

MVC And Frameworks in a PHP Web Application

Internet Applications, ID1354

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The id1354-fw
Framework

Section

Object Oriented Design!

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Object Oriented Design!

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Object Oriented Design!

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- ▶ **Low coupling**, Objects and subsystems do not depend on each other more than necessary.

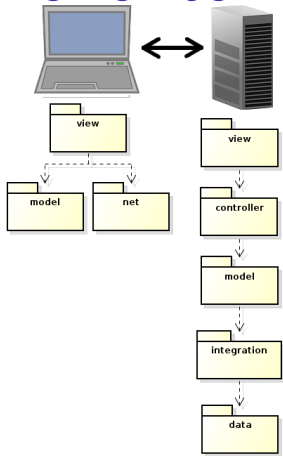
Object Oriented Design!

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- ▶ We want the code to be **easy to modify** and **easy to understand**. To achieve this we need (among other things):
- ▶ **High Cohesion**, Each class, method, etc has well-defined knowledge and a well-defined task.
- ▶ **Low coupling**, Objects and subsystems do not depend on each other more than necessary.
- ▶ **Encapsulation**, Objects and subsystems do not reveal their internals.

Remember: Server-Side Layers

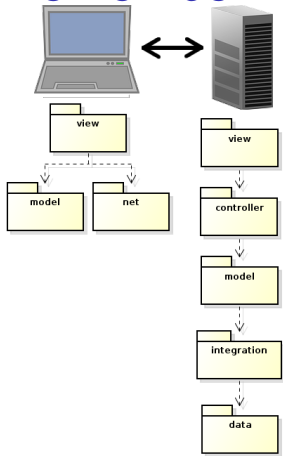


- ▶ The server has the same layers as a **stand-alone MVC** architecture.

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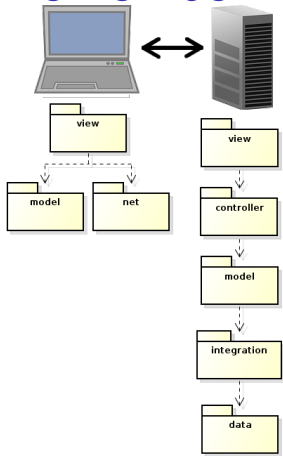


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- ▶ **The server's view layer** gets HTTP requests and creates HTTP responses.

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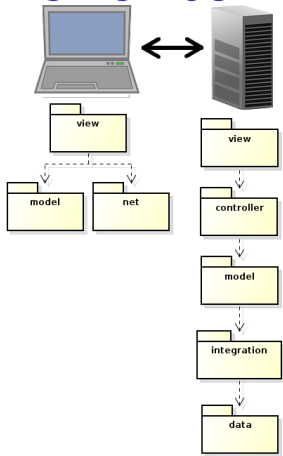
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Remember: Server-Side Layers



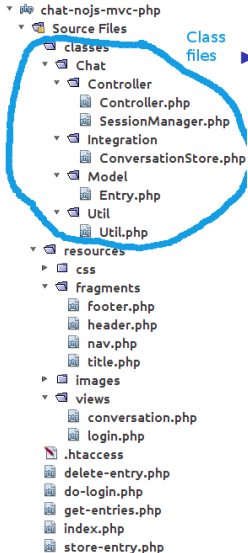
- ▶ The server has the same layers as a **stand-alone MVC** architecture.
- ▶ The server's **view layer** gets HTTP requests and creates HTTP responses.
- ▶ The MVC pattern states that all UI related code shall be in the view. From **controller and down there is only plain object-oriented code.**

Remember: Server-Side Layers



- ▶ The server has the same layers as a **stand-alone MVC** architecture.
- ▶ The server's **view layer** gets HTTP requests and creates HTTP responses.
- ▶ The MVC pattern states that all UI related code shall be in the view. From **controller and down there is only plain object-oriented code**.
- ▶ This means that controller and lower layers are coded **exactly as for a stand-alone application**. Only the view is specific for a web application.

