

# The Definitive Guide to Yii 1.1

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# CHAPTER 1

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## Getting Started

### 1.1 The Definitive Guide to Yii

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### 1.2 New Features

This page summarizes the main new features introduced in each Yii release.

#### 1.2.1 Version 1.1.11

- [Added http caching support](#)
- [Added console application exit codes](#)
- [Added model validation rules blacklisting](#)
- [Added git and hg support](#)

#### 1.2.2 Version 1.1.8

- [Added support for using custom URL rule classes](#)

#### 1.2.3 Version 1.1.7

- [Added RESTful URL support](#)
- [Added query caching support](#)
- [Now it's possible to pass parameters for relational named scopes](#)

- [Added ability to perform Relational query without getting related models](#)
- [Added support for HAS\\_MANY through and HAS\\_ONE through AR relations](#)
- [Added transaction support for the DB migration feature](#)
- [Added support for using parameter binding with class-based actions](#)
- [Added support for performing seamless client-side data validation using CActive-Form](#)

#### 1.2.4 Version 1.1.6

- [Added query builder](#)
- [Added database migration](#)
- [Best MVC Practices](#)
- [Added support for using anonymous parameters and global options in console commands](#)

#### 1.2.5 Version 1.1.5

- [Added support for console command actions and parameter binding](#)
- [Added support for autoloading namespaced classes](#)
- [Added support for theming widget views](#)

#### 1.2.6 Version 1.1.4

- [Added support for automatic action parameter binding](#)

#### 1.2.7 Version 1.1.3

- [Added support to configure widget default values in application configuration](#)

#### 1.2.8 Version 1.1.2

- [Added a Web-based code generation tool called Gii](#)

### 1.2.9 Version 1.1.1

- Added CActiveForm which simplifies writing form-related code and supports seamless and consistent validation on both client and server sides.
- Refactored the code generated by the yiic tool. In particular, the skeleton application is now generated with multiple layouts; the operation menu is reorganized for CRUD pages; added search and filtering feature to the admin page generated by crud command; used CActiveForm to render a form.
- [Added support to allow defining global yiic commands](#)

### 1.2.10 Version 1.1.0

- [Added support for writing unit and functional tests](#)
- [Added support for using widget skins](#)
- [Added an extensible form builder](#)
- Improved the way of declaring safe model attributes. See [Securing Attribute Assignments](#).
- Changed the default eager loading algorithm for relational active record queries so that all tables are joined in one single SQL statement.
- Changed the default table alias to be the name of active record relations.
- [Added support for using table prefix](#).
- Added a whole set of new extensions known as the [Zii library](#).
- The alias name for the primary table in an AR query is fixed to be 't'

## 1.3 Upgrading from Version 1.0 to 1.1

### 1.3.1 Changes Related with Model Scenarios

- Removed CModel::safeAttributes(). Safe attributes are now defined to be those that are being validated by some rules as defined in CModel::rules() for the particular scenario.
- Changed CModel::validate(), CModel::beforeValidate() and CModel::afterValidate(). CModel::setAttributes(), CModel::getSafeAttributeNames() The 'scenario' parameter is removed. You should get and set the model scenario via CModel::scenario.

- Changed `CModel::getValidators()` and removed `CModel::getValidatorsForAttribute()`. `CModel::getValidators()` now only returns validators applicable to the scenario as specified by the model's scenario property.
- Changed `CModel::isAttributeRequired()` and `CModel::getValidatorsForAttribute()`. The scenario parameter is removed. The model's scenario property will be used, instead.
- Removed `CHtml::scenario`. `CHtml` will use the model's scenario property instead.

### 1.3.2 Changes Related with Eager Loading for Relational Active Record

- By default, a single JOIN statement will be generated and executed for all relations involved in the eager loading. If the primary table has its `LIMIT` or `OFFSET` query option set, it will be queried alone first, followed by another SQL statement that brings back all its related objects. Previously in version 1.0.x, the default behavior is that there will be  $N+1$  SQL statements if an eager loading involves `N HAS_MANY` or `MANY_MANY` relations.

### 1.3.3 Changes Related with Table Alias in Relational Active Record

- The default alias for a relational table is now the same as the corresponding relation name. Previously in version 1.0.x, by default Yii would automatically generate a table alias for each relational table, and we had to use the prefix `??.` to refer to this automatically generated alias.
- The alias name for the primary table in an AR query is fixed to be `t.` Previously in version 1.0.x, it was the same as the table name. This will cause existing AR query code to break if they explicitly specify column prefixes using the table name. The solution is to replace these prefixes with `'t.'`.

### 1.3.4 Changes Related with Tabular Input

- For attribute names, using `Field[$i]` is not valid anymore, they should look like `[$i]Field` in order to support array-typed fields (e.g. `[$i]Field[$index]`).

### 1.3.5 Other Changes

- The signature of the `CActiveRecord` constructor is changed. The first parameter (list of attributes) is removed.

## 1.4 What is Yii

Yii is a high-performance, component-based PHP framework for developing large-scale Web applications rapidly. It enables maximum reusability in Web programming and can significantly accelerate your Web application development process. The name Yii (pronounced Yee or [ji:]) is an acronym for "**Yes It Is!**". This is often the accurate, and most concise response to inquires from those new to Yii:

Is it fast? ... Is it secure? ... Is it professional? ... Is it right for my next project? ... **Yes, it is!**

### 1.4.1 Requirements

To run a Yii-powered Web application, you need a Web server that supports PHP 5.1.0.

For developers who want to use Yii, understanding object-oriented programming (OOP) is very helpful, because Yii is a pure OOP framework.

### 1.4.2 What is Yii Best for?

Yii is a generic Web programming framework that can be used for developing virtually any type of Web application. Because it is light-weight and equipped with sophisticated caching mechanisms, it is especially suited to high-traffic applications, such as portals, forums, content management systems (CMS), e-commerce systems, etc.

### 1.4.3 How does Yii Compare with Other Frameworks?

Like most PHP frameworks, Yii is an MVC framework.

Yii excels other PHP frameworks at being efficient, feature-rich and clearly-documented. Yii is carefully designed from the ground up to be fit for serious Web application development. It is neither a byproduct of some project nor a conglomerate of third-party work. It is the result of the authors' rich experience with Web application development and their investigation of the most popular Web programming frameworks and applications.

## 1.5 Installation

Installation of Yii mainly involves the following two steps:

1. Download Yii Framework from [yiiframework.com](http://yiiframework.com).
2. Unpack the Yii release file to a Web-accessible directory.

**Tip:** Yii does not need to be installed under a Web-accessible directory. A Yii application has one entry script which is usually the only file that needs to be exposed to Web users. Other PHP scripts, including those from Yii, should be protected from Web access; otherwise they might be exploited by hackers.

### 1.5.1 Requirements

After installing Yii, you may want to verify that your server satisfies Yii's requirements. You can do so by accessing the requirement checker script via the following URL in a Web browser:

```
http://hostname/path/to/yii/requirements/index.php
```

Yii requires PHP 5.1, so the server must have PHP 5.1 or above installed and available to the web server. Yii has been tested with [Apache HTTP server](#) on Windows and Linux. It may also run on other Web servers and platforms, provided PHP 5.1 is supported.

## 1.6 Apache and Nginx configurations

### 1.6.1 Apache

Yii is ready to work with a default Apache web server configuration. The `.htaccess` files in Yii framework and application folders restrict access to the restricted resources. To hide the bootstrap file (usually `index.php`) in your URLs you can add `mod_rewrite` instructions to the `.htaccess` file in your document root or to the virtual host configuration:

```
RewriteEngine on

# if a directory or a file exists, use it directly
RewriteCond %{REQUEST_FILENAME} !-f
RewriteCond %{REQUEST_FILENAME} !-d
# otherwise forward it to index.php
RewriteRule . index.php
```

### 1.6.2 Nginx

You can use Yii with [Nginx](#) and PHP with [FPM SAPI](#). Here is a sample host configuration. It defines the bootstrap file and makes yii catch all requests to unexisting files, which allows us to have nice-looking URLs.

```
server {
    set $host_path "/www/mysite";
    access_log /www/mysite/log/access.log main;

    server_name mysite;
    root $host_path/htdocs;
    set $yii_bootstrap "index.php";

    charset utf-8;

    location / {
        index index.html $yii_bootstrap;
        try_files $uri $uri/ /$yii_bootstrap?$args;
    }

    location ~ ~(protected|framework|themes/\w+/views) {
        deny all;
    }

    #avoid processing of calls to unexisting static files by yii
    location ~ \.(js|css|png|jpg|gif|swf|ico|pdf|mov|fla|zip|rar)$ {
        try_files $uri =404;
    }

    # pass the PHP scripts to FastCGI server listening on 127.0.0.1:9000
    #
    location ~ \.php {
        fastcgi_split_path_info ^(.+\.php)(.*)$;

        #let yii catch the calls to unexisting PHP files
        set $fsn /$yii_bootstrap;
        if (-f $document_root$fastcgi_script_name){
            set $fsn $fastcgi_script_name;
        }

        fastcgi_pass 127.0.0.1:9000;
        include fastcgi_params;
        fastcgi_param SCRIPT_FILENAME $document_root$fsn;

        #PATH_INFO and PATH_TRANSLATED can be omitted, but RFC 3875 specifies them for CGI
        fastcgi_param PATH_INFO $fastcgi_path_info;
        fastcgi_param PATH_TRANSLATED $document_root$fsn;
    }

    location ~ /\.ht {
        deny all;
    }
}
```

Using this configuration you can set `cgi.fix_pathinfo=0` in `php.ini` to avoid many unnecessary system `stat()` calls.

## 1.7 Creating Your First Yii Application

To give you an initial experience with Yii, in this section we describe how to create your first Yii application. We will use `yiic` (command line tool) to create a new Yii application and `Gii` (powerful web based code generator) to automate code creation for certain tasks. For convenience, we assume that `YiiRoot` is the directory where Yii is installed, and `WebRoot` is the document root of our Web server.

Run `yiic` on the command line as follows:

```
% YiiRoot/framework/yiic webapp WebRoot/testdrive
```

**Note:** When running `yiic` on Mac OS, Linux or Unix, you may need to change the permission of the `yiic` file so that it is executable. Alternatively, you may run the tool as follows,

```
% cd WebRoot
% php YiiRoot/framework/yiic.php webapp testdrive
```

This will create a skeleton Yii application under the directory `WebRoot/testdrive`. The application has a directory structure that is needed by most Yii applications.

Without writing a single line of code, we can test drive our first Yii application by accessing the following URL in a Web browser:

```
http://hostname/testdrive/index.php
```

As we can see, the application has four pages: the homepage, the about page, the contact page and the login page. The contact page displays a contact form that users can fill in to submit their inquiries to the webmaster, and the login page allows users to be authenticated before accessing privileged contents. See the following screenshots for more details.

The following diagram shows the directory structure of our application. Please see [Conventions](#) for a detailed explanation.

```
testdrive/
```



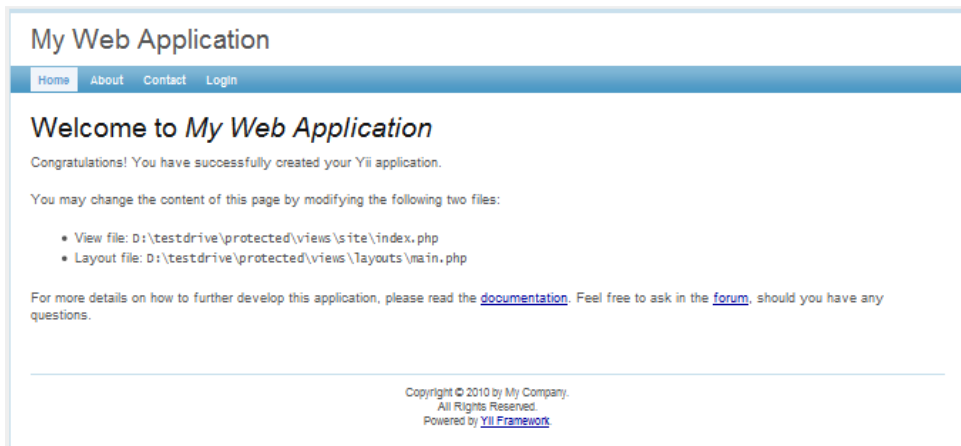


Figure 1.1: Home page

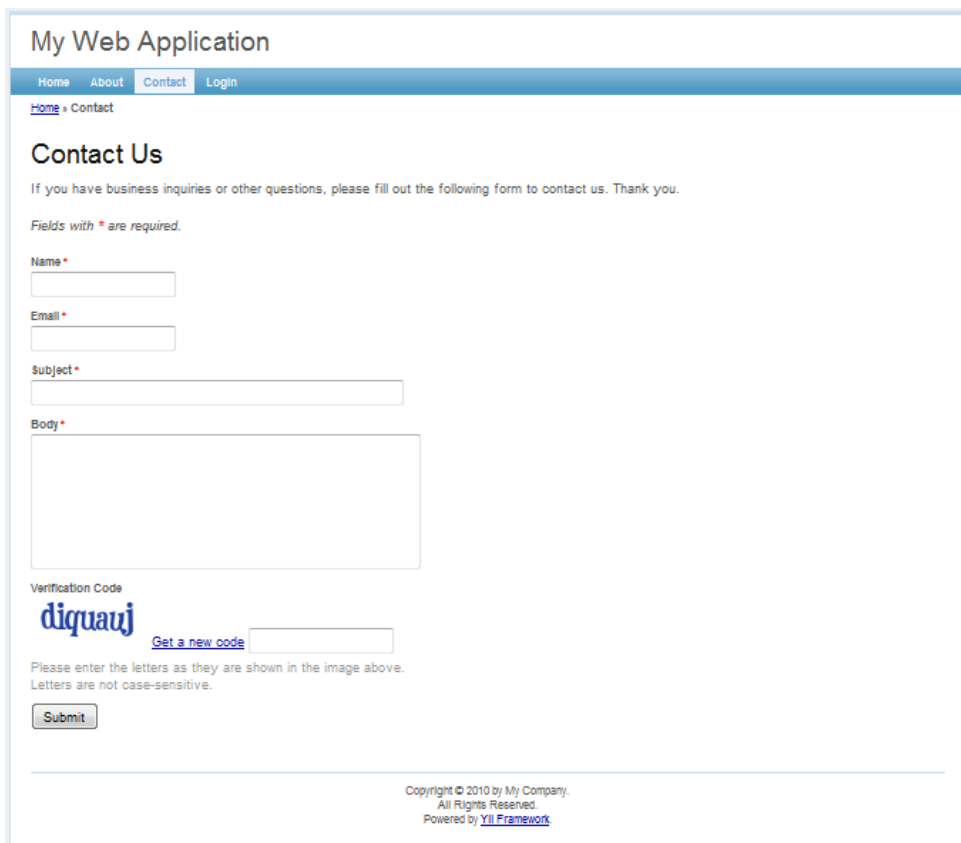


Figure 1.2: Contact page

The screenshot shows a web application titled "My Web Application" with a navigation bar containing "Home", "About", "Contact", and "Login". The "Contact" tab is active, and the breadcrumb "Home » Contact" is displayed. The main heading is "Contact Us", followed by the text "If you have business inquiries or other questions, please fill out the following form to contact us. Thank you." and a note "Fields with \* are required.".

A red-bordered box contains the following error messages:

- Please fix the following input errors:
- Subject cannot be blank.
- Body cannot be blank.
- The verification code is incorrect.

The form fields are as follows:

- Name \***: A text input field containing "tester".
- Email \***: A text input field containing "tester@example.com".
- Subject \***: A text input field that is empty.
- Body \***: A large text area that is empty.
- Verification Code**: A CAPTCHA image showing the word "diqvauj" in a stylized font. Below the image is a link "Get a new code" and an empty input field.

Below the CAPTCHA, the text reads: "Please enter the letters as they are shown in the image above. Letters are not case-sensitive." A "Submit" button is located at the bottom of the form.

The footer contains the text: "Copyright © 2010 by My Company. All Rights Reserved. Powered by [Yii Framework](#)."

Figure 1.3: Contact page with input errors

The screenshot shows the same web application as Figure 1.3, but with a success message. The navigation bar and breadcrumb are identical. The main heading "Contact Us" is followed by a green-bordered box containing the text: "Thank you for contacting us. We will respond to you as soon as possible."

The footer contains the text: "Copyright © 2010 by My Company. All Rights Reserved. Powered by [Yii Framework](#)."

Figure 1.4: Contact page with success message

Figure 1.5: Login page

<code>index.php</code>	Web application entry script file
<code>index-test.php</code>	entry script file for the functional tests
<code>assets/</code>	containing published resource files
<code>css/</code>	containing CSS files
<code>images/</code>	containing image files
<code>themes/</code>	containing application themes
<code>protected/</code>	containing protected application files
<code>yiic</code>	yiic command line script for Unix/Linux
<code>yiic.bat</code>	yiic command line script for Windows
<code>yiic.php</code>	yiic command line PHP script
<code>commands/</code>	containing customized <code>yiic</code> commands
<code>shell/</code>	containing customized <code>yiic shell</code> commands
<code>components/</code>	containing reusable user components
<code>Controller.php</code>	the base class for all controller classes
<code>UserIdentity.php</code>	the <code>UserIdentity</code> class used for authentication
<code>config/</code>	containing configuration files
<code>console.php</code>	the console application configuration
<code>main.php</code>	the Web application configuration
<code>test.php</code>	the configuration for the functional tests
<code>controllers/</code>	containing controller class files
<code>SiteController.php</code>	the default controller class
<code>data/</code>	containing the sample database
<code>schema.mysql.sql</code>	the DB schema for the sample MySQL database
<code>schema.sqlite.sql</code>	the DB schema for the sample SQLite database
<code>testdrive.db</code>	the sample SQLite database file
<code>extensions/</code>	containing third-party extensions
<code>messages/</code>	containing translated messages
<code>models/</code>	containing model class files

LoginForm.php	the form model for <code>&amp;#039;login&amp;#039;</code> action
ContactForm.php	the form model for <code>&amp;#039;contact&amp;#039;</code> action
runtime/	containing temporarily generated files
tests/	containing test scripts
views/	containing controller view and layout files
layouts/	containing layout view files
main.php	the base layout shared by all pages
column1.php	the layout for pages using a single column
column2.php	the layout for pages using two columns
site/	containing view files for the <code>&amp;#039;site&amp;#039;</code> controller
pages/	containing "static" pages
about.php	the view for the "about" page
contact.php	the view for <code>&amp;#039;contact&amp;#039;</code> action
error.php	the view for <code>&amp;#039;error&amp;#039;</code> action (displaying external errors)
index.php	the view for <code>&amp;#039;index&amp;#039;</code> action
login.php	the view for <code>&amp;#039;login&amp;#039;</code> action

Application generator described above also supports creation of files needed by Git version control system. The following command would create necessary `.gitignore` (e.g. content of the `assets` and `runtime` shouldn't be tracked) and `.gitkeep` (forces tracking of initially empty but important directories) files:

```
% YiiRoot/framework/yiic webapp WebRoot/testdrive git
```

Another supported VCS is Mercurial: pass the `hg` value as third parameter in case you're using this VCS. This feature is available since version 1.1.11.

### 1.7.1 Connecting to Database

Most Web applications are backed by databases. Our test-drive application is not an exception. To use a database, we need to tell the application how to connect to it. This is done in the application configuration file `WebRoot/testdrive/protected/config/main.php`, highlighted as follows,

```
return array(
    .....
    'components'=>array(
        .....
        'db'=>array(
            'connectionString'=>'sqlite:protected/data/testdrive.db',
        ),
    ),
    .....
);
```

The above code instructs Yii that the application should connect to the SQLite database `WebRoot/testdrive/protected/data/testdrive.db` when needed. Note that the SQLite database is already included in the skeleton application that we just generated. The database contains only a single table named `tbl_user`:

```
CREATE TABLE tbl_user (  
    id INTEGER NOT NULL PRIMARY KEY AUTOINCREMENT,  
    username VARCHAR(128) NOT NULL,  
    password VARCHAR(128) NOT NULL,  
    email VARCHAR(128) NOT NULL  
);
```

If you want to try a MySQL database instead, you may use the included MySQL schema file `WebRoot/testdrive/protected/data/schema.mysql.sql` to create the database.

**Note:** To use Yii's database feature, we need to enable the PHP PDO extension and the driver-specific PDO extension. For the test-drive application, we need to turn on both the `php_pdo` and `php_pdo_sqlite` extensions.

### 1.7.2 Implementing CRUD Operations

Now comes the fun part. We would like to implement CRUD (create, read, update and delete) operations for the `tbl_user` table we just created. This is also commonly needed in practical applications. Instead of taking the trouble to write the actual code, we will use Gii – a powerful Web-based code generator.

**Info:** Gii has been available since version 1.1.2. Before that, we could use the aforementioned `yiic` tool to accomplish the same goal. For more details, please refer to [Implementing CRUD Operations with yiic shell](#).

### Configuring Gii

In order to use Gii, we first need to edit the file `WebRoot/testdrive/protected/config/main.php`, which is known as the [application configuration](#) file:

```
return array(  
    .....  
    'import'=>array(  
        'application.models.*',
```

```

        'application.components.*',
    ),

    'modules'=>array(
        'gii'=>array(
            'class'=>'system.gii.GiiModule',
            'password'=>'pick up a password here',
        ),
    ),
);

```

Then, visit the URL `http://hostname/testdrive/index.php?r=gii`. We will be prompted for a password, which should be the one that we just entered in the above application configuration.

## Generating the User Model

After login, click on the link **Model Generator**. This will bring us to the following model generation page,

**Model Generator**

This generator generates a model class for the specified database table.

Fields with \* are required. Click on the highlighted fields to edit them.

Database Connection \*  
db

Table Prefix  
[empty]

Table Name \*  
tbl\_user

Model Class \*  
User

Base Class \*  
 CActiveRecord

Model Path \*  
application.models

Build Relations  
☒

Code Template \*  
default (C:\\_work\jetbrains\yii\framework\gii\generators\model\templates\default)

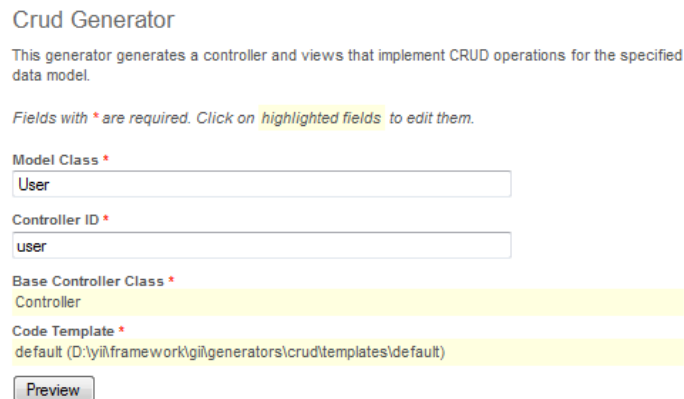
Preview

**Figure 1.6:** Model Generator

In the **Table Name** field, enter `tbl_user`. In the **Model Class** field, enter `User`. Then press the **Preview** button. This will show us the new code file to be generated. Now press the **Generate** button. A new file named `User.php` will be generated under `protected/models`. As we will describe later in this guide, this `User` model class allows us to talk to the underlying database `tbl_user` table in an object-oriented fashion.

## Generating CRUD Code

After creating the model class file, we will generate the code that implements the CRUD operations about the user data. We choose the **Crud Generator** in Gii, shown as follows,



**Crud Generator**

This generator generates a controller and views that implement CRUD operations for the specified data model.

*Fields with \* are required. Click on highlighted fields to edit them.*

**Model Class \***  
User

**Controller ID \***  
user

**Base Controller Class \***  
Controller

**Code Template \***  
default (D:\yii\framework\gii\generators\crud\templates\default)

**Figure 1.7:** CRUD Generator

In the **Model Class** field, enter **User**. In the **Controller ID** field, enter **user** (in lower case). Now press the **Preview** button followed by the **Generate** button. We are done with the CRUD code generation.

## Accessing CRUD Pages

Let's enjoy our work by browsing the following URL:

`http://hostname/testdrive/index.php?r=user`

This will display a list of user entries in the `tbl_user` table.

Click the **Create User** button on the page. We will be brought to the login page if we have not logged in before. After logging in, we see an input form that allows us to add a new user entry. Complete the form and click the **Create** button. If there is any input error, a nice error prompt will show up which prevents us from saving the input. Back on the user list page, we should see the newly added user appearing in the list.

Repeat the above steps to add more users. Notice that the user list page will automatically paginate the user entries if there are too many to be displayed in one page.

If we login as an administrator using `admin/admin`, we can view the user admin page with the following URL:

`http://hostname/testdrive/index.php?r=user/admin`

This will show us the user entries in a nice tabular format. We can click on the table header cells to sort the corresponding columns. We can click on the buttons on each row of data to view, update or delete the corresponding row of data. We can browse different pages. We can also filter and search to look for the data we are interested in.

All these nice features come without requiring us to write a single line of code!

The screenshot displays a web application interface for managing users. At the top, there's a navigation bar with links: Home, About, Contact, and Logout (admin). Below this, a breadcrumb trail shows 'Home » Users » Manage'. The main heading is 'Manage Users', with a link for 'Advanced Search'. On the right, there's an 'Operations' sidebar with buttons for 'List User' and 'Create User'. The central area contains a search form with fields for 'Id', 'Username', and 'Email', and a 'Search' button. Below the search form, it says 'Displaying 1-10 of 21 result(s)'. A table lists 10 users with columns for Id, Username, Password, and Email. Each row has three action icons (view, update, delete). At the bottom, there's a pagination control 'Go to page: < Previous 1 2 3 Next >' and a footer with copyright information.

Id	Username	Password	Email
1	test1	pass1	test1@example.com
2	test2	pass2	test2@example.com
3	test3	pass3	test3@example.com
4	test4	pass4	test4@example.com
5	test5	pass5	test5@example.com
6	test6	pass6	test6@example.com
7	test7	pass7	test7@example.com
8	test8	pass8	test8@example.com
9	test9	pass9	test9@example.com
10	test10	pass10	test10@example.com

**Figure 1.8:** User admin page



# My Web Application

[Home](#) [About](#) [Contact](#) [Logout \(admin\)](#)

[Home](#) > [Users](#) > Create

## Create User

Fields with \* are required.

Please fix the following input errors:

- Password cannot be blank.
- Email cannot be blank.

Username \*

test

Password \*

Email \*

Create

Operations

[List User](#)[Manage User](#)

Copyright © 2010 by My Company.  
All Rights Reserved.  
Powered by [Yii Framework](#).

Figure 1.9: Create new user page



# CHAPTER 2

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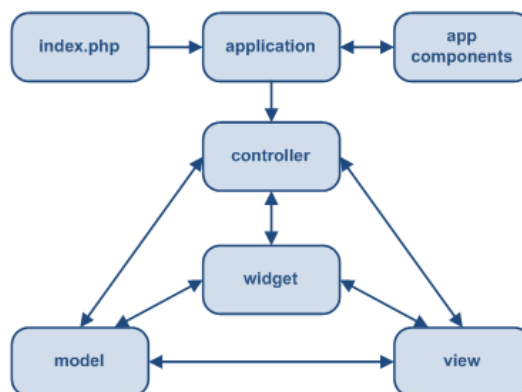
## Fundamentals

### 2.1 Model-View-Controller (MVC)

Yii implements the model-view-controller (MVC) design pattern, which is widely adopted in Web programming. MVC aims to separate business logic from user interface considerations, so that developers can more easily change each part without affecting the other. In MVC, the model represents the information (the data) and the business rules; the view contains elements of the user interface such as text, form inputs; and the controller manages the communication between the model and the view.

Besides implementing MVC, Yii also introduces a front-controller, called `Application`, which encapsulates the execution context for the processing of a request. `Application` collects some information about a user request and then dispatches it to an appropriate controller for further handling.

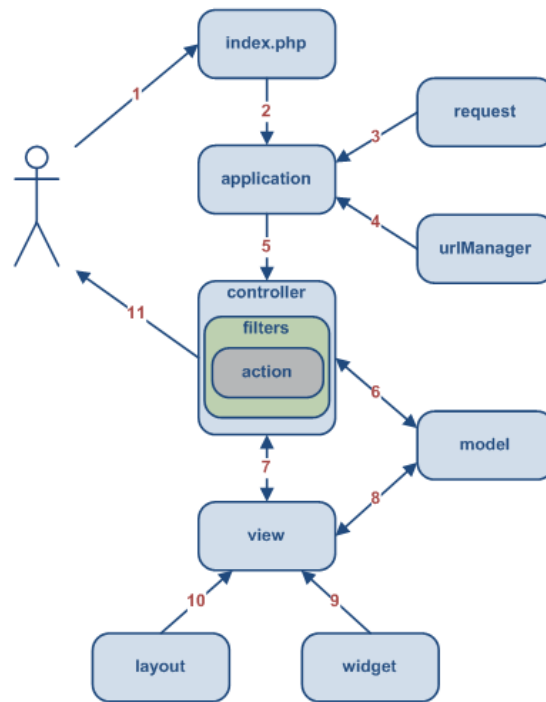
The following diagram shows the static structure of a Yii application:



**Figure 2.1:** Static structure of Yii application

### 2.1.1 A Typical Workflow

The following diagram shows a typical workflow of a Yii application when it is handling a user request:



**Figure 2.2:** Typical workflow of a Yii application

1. A user makes a request with the URL `http://www.example.com/index.php?r=post/show&id=1` and the Web server handles the request by executing the bootstrap script `index.php`.
2. The bootstrap script creates an [Application](#) instance and runs it.
3. The Application obtains detailed user request information from an application component named `request`.
4. The application determines the requested [controller](#) and [action](#) with the help of an application component named `urlManager`. For this example, the controller is `post`, which refers to the `PostController` class; and the action is `show`, whose actual meaning is determined by the controller.
5. The application creates an instance of the requested controller to further handle the user request. The controller determines that the action `show` refers to a method

named `actionShow` in the controller class. It then creates and executes filters (e.g. access control, benchmarking) associated with this action. The action is executed if it is allowed by the filters.

6. The action reads a `Post` `model` whose ID is 1 from the database.
7. The action renders a `view` named `show` with the `Post` model.
8. The view reads and displays the attributes of the `Post` model.
9. The view executes some `widgets`.
10. The view rendering result is embedded in a `layout`.
11. The action completes the view rendering and displays the result to the user.

## 2.2 Entry Script

The entry script is the bootstrap PHP script that handles user requests initially. It is the only PHP script that end users can directly request to execute.

In most cases, the entry script of a Yii application contains code that is as simple as this:

```
// remove the following line when in production mode
defined('YII_DEBUG') or define('YII_DEBUG',true);
// include Yii bootstrap file
require_once('path/to/yii/framework/yii.php');
// create application instance and run
$configFile='path/to/config/file.php';
Yii::createWebApplication($configFile)->run();
```

The script first includes the Yii framework bootstrap file `yii.php`. It then creates a Web application instance with the specified configuration and runs it.

### 2.2.1 Debug Mode

A Yii application can run in either debug or production mode, as determined by the value of the constant `YII_DEBUG`. By default, this constant value is defined as `false`, meaning production mode. To run in debug mode, define this constant as `true` before including the `yii.php` file. Running the application in debug mode is less efficient because it keeps many internal logs. On the other hand, debug mode is also more helpful during the development stage because it provides richer debugging information when an error occurs.

## 2.3 Application

The application object encapsulates the execution context within which a request is processed. Its main task is to collect some basic information about the request, and dispatch it to an appropriate controller for further processing. It also serves as the central place for keeping application-level configuration settings. For this reason, the application object is also called the `front-controller`.

The application object is instantiated as a singleton by the [entry script](#). The application singleton can be accessed at any place via `Yii::app()`.

### 2.3.1 Application Configuration

By default, the application object is an instance of [CWebApplication](#). To customize it, we normally provide a configuration settings file (or array) to initialize its property values when it is being instantiated. An alternative way of customizing it is to extend [CWebApplication](#).

The configuration is an array of key-value pairs. Each key represents the name of a property of the application instance, and each value the corresponding property's initial value. For example, the following configuration array sets the [name](#) and [defaultController](#) properties of the application.

```
array(  
    'name'=>'Yii Framework',  
    'defaultController'=>'site',  
)
```

We usually store the configuration in a separate PHP script (e.g. `protected/config/main.php`). Inside the script, we return the configuration array as follows:

```
return array(...);
```

To apply the configuration, we pass the configuration file name as a parameter to the application's constructor, or to [Yii::createWebApplication\(\)](#) in the following manner, usually in the [entry script](#):

```
$app=Yii::createWebApplication($configFile);
```

**Tip:** If the application configuration is very complex, we can split it into several files, each returning a portion of the configuration array. Then, in the main configuration file, we can call PHP `include()` to include the rest of the configuration files and merge them into a complete configuration array.

### 2.3.2 Application Base Directory

The application base directory is the root directory under which all security-sensitive PHP scripts and data reside. By default, it is a subdirectory named `protected` that is located under the directory containing the entry script. It can be customized by setting the `basePath` property in the [application configuration](#).

Contents under the application base directory should be protected against being accessed by Web users. With [Apache HTTP server](#), this can be done easily by placing an `.htaccess` file under the base directory. The content of the `.htaccess` file would be as follows:

```
deny from all
```

### 2.3.3 Application Components

The functionality of the application object can easily be customized and enriched using its flexible component architecture. The object manages a set of application components, each implementing specific features. For example, it performs some initial processing of a user request with the help of the [CUrlManager](#) and [CHttpRequest](#) components.

By configuring the `components` property of the application instance, we can customize the class and property values of any application component used. For example, we can configure the [CMemCache](#) component so that it can use multiple memcache servers for caching, like this:

```
array(
    .....
    'components'=>array(
        .....
        'cache'=>array(
            'class'=>'CMemCache',
            'servers'=>array(
                array('host'=>'server1', 'port'=>11211, 'weight'=>60),
                array('host'=>'server2', 'port'=>11211, 'weight'=>40),
            ),
        ),
    ),
),
)
```

In the above, we added the `cache` element to the `components` array. The `cache` element states that the class of the component is `CMemCache` and its `servers` property should be initialized as such.

To access an application component, use `Yii::app()->ComponentID`, where `ComponentID` refers to the ID of the component (e.g. `Yii::app()->cache`).

An application component may be disabled by setting `enabled` to `false` in its configuration. Null is returned when we access a disabled component.

**Tip:** By default, application components are created on demand. This means an application component may not be created at all if it is not accessed during a user request. As a result, the overall performance may not be degraded even if an application is configured with many components. Some application components (e.g. `CLogRouter`) may need to be created regardless of whether they are accessed or not. To do so, list their IDs in the `preload` application property.

### 2.3.4 Core Application Components

Yii predefines a set of core application components to provide features common among Web applications. For example, the `request` component is used to collect information about a user request and provide information such as the requested URL and cookies. By configuring the properties of these core components, we can change the default behavior of nearly every aspect of Yii.

Here is a list the core components that are pre-declared by `CWebApplication`:

- `assetManager`: `CAssetManager` - manages the publishing of private asset files.
- `authManager`: `CAuthManager` - manages role-based access control (RBAC).
- `cache`: `CCache` - provides data caching functionality. Note, you must specify the actual class (e.g. `CMemCache`, `CDbCache`). Otherwise, null will be returned when you access this component.
- `clientScript`: `CClientScript` - manages client scripts (javascript and CSS).
- `coreMessages`: `CPhpMessageSource` - provides translated core messages used by the Yii framework.
- `db`: `CDbConnection` - provides the database connection. Note, you must configure its `connectionString` property in order to use this component.



- **errorHandler**: [CErrorHandler](#) - handles uncaught PHP errors and exceptions.
- **format**: [CFormatter](#) - formats data values for display purpose.
- **messages**: [CPhpMessageSource](#) - provides translated messages used by the Yii application.
- **request**: [CHttpRequest](#) - provides information related to user requests.
- **securityManager**: [CSecurityManager](#) - provides security-related services, such as hashing and encryption.
- **session**: [CHttpSession](#) - provides session-related functionality.
- **statePersister**: [CStatePersister](#) - provides the mechanism for persisting global state.
- **urlManager**: [CUrlManager](#) - provides URL parsing and creation functionality.
- **user**: [CWebUser](#) - carries identity-related information about the current user.
- **themeManager**: [CThemeManager](#) - manages themes.

### 2.3.5 Application Life Cycle

When handling a user request, an application will undergo the following life cycle:

1. Pre-initialize the application with [CApplication::preinit\(\)](#);
2. Set up the class autoloader and error handling;
3. Register core application components;
4. Load application configuration;
5. Initialize the application with [CApplication::init\(\)](#)
  - Register application behaviors;
  - Load static application components;
6. Raise an [onBeginRequest](#) event;
7. Process the user request:
  - Collect information about the request;
  - Create a controller;
  - Run the controller;
8. Raise an [onEndRequest](#) event;

## 2.4 Controller

A controller is an instance of `CController` or of a class that extends `CController`. It is created by the application object when the user requests it. When a controller runs, it performs the requested action, which usually brings in the needed models and renders an appropriate view. An action, in its simplest form, is just a controller class method whose name starts with `action`.

A controller has a default action. When the user request does not specify which action to execute, the default action will be executed. By default, the default action is named as `index`. It can be changed by setting the public instance variable, `CController::defaultAction`.

The following code defines a `site` controller, an `index` action (the default action), and a `contact` action:

```
class SiteController extends CController
{
    public function actionIndex()
    {
        // ...
    }

    public function actionContact()
    {
        // ...
    }
}
```

### 2.4.1 Route

Controllers and actions are identified by IDs. A Controller ID is in the format `path/to/xyz`, which corresponds to the controller class file `protected/controllers/path/to/xyzController.php`, where the token `xyz` should be replaced by actual names; e.g. `post` corresponds to `protected/controllers/PostController.php`. Action ID is the action method name without the action prefix. For example, if a controller class contains a method named `actionEdit`, the ID of the corresponding action would be `edit`.

Users request a particular controller and action in terms of route. A route is formed by concatenating a controller ID and an action ID, separated by a slash. For example, the route `post/edit` refers to `PostController` and its `edit` action. By default, the URL `http://hostname/index.php?r=post/edit` would request the `post` controller and the `edit` action.

**Note:** By default, routes are case-sensitive. It is possible to make routes case-insensitive by setting `CUrlManager::caseSensitive` to false in the application configuration. When in case-insensitive mode, make sure you follow the convention that directories containing controller class files are in lowercase, and both `controller map` and `action map` have lowercase keys.

An application can contain `modules`. The route for a controller action inside a module is in the format `moduleID/controllerID/actionID`. For more details, see the [section about modules](#).

### 2.4.2 Controller Instantiation

A controller instance is created when `CWebApplication` handles an incoming request. Given the ID of the controller, the application will use the following rules to determine what the controller class is and where the class file is located.

- If `CWebApplication::catchAllRequest` is specified, a controller will be created based on this property, and the user-specified controller ID will be ignored. This is mainly used to put the application in maintenance mode and display a static notice page.
- If the ID is found in `CWebApplication::controllerMap`, the corresponding controller configuration will be used to create the controller instance.
- If the ID is in the format `'path/to/xyz'`, the controller class name is assumed to be `XyzController` and the corresponding class file is `protected/controllers/path/to/XyzController.php`. For example, a controller ID `admin/user` would be mapped to the controller class `UserController` and the class file `protected/controllers/admin/UserController.php`. If the class file does not exist, a 404 `CHttpException` will be raised.

When `modules` are used, the above process is slightly different. In particular, the application will check whether or not the ID refers to a controller inside a module, and if so, the module instance will be created first, followed by the controller instance.

### 2.4.3 Action

As previously noted, an action can be defined as a method whose name starts with the word `action`. A more advanced technique is to define an action class and ask the controller to instantiate it when requested. This allows actions to be reused and thus introduces more reusability.

To define a new action class, do the following:

```
class UpdateAction extends CAction
{
    public function run()
    {
        // place the action logic here
    }
}
```

To make the controller aware of this action, we override the `actions()` method of our controller class:

```
class PostController extends CController
{
    public function actions()
    {
        return array(
            'edit'=>'application.controllers.post.UpdateAction',
        );
    }
}
```

In the above, we use the path alias `application.controllers.post.UpdateAction` to specify that the action class file is `protected/controllers/post/UpdateAction.php`.

By writing class-based actions, we can organize an application in a modular fashion. For example, the following directory structure may be used to organize the code for controllers:

```
protected/
  controllers/
    PostController.php
    UserController.php
  post/
    CreateAction.php
    ReadAction.php
    UpdateAction.php
  user/
    CreateAction.php
    ListAction.php
    ProfileAction.php
    UpdateAction.php
```

### Action Parameter Binding

Since version 1.1.4, Yii has added support for automatic action parameter binding. That is, a controller action method can define named parameters whose value will be automatically populated from `$_GET` by Yii.

To illustrate how this works, let's assume we need to write a `create` action for `PostController`. The action requires two parameters:

- **category**: an integer indicating the category ID under which the new post will be created;
- **language**: a string indicating the language code that the new post will be in.

We may end up with the following boring code for the purpose of retrieving the needed parameter values from `$_GET`:

```
class PostController extends CController
{
    public function actionCreate()
    {
        if(isset($_GET['category']))
            $category=(int)$_GET['category'];
        else
            throw new CHttpException(404,'invalid request');

        if(isset($_GET['language']))
            $language=$_GET['language'];
        else
            $language='en';

        // ... fun code starts here ...
    }
}
```

Now using the action parameter feature, we can achieve our task more pleasantly:

```
class PostController extends CController
{
    public function actionCreate($category, $language='en')
    {
        $category=(int)$category;

        // ... fun code starts here ...
    }
}
```

```
}  
}
```

Notice that we add two parameters to the action method `actionCreate`. The name of these parameters must be exactly the same as the ones we expect from `$_GET`. The `$language` parameter takes a default value `en` in case the request does not include such a parameter. Because `$category` does not have a default value, if the request does not include a `category` parameter, a [CHttpException](#) (error code 400) will be thrown automatically.

Starting from version 1.1.5, Yii also supports array type detection for action parameters. This is done by PHP type hinting using syntax like the following:

```
class PostController extends CController  
{  
    public function actionCreate(array $categories)  
    {  
        // Yii will make sure that $categories is an array  
    }  
}
```

That is, we add the keyword `array` in front of `$categories` in the method parameter declaration. By doing so, if `$_GET['categories']` is a simple string, it will be converted into an array consisting of that string.

**Note:** If a parameter is declared without the `array` type hint, it means the parameter must be a scalar (i.e., not an array). In this case, passing in an array parameter via `$_GET` would cause an HTTP exception.

Starting from version 1.1.7, automatic parameter binding also works for class-based actions. When the `run()` method of an action class is defined with some parameters, they will be populated with the corresponding named request parameter values. For example,

```
class UpdateAction extends CAction  
{  
    public function run($id)  
    {  
        // $id will be populated with $_GET['id']  
    }  
}
```

### 2.4.4 Filter

Filter is a piece of code that is configured to be executed before and/or after a controller action executes. For example, an access control filter may be executed to ensure that the user is authenticated before executing the requested action; a performance filter may be used to measure the time spent executing the action.

An action can have multiple filters. The filters are executed in the order that they appear in the filter list. A filter can prevent the execution of the action and the rest of the unexecuted filters.

A filter can be defined as a controller class method. The method name must begin with `filter`. For example, a method named `filterAccessControl` defines a filter named `accessControl`. The filter method must have the right signature:

```
public function filterAccessControl($filterChain)
{
    // call $filterChain->run() to continue filter and action execution
}
```

where `$filterChain` is an instance of `CFilterChain` which represents the filter list associated with the requested action. Inside a filter method, we can call `$filterChain->run()` to continue filter and action execution.

