PHP + MySQL

- MySQL on the command line is great and all… well not its not really that great
- Using MySQL in PHP is somewhat similar to the command line:
  - Set up a connection to a MySQL database
  - Issue a bunch of commands to the database

PDO

- PHP Data Objects
- The modern way to access databases from within PHP
- No more `mysql_connect, mysql_query,` etc.
- No, the `mysqli` commands aren't really any better.

PDO Connection

- Still need the same pieces of data:
  - Database host
  - Username
  - Password

PDO Connection

```php
$dsn = 'mysql:dbname=cs337;host=localhost';
$user = 'root';
$password = 'somepassword';

$db = new PDO($dsn, $user, $password);
```

- We make a new PDO object based off the data source properties
- Can make PDO objects for a wide variety of databases, not just MySQL

PDO Connection

- For our AWS Servers, access is only available from localhost, and no user/password is required

```
$dsn = 'mysql:dbname=cs337;host=localhost';

$db = new PDO($dsn);
```

- Once we have a connection set up, we can start talking to our database using our newly created object

```php
<?php

$dsn = 'mysql:dbname=cs337;host=localhost';
$user = 'root';
$password = 'somepassword';
$db = new PDO($dsn, $user, $password);

// Get the submitted form data
$name = $_REQUEST['name'];
$phone = $_REQUEST['phone'];
$email = $_REQUEST['email'];

// Create our insert query
$sql = "INSERT INTO staff (name, phone, email)
        VALUES ('{$name}','{$phone}','{$email}')";
$db->query($sql);
```

Aside: PHP Strings & Variable Expansion

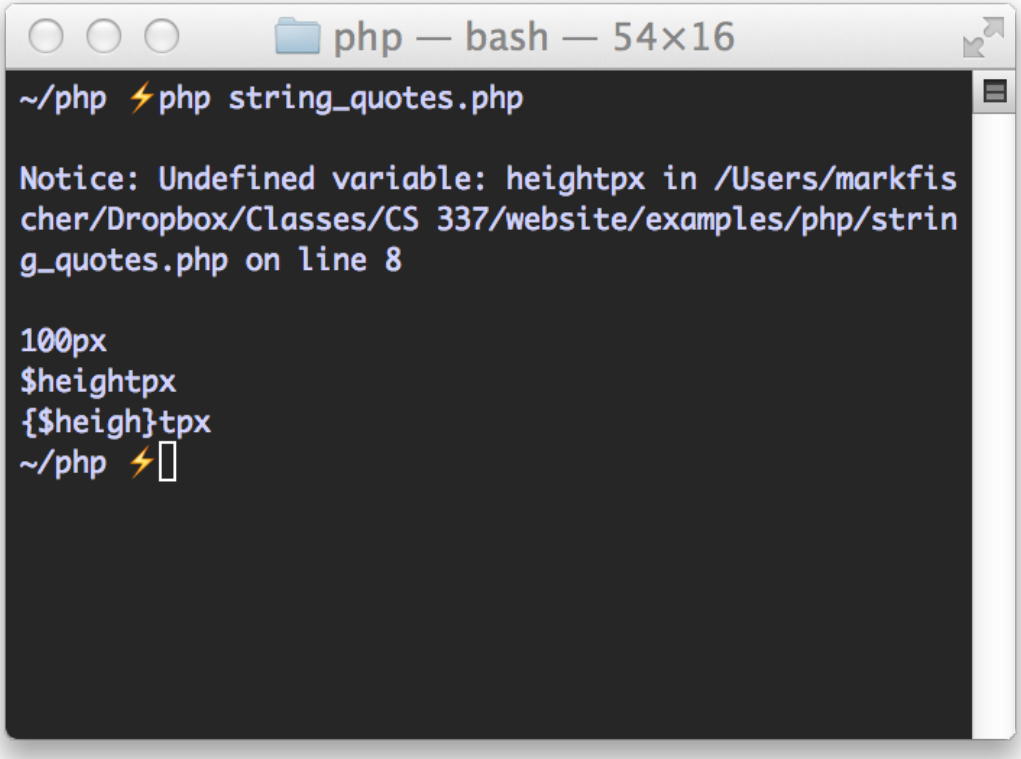
```
// Create our insert query
$sql = "INSERT INTO staff (name, phone, email)
        VALUES ('{$name}','{$phone}','{$email}')";
```

