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Database and Models - tutorials

1. Docs »
2. MVC Tutorials »
3. Getting Started with Zend Framework »
4. Database and Models

The database

Now that we have the `Album` module set up with controller action methods and view scripts, it is time to look at the model section of our application. Remember that the model is the part that deals with the application's core purpose (the so-called “business rules”) and, in our case, deals with the database. We will make use of zend-db's `Zend\Db\TableGateway\TableGateway` to find, insert, update, and delete rows from a database table.

We are going to use Sqlite, via PHP's PDO driver. Create a text file `data/schema.sql` with the following contents:

```
 CREATE TABLE album (id INTEGER PRIMARY KEY AUTOINCREMENT, artist
varchar(100) NOT NULL, title varchar(100) NOT NULL);
INSERT INTO album (artist, title) VALUES ('The Military Wives', 'In My
Dreams');
INSERT INTO album (artist, title) VALUES ('Adele', '21');
INSERT INTO album (artist, title) VALUES ('Bruce Springsteen',
'Wrecking Ball (Deluxe)');
INSERT INTO album (artist, title) VALUES ('Lana Del Rey', 'Born To
Die');
INSERT INTO album (artist, title) VALUES ('Gotye', 'Making Mirrors');
```

(The test data chosen happens to be the Bestsellers on Amazon UK at the time of writing!)

Now create the database using the following:

```
$ sqlite data/zftutorial.db < data/schema.sql
```

Some systems, including Ubuntu, use the command `sqlite3` ; check to see which one to use on your system.

> **Using PHP to create the database**
>
> If you do not have Sqlite installed on your system, you can use PHP to load the database using the same SQL schema file created earlier. Create the file `data/load_db.php` with the following contents:
>
> ```
> <?php
> $db = new PDO('sqlite:' . realpath(__DIR__) . '/zftutorial.db');
> $fh = fopen(__DIR__ . '/schema.sql', 'r');
> while ($line = fread($fh, 4096)) {
>     $db->exec($line);
> }
> fclose($fh);
> ```
>
> Once created, execute it:
>
> ```
> $ php data/load_db.php
> ```

We now have some data in a database and can write a very simple model for it.

The model files

Zend Framework does not provide a zend-model component because the model is your business logic, and it's up to you to decide how you want it to work. There are many components that you can use for this depending on your needs. One approach is to have model classes represent each entity in your application and then use mapper objects that load and save entities to the database. Another is to use an Object-Relational Mapping (ORM) technology, such as Doctrine or Propel.

For this tutorial, we are going to create a model by creating an `AlbumTable` class that consumes a `Zend\Db\TableGateway\TableGateway` , and in which each album will be represented as an `Album` object (known as an *entity*). This is an implementation of the Table Data Gateway design pattern to allow for interfacing with data in a database table. Be aware, though, that the Table Data Gateway pattern can become limiting in larger systems. There is also a temptation to put database access code into controller action methods as these are exposed by `Zend\Db\TableGateway\AbstractTableGateway` . *Don't do this*!

Let's start by creating a file called `Album.php` under `module/Album/src/Model` :

```
 namespace Album\Model;

class Album
{
    public $id;
    public $artist;
    public $title;

    public function exchangeArray(array $data)
    {
        $this->id     = !empty($data['id']) ? $data['id'] : null;
        $this->artist = !empty($data['artist']) ? $data['artist'] :
null;
        $this->title  = !empty($data['title']) ? $data['title'] : null;
    }
}
```

Our `Album` entity object is a PHP class. In order to work with zend-db's `TableGateway` class, we need to implement the `exchangeArray()` method; this method copies the data from the provided array to our entity's properties. We will add an input filter later to ensure the values injected are valid.

Next, we create our `AlbumTable.php` file in `module/Album/src/Model` directory like this:

```
 namespace Album\Model;

use RuntimeException;
use Zend\Db\TableGateway\TableGatewayInterface;

class AlbumTable
{
    private $tableGateway;

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

    public function fetchAll()
    {
        return $this->tableGateway->select();
    }

    public function getAlbum($id)
    {
        $id = (int) $id;
        $rowset = $this->tableGateway->select(['id' => $id]);
        $row = $rowset->current();
        if (! $row) {
            throw new RuntimeException(sprintf(
                'Could not find row with identifier %d',
                $id
            ));
        }

        return $row;
    }

    public function saveAlbum(Album $album)
    {
        $data = [
            'artist' => $album->artist,
            'title'  => $album->title,
        ];

        $id = (int) $album->id;

        if ($id === 0) {
            $this->tableGateway->insert($data);
            return;
        }

        if (! $this->getAlbum($id)) {
            throw new RuntimeException(sprintf(
                'Cannot update album with identifier %d; does not
exist',
                $id
            ));
        }

        $this->tableGateway->update($data, ['id' => $id]);
    }

    public function deleteAlbum($id)
    {
        $this->tableGateway->delete(['id' => (int) $id]);
    }
}
```

