2022

SQL INJECTION
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What you are expected to do: Using this document and other resources, you are expected to have a good understanding of SQL Injection in general, be able to apply certain methods to detect SQL vulnerabilities in a low-security database system, and also have a basic knowledge in writing SQL queries. You should be able to install the required programs (Linux, DVWA, php, mysql, apache2 etc.) on your computer and update them accordingly. It is your responsibility to ensure that the versions of the relevant programs are compatible and ready to run. You will be asked to obtain database tables and column information of users in the database using SQL queries on the DVWA website. You may be asked to concatenate or select certain columns of user information from the tables, and also regarding to how these attacks can be prevented to protect the information of users.

Ne yapmanız bekleniyor: Bu dokümanı ve diğer kaynakları kullanarak SQL Injection'ın genel çalışma mantığını anlamanız, düşük güvenlikli bir veritabanı sisteminde SQL güvenlik açıklarını tespit etmek için belirli yöntemler uygulamanız ve ayrıca SQL sorguları yazma konusunda temel bilgilere sahip olmanız bekleniyor. Gerekli sistemleri (Linux, DVWA, php, mysql, apache2 vb.) bilgisayarınıza kurmalı ve buna göre güncelleyebilmelisiniz. İlgili programların versiyonlarının uyumlu ve çalışmaya hazır olması sizin sorumluluğunuzdadır. DVWA web sitesinde SQL sorgularını kullanarak veritabanındaki kullanıcıların veritabanı tablolarını ve sütun bilgilerini elde etmeniz istenecektir. Tablolardan belirli kullanıcı bilgileri sütunlarını birleştirmeniz veya seçmeniz istenebilir ve ayrıca kullanıcıların bilgilerini korumak için bu saldırıların nasıl önlenebileceği sorulabilir.

SQL INJECTION (LOW)

SQL Injection (Low)

Injection attacks occur when data from users is used unchecked in commands or database queries. SQL Injection attacks also allow certain SQL queries to be executed without authorization in the database that is used by the target website.

The ability to run SQL queries on the database by unauthorized persons also means that the attacker can have access to lots of data in the system or to the user using the system.

Damn Vulnerable Web Application(DVWA)

DVWA is a PHP/mysql web application.

The aim is to provide a working environment for people working on system security.

Attacks on DVWA:

SQL Injection
Brute Force
Command injection
XSS, CSRF …

SQL INJECTION IMPLEMENTATION STEPS

The application is implemented on Ubuntu. Other Linux distributions such as Kali can also be used, but there may be some changes in DVWA and mysql installations. These steps were followed using Ubuntu 22.04.01 distribution. It is recommended that the installation be done in the Ubuntu distribution by following the steps below.

First of all, Ubuntu 22.04.01 operating system must be installed in a virtualization program such as VirtualBox, VMWare.

By opening the terminal, the necessary updates and packages for SQL Injection are installed on the system.

1. **System Updates**
   1.1. Apt update

```
sudo apt update && sudo apt upgrade
```

   1.2. Apt and Apache Web Server, Mysql Database, Php and Git Installation

```
sudo apt install apache2 mysql-server php php-mysqli php-gd libapache2-mod-php git
```

2. **DVWA Installation**

2.1. Downloading DVWA, deleting the default web application (index.html) and replacing it with the DVWA application.

```
cd ~
git clone --recursive https://github.com/ethicalhack3r/DVWA.git
sudo rm /var/www/html/index.html
sudo cp -r ~/DVWA/* /var/www/html/
cd /var/www/html
```

2.2. Creating a php config file.

```
sudo cp config/config.inc.php.dist config/config.inc.php
```

Define required permissions for general use (not just SQL injection) in DVWA

```
sudo chmod 757 /var/www/html/hackable/uploads/
sudo chmod 646 /var/www/html/external/phpids/0.6/lib/IDS/tmp/phpids_log.txt
sudo chmod 757 /var/www/html/config
```

Configuring php for DVWA (setting allow_url_include off to on)

Firstly, the installed PHP version is checked (can be versions such as 7.2, 8.1).

```
php -v
```

Based on the installed version, the line "allow_url_include = Off" is replaced with "On" in nano. (in our case PHP 8.1 is installed)

```
sudo nano /etc/php/8.1/apache2/php.ini
```

