

Introduction to PDO (PHP Data Objects Layer)

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What is PDO

- Common interface to any number of database systems.
- Written in C, so you know it's *FAST*
- Designed to make use of all the PHP 5.1 features to simplify usage.

Why is it needed?

- Current state of affairs:

- Many native database extensions that are similar but do not provide the same interface.

- In most cases, very old code that does not even scratch the surface of what PHP can offer.

- In many instances does not account for all the capabilities offered by the database.

- Ex. SQLite, MySQL extensions

Database Support

- At this time PDO offers the following drivers:
 - ✓ MySQL 3,4,5 (depends on client libs)
 - ✓ PostgreSQL
 - ✓ SQLite 2 & 3
 - ✓ ODBC
 - ✓ Informix
 - ✓ Oracle
 - ✓ Firebird
 - ✓ FreeTDS/Sybase/MSSQL

Installing PDO

- PDO is divided into two components
 - * CORE (provides the interface)
 - * DRIVERS (access to particular database)
 - Ex. pdo_mysql
- The CORE is enabled by default, drivers with the exception of pdo_sqlite are not.

Actual Install Steps

- PECL Way

- `pecl install pdo_[driver_name]`

- Update `php.ini` and add `extension=pdo_[driver_name].so` (or `.dll` on win32)

- Built into PHP

- `./configure --with-pdo-[driver_name]`

- For Win32 dlls for each driver are available.

Using PDO: Connecting

- As is the case with all database interfaces, the 1st step involves establishing a connection.

```
// MySQL connection
```

```
new PDO('mysql:host=localhost;dbname=testdb',  
$login, $passwd);
```

```
// PostgreSQL
```

```
new PDO('pgsql:host=localhost port=5432  
dbname=testdb user=john password=mypass');
```

```
// SQLite
```

```
new PDO('sqlite:/path/to/database_file');
```

Connection Failure Handling

- As is the case with most native PHP objects, instantiation failure lead to an exception being thrown.

```
try {  
    $db = new PDO (...);  
} catch (PDOException $e) {  
    echo $e->getMessage();  
}
```

Persistent Connections

- Connecting to complex databases like Oracle is a slow process, it would be nice to re-use a previously opened connection.

```
$opt = array(PDO::ATTR_PERSISTENT => TRUE);  
try {  
    $db = new PDO("dsn", $l, $p, $opt);  
} catch (PDOException $e) {  
    echo $e->getMessage();  
}
```

DSN INI Tricks

- The DSN string can be an INI setting and you can "name" as many DSNs as you like.

```
ini_set("pdo.dsn.ilias", "sqlite::memory");  
try {  
    $db = new PDO("ilias");  
} catch (PDOException $e) {  
    echo $e->getMessage();  
}
```

Let's Run Some Queries

- Query execution in PDO can be done in two ways
 - ✓ Prepared Statements (recommended for speed & security)
 - ✓ Direct Execution

Direct Query Execution

- Queries that modify information need to be run via `exec()` method.

```
$db = new PDO("DSN");
```

```
$db->exec("INSERT INTO foo (id)  
VALUES ('bar')");
```

```
$db->exec("UPDATE foo SET id='bar'");
```

- The return value is the number of rows affected by the operation or `FALSE` on error.

Direct Query Execution

Cont.

- In some cases “change” queries may not affect any rows and will return 0, so type-sensitive compare is essential in avoiding false positives!

```
$qry = "UPDATE foo SET id='bar'";  
$res = $db->exec($qry) or die(); // Wrong
```

```
if (!$res) // Wrong
```

```
if ($res !== FALSE) // Correct
```

Error Info Retrieval

- PDO Provides 2 methods of getting error information:
 - `errorCode()` - `SQLSTATE` error code
 - Ex. 42000 == Syntax Error
 - `errorInfo()` - Detailed error information
 - Ex. `array(`
 - `[[0]] => 42000,`
 - `[[1]] => 1064`
 - `[[2]] => Syntax Error`
 - `)`

Better Error Handling

- It stands to reason that being an OO extension PDO would allow error handling via Exceptions.

```
$db->setAttribute(  
    PDO::ATTR_ERRMODE,  
    PDO::ERRMODE_EXCEPTION  
);
```

- Now any query failure will throw an Exception.

Back to Query Execution

- When executing queries that retrieve information the query() method needs to be used.

```
$res = $db->query("SELECT * FROM foo");  
// $res == PDOStatement Object
```

- On error FALSE is returned

Fetch Query Results

- Perhaps one of the biggest features of PDO is its flexibility when it comes to how data is to be fetched.

- Array (Numeric or Associated Indexes)

- Strings (for single column result sets)

- Objects

- Callback function

- Lazy fetching

- Iterators

- And there is more!!!!**

Array Fetching

```
$res = $db->query("SELECT * FROM foo");  
while ($row = $res->fetch(PDO::FETCH_NUM)) {  
    // $row == array with numeric keys  
}
```

```
$res = $db->query("SELECT * FROM foo");  
while ($row = $res->fetch(PDO::FETCH_ASSOC)) {  
    // $row == array with associated (string) keys  
}
```

```
$res = $db->query("SELECT * FROM foo");  
while ($row = $res->fetch(PDO::FETCH_BOTH)) {  
    // $row == array with associated & numeric keys  
}
```

Fetch as String

- Many applications need to fetch data contained within just a single column.

```
$u = $db->query("SELECT id FROM users WHERE  
login='login' AND password='password'");  
  
// fetch(PDO::FETCH_COLUMN)  
if ($u->fetchColumn()) { // returns a string  
    // login OK  
} else {  
    // authentication failure  
}
```

Fetch as a Standard Object

- You can fetch a row as an instance of `stdClass` where column name == property name.

```
$res = $db->query("SELECT * FROM foo");  
  
while ($obj = $res->fetch(PDO::FETCH_OBJ)) {  
    // $obj == instance of stdClass  
}
```

Fetch Into a Class

- PDO allows the result to be fetched into a class type of your choice.

```
$res = $db->query("SELECT * FROM foo");  
$res->setFetchMode(  
    PDO::FETCH_CLASS,  
    "className",  
    array('optional'='Constructor Params')  
);  
while ($obj = $res->fetch()) {  
    // $obj == instance of className  
}
```

Fetch Into a Class Cont.