There's a lot going on here. Firstly, we set the protected property `$tableGateway` to the `TableGateway` instance passed in the constructor, hinting against the `TableGatewayInterface` (which allows us to provide alternate implementations easily, including mock instances during testing). We will use this to perform operations on the database table for our albums.

We then create some helper methods that our application will use to interface with the table gateway. `fetchAll()` retrieves all albums rows from the database as a `ResultSet` , `getAlbum()` retrieves a single row as an `Album` object, `saveAlbum()` either creates a new row in the database or updates a row that already exists, and `deleteAlbum()` removes the row completely. The code for each of these methods is, hopefully, self-explanatory.

Using ServiceManager to configure the table gateway and inject into the AlbumTable

In order to always use the same instance of our `AlbumTable` , we will use the `ServiceManager` to define how to create one. This is most easily done in the `Module` class where we create a method called `getServiceConfig()` which is automatically called by the `ModuleManager` and applied to the `ServiceManager` . We'll then be able to retrieve when we need it.

To configure the `ServiceManager` , we can either supply the name of the class to be instantiated or a factory (closure, callback, or class name of a factory class) that instantiates the object when the `ServiceManager` needs it. We start by implementing `getServiceConfig()` to provide a factory that creates an `AlbumTable` . Add this method to the bottom of the `module/Album/src/Module.php` file:

```
namespace Album;


use Zend\Db\Adapter\AdapterInterface;
use Zend\Db\ResultSet\ResultSet;
use Zend\Db\TableGateway\TableGateway;
use Zend\ModuleManager\Feature\ConfigProviderInterface;
```

```
class Module implements ConfigProviderInterface
{



    public function getServiceConfig()
    {
        return [
            'factories' => [
                Model\AlbumTable::class => function($container) {
                    $tableGateway =
$container->get(Model\AlbumTableGateway::class);
                    return new Model\AlbumTable($tableGateway);
                },
                Model\AlbumTableGateway::class => function ($container)
{
                    $dbAdapter =
$container->get(AdapterInterface::class);
                    $resultSetPrototype = new ResultSet();
                    $resultSetPrototype->setArrayObjectPrototype(new
Model\Album());
                    return new TableGateway('album', $dbAdapter, null,
$resultSetPrototype);
                },
            ],
        ];
    }
}
```

This method returns an array of `factories` that are all merged together by the `ModuleManager` before passing them to the `ServiceManager`. The factory for `Album\Model\AlbumTable` uses the `ServiceManager` to create an `Album\Model\AlbumTableGateway` service representing a `TableGateway` to pass to its constructor. We also tell the `ServiceManager` that the `AlbumTableGateway` service is created by fetching a `Zend\Db\Adapter\AdapterInterface` implementation (also from the `ServiceManager`) and using it to create a `TableGateway` object. The `TableGateway` is told to use an `Album` object whenever it creates a new result row. The `TableGateway` classes use the prototype pattern for creation of result sets and entities. This means that instead of instantiating when required, the system clones a previously instantiated object. See PHP Constructor Best Practices and the Prototype Pattern for more details.

Factories

> The above demonstrates building factories as closures within your module class. Another option is to build the factory as a *class*, and then map the class in your module configuration. This approach has a number of benefits:
>
> - The code is not parsed or executed unless the factory is invoked.
> - You can easily unit test the factory to ensure it does what it should.
> - You can extend the factory if desired.
> - You can re-use the factory across multiple instances that have related construction.
>
> Creating factories is covered in the zend-servicemanager documentation.

The `Zend\Db\Adapter\AdapterInterface` service is registered by the zend-db component. You may have noticed earlier that `config/modules.config.php` contains the following entries:

```
 return [
    'Zend\Form',
    'Zend\Db',
    'Zend\Router',
    'Zend\Validator',

],
```

All Zend Framework components that provide zend-servicemanager configuration are also exposed as modules themselves; the prompts as to where to register the components during our initial installation occurred to ensure that the above entries are created for you.

