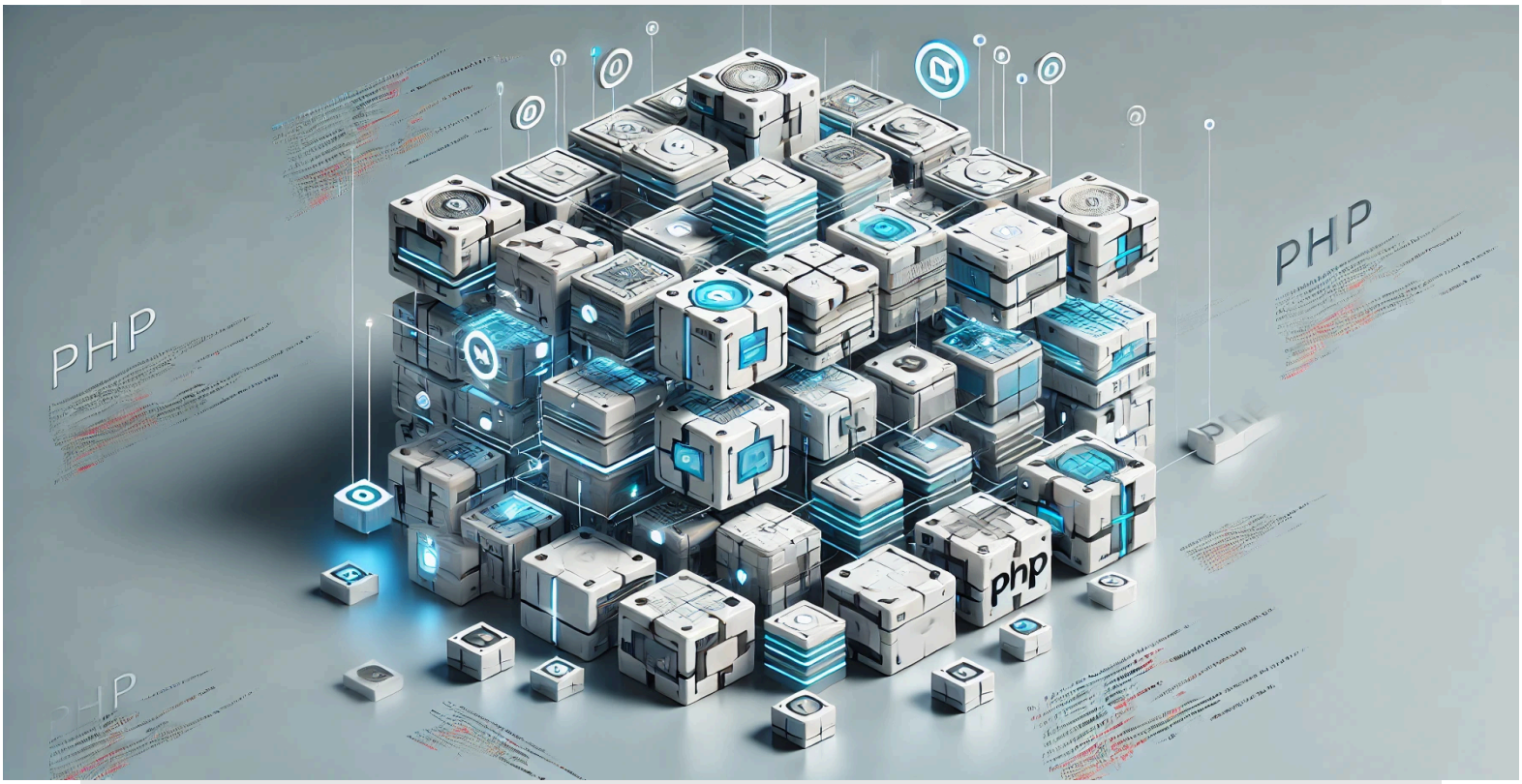
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LET'S TALK - BUILDING A MODULAR PHP FRAMEWORK PART 3

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In this third installment of our **Building a Modular PHP Framework** series, we will cover:

- Cross-Site Request Forgery (CSRF)
- API and Endpoint creation
- Database Handling including:
  - Managing the database structure using Schema
  - Managing database queries using Query

We'll build upon the groundwork set up in the previous parts, focusing on security (CSRF), setting up API routes, and more advanced database handling.

CROSS-SITE REQUEST FORGERY (CSRF)

What is CSRF? Cross-Site Request Forgery (CSRF) is a type of web security vulnerability that allows an attacker to trick users into performing unwanted actions on a website or web application where they are already authenticated. Essentially, the attacker exploits the user's browser session (including cookies) to send unauthorized requests, often without the user's awareness.

To protect against CSRF, we generate and validate a secret token that must be included in all non-GET requests.

We ensure our session is started in the **Bootstrap** class:

```php
// Start the session
if (!defined('STDIN') && session_status() === PHP_SESSION_NONE) {
    ini_set('session.cookie_samesite', 'Strict');
    ini_set('session.cookie_secure', 'On');
    session_start();
}
```

Then we create our **CSRF** class:

Source: CSRF.php

src/CSRF.php

```php
<?php

/**
 * Core Framework - CSRF
 *
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core;
```

```php
// Import additionnal class into the global namespace
use Exception;

class CSRF {

    const FIELD = 'csrf';
    const LENGTH = 32;
    const ROTATION = true;

    // Global Properties
    protected $Request;
    protected $Output;
    protected $Config;

    // Properties
    protected $Token = null;
    protected $Field = self::FIELD;
    protected $Length = self::LENGTH;
    protected $Rotate = self::ROTATION;

    /**
     * Create a new CSRF instance.
     *
     * @param  string|null  $field
     * @return void
     */
    public function __construct(){

        // Import Global Variables
        global $REQUEST, $OUTPUT, $CONFIG;

        // Initialize Properties
        $this->Request = $REQUEST;
        $this->Output = $OUTPUT;
        $this->Config = $CONFIG;

        // Add the csrf config file
        $this->Config->add('csrf');

        // Retrieve and Set CSRF Settings
        $this->Field = $this->Config->get('csrf', 'field') ??
$this->Field;
```

```
        $this->Length = $this->Config->get('csrf', 'length') ??
$this->Length;
        $this->Rotate = $this->Config->get('csrf', 'rotate') ??
$this->Rotate;

        // Check if the method used should be validated
        if(!defined('STDIN') && in_array($this->Request->getMethod(),
['POST', 'PUT', 'PATCH', 'DELETE'])){
            if(!$this->validate($this->Request->getParams('POST',
$this->Field) ?? null)){
                $this->Output->print(
                    'Invalid CSRF Token',
                    array('Content-Type: application/json', 'HTTP/1.1
403 Forbidden'),
                );
            }
        }
    }

    /**
     * Generate token.
     * @return $this
     */
    protected function generate(){

        // Retrieve the existing Token
        $token = $this->Request->getParams('SESSION', $this->Field) ??
bin2hex(random_bytes((int) ($this->Length / 2)));

        // Store the token
        $this->Token = $token;
        $this->Request->setParams('SESSION', $this->Field,
$this->Token);

        // Return
        return $this;
    }

    /**
     * Clear token.
     * @return $this
     */
```

```
    protected function clear(){

        // Check if rotate is enabled
        if($this->Rotate){

            // Clear the token
            $this->Token = null;
            $this->Request->setParams('SESSION', $this->Field, null);
        }

        // Return
        return $this;
    }

    /**
     * Get token.
     * @return string $this->Token
     */
    public function token(){
        return $this->generate()->Token;
    }

    /**
     * Validate a token.
     * @param  string  $token
     * @return boolean
     */
    public function validate(?string $token){
        $this->generate();
        if(!empty($token) && hash_equals($token, $this->Token)){
            $this->clear()->generate();
            return true;
        }
        return false;
    }

    /**
     * Generate a hidden input field.
     */
    public function field(){
        return '<input type="hidden" name="' . $this->Field . '"
value="' . $this->token() . '">';
    }
```

```
}
```

