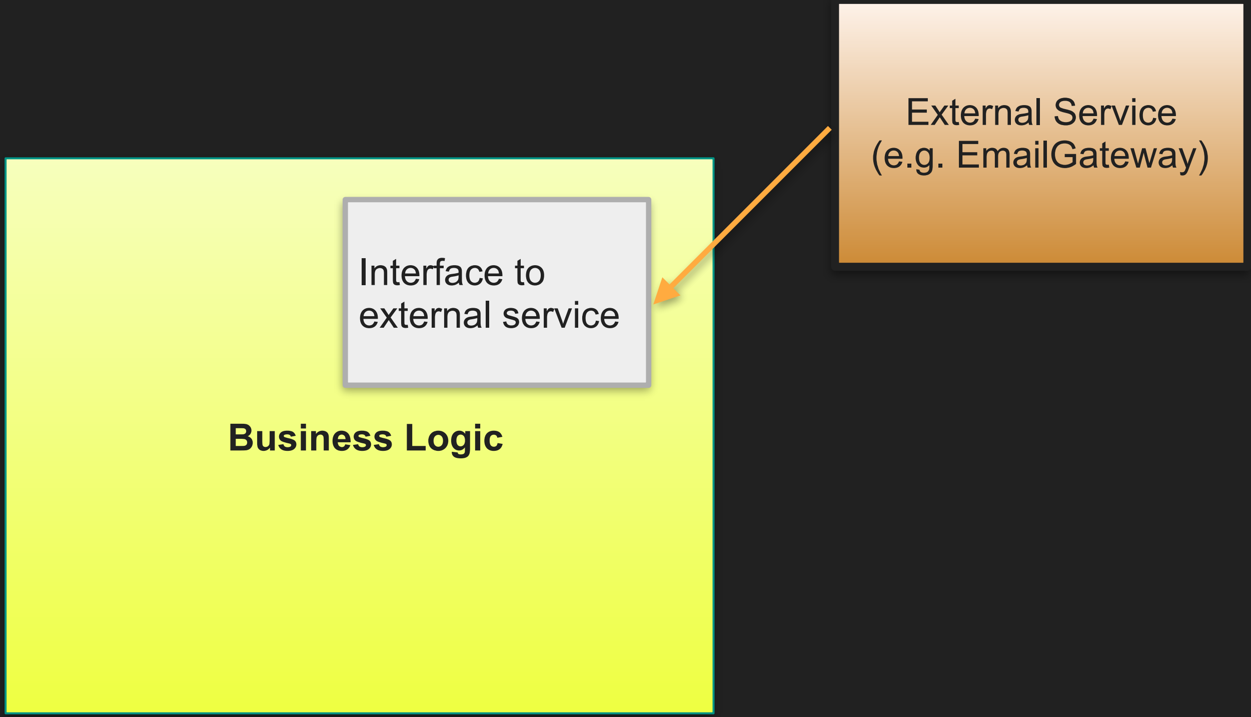
Existing tests - Correct

- Tests as before
- Stub for RecentPasswordChecker
- isRecentPassword always returns false

