A Closer Look at SQL Injection Attack

What is a SQL Injection (SQLi) Attack?

- Many web applications take user input from a form
- Often this user input is used literally in the construction of a SQL query submitted to a database. For example:

  SELECT productdata FROM table WHERE productname = '***user input product name***' ;

- A SQL injection attack involves placing SQL statements in the user input

https://www.helpnetsecurity.com/2021/01/11/sql-injection-bug/

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Matias Madou, CTO, Secure Code Warrior
January 11, 2021

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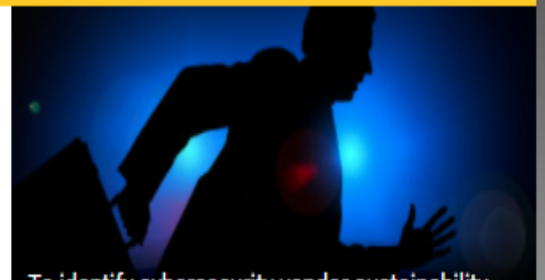
SQL injection: The bug that seemingly can't be squashed

If you're in a hands-on cybersecurity role that requires some familiarity with code, chances are good that you've had to think about SQL injection over and over (and over) again.



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Structured Query Language (SQL)

- Widely used **database query language**
- Retrieve a set of records, e.g.,

  SELECT * FROM Person WHERE Username='Lee'
- Add data to the table, e.g.,

  INSERT INTO Key (Username, Key) VALUES ('Lee', Ifoutw2)
- Modify data, e.g.,

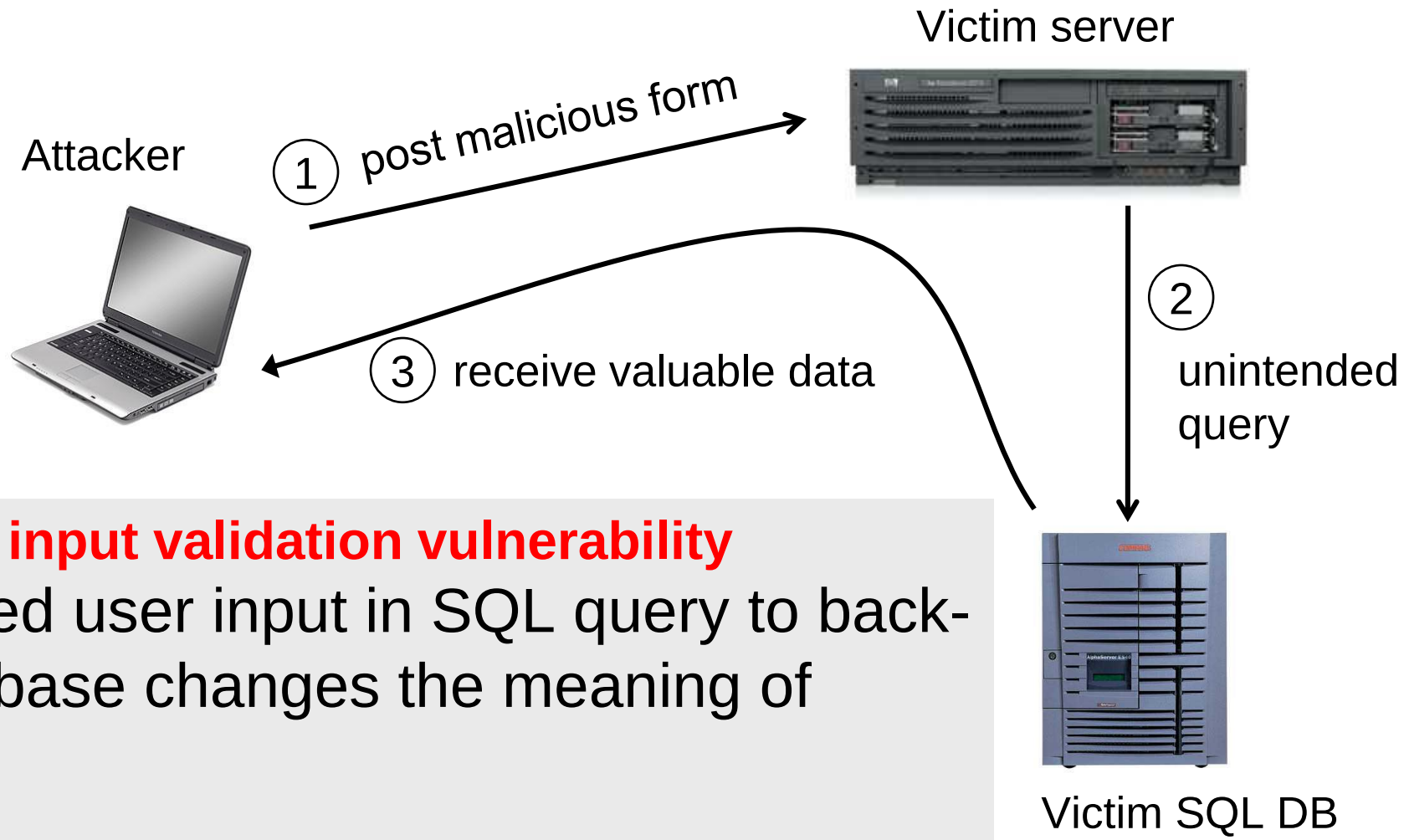
  UPDATE Keys SET Key=ifoutw2 WHERE PersonID=8