The CSRF class:

- Retrieves any application configuration or uses default values.
- Validates the token for non-GET requests.
- Generates a new token if none exist, storing it in the session.
- Provides a simple `field()` method to inject into forms.

SETTING UP APACHE CONFIGURATION (.HTACCESS)

To ensure our application can handle routes correctly, we create two **.htaccess** files: one in the **root** directory and one in the **webroot** subdirectory.

Source: .htaccess

.htaccess

```
AddType application/javascript .mjs

<IfModule mod_headers.c>
  RequestHeader unset Proxy
</IfModule>

<IfModule mod_rewrite.c>
  RewriteEngine on
  RewriteRule ^(\.well-known/.*)$ @@ [L]
  RewriteRule ^$ webroot/ [L]
  RewriteRule (.*) webroot/@@ [L]
</IfModule>
```

Source: .htaccess

webroot/.htaccess

```
AddType application/javascript .mjs

<IfModule mod_headers.c>
  RequestHeader unset Proxy
</IfModule>

<IfModule mod_rewrite.c>
  RewriteEngine On
  RewriteBase /
  RewriteCond %{REQUEST_FILENAME} !-d
  RewriteCond %{REQUEST_FILENAME} !-f
  RewriteRule ^(.+)$ index.php [QSA,L]
  RewriteRule ^cli - [F,L]
  RewriteRule ^.htaccess - [F,L]
</IfModule>
```

These rules ensure that calls are properly routed through our **index.php**, and any CLI or .htaccess direct calls are disallowed.

BUILDING THE API MODULE

The **API** module allows us (and potentially third parties) to request, exchange, or synchronize data with our application. Our API logic is contained in two main files: **API.php** and **Endpoint.php**.

Source: API.php

src/API.php

```
<?php

/**
 * Core Framework - API
 *
```

```
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core;

// Import additionnal class into the global namespace
use Exception;

class API {

    // Global Properties
    protected $Output;
    protected $Request;
    protected $Config;
    protected $Auth;

    /**
     * Constructor
     */
    public function __construct() {

        // Import Global Variables
        global $OUTPUT, $REQUEST, $CONFIG, $AUTH;

        // Initialize Properties
        $this->Output = $OUTPUT;
        $this->Request = $REQUEST;
        $this->Config = $CONFIG;
        $this->Auth = $AUTH;
    }

    /**
     * Execute the API Request
     */
    public function request(){

        // Retrieve the namespace
        $namespace = $this->Request->getNamespace();

        // Parse the namespace
```

```
        $parts = explode("/", trim($namespace, "/"));

        // Check if the namespace is valid
        if(count($parts) > 1){

            // Set the endpoint and method
            $endpoint = $parts[0];
            $class = ucfirst($endpoint) . "Endpoint";
            $method = $parts[1] . 'Action';

            // Set the endpoint path
            $path = $this->Config->root() . "/Endpoint/" .
ucfirst($endpoint) . "Endpoint.php";

            // Check if the endpoint exists
            if(!is_file($path)){

                // Set the path to the plugin path
                $path = $this->Config->root() . "/lib/plugins/" .
$endpoint . "/Endpoint.php";
            }

            // Check if the endpoint exists
            if(is_file($path)){

                // Load the endpoint
                require_once $path;

                // Check if the class exists
                if(class_exists($class)){

                    // Initialize the endpoint
                    $object = new $class();

                    // Check if the method exists
                    if(method_exists($object, $method)){

                        // Retrieve Auth Properties
                        $public = $object->getPublic();
                        $level = $object->getLevel();
                        $permission = "Endpoint>" . $namespace;

                        // Check if Auth is available and if the
```

```
endpoint is public
                        if(get_class($this->Auth) !== "Strap" &&
!$public){

                            // Check if the user is authenticated
                            if(!$this->Auth->isAuthenticated()){

                                // Send unauthorized
                                $this->Output->print('Unauthorized',
array('HTTP/1.1 401 Unauthorized'));
                            }

                            // Check if the user has the required
permission
                            if(!$this->Auth->hasPermission($permission,
$level)){

                                // Send forbidden
                                $this->Output->print('Forbidden',
array('HTTP/1.1 403 Forbidden'));
                            }
                        }

                        // Call the method
                        $results = $object->{$method}();

                        // Send the output
                        $this->Output->print($results['data'] ?? [],
array('HTTP/1.1 ' . $results['status'] ?? 500 . ' '. $results['message']
?? 'Internal Server Error'));
                    } else {

                        // Could not find the method, send not
implemented
                        $this->Output->print('Could not find the
method', array('HTTP/1.1 501 Not Implemented'));
                    }
                } else {

                    // Could not find the class, send not implemented
                    $this->Output->print('Could not find the endpoint',
array('HTTP/1.1 501 Not Implemented'));
```

```
                }
            } else {

                // Could not find the endpoint
                $this->Output->print('Could not find the endpoint',
array('HTTP/1.1 404 Not Found'));
            }
        } else {

            // Could not identify the Controller and/or Method, send bad
request
            $this->Output->print('Could not identify the Controller
and/or Action', array('HTTP/1.1 400 Bad Request'));
        }
    }
}
```

Source: Endpoint.php

src/Endpoint.php

```
<?php

/**
 * Core Framework - Endpoint
 *
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core;

// Import additionnal class into the global namespace
use Exception;

abstract class Endpoint {

    // Global Properties
```

```
    protected $Auth;
    protected $Model;
    protected $Helper;
    protected $Output;
    protected $Request;

    // Auth Properties
    protected $Level;
    protected $Public;

    /**
     * Constructor
     */
    public function __construct(){

        // Import Global Variables
        global $AUTH, $MODAL, $HELPER, $OUTPUT, $REQUEST;

        // Initialize Properties
        $this->Auth = $AUTH;
        $this->Model = $MODAL;
        $this->Helper = $HELPER;
        $this->Output = $OUTPUT;
        $this->Request = $REQUEST;
    }

    /**
     * Magic Method to catch all undefined methods
     * @param string $name
     * @param array $arguments
     * @return void
     */
    public function __call($name, $arguments) {

        // Send the output
        $this->Output->print('Endpoint not Implemented', array('HTTP/1.1
501 Not Implemented'));
    }

    /**
     * Get the public status
     */
```

```
    public function getPublic() {
        return $this->Public;
    }

    /**
     * Get the level
     */
    public function getLevel() {
        return $this->Level;
    }
}
```

How it works:

1. We parse the request's namespace to figure out the endpoint and the action.
2. We attempt to load a matching class from `/Endpoint` or from a plugin directory.
3. If it exists, we instantiate it and check if the requested method is present.
4. Optional authentication and permission checks are performed.
5. The action is executed, and we return the result as JSON with the appropriate HTTP status code.

