Integration Testing PHP Applications

OSCON 2008
Mike Naberezny

Maintainable Software

http://maintainable.com

About Me

- http://mikenaberezny.com
- http://maintainable.com
- http://ohloh.net/accounts/mnaberez

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Later Today

- Supervisor as a Platform
  (UNIX Process Control System in Python)
- Room D138 at 4:30pm

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About You

- Web application developer, using PHP
- Already writing unit tests
- Ready for the next level

Integration Tests

- Testing the application or its components on a higher level than unit tests
- Overlap with functional, acceptance tests. Don’t get hung up on terminology.
- Making HTTP Requests (real or fake) to the application and testing the responses

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Agenda

- Markup and Testability
- CSS Selector Basics
- PHPUnit SeleniumTestCase
- Roll Your Own
- Extras
- Q & A

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Markup and Testability

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Testability

- Unit testing can be very difficult if the application does not cleanly separate concerns
- Tests that look at response HTML are more forgiving about the underlying implementation
- Separating concerns on both the server side and the client side greatly enhances testability and maintainability

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Yesterday’s Application

- Big files, all mixed up
  - PHP and SQL
  - HTML with <FONT> tags
  - JavaScript

- Unit testing next to impossible
- Integration testing possible, probably not fun

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Today's Application

- Small, well-separated files
  - PHP projects became more organized
  - Basic object orientation greatly helped
  - Templating systems separated application logic from presentation logic
- Unit testing possible, Maintenance easier
- Hopefully you are here already

Application Developer

- Server-side technologies you need to know:
  - PHP, Basic OOP, Basic Testing
  - Relational Databases
  - HTTP and Best Practices
  - Separation of Concerns

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Application Developer

- Client-side techniques you need to know:
  - XHTML and CSS
  - DOM
  - JavaScript, JSON, XML
  - Separation of Concerns

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Application Developer

- Client-side techniques have evolved along with the server side.
- You need to understand them regardless of your specific role as a web developer.

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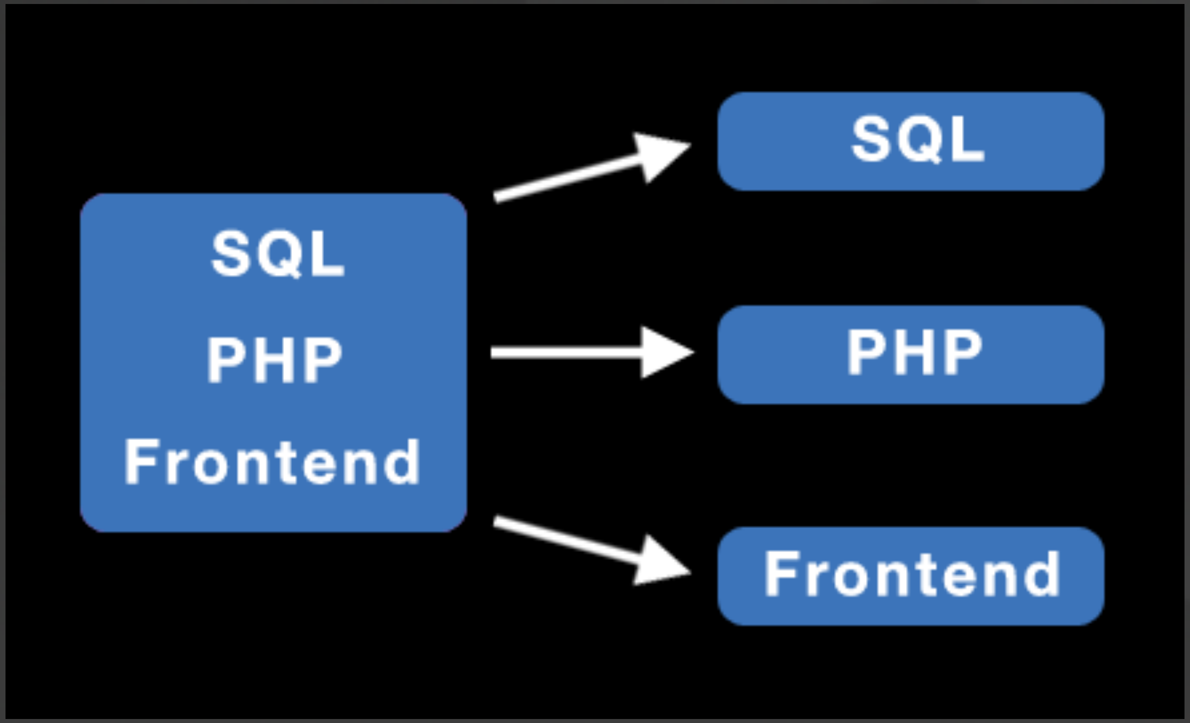
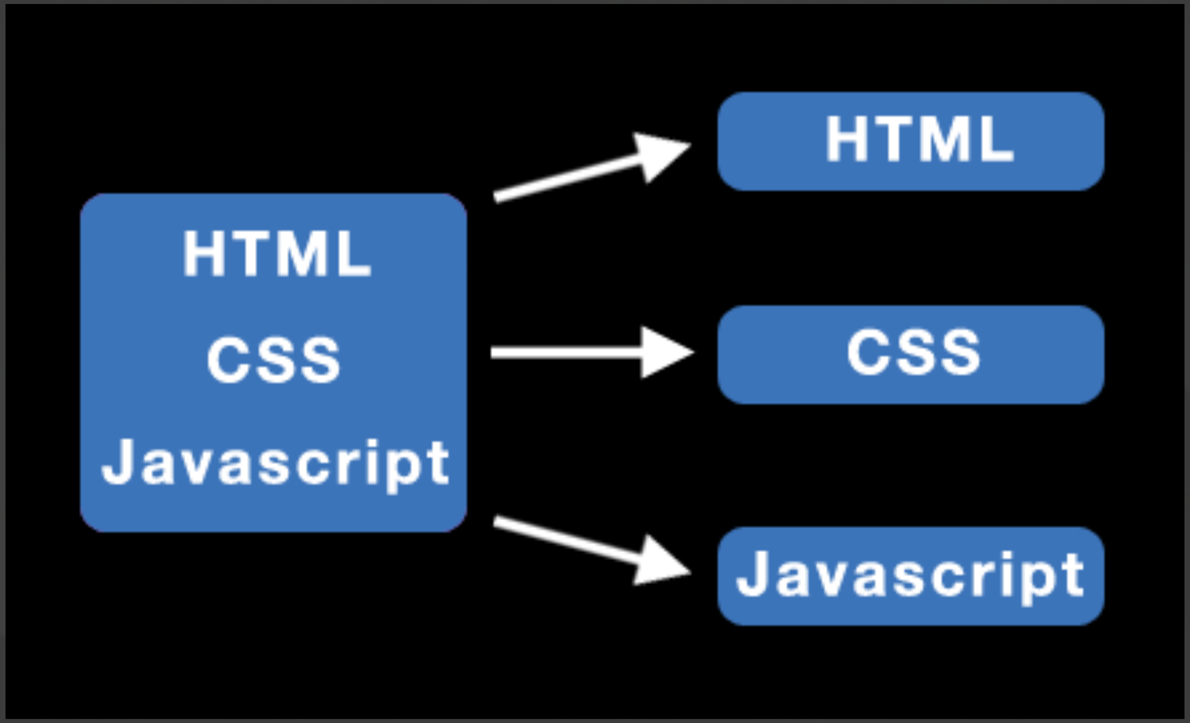
Separating Concerns