Sample PHP Code

```
$selecteduser = $_GET['user'];
$sql = "SELECT Username, Key FROM Key”.
        "WHERE Username='$selecteduser'";
$rs = $db->executeQuery($sql);
```

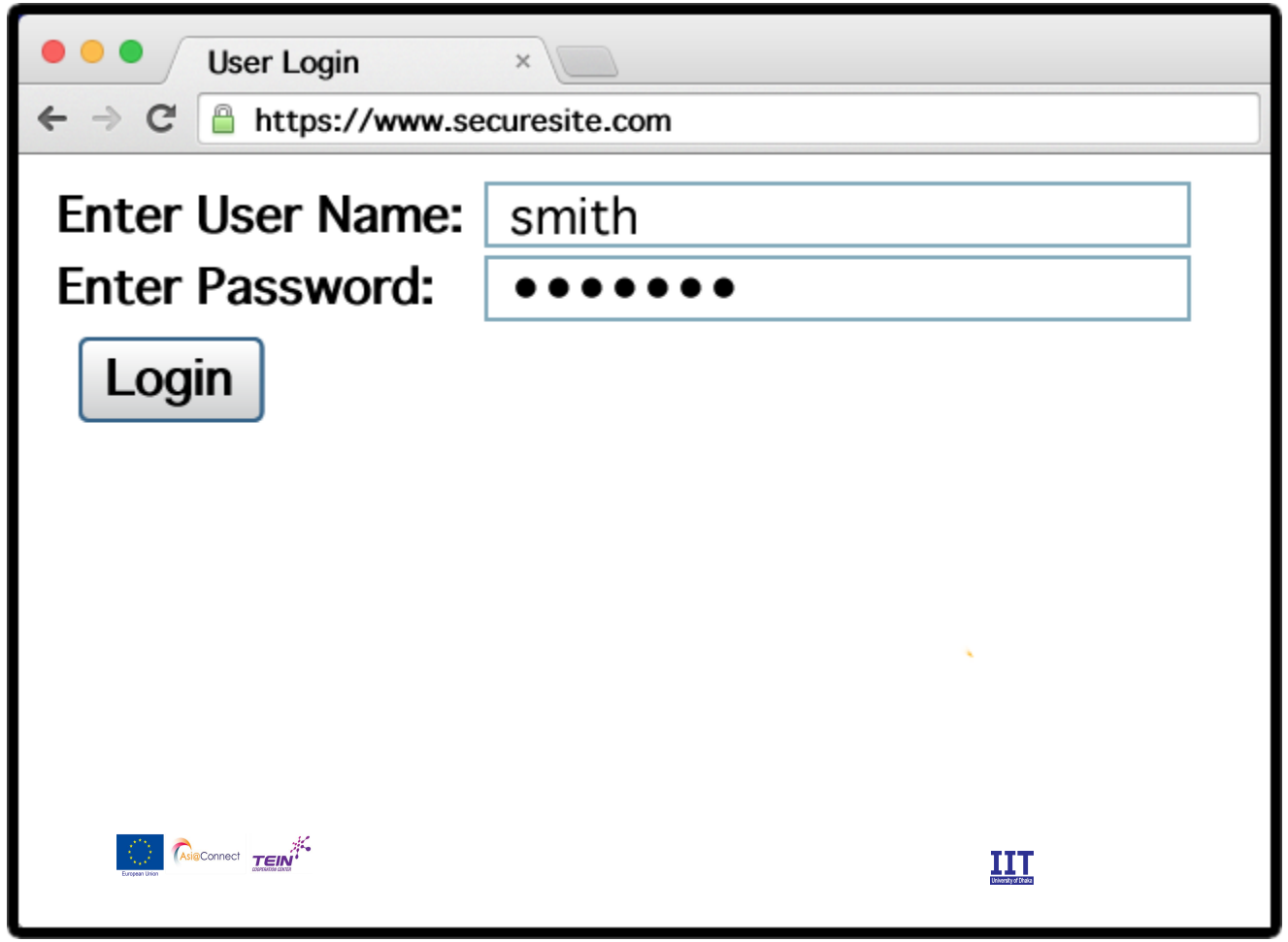
- What if **‘user’ is a malicious string** that changes the meaning of the query?