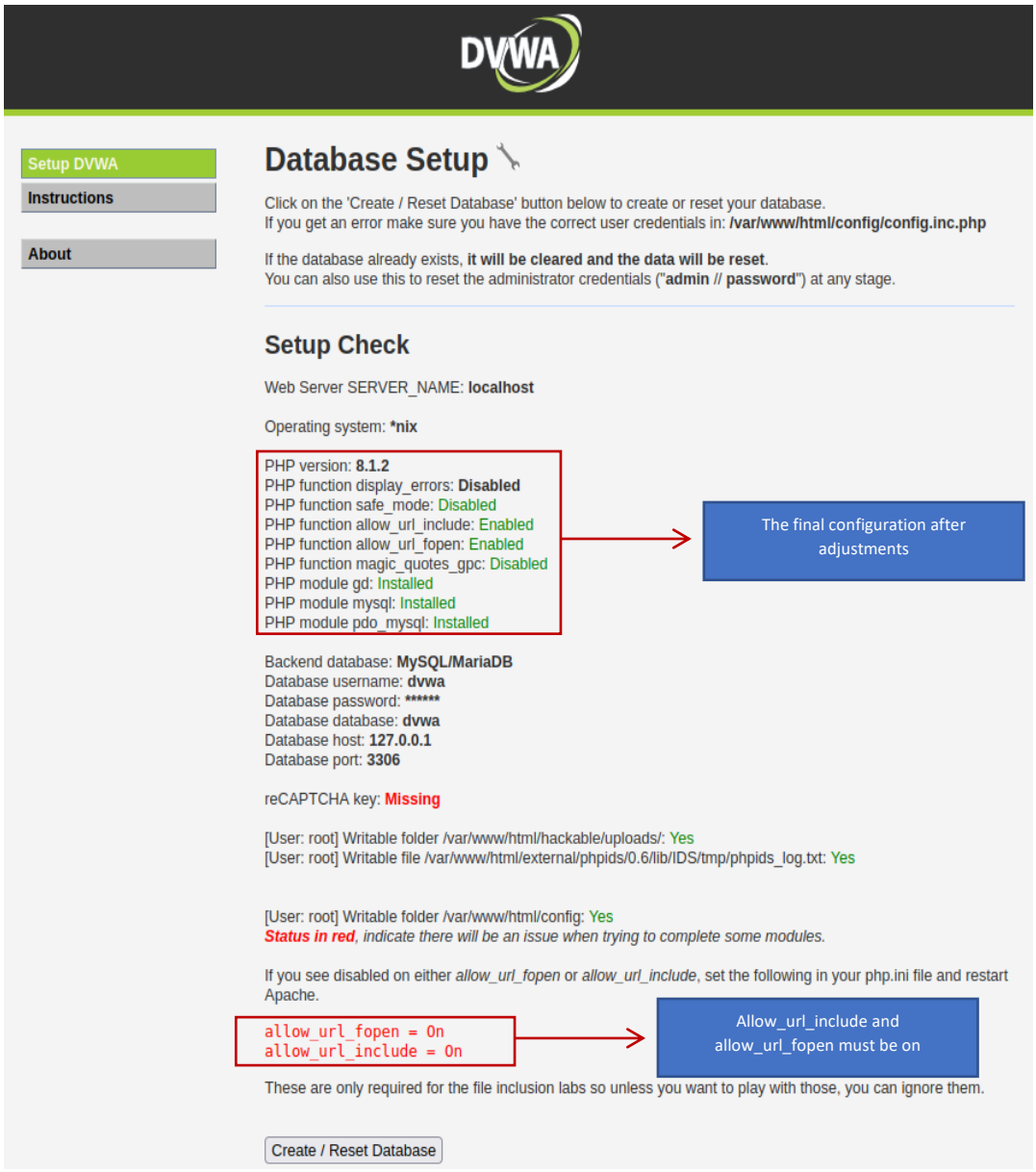
By searching in Nano with Ctrl + W, the relevant line is found and changed.