Separate both server-side and
client-side code by type and responsibility.

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Today's Application

- XHTML, CSS, Javascript cleanly separated into different files.
- The DOM lets all of these client-side technologies hang together cleanly.
- CSS Selectors and newer JavaScript libraries make this much easier

Testability

- Your markup determines how much fun you will have doing your testing.
- You need to understand markup, DOM, selectors, and then design for testability.
- The DOM is an integration point for your tests, through selectors.

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CSS Selector Basics

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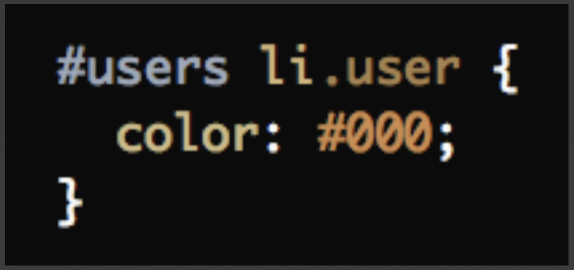
CSS Selectors



```
#users li.user {
  color: #000;
}
```

- Simple, convenient
- Have become the standard for accessing DOM, driven by CSS
- You don't need to be a designer, you do need be able to read this selector and write others like it.

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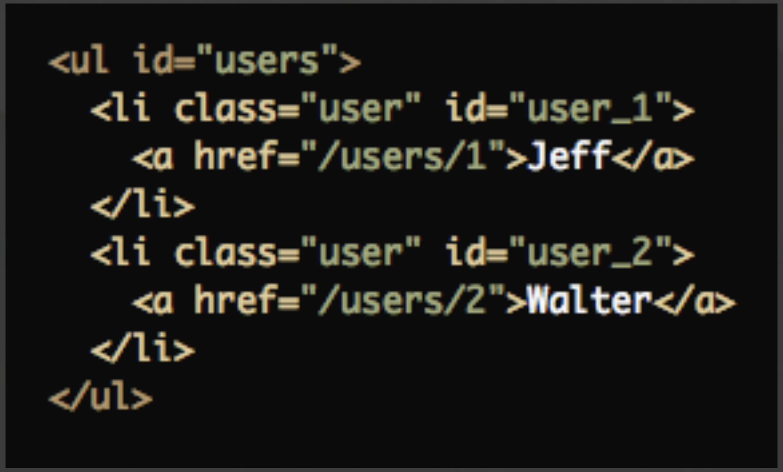
CSS Selectors

- All inlined CSS and JS has been removed.
- Readable by human or machine.
- IDs must begin with alpha character and may only be used once.
- A class can be used multiple times.



```
<ul id="users">
  <li class="user" id="user_1">
    <a href="/users/1">Jeff</a>
  </li>
  <li class="user" id="user_2">
    <a href="/users/2">Walter</a>
  </li>
</ul>
```

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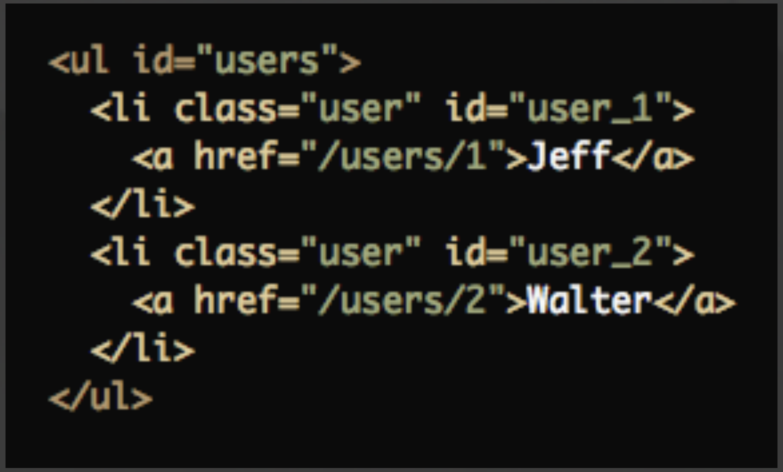
CSS Selectors

- Strategically placed IDs and class names to easily reference elements individually or as a group.
- Specific elements get an ID.
- Elements you're looping over or that you'll reference as a collection can use a class.



```
<ul id="users">
  <li class="user" id="user_1">
    <a href="/users/1">Jeff</a>
  </li>
  <li class="user" id="user_2">
    <a href="/users/2">Walter</a>
  </li>
</ul>
```

