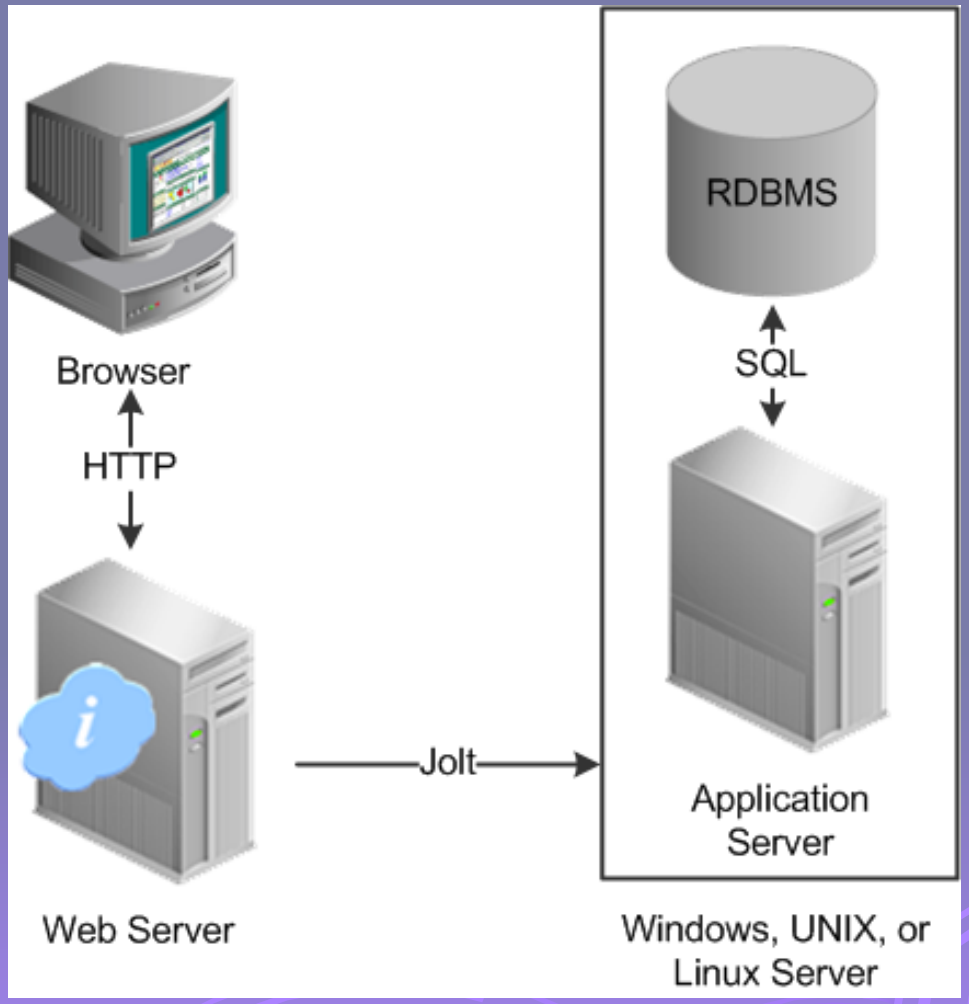
TTM4536 - Ethical Hacking - Information Security, Specialization Course

