Web Development

Chapter 5. OOP in PHP

1

Object-Oriented Programming (OOP)

- **Object**: Instance (occurrance) of a **class**
- Classes/Objects **encapsulates** their data (called **attributes**) and behaviour (called **methods**)
- **Inheritance**: Define a new class by saying that it's like an existing class, but with certain new or changed attributes and methods.
  - The old class: superclass/parent/base class
  - The new class: subclass/child/derived class

2

2

PHP 5

- Single-inheritance
- Access-restricted
- Overloadable
- Object ~ pass-by-reference

3

3

Content

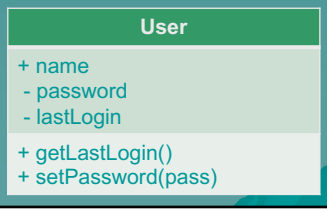
1. Creating an Object
2. Accessing attributes and methods
3. Building a class
4. Introspection

4

4

1. Creating an Object

- Syntax:
  - *$object = new Class([agrs]);*
- E.g.:
  - $obj1= new User();
  - $obj2 = new User('Fred', "abc123"); //args
  - $obj3 = new 'User'; // does not work
  - $class = 'User'; $obj4= new $class; //ok



5

5

Content

6

6

2. Accessing Attributes and Methods

- *Syntax: Using ->*
  - *$object->attribute_name*
  - *$object->method_name([arg, ...])*
- E.g.

```
// attribute access
$obj1->name = "Micheal";
print("User name is " . $obj1->name);
$obj1->getLastLogin( ); // method call
// method call with args
$obj1->setPassword("Test4");
```

7

7

Content

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8

8

3.1. Syntax to declare a Class

```
class ClassName [extends BaseClass]{
   [[var] access $attribute [ = value ]; ... ]
   [access function method_name (args) {
         // code
      } ...
   ]
}
```

- access can be: **public**, **protected** or **private** (default is public).
- ClassNames, atributes, methods are case-sensitive and conform the rules for PHP identifiers
- attributes or methods can be declared as **static** or **const**

9

9

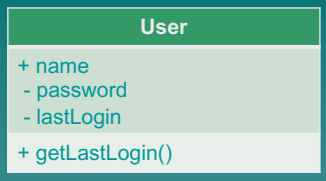
Rules for PHP Identifiers

- Must include:
  - **ASCII letter (a-zA-Z)**
  - **Digits (0-9)**
  - **_**
  - ASCII character between **0x7F (DEL) and 0xFF**
- Do not start by a digit

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
128	80	Ç	160	A0	á	192	C0	└	224	E0	α
129	81	ü	161	A1	í	193	C1	┴	225	E1	ß
130	82	é	162	A2	ó	194	C2	┬	226	E2	Γ
131	83	â	163	A3	ú	195	C3	├	227	E3	π
132	84	ä	164	A4	ñ	196	C4	─	228	E4	Σ
133	85	à	165	A5	Ñ	197	C5	┼	229	E5	σ
134	86	å	166	A6	ª	198	C6	╞	230	E6	µ
135	87	ç	167	A7	º	199	C7	╟	231	E7	τ
136	88	ê	168	A8	¿	200	C8	╚	232	E8	Φ
137	89	ë	169	A9	⌐	201	C9	╔	233	E9	Θ
138	8A	è	170	AA	¬	202	CA	╩	234	EA	Ω
139	8B	ï	171	AB	½	203	CB	╦	235	EB	δ
140	8C	î	172	AC	¼	204	CC	╠	236	EC	∞
141	8D	ì	173	AD	¡	205	CD	═	237	ED	ø
142	8E	Ä	174	AE	«	206	CE	╬	238	EE	ε
143	8F	Å	175	AF	»	207	CF	╧	239	EF	∩
144	90	É	176	B0	░	208	D0	╨	240	F0	≡
145	91	æ	177	B1	▒	209	D1	╤	241	F1	±
146	92	Æ	178	B2	▓	210	D2	╥	242	F2	≥
147	93	ô	179	B3	│	211	D3	╙	243	F3	≤
148	94	ö	180	B4	┤	212	D4	╘	244	F4	⌠
149	95	ò	181	B5	╡	213	D5	╒	245	F5	⌡
150	96	û	182	B6	╢	214	D6	╓	246	F6	÷
151	97	ù	183	B7	╖	215	D7	╫	247	F7	≈
152	98	ÿ	184	B8	╕	216	D8	╪	248	F8	°
153	99	Ö	185	B9	╣	217	D9	┘	249	F9	∙
154	9A	Ü	186	BA	║	218	DA	┌	250	FA	·
155	9B	¢	187	BB	╗	219	DB	█	251	FB	√
156	9C	£	188	BC	╝	220	DC	▄	252	FC	ⁿ
157	9D	¥	189	BD	╜	221	DD	▌	253	FD	²
158	9E	₧	190	BE	╛	222	DE	▐	254	FE	■
159	9F	ƒ	191	BF	┐	223	DF	▀	255	FF	