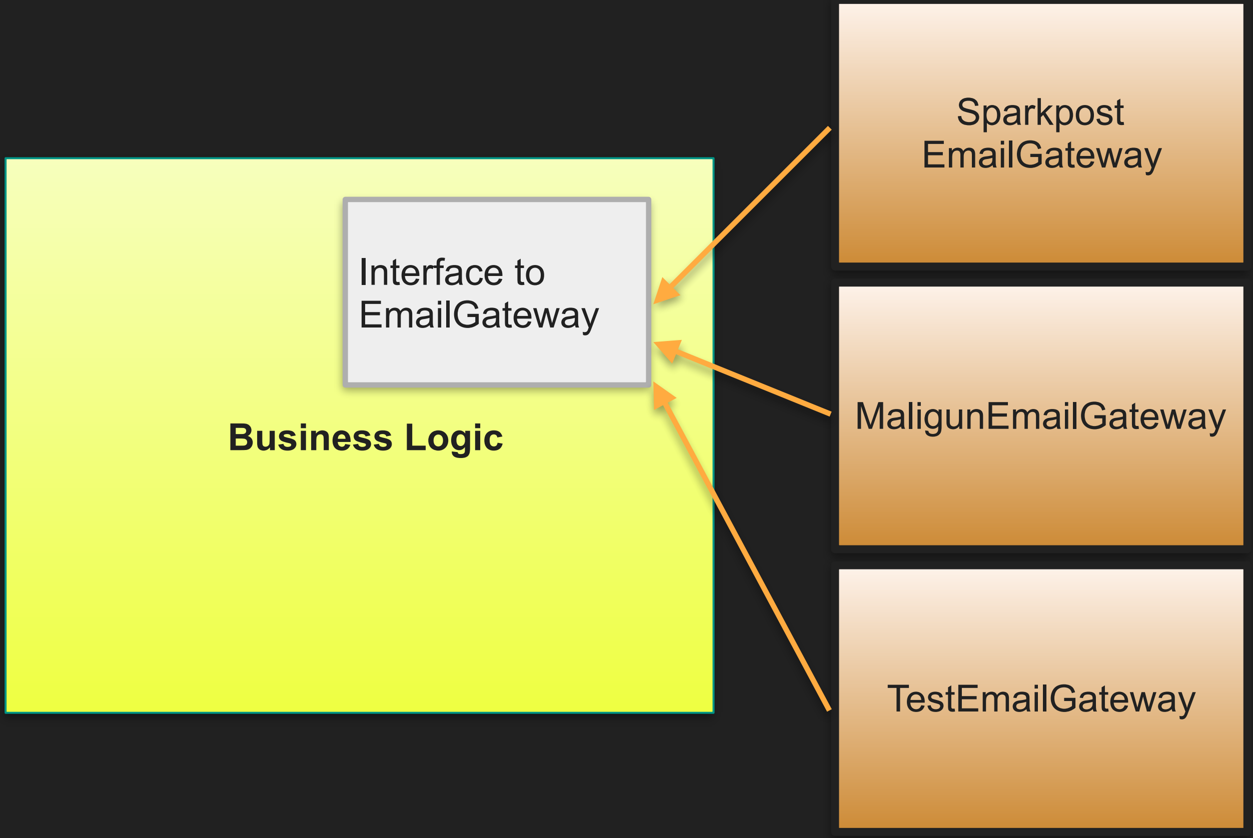
Take away:
Use stubs unless you actually need mocks

Architecture: Bigger tests

Business Logic



@DaveLiddament



@DaveLiddament

Email Gateway Interface

```
interface EmailGatewayInterface
{
    /**
     * Gateway for sending and email
     *
     * @param EmailMessage $message to send
     */
     public function sendEmail(EmailMessage $message);
}
```