A filter can also be an instance of `CFilter` or its child class. The following code defines a new filter class:

```
class PerformanceFilter extends CFilter
{
    protected function preFilter($filterChain)
    {
        // logic being applied before the action is executed
        return true; // false if the action should not be executed
    }

    protected function postFilter($filterChain)
    {
        // logic being applied after the action is executed
    }
}
```

To apply filters to actions, we need to override the `CController::filters()` method. The method should return an array of filter configurations. For example,

```
class PostController extends CController
{
    .....
    public function filters()
    {
        return array(
            'postOnly + edit, create',
            array(
                'application.filters.PerformanceFilter - edit, create',
                'unit'=>'second',
            ),
        );
    }
}
```

The above code specifies two filters: `postOnly` and `PerformanceFilter`. The `postOnly` filter is method-based (the corresponding filter method is defined in `CController` already); while the `PerformanceFilter` filter is object-based. The path alias `application.filters.PerformanceFilter` specifies that the filter class file is `protected/filters/PerformanceFilter`. We use an array to configure `PerformanceFilter` so that it may be used to initialize the property values of the filter object. Here the `unit` property of `PerformanceFilter` will be initialized as `'second'`.

Using the plus and the minus operators, we can specify which actions the filter should and should not be applied to. In the above, the `postOnly` filter will be applied to the `edit` and `create` actions, while `PerformanceFilter` filter will be applied to all actions EXCEPT `edit` and `create`. If neither plus nor minus appears in the filter configuration, the filter will be applied to all actions.

## 2.5 Model

A model is an instance of `CModel` or a class that extends `CModel`. Models are used to keep data and their relevant business rules.

A model represents a single data object. It could be a row in a database table or an html form with user input fields. Each field of the data object is represented by an attribute of the model. The attribute has a label and can be validated against a set of rules.

Yii implements two kinds of models: Form models and active records. They both extend from the same base class, `CModel`.

A form model is an instance of `CFormModel`. Form models are used to store data collected from user input. Such data is often collected, used and then discarded. For example, on a login page, we can use a form model to represent the username and password information



that is provided by an end user. For more details, please refer to [Working with Forms](#)

Active Record (AR) is a design pattern used to abstract database access in an object-oriented fashion. Each AR object is an instance of `CActiveRecord` or of a subclass of that class, representing a single row in a database table. The fields in the row are represented as properties of the AR object. Details about AR can be found in [Active Record](#).

## 2.6 View

A view is a PHP script consisting mainly of user interface elements. It can contain PHP statements, but it is recommended that these statements should not alter data models and should remain relatively simple. In the spirit of separating of logic and presentation, large chunks of logic should be placed in controllers or models rather than in views.

A view has a name which is used to identify the view script file when rendering. The name of a view is the same as the name of its view script. For example, the view name `edit` refers to a view script named `edit.php`. To render a view, call `CController::render()` with the name of the view. The method will look for the corresponding view file under the directory `protected/views/ControllerID`.

Inside the view script, we can access the controller instance using `$this`. We can thus pull in any property of the controller by evaluating `$this->propertyName` in the view.

We can also use the following push approach to pass data to the view:

```
$this->render('edit', array(
    'var1'=>$value1,
    'var2'=>$value2,
));
```

In the above, the `render()` method will extract the second array parameter into variables. As a result, in the view script we can access the local variables `$var1` and `$var2`.

### 2.6.1 Layout

Layout is a special view that is used to decorate views. It usually contains parts of a user interface that are common among several views. For example, a layout may contain a header and a footer, and embed the view in between, like this:

```
.....header here.....
<?php echo $content; ?>
.....footer here.....
```

where `$content` stores the rendering result of the view.

Layout is implicitly applied when calling `render()`. By default, the view script `protected/views/layouts/main.php` is used as the layout. This can be customized by changing either `CWebApplication::layout` or `CController::layout`. To render a view without applying any layout, call `renderPartial()` instead.

### 2.6.2 Widget

A widget is an instance of `CWidget` or a child class of `CWidget`. It is a component that is mainly for presentational purposes. A widget is usually embedded in a view script to generate a complex, yet self-contained user interface. For example, a calendar widget can be used to render a complex calendar user interface. Widgets facilitate better reusability in user interface code.

To use a widget, do as follows in a view script:

```
<?php $this->beginWidget('path.to.WidgetClass'); ?>
...body content that may be captured by the widget...
<?php $this->endWidget(); ?>
```

or

```
<?php $this->widget('path.to.WidgetClass'); ?>
```

The latter is used when the widget does not need any body content.

Widgets can be configured to customize their behavior. This is done by setting their initial property values when calling `CBaseController::beginWidget` or `CBaseController::widget`. For example, when using a `CMaskedTextField` widget, we might like to specify the mask being used. We can do so by passing an array of initial property values as follows, where the array keys are property names and array values are the initial values of the corresponding widget properties:

```
<?php
$this->widget('CMaskedTextField',array(
    'mask'=>'99/99/9999'
));
?>
```

To define a new widget, extend `CWidget` and override its `init()` and `run()` methods:

```
class MyWidget extends CWidget
{
    public function init()
    {
        // this method is called by CController::beginWidget()
    }

    public function run()
    {
        // this method is called by CController::endWidget()
    }
}
```

Like a controller, a widget can also have its own view. By default, widget view files are located under the `views` subdirectory of the directory containing the widget class file. These views can be rendered by calling `CWidget::render()`, similar to that in controller. The only difference is that no layout will be applied to a widget view. Also, `$this` in the view refers to the widget instance instead of the controller instance.

**Tip:** `CWidgetFactory::widgets` can be used to configure widgets on a site-wide basis, allowing much easier base configuration. You can find more details on the [theming page](#)

### 2.6.3 System View

System views refer to the views used by Yii to display error and logging information. For example, when a user requests for a non-existing controller or action, Yii will throw an exception explaining the error. Yii displays the exception using a specific system view.

The naming of system views follows some rules. Names like `errorXXX` refer to views for displaying `CHttpException` with error code `XXX`. For example, if `CHttpException` is raised with error code 404, the `error404` view will be displayed.

Yii provides a set of default system views located under `framework/views`. They can be customized by creating the same-named view files under `protected/views/system`.

## 2.7 Component

Yii applications are built upon components which are objects written to a specification. A component is an instance of `CComponent` or its derived class. Using a component mainly involves accessing its properties and raising/handling its events. The base class `CComponent` specifies how to define properties and events.

### 2.7.1 Component Property

A component property is like an object's public member variable. We can read its value or assign a value to it. For example,

```
$width=$component->textWidth;    // get the textWidth property
$component->enableCaching=true;    // set the enableCaching property
```

To define a component property, we can simply declare a public member variable in the component class. A more flexible way, however, is by defining getter and setter methods like the following:

```
public function getTextWidth()
{
    return $this->_textWidth;
}

public function setTextWidth($value)
{
    $this->_textWidth=$value;
}
```

The above code defines a writable property named `textWidth` (the name is case-insensitive). When reading the property, `getTextWidth()` is invoked and its returned value becomes the property value; Similarly, when writing the property, `setTextWidth()` is invoked. If the setter method is not defined, the property would be read-only and writing it would throw an exception. Using getter and setter methods to define a property has the benefit that additional logic (e.g. performing validation, raising events) can be executed when reading and writing the property.

**Note:** There is a slight difference between a property defined via getter/setter methods and a class member variable. The name of the former is case-insensitive while the latter is case-sensitive.

### 2.7.2 Component Event

Component events are special properties that take methods (called **event handlers**) as their values. Attaching (assigning) a method to an event will cause the method to be invoked automatically at the places where the event is raised. Therefore, the behavior of a component can be modified in a way that may not be foreseen during the development of the component.

A component event is defined by defining a method whose name starts with `on`. Like property names defined via getter/setter methods, event names are case-insensitive. The following code defines an `onClicked` event:

```
public function onClicked($event)
{
    $this->raiseEvent('onClicked', $event);
}
```

where `$event` is an instance of `CEvent` or its child class representing the event parameter.

We can attach a method to this event as follows:

```
$component->onClicked=$callback;
```

where `$callback` refers to a valid PHP callback. It can be a global function or a class method. If the latter, the callback must be given as an array: `array($object, 'methodName')`.

The signature of an event handler must be as follows:

```
function methodName($event)
{
    .....
}
```

where `$event` is the parameter describing the event (it originates from the `raiseEvent()` call). The `$event` parameter is an instance of `CEvent` or its derived class. At the minimum, it contains the information about who raises the event.

An event handler can also be an anonymous function which is supported by PHP 5.3 or above. For example,

```
$component->onClicked=function($event) {
    .....
}
```

If we call `onClicked()` now, the `onClicked` event will be raised (inside `onClicked()`), and the attached event handler will be invoked automatically.

An event can be attached with multiple handlers. When the event is raised, the handlers will be invoked in the order that they are attached to the event. If a handler decides to prevent the rest handlers from being invoked, it can set `$event->handled` to be true.

### 2.7.3 Component Behavior

A component supports the `mixin` pattern and can be attached with one or several behaviors. A *behavior* is an object whose methods can be 'inherited' by its attached component through the means of collecting functionality instead of specialization (i.e., normal class inheritance). A component can be attached with several behaviors and thus achieve 'multiple inheritance'.

Behavior classes must implement the `[IBehavior]` interface. Most behaviors can extend from the `CBehavior` base class. If a behavior needs to be attached to a `model`, it may also extend from `CModelBehavior` or `CActiveRecordBehavior` which implements additional features specific for models.

To use a behavior, it must be attached to a component first by calling the behavior's `[attach()—IBehavior::attach]` method. Then we can call a behavior method via the component:

```
// $name uniquely identifies the behavior in the component
$component->attachBehavior($name,$behavior);
// test() is a method of $behavior
$component->test();
```

An attached behavior can be accessed like a normal property of the component. For example, if a behavior named `tree` is attached to a component, we can obtain the reference to this behavior object using:

```
$behavior=$component->tree;
// equivalent to the following:
// $behavior=$component->asa('tree');
```

A behavior can be temporarily disabled so that its methods are not available via the component. For example,

```
$component->disableBehavior($name);
// the following statement will throw an exception
$component->test();
$component->enableBehavior($name);
// it works now
$component->test();
```

It is possible that two behaviors attached to the same component have methods of the same name. In this case, the method of the first attached behavior will take precedence.

When used together with [events](#), behaviors are even more powerful. A behavior, when being attached to a component, can attach some of its methods to some events of the component. By doing so, the behavior gets a chance to observe or change the normal execution flow of the component.

A behavior's properties can also be accessed via the component it is attached to. The properties include both the public member variables and the properties defined via getters and/or setters of the behavior. For example, if a behavior has a property named `xyz` and the behavior is attached to a component `$a`. Then we can use the expression `$a->xyz` to access the behavior's property.

## 2.8 Module

A module is a self-contained software unit that consists of [models](#), [views](#), [controllers](#) and other supporting components. In many aspects, a module resembles to an [application](#). The main difference is that a module cannot be deployed alone and it must reside inside of an application. Users can access the controllers in a module like they do with normal application controllers.

Modules are useful in several scenarios. For a large-scale application, we may divide it into several modules, each being developed and maintained separately. Some commonly used features, such as user management, comment management, may be developed in terms of modules so that they can be reused easily in future projects.

### 2.8.1 Creating Module

A module is organized as a directory whose name serves as its unique [ID](#). The structure of the module directory is similar to that of the [application base directory](#). The following shows the typical directory structure of a module named `forum`:

```
forum/
  ForumModule.php      the module class file
  components/          containing reusable user components
    views/             containing view files for widgets
  controllers/         containing controller class files
    DefaultController.php the default controller class file
  extensions/          containing third-party extensions
  models/              containing model class files
  views/               containing controller view and layout files
    layouts/           containing layout view files
    default/           containing view files for DefaultController
      index.php        the index view file
```

A module must have a module class that extends from `CWebModule`. The class name is determined using the expression `ucfirst($id).'Module'`, where `$id` refers to the module ID (or the module directory name). The module class serves as the central place for storing information shared among the module code. For example, we can use `CWebModule::params` to store module parameters, and use `CWebModule::components` to share application components at the module level.

**Tip:** We can use the module generator in Gii to create the basic skeleton of a new module.

### 2.8.2 Using Module

To use a module, first place the module directory under `modules` of the [application base directory](#). Then declare the module ID in the `modules` property of the application. For example, in order to use the above `forum` module, we can use the following [application configuration](#):

```
return array(
    .....
    'modules'=>array('forum',...),
    .....
);
```

A module can also be configured with initial property values. The usage is very similar to configuring application components. For example, the `forum` module may have a property named `postPerPage` in its module class which can be configured in the [application configuration](#) as follows:

```
return array(
    .....
    'modules'=>array(
        'forum'=>array(
            'postPerPage'=>20,
        ),
    ),
    .....
);
```

The module instance may be accessed via the `module` property of the currently active controller. Through the module instance, we can then access information that are shared at the module level. For example, in order to access the above `postPerPage` information, we can use the following expression:



```
$postPerPage=Yii::app()->controller->module->postPerPage;  
// or the following if $this refers to the controller instance  
// $postPerPage=$this->module->postPerPage;
```

A controller action in a module can be accessed using the [route](#) `moduleID/controllerID/actionID`. For example, assuming the above `forum` module has a controller named `PostController`, we can use the [route](#) `forum/post/create` to refer to the `create` action in this controller. The corresponding URL for this route would be `http://www.example.com/index.php?r=forum/post/create`.

**Tip:** If a controller is in a sub-directory of `controllers`, we can still use the above [route](#) format. For example, assuming `PostController` is under `forum/controllers/admin`, we can refer to the `create` action using `forum/admin/post/create`.

### 2.8.3 Nested Module

Modules can be nested in unlimited levels. That is, a module can contain another module which can contain yet another module. We call the former *parent module* while the latter *child module*. Child modules must be declared in the [modules](#) property of their parent module, like we declare modules in the application configuration shown as above.

To access a controller action in a child module, we should use the route `parentModuleID/childModuleID/controllerID/actionID`.

## 2.9 Path Alias and Namespace

Yii uses path aliases extensively. A path alias is associated with a directory or file path. It is specified in dot syntax, similar to that of widely adopted namespace format:

```
RootAlias.path.to.target
```

where `RootAlias` is the alias of some existing directory.

By using `YiiBase::getPathOfAlias()`, an alias can be translated to its corresponding path. For example, `system.web.CController` would be translated as `yii/framework/web/CController`.

We can also use `YiiBase::setPathOfAlias()` to define new root path aliases.

### 2.9.1 Root Alias

For convenience, Yii predefines the following root aliases:

- `system`: refers to the Yii framework directory;
- `zii`: refers to the [Zii library](#) directory;
- `application`: refers to the application's [base directory](#);
- `webroot`: refers to the directory containing the [entry script](#) file.
- `ext`: refers to the directory containing all third-party [extensions](#).

Additionally, if an application uses [modules](#), each module will have a predefined root alias that has the same name as the module ID and refers to the module's base path. For example, if an application uses a module whose ID is `users`, a root alias named `users` will be predefined.

### 2.9.2 Importing Classes

Using aliases, it is very convenient to include the definition of a class. For example, if we want to include the `CController` class, we can call the following:

```
Yii::import('system.web.CController');
```

The `import` method differs from `include` and `require` in that it is more efficient. The class definition being imported is actually not included until it is referenced for the first time (implemented via PHP autoloading mechanism). Importing the same namespace multiple times is also much faster than `include_once` and `require_once`.

**Tip:** When referring to a class defined by the Yii framework, we do not need to import or include it. All core Yii classes are pre-imported.

### Using Class Map

Starting from version 1.1.5, Yii allows user classes to be pre-imported via a class mapping mechanism that is also used by core Yii classes. Pre-imported classes can be used anywhere in a Yii application without being explicitly imported or included. This feature is most useful for a framework or library that is built on top of Yii.

To pre-import a set of classes, the following code must be executed before `CWebApplication::run()` is invoked:

```
Yii::$classMap=array(  
    'ClassName1' => 'path/to/ClassName1.php',  
    'ClassName2' => 'path/to/ClassName2.php',  
    .....  
);
```

### 2.9.3 Importing Directories

We can also use the following syntax to import a whole directory so that the class files under the directory can be automatically included when needed.

```
Yii::import('system.web.*');
```

Besides `import`, aliases are also used in many other places to refer to classes. For example, an alias can be passed to `Yii::createComponent()` to create an instance of the corresponding class, even if the class file was not included previously.

### 2.9.4 Namespace

A namespace refers to a logical grouping of some class names so that they can be differentiated from other class names even if their names are the same. Do not confuse path alias with namespace. A path alias is merely a convenient way of naming a file or directory. It has nothing to do with a namespace.

**Tip:** Because PHP prior to 5.3.0 does not support namespace intrinsically, you cannot create instances of two classes who have the same name but with different definitions. For this reason, all Yii framework classes are prefixed with a letter 'C' (meaning 'class') so that they can be differentiated from user-defined classes. It is recommended that the prefix 'C' be reserved for Yii framework use only, and user-defined classes be prefixed with other letters.

### 2.9.5 Namespaced Classes

A namespaced class refers to a class declared within a non-global namespace. For example, the `application\components\GoogleMap` class is declared within the namespace `application\components`. Using namespaced classes requires PHP 5.3.0 or above.

Starting from version 1.1.5, it is possible to use a namespaced class without including it explicitly. For example, we can create a new instance of `application\components\GoogleMap` without including the corresponding class file explicitly. This is made possible with the enhanced Yii class autoloading mechanism.

In order to be able to autoload a namespaced class, the namespace must be named in a way similar to naming a path alias. For example, the class `application\components\GoogleMap` must be stored in a file that can be aliased as `application.components.GoogleMap`.

So to use custom namespace starting with, for example, `\myspace` where classes are located at `/var/www/common/myspace/`, the only thing you should do is to define a path alias like the following:

```
Yii::setPathOfAlias('myspace', '/var/www/common/myspace/');
```

### 2.9.6 Namespaced Controllers

By default Yii uses controllers from the global namespace. These classes are located under `protected/controllers`. You can change this behavior in two different ways: using `controllerMap` and using `controllerNamespace`. The former allows you to use controllers from various namespaces. The latter requires less configuration while setting a common namespace for all controllers.

#### Using `controllerMap`

The best way to change controller map is to use the configuration file (`protected/config/main.php`):

```
// adding "myspace" namespace
Yii::setPathOfAlias('myspace', '/var/www/common/myspace/');

return array(
    'basePath'=>dirname(__FILE__).DIRECTORY_SEPARATOR.'..',
    'name'=>'My Web Application',

    'controllerMap' => array(
        'test' => '\myspace\controllers\TestController',
    ),
);
```

When user tries to load any of the controllers defined in `controllerMap`, Yii loads the specified classes, bypassing the normal controller loading method. In case of `test` Yii

will load the namespaced class `\mynamespace\controllers\TestController` located at `/var/www/common/mynamespace/controllers/TestController.php`.

Note that controller code should be properly namespaced:

```
// define namespace:
namespace mynamespace\controllers;

// since class is now under namespace, global namespace
// should be referenced explicitly using "\":
class TestController extends \CController
{
    public function actionIndex()
    {
        echo 'This is TestController from \mynamespace\controllers';
    }
}
```

### Using controllerNamespace

Since application is the module itself, you can use `controllerNamespace` property in the same way as described in "Namespaced Modules" below.

## 2.9.7 Namespaced Modules

Sometimes it's useful to namespace the whole module. For example, if you want to put `testmodule` under `\mynamespace\modules\testmodule` pointing to `/var/www/common/mynamespace/modules/testmodule` you should first create the following file structure:

```
/var/www/common/mynamespace/modules
testmodule
  controllers
    DefaultController.php
  views
    default
      index.php
    TestmoduleModule.php
```

`index.php` view is the same as in regular module. `TestmoduleModule.php` and `DefaultController.php` are namespaced.

`TestmoduleModule.php`:

```
// define namespace:
namespace mynamespace\modules\testmodule;

// since class is now under namespace, global namespace
// should be referenced explicitly using "\":
class TestmoduleModule extends \CWebModule
{
    // setting non-global controllers namespace (also can be done via config)
    public $controllerNamespace = '\mynamespace\modules\testmodule\controllers';

    // usual module code
}
```

DefaultController.php:

```
<?php
// define namespace:
namespace mynamespace\modules\testmodule\controllers;

// since class is now under namespace, global namespace
// should be referenced explicitly using "\":
class DefaultController extends \Controller
{
    public function actionIndex()
    {
        $this->render('index');
    }
}
```

Now the only thing left is to add our module to the application. The best way to do it is to specify it in the application config file (protected/config/main.php):

```
// adding "mynamespace" namespace
Yii::setPathOfAlias('mynamespace', '/var/www/common/mynamespace/');

return array(
    'basePath'=>dirname(__FILE__).DIRECTORY_SEPARATOR.'..',
    'name'=>'My Web Application',

    'modules'=>array(
        'testmodule' => array(
            'class' => '\mynamespace\modules\testmodule\TestModuleModule',
        ),
    ),
);
```

## 2.10 Conventions

Yii favors conventions over configurations. Follow the conventions and one can create sophisticated Yii applications without writing and managing complex configurations. Of course, Yii can still be customized in nearly every aspect with configurations when needed.

Below we describe conventions that are recommended for Yii programming. For convenience, we assume that `WebRoot` is the directory that a Yii application is installed at.

### 2.10.1 URL

By default, Yii recognizes URLs with the following format:

```
http://hostname/index.php?r=ControllerID/ActionID
```

The `r` GET variable refers to the [route](#) that can be resolved by Yii into controller and action. If `ActionID` is omitted, the controller will take the default action (defined via `CController::defaultAction`); and if `ControllerID` is also omitted (or the `r` variable is absent), the application will use the default controller (defined via `CWebApplication::defaultController`).

With the help of [CUrlManager](#), it is possible to create and recognize more SEO-friendly URLs, such as `http://hostname/ControllerID/ActionID.html`. This feature is covered in detail in [URL Management](#).

### 2.10.2 Code

Yii recommends naming variables, functions and class types in camel case which capitalizes the first letter of each word in the name and joins them without spaces. Variable and function names should have their first word all in lower-case, in order to differentiate from class names (e.g. `$basePath`, `runController()`, `LinkPager`). For private class member variables, it is recommended to prefix their names with an underscore character (e.g. `$_actionList`).

Because namespace is not supported prior to PHP 5.3.0, it is recommended that classes be named in some unique way to avoid name conflict with third-party classes. For this reason, all Yii framework classes are prefixed with letter "C".

A special rule for controller class names is that they must be appended with the word `Controller`. The controller ID is then defined as the class name with first letter in lower case and the word `Controller` truncated. For example, the `PageController` class will have the ID `page`. This rule makes the application more secure. It also makes the URLs related with controllers a bit cleaner (e.g. `/index.php?r=page/index` instead of `/index.`

`php?r=PageController/index).`

### 2.10.3 Configuration

A configuration is an array of key-value pairs. Each key represents the name of a property of the object to be configured, and each value the corresponding property's initial value. For example, `array('name'=>'My application', 'basePath'=>'./protected')` initializes the `name` and `basePath` properties to their corresponding array values.

Any writable properties of an object can be configured. If not configured, the properties will take their default values. When configuring a property, it is worthwhile to read the corresponding documentation so that the initial value can be given properly.

### 2.10.4 File

Conventions for naming and using files depend on their types.

Class files should be named after the public class they contain. For example, the `CController` class is in the `CController.php` file. A public class is a class that may be used by any other classes. Each class file should contain at most one public class. Private classes (classes that are only used by a single public class) may reside in the same file with the public class.

View files should be named after the view name. For example, the `index` view is in the `index.php` file. A view file is a PHP script file that contains HTML and PHP code mainly for presentational purpose.

Configuration files can be named arbitrarily. A configuration file is a PHP script whose sole purpose is to return an associative array representing the configuration.

### 2.10.5 Directory

Yii assumes a default set of directories used for various purposes. Each of them can be customized if needed.

- `WebRoot/protected`: this is the [application base directory](#) holding all security-sensitive PHP scripts and data files. Yii has a default alias named `application` associated with this path. This directory and everything under should be protected from being accessed by Web users. It can be customized via `CWebApplication::basePath`.
- `WebRoot/protected/runtime`: this directory holds private temporary files generated during runtime of the application. This directory must be writable by Web server



process. It can be customized via [CApplication::runtimePath](#).

- `WebRoot/protected/extensions`: this directory holds all third-party extensions. It can be customized via [CApplication::extensionPath](#). Yii has a default alias named `ext` associated with this path.
- `WebRoot/protected/modules`: this directory holds all application [modules](#), each represented as a subdirectory.
- `WebRoot/protected/controllers`: this directory holds all controller class files. It can be customized via [CWebApplication::controllerPath](#).
- `WebRoot/protected/views`: this directory holds all view files, including controller views, layout views and system views. It can be customized via [CWebApplication::viewPath](#).
- `WebRoot/protected/views/ControllerID`: this directory holds view files for a single controller class. Here `ControllerID` stands for the ID of the controller. It can be customized via [CController::viewPath](#).
- `WebRoot/protected/views/layouts`: this directory holds all layout view files. It can be customized via [CWebApplication::layoutPath](#).
- `WebRoot/protected/views/system`: this directory holds all system view files. System views are templates used in displaying exceptions and errors. It can be customized via [CWebApplication::systemViewPath](#).
- `WebRoot/assets`: this directory holds published asset files. An asset file is a private file that may be published to become accessible to Web users. This directory must be writable by Web server process. It can be customized via [CAssetManager::basePath](#).
- `WebRoot/themes`: this directory holds various themes that can be applied to the application. Each subdirectory represents a single theme whose name is the subdirectory name. It can be customized via [CThemeManager::basePath](#).

### 2.10.6 Database

Most Web applications are backed by some database. For best practice, we propose the following naming conventions for database tables and columns. Note that they are not required by Yii.

- Both database tables and columns are named in lower case.
- Words in a name should be separated using underscores (e.g. `product_order`).

- For table names, you may use either singular or plural names, but not both. For simplicity, we recommend using singular names.
- Table names may be prefixed with a common token such as `tbl_`. This is especially useful when the tables of an application coexist in the same database with the tables of another application. The two sets of tables can be readily separate by using different table name prefixes.

## 2.11 Development Workflow

Having described the fundamental concepts of Yii, we show the common workflow for developing a web application using Yii. The workflow assumes that we have done the requirement analysis as well as the necessary design analysis for the application.

1. Create the skeleton directory structure. The `yiic` tool described in [Creating First Yii Application](#) can be used to speed up this step.
2. Configure the [application](#). This is done by modifying the application configuration file. This step may also require writing some application components (e.g. the user component).
3. Create a [model](#) class for each type of data to be managed. The `Gii` tool described in [Creating First Yii Application](#) and in [Automatic Code Generation](#) can be used to automatically generate the [active record](#) class for each interested database table.
4. Create a [controller](#) class for each type of user requests. How to classify user requests depends on the actual requirement. In general, if a model class needs to be accessed by users, it should have a corresponding controller class. The `Gii` tool can automate this step, too.
5. Implement [actions](#) and their corresponding [views](#). This is where the real work needs to be done.
6. Configure necessary action [filters](#) in controller classes.
7. Create [themes](#) if the theming feature is required.
8. Create translated messages if [internationalization](#) is required.
9. Spot data and views that can be cached and apply appropriate [caching](#) techniques.
10. Final [tune up](#) and deployment.

For each of the above steps, test cases may need to be created and performed.

## 2.12 Best MVC Practices

Although Model-View-Controller (MVC) is known by nearly every Web developer, how to properly use MVC in real application development still eludes many people. The central idea behind MVC is **code reusability and separation of concerns**. In this section, we describe some general guidelines on how to better follow MVC when developing a Yii application.

To better explain these guidelines, we assume a Web application consists of several sub-applications, such as

- front end: a public-facing website for normal end users;
- back end: a website that exposes administrative functionality for managing the application. This is usually restricted to administrative staff;
- console: an application consisting of console commands to be run in a terminal window or as scheduled jobs to support the whole application;
- Web API: providing interfaces to third parties for integrating with the application.

The sub-applications may be implemented in terms of [modules](#), or as a Yii application that shares some code with other sub-applications.

### 2.12.1 Model

[Models](#) represent the underlying data structure of a Web application. Models are often shared among different sub-applications of a Web application. For example, a `LoginForm` model may be used by both the front end and the back end of an application; a `News` model may be used by the console commands, Web APIs, and the front/back end of an application. Therefore, models

- should contain properties to represent specific data;
- should contain business logic (e.g. validation rules) to ensure the represented data fulfills the design requirement;
- may contain code for manipulating data. For example, a `SearchForm` model, besides representing the search input data, may contain a `search` method to implement the actual search.

Sometimes, following the last rule above may make a model very fat, containing too much code in a single class. It may also make the model hard to maintain if the code

it contains serves different purposes. For example, a `News` model may contain a method named `getLatestNews` which is only used by the front end; it may also contain a method named `getDeletedNews` which is only used by the back end. This may be fine for an application of small to medium size. For large applications, the following strategy may be used to make models more maintainable:

- Define a `NewsBase` model class which only contains code shared by different sub-applications (e.g. front end, back end);
- In each sub-application, define a `News` model by extending from `NewsBase`. Place all of the code that is specific to the sub-application in this `News` model.

So, if we were to employ this strategy in our above example, we would add a `News` model in the front end application that contains only the `getLatestNews` method, and we would add another `News` model in the back end application, which contains only the `getDeletedNews` method.

In general, models should not contain logic that deals directly with end users. More specifically, models

- should not use `$_GET`, `$_POST`, or other similar variables that are directly tied to the end-user request. Remember that a model may be used by a totally different sub-application (e.g. unit test, Web API) that may not use these variables to represent user requests. These variables pertaining to the user request should be handled by the Controller.
- should avoid embedding HTML or other presentational code. Because presentational code varies according to end user requirements (e.g. front end and back end may show the detail of a news in completely different formats), it is better taken care of by views.

### 2.12.2 View

**Views** are responsible for presenting models in the format that end users desire. In general, views

- should mainly contain presentational code, such as HTML, and simple PHP code to traverse, format and render data;
- should avoid containing code that performs explicit DB queries. Such code is better placed in models.

- should avoid direct access to `$_GET`, `$_POST`, or other similar variables that represent the end user request. This is the controller's job. The view should be focused on the display and layout of the data provided to it by the controller and/or model, but not attempting to access request variables or the database directly.
- may access properties and methods of controllers and models directly. However, this should be done only for the purpose of presentation.

Views can be reused in different ways:

- Layout: common presentational areas (e.g. page header, footer) can be put in a layout view.
- Partial views: use partial views (views that are not decorated by layouts) to reuse fragments of presentational code. For example, we use `_form.php` partial view to render the model input form that is used in both model creation and updating pages.
- Widgets: if a lot of logic is needed to present a partial view, the partial view can be turned into a widget whose class file is the best place to contain this logic. For widgets that generate a lot of HTML markup, it is best to use view files specific to the widget to contain the markup.
- Helper classes: in views we often need some code snippets to do tiny tasks such as formatting data or generating HTML tags. Rather than placing this code directly into the view files, a better approach is to place all of these code snippets in a view helper class. Then, just use the helper class in your view files. Yii provides an example of this approach. Yii has a powerful [CHtml](#) helper class that can produce commonly used HTML code. Helper classes may be put in an [autoloadable directory](#) so that they can be used without explicit class inclusion.

### 2.12.3 Controller

[Controllers](#) are the glue that binds models, views and other components together into a runnable application. Controllers are responsible for dealing directly with end user requests. Therefore, controllers

- may access `$_GET`, `$_POST` and other PHP variables that represent user requests;
- may create model instances and manage their life cycles. For example, in a typical model update action, the controller may first create the model instance; then populate the model with the user input from `$_POST`; after saving the model successfully,

the controller may redirect the user browser to the model detail page. Note that the actual implementation of saving a model should be located in the model instead of the controller.

- should avoid containing embedded SQL statements, which are better kept in models.
- should avoid containing any HTML or any other presentational markup. This is better kept in views.

In a well-designed MVC application, controllers are often very thin, containing probably only a few dozen lines of code; while models are very fat, containing most of the code responsible for representing and manipulating the data. This is because the data structure and business logic represented by models is typically very specific to the particular application, and needs to be heavily customized to meet the specific application requirements; while controller logic often follows a similar pattern across applications and therefore may well be simplified by the underlying framework or the base classes.

# CHAPTER 3

---

## Working with Forms

### 3.1 Working with Form

Collecting user data via HTML forms is one of the major tasks in Web application development. Besides designing forms, developers need to populate the form with existing data or default values, validate user input, display appropriate error messages for invalid input, and save the input to persistent storage. Yii greatly simplifies this workflow with its MVC architecture.

The following steps are typically needed when dealing with forms in Yii:

1. Create a model class representing the data fields to be collected;
2. Create a controller action with code that responds to form submission.
3. Create a form in the view script file associated with the controller action.

In the next subsections, we describe each of these steps in detail.

### 3.2 Creating Model

Before writing the HTML code needed by a form, we should decide what kind of data we are expecting from end users and what rules these data should comply with. A model class can be used to record these information. A model, as defined in the [Model](#) subsection, is the central place for keeping user inputs and validating them.

Depending on how we make use of the user input, we can create two types of model. If the user input is collected, used and then discarded, we would create a [form model](#); if the user input is collected and saved into database, we would use an [active record](#) instead. Both types of model share the same base class [CModel](#) which defines the common interface needed by form.

**Note:** We are mainly using form models in the examples of this section. However, the same can also be applied to [active record](#) models.

### 3.2.1 Defining Model Class

Below we create a `LoginForm` model class used to collect user input on a login page. Because the login information is only used to authenticate the user and does not need to be saved, we create `LoginForm` as a form model.

```
class LoginForm extends CFormModel
{
    public $username;
    public $password;
    public $rememberMe=false;
}
```

Three attributes are declared in `LoginForm`: `$username`, `$password` and `$rememberMe`. They are used to keep the user-entered username and password, and the option whether the user wants to remember his login. Because `$rememberMe` has a default value `false`, the corresponding option when initially displayed in the login form will be unchecked.

**Info:** Instead of calling these member variables properties, we use the name *attributes* to differentiate them from normal properties. An attribute is a property that is mainly used to store data coming from user input or database.

### 3.2.2 Declaring Validation Rules

Once a user submits his inputs and the model gets populated, we need to make sure the inputs are valid before using them. This is done by performing validation of the inputs against a set of rules. We specify the validation rules in the `rules()` method which should return an array of rule configurations.

```
class LoginForm extends CFormModel
{
    public $username;
    public $password;
    public $rememberMe=false;

    private $_identity;
```



```

public function rules()
{
    return array(
        array('username, password', 'required'),
        array('rememberMe', 'boolean'),
        array('password', 'authenticate'),
    );
}

public function authenticate($attribute,$params)
{
    $this->identity=new UserIdentity($this->username,$this->password);
    if(!$this->identity->authenticate())
        $this->addError('password','Incorrect username or password.');
```

The above code specifies that `username` and `password` are both required, `password` should be authenticated, and `rememberMe` should be a boolean.

Each rule returned by `rules()` must be of the following format:

```
array('AttributeList', 'Validator', 'on'=>'ScenarioList', ...additional options)
```

where `AttributeList` is a string of comma-separated attribute names which need to be validated according to the rule; `Validator` specifies what kind of validation should be performed; the `on` parameter is optional which specifies a list of scenarios where the rule should be applied; and additional options are name-value pairs which are used to initialize the corresponding validator's property values.

Since version 1.1.11 it is possible to blacklist scenarios. If you don't want to perform validation for some rule when particular scenarios are active you could specify `except` parameter containing their names. Syntax is the same as for `on` parameter.

List of scenarios (`on` and `except` parameters) could be specified in two different forms which means the same:

```

// arbitrary array with scenario names
'on'=>array('update', 'create'),
// string with scenario names separated with commas (spaces are ignored)
'except'=>'ignore, this, scenarios, at-all',
```

There are three ways to specify `Validator` in a validation rule. First, `Validator` can be the name of a method in the model class, like `authenticate` in the above example. The validator method must be of the following signature:

```
/**
 * @param string $attribute the name of the attribute to be validated
 * @param array $params options specified in the validation rule
 */
public function ValidatorName($attribute,$params) { ... }
```

Second, `Validator` can be the name of a validator class. When the rule is applied, an instance of the validator class will be created to perform the actual validation. The additional options in the rule are used to initialize the instance's attribute values. A validator class must extend from `CValidator`.

Third, `Validator` can be a predefined alias to a validator class. In the above example, the name `required` is the alias to `CRequiredValidator` which ensures the attribute value being validated is not empty. Below is the complete list of predefined validator aliases:

- `boolean`: alias of `CBooleanValidator`, ensuring the attribute has a value that is either `CBooleanValidator::trueValue` or `CBooleanValidator::falseValue`.
- `captcha`: alias of `CCaptchaValidator`, ensuring the attribute is equal to the verification code displayed in a `CAPTCHA`.
- `compare`: alias of `CCompareValidator`, ensuring the attribute is equal to another attribute or constant.
- `email`: alias of `CEmailValidator`, ensuring the attribute is a valid email address.
- `date`: alias of `CDateValidator`, ensuring the attribute represents a valid date, time, or datetime value.
- `default`: alias of `CDefaultValueValidator`, assigning a default value to the specified attributes.
- `exist`: alias of `CExistValidator`, ensuring the attribute value can be found in the specified table column.
- `file`: alias of `CFileValidator`, ensuring the attribute contains the name of an uploaded file.
- `filter`: alias of `CFilterValidator`, transforming the attribute with a filter.
- `in`: alias of `CRangeValidator`, ensuring the data is among a pre-specified list of values.
- `length`: alias of `CStringValidator`, ensuring the length of the data is within certain range.

- `match`: alias of `CRegularExpressionValidator`, ensuring the data matches a regular expression.
- `numerical`: alias of `CNumberValidator`, ensuring the data is a valid number.
- `required`: alias of `CRequiredValidator`, ensuring the attribute is not empty.
- `type`: alias of `CTypeValidator`, ensuring the attribute is of specific data type.
- `unique`: alias of `CUniqueValidator`, ensuring the data is unique in a database table column.
- `url`: alias of `CUrlValidator`, ensuring the data is a valid URL.

Below we list some examples of using the predefined validators:

```
// username is required
array('username', 'required'),
// username must be between 3 and 12 characters
array('username', 'length', 'min'=>3, 'max'=>12),
// when in register scenario, password must match password2
array('password', 'compare', 'compareAttribute'=>'password2', 'on'=>'register'),
// when in login scenario, password must be authenticated
array('password', 'authenticate', 'on'=>'login'),
```

### 3.2.3 Securing Attribute Assignments

After a model instance is created, we often need to populate its attributes with the data submitted by end-users. This can be done conveniently using the following massive assignment:

```
$model=new LoginForm;
if(isset($_POST['LoginForm']))
    $model->attributes=$_POST['LoginForm'];
```

The last statement is called *massive assignment* which assigns every entry in `$_POST['LoginForm']` to the corresponding model attribute. It is equivalent to the following assignments:

```
foreach($_POST['LoginForm'] as $name=>$value)
{
    if($name is a safe attribute)
        $model->$name=$value;
}
```

It is crucial to determine which attributes are safe. For example, if we expose the primary key of a table to be safe, then an attacker could get a chance to modify the primary key of the given record and thus tamper the data he is not authorized to.

### Declaring Safe Attributes

An attribute is considered safe if it appears in a validation rule that is applicable in the given scenario. For example,

```
array('username, password', 'required', 'on'=>'login, register'),  
array('email', 'required', 'on'=>'register'),
```

In the above, the `username` and `password` attributes are required in `login` scenario, while the `username`, `password` and `email` attributes are required in `register` scenario. As a result, if we perform a massive assign when in `login` scenario, only `username` and `password` will be massively assigned since they are the only attributes appearing in the validation rules for `login`. On the other hand, if the scenario is `register`, the three attributes can all be massively assigned.

```
// in login scenario  
$model=new User('login');  
if(isset($_POST['User']))  
    $model->attributes=$_POST['User'];  
  
// in register scenario  
$model=new User('register');  
if(isset($_POST['User']))  
    $model->attributes=$_POST['User'];
```

So why do we use such a policy to determine if an attribute is safe or not? The rationale behind is that if an attribute already has one or several validation rules to check its validity, what else should we worry about it?

It is important to remember that validation rules are used to check user input data rather than the data that we generate in the code (e.g. timestamp, auto-generated primary key). Therefore, DO NOT add validation rules for those attributes which do not expect inputs from end-users.

Sometimes, we want to declare an attribute to be safe, even though we do not really have any specific rule for it. An example is an article's content attribute which can take any user input. We can use the special `safe` rule to achieve this goal:

```
array('content', 'safe')
```

For completeness, there is also an `unsafe` rule which is used to explicitly declare an attribute to be unsafe:

```
array('permission', 'unsafe')
```

The `unsafe` rule is rarely used, and it is an exception to our previous definition of safe attributes.

For data entries that are not safe, we need to assign them to the corresponding attributes using individual assign statements, like the following:

```
$model->permission='admin';  
$model->id=1;
```

### 3.2.4 Triggering Validation

Once a model is populated with user-submitted data, we can call `CModel::validate()` to trigger the data validation process. The method returns a value indicating whether the validation is successful or not. For `CActiveRecord` models, validation may also be automatically triggered when we call its `CActiveRecord::save()` method.

We can set a scenario with the `scenario` property and therewith indicate which set of validation rules should be applied.

Validation is performed in a scenario basis. The `scenario` property specifies which scenario the model is being used in and which set of validation rules should be used. For example, in the `login` scenario, we only want to validate the `username` and `password` inputs of a user model; while in the `register` scenario, we need to validate more inputs, such as `email`, `address`, etc. The following example shows how to perform validation in the `register` scenario:

```
// creates a User model in register scenario. It is equivalent to:  
// $model=new User;  
// $model->scenario='register';  
$model=new User('register');  
  
// populates the input values into the model  
$model->attributes=$_POST['User'];  
  
// performs the validation
```

```
if($model->validate()) // if the inputs are valid
    ...
else
    ...
```

The applicable scenarios that a rule is associated can be specified via the `on` option in the rule. If the `on` option is not set, it means the rule will be used for all scenarios. For example,

```
public function rules()
{
    return array(
        array('username', 'password', 'required'),
        array('password_repeat', 'required', 'on'=>'register'),
        array('password', 'compare', 'on'=>'register'),
    );
}
```

The first rule will be applied in all scenarios, while the next two rules will only be applied in the `register` scenario.

### 3.2.5 Retrieving Validation Errors

Once validation is done, any possible errors will be stored in the model object. We can retrieve the error messages by calling `CModel::getErrors()` and `CModel::getError()`. The difference between the two methods is that the first method will return *all* errors for the specified model attribute while the second method will only return the *first* error.

### 3.2.6 Attribute Labels

When designing a form, we often need to display a label for each input field. The label tells a user what kind of information he is expected to enter into the field. Although we can hardcode a label in a view, it would offer more flexibility and convenience if we specify it in the corresponding model.

By default, `CModel` will simply return the name of an attribute as its label. This can be customized by overriding the `attributeLabels()` method. As we will see in the following subsections, specifying labels in the model allows us to create a form more quickly and powerful.

## 3.3 Creating Action

Once we have a model, we can start to write logic that is needed to manipulate the model. We place this logic inside a controller action. For the login form example, the following code is needed:

```
public function actionLogin()
{
    $model=new LoginForm;
    if(isset($_POST['LoginForm']))
    {
        // collects user input data
        $model->attributes=$_POST['LoginForm'];
        // validates user input and redirect to previous page if validated
        if($model->validate())
            $this->redirect(Yii::app()->user->returnUrl);
    }
    // displays the login form
    $this->render('login',array('model'=>$model));
}
```

In the above, we first create a `LoginForm` model instance; if the request is a POST request (meaning the login form is submitted), we populate `$model` with the submitted data `$_POST['LoginForm']`; we then validate the input and if successful, redirect the user browser to the page that previously needed authentication. If the validation fails, or if the action is initially accessed, we render the `login` view whose content is to be described in the next subsection.