SQL Injection: Basic Idea

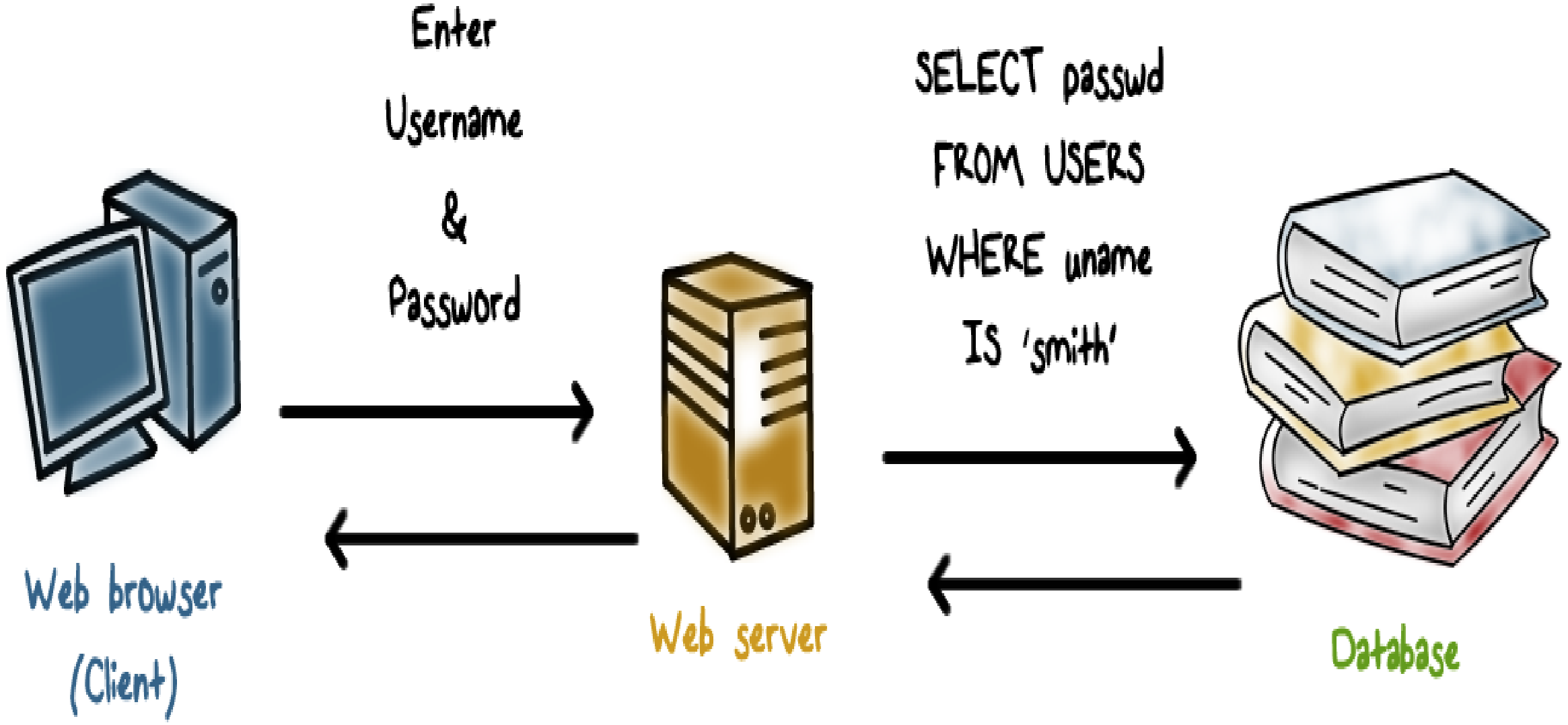


- **This is an input validation vulnerability**
  Unsanitized user input in SQL query to back-end database changes the meaning of query

