MVC And Frameworks in a PHP Web Application

Internet Applications, ID1354
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- MVC in a PHP Web Application
- The id1354-fw Framework
Section

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Object Oriented Design!

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  - **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.
The MVC Architectural Pattern

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- **Controller** is an **intermediary between View and Model**. Each user action should correspond to one method call from view to controller. It is the task of the controller to know in detail which objects and methods in the model should be called (and in which order) to perform a particular task.
Remember: Server-Side Layers

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- 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.
It is a good practice to organize server-side code as in a Java application. One **file per class** and one **directory per namespace**.
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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.

Enable autoloading classes, see below. This relieves us of `include` and `require` statements.

```php
spl_autoload_register(function ($class) {
    include 'classes/' . str_replace('\', '/', $class) . '.php';
});
```
We would like to place the view in classes. However:

- We do not want HTML in our PHP classes.
- We do not want HTTP access to our classes directory.
- We cannot 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.
View Files

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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.
Warning: Infrastructure Code!

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  - Include fragments (header, footer, etc) in the view.
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  - Route a HTTP request to a method in a class.
  - Read HTTP parameters.
  - Include the file with the next view.
  - 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:

- Reuse code from previous applications.
- 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.
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  - 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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- Then, we will identify what we need the framework to do.
Exactly What is the Framework’s Task?

▶ 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.
Architecture
MVC in a PHP Web Application
The id1354-fw Framework

New Entry, **store-entry.php**

```php
namespace Chat\View;

use \Chat\Util\Util;
use \Chat\Model\Entry;
use Chat\Controller\SessionManager;

require_once 'classes/Chat/Util/Util.php';
Util::initRequest();

if (empty($_POST[CHAT_MSG_KEY])) {
    $msg = "";
} else {
    $msg = $_POST[CHAT_MSG_KEY];
}

$controller = SessionManager::getController();
$controller->addEntry(new Entry($controller->getUsername(), $msg));
$entries = $controller->getConversation();
$username = $controller->getUsername();
SessionManager::storeController($controller);

include CHAT_VIEWS . 'conversation.php';
```

- The HTML form with the new entry is submitted to **store-entry.php**
New Entry, `store-entry.php`

```
namespace Chat\View;
use \Chat\Util\Util;
use \Chat\Model\Entry;
use Chat\Controller\SessionManager;

require_once 'classes/Chat/Util/Util.php';
Util::initRequest();

if (empty($_POST[CHAT_MSG_KEY])) {
    $msg = "";
} else {
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$controller = SessionManager::getController();
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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.
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- 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.
store-entry.php (Cont’d)

```php
namespace Chat\View;
use \Chat\Util\Util;
use \Chat\Model\Entry;
use Chat\Controller\SessionManager;

require_once 'classes/Chat/Util/Util.php';
Util::initRequest();

if (empty($_POST[CHAT_MSG_KEY])) {
    $msg = "";
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SessionManager::storeController($controller);

include CHAT_VIEWS . 'conversation.php';
```

- 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.
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.
namespace Chat\View;
use Chat\Util\Util;
use Chat\Model\Entry;
use Chat\Controller\SessionManager;

require_once 'classes/Chat/Util/Util.php';
Util::initRequest();

if (empty($_POST[CHAT_MSG_KEY])) {
    $msg = "";
} else {
    $msg = $_POST[CHAT_MSG_KEY];
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$controller = SessionManager::getController();
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include CHAT_VIEWS . 'conversation.php';
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include CHAT_VIEWS . 'conversation.php';
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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.
namespace Chat\View;
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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.
store-entry.php (Cont’d)