The end result is that we can already rely on having a factory for the `Zend\Db\Adapter\AdapterInterface` service; now we need to provide configuration so it can create an adapter for us.

Zend Framework's `ModuleManager` merges all the configuration from each module's `module.config.php` file, and then merges in the files in `config/autoload/` (first `*.global.php` files, and then `*.local.php` files). We'll add our database configuration information to `global.php`, which you should commit to your version control system. You can use `local.php` (outside of the VCS) to store the credentials for your database if you want to. Modify `config/autoload/global.php` (in the project root, not inside the `Album` module) with following code:

```
return [
    'db' => [
        'driver' => 'Pdo',
        'dsn'    => sprintf('sqlite:%s/data/zftutorial.db',
realpath(getcwd())),
    ],
];
```

If you were configuring a database that required credentials, you would put the general configuration in your `config/autoload/global.php` , and then the configuration for the current environment, including the DSN and credentials, in the `config/autoload/local.php` file. These get merged when the application runs, ensuring you have a full definition, but allows you to keep files with credentials outside of version control.

Back to the controller

Now that we have a model, we need to inject it into our controller so we can use it.

Firstly, we'll add a constructor to our controller. Open the file `module/Album/src/Controller/AlbumController.php` and add the following property and constructor:

```
namespace Album\Controller;


use Album\Model\AlbumTable;
use Zend\Mvc\Controller\AbstractActionController;
use Zend\View\Model\ViewModel;

class AlbumController extends AbstractActionController
{

    private $table;


    public function __construct(AlbumTable $table)
    {
        $this->table = $table;
    }
}
```

Our controller now depends on `AlbumTable`, so we will need to create a factory for the controller. Similar to how we created factories for the model, we'll create in in our `Module` class, only this time, under a new method, `Album\Module::getControllerConfig()` :

```
 namespace Album;

use Zend\Db\Adapter\Adapter;
use Zend\Db\ResultSet\ResultSet;
use Zend\Db\TableGateway\TableGateway;
use Zend\ModuleManager\Feature\ConfigProviderInterface;

class Module implements ConfigProviderInterface
{



    public function getControllerConfig()
    {
        return [
            'factories' => [
                Controller\AlbumController::class =>
function($container) {
                    return new Controller\AlbumController(
                        $container->get(Model\AlbumTable::class)
                    );
                },
            ],
        ];
    }
}
```

Because we're now defining our own factory, we can modify our `module.config.php` to remove the definition. Open `module/Album/config/module.config.php` and remove the following lines:

```
 <?php
namespace Album;
```

```
use Zend\ServiceManager\Factory\InvokableFactory;

return [

    'controllers' => [
        'factories' => [
            Controller\AlbumController::class =>
InvokableFactory::class,
        ],
    ],


];
```

We can now access the property `$table` from within our controller whenever we need to interact with our model.

Listing albums

In order to list the albums, we need to retrieve them from the model and pass them to the view. To do this, we fill in `indexAction()` within `AlbumController`. Update the `AlbumController::indexAction()` as follows:

```
    public function indexAction()
    {
        return new ViewModel([
            'albums' => $this->table->fetchAll(),
        ]);
    }
```

With Zend Framework, in order to set variables in the view, we return a `ViewModel` instance where the first parameter of the constructor is an array containing data we wish to represent. These are then automatically passed to the view script. The `ViewModel` object also allows us to change the view script that is used, but the default is to use `{module name}/{controller name}/{action name}`. We can now fill in the `index.phtml` view script:

```
<?php
```

```
$title = 'My albums';
$this->headTitle($title);
?>
<h1><?= $this->escapeHtml($title) ?></h1>
<p>
    <a href="<?= $this->url('album', ['action' => 'add']) ?>">Add new
album</a>
</p>

<table class="table">
<tr>
    <th>Title</th>
    <th>Artist</th>
    <th>&nbsp;</th>
</tr>
<?php foreach ($albums as $album) : ?>
    <tr>
        <td><?= $this->escapeHtml($album->title) ?></td>
        <td><?= $this->escapeHtml($album->artist) ?></td>
        <td>
            <a href="<?= $this->url('album', ['action' => 'edit', 'id'
=> $album->id]) ?>">Edit</a>
            <a href="<?= $this->url('album', ['action' => 'delete',
'id' => $album->id]) ?>">Delete</a>
        </td>
    </tr>
<?php endforeach; ?>
</table>
```

The first thing we do is to set the title for the page (used in the layout) and also set the title for the `<head>` section using the `headTitle()` view helper which will display in the browser's title bar. We then create a link to add a new album.