10

Example – Define User class




```
//define class for tracking users
class User {
   public $name;
   private $password, $lastLogin;
   public function __construct($name, $password) {
      $this->name = $name;
      $this->password = $password;
      $this->lastLogin = time();
   }
   function getLastLogin() {
      return(date("M d Y", $this->lastLogin));
   }
}
```

A special variable for the particular instance of the class

11

11

3.2. Constructors and Destructors

- Constructor
  - `__construct([agrs])`
  - executed immediately upon creating an object from that class
- Destructor
  - `__destruct()`
  - calls when we want to destroy the object
- 2 special namespaces:
  - self: refers to the current class
  - parent: refers to the immediate ancestor
    - Call parents' constructor: `parent::__construct`

12

12

Example

```
<?php
  class BaseClass {
     function __construct() {
         print "In BaseClass constructor\n";
     }
  }

  class SubClass extends BaseClass {
     function __construct() {
         parent::__construct();
         print "In SubClass constructor\n";
     }
  }

  $obj = new BaseClass();
  $obj = new SubClass();
?>
```

13

13

3.3. Static & constant class members

- Static member
  - Not relate/belong to an any particular object of the class, but to the class itself.
  - Cannot use `$this` to access static members but can use with `self` namespace or ClassName.
  - E.g.
    - count is a static attribute of Counter class
    - `self::$count` or `Counter::$count`
- Constant member
  - value cannot be changed
  - can be accessed directly through the class or within object methods using the `self` namespace.

14

14

Example

```
class Counter {
   private static $count = 0;
   const VERSION = 2.0;
   function __construct(){ self::$count++; }
   function __destruct(){ self::$count--; }
   static function getCount() {
      return self::$count;
   }
}
$c1 = new Counter();
print($c1->getCount() . "<br>\n");
$c2 = new Counter();
print(Counter::getCount() . "<br>\n");

$c2 = NULL;
print($c1->getCount() . "<br>\n");
print("Version used: ".Counter::VERSION."<br>\n");
```

1
2
1
Version used: 2

15

15

3.4. Cloning Object

- `$a = new SomeClass();`
- `$b = $a;`
- **`$a and $b point to the same underlying instance of SomeClass`**
- → Changing $a attributes' value also make $b attributes changing
- → Create a replica of an object so that changes to the replica are not reflected in the original object? → CLONING

16

16

3.4. Object Cloning

- Special method in every class: `__clone()`
  - Every object has a default implementation for `__clone()`
  - Accepts no arguments
- Call cloning:
  - `$copy_of_object = clone $object;`
  - E.g.

```
$a = new SomeClass();
$b = clone $a;
```

17

17

Example - Cloning

```
class ObjectTracker {
    private static $nextSerial = 0;
    private $id, $name;
    function __construct($name) {
        $this->name = $name;
        this->id = ++self::$nextSerial;
    }
    function __clone(){
        $this->name = "Clone of $this->name";
        $this->id = ++self::$nextSerial;
    }
    function getId() { return($this->id); }
    function getName() { return($this->name); }
    function setName($name) { $this->name = $name; }
}
$ot = new ObjectTracker("Zeev's Object");
$ot2 = clone $ot; $ot2->setName("Another object");
print($ot->getId() . " " . $ot->getName() . "<br>");
print($ot2->getId() . " " . $ot2->getName() . "<br>");
```

Hello world!
1 Zeev's Object
2 Another object

18

18

3.5. User-level overloading

- Overloading in PHP provides means dynamic "create" attributes and methods.
- The overloading methods are invoked when interacting with attributes or methods that have not been declared or are not visible in the current scope
  - inaccessible properties
- All overloading methods must be defined as *public*.