- Here we have a PHP string surrounded by double quotes.
- Inside, we have variables **`$name`**, **`$phone`**, **`$email`**
- These will be replaced with their actual string contents.
- The curly braces `{ }` help PHP limit variable name searching

Aside: PHP Strings & Variable Expansion

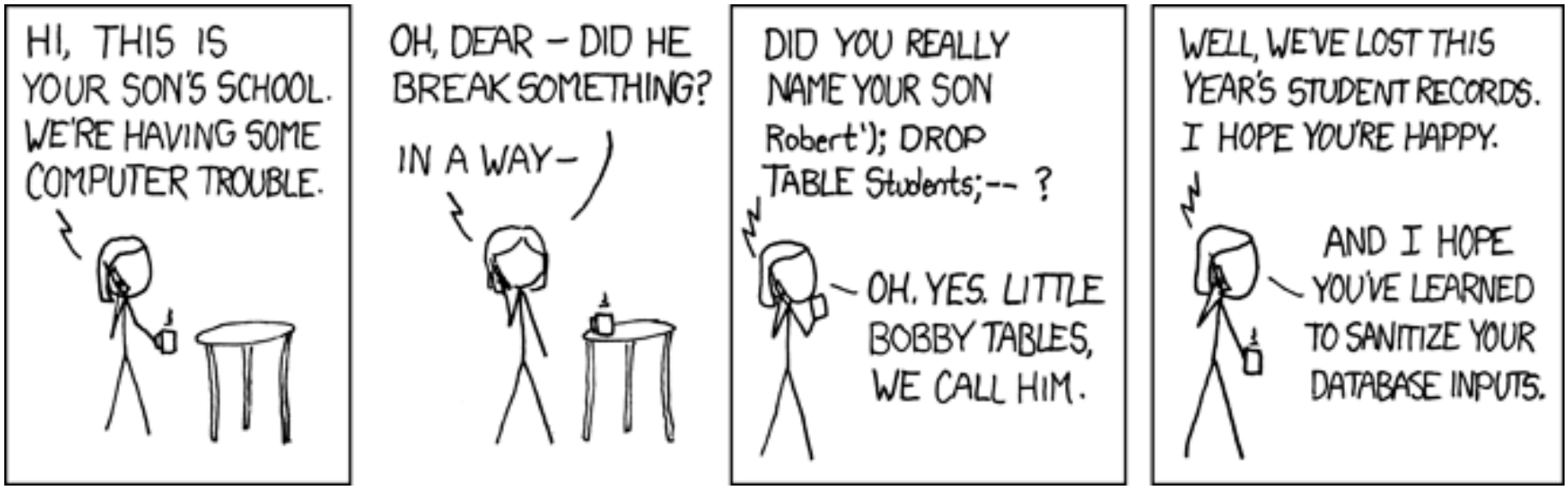
- Variable expansion only happens inside double quoted strings
- Single quoted strings are evaluated as literals

```php
<?php

ini_set('display_errors', 'on');
error_reporting(E_ERROR | E_WARNING
               | E_NOTICE | E_PARSE);

$height = 100;

echo "$heightpx";
echo "\n";

echo "{$height}px";
echo "\n";

echo '$heightpx';
echo "\n";

echo '{$heigh}tpx';
echo "\n";
```



Congratulations!

You now know just enough to be very dangerous…


HI, THIS IS YOUR SON'S SCHOOL. WE'RE HAVING SOME COMPUTER TROUBLE.
OH, DEAR – DID HE BREAK SOMETHING?
IN A WAY–
DID YOU REALLY NAME YOUR SON Robert'); DROP TABLE Students;-- ?
OH. YES. LITTLE BOBBY TABLES, WE CALL HIM.
WELL, WE'VE LOST THIS YEAR'S STUDENT RECORDS. I HOPE YOU'RE HAPPY.
AND I HOPE YOU'VE LEARNED TO SANITIZE YOUR DATABASE INPUTS.