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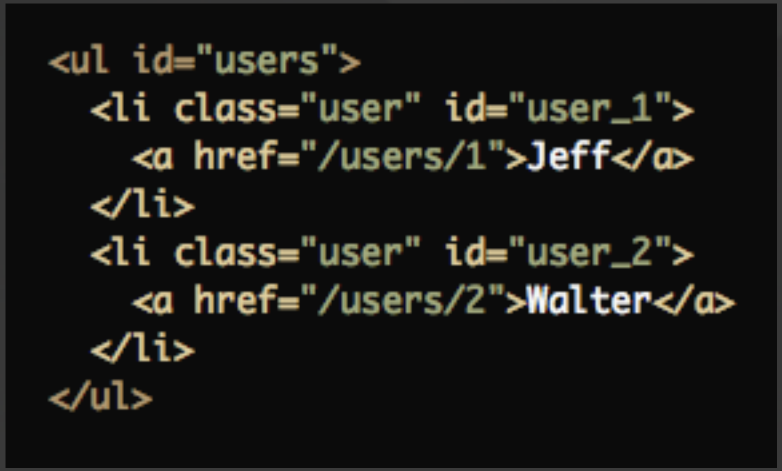
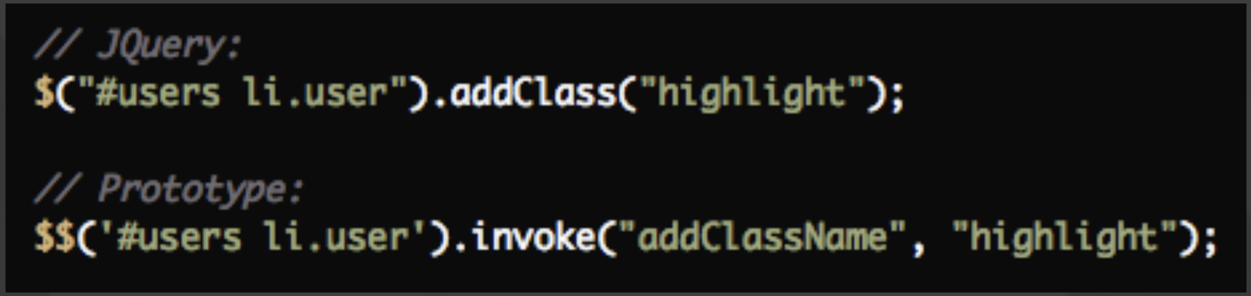
CSS Selectors



```html
<ul id="users">
  <li class="user" id="user_1">
    <a href="/users/1">Jeff</a>
  </li>
  <li class="user" id="user_2">
    <a href="/users/2">Walter</a>
  </li>
</ul>
```



```javascript
// JQuery:
$("#users li.user").addClass("highlight");

// Prototype:
$$('#users li.user').invoke("addClassName", "highlight");
```

- CSS selectors and newer JS libraries make life much easier.
- Your PHP code can use the same selectors for testing!

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PHPUnit SeleniumTestCase

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Selenium RC

- Browser-based testing tool
  - Launches a web browser
  - Retrieves URL
  - Inspects Results
- PHPUnit Integration is Simple to Use

Selenium RC

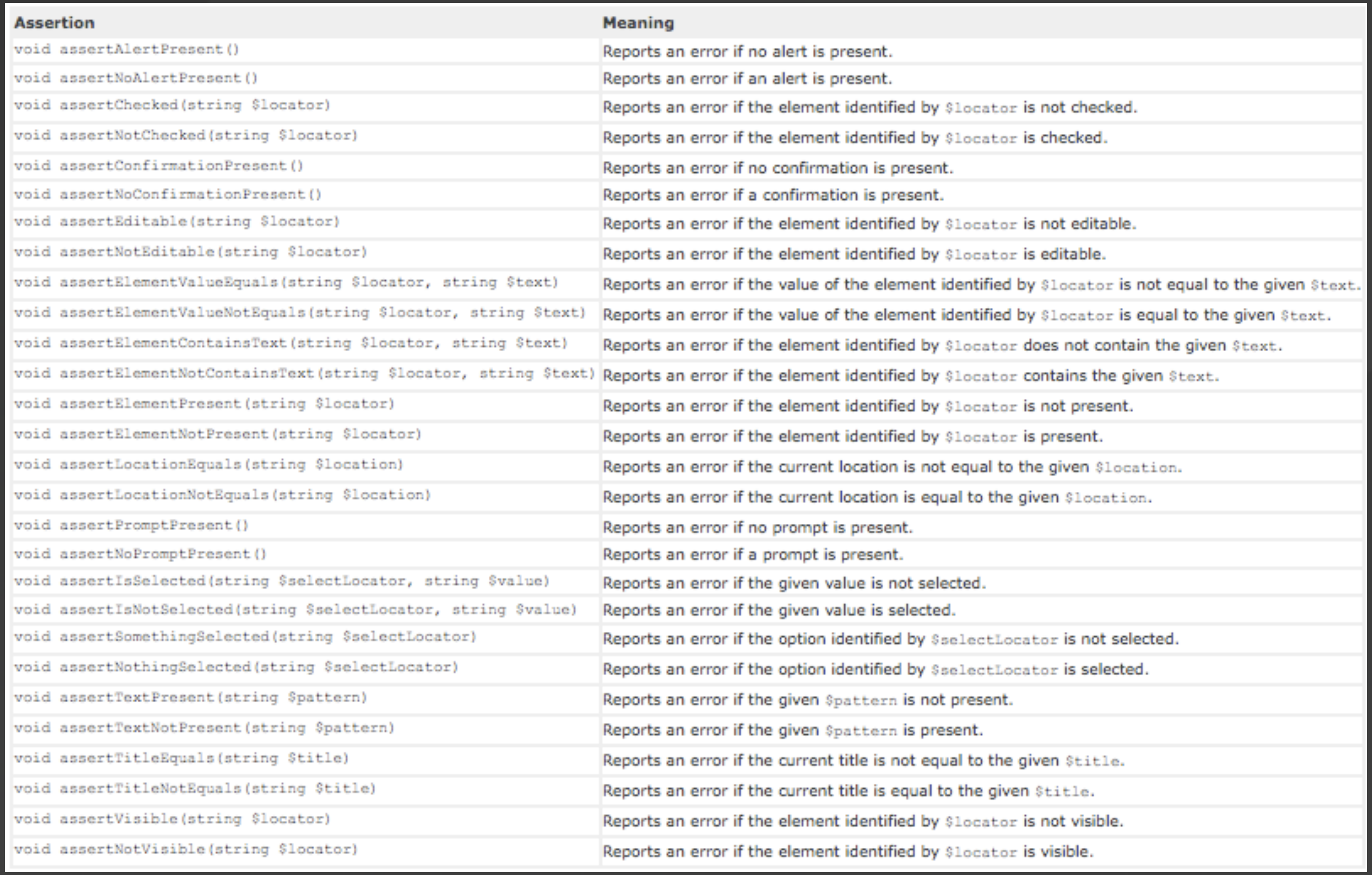
- Download and install Selenium Server
- Launch Selenium Server on Command Line
- Run PHPUnit Tests utilizing Selenium
- Shut down Selenium Server

First Selenium Test

```php
class WebTest extends PHPUnit_Extensions_SeleniumTestCase
{
    protected function setUp()
    {
        $this->setBrowser('*firefox');
        $this->setBrowserUrl('http://www.example.com/');
    }

    public function testTitle()
    {
        $this->open('http://www.example.com/');
        $this->assertTitleEquals('Example Web Page');
    }
}
```