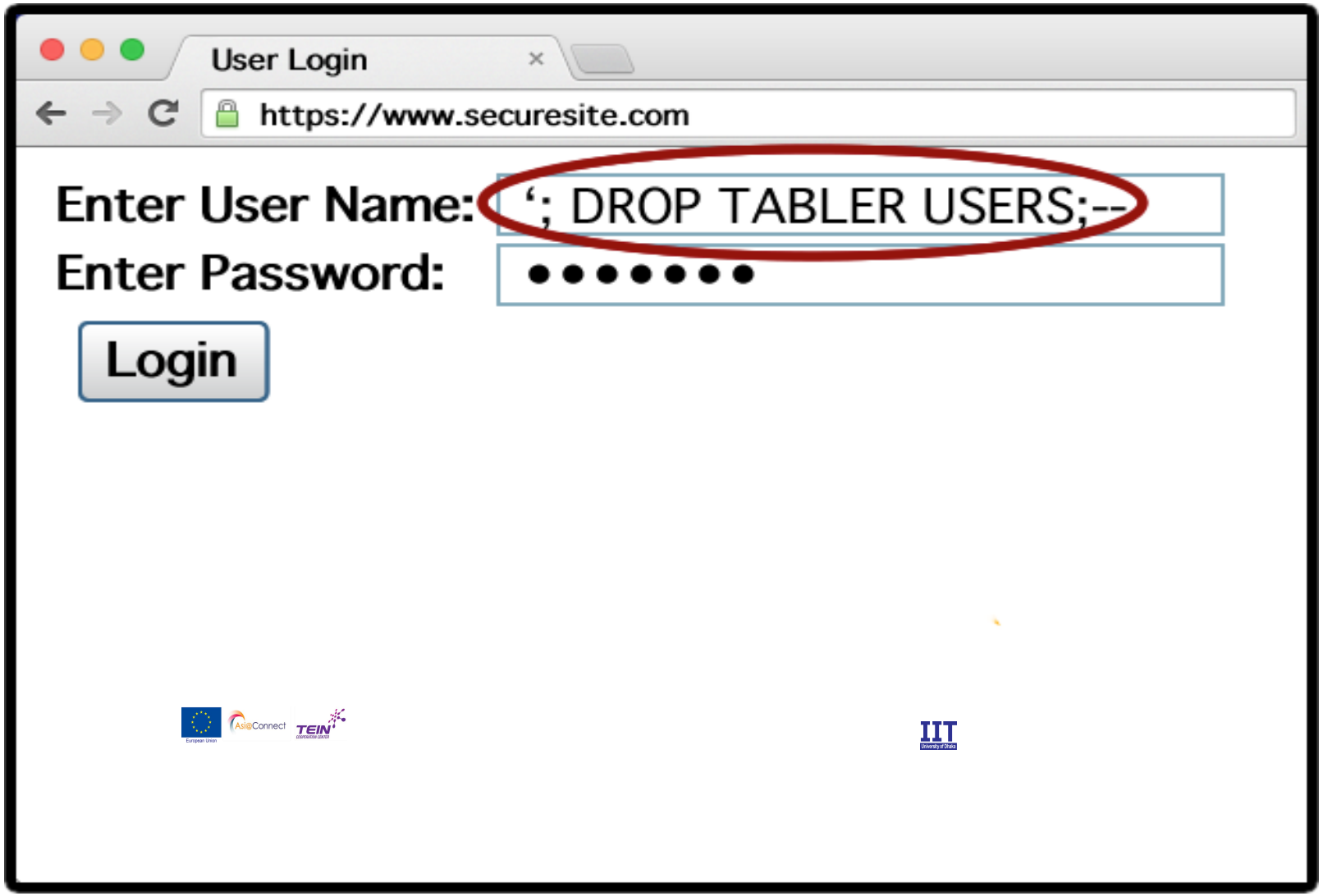
Example Login Prompt



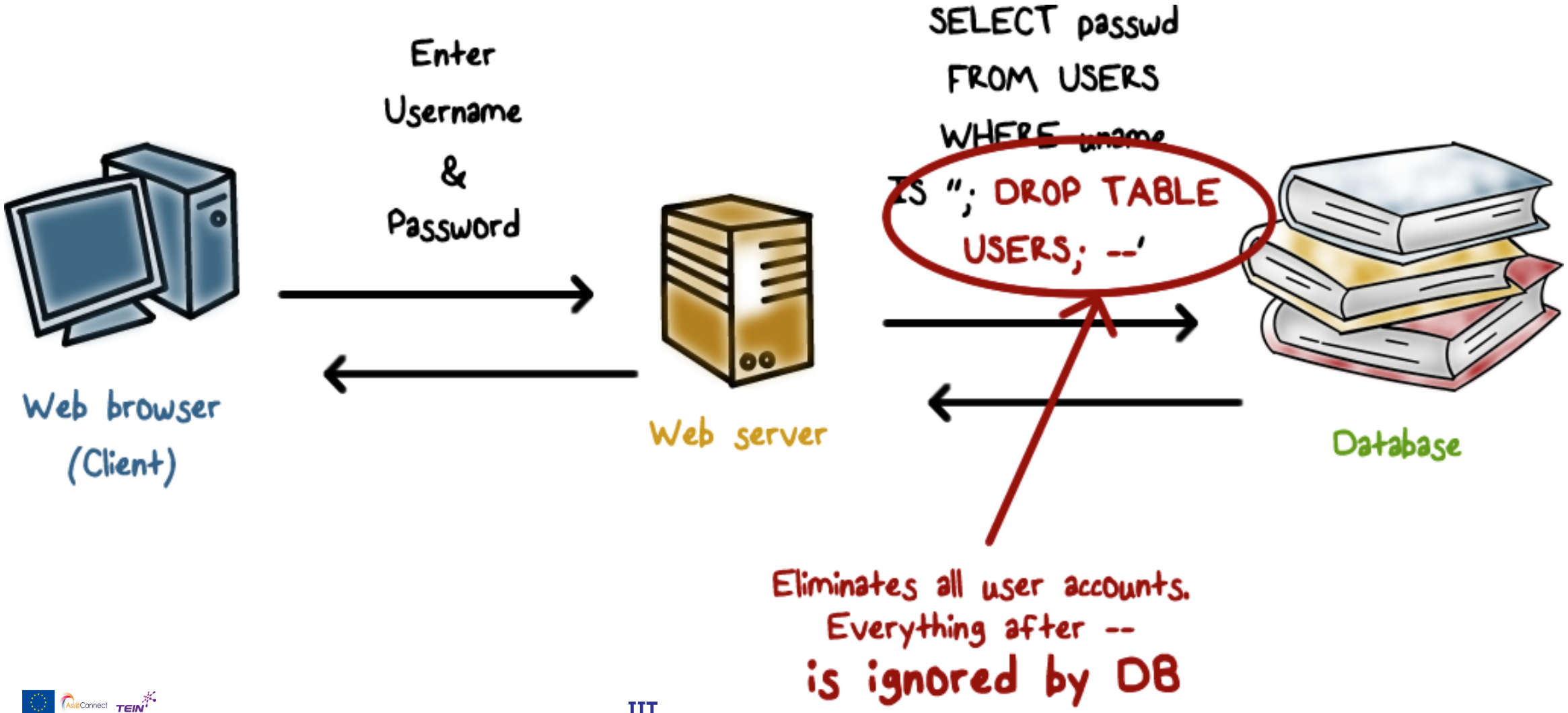
Normal Login



Malicious User Input



Example SQL Injection Attack



SQL Injection Attack #1

Unauthorized Access Attempt:

`password =` **’ or 1=1 --**

SQL statement becomes:

select count(*) from *users* **where** *username* = *‘user’* **and**

password = *‘’* **or 1=1 –**

Checks if password is empty OR 1=1, which is always true, permitting access.

SQL Injection Attack #2

Database Modification Attack:

`password =` foo'; **delete from table** *users*

where *username* **like** '%

DB executes ***two*** SQL statements:

select count(*) from *users* **where** *username* = *'user'* **and** *password* = *'foo'* ;

delete from table *users* **where** *username* **like** '%'

Another SQL Injection Example

[From Kevin Mitnick's "The Art of Intrusion"]

- User enters: ' OR WHERE pwd LIKE '% as both name and passwd
- Server executes:

SELECT * WHERE user='' OR ~~WHERE~~ pwd LIKE '%' AND pwd='' OR ~~WHERE~~ pwd LIKE '%'