>>>; Whether to allow include/require to open URLs (like http:// or ftp://) as files.
>>>; http://php.net/allow-url-include
>>> allow_url_include = **On**

The web server (apache2) must be restarted in order for the settings to be active.

```
sudo systemctl restart apache2
```

Check the DVWA status by going to “localhost/setup.php” or “127.0.0.1/setup.php” in the web browser:



Lastly, with the following command, the mysql command line is activated and the following 5 commands are run one after the other.

```
sudo mysql -u root -p
```

2.3. When we are in the mysql command line, the following commands should be run.

mysql> `DROP USER 'root'@'localhost';`
Query OK, 0 rows affected (0.00 sec)

mysql> `CREATE USER 'root'@'localhost' IDENTIFIED BY 'p@ssw0rd';`
Query OK, 0 rows affected (0.00 sec)

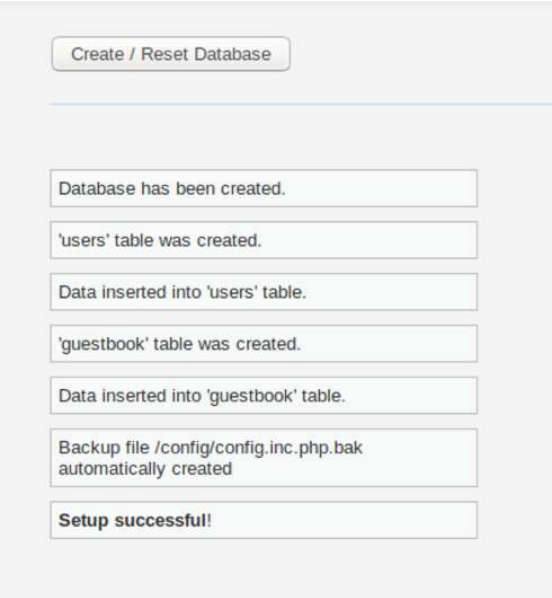
mysql> `GRANT ALL PRIVILEGES ON *.* TO 'root'@'localhost' WITH GRANT OPTION;`
Query OK, 0 rows affected (0.00 sec)

mysql> `FLUSH PRIVILEGES;`
Query OK, 0 rows affected (0.00 sec)

mysql> `exit`

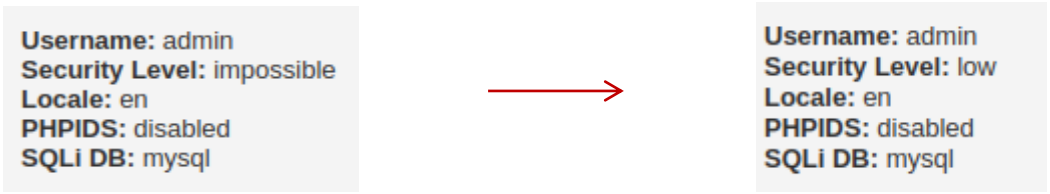
Bye

Thus, the database is made accessible without the need to change the database input string defined in the PHP configurations.



After the installation is complete, we can go to “localhost/login.php” or “127.0.0.1/login.php” and log in with the default username and password. (ID: admin, Password: password)

After logging in, go to the SQL Injection page from the left menu. At the bottom left of the screen, we see that the Security Level is set to impossible by default. To change it to low, go to the DVWA Security page from the left menu and change the Security Level to low.



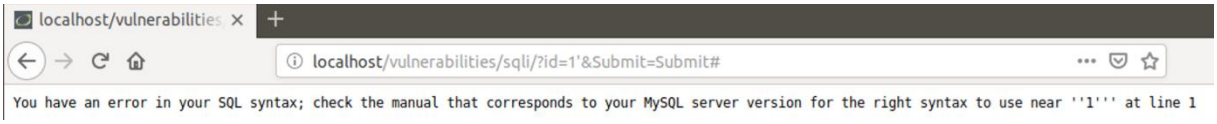
When we enter the SQL Injection page again and type `1` in the User ID text box and press Submit, the result is as follows:

By gaining access to the database, the ID value entered in the text box is taken and the First name and Surname information corresponding to that ID value are printed on the screen.

The quotation character is commonly used when specifying values in SQL queries.

Whether or not we get an error for the quote(') character will guide us on our attack strategy. (Note: If a blank white page is encountered, it may also mean an error was received)

Let's see what happens when we Submit by typing `1` in the User ID text box:



As you can see, we got an error and this error shows us that the quotation character is used in queries.

We also saw that there was no validation for the quote character because the error message we saw was provided by the server/database. In other words, there is no checking mechanism on the server or database side.