**Tip:** In the login action, we use `Yii::app()->user->returnUrl` to get the URL of the page that previously needed authentication. The component `Yii::app()->user` is of type `CWebUser` (or its child class) which represents user session information (e.g. username, status). For more details, see [Authentication and Authorization](#).

Let's pay special attention to the following PHP statement that appears in the login action:

```
$model->attributes=$_POST['LoginForm'];
```

As we described in [Securing Attribute Assignments](#), this line of code populates the model with the user submitted data. The `attributes` property is defined by `CModel` which expects an array of name-value pairs and assigns each value to the corresponding model

attribute. So if `$_POST['LoginForm']` gives us such an array, the above code would be equivalent to the following lengthy one (assuming every needed attribute is present in the array):

```
$model->username=$_POST['LoginForm']['username'];  
$model->password=$_POST['LoginForm']['password'];  
$model->rememberMe=$_POST['LoginForm']['rememberMe'];
```

**Note:** In order to let `$_POST['LoginForm']` to give us an array instead of a string, we stick to a convention when naming input fields in the view. In particular, for an input field corresponding to attribute `a` of model class `C`, we name it as `C[a]`. For example, we would use `LoginForm[username]` to name the input field corresponding to the `username` attribute.

The remaining task now is to create the `login` view which should contain an HTML form with the needed input fields.

### 3.4 Creating Form

Writing the `login` view is straightforward. We start with a `form` tag whose `action` attribute should be the URL of the `login` action described previously. We then insert labels and input fields for the attributes declared in the `LoginForm` class. At the end we insert a submit button which can be clicked by users to submit the form. All these can be done in pure HTML code.

Yii provides a few helper classes to facilitate view composition. For example, to create a text input field, we can call `CHtml::textField()`; to create a drop-down list, call `CHtml::dropDownList()`.

**Info:** One may wonder what is the benefit of using helpers if they require similar amount of code when compared with plain HTML code. The answer is that the helpers can provide more than just HTML code. For example, the following code would generate a text input field which can trigger form submission if its value is changed by users.

```
CHtml::textField($name,$value,array('submit'=>''));
```

It would otherwise require writing clumsy JavaScript everywhere.

In the following, we use `CHtml` to create the login form. We assume that the variable `$model` represents `LoginForm` instance.



```

<div class="form">
<?php echo CHtml::beginForm(); ?>

    <?php echo CHtml::errorSummary($model); ?>

    <div class="row">
        <?php echo CHtml::activeLabel($model,'username'); ?>
        <?php echo CHtml::activeTextField($model,'username') ?>
    </div>

    <div class="row">
        <?php echo CHtml::activeLabel($model,'password'); ?>
        <?php echo CHtml::activePasswordField($model,'password') ?>
    </div>

    <div class="row rememberMe">
        <?php echo CHtml::activeCheckBox($model,'rememberMe'); ?>
        <?php echo CHtml::activeLabel($model,'rememberMe'); ?>
    </div>

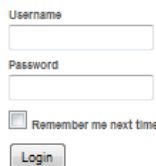
    <div class="row submit">
        <?php echo CHtml::submitButton('Login'); ?>
    </div>

<?php echo CHtml::endForm(); ?>
</div><!-- form -->

```

The above code generates a more dynamic form. For example, `CHtml::activeLabel()` generates a label associated with the specified model attribute. If the attribute has an input error, the label's CSS class will be changed to `error`, which changes the appearance of the label with appropriate CSS styles. Similarly, `CHtml::activeTextField()` generates a text input field for the specified model attribute and changes its CSS class upon any input error.

If we use the CSS style file `form.css` provided by the yiic script, the generated form would be like the following:



**Figure 3.1:** The login page

Starting from version 1.1.1, a new widget called `CActiveForm` is provided to facilitate form

**Figure 3.2:** The login with error page

creation. The widget is capable of supporting seamless and consistent validation on both client and server sides. Using `CActiveForm`, the above view code can be rewritten as:

```
<div class="form">
<?php $form=$this->beginWidget('CActiveForm'); ?>

    <?php echo $form->errorSummary($model); ?>

    <div class="row">
        <?php echo $form->label($model,'username'); ?>
        <?php echo $form->textField($model,'username') ?>
    </div>

    <div class="row">
        <?php echo $form->label($model,'password'); ?>
        <?php echo $form->passwordField($model,'password') ?>
    </div>

    <div class="row rememberMe">
        <?php echo $form->checkBox($model,'rememberMe'); ?>
        <?php echo $form->label($model,'rememberMe'); ?>
    </div>

    <div class="row submit">
        <?php echo CHtml::submitButton('Login'); ?>
    </div>

<?php $this->endWidget(); ?>
</div><!-- form -->
```

### 3.5 Collecting Tabular Input

Sometimes we want to collect user input in a batch mode. That is, the user can enter the information for multiple model instances and submit them all at once. We call this

*tabular input* because the input fields are often presented in an HTML table.

To work with tabular input, we first need to create or populate an array of model instances, depending on whether we are inserting or updating the data. We then retrieve the user input data from the `$_POST` variable and assign it to each model. A slight difference from single model input is that we retrieve the input data using `$_POST['ModelClass'][$i]` instead of `$_POST['ModelClass']`.

```
public function actionBatchUpdate()
{
    // retrieve items to be updated in a batch mode
    // assuming each item is of model class 'Item'
    $items=$this->getItemsToUpdate();
    if(isset($_POST['Item']))
    {
        $valid=true;
        foreach($items as $i=>$item)
        {
            if(isset($_POST['Item'][$i]))
                $item->attributes=$_POST['Item'][$i];
            $valid=$item->validate() && $valid;
        }
        if($valid) // all items are valid
            // ...do something here
    }
    // displays the view to collect tabular input
    $this->render('batchUpdate',array('items'=>$items));
}
```

Having the action ready, we need to work on the `batchUpdate` view to display the input fields in an HTML table.

```
<div class="form">
<?php echo CHtml::beginForm(); ?>
<table>
<tr><th>Name</th><th>Price</th><th>Count</th><th>Description</th></tr>
<?php foreach($items as $i=>$item): ?>
<tr>
<td><?php echo CHtml::activeTextField($item,"[$i]name"); ?></td>
<td><?php echo CHtml::activeTextField($item,"[$i]price"); ?></td>
<td><?php echo CHtml::activeTextField($item,"[$i]count"); ?></td>
<td><?php echo CHtml::activeTextArea($item,"[$i]description"); ?></td>
</tr>
<?php endforeach; ?>
</table>
```

```
<?php echo CHtml::submitButton('Save'); ?>
<?php echo CHtml::endForm(); ?>
</div><!-- form -->
```

Note in the above that we use "`[$i]name`" instead of "`name`" as the second parameter when calling `CHtml::activeTextField`.

If there are any validation errors, the corresponding input fields will be highlighted automatically, just like the single model input we described earlier on.

## 3.6 Using Form Builder

When creating HTML forms, we often find that we are writing a lot of repetitive view code which is difficult to be reused in a different project. For example, for every input field, we need to associate it with a text label and display possible validation errors. To improve the reusability of these code, we can use the form builder feature.

### 3.6.1 Basic Concepts

The Yii form builder uses a `CForm` object to represent the specifications needed to describe an HTML form, including which data models are associated with the form, what kind of input fields there are in the form, and how to render the whole form. Developers mainly need to create and configure this `CForm` object, and then call its rendering method to display the form.

Form input specifications are organized in terms of a form element hierarchy. At the root of the hierarchy, it is the `CForm` object. The root form object maintains its children in two collections: `CForm::buttons` and `CForm::elements`. The former contains the button elements (such as submit buttons, reset buttons), while the latter contains the input elements, static text and sub-forms. A sub-form is a `CForm` object contained in the `CForm::elements` collection of another form. It can have its own data model, `CForm::buttons` and `CForm::elements` collections.

When users submit a form, the data entered into the input fields of the whole form hierarchy are submitted, including those input fields that belong to the sub-forms. `CForm` provides convenient methods that can automatically assign the input data to the corresponding model attributes and perform data validation.

### 3.6.2 Creating a Simple Form

In the following, we show how to use the form builder to create a login form.

First, we write the login action code:

```
public function actionLogin()
{
    $model = new LoginForm;
    $form = new CForm('application.views.site.loginForm', $model);
    if($form->submitted('login') && $form->validate())
        $this->redirect(array('site/index'));
    else
        $this->render('login', array('form'=>$form));
}
```

In the above code, we create a `CForm` object using the specifications pointed to by the path alias `application.views.site.loginForm` (to be explained shortly). The `CForm` object is associated with the `LoginForm` model as described in [Creating Model](#).

As the code reads, if the form is submitted and all inputs are validated without any error, we would redirect the user browser to the `site/index` page. Otherwise, we render the login view with the form.

The path alias `application.views.site.loginForm` actually refers to the PHP file `protected/views/site/loginForm.php`. The file should return a PHP array representing the configuration needed by `CForm`, as shown in the following:

```
return array(
    'title'=>'Please provide your login credential',

    'elements'=>array(
        'username'=>array(
            'type'=>'text',
            'maxlength'=>32,
        ),
        'password'=>array(
            'type'=>'password',
            'maxlength'=>32,
        ),
        'rememberMe'=>array(
            'type'=>'checkbox',
        )
    ),

    'buttons'=>array(
        'login'=>array(
            'type'=>'submit',
            'label'=>'Login',
        ),
    ),
);
```

```
    ),
};
```

The configuration is an associative array consisting of name-value pairs that are used to initialize the corresponding properties of `CForm`. The most important properties to configure, as we aforementioned, are `CForm::elements` and `CForm::buttons`. Each of them takes an array specifying a list of form elements. We will give more details on how to configure form elements in the next sub-section.

Finally, we write the `login` view script, which can be as simple as follows,

```
<h1>Login</h1>

<div class="form">
<?php echo $form; ?>
</div>
```

**Tip:** The above code `echo $form;` is equivalent to `echo $form->render();`. This is because `CForm` implements `__toString` magic method which calls `render()` and returns its result as the string representation of the form object.

### 3.6.3 Specifying Form Elements

Using the form builder, the majority of our effort is shifted from writing view script code to specifying the form elements. In this sub-section, we describe how to specify the `CForm::elements` property. We are not going to describe `CForm::buttons` because its configuration is nearly the same as `CForm::elements`.

The `CForm::elements` property accepts an array as its value. Each array element specifies a single form element which can be an input element, a static text string or a sub-form.

#### Specifying Input Element

An input element mainly consists of a label, an input field, a hint text and an error display. It must be associated with a model attribute. The specification for an input element is represented as a `CFormInputElement` instance. The following code in the `CForm::elements` array specifies a single input element:

```
'username'=>array(
```

```
'type'=>'text',  
'maxlength'=>32,  
)
```

It states that the model attribute is named as `username`, and the input field type is `text` whose `maxlength` attribute is 32.

Any writable property of `CFormInputElement` can be configured like above. For example, we may specify the `hint` option in order to display a hint text, or we may specify the `items` option if the input field is a list box, a drop-down list, a check-box list or a radio-button list. If an option name is not a property of `CFormInputElement`, it will be treated the attribute of the corresponding HTML input element. For example, because `maxlength` in the above is not a property of `CFormInputElement`, it will be rendered as the `maxlength` attribute of the HTML text input field.

The `type` option deserves additional attention. It specifies the type of the input field to be rendered. For example, the `text` type means a normal text input field should be rendered; the `password` type means a password input field should be rendered. `CFormInputElement` recognizes the following built-in types:

- `text`
- `hidden`
- `password`
- `textarea`
- `file`
- `radio`
- `checkbox`
- `listbox`
- `dropdownlist`
- `checkboxlist`
- `radiolist`

Among the above built-in types, we would like to describe a bit more about the usage of those "list" types, which include `dropdownlist`, `checkboxlist` and `radiolist`. These types require setting the `items` property of the corresponding input element. One can do so like the following:

```

'gender'=>array(
  'type'=>'dropdownlist',
  'items'=>User::model()->getGenderOptions(),
  'prompt'=>'Please select:',
),
...

class User extends CActiveRecord
{
  public function getGenderOptions()
  {
    return array(
      0 => 'Male',
      1 => 'Female',
    );
  }
}

```

The above code will generate a drop-down list selector with prompt text "please select:". The selector options include "Male" and "Female", which are returned by the `getGenderOptions` method in the `User` model class.

Besides these built-in types, the `type` option can also take a widget class name or the path alias to it. The widget class must extend from `CInputWidget` or `CJuiInputWidget`. When rendering the input element, an instance of the specified widget class will be created and rendered. The widget will be configured using the specification as given for the input element.

### Specifying Static Text

In many cases, a form may contain some decorational HTML code besides the input fields. For example, a horizontal line may be needed to separate different portions of the form; an image may be needed at certain places to enhance the visual appearance of the form. We may specify these HTML code as static text in the `CForm::elements` collection. To do so, we simply specify a static text string as an array element in the appropriate position in `CForm::elements`. For example,

```

return array(
  'elements'=>array(
    .....
    'password'=>array(
      'type'=>'password',

```



```

        'maxlength'=>32,
    ),

    '<hr />',

    'rememberMe'=>array(
        'type'=>'checkbox',
    )
),
.....
);

```

In the above, we insert a horizontal line between the `password` input and the `rememberMe` input.

Static text is best used when the text content and their position are irregular. If each input element in a form needs to be decorated similarly, we should customize the form rendering approach, as to be explained shortly in this section.

### Specifying Sub-form

Sub-forms are used to divide a lengthy form into several logically connected portions. For example, we may divide user registration form into two sub-forms: login information and profile information. Each sub-form may or may not be associated with a data model. In the user registration form example, if we store user login information and profile information in two separate database tables (and thus two data models), then each sub-form would be associated with a corresponding data model. If we store everything in a single database table, then neither sub-form has a data model because they share the same model with the root form.

A sub-form is also represented as a `CForm` object. In order to specify a sub-form, we should configure the `CForm::elements` property with an element whose type is `form`:

```

return array(
    'elements'=>array(
        .....
        'user'=>array(
            'type'=>'form',
            'title'=>'Login Credential',
            'elements'=>array(
                'username'=>array(
                    'type'=>'text',
                ),
            ),
        ),
    ),
);

```

```

        'password'=>array(
            'type'=>'password',
        ),
        'email'=>array(
            'type'=>'text',
        ),
    ),
),
    'profile'=>array(
        'type'=>'form',
        .....
    ),
    .....
),
    .....
);

```

Like configuring a root form, we mainly need to specify the `CForm::elements` property for a sub-form. If a sub-form needs to be associated with a data model, we can configure its `CForm::model` property as well.

Sometimes, we may want to represent a form using a class other than the default `CForm`. For example, as will show shortly in this section, we may extend `CForm` to customize the form rendering logic. By specifying the input element type to be `form`, a sub-form will automatically be represented as an object whose class is the same as its parent form. If we specify the input element type to be something like `XYZForm` (a string terminated with `Form`), then the sub-form will be represented as a `XYZForm` object.

### 3.6.4 Accessing Form Elements

Accessing form elements is as simple as accessing array elements. The `CForm::elements` property returns a `CFormElementCollection` object, which extends from `CMap` and allows accessing its elements like a normal array. For example, in order to access the `username` element in the login form example, we can use the following code:

```
$username = $form->elements['username'];
```

And to access the `email` element in the user registration form example, we can use

```
$email = $form->elements['user']->elements['email'];
```

Because `CForm` implements array access for its `CForm::elements` property, the above code can be further simplified as:

```
$username = $form['username'];
$email = $form['user']['email'];
```

### 3.6.5 Creating a Nested Form

We already described sub-forms. We call a form with sub-forms a nested form. In this section, we use the user registration form as an example to show how to create a nested form associated with multiple data models. We assume the user credential information is stored as a `User` model, while the user profile information is stored as a `Profile` model.

We first create the `register` action as follows:

```
public function actionRegister()
{
    $form = new CForm('application.views.user.registerForm');
    $form['user']->model = new User;
    $form['profile']->model = new Profile;
    if($form->submitted('register') && $form->validate())
    {
        $user = $form['user']->model;
        $profile = $form['profile']->model;
        if($user->save(false))
        {
            $profile->userID = $user->id;
            $profile->save(false);
            $this->redirect(array('site/index'));
        }
    }

    $this->render('register', array('form'=>$form));
}
```

In the above, we create the form using the configuration specified by `application.views.user.registerForm`. After the form is submitted and validated successfully, we attempt to save the user and profile models. We retrieve the user and profile models by accessing the `model` property of the corresponding sub-form objects. Because the input validation is already done, we call `$user->save(false)` to skip the validation. We do this similarly for the profile model.

Next, we write the form configuration file `protected/views/user/registerForm.php`:

```
return array(
    'elements'=>array(
        'user'=>array(
```

```

        'type'=>'form',
        'title'=>'Login information',
        'elements'=>array(
            'username'=>array(
                'type'=>'text',
            ),
            'password'=>array(
                'type'=>'password',
            ),
            'email'=>array(
                'type'=>'text',
            )
        ),
    ),
),

'profile'=>array(
    'type'=>'form',
    'title'=>'Profile information',
    'elements'=>array(
        'firstName'=>array(
            'type'=>'text',
        ),
        'lastName'=>array(
            'type'=>'text',
        ),
    ),
),
),
),

'buttons'=>array(
    'register'=>array(
        'type'=>'submit',
        'label'=>'Register',
    ),
),
);

```

In the above, when specifying each sub-form, we also specify its `CForm::title` property. The default form rendering logic will enclose each sub-form in a field-set which uses this property as its title.

Finally, we write the simple `register` view script:

```

<h1>Register</h1>

<div class="form">
<?php echo $form; ?>
</div>

```

### 3.6.6 Customizing Form Display

The main benefit of using form builder is the separation of logic (form configuration stored in a separate file) and presentation (`CForm::render` method). As a result, we can customize the form display by either overriding `CForm::render` or providing a partial view to render the form. Both approaches can keep the form configuration intact and can be reused easily.

When overriding `CForm::render`, one mainly needs to traverse through the `CForm::elements` and `CForm::buttons` collections and call the `CFormElement::render` method of each form element. For example,

```
class MyForm extends CForm
{
    public function render()
    {
        $output = $this->renderBegin();

        foreach($this->getElements() as $element)
            $output .= $element->render();

        $output .= $this->renderEnd();

        return $output;
    }
}
```

We may also write a view script `_form` to render a form:

```
<?php
echo $form->renderBegin();

foreach($form->getElements() as $element)
    echo $element->render();

echo $form->renderEnd();
```

To use this view script, we can simply call:

```
<div class="form">
<?php $this->renderPartial('_form', array('form'=>$form)); ?>
</div>
```

If a generic form rendering does not work for a particular form (for example, the form needs some irregular decorations for certain elements), we can do like the following in a view script:

```
some complex UI elements here
```

```
<?php echo $form['username']; ?>
```

```
some complex UI elements here
```

```
<?php echo $form['password']; ?>
```

```
some complex UI elements here
```

In the last approach, the form builder seems not to bring us much benefit, as we still need to write similar amount of form code. It is still beneficial, however, that the form is specified using a separate configuration file as it helps developers to better focus on the logic.

# CHAPTER 4

---

## Working with Databases

### 4.1 Working with Database

Yii provides powerful support for database programming.

Built on top of the PHP Data Objects (PDO) extension, Yii Data Access Objects (DAO) enables accessing to different database management systems (DBMS) in a single uniform interface. Applications developed using Yii DAO can be easily switched to use a different DBMS without the need to modify the data accessing code.

Yii Query Builder offers an object-oriented method for building SQL queries, which helps reduce risk of SQL injection attacks.

And Yii Active Record (AR), implemented as a widely adopted Object-Relational Mapping (ORM) approach, further simplifies database programming. Representing a table in terms of a class and a row an instance, Yii AR eliminates the repetitive task of writing those SQL statements that mainly deal with CRUD (create, read, update and delete) operations.

Although the included Yii database features can handle nearly all database-related tasks, you can still use your own database libraries in your Yii application. As a matter of fact, Yii framework is carefully designed to be used together with other third-party libraries.

### 4.2 Data Access Objects (DAO)

Data Access Objects (DAO) provides a generic API to access data stored in different database management systems (DBMS). As a result, the underlying DBMS can be changed to a different one without requiring change of the code which uses DAO to access the data.

Yii DAO is built on top of [PHP Data Objects \(PDO\)](#) which is an extension providing unified data access to many popular DBMS, such as MySQL, PostgreSQL. Therefore, to use Yii DAO, the PDO extension and the specific PDO database driver (e.g. PDO\_MYSQL) have to be installed.

Yii DAO mainly consists of the following four classes:

- [CDbConnection](#): represents a connection to a database.
- [CDbCommand](#): represents an SQL statement to execute against a database.
- [CDbDataReader](#): represents a forward-only stream of rows from a query result set.
- [CDbTransaction](#): represents a DB transaction.

In the following, we introduce the usage of Yii DAO in different scenarios.

#### 4.2.1 Establishing Database Connection

To establish a database connection, create a [CDbConnection](#) instance and activate it. A data source name (DSN) is needed to specify the information required to connect to the database. A username and password may also be needed to establish the connection. An exception will be raised in case an error occurs during establishing the connection (e.g. bad DSN or invalid username/password).

```
$connection=new CDbConnection($dsn,$username,$password);  
// establish connection. You may try...catch possible exceptions  
$connection->active=true;  
.....  
$connection->active=false; // close connection
```

The format of DSN depends on the PDO database driver in use. In general, a DSN consists of the PDO driver name, followed by a colon, followed by the driver-specific connection syntax. See [PDO documentation](#) for complete information. Below is a list of commonly used DSN formats:

- SQLite: `sqlite:/path/to/dbfile`
- MySQL: `mysql:host=localhost;dbname=testdb`
- PostgreSQL: `pgsql:host=localhost;port=5432;dbname=testdb`
- SQL Server: `mssql:host=localhost;dbname=testdb`
- Oracle: `oci:dbname=//localhost:1521/testdb`

Because [CDbConnection](#) extends from [CApplicationComponent](#), we can also use it as an application component. To do so, configure in a db (or other name) application component in the [application configuration](#) as follows,



```

array(
    .....
    'components'=>array(
        .....
        'db'=>array(
            'class'=>'CdbConnection',
            'connectionString'=>'mysql:host=localhost;dbname=testdb',
            'username'=>'root',
            'password'=>'password',
            'emulatePrepare'=>true, // needed by some MySQL installations
        ),
    ),
)

```

We can then access the DB connection via `Yii::app()->db` which is already activated automatically, unless we explicitly configure `CdbConnection::autoConnect` to be false. Using this approach, the single DB connection can be shared in multiple places in our code.

### 4.2.2 Executing SQL Statements

Once a database connection is established, SQL statements can be executed using `CdbCommand`. One creates a `CdbCommand` instance by calling `CdbConnection::createCommand()` with the specified SQL statement:

```

$connection=Yii::app()->db; // assuming you have configured a "db" connection
// If not, you may explicitly create a connection:
// $connection=new CdbConnection($dsn,$username,$password);
$command=$connection->createCommand($sql);
// if needed, the SQL statement may be updated as follows:
// $command->text=$newSQL;

```

A SQL statement is executed via `CdbCommand` in one of the following two ways:

- `execute()`: performs a non-query SQL statement, such as INSERT, UPDATE and DELETE. If successful, it returns the number of rows that are affected by the execution.
- `query()`: performs an SQL statement that returns rows of data, such as SELECT. If successful, it returns a `CdbDataReader` instance from which one can traverse the resulting rows of data. For convenience, a set of `queryXXX()` methods are also implemented which directly return the query results.

An exception will be raised if an error occurs during the execution of SQL statements.

```
$rowCount=$command->execute(); // execute the non-query SQL
$dataReader=$command->query(); // execute a query SQL
$rows=$command->queryAll(); // query and return all rows of result
$row=$command->queryRow(); // query and return the first row of result
$column=$command->queryColumn(); // query and return the first column of result
$value=$command->queryScalar(); // query and return the first field in the first row
```

### 4.2.3 Fetching Query Results

After `CDbCommand::query()` generates the `CDbDataReader` instance, one can retrieve rows of resulting data by calling `CDbDataReader::read()` repeatedly. One can also use `CDbDataReader` in PHP's `foreach` language construct to retrieve row by row.

```
$dataReader=$command->query();
// calling read() repeatedly until it returns false
while(($row=$dataReader->read())!==false) { ... }
// using foreach to traverse through every row of data
foreach($dataReader as $row) { ... }
// retrieving all rows at once in a single array
$rows=$dataReader->readAll();
```

**Note:** Unlike `query()`, all `queryXXX()` methods return data directly. For example, `queryRow()` returns an array representing the first row of the querying result.

### 4.2.4 Using Transactions

When an application executes a few queries, each reading and/or writing information in the database, it is important to be sure that the database is not left with only some of the queries carried out. A transaction, represented as a `CDbTransaction` instance in Yii, may be initiated in this case:

- Begin the transaction.
- Execute queries one by one. Any updates to the database are not visible to the outside world.
- Commit the transaction. Updates become visible if the transaction is successful.
- If one of the queries fails, the entire transaction is rolled back.

The above workflow can be implemented using the following code:

```

$transaction=$connection->beginTransaction();
try
{
    $connection->createCommand($sql1)->execute();
    $connection->createCommand($sql2)->execute();
    //.... other SQL executions
    $transaction->commit();
}
catch(Exception $e) // an exception is raised if a query fails
{
    $transaction->rollback();
}

```

#### 4.2.5 Binding Parameters

To avoid [SQL injection attacks](#) and to improve performance of executing repeatedly used SQL statements, one can "prepare" an SQL statement with optional parameter placeholders that are to be replaced with the actual parameters during the parameter binding process.

The parameter placeholders can be either named (represented as unique tokens) or unnamed (represented as question marks). Call `CDbCommand::bindParam()` or `CDbCommand::bindValue()` to replace these placeholders with the actual parameters. The parameters do not need to be quoted: the underlying database driver does it for you. Parameter binding must be done before the SQL statement is executed.

```

// an SQL with two placeholders ":username" and ":email"
$sql="INSERT INTO tbl.user (username, email) VALUES(:username,:email)";
$command=$connection->createCommand($sql);
// replace the placeholder ":username" with the actual username value
$command->bindParam(":username",$username,PDO::PARAM_STR);
// replace the placeholder ":email" with the actual email value
$command->bindParam(":email",$email,PDO::PARAM_STR);
$command->execute();
// insert another row with a new set of parameters
$command->bindParam(":username",$username2,PDO::PARAM_STR);
$command->bindParam(":email",$email2,PDO::PARAM_STR);
$command->execute();

```

The methods `bindParam()` and `bindValue()` are very similar. The only difference is that the former binds a parameter with a PHP variable reference while the latter with a value. For parameters that represent large blocks of data memory, the former is preferred for performance consideration.

For more details about binding parameters, see the [relevant PHP documentation](#).

### 4.2.6 Binding Columns

When fetching query results, one can also bind columns with PHP variables so that they are automatically populated with the latest data each time a row is fetched.

```
$sql="SELECT username, email FROM tbl_user";
$dataReader=$connection->createCommand($sql)->query();
// bind the 1st column (username) with the $username variable
$dataReader->bindColumn(1,$username);
// bind the 2nd column (email) with the $email variable
$dataReader->bindColumn(2,$email);
while($dataReader->read()!==false)
{
    // $username and $email contain the username and email in the current row
}
```

### 4.2.7 Using Table Prefix

Yii provides integrated support for using table prefix. Table prefix means a string that is prepended to the names of the tables in the currently connected database. It is mostly used in a shared hosting environment where multiple applications share a single database and use different table prefixes to differentiate from each other. For example, one application could use `tbl_` as prefix while the other `yii_`.

To use table prefix, configure the `CDbConnection::tablePrefix` property to be the desired table prefix. Then, in SQL statements use `{{TableName}}` to refer to table names, where `TableName` means the table name without prefix. For example, if the database contains a table named `tbl_user` where `tbl_` is configured as the table prefix, then we can use the following code to query about users:

```
$sql='SELECT * FROM {{user}}';
$users=$connection->createCommand($sql)->queryAll();
```

## 4.3 Query Builder

The Yii Query Builder provides an object-oriented way of writing SQL statements. It allows developers to use class methods and properties to specify individual parts of a SQL statement. It then assembles different parts into a valid SQL statement that can be further executed by calling the DAO methods as described in [Data Access Objects](#). The following shows a typical usage of the Query Builder to build a SELECT SQL statement:

```
$user = Yii::app()->db->createCommand()
```

```
->select('id, username, profile')
->from('tbl_user u')
->join('tbl_profile p', 'u.id=p.user_id')
->where('id=:id', array(':id'=>$id))
->queryRow();
```

The Query Builder is best used when you need to assemble a SQL statement procedurally, or based on some conditional logic in your application. The main benefits of using the Query Builder include:

- It allows building complex SQL statements programmatically.
- It automatically quotes table names and column names to prevent conflict with SQL reserved words and special characters.
- It also quotes parameter values and uses parameter binding when possible, which helps reduce risk of SQL injection attacks.
- It offers certain degree of DB abstraction, which simplifies migration to different DB platforms.

It is not mandatory to use the Query Builder. In fact, if your queries are simple, it is easier and faster to directly write SQL statements.

**Note:** Query builder cannot be used to modify an existing query specified as a SQL statement. For example, the following code will not work:

```
$command = Yii::app()->db->createCommand('SELECT * FROM tbl_user');
// the following line will NOT append WHERE clause to the above SQL
$command->where('id=:id', array(':id'=>$id));
```

In other words, do not mix the usage of plain SQL and query builder.

#### 4.3.1 Preparing Query Builder

The Yii Query Builder is provided in terms of [CDbCommand](#), the main DB query class described in [Data Access Objects](#).

To start using the Query Builder, we create a new instance of [CDbCommand](#) as follows,

```
$command = Yii::app()->db->createCommand();
```

That is, we use `Yii::app()->db` to get the DB connection, and then call `CDbConnection::createCommand()` to create the needed command instance.

Note that instead of passing a whole SQL statement to the `createCommand()` call as we do in [Data Access Objects](#), we leave it empty. This is because we will build individual parts of the SQL statement using the Query Builder methods explained in the following.

### 4.3.2 Building Data Retrieval Queries

Data retrieval queries refer to SELECT SQL statements. The query builder provides a set of methods to build individual parts of a SELECT statement. Because all these methods return the `CDbCommand` instance, we can call them using method chaining, as shown in the example at the beginning of this section.

- `select()`: specifies the SELECT part of the query
- `selectDistinct()`: specifies the SELECT part of the query and turns on the DISTINCT flag
- `from()`: specifies the FROM part of the query
- `where()`: specifies the WHERE part of the query
- `andWhere()`: appends condition to the WHERE part of the query with AND operator
- `orWhere()`: appends condition to the WHERE part of the query with OR operator
- `join()`: appends an inner join query fragment
- `leftJoin()`: appends a left outer join query fragment
- `rightJoin()`: appends a right outer join query fragment
- `crossJoin()`: appends a cross join query fragment
- `naturalJoin()`: appends a natural join query fragment
- `group()`: specifies the GROUP BY part of the query
- `having()`: specifies the HAVING part of the query
- `order()`: specifies the ORDER BY part of the query
- `limit()`: specifies the LIMIT part of the query
- `offset()`: specifies the OFFSET part of the query

- `union()`: appends a UNION query fragment

In the following, we explain how to use these query builder methods. For simplicity, we assume the underlying database is MySQL. Note that if you are using other DBMS, the table/column/value quoting shown in the examples may be different.

### `select()`

```
function select($columns='*')
```

The `select()` method specifies the SELECT part of a query. The `$columns` parameter specifies the columns to be selected, which can be either a string representing comma-separated columns, or an array of column names. Column names can contain table prefixes and/or column aliases. The method will automatically quote the column names unless a column contains some parenthesis (which means the column is given as a DB expression).

Below are some examples:

```
// SELECT *
select()
// SELECT 'id', 'username'
select('id, username')
// SELECT 'tbl_user`.`id', 'username' AS 'name'
select('tbl_user.id, username as name')
// SELECT 'id', 'username'
select(array('id', 'username'))
// SELECT 'id', count(*) as num
select(array('id', 'count(*) as num'))
```

### `selectDistinct()`

```
function selectDistinct($columns)
```

The `selectDistinct()` method is similar as `select()` except that it turns on the DISTINCT flag. For example, `selectDistinct('id, username')` will generate the following SQL:

```
SELECT DISTINCT 'id', 'username'
```

## from()

```
function from($tables)
```

The `from()` method specifies the FROM part of a query. The `$tables` parameter specifies which tables to be selected from. This can be either a string representing comma-separated table names, or an array of table names. Table names can contain schema prefixes (e.g. `public.tbl_user`) and/or table aliases (e.g. `tbl_user u`). The method will automatically quote the table names unless it contains some parenthesis (which means the table is given as a sub-query or DB expression).

Below are some examples:

```
// FROM 'tbl_user'
from('tbl_user')
// FROM 'tbl_user' 'u', 'public'.tbl_profile 'p'
from('tbl_user u, public.tbl_profile p')
// FROM 'tbl_user', 'tbl_profile'
from(array('tbl_user', 'tbl_profile'))
// FROM 'tbl_user', (select * from tbl_profile) p
from(array('tbl_user', '(select * from tbl_profile) p'))
```

## where()

```
function where($conditions, $params=array())
```

The `where()` method specifies the WHERE part of a query. The `$conditions` parameter specifies query conditions while `$params` specifies the parameters to be bound to the whole query. The `$conditions` parameter can be either a string (e.g. `id=1`) or an array of the format:

```
array(operator, operand1, operand2, ...)
```

where `operator` can be any of the following:

- **and**: the operands should be concatenated together using AND. For example, `array('and', 'id=1', 'id=2')` will generate `id=1 AND id=2`. If an operand is an array, it will be converted into a string using the same rules described here. For example, `array('and', 'type=1', array('or', 'id=1', 'id=2'))` will generate `type=1 AND (id=1 OR id=2)`. The method will NOT do any quoting or escaping.



- **or**: similar as the **and** operator except that the operands are concatenated using **OR**.
- **in**: operand 1 should be a column or DB expression, and operand 2 be an array representing the range of the values that the column or DB expression should be in. For example, `array('in', 'id', array(1,2,3))` will generate `id IN (1,2,3)`. The method will properly quote the column name and escape values in the range.
- **not in**: similar as the **in** operator except that **IN** is replaced with **NOT IN** in the generated condition.
- **like**: operand 1 should be a column or DB expression, and operand 2 be a string or an array representing the range of the values that the column or DB expression should be like. For example, `array('like', 'name', '%tester%')` will generate `name LIKE '%tester%'`. When the value range is given as an array, multiple **LIKE** predicates will be generated and concatenated using **AND**. For example, `array('like', 'name', array('%test%', '%sample%'))` will generate `name LIKE '%test%' AND name LIKE '%sample%'`. The method will properly quote the column name and escape values in the range.
- **not like**: similar as the **like** operator except that **LIKE** is replaced with **NOT LIKE** in the generated condition.
- **or like**: similar as the **like** operator except that **OR** is used to concatenated several **LIKE** predicates.
- **or not like**: similar as the **not like** operator except that **OR** is used to concatenated several **NOT LIKE** predicates.

Below are some examples of using **where**:

```
// WHERE id=1 or id=2
where('id=1 or id=2')
// WHERE id=:id1 or id=:id2
where('id=:id1 or id=:id2', array(':id1'=>1, ':id2'=>2))
// WHERE id=1 OR id=2
where(array('or', 'id=1', 'id=2'))
// WHERE id=1 AND (type=2 OR type=3)
where(array('and', 'id=1', array('or', 'type=2', 'type=3'))))
// WHERE 'id' IN (1, 2)
where(array('in', 'id', array(1, 2)))
// WHERE 'id' NOT IN (1, 2)
where(array('not in', 'id', array(1,2)))
// WHERE 'name' LIKE '%Qiang%'
where(array('like', 'name', '%Qiang%'))
// WHERE 'name' LIKE '%Qiang' AND 'name' LIKE '%Xue'
```

```

where(array('like', 'name', array('%Qiang', '%Xue')))
// WHERE 'name' LIKE '%Qiang' OR 'name' LIKE '%Xue'
where(array('or like', 'name', array('%Qiang', '%Xue')))
// WHERE 'name' NOT LIKE '%Qiang%'
where(array('not like', 'name', '%Qiang%'))
// WHERE 'name' NOT LIKE '%Qiang%' OR 'name' NOT LIKE '%Xue%'
where(array('or not like', 'name', array('%Qiang%', '%Xue%')))

```

Please note that when the operator contains `like`, we have to explicitly specify the wildcard characters (such as `%` and `_`) in the patterns. If the patterns are from user input, we should also use the following code to escape the special characters to prevent them from being treated as wildcards:

```

$keyword=$_GET['q'];
// escape % and _ characters
$keyword=strtr($keyword, array('%'=>'\\%', '_'=>'\\_'));
$command->where(array('like', 'title', '%'.$keyword.'%'));

```

## andWhere()

```
function andWhere($conditions, $params=array())
```

The `addWhere()` method appends given condition to the `WHERE` part of a query with `AND` operator. Behavior of this method is almost the same as `where()` except it appends condition not replaces it. Refer to the `where()` documentation for more information on parameters of this method.

## orWhere()

```
function orWhere($conditions, $params=array())
```

The `orWhere()` method appends given condition to the `WHERE` part of a query with `OR` operator. Behavior of this method is almost the same as `where()` except it appends condition not replaces it. Refer to the `where()` documentation for more information on parameters of this method.

## order()

```
function order($columns)
```

The `order()` method specifies the ORDER BY part of a query. The `$columns` parameter specifies the columns to be ordered by, which can be either a string representing comma-separated columns and order directions (ASC or DESC), or an array of columns and order directions. Column names can contain table prefixes. The method will automatically quote the column names unless a column contains some parenthesis (which means the column is given as a DB expression).

Below are some examples:

```
// ORDER BY 'name', 'id' DESC
order('name, id desc')
// ORDER BY 'tbl_profile`.`name`, 'id' DESC
order(array('tbl_profile.name', 'id desc'))
```

### `limit()` and `offset()`

```
function limit($limit, $offset=null)
function offset($offset)
```

The `limit()` and `offset()` methods specify the LIMIT and OFFSET part of a query. Note that some DBMS may not support LIMIT and OFFSET syntax. In this case, the Query Builder will rewrite the whole SQL statement to simulate the function of limit and offset.

Below are some examples:

```
// LIMIT 10
limit(10)
// LIMIT 10 OFFSET 20
limit(10, 20)
// OFFSET 20
offset(20)
```

### `join()` and its variants

```
function join($table, $conditions, $params=array())
function leftJoin($table, $conditions, $params=array())
function rightJoin($table, $conditions, $params=array())
function crossJoin($table)
function naturalJoin($table)
```

The `join()` method and its variants specify how to join with other tables using INNER JOIN, LEFT OUTER JOIN, RIGHT OUTER JOIN, CROSS JOIN, or NATURAL JOIN. The `$table` parameter

specifies which table to be joined with. The table name can contain schema prefix and/or alias. The method will quote the table name unless it contains a parenthesis meaning it is either a DB expression or sub-query. The `$conditions` parameter specifies the join condition. Its syntax is the same as that in `where()`. And `$params` specifies the parameters to be bound to the whole query.

Note that unlike other query builder methods, each call of a join method will be appended to the previous ones.

Below are some examples:

```
// JOIN 'tbl_profile' ON user_id=id
join('tbl_profile', 'user_id=id')
// LEFT JOIN 'pub'. 'tbl_profile' 'p' ON p.user_id=id AND type=1
leftJoin('pub.tbl_profile p', 'p.user_id=id AND type=:type', array(':type'=>1))
```

## group()

```
function group($columns)
```

The `group()` method specifies the GROUP BY part of a query. The `$columns` parameter specifies the columns to be grouped by, which can be either a string representing comma-separated columns, or an array of columns. Column names can contain table prefixes. The method will automatically quote the column names unless a column contains some parenthesis (which means the column is given as a DB expression).

Below are some examples:

```
// GROUP BY 'name', 'id'
group('name, id')
// GROUP BY 'tbl_profile'. 'name', 'id'
group(array('tbl_profile.name', 'id'))
```

## having()

```
function having($conditions, $params=array())
```

The `having()` method specifies the HAVING part of a query. Its usage is the same as `where()`.

Below are some examples:

```
// HAVING id=1 or id=2
having('id=1 or id=2')
// HAVING id=1 OR id=2
having(array('or', 'id=1', 'id=2'))
```

### union()

```
function union($sql)
```

The `union()` method specifies the UNION part of a query. It appends `$sql` to the existing SQL using UNION operator. Calling `union()` multiple times will append multiple SQLs to the existing SQL.

Below are some examples:

```
// UNION (select * from tbl_profile)
union('select * from tbl_profile')
```

### Executing Queries

After calling the above query builder methods to build a query, we can call the DAO methods as described in [Data Access Objects](#) to execute the query. For example, we can call `CDbCommand::queryRow()` to obtain a row of result, or `CDbCommand::queryAll()` to get all rows at once. Example:

```
$users = Yii::app()->db->createCommand()
    ->select('*')
    ->from('tbl_user')
    ->queryAll();
```

### Retrieving SQLs

Besides executing a query built by the Query Builder, we can also retrieve the corresponding SQL statement. This can be done by calling `CDbCommand::getText()`.

```
$sql = Yii::app()->db->createCommand()
    ->select('*')
    ->from('tbl_user')
    ->text;
```

If there are any parameters to be bound to the query, they can be retrieved via the `CDbCommand::params` property.

### Alternative Syntax for Building Queries

Sometimes, using method chaining to build a query may not be the optimal choice. The Yii Query Builder allows a query to be built using simple object property assignments. In particular, for each query builder method, there is a corresponding property that has the same name. Assigning a value to the property is equivalent to calling the corresponding method. For example, the following two statements are equivalent, assuming `$command` represents a `CDbCommand` object:

```
$command->select(array('id', 'username'));  
$command->select = array('id', 'username');
```

Furthermore, the `CDbConnection::createCommand()` method can take an array as the parameter. The name-value pairs in the array will be used to initialize the properties of the created `CDbCommand` instance. This means, we can use the following code to build a query:

```
$row = Yii::app()->db->createCommand(array(  
    'select' => array('id', 'username'),  
    'from' => 'tbl_user',  
    'where' => 'id=id',  
    'params' => array(':id'=>1),  
))->queryRow();
```

### Building Multiple Queries

A `CDbCommand` instance can be reused multiple times to build several queries. Before building a new query, however, the `CDbCommand::reset()` method must be invoked to clean up the previous query. For example:

```
$command = Yii::app()->db->createCommand();  
$users = $command->select('*')->from('tbl_users')->queryAll();  
$command->reset(); // clean up the previous query  
$posts = $command->select('*')->from('tbl_posts')->queryAll();
```

### 4.3.3 Building Data Manipulation Queries

Data manipulation queries refer to SQL statements for inserting, updating and deleting data in a DB table. Corresponding to these queries, the query builder provides `insert`, `update` and `delete` methods, respectively. Unlike the `SELECT` query methods described above, each of these data manipulation query methods will build a complete SQL statement and execute it immediately.

- `insert()`: inserts a row into a table
- `update()`: updates the data in a table
- `delete()`: deletes the data from a table

Below we describe these data manipulation query methods.

#### `insert()`

```
function insert($table, $columns)
```

The `insert()` method builds and executes an `INSERT` SQL statement. The `$table` parameter specifies which table to be inserted into, while `$columns` is an array of name-value pairs specifying the column values to be inserted. The method will quote the table name properly and will use parameter-binding for the values to be inserted.