Wildcard matches <u>any</u> password

- Logs in with the credentials of the first person in the database (typically, administrator!)

It Gets Better

- User gives username

  ′ exec cmdshell ‘net user badguy badpwd’ / ADD --

- Web server executes query

  set UserFound=execute(

  SELECT * FROM UserTable WHERE

  username= ‘’ exec … -- …);

- Creates an account for badguy on DB server

More SQL Injection Attacks

- Create new users

  ’; INSERT INTO USERS (‘uname’,‘passwd’,‘salt’)

  VALUES (‘hacker’,‘38a74f’, 3234);

- Reset password

  ’; UPDATE USERS SET email=hcker@root.org WHERE

  email=victim@yahoo.com

An example Vulnerable Website

https://www.hacksplaining.com/exercises/sql-injection#/start

How to Prevent SQLi attack?

- Check syntax of input for validity
  - **Many classes of input have fixed languages**
    - Email addresses, dates, part numbers, etc.
    - Verify that the input is a valid string in the language
    - Some languages allow problematic characters (e.g., ‘*’ in email); may decide to not allow these
    - Exclude quotes and semicolons
  - Not always possible: consider the name Bill O’Reilly

How to Prevent SQLi attack?

- Have length limits on input
  - Many SQL injection attacks depend on entering long strings
- Use provided functions for escaping strings
  - Many attacks can be thwarted by simply using the SQL string escaping mechanism
    - ‘ → \’ and “ → \”
  - mysql_real_escape_string() is the preferred function for this
- Will not guard against all attacks
  - Consider:
    - SELECT fields FROM table WHERE id = **23 OR 1=1**
    - No quotes here!

Overall Prevention Policy

- Prevent leakage of database schema and other information
- Limit privileges (defense in depth)
- Encrypt sensitive data stored in database
- Harden DB server and host OS
- Apply input validation

Lets Try some examples

Please Visit:

http://sqlfiddle.com/#!9/1bff5c/1

Further Practice

https://seedsecuritylabs.org/Labs_16.04/Web/Web_SQL_Injection/