Security Concerns

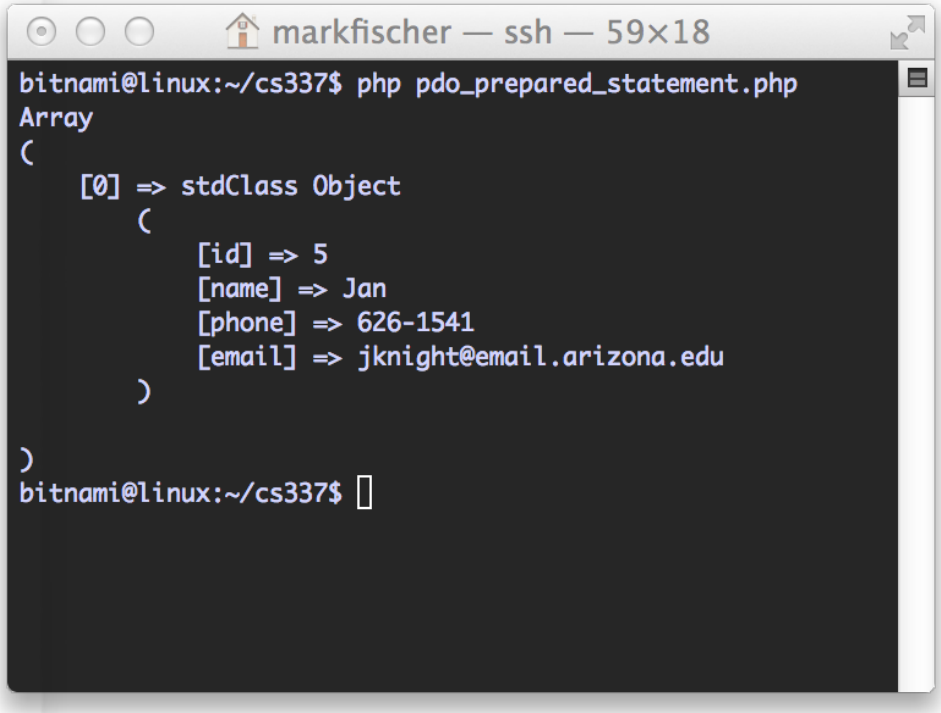
- Trusting user input is very dangerous
- SQL Injection and Code Injection
- Cross Site Scripting attacks
- Examples

Prepared Statements

- Allows us to make sure that nothing can ‘break out’ of the SQL statement.
- Much more secure than trying to build SQL statements through string concatenation.
- If you encounter `mysql_query` or `mysqli_query`, you should really consider refactoring to use PDO.

Prepared Statements

```php
<?php
ini_set('display_errors', 'on');

$dsn = 'mysql:dbname=cs337;host=localhost';
$user = 'root';
$password = 'password';
$db = new PDO($dsn, $user, $password);

$sql = "SELECT * FROM staff
        WHERE phone=? AND name=?";

$stmt = $db->prepare($sql);
$stmt->execute(array("626-1541", "Jan"));

$results = $stmt->fetchAll(PDO::FETCH_CLASS);

print_r($results);
```



Prepared Statements

```php
$stmt = $db->prepare($sql);
$stmt->execute(array("626-1541", "Jan"));
```

- We call the `PDO::prepare()` method first
- This returns a new `PDOStatement` object
- We then call the `execute()` method on the newly created `PDOStatement`, not on the `PDO` object

http://php.net/manual/en/class.pdostatement.php

```php
$stmt = $db->prepare($sql);
$stmt->execute(array("626-1541", "Jan"));
```