19

19

3.5.1. Attribute overloading

- `void __set (string $name , mixed $value)`
  - is run when writing data to inaccessible attributes
- `mixed __get (string $name)`
  - is utilized for reading data from inaccessible attributes
- `bool __isset (string $name)`
  - is triggered by calling isset() or empty() on inaccessible attributes
- `void __unset (string $name)`
  - is invoked when unset() is used on inaccessible attributes

Note: The return value of **__set()** is ignored because of the way PHP processes the assignment operator. Similarly, **__get()** is never called when chaining assignments together like this:

```
$a = $obj->b = 8;
```

20

20

Example - Attribute overloading

```
class PropertyTest {
    private $data = array();
    public $declared = 1;
    private $hidden = 2;
    public function __set($name, $value) {
      echo "Setting '$name' to '$value'<br>";
      $this->data[$name] = $value;
    }
    public function __get($name) {
        echo "Getting '$name'<br>";
        if (array_key_exists($name, $this->data)) {
            return $this->data[$name];
        }
    }
    public function __isset($name) {
        echo "Is '$name' set?<br>";
        return isset($this->data[$name]);
    }
     public function __unset($name) {
        echo "Unsetting '$name'<br>";
        unset($this->data[$name]);
    }
    public function getHidden() {
        return $this->hidden;
    }
}
```

```
Setting 'a' to '1'
Getting 'a'
1
Is 'a' set?
bool(true) Unsetting 'a'
Is 'a' set?
bool(false)
1
2
Getting 'hidden'
```

```
$obj = new PropertyTest;

$obj->a = 1;
echo $obj->a."<br>";

var_dump(isset($obj->a));
unset($obj->a);
var_dump(isset($obj->a));
echo "<br>";

echo $obj->declared."<br>";
echo $obj->getHidden()."<br>"
echo $obj->hidden."<br>";
```

21

3.5.2. Method overloading

- **mixed** __call (string $name, array $arguments)
  - is triggered when invoking inaccessible methods in an object context
- **mixed** __callStatic (string $name, array $arguments)
  - is triggered when invoking inaccessible methods in a static context.

22

22

Example – Method Overloading

```
class MethodTest {
    public function __call($name, $arguments) {
        // Note: value of $name is case sensitive.
        echo "Calling object method '$name' "
                . implode(', ', $arguments). "<br>";
    }

    public static function __callStatic($name, $arguments) {
        // Note: value of $name is case sensitive.
        echo "Calling static method '$name' "
                . implode(', ', $arguments). "<br>";
    }
}

$obj = new MethodTest;
$obj->runTest('in object context');
MethodTest::runTest('in static context');
```

```
Calling object method 'runTest' in object context
Calling static method 'runTest' in static context
```

23

23

```
<?php
  class Foo {
     static $vals;
     public static function __callStatic($func, $args) {
              if (!empty($args)) {
                  self::$vals[$func] = $args[0];
              } else {
                  return self::$vals[$func];
              }
          }
      }
  ?>

  Which would allow you to say:

  <?php
      Foo::username('john');
      print Foo::username(); // prints 'john'
  ?>
```

24

24

3.6. Autoloading class

- Using a class you haven't defined, PHP generates a fatal error
- → Can use `include` statement
- → Can use a global function `__autoload()`
  - single parameter: the name of the class
  - automatically called when you attempt to use a class PHP does not recognize

25

25

Example - Autoloading class

```
//define autoload function
function __autoload($class) {
   include("class_".ucfirst($class).".php");
}
//use a class that must be autoloaded
$u = new User;
$u->name = "Leon";
$u->printName();
```

26

26

3.7. Namespace

- ~folder, ~package
- Organize variables, functions and classes
- Avoid confliction in naming variables, functions and classes
- The `namespace` statement gives a name to a block of code
- From outside the block, scripts must refer to the parts inside with the name of the namespace using the `::` operator