Below is an example:

```
// build and execute the following SQL:
// INSERT INTO 'tbl_user' ('name', 'email') VALUES (:name, :email)
$command->insert('tbl_user', array(
    'name'=>'Tester',
    'email'=>'tester@example.com',
));
```

#### `update()`

```
function update($table, $columns, $conditions='', $params=array())
```

The `update()` method builds and executes an `UPDATE` SQL statement. The `$table` parameter specifies which table to be updated; `$columns` is an array of name-value pairs

specifying the column values to be updated; `$conditions` and `$params` are like in `where()`, which specify the WHERE clause in the UPDATE statement. The method will quote the table name properly and will use parameter-binding for the values to be updated.

Below is an example:

```
// build and execute the following SQL:
// UPDATE 'tbl_user' SET 'name'=:name WHERE id=:id
$command->update('tbl_user', array(
    'name'=>'Tester',
), 'id=:id', array(':id'=>1));
```

### `delete()`

```
function delete($table, $conditions='', $params=array())
```

The `delete()` method builds and executes a DELETE SQL statement. The `$table` parameter specifies which table to delete from; `$conditions` and `$params` are like in `where()`, which specify the WHERE clause in the DELETE statement. The method will quote the table name properly.

Below is an example:

```
// build and execute the following SQL:
// DELETE FROM 'tbl_user' WHERE id=:id
$command->delete('tbl_user', 'id=:id', array(':id'=>1));
```

### 4.3.4 Building Schema Manipulation Queries

Besides normal data retrieval and manipulation queries, the query builder also offers a set of methods for building and executing SQL queries that can manipulate the schema of a database. In particular, it supports the following queries:

- `createTable()`: creates a table
- `renameTable()`: renames a table
- `dropTable()`: drops a table
- `truncateTable()`: truncates a table
- `addColumn()`: adds a table column



- `renameColumn()`: renames a table column
- `alterColumn()`: alters a table column
- `dropColumn()`: drops a table column
- `createIndex()`: creates an index
- `dropIndex()`: drops an index

**Info:** Although the actual SQL statements for manipulating database schema vary widely across different DBMS, the query builder attempts to provide a uniform interface for building these queries. This simplifies the task of migrating a database from one DBMS to another.

### Abstract Data Types

The query builder introduces a set of abstract data types that can be used in defining table columns. Unlike the physical data types that are specific to particular DBMS and are quite different in different DBMS, the abstract data types are independent of DBMS. When abstract data types are used in defining table columns, the query builder will convert them into the corresponding physical data types.

The following abstract data types are supported by the query builder.

- `pk`: a generic primary key type, will be converted into `int(11) NOT NULL AUTO_INCREMENT PRIMARY KEY` for MySQL;
- `string`: string type, will be converted into `varchar(255)` for MySQL;
- `text`: text type (long string), will be converted into `text` for MySQL;
- `integer`: integer type, will be converted into `int(11)` for MySQL;
- `float`: floating number type, will be converted into `float` for MySQL;
- `decimal`: decimal number type, will be converted into `decimal` for MySQL;
- `datetime`: datetime type, will be converted into `datetime` for MySQL;
- `timestamp`: timestamp type, will be converted into `timestamp` for MySQL;
- `time`: time type, will be converted into `time` for MySQL;

- **date**: date type, will be converted into `date` for MySQL;
- **binary**: binary data type, will be converted into `blob` for MySQL;
- **boolean**: boolean type, will be converted into `tinyint(1)` for MySQL;
- **money**: money/currency type, will be converted into `decimal(19,4)` for MySQL. This type has been available since version 1.1.8.

### `createTable()`

```
function createTable($table, $columns, $options=null)
```

The `createTable()` method builds and executes a SQL statement for creating a table. The `$table` parameter specifies the name of the table to be created. The `$columns` parameter specifies the columns in the new table. They must be given as name-definition pairs (e.g. `'username'=>'string'`). The `$options` parameter specifies any extra SQL fragment that should be appended to the generated SQL. The query builder will quote the table name as well as the column names properly.

When specifying a column definition, one can use an abstract data type as described above. The query builder will convert the abstract data type into the corresponding physical data type, according to the currently used DBMS. For example, `string` will be converted into `varchar(255)` for MySQL.

A column definition can also contain non-abstract data type or specifications. They will be put in the generated SQL without any change. For example, `point` is not an abstract data type, and if used in a column definition, it will appear as is in the resulting SQL; and `string NOT NULL` will be converted into `varchar(255) NOT NULL` (i.e., only the abstract type `string` is converted).

Below is an example showing how to create a table:

```
// CREATE TABLE 'tbl_user' (
//     'id' int(11) NOT NULL AUTO_INCREMENT PRIMARY KEY,
//     'username' varchar(255) NOT NULL,
//     'location' point
// ) ENGINE=InnoDB
createTable('tbl_user', array(
    'id' => 'pk',
    'username' => 'string NOT NULL',
    'location' => 'point',
), 'ENGINE=InnoDB')
```

### renameTable()

```
function renameTable($table, $newName)
```

The `renameTable()` method builds and executes a SQL statement for renaming a table. The `$table` parameter specifies the name of the table to be renamed. The `$newName` parameter specifies the new name of the table. The query builder will quote the table names properly.

Below is an example showing how to rename a table:

```
// RENAME TABLE 'tbl_users' TO 'tbl_user'
renameTable('tbl_users', 'tbl_user')
```

### dropTable()

```
function dropTable($table)
```

The `dropTable()` method builds and executes a SQL statement for dropping a table. The `$table` parameter specifies the name of the table to be dropped. The query builder will quote the table name properly.

Below is an example showing how to drop a table:

```
// DROP TABLE 'tbl_user'
dropTable('tbl_user')
```

### truncateTable()

```
function truncateTable($table)
```

The `truncateTable()` method builds and executes a SQL statement for truncating a table. The `$table` parameter specifies the name of the table to be truncated. The query builder will quote the table name properly.

Below is an example showing how to truncate a table:

```
// TRUNCATE TABLE 'tbl_user'
truncateTable('tbl_user')
```

### **addColumn()**

```
function addColumn($table, $column, $type)
```

The `addColumn()` method builds and executes a SQL statement for adding a new table column. The `$table` parameter specifies the name of the table that the new column will be added to. The `$column` parameter specifies the name of the new column. And `$type` specifies the definition of the new column. Column definition can contain abstract data type, as described in the subsection of "createTable". The query builder will quote the table name as well as the column name properly.

Below is an example showing how to add a table column:

```
// ALTER TABLE 'tbl_user' ADD 'email' varchar(255) NOT NULL
addColumn('tbl_user', 'email', 'string NOT NULL')
```

### **dropColumn()**

```
function dropColumn($table, $column)
```

The `dropColumn()` method builds and executes a SQL statement for dropping a table column. The `$table` parameter specifies the name of the table whose column is to be dropped. The `$column` parameter specifies the name of the column to be dropped. The query builder will quote the table name as well as the column name properly.

Below is an example showing how to drop a table column:

```
// ALTER TABLE 'tbl_user' DROP COLUMN 'location'
dropColumn('tbl_user', 'location')
```

### **renameColumn()**

```
function renameColumn($table, $name, $newName)
```

The `renameColumn()` method builds and executes a SQL statement for renaming a table column. The `$table` parameter specifies the name of the table whose column is to be renamed. The `$name` parameter specifies the old column name. And `$newName` specifies the new column name. The query builder will quote the table name as well as the column names properly.

Below is an example showing how to rename a table column:

```
// ALTER TABLE 'tbl_users' CHANGE 'name' 'username' varchar(255) NOT NULL
renameColumn('tbl_user', 'name', 'username')
```

### **alterColumn()**

```
function alterColumn($table, $column, $type)
```

The `alterColumn()` method builds and executes a SQL statement for altering a table column. The `$table` parameter specifies the name of the table whose column is to be altered. The `$column` parameter specifies the name of the column to be altered. And `$type` specifies the new definition of the column. Column definition can contain abstract data type, as described in the subsection of "createTable". The query builder will quote the table name as well as the column name properly.

Below is an example showing how to alter a table column:

```
// ALTER TABLE 'tbl_user' CHANGE 'username' 'username' varchar(255) NOT NULL
alterColumn('tbl_user', 'username', 'string NOT NULL')
```

### **addForeignKey()**

```
function addForeignKey($name, $table, $columns,
    $refTable, $refColumns, $delete=null, $update=null)
```

The `addForeignKey()` method builds and executes a SQL statement for adding a foreign key constraint to a table. The `$name` parameter specifies the name of the foreign key. The `$table` and `$columns` parameters specify the table name and column name that the foreign key is about. If there are multiple columns, they should be separated by comma characters. The `$refTable` and `$refColumns` parameters specify the table name and column name that the foreign key references. The `$delete` and `$update` parameters specify the ON DELETE and ON UPDATE options in the SQL statement, respectively. Most DBMS support these options: RESTRICT, CASCADE, NO ACTION, SET DEFAULT, SET NULL. The query builder will properly quote the table name, index name and column name(s).

Below is an example showing how to add a foreign key constraint,

```
// ALTER TABLE 'tbl_profile' ADD CONSTRAINT 'fk_profile_user_id'
```

```
// FOREIGN KEY ('user_id') REFERENCES 'tbl_user' ('id')
// ON DELETE CASCADE ON UPDATE CASCADE
addForeignKey('fk_profile_user_id', 'tbl_profile', 'user_id',
    'tbl_user', 'id', 'CASCADE', 'CASCADE')
```

## dropForeignKey()

```
function dropForeignKey($name, $table)
```

The `dropForeignKey()` method builds and executes a SQL statement for dropping a foreign key constraint. The `$name` parameter specifies the name of the foreign key constraint to be dropped. The `$table` parameter specifies the name of the table that the foreign key is on. The query builder will quote the table name as well as the constraint names properly.

Below is an example showing how to drop a foreign key constraint:

```
// ALTER TABLE 'tbl_profile' DROP FOREIGN KEY 'fk_profile_user_id'
dropForeignKey('fk_profile_user_id', 'tbl_profile')
```

## createIndex()

```
function createIndex($name, $table, $column, $unique=false)
```

The `createIndex()` method builds and executes a SQL statement for creating an index. The `$name` parameter specifies the name of the index to be created. The `$table` parameter specifies the name of the table that the index is on. The `$column` parameter specifies the name of the column to be indexed. And the `$unique` parameter specifies whether a unique index should be created. If the index consists of multiple columns, they must be separated by commas. The query builder will properly quote the table name, index name and column name(s).

Below is an example showing how to create an index:

```
// CREATE INDEX 'idx_username' ON 'tbl_user' ('username')
createIndex('idx_username', 'tbl_user', 'username')
```

## dropIndex()

```
function dropIndex($name, $table)
```

The `dropIndex()` method builds and executes a SQL statement for dropping an index. The `$name` parameter specifies the name of the index to be dropped. The `$table` parameter specifies the name of the table that the index is on. The query builder will quote the table name as well as the index names properly.

Below is an example showing how to drop an index:

```
// DROP INDEX 'idx_username' ON 'tbl_user'
dropIndex('idx_username', 'tbl_user')
```

## 4.4 Active Record

Although Yii DAO can handle virtually any database-related task, chances are that we would spend 90% of our time in writing some SQL statements which perform the common CRUD (create, read, update and delete) operations. It is also difficult to maintain our code when they are mixed with SQL statements. To solve these problems, we can use Active Record.

Active Record (AR) is a popular Object-Relational Mapping (ORM) technique. Each AR class represents a database table (or view) whose attributes are represented as the AR class properties, and an AR instance represents a row in that table. Common CRUD operations are implemented as AR methods. As a result, we can access our data in a more object-oriented way. For example, we can use the following code to insert a new row to the `tbl_post` table:

```
$post=new Post;
$post->title='sample post';
$post->content='post body content';
$post->save();
```

In the following we describe how to set up AR and use it to perform CRUD operations. We will show how to use AR to deal with database relationships in the next section. For simplicity, we use the following database table for our examples in this section. Note that if you are using MySQL database, you should replace `AUTOINCREMENT` with `AUTO_INCREMENT` in the following SQL.

```
CREATE TABLE tbl_post (
    id INTEGER NOT NULL PRIMARY KEY AUTOINCREMENT,
    title VARCHAR(128) NOT NULL,
    content TEXT NOT NULL,
    create_time INTEGER NOT NULL
);
```

**Note:** AR is not meant to solve all database-related tasks. It is best used for modeling database tables in PHP constructs and performing queries that do not involve complex SQLs. Yii DAO should be used for those complex scenarios.

#### 4.4.1 Establishing DB Connection

AR relies on a DB connection to perform DB-related operations. By default, it assumes that the `db` application component gives the needed `CDbConnection` instance which serves as the DB connection. The following application configuration shows an example:

```
return array(  
    'components'=>array(  
        'db'=>array(  
            'class'=>'system.db.CDbConnection',  
            'connectionString'=>'sqlite:path/to/dbfile',  
            // turn on schema caching to improve performance  
            // 'schemaCachingDuration'=>3600,  
        ),  
    ),  
);
```

**Tip:** Because Active Record relies on the metadata about tables to determine the column information, it takes time to read the metadata and analyze it. If the schema of your database is less likely to be changed, you should turn on schema caching by configuring the `CDbConnection::schemaCachingDuration` property to be a value greater than 0.

Support for AR is limited by DBMS. Currently, only the following DBMS are supported:

- MySQL 4.1 or later
- PostgreSQL 7.3 or later
- SQLite 2 and 3
- Microsoft SQL Server 2000 or later
- Oracle

If you want to use an application component other than `db`, or if you want to work with multiple databases using AR, you should override `CActiveRecord::getDbConnection()`. The `CActiveRecord` class is the base class for all AR classes.



**Tip:** There are two ways to work with multiple databases in AR. If the schemas of the databases are different, you may create different base AR classes with different implementation of `getDbConnection()`. Otherwise, dynamically changing the static variable `CActiveRecord::db` is a better idea.

#### 4.4.2 Defining AR Class

To access a database table, we first need to define an AR class by extending `CActiveRecord`. Each AR class represents a single database table, and an AR instance represents a row in that table. The following example shows the minimal code needed for the AR class representing the `tbl_post` table.

```
class Post extends CActiveRecord
{
    public static function model($className=__CLASS__)
    {
        return parent::model($className);
    }

    public function tableName()
    {
        return 'tbl_post';
    }
}
```

**Tip:** Because AR classes are often referenced in many places, we can import the whole directory containing the AR class, instead of including them one by one. For example, if all our AR class files are under `protected/models`, we can configure the application as follows:

```
return array(
    'import'=>array(
        'application.models.*',
    ),
);
```

By default, the name of the AR class is the same as the database table name. Override the `tableName()` method if they are different. The `model()` method is declared as such for every AR class (to be explained shortly).

**Info:** To use the [table prefix feature](#), the `tableName()` method for an AR class may be overridden as follows,

```
public function tableName()  
{  
    return '{{post}}';  
}
```

That is, instead of returning the fully qualified table name, we return the table name without the prefix and enclose it in double curly brackets.

Column values of a table row can be accessed as properties of the corresponding AR instance. For example, the following code sets the `title` column (attribute):

```
$post=new Post;  
$post->title='a sample post';
```

Although we never explicitly declare the `title` property in the `Post` class, we can still access it in the above code. This is because `title` is a column in the `tbl_post` table, and `CActiveRecord` makes it accessible as a property with the help of the PHP `__get()` magic method. An exception will be thrown if we attempt to access a non-existing column in the same way.

**Info:** In this guide, we use lower case for all table names and column names. This is because different DBMS handle case-sensitivity differently. For example, PostgreSQL treats column names as case-insensitive by default, and we must quote a column in a query condition if the column contains mixed-case letters. Using lower case would help eliminate this problem.

AR relies on well defined primary keys of tables. If a table does not have a primary key, it is required that the corresponding AR class specify which column(s) should be the primary key by overriding the `primaryKey()` method as follows,

```
public function primaryKey()  
{  
    return 'id';  
    // For composite primary key, return an array like the following  
    // return array('pk1', 'pk2');  
}
```

### 4.4.3 Creating Record

To insert a new row into a database table, we create a new instance of the corresponding AR class, set its properties associated with the table columns, and call the `save()` method to finish the insertion.

```
$post=new Post;
$post->title='sample post';
$post->content='content for the sample post';
$post->create_time=time();
$post->save();
```

If the table's primary key is auto-incremental, after the insertion the AR instance will contain an updated primary key. In the above example, the `id` property will reflect the primary key value of the newly inserted post, even though we never change it explicitly.

If a column is defined with some static default value (e.g. a string, a number) in the table schema, the corresponding property in the AR instance will automatically has such a value after the instance is created. One way to change this default value is by explicitly declaring the property in the AR class:

```
class Post extends CActiveRecord
{
    public $title='please enter a title';
    .....
}

$post=new Post;
echo $post->title; // this would display: please enter a title
```

An attribute can be assigned a value of `CDbExpression` type before the record is saved (either insertion or updating) to the database. For example, in order to save a timestamp returned by the MySQL `NOW()` function, we can use the following code:

```
$post=new Post;
$post->create_time=new CDbExpression('NOW()');
// $post->create_time='NOW()'; will not work because
// 'NOW()' will be treated as a string
$post->save();
```

**Tip:** While AR allows us to perform database operations without writing cumbersome SQL statements, we often want to know what SQL statements are executed by AR underneath. This can be achieved by turning on the [logging feature](#) of Yii. For example, we can turn on [CWebLogRoute](#) in the application configuration, and we will see the executed SQL statements being displayed at the end of each Web page. We can set [CDbConnection::enableParamLogging](#) to be true in the application configuration so that the parameter values bound to the SQL statements are also logged.

#### 4.4.4 Reading Record

To read data in a database table, we call one of the `find` methods as follows.

```
// find the first row satisfying the specified condition
$post=Post::model()->find($condition,$params);
// find the row with the specified primary key
$post=Post::model()->findByPk($postID,$condition,$params);
// find the row with the specified attribute values
$post=Post::model()->findByAttributes($attributes,$condition,$params);
// find the first row using the specified SQL statement
$post=Post::model()->findBySql($sql,$params);
```

In the above, we call the `find` method with `Post::model()`. Remember that the static method `model()` is required for every AR class. The method returns an AR instance that is used to access class-level methods (something similar to static class methods) in an object context.

If the `find` method finds a row satisfying the query conditions, it will return a `Post` instance whose properties contain the corresponding column values of the table row. We can then read the loaded values like we do with normal object properties, for example, `echo $post->title;`

The `find` method will return null if nothing can be found in the database with the given query condition.

When calling `find`, we use `$condition` and `$params` to specify query conditions. Here `$condition` can be string representing the `WHERE` clause in a SQL statement, and `$params` is an array of parameters whose values should be bound to the placeholders in `$condition`. For example,

```
// find the row with postID=10
$post=Post::model()->find('postID=:postID', array(':postID'=>10));
```

**Note:** In the above, we may need to escape the reference to the `postID` column for certain DBMS. For example, if we are using PostgreSQL, we would have to write the condition as `"postID"=:postID`, because PostgreSQL by default will treat column names as case-insensitive.

We can also use `$condition` to specify more complex query conditions. Instead of a string, we let `$condition` be a `CDbCriteria` instance, which allows us to specify conditions other than the `WHERE` clause. For example,

```
$criteria=new CDbCriteria;
$criteria->select='title'; // only select the 'title' column
$criteria->condition='postID=:postID';
$criteria->params=array(':postID'=>10);
$post=Post::model()->find($criteria); // $params is not needed
```

Note, when using `CDbCriteria` as query condition, the `$params` parameter is no longer needed since it can be specified in `CDbCriteria`, as shown above.

An alternative way to `CDbCriteria` is passing an array to the `find` method. The array keys and values correspond to the criteria's property name and value, respectively. The above example can be rewritten as follows,

```
$post=Post::model()->find(array(
    'select'=>'title',
    'condition'=>'postID=:postID',
    'params'=>array(':postID'=>10),
));
```

**Info:** When a query condition is about matching some columns with the specified values, we can use `findByAttributes()`. We let the `$attributes` parameters be an array of the values indexed by the column names. In some frameworks, this task can be achieved by calling methods like `findByNameAndTitle`. Although this approach looks attractive, it often causes confusion, conflict and issues like case-sensitivity of column names.

When multiple rows of data matching the specified query condition, we can bring them in all together using the following `findAll` methods, each of which has its counterpart `find` method, as we already described.

```
// find all rows satisfying the specified condition
$post=Post::model()->findAll($condition,$params);
// find all rows with the specified primary keys
$post=Post::model()->findAllByPk($postIDs,$condition,$params);
// find all rows with the specified attribute values
$post=Post::model()->findAllByAttributes($attributes,$condition,$params);
// find all rows using the specified SQL statement
$post=Post::model()->findAllBySql($sql,$params);
```

If nothing matches the query condition, `findAll` would return an empty array. This is different from `find` who would return null if nothing is found.

Besides the `find` and `findAll` methods described above, the following methods are also provided for convenience:

```
// get the number of rows satisfying the specified condition
$n=Post::model()->count($condition,$params);
// get the number of rows using the specified SQL statement
$n=Post::model()->countBySql($sql,$params);
// check if there is at least a row satisfying the specified condition
$exists=Post::model()->exists($condition,$params);
```

#### 4.4.5 Updating Record

After an AR instance is populated with column values, we can change them and save them back to the database table.

```
$post=Post::model()->findByPk(10);
$post->title='new post title';
$post->save(); // save the change to database
```

As we can see, we use the same `save()` method to perform insertion and updating operations. If an AR instance is created using the `new` operator, calling `save()` would insert a new row into the database table; if the AR instance is the result of some `find` or `findAll` method call, calling `save()` would update the existing row in the table. In fact, we can use `CActiveRecord::isNewRecord` to tell if an AR instance is new or not.

It is also possible to update one or several rows in a database table without loading them first. AR provides the following convenient class-level methods for this purpose:

```
// update the rows matching the specified condition
Post::model()->updateAll($attributes,$condition,$params);
// update the rows matching the specified condition and primary key(s)
```

```
Post::model()->updateByPk($pk,$attributes,$condition,$params);  
// update counter columns in the rows satisfying the specified conditions  
Post::model()->updateCounters($counters,$condition,$params);
```

In the above, `$attributes` is an array of column values indexed by column names; `$counters` is an array of incremental values indexed by column names; and `$condition` and `$params` are as described in the previous subsection.

#### 4.4.6 Deleting Record

We can also delete a row of data if an AR instance has been populated with this row.

```
$post=Post::model()->findByPk(10); // assuming there is a post whose ID is 10  
$post->delete(); // delete the row from the database table
```

Note, after deletion, the AR instance remains unchanged, but the corresponding row in the database table is already gone.

The following class-level methods are provided to delete rows without the need of loading them first:

```
// delete the rows matching the specified condition  
Post::model()->deleteAll($condition,$params);  
// delete the rows matching the specified condition and primary key(s)  
Post::model()->deleteByPk($pk,$condition,$params);
```

#### 4.4.7 Data Validation

When inserting or updating a row, we often need to check if the column values comply to certain rules. This is especially important if the column values are provided by end users. In general, we should never trust anything coming from the client side.

AR performs data validation automatically when `save()` is being invoked. The validation is based on the rules specified in the `rules()` method of the AR class. For more details about how to specify validation rules, refer to the [Declaring Validation Rules](#) section. Below is the typical workflow needed by saving a record:

```
if($post->save())  
{  
    // data is valid and is successfully inserted/updated  
}  
else
```

```
{  
    // data is invalid. call getErrors() to retrieve error messages  
}
```

When the data for inserting or updating is submitted by end users in an HTML form, we need to assign them to the corresponding AR properties. We can do so like the following:

```
$post->title=$_POST['title'];  
$post->content=$_POST['content'];  
$post->save();
```

If there are many columns, we would see a long list of such assignments. This can be alleviated by making use of the `attributes` property as shown below. More details can be found in the [Securing Attribute Assignments](#) section and the [Creating Action](#) section.

```
// assume $_POST['Post'] is an array of column values indexed by column names  
$post->attributes=$_POST['Post'];  
$post->save();
```

#### 4.4.8 Comparing Records

Like table rows, AR instances are uniquely identified by their primary key values. Therefore, to compare two AR instances, we merely need to compare their primary key values, assuming they belong to the same AR class. A simpler way is to call `CActiveRecord::equals()`, however.

**Info:** Unlike AR implementation in other frameworks, Yii supports composite primary keys in its AR. A composite primary key consists of two or more columns. Correspondingly, the primary key value is represented as an array in Yii. The `primaryKey` property gives the primary key value of an AR instance.

#### 4.4.9 Customization

`CActiveRecord` provides a few placeholder methods that can be overridden in child classes to customize its workflow.

- `beforeValidate` and `afterValidate`: these are invoked before and after validation is performed.
- `beforeSave` and `afterSave`: these are invoked before and after saving an AR instance.



- `beforeDelete` and `afterDelete`: these are invoked before and after an AR instance is deleted.
- `afterConstruct`: this is invoked for every AR instance created using the `new` operator.
- `beforeFind`: this is invoked before an AR finder is used to perform a query (e.g. `find()`, `findAll()`).
- `afterFind`: this is invoked after every AR instance created as a result of query.

#### 4.4.10 Using Transaction with AR

Every AR instance contains a property named `dbConnection` which is a `CDbConnection` instance. We thus can use the `transaction` feature provided by Yii DAO if it is desired when working with AR:

```
$model=Post::model();
$transaction=$model->dbConnection->beginTransaction();
try
{
    // find and save are two steps which may be intervened by another request
    // we therefore use a transaction to ensure consistency and integrity
    $post=$model->findByPrimaryKey(10);
    $post->title='new post title';
    $post->save();
    $transaction->commit();
}
catch(Exception $e)
{
    $transaction->rollback();
}
```

#### 4.4.11 Named Scopes

**Info:** The original idea of named scopes came from Ruby on Rails.

A *named scope* represents a *named* query criteria that can be combined with other named scopes and applied to an active record query.

Named scopes are mainly declared in the `CActiveRecord::scopes()` method as name-criteria pairs. The following code declares two named scopes, `published` and `recently`, in the `Post` model class:

```
class Post extends ActiveRecord
{
    .....
    public function scopes()
    {
        return array(
            'published'=>array(
                'condition'=>'status=1',
            ),
            'recently'=>array(
                'order'=>'create_time DESC',
                'limit'=>5,
            ),
        );
    }
}
```

Each named scope is declared as an array which can be used to initialize a `CDbCriteria` instance. For example, the `recently` named scope specifies that the `order` property to be `create_time DESC` and the `limit` property to be 5, which translates to a query criteria that should bring back the most recent 5 posts.

Named scopes are mostly used as modifiers to the `find` method calls. Several named scopes may be chained together and result in a more restrictive query result set. For example, to find the recently published posts, we can use the following code:

```
$posts=Post::model()->published()->recently()->findAll();
```

In general, named scopes must appear to the left of a `find` method call. Each of them provides a query criteria, which is combined with other criterias, including the one passed to the `find` method call. The net effect is like adding a list of filters to a query.

**Note:** Named scopes can only be used with class-level methods. That is, the method must be called using `ClassName::model()`.

## Parameterized Named Scopes

Named scopes can be parameterized. For example, we may want to customize the number of posts specified by the `recently` named scope. To do so, instead of declaring the named scope in the `ActiveRecord::scopes` method, we need to define a new method whose name is the same as the scope name:

```
public function recently($limit=5)
{
    $this->getDbCriteria()->mergeWith(array(
        'order'=>'create_time DESC',
        'limit'=>$limit,
    ));
    return $this;
}
```

Then, we can use the following statement to retrieve the 3 recently published posts:

```
$posts=Post::model()->published()->recently(3)->findAll();
```

If we do not supply the parameter 3 in the above, we would retrieve the 5 recently published posts by default.

### Default Scope

A model class can have a default scope that would be applied for all queries (including relational ones) about the model. For example, a website supporting multiple languages may only want to display contents that are in the language the current user specifies. Because there may be many queries about the site contents, we can define a default scope to solve this problem. To do so, we override the `CActiveRecord::defaultScope` method as follows,

```
class Content extends CActiveRecord
{
    public function defaultScope()
    {
        return array(
            'condition'=>"language='".Yii::app()->language.'" ",
        );
    }
}
```

Now, if the following method call will automatically use the query criteria as defined above:

```
$contents=Content::model()->findAll();
```

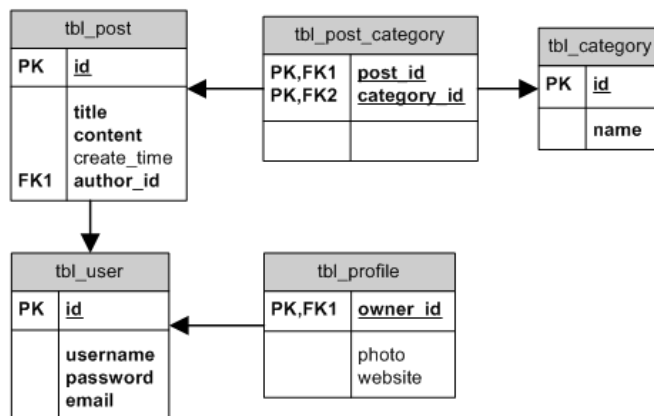
**Note:** Default scope and named scopes only apply to **SELECT** queries. They are ignored for **INSERT**, **UPDATE** and **DELETE** queries. Also, when declaring a scope (default or named), the AR class cannot be used to make DB queries in the method that declares the scope.

## 4.5 Relational Active Record

We have already seen how to use Active Record (AR) to select data from a single database table. In this section, we describe how to use AR to join several related database tables and bring back the joint data set.

In order to use relational AR, it is recommended that primary-foreign key constraints are declared for tables that need to be joined. The constraints will help to keep the consistency and integrity of the relational data.

For simplicity, we will use the database schema shown in the following entity-relationship (ER) diagram to illustrate examples in this section.



**Figure 4.1:** ER Diagram

**Info:** Support for foreign key constraints varies in different DBMS. SQLite 3.6.19 or prior does not support foreign key constraints, but you can still declare the constraints when creating tables. MySQLs MyISAM engine does not support foreign keys at all.

### 4.5.1 Declaring Relationship

Before we use AR to perform relational query, we need to let AR know how one AR class is related with another.

Relationship between two AR classes is directly associated with the relationship between the database tables represented by the AR classes. From database point of view, a relationship between two tables A and B has three types: one-to-many (e.g. `tbl_user` and `tbl_post`), one-to-one (e.g. `tbl_user` and `tbl_profile`) and many-to-many (e.g. `tbl_category` and `tbl_post`). In AR, there are four types of relationships:

- **BELONGS\_TO**: if the relationship between table A and B is one-to-many, then B belongs to A (e.g. `Post` belongs to `User`);
- **HAS\_MANY**: if the relationship between table A and B is one-to-many, then A has many B (e.g. `User` has many `Post`);
- **HAS\_ONE**: this is special case of **HAS\_MANY** where A has at most one B (e.g. `User` has at most one `Profile`);
- **MANY\_MANY**: this corresponds to the many-to-many relationship in database. An associative table is needed to break a many-to-many relationship into one-to-many relationships, as most DBMS do not support many-to-many relationship directly. In our example database schema, the `tbl_post_category` serves for this purpose. In AR terminology, we can explain **MANY\_MANY** as the combination of **BELONGS\_TO** and **HAS\_MANY**. For example, `Post` belongs to many `Category` and `Category` has many `Post`.

Declaring relationship in AR involves overriding the `relations()` method of `CActiveRecord`. The method returns an array of relationship configurations. Each array element represents a single relationship with the following format:

```
'VarName'=>array('RelationType', 'ClassName', 'ForeignKey', ...additional options)
```

where `VarName` is the name of the relationship; `RelationType` specifies the type of the relationship, which can be one of the four constants: `self::BELONGS_TO`, `self::HAS_ONE`, `self::HAS_MANY` and `self::MANY_MANY`; `ClassName` is the name of the AR class related to this AR class; and `ForeignKey` specifies the foreign key(s) involved in the relationship. Additional options can be specified at the end for each relationship (to be described later).

The following code shows how we declare the relationships for the `User` and `Post` classes.

```

class Post extends CActiveRecord
{
    .....

    public function relations()
    {
        return array(
            'author'=>array(self::BELONGS_TO, 'User', 'author_id'),
            'categories'=>array(self::MANY_MANY, 'Category',
                'tbl_post_category(post_id, category_id)'),
        );
    }
}

class User extends CActiveRecord
{
    .....

    public function relations()
    {
        return array(
            'posts'=>array(self::HAS_MANY, 'Post', 'author_id'),
            'profile'=>array(self::HAS_ONE, 'Profile', 'owner_id'),
        );
    }
}

```

**Info:** A foreign key may be composite, consisting of two or more columns. In this case, we should concatenate the names of the foreign key columns and separate them with commas or an array such as `array('key1','key2')`. In case you need to specify custom PK->FK association you can define it as `array('fk'=>'pk')`. For composite keys it will be `array('fk_c1'=>'pk_c1','fk_c2'=>'pk_c2')`. For MANY\_MANY relationship type, the associative table name must also be specified in the foreign key. For example, the `categories` relationship in `Post` is specified with the foreign key `tbl_post_category(post_id, category_id)`. The declaration of relationships in an AR class implicitly adds a property to the class for each relationship. After a relational query is performed, the corresponding property will be populated with the related AR instance(s). For example, if `$author` represents a `User` AR instance, we can use `$author->posts` to access its related `Post` instances.

### 4.5.2 Performing Relational Query

The simplest way of performing relational query is by reading a relational property of an AR instance. If the property is not accessed previously, a relational query will be initiated, which joins the two related tables and filters with the primary key of the current

AR instance. The query result will be saved to the property as instance(s) of the related AR class. This is known as the *lazy loading* approach, i.e., the relational query is performed only when the related objects are initially accessed. The example below shows how to use this approach:

```
// retrieve the post whose ID is 10
$post=Post::model()->findPk(10);
// retrieve the post's author: a relational query will be performed here
$author=$post->author;
```

**Info:** If there is no related instance for a relationship, the corresponding property could be either null or an empty array. For `BELONGS_TO` and `HAS_ONE` relationships, the result is null; for `HAS_MANY` and `MANY_MANY`, it is an empty array. Note that the `HAS_MANY` and `MANY_MANY` relationships return arrays of objects, you will need to loop through the results before trying to access any properties. Otherwise, you may receive "Trying to get property of non-object" errors.

The lazy loading approach is very convenient to use, but it is not efficient in some scenarios. For example, if we want to access the author information for *N* posts, using the lazy approach would involve executing *N* join queries. We should resort to the so-called *eager loading* approach under this circumstance.

The eager loading approach retrieves the related AR instances together with the main AR instance(s). This is accomplished by using the `with()` method together with one of the `find` or `findAll` methods in AR. For example,

```
$posts=Post::model()->with('author')->findAll();
```

The above code will return an array of `Post` instances. Unlike the lazy approach, the `author` property in each `Post` instance is already populated with the related `User` instance before we access the property. Instead of executing a join query for each post, the eager loading approach brings back all posts together with their authors in a single join query!

We can specify multiple relationship names in the `with()` method and the eager loading approach will bring them back all in one shot. For example, the following code will bring back posts together with their authors and categories:

```
$posts=Post::model()->with('author','categories')->findAll();
```

We can also do nested eager loading. Instead of a list of relationship names, we pass in a hierarchical representation of relationship names to the `with()` method, like the following,

```
$posts=Post::model()->with(  
    'author.profile',  
    'author.posts',  
    'categories')->findAll();
```

The above example will bring back all posts together with their author and categories. It will also bring back each author's profile and posts.

Eager loading may also be executed by specifying the `CdbCriteria::with` property, like the following:

```
$criteria=new CdbCriteria;  
$criteria->with=array(  
    'author.profile',  
    'author.posts',  
    'categories',  
);  
$posts=Post::model()->findAll($criteria);
```

or

```
$posts=Post::model()->findAll(array(  
    'with'=>array(  
        'author.profile',  
        'author.posts',  
        'categories',  
    )  
));
```

### 4.5.3 Performing Relational query without getting related models

Sometimes we need to perform query using relation but don't want to get related models. Let's assume we have Users who posted many Posts. Post can be published but also can be in a draft state. This is determined by `published` field in the post model. Now we need to get all users who have published posts and we are not interested in posts themselves. This can be achieved the following way:

```
$users=User::model()->with(array(  
    'posts'=>array(  

```



```
// we don't want to select posts
'select'=>false,
// but want to get only users with published posts
'joinType'=>'INNER JOIN',
'condition'=>'posts.published=1',
),
))->findAll();
```

#### 4.5.4 Relational Query Options

We mentioned that additional options can be specified in relationship declaration. These options, specified as name-value pairs, are used to customize the relational query. They are summarized as below.

- **select**: a list of columns to be selected for the related AR class. It defaults to `'*'`, meaning all columns. Column names referenced in this option should be disambiguated.
- **condition**: the `WHERE` clause. It defaults to empty. Column names referenced in this option should be disambiguated.
- **params**: the parameters to be bound to the generated SQL statement. This should be given as an array of name-value pairs.
- **on**: the `ON` clause. The condition specified here will be appended to the joining condition using the `AND` operator. Column names referenced in this option should be disambiguated. This option does not apply to `MANY_MANY` relations.
- **order**: the `ORDER BY` clause. It defaults to empty. Column names referenced in this option should be disambiguated.
- **with**: a list of child related objects that should be loaded together with this object. Be aware that using this option inappropriately may form an infinite relation loop.
- **joinType**: type of join for this relationship. It defaults to `LEFT OUTER JOIN`.
- **alias**: the alias for the table associated with this relationship. It defaults to null, meaning the table alias is the same as the relation name.
- **together**: whether the table associated with this relationship should be forced to join together with the primary table and other tables. This option is only meaningful for `HAS_MANY` and `MANY_MANY` relations. If this option is set false, the table associated with the `HAS_MANY` or `MANY_MANY` relation will be joined with the primary table in a separate SQL query, which may improve the overall query performance since less duplicated

data is returned. If this option is set true, the associated table will always be joined with the primary table in a single SQL query, even if the primary table is paginated. If this option is not set, the associated table will be joined with the primary table in a single SQL query only when the primary table is not paginated. For more details, see the section "Relational Query Performance".

- **join:** the extra JOIN clause. It defaults to empty. This option has been available since version 1.1.3.
- **group:** the GROUP BY clause. It defaults to empty. Column names referenced in this option should be disambiguated.
- **having:** the HAVING clause. It defaults to empty. Column names referenced in this option should be disambiguated.
- **index:** the name of the column whose values should be used as keys of the array that stores related objects. Without setting this option, an related object array would use zero-based integer index. This option can only be set for HAS\_MANY and MANY\_MANY relations.
- **scopes:** scopes to apply. In case of a single scope can be used like 'scopes'=>'scopeName', in case of multiple scopes can be used like 'scopes'=>array('scopeName1', 'scopeName2'). This option has been available since version 1.1.9.

In addition, the following options are available for certain relationships during lazy loading:

- **limit:** limit of the rows to be selected. This option does NOT apply to BELONGS\_TO relation.
- **offset:** offset of the rows to be selected. This option does NOT apply to BELONGS\_TO relation.
- **through:** name of the model's relation that will be used as a bridge when getting related data. Can be set only for HAS\_ONE and HAS\_MANY. This option has been available since version 1.1.7.

Below we modify the `posts` relationship declaration in the `User` by including some of the above options:

```
class User extends ActiveRecord
{
    public function relations()
```

```

    {
      return array(
        'posts'=>array(self::HAS_MANY, 'Post', 'author_id',
          'order'=>'posts.create_time DESC',
          'with'=>'categories'),
        'profile'=>array(self::HAS_ONE, 'Profile', 'owner_id'),
      );
    }
  }
}

```

Now if we access `$author->posts`, we would obtain the author's posts sorted according to their creation time in descending order. Each post instance also has its categories loaded.

#### 4.5.5 Disambiguating Column Names

When a column name appears in two or more tables being joined together, it needs to be disambiguated. This is done by prefixing the column name with its table's alias name.

In relational AR query, the alias name for the primary table is fixed as `t`, while the alias name for a relational table is the same as the corresponding relation name by default. For example, in the following statement, the alias name for `Post` and `Comment` is `t` and `comments`, respectively:

```
$posts=Post::model()->with('comments')->findAll();
```

Now assume both `Post` and `Comment` have a column called `create_time` indicating the creation time of a post or comment, and we would like to fetch posts together with their comments by ordering first the posts' creation time and then the comments' creation time. We need to disambiguate the `create_time` column like the following:

```

$posts=Post::model()->with('comments')->findAll(array(
  'order'=>'t.create_time, comments.create_time'
));

```

#### 4.5.6 Dynamic Relational Query Options

We can use dynamic relational query options in both `with()` and the `with` option. The dynamic options will overwrite existing options as specified in the `relations()` method. For example, with the above `User` model, if we want to use eager loading approach to bring back posts belonging to an author in *ascending order* (the `order` option in the relation specification is descending order), we can do the following:

```
User::model()->with(array(
    'posts'=>array('order'=>'posts.create_time ASC'),
    'profile',
))->findAll();
```

Dynamic query options can also be used when using the lazy loading approach to perform relational query. To do so, we should call a method whose name is the same as the relation name and pass the dynamic query options as the method parameter. For example, the following code returns a user's posts whose `status` is 1:

```
$user=User::model()->findByPk(1);
$posts=$user->posts(array('condition'=>'status=1'));
```

#### 4.5.7 Relational Query Performance

As we described above, the eager loading approach is mainly used in the scenario when we need to access many related objects. It generates a big complex SQL statement by joining all needed tables. A big SQL statement is preferable in many cases since it simplifies filtering based on a column in a related table. It may not be efficient in some cases, however.

Consider an example where we need to find the latest posts together with their comments. Assuming each post has 10 comments, using a single big SQL statement, we will bring back a lot of redundant post data since each post will be repeated for every comment it has. Now let's try another approach: we first query for the latest posts, and then query for their comments. In this new approach, we need to execute two SQL statements. The benefit is that there is no redundancy in the query results.

So which approach is more efficient? There is no absolute answer. Executing a single big SQL statement may be more efficient because it causes less overhead in DBMS for parsing and executing the SQL statements. On the other hand, using the single SQL statement, we end up with more redundant data and thus need more time to read and process them.

For this reason, Yii provides the `together` query option so that we choose between the two approaches as needed. By default, Yii uses eager loading, i.e., generating a single SQL statement, except when `LIMIT` is applied to the primary model. We can set the `together` option in the relation declarations to be true to force a single SQL statement even when `LIMIT` is used. Setting it to false will result in some of tables will be joined in separate SQL statements. For example, in order to use separate SQL statements to query for the latest posts with their comments, we can declare the `comments` relation in `Post` class as follows,

```
public function relations()
```

```

{
    return array(
        'comments' => array(self::HAS_MANY, 'Comment', 'post_id',
            'together'=>false),
    );
}

```

We can also dynamically set this option when we perform the eager loading:

```

$posts = Post::model()->with(
    array('comments'=>array(
        'together'=>false
    ))
)->findAll();

```

#### 4.5.8 Statistical Query

Besides the relational query described above, Yii also supports the so-called statistical query (or aggregational query). It refers to retrieving the aggregational information about the related objects, such as the number of comments for each post, the average rating for each product, etc. Statistical query can only be performed for objects related in `HAS_MANY` (e.g. a post has many comments) or `MANY_MANY` (e.g. a post belongs to many categories and a category has many posts).

Performing statistical query is very similar to performing relation query as we described before. We first need to declare the statistical query in the `relations()` method of `CActiveRecord` like we do with relational query.

```

class Post extends CActiveRecord
{
    public function relations()
    {
        return array(
            'commentCount'=>array(self::STAT, 'Comment', 'post_id'),
            'categoryCount'=>array(
                self::STAT, 'Category', 'post_category(post_id, category_id)'
            ),
        );
    }
}

```

In the above, we declare two statistical queries: `commentCount` calculates the number of comments belonging to a post, and `categoryCount` calculates the number of categories

that a post belongs to. Note that the relationship between `Post` and `Comment` is `HAS_MANY`, while the relationship between `Post` and `Category` is `MANY_MANY` (with the joining table `post_category`). As we can see, the declaration is very similar to those relations we described in earlier subsections. The only difference is that the relation type is `STAT` here.