- We then call the **`execute()`** method on the newly created **`PDOStatement`**, not on the **`PDO`** object
- We pass along an array of replacement values in an array to the execute method
- The order of the array values must match the SQL

```php
$sql = "SELECT * FROM staff
        WHERE phone=? AND name=?";
```

http://php.net/manual/en/class.pdostatement.php

Prepared Statements

- Note that you do not enclose the `?` placeholders in single quotes
- The PDO layer and database takes care of quoting strings for us

```
$sql = "SELECT * FROM staff
        WHERE phone=? AND name=?";
```

```
$sql = "INSERT INTO staff (name, phone, email)
        VALUES ('{$name}','{$phone}','{$email}')";
```

PHP Objects

Round Two

More Object-y Things

- OOP - Object Oriented Programming
- PHP supports just about all OOP patterns
- Static Object calls vs Instantiated

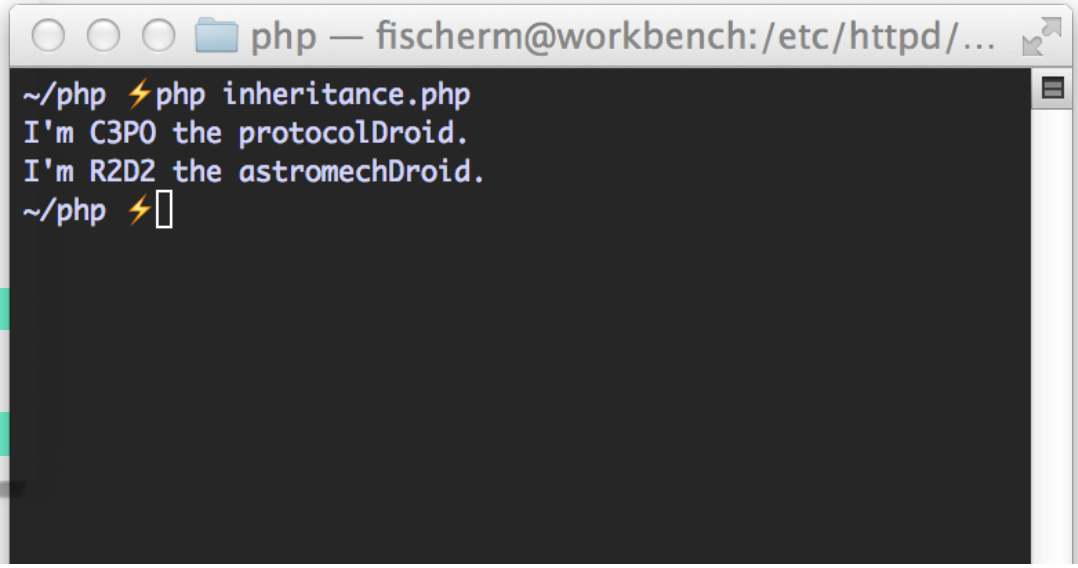
Inheritance

- Basically, Class A can inherit from Class B
- Define properties and behavior on a “Parent” class which can be inherited by “Child” classes.
- Example

Inheritance

```php
<?php

class droid
{
  private $name = "";

  public function __construct($setName) {
    $this->name = $setName;
  }

  public function status() {
    echo "I'm {$this->name} the "
          . get_class($this) . ".\n";
  }
}

class protocolDroid extends droid {
  public function translate() {
    return "Beep boop";
  }
}

class astromechDroid extends droid {
  public function pilot() {
    return "Zzzooooooom!";
  }
}

$c3po = new protocolDroid("C3PO");
$c3po->status();

$r2 = new astromechDroid("R2D2");
$r2->status();
```

- `droid` is the Parent Class
- Two Child Classes
  - `protocolDroid` & `astromechDroid`



Inheritance

```php
<?php

class droid
{
  private $name = "";

  public function __construct($setName) {
    $this->name = $setName;
  }

  public function status() {
    echo "I'm {$this->name} the "
          . get_class($this) . ".\n";
  }
}
```

- The **droid** class defines a **status()** method.