@DaveLiddament

EmailMessage

To

From

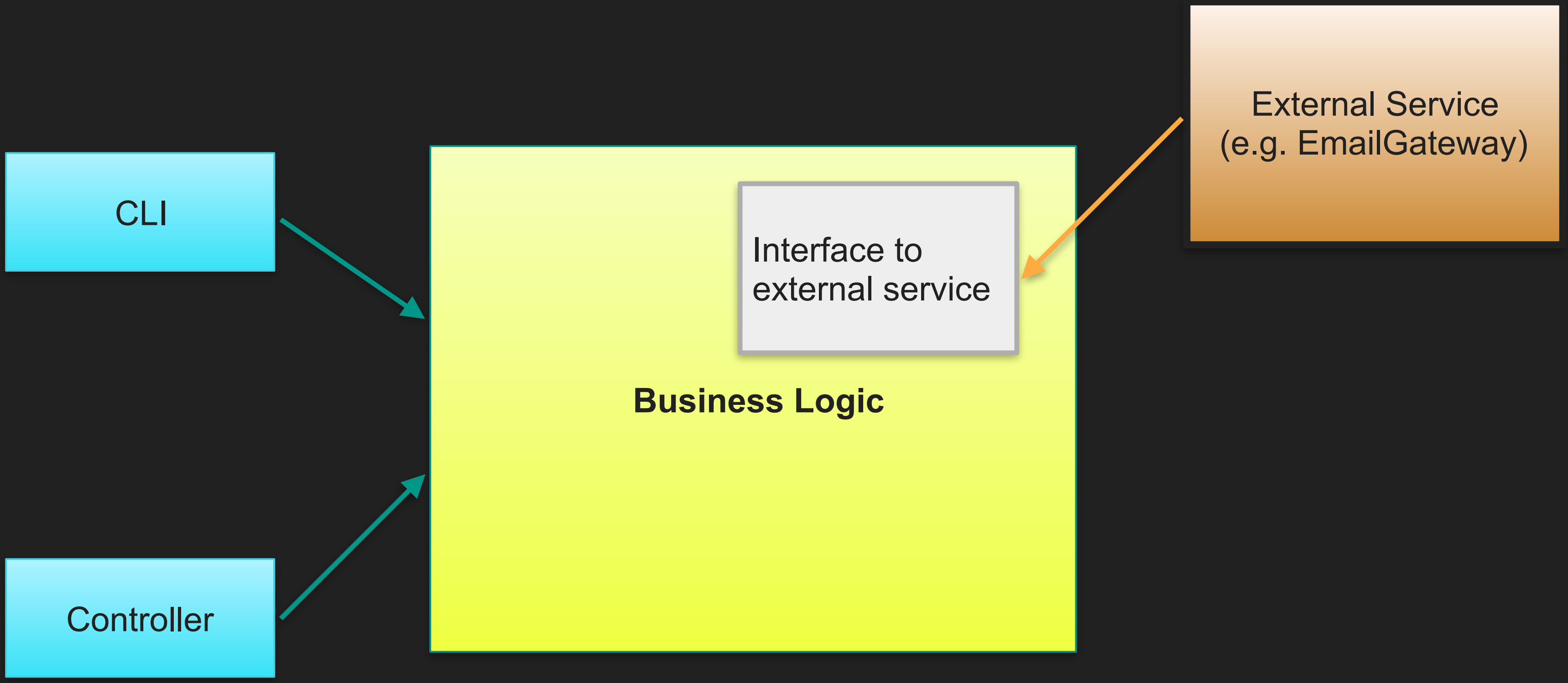
CC

Subject

Message Body

Template Name

Template Data


CLI
Controller
Interface to external service
Business Logic
External Service (e.g. EmailGateway)

@DaveLiddament

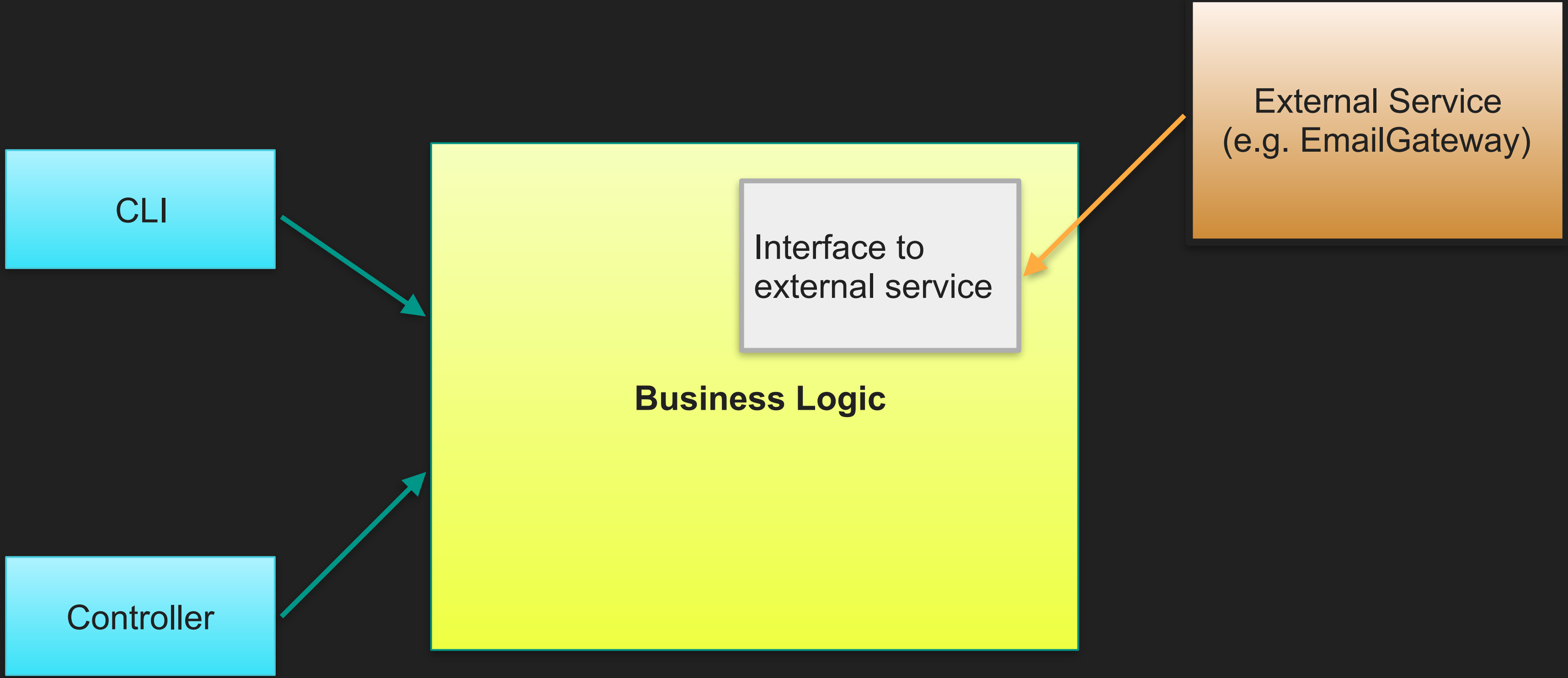
Thin Controllers

```
class UserController
{
  public function confirmUser()
  {
    $token = Input::get("token");
    $success = $this->userService->confirmUser($token);

    if ($success) {
      // Handle success
    } else {
      // Handle failure
    }
  }
```

