Lesson 7: WEB APPLICATION SECURITY - INTRODUCTION TO SQL INJECTION TECHNIQUES

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INFORMATION SECURITY ENCYCLOPEDIA

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Security Incidents I: Kaspersky

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Kaspersky Web Site Hacked With SQL Injection

By Stefanie Hoffman, ChannelWeb
7:51 PM EST lun. feb. 09, 2009

Discuss This

A security vulnerability in Moscow-based Kaspersky Lab's U.S. Web site was made public after a hacker launched a SQL attack and posted listings of tables contained on the security company's site.

The hacker, known as Unu, posted screen shots as well as a list of tables Feb. 7 to a blog after hacking into the security company's Web site via a simple SQL injection attack that allowed information to be exposed by entering secret username and password information.

"Kaspersky is one of the leading companies in the security and antivirus market. It seems as though they are not able to secure their own databases," the hacker said on a hackerblog.org posting. "Alter one of the parameters and you have access to EVERYTHING: users, activation codes, lists of bugs, admins, shop, etc."

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Security Incidents II: NASA

SC Magazine Virtual Symposium: Botnets

Home > News > NASA sites hacked via SQL injection

NASA sites hacked via SQL injection

Angela Moscaritolo December 07, 2009

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Two NASA sites recently were hacked by an individual wanting to demonstrate that the sites are susceptible to SQL injection.

The websites for NASA's Instrument Systems and Technology Division and Software Engineering Division were accessed by a researcher, who posted to his blog screen shots taken during the hack.

The researcher, using the alias "c0de.breaker," used SQL injection to hijack the sites, Gunter Ollmann, VP of research at security firm Damballa, who recently wrote about the hack, told SCMagazineUS.com on Monday.

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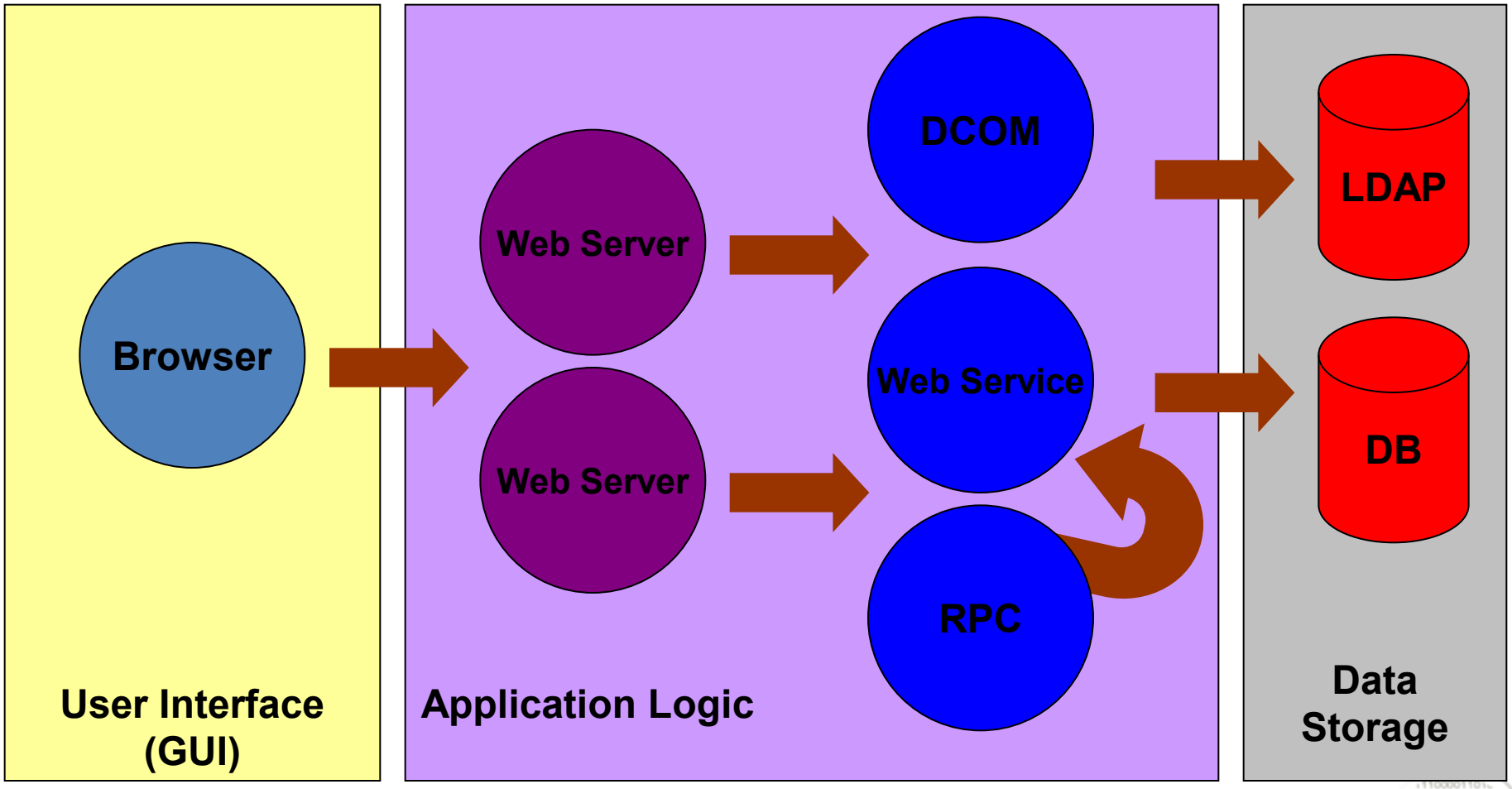
Architecture of a Web Application