Inheritance

```php
<?php

class droid
{
  private $name = "";

  public function __construct($setName) {
    $this->name = $setName;
  }

  public function status() {
    echo "I'm {$this->name} the "
         . get_class($this) . ".\n";
  }
}

class protocolDroid extends droid {
  public function translate() {
    return "Beep boop";
  }
}
```

- Inheritance is the big idea.
- PHP implements this via the **`extends`** keyword.
- Here the **`protocolDroid`** class ***`extends`*** the **`droid`** class.

Inheritance

- When one class ***extends*** another, it is inheriting the properties and methods of the parent class.

```
class protocolDroid extends droid {
  public function translate() {
    return "Beep boop";
  }
}
```

Inheritance

```php
<?php

class droid
{
  private $name = "";

  public function __construct($setName) {
    $this->name = $setName;
  }

  public function status() {
    echo "I'm {$this->name} the "
          . get_class($this) . ".\n";
  }
}

class protocolDroid extends droid {
  public function translate() {
    return "Beep boop";
  }
}
```

- When a Child class ***extends*** a Parent class, the Child class *inherits* the **methods** and **properties** of the Parent.

- (that sounds suspiciously like something that may turn up on a final)

- Here the `protocolDroid` class will have a `status()` method, even though it doesn't define it itself.

Inheritance

```php
<?php

class droid
{
  private $name = "";

  public function __construct($setName) {
    $this->name = $setName;
  }

  public function status() {
    echo "I'm {$this->name} the "
         . get_class($this) . ".\n";
  }
}

class protocolDroid extends droid {
  public function translate() {
    return "Beep boop";
  }
}

class astromechDroid extends droid {
  public function pilot() {
    return "Zzzooooooom!";
  }
}

$c3po = new protocolDroid("C3PO");
$c3po->status();

$r2 = new astromechDroid("R2D2");
$r2->status();
```

- The `get_class()` PHP function returns a string containing the name of the class.
- The Child classes do not implement their own constructor, so the Parent's is used.

```
php — fischerm@workbench:/etc/httpd/...
~/php ⚡php inheritance.php
I'm C3PO the protocolDroid.
I'm R2D2 the astromechDroid.
~/php ⚡
```

Inheritance Demo

php/inheritance.php

Encapsulation

- Fancy way of saying “hiding things from people”
- Allows the developer of a Class a way to keep the implementation details of the Class hidden from the outside of that Class.
- Allows for selective inheritance.

Encapsulation Case Study

- Suppose we have a Class describing a Ticketing service.
- Our Ticketing service can create a support ticket, update a ticket, retrieve a ticket, etc.

Ticket Example

php/ticket_class.php

```php
<?php

class ticketer {

  // Property to hold our database connection
  public $db;

  public function __construct() {
    // Connect to our database
    $this->db = new PDO($dsn, $user, $pass);
  }

  public function newTicket() {
    $sql = "INSERT INTO tickets ....";
    $stmt = $this->db->prepare($sql);
    $stmt->execute();
    $newTicketID = $this->getLastInserID();
    return $this->getTicket($newTicketID);
  }

  public function getTicket($ticketID) {
    // ...
  }

}
```

- Our basic Class describing a ticketing service.
- Uses a Database to store data.
- Methods for creating / getting tickets.

Ticket Example

php/ticket_example.php

```php
<?php

require "ticket_class.php";

$tickets = new ticketer();

$newTicket = $tickets->newTicket();
```