With the above declaration, we can retrieve the number of comments for a post using the expression `$post->commentCount`. When we access this property for the first time, a SQL statement will be executed implicitly to retrieve the corresponding result. As we already know, this is the so-called *lazy loading* approach. We can also use the *eager loading* approach if we need to determine the comment count for multiple posts:

```
$posts=Post::model()->with('commentCount', 'categoryCount')->findAll();
```

The above statement will execute three SQLs to bring back all posts together with their comment counts and category counts. Using the lazy loading approach, we would end up with  $2*N+1$  SQL queries if there are  $N$  posts.

By default, a statistical query will calculate the `COUNT` expression (and thus the comment count and category count in the above example). We can customize it by specifying additional options when we declare it in `relations()`. The available options are summarized as below.

- **select:** the statistical expression. Defaults to `COUNT(*)`, meaning the count of child objects.
- **defaultValue:** the value to be assigned to those records that do not receive a statistical query result. For example, if a post does not have any comments, its `commentCount` would receive this value. The default value for this option is 0.
- **condition:** the `WHERE` clause. It defaults to empty.
- **params:** the parameters to be bound to the generated SQL statement. This should be given as an array of name-value pairs.
- **order:** the `ORDER BY` clause. It defaults to empty.
- **group:** the `GROUP BY` clause. It defaults to empty.
- **having:** the `HAVING` clause. It defaults to empty.

### 4.5.9 Relational Query with Named Scopes

Relational query can also be performed in combination with [named scopes](#). It comes in two forms. In the first form, named scopes are applied to the main model. In the second form, named scopes are applied to the related models.

The following code shows how to apply named scopes to the main model.

```
$posts=Post::model()->published()->recently()->with('comments')->findAll();
```

This is very similar to non-relational queries. The only difference is that we have the `with()` call after the named-scope chain. This query would bring back recently published posts together with their comments.

And the following code shows how to apply named scopes to the related models.

```
$posts=Post::model()->with('comments:recently:approved')->findAll();
// or since 1.1.7
$posts=Post::model()->with(array(
    'comments'=>array(
        'scopes'=>array('recently','approved')
    ),
))->findAll();
// or since 1.1.7
$posts=Post::model()->findAll(array(
    'with'=>array(
        'comments'=>array(
            'scopes'=>array('recently','approved')
        ),
    ),
));
```

The above query will bring back all posts together with their approved comments. Note that `comments` refers to the relation name, while `recently` and `approved` refer to two named scopes declared in the `Comment` model class. The relation name and the named scopes should be separated by colons.

Occasionally you may need to retrieve a scoped relationship using a lazy-loading approach, instead of the normal eager loading method shown above. In that case, the following syntax will do what you need:

```
[php] // note the repetition of the relationship name, which is necessary
$post->comments('comments:approved');
```

Named scopes can also be specified in the `with` option of the relational rules declared in `CActiveRecord::relations()`. In the following example, if we access `$user->posts`, it would bring back all *approved* comments of the posts.

```
class User extends CActiveRecord
{
    public function relations()
    {
        return array(
            'posts'=>array(self::HAS_MANY, 'Post', 'author_id',
                'with'=>'comments:approved'),
        );
    }
}

// or since 1.1.7
class User extends CActiveRecord
{
    public function relations()
    {
        return array(
            'posts'=>array(self::HAS_MANY, 'Post', 'author_id',
                'with'=>array(
                    'comments'=>array(
                        'scopes'=>'approved'
                    ),
                ),
            ),
        );
    }
}
```

**Note:** Before 1.1.7 named scopes applied to related models must be specified in `CActiveRecord::scopes`. As a result, they cannot be parameterized.

Since 1.1.7 it's possible to pass parameters for relational named scopes. For example, if you have scope named `rated` in the `Post` that accepts minimum rating of post, you can use it from `User` the following way:

```
$users=User::model()->findAll(array(
    'with'=>array(
        'posts'=>array(
            'scopes'=>array(
                'rated'=>5,
```



```

        ),
    ),
),
));

class Post extends ActiveRecord
{
    .....

    public function rated($rating)
    {
        $this->getDbCriteria()->mergeWith(array(
            'condition'=>'rating=:rating',
            'params'=>array(':rating'=>$rating),
        ));
        return $this;
    }

    .....
}

```

#### 4.5.10 Relational Query with through

When using `through`, relation definition should look like the following:

```
'comments'=>array(self::HAS_MANY,'Comment',array('key1'=>'key2'),'through'=>'posts'),
```

In the above `array('key1'=>'key2')`:

- `key1` is a key defined in relation specified in `through` (`posts` is this case).
- `key2` is a key defined in a model relation points to (`Comment` in this case).

`through` can be used with both `HAS_ONE` and `HAS_MANY` relations.

##### HAS\_MANY through

An example of `HAS_MANY` with `through` is getting users from a particular group when users are assigned to groups via roles.

A bit more complex example is getting all comments for all users of a particular group. In this case we have to use several relations with `through` in a single model:

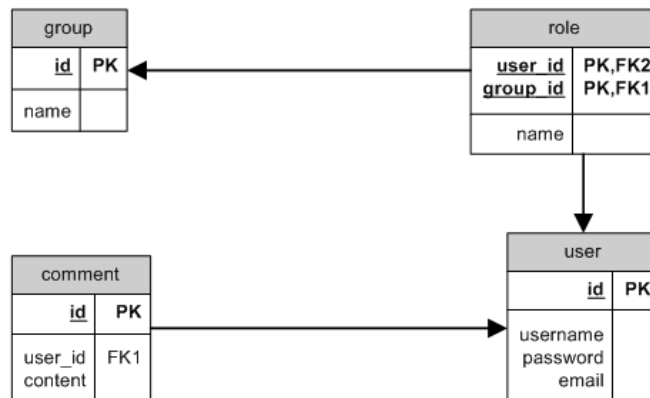


Figure 4.2: HAS\_MANY through ER

```

class Group extends CActiveRecord
{
    ...
    public function relations()
    {
        return array(
            'roles'=>array(self::HAS_MANY,'Role','group_id'),
            'users'=>array(
                self::HAS_MANY,'User',array('user_id'=>'id'),'through'=>'roles'
            ),
            'comments'=>array(
                self::HAS_MANY,'Comment',array('id'=>'user_id'),'through'=>'users'
            ),
        );
    }
}

```

```

;h4 id="usage-examples";Usage examples;/h4;

```

```

// get all groups with all corresponding users
$groups=Group::model()->with('users')->findAll();

// get all groups with all corresponding users and roles
$groups=Group::model()->with('roles','users')->findAll();

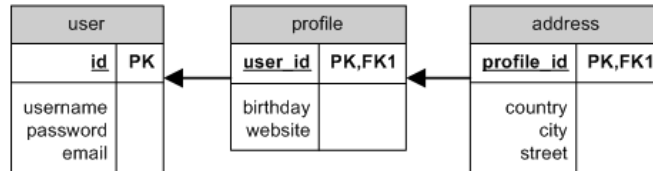
// get all users and roles where group ID is 1
$group=Group::model()->findByPk(1);
$users=$group->users;
$roles=$group->roles;

// get all comments where group ID is 1

```

```
$group=Group::model()->findByPk(1);
$comments=$group->comments;
```

### HAS\_ONE through



**Figure 4.3:** HAS\_ONE through ER

An example of using HAS\_ONE with through is getting user address where user is bound to address using profile. All these entities (user, profile, and address) do have corresponding models:

```
class User extends ActiveRecord
{
    ...
    public function relations()
    {
        return array(
            'profile'=>array(self::HAS_ONE,'Profile','user_id'),
            'address'=>array(
                self::HAS_ONE,'Address',array('id'=>'profile_id'),
                'through'=>'profile'
            ),
        );
    }
}
```

Usage examples:

```
// get address of a user whose ID is 1
$user=User::model()->findByPk(1);
$address=$user->address;
```

### through on self

through can be used for a model bound to itself using a bridge model. In our case it's a user mentoring other users:

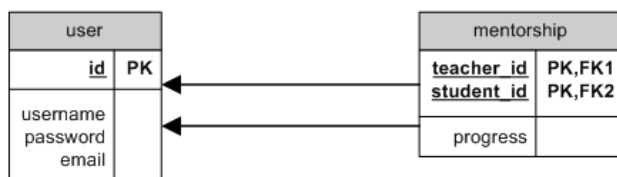


Figure 4.4: through self ER

That's how we can define relations for this case:

```

class User extends CActiveRecord
{
    ...
    public function relations()
    {
        return array(
            'mentorships'=>array(
                self::HAS_MANY, 'Mentorship', 'teacher_id', 'joinType'=>'INNER JOIN'
            ),
            'students'=>array(
                self::HAS_MANY, 'User', array('student_id'=>'id'),
                'through'=>'mentorships', 'joinType'=>'INNER JOIN'
            ),
        );
    }
}
  
```

```

<h4 id="usage-examples">Usage examples</h4>
  
```

```

// get all students taught by teacher whose ID is 1
$teacher=User::model()->findByPk(1);
$students=$teacher->students;
  
```

## 4.6 Database Migration

**Note:** The database migration feature has been available since version 1.1.6.

Like source code, the structure of a database is evolving as we develop and maintain a database-driven application. For example, during development, we may want to add a new table; or after the application is put into production, we may realize the need of adding

an index on a column. It is important to keep track of these structural database changes (called **migration**) like we do with our source code. If the source code and the database are out of sync, it is very likely the whole system may break. For this reason, Yii provides a database migration tool that can keep track of database migration history, apply new migrations, or revert existing ones.

The following steps show how we can use database migration during development:

1. Tim creates a new migration (e.g. create a new table)
2. Tim commits the new migration into source control system (e.g. SVN, GIT)
3. Doug updates from source control system and receives the new migration
4. Doug applies the migration to his local development database

Yii supports database migration via the `yiic migrate` command line tool. This tool supports creating new migrations, applying/reverting/redoing migrations, and showing migration history and new migrations.

In the following, we will describe how to use this tool.

**Note:** It's better to use application-specific `yiic` (e.g. `cd path/to/protected`) when working with `migrate` command instead of one from `framework` directory. Make sure you have `protected/migrations` directory and it is writable. Also check if you've configured database connection in your `protected/config/console.php`.

#### 4.6.1 Creating Migrations

To create a new migration (e.g. create a news table), we run the following command:

```
yiic migrate create <name>
```

The required `name` parameter specifies a very brief description of the migration (e.g. `create_news_table`). As we will show in the following, the `name` parameter is used as part of a PHP class name. Therefore, it should only contain letters, digits and/or underscore characters.

```
yiic migrate create create_news_table
```

The above command will create under the `protected/migrations` directory a new file named `m101129_185401_create_news_table.php` which contains the following initial code:

```

class m101129_185401_create_news_table extends CDbMigration
{
    public function up()
    {
    }

    public function down()
    {
        echo "m101129_185401_create_news_table does not support migration down.\n";
        return false;
    }

    /*
    // implement safeUp/safeDown instead if transaction is needed
    public function safeUp()
    {
    }

    public function safeDown()
    {
    }
    */
}

```

Notice that the class name is the same as the file name which is of the pattern `m<timestamp>_<name>`, where `<timestamp>` refers to the UTC timestamp (in the format of `yymmdd_hhmmss`) when the migration is created, and `<name>` is taken from the command's `name` parameter.

The `up()` method should contain the code implementing the actual database migration, while the `down()` method may contain the code reverting what is done in `up()`.

Sometimes, it is impossible to implement `down()`. For example, if we delete table rows in `up()`, we will not be able to recover them in `down()`. In this case, the migration is called irreversible, meaning we cannot roll back to a previous state of the database. In the above generated code, the `down()` method returns `false` to indicate that the migration cannot be reverted.

**Info:** Starting from version 1.1.7, if the `up()` or `down()` method returns `false`, all the following migrations will be canceled. Previously in version 1.1.6, one has to throw exceptions to cancel the following migrations.

As an example, let's show the migration about creating a news table.

```

class m101129_185401_create_news_table extends CDbMigration

```

```
{
    public function up()
    {
        $this->createTable('tbl_news', array(
            'id' => 'pk',
            'title' => 'string NOT NULL',
            'content' => 'text',
        ));
    }

    public function down()
    {
        $this->dropTable('tbl_news');
    }
}
```

The base class `CDbMigration` provides a set of methods for manipulating data and schema of a database. For example, `CDbMigration::createTable` will create a database table, while `CDbMigration::insert` will insert a row of data. These methods all use the database connection returned by `CDbMigration::getDbConnection()`, which by default returns `Yii::app()->db`.

**Info:** You may notice that the database methods provided by `CDbMigration` are very similar to those in `CDbCommand`. Indeed they are nearly the same except that `CDbMigration` methods will measure the time used by their methods and print some messages about the method parameters.

#### 4.6.2 Transactional Migrations

**Info:** The feature of transactional migrations has been supported since version 1.1.7.

While performing complex DB migrations, we usually want to make sure that each migration succeed or fail as a whole so that the database maintains the consistency and integrity. In order to achieve this goal, we can exploit DB transactions.

We could explicitly start a DB transaction and enclose the rest of the DB-related code within the transaction, like the following:

```
class m101129_185401_create_news_table extends CDbMigration
{
    public function up()
```

```

{
    $transaction=$this->getDbConnection()->beginTransaction();
    try
    {
        $this->createTable('tbl_news', array(
            'id' => 'pk',
            'title' => 'string NOT NULL',
            'content' => 'text',
        ));
        $transaction->commit();
    }
    catch(Exception $e)
    {
        echo "Exception: ".$e->getMessage()."\n";
        $transaction->rollback();
        return false;
    }
}

// ...similar code for down()
}

```

However, an easier way to get transaction support is to implement the `safeUp()` method instead of `up()`, and `safeDown()` instead of `down()`. For example,

```

class m101129_185401_create_news_table extends CDbMigration
{
    public function safeUp()
    {
        $this->createTable('tbl_news', array(
            'id' => 'pk',
            'title' => 'string NOT NULL',
            'content' => 'text',
        ));
    }

    public function safeDown()
    {
        $this->dropTable('tbl_news');
    }
}

```

When Yii performs the migration, it will start a DB transaction and then call `safeUp()` or `safeDown()`. If any DB error occurs in `safeUp()` or `safeDown()`, the transaction will be rolled back, thus ensuring the database remain in a good shape.



**Note:** Not all DBMS support transactions. And some DB queries cannot be put into a transaction. In this case, you will have to implement `up()` and `down()`, instead. And for MySQL, some SQL statements may cause [implicit commit](#).

### 4.6.3 Applying Migrations

To apply all available new migrations (i.e., make the local database up-to-date), run the following command:

```
yiic migrate
```

The command will show the list of all new migrations. If you confirm to apply the migrations, it will run the `up()` method in every new migration class, one after another, in the order of the timestamp value in the class name.

After applying a migration, the migration tool will keep a record in a database table named `tbl_migration`. This allows the tool to identify which migrations have been applied and which are not. If the `tbl_migration` table does not exist, the tool will automatically create it in the database specified by the `db` application component.

Sometimes, we may only want to apply one or a few new migrations. We can use the following command:

```
yiic migrate up 3
```

This command will apply the 3 new migrations. Changing the value 3 will allow us to change the number of migrations to be applied.

We can also migrate the database to a specific version with the following command:

```
yiic migrate to 101129_185401
```

That is, we use the timestamp part of a migration name to specify the version that we want to migrate the database to. If there are multiple migrations between the last applied migration and the specified migration, all these migrations will be applied. If the specified migration has been applied before, then all migrations applied after it will be reverted (to be described in the next section).

#### 4.6.4 Reverting Migrations

To revert the last one or several applied migrations, we can use the following command:

```
yiic migrate down [step]
```

where the optional `step` parameter specifies how many migrations to be reverted back. It defaults to 1, meaning reverting back the last applied migration.

As we described before, not all migrations can be reverted. Trying to revert such migrations will throw an exception and stop the whole reverting process.

#### 4.6.5 Redoing Migrations

Redoing migrations means first reverting and then applying the specified migrations. This can be done with the following command:

```
yiic migrate redo [step]
```

where the optional `step` parameter specifies how many migrations to be redone. It defaults to 1, meaning redoing the last migration.

#### 4.6.6 Showing Migration Information

Besides applying and reverting migrations, the migration tool can also display the migration history and the new migrations to be applied.

```
yiic migrate history [limit]  
yiic migrate new [limit]
```

where the optional parameter `limit` specifies the number of migrations to be displayed. If `limit` is not specified, all available migrations will be displayed.

The first command shows the migrations that have been applied, while the second command shows the migrations that have not been applied.

#### 4.6.7 Modifying Migration History

Sometimes, we may want to modify the migration history to a specific migration version without actually applying or reverting the relevant migrations. This often happens when developing a new migration. We can use the following command to achieve this goal.

```
yiic migrate mark 101129_185401
```

This command is very similar to `yiic migrate to` command, except that it only modifies the migration history table to the specified version without applying or reverting the migrations.

#### 4.6.8 Customizing Migration Command

There are several ways to customize the migration command.

##### Use Command Line Options

The migration command comes with four options that can be specified in command line:

- **interactive:** boolean, specifies whether to perform migrations in an interactive mode. Defaults to true, meaning the user will be prompted when performing a specific migration. You may set this to false should the migrations be done in a background process.
- **migrationPath:** string, specifies the directory storing all migration class files. This must be specified in terms of a path alias, and the corresponding directory must exist. If not specified, it will use the `migrations` sub-directory under the application base path.
- **migrationTable:** string, specifies the name of the database table for storing migration history information. It defaults to `tbl_migration`. The table structure is `version varchar(255) primary key, apply_time integer`.
- **connectionID:** string, specifies the ID of the database application component. Defaults to `'db'`.
- **templateFile:** string, specifies the path of the file to be served as the code template for generating the migration classes. This must be specified in terms of a path alias (e.g. `application.migrations.template`). If not set, an internal template will be used. Inside the template, the token `{ClassName}` will be replaced with the actual migration class name.

To specify these options, execute the migrate command using the following format

```
yiic migrate up --option1=value1 --option2=value2 ...
```

For example, if we want to migrate for a `forum` module whose migration files are located within the module's `migrations` directory, we can use the following command:

```
yiic migrate up --migrationPath=ext.forum.migrations
```

### Configure Command Globally

While command line options allow us to configure the migration command on-the-fly, sometimes we may want to configure the command once for all. For example, we may want to use a different table to store the migration history, or we may want to use a customized migration template. We can do so by modifying the console application's configuration file like the following,

```
return array(
    .....
    'commandMap'=>array(
        'migrate'=>array(
            'class'=>'system.cli.commands.MigrateCommand',
            'migrationPath'=>'application.migrations',
            'migrationTable'=>'tbl_migration',
            'connectionID'=>'db',
            'templateFile'=>'application.migrations.template',
        ),
        .....
    ),
    .....
);
```

Now if we run the `migrate` command, the above configurations will take effect without requiring us to enter the command line options every time.

# CHAPTER 5

---

## Caching

### 5.1 Caching

Caching is a cheap and effective way to improve the performance of a Web application. By storing relatively static data in cache and serving it from cache when requested, we save the time needed to generate the data.

Using cache in Yii mainly involves configuring and accessing a cache application component. The following application configuration specifies a cache component that uses memcache with two cache servers.

```
array(  
    .....  
    'components'=>array(  
        .....  
        'cache'=>array(  
            'class'=>'system.caching.CMemCache',  
            'servers'=>array(  
                array('host'=>'server1', 'port'=>11211, 'weight'=>60),  
                array('host'=>'server2', 'port'=>11211, 'weight'=>40),  
            ),  
        ),  
    ),  
);
```

When the application is running, the cache component can be accessed via `Yii::app()->cache`.

Yii provides various cache components that can store cached data in different media. For example, the [CMemCache](#) component encapsulates the PHP memcache extension and uses memory as the medium of cache storage; the [CApcCache](#) component encapsulates the PHP APC extension; and the [CDbCache](#) component stores cached data in database. The following is a summary of the available cache components:

- [CMemCache](#): uses PHP [memcache extension](#).

- **CApcCache**: uses PHP **APC** extension.
- **CXCache**: uses PHP **XCache** extension.
- **CEAcceleratorCache**: uses PHP **EAccelerator** extension.
- **CDbCache**: uses a database table to store cached data. By default, it will create and use a SQLite3 database under the runtime directory. You can explicitly specify a database for it to use by setting its **connectionID** property.
- **CZendDataCache**: uses **Zend Data Cache** as the underlying caching medium.
- **CFileCache**: uses files to store cached data. This is particular suitable to cache large chunk of data (such as pages).
- **CDummyCache**: presents dummy cache that does no caching at all. The purpose of this component is to simplify the code that needs to check the availability of cache. For example, during development or if the server doesn't have actual cache support, we can use this cache component. When an actual cache support is enabled, we can switch to use the corresponding cache component. In both cases, we can use the same code `Yii::app()->cache->get($key)` to attempt retrieving a piece of data without worrying that `Yii::app()->cache` might be null.

**Tip:** Because all these cache components extend from the same base class **CCache**, one can switch to use a different type of cache without modifying the code that uses cache.

Caching can be used at different levels. At the lowest level, we use cache to store a single piece of data, such as a variable, and we call this *data caching*. At the next level, we store in cache a page fragment which is generated by a portion of a view script. And at the highest level, we store a whole page in cache and serve it from cache as needed.

In the next few subsections, we elaborate how to use cache at these levels.

**Note:** By definition, cache is a volatile storage medium. It does not ensure the existence of the cached data even if it does not expire. Therefore, do not use cache as a persistent storage (e.g. do not use cache to store session data).

## 5.2 Data Caching

Data caching is about storing some PHP variable in cache and retrieving it later from cache. For this purpose, the cache component base class `CCache` provides two methods that are used most of the time: `set()` and `get()`.

To store a variable `$value` in cache, we choose a unique ID and call `set()` to store it:

```
Yii::app()->cache->set($id, $value);
```

The cached data will remain in the cache forever unless it is removed because of some caching policy (e.g. caching space is full and the oldest data are removed). To change this behavior, we can also supply an expiration parameter when calling `set()` so that the data will be removed from the cache after a certain period of time:

```
// keep the value in cache for at most 30 seconds
Yii::app()->cache->set($id, $value, 30);
```

Later when we need to access this variable (in either the same or a different Web request), we call `get()` with the ID to retrieve it from cache. If the value returned is false, it means the value is not available in cache and we should regenerate it.

```
$value=Yii::app()->cache->get($id);
if($value===false)
{
    // regenerate $value because it is not found in cache
    // and save it in cache for later use:
    // Yii::app()->cache->set($id,$value);
}
```

When choosing the ID for a variable to be cached, make sure the ID is unique among all other variables that may be cached in the application. It is NOT required that the ID is unique across applications because the cache component is intelligent enough to differentiate IDs for different applications.

Some cache storages, such as MemCache, APC, support retrieving multiple cached values in a batch mode, which may reduce the overhead involved in retrieving cached data. A method named `mget()` is provided to exploit this feature. In case the underlying cache storage does not support this feature, `mget()` will still simulate it.

To remove a cached value from cache, call `delete()`; and to remove everything from cache, call `flush()`. Be very careful when calling `flush()` because it also removes cached data that are from other applications.

**Tip:** Because `CCache` implements `ArrayAccess`, a cache component can be used liked an array. The followings are some examples:

```
$cache=Yii::app()->cache;  
$cache['var1']=$value1; // equivalent to: $cache->set('var1',$value1);  
$value2=$cache['var2']; // equivalent to: $value2=$cache->get('var2');
```

### 5.2.1 Cache Dependency

Besides expiration setting, cached data may also be invalidated according to some dependency changes. For example, if we are caching the content of some file and the file is changed, we should invalidate the cached copy and read the latest content from the file instead of the cache.

We represent a dependency as an instance of `CCacheDependency` or its child class. We pass the dependency instance along with the data to be cached when calling `set()`.

```
// the value will expire in 30 seconds  
// it may also be invalidated earlier if the dependent file is changed  
Yii::app()->cache->set($id, $value, 30, new CFileCacheDependency('FileName'));
```

Now if we retrieve `$value` from cache by calling `get()`, the dependency will be evaluated and if it is changed, we will get a false value, indicating the data needs to be regenerated.

Below is a summary of the available cache dependencies:

- `CFileCacheDependency`: the dependency is changed if the file's last modification time is changed.
- `CDirectoryCacheDependency`: the dependency is changed if any of the files under the directory and its subdirectories is changed.
- `CDbCacheDependency`: the dependency is changed if the query result of the specified SQL statement is changed.
- `CGlobalStateCacheDependency`: the dependency is changed if the value of the specified global state is changed. A global state is a variable that is persistent across multiple requests and multiple sessions in an application. It is defined via `CApplication::setGlobalState()`.
- `CChainedCacheDependency`: the dependency is changed if any of the dependencies on the chain is changed.



- **CExpressionDependency**: the dependency is changed if the result of the specified PHP expression is changed.

### 5.2.2 Query Caching

Since version 1.1.7, Yii has added support for query caching. Built on top of data caching, query caching stores the result of a DB query in cache and may thus save the DB query execution time if the same query is requested in future, as the result can be directly served from the cache.

**Info:** Some DBMS (e.g. **MySQL**) also support query caching on the DB server side. Compared with the server-side query caching, the same feature we support here offers more flexibility and potentially may be more efficient.

#### Enabling Query Caching

To enable query caching, make sure **CDbConnection::queryCacheID** refers to the ID of a valid cache application component (it defaults to **cache**).

#### Using Query Caching with DAO

To use query caching, we call the **CDbConnection::cache()** method when we perform DB queries. The following is an example:

```
$sql = 'SELECT * FROM tbl_post LIMIT 20';  
$dependency = new CDbCacheDependency('SELECT MAX(update_time) FROM tbl_post');  
$rows = Yii::app()->db->cache(1000, $dependency)->createCommand($sql)->queryAll();
```

When running the above statements, Yii will first check if the cache contains a valid result for the SQL statement to be executed. This is done by checking the following three conditions:

- if the cache contains an entry indexed by the SQL statement.
- if the entry is not expired (less than 1000 seconds since it was first saved in the cache).
- if the dependency has not changed (the maximum **update\_time** value is the same as when the query result was saved in the cache).

If all of the above conditions are satisfied, the cached result will be returned directly from the cache. Otherwise, the SQL statement will be sent to the DB server for execution, and the corresponding result will be saved in the cache and returned.

## Using Query Caching with ActiveRecord

Query caching can also be used with [Active Record](#). To do so, we call a similar [CActiveRecord::cache\(\)](#) method like the following:

```
$dependency = new CDbCacheDependency('SELECT MAX(update_time) FROM tbl_post');
$posts = Post::model()->cache(1000, $dependency)->findAll();
// relational AR query
$posts = Post::model()->cache(1000, $dependency)->with('author')->findAll();
```

The `cache()` method here is essentially a shortcut to [CDbConnection::cache\(\)](#). Internally, when executing the SQL statement generated by ActiveRecord, Yii will attempt to use query caching as we described in the last subsection.

## Caching Multiple Queries

By default, each time we call the `cache()` method (of either [CDbConnection](#) or [CActiveRecord](#)), it will mark the next SQL query to be cached. Any other SQL queries will NOT be cached unless we call `cache()` again. For example,

```
$sql = 'SELECT * FROM tbl_post LIMIT 20';
$dependency = new CDbCacheDependency('SELECT MAX(update_time) FROM tbl_post');

$rows = Yii::app()->db->cache(1000, $dependency)->createCommand($sql)->queryAll();
// query caching will NOT be used
$rows = Yii::app()->db->createCommand($sql)->queryAll();
```

By supplying an extra `$queryCount` parameter to the `cache()` method, we can enforce multiple queries to use query caching. In the following example, when we call `cache()`, we specify that query caching should be used for the next 2 queries:

```
// ...
$rows = Yii::app()->db->cache(1000, $dependency, 2)->createCommand($sql)->queryAll();
// query caching WILL be used
$rows = Yii::app()->db->createCommand($sql)->queryAll();
```

As we know, when performing a relational AR query, it is possible several SQL queries will be executed (by checking the [log messages](#)). For example, if the relationship between Post and Comment is HAS\_MANY, then the following code will actually execute two DB queries:

- it first selects the posts limited by 20;
- it then selects the comments for the previously selected posts.

```
$posts = Post::model()->with('comments')->findAll(array(  
    'limit'=>20,  
));
```

If we use query caching as follows, only the first DB query will be cached:

```
$posts = Post::model()->cache(1000, $dependency)->with('comments')->findAll(array(  
    'limit'=>20,  
));
```

In order to cache both DB queries, we need supply the extra parameter indicating how many DB queries we want to cache next:

```
$posts = Post::model()->cache(1000, $dependency, 2)->with('comments')->findAll(array(  
    'limit'=>20,  
));
```

### Limitations

Query caching does not work with query results that contain resource handles. For example, when using the BLOB column type in some DBMS, the query result will return a resource handle for the column data.

Some caching storage has size limitation. For example, memcache limits the maximum size of each entry to be 1MB. Therefore, if the size of a query result exceeds this limit, the caching will fail.

## 5.3 Fragment Caching

Fragment caching refers to caching a fragment of a page. For example, if a page displays a summary of yearly sale in a table, we can store this table in cache to eliminate the time needed to generate it for each request.

To use fragment caching, we call `CController::beginCache()` and `CController::endCache()` in a controller's view script. The two methods mark the beginning and the end of the page content that should be cached, respectively. Like [data caching](#), we need an ID to identify the fragment being cached.

```
...other HTML content...
<?php if($this->beginCache($id)) { ?>
...content to be cached...
<?php $this->endCache(); } ?>
...other HTML content...
```

In the above, if `beginCache()` returns false, the cached content will be automatically inserted at the place; otherwise, the content inside the if-statement will be executed and be cached when `endCache()` is invoked.

### 5.3.1 Caching Options

When calling `beginCache()`, we can supply an array as the second parameter consisting of caching options to customize the fragment caching. As a matter of fact, the `beginCache()` and `endCache()` methods are a convenient wrapper of the `COutputCache` widget. Therefore, the caching options can be initial values for any properties of `COutputCache`.

#### Duration

Perhaps the most commonly option is `duration` which specifies how long the content can remain valid in cache. It is similar to the expiration parameter of `CCache::set()`. The following code caches the content fragment for at most one hour:

```
...other HTML content...
<?php if($this->beginCache($id, array('duration'=>3600))) { ?>
...content to be cached...
<?php $this->endCache(); } ?>
...other HTML content...
```

If we do not set the duration, it would default to 60, meaning the cached content will be invalidated after 60 seconds.

Starting from version 1.1.8, if the duration is set 0, any existing cached content will be removed from the cache. If the duration is a negative value, the cache will be disabled, but existing cached content will remain in the cache. Prior to version 1.1.8, if the duration is 0 or negative, the cache will be disabled.

## Dependency

Like [data caching](#), content fragment being cached can also have dependencies. For example, the content of a post being displayed depends on whether or not the post is modified.

To specify a dependency, we set the [dependency](#) option, which can be either an object implementing [ICacheDependency] or a configuration array that can be used to generate the dependency object. The following code specifies the fragment content depends on the change of `lastModified` column value:

```
...other HTML content...
<?php if($this->beginCache($id, array('dependency'=>array(
    'class'=>'system.caching.dependencies.CDbCacheDependency',
    'sql'=>'SELECT MAX(lastModified) FROM Post')))) { ?>
...content to be cached...
<?php $this->endCache(); } ?>
...other HTML content...
```

## Variation

Content being cached may be varied according to some parameters. For example, the personal profile may look differently to different users. To cache the profile content, we would like the cached copy to be varied according to user IDs. This essentially means that we should use different IDs when calling [beginCache\(\)](#).

Instead of asking developers to variate the IDs according to some scheme, [COutputCache](#) is built-in with such a feature. Below is a summary.

- [varyByRoute](#): by setting this option to true, the cached content will be varied according to [route](#). Therefore, each combination of the requested controller and action will have a separate cached content.
- [varyBySession](#): by setting this option to true, we can make the cached content to be varied according to session IDs. Therefore, each user session may see different content and they are all served from cache.
- [varyByParam](#): by setting this option to an array of names, we can make the cached content to be varied according to the values of the specified GET parameters. For example, if a page displays the content of a post according to the `id` GET parameter, we can specify [varyByParam](#) to be `array('id')` so that we can cache the content for each post. Without such variation, we would only be able to cache a single post.

- **varyByExpression**: by setting this option to a PHP expression, we can make the cached content to be varied according to the result of this PHP expression.

## Request Types

Sometimes we want the fragment caching to be enabled only for certain types of request. For example, for a page displaying a form, we only want to cache the form when it is initially requested (via GET request). Any subsequent display (via POST request) of the form should not be cached because the form may contain user input. To do so, we can specify the **requestTypes** option:

```
...other HTML content...
<?php if($this->beginCache($id, array('requestTypes'=>array('GET')))) { ?>
...content to be cached...
<?php $this->endCache(); } ?>
...other HTML content...
```

### 5.3.2 Nested Caching

Fragment caching can be nested. That is, a cached fragment is enclosed within a bigger fragment that is also cached. For example, the comments are cached in an inner fragment cache, and they are cached together with the post content in an outer fragment cache.

```
...other HTML content...
<?php if($this->beginCache($id1)) { ?>
...outer content to be cached...
    <?php if($this->beginCache($id2)) { ?>
        ...inner content to be cached...
        <?php $this->endCache(); } ?>
    ...outer content to be cached...
    <?php $this->endCache(); } ?>
...other HTML content...
```

Different caching options can be set to the nested caches. For example, the inner cache and the outer cache in the above example can be set with different duration values. Even when the data cached in the outer cache is invalidated, the inner cache may still provide the valid inner fragment. However, it is not true vice versa. If the outer cache is evaluated to be valid, it will continue to provide the same cached copy even after the content in the inner cache has been invalidated. You must be careful in setting the durations or the dependencies of the nested caches, otherwise the outdated inner fragments may be kept in the outer fragment.

## 5.4 Page Caching

Page caching refers to caching the content of a whole page. Page caching can occur at different places. For example, by choosing an appropriate page header, the client browser may cache the page being viewed for a limited time. The Web application itself can also store the page content in cache.

### 5.4.1 Output Caching

Page caching can be considered as a special case of [fragment caching](#). Because the content of a page is often generated by applying a layout to a view, it will not work if we simply call `beginCache()` and `endCache()` in the layout. The reason is because the layout is applied within the `CController::render()` method AFTER the content view is evaluated.

To cache a whole page, we should skip the execution of the action generating the page content. We can use `COutputCache` as an action [filter](#) to accomplish this task. The following code shows how we configure the cache filter:

```
public function filters()
{
    return array(
        array(
            'COutputCache',
            'duration'=>100,
            'varyByParam'=>array('id'),
        ),
    );
}
```

The above filter configuration would make the filter to be applied to all actions in the controller. We may limit it to one or a few actions only by using the plus operator. More details can be found in [filter](#).

**Tip:** We can use `COutputCache` as a filter because it extends from `CFilterWidget`, which means it is both a widget and a filter. In fact, the way a widget works is very similar to a filter: a widget (filter) begins before any enclosed content (action) is evaluated, and the widget (filter) ends after the enclosed content (action) is evaluated.

### 5.4.2 HTTP Caching

In addition to simply caching the output of an action, Yii introduced `CHttpCacheFilter` in version 1.1.11. This filter aids in setting the aforementioned headers to notify a client that

a page's content has not been changed since the last request, so the server will not have to re-transmit the content. `CHttpCacheFilter` can be set up similar to `COutputCache`:

```
public function filters()
{
    return array(
        array(
            'CHttpCacheFilter + index',
            'lastModified'=>Yii::app()->db->createCommand("SELECT MAX('update_time') FROM {{post}}")->queryScalar()
        ),
    );
}
```

The above code will set the `Last-Modified` header to the last date at which a post was updated. You can also use `CHttpCacheFilter::lastModifiedExpression` to set the `Last-Modified` header using a php expression.

**Tip:** Both, `CHttpCacheFilter::lastModifiedExpression` and `CHttpCacheFilter::lastModified` can take either an integer representing an epochal Unix timestamp or an arbitrary string representing a human-readable date. As long as later one can be parsed by `strtotime()`, no further conversion is necessary.

The "Entity Tag" (or `ETag` for short) header can be set in a similar fashion through `CHttpCacheFilter::etagSeed` and `CHttpCacheFilter::etagSeedExpression`, respectively. Both will be serialized (so you can use either a single value or an entire array) and are used to generate a quoted, base64-encoded SHA1 hash serving as content for the `ETag` header. This differs from the way the `Apache Webserver` and others are generating their `ETags`. However, this method is perfectly in line with the RFC and turned out to be more feasible for use in a framework.

**Note:** In order to comply with [RFC 2616, section 13.3.4](#), `CHttpCacheFilter` will send out `ETag` and `Last-Modified` headers if they can both be generated. Consequently, both will be used for cache validation if sent by the client.

Since entity tags are hashes, they allow more complex and/or more precise caching strategies than `Last-Modified` headers. For instance, an `ETag` can be invalidated if the site has switched to another theme.



**Tip:** Expensive expressions for `CHttpCacheFilter::etagSeedExpression` may defeat the purpose of `CHttpCacheFilter` and introduce unnecessary overhead, since they need to be re-evaluated on every request. Try to find a simple expression that invalidates the cache if the page *content* has been modified.

## SEO Implications

Search engine bots tend to respect cache headers. Since some crawlers have a limit on how many pages per domain they process within a certain time span, introducing caching headers may help indexing your site as they reduce the number of pages that need to be processed.

## 5.5 Dynamic Content

When using [fragment caching](#) or [page caching](#), we often encounter the situation where the whole portion of the output is relatively static except at one or several places. For example, a help page may display static help information with the name of the user currently logged in displayed at the top.

To solve this issue, we can variate the cache content according to the username, but this would be a big waste of our precious cache space since most content are the same except the username. We can also divide the page into several fragments and cache them individually, but this complicates our view and makes our code very complex. A better approach is to use the *dynamic content* feature provided by `CController`.

A dynamic content means a fragment of output that should not be cached even if it is enclosed within a fragment cache. To make the content dynamic all the time, it has to be generated every time even when the enclosing content is being served from cache. For this reason, we require that dynamic content be generated by some method or function.

We call `CController::renderDynamic()` to insert dynamic content at the desired place.

```
...other HTML content...
<?php if($this->beginCache($id)) { ?>
...fragment content to be cached...
    <?php $this->renderDynamic($callback); ?>
...fragment content to be cached...
<?php $this->endCache(); } ?>
...other HTML content...
```

In the above, `$callback` refers to a valid PHP callback. It can be a string referring to

the name of a method in the current controller class or a global function. It can also be an array referring to a class method. Any additional parameters to `renderDynamic()` will be passed to the callback. The callback should return the dynamic content instead of displaying it.

# CHAPTER 6

---

## Extending Yii

### 6.1 Extending Yii

Extending Yii is a common activity during development. For example, when you write a new controller, you extend Yii by inheriting its `CController` class; when you write a new widget, you are extending `CWidget` or an existing widget class. If the extended code is designed to be reused by third-party developers, we call it an *extension*.

An extension usually serves for a single purpose. In Yii's terms, it can be classified as follows,

- application component
- behavior
- widget
- controller
- action
- filter
- console command
- validator: a validator is a component class extending `CValidator`.
- helper: a helper is a class with only static methods. It is like global functions using the class name as their namespace.
- module: a module is a self-contained software unit that consists of `models`, `views`, `controllers` and other supporting components. In many aspects, a module resembles to an `application`. The main difference is that a module is inside an application. For example, we could have a module that provides user management functionalities.

An extension can also be a component that does not fall into any of the above categories. As a matter of fact, Yii is carefully designed such that nearly every piece of its code can be extended and customized to fit for individual needs.

## 6.2 Using Extensions

Using an extension usually involves the following three steps:

1. Download the extension from Yii's [extension repository](#).
2. Unpack the extension under the `extensions/xyz` subdirectory of [application base directory](#), where `xyz` is the name of the extension.
3. Import, configure and use the extension.

Each extension has a name that uniquely identifies it among all extensions. Given an extension named as `xyz`, we can always use the path alias `ext.xyz` to locate its base directory which contains all files of `xyz`.

Different extensions have different requirements about importing, configuration and usage. In the following, we summarize common usage scenarios about extensions, according to their categorization described in the [overview](#).

### 6.2.1 Zii Extensions

Before we start describing the usage of third-party extensions, we would like to introduce the Zii extension library, which is a set of extensions developed by the Yii developer team and included in every release.

When using a Zii extension, one must refer to the corresponding class using a path alias in the form of `zii.path.to.ClassName`. Here the root alias `zii` is predefined by Yii. It refers to the root directory of the Zii library. For example, to use [CGridView](#), we would use the following code in a view script when referring to the extension:

```
$this->widget('zii.widgets.grid.CGridView', array(
    'dataProvider'=>$dataProvider,
));
```

### 6.2.2 Application Component

To use an application component, we first need to change the [application configuration](#) by adding a new entry to its `components` property, like the following:

```

return array(
    // 'preload'=>array('xyz',...),
    'components'=>array(
        'xyz'=>array(
            'class'=>'ext.xyz.XyzClass',
            'property1'=>'value1',
            'property2'=>'value2',
        ),
        // other component configurations
    ),
);

```

Then, we can access the component at any place using `Yii::app()->xyz`. The component will be lazily created (that is, created when it is accessed for the first time) unless we list it the `preload` property.

### 6.2.3 Behavior

[Behavior](#) can be used in all sorts of components. Its usage involves two steps. In the first step, a behavior is attached to a target component. In the second step, a behavior method is called via the target component. For example:

```

// $name uniquely identifies the behavior in the component
$component->attachBehavior($name,$behavior);
// test() is a method of $behavior
$component->test();

```

More often, a behavior is attached to a component using a configurative way instead of calling the `attachBehavior` method. For example, to attach a behavior to an application component, we could use the following [application configuration](#):

```

return array(
    'components'=>array(
        'db'=>array(
            'class'=>'CDbConnection',
            'behaviors'=>array(
                'xyz'=>array(
                    'class'=>'ext.xyz.XyzBehavior',
                    'property1'=>'value1',
                    'property2'=>'value2',
                ),
            ),
        ),
    ),
    //....
);

```

```
    ),
);
```

The above code attaches the `xyz` behavior to the `db` application component. We can do so because `CApplicationComponent` defines a property named `behaviors`. By setting this property with a list of behavior configurations, the component will attach the corresponding behaviors when it is being initialized.

For `CController`, `CFormModel` and `CActiveRecord` classes which usually need to be extended, attaching behaviors can be done by overriding their `behaviors()` method. The classes will automatically attach any behaviors declared in this method during initialization. For example,

```
public function behaviors()
{
    return array(
        'xyz'=>array(
            'class'=>'ext.xyz.XyzBehavior',
            'property1'=>'value1',
            'property2'=>'value2',
        ),
    );
}
```

#### 6.2.4 Widget

`Widgets` are mainly used in `views`. Given a widget class `XyzClass` belonging to the `xyz` extension, we can use it in a view as follows,

```
// widget that does not need body content
<?php $this->widget('ext.xyz.XyzClass', array(
    'property1'=>'value1',
    'property2'=>'value2')); ?>

// widget that can contain body content
<?php $this->beginWidget('ext.xyz.XyzClass', array(
    'property1'=>'value1',
    'property2'=>'value2')); ?>

...body content of the widget...

<?php $this->endWidget(); ?>
```

### 6.2.5 Action

[Actions](#) are used by a [controller](#) to respond specific user requests. Given an action class `XYZClass` belonging to the `xyz` extension, we can use it by overriding the `CController::actions` method in our controller class:

```
class TestController extends CController
{
    public function actions()
    {
        return array(
            'xyz'=>array(
                'class'=>'ext.xyz.XyzClass',
                'property1'=>'value1',
                'property2'=>'value2',
            ),
            // other actions
        );
    }
}
```

Then, the action can be accessed via [route](#) `test/xyz`.