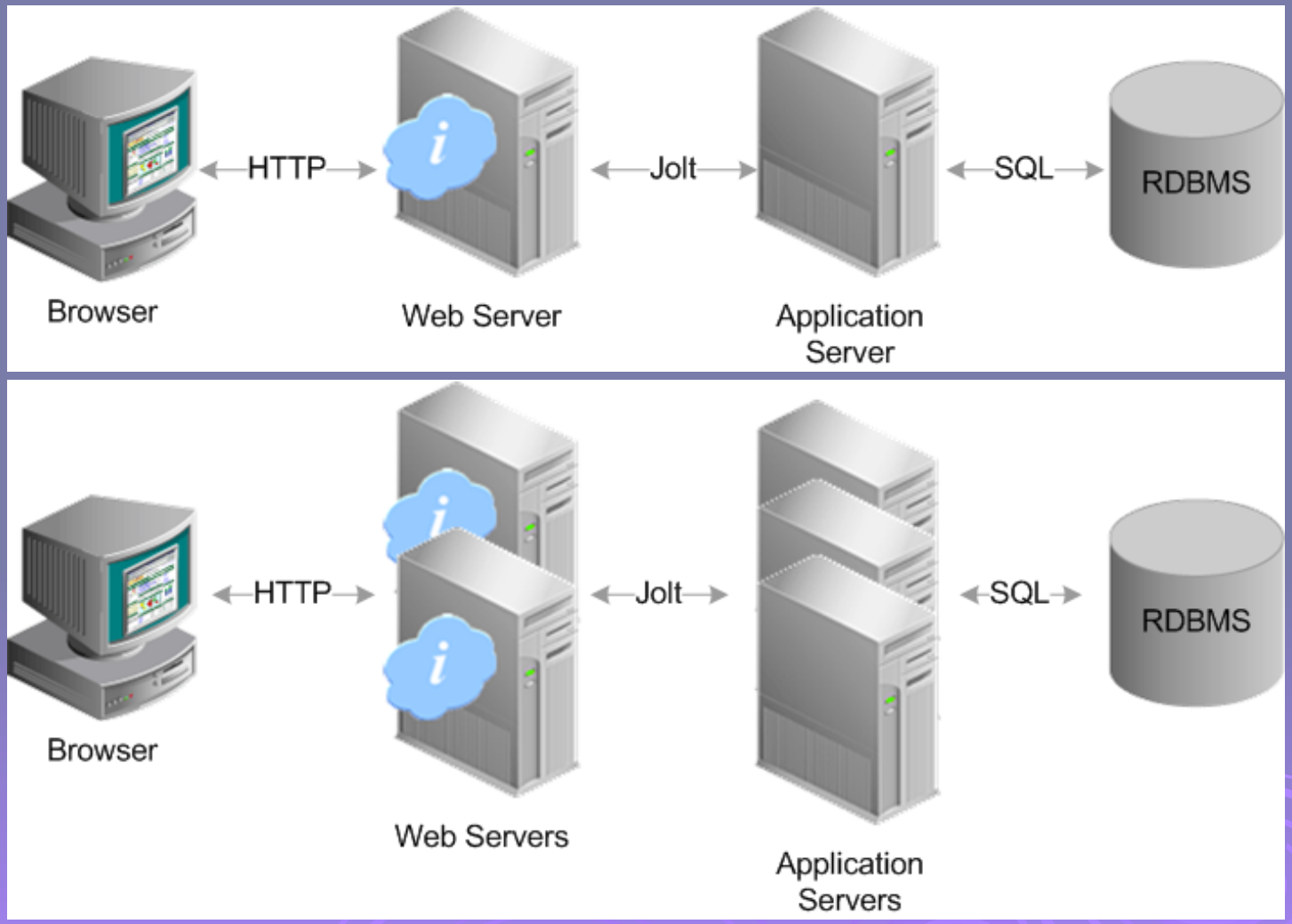
- Plan for 24 Oct 2017
- SQL Injections

Logical and physical relation between web servers and relational database servers



Logical relation

Logical and physical relation between web servers and relational database servers



Physical relation

What is a SQL Injection 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

An Example SQL Injection Attack

Product Search: **blah ‘ OR ‘x’ = ‘x**

- This input is put directly into the SQL statement within the Web application:
  - $query = “SELECT prodinfo FROM prodtable WHERE prodname = ‘” . $_POST[‘prod_search’] . “’ ”;
- Creates the following SQL:
  - SELECT prodinfo FROM prodtable WHERE prodname = **‘blah ‘ OR ‘x’ = ‘x’**
  - Attacker has now successfully caused the entire database to be returned.

A More Malicious Example

- What if the attacker had instead entered:
  - **blah ‘; DROP TABLE prodinfo; --**
- Results in the following SQL:
  - SELECT prodinfo FROM prodtable WHERE prodname = **‘blah’; DROP TABLE prodinfo; --’**
  - Note how comment (--) consumes the final quote
- Causes the entire database to be deleted
  - Depends on knowledge of table name
  - This is sometimes exposed to the user in debug code called during a database error
  - Use non-obvious table names, and never expose them to user
- Usually data destruction is not your worst fear, as there is low economic motivation

Other injection possibilities

- Using SQL injections, attackers can:
  - Add new data to the database
    - Could be embarrassing to find yourself selling politically incorrect items on an eCommerce site
    - Perform an INSERT in the injected SQL
  - Modify data currently in the database
    - Could be very costly to have an expensive item suddenly be deeply ‘discounted’
    - Perform an UPDATE in the injected SQL
  - Often can gain access to other user’s system capabilities by obtaining their password

Defenses

- Use provided functions for escaping strings
  - Many attacks can be thwarted by simply using the SQL string escaping mechanism
    - Instead of ‘ use \’

    and
    - Instead of “ use \”
  - Or use mysql_real_escape_string() as the preferred function for this
- Not a silver bullet!
  - Consider:
    - SELECT fields FROM table WHERE id = **23 OR 1=1**
    - No quotes here!