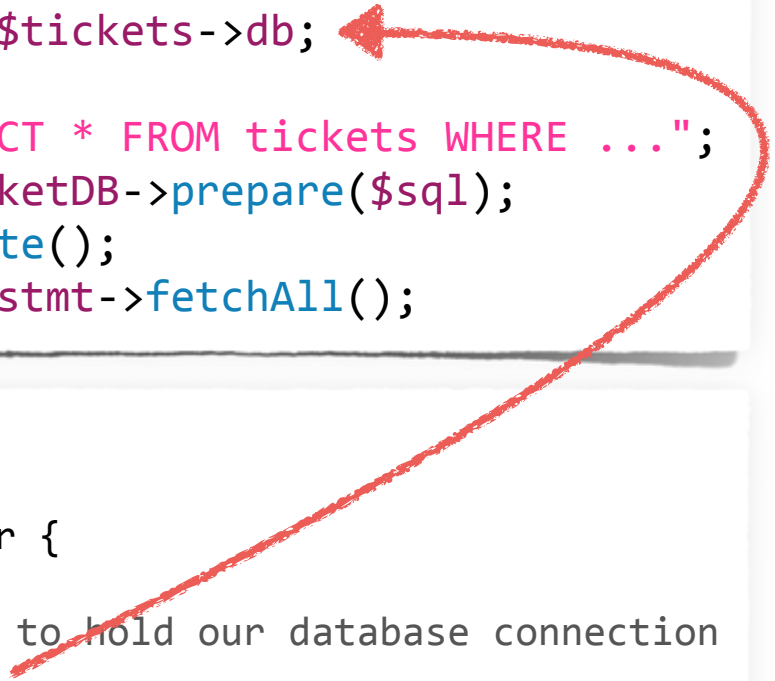
- A sample bit of code that uses our ticketer class
- Creates a new instance of our ticketed class.
- Creates a new ticket.

Ticket Example

php/ticket_example.php

```php
<?php

require "ticket_class.php";

$tickets = new ticketer();

$newTicket = $tickets->newTicket();

$ticketDB = $tickets->db;

$sql = "SELECT * FROM tickets WHERE ...";
$stmt = $ticketDB->prepare($sql);
$stmt->execute();
$results = $stmt->fetchAll();
```

```php
<?php

class ticketer {

  // Property to hold our database connection
  public $db;
  ...
```



- We want to do some additional querying that's not built into the **`ticketer`** class
- Grab the **`ticketer::$db`** property from our object.
- Execute our own local SQL queries.

Ticket Example

php/ticket2_class.php

```php
<?php

class ticketer {

  // Property to hold our redis connection
  public $redis;

  public function __construct() {
    // Connect to our redis source
    $this->redis = new redis($host, $port,
$user, $pass);
  }

  public function newTicket() {
    $t = $this->newTicketTemplate();
    $t->id = $this->newTicketID();
    $this->redis->add($t);
    return $t;
  }

  public function getTicket($ticketID) {
    // ...
  }

}
```

- Alice decides MySQL was too slow
- Switched to Redis for our data store backend.

http://redis.io

Ticket Example

php/ticket_example.php

```php
<?php

require "ticket_class.php";

$tickets = new ticketer();

$newTicket = $tickets->newTicket();

$ticketDB = $tickets->db;

$sql = "SELECT * FROM tickets WHERE ...";
$stmt = $ticketDB->prepare($sql);
$stmt->execute();
$results = $stmt->fetchAll();
```

- What happens to our code that depended on getting a reference to the database connection?

visibility

- PHP gives us tools to prevent access to properties and methods from outside of the object itself.
- This is known as *visibility*
  - public
  - private
  - protected

http://php.net/manual/en/language.oop5.visibility.php

public

- Public properties and methods are available to any code that references the class or instantiated objects.
- This is why we were able to get a reference to the ticketer database property.

```php
<?php

class ticketer {

  // Property to hold our database connection
  public $db;
  ...
```

```php
<?php

require "ticket_class.php";

$tickets = new ticketer();

$newTicket = $tickets->newTicket();

$ticketDB = $tickets->db;

$sql = "SELECT * FROM tickets WHERE
```

private

- I lied a little bit back there when we talked about inheritance
- Private properties and methods are ***only*** available within the object instances itself.
- This would prevent anyone from getting a reference to the ticketer database property.

```php
<?php

class ticketer {

  // Property to hold our database connection
  private $db;
  ...
```