### 6.2.6 Filter

[Filters](#) are also used by a [controller](#). They mainly pre- and post-process the user request when it is handled by an [action](#). Given a filter class `XYZClass` belonging to the `xyz` extension, we can use it by overriding the `CController::filters` method in our controller class:

```
class TestController extends CController
{
    public function filters()
    {
        return array(
            array(
                'ext.xyz.XyzClass',
                'property1'=>'value1',
                'property2'=>'value2',
            ),
            // other filters
        );
    }
}
```

In the above, we can use plus and minus operators in the first array element to apply the filter to limited actions only. For more details, please refer to the documentation of [CController](#).

### 6.2.7 Controller

A [controller](#) provides a set of actions that can be requested by users. In order to use a controller extension, we need to configure the [CWebApplication::controllerMap](#) property in the [application configuration](#):

```
return array(  
    'controllerMap'=>array(  
        'xyz'=>array(  
            'class'=>'ext.xyz.XyzClass',  
            'property1'=>'value1',  
            'property2'=>'value2',  
        ),  
        // other controllers  
    ),  
);
```

Then, an action a in the controller can be accessed via [route xyz/a](#).

### 6.2.8 Validator

A validator is mainly used in a [model](#) class (one that extends from either [CFormModel](#) or [CActiveRecord](#)). Given a validator class [XyzClass](#) belonging to the [xyz](#) extension, we can use it by overriding the [CModel::rules](#) method in our model class:

```
class MyModel extends CActiveRecord // or CFormModel  
{  
    public function rules()  
    {  
        return array(  
            array(  
                'attr1, attr2',  
                'ext.xyz.XyzClass',  
                'property1'=>'value1',  
                'property2'=>'value2',  
            ),  
            // other validation rules  
        );  
    }  
}
```



### 6.2.9 Console Command

A [console command](#) extension usually enhances the yiic tool with an additional command. Given a console command `XYZClass` belonging to the `xyz` extension, we can use it by configuring the configuration for the console application:

```
return array(  
    'commandMap'=>array(  
        'xyz'=>array(  
            'class'=>'ext.xyz.XyzClass',  
            'property1'=>'value1',  
            'property2'=>'value2',  
        ),  
        // other commands  
    ),  
);
```

Then, we can use the yiic tool is equipped with an additional command `xyz`.

**Note:** A console application usually uses a configuration file that is different from the one used by a Web application. If an application is created using `yiic webapp` command, then the configuration file for the console application `protected/yiic` is `protected/config/console.php`, while the configuration file for the Web application is `protected/config/main.php`.

### 6.2.10 Module

Please refer to the section about [modules](#) on how to use a module.

### 6.2.11 Generic Component

To use a generic [component](#), we first need to include its class file by using

```
Yii::import('ext.xyz.XyzClass');
```

Then, we can either create an instance of the class, configure its properties, and call its methods. We may also extend it to create new child classes.

## 6.3 Creating Extensions

Because an extension is meant to be used by third-party developers, it takes some additional efforts to create it. The followings are some general guidelines:

- An extension should be self-contained. That is, its external dependency should be minimal. It would be a headache for its users if an extension requires installation of additional packages, classes or resource files.
- Files belonging to an extension should be organized under the same directory whose name is the extension name
- Classes in an extension should be prefixed with some letter(s) to avoid naming conflict with classes in other extensions.
- An extension should come with detailed installation and API documentation. This would reduce the time and effort needed by other developers when they use the extension.
- An extension should be using an appropriate license. If you want to make your extension to be used by both open-source and closed-source projects, you may consider using licenses such as BSD, MIT, etc., but not GPL as it requires its derived code to be open-source as well.

In the following, we describe how to create a new extension, according to its categorization as described in [overview](#). These descriptions also apply when you are creating a component mainly used in your own projects.

### 6.3.1 Application Component

An application component should implement the interface `[IApplicationComponent]` or extend from `CApplicationComponent`. The main method needed to be implemented is `[IApplicationComponent::init]` in which the component performs some initialization work. This method is invoked after the component is created and the initial property values (specified in [application configuration](#)) are applied.

By default, an application component is created and initialized only when it is accessed for the first time during request handling. If an application component needs to be created right after the application instance is created, it should require the user to list its ID in the `CApplication::preload` property.

### 6.3.2 Behavior

To create a behavior, one must implement the `[IBehavior]` interface. For convenience, Yii provides a base class `CBehavior` that already implements this interface and provides some additional convenient methods. Child classes mainly need to implement the extra methods that they intend to make available to the components being attached to.

When developing behaviors for `CModel` and `CActiveRecord`, one can also extend `CModelBehavior` and `CActiveRecordBehavior`, respectively. These base classes offer additional features that are specifically made for `CModel` and `CActiveRecord`. For example, the `CActiveRecordBehavior` class implements a set of methods to respond to the life cycle events raised in an `ActiveRecord` object. A child class can thus override these methods to put in customized code which will participate in the AR life cycles.

The following code shows an example of an `ActiveRecord` behavior. When this behavior is attached to an AR object and when the AR object is being saved by calling `save()`, it will automatically sets the `create_time` and `update_time` attributes with the current timestamp.

```
class TimestampBehavior extends CActiveRecordBehavior
{
    public function beforeSave($event)
    {
        if($this->owner->isNewRecord)
            $this->owner->create_time=time();
        else
            $this->owner->update_time=time();
    }
}
```

### 6.3.3 Widget

A `widget` should extend from `CWidget` or its child classes.

The easiest way of creating a new widget is extending an existing widget and overriding its methods or changing its default property values. For example, if you want to use a nicer CSS style for `CTabView`, you could configure its `CTabView::cssFile` property when using the widget. You can also extend `CTabView` as follows so that you no longer need to configure the property when using the widget.

```
class MyTabView extends CTabView
{
    public function init()
    {
        if($this->cssFile===null)
        {
            $file=dirname(__FILE__).DIRECTORY_SEPARATOR.'tabview.css';
            $this->cssFile=Yii::app()->getAssetManager()->publish($file);
        }
        parent::init();
    }
}
```

In the above, we override the `CWidget::init` method and assign to `CTabView::cssFile` the URL to our new default CSS style if the property is not set. We put the new CSS style file under the same directory containing the `MyTabView` class file so that they can be packaged as an extension. Because the CSS style file is not Web accessible, we need to publish as an asset.

To create a new widget from scratch, we mainly need to implement two methods: `CWidget::init` and `CWidget::run`. The first method is called when we use `$this->beginWidget` to insert a widget in a view, and the second method is called when we call `$this->endWidget`. If we want to capture and process the content displayed between these two method invocations, we can start *output buffering* in `CWidget::init` and retrieve the buffered output in `CWidget::run` for further processing.

A widget often involves including CSS, JavaScript or other resource files in the page that uses the widget. We call these files *assets* because they stay together with the widget class file and are usually not accessible by Web users. In order to make these files Web accessible, we need to publish them using `CWebApplication::assetManager`, as shown in the above code snippet. Besides, if we want to include a CSS or JavaScript file in the current page, we need to register it using `CClientScript`:

```
class MyWidget extends CWidget
{
    protected function registerClientScript()
    {
        // ...publish CSS or JavaScript file here...
        $cs=Yii::app()->clientScript;
        $cs->registerCssFile($cssFile);
        $cs->registerScriptFile($jsFile);
    }
}
```

A widget may also have its own view files. If so, create a directory named `views` under the directory containing the widget class file, and put all the view files there. In the widget class, in order to render a widget view, use `$this->render('ViewName')`, which is similar to what we do in a controller.

### 6.3.4 Action

An *action* should extend from `CAction` or its child classes. The main method that needs to be implemented for an action is `[IAction::run]`.

### 6.3.5 Filter

A [filter](#) should extend from [CFilter](#) or its child classes. The main methods that need to be implemented for a filter are [CFilter::preFilter](#) and [CFilter::postFilter](#). The former is invoked before the action is executed while the latter after.

```
class MyFilter extends CFilter
{
    protected function preFilter($filterChain)
    {
        // logic being applied before the action is executed
        return true; // false if the action should not be executed
    }

    protected function postFilter($filterChain)
    {
        // logic being applied after the action is executed
    }
}
```

The parameter `$filterChain` is of type [CFilterChain](#) which contains information about the action that is currently filtered.

### 6.3.6 Controller

A [controller](#) distributed as an extension should extend from [CExtController](#), instead of [CController](#). The main reason is because [CController](#) assumes the controller view files are located under `application.views.ControllerID`, while [CExtController](#) assumes the view files are located under the `views` directory which is a subdirectory of the directory containing the controller class file. Therefore, it is easier to redistribute the controller since its view files are staying together with the controller class file.

### 6.3.7 Validator

A validator should extend from [CValidator](#) and implement its [CValidator::validateAttribute](#) method.

```
class MyValidator extends CValidator
{
    protected function validateAttribute($model,$attribute)
    {
        $value=$model->$attribute;
        if($value has error)
            $model->addError($attribute,$errorMessage);
    }
}
```

```
}  
}
```

### 6.3.8 Console Command

A [console command](#) should extend from `CConsoleCommand` and implement its `CConsoleCommand::run` method. Optionally, we can override `CConsoleCommand::getHelp` to provide some nice help information about the command.

```
class MyCommand extends CConsoleCommand  
{  
    public function run($args)  
    {  
        // $args gives an array of the command-line arguments for this command  
    }  
  
    public function getHelp()  
    {  
        return 'Usage: how to use this command';  
    }  
}
```

### 6.3.9 Module

Please refer to the section about [modules](#) on how to create a module.

A general guideline for developing a module is that it should be self-contained. Resource files (such as CSS, JavaScript, images) that are used by a module should be distributed together with the module. And the module should publish them so that they can be Web-accessible.

### 6.3.10 Generic Component

Developing a generic component extension is like writing a class. Again, the component should also be self-contained so that it can be easily used by other developers.

## 6.4 Using 3rd-Party Libraries

Yii is carefully designed so that third-party libraries can be easily integrated to further extend Yii's functionalities. When using third-party libraries in a project, developers often encounter issues about class naming and file inclusion. Because all Yii classes are prefixed with letter C, it is less likely class naming issue would occur; and because Yii relies on [SPL](#)

`autoload` to perform class file inclusion, it can play nicely with other libraries if they use the same autoloading feature or PHP include path to include class files.

Below we use an example to illustrate how to use the `Zend_Search_Lucene` component from the `Zend framework` in a Yii application.

First, we extract the Zend framework release file to a directory under `protected/vendors`, assuming `protected` is the `application base directory`. Verify that the file `protected/vendors/Zend/Search/Lucene.php` exists.

Second, at the beginning of a controller class file, insert the following lines:

```
Yii::import('application.vendors.*');  
require_once('Zend/Search/Lucene.php');
```

The above code includes the class file `Lucene.php`. Because we are using a relative path, we need to change the PHP include path so that the file can be located correctly. This is done by calling `Yii::import` before `require_once`.

Once the above set up is ready, we can use the `Lucene` class in a controller action, like the following:

```
$lucene=new Zend_Search_Lucene($pathOfIndex);  
$hits=$lucene->find(strtolower($keyword));
```

### 6.4.1 Using namespaced 3rd-Party Libraries

In order to use namespaced library that follows

(such as Zend Framework 2 or Symfony2) you need to register its root as path alias.

As an example we'll use `Imagine`. If we put the `Imagine` directory under `protected/vendors` we'll be able to use it like the following:

```
Yii::setPathOfAlias('Imagine',Yii::getPathOfAlias('application.vendors.Imagine'));  
  
// Then standard code from Imagine guide:  
// $imagine = new Imagine\Gd\Imagine();  
// etc.
```

In the code above the name of the alias we've defined should match the first namespace part used in the library.

### 6.4.2 Using Yii in 3rd-Party Systems

Yii can also be used as a self-contained library to support developing and enhancing existing 3rd-party systems, such as WordPress, Joomla, etc. To do so, include the following code in the bootstrap code of the 3rd-party system:

```
require_once('path/to/yii.php');  
Yii::createWebApplication('path/to/config.php');
```

The above code is very similar to the bootstrap code used by a typical Yii application except one thing: it does not call the `run()` method after creating the Web application instance.

Now we can use most features offered by Yii when developing 3rd-party enhancements. For example, we can use `Yii::app()` to access the application instance; we can use the database features such as DAO and ActiveRecord; we can use the model and validation feature; and so on.



# CHAPTER 7

---

## Testing

### 7.1 Testing

Testing is an indispensable process of software development. Whether we are aware of it or not, we conduct testing all the time when we are developing a Web application. For example, when we write a class in PHP, we may use some `echo` or `die` statement to show that we implement a method correctly; when we implement a Web page containing a complex HTML form, we may try entering some test data to ensure the page interacts with us as expected. More advanced developers would write some code to automate this testing process so that each time when we need to test something, we just need to call up the code and let the computer to perform testing for us. This is known as *automated testing*, which is the main topic of this chapter.

The testing support provided by Yii includes *unit testing* and *functional testing*.

A unit test verifies that a single unit of code is working as expected. In object-oriented programming, the most basic code unit is a class. A unit test thus mainly needs to verify that each of the class interface methods works properly. That is, given different input parameters, the test verifies the method returns expected results. Unit tests are usually developed by people who write the classes being tested.

A functional test verifies that a feature (e.g. post management in a blog system) is working as expected. Compared with a unit test, a functional test sits at a higher level because a feature being tested often involves multiple classes. Functional tests are usually developed by people who know very well the system requirements (they could be either developers or quality engineers).

#### 7.1.1 Test-Driven Development

Below we show the development cycles in the so-called [test-driven development \(TDD\)](#):

1. Create a new test that covers a feature to be implemented. The test is expected to

fail at its first execution because the feature has yet to be implemented.

2. Run all tests and make sure the new test fails.
3. Write code to make the new test pass.
4. Run all tests and make sure they all pass.
5. Refactor the code that is newly written and make sure the tests still pass.

Repeat step 1 to 5 to push forward the functionality implementation.

### 7.1.2 Test Environment Setup

The testing supported provided by Yii requires [PHPUnit 3.5+](#) and [Selenium Remote Control 1.0+](#). Please refer to their documentation on how to install PHPUnit and Selenium Remote Control.

When we use the `yiic webapp` console command to create a new Yii application, it will generate the following files and directories for us to write and perform new tests:

<code>testdrive/</code>	
<code>protected/</code>	containing protected application files
<code>tests/</code>	containing tests for the application
<code>fixtures/</code>	containing database fixtures
<code>functional/</code>	containing functional tests
<code>unit/</code>	containing unit tests
<code>report/</code>	containing coverage reports
<code>bootstrap.php</code>	the script executed at the very beginning
<code>phpunit.xml</code>	the PHPUnit configuration file
<code>WebTestCase.php</code>	the base class for Web-based functional tests

As shown in the above, our test code will be mainly put into three directories: `fixtures`, `functional` and `unit`, and the directory `report` will be used to store the generated code coverage reports.

To execute tests (whether unit tests or functional tests), we can execute the following commands in a console window:

```
% cd testdrive/protected/tests
% phpunit functional/PostTest.php    // executes an individual test
% phpunit --verbose functional      // executes all tests under functional
% phpunit --coverage-html ./report unit
```

In the above, the last command will execute all tests under the `unit` directory and generate a code-coverage report under the `report` directory. Note that [xdebug extension](#) must be installed and enabled in order to generate code-coverage reports.

### 7.1.3 Test Bootstrap Script

Let's take a look what may be in the `bootstrap.php` file. This file is so special because it is like the [entry script](#) and is the starting point when we execute a set of tests.

```
$yiit='path/to/yii/framework/yiit.php';
$config=dirname(__FILE__).'/../config/test.php';
require_once($yiit);
require_once(dirname(__FILE__).'/WebTestCase.php');
Yii::createWebApplication($config);
```

In the above, we first include the `yiit.php` file from the Yii framework, which initializes some global constants and includes necessary test base classes. We then create a Web application instance using the `test.php` configuration file. If we check `test.php`, we shall find that it inherits from the `main.php` configuration file and adds a `fixture` application component whose class is [CDbFixtureManager](#). We will describe fixtures in detail in the next section.

```
return CMap::mergeArray(
    require(dirname(__FILE__).'/main.php'),
    array(
        'components'=>array(
            'fixture'=>array(
                'class'=>'system.test.CDbFixtureManager',
            ),
            /* uncomment the following to provide test database connection
            'db'=>array(
                'connectionString'=>'DSN for test database',
            ),
            */
        ),
    ),
);
```

When we run tests that involve database, we should provide a test database so that the test execution does not interfere with normal development or production activities. To do so, we just need to uncomment the `db` configuration in the above and fill in the `connectionString` property with the DSN (data source name) to the test database.

With such a bootstrap script, when we run unit tests, we will have an application instance that is nearly the same as the one that serves for Web requests. The main difference is that it has the fixture manager and is using the test database.

## 7.2 Defining Fixtures

Automated tests need to be executed many times. To ensure the testing process is repeatable, we would like to run the tests in some known state called *fixture*. For example, to test the post creation feature in a blog application, each time when we run the tests, the tables storing relevant data about posts (e.g. the `Post` table, the `Comment` table) should be restored to some fixed state. The [PHPUnit documentation](#) has described well about generic fixture setup. In this section, we mainly describe how to set up database fixtures, as we just described in the example.

Setting up database fixtures is perhaps one of the most time-consuming parts in testing database-backed Web applications. Yii introduces the [CDbFixtureManager](#) application component to alleviate this problem. It basically does the following things when running a set of tests:

- Before all tests run, it resets all tables relevant to the tests to some known state.
- Before a single test method runs, it resets the specified tables to some known state.
- During the execution of a test method, it provides access to the rows of the data that contribute to the fixture.

To use [CDbFixtureManager](#), we configure it in the [application configuration](#) as follows,

```
return array(  
    'components'=>array(  
        'fixture'=>array(  
            'class'=>'system.test.CDbFixtureManager',  
        ),  
    ),  
);
```

We then provide the fixture data under the directory `protected/tests/fixtures`. This directory may be customized to be a different one by configuring the [CDbFixtureManager::basePath](#) property in the application configuration. The fixture data is organized as a collection of PHP files called fixture files. Each fixture file returns an array representing the initial rows of data for a particular table. The file name is the same as the table name.

The following is an example of the fixture data for the `Post` table stored in a file named `Post.php`:

```
<?php
return array(
    'sample1'=>array(
        'title'=>'test post 1',
        'content'=>'test post content 1',
        'createTime'=>1230952187,
        'authorId'=>1,
    ),
    'sample2'=>array(
        'title'=>'test post 2',
        'content'=>'test post content 2',
        'createTime'=>1230952287,
        'authorId'=>1,
    ),
);
```

As we can see, two rows of data are returned in the above. Each row is represented as an associative array whose keys are column names and whose values are the corresponding column values. In addition, each row is indexed by a string (e.g. `sample1`, `sample2`) which is called *row alias*. Later when we write test scripts, we can conveniently refer to a row by its alias. We will describe this in detail in the next section.

You may notice that we do not specify the `id` column values in the above fixture. This is because the `id` column is defined to be an auto-incremental primary key whose value will be filled up when we insert new rows.

When `CDbFixtureManager` is referenced for the first time, it will go through every fixture file and use it to reset the corresponding table. It resets a table by truncating the table, resetting the sequence value for the table's auto-incremental primary key, and then inserting the rows of data from the fixture file into the table.

Sometimes, we may not want to reset every table which has a fixture file before we run a set of tests, because resetting too many fixture files could take very long time. In this case, we can write a PHP script to do the initialization work in a customized way. The script should be saved in a file named `init.php` under the same directory that contains other fixture files. When `CDbFixtureManager` detects the existence of this script, it will execute this script instead of resetting every table.

It is also possible that we do not like the default way of resetting a table, i.e., truncating it and inserting it with the fixture data. If this is the case, we can write an initialization script for the specific fixture file. The script must be named as the table name suffixed

with `.init.php`. For example, the initialization script for the `Post` table would be `Post.init.php`. When `CDbFixtureManager` sees this script, it will execute this script instead of using the default way to reset the table.

**Tip:** Having too many fixture files could increase the test time dramatically. For this reason, you should only provide fixture files for those tables whose content may change during the test. Tables that serve as look-ups do not change and thus do not need fixture files.

In the next two sections, we will describe how to make use of the fixtures managed by `CDbFixtureManager` in unit tests and functional tests.

### 7.3 Unit Testing

Because the Yii testing framework is built on top of `PHPUnit`, it is recommended that you go through the [PHPUnit documentation](#) first to get the basic understanding on how to write a unit test. We summarize in the following the basic principles of writing a unit test in Yii:

- A unit test is written in terms of a class `XyzTest` which extends from `CTestCase` or `CDbTestCase`, where `Xyz` stands for the class being tested. For example, to test the `Post` class, we would name the corresponding unit test as `PostTest` by convention. The base class `CTestCase` is meant for generic unit tests, while `CDbTestCase` is suitable for testing [active record](#) model classes. Because `PHPUnit_Framework_TestCase` is the ancestor class for both classes, we can use all methods inherited from this class.
- The unit test class is saved in a PHP file named as `XyzTest.php`. By convention, the unit test file may be stored under the directory `protected/tests/unit`.
- The test class mainly contains a set of test methods named as `testAbc`, where `Abc` is often the name of the class method to be tested.
- A test method usually contains a sequence of assertion statements (e.g. `assertTrue`, `assertEquals`) which serve as checkpoints on validating the behavior of the target class.

In the following, we mainly describe how to write unit tests for [active record](#) model classes. We will extend our test classes from `CDbTestCase` because it provides the database fixture support that we introduced in the previous section.

Assume we want to test the `Comment` model class in the [blog demo](#). We start by creating a class named `CommentTest` and saving it as `protected/tests/unit/CommentTest.php`:

```
class CommentTest extends CDbTestCase
{
    public $fixtures=array(
        'posts'=>'Post',
        'comments'=>'Comment',
    );

    .....
}
```

In this class, we specify the `fixtures` member variable to be an array that specifies which fixtures will be used by this test. The array represents a mapping from fixture names to model class names or fixture table names (e.g. from fixture name `posts` to model class `Post`). Note that when mapping to fixture table names, we should prefix the table name with a colon (e.g. `:Post`) to differentiate it from model class name. And when using model class names, the corresponding tables will be considered as fixture tables. As we described earlier, fixture tables will be reset to some known state each time when a test method is executed.

Fixture names allow us to access the fixture data in test methods in a convenient way. The following code shows its typical usage:

```
// return all rows in the 'Comment' fixture table
$comments = $this->comments;
// return the row whose alias is 'sample1' in the 'Post' fixture table
$post = $this->posts['sample1'];
// return the AR instance representing the 'sample1' fixture data row
$post = $this->posts('sample1');
```

**Note:** If a fixture is declared using its table name (e.g. `'posts'=>':Post'`), then the third usage in the above is not valid because we have no information about which model class the table is associated with.

Next, we write the `testApprove` method to test the `approve` method in the `Comment` model class. The code is very straightforward: we first insert a comment that is pending status; we then verify this comment is in pending status by retrieving it from database; and finally we call the `approve` method and verify the status is changed as expected.

```

public function testApprove()
{
    // insert a comment in pending status
    $comment=new Comment;
    $comment->setAttributes(array(
        'content'=>'comment 1',
        'status'=>Comment::STATUS_PENDING,
        'createTime'=>time(),
        'author'=>'me',
        'email'=>'me@example.com',
        'postId'=>$this->posts['sample1']['id'],
    ),false);
    $this->assertTrue($comment->save(false));

    // verify the comment is in pending status
    $comment=Comment::model()->findByPk($comment->id);
    $this->assertTrue($comment instanceof Comment);
    $this->assertEquals(Comment::STATUS_PENDING,$comment->status);

    // call approve() and verify the comment is in approved status
    $comment->approve();
    $this->assertEquals(Comment::STATUS_APPROVED,$comment->status);
    $comment=Comment::model()->findByPk($comment->id);
    $this->assertEquals(Comment::STATUS_APPROVED,$comment->status);
}

```

## 7.4 Functional Testing

Before reading this section, it is recommended that you read the [Selenium documentation](#) and the [PHPUnit documentation](#) first. We summarize in the following the basic principles of writing a functional test in Yii:

- Like unit test, a functional test is written in terms of a class `XYZTest` which extends from `CWebTestCase`, where `XYZ` stands for the class being tested. Because `PHPUnit_Extensions_SeleniumTestCase` is the ancestor class for `CWebTestCase`, we can use all methods inherited from this class.
- The functional test class is saved in a PHP file named as `XYZTest.php`. By convention, the functional test file may be stored under the directory `protected/tests/functional`.
- The test class mainly contains a set of test methods named as `testAbc`, where `Abc` is often the name of a feature to be tested. For example, to test the user login feature, we can have a test method named as `testLogin`.



- A test method usually contains a sequence of statements that would issue commands to Selenium RC to interact with the Web application being tested. It also contains assertion statements to verify that the Web application responds as expected.

Before we describe how to write a functional test, let's take a look at the `WebTestCase.php` file generated by the `yiic webapp` command. This file defines `WebTestCase` that may serve as the base class for all functional test classes.

```
define('TEST_BASE_URL','http://localhost/yii/demos/blog/index-test.php/');

class WebTestCase extends CWebTestCase
{
    /**
     * Sets up before each test method runs.
     * This mainly sets the base URL for the test application.
     */
    protected function setUp()
    {
        parent::setUp();
        $this->setBrowserUrl(TEST_BASE_URL);
    }

    .....
}
```

The class `WebTestCase` mainly sets the base URL of the pages to be tested. Later in test methods, we can use relative URLs to specify which pages to be tested.

We should also pay attention that in the base test URL, we use `index-test.php` as the entry script instead of `index.php`. The only difference between `index-test.php` and `index.php` is that the former uses `test.php` as the application configuration file while the latter `main.php`.

We now describe how to test the feature about showing a post in the [blog demo](#). We first write the test class as follows, noting that the test class extends from the base class we just described:

```
class PostTest extends WebTestCase
{
    public $fixtures=array(
        'posts'=>'Post',
    );

    public function testShow()
```

```
{
    $this->open('post/1');
    // verify the sample post title exists
    $this->assertTextPresent($this->posts['sample1']['title']);
    // verify comment form exists
    $this->assertTextPresent('Leave a Comment');
}

.....
}
```

Like writing a unit test class, we declare the fixtures to be used by this test. Here we indicate that the `Post` fixture should be used. In the `testShow` test method, we first instruct Selenium RC to open the URL `post/1`. Note that this is a relative URL, and the complete URL is formed by appending it to the base URL we set in the base class (i.e. `http://localhost/yii/demos/blog/index-test.php/post/1`). We then verify that we can find the title of the `sample1` post can be found in the current Web page. And we also verify that the page contains the text `Leave a Comment`.

**Tip:** Before running functional tests, the Selenium-RC server must be started. This can be done by executing the command `java -jar selenium-server.jar` under your Selenium server installation directory.

# CHAPTER 8

---

## Special Topics

### 8.1 Automatic Code Generation

Starting from version 1.1.2, Yii is equipped with a Web-based code generation tool called *Gii*. It supercedes the previous `yiic shell` generation tool which runs on command line. In this section, we will describe how to use Gii and how to extend Gii to increase our development productivity.

#### 8.1.1 Using Gii

Gii is implemented in terms of a module and must be used within an existing Yii application. To use Gii, we first modify the application configuration as follows:

```
return array(
    . . . . .
    'modules'=>array(
        'gii'=>array(
            'class'=>'system.gii.GiiModule',
            'password'=>'pick up a password here',
            // 'ipFilters'=>array(...a list of IPs...),
            // 'newFileMode'=>0666,
            // 'newDirMode'=>0777,
        ),
    ),
);
```

In the above, we declare a module named `gii` whose class is `[GiiModule]`. We also specify a password for the module which we will be prompted for when accessing Gii.

By default for security reasons, Gii is configured to be accessible only on localhost. If we want to make it accessible on other trustable computers, we can configure the `[GiiModule::ipFilters]` property as shown in the above code.

Because Gii may generate and save new code files in the existing application, we need to make sure that the Web server process has the proper permission to do so. The above `[GiiModule::newFileMode]` and `[GiiModule::newDirMode]` properties control how the new files and directories should be generated.

**Note:** Gii is mainly provided as a development tool. Therefore, it should only be installed on a development machine. Because it can generate new PHP script files in the application, we should pay sufficient attention to its security measures (e.g. password, IP filters).

We can now access Gii via the URL `http://hostname/path/to/index.php?r=gii`. Here we assume `http://hostname/path/to/index.php` is the URL for accessing the existing Yii application.

If the existing Yii application uses path-format URLs (see [URL management](#)), we can access Gii via the URL `http://hostname/path/to/index.php/gii`. We may need to add the following URL rules to the front of the existing URL rules:

```
'components'=>array(
    .....
    'urlManager'=>array(
        'urlFormat'=>'path',
        'rules'=>array(
            'gii'=>'gii',
            'gii/<controller:\w+>'=>'gii/<controller>',
            'gii/<controller:\w+>/<action:\w+>'=>'gii/<controller>/<action>',
            ...existing rules...
        ),
    ),
),
```

Gii comes with a few default code generators. Each code generator is responsible for generating a specific type of code. For example, the controller generator generates a controller class together with a few action view scripts; the model generator generates an ActiveRecord class for the specified database table.

The basic workflow of using a generator is as follows:

1. Enter the generator page;
2. Fill in the fields that specify the code generation parameters. For example, to use the module generator to create a new module, you need to specify the module ID;

3. Press the **Preview** button to preview the code to be generated. You will see a table showing a list of code files to be generated. You can click on any of them to preview the code;
4. Press the **Generate** button to generate the code files;
5. Review the code generation log.

### 8.1.2 Extending Gii

While the default code generators coming with Gii can generate very powerful code, we often want to customize them or create new ones to fit for our taste and needs. For example, we may want the generated code to be in our own favorite coding styles, or we may want to make the code to support multiple languages. All these can be done easily with Gii.

Gii can be extended in two ways: customizing the code templates of the existing code generators, and writing new code generators.

#### Structure of a Code Generator

A code generator is stored under a directory whose name is treated as the generator name. The directory usually consists of the following content:

model/	the model generator root folder
ModelCode.php	the code model used to generate code
ModelGenerator.php	the code generation controller
views/	containing view scripts for the generator
index.php	the default view script
templates/	containing code template sets
default/	the <code>default</code> code template set
model.php	the code template for generating model class code

#### Generator Search Path

Gii looks for available generators in a set of directories specified by the `[GiiModule::generatorPaths]` property. When customization is needed, we can configure this property in the application configuration as follows,

```
return array(
    'modules' => array(
```

```

        'gii'=>array(
            'class'=>'system.gii.GiiModule',
            'generatorPaths'=>array(
                'application.gii',    // a path alias
            ),
        ),
    ),
);

```

The above configuration instructs Gii to look for generators under the directory aliased as `application.gii`, in addition to the default location `system.gii.generators`.

It is possible to have two generators with the same name but under different search paths. In this case, the generator under the path specified earlier in `[GiiModule::generatorPaths]` will take precedence.

## Customizing Code Templates

This is the easiest and the most common way of extending Gii. We use an example to explain how to customize code templates. Assume we want to customize the code generated by the model generator.

We first create a directory named `protected/gii/model/templates/compact`. Here `model` means that we are going to *override* the default model generator. And `templates/compact` means we will add a new code template set named `compact`.

We then modify our application configuration to add `application.gii` to `[GiiModule::generatorPaths]`, as shown in the previous sub-section.

Now open the model code generator page. Click on the `Code Template` field. We should see a dropdown list which contains our newly created template directory `compact`. However, if we choose this template to generate the code, we will see an error. This is because we have yet to put any actual code template file in this new `compact` template set.

Copy the file `framework/gii/generators/model/templates/default/model.php` to `protected/gii/model/templates/compact`. If we try generating again with the `compact` template, we should succeed. However, the code generated is no different from the one generated by the `default` template set.

It is time for us to do the real customization work. Open the file `protected/gii/model/templates/compact/model.php` to edit it. Remember that this file will be used like a view script, which means it can contain PHP expressions and statements. Let's modify the

template so that the `attributeLabels()` method in the generated code uses `Yii::t()` to translate the attribute labels:

```
public function attributeLabels()
{
    return array(
<?php foreach($labels as $name=>$label): ?>
        <?php echo "'$name' => Yii::t('application', '$label'),\n"; ?>
<?php endforeach; ?>
    );
}
```

In each code template, we can access some predefined variables, such as `$labels` in the above example. These variables are provided by the corresponding code generator. Different code generators may provide different set of variables in their code templates. Please read the description in the default code templates carefully.

## Creating New Generators

In this sub-section, we show how to create a new generator that can generate a new widget class.

We first create a directory named `protected/gii/widget`. Under this directory, we will create the following files:

- `WidgetGenerator.php`: contains the `WidgetGenerator` controller class. This is the entry point of the widget generator.
- `WidgetCode.php`: contains the `WidgetCode` model class. This class has the main logic for code generation.
- `views/index.php`: the view script showing the code generator input form.
- `templates/default/widget.php`: the default code template for generating a widget class file.

h4 id="creating-x-4136x" Creating `WidgetGenerator.php` h4

The `WidgetGenerator.php` file is extremely simple. It only contains the following code:

```
class WidgetGenerator extends CCodeGenerator
```

```
{
    public $codeModel='application.gii.widget.WidgetCode';
}
```

In the above code, we specify that the generator will use the model class whose path alias is `application.gii.widget.WidgetCode`. The `WidgetGenerator` class extends from `CCodeGenerator` which implements a lot of functionalities, including the controller actions needed to coordinate the code generation process.

```
<h4 id="creating-x-4139x">Creating WidgetCode.php</h4>
```

The `WidgetCode.php` file contains the `WidgetCode` model class that has the main logic for generating a widget class based on the user input. In this example, we assume that the only input we want from the user is the widget class name. Our `WidgetCode` looks like the following:

```
class WidgetCode extends CCodeModel
{
    public $className;

    public function rules()
    {
        return array_merge(parent::rules(), array(
            array('className', 'required'),
            array('className', 'match', 'pattern'=>'/^\\w+$/'),
        ));
    }

    public function attributeLabels()
    {
        return array_merge(parent::attributeLabels(), array(
            'className'=>'Widget Class Name',
        ));
    }

    public function prepare()
    {
        $path=Yii::getPathOfAlias('application.components.' . $this->className) . '.php';
        $code=$this->render($this->templatepath.'/widget.php');

        $this->files[] = new CCodeFile($path, $code);
    }
}
```

The `WidgetCode` class extends from `CCodeModel`. Like a normal model class, in this class we can declare `rules()` and `attributeLabels()` to validate user inputs and provide at-



tribute labels, respectively. Note that because the base class `CCodeModel` already defines some rules and attribute labels, we should merge them with our new rules and labels here.

The `prepare()` method prepares the code to be generated. Its main task is to prepare a list of `CCodeFile` objects, each of which represent a code file being generated. In our example, we only need to create one `CCodeFile` object that represents the widget class file being generated. The new widget class will be generated under the `protected/components` directory. We call `CCodeFile::render` method to generate the actual code. This method includes the code template as a PHP script and returns the echoed content as the generated code.

```
¡h4 id="creating-x-4142x"¿Creating views/index.php¡/h4¿
```

Having the controller (`WidgetGenerator`) and the model (`WidgetCode`), it is time for us to create the view `views/index.php`.

```
<h1>Widget Generator</h1>
```

```
<?php $form=$this->beginWidget('CCodeForm', array('model'=>$model)); ?>

    <div class="row">
        <?php echo $form->labelEx($model,'className'); ?>
        <?php echo $form->textField($model,'className',array('size'=>65)); ?>
        <div class="tooltip">
            Widget class name must only contain word characters.
        </div>
        <?php echo $form->error($model,'className'); ?>
    </div>

<?php $this->endWidget(); ?>
```

In the above, we mainly display a form using the `CCodeForm` widget. In this form, we display the field to collect the input for the `className` attribute in `WidgetCode`.

When creating the form, we can exploit two nice features provided by the `CCodeForm` widget. One is about input tooltips. The other is about sticky inputs.

If you have tried any default code generator, you will notice that when setting focus in one input field, a nice tooltip will show up next to the field. This can easily achieved here by writing next to the input field a `div` whose CSS class is `tooltip`.

For some input fields, we may want to remember their last valid values so that the user can save the trouble of re-entering them each time they use the generator to generate code. An example is the input field collecting the controller base class name default controller

generator. These sticky fields are initially displayed as highlighted static text. If we click on them, they will turn into input fields to take user inputs.

In order to declare an input field to be sticky, we need to do two things.

First, we need to declare a `sticky` validation rule for the corresponding model attribute. For example, the default controller generator has the following rule to declare that `baseClass` and `actions` attributes are sticky:

```
public function rules()
{
    return array_merge(parent::rules(), array(
        .....
        array('baseClass', 'actions', 'sticky'),
    ));
}
```

Second, we need to add a CSS class named `sticky` to the container `div` of the input field in the view, like the following:

```
<div class="row sticky">
    ...input field here...
</div>
```

h4 id="creating-x-4145x" Creating templates/default/widget.php

Finally, we create the code template `templates/default/widget.php`. As we described earlier, this is used like a view script that can contain PHP expressions and statements. In a code template, we can always access the `$this` variable which refers to the code model object. In our example, `$this` refers to the `WidgetModel` object. We can thus get the user-entered widget class name via `$this->className`.

```
<?php echo '<?php'; ?>

class <?php echo $this->className; ?> extends CWidget
{
    public function run()
    {
    }
}
```

This concludes the creation of a new code generator. We can access this code generator immediately via the URL `http://hostname/path/to/index.php?r=gii/widget`.

## 8.2 URL Management

Complete URL management for a Web application involves two aspects:

1. When a user request comes in terms of a URL, the application needs to parse it into understandable parameters.
2. The application needs to provide a way of creating URLs so that the created URLs can be understood by the application.

For a Yii application, these are accomplished with the help of [CUrlManager](#).

**Note:** You can specify URLs without using Yii but it is not recommended since you will not be able to easily change URLs via configuration without touching application code or to achieve application portability.

### 8.2.1 Creating URLs

Although URLs can be hardcoded in controller views, it is often more flexible to create them dynamically:

```
$url=$this->createUrl($route,$params);
```

where `$this` refers to the controller instance; `$route` specifies the [route](#) of the request; and `$params` is a list of GET parameters to be appended to the URL.

By default, URLs created by `createUrl` is in the so-called `get` format. For example, given `$route='post/read'` and `$params=array('id'=>100)`, we would obtain the following URL:

```
/index.php?r=post/read&id=100
```

where parameters appear in the query string as a list of `Name=Value` concatenated with the ampersand characters, and the `r` parameter specifies the request [route](#). This URL format is not very user-friendly because it requires several non-word characters.

**Tip:** In order to generate URL with a hashtag, for example `/index.php?r=post/read&id=100#title`, you need to specify parameter named `#` using `$this->createUrl('post/read',array('id'=>100,'#'=>'title'))`.

We could make the above URL look cleaner and more self-explanatory by using the so-called `path` format which eliminates the query string and puts the GET parameters into the path info part of URL:

```
/index.php/post/read/id/100
```

To change the URL format, we should configure the `urlManager` application component so that `createUrl` can automatically switch to the new format and the application can properly understand the new URLs:

```
array(  
    .....  
    'components'=>array(  
        .....  
        'urlManager'=>array(  
            'urlFormat'=>'path',  
        ),  
    ),  
);
```

Note that we do not need to specify the class of the `urlManager` component because it is pre-declared as `CUrlManager` in `CWebApplication`.

**Tip:** The URL generated by the `createUrl` method is a relative one. In order to get an absolute URL, we can prefix it with `Yii::app()->request->hostInfo`, or call `createAbsoluteUrl`.

### 8.2.2 User-friendly URLs

When `path` is used as the URL format, we can specify some URL rules to make our URLs even more user-friendly. For example, we can generate a URL as short as `/post/100`, instead of the lengthy `/index.php/post/read/id/100`. URL rules are used by `CUrlManager` for both URL creation and parsing purposes.

To specify URL rules, we need to configure the `rules` property of the `urlManager` application component:

```
array(  
    .....  
    'components'=>array(  
        .....  
    ),  
);
```

```

'urlManager'=>array(
    'urlFormat'=>'path',
    'rules'=>array(
        'pattern1'=>'route1',
        'pattern2'=>'route2',
        'pattern3'=>'route3',
    ),
),
);

```

The rules are specified as an array of pattern-route pairs, each corresponding to a single rule. The pattern of a rule is a string used to match the path info part of URLs. And the route of a rule should refer to a valid controller [route](#).

Besides the above pattern-route format, a rule may also be specified with customized options, like the following:

```

'pattern1'=>array('route1', 'urlSuffix'=>'.xml', 'caseSensitive'=>false)

```

Starting from version 1.1.7, the following format may also be used (that is, the pattern is specified as an array element), which allows specifying several rules with the same pattern:

```

array('route1', 'pattern'=>'pattern1', 'urlSuffix'=>'.xml', 'caseSensitive'=>false)

```

In the above, the array contains a list of extra options for the rule. Possible options are explained as follows:

- **pattern**: the pattern to be used for matching and creating URLs. This option has been available since version 1.1.7.
- **urlSuffix**: the URL suffix used specifically for this rule. Defaults to null, meaning using the value of [CUrlManager::urlSuffix](#).
- **caseSensitive**: whether this rule is case sensitive. Defaults to null, meaning using the value of [CUrlManager::caseSensitive](#).
- **defaultParams**: the default GET parameters (`name=>value`) that this rule provides. When this rule is used to parse the incoming request, the values declared in this property will be injected into `$_GET`.

- **matchValue**: whether the GET parameter values should match the corresponding sub-patterns in the rule when creating a URL. Defaults to null, meaning using the value of `CUrlManager::matchValue`. If this property is false, it means a rule will be used for creating a URL if its route and parameter names match the given ones. If this property is set true, then the given parameter values must also match the corresponding parameter sub-patterns. Note that setting this property to true will degrade performance.
- **verb**: the HTTP verb (e.g. GET, POST, DELETE) that this rule must match in order to be used for parsing the current request. Defaults to null, meaning the rule can match any HTTP verb. If a rule can match multiple verbs, they must be separated by commas. When a rule does not match the specified verb(s), it will be skipped during the request parsing process. This option is only used for request parsing. This option is provided mainly for RESTful URL support. This option has been available since version 1.1.7.
- **parsingOnly**: whether the rule is used for parsing request only. Defaults to false, meaning a rule is used for both URL parsing and creation. This option has been available since version 1.1.7.

### 8.2.3 Using Named Parameters

A rule can be associated with a few GET parameters. These GET parameters appear in the rule's pattern as special tokens in the following format:

```
<ParamName:ParamPattern>
```

where `ParamName` specifies the name of a GET parameter, and the optional `ParamPattern` specifies the regular expression that should be used to match the value of the GET parameter. In case when `ParamPattern` is omitted, it means the parameter should match any characters except the slash /. When creating a URL, these parameter tokens will be replaced with the corresponding parameter values; when parsing a URL, the corresponding GET parameters will be populated with the parsed results.

Let's use some examples to explain how URL rules work. We assume that our rule set consists of three rules:

```
array(
    'posts'=>'post/list',
    'post/<id:\d+>'=>'post/read',
    'post/<year:\d{4}>/<title>'=>'post/read',
)
```

- Calling `$this->createUrl('post/list')` generates `/index.php/posts`. The first rule is applied.
- Calling `$this->createUrl('post/read',array('id'=>100))` generates `/index.php/post/100`. The second rule is applied.
- Calling `$this->createUrl('post/read',array('year'=>2008,'title'=>'a sample post'))` generates `/index.php/post/2008/a%20sample%20post`. The third rule is applied.
- Calling `$this->createUrl('post/read')` generates `/index.php/post/read`. None of the rules is applied.