Class Files

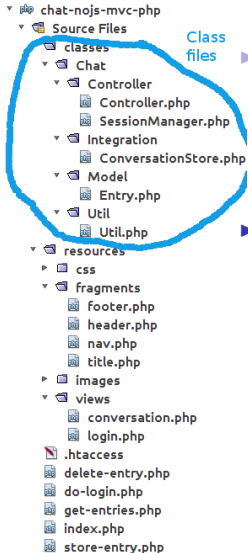


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Class Files



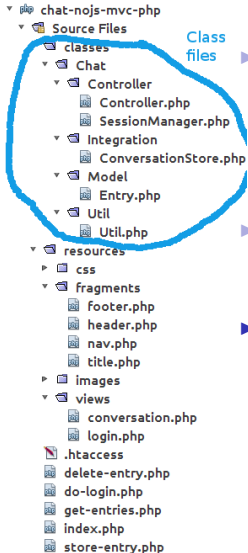
Class files

- ▶ It is a good practice to organize server-side code as in a Java application. One file per class and one directory per namespace.
- ▶ Place all classes in a separate directory, for example **classes**.

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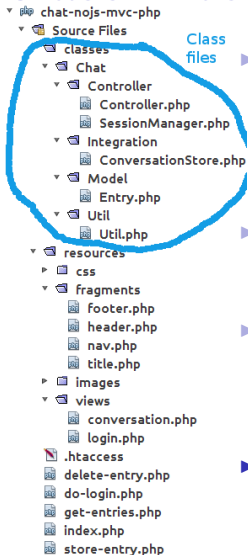
▶ Place all classes in a separate directory, for example **classes**.

▶ Protect classes from direct HTTP access by denying access to the **classes** directory.

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Class Files



- ▶ It is a good practice to organize server-side code as in a Java application. One **file per class** and one **directory per namespace**.
- ▶ Place all classes in a **separate directory**, for example **classes**.
- ▶ Protect classes from direct HTTP access by denying access to the **classes** directory.
- ▶ Enable **autoloading classes**, see below. This relieves us of **include** and **require** statements.

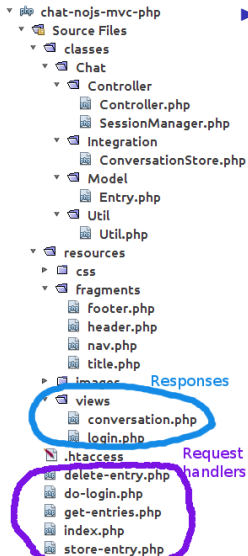
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View Files

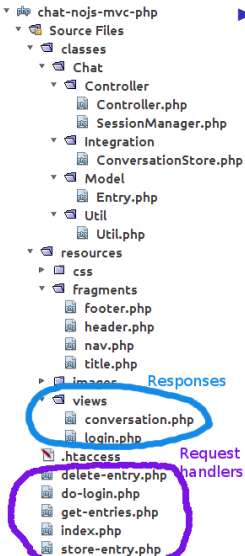
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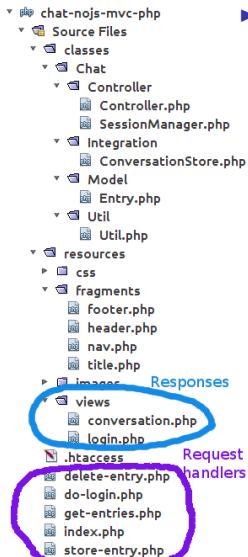


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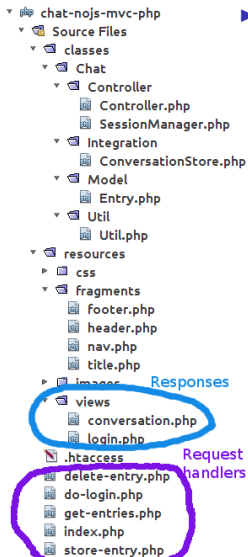


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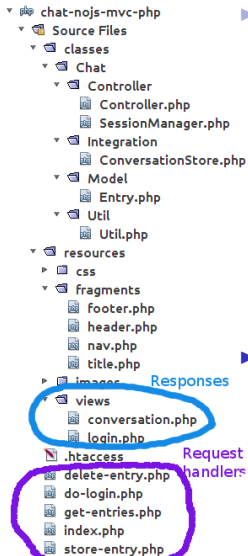


- ▶ We would like to place the **view in classes**. However:
 - ▶ We do **not want HTML** in our PHP classes.
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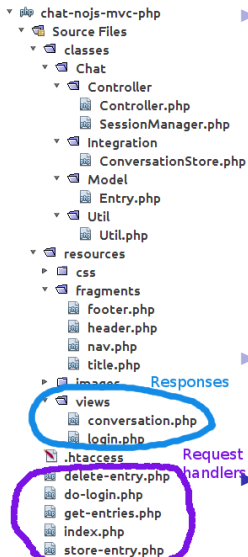


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- ▶ Therefore, we need a PHP file without classes to **interpret the HTTP request** and direct it to the correct classes.