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OWASP Top 10

OWASP Top 10 – 2007 (Previous)	OWASP Top 10 – 2010 (New)
A2 – Injection Flaws	A1 – Injection
A1 – Cross Site Scripting (XSS)	A2 – Cross-Site Scripting (XSS)
A7 – Broken Authentication and Session Management	A3 – Broken Authentication and Session Management
A4 – Insecure Direct Object Reference	A4 – Insecure Direct Object References
A5 – Cross Site Request Forgery (CSRF)	A5 – Cross-Site Request Forgery (CSRF)
<was T10 2004 A10 – Insecure Configuration Management>	A6 – Security Misconfiguration (NEW)
A8 – Insecure Cryptographic Storage	A7 – Insecure Cryptographic Storage
A10 – Failure to Restrict URL Access	A8 – Failure to Restrict URL Access
A9 – Insecure Communications	A9 – Insufficient Transport Layer Protection
<not in T10 2007>	A10 – Unvalidated Redirects and Forwards (NEW)
A3 – Malicious File Execution	<dropped from T10 2010>
A6 – Information Leakage and Improper Error Handling	<dropped from T10 2010>

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Code Injection

- Applications with poor data input verification
  - User data
    - Forms
    - Cookies
    - ….
  - Data from procedure calls
    - Links
    - Function Scripts
    - Actions
    - …
- User data used in database queries
- Poor construction of queries into databases
- Attacks
  - SQL Injection, LDAP Injection, Xpath Injection
  - ….

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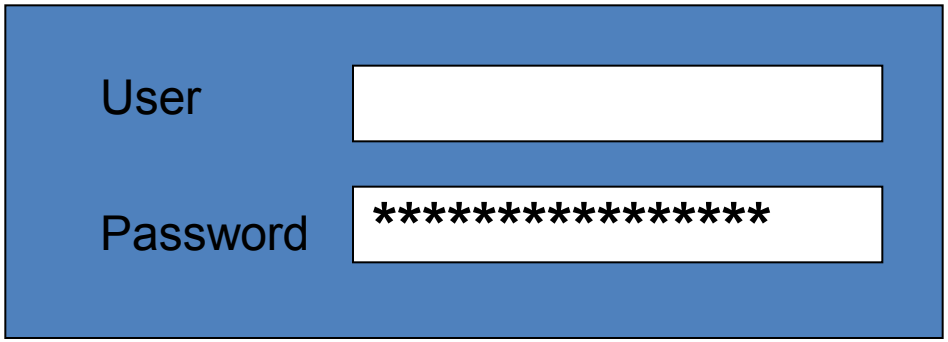
Code Injection: Example