More Defenses

- 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
    - Sometime languages allow problematic characters (e.g., '*' in email addresses); may decide to not allow these
    - If you can exclude quotes and semicolons that's good
  - Not always possible: consider the name Bill O'Reilly
    - Want to allow the use of single quotes in names
- Have length limits on input
  - Many SQL injection attacks depend on entering long strings

Even More Defenses

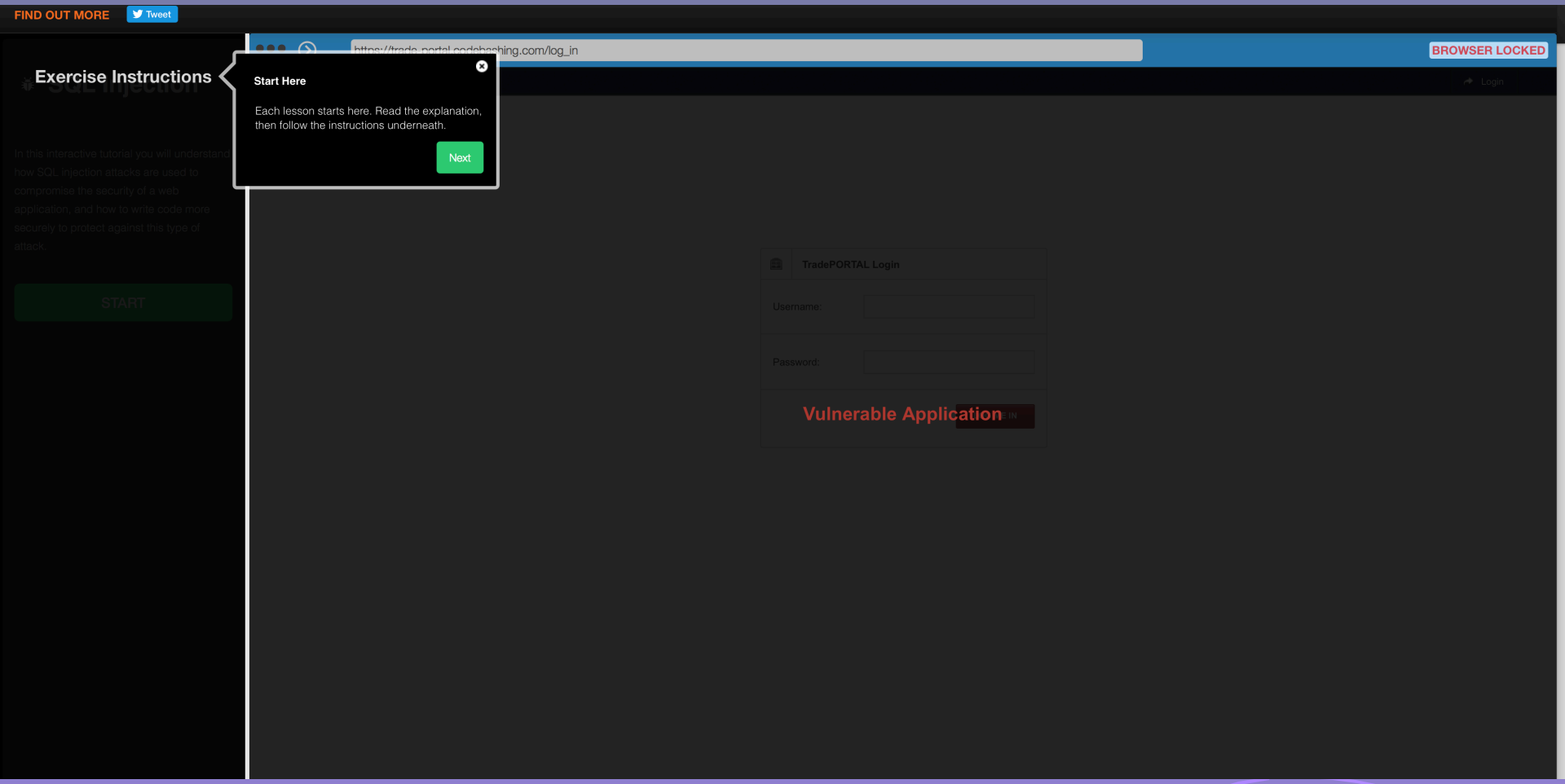
- Insert code that scans query string for undesirable word combinations that indicate SQL statements
  - INSERT, DROP, etc.
  - If you see these, can check against SQL syntax to see if they represent a statement or valid user input
- Limit database permissions and segregate users
  - If you're only reading the database, connect to database as a user that only has read permissions
  - Never connect as a database administrator in your web application