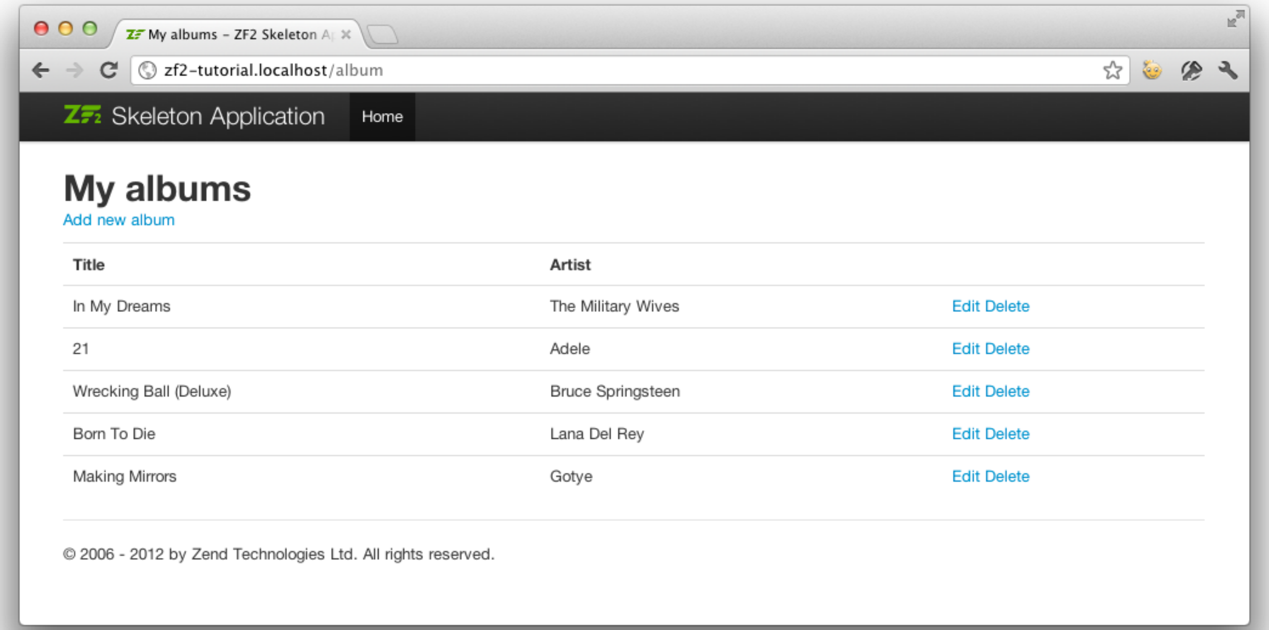
The `url()` view helper is provided by zend-mvc and zend-view, and is used to create the links we need. The first parameter to `url()` is the route name we wish to use for construction of the URL, and the second parameter is an array of variables to substitute into route placeholders. In this case we use our `album` route which is set up to accept two placeholder variables: `action` and `id` .

We iterate over the `$albums` that we assigned from the controller action. zend-view automatically ensures that these variables are extracted into the scope of the view script; you may also access them using `$this->{variable name}` in order to differentiate between variables provided to the view script and those created inside it.

We then create a table to display each album's title and artist, and provide links to allow for editing and deleting the record. A standard `foreach:` loop is used to iterate over the list of albums, and we use the alternate form using a colon and `endforeach;` as it is easier to scan than to try and match up braces. Again, the `url()` view helper is used to create the edit and delete links.

> **Escaping**
>
> We always use the `escapeHtml()` view helper to help protect ourselves from Cross Site Scripting (XSS) vulnerabilities.

If you open `http://localhost:8080/album` (or `http://zf-tutorial.localhost/album` if you are using self-hosted Apache) you should see this:



My albums

Add new album

Title	Artist	
In My Dreams	The Military Wives	Edit Delete
21	Adele	Edit Delete
Wrecking Ball (Deluxe)	Bruce Springsteen	Edit Delete
Born To Die	Lana Del Rey	Edit Delete
Making Mirrors	Gotye	Edit Delete

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