This would cause a fatal error now

```php
<?php

require "ticket_class.php";

$tickets = new ticketer();

$newTicket = $tickets->newTicket(

$ticketDB = $tickets->db;

$sql = "SELECT * FROM tickets WHE
```

protected

- Protected properties and methods are available only within the object instances itself *and* any subclasses.

```php
<?php
class droid
{
  protected $name = "";

  public function __construct($setName) {
    $this->name = $setName;
  }

  public function status() {
    echo "I'm {$this->name} the "
          . get_class($this) . ".\n";
  }
}

class astromechDroid extends droid {
  public function pilot() {
```

php/visibility.php

```php
<?php
class droid
{
  protected $name = "";

  public function __construct($setName) {
    $this->name = $setName;
  }

  public function status() {
    echo "I'm {$this->name} the "
         . get_class($this) . ".\n";
  }
}

class astromechDroid extends droid {
  public function pilot() {
    return "Zzzooooooom!";
  }

  public function description() {
    $desc = "Astromech Droid: ";
    $desc .= $this->name;
    return $desc;
  }
}
```

OK

```php
$r2 = new astromechDroid("R2D2");
echo $r2->description() . "\n";

echo $r2->name . "\n";
```

Not OK

```
php — fischerm@workbench:/...
~/php ⚡php visibility.php
Astromech Droid: R2D2

Fatal error: Cannot access protected property astr
omechDroid::$name in /Users/markfischer/Dropbox/Cl
asses/CS 337/website/examples/php/visibility.php o
n line 34
~/php ⚡
```

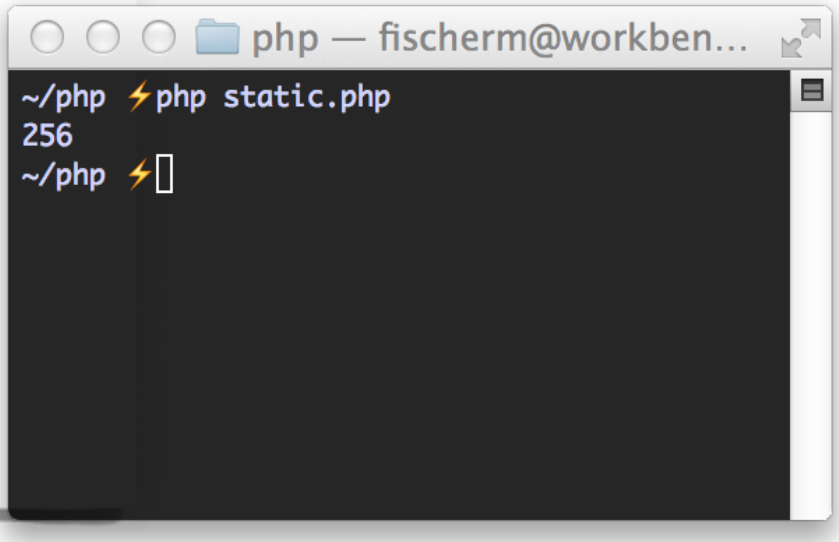
Static Access

- Up to now we've mostly been instantiating our classes as objects
- But we don't have to!
- Maybe you don't want a whole bunch of distinct objects, maybe you want a utility class?

Static Access

- Using the static keyword

```php
<?php

ini_set('display_errors', 'on');

class util {
  public static function pow($base, $power) {
    $product = 1;
    for ($i = 0; $i < $power; $i++) {
      $product = $product * $base;
    }
    return $product;
  }
}

echo util::pow(2, 8) . "\n";
```



Static Access

```
util::pow(2, 8);
```

- Using the `className::method()` syntax we can call a static method directly from the Class definition without having to create an instance of that Class.
- Can also access static properties in a similar way.
- Also used to reference constants on Classes.

Constants

```php
<?php

class util {

  const HOSTNAME = 'localhost';
  const CURRENT_VERSION = '1.7.10';

}

echo util::CURRENT_VERSION . "\n";
```

- Classes can define constants
- Constants *cannot* be modified at runtime
- Good for things you know won't change, like a version number or other setting.

Working with JSON

- PHP has built in support for dealing with JSON encoded data
- Convert JSON text to PHP data structures:
  - `$var1 = json_decode( string );`
- Convert PHP data structures to JSON
  - `$json = json_encode( $var1 );`
- Examples