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View Files



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 - ▶ We do **not want HTML** in our PHP classes.
 - ▶ We do **not want HTTP access** to our classes directory.
 - ▶ We can **not write a URL** that addresses a method in a class. A URL can only address a file.
- ▶ Therefore, we need a PHP file without classes to **interpret the HTTP request** and direct it to the correct classes.
- ▶ If the response is a HTML document, we also need to **include a HTML file**, since we do **not want to mix** the HTML document with the PHP classes.

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- ▶ There will be quite a lot of **code that is identical for each application**, for example to:

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 - ▶ Route a HTTP request to a method in a class.

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 - ▶ Read HTTP parameters.
 - ▶ Include the HTTP response.
 - ▶ Include fragments (header, footer, etc) in the view.

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 - ▶ Include class files
 - ▶ Route a HTTP request to a method in a class.
 - ▶ Read HTTP parameters.
 - ▶ Include the HTTP response.
 - ▶ Include fragments (header, footer, etc) in the view.
- ▶ This is called **infrastructure code** and is a **strong call for a framework**.

We Must Use a Framework

- ▶ A framework is necessary to:

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- ▶ A framework is necessary to:
 - ▶ **Reuse** code from previous applications.

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- ▶ A framework is necessary to:
 - ▶ **Reuse** code from previous applications.
 - ▶ Avoid the **big risk of bad architecture**.

We Must Use a Framework

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- ▶ A framework is necessary to:
 - ▶ Reuse code from previous applications.
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We Must Use a Framework

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- ▶ A framework is necessary to:
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 - ▶ Thoroughly tested and proven to work well.

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- ▶ A framework is necessary to:
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 - ▶ Avoid the **big risk of bad architecture**.
 - ▶ Avoid writing new code which means **introducing new bugs**.
 - ▶ Thoroughly **tested and proven** to work well.
 - ▶ Lots of **documentation**, easy to get help.
 - ▶ Infrastructure code is **difficult to write**.

We Must Use a Framework

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- ▶ A framework is necessary to:
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 - ▶ Avoid the big risk of bad architecture.
 - ▶ Avoid writing new code which means introducing new bugs.
 - ▶ Thoroughly tested and proven to work well.
 - ▶ Lots of documentation, easy to get help.
 - ▶ Infrastructure code is difficult to write.
 - ▶ Preferably, the framework should use callbacks, i.e., the framework calls our code.
Thus, the framework also handles flow control.

Exactly What is the Framework's Task?

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- ▶ First, we will look at the chat application **without a framework**, to get a feeling for what is needed.
 - ▶ We will look at a sample request, namely to **write a new entry** in the conversation.
- ▶ Then, we will identify what we **need the framework to do**.

Exactly What is the Framework's Task?

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- ▶ First, we will look at the chat application **without a framework**, to get a feeling for what is needed.
 - ▶ We will look at a sample request, namely to **write a new entry** in the conversation.
- ▶ Then, we will identify what we **need the framework to do**.
- ▶ Third, we will look at the chat **with a framework**.