In summary, when using `createUrl` to generate a URL, the route and the GET parameters passed to the method are used to decide which URL rule to be applied. If every parameter associated with a rule can be found in the GET parameters passed to `createUrl`, and if the route of the rule also matches the route parameter, the rule will be used to generate the URL.

If the GET parameters passed to `createUrl` are more than those required by a rule, the additional parameters will appear in the query string. For example, if we call `$this->createUrl('post/read',array('id'=>100,'year'=>2008))`, we would obtain `/index.php/post/100?year=2008`. In order to make these additional parameters appear in the path info part, we should append `/*` to the rule. Therefore, with the rule `post/<id:\d+>/*`, we can obtain the URL as `/index.php/post/100/year/2008`.

As we mentioned, the other purpose of URL rules is to parse the requesting URLs. Naturally, this is an inverse process of URL creation. For example, when a user requests for `/index.php/post/100`, the second rule in the above example will apply, which resolves in the route `post/read` and the GET parameter `array('id'=>100)` (accessible via `$_GET`).

**Note:** Using URL rules will degrade application performance. This is because when parsing the request URL, `CUrlManager` will attempt to match it with each rule until one can be applied. The more the number of rules, the more the performance impact. Therefore, a high-traffic Web application should minimize its use of URL rules.

### 8.2.4 Parameterizing Routes

We may reference named parameters in the route part of a rule. This allows a rule to be applied to multiple routes based on matching criteria. It may also help reduce the number of rules needed for an application, and thus improve the overall performance.

We use the following example rules to illustrate how to parameterize routes with named parameters:

```
array(
    '<_c:(post|comment)>/<id:\d+>/<_a:(create|update|delete)>' => '<_c>/<_a>',
    '<_c:(post|comment)>/<id:\d+>' => '<_c>/read',
    '<_c:(post|comment)>s' => '<_c>/list',
)
```

In the above, we use two named parameters in the route part of the rules: `_c` and `_a`. The former matches a controller ID to be either `post` or `comment`, while the latter matches an action ID to be `create`, `update` or `delete`. You may name the parameters differently as long as they do not conflict with GET parameters that may appear in URLs.

Using the above rules, the URL `/index.php/post/123/create` would be parsed as the route `post/create` with GET parameter `id=123`. And given the route `comment/list` and GET parameter `page=2`, we can create a URL `/index.php/comments?page=2`.

### 8.2.5 Parameterizing Hostnames

It is also possible to include hostname into the rules for parsing and creating URLs. One may extract part of the hostname to be a GET parameter. For example, the URL `http://admin.example.com/en/profile` may be parsed into GET parameters `user=admin` and `lang=en`. On the other hand, rules with hostname may also be used to create URLs with parameterized hostnames.

In order to use parameterized hostnames, simply declare URL rules with host info, e.g.:

```
array(
    'http://<user:\w+>.example.com/<lang:\w+>/profile' => 'user/profile',
)
```

The above example says that the first segment in the hostname should be treated as `user` parameter while the first segment in the path info should be `lang` parameter. The rule corresponds to the `user/profile` route.

Note that `CUrlManager::showScriptName` will not take effect when a URL is being created using a rule with parameterized hostname.

Also note that the rule with parameterized hostname should NOT contain the sub-folder if the application is under a sub-folder of the Web root. For example, if the application is under `http://www.example.com/sandbox/blog`, then we should still use the same URL rule as described above without the sub-folder `sandbox/blog`.



### 8.2.6 Hiding index.php

There is one more thing that we can do to further clean our URLs, i.e., hiding the entry script `index.php` in the URL. This requires us to configure the Web server as well as the `urlManager` application component.

We first need to configure the Web server so that a URL without the entry script can still be handled by the entry script. For [Apache HTTP server](#), this can be done by turning on the URL rewriting engine and specifying some rewriting rules. We can create the file `/wwwroot/blog/.htaccess` with the following content. Note that the same content can also be put in the Apache configuration file within the `Directory` element for `/wwwroot/blog`.

```
RewriteEngine on

# if a directory or a file exists, use it directly
RewriteCond %{REQUEST_FILENAME} !-f
RewriteCond %{REQUEST_FILENAME} !-d

# otherwise forward it to index.php
RewriteRule . index.php
```

We then configure the `showScriptName` property of the `urlManager` component to be `false`.

Now if we call `$this->createUrl('post/read',array('id'=>100))`, we would obtain the URL `/post/100`. More importantly, this URL can be properly recognized by our Web application.

### 8.2.7 Faking URL Suffix

We may also add some suffix to our URLs. For example, we can have `/post/100.html` instead of `/post/100`. This makes it look more like a URL to a static Web page. To do so, simply configure the `urlManager` component by setting its `urlSuffix` property to the suffix you like.

### 8.2.8 Using Custom URL Rule Classes

**Note:** Using custom URL rule classes has been supported since version 1.1.8.

By default, each URL rule declared with `CUrlManager` is represented as a `CUrlRule` object which performs the task of parsing requests and creating URLs based on the rule specified.

While `CUrlRule` is flexible enough to handle most URL formats, sometimes we still want to enhance it with special features.

For example, in a car dealer website, we may want to support the URL format like `/Manufacturer/Model`, where `Manufacturer` and `Model` must both match some data in a database table. The `CUrlRule` class will not work because it mostly relies on statically declared regular expressions which have no database knowledge.

We can write a new URL rule class by extending from `CBaseUrlRule` and use it in one or multiple URL rules. Using the above car dealer website as an example, we may declare the following URL rules,

```
array(
    // a standard rule mapping '/' to 'site/index' action
    '' => 'site/index',

    // a standard rule mapping '/login' to 'site/login', and so on
    '<action:(login|logout|about)>' => 'site/<action>',

    // a custom rule to handle '/Manufacturer/Model'
    array(
        'class' => 'application.components.CarUrlRule',
        'connectionID' => 'db',
    ),

    // a standard rule to handle 'post/update' and so on
    '<controller:\w+>/<action:\w+>' => '<controller>/<action>',
),
```

In the above, we use the custom URL rule class `CarUrlRule` to handle the URL format `/Manufacturer/Model`. The class can be written like the following:

```
class CarUrlRule extends CBaseUrlRule
{
    public $connectionID = 'db';

    public function createUrl($manager,$route,$params,$ampersand)
    {
        if ($route==='car/index')
        {
            if (isset($params['manufacturer'], $params['model']))
                return $params['manufacturer'] . '/' . $params['model'];
            else if (isset($params['manufacturer']))
                return $params['manufacturer'];
        }
        return false; // this rule does not apply
    }
}
```

```

    }

    public function parseUrl($manager,$request,$pathInfo,$rawPathInfo)
    {
        if (preg_match('%^(\\w+)(/?(\\w+))?$', $pathInfo, $matches))
        {
            // check $matches[1] and $matches[3] to see
            // if they match a manufacturer and a model in the database
            // If so, set $_GET['manufacturer'] and/or $_GET['model']
            // and return 'car/index'
        }
        return false; // this rule does not apply
    }
}

```

The custom URL class must implement the two abstract methods declared in [CBaseUrlRule](#):

- [createUrl\(\)](#)
- [parseUrl\(\)](#)

Besides the above typical usage, custom URL rule classes can also be implemented for many other purposes. For example, we can write a rule class to log the URL parsing and creation requests. This may be useful during development stage. We can also write a rule class to display a special 404 error page in case all other URL rules fail to resolve the current request. Note that in this case, the rule of this special class must be declared as the last rule.

## 8.3 Authentication and Authorization

Authentication and authorization are required for a Web page that should be limited to certain users. *Authentication* is about verifying whether someone is who they claim to be. It usually involves a username and a password, but may include any other methods of demonstrating identity, such as a smart card, fingerprints, etc. *Authorization* is finding out if the person, once identified (i.e. authenticated), is permitted to manipulate specific resources. This is usually determined by finding out if that person is of a particular role that has access to the resources.

Yii has a built-in authentication/authorization (auth) framework which is easy to use and can be customized for special needs.

The central piece in the Yii auth framework is a pre-declared *user application component*

which is an object implementing the `[IWebUser]` interface. The user component represents the persistent identity information for the current user. We can access it at any place using `Yii::app()->user`.

Using the user component, we can check if a user is logged in or not via `CWebUser::isGuest`; we can [login](#) and [logout](#) a user; we can check if the user can perform specific operations by calling `CWebUser::checkAccess`; and we can also obtain the [unique identifier](#) and other persistent identity information about the user.

### 8.3.1 Defining Identity Class

As mentioned above, authentication is about validating the identity of the user. A typical Web application authentication implementation usually involves using a username and password combination to verify a user's identity. However, it may include other methods and different implementations may be required. To accommodate varying authentication methods, the Yii auth framework introduces the identity class.

We define an identity class which contains the actual authentication logic. The identity class should implement the `[IUserIdentity]` interface. Different identity classes can be implemented for different authentication approaches (e.g. OpenID, LDAP, Twitter OAuth, Facebook Connect). A good start when writing your own implementation is to extend `CUserIdentity` which is a base class for the authentication approach using a username and password.

The main work in defining an identity class is the implementation of the `[IUserIdentity::authenticate]` method. This is the method used to encapsulate the main details of the authentication approach. An identity class may also declare additional identity information that needs to be persistent during the user session.

```
<h4 id="an-example">An Example</h4>
```

In the following example, we use an identity class to demonstrate using a database approach to authentication. This is typical in Web applications. A user will enter their username and password into a login form, and then we validate these credentials, using [ActiveRecord](#), against a user table in the database. There are actually a few things being demonstrated in this single example:

1. The implementation of the `authenticate()` method to use the database to validate credentials.
2. Overriding the `CUserIdentity::getId()` method to return the `_id` property because the default implementation returns the username as the ID.

3. Using the `setState()` (`CBaseUserIdentity::setState`) method to demonstrate storing other information that can easily be retrieved upon subsequent requests.

```
class UserIdentity extends CUserIdentity
{
    private $_id;
    public function authenticate()
    {
        $record=User::model()->findByAttributes(array('username'=>$this->username));
        if($record===null)
            $this->errorCode=self::ERROR_USERNAME_INVALID;
        else if($record->password!==crypt($this->password,$record->password))
            $this->errorCode=self::ERROR_PASSWORD_INVALID;
        else
        {
            $this->_id=$record->id;
            $this->setState('title', $record->title);
            $this->errorCode=self::ERROR_NONE;
        }
        return !$this->errorCode;
    }

    public function getId()
    {
        return $this->_id;
    }
}
```

When we cover login and logout in the next section, we'll see that we pass this identity class into the login method for a user. Any information that we store in a state (by calling `CBaseUserIdentity::setState`) will be passed to `CWebUser`, which in turn will store them in a persistent storage, such as session. This information can then be accessed like properties of `CWebUser`. In our example, we stored the user title information via `$this->setState('title', $record->title);`. Once we complete our login process, we can obtain the title information of the current user by simply using `Yii::app()->user->title`.

**Info:** By default, `CWebUser` uses session as persistent storage for user identity information. If cookie-based login is enabled (by setting `CWebUser::allowAutoLogin` to be true), the user identity information may also be saved in cookie. Make sure you do not declare sensitive information (e.g. password) to be persistent.

## Storing passwords in the database

Secure storage of user passwords in a database requires some care. An attacker that has stolen your user table (or a backup of it) can recover passwords using standard techniques if you don't protect against them. In particular you should salt the password before hashing and use a hash function that takes the attacker a long time to compute. The above code example uses the built-in PHP `crypt()` function which, with appropriate use, returns hashes that are very hard to crack.

To learn more about these topics please read.

- [PHP `crypt\(\)` function](#)
- [Yii Wiki article Use `crypt\(\)` for password storage](#)

### 8.3.2 Login and Logout

Now that we have seen an example of creating a user identity, we use this to help ease the implementation of our needed login and logout actions. The following code demonstrates how this is accomplished:

```
// Login a user with the provided username and password.
$identity=new UserIdentity($username,$password);
if($identity->authenticate())
    Yii::app()->user->login($identity);
else
    echo $identity->errorMessage;
.....
// Logout the current user
Yii::app()->user->logout();
```

Here we are creating a new `UserIdentity` object and passing in the authentication credentials (i.e. the `$username` and `$password` values submitted by the user) to its constructor. We then simply call the `authenticate()` method. If successful, we pass the identity information into the `CWebUser::login` method, which will store the identity information into persistent storage (PHP session by default) for retrieval upon subsequent requests. If the authentication fails, we can interrogate the `errorMessage` property for more information as to why it failed.

Whether or not a user has been authenticated can easily be checked throughout the application by using `Yii::app()->user->isGuest`. If using persistent storage like session (the default) and/or a cookie (discussed below) to store the identity information, the user

can remain logged in upon subsequent requests. In this case, we don't need to use the `UserIdentity` class and the entire login process upon each request. Rather `CWebUser` will automatically take care of loading the identity information from this persistent storage and will use it to determine whether `Yii::app()->user->isGuest` returns true or false.

### 8.3.3 Cookie-based Login

By default, a user will be logged out after a certain period of inactivity, depending on the [session configuration](#). To change this behavior, we can set the `allowAutoLogin` property of the user component to be true and pass a duration parameter to the `CWebUser::login` method. The user will then remain logged in for the specified duration, even if he closes his browser window. Note that this feature requires the user's browser to accept cookies.

```
// Keep the user logged in for 7 days.  
// Make sure allowAutoLogin is set true for the user component.  
Yii::app()->user->login($identity, 3600*24*7);
```

As we mentioned above, when cookie-based login is enabled, the states stored via `CBaseUserIdentity::setState` will be saved in the cookie as well. The next time when the user is logged in, these states will be read from the cookie and made accessible via `Yii::app()->user`.

Although Yii has measures to prevent the state cookie from being tampered on the client side, we strongly suggest that security sensitive information be not stored as states. Instead, these information should be restored on the server side by reading from some persistent storage on the server side (e.g. database).

In addition, for any serious Web applications, we recommend using the following strategy to enhance the security of cookie-based login.

- When a user successfully logs in by filling out a login form, we generate and store a random key in both the cookie state and in persistent storage on server side (e.g. database).
- Upon a subsequent request, when the user authentication is being done via the cookie information, we compare the two copies of this random key and ensure a match before logging in the user.
- If the user logs in via the login form again, the key needs to be re-generated.

By using the above strategy, we eliminate the possibility that a user may re-use an old state cookie which may contain outdated state information.

To implement the above strategy, we need to override the following two methods:

- `CUserIdentity::authenticate()`: this is where the real authentication is performed. If the user is authenticated, we should re-generate a new random key, and store it in the database as well as in the identity states via `CBaseUserIdentity::setState`.
- `CWebUser::beforeLogin()`: this is called when a user is being logged in. We should check if the key obtained from the state cookie is the same as the one from the database.

### 8.3.4 Access Control Filter

Access control filter is a preliminary authorization scheme that checks if the current user can perform the requested controller action. The authorization is based on user's name, client IP address and request types. It is provided as a filter named as `"accessControl"`.

**Tip:** Access control filter is sufficient for simple scenarios. For more complex access control you may use role-based access (RBAC), which we will cover in the next subsection.

To control the access to actions in a controller, we install the access control filter by overriding `CController::filters` (see [Filter](#) for more details about installing filters).

```
class PostController extends CController
{
    .....
    public function filters()
    {
        return array(
            'accessControl',
        );
    }
}
```

In the above, we specify that the `access control` filter should be applied to every action of `PostController`. The detailed authorization rules used by the filter are specified by overriding `CController::accessRules` in the controller class.

```
class PostController extends CController
{
```



```

.....
public function accessRules()
{
    return array(
        array('deny',
            'actions'=>array('create', 'edit'),
            'users'=>array('?'),
        ),
        array('allow',
            'actions'=>array('delete'),
            'roles'=>array('admin'),
        ),
        array('deny',
            'actions'=>array('delete'),
            'users'=>array('*'),
        ),
    );
}
}

```

The above code specifies three rules, each represented as an array. The first element of the array is either 'allow' or 'deny' and the other name-value pairs specify the pattern parameters of the rule. The rules defined above are interpreted as follows: the `create` and `edit` actions cannot be executed by anonymous users; the `delete` action can be executed by users with `admin` role; and the `delete` action cannot be executed by anyone.

The access rules are evaluated one by one in the order they are specified. The first rule that matches the current pattern (e.g. username, roles, client IP, address) determines the authorization result. If this rule is an `allow` rule, the action can be executed; if it is a `deny` rule, the action cannot be executed; if none of the rules matches the context, the action can still be executed.

**Tip:** To ensure an action does not get executed under certain contexts, it is beneficial to always specify a matching-all `deny` rule at the end of rule set, like the following:

```

return array(
    // ... other rules...
    // the following rule denies 'delete' action for all contexts
    array('deny',
        'actions'=>array('delete'),
    ),
);

```

The reason for this rule is because if none of the rules matches a context, then the action will continue to be executed.

An access rule can match the following context parameters:

- **actions**: specifies which actions this rule matches. This should be an array of action IDs. The comparison is case-insensitive.
- **controllers**: specifies which controllers this rule matches. This should be an array of controller IDs. The comparison is case-insensitive.
- **users**: specifies which users this rule matches. The current user's **name** is used for matching. The comparison is case-insensitive. Three special characters can be used here:
  - \*: any user, including both anonymous and authenticated users.
  - ?: anonymous users.
  - @: authenticated users.
- **roles**: specifies which roles that this rule matches. This makes use of the **role-based access control** feature to be described in the next subsection. In particular, the rule is applied if `CWebUser::checkAccess` returns true for one of the roles. Note, you should mainly use roles in an **allow** rule because by definition, a role represents a permission to do something. Also note, although we use the term **roles** here, its value can actually be any auth item, including roles, tasks and operations.
- **ips**: specifies which client IP addresses this rule matches.
- **verbs**: specifies which request types (e.g. GET, POST) this rule matches. The comparison is case-insensitive.
- **expression**: specifies a PHP expression whose value indicates whether this rule matches. In the expression, you can use variable `$user` which refers to `Yii::app()->user`.

### 8.3.5 Handling Authorization Result

When authorization fails, i.e., the user is not allowed to perform the specified action, one of the following two scenarios may happen:

- If the user is not logged in and if the **loginUrl** property of the user component is configured to be the URL of the login page, the browser will be redirected to that page. Note that by default, **loginUrl** points to the `site/login` page.
- Otherwise an HTTP exception will be displayed with error code 403.

When configuring the `loginUrl` property, one can provide a relative or absolute URL. One can also provide an array which will be used to generate a URL by calling `CWebApplication::createUrl`. The first array element should specify the `route` to the login controller action, and the rest name-value pairs are GET parameters. For example,

```
array(  
    .....  
    'components'=>array(  
        'user'=>array(  
            // this is actually the default value  
            'loginUrl'=>array('site/login'),  
        ),  
    ),  
)
```

If the browser is redirected to the login page and the login is successful, we may want to redirect the browser back to the page that caused the authorization failure. How do we know the URL for that page? We can get this information from the `returnUrl` property of the user component. We can thus do the following to perform the redirection:

```
Yii::app()->request->redirect(Yii::app()->user->returnUrl);
```

### 8.3.6 Role-Based Access Control

Role-Based Access Control (RBAC) provides a simple yet powerful centralized access control. Please refer to the [Wiki article](#) for more details about comparing RBAC with other more traditional access control schemes.

Yii implements a hierarchical RBAC scheme via its `authManager` application component. In the following, we first introduce the main concepts used in this scheme; we then describe how to define authorization data; at the end we show how to make use of the authorization data to perform access checking.

#### Overview

A fundamental concept in Yii's RBAC is *authorization item*. An authorization item is a permission to do something (e.g. creating new blog posts, managing users). According to its granularity and targeted audience, authorization items can be classified as *operations*, *tasks* and *roles*. A role consists of tasks, a task consists of operations, and an operation is a permission that is atomic. For example, we can have a system with `administrator` role which consists of `post management` task and `user management` task. The user management

task may consist of `create user`, `update user` and `delete user` operations. For more flexibility, Yii also allows a role to consist of other roles or operations, a task to consist of other tasks, and an operation to consist of other operations.

An authorization item is uniquely identified by its name.

An authorization item may be associated with a *business rule*. A business rule is a piece of PHP code that will be executed when performing access checking with respect to the item. Only when the execution returns true, will the user be considered to have the permission represented by the item. For example, when defining an operation `updatePost`, we would like to add a business rule that checks if the user ID is the same as the post's author ID so that only the author himself can have the permission to update a post.

Using authorization items, we can build up an *authorization hierarchy*. An item A is a parent of another item B in the hierarchy if A consists of B (or say A inherits the permission(s) represented by B). An item can have multiple child items, and it can also have multiple parent items. Therefore, an authorization hierarchy is a partial-order graph rather than a tree. In this hierarchy, role items sit on top levels, operation items on bottom levels, while task items in between.

Once we have an authorization hierarchy, we can assign roles in this hierarchy to application users. A user, once assigned with a role, will have the permissions represented by the role. For example, if we assign the `administrator` role to a user, he will have the administrator permissions which include `post management` and `user management` (and the corresponding operations such as `create user`).

Now the fun part starts. In a controller action, we want to check if the current user can delete the specified post. Using the RBAC hierarchy and assignment, this can be done easily as follows:

```
if(Yii::app()->user->checkAccess('deletePost'))
{
    // delete the post
}
```

### 8.3.7 Configuring Authorization Manager

Before we set off to define an authorization hierarchy and perform access checking, we need to configure the `authManager` application component. Yii provides two types of authorization managers: `CPhpAuthManager` and `CDbAuthManager`. The former uses a PHP script file to store authorization data, while the latter stores authorization data in database. When we configure the `authManager` application component, we need to specify

which component class to use and what are the initial property values for the component. For example,

```
return array(
    'components'=>array(
        'db'=>array(
            'class'=>'CDbConnection',
            'connectionString'=>'sqlite:path/to/file.db',
        ),
        'authManager'=>array(
            'class'=>'CDbAuthManager',
            'connectionID'=>'db',
        ),
    ),
);
```

We can then access the `authManager` application component using `Yii::app()->authManager`.

### 8.3.8 Defining Authorization Hierarchy

Defining authorization hierarchy involves three steps: defining authorization items, establishing relationships between authorization items, and assigning roles to application users. The `authManager` application component provides a whole set of APIs to accomplish these tasks.

To define an authorization item, call one of the following methods, depending on the type of the item:

- `CAuthManager::createRole`
- `CAuthManager::createTask`
- `CAuthManager::createOperation`

Once we have a set of authorization items, we can call the following methods to establish relationships between authorization items:

- `CAuthManager::addItemChild`
- `CAuthManager::removeItemChild`
- `CAuthItem::addChild`
- `CAuthItem::removeChild`

And finally, we call the following methods to assign role items to individual users:

- `CAuthManager::assign`
- `CAuthManager::revoke`

Below we show an example about building an authorization hierarchy with the provided APIs:

```
$auth=Yii::app()->authManager;

$auth->createOperation('createPost','create a post');
$auth->createOperation('readPost','read a post');
$auth->createOperation('updatePost','update a post');
$auth->createOperation('deletePost','delete a post');

$bizRule='return Yii::app()->user->id==$params["post"]->authID;';
$task=$auth->createTask('updateOwnPost','update a post by author himself',$bizRule);
$task->addChild('updatePost');

$role=$auth->createRole('reader');
$role->addChild('readPost');

$role=$auth->createRole('author');
$role->addChild('reader');
$role->addChild('createPost');
$role->addChild('updateOwnPost');

$role=$auth->createRole('editor');
$role->addChild('reader');
$role->addChild('updatePost');

$role=$auth->createRole('admin');
$role->addChild('editor');
$role->addChild('author');
$role->addChild('deletePost');

$auth->assign('reader','readerA');
$auth->assign('author','authorB');
$auth->assign('editor','editorC');
$auth->assign('admin','adminD');
```

Once we have established this hierarchy, the `authManager` component (e.g. `CPhpAuthManager`, `CDbAuthManager`) will load the authorization items automatically. Therefore, we only need to run the above code one time, and NOT for every request.

**Info:** While the above example looks long and tedious, it is mainly for demonstrative purposes. Developers will usually need to develop some administrative user interfaces so that end users can establish an authorization hierarchy more intuitively.

### 8.3.9 Using Business Rules

When we are defining the authorization hierarchy, we can associate a role, a task or an operation with a so-called *business rule*. We may also associate a business rule when we assign a role to a user. A business rule is a piece of PHP code that is executed when we perform access checking. The returning value of the code is used to determine if the role or assignment applies to the current user. In the example above, we associated a business rule with the `updateOwnPost` task. In the business rule we simply check if the current user ID is the same as the specified post's author ID. The post information in the `$params` array is supplied by developers when performing access checking.

#### Access Checking

To perform access checking, we first need to know the name of the authorization item. For example, to check if the current user can create a post, we would check if he has the permission represented by the `createPost` operation. We then call `CWebUser::checkAccess` to perform the access checking:

```
if(Yii::app()->user->checkAccess('createPost'))
{
    // create post
}
```

If the authorization rule is associated with a business rule which requires additional parameters, we can pass them as well. For example, to check if a user can update a post, we would pass in the post data in the `$params`:

```
$params=array('post'=>$post);
if(Yii::app()->user->checkAccess('updateOwnPost',$params))
{
    // update post
}
```

## Using Default Roles

Many Web applications need some very special roles that would be assigned to every or most of the system users. For example, we may want to assign some privileges to all authenticated users. It poses a lot of maintenance trouble if we explicitly specify and store these role assignments. We can exploit *default roles* to solve this problem.

A default role is a role that is implicitly assigned to every user. We do not need to explicitly assign it to a user. When `CWebUser::checkAccess` is invoked, default roles will be checked first as if they are assigned to the user.

Default roles must be declared in the `CAuthManager::defaultRoles` property. For example, the following configuration declares two roles to be default roles: `authenticated` and `admin`.

```
return array(  
    'components'=>array(  
        'authManager'=>array(  
            'class'=>'CDBAuthManager',  
            'defaultRoles'=>array('authenticated', 'admin'),  
        ),  
    ),  
);
```

Because a default role is assigned to every user, it usually needs to be associated with a business rule that determines whether the role really applies to the user. For example, the following code defines two roles, `authenticated` and `admin`, which effectively apply to authenticated users and users with the username `admin`, respectively.

```
$bizRule='return !Yii::app()->user->isGuest;';  
$auth->createRole('authenticated', 'authenticated user', $bizRule);  
  
$bizRule='return Yii::app()->user->name === "admin";';  
$auth->createRole('admin', 'admin user', $bizRule);
```

**Info:** Since version 1.1.11 the `$params` array passed to a business rule has a key named `userId` whose value is the id of the user the business rule is checked for. You would need this if you call `CDBAuthManager::checkAccess()` or `CPhpAuthManager::checkAccess()` in places where `Yii::app()->user` is not available or not the user you are checking access for.



## 8.4 Theming

Theming is a systematic way of customizing the outlook of pages in a Web application. By applying a new theme, the overall appearance of a Web application can be changed instantly and dramatically.

In Yii, each theme is represented as a directory consisting of view files, layout files, and relevant resource files such as images, CSS files, JavaScript files, etc. The name of a theme is its directory name. All themes reside under the same directory `WebRoot/themes`. At any time, only one theme can be active.

**Tip:** The default theme root directory `WebRoot/themes` can be configured to be a different one. Simply configure the `basePath` and the `baseUrl` properties of the `themeManager` application component to be the desired ones.

### 8.4.1 Using a Theme

To activate a theme, set the `theme` property of the Web application to be the name of the desired theme. This can be done either in the [application configuration](#) or during runtime in controller actions.

**Note:** Theme name is case-sensitive. If you attempt to activate a theme that does not exist, `Yii::app()->theme` will return `null`.

### 8.4.2 Creating a Theme

Contents under a theme directory should be organized in the same way as those under the [application base path](#). For example, all view files must be located under `views`, layout view files under `views/layouts`, and system view files under `views/system`. For example, if we want to replace the `create` view of `PostController` with a view in the `classic` theme, we should save the new view file as `WebRoot/themes/classic/views/post/create.php`.

For views belonging to controllers in a [module](#), the corresponding themed view files should also be placed under the `views` directory. For example, if the aforementioned `PostController` is in a module named `forum`, we should save the `create` view file as `WebRoot/themes/classic/views/forum/post/create.php`. If the `forum` module is nested in another module named `support`, then the view file should be `WebRoot/themes/classic/views/support/forum/post/create.php`.

**Note:** Because the `views` directory may contain security-sensitive data, it should be configured to prevent from being accessed by Web users.

When we call `render` or `renderPartial` to display a view, the corresponding view file as well as the layout file will be looked for in the currently active theme. And if found, those files will be rendered. Otherwise, it falls back to the default location as specified by `viewPath` and `layoutPath`.

**Tip:** Inside a theme view, we often need to link other theme resource files. For example, we may want to show an image file under the theme's `images` directory. Using the `baseUrl` property of the currently active theme, we can generate the URL for the image as follows,

```
Yii::app()->theme->baseUrl . '/images/FileName.gif'
```

Below is an example of directory organization for an application with two themes `basic` and `fancy`.

```
WebRoot/
  assets
  protected/
    .htaccess
    components/
    controllers/
    models/
    views/
      layouts/
        main.php
      site/
        index.php
  themes/
    basic/
      views/
        .htaccess
        layouts/
          main.php
        site/
          index.php
    fancy/
      views/
        .htaccess
        layouts/
          main.php
```

```
site/  
    index.php
```

In the application configuration, if we configure

```
return array(  
    'theme'=>'basic',  
    .....  
);
```

then the `basic` theme will be in effect, which means the application's layout will use the one under the directory `themes/basic/views/layouts`, and the site's index view will use the one under `themes/basic/views/site`. In case a view file is not found in the theme, it will fall back to the one under the `protected/views` directory.

### 8.4.3 Theming Widgets

Starting from version 1.1.5, views used by a widget can also be themed. In particular, when we call `CWidget::render()` to render a widget view, Yii will attempt to search under the theme folder as well as the widget view folder for the desired view file.

To theme the view `xyz` for a widget whose class name is `Foo`, we should first create a folder named `Foo` (same as the widget class name) under the currently active theme's view folder. If the widget class is namespaced (available in PHP 5.3.0 or above), such as `\app\widgets\Foo`, we should create a folder named `app-widgets_Foo`. That is, we replace the namespace separators with the underscore characters.

We then create a view file named `xyz.php` under the newly created folder. To this end, we should have a file `themes/basic/views/Foo/xyz.php`, which will be used by the widget to replace its original view, if the currently active theme is `basic`.

### 8.4.4 Customizing Widgets Globally

**Note:** this feature has been available since version 1.1.3.

When using a widget provided by third party or Yii, we often need to customize it for specific needs. For example, we may want to change the value of `CLinkPager::maxButtonCount` from 10 (default) to 5. We can accomplish this by passing the initial property values when calling `CBaseController::widget` to create a widget. However, it becomes troublesome to do so if we have to repeat the same customization in every place we use `CLinkPager`.

```
$this->widget('CLinkPager', array(
    'pages'=>$pagination,
    'maxButtonCount'=>5,
    'cssFile'=>false,
));
```

Using the global widget customization feature, we only need to specify these initial values in a single place, i.e., the application configuration. This makes the customization of widgets more manageable.

To use the global widget customization feature, we need to configure the `widgetFactory` as follows:

```
return array(
    'components'=>array(
        'widgetFactory'=>array(
            'widgets'=>array(
                'CLinkPager'=>array(
                    'maxButtonCount'=>5,
                    'cssFile'=>false,
                ),
                'CJuiDatePicker'=>array(
                    'language'=>'ru',
                ),
            ),
        ),
    ),
);
```

In the above, we specify the global widget customization for both `CLinkPager` and `CJuiDatePicker` widgets by configuring the `CWidgetFactory::widgets` property. Note that the global customization for each widget is represented as a key-value pair in the array, where the key refers to the widget class name while the value specifies the initial property value array.

Now, whenever we create a `CLinkPager` widget in a view, the above property values will be assigned to the widget, and we only need to write the following code in the view to create the widget:

```
$this->widget('CLinkPager', array(
    'pages'=>$pagination,
));
```

We can still override the initial property values when necessary. For example, if in some view we want to set `maxButtonCount` to be 2, we can do the following:

```
$this->widget('CLinkPager', array(
    'pages'=>$pagination,
    'maxButtonCount'=>2,
));
```

### 8.4.5 Skin

While using a theme we can quickly change the outlook of views, we can use skins to systematically customize the outlook of the [widgets](#) used in the views.

A skin is an array of name-value pairs that can be used to initialize the properties of a widget. A skin belongs to a widget class, and a widget class can have multiple skins identified by their names. For example, we can have a skin for the [CLinkPager](#) widget and the skin is named as `classic`.

In order to use the skin feature, we first need to modify the application configuration by configuring the [CWidgetFactory::enableSkin](#) property to be true for the `widgetFactory` application component:

```
return array(
    'components'=>array(
        'widgetFactory'=>array(
            'enableSkin'=>true,
        ),
    ),
);
```

Please note that in versions prior to 1.1.3, you need to use the following configuration to enable widget skinning:

```
return array(
    'components'=>array(
        'widgetFactory'=>array(
            'class'=>'CWidgetFactory',
        ),
    ),
);
```

We then create the needed skins. Skins belonging to the same widget class are stored in a single PHP script file whose name is the widget class name. All these skin files are stored under `protected/views/skins`, by default. If you want to change this to be a different directory, you may configure the `skinPath` property of the `widgetFactory` component. As an example, we may create under `protected/views/skins` a file named `CLinkPager.php` whose content is as follows,

```
<?php
return array(
    'default'=>array(
        'nextPageLabel'=>'next',
        'prevPageLabel'=>'prev',
    ),
    'classic'=>array(
        'header'=>'',
        'maxButtonCount'=>5,
    ),
);
```

In the above, we create two skins for the `CLinkPager` widget: `default` and `classic`. The former is the skin that will be applied to any `CLinkPager` widget that we do not explicitly specify its `skin` property, while the latter is the skin to be applied to a `CLinkPager` widget whose `skin` property is specified as `classic`. For example, in the following view code, the first pager will use the `default` skin while the second the `classic` skin:

```
<?php $this->widget('CLinkPager'); ?>

<?php $this->widget('CLinkPager', array('skin'=>'classic')); ?>
```

If we create a widget with a set of initial property values, they will take precedence and be merged with any applicable skin. For example, the following view code will create a pager whose initial values will be `array('header'=>'', 'maxButtonCount'=>6, 'cssFile'=>false)`, which is the result of merging the initial property values specified in the view and the `classic` skin.

```
<?php $this->widget('CLinkPager', array(
    'skin'=>'classic',
    'maxButtonCount'=>6,
    'cssFile'=>false,
)); ?>
```

Note that the skin feature does NOT require using themes. However, when a theme is active, Yii will also look for skins under the `skins` directory of the theme's view directory (e.g. `WebRoot/themes/classic/views/skins`). In case a skin with the same name exists in both the theme and the main application view directories, the theme skin will take precedence.

If a widget is using a skin that does not exist, Yii will still create the widget as usual without any error.

**Info:** Using skin may degrade the performance because Yii needs to look for the skin file the first time a widget is being created.

Skin is very similar to the global widget customization feature. The main differences are as follows.

- Skin is more related with the customization of presentational property values;
- A widget can have multiple skins;
- Skin is themeable;
- Using skin is more expensive than using global widget customization.

## 8.5 Logging

Yii provides a flexible and extensible logging feature. Messages logged can be classified according to log levels and message categories. Using level and category filters, selected messages can be further routed to different destinations, such as files, emails, browser windows, etc.

### 8.5.1 Message Logging

Messages can be logged by calling either `Yii::log` or `Yii::trace`. The difference between these two methods is that the latter logs a message only when the application is in [debug mode](#).

```
Yii::log($message, $level, $category);  
Yii::trace($message, $category);
```

When logging a message, we need to specify its category and level. Category is a string in the format of `xxx.yyy.zzz` which resembles to the [path alias](#). For example, if a message is logged in [CController](#), we may use the category `system.web.CController`. Message level should be one of the following values:

- **trace**: this is the level used by `Yii::trace`. It is for tracing the execution flow of the application during development.
- **info**: this is for logging general information.

- **profile**: this is for performance profile which is to be described shortly.
- **warning**: this is for warning messages.
- **error**: this is for fatal error messages.

### 8.5.2 Message Routing

Messages logged using `Yii::log` or `Yii::trace` are kept in memory. We usually need to display them in browser windows, or save them in some persistent storage such as files, emails. This is called *message routing*, i.e., sending messages to different destinations.

In Yii, message routing is managed by a `CLogRouter` application component. It manages a set of the so-called *log routes*. Each log route represents a single log destination. Messages sent along a log route can be filtered according to their levels and categories.

To use message routing, we need to install and preload a `CLogRouter` application component. We also need to configure its `routes` property with the log routes that we want. The following shows an example of the needed [application configuration](#):

```
array(
    .....
    'preload'=>array('log'),
    'components'=>array(
        .....
        'log'=>array(
            'class'=>'CLogRouter',
            'routes'=>array(
                array(
                    'class'=>'CFileLogRoute',
                    'levels'=>'trace, info',
                    'categories'=>'system.*',
                ),
                array(
                    'class'=>'CEmailLogRoute',
                    'levels'=>'error, warning',
                    'emails'=>'admin@example.com',
                ),
            ),
        ),
    ),
),
```

In the above example, we have two log routes. The first route is `CFileLogRoute` which saves messages in a file under the application runtime directory. Only messages whose



level is `trace` or `info` and whose category starts with `system.` are saved. The second route is `CEmailLogRoute` which sends messages to the specified email addresses. Only messages whose level is `error` or `warning` are sent.

In a more advanced example (using an `exclude` feature available in Yii 1.1.13+), we can prevent certain categories from appearing in our logs:

```
'routes'=>array(
    array(
        'class'=>'CEmailLogRoute',
        'levels'=>'error, warning',
        'except'=>'system.CModule.*' // Will email everything except any CModule logs
        'emails'=>'admin@example.com',
    ),
    array(
        'class'=>'CWebLogRoute',
        'categories'=>'system.db.*',
        'except'=>'system.db.ar.*', // shows all db level logs but nothing in the ar category
    ),
),
```

The following log routes are available in Yii:

- `CDbLogRoute`: saves messages in a database table.
- `CEmailLogRoute`: sends messages to specified email addresses.
- `CFileLogRoute`: saves messages in a file under the application runtime directory.
- `CWebLogRoute`: displays messages at the end of the current Web page.
- `CProfileLogRoute`: displays profiling messages at the end of the current Web page.

**Info:** Message routing occurs at the end of the current request cycle when the `onEndRequest` event is raised. To explicitly terminate the processing of the current request, call `CApplication::end()` instead of `die()` or `exit()`, because `CApplication::end()` will raise the `onEndRequest` event so that the messages can be properly logged.

### 8.5.3 Message Filtering

As we mentioned, messages can be filtered according to their levels and categories before they are sent along a log route. This is done by setting the `levels` and `categories` properties

of the corresponding log route. Multiple levels or categories should be concatenated by commas.

Because message categories are in the format of `xxx.yyy.zzz`, we may treat them as a category hierarchy. In particular, we say `xxx` is the parent of `xxx.yyy` which is the parent of `xxx.yyy.zzz`. We can then use `xxx.*` to represent category `xxx` and all its child and grandchild categories.

#### 8.5.4 Logging Context Information

We can log additional context information, such as PHP predefined variables (e.g. `$_GET`, `$_SERVER`), session ID, user name, etc. This is accomplished by specifying the `CLogRoute::filter` property of a log route to be a suitable log filter.

The framework comes with the convenient `CLogFilter` that may be used as the needed log filter in most cases. By default, `CLogFilter` will log a message with variables like `$_GET`, `$_SERVER` which often contains valuable system context information. `CLogFilter` can also be configured to prefix each logged message with session ID, username, etc., which may greatly simplifying the global search when we are checking the numerous logged messages.

The following configuration shows how to enable logging context information. Note that each log route may have its own log filter. And by default, a log route does not have a log filter.

```
array(
    .....
    'preload'=>array('log'),
    'components'=>array(
        .....
        'log'=>array(
            'class'=>'CLogRouter',
            'routes'=>array(
                array(
                    'class'=>'CFileLogRoute',
                    'levels'=>'error',
                    'filter'=>'CLogFilter',
                ),
                ...other log routes...
            ),
        ),
    ),
),
)
```

Yii supports logging call stack information in the messages that are logged by calling `Yii::`

`:trace`. This feature is disabled by default because it lowers performance. To use this feature, simply define a constant named `YII_TRACE_LEVEL` at the beginning of the entry script (before including `yii.php`) to be an integer greater than 0. Yii will then append to every trace message with the file name and line number of the call stacks belonging to application code. The number `YII_TRACE_LEVEL` determines how many layers of each call stack should be recorded. This information is particularly useful during development stage as it can help us identify the places that trigger the trace messages.

### 8.5.5 Performance Profiling

Performance profiling is a special type of message logging. Performance profiling can be used to measure the time needed for the specified code blocks and find out what the performance bottleneck is.

To use performance profiling, we need to identify which code blocks need to be profiled. We mark the beginning and the end of each code block by inserting the following methods:

```
Yii::beginProfile('blockID');
...code block being profiled...
Yii::endProfile('blockID');
```

where `blockID` is an ID that uniquely identifies the code block.

Note, code blocks need to be nested properly. That is, a code block cannot intersect with another. It must be either at a parallel level or be completely enclosed by the other code block.

To show profiling result, we need to install a [CLogRouter](#) application component with a [CProfileLogRoute](#) log route. This is the same as we do with normal message routing. The [CProfileLogRoute](#) route will display the performance results at the end of the current page.

```
array(
    .....
    'preload'=>array('log'),
    'components'=>array(
        .....
        'log'=>array(
            'class'=>'CLogRouter',
            'routes'=>array(
                array(
                    'class'=>'CProfileLogRoute',
                    'report'=>'summary',
```

```

        // lists execution time of every marked code block
        // report can also be set to callstack
    ),
    ...other log routes...
),
),
),
)

```

### 8.5.6 Profiling SQL Executions

Profiling is especially useful when working with database since SQL executions are often the main performance bottleneck of an application. While we can manually insert `beginProfile` and `endProfile` statements at appropriate places to measure the time spent in each SQL execution, Yii provides a more systematic approach to solve this problem.

By setting `CDbConnection::enableProfiling` to be true in the application configuration, every SQL statement being executed will be profiled. The results can be readily displayed using the aforementioned `CProfileLogRoute`, which can show us how much time is spent in executing what SQL statement. We can also call `CDbConnection::getStats()` to retrieve the total number SQL statements executed and their total execution time.

## 8.6 Error Handling

Yii provides a complete error handling framework based on the PHP 5 exception mechanism. When the application is created to handle an incoming user request, it registers its `handleError` method to handle PHP warnings and notices; and it registers its `handleException` method to handle uncaught PHP exceptions. Consequently, if a PHP warning/notice or an uncaught exception occurs during the application execution, one of the error handlers will take over the control and start the necessary error handling procedure.

**Tip:** The registration of error handlers is done in the application's constructor by calling PHP functions `set_exception_handler` and `set_error_handler`. If you do not want Yii to handle the errors and exceptions, you may define constant `YII_ENABLE_ERROR_HANDLER` and `YII_ENABLE_EXCEPTION_HANDLER` to be false in the [entry script](#).

By default, `handleError` (or `handleException`) will raise an `onError` event (or `onException` event). If the error (or exception) is not handled by any event handler, it will call for help from the `errorHandler` application component.