DATABASE HANDLING

In part 2, we introduced **models**. Now, we'll refine how we handle the database itself, including queries and schema management. Let's break down the various classes.

THE DATABASE CLASS

Sources: Database.php

src/Database.php

```
<?php
```

```php
/**
 * Core Framework - Database
 *
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core;

// Import additionnal class into the global namespace
use LaswitchTech\Core\Connector\MySQL;
use LaswitchTech\Core\Connector\PostgreSQL;
use LaswitchTech\Core\Connector\SQLite;
use Exception;

class Database {

    /**
     * @var Config
     */
    private $Config;

    /**
     * @var Connector
     */
    private $connector;

    /**
     * Constructor
     */
    public function __construct()
    {

        // Import Global Variables
        global $CONFIG;

        // Initialize Properties
        $this->Config = $CONFIG;

        // Load the Database Configuration
        $this->Config->add('database');
```

```
        // Instantiate the appropriate connector
        switch($this->Config->get('database', 'connector')) {
            case 'mysql':
                $this->connector = new MySQL();
                break;
            default:
                throw new Exception('Invalid database connector');
        }

        // Connect to the database
        $this->connector->connect();
    }

    /**
     * Destructor
     */
    public function __destruct()
    {
        $this->close();
    }

    /**
     * Check if the database is connected
     *
     * @return bool
     */
    public function isConnected(): bool
    {
        if ($this->connector === null) {
            return false;
        }
        return $this->connector->isConnected();
    }

    /**
     * Close the connection
     */
    public function close(): void
    {
        if ($this->connector !== null) {
            $this->connector->close();
        }
```

```
    }

    /**
     * Create a new Query object
     *
     * @return Query
     */
    public function query(): Query
    {
        return new Query($this->connector);
    }

    /**
     * Create a new Schema object
     *
     * @return Schema
     */
    public function schema(): Schema
    {
        return new Schema($this->connector);
    }
}
```

This class loads our database configuration and spins up the correct **Connector** based on our config file. It also provides helper methods for creating new **Query** or **Schema** objects.

CONNECTOR AND MYSQL CLASSES

Sources: Connector.php

src/Connector.php

```
<?php

/**
 * Core Framework - Connector
```

```
 *
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core;

// Import additionnal class into the global namespace
use Exception;

abstract class Connector {

    /**
     * @var mixed
     */
    protected $Config;

    /**
     * Constructor
     *
     * Here you might load global config or do other setup tasks.
     * For this example, we assume there's a $CONFIG global object
     * that stores DB credentials, etc.
     */
    public function __construct()
    {
        global $CONFIG;
        $this->Config = $CONFIG;

        // If you have a method $CONFIG->add('database') to load DB
config, do that here.
        if (method_exists($this->Config, 'add')) {
            $this->Config->add('database');
        }
    }

    /**
     * Connect method to be overridden by child classes
     */
    public function connect()
    {
        // Implementation in child classes
```

```
    }

    /**
     * Close method to be overridden by child classes
     */
    public function close()
    {
        // Implementation in child classes
    }

    /**
     * Check if connected
     *
     * @return bool
     */
    public function isConnected(): bool
    {
        // Implementation in child classes
        return false;
    }

    /**
     * Execute a query
     *
     * @param string $sql
     * @return mixed
     */
    public function query(string $sql)
    {
        // Implementation in child classes
    }

    /**
     * Describe a table
     *
     * @param string $table
     * @return mixed
     */
    public function describe(string $table)
    {
        // Implementation in child classes
    }
```

```
    /**
     * Get the ID of the last inserted row
     *
     * @return int
     */
    public function lastId(): int
    {
        // Implementation in child classes
        return 0;
    }

    /**
     * Get the number of affected rows
     *
     * @return int
     */
    public function affectedRows(): int
    {
        // Implementation in child classes
        return 0;
    }

    /**
     * Prepare a query
     *
     * @param string $sql
     */
    public function prepare(string $sql, array $params = [])
    {
        // Implementation in child classes
        return false;
    }
}
```

Sources: MySQL.php

src/Connector/MySQL.php

```php
<?php

/**
 * Core Framework - MySQL
 *
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core\Connector;

// Import additionnal class into the global namespace
use LaswitchTech\Core\Connector;
use Exception;
use mysqli;

class MySQL extends Connector {

    /**
     * @var mysqli
     */
    private $mysqli;

    /**
     * @var array
     */
    private static $describeCache = [];

    /**
     * Establish the MySQL connection
     *
     * @throws Exception
     */
    public function connect()
    {
        // In a real-world scenario, retrieve these from $this->Config
        // e.g. $dbConfig = $this->Config->get('database');
        // For demonstration, we'll just hardcode or assume values are
set in $dbConfig.
        $dbConfig = $this->Config->get('database') ?? [];
```

```
        $host = $dbConfig['host'] ?? 'localhost';
        $user = $dbConfig['username'] ?? 'root';
        $pass = $dbConfig['password'] ?? '';
        $name = $dbConfig['database'] ?? 'demo';

        $this->mysqli = new mysqli($host, $user, $pass, $name);

        if ($this->mysqli->connect_error) {
            throw new Exception('MySQL Connection Error: ' .
$this->mysqli->connect_error);
        }
    }

    /**
     * Close the connection
     */
    public function close()
    {
        if ($this->mysqli) {
            $this->mysqli->close();
        }
    }

    /**
     * Check if connected
     *
     * @return bool
     */
    public function isConnected(): bool
    {
        return ($this->mysqli && !$this->mysqli->connect_errno);
    }

    /**
     * Execute a query
     *
     * @param string $sql
     * @return mixed
     * @throws Exception
     */
    public function query(string $sql)
    {
        $result = $this->mysqli->query($sql);
```

```
        if ($result === false) {
            throw new Exception('MySQL Query Error: ' .
$this->mysqli->error);
        }
        return $result;
    }

    /**
     * Describe a table
     *
     * @param string $table
     * @return mixed
     */
    public function describe(string $table)
    {
        if (!isset(self::$describeCache[$table])) {
            $result = $this->mysqli->query("DESCRIBE `$table`");
            self::$describeCache[$table] =
$result->fetch_all(MYSQLI_ASSOC);
        }
        return self::$describeCache[$table];
    }

    /**
     * Return the number of affected rows in last operation
     *
     * @return int
     */
    public function affectedRows(): int
    {
        return (int) $this->mysqli->affected_rows;
    }

    /**
     * Return the ID of the last inserted row
     *
     * @return int
     */
    public function lastId(): int
    {
        return (int) $this->mysqli->insert_id;
```

```
    }

    /**
     * Prepare a query
     *
     * @param string $sql
     */
    public function prepare(string $sql, array $params = [])
    {
        // 1) Prepare the statement
        $stmt = $this->mysqli->prepare($sql);
        if ($stmt === false) {
            throw new Exception('MySQL Prepare Error: ' .
$this->mysqli->error);
        }

        // 2) Build the type string.
        if (!empty($params)) {
            $types = '';
            foreach($params as $param) {
                if (is_int($param)) {
                    $types .= 'i';              // Integer
                } elseif (is_float($param)) {
                    $types .= 'd';              // Double
                } elseif (is_string($param)) {
                    $types .= 's';              // String
                } else {
                    $types .= 'b';              // Blob and Unknown
                }
            }

            // 3) Bind the parameters
            $stmt->bind_param($types, ...$params);
        }

        // 4) Execute
        if (!$stmt->execute()) {
            throw new Exception('MySQL Execute Error: ' . $stmt->error);
        }

        return $stmt;
    }
```

```
}
```