```php
namespace Chat\View;
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$entries = $controller->getConversation();
$username = $controller->getUsername();
SessionManager::storeController($controller);

include CHAT_VIEWS . 'conversation.php';
```

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

public static function initRequest() {
    spl_autoload_register(function ($class) {
        require_once 'classes/' .
            \str_replace('\\', '/', $class) .
               '.php';
    });

    session_start();
    self::defineConstants();
}

- Lines 2-6 registers the autoloader.
public static function initRequest() {
    spl_autoload_register(function ($class) {
        require_once 'classes/' .
            str_replace('\', '/', $class) .
            '.php';
    });

    session_start();
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}

- Lines 2-6 registers the autoloader.
- Line 8 starts a session if there is none.
**Util.php**

```php
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    spl_autoload_register(function ($class) {
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    });

    session_start();

    self::defineConstants();
}
```

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

```php
const SYMBOL_PREFIX = "CHAT_";
private static function defineConstants() {
    self::defineConstant('MSG_KEY', 'msg');
    self::defineConstant('NICK_KEY', 'nickName');
    self::defineConstant('TIMESTAMP_KEY', 'timestamp');
    self::defineConstant('VIEWS', 'resources/views/');
    self::defineConstant('FRAGMENTS', 'resources/fragments/');
}
```

```php
private static function defineConstant($param, $value) {
    define(self::SYMBOL_PREFIX . $param, $value);
}
```
**SessionManager.php**

```php
const CONTROLLER_KEY = 'controller';

public static function getController() {
    if (isset($_SESSION[self::CONTROLLER_KEY])) {
        return unserialize($_SESSION[self::CONTROLLER_KEY]);
    } else {
        return new Controller();
    }
}

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

- Line 4 checks if a `Controller` object is stored in the session.
- Line 5 reads the stored `Controller`.
- Line 7 creates a new `Controller`.
- Line 12 stores the `Controller` in the session.
```php
const CONTROLLER_KEY = 'controller';

/**
 * Get the controller stored in the session.
 * @return Controller The stored controller.
 */
public static function getController() {
    if (isset($_SESSION[CONTROLLER_KEY])) {
        return unserialize($_SESSION[CONTROLLER_KEY]);
    } else {
        return new Controller();
    }
}

/**
 * Store the controller in the session.
 * @param Controller $controller The controller to store.
 */
public static function storeController(Controller $controller) {
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The view, `conversation.php`

- The view should consist of only HTML. Unfortunately, this goal is not reached:
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.

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

```php
...<div class="col span_4_of_4">
  <div>
    <?php
    foreach ($entries as $entry) {
      if (!$entry->isDeleted()) {
        echo ('<p class="author">' . $entry->getNickName() . ':</p>');
        echo('<p class="entry">');
        echo(nl2br($entry->getMsg()));
        echo ('</p>');
        if ($entry->getNickName() === $username) {
          echo('<form action="delete-entry.php">');
          echo('<input type="hidden" name="timestamp" value="' . $entry->getTimestamp() . '"/>');
          echo('<input type="submit" value="Delete"/>');
          echo('</form>');
        }
      }
    }
  </div>
</div>...
```
Other Layers, No Problem

- 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

- 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.
Question 1
Let’s Look for Infrastructure Code

▶ In store-entry, Util and SessionManager there is no code at all specific for this application!
Let’s Look for Infrastructure Code

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

► One could argue that the call to the controller in `store-entry.php` is **application specific**.
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- One could argue that the call to the controller in store-entry.php is application specific.
  - 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

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  - **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.
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- **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:
  - Composite views, there should be a mechanism to specify fragments (header, footer etc) for inclusion without having to mix HTML and PHP.
  - 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.
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Section

- MVC in a PHP Web Application
- The id1354-fw Framework
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PHP Frameworks

- 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?
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- The full documentation, including installation instructions, is included in the id1354-fw.zip file available at the course web.
Class Loading

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- 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

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- 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

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- 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

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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

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- 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. `views/` is prepended to the returned path and `.php` is appended to the path.
Question 3
Composite Views and Templates

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- Therefore, we still have to mix PHP in the HTML code to include data and fragments in the view.
Mission Completed (Almost)

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- But there is still PHP in the HTML code...