Selenium Assertions



Assertion	Meaning
`void assertAlertPresent()`	Reports an error if no alert is present.
`void assertNoAlertPresent()`	Reports an error if an alert is present.
`void assertChecked(string $locator)`	Reports an error if the element identified by `$locator` is not checked.
`void assertNotChecked(string $locator)`	Reports an error if the element identified by `$locator` is checked.
`void assertConfirmationPresent()`	Reports an error if no confirmation is present.
`void assertNoConfirmationPresent()`	Reports an error if a confirmation is present.
`void assertEditable(string $locator)`	Reports an error if the element identified by `$locator` is not editable.
`void assertNotEditable(string $locator)`	Reports an error if the element identified by `$locator` is editable.
`void assertElementValueEquals(string $locator, string $text)`	Reports an error if the value of the element identified by `$locator` is not equal to the given `$text`.
`void assertElementValueNotEquals(string $locator, string $text)`	Reports an error if the value of the element identified by `$locator` is equal to the given `$text`.
`void assertElementContainsText(string $locator, string $text)`	Reports an error if the element identified by `$locator` does not contain the given `$text`.
`void assertElementNotContainsText(string $locator, string $text)`	Reports an error if the element identified by `$locator` contains the given `$text`.
`void assertElementPresent(string $locator)`	Reports an error if the element identified by `$locator` is not present.
`void assertElementNotPresent(string $locator)`	Reports an error if the element identified by `$locator` is present.
`void assertLocationEquals(string $location)`	Reports an error if the current location is not equal to the given `$location`.
`void assertLocationNotEquals(string $location)`	Reports an error if the current location is equal to the given `$location`.
`void assertPromptPresent()`	Reports an error if no prompt is present.
`void assertNoPromptPresent()`	Reports an error if a prompt is present.
`void assertIsSelected(string $selectLocator, string $value)`	Reports an error if the given value is not selected.
`void assertIsNotSelected(string $selectLocator, string $value)`	Reports an error if the given value is selected.
`void assertSomethingSelected(string $selectLocator)`	Reports an error if the option identified by `$selectLocator` is not selected.
`void assertNothingSelected(string $selectLocator)`	Reports an error if the option identified by `$selectLocator` is selected.
`void assertTextPresent(string $pattern)`	Reports an error if the given `$pattern` is not present.
`void assertTextNotPresent(string $pattern)`	Reports an error if the given `$pattern` is present.
`void assertTitleEquals(string $title)`	Reports an error if the current title is not equal to the given `$title`.
`void assertTitleNotEquals(string $title)`	Reports an error if the current title is equal to the given `$title`.
`void assertVisible(string $locator)`	Reports an error if the element identified by `$locator` is not visible.
`void assertNotVisible(string $locator)`	Reports an error if the element identified by `$locator` is visible.

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Selenium Assertions

- Fairly rich assertion vocabulary with specific assertions like assertTitleEquals()
- General purpose element assertions like assertElementPresent() take $locator
- Element locators can be a number of formats such as XPath.

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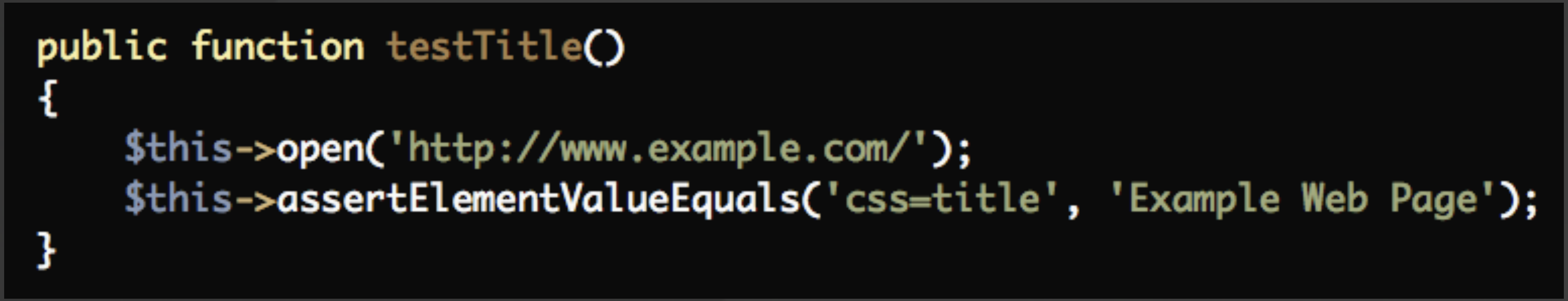
Selenium Assertions



```
public function testTitle()
{
    $this->open('http://www.example.com/');
    $this->assertElementValueEquals('css=title', 'Example Web Page');
}
```

- Locators can be CSS selectors! “css=title”
- Use $locator with CSS selectors where possible, keeping your test conventions congruent with your CSS and JavaScript

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Selenium Disadvantages

- Launching browser is too slow to be fun
- Somewhat fragile due to moving parts
- Falls down where browser falls down