Connector is an abstract class; each database engine (e.g., MySQL, SQLite, PostgreSQL) implements its own version of these methods. In our example, we've only implemented the **MySQL** connector.

THE QUERY CLASS

Sources: Query.php

src/Query.php

```php
<?php

/**
 * Core Framework - Query
 *
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core;

// Import additionnal class into the global namespace
use LaswitchTech\Core\Connector;
use Exception;

class Query {

    /**
     * List of valid SQL operators
     *
     * @var array
     */
    const operators = ['=', '!=', '<>', '>', '<', '>=', '<=', 'LIKE',
```

```
'NOT LIKE', 'IS NULL', 'IS NOT NULL'];

    /**
     * List of valid SQL conjunctions
     *
     * @var array
     */
    const conjunctions = ['AND', 'OR'];

    /**
     * List of valid SQL directions
     *
     * @var array
     */
    const directions = ['ASC', 'DESC'];

    /**
     * List of valid SQL join types
     *
     * @var array
     */
    const types = ['LEFT', 'RIGHT', 'INNER', 'FULL', 'SELF'];

    /**
     * @var Connector
     */
    private $connector;

    /**
     * Query type: 'select', 'insert', 'update', 'delete'
     *
     * @var string
     */
    private $type;

    /**
     * Fields to select (for SELECT queries)
     *
     * @var string
     */
    private $fields = '*';

    /**
```

```
     * Table name
     *
     * @var string
     */
    private $table;

    /**
     * Index column
     *
     * @var string
     */
    private $index;

    /**
     * Limit of rows to return
     *
     * @var int
     */
    private $limit;

    /**
     * Filter key
     *
     * @var int
     */
    private $filter;

    /**
     * Array of WHERE clauses
     *
     * @var array
     */
    private $where = [];

    /**
     * Array of JOIN clauses
     *
     * @var array
     */
    private $join = [];

    /**
```

```
     * Array of ORDER BY clauses
     *
     * @var array
     */
    private $order = [];

    /**
     * Key/value pairs for INSERT/UPDATE
     *
     * @var array
     */
    private $values = [];

    /**
     * Parameters for INSERT/UPDATE
     *
     * @var array
     */
    private $params = [];

    /**
     * Constructor
     *
     * @param Connector $connector
     */
    public function __construct(Connector $connector)
    {
        $this->connector = $connector;
    }

    /**
     * Return the SQL query string
     */
    public function __toString()
    {
        return $this->buildQuery();
    }

    /**
     * SELECT query
     *
     * @param string $fields
     * @return self
```

```
     */
    public function select(string $fields = '*'): self
    {
        $this->type = 'select';
        $this->fields = $fields;
        return $this;
    }

    /**
     * FROM clause
     *
     * @param string $table
     * @return self
     */
    public function table(string $table): self
    {
        $this->table = $table;
        return $this;
    }

    /**
     * JOIN clause
     *
     * @param string $table
     * @param string $on
     * @param string $type
     * @return self
     */
    public function join(string $key, string $table, string $column,
string $operator = '=', string $type = 'LEFT'): self
    {
        $operator = (in_array($operator,self::operators)) ? $operator :
'=';
        $type = (in_array($type,self::types)) ? $type : 'LEFT';

        $this->join[] = [
            'table' => $table,
            'column' => $column,
            'key' => $key,
            'operator' => $operator,
            'type' => $type
        ];
```

```
        return $this;
    }

    /**
     * WHERE initiator
     *
     * @param string $conjunction
     * @return self
     */
    public function filter(string $conjunction = 'AND'): self
    {
        $conjunction = (in_array($conjunction,self::conjunctions)) ?
$conjunction : 'AND';

        $this->where[] = [
            'conjunction' => $conjunction,
            'clauses' => []
        ];
        $this->filter = count($this->where) - 1;
        return $this;
    }

    /**
     * WHERE clause
     *
     * @param string $column
     * @param mixed  $value
     * @param string $operator
     * @param string $conjunction
     * @return self
     */
    public function where(string $column, $value, string $operator =
null, string $conjunction = 'AND'): self
    {
        $operator = (in_array($operator,self::operators)) ? $operator :
'=';
        $conjunction = (in_array($conjunction,self::conjunctions)) ?
$conjunction : 'AND';

        if(empty($this->where)){
            $this->filter();
        }
        $this->where[$this->filter]['clauses'][] = [
```

```
            'conjunction' => $conjunction,
            'operator' => $operator,
            'column' => $column,
            'value' => $value
        ];
        return $this;
    }

    /**
     * ORDER BY clause
     *
     * @param string $column
     * @param string $direction
     * @return self
     */
    public function order(string $column, string $direction = 'ASC'): self
    {
        $direction = (in_array($direction,self::directions)) ? $direction : 'ASC';

        $this->order[] = [
            'column' => $column,
            'direction' => $direction
        ];
        return $this;
    }

    /**
     * INDEX clause
     *
     * @param string $column
     * @return self
     */
    public function index(string $column): self
    {
        $this->index = $column;
        return $this;
    }

    /**
     * LIMIT clause
```

```
     *
     * @param int $limit
     * @return self
     */
    public function limit(int $limit): self
    {
        $this->limit = $limit;
        return $this;
    }

    /**
     * INSERT query
     *
     * @param array  $data
     * @return self
     */
    public function insert(array $data): self
    {
        $this->type = 'insert';
        $this->values = $data;
        return $this;
    }

    /**
     * UPDATE query
     *
     * @param array  $data
     * @return self
     */
    public function update(array $data): self
    {
        $this->type = 'update';
        $this->values = $data;
        return $this;
    }

    /**
     * DELETE query
     *
     * @return self
     */
    public function delete(): self
    {
```

```
        $this->type = 'delete';
        return $this;
    }

    /**
     * Execute the query and return the result
     *
     * For a SELECT, returns an array of rows.
     * For INSERT, UPDATE, DELETE, returns the number of affected rows.
     *
     * @return mixed
     * @throws Exception
     */
    public function result()
    {
        $sql = $this->buildQuery();
        $result = $this->connector->prepare($sql, $this->params);
        if ($this->type === 'select') {
            $result = $result->get_result();
            $rows = [];
            while ($row = $result->fetch_assoc()) {
                $rows[] = $row;
            }
            return $this->buildRows($rows);
        }
        return $this->connector->affectedRows();
    }

    /**
     * Build the rows array
     *
     * @param array $results
     * @return array
     */
    private function buildRows($results)
    {