27

27

3.7. Namespace (2)

- You cannot create a hierarchy of namespaces
- → namespace's name includes colons as long as they are not the first character, the last character or next to another colon
- → use colons to divide the names of your namespaces into logical partitions like parent-child relationships to anyone who reads your code
- E.g. `namespace ict:abc { ... }`

28

28

Example - Namespace

```
namespace core_php:utility {
   class TextEngine {
      public function uppercase($text) {
            return(strtoupper($text));
      }
   }
   function uppercase($text) {
      $e = new TextEngine;
      return($e->uppercase($text));
   }
}
$e = new core_php:utility::TextEngine;
print($e->uppercase("from object") . "<br>");
print(core_php:utility::uppercase("from function")
                                          ."<br>");
import class TextEngine from core_php:utility;
$e2 = new TextEngine;
```

```
import * from myNamespace
```

29

29

3.8. Abstract methods and abstract classes

- Single inheritance
- Abstract methods, abstract classes, interface (implements) like Java
- You cannot instantiate an abstract class, but you can extend it or use it in an `instanceof` expression

30

30

```
abstract class Shape {
   abstract function getArea();
}
abstract class Polygon extends Shape {
   abstract function getNumberOfSides();
}
class Triangle extends Polygon {
   public $base;
   public $height;
   public function getArea() {
      return(($this->base * $this->height)/2);
   }
   public function getNumberOfSides() {
      return(3);
   }
}
```

31

31

```
class Rectangle extends Polygon {
   public $width; public $height;
   public function getArea() {
      return($this->width * $this->height);
   }
   public function getNumberOfSides() {
      return(4);
   }
}
class Circle extends Shape {
   public $radius;
   public function getArea() {
      return(pi() * $this->radius * $this->radius);
   }
}
class Color {
  public $name;
}
```

32

32

```php
$myCollection = array();
$r = new Rectangle; $r->width = 5; $r->height = 7;
$myCollection[] = $r; unset($r);
$t = new Triangle; $t->base = 4; $t->height = 5;
$myCollection[] = $t; unset($t);
$c = new Circle; $c->radius = 3;
$myCollection[] = $c; unset($c);
$c = new Color; $c->name = "blue";
$myCollection[] = $c; unset($c);
foreach($myCollection as $s) {
  if($s instanceof Shape) {
      print("Area: " . $s->getArea() . "<br>\n");
  }
  if($s instanceof Polygon) {
      print("Sides: " . $s->getNumberOfSides() . "<br>\n");
  }
  if($s instanceof Color) {
      print("Color: $s->name<br>\n");
  }
  print("<br>\n");
}
```

33

33

Content

1. Creating an Object
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3. Building a class
4. Introspection

34

34

4. Introspection

- Ability of a program to examine an object's characteristics, such as its name, parent class (if any), attributes, and methods.
- Discover which methods or attributes are defined when you write your code at runtime, which makes it possible for you to write generic debuggers, serializers, profilers, etc

35

35

4.1. Examining Classes

- **`class_exists(classname)`**
  - determine whether a class exists
- **`get_declared_classes()`**
  - returns an array of defined classes
- **`get_class_methods(`*`classname`*`)`**
  - Return an array of methods that exist in a class
- **`get_class_vars (`*`classname`*`)`**
  - Return an array of attributes that exist in a class
- **`get_parent_class(classname)`**
  - Return name of the parent class
  - Return FALSE if there is no parent class

36

36

```
function display_classes ( ) {
    $classes = get_declared_classes( );
    foreach($classes as $class) {
        echo "Showing information about $class<br />";
        echo "$class methods:<br />";
        $methods = get_class_methods($class);
        if(!count($methods)) {
            echo "<i>None</i><br />";
        } else { foreach($methods as $method) {
                    echo "<b>$method</b>( )<br />";
                }
        }
        echo "$class attributes:<br />";
        $attributes = get_class_vars($class);
        if(!count($attributes)) { echo "<i>None</i><br />"; }
        else {
            foreach(array_keys($attributes) as $attribute) {
                echo "<b>\$$attribute</b><br />";
            }
        }
        echo "<br />";
    }
}
```

37

37

38

39