More Defenses

- Configure database error reporting
  - Default error reporting often gives away information that is valuable for attackers (table name, field name, etc.)
  - Configure so that this information is never exposed to a user
- If possible, use bound variables
  - Some libraries allow you to bind inputs to variables inside a SQL statement
  - PERL example (from http://www.unixwiz.net/techtips/sql-injection.html)

```
$sth = $dbh->prepare("SELECT email, userid FROM members WHERE
    email = ?;");
$sth->execute($email);
```

https://www.codebashing.com/sql_demo



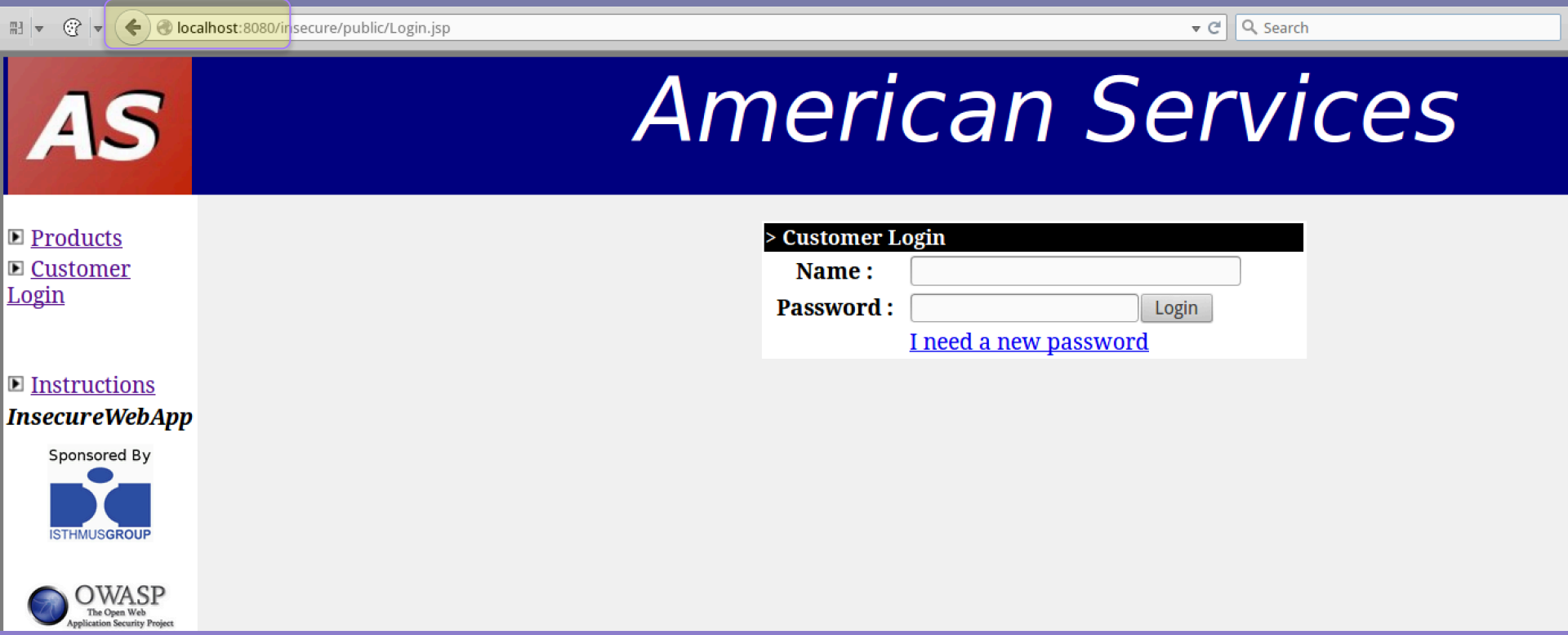
Go trough all the demo instructions on this web site

Remember Web Security Dojo?