        $rows = [];
        foreach ($results as $result){
            $row = [];
            foreach ($result as $key => $value){
                if (strpos($key, 't__') === 0) {
                    if(!isset($row[substr($key, 3)])){
```

```
                        $row[substr($key, 3)] = $value;
                    }
                } else {
                    $parts = explode('__', substr($key, 3));
                    $key = $parts[0];
                    $column = $parts[1];
                    $row[$key] = (!isset($row[$key])) ? [] : $row[$key];
                    $row[$key] = (!is_array($row[$key])) ? [] :
$row[$key];
                    $row[$key][$column] = $value;
                }
            }
            if($this->index && isset($result['t__'.$this->index])){
                $rows[$result['t__'.$this->index]] = $row;
            } else {
                $rows[] = $row;
            }
        }
        return $rows;
    }

    /**
     * Return the ID of the last inserted record
     *
     * @return int
     */
    public function lastId(): int
    {
        return $this->connector->lastId();
    }

    /**
     * Build the SQL query from the given parameters
     *
     * @return string
     */
    private function buildQuery(): string
    {
        $this->params = [];
        switch ($this->type) {
            case 'select':
                $sql = "SELECT {$this->buildFields()} FROM
`{$this->table}` AS t";
```

```
                if (!empty($this->join)) {
                    $sql .= ' ' . $this->buildJoin();
                }
                if (!empty($this->where)) {
                    $sql .= ' WHERE ' . $this->buildWhere();
                }
                if (!empty($this->order)) {
                    $sql .= ' ORDER BY ' . $this->buildOrder();
                }
                if ($this->limit) {
                    $sql .= " LIMIT {$this->limit}";
                }
                return $sql;

            case 'insert':
                $columns = array_keys($this->values);
                foreach ($columns as $key => $column) {
                    $columns[$key] = "`{$column}`";
                }
                $columns = implode(',', $columns);
                $values = implode(',', array_map([$this, 'addParam'],
array_values($this->values)));
                return "INSERT INTO `{$this->table}` ({$columns}) VALUES
({$values})";

            case 'update':
                $sets = [];
                foreach ($this->values as $col => $val) {
                    $sets[] = "`{$col}` = " . $this->addParam($val);
                }
                $sql = "UPDATE `{$this->table}` SET " . implode(', ',
$sets);
                if (!empty($this->where)) {
                    $sql .= ' WHERE ' . $this->buildWhere();
                }
                return $sql;

            case 'delete':
                $sql = "DELETE FROM `{$this->table}`";
                if (!empty($this->where)) {
                    $sql .= ' WHERE ' . $this->buildWhere();
                }
```

```
                return $sql;
            }

            throw new Exception("Invalid query type: {$this->type}");
        }

        /**
         * Build the Fields clause
         *
         * @return string
         */
        private function buildFields(): string
        {
            if($this->fields == '*'){
                $fields = [];
                $columns = $this->connector->describe($this->table);
                foreach ($columns as $column) {
                    $fields[] = "t.`{$column['Field']}` AS
`t__{$column['Field']}`";
                }
                foreach ($this->join as $join) {
                    $columns = $this->connector->describe($join['table']);
                    foreach ($columns as $column) {
                        $fields[] = "j__{$join['key']}.`{$column['Field']}`
AS `j__{$join['key']}__{$column['Field']}`";
                    }
                }
            } else {
                $fields = explode(',', $this->fields);
                foreach ($fields as $key => $field) {
                    $field = trim($field);
                    if(strpos($field, '.') !== false){
                        $parts = explode('.', $field);
                        $joint = $parts[0];
                        $column = $parts[1];
                        $fields[$key] = "`j__{$joint}`.`{$column}` AS
`j__{$joint}__{$column}`";
                    } else {
                        $fields[$key] = "t.`{$field}` AS `t__{$field}`";
                    }
                }
            }
            return implode(', ', $fields);
```

```
    }

    /**
     * Build the JOIN clause
     *
     * @return string
     */
    private function buildJoin(): string
    {
        $clauses = [];
        foreach ($this->join as $join) {
            $clauses[] = "{$join['type']} JOIN `{$join['table']}` AS
`j__{$join['key']}` ON t.`{$join['key']}` {$join['operator']}
`j__{$join['key']}`.`{$join['column']}`";
        }
        return implode(' ', $clauses);
    }

    /**
     * Build the WHERE clause
     *
     * @return string
     */
    private function buildWhere(): string
    {
        $filters = '';
        foreach ($this->where as $filter => $where) {
            $clauses = [];
            foreach ($where['clauses'] as $i => $condition) {
                $conjunction = $condition['conjunction'];
                if($this->type === 'select'){
                    $col = (strpos($condition['column'], '.') !== false)
? "`".str_replace('.','`.`',$condition['column'])."`" :
"t.`{$condition['column']}`";
                } else {
                    $col = "`{$condition['column']}`";
                }
                $op = $condition['operator'];
                $val = (in_array($op, ['IS NULL', 'IS NOT NULL'])) ? ''
: $this->addParam($condition['value']);
                $clause = "{$col} {$op} {$val}";
                $clauses[] = ($i > 0) ? "{$conjunction} {$clause}" :
```

```
$clause;
            }
            $filters .= ($filter > 0) ? " {$where['conjunction']} " :
'';
            $filters .= "(".implode(' ', $clauses).")";
        }
        return $filters;
    }

    /**
     * Build the ORDER BY clause
     *
     * @return string
     */
    private function buildOrder(): string
    {
        $clauses = [];
        foreach ($this->order as $order) {
            $clauses[] = "`{$order['column']}` {$order['direction']}";
        }
        return implode(', ', $clauses);
    }

    /**
     * Add a parameter to the list and return a placeholder
     *
     * @param mixed $value
     * @return string
     */
    private function addParam($value): string
    {
        if (is_array($value)) {
            $value = json_encode($value, JSON_UNESCAPED_SLASHES |
JSON_PRETTY_PRINT);
        }
        $this->params[] = $value;

        return '?';
    }
}
```

The **Query** class allows you to build SQL queries in a structured, chainable way. Once you've constructed the query, calling `→result()` executes it. For instance:

```
$db = new Database();
$data = $db->query()
    ->select('*')
    ->table('users')
    ->filter()
    ->where('username', 'jdoe')
    ->result();
```