Thin Controllers

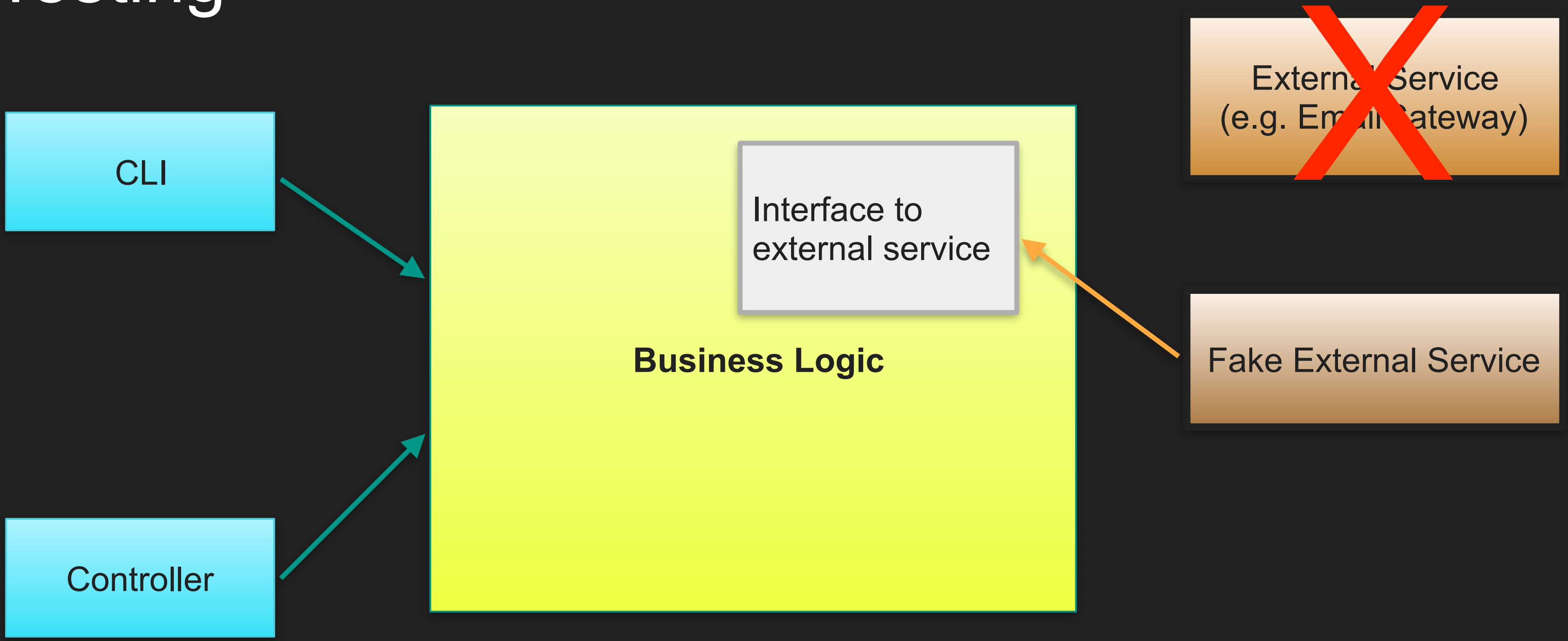
```
class UserController
{
      public function confirmUser()
      {
      $token = Input::get("token");
        $success = $this->userService->confirmUser($token);

      if ($success) {
        // Handle success
      } else {
        // Handle failure
      }
    }
```