New Entry, `store-entry.php`

```
1 namespace Chat\View;
2 use \Chat\Util\Util;
3 use \Chat\Model\Entry;
4 use Chat\Controller\SessionManager;
5
6 require_once 'classes/Chat/Util/Util.php';
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```

- ▶ The HTML form with the new entry is submitted to `store-entry.php`
- ▶ Line 6 loads the `Util` class. Since the autoloader is not yet registered, it is loaded manually.
- ▶ Line 7 calls the `initRequest` method, which performs tasks similar for all requests.

MVC in a PHP Web
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store-entry.php (Cont'd)

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- ▶ Lines 9-13 sets **\$msg** to the value of the **HTTP parameter with the new entry**. If there is no such parameter, it is set to the empty string.

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- ▶ Lines 9-13 sets `$msg` to the value of the [HTTP parameter with the new entry](#). If there is no such parameter, it is set to the empty string.
- ▶ Line 15 gets the [controller of the current session](#). Remember that [all state is lost after a request](#). We have to store the controller, with its references to the model, in the session.

MVC in a PHP Web Application

The id1354-fw Framework

store-entry.php (Cont'd)

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- ▶ Line 16 is the method **call to the controller**. This is where all request handling is done, the new entry is stored.

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- ▶ Line 16 is the method **call to the controller**. This is where all request handling is done, the new entry is stored.
- ▶ Lines 17-18 calls the controller to **get data** that is needed in the next view.
- ▶ Line 19 again **stores the controller in the session**, for use in the next request.

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store-entry.php (Cont'd)

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- ▶ Line 21 includes the file with the next view. Note that the variables `$entries` and `$username` are available in that file.

Util.php

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```
1 public static function initRequest() {
2     spl_autoload_register(function ($class) {
3         require_once 'classes/' .
4             \str_replace('\\', '/', $class) .
5             '.php';
6     });
7
8     session_start();
9     self::defineConstants();
10 }
```

- ▶ Lines 2-6 registers the autoloader.

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```

- ▶ Lines 2-6 registers the autoloader.
- ▶ Line 8 starts a session if there is none.
- ▶ Line 9 creates constants for HTTP parameter keys:

```
1 const SYMBOL_PREFIX = "CHAT_";
2 private static function defineConstants() {
3     self::defineConstant('MSG_KEY', 'msg');
4     self::defineConstant('NICK_KEY', 'nickName');
5     self::defineConstant('TIMESTAMP_KEY', 'timestamp');
6     self::defineConstant('VIEWS', 'resources/views/');
7     self::defineConstant('FRAGMENTS', 'resources/fragments/');
8 }
9 private static function defineConstant($param, $value) {
10     define(self::SYMBOL_PREFIX . $param, $value);
11 }
```

SessionManager.php

MVC in a PHP Web
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```
1 const CONTROLLER_KEY = 'controller';
2
3 public static function getController() {
4     if (isset($_SESSION[self::CONTROLLER_KEY])) {
5         return unserialize($_SESSION[self::CONTROLLER_KEY]);
6     } else {
7         return new Controller();
8     }
9 }
10
11 public static function storeController(Controller $controller) {
12     $_SESSION[self::CONTROLLER_KEY] = serialize($controller);
13 }
```

- ▶ Line 4 checks if a **Controller** object is stored in the session.

SessionManager.php

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11 public static function storeController(Controller $controller) {
12     $_SESSION[self::CONTROLLER_KEY] = serialize($controller);
13 }
```

- ▶ Line 4 checks if a **Controller** object is stored in the session.
- ▶ Line 5 reads the stored **Controller**.

SessionManager.php

MVC in a PHP Web
Application

The id1354-fw
Framework

```
1 const CONTROLLER_KEY = 'controller';
2
3 public static function getController() {
4     if (isset($_SESSION[self::CONTROLLER_KEY])) {
5         return unserialize($_SESSION[self::CONTROLLER_KEY]);
6     } else {
7         return new Controller();
8     }
9 }
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- ▶ Line 4 checks if a **Controller** object is stored in the session.
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MVC in a PHP Web
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- ▶ Line 4 checks if a **Controller** object is stored in the session.
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The view, `conversation.php`

- ▶ The view should consist of **only HTML**. Unfortunately, this goal is **not reached**:
- ▶ First, since there are header, footer and navigation **fragments that appear on each page**, we have to include them to avoid duplicated code. These inclusions are **PHP statements**, see lines 2 and 6 below.

MVC in a PHP Web Application

The id1354-fw Framework

```
1 ...
2 <header class="section group">
3     <?php include CHAT_FRAGMENTS . 'header.php' ?>
4 </header>
5
6 <main class="section group">
7     <nav class="section group">
8         <?php include CHAT_FRAGMENTS . 'nav.php' ?>
9     </nav>
10 ...
```

The view (Cont'd)

- ▶ Second, to generate the conversation view from the `$entries` variable is also PHP code.

MVC in a PHP Web Application

The id1354-fw Framework