THE SCHEMA AND DEFINITION CLASSES

Sources: Schema.php

src/Schema.php

```
<?php

/**
 * Core Framework - Schema
 *
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core;

// Import additionnal class into the global namespace
use LaswitchTech\Core\Definition;
use LaswitchTech\Core\Connector;
use Exception;

class Schema {

    /**
     * @var Connector
```

```
     */
    private $connector;

    /**
     * Definition path
     *
     * @var string
     */
    private $path;

    /**
     * Table name
     *
     * @var string
     */
    private $table;

    /**
     * Definitions
     *
     * @var array
     */
    private $definitions = [];

    /**
     * Table engine
     *
     * @var string
     */
    private $engine = 'InnoDB';

    /**
     * Table charset
     *
     * @var string
     */
    private $charset = 'utf8mb4';

    /**
     * Table collation
     *
     * @var string
     */
```

```
    private $collation = 'unicode_ci';

    /**
     * Constructor
     *
     * @param Connector $connector
     */
    public function __construct(Connector $connector)
    {
        global $CONFIG;
        $this->path = $CONFIG->root() . '/Definition';

        $this->connector = $connector;
    }

    /**
     * Describe a table
     *
     * @return mixed
     */
    public function describe()
    {
        $definitions = [];
        foreach ($this->definitions as $column => $definition) {
            $definitions[] = $definition->define();
        }
        return $definitions;
    }

    /**
     * DEFINE the table
     *
     * @param string $table
     * @return self
     */
    public function define(string $table): self
    {
        $this->table = $table;
        $path = $this->path . DIRECTORY_SEPARATOR . $table . '.map';

        // If the definition file does not exist, generate the
definition
```

```
        if (!file_exists($path)) {

            // Load the table definition
            $definitions = $this->connector->describe($table);

            // Retrieve the table engine, charset and collation
            $sql = "SHOW TABLE STATUS LIKE '{$table}'";
            $result = $this->connector->query($sql);
            $row = $result->fetch_assoc();

            // Set the table engine
            $this->engine = $row['Engine'];

            // Set the table charset and collation
            $Collation = explode('_', $row['Collation']);
            $this->charset = $Collation[0];
            $this->collation =
str_replace($this->charset.'_','',$row['Collation']);
        } else {

            // Retrieve the definition from the file
            $definitions = json_decode(file_get_contents($path), true);

            // Loop through the definition
            foreach ($definitions as $key => $definition) {
                if(in_array($key, ['engine', 'charset', 'collation'])) {
                    $this->{$key} = $definition;
                    unset($definitions[$key]);
                }
            }
        }

        // Load the definition
        foreach ($definitions as $key => $definition) {
            $this->column($definition['Field'], $definition);
        }

        // If the definition file does not exist, create it
        if (!file_exists($path)) {

            // Save the definition
            $this->save();
        }
```

```
        return $this;
    }

    /**
     * Get a column's Definition
     *
     * @param string $column
     * @param array $definition
     * @return Definition
     */
    public function column(string $column, array $definition = []):
Definition
    {
        if(!isset($this->definitions[$column])) {
            $this->definitions[$column] = new Definition($column,
$definition);
        }
        return $this->definitions[$column];
    }

    /**
     * Rename a column
     *
     * @param string $column
     * @param string $newName
     * @return self
     */
    public function rename(string $column, string $newName): self
    {
        if(isset($this->definitions[$column])) {
            $this->definitions[$newName] = $this->definitions[$column];
            unset($this->definitions[$column]);
            $this->definitions[$newName]->rename($newName);
        }
        // $sql = "ALTER TABLE `{$this->table}` CHANGE `{$column}`
`{$newName}` {$this->definitions[$newName]->define()['Type']}";
        // $this->connector->query($sql);
        return $this;
    }

    /**
```

```
     * Remove a column
     *
     * @param string $column
     * @return self
     */
    public function remove(string $column): self
    {
        if(isset($this->definitions[$column])) {
            unset($this->definitions[$column]);
        }
        return $this;
    }

    /**
     * Save the definition to a file
     *
     * @return self
     */
    public function save(): self
    {
        $definitions = [];
        foreach ($this->definitions as $definition) {
            $definitions[] = $definition->define();
        }
        $definitions['engine'] = $this->engine;
        $definitions['charset'] = $this->charset;
        $definitions['collation'] = $this->collation;
        $path = $this->path . DIRECTORY_SEPARATOR . $this->table .
'.map';
        if(!is_dir($this->path)) { mkdir($this->path, 0777, true); }
        file_put_contents($path, json_encode($definitions,
JSON_PRETTY_PRINT | JSON_UNESCAPED_SLASHES));
        return $this;
    }

    /**
     * Compare the in-memory definition with the actual DB structure.
     *
     * If $asQueries = false, return a descriptive array of differences.
     * If $asQueries = true, return an array of SQL statements that
would
     * apply the changes needed to sync the DB to the in-memory
definitions.
```

```
     *
     * @param bool $asQueries
     * @return array
     */
    public function compare(bool $asQueries = false): array
    {
        // Make sure we have a table name
        if (empty($this->table)) {
            return [];
        }

        // Get columns from DB
        $dbCols = $this->connector->describe($this->table);
        $dbMap = [];
        foreach ($dbCols as $col) {
            $dbMap[$col['Field']] = $col;
        }

        // Get columns from memory
        $memoryMap = [];
        foreach ($this->definitions as $definitionObj) {
            $arr = $definitionObj->define();
            $memoryMap[$arr['Field']] = $arr;
        }

        // We will accumulate a list of changes (descriptive or queries)
        $changes = [];

        // 1) Handle Renamed Columns
        //    If in-memory column has "Previously" => we interpret that
as "rename oldName -> newName"
        //    if oldName actually exists in $dbMap, we know it's a
rename.
        //    Then we can remove oldName from $dbMap to avoid also
dropping it below.
        foreach ($memoryMap as $newName => $memDef) {
            if (!empty($memDef['Previously']) &&
isset($dbMap[$memDef['Previously']])) {
                $oldName = $memDef['Previously'];
                if (isset($dbMap[$oldName]) &&
!isset($changes[$newName])) {
                    // It's truly a rename from $oldName to $newName
```

```
                    if ($asQueries) {
                        $changes[$newName] =
$this->buildRenameQuery($oldName, $newName, $memDef);
                    } else {
                        $changes[$newName] = [
                            'action'   => 'rename',
                            'oldName'  => $oldName,
                            'newName'  => $newName,
                            'details'  => $memDef
                        ];
                    }
                    // We handle the rename by removing the oldName from
$dbMap
                    // and also removing $newName from $memoryMap so we
don't handle it again
                    unset($dbMap[$oldName]);
                    // (We won't remove from $memoryMap here, because we
need it for next steps—some prefer to do so, but you can also mark it
somehow.)
                }
            }
        }

        // 2) Handle Added Columns
        //    If a column is in memoryMap but not in $dbMap => it's a
new column
        foreach ($memoryMap as $colName => $memDef) {
            if (!isset($dbMap[$colName]) && !isset($changes[$colName]))
{
                // We skip columns that are flagged as a rename
                // if $memDef['Previously'] was set but didn't match a
DB col, this might be a rename from a non-existing col
                // We'll treat it as "add" anyway
                if ($asQueries) {
                    $changes[$colName] =
$this->buildAddColumnQuery($colName, $memDef);
                } else {
                    $changes[$colName] = [
                        'action'  => 'add',
                        'column'  => $colName,
                        'details' => $memDef
                    ];
                }
```

```
            }
        }

        // 3) Handle Dropped Columns