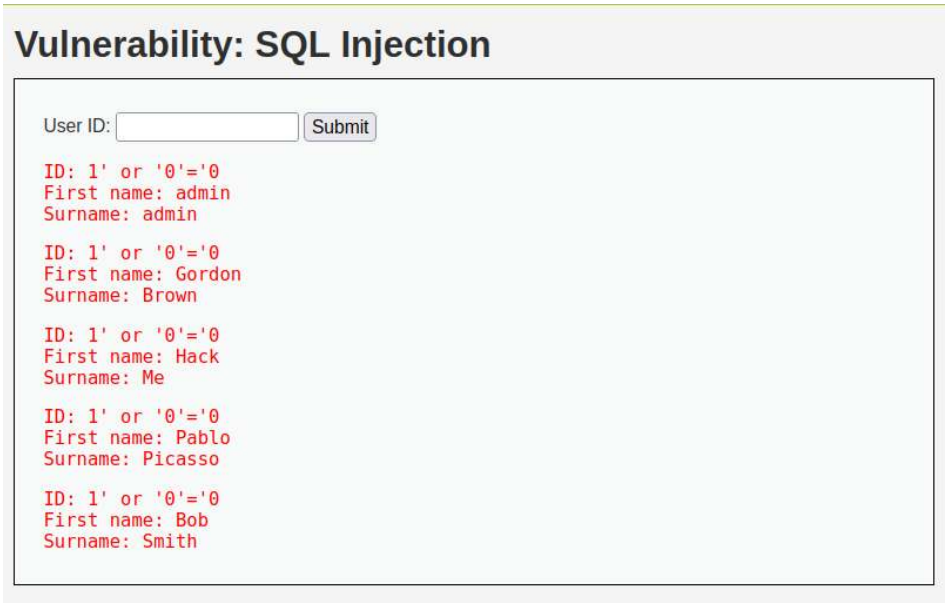
SQL Injection Source

vulnerabilities/sqli/source/low.php

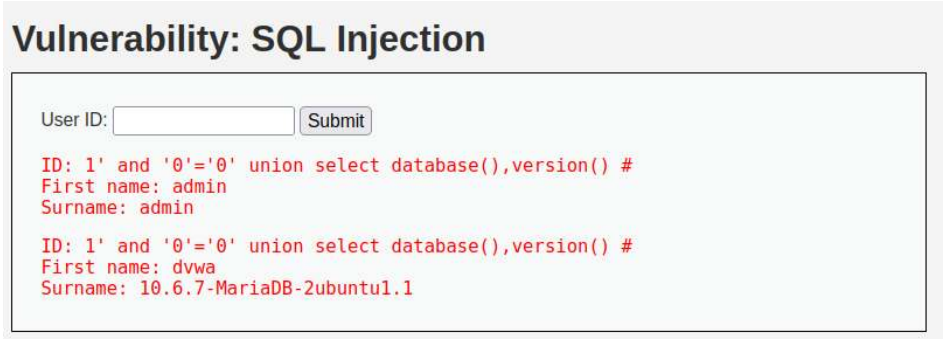
```php
<?php

if( isset( $_REQUEST[ 'Submit' ] ) ) {
    // Get input
    $id = $_REQUEST[ 'id' ];

    // Check database
    $query  = "SELECT first_name, last_name FROM users WHERE user_id = '$id';";
    $result = mysqli_query($GLOBALS["___mysqli_ston"],  $query ) or die( '<pre>' . ((is_object($GLOBALS[

    // Get results
    while( $row = mysqli_fetch_assoc( $result ) ) {
        // Get values
        $first = $row["first_name"];
        $last  = $row["last_name"];

        // Feedback for end user
        echo "<pre>ID: {$id}<br />First name: {$first}<br />Surname: {$last}</pre>";
    }

    mysqli_close($GLOBALS["___mysqli_ston"]);
}

?>
```

If the # character is appended to the end of the input, the remainder of the SQL query can be commented out, creating the environment for the attack.

If we write `1'or '0'='0` in the User ID field, we can have the information of all the records in the query table:

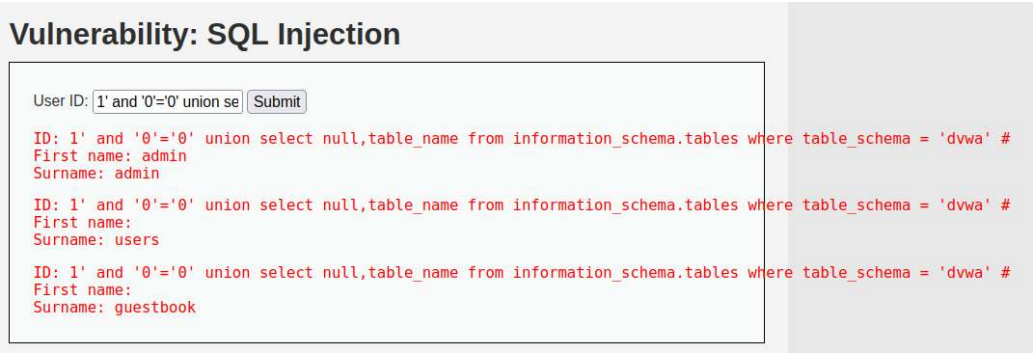


When we run the query `1' and '0'='0'` union select database(),version() # we can get information about the operating system and mysql version used.



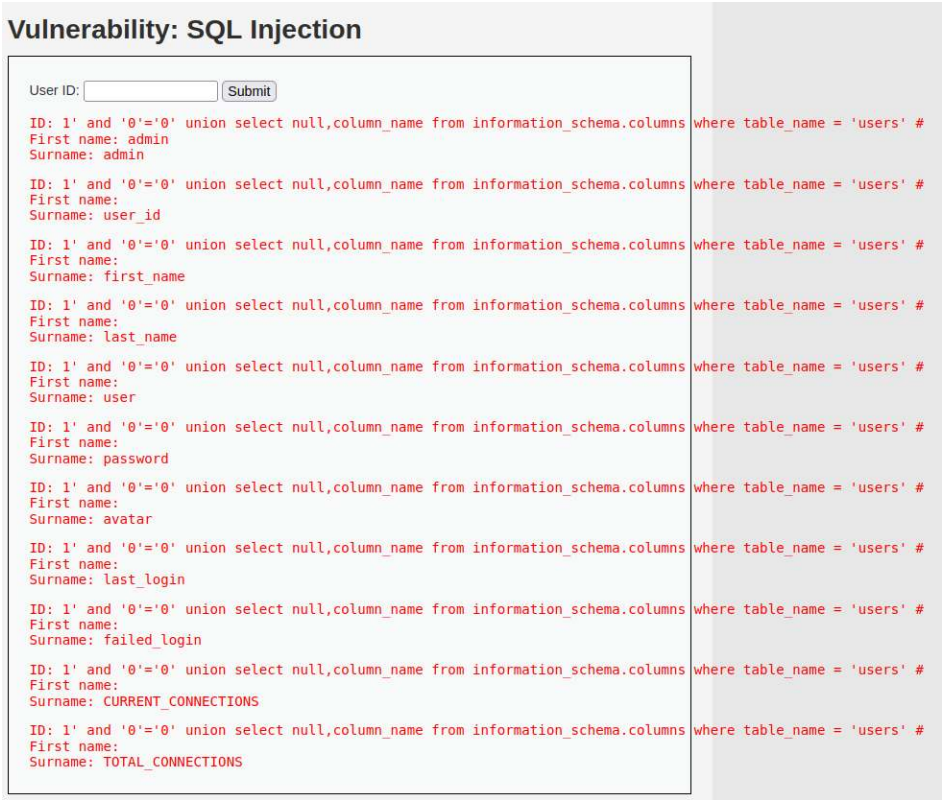
Now that we know what kind of system we are attacking, we can access more detailed information. For example, we can learn other table names in the database from the table schema.

Fort that run `1' and '0'='0' UNION SELECT null,table_name from information_schema.tables where table_schema = 'dvwa' #` query:



As you can see, it has been determined that there are user and guestbook tables. Now that we know the tables, we can obtain the column information in the user or guestbook table.

For that run `1' and '0'='0' UNION SELECT null,column_name from information_schema.columns where table_name = 'users' #` query.



We learned that the column names in the User table are user_id, first_name, last_name, user, password, avatar, last_login, failed _login, CURRENT_CONNECTIONS and TOTAL_CONNECTIONS.

Now we know the database type, database version, all the tables, the user table we decided to attack, and its columns. We will be able to access all kinds of information of users.

Using the union operator with group_concat we can increase the number of columns we want to select:

```
1' UNION SELECT "Listele:", group_concat("ID: ", user_id, "; Ad: ", first_name, "; Soyad: ", last_name, "; Hesap Adı: ", user, "; Parola:", password, "; Resim: ", avatar, 0x0A) from users #
```

We have gained access to the users' names, surnames, account names, passwords and pictures in the database.