Before starting Kali and Dojo do the following in VirtualBox

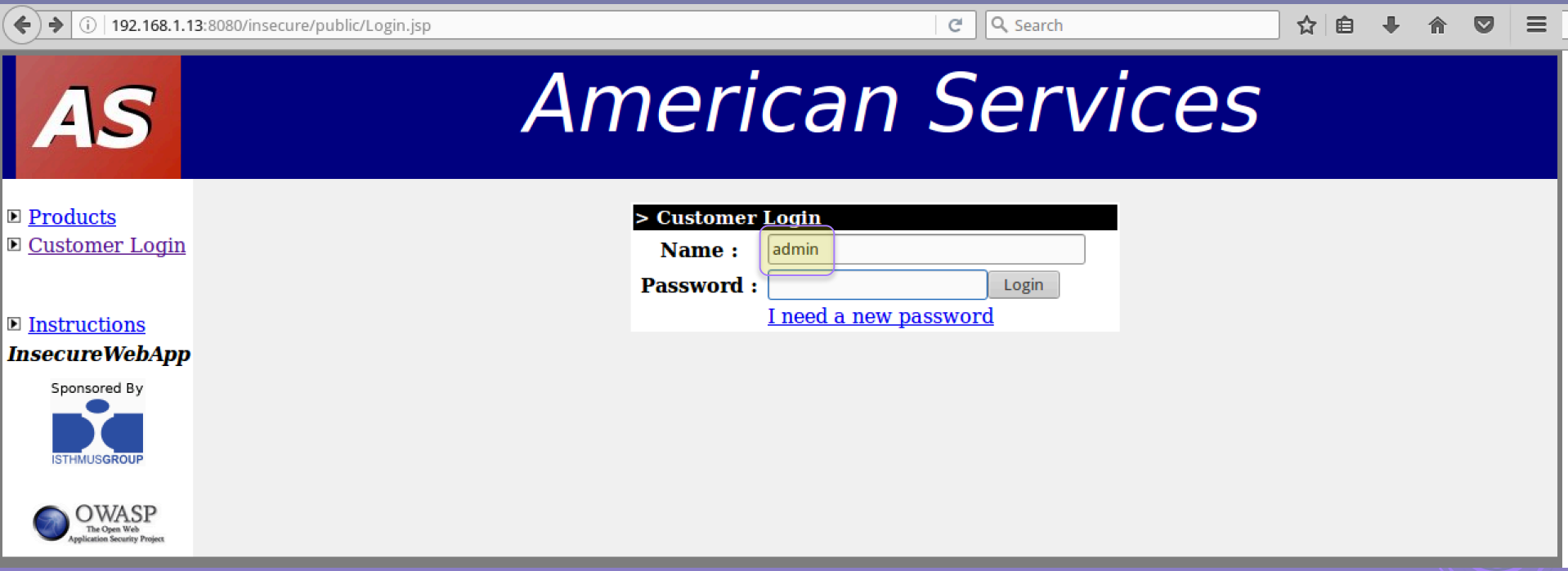
1. In Preferences go to Network
2. Change Network adapters for both Kali and Dojo to be Bridged

1. Start Dojo and find out its IP address
2. Start Firefox and open localhost
3. Start the vulnerable web server Insecure Web App.
4. See that the port that the server is listening is 8080


localhost:8080/insecure/public/Login.jsp
Search
AS
American Services
Products
Customer Login
Instructions
InsecureWebApp
Sponsored By
ISTHMUSGROUP
OWASP
The Open Web Application Security Project
> Customer Login
Name :
Password :
Login
I need a new password

- On Kali machine in a browser put the address of the web site of the dojo Insecure Web App

- Try the username admin to break the login access by injecting some SQL query for the password field