        //    If a column is in DB but not in memory => it's removed
        //    (unless it's renamed, which we handled earlier by
unsetting from $dbMap)
        foreach ($dbMap as $colName => $dbDef) {
            if (!isset($memoryMap[$colName]) &&
!isset($changes[$colName])) {
                if ($asQueries) {
                    $changes[$colName] = "ALTER TABLE `{$this->table}`
DROP COLUMN `{$colName}`";
                } else {
                    $changes[$colName] = [
                        'action' => 'drop',
                        'column' => $colName,
                        'dbDef'  => $dbDef
                    ];
                }
            }
        }

        // 4) Handle Modified Columns
        //    If a column is both in DB and in memory (and not renamed),
check differences (type, null, default, etc.)
        //    Then build a "modify" or "change" query if there's a
difference
        foreach ($memoryMap as $colName => $memDef) {
            if (isset($dbMap[$colName]) && !isset($changes[$colName])) {
                // Compare details
                $dbDef = $dbMap[$colName];
                // We'll do a simple comparison on "Type", "Null",
"Default", "Extra", "Key"
                $diff = $this->compareColumnDefs($dbDef, $memDef);
                if (!empty($diff)) {
                    // We have differences
                    if ($asQueries) {
                        // A "MODIFY COLUMN" or "CHANGE COLUMN"
statement can be used.
                        // Typically use "MODIFY" if we keep the same
col name
```

```
                        // We'll build a "MODIFY" statement
                        $changes[$colName] =
$this->buildModifyColumnQuery($colName, $memDef);
                    } else {
                        $changes[$colName] = [
                            'action' => 'modify',
                            'column' => $colName,
                            'dbDef'  => $dbDef,
                            'memDef' => $memDef,
                            'diff'   => $diff
                        ];
                    }
                }
            }
        }

        return $changes;
    }

    /**
     * Compare two column definitions (DB vs memory).
     * Return an array of differences or an empty array if none.
     *
     * For simplicity, we only compare keys we care about:
     * 'Type', 'Null', 'Default', 'Extra', 'Key'.
     */
    private function compareColumnDefs(array $dbDef, array $memDef):
array
    {
        $keysToCheck = array_keys($dbDef);
        $diff = [];
        foreach ($keysToCheck as $key) {
            // Normalize or parse if needed, e.g. 'int(11)' vs 'int(10)'
            // For now, let's do a plain string compare
            $dbVal  = isset($dbDef[$key])  ? $dbDef[$key]  : null;
            $memVal = isset($memDef[$key]) ? $memDef[$key] : null;
            if ($dbVal != $memVal) {
                $diff[$key] = ["db"=>$dbVal, "mem"=>$memVal];
            }
        }
        return $diff;
    }
```

```
    /**
     * Build the SQL to rename a column.
     * e.g. ALTER TABLE tableName CHANGE oldName newName newDefinition
     */
    private function buildRenameQuery(string $oldName, string $newName,
array $memDef): string
    {
        $colDefSQL = $this->buildColumnSQL($memDef, $newName);
        return "ALTER TABLE `{$this->table}` CHANGE `{$oldName}`
`{$newName}` {$colDefSQL}";
    }

    /**
     * Build the SQL to add a new column.
     * e.g. ALTER TABLE tableName ADD COLUMN colName colDefinition
     */
    private function buildAddColumnQuery(string $colName, array
$memDef): string
    {
        $colDefSQL = $this->buildColumnSQL($memDef, $colName);
        return "ALTER TABLE `{$this->table}` ADD COLUMN {$colDefSQL}";
    }

    /**
     * Build the SQL to modify an existing column (same name, changed
type, etc).
     * e.g. ALTER TABLE tableName MODIFY COLUMN colName colDefinition
     */
    private function buildModifyColumnQuery(string $colName, array
$memDef): string
    {
        $colDefSQL = $this->buildColumnSQL($memDef, $colName);
        return "ALTER TABLE `{$this->table}` MODIFY COLUMN
{$colDefSQL}";
    }

    /**
     * Build the column definition snippet, e.g.
     *   `age` int(11) NOT NULL DEFAULT '0' AUTO_INCREMENT
     *
     * If the column is 'NULL' then we do "NULL" instead of "NOT NULL".
     */
```

```
    private function buildColumnSQL(array $memDef, string $colName): string
    {
        // We'll need:
        // - column name
        // - type
        // - null vs not null
        // - default
        // - extra (auto_increment / on update CURRENT_TIMESTAMP)
        // Possibly also Key, but in MySQL you'd typically do PK or unique in separate statements,
        // or in the create statement. For an "ALTER" approach, we might skip 'Key' here.

        $type = $memDef['Type'] ?? 'varchar(255)';

        // Null / not null
        $null = (isset($memDef['Null']) && $memDef['Null'] === 'YES') ? "NULL" : "NOT NULL";

        // Default
        $defaultSQL = "";
        if(!in_array($type, ['tinytext', 'text', 'mediumtext', 'longtext', 'tinyblob', 'blob', 'mediumblob', 'longblob'])) {
            if (array_key_exists('Default', $memDef)) {
                $defaultVal = $memDef['Default'];
                if ($defaultVal === 'CURRENT_TIMESTAMP') {
                    $defaultSQL = "DEFAULT CURRENT_TIMESTAMP";
                } else {
                    if ($defaultVal === null && $null === "NULL") {
                        $defaultSQL = "DEFAULT NULL";
                    } elseif ($defaultVal !== null) {
                        $escaped = addslashes($defaultVal);
                        $defaultSQL = "DEFAULT '{$escaped}'";
                    }
                }
            }
        }

        // Extra
        $extra = "";
        if (!empty($memDef['Extra'])) {
            // e.g. "auto_increment" or "on update CURRENT_TIMESTAMP"
```

```
            $extra = strtoupper($memDef['Extra']);
        }

        return "`{$colName}` {$type} {$null}"
               . (empty($defaultSQL) ? "" : " {$defaultSQL}")
               . (empty($extra) ? "" : " {$extra}");
    }

    /**
     * Build the CREATE TABLE SQL, e.g.
     *  CREATE TABLE `tableName` (
     *
     * @return string
     */
    private function buildCreate(): string
    {
        $columnLines = [];
        foreach ($this->definitions as $definition) {
            $columnLines[] =
$this->buildColumnSQL($definition->define(),
$definition->define()['Field']);
        }

        // Check if we have primary keys
        $primaryKeys = [];
        foreach ($this->definitions as $definition) {
            if (isset($definition->define()['Key']) &&
$definition->define()['Key'] === 'PRI') {
                $primaryKeys[] = $definition->define()['Field'];
            }
        }

        // If we have primary keys, add a line for them
        if (!empty($primaryKeys)) {
            $pk = "`" . implode("`,`", $primaryKeys) . "`";
            $columnLines[] = "PRIMARY KEY ($pk)";
        }

        // For demonstration, assume InnoDB engine
        // In real usage, you might store the engine in definition or
config
        $columnsSQL = implode(",\n  ", $columnLines);
```

```
        $sql = "CREATE TABLE `{$this->table}` (\n  {$columnsSQL}\n)
ENGINE={$this->engine} DEFAULT CHARSET={$this->charset}
COLLATE={$this->collation}";
        return $sql;
    }

    /**
     * Drop the table if it exists
     *
     * @return self
     * @throws Exception
     */
    public function drop(): self
    {
        if (empty($this->table)) {
            throw new Exception("No table defined.");
        }
        $sql = "DROP TABLE IF EXISTS `{$this->table}`";
        $this->connector->query($sql);

        return $this;
    }

    /**
     * Truncate the table
     *
     * @return self
     * @throws Exception
     */
    public function truncate(): self
    {
        if (empty($this->table)) {
            throw new Exception("No table defined.");
        }
        $sql = "TRUNCATE TABLE `{$this->table}`";
        $this->connector->query($sql);

        return $this;
    }

    /**
     * Update the table
     *
```

```
     * @return self
     */
    public function update(): self
    {
        $changes = $this->compare(true);
        foreach ($changes as $change) {
            $this->connector->query($change);
        }
        return $this;
    }

    /**
     * Create the table
     *
     * @return self
     */
    public function create(): self
    {
        $sql = $this->buildCreate();
        $this->connector->query($sql);
        return $this;
    }

    /**
     * Return if the table exists
     *
     * @return bool
     */
    public function exists(): bool
    {
        $sql = "SHOW TABLES LIKE '{$this->table}'";
        $result = $this->connector->query($sql);
        return $result->num_rows > 0;
    }
}
```