@DaveLiddament


CLI
Controller
Interface to external service
Business Logic
External Service (e.g. EmailGateway)

@DaveLiddament

Testing

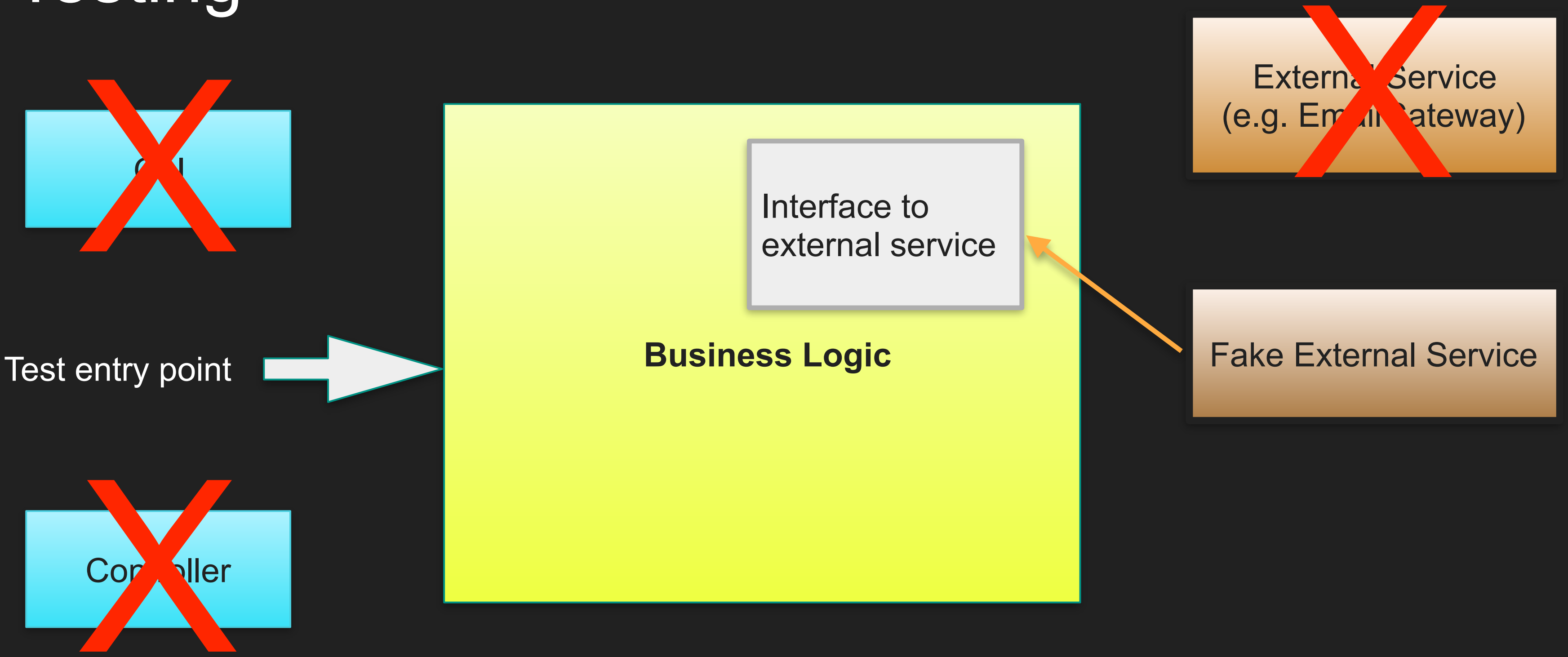

CLI
Controller
Interface to external service
Business Logic
External Service (e.g. Email Gateway)
Fake External Service