```
1  ...
2  <div class="col span_4_of_4">
3      <?php
4          foreach ($entries as $entry) {
5              if (!$entry->isDeleted()) {
6                  echo("<p class='author'>" . $entry->getNickName() . " :</p>");
7                  echo("<p class='entry'>");
8                  echo(nl2br($entry->getMsg()));
9                  echo("</p>");
10                 if ($entry->getNickName() === $username) {
11                     echo("<form action='delete-entry.php'>");
12                     echo("<input type='hidden' name='timestamp' value=' " .
13                         $entry->getTimestamp() . "' />");
14                     echo("<input type='submit' value='Delete' />");
15                     echo("</form>");
16                 }
17             }
18         }
19     ?>
20 </div>
21 ...
```

Question 1

Other Layers, No Problem

MVC in a PHP Web Application

The id1354-fw Framework

- ▶ Now we have **seen all view code** related to creating a new entry in the conversation. The view is normally the hardest part of a web application.

Other Layers, No Problem

MVC in a PHP Web Application

The id1354-fw Framework

- ▶ Now we have **seen all view code** related to creating a new entry in the conversation. The view is normally the hardest part of a web application.
- ▶ Controller and lower layers are **plain PHP code**, created with normal object-oriented analysis, design and programming methodologies.

Let's Look for Infrastructure Code

- ▶ In **store-entry**, **Util** and **SessionManager** there is **no code at all** specific for this application!

MVC in a PHP Web Application

The id1354-fw Framework

Let's Look for Infrastructure Code

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MVC in a PHP Web Application

The id1354-fw Framework

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MVC in a PHP Web Application

The id1354-fw Framework

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MVC in a PHP Web Application

The id1354-fw Framework

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 - ▶ However, we are rid of also this line if the framework allows us to specify a **URL-to-method mapping**, which most frameworks do.
- ▶ One could also argue that the names of the HTTP parameters are application specific.
 - ▶ But, most frameworks enable specifying those as **method parameters in the URL-to-method-mapping!**

The Framework's tasks

- ▶ Therefore, the framework must handle:

MVC in a PHP Web
Application

The id1354-fw
Framework

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 - ▶ **Routing**, which means to map a URL to a specified method in a specified class.
 - ▶ **HTTP parameters**, it should be possible to specify how parameters are passed as arguments to the methods specified by the routing rules.
 - ▶ **HTTP sessions**, all objects in controller and lower layers should be stored in the `$_SESSION` superglobal.
 - ▶ **Templating**, to generate a view from data, we need something to replace the PHP code looping through the `$conversation` variable.

The Framework's tasks, Cont'd

- ▶ The framework must handle:

MVC in a PHP Web
Application

The id1354-fw
Framework

The Framework's tasks, Cont'd

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The Framework's tasks, Cont'd

- ▶ The framework must handle:
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 - ▶ Not only should it be possible to reuse the fragments, **also the page layout should be reused**. This means only the content of the main area should be specific for a page.
- ▶ There are many **other requirements** that should be managed by a framework, but which we have skipped in this small example.

Section

MVC in a PHP Web
Application

The id1354-fw
Framework

PHP Frameworks

MVC in a PHP Web
Application

The id1354-fw
Framework

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PHP Frameworks

MVC in a PHP Web Application

The id1354-fw Framework

- ▶ There are **many PHP frameworks**, of different size and quality.
- ▶ Some interesting and often used frameworks are Zend, Symfony, Yii, Laravel and Phalcon.
- ▶ Here, we will have a look at a framework written specifically for this course, the **id1354-fw** framework.

The id1354-fw Framework

- ▶ But frameworks should be reused?? **Why write a new one?**

MVC in a PHP Web Application

The id1354-fw Framework

The id1354-fw Framework

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- ▶ The id1354-fw framework is very small, but still has **exactly the features we are looking for** (except templating and composite views) and nothing more. It will also be supported as long as it is used in the course.

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- ▶ But frameworks should be reused?? **Why write a new one?**
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- ▶ **Now, we will look at the id1354-fw framework and how it changes the Chat application.**

The id1354-fw Framework

- ▶ But frameworks should be reused?? [Why write a new one?](#)
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- ▶ Now, we will look at the id1354-fw framework and how it changes the Chat application.
- ▶ The [full documentation](#) is included in the **id1354-fw.zip** file available at the course web.

Class Loading

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MVC in a PHP Web
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The id1354-fw
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- ▶ You do not have to **include** or **require** any classes, they are **loaded by the framework**.
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Class Loading