Sources: Definition.php

src/Definition.php

```php
<?php

/**
 * Core Framework - Definition
 *
 * @license    MIT (https://mit-license.org/)
 * @author     Louis Ouellet <louis@laswitchtech.com>
 */

// Declaring namespace
namespace LaswitchTech\Core;

// Import additionnal class into the global namespace
use Exception;

class Definition {

    /**
     * List of default length for types
     *
     * @var array
     */
    const lengths = [
        // Numeric
        'int' => 11,
        'tinyint' => 4,
        'smallint' => 6,
        'mediumint' => 9,
        'bigint' => 20,
        // -
        'decimal' => 10,
        'float' => 12,
        'double' => 22,
        'real' => 12,
        // -
        'bit' => 1,
        'boolean' => 1,
        'serial' => 10,

        // Date and Time
        'date' => 0,
```

```
            'datetime' => 0,
            'timestamp' => 0,
            'time' => 0,
            'year' => 4,

            // String
            'char' => 255,
            'varchar' => 255,
            // -
            'tinytext' => 0,
            'text' => 0,
            'mediumtext' => 0,
            'longtext' => 0,
            // -
            'binary' => 255,
            'varbinary' => 255,
            // -
            'tinyblob' => 0,
            'blob' => 0,
            'mediumblob' => 0,
            'longblob' => 0,
            // -
            'enum' => 0,
            'set' => 0,

            // Spatial
            'geometry' => 0,
            'point' => 0,
            'linestring' => 0,
            'polygon' => 0,
            'multipoint' => 0,
            'multilinestring' => 0,
            'multipolygon' => 0,
            'geometrycollection' => 0,

            // JSON
            'json' => 0,
        ];

        /**
         * Column name
         *
```

```
     * @var string
     */
    private $column;

    /**
     * Table definition
     *
     * @var array
     */
    private $definition = [
        "Field" => null,
        "Type" => "varchar(255)",
        "Null" => "YES",
        "Key" => "",
        "Default" => null,
        "Extra" => ""
    ];

    /**
     * Constructor
     *
     * @param string $column
     * @param array $definition
     */
    public function __construct(string $column, array $definition = [])
    {
        $this->column = $column;
        foreach($definition as $key => $value) {
            $this->definition[$key] = $value;
        }
        $this->definition['Field'] = $column;
    }

    /**
     * Define the column
     *
     * @return array
     */
    public function define(): array
    {
        return $this->definition;
    }
```

```php
    /**
     * Set the column type
     *
     * @param string $type
     * @param int $length
     * @return self
     */
    public function type(string $type, int $length = 0): self
    {
        $length = ($length > 0) ? $length : self::lengths[$type];
        $this->definition['Type'] = $type . ($length > 0 ? "($length)" :
"");
        return $this;
    }

    /**
     * Set the column as nullable
     *
     * @param bool $isNull
     * @return self
     */
    public function nullable(bool $isNull = true): self
    {
        $this->definition['Null'] = ($isNull) ? "YES" : "NO";
        return $this;
    }

    /**
     * Set the column default value
     *
     * @param string $value
     * @return self
     */
    public function default(string $value = null): self
    {
        $this->definition['Default'] = $value;
        return $this;
    }

    /**
     * Set the column as primary key
     *
```

```
     * @param bool $isPrimary
     * @return self
     */
    public function primary(bool $isPrimary = true): self
    {
        $this->definition['Key'] = ($isPrimary) ? "PRI" : "";
        return $this;
    }

    /**
     * Set the column as unique
     *
     * @param bool $isUnique
     * @return self
     */
    public function unique(bool $isUnique = true): self
    {
        $this->definition['Key'] = ($isUnique) ? "UNI" : "";
        return $this;
    }

    /**
     * Set the column as auto increment
     *
     * @param bool $isAutoIncrement
     * @return self
     */
    public function autoIncrement(bool $isAutoIncrement = true): self
    {
        $this->definition['Extra'] = ($isAutoIncrement) ?
"auto_increment" : "";
        return $this;
    }

    /**
     * Set on update current timestamp
     *
     * @param bool $isOnUpdate
     * @return self
     */
    public function onUpdate(bool $isOnUpdate = true): self
    {
        $this->definition['Extra'] = ($isOnUpdate) ? "on update
```

```
CURRENT_TIMESTAMP" : "";
        return $this;
    }

    /**
     * Rename the column
     *
     * @param string $name
     * @return self
     */
    public function rename(string $name): self
    {
        $this->definition['Field'] = $name;
        $this->definition['Previously'] = $this->column;
        $this->column = $name;
        return $this;
    }
}
```

These classes let you manage table structures and column definitions in a more programmatic way. You can:

- Generate (or read) column definitions
- Track changes to the schema
- Compare or rename columns
- Create new tables or update existing ones

CONCLUSION

We have now implemented several key features in our PHP framework:

- **CSRF Protection** to secure your application from malicious form submissions
- **API Module** to handle routing, request processing, and future authentication/authorization
- **Database Handling** through connectors (e.g., MySQL), a chainable Query builder, and a Schema system for defining and updating tables

With these pieces in place, our framework is capable of handling basic security, robust data operations, and modular endpoint structures. In the next installments, we'll expand authentication mechanisms, discuss more advanced routing or plugin architectures, and continue refining our framework to be both extensible and secure.

GITHUB REPOSITORY

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