- User authentication against database




```
Select iduser from table_users
Where name_user='$user'
And password='$password';
```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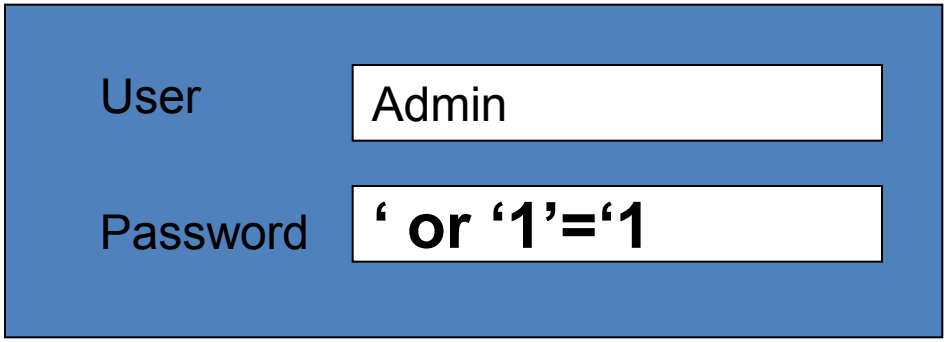
Code Injection: Example



Select iduser from table_users

Where name_user=‘Admin’

And password=‘’ or ‘1’=‘1’;

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Impact

- Allow an attacker to:
  - Skip access restrictions
  - Escalate privileges
  - Extract information from the database
  - RDBMS stop
  - Run commands in user context db within the server

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Types of Attacks: Inbound

- Access information with listing procedures

  http://www.myweb.com/prog.asp?parameter1=hello

  http://www.myweb.com/prog.asp?parameter1=‘ union select name, password,1,1,1 from table_users; other instruction; xp_cmdshell(“del c:\boot.ini”); shutdown --

  OR

  http://www.myweb.com/prog.asp?parameter1=1

  http://www.myweb.com/prog.asp?parameter1=-1 union select .....; other instruction; --

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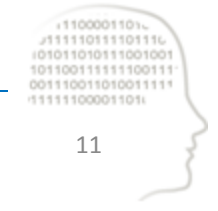
Types of Attacks: Outbound

- The attacker dumps data using the application's error messages and the data repository

```
Microsoft OLE DB Provider for ODBC Drivers error '80040e14'

[Microsoft][ODBC SQL Server Driver][SQL Server]Comilla no cerrada antes de la cadena de caracteres 'd'.

/index.asp, line 23
```



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Blind attacks

- The web application doesn't display any error messages
  - An outbound attack isn't possible
- The application doesn't process commands
  - An inbound attack isn't possible
- True and False conditions are injected Examples:
  - http://server/myphp.php?id=1 and 1=1
  - http://server/myphp.php?id=1 and 1=2

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Blind Attacks

- How to recognize different behaviours?
  - Gives an error code
  - Gives an error page
  - Changes the signature hash
  - Changes the html tree
  - It takes longer to respond
  - …
- If the page reacts differently to injections of True and False, then you can extract data using Boolean searches
  - http://www.server.com/show_news.php?v_id=1 and (100=(select top 1 ascii(substring(login,1,1)) from users))

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Time-based attacks

- If the content of the answers is identical in both cases, you can still achieve the goal changing the server response time conditionally
  - If the injected condition is true, the application will take a few seconds to answer
  - If the condition is false, the application will return the same answer, but taking the usual time
- The same injection techniques described above can be used

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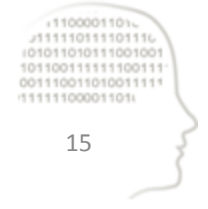
Time-based SQL Injection

- How can we get the delay?
  - Using delay instructions implemented in the database manager
    - SQL Server: *waitfor delay*
    - Oracle: *dbms_lock.sleep*
    - MySQL: *sleep*
    - *Postgres: pg_sleep*
  - Using heavy queries that consume a lot of the server's resources (CPU or memory)
    - CROSS JOIN involving many tables
  - Any other way (e.g.: xp_cmdshell 'ping…')



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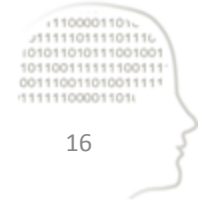
Countermeasures

- Not confiding in client based protection measures
- Checking input data
- Creating SQL statements with secure components
- Fortifying the web server
  - Error codes
  - Restriction of verbs, lengths, etc...
  - HTTP Content Filtering in the Firewall (WAF)
- Fortification of DBMS
  - Restriction of motor/user privileges access from the web
  - Isolation of databases



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