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Roll Your Own

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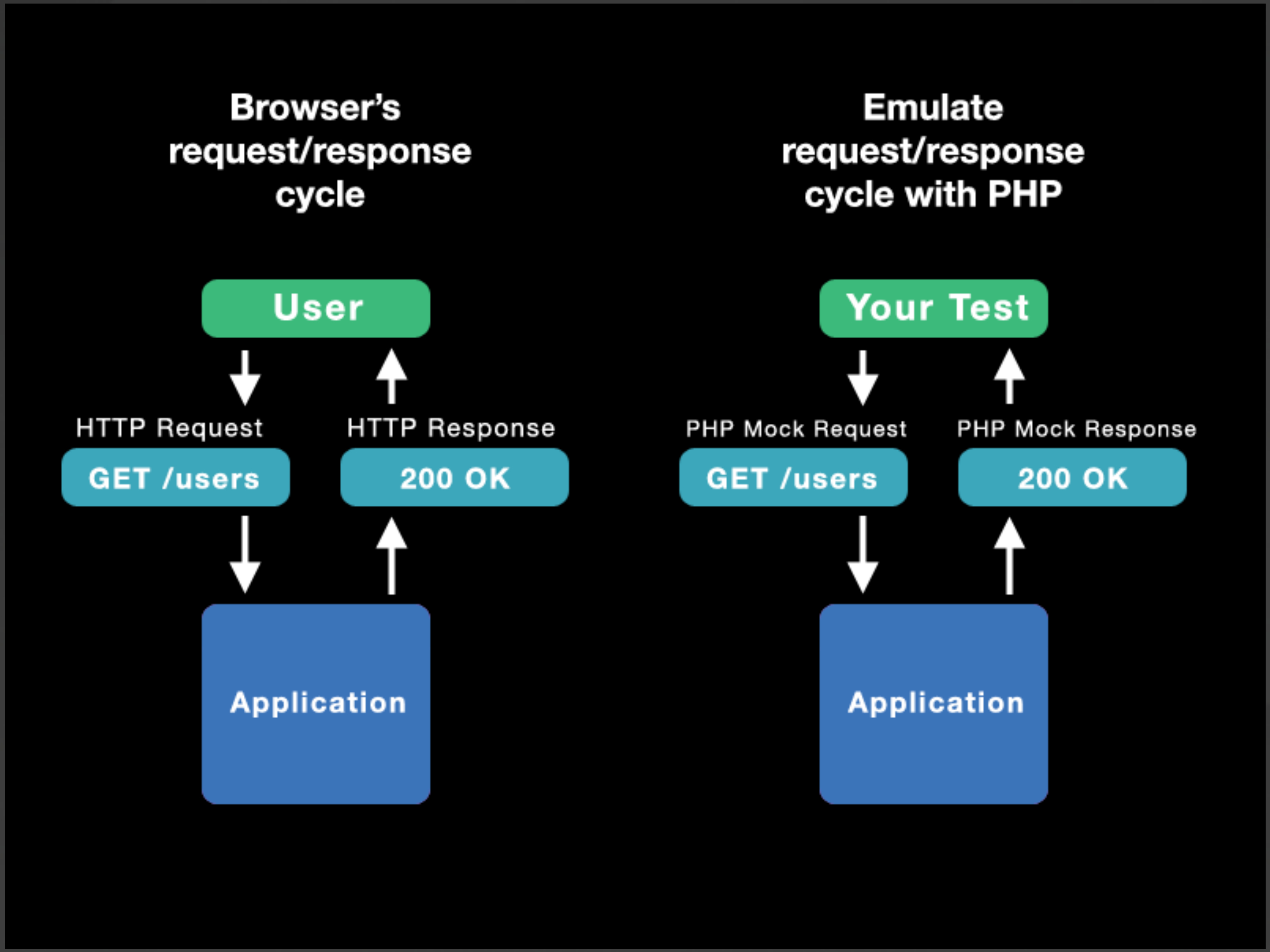
Roll Your Own

- Functional or integration tests that don't depend on HTTP or the browser
- Some PHP frameworks may already have what you need, borrow from them
- More work to build the test harness, but testing is faster and more fun when done

Roll Your Own



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Roll Your Own

- Your application probably needs some sort of request and response objects
- Subclass PHPUnit_Framework_TestCase

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Roll Your Own

```
/**
 * @group functional
 */
class ItemsControllerTest extends Mad_Test_Functional {
    public function setUp()
    {
        $this->request  = new Mad_Controller_Request_Mock();
        $this->response = new Mad_Controller_Response_Mock();

        $this->session = array('version' => Session::VERSION,
                               'user_id' => 1);

        $this->loadFixtures('Items');
    }

    public function testIndexDisplaysItems()
    {
        $this->get('/', array(), $this->session);

        $this->assertResponse(200);
        $this->assertSelect("#eng_items tr.eng_item", 4);

        // no clear filter button
        $this->assertSelect('h2#filters img', false);
    }
```

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Roll Your Own

- Add methods to make fake GET, POST, PUT, DELETE requests
- Add assertions for response code and body
- http://framework.maintainable.com has test code you can use as a starting point
- PHPUnit 3.3 CSS Selector Assertions

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PHPUnit 3.3

- Patch almost ready, based on our existing work
- Simple assertions for CSS selectors on strings:
  - assertSelectCount() / assertSelectNotCount()
  - assertSelectEquals() / assertSelectNotEquals()
  - assertSelectRegexp() / assertSelectNotRegexp()

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Extras

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JavaScript Unit Tests

- JavaScript can be unit-tested in a browser if it is sufficiently separated from HTML
- The unittest.js library from Scriptaculous is a nice solution for this

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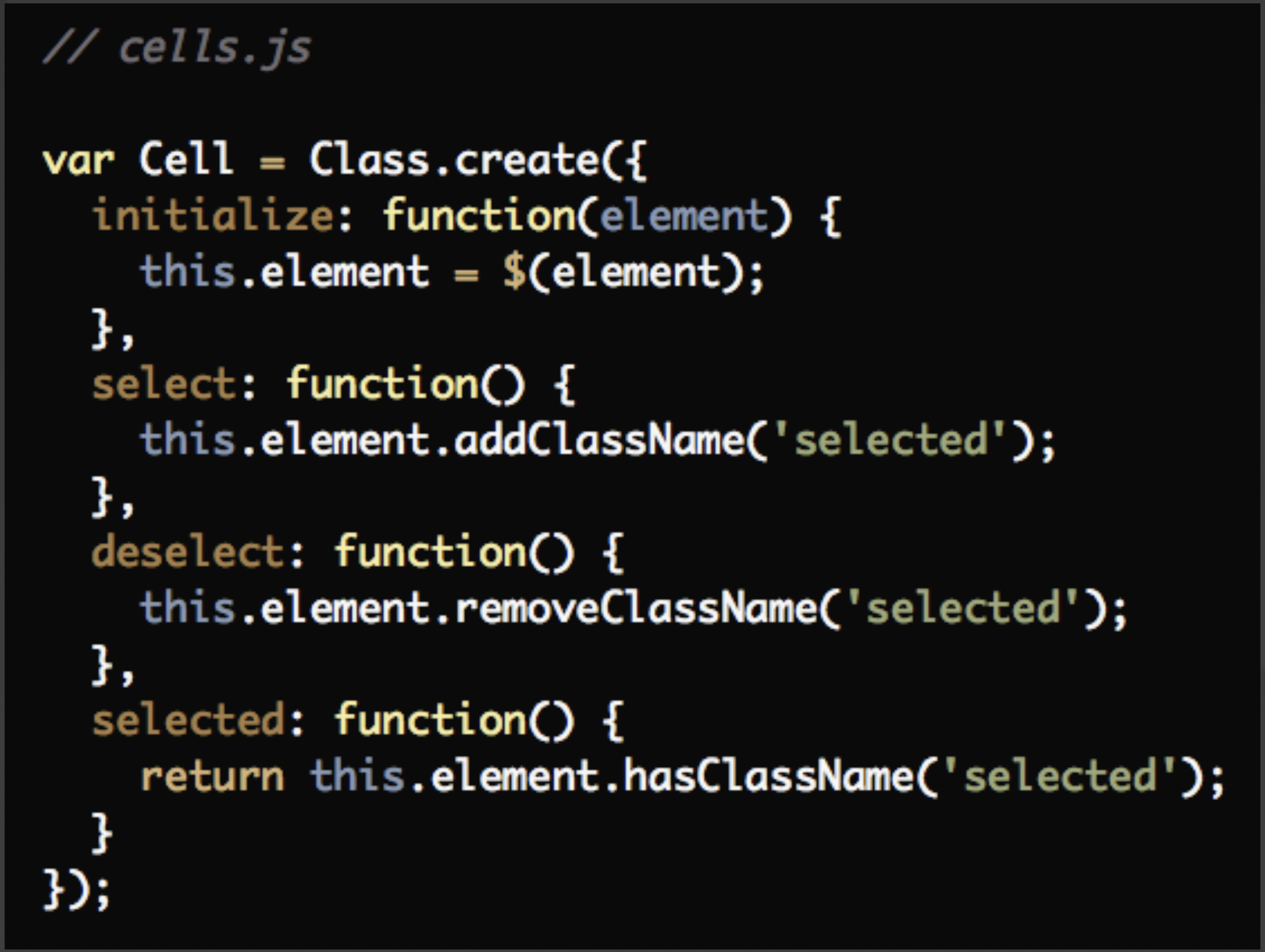
JavaScript Unit Tests



```
// cells.js

var Cell = Class.create({
  initialize: function(element) {
    this.element = $(element);
  },
  select: function() {
    this.element.addClassName('selected');
  },
  deselect: function() {
    this.element.removeClassName('selected');
  },
  selected: function() {
    return this.element.hasClassName('selected');
  }
});
```