@DaveLiddament

Email Gateway Fake

```
class EmailGatewayFake implements EmailGatewayInterface
{
    public function sendEmail(EmailMessage $message)
    {
      /* implementation that stores all messages for searching */
    }

    /**
     * Find emails that would have been sent
     *
     * @param array $criteria e.g.:
     *      ['to' => 'dave@example.com', 'template' => 'RegisterUser']
     * @return EmailMessage[] messages that meet criteria
     */
     public function findEmails(array $criteria)

}
```

Testing



GUI
Test entry point
Controller
Interface to external service
Business Logic
External Service (e.g. Email Gateway)
Fake External Service

@DaveLiddament

Testing User Registration

```
class PasswordValidatorTest extends AbstractTestCase
{
  public function testUpdatePassword()
  {
          // Get the UserService and register a new user
          $userService = $this->container->get("UserService");
          $userService->registerUser(“dave@example.com”, “1stPassword");

          // Get the EmailGatewayStub and find the registration email
          $emailGateway = $this->container->get("EmailGateway");
          $emails = $emailGateway->findEmails(
            [“to” => “dave@example.com”, “template” => “RegisterUser”]);
          $this->assertEquals(1, count($emails));

          // Get confirmation token from the registration email
          $data = $emails[0]->getData();
          $confirmationToken = $data[“confirmationToken”];

          // Complete registration
          $this->assertTrue($userService->confirmUser($confirmationToken));
```

@DaveLiddament

Testing User Registration

```
class PasswordValidatorTest extends AbstractTestCase
{
  public function testUpdatePassword()
  {
         // Get the UserService and register a new user
         $userService = $this->container->get("UserService");
         $userService->registerUser("dave@example.com", "1stPassword");

         // Get the EmailGatewayFake and find the registration email
         $emailGateway = $this->container->get("EmailGateway");
         $emails = $emailGateway->findEmails(
           ["to" => "dave@example.com", "template" => "RegisterUser"]);
         $this->assertEquals(1, count($emails));

         // Get confirmation token from the registration email
         $data = $emails[0]->getData();
         $confirmationToken = $data["confirmationToken"];

         // Complete registration
         $this->assertTrue($userService->confirmUser($confirmationToken));
```

@DaveLiddament

Testing User Registration

```
class PasswordValidatorTest extends AbstractTestCase
{
  public function testUpdatePassword()
  {
         // Get the UserService and register a new user
         $userService = $this->container->get("UserService");
         $userService->registerUser("dave@example.com", "1stPassword");

         // Get the EmailGatewayStub and find the registration email
         $emailGateway = $this->container->get("EmailGateway");
         $emails = $emailGateway->findEmails(
           ["to" => "dave@example.com", "template" => "RegisterUser"]);
         $this->assertEquals(1, count($emails));

         // Get confirmation token from the registration email
         $data = $emails[0]->getData();
         $confirmationToken = $data["confirmationToken"];

         // Complete registration
         $this->assertTrue($userService->confirmUser($confirmationToken));
```

@DaveLiddament

Testing User Registration

```
class PasswordValidatorTest extends AbstractTestCase
{
  public function testUpdatePassword()
  {
          // Get the UserService and register a new user
          $userService = $this->container->get("UserService");
          $userService->registerUser(“dave@example.com”, “1stPassword");

          // Get the EmailGatewayStub and find the registration email
          $emailGateway = $this->container->get("EmailGateway");
          $emails = $emailGateway->findEmails(
            [“to” => “dave@example.com”, “template” => “RegisterUser”]);
          $this->assertEquals(1, count($emails));

          // Get confirmation token from the registration email
          $data = $emails[0]->getData();
          $confirmationToken = $data[“confirmationToken”];

          // Complete registration
          $this->assertTrue($userService->confirmUser($confirmationToken));
```