- PDO allows the query result to be used to determine the destination class.

```
$res = $db->query("SELECT * FROM foo");
$res->setFetchMode(
    PDO::FETCH_CLASS |
    PDO::FETCH_CLASSTYPE
);
while ($obj = $res->fetch()) {
    // $obj == instance of class whose name is
    // found in the value of the 1st column
}
```

Fetch Into an Object

- PDO even allows retrieval of data into an existing object.

```
$u = new userObject;
```

```
$res = $db->query("SELECT * FROM users");  
$res->setFetchMode(PDO::FETCH_INT, $u);
```

```
while ($res->fetch()) {  
    // will re-populate $u with row values  
}
```

Result Iteration

- PDOStatement implements Iterator interface, which allows for a method-less result iteration.

```
$res = $db->query(
    "SELECT * FROM users",
    PDO::FETCH_ASSOC
);
foreach ($res as $row) {
    // $row == associated array
    // representing the row's values.
}
```

Lazy Fetching

- Lazy fetches returns a result in a form object, but holds off populating properties until they are actually used.

```
$res = $db->query(
    "SELECT * FROM users", PDO::FETCH_LAZY
);
foreach ($res as $row) {
    echo $row['name']; // only fetch name column
}
```

fetchAll()

- The fetchAll() allows retrieval of all results from a query right away. (handy for templates)

```
$qry = "SELECT * FROM users";  
$res = $db->query($qry)->fetchAll(  
    PDO::FETCH_ASSOC  
);  
// $res == array of all result rows, where each row  
// is an associated array.
```

- * Can be quite memory intensive for large results sets!

Callback Function

- PDO also provides a fetch mode where each result is processed via a callback function.

```
function draw_message($subject,$email) { ... }

$res = $db->query("SELECT * FROM msg");

$res->fetchAll(
    PDO::FETCH_FUNC,
    "draw_message"
);
```

Direct Query Problems

- Query needs to be interpreted on each execution can be quite waste for frequently repeated queries.
- Security issues, un-escaped user input can contain special elements leading to SQL injection.

Escaping in PDO

- Escaping of special characters in PDO is handled via the `quote()` method.

```
$qry = "SELECT * FROM users WHERE  
login=" . $db->quote($_POST['login']) . "  
AND  
passwd=" . $db->quote($_POST['pass']);
```

Prepared Statements

- Compile once, execute as many times as you want.
- Clear separation between structure and input, which prevents SQL injection.
- Often faster than `query()` / `exec()` even for single runs.

Prepared Statements in Action

```
$stmt = $db->prepare(  
    "SELECT * FROM users WHERE id=?"  
);  
  
$stmt->execute(array($_GET['id']));  
  
$stmt->fetch(PDO::FETCH_ASSOC);
```

Bound Parameters

- Prepared statements parameters can be given names and bound to variables.

```
$stmt = $db->prepare(
`INSERT INTO users VALUES (:name, :pass, :mail)`);

foreach (array('name', 'pass', 'mail') as $v)
    { $stmt->bindParam(`:`.$v, $$v); }

$fp = fopen("./users.csv", "r");
while (list($name, $pass, $mail) = fgetcsv($fp, 4096))
    {
        $stmt->execute();
    }
```

Bound Result Columns

- Result columns can be bound to variables as well.

```
$qry = "SELECT :type, :data FROM images LIMIT 1";  
$stmt = $db->prepare($qry);
```

```
$fp = fopen(tempname("/tmp", "LOB"), "w");  
$stmt->bindParam(':type', $type);  
$stmt->bindParam(':type', $fp, PDO::PARAM_LOB);  
$stmt->execute(PDO::FETCH_BOUND);
```

```
header("Content-Type: ".$type);  
fflush($fp);  
fseek($fp, 0, SEEK_SET);  
fpassthru($fp);  
fclose($fp);
```

Partial Data Retrieval

- In some instances you only want part of the data on the cursor. To properly end the cursor use the `closeCursor()` method.

```
$res = $db->query("SELECT * FROM users");  
foreach ($res as $v) {  
    if ($res['name'] == 'end') {  
        $res->closeCursor();  
        break;  
    }  
}
```

Transactions

- Nearly all PDO drivers talk with transactional DBs, so PDO provides handy methods for this purpose.

```
$db->beginTransaction();  
if ($db->exec($qry) === FALSE) {  
    $db->rollback();  
}  
$db->commit();
```

Extending PDO

```
class DB extends PDO
{
    function query($qry, $mode=NULL) {
        $res = parent::query($qry, $mode);
        if (!$res) {
            var_dump($qry, $this->errorInfo());
            return null;
        } else {
            return $res;
        }
    }
}
```

Questions