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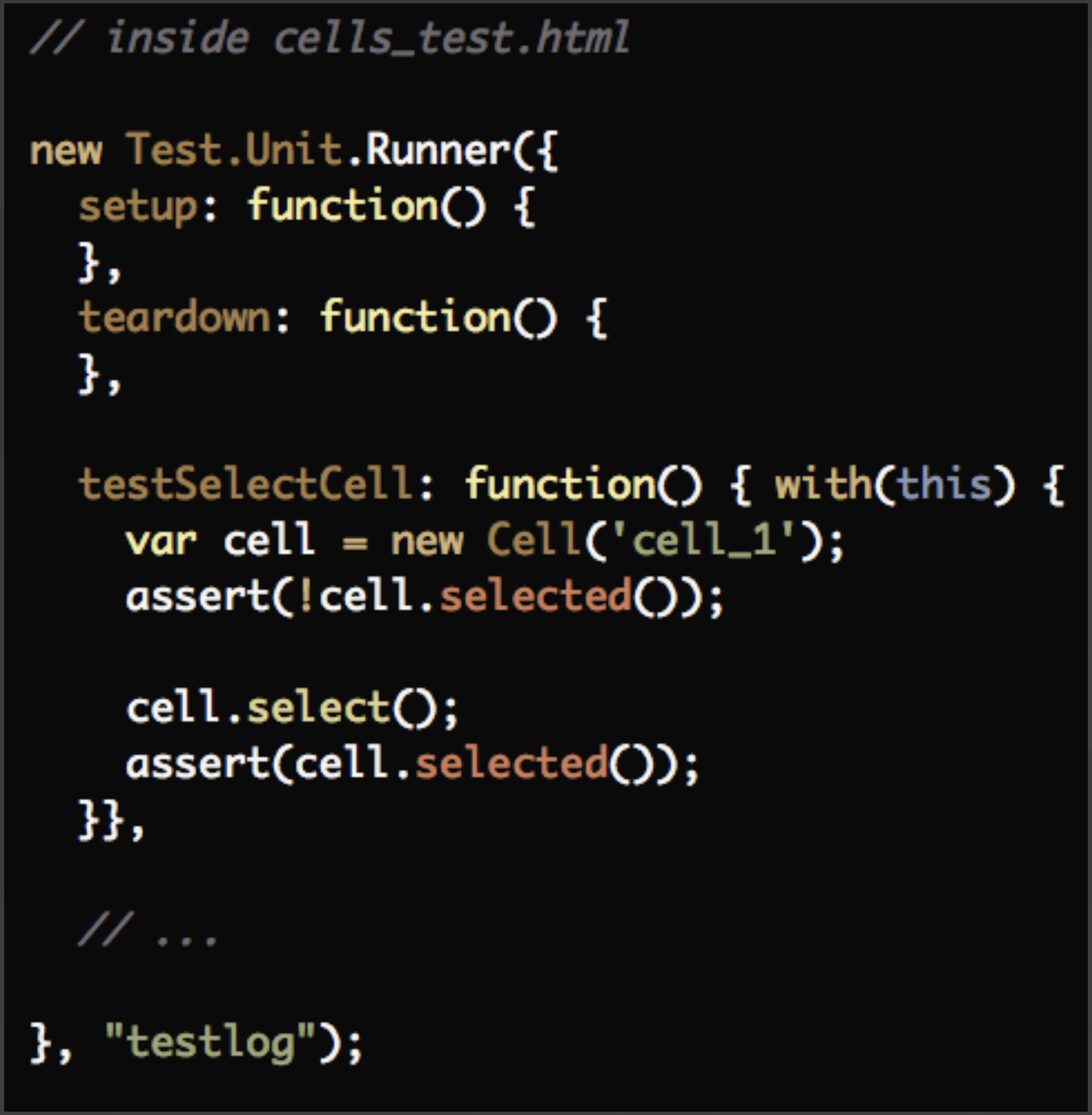
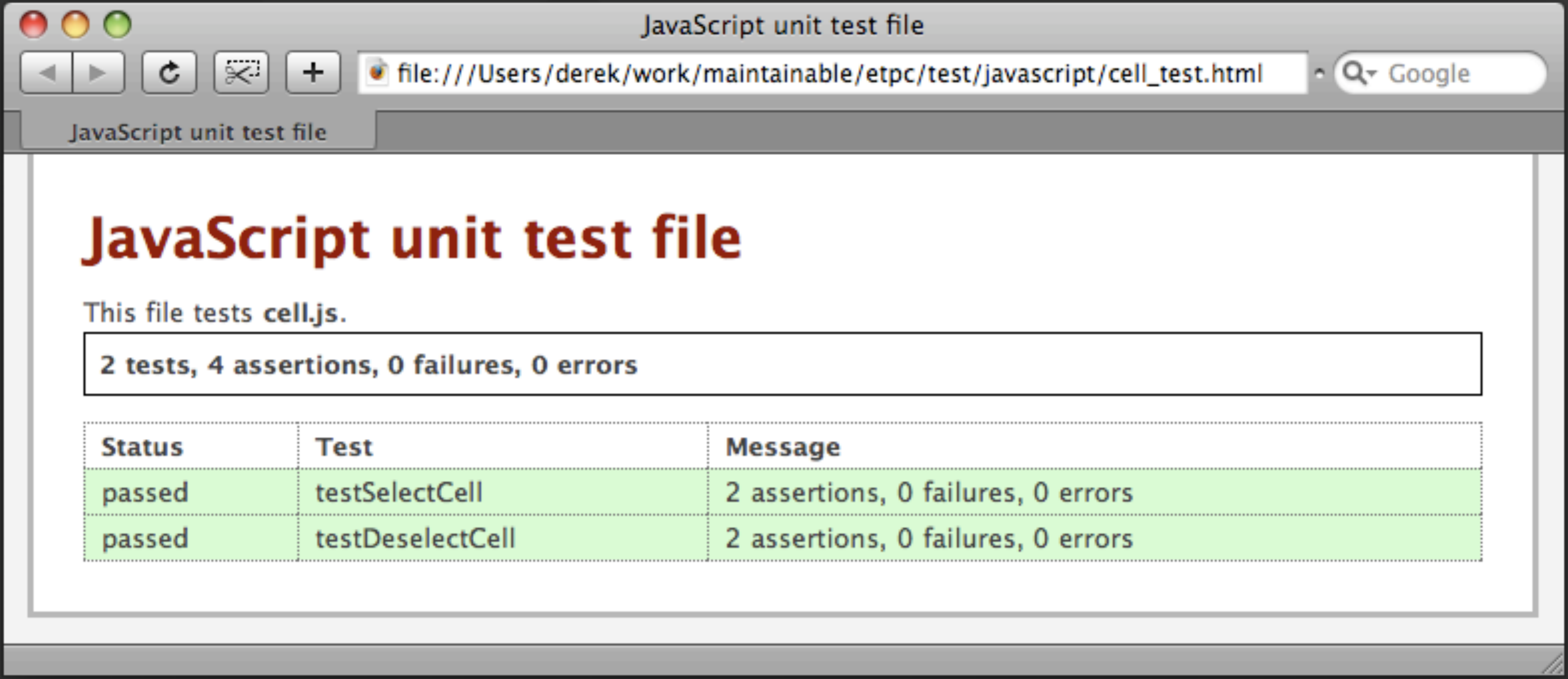
Javascript Unit Tests



```
// inside cells_test.html

new Test.Unit.Runner({
  setup: function() {
  },
  teardown: function() {
  },

  testSelectCell: function() { with(this) {
    var cell = new Cell('cell_1');
    assert(!cell.selected());

    cell.select();
    assert(cell.selected());
  }},

  // ...

}, "testlog");
```