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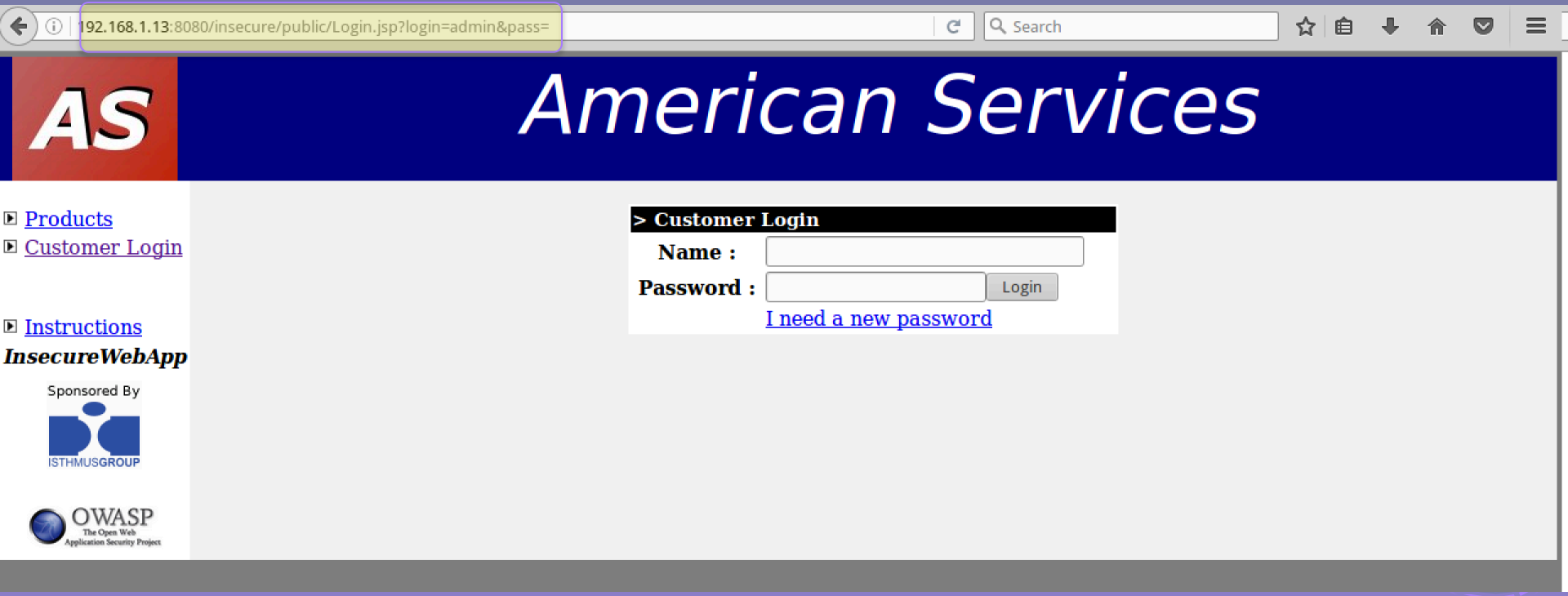

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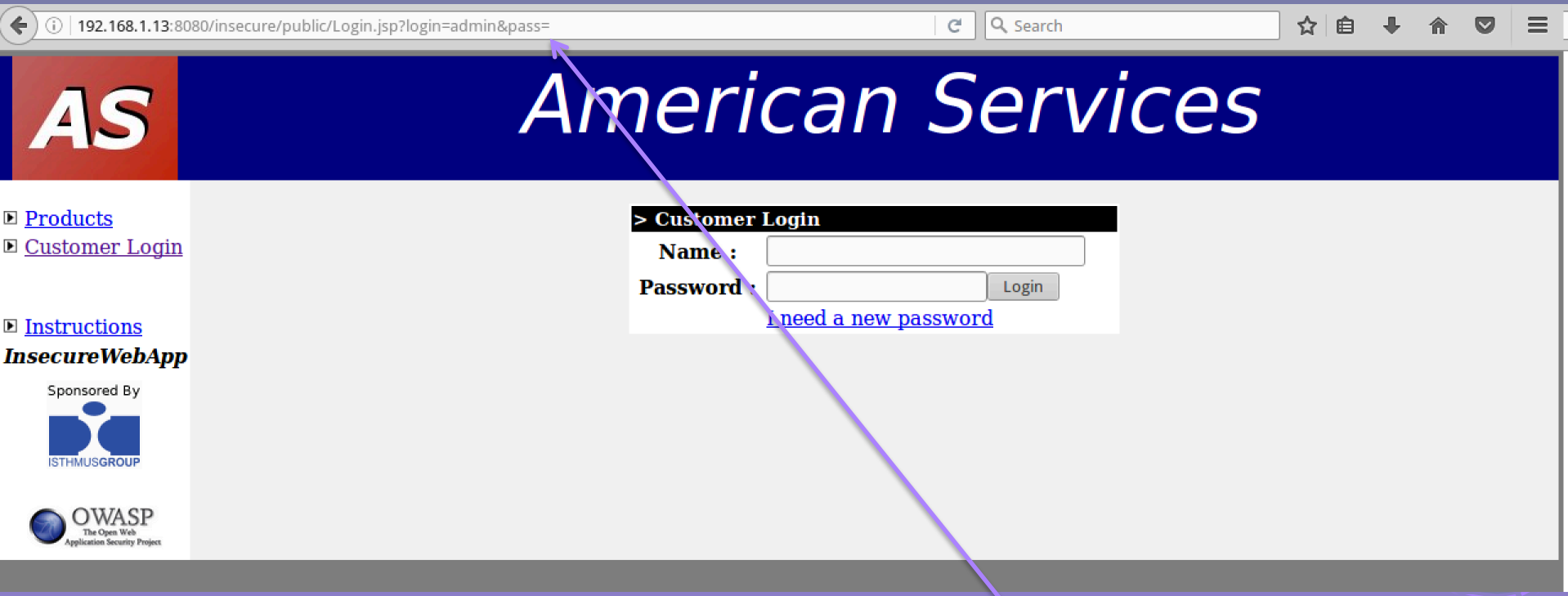