@DaveLiddament

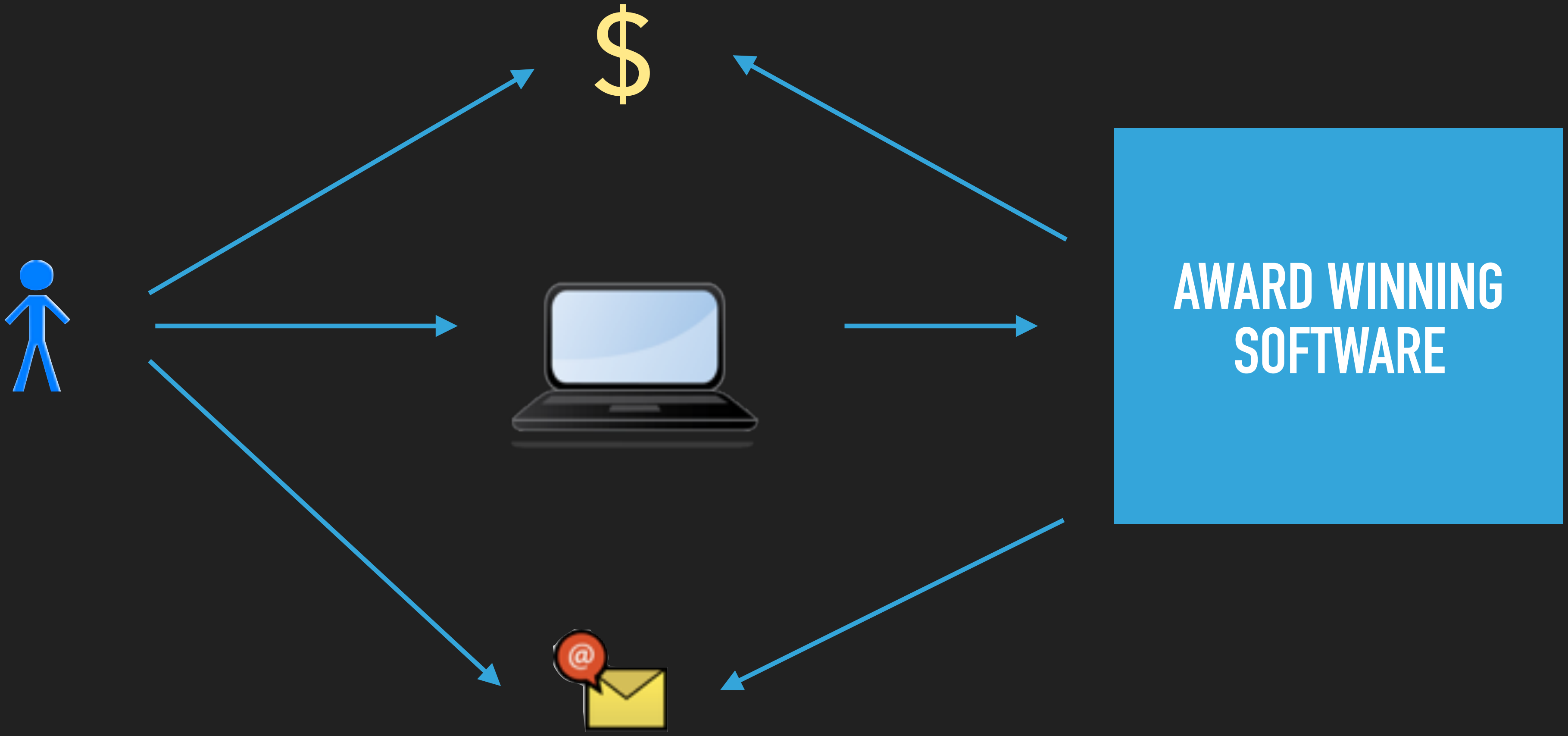
A codebase that's
easy to test
is probably
well architected

Can we automate anything else?

Automating as much as we can:

```
php bin/console test:emailgateway --to dave@lampbristol.com

Sending email:
To      [dave@lampbristol.com]
From    [test@lampbristol.com]
CC      [dave+1@lampbristol.com]
Subject [Test email 2016-02-08 19:37]
Body    [Hi,
         This is a test email.
         Sent at 2016-02-08 19:37.
         From your tester]
```

Still need manual system tests



Summary

#1 We need a test suite

- Proves code works
- Stops regression
- Enables refactoring

#2 Ideal test suite…

- Fast to execute
- High coverage
- Low maintenance

#3 Write testable code

- Well architected
- Easy to maintain
- Easier to automate tests

Questions