JavaScript Unit Tests


JavaScript unit test file
file:///Users/derek/work/maintainable/etpc/test/javascript/cell_test.html
Google
JavaScript unit test file

JavaScript unit test file

This file tests **cell.js**.

```
2 tests, 4 assertions, 0 failures, 0 errors
```

Status	Test	Message
passed	testSelectCell	2 assertions, 0 failures, 0 errors
passed	testDeselectCell	2 assertions, 0 failures, 0 errors

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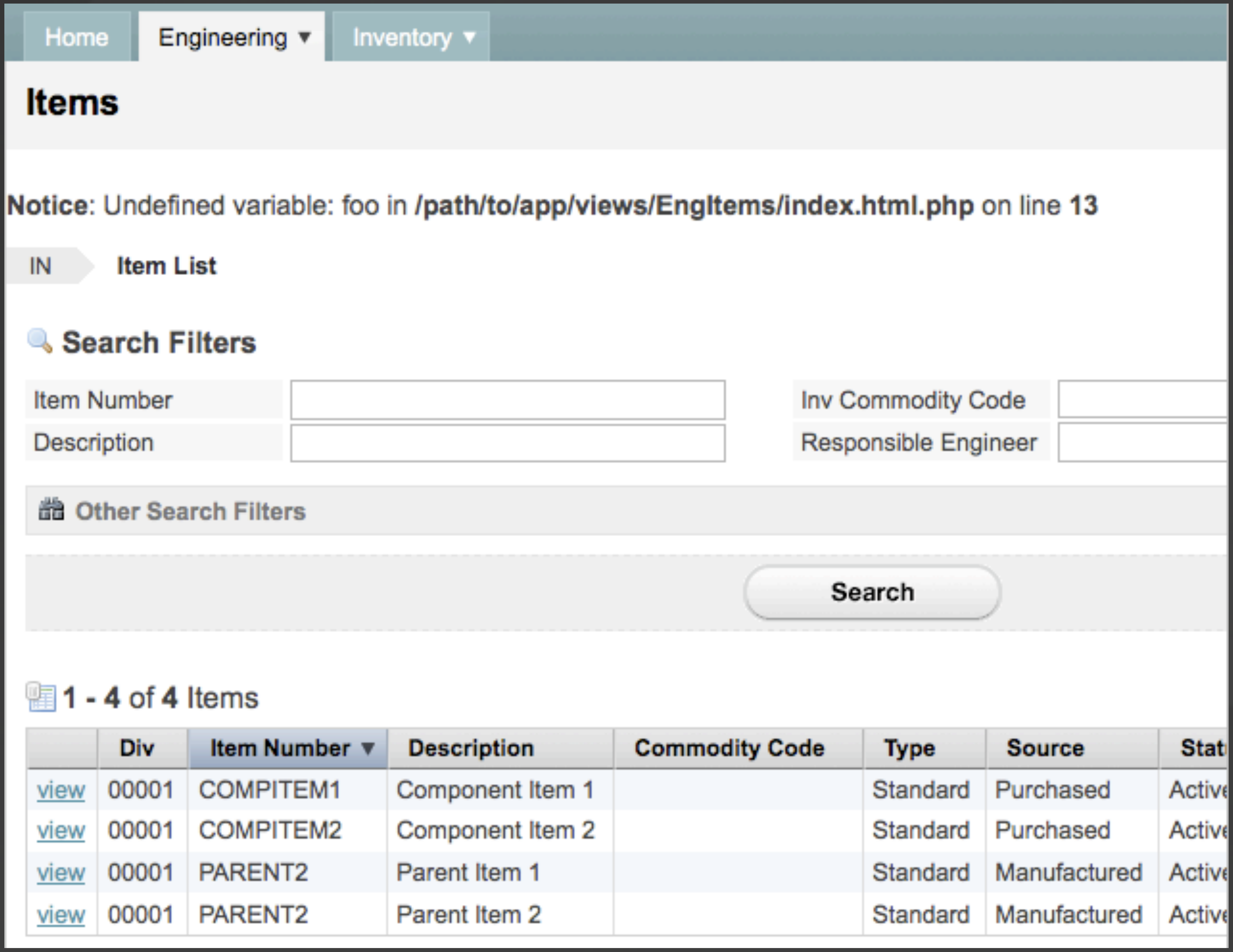
Inline PHP Errors