### 8.6.1 Raising Exceptions

Raising exceptions in Yii is not different from raising a normal PHP exception. One uses the following syntax to raise an exception when needed:

```
throw new ExceptionClass('ExceptionMessage');
```

Yii defines three exception classes: `CException`, `CDbException` and `CHttpException`. `CException` is a generic exception class. `CDbException` represents an exception that is caused by some DB-related operations. `CHttpException` represents an exception that should be displayed to end users and carries a `statusCode` property representing an HTTP status code. The class of an exception determines how it should be displayed, as we will explain next.

**Tip:** Raising a `CHttpException` exception is a simple way of reporting errors caused by user misoperation. For example, if the user provides an invalid post ID in the URL, we can simply do the following to show a 404 error (page not found):

```
// if post ID is invalid
throw new CHttpException(404, 'The specified post cannot be found.');
```

### 8.6.2 Displaying Errors

When an error is forwarded to the `CErrorHandler` application component, it chooses an appropriate view to display the error. If the error is meant to be displayed to end users, such as a `CHttpException`, it will use a view named `errorXXX`, where `XXX` stands for the HTTP status code (e.g. 400, 404, 500). If the error is an internal one and should only be displayed to developers, it will use a view named `exception`. In the latter case, complete call stack as well as the error line information will be displayed.

**Info:** When the application runs in `production mode`, all errors including those internal ones will be displayed using view `errorXXX`. This is because the call stack of an error may contain sensitive information. In this case, developers should rely on the error logs to determine what is the real cause of an error.

`CErrorHandler` searches for the view file corresponding to a view in the following order:

1. `WebRoot/themes/ThemeName/views/system`: this is the `system` view directory under the currently active theme.

2. `WebRoot/protected/views/system`: this is the default `system` view directory for an application.
3. `yii/framework/views`: this is the standard system view directory provided by the Yii framework.

Therefore, if we want to customize the error display, we can simply create error view files under the system view directory of our application or theme. Each view file is a normal PHP script consisting of mainly HTML code. For more details, please refer to the default view files under the framework's `view` directory.

### 8.6.3 Handling Errors Using an Action

Yii allows using a [controller action](#) to handle the error display work. To do so, we should configure the error handler in the application configuration as follows:

```
return array(  
    .....  
    'components'=>array(  
        'errorHandler'=>array(  
            'errorAction'=>'site/error',  
        ),  
    ),  
);
```

In the above, we configure the `CErrorHandler::errorAction` property to be the route `site/error` which refers to the `error` action in `SiteController`. We may use a different route if needed.

We can write the error action like the following:

```
public function actionError()  
{  
    if($error=Yii::app()->errorHandler->error)  
        $this->render('error', $error);  
}
```

In the action, we first retrieve the detailed error information from `CErrorHandler::error`. If it is not empty, we render the `error` view together with the error information. The error information returned from `CErrorHandler::error` is an array with the following fields:

- `code`: the HTTP status code (e.g. 403, 500);

- **type**: the error type (e.g. `CHttpException`, `PHP Error`);
- **message**: the error message;
- **file**: the name of the PHP script file where the error occurs;
- **line**: the line number of the code where the error occurs;
- **trace**: the call stack of the error;
- **source**: the context source code where the error occurs.

**Tip:** The reason we check if `CErrorHandler::error` is empty or not is because the **error** action may be directly requested by an end user, in which case there is no error. Since we are passing the `$error` array to the view, it will be automatically expanded to individual variables. As a result, in the view we can access directly the variables such as `$code`, `$type`.

#### 8.6.4 Message Logging

A message of level **error** will always be logged when an error occurs. If the error is caused by a PHP warning or notice, the message will be logged with category `php`; if the error is caused by an uncaught exception, the category would be `exception.ExceptionClassName` (for `CHttpException` its `statusCode` will also be appended to the category). One can thus exploit the **logging** feature to monitor errors happened during application execution.

## 8.7 Web Service

**Web service** is a software system designed to support interoperable machine-to-machine interaction over a network. In the context of Web applications, it usually refers to a set of APIs that can be accessed over the Internet and executed on a remote system hosting the requested service. For example, a **Flex**-based client may invoke a function implemented on the server side running a PHP-based Web application. Web service relies on **SOAP** as its foundation layer of the communication protocol stack.

Yii provides `CWebService` and `CWebServiceAction` to simplify the work of implementing Web service in a Web application. The APIs are grouped into classes, called *service providers*. Yii will generate for each class a **WSDL** specification which describes what APIs are available and how they should be invoked by client. When an API is invoked by a client, Yii will instantiate the corresponding service provider and call the requested API to fulfill the request.

**Note:** `CWebService` relies on the [PHP SOAP extension](#). Make sure you have enabled it before trying the examples displayed in this section.

### 8.7.1 Defining Service Provider

As we mentioned above, a service provider is a class defining the methods that can be remotely invoked. Yii relies on [doc comment](#) and [class reflection](#) to identify which methods can be remotely invoked and what are their parameters and return value.

Let's start with a simple stock quoting service. This service allows a client to request for the quote of the specified stock. We define the service provider as follows. Note that we define the provider class `StockController` by extending `CController`. This is not required.

```
class StockController extends CController
{
    /**
     * @param string the symbol of the stock
     * @return float the stock price
     * @soap
     */
    public function getPrice($symbol)
    {
        $prices=array('IBM'=>100, 'GOOGLE'=>350);
        return isset($prices[$symbol])?$prices[$symbol]:0;
        //...return stock price for $symbol
    }
}
```

In the above, we declare the method `getPrice` to be a Web service API by marking it with the tag `@soap` in its doc comment. We rely on doc comment to specify the data type of the input parameters and return value. Additional APIs can be declared in the similar way.

### 8.7.2 Declaring Web Service Action

Having defined the service provider, we need to make it available to clients. In particular, we want to create a controller action to expose the service. This can be done easily by declaring a `CWebServiceAction` action in a controller class. For our example, we will just put it in `StockController`.

```
class StockController extends CController
{
```



```
public function actions()
{
    return array(
        'quote'=>array(
            'class'=>'CWebServiceAction',
        ),
    );
}

/**
 * @param string the symbol of the stock
 * @return float the stock price
 * @soap
 */
public function getPrice($symbol)
{
    //...return stock price for $symbol
}
}
```

That is all we need to create a Web service! If we try to access the action by URL `http://hostname/path/to/index.php?r=stock/quote`, we will see a lot of XML content which is actually the WSDL for the Web service we defined.

**Tip:** By default, `CWebServiceAction` assumes the current controller is the service provider. That is why we define the `getPrice` method inside the `StockController` class.

### 8.7.3 Consuming Web Service

To complete the example, let's create a client to consume the Web service we just created. The example client is written in PHP, but it could be in other languages, such as Java, C#, Flex, etc.

```
$client=new SoapClient('http://hostname/path/to/index.php?r=stock/quote');
echo $client->getPrice('GOOGLE');
```

Run the above script in either Web or console mode, and we shall see 350 which is the price for GOOGLE.

### 8.7.4 Data Types

When declaring class methods and properties to be remotely accessible, we need to specify the data types of the input and output parameters. The following primitive data types

can be used:

- `str/string`: maps to `xsd:string`;
- `int/integer`: maps to `xsd:int`;
- `float/double`: maps to `xsd:float`;
- `bool/boolean`: maps to `xsd:boolean`;
- `date`: maps to `xsd:date`;
- `time`: maps to `xsd:time`;
- `datetime`: maps to `xsd:dateTime`;
- `array`: maps to `xsd:string`;
- `object`: maps to `xsd:struct`;
- `mixed`: maps to `xsd:anyType`.

If a type is not any of the above primitive types, it is considered as a composite type consisting of properties. A composite type is represented in terms of a class, and its properties are the class' public member variables marked with `@soap` in their doc comments.

We can also use array type by appending `[]` to the end of a primitive or composite type. This would specify an array of the specified type.

Below is an example defining the `getPosts` Web API which returns an array of `Post` objects.

```
class PostController extends CController
{
    /**
     * @return Post[] a list of posts
     * @soap
     */
    public function getPosts()
    {
        return Post::model()->findAll();
    }
}

class Post extends CActiveRecord
{
    /**
     * @var integer post ID
```

```

    * @soap
    */
    public $id;
    /**
     * @var string post title
     * @soap
     */
    public $title;

    public static function model($className=__CLASS__)
    {
        return parent::model($className);
    }
}

```

### 8.7.5 Class Mapping

In order to receive parameters of composite type from client, an application needs to declare the mapping from WSDL types to the corresponding PHP classes. This is done by configuring the `classMap` property of `CWebServiceAction`.

```

class PostController extends CController
{
    public function actions()
    {
        return array(
            'service'=>array(
                'class'=>'CWebServiceAction',
                'classMap'=>array(
                    'Post'=>'Post', // or simply 'Post'
                ),
            ),
        );
    }
    .....
}

```

### 8.7.6 Intercepting Remote Method Invocation

By implementing the `IWebServiceProvider` interface, a service provider can intercept remote method invocations. In `IWebServiceProvider::beforeWebMethod`, the provider may retrieve the current `CWebService` instance and obtain the name of the method currently being requested via `CWebService::methodName`. It can return false if the remote method should not be invoked for some reason (e.g. unauthorized access).

## 8.8 Internationalization

Internationalization (I18N) refers to the process of designing a software application so that it can be adapted to various languages and regions without engineering changes. For Web applications, this is of particular importance because the potential users may be worldwide.

Yii provides support for I18N in several aspects.

- It provides the locale data for each possible language and variant.
- It provides message and file translation service.
- It provides locale-dependent date and time formatting.
- It provides locale-dependent number formatting.

In the following subsections, we will elaborate each of the above aspects.

### 8.8.1 Locale and Language

Locale is a set of parameters that defines the user's language, country and any special variant preferences that the user wants to see in their user interface. It is usually identified by an ID consisting of a language ID and a region ID. For example, the ID `en_US` stands for the locale of English and United States. For consistency, all locale IDs in Yii are canonicalized to the format of `LanguageID` or `LanguageID_RegionID` in lower case (e.g. `en`, `en_us`).

Locale data is represented as a `CLocale` instance. It provides locale-dependent information, including currency symbols, number symbols, currency formats, number formats, date and time formats, and date-related names. Since the language information is already implied in the locale ID, it is not provided by `CLocale`. For the same reason, we often interchangeably use the term locale and language.

Given a locale ID, one can get the corresponding `CLocale` instance by `CLocale::getInstance($localeID)` or `CApplication::getLocale($localeID)`.

**Info:** Yii comes with locale data for nearly every language and region. The data is obtained from [Common Locale Data Repository](#) (CLDR). For each locale, only a subset of the CLDR data is provided as the original data contains a lot of rarely used information. Users can also supply their own customized locale data. To do so, configure the `CApplication::localeDataPath` property with the directory that contains the customized locale data. Please refer to the locale data files under `framework/i18n/data` in order to create customized locale data files.

For a Yii application, we differentiate its [target language](#) from [source language](#). The target language is the language (locale) of the users that the application is targeted at, while the source language refers to the language (locale) that the application source files are written in. Internationalization occurs only when the two languages are different.

**Tip:** It's better to leave English as a source language since it will be easier to find people translating from English to any other language.

One can configure [target language](#) in the [application configuration](#), or change it dynamically before any internationalization occurs.

**Tip:** Sometimes, we may want to set the target language as the language preferred by a user (specified in the user's browser preferences). To do so, we can retrieve the user preferred language ID using `CHttpRequest::preferredLanguage`.

### 8.8.2 Translation

The most needed I18N feature is perhaps translation, including message translation and view translation. The former translates a text message to the desired language, while the latter translates a whole file to the desired language.

A translation request consists of the object to be translated, the source language that the object is in, and the target language that the object needs to be translated to. In Yii, the source language defaults to the [application source language](#) while the target language defaults to the [application language](#). If the source and target languages are the same, translation will not occur.

#### Message Translation

Message translation is done by calling `Yii::t()`. The method translates the given message from [source language](#) to [target language](#).

When translating a message, its category has to be specified since a message may be translated differently under different categories (contexts). The category `yii` is reserved for messages used by the Yii framework core code.

Messages can contain parameter placeholders which will be replaced with the actual parameter values when calling `Yii::t()`. For example, the following message translation request would replace the `{alias}` placeholder in the original message with the actual alias value.

```
Yii::t('app', 'Path alias "{alias}" is redefined.',  
array('{alias}'=>$alias))
```

**Note:** Messages to be translated must be constant strings. They should not contain variables that would change message content (e.g. "Invalid `{message}` content."). Use parameter placeholders if a message needs to vary according to some parameters.

Translated messages are stored in a repository called *message source*. A message source is represented as an instance of `CMessageSource` or its child class. When `Yii::t()` is invoked, it will look for the message in the message source and return its translated version if it is found.

Yii comes with the following types of message sources. You may also extend `CMessageSource` to create your own message source type.

- `CPhpMessageSource`: the message translations are stored as key-value pairs in a PHP array. The original message is the key and the translated message is the value. Each array represents the translations for a particular category of messages and is stored in a separate PHP script file whose name is the category name. The PHP translation files for the same language are stored under the same directory named as the locale ID. And all these directories are located under the directory specified by `basePath`.
- `CGettextMessageSource`: the message translations are stored as `GNU Gettext` files.
- `CDbMessageSource`: the message translations are stored in database tables. For more details, see the API documentation for `CDbMessageSource`.

A message source is loaded as an application component. Yii pre-declares an application component named `messages` to store messages that are used in user application. By default,

the type of this message source is `CPhpMessageSource` and the base path for storing the PHP translation files is `protected/messages`.

In summary, in order to use message translation, the following steps are needed:

1. Call `Yii::t()` at appropriate places;
2. Create PHP translation files as `protected/messages/LocaleID/CategoryName.php`. Each file simply returns an array of message translations. Note, this assumes you are using the default `CPhpMessageSource` to store the translated messages.
3. Configure `CApplication::sourceLanguage` and `CApplication::language`.

**Tip:** The `yiic` tool in Yii can be used to manage message translations when `CPhpMessageSource` is used as the message source. Its `message` command can automatically extract messages to be translated from selected source files and merge them with existing translations if necessary. For more details of using the `message` command, please run `yiic help message`.

When using `CPhpMessageSource` to manage message source, messages for an extension class (e.g. a widget, a module) can be specially managed and used. In particular, if a message belongs to an extension whose class name is `Xyz`, then the message category can be specified in the format of `Xyz.categoryName`. The corresponding message file will be assumed to be `BasePath/messages/LanguageID/categoryName.php`, where `BasePath` refers to the directory that contains the extension class file. And when using `Yii::t()` to translate an extension message, the following format should be used, instead:

```
Yii::t('Xyz.categoryName', 'message to be translated')
```

Yii supports `choice format`, which is also known as plural forms. Choice format refers to choosing a translation according to a given number value. For example, in English, the word 'book' may either take a singular form or a plural form depending on the number of books, while in other languages, the word may not use different forms (such as in Chinese) or may use more complex plural form rules (such as in Russian). Choice format solves this problem in a simple yet effective way.

To use choice format, a translated message must consist of a sequence of expression-message pairs separated by `|`, as shown below:

```
'expr1#message1|expr2#message2|expr3#message3'
```

where `exprN` refers to a valid PHP expression which evaluates to a boolean value indicating whether the corresponding message should be returned. Only the message corresponding to the first expression that evaluates to true will be returned. An expression can contain a special variable named `n` (note, it is not `$n`) which will take the number value passed as the first message parameter. For example, assuming a translated message is:

```
'n==1#one book|n>1#many books'
```

and we are passing a number value 2 in the message parameter array when calling `Yii::t()`, we would obtain `many books` as the final translated message:

```
Yii::t('app', 'n==1#one book|n>1#many books', array(1));  
//or since 1.1.6  
Yii::t('app', 'n==1#one book|n>1#many books', 1);
```

As a shortcut notation, if an expression is a number, it will be treated as `n==Number`. Therefore, the above translated message can be also be written as:

```
'1#one book|n>1#many books'
```

## Plural forms format

Since version 1.1.6 CLDR-based plural choice format can be used with a simpler syntax. It is handy for languages with complex plural form rules.

The rule for English plural forms above can be written in the following way:

```
Yii::t('test', 'cucumber|cucumbers', 1);  
Yii::t('test', 'cucumber|cucumbers', 2);  
Yii::t('test', 'cucumber|cucumbers', 0);
```

The code above will give you:

```
cucumber  
cucumbers  
cucumbers
```

If you want to include number you can use the following code.



```
echo Yii::t('test', '{n} cucumber|{n} cucumbers', 1);
```

Here {n} is a special placeholder holding number passed. It will print 1 cucumber.

You can pass additional parameters:

```
Yii::t('test', '{username} has a cucumber|{username} has {n} cucumbers',  
array(5, '{username}' => 'samdark'));
```

and even replace a number parameter with something else:

```
function convertNumber($number)  
{  
    // convert number to word  
    return $number;  
}  
  
Yii::t('test', '{n} cucumber|{n} cucumbers',  
array(5, '{n}' => convertNumber(5)));
```

The number of plural expressions will vary by language. For example:

```
Yii::t('app', '{n} cucumber|{n} cucumbers', 62);  
Yii::t('app', '{n} cucumber|{n} cucumbers', 1.5);  
Yii::t('app', '{n} cucumber|{n} cucumbers', 1);  
Yii::t('app', '{n} cucumber|{n} cucumbers', 7);
```

when translated into Russian will have 4 instead of 2 message expressions:

```
'{n} cucumber|{n} cucumbers' => '{n} |{n} |{n} |{n} ',
```

which will produce:

```
62  
1.5  
1  
7
```

**Info:** to learn about how many expressions you should supply and in which order they should be, please refer to CLDR [Language Plural Rules](#) page.

## File Translation

File translation is accomplished by calling `CApplication::findLocalizedFile()`. Given the path of a file to be translated, the method will look for a file with the same name under the `LocaleID` subdirectory. If found, the file path will be returned; otherwise, the original file path will be returned.

File translation is mainly used when rendering a view. When calling one of the render methods in a controller or widget, the view files will be translated automatically. For example, if the `target language` is `zh_cn` while the `source language` is `en_us`, rendering a view named `edit` would result in searching for the view file `protected/views/ControllerID/zh_cn/edit.php`. If the file is found, this translated version will be used for rendering; otherwise, the file `protected/views/ControllerID/edit.php` will be rendered instead.

File translation may also be used for other purposes, for example, to display a translated image or load a locale-dependent data file.

### 8.8.3 Date and Time Formatting

Date and time are often in different formats in different countries or regions. The task of date and time formatting is thus to generate a date or time string that fits the specified locale. Yii provides `CDateFormatter` for this purpose.

Each `CDateFormatter` instance is associated with a target locale. To get the formatter associated with the target locale of the whole application, we can simply access the `dateFormatter` property of the application.

The `CDateFormatter` class mainly provides two methods to format a UNIX timestamp.

- `format`: this method formats the given UNIX timestamp into a string according to a customized date-time pattern (e.g. `$dateFormatter->format('yyyy-MM-dd',$timestamp)`).
- `formatDateTime`: this method formats the given UNIX timestamp into a string according to a pattern predefined in the target locale data (e.g. `short` format of date, `long` format of time).

### 8.8.4 Number Formatting

Like data and time, numbers may also need to be formatted differently in different countries or regions. Number formatting includes decimal formatting, currency formatting and percentage formatting. Yii provides `CNumberFormatter` for these tasks.

To get the number formatter associated with the target locale of the whole application, we can access the `numberFormatter` property of the application.

The following methods are provided by `CNumberFormatter` to format an integer or double value.

- `format`: this method formats the given number into a string according to a customized pattern (e.g. `$numberFormatter->format('#,##0.00',$number)`).
- `formatDecimal`: this method formats the given number using the decimal pattern predefined in the target locale data.
- `formatCurrency`: this method formats the given number and currency code using the currency pattern predefined in the target locale data.
- `formatPercentage`: this method formats the given number using the percentage pattern predefined in the target locale data.

## 8.9 Using Alternative Template Syntax

Yii allows developers to use their own favorite template syntax (e.g. Prado, Smarty) to write controller or widget views. This is achieved by writing and installing a `viewRenderer` application component. The view renderer intercepts the invocations of `CBaseController::renderFile`, compiles the view file with customized template syntax, and renders the compiling results.

**Info:** It is recommended to use customized template syntax only when writing views that are less likely to be reused. Otherwise, people who are reusing the views would be forced to use the same customized template syntax in their applications.

In the following, we introduce how to use `CPradoViewRenderer`, a view renderer that allows developers to use the template syntax similar to that in `Prado framework`. For people who want to develop their own view renderers, `CPradoViewRenderer` is a good reference.

### 8.9.1 Using CPradoViewRenderer

To use `CPradoViewRenderer`, we just need to configure the application as follows:

```
return array(
```

```

    'components'=>array(
        . . . . .,
        'viewRenderer'=>array(
            'class'=>'CPradoViewRenderer',
        ),
    ),
);

```

By default, `CPradoViewRenderer` will compile source view files and save the resulting PHP files under the `runtime` directory. Only when the source view files are changed, will the PHP files be re-generated. Therefore, using `CPradoViewRenderer` incurs very little performance degradation.

**Tip:** While `CPradoViewRenderer` mainly introduces some new template tags to make writing views easier and faster, you can still write PHP code as usual in the source views.

In the following, we introduce the template tags that are supported by `CPradoViewRenderer`.

### Short PHP Tags

Short PHP tags are shortcuts to writing PHP expressions and statements in a view. The expression tag `<%= expression %>` is translated into `<?php echo expression ?>`; while the statement tag `<% statement %>` to `<?php statement ?>`. For example,

```

<%= CHtml::textField($name,'value'); %>
<% foreach($models as $model): %>

```

is translated into

```

<?php echo CHtml::textField($name,'value'); ?>
<?php foreach($models as $model): ?>

```

### Component Tags

Component tags are used to insert a `widget` in a view. It uses the following syntax:

```
<com:WidgetClass property1=value1 property2=value2 ...>
    // body content for the widget
</com:WidgetClass>

// a widget without body content
<com:WidgetClass property1=value1 property2=value2 .../>
```

where `WidgetClass` specifies the widget class name or class [path alias](#), and property initial values can be either quoted strings or PHP expressions enclosed within a pair of curly brackets. For example,

```
<com:CCaptcha captchaAction="captcha" showRefreshButton={false} />
```

would be translated as

```
<?php $this->widget('CCaptcha', array(
    'captchaAction'=>'captcha',
    'showRefreshButton'=>false)); ?>
```

**Note:** The value for `showRefreshButton` is specified as `{false}` instead of `"false"` because the latter means a string instead of a boolean.

## Cache Tags

Cache tags are shortcuts to using [fragment caching](#). Its syntax is as follows,

```
<cache:fragmentID property1=value1 property2=value2 ...>
    // content being cached
</cache:fragmentID >
```

where `fragmentID` should be an identifier that uniquely identifies the content being cached, and the property-value pairs are used to configure the fragment cache. For example,

```
<cache:profile duration={3600}>
    // user profile information here
</cache:profile >
```

would be translated as

```
<?php if($this->beginCache('profile', array('duration'=>3600))): ?>
    // user profile information here
</php $this->endCache(); endif; ?>
```

## Clip Tags

Like cache tags, clip tags are shortcuts to calling `CBaseController::beginClip` and `CBaseController::endClip` in a view. The syntax is as follows,

```
<clip:clipID>
    // content for this clip
</clip:clipID >
```

where `clipID` is an identifier that uniquely identifies the clip content. The clip tags will be translated as

```
<?php $this->beginClip('clipID'); ?>
    // content for this clip
</php $this->endClip(); ?>
```

## Comment Tags

Comment tags are used to write view comments that should only be visible to developers. Comment tags will be stripped off when the view is displayed to end users. The syntax for comment tags is as follows,

```
<!--
view comments that will be stripped off
-->
```

### 8.9.2 Mixing Template Formats

Starting from version 1.1.2, it is possible to mix the usage of some alternative template syntax with the normal PHP syntax. To do so, the `CViewRenderer::fileExtension` property of the installed view renderer must be configured with a value other than `.php`. For example, if the property is set as `.tpl`, then any view file ending with `.tpl` will be rendered using the installed view renderer, while all other view files ending with `.php` will be treated as normal PHP view script.

## 8.10 Console Applications

Console applications are mainly used to perform offline work needed by an online Web application, such as code generation, search index compiling, email sending, etc. Yii provides a framework for writing console applications in an object-oriented way. It allows a console application to access the resources (e.g. DB connections) that are used by an online Web application.

### 8.10.1 Overview

Yii represents each console task in terms of a [command](#). A console command is written as a class extending from [CConsoleCommand](#).

When we use the `yiic webapp` tool to create an initial skeleton Yii application, we may find two files under the `protected` directory:

- `yiic`: this is an executable script used on Linux/Unix;
- `yiic.bat`: this is an executable batch file used on Windows.

In a console window, we can enter the following commands:

```
cd protected
yiic help
```

This will display a list of available console commands. By default, the available commands include those provided by Yii framework (called **system commands**) and those developed by users for individual applications (called **user commands**).

To see how to use a command, we can execute

```
yiic help <command-name>
```

And to execute a command, we can use the following command format:

```
yiic <command-name> [parameters...]
```

### 8.10.2 Creating Commands

Console commands are stored as class files under the directory specified by [CConsoleApplication::commandPath](#). By default, this refers to the directory `protected/commands`.

A console command class must extend from `CConsoleCommand`. The class name must be of format `XYZCommand`, where `XYZ` refers to the command name with the first letter in upper case. For example, a `sitemap` command must use the class name `SitemapCommand`. Console command names are case-sensitive.

**Tip:** By configuring `CConsoleApplication::commandMap`, one can also have command classes in different naming conventions and located in different directories.

To create a new command, one often needs to override `CConsoleCommand::run()` or develop one or several command actions (to be explained in the next section).

When executing a console command, the `CConsoleCommand::run()` method will be invoked by the console application. Any console command parameters will be passed to the method as well, according to the following signature of the method:

```
public function run($args) { ... }
```

where `$args` refers to the extra parameters given in the command line.

Within a console command, we can use `Yii::app()` to access the console application instance, through which we can also access resources such as database connections (e.g. `Yii::app()->db`). As we can tell, the usage is very similar to what we can do in a Web application.

**Info:** Starting from version 1.1.1, we can also create global commands that are shared by **all** Yii applications on the same machine. To do so, define an environment variable named `YII_CONSOLE_COMMANDS` which should point to an existing directory. We can then put our global command class files under this directory.

### 8.10.3 Console Command Action

**Note:** The feature of console command action has been available since version 1.1.5.

A console command often needs to handle different command line parameters, some required, some optional. A console command may also need to provide several sub-commands to handle different sub-tasks. These work can be simplified using console command actions.



A console command action is a method in a console command class. The method name must be of the format `actionXyz`, where `Xyz` refers to the action name with the first letter in upper-case. For example, a method `actionIndex` defines an action named `index`.

To execute a specific action, we use the following console command format:

```
yiic <command-name> <action-name> --option1=value1 --option2=value2 ...
```

The additional option-value pairs will be passed as named parameters to the action method. The value of a `xyz` option will be passed as the `$xyz` parameter of the action method. For example, if we define the following command class:

```
class SitemapCommand extends CConsoleCommand
{
    public function actionIndex($type, $limit=5) { ... }
    public function actionInit() { ... }
}
```

Then, the following console commands will all result in calling `actionIndex('News', 5)`:

```
yiic sitemap index --type=News --limit=5

// $limit takes default value
yiic sitemap index --type=News

// $limit takes default value
// because 'index' is a default action, we can omit the action name
yiic sitemap --type=News

// the order of options does not matter
yiic sitemap index --limit=5 --type=News
```

If an option is given without value (e.g. `--type` instead of `--type=News`), the corresponding action parameter value will be assumed to be boolean `true`.

**Note:** We do not support alternative option formats such as `--type News`, `-t News`.

A parameter can take an array value by declaring it with array type hinting:

```
public function actionIndex(array $types) { ... }
```

To supply the array value, we simply repeat the same option in the command line as needed:

```
yiic sitemap index --types=News --types=Article
```

The above command will call `actionIndex(array('News', 'Article'))` ultimately.

Starting from version 1.1.6, Yii also supports using anonymous action parameters and global options.

Anonymous parameters refer to those command line parameters not in the format of options. For example, in a command `yiic sitemap index --limit=5 News`, we have an anonymous parameter whose value is `News` while the named parameter `limit` is taking the value 5.

To use anonymous parameters, a command action must declare a parameter named as `$args`. For example,

```
public function actionIndex($limit=10, $args=array()) {...}
```

The `$args` array will hold all available anonymous parameter values.

Global options refer to those command line options that are shared by all actions in a command. For example, in a command that provides several actions, we may want every action to recognize an option named as `verbose`. While we can declare `$verbose` parameter in every action method, a better way is to declare it as a **public member variable** of the command class, which turns `verbose` into a global option:

```
class SitemapCommand extends CConsoleCommand
{
    public $verbose=false;
    public function actionIndex($type) {...}
}
```

The above code will allow us to execute a command with a `verbose` option:

```
yiic sitemap index --verbose=1 --type=News
```

#### 8.10.4 Exit Codes

**Note:** The possibility to return exit codes in console commands has been available since version 1.1.11.

When running console commands automatically, via cronjob or using a continuous integration server, it is always interesting if the command ran successfully or if there were errors. This can be done by checking the exit code a process returns on exit.

These codes are integer values between 0 and 254 (this is the range in [php world](#)), where 0 should be returned on success and all other values greater than 0 will indicate an error.

In an action method or in the `run()` method of your console command you can return an integer value to exit your application with an exit code. Example:

```
if (/* error */) {  
    return 1; // exit with error code 1  
}  
// ... do something ...  
return 0; // exit successfully
```

When there is no return value, application will exit with code 0.

### 8.10.5 Customizing Console Applications

By default, if an application is created using the `yiic webapp` tool, the configuration for the console application will be `protected/config/console.php`. Like a Web application configuration file, this file is a PHP script which returns an array representing the property initial values for a console application instance. As a result, any public property of [CConsoleApplication](#) can be configured in this file.

Because console commands are often created to serve for the Web application, they need to access the resources (such as DB connections) that are used by the latter. We can do so in the console application configuration file like the following:

```
return array(  
    .....  
    'components'=>array(  
        'db'=>array(  
            .....  
        ),  
    ),  
);
```

As we can see, the format of the configuration is very similar to what we do in a Web application configuration. This is because both [CConsoleApplication](#) and [CWebApplication](#) share the same base class.

## 8.11 Security

### 8.11.1 Cross-site Scripting Prevention

Cross-site scripting (also known as XSS) occurs when a web application gathers malicious data from a user. Often attackers will inject JavaScript, VBScript, ActiveX, HTML, or Flash into a vulnerable application to fool other application users and gather data from them. For example, a poorly designed forum system may display user input in forum posts without any checking. An attacker can then inject a piece of malicious JavaScript code into a post so that when other users read this post, the JavaScript runs unexpectedly on their computers.

One of the most important measures to prevent XSS attacks is to check user input before displaying them. One can do HTML-encoding with the user input to achieve this goal. However, in some situations, HTML-encoding may not be preferable because it disables all HTML tags.

Yii incorporates the work of [HTMLPurifier](#) and provides developers with a useful component called [CHtmlPurifier](#) that encapsulates [HTMLPurifier](#). This component is capable of removing all malicious code with a thoroughly audited, secure yet permissive whitelist and making sure the filtered content is standard-compliant.

The [CHtmlPurifier](#) component can be used as either a [widget](#) or a [filter](#). When used as a widget, [CHtmlPurifier](#) will purify contents displayed in its body in a view. For example,

```
<?php $this->beginWidget('CHtmlPurifier'); ?>
...display user-entered content here...
<?php $this->endWidget(); ?>
```

### 8.11.2 Cross-site Request Forgery Prevention

Cross-Site Request Forgery (CSRF) attacks occur when a malicious web site causes a user's web browser to perform an unwanted action on a trusted site. For example, a malicious web site has a page that contains an image tag whose `src` points to a banking site: `http://bank.example/withdraw?transfer=10000&to=someone`. If a user who has a login cookie for the banking site happens to visit this malicious page, the action of transferring 10000 dollars to someone will be executed. Contrary to cross-site, which exploits the trust a user has for a particular site, CSRF exploits the trust that a site has for a particular user.

To prevent CSRF attacks, it is important to abide to the rule that `GET` requests should only be allowed to retrieve data rather than modify any data on the server. And for `POST` requests, they should include some random value which can be recognized by the server to ensure the form is submitted from and the result is sent back to the same origin.

Yii implements a CSRF prevention scheme to help defeat POST-based attacks. It is based on storing a random value in a cookie and comparing this value with the value submitted via the POST request.

By default, the CSRF prevention is disabled. To enable it, configure the [CHttpRequest](#) application component in the [application configuration](#) as follows,

```
return array(  
    'components'=>array(  
        'request'=>array(  
            'enableCsrfValidation'=>true,  
        ),  
    ),  
);
```

And to display a form, call [CHtml::form](#) instead of writing the HTML form tag directly. The [CHtml::form](#) method will embed the necessary random value in a hidden field so that it can be submitted for CSRF validation.

### 8.11.3 Cookie Attack Prevention

Protecting cookies from being attacked is of extreme importance, as session IDs are commonly stored in cookies. If one gets hold of a session ID, he essentially owns all relevant session information.

There are several countermeasures to prevent cookies from being attacked.

- An application can use SSL to create a secure communication channel and only pass the authentication cookie over an HTTPS connection. Attackers are thus unable to decipher the contents in the transferred cookies.
- Expire sessions appropriately, including all cookies and session tokens, to reduce the likelihood of being attacked.
- Prevent cross-site scripting which causes arbitrary code to run in a user's browser and expose his cookies.
- Validate cookie data and detect if they are altered.

Yii implements a cookie validation scheme that prevents cookies from being modified. In particular, it does HMAC check for the cookie values if cookie validation is enabled.

Cookie validation is disabled by default. To enable it, configure the [CHttpRequest](#) application component in the [application configuration](#) as follows,

```
return array(  
    'components'=>array(  
        'request'=>array(  
            'enableCookieValidation'=>true,  
        ),  
    ),  
);
```

To make use of the cookie validation scheme provided by Yii, we also need to access cookies through the `cookies` collection, instead of directly through `$_COOKIES`:

```
// retrieve the cookie with the specified name  
$cookie=Yii::app()->request->cookies[$name];  
$value=$cookie->value;  
.....  
// send a cookie  
$cookie=new CHttpCookie($name,$value);  
Yii::app()->request->cookies[$name]=$cookie;
```

## 8.12 Performance Tuning

Performance of Web applications is affected by many factors. Database access, file system operations, network bandwidth are all potential affecting factors. Yii has tried in every aspect to reduce the performance impact caused by the framework. But still, there are many places in the user application that can be improved to boost performance.

### 8.12.1 Enabling APC Extension

Enabling the [PHP APC extension](#) is perhaps the easiest way to improve the overall performance of an application. The extension caches and optimizes PHP intermediate code and avoids the time spent in parsing PHP scripts for every incoming request.

### 8.12.2 Disabling Debug Mode

Disabling debug mode is another easy way to improve performance. A Yii application runs in debug mode if the constant `YII_DEBUG` is defined as true. Debug mode is useful during development stage, but it would impact performance because some components cause extra burden in debug mode. For example, the message logger may record additional debug information for every message being logged.

### 8.12.3 Using `yiilite.php`

When the [PHP APC extension](#) is enabled, we can replace `yii.php` with a different Yii bootstrap file named `yiilite.php` to further boost the performance of a Yii-powered application.

The file `yiilite.php` comes with every Yii release. It is the result of merging some commonly used Yii class files. Both comments and trace statements are stripped from the merged file. Therefore, using `yiilite.php` would reduce the number of files being included and avoid execution of trace statements.

Note, using `yiilite.php` without APC may actually reduce performance, because `yiilite.php` contains some classes that are not necessarily used in every request and would take extra parsing time. It is also observed that using `yiilite.php` is slower with some server configurations, even when APC is turned on. The best way to judge whether to use `yiilite.php` or not is to run a benchmark using the included `hello world` demo.

### 8.12.4 Using Caching Techniques

As described in the [Caching](#) section, Yii provides several caching solutions that may improve the performance of a Web application significantly. If the generation of some data takes long time, we can use the [data caching](#) approach to reduce the data generation frequency; If a portion of page remains relatively static, we can use the [fragment caching](#) approach to reduce its rendering frequency; If a whole page remains relative static, we can use the [page caching](#) approach to save the rendering cost for the whole page.

If the application is using [Active Record](#), we should turn on the schema caching to save the time of parsing database schema. This can be done by configuring the `CDbConnection::schemaCachingDuration` property to be a value greater than 0.

Besides these application-level caching techniques, we can also use server-level caching solutions to boost the application performance. As a matter of fact, the [APC caching](#) we described earlier belongs to this category. There are other server techniques, such as [Zend Optimizer](#), [eAccelerator](#), [Squid](#), to name a few.

### 8.12.5 Database Optimization

Fetching data from database is often the main performance bottleneck in a Web application. Although using caching may alleviate the performance hit, it does not fully solve the problem. When the database contains enormous data and the cached data is invalid, fetching the latest data could be prohibitively expensive without proper database and query design.

Design index wisely in a database. Indexing can make `SELECT` queries much faster, but it may slow down `INSERT`, `UPDATE` or `DELETE` queries.

For complex queries, it is recommended to create a database view for it instead of issuing the queries inside the PHP code and asking DBMS to parse them repetitively.

Do not overuse [Active Record](#). Although [Active Record](#) is good at modelling data in an OOP fashion, it actually degrades performance due to the fact that it needs to create one or several objects to represent each row of query result. For data intensive applications, using [DAO](#) or database APIs at lower level could be a better choice.

Last but not least, use `LIMIT` in your `SELECT` queries. This avoids fetching overwhelming data from database and exhausting the memory allocated to PHP.

### 8.12.6 Minimizing Script Files

Complex pages often need to include many external JavaScript and CSS files. Because each file would cause one extra round trip to the server and back, we should minimize the number of script files by merging them into fewer ones. We should also consider reducing the size of each script file to reduce the network transmission time. There are many tools around to help on these two aspects.

For a page generated by Yii, chances are that some script files are rendered by components that we do not want to modify (e.g. Yii core components, third-party components). In order to minimizing these script files, we need two steps.

First, we declare the scripts to be minimized by configuring the `scriptMap` property of the `clientScript` application component. This can be done either in the application configuration or in code. For example,

```
$cs=Yii::app()->clientScript;
$cs->scriptMap=array(
    'jquery.js'=>'/js/all.js',
    'jquery.ajaxqueue.js'=>'/js/all.js',
    'jquery.metadata.js'=>'/js/all.js',
    .....
);
```

What the above code does is that it maps those JavaScript files to the URL `/js/all.js`. If any of these JavaScript files need to be included by some components, Yii will include the URL (once) instead of the individual script files.

Second, we need to use some tools to merge (and perhaps compress) the JavaScript files



into a single one and save it as `js/all.js`.

The same trick also applies to CSS files.

We can also improve page loading speed with the help of [Google AJAX Libraries API](#). For example, we can include `jquery.js` from Google servers instead of our own server. To do so, we first configure the `scriptMap` as follows,

```
$cs=Yii::app()->clientScript;
$cs->scriptMap=array(
    'jquery.js'=>false,
    'jquery.ajaxqueue.js'=>false,
    'jquery.metadata.js'=>false,
    .....
);
```

By mapping these script files to false, we prevent Yii from generating the code to include these files. Instead, we write the following code in our pages to explicitly include the script files from Google,

```
<head>
<?php echo CGoogleApi::init(); ?>

<?php echo CHtml::script(
    CGoogleApi::load('jquery','1.3.2') . "\n" .
    CGoogleApi::load('jquery.ajaxqueue.js') . "\n" .
    CGoogleApi::load('jquery.metadata.js')
); ?>
.....
</head>
```

## 8.13 Code Generation using Command Line Tools (deprecated)

**Note:** The code generators in `yiic shell` have been deprecated since version 1.1.2. Please use the more powerful and extensible Web-based code generators available in [Gii](#), instead.

Open a command line window, and execute the commands listed as follows,

```
% cd WebRoot/testdrive
```

```
% protected/yiic shell
Yii Interactive Tool v1.1
Please type '&#039;help' for help. Type '&#039;exit' to quit.
>> model User tbl_user
    generate models/User.php
    generate fixtures/tbl_user.php
    generate unit/UserTest.php
```

The following model classes are successfully generated:

User

If you have a '&#039;db' database connection, you can test these models now with:

```
$model=User::model()->find();
print_r($model);
```

```
>> crud User
    generate UserController.php
    generate UserTest.php
    mkdir D:/testdrive/protected/views/user
    generate create.php
    generate update.php
    generate index.php
    generate view.php
    generate admin.php
    generate _form.php
    generate _view.php
```

Crud '&#039;user' has been successfully created. You may access it via:  
<http://hostname/path/to/index.php?r=user>

In the above, we use the `yiic shell` command to interact with our skeleton application. At the prompt, we execute two sub-commands: `model User tbl_user` and `crud User`. The former generates a model class named `User` for the `tbl_user` table, while the latter analyzes the `User` model and generates the code implementing the corresponding CRUD operations.

**Note:** You may encounter errors like "...could not find driver", even though the requirement checker shows you have already enabled PDO and the corresponding PDO driver. If this happens, you may try to run the `yiic` tool as follows,

```
% php -c path/to/php.ini protected/yiic.php shell
```

where `path/to/php.ini` represents the correct PHP ini file.

Let's enjoy our work by browsing the following URL:

<http://hostname/testdrive/index.php?r=user>

This will display a list of user entries in the `tbl_user` table.

Click the **Create User** button on the page. We will be brought to the login page if we have not logged in before. After logged in, we see an input form that allows us to add a new user entry. Complete the form and click on the **Create** button. If there is any input error, a nice error prompt will show up which prevents us from saving the input. Back to the user list page, we should see the newly added user appearing in the list.

Repeat the above steps to add more users. Notice that user list page will automatically paginate the user entries if there are too many to be displayed in one page.

If we login as an administrator using `admin/admin`, we can view the user admin page with the following URL:

```
http://hostname/testdrive/index.php?r=user/admin
```

This will show us the user entries in a nice tabular format. We can click on the table header cells to sort the corresponding columns. We can click on the buttons on each row of data to view, update or delete the corresponding row of data. We can browse different pages. We can also filter and search to look for the data we are interested in.

All these nice features come without requiring us to write a single line of code!

## My Web Application

[Home](#) [About](#) [Contact](#) [Logout \(admin\)](#)

[Home](#) » [Users](#) » Manage

### Manage Users

[Advanced Search](#)

Id

Username

Email





















Search

Operations

[List User](#)

[Create User](#)

Displaying 1-10 of 21 result(s).

Id	Username	Password	Email	
1	test1	pass1	test1@example.com	 
2	test2	pass2	test2@example.com	 
3	test3	pass3	test3@example.com	 
4	test4	pass4	test4@example.com	 
5	test5	pass5	test5@example.com	 
6	test6	pass6	test6@example.com	 
7	test7	pass7	test7@example.com	 
8	test8	pass8	test8@example.com	 
9	test9	pass9	test9@example.com	 
10	test10	pass10	test10@example.com	 

Go to page: [< Previous](#) [1](#) [2](#) [3](#) [Next >](#)

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Figure 8.1: User admin page

# My Web Application

[Home](#) [About](#) [Contact](#) [Logout \(admin\)](#)

[Home](#) > [Users](#) > Create

## Create User

Fields with \* are required.

Please fix the following input errors:

- Password cannot be blank.
- Email cannot be blank.

Username \*

Password \*

Password cannot be blank.

Email \*

Email cannot be blank.

Create

Operations

[List User](#)[Manage User](#)

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Figure 8.2: Create new user page