Bypass the authentication by gluing to pass= some of the following

'OR 1=1--

or

') OR 1=1--

or

' OR '1'='1'--

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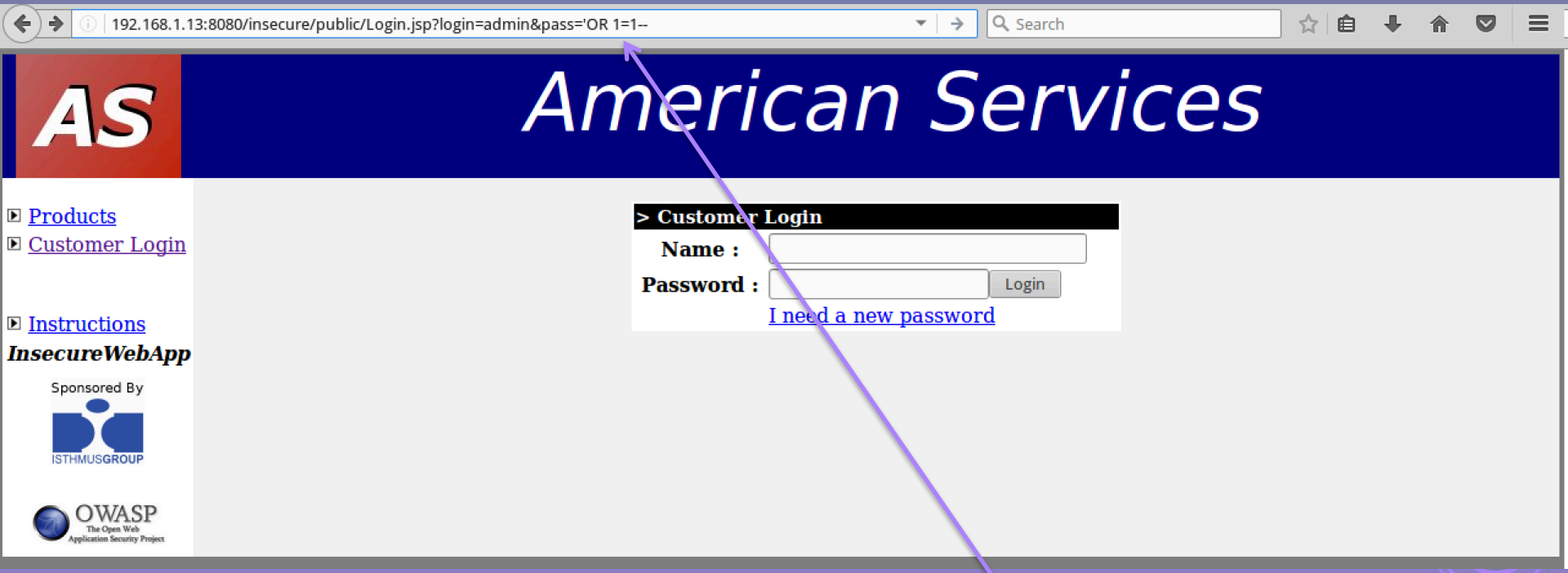

