

SQL Injection Attacks Detection & Prevention Techniques

Gülsüm Yiğit and Merve Arnavutoglu

Abstract—SQL Injection Attack (SQLIA) is a type of code injection technique that threatens confidentiality, integrity, and availability of web databases. The attacker mostly exploits incorrectly filtered user inputs such as text fields in web applications and tries to insert malicious SQL statements into a legitimate query via the vulnerable user input. By doing so, the attacker can access, insert, modify, or delete critical information in a database without proper authorization. In this survey, we describe and categorize types of SQLIA, and analyze existing detection and prevention techniques against such attacks.

Index Terms—SQL injection, attacks, cyber security.

I. INTRODUCTION

The rapid growth of internet made web applications one of the most popular communication channels. SQL injection is among the oldest such attacks, but even today stands as a serious threat to confidentiality, integrity, and availability of web databases. Last five OWASP (The Open Web Application Security Project) reports for the top 10 web application vulnerabilities showed that SQL injection is ranked first among other vulnerabilities [1].

In a successful SQL injection attack (SQLIA), the attacker tricks a web application in executing a malicious SQL statement. The malicious statement is, for example, sent via user input fields in web forms. If the application fails to validate the input properly, the malicious statements are injected into legitimate queries and forwarded to the DBMS [2]-[5].

In Section II, we list threats posed by SQLIA in detail. In Section III, we describe how a simple attack is performed in detail. In Section IV, we categorize different types of attacks on relational databases and describe what threat category the attack falls into. In Section V, we survey some defense mechanisms against injection attacks.

II. THREADS POSED BY SQL INJECTION ATTACKS

The harm done by SQLIA can be disastrous because a successful SQL injection can read sensitive data from the database, modify database data (Insert/Update/Delete), execute administrative operations on the database such as shutdown the DBMS, recover the content on the DBMS file system and execute commands (xp_cmdshell) to the operating system [4]. We can categorize the threats posed by SQLIA as follows:

Bypassing Authentication: If there is no proper validation on username and password, an attacker can login to the system without knowing the correct username or/and password.

Destroying Integrity: Via injected SQL statements, an attacker may modify/delete data items in the database systems.

Breaching Confidentiality: SQL injection may enable an attacker to learn about content that is otherwise not accessible. Depending on the type of the vulnerability, the information leaked can go from a simple boolean result to disclosure of the whole database.

Bypassing Authorization: With a successful injection, an attacker can query any parts of the database bypassing of any access control mechanisms [4].

Loss of Availability: For systems that allow function calls to DBMS, an attacker can shut down or crash the database service thus rendering it unavailable to other legitimate users.

III. SQL INJECTION ATTACK

We now demonstrate a typical SQLIA on the login page of a vulnerable web application. Suppose that, on the login page, 'login.php', we have a submit button and two text boxes; one for the username and the other for the password.

```
<input type="text" id="username"
name="username" value="">
<input type="password" id="password" name="password"
value="">
```

When the user enters the username and password, it will be posted to 'login.php' via HTTP_POST method. Application will check if any record exists in, say, the USERS table. In the 'login.php', a query will be executed through the user inputs.

```
$username = $_POST['username'];
$password = $_POST['password'];
$query="Select * from USERS
where username='$username' and
password='$password'";
```

Assume that a valid username and password pair is 'Admin' and '12345'. Once the user enters the following inputs to the two textbox of username and password, the following query will dynamically be constructed.

```
$username = "Admin";
$password = "12345";
$query = "Select* from USERS
where username = 'Admin' AND
password = '12345'";
```

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Gülsüm Yiğit and Merve Arnavutoglu are with the Electronics and Computer Engineering Department, University of Gazişehir, Turkey (e-mail: gulsuinyigit@gmail.com, merve.arnavutoglu@gmail.com).

Detection And Prevention Of Sql Injection Attacks

**Suresh Chandra Satapathy,A.
Govardhan,K. Srujan Raju,J. K. Mandal**



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