Items

Notice: Undefined variable: foo in **/path/to/app/views/EngItems/index.html.php** on line **13**

Search Filters

Item Number		Inv Commodity Code	
Description		Responsible Engineer	

1 - 4 of 4 Items

	Div	Item Number ▾	Description	Commodity Code	Type	Source	Stat
view	00001	COMPITEM1	Component Item 1		Standard	Purchased	Active
view	00001	COMPITEM2	Component Item 2		Standard	Purchased	Active
view	00001	PARENT2	Parent Item 1		Standard	Manufactured	Active
view	00001	PARENT2	Parent Item 2		Standard	Manufactured	Active

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Inline PHP Errors

- Run your application with display_errors=On during tests, off in production.
- PHP errors output on a page are easily missed by tests if not explicitly checked.
- Test response body for “<b>Notice” etc.

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Errors as Exceptions

```
class YourPrefix_ErrorHandler
{

    public static function handle($errno, $errstr, $errfile, $errline)
    {
        if (ini_get('error_reporting') == 0) {
            // silence operator ("@") was used
            return;
        }

        throw new Exception($errstr, $errno);
    }

}

$callback = array('YourPrefix_ErrorHandler', 'handle');
set_error_handler($callback);
```

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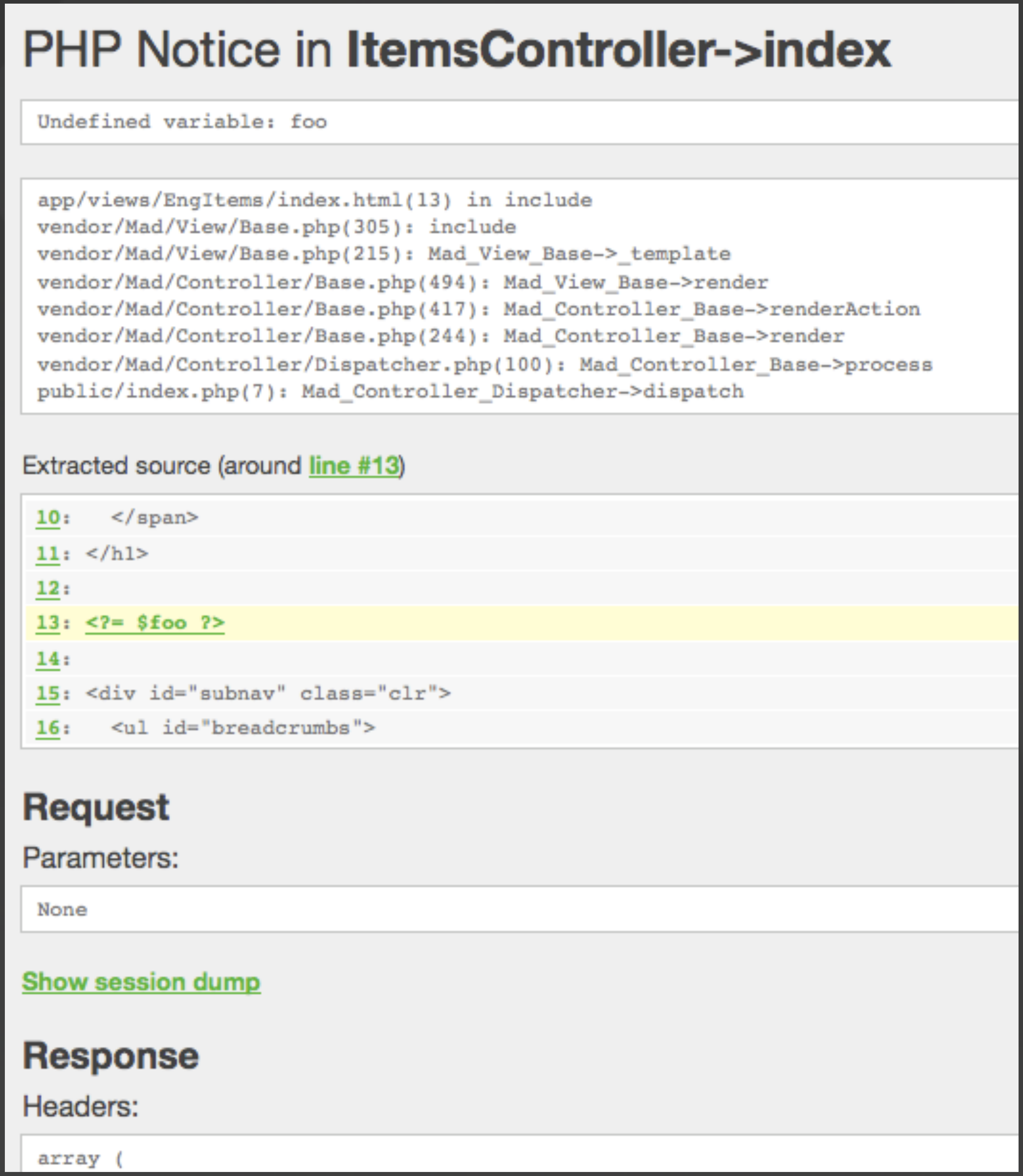
Errors as Exceptions



PHP Notice in **ItemsController->index**

```
Undefined variable: foo
```

```
app/views/EngItems/index.html(13) in include
vendor/Mad/View/Base.php(305): include
vendor/Mad/View/Base.php(215): Mad_View_Base->_template
vendor/Mad/Controller/Base.php(494): Mad_View_Base->render
vendor/Mad/Controller/Base.php(417): Mad_Controller_Base->renderAction
vendor/Mad/Controller/Base.php(244): Mad_Controller_Base->render
vendor/Mad/Controller/Dispatcher.php(100): Mad_Controller_Base->process
public/index.php(7): Mad_Controller_Dispatcher->dispatch
```

Extracted source (around line #13)

```
10:   </span>
11: </h1>
12:
13: <?= $foo ?>
14:
15: <div id="subnav" class="clr">
16:   <ul id="breadcrumbs">
```

Request

Parameters:

```
None
```

Show session dump

Response

Headers:

```
array (
```

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Q & A

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Thank You

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