Bypass the authentication by gluing to pass= some of the following
'OR 1=1--
or
') OR 1=1--
or
' OR '1'='1'-- or try something else

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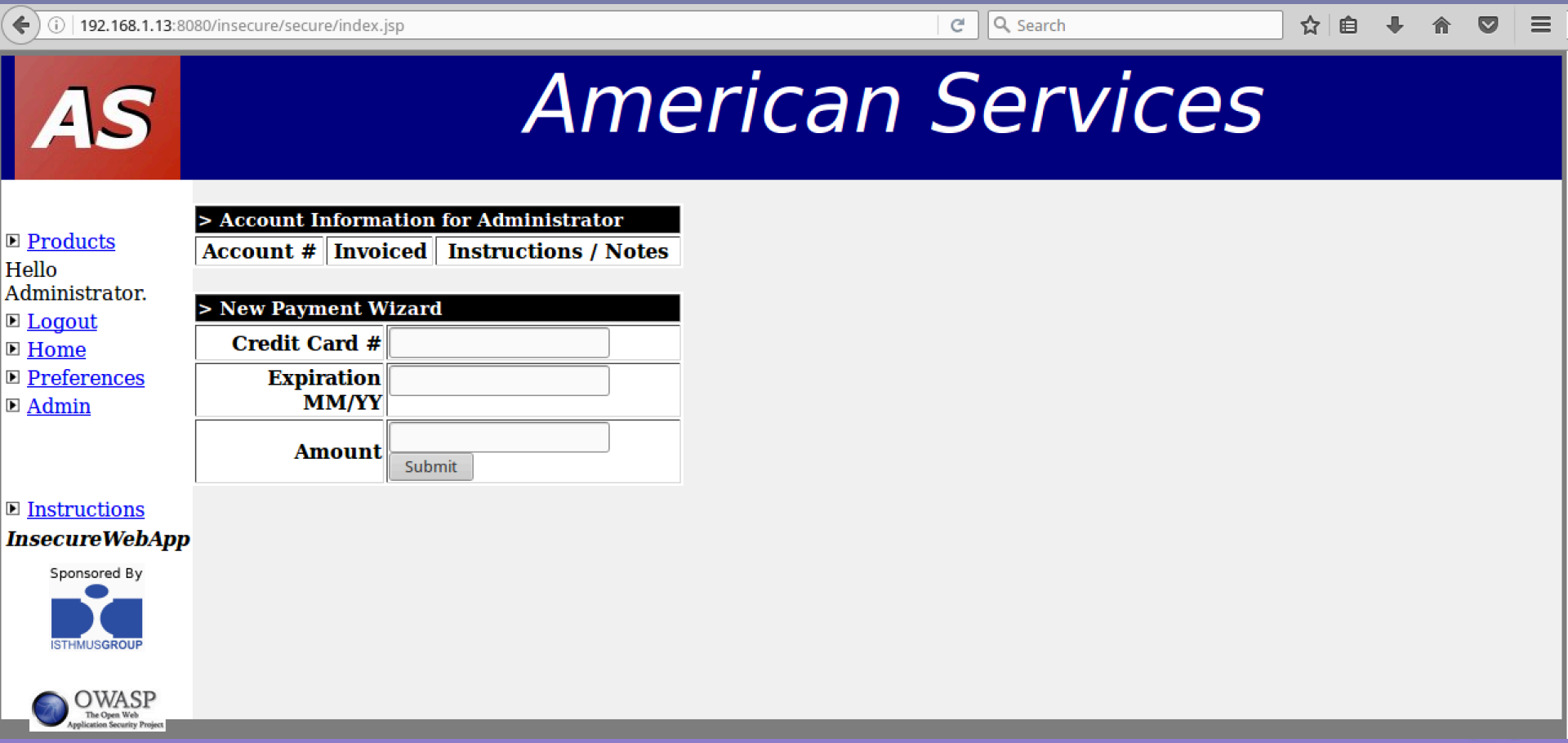

The power of sqlmap

- In a web browser in Kali go to the web page http://sqlmap.org
- Install the latest sqlmap tool:
  - Download the tarball
  - tar zxvf sqlmap*
  - Go to the sqlmap folder
  - Run: python sqlmap.py

- There are 1 + 12 videos (around 1 minute each) demonstrating the work with sqlmap
- Repeat the demos presented in the videos on http://sqlmap.org