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ You do not have to **include** or **require** any classes, they are **loaded by the framework**.
- ▶ Place all your classes under the **classes** directory that is created when the framework is installed.
- ▶ Use a directory structure matching the namespaces and name each file after the class in the file.
 - ▶ For example, the class **MyClass** in the namespace **\MyApp\Model** shall be in the file **classes/MyApp/Model/MyClass.php**.

Routing

- ▶ To create a class that handles a HTTP request, write a class that extends `\Id1354fw\View\AbstractRequestHandler`.

Routing

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ To create a class that handles a HTTP request, write a class that extends `\Id1354fw\View\AbstractRequestHandler`.
- ▶ This class shall have the method **protected function doExecute()**, which performs all work needed to handle the http request.

Something.

Routing

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ To create a class that handles a HTTP request, write a class that extends `\Id1354fw\View\AbstractRequestHandler`.
- ▶ This class shall have the method `protected function doExecute()`, which performs all work needed to handle the http request.
- ▶ If this class is called `\MyApp\View\Something`, the `doExecute` method is called when the user requests the url `http://<yourserver>/<yourwebapp>/Myapp/View/Something`.

HTTP Parameters

- ▶ The HTTP request handling class must have a set method for each http post and get parameter.

HTTP Parameters

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ The HTTP request handling class must have a set method for each http post and get parameter.
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HTTP Parameters

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ The HTTP request handling class must have a **set method for each http post and get parameter**.
- ▶ If the parameter is called **myParam**, the set method must be `public function setMyParam($value)`.
- ▶ This function will be called with the value of the http parameter before the **doExecute** method is called.

Question 2

Sessions

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ The request handler contains the object **`$this->session`**, which has the following **session handling methods**.

Sessions

MVC in a PHP Web
Application

The id1354-fw
Framework

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Sessions

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Sessions

MVC in a PHP Web
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The id1354-fw
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 - ▶ **`invalidate`**, stops the session, discards all session data, unsets the session id and destroys the session cookie.
 - ▶ **`set`**, stores a key/value pair in the session.
 - ▶ **`get`**, reads a value stored in the session.

View Handling

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ To make available **data in the next view**, call the method **addVariable(\$name, \$value)** in the **doExecute** method.

View Handling

- ▶ To make available **data in the next view**, call the method `addVariable($name, $value)` in the `doExecute` method.
- ▶ This will make the parameter **`$value`** available in the next view, in a variable called **`$name`**.

View Handling

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ To make available **data in the next view**, call the method **addVariable(\$name, \$value)** in the **doExecute** method.
- ▶ This will make the parameter **\$value** available in the next view, in a variable called **\$name**.
- ▶ The **doExecute** method shall return the path to the **file with the next view**.

Question 3

Composite Views and Templates

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ Unfortunately, **composite views and templates are not handled** by the id1354-fw framework.

Composite Views and Templates

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ Unfortunately, **composite views and templates are not handled** by the id1354-fw framework.
- ▶ Therefore, we still have to mix PHP in the HTML code to include data and fragments in the view.

Mission Completed (Almost)

- ▶ Now compare the chat application with and without the framework. With the framework, there is **no infrastructure code!!**

Mission Completed (Almost)

MVC in a PHP Web
Application

The id1354-fw
Framework

- ▶ Now compare the chat application with and without the framework. With the framework, there is **no infrastructure code!!**
- ▶ Adding more functionality involves only new implementations of **AbstractRequestHandler**, and ordinary object-oriented code in controller and lower layers.

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MVC in a PHP Web
Application

The id1354-fw
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- ▶ Now compare the chat application with and without the framework. With the framework, there is **no infrastructure code!!**
- ▶ Adding more functionality involves only new implementations of **AbstractRequestHandler**, and ordinary object-oriented code in controller and lower layers.
- ▶ **All this is application specific!**

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MVC in a PHP Web
Application

The id1354-fw
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- ▶ Now compare the chat application with and without the framework. With the framework, there is **no infrastructure code!!**
- ▶ Adding more functionality involves only new implementations of **AbstractRequestHandler**, and ordinary object-oriented code in controller and lower layers.
- ▶ All this is application specific!
- ▶ But